X.25

August 2000

X.25

A REFERENCE 5

1 X.25 6

1.1 An Introduction to X.25 6

1.1.1 Call Setup 7

1.1.2 Data Links and Virtual Circuits 8

1.1.3 Point-to-Point and Point-to-Multipoint Interfaces 10

1.1.4 X.25 Addressing Schemes 10

1.1.5 X.25 Routing 13

1.2 Setup Tool Menus 15

1.3 X.25 Features 29

1.3.1 How do I Configure an X.31 Link (X.25 in the D-Channel)? 30

1.3.2 How do I Configure X.31 in the B-Channel (Case A/Case B)? 33

1.3.3 How do I Configure my X.21 Module so I can Access my X.25 Network? 37

1.3.4 How do I Configure X.25 Access for a Host on my LAN? 40

1.3.5 How do I Configure ISDN Dialup Access for an X.25 Partner? 43

1.3.6 How do I Configure X.25 Dialout Without Configuration? 46

1.3.7 How do I Route IP Traffic over X.25 with MPX25? 51

1.3.8 How do I Use the Router as a TCP-X.25 Bridge? 53

1.3.9 How do I Configure the Routing for Using an X.25 PAD? 57

1.4 X.25 Utilities 61

1.4.1 X.25 PAD 61

1.5 X.25 Diagnostic Code 86

1.5.1 Clear Causes 87

1.5.2 Diagnostic Causes 88

1.5.3	Restart Causes	93
1.5.4	Reset Causes	93
1.6	**X.25 Syslog Messages**	**94**
1.7	**X.21 Communications Module**	**101**
1.7.1	CM-X21Adapter	102

REFERENCE

1 X.25

We start this chapter with an introduction to X.25 to give you an overview of the X.25 protocol.

Then we will cover all of the menus and settings you will see while using Setup Tool to configure the X.25 protocol on your router.

Following that are several brief examples for configuring the available X.25 features on your router.

Under Utilities you find the X.25 PAD and a reference of X.25 relevant SNMP shell commands.

Lastly, hardware specifications for the CM-X21 communications module are covered.

1.1 An Introduction to X.25

Packet Switching

X.25 is commonly referred to as being a Connection-Oriented, Reliable, Packet-Switched network. These catchwords describe some of the important characteristics of X.25 networks which are explained briefly here to help you better understand X.25.

Connection-Oriented

X.25 is connection-oriented which means that when data needs to be transferred, a connection must first be established. Communications parameters such as window size and packet sizes are negotiated when the connection is first established.

Multiple connections between two end points can be achieved by multiplexing logical connections onto data links. Different logical connections (or “Virtual Circuits”) are identified by assigning a virtual circuit number for each logical connection. This number is included in the header of each X.25 data-packet.

Packet Switched

X.25 is a packet switched network which means that user data is divided up and placed into X.25 packets of a predefined maximum length (usually 128 bytes). Each packet is assigned a virtual circuit number and is transmitted over the data link.

With a 128 byte packet size, user data must normally be fragmented into many packets. The X.25 frame format defines a special field, M-bit (M for more), which is used to allow fragmented packets to be reunited at the receiving station.

Reliable X.25 connections are reliable connections which means that all data packets sent are confirmed by the receiving station. This is achieved using either special packets (Receiver Ready packets) or by having the receiving station “piggy-back” confirmation messages onto other packets. Also, in X.25, packets always arrive in sequence at the receiving station.

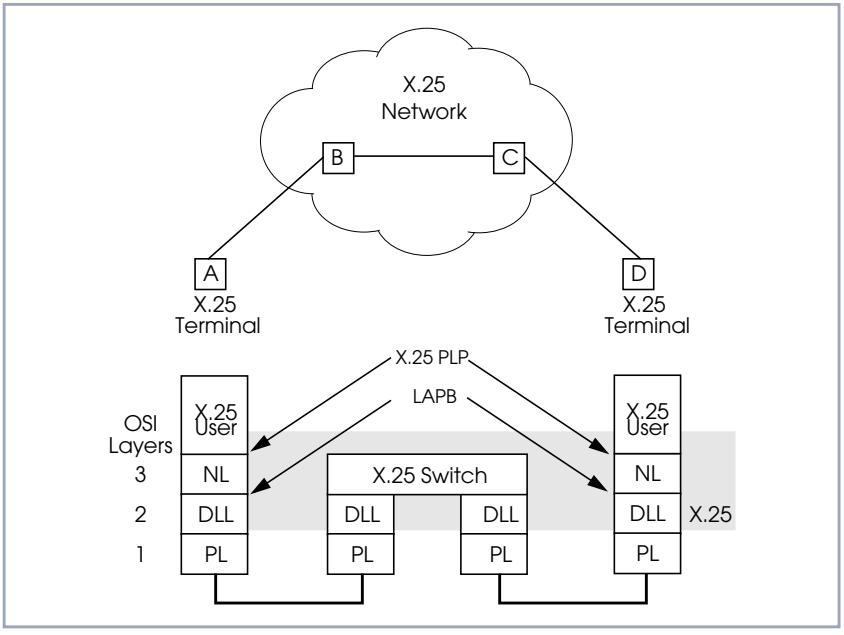


Figure A-1: X.25 Network Scenario

1.1.1 Call Setup

Before data can be exchanged among X.25 partners an X.25 call must be set-up. An X.25 CALL packet is sent by the calling partner to the called partner who can accept/refuse the connection. Once a call has been established, a unique

Virtual Circuit (VC) number is assigned to the connection which is used throughout the duration of the connection.

If an X.25 network lies between two end stations, the VC numbers used by each end station may be different. For example, if hosts A and D in the diagram above are communicating, the VC number used for the A–B connection may be different from the one used for C–D.

After the call is initially setup all packets exchanged between the partners follow a fixed path defined during the initial call setup phase. Once the connection is no longer needed, it can be disconnected, and later reused by the same or different communications partners.

1.1.2 Data Links and Virtual Circuits

Data Link A data link is a direct, point-to-point, connection between two X.25 stations. This physical connection can be via an ISDN B or D channel, an X.21 connection, or an ethernet connection (LLC2). On a point-to-multipoint physical medium (i.e. ethernet), multiple point-to-point data links are multiplexed over the same physical interface.

Virtual Channel A virtual channel (VC) is a Logical Connection that is multiplexed onto a data link. This means that multiple X.25 connections can exist over the same physical medium, simultaneously.

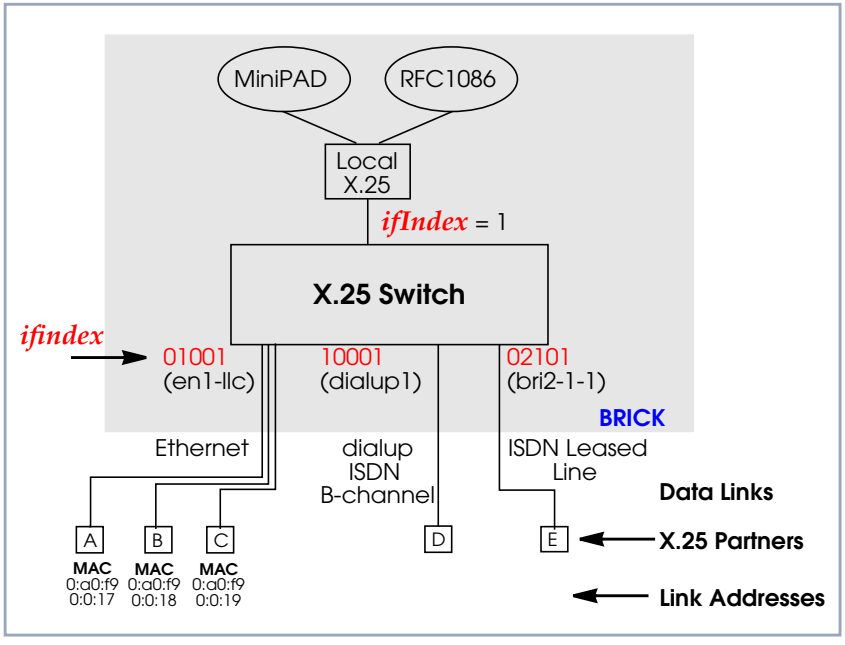


Figure A-2: Data Links and Virtual Channels

In X.25, each data link uses one interface. The characteristics of each data link are defined in ***SETUP TOOL*** ➧ ***X.25*** ➧ ***LINK CONFIGURATION*** menu or in the **x25LinkPresetTable**. These characteristics, such as window and packet size, can be changed by editing these links.

To display a list of all available interfaces known to the system you can use the `ifstat` command.

There are three types of interfaces available on the BinTec router; the first of which is always available. The other interface types will depend on your particular configuration.

- Local Interface
  The local interface is a special interface and is always available on the BinTec router.

- Point-to-Point Interface
  This interface is referred to as being Point-to-Point because the two end stations of the connection are determined solely by the **IfIndex**. These interfaces include: ISDN dialup, ISDN leased lines, and X.31 interfaces.

- Point-to-Multipoint Interface
  The Point-to-Multipoint interface is referred to as such because the **IfIndex** does not completely specify an end-to-end connection. Additional information is required (such as the end stations MAC address) when creating these interfaces to provide an end-to-end link. These interfaces include: LAN connections over LLC2.

1.1.3 Point-to-Point and Point-to-Multipoint Interfaces

One of the characteristics of an X.25 interface that must be defined is the encapsulation it uses.

When creating X.25 Point-to-Point interfaces in the ***WAN PARTNER*** ➧ **Add** menu in Setup Tool or in the **biboPPPTable**, you can specify either **x25** or **x25_ppp** encapsulation. By default, x25 encapsulation is used. This allows an interface to be used solely for X.25 traffic. Using x25_ppp allows PPP and X.25 traffic to be routed over the same interface (i.e. multiplexing IP datagrams and X.25 packets simultaneously over the same ISDN channel).

For X.25 Point-to-Multipoint interfaces such as ethernet, you must use the enx*-llc interfaces, since not all ethernet interfaces on the BinTec router support X.25 (i.e. enx, enx-snap, and enx-nov802.3)

1.1.4 X.25 Addressing Schemes

As in TCP/IP networks, each host in an X.25 network must be uniquely identified before communication between them is possible. However, there is one important difference. In TCP/IP, each data packet contains the source/destination addresses and is routed individually (packets can take different paths). In X.25, addresses are only used during call setup and all subsequent data packets follow the same exact route.

In X.25, three different address formats, can be used to identify X.25 hosts:

- Standard X.25 Addressing (X.121)
- Extended X.25 Addressing
- NSAP (Network Service Access Point) Addresses (X.213)

Standard X.25 Addressing (X.121)

The X.121 addressing scheme is the oldest and most common format used in X.25 networks. X.121 addresses consist of up to 15 digits and may begin with a leading escape digit (normally a 0). If the leading 0 is present, it is assumed to be an international address, otherwise a national address is assumed. For example (Note that spaces in the example addresses are used only for added readability):

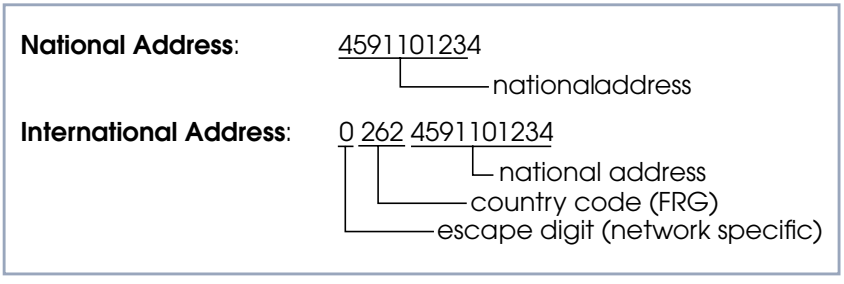


Figure A-3: Standard X.25 Addressing (X.121)

When working within ISDN, E.164 addresses are used instead of X.121 addresses. E.164 describes the numbering plan of the ISDN network and the commonly known telephone numbering system consisting of country code, area code, and subscriber number. To address other ISDN devices, an international ISDN number (according to E.164) is used which is similar to a national X.121

address. An additional zero following the escape code specifies an ISDN address for internetworking. For example:

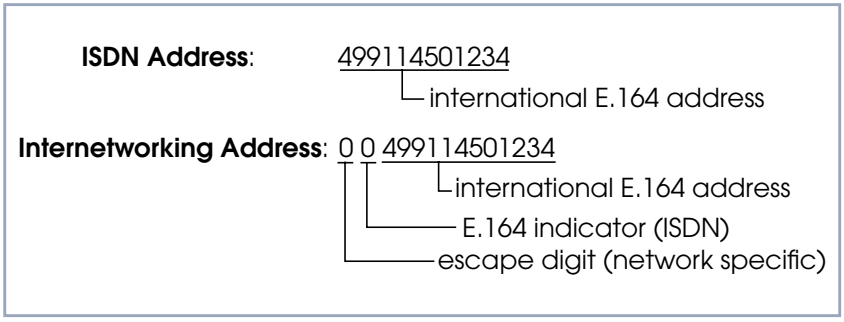


Figure A-4: E.164 Addressing within ISDN

Extended X.25 Addressing

The extended addressing format provides a standardized way for distinguishing different types of addresses in X.25. However, many public networks do not support this addressing format (The BinTec router supports extended addresses and differentiates between standard and extended addresses using a leading @ in the ~Addr field).

When the call is setup, a special bit (the A bit) in the call packet is used to define whether the addresses used are standard or extended. When the A bit is set, an extended address is used which consists of up to 255 digits (Most implementations are currently using less than 42 digits). The first two digits have special meanings and specify the Type of Address (TOA) and Numbering Plan Identification (NPI) respectively.

Sequence	Digits	TOA and NPI Digits
First Digits	0	Network dependent number
	1	International number
	2	National number
Second Digits	1	E.164 ISDN numbering plan
	3	X.121 numbering plan

Table A-1: Extended X.25 Addressing

For example, the following addresses are characterized according to their TOA and NPI digits (Spaces in the example addresses are used only for added readability).

Addresses	Digits
A national X.121 address	@2 3 4591101234
An international X.121 address	@2 3 4591101234
National E.164 address	@2 1 9114501234
International E.164 address	@1 1 49 9114501234

NSAP Addresses (X.213)

An alternative to the standard and extended formats is the NSAP (Network Service Access Point) address format. The NSAP format is defined in X.213. Only a few public networks support this format.

The NSAP format is complex. For our purposes it should be sufficient to say that NSAP addresses consist of up to 40 hexadecimal characters.

Two types of NSAP addresses also exist, OSI conform (indicated by a leading X) and Non-OSI conformant (indicated by a leading N).

Some example NSAP addresses are as follows:

Addresses	Digits
OSI compatible address	X 37 26245911012340 4711 abc
Non-OSI compatible address	N 0123456789abcdef

NSAPS can be used, instead of or in addition to, the other address formats.

1.1.5 X.25 Routing

To give you an overview of X.25 routing we use the **x25RouteTable** of the MIB, which shows X.25 routing systematically. To configure routes via the Setup Tool, you must enter the menu ***X.25*** ➧ ***ROUTING*** ➧ ***ADD*** as described in the following chapter.

The routing of X.25 packets is accomplished via a routing table similar to the **ipRouteTable**. The BinTec router uses entries in the **x25RouteTable** to determine which link to route X.25 calls it receives. Routing decisions can be made based on the source link and/or different parameters found in the call packet.

