funkwerk
enterprise communications

User's Guide

bintec R1200 / R1200w(u) / R3000 / R3000w / R3400 / R3800(wu)

X.25

Version 0.9

Purpose

This document is part of the user's guide to the installation and configuration of bintec gateways running software release 7.4.10 or later. For up-to-the-minute information and instructions concerning the latest software release, you should always read our **Release Notes**, especially when carrying out a software update to a later release level. The latest **Release Notes** can be found at www.funkwerk-ec.com.

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R&TTE Directive 1999/5/EG

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1 X.25 Menu

The *X.25* menu is described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25]: X.25 Configuration                                      MyGateway


                        Static Settings
                        Link Configuration
                        Routing
                        Multiprotocol over X.25
                        XOT
                        X.25 to TCP conversion
                        X.25 over ISDN


                        EXIT
```

The ***X.25*** main menu provides access to the submenus:

- ***STATIC SETTINGS***
- ***LINK CONFIGURATION***
- ***ROUTING***
- ***MULTIPROTOCOL OVER X.25***
- ***XOT***
- ***X.25 TO TCP CONVERSION***
- ***X.25 OVER ISDN.***

X.25 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 will be explained briefly in the following chapters.

Connection-Oriented X.25 is connection-oriented, which means that, when data needs to be transferred, a connection must first be established. Communication parameters such as window size and packet size are negotiated, when the connection is 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 each logical connection a virtual circuit number. 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 subdivided 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 will be fragmented into many packets. The X.25 frame format defines a special field, M-bit (from more data packet), 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 “piggyback” confirmation messages onto other packets. Also, in X.25, packets always arrive in sequence at the receiving station.

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 during the whole connection time.

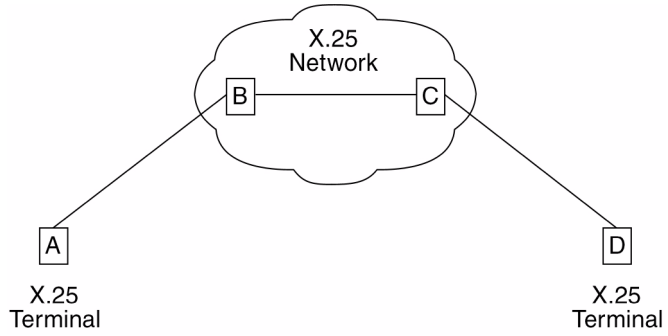


Figure 1-1: X.25 scenario

In an X.25 network it is possible, that the VC numbers used by two connected end stations differ. For example, if hosts A and D are communicating across B and C, the VC number used for the A–B connection segment may be different from the one used for C–D.

After the call being initially set up, 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 communication partners.

1.1.1 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 set up 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.

In X.25, each data link uses one interface. The characteristics of each data link are defined in the ***X.25*** ➜ ***LINK CONFIGURATION*** menu. These characteristics, such as window and packet size, can be changed by editing the respective link.

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 type includes ISDN dialup, ISDN leased lines, serial and X.31 interfaces.
- Point-to-multipoint interface
  This interface type includes LAN connections over LLC2.

1.1.2 Point-to-Point and Point-to-Multipoint Interfaces

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

When creating X.25 point-to-point interfaces in the ***WAN PARTNER*** ➜ ***ADD*** menu, 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-y-llc* interfaces, since not all Ethernet interfaces on the bintec router support X.25 (i.e. *enx-y*, *enx-y-snap*, and *enx-y-nov802.3* with x= slot and y= unit.)

1.1.3 X.25 Addressing Schemes

As in TCP/IP networks, each host in an X.25 network must be uniquely identified before communication between two hosts 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):

National Address 4591101234

International Address 0 262 4591101234

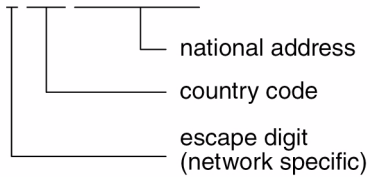


Figure 1-2: Standard X.25 addressing (X.121)

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.

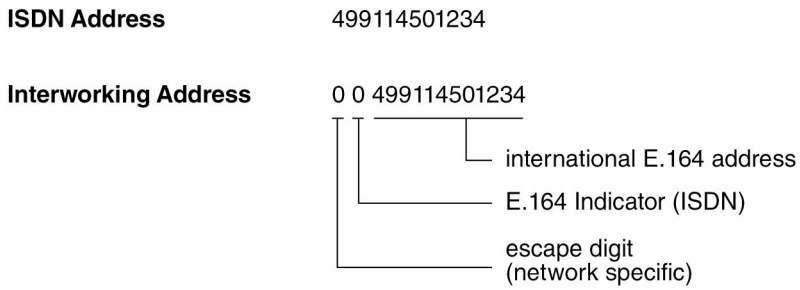


Figure 1-3: E.164 addressing within ISDN

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 address field.)

When the call is set up, 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 are used for special purposes 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 1-1: 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
National X.121 address	@2 3 4591101234
International X.121 address	@1 3 4591101234
National E.164 address	@2 1 9114501234
International E.164 address	@1 1 49 9114501234

Table 1-2: Example addresses

NSAP Addresses (X.213)

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

The NSAP format has a complex structure. NSAP addresses consist of up to 40 hexadecimal characters.

Two types of NSAP addresses are defined, OSI compliant (indicated by a leading X) and Non-OSI compliant (indicated by a leading N).

1.1.4 X.25 Routing

To configure X.25 routes you must open the ***X.25*** ➜ ***ROUTING*** ➜ ***ADD*** menu.

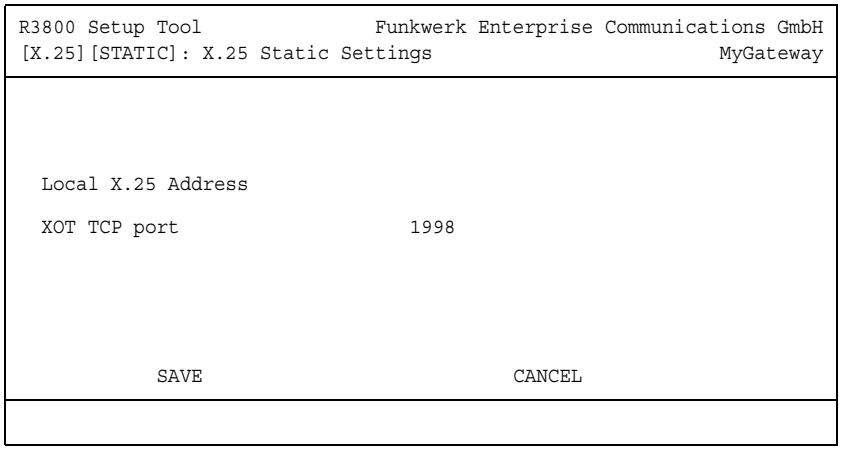
Routing decisions can be made based on the source link and/or different parameters included in the call packet.

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

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

2 Static Settings Submenu

The fields of the *STATIC SETTINGS* menu are described below.



In the ***X.25*** ➜ ***STATIC SETTINGS*** menu you define the router's local X.25 address and the XOT TCP port if necessary.

The menu consists of the following fields:

Feld	Wert
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 is assigned an X.25 address automatically. The X.25 address must be set for sites with private X.25 networks, or when X.25 in the B channel is used.

Feld	Wert
XOT TCP port	The port at which the router accepts XoT connections must be configured first. The default port is *1998*, but your gateway allows a free choice of the port, too, to support specific requirements. All packets arriving at this port are forwarded to the local XoT service of the bintec-Gateway. This service processes them according to the configuration of the interfaces.

Table 2-1: ***STATIC SETTINGS*** menu fields

3 Link Configuration Submenu

The *LINK CONFIGURATION* submenu is described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][LINK]: X.25 Link Configuration                          MyGateway


 Select link to configure


 en1-0-llc (create new configuration)
 en1-4-llc (create new configuration)
 ethoa50-0-llc (create new configuration)
 ethoa50-1-llc (create new configuration)



    DELETE CONFIGURATION          EXIT
```

The ***X.25*** ➜ ***LINK CONFIGURATION*** menu displays a list of all interfaces that support the X.25 protocol.

The list of available interfaces is a combination of hardware (modules installed) and software interfaces.

- Hardware interfaces (Ethernet, Serial, X.31)
  Depending on which modules are installed, the system creates initial links like enx-y-llc or six-y.
  If your ISDN provider provides for X.31 services, an X.31 link is also present. X.31 links have the format x31d-x-y-z with z = TEI.
- Software interfaces (X.25 over ISDN, WAN partner, XOT)
  Each X.25-compatible entry configured on the system will be displayed.

