3Com Router 5000 Family and Router 6000 Family Module Guide

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Chapter 1 Overview

Information about interface cards and modules other than Smart Interface Cards (SICs), Multi-Functional Interface Modules (MIMs), and Flexible Interface Cards (FICs) are beyond the scope of this manual. This specifically addresses the modules associated with this release. Information on other modules appears in the Router 5000 or Router 6000 Family Installation Manuals.

1.1 Types of SICs

3Com 5000 Router Family provide two SIC slots which can accept the following types of SICs for this release.

- Router 1-Port 10/100 SIC (3C13712)
- Router 1-Port Serial SIC (3C13714)
- Router 1-Port SAE SIC card (3C13715)
- Router 2-Port ISDN-S/T SIC (3C13716)
- Router 2-Port ISDN-U SIC (3C13718)
- Router 1-Port Fractional T1 SIC (3C13720A)
- Router 1-Port Fractional E1 SIC (3C13722)
- Router 1-Port Analog Modem SIC (3C13724)
- Router 1-port FXS SIC card (3C13725)
- Router 2-port FXS SIC card (3C13726)
- Router 1-port FXO SIC card (3C13727)
- Router 2-port FXO SIC card (3C13728)

1.2 Types of MIMs

3Com 5000 Router Family modular routers provide MIM slots for this release and support the following MIMs:

- Router 2-Port 10/100 MIM ((3C13761)
- Router 2-Port Enhanced Serial MIM (3C13762)
- Router 4-Port Serial MIM (3C13763)
- Router 4-Port Enhanced Serial MIM (3C13764)
- Router 2-Port CE1/PRI MIM (3C13765)
- Router 4-Port CE1/PRI MIM (3C13766)
- Router 4-Port ISDN-S/T MIM (3C13767)
- Router 2-Port CT1/PRI MIM (3C13769A)
- Router 1-Port ADSL over POTS MIM (3C13770)
- Router NDEC Encryption Accelerator MIM (3C13771-75)
- Router 2-Port ADSL over POTS MIM (3C13772)

- Router NDEC2 Encryption Accelerator MIM (3CR13773-75)
- Router 1-Port 10/100/1000 MIM (3C13774)
- Router 1-Port CT-3 MIM (3C13775A)
- Router 1-Port CE3 MIM (3C13777)
- Router 4-Port E1 IMA MIM (3C13778)
- Router 4-Port T1 IMA MIM (3C13779)
- Router 2-port FXS MIM module (3C13780)
- Router 2-port FXO MIM module (3C13783)
- Router 2-port E&M MIM module (3C13785)
- Router 4-port FXS MIM module (3C13781)
- Router 4-port FXO MIM module (3C13784)
- Router 4-port E&M module (3C13786)
- Router 1-port E1 Voice MIM module (3C13787)
- Router 1-port T1 Voice MIM module (3C13788)

1.3 Types of FICs

3Com 6000 Router Family modular routers provide FIC slots for this release and support the following FICs:

- Router 1-Port 100FX MM FIC (3C13860)
- Router 2-Port 10/100 FIC (3C13861)
- Router 1-Port 100FX SM FIC (3C13862)
- Router 4-Port Enhanced Serial FIC (3C13863)
- Router 8-Port Enhanced Serial FIC (3C13864)
- Router 4-Port CE1/PRI FIC (3C13866)
- Router 4-Port CT1/PRI FIC (3C13870A)
- Router 1-Port ADSL (over POTS) FIC (3C13871)
- Router 2-Port ADSL (over POTS) FIC (3C13872)
- Router NDEC2 Encryption Accelerator FIC (3CR13873-75)
- Router 4-Port E1 IMA FIC (3C13874)
- Router 4-Port T1 IMA FIC (3C13875)
- Router 1-Port E3 ATM FIC (3C13876)
- Router 1-Port T3 ATM FIC (3C13877)
- Router 4-Port Fractional T1 FIC (3C13821)
- Router 4-Port Fractional E1 FIC (3C13823)
- Router 1-Port OC-3 POS FIC (3C13881)
- Router 1-Port OC-3 ATM MM FIC (3C13882)
- Router 1-Port OC-3 ATM SM FIC (3C13884)
- Router 1-Port OC-3 ATM SML FIC (3C13886)
- Router 1-Port 10/100/1000 FIC (3C13887)
- Router 1-Port Gigabit Ethernet Fiber FIC (3C13879)
- Router 1-Port 1000Base-SX SFP FIC (3CSFP91)

- Router 1-Port CE3 FIC (3C13888)
- Router 1-Port CT3 FIC (3C13889A)
- Router 1-Port Fractional T1 FIC (3C13889A)
- Router 1-Port Fractional T3 FIC (3C13889A)
- Router 2-Port FXS FIC (3C13890)
- Router 4-Port FXS FIC (3C13891)
- Router 2-Port FXO FIC (3C13893)
- Router 4-Port FXO FIC (3C13894)
- Router 2-Port E&M FIC (3C13895)
- Router 4-Port E&M FIC (3C13896)
- Router 1-Port E1 Voice FIC (3C13897)
- Router 1-Port T1 Voice FIC (3C13898)
- Router RPU2 Encryption Accelerator FIC (3CR13806-75)

1.4 SIC/MIM Purchasing Guideline

You may equip a 3Com Series Modular Router with appropriate SICs and MIMs and are allowed to:

- Install several SICs or MIMs of the same type on the router;
- Install a SIC or MIM in any slot on the router, disregarding its type.

Also, you should:

- Select interface cable appropriate to each SIC or MIM;

1.5 Installation/Removal of SIC and MIM

Warning:

3Com 5000 Family Routers do not support online insertion and removal of SICs and MIMs. Before implementing any of the following operations, wear an anti-static wrist strap and ESD-preventive glove, and make sure that the power of the Router has been turned off and the power cord has been unplugged. Otherwise, the operator may get an electric shock or the Router may get damaged.

Caution:

- The electromagnetic interference (EMI) gaskets on the front panel of each MIM/SIC can protect the whole router. Please leave the gaskets intact when uninstalling or replacing the MIM/SIC and never remove them;

- In case of the possible damage to MIMs, put the MIMs on the Printed Circuit Board (PCB) tray during the installation and replacement;
- Hold the circuit board by the edge and do not touch the components and the surface of the PCB;
- If you are not planning to install a new MIM/SIC after removing the old one, install a blank filler panel to keep the chassis dust-free and thereby to ensure the normal ventilation of the Router.

1.5.1 Installing/Removing SIC

I. Tools required

- Flat-blade screwdriver
- ESD-preventive wrist strap and ESD-preventive glove

II. Removing blank filler panel from SIC slot

Following the rotating direction shown in this figure, remove the captive screws of the blank filler panel using the flat-blade screwdriver.

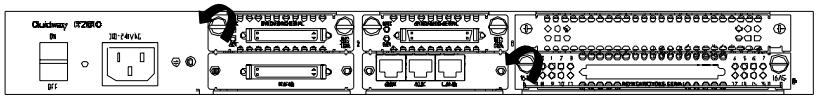

Figure 1-1 Removing the blank filler panel from a SIC slot

III. Installing SIC

Follow these steps to install a SIC:

Step 1: Place the rear panel of the Router towards you;

Step 2: Turn off the power switch of the Router and unplug the power cord;

Step 3: Take out the SIC and align its remote edge with the edge of the slot on the Router's rear panel;

Step 4: Push the SIC into the Router until it closely mates with the rear panel of the Router;

Step 5: Fasten the SIC into the Router with captive screws;

Step 6: Power on the Router, and check the LEDs of the corresponding slot on the front panel: after the initialization of the SIC, ON means that the SIC is operating normally and OFF means that its Power-On Self-Test (POST) has failed. In the latter case, please contact your agent.

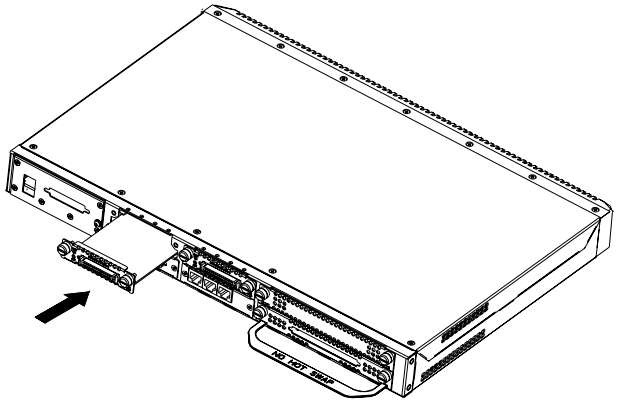

Figure 1-2 Installing SIC

IV. Removing SIC

Follow these steps to remove a SIC:

Step 1: Place the rear panel of the Router towards you;

Step 2: Turn off the power switch of the Router and unplug the power cord;

Step 3: Unplug all the network interface cables connected to the rear panel of the Router;

Step 4: Remove the captive screws on both sides of the SIC using the flat-blade screwdriver;

Step 5: Pull the SIC outward until it is completely taken out of the Router chassis.

1.5.2 Installing/Removing MIM

I. Tools required

- Flat-blade screwdriver
- ESD-preventive wrist strap and ESD-preventive glove

II. Installing MIM

Follow these steps to install a MIM:

Step 1: Place the rear panel of the Router towards you;

Step 2: Turn off the power switch of the Router and unplug the power cord;

Step 3: Select a slot and insert the MIM along the guides in the slot until it contacts the rear panel of the Router;

Step 4: Fix the MIM into the Router with captive screws;

Step 5: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent.

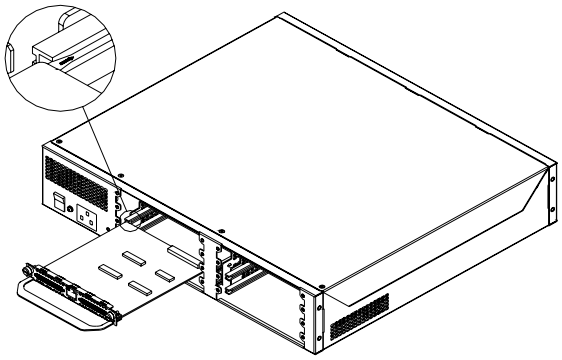

Figure 1-3 Installing MIM (1)

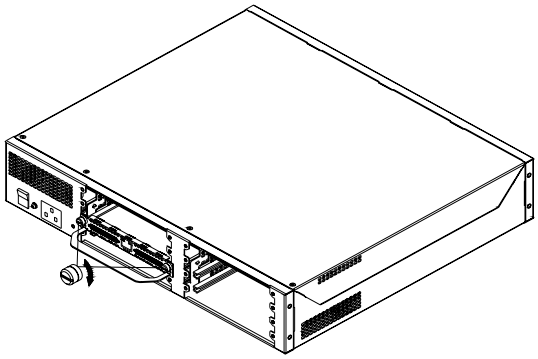

Figure 1-4 Installing MIM (2)

III. Removing MIM

Follow these steps to remove a MIM:

Step 1: Place the rear panel of the Router towards you;

Step 2: Turn off the power switch of the Router and unplug the power cord;

Step 3: Unplug all interface cables from the rear panel of the Router;

Step 4: Loosen the captive screws at both sides of the MIM;

Step 5: Pull the MIM towards you until it is completely separated from the bottom of the router.

1.5.3 Installing/Removing an FIC

Caution:

The EMI gaskets on the FIC panel can filter electromagnetic interference of the router. Do not damage them when uninstalling or replacing an FIC.

If you do not install a new FIC after removing the old one, replace the blank filter panel to keep off the dust and ensure adequate ventilation of the router.

The router series supports hot swapping. Thus, you can remove or install FICs when the router is running without disconnecting the power supply. But before that, you must first execute the remove slot command; otherwise, unknown errors might occur. When you replace the removed FICs, you do not need to execute the undo remove slot command however.

If you execute the remove slot command inadvertently, you can cancel that operation by using the undo remove slot command.

I. Tools required

ESD-preventive wrist strap

II. Removing an FIC

Step 1: Place the router with the front panel forward.

Step 2: Remove the cables connected to the FIC.

Step 3: Loosen the captive screws at both sides of the FIC.

Step 4: Push the ejector levers at both sides of the FIC outward, pull the FIC out of the slot along the guides until disengaging it totally from the slot.

III. Installing an FIC

Step 1: Place the router with the front panel forward.

Step 2: Align the remote edge of the FIC with the slot edge, push it into the slot, push the ejector levers inward until it presses against the FIC panel (the angles thus formed between the FIC panel and the levers are the minimum angles).

Step 3: Fix the FIC in the chassis by fastening the captive screws.

Repeat these steps to install all the other FICs.

1.6 Troubleshooting

3Com 5000 Routers LEDs, indicate the state of the module as follows:

After the installation of a SIC/MIM, turn on the power and view the corresponding LEDs (such as SLOT0, SLOT1 or SLOT2) on the cover of the Router chassis: ON means that the SIC/MIM is operating normally and OFF means that the Power-On Self-Test (POST) of the SIC/MIM has failed.

If the installed SIC/MIM is in abnormal state, check that:

- Proper interface cable is used;
- The LEDs on the panel of SIC/MIM are displaying normally (see the section introducing the SIC/MIM for its LED status and description);
- The SIC/MIM accepts the configuration and works well using the **display** command.

Chapter 2 Smart Interface Cards (Router 5000)

2.1 Router 1-Port 10/100 SIC

1-port 10Base-T/100Base-TX Ethernet interface card, in which FE stands for Fast Ethernet module. This is used to implement the communication between Routers and LANs. It supports:

- Effective transmission distance of 100 meters with category-5 twisted pair cables;
- Operating speeds of both 100 Mbps and 10 Mbps and autosensing;
- Both full duplex (in common use) and half-duplex operating modes.

2.1.1 Interface Attributes

The interface attributes of Router 1-Port 10/100 SIC are given in the following table:

Table 2-1 Interface attributes of Router 1-Port 10/100 SIC

Attribute	Router 1-Port 10/100 SIC	
Connector type	RJ-45	
Interface type	MDI	
Number of connectors	1	
Cable type	Straight-through Ethernet cable	

Router 1-Port 10/100 SIC panel is shown in the following figure:

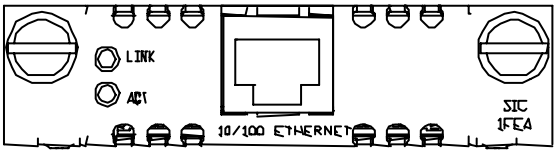

Figure 2-1 Router 1-Port 10/100 SIC panel

The status description of the LEDs on Router 1-Port 10/100 SIC panel is listed in the following table:

Table 2-2 Description of the LEDs on Router 1-Port 10/100 SIC panel

LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is

	being received or/and transmitted.

2.1.2 Interface Cable

Normally, category-5 twisted pair cable is adopted to connect the 10BASE-T /100BASE-TX Ethernet interface to the Ethernet, as shown in the following figure:

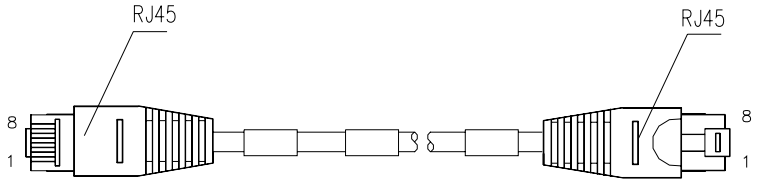

Figure 2-2 Ethernet cable

Ethernet cables fall into two categories: straight-through cables and crossover cables, specifically,

- Straight-through cable: the wire sequences of the twisted pair cable crimped in the RJ-45 connectors at both ends are completely the same. It is used to connect terminal devices (such as PCs, routers) to Hubs or LAN Switches.
- Crossover cable: The wire sequences of twisted pair cable crimped in the RJ-45 connectors at both ends are different. It can be used to connect two terminal devices (such as PCs and Routers). You can such kind of cables by yourself if necessary.

2.1.3 Connecting the Interface Cable

If the SIC has been properly installed, follow these steps to connect the interface cable:

Step 1: Connect the Ethernet port of SIC to a PC or router using a crossover cable and to a Hub or LAN Switch using a straight-through cable;

Step 2: Power on the Router and check the SLOT1 LED on its front panel: ON means that the SIC is operating normally and OFF means that the Power-On Self-Test (POST) of the SIC has failed. In the latter case, please contact your agent.

Step 3: Check the status of LINK LED on the panel: ON means the link is connected and OFF means the link is not connected. In the latter case, check the line.

2.2 Router 1-Port Serial SIC

2.2.1 Introduction

1-port multiprotocol synchronous/asynchronous serial interface card (Router 1-Port Serial SIC) supports both synchronous and asynchronous operating modes. It supports:

- Transmission/Receiving and handling of synchronous and asynchronous serial data streams;
- Different operating modes, such as V.24/V.35 and DTE/DCE, depending on the actual applications;
- Automatic external cable type detection without the need of manual configuration;
- Local loopback and remote loopback, facilitating fault test and location.

I. Synchronous and asynchronous

In different operating modes, a synchronous/asynchronous serial interface supports different signal standards and baud rates and the maximum transmission distance of the signals is related to the baud rate setting. For the relationships between cable type, baud rate setting and signal transmission distance, see the following table.

Table 2-3 Baud rate and transmission distance of V.24 (RS232)/V.35 cable

V.24 (RS232)		V.35	
Baud rate (bps)	Maximum transmission Distance (m)	Baud rate (bps)	Maximum transmission Distance (m)
2400	60	2400	1250
4800	60	4800	625
9600	30	9600	312
19200	30	19200	156
38400	20	38400	78
64000	20	56000	60
115200	10	64000	50
-	-	2048000	30

Caution:

The baud rate cannot exceed 64 kbps if V.24 cable is used and the interface operates in synchronous mode.

II. DTE and DCE

The synchronous serial interface supports both DTE (Data Terminal Equipment) and DCE (Data Circuit-terminating Equipment) operating modes. Given that two devices are directly connected, if one operates in the DTE mode, the other will operate in the DCE mode. The DCE device provides the synchronous clock and specifies the communicating rate. The DTE device receives the synchronous clock and communicates at the specified rate. Generally, the Router is used as a DTE device. To make sure that the device is a DTE or DCE, refer to the manual shipped with this device. In addition, the following table may also help you to identify the type of the device.

Table 2-4 Typical DTE and DCE equipment

Equipment type	Interface type	Typical equipment
DTE	Male	PC, Router
DCE	Female	Modem, Multiplexer, CSU/DSU

Asynchronous serial interface is generally used as dialing port and connected to a modem or a Terminal Adapter (TA). In this case, regardless of the operating mode of the device, only an appropriate baud rate for the interface needs to be selected.

Synchronous serial interface is generally used for the direct connection to such a device as DDN, frame relay, or X.25 switch.

2.2.2 Appearance

Router 1-Port Serial SIC is illustrated in the following figure:

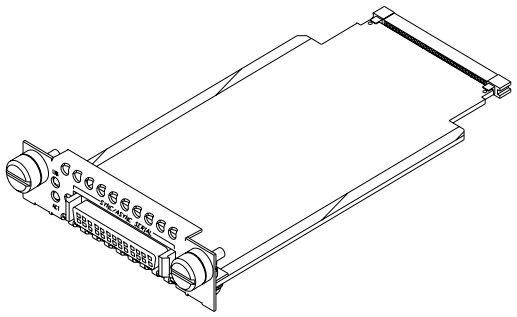

Figure 2-3 Router 1-Port Serial SIC

2.2.3 Interface Attributes

The interface attributes of Router 1-Port Serial SIC are given in the following table:

Table 2-5 Interface attributes of Router 1-Port Serial SIC

Attribute	Description			
	Synchronous	Asynchronous		
Connector type	DB50			
Number of connectors	1			
Cable type	V.24 (RS232) DTE cable V.24 (RS232) DCE cable V.35 DTE cable V.35 DCE cable			
Interface standard and Operating mode	V.24	V.35		RS232
	DTE, DCE	DTE	DCE	
Minimum baud rate (bps)	1200	1200	1200	300
Maximum baud rate (bps)	64K	4.096M	2.048M	115.2K

Attribute	Description	
	Synchronous	Asynchronous
Supported service	DDN leased line Terminal access Backup	Modem dial-up Dumb terminal access Asynchronous leased line Backup

2.2.4 Interface LEDs

Router 1-Port Serial SIC panel is shown in the following figure:

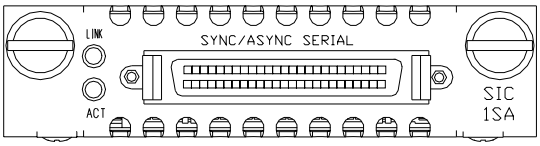

Figure 2-4 Router 1-Port Serial SIC panel

The status description of the LEDs on Router 1-Port Serial SIC panel is listed in the following table:

Table 2-6 Description of the LEDs on Router 1-Port Serial SIC panel

LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

2.2.5 Interface Cable

Router 1-Port Serial SIC interface cables are synchronous/asynchronous serial interface cables that fit into four types:

- V.24 (RS232) DTE cable, with DB25 (male) connector at the network end;
- V.24 (RS232) DCE cable, with DB25 (female) connector at the network end;
- V.35 DTE cable, with 34PIN (male) connector at the network end;
- V.35 DCE cable, with 34PIN (female) connector at the network end.

At one end of these cables is DB50 connector for the connection to a router, and at the other end (network end) is a connector whose type varies by the network device (or line type) to be connected.

Caution:

The four types of cables listed above are optional, which must be selected while purchasing the Router 1-Port Serial SIC. Otherwise they will not be supplied.

- V.24 (RS232) DTE cable

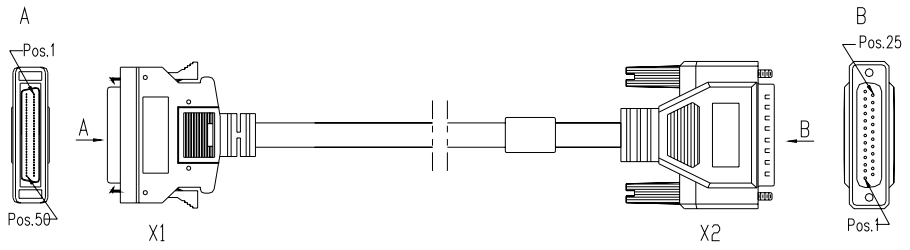

Figure 2-5 V.24 (RS232) DTE cable

- V.24 (RS232) DCE cable

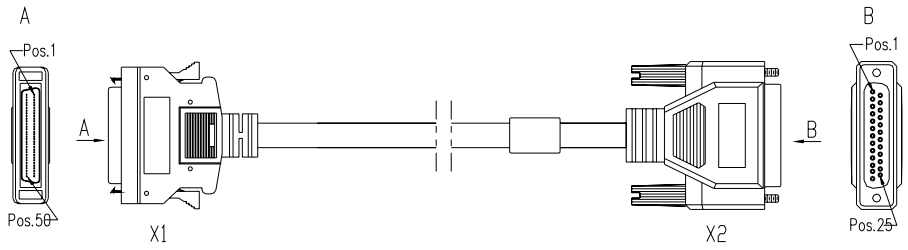

Figure 2-6 V.24 (RS232) DCE cable

- V.35 DTE cable

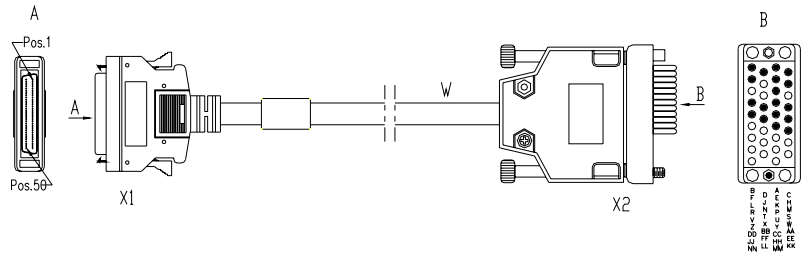

Figure 2-7 V.35 DTE cable

- V.35 DCE cable

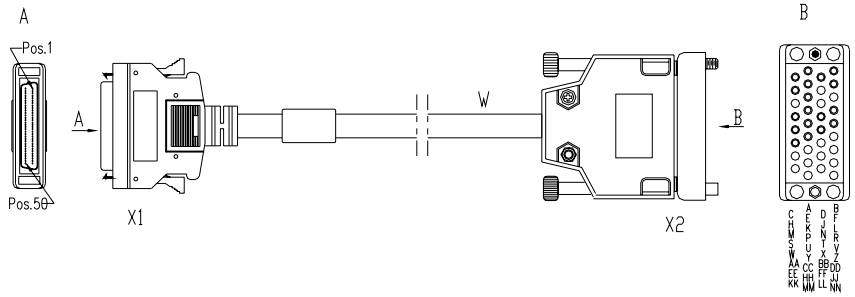

Figure 2-8 V.35 DCE cable

For the pinouts of synchronous/asynchronous serial interface cable, see *Low-End and Mid-Range Series Routers Cable Manual*.

2.2.6 Connecting Interface Cable

Warning:

Do not plug or unplug synchronous/asynchronous serial interface cables when the Router has power. Otherwise, it is likely to damage the equipment and ports.

If the SIC has been properly installed, follow these steps to connect the synchronous/asynchronous serial interface cable:

Step 1: Insert the DB50 connector of the cable into the DB50 port on the Router 1-Port Serial SIC;

Step 2: Connect the other end of the cable to:

- CSU/DSU (a type of data transfer device), if the WAN is a DDN line, or
- Analog modem, if the WAN is a dial-up line.

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the SIC is operating normally and OFF means that the POST of the SIC has failed. In the latter case, please contact your agent;

Step 4: Check the status of LINK LED on the Router 1-Port Serial SIC panel: ON means the link is connected and OFF means the link is not connected. In the latter case, check the line.

2.3 Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC

2.3.1 Introduction

1/2-port ISDN BRI S/T interface cards (Router 2-Port ISDN-S/T SIC) serve to transmit/receive and handle one and two channels of ISDN BRI S/T data streams. 1/2-port ISDN BRI U interface cards (Router 2-Port ISDN-U SIC) server to transmit/receive and handle one and two channels of ISDN BRI U data streams.

Both Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC have two types of operating modes: dial-up and leased line.

2.3.2 Appearance

Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC are shown in the following figures:

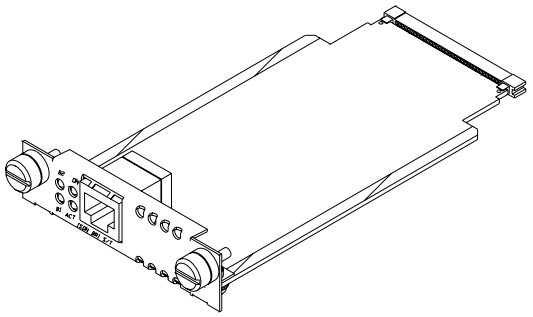

Figure 2-9 Router 2-Port ISDN-S/T SIC

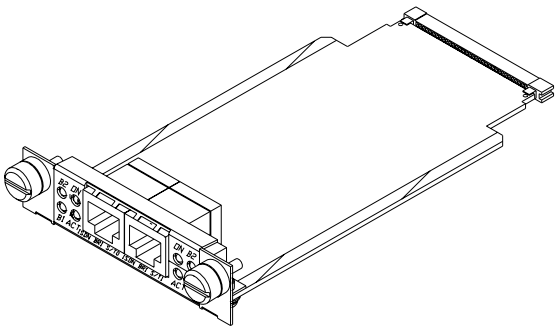

Figure 2-10 Router 2-Port ISDN-U SIC

2.3.3 Interface Attributes

The interface attributes of Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC are given in the following table:

Table 2-7 Interface attributes of Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC

Attribute	Description
Connector type	RJ45 (Router 2-Port ISDN-S/T SIC) RJ45 (Router 2-Port ISDN-U SIC, compatible with RJ11)
Number of connectors	1 2
Cable type	Telephone cable with ferrite core
Protocol standard	ITU-T I.430, Q.921, Q.931 Recommendations
Operating mode	ISDN dial-up mode ISDN leased line mode
Supported service	ISDN ISDN complementary services Multi-user number Sub-address Backup

2.3.4 Interface LEDs

Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC panels are shown in the following figures:

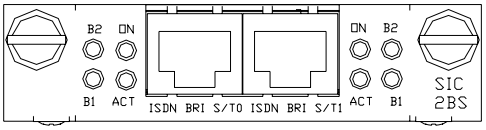

Figure 2-11 SIC-2BS panel

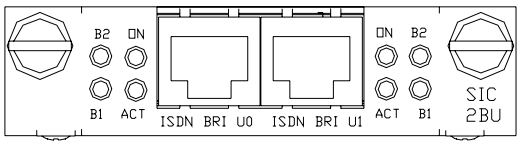

Figure 2-12 SIC-2BU panel

The status description of the LEDs is given in the following table:

Table 2-8 Description of the LEDs on SIC-BS and SIC-BU panels

LED	Description
B1	OFF means B1 channel is idle. Blinking means B1 channel is occupied and data communication is being conducted.
B2	OFF means B2 channel is idle. Blinking means B2 channel is occupied and data communication is being conducted.
ACT	OFF means deactivation. Blinking means activating process. ON means active status.
ON	OFF means the power to the SIC is disconnected (caused by the failure of power supply to the SIC and so on). ON means the SIC is normally powered on.

Note:

For ISDN, “active” describes the action or process that a terminal device synchronizes the network clock. It belongs to the physical layer category. In order to decrease power consumption of exchange device and etc., usually the terminals and network (LT port) should be “deactivated”.

2.3.5 Interface Cable

Both of Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC use the telephone cable with ferrite core.

Caution:

The relevant cables have been included in the standard configurations of Router 2-Port ISDN-S/T SIC and Router 2-Port ISDN-U SIC.

2.3.6 Connecting Interface Cable

Caution:

- You should connect a cable to the port with the correct mark. Misplugging is prone to impair the SIC/MIM and even damage the router.
- When using a telephone cable with ferrite core outdoors, you are recommended to install a special lightning arrester on the input end of the cable in order to avoid lightning more effectively.

If the SIC has been properly installed, follow these steps to connect the cable:

Step 1: Confirm the type of the ISDN line provided by your telecom service provider;

Step 2: Connect the cable;

- For Router 2-Port ISDN-S/T SIC

If the ISDN U interface is adopted for the line, use NT1 for conversion. The connecting procedure is to insert one end of the telephone cable with ferrite core into the BRI S/T interface of Router 2-Port ISDN-S/T SIC and the other end into the NT1.

If the line uses the ISDN S/T interface, directly insert the cable with ferrite core into the BRI S/T interface of the Router 2-Port ISDN-S/T SIC and the other end into the ISDN S/T interface.

- For Router 2-Port ISDN-U SIC

If the ISDN U interface is adopted for the line, directly insert the cable with ferrite core into the BRI U interface of the Router 2-Port ISDN-U SIC and the other end into the ISDN U interface.

If the line uses the ISDN S/T interface, contact the agent and replace the SIC with Router 2-Port ISDN-S/T SIC.

Step 3: Power on the Router, and check the corresponding Related LED on the front panel of the Router. If the LED is ON, it indicates that the SIC has passed the self-test and can operate normally. If the LED is OFF, it indicates the failure of the self-test. In such a case, please contact your agent.

Step 4: Check the LED on the SIC panel: ON means the SIC is normally powered on. If it is OFF, contact the agent.

2.4 Router 1-Port Fractional E1 SIC

2.4.1 Introduction

1-port channelized E1/cE1/PRI compatible interface card supports:

- Transmission/Receiving and handling of E1 data streams;
- CE1 (channelized E1) access;
- ISDN PRI function;
- Remote loopback and local loopback functions, facilitating fault test and location.

It is possible to use the card for multiple purposes through different configurations.

Following are the differences between SIC-EPRI and 1-port Fractional E1 interface card (Router 1-Port Fractional E1 SIC):

- FE1 mode of Router 1-Port Fractional E1 SIC can support only one channel bundle (the rate is n x 64kbps, n=1-31), while the 31 channels can be grouped into multiple arbitrary bundles by SIC-EPRI;
- Router 1-Port Fractional E1 SIC does not support PRI mode.

2.4.2 Appearance

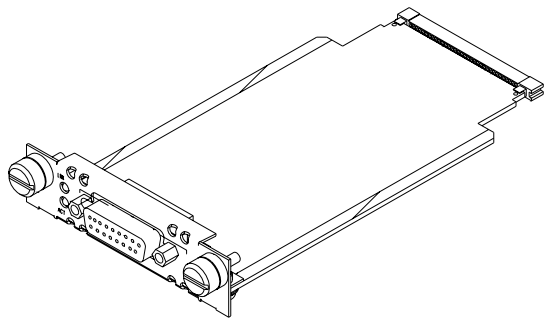

Figure 2-13 Router 1-Port Fractional E1 SIC

2.4.3 Interface Attributes

The interface attributes of Router 1-Port Fractional E1 SIC are given in the following table:

Table 2-9 Interface attributes of Router 1-Port Fractional E1 SIC

Attribute	Description
Connector type	DB15
Number of connectors	1
Interface standard	G.703, G.704
Interface rate	2.048Mbps
Cable type	75-ohm non-balanced coaxial cable (DB15 to BNC) 120-ohm balanced twisted-pair cable (DB15 to RJ45) Coaxial connector, network interface connector and 75-ohm to 120-ohm adapter
Operating mode	E1 cE1, ISDN PRI (supported by SIC-EPRI only) FE1(supported by Router 1-Port Fractional E1 SIC only)
Supported service	Backup Terminal access ISDN (supported by SIC-EPRI only)

2.4.4 DIP Switch

E1/cE1/PRI interface is compatible with both 75-ohm impedance and 120-ohm impedance. The interface matches different types of impedance through an 8BIT DIP switch. By default, all the 8 positions of the DIP switch are ON, as shown in the following figure:

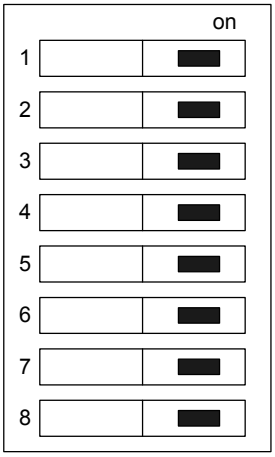

Figure 2-14 Default setting of the DIP switches

8BIT description and settings of DIP switch are given in the following table:

Table 2-10 Description and settings of the internal DIP switch of SIC-ERRI/Router 1-Port Fractional E1 SIC

DIP switch	Description	75 -ohm impedance	120 -ohm impedance
1BIT	Switch for 75-ohm/120-ohm options	ON	OFF
2BIT		ON	OFF
3BIT		ON	OFF
4BIT		ON	OFF
5BIT		ON	OFF
6BIT	Switch for RxRing grounding mode options	OFF: RxRing grounding via capacitor ON: RxRing directly grounding	-
7BIT	Switch for RxShield grounding options	-	ON: RxShield grounding OFF: RxShield ungrounding

DIP switch	Description	75 -ohm impedance	120 -ohm impedance
8BIT	Switch for RxShield grounding options	-	OFF: RxShield grounding via capacitor ON: RxShield directly grounding

Caution:

- When setting internal DIP switch, you are recommended to: turn ON all BITs from 1 to 8 when a 75-ohm cable is connected. Turn OFF all BITs from 1 to 8 when a 120-ohm cable is connected;
- The default configuration of internal DIP switch is that all the 8 positions of the BIT switch are ON, that is, the E1 interface impedance is 75-ohm.

