Configuring X.25 Services

BayRS Version 12.10
Site Manager Software Version 6.10

Part No. 117377-B Rev. 00
February 1998

Bay Networks

Bay Networks

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Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (refer to the installation guide that came with your router).
- Connect the router to the network and create a pilot configuration file (see *Quick-Starting Routers*, *Configuring BayStack Remote Access*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks Site Manager and router software. For instructions, refer to *Upgrading Routers from Version 7–11.xx to Version 12.00*.

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is **ping** *<ip_address>*, you enter **ping 192.32.10.12**
bold text	Indicates text that you need to enter, command names, and buttons in menu paths. Example: Enter **wfsm &**
	Example: Use the **dinfo** command.
	Example: ATM DXI > Interfaces > **PVCs** identifies the PVCs button in the window that appears when you select the Interfaces option from the ATM DXI menu.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
quotation marks (“ ”)	Indicate the title of a chapter or section within a book.
`screen text`	Indicates data that appears on the screen. Example: `Set Bay Networks Trap Monitor Filters`

separator (>)	Separates menu and option names in instructions and internal pin-to-pin wire connections. Example: Protocols > AppleTalk identifies the AppleTalk option in the Protocols menu. Example: Pin 7 > 19 > 20
vertical line (|)	Indicates that you enter only one of the parts of the command. The vertical line separates choices. Do not type the vertical line when entering the command. Example: If the command syntax is **show at routes** | **nets**, you enter either **show at routes** or **show at nets**, but not both.

Acronyms

ATM	Asynchronous Transfer Mode
APPN	Advanced Peer-to-Peer Networking
BFE	Blacker front-end encryption
BofL	Breath of Life (message)
CUG	closed user group
CUGOA	closed user group with outgoing access
DCE	data circuit-terminating equipment
DDN	Defense Data Network
DLSw	Data Link Switching
DNIC	data network identification code
DTE	data terminal equipment
FEP	front-end processor
FDDI	Fiber Distributed Data Interface
FTP	File Transfer Protocol
HDLC	High-level Data Link Control
IEEE	Institute of Electrical Engineers
IP	Internet Protocol
IPEX	IP Encapsulation of X.25
ISDN	Integrated Services Digital Network
ISO	International Organization for Standardization
ITU-T	International Telecommunications Union–Telecommunication (formerly CCITT)
LAN	local area network

LAP	Link Access Procedure
LAPB	Link Access Procedure Balanced
LAPD	Link Access Procedure on the D Channel
LCN	logical channel number
LLC	Logical Link Control
M-bit	More bit
MAC	media access control
MCT1	Multichannel T1
MIB	management information base
MTU	maximum transmission unit
NCP	Network Control Program
NPSI	NCP Packet Switching Interface
NUI	Network User Identification
OSI	Open Systems Interconnection
OSPF	Open Shortest Path First
PAD	packet assembler/disassembler
PDN	Public Data Network
PDU	protocol data unit
PLP	Packet Layer Protocol
PPP	Point-to-Point Protocol
PSN	packet-switching network
PtoP	Point-to-Point
PVC	permanent virtual circuit
Q-bit	Qualified data bit
QLLC	Qualified Logical Link Control
RPOA	recognized private operating agencies
SAP	service access point
SDLC	Synchronous Data Link Control
SNA	Systems Network Architecture
SNMP	Simple Network Management Protocol
SNPA	Subnetwork Point of Attachment
SVC	switched virtual circuit
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TE1	Terminal Equipment Type 1
VC	virtual circuit
WAN	wide area network
XID	exchange identification

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Valbonne, France	33-4-92-96-69-68	33-4-92-96-69-98
Sydney, Australia	61-2-9927-8800	61-2-9927-8811
Tokyo, Japan	81-3-5402-0180	81-3-5402-0173

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Europe, Middle East, and Africa	33-4-92-96-15-83
Asia/Pacific	61-2-9927-8822
Tokyo and Japan	81-3-5402-7041

Chapter 1
X.25 Overview

The following sections present an overview of X.25.

Introduction

The X.25 Protocol transports LAN traffic to packet-switching networks (PSNs). X.25 allows many different kinds of equipment to communicate across networks at a relatively low cost.

Common carriers, mainly the telephone companies, designed X.25. An agency of the United Nations, the International Telecommunication Union-Telecommunications sector (ITU-T, formerly CCITT), administers the X.25 Protocol. X.25 is a global standard, and is the dominant communications protocol in use around the world today.

X.25 Interface

X.25 defines the interaction across PSNs between data terminal equipment (DTE) and data circuit-terminating equipment (DCE). DTEs include devices such as terminals, hosts, and routers; DCEs include devices such as modems, packet switches, and other ports.

Figure 1-1 shows an X.25 network. A DTE (in this case, Router A) connects to a DCE in the PSN. The PSN connects to another DCE and, finally, to another DTE (Router B).

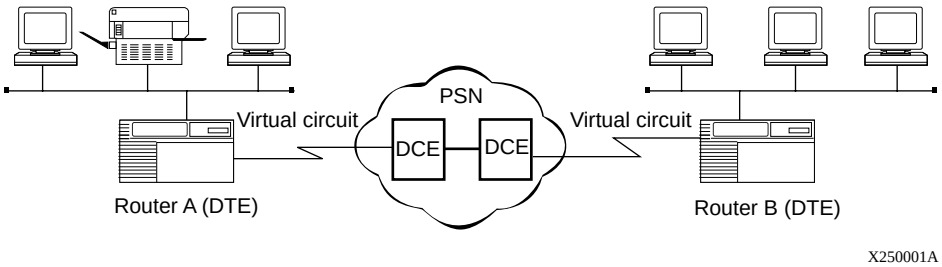


Figure 1-1. X.25 Network

To begin communication, one DTE device (for example, a router) calls another DTE to request a data exchange session. The called DTE can accept or refuse the connection. If the called DTE accepts the connection, the two systems begin full-duplex data transfer. Either side can terminate the connection at any time. Because Public Data Networks (PDNs), the most commonly used type of PSN, typically use error-prone analog lines, the X.25 Protocol provides extensive error checking, recovery, and packet sequencing.

A DTE can be a device that does not itself implement X.25. In this case, the DTE connects to a DCE through a packet assembler/disassembler (PAD), which is a device that translates data into packet form.

X.25 and the OSI Model

The Open Systems Interconnection (OSI) Basic Reference Model combines a nonproprietary structured computer system architecture with a set of common communication protocols. It comprises seven layers. Each layer provides specific functions or services and follows the corresponding OSI communications protocols to perform those services.

The X.25 Protocol focuses on three of the seven layers in the OSI model: the physical layer, the data link layer, and the network, or packet, layer. As you read the following sections, refer to Figure 1-2, which illustrates the correspondence between X.25 and the OSI model. Figure 1-2 conforms to the typical rendering of the OSI model, which depicts the physical layer at the bottom of the protocol stack, and refers to succeeding layers as representing higher-level protocols.

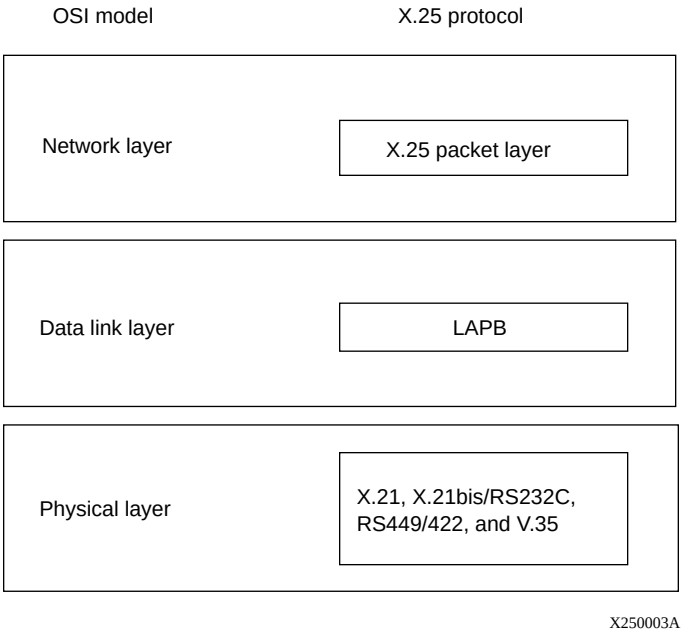


Figure 1-2. OSI/X.25 Correspondence

Physical Layer

The physical layer transmits bits across the physical connection or modem interface. Bay Networks supports all of the standard media for X.25 transmission: X.21, X.21bis/RS232C, RS449/422, and V.35.

Data Link Layer

The data link layer defines the link access procedures for transferring frames of data accurately and reliably across the access lines between the DTE and the DCE.

Link Access Procedure Balanced Protocol

X.25 uses the Link Access Procedure Balanced (LAPB) protocol at the data link layer to:

- Initialize the link between the DTE and the local DCE device
- Frame X.25 data packets before transmitting them to the DCE

LAPB is a version of high-level data link control (HDLC), which is an OSI standard.

Figure 1-3 shows the LAPB frame. The LAPB Information field contains the X.25 data packet. When an X.25 packet reaches the destination router, the LAPB protocol strips away the LAPB frame and delivers the packet to the network layer for further processing.

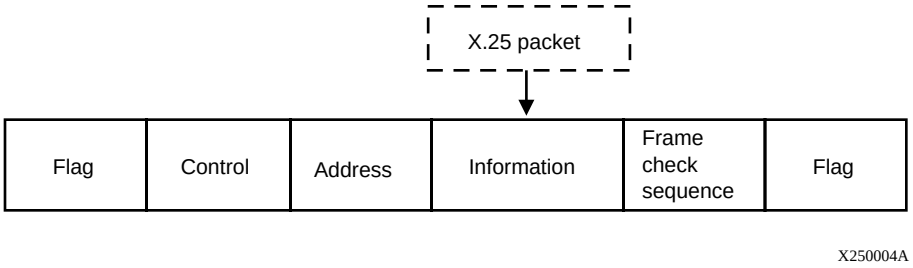


Figure 1-3. LAPB Frame

LAPB Implementation on Bay Networks Routers

The implementation of the LAPB protocol on the AN® and ASN™ routers, and on BN® and LN® routers with an Octal Sync link module, differs from that on other Bay Networks routers. On the AN and ASN routers and BN and LN routers with Octal Sync, LAPB is implemented in software in routers that use the QUICC 68360 driver. You can configure LAPB line parameters for these routers. For all other link modules, LAPB is implemented in the hardware using the MK5025 chip, and you cannot configure LAPB line parameters.

Note: The different LAPB implementations result in two different LAPB management information bases (MIBs). This means that if you copy an existing configuration from a Bay Networks router that uses the MK5025 chip to the AN or ASN, or the BN or LN with Octal Sync, the configuration may not work because the location of the LAPB MIB is different.

When you configure X.25, you automatically set up LAPB. For information about editing LAPB parameters, refer to Chapter 5, "Configuring LAPB."

Network Layer

The network, or packet, layer establishes the *virtual circuit* (VC) and provides procedures for call establishment, data transfer, flow control, error recovery, and call clearing. The router uses the network layer to determine destination X.121 addresses and to specify which user-configurable X.25 facilities the network layer supports. (For more information about X.121 addresses, see "Determining the X.121 Destination" on page 1-10.) The X.25 Protocol defines *how* the DTE and its respective DCE communicate and exchange data.

The X.25 network transmits data over virtual circuits between each source and destination on the network. Because as many as 128 VCs can exist on the same physical link at the same time, multiple devices can share the bandwidth of the transmission line, sending data in multiple packets from the source to the destination.

X.25 Service Types

The Bay Networks router transmits data across these types of X.25 network services.

- Public Data Network (PDN)

  The X.25 PDN service provides end-to-end connectivity between the router and a remote DTE that supports Internet RFC 1356 X.25 services. The Bay Networks router supports Internet RFC 1356 for IP, OSI, DECnet, IPX, and XNS.

- Defense Data Network (DDN)

  The X.25 DDN service provides end-to-end connectivity between a router and a remote DTE that supports X.25 DDN Standard Service. IP uses DDN service to transmit IP datagrams. OSI uses DDN service to send OSI protocol data units (PDUs) over the X.25 network. No other protocols use DDN services.

  You can implement an X.25 DDN network as a Blacker front-end encryption (BFE) network. BFE is an external, standalone encryption device that you connect to your router to establish X.25 DDN networks.

- Point-to-Point Service

  Point-to-Point service is proprietary to Bay Networks, so Bay Networks routers must be at both ends of the connection. AppleTalk, transparent and spanning tree bridging, DECnet, IP, VINES, XNS, IPX, and OSI can use Point-to-Point X.25 service to transmit datagrams over the X.25 network.

- IP Encapsulation of X.25 (IPEX)

  IPEX allows two X.25 systems to exchange data by tunneling over a TCP/IP network.

- X.25 Gateway

  X.25 Gateway allows an X.25 system to exchange data with TCP/IP hosts. For more information, refer to *Configuring X.25 Gateway Services*.

- Qualified Logical Link Control (QLLC)

  QLLC transfers IBM Systems Network Architecture (SNA) traffic over an X.25 network.

The type of traffic that the router forwards depends upon the type of network layer service enabled on each of the router's network interfaces. For example, if you configure an interface for DDN services, you cannot configure any other type of service. You can, however, configure an interface to run PDN IPEX, QLLC, and Point-to-Point services together.

PVCs and SVCs

Bay Networks X.25 services enable you to configure both permanent virtual circuits (PVCs) and switched virtual circuits (SVCs).

A *PVC* is a permanent logical path that you configure between two DTEs. It uses a fixed logical channel to maintain a fixed point-to-point connection between two end stations on a network. A PVC requires no setup operation before or disconnect operation after data travels between these end stations.

An *SVC* is a connection across a network that exists only as long as data travels across that circuit. An SVC is established on an as-needed basis, and can connect any two end stations in the network. SVCs have three separate phases: call setup, data transfer and call disconnection.

You can configure a combination of PVCs and SVCs on the same interface.

For instructions on configuring X.25 PVCs and SVCs, refer to Chapter 3, "Enabling X.25 Service".

How X.25 Services Work

End users on a LAN use the services of the Bay Networks router to access X.25 networks. The router acts as a DTE device; it encapsulates user data in X.25 format and transmits it across the network.

PVC Services

PVCs work the same way as SVCs, except that you configure permanent mappings for PVCs, while SVCs create mappings each time a call occurs.

You create permanent mappings by assigning the appropriate PVC LCN in the adjacent host record for the specified protocol. The PVC LCN value cannot be numerically equal to any SVC remote X.121 address that is configured in an adjacent host record for the same protocol and on the same next-hop interface.

Configuring X.25 PVCs for IP, IPX, and DECnet

Enter a PVC LCN value in the Adjacent Host Address parameter.

Configuring X.25 PVCs for OSI

Enter a PVC LCN value in the SNPA parameter.

Note: X.25 PVCs do not work with XNS.

SVC Services

To demonstrate how Bay Networks X.25 services work for SVCs, the following sections explain how Router A, which is configured for X.25 PDN services, routes data from IP end station 1.1.1.2 over the X.25 network to IP end station 3.1.1.2. Refer to Figure 1-4 as you read the next sections.

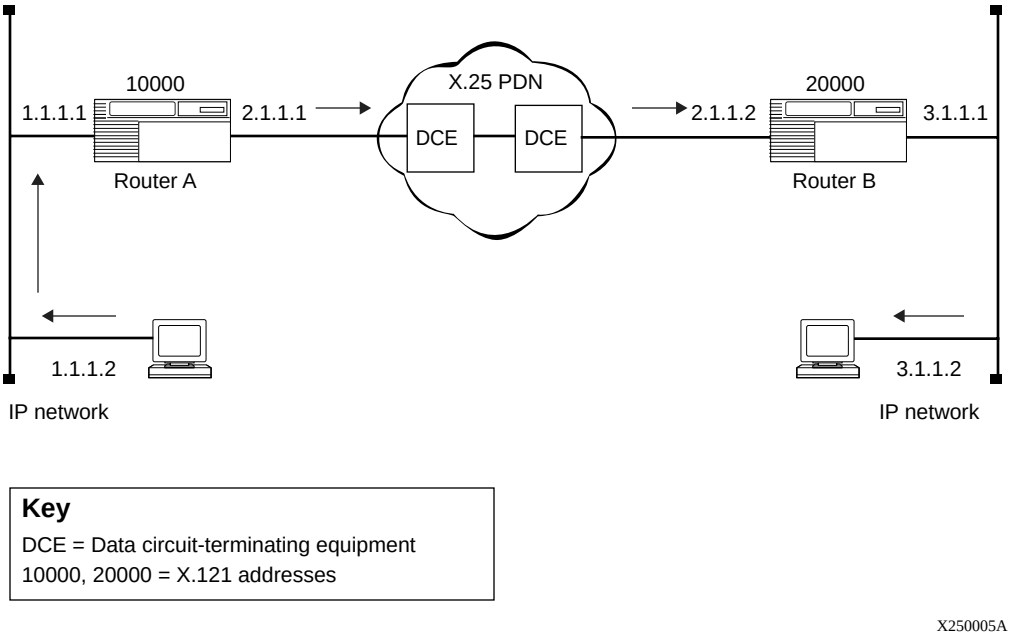


Figure 1-4. Sample X.25 Configuration

Determining the X.121 Destination

Each interface connecting to the X.25 network has an X.121 address, which consists of 1 to 15 decimal digits. For example, in Figure 1-4 the X.121 network addresses for Routers A and B are 10000 and 20000, respectively. Router A communicates with Router B over the X.25 network by setting up virtual circuits that connect the two X.25 interfaces.

Data transmission begins when:

1. Router A receives an IP datagram from IP end station 1.1.1.2 that is destined for end station 3.1.1.2.
2. Router A checks its IP routing table to determine the next hop on the datagram's path (in this example, IP address 2.1.1.2).
3. When Router A determines that the next hop is located across the X.25 network, it checks to see which destination X.121 address maps to the next hop's IP address via the IP adjacent host table (in this example, X.121 address 20000).
4. To transmit the datagram across the network, the router now establishes a virtual connection between itself and destination X.121 address 20000.

   Router A begins by selecting an unused virtual circuit. The router assigns the circuit a 12-bit virtual circuit number (Figure 1-5), which it chooses from a user-specified range of virtual circuit numbers. The virtual circuit number identifies the logical channel portion of the circuit that connects the router and its DCE.

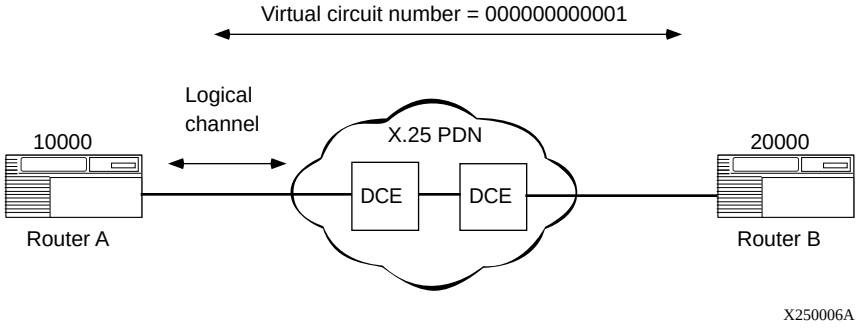


Figure 1-5. Virtual Circuit Connecting Bay Networks Routers

The logical channel consists of a 4-bit logical channel group number concatenated with an 8-bit logical channel number. The logical channel number identifies this circuit as the one that will carry all data transmitted between the router and the destination DTE, when the connection to the destination X.121 address is established.

Establishing an SVC

After Router A determines the destination X.121 address, the two routers establish an SVC as follows:

1. Router A uses the services of the packet layer protocol to generate a call request packet that it sends to Router B.

   Along with various optional X.25 facilities, the call request packet specifies the outgoing logical channel number, Router A's X.121 address, and Router B's X.121 address (Figure 1-6).

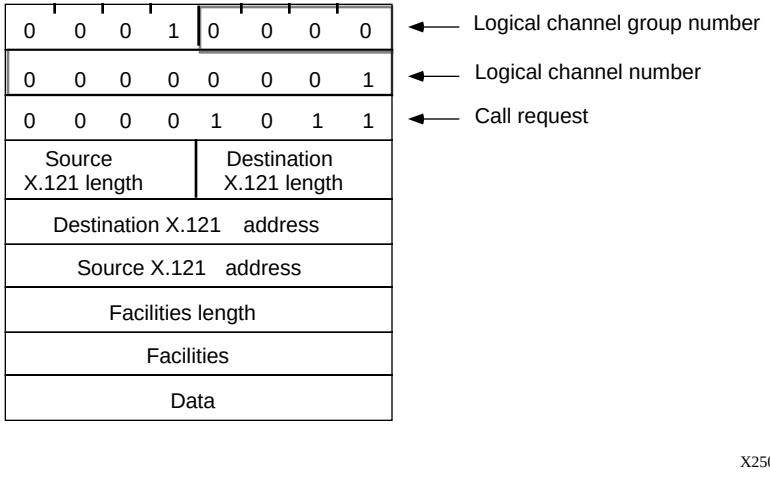


Figure 1-6. X.25 Call Request Packet Format

2. When the local DCE receives Router A's call request, the DCE forwards it across the X.25 network, where it is eventually routed to Router B.
3. Router B checks the called address for a match to its configured X.121 address. It also checks the calling address for a match to the remote X.121 address configured in the service record.

4. If it finds both matches, it accepts the call, and responds with a call accept packet that establishes the virtual connection between the two routers.

When the SVC is established, the router can transmit and receive data (Figure 1-7).

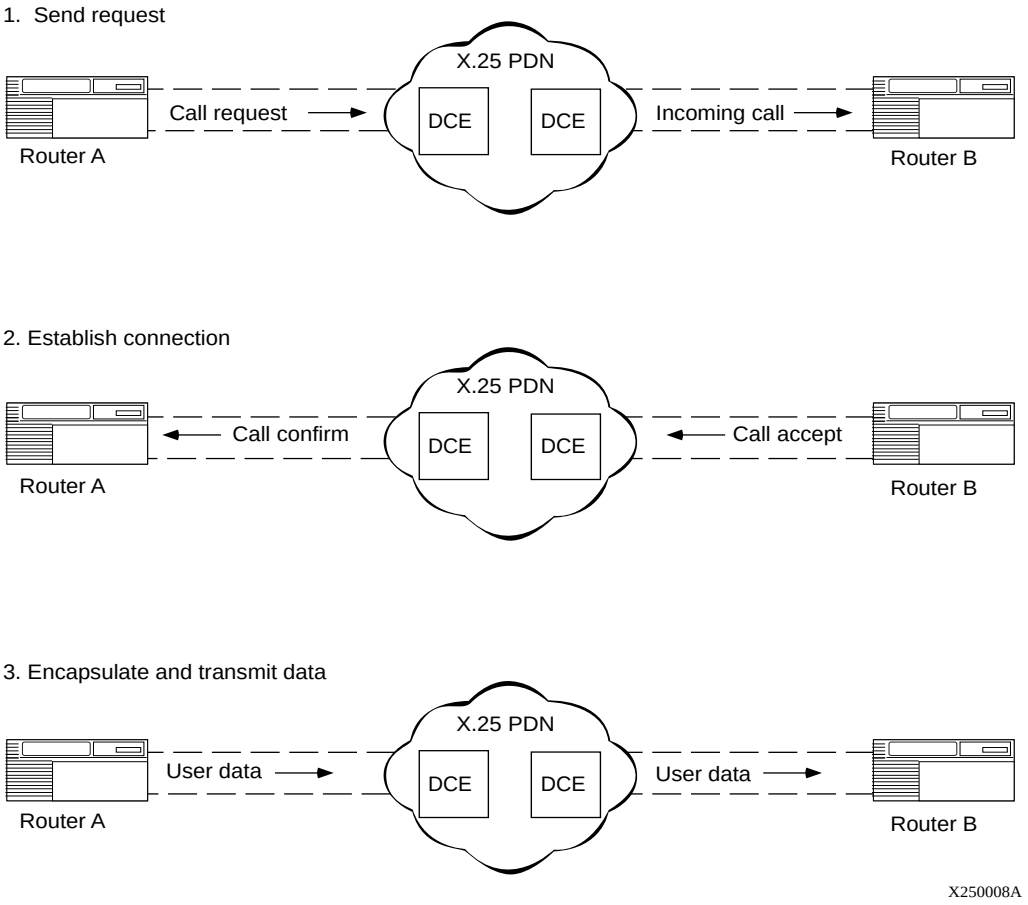


Figure 1-7. Setting Up an X.25 Call Connection

Transmitting Data

After Router B establishes the circuit, data travels between end stations 1.1.1.2 and 3.1.1.2 as follows:

1. Router A begins processing the packets it receives from IP end station 1.1.1.2 across the X.25 network to Router B.
2. Router B removes the X.25 packet headers and trailers and forwards only the IP data to IP end station 3.1.1.2 (Figure 1-8).
3. IP end station 3.1.1.2 transmits data to end station 1.1.1.2.

   Note that other IP end stations (for example, 1.1.1.3) can use the virtual circuit to transmit data in the direction of end station 3.1.1.2 until the call is cleared.

   The call request and call accept packets specify the logical channel numbers (LCNs) assigned to the virtual connections between each router and its corresponding DCE. As a result, subsequent X.25 data packets contain only the logical channel numbers, rather than the complete X.121 destination addresses.

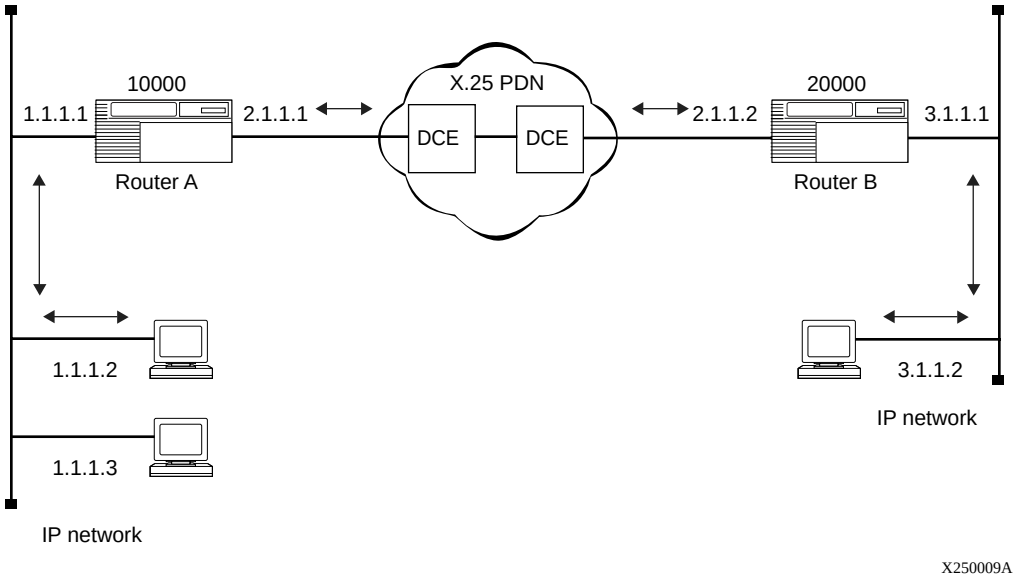


Figure 1-8. Routing IP Traffic across the X.25 Network

IPEX

Bay Networks X.25 services include IP Encapsulation of X.25 (IPEX). IPEX lets you send and receive messages between two X.25 systems via a TCP/IP network. The tunneling maps TCP sockets to X.25 virtual circuits.

IPEX works with X.25 virtual circuits, both PVCs and SVCs, as well as with TCP/IP protocols over all interface types that Bay Networks routers support.

Note: In this document, the acronym IPEX refers to both the Bay Networks router when configured to provide X.25 tunneling service, and to the software that implements the tunneling, depending on the context.

IPEX supports:

- TCP/IP over Fiber Distributed Data Interface (FDDI), Ethernet, and Token Ring LAN media
- X.25 over synchronous interfaces (6 MB/s maximum)

How IPEX Works

Tunneling support attaches an X.25 DTE or DCE to the IPEX router, which converts X.25 data to TCP and uses TCP/IP to carry the X.25 data to another, remote IPEX router, which converts it back to X.25. Figure 1-9 illustrates this conversion.

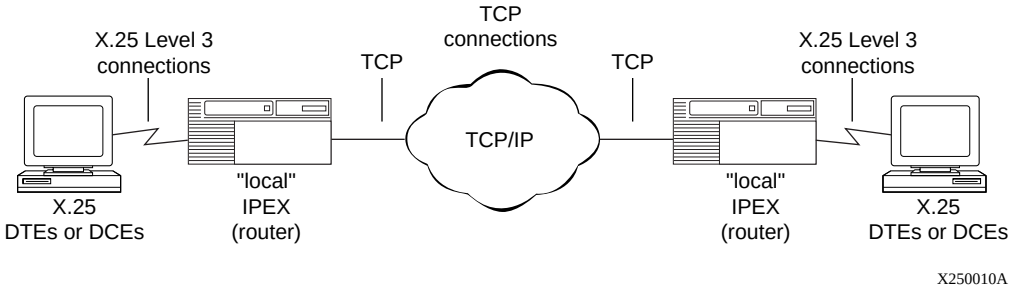


Figure 1-9. Sample Network Topology with TCP/IP Tunneling and IPEX

The sample configuration shows X.25 DTEs or DCEs connected to Bay Networks routers by standard X.25 lines, interfaces, and software, and a network of routers interconnected by standard TCP/IP lines and interfaces. You can connect the DTEs or DCEs to the router using any synchronous or Multichannel T1 (MCT1) port type.

Levels of Tunneling

Figure 1-10 shows the levels of tunneling within the IPEX router.

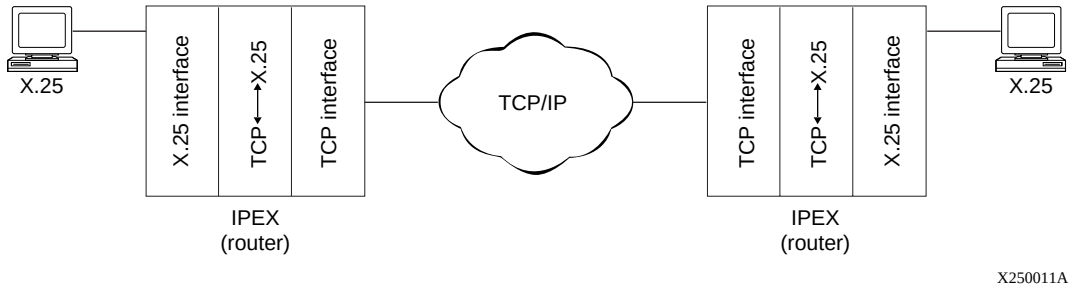


Figure 1-10. Levels of Tunneling with IPEX

When communicating with an X.25 DTE, the Bay Networks IPEX router acts as an X.25 DCE. Conversely, when communicating with an X.25 DCE, the Bay Networks IPEX router acts as an X.25 DTE. The IPEX router provides X.25 VC support. You define the connection between two X.25 systems during configuration. When either a DCE or DTE initiates a call, the router establishes a TCP connection. VCs must have an X.121 address for the router to make the TCP connection.

IPEX Network Interfaces

Bay Networks routers that support IPEX services use the following protocols:

- X.25 Packet Layer Protocol (PLP)
- Transmission Control Protocol (TCP)
- Internet Protocol (IP)

X.25 PLP Interface

The X.25 PLP interface corresponds to OSI layer 3. On an X.25 PLP interface, you can create and configure multiple VCs.

On an X.25 interface, you can configure IPEX service and another type of X.25 service: PDN, Point-to-Point, or QLLC. IPEX uses the X.25 flow-control mechanisms to detect any congestion in the X.25 connection.

IPEX uses the X.25 PLP client interface to:

- Open and close X.25 connections.
- Send data to the X.25 module for transmission.
- Process received data delivered from the X.25 module.
- Control the flow of data across the client interface.
- Ensure data integrity.