Configuration is carried out in ***X.25*** ➜ ***LINK CONFIGURATION*** ➜ ***EDIT***.

This menu is used to configure the basic characteristics of the X.25 link.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25] [LINK] [ADD]                                            MyGateway


  Link                              en1-0-llc
  L3 Mode                           dte
  L3 Packet Size                    default: 128     max: 128
  L3 Window Size                    default: 2       max: 7
  Windowsize/Packetsize Neg.        when necessary (default)
  Logical Channel Number 0          disable
  Lowest Two-Way-Channel (LTC)      1
  Highest Two-Way-Channel (HTC)     2
  Partner MAC Address (LLC)

  L2 Window Size                    2
  Layer 2 Behaviour                 disconnect when idle


               SAVE                                  CANCEL
```

The menu consists of the following fields:

Feld	Wert
Link	This is the name of the link your are editing. The field cannot be edited.
L3 Mode	This defines the mode the router operates in at Layer 3 of the X.25 protocol stack. Possible values: ■ *dce* (default value): The router must provide clocking information. ■ *dte*: Clocking information is provided for by the remote side of the link.
L3 Window Size / Packet Size	Defines the default and maximum values for packet size (*128*, …, *4096* bytes) and window size (*2* through *127*).

Feld	Wert
Windowsize/Packetsize Neg.	Decides whether window/packet size negotiation is made for this X.25 link. Possible values: ■ *never:* No negotiation. When a call arrives that does not correspond to the default size, the call is cleared. ■ *always*: Window/Packet size will always be negotiated. ■ *when necessary (default)* (default value): Negotiations are only initiated, when the requested values differ from the default values.
Logical Channel Number 0	Indicates, whether VC number 0 shall be allowed on the link. Possible values: ■ *disable* (default): In the ***Lowest Two-Way-Channel (LTC)*** and ***Highest Two-Way-Channel (HTC)*** fields the values -1 or 0 may be used to specify the absence of a channel. This is for compatibility reasons to former versions. ■ *enable*: VC number 0 is allowed. In the ***Lowest Two-Way-Channel (LTC)*** and ***Highest Two-Way-Channel (HTC)*** fields the value -1 shall be used to indicate the absence of specified channels. This invalidates old configurations, for which a value of 0 specifies the absence of a specified channel.

Feld	Wert
Lowest Two-Way-Channel (LTC)	LTC and HTC must be set specifying the number of virtual channel(s) made available by your X.25 network provider. Defines the lowest number that can be assigned to a virtual channel.
Highest Two-Way-Channel (HTC)	LTC and HTC must be set specifying the number of virtual channel(s) made available by your X.25 network provider. 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.
L2 Window Size	Defines the Layer 2 Window Size. Possible values: *2* .. *127*. Default value: *2*.
Layer 2 Behaviour	Defines whether (and if so, when) the link should be disconnected when no virtual channels are active. Possible values: ■ *disconnect when idle* (default value) ■ *disconnect after timeout* ■ *always active* ■ *don't disconnect when idle.*
Disconnect Timeout	Only for ***LAYER 2 BEHAVIOUR*** = *disconnect after timeout*. Time in milliseconds to wait before closing the link once the line becomes inactive. Possible values: *2* .. *3000*.

Table 3-1: ***LINK CONFIGURATION*** ➜ ***EDIT*** menu fields

Attention!

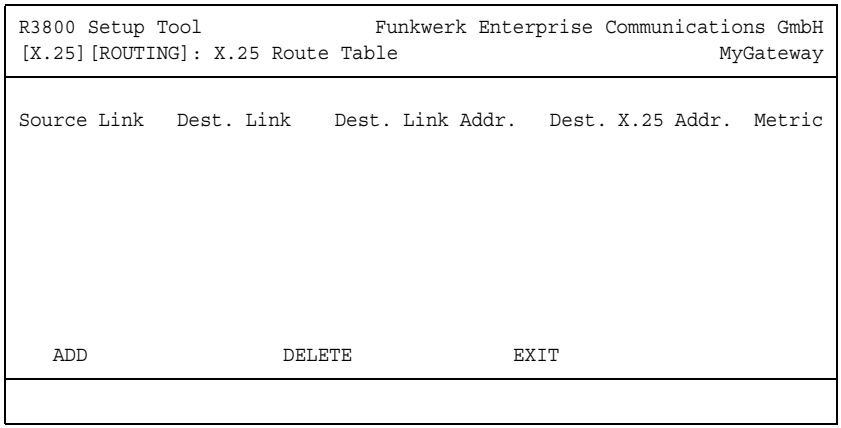
When establishing X.25 connections via ISDN dialup, it may occur with certain settings that unintentional permanent connections are established.

It is important to note that, if the field ***Layer 2 Behaviour*** is set to *always active*, the bintec router will continue to establish layer 2 with the effect of permanent B-channel connections and increased costs.

Thus, to prevent this make sure an option other than *always active* is selected in the ***Layer 2 Behaviour*** field.

4 Routing Submenu

The fields of the *ROUTING* submenu are described below.



The ***X.25*** ➜ ***ROUTING*** 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.

X.25 routes configured with the Setup Tool are based on three factors:

- Source link
  The link the X.25 call packet first arrived on.
- Destination Link
  The link the X.25 call packet is to be sent to.
- Destination X.25 Address
  The address the packet is addressed to.

These three parameters are to be specified to define the destination link via which the X.25 packets will be routed. Standard wildcard characters can also be used in the ***DESTINATION X.25 ADDRESS*** parameter.

Example	Meaning
{123}45	Either 12345 or 45

Example	Meaning
[68]*	Any number starting with 6 or 8
[^5]*	Any number not starting with 5
624*	All numbers starting with 624

Table 4-1: Examples for Wildcard Usage

Since some calls may match more than one route, 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).

Note

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.

Configuration is carried out in ***X.25*** ➜ ***ROUTING***➜ ***ADD/EDIT***.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][ROUTING][ADD]                                          MyGateway


   Source Link                      any
   Destination Link                 en1-0-llc

   Destination X.25 Address

   Metric                           0


              SAVE                            CANCEL
```

The menu consists of the following fields:

Field	Description
Source Link	Here you can select the link X.25 call packets first arrive on.
Destination Link	Here you can select the link X.25 call packets will be sent to. Possible values are the available interfaces. When your destination link is a multipoint interface, you additionally have to adjust the destination link address (LLC).
Destination Link Address (LLC)	Only for ***DESTINATION LINK*** = *<point-to-multipoint interface>*. Defines the MAC address of the destination link for a multipoint interface.
Destination X.25 Address	Defines the address the packet is addressed to.
Metric	Defines if and how the route is prioritized. A route with the lowest metric value always has higher priority (possible values *0...255*). The default value is *0*.

Table 4-2: ***ROUTING*** ➜ ***ADD/EDIT*** menu fields

5 Multiprotocol over X.25 Submenu

The fields of the *MULTIPROTOCOL OVER X.25* submenu are decribed below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR]: Multiprotocol over X.25                          MyGateway

 Interface Name      Destination X.25 Address  Encapsulation

    ADD                 DELETE              EXIT
```

The ***X.25*** ➜ ***MULTIPROTOCOL OVER X.25*** menu lists the Multiprotocol Routing over X.25 (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.

Note

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

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

Configuration is carried out in ***X.25*** ➜ ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT***.

Use this menu to add or change MPX25 interfaces.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD]: Configure X.25 MPR Partner                   MyGateway

Partner Name

Encapsulation                    ip_rfc877
X.25 Destination Address



Advanced Settings >

IP >

            SAVE                              CANCEL
```

The menu consists of the followiing fields:

Field	Description
Partner Name	Enter a unique name to identify this MPX25 partner.

Field	Description
Encapsulation	Here you select the type of encapsulation respectively the protocol to be used. Note that the remote MPX25 partner must be configured to use the same encapsulation. Possible values: ■ *ip_rfc877* (default value) or *ip*: You must define the IP settings in the ***IP*** submenu (see below). ■ *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. ■ *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 5-1: ***MULTIPROTOCOL OVER X.25*** menu fields

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

Table 5-2: Encapsulation

The menu ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** provides access to the following submenus:

- ***ADVANCED SETTINGS***
- ***IP*** (not displayed for ***ENCAPSULATION*** = *ipx*).