The routing table for our example switch (see section A, chapter 1.1.2, page 8) might look as follows:

	SrcIfIndex	SrcLinkAddr	DstAddr	DstIfIndex	DstLinkAddr
00	en1-llc	0:a0:f9:0:0:17		dialup1	
01	dialup1			en1-llc	0:a0:f9:0:0:17
02	en1-llc	0:a0:f9:0:0:18		bri2-1-1	
03	bri2-1-1			en1-llc	0:a0:f9:0:0:18
04	en1-llc	0:a0:f9:0:0:19	[0-4]*	dialup1	
05	en1-llc	0:a0:f9:0:0:19	[5-9]*	bri2-1-1	

Table A-2: Example Switch Routing Table

Here, the first two entries route all calls between partners A and D. The third and fourth entries provide routes for all calls between partners B and E. The last two entries specify routes for calls originating from partner C. Any calls to an X.25 destination address beginning with 0, 1, 2, 3, or 4 are routed to D. All calls beginning with 5, 6, 7, 8, or 9, originating from C, are routed to E.

Calls with extended addresses are not routed since no routing entry for calls with a leading “@” is present. Therefore, such calls are refused.

Since some calls may match more than one route in the table, a metric can be used to prioritize routes. A route with the lowest metric value always has higher priority.

1.2 Setup Tool Menus

After entering `setup` from the shell prompt Setup Tool's Main Menu is displayed as below. Depending on your hardware setup and software configuration your router's menu may differ slightly.

```
BinTec router Setup Tool                          BinTec Communications AG
                                                                  MyRouter

Licenses                    System
Slot1:              CM-BNC/TP, Ethernet
Slot2:              CM-2XBRI, ISDN S0, Unit 0
                    CM-2XBRI, ISDN S0, Unit 1
Slot3:              CM-1BRI, ISDN S0

WAN Partner
IP          IPX          X.25

Configuration Management
Monitoring and Debugging
EXIT

Press <Ctrl-n>, <Ctrl-p> to scroll through menu items, <Return> to
enter
```

➤ Go to ***X.25.***
This is the point where our exploration of Setup Tool begins.
The X.25 menu contains several submenus used to configure the X.25 protocol on the router.

```
BinTec router Setup Tool                          BinTec Communications AG
[X.25]: X.25 Configuration                                        MyRouter



    Static Settings
    Link Configuration
    Routing
    Multiprotocol over X.25

                EXIT


Press <Ctrl-n>, <Ctrl-p> to scroll through menu items, <Return> to
enter
```

Field	Meaning
Static Settings	contains the router's X.25 address
Link Configuration	lists all X.25-compatible interfaces on the router, and is used to configure them respectively
Routing	contains the router's X.25 routing table.
Multiprotocol over X.25	is used to configure the Multiprotocol Routing over X.25 (MPX25) feature.

TABLE A-3: X.25 CONFIGURATION

Static Settings

➤ Go to ***STATIC SETTINGS.***
The X.25 Static Settings menu contains the router's local X.25 address.

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][STATIC]: X.25 Static Settings                        MyRouter

                Local X.25 Address

                SAVE                    CANCEL

Press <Ctrl-n>, <Ctrl-p> to scroll through menu items, <Return> to
enter
```

Field	Meaning
Local X.25 Address	The router's official X.25 address. Setting this variable is only required if the router is not directly connected to an official X.25 data network. When connected directly, the router ascertains its X.25 address automatically. The X.25 address must be set here for sites implementing private X.25 networks, or when X.25 in the B-channel is used.

Table A-4: ***X.25*** ➧ ***STATIC SETTINGS***

Link Configuration

➤ Go to ***LINK CONFIGURATION.***

This menu displays a list of all interfaces that support the X.25 protocol. The number of available interfaces listed here is a combination of hardware (which modules are installed) and software interfaces (configured WAN partners).

– Dialup interfaces
  Entries for each X.25-compatible WAN partner configured on the system.
– Hardware interfaces
  Depending on which slot the X.21 module is installed in (1 through 3 on a BRICK-XM, 1 through 6 on a BRICK-XL2), the system creates an initial link using xi1 through xi3 (xi6).
– X.31 interfaces
  If you are receiving X.31 services from your ISDN provider an X.31 link is also present. X.31 links have the format:
  `x31d-<`*slot number*`>-<`*unit number*`>-<`*TEI*`>`

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][LINK]: X.25 Link Configuration                       MyRouter


    Select Link to Configure

    x31d2-0-1
    en1-llc (create new configuration)


DELETE CONFIGURATION         EXIT


Press <Ctrl-n>, <Ctrl-p> to scroll, <Space> tag/untag DELETE, <Return>
to edit
```

- Before an X.25-compatible interface can be used, its link characteristics must first be set.
- To edit an X.25 link mark the entry and then press **Enter**.
- To remove an X.25 link, tag the entry for deletion (spacebar) and select **DELETE CONFIGURATION.**

Configure the X.25 link

- Select ***EDIT.***
  This menu is used to configure the basic characteristics of the X.25 link.

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][LINK][EDIT]: Change X.25 Link Configuration          MyRouter

    Link                          en1-llc
    L3 Mode                       dte
    L3 Packet Size                default: 128     max: 128
    L3 Window Size                default: 2       max: 7
    Windowsize/Packetsize Neg.    when necessary (default)

    Lowest Two-Way-Channel (LTC) 1
    Highest Two-Way-Channel (HTC)2

    Partner MAC Address (LLC)

    Layer 2 Behavior              disconnect after timeout
    Disconnect Timeout            1000

            SAVE                      CANCEL


Use <Space> to select
```

Field	Meaning
Link	This is the name of the link your are editing and cannot be changed here
L3 Mode	This defines the mode the router operates in at Layer 3 of the X.25 protocol stack. Set to DCE if the router must provide clocking information or DTE if provided by the remote side of link
L3 Window Size / Packet Size	Defines the *default* and *maximum* values for Packet size (128, …, 4096 bytes) and Window size (2 through 127)
Windowsize/Packetsize Neg.	Decides whether window/packetsize negotiation is made for this X.25 link. The possible values are *never*, *always* and *when necessary*, where *when necessary* is the default value. The value *never* means no negotiation. When a call arrives that does not correspond to the default size, the call is cleared. *Always* means negotiations are always made and when *when necessary* is selected, there are only negotiations, when the requested values differ from the default values.
Lowest Two-Way-Channel (LTC)	LTC and HTC must be set to reflect the number of Virtual Channel(s) you have arranged for from your X.25 network provider.
Highest Two-Way-Channel (HTC)	Defines the highest number that can be assigned to a Virtual Channel.
Partner MAC Address (LLC)	Used when configuring a link for a partner on the LAN and specifies the host's MAC or hardware address.
Layer 2 Behaviour	Defines whether (and if so, when) the link should be disconnected when no virtual channels are active.
Disconnect Timeout	Time in milliseconds to wait before closing the link once the line becomes inactive.

Table A-5: ***X.25*** ➧ ***LINK CONFIGURATION*** ➧ ***EDIT***

Caution!

When establishing X.25 connections via ISDN, it may occur that unintentional permanent connections are established in combination with certain settings.

It is important to note that if **L2IdleTimer** is set to *-1* in the **X25LinkPresetTable**, or in the Setup Tool field **Layer 2 Behaviour** to *always active*, the BinTec router will continue to establish layer 2 with the effect of permanent B-channel connections and increased costs.

➤ Thus, if you want to prevent this, make sure to give the **L2IdleTimer** variable a value other than *-1* or to a setting other than *always active* in Setup Tool's **Layer 2 Behaviour** field.

Configure X.25 Routes

■ Go to ***ROUTING.***
This menu displays the X.25 routing table. X.25 routes are used for routing traffic over X.25 interfaces. Routes can be added, removed, or changed here.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][ROUTING]: X.25 Route Table                              MyRouter


Source Link  Dest. Link   Dest. Link Addr. Dest X.25 Addr.  Metric



        ADD              DELETE           EXIT
```

To edit an X.25 route, mark the entry and then press **Return**.

➤ Select ***ADD.***
X.25 routes configured with Setup Tool are based on two factors:

– Source link
Link X.25 call_packet first arrived on.

– Dest. X.25 Address
  The address the packet is addressed to.

You must define the destination link where the X.25 packets will be routed by specifying these two parameters. Standard wildcard characters can also be used in the Destination Address parameter.

Example	Meaning
{123}45	Either 12345 or 45
[68]*	Any # starting with 6 or 8
[^5]*	Any # not starting with 5
624*	All #s starting with 624

Table A-6: Examples for Wildcard Usage

Since some calls may match more than one route in the table, a metric can be used to prioritize routes. A route with the lowest metric value always has higher priority.

When your destination link is a multipoint interface, you additionally have to adjust the Destination Link Address (LLC).

Also note that there are different X.25 addressing standards, and depending on where the X.25 partner is calling from, the actual X.25 address received by the router may differ.

```
BinTec router                                  BinTec Communications AG
[X.25][ROUTING][EDIT]: Add or Change X.25 Routes                MyRouter



    Source Link                 any
    Destination Link            local

Destination X.25 Address        45*

Metric                          0

            SAVE                    CANCEL

Use <Space> to select
```

Multiprotocol Routing over X.25

➤ Go to ***MULTIPROTOCOL OVER X.25.***
This menu lists the Multiprotocol Routing over X.25, or MPX25, interfaces configured on the system. MPX25 allows the router to route IP, IPX, and Bridge, traffic over X.25 links. Each MPX25 interface defines an X.25 link to route one or more protocols over.

The underlying X.25 subsystem must first be configured before any MPX25 interface can be configured here. See the menus:

- ***X.25*** ➧ ***STATIC SETTINGS***
- ***X.25*** ➧ ***LINK CONFIGURATION***
- ***X.25*** ➧ ***ROUTING***

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][MPR]: Multiprotocol over X.25                            MyRouter


    Interface Name           Destination X.25 Address Encapsulation


        ADD              DELETE           EXIT
```

➤ Select ***ADD.***
Use this menu to add or change MPX25 interfaces.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][MPR][ADD]: Add or change X.25 MPR                          MyRouter


    Partner Name                 mpxpartner1

    Encapsulation                ip_rfc877
    X.25 Destination Address     49911555


Advanced Settings>

IP>
IPX>

                SAVE                CANCEL

Enter string, max length = 25 chars
```

Field	Meaning
Partner Name	Enter a unique name to identify this MPX25 partner
Encapsulation	Here you select the type of encapsulation/protocol to use. Note that the remote MPX25 partner must be configured to use the same encapsulation. When selecting *ip_rfc877* or *ip*, you must define the IP settings in the IP Submenu (see below). When selecting *mpr*, you can enter IP and IPX settings in the respective submenus (see below). When you define the settings for both submenus, both will be routed, but you can also decide to configure just one of the protocols or none of it. The Bridge functionality is always available, when mpr is selected and needs no configuration. When selecting *ipx*, you must define the IPX settings in the IP menu.
X.25 Destination Address	The X.25 address for this partner. There must be an appropriate X.25 route for this address in the X.25 routing table. The special “{“ and “}“ characters can be used to define an optional string of digits to use when matching incoming X.25 calls. For outgoing calls to this partner, the digits between these characters are used. *{00}4991155* matches both *004991155* and *4991155* for incoming calls, outgoing calls are placed using *004991155*.

Table A-7: ***X.25*** ➧ ***MULTIPROTOCOL OVER X.25*** ➧ ***ADD***

Protocol			Encapsulation
IP	IPX	Bridge	
X			ip_rfc877
X			ip
X	X	X	mpr
	X		ipx

Table A-8: Encapsulation

Configuring IP Settings

➤ Go to ***IP.***
This is where you configure the IP settings for this remote MPX25 partner and is only available if the IP protocol or *mpr* has been enabled.

The settings used in this menu are the same as those used in the ***WAN PARTNER ➧ ADD ➧ IP*** menu but only apply to this MPX25 partner.

Configuring IPX Settings

➤ Go to ***IPX .***
This is where you configure the IP settings for this remote MPX25 partner and is only available if the IP protocol or *mpr* has been enabled.

The settings used in this menu are the same as those used in the ***WAN PARTNER ➧ ADD ➧ IPX X.25*** menu but only apply to this MPX25 partner.

➤ Go to ***X.25 ➧ MULTIPROTOCOL OVER X.25 ➧ ADD ➧ ADVANCED SETTINGS.***
This menu can be used to configure advanced features.

The settings used in this menu are a subset of those used in the ***WAN PARTNER ➧ ADD ➧ ADVANCED SETTINGS*** menu but only apply to this MPX25 partner.

Monitoring the Router's Operational Status

➤ Go to ***MONITORING AND DEBUGGING.***
This menu consists of several submenus which allow you to monitor the router's operational status (and debug problems) in different ways.

```
BinTec router Setup Tool                          BinTec Communications AG
[MONITOR]: Monitoring and Debugging                                MyRouter


                          ISDN Monitor
                          ISDN Credits
                          X.25 Monitor
                          Interfaces
                          Messages
                          TCP/IP
                          OSPF

                          EXIT
```

Field	Meaning
ISDN Monitor	lets you track incoming and outgoing ISDN calls.
ISDN Credits	lets you track credits based accounting
X.25 Monitor	lets you track incoming and outgoing X.25 calls
Interfaces	lets you monitor traffic by interface
Messages	displays system messages generated by the router's system logging and accounting mechanisms
TCP/IP	menu lets you monitor IP traffic by protocol
OSPF	menu lets you monitor IP traffic by protocol

Table A-9: ***MONITORING AND DEBUGGING***

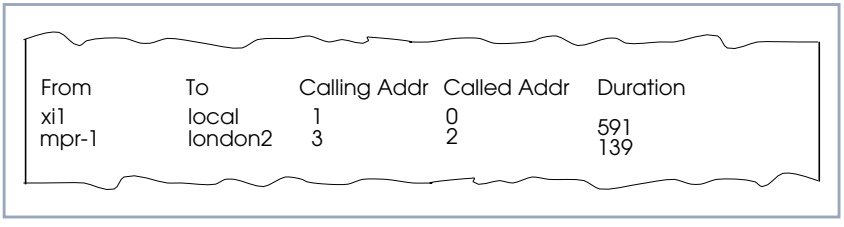
➤ Go to ***X.25 MONITOR.***

The X.25 Monitor menu initially display all active X.25 connections. These calls include leased and dialup connections made through X.25 public networks or over ISDN.

As when using the ISDN Monitor, the menu commands (c, h, d, and s) listed at the bottom of the screen list different statistics relating to X.25 calls.

```
BinTec router Setup Tool                        BinTec Communications AG
[MONITOR][X.25 CALLS]: X.25 Monitor                              MyRouter

From        To      Calling Addr     Called Addr      Duration

xi3         local   1       0        0                591




EXIT

(c)alls(h)istory(d)etails(s)tatistics
```

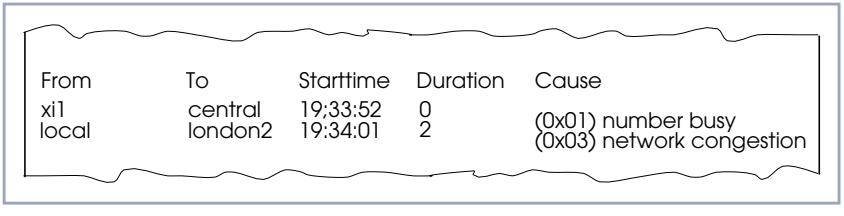
The **(c)alls** listing shows currently established X.25 connections.



From	To	Calling Addr	Called Addr	Duration
xi1	local	1	0	591
mpr-1	london2	3	2	139

Figure A-5: (C)alls Listing

The **(h)istory** listing shows a list of completed X.25 connections (both incoming and outgoing) since the last system reboot.