TCP Interface

IPEX appears to TCP as a client. As such, IPEX specifies the *socket* for the local TCP interface (consisting of its IP address and TCP port number) and another socket for the remote TCP interface to establish a connection.

For VCs using IPEX, when the local X.25 DCE or DTE requests an X.25 end-to-end switched connection, the local router contacts the remote IPEX router to establish a unique TCP connection for that X.25 connection.

Because a large number of TCP connections may be active concurrently to support many tunneling sessions, IPEX service uses a large range of TCP port numbers to create separate sockets for the individual tunneling sessions. However, IPEX service does not use any port numbers that are reserved for the standard TCP/IP protocols, UNIX system services, or other TCP client services provided in the software. The port numbers reserved for IPEX service range from 12,304 through 16,399.

IPEX uses the TCP client interface to:

- Open, close, and check the status of TCP connections.
- Send data to the TCP module for transmission.
- Process received data delivered from the TCP module.
- Control the flow of data across the client interface.
- Ensure data integrity across the IP network.

IPEX Facility Support

IPEX handles only the following X.25 PLP facilities:

- **Default Packet Size and Default Window Size:** The IPEX router examines the packet and window size in the X.25 call from the client terminal. When the router has validated and accepted these parameters, it sets up the optimal flow control queues at the X.25 client interface, as well as the optimal receive and transmit windows at the TCP client interface.
- **Flow Control Parameter Negotiation:** The IPEX router can support the largest packet size defined in the X.25 standard. Therefore, it always accepts the proposed window and packet size parameters in the X.25 call packet from the client terminal after they are validated, without negotiating a smaller window or packet size.

Sequence of Connections with IPEX

Figure 1-11 illustrates the sequence of calls and connections in X.25 TCP/IP tunneling, as follows:

1. The local IPEX router receives an incoming X.25 call request from a client X.25 terminal.
2. The local IPEX router sends a TCP connection request to the IPEX router serving the remote X.25 terminal.
3. The remote IPEX router then sends a call request to the remote X.25 terminal.
4. That terminal then responds with an X.25 call accepted packet.
5. The remote IPEX router accepts the TCP connection.
6. The local IPEX router accepts the local X.25 connection.

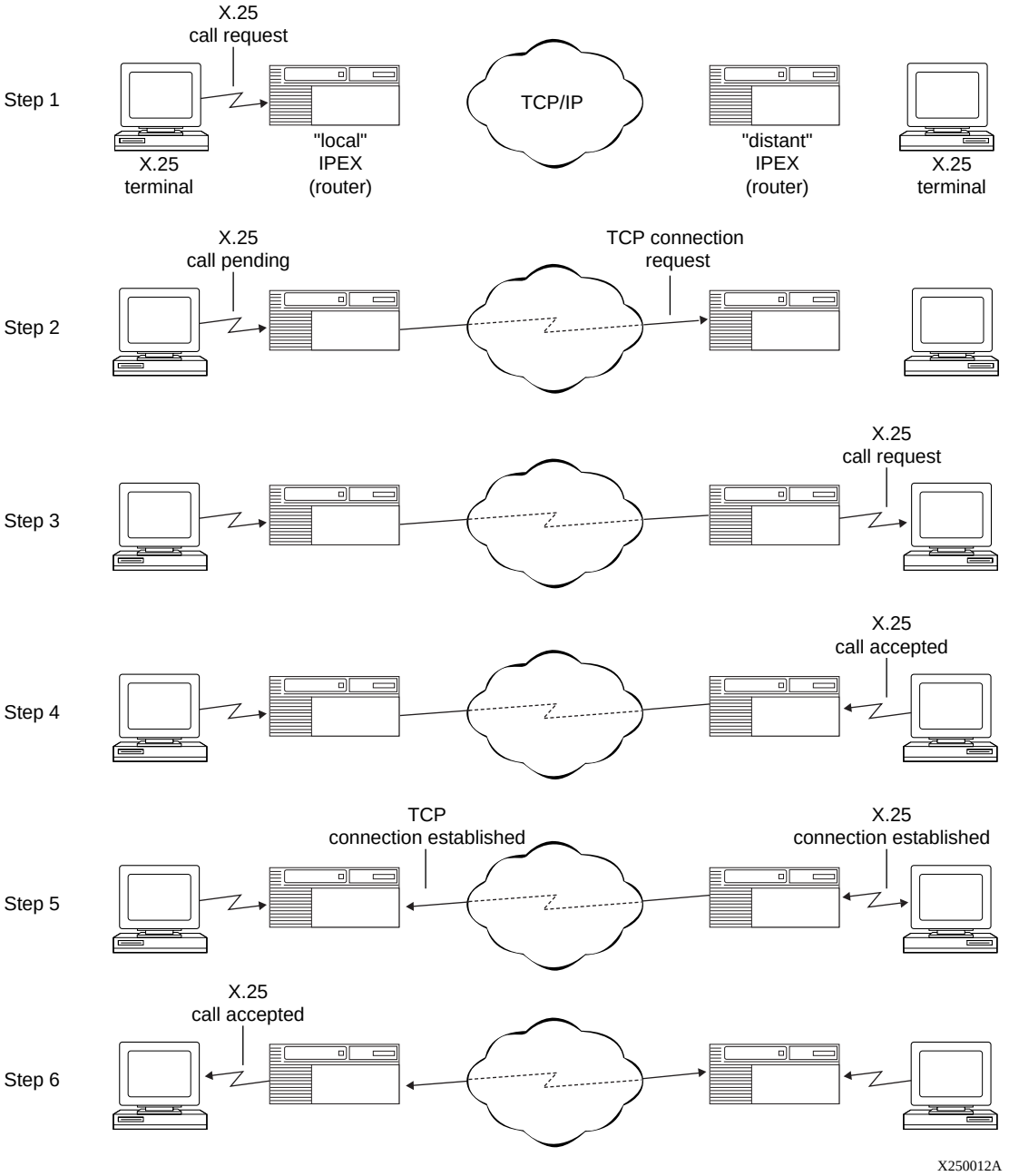


Figure 1-11. How IPEX Establishes Connections

IPEX Mapping

For each established VC connection that contains a specified X.25 called address (X.121 address), IPEX establishes a TCP connection from IPEX to a TCP/IP server. This connection consists of the IP address and the TCP port number of a remote TCP/IP peer that correspond to the X.25 called address. To enable X.25-to-TCP conversion, you must configure the following information:

- The point of attachment (that is, the circuit interface) on the IPEX system at which the VC establishes the connection.
- The VC LCN range at the packet level.
- The X.25 called address of the incoming call request from the X.25 DTE/DCE to IPEX.
- The associated remote TCP socket (IP address and TCP port number) that identifies the destination of the TCP connection.

This mapping sets a path for forwarding data received on an X.25 virtual circuit to a specific remote TCP/IP peer.

Mapping Types

To configure IPEX, you must select either local or end-to-end mapping, which determines whether facilities, call user data, M-bit and Q-bit support terminate locally or are passed across the TCP/IP connection.

If you set the mapping type to local, IPEX ports can support different packet sizes at each end, but message size can be no longer than 4 KB.

If you configure end-to-end mapping, all IPEX ports must have the same packet and window size, or the M-bit support will not function properly. End-to-end mapping allows unlimited message size.

IPEX Connection Summary

To set up a reliable tunneling session, each side must successfully establish a connection. When one side receives a call request, the other side attempts to connect. If the connection attempt fails on the remote side, the local side will reject the call request it received because the tunneling session cannot be set up.

Figure 1-12 shows how IPEX mediates the interaction between the two protocol stacks as the data flows between the X.25 client terminals and the TCP-based hosts.

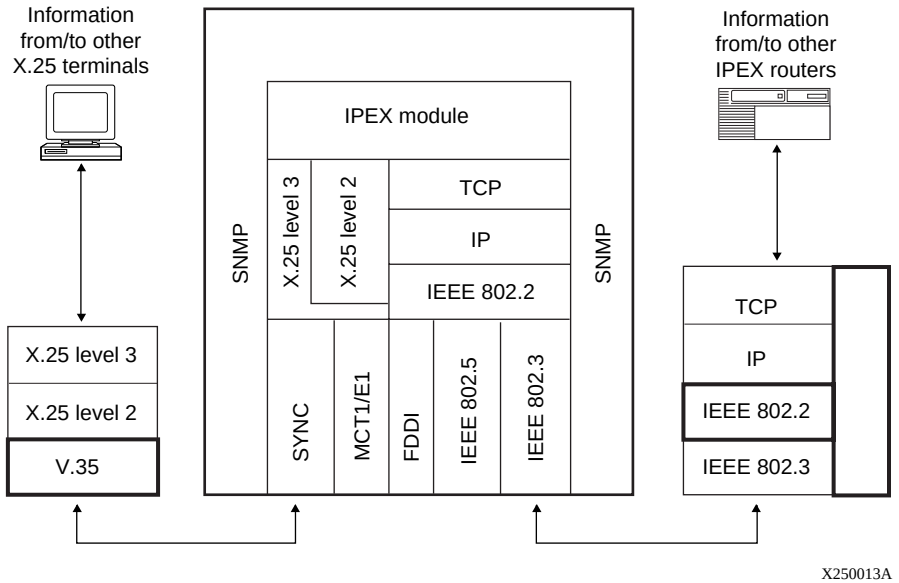


Figure 1-12. Role of the X.25 and TCP Protocol Stacks in IPEX

The TCP and X.25 communication stacks share the responsibility for maintaining a reliable and efficient data flow. That is, if data loss occurs because of a lack of software resources or intermittent transmission errors, the communication stack on that side must retransmit the lost data. In addition, both sides must independently maintain protocol flow control.

Data loss may also occur due to hardware or other catastrophic failures. You must implement redundancy in the network topology design and provide manual or automated intervention to handle these types of data communication failures.

IPEX Handling of Large Data Messages (M-bit)

X.25 is a message-based protocol, and TCP is an unstructured stream protocol. They differ in the way they send outgoing traffic from their clients and deliver incoming traffic to their clients.

How X.25 Handles Large Data Messages

When the X.25 client submits an X.25 message that is larger than an X.25 packet size, the X.25 protocol fragments the message. X.25 then transmits the sequence of packets containing these fragments. Within each packet, X.25 includes a flag (M-bit) that indicates the fragmentation and helps the receiver reassemble the message.

How TCP Handles Large Data Messages

TCP, on the other hand, does not have a flag to mark fragmentation of messages that are bigger than the TCP maximum transmission unit (MTU) size. The portion of a message that does not fit into one TCP data segment is sent in a subsequent data segment. Without a flag or any indication of the size of the message, the TCP client has no way of determining the boundary of a message; that is, whether the complete message is contained within one or in several data segments. Hence, once IPEX receives the X.25 user data and translates it to a TCP data segment, the message boundary is lost.

To minimize changes in the existing host applications, IPEX maintains the X.25 message boundary. IPEX structures the application information into message blocks before encapsulating it in TCP data segments.

Q-bit Support

IPEX service includes support for the Qualified data bit (Q-bit), which is transported generically through the network. A Q-bit value of 1 indicates that the frame is a control frame, and a value of 0 indicates that it is a data frame.

X.25 PAD

An X.25 PAD (packet assembler/disassembler) provides access to an X.25 network for devices, often character terminals, that are not capable of sending and receiving traffic across the X.25 interface. The PAD establishes and maintains the link with the packet-switched network, assembles and disassembles packets, communicates with the character terminal, and handles special control processes for the character terminal. Bay Networks X.25 PAD services comply with the CCITT so-called Triple X Standards, Recommendations X.3, X.28, and X.29.

Bay Networks X.25 PAD services work only with X.25 SVCs for the current software release, and only with the ARN router.

For instructions on installing an X.25 PAD, see *Installing the X.25 PAD*. For instructions on using Site Manager to configure X.25 PAD Services, see Chapter 7, "Enabling and Configuring X.25 PAD Services."

QLLC

Bay Networks X.25 services include Qualified Logical Link Control (QLLC), a protocol that transfers IBM SNA data over an X.25 network. QLLC carries both Logical Link Control (LLC) information and SNA data across an X.25 network.

For example, with QLLC support, a Bay Networks router can send and receive X.25 packets from an IBM host running IBM's X.25 NCP Packet Switching Interface (NPSI) and downstream QLLC compatible SNA endstations. It can also work with other topologies, several of which are illustrated in Appendix D, "QLLC Technical Supplement."

QLLC and DLSw or APPN

You must run DLSw or APPN when you use QLLC. The router transmits the SNA data contained within QLLC packets over SDLC or LLC (token ring, Ethernet, frame relay) data links that use DLSw services.

QLLC works with all media that X.25 supports. You can establish as many as 128 simultaneous QLLC virtual circuits on a physical link.

To configure DLSw, see *Configuring DLSw Services*. To configure APPN, see *Configuring APPN Services*.

NPSI

IBM's NCP Packet Switching Interface (NPSI) software allows SNA hosts to attach to X.25 networks, and to support virtual circuits for both incoming and outgoing calls. NPSI makes X.25 virtual circuits appear to SNA hosts as point-to-point (SDLC) links.

How QLLC Works

The interfaces that you configure for QLLC conversion are the serial interfaces of the X.25 network that connect to the remote devices with which you want your local SNA devices to communicate.

Sequence of Connections with QLLC

When an X.25 attached device (for example, an IBM 3174 control unit) wants to send data to an IBM host, the 3174 sends an X.25 call request packet. The IBM host running NPSI receives the call request, and establishes a QLLC session with the 3174.

QLLC Address Mapping

The QLLC software *maps* or matches the MAC address that DLSw recognizes to an X.121 address that X.25 recognizes. It also translates the data into a format the receiving device can comprehend. There are two different ways to create the mappings that QLLC requires: mappings that use wildcards, and individual mappings between each endstation and a host.

See Appendix D, “QLLC Technical Supplement,” for examples that illustrate these types of networks and the ways you can configure QLLC mapping for them.

QLLC Adjacent and Partner Devices

Bay Networks QLLC uses the terms *adjacent* and *partner* to describe the X.121 and MAC addresses that map to each other. These terms are relative to the interface that runs the QLLC/X.25 software.

The Adjacent X.121 DTE/DCE device connects to the interface that is running the QLLC/X.25 software, either directly or indirectly. It maps to that device’s Adjacent MAC address.

The Partner X.121 DTE/DCE device connects through the DLSw network. It maps to that device’s Partner MAC Address.

In Figure D-1 on page D-3, for example, Router A connects to the SNA mainframe through the X.25 network, so the mainframe is an adjacent device. The PC, the 3174 control unit, and the AS400 are partner devices because they connect through the DLSw network, and not through the X.25 network.

In Figure D-4 on page D-9, Router A connects to the SNA mainframe through a token ring network, so it is a partner device. Router A connects to the PC through the X.25 network, so the PC is an adjacent device. The mainframe is an adjacent device for Router B, because they connect through the X.25 network. The PC is a partner device for Router B.

Wildcard Mapping, Simply Configured

Wildcards work for LLC endstations that initiate connections to QLLC hosts, and for QLLC endstations that initiate connections to LLC hosts. Wildcard mapping minimizes configuration requirements. You can configure a single endstation-to-host map and apply it to any number of QLLC connections, depending on the wildcard you specify. Wildcard mapping is especially useful for networks that have a large number of endstations that transmit data to one host. It also allows you to add or delete endstations on your network without reconfiguring QLLC.

To use wildcard mapping, you identify the host by mapping its MAC address to a virtual X.121 Address. Wildcard mapping works only in networks where the host never originates the connection, and therefores does not need to know the MAC addresses of the endstations.

For instructions on using Site Manager to configure wildcard mappings, see Chapter 8, “Configuring QLLC.” For a detailed description of wildcard mapping in complex networks, see page D-10.

Configuring Wildcard Mapping for LLC Endstations to a QLLC Host

To use the simplest form of wildcard mapping for LLC endstations to a QLLC host, you assign a wildcard value of “.*”, which means “Don’t Care”, for the endstation MAC address, which can apply to any number of endstations. You then map the “Don’t Care” wildcard to the X.121 address of the router through which traffic must pass to reach the host.

Configuring Wildcard Mapping for QLLC Endstations to LLC Hosts

To use the simplest form of wildcard mapping for QLLC endstations to an LLC host, you assign a wildcard value of ".*", which means "Don't Care", for the endstation Adjacent X.121 Address, which can apply to any number of endstations. You then map the "Don't Care" wildcard to the X.121 address of the adjacent QLLC/X.25 device.

Wildcard Mapping and Backward Compatibility

Earlier versions of Bay RS allow only one QLLC mapping per unique X.121 address pair. The wildcard feature in Bay RS 12.10 allows multiple QLLC sessions and VCs for a unique X.121 address pair. However, if you have a backbone node topology with QLLC between a 12.10 router and a router running an earlier version of software, and the call originates from the 12.10 router, you cannot use wildcard mappings at all.

Coordinating X.25 and DLSw Parameters for QLLC

In addition to setting QLLC parameters, you must coordinate X.25 packet size parameters with the SNA frame size to ensure that they are compatible.

Chapter 2
Implementation Notes

This chapter describes special features of the Bay Networks X.25 implementation, including:

Data Compression

Bay Networks data compression software enables you to reduce line costs and improve response times over X.25 networks.

Data compression eliminates redundancies in data streams. When you use compression on your network, bandwidth efficiency improves, enabling you to transmit more data over a given amount of network bandwidth.

To use data compression with X.25, you must set the X.25 service record parameter, Enable Compression, to Enable. For information about how to access this parameter, see Chapter 4, "Editing X.25 Parameters."

For a complete discussion of data compression, descriptions of compression parameters, and instructions for configuring compression for an X.25 interface, see *Configuring Data Compression Services*.

Load Sharing

The Bay Networks implementation of X.25 on PDN networks includes load sharing across as many as four VCs, using a round-robin algorithm to distribute traffic. This feature improves performance by increasing the effective window size, that is, the number of packets that a DTE can transmit before it receives an acknowledgment.

To take advantage of multiple virtual connections and load sharing across them, you must set the Max Connections network service record parameter to a value greater than 1 (see page 4-2).

IPEX and QLLC do not support load sharing.

Clocking Sources for Routers Set Back-to-Back

If two Bay Networks routers are operating back-to-back without a clocking source, you must configure internal clocking on both routers. Use a crossover cable to connect the ports.

The default clocking source for X.25 is external. When you configure X.25 and LAPB on an existing network, external clocking can cause unpredictable results on any internally clocked line. Clocking sources must be the same for each router that you connect back-to-back.

Packet-level Parameters: Max Window Size and Max Packet Length

When you configure X.25 packet-level parameters, make certain to set the Max Window Size and Max Packet Length parameters for peer routers to the same value if you also enable flow control. If you do not, the routers cannot perform network service-level negotiations.

For QLLC and IPEX, set Max Window Size and Max Packet Length parameters according to the values in the attached X.25 devices. For example, if you set the Max Window Size for Router A to 7, set the Max Window Size for peer Router B to 7. Similarly, if you set the Max Packet Length for Router A to 512, set the Max Packet Length for peer Router B to 512.

Window size and packet length can affect packet throughput across the X.25 network. Setting either the Max Window Size or Max Packet Length parameter too low can cause the router to drop packets. You may want to configure these parameters at higher values than the default settings. For information about how to access these parameters, see Chapter 4, "Editing X.25 Parameters."

Flow-Control Negotiation

The Bay Networks implementation of X.25 enables the router to negotiate flow control, which regulates the rate of data transfer among elements of a network to prevent congestion and overload. For flow-control negotiation to work properly, you must set the parameters in Tables 2-1 and 2-2 as shown.

Table 2-1. X.25 Packet-level Parameters

Parameter	Value
Flow Control Negotiation	On
Max Window Size	For an explanation of value options, see Help or page A-14.
Max Packet Length	For an explanation of value options, see Help or page A-15.
Acceptance Format	DEFEXT (specifies default Basic format)
Release Format	DEFEXT (specifies default Basic format)

Table 2-2. X.25 Service Record Parameters

Parameter	Value
Flow Facility	Negot (negotiate flow facility)
Window Size	For an explanation of value options, see Help or page A-35.
Packet Size	For an explanation of value options, see Help or page A-35.

Configuring LAPB for an AN or ASN

When you create a new X.25 line on a Bay Networks AN or ASN router, Site Manager automatically uses default values to configure LAPB. If you want to edit the LAPB parameters, you can access them through the Edit Line Parameters window after you have created the new X.25 line. For further information, see *Configuring Line Services*.

Configuring Synchronous Lines with X.25

Table 2-3 shows the default synchronous line configurations for an AN/ASN and a BN/VME router.

Table 2-3. Synchronous Line Parameter Defaults for X.25

Synchronous Line Parameter	AN/ASN X.25	BN/VME X.25
BOFL	Disable	Disable
MTU[a]	512	1600
Service	Transparent	LAPB
Transmit Window Size	1	7
Min Frame Spacing[a]	1	1
Local Addr	7	1[†]
Promiscuous	Enable	Disable
Remote Addr	7	3[†]
WAN Protocol	LAPB	X.25
Sync Polling[b]	Enable	Disable

a. Set this parameter to the same value on both sides of the X.25 connection. The default is calculated to be 2 times the packet size times the window size. For nonsegmenting protocols (AppleTalk, DECnet), you may need to increase the MTU to a larger value.

b. Set this parameter to Disable if the physical interface is not V.35.

If you want to edit the synchronous line parameters, you can access them through the Edit Line Parameters window after you have created the new X.25 line. For more information on these parameters, see *Configuring Line Services*.

DDN Default Service Record

When you configure the Service Type as DDN, you can automatically configure service records that use default parameter values for every DDN SVC on your network. This means that you do not have to individually configure DDN service records. To use the default DDN service record feature, set the Use Default Service Configuration packet-level parameter to ON.

You can also change the default values that apply when you set the Use Default Service Configuration parameter to ON. For instructions, see Chapter 4, "Editing X.25 Parameters."

If you want to configure specific DDN SVCs with nondefault values, you can configure them individually. If you set the Default DDN parameter to ON, the default values apply to all SVCs, but if you then edit an individual SVC, values that you assign to that SVC apply.

RFC 1356 Multiplexing

Bay Networks supports RFC 1356 multiplexing. *RFC 1356* defines a standard for multiprotocol encapsulation over X.25 networks. Bay Networks implements RFC 1356 for IP, OSI, IPX, DECnet, and XNS. This means you can use Bay Networks routers at one end of a connection, and equipment from another vendor (that also supports RFC 1356 for these protocols) at the other end of the connection.

Multiplexing enables you to send multiple protocols over a single virtual circuit. Bay Networks advises multiplexing when you configure multiple routing protocols on a PDN type of service.

You enable multiplexing by setting the Enable 1356 Multiplexing parameter. If you set this parameter to Enable, the router can use RFC 1356 Null Encapsulation to send multiple protocols over a single virtual circuit. If you set the value to Disable, the router uses RFC 1356 Normal Encapsulation for IP and OSI, and RFC 1356 SNAP Encapsulation for IPX DECnet and XNS, opening a separate virtual circuit for each protocol. The default setting is Disable. See Figures 2-1 and 2-2 for illustrations of Null and Normal Encapsulation.

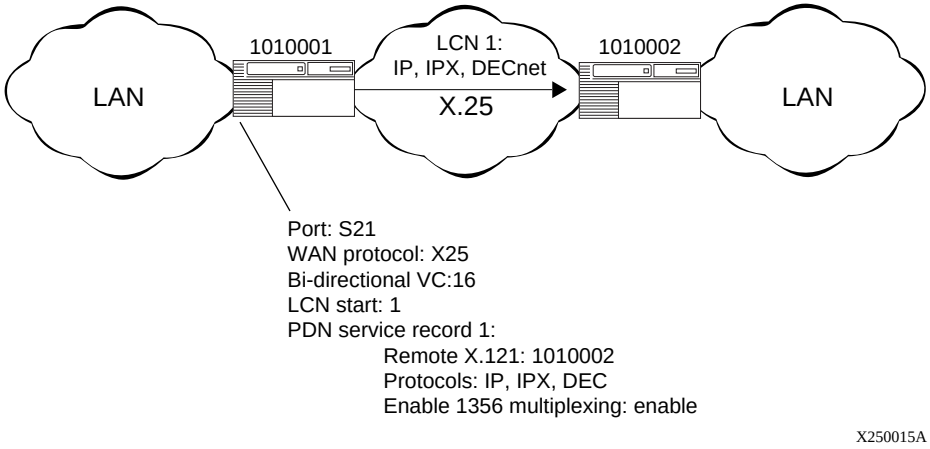


Figure 2-1. RFC 1356 Null Encapsulation

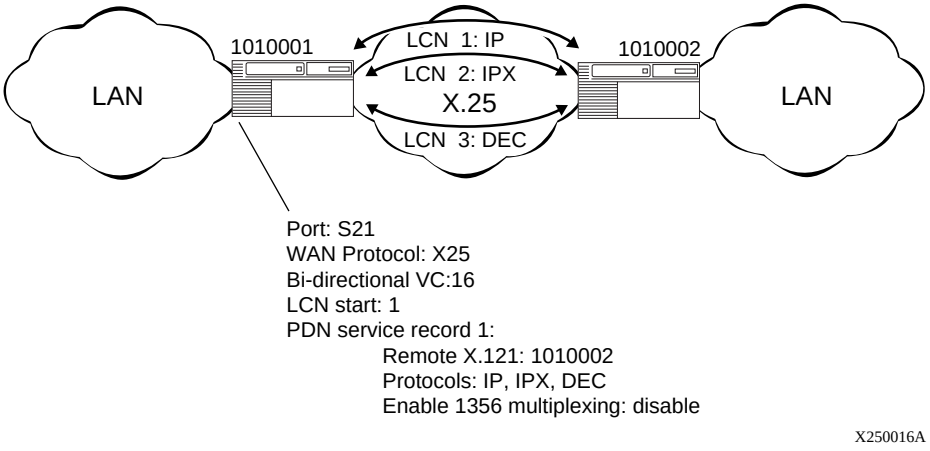


Figure 2-2. RFC 1356 Normal Encapsulation

PtoP Encapsulation

Bay Networks also has Point-to-Point (PtoP), a proprietary encapsulation method for LAN protocols. PtoP requires a Bay Networks router at both ends of a connection. You must use PtoP to encapsulate AppleTalk, Banyan VINES and Bridge traffic.

X.25 over ISDN D Channel

X.25 over the ISDN D channel allows the router to transport X.25 packets without incurring the expense of a leased line. You can use the ISDN line for normal switched service applications as well as for X.25 traffic.

Bay Networks implementation of X.25 over the ISDN D channel is based on ITU-T (formerly CCITT) recommendation X.31.

IPEX Local Switching and X.25 over the D Channel

The most common implementation of X.25 over the D channel uses IP encapsulation of X.25 (IPEX) single-node switching. You configure IPEX on the backplane of a single router. A normal IPEX configuration performs local X.25 switching, and a circuitless IP network simulates an IP cloud. For instructions on configuring IPEX single-node switching, see page C-4.

Requirements and Limitations

Be aware of the following X.25 requirements and limitations:

- X.25 over the ISDN D channel works with AN, ASN, and ARN routers, and with single or quad ISDN/BRI modules only.
- A slot configured with X.25 over ISDN D channel must have both X.25 PLP and ISDN subsystems loaded.
- The maximum number of logical channels per slot is 64.
- Maximum packet size is 256 octets (result of the I-field length limitation of the LAPD information frame.)
- Throughput maximum is 9600 b/s.

- This feature does not support ISDN leased lines where the D channel does not exist.
- The router does not prioritize ISDN signaling traffic and the X.25 traffic on the D channel.
- Bay Networks implementation of X.25 over the ISDN D channel complies with standards in effect in France, Spain, and Germany.

Using Regular ISDN and X.25 over the ISDN D Channel

Any slot on the router that you configure with X.25 over ISDN using the D channel can also use regular ISDN. However, dynamically enabling or disabling X.25 over ISDN using D channel affects the active calls of the normal ISDN. Similarly, dynamically changing the ISDN switch-related MIBs (global rate adaption or incoming call filter attributes) affects X.25 over ISDN using D channel.

Further Information

For further information and instructions on configuring X.25 over the D channel, see *Configuring Dial Services*.

Chapter 3
Enabling X.25 Service

The sections that follow describe how to enable X.25 services. When you enable X.25 service, you must configure a subset of X.25 parameters. The Configuration Manager supplies default values for the remaining parameters. If you want to edit these default values, see Chapter 4, "Editing X.25 Parameters." Before you edit any default values, you should consult *Configuring and Managing Routers with Site Manager.*

Preparing a Configuration File

To prepare a configuration file:

1. **Create and save a configuration file that has at least one WAN interface.**
2. **Retrieve the configuration file in local, remote, or dynamic mode.**

Enabling X.25 on an Interface

To enable X.25 service, you must perform the following steps, each of which is explained in more detail in the next sections.

1. **Select the link or net module connector on which you are enabling X.25.**
2. **Select the X.25 Protocol.**
3. **Configure X.25 packet-level parameters.**
4. **Add X.25 network service records.**

Selecting a Connector

To select a connector:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose a link or net module.	The Add Circuit window opens and the circuit you chose is highlighted.
2. Click on **OK.**	The WAN Protocols window opens.
3. Choose X.25 and click on **OK**.	The X.25 Packet Config window opens.

Configuring X.25 Packet-level Parameters

To configure X.25 packet-level parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the X.25 Packet Config window, set the following X.25 packet-level parameters, using **Help** or the descriptions that begin on page A-2: • **Link Address Type** • **Network Address Type** • **PDN X.121/E.164 Address** • **DDN IP Address** • **Number of PVC Channels** • **PVC LCN Start** • **Number of Incoming SVC Channels** • **Incoming SVC LCN Start** • **Number of Bidirectional SVC Channels** • **Bidirectional SVC LCN Start** • **Number of Outgoing SVC Channels** • **Outgoing SVC LCN Start** • **Use Default Service Configuration**	
2. When you are done, click on **OK.**	The X. 25 Service Configuration window opens.
3. Go to "Adding X.25 Network Service Records" on page 3-4.	

Adding X.25 Network Service Records

To add X.25 network service records:

Site Manager Procedure	
You do this	**System responds**
1. From the X.25 Service Configuration window, click on **Add.**	The X.25 Service window opens.
2. Set the following X.25 network service parameters using **Help** or the descriptions that begin on page A-27: • **Type** • **Remote IP Address** • **Remote X.121/E.164 Address** • **Connection ID (for PtoP only)** • **Enable 1356 Multiplexing** • **Service VC Type** • **First PVC LCN** • **Number of PVC LCN** • **Window Size** • **Packet Size**	
3. When you are done, click on **OK**.	The X.25 Service Configuration window opens. It now displays the service record you just added.
4. Add more service records by repeating steps 1 through 3.	
5. Enable bridging and routing services on the X.25 circuit. You must choose SVC as the Service Type to enable bridging. For further information about bridging and routing services, see *Configuring Bridging Services* or *Configuring and Managing Routers with Site Manager*.	
6. When you are done, click on **OK.**	You return to the X.25 Service Configuration window.
7. Click on **Done**.	You return to the main Configuration Manager window.

Note: If you selected IPEX as a value for the Type parameter, the IPEX Mapping Table Configuration window appears when you click on OK in step 3. For instructions on configuring IPEX mapping parameters, see Chapter 6, "Configuring IPEX." If you selected QLLC, the QLLC Mapping Table Configuration window appears. For instructions on configuring QLLC mapping parameters, see Chapter 8, "Configuring QLLC."

Adding X.25 Network Service Records to a Previously Configured Interface

To add a new network service record to an existing X.25 interface:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the X.25 interface to which you want to add network service records.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X25 Protocol > Service**.	The X.25 Service Configuration window opens. It lists all network service records currently defined for the interface.
5. Follow the instructions in the previous section, "Adding X.25 Network Service Records." on page 3-4.	

Chapter 4
Editing X.25 Parameters

After you enable X.25, you can edit all X.25 parameters from the Configuration Manager window. For instructions on using Site Manager to access the Configuration Manager, see *Configuring and Managing Routers with Site Manager.*

To edit parameters for or delete X.25, see the following topics.

The Technician Interface allows you to modify parameters by executing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

Caution: The Technician Interface does not verify the validity of the value you enter for a parameter. Entering an invalid value can corrupt your configuration.