5.1 Advanced Settings Submenu

The fields of the *ADVANCED SETTINGS* submenu are described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][ADVANCED]: Advanced X.25                      MyGateway
                            MPR Settings ()


Static Short Hold (sec)                60

Delay after Connection Failure (sec)   60



              OK                                CANCEL
```

Specific functions make it possible to define the characteristics for connections to X.25 partners individually and are configured in the ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***ADVANCED SETTINGS*** menu.

Defining short hold

➤➤ **Short hold** is defined to clear an unused connection automatically, i.e. when no more user data is sent, and thus save charges. The static short hold tells the gateway the duration of the idle time after which it is to clear down the connection.

Static

The static short hold setting determines how much time should pass between sending the last ➤➤ user **data packet** and clearing the connection. Enter a fixed period of time in seconds.

Delay after connection failure

This function enables you to set the period of time the gateway is to wait for an attempt to set up an outgoing connection after an unsuccessful attempt to set up a call.

The menu consists of the following fields:

Field	Description
Static Short Hold (sec)	Idle time in seconds for static short hold. Default value is *60*.
Delay after Connection Failure (sec)	Block timer. Indicates the wait time in seconds before the gateway tries again after an attempt to establish a connection has failed. Default value is *60*.

Table 5-3: ***ADVANCED SETTINGS*** menu fields

5.2 IP Submenu

The *IP* submenu is described below.

The ***X.25*** ➜ ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***IP*** submenu is used for defining routing settings specifically for a WAN partner.

The ***IP*** submenu consists of the following additional submenus:

- ***BASIC IP-SETTINGS***
- ***MORE ROUTING***
- ***ADVANCED SETTINGS.***

5.2.1 Basic IP-Settings Submenu

The fields of the *BASIC IP-SETTINGS* submenu are described below. When *TRANSIT NETWORK* is set to *yes*, the following screen is displayed (example addresses are used):

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][IP][BASIC]: IP-Settings ()                    MyGateway


 IP Transit Network                    yes



 Local IP Address                      192.168.100.1
 Partner IP Address                    192.168.100.2


 Default Route                         no

 Remote IP Address                     192.168.1.0
 Remote Netmask                        255.255.255.0


           SAVE                                CANCEL
```

To be able to transfer IP datagrams between two remote LANs, the gateway must know the route to the respective destination network. In this menu you can define the basic routing or generate a default route to the partner gateway.

Default route All data is sent automatically to the WAN partner on a default route, if no other route matches.

You can configure several default routes on your gateway, but only one can be active. Make sure that you set different values for ***METRIC***, if you configure more than one default route.

Transit network

You use an additional WAN IP address each for your gateway and the WAN partner. This sets up a virtual IP network – called a transit network – during the connection. You do not normally need this setting, but it is necessary for some special configurations.

The menu consists of the following fields:

Feld	Wert
IP Transit Network	Defines whether your gateway uses a transit network to the WAN partner. Possible values: ■ *yes*: A transit network is used. ■ *no* (default value): A transit network is not used. ■ *dynamic client*: Your gateway receives an IP address dynamically. ■ *dynamic server*: Your gateway assigns IP addresses to the remote gateway dynamically.
Local IP Address	Only for ***IP TRANSIT NETWORK*** = *yes, no*. ■ if *yes* = WAN IP address of your gateway ■ if *no* = LAN IP address of your gateway.
Partner IP Address	Only for ***IP TRANSIT NETWORK*** = *yes*. WAN partner's WAN IP address in the transit network.
Enable NAT	Only for ***IP TRANSIT NETWORK*** = *dynamic client*. Possible values: ■ *yes*: NAT is activated for this WAN partner. ■ *no* (default value): NAT is deactivated for this WAN partner. The settings in this menu correspond to NAT activation in the ***IP*** ➜ ***NETWORK ADDRESS TRANSLATION*** ➜ ***EDIT*** menu.

Feld	Wert
Default Route	Only for ***IP TRANSIT NETWORK*** = *dynamic client*, *no* or *yes*. Possible values: ■ *yes*: The route to this WAN partner is defined as default route. ■ *no* (default value): The route to this WAN partner is not defined as default route.
Remote IP Address	Only for ***IP TRANSIT NETWORK*** = *yes* or *no*. WAN partner's LAN IP address.
Remote Netmask	Only for ***IP TRANSIT NETWORK*** = *yes* or *no*. WAN partner's LAN netmask.

Table 5-4: ***BASIC IP-SETTINGS*** menu fields

5.2.2 More Routing Submenu

The fields of the *MORE ROUTING* submenu are described below.

If a route has been entered for a specific connection partner in ***BASIC IP-SETTINGS***, a routing entry is created automatically in your gateway's routing table. The submenu ***MORE ROUTING*** appears in the ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***IP*** menu. In this menu you can edit the routing entries of a specific WAN partner and add other entries.

The IP routes for a specific WAN Partner are listed in the ***MULTIPROTOCOL OVER X.25 ➜ ADD/EDIT ➜ IP ➜ MORE ROUTING*** menu:

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][IP][ROUTING]: IP Routing ()                   MyGateway

 The flags are:  U (Up), D (Dormant), B (Blocked),
                 G (Gateway Route), I (Interface Route),
                 S (Subnet Route), H (Host Route), E (Extended Route)

 Destination   Gateway       Mask            Flags Met. Interface  Pro
 192.168.1.0   192.168.100.2 255.255.255.0   DG    1    Filiale    loc
 192.168.100.2 192.268.100.1 255.255.255.0   DH    1    Filiale    loc


   ADD               ADDEXT            DELETE             EXIT
```

FLAGS shows the current status (*Up*, *Dormant*, *Blocked*) and the type of route (*Gateway Route*, *Interface Route*, *Subnet Route*, *Host Route*, *Extended Route*). The protocol with which your gateway has "learned" the routing entry is displayed under ***PRO***, e.g. *loc* = local, i.e. manually entered.

More routes are added in the ***MULTIPROTOCOL OVER X.25 ➜ ADD/EDIT ➜ IP ➜ MORE ROUTING ➜ ADD*** menu. Existing entries can be edited by tagging the desired list entry and pressing the Return key.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][IP][ROUTING][ADD]                             MyGateway

 Route Type                    Network route
 Network                       WAN without transit network

 Destination IP-Address

 Partner / Interface

 Metric                        1


            SAVE                                  CANCEL
```

The ***MORE ROUTING ➜ ADD/EDIT*** menu consists of the following fields:

Feld	Wert
Route Type	Type of route. Possible values: ■ *Host route* (default value): Route to a single host. ■ *Network route*: Route to a network. ■ *Default route*: The route applies for all IP addresses and if no other suitable route is available.
Network	Defines the type of connection. For possible values see table “Selection options in Network field,” on page 33. The displayed value cannot be modified in this menu. It depends on the setting of ***IP TRANSIT NETWORK*** in ***MULTIPROTOCOL OVER X.25 ➜ ADD/EDIT ➜ IP ➜ BASIC IP SETTINGS***.
Destination IP Address	Only for ***ROUTE TYPE*** = *Host route* or *Network route*. IP address of the destination host or network.
Netmask	Only for ***ROUTE TYPE*** = *Network route* Netmask for ***DESTINATION IP ADDRESS*** If no entry is made the gateway uses a standard netmask.
Gateway IP Address	Only for ***NETWORK*** = *WAN with transit network*. IP address of the host to which your gateway should forward the IP packets.
Partner / Interface	Only for ***NETWORK*** = *WAN without transit network* Displays the connection partner. Field cannot be modified.

Feld	Wert
Metric	The lower the value, the higher the priority of the route (possible values *0...15*). The default value is *1*.

Table 5-5: ***MORE ROUTING*** menu fields

NETWORK offers the following selection options:

Description	Meaning
WAN without transit network	Route to a destination host or LAN that can be reached via a connection partner without including any transit network available.
WAN with transit network	Route to a destination host or LAN that can be reached via a connection partner via a transit network.

Table 5-6: Selection options in ***NETWORK*** field

In addition to the normal routing table, the gateway can also make routing decisions based on an extended routing table. Apart from the source and destination address, the gateway can also include the protocol, source and destination port, type of service (TOS) and the status of the gateway interface in the decision.

Entries in the Extended Routing Table are treated preferentially compared with entries in the normal routing table.

To create extended IP routing entries, press the ***ADDEXT*** button to open the relevant menu.

Example Extended IP Routing (XIPR) is useful, for example, if two networks are connected via ISDN with a LAN-LAN connection, but certain services (e.g. Telnet) should be routed over an X.25 link and not over an ISDN switched connection. By making entries in the Extended Routing Table, you can allow part of the IP traffic to run over the ISDN switched connection and part of the IP traffic (e.g. for Telnet) to run over an X.25 link.