2.4.5 Interface LEDs

Router 1-Port Fractional E1 SIC panel is shown in the following figure:

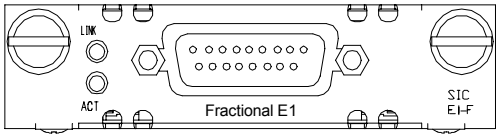

Figure 2-15 Router 1-Port Fractional E1 SIC panel

The status description of the LEDs is given in the following table:

Table 2-11 Description of the LEDs on Router 1-Port Fractional E1 SIC panel

LED	Description
LINK	OFF means the link is not connected. ON means the link is connected and can correctly receive carrier (E1 mode) or frame synchronous signals (cE1/PRI or FE1).
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

2.4.6 Interface Cable

Interface cables for Router 1-Port Fractional E1 SIC are standard E1 G.703 cables. E1 G.703 cables have two types: 75-ohm non-balanced coaxial cables and 120-ohm balanced twisted pair cables, shown as follows:

- 75-ohm non-balanced coaxial cable

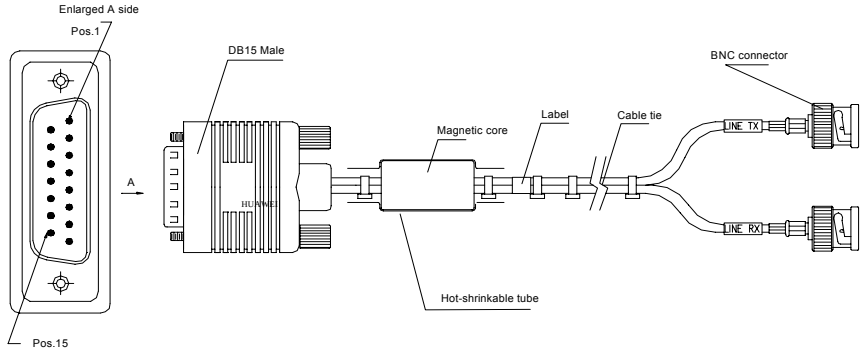

Figure 2-16 E1 G.703 75-ohm non-balanced coaxial cable

75-ohm non-balanced coaxial cable connects Router 1-Port Fractional E1 SIC with the DB15 connector and the network end with the BNC connector.

Note:

A pair of coaxial connectors are available for extending the E1 cable. Both ends of the connectors are BNC receptacles that can be used to connect two 75-ohm non-balanced coaxial cables with BNC connectors.

- 120-ohm balanced twisted pair cable

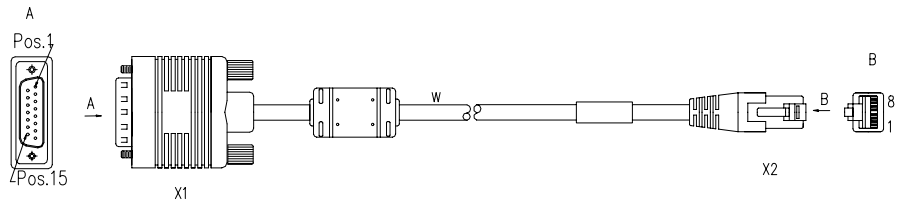

Figure 2-17 E1 G.703 120-ohm balanced twisted pair cable

120-ohm balanced twisted pair cable connects Router 1-Port Fractional E1 SIC with the DB15 connector and network end with the RJ45 connector.

Note:

A network interface connector is available for extending the E1 cable. Both ends of the connector are RJ45 jacks that can be used to connect two 120-ohm balanced twisted pair cables.

In addition, a 75-ohm to 120-ohm adapter is available.

For the pinouts of E1 cables, see *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

E1 cable, coaxial connector, network interface connector and 75ohm-to-120ohm adapter are optional, which must be ordered together with Router 1-Port Fractional E1 SIC. Otherwise they will not be supplied.

2.4.7 Connecting Interface Cable

Caution:

When using E1 cable outdoors, you are recommended to install a special lightning arrester on the input end of the cable in order to avoid lightning more effectively.

If the SIC has been properly installed, follow these steps to connect the cable:

Step 1: Check the type of E1 cable and correctly set the DIP switch (the ex-factory setting of E1/cE1/PRI interface impedance is 75-ohm);

Step 2: Connect the DB15 connector of E1 cable to Router 1-Port Fractional E1 SIC;

Step 3: Connect the other end of the E1 cable to the corresponding network device:

1) When the E1 cable is a 75-ohm unbalanced coaxial cable:

- Directly connect the BNC connector of the cable to the remote equipment if there is no need for extension, or
- Connect the BNC connector of the cable to the coaxial connector and the other end of the coaxial connector to the remote network equipment through a 75-ohm E1 trunk cable, if cable extension is needed.

Caution:

The wire marked TX in the E1 cable should be connected to the peer wire marked RX and the wire marked RX should be connected to the peer wire marked TX.

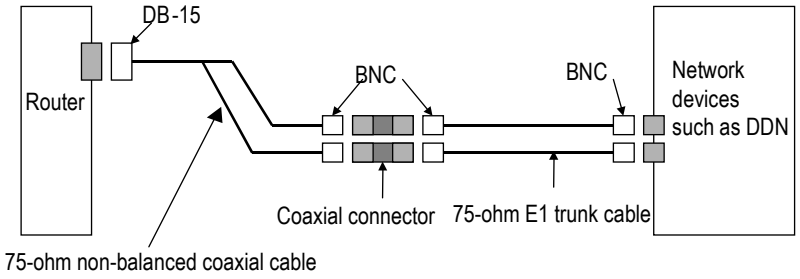

Figure 2-18 Extending an E1 75-ohm non-balanced coaxial cable

If the remote device has 120-ohm interface, it is needed to use a 75-ohm-to-120-ohm adapter or use a 120-ohm cable.

2) When the E1 cable is a 120-ohm balanced twisted pair cable:

- Directly connect the RJ45 connector of the cable to the RJ45 port of the remote equipment, if there is no need to extend the E1 cable, or
- Connect the RJ45 connector of the cable to the network connector and the other end of the network connector to the network equipment through a 120-ohm E1 trunk cable, if cable extension is needed.

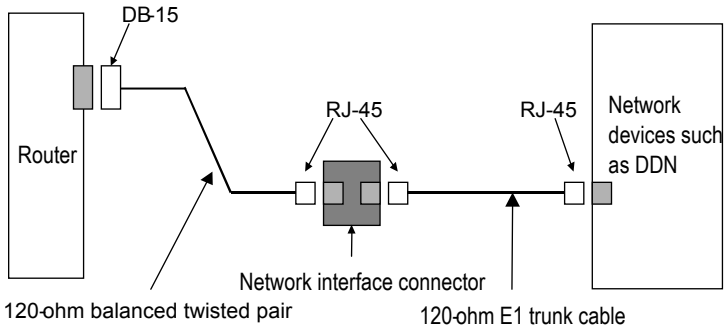

Figure 2-19 Extending an E1 120-ohm balanced twisted pair cable

Step 4: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the SIC is operating normally and OFF means that the Power-On Self-Test (POST) of the SIC has failed. In the latter case, please contact your agent;

Step 5: Check the status of LINK LED on the Router 1-Port Fractional E1 SIC panel: ON means the link is connected and OFF means the link is not connected. In the latter case, check the line.

2.5 Router 1-Port Fractional T1 SIC

2.5.1 Introduction

1-port channelized T1/cT1/PRI compatible interface card supports:

- Transmission/Receiving and handling of T1 data streams;
- cT1 (channel T1) access;
- ISDN PRI function;
- Remote loopback and local loopback, facilitating the effective and flexible debugging.

It is possible to use the card for multiple purposes through different configurations.

Following are the differences between and 1-port Fractional T1 interface card (Router 1-Port Fractional T1 SIC):

- FT1 mode of Router 1-Port Fractional T1 SIC can support only one channel bundle (the rate is n x 56 kbps, n=1-24), while the 24 channels can be grouped into multiple arbitrary bundles by SIC-TPRI.
- Router 1-Port Fractional T1 SIC does not support PRI mode.

2.5.2 Appearance

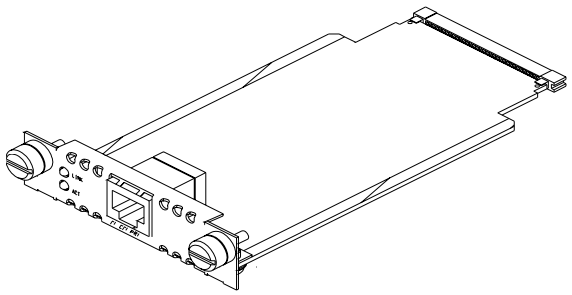

Figure 2-20 Router 1-Port Fractional T1 SIC

2.5.3 Interface Attributes

The interface attributes of Router 1-Port Fractional T1 SIC are given in the following table:

Table 2-12 Interface attributes of Router 1-Port Fractional T1 SIC

Attribute	Description
Connector type	RJ45
Number of connectors	1
Interface standard	G.703/T1.102, G.704
Interface rate	1.544Mbps
Cable type	T1 cable (100-ohm standard shielded network cable)
Operating mode	cT1, ISDN PRI FT1(supported by Router 1-Port Fractional T1 SIC only)
Supported service	Backup Terminal access ISDN (supported by SIC-TPRI ony)

2.5.4 Interface LEDs

Router 1-Port Fractional T1 SIC panel is shown in the following figure:

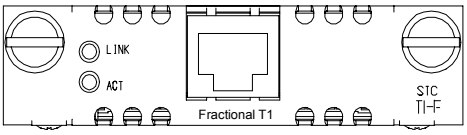

Figure 2-21 Router 1-Port Fractional T1 SIC panel

The status description of the LEDs is given in the following table:

Table 2-13 Description of the LEDs on Router 1-Port Fractional T1 SIC panel

LED	Description
LINK	OFF means the link is not connected. ON means the link is connected and frame synchronization signal can be correctly received.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

2.5.5 Interface Cable

Router 1-Port Fractional T1 SIC interface cable is 100-ohm standard shielded network cable that has RJ45 connectors at both ends. The following figure illustrates a Router 1-Port Fractional T1 SIC interface cable:

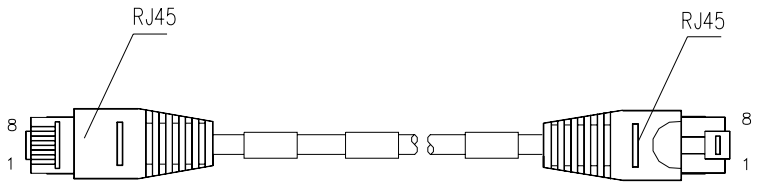

Figure 2-22 T1 cable

For the pinouts of T1 cable, see *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

Relevant cables are included in the standard shipment package of Router 1-Port Fractional T1 SIC.

2.5.6 Connecting Interface Cable

Caution:

- You should connect a cable to the port with the correct mark. Misplugging is prone to impair the SIC/MIM and even damage the router.
- When using T1 cable outdoors, you are recommended to install a special lightning arrester on the input end of the cable so as to avoid lightning more effectively.

If the SIC has been properly installed, follow these steps to connect the cable:

Step 1: Connect one end of the T1 cable to the RJ45 port of Router 1-Port Fractional T1 SIC;

Step 2: Connect the other end of the T1 cable to the relevant equipment;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the SIC is operating normally and OFF means that the POST of the SIC has failed. In the latter case, please contact your agent.

Step 4: Check the status of LINK LED on the Router 1-Port Fractional T1 SIC panel: ON means the link is connected and OFF means the link is not connected. In the latter case, check the line.

2.6 Router 1-Port Analog Modem SIC

2.6.1 Introduction

1/2-port analog modem interface card（Router 1-Port Analog Modem SIC) integrates the functions of asynchronous interface and external modem, that is, allowing 1/2 channel(s) of remote modem subscribers to directly access the Router. They support:

- Data rate of 56 kbps.
- Accessing and handling analog signals and transmitting the processed data to the Router host through the serial interface bus. And also, processing the data received from the host and then transmitting them to the PSTN via the telephone port.

2.6.2 Appearance

Router 1-Port Analog Modem SIC and are shown in the following figures:

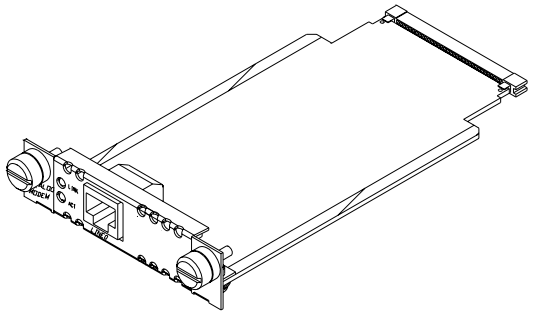

Figure 2-23 Router 1-Port Analog Modem SIC

2.6.3 Interface Attributes

The interface attributes of Router 1-Port Analog Modem SIC are given in the following table:

Table 2-14 Interface attributes of Router 1-Port Analog Modem SIC

Attribute	Description
Connector type	RJ11

Attribute	Description
Number of connectors	1 (Router 1-Port Analog Modem SIC) 2 ()
Cable type	Telephone cable with ferrite core
Maximum speed	56kbps
Supported standard	ITU-T V.90, V.34 (33.6 kbps), V.FC, V.32 bis, V.32, V.22 bis, V.22A/B, V.23, V.21, Bell 212A a, Bell 103.
Supported service	Modem dial-up

2.6.4 Interface LEDs

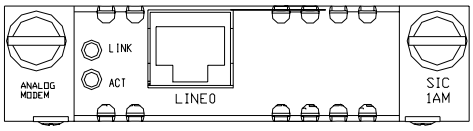

Figure 2-24 Router 1-Port Analog Modem SIC panel

Table 2-15 Description of the LEDs on Router 1-Port Analog Modem SIC panel

LED	Description
LINK	OFF means the link is idle. ON means the connection has been established. Blinking means the connection is being set up.
ACT	OFF means the link is idle. Blinking means data is being transmitted or received.

2.6.5 Interface Cable

The connection cables for Router 1-Port Analog Modem SIC are telephone cables with ferrite core. Both ends of the cables are RJ11 connectors. For cable pinouts, refer to *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

Relevant cables are included in the standard shipment package of Router 1-Port Analog Modem SIC.

2.6.6 Connecting Interface Cable

Caution:

- You should connect a cable to the port with the correct mark. Misplugging is prone to impair the SIC/MIM and even damage the router.
- You are recommended to install a special lightning arrester on the input end of the telephone line in order to avoid the lightning effects more efficiently.

If the SIC has been properly installed, follow these steps to connect the cable:

Step 1: Insert the end with ferrite core into one LINE port of Router 1-Port Analog Modem SIC;

Step 2: Plug the other end of the cable into the telephone wall jack;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the SIC is operating normally and OFF means that the POST of the SIC has failed. In the latter case, please contact your agent.

2.7 Router 1-Port FXS SIC/FXO SIC and Router 2-Port FXS SIC/FXO SIC

2.7.1 Introduction

1/2-port voice subscriber circuit interface card (Router 1 or 2-Port FXS SIC) and 1/2-port voice AT0 analog trunk interface card (Router 1 or 2-Port FXO SIC) serve to access and handle 1/2 channel(s) of analog voice signals over data communication networks. The differences between FXS SIC and FXO SIC are listed below:

- FXS SIC cards are analog subscriber line cards that provide ordinary analog telephone and fax access and also can connect AT0 loop trunks of exchanges;
- FXO SIC cards are loop trunk cards that provide access of common subscriber lines of exchanges.

Caution:

While using FXS SIC/FXO SIC, you must ensure that the 3Com Routers can be connected to IP networks or other WANs.

2.7.2 Appearance

- Router 1-Port FXS/FXO SIC

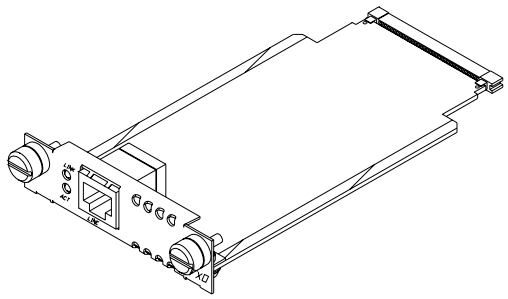

Figure 2-25 Router 1-Port FXS/FXO SIC

- Router 2-Port FXS/FXO SIC

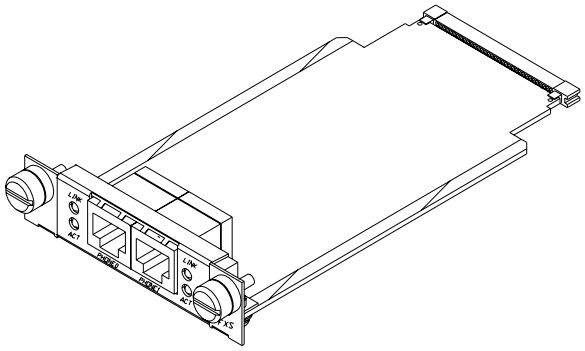

Figure 2-26 Router 2-Port FXS/FXO SIC

2.7.3 Interface Attributes

The interface attributes of Router 1-Port FXS/FXO SIC and Router 2-Port FXS/FXO SIC are given in the following table:

Table 2-16 Interface attributes of Router 1-Port FXS/FXO SIC and Router 2-Port FXS/FXO SIC

Attribute	Description
Connector type	RJ11
Number of connectors	1 (Router 1-Port FXS/FXO SIC) 2 (Router 2-Port FXS/FXO SIC)
Interface standard	Subscriber circuit interface (Router 1 or 2-Port FXS SIC) compliant with ITU Q.512. Loop trunk interface (SIC-1FXO/SIC-2FXO) compliant with ITU Q.552. Over-current and over-voltage protection compliant with ITU K.20
Cable type	Telephone cable with ferrite core.
Dialing mode	Supports DTMF, not supports pulse dial-up.
Bandwidth	300 to 3400Hz

2.7.4 Interface LEDs

- Router 1-Port FXS/FXO SIC panel

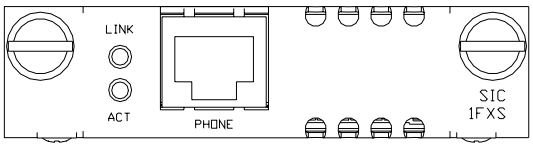

Figure 2-27 Router 1-Port FXS SIC panel

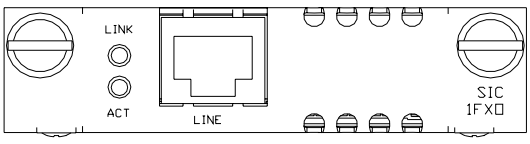

Figure 2-28 Router 1-Port FXO SIC panel

- Router 2-Port FXS/FXO SIC panel

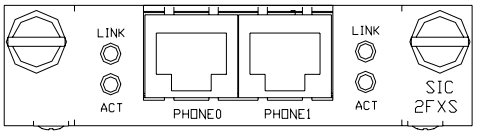

Figure 2-29 Router 2-Port FXS SIC panel

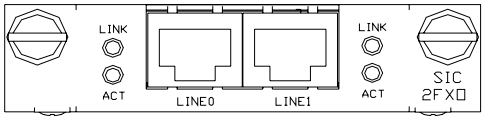

Figure 2-30 Router 2-Port FXO SIC panel

The status description of the LEDs of Router 1-Port FXS/FXO SIC and Router 2- Port FXS/FXO SIC is shown in the following table:

Table 2-17 Description of the LEDs on Router 1-Port FXS/FXO SIC and Router 2-Port FXS/FXO SIC panels

LED	Description
LINK	OFF means the link is idle. ON means the link is being occupied for call connection.
ACT	OFF means the link is idle. ON means the link is being occupied for communication.

2.7.5 Interface Cable

Connection cables for Router 1-Port FXS/FXO SIC and Router 2- Port FXS/FXO SIC are telephone cables with ferrite core. Both ends of the cables are RJ11 connectors. For cable pinouts, see *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

The standard shipment package of Router 1-Port FXS/FXO SIC and Router 2-Port FXS/FXO SIC includes a ferrite core telephone cable.

2.7.6 Connecting Interface Cable

Caution:

- You should connect a cable to the port with the correct mark. Misplugging is prone to impair the SIC/MIM and even damage the router.
- When the telephone cable is used outdoors, it is recommended that users install a special lightning arrester on the input end of the cable in order to avoid the lightning effects more efficiently.
- One end of the telephone cable has a ferrite core. To ensure the compatibility of the Router, users should connect the end with the ferrite core to the Router.

If the SIC is properly installed, follow these steps to connect the cable:

Step 1: Connect the end with the ferrite core to a RJ11 port of FXS/FXO SIC ;

Step 2: Insert the other end to

- a telephone or fax or the AT0 loop trunk if a Router 1 or 2-Port FXS SIC is installed;
- a subscriber line of exchange if a Router 1 or 2-Port FXO SIC is installed;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the SIC is operating normally and OFF means that the POST of the SIC has failed. In the latter case, please contact your agent.

2.8 Router 1-Port SAE SIC

2.8.1 Introduction

Router 1-Port SAE SIC, 1-port enhanced high-speed sync/async serial interface card, provides functions similar to SA, but its serial interfaces support more protocols, such as RS449, X.21, and RS530.

2.8.2 Interface Attributes

The interface attributes of the Router 1-Port SAE SIC are given in the following table:

Table 2-18 Interface attributes of the Router 1-Port SAE SIC

Attribute	Description		
	Synchronous		Asynchronous
Connector	DB-28		
Number of connectors	1		
Interface standard and	V.24	V.35, RS449, X.21, RS530	RS232

Attribute	Description		
	Synchronous		Asynchronous
operating mode	DTE, DCE	DTE, DCE	
Minimum baud rate (bps)	1200	1200	300
Maximum baud rate (bps)	64 k	2.048 M	115.2
Cable	V.24 (RS232) DTE cable V.24 (RS232) DCE cable V.35 DTE cable V.35 DCE cable X.21 DTE cable X.21 DCE cable RS449 DTE cable RS449 DCE cable RS530 DTE cable RS530 DCE cable		
Services supported	1) DDN leased line 2) Terminal access service		1) Dialup through modems 2) Backup 3) Async leased line 4) Terminal access

2.8.3 Interface LEDs

Router 1-Port SAE SIC panel is shown in the following figure:

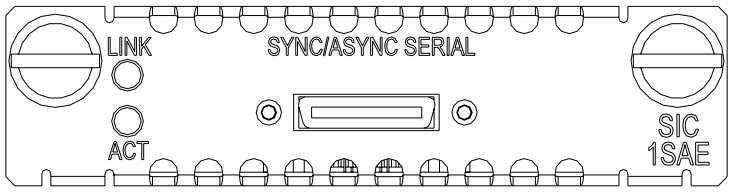

Figure 2-31 Router 1-Port SAE SIC panel

Description of the LEDs on Router 1-Port SAE SIC panel is given in the following table:

Table 2-19 LEDs on Router 1-Port SAE SIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

2.8.4 Interface Cable

The Router 1-Port SAE SIC uses a synchronous/asynchronous serial interface cable with DB-28 connectors for connection.

Before connecting to a port on the Router 1-Port SAE SIC, confirm the line properties of the interface to select an appropriate cable from the following cable options:

- V.24 (RS232) DTE cable: DB-25 (male) connector at the network end
- V.24 (RS232) DCE cable: DB-25 (female) connector at the network end
- V.35 DTE cable: 34PIN (male) connector at the network end
- V.35 DCE cable: 34PIN (female) connector at the network end
- X.21 DTE cable: DB-15 (male) connector at the network end
- X.21 DCE cable: DB-15 (female) connector at the network end
- RS449 DTE cable: DB-37 (male) connector at the network end
- RS449 DCE cable: DB-37 (female) connector at the network end
- RS530 DTE cable: DB-25 (male) connector at the network end
- RS530 DCE cable: DB-25 (female) connector at the network end

At one end of these cables is a DB-28 connector and at the other end is the connector that varies with the port at the network side.

- V.24 DTE cable

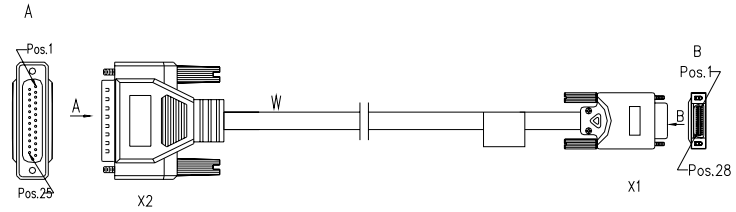

Figure 2-32 V24 DTE cable

- V.24 DCE cable

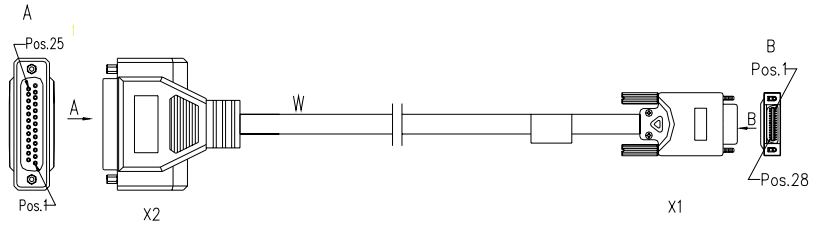

Figure 2-33 V.24 DCE cable

- V.35 DTE cable

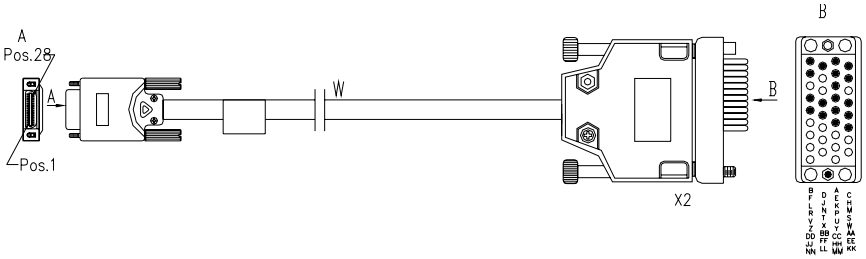

Figure 2-34 V.35 DTE cable

- V.35 DCE cable

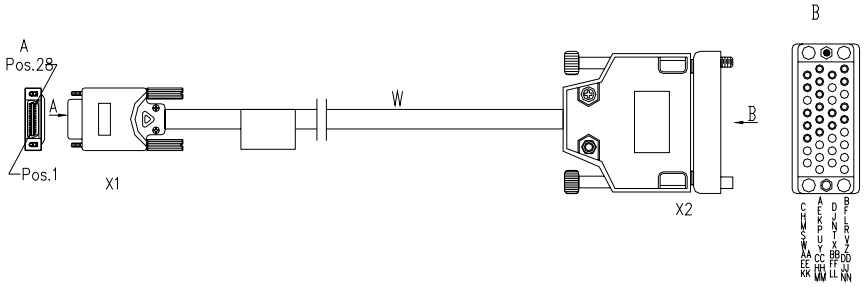

Figure 2-35 V.35 DCE cable

- X.21 DTE cable

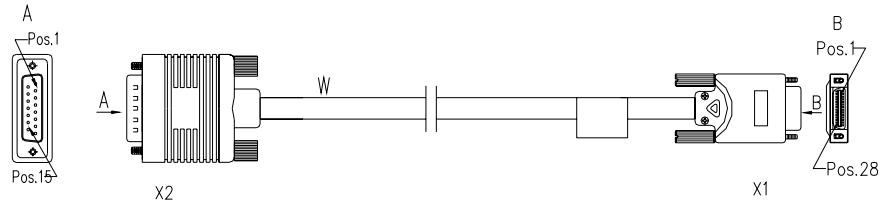

Figure 2-36 X.21 DTE cable

- X.21 DCE cable

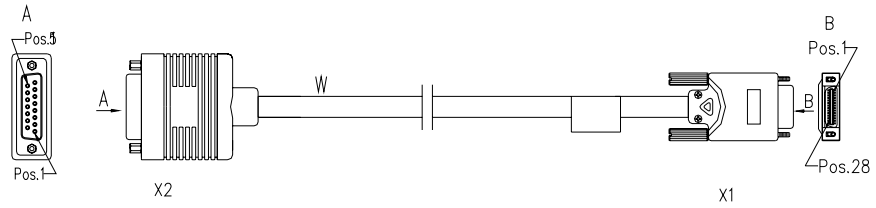

Figure 2-37 X.21 DCE cable

- RS449 DTE cable

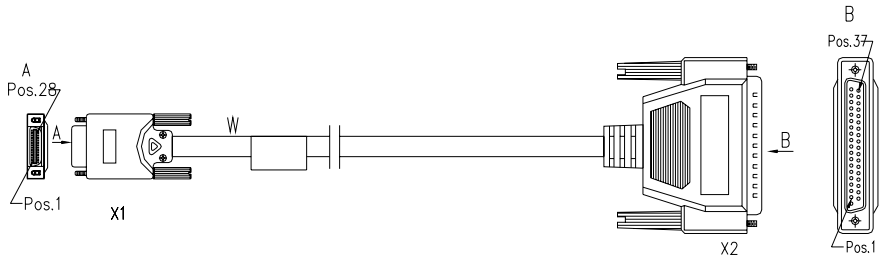

Figure 2-38 RS449 DTE cable

- RS449 DCE cable

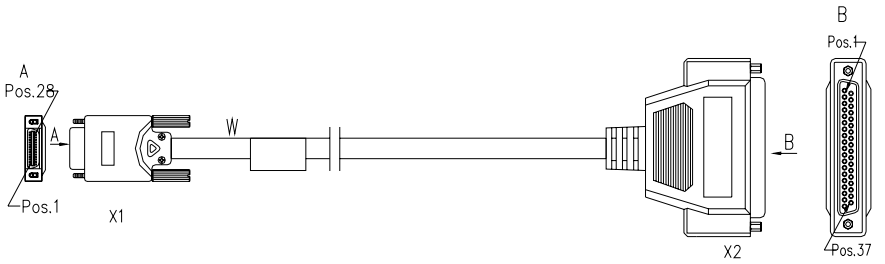

Figure 2-39 RS449 DCE cable

- RS530 DTE cable

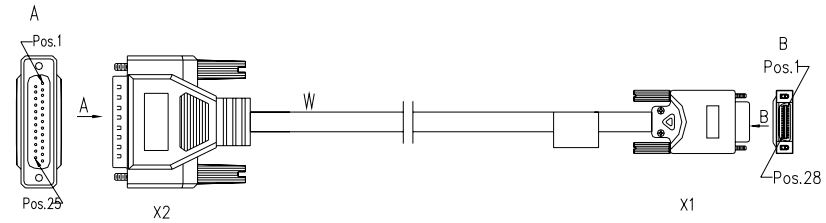

Figure 2-40 RS530 DTE cable

- RS530 DCE cable

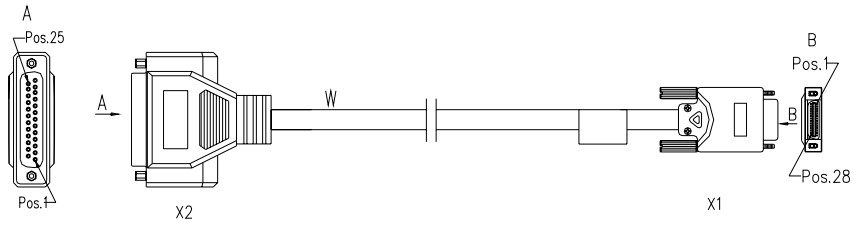

Figure 2-41 RS530 DCE cable

Note:

These cables are optional items. You need to select one when purchasing a Router 1-Port SAE SIC card; otherwise, the cable is not provided.

Chapter 3 Multifunctional Interface Modules (Router 5000)

3.1 Router 2-Port FXS/FXO/E&M MIM Modules & Router 4-Port 4FXS/4FXO/4E&M MIM Modules

3.1.1 Introduction

2/4-port voice subscriber circuit interface module (Router 2 or 4-Port FXS MIM) serves to access and handle 2/4 channels of ordinary analog phone, fax, or AT0 loop trunk of telephone exchange.

2/4-port voice AT0 analog trunk interface module (Router 2 or 4-Port FXO MIM) serves to access and handle 2/4 channels of common user lines of telephone exchange.

2/4-port voice E&M analog trunk interface module (Router 2 or 4-Port E&M MIM) serves to access and handle 2/4 channels of E&M analog trunks.

These modules make it possible to transfer voice signals over data communication networks.

⚠ **Caution:**

When connecting a voice MIM, make sure that 3Com 5000 Family Routers can be connected to an IP network or other LAN.