From	To	Starttime	Duration	Cause
xi1	central	19;33:52	0	(0x01) number busy
local	london2	19:34:01	2	(0x03) network congestion

Figure A-6: (H)istory Listing

For completed calls, you can display additional information about the call. Select a call from the list, then enter d to see a detailed listing.

The **(d)etails** listing shows specific information about completed calls.

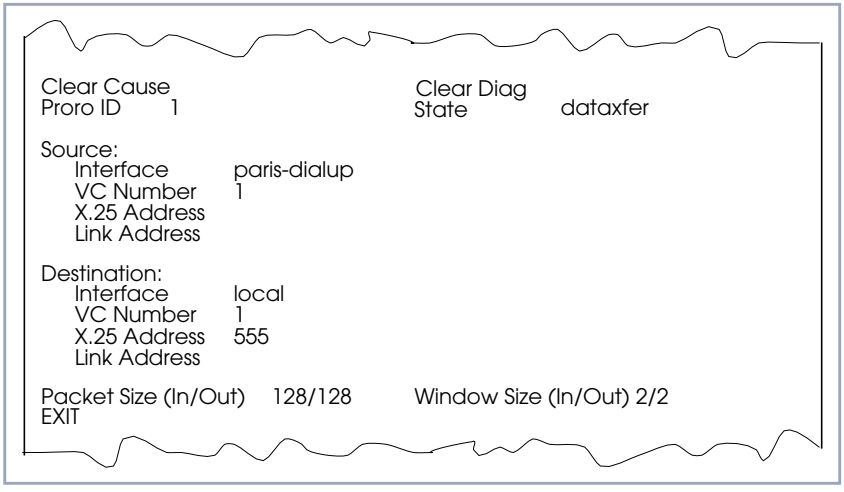


Figure A-7: (D)etails Listing

The **(s)tatistics** listing shows transfer activity for established X.25 calls.

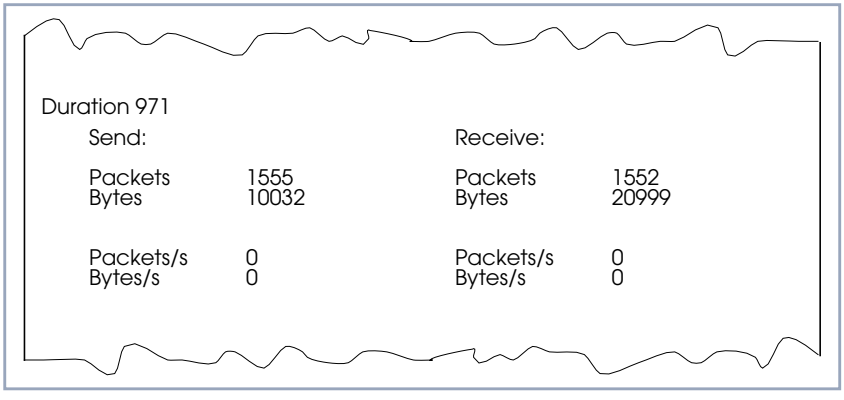


Figure A-8: (S)tatistics Listing

1.3 X.25 Features

The following pages describe configuring some of the most common X.25 features on the router such as:

How do I configure an X.31 link (X.25 in the D-channel)?

How do I route IP traffic over X.25 with MPX25?

How do I configure X.31 in the B-channel (Case A/Case B)?

How do I configure my X.21 module so I can access my X.25 network?

How do I configure X.25 access for a host on my LAN?

How do I configure ISDN dialup access for an X.25 partner?

How do I configure X.25 dialout without configuration?

How do I use the router as a TCP-X.25 bridge?

How do I configure the routing for using an X.25 PAD?

Special Note: The X.25 Local Interface

In X.25 routing the router decides where to forward X.25 calls based on the configured X.25 routes. An X.25 route can lead to a point-to-multipoint interface such as an ethernet, or a point-to-point interface such as a dialup ISDN or X.25 network partner. Another option is the router's special "local" interface.

This local interface is an internal virtual interface. Here, the X.25 packet is given to one of the router's software processes depending on contents (user data field) of the X.25 packet. The respective software process may need to reroute the call in which case the packet is passed back to the lower level routing in-

stance. For example, when routing IP traffic over X.25 links ("Configure a New MPX Partner", page 52).

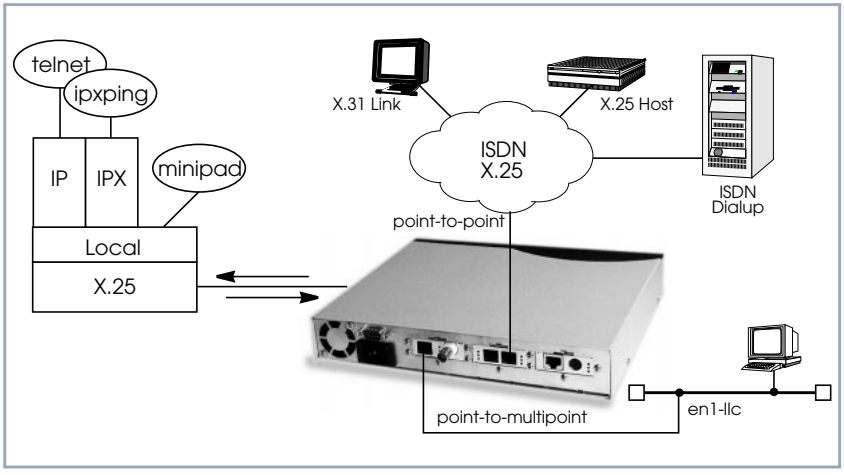


Figure A-9: Local Interface

1.3.1 How do I Configure an X.31 Link (X.25 in the D-Channel)?

X.31 is a supplementary service offered by your ISDN provider which allows X.25 packets to be transmitted over an ISDN D-channel. This section describes configuring the X.31 data link that can be used by hosts on the LAN to connect to stations on the public X.25 network.

Before you begin

Before you start, verify the following information from your ISDN carrier.

- The TEI value assigned to this interface.
- The Window and Packet size to use for Layer 3.
- The router's X.25 address.
- The ISDN telephone number for this subscriber outlet.

Verify License

➤ Verify in the ***LICENSES*** menu that your X.25 license is valid. You should find "X25 (valid)"

Configure the X.31 Link

➤ Go to ***X.25*** ➧ ***LINK CONFIGURATION***.

If the router is connected to the ISDN subscriber outlet you're receiving the X.31 service on, you should see an X.31 link in this menu, otherwise connect the cabling and reboot the system. When autodetected properly this link has the form:

`x31d`*<Module Slot>-<ISDN Unit>-<TEI Value>*

➤ Verify the detected TEI value is correct then mark the link and press **Return** to define the characteristics of this data link.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][LINK][ADD]: X.25 Link Configuration                      MyRouter


    Link                              x31d2-0-1
    L3 Mode                           dte
    L3 Packet Size                    default:128      max:128
    L3 Window Size                    default:2        max:7
    Windowsize/Packetsize Neg.        when necessary (default)

    Lowest Two-Way-Channel (LTC)      1
    Highest Two-Way-Channel (HTC)     2

    L2 Window Size                    2
    Layer 2 Behavior                  disconnect when idle

                SAVE                  CANCEL

Use <Space> to select
```

Create Route for Incoming Calls

➤ Go to ***ROUTING.***

Create a route for incoming calls. This will allow calls arriving on the X.31 link that are addressed to the router's X.25 address to be given to the local interface (see for information "Special Note: The X.25 Local Interface", page 29).

Result

PAD calls are given to the PAD subsystem, calls containing IP data go to the IP subsystem, etc.

```
BinTec router Setup Tool                          BinTec Communications AG
[X.25][Routing]: X.25 Route Table                                 MyRouter

Source link      Dest. Link   Dest. Link Addr. Dest X.25    Metric

        ADD              DELETE           EXIT
```

The following entries should be made:

Field	Value
Source link	x31d*<slot>-<unit>-<TEI>*
Destination Link	*local*
Destination X.25 Address	router's ISDN telno

Table A-10: ***X.25 ROUTE TABLE***: Incoming Calls

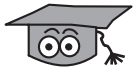
The router's ISDN telephone number used here should be in the format: *<country code><area code><local number>*

Create Route for Outgoing Calls

- Go to ***ROUTING.***
- Create an X.25 route for outgoing calls. This route says that all calls from the local interface are routed to the X.31 link (see for information "Special Note: The X.25 Local Interface", page 29).

Field	Possible Value
Source link	*local*
Destination Link	x31d*<slot>-<unit>-<TEI>*
Destination X.25 Address	leave empty

Table A-11: ***X.25 ROUTE TABLE***: Outgoing Calls



More Info

Testing the X.31 Link:

You can test the X.31 link from a remote X.25 host using a PAD (Packet Assembler Disassembler) by calling the router at its X.25 address.

In Germany, a special “Echo Port” provided by the Deutsche Telekom can be used to verify your router is accessible over X.31.

- Using minipad from the SNMP shell call the echo port with: `minipad 026245911029002.`
- You should see a login prompt. Close the X.25 call with **Control-P.**
- You can also connect to the Deutsche Telekom’s Traffic Generator service to verify data transfers are possible over the X.31 link. This can be done with: `minipad 026245911029003.`

1.3.2 How do I Configure X.31 in the B-Channel (Case A/Case B)?

The router supports X.31 in the B-channel according to Case A and B. Case A and B are alternative procedures that can be used to access the public X.25

network from an S0 interface. In both scenarios the router accesses X.25 hosts through the Packet Handler Interface (PHI) provided by the ISDN carrier.

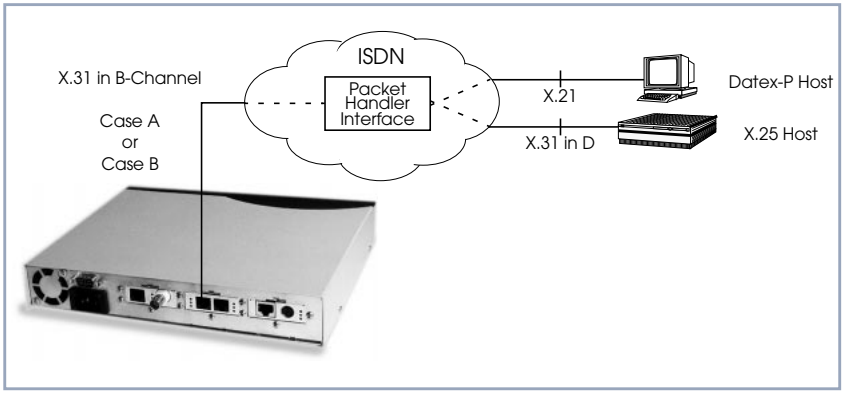


Figure A-10: X.31 in B-Channel

When using the X.31 in the B-channel on the router, a WAN Partner interface can be configured for this PHI that can be used as a virtual router for all X.25 hosts. Individual X.25 Partner interfaces are not required.

Before you begin,

you will need the following information:

- The router's ISDN telephone number.
- Case A only) The telephone number of your local PHI. Contact your local carrier for this information.

Configure WAN Partner

➤ Go to ***WAN PARTNER*** ➧ ***ADD.***

➤ Firstly, configure the PHI as a new WAN partner.

```
BinTec router Setup Tool                    BinTec Communications AG
[WAN][EDIT]: Configure WAN Partner                          MyRouter


Partner Name                 phi

Encapsulation                X.31 B-Channel
Compression                  none
Encryption                   none
Calling Line Identification  no

PPP>
Advanced Settings>
WAN Numbers>

IP>
IPX>

                SAVE                CANCEL

Enter string, max length = 25 chars
```

➤ Go to ***WAN NUMBERS***.

➤ Set your PHI's ISDN number if your carrier supports Case A. For Case B you do not need to configure the number.

Field	Possible Value
WAN Number	PHI's telephone number
Direction	*both*

Table A-12: ***WAN NUMBERS*** Configuration

Configure the Link

➤ Go to ***X.25*** ➧ ***LINK CONFIGURATION*** ➧ ***X.25 LINK CONFIGURATION.***

➤ Set the link characteristics for the partner you just created in the previous step. In most cases the following can be used. If connections can not be established, verify with you carrier.

```
BinTec router Setup Tool                          BinTec Communications AG
[X.25][Link][ADD]: X.25 Link Configuration                        MyRouter


    Link                                 x31d2-0-1
    L3 Mode                              dte
    L3 Packet Size                       default:128      max:128
    L3 Window Size                       default:2        max:7
    Windowsize/Packetsize Neg.           when necessary (default)

    Lowest Two-Way-Channel (LTC)         1
    Highest Two-Way-Channel (HTC)        2

    L2 Window Size                       2
    Layer 2 Behavior                     disconnect when idle

                SAVE                     CANCEL
```

Route for Incoming Calls

- Go to ***X.25*** ➧ ***ROUTING*** ➧ ***ADD.***
- Create a route for incoming calls. This will allow calls coming from our PHI interface that are addressed to the router's X.25 telephone number to be given to the local interface (see for information "Special Note: The X.25 Local Interface", page 29).
- Insert the **Source Link**, e.g. ***x31d2-0-1***.
- Insert the interface name for PHI, e.g. ***local*** as **Destination Link.**
- Insert the router's ISDN telephone number as **Destination X.25 Address,** e.g. ***12345***.

```
BinTec router Setup Tool                          BinTec Communications AG
[X.25][ROUTING][ADD]: X.25 Route Table                            MyRouter


Source Link                  x31d2-0-1
Destination Link             local

Destination X.25 Address     12345
Metric


            SAVE                 CANCEL
Use <Space> to select
```

Route for Outgoing Calls

- Create another route for outgoing calls. This route says that all calls from the local interface are routed to the PHI (see for information "Special Note: The X.25 Local Interface", page 29).
- Insert the **Source Link**, e.g. ***local*** .
- Insert the interface name for PHI, e.g. ***x31d2-0-1*** as **Destination Link.**
- Leave **Destination X.25 Address** empty.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][ROUTING][ADD]: X.25 Route Table                          MyRouter



Source Link                    local
Destination Link               x31d2-0-1

Destination X.25 Address
Metric


              SAVE                  CANCEL
```

1.3.3 How do I Configure my X.21 Module so I can Access my X.25 Network?

You can use the CM-X21 communications module to connect networks over a public (or private) X.25 data network.

Before you begin,

you will need the following information:

- The number of Virtual Channels, and the Window and Packet sizes assigned by your X.25 network service provider.
- Your router's official X.25 address.
- The remote partner's official X.25 address.
- Decide what types of traffic will be routed over this interface.

Configure Hardware Interface

- Go to ***CM-X.21, X.21*** to configure the hardware interface.
- In the field **Layer 1 Mode** set the value *dte*.
- In the field **Layer 2 Mode** set the value *auto*.

```
BinTec router Setup Tool                        BinTec Communications AG
[SLOT 2 X.21]: Configure X.21 Interface                          MyRouter


        Layer 1 Mode              dte
        Layer 2 Mode              auto


                SAVE                  CANCEL

Use <Space> to select
```

Edit WAN Partner

- Go to ***WAN PARTNER*** to locate the appropriate X.21 entry to configure (X.21 partner entries have the format: xi<slot number>, e. g. ***xi2***) and enable **Encapsulation** *X.25*.
- Select *xi2* and press **Return**.
- Confirm with **Save**.

Configure Data Link

- Go to ***X.25*** ➧ ***LINK CONFIGURATION***.
- Locate the X.21 entry for the WAN partner you just configured.
- Press **Enter**.
- In the field **L3 Mode** select *dte***.**
  In the field **L3 Packet Size** select <Packet assigned by network>.
  In the field **L3 Window Size** select <Win Size assigned by network>.
  In the field **Windowsize/Packetsize Neg.** select *when necessary (default).*
  In the field **Lowest Two-Way-Channel** select <LTC assigned by network>.
  In the field **Highest Two-Way-Channel** select <HTC assigned by network>.
  In the field **Layer 2 Behaviour** select *always active*.
- Confirm with **SAVE**.