Configuration is carried out in ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***IP*** ➜ ***MORE ROUTING*** ➜ ***ADDEXT***.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][IP][ROUTING][ADD]: IP Routing                MyGateway
                                    - Extended Route

 Route Type                  Host route
 Network                     WAN without transit network

 Destination IP-Address

 Partner / Interface         mprf1       Mode  always

 Metric                      1
 Source Interface            don't verify
 Source IP-Address
 Source Mask
 Type of Service (TOS)       00000000      TOS Mask  00000000
 Protocol                    don't verify


              SAVE                                CANCEL
```

The menu contains the following fields:

Field	Description
Route Type	Type of route. Possible values: ■ *Host route* (default value): Route to a single host ■ *Network route*: Route to a network ■ *Default route*: The Route applies for all IP addresses and if no other suitable route is available.
Network	Defines the type of connection, see table "Selection options in Network field," on page 33. The displayed value cannot be modified in this menu. It depends on the setting of ***IP TRANSIT NETWORK*** in ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***IP*** ➜ ***BASIC IP SETTINGS***.

Field	Description
Destination IP Address	Only for ***ROUTE TYPE*** = *Host route* or *Network route* IP address of the destination host or LAN.
Netmask	Only for ***ROUTE TYPE*** = *Network route* Netmask for ***DESTINATION IP-ADDRESS***.
Partner / Interface	Only for ***NETWORK*** = *WAN without transit network* Displays the connection partner. Field cannot be modified.
Mode	Only for ***NETWORK*** = *WAN without transit network*. Defines when the connection partner is to be used. Possible values see table “Mode selection options,” on page 36
Metric	The lower the value, the higher the priority of the route (possible values *0...15*). Default value is *1*.
Source Interface	Interface over which the data packets reach the gateway. Default value is *don’t verify*.
Source IP-Address	IP address of the source host or LAN.
Source Mask	Netmask for ***SOURCE IP-ADDRESS***.
Type of Service (TOS)	Possible values: *0..255* as bit string.
TOS Mask	Bit mask for ***TYPE OF SERVICE***.
Protocol	Defines a protocol. Possible values: *don’t verify, icmp, ggp, tcp, egp, pup, udp, hmp, xns, rdp, rsvp, gre, esp, ah, igrp, ospf, l2tp.* Default value is *don’t verify*.

Field	Description
Source Port	Only for ***PROTOCOL*** = *tcp* or *udp* Source port number or range of source port numbers.
Destination Port	Only for ***PROTOCOL*** = *tcp* or *udp* Destination port number or range of destination port numbers.

Table 5-7: ***ADDEXT*** menu fields

The ***MODE*** field includes the following selection options:

Description	Meaning
always	Always use the route.
dialup wait	Use the route if the interface is "*up*". If the interface is "*dormant*", dial and wait until the interface is "*up*". Otherwise reroute.
dialup continue	Use the route if the interface is "*up*". If the interface is "*dormant*", dial but reroute until the interface is "*up*". Otherwise reroute.
up only	Use the route if the interface is "*up*". Otherwise reroute.

Table 5-8: ***MODE*** selection options

The ***SOURCE PORT*** and ***DESTINATION PORT*** fields contain the following selection options:

Description	Meaning
any (default value)	The route is valid for all ➤➤ **port** numbers.
specify	Enables the entry of a port number.
specify range	Enables the entry of a range of port numbers.
priv (0...1023)	Privileged port numbers: 0 ... 1023.

Description	Meaning
server (5000....32767)	Server port numbers: 5000 ... 32767.
clients 1 (1024....4999)	Client port numbers: 1024 ... 4999.
clients 2 (32768....65535)	Client port numbers: 32768 ... 65535.
unpriv (1024...65535)	Unprivileged port numbers: 1024 ... 65535.

Table 5-9: Selection options of ***SOURCE PORT*** and ***DESTINATION PORT***

5.2.3 Advanced Settings Submenu

The fields of the *ADVANCED SETTINGS* submenu are described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][MPR][ADD][IP][ADVANCED]: Advanced X.25                  MyGateway
                                 MPR Settings


   RIP Send                              none
   RIP Receive                           none

   IP Accounting                         off
   Back Route Verify                     off
   Route Announce                        up or dormant
   Proxy Arp                             off

   Van Jacobson Header Compression       off


            OK                                        CANCEL
```

Extended routing settings and other adjustments for the respective connection partner can be made in the ***MULTIPROTOCOL OVER X.25*** ➜ ***ADD/EDIT*** ➜ ***IP*** ➜ ***ADVANCED SETTINGS*** menu.

RIP The entries in the routing table can be defined statically or the routing table can be updated constantly by a dynamic exchange of routing information between several gateways. This exchange is controlled by a Routing Protocol, e.g. RIP (Routing Information Protocol).

Gateways use ➤➤ **RIP** to exchange information stored in routing tables by communicating with each other at regular intervals. The gateway supports both version 1 and version 2 of RIP, either individually or together.

RIP is configured separately for LAN and WAN.

Active and passive

Gateways can be defined as active or passive gateways: Active gateways offer their routing entries to other gateways via ➤➤ **broadcasts**. Passive gateways accept the information from the active gateways and store it, but do not pass on their own routing entries. The gateway can be either active or passive.

Connection partner

If you negotiate with a connection partner to receive and/or send RIP packets, your gateway can exchange routing information dynamically with the gateways in the LAN of the remote gateway.

Note

Receiving routing tables via the RIP is a possible security loophole, as external computers or gateways can change the routing functionality of the gateway.

RIP packets do not set up or hold dialup connections.

IP Accounting This option is for activating or deactivating the creation of IP accounting messages for this connection partner. If IP accounting is activated, a statistics message is generated, which contains detailed information about the connections to this WAN partner. (Settings for storage of accounting messages into a file can be done in ***System*** ➜ ***External System Logging***.)

Back Route Verification This term conceals a simple but very powerful function of the gateway. If Back-route Verification is activated for a connection partner, data packets are only accepted at the interface if answering packets would be routed over the same interface. You can therefore prevent packets with fake IP addresses being accepted – even without filters.

Route Announce This option enables you to set when routing protocols (e.g. RIP), that have been activated if applicable, propagate the IP routes defined for this interface.

Proxy ARP ➤➤ **Proxy ARP** enables the gateway to answer ➤➤ **ARP** requests from its own LAN acting for the defined connection partner. If a host in the LAN wants to set up a connection to another host in the LAN or to a connection partner, but

does not know its hardware address (MAC address), it sends an ARP request as a ➤➤ **broadcast** to the network. If Proxy ARP is activated on the gateway and the desired target host can be reached e.g. via a host route, the gateway answers the ARP request with its own hardware address. The ➤➤ **data packets** are sent to the gateway, which then forwards them to the desired host.

Note

Verify that Proxy ARP is activated on the LAN side, too.

The ***ADVANCED SETTINGS*** menu consists of the following fields:

Field	Description
RIP Send	Enables RIP packets to be sent via the interface to the connection. Possible values: see table “Selection options for RIP Send and RIP Receive,” on page 41.
RIP Receive	For receiving RIP packets via the interface to the connection. Possible values: see table “Selection options for RIP Send and RIP Receive,” on page 41.
IP Accounting	For generating accounting messages for e.g. ➤➤ **TCP**, ➤➤ **UDP** and ICMP sessions. Possible values: *on*, *off* (default value).
Back Route Verify	Activates Back Route Verification for the interface to the connection. Possible values: *on, off* (default value).

Field	Description
Route Announce	Possible values: ■ *up or dormant* (default value): Routes are propagated if the interface's status is *up* or *dormant*. ■ *always*: Routes are always propagated independent of operational status. ■ *up only*: Routes are only propagated if the interface status is *up*.
Proxy ARP	Enables the gateway to answer ARP requests from the own LAN acting for the defined connection. Possible values: see table "Proxy ARP selection options," on page 42.
Van Jacobson Header Compression	Reduces the size of the TCP/IP packet. Possible values: ■ *on*: VJHC activated. ■ *off*: VJHC deactivated.

Table 5-10: ***ADVANCED SETTINGS*** menu fields

RIP SEND and ***RIP RECEIVE*** contain the following selection options:

Description	Meaning
none (default value)	Not activated.
RIP V2 multicast	Only for ***RIP SEND*** The gateway waits for version 2 RIP packets with RIP V2 multicast address 224.0.0.9.
RIP V1 triggered	RIP V1 messages are sent rsp. received and processed as per RFC 2091 (Triggered ➤➤ **RIP**).