3.1.2 Appearance

I. Router 2-Port FXS/FXO/E&M MIM module

The appearance of Router 2-Port FXS/FXO/E&M MIM Module is shown in the following figure:

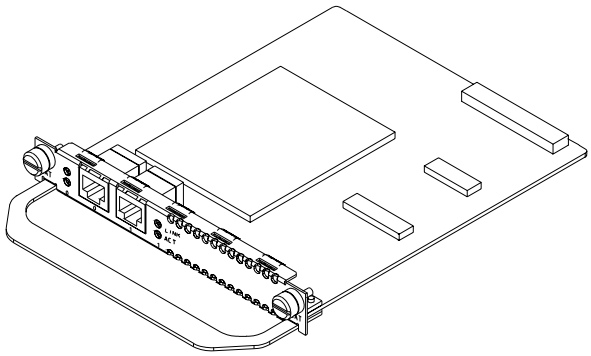

Figure 3-1 Router 2-Port FXS/FXO/E&M MIM MOdule

II. Router 4-Port FXS/FXO/E&M MIM module

The appearance of Router 4-Port FXS/FXO/E&M is shown in the following figure:

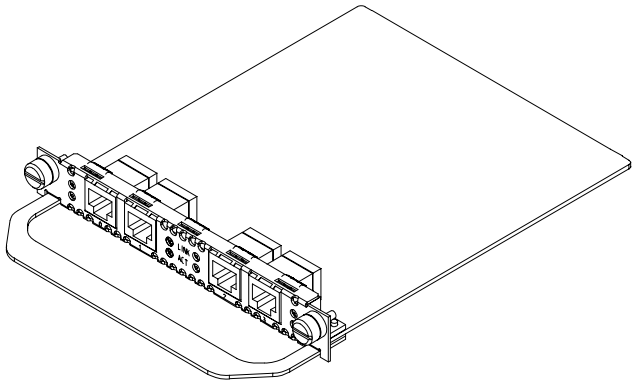

Figure 3-2 Router 4-Port FXS/FXO/E&M

3.1.3 Interface Attributes

The interface attributes of FXS/FXO/E&M modules are given in the following table:

Table 3-1 Interface attributes of 2FXS/2FXO/2E&M and 4FXS/4FXO/4E&M and 8FXS

Attribute	Description	
Connector	RJ45	
Number of connectors	2 (Router 2-Port FXS/FXO/E&M MIM module) 4 (Router 4-Port FXS/FXO/E&M MIM module)	
Cable	Telephone cable with ferrite core E&M trunk (for E&M module, which should be made by users depending on	

Attribute	Description
	the actual needs at the site.)
Interface standard	ITU Q.512-compliant subscriber circuit interface (Router 2-Port FXS) ITU Q.552-comliant loop trunk interface (Router 2 or 4-Port FXO) G.712-compliant E&M trunk interface (Router 2 or 4 -Port E&M), E&M interface (supporting Bell type I, II, III, V, and support 2-wire and 4-wire). ITU K.20-compliant overcurrent and overvoltage protection
Dial-up mode	DTMF (Dual-Tone Multi-Frequency) but not pulse dial-up
Bandwidth	300 to 3400 Hz

3.1.4 Interface LEDs

Voice MIM panels are shown in the following figures:

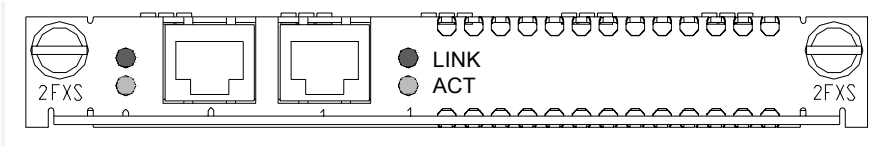

Figure 3-3 Router 2-Port FXS panel

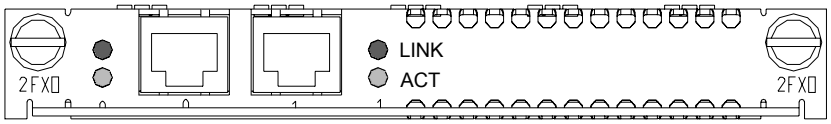

Figure 3-4 2 Router 2-Port FXO panel

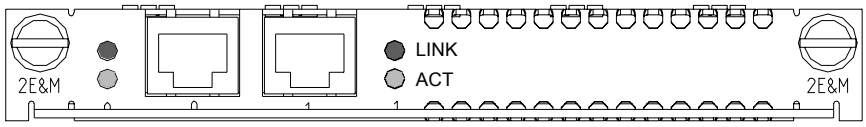

Figure 3-5 Router 2-Port E&M panel

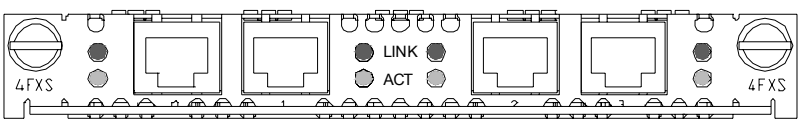

Figure 3-6 Router 4-Port FXS panel

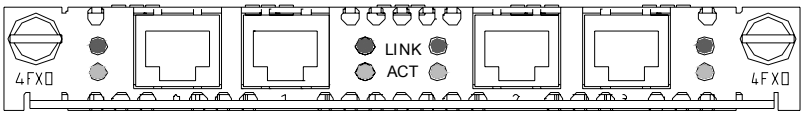

Figure 3-7 Router 4-Port FXO panel

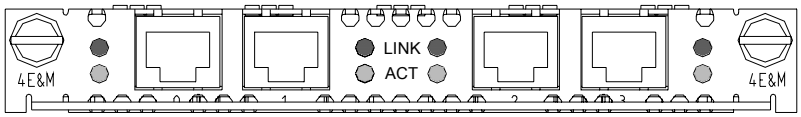

Figure 3-8 Router 4-Port E&M panel

Table 3-2 Description of the LEDs on voice MIM panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means the channel is idle. ON means there is call activity.

3.1.5 Interface Cable

External interfaces of Router 2-Port FXS/FXO/E&M module and Router 4-Port FXS/FXO/E&M module are standard RJ45 connectors.

Interface cables for Router 2-Port FXS/FXO and Router 4-Port FXS/FXO are telephone cables with ferrite core, and both ends of which are RJ11 connectors. Cables for Router 2 and 4-Port E&M need to be selected according to the type of telephone exchange to be connected.

Note:

- To ensure the consistency of the receptacles on MIMs, RJ45 receptacles are used as external interfaces for FXS/FXO/E&M modules. Because they are compatible with RJ11 connectors, they can be used as normal.
- Telephone cables have been included in the standard shipment package of Router 2-Port FXS/FXO, Router 4-Port FXS/FXO modules.

I. Interface cable of FXS/FXO modules

Connection cables for Router 2-Port FXS/FXO and Router 4-Port FXS/FXO are telephone cables with ferrite core.

II. Interface cable of E&M modules

E&M modules of 3Com 5000 Family Routers support Bell I, II, III, V switches, and 2-wire & 4-wire voice signals.

It is recommended to use Bell V 4-wire voice signal to communicate with the Router in practice.

The sequence of E&M RJ45 pins is shown in the following figure, numbered 1 to 8 from left to right:

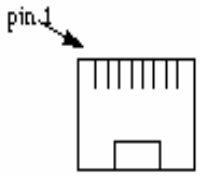

Figure 3-9 Sequence of RJ45 pins

When connection is made in Bell V 4-wire mode, the pinouts of RJ45 receptacles at router side and at the switch side are shown in the following figure:

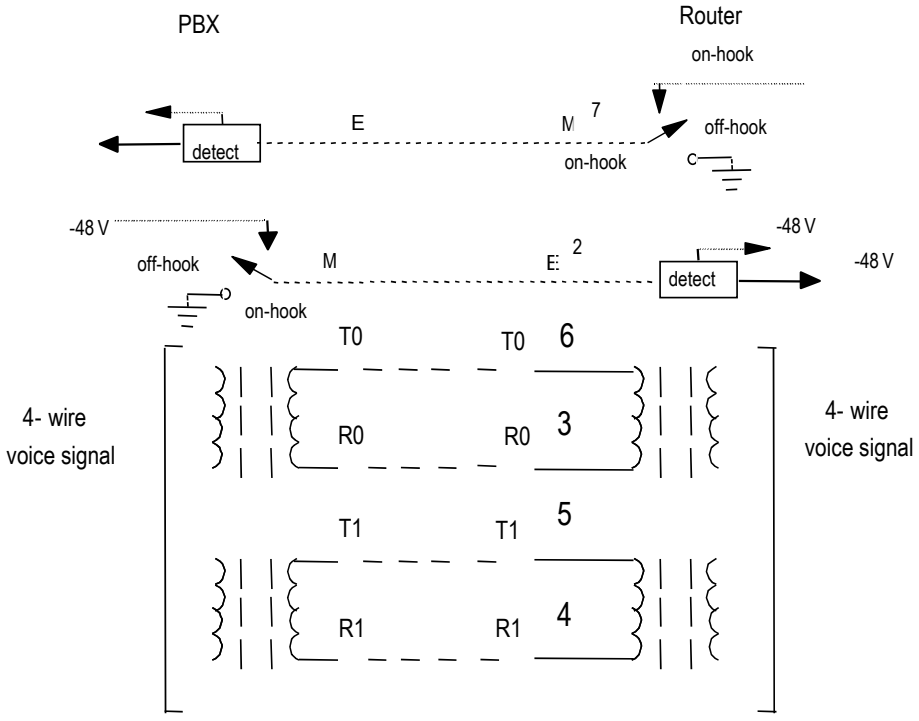

Figure 3-10 E&M interface cable (Bell V 4-wire)

Table 3-3 Pinouts of E&M interface cable (Bell V 4-wire)

Router side		Signal at switch side (Bell V 4-wire)
RJ45 Pin	RJ45 interface signal	
1	SB (negative power supply)	-
2	E	M
3	RING0	RING0
4	RING1	RING1
5	TIP1	TIP1
6	TIP0	TIP0
7	M	E
8	SG (negative power supply ground)	-

Note:

- Interface cables of Router 2-Port FXS/FXO and Router 4-Port FXS/FXO modules are magnetic loop lines with a ferrite core at one end. To ensure EMC of the Router, connect the end with ferrite core to the Router.
- Because it is hard to determine the type of the switch to be connected and its connectors, interface cables of Router 2 and 4-Port E&M/E&M modules have to be prepared according to the on-spot conditions or by the user. To ensure the EMC of the Router, install a ferrite core near the connector of the prepared E&M module interface cable by the router side.

3.1.6 Connecting Interface Cable

Caution:

- Some measures are taken to protect voice modules. Still, you are recommended to install a special lightning arrester at the input end of each connection cable to obtain better lightning protection effect when the cable is led outdoors;
- Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage interface modules and even the Router.
- As provisioned by Bell V, cables for FXS/FXO/E&M modules do not provide PGND wire. For this reason, a loop should be formed via the earth ground between the Router and the connected switch. In practice, the PGND wire of the switch can be connected to the chassis of the Router;
- To ensure the EMC of the whole Router, you should connect the end of the cable with ferrite core to the Router.

Step 1: Plug one end of the cable into the RJ45 port on Router 2-Port FXS/FXO/E&M;

Step 2: Connect the other end of the cable to:

- Telephone set, fax or AT0 loop trunk of telephone exchange, if you have installed an FXS module;
- Subscriber line of telephone exchange, if you have installed an FXO module;
- E&M trunk of telephone exchange, if you have installed an E&M module;

Step 3: Power on the Router and check the LEDs for the slot on the front panel of the Router. Several seconds after the MIM is initialized, all the LEDs will blink once, meaning it has completed POST and is ready for work. If it fails to pass POST, the LEDs for it will keep OFF. In this case, contact your agent.

3.2 Router E1 Voice Module

3.2.1 Introduction

Router E1 Voice Module can handle dense voice signals in VoIP system. It can carry out the VoIP function over E1 lines and transmit both voice and data signals over E1 lines at the same time.

Router E1 Voice Module is structured in the form of board plus daughter card. It provides a CE1/PRI port, allowing the access of 30 channels of voice signals.

3.2.2 Appearance

The appearance of Router E1 Voice Module is shown in the following figure:

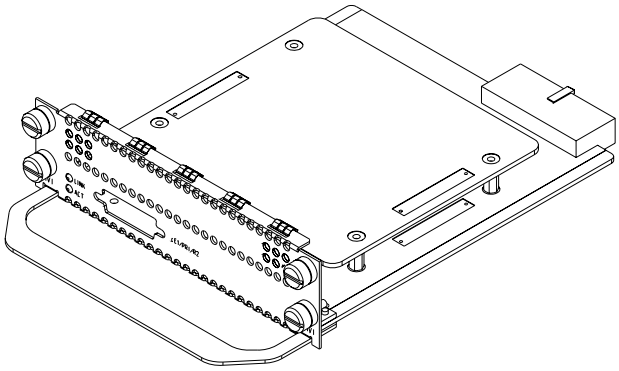

Figure 3-11 Router E1Voice Module

3.2.3 Interface Attributes

The interface attributes of Router E1 Voice Module are given in the following table.

Table 3-4 Interface attributes of Router E1 Voice Module

Attribute	Description
Connector	DB15
Number of connectors	1
Operating mode	1) E1 2) CE1 3) ISDN PRI
Interface rate	2.048Mbps
Cable	E1 120-ohm balanced twisted pair cable 75ohm-to-120ohm adapter Network interface connector
Services supported	1) R2 signaling 2) DSS1 signaling 3) IP Fax 4) General VoIP features in 3COM Router SOFTWARE

3.2.4 Interface LEDs

Router E1 Voice Module panel is shown in the following figure:

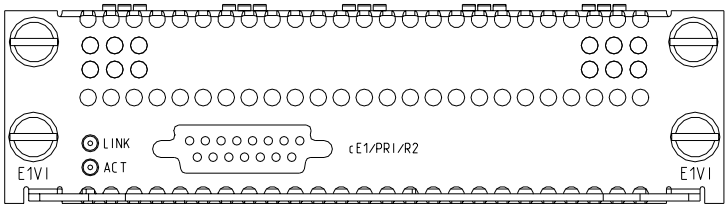

Figure 3-12 Router E1Voice Module panel

Description of the LEDs on Router E1 Voice Module panel is given in the following table:

Table 3-5 Description of the LEDs on Router E1Voice Module panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received. Blinking means there is data being transmitted or received.

3.2.5 Interface Cable

Router E1 Voice Module interface cables are G.703-compliant 120-ohm balanced twisted pair cables. At one end of the cable is a DB-15 male connector for the connection to the Router, and at the other end is an RJ-45 connector for the connection to the network.

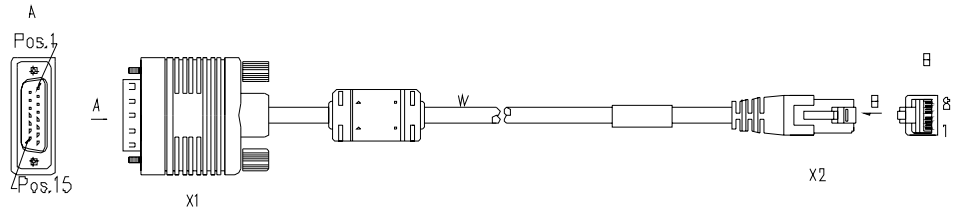

Figure 3-13 120-ohm balanced twisted pair cable

If the cable with the resistance of 75-ohm is needed, a 75-ohm-to-120-ohm cable adapter (one end is BNC connector and the other end is RJ45 connector) which is illustrated in the following figure can be installed.

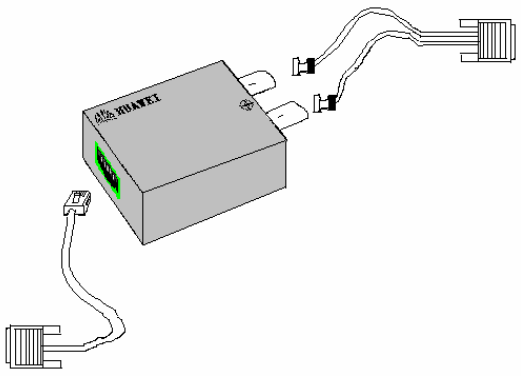

Figure 3-14 75-ohm-to120-ohm adapter (with BNC connector)

Caution:

- For the convenience of extending the connection of E1 120-ohm balanced twisted pair cable, you can use network interface connector.
- E1 120-ohm balanced twisted pair cable, network interface connector, 75-ohm-to-120-ohm adapter are optional accessories, and you need to make a selection when purchasing an E1VI module; otherwise, they are not provided.

3.2.6 Connecting Interface Cable

Caution:

- Some measures are taken to protect Router E1 Voice Module. Still, you are recommended to install a special lightning arrester at the input end of its connection cable to obtain better lightning protection when the cable is led outdoors;
- Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage the MIM and even the Router.

Step 1: Plug the DB15 connector of the cable into the DB15 port on the Router E1 Voice Module module and fasten the screws;

Step 2: Connect the RJ45 connector of the cable to:

- The peer device directly, if the resistance of the port to be connected is 120-ohm, and there is no need to extend the cable;

- A network interface connector and then the peer device using another E1 120-ohm balanced twisted pair cable, if the resistance of the port to be connected is 120-ohm, and there is a need to extend the cable, as illustrated in the following figure.

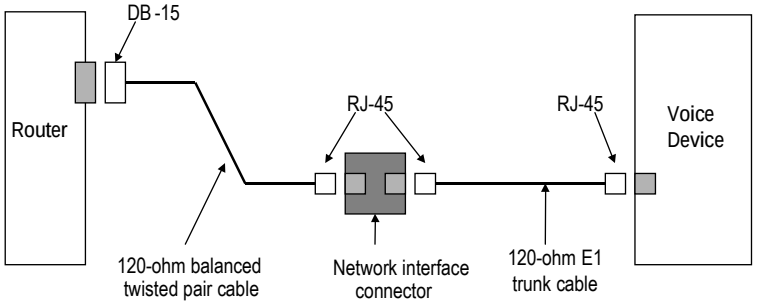

Figure 3-15 Extending E1 120-ohm balanced twisted pair cable

- The peer device using a 75ohm-to-120ohm adapter, if the resistance of the peer device is 75-ohm;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means Router E1 Voice Module is operating normally and OFF means the POST of Router E1 Voice Module has failed. In the latter case, please contact your agent;

Step 4: Check the status of the LINK LED on the Router E1 Voice Module panel. It is OFF when fault has occurred to the link. In this case, please check the link.

3.3 Router T1 Voice Module

3.3.1 Introduction

Router T1 Voice Module can handle dense signals in VoIP systems. It can implement the VoIP function over T1 lines and transmit voice and data signals over T1 lines at the same time.

Router T1 Voice Module is structured in the form of board plus daughter card. It provides a CT1/PRI port, allowing the access of 24 channels of voice signals.

3.3.2 Appearance

The appearance of Router T1 Voice Module is shown in the following figure:

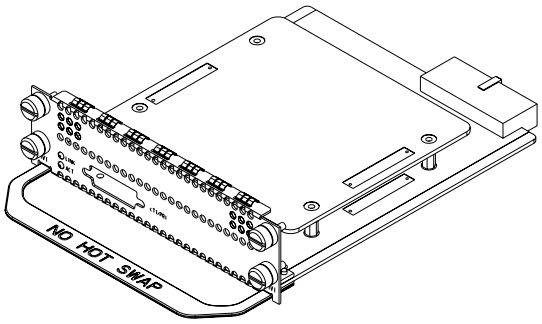

Figure 3-16 Router T1Voice Module

3.3.3 Interface Attributes

The interface attributes of Router T1 Voice Module are given in the following table:

Table 3-6 Interface attributes of Router T1 Voice Module

Attribute	Description
Connector	DB15
Number of connectors	1
Cable	Router T1 Voice Module cable (100-ohm balanced shielded twisted pair cable) Network interface connector
Operating mode	CT1 ISDN PRI
Interface rate	1.544Mbps
Supported services	1) DSS1 signaling 2) IP fax 3) General VoIP features in 3COM Router SOFTWARE

3.3.4 Interface LEDs

Router T1 Voice Module panel is shown in the following figure:

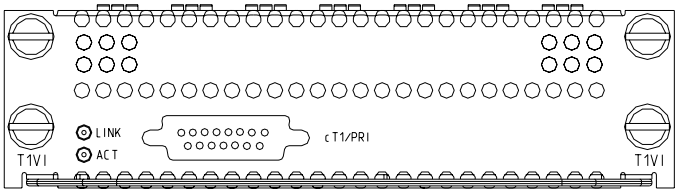

Figure 3-17 Router T1 Voice Module panel

Description of the LEDs on Router T1 Voice Module panel is given in the following table.

Table 3-7 Description of the LEDs on Router T1Voice Module panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

3.3.5 Interface Cable

Router T1 Voice Module interface cables are 100-ohm balanced shielded twisted pairs. At one end of each cable is a DB-15 male connector for the connection to a Router T1 Voice Module module, and at the other end is an RJ-45 connector for the connection to the voice device, as shown in the following figure:

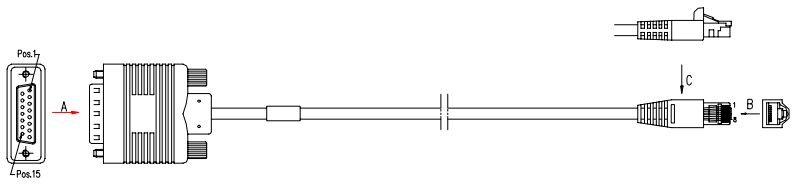

Figure 3-18 Router T1 Voice Module cable

In addition, you may use a network interface connector to extend a Router T1 Voice Module cable.

Caution:

Both Router T1 Voice Module cable and network interface connector are optional accessories. You should order them when ordering a Router T1 Voice Module. Otherwise, they will not be provided.

3.3.6 Connecting Interface Cable

Caution:

- Some measures are taken to protect Router T1 Voice Module. Still, you are recommended to install a special lightning arrester at the input end of its connection cable to obtain better lightning protection when the cable is led outdoors;
- Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage interface modules and even the Router.

Step 1: Insert one end of a Router T1 Voice Module cable into the DB15 port on the Router T1 Voice Module;

Step 2: Connect the other end of the Router T1 Voice Module cable to:

- The peer device if the cable is long enough;
- A network interface connector and then the peer device using another Router T1 Voice Module cable, if it is not long enough, as shown in the following figure:

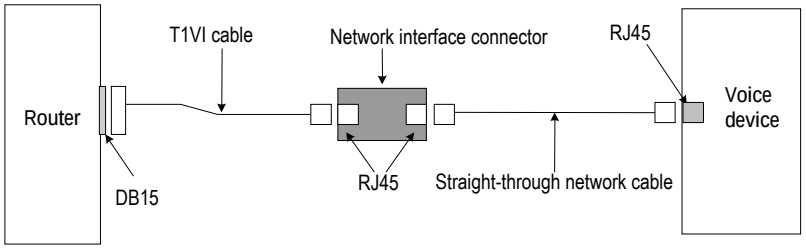

Figure 3-19 Extending a Router T1 Voice Module cable

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel of the Router: ON means Router T1 Voice Module is operating normally and OFF means the POST of Router T1 Voice Module has failed. In the latter case, please contact your agent;

Step 4: Check the status of the LINK LED on the Router T1 Voice Module panel. It is OFF when fault has occurred to the link. In this case, please check the link.

3.4 NDEC Module

3.4.1 Introduction

Network Data Encryption Module (NDEC) supports IPSec protocol and speeds up the encryption of IP packets by means of hardware, featuring high performance and high reliability.

When NDEC module is inserted, the main board of the router handles IP packet forwarding and implements the VPN with encryption features, and then the NDEC will complete the task of encryption.

3.4.2 Appearance

The appearance of NDEC module is shown in the following figure.

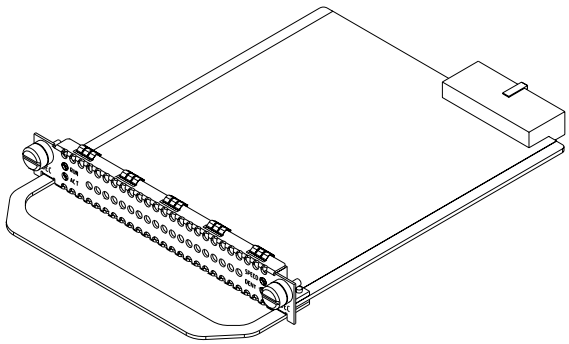

Figure 3-20 NDEC

3.4.3 Interface Attributes

The interface attributes of NDEC are given in the following table:

Table 3-8 Interface attributes of NDEC

Attribute	Description
Protocol supported	IPSec
The maximum number of concurrent IPSec connections	100
Hardware algorithm	1) Key algorithm (DES, 3DES, AES, QC5, Blowfish, Cast-128, SkipJack) 2) Authentication algorithm (MD5, SHA-1 hash algorithm)

3.4.4 Interface LEDs

NDEC panel is shown in the following figure:

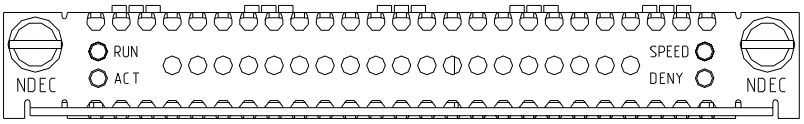

Figure 3-21 NDEC panel

Table 3-9 Description of the LEDs on NDEC panel

LED	Description
RUN	OFF: The module is not powered ON, the PSU has failed to operate or a serious hardware fault has occurred. Fast blinking (4Hz): The hardware initialization is not done yet: Slowly blinking (2-second ON and 2-second OFF): The hardware initialization is done, but the module has not entered the normal software initialization flow; Normal blinking (1-second ON and 1-second OFF): The module is operating normally; Steady ON: The software initialization has failed and the service cannot be run normally.
ACT	Fast blinking: The module is in the loading status. Steady ON: Module loading has failed. Fast blinking unsteadily: The module is operating normally, and the data is being transmitted or received between the module and the host. OFF: The module is operating normally, and there is no data being transmitted or received between the module and the host.
SPEED	ON: The module is booting the system after power-on. OFF: The module is operating normally.
DENY	Fast blinking: The request of module software for memory has failed and the service cannot be run normally. OFF: The module is operating normally.

3.4.5 Troubleshooting

1) Symptom 1: All the LEDs are OFF after the Router is started up.

Troubleshooting: All the LEDs should fast blink once upon the startup of the device. They are keeping ON if the module or some hardware of the module is not powered on properly. Check whether the power supply is correctly connected. If the power supply is operating, the fuse might be blown or anomalies have occurred to the Complex Programmable Logic Device (CPLD). In this case, please contact your agent.

2) Symptom 2: All the LEDs are steadily ON after the device is started up.

Troubleshooting: All the LEDs should fast blink once upon the startup of the device and then go OFF immediately, if the processor of the module starts working. All the LEDs are ON steadily, if the system bus of the module is not in normal state or anomalies have occurred to the CPLD.

3) Symptom 3: RUN LED is ON steadily.

Troubleshooting: When the module is operating, RUN LED should fast blinks, instead of keeping ON steadily. RUN LED is steadily ON, if the module is powered up but not started normally, or if the module is reset forcibly. If at the same time other one or two LEDs (such as ACT, SPEED, and DENY) are ON, it is likely the problem of the NDEC or the Router. RUN LED keeps ON after several times of blinking, if module initialization fails.

4) Symptom 4: RUN LED is fast blinking all the time when the device is being started up.

Troubleshooting: After the Router is powered ON, RUN LED fast blinks all the time until module initialization is completed. During the process, if DENY LED blinks occasionally, there might be fault in the memory. In this case, please contact your agent for repairing the module. SPEED LED lights during the process, if the module system boot fails. In this case, check the configuration of the system or contact your agent.

5) Symptom 5: RUN LED blinks slowly after the device is started up.

Troubleshooting: If the module is in offline state, the RUN LED blinks slowly. Check that the configuration of the Router is correct, and make sure NEDC is supported.

6) Symptom 6: ACT LED is ON steadily.

Troubleshooting: If the firmware is being upgraded, ACT LED blinks. If the upgrade fails, the LED is ON steadily and you need to upgrade the software again. If the problem still exists, contact your agent.

7) Symptom 7: DENY LED blinks during normal operations.

Troubleshooting: DENY LED blinks during normal operations, if the module performance or capacity is inadequate for encryption processing at a moment. This is not a hardware failure but a phenomenon caused by technical specifications limitation

of the current NDEC module. If it is necessary to upgrade the processing capability of the NDEC module, please contact your agent.

3.5 Router 2-Port 10/100 MIM

3.5.1 Introduction

The 2-port 10Base-T/100Base-TX FE interface card (Router 2-Port 10/100 MIM) provides one/two 10/100 Mbps RJ-45 Ethernet interface(s) for router-and-LAN communication.

The cards support:

- 100 meters (328.1 ft.) of transmission segment over the category-5 twisted-pair cable.
- Operation at 100 Mbps and 10 Mbps, autosensing.
- Full duplex and half-duplex, with the former in common use.

3.5.2 Interface Attributes

The following table describes the interface attributes of the FIC-FE cards.

Table 3-10 Router 2-Port 10/100 MIM interface attributes

Attribute	Description	
		Router 2-Port 10/100 MIM
Connector	RJ-45	
Number of connectors	1	2
Cable	Straight-through Ethernet cable	
Operating mode	Full duplex/half-duplex 10/100 Mbps auto-sensing	
Supported frame format	Ethernet_II Ethernet_SNAP	

3.5.3 Interface LEDs

The following figure illustrates an Router 2-Port 10/100 MIM panel.

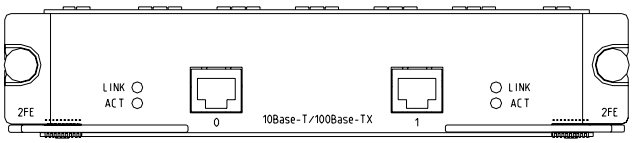

Figure 3-22 Router 2-Port 10/100 MIM panel

The following table describes the LEDs on the /Router 2-Port 10/100 MIM panel.

Table 3-11 LEDs on the Router 2-Port 10/100 MIM panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

3.5.4 Interface Cable

I. Ethernet cable

As shown in the following figure, the Ethernet cables for FIC-FE cards are category-5 twisted pairs with RJ-45 connectors. Pins 1 and 2 of the interface are used for transmitting data, and pins 3 and 6 are used for receiving data.

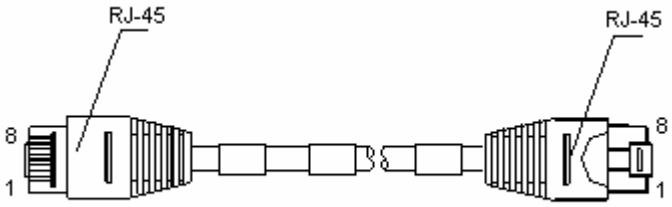

Figure 3-23 Ethernet cable

II. Making Ethernet cables

You can use category 5 twisted-pair cables to make Ethernet cables. A category 5 twisted-pair cable is composed of eight wires that are identified and grouped by colors of the outer insulator. Usually a solid color wire and a white/solid color wire are organized in pairs. But sometimes, wires are also paired by color dots.

Ethernet cables fit into two categories: straight-through and crossover.

- Straight-through cable: The wires are crimped in the RJ-45 connectors at both ends in the same order. The cable is used for connecting a terminal device (for

example, PC or router) to a HUB or LAN switch. The cables delivered with the router are straight-through cables.

- Crossover cable: The wires are crimped in the RJ-45 connectors at both ends in different orders. The cable is used for connecting two terminal devices (for example, PC and router). You can make cables as needed.

Note:

In making network cables, shielded cables are preferred for electromagnetic compatibility sake.

The interface cables in the standard package of cards are straight-through cables.

3.5.5 Connecting the Interface Cable

Step 1: Plug one end of the cable to an Ethernet port on the router and another end to the device to be connected. (For a PC or router, use a straight-through cable; for a HUB or LAN switch, use a crossover cable.)

Step 2: Power on the router and check the behavior of the LINK LED on the panel: ON means that a link is present and OFF means that no link is present. In the latter case, check the line status.

Caution:

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

3.6 Router 4-Port Serial MIM Module

3.6.1 Introduction

4-port high-speed sync/async serial interface module (Router 4-Port Serial MIM) supports both synchronous and asynchronous modes to transmit/receive and handle data streams at sync/async serial interfaces. The modules also support Data Terminal Equipment/Data Circuit-terminating Equipment (DTE/DCE) mode when they are in synchronous operating mode.

I. Synchronous and asynchronous

In different operating modes, a sync/async serial interface supports different signal standards and baud rates. And the maximum transmission distance of signals is related to the baud rate setting. For the relationships between cable type, baud rate setting and signal transmission distance, see the following table.

Table 3-12 Baud rate and transmission distance of V.24 (RS232)/V.35 cable

V.24 (RS232)		V.35	
Baud rate (bps)	Maximum transmission Distance (m)	Baud rate (bps)	Maximum transmission Distance (m)
2400	60	2400	1250
4800	60	4800	625
9600	30	9600	312
19200	30	19200	156
38400	20	38400	78
64000	20	56000	60
115200	10	64000	50
-	-	2048000	30

Caution:

Baud rate cannot exceed 64 kbps if V.24 cable is used and the interface operates in synchronous mode.

II. Introduction to DTE and DCE

Synchronous serial interfaces support both DTE and DCE operating modes. Given two directly connected devices, if one operates in the DTE mode, the other will operate in the DCE mode. The DCE device provides the synchronous clock and specifies the communicating rate. The DTE device receives the synchronous clock and communicates at the specified rate. Generally, the Router is used as a DTE device. To make sure that the device is a DTE or DCE, refer to the manual shipped with this device. In addition, the following table may also help you to identify the type of the device.

Table 3-13 Typical DTE and DCE equipment

Equipment type	Interface type	Typical equipment
DTE	Male	PC, Router
DCE	Female	Modem, Multiplexer, CSU/DSU

Asynchronous serial interface is generally used as dialing port and connected to a modem or a Terminal Adapter (TA). In this case, regardless of the operating mode of the device, only an appropriate baud rate for the interface needs to be selected.

Serial interface is generally used for the direct connection to such a device as DDN, frame relay, or X.25 switch.

3.6.2 Interface Attributes

The interface attributes of Router 4-Port Serial MIM are given in the following table:

Table 3-14 Interface attributes of Router 4-Port Serial MIM

<table>
<tr><th rowspan="2">Attribute</th><th colspan="4">Description</th></tr>
<tr><th colspan="3">Synchronous</th><th>Asynchronous</th></tr>
<tr><td>Connector</td><td colspan="4">DB100 (Router 4-Port Serial MIM)</td></tr>
<tr><td>Number of connectors</td><td colspan="4">1 (Router 4-Port Serial MIM)</td></tr>
<tr><td rowspan="2">Interface standard and operating mode</td><td>V.24</td><td colspan="2">V.35</td><td rowspan="2">RS232</td></tr>
<tr><td>DTE
DCE</td><td>DTE</td><td>DCE</td></tr>
<tr><td>Minimum baud rate
(bps)</td><td>1200</td><td>1200</td><td>1200</td><td>300</td></tr>
<tr><td>Maximum baud rate
(bps)</td><td>64 k</td><td>4.096 M</td><td>2.048 M</td><td>115.2</td></tr>
<tr><td>Cable</td><td colspan="4">V.24 (RS232) DTE cable
V.24 (RS232) DCE cable
V.35 DTE cable
V.35 DCE cable
Router 4-Port Serial MIM conversion cable (Router 4-Port Serial MIM)</td></tr>
<tr><td>Services supported</td><td colspan="3">DDN leased line
Terminal access service</td><td>Dialup through modem
Backup
Async leased line
Dumb terminal access</td></tr>
</table>

3.6.3 Interface LEDs

Router 4-Port Serial MIM panel is shown in the following figure:

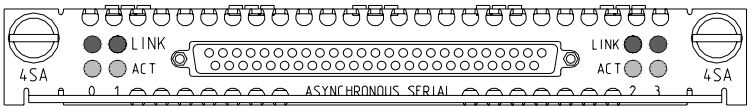

Figure 3-24 Router 4-Port Serial MIM panel

Description of the LEDs on Router 4-Port Serial MIM is given in the following table:

Table 3-15 Description of the LEDs on Router 4-Port Serial MIM panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

3.6.4 Interface Cable

I. Router 4-Port Serial MIM interface cable

Router 4-Port Serial MIM provides a 1-to-4 conversion cable (Router 4-Port Serial MIM conversion cable). One end of the cable is DB100 connector for connecting Router 4-Port Serial MIM, and the other end is DB50 (female) connector for connecting a sync/async serial interface cable. Like , four types of sync/async serial interface cables are available:

- V.24 (RS232) DTE cable
- V.24 (RS232) DCE cable
- V.35 DTE cable
- V.35 DCE cable

For the pinouts of these cables, see *Low-End and Mid-Range Series Routers Cable Manual*.