Route for Incoming Calls

- Go to ***X.25*** ➧ ***ROUTING*** ➧ ***ADD*** to create a route for incoming calls. This will allow calls arriving on the X.21 link that are addressed to the router's X.25 address to be given to the local interface.
- In the field **Source Link** select your X.21 link, e. g. *xi2*.
- In the field **Destination Link** select *local*.
- In the field **Destination X.25 Address** enter the BinTec router's X.25 address. e. g. ***026245911029002***.
- Confirm with **SAVE**.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][ROUTING][ADD]: X.25 Route Table                           MyRouter



            Source Link                  xi2
            Destination Link             local

            Destination X.25 Address     026245911029002

            Metric                       0


                SAVE                CANCEL
```

Route for Outgoing Calls

- Go to ***x.25*** ➧ ***ROUTING*** ➧ ***ADD.***
- Create another route for outgoing calls. This route says that all calls from the local interface are routed over the X.21 link.
- In the field **Source Link** select *local*.
- In the field **Destination Link** select your X.21 link, e. g. *xi2*.
- Leave the field **Destination X.25 Address** empty.

More Info

- Depending on how you have set up X.25 routing, you can test your X.25 configurations using minipad. See "Minipad", page 84. In Germany, call the local echo port to verify X.25 calls can reach the X.25 network with: `minipad 45911029002.`

- Or, if you have more than 1 virtual channel available, you can also place a call to your own router's X.25 address with: minipad `your router's X.25 address`.
- The call should go out one virtual channel, and come back in on a second virtual channel and you should receive a new login prompt. This can be verified by displaying the **x25CallTable** from the shell, or in Setup Tool under ***Monitoring and Debugging*** ➧ ***X.25 Monitor.***

1.3.4 How do I Configure X.25 Access for a Host on my LAN?

LAN hosts can utilize X.25 WAN links provided by the router to connect to remote X.25 hosts. The appropriate WAN links should already be configured. This section describes how to configure the LLC link (X.25 over ethernet), the local portion of the end–to–end communication link. An LLC link is specific to a particular LAN host.

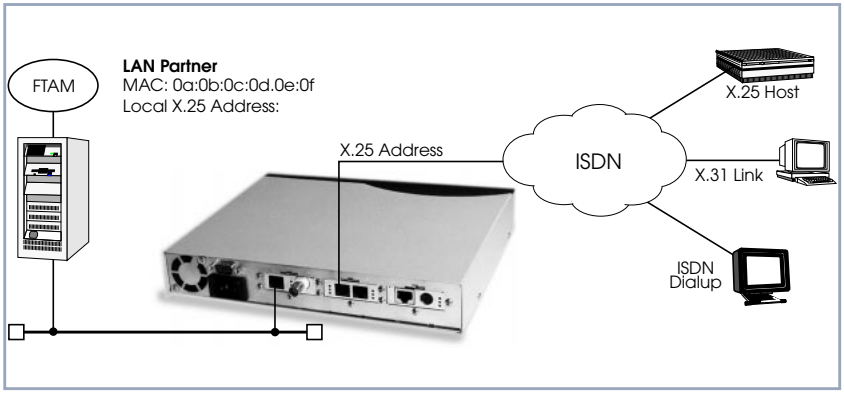


Figure A-11: Configuration of the LLC Link

Before you begin,

you will need the following information:

- The router's X.25 address.
- The LAN partner's MAC address.
- A locally assigned X.25 address for the LAN partner.

Configure X.25 Local Address

➤ Go to ***X.25*** ➧ ***STATIC SETTINGS.***

➤ First, verify the router's local X.25 address is configured, e.g. ***22***.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][STATIC]: X.25 Static Settings                            MyRouter


    Local X.25 Address       22

                  SAVE                  CANCEL

Enter string, max length = 35 chars
```

Create LAN Host Link

➤ Go to ***LINK CONFIGURATION.***

➤ Create a new link for the host on the router's LAN.

➤ Select the appropriate link template from the list depending on which LAN this host is on.
Ethernet templates have the format: en<*slot*>-llc (create new configuration).

➤ Mark the entry and press **Return** to configure the link. For ethernet links the following settings should be acceptable:

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][LINK][ADD]: X.25 Link Configuration                      MyRouter


    Link
    L3 Mode                             dce
    L3 Packet Size                      1024 bytes
    L3 Window Size                      5
    Windowsize/Packetsize Neg.          when necessary (default)

    Lowest Two-Way-Channel (LTC)        1
    Highest Two-Way-Channel (HTC)       4095
    Partner MAC Address (LLC)           <LAN Partner's MAC address>

    L2 Window Size
    Layer 2 Behavior                    disconnect when idle

                SAVE                    CANCEL


Use <Space> to select
```

An X.25 (LLC) link now exists for our LAN host. You may need to verify the Packet and Window sizes and the number of Virtual Channels for this link are compatible with the settings used on the LAN host.

Edit X.25 Routing Table

- Go to ***ROUTING*** ➧ ***ADD.***
- Create an X.25 route that says: give incoming calls from this LAN Partner that are addressed to the router's X.25 address to the special local interface (see for information "Special Note: The X.25 Local Interface", page 29).

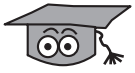
```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                          MyRouter



Source Link                 en1-llc
Destination Link            local

Destination X.25 Address    <router's X.25 address>
Metric


            SAVE                CANCEL


Use <Space> to select
```

Another Route...

➤ Create another route so that X.25 calls addressed to our LAN host find the correct link. This route says: all X.25 calls received from the local interface that are addressed to our LAN host should be routed to the host at MAC address over the ethernet link.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                          MyRouter



Source Link                          local
Destination Link                     en1-llc

Destination Link Address (LLC)       <LAN Partner's MAC address>
Destination X.25 Address             <LAN Partner's X.25 address>

Metric


             SAVE                    CANCEL

Use <Space> to select
```

More Info



Depending on how you have set up X.25 routing, you can test your X.25 configurations using minipad. See "Minipad", page 84.

1.3.5 How do I Configure ISDN Dialup Access for an X.25 Partner?

This section describes how to configure an ISDN dialup access for an X.25 partner. Here an available ISDN B-channel will be used to transfer X.25 user data with this remote host.

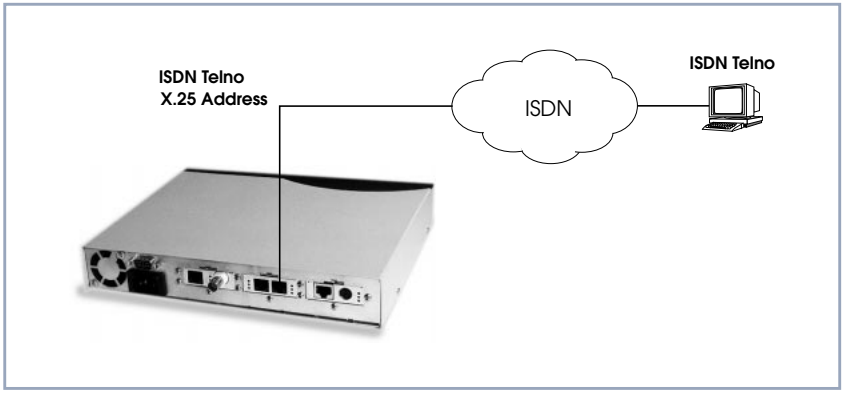


Figure A-12: ISDN Dialup Access

Before you begin,

you will need the following information:

- The router's ISDN telephone number and X.25 address.
- The remote X.25 partner's ISDN telephone number.

Configure X.25 Local Address

➤ Go to ***X.25*** ➧ ***STATIC SETTINGS.***

➤ Verify the router's X.25 address is set here.

Edit WAN Partner

➤ Go to ***WAN PARTNER*** ➧ ***ADD.***

➤ Create a new WAN partner interface and enable X.25 traffic.

```
BinTec router Setup Tool                        BinTec Communications AG
[WAN][ADD]: Configure WAN Partner                                MyRouter

Partner Name

Encapsulation                X.25
Compression                  none
Encryption                   none
Calling Line Identification  no

PPP>
Advanced Settings>
WAN Numbers>

IP>
IPX>

                 SAVE                CANCEL

Use <Space> to select
```

➤ Go to ***WAN NUMBERS*** ➧ ***ADD.***

➤ Set the partner's ISDN number as WAN Number:

```
BinTec router Setup Tool                        BinTec Communications AG
[WAN][ADD][WAN NUMBERS]: WAN Numbers ()                          MyRouter


    Number           <the X.25 partner's ISDN telephone number>
    Direction        both

    Advanced Settings>


                 SAVE                CANCEL

Use <Space> to toggle
```

If the remote site is another BinTec router verify the Incoming Call Answering settings configured there to ensure this number will be dispatched to the routing service.

Return to the previous menu and select **SAVE.**

1.3.6 How do I Configure X.25 Dialout Without Configuration?

In an X.25 network there is often a large amount of connection partners. Because the number of X.25 partners can theoretically be infinite, there is the possibility to configure dial–out to X.25 partners without configuring the partners individually.

For outgoing X. 25 calls a feature is implemented, which generates a ISDN number out of the destination X.25 address or the destination NSAP (Network Service Access Point).

Before you begin,

you will need the following information:

- The router's ISDN telephone number and X.25 address.

Configure X.25 Local Address

➤ Go to ***X.25*** ➧ ***STATIC SETTINGS.***

➤ Verify the router's X.25 address is set here (optional).

Edit WAN Partner

➤ Go to ***WAN PARTNER*** ➧ ***ADD.***

➤ Create a new WAN partner interface and enable X.25 without configuration:

```
BinTec router Setup Tool                        BinTec Communications AG
[WAN][ADD]: Configure WAN Partner                                MyRouter

Partner Name

Encapsulation                X.25 No Configuration, No Signalling
Compression                  none
Encryption                   none
Calling Line Identification  no

PPP>
Advanced Settings>
WAN Numbers>

IP>
IPX>
Bridge>

                  SAVE                  CANCEL

Use <Space> to select
```

The following steps must be configured via the SNMP shell in the MIB, because the necessary variables cannot be configured via the Setup Tool:

x25RouteTable

By adding the new WAN partner as described before, a new interface was created.

In the **x25RouteTable** now a route for this new interface must be defined.

Example:

```
inx   SrcIfIndex(*rw)   SrcLinkAddr(rw)      DstIfIndex(*rw)
      DstLinkAddr(rw)   DstLinkAddrMode(-rw) SrcAddr(rw)
      SrcNSAP(rw)       DstAddr(rw)          DstNSAP(rw)
      ProtocolId(rw)    CallUserData(rw)     RPOA(rw)
      NUI(rw)           RewritingRule(rw)    Metric(rw)
      Cug(rw)           CugOutgoing(rw)      CugBilateral(rw)

00    1                                      10008
                      rule
                      "*11499119673123"
      -1                                     -1
                      8                      0
      -1              -1                     -1
```

- For the variables **SrcAddr** and **DestAddr** you can use wildcards.
- The variable **DstLinkAddrMode** can be set to *auto* or *rule*.
  When set to auto the BinTec router can generate the destination ISDN number automatically. A requirement for this function is that the X.25 address contains the ISDN number conform to the (extended) X.121 address format.

X.121 Address Format

When the extended X.121 address format is used for the destination X.25 address contained in the X.25 call packet, the BinTec router assumes that the address starts with an “@” followed by a ”0” (TOA) and a “1” (NPI for ISDN). These three digits are deleted and the rest of the X.25 address is taken over as the destination ISDN number.

When the normal X.121 address format is used, the BinTec router looks for a “0” (escape character for ISDN) or a “9” (escape character for analog connections) as the first digit of the X.25 address, deletes this first digit and again takes the rest of the X.25 address as the destination ISDN number.

These conventions are the requirement for using the value *auto* in the variable **DstLinkAddrMode**.

In case the ISDN number is not contained in the X.25 address of the call packet, the generation of the destination ISDN number must be defined via a rule like explained in the following.

You can set the variable **DstLinkAddrMode** to rule. When done so, the variable **RewritingRule** must be assigned an integer from 0 to 999999, which is the number of the rewriting rule used. Then you must generate an entry in the **x25RewriteTable** with this rewriting rule number.

x25RewriteTable

The rule for converting the destination X.25 address respectively NSAP into an ISDN number is defined in the variable **dstLinkAddr** of the **x25RewriteTable**. This table contains table entries, which each belong to one rewriting rule number (variable **RewritingRule**). These numbers are referenced in the **x25RouteTable** described earlier.

Example:

```
inx   RewritingRule(*rw)ReverseCharging(-rw) RPOA(rw)
      NUI(rw)           SrcAddr(rw)          SrcNSAP(rw)
      DstAddr(rw)       DstNSAP(rw)          ProtocolId(rw)
      CallUserData(rw)  RespSrcAddr(rw)      RespSrcNSAP(rw)
      RespDstAddr(rw)   RespDstNSAP(rw)      RespProtocolId(rw)
      RespCallUserData(rw)Cug(rw)            CugOutgoing(rw)
      CugBilateral(rw)  DstLinkAddr(rw)

00    8                 dont_change          dont_change

                                             -1

                                             -1
                        -1                   -1
      -1                "X%%%%00.....%%%456"
```

The format of the variable **dstLinkAddr** consists of the following components:

[Layer 1/Address Type] Input Rule

- Layer 1/Address Type
  - This part of the variable **dstLinkAddr** is optional.
  - When nothing is defined “data_64k” is used as default.

Part of dstLinkAddr	Meaning
1	analog (modem)
2	V110_9600
3	MAC address
4	IP address

Table A-13: Part of **dstLinkAddr**

- Input
  - This part of the variable **dstLinkAddr** is mandatory.
  - It defines whether the input for the conversion is an X.25 address or a NSAP.

Part of dstLinkAddr	Meaning
X	X.25 address
N	NSAP

Table A-14: Part of **dstLinkAddr**

- Rule
  - This part of the variable **dstLinkAddr** is mandatory.

Part of dstLinkAddr	Meaning
.	take over one digit
%	delete one digit
*	take over the remaining digits
0-9	insert digits

Table A-15: Part of **dstLinkAddr**

Examples:

Rule	X.25 Address/NSAP	ISDN Number / MAC Address / IP Address
X%%%%%00.....%%%456	@11499119673123	009119673456
X%%%%%00.....4*	@11499119673123	0091196734123
N%%00.....4*	499119673123	0091196734123
3X%%%*	@5200a0f9000123	00:a0:f9:00:01:23
4X%%%*	@53c03635a0	192.54.53.160

Table A-16: Examples

1.3.7 How do I Route IP Traffic over X.25 with MPX25?

The router can be configured to route multiple protocols (IP, IPX, and Bridging) over X.25. This mechanism allows you to use existing X.25 links as the transport medium for routing other protocols. We call these interfaces MPX25 for short. We assume that the X.31 link has already been configured and that the appropriate routes are set. (Configuring different X.25 links are described beginning with "How do I Configure an X.31 Link (X.25 in the D-Channel)?", page 30.)