Description	Meaning
RIP V2 triggered	RIP V2 messages are sent rsp. received and processed as per RFC 2091 (Triggered ➤➤ **RIP**).
RIP V1	For sending and receiving version 1 RIP packets.
RIP V2	For sending and receiving version 2 RIP packets.
RIP V1 + V2	For sending and receiving RIP packets of both version 1 and 2.

Table 5-11: Selection options for ***RIP SEND*** and ***RIP RECEIVE***

PROXY ARP offers the following selection options:

Description	Meaning
off (default value)	Deactivates Proxy ARP for this WAN partner.
on (up or dormant)	The gateway answers an ARP request only if the status of the connection is *up* (active) or *dormant* (idle). In the case of *dormant*, the gateway only answers the ARP request; the connection is not set up until someone actually wants to use the route.

Description	Meaning
on (up only)	The gateway answers an ARP request only if the status of the connection is *up* (active), i.e. a connection already exists.

Table 5-12: ***PROXY ARP*** selection options

6 XOT Submenu

The fields of the *XOT* menu are described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][XOT]: XOT Table                                          MyGateway

Interface      InIPAddr      InIPMask      OutIPAddr     OPort InAllow




   ADD                 DELETE              EXIT
```

In the ***X.25*** ➜ ***XOT*** menu you configure the major XoT parameters.

XoT XoT makes it possible to send X.25 packets over an IP network. This is done by "wrapping" X.25 packets in TCP packets and then sending them over an IP network.

Configuration is carried out in ***X.25*** ➜ ***XOT*** ➜ ***ADD/EDIT***.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[[X.25][XOT][ADD]                                              MyGateway


 Interface Name

 Allow Incoming XOT Calls                   yes
 Incoming Partner Source IP Address
 Mask

 Outgoing Partner Destination IP Address


 Source IP Address

 Max Number of XOT Links                    5
 MTU                                        1456


         SAVE                                CANCEL
```

The menu contains the following fields

Field	Description
Interface Name	Here you enter any desired name (max. 25 characters) for the XoT interface.
Allow Incoming XOT Calls	Defines whether or not incoming XoT connections are permitted. Possible values: ■ *yes* (default value): Incoming XoT packets are accepted at this interface. ■ *no*: Incoming XoT connections are not accepted at this interface (but outgoing connections can be set up).

Field	Description
Incoming Partner Source IP Address	Only for ***ALLOW INCOMING XOT CALLS*** = *yes* Defines the IP address of the XoT partner that is sending XoT packets. If you enter *0.0.0.0* as IP address, connections are accepted from any IP addresses.
Mask	Only for ***ALLOW INCOMING XOT CALLS*** = *yes* The netmask belonging to the IP address (***INCOMING PARTNER SOURCE IP ADDRESS***). You have the option of entering no IP address, but defining a netmask. Connections are then accepted from all IP addresses fitting this netmask.
Outgoing Partner Destination IP Address	Here you enter the IP address of the XoT partner to whom XoT packets are to be sent.
Destination Port	Only if an IP address is set in the field ***OUTGOING PARTNER DESTINATION IP ADDRESS***. Here you enter the port to whom XoT packets are to be sent to. Possible values: *1 .. 65535*. Default value: *1998*
Source IP Address	Source IP address for outgoing calls (optional).
Max Number of XOT Links	Defines the maximum number of incoming and outgoing XoT connections to this XoT partner. Possible values: *1 .. 9999*. Default value: *5*.
MTU	The maximum transfer unit (MTU) defines the maximum size of the packets to be sent (in bits). Possible values: *576* to *8180*. Default value is *1456*.

Table 6-1: ***XOT*** menu fields

7 X.25 to TCP conversion Submenu

X.25 Networks

Today, there are only few generic X.25 networks in use. Many servers usually still speak X.25, but most terminals are connected to the Public Switched Telephone Network (PSDN) by either analogue (POTS) or digital (ISDN) connections. The original principle, however, has not changed. We use PAD and a X.25 network to transfer the data.

TCP/IP is already part of this scheme. With XoT (X.25 over TCP) we can use TCP/IP based networks (like the Internet) to transport X.25 Layer 3 protocol elements.

Today's equipment manufactures start to provide pure TCP/IP based communication. The requirement to still connect older devices creates a need for X.25 to TCP converters.

This document provides information about the X.25 to TCP converter of bintec routers.

Principles

The "X.25 to TCP" feature converts X.25 calls to TCP calls and vice versa. The parameters of the different calls are translated with the help of a conversion table.

The table is used in two directions. If X.25 calls are received, an entry matching the parameters of the X.25 call request packet is searched in the table. If an entry is found, a TCP call is created. The call parameters of the TCP call are derived from the same entry. The call parameters of the X.25 call will be translated into the call parameters of a TCP call.

The same procedure can also be performed in the other direction.

Routing Configuration

The "X.25 to TCP" feature is implemented in the router as a local X.25 and TCP application. This means, that one end of both the TCP and the X.25 connection is terminated within the router. Consequently, routing has to be configured to route the original call to the router itself.

For the TCP side, the destination IP address of incoming calls has to be a local address of the router. Multiple local IP addresses may be defined using special IP routes. A single address or a complete subnetwork may be defined to be a

local address by pointing the route to the local interface. The destination IP port number has to be a predefined port number.

For the X.25 side, the incoming call has to be routed to the local interface.

Care has to be taken not to define local addresses twice for different applications. It is, for example, not possible to use the TELNET port for X.25 over TCP without switching the local TELNET feature off. Another example is the local X.25 MINIPAD application. Incoming calls have to be distinguished by a different X.25 Protocol ID or the MINIPAD feature has to be switched off.

Outgoing X.25 and TCP calls are originated at the local interface and are processed by either the X.25 or the IP routing mechanisms before the calls can be delivered to their final destination interface.

The fields of the ***X.25 TO TCP CONVERSION*** menu are described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 TO TCP]: X25 to TCP Table                            MyGateway

Cl-Index St Rm IP:Port - Lo IP:Por <> Lo Addr(NSAP) - Rm Addr(NSAP) Met




    ADD                 DELETE              EXIT
```

The configuration of X.25 to TCP conversion is made in the ***X.25*** ➜ ***X.25 TO TCP CONVERSION*** ➜ ***ADD/EDIT*** menu. One parameter set in this menu generates one entry in the X.25 to TCP table (the empty table without entries see above).

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 TO TCP][ADD]                                        MyGateway


Index:
Description:
State: valid    Direction: both         Class: Normal         Metric: 1

X.25                              TCP
Remote Address:                   Local Address:
Remote NSAP:                      Local Port:
Local Address:                    Remote Address:
Local NSAP:                       Remote Mask:
Protocol Id:                      Remote Port:        to
Call User Data:                   Monitor Remote Address:  off
Clsd User Group:  Out:   Bil:

Packetizing: none   RESET Behavior: accept   INTR Behavior: ignore


           SAVE                                  CANCEL
```

The menu ***X.25*** ➜ ***X.25 TO TCP CONVERSION*** ➜ ***ADD/EDIT*** consists of the following fields:

Feld	Wert
Index	The system assigns a free (not yet used) unique integer number to each table entry. If there are no table entries yet, the system begins numbering with *1*.
Description	Here you can enter a unique arbitrary name to identify a table entry. The maximum length of the entry is 60 characters.

Feld	Wert
State	Determines the status of a table entry. Possible values: ■ *valid* (default value): The table entry is valid and will be used for conversion. ■ *invalid*: The table entry is not valid and will be ignored.
Direction	Specifies the direction the conversion shall be used for. Possible values: ■ *both* (default value): Used for conversion in both directions. ■ *TCP to X.25*: Used to convert incoming TCP calls to X.25 calls. ■ *X.25 to TCP*: Used to convert incoming X.25 calls to TCP calls.

Feld	Wert
Class	Allows to break down the one-to-one relation of the X.25 and TCP call parameters to up to four subrelations. This makes it possible to translate portions of the address spaces independently and thus to avoid very large conversion tables (see “Complex Configurations” on page 57). Possible values: ■ *Normal* (default value): One rule translates exactly one call. ■ *Master plus 1*: One master rule and one *subrule 1* will perform the translation of a call. ■ *Master plus 2*: One master rule, one *subrule 1,* one *subrule 2* will perform the translation of a call. ■ *Master plus 3*: One master rule, one *subrule 1,* one *subrule 2*, one *subrule 3* will perform the translation of a call. ■ *Subrule 1*: Performs the translation of a call in combination with the respective master rule. Depending on the master rule, additional subrules may be necessary.

