Teldat Router

X.25/ISDN Configuration

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Chapter 1
X.25 Protocol

1. Introduction

The idea of network computers emerged at the beginning of the 60s, when more powerful and reliable models began to be produced, it became necessary to interconnect computers located in remote places, with the aim of sharing the hardware and software resources provided by the network.

The interconnection of computers was based initially on the use of existing networks at that time, in other words telephone lines, and the first efforts were centered on achieving reliable transmission through them.

The idea of packet switching came from the ARPA (Advanced Research Projects Agency) of the U.S. defense department, working on the basic premise that short messages or packets decrease the storage size and therefore the average delay. This led to the creation of the ARPANET network (Advanced Research Projects Agency NETwork), at the end of the 60s and beginning of the 70s. With the idea that this was the solution to achieving an international switching and data transportation service in the medium term, they began to make the first packet switching networks, Datapac (first public network), Telenet, Transpac, etc., that gradually moved on to other projects.

In recent decades public and international bodies (CCITT*, ISO, IEEE, ...) have started to show interest in the structuring and rationalization of the different functions that appear in data communication, and some architectures stratified in levels and layers emerge (SNA, DECNET, DSE, DNA, BNA, etc.).

In 1976, the CCITT* developed the X.25 recommendation for public data communication networks with the aim of establishing the international interconnection of national public networks and this is the current tendency in all communication companies.

* Now ITU-T

2. Packet switching

The packet switching technique consists of data transmission in groups through the network. Each one of these has a header where the associated virtual circuit is specified and it travels through the network independently from the rest, without the network user really knowing the "itinerary" followed by the packets transmitted.

The large increase in the use of public switched networks is due to the advantages supplied to the users in contrast to switching circuits for certain types of data transfer.

These advantages include:

Flexibility

A computer system that connects to a packet switching network can access or be accessed by any other system. Connection to the network, however, can be carried out step by step, and the data from several users can be multiplexed in the same line thanks to the use of an address (logical channel) contained in the packets themselves, which allows for great interconnection flexibility between Host, terminals and information systems.

Low Cost

In packet switching you pay per bit of information transmitted plus a specific fixed charge for renting the line. In a leased line, in switching circuits, you pay a fixed amount for renting, independent of the quantity of the data transmitted. The high cost of renting means that leased lines are more cost effective than switching packets when the volume of data transmitted is very high. As usually the applications utilized in daily life are transactional these generate little traffic, making it advisable to use packet switching. Furthermore, in packet switching the increase of traffic in international communications is less than in switched circuits.

Alternative Routes

The advantage here is to be found within the basic structure of the network itself and in the standardization of data through frames and packets. A generic network will be composed of data terminal equipment (DTE), data circuit equipment (DCE) and packet switching nodes (PSN). In this way, if a line or switching center breaks down, the packets can be routed through other alternative routes, as they contain the destination address and, therefore, do not require a physical connection between source and destination.

Easy Access

One of the major advantages of the use of packet switching networks is easy access through the interfaces Network/User, well determined and regulated by the CCITT* X.25 recommendation. This has allowed the normalization of telematic equipment and of public networks in different countries, hence facilitating access and interconnection.

* Today ITU-T

3. The X.25 Recommendation

The first version of the X.25 recommendation appeared in 1976 and was revised several times over the following years. Its objective was to standardize access from the data terminal equipment (DTE) to the services offered by the packet switching public networks.

This recommendation was the first to be structured in accordance with the layer model set up by the ISO (International Standards Organization) to interconnect open systems and establish protocols and interfaces from the first three layers in order to offer to the higher layers (from 4-7) the so-called service network.

For layer 1, X.25 suggests the X.21 recommendation for DTE-DCE interconnections functioning synchronously in public networks, the X.24 recommendation for the definition of link circuits and the X.26 and X.27 ones for electrical characteristics.

For the DTE-DCE interconnections using synchronous modems, X.25 suggests the X.21 bis recommendation and the V.28 and X.26 recommendations for electrical characteristics and the V.24 for link circuits characteristics. The V.24 and V.28 recommendations are largely equivalent to the RS-232 norm of the EIA (Electronic Industries Association).

On the link layer the access procedure is defined for the interchange of data between the DTE and the DCE. X.25 uses a subset of the HDLC procedure (High-level Data Link Control) specified by ISO, called LAPB (Link Access Procedure Balanced), arrived at after modifications to the initial proposals.

Layer 3, that in X.25 may be called packet layer, has the setting up, maintenance and disconnection of the virtual circuits functions assigned to it. In it the procedure for the interchange of data packets and of control between the DTE and the DCE is defined. This interchange is carried out through the logical channels, several channels can exist between DTE and DCE.

4. Configuration Commands

To enter in the X.25 Protocol configuration, access through the main menu in the following way:

1. At the (*) prompt, enter **PROCESS 4** (or **P 4**).
2. At the configuration prompt (Config>), enter **NODE X25**.
3. At the X.25 protocol configuration prompt (X25 Config>), use the configuration commands which are described in this chapter to configure the X.25 Protocol parameters.

The X.25 protocol configuration commands are numerated and described. The letters written in **bold** are the minimum number of characters that have to be entered to make the command effective.

Command	Functions
? (HELP)	Lists the available commands or their options.
ADD	Permit you to add certain X.25 interface configuration parameters: addresses, routes and facilities.
APPLY	Allows dynamic updating of the changes introduced in the routing commands.
ASSIGN	Allows you to assign a permanent virtual circuit (PVC) to another PVC or to an IP address.
CHANGE	Permits you to change the IP address parameters associated to the X.25 addresses.
DELETE	Allows you to delete some of the X.25 protocol configuration parameters.
DISABLE	Allows you to disable some the of X.25 protocol options.
ENABLE	Allows you to enable some the of X.25 protocol options.
LIST	Lists the configuration parameters.
RESTORE	Allows you to restore the default X.25 protocol parameter values.
SET	Permits configuration of the X.25 protocol parameters.
EXIT	Return to the Config> prompt.

X.25 Protocol configuration commands

4.1. ? (HELP)

Displays the list of available commands or their options.

Syntax:

```
X25 Config> ?
```

Example:

```
X25 Config> ?
ADD
APPLY
ASSIGN
CHANGE
DELETE
DISABLE
ENABLE
LIST
RESTORE
SET
EXIT
X25 Config>
```

4.2. ADD

Allows you to aggregate certain configuration parameters of the X.25 interface: addresses, facilities and routing.

Syntax:

```
X25 Config> ADD ?
ADDRESS
FACILITY
ROUTING
```

a) ADD ADDRESS

Allows you to associate an IP address with X.25 addresses.

Example:

```
X25 Config> ADD ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
NA calling? 20001
Time release without data(0-65000)[60]?
Encapsulation (IP, Null)[IP]?
Compression(Yes/No)? NO
X25 Config>
```

b) ADD FACILITY

Allows you to change the NA calling, adding or changing the user data and adding or changing the call packet facilities (window negotiation and packet length, reverse charge, closed user group and user network identification).

Example:

```
X25 Config> ADD FACILITY
NA (digit or X)? 123456
NA new (digit , X or S)? 999SXX                          (1)
Routing Port number   Ports(3-8) Router(2): 3            (2)
Priority(0-9) [0]: 1
Choose Window(Yes/No)(N)? Y
Write window of called(2-127)[7]: 7
Write window of caller(2-127)[7]: 7
Choose packet length(Yes/No)[N]? Y
Length of called(128-1024)[128]: 256
Length of caller(128-1024)[128]: 256
Reverse charge(Yes/No)[N]? Y
Closed User Group(Yes/No)[N]? Y
Type of group (Normal, Bilateral, Outgoing)[N]: N        (3)
Number of group: 0401
Network User Identifier: teldatnet                       (4)
User data: C0
X25 Config>
```

(1) **S** suppresses the digit in this position, **X** does not change it.

(2) If no port is configured, all outgoing calls from the **Teldat Router** are changed.

(3) The closed user group can be Normal (N), Bilateral (B) or Outgoing (O): closed user group with exit access. The value should be digits from 0 to 9.

(4) ASCII characters.

c) ADD ROUTING

Allows you to associate X.25 addresses with physical ports.

Example:

```
X25 Config> ADD ROUTING

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
ISDN 1   5 ISDN D channel: X25             A000000             1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00    9C
ISDN 2   6 ISDN D channel: X25             A200000             1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00    9B
LAN      0 Token Ring                      9000000             1C
WAN1     3 X25                             F001600  F000C00    9E
WAN2     4 X25                             F001620  F000D00    9D

Number of routing port   Ports(3-8) Router(2): 3
Write priority(0-9)[0]1                                  (*)
Write rerouting(Y,N,E)[N]N                               (**)
Value of NA? 123456
Protocol identifier (hex): [0]?                          (***)
X25 Config>
```

(*) The routing with the highest priority corresponds to the lowest number.