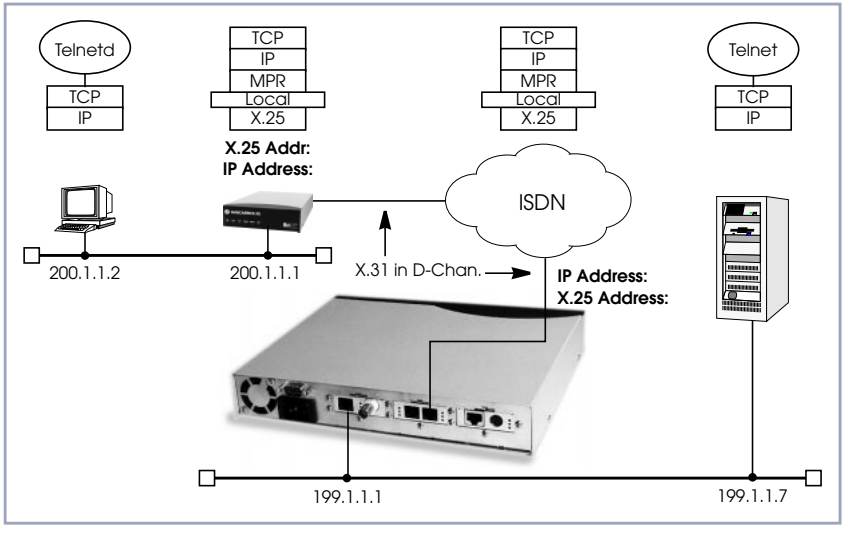


Figure A-13: Routing over X.25

Before you begin,

you will need the following information:

- The router's X.25 address.
- The remote partner's X.25 address.
- The remote partner's IP address.

Configure a New MPX Partner

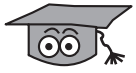
- Go to ***X.25*** ➧ ***MULTIPROTOCOL OVER X.25*** ➧ ***ADD.***
- Create a new MPX25 interface for the remote X.25 partner. Here we define the types of traffic (IP, IPX, and Bridge) to transport over this link. For our example earlier, we will only route IP.
- Select an **Encapsulation**, e.g. ***ip_rfc877***.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][MPR][ADD]:Configure X.25 MPR Partner                      MyRouter

Partner Name

Encapsulation                ip_rfc877
X.25 Destination Address     <MPX25 partner's X.25 address>



Advanced Settings>

IP>
IPX>

                  SAVE                CANCEL

Enter string, max length = 25 chars
```

Only if an X.31 in D-channel link is being used as the transport medium, the X.25 address entered here should be preceded by {*00*}. This will allow outgoing calls to be placed correctly (using: *00<country code><area code><local number>*) and incoming calls to be identified (the X.25 network delivers calls without the preceding 00).

- Edit the protocol-relevant settings for this partner. In our example, we are routing IP over X.25, so we need to set the remote partner's IP address here.
- Go to ***IP.***

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][MPR][ADD][IP]: IP Configuration ()                    MyRouter

IP Transit Network                yes

local ISDN IP Address             172.16.98.91
Partner's ISDN IP Address         <MPX25 partner's IP address>

Partner's LAN IP Address
Partner's LAN Netmask

Advanced Settings>

                SAVE                        CANCEL
```



More Info

Depending on how you have set up X.25 routing, you can test your X.25 configurations using minipad. See "Minipad", page 84.

1.3.8 How do I Use the Router as a TCP-X.25 Bridge?

The router can be used as a TCP-X.25 bridge as described in RFC 1086.

Using this mechanism, the router can be used to allow X.25 and TCP hosts to communicate by providing an end–to–end ISO–TP0 connection.

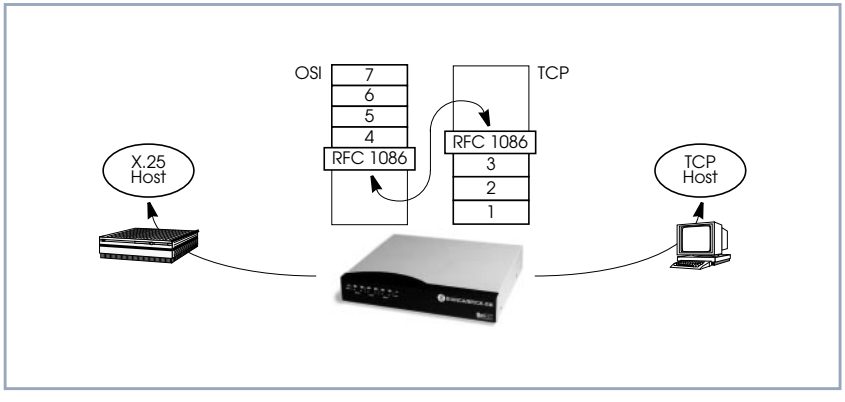


Figure A-14: The Router as a TCP–X.25 Bridge

Depending on which side initiates the connection (see the examples under "More Info", page 33) the router performs the appropriate protocol mappings as shown earlier.

Before you begin:

No special information is required to configure the router as an ISO–TP0 bridge. Please note, however, that TCP clients must support RFC 1006 which describes how to transmit TP0 packets over TCP.

Verify License

- Go to ***LICENSES.***
- Verify your X.25 license. You should see **X.25(valid)** in this menu.

Route for Outgoing Calls

- Go to ***X.25*** ➧ ***ROUTING*** ➧ ***ADD.***
- X.25 routing must be configured so that incoming and outgoing calls can be established. Using the special local interface (see "Special Note: The X.25 Local Interface", page 29) a minimum X.25 routing setup could be used as follows:

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                       MyRouter


        Source Link              local
        Destination Link         x31d2-0-1


        Destination X.25 Address

        Metric                   0


                SAVE                CANCEL

Use <Space> to select
```

Possible Values	Meaning
x31d2-0-1	Use an available X.25 compatible interface name here. By default interfaces for ISDN: x31d-*<slot #>-<unit #>-<TEI>* and X.21 modules: xi*<slot #>* are available.

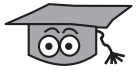
Table A-17: **Destination Link**

Route for Incoming Calls

➤ Go to ***X.25*** ➧ ***ROUTING*** ➧ ***ADD.***

➤ Create another route for incoming calls. The interface name used in the **Source Link** field should be the same interface used in the previous step.

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                          MyRouter


        Source Link              x31d2-0-1
        Destination Link         local


        Destination X.25 Address

        Metric                   0

                 SAVE                 CANCEL

Use <Space> to select
```



More Info

Two common uses for this mechanism are as follows:

- TCP Client requests connection to X.25 Server
- X.25 Client requests connection to TCP Server

For more detailed reference please refer to RFCs 1006 and 1086 respectively.

1. TCP Client requests connection to X.25 Server

Here the TCP-Client initiates a connection (as defined in RFC 1086) with the router using TCP port *146*. The router then contacts the remote X.25-Server

and transparent TP0 packets can begin to be exchanged between the two end-points.

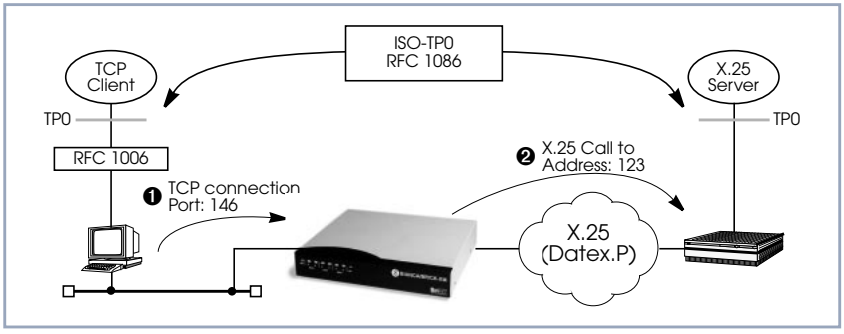


Figure A-15: TCP Client requests connection to X.25 Server

2. X.25 Client requests connection to TCP Server

Here the TCP-Server must first initiate a connection with the router at TCP port 146 where it registers its IP address and port number. It instructs the router to accept incoming calls addressed to an X.25 address (*123*) and route the connection to the registered TCP port number (*6002*) and IP address (*10.5.5.5*).

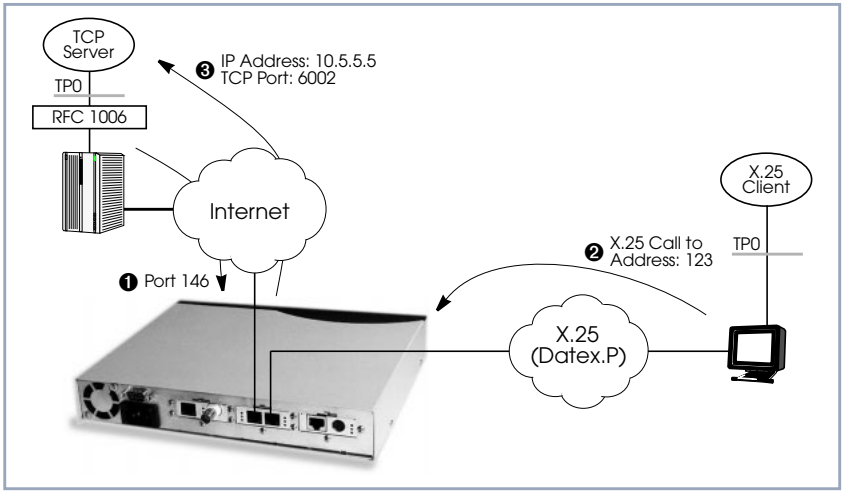


Figure A-16: X.25 Client requests connection to TCP Server

The router will listen for incoming calls to the registered address only as long as the TCP (port 146) connection between the registering host and the router exists.

1.3.9 How do I Configure the Routing for Using an X.25 PAD?

To configure the X.25 PAD utility the ISDN interface configuration must be extended and a new software interface for the X.25 PAD must be created.

Before you begin:

Before you start you will need the following information:

The X.25 PAD's unique MSN (Multiple Subscriber Number)

The remote X.25 network partner's name and possibly X.25 address

Configure Hardware Interface

➤ Go to ***CM-1BRI, ISDN S0*** ➧ ***INCOMING CALL ANSWERING*** ➧ ***ADD.***

➤ Create a new entry for incoming calls on the ISDN interface to be routed to the X.25 PAD.

```
BinTec router Setup Tool                        BinTec Communications AG
SLOT 2 ISDN BRI][INCOMING][ADD]: Incoming Call Answering      MyRouter


        Item                X.25 PAD
        Number              <X.25 PAD's MSN>
        Mode                right to left
        Username
        Bearer


                  SAVE                CANCEL

Use <Space> to select
```

Edit WAN Partner

➤ Next you must add the *X.25 PAD* as a new WAN partner.
Because the X.25 PAD's WAN partners can not be identified by their caller's numbers, you must create one WAN Partner.

- Go to ***WAN PARTNER*** ➧ ***ADD.***
- Create a new WAN partner interface:

```
BinTec router Setup Tool                        BinTec Communications AG
[WAN][ADD]: Configure WAN Partner                                MyRouter

Partner Name                 <X.25 PAD's partner name>

Encapsulation                X.25 PAD
Compression
Encryption
Calling Line Identification

PPP>
Advanced Settings>
WAN Numbers>

IP>
IPX>

                       SAVE                      CANCEL

Use <Space> to select
```

Create X.25 PAD Link

- Go to ***X.25*** ➧ ***LINK CONFIGURATION.***
- Create a new link for the X.25 PAD's partner.
- Select the appropriate link template from the list:

```
BinTec router Setup Tool                        BinTec Communications AG
[X.25][LINK]: X.25 Link Configuration                            MyRouter


Select Link to configure

<X.25 PAD's partner name> (create new configuration)


    DELETE CONFIGURATION             EXIT

Press <Ctrl-n>, <Ctrl-p> to scroll, <Space> tag/untag DELETE, <Return>
```

- Edit the items and change them, if necessary. You might e.g. want to configure special values for **L3 Packet Size**, **L3 Window Size** or **Windowsize/ Packetsize Neg**.
- In general the default values you will find in this menu do not have to be changed. But even, if you do not make any changes you must leave the

menu with **SAVE** to configure the Link Configuration for the X.25 PAD Partner.

Edit X.25 Routing Table

Depending on whether you want to define a static route from the X.25 PAD's partner interface to a single X.25 host/remote partner or multiple routes between several X.25 partners, the routing information differs.

1. Routing configuration for a static routing between two X.25 partners (the X.25 PAD's partner and a remote X.25 host/partner).

➤ Go to ***X.25*** ➧ ***ROUTING*** ➧ ***ADD.***

➤ Create an X.25 route that routes outgoing calls from the X.25 PAD to the remote X.25 network partner (X.25 host).

```
BinTec router Setup Tool                          BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                            MyRouter


    Source Link                    <X.25 PAD's partner name>
    Destination Link               <X.25 network partner name>


    Destination X.25 Address

    Metric


                  SAVE                  CANCEL

Use <Space> to select
```

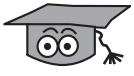
The partner used in the Destination Link must be configured before as an X.25 partner.

2. This second configuration is an example for connecting three X.25 partners, one of them the X.25 PAD's partner.

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                      MyRouter


    Source Link                  <X.25 PAD's partner name>
    Destination Link             <X.25 network partner name A>


    Destination X.25 Address     1*

    Metric


                SAVE                 CANCEL

Use <Space> to select
```

```
BinTec router Setup Tool                    BinTec Communications AG
[X.25][Routing][ADD]: X.25 Route Table                      MyRouter


    Source Link                  <X.25 PAD's partner name>
    Destination Link             <X.25 network partner name B>