The following figure illustrates a Router 4-Port Serial MIM conversion cable:

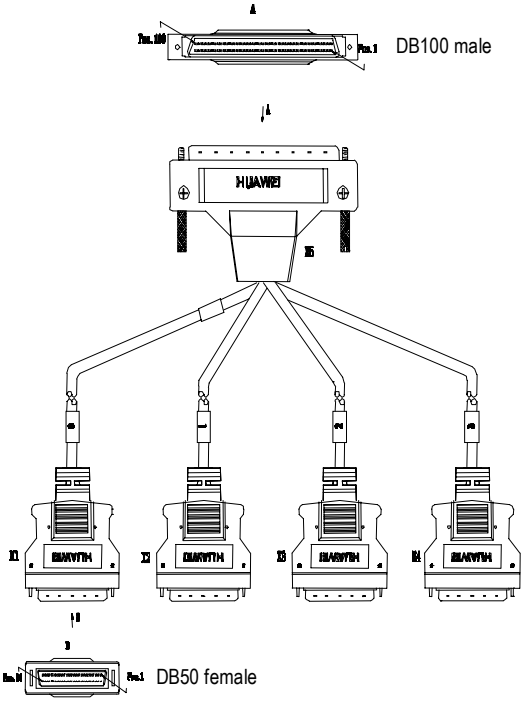

Figure 3-25 Router 4-Port Serial MIM conversion cable

For the pinouts of Router 4-Port Serial MIM conversion cable, see *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

Router 4-Port Serial MIM conversion cable is the required by Router 4-Port Serial MIM module, while the four sync/async serial interface cables are optional. You need to order them; otherwise, they will not be provided.

3.6.5 Connecting the Interface Cable

Warning:

In case of possible device and port damages, do not plugging or unplug connection cables of SA modules when the router is powered on.

Caution:

Before connecting an SA module, confirm the model of the equipment to be connected to the SA module (that is, sync/async mode, DTE/DCE mode, and so on), signaling criterion required by the access equipment, baud rate, and timing clock.

I. Connecting interface cable of Router 4-Port Serial MIM

Step 1: Plug the DB-100 connector of a Router 4-Port Serial MIM conversion cable to the appropriate DB-100 port on the Router 4-Port Serial MIM module;

Step 2: Select a correct sync/async serial interface cable. Connect one end of the cable to the DB50 connector of the Router 4-Port Serial MIM conversion cable and the other end to:

- Port of CSU/DSU, if the WAN is a DDN line;
- Serial port of analog modem, if the WAN is a dial-up line;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent.

Step 4: Check the behavior of the LINK LED on the Router 4-Port Serial MIM panel. It is OFF when the line is faulty and signal is out of synchronization.

Caution:

You should connect a cable to the port with the correct mark. Misplugging is prone to impair the SIC/MIM and even damage the router.

3.7 Router 2 AND 4-Port Enhanced Serial MIM

3.7.1 Introduction

Router 2 AND 4-Port Enhanced Serial MIM, 2-/4-port enhanced high-speed sync/async serial interface card, transmits, receives, and processes data on the synchronous/asynchronous serial interface. They support both synchronous and asynchronous modes. In the former case, they support the DTE/DCE mode.

I. DTE and DCE

An FIC-SA card is usually connected to an external modem for dialing purpose, where an appropriate baud rate setting is required.

The synchronous serial interface can work in either DTE or DCE mode. Two directly connected devices must work as DTE and DCE respectively. The DCE provides clock synchronization and specifies the communication rate, whereas the DTE accepts clock synchronization and communicates at the specified rate.

The router normally works as a DTE. To identify whether the equipment connected to the router is DTE or DCE, refer to the manual shipped with the equipment.

II. Speed and transmission segment of synchronous/asynchronous serial interface

In different operating modes, the synchronous/asynchronous serial interface supports different electric signal specifications and baud rates. In addition, the maximum signal transmission segment depends not only on the specified baud rate but also on the selected cable. The following table shows how the cable type, baud rate, and the maximum signal transmission segment related to each other.

Table 3-16 Speed and transmission segment of the V.24 (RS232)/V.35 cable

V.24 (RS232)		V.35	
Baud rate (bps)	Max. transmission segment	Baud rate (bps)	Max. transmission segment
2400	60 m (196.9 ft.)	2400	1250 (4101 ft.)
4800	60 m (196.9 ft)	4800	625 m (2050.5 ft.)
9600	30 m (98.4 ft.)	9600	312 m (1023.6 ft.)
19200	30 m (98.4 ft)	19200	156 m (511.8 ft.)
38400	20 m 65.6 ft.)	38400	78 m (255.9 ft.)
64000	20 m (65.6 ft)	56000	60 m (196.9 ft.)
115200	10 m (32.8 ft.)	64000	50 m (164 ft.)
—	—	2048000	30 m (98.4 ft.)

Note:

When a V.24 cable is used, the baud rate of the FIC-SA in synchronous mode shall not exceed 64 Kbps.

3.7.2 Interface Attributes

The following table describes the interface attributes of the FIC-SAE:

Table 3-17 Interface attributes of the Router 2 AND 4-Port Enhanced Serial MIM

Attribute	Description			
	Synchronous			Asynchronous
Connector	DB-28			
Number of connectors	2 (FIC-2SAE) 4 (FIC-4SAE) 8 (FIC-8SAE)			
Interface standard and operating mode	V.24	V.35, RS449, X.21, RS530		RS232
	DTE, DCE	DTE	DCE	
Min. baud rate(bps)	1200	1200		300
Max. baud rate(bps)	64 k	4.096 M	2.048 M	115.2
Cable	V.24 (RS232) DTE cable V.24 (RS232) DCE cable V.35 DTE cable V.35 DCE cable X.21 DTE cable X.21 DCE cable RS449 DTE cable RS449 DCE cable RS530 DTE cable RS530 DCE cable			
Supported service	1) DDN leased line 2) Terminal access service			1) Dialup through modem 2) Backup 3) Asynchronous leased line 4) Terminal access service

3.7.3 Interface LEDs

The following figures show the 2 and 4-port panels:

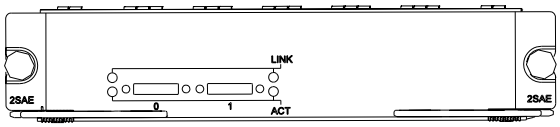

Figure 3-26 2-port panel

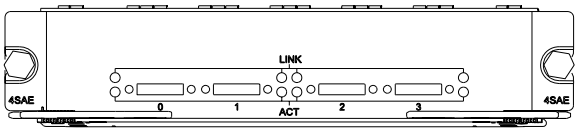

Figure 3-27 4-port panel

The following table describes the LEDs on the panel:

Table 3-18 LEDs on the panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received. Blinking means data is being transmitted and/or received.

3.7.4 Interface Cable

The MIM cards use synchronous/asynchronous serial interface cables with DB-28 connectors.

Before connecting a card, identify the line properties and then select the proper interface cable from the following ten cable options:

- V.24 (RS232) DTE cable: DB-25 plug at the network end
- V.24 (RS232) DCE cable: DB-25 receptacle at the network end
- V.35 DTE cable: 34PIN plug at the network end
- V.35 DCE cable: 34PIN receptacle at the network end
- X.21 DTE cable: DB-15 plug at the network end
- X.21 DCE cable: DB-15 receptacle at the network end
- RS449 DTE cable: DB-37 plug at the network end
- RS449 DCE cable: DB37 receptacle at the network end
- RS530 DTE cable: DB-25 plug at the network end
- RS530 DCE cable: DB25 receptacle at the network end

All these cables use a DB-28 connector to connect the router, but the connector at the network end varies with the type of the to-be-connected network.

- V.24 DTE cable

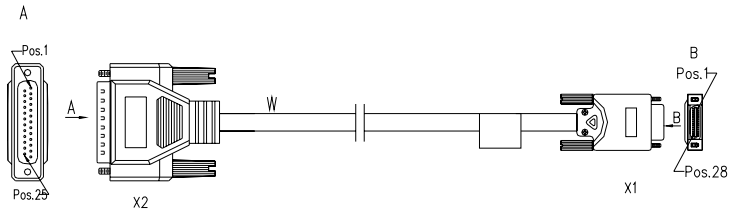

Figure 3-28 V24 DTE cable

- V.24 DCE cable

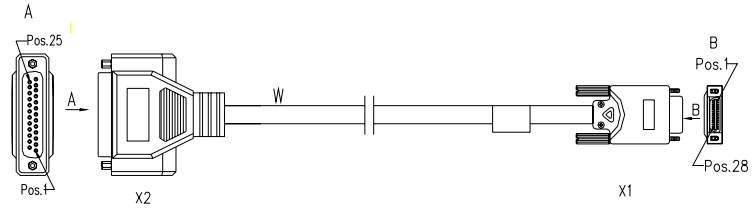

Figure 3-29 V.24 DCE cable

- V.35 DTE cable

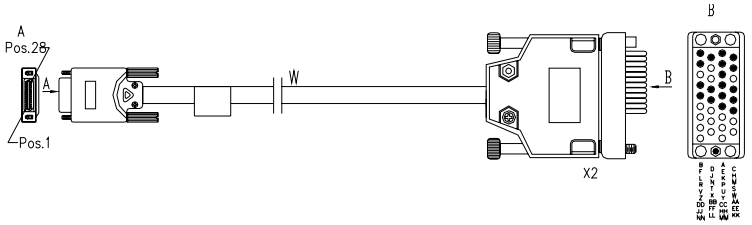

Figure 3-30 V.35 DTE cable

- V.35 DCE cable

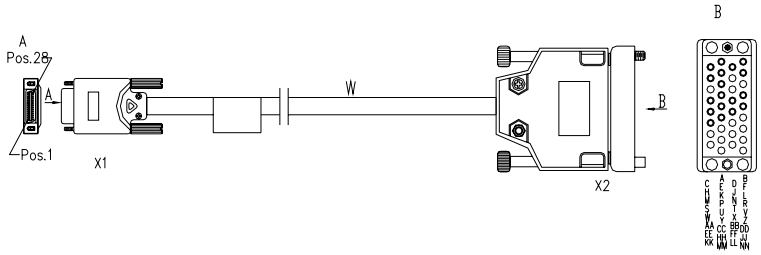

Figure 3-31 V.35 DCE cable

- X.21 DTE cable

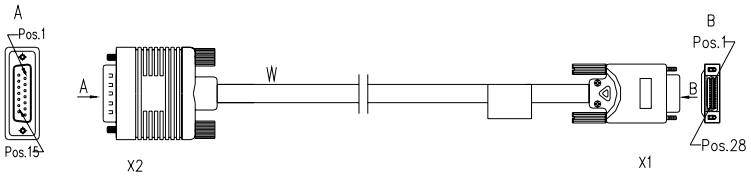

Figure 3-32 X.21 DTE cable

- X.21 DCE cable

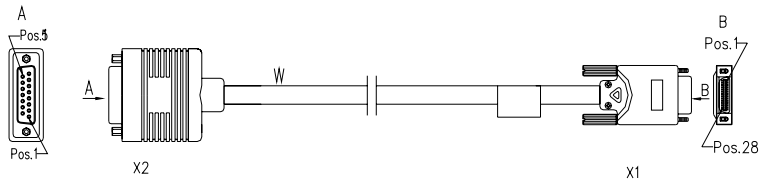

Figure 3-33 X.21 DCE cable

- RS449 DTE cable

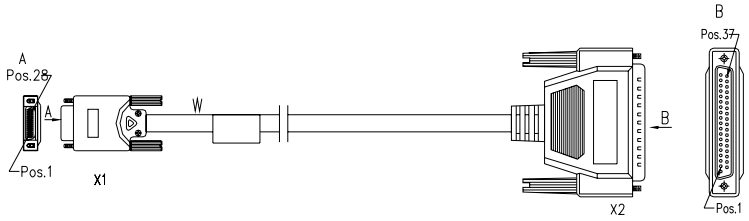

Figure 3-34 RS449 DTE cable

- RS449 DCE cable

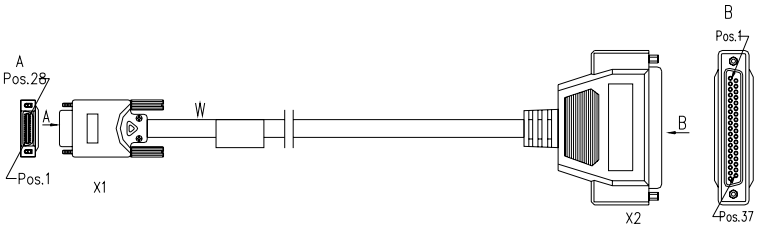

Figure 3-35 RS449 DCE cable

- RS530 DTE cable

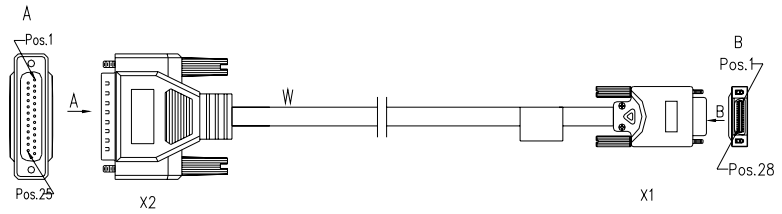

Figure 3-36 RS530 DTE cable

- RS530 DCE cable

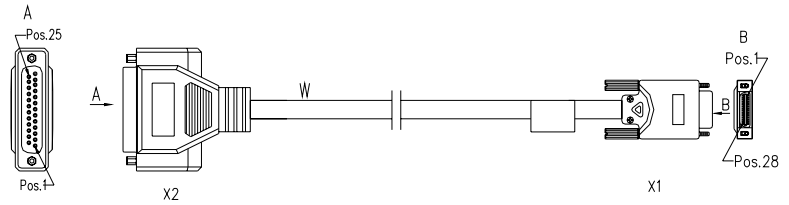

Figure 3-37 RS530 DCE cable

Note:

These cables are optional. You must order them together with the MIM card. Otherwise, they are not provided.

3.7.5 Connecting the Interface Cable

Caution:

Do not plug or unplug interface cables into or from the MIM card to prevent the device or ports from being impaired.

Before connecting an MIM card, identify the type of the equipment to be connected (that is, the synchronous/asynchronous mode, DTE/DCE mode, and so on), signaling criterion required by the access equipment, baud rate, and line clock.

Step 1: Identify type of the interface to be connected and then choose the correct synchronous/asynchronous serial interface cable.

Step 2: Plug the DB-28 connector of the cable to the corresponding DB-28 port on the MIM card.

Step 3: Connect the other end of the cable as follows:

- If the WAN is a DDN line, connect the cable to the port on the CSU/DSU.
- If the WAN is a dialup line, connect the cable to the serial port of an analog modem.

Step 4: Power on the router, and check behavior of the LINK LED on the MIM panel. It is OFF when fault occurs on the line and signal is not synchronized. Check the line status.

3.8 Router 2 and 4-Port CE1/PRI MIM Modules

3.8.1 Introduction

I. 2 and 4-Port CE1/PRI

Router 2 and 4-Port CE1/PRI MIM, the 1-/2-/4-port channelized E1/PRI interface module, transmits, receives, and processes E1 data traffic. In addition, you can use the card for other purposes, such as CE1 access and the ISDN PRI function.

II.

The module is different from the 2 and 4-Port CE1/PRI module in the sense that:

- The FE1 operating mode supported by the E1-F cards allows only one n x 64 kbps bundle to be formed on each interface, where n = 1 to 31. However, an E1 card allows arbitrary grouping of 31 channels and multiple bundles.
- The E1-F modules do not support PRI mode.

3.8.2 Interface Attributes

The interface attributes of Router 2 and 4-Port CE1/PRI MIM and are given in the following table:

Table 3-19 Interface attributes of Router 2 and 4-Port CE1/PRI MIM and

Attribute	Description		
		2-port module	4-port module
Connector		DB-15	DB-25
Number of connectors		2	1
Interface standard	G.703, G.704		
Interface rate	2.048 Mbps		

Cable type	E1 75-ohm non-balanced coaxial cable E1 120-ohm balanced twisted pair cable 120-ohm 4E1 conversion cable (4E1/4E1-F modules) 75-ohm 4E1 conversion cable (4E1/4E1-F modules) Coaxial connector, network interface connector and 75-ohm to 120-ohm adapter (with BNC connector)
Operating mode	E1, CE1, ISDN PRI (only supported by Router 2 and 4-Port CE1/PRI MIM) FE1 (only supported by)
Services supported	1) Backup 2) Terminal access service 3) ISDN PRI (only supported by Router 2 and 4-Port CE1/PRI MIM)

3.8.3 Interface LEDs

The following figure illustrates a 2-port panel.

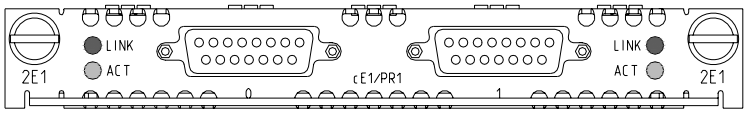

Figure 3-38 2-port panel

The following figure illustrates a 4-port module.

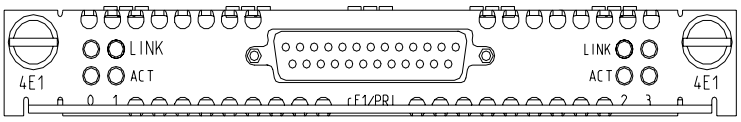

Figure 3-39 4-port panel

Description about the LEDs on E1/E1-F panels is given in the following table:

Table 3-20 Description about the LEDs on E1/E1-F panels

LED	Description
LINK	ON means the carrier signal has been received. OFF means no carrier signal has been received.

ACTIVE	OFF means no data is being transmitted or received. ON means data is being transmitted or received.

3.8.4 Interface Cable

I. Interface cable of 2-port modules

2-port interface cables are G.703-compliant cables (referred to as E1 cables throughout the rest part of the manual). E1 cables are divided into two types: 75-ohm unbalanced coaxial cables and 120-ohm balanced twisted pair cables.

- 75-ohm unbalanced coaxial cable

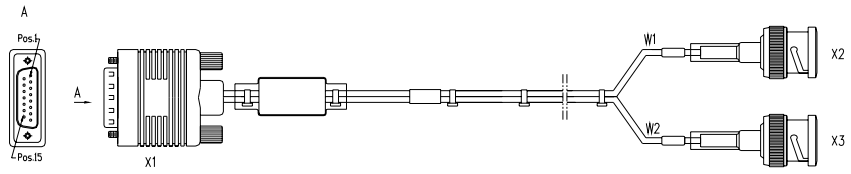

Figure 3-40 E1 75-ohm unbalanced coaxial cable

Note:

You can select a pair of coaxial connectors with a BNC receptacle at both ends that connect two 75-ohm unbalanced coaxial cables with BNC connectors. The coaxial connectors are used for the extension connection with E1 75-ohm unbalanced coaxial cable.

- 120-ohm balanced twisted pair cable

At the router side, the connector of the cable is DB-15 (male); at the network side, the connector is RJ-45, as illustrated in the following figure.

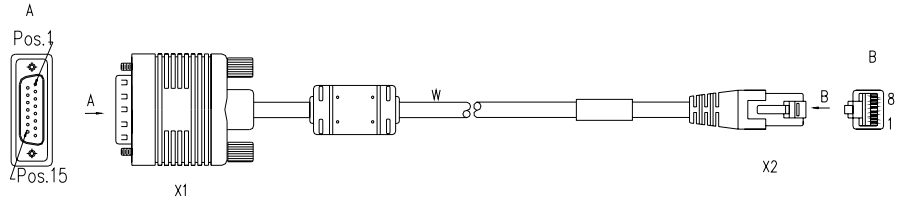

Figure 3-41 2-port 120-ohm balanced twisted pair cable

Note:

You can select a network interface connectors with an RJ-45 receptacle at both ends that connect two 120-ohm balanced twisted pair cables with BNC connectors. The network interface connector is used in the extension connection with E1 120-ohm balanced twisted pair cables.

In addition, a 75-ohm to 120-ohm adapter is provided.

For the pinouts of E1cables, see *Low-End and Mid-Range Series Routers Cable Manual*.

Caution:

E1 cable, coaxial connector, network interface connector and 75-ohm to 120-ohm adapter are all optional accessories, you need to order them when purchasing 2-port modules; otherwise, they are not provided.

II. Conversion cable for 4-port module

4-port modules provide two types of "1-to-4" conversion cables: 120-ohm 4-port module conversion cable and 75-ohm 4-port module conversion cable. At one end of these two types of cables is a DB-25 connector used to connect a router, and at the other end are four DB-15 connectors used to connect E1 cables. You can distinguish these two types of cables by the main labels. There are the words "4-port module -120Ohm-CAB " printed on the main label for 120-ohm 4-port module conversion cables whereas the words "4-port module -75Ohm-CAB" are printed on the main label for 75-ohm 4-port module conversion cables.

The two types of cables have a similar appearance, as illustrated in the following figures. However, a 75-ohm 4-port module conversion cable uses 8-core coaxial cables but a 120-ohm 4-port module conversion cable uses four twisted pair cables.

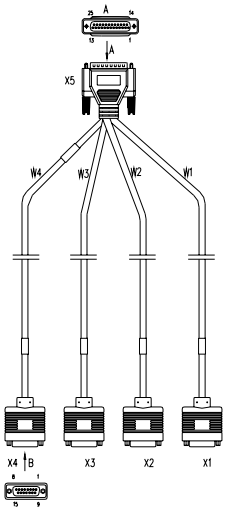

Figure 3-42 120-ohm 4-port module conversion cable

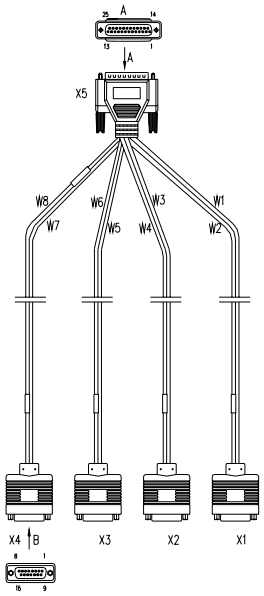

Figure 3-43 75-ohm 4-port module conversion cable

Caution:

Both 75-ohm 4-port module 1 and 120-ohm 4-port module conversion cables are required for 4-port module modules, while E1 cable is optional, so you need to order E1 cables when purchasing a 4-port module module. Otherwise, they will not be provided.

In addition, a 75-ohm to 120-ohm adapter is provided. For the pinouts of cables, see *Low-End and Mid-Range Series Routers Cable Manual*.

3.8.5 Internal DIP Switches

Router 2 and 4-Port CE1/PRI MIM and modules provide internal DIP switches, and the setting of DIP switches decides the interface impedance and grounding mode.

Table 3-21 Correlation between DIP switches of Router 2 and 4-Port CE1/PRI MIM and modules and E1 interface

Module				2-port		4-port	
DIP switch	S1			S1	S3	S4	S5
E1 interface	Interface 0			Interface 0	Interface 1	Interface 2	Interface 3

By default, all the DIP switches for Router 2 and 4-Port CE1/PRI MIM and modules are set to ON, as illustrated in the following figure:

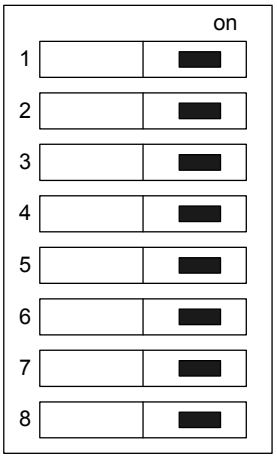

Figure 3-44 Default setting of DIP switches for Router 2 and 4-Port CE1/PRI MIM and modules

Description of DIP switch settings is given in the following table for Router 2 and 4-Port CE1/PRI MIM and modules:

Table 3-22 Description of DIP switch settings of Router 2 and 4-Port CE1/PRI MIM and modules

DIP	Description	Configuration of 75-ohm impedance	Configuration of 120-ohm impedance
1BIT	75-ohm/120-ohm selection switch	ON	OFF
2BIT		ON	OFF

3BIT		ON	OFF
4BIT		ON	OFF
5BIT		ON	OFF
6BIT	RxRing grounding mode selection switch	OFF: RxRing is grounded via capacitance. ON: RxRing is grounded directly.	-
7BIT	RxShield grounding mode selection switch	-	ON: RxShield is grounded. OFF: RxShield is not grounded.
8BIT	SxShield grounding mode selection switch	-	OFF: RxShield is grounded via capacitance ON: RxShield is grounded directly.

Caution:

It is recommended to select the DIP switch of Router 2 and 4-Port CE1/PRI MIM and modules in this way: when connecting 75-ohm cable, flip BIT1-8 to ON, and when connecting 120-ohm cable, flip BIT1-8 to OFF. Positions of DIP switches can only be changed by the trained personnel.

By default, all of the DIP switches of Router 2 and 4-Port CE1/PRI MIM and modules are factory-configured to ON, that is, the impedance of E1 interface is 75-ohm.

3.8.6 Connecting the Interface Cable

Caution:

Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage interface modules and even the Router;

Some protection measures are taken for Router 2 and 4-Port CE1/PRI MIM and modules. Still, you are recommended to install a special lightning arrester at the input end of the cable leading to the outdoors in order to protect the line against lightning strikes more efficiently.

I. Connecting interface cable of 1E1/2E1 and modules

Step 1: Check the type of cable, and set the DIP switches module correctly;

Step 2: Plug the DB-15 connector of the cable into the port on the module;

Step 3: Connect the other end of the cable to the network device;

1) When using 75-ohm unbalanced coaxial cable,

- Connect its BNC connector to the device to be connected directly, if cable extension is not needed;
- Connect its BNC connector to a coaxial connector and the other end of the coaxial connector to the device to be connected through a 75-ohm trunk cable, if cable extension is needed;

Caution:

Connect the local Tx wire in the cable to the remote Rx wire and the local Rx wire to the remote Tx wire.

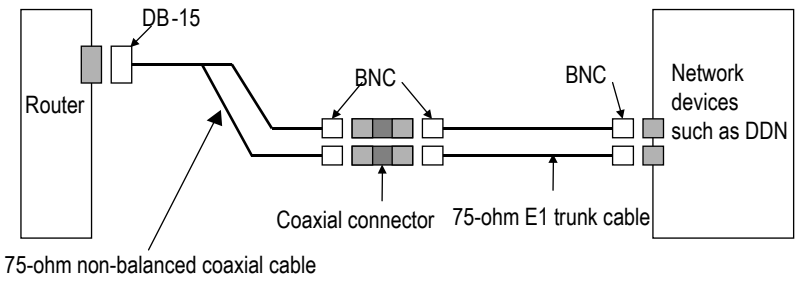

Figure 3-45 Extending an 75-ohm unbalanced coaxial cable

- If the port on the network device to be connected has a 120-ohm port, use a 75-ohm to 120-ohm adapter, or use a 120-ohm cable instead.

2) When using a 120-ohm balanced twisted pair cable,

- Connect its RJ-45 connector to the RJ-45 port on the device to be connected directly, if cable extension is not needed.
- Connect its RJ-45 connector to a network interface connector and then the other end of the network interface connector to the network device to be connected through a 120-ohm E1 trunk cable, if cable extension is needed.

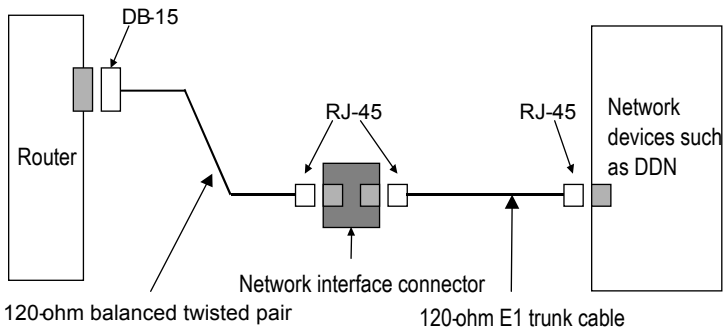

Figure 3-46 Extending an 120-ohm balanced twisted pair cable

Step 4: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent;

Step 5: Check the behavior of the LINK LED on the module panel. It is OFF when fault has occurred on the link and signal is out of synchronization. In this case, please check the link.

II. Connecting interface cable of 4-port

Step 1: Select the appropriate cable and cable according to type of the port on the remote device, and set DIP switches of module correctly;

- If the resistance of the port on the device to be connected is 75-ohm, select a 75-ohm E1 non-balanced coaxial cable and a 75-ohm 4E1 conversion cable, and set all the DIP switches on the 4E1/4E1-F module to “ON” (that is, the port resistance is 75-ohm).
- If the resistance of the port on the device to be connected is 120-ohm, select a 120-ohm balanced twisted pair cable and a 120-ohm conversion cable, and set all the DIP switches on the module to “OFF” (that is, the port resistance is 120-ohm).

Step 2: Plug the DB-25 connector of the conversion cable into a DB-25 port on or module, and tighten the screws;

Step 3: Connect the DB-15 connector of the conversion cable to the cable, making sure of wire sequence of the connector;

Step 4: Connect the E1 cable to the device to be connected.

Step 5: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent;

Step 6: Check the behavior of the LINK LED on the module panel. It is OFF when fault has occurred on the link and signal is out of synchronization. In this case, please check the link.

3.9 Router 4-Port ISDN-S/T MIM Module

3.9.1 Introduction

4-port ISDN BRI interface module (Router 4-Port ISDN-S/T MIM) serves to transmit/receive and handle four channels of data streams on the ISDN BRI S/T interface.

Router 4-Port ISDN-S/T MIM can work in dialup mode and leased line service mode.

3.9.2 Interface Attributes

The interface attributes of Router 4-Port ISDN-S/T MIM are given in the following figure:

Table 3-23 Interface attributes of Router 4-Port ISDN-S/T MIM

Attribute	Description
Connector	RJ-45
Number of connectors	4
Cable	ISDN S/T cable
Protocols and standards	ITU-T I.430, Q.921, Q.931 compliant
Operating mode	1) ISDN dialup 2) ISDN leased line
Services supported	1) ISDN 2) Supplementary ISDN services 3) Multi-user number 4) Sub-address 5) Backup

3.9.3 Internal DIP switches

The purpose of internal DIP switches of Router 4-Port ISDN-S/T MIM is to set the matched resistance on an ISDN BRI S/T port. The setting of this switch (DIP S1) decides the use of 100-ohm resistance on the ISDN BRI S/T port.

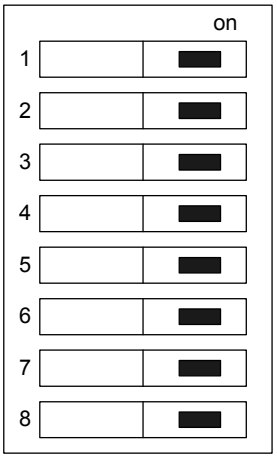

Figure 3-47 Default setting of DIP switch for Router 4-Port ISDN-S/T MIM module

Table 3-24 Configuration of DIP switches for Router 4-Port ISDN-S/T MIM module

DIP switch	Description		Default setting	Port
1. 2BIT	ON	Uses 100-ohm resistance	ON	0
	OFF	Not uses 100-ohm resistance		
3. 4BIT	ON	Uses 100-ohm resistance	ON	1
	OFF	Not uses 100-ohm matched resistance		
5. 6BIT	ON	Uses 100-ohm resistance	ON	2
	OFF	Not uses 100-ohm resistance		
7. 8BIT	ON	Uses 100-ohm resistance	ON	3
	OFF	Not uses 100-ohm resistance		

3.9.4 Interface LEDs

Router 4-Port ISDN-S/T MIM panel is shown in the following figure:

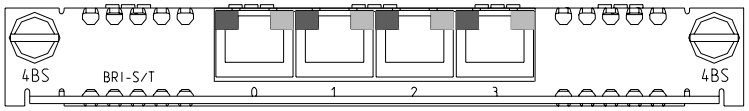

Figure 3-48 Router 4-Port ISDN-S/T MIM panel

Description of the LEDs on Router 4-Port ISDN-S/T MIM panel is shown in the following table:

Table 3-25 Description of the LEDs on Router 4-Port ISDN-S/T MIM panel

LED	Description
Yellow lamp on the left	OFF means channel B1 is idle. ON means channel B1 is occupied and data communication is going on.
Green lamp on the right	OFF means channel B2 is idle. ON means channel B2 is occupied and data communication is going on.

3.9.5 Interface Cable

Interface cables of Router 4-Port ISDN-S/T MIM are standard ISDN S/T interface cables. Pins 3 and 6 are for transmitting data, and pins 4 and 5 are for receiving data. At both ends of the cables are RJ-45 connectors.

Figure 3-49 ISDN S/T cable

3.9.6 Connecting the Interface Cable

Caution:

Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage MIMs and even the Router.

Step 1: On Router 4-Port ISDN-S/T MIM, choose the port for connection;

Step 2: Confirm the type of ISDN line provided by the telecom carrier;

Step 3: Connect the cable:

- If the line is an ISDN U line, adapt it using an NT1 adapter by plugging one end of the S/T interface cable to the S/T port of the NT1 adapter and the other end to the BRI port on Router 4-Port ISDN-S/T MIM;
- If the line is an ISDN BRI S/T interface line, directly connect the cable to the BRI port on Router 4-Port ISDN-S/T MIM;

Step 4: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that Router 4-Port ISDN-S/T MIM is operating normally and OFF means that the POST of Router 4-Port ISDN-S/T MIM has failed. In the latter case, please contact your agent.

3.10 Router 2-Port CT1/PRI MIM

3.10.1 Introduction

I. Router 2-Port CT1/PRI MIMmodule

1/2/4-port channelized T1/PRI interface module serves to transmit/receive and handle T1 data streams, provide CT1 access, and fulfill the function of ISDN PRI. Thereby, one card can be used for multiple purposes.