(**) The rerouting option allows you to carry out rerouting if the routing or route with the highest priority is unavailable or all their logical channels are busy. The possible values are:

Y: Yes, carries out rerouting.

N: No, does not carry out rerouting.

E: Exclusively rerouting: This option prevents an X.25 call being routed towards the same port that it entered by, i.e. if the highest priority routing routes the call towards an SVC from the same port which it entered by, a search to see if there are other routes towards other ports is carried out.

(***) The Protocol identifier field allows you to carry out routing depending on the first octet of the user data field which identifies the protocol. If this field is not programmed, it is ignored.

4.3. APPLY

Allows dynamic updating of the changes entered in the routing commands.

Syntax:

```
X25 Config> APPLY
```

Example:

```
X25 Config> APPLY
X25 Config>
```

4.4. ASSIGN

Allows you to assign a PVC to another PVC or to an IP address.

Syntax:

```
X25 Config> ASSIGN ?
ADDRESS-TO-PERMANENT
PERMANENT-TO-PERMANENT
```

a) ASSIGN ADDRESS-TO-PERMANENT

Associates a PVC to an IP address so that all the datagrams with this destination address are routed by a specific PVC.

Example:

```
X25 Config> ASSIGN ADDRESS-TO-PERMANENT
IP Address [0.0.0.0]? 192.168.1.1
Encapsulation (IP, Null)[IP]? IP
Compression(Yes/No)? Y
Port(3-4): 3
Channel: [1]? 1
X25 Config>
```

b) ASSIGN PERMANENT-TO-PERMANENT

Assigns a PVC to another permanent circuit of a different port in order to switch packets from one to the other.

Example:

```
X25 Config> ASSIGN PERMANENT-TO-PERMANENT
Port(3-4): 3
Channel: [1]? 1
Associated with:
Port(3-4): 4
Channel: [1]? 2
X25 Config>
```

4.5. CHANGE

Syntax:

```
X25 Config> CHANGE ?
ADDRESS
```

a) CHANGE ADDRESS

Permits you to change the IP address parameters associated to X.25 addresses.

Example:

```
X25 Config> CHANGE ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
New NA? 20444
NA calling? 20001
Time release without data(0-65000)[60]? 30
Encapsulation (IP, Null)[IP]? IP
Compression(Yes/No)? N
X25 Config>
```

4.6. DELETE

Permits you to delete some of the X.25 protocol configuration parameters.

Syntax:

```
X25 Config> DELETE ?
ADDRESS
FACILITY
NA-CALLING
PERMANENT
ROUTING
```

a) DELETE ADDRESS

Deletes the configuration of an IP address associated with X.25 addresses.

Example:

```
X25 Config> DELETE ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
X25 Config>
```

b) DELETE FACILITY

Deletes some of the configured facilities.

Example:

```
X25 Config> DELETE FACILITY
Entry number:2
num P Prt NA              NNA             Wcd Wcr Lcd Lcr  RC   CUG      NUI/UD
2   1  3  123456          999SXX           7   7   SI 256  256  YES---- teldatnet/C0
Delete this entry?(Yes/No)[N]? y
Facility deleted
X25 Config>
```

c) DELETE NA-CALLING

Deletes the configured NA from some of the X.25 ports.

Example:

```
X25 Config> DELETE NA-CALLING
Port number(3-4): 3
Deleted NA-CALLING port 3
X25 Config>
```

d) DELETE PERMANENT

Allows you to delete the assignment between two permanent virtual circuits.

Example:

```
X25 Config> DELETE PERMANENT
Entry number:1
Entry        Port      PVC     Port      PVC
   1           3        1        4        2
Delete this entry?(Yes/No)[N]? Y
Routing deleted
X25 Config>
```

e) DELETE ROUTING

Deletes a routing, i.e. the association between an X.25 address and a port.

Example:

```
X25 Config> DELETE ROUTING
Entry number:1
Entry        Port      priority     routing              NA        UD
 1           3            1            N       XXXXXXXXXXXXXXX
Delete this entry?(Yes/No)[N]? y
Routing deleted
X25 Config>
```

4.7. DISABLE

Permits you to disable some of the X.25 protocol options.

Syntax:

```
X25 Config> DISABLE ?
CHECK-INPUT-CALLING
EXT-FRAME-MODE
EXT-PACKET-MODE
SABM-ACTIVE
```

a) DISABLE CHECK-INPUT-CALLING

Disables the NA calling check. This parameter should always be *Enabled* if you are going to route IP over X.25.

Example:

```
X25 Config> DISABLE CHECK-INPUT-CALLING
X25 Config>
```

b) DISABLE EXT-FRAME-MODE

Specifies the NS field module of the X.25 link layer, i.e. the module used to consecutively number the sent LAPB frames. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> DISABLE EXT-FRAME-MODE
Port number(3-4):3
X25 Config>
```

c) DISABLE EXT-PACKET-MODE

Specifies the PS field module of the X.25 network layer, i.e. the module used to consecutively number the sent X.25 packets. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> DISABLE EXT-PACKET-MODE
Port number(3-4):3
X25 Config>
```

d) DISABLE SABM-ACTIVE

On disabling this option, the X.25 layer 2 entity waits as it is the remote entity which establishes the link.

Example:

```
X25 Config> DISABLE SABM-ACTIVE
Port number(3-4):3
X25 Config>
```

4.8. ENABLE

Allows you to enable certain X.25 protocol configuration parameters.

Syntax:

```
X25 Config> ENABLE ?
ALWAYS-SABM-ACTIVE
CHECK-INPUT-CALLING
EXT-FRAME-MODE
EXT-PACKET-MODE
SABM-ACTIVE
```

a) ENABLE ALWAYS-SABM-ACTIVE

On enabling this option, the X.25 layer 2 entity continually tries to establish the link transmitting SABM not just N2 times. This value can only be configured if the port is DCE at a physical level.

Example:

```
X25 Config> ENABLE ALWAYS-SABM-ACTIVE
Port number(3-4):3
X25 Config>
```

b) ENABLE CHECK-INPUT-CALLING

Enables the NA calling check: makes the router verify that a specific NA calling is in its tables. This parameter should always be *Enabled* if you are going to route IP over X.25.

Example:

```
X25 Config> ENABLE CHECK-INPUT-CALLING
X25 Config>
```

c) ENABLE EXT-FRAME-MODE

Specifies the NS field module of the X.25 link layer, i.e. the module used to consecutively number the sent LAPB frames. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> ENABLE EXT-FRAME-MODE
Port number(3-4):3
X25 Config>
```

d) ENABLE EXT-PACKET-MODE

Specifies the PS field module of the X.25 network layer, i.e. the module used to consecutively number the sent X.25 packets. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> ENABLE EXT-PACKET-MODE
Port number(3-4):3
X25 Config>
```

e) ENABLE SABM-ACTIVE

On enabling this option, the X.25 layer 2 entity tries to establish the link transmitting SABM (Enabled) N2 times. The default value is enabled.

Example:

```
X25 Config> ENABLE SABM-ACTIVE
Port number(3-4):3
X25 Config>
```

4.9. LIST

Allows you to list the configuration parameter values.

Syntax:

```
X25 Config> LIST ?
ADDRESS
ALL
ASSIGN
FACILITY
GLOBAL
PORT
ROUTING
```

a) LIST ADDRESS

List the IP addresses associated to the X.25 addresses.

Example:

```
X25 Config> LIST ADDRESS
IP Address         X25 clld Address   X25 clng Address Idle Time Encapsulation
192.100.3.1                 345820                          60        IP
192.100.4.4                  20004              20001      60        IP
X25 Config>
```

b) LIST ALL

Lists all the configuration parameters of the X.25 ports and the global configuration parameters.