    Destination X.25 Address     2*

    Metric


                SAVE                 CANCEL

Use <Space> to select
```

The partners used in the Destination Link must be configured before as X.25 partners.



More Info

For further information see "X.25 PAD", page 61.

1.4 X.25 Utilities

1.4.1 X.25 PAD

General

The PAD is a data assembly/disassembly facility used to connect character-oriented asynchronous data terminal equipment (DTE) to the packet-oriented X.25 network (Datex-P). It is the task of PAD to convert character streams coming from the DTE into data packets and resolve data packets coming from the network into individual character streams that can be displayed on the DTE. In this context the character-oriented data terminal equipment is also called start-stop mode DTE (short: DTE) and a remote X.25 host is defined as packet mode DTE.

Recommendation X.29 defines the procedures between a PAD and a packet-mode DTE or another PAD and recommendation X.28 defines the DTE interface of a start-stop mode DTE accessing the PAD.

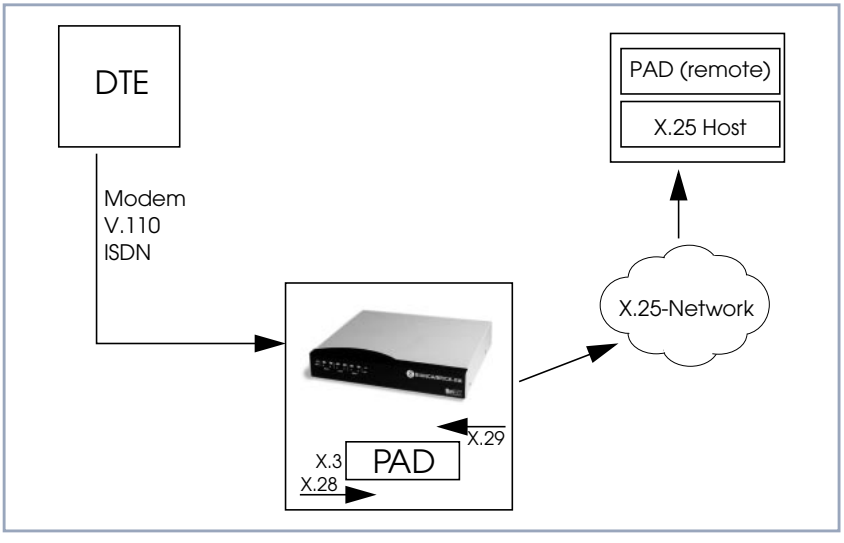


Figure A-17: X.25 PAD

The PAD program is an implementation of the X.25 PAD according to the three following ITU-T recommendations:

- X.3: Parameter definition
- X.28: User interface / commands
- X.29: PAD to PAD protocol

In each case, the standard of 1988 is implemented. The implementation should, however, also be compatible to earlier versions.

PAD features one command mode and one data transfer state. The commands are described below. PAD can manage only exiting calls, it cannot be called itself.

PAD command signals are directed from the DTE to the PAD and are described under "Commands Conforming to X.28", page 75. PAD service signals are directed from the PAD to the DTE and serve for e.g acknowledging PAD commands and or transmitting call progress signals to the DTE.

Additional Features

There are two additional features built into the PAD to extend the standard X.25 PAD functionality.

One is the additional variable **AutoCallDstAdr** in the **x25PadProfileTable**, which can contain an X.25 address, the PAD automatically establishes a connection to. The value of this variable must be defined in the **x25PadProfileTable** on the BinTec router.

The second item is a timer that determines, when to close down a connection to the remote X.25 station, after the DTE has sent the CLR command to the PAD. This time period is defined by configuring the X.25 PAD's partner. It results from the sum of the values of two items in Setup Tool: **Static Short Hold** in the ***WAN*** ➧ ***EDIT*** ➧ ***ADVANCED*** menu (Short Hold in the **bibоPPPTable** of the MIB) and **Disconnect Timeout** in the ***X25*** ➧ ***LINK*** ➧ ***EDIT*** menu (**L2IdleTimer** in the **X25LinkPresetTable** of the MIB).

PAD Parameters

All PAD parameters are stored in the variables of the **x25PadProfileTable** on the BinTec router and can be edited there.

Additional Entries

Additional Entries	Meaning
Number	The value of this parameter defines the unique number of the PAD Profile. Possible values: 0-99: **PadProfileTable** numbers. The **PadProfileTables** 0, 90 and 91 (see later) are implemented in the BinTec router.
State	This parameter describes the state of the profile. 1. The Profile is valid. (**valid**) 2. The Profile is set to delete. (**delete**) The default value is *1* resp. *valid*.
AutoCallDstAddr	When this parameter is set to a non-empty string, a call will automatically be established to this PAD address. By default this variable is empty. To activate the autocall function the user must enter a value (valid X.25 address) for this variable in the **x25PadProfileTable** (described later) on the BinTec router.

Table A-18: Additional Entries

Standard Parameters The 22 standard PAD parameters defined in X.3 are listed in the table:

Number	Parameter	Description
1	Escape	PAD recall using a character
2	Echo	Echo
3	ForwardChar	Selection of the data forwarding character
4	IdleTimer	Selection of idle timer delay
5	DevControl	Ancillary device control
6	SigControl	Control of PAD service control
7	BrkControl	Operation on receipt of the break signal
8	Discard	Discard output
9	CRPadding	Padding after carriage return
10	LineFold	Line Folding
11	Speed	Binary speed (read only)
12	FlowControl	Flow control of the PAD
13	LFInsert	Linefeed insertion after carriage return
14	LFPadding	Padding after linefeed
15	Edit	Editing
16	CharDel	Character delete
17	LineDel	Line delete
18	LineDisp	Line display
19	SigEdit	Editing PAD service signals
20	EchoMask	Echo mask
21	Parity	Parity treatment
22	PageWait	Page wait

Table A-19: Standard Parameters

The exact meanings of the individual parameters and their possible values are described in the following sections; **^X** stands for the simultaneously pressing the **Control** key (also **Ctrl**) and the **X** key; terms such as ***BEL*** or ***ACK*** refer to the corresponding characters in the International Alphabet No. 5 (IA5) according to ITU-T T.50.

Standard Parameters and their Meaning

1 Escape Definition of a character which causes PAD to switch from the data transfer to the command mode (escape character).

Possible values:

- 0: It is not possible to leave the data transfer state.
- 1: Leave the data transfer state with **^P**.
- 32-126: Defines the character of the IA5 with the number specified as escape character.

The default value is *0*.

If a connection exists, the PAD automatically switches back to the data transfer state after input of a valid command. An exception is the clear command.

2 Echo Defines whether the echo mode is enabled or not.

Possible values:

- 0: The echo mode is disabled; no echo. (**no_echo**).
- 1: The echo mode is enabled. (**echo**).

The default value is *0* resp. *no_echo*.

Specifies whether an echo is to be created by the PAD or not.

Using parameter 20, **EchoMask**, specific characters can be exempted from the echo mode.

3 ForwardChar Definition of characters upon which the PAD forwards the data entered up to that point as a packet (data forwarding character).

Possible values:

- 0: No data forwarding character assigned.

- 1: The characters *<A>-<Z>, <a>-<z>,* and *<0>-<9>* serve as data forwarding characters.
- 2: Data forwarding via activation of the **Return** key (IA5 character 0/13, CR).
- 4: Data forwarding after input of either ESC, BEL, ENQ or ACK.
- 8: Data forwarding after input of either DEL, CAN or DC2.
- 16: Data forwarding after input of either EOT or EXT.
- 32: Data forwarding after input of either HT, LF, VT or FF.
- 64: All characters in columns 0 and 1 of the IA5 not specified above serve for data forwarding.

The default value is 0.

These values correspond to the individual bits in the 1-byte value that can be assigned to this parameter. The values can also be freely combined, e.g.:

- 126: All characters of columns 0 and 1 of the IA5 and the character 7/15, DEL serve for data forwarding (combination of the values 2+4+8+16+32+64).

Using the national parameters 121 and 122, another data forwarding character can be defined for each of them. Data forwarding takes place additionally via the BREAK signal and timer delay in the PAD (parameter 4, IdleTimer).

4 Idle Timer Defines whether after a specific amount of time all data entered up to this point are to be forwarded as a packet.

Possible values:

- 0: No timer-controlled data forwarding.
- 1-255: n*50ms after the last input of a character, the data entered up to that point are forwarded as a packet.

The default value is 5 (= 250 ms).

The parameter value *n* indicates the delay time as a multiple of 50 ms, thus times of up to approx. 12s are possible.

If parameter 15, Edit, is set to *1*, timer-controlled data forwarding is disabled.

5 DevControl Defines use of the characters DC1 and DC3 for the control of ancillary devices.

Possible values:

- 0: No use of DC1 and DC3. (*no_use*)

DC1 corresponds to X-ON or **^Q**, DC3 corresponds to X-OFF or **^S**.

6 SigControl Defines whether, and if so how, PAD service signals are forwarded to the DTE.

Possible values:

- 0: X.28 mode without PAD service signals.
- 1: X.28 messages are transmitted to the DTE.

5: X.28 messages are transmitted to the DTE, additionally a prompt (*) is output in the command mode.

The default value is 1.

7 BrkControl Defines the reaction of the PAD to the reception of the BREAK signal from the start-stop mode DTE in data transfer state.

Possible values:

- 0: No reaction.
- 1: Data forwarding, an interrupt packet is transmitted, the PAD remains in data transfer state.
- 2: Data forwarding, the virtual connection is reset with possible data loss, the PAD remains in data transfer state.
- 4: Send an “indication of break” PAD message to the packet-mode DTE (remote PAD).
- 5: Send an interrupt packet followed by an “indication of break” PAD message to the packet-mode DTE.
- 8: Data forwarding, switch to command mode.
- 16: Discard output data to the DTE.
- 21: Discard all output data to the DTE, data forwarding, send an interrupt packet and the PAD service signal BREAK indication with parameter field in which parameter 8 is set to 1, the PAD remains in data transfer state.

The default value is 8.

If no connection has been established, the BREAK signal is ignored.

The BREAK signal is not a character of the IA5. It always consists of an approx. 150 ms long continuous string of the level for binary 0.

Receiving a BREAK signal is a requirement for packet forwarding by the PAD except for parameter 7 is set to 0.

8 Discard Defines whether user sequences in packets are output to the DTE or not.

If parameter 7 is set to 21, parameter 8 is set to 1 when a BREAK signal is received. From now on, all data outputs to the DTE are ignored until parameter 8 is reset to 0.

Possible values:

- 0: Normal data output to the DTE. (*normal_data_delivery*).
- 1: Data outputs to the DTE are ignored. (*discard_output*).

The default value is 0 resp. normal_data_delivery.

9 CRPadding Defines the number of padding characters (NUL) generated after a CR to the DTE.

This parameter has meaning only for purely mechanical DTE (e.g. teletyper - it bridges the time required for the actual carriage return. For modern DTE this parameter is unnecessary, sometimes even interferes (e.g. with direct storing of data in a file).

Possible values:

- 0: No padding characters.
- 1–255: Number of padding characters (NUL) - only useful for purely mechanical DTE.

The default value is 0.

This parameter is only used upon PAD service signals.

10 LineFold Defines the number of characters after which automatic line folding (inserting the character CR) is to take place.

Possible values:

- 0: No automatic line folding.

Depending on the settings of parameters 13 or 126, LF is inserted in addition to CR.

11 Speed Defines the transmission speed of the DTE. This parameter is set automatically by the PAD. The parameter is only used internally and not listed in the **x25PadProfileTable**. The possible values are described in ITU X.3.

12 FlowControl Defines whether the user can effect a short-time stop (DC3) and restart (DC1) of the data flow to the DTE via input of the control characters DC1 and DC3.

Possible values:

- 0: No use of DC1 and DC3 for data flow control. (*no_use_DC1_DC3*).

DC1 corresponds to X-ON or ^Q, DC3 corresponds to X-OFF or **^S**.

13 LFInsert Defines whether the PAD inserts a LF after receiving CR.

Possible values:

0: No LF insertion.

1: LF insertion after each CR in the data stream to the start-stop mode DTE.

2: LF insertion after each CR from the start-stop mode DTE.

4: LF insertion after each CR in the echo stream to the start-stop mode DTE.

5: Combination of 1 and 4.

6: Combination of 2 and 4.

7: Combination of 1, 2 and 4.

The default value is 0.

This parameter is only applied in data transfer mode.

14 LFPadding Defines the number of padding characters (NUL) which are output after an LF to the DTE.

Possible values:

- 0: No padding characters.

15 Edit Defines whether editing of user data is possible in data transfer state or not. If parameter 15 is set to 1, parameter 4 is disabled.

Possible values:

- 0: Editing not possible (*no_editing_user_data*).
- 1: Editing possible (*editing_user_data*).

The default value is 0 resp. no_editing_user_data.

16 CharDel

Defines whether it is possible to delete characters already entered and which character is used for this function.

Possible values:

- 0–127: Decimal value of the character from the IA5 to be used for character delete.

The default value is 0.

17 LineDel

Defines whether it is possible to delete a line already entered and which character is to be used for this function.

Possible values:

- 0–127: Decimal value of the character from the IA5 to be used for character delete.

The default value is 0.

18 LineDisp

Defines whether the characters entered and not yet forwarded can be output again on the DTE and which character is to be used for this function.

Possible values:

- 0–127: Decimal value of the character from the IA5 to be used for character delete.

The default value is 0.

19 SigEdit Defines which PAD service signals are output after editing (character or line delete).

Possible values:

- 0: No editing PAD service signals.
- 1: Editing PAD service signals for printer; "XXX" is output to confirm line delete, "\" to confirm character delete.
- 2: Editing PAD service signals for display units; characters and lines are deleted visibly on the screen.
- 8, 32-126: Decimal value of the character from the IA5 that is to be output as editing PAD service signal for character delete.

The default value is 0.

20 EchoMask Defines which characters are to be exempted from the echo function.

Possible values:

- 0: No echo mask.
- 1: No echo of character CR.
- 2: No echo of character LF.
- 4: No echo of characters VT, HT and FF.
- 8: No echo of characters BEL and BS.
- 16: No echo of characters BEL and BS.
- 32: No echo of characters ACK, NAK, STX, SOH, EOT, ETB and ETX.
- 64: No echo of the editing characters defined in parameters 16, 17 and 18.
- 128: No echo of DEL and of all characters in columns 0 and 1 of the IA5 not mentioned above.

The default value is 0.

Combinations of the given values are permitted.

The echo mask is effective only if parameter 2 is set to 1.

21 Parity Defines whether parity bits are checked and/or generated in the PAD.

Possible values:

- 0: No parity bit checking or generation (*no_parity*).

22 PageWait Defines the number of lines (or LF characters) after which the PAD is to interrupt output to the DTE.

Possible values:

- 0: Page wait disabled.

National Parameters According to Datex-P

If a national parameter is changed, the respective standard parameter is changed also, and vice versa.

National Parameters	Meaning
118 XCharDel	This parameter is a repetition of parameter 16. The default value is 0.
119 XLineDel	This parameter is a repetition of parameter 17. The default value is 0.
120 XLineDisp	This parameter is a repetition of parameter 18. The default value is 0.
121 XForwardChar1 and 122 XForwardChar2	Allow the definition of up to two data forwarding characters in addition to parameter 3. Possible values: ■ 0: No additional data forwarding character. ■ 1–126: Decimal value of the character from the IA5 to be used as data forwarding character. The default value for both parameters is 0.
123 XParity	Corresponds to parameter 21. Possible values: ■ 0: No parity bit checking or generation (*no_parity*).

National Parameters	Meaning