II.

1/2/4-port fractional T1 interface module and module are different in the sense that:

- FT1 operating mode supported by T1-F modules allows only one bundle. In other words, the time slots can only be bundled into one nx64 kbps or 56 kbps channel, where n=1-24. However, a CT1 module allows of arbitrary grouping of the 24 channels;
- T1-F does not support PRI mode.

3.10.2 Interface Attributes

The interface attributes of Router 2-Port CT1/PRI MIM modules are given in the following table:

Table 3-26 Interface attributes of Router 2-Port CT1/PRI MIM and modules

Attribute	Description
Connector	RJ-45
Number of connectors	2

Attribute	Description
Interface standard	G.703/T1.102 G.704 AT&T TR 54016 AT&T TR 62411 ANSI T1.403
Interface rate	1.544Mbps
Cable type	T1 cable (100-ohm shielding network cable)
Operating mode	CT1, ISDN PRI (Router 2-Port CT1/PRI MIMmodule) FT1 (module)
Services supported	1) Backup 2) Terminal access service 3) ISDN PRI (Router 2-Port CT1/PRI MIMmodule)

3.10.3 Interface LEDs

The panel is similar to that of the MIM, and they differ only in silk-screen.

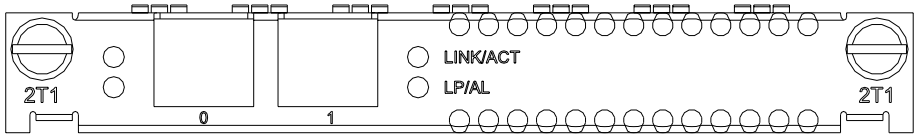

Figure 3-50 2T1/2T1-F panel

Table 3-27 Description of the LEDs

LED	Description
LINK/ACT	ON means the carrier signal has been received. OFF means no carrier signal has been received. Blinking means data is being transmitted or/and received.
LP/AL	ON means the interface is in a loopback. Blinking means an AIS, LFA, or RAI alarm signal is present. OFF means no loopback or alarm is present.

Note:

AIS = Alarm indication signal; LFA = loss of frame alignment; RAI = Remote alarm indication

3.10.4 Interface Cable

Interface cables (T1 cables) for modules are 100-ohm straight-through shielding network cables, as shown in the following figure:

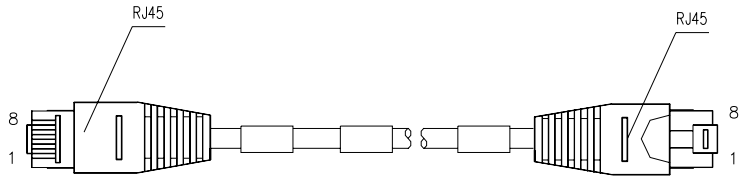

Figure 3-51 T1 cable

In addition, you may use a network interface connector to extend a T1 cable. Both ends of the connector are RJ-45 jacks that can connect two network cables.

Caution:

Both T1 cable and network interface connector are optional accessories. You should order them together with the module. Otherwise, they will not be provided.

3.10.5 Connecting the Interface Cable

Caution:

Read the mark identifying a port before you connect a cable to it, making sure it is the correct port. Wrong connection tends to damage interface modules and even the Router;

Some protection measures are taken for Router 2-Port CT1/PRI MIM. Still, you are recommended to install a special lightning arrester at the input end of the cable leading to the outdoors in order to protect the line against lightning strikes more efficiently.

Step 1: Insert one end of a T1 cable into the RJ-45 connector on the T1 or T1-F module;

Step 2: Connect the other end of the cable to the device to be connected:

- directly if the cable is long enough; or
- after extending the cable if it is not long enough, as shown in the following figure:

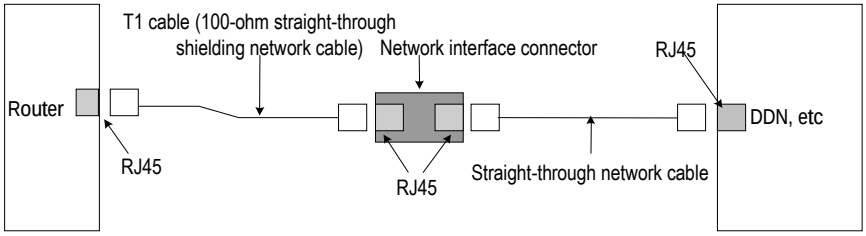

Figure 3-52 Extending a T1 cable

Step 3: Power on the Router, and check the corresponding LED READY on the front panel of the router for the slot: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent;

Step 4: Check the behavior of the LINK LED on the T1 or T1-F panel. It is OFF when the line is faulty and signal is Off.

3.11 Router 1-Port ADSL Over POTS MIM

3.11.1 Introduction

Router 1-Port ADSL Over POTS MIM/, the 1-/2-port ADSL over PSTN interface card, allows a LAN subscriber to connect to the digital subscriber's loop access multiplexer (DSLAM) at the central office over a regular analog subscriber line or telephone line. Thus, the subscriber can access the ATM/IP backbone or the Internet to enjoy services such as high-speed data communication and video on demand (VoD).

ADSL transmits data in the high frequency band above 26 kHz. Therefore, it can provide services without interfering with the voice service being provided in the low frequency band (0 to 4 kHz) on the same line. It provides downlink rates in the range 32 kbps to 8 Mbps and uplink rates in the range 32 kbps to 1 Mbps.

The ADSL interface cards provide these functions:

- Manual ADSL line activation and deactivation, supporting SAR loopback for convenient fault isolation.
- Interface standards of G. DMT, G. Lite, and T1.413, auto-sensing.
- Trellis coding (except for G. Lite) on ADSL interfaces, enhancing stability of ADSL connections.

3.11.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port ADSL Over POTS MIM.

Table 3-28 Interface attributes of the Router 1-Port ADSL Over POTS MIM

Attribute	Router 1-Port ADSL Over POTS MIM	
Connector	RJ-11	
Number of connectors	1 (Router 1-Port ADSL Over POTS MIM) 2 ()	
Interface standard	ITU-T 992.1 G.DMT ITU-T 992.2 G.Lite ANSI T1.413 Issue 2	
Interface rate	In ADSL full rate mode (ITU-T 992.1 G.DMT/ANSI T1.413): 8160 kbps (downlink rate) 896 kbps (uplink rate).	
Cable and the Max. transmission segment	In full rate mode, 1.8 km (1.1 mi.) over the telephone cable (depending on the line quality).	
Supported service	ADSL over the regular telephone line	

3.11.3 Panel and Interface LED

The following figure illustrates the Router 1-Port ADSL Over POTS MIM panel.

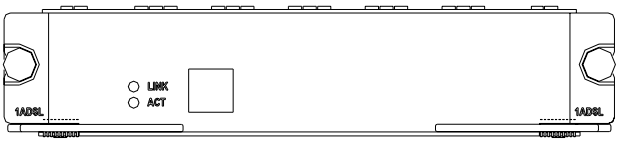

Figure 3-53 Router 1-Port ADSL Over POTS MIM panel

The following table describes the LEDs on the card panels.

Table 3-29 LEDs on the Router 1-Port ADSL Over POTS MIM panel

LED	Description
LINK	OFF means the loop is inactive; ON means the loop has been activated and has entered the data mode; blinking means the loop is being activated.
ACT	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

3.11.4 Interface Cable

The interface cables that the Router 1-Port ADSL Over POTS MIM uses are regular telephone cables.

Note:

The standard equipping package of the Router 1-Port ADSL Over POTS MIM includes the regular telephone cable(s). You can separately order an external splitter as needed.

3.11.5 Connecting the Interface Cable

In G. Lite mode, no splitter is needed. You can directly connect the router to the PSTN using a telephone cable, and simply connect the phone-set in parallel with the router at the cable distribution box.

Full rate mode requires a splitter. Follow these steps to connect the cables:

Step 1: Plug one end of a telephone cable into the ADSL port on the router, and the other end into the internal ADSL port on the splitter.

Step 2: Connect the telephone to the phone port on the splitter with another telephone cable.

Step 3: Connect the external ADSL port on the splitter to the PSTN with a third telephone cable.

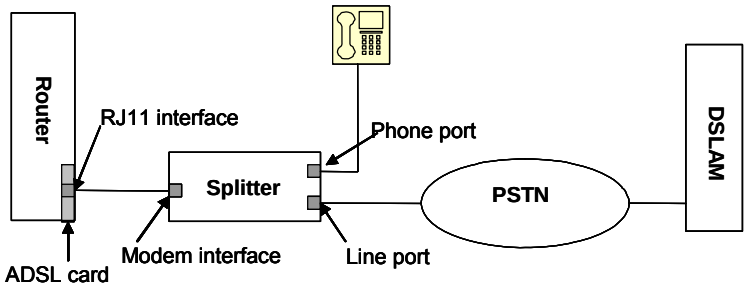

Figure 3-54 Connecting the Router 1-Port ADSL Over POTS MIM

3.12 Router 2-Port ADSL Over POTS MIM

3.12.1 Introduction

Router 2-Port ADSL Over POTS MIM, the 2-port ADSL over PSTN interface card, allows a LAN subscriber to connect to the digital subscriber's loop access multiplexer (DSLAM) at the central office over a regular analog subscriber line or telephone line. Thus, the subscriber can access the ATM/IP backbone or the Internet to enjoy services such as high-speed data communication and video on demand (VoD).

ADSL transmits data in the high frequency band above 26 kHz. Therefore, it can provide services without interfering with the voice service being provided in the low frequency band (0 to 4 kHz) on the same line. It provides downlink rates in the range 32 kbps to 8 Mbps and uplink rates in the range 32 kbps to 1 Mbps.

The ADSL interface cards provide these functions:

- Manual ADSL line activation and deactivation, supporting SAR loopback for convenient fault isolation.
- Interface standards of G. DMT, G. Lite, and T1.413, auto-sensing.
- Trellis coding (except for G. Lite) on ADSL interfaces, enhancing stability of ADSL connections.

3.12.2 Interface Attributes

The following table describes the interface attributes of the Router 2-Port ADSL Over POTS MIM.

Table 3-30 Interface attributes of the Router 2-Port ADSL Over POTS MIM

Attribute		Router 2-Port ADSL Over POTS MIM
Connector	RJ-11	

Number of connectors	1 () 2 (Router 2-Port ADSL Over POTS MIM)
Interface standard	ITU-T 992.1 G.DMT ITU-T 992.2 G.Lite ANSI T1.413 Issue 2
Interface rate	In ADSL full rate mode (ITU-T 992.1 G.DMT/ANSI T1.413): 8160 kbps (downlink rate) 896 kbps (uplink rate).
Cable and the Max. transmission segment	In full rate mode, 1.8 km (1.1 mi.) over the telephone cable (depending on the line quality).
Supported service	ADSL over the regular telephone line

3.12.3 Panel and Interface LED

The following figure illustrates the Router 2-Port ADSL Over POTS MIM panel.

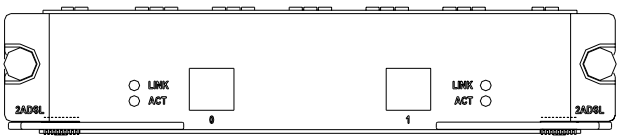

Figure 3-55 Router 2-Port ADSL Over POTS MIM panel

The following table describes the LEDs on the card panels.

Table 3-31 LEDs on the Router 2-Port ADSL Over POTS MIM panel

LED	Description
LINK	OFF means the loop is inactive; ON means the loop has been activated and has entered the data mode; blinking means the loop is being activated.
ACT	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

3.12.4 Interface Cable

The interface cables that the Router 2-Port ADSL Over POTS MIM uses are regular telephone cables.

🕮 **Note:**

The standard equipping package of the Router 2-Port ADSL Over POTS MIM includes the regular telephone cable(s). You can separately order an external splitter as needed.

3.12.5 Connecting the Interface Cable

In G. Lite mode, no splitter is needed. You can directly connect the router to the PSTN using a telephone cable, and simply connect the phone-set in parallel with the router at the cable distribution box.

Full rate mode requires a splitter. Follow these steps to connect the cables:

Step 1: Plug one end of a telephone cable into the ADSL port on the router, and the other end into the internal ADSL port on the splitter.

Step 2: Connect the telephone to the phone port on the splitter with another telephone cable.

Step 3: Connect the external ADSL port on the splitter to the PSTN with a third telephone cable.

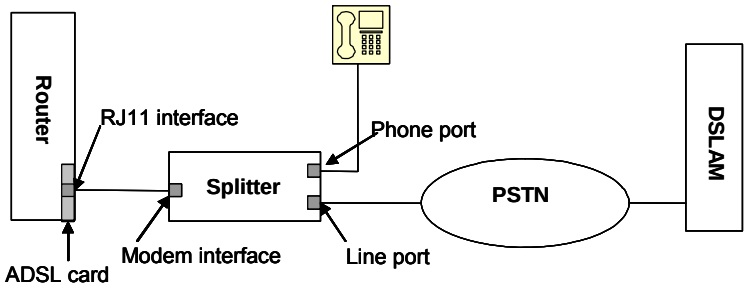

Figure 3-56 Connecting the Router 2-Port ADSL Over POTS MIM

3.13 Router NDEC2 Encryption Accelerator MIM

3.13.1 Introduction

High Network Data Encryption (Router NDEC2 Encryption Accelerator MIMfor short) supports IPsec protocol, multiple hardware encryption/decryption and hash algorithm to speed up the encryption of the IP packets, featuring high-performance and high-reliability.

Insert Router NDEC2 Encryption Accelerator MIM in the MIM slot of a low-end and mid-range modular router. The main board forwards the IP packets and implements the VPN with encryption feature which is complemented by encryption card.

3.13.2 Appearance

The appearance of Router NDEC2 Encryption Accelerator MIM is shown as below:

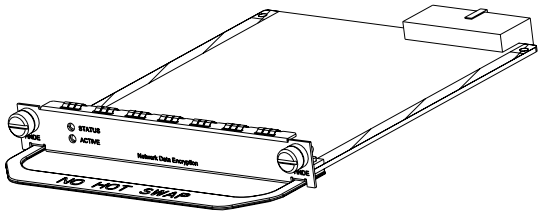

Figure 3-57 Router NDEC2 Encryption Accelerator MIM

3.13.3 Interface Attributes

Table 3-32 Router NDEC2 Encryption Accelerator MIM features

Feature	Description
Protocol supported	IPsec
The maximum number of concurrent IPSec connections	100
Hardware algorithm	1) key algorithm (DES, 3DES, AES) 2) Authentication algorithm (HMAC-MD5-96, HMAC-SHA-1-96)

3.13.4 Interface LEDs

The front panel of Router NDEC2 Encryption Accelerator MIM is shown in the following figure:

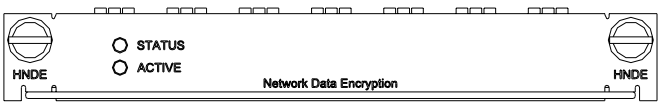

Figure 3-58 Router NDEC2 Encryption Accelerator MIMpanel

Table 3-33 Description of the LEDs on Router NDEC2 Encryption Accelerator MIMpanel

LED	Indication
STATUS	ON (green): The Router NDEC2 Encryption Accelerator MIM is powered on properly. OFF: There is no power supply, damaged power supply, or sever hardware failure.
ACTIVE	OFF after flashing yellow for two seconds: Initialized the Router NDEC2 Encryption Accelerator MIM. Blinking continuously: The Router NDEC2 Encryption Accelerator MIM operates normally and there is data transmission with the host. OFF: Router NDEC2 Encryption Accelerator MIM runs normally and no data transmission exists with the host.

3.13.5 Troubleshooting

1) Symptom 1: The STATUS LED stays off after turning on the router.

Troubleshooting: The STATUS LED should stay solid on after powered on. The OFF status indicates that the Router NDEC2 Encryption Accelerator MIM or some hardware is not powered on properly. Check the connection of the power supply.

If the device is powered on, the failure may due to the damaged power supply of the module, or abnormal operation of CPLD (Complex Programmable Logic Device). In these circumstances, contact our agents for support.

2) Symptom 2: The ACTIVE LED stays off when powering on the router.

Troubleshooting: When powering up the device, the ACTIVE LED should flashing for two seconds before turning off, which indicates the encryption processor of the Router NDEC2 Encryption Accelerator MIM has been configured and is ready for work. If the ACTIVE LED stays on when powering up the device, this means the initialization of the processor fails and the system bus does not work normally. Check the connection between the Router NDEC2 Encryption Accelerator MIM and the host. If the connection is good, the abnormal status may due to the host or the Router NDEC2 Encryption Accelerator MIM, contact our agents for support.

3) Symptom 3: The ACTIVE LED stays on or off when the Router NDEC2 Encryption Accelerator MIM is running.

Troubleshooting: The ACTIVE LED should be blinking when the Router NDEC2 Encryption Accelerator MIM runs the encryption service. The solid on or off indicates the system bus works abnormally. Check the connection between the Router NDEC2 Encryption Accelerator MIM and host. If the connection is good, the abnormal status

may due to the host or the Router NDEC2 Encryption Accelerator MIM, contact our agents for support.

3.14 Router 4-Port E1 IMA MIM

3.14.1 Introduction

The Router 4-Port E1 IMA MIM interface card provides four E1 interfaces that support inverse multiplexing for ATM (IMA) technology. The IMA technology is a method to multiplex many low-speed links to one high-speed ATM cell flow: the transmission end splits the cell flow of the ATM set to many low-speed E1 links, and the remote end multiplexes these low-speed E1 links to one single cell flow. This technology is cost-effective and flexible for application and mainly used in network applications that transmit ATM cell through plesiochronous digital hierarchy (PDH) network.

3.14.2 Appearance of the Interface Card

The following figure shows the appearance of the Router 4-Port E1 IMA MIM interface card:

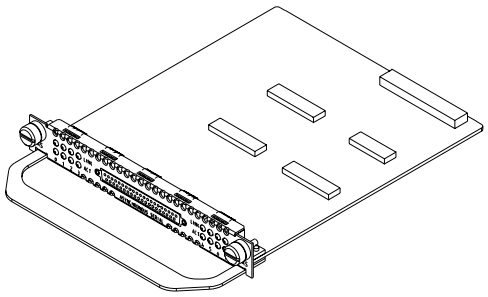

Figure 3-59 Appearance of the Router 4-Port E1 IMA MIM interface card

3.14.3 Interface Attributes

The following table describes the Router 4-Port E1 IMA MIM interface attributes:

Table 3-34 Router 4-Port E1 IMA MIM interface attributes

Item	Description			
	Router 4-Port E1 IMA MIM (75-ohm)		Router 4-Port E1 IMA MIM (120-ohm)	
Connector type	DB68			
Connector quantity	One			

Item	Description			
		Router 4-Port E1 IMA MIM (75-ohm)		Router 4-Port E1 IMA MIM (120-ohm)
Interface standard	ITU-G.703, ITU-G.704			
Interface rate	2.048 Mbps			
Cable type	E1 coaxial cable		Shielded twisted pair	
Cable characteristic impedance	75 ohm		120 ohm	
Max transmission distance	500 m (1640.4 in.)		150 m (492.1 in.)	
Operating mode	ATM E1 standalone link /IMA binding mode			
Service	AAL5			
Protocol	PPPoA, PPPoEoA, IPoA, IPoEoA			
Transmission rate	CBR/VBR-rt/VBR-nrt/UBR			

3.14.4 Panels and Interface LEDs

The following figures show the panels of the Router 4-Port E1 IMA MIM interface cards:

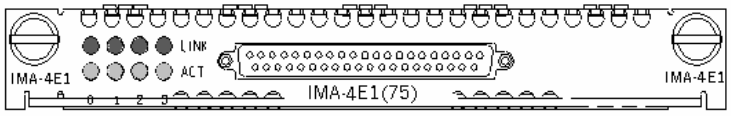

Figure 3-60 Front panel of the 75-ohm Router 4-Port E1 IMA MIMinterface card

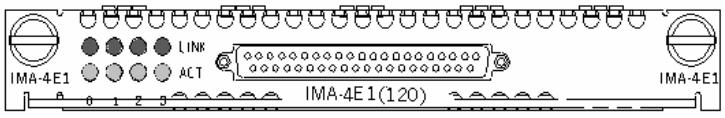

Figure 3-61 Front panel of the 120-ohm Router 4-Port E1 IMA MIMinterface card

The LEDs on the front panel of the Router 4-Port E1 IMA MIM interface card, as described in the following table:

Table 3-35 Meaning of the LEDs

LED	Meaning
LINK	OFF: the link is disconnected. ON: the link is connected.
ACT	Blink: data is being transmitted/received. Off: no data is being transmitted/received.

3.14.5 Interface Cable

The RT-Router 4-Port E1 IMA MIM provides four E1 ports and adopts a 120-ohm or a 75-ohm Router 4-Port E1 IMA MIM conversion cable. The two types of cables have similar appearance. Both of them have a DB68 connector at one end used to connect a router. While at the other end, the 75-ohm Router 4-Port E1 IMA MIM conversion cable can be connected with eight coaxial cables; and the 120-ohm Router 4-Port E1 IMA MIM conversion cable can be connected with four twisted pairs.

3.14.6 Connection of the Interface Cable

Perform the following procedure to connect the RT-Router 4-Port E1 IMA MIM interface cable:

1) Choose an appropriate type of IMA-8E1/Router 4-Port E1 IMA MIM cable depending on the interface type of the peer device.
- If the interface impedance of the peer device is 75 ohm, use a 75-ohm Router 4-Port E1 IMA MIM conversion cable.
- If the interface impedance of the peer device is 120 ohm, use a 120-ohm Router 4-Port E1 IMA MIM conversion cable.

2) Insert the Router 4-Port E1 IMA MIM conversion cable at the DB68 end to the DB68 port of the Router 4-Port E1 IMA MIM interface card, and fasten the fixed screws of the cable.
3) Check the serial number of the other end of the IMA-4E1 conversion cable and connect it with an E1 cable.
4) Connect the E1 cable with a peer device.
5) Check the slot-corresponding LED on the front panel of the router after power-on. If the LED lights, it indicates the interface card passed the self test and operates normally. If the LED is off, it indicates the interface card did not pass the self test, in this case, contact your agent.

6) Check the status of the LINK LED on the panel of the IMA-4E1 interface card after power-on. If the LED is off (indicating the line is faulty, and the signal is desynchronized), check the line.

3.15 Router 4-Port T1 IMA MIM

3.15.1 Introduction to the Interface card

The Router 4-Port T1 IMA MIM interface card provides four T1 interfaces that support the IMA technology. The network application of the two cards is similar to the IMA-8E1/ IMA-4E1 interface card.

3.15.2 Appearance of the Interface Card

The following figure shows the appearance of the Router 4-Port T1 IMA MIM interface card:

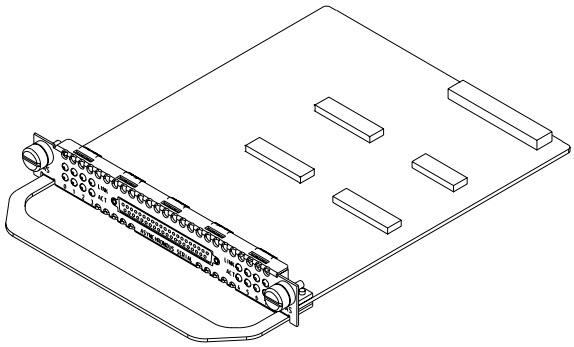

Figure 3-62 Appearance of the Router 4-Port T1 IMA MIM interface card

3.15.3 Interface Attributes

The following table describes the Router 4-Port T1 IMA MIM interface attributes:

Table 3-36 Router 4-Port T1 IMA MIM interface attributes

Item	Description	
		Router 4-Port T1 IMA MIM
Connector type	DB68	
Connector quantity	One	
Interface standard	ITU-G.703, ITU-G.704	
Cable type	T1 shielded twisted pair	

Cable characteristic impedance	100 ohm
Max transmission distance	150 m (492.1 in.)
Operating mode	ATM T1 standalone link/IMA binding mode
Service	AAL5
Protocol	PPPoA, PPPoEoA, IPoA, IPoEoA
Transmission rate	CBR/VBR-rt/VBR-nrt/UBR

3.15.4 Panels and Interface LEDs

The following figures show the panels of the Router 4-Port T1 IMA MIM interface cards:

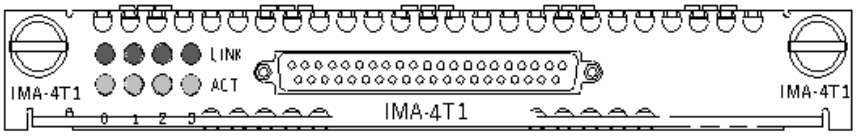

Figure 3-63 Front panel of the IMA-4T1 interface card

The LEDs on the front panel of the Router 4-Port T1 IMA MIM panel, as described in the following table:

Table 3-37 Meaning of the LEDs

LED	Meaning
LINK	OFF: the link is disconnected. ON: the link is connected.
ACT	Blink: data is being transmitted/received. Off: no data is being transmitted/received.

3.15.5 Connection of the Interface Cable

1) Insert the Router 4-Port T1 IMA MIM conversion cable at the DB68 end to the DB68 port of the Router 4-Port T1 IMA MIM interface card.

2) Connect one RJ45 connector of the Router 4-Port T1 IMA MIM conversion cable to a peer device.
3) Check the status of the LINK LED on the panel of the Router 4-Port T1 IMA MIM interface card. If the LED is off (indicating the line is faulty), check the line.

3.16 Router 1-Port CE3 MIM Module

3.16.1 Introduction

1-port channelized E3 interface module (Router 1-Port CE3 MIM) serves to:

- Transmit/Receive and handle one channel of E3 fast traffic, as well as provide the accessing of E3 traffic when working in E3 mode; and
- Provide the low-speed accessing service at the speed of n x 64 kbps, where n is smaller than or equal to 128, when working in CE3 mode.

Note:

E3 represents the tertiary group rate of E system in the TDM system, that is, 34.368Mbps. An E3 channel can be channelized into 16 E1 lines through the demultiplexing processes of E23 and E12, each E1 line supporting both the operating modes of E1 and CE1. E23 is used to indicate either E2-to-E3 multiplex or E3-to-E2 demultiplex, and E12 to indicate E1-to-E2 multiplex or E2-to-E1 demultiplex. “E23” and “E12” discussed here represent the demultiplex process.

3.16.2 Interface Attributes

The interface attributes of Router 1-Port CE3 MIM are given in the following table:

Table 3-38 Interface attributes of Router 1-Port CE3 MIM

Attribute	Description
Connector	SMB
Number of connectors	2
Interface standard	G.703, G.704, G.751
Interface rate	34.368Mbps
Interface cable type	E3 cable (75ohm coaxial cable)
Operating mode	E3 CE3
Services supported	E3 leased line

3.16.3 Interface LEDs

Router 1-Port CE3 MIM panel is shown in the following figure:

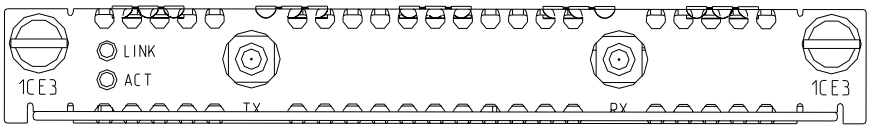

Figure 3-64 Router 1-Port CE3 MIM panel

Description of the LEDs on Router 1-Port CE3 MIM panel is given in the following table:

Table 3-39 Description of the LEDs on Router 1-Port CE3 MIM panel

LED	Description
LINK	OFF means the link is not set up. ON means the link has been set up.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

3.16.4 Interface Cable

The external interface provided by a Router 1-Port CE3 MIM module is two SMB sockets respectively for Tx (Transmitter end) and Rx (Receiver end). The interface adopts 75ohm unbalanced transmission mode and uses a pair of 75ohm unbalanced coaxial cables to connect the peer device.

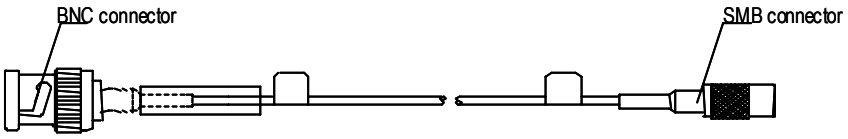

Figure 3-65 E3/T3 cable

Note:

Router 1-Port CE3 MIM uses the same cable, which is called E3/T3 cable in this manual.

The standard configuration package of Router 1-Port CE3 MIM has included the interface cable.

3.16.5 Connecting the Interface Cable

Caution:

Some measures have been taken to protect the Router 1-Port CE3 MIM module. To achieve better lightning protection effects, however, you are recommended to add a special lightning arrester at the input end of the E3 or T3 cable when it is led outdoors.

Step 1: Connect the SMB connector of an E3 or T3 cable to the Tx port of Router 1-Port CE3 MIM and another end to the Rx port of the device to be connected;

Step 2: Connect the SMB connector of another E3 or T3 cable to the Rx port of Router 1-Port CE3 MIM and another end to the Tx port of the peer device;

Step 3: Power on the Router, and check the LEDs of the corresponding slot on the front panel: ON means that the MIM is operating normally and OFF means that the POST of the MIM has failed. In the latter case, please contact your agent;

Step 4: Check the behavior of the LINK LED on the Router 1-Port CE3 MIM panel. It is OFF when the line is faulty and signal is out of synchronization. In this case, check the link.

3.17 Router 1-Port CT3 MIM Module

3.17.1 Introduction

1-port channelized T3 interface module (Router 1-Port CT3 MIM) serves to:

- Transmit/Receive and handle one channel of T3 fast traffic, as well as provide the accessing of T3 traffic when working in T3 mode; and
- Provide the low-speed accessing service at the speed of n x 64 kbps or 56 kbps, where n is smaller than or equal to 128, when working in CT3 mode.

Note:

T3 represents the tertiary group rate of T system in the TDM system, that is, 44.736 Mbps. A T3 channel can be channelized into 28 T1 lines through the demultiplexing processes of T23 and T12, each T1 line also supporting the operating modes of CT1. T23 is used to indicate either T2-to-T3 multiplex or T3-to-T2 demultiplex, and T12 to indicate T1-to-T2 multiplex or T2-to-T1 demultiplex. “T23” and “T12” discussed here represent the demultiplex process.

3.17.2 Interface Attributes

The interface attributes of Router 1-Port CT3 MIM are given in the following table:

Table 3-40 Interface attributes of Router 1-Port CT3 MIM

Attribute	Description
Connector	SMB
Number of connectors	2
Interface standard	G.703 G.704 G.752 AT&T TR 54014 AT&T TR 62415 ANSI T1.107
Interface rate	44.736 Mbps
Interface cable type	T3 cable (75-ohm coaxial cable)
Operating mode	T3 CT3
Services supported	T3 leased line

3.17.3 Interface LEDs

Router 1-Port CT3 MIM panel is shown in the following figure:

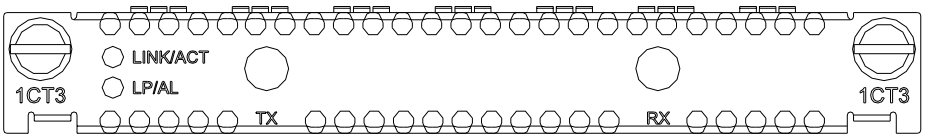

Figure 3-66 Router 1-Port CT3 MIM panel

Description of the LEDs on Router 1-Port CT3 MIM panel is shown in the following table:

Table 3-41 Description of the LEDs on Router 1-Port CT3 MIM panel

LED	Description
LINK/ACT	ON means the carrier signal has been received. OFF means no carrier signal has been received. Blinking means data is being transmitted or/and received.

LP/AL	ON means the interface is in a loopback. Blinking means an AIS, LFA, or RAI alarm signal is present. OFF means no loopback or alarm is present.
Note: AIS = Alarm indication signal; LFA = loss of frame alignment; RAI = Remote alarm indication	

3.17.4 Interface Cable

Router 1-Port CT3 MIM and Router 1-Port CE3 MIM use the same type of interface cables and make connection in the same way.

3.18 Router 1-Port 10/100/1000 MIM

3.18.1 Introduction

Router 1-Port 10/100/1000 MIM, the 1-port 10Base-T/100Base-TX/1000Base-T Ethernet electrical interface card, is used for router-to-LAN communication.

The cards support:

- 100 meters (328.1 ft.) of transmission segment over the category-5 twisted-pair cable.
- Operation at 1000Mbps, 100Mbps, and 10Mbps, auto-sensing.
- Half-duplex/full duplex, autonegotiation

3.18.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port 10/100/1000 MIM:

Table 3-42 Interface attributes of the Router 1-Port 10/100/1000 MIM

Attribute	Router 1-Port 10/100/1000 MIM	
Connector	RJ-45	
Number of connectors	1	
Interface type	MDI/MDIX	
Interface standard	802.3, 802.3u, and 802.3ab	
Cable type	Ethernet cable	
Operating mode	10/100/1000 Mbps auto-sensing Half-duplex/full duplex, autonegotiation	

The following figures show the Router 1-Port 10/100/1000 MIM panels.

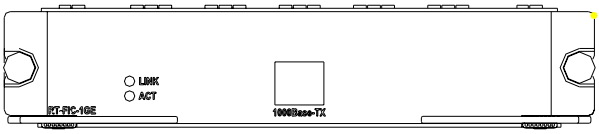

Figure 3-67 Router 1-Port 10/100/1000 MIM panel

The following table describes the LEDs on the Router 1-Port 10/100/1000 MIM panel.

Table 3-43 LEDs on the Router 1-Port 10/100/1000 MIM panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received. Blinking means data is being transmitted and/or received.

3.18.3 Interface Cable

Router 1-Port 10/100/1000 MIM uses both crossover and straight-through cables for connection.

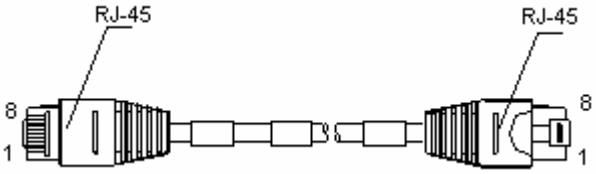

Figure 3-68 Ethernet cable

3.18.4 Connecting the Interface Cable

Step 1: Connect one end of the cable to the Ethernet interface on the router and the other end to another device.

Step 2: Power on the router and check the behavior of the LINK LED on the panel. ON means a link is present and OFF means no link is present. In the latter case, check the line status.