Editing the X.25 Global Parameter

The X.25 Global parameter enables X.25 services for the entire router without deleting X.25. To edit the X.25 Global parameter:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > X25 > Global**.	The Edit X.25 Global Parameters window opens.
2. Enable or disable X.25 services, using **Help** or the Enable parameter description on page A-2.	
3. Click on **OK**.	You return to the main Configuration Manager window.

Editing X.25 Packet-level Parameters

The X.25 packet-level parameters are specific to individual X.25 interfaces. To edit packet-level parameters for an existing interface:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the X.25 interface that you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X25 Protocol > Packet**.	The X.25 Packet Level Edit window opens.
5. Edit the packet-level parameters that you want to change, using **Help** or the parameter descriptions that begin on page page A-2.	
6. When you are done, click on **OK**.	You return to the main Configuration Manager window.

Note: When you reconfigure an interface in dynamic configuration mode, X.25 packet-level and LAPB service restart on that interface.

Editing X.25 Network Service Records

To edit the parameters for an existing X.25 network service record:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the X.25 interface that you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X25 Protocol > Service**.	The X.25 Service Configuration window opens. It lists all currently defined network service records.
5. Choose the service record you want to edit.	
6. Edit the network service parameters that you want to change, using **Help** or the parameter descriptions that begin on page page A-27.	
7. If you are configuring DDN Service Records and you want to change the default values for service record parameters, click on **Default DDN**.	The DDN Service window opens.
8. Edit DDN parameters.	
9. Click on **Apply**.	
10. Click on **Done**.	You return to the X.25 Service Configuration window.
11. When you are done editing all parameters, click on **OK**.	You return to the main Configuration Manager window.

Deleting X.25 Network Service Records

To delete a network service record:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the X.25 interface that you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X25 Protocol > Service**.	The X.25 Service Configuration window opens. It lists all currently defined network service records.
5. Choose the service record you want to delete.	
6. Click on **Delete**.	The X.25 Service Configuration window no longer lists the network service record you deleted.
7. Click on **Done**.	You return to the main Configuration Manager window.

Deleting X.25 from the Router

To delete X.25 from the router globally:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > X25 > Delete X25**.	A window opens and prompts: `Do you REALLY want to delete X.25?`
2. Click on **OK**.	You return to the main Configuration Manager window. X.25 is no longer configured on the router.

Chapter 5
Configuring LAPB

The Link Access Procedure Balanced (LAPB) protocol is a subset of the High-Level Data Link Control (HDLC) protocol, which is an OSI link layer standard. This chapter includes:

Properties of the LAPB Protocol

The implementation of the LAPB protocol differs among Bay Networks routers. On the AN, ANH, ARN, and ASN routers, and BN and LN routers with the Octal Sync link module, LAPB is implemented in the software. For all other link modules, LAPB is implemented in the hardware, and you cannot configure LAPB line parameters.

Bay Networks routers use the services of LAPB to initialize the link between the router and the local DCE device, and to frame X.25 data packets before transmitting them to the DCE. X.25 uses the LAPB protocol at the data link layer to:

- Initialize the link between the DTE and the local DCE device.
- Frame X.25 data packets before transmitting them to the DCE.

The LAPB information field contains the X.25 packets. When an X.25 packet reaches the destination router, the LAPB protocol strips away the LAPB frame and delivers the packet to the network layer for further processing.

Editing LAPB Parameters

When you configure a circuit for the X.25 protocol on an Octal Sync link module, or any synchronous line on Bay Networks AN, ANH, ARN, or ASN routers, the router automatically configures the LAPB protocol. The Edit SYNC Parameters window includes an additional LAPB button.

To edit LAPB parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits** > **Edit Circuit**.	The Circuit Definition window opens.
2. Choose the X.25 interface that you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Click on **X25 Protocol > Lapb params**.	The Edit LAPB Parameters window opens.
5. Edit the LAPB parameters, using **Help** or the LAPB parameter descriptions that begin on page A-42. When you are finished, click on **OK**.	
6. When you are finished, click on **OK**.	You return to theCircuit Definition window.
7. Click on **OK**.	You return to the main Configuration Manager window.

Chapter 6
Configuring IPEX

This chapter provides instruction on the following:

The Technician Interface allows you to modify parameters by executing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, see *Using Technician Interface Software*.

Caution: The Technician Interface does not verify the validity of the parameter values you enter. Entering an invalid value can corrupt your configuration.

Accessing IPEX Global Parameters

After you have configured a network interface circuit for X.25 IPEX, you can edit the IPEX global parameters. To edit IPEX global parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > IPEX > Global.**	The Edit IPEX Global Parameters window opens.
2. Edit the following parameters, using **Help** or the IPEX global parameter descriptions that begin on page A-49. • **Enable** • **Max Message Size** • **Insert Called DTE Address** • **Insert Calling DTE Address**	
3. Click on **OK**.	You return to the main Configuration Manager window.

Configuring IPEX Mapping Entries

To set up the mapping between the X.25 and TCP interfaces, follow these steps, which are explained in more detail in the next sections:

1. **Add an entry to the IPEX mapping table.**
2. **Configure the IPEX mapping parameters, using Help or the parameter descriptions beginning on page A-51.**

Adding an IPEX Mapping Table Entry

To add an entry to the IPEX mapping table:

1. **Choose IPEX as the service type for the service record you are configuring.**
2. **Choose a source connection type (SVC, PVC, or TCP).**
3. **Choose a mapping type (Local, End-to-End, or Gateway).**
4. **Map source and destination addresses.**

5. Setting the Type Parameter

The Type parameter determines the service this X.25 connection provides. To set the Type parameter:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits.**	The Circuit List window opens.
2. Choose an X.25 interface, and click on **Edit**.	The Circuit Definition window opens.
3. Choose **Protocols > Service**.	The X.25 Service Configuration window opens.
4. Click on **Add**.	The X.25 Service window opens.
5. Set the **Type** parameter to **IPEX**, using **Help** or the parameter description on page A-27.	
6. Click on **OK**.	You return to the X.25 Service window, which now lists IPEX as the Type parameter entry.
7. If the Service VC type is **PVC**, set the following parameters, using **Help** or the parameter descriptions that begin on page A-28: • **PVC LCN** • **First PVC LCN**	
8. When you are done, click on **OK**.	The IPEX Mapping Table Configuration window opens.

Choosing a Source Connection Type

Each IPEX connection has a source connection type of PVC, SVC, or TCP. Either the source or destination connection type (but not both) must be TCP. To choose a source connection type:

Site Manager Procedure	
You do this	**System responds**
1. In the IPEX Mapping Table Configuration window, click on **Add**.	The IPEX Mapping Add window opens.
2. Set the **Source Connection Type** parameter, using **Help** or the parameter description on page A-51.	
3. Click on **OK**.	You return to the IPEX Mapping Add window. It displays the connection type you chose.

Choosing a Mapping Type

The mapping type specifies whether facilities, call user data, M-bit, and Q-bit support terminate locally or are passed end-to-end. To choose a mapping type:

Site Manager Procedure	
You do this	**System responds**
1. In the IPEX Mapping Add window, set the **Mapping Type** parameter, using **Help** or the parameter description on page A-52.	The Values Selection window opens.
2. Click on **OK**.	The IPEX Mapping Parameters window opens. The parameters in the window vary depending on what mapping type you chose.

Mapping Source and Destination Addresses

Your task is to configure source and destination addresses, the format of which varies according to connection type. To configure IPEX mappings:

Site Manager Procedure	
You do this	**System responds**
1. In the IPEX Mapping Parameters window, set mapping parameters appropriate to the connection type, using **Help** or the parameter descriptions that begin on page A-52: If you are configuring a PVC, enter values in these parameters: • **Source PVC LCN** • **Remote IP Address** • **Remote TCP Port Number** If you are configuring an SVC, enter values in these parameters: • **X.121 Called Address** • **Remote IP Address** • **Remote TCP Port Number** If you are configuring TCP, enter values in these parameters: • **Local TCP Port** • **Destination Connection Type** • **Destination PVC LCN** (only if the source connection type is PVC)	
2. When you are done, click on **OK**.	You return to the IPEX Mapping Add window.
3. Add as many IPEX mappings as your network requires. When you are finished, click on **OK**.	You return to the IPEX Mapping Configuration window.
4. Edit other IPEX Mapping parameters as your network requires. When you are finished, click on **Done**.	You return to the X.25 Service window.
5. Click on **OK**.	You return to the X.25 Service Configuration window.
6. Click on **Done**.	You return to the main Configuration Manager window.

Editing IPEX Mapping Table Entries

To edit an IPEX mapping table:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > IPEX > IPEX Mapping Table.**	The IPEX Mapping Table Configuration window opens.
2. Choose the entry you want to edit.	
3. Edit parameter values, using **Help** or the descriptions that begin on page A-51.	
4. Click on **Apply** to save the new configuration.	
5. Click on **Done**.	You return to the main Configuration Manager window.

Deleting IPEX Mapping Table Entries

To delete an entry from the IPEX Mapping Table:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > IPEX > IPEX Mapping Table.**	The IPEX Mapping Table Configuration window opens.
2. Choose the entry you want to delete.	
3. Click on **Delete**.	The system software deletes the entry you chose, and it no longer appears in the list of IPEX Mapping Table entries.
4. Click on **Done**	You return to the main Configuration Manager window.

Deleting IPEX from the Router

To delete IPEX globally:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > IPEX > Global > Delete IPEX.**	A window opens and prompts: `Do you REALLY want to delete IPEX?`
2. Click on **OK.**	You return to the main Configuration Manager window. IPEX is no longer configured on the router.

Chapter 7
Enabling and Configuring X.25 PAD Services

This chapter describes how you can configure and use X.25 PAD services.

To configure X.25 PAD, you enable X.25 services, configure packet-level parameters and add at least one X.25 service record with IPEX as the service type. For further information about enabling X.25, see Chapter 3.

Enabling X.25 PAD Services

To enable X.25 PAD services:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose the adapter module on which you are enabling X.25.	The Module List window opens.
2. Choose **ISDB** from the list of adapter modules.	
3. Click on **OK**.	You return to the Configuration Manager.
4. Click on the **COM port**.	The Add Circuit window opens.
5. Click on **OK**.	The WAN Protocols menu opens. X.25/X.25 PAD is the only option.
6. Click on **OK**.	The X.25 Packet Configuration window opens.
7. Enter values for the following parameters, using **Help** or the parameter descriptions in this guide. • **PDN X.121/E.164 Address** (page A-4) • **Prepend DNIC** (page A-60) • **Subaddress Length** (page A-61) • **Number of Bidirectional SVC Channels** (page A-9) • **Bidirectional SVC LCN Start** (page A-9) The Link Address Type is always DCE, and the Network Address Type is always PDN.	
8. Click on **OK**.	The Select X.25 PAD Ports window opens.
9. See the next section, “Configuring X.25 PAD Ports” on page 7-5.	

Configuring X.25 PAD Ports

The Select X.25 PAD Ports window displays the eight X.25 PAD ports, each of which defaults to Enable. You can disable one or more of these ports by completing the tasks in the following table.

Site Manager Procedure	
You do this	**System responds**
1. In the X.25 PAD Ports, window, choose the port that you want to disable.	
1. Click on **Values** and choose **Disable**.	X.25 PAD services are disabled for the port.
2. Click on **OK** to exit the window.	The X.25 Service Configuration window opens.

Choosing an X.25 Service Type

Your only task is to choose IPEX as the X.25 Service type. You can also edit other IPEX parameters (for information, see Chapter 6, “Configuring IPEX”). To choose an X.25 service type:

Site Manager Procedure	
You do this	**System responds**
1. In the X.25 Service Configuration window, click on **Add**.	The X.25 Service window opens.
2. Choose **IPEX** as the value in the **Type** parameter.	
3. Click on **OK**.	The IPEX Mapping Table Configuration window opens.
4. Click on **Add**.	The IPEX Mapping Type window opens.
5. Choose a **Source Connection Type**, SVC or TCP.	
6. Click on **OK**.	The IPEX Mapping Parameters window opens.
7. Configure other IPEX parameters as your network requires.	

Site Manager Procedure *(continued)*	
You do this	**System responds**
8. When you are done, click on **OK**.	You return to the IPEX Mapping Table Configuration window.
9. Click on **Done**.	You return to the X.25 Service Configuration window.
10. Click on **Done**.	You return to the main Configuration Manager window.

Editing X.25 PAD Global Parameters

To edit X.25 PAD global parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose the **X.25 PAD** port.	
2. Choose **Edit Circuit**.	The Circuit Definition window opens.
3. Choose **X25/ISDB > X25 PAD Global**.	The X.25 PAD Global Parameters window opens.
4. Edit the following X.25 PAD Global parameters, using **Help** or the parameter descriptions beginning on page A-59 as a guide: • **Enable** • **X.121 Address** • **Prepend DNIC** • **Subaddress Length**	
5. When you are finished, click on **OK**.	You return to the main Configuration Manager window.

Configuring X.25 PAD Port Parameters

You configure X.25 PAD port parameters, which determine the action that a PAD takes when it receives data from a DTE. You must configure the X.121 subaddress for each port. The remaining parameters have default values, which you can edit according to the requirements of your network. These are the X.25 PAD port parameters.

- Enable
- X.121 Subaddress
- Escape character
- Echo
- Data Forwarding Character
- Idle Timer
- Ancillary Device Control
- Service Signals
- Break
- Discard Output
- Carriage Return Pad
- Line Folding
- Flow Control
- Linefeed Insert
- Linefeed PAD
- Edit
- Character Delete
- Line Delete
- Line Display
- Edit PAD Service Signals
- Echo Mask
- Parity
- Page Wait
- User Data
- Raw Facilities Data
- Reverse Charge
- Throughput Class Negotiation
- Packet Size Negotiation
- Window Size Negotiation
- Interval Timer

To edit X.25 PAD Port parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose the **X.25 PAD** port.	
2. Choose **Edit Circuit**.	The Circuit Definition window opens.
3. Choose **X25/ISDB > X25 PAD Port**.	The X.25 PAD Port Parameters window opens.
4. Edit the X.25 PAD Port parameters, using Help or the parameter descriptions beginning on page A-61.	
5. When you are finished, click on **OK**.	You return to the main Configuration Manager window.

Configuring Intelligent Serial Daughter Board (ISDB) Parameters

When you enable X.25 PAD services, default values are in effect for all ISDB parameters. You can change these values, depending on your network requirements. Using Site Manager, you can edit the following ISDB parameters.

- Enable (Global)
- Enable (Port)
- Baud Rate
- Data Bits
- Parity
- Stop Bits
- Cts (Clear to Send)
- Dsr (Data Set Ready)
- Dcd (Data Carrier Detect)
- Prompt
- Inactivity Timeout
- Async Port Flow Control
- Remote Terminal Flow Control
- Dtr Action
- Flow Control Action

Disabling X.25 PAD Services on the ISDB

To disable X.25 PAD services on the ISDB:

Site Manager Procedure	
You do this	**System responds**
1. If you want to disable X.25 PAD services for a port, in the main Configuration Manager window, choose the ISDB port.	
2. Choose **Edit Circuit**.	The Circuit Definition window opens.
3. Choose **X25/ISDB > ISDB Global**.	The ISDB Global Parameter window opens. The only global parameter is the Enable parameter.
4. Click on the **Values** button, and choose **Disable**.	X.25 PAD services are disabled on the ISDB.

Editing the ISDB Port Parameters

To edit ISDB port parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose the **X.25 PAD** port.	
2. Choose **Edit Circuit**.	The Circuit Definition window opens.
3. Choose **X25/ISDB > ISDB Port Parameters**.	The ISDB Port Parameters window opens.
4. Edit the parameters, using **Help** or the parameter descriptions that begin on page A-78.	
5. When you are done, click on **OK**.	You return to the Configuration Manager.

Configuring Port-to-Port Communication on the Same X.25 PAD

To configure port to port communication on the same X.25 PAD:

1. **Set the X.121 address for the packet-level PDN X.121/E.164 Address parameter to a different value than the X.25 PAD Global X.121 Address parameter. The new value must also be unique on your network.**

   These two addresses are normally the same when the the X.25 PAD connects to a remote device. When you configure port-to-port communication on the same PAD, they must be different so that the router can distinguish between them.

2. **Configure an SVC-to-TCP IPEX mapping.**

   The called X.121 address should be the same value as the X.25 PAD Global X.121 Address parameter. Append the subaddress to that identifies the port for this connection to the X.121 portion of the called address (see the topic, "Configuring X.25 PAD Ports," on page 7-5). The Remote IP address is an IP address that has configured been configured on the router. The Remote TCP Port Number is the TCP port that the router will use to make this connection.

Initiating X.25 PAD Calls

To use an X.25 PAD, you connect a terminal server to the console port of the breakout box, and initiate a call at the PAD prompt (here represented by $) using one or a combination of the following rules:

- Enter the address you are calling, often referred to as the *called address*, and press Return.

  Example: $**31105080033301**

- Enter the **call** or **c** command followed by the called address, and press Return.

  Examples: $**call31105080033301** or $**c31105080033301**

- If you set the Prepend DNIC parameter to YES, omit the first 4 digits of the called address.

  Examples: For X.121 address 31105080033301 the DNIC is the first 4 digits, 3110, and the subaddress is the last two digits, 01. Place the call as follows:

  $**5080033301** or $**call5080033301** or $**c5080033301**

- You can override a Prepend DNIC parameter that is set to YES by putting a colon (**:**) in front of the called address.

  Examples: $**:31105080033301** or $**call:31105080033301** or $**c:31105080033301**

- You can separate the X.121 address and the subaddress.

  $**31150800333.01** or $**call31150800333.01** or $**c31150800333.01**

Changing Between Command Mode and Data Transfer Mode

The X.25 PAD operates in two modes: command mode and data transfer mode. After you initiate a call, you are in command mode. To change modes:

Mode Change	Keystrokes
Command Mode to Data Transfer Mode	Carriage Return + ^P (Escape character) + a second Carriage Return
Data Transfer Mode to Command Mode	CO (Continue) + Carriage Return

X.25 PAD Commands

You can issue commands at the X.25 PAD command line to make changes dynamically. Be aware that these changes do not alter the MIB, and are not saved. To make permanent changes to your configuration, use Site Manager. You can issue the following commands at the X.25 PAD command line. You can issue these commands in either upper or lower case, or with initial capital letters.

Table 7-1. X.25 PAD Commands

Command	Description
c or call	Places a call.
continue or co	Returns the PAD to data mode.
clr	Clears the current call.
iclr	Sends a clear request packet, but the PAD continues to send data until it receives a clear confirm packet from the router.
par?	Requests the current values of all the local PAD parameters.

(continued)

Table 7-1. X.25 PAD Commands *(continued)*

Command	Description
rpar?	Requests the current values of all the remote PAD parameters.
set ***<nn>:<vv>***	Changes the current values of specified local PAD parameters.
set? ***<nn>:<vv>***	Changes the current values of specified local PAD parameters, and displays the changed values.
rset ***<nn>:<vv>***	Changes the current values of specified remote PAD parameters.
rset? ***<nn>:<vv>***	Changes the current values of specified remote parameters, and displays the changed values.
stat	Requests the local PAD call status.
prof 1/2	Assigns the current values of the local PAD to a predefined profile.
int	Transmits an interrupt packet.
break	Transmits a break packet.
reset	Transmits a reset packet.
fcty ***<string>***	Adds user defined facilities to outgoing calls. If you issue this command with no arguments, the result is that the PAD includes no facilities.
udat ***<string>***	Adds user defined user data to outgoing calls. If you issue this command with no arguments, the result is that the PAD includes no user data.

For further information about X.25 PAD commands, including parameter numbers, see the CCITT X.3 Recommendation.

Managing the ISDB with Subcommands

The following isdb subcommands allow you to manage the ISDB from the Technician Interface. There are other subcommands that allow you to monitor your network. Appendix E, "X.25 PAD Technical Supplement," defines these commands.

Use the following syntax for the **isdb** command and subcommands.

isdb *<subcommand>* [**-s** *<slot>*] [**-c** *<connector>*] [**-p** *<port>*] [*<vol>*:*<filename>*]

isdb	The command that allows you to view data from the ISDB
<subcommand>	Subcommand (listed in the next section)
<slot>	Slot number
<connector>	Connector number
<port>	Serial port number
<vol>	Volume number
<filename>	ISDB image name

Subcommand Definitions

isdb start

Enables the image to run on the ISDB. The ISDB image starts automatically when the hardware and the ISDB subsystem initialize (after power up, cold start, or initial dyamic configuration). You must manually start the ISDB by issuing the **start** command after issuing a **download**, **upload**, or **stop** command.

isdb stop

Halts the operation of the image running on the ISDB. You should issue the **stop** command before you download a new image, upload a memory dump, or troubleshoot.

isdb reset

Resets ISDB hardware. After you issue the **reset** command, the ISDB re-initializes itself and then continues normal operation. When the hardware appears not to be operating, the **reset** command lets you reset the ISDB without resetting the router.

isdb download

Downloads the ISDB executable. Lets you download an ISDB image from the flash to the ISDB. You must first issue the **stop** command to stop the operation of the image currently running on the ISDB. Then issue the **download** command. Finally, after the download has completed, you must issue the **start** command.

isdb upload

Uploads the DRAM of the ISDB hardware for troubleshooting. The upload file requires 2 MB of flash space, and takes about three minutes to complete. You must first issue the **stop** command to stop the operation of the image currently running on the ISDB. Then issue the **upload** command. Finally, after the upload has completed, you must issue the **start** command.

Using isdb Subcommands: An Example

Here is an example that uses the **stop**, **download**, and **start** commands. Note the sequence and syntax.

isdb stop -c 1	where **1** is the connector
isdb download -c 1 1:isdb.img	where **1** is the connector and **1:isdb.img** is the volume number and the name of the ISDB image file

The download operation takes about two minutes to complete. To check on the process, you can view the router log:

log -fftwid -eISDB

```
#3: 12/15/97 11:33:16.699   INFO      SLOT  1  ISDB Code:  23
Isdb Hardware Stop Connector 1
#4: 12/15/97 11:33:50.450   INFO      SLOT  1  ISDB Code:  11
Download Started
#5: 12/15/97 11:34:18.406   INFO      SLOT  1  ISDB Code:  13
Download/Upload operation complete
#6: 12/15/97 11:34:18.808   INFO      SLOT  1  ISDB Code:  25
Isdb Hardware Flash Burn Starting
#7: 12/15/97 11:35:45.626   INFO      SLOT  1  ISDB Code:  26
Isdb Hardware Flash Burn Complete
```

After you have downloaded the new isdb image, issue the **isdb start** command to resume operation of the isdb.

isdb start -c 1	where **1** is the connector

You follow the same sequence to use the **upload** subcommand.

Chapter 8
Configuring QLLC

This chapter describes how to configure QLLC, including:

The Technician Interface allows you to modify parameters by executing **set** and **commit** commands with the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

Caution: The Technician Interface does not verify the validity of the parameter values you enter. Entering an invalid value can corrupt your configuration.

Configuring QLLC Mapping Entries

To configure an X.25 network interface circuit for QLLC:

1. **Add an entry to the QLLC mapping table (only for DLSw support).**
2. **Configure the QLLC mapping parameters (only for DLSw support.)**
3. **Configure DLSw or APPN over X.25 circuits.**

   Refer to *Configuring DLSw Services* or *Configuring APPN Services.*

Adding a QLLC Mapping Table Entry

To add an entry to the QLLC mapping table:

1. **Choose QLLC as the service type for the service record you are configuring.**
2. **Set the Remote X.121/E.164 Address parameter.**
3. **Set the Pool Start and MAC Pool Size parameters if you use wildcards.**
4. **Create a mapping entry.**

Setting Service Record Parameters for QLLC

To set the Type, the Remote X.121/E.164 Address, the MAC Pool Start, and MAC Pool Size parameters:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits.**	The Circuit List window opens.
2. Choose an X.25 interface, and click on **Edit**.	The Circuit Definition window opens.
3. Choose **Protocols > Service**.	The X.25 Service Configuration window opens.
4. Click on **Add**.	The X.25 Service window opens.
5. Set the **Type** parameter to **QLLC**, using **Help** or the parameter description on page A-27.	

Site Manager Procedure	
You do this	**System responds**
6. Enter the appropriate address in the **Remote X.121/E.164** parameter, using **Help** or the parameter description on page A-30.	
7. Scroll through the parameter list and set the **MAC Pool Start** and **MAC Pool Size** parameters, using **Help** or the parameter descriptions beginning on page A-41.	
8. Click on **OK**.	The QLLC Mapping Table Configuration window opens.

Adding a Mapping Entry

You define either a wildcard or station-to-host mapping entry by supplying a Map Entry Name, Adjacent and Partner X.121 addresses, and Adjacent and Partner MAC addresses.

In defining these mapping entries, the difference is that when you configure station-to-host mappings, you must supply addresses for each individual station. When you use a wildcard, the wildcard replaces at least one, and usually more than one station address, and you can use a null value.

The major conceptual difference is that when you use wildcards, you focus on the router that connects to the host, rather than on individual endstations.

Site Manager Procedure	
You do this	**System responds**
1. In the QLLC Mapping Table Configuration window, click on **Add**.	The QLLC Mapping Parameters window opens.
2. Enter values for the following parameters, using **Help** or the parameter descriptions beginning on page A-83: • **Map Entry Name** • **Adjacent DTE/DCE X.121 Address** • **Adjacent MAC Address** • **Partner DTE/DCE X.121 Address** • **Partner MAC Address**	

Site Manager Procedure	
You do this	**System responds**
3. When you are finished, click on **OK**.	You return to the QLLC Mapping Table Configuration window.
4. Create more mappings as your network requires. When you are finished, click on **Done**.	You return to the main Configuration Manager window.

Note: Each mapping entry must have a unique combination of adjacent X.121 address, partner X.121 address, and protocol ID.

Editing a QLLC Mapping Table Entry

To edit a QLLC mapping table entry:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the circuit you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X.25 Protocol > Service**	The X.25 Service Configuration window opens.
5. Choose **QLLC**.	The QLLC Mapping Table Configuration window opens.
6. Choose a mapping table entry and edit the parameters, using **Help** or the parameter descriptions that begin on page A-83.	
7. Click on **Apply** to save the new configuration.	
8. Click on **Done**.	You return to the main Configuration Manager window.

Deleting a QLLC Mapping Table Entry

To delete a QLLC mapping table entry.

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Circuits > Edit Circuits**.	The Circuit List window opens.
2. Choose the circuit you want to edit.	
3. Click on **Edit**.	The Circuit Definition window opens.
4. Choose **X.25 Protocol > Service**	The X.25 Service Configuration window opens.
5. Choose **QLLC**.	The QLLC Mapping Table Configuration window opens.
6. Choose a mapping table entry.	
7. Click on **Delete.**	The entry is deleted and no longer appears in the mapping table.
8. Click on **Done**.	You return to the main Configuration Manager window.

Deleting QLLC from the Router

To delete QLLC globally:

Site Manager Procedure	
You do this	**System responds**
1. In the main Configuration Manager window, choose **Protocols > QLLC > Global > Delete QLLC.**	A window opens and prompts: `Do you REALLY want to delete QLLC?`
2. Click on **OK.**	You return to the main Configuration Manager window. QLLC is no longer configured on the router.

Appendix A
Site Manager Parameters

This Appendix provides information on all X.25 parameters. It includes the following topics:

X.25 Global Parameter

Use the following parameter description to edit the parameters:X.25:global;X.25:parameters:global X.25 global parameter.

Parameter: Enable

Path: Configuration Manager > Protocols > X.25 > Global

Default: Enable

Options: Enable | Disable

Function: Globally enables or disables X.25 services.

Instructions: Set to Disable if you want to disable X.25 on this interface without deleting it. Set to Enable to reenable X.25 service, if you previously disabled it.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.9.1.1.2

X.25 Packet-Level Parameters

Use the following descriptions to set or edit packet-level parameters.

Caution: Line speed, packet size, and window size all affect packet throughput across the X.25 network. Setting any of these variables too low can cause the router to drop packets. Therefore, use caution when changing the default settings for the following X.25 parameters:

- Max Window Size
- Max Packet Length
- Window Size
- Packet Size

Parameter: Enable

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Enable

Options: Enable | Disable

Function: Enables or disables packet-level services for the interface.

Instructions: Set to Disable to disable packet-level services.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.2

Parameter: Link Address Type

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: DCE

Options: DCE | DTE

Function: Specifies whether this interface provides logical DCE or DTE services.

Instructions: Specify the service type as DCE or DTE. You must set one end of the link as a DCE and the other end as a DTE.

Parameter: **Network Address Type**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: PDN_Network

Options: PDN_Network | DDN_Network | BFE_Network

Function: Specifies the type of X.25 network to which the interface connects. The value of this parameter determines the format of the local X.121 address.

Instructions: Specify PDN_Network for a Public Data Network or a Point-to-Point connection. Specify DDN_Network for a Defense Data Network. Specify BFE_Network for a DDN that uses BFE encryption.

If you specify PDN_Network you must enter the local address in X.121 address format: that is, you must specify a value for the PDN X.121/E.164 Address parameter.

If you specify DDN_Network or BFE_Network, you must enter the local address in IP address format: that is, you must specify a value for the DDN IP Address parameter. The router will translate the address into X.121 format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.50

Parameter: **PDN X.121/E.164 Address**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: None

Options: Any valid X.121 or E.164 address

Function: Specifies the X.121 or E.164 address assigned to this interface. The X.25 network service provider supplies the X.121 or E.164 address.

Set this parameter only if you set the Network Address Type parameter to PDN_Network.

Instructions: Enter the appropriate X.121 or E.164 address (up to 15 decimal digits).

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.52

Parameter: DDN IP Address

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: None

Options: Any valid IP address

Function: Specifies the IP address assigned to this interface. The router translates the address into X.121 format and uses it as the local address.

Set this parameter only if you set the Network Address Type parameter to DDN_Network or BFE_Network.

Instructions: Enter the appropriate IP address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.51

Parameter: Sequence Size

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: MOD8

Options: MOD8 | MOD128

Function: Specifies the modulo of sequence numbering.

Instructions: Set to the appropriate sequence size.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.10

Parameter: **Restart Procedure Type**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: DTE_Restart (for DTE) or DCE_Restart (for DCE)

Options: DTE_Restart | DTE_Norestart | DTE_DXE | DCE_Restart

Function: For each X.25 interface, this parameter specifies the device type (DTE or DCE) at the X.25 packet level. It also enables you to turn on restart procedures, which clear all virtual circuits and let you initialize a link. You can also use the restart procedures to recover from a network failure.

Instructions: Select the value that matches your device type and determine whether you want to enable restart procedures. Select DTE_Restart if your interface is a DTE. Select DCE_Restart if your interface is a DCE. Select DTE_Norestart if you have a DTE interface but do not want to enable restart procedures. DTE_DXE is for a DTE/DTE environment, and it leaves the DTE unassigned, while still providing restart procedures.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.45

Parameter: **Default Tx/Rx Window Size**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 2

Options: 1 to 7 (for MOD8) or 1 to 127 (for MOD128)

Function: Specifies a default window size for this packet layer.

The value in this parameter applies only if the Flow Control Negotiation parameter is set to OFF in both the packet level and service record parameters.

Instructions: To specify a window size other than 2, enter a value within the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.42

Parameter: Default Tx/Rx Pkt Length

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 128

Options: 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096

Function: Specifies a default packet size for this packet layer.

The value in this parameter applies only if the Flow Control Negotiation parameter is set to OFF.

Instructions: To specify a nonstandard default packet size, set to one of the available options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.43

Note: The following parameters for configuring virtual channels require that you specify logical channel number (LCN) value ranges. Use the following guidelines when specifying LCN ranges for PVCs and SVCs:

- Each VC channel you configure on the router must have a unique LCN.
- There is one type of PVC.
- There are three types of SVC channels: incoming, bidirectional, and outgoing.
- You must configure at least one VC channel for X.25 to establish calls.
- Configure PVCs before you configure SVCs.
- The total number of channels you configure cannot exceed 512.