Feld	Wert
Class (cont.)	■ *Subrule 2*: Performs the translation of a call in combination with the respective master rule. Depending on the master rule, one *subrule 1* and, if so, one *subrule 3* may be necessary. ■ *Subrule 3*: Performs the translation of a call in combination with the master rule *Master plus 3* and one *subrule 1* and one *subrule 2*.
Metric	Arranges the table entries for the matching process. If multiple entries match an incoming TCP or X.25 call, the entry with the lowest ***METRIC*** value will be used. Possible values are integers. The default value is *1*.
X.25 Remote Address	Enter the called X.25 address used in outgoing X.25 calls or the calling X.25 address to match for incoming X.25 calls. In the latter case, wildcards may be used.
X.25 Remote NSAP	Enter the called X.25 NSAP (Network Service Access Point) used in outgoing X.25 calls or the calling X.25 NSAP to match for incoming X.25 calls. In the latter case, wildcards may be used.
X.25 Local Address	Enter the calling X.25 address used in outgoing X.25 calls or the called X.25 address to match for incoming X.25 calls. In the latter case, wildcards may be used.
X.25 Local NSAP	Enter the calling X.25 NSAP used in outgoing X.25 calls or the called X.25 NSAP to match for incoming X.25 calls. In the latter case, wildcards may be used.

Feld	Wert
X.25 Protocol Id	Enter the Protocol ID used for outgoing X.25 calls or to match for incoming X.25 calls. Possible values are all hexadecimal numbers *0...ffffffff*.
X.25 Call User Data	For outgoing X.25 calls: Here you can enter the Call User Data field for an outgoing X.25 Call Request packet. For incoming X.25 calls: The entry will be compared with the Call User Data field of the received X.25 Call Request packet beginning from the left.
TCP Local Address	Incoming TCP calls: If you enter a value other than 0.0.0.0, the entered IP address is compared against the called IP address of the TCP call. Multiple local IP addresses can be defined to extend the address space for TCP calls. Outgoing TCP calls: This field is used as calling IP address. Make sure, that this address really is a local address. Otherwise no connection can be established.
TCP Local Port	Only used for incoming TCP calls. Specifies the local port number the converter is listening. Multiple local ports can be defined to extend the address space for TCP calls.

Feld	Wert
TCP Remote Address / TCP Remote Mask	Incoming TCP calls: If ***TCP REMOTE MASK*** is set to a value other than 0.0.0.0, the calling IP address is masked with ***TCP REMOTE MASK*** and compared to ***TCP REMOTE ADDRESS***. Outgoing TCP calls: The field ***TCP REMOTE ADDRESS*** specifies the target IP address for the TCP call. The field ***TCP REMOTE MASK*** is ignored.
TCP Remote Port	Here you can enter a port range. Incoming TCP calls: The calling TCP port of the call is checked for the specified port range. Outgoing TCP Calls: The first value of the port range specifies the destination port.
TCP Monitor Remote Address	When the table entry is used to convert incoming X.25 calls to TCP calls (***DIRECTION*** = *both* or ***DIRECTION*** = *X.25 to TCP*), the TCP target host (***TCP REMOTE ADDRESS***) may be monitored for reachability. In this case, the entry will only be used, when the target host is reachable with ICMP Echo Request (ping) packets. Other entries matching the same X.25 call may be used to divert the TCP call to a different target, if the target host of the table entry is not reachable. Possible values: ■ *on*: Monitors the target host. ■ *off* (default value): No monitoring of the target host.

Feld	Wert
Clsd User Group	Creates a "Closed User Group" facility element for outgoing X.25 calls. Possible values: *0...9999*.
Clsd User Group Out	Creates a "Closed User Group with outgoing access" facility element for outgoing X.25 calls. Possible values: *0...9999*.
Clsd User Group Bil	Creates a "Bilateral Closed User Group" facility element for outgoing X.25 calls. Possible values: *0...9999*.
Packetizing	Specifies, how X.25 packets shall be encoded in the TCP data stream. Possible values: ■ *none* (default value): The payload of the X.25 packets is integrated into the TCP data stream without a header. The converter decides itself, how octets received from the TCP connection are integrated into X.25 packets. The information about X.25 packet boarders is lost in the TCP connection. ■ *ATOS*: A simple two octet header (low octet first) specifies the length of a X.25 packet in the TCP connection. The length includes the header, so a value of three means an X.25 packet consisting of one octet. ■ *RFC 1006*: A four octet header according to RFC 1006 is used to specify the packet length of the X.25 packet in the TCP connection.

Feld	Wert
RESET Behavior	Specifies the behaviour of the converter, when it receives a Reset Request packet on the X.25 connection. Possible values: ■ *accept* (default value): The reset is confirmed with Reset Response. The conversion continues. The TCP side does not state, that a reset occurred. ■ *clear*: Clears the X.25 connection and the corresponding TCP.
INTR Behavior	Specifies the behaviour of the converter, when it receives an Interrupt Indication packet on the X.25 connection. Possible values: ■ *ignore* (default value): The Interrupt Indication is confirmed with an Interrupt Confirm and the conversion continues. The TCP side does not state, that an Interrupt Indication occured. ■ *pass*: The Interrupt Indication is confirmed with an Interrupt Confirm. The data passed with the Interrupt indication is integrated into the TCP connection and the conversion continues. The TCP side does not state, that the data came from an Interrupt Request. ■ *clear*: Clears the X.25 connection and the corresponding TCP connection.

Table 7-1: ***X.25 TO TCP CONVERSION*** menu fields

7.1 Complex Configurations

So far, the current chapter describes, how the X.25 to TCP converter converts the address spaces of X.25 and TCP by a single one-to-one relation. This may result in very large translation tables. For example, if the converter shall convert calls from 300 clients to 100 servers for 10 applications, this causes a table size of 300,000 entries which is practically impossible to handle even for the fastest router.

To come around this problem, it is possible to translate portions of the address spaces independently of other portions. It is possible to perform the translation of up to four portions independently.

By default, in the ***SETUP TOOL*** the ***CLASS*** field is set to the value *normal*. A single rule describing the translation is sufficient for the translation.

If the ***CLASS*** field is - for example - set to *Master plus1*, the single rule is no longer sufficient. A second rule is needed for a complete address translation. The second rule is searched with the same matching mechanisms among the rules with the ***CLASS*** field set to *subrule 1*. If the second rule cannot be found, the translation is aborted with a syslog-message.

Multiple Rules

The first rule is called "master rule", because its fields describe the behaviour during the established calls (i.e. fields ***PACKETIZING***, ***RESET BEHAVIOR***, ***INTR BEHAVIOT***). The second rule, the so-called "subrule", is only used to assist in address translation.

This scheme can be enhanced up to four rules for a single translation. This is reached by setting the ***CLASS*** field to *Master plus 3*. Three subrules (*subrule 1*, *subrule 2* and *subrule 3*) must be found for a single translation.

It is entirely up to the user, which parts of the address spaces are translated by what master or subrule. After all necessary rules could be found in the table, they are always processed in the order

subrule 3 -> subrule 2 -> subrule 1 -> master rule

Example

For example:

Create a table, that translates the addresses of three X.25 clients, two IP servers and two applications:

X.25 clients:

Class = Master plus 2; X.25 Remote Address = 4500000001;
TCP Local Address = 10.0.0.1

Class = Master plus 2; X.25 Remote Address = 4500000002;
TCP Local Address = 10.0.0.2

Class = Master plus 2; X.25 Remote Address = 4500000003;
TCP Local Address = 10.0.0.3

TCP servers:

Class = Subrule 1; X.25 Local Address = 45999999991;
TCP Remote Address = 10.1.1.1

Class = Subrule 1; X.25 Local Address = 45999999992;
TCP Remote Address = 10.1.1.2

Applications:

Class = Subrule 2; X.25 Protocol Id = 123; TCP Remote Port = 4711

Class = Subrule 2; X.25 Protocol Id = 124; TCP Remote Port = 4712

In a standard system each combination would require an entry. This would result in 3 x 2 x 2 = 12 entries. The example above contains only seven entries. Thus, five table entries are "saved".

Note

Please monitor the processing sequence of the master and the corresponding subrules.

The last processed rule "wins"!

The result of the previous rules can be used for X.25 addresses, NSAPs and Call User Data. An asterisk ('*') used in a rule is substituted by the result of the previous rule. For example:

Class = Subrule 1; TCP Local Port = 4711; X.25 Remote NSAP = 1234

Class = Master plus 1; TCP Local Address = 10.0.0.1;
X.25 Remote NSAP = 010000000001*

If with the above configuration, the translator receives a TCP call for address 10.0.0.1 and port 4711, an X.25 call with a remote NSAP field of 0100000000011234 is created. This is a common case, because the X.25 NSAP encodes node-addresses as well as application addresses.