Example:

```
X25 Config> LIST ALL
Port number (3-4):
Port information: 4(X25)
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
PVC low: 0
PVC high: 0
SVC low: 100
SVC high: 100
Channels direction:  DEC
Interface address:  DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Speed: 9600

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
---      9 XOT                                  0             0
ISDN 1   5 ISDN D channel: X25             A000000            1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00   9C
ISDN 2   6 ISDN D channel: X25             A200000            1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Ethernet                        9000000            1C
WAN1     3 X25                             F001600  F000C00   9E
WAN2     4 X25                             F001620  F000D00   9D

Entry        Port      priority     routing             NA        UD
 1           3(X25)       0             N       XXXXXXXXXXXXXXX

IP Address         X25 clld Address   X25 clng Address Idle Time Encapsulation
192.100.3.1                 345820                          60        IP
192.100.4.4                  20004              20001      60        IP
```

```
X.25 global data:
Max. datagram length: 1500
Backup recover attempt time: 0
Max dynamically added addresses: 10
Check input call:  Enabled

Packet facilities:
num P Prt NA             NNA             Wcd Wcr Lcd  Lcr  RC  CUG   NUI/UD

1   7  3  XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX  -   -   -    -   NO ----
X25 Config>
```

c) LIST ASSIGN

Lists the PVC configured associations.

Syntax:

```
X25 Config> LIST ASSIGN ?
ADDRESS
PERMANENT
```

LIST ASSIGN ADDRESS

Lists the PVC associated with the IP addresses.

Example:

```
X25 Config> LIST ASSIGN ADDRESS

Nentry    IP address       Port      PVC  Encapsulation
   1      192.100.4.69      3        1        IP
X25 Config>
```

LIST ASSIGN PERMANENT

Lists the associations between the permanent virtual circuits.

Example:

```
X25 Config> LIST ASSIGN PERMANENT

Entry        Port      PVC     Port      PVC
   1           3        1        4        1
X25 Config>
```

d) LIST FACILITY

Lists the configured facilities.

Example:

```
X25 Config> LIST FACILITY
Packet facilities:
num P Prt NA              NNA             Wcd Wcr Lcd  Lcr  RC  CUG   NUI/UD

1   1  3  123456          999SXX          7   7   256  256  YES---- teldatnet/C0
X25 Config>
```

e) LIST GLOBAL

Lists the global parameters, i.e. the parameters common to all the ports supporting X.25.

Example:

```
X25 Config> LIST GLOBAL
X.25 global data:
Max. datagram length: 1500
Backup recover attempt time: 0
Max dynamically added addresses: 10
Check input call:  Enabled
X25 Config>
```

f) LIST PORT

Lists the X.25 port's specific parameters.

Example:

```
X25 Config> LIST PORT
Port number(3-4):
Port information: 3(X25)
Layer 3 Window: 2
Packet ext mode:  Enabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
PVC low: 0
PVC high: 0
SVC low: 100
SVC high: 100
Channels direction:  DEC
Interface address: DTE
Layer 2 Window: 7
Frames ext mode:  Enabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Speed: 9600
X25 Config>
```

g) LIST ROUTING

Lists the table of all routes configured for the ports supporting X.25.

Example:

```
X25 Config> LIST ROUTING

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
ISDN 1   5 ISDN D channel: X25             A000000            1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00   9C
ISDN 2   6 ISDN D channel: X25             A200000            1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Token Ring                      9000000            1C
WAN1     3 X25                             F001600  F000C00   9E
WAN2     4 X25                             F001620  F000D00   9D

Entry        Port      priority     routing              NA        UD
 1           3(X25)       1            N                123456
 2           2(ROUTER)    0            N               3XXXXXX
X25 Config>
```

4.10. RESTORE

Allows you to restore the default configurations.

Syntax:

```
X25 Config> RESTORE ?
ALL
PORT
```

a) *RESTORE ALL*

Restores the configuration default values of the X.25 ports, the routing and the global parameters.

Example:

```
X25 Config> RESTORE ALL
Restored default values for all ports
Restored default values for routing
Restored default global values
X25 Config>
```

b) *RESTORE PORT*

Restores the default X.25 values which pass as parameters.

Example:

```
X25 Config> RESTORE PORT
Port number(3-4):3
Restored default values port number: 3
X25 Config>
```

4.11. SET

Allows you to configure the following parameters.

Syntax:

```
X25 Config> SET ?
BKUP-RCV-TIME
CHANNEL-DIRECTION
DATAGRAM-LENGTH
FRAME-WINDOW
INTERFACE-DIRECTION
MAX-ADD-DIR
N1
N2
NA-CALLING
PACKET-WINDOW
PACKET-SIZE
PROCESS-NA-CALLING
PVC
SPEED
SVC
T1
T3
```

a) SET BKUP-RCV-TIME

Allows you to configure the retry time between calls in order to activate the inactive NUA (provided that the X.25 call is established) and the static IP routes associated to them. If 0 is configured, this prevents call retries meaning the static routes configured for X.25 are always active. This is a global parameter for all the X.25 ports.

For further information please consult the IP manual and the chapter on static routes.

Example:

```
X25 Config> SET BKUP-RCV-TIME
Back up recover time(0-65000)[0]?
X25 Config>
```

b) SET CHANNEL-DIRECTION

Allows you to configure the number in the logical channel in increasing order or decreasing which correspond to the values DECREASING and INCREASING. DECREASING is configured by default.

Syntax:

```
X25 Config> SET CHANNEL-DIRECTION ?
DECREASING
INCREASING
```

SET CHANNEL-DIRECTION DECREASING

With this value the logical channels use a decreasing order.

Example:

```
X25 Config> SET CHANNEL-DIRECTION DECREASING
Port number(3-4):
X25 Config>
```

SET CHANNEL-DIRECTION INCREASING

With this value the logical channels use an increasing order.

Example:

```
X25 Config> SET CHANNEL-DIRECTION INCREASING
Port number(3-4):
X25 Config>
```

c) SET DATAGRAM-LENGTH

Configures the maximum length of the datagram, i.e. the maximum length of the data unit (a string of packets with M bit).

Example:

```
X25 Config> SET DATAGRAM-LENGTH
Maximum datagram length(256-18000)[1500]?
X25 Config>
```

d) SET FRAME-WINDOW

Configures the window used by the LAPB layer 2 protocol, under X.25. The default value is 7. The range of values is between 1 and 128.

Example:

```
X25 Config> SET FRAME-WINDOW
Port number(3-4):3
Frame window size(1-128)[7] 7
X25 Config>
```

e) SET INTERFACE-DIRECTION

The X.25 layer 2 LAPB protocol behavior is specified as terminal (DTE) or modem (DCE). By default, it acts as a terminal (DTE). If the value for this parameter has been incorrectly configured, the **Teldat Router** automatically changes the operation mode adapting the behavior to layer 2 of the device it is connected to.

Example:

```
X25 Config> SET INTERFACE-DIRECTION
Port number(3-4):3
Interface address(DTE o DCE)[DTE]DTE
X25 Config>
```

f) SET MAX-ADD-DIR

Configures the maximum number of IP address that can be dynamically aggregated. The values range between 0 and 500.

Example:

```
X25 Config> SET MAX-ADD-DIR
Max dynamically added addresses(0-500)[10]?
X25 Config>
```

g) SET N1

Configures the maximum frame length permitted at reception of the information I frames.

Please note that the maximum N1 frame length is imposed by the maximum packet length plus the layer 2 and 3 header length. This is 7 bytes.

This parameter must be configured when you wish the router to accept calls containing features with packet size at reception greater than that configured in the port.

If a call requesting packet size greater than that configured for this port arrives at reception (this is the N1 value less the 7 header bytes), the **Teldat Router** reduces the size value of the requested packet in the response packet features to the maximum value supported by the device for the configured N1.

Example:

```
X25 Config> SET N1
Port number(3-4):
Frame length(1-4096)[263]?
X25 Config>
```

h) SET N2

Configures the maximum number of retransmissions for an unacknowledged frame. The default value is 10 and the values range between 1 and 100.

Example:

```
X25 Config> SET N2
Port number(3-4):
Maximum number of transmt.(1-100)[10]
X25 Config>
```

i) SET NA-CALLING

Configures the NA which is the calling X.25 address of the call request packets which exit via the port independently of the NA they have been received with in the **Teldat Router**. This is not programmed by default.

Example:

```
X25 Config> SET NA-CALLING
Port number(3-4):3
NA calling? 40004
X25 Config>
```

j) SET PACKET-WINDOW

Configures the layer 3 window, i.e. the maximum number of X.25 packets which can be awaiting acknowledgment. The window is contracted through your carrier and can have values between 1 and 128. The default value is 2.

Example:

```
X25 Config> SET PACKET-WINDOW
Port number(3-4):3
Packet window(1-128)[2]2
X25 Config>
```

k) SET PACKET-SIZE

Specifies the maximum length of an X.25 packet. The maximum length is limited to 4.096 octets. The default value is 256 octets.