Parameter: Number of PVC Channels

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: None

Options: 0 to 512

Function: Specifies the number of permanent logical channels for this interface.

Instructions: Enter the number of permanent logical channels that you assign to this interface. Configure PVC channels before you configure SVC channels.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.55

Parameter: PVC LCN Start

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: None

Options: 0 to 4095

Function: Specifies the lowest logical channel number for the PVCs on this interface.

Instructions: Enter a number in the range allowed. Remember that PVC and SVC channel numbers cannot overlap. Choose a small enough value for this parameter so that the last channel number will be less than 4095.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.56

Parameter: Number of Incoming SVC Channels

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 512

Function: Specifies the number of switched logical channels that accept incoming calls only.

Instructions: Enter the number of channels that you assign to incoming calls only on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.36

Parameter: Incoming SVC LCN Start

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 4095

Function: Specifies the lowest logical channel number that the router can assign to logical channels that accept incoming call requests only.

Instructions: Enter a number greater than the highest number reserved for PVC channels, but small enough that the last SVC channel number will be less than 4095.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.37

Parameter: Number of Bidirectional SVC Channels

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 512; only 16 are available for X.25 PAD

Function: Specifies the number of switched logical channels that both accept incoming calls and transmit outgoing calls.

Instructions: Enter the number of logical channels that you assign to both accept and transmit calls on this interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.38

Parameter: Bidirectional SVC LCN Start

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 4095

Function: Specifies the lowest logical channel number that the router can assign to bidirectional logical channels.

Instructions: Enter a number greater than the highest number reserved for incoming SVC channels, but small enough that the last SVC channel number will be less than 4095.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.39

Parameter: Number of Outgoing SVC Channels

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 512

Function: Specifies the number of switched logical channels that transmit outgoing calls only.

Instructions: Enter the number of channels that you assign to outgoing calls only.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.40

Parameter: **Outgoing SVC LCN Start**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 0

Options: 0 to 4095

Function: Specifies the lowest logical channel number that the router can assign to logical channels that transmit outgoing call requests only.

Instructions: Enter a number greater than the highest number reserved for bidirectional SVC channels, but small enough that the last SVC channel number will be less than 4095.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.41

Parameter: **Use Default Service Configuration**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Creates default DDN service records for every DDN SVC on your network.

Instructions: Select ON if you want to use default values for your DDN SVCs. If you want to set this parameter to ON and still individually configure some of your DDN SVCs, see "Editing X.25 Network Service Records," on page 4-3.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.54

Parameter: T1 Timer

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 60

Options: 1 to 999 seconds

Function: Specifies how long the router waits to receive an acknowledgment of a transmitted command frame. Specifically, the T1 timer sets, in seconds, the timeout values for Restart, Reset, and Clear commands. The router uses this timer to set up data links.

Instructions: You should accept the default value, 60, for most configurations.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.32

Caution: We recommend that you accept the default T1 Timer, T2 Timer, T3 Timer, and T4 Timer values. Reset these parameters with caution.

Parameter: T2 Timer

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 180

Options: 1 to 999 seconds

Function: Specifies the call-confirmation timeout value in seconds. The value for this timer is the amount of time the router has to respond to a call-confirmation condition. This timer represents the ITU-T (formerly CCITT) T11 timer for the DCE and the T21 timer for the DTE.

Instructions: You should accept the default value, 180, for most configurations.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.33

Parameter: T3 Timer

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet
Default:	200
Options:	200 to 2000 milliseconds
Function:	Specifies the congestion or busy condition watchdog timeout value in milliseconds. The value for this timer is the length of time the router has to respond to a congestion or busy condition.
Instructions:	You should accept the default value, 200, for most configurations.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.34

Parameter: T4 Timer

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet
Default:	200
Options:	200 to 2000 milliseconds
Function:	Specifies the data packet transmission watchdog timeout value in milliseconds. The value for this timer is the length of time that the router has to respond to an acknowledgment frame. This is a Bay Networks proprietary internal timer.
Instructions:	You should accept the default value, 200, for most configurations.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.35

Parameter: **Flow Control Negotiation**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables the flow-control negotiation facility on this interface.

When you enable flow-control negotiation, the router can negotiate the maximum window size and packet length for virtual circuits on this interface on a per-call basis. It uses the Max Window Size and Max Packet Length parameter settings as a boundary check during negotiations. The receiving DTE may accept these values or reply with a counterproposal.

When you disable flow-control negotiation, the router uses the values specified by these parameters:

Default Tx/Rx Window Size

Default Tx/Rx Pkt Length

Configure the remote peer router to match these default values.

Instructions: To enable flow-control negotiation, set this parameter to ON. Then be sure to set the following parameters as shown in Table A-1, or flow-control negotiation will not work

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.14

Table A-1. Parameter Settings for Flow-Control Negotiation

Parameter	Value
X. 25 Packet-Level parameters	
Max Window Size/Max Packet Length	See parameter descriptions
Acceptance Format	DEFEXT
Release Format	DEFEXT
X. 25 Service Record parameters	
Flow Facility	Negot
Window Size/Packet Size	See parameter descriptions

Parameter: Max Window Size

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 2

Options: 1 to 7 (for MOD8) or 1 to 127 (for MOD128)

Function: Specifies the maximum window size allowed in the facilities field of outgoing and incoming call request packets generated by the router and transmitted on this interface.

Instructions: If you set the Sequence Size parameter to MOD8, accept the default, 2, or enter a value between 1 and 7. If you set the Sequence Size parameter to MOD128, enter a value between 1 and 127.

On peer routers, the values of Max Window Size and Max Packet Length parameters must be the same.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.11

Caution: Window size and packet length can affect packet throughput across the X.25 network. Setting either the Max Window Size or Max Packet Length parameter too low can cause the router to drop packets.

Parameter: **Max Packet Length**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 128

Options: 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096

Function: Specifies the maximum length, in bytes, of the information field of outgoing X.25 packets generated by the router and transmitted on this interface.

Instructions: Accept the default, 128, or set to one of the available options.

On peer routers, the values of Max Window Size and Max Packet Length parameters must be the same.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.12

Caution: Window size and packet length can affect packet throughput across the X.25 network. Setting either the Max Window Size or Max Packet Length parameter too low can cause the router to drop packets.

Parameter: **Tx/Rx Throughput Class**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: THRCLASS19200

Options: THRCLASS75 | 150 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 48000 | 64000

Function: Specifies the default data throughput rate (amount of data in bits per second) for packets transmitted and received on this X.25 interface. This is the throughput value that the router first uses when bringing up the line.

If the router receives an incoming call requesting to negotiate a throughput rate different from this value, the router checks the Max Throughput Class parameter value to determine whether it can support the requested rate.

Instructions: To specify a nonstandard default data throughput rate, select one of the available options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.44

Parameter: Throughput Class Negotiation

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Permits the negotiation of throughput classes, allowing you to determine the amount of throughput you want to go through the switch.

When you enable this parameter, the router can negotiate the throughput rate for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed rate or reply with a counterproposal.

Instructions: If you want the router to accept calls with throughput negotiation, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.15

Parameter: Max Throughput Class

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: 19200

Options: 75 | 150 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 48000 | 64000

Function: Specifies the maximum throughput rate (amount of data in bits per second) that this VC can send across the X.25 network.

If the Throughput Class Negotiation parameter is set to ON, the default value (19200) is the maximum value allowed by this parameter.

Instructions: Accept the default, 19200, or select one of the available options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.13

Parameter: **Network User Identification**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Specifies whether this interface supports the Network User Identification (NUI) service facility.

When you enable this parameter, the router can provide administrative and management information to the DCE on a per-call basis.

Instructions: To enable NUI support, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.16

Parameter: **Incoming Calls Accept**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: ON

Options: ON | OFF

Function: Specifies whether this interface accepts incoming calls.

When you enable this parameter, the router can accept incoming call requests on this interface.

Instructions: To disable incoming calls, set this parameter to OFF.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.17

Parameter: Outgoing Calls Accept

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: ON

Options: ON | OFF

Function: Specifies whether this interface generates outgoing call requests.

When you enable this parameter, the router can initiate outgoing call requests on this interface.

Instructions: To disable outgoing calls, set this parameter to OFF.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.18

Parameter: Fast Select Accept

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables the fast select accept facility on this interface.

When you enable this parameter, the router can accept incoming call requests with fast select facility on this interface.

Instructions: To enable the fast select accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.19

Parameter: **Reverse Charge Accept**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge accept facility on this interface.

When you enable this parameter, the router can accept calls with the reverse charge facility.

Instructions: To enable the reverse charge accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.20

Note: When this parameter is set to ON, the router accepts calls with the reverse charge facility, but it does not maintain a record of the charges.

Parameter: **Fast Select**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables the fast select accept request facility on this interface.

When you enable this parameter, call request packets the router generates and transmits on this interface can contain up to 128 bytes of user data.

Instructions: To enable the fast select request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.21

Parameter: Reverse Charging

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge request facility on this interface.

Packet network charges accrue whenever the router generates an outgoing call request packet. When you enable this parameter, these packet network charges are charged to the receiving DTE.

Instructions: To enable the reverse charge request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.22

Parameter: CUG Selection

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Null

Options: Null | Basic (16) | Extended (32)

Function: Specifies the type of closed user group (CUG) facility that the interface supports.

Instructions: If you accept the default value, Null, no closed user groups are supported; if you set this parameter to Basic, the Basic facility is supported; if you set this parameter to Extended, the Extended facility is supported. Ensure that the value of this parameter matches the value of the network service record parameter CUG Facility Format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.23

Parameter: **CUG Outgoing Access**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Null

Options: Null | CUGOA

Function: Specifies whether or not this interface supports a closed user group (CUG) with outgoing access.

Instructions: To enable CUG with outgoing access, set this parameter to CUGOA. If you enable this option, set the CUG Selection parameter to Extended. In addition, set the network service record parameter CUG Facility Type to OA.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.24

Parameter: **CUG Bilateral Selection**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Null

Options: Null | Bilateral

Function: Specifies whether or not this interface supports a bilateral closed user group (CUG).

Instructions: To enable CUG with bilateral facility support, set this parameter to Bilateral. If you enable this option, set the CUG Selection parameter to Extended. In addition, set the network service record parameter CUG Facility Type to Bilateral.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.25

Parameter: RPOA Selection

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Enables the recognized private operating agencies (RPOA) selection facility on this interface. When you enable this parameter, the router can accept incoming calls with this facility; the router accepts both RPOA Basic format and Extended format.

Instructions: To enable the RPOA facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.26

Note: When this parameter is set to ON, the router accepts calls with the RPOA facility, but it does not validate them.

Parameter: Charging Information

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Specifies whether this packet layer accepts incoming calls with charging information; however, the packet layer does not collect any charging information.

Instructions: To enable the charging information facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.27

Parameter: Transit Delay

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: OFF

Options: ON | OFF

Function: Specifies whether this packet layer accepts incoming calls with transit delay. Note that the router does not send outgoing calls with transit delay.

Instructions: To enable transit delay, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.28

Parameter: Full Addressing

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: ON

Options: ON | OFF

Function: Specifies whether the router includes a full local DTE address in all outgoing call requests transmitted on this interface.

Instructions: To enable full addressing, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.29

Parameter: Acceptance Format

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Basic (2)

Options: Basic (2) | Allext (255) | Defext (128)

Function: Specifies the call accept packet format as follows:

- Basic is Basic call accept packet format.
- Allext is Extended call accept packet format.
- Defext specifies that when an incoming call does not include facilities, a default Basic call accept packet format is used.

Instructions: Select the appropriate call accept packet format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.30

Parameter: Release Format

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Basic (2)

Options: Basic (2) | Allext (255) | Defext (128)

Function: Specifies the call accept packet format as follows:

- Basic is Basic call accept packet format.
- Allext is Extended call accept packet format.
- Defext specifies that when an incoming call does not include facilities, a default Basic call accept packet format is used.

Instructions: Select the appropriate call clear packet format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.31

Parameter: CCITT Conformance

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: DXE1988

Options: DXE1980 | DXE1984 | DXE1988 | FDSEL1980 | FDSEL1984 | FDSEL1988

Function: Specifies the CCITT (now ITU-T) specification to which the router's operation conforms.

Instructions: Select a CCITT conformance year that matches your network requirements. For example, if you are connecting to a DXE1980-compliant network, select DXE1980

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.46

Parameter: Network Standard

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: None

Options: None | ISO | DOD

Function: Specifies the network standard with which your router complies. The value of this parameter is in addition to the ITU-T (formerly CCITT) specification with which your network conforms.

Instructions: Select the appropriate network standard. Choose None if you want to use only the CCITT Conformance value. Select ISO if you are connecting to a network that complies with the International Organization for Standardization. Select DOD if you are connecting to a network that complies with Department of Defense specifications (DDN networks).

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.47

Parameter: Statistics Computation

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet

Default: Disable

Options: Enable | Disable

Function: Specifies whether the router computes statistics and X.25 debug logging for the packet level and all the virtual circuits associated with this line instance. If you set this parameter to Disable, the router computes no statistics, which maximizes data throughput. If you set this parameter to Enable, the router computes statistics.

Instructions: Set this parameter to Enable or Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.5.1.49

Parameter: Client Response Timer

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet
Default:	120
Options:	1 to 999 seconds
Function:	Specifies the client application response timeout period in seconds to allow for extended delays that can occur negotiating with remote clients. This timer must have a value greater than that for the T3 Timer parameter, and less than the value for the T2 Timer parameter.
Instructions:	You should accept the default value for most configurations.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.57

Parameter: Client PDU Size

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Packet
Default:	1600
Options:	1600 to 4096 bytes
Function:	This value represents the largest message size X.25 will handle on a given logical channel.
Instructions:	Accept the default, or enter another value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.5.1.58

X.25 Network Service Record Parameters

Use the following descriptions to set or edit network service record parameters.

Parameter: Enable

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: Enable

Options: Enable | Disable

Function: Enables or disables the network service record.

Instructions: Set this parameter to Disable only if you want to disable this service record.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.2

Parameter: Type

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: PDN | DDN | PtoP | IPEX | QLLC

Function: Specifies the type of X.25 service that this interface supplies.

- PDN for Public Data Network service
- DDN for Defense Data Network service
- PtoP for Point-to-Point network service
- IPEX for TCP/IP Tunneling over X.25
- QLLC for Qualified Logical Link Control service

Instructions: Choose one of these network service types. If you specify IPEX or QLLC you must configure several IPEX or QLLC specific parameters. For parameters specific to IPEX, see page A-49. For QLLC parameters, see page A-83.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.9

Parameter: Service VC Type

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: SVC

Options: SVC | PVC

Function: Specifies whether this service record applies to an SVC or a PVC.

Instructions: Select the VC type that describes this circuit.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.36

Note: You can enable bridging only with SVC Service VC Type. Bridging does not work with PVCs.

Parameter: PVC LCN

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: 1 to 4095

Function: Specifies the logical channel number of the PVC for this service record.

Instructions: Enter the LCN for this PVC.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.37

Parameter: First PVC LCN

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 1

Options: 0 to 4095

Function: Identifies the lowest PVC logical channel number for the interface. Note that each PVC requires its own service record.

Instructions: Enter the lowest PVC logical channel number.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.37

Parameter: Number of PVC LCN

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 1

Options: 1 to 512

Function: Specifies the total number of PVC logical channel numbers for the interface. You must enter a value in this parameter if you want to use the Copy function to replicate your X.25 Gateway configurations (see *Configuring X.25 Gateway Services*).

Instructions: Enter the number of PVC LCNs on this interface.

Parameter: Connection ID

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 1

Options: 1 to 255

Function: Identifies each circuit to its remote destination. You can have multiple Point-to-Point circuits configured to the same X.121 destination. Each of them requires a unique Connection ID. Assign the same connection ID to both the local and remote configurations for each circuit. You use the Type parameter with PTOP service only.

Instructions: Assign a unique connection ID for each X.121 connection.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.11

Parameter: Remote IP Address

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 0.0.0.0

Options: Any valid IP address

Function: Specifies a destination IP address that is reachable over this X.25 interface. This parameter is not used with Point-to-Point service.

You must specify a remote IP address if you plan to enable IP on this interface. For DDN services, the router translates the remote IP address you specify into an X.121 address so that it can route IP traffic over the network. For PDN services, the router uses the remote IP address you specify to define an adjacent host for the IP interface.

Instructions: Enter a destination 32-bit destination IP address in dotted-decimal notation.

If you run OSI over DDN, you must also enter this IP in the subnetwork point of attachment (SNPA) field of the OSI External Address Adjacency Configuration window. To enter this value in the SNPA field, you must first convert the IP address into X.121 format. For more information, see *Configuring OSI Services*.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.12

Parameter: Remote X.121/E.164 Address

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: Any valid X.121 or E.164 address

Function: Specifies a destination X.121 or E.164 address. You must specify a destination X.121 or E.164 address if you are configuring PDN, QLLC, or Point-to-Point services. If you are configuring DDN services, the router derives this address from the remote IP address.

Instructions: Enter a destination X.121or E.164 address (up to 15 decimal digits) that is reachable over this X.25 interface.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.12

Parameter: Enable 1356 Multiplexing

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: Disable

Options: Enable | Disable

Function: If you set this parameter to Enable, the router can use RFC 1356 Null Encapsulation to send multiple protocols over a single virtual circuit. If you set the value to Disable, the router uses RFC 1356 Normal Encapsulation for IP and OSI, and RFC 1356 SNAP Encapsulation for any of the other protocols, opening a separate virtual circuit for each protocol.

You should use multiplexing only when you configure multiple routing protocols on a PDN type of service.

Instructions: Select Enable if you want to multiplex traffic over a single virtual circuit. Otherwise, select Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.34

Parameter: Enable Compression

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: Disable

Options: Enable | Disable

Function: Enables data compression.

Instructions: Set this parameter to Enable if you want the X.25 service to use compression for this connection. Otherwise, accept the default, Disable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.33

Parameter: Broadcast

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Indicates whether you want the X.25 service to send IP, IPX, or DECnet broadcast messages to the remote IP address.

Instructions: Set this parameter to ON if you want the X.25 service to send broadcast messages to the IP address. Otherwise, accept the default, OFF.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.14

Parameter: Max Connections

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 2

Options: 1 to 4

Function: Specifies the maximum number of virtual circuits that the router can establish with the remote device specified in this record. Increasing the number of connections to the same destination may improve the rate of data throughput

To take advantage of multiple virtual connections and load sharing across them, set this parameter to a value greater than 1. This parameter has meaning only for PDN services.

Instructions: Accept the default, 2, or enter a value within the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.15

Parameter: **Precedence**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Specifies the priority of IP packets that this X.25 interface transmits and that traverse the X.25 network. This parameter has meaning only for DDN services.

Instructions: To enable IP packet prioritization, set Precedence to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.16

Parameter: **Max Idle (min)**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 2, except QLLC default is 0

Options: 0 to 999 minutes

Function: Specifies the maximum number of minutes that a virtual circuit can remain idle. Once the Max Idle timer expires, X.25 clears the circuit. Point-to-Point connections do not use this parameter. QLLC has a default of 0 for this parameter, which disables the parameter. When this parameter is disabled, the circuit can remain up but idle indefinitely.

Use this parameter to minimize CPU and network overhead during periods of low datagram traffic.

PVCs do not use this parameter.

Instructions: Accept the default value, 2, or enter a timeout value within the specified range. To disable this parameter, enter a value of 0.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.17

Parameter: Call Retry

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service
Default:	60
Options:	10 to 999
Function:	Specifies the interval in seconds between call request packets the router sends to a specific destination. If a call attempt fails, the router waits the number of seconds this parameter specifies before sending another call request packet to the destination. If the router receives any IP datagrams for this destination, it drops them during this period.
Instructions:	Accept the default 60, or enter a call retry interval within the specified range.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.18

Parameter: Flow Facility

Path:	Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service
Default:	Default
Options:	Negot | Default
Function:	Enables or disables the X.25 flow-control facility on each virtual circuit. If you enable this parameter, calls the router transmits to the remote X.121 address in this service record will contain flow control. You must also enable the flow-control facility at the packet layer.
Instructions:	To enable flow-control facility negotiations, set this parameter to Negot.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.4.2.1.19

Parameter: Window Size

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 2

Options: 1 through 7 (for MOD8) or 1 through 127 (for MOD128)

Function: Specifies the window size that appears in the facilities field of outgoing call request packets to the X.121 or E.164 address in this service record

Instructions: Accept the default, 2, or enter a window size within the specified range.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.20

Caution: Window size and packet size can affect packet throughput across the X.25 network. Setting the Window Size or Packet Size parameter too low could cause the router to drop packets

Parameter: Packet Size

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 128

Options: 16 | 32 | 64 | 128 | 256 | 512 | 1024 | 2048 | 4096

Function: Specifies the packet size that appears in the facilities field of outgoing call request packets to the remote X.121 or E.164 address in this service record.

Instructions: Accept the default, 128, or enter a packet size within the specified range. Do not set this parameter to a value greater than you specify for the packet-level parameter Max Packet Length.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.21

Caution: Window size and packet size can affect packet throughput across the X.25 network. Setting the Window Size or Packet Size parameter too low could cause the router to drop packets

Parameter: Fast Select Request

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Enables the fast select request facility on each virtual circuit.

When you enable this parameter, call request packets this router generates and sends to the remote X.121 address in this service record contain the fast select request facility.

Instructions: To enable the fast select request facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.22

Parameter: Fast Select Accept

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Enables the fast select accept facility.

When you enable the fast select accept facility, the router can accept incoming fast select call requests from the remote X.121 address in this service record.

Instructions: To enable the fast select accept facility, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.23

Parameter: Reverse Charge Request

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge request facility.

Packet network charges accrue whenever the router generates an outgoing call request packet. When you enable Reverse Charge Request, these packet network charges accrue to the receiving DTE.

Instructions: To enable the Packet network charges accrue whenever the router generates an outgoing call request packet. When you enable Reverse Charge Request, these packet network charges accrue to the receiving DTE.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.24

Parameter: Reverse Charge Accept

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: OFF

Options: ON | OFF

Function: Enables or disables the reverse charge accept facility.

When you enable this parameter, the router accepts network packet charges from incoming call request packets.

Instructions: To enable this parameter, the router accepts network packet charges from incoming call request packets.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.25

Parameter: **DDN BFE**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service >Default DDN

Default: Disable

Options: Disable | Enable

Function: Enables or disables DDN Blacker front-end encryption (BFE) support.

Instructions: To enable DDN BFE support, set this parameter to Enable.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.31

Parameter: User Facility (hex)

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: Any facility that needs to be included in the call request packet

Function: Allows transmission to the facilities listed in Table A-2. To generate a call with such a facility, you must also set the associated parameter at the packet level to ON. The facility names in Table A-2 are also the names of the packet-level parameters.

Instructions: Enter a hexadecimal facility code (Table A-2) to specify a facility.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.29

Table A-2. User Facilities and Codes

Facility/Packet-Level Parameter	Code
Throughput Class Negotiation	02
Network User Identification	C6
RPOA Selection	44
Transit Delay	49

Note: To set the parameter back to null after you have configured it:

1. **Select User Facility from the appropriate network service record.**
2. **Overwrite the erroneous value by typing all spaces where you previously entered a hexadecimal value.**
3. **Click on Apply to implement your changes.**
4. **Click on Done to exit the X.25 Service Configuration window.**

Parameter: **CUG Facility Format**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: None │ Basic │ Extended

Function: Specifies the closed user group (CUG) facility format that the interface can accept. The value of this parameter should match that of the X.25 packet-level parameter CUG Selection.

Instructions: If you are not configuring a CUG for this interface, select None. To configure the Basic format, select Basic. To configure the extended format, select Extended.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.26

Parameter: **CUG Facility Type**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: Normal

Options: Normal │ OA │ Bilateral

Function: Defines the type of CUG facility that the interface will accept. This parameter works with the X.25 packet-level parameters CUG Outgoing Access and CUG Bilateral Selection.

Instructions: Select Normal to enable routing between CUGs.

Select OA to allow communication between CUGs with outgoing access. If you select OA, make sure that you set the packet-level parameter CUG Outgoing Access to CUGOA.

Select Bilateral to allow communication between bilateral CUGs. If you select this option, make sure that you set the packet-level parameter CUG Bilateral Selection to Bilateral.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.27

Parameter: CUG Number

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 0

Options: 0 to 9999

Function: Identifies each CUG with a number so that information is routed to the correct CUG.

Instructions: Enter a number for the closed user group.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.28

Parameter: MAC Pool Start

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: None

Options: A MAC address that is unique on the DLSw network.

Function: Identifies the first address in the MAC address pool. The QLLC software dynamically assigns addresses from this pool to each QLLC/X.25 endstation that originates a QLLC session if the Adjacent MAC address field of the QLLC address mapping is null.

You must enter a value in this field if you use a QLLC wildcard, and if the connection type is QLLC endstation to LLC host.

Instructions: Enter the MAC address that you want the software to use as the first MAC address in the pool. It must be unique on the DLSw network, and must use the standard, 6-byte MAC address format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.38

Parameter: **MAC Pool Size**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Service

Default: 0

Options: 0 to 2147483647

Function: Sets the size of the MAC address pool for a QLLC network that uses wildcards. You must enter a value in this field if you use a QLLC wildcard.

Instructions: Choose a value appropriate to the size of your QLLC network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.2.1.39

LAPB Parameters

Parameter: **Enable**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Enable

Options: Enable | Disable

Function: Globally enables or disables LAPB services. The router enables LAPB line services when you configure the X.25 protocol. You can disable and reenable LAPB services on the interface without moving any physical cabling.

Instructions: Select Disable to disable LAPB services.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.2

Parameter: Station Type

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: DTE

Options: DTE | DCE | DXE

Function: Identifies the station type, that is, whether the device is a DTE or DCE for this interface.

Instructions: If your device is data terminal equipment, select DTE. If your device is data communications equipment, select DCE. If you do not want to assign a specific station type, and instead want the network to determine the station type, choose DXE. This value indicates that the router is in unassigned mode; it is neither a DTE nor a DCE. If you select DXE, the router will send an exchange identification (XID), but negotiation will not take place until the network assigns a station type.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.7

Parameter: Control Field

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Modulo 8

Options: Modulo 8 | Modulo 128

Function: Specifies the window size, or modulo, of the sequence numbering that the router uses to number frames.

Instructions: Select the appropriate window size for your configuration.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.8

Parameter: Max N1 Frame Size (octets)

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 256

Options: 3 to 4500 bytes

Function: Specifies the frame size, in bytes, for a frame that the router or network transmits. This number excludes flags and 0 bits inserted for transparency.

Instructions: Select the frame size that suits your network configuration.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.9

Parameter: Window Size

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 7

Options: 1 to 127

Function: Specifies the default transmit and receive window size for the interface. This value is the maximum number of unacknowledged sequence frames that may be outstanding from the router or the network at any one time.

Instructions: Enter the appropriate window size for your configuration.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.10

Parameter: Max N2 Retries

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 10

Options: 1 to 64

Function: Determines the value of the N2 retry count, which is the number of retransmission attempts that the router makes, per frame, before it considers the line to be down. The retry count is the maximum number of attempts following the expiration of the T1 timer.

Instructions: Specify the number of times you want the router to try to retransmit.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.11

Parameter: **Max T1 Acknowledge Timer (seconds)**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 30

Options: 1 to 9999 seconds

Function: Specifies the maximum time, in seconds, that the router waits for an acknowledgment of a frame that it has sent to the network.

Instructions: Enter the maximum time, in seconds, that you would like the router to wait for a frame acknowledgment from the network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.12

Parameter: **Max T2 Acknowledge Timer (seconds)**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 1

Options: 1 to 9999 seconds

Function: Specifies the time, in seconds, that the router waits before sending an acknowledgment for a sequenced frame. A value of 1 means that the router does not delay before generating an acknowledgment.

Instructions: Enter the amount of time that you want the router to wait before acknowledging a frame.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.13

Parameter: Max T3 Disconnect Timer (seconds)

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: 60

Options: 1 to 9999 seconds

Function: Specifies the time, in seconds, that the router waits before determining that the link is disconnected. A value of 1 indicates that once the router completes the frame exchange to bring down the link, it considers the link disconnected.

Instructions: Enter the amount of time that you want the router to wait before the router considers the link disconnected.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.12

Parameter: Initiate Link Setup Action

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Active

Options: Active | Passive

Function: Identifies whether or not the router initiates link setup or waits for the network to initiate.

Instructions: Enter Active if you want the router to initiate link setup; or enter Passive if you want the network to initiate link setup.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.16

Parameter: **Enable Rx/Tx of XID Frames**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Disable

Options: Enable | Disable

Function: Enables or disables the transmission and reception of test XID frames by the router.

Instructions: Select Enable to allow the router to send XID frames. Select Disable to prevent the router from sending XID frames.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.17

Parameter: **Idle RR Frames**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Off

Options: On | Off

Function: Enables or disables the transmission and reception of RR frames during periods when there are no information frame exchanges. When this parameter is set to On, an RR is transmitted when no traffic is present on the physical media.

Instructions: Select On or Off.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.40

Parameter: **Command/Response Address**

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: DTE

Options: DTE | DCE

Function: Specifies the local command or response address, which is the DTE or DCE value expressed as a single octet.

Instructions: Enter DTE for the DTE address; or enter DCE for the DCE address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.18

Parameter: WAN Protocol

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: Standard

Options: Standard | X.25

Function: Specifies the WAN protocol you want on this interface.

Instructions: Do not change this value. Use the Circuit List window to change the protocol.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.20

Parameter: Network Link Type

Path: Configuration Manager > Circuits > Edit Circuits > Choose an Interface > Edit > X25 Protocol > Lapb params

Default: NET2

Options: GOSIP | NET2

Function: Sets the link type used with the X.25 network hardware.

Instructions: Select NET2 or GOSIP.

MIB Object ID: 1.3.6.1.4.1.18.3.5.1.8.1.39

IPEX Global Parameters

This section describes the IPEX global parameters you can modify from the Edit IPEX Global Parameters window.

Parameter: Enable

Path: Configuration Manager > Protocols > IPEX > Global

Default: Enable

Options: Enable | Disable

Function: Globally enables or disables IPEX.

Instructions: Select Enable (the default) to activate IPEX on all interfaces.

Select Disable to deactivate IPEX on all interfaces. Selecting this option when the Configuration Manager is in dynamic mode terminates all active IPEX sessions.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.1.2

Note: When you create X.25 interfaces that use IPEX service, the service is globally enabled automatically.

Parameter: Max Message Size

Path: Configuration Manager > Protocols > IPEX > Global

Default: 1600

Options: 16 through 4096 bytes

Function: The maximum client message size that IPEX transports. The value for this parameter cannot be larger than that for the Client Queue Size parameter, and the software prevents you from assigning a value that is too large.

Instructions: Accept the default, or assign a value equal or less than that for the client queue size.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.1.4

Parameter: Insert Called DTE Address

Path: Configuration Manager > Protocols > IPEX > Global

Default: Disable

Options: Enable | Disable

Function: Many DTE devices cannot provide the called DTE X.121 address that IPEX requires. When you enable this parameter, and an IPEX device receives an incoming call request packet that does not include a called DTE X.121 address, the IPEX software searches all the mapping records associated with its circuit interface until it locates a mapping record that is a source type SVC record and has an X.121 called address. IPEX then copies the X.121 called address from the mapping record to the call request packet that lacks an X.121 address, and sends the packet to the remote IPEX router to establish the IPEX session.

Instructions: Choose Enable to enable address insertion.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.1.5

Parameter: Insert Calling DTE Address

Path: Configuration Manager > Protocols > IPEX > Global

Default: Disable

Options: Enable | Disable

Function: Many DTE devices cannot provide the calling DTE X.121 address that IPEX requires. When you enable this parameter, and an IPEX device receives an outgoing call request packet that does not include a calling DTE X.121 address, the IPEX software searches all the mapping records associated with its circuit interface until it locates a mapping record that is a source type SVC record and has an X.121 calling address. IPEX then copies the X.121 calling address from the mapping record to the call request packet that lacks an X.121 address, and sends the packet to the remote IPEX router to establish the IPEX session.