125 XDelay	Defines how long data forwarding is to be delayed if it occurs simultaneously with a data input. Possible values: ■ 0: No delay of data forwarding. Only with full-duplex connections (parameter 2 is set to 1). ■ 1–255: Number of seconds by which data forwarding is to be delayed. The default value is 0. If input editing is possible (parameter 15 is set to 1), a sufficiently large value should be selected for parameter 125 (e.g. 60 seconds) so that incoming data are not written into the data to be edited. Each character entered resets the delay counter to 0. However, after input of an appropriate character, data forwarding starts immediately.
126 XLFInsert	This parameter is a repetition of parameter 13. The default value is 0.

Table A-20: National Parameters and their Meaning

PAD Commands

Guidelines on Notation

The PAD understands the commands described below.

The character "↵" stands for pressing the **Return** key (carriage return).

Alternatives are separated by a "|"; for example, "yes|no" means, that either "yes" or "no" can be entered.

Terms in [square brackets] are optional, terms in {curved brackets} are optional and can be repeated any number of times, terms in <angle brackets> must be

replaced by an appropriate character sequence (e.g., <ParNo> stands for a specific parameter number).

Except for the characters {[<|>]} and text in parentheses, all characters of the commands must be entered exactly as indicated in this section.

Upper and lower case letters as well as spaces can be used freely within the commands - internally, lower case letters are converted to upper case letters, spaces are ignored, and the command is executed only after these processes.

The service signals output by the PAD are given here for the standard setting (parameter 6 has the value 1).

Commands Conforming to X.28

STAT↵ Queries the status of a connection. In response, one of the following messages is given, depending on whether the connection is free or engaged:

- FREE: not connected.
- ENGAGED: connected

CLR↵ Disconnects the selected virtual connection. The command is acknowledged with the message:

- CLR CONF: Disconnect, local cause.

Data that are still in the network when the command is transmitted can be lost.

Within a specified time interval (see "Additional Features", page 62) after a CLR command has been sent, another command can be sent or a new connection can be initiated.

ICLR↵ After having received this command the PAD transmits an "Invitation to clear" to the remote partner, i.e. an "invitation" to disconnect the existing connection.

In all the following commands, possible inputs for <ParNo> are the number of the respective parameter (1-22, 118-123, 125-126).

Generally, only the parameter number is indicated in PAD outputs.

PAR? [<ParNo>{,<ParNo>}]↵ Queries the current values of the parameters indicated or of all parameters if no parameter number is given (here the square brackets indicate that the specification of the parameters is optional).

The parameter values are output as follows:

PAR <ParNo>:<value>>{,<ParNo>:<value>}.

If an invalid parameter number was entered for <ParNo>, the following message is output:

PAR <ParNo>:INV.

RPAR? [<ParNo>{,<ParNo>}]↵

Queries the current values of the parameters indicated or of all parameters if no parameter number is given (here the square brackets indicate that the specification of the parameters is optional) of the remote PAD (= the packet-mode DTE). The local PAD won't put out a message until the remote PAD has answered. When the remote PAD answers with the value(s) of the parameter(s), the local PAD puts them out to the start-stop mode DTE.

The parameter values are output as follows:

PAR <ParNo>:<value>>{,<ParNo>:<value>}.

If an invalid parameter number was entered for <ParNo>, the following message is output:

PAR <ParNo>:INV.

SET <ParNo>:<value>{,<ParNo>:<value>}↵

Used for setting the parameter values.

The value ranges for the individual parameters are described in detail in the sections "Additional Entries", "PAD Parameters", "National Parameters".

If an invalid parameter number was entered for <ParNo>, the following message is output:

PAR <ParNo>:INV.

If the parameter number and value entered were valid no confirmation message is put out.

SET? <ParNo>:<value>{,<ParNo>:<value>}↵

Used for setting and querying the parameter values.

The value ranges for the individual parameters are described in detail in the sections "Additional Entries", "PAD Parameters", "National Parameters".

If an invalid parameter number was entered for <ParNo>, the following message is output:

PAR <ParNo>:INV.

If the parameter number and value entered were valid, the parameters just set are output for checking purposes in the following form:

PAR <ParNo>:<value> {,<ParNo>:<value>}.

RSET? <ParNo>:<value>{,<ParNo>:<value>}↵

Used for setting and querying the parameter values of the remote PAD. When the local PAD receives this command, it will send a request to set and put out the specified parameters to the remote PAD. The local PAD won't put out a message until the remote PAD has answered. When the remote PAD answers with the value(s) of the parameter(s), the local PAD puts them out to the start-stop mode DTE.

The value ranges for the individual parameters are described in detail in the sections "Additional Entries", "PAD Parameters", "National Parameters".

If an invalid parameter number was entered for <ParNo>, the following message is output:

PAR <ParNo>:INV.

If the parameter number and value entered were valid, the parameters just set are output for checking purposes in the following form:

PAR <ParNo>:<value> {,<ParNo>:<value>}

Priorities

It is possible and permissible to assign the same value (especially the same character) to different parameters (and thus to the functions controlled by them). If the PAD receives such a character assigned to several functions, it executes only the function with the highest priority.

The priorities are defined as indicated in the table

Priority	PAD Functions	ParNo
highest	Recall of the PAD	1
	Command separating character (“+”, “↵“)	-
	DC1, DC3	12, 22
	Output of last line	18/ 120
	Delete one character	16/ 118
	Delete one line	17/ 119
lowest	Data forwarding character	3

Table A-21: Priority Table

PROF <ProfileNo>↵ Used for selection of settings for profile <ProfileNo>.

The values 0-99 are possible as <ProfileNo>; the settings of profiles 0, 90 and 91 are summarized in the following table. User-specific settings for profiles 0-89 and 92-99 are possible.

Parameters	Profiles		
	0	90	91
Escape	0	1	0
Echo	0	1	0
ForwardChar	0	126	0
IdleTimer	30	0	20
DevControl	0	1	0
SigControl	1	1	0
BrkControl	8	2	2
Discard	0	0	0
CRPadding	0	0	0
LineFold	0	0	0
FlowControl	0	1	0
(X)LFInsert	0	0	0
LFPadding	0	0	0
Edit	0	0	0
(X)CharDel	0	127	127
(X)LineDel	0	24	24
(X)LineDisp	0	18	18
SigEdit	0	1	1
EchoMask	0	0	0
Parity	0	0	0
PageWait	0	0	0
XForwardChar1	0	0	0
XForwardChar2	0	0	0
XParity	0	0	0

Parameters	Profiles		
	0	90	91
XDelay	0	0	0

Table A-22: Settings for PROF <ProfileNo>

- Profile 0 is the initial profile set at the start of PAD.
- Profile 90 is the simple standard profile according to X.28.
- Profile 91 is the standard transparent profile according to X.28.

(The settings for the individual profiles can be queried on the BinTec router in the **x25PadProfileTable**.).

RESET↵ Resets an existing connection to the initial state without disconnecting it, i.e. all data packets sequence numbers are set to 0 and no data packets are on the transfer section.

INT↵ Transmits an interrupt packet. The PAD only sends a line feed (CR LF) as acknowledgment of this command.

<address>↵ Establishes a connection to the <address> (valid X.25 address) indicated after a physical connection has been established.

^P After input of this character the PAD switches from the data transfer state to the command mode, if parameter 1 has the value 1. Other characters are also possible instead of **^P** (**Control-P**), please refer to the description of parameter 1 in "Standard Parameters and their Meaning", page 65.

This command is acknowledged by a prompt * only if parameter 6 is set to an appropriate value.

The PAD now waits for the input of a PAD command.

In the X.28 mode, the PAD automatically returns to the data transfer state after each command (except the CLR command).

Under certain conditions, it is possible to effect a short-time stop and restart of the output by entering DC1 and DC3.

Further Commands

In addition, the following command is implemented:

BYE↵ Terminates PAD (and disconnects an existing connection).

Validity of PAD Commands

The following matrix shows the validity of PAD command signals in dependence of the state of the DTE (start-stop mode DTE):

PAD Commands	Valid before virtual call setup	Valid after escaping from data transfer state
<address>	X	
PROF	X	X
SET	X	X
SET?	X	X
PAR?	X	X
CLR		X
STAT	X	X
RESET		X
INT		X
RSET?		X
RPAR?		X
ICLR		X

Table A-23: Validity of PAD Commands

Initial Profile

Whenever a new PAD is created by accepting an ISDN call, the values of the parameters are initialized according to the initial profile, which is always profile 0.

The profiles 0 (initial profile), 90 (simple standard profile) and 91 (transparent standard profile) are by default implemented in the BinTec router. These profiles can be selected with the command PROF (see "PROF <ProfileNo>ø",

page 78). These three profiles can also be selected, when they are not entered in the **x25PadProfileTable**.

In the following paragraphs, the default settings for all parameters are indicated, with the number (here the PAD parameter number, not the number of the table entry) and name of the parameter followed by a description of the value selected.

Parameter	Default Setting	Meaning
1 Escape	0	It is not possible to leave the data transfer state.
2 Echo	0	The echo mode is disabled; no echo. (no_echo)
3 ForwardChar	0	No data forwarding character assigned.
4 Idle Timer	5	5*50ms= 250 ms
5 DevControl	0	No use of DC1 and DC3 (no_use).
6 SigControl	1	X.28 messages are transmitted to the DTE.
7 BrkControl	8	Data forwarding, switch to command mode.
8 Discard	0	Normal data output to the DTE (normal_data_delivery).
9 CRPadding	0	X.28 messages are transmitted to the DTE.
10 LineFold	0	No automatic line folding.
11 Speed		Detected automatically; internal value
12 FlowControl	0	No use of DC1 and DC3 for data flow control. (no_use_DC1_DC3)
13 LFInsert	0	Editing not possible (no_editing_user_data).
14 LFPadding	0	No padding characters.
15 Edit	0	Editing not possible (no_editing_user_data).
16 CharDel	0	No editing.
17 LineDel	0	No editing.
18 LineDisp	0	No display.

Parameter	Default Setting	Meaning
19 SigEdit	0	No editing PAD service signals.
20 EchoMask	0	No echo mask.
21 Parity	0	No parity bit checking or generation (no_parity).
22 PageWait	0	Page wait disabled.
118 XCharDel		Repetition of parameter 16.
119 XLineDel		Repetition of parameter 17.
120 XLineDisp		Repetition of parameter 18.
121 XForwardChar1	0	No additional data forwarding character.
122 XForwardChar2	0	No additional data forwarding character.
123 XParity	0	No parity bit checking or generation (no_parity).
125 XDelay	0	No delay of data forwarding; Only with full-duplex connections (parameter 2 is set to 1).
126 XLFInsert		Repetition of parameter 13.

Table A-24: Default Parameter Settings

Disconnect by the remote PAD

If a connection is cleared by the remote PAD or by the network, the local PAD returns to the command mode. If parameter 6 (PAD messages) is set to 0, the PAD cannot communicate the disconnect to the user. The PAD is terminated in this case.

Configuration Necessities for the PAD

The configuration of the X.25 PAD is described in section A, chapter 1.3.9, page 57.

Minipad

The following prompt is displayed with the command `minipad`:

`[-7] [-p pktsz] [-w winsz] [-c cug][-o outgocug] [-b bcug] <x25address>`

The minipad program is a basic PAD (Packet Assembler/Disassembler) program that can be used to provide a remote login services for remote X.25 hosts. Minipad takes the following arguments:

Command	Argument	Meaning
`-7`		Use 7 bit data bytes only.
`-p`	pktsz	Open data connection with packet size <pktsz>.
`-w`	winsz	Open data connection with window size <winsz>.
`-c`	cug	Closed user group. Possible values for ‹cug›: 0-9999.
`-o`	outgocug	Closed user group with outgoing access. Possible values for ‹outgocug›: 0-9999.
`-b`	bcug	Bilateral Closed user group. Possible values for ‹bcug›: 0-9999.
	<x25address>	Either a standard X.121 address or an extended address.

Table A-25: Minipad Usage

Minipad is also useful for testing X.25 routes. To diasble X.25 connections to the minipad, **x25LocalPadCall** must be set to `dont_accept`.

1.5 X.25 Diagnostic Code

X.25 diagnostic codes are reported in the **x25CallHistoryTable**. Note that only clear and diagnostic causes reported by the ISDN are stored in this table (via the **ClearCause** and **ClearDiag** fields). Restart and Reset causes may be detected when tracing ISDN channels.

The diagnostic codes are divided up in following groups:

- Clear Causes
- Diagnostic Causes
- Restart Causes
- Reset Causes

1.5.1 Clear Causes

Clear causes are reported in the **ClearCause** field of the **x25CallHistoryTable.**

Decimal	Hexa	Meaning
1	0x01	number busy
3	0x03	invalid facility request
5	0x05	network congestion
9	0x09	out of order
11	0x0B	access barred
13	0x0D	not obtainable
17	0x11	remote procedure error
19	0x13	local procedure error
21	0x15	RPOA out of order
25	0x19	reverse charging acceptance not subscribed
33	0x21	incompatible destination
41	0x29	fast select acceptance not subscribed
57	0x39	ship absent

Table A-26: Clear Causes

1.5.2 Diagnostic Causes

Diagnostic causes are reported in the **ClearDiag** field of the **x25CallHistoryTable.**

Decimal	Hexa	Meaning
0	0x00	no additional information
1	0x01	invalid P (S)
2	0x02	invalid P (R)
16	0x10	packet type invalid
17	0x11	for state r1
18	0x12	for state r2
19	0x13	for state r3
20	0x14	for state p1
21	0x15	for state p2
22	0x16	for state p3
23	0x17	for state r1
24	0x18	for state p5
25	0x19	for state p6
26	0x1a	for state p7
27	0x1b	for state d1
28	0x1c	for state d2
29	0x1d	for state d3
32	0x20	packet not allowed
33	0x21	unidentifiable packet
34	0x22	call on one-way logical channel
35	0x23	invalid packet type on a PVC
36	0x24	packet on unassigned logical channel

Decimal	Hexa	Meaning
37	0x25	reject not subscribed to
38	0x26	packet too short
39	0x27	packet too long
40	0x28	invalid GFI
41	0x29	restart packet with nonzero logical channel identifier
42	0x2a	packet type not compatible with facility
43	0x2b	unauthorized interrupt confirmation
44	0x2c	unauthorized interrupt
45	0x2d	unauthorized reject
48	0x30	time expired
49	0x31	for incoming call
50	0x32	for clear indication
51	0x33	for reset indication
52	0x34	for restart indication
53	0x35	for call deflection
64	0x40	call set-up, call clearing or registration problem
65	0x41	facility/registration code not allowed
66	0x42	facility parameter not allowed
67	0x43	invalid called DTE address
68	0x44	invalid calling DTE address
69	0x45	invalid facility/registration length
70	0x46	incoming call barred
71	0x47	no logical channel available
72	0x48	call collision

Decimal	Hexa	Meaning
73	0x49	duplicate facility request
74	0x4a	nonzero address length
75	0x4b	nonzero facility length
76	0x4c	facility not provided when expected
77	0x4d	invalid CCITT-specified DTE facility
78	0x4e	max number of call redirections/ deflections exceeded
80	0x50	miscellaneous
81	0x51	improper cause code from DTE
82	0x52	non aligned octet
83	0x53	inconsistent Q bit setting
84	0x54	NUI problem
112	0x70	international problem
113	0x71	remote network problem
114	0x72	international protocol problem
115	0x73	international link out of order
116	0x74	international link busy
117	0x75	international link busy
118	0x76	remote network facility problem
119	0x77	international routing problem
120	0x78	temporary routing problem
121	0x79	unknown called DNIC
122	0x7a	maintenance action