Example:

```
X25 Config> SET PACKET-SIZE
Port number(3-4):3
Packet size(1-4096)[256]?256
X25 Config>
```

l) SET PROCESS-NA-CALLING

This option allows you to add or suppress the NA of the calling packets processed by the **Teldat Router**. The values that can be taken are:

T (Two-way calls): Adds the NA to all the calls.

S (Suppress): Suppress the NA in all the calls which pass through the port.

O (Outgoing Calls): Adds the NA to all the outgoing calls.

I (Incoming Calls): Adds the NA to all the incoming calls.

A (Automatic): Depending on the interface, if it is a DCE the NA is added to all the calls entering through the port, if it is a DTE, the NA is added to all the outgoing calls.

The default value is "O".

Example:

```
X25 Config> SET PROCESS-NA-CALLING
Port number(3-4):
Calling NA process [T,S,I,O,A]I:
X25 Config>
```

m) SET PVC

Allows you to configure the PVC numbers used in the X.25 communications. The PVC range used by your device will be negotiated with your carrier. The permitted values range between 0 and 4.096.

Syntax:

```
X25 Config> SET PVC ?
LOW
HIGH
```

SET PVC LOW

Configures the lowest PVC number that can be used in X.25 communications. The default value is 0.

Example:

```
X25 Config> SET PVC LOW
Port number(3-4):
PVC low(0-4096)[0]?
X25 Config>
```

SET PVC HIGH

Configures the highest PVC number that can be used in X.25 communications. The default value is 0.

Example:

```
X25 Config> SET PVC HIGH
Port number(3-4):
PVC high(0-4096)[0]?
X25 Config>
```

n) SET SPEED

You can configure the binary regime through this parameter through which the X.25 interface operates. The possible values are the range of synchronous speeds from 1200 to 2048 Mbps. The speed used by default is 9600 bps.

Example:

```
X25 Config> SET SPEED
Port number(3-4):3
Port speed rate[9600]?
X25 Config>
```

Note: In cases where the lines are DTE (at a physical layer) this value is indifferent as the clock is external except where you are using line 2. Here the exact external clock value must be configured.

o) SET SVC

Allows you to configure the SVC numbers used in X.25 communications. The SVC range used by your device will be negotiated with your carrier. The permitted values range between 0 and 4.096.

Syntax:

```
X25 Config> SET SVC ?
LOW
HIGH
```

SET SVC LOW

Configures the lowest SVC number that can be used in X.25 communications. The default value is 100.

Example:

```
X25 Config> SET SVC LOW
Port number(3-4):3
SVC low(0-4096)[100]?
X25 Config>
```

SET SVC HIGH

Configures the highest SVC number that can be used in X.25 communications. The default value is 100.

Example:

```
X25 Config> SET SVC HIGH
Port number(3-4):3
SVC high(0-4096)[100]?
X25 Config>
```

p) SET T1

Configure T1, this is the maximum wait time in tenths of seconds for frame acknowledgement. Once this has elapsed and if no frames have been exchanged, the **Teldat Router** retranmits the frame awaiting acknowledgement. The default value is 10. The permitted range of values is between 1 and 100.

Example:

```
X25 Config> SET T1
Port number(3-4):3
Timer T1(1-100)[10]?
X25 Config>
```

q) SET T3

Configures T3, this is the maximum time for inactivity on the line in tenths of seconds. Once this has elapsed and if no frames have been exchanged, the **Teldat Router** sends an RR with a poll bit. The default value is 60. The permitted range of values is between 1 and 100.

Example:

```
X25 Config> SET T3
Port number(3-4):3
Timer T3(1-100)[60]?
X25 Config>
```

4.12. EXIT

The **EXIT** command is used to return to the previous prompt.

Syntax:

```
X25 Config> EXIT
```

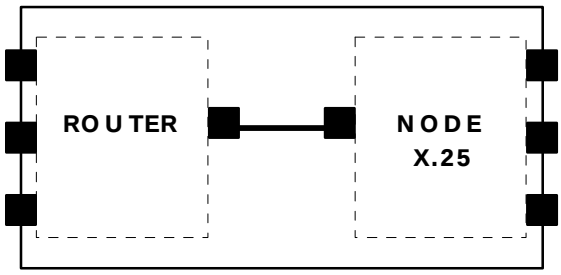
Example:

```
X25 Config> EXIT
Config>
```

5. Configuration Example

From a functional point of view, there are two virtual devices integrated in the **Teldat Router**:

1. A router which carries out the internetworking functions.
2. A packet switch for packets coming from both the router and the X.25 and ISDN ports when they are transporting X.25.



As can be seen in the figure, each virtual device controls its own set of interfaces. This is necessary in order to identify the precise form of the distinct interfaces and to know if the interface belongs to the router or the node.

The way to identify the interfaces in the **Teldat Router** configuration is through a number.

Through the configuration procedure's **LIST DEVICES**, you can obtain the interface identification table. Exiting this command in a specific device is shown below:

```
Config> LIST DEVICES

Con     Ifc Type of interface                  CSR      CSR2  int
---       1 Router->Node                         0             0
---       2 Node->Router                         0             0
ISDN 1    5 ISDN D channel: X25           A000000             1B
ISDN 1    7 ISDN B channel: X25           F001640  F000E00    9C
ISDN 2    6 ISDN D channel: X25           A200000             1B
ISDN 2    8 ISDN B channel: X25           F001660  F000F00    9B
LAN       0 Token Ring                    9000000             1C
WAN1      3 X25                           F001600  F000C00    9E
WAN2      4 X25                           F001620  F000D00    9D
Config>
```

The first column indicates the physical connector corresponding to the interface, the second the interface identification, the third specifies the programmed interface type, the CSR, CSR2 and int columns refer to the memory positions within the device and the interruption addresses.

As you can see, interfaces 5 and 7 share the ISDN 1 connector while interfaces 6 and 8 share ISDN 2.

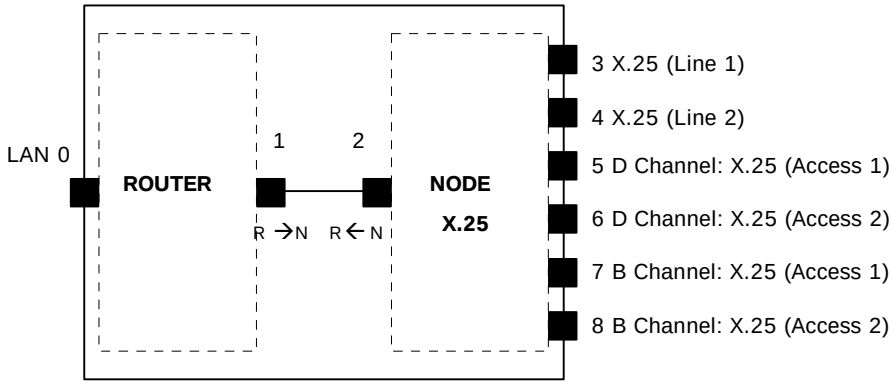
Another important aspect is that there are interfaces which are not associated to a physical connector. This is the case of interfaces 1 and 2 in the example. It is these interfaces which permit you to join the virtual machines and therefore do not have an external connector associated to them.

You must take the following into account with respect to the interface numbers:

- The interfaces controlled by the node are: the Node->Router, the X.25 and ISDN (which transports X.25).
- All the other interfaces are controlled by the router.

- The router interfaces begin with 0 normally corresponding to the LAN connector and end with Router->Node. The node interfaces are as follows.

Using this information you can redesign the previous figure for this case:



Suppose now you change the protocol of one of the WAN lines through the **SET DATA-LINK** command and subsequently consult the interface table.