Instructions: Choose Enable to enable address insertion.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.16

IPEX Mapping Parameters

Parameter:	**Source Connection Type**
Path:	Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default:	None
Options:	PVC | SVC | TCP
Function:	Specifies the type of connection at the sending end of the original message. PVC and SVC specify an X.25 Level 3 connection, either a permanent virtual circuit or a switched virtual circuit. TCP is a Transmission Control Protocol connection. Source connection types PVC and SVC send to destination connection type TCP. Source connection type TCP sends to destination connection type PVC or SVC.
Instructions:	Select PVC to specify an X.25 connection to a permanent virtual circuit. Select SVC to specify an X.25 connection to a switched virtual circuit. Select TCP to specify a Transmission Control Protocol connection.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.4

Note: Either the source or the destination connection type (but not both) must be TCP.

Parameter: **Mapping Type**

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: End_to_End

Options: Local │ End_to_End │ Gateway

Function: Specifies whether facilities, call user data, M-bit, and Q-bit support terminate locally or are passed end-to-end. X.25 parameters that you configure at the packet and service-record level determine which facilities are supported. The last option is to configure X.25 Gateway services.

If you set this parameter to Local, IPEX ports can support different packet sizes at each end. You must also configure the Source X.121 Address parameter for an SVC source connection type, and both Source and Destination X.121 Address parameters for a TCP source connection type.

If you configure End-to-End mapping, assign to all IPEX ports the same packet and window size, because different packet sizes impede M-bit support.

For information about X.25 Gateway services, see *Configuring X.25 Gateway Services*.

Instructions: Select Local or End_to_End.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.16

IPEX Parameters for PVC and SVC Connections

You configure the following parameters when the source connection type is PVC or SVC.

Parameter: **Source PVC LCN**

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: None

Options: 1 to 4095

Function: Specifies the inbound PVC LCN that you map to the TCP connection. The port monitors the X.25 calls for this LCN to initiate the connection.

Instructions: This window appears only if you chose PVC as your source connection type. Enter the LCN of the PVC for this IPEX connection.

Parameter: X.121 Called Address

Path:	Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default:	None
Options:	Any valid X.121 address
Function:	Specifies the inbound X.121 called address that you map to the TCP connection. The port monitors the X.25 calls for this X.121 called address to initiate the connection.
Instructions:	inbound X.121 called address that you map to the TCP connection. The port monitors the X.25 calls for this X.121 called address to initiate the connection.
MIB Object ID:	1.3.6.1.4.18.3.5.15.2.1.6

Parameter: Remote IP Address

Path:	Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default:	None
Options:	Any valid IP address
Function:	Specifies the remote IP address used to establish a TCP connection to the destination. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the IP address of the remote connection using dotted-decimal notation (for example, 1.1.1.1). Consult your network administrator for the correct value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.12

Parameter: Remote TCP Port Number

Path:	Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default:	None
Options:	The TCP port number at the remote connection, a value between 12304 and 16399.
Function:	Specifies the remote TCP port number used to establish a TCP connection to the destination. The remote TCP port originates connections to the local TCP port. You configure this parameter only when the source connection type is SVC.
Instructions:	Enter the TCP port number for the remote connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.13

IPEX Parameters for TCP Connections

You configure the following parameters when the source connection type is TCP

Parameter: Local TCP Port

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default: None
Options: The local TCP port number, a value between 12304 and 16399.
Function: Specifies the TCP port in the local IPEX connection. This port accepts inbound TCP connections from the remote TCP port. You configure this parameter when the Source Connection Type is TCP.
Instructions: Enter the TCP port number.
MIB Object ID: 1.3.6.1.4.18.3.5.15.2.1.5

Parameter: Destination Connection Type

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default: None
Options: SVC | PVC
Function: Specifies either SVC or PVC as the destination connection for this TCP source connection.
Instructions: Choose the value that applies to your network.

Note: Either the source or the destination connection type (but not both) must be TCP.

Parameter: Destination PVC LCN

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: None

Options: 1 to 4095

Function: Specifies the PVC LCN that you map to the TCP connection. The port monitors the X.25 calls for this LCN to initiate the connection.

Instructions: This window appears only if you chose PVC as your source connection type. Enter the LCN of the PVC for this IPEX connection.

Additional IPEX Mapping Parameters

These parameters have default values that you can edit, or are used in only very specific situations.

Parameter: Enable

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: Enable

Options: Enable | Disable

Function: Enables or disables a particular IPEX mapping entry on this interface.

Instructions: Select Enable (the default) to activate this IPEX mapping entry.

Select Disable only if you want to deactivate this mapping entry. When you select Disable, you eliminate all active IPEX sessions established with this mapping entry.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.2

Parameter: Source X.121 Address

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: None

Options: Any valid X.121 address

Function: Specifies the calling X.121 address that will be inserted in the outbound X.25 call packet. You configure this parameter only when the source connection is type TCP, the destination connection is type SVC, and only when you set the Mapping Type parameter to Local.

Instructions: Enter the calling X.121 address (up to 15 decimal digits). The source address is based on where the call originated. Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.9

Parameter: Destination X.121 Address

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: None

Options: Any valid X.121 address

Function: Specifies the called X.121 address that will be inserted in the outbound X.25 call packet. You configure this parameter only when the source connection is type TCP, the destination connection is type SVC, and only when you set the Mapping Type parameter to Local.

Instructions: Enter the called X.121 address (up to 15 decimal digits). The destination address depends on the network device to which this circuit is connected. Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.10

Parameter: **Client Queue Size**

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: The larger of TCP Max Window Size or IPEX Max Message Size, usually 4096

Options: 16 to 8192 bytes

Function: Specifies the size (in bytes) of the IPEX queues used for buffering data between TCP and X.25. The value of this parameter must be at least as large as that of the Maximum Message Size parameter, and the software prevents you from assigning a lower value.

Instructions: Accept the default, or select a client queue size at least as large as the maximum message size.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.14

Parameter: **X.25 Call User Data**

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: None

Options: Any valid call user data up to 128 bytes

Function: Specifies the X.25 call user data field content inserted in the X.25 Call Request packet. You configure this parameter only when the source connection type is TCP, the destination connection is type SVC, and the mapping type is Local.

Instructions: Enter the appropriate data in ASCII format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.10

Parameter: Idle Session Timer

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: 120

Options: 0 to 86,400 seconds

Function: Specifies the timeout period, in seconds, that an established TCP connection can be inactive before the router sends messages to the peer to verify that the peer is alive.

If you set this parameter to zero, you disable the keepalive feature.

Instructions: Accept the default, or adjust the timer if your network requires a shorter or longer idle time.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.18

Parameter: Keep Alive Retransmit Timer

Path: Configuration Manager > Protocols > IPEX > IPEX Mapping Table

Default: 3

Options: 0 to 600 seconds

Function: Specifies the interval, in seconds, at which the router will retransmit unacknowledged keepalive messages. If you set the Idle Session Timer to 0, this timer's value has no impact. If you set the Idle Session Timer to a value other than 0, and this timer is 0, the router does not send keepalive messages, and the TCP session terminates when the idle session timer expires.

The time you set should be larger than the round-trip network delay, or retransmits will occur unnecessarily.

Instructions: Accept the default, or adjust to be longer than the round-trip network delay.

MIB Object ID: 1.3.6.1.4.1.18.3.5.15.2.1.19

Parameter:	**Keep Alive Retransmit Count**
Path:	Configuration Manager > Protocols > IPEX > IPEX Mapping Table
Default:	5
Options:	0 to 99
Function:	Specifies the number of unacknowledged keepalive messages that the router retransmits before the TCP session terminates. If you set this parameter to 0, the router will send only one keepalive message
Instructions:	Accept the default or adjust to meet requirements for the total time the router needs to detect that the peer connection has terminated. The total time is the sum of the Idle Session Timer and the Keep Alive Retransmit Timer times the Keep Alive Retransmit Count.
MIB Object ID:	1.3.6.1.4.1.18.3.5.15.2.1.20

X.25 PAD Global Parameters

Parameter:	**Enable**
Path:	Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Global
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables X.25 PAD service on this interface.
Instructions:	To use X.25 PAD services, accept the default, Enable.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.12.1.1.2

Parameter: **X.121 Address**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Global

Default: The X.121 Address that you provided for the X.25 packet-level PDN X.121 Address parameter

Options: Any valid X.121 address; for X.25 PAD, the length of the X.121 address plus the subaddress must be less than or equal to 14 digits.

Function: Specifies the X.121 address assigned to this interface. The X.25 network service provider supplies the X.121 address.

Instructions: Confirm that Site Manager displays the appropriate X.121 address.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.1.1.7

Note: Whenever the X.121 Address changes, you must execute an **isdb start** command for the change to take effect. For information on ISDB subcommands, see Appendix E, "X.25 PAD Technical Supplement."

Parameter: **Prepend DNIC**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Global

Default: No

Options: Yes | No

Function: A Data Network Identification Code (DNIC) is an address the router uses to reach a host residing on a different packet-switched network. It is the data equivalent of a telephone number with country code and area code, typically a 4-digit number; the first 3 digits specify a country, and the fourth specifies a PDN within that country.

Enabling this parameter allows you to omit the first 4 letters of the called address when you are initiating a call at the X.25 PAD prompt. The software will automatically prepend the first 4 digits of the configured X.121 address to the called address you enter at the PAD prompt.

Instructions: To enable this parameter, set it to Yes. Otherwise, accept the default, No.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.1.1.8

Parameter: **Subaddress Length**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Global

Default: 2

Options: 0 to 8 bytes

Function: The length of the subaddress, which is the address for a particular application or program on the network.

Instructions: Enter a value that indicates the length in bytes of subaddresses on your network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.1.1.9

X.25 PAD Port Parameters

Parameter: **Enable**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: Enable

Options: Enable | Disable

Function: Enables or Disables X.25 PAD services on this port.

Instructions: Accept the default, enable, to use X.25 PAD services on this port.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.2

Parameter: **X.121 Subaddress**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: Any valid X.121 subaddress, 1 to 8 bytes long

Function: The subaddress portion of an X.121 address is used by an application, and is transparent to the network. The subaddress length must be less than or equal to the value you set for the Global X.25 PAD Subaddress Length parameter.

Instructions: Enter the X.121 subaddress.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.7

Note: Whenever the X.121 Subaddress changes, you must execute an **isdb start** command for the change to take effect. For information on ISDB subcommands, see Appendix E, "X.25 PAD Technical Supplement".

Parameter: **Escape Character**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 1

Options: 0, 1, 32 to 126

A value of 0 disables the feature. There is no Escape character.

A value of 1 designates DLE to be the Escape character.

Values of 32 to 126 are user-defined characters. These are binary representation of decimal values in accordance with Recommendation 7.50.

Function: When the PAD receives this character, it changes from receiving and transmitting data to command state. In command state the PAD awaits commands from the character terminal.

Instructions: Enter 0 if you do not want to use command mode. Enter 1 to make the DLE key the Escape character. Consult Recommendation 7.50 to define another key as the Escape character.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.9

Parameter: Echo

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: Echo

Options: No Echo | Echo | Only Echo in Command Mode

Function: Determines whether the DTE has its output sent back to it from the PAD, where it would appear on either the terminal screen or as output to a printer. An echo can be generated from the PAD or from the host.

Instructions: Accept the default, Echo, to have the DTE display output it sends to the PAD. This achieves a fast response (the echo does not travel across the network).

Choose No Echo when the host application echoes. Otherwise double characters will appear on your screen or printer (e.g., LLiikkee tthheessee).

Choose Only Echo in Command Mode to have the PAD generate an Echo only for commands.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.10

Parameter: Data Forwarding Character

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 2

Options: The keyboard characters next to the numerals that follow. The last two options combine values from those that precede them.

0 NO DATA FORWARDING CHAR

1 ALPHANUMERIC CHAR

2 CR

4 ESC BELL ENQ ACK

8 DEL CAN DC2

16 ETX EOT

18 CR EOT ETX

32 HT LF VT FF

64 COL 0 & 1 EXCEPT 2 4 8 16 32

126 2 + 4 + 8 + 16 + 32 + 64

Function: Specifies a keyboard character that instructs the PAD to transmit data. The PAD buffers data it receives from the character terminal until it receives a data forwarding character, or until the buffer is full, or until either the idle timer or interval timer expires. Then it assembles the data in X.25 format and transmits it.

Instructions: Enter one of the options listed.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.11

Parameter: **Idle Timer**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 0

Options: 0 to 255, in units of 0.05 seconds (a value of 10 is half a second).

Function: The amount of time that the X.25 PAD can be idle before it sends any data that is in its character buffer. A value of 0 disables this parameter, and the PAD sends data based on the value in the Data Forwarding Character parameter.

Instructions: If you want to use the idle timer, set a value within the range given.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.12

Parameter: **Ancillary Device Control**

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: XON/XOFF in Command Mode and Data Transfer

Options: No XON/XOFF | XON/XOFF in Data Transfer | XON/XOFF in Command Mode and Data Transfer

Function: If the PAD has an intelligent terminal attached (such as a PC transmitting data directly from its hard disk), the PAD may receive data faster than it can process and forward it. This parameter enables the use of flow control that sends a character to the intelligent terminal indicating that it should stop sending data (XON), or that it can resume sending data when the congestion has cleared (XOFF). You can use flow control in both command mode and data transfer, or just in data transfer.

Instructions: Accept the default or choose another option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.1.13

Parameter:	**Service Signals**
Path:	Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port
Default:	5 - Service Signals and Prompt Sent Standard Form
Options:	0, 1, 4, 5
	0 instructs the PAD to send no service signals.
	1 sends service signals other than the prompt in standard form.
	4 sends prompt only in standard form.
	5 sends service signals and prompt in standard form.
Function:	Service signals are messages the PAD sends to the DTE in response to external events such as the X.25 call being either cleared or reset. This parameter determines the format of PAD service signals.
Instructions:	Accept the default or choose one of the other options.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.12.4.1.14

Parameter: Break

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 4

Options: 0, 1, 2, 4, 5, 8, 16, 21

0 indicates no action on receipt of a break message.

1 instructs the PAD to send an interrupt message to the host.

2 instructs the PAD to send a reset message to the host

4 instructs the PAD to send an indication of the break message to the DTE.

5 enables both options 1 and 4.

8 instructs the PAD to escape from data transfer state. The PAD awaits a command.

16 instructs the PAD to discard output to the DTE.

21 enables options 1, 4, and 16.

Function: Defines how the host to which the PAD connects indicates a problem. An example of a problem is receipt of a long, continuing data stream that may indicate that the terminal is stuck in a loop, or constant transmit mode.

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.15

Parameter: Discard Output

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 0

Options: 0, 1

0 delivers data in the normal manner.

1 discards data.

Function: Determines whether data will be delivered to the DTE in the normal manner or be discarded.

Instructions: Accept the default to deliver data, or choose discard.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.16

Parameter: Carriage Return Pad

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 0

Options: 0 to 255

Function: Specifies the number of padding characters to be inserted in a data stream to the DTE after a carriage return. A value of 0 in this parameter turns this feature off.

Instructions: Accept the default or enter another value within the range specified.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.1.1.8

Parameter: Line Folding

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 80

Options: 0 to 255

Function: Specifies the number of characters per line that the PAD transmits without inserting form effectors (carriage return, form feed, or line feed).

Instructions: Accept the default, or choose another value within the range specified.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.18

Parameter: Flow Control

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: XON/OFF

Options: NO XON/XOFF disables flow control.

XON/XOFF enables flow control.

Function: Allows the DTE rather than the PAD to control the rate at which it sends data by using XON and XOFF characters.

Instructions: Accept the default to enable flow control. Choose No XON/XOFF to disable this feature.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.20

Parameter: Linefeed Insert

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 4

Options: 0 to 7, except for 3

0 disables the feature.

1 inserts a linefeed after a carriage return in the data stream to the DTE.

2 inserts a linefeed after a carriage return in the data stream from the DTE.

4 inserts a linefeed after a carriage return in the echo stream to the DTE.

5 enables options 1 and 4.

6 enables options 2 and 4.

7 enables options 1, 2, and 4.

Function: Allows you to control the insertion of a linefeed.

Instructions: Accept the default or enter one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.21

Parameter: Linefeed PAD

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 0

Options: 0 to 255

Function: Specifies the number of padding characters to be inserted in a data stream to the DTE after a linefeed. A value of 0 in this parameter turns this feature off.

Instructions: Accept the default, or choose another value within the range specified.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.22

Parameter: Edit

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: Edit in Data Transfer

Options: No Edit in Data Transfer | Edit in Data Transfer

Function: Allows the character terminal to edit characters that are in a buffer of the PAD awaiting transmission.

Instructions: Accept the default, Edit, or choose No Edit.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.23

Parameter: Character Delete

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 127

Options: 0 to 127

Function: When the PAD detects the ASCII value you specify in this parameter, it deletes the immediately preceding character. The default value, 127, is the [DEL] character.

The Edit parameter must be set to Edit in Data Transfer for this parameter to have meaning.

Instructions: Accept the default or enter the ASCII value for the keyboard character that you want to instruct the PAD to delete a character.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.24

Parameter: Line Delete

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 24

Options: 0 to 127

Function: When the PAD detects the ASCII value you specify in this parameter, it deletes the immediately preceding line, which is the entire contents of the buffer if you use a carriage return for the line forwarding character. The default value of 24 is the [Cancel] character, which you generate by typing [Control + X] at the DTE keyboard.

The Edit parameter must be set to Edit in Data Transfer for this parameter to have meaning.

Instructions: Accept the default or enter the ASCII value for the keyboard character that you want to instruct the PAD to delete a line.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.25

Parameter: Line Display

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 18

Options: 0 to 127

Function: Allows the complete contents of the PAD buffer to be displayed on a new line on the character terminal. You generate the default value, 18, by typing [Control + R] at the DTE keyboard.

The Edit parameter must be set to Edit in Data Transfer for this parameter to have meaning.

Instructions: Accept the default or enter the ASCII value for the keyboard character that you want to instruct the PAD to display the contents of the PAD buffer.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.26

Parameter:	**Edit PAD Service Signals**
Path:	Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port
Default:	2
Options:	0, 1, 2, 8, 32 to 126 ASCII
	0 disables the feature.
	1 edits PAD service signals for printing terminals.
	2 edits PAD service signals for display terminals.
	8 and 32 to 1126 edit PAD service signals using the character that you specify in this range.
Function:	Specifies whether the buffer you edit using the Character Delete and Buffer Delete functions will be visible on a screen or a printer.
	The Service Signals parameter must be set to one of the transmit options for this parameter to have meaning.
Instructions:	Accept the default or enter another value.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.12.4.1.27

Parameter: Echo Mask

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: NO ECHO MASK

Options: NO ECHO MASK means that all characters are echoed.

NO ECHO OF CR means that carriage returns are not echoed.

NO ECHO OF LF means that linefeeds are not echoed.

NO ECHO OF VT HT FF means that those keys are not echoed.

NO ECHO OF BEL BS means that those keys are not echoed.

NO ECHO OF ESC ENQ means that those keys are not echoed.

NO ECHO OF ACK NAK STX SOH EOT ETB ETX means that those keys are not echoed.

NO ECHO OF EDIT CHARACTERS means that the characters set in the Character Delete, Line Delete and Line Display parameters are not echoed.

NO ECHO DEL, COL 0&1 NOT LISTED means that other characters in columns 0 and 1 of IA5 and DEL are not echoed.

Function: When the Echo parameter is on, this parameter allows you to limit the kinds of characters to be echoed.

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.28

Parameter: Parity

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: Parity Check Generation

Options: No Parity Check Generation disables parity check, disables parity generation, and the eighth bit is not used.

Parity Check enables parity check.

Parity Generation enables parity generation.

Parity Check Generation enables parity check and parity generation.

No Parity/Transparent bit 8 disables parity, and the eighth bit is used to generate the extended character set.

Function: Determines how the PAD treats parity.

Instructions: Accept the default or choose another option.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.29

Parameter: Page Wait

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: 0

Options: 0 to 255 lines of data

Function: Allows the PAD to send from 0 to 255 lines of data (a page) at a time to the terminal. The PAD then stops transmission until it receives any character from the terminal, at which point it sends another page of data.

Instructions: If you want to display a page of data at a time, enter the number of lines that your terminal can display.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.30

Parameter: User Data

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: Any valid call user data up to 16 bytes

Function: Specifies the user data field content inserted in the X.25 call packet.

Instructions: Enter the appropriate data in hexadecimal format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.32

Parameter: Raw Facilities Data

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: Any valid raw facilities data up to 63 bytes that needs to be included in the call request packet.

Function: Allows you to add support for facilities. To generate a call with support for a facility, you must enter the appropriate facility code in this parameter. You must also set the associated parameter at the X.25 packet level to ON.

Instructions: Enter the appropriate data in hexadecimal format.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.34

Parameter: Reverse Charge

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: None - No reverse charging facility is in the call request packet.

ON - The reverse charging facility is requested.

OFF - The reverse charging facility is not requested.

Function: When you set this parameter to ON you authorize the DCE to transmit to the DTE incoming calls that request reverse charging.

Instructions: If you want to use reverse charging, set this parameter to ON.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.35

Parameter: Throughput Class Negotiation

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: THRCLASS75 | 150 | 300 | 600 | 1200 | 2400 | 4800 | 9600 | 19200 | 48,000 | 64,000

Function: Permits the PAD to negotiate the throughput rate for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed rate or reply with a counterproposal.

Instructions: Enter the appropriate value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.36

Parameter: Packet Size Negotiation

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: None | 16 | 32 | 64 | 128 | 256

Function: Permits the PAD to negotiate the packet size for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed size or reply with a counterproposal.

Instructions: Enter the appropriate value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.37

Parameter: Window Size Negotiation

Path: Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port

Default: None

Options: None 1 | 2 | 3 | 4 | 5 | 6 | 7

Function: Permits the negotiation of window size. When you enable this parameter, the router can negotiate the window size on a per-call basis. The receiving DTE may accept the proposed size or reply with a counterproposal.

Instructions: Enter the appropriate value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.12.4.1.38

Parameter:	**Interval Timer**
Path:	Configuration Manager > X.25 PAD port > Edit Circuit > X25/ISDB > X25PAD Port
Default:	0
Options:	0 to 999, in units where 1 equals 10 milliseconds
Function:	The amount of time that the X.25 PAD waits before forwarding the current contents of its character buffer.
Instructions:	Enter a value in the range given.
MIB Object ID:	1.3.6.1.4.1.18.3.5.9.12.4.1.39

ISDB Global Parameter

Parameter:	**Enable**
Path:	Configuration Manager > Protocols > ISDB Global
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables X.25 PAD service on this interface.
Instructions:	Set to Disable if you want to disable X.25 PAD service on this interface without deleting it. Set to Enable to re-enable X.25 PAD service, if you previously disabled it.
MIB Object ID:	1.3.6.1.4.1.18.3.4.33.1.1.2

ISDB Port Parameters

Parameter: Enable

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Enable

Options: Enable | Disable

Function: Enables or disables X.25 PAD service on this port.

Instructions: Set to Disable if you want to disable X.25 PAD service on this port without deleting it. Set to Enable to reenable X.25 PAD service, if you previously disabled it.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.2

Parameter: Baud Rate

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: 9600b

Options: 300 | 1200 | 2400 | 4800 | 9600 | 19200

Function: Specifies the baud rate for the asynchronous port

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.7

Parameter: Data Bits

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: 8

Options: 5 to 8

Function: Determines the number of data bits on this asynchronous port.

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.8

Parameter: Parity

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port
Default: None
Options: None | Odd | Even
Function: Determines the type of parity for this asynchronous port.
Instructions: Accept the default or choose one of the other options.
MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.9

Parameter: Stop Bits

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port
Default: S1 bit
Options: S1 | S15 | S2
Function: Indicates the bit that will indicate the end of a data segment for this port.
Instructions: Accept the default or choose one of the other options.
MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.10

Parameter: Cts (Clear to Send)

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port
Default: Always On
Options: Always On | Always Off | Follow Flow Control | Follow RTS
Function: DCE configuration of the Clear to Send signal for this ISDB port.
Instructions: Accept the default or choose one of the other options.
MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.11

Parameter: Dsr (Data Set Ready)

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Always On

Options: Always On │ Always Off │ Follow DTR │ Toggle on Disconnect

Function: DCE configuration of the Data Set Ready signal, which indicates that the port is ready to send data.

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.12

Parameter: Dcd (Data Carrier Detect)

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Always On

Options: Always On │ Always Off │ Follow DTR │ Follow VC

Function: The DCD is a signal from the DCE to the DTE indicating that it is receiving a carrier signal from the DCE at the remote end of the connection.

Instructions: Accept the default or choose one of the other options.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.13

Parameter: Prompt

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: None

Options: Any text string up to 15 characters.

Function: Specifies the character string to be used for the port prompt.

Instructions: Enter the text string that you want to become the prompt.

MIB Object ID: 1.3.6.1.4.1.18.3.4.33.3.1.14

Parameter: Inactivity Timeout

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: 0

Options: 0 to 255

Function: Specifies the amount of time in seconds of inactivity, after which the port will reset.

Instructions: Enter a value in the specified range.

MIB Object ID:. 1.3.6.1.4.1.18.3.4.33.3.16

Parameter: Async Port Flow Control

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Enable

Options: Enable | Disable

Function: Enables or disables flow control from the DTE to the ISDB asynchronous port.

Instructions: Accept the default to enable flow control, or choose Disable to disable this feature.

MIB Object ID:. 1.3.6.1.4.1.18.3.4.33.3.1.19

Parameter: Remote Terminal Flow Control

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Disable

Options: Enable | Disable

Function: Enables or disables flow control from the ISDB to the terminal on the ISDB asynchronous port.

Instructions: Choose Enable to use flow control, or accept the default, Disable, to disable this feature.

MIB Object ID:. 1.3.6.1.4.1.18.3.4.33.3.1.20

Parameter: Dtr (Data Terminal Ready) Action

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Enable

Options: Enable | Disable

Function: Determines whether an action is taken when the DTR signal changes. A loss of the DTR signal results in the loss of communication between the ISDB and the terminal.

Instructions: Accept the default to enable the DTR action for this ISDB port, or set this parameter to Disable make the DTR action inactive.

MIB Object ID:. 1.3.6.1.4.1.18.3.4.33.3.1.21

Parameter: Flow Control Action

Path: Configuration Manager > X.25 PAD Port > Edit Circuit > X25/ISDB > ISDB Port

Default: Enable

Options: Enable | Disable

Function: Determines whether the PAD notifies the ISDB when a flow control change occurs.

Instructions: Accept the default to enable the PAD to notify the ISDB when a change occurs, or choose Disable to disable this feature.

MIB Object ID:. 1.3.6.1.4.1.18.3.4.33.3.1.22

QLLC Parameters

This section describes the QLLC mapping parameters that you can configure in the QLLC Mapping Parameters window. It also describes additional parameters that you can modify in the QLLC Mapping Table Configuration window.

Parameter: Map Entry Name

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: None

Options: Any text string

Function: Provides a name for the QLLC mapping entry.

Instructions: Enter a text string that describes this mapping entry.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.18

Parameter: Adjacent DTE/DCE X.121 Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: None

Options: Any valid X.121 address

Function: Specifies the X.121 device that connects to the interface running the QLLC/X.25 software, either directly or indirectly. QLLC software maps the adjacent X.121 address to the adjacent MAC address.

Instructions: Accept the value that the software automatically carries forward from the X.25 service record, or enter the appropriate X.121 address (up to 15 decimal digits). Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.7

Parameter: Protocol ID (PID) (hex)

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: 0xC3

Options: A hexadecimal value from 0x01 through 0xFE

Function: Specifies the protocol ID used in the first byte of the Call User Data of the X.25 Call Request packet.

Instructions: Accept the default, or select another value within the range given. The PID must be set to the value of the adjacent X.25/QLLC device.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.8

Parameter: Adjacent MAC Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: None

Options: The MAC address assigned to this QLLC device. It must be unique within your DLSw network.

Function: Specifies the MAC address assigned to the device that connects to the interface running the QLLC/X.25 software. QLLC software maps the adjacent MAC Address to the adjacent X.121 address.

If you are using wildcards, and you want to set this parameter to null, enter nothing. If you do set this parameter to null, the QLLC software dynamically assigns a MAC address from the address pool defined in the X.25 service record.

Instructions: Enter the adjacent MAC address. Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.11

Parameter: Partner DTE/DCE X.121 Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: None

Options: Any valid X.121 address

Function: Specifies the X.121 address of the device that connects through the DLSw network. QLLC software maps the partner X.121 address to the partner MAC address.

Instructions: Enter the partner X.121 address (up to 15 decimal digits). Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.6

Parameter: Partner MAC Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: None

Options: The MAC address assigned to this SNA device. It must be unique within your network.

Function: Specifies the MAC address assigned to the device that connects through the DLSw network. The QLLC software maps the partner MAC address to the partner X.121 address.

Instructions: Enter the MAC address. Consult your network administrator for the correct value.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.9

Parameter: Generate XID

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: Disable

Options: Enable | Disable

Function: Allows a non-NPSI host to establish a session with a QLLC endstation.

Instructions: Set to Enable when a PU 2.0 QLLC device connects through DLSw to a non-X.25 host.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.16

Parameter: Enable

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: Enable

Options: Enable | Disable

Function: Enables or disables a particular QLLC mapping entry on this interface.

Instructions: Accept the default, Enable, to activate this QLLC mapping entry.

Select Disable only if you want to deactivate this mapping entry. When you select Disable, you eliminate all active QLLC sessions established with this mapping entry.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.2

Parameter: Adjacent SAP Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: 0x04

Options: A hexadecimal value from 0x01 through FE.

Function: Specifies the SAP address associated with a communication subsystem on an adjacent device. If you have two data streams running between the same two end points, you must assign different SAP numbers to each of these streams.

Instructions: Accept the default, or specify the SAP address associated with a specific communication subsystem. For example, the SAP associated with SNA is 0x04. You must include the 0x prefix.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.12

Parameter: Partner SAP Address

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: 0x04

Options: A hexadecimal value from 0x01 through FE.

Function: Specifies the SAP address associated with a communication subsystem on an partner device.

If you have two data streams running between the same two end points, you must assign different SAP numbers to each of these streams.

Instructions: Accept the default, or specify the SAP address associated with a specific communication subsystem. For example, the SAP associated with SNA is 0x04. You must include the 0x prefix.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.10

Parameter: **Options**

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: 0x0

Options: See Table A-3.

Function: Specifies when to forward an XID to the adjacent device.

Instructions: Accept the default, 0x0, if you are connecting to a device running PU 2.0 traffic.

Choose 0x001 if you are connecting to a host running PU 2.1 traffic.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.13

Table A-3. XID Forwarding Options

Hexadecimal Value	Decimal Value	Message/Event
0x0	0	Wait for Adjacent DTE/DCE to send an QXID before forwarding an QXID to it.
0x0001	1	Do not wait; send an QXID without receiving an QXID first.
0x0002	2	Enable when SDLC endstations connect to QLLC hosts that do not support receipt of XID polls and do not retransmit XIDs.
0X0004	4	The software sets the parameter to this field automatically when the Partner MAC Address contains a wildcard. Do not change this value.

Parameter: Trace

Path: Configuration Manager > Circuits > Edit Circuits > Edit > X.25 Protocol > Service > QLLC

Default: Disable (0x0)

Options: See Table A-4.

Function: This object is a bit mask used to enable logging of internal QLLC messages and events. You can add values and enter the sum to enable multiple message groups.

Enabling this parameter has a small impact on router performance. You may want to disable this parameter after you are sure that the configuration works.

Instructions: Accept the default, Disable, or enable the type of debugging that you want on your network.

MIB Object ID: 1.3.6.1.4.1.18.3.5.9.4.8.1.14

Table A-4. Trace Options

Hexadecimal Value	Decimal Value	Message/Event
0x0	0	Disable
0x0001	1	Enable QLLC logging
0x0002	2	Data frames/packets
0x0004	4	Flow control messages
0x0008	8	Client registration messages
0x0010	16	X.25 session establishment messages
0x0020	32	Test frames/packets
0x0040	64	XID frames/packets
0x0080	128	Set Mode frames/packets
0x0100	256	Disconnect frames/packets
0x0200	512	Configuration changes
0x0400	1024	Death of client (DLSw)
0x0800	2048	Data Path (DP) messages

Appendix B
X.25 Default Parameter Settings

Tables B-1 through B-11 list X.25, LAPB, IPEX, X.25 PAD, and QLLC parameters and their default values.