Chapter 4 Flexible Interface Cards (Router 6000)

4.1 Router 2-Port 10/100 FIC

4.1.1 Introduction

The Router 2-port 10Base-T/100Base-TX FE interface card (3C13861) provides two 10/100 Mbps RJ-45 Ethernet interface(s) for router-and-LAN communication.

The cards support:

- 100 meters (328.1 ft.) of transmission segment over the category-5 twisted-pair cable.
- Operation at 100 Mbps and 10 Mbps, autosensing.
- Full duplex and half-duplex, with the former in common use.

4.1.2 Interface Attributes

The following table describes the interface attributes of the FIC-FE cards.

Table 4-1 FIC-2FE interface attributes

Attribute	Description	
		Router 2-Port 10/100
Connector	RJ-45	
Number of connectors	1	2
Cable	Straight-through Ethernet cable	
Operating mode	Full duplex/half-duplex 10/100 Mbps auto-sensing	
Supported frame format	Ethernet_II Ethernet_SNAP	

4.1.3 Panel and Interface LEDs

The following figure illustrates an Router 2-Port 10/100 panel.

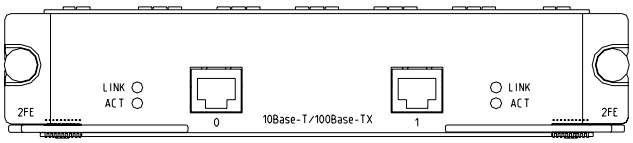

Figure 4-1 Router 2-Port 10/100 panel

The following table describes the LEDs on the Router 2-Port 10/100 panel.

Table 4-2 LEDs on the Router 2-Port 10/100 panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

4.1.4 Interface Cable

I. Ethernet cable

As shown in the following figure, the Ethernet cables for Router 2-Port 10/100 cards are category-5 twisted pairs with RJ-45 connectors. Pins 1 and 2 of the interface are used for transmitting data, and pins 3 and 6 are used for receiving data.

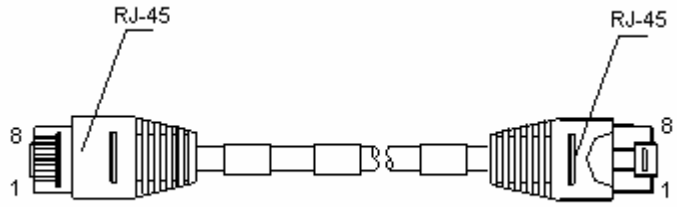

Figure 4-2 Ethernet cable

II. Making Ethernet cables

You can use category 5 twisted-pair cables to make Ethernet cables. A category 5 twisted-pair cable is composed of eight wires that are identified and grouped by colors of the outer insulator. Usually a solid color wire and a white/solid color wire are organized in pairs. But sometimes, wires are also paired by color dots.

Ethernet cables fit into two categories: straight-through and crossover.

- Straight-through cable: The wires are crimped in the RJ-45 connectors at both ends in the same order. The cable is used for connecting a terminal device (for

example, PC or router) to a HUB or LAN switch. The cables delivered with the router are straight-through cables.

- Crossover cable: The wires are crimped in the RJ-45 connectors at both ends in different orders. The cable is used for connecting two terminal devices (for example, PC and router). You can make cables as needed.

Note:

In making network cables, shielded cables are preferred for electromagnetic compatibility sake.

The interface cables in the standard package of Router 2-Port 10/100 cards are straight-through cables.

4.1.5 Connecting the Interface Cable

Step 1: Plug one end of the cable to an Ethernet port on the router and another end to the device to be connected. (For a PC or router, use a straight-through cable; for a HUB or LAN switch, use a crossover cable.)

Step 2: Power on the router and check the on the FIC-FE panel: ON means that a link is present and OFF means that no link is present. In the latter case, check the line status.

Caution:

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

4.2 Router 1-Port 100FX MM FIC/100FX SM FIC

4.2.1 Introduction

Router 1-Port 100FX MM FIC/100FX SM FIC Ethernet multi-mode fiber interface card, provides one 100 Mbps Ethernet multi-mode fiber interface.

Router 1-Port 100FX MM FIC/100FX SM FIC Ethernet single-mode fiber interface card, provides one 100 Mbps Ethernet single mode fiber interface.

The use of optical fibers allows the Router 1-Port 100FX MM FIC/100FX SM FIC to provide high reliability and good transmission quality for the router-to-LAN communication. The interface can work in megabit full duplex mode.

Note:

Depending on how light travels, optical fibers are divided into multi-mode optical fiber and single-mode optical fiber.

Single-mode optical fiber has very thin core, and transmits only in single mode on a given wavelength. It features wide band and large transmission capacity.

Multi-mode optical fiber allows transmission in multiple modes on a given wavelength. In multi-mode, lights in different modes travel at different speeds, resulting in phase distortion and thus limiting the transmission band. In terms of fiber core size, there are two types of multi-mode optical fibers: 62.5 μm and 50 μm, the transmission media accepted by the ISO/IEC 11801 standard.

4.2.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port 100FX MM FIC/100FX SM FIC.

Table 4-3 Router 1-Port 100FX MM FIC/100FX SM FIC interface attributes

Attribute		Description	
		100FX SM	100FX MM
Connector		SC	
Number of connectors		1	
Optical fiber mode		Single-mode	Multi-mode
Max. transmission segment		15 km (9.3 mi.)	2 km (1.2 mi.)
Central wavelength		1310nm (1261 to 1360nm)	1315nm (1270 to 1360 nm)
Optical transmitter power	Min.	-15 dBm	-20 dBm
	Max.	-8 dBm	-14 dBm
Receiver sensitivity	Min.	-31 dBm	-31 dBm
	Max.	-8 dBm	-14 dBm
Operating mode		Full duplex 100Mbps	
Supported frame format		Ethernet_II	

Attribute	Description	
	100FX SM	100FX MM
	Ethernet_SNAP	

4.2.3 Panel and Interface LEDs

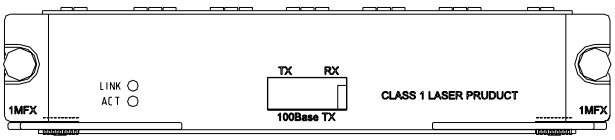

Figure 4-3 100FX MM panel

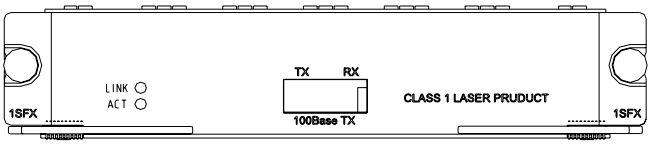

Figure 4-4 100FX SM panel

The following table describes the LEDs on the card panel.

Table 4-4 LEDs on the Router 1-Port 100FX MM FIC/100FX SM FIC panel

LED	Description
LINK	OFF means no Rx link is present, and ON means an Rx link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

4.2.4 Interface Optical Fiber

The 100FX MM should be connected to multi-mode optical fiber and the 100FX SM to single-mode optical fiber. Because the optical interfaces on both cards are SC-type optical receptacles, you must use the optical fibers with SC-type connectors to connect them.

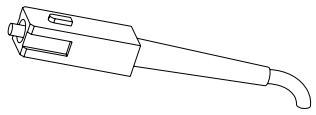

Figure 4-5 SC-type fiber-optic connector

Note:

Fiber-optic connectors, according to ITU, are passive components that are used to stably but not permanently connect two or more optical fibers. They are passive components indispensable to the fiber-optic communications system in the sense that they allow optical channel connections removable.

There are many types of optical fiber connectors, such as:

FC: Round-shape threaded fiber-optic connector

ST: Round-shape plug-in fiber-optic connector

SC: Square fiber-optic connector

MT-RJ: Square transceiving fiber-optic connector

Note:

The two types of optical fibers are optional. You need to select fibers when purchasing an Router 1-Port 100FX MM FIC/100FX SM FIC; otherwise, they are not provided.

4.2.5 Connecting the Interface Optical Fiber

Caution:

When connecting an optical fiber, note that:

Do not over-bend the optical fiber. Its curvature radius must be no less than 10 cm (3.9 in).

Ensure that the Tx and Rx ends are connected correctly.

Ensure that the fiber ends are clean and free of dust.

Warning:

Laser danger: Invisible laser radiation may be emitted from the fiber-optic ports which are connected with lasers. To protect your eyes against radiation harm, never stare into an open fiber-optic port.

Step 1: Locate the Rx and Tx ports on the interface card. Connect them to another device with two optical fibers: Rx to Tx and Tx to Rx.

Step 2: Power on the router and check the behavior of the LINK LED on the card panel: ON means an Rx link is present and OFF means the opposite. In the latter case, check the line status.

4.3 Router 1-Port 10/100/1000 FIC

4.3.1 Introduction

Router 1-Port 10/100/1000 FIC, the 1-port 10Base-T/100Base-TX/1000Base-T Ethernet electrical interface card, is used for router-to-LAN communication.

The cards support:

- 100 meters (328.1 ft.) of transmission segment over the category-5 twisted-pair cable.
- Operation at 1000Mbps, 100Mbps, and 10Mbps, auto-sensing.
- Half-duplex/full duplex, autonegotiation

4.3.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port 10/100/1000 FIC:

Table 4-5 Interface attributes of the Router 1-Port 10/100/1000 FIC

Attribute	1-Port 10/100/1000 FIC,	
Connector	RJ-45	
Number of connectors	1	2
Interface type	MDI/MDIX	
Interface standard	802.3, 802.3u, and 802.3ab	
Cable type	Ethernet cable	
Operating mode	10/100/1000 Mbps auto-sensing Half-duplex/full duplex, autonegotiation	

4.3.3 Panel and Interface LEDs

The following figures show the 1-Port 10/100/1000 FIC panel.

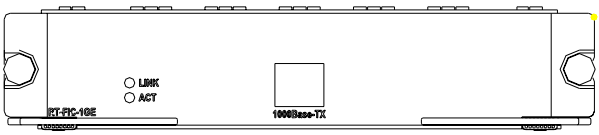

Figure 4-6 1-Port 10/100/1000 FIC, panel

The following table describes the LEDs on the Router 1-Port 10/100/1000 FIC panel.

Table 4-6 LEDs on the Router 1-Port 10/100/1000 FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received. Blinking means data is being transmitted and/or received.

4.3.4 Interface Cable

Router 1-Port 10/100/1000 FIC uses both crossover and straight-through cables for connection.

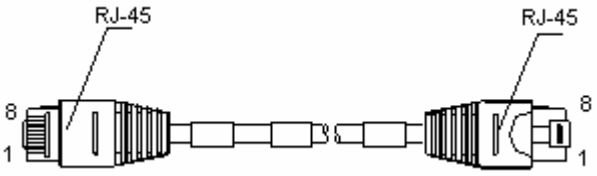

Figure 4-7 Ethernet cable

4.3.5 Connecting the Interface Cable

Step 1: Connect one end of the cable to the Ethernet interface on the router and the other end to another device.

Step 2: Power on the router and check the behavior of the LINK LED on the panel. ON means a link is present and OFF means no link is present. In the latter case, check the line status.

4.4 Router 1-Port Gigabit Ethernet Fiber FIC

4.4.1 Introduction

The 1-port 1000Base-SX/1000Base-LX GE fiber interface card, is used for router-to-LAN communication.

The cards support:

- Operation at 1000 Mbps
- Full duplex

4.4.2 Interface Attributes

The following table describes the interface attributes of the 1-Port GIGABIT ETHERNET FIC/FIC-2GEF:

Table 4-7 Interface attributes of the 1-Port GIGABIT ETHERNET FIC

Attribute		1-Port GIGABIT ETHERNET FIC		
Connector				
Number of interfaces		1		
Interface standard				
Optical transmitter power	Type	Multi-mode short-haul (850 nm)	Single-mode medium-haul (1310 nm)	Long-haul (1310 nm)
	Min.	-9.5 dBm	-9 dBm	-2 dBm
	Max.	0 dBm	-3 dBm	5 dBm
Receiver sensitivity		-17 dBm	-20 dBm	-23 dBm
Central wavelength		850 nm	1310 nm	1310 nm
Fiber type		62.5/125 μm multi-mode	9/125 μm single mode	9/125 μm single mode
Max. transmission segment		0.55 km (0.34 mi.)	10 km (6.21 mi.)	40 km (24.86 mi.)
Operating mode				

4.4.3 Panel and Interface LEDs

The following figures illustrate the 1-Port GIGABIT ETHERNET FIC panel:

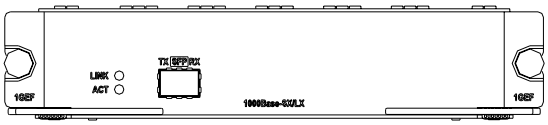

Figure 4-8 1-Port GIGABIT ETHERNET FIC panel

The following table describes the LEDs on the 1-Port GIGABIT ETHERNET FIC.

Table 4-8 LEDs on the 1-Port GIGABIT ETHERNET FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

4.4.4 Interface Cable

For 1-Port GIGABIT ETHERNET FIC, select optical fibers depending on the type of the installed 1000Base-SX/1000 Base-LX SFP. As the interfaces that these SFP modules provide use LC-type fiber-optic connectors, you must use fibers with LC-type connectors for them.

Figure 4-9 LC-type fiber-optic connector

🕮 Note:

LC-type fiber-optic connectors were compact fiber-optic connectors developed by Lucent.

The fibers are provided depending on the purchased SFPs. Therefore you must provide information on the SFPs when purchasing FICs; otherwise, the fibers are not provided.

4.4.5 Connecting the Interface Optic Fiber

⚠ Caution:

In connecting the optical fiber, observe the following:

Do not over-bend the optical fiber. Its curvature radius must be no less than 10 cm (3.9 in).

Ensure that the Tx and Rx ends are correctly connected.

Ensure that the fiber ends are clean.

⚠ Warning:

Laser danger: Invisible laser radiation may be emitted from the fiber-optic ports which are connected with lasers. To protect your eyes against radiation harm, never stare into an open fiber-optic port.

Step 1: Insert the SFP module into its corresponding slot.

Step 2: Locate the Rx and Tx ports of the GE interface. Connect them to another device with two optical fibers: Rx to Tx and Tx to Rx.

Step 3: Power on the router and check the status of the LINK LED on the card panel. ON means an Rx link is present and OFF means the opposite. In the latter case, check the line status.

status.

4.5 1-Port GEF FIC

4.5.1 Introduction

1-Port GEF FIC, the 1-port/2-port 1000Base-SX/1000Base-LX GE fiber interface card, is used for router-to-LAN communication.

The cards support:

- Five types of 1000Base-SX/1000Base-LX SFP modules: multi-mode short-haul (850 nm), single-mode medium-haul (1310 nm), single-mode long-haul (1310 nm), single mode long-haul (1550 nm), and single-mode ultra-long haul (1550 nm)
- Operation at 1000 Mbps

- Full duplex

4.5.2 Interface Attributes

The following table describes the interface attributes of the 1-Port GEF FIC:

Table 4-9 Interface attributes of the 1-Port GEF FIC

Attribute		1-Port GEF FIC				
Connector		SFP				
Number of interfaces		1				
Interface standard		802.3, 802.3u, 802.3ab				
Optical transmitter power	Type	Multi-mode short-haul (850 nm)	Single-mode medium-haul (1310 nm)	Long-haul (1310 nm)		
	Min.	-9.5 dBm	-9 dBm	-2 dBm		
	Max.	0 dBm	-3 dBm	5 dBm		
Receiver sensitivity		-17 dBm	-20 dBm	-23 dBm		
Central wavelength		850 nm	1310 nm	1310 nm		
Fiber type		62.5/125 μm multi-mode	9/125 μm single mode	9/125 μm single mode		
Max. transmission segment		0.55 km (0.34 mi.)	10 km (6.21 mi.)	40 km (24.86 mi.)	40 km (24.86 mi.)	70 km (43.50 mi.)
Operating mode		1000 Mbps Full duplex				

4.5.3 Interface LEDs

The following figures illustrate the 1-Port GEF FIC:

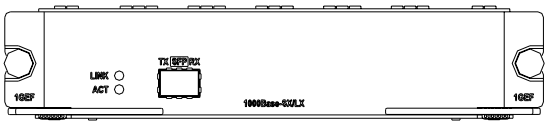

Figure 4-10 1-Port GEF FIC panel

The following table describes the LEDs on the 1-Port GEF FIC panels.

Table 4-10 LEDs on the 1-Port GEF FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

4.5.4 Interface Cable

For 1-Port GEF FIC cards, select optical fibers depending on the type of the installed 1000Base-SX/1000 Base-LX SFP. As the interfaces that these SFP modules provide use LC-type fiber-optic connectors, you must use fibers with LC-type connectors for them.

Figure 4-11 LC-type fiber-optic connector

Note:

LC-type fiber-optic connectors were compact fiber-optic connectors developed by Lucent.
The fibers are provided depending on the purchased SFPs. Therefore you must provide information on the SFPs when purchasing FICs; otherwise, the fibers are not provided.

4.5.5 Connecting the Interface Optic Fiber

Caution:

When connecting the optical fiber, observe the following:

Do not over-bend the optical fiber. Its curvature radius must be no less than 10 cm (3.9 in).

Ensure that the Tx and Rx ends are correctly connected.

Ensure that the fiber ends are clean.

Warning:

Laser danger: Invisible laser radiation may be emitted from the fiber-optic ports which are connected to lasers. To protect your eyes against radiation harm, never stare into an open fiber-optic port.

Step 1: Insert the SFP optical module into its corresponding slot.

Step 2: Locate the Rx and Tx ports of the GEF interface. Connect them to another device with two optical fibers: Rx to Tx and Tx to Rx.

Step 3: Power on the router and check the behavior of the LINK LED on the card panel. ON means an Rx link is present and OFF means the opposite. In the latter case, check the line status.

4.6 Router 4-Port/8-Port Enhanced Serial FIC

4.6.1 Introduction

Router 4-Port/8-Port Enhanced Serial FIC, 2-/4-/8-port enhanced high-speed sync/async serial interface card, transmits, receives, and processes data on the synchronous/asynchronous serial interface. They support both synchronous and asynchronous modes. In the former case, they support the DTE/DCE mode.

I. DTE and DCE

An FIC-SA card is usually connected to an external modem for dialing purpose, where an appropriate baud rate setting is required.

The synchronous serial interface can work in either DTE or DCE mode. Two directly connected devices must work as DTE and DCE respectively. The DCE provides clock

synchronization and specifies the communication rate, whereas the DTE accepts clock synchronization and communicates at the specified rate.

The router normally works as a DTE. To identify whether the equipment connected to the router is DTE or DCE, refer to the manual shipped with the equipment.

II. Speed and transmission segment of synchronous/asynchronous serial interface

In different operating modes, the synchronous/asynchronous serial interface supports different electric signal specifications and baud rates. In addition, the maximum signal transmission segment depends not only on the specified baud rate but also on the selected cable. The following table shows how the cable type, baud rate, and the maximum signal transmission segment related to each other.

Table 4-11 Speed and transmission segment of the V.24 (RS232)/V.35 cable

V.24 (RS232)		V.35	
Baud rate (bps)	Max. transmission segment	Baud rate (bps)	Max. transmission segment
2400	60 m (196.9 ft.)	2400	1250 (4101 ft.)
4800	60 m (196.9 ft)	4800	625 m (2050.5 ft.)
9600	30 m (98.4 ft.)	9600	312 m (1023.6 ft.)
19200	30 m (98.4 ft)	19200	156 m (511.8 ft.)
38400	20 m 65.6 ft.)	38400	78 m (255.9 ft.)
64000	20 m (65.6 ft)	56000	60 m (196.9 ft.)
115200	10 m (32.8 ft.)	64000	50 m (164 ft.)
—	—	2048000	30 m (98.4 ft.)

Note:

When a V.24 cable is used, the baud rate of the Router 4-Port Enhanced Serial FIC in synchronous mode shall not exceed 64 Kbps.

4.6.2 Interface Attributes

The following table describes the interface attributes of the Router 4-Port Enhanced Serial:

Table 4-12 Interface attributes of the Router 4-Port/8-Port Enhanced Serial

<table>
<tr><th rowspan="2">Attribute</th><th colspan="4">Description</th></tr>
<tr><th colspan="3">Synchronous</th><th>Asynchronous</th></tr>
<tr><td>Connector</td><td colspan="4">DB-28</td></tr>
<tr><td>Number of connectors</td><td colspan="4">4
8</td></tr>
<tr><td rowspan="2">Interface standard and operating mode</td><td>V.24</td><td colspan="2">V.35, RS449, X.21, RS530</td><td rowspan="2">RS232</td></tr>
<tr><td>DTE, DCE</td><td>DTE</td><td>DCE</td></tr>
<tr><td>Min. baud rate(bps)</td><td>1200</td><td colspan="2">1200</td><td>300</td></tr>
<tr><td>Max. baud rate(bps)</td><td>64 k</td><td>4.096 M</td><td>2.048 M</td><td>115.2</td></tr>
<tr><td>Cable</td><td colspan="4">V.24 (RS232) DTE cable
V.24 (RS232) DCE cable
V.35 DTE cable
V.35 DCE cable
X.21 DTE cable
X.21 DCE cable
RS449 DTE cable
RS449 DCE cable
RS530 DTE cable
RS530 DCE cable</td></tr>
<tr><td>Supported service</td><td colspan="3">1) DDN leased line
2) Terminal access service</td><td>1) Dialup through modem
2) Backup
3) Asynchronous leased line
4) Terminal access service</td></tr>
</table>

4.6.3 Panel and Interface LEDs

The following figures show the Router 4/8-Port Enhanced Serial FIC panels:

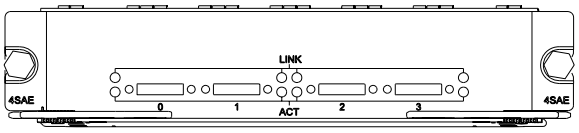

Figure 4-12 Router 4-Port Enhanced Serial FIC panel

The following table describes the LEDs on the Router 4-Port Enhanced Serial FIC panel:

Table 4-13 LEDs on the Router 4-Port Enhanced Serial FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received. Blinking means data is being transmitted and/or received.

The following figure shows the Router 8-Port Enhanced Serial FIC panel:

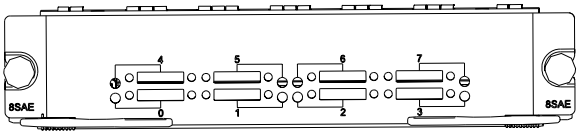

Figure 4-13 Router 8-Port Enhanced Serial FIC front panel

On the Router 8-Port Enhanced Serial FIC panel, each link corresponds to a LED. ON means a link is present; blinking means data is being transmitted and/or received.

4.6.4 Interface Cable

The FIC-SAE cards use synchronous/asynchronous serial interface cables with DB-28 connectors.

Before connecting an FIC-SAE card, identify the line properties and then select the proper interface cable from the following ten cable options:

- V.24 (RS232) DTE cable: DB-25 plug at the network end
- V.24 (RS232) DCE cable: DB-25 receptacle at the network end
- V.35 DTE cable: 34PIN plug at the network end
- V.35 DCE cable: 34PIN receptacle at the network end

- X.21 DTE cable: DB-15 plug at the network end
- X.21 DCE cable: DB-15 receptacle at the network end
- RS449 DTE cable: DB-37 plug at the network end
- RS449 DCE cable: DB37 receptacle at the network end
- RS530 DTE cable: DB-25 plug at the network end
- RS530 DCE cable: DB25 receptacle at the network end

All these cables use a DB-28 connector to connect the router, but the connector at the network end varies with the type of the to-be-connected network.

- V.24 DTE cable

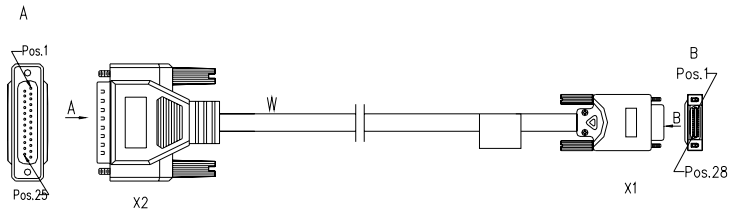

Figure 4-14 V24 DTE cable

- V.24 DCE cable

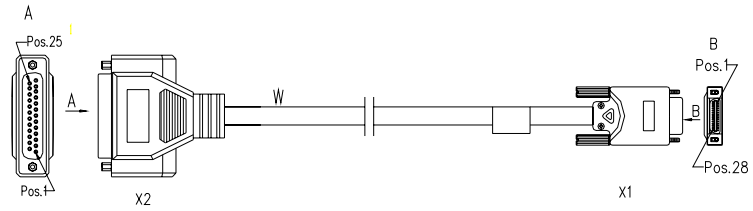

Figure 4-15 V.24 DCE cable

- V.35 DTE cable

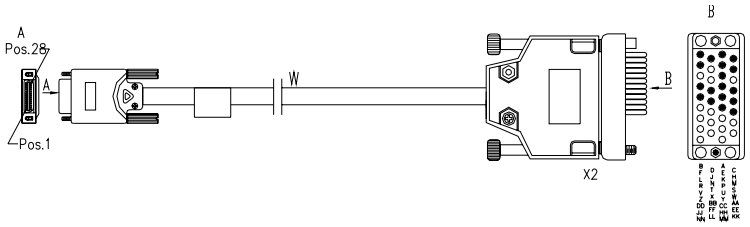

Figure 4-16 V.35 DTE cable

- V.35 DCE cable

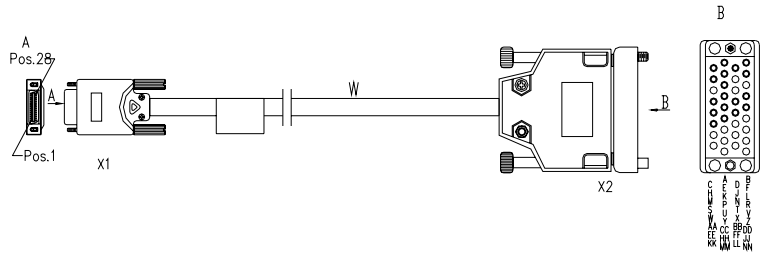

Figure 4-17 V.35 DCE cable

- X.21 DTE cable

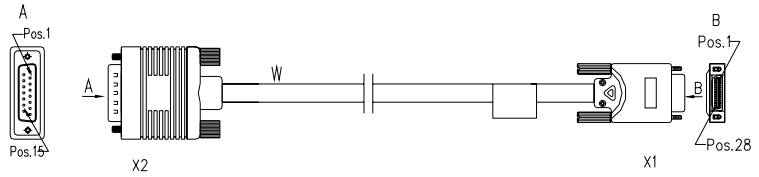

Figure 4-18 X.21 DTE cable

- X.21 DCE cable

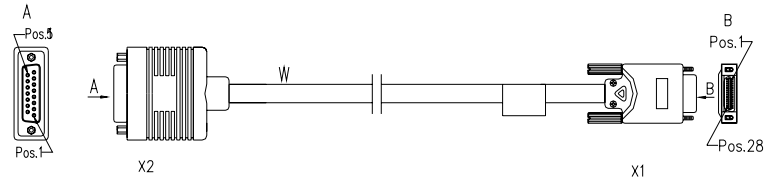

Figure 4-19 X.21 DCE cable

- RS449 DTE cable

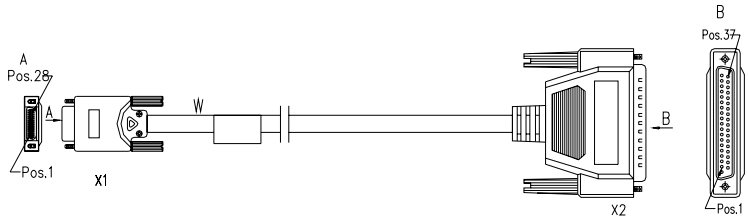

Figure 4-20 RS449 DTE cable

- RS449 DCE cable

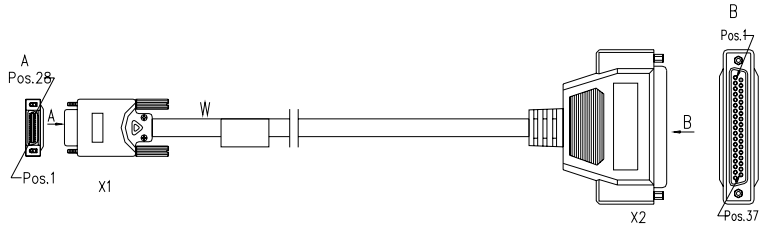

Figure 4-21 RS449 DCE cable

- RS530 DTE cable

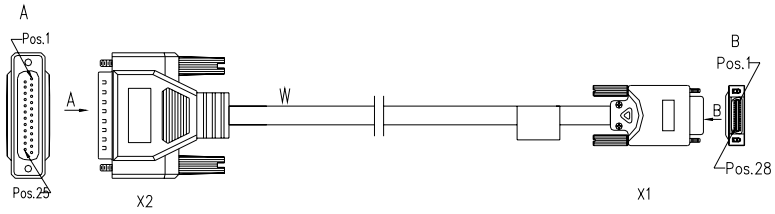

Figure 4-22 RS530 DTE cable

- RS530 DCE cable

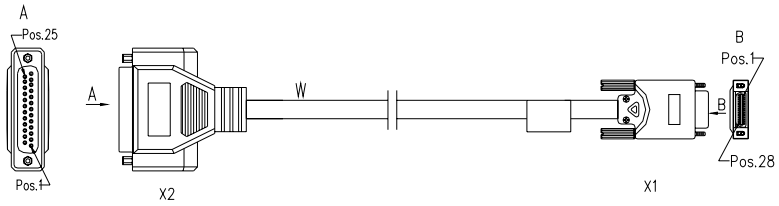

Figure 4-23 RS530 DCE cable

Note:

These cables are optional. You must order them together with the FIC card. Otherwise, they are not provided.

4.6.5 Connecting the Interface Cable

Caution:

Before connecting an FIC card, identify the type of the equipment to be connected (that is, the synchronous/asynchronous mode, DTE/DCE mode, and so on), signaling criterion required by the access equipment, baud rate, and line clock.

Step 1: Identify type of the interface to be connected and then choose the correct synchronous/asynchronous serial interface cable.

Step 2: Plug the DB-28 connector of the cable to the corresponding DB-28 port on the FIC-SAE card.

Step 3: Connect the other end of the cable as follows:

- If the WAN is a DDN line, connect the cable to the port on the CSU/DSU.
- If the WAN is a dialup line, connect the cable to the serial port of an analog modem.

Step 4: Power on the router, and check behavior of the LINK LED on the FIC-SAE panel. It is OFF when fault occurs on the line and signal is not synchronized. Check the line status.

4.7 Router 4-Port CE1/PRI FIC

4.7.1 Introduction

I. Router 4-Port CE1/PRI FIC

Router 4-Port CE1/PRI FIC, the 4-port channelized E1/PRI interface card, transmits, receives, and processes E1 data traffic. In addition, you can use the card for other purposes, such as CE1 access and the ISDN PRI function.

4.7.2 Interface Attributes

The following table describes the interface attributes of the FIC-E1 and FIC-E1-F cards.

Table 4-14 Interface attributes of the FIC-E1 and FIC-E1-F cards

Attribute	Description		
			Router 4-Port CE1/PRI FIC
Connector			DB-25

Attribute	Description		
			Router 4-Port CE1/PRI FIC
Number of connectors			1
Interface standard	G.703, G.704		
Interface rate	2.048 Mbps		
Cable type	E1 75-ohm unbalanced coaxial cable E1 120-ohm balanced twisted-pair cable 120-ohm 4E1 adapter cable (Router 4-Port CE1/PRI FIC) 75-ohm 4E1 adapter cable (Router 4-Port CE1/PRI FIC) Coaxial connector, network connector, 75-to-120-ohm adapter (with BNC connector)		
Supported service	Backup Leased line		

4.7.3 Panel and Interface LEDs

The following figure illustrates the Router 4-Port CE1/PRI FIC panel.

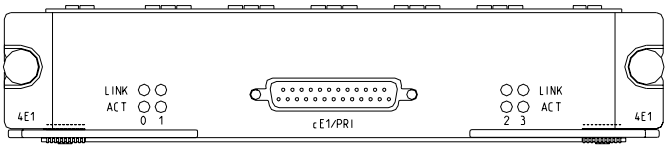

Figure 4-24 Router 4-Port CE1/PRI FIC panel

The following table describes the LEDs on the card panels.

Table 4-15 LEDs on the FIC-E1 and FIC-E1-F panels

LED	Description
LINK	OFF means no link is present; ON means a link is present.

ACTIVE	OFF means no data is being transmitted or received on the interface; blinking means data is being transmitted and/or received.

4.7.4 Interface Cable

I. Interface cable of the Router 4-Port CE1/PRI FIC

Interface cables for the Router 4-Port CE1/PRI FIC are G.703-compliant cables, also known as E1 cables. The cables are divided into two categories: 75-ohm unbalanced coaxial and 120-ohm balanced twisted-pair.

- 75-ohm unbalanced coaxial cable

As shown in the following figure, at the router end of the cable is a DB-15 plug and at the network end are two BNC receptacles.

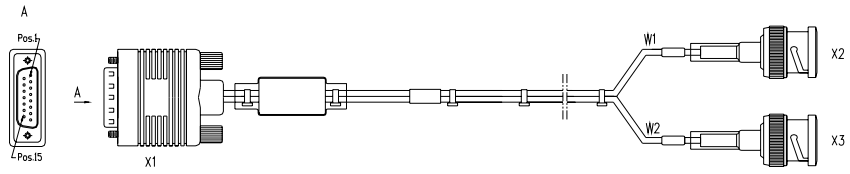

Figure 4-25 E1 75-ohm unbalanced coaxial cable

(Note:

To extend an E1 75-ohm unbalanced coaxial cable, you can select a pair of coaxial connectors with a BNC receptacle at each end to connect the BNC receptacles of the cable each to a 75-ohm unbalanced coaxial cable with BNC connectors.

- 120-ohm balanced twisted-pair cable

As shown in the following figure, at the router end of the cable is a DB-15 plug and at the network end is an RJ-45 connector.

□

Figure 4-26 E1 120-ohm balanced twisted-pair cable

(Note:

To extend an E1 120-ohm balanced twisted-pair cable, you can select a network connector with an RJ-45 receptacle at each end to connect the cable to another 120-ohm balanced twisted-pair cable.

In addition, you are available with 75-ohm-to-120-ohm adapters.

(Note:

E1 cable, coaxial connector, network connector, and 75-ohm-to-120-ohm adapter are all optional accessories. They are provided only when ordered.