Note

The usage of different master-rule-classes in one and the same table is strongly discouraged.

8 X.25 over ISDN Submenu

X.25

The TCP/IP protocol family penetrates applications being classically in the domain of the X.25 protocol family.

For example, Point-of-Sales (POS) applications have historically been set up with X.25. The terminals were using an asynchronous, serial protocol to transfer standardized POS messages to the POS server. The terminals where connected to an X.25 PAD with a RS232 (V.24) connection. The X.25 PAD established X.25 calls via a generic X.25 network to a server connected directly to X.25.

Today, there are only few generic X.25 networks in use. Most servers still speak X.25, but today most terminals are connected to the Public Switched Telephone Network (PSDN) by either analogue (POTS) or digital (ISDN) connections.

bintec gateways are able to route X.25 calls between the PSTN and other X.25 carrying networks (i.e. X.21, Ethernet, TCP, …). They are often used as dialin-node for example for POS purposes. All ISDN capable bintec gateways can work with digital connected terminals. Analogously connected terminals can serve bintec gateways with built-in digital modems.

bintec gateways may not only route X.25 calls. They are also capable to terminate X.25 calls and convert them to TCP. This can be achieved by using the feature "X.25 to TCP conversion" (see “X.25 to TCP conversion Submenu” on page 47).

This document provides for information about the "X.25 over ISDN" feature of bintec gateways.

Principles

ISDN, or more generally speaking of PSTN, can be seen as an X.25 carrying physical network (layer 1 of the OSI model). Physical networks are set up as so-called "interfaces" within bintec gateways. Interfaces can be hardware-oriented or virtual. The X.25 switch routes X.25 calls between different interfaces.

Hardware oriented interfaces correspond to real hardware units. The Ethernet interfaces of the bintec router corresponds exactly to the physical plug representing the Ethernet connection. If there are multiple Ethernet plugs, there are also multiple Ethernet interfaces. Ethernet is a typical example of a hardware-oriented interface.

For X.25 over ISDN, hardware oriented interfaces cannot be used. The interfaces shall be corresponding to the connection to a specific communication partner or a set of communication partners. These partners are more related to the dialled number and not to the ISDN hardware that is finally used to establish the ISDN calls.

Imagine a number of primary rate ISDN lines connected to the public network. When a specific partner shall be reached, any of those lines can be used to establish the call, as long as the dialled number is correct. For incoming calls, it is not even known in advance, on which ISDN line the call will appear, since this is decided by the public ISDN network.

Therefore, it makes sense to use virtual interfaces for X.25 over ISDN. This is the way, X.25 over ISDN is implemented in bintec gateways. An arbitrary number of virtual interfaces can be defined by the user. Each virtual interface gets assigned a set of parameters describing the common behaviour for all ISDN calls assigned to the specific interface. These parameters also include the PSTN numbers to dial or to identify.

X.25 over ISDN interfaces can be monitored by the following tools for monitoring interfaces:

- The command *ifstat*
- The command *netstat*
- The Setup Tool.

The fields of the ***X.25 OVER ISDN*** menu are described below.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 OVER ISDN]: X25 over ISDN Interfaces                MyGateway

 Index  Name                  Type        Status   Curr Calls  Max Calls

    ADD                  DELETE              EXIT
```

In the ***X.25*** ➜ ***X.25 OVER ISDN*** menu, the X.25 over ISDN interfaces are displayed. As long as no interfaces are set, there will be no entries.

Note

In the ***ISDN*** ➜ ***INCOMING CALL ANSWERING*** menu, make sure to configure all numbers that shall be used for incoming ISDN calls with ***X.25 OVER ISDN***.

For each ISDN interface, a number has to be defined in the ***NUMBER*** field for routing incoming ISDN calls to the desired X.25 over ISDN interface.

Please ensure that numbers are unique and do not overlap. An ISDN call can only be delivered to exactly one point. It is not possible to use the same local number for *PPP* and *X.25 over ISDN*.

For basic rate interfaces without DDI use the mode "right to left". In this case, the Called Party Number of incoming calls is compared right-to-left with predefined numbers. An entry matches, if the last digits match. It is not necessary to specify the complete subscriber number. The last n unique digits are sufficient.

For primary rate interfaces or basic rate interfaces with DDI, use the mode "left to right" and specify the complete subscriber number including extension, as received from the ISDN network.

The configuration of X.25 over ISDN interfaces is carried out in the ***X.25*** ➜ ***X.25 OVER ISDN*** ➜ ***ADD/EDIT*** menu.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 OVER ISDN][ADD]                                      MyGateway

 Interface: 0     Name:                          Type:   one to one

 ISDN Numbers >
 Signalling:

 Dial Parameters:


 Layer 1 Parameters:
   Protocol: auto                              Modem Profile: 1

 Layer 2 Parameters:
   Protocol: auto           Mode: auto  PAD Profile: 0



              SAVE                           CANCEL
```

The ***X.25*** ➜ ***X.25 OVER ISDN*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Feld	Wert
Interface	The system assigns a free unique integer number to each interface. If there are no interfaces yet, the system begins numbering with *27000*.
Name	Here you can enter a unique name to identify an interface.

Feld	Wert
Type	Describes the behaviour of the interface for outgoing X.25 calls. Possible values: ■ *one to one* (default value): Each outgoing X.25 call creates a directly assigned outgoing ISDN call. If the X.25 call is cleared before the connection is established, the connection procedure for ISDN and LAPB is aborted immediately. If the ISDN or LAPB setup fails, the X.25 call is cleared without retries. ■ *multiple VC*: As long as virtual circuits are available for outgoing calls, existing ISDN calls are used. New ISDN calls are created if no more VCs for outgoing calls are available. The assignment of the X.25 call to the ISDN call takes place after LAPB has been established. If the X.25 call is cleared before the connection is established, connection setup for ISDN and LAPB continues. For incoming calls, the behaviour is always the same regardless of the settings.

Feld	Wert
Signalling	Enter the signalling code here. The signalling code is an abbreviation for common settings of the ISDN information elements Bearer Capability (BC), High Layer Compatibility (HLC), and Low Layer Compatibility (LLC). The following values are recommended: ■ *0x0805*: Native X.25 over transparent B-Channel ■ *0x0102*: PAD over analogue modem ■ *0x0700*: PAD over LAPB (X.75, compatible to *isdnlogin*) ■ *0x07b0*: PAD over V.120 bitrate adaptation 64k ■ *0x07b9*: PAD over V.120 bitrate adaptation 56k ■ *0x07C0*: PAD over V.110 bitrate adaptation 1200 ■ *0x07C3*: PAD over V.110 bitrate adaptation 2400 ■ *0x07C4*: PAD over V.110 bitrate adaptation 4800 ■ *0x07C5*: PAD over V.110 bitrate adaptation 9600 ■ *0x07C6*: PAD over V.110 bitrate adaptation 14400 ■ *0x07C7*: PAD over V.110 bitrate adaptation 19200 ■ *0x0740*: PAD over V.110 bitrate adaptation 38400.

Feld	Wert
Signalling (cont.)	For outgoing ISDN calls: If this field is set to 0x0000, the signalling is derived from the settings for ***Layer 1 Protocol*** and ***Layer 2 Protocol***. If this field is different from 0x0000, the signalling is sent as specified by the value of this field. The settings for ***Layer 1 Protocol*** and ***Layer 2 Protocol*** are derived from the signalled information elements, if not specified explicitly (not *auto*) in the fields ***Layer 1 Protocol*** or ***Layer 2 Protocol***. For incoming ISDN calls: If this field is set to *0x0000*, all ISDN calls are accepted that specify a supported setting of BC, LLC and HLC. If this field is different from *0x0000*, only ISDN calls with the corresponding setting of BC, LLC, HLC are accepted.
Max Retries	Only for ***Type*** = *multiple VC*. Specifies the maximum number of retries for outgoing ISDN calls. Possible values: *0* .. *100*. Default value is *0*.
Retry Time	Only for ***Type*** = *multiple VC*. Specifies the time in seconds to wait between two retries. If the value is negative, a random number between one second and the positive value of the field is used as waiting time. Possible values: *-3600* .. *3600*. Default value is *0*.