Table B-1. X.25 Global Parameter

Parameter	Default
Enable	Enable

Table B-2. X.25 Packet-Level Parameters

Parameter	Default
Enable	Enable
Link Address Type	DCE
Network Address Type	PDN_Network
PDN X.121/E.164 Address	None
DDN IP Address	None
Sequence Size	MOD8
Restart Procedure Type	DTE_Restart (for DTE) DCE_Restart (for DCE)

(continued)

Table B-2. X.25 Packet-Level Parameters *(continued)*

Parameter	Default
Default Tx/Rx Window Size	2
Default Tx/Rx Pkt Length	128
Number of PVC Channels	0
PVC LCN Start	0
Number of Incoming SVC Channels	0
Incoming SVC LCN Start	0
Number of Bidirectional SVC Channels	0
Bidirectional SVC LCN Start	0
Number of Outgoing SVC Channels	0
Outgoing SVC LCN Start	0
Use Default Service Configuration	OFF
T1 Timer	60 s
T2 Timer	180 s
T3 Timer	200 ms
T4 Timer	200 ms
Flow Control Negotiation	Off
Max Window Size	2
Max Packet Length	128
Tx/Rx Throughput Class	THRCLASS19200
Throughput Class Negotiation	Off
Max Throughput Class	19200

(continued)

Table B-2. X.25 Packet-Level Parameters *(continued)*

Parameter	Default
Network User Identification	Off
Incoming Calls Accept	On
Outgoing Calls Accept	On
Fast Select Accept	Off
Reverse Charge Accept	Off
Fast Select	Off
Reverse Charging	Off
CUG Selection	Null
CUG Outgoing Access	Null
CUG Bilateral Selection	Null
RPOA Selection	Off
Charging Information	Off
Transit Delay	Off
Full Addressing	On
Acceptance Format	Basic (2)
Release Format	Basic (2)
CCITT Conformance	DXE1988
Network Standard	None
Statistics Computation	Disable
Client Response Timer	120
Client PDU Size	1600

Table B-3. X.25 Network Service Record Parameters

Parameter	Default
Enable	Enable
Type	None
Service VC Type	SVC
PVC LCN	None
Number of PVC LCN	1
Connection ID	1
Remote IP Address	0.0.0.0
Remote X.121/E.164 Address	None
Enable 1356 Multiplexing	Disable
Enable Compression	Disable
Broadcast	Off
Max Connections	2
Precedence	Off
Max Idle (Mins)	2
Call Retry	60
Flow Facility	Default
Window Size	2
Packet Size	128
Fast Select Request	Off
Fast Select Accept	Off
Reverse Charge Request	Off
Reverse Charge Accept	Off
DDN BFE	Disable

(continued)

Table B-3. X.25 Network Service Record Parameters *(continued)*

Parameter	Default
User Facility (hex)	None
CUG Facility Format	None
CUG Facility Type	Normal
CUG Number	0
MAC Pool Start	None
MAC Pool Size	0

Table B-4. LAPB Parameters

Parameter	Default
Enable	Enable
Station Type	DTE
Control Field	Modulo 8
Max N1 Frame Size (octets)	256 bytes
Window Size	7
Max N2 Retries	10
Max T1 Acknowledge Timer (seconds)	30 seconds
Max T2 Acknowledge Timer (seconds)	1 seconds
Max T3 Disconnect Timer (seconds)	60 seconds
Initiate Link Setup Action	Active
Enable Rx/Tx/of XID Frames	Disable
Command/Response Address	DTE
WAN Protocol	Standard
Network Link Type	NET2
Idle RR Frames	Off

Table B-5. IPEX Global Parameters

Parameter	Default
Enable	Enable
Max Message Size	1600
Insert Called DTE Address	Disable
Insert Calling DTE Address	Disable

Table B-6. IPEX Mapping Parameters

IPEX Mapping Parameter	Default
Source Connection Type	None
Mapping Type	None
TCP Circuit Name	None
TCP Header Type	None; used only with X.25 Gateway
Parameters for PVC and SVC Connections	**Default**
Source PVC LCN	None; used only with PVC connections
X.121 Called Address	None; used only with SVC connections
Mapping Type	End_to_End
Remote IP Address	None
Remote TCP Port Number	None
Parameters for TCP Connections	**Default**
Local TCP Port	None
Destination Connection Type	None
Destination PVC LCN	None
Additional Mapping Parameters	**Default**
Enable	Enable

(continued)

Table B-6. IPEX Mapping Parameters

IPEX Mapping Parameter	Default
Source X.121 Address	None
Destination X.121 Address	None
Client Queue Size	Set to the larger of TCP Max Window Size or IPEX Max Message Size, usually 4096
X.25 Call User Data	None
Idle Session Timer	120 seconds
Keep Alive Retransmit Timer	3 seconds
Keep Alive Retransmit Count	5

Table B-7. X.25 PAD Global Parameters

Parameter	Default
Enable	Enable
X.121 Address	The address that you provided for the X.25 packet-level PDN X.121 Address parameter
DNIC	None
Subaddress Length	2 bytes

Table B-8. X.25 PAD Port Parameters

Parameter	Default
Enable	Enable
X.121 Subaddress	None
Escape Character	1
Echo	Echo

(continued)

Table B-8. X.25 PAD Port Parameters *(continued)*

Parameter	Default
Data Forwarding Character	2
Idle Timer	0
Ancillary Device Control	XON/XOFF in Command Mode and Data Transfer
Service Signals	5 Service Signals and Prompt Sent Standard Form
Break	4 Sends an indication of the break message to the DTE.
Discard Output	0 Delivers data in normal manner.
Carriage Return Pad	0
Line Folding	80
Flow Control	XON/OFF
Linefeed Insert	4
Linefeed PAD	0
Edit	Edit in Data Transfer
Character Delete	127
Line Delete	24
Line Display	18
Edit PAD Service Signals	2
Echo Mask	No Echo Mask
Parity	Parity Check Generation
Page Wait	0
User Data	None
Raw Facilities Data	None
Reverse Charge	None
Throughput Class Negotiation	None
Packet Size Negotiation	None
Window Size Negotiation	None
Interval Timer	0

Table B-9. ISDB Global Parameter

Parameter	Default
Enable	Enable

Table B-10. ISDB Port Parameters

Parameter	s sDefault
Enable	Enable
Baud Rate	9600b
Data Bits	8
Parity	None
Stop Bits	S1 bit
Cts (Clear to Send)	Always On
Dsr (Data Set Ready)	Always On
Dcd (Data Carrier Detect)	Always On
Prompt	None
Inactivity Timeout	0
Async Port Flow Control	Enable
Remote Terminal Flow Control	Disable
Dtr (Data Terminal Ready) Action	Enable
Flow Control Action	Enable

Table B-11. QLLC Parameters

QLLC Mapping Parameters	**Default**
Map Entry Name	None
Adjacent DTE/DCE X.121 Address	None
Protocol ID (PID)	0xC3
Adjacent MAC Address	None
Partner DTE/DCE X.121 Address	None
Partner MAC Address	None
Generate XID	Disable
Additional Parameters	**Default**
Enable	Enable
Adjacent SAP Address	0x04
Partner SAP Address	0x04
Options	Wait
Trace	Disable (0x0)

Appendix C
Sample IPEX Configurations

IPEX Mapping Example

This sample configuration for IPEX mapping parameters (Figure C-1) illustrates two X.25 terminals that use X.25 TCP/IP Tunneling.

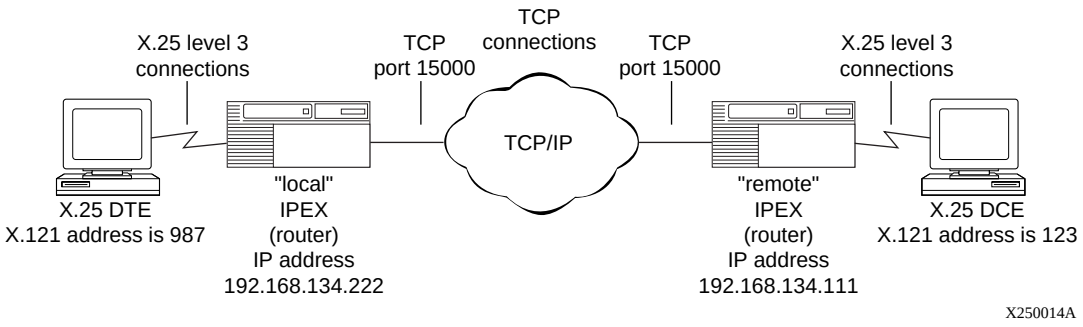


Figure C-1. Sample Configuration for Mapping Parameters

In this example, the calling X.25 terminal on the left (987) sends the called address (123) to the first IPEX router, establishing an SVC source connection with a TCP destination connection. The call is tunneled through the TCP/IP network to the second IPEX router, which establishes a source TCP connection with an SVC destination connection to the X.25 terminal on the right.

Figures A-2 through A-5 show the parameter settings for full-duplex calls for this configuration. Figures C-2 and C-5 show the settings for 987 calling 123, and Figures C-4 and C-3 show the settings for 123 calling 987.

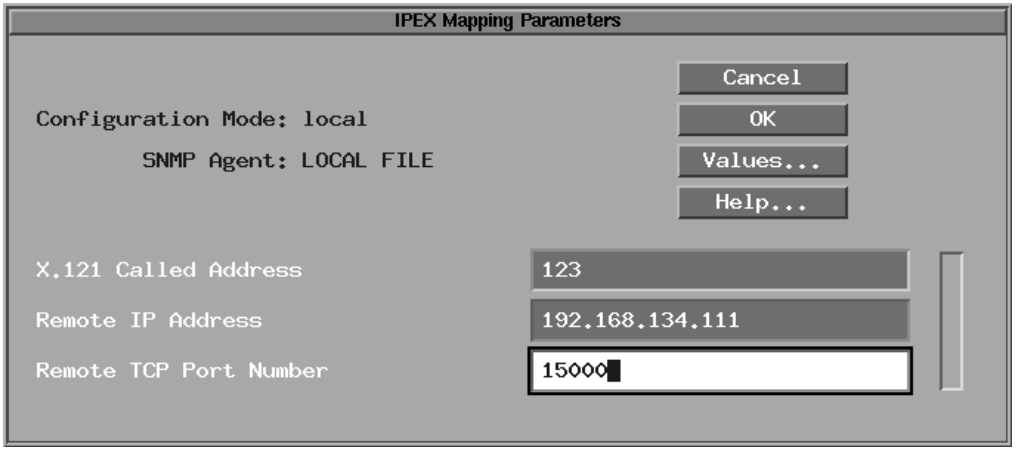


Figure C-2. IPEX Mapping Parameters for Local SVC Connection Type

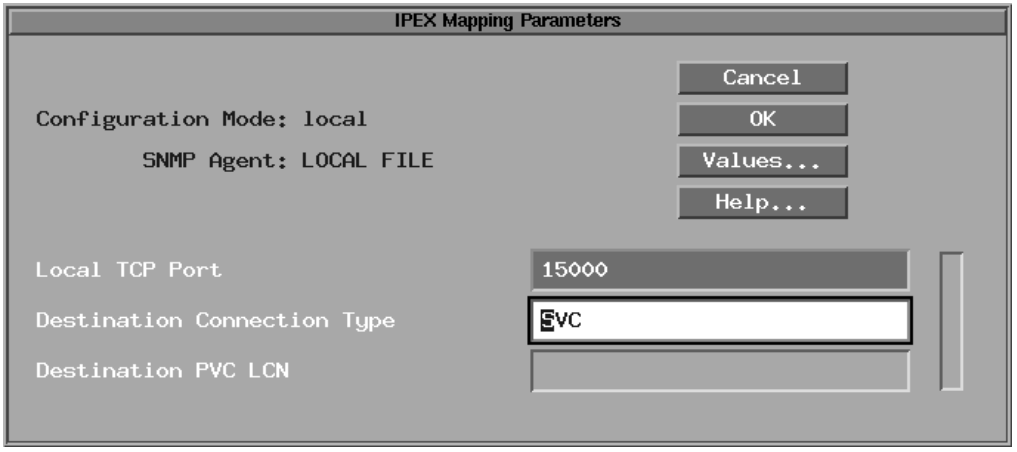


Figure C-3. IPEX Mapping Parameters for Local TCP Connection Type

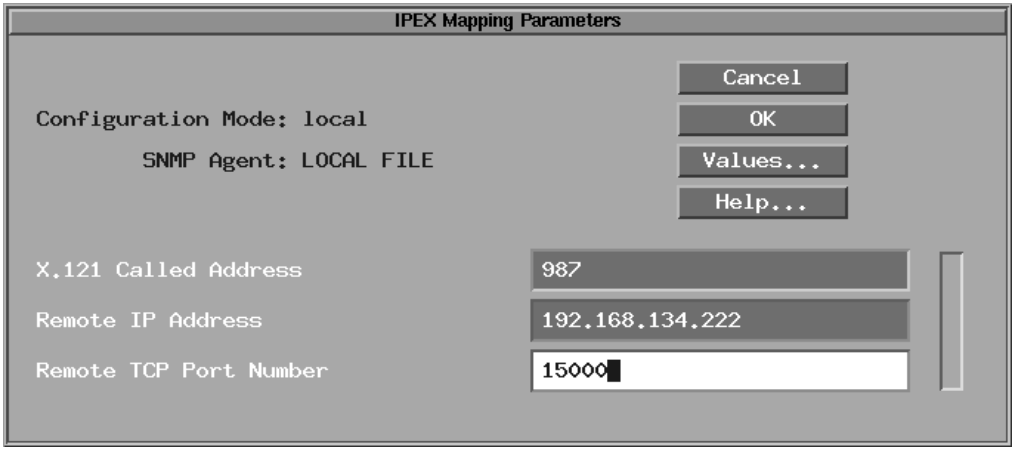


Figure C-4. IPEX Mapping Parameters for Remote SVC Connection Type

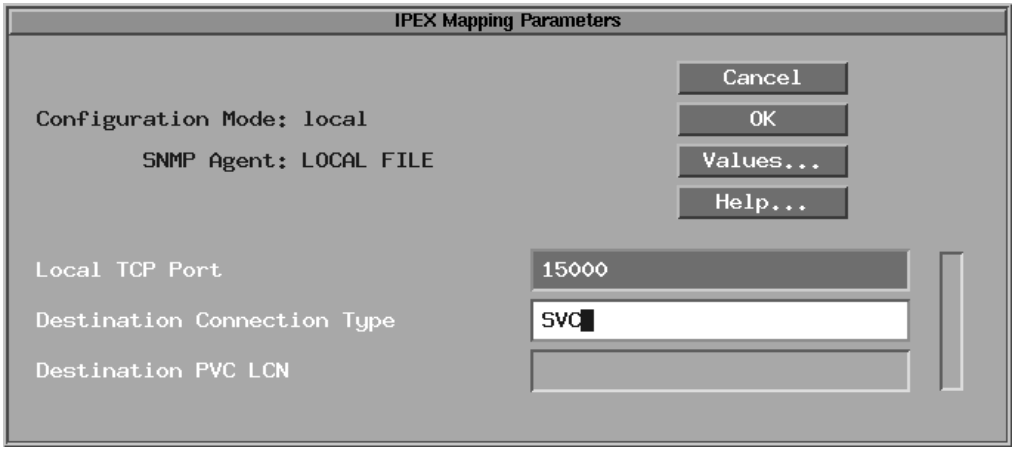


Figure C-5. IPEX Mapping Parameters for Remote TCP Connection Type

IPEX Single-Node Switching

IPEX single-node switching is IPEX configured on the backplane of a single router. A normal IPEX configuration performs local X.25 switching, and a circuitless IP network simulates an IP cloud. Figure C-6 illustrates single-node switching.

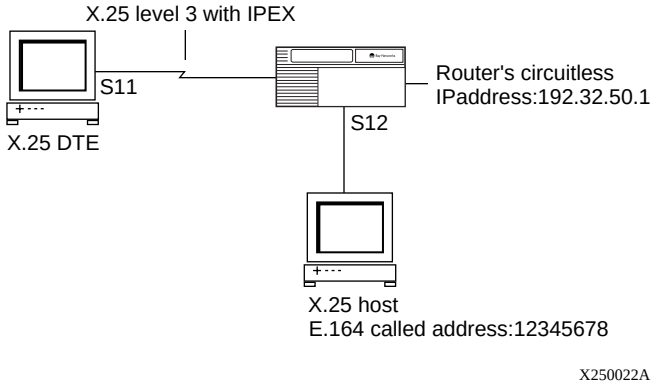


Figure C-6. IPEX Single-Node Switching

If the router receives an X.121 called address for a VC, with the call request coming from the X.25 port, it sends the packet to a TCP destination port and IP address that you choose. For this example, the router sends the packet to the circuitless IP address, or any other IP address on the local router.

If the router receives an incoming TCP/IPEX packet from the configured TCP port number, it sends the IPEX packet out on the X.25 port.

Configuring IPEX Local X.25 Switching

This example assumes that you have already configured a circuitless IP address. For information about configuring IP, refer to *Configuring IP Services*. For information about configuring X.25, refer to *Configuring X.25 Services*.

Configuring the PVC or SVC Connection

Use these instructions to configure the PVC or SVC connection. For parameter descriptions, see Appendix A.

Site Manager Procedure	
You do this	**System responds**
1. Choose a port, and click on **OK**.	The WAN Protocols window opens.
2. Choose X.25 from the protocols window.	
3. Click on **OK**.	The X.25 Packet Configuration window opens.
4. Set the following parameters according to the requirements of your network, using **Help** or the parameter descriptions that begin on page A-3: • **Link Address Type** • **PDN X.121/E.164 Address** • **Number of PVC Channels** • **PVC LCN Start** • **Number of Incoming SVC Channels** • **Incoming SVC LCN Start** • **Number of Bidirectional SVC Channels** • **Bidirectional SVC LCN Start** • **Number of Outgoing SVC Channels** • **Outgoing SVC LCN Start**	
5. Click on **OK**.	The X.25 Service Configuration window opens.
6. Click on **Add**.	The X.25 Service window opens.
7. Set the following parameters, using **Help** or the parameter descriptions that begin on page A-27: • **Type** (set this parameter to IPEX) • **Service VC Type**	
8. If you chose **PVC** as the **Service VC Type**, set the following parameters, using **Help** or the parameter descriptions that begin on page A-28: • **PVC LCN** • **First PVC LCN** • **Number of PVC LCN**	

Site Manager Procedure	
You do this	**System responds**
9. Click on **OK**.	The IPEX Mapping Table Configuration window opens.
10. Click on **Add**.	The IPEX Mapping Add window opens.
11. Set the **Source Connection Type** parameter to **PVC** or **SVC**, using **Help** or the parameter description on page A-51.	
12. Set the **Mapping Type** parameter to **End_to_End**, unless you must perform X.121 address translation, which is only possible in local mode.	
13. Click on **OK**.	The IPEX Mapping parameters window for PVC or SVC opens.
14. Enter a **Source PVC LCN** or an **X.121 Called Address**, as appropriate. Use **Help** or the parameter descriptions that begin on page A-52.	In this example, the X.121 address is 12345678.
15. Enter the **Remote IP Address**.	In this example the address is 192.32.50.1.
16. Enter the **Remote TCP Port Number**.	This is the destination TCP port number that receives the IPEX packets. For this example, enter 13000 for COM1.
17. Click on **OK**.	You return to the IPEX Mapping Table Configuration window.
18. Click on **Done**.	You return to the X.25 Service Configuraiton window.
19. Click on **Done**.	You return to the Main Configuration Manager window.

Configuring the TCP Connection

To configure the TCP connection:.

Site Manager Procedure	
You do this	**System responds**
1. Follow steps 1 to 10 in the previous section, “Configuring the PVC or SVC Connection” on page C-5, but choose a different COM port.	
2. Set the **Source Connection Type** parameter to **TCP**, using **Help** or the parameter description on page A-51.	
3. Set the **Mapping Type** parameter to **End_to_End**, unless you must perform X.121 address translation, which is only possible in local mode.	
4. Click on **OK**.	The IPEX Mapping parameters window for TCP opens.
5. Enter the **Local TCP Port** number. Use **Help** or the parameter description on page A-54.	In this example, the number is 13000.
6. Set the **Destination Connection Type** to either **PVC** or **SVC.** If you choose **PVC**, set the **Destination PVC LCN** parameter also. Use **Help** or the parameter descriptions on page A-54.	
7. Click on **OK**.	You return to the IPEX Mapping Table Configuration window.
8. Click on **Done**.	You return to the X.25 Service Configuraiton window.
9. Click on **Done**.	You have completed the IPEX configuration. You return to the Main Configuration Manager window.

Note: This example allows calls from the X.25 DTE to the X.25 host. After the initial call, traffic can flow in both directions. To allow either side of the connection to make call requests, you must make the same configuration again, but in the opposite direction. That is, create an SVC mapping type on the X.25 host, and a TCP mapping type on the X.25 DTE. For the second configuration, use a different TCP port. Both mapping types can exist on the same interface.

Appendix D
QLLC Technical Supplement

This appendix contains examples of networks that use QLLC and also provides complete information on using QLLC wildcards in mapping addresses.

QLLC Configuration Examples

The sections that follow illustrate typical QLLC network topologies when used with DLSw.

Sample Network Topologies

QLLC conversion supports the following network topologies:

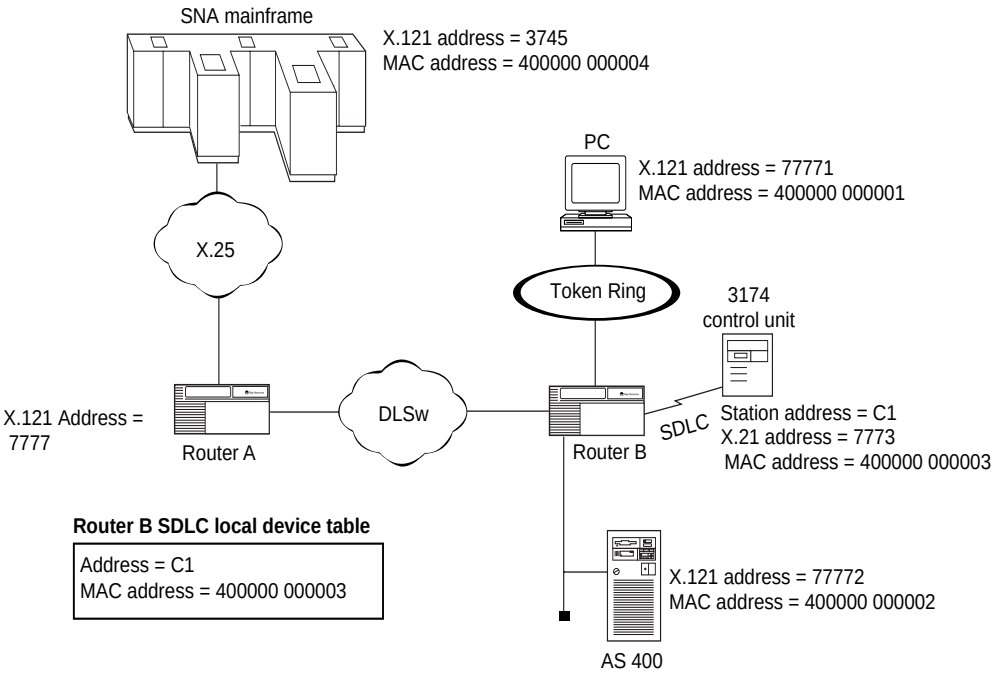
- Upstream QLLC
- Downstream QLLC
- Endpoint QLLC
- Backbone QLLC

Upstream QLLC Network

Figure D-1 shows support for upstream X.25 networks. The DLSw network connects to an upstream QLLC host through an X.25 network, and to SDLC- and LLC-attached SNA end stations. The end stations can be PU2.0 devices, such as the AS 400, IBM 3174, PS/2, and IBM 5394. A QLLC host might be an AS 400 or an IBM mainframe running NPSI software.

Mapping Tables

Figure D-1 also shows wildcard and station-to-station mapping tables between endstations and the SNA mainframe. The wildcard maps focus on Router A rather than on individual endstations; the partner MAC address is therefore irrelevant, which allows the “Don’t Care” wildcard.



Router A station-to-station mapping table (enables PC, 3174, and AS 400 to reach SNA mainframe)

Map Name	Adjacent X.121 Address	Partner X.121 Address	Adjacent MAC Address	Partner MAC Address
PC Map	3745	7771	400000 000004	400000 000001
AS 400 Map	3745	7772	400000 000004	400000 000002
3174 Map	3745	7773	400000 000004	400000 000003

Router A wildcard mapping table (enables PC, 3174, and AS 400 to reach SNA mainframe)

Map Name	Adjacent X.121 Address	Partner X.121 Address	Adjacent MAC Address	Partner MAC Address
SNA mainframe	3745	7777	400000 000004	.*

X250017A

Figure D-1. Upstream QLLC Network

Downstream QLLC Network

Figure D-2 shows support for downstream QLLC devices. The DLSw network connects to upstream SDLC- or LLC-attached SNA hosts, and downstream QLLC-compatible attached SNA end stations. The end station can be a PU2.0 device, such as an AS 400, IBM 3174, PS/2, or IBM 5394. The SNA host might be an AS 400 or an IBM mainframe.

Mapping Tables

Figure B-3 shows examples of how station-to-station and wildcard mapping tables can work for this network.

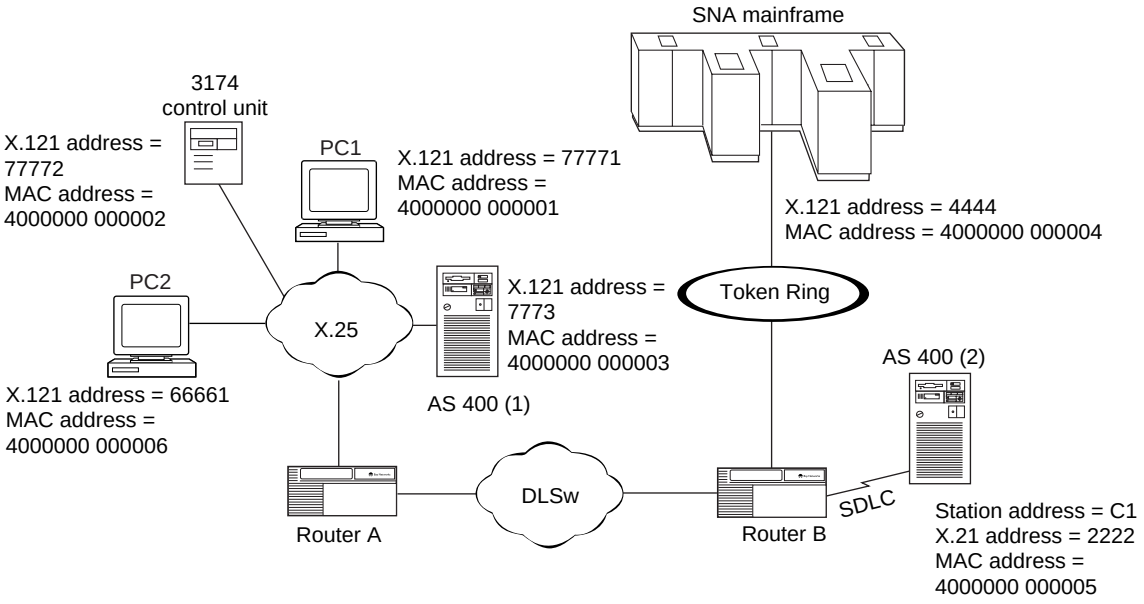
The 3174 Map, the PC1 Map, and the AS 400 (1) Map are examples of station-to-station maps that enable endstations to connect to a host.

The SNA Mainframe map and the AS 400 (2) map both use wildcards. The wildcard maps focus on Router A, rather than on individual endstations. Note that the SNA Mainframe map enbles the same connections as the station-to-station maps.

The SNA Mainframe and AS 400 (2) maps also show how you can create multiple mappings on a network.

Setting the Generate XID Parameter

Set the Generate XID parameter to Enable when you configure a secondary X.25 device to communicate with a non-X.25/QLLC primary device. This means that for the FEP, the AS 400, and the IBM 3745 in Figure D-2, you should set this parameter to Enable.



Router B SDLC local device table

Address = C1 MAC Address = 4000000EAC0

Router A station-to-staion mapping table (enables 3174, PC1, and AS 400 (1) to reach SNA mainframe)

Map Name	Adjacent X.121 Address	Partner X.121 Address	Adjacent MAC Address	Partner MAC Address
3174	77772	4444	400000 000002	400000 000004
PC1 Map	77771	4444	400000 000001	400000 000004
AS 400 (1) Map	77773	4444	400000 000003	400000 000004

Router A using . wildcard

Map Name	Adjacent X.121 Address	Partner X.121 Address	Adjacent MAC Address	Partner MAC Address
SNA Mainframe **(enables 3174, PC1 and AS 400 (1) to reach SNA mainframe)**	7777.	8888	(leave blank)	400000 000004
AS 400 (2) **(enables PC2 to reach AS400 (2))**	6666.	8888	(leave blank)	400000 000004

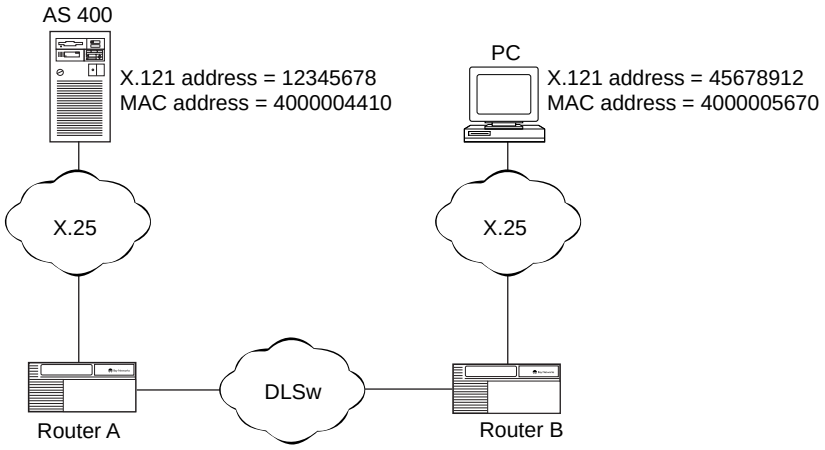
Figure D-2. Downstream QLLC Network

Endpoint QLLC Network

Figure D-3 shows support for a network that connects an upstream X.25-attached SNA end station, and a downstream X.25-attached SNA end station. The end stations can be an AS 400 and a PC supporting a hierarchical protocol such as SNA or a peer-to-peer protocol such as APPN.

Setting the Options Parameter

When both end stations are X.25/QLLC devices, set the Options parameter to Don’t Wait.