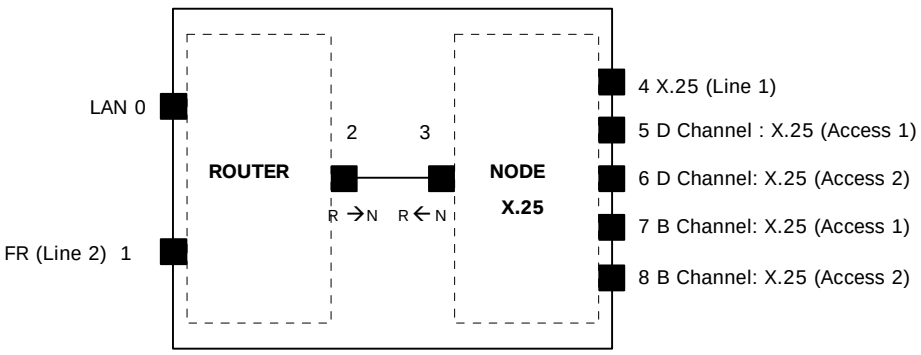
In the following example, Frame Relay protocol is assigned to physical line 2:

```
Config> SET DATA-LINK FRAME-RELAY
which port will be changed[1]? 2
Config> LIST DEVICES

Con    Ifc Type of interface                  CSR      CSR2  int
---      2 Router->Node                         0                0
---      3 Node->Router                         0                0
ISDN 1   5 ISDN D channel: X25            A000000                1B
ISDN 1   7 ISDN B channel: X25            F001640  F000E00       9C
ISDN 2   6 ISDN D channel: X25            A200000                1B
ISDN 2   8 ISDN B channel: X25            F001660  F000F00       9B
LAN      0 Token Ring                     9000000                1C
WAN1     4 X25                            F001600  F000C00       9E
WAN2     1 Frame Relay                    F001620  F000D00       9D
Config>
```

As you can see, there is one more interface controlled by the router and one less by the node. You can also see that the interface corresponding to line 2 is number 1 while the interface corresponding to line 1 is number 4.

In this new example, the diagram looks like this:



This ISDN interfaces can be controlled by both the node and the router depending on the type of information transported in channel B. If this is X.25, as in the previous examples, the ISDN interfaces appear on the node side. If it is PPP or Frame Relay backup, then they appear on the router side. X.25 via channel D always appears on the node side.

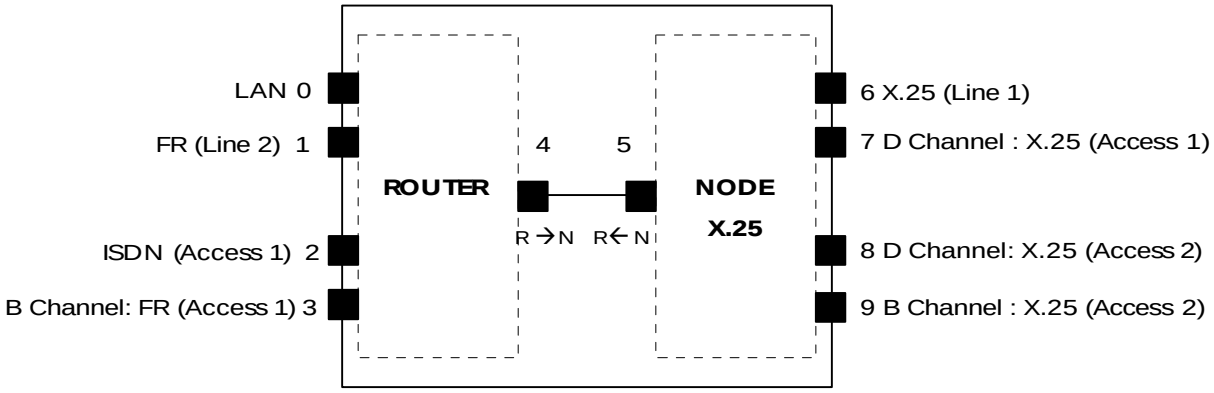
In the following example an ISDN interface transporting Frame Relay backup to a basic access 1 is configured:

```
Config> ADD DEVICE FR-DIAL
Type basic access ISDN [2]? 1
If you are going to config more than two DIAL interfaces, you must config what
they have CSR:F011640 and CSR:F011660 over the ISDN 2 connector
Ifc number to delete: [0]? 7
Added FR-DIAL interface with num: 3
Config>LIST DEVICES

Con    Ifc Type of interface                  CSR     CSR2  int
---      4 Router->Node                         0             0
---      5 Node->Router                         0             0
ISDN 1   2 ISDN                            F001640  F000E00   9C
ISDN 1   3 Channel B: FR                       0             0
ISDN 1   7 ISDN D channel: X25             A000000           1B
ISDN 2   8 ISDN D channel: X25             A200000           1B
ISDN 2   9 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Token Ring                      9000000           1C
WAN1     6 X25                             F001600  F000C00   9E
WAN2     1 Frame Relay                     F001620  F000D00   9D
Config>
```

In this new configuration there are two more interfaces controlled by the router, a physical with number 2 and a logical with number 3. The X.25, from the number 1 basic access via channel B which was associated to the node, disappears.

In this new example, the device diagram is as follows:



When you are configuring a device, you must correctly identify the interfaces through the identifier shown in the list interfaces table. The connector number should not be used.

Therefore, the first rule to bear in mind when configuring the interfaces is:

Take no notice of the device connector numbers, only the logical numeration. This is obtained through the **LIST DEVICES** command.

6. Configuration of the Global Parameters

The global parameters of the switch system allows you to define certain parameters common to all ports that support X.25.

The **LIST GLOBAL** command permits you to view these parameters:

```
X25 Config> LIST GLOBAL
X.25 global data:
Max. datagram length: 1500
Backup recover attempt time: 0
Max dynamically added addresses: 10
Check input call:  Enabled
X25 Config>
```

The *Max. datagram length* field represents the maximum length of the data unit, i.e. a string of packets with M bit.

The *Check input call* field ensures that the router verifies that a determine NA calling is in its tables. This parameter should always be *Enabled* if you are going to route IP over X.25.

The *Max dynamically added addresses* command, permits you to configure how many IP address can be dynamically added, i.e. without having to restart the device in order to activate them.

The *Backup recover attempt time* field permits you to configure a time interval where the calls are tried over the main route to see if this has been reestablished (see document Dm502-I TCP-IP Configuration for more information on static routes).

7. X.25 parameters configuration

In order to execute the configuration of protocol X.25 you proceed in the following way: From the system console type P4 to enter into the configuration process.

```
*
*P4
Config>
```

- Access at the X.25 prompt

Type **NODE X25** to enter the X.25 port configuration. A list of configured interfaces can be examined in the **Teldat Router** by typing **LIST DEVICES** at the user configuration *Config>* prompt.

```
Config> NODE X25
X25 Config>
```

- The currently configured values of the port you wish to use, viewed on-screen

To do this type at the *X25 Config>* prompt the command **LIST PORT** [Port number]; the port number is obtained as indicated in the paragraph above, using the command **LIST DEVICES** at the user configuration *Config>* prompt.

```
X25 Config> LIST PORT 3
Port information: 6(X25)
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
NA calling process: Automatic
PVC low: 0
PVC high: 0
SVC low: 100
SVC high: 100
Channels direction:  DEC
Interface address:  DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Speed: 9600
X25 Config>
```

- X.25 Parameter Configuration

The meaning of the parameters and commands that modify them are as follows:

7.1. Layer 3 Window

Specifies the maximum number of X.25 packets that can be waiting for acknowledgment. The window is negotiated with your carrier, and can have values which range between 1 and 128. The default value is 2.

Example:

```
X25 Config> SET PACKET-WINDOW
Port number (3-4):3
Packet window (1-128) [2] 2
X25 Config>
```

7.2. Extended Mode Packets

Specifies the module of the PS field of the X.25 network layer i.e. the module used to consecutively number the X.25 packets sent. It can have a value of 8 or 128, corresponding to the Disabled and Enabled value of this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> ENABLE EXT-FRAME-MODE
Port number (3 -4): 3
X25 Config>
```

Or

```
X25 Config> DISABLE EXT-FRAME-MODE
Port number (3 -4): 3
X25 Config>
```

7.3. Packet Size

Specifies the maximum size of a X.25 packet. The maximum size is restricted to 4096 octets. The default value adopted is 256 octets.

Example:

```
X25 Config> SET PACKET-SIZE
Port number (3 -4): 3
Packet size (1-4096)[256]?256
X25 Config>
```

7.4. NA Calling

The NA (Network Address) is the X.25 calling address of the call request packets that exit through the port, independent of the received NA to the **Teldat Router**. No default is programmed.

Example:

```
X25 Config> SET NA-CALLING
Port number (3 - 4):3
NA calling? 40004
X25 Config>
```

The number can consist of a maximum of 15 ASCII characters. In order to delete use the command **DELETE NA-CALLING**.

7.5. NR calling process

This option allows you to add or suppress the calling packets NA processed by the **Teldat Router**. The values that can be taken are:

T (Two-way calls): Adds the NA to all calls.

S (Suppress): Suppresses the NA in all calls that pass through the port.

O (Outgoing Calls): Adds the NA to all outgoing calls.

I (Incoming Calls): Adds the NA to incoming calls.

A (Automatic): Depends on the interface, if it is a DCE, NA is added to all calls that enter through the port. If it is a DTE, NA is added to all outgoing calls.

The default value is "O".

Example:

```
X25 Config> SET PROCESS-NA-CALLING
Port number (3 - 4):
Calling NA process [T, S, I, O, A]I:
X25 Config>
```

In cases where the calling packet already contains an NA, if the length is greater than the programmed NA, only the first digits will be changed. The sub-address contained in the calling packet is conserved.

7.6. PVC Low

Indicates the lowest PVC number that can be used in X.25 communications. The range of PVC's your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4.096. The default value is 0.

Example:

```
X25 Config> SET PVC LOW
Port number (3 - 4):
PVC low (0-4096) [0]?
X25 Config>
```

7.7. PVC High

Indicates the highest PVC number that can be used in X.25 communications. The range of PVC's your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4096. The default value is 0.

Example:

```
X25 Config> SET PVC HIGH
Port number (3 - 4):
PVC high (0-4096)[0]?
X25 Config>
```

7.8. SVC Low

Indicates the lowest SVC that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4.096. The default value is 100.

Example:

```
X25 Config> SET SVC LOW
Port number (3 - 4):
SVC low (0-4096)[100]?
X25 Config>
```

7.9. SVC High

Indicates the highest SVC number that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4.096. The default value is 100.

Example:

```
X25 Config> SET SVC HIGH
Port number (3 - 4):
SVC high (0-4096)[100]?
X25 Config>
```

7.10. Channel Direction

Specifies the logical channel numbers which will be used in order from the lowest to the highest or vice versa. The possible values are INCREASING and DECREASING. The default configuration is DECREASING.

Example:

```
X25 Config> SET CHANNEL-DIRECTION DECREASING
Port number (3 - 4):
X25 Config>
```

7.11. Interface Direction

The X.25 LAPB layer 2 protocol behavior is specified as terminal (DTE) or modem (DCE). By default, it acts as a terminal (DTE). If the value for this parameter has been incorrectly configured, the **Teldat Router** automatically changes the operation mode adapting the behavior to layer 2 of the device it is connected to.

Example:

```
X25 Config> SET INTERFACE-DIRECTION
Port number (3-4):3
Interface address (DTE o DCE) [DTE]DTE
X25 Config>
```

7.12. Layer 2 Window

Configures the window used by the LAPB layer 2 protocol, under X.25. The default value is 7. The range of values is between 1 and 128.

Example:

```
X25 Config> SET FRAME-WINDOW
Port number (3-4):
Frame window size (1-128) [7] 7
X25 Config>
```

7.13. Extended Frames Mode

Specifies module of the NS field of X.25 link layer, i.e. the module used to consecutively number the LAPB frames sent. It can have the value of 8 or 128, corresponding to the Disabled and Enabled value of this parameter. The default value is 8 (Disabled).

Example:

```
X25 Config> ENABLE EXT-PACKET-MODE
Port number(3-4):3
X25 Config>
```

7.14. T1

T1 is the maximum wait time in tenths of seconds for frame acknowledgement. Once this has lapsed and if no frames have been exchanged, the **Teldat Router** retransmits the frames awaiting acknowledgement. The default value is 10. The range of permitted values is between 1 and 100.

Example:

```
X25 Config> SET T1
Port number(3-4):
Timer T1(1-100)[60]?
X25 Config>
```

7.15. T3

This is the maximum time for inactivity on the line in tenths of seconds. Once this has lapsed and if no frames have been exchanged, the **Teldat Router** sends a RR with poll bit. The default value is 60, and the range of values permitted is between 1 and 100.

Example:

```
X25 Config> SET T3
Port number(3-4):
Timer T3(1-100)[60]?
X25 Config>
```

7.16. N1

This is the maximum frame length permitted at reception including the headers and flags. The default value is 263 corresponding to the 256 packet length and the range of values is between 1 and 4096.
Should you wish to modify this enter:

Example:

```
X25 Config> SET N1
Port number(3-4):
Frame length(1-4096)[263]?
X25 Config>
```

7.17. N2

This is the maximum number of retransmissions of a non validated frame. The default value is 10 and the range of values is between 1 and 100. If you wish to modify the value, type:

Example:

```
X25 Config> SET N2
Port number(3-4):
Maximum number of transmt.(1-100)[10]
X25 Config>
```

7.18. SABM

Determines if the X.25 layer 2 entity tries to establish continually the link transmitting SABM (Enabled) or waits for the remote entity to establish the link (Disabled). The default value is enabled.

Example:

```
X25 Config> ENABLE SABM-ACTIVE
Port number(3-4):
X25 Config>
```

or:

```
X25 Config> DISABLE SABM-ACTIVE
Port number(3-4):
X25 Config>
```

7.19. Speed

Through this parameter is configured the bit rate of the X.25 interface. The possible values are the range of synchronous speeds from 1.200 to 2,048 Mbps. The speed of 64 Kbps is employed by default.

Example:

```
X25 Config> SET SPEED
Port number (3-4):
Port speed rate [9600]?
X25 Config>
```

Note: In cases where the lines are DTE (at a physical layer) this value is indifferent as the clock is external except where you are using line 2. Here the exact external clock value must be configured.

8. X.25 Monitoring Commands

To enter in the X.25 Protocol monitoring, access through the main menu in the following way:

1. At the (*) prompt, enter **PROCESS 3** (or **P 3**).
2. At the monitoring prompt (+), enter **NODE X25**.
3. At the X.25 protocol monitoring prompt (X25>), use the monitoring commands which are described in this chapter to monitor the X.25 Protocol parameters.

The X.25 protocol monitoring commands are numerated and described. The letters written in **bold** are the minimum number of characters that have to be entered to make the command effective.

Command	Functions
? (HELP)	Lists the available commands or their options.
CLEAR port channel	Command to release the X.25 calls.
COMPRESIÓN	Displays the compression commands.
DELETE	Deletes the traffic and call statistics.
DISPLAY	Allows you to see the release causes and diagnosis associated with each number as well as the status of the X.25 ports.
LIST	Lists a series of calls and traffic statistics.
EXIT	Returns to previous prompt.

X.25 Protocol Monitoring Commands

8.1. ? (HELP)

Displays the list of available commands or their options.

Syntax:

```
X25> ?
```

Example:

```
X25> ?
CLEAR port channel
COMPRESSION
DELETE
DISPLAY
LIST
EXIT
X25>
```

8.2. CLEAR port channel

Releases the X.25 call from the port and logical channel that are entered as parameters.

Syntax:

```
X25> CLEAR port channel
```

Example:

```
X25> CLEAR
Port number(3-9):3
[100]?

Call cleared
X25>
```

8.3. COMPRESSION

Command to view the compression statistics.

Syntax:

```
X25> COMPRESSION ?
RESTART-STATISTICS
STATISTICS
VERSION
```

a) *COMPRESSION RESTART-STATISTICS*

Deletes the compression statistics.

Example:

```
X25> COMPRESSION RESTART-STATISTICS
X25>
```

b) *COMPRESSION STATISTICS*

Lists the compression statistics.

Example:

```
X25> COMPRESSION STATISTICS


FRAMES        COMPRESSION    (bytes          ) DECOMPRESSION  (bytes          )
------------- ------------------------------- -------------------------------
MANAGED       0              (0              ) 0              (0              )
PROCESSED     0              (0              ) 0              (0              )
NOT PROCESSED 0              (0              ) 0              (0              )
ERR_CODE      0                                0
OUT OF SEQ.   0                                0
ERR_LEN       0                                0
================================================================================
STATISTICS BEGINING 04/06/99 00:35:50
SESSIONS PENDING FOR FREE FROM MEMORY            0
X25>
```

c) COMPRESSION VERSION

Indicates the compression software version.

Example:

```
X25> COMPRESSION VERSION

Revision: 1.1.2.1 $$Name: NPLS_V_7_5_0R $
X25>
```

8.4. DELETE

Command to delete the traffic and released calls statistics.

Syntax:

```
X25> DELETE ?
CALLS
FRAMES
FRAME-ERRORS
TRAFFIC
```

a) DELETE CALLS

Deletes the buffer where the released call information is stored.

Example:

```
X25> DELETE CALLS

RELEASED CALLS DELETED

Released calls buffer deleted

X25>
```

b) DELETE FRAMES

This command returns the counters to zero where the number of detected errors in the sequence number (***N(s)***) and the number of the various types of frames are kept: (***I, RR, RNR, REJ, FRMR, UI*** (only LAPD)) which are transmitted and received by each port. You need to indicate the number of the port where you wish to return the counters to zero.

Example:

```
X25> DELETE FRAMES
Port number(3-9):3
Transmitted and received frames counters cleared