144	0x90	timer expired or retransmission count surpassed
145	0x91	for interrupt

Decimal	Hexa	Meaning
146	0x92	for data
147	0x93	for reject
160	0xa0	DTE-specific signals
161	0xa1	DTE operational
162	0xa2	DTE not operational
163	0xa3	DTE resource constraint
164	0xa4	fast select not subscribed
165	0xa5	invalid partially full data packet
166	0xa6	D-bit procedure not supported
167	0xa7	registration/cancellation confirmed
224	0xe0	OSI network service problem
225	0xe1	disconnection (transient condition)
226	0xe2	disconnection (permanent condition)
227	0xe3	connection rejection– reason unspecified (transient condition)
228	0xe4	connection rejection - reason unspecified (permanent condition)
229	0xe5	connection rejection - quality of service not available (transient condition)
230	0xe6	connection rejection - quality of service not available (permanent condition)
231	0xe7	connection rejection - NSAP unreachable (transient condition)
232	0xe8	connection rejection - NSAP unreachable (permanent condition)
233	0xe9	reset - reason unspecified

Decimal	Hexa	Meaning
234	0xea	reset - congestion
235	0xeb	connection rejection - NSAP address unknown (permanent condition)
240	0xf0	higher layer initiated
241	0xf1	disconnection - normal
242	0xf2	disconnection - abnormal
243	0xf3	disconnection - incompatible information in user data
244	0xf4	connection rejection - reason unspecified (transient condition)
245	0xf5	connection rejection - reason unspecified (permanent condition)
246	0xf6	connection rejection - quality of service not available (transient condition)
247	0xf7	connection rejection - quality of service not available (permanent condition)
248	0xf8	connection rejection - incompatible information in user data
249	0xf9	connection rejection - unrecognizable protocol identifier in user data
250	0xfa	reset - user synchronization

Table A-27: Diagnostic Causes

1.5.3 Restart Causes

Restart causes are reported by the ISDN and may be detected when tracing ISDN channels.

These causes are not stored on the BinTec router.

Decimal	Hexa	Meaning
1	0x01	local procedure error
3	0x03	network congestion
7	0x07	network operational

Table A-28: Restart Causes

1.5.4 Reset Causes

Reset causes are reported by the ISDN and may be detected when tracing ISDN channels.

These causes are not stored on the BinTec router.

Decimal	Hexa	Meaning
3	0x03	remote procedure error
5	0x05	local procedure error
7	0x07	network congestion
17	0x11	incompatible destination
1	0x01	out of order (PVC)
9	0x09	remote DTE operational (PVC)
15	0x0F	network operational (PVC)
29	0x0D	network out of order (PVC)

Table A-29: Reset Causes

1.6 X.25 Syslog Messages

(**biboAdmSyslogSubject** = x25)

The value <fd> used in X.25 system messages is an internal file number to discriminate between the different X.25 and TCP connections.

biboAdmSyslogMessage	Meaning	-Level
`ifc 1 vc <vc>: receive window exceeded, call cleared.`	Protocol error in X.25 connection directly to BinTec router (Interface 1).	err
`ifc 1 vc <vc>: N(R) out of range, call cleared.`	Protocol error in X.25 connection directly to BinTec router (Interface 1).	err
`Cannot rewrite call packet; Rule ... does not exist.`	A rewriting rule has been referenced in **x25RouteTable**, that is not defined in **x25RewriteTable.**	err
`Unable to route call to IFC ... (X.25 not supported) cannot use ifc ... for routing (ifc does not support X25).`	The specified target interface in an entry of the **x25RouteTable** does not support X.25.	err
`source address too long (... bytes)`	The Link Layer Address (MAC) of a target interface specified in the **x25RouteTable** is longer than 20 Octets.	err
`cannot use undefined ifc ... for routing`	The target interface of an entry in the **x25RouteTable** does not exist.	err

biboAdmSyslogMessage	Meaning	-Level

`channel misconfiguration (HIC) on ifc <ifc>`
`channel misconfiguration (LTC) on <ifc>`
`channel misconfiguration (HTC) on ifc <ifc>`
`channel misconfiguration (LOC) on ifc <ifc>`
`channel misconfiguration (HOC) on ifc <ifc>`
	The channel specification of a link in the **x25LinkPresetTable** does not match the condition:
	LIC <= HIC < LTC <= HTC < LOC <= HOC
		err

`ifc=<ifc> [addr=...] vc=<vc> recv CALL` `<SrcAddr> -> <DstAddr> fac=<fac> cud=<user data>`	An X.25 CALL-REQUEST/INDICATION has been received. The message contains the interface index, optionally the link-address, the virtual circuit number, source and target address, the call facilities and the call user data.	debug
`ifc=<ifc> [addr=...] vc=<vc> send CALL` `<SrcAddr> -> <DstAddr> fac=<fac> cud=<user data>`	An X.25 CALL-REQUEST/INDICATION is being sent The message contains the interface index, optionally the link-address, the virtual circuit number, source and target address, the call facilities and the call user data.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv CALL CONFIRM` `<SrcAddr> -> <DstAddr> fac=<fac> cud=<user data>`	An X.25 CALL-RESPONSE/CONFIRMATION has been received. The message contains the interface index, optionally the link-address, the virtual circuit number, source and target address, the call facilities and the call user data.	debug
`ifc=<ifc> [addr=...] vc=<vc> send CALL CONFIRM` `<SrcAddr> -> <DstAddr> fac=<fac> cud=<user data>`	An X.25 CALL-RESPONSE/CONFIRMATION is being sent. The message contains, the interface index, optionally the link-address, the virtual circuit number, source and target address, the call facilities and the call user data.	debug

biboAdmSyslogMessage	Meaning	-Level
`ifc=<ifc> [addr=...] vc=<vc> recv CLEAR` `ifc=<ifc> [addr=...] vc=<vc> recv CLEAR`	A X.25 CLEAR-REQUEST/INDICATION has been received with the given cause and diagnostic codes. The value -1 means, cause or diagnostic not present.	debug
`ifc=<ifc> [addr=...] vc=<vc> send CLEAR`	A X.25 CLEAR-REQUEST/INDICATION is being sent with the given cause and diagnostic codes. The value -1 means, cause or diagnostic not present.	debug
`ifc=<ifc> [addr=...] vc=<vc> send CLEAR`	A X.25 CLEAR-REQUEST/INDICATION is being sent without cause and diagnostic.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv CLEAR CONFIRM`	A X.25 CLEAR-RESPONSE/CONFIRM has been received on the given VC.	debug
`ifc=<ifc> [addr=...] vc=<vc> send CLEAR CONFIRM`	A X.25 CLEAR-RESPONSE/CONFIRM is being sent.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv RESET`	A X.25 RESET-REQUEST/INDICATION has been received on the given VC.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv RESET CONFIRM`	A X.25 RESET-RESPONSE/CONFIRM is being sent.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv INTERRUPT`	A X.25 INTERRUPT has been received on the given VC.	debug
`ifc=<ifc> [addr=...] vc=<vc> send RESET CONFIRM`	A X.25 RESET-RESPONSE/CONFIRM is being sent.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv INTERRUPT`	A X.25 INTERRUPT has been received on the given VC	debug
`ifc=<ifc> [addr=...] vc=<vc> send INTERRUPT`	A X.25 INTERRUPT is being sent.	debug
`ifc=<ifc> [addr=...] vc=<vc> recv INTERRUPT CONFIRM`	A X.25 INTERRUPT-CONFIRM has been sent on the given VC	debug
`ifc=<ifc> [addr=...] vc=<vc> send INTERRUPT CONFIRM`	A X.25 INTERRUPT-CONFIRM is being sent.	debug

biboAdmSyslogMessage	Meaning	-Level
`ifc=<ifc> [addr=...] vc=<vc> recv DIAG cause=<causecode> diag=<diagcode>`	A X.25 DIAG has been received on the given VC. This message is ignored.	debug
`ifc=<ifc> [addr=...] vc=<vc> invalid VC number`	A call on an unassigned VC number was received.	debug
`ifc=<ifc> [addr=...] vc=<vc> call collision`	A call collision occurred on the given VC and will be handled according to X.25.	debug
`ifc=<ifc> [addr=...] vc=<vc> TIMEOUT`	A timeout condition occurred on a VC while waiting for a CALL-RESPONSE/CONFIRMATION, CLEAR-RESPONSE/CONFIRMATION, or a RESET-RESPONSE/CONFIRMATION. The call will be cleared.	debug
`ifc=<ifc> [addr=...] vc=<vc> windowsize=<incoming>/<outgoing> packetsize=<incoming>/<outgoing>`	The call's incoming/outgoing parameters for windowsize and packetsize will used according to the given values (possibly after negotiation).	debug
`ifc=<ifc> [addr=...] recv RESTART cause=<cause>`	A restart packet has been received on the given link with the given cause. If the cause value is set to -1, the cause was not present in the message.	debug
`ifc=<ifc> [addr=...] send RESTART`	A RESTART packet is being sent over the given link.	debug
`ifc=<ifc> [addr=...] recv RESTART CONFIRM`	A RESTART-CONFIRM packet has been received on the given link.	debug
`ifc=<ifc> [addr=...] send RESTART CONFIRM`	A RESTART-CONFIRM packet is being sent over the given link	debug
`ifc=<ifc> [addr=...] vc=<vc> recv ILLEGAL message`	An unknown message has been received on the given VC.	debug
`ifc=<ifc> [addr=...] vc=<vc> invalid VC number`	An unknown message has been received on the given VC.	debug

biboAdmSyslogMessage	Meaning	-Level
`ifc=<ifc> [addr=...] TIMEOUT`	A timeout occurred on the given link, while waiting for RESTART, RESTART-CONFIRMATION, XID negotiation, link establishment or being idle.	debug
`ifc=<ifc> [addr=...] restarting`	The restart procedure starts on the given link and a restart packet is being sent.	debug
`ifc=<ifc> [addr=...] resetting layer 2`	The layer 2 of the given link is being reset due to a timeout while waiting for a RESTART. A SABM[E] will be sent.	debug
`ifc=<ifc> [addr=...] disconnecting layer 2`	The given link will be disconnected, while being idle, i.e. no VCs being established. A DISC will be sent.	debug
`ifc=<ifc> [addr=...] connecting layer 2`	The given link will be established and a SABM[E] will be sent.	debug
`ifc=<ifc> [addr=...] layer 2 connected`	The connect request (SABM[e]) has been accepted by the peer and a UA frame has been received.	debug
`ifc=<ifc> [addr=...] accept layer 2 connect`	An incoming connect indication (SABM[E]) on the given link will be accepted and a UA frame being sent.	debug
`ifc=<ifc> [addr=...] accept layer 2 reset`	An incoming reset indication (SABM[E]) on the given link will be accepted and a UA frame being sent.	debug
`ifc=<ifc> [addr=...] layer 2 reset`	The reset request (SABM[e]) has been accepted by the peer and a UA frame has been received.	debug

biboAdmSyslogMessage	Meaning	-Level
`ifc=<ifc> [addr=...] layer 2 disconnected`	A disconnect indication (DISC) has been received on the given link and the link is no longer established.	debug
`dialup ifc ...`	The given interface is dialed up due to an X.25 call routed to it. The message contains, the interface index, optionally the link-address, the virtual circuit number, source and target address, the call facilities and the call user data.	debug
`txd[<fd>]: <tcpaddr>:<port> New TCP connection`	A new incoming TCP connection from the specified TCP address via the local port 146 has been established.	debug
`txd[<fd>]: <tcpaddr>:<port> First byte ... - not supported`	The first byte the TCP host sent to port 146 isn't supported by the BinTec router. Only the values 1 and 2 are allowed.	debug
`txd[<fd>]: <tcpaddr>:<port> Connect to a particular X.25 host`	The host with the specified TCP address wants to connect to a particular X.25 host.	debug
`txd[<fd>]: <tcpaddr>:<port> Listen for incoming X.25 call on addr=<address>`	The host with the specified TCP address wants to listen for incoming X.25 connections for the specified X.25 listening address.	debug
`txd[<fd>]: <tcpaddr>:<port>`	Timeout while reading X.25 address The specified TCP host didn't send the X.25 address completely within a certain amount of time.	debug
`txd[<fd>]: <tcpaddr>:<port> unsupported X.25 address type`	The address type field entry of the X.25 address, the TCP host sent, isn't supported by the BinTec router. Only the values 3 and 4 are allowed.	debug

biboAdmSyslogMessage	Meaning	-Level
txd[<fd>]: <tcpaddr>:<port> Could not read 16 byte TCP/IP packet	The specified TCP host didn't send the complete TCP/IP address of the listening TCP host within a certain amount of time.	debug
txd[<fd>]: <tcpaddr>:<port> IP Address type ... not supported	The address type field entry of the TCP/IP address of the listening TCP host, isn't supported by the BinTec router. Only the value 2 is allowed.	debug
txd[<fd>]: <tcpaddr>:<port> Connection to X.25 host addr=... failed	The TCP host wanted to connect to the specified X.25 address but the BinTec router could not reach the X.25 host.	debug
txd[<fd>]: X.25 CALL_IND dest_addr=<address>	An X.25 call indication for the specified X.25 address was received by the BinTec router.	debug
txd[<fd>]: Connection failed - wrong X.25 address	There is currently no TCP host bound to the X.25 address of the previously received X.25 call indication.	debug
txd[<fd>]: Connected to X.25 addr=...	An incoming X.25 connection was established	debug
txd[<fd>]: Connected to TCP <tcpaddr>:<port>	The BinTec router opened an new TCP connection to the specified listening TCP host.	debug
txd[<fd>]: <tcpaddr>:<port> TCP <--> txd[<fd>] X.25 addr=... connected	The BinTec router connected an incoming X.25 call to the specified TCP host.	debug
txd[<fd>]: Disconnect and close connection	The BinTec router disconnects the TCP host and the X.25 host.	debug
txd[<fd>]: Received disconnect, cause=<causecode> diag=<diagcode>	The BinTec router received a disconnect message from the X.25 connection. The cause and diagnostic codes of the X.25 clear indication message are shown.	debug

biboAdmSyslogMessage	Meaning	-Level
`txd[<fd>]: Received disconnect`	The BinTec router received a disconnect message from the TCP connection.	debug
`No License`	An attempt has been made to use X.25 without a valid license.	info

Table A-30: **biboAdmSyslogMessage** Table and Meaning

1.7 X.21 Communications Module

Normal Operation Mode

During normal operation, PWR (power) always displays whether the router is receiving power. ERR (error) is normally off but may blink when an error, such as a cabling problem, has occurred.

Depending on which slots your communications modules are installed in, the A/B LEDs for slots 1, 2, and 3 are as follows:

CM-X21		
LED	**State**	**Meaning**
A	On	Currently receiving an X.21 frame.
B	On	Currently sending an X.21 frame.

Table A-31: LED Status

Depending on which slots your communications modules are installed in, the LEDs for slots 1 through 6 (S1... S6) are as follows:

Modules	State	Meaning
CM-X21	On	Sending or receiving a packet.

Table A-32: Module Status

1.7.1 CM-X21Adapter

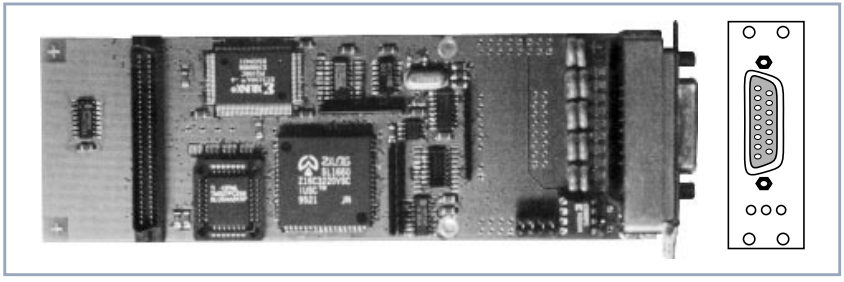


Figure A-18: CM-X21Adapter

The CM-X21 module provides a standard X.21 interface which complies with the V.11 recommendation. The X.21 interface provides a full-duplex synchronous mode and can be configured to operate as either a DTE (passive mode) or DCE (active mode). When in active mode the X.21 interface can be set to operate at baud rates between 2400 and 2048k.

There are also three status indicators located on the back plane. The LEDs indicate various status conditions, as follows:

Color	State	Meaning
Red	On	Error transmitting a packet.
Amber	On	Frame being sent/received.
Green	On	Layer 1 is active (i.e., incoming and outgoing calls are possible).

Table A-33: CM-X21 back plane LEDs

The four jumper settings on the X.21 module are intended for future use. They should remain bridged (or jumpered), these are the default settings and should not be changed.

15 Pin Port for the CM-X21

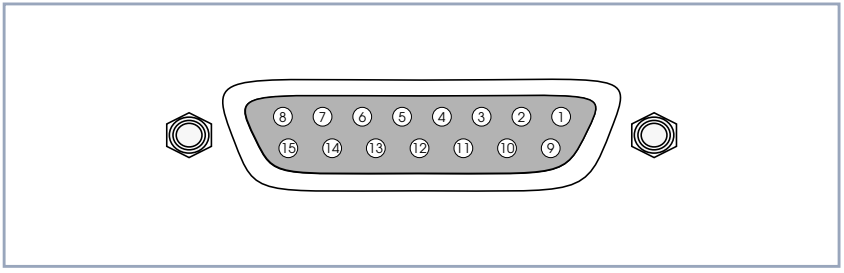


Figure A-19: 15 Pin X21 Port

The pin assignments for the CM-X21 module conform to the V.11 recommendations and are as follows:

Pin	Function	Mnemonic
1	Protection Ground	PG
2	Transmit (A)	T
3	Control (A)	I
4	Receive (A)	R
5	Indicate (A)	I
6	Signal Timing Element (A)	S
7	Not Connected	
8	Signal Ground	SG
9	Transmit (B)	T
10	Control (B)	I
11	Receive (B)	R
12	Indicate (B)	I
13	Signal Timing Element (B)	S
14	Not Connected	
15	Not Connected	

Table A-34: Pin Assignment