Router A mapping table

AS 400 parameters map to	PC
Adjacent DTE/DCE X.121 address = 12345678 Adjacent MAC address = 4000004410	Partner DTE/DCE X.121 address = 45678912 Partner MAC address = 4000005670

Router B mapping table

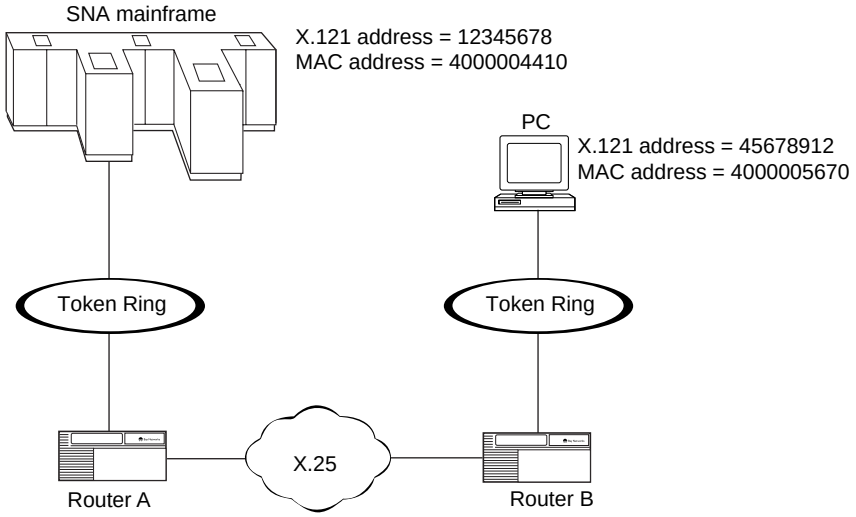
PC parameters map to	AS 400
Adjacent DTE/DCE X.121 address = 45678912 Adjacent MAC address = 4000005670	Partner DTE/DCE X.121 address = 12345678 Partner MAC address = 4000004410

X250020A

Figure D-3. Endpoint QLLC Network

Backbone QLLC Network

Figure D-4 shows support for an X.25 backbone. This X.25 network connects to an upstream SNA mainframe, and a downstream PC through an X.25 backbone network. See "QLLC Adjacent and Partner Devices," on page 1-23 for definitions of adjacent and partner devices.



Router A mapping table

SNA mainframe parameters map to	PC
Adjacent DTE/DCE X.121 address = 45678912 Adjacent MAC address = 4000005670	Partner DTE/DCE X.121 address =12345678 Partner MAC address = 4000004410

Router B mapping table

PC parameters map to	SNA mainframe
Adjacent DTE/DCE X.121 address =12345678 Adjacent MAC address = 4000004410	Partner DTE/DCE X.121 address = 45678912 Partner MAC address = 4000005670

X250021A

Figure D-4. X.25 Backbone QLLC Network

Wildcard Mapping for Complicated Networks

The following sections fully explain how to use QLLC mapping.

Making Wildcards

You define wildcards as regular expressions, using the characters defined in Table D-1.

Table D-1. Characters in Wildcard Addresses

Wildcard Character	Function
C	Matches any character except those listed below. An ordinary character (for example, a, b, 7, or 5) matches only itself.
. (dot or period) (. = 0x 2E)	Matches a single character. Example: **7777.** Matches: 77771, 77773, and 77772 Does not match: 777712 or 7777123
^ (caret or circumflex) (^ = 0x 5E)	The caret has special meaning only when it is the leftmost character in the wildcard expression.
$ (currency symbol) ($ = 0x 24)	The currency symbol has special meaning only when it is the rightmost character in a wildcard expression. As such, it constrains the expression to match the rightmost portion of a line. A match of this type is an *anchored* match because it is anchored to a specific place in the line.
[c...] ([= 0x 5B) (] = 0x 5D)	As the rightmost element in a string, this element tells the wildcard to match any one of the characters enclosed in the brackets. Example: 40000000000[123] Matches: 400000000001, 400000000002, or 400000000003

(continued)

Table D-1. Characters in Wildcard Addresses *(continued)*

Wildcard Character	Function
[^c...] (^ = 0x 5E)	When a caret is the first character of the bracketed string, the wildcard expression matches any character except those in the remainder of the string. Example: [^45678] Matches: any character except 4, 5, 6, 7, or 8
[l-r] (- = 0x 2D)	The minus sign between two characters indicates a range of consecutive ASCII characters to match. This bracketed string of characters is known as a *character class*. Example: [0-9] Matches: 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9

Concatenating Wildcards

You can construct longer wildcards by combining single-character regular expressions, using the rules and operators in Table D-2. A wildcard that you make from a concatenation of regular expressions matches a concatenation of address digits, each of which is a match for a successive regular expression in the search pattern.

Table D-2. Concatenation Rules and Operators for Wildcards

Rule/Operator	Interpretation
? (question mark) (? = 0x 3F)	A single-character regular expression followed by a question mark matches zero or exactly one occurrence of that single-character regular expression. Example: [0-9]? Matches: any string of zero or exactly one digit.
* (asterisk) (* = 0x 2A)	A single-character regular expression followed by an asterisk matches zero or more occurrences of that single-character regular expression. Example: [0-9]* Matches: any string of zero or more digits

(continued)

Table D-2. Concatenation Rules and Operators for Wildcards *(continued)*

Rule/Operator	Interpretation
+ (plus sign) (+ = 0x 2B)	A single-character regular expression followed by a plus sign matches one or more occurrences of that single-character regular expression. Example: [0-9]+ Matches: any string with one or more digits.
{m} {m,} {m, n} where m and n are integers ({ = 0x 7B) (} = 0x 7D) (, = 0x 2C)	A one-character regular expression followed by {m}, {m,}, or {m,n} is a regular expression that matches a range of occurrences of the one-character regular expression. The values m and n must be non-negative integers less than 255. The symbols in braces mean the following: {m} matches *exactly* m occurrences {m,} matches *at least* m occurrences {m, n} matches *any number* of occurrences between m and n. Whenever a choice exists, the regular expression matches as many occurrences as possible.

Table D-3 lists the operators that you can use to construct regular expressions from more-than-single-character regular expressions.

Table D-3. Multi-Character Concatenation Operators for Wildcards

Operator	Interpretation
(...) (regular expressions enclosed in parentheses) ((=0x 28) () = 0x 29)	A regular expression enclosed within parentheses matches whatever the unadorned regular expression matches. You use parentheses to group a series of regular expressions that you want the software to treat as a single-character regular expression. Example: 0[Xx]? Matches: 0 0X or 0x Example: (0[Xx])? Matches nothing, 0x, or 0x You can have up to 9 such substrings in a regular expression, and you can nest parentheses.
| (vertical bar) (| = 0x 7c)	Two regular expressions separated by a vertical bar match either a match for the first or a match for the second. Example: 7777(12|16) Matches 777712 or 777716
[ ] (square brackets ([=0x 5B) (] = 0x 5D)	Matches any single character in the bracketed set. Example: 40000000000[123] Matches: 400000000001, 400000000002, or 400000000003

Wildcard Configuration Rules

Table D-4 specifies the rules that govern how you make wildcards for QLLC address mapping parameters.

Table D-4. Wildcard Configuration Rules

Adjacent X.121 Address

- Can only contain decimal digits and wildcard characters.
- If only decimal digits, string length must be 1 to 15 digits long.
- If wildcard characters, string length must be 1 to 40 characters long.

(continued)

Table D-4. Wildcard Configuration Rules *(continued)*

- Wildcard characters are not allowed if partner MAC address contains wildcard characters.
- If only ".*" wildcard characters are used, then Site Manager displays the address as "Don't Care"
- If a (, [, or { wildcard is used, there must be a matching),], or } wildcard.

Partner X.121 Address

- Can only contain decimal digits.
- String length must be 1 to 15 digits long.

Partner MAC Address

- Can only contain hexadecimal digits and wildcard characters.
- If only hexadecimal digits, string length must be 12 digits long.
- If wildcard characters, string length must be 2 to 40 characters long.
- Wildcard characters are not allowed if adjacent X.121 address contains wildcard characters.
- If only ".*" wildcard characters are used, then Site Manager displays the address as "Don't Care"
- If a (, [, or { wildcard character is used, there must be a matching),], or } wildcard.

Adjacent MAC Address

- Can only contain hexadecimal digits or nothing.
- String length must be 12 digits or zero.
- String length of zero not allowed if partner MAC address contains wildcard characters.
- If string length is zero, then Site Manager displays the address as "Pool Address."

Options bitmask

- If partner MAC address contains wildcard characters, then Option 0x0004 must be enabled.

Wildcard Overlaps

When you use wildcards to create QLLC maps for service records with multiple mappings, you may inadvertently define maps that overlap, For example, if you have more than one map with the same adjacent MAC address, and you use the ".*" ("Don't Care") wildcard for one of the maps, by definition the maps overlap. In this situation, the router software searches the maps according to the rules in the next section, and forwards the data according to the first applicable map.

Searching the Maps

The software searches the maps in reverse ASCII order as follows:

- Lowercase alpha characters, f to a
- Uppercase alpha characters, F to A
- 9 to 0
- Special characters in reverse order to how they appear in the ASCII character set

For more information, see Appendix G, "ASCII Character Set."

Individual Station-to-Host Mapping

To map each endstation to a host, you assign a virtual MAC address to the X.25 device, and map that MAC address to the device's X.121 address. You also assign a virtual X.121 address to the DLSw device, and map that address to the DLSw device's MAC address. These mappings set a path for forwarding data between an X.25 VC and a specific remote DLSw device. You must configure one mapping entry for each VC.

You can use mappings of this sort for either traffic that originates from endstations, or for traffic that originates from hosts. For instructions on using Site Manager to configure station-to-host mappings, see Chapter 8, "Configuring QLLC."

Appendix E
X.25 PAD Technical Supplement

This appendix provides information about:

isdb Subcommands

You can manage the ISDB and view ISDB data for your network by issuing the command **isdb** with subcommands.

Using the isdb help Command

You can list and review all isdb subcommands by entering the following command line at either the Technician Interface or BCC (Bay Command Console) prompt:

help isdb

This command also displays the correct syntax and available parameters for the command **isdb**.

Using isdb Subcommands

Table E-1 lists and describes all ISDB subcommands. Directions for using the **start**, **stop**, **reset**, **download**, and **upload** commands are in Chapter 7, *Configuring X.25 PAD*. Expanded definitions for the remaining subcommands, which display statistics about the state of the ISDB, follow Table E-1.

Use the following syntax for the **isdb** command and subcommands.

isdb <*subcommand*> [**-s** <*slot*>] [**-c** <*connector*>] [**-p** <*port*>] [<*vol*>:<*filename*>

]

isdb	Refers to the **isdb** command, which allows you to view data from the ISDB.
<*subcommand*>	Is the subcommand.
<*slot*>	Is the number of the slot.
<*connector*>	Is the number of the connector.
<*port*>	Is the number of the serial port.
<*vol*>	Is the volume number.
<*filename*>	Is the name of the ISDB image.

Table E-1. ISDB Subcommands

Subcommand	Description
start	Starts the ISDB executable file. Whenever the X.121 address or subaddress changes, you must execute the **start** command for the changes to take effect.
stop	Stops the ISDB executable file.
reset	Resets ISDB hardware.
download	Downloads the ISDB executable file.
upload	Uploads the ISDB executable.
status	Describes the state of the ISDB subsystem. Execute this command to quickly determine whether the IDSB has started, stopped, or is recovering. You can also verify the state of a download or upload operation.
padcfg	Displays X.25 PAD global configuration information
padportcfg	Displays X.25 PAD port configuration information.
pad	Displays X.25 PAD global statistics.
padport	Displays X.25 PAD port statistics.
padports	Displays X.25 PAD port statistics for all ports.
portcfg	Displays ISDB port configuration information.

(continued)

Table E-1. ISDB Subcommands *(continued)*

Subcommand	Description
port	Displays ISDB port statistics.
ports	Displays ISDB port statistics for all ports.
scc	Displays ISDB channel statistics.
info	Displays ISDB resource information.

isdb status

Describes the state of the ISDB subsystem, and includes the following statistics. Execute this command to quickly determine whether the IDSB has started, stopped, or is recovering. You can also verify the state of a download or upload operation.

Connector	Connector 1	ISDB resides in the top slot of the ARN.
	Connector 2	ISDB resides in the bottom slot of the ARN.
Connector State	started	The GAME subsystem is initialized, or either the **isdb start** or **isdb reset** command is issued.
	stopped	The **isdb start**, **isdb stop**, or **isdb reset** command is issued.
	recover	Connector State changes from *started* to *recover* when any of the following occurs: • The ISDB does not answer polls for one minute. • The ISDB performs a warm start and communicates this to the GAME ISDB subsystem. • The ISDB faults and is able to communicate the fault to the GAME ISDB subsystem.

Poll Gate State	up	The Connector State is *started*, and the ISDB successfully answers polls.
	down	The connector state is *stopped* or *recover*, or the ISDB was reset when the GAME ISDB subsystem initialized.
	init	The connector state is *started* or *recover*, and an ISDB whoami message is received. A connector up message is then sent to the ISDB. If the ISDB acknowledges this message, the Poll Gate State changes to *up*, and polls are sent to the ISDB.
Transfer in Progress	none	Neither a file transfer nor a flash burn is occurring.
	transfer	A download or upload is occurring.
	burn	A successful download has occurred, and the flash is being updated with this new image.
Transfer Bytes		If Transfer in Progress shows *transfer*, then this value is the number of bytes of the file transfer that has been completed.
Transfer Direction	none	No download or upload in progress.
	up	Upload in progress.
	down	Download in progress.
Burn Time		The number of seconds into a flash burn. Valid only when Transfer in Progress is *burn*.
Recover Time		The number of seconds that Connector State has been *recover.*
Sequence		The sequence number of the current poll message that is sent to the ISDB image to see if it is alive. Polls are sent only when Connector State is *started*.
Limit		The last acknowledged Sequence + the Poll Increment - 1. If the Sequence is greater than this number, the Connector State changes from *started* to *recover.*
Auto Restart	on	The ISDB subsystem restarts the ISDB when it determines that the ISDB has failed.
	off	The ISDB subsystem does not restart the ISDB when it determines that the ISDB has failed.

Auto ULD	on	The ISDB subsystem uploads the ISDB DRAM contents when it detects an ISDB failure.
	off	The ISDB subsystem does not upload the ISDB DRAM contents when it detects an ISDB failure.
HW Command Trace	on	Debug information is logged during when certain hardware commands are issued to the ISDB.
	off	Debug information is not logged.
DownUP Trace	on	Debug information is logged during download or upload operations.
	off	Debug information is not logged.
Seconds Per Poll		The interval between polls sent to the ISDB.
Poll Increment		Equals 60 divided by the value for Seconds Per Poll.
Ctrl GH MIB GH TI GH DownUP GH Driver GH Poll GH		These are gate handles or task IDs of the GAME ISDB subsystem. The non-zero values of these parameters are meaningful only to Bay Networks Engineering. If any of these parameters remains equal to zero after the ISDB initializes, an error has occurred.

Sample Display - isdb status

```
Connector          1   Connector State        started
  Ctrl GH     c00001aa   Poll Gate State             up   Auto Restart      on
  MIB GH      c000209b   Transfer In Progress      none   Auto Uld         off
  TI GH       c0002099   Transfer Bytes               0   HW Command Trace off
  DownUp GH   c000209a   Transfer Direction        none   DownUp Trace     off
  Driver GH   c0002093   Burn Time                    0   Poll Increment    12
  Poll GH     c00020aa   Recover Time                 0
  Sequence          15   Limit                       26   Seconds Per Poll   5
```

isdb padcfg

Displays the following X.25 PAD global configuration information:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2:ISDB resides in the bottom slot of the ARN.
Local X.121	Specifies the X.121 address assigned to this interface. The X.25 network service provider supplies the X.121 address.
DNIC	A Data Network Identification Code (DNIC) is an address the router uses to reach a host residing on a different packet-switched network. It is the data equivalent of a telephone number with country code and area code, typically a 4 digit number; the first 3 digits specify a country, and the fourth specifies a PDN within that country.
LCN Low	Specifies the lowest logical channel number that the router has assigned for bidirectional logical channels.
LCN High	Specifies the highest logical channel number that the router has assigned for bidirectional logical channels.
Subaddress Length	The length of the subaddress from 0 to 8. A subaddress is the address for a particular application or program on the network.

Sample Display - isdb padcfg

```
State                       enabled    Slot                          1
  Connector                       1
  Local X.121          311050800444    DNIC
  LCN Low                         1    LCN High                     16
  SubAddress Length               2
```

isdb padportcfg

Displays the following X.25 PAD port configuration information:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2:ISDB resides in the bottom slot of the ARN.
Subaddress	The subaddress portion of an X.121 address that is used by an application, and is transparent to the network. The subaddress length must be less than or equal to the value that was set for the Global X.25 PAD Subaddress Length parameter.
Subaddress Length	Length of the port subaddress ranging from 1 to 8.
Escape	When the PAD receives this character, it changes from receiving and transmitting data to its command state. In its command state the PAD awaits commands from the character terminal. Options: 0 | 1 | 32 to 126 0 to disables the feature. There is no Escape character. 1 designates DLE to be the Escape character. 32 to 126 are user-defined characters.
Echo	Determines whether the DTE has its output sent back to it from the PAD, where it would appear on either the terminal screen or as output to a printer. An echo may be generated from the PAD or from the host. Options: 0 No Echo | 1 Echo | 2 Only Echo in Command Mode
Forward	Specifies keyboard characters that instruct the PAD to transmit data. The PAD buffers data it receives from the character terminal until it receives a data forwarding character. Then it assembles the data in X.25 format and transmits it. Options are: 0 No Data Forwarding Characters 1 Alphanumeric Characters 2 CR 4 ESC BELL ENQ ACK 8 DEL CAN DC2 16 ETX EOT 18 CR EOT ETX 64 Col 0 and 1 of IA5 except 2, 4, 8,16, 32 126 Options 2 + 4 + 8 + 16 + 32 + 64

Idle	The amount of time that the X.25 PAD can be idle before it sends any data that is in its character buffer. A value of 0 disables this parameter, and the PAD sends data based on the value in the Data Forwarding Character parameter above. The Idle parameter ranges from 0 to 255, in units of 0.05 seconds (a value of 10 is half a second).
Device	If the PAD has an intelligent terminal attached (such as a PC transmitting data directly from its hard disk), the PAD may receive data faster than it can process and forward. This parameter enables the use of flow control that sends a character to the intelligent terminal indicating that it should stop sending data (XON), or that it can resume sending data when the congestion has cleared (XOFF). You can use flow control in both command mode and data transfer, or just in data transfer. Options: 0 No XON/XOFF | 1 XON/XOFF | 2 XON/XOFF in Command and Data Transfer
Signals	Service signals are messages sent from the PAD to the DTE in response to external events such as the X.25 call being either cleared or reset. This parameter determines the format of PAD service signals. Options are 0, 1, 4, 5 0 instructs the PAD to send no service signals. 1 sends service signals other than the prompt in standard form. 4 sends prompt only in standard form. 5 sends service signals and prompt in standard form.
Break	Defines how the host to which the PAD connects indicates a problem. An example of a problem is receipt of a long, continuing data stream that may indicate that the terminal is stuck in a loop, or in constant transmit mode. Options are 0, 1, 2, 4, 5, 8, 16, 21 0 indicates no action on receipt of a break message. 1 instructs the PAD to send an interrupt message to the host. 2 instructs the PAD to send a reset message to the host. 4 instructs the PAD to send an indication of the break message to the DTE. 8 instructs the PAD to escape from data transfer state; The PAD awaits a command. 16 instructs the PAD to discard output to the DTE. 21 enables options 1, 4, and 16.

Discard	Determines whether data will be delivered to the DTE in the normal manner or be discarded. 0 delivers data in the normal manner. 1 discards data.
CRpad	Specifies the number of padding characters to be inserted in a data stream to the DTE after a carriage return. A value of 0 in this parameter turns this feature off. Options: 0 to 255
Folding	Specifies the number of characters per line that the PAD transmits without inserting form effectors (carriage return, form feed, or line feed). Options: 0 to 255
Speed	Binary speed of the start-stop mode DTE. This is a read only parameter.
Flow	Allows the DTE rather than the PAD to control the rate at which it sends data by using XON and XOFF characters. Options: 0 NO XON/XOFF disables flow control. 1 XON/XOFF enables flow control
LFinsert	Allows you to control the insertion of a linefeed. Options: 0 to 7, except 3 0 disables the feature. 1 inserts a linefeed after a carriage return in the data stream to the DTE. inserts a linefeed after a carriage return in the data stream from the DTE. 4 inserts a linefeed after a carriage return in the echo stream to the DTE. 5 enables options 1 and 4. 6 enables options 2 and 4. 7 enables options 1, 2, and 4.
LFpad	Specifies the number of padding characters to be inserted in a data stream to the DTE after a linefeed. A value of 0 in this parameter turns this feature off. Options: 0 to 255
Edit	Allows the character terminal to edit characters that are in a buffer of the PAD awaiting transmission. Options: 0 = No Edit in Data Transfer 1 = Edit in Data Transfer

Cdelete	When the PAD detects the ASCII value you specify in this parameter, it deletes the immediately preceding character. The default value, 127, is the [DEL] character. Options: 0 to 127
Ldelete	When the PAD detects the ASCII value you specify in this parameter, it deletes the immediately preceding line, which is the entire contents of the buffer if you use a carriage return for the line forwarding character. The default value of 24 is the [Cancel] character, which you generate by typing [Control + X] at the DTE keyboard. Options: 0 to 127
Ldisplay	This parameter allows the complete contents of the PAD buffer to be displayed on a new line on the character terminal. You generate the default value, 18, by typing [Control + R] at the DTE keyboard. Options: 0 to 127
Esignals	Specifies how the PAD edits service signals. The Service Signals parameter must be set to one of the transmit options for this parameter to have meaning. Options: 0, 1, 2, 8, 32 to 126 0 disables the feature. 1 edits PAD service signals for printing terminals. 2 edits PAD service signals for display terminals. 8 and 32 to 126 edit PAD service signals using the character that you specify in this range.
Mask	When the Echo parameter is on, this parameter allows you to limit the kinds of characters to be echoed. Options: 0, 1, 2, 4, 8, 16, 32, 64, 128 0 NO ECHO MASK means that all characters are echoed. 1 NO ECHO OF CR means that carriage returns are not echoed. 2 NO ECHO OF LF means that linefeeds are not echoed. 4 NO ECHO OF VT HT FF means that those keys are not echoed. 8 NO ECHO OF BEL BS means that those keys are not echoed. 16 NO ECHO OF ESC ENQ means that those keys are not echoed. 32 NO ECHO OF ACK NAK STX SOH EOT ETB ETX means that those keys are not echoed. 64 NO ECHO OF EDIT CHARACTERS means that the characters set in the Character Delete, Line Delete and Line Display parameters are not echoed. 128 NO ECHO DEL, COL 0&1 NOT LISTED means that other characters in columns 0 and 1 of IA5 and DEL are not echoed.

Parity	Determines how the PAD treats parity. Options: 0, 1, 2, 3 0 No Parity Check Generation disables parity check, and the eighth bit is not used. 1 Parity Generation enables parity check 2 Parity Check Generation enables parity check and parity generation. 3 No Parity/Transparent bit disable parity, and the eighth bit is used to generate the extended character set
Page	Allows the PAD to send from 0 to 255 lines of data (a page) at a time to the terminal. The PAD then stops transmission until it receives any character from the terminal, at which point it sends another page of data. Options: 0 to 255 lines of data
User Data Length	Length of the User Data field which ranges from 0 to 16 bytes.
User Data	Specifies the user data field content inserted in the X.25 call packet.
Raw Facilities Length	Length of the Raw Facilities field which ranges from 0 to 63 bytes.
Raw Facilities	Allows you to add support for facilities. To generate a call with support for a facility, you must enter the appropriate facility code in this parameter. You must also set the associated parameter at the X.25 packet level to ON.
Reverse Charge	When you enable this parameter you authorize the DCE to transmit to the DTE incoming calls that request reverse charging.
Throughput Class Neg	Permits the PAD to negotiate the throughput rate for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed rate or reply with a counterproposal.
Packet Size Neg	Permits the PAD to negotiate the packet size for virtual circuits on this interface on a per-call basis. The receiving DTE may accept the proposed size or reply with a counterproposal.
Window Size Neg	Permits the negotiation of window size. When you enable this parameter, the router can negotiate the window size on a per-call basis. The receiving DTE may accept the proposed size or reply with a counterproposal.
Interval Timer	The amount of time that the X.25 PAD waits before forwarding the current contents of its character buffer. The interval timer ranges from 0 to 999, in units where 1 equals 10 milliseconds.

Sample Display - isdb padportcfg

```
State                        enabled    Slot                              1
  Connector                        1    Port                              1
  Sub Address                     01    Sub Address Length                2
  Escape      1   Echo          1   Forward      2   Idle          0
  Device      2   Signals       5   Break        4   Discard       0
  CRpad       0   Folding      80   Speed       14   Flow          1
  LFinsert    4   LFpad         0   Edit         1   Cdelete     127
  Ldelete    24   Ldisplay     18   Esignals     2   Mask          0
  Parity      3   Page          0
  User Data Length         0    UserData  00000000000000000000000000000000
  Raw Facilities Length    0    Raw Facilities
  00000000000000000000000000000000000000000000000000000000000000000000
  00000000000000000000000000000000000000000000000000000000000000000000
  Reverse Charge            0000    Thoughput Class Neg          0000
  Packet Size Neg       42070700    Window Size Neg          43020200
  Interval Timer               0
```

isdb pad

Displays the following X.25 PAD global statistics:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2:ISDB resides in the bottom slot of the ARN.
Total Connection Count	Total number of connections made to the X.25 Pad
Received RR Count	Number of receiver ready packets received by the PAD.
Transmitted RR Count	Number of receiver ready packets transmitted by the PAD.
Received RNR Count	Number of receiver not ready packets received by the PAD.
Transmitted RNR Count	Number of receiver not ready packets transmitted by the PAD.
Received Restart Count	Number of restart packets received by the PAD.
Transmitted Restart Cnt	Number of restart packets transmitted by the PAD.

Sample Display - isdb pad

```
State                        enabled    Slot                              1
  Connector                          1    Total Connection Count          0
  Received RR Count                  0    Transmitted RR Count            0
  Received RNR Count                 0    Transmitted RNR Count           0
  Received Restart Count             1    Transmitted Restart Cnt         1
```

isdb padport

Displays X.25 PAD port statistics, including the following:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2: ISDB resides in the bottom slot of the ARN.
Port	Displays the port number, which ranges from 1 to 8.
Remote X.121	X.121 address of the remote X.25 Pad that is currently connected. If there is no connection, remote X.121 will not be set.
LCN	Logical channel number for the current connection.
Call Duration	The duration of the call in seconds.
Receive Octets	Number of octets received on this PAD port.
Transmit Octets	Number of octets transmitted on this PAD port.
Receive Packets	Number of packets received on this PAD port.
Transmit Packets	Number of packets transmitted on this PAD port.
Receive RRs	Number of receiver ready packets received on this PAD port.
Transmit RRs	Number of receiver ready packets transmitted on this PAD port.
Receive RNRs	Number of receiver not ready packets received on this PAD port.
Transmit RNRs	Number of receiver not ready packets transmitted on this PAD port.
Receive Clears	Number of call clear packets received on this PAD port.
Transmit Clears	Number of call clear packets transmitted on this PAD port.
Receive Resets	Number of reset packets received on this PAD port.
Transmit Resets	Number of reset packets transmitted on this PAD port.

Receive Calls	Number of call request packets received on this PAD port.
Transmit Calls	Number of call request packets transmitted on this PAD port.
Connects	Number of connections made to this PAD port.
Disconnects	Number of disconnects made to this PAD port.
Last Cause	Last cause code on this PAD port.
Last Diagnostic	Last diagnostic code on this PAD port.
Transmit RRs	Number of receiver ready packets transmitted on this PAD port.

Sample Display - isdb padport

```
State                      enabled    Slot                          1
  Connector                        1    Port                        1
  Remote X.121                          LCN                         0
  Call Duration                    0
  Receive Octets                   0    Transmit Octets             3
  Receive Packets                  0    Transmit Packets            0
  Receive RRs                      0    Transmit RRs                0
  Receive RNRs                     0    Transmit RNRs               0
  Receive Clears                   0    Transmit Clears             0
  Receive Resets                   0    Transmit Resets             0
  Receive Calls                    0    Transmit Calls              0
  Connects                         0    Disconnects                 0
  Last Cause                       0    Last Diagnostic             0
```

isdb padports

Displays the following X.25 statistics for all ports:

Port	Number of the port that this display represents.
State	The state of the port. The port can be enabled, disabled, connected, down, or unused.
Receive Packets	Number of packets received on this port.
Transmit Packets	Number of packets transmitted on this port.

Remote X.121	X.121 address of the remote X.25 PAD that is presently connected.
LCN	Logical channel number for the current connection.

Sample Display - isdb padports

```
Port     State   Receive Packets  Transmit Packets    Remote X.121     LCN
   1      enabled               0                 0                        0
   2         down               0                 0                        0
   3         down               0                 0                        0
   4         down               0                 0                        0
   5         down               0                 0                        0
   6         down               0                 0                        0
   7         down               0                 0                        0
   8         down               0                 0                        0
```

isdb portcfg

Displays the following ISDB port configuration information:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2:ISDB resides in the bottom slot of the ARN.
Port	Displays the port number, which ranges from 1 to 8.
Baud Rate	Determines the baud rate configured on this port. Options: 300 | 1200 | 2400 | 4800 | 9600 | 19200
Parity	Determines the type of parity configured on this port. Options: None | Odd | Even
Data Bits	Determines the number of data bits per unit of data for this port. Options: Five | Six | Seven | Eight
Stop Bits	Displays the bit that will indicate the end of a data segment for this port. Options: S1Bit | S15Bit | S2Bit

Receive Xoff	Enables or disables flow control from the terminal to the ISDB asynchronous port. Options: Enable | Disable
Transmit Xoff	Enables or disables flow control from the ISDB to the terminal on the ISDB asynchronous port. Options: Enable | Disable
Cts	DCE configuration of the clear to send signal for this ISDB port. Options: Always On | Always Off | Follow Flow Control | Follow RTS
Dsr	DCE configuration of the data set ready signal, which indicates that the port is ready to send data. Options: Always On | Always Off | Follow DTR | Toggle on Disconnect
Dcd	The DCD is a signal from the DCE to the DTE indicating that it is receiving a carrier signal from the DCE at the other remote end of the connection. Options: Always On | Always Off | Follow DTR | Follow VC
Dtr Notify	Determines whether an action is taken when the DTR signal changes. A loss of the DTR signal results in the loss of communication between the ISDB and the terminal. Options: Enable | Disable
Receive Xoff Notify	Determines whether the PAD notifies the ISDB when a flow control change occurs. Options: Enable | Disable
Inactivity Timeout	Async port is reset after the inactivity period. Inactivity period is measured in seconds. Range of inactivity timer is 0 to 255.
Receive Queue	Size of the asynchronous port receive queue. Range is 8 to 8192. This parameter should only be modified for debug purposes.
Transmit Queue	Size of the asynchronous port transmit queue. Range is 8 to 8192. This parameter should only be modified for debug purposes.
Prompt	Character string to be used for asynchronous port prompt.
Parser	Default command parser for asynchronous port. Options: Menu 1 | Test 2 | X25Pad 3
State	Current state of the asynchronous port on the ISDB. The ISDB port can be enabled, disabled or unused.
Slot	Slot that the ISDB resides on.

Sample Display - isdb portcfg

```
State                        enabled    Slot                          1
  Connector                        1      Port                        1
  Baud Rate                     9600      Cts                  always on
  Parity                        none      Dsr                  always on
  Data Bits                        8      Dcd                  always on
  Stop Bits                        1      Dtr Notify             enabled
  Receive Xoff                enabled      Receive Xoff Notify    enabled
  Transmit Xoff              disabled      Inactivity Timeout           0
  Receive Queue                 8192      Transmit Queue            8192
  Prompt            [               ]      Parser                  x25pad
```

isdb port

Displays the following ISDB port statistics:

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2: ISDB resides in the bottom slot of the ARN.
Port	Displays the port number, which ranges from 1 to 8.
Receive Octets	Number of octets received on this asynchronous port.
Transmit Octets	Number of octets transmitted on this asynchronous port.
Receive Lacks	Number of lack of resources encountered while receiving on this asynchronous port. A receive lack of resources occurs when the ISDB receive queue is full.
Transmit Lacks	Number of lack of resources encountered when transmitting on this asynchronous port. A transmit lack of resource occurs when the ISDB transmit queue is full.
Receive Waits	Number of times a wait condition happened while trying to send data between the ISDB receive queue and its application the X.25 PAD. The receive queue is ready to send data, but the application may not be ready to receive it.