Feld	Wert
Block Time	Only for ***TYPE*** = *multiple VC*. Specifies the time in seconds, how long the interface shall stay in blocked state. Thereafter, the interface is *up* again and can be used by the X.25 switch for routing. When the outgoing ISDN call has been retried for ***MAXRETRIES*** times, the interface enters into the blocked state. The X.25 switch ignores blocked interfaces for routing and is able to use alternative routes. Possible values: *0* .. *3600*. Default value is *30*.

Feld	Wert
Layer 1 Protocol	Specifies the Layer 1 Protocol to be used for the interface. ■ *auto* (default value)*:* The Layer 1 Protocol is derived from signalling received from the network for incoming calls or sent for outgoing calls. Outgoing calls with unspecified signalling (***SIGNALLING*** = *0x0000*) use *synchronous HDLC 64K*. ■ *synchronous HDLC 64K:* Synchronous HDLC framing 64 kBit/s* ■ *synchronous HDLC 56K:* Synchronous HDLC framing 56 kBit/s* ■ *Asynchronous V.110 1200:* Asynchronous V.110 bitrate adaptation using 1200 Bit/s** ■ *Asynchronous V.110 2400:* Asynchronous V.110 bitrate adaptation using 2400 Bit/s** ■ *Asynchronous V.110 4800:* Asynchronous V.110 bitrate adaptation using 4800 Bit/s** ■ *Asynchronous V.110 7200:* Asynchronous V.110 bitrate adaptation using 7200 Bit/s** ■ *Asynchronous V.110 9600:* Asynchronous V.110 bitrate adaptation using 9600 Bit/s** ■ *Asynchronous V.110 14400:* Asynchronous V.110 bitrate adaptation using 14400 Bit/s** ■ *Asynchronous V.110 19200:* Asynchronous V.110 bitrate adaptation using 19200 Bit/s**

Feld	Wert
Layer 1 Protocol (cont.)	■ *Asynchronous V.110 28800:* Asynchronous V.110 bitrate adaptation using 28800 Bit/s** ■ *Asynchronous V.110 38400:* Asynchronous V.110 bitrate adaptation using 38400 Bit/s**
Layer 1 Protocol (Fortsetzung)	■ *synchronous V.120 64k*: Synchronous V.120 bitrate adaptation using 64 kBit/s** ■ *synchronous V.120 56k*: Synchronous V.120 bitrate adaptation using 56 kBit/s** ■ *Asynchronous analogue modem*: * The automatic layer 2 protocol is *LAPB.* ** The automatic layer 2 protocol is *PAD.*
Layer 1 Modem Profile	Specifies the modem profile, if a modem is used.

Feld	Wert
Layer 2 Protocol	Specifies the layer 2 protocol to be used for the interface. Possible values: ■ *auto* (default value): The layer 2 protocol is derived from signalling. Outgoing calls with unspecified signalling (***SIGNALLING*** = *0x0000*) use LAPB. If the signalling specifies an asynchronous layer 1 protocol, PAD is used. If the signalling specifies a synchronous layer 1 protocol and X.25, LAPB is used. If the layer 1 protocol is synchronous but no X.25 is signalled, PAD over LAPB is used. ■ *LAPB*: This setting uses LAPB in the B channel. If an asynchronous layer 1 protocol is used, asynchronous HDLC is used for framing. ■ *PAD*: This setting uses a PAD instance in the B channel. ■ *PAD over LAPB*: This setting uses a PAD instance on top of a LAPB implementation. It can be used to support synchronous terminal adapters which are used to convey PAD commands. If an asynchronous layer 1 protocol is used, asynchronous HDLC is used for framing.

Feld	Wert
Layer 2 Mode	Specifies the DTE/DCE Mode for the LAPB. Possible Values: ■ *auto* (default value): DTE mode is used for outgoing ISDN calls, DCE is used for incoming ISDN calls. ■ *dte*: DTE mode is selected for incoming and outgoing ISDN calls. ■ *dce*: DCE mode is selected for incoming and outgoing ISDN calls.
Layer 2 PAD Profile	If a PAD is used, this field specifies the initial PAD profile to be used.

Table 8-1: ***X.25 OVER ISDN*** menu fields

Note

Make sure to specify the X.25 layer 2 and layer 3 parameters for the X.25 over ISDN interfaces configured here in the ***X.25*** ➜ ***LINK CONFIGURATION*** menu.

8.1 ISDN Numbers Submenu

The *ISDN NUMBERS* Submenu is described below.

The ISDN number to be dialed for outgoing calls or to be verified for incoming calls can be configured by selecting the ***X.25*** ➜ ***X.25 OVER ISDN*** ➜ ***ADD/EDIT***

→ ***ISDN NUMBERS*** submenu. The configuration is the same as the configuration of ISDN numbers for the PPP subsystem.

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 OVER ISDN][WAN NUMBERS]: WAN Numbers ()            MyGateway


   WAN Numbers for this partner:

     WAN Number             Direction




   ADD                  DELETE              EXIT
```

Additional numbers can be added or existing entries can be edited in the ***X.25*** → ***X.25 OVER ISDN*** → ***ADD/EDIT*** → ***ISDN NUMBERS*** → ***ADD/EDIT*** menu:

```
R3800 Setup Tool                Funkwerk Enterprise Communications GmbH
[X.25][X25 OVER ISDN][WAN NUMBERS][ADD]: Add or Change        MyGateway
                                      WAN Numbers ()


  Number
  Direction                          outgoing

  Advanced Settings >

  ISDN Ports to use  <X> Slot 0 Auxiliary    <X> Slot 2 BRI
                     <X> Slot 2 BRI




           SAVE                                  CANCEL
```

The ***X.25*** ➜ ***X.25 OVER ISDN*** ➜ ***ADD/EDIT*** ➜ ***ISDN NUMBERS*** ➜ ***ADD/EDIT*** menu consists of the following fields:

Field	Description
Number	Number of WAN partner. The calling party number of the incoming call is compared with the set ***NUMBER***. The calling party number can be read in ***MONITORING & DEBUGGING*** ➜ ***ISDN MONITOR*** as ***REMOTE NUMBER***.
Direction	Defines whether ***NUMBER*** should be used for incoming or outgoing calls or for both. Possible values: ■ *outgoing* (default value): For outgoing calls, where you dial your WAN partner. ■ *both (CLID)*: For incoming and outgoing calls. ■ *incoming (CLID):* For incoming calls, where your WAN partner dials in to your gateway.
ISDN Ports to Use	Defines the ISDN ports to be used. ■ Slot 0 Auxiliary: no entry or *X* ■ Slot 2 ISDN S0: no entry or *X*.

Table 8-2: ***ISDN NUMBERS*** menu fields

Note

When the gateway is connected to a PABX system for which a "0" prefix is necessary for external line access, this "0" must be considered when entering the access number.

Wildcards

When entering the ***NUMBER***, you can either enter the extension digit for digit or you can replace single numbers or groups of numbers with wildcards. ***NUMBER*** can therefore equal various extensions.

You can use the following wildcards, which have different effects for incoming and outgoing calls:

Wildcard	Meaning		Example		
	Incoming calls	Outgoing calls	Number	The gateway accepts incoming calls e.g. with:	Outgoing calls, i.e. the gateway sets up a connection to the WAN partner with:
*	Matches a group of none or more digits.	Is ignored.	123*	123, 1234, 123789	123
?	Matches exactly one digit.	Is replaced by 0.	123?	1234, 1238, 1231	1230
[a-b]	Defines a range of matching digits.	The first digit of the specified range is used.	123[5-9]	1235, 1237, 1239	1235
[^a-b]	Defines a range of excluded digits.	The first digit after the specified range is used.	123[^0-5]	1236, 1238, 1239	1236
{ab}	Optional sequence to match.	Sequence is used.	{00}1234	001234 and 1234	001234

Table 8-3: Wildcards for incoming and outgoing calls

Note

If the calling party number of an incoming call matches both a WAN partner's ***NUMBER*** with wildcards and a WAN partner's ***NUMBER*** without wildcards, the entry without wildcards is always used.

8.2 Submenu Advanced Settings

The *X.25* ➜ *X.25 over ISDN* ➜ *ADD/EDIT* ➜ *ISDN Numbers* ➜ *ADD/EDIT* ➜ *Advanced Settings* submenu is described below.

The gateway supports the use of the “Closed User Group” service feature, which you can request for your ISDN line from your telephone company. The reachability of your ISDN S0 interface is monitored and controlled by the exchanges if this feature is selected.

If no "Closed User Group" is defined, the ***Closed User Group*** (=CUG) field shows *none* (default value). To activate a closed user group for a WAN partner, select *specify*. Enter the CUG index in the field that opens. You can obtain information about CUGs from your telephone provider.

Index: X.25