II. Interface cable of the Router 4-Port CE1/PRI FIC

Router 4-Port CE1/PRI FIC provides two types of 1-to-4 adapter cables: 120-ohm 4E1 and 75-ohm 4E1. At one end of both cables is a DB-25 connector for connecting the router, and at the other end are four DB-15 connectors for connecting E1 cables. You can distinguish between them by the main label text: “4E1-120Ohm-CAB“ for the 120-ohm 4E1 adapter cable and “4E1-75Ohm-CAB” for the 75-ohm 4E1 adapter cable.

As shown in the following two figures, both cables look similar except that the 75-ohm 4E1 adapter cable uses eight coaxial cables but the 120-ohm 4E1 adapter cable uses four twisted-pair cables.

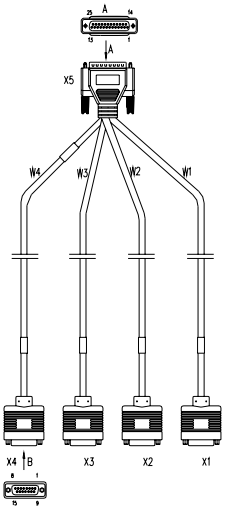

Figure 4-27 120-ohm 4E1 adapter cable

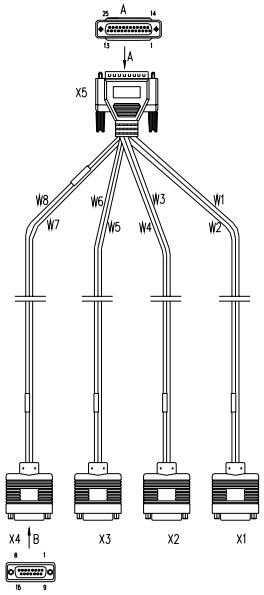

Figure 4-28 75-ohm 4E1 adapter cable

Note:

Both 75-ohm 4E1 and 120-ohm 4E1 adapter cables are required for Router 4-Port CE1/PRI FIC.

In addition, you are available with 75-ohm-to-120-ohm adapters.

4.7.5 Internal DIP Switch

The FIC-E1 and the FIC-E1-F cards provide internal DIP switches, the setting of which decides interface impedance and the grounding mode.

Table 4-16 DIP switches and E1 interfaces of the FIC-E1/FIC-E1-F cards

Card				Router 4-Port CE1/PRI FIC			
DIP switch				S1	S2	S3	S4
Controlled E1 interface				Interface 0	Interface 1	Interface 2	Interface 3

4.7.6 Connecting the Interface Cable

Caution:

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

If outdoor cabling is involved, consider to install a special lightning arrester at the input end of the interface cable for better lightning protection.

I. Connecting the interface cable of the Router 4-Port CE1/PRI FIC

Step 1: Identify type of the E1 cable, and set the DIP switch for the to-be-connected E1/FE1 port correctly.

Step 2: Plug the DB-15 connector of the E1 cable into the E1/FE1 port on the card.

Step 3: Connect the other end of the E1 cable to another device.

1) When using a 75-ohm unbalanced coaxial cable, do the following:

- If no cable extension is needed, directly connect the BNC connector of the cable to the device.
- If cable extension is needed, connect the BNC connector of the cable to a coaxial connector, and then connect the other end of the coaxial connector to the device using a 75-ohm E1 trunk cable.

Caution:

When connecting the router to another device using an E1 coaxial cable, make connection with the TX end to the RX end and the RX end to the TX end.

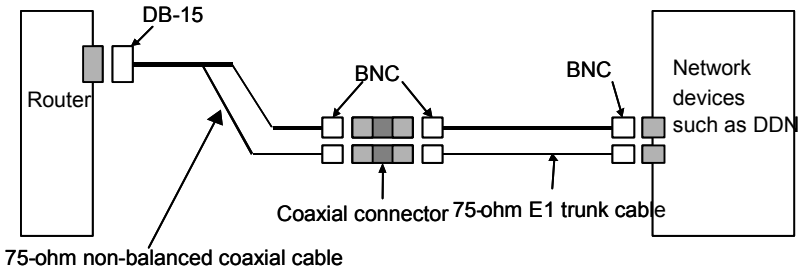

Figure 4-29 Extending an E1 75-ohm unbalanced coaxial cable

- If the to-be-connected network device has a 120-ohm port, you need a 75-ohm-to-120-ohm adapter or a 120-ohm cable instead.

2) When using a 120-ohm balanced twisted-pair cable, do the following:

- If no cable extension is needed, directly connect the RJ-45 connector of the cable to the RJ-45 port on the device.
- If cable extension is needed, connect the RJ-45 connector of the cable to a network interface connector, and the other end of the network interface connector to the device using a 120-ohm E1 trunk cable.

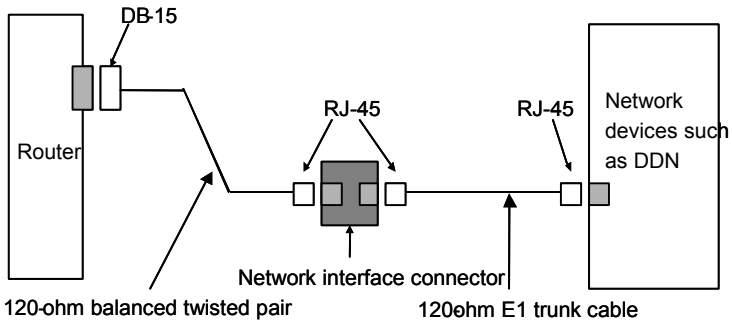

Figure 4-30 Extending an E1 120-ohm balanced twisted-pair cable

Step 4: Power on the router, and check the behavior of the LINK LED on the card: OFF means fault occurs on the line and the signal is not synchronized. Check the line status.

II. Connecting the interface cable of the Router 4-Port CE1/PRI FIC

Step 1: Select the cable appropriate to the type of the port on the to-be-connected device, and correctly set the DIP switch.

- If the impedance of the to-be-connected port is 75-ohm, select E1 75-ohm unbalanced coaxial and 75-ohm 4E1 adapter cables, and set all the BITs of the DIP switch to the ON position (that is, the port impedance is 75-ohm).
- If the impedance of the to-be-connected port is 120-ohm, select E1 120-ohm balanced twisted-pair and 120-ohm 4E1 adapter cables, and set all the BITs of the DIP switch to the OFF position (that is, the port impedance is 120-ohm).

Step 2: Insert the DB-25 connector of the 4E1 adapter cable into the to-be-connected port on the Router 4-Port CE1/PRI FIC and tighten the thumbscrews.

Step 3: Identify the sequence number of the DB-15 connector at the other end of the cable, and connect the connector to an E1 cable.

Step 4: Connect the E1 cable to another device, by reference to the previous subsection.

Step 5: Power on the router, and check the behavior of the LINK LED on the card panel: OFF means fault occurs on the line and the signal is not synchronized. Check the line status.

4.8 Router 4-Port CT1/PRI FIC and Router 4-Port Fractional T1 FIC

4.8.1 Introduction

I. Router 4-Port CT1/PRI FIC

Router 4-Port CT1/PRI FIC, the 4-port channelized T1/PRI interface card, transmits, receives, and processes T1 data traffic. In addition, you can use the card for other purposes, such as CE1 access and the ISDN PRI function.

II. Router 4-Port Fractional T1 FIC

Router 4-Port Fractional T1 FIC, the 4-port fractional T1 interface card, differs from the Router 4-Port CT1/PRI FIC primarily in the sense that:

- The FT1 operating mode supported by the T1-F cards allows only one n x 64 kbps or n x 56 kbps bundle to be formed on each interface, where n = 1 to 24. However, a T1 card allows arbitrary grouping of 24 channels and multiple bundles.
- The T1 cards do not support PRI mode.

4.8.2 Interface Attributes

The following table describes the interface attributes of the cards.

Table 4-17 Interface attributes of the cards

Attribute	Description
Connector	RJ-45
Number of connectors	1 2 4
Interface standard	G.703/T1 102, G.704
Interface rate	1.544 Mbps
Cable type	T1 cable (100-ohm straight-through shielded cable)
Operating mode	CT1, ISDN PRI (only supported by the cards) FT1 (only supported by the cards)

Attribute	Description
Supported service	Backup Leased line ISDN PRI (only supported by the cards)

4.8.3 Panel and Interface LEDs

The following figure illustrates the panel.

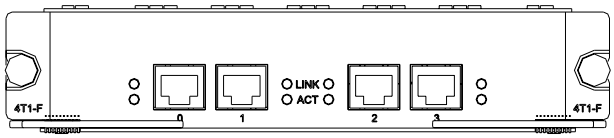

Figure 4-31 Router 4-Port Fractional T1 FIC panel

The following table describes the LEDs on the card panels.

Table 4-18 LEDs on the panels

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface; blinking means data is being transmitted and/or received.

4.8.4 Interface Cable

Interface cables (T1 cables) for the cards are 100-ohm straight-through shielded cables, as shown in the following figure:

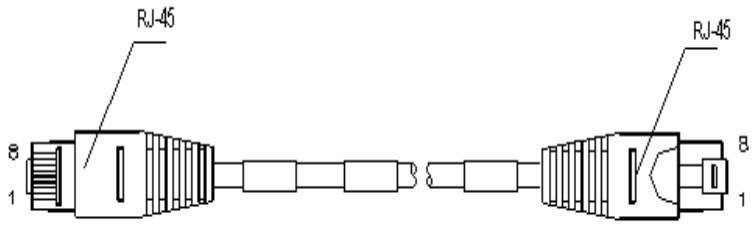

Figure 4-32 T1 cable

To extend a T1 cable, you may connect the cable to another one using a network interface connector with an RJ-45 receptacle at each end.

Note:

Both T1 cable and network interface connector are optional accessories and are provided only when ordered.

4.8.5 Connecting the Interface Cable

Caution:

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

If outdoor cabling is involved, consider to install a special lightning arrester at the input end of the T1 interface cable for better lightning protection.

Step 1: Insert one end of the T1 cable into the to-be-connected RJ-45 connector on the card.

Step 2: Connect the other end of the cable to another device directly if the cable is long enough. If not, extend the cable before you do that, as shown in the following figure:

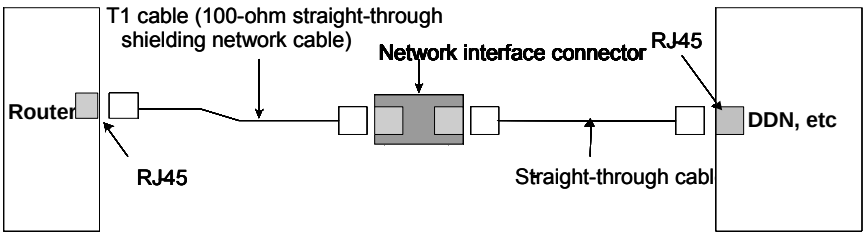

Figure 4-33 Extending a T1 cable

Step 3: Power on the router, and check the behavior of the LINK LED on the card panel: OFF means fault occurs on the line. Check the line status.

4.9 Router 1-Port CE3 FIC

4.9.1 Introduction

Router 1-Port CE3 FIC, the 1-port channelized E3 interface card, delivers these functions:

- In E3 mode, transmitting, receiving, and processing one channel of E3 fast traffic; providing E3 traffic access.
- In CE3 mode, providing the subscribers with N x 64 kbps low-speed access, where N is smaller than or equal to 128.

Note:

E3 represents the tertiary group rate of E system in the TDM system, that is, 34.368 Mbps. Through E23 and E12 demultiplexing, an E3 channel can be channelized into 16 E1 lines, each supporting both the E1 and CE1 modes. E23 means either E2-to-E3 multiplex or E3-to-E2 demultiplex, and E12 means E1-to-E2 multiplex or E2-to-E1 demultiplex. “E23” and “E12” discussed here represent the demultiplex process.

4.9.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port CE3 FIC.

Table 4-19 Router 1-Port CE3 FIC interface attributes

Attribute	Description
Connector	SMB
Number of connectors	2
Interface standard	G.703, G.704, G.751
Interface rate	34.368 Mbps
Cable type	E3 cable (75-ohm coaxial cable)
Operating mode	E3 CE3
Supported service	E3 leased line

4.9.3 Panel and Interface LEDs

The following figure illustrates an Router 1-Port CE3 FIC panel.

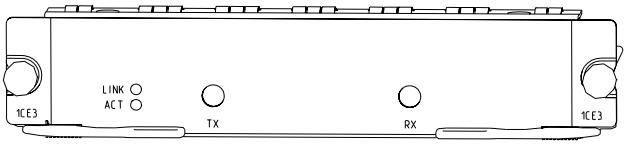

Figure 4-34 Router 1-Port CE3 FIC panel

The following table describes the LEDs on the card panel.

Table 4-20 LEDs on the Router 1-Port CE3 FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received on the interface; blinking means data is being transmitted and/or received.

4.9.4 Interface Cable

The external interface provided by the Router 1-Port CE3 FIC uses two SMB sockets respectively for data transmitting (Tx) and data receiving (Rx). The interface transmits in 75-ohm unbalanced mode and uses a pair of 75-ohm unbalanced coaxial cables to connect another device.

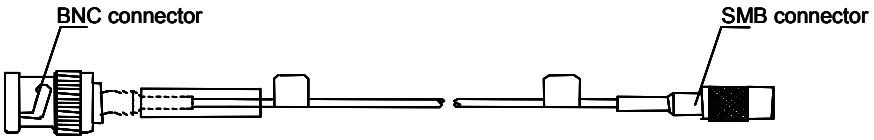

Figure 4-35 E3/T3 cable

Note:

The Router 1-Port CE3 FIC and the Router 1-Port CT3 FIC use the same cable, called E3/T3 cable in this manual.

The standard equipping package of the Router 1-Port CE3 FIC includes the required interface cable.

4.9.5 Connecting the Interface Cable

Caution:

By design, the Router 1-Port CE3 FIC is protected against lightning strikes. But when outdoor cabling is involved, you are recommended to add a special lightning arrester at the input end of the E3/T3 cable for better protection.

Step 1: Connect the SMB connector of an E3/T3 cable to the Tx port on the Router 1-Port CE3 FIC and the other end to the Rx port on another device.

Step 2: Connect the SMB connector of another E3/T3 cable to the Rx port on the Router 1-Port CE3 FIC and the other end to the Tx port on another device.

Step 3: Power on the router, and check the behavior of the LINK LED on the Router 1-Port CE3 FIC panel: OFF means fault occurs on the line and the signal is not synchronized. Check the line status.

4.10 Router 1-Port CT3 FIC

4.10.1 Introduction

Router 1-Port CT3 FIC, the 1-port channelized T3 interface card, delivers these functions:

- In T3 mode, transmitting, receiving, and processing one channel of T3 fast traffic; providing T3 traffic access.
- In CT3 mode, providing the subscribers with N x 64 kbps or N x 56 kbps low-speed access, where N is smaller than or equal to 128.

Note:

T3 represents the tertiary group rate of T system in the TDM system, that is, 44.736 Mbps. Through T23 and T12A demultiplexing, a T3 channel can be channelized into 28 T1 lines, each also supporting the operating mode of CT1. T23 means either T2-to-T3 multiplex or T3-to-T2 demultiplex, and T12 means T1-to-T2 multiplex or T2-to-T1 demultiplex. “T23” and “T12” discussed here represent the demultiplex process.

4.10.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port CT3 FIC.

Table 4-21 Router 1-Port CT3 FIC interface attributes

Attribute	Description
Connector	SMB
Number of connectors	2
Interface standard	G.703, G.704, G.752
Interface rate	44.736 Mbps
Cable	T3 cable (75-ohm coaxial cable)
Operating mode	T3 CT3
Supported service	T3 leased line

4.10.3 Panel and Interface LEDs

The following figure illustrates an Router 1-Port CT3 FIC panel.

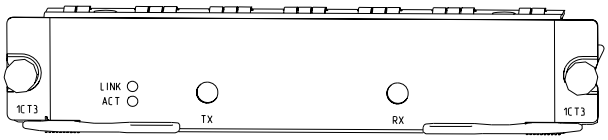

Figure 4-36 Router 1-Port CT3 FIC panel

The following table describes the LEDs on the card panel.

Table 4-22 LEDs on the Router 1-Port CT3 FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received on the interface; blinking means data is being transmitted and/or received.

4.10.4 Interface Cable

Refer to the section **Error! Reference source not found.**"**Error! Reference source not found.**".

The interface cable for the Router 1-Port CT3 FIC is the same as that for the Router 1-Port CE3 FIC and is connected in the same way.

4.11 8.8 Router 1-Port E3 ATM FIC

4.11.1 Introduction

8.8 Router 1-Port E3 ATM FIC, the 1-port 34Mbps ATM-E3 interface card, provides these functions:

- Two ATM cell mapping modes: ATM direct mapping (ADM) and physical layer convergence protocol (PLCP).
- Scrambling in data transmission.
- Line clock (when working as DTE interface) and internal clock (when working as DCE interface).
- Four types of test measures: local cell loopback, local loopback, remote payload loopback, and remote line loopback.

Note:

You may equip your router with 8.8 Router 1-Port E3 ATM FIC cards to its full capacity. Yet, you are recommended to install only one 8.8 Router 1-Port E3 ATM FIC on it, whatever its model is, to ensure performance of some key services.

4.11.2 Interface Attributes

The following table describes the interface attributes of the 8.8 Router 1-Port E3 ATM FIC.

Table 4-23 Interface attributes of the 8.8 Router 1-Port E3 ATM FIC

Attribute	8.8 Router 1-Port E3 ATM FIC
Connector	SMB
Number of connectors	2
Interface standard	G.703, G.751, G.832, G.823
Interface rate	34.368 Mbps
Interface cable	E3/T3 cable (75-ohm coaxial cables)
Supported services	ATM traffic CBR (constant bit rate), rt_VBR (variable bit rate-real time), nrt_VBR (variable bit rate-non real time), UBR (unspecified bit rate)

4.11.3 Panel and Interface LEDs

The following figure illustrates the 8.8 Router 1-Port E3 ATM FIC panel:

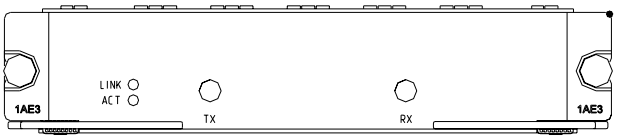

Figure 4-37 8.8 Router 1-Port E3 ATM FIC panel

The following table describes the LEDs on the 8.8 Router 1-Port E3 ATM FIC panel.

Table 4-24 LEDs on the 8.8 Router 1-Port E3 ATM FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

4.11.4 Interface Cable

The interface that the 8.8 Router 1-Port E3 ATM FIC provides uses two SMB sockets for data transmitting and receiving respectively. The ports adopt the 75-ohm unbalanced transmission mode and are connected to the peer device using a pair of 75-ohm unbalanced coaxial cables. Several cable length options are available.

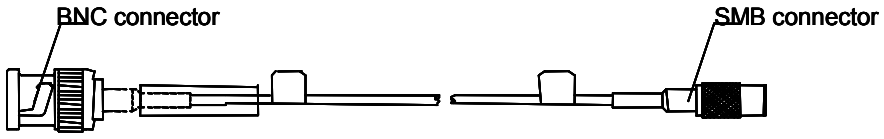

Figure 4-38 E3/T3 cable

Note:

The 8.8 Router 1-Port E3 ATM FIC uses the same type of cables for connection, which are called E3/T3 cables in this manual.

4.11.5 Connecting the Interface Cable

Caution:

By design, the 8.8 Router 1-Port E3 ATM FIC is protected against lightning strikes. But when outdoor cabling is involved, you are recommended to add a special lightning arrester at the input end of the E3/T3 cable for better protection.

Step 1: Connect the SMB connector of an E3/T3 cable to the Tx port on the 8.8 Router 1-Port E3 ATM FIC and another end to the Rx port on another device.

Step 2: Connect the SMB connector of another E3/T3 cable to the Rx port on the 8.8 Router 1-Port E3 ATM FIC and another end to the Tx port on another device.

Step 3: Check the behavior of the LINK LED on the 8.8 Router 1-Port E3 ATM FIC panel: OFF means fault occurs on the line and the signal is out of synchronization. Check the line status.

4.12 Router 1-Port T3 ATM FIC

4.12.1 Introduction

Router 1-Port T3 ATM FIC, the 1-port 44Mbps ATM-T3 interface card, provides these functions:

- Two ATM cell mapping modes: ADM and PLCP.
- Scrambling in data transmission.
- Line clock (when working as DTE interface) and internal clock (when working as DCE interface).
- Four types of test measures: local cell loopback, local loopback, remote payload loopback, and remote line loopback.

Note:

You may equip your router with Router 1-Port T3 ATM FIC cards to its full capacity. Yet, you are recommended to install only one Router 1-Port T3 ATM FIC on it, whatever its model is, to ensure performance of some key services.

4.12.2 Interface Attributes

The following table describes the interface of the Router 1-Port T3 ATM FIC.

Table 4-25 Interface attributes of the Router 1-Port T3 ATM FIC

Attribute	Router 1-Port T3 ATM FIC
Connector	SMB
Number of connectors	2
Interface standard	G.703, G.704, G.823
Interface rate	44.736 Mbps
Interface cable	E3/T3 cable (75-ohm coaxial cables)
Supported services	ATM Traffic CBR, rt_VBR, nrt_VBR, UBR

4.12.3 Panel and Interface LEDs

The following figure illustrates the Router 1-Port T3 ATM FIC panel:

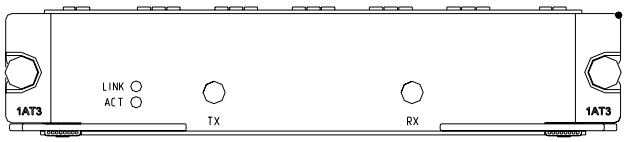

Figure 4-39 Router 1-Port T3 ATM FIC panel

The following table describes the LEDs on the Router 1-Port T3 ATM FIC panel.

Table 4-26 LEDs on the Router 1-Port T3 ATM FIC panel

LED	Color	State	Meaning
LINK/ACT	Green	Solid On	Receive Carrier detected
		Blinking On	Receiving or transmitting data
		Off	Receive LOS
LP/ALM	Yellow	Solid On	Loop back set(remote

			, payload, local or cell)
		Blinking On	Alarm detected, loop back not set
		Off	Loop back not set, no alarms detected

Note that following alarms can be indicated by LP/ALM blinking on: LOS, OOF, AIS, RED, FERF.

Note：if atm interface is shutdown, both LINK/ACT and LP/ALM will be off.

4.12.4 Interface Cable

The interface that the Router 1-Port T3 ATM FIC provides uses two SMB sockets for data transmitting and receiving respectively. The ports adopt the 75-ohm unbalanced transmission mode and are connected to the peer device using a pair of 75-ohm unbalanced coaxial cables as shown in Figure 4-38. Several cable length options are available.

Note:

The Router 1-Port T3 ATM FIC and 8.8 Router 1-Port E3 ATM FIC cards use the same type of cables for connection, which are called E3/T3 cables in this manual.

4.12.5 Connecting the Interface Cable

Caution:

By design, the Router 1-Port T3 ATM FIC is protected against lightning strikes. But when outdoor cabling is involved, you are recommended to add a special lightning arrester at the input end of the E3/T3 cable for better protection.

Step 1: Connect the SMB connector of an E3/T3 cable to the Tx port on the Router 1-Port T3 ATM FIC and another end to the Rx port on another device.

Step 2: Connect the SMB connector of another E3/T3 cable to the Rx port on the Router 1-Port T3 ATM FIC and another end to the Tx port on another device.

Step 3: Check the behavior of the LINK LED on the Router 1-Port T3 ATM FIC panel: OFF means fault occurs on the line and the signal is out of synchronization. Check the line status.

4.13 Router 1-Port OC-3 ATM MM FIC / Router 1-Port OC-3 ATM SM FIC / Router 1-Port OC-3 ATM SML FIC

4.13.1 Introduction

Three ATM fiber interface card options are available with your router:

- 1-port ATM 155 Mbps multi-mode fiber interface card (Router 1-Port OC-3 ATM MM FIC)
- 1-port ATM 155 Mbps single-mode fiber interface card (Router 1-Port OC-3 ATM SM FIC)
- 1-port ATM 155 Mbps single-mode long-haul fiber interface card (Router 1-Port OC-3 ATM SML FIC)

They provide the following functions:

- Two frame formats: SDH STM-1 and SONET OC-3.
- Scrambling in data transmission.
- Line clock (when working as DTE interface), and internal clock (when working as DCE interface)
- Three test measures: local cell loopback, local payload loopback and remote loopback.

4.13.2 Interface Attributes

The following table describes the interface attributes of the ATM cards.

Table 4-27 Interface attributes of the ATM cards

Attribute	Router 1-Port OC-3 ATM MM FIC	Router 1-Port OC-3 ATM SM FIC	Router 1-Port OC-3 ATM SML FIC
Fiber-optic connector	SC		
Number of connectors	1		

Attribute	Router 1-Port OC-3 ATM MM FIC	Router 1-Port OC-3 ATM SM FIC	Router 1-Port OC-3 ATM SML FIC
Interface standard	SONET OC-3/SDH STM-1		
Interface rate	155 Mbps		
Max. transmission segment over the selected cable	2 km (1.2 mi.) over the multi-mode optical fiber	15 km (9.3 mi.) over the single-mode optical fiber	Single-mode optical fiber of 30km transmission distance
Transmitter	LD	LED	LD
Optical transmitter power	Min: -15dBm Max: -8dBm	Min: -15dBm Max: -8dBm	Min: -5dBm Max: 0dBm
Receiver sensitivity	Min: -28dBm Max: -8dBm	Min: -30dBm Max: -14dBm	Min: -34dBm Max: -10dBm
Central wavelength	1310 nm		
Supported service	ATM traffic CBR, rt_VBR, nrt_VBR, UBR		

4.13.3 Panel and Interface LEDs

The following figure illustrates the Router 1-Port OC-3 ATM MM FIC panel.

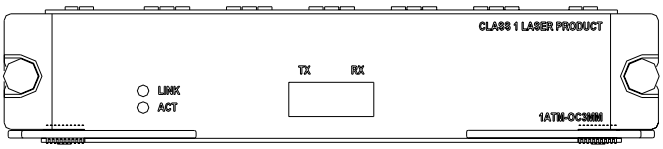

Figure 4-40 Router 1-Port OC-3 ATM MM FIC panel

The following figure illustrates the Router 1-Port OC-3 ATM SM FIC panel.

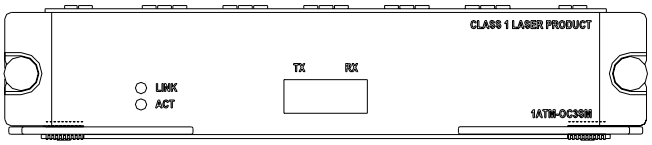

Figure 4-41 Router 1-Port OC-3 ATM SM FIC panel

The following figure illustrates the Router 1-Port OC-3 ATM SML FIC panel.

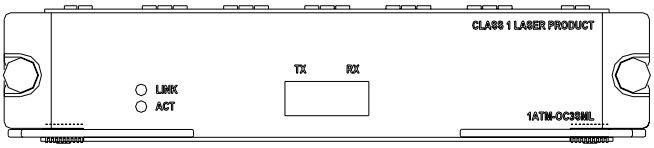

Figure 4-42 Router 1-Port OC-3 ATM SML FIC panel

The following table describes the LEDs on the card panels.

Table 4-28 LEDs on the ATM card panels

LED	Color	State	Meaning
LINK/ACT	Green	Solid On	Receive Carrier detected
		Blinking On	Receiving or transmitting data
		Off	Receive LOS
LP/ALM	Yellow	Solid On	Loop back set(remote, local or cell)
		Blinking On	Alarm detected, loop back not set
		Off	Loop back not set, no

			alarms detected

Note that following alarms can be indicated by LP/ALM blinking on:

SDH/SONET Layer	Alarm Type
section layer	LOL, LOS, OOF, LOF
line layer	LOP, AIS, RDI, REI
path layer	AIS, RDI, REI

Note：if atm interface is shutdown, both LINK/ACT and LP/ALM will be off.

4.13.4 Interface Optical Fiber

The Router 1-Port OC-3 ATM MM FIC uses multi-mode optical fiber and the Router 1-Port OC-3 ATM SM FIC/Router 1-Port OC-3 ATM SML FIC uses single-mode optical fiber. As they all use SC-type fiber-optic connectors, the connectors of the optical fibers must also be SC-type connectors. You are available with several cable length options. For more information, refer to the section “Connecting the Interface Optical Fiber”.

Warning:

Laser danger: Invisible laser radiation may be emitted from the fiber-optic ports which are connected with lasers. To protect your eyes against radiation harm, never stare into an open fiber-optic port.

Caution:

The Router 1-Port OC-3 ATM SML FIC provides a long-haul fiber interface. It requires transmission distance at least longer than 25 km (15.5 in.); otherwise, the interface cannot receive signals.

The Router 1-Port OC-3 ATM MM FIC must be connected using the multi-mode optical fiber whereas the Router 1-Port OC-3 ATM SM FIC/ Router 1-Port OC-3 ATM SML FIC must be connected using the single-mode optical fiber.

4.14 Router 1/2-Port ADSL FIC

4.14.1 Introduction

Router 1/2-Port ADSL FIC, the 1-/2-port ADSL over PSTN interface card, allows a LAN subscriber to connect to the digital subscriber's loop access multiplexer (DSLAM) at the central office over a regular analog subscriber line or telephone line. Thus, the subscriber can access the ATM/IP backbone or the Internet to enjoy services such as high-speed data communication and video on demand (VoD).

ADSL transmits data in the high frequency band above 26 kHz. Therefore, it can provide services without interfering with the voice service being provided in the low frequency band (0 to 4 kHz) on the same line. It provides downlink rates in the range 32 kbps to 8 Mbps and uplink rates in the range 32 kbps to 1 Mbps.

The ADSL interface cards provide these functions:

- Manual ADSL line activation and deactivation, supporting SAR loopback for convenient fault isolation.
- Interface standards of G. DMT, G. Lite, and T1.413, auto-sensing.
- Trellis coding (except for G. Lite) on ADSL interfaces, enhancing stability of ADSL connections.

4.14.2 Interface Attributes

The following table describes the interface attributes of the Router 1/2-Port ADSL FIC.

Table 4-29 Interface attributes of the Router 1/2-Port ADSL FIC

Attribute	Router 1-Port ADSL FIC	Router 2-Port ADSL FIC
Connector	RJ-11	
Number of connectors	1 (Router 1-Port ADSL FIC) 2 (Router 2-Port ADSL FIC)	
Interface standard	ITU-T 992.1 G.DMT ITU-T 992.2 G.Lite ANSI T1.413 Issue 2	
Interface rate	In ADSL full rate mode (ITU-T 992.1 G.DMT/ANSI T1.413): 8160 kbps (downlink rate) 896 kbps (uplink rate).	
Cable and the Max. transmission segment	In full rate mode, 1.8 km (1.1 mi.) over the telephone cable (depending on the line quality).	

Supported service	ADSL over the regular telephone line

4.14.3 Panel and Interface LED

The following figure illustrates the Router 1-Port ADSL FIC panel.

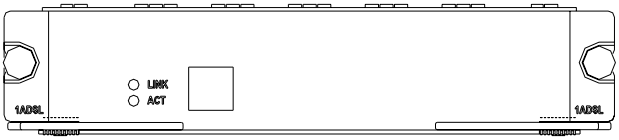

Figure 4-43 Router 1-Port ADSL FIC panel

The following figure illustrates the Router 2-Port ADSL FIC panel.

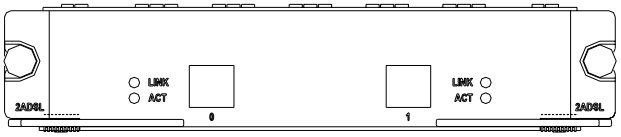

Figure 4-44 Router 2-Port ADSL FIC panel

The following table describes the LEDs on the card panels.

Table 4-30 LEDs on the Router 1/2-Port ADSL FIC panel

LED	Description
LINK	OFF means the loop is inactive; ON means the loop has been activated and has entered the data mode; blinking means the loop is being activated.
ACT	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

4.14.4 Interface Cable

The interface cables that the Router 1/2-Port ADSL FIC uses are regular telephone cables.

Note:

The standard equipping package of the Router 1/2-Port ADSL FIC includes the regular telephone cable(s). You can order a separate external splitter as needed.

4.14.5 Connecting the Interface Cable

G. Lite mode requires no splitter. You can directly connect the router to the PSTN using a telephone cable, and simply connect the phone-set in parallel with the router at the cable distribution box.

Full rate mode requires a splitter. Follow these steps to connect the cables:

Step 1: Plug one end of a telephone cable into the ADSL port on the router, and the other end into the internal ADSL port on the splitter.

Step 2: Connect the telephone to the phone port on the splitter with another telephone cable.

Step 3: Connect the external ADSL port on the splitter to the PSTN with a third telephone cable.

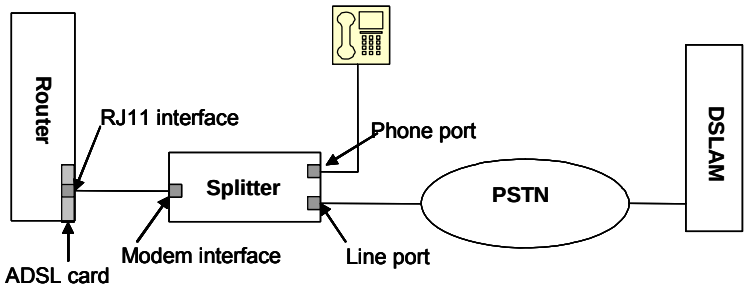

Figure 4-45 Connecting the Router 1/2-Port ADSL FIC

4.15 Router 1-Port ADSL FIC/Router 2-Port ADSL FIC

4.15.1 Introduction

Router 1-Port ADSL FIC/Router 2-Port ADSL FIC, the 1-/2-port ADSL over ISDN interface card, uses the RJ-11 connector for the WAN interface. It allows a LAN subscriber to connect to the DSLAM at the central office over a regular analog subscriber line or telephone line. Thus, the subscriber can access the ATM/IP backbone or the Internet to enjoy services such as high-speed data communication and video on demand (VoD).

The card transmits data in the high frequency band above 138 kHz. Therefore, it can provide services on the same line without interfering with the ISDN service being

provided on the same line. It provides downlink rates in the range 32 kbps to 8 Mbps and uplink rates in the range 32 kbps to 1 Mbps.

The FIC-ADSL-I interface cards provide these functions:

- Manual ADSL line activation and deactivation, supporting SAR loopback for convenient fault isolation.
- G.992.1-compliant interface(s), auto-sensing.
- Trellis coding on ADSL interfaces, enhancing stability of ADSL connections.