Transmit Waits	Number of times a wait condition happened while sending data between the application, X.25 PAD, and the ISDB transmit queue. Instead of generating a lack of resource condition while sending to a full transmit queue, the application decides to “wait” for conditions to change.
Breaks Detected	Number of breaks detected on this asynchronous port.
Parity Errors	Number of parity errors detected on this asynchronous port.
Framing Errors	Number of framing errors detected on this asynchronous port.
Overrun Errors	Number of overrun errors detected on this asynchronous port. An overrun error occurs when we try to receive data and the ISDB driver FIFO queue is already full.
Cts State	Current state of clear to send signal. Signal is on or off.
Cts Transitions	Number of times the clear to send signal has changed state.
Rts State	Current state of request to send signal. Signal is on or off.
Rts Transitions	Number of times the request to send signal has changed state.
Dsr State	Current state of data set ready. Signal is on or off.
Dsr Transitions	Number of times the data set ready signal has changed state.
Dcd State	Current state of data carrier detect. Signal is on or off.
Dcd Transitions	Number of times the clear to send signal has changed state.
Dtr State	Current state of data terminal ready. Signal is on or off.
Dtr Transitions	Number of times the data terminal ready signal has changed state.
Receive Interrupts	Number of receive interrupts on this asynchronous port.
Transmit Interrupts	Number of transmit interrupts on this port.
Modem Interrupts	Number of modem interrupts on this port.
Special Characters	Number of times XON/XOFF changes are detected.
Receive State	Hardware chip is enabled or disabled for receiving.
Transmit State	Hardware chip is enabled or disabled for transmitting.
Receive Flow State	ISDB either suspends or resumes output to the remote terminal.
Transmit Flow State	Remote terminal either suspends or resumes output to the ISDB.

Sample Display - isdb port

```
State                        enabled    Slot                            1
  Connector                        1      Port                          1
  Receive Octets                   0      Transmit Octets               3
  Receive Lacks                    0      Transmit Lacks                0
  Receive Waits                    0      Transmit Waits                0
  Breaks Detected                  0      Parity Errors                 0
  Framing Errors                   0      Overrun Errors                0
  Cts State                       on      Cts Transitions               1
  Rts State                       on      Rts Transitions               1
  Dsr State                       on      Dsr Transitions               1
  Dcd State                       on      Dcd Transitions               1
  Dtr State                       on      Dtr Transitions               1
  Receive Interrupts               0      Transmit Interrupts           6
  Modem Interrupts                 0      Special Characters            0
  Receive  State             enabled      Receive  Flow State      normal
  Transmit State             enabled      Transmit Flow State      normal
```

isdb ports

Displays the following ISDB port statistics for all ISDB asynchronous ports:

Port	Displays the port number, ranging from 1 to 8.
State	Current state of the asynchronous port on the ISDB. The asynchronous port can be in the following states: up, down, or init.
Receive Octets	Number of octets received on this asynchronous port
Transmit Octets	Number of octets transmitted on this asynchronous port.
Signal States	Displays the current state of the following five signals: clear to send, request to send, data set ready, data carrier detect, and data terminal ready. The signal is enabled if it is in capital letters and is disabled if it is in lowercase letters.

Sample Display - isdb ports

```
Port    State    Receive Octets  Transmit Octets         Signal States
   1      enabled               0                3    CTS  RTS  DSR  DCD  DTR
   2      enabled               0                0    CTS  rts  DSR  DCD  dtr
   3      enabled               0                0    CTS  rts  DSR  DCD  dtr
   4      enabled               0                0    CTS  rts  DSR  DCD  dtr
   5      enabled               0                0    CTS  rts  DSR  DCD  dtr
   6      enabled               0                0    CTS  rts  DSR  DCD  dtr
   7      enabled               0                0    CTS  rts  DSR  DCD  dtr
   8      enabled               0                0    CTS  rts  DSR  DCD  dtr
```

idsb scc

Displays the following ISDB channel statistics. These statistics correspond to the traffic that is taking place between the ISDB and the router across the router backplane.

State	Displays whether X.25 PAD services are enabled, disabled or not used on this interface.
Slot	Slot number that X.25 PAD services are running on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2: ISDB resides in the bottom slot of the ARN.
Rx Frames	Number of frames received by the ISDB across the backplane.
Tx Frames	Number of frames transmitted by the ISDB to the router across the backplane.
Rx Octets	Number of octets received by the ISDB across the backplane.
Tx Octets	Number of octets transmitted by the ISDB to the router across the backplane.
Rx Lacks	Number of receive frames dropped due to a lack of resources.
Tx Lacks	Number of transmit frames dropped due to a lack of resources.
Rx Datalink Msg Lacks	Number of receive datalink messages dropped due to a lack of resources. A datalink message is a message that uses LAPB as its datalink header.
Rx Management Msg Lacks	Number of receive management messages dropped due to a lack of resources. A management message is a message that is used for MIB queries.

Tx Messages	Number of messages originated by the ISDB and sent to the driver for transmission.
Rx Interrupts	Number of interrupts that have been triggered on the ISDB due to receiving frames.
Tx Interrupts	Number of interrupts that have been triggered on the ISDB due to transmitting frames.
Rx Datalink Frames	Number of frames that have been received by the ISDB that used LAPB as their datalink header.
Tx Datalink Frames	Number of frames that have been transmitted by the ISDB that used LAPB as their datalink header.
Rx Datalink Discards	Number of receive datalink frames that have been discarded because LAPB on the ISDB has not been started.
Rx Management Frames	Number of management frames that have been received by the ISDB. Management frames are sent between the router and the ISDB to resolve mib queries.
Tx Management Frames	Number of management frames that have been transmitted by the ISDB. Management frames are sent between the router and the ISDB to resolve mib queries.
Rx Unknown Frames	Number of frames received by the ISDB that are neither datalink frames nor management frames.
Tx Unknown Frames	Number of frames transmitted by the ISDB that are neither datalink frames nor management frames.
Rx Large Frames	Number of frames received by the ISDB that are larger than 261 bytes.
Rx Small Frames	Number of frames received by the ISDB that are smaller than 2 bytes.
Tx Large Messages	Number of messages that the ISDB tries to send to the driver but cannot because the composed message is larger than 261 bytes.
Tx Small Messages	Number of messages that the ISDB tries to send to the driver but cannot because the composed message is smaller than 2 bytes.
Rx Incomplete Frames	Number of frames received by the ISDB that have not been chained together correctly. Upon receipt of frames the driver does not find the first in frame and last in frame flags to be set correctly.
Tx Aborted Frames	Number of frames that have been transmitted during which the clear to send signal has been lost.
Rx Overflows	Number of times the ISDB driver FIFO (first-in-first-out) queue was full while it was trying to receive a frame.

Tx Underflows	Number of times the ISDB driver FIFO queue was empty while it was trying to transmit a frame.
Rx Bad Frames	Number of frames that the ISDB received that have the following errors. First the ISDB received a frame that contained a number of bits not exactly divisible by eight. Second the ISDB received a frame with a minimum of seven consecutive ones or third the ISDB received a frame that contained a CRC error.
Rx Runts	Number of frames that the ISDB received where the carrier detect signal was negated during frame reception.

Sample Display - isdb scc

```
State                          up    Slot                          1
  Connector                     1
  Rx Frames                    932    Tx Frames                   933
  Rx Octets                  20125    Tx Octets                 20273
  Rx Lacks                       0    Tx Lacks                      0
  Rx Datalink Msg Lacks          0
  Rx Management Msg Lacks        0    Tx Messages                 933
  Rx Interrupts                931    Tx Interrupts               933
  Rx Datalink Frames           304    Tx Datalink Frames          303
  Rx Datalink Discards           0
  Rx Management Frames         628    Tx Management Frames        630
  Rx Unknown Frames              0    Tx Unknown Frames             0
  Rx Large Frames                0    Tx Large Messages             0
  Rx Small Frames                0    Tx Small Messages             0
  Rx Incomplete Frames           0    Tx Aborted Frames             0
  Rx Overflows                   0    Tx Underflows                 0
  Rx Bad Frames                  0
  Rx Runts                       0
```

isdb info

Displays ISDB resource information, including the following:

State	State of the ISDB. The ISDB can be in the following states: up or down.
Slot	Slot that the ISDB resides on.
Connector	Connector is 1: ISDB resides in the top slot of the ARN. Connector is 2: ISDB resides in the bottom slot of the ARN.
Version	Version of the ISDB image.
Start Count	Number of times the **isdb start** command has been issued to the ISDB.
Author Unknown	If this statistic is non-zero, the ISDB has detected a non-fatal event that is unusual to the operation of the ISDB. This statistic may be used in conjunction with debug efforts to detect if a condition has occured on the ISDB.
Current Connections	Number of presently connected X.25 PAD sessions.
Total Connections	Number of connections made to the X.25 PAD during the time that the ISDB has been running. The **isdb reset** command will re-initialize the total connection count to zero.
Current CPU Idle	Number of cycles that have been run on the ISDB since the last **isdb info** command has been run. This statistic will be zero and will not be applicable when the ISDB is running in X.25 PAD mode.
Total CPU Idle	Total number of cycles that have been run on the ISDB since it has been booted up. This statistic will be zero and will not be applicable when the ISDB is running in X.25 PAD mode.
Free Memory	Current free memory that resides on the ISDB.
Largest Memory Block	Current largest memory block that resides on the ISDB.
Msg Queue Lacks	Number of times a lack of resources happened while trying write data into the message queue.
Hardware Timeouts	Number of times that a fatal error occurred on the ISDB that caused the ISDB to timeout.
Alarm Count	Number of times that a fatal error occurred on the ISDB that caused the ISDB to register an alarm.

Autovector 1 Interrupts	An autovector 1 interrupt indicates that a fatal error has happened on the ISDB.
Autovector 2 Interrupts	Number of asynchronous data transmit interrupts that have occurred on all eight ports of the ISDB.
Autovector 3 Interrupts	Number of modem interrupts that have occurred on all eight ports of the ISDB. A modem interrupt happens when DTR or RTS signals change.
Autovector 4 Interrupts	An autovector 4 interrupt indicates that a fatal error has happened on the ISDB.
Autovector 5 Interrupts	Number of data receive interrupts that have occurred on all eight ports on the ISDB.
Autovector 6 Interrupts	An autovector 6 interrupt indicates that a fatal error has happened on the ISDB.
Autovector 7 Interrupts	An autovector 7 interrupt indicates that a fatal error has happened on the ISDB.
Scc Interrupts	Number of interrupts that have occurred while the ISDB has been transmitting and receiving data on all eights of its ports.
Error Interrupts	Number of error interrupts that have occurred on the ISDB. An error interrupt indicates that a fatal error has occurred.
Bus Errors	Number of fatal bus errors that have occurred on the ISDB.
Timer 1 Interrupts	System clock interrupts. One timer 1 interrupt equals 10 ms.
Timer 2 Interrupts	Interrupt used internally for debug.
Timer 3 Interrupts	Interrupt used internally for debug.
Timer 4 Interrupts	Interrupt used internally for debug.

Sample Display - isdb info

```
isdb info -c1
  State                          up    Slot                          1
  Connector                       1    Version                     122
  Start Count                     0    Author Unknown                0
  Current Connections             0    Total Connections             0
  Current CPU Idle                0    Total CPU Idle                0
  Free Memory                332568    Largest Memory Block     332480
  Task Count                     13    Msg Queue Lacks               0
  Hardware Timeouts               0    Alarm Count                   0
  Autovector 1 Interrupts         0    Autovector 2 Interrupts       6
  Autovector 3 Interrupts         0    Autovector 4 Interrupts       0
  Autovector 5 Interrupts         0    Autovector 6 Interrupts       0
  Autovector 7 Interrupts         0    Scc Interrupts             1879
  Error Interrupts                0    Bus Errors                    0
  Timer 1 Interrupts         304975    Timer 2 Interrupts       304872
  Timer 3 Interrupts              0    Timer 4 Interrupts            0
```

X.25 PAD Cause Codes

If an X.25 PAD receives a Clear, Reset, or Restart request, it forwards the packet with cause and diagnostic code transparently. If the PAD detects an error, it generates a packet with the X.25 PAD specific cause and diagnostic code, and displays the error message on the X.25 PAD command line.

Error Condition	Cause Code
Clear Cause Codes	
DTE originated	0xx00
Number busy	0x01
Invalid facility request	0x03
Network congestion	0x05
Out of order	0x09
Code access barred	0x0B
Not obtainable	0x0D
RPE	0x11
LPE	0x13
RCA not subscribed	0x19

(continued)

Error Condition	**Cause Code** *(continued)*
Incompatible destination	0x21
FSA not subscribed	0x29
PAD originated	0x3F
Private network originated	0x80
RPOA out of order	0x15
Reset Cause Codes	
DTE originated	0x00
Out of order	0x01
RPE	0x03
LPE	0x05
Network congestion	0x07
Remote DTE operational	0x09
Network operational	0x0F
Incompatible destination	0x11
Network out of order	0x1D
PAD resetting	0x3F
Restart Cause Codes	
LPE	0x00
Network congestion	0x03
Network operational	0x07
Diagnostic Codes	
No additional information	0x00
Facility not allowed	0x40
Facility code not allowed	0x41
Facility parameter not allowed	0x42
Invalid called address	0x43
Invalid calling address	0x44
Invalid facility length	0x45
Packet too long	0x27
Packet type not compatible with facility	0x2A

(continued)

Error Condition	**Cause Code** *(continued)*
Invalid PS	0x01
Invalid PR	0x02
Invalid packet type	0x10
Invalid pkt RST_EXT state	0x11
Invalid Pkt RST_INT state	0x12
Invalid packet for XP0	0x14
Invalid packet for P2	0x15
Invalid packet for XP1	0x16
Invalid packet for XP2	0x17
Invalid packet for P5	0x18
Invalid packet for XP3	0x19
Invalid packet for d1	0x1B
Invalid packet for XP7	0x1D
Packet not allowed	0x20
Unidentifiable packet	0x21
Call on one way LCN	0x22
Invalid packet for PVC	0x23
LCN not assigned	0x24
Reject not subscribed	0x25
Packet too short	0x26
Invalid GFI	0x28
Non zero LCN	0x29
Invalid facility	0x2A
Unauthorized INTC	0x2B
Unauthorized INT	0x2C
Unauthorized REJ	0x2D
Time expired	0x30
Time expired for CAR	0x31
Time expired for CLR	0x32
Time expired for RES	0x33

(continued)

Error Condition	**Cause Code** *(continued)*
Time expired for RST	0x34
Incoming call barred	0x46
No LCN available	0x47
Call collision	0x48
Duplicate facility request	0x49
Non zero address length	0x4A
Non zero facility length	0x4B
Facility not provided	0x4C
Improper cause from DTE	0x51
Inconsistent Q-bit setting	0x53
Network-Specific Diag Info	0x80
Inacitivity timer expired	0x81
M-bit violation	0x6F
Remote network problem	0x71
Internetwork protocol problem	0x72
Internetwork link out of order	0x73
Internetwork link busy	0x74
Internetwork routing problem	0x77
Unknown called DNIC	0x7A
Unknown calling DNIC	0x61
Invalid utility length	0x65

Appendix F
IPEX Cause and Diagnostic Codes

If IPEX receives a Disconnect Request from TCP or a Disconnect Indication from Packet Layer Protocol (PLP), IPEX forwards the packet with cause and diagnostic code transparently.

If IPEX detects an error, a Clear Request packet with IPEX specific cause and diagnostic code is generated and sent to PLP. The lists of IPEX cause and diagnostic codes follows.

IPEX Originated Cause Code in Disconnect Request Packet

IPEX_X25_CAUSE_OPERATIONAL 0x09

IPEX Originated Diagnostic Codes in Clear Request Packet

IPEX Cause/Diagnostic Code	Error Condition
(0x09, 0x60)	TCP gate failed.
(0x09, 0x61)	IPEX session failed.
(0x09, 0x62)	IPEX mapping is disabled.
(0x09, 0x63)	IPEX cct is not up.

IPEX Originated Diagnostic Codes Due to TCP Error

When IPEX detects a TCP error, it maps the TCP error status code into X.25 diagnostic code by adding 0x20 to TCP error status code.

The mapping table follows:

IPEX Cause/Diagnostic Code	TCP Error	Error Condition
(0x09, 0x84)	0x64	Disconnect is per user request.
(0x09, 0x85)	0x65	Disconnect reason is unknown to TCP.
(0x09, 0x86)	0x66	Network management deleted/disabled all of TCP connection.
(0x09, 0x87)	0x67	The remote TCP disconnected.
(0x09, 0x88)	0x68	TCP panicked somewhere.
(0x09, 0x89)	0x69	IP registration failed.
(0x09, 0x8a)	0x6a	Buffer could not be allocated.
(0x09, 0x8b)	0x6b	GAME RPC call timeout with no response.
(0x09, 0x8c)	0x6c	Another connection exists with the same socket definitions.
(0x09, 0x8d)	0x6d	An unexpected disconnect of the timer gate for this connection occurred.
(0x09, 0x8e)	0x6e	TCP quit because a maximum number of retries was reached on a (re)transmit without acknowledgment from the remote TCP system.
(0x09, 0x8f)	0x6f	An unexpected disconnect of the client transmit gate for this connection occurred.
(0x09, 0x90)	0x70	An unexpected disconnect of the client receive gate for this connection occurred.
(0x09, 0x91)	0x71	The IP reassembly gate for the given interface disconnected.
(0x09, 0x92)	0x72	TCP protocol error occurred.
(0x09, 0x93)	0x73	Connection was idle for too long.
(0x09, 0x94)	0x74	Client was idle for too long.
(0x09, 0x95)	0x75	Out of Sequence SYN received.
(0x09, 0x96)	0x76	TCP function called from wrong gate.
(0x09, 0x97	0x77	Normal close.
(0x09, 0x98)	0x78	Client (Interface) Error.
(0x09, 0x99)	0x79	No response to keep alive.

X.25 Originated Cause and Diagnostic Codes Associated with Clear Request Packets

Cause Code	Diagnostic Code	Error Condition
0x09	Maintenance action. 0x7a	Self-clearing of virtual circuits out of order. P4_frozen state, T2 expired. P4_wakeup.
DTE originated 0x00	Maintenance action. 0x7a	Deregistration of PLP service user.
Local procedure error 0x13	Call setup or call clearing problem. 0x40	Local_calling state receives call request (DCE).
Local procedure error 0x13	Not applicable packet in state p1 (DTE). 0x14	Logical_channel_ready state receives CCALL, CCLR.
Local procedure error 0x13	Not applicable packet in state p2 (DCE). 0x15	Logical_channel_ready state receives CCALL, CCLR.
Local procedure error 0x13	Not applicable packet in state p3 (DTE). 0x16	P2_remote_calling state receives CALL, CCALL, CCLR, Invalid packet.
Local procedure error 0x13	Not applicable packet in state p3 (DCE). 0x16	P2_local_calling state receives CCLR, Invalid packet.
Local procedure error 0x13	Not applicable packet in state p2 (DCE). 0x15	Local_calling state receives CCLR, Invalid packet.
Local procedure error 0x13	Not applicable packet in state p4. 0x17	P4 state receives CALL, CCALL, CCLR.

(continued)

Cause Code	Diagnostic Code	Error Condition
Local procedure error 0x13	Not applicable packet in state p5. 0x18	P2_collision state receives CALL, CCLR, invalid.
Local procedure error 0x13	Not applicable packet in state p6 (DCE). 0x19	P2_remote_clearing state receives CALL, CCALL, CCLR, invalid
Local procedure error 0x13	Not applicable packet in state p7 (DTE). 0x20	P2_remote_clearing state receives CALL, CCLR, CCALL invalid
Local procedure error 0x13	Call connected dog timer expired. 0x31	P2_local_calling state watch T2 expired.
Local procedure error 0x13	Clear confirm watch dog timer 1st expired. 0x32	P2_local_clearing state T1 expired.
Local procedure error 0x13	Reset confirm watch dog timer 2nd expired. 0x33	P2_SVC_setup state T1 expired.
Local procedure error 0x13	Unidentifiable packet. 0x21 (33)	Error in PLP2
Local procedure error 0x13	Too short packet. 0x26 (38)	Error in PLP2
Local procedure error 0x13	Too long packet. 0x27 (39)	Error in PLP2
Local procedure error 0x13	Nonzero LCN. 0x29 (41)	Error in PLP2
Local procedure error 0x13	Not applicable packet in state px. 0x13 + px	Error in PLP2

(continued)

Cause Code	Diagnostic Code	Error Condition
Local procedure error 0x13	Improper cause code from DTE. 0x51 (82)	Error in PLP2
Local procedure error 0x13	Not acceptable intermediate packet length. OX40 (64)	Error in PLP2
Local procedure error 0x13	Packet not conformant with requested facility. 0x2a	Error in PLP2
Local procedure error 0x13	Nonzero address length field. 0x4a	Error in PLP2
Unknown called address 0x0d	Null 0x00	Error in PLP2
Local procedure error 0x13	Invalid called DTE address. 0x43	Error in PLP2
Local procedure error 0x13	Invalid calling DTE address. 0x44	Error in PLP2
Invalid facility request 0x03	Unknown facility code. 0x41	Error in PLP2
Local procedure error 0x13	Duplicated facility code. 0x49	Error in PLP2
Invalid facility request 0x03	Facility parameter not allowed. 0x42	Error in PLP2

(continued)

Cause Code	Diagnostic Code	Error Condition
Local procedure error 0x13	Exceeding facility length. 0x45	Error in PLP2
Access barred 0x0b	Not both way or one way incoming LC. 0x46	Error in PLP2
Access barred 0x0b	Null 0x00	Error in PLP2
Invalid facility 0x03	Not available facility service. 0x4d	Error in p1_local_restart.
Local procedure error 0x13	Facility parameter not allowed. 0x42	Negotiation Error in call request packet in p1 state.
Out of order 0x09	Call setup or clearing problem. 0x40	p2_remote_calling state timer expired.
Local procedure error 0x13	Call setup or clearing problem. 0x40	p2_local_calling state zt4 expired.

X.25 Originated Cause and Diagnostic Codes Associated with Restart Packets

Cause Code	Diagnostic Code	Error Condition
Local procedure error 0x01	Packet type invalid for r1. 0x11 (17)	Invalid event in state r1.
Local procedure error 0x01	Not applicable packet in state r2 (DCE). 0x12 (18)	Invalid event in state r2.
Local procedure error 0x01	Not applicable packet in state r3 (DTE). 0x13 (19)	Invalid event in state r3.
Local procedure error 0x01	Confirmation watchdog timer first expiration. 0x34 (52)	Local Restart state, watchdog timer expiration.
Local procedure error 0x01	Reject supported but not subscribed to. (0x21 (33)	Error in p1_local_restart.
Local procedure error 0x01	Unidentifiable packet. 0x26 (38)	Error in p1_local_restart.
Local procedure error 0x01	Too short packet. 0x26 (38)	Error in p1_local_restart.
Local procedure error 0x01	Too long packet. 0x27 (39)	Error in p1_local_restart.
Local procedure error 0x01	Nonzero LCN. 0x29 (41)	Error in p1_local_restart.
Local procedure error 0x01	Not applicable packet in state r2. 0x12 (18)	Invalid packet.

(continued)

Cause Code	Diagnostic Code	Error Condition
Network Operational 0x07	No additional information. 0x00	In P1 restart local/remote state receives Reset Ind.
DTE originated 0x00	No additional information. 0x00	In P1 DTE_DXE_wait state receives error packet or T4 expired.

X.25 Originated Cause and Diagnostic Codes Associated with Diagnostic Packets

Cause Code	Diagnostic Code	Error Condition
DTE originated 0x00	Confirmation watchdog timer second expiration. 0x34 (52)	Local restart state, watchdog timer second expiration.
DTE originated 0x00	Unidentifiable packet. 0x21 (40)	Invalid packet in p1.
DTE originated 0x00	Too short packet. 0x26 (38)	Invalid packet in p1.
DTE originated 0x00	Invalid bits 5-8 (GFI). 0x28 (40)	Invalid packet in p1.
DTE originated 0x00	Invalid LCN. 0x24 (40)	Invalid packet in p1.
DTE originated 0x00	Too long packet. 0x27 (39)	Invalid packet in p1.
DTE originated 0x00	Clear confirm watchdog timer second expired. 0x32	P2_local_clearing state. Clear confirm watchdog timer second expired.

X.25 Originated Cause and Diagnostic Codes Associated with Reset Packets

Cause Code	Diagnostic Code	Error Condition
User defined 0xxx	User defined 0xxx	Local Restart state.
Local procedure error 0x05	Confirmation watchdog timer first expiration. 0x33 (51)	1. P3_local_reset state T1 expired. 2. P4_disabled-T1 expired.
Local procedure error 0x05	Not applicable packet in state d1. 0x1b (27)	P3_flow_control_ready state received Reset Confirm.
Local procedure error 0x05	Not applicable packet in state d2 (DCE). 0x1c (28)	P3 _remote_reset state received Reset Confirm or invalid packet.
Local procedure error 0x05	Not applicable packet in state d3 (DTE). 0x1d (29)	P3_local reset state received Reset Confirm.
Local procedure error 0x05	Unidentifiable packet. 0x21 (33)	1. Error in p3_local_reset. 2. Error in P4_disabled.
Local procedure error 0x05	Reject but not subscribed to. 0x25 (37)	1. Error in p3_local_reset. 2. Error in p4_disabled.
Local procedure error 0x05	Too short packet. 0x26 (38)	1. Error in p3_local_reset. 2. Error in p4_disabled.
Local procedure error 0x05	Too long packet. 0x27 (39)	1. Error in p3_local_reset. 2. Error in p4_disabled.
Local procedure error 0x05	Nonzero LCN. 0x29 (41)	1. Error in p3_local_reset. 2. Error in p4_disabled.

(continued)

Cause Code	Diagnostic Code	Error Condition
Local procedure error 0x05	Not applicable packet in state dx (DCE). 0x1b +dx	Error in p3_local_reset.
Local procedure error 0x05	Not applicable packet in state dx (DCE). 0x1b +d?	Error in p3_local_reset.
Local procedure error 0x05	Forbidden packet on PVC. 0x23	1.Error in p3_local_reset. 2. Error in p4_disabled.
Local procedure error 0x05	Bad PS. 0x01	Error in p3_local_reset.
Local procedure error 0x05	Bad PR. 0x02	Error in p3_local_reset.
Local procedure error 0x05	Bad Q bit. 0x53	Error in p3_local_reset.
Local procedure error 0x05	Improper case code from DTE. 0x51	Error in p3_local_reset.
Local procedure error 0x05	Not applicable interrupt packet in this state. 0x2c	INTR in p5_remote_interrup state.
Local procedure error 0x05	Not applicable interrupt confirm packet in this state. 0x2b	CINTR in p5_remote_interrup state.
Not usable PVC 0x1d	Not used. 0x00	CINTR in p5_remote_interrup state.

(continued)

Cause Code	Diagnostic Code	Error Condition
Network disorder	Not used. 0x00	Error in p4_disabled bad ps, pr, q bit, cause.
Not used 0x00	Reset confirm. Watch dog second expired. 0x33	Error in p4_disabled timer. Reset confirm. Watch dog timer second expired.

Appendix G
ASCII Character Set

This is the ASCII character set and equivalent values in decimal, octal, and hexadecimal.

Nonprinting Characters

Decimal	*Octal*	*Hex*	*Character*	*Remark*
0	000	00	CTRL-@	NUL (Null prompt)
1	001	01	CTRL-A	SOH (Start of heading)
2	002	02	CTRL-B	STX (Start of text)
3	003	03	CTRL-C	ETX (End of text)
4	004	04	CTRL-D	EOT (End of transmission)
5	005	05	CTRL-E	ENQ (Enquiry)
6	006	06	CTRL-F	ACK (Acknowledge)
7	007	07	CTRL-G	BEL (Bell)
8	010	08	CTRL-H	BS (Backspace)
9	011	09	CTRL-I	HT (Horizontal tab)
10	012	0A	CTRL-J	LF (Linefeed)
11	013	0B	CTRL-K	VT (Vertical tab)
12	014	0C	CTRL-L	NP (New page) or FF (Formfeed)
13	015	0D	CTRL-M	CR (Carriage return)
14	016	0E	CTRL-N	SO (Shift out)
15	017	0F	CTRL-O	SI (Shift in)
16	020	10	CTRL-P	DLE (Data link escape)
17	021	11	CTRL-Q	DC1 (X-ON)
18	022	12	CTRL-R	DC2
19	023	13	CTRL-S	DC3 (X-OFF)
20	024	14	CTRL-T	DC4
21	025	15	CTRL-U	NAK (No acknowledge)
22	026	16	CTRL-V	SYN (Synchronous idle)
23	027	17	CTRL-W	ETB (End transmission blocks)
24	030	18	CTRL-X	CAN (Cancel)
25	031	19	CTRL-Y	EM (End of medium)
26	032	1A	CTRL-Z	SUB (Substitute)
27	033	1B	CTRL-[	ESC (Escape)
28	034	1C	CTRL-\	FS (File separator)
29	035	1D	CTRL-]	GS (Group separator)
30	036	1E	CTRL-^	RS (Record separator)
31	037	1F	CTRL-_	US (Unit separator)
127	177	7F		DEL (Delete or rubout)

Printing Characters

Decimal	*Octal*	*Hex*	*Character*	*Remark*
32	040	20		Space
33	041	21	!	Exclamation Point
34	042	22	"	Double quote
35	043	23	#	Sharp Sign
36	044	24	$	Dollar Sign
37	045	25	%	Percent Sign
38	046	26	&	Ampersand
39	047	27	'	Apostrophe
40	050	28	(	Left Parenthesis
41	051	29	)	Right Parenthesis
42	052	2A	*	Asterisk
43	053	2B	+	Plus Sign
44	054	2C	,	Comma
45	055	2D	-	Hyphen
46	056	2E	.	Period
47	057	2F	/	Slash (Virgule)
48	060	30	0	
49	061	31	1	
50	062	32	2	
51	063	33	3	
52	064	34	4	
53	065	35	5	
54	066	36	6	
55	067	37	7	
56	070	38	8	
57	071	39	9	
58	072	3A	:	Colon
59	073	3B	;	Semicolon
60	074	3C	<	Left Angle Bracket
61	075	3D	=	Equal Sign
62	076	3E	>	Right Angle Bracket
63	077	3F	?	Question Mark
64	100	40	@	"At" Sign
65	101	41	A	
66	102	42	B	
67	103	43	C	
68	104	44	D	
69	105	45	E	
70	106	46	F	
71	107	47	G	
72	110	48	H	
73	111	49	I	
74	112	4A	J	

Printing Characters (continued)

Decimal	*Octal*	*Hex*	*Character*	*Remark*
75	113	4B	K	
76	114	4C	L	
77	115	4D	M	
78	116	4E	N	
79	117	4F	O	
80	120	50	P	
81	121	51	Q	
82	122	52	R	
83	123	53	S	
84	124	54	T	
85	125	55	U	
86	126	56	V	
87	127	57	W	
88	130	58	X	
89	131	59	Y	
90	132	5A	Z	
91	133	5B	[	Left Square Bracket
92	134	5C	\	Backslash
93	135	5D	]	Right Square Bracket
94	136	5E	^	Caret
95	137	5F	_	Underscore
96	140	60	`	Back Quote
97	141	61	a	
98	142	62	b	
99	143	63	c	
100	144	64	d	
101	145	65	e	
102	146	66	f	
103	147	67	g	
104	150	68	h	
105	151	69	i	
106	152	6A	j	
107	153	6B	k	
108	154	6C	l	
109	155	6D	m	
110	156	6E	n	
111	157	6F	o	
112	160	70	p	
113	161	71	q	
114	162	72	r	
115	163	73	s	
116	164	74	t	
117	165	75	u	

Printing Characters (continued)

Decimal	*Octal*	*Hex*	*Character*	*Remark*
118	166	76	v	
119	167	77	w	
120	170	78	x	
121	171	79	y	
122	172	7A	z	
123	173	7B	{	Left Curly Brace
124	174	7C	|	Vertical Bar
125	175	7D	}	Right Curly Brace
126	176	7E	~	Tilde

Index

E

F

G

H

I

K

L

M

N

O

P

Q

R

S

T

U

V

W

X