4.15.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port ADSL FIC-I/Router 2-Port ADSL FIC.

Table 4-31 Interface attributes of the Router 1-Port ADSL FIC/Router 2-Port ADSL FIC

Attribute	Router 1-Port ADSL FIC	Router 2-Port ADSL FIC
Connector	RJ-11	
Number of connectors	1	2
Interface standard	G. 992.1	
Interface rate	Downlink: 8 Mbps Uplink: 1024 kbps	
Interface cable	Regular telephone cable	
Supported services	ADSL over ISDN	

4.15.3 Panel and Interface LEDs

The following figures illustrate the Router 1-Port ADSL FIC panel:

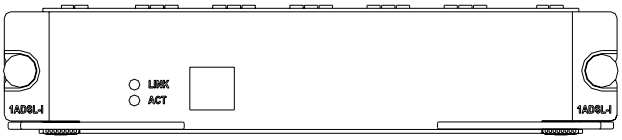

Figure 4-46 Router 1-Port ADSL FIC panel

The following figures illustrate the Router 2-Port ADSL FIC panel:

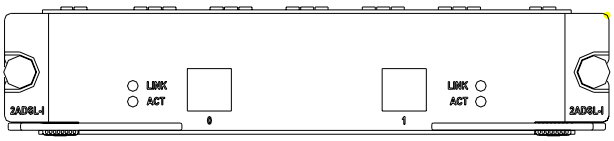

Figure 4-47 Router 2-Port ADSL FIC panel

The following table describes the LEDs on the panels.

Table 4-32 LEDs on the panels

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received or/and transmitted.

4.15.4 Interface Cable

The FIC-ADSL-I cards use regular telephone cables for connection.

4.15.5 Connecting the Interface Cable

To connect an interface on an card, you need to install a splitter. Follow these steps:

Step 1: Plug one end of a telephone cable into the RJ-11 port on the router and the other end into the internal ADSL-I port on the splitter;

Step 2: Connect an ISDN NT1 to the splitter using another telephone cable;

Step 3: Connect the external ADSL-I port on the splitter to ISDN using a third telephone cable.

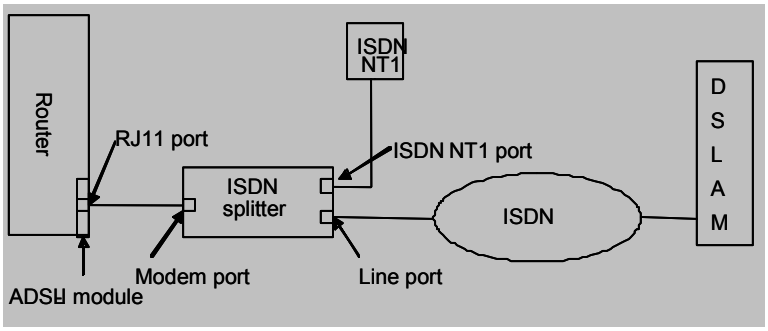

Figure 4-48 Connect the FIC

4.16 Router 4-Port E1 IMA FIC

4.16.1 Introduction

Router 4-Port E1 IMA FIC, the 4port E1 ATM inverse multiplexing interface card provides four or eight E1 interfaces that support inverse multiplexing for ATM (IMA) technology.

IMA technology distributes an ATM cell stream over multiple low-speed links on a cell by cell basis and reassembles the cells into the original stream at the far end. It is a cost-effective way for you to transmit high-speed ATM cell streams over low-speed links while allowing for great flexibility.

This technology is common on a PDH network over which ATM cells are transmitted.

4.16.2 Interface Attributes

The following table describes the interface attributes:

Table 4-33 Interface attributes of the Router 4-Port E1 IMA FIC

Attribute	Description			
	Router 4-Port E1 IMA FIC (75-ohm)	(75-ohm)	Router 4-Port E1 IMA FIC (120-ohm)	(120-ohm)
Connector	DB-68			
Number of connectors	1			
Interface standard	ITU-G.703, ITU-G.704			
Interface rate	2.048 Mbps			
Cable type	75-ohm 8E1 conversion cable		120-ohm 8E1 conversion cable	
Cable characteristic impedance	75-ohm		120-ohm	
Max transmission distance	500 m (1640.4 feet)		150 m (492.1 feet)	
Operating mode	ATM E1 independent link /IMA bundle mode			
Supported service	AAL5			
Protocol	PPPoA, PPPoEoA, IPoA, IPoEoA			
Transmission rate	CBR/VBR-rt/VBR-nrt/UBR			

4.16.3 Panel and Interface LEDs

The following figures illustrate the Router 4-Port E1 IMA FIC (75-ohm) panels:

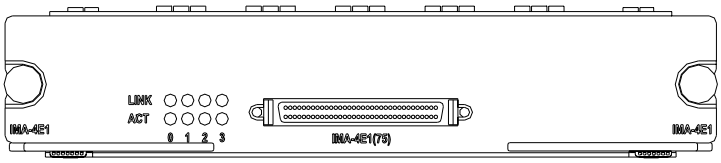

Figure 4-49 75-ohm Router 4-Port E1 IMA FIC panel

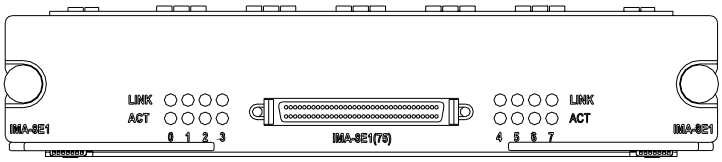

Figure 4-50 75-ohm panel

The following table describes the LEDs on Router 4-Port E1 IMA FIC panels:

Table 4-34 LEDs on Router 4-Port E1 IMA FIC panels

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received and/or transmitted.

4.16.4 Interface Cable

The Router 4-Port E1 IMA FIC card provides four E1 ports and adopts a 120-ohm or a 75-ohm 4E1 conversion cable. The two types of cables look similar. Both of them have a DB-68 connector at one end for connecting the router. At the other end, however, the 75-ohm 4E1 conversion cable provides eight coaxial cable connectors; and the 120-ohm 4E1 conversion cable provides four twisted pair cable connectors.

The card provides eight E1 ports and adopts a 120-ohm or a 75-ohm 8E1 conversion cable. The two types of 8E1 conversion cables are similar to the two types of 4E1 conversion cables except that the 75-ohm 8E1 conversion cable provides 16 coaxial cable connectors and the 120-ohm 8E1 conversion cable provides eight twisted pair cable connectors, as shown in the following figures:

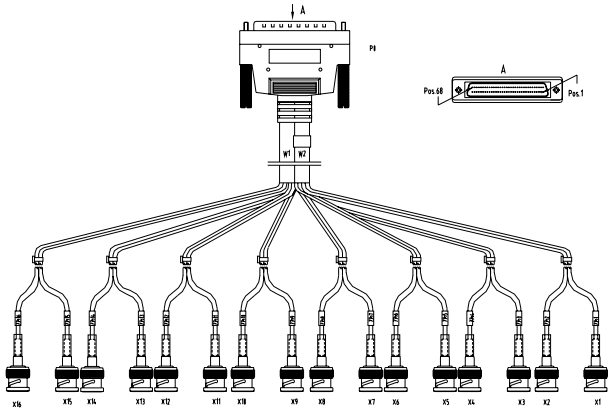

Figure 4-51 75-ohm 8E1 conversion cable

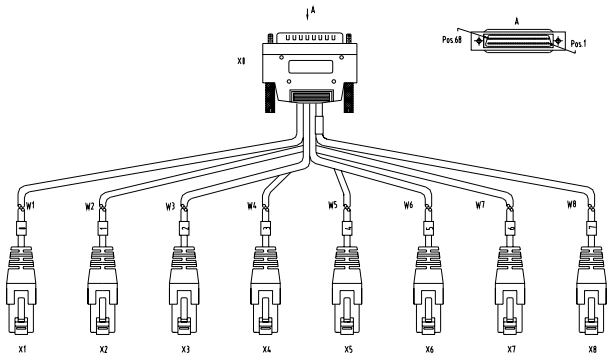

Figure 4-52 120-ohm conversion cable

4.16.5 Connecting the Interface Cable

Step 1: Choose a conversion cable appropriate to the interface type of the device to be connected.

- If the interface impedance of the device to be connected is 75-ohm, use a 75-ohm 4E1/8E1 conversion cable.
- If the interface impedance of the device to be connected is 120-ohm, use a 120-ohm 4E1/8E1 conversion cable.

Step 2: Insert the DB-68 connector of the cable to the DB-68 port on the Router 4-Port E1 IMA FIC/ card, and fasten the cable fastening screws.

Step 3: Identify the sequence number of the other end of the 4E1/8E1 conversion cable and connect it with the intended device.

Step 4: Power on the router. Check the behavior of the LINK LED for the slot on the card panel: OFF means that fault has occurred on the line and signal is out of synchronization. Check the link status.

4.17 Router 4-Port T1 IMA FIC

4.17.1 Introduction

Router 4-Port T1 IMA FIC, the 4-port T1 ATM inverse multiplexing interface card provides four or eight T1 interfaces that support the IMA technology. Their network application is similar to that of the Router 4-Port E1 IMA FIC card.

4.17.2 Interface Attributes

The following table describes the interface attributes of the Router 4-Port T1 IMA FIC:

Table 4-35 Interface attributes of the Router 4-Port T1 IMA FIC

Attribute	Description	
	Router 4-Port T1 IMA FIC	
Connector	DB-68	
Number of connectors	1	
Interface standard	ITU-G.703, ITU-G.704	
Cable type	8T1 conversion cable	
Cable characteristic impedance	100-ohm	
Max transmission distance	150 m (492.1 feet)	
Operating mode	ATM T1 independent link/IMA bundle mode	
Supported service	AAL5	
Protocol	PPPoA, PPPoEoA, IPoA, IPoEoA	
Transmission rate	CBR/VBR-rt/VBR-nrt/UBR	

4.17.3 Panel and Interface LEDs

The following figures illustrate the Router 4-Port T1 IMA FIC panels:

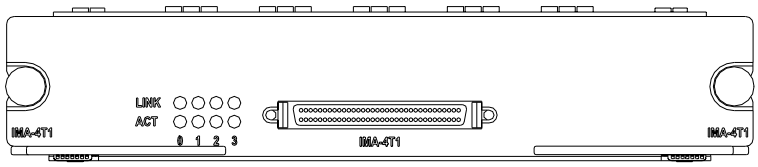

Figure 4-53 Router 4-Port T1 IMA FIC panel

The following table describes the LEDs on Router 4-Port T1 IMA FIC panel:

Table 4-36 LEDs on Router 4-Port T1 IMA FIC/ panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACT	OFF means no data is being transmitted or received; blinking means data is being received and/or transmitted.

4.17.4 Interface Cable

The Router 4-Port T1 IMA FIC card provides four or eight T1 ports and uses the 4T1 conversion cable for connection. At one end of the cable is a DB-68 connector for connecting the router and at the other end are four or eight RJ-45 connectors for connecting other devices.

4.17.5 Connecting the Interface Cable

Step 1: Insert the DB-68 connector of the conversion cable to the DB-68 port on the Router 4-Port T1 IMA FIC card.

Step 2: Connect one RJ-45 connector at the other end of the cable to the device to be connected.

Step 3: Power on the router. Check the behavior of the LINK LED on the card panel: OFF means fault has occurred on the link. Check the line status.

4.18 Router 1-Port OC3 POS FIC

4.18.1 Introduction

Router 1-Port OC3 POS FIC, the 1-port SDH/SONET interface card, supports interface rates up to 155.52 Mbps.

The Router 1-Port OC3 POS FIC uses the protocols such as PPP, Frame Relay and HDLC at the data link layer and IP at the network layer. It allows direct transmission of packets over SONET/SDH. It supports:

- Four types of SFP: multi-mode short-haul (1310 nm), single mode medium-haul (1310 nm), single mode long-haul (1310 nm), and single-mode ultra-long haul (1550 nm).
- 155.52 Mbps fractional interface

4.18.2 Interface Attributes

The following table describes the interface attributes of the Router 1-Port OC3 POS FIC.

Table 4-37 Interface attributes of the Router 1-Port OC3 POS FIC

Attribute		Router 1-Port OC3 POS FIC			
Connector		SFP/LC			
Interface standard		SONET OC-3/SDH STM-1			
Number of interfaces		1			
Interface rate		155.52 Mbps			
Optical transmitter power	Type	Multi-mode short-haul	Single mode medium-haul	Single mode long-haul	Single mode ultra-long haul
	Min.	-19.0 dBm	-15.0 dBm	-5.0 dBm	-5.0 dBm
	Max.	-14.0 dBm	-8.0 dBm	0. dBm	0. dBm
Receiver sensitivity		-30.0 dBm	-28.0 dBm	-34.0 dBm	-34.0 dBm
Overload optical power		-14.0 dBm	-7.0 dBm	-9.0 dBm	-10.0 dBm
Central wavelength		1310 nm	1310 nm	1310 nm	1550 nm
Fiber type		62.5/125 μm multi-mode	9/125 μm single mode	9/125 μm single mode	9/125 μm single mode
Max. transmission segment		2 km (1.2 mi.)	15 km (9.3 mi.)	40 km (24.9 mi)	80 km (49.7 mi)

4.18.3 Panel and Interface LEDs

The following figure illustrates the Router 1-Port OC3 POS FIC panel:

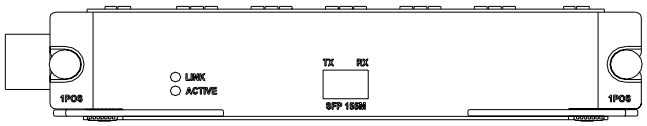

Figure 4-54 Router 1-Port OC3 POS FIC panel

The following table describes the LEDs on the Router 1-Port OC3 POS FIC panel.

Table 4-38 LEDs on the Router 1-Port OC3 POS FIC panel

LED	Color	State	Meaning
LINK/ACT	Green	Solid On	Receive Carrier detected
		Blinking On	Receiving or transmitting data
		Off	Receive LOS
LP/ALM	Yellow	Solid On	Loop back set(remote or local)
		Blinking On	Alarm detected, loop back not set
		Off	Loop back not set, no alarms detected

Note that following alarms can be indicated by LP/ALM blinking on:

SDH/SONET Layer	Alarm Type
section layer	LOS, LOF, OOF
line layer	AIS, RDI
path layer	LOP, AIS, RDI

Note：if pos interface is shutdown, both LINK/ACT and LP/ALM will be off. Interface Optical Fiber

Like the FICCPOS, the Router 1-Port OC3 POS FIC uses optical fibers with LC-type connectors (see **Error! Reference source not found.**).

4.18.4 Connecting the Interface Optical Fiber

Step 1: Insert the SFP card into its corresponding slot.

Step 2: Locate the Rx and Tx fiber-optic interfaces on the interface card. Use two fibers to connect the Router 1-Port OC3 POS FIC to another device: Rx to Tx and Tx to Rx.

Step 3: Power on the device and check the LINK LED on the Router 1-Port OC3 POS FIC panel: ON means the Rx link is present and OFF means the opposite. In the latter case, check the line status.

Warning:

Because invisible laser radiation may be emitted from the aperture of an optical port when no fiber is connected or the dust cap is removed, do not stare into the open aperture.
Replace the dust cap when no fiber is connected to the optical port.

4.19 Router 2-Port FXS/2-Port FXO FIC and Router 4-Port FXS/4-Port FXO FIC

4.19.1 Introduction

The 2-/4-port voice subscriber circuit interface card, processes and transmits over data communications networks voice signals for 2/4 regular analog phones, faxes, or AT0 loop trunks of telephone exchanges.

The 2-/4-port voice AT0 analog trunk interface card, processes and transmits over data communications networks voice signals for 2/4 loops of telephone exchanges.

Caution:

When connecting the Router 2-Port FXS/2-Port FXO FIC or the Router 4-Port FXS/4-Port FXO FIC, make sure your router has access to an IP network or some other WAN.

4.19.2 Interface Attributes

The following table describes the interface attributes of the Router 2-Port FXS/2-Port FXO FIC and the Router 4-Port FXS/4-Port FXO FIC.

Table 4-39 Interface attributes of the Router 2-Port FXS/2-Port FXO FIC and the Router 4-Port FXS/4-Port FXO FIC

Attribute	Description
Connector	RJ-45
Number of connectors	2 (Router 2-Port FXS/2-Port FXO FIC) 4 (Router 4-Port FXS/4-Port FXO FIC)
Cable	Telephone cable with ferrite core
Interface standard	ITU Q.512-compliant subscriber circuit interface ITU Q.552-compliant loop trunk interface ITU K.20-compliant overcurrent protection
Dial-up mode	Dual-tone multifrequency (DTMF), compliant with GB3378 (Pulse dial is not available.)
Bandwidth	300 to 3400Hz

4.19.3 Panel and Interface LEDs

The following figure illustrates the 2-Port FXS panel:

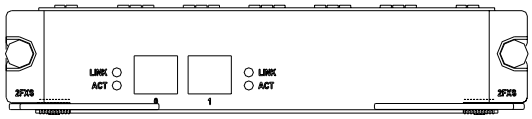

Figure 4-55 2-Port FXS FIC panel

The following figure illustrates the 2-Port FXO panel:

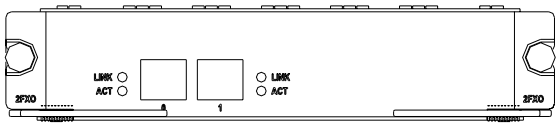

Figure 4-56 2-Port FXO panel

The following figure illustrates the 4-Port FXS FIC panel:

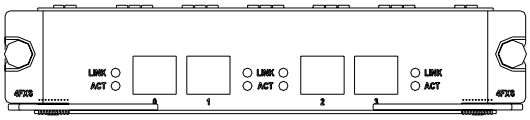

Figure 4-57 4-Port FXS FIC panel

The following figure illustrates the 4-Port FXO FIC panel:

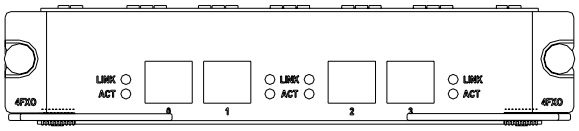

Figure 4-58 4-Port FXO FIC panel

Table 4-40 LEDs on the Router 2-Port FXS FIC/Router 4-Port FXS FIC

LED	Description
LINK	OFF means that no link is present; ON means a link is present.
ACT	OFF means the channel is idle and ON means there is call activity.

4.19.4 Interface Cable

The external interfaces of the Router 2-Port FXS/2-Port FXO FIC and the Router 4-Port FXS/4-Port FXO FIC are standard RJ-45 connectors.

The interface cables for the cards are telephone cables with ferrite core, both ends of which are RJ-11 connectors.

Note:

RJ-45 receptacles on the FXO/FXS cards also accept RJ-11 connectors.

The standard equipping package for the Router 2-Port FXS/2-Port FXO FIC and the Router 4-Port FXS/4-Port FXO FIC includes the regular telephone cables.

4.19.5 Connecting the Interface Cable

Caution:

If outdoor cabling is involved, consider to install a special lightning arrester at the input end of the interface cable for better lightning protection.

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

In connecting an interface cable, note to connect the end with ferrite core to the router for EMC sake.

Step 1: Insert the ferrite core end of the cable into the to-be-connected RJ-45 port on the interface card.

Step 2: Connect the other end of the cable as follows:

- For a card, connect to a phone-set, fax or AT0 loop trunk of telephone exchange.
- For a connect to a regular subscriber line of telephone exchange.

4.20 Router 1-Port E1 Voice FIC

4.20.1 Introduction

Router 1-Port E1 Voice FIC, the 1-port E1 voice interface card, is intended for handling dense voice signals in a VoIP system. It delivers the VoIP function on E1 lines, allowing integrated voice and data transmission.

The Router 1-Port E1 Voice FIC comprises one motherboard and one daughter card, providing one CE1/PRI interface for handling 30 channels of voice signals.

4.20.2 Interface Attributes

The following table describes the Router 1-Port E1 Voice FIC interface attributes.

Table 4-41 Interface attributes of the Router 1-Port E1 Voice FIC

Attribute	Description
Connector	DB-15
Number of connectors	1
Operating mode	E1 CE1 ISDN PRI
Interface rate	2.048Mbps
Cable	E1 120-ohm balanced twisted-pair cable 75-to-120-ohm adapter (with BNC connectors) Network connector
Supported service	R2 signaling DSS1 signaling IP Fax Generic VoIP features in 3COM Router SOFTWARE

4.20.3 Panel and Interface LEDs

The following figure illustrates the Router 1-Port E1 Voice FIC panel.

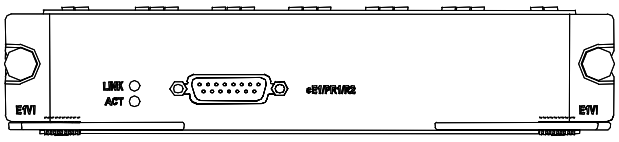

Figure 4-59 Router 1-Port E1 Voice FIC panel

The following table describes the LEDs on the card panel.

Table 4-42 LEDs on the Router 1-Port E1 Voice FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

4.20.4 Interface Cable

Router 1-Port E1 Voice FIC cables are G.703-compliant 120-ohm balanced twisted-pair cables, with a DB-15 connector at the router end and an RJ-45 connector at the network end.

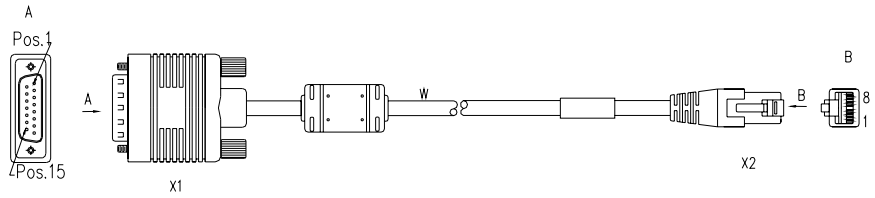

Figure 4-60 E1 120-ohm balanced twisted-pair cable

If you want a 75-ohm cable, you can use a 75-to-120-ohm adapter (with a BNC connector at one end and an RJ-45 connector at the other end) as shown in the following figure.

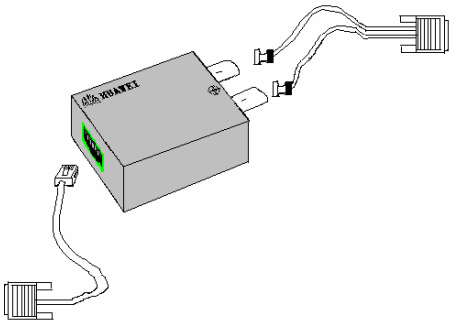

Figure 4-61 75-to-120-ohm adapter (with BNC connectors)

Note:

To extend E1 120-ohm balanced twisted-pair cables, use network connectors.

E1 120-ohm balanced twisted pair cables, network connectors, and 75-to-120-ohm adapters are optional accessories; they are provided only when ordered.

4.20.5 Connecting the Interface Cable

Caution:

If outdoor cabling is involved, consider to install a special lightning arrester at the input end of the interface cable for better lightning protection.

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

Step 1: Insert the DB-15 connector of the cable into the DB-15 port on the Router 1-Port E1 Voice FIC and tighten the thumbscrews.

Step 2: Connect the RJ-45 connector at the other end of the cable as follows:

- If the impedance of the to-be-connected port is 120-ohm, and if cable extension is not required,

Directly plug the RJ-45 connector into the port.

- If the impedance of the to-be-connected port is 120-ohm, and if cable extension is required,

Extend the E1 120-ohm balanced twisted-pair cable with a network connector, as shown in the following figure.

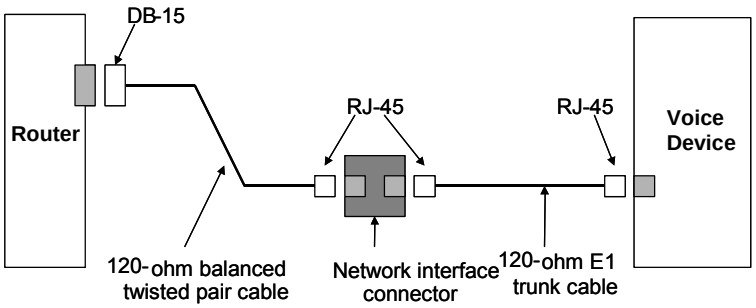

Figure 4-62 Extend an E1 120-ohm balanced twisted-pair cable

- If the impedance of the to-be-connected port is 75-ohm,

Use a 75-to-120-ohm adapter for connection.

Step 3: Power on the router, and check the behavior of the LINK LED on the Router 1-Port E1 Voice FIC panel: OFF means fault occurs on the line. Check it for the cause.

4.21 Router 1-Port T1 Voice FIC

4.21.1 Introduction

Router 1-Port T1 Voice FIC, the 1-port T1 voice interface card, is intended for handling dense signals in a VoIP system. It delivers the VoIP function on T1 lines, allowing integrated transmission of voice and data.

The Router 1-Port T1 Voice FIC comprises one motherboard and one daughter card, providing a CT1/PRI interface for handling 24 channels of voice signals.

4.21.2 Interface Attributes

The following table describes the Router 1-Port T1 Voice FIC interface attributes.

Table 4-43 Interface attributes of the Router 1-Port T1 Voice FIC

Attribute	Description
Connector	DB-15
Number of connectors	1
Cable	Router 1-Port T1 Voice FIC cable (100-ohm balanced STP) Network connector
Operating mode	CT1 ISDN PRI
Interface rate	1.544 Mbps
Supported service	DSS1 signaling Generic VoIP features in 3COM Router SOFTWARE

4.21.3 Panel and Interface LEDs

The following figure illustrates the Router 1-Port T1 Voice FIC panel.

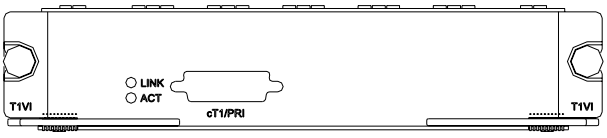

Figure 4-63 Router 1-Port T1 Voice FIC panel

The following table describes the LEDs on the card panel.

Table 4-44 LEDs on the Router 1-Port T1 Voice FIC panel

LED	Description
LINK	OFF means no link is present; ON means a link is present.
ACTIVE	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted and/or received.

4.21.4 Interface Cable

The Router 1-Port T1 Voice FIC uses T1VI cables, that is, 100-ohm balanced STPs. At one end of the cable is a DB-15 connector for connecting the Router 1-Port T1 Voice FIC, and at the other end is an RJ-45 connector for connecting a voice device, as shown in the following figure:

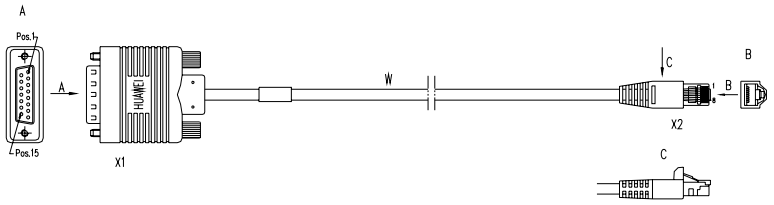

Figure 4-64 T1VI cable

In addition, you may use network connectors to extend T1VI cables.

Note:

Both T1VI cables and network connectors are optional accessories. They are provided only when ordered.

4.21.5 Connecting the Interface Cable

Caution:

If outdoor cabling is involved, consider to install a special lightning arrester at the input end of the interface cable for better lightning protection.

Before you connect a port, read its label carefully; a wrong connection can cause damages to the interface card and even the device.

Step 1: Insert one end of the T1VI cable into the DB-15 port on the Router 1-Port T1 Voice FIC.

Step 2: Connect the other end of the cable to another device directly or after extending the cable as shown in the following figure:

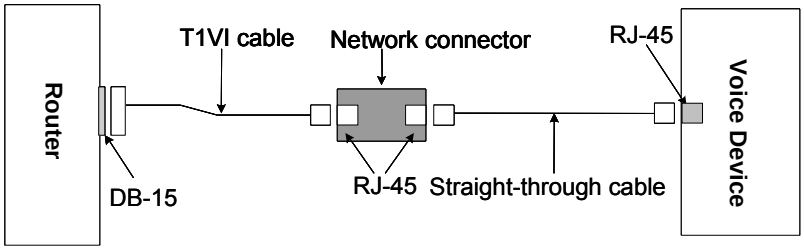

Figure 4-65 Extending a T1VI cable

Step 3: Power on the router, and check the behavior of the LINK LED on the card panel: OFF means fault occurs on the line. Check it for the cause.

4.22 Router NDEC2 Encryption Accelerator FIC

4.22.1 Introduction

Router NDEC2 Encryption Accelerator FIC, the high network data encryption card, delivers IPSec and hardware-based IP packet encryption. It supports multiple hardware encryption/decryption and hash algorithms, thus providing encryption with high performance and reliability.

The Router NDEC2 Encryption Accelerator FIC is intended for low-end and mid-range modular routers. Installed with an Router NDEC2 Encryption Accelerator FIC, the main board of your router can implement VPN with encryption provided by the Router NDEC2 Encryption Accelerator FIC in addition to IP packet forwarding.

4.22.2 Interface Features

The following table describes the interface attributes of the Router NDEC2 Encryption Accelerator FIC.

Table 4-45 Interface attributes of the Router NDEC2 Encryption Accelerator FIC

Attribute	Description
Protocol supported	IPsec
Hardware algorithm	key algorithm (DES, 3DES, AES) Authentication algorithm (HMAC-MD5-96, HMAC-SHA-1-96)

4.22.3 Panel and LEDs

The following figure illustrates the Router NDEC2 Encryption Accelerator FIC panel:

Figure 4-66 Router NDEC2 Encryption Accelerator FIC panel

The following table describes the LEDs on the Router NDEC2 Encryption Accelerator FIC panel.

Table 4-46 LEDs on the Router NDEC2 Encryption Accelerator FIC

LED	Description
STATUS	Solid green: Power is being supplied to the Router NDEC2 Encryption Accelerator FIC normally. OFF: The card is not powered, the power supply of the card has failed or a serious hardware fault occurs.
ACTIVE	OFF after two-second flashing (yellow): The card finishes initialization. Blinking: The card operates normally and data is being transmitted or received. OFF: The card is operating normally but not sending or receiving data.

4.22.4 Troubleshooting

You may learn how well the encryption card is operating by reading the LEDs on it.

For the correct LED behaviors, refer to Table 4-46.

Table 4-47 Troubleshooting by reading the LED behaviors

Incorrect LED behaviors	Reason	Action to take
STATUS LED remains OFF at router startup.	The card or some hardware parts on the card are not supplied with power properly.	1) Check that the power supply of the router is correctly connected. 2) Check that the power is being supplied. 3) Contact your sales agent for help: the power supply of the card may have been damaged or anomalies have occurred to the CPLD.
ACTIVE LED remains OFF at device startup.	The encryption processor failed to initialize the configurations possibly due to a system bus problem.	1) Check that the card is securely connected to the host. 2) Contact your sales agent for help: the host or the card may be problematic.
ACTIVE LED is solid ON or OFF when the card is operating.	The system bus is not working properly.	1) Check that the card is securely connected to the host. 2) Contact your sales agent for help: the host or the card may be problematic.

4.23 RPU2 Encryption Accelerator

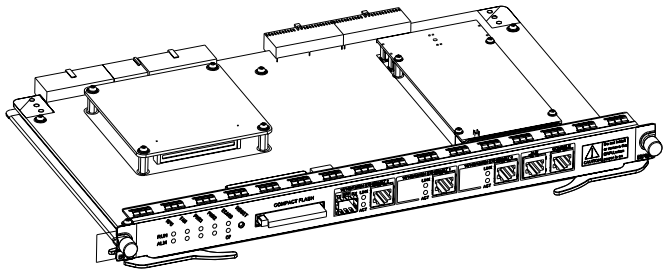

Figure 4-67 RPU2

4.23.2 Specifications

Table 4-48 RPU2 Specifications

Item	Specifications
Fixed interface	2 x 10/100/1000 Mbps electrical Ethernet interfaces 1 x Combo Port (Combo port is 10/100/1000 Mbps or SFP Interface) 1 AUX port 1 console port CF card slot (the CF card is optional)
Processor	700 MHz
Boot ROM	512 KB
NVRAM	512 KB
DDR SDRAM	512 MB
Flash	64 MB

Note:

SDRAM is the memory where the communication data between the system and CPU is stored.

NVRAM is the place where the alarm records are stored.

4.23.3 LED and button

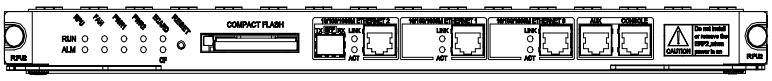

Figure 4-68 Front panel of RPU2

Table 4-49 RPU2 LEDs and the button

LED and button		Description
RUN (green)	RPU	System operating LED. Blinking means CPU is in normal operation; steady ON or OFF means CPU has failed.
	FAN	Steady ON means the FAN module is operating normally.

LED and button		Description
	PWR1	Steady ON means the PSU 1 is operating normally, and steady OFF means the PSU 1 is not present or has failed.
	PWR2	Steady ON means the PSU 2 is operating normally, and steady OFF means the PSU 2 is not present or has failed.
ALM (red)	RPU	ON means CPU has received an alarm signal, such as PSU or FAN alarm (due to overtemperature, for example).
	FAN	ON means the FAN module is not present or its rotation is blocked.
	PWR1	ON means the PSU 1 has failed.
	PWR2	ON means the PSU 2 has failed.
ECARD (green)		OFF means no card is present. ON means a card is present and initialized. Blinking means data is being transmitted or/and received.
CF (green)		OFF means no CF card is present. ON means a CF card is present. Blinking means the CF card is reading/writing data. To prevent data corruption, do not remove the running CF card.
RESET		The RPU2 hardware reset button.
10/100/1000 Mbps interface LED	LINK (green)	OFF means no link is present and ON means a link is present.
	ACT (yellow)	OFF means no data is being transmitted or received on the interface and blinking means data is being transmitted or/and received.

4.23.4 Interface

The RPU2 provides a 10/100/1000 Mbps fiber-optic interface in addition to console port, AUX port, and 10/100/1000 Mbps electrical Ethernet interfaces.

4.23.5 Encryption daughter card

An encryption daughter card can be installed on the RPU2. It supports IPSec and by using hardware encryption expedites IP packet encryption. The use of hardware encryption/decryption and hashing operation allows the router to encrypt packets with high performance and reliability.

Attribute	Description
Protocol	IPSec
Hardware encryption algorithm	Key algorithms: DES, 3DES, AES Authentication algorithms: HMAC-MD5-96, HMAC-SHA-1-96