X25>
```

c) DELETE FRAME-ERRORS

This command is used to return those counters used to keep the number of detected frame errors to zero: *too short frames, incorrect length, invalid address or whose control field contains a value not associated to any type of frame.*

Example:

```
X25> DELETE FRAME-ERRORS

Erroneous Frame counters cleared

X25>
```

d) DELETE TRAFFIC

This command returns those counters to zero where the number of transmitted and received packets is kept for each of the logical channels associated to a port. You need to indicate the number of the port where you wish to return the counters to zero.

Example:

```
X25> DELETE TRAFFIC
Port number(3-9):3
Packet counters cleared

X25>
```

8.5. DISPLAY

This command displays the release causes and diagnosis as well as the X.25 ports.

Syntax:

```
X25> DISPLAY ?
CAUSES
DIAGNOSTICS
PORT-STATUS
```

a) DISPLAY CAUSES

Displays the interpretation of the cause which is entered as a hexadecimal parameter.

Example:

```
X25> DISPLAY CAUSES

Cause Code (in hex)(0-FF): 9

Cause (9):  Out of order

X25>
```

b) DISPLAY DIAGNOSTICS

Displays the diagnosis interpretation which is entered as hexadecimal parameter.

Example:

```
X25> DISPLAY DIAGNOSTICS

Diagnostic Code (in hex)(0-FF): 01

Diagnostic (1):  Invalid P(S)

X25>
```

c) DISPLAY PORT-STATUS

Displays the general state of a port and gives the following information.

Line	Line to which the port number is associated.
Interface type	DCE (modem) or DTE (terminal). This is the type of driver which has been installed for this port.
Status	For lines with series V interface, this proportions the state of the ***RTS, DTR, CTS, DSR y DCD*** signals**.** For ISDN interfaces, this give the physical layer state.
Restart Status	Status of the restart component.
LCN	Logical channel.
WINDOW	Layer 3 window for each logical channel.
N(s)	Sequence number of the following data packet for transmitting.
N(r)	Sequence number of the following data packet for receiving.
N(ack)	Sequence number of the last recognized data packet.
STATE	Data component state.

Example:

```
X25> DISPLAY PORT-STATUS
Port number(3-9):3
Line: 1

Interface type: DCE

   Circuit:      105 108 106 107 109
   RS232-C:      RTS DTR CTS DSR DCD
   Status:        ON  ON  ON  ON  ON

Restart Status: Ready (R1)

LCN    WINDOW   N(s)  N(r)  N(ack)     STATE
 100      2       0     0      0     P1 Ready
 101      2       0     0      0     P1 Ready

X25>
```

8.6. LIST

Lists a series of calls and traffic statistics.

Syntax:

```
X25> LIST ?
ACTIVE-CALLS
RELEASED-CALLS
FRAMES
FRAME-ERRORS
TRAFFIC
```

a) LIST ACTIVE-CALLS

This provides information on those connections which are currently established through a specific port, this can be X.25, ISDN over LAPB or ISDN over LAPD. You need to specify the number of the port where you wish to access the information on the calls associated with it.

Example:

```
X25> LIST ACTIVE-CALLS

Port number(3-9):3
No calls at this port

X25>
```

```
X25> LIST ACTIVE-CALLS

Port number(3-9):3
LCN        CALLED AD      CALLING AD     PORT       TYPE   PROTOCOL    H/START
 158            2074            1074        0        OUT      IP       09:29:23
 159            2087            1087        0        OUT      IP       09:29:23

Total active calls: 98

X25>
```

The meaning of each field is:

LCN	Logical channel number.
CALLED AD	Called DTE address.
CALLING AD	Calling DTE address.
PORT	Port associated to the call.
TYPE	Type of channel according to direction. This can be: *Incoming* ***(IN),*** *Outgoing* ***(OUT)*** or *Permanent* ***(PER)*** **.**
PROTOCOL	Indicates the protocol used in the communication. This can be: ***DSA, IP, QLLC, VTX or X28***. In cases where it is none of the above, the content is printed (in hexadecimal) of the first 4 octets from the called packet's User Data where the protocol identifier is found.
H/START	Indicates the time that the call was established.

b) LIST RELEASED-CALLS

Provides information on the connections that have already been released. The relative data on the last 100 released calls is stored together with order in which they were released.

If you wish to have information on a specific number of the last calls, enter the number of calls you wish to see after the command.

Example:

```
X25> LIST RELEASED-CALLS

PORT LCN TYP   PROTOCOL      CALLED AD/ CC DC  DIR  T/START   D/END
                            CALLING AD             T/END     D/END
  3  244 OUT        IP            2028 00 00  REQ  09:29:22  09/06/99
                                   1028              11:32:57  09/06/99
  3  240 OUT        IP            2062 00 00  REQ  09:29:22  09/06/99
                                   1062              11:33:00  09/06/99

X25>
```

The meaning of the fields is:

PORT Port where the call release has been received.

NCL Logical channel number.

TYP Type of channel according to direction. This can be: *Incoming* ***(IN),*** *Outgoing* ***(OUT)*** or *Permanent* ***(PER)*** **.**

PROTOCOL Indicates the protocol used in the communication. This can be: ***DSA, IP, QLLC, VTX or X28***. In cases where it is none of the above, the content is printed (in hexadecimal) of the first 4 octets from the called packet's User Data where the protocol identifier is found.

CALLED AD Called DTE address.

CALLING AD Calling DTE address.

CC Cause of release of call (in hexadecimal).

DC Diagnosis of release of call (in hexadecimal).

DIR Indicates who has provoked the release. This could be: Internal (INT), release Indication (IND): generated by the DCE and release Request (REQ): generated by the DTE.

T/END Indicates the time of establishment and release of call.

D/END Indicates the date of establishment and release of call.

c) LIST FRAMES

This command list the statistics on the number of different types of frames transmitted or received through a port, classing them by type. You need to enter the number of the port where you wish to view these statistics.

Example:

```
X25> LIST FRAMES
Port number(3-9):3

I Frames   : transmitted  =  1340312    received  =  1527784
RR Frames  : transmitted  =      413    received  =   700841
RNR Frames : transmitted  =        0    received  =        0
REJ Frames : transmitted  =        0    received  =        0
FRMR Frames: transmitted  =        0    received  =        0

Errors in N(S):        0

Timeout T1:            0
X25>
```

The displayed statistics indicate the number of the following types of frames transmitted and received:

I Information frames.

RR Supervision frames *Receive Ready*.

RNR Supervision frames *Receive Not Ready*.

REJ Supervision frames *Reject.*

FRMR Unnumbered frames *Frame Reject.*

UI Unnumbered information frames (Only in LAPD links).

Lastly, in the Errors in **N(S)** field, the number of frames in which errors have been detected in the sequence number are displayed and the Timeouts T1 show T1 lapsed times.

d) LIST FRAME-ERRORS

This command offers the number of error frames detected at the LAPB link over which distinct connections are established and classes the errors in: *too short frames, incorrect length, invalid address or whose control field contains a value not associated to any type of frame.*

Example:

```
X25> LIST FRAME-ERRORS

Too short frames:                    0
Incorrect length frames:             0
Invalid address frames:              0
Undefined control field frames:      0

X25>
```

e) LIST TRAFFIC

Offers information on the number of packets transmitted and received through a port, specifying the logical channel through which they are sent or received. You need to enter the number of the port where you wish to obtain the statistics.

Example:

```
X25> LIST TRAFFIC
Port number(3-9):3
LCN       TRANSMITTED     RECEIVED
100                0            0

TOTAL              0            0

X25>
```

8.7. EXIT

The **EXIT** command is used to return to the previous prompt.

Syntax:

```
X25> EXIT
```

Example:

```
X25> EXIT
+
```

Chapter 2
X.25 over ISDN

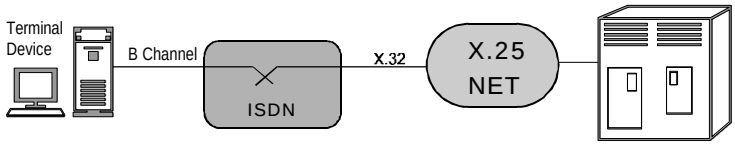
1. Introduction

To correctly program the parameters corresponding to the ISDN lines, it is advisable to clarify some ideas about ISDN.

The ISDN apart from transparent connection also provides two categories of services for the packet terminals connected to it:

- Case A: **Access to the services offered by the public data network through packet switching**

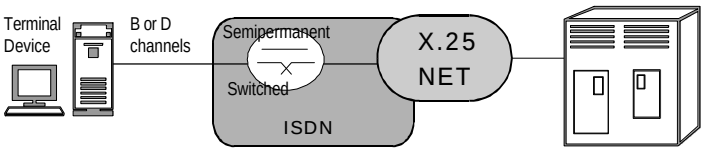
Case A



In this case the ISDN provides a connection through switched circuits between the user and the X.25 network port. This connection is established on demand (switched connection), and allows the user to access the X.25 services according to the X.32 norm. It is only possible through the B channel. It provides switched virtual circuits.

- Case B: **ISDN Virtual Circuit Service**

Case B

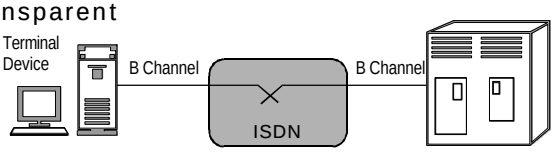


In this case the connections which function with ISDN packet switching can be set up permanently (semi-permanent connection) or be set up on demand (switched connection).

In the first case the services available are the (PVC) Permanent Virtual Circuit and the (SVC) Switched Virtual Circuit, whilst in the second case only the switched virtual circuit service is provided. Both types of connection are possible through B or D channel.

- Transparent Mode

Transparent



A transparent switched call can be established from end to end, using a B channel (64Kps). Information in any format can be sent through this.

The possible combinations, as they appear in the following sections, are:

Through D channel:

- Case B semi-permanent connection: **X.25 semi-permanent through D channel**

Through B channel

- Case A: **Circuit Mode through B channel**
- Case B semi-permanent connection: **X.25 semi-permanent through B channel**
- Case B switched connection: **Packet Mode through B channel**
- Transparent: B channel transparent end to end: **X.25 transparent through B channel**

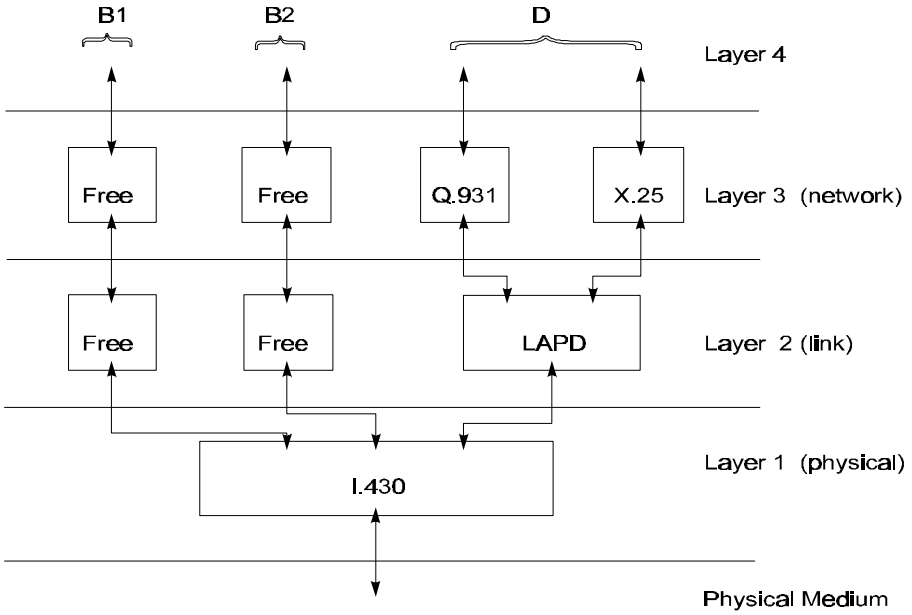
As you can see, alternatives emerge when selecting the mode of using B channel for data communication. The form of access through D channel is always semi-permanent.

For example, the semi-permanent D channel can be used for the "normal" teleprocess and simultaneously the B Channel in a transparent mode for massive data transfers (files, images, etc.).

Architecture of ISDN Protocols

In the following explanation, the figures and reasons refer exclusively to data communications, independent of the fact that simultaneously they may be using the basic access transmission capacities for voice services.

The following figure shows the architecture of the basic access protocols:



At a physical layer the **I.430** recommendation is respected, which stipulates amongst other things the multiplexing of the two B channels (2x64 Kbps) and the D channel (16kps), and the priority mechanisms and collision detection regulating the multiple access to D Channel of the devices.

The B channels are free as far as the assignation of protocols is concerned, each channel being accessible through a single device during the time that the service requested lasts.

Q.931

Any device can try to access the D channel at any time, to request a B channel, with the signaling protocol **Q.931**, or to send data through **X.25**.

A link layer is needed for this, capable of networking information from different entities at layer 3. This is achieved with the **LAPD** (Link Access Procedure D-Channel), modification of LAPB that extends the address field to two octets, the "TEI" and the "IPAS".

TEI

Due to the multiplexing at a physical layer of up to eight terminals, it is necessary to differentiate which device of those connected, the layer 2 information sent by the network is directed to. The Terminal Equipment Identifier (**TEI**) is used for this purpose.

The value of the TEI can be *fixed*, negotiated when the service is requested from your carrier and always the same for all calls, or *automatic*, negotiated with the network in each call.

SAPI

In the same device, the layer 2 must know to which higher layer entity, X.25 or Q.931, it must give frame information. The *Service Access Point Identifier* (**SAPI**) is used for this.

If it is X.25 it takes the value of 16. If it is Q.931 it takes the value 0.

2. ISDN Configuration Commands

In order to enter the ISDN configuration, you need to access through the main menu in the following way:

1. At the (*) prompt, enter **PROCESS 4** (or **P 4**).
2. At the configuration prompt (Config>), enter **NODE ISDN**.
3. At the ISDN protocol configuration prompt (ISDN Config>), use the configuration commands which are described in this chapter to configure the ISDN parameters.

The ISDN configuration commands are numerated and described. The letters written in **bold** are the minimum number of characters that have to be entered to make the command effective.

Command	Functions
? (HELP)	Lists the available commands or their options.
ADD	Permits you to add certain X.25 interface configuration parameters: addresses, routes and facilities.
APPLY	Allows dynamic updating of the changes introduced in the routing commands.
CHANGE	Permits you to change the IP address parameters associated to the X.25 addresses.
DELETE	Allows you to delete some of the X.25 and ISDN protocol configuration parameters.
DISABLE	Allows you to disable some the of X.25 and ISDN protocol options.
ENABLE	Allows you to enable some the of X.25 and ISDN protocol options.
LIST	Lists the configuration parameters.
RESTORE	Allows you to restore the default X.25 and ISDN protocol parameter values.
SET	Permits configuration of the X.25 and ISDN protocol parameters.
EXIT	Return to the Config> prompt.

ISDN configuration commands

2.1. ? (HELP)

Displays the list of available commands or their options.

Syntax:

```
ISDN Config> ?
```

Example:

```
ISDN Config> ?
ADD
APPLY
CHANGE
DELETE
DISABLE
ENABLE
LIST
RESTORE
SET
EXIT
ISDN Config>
```

2.2. ADD

Permits you to add certain X.25 interface configuration parameters: addresses, facilities and routing.

Syntax:

```
ISDN Config> ADD ?
ADDRESS
FACILITY
ROUTING
```

a) ADD ADDRESS

Permits you to associate an IP address with X.25 addresses.

Example:

```
ISDN Config> ADD ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
NA calling? 20001
Time release without data(0-65000)[60]?
Encapsulation (IP, Null)[IP]?
Compression(Yes/No)? NO
ISDN Config>
```

b) ADD FACILITY

Allows you to change the called NA, adding or changing the user data and adding or changing the call packet facilities (window negotiation and packet length, reverse charge, closed user group and user network identification).

Example:

```
ISDN Config> ADD FACILITY
NA (digit or X)? 123456
NA new (digit , X or S)? 999SXX                          (1)
Routing Port number   Ports(3-8) Router(2): 7            (2)
Priority[0-9](0): 1
Choose Window(Yes/No)(N)? Y
Write window of called(2-127)[7]: 7
Write window of caller(2-127)[7]: 7
Choose packet length(Yes/No)(N)? Y
Length of called(128-1024)[128]: 256
Length of caller(128-1024)[128]: 256
Reverse charge(Yes/No)(N)? Y
Closed User Group(Yes/No)(N)? Y
Type of group (Normal, Bilateral, Outgoing)[N]: N        (3)
Number of group: 0401
Network User Identifier: teldatnet                       (4)
User data: C0
ISDN Config>
```

(1) **S** suppresses the digit in this position, **X** does not change it.

(2) If no port is configured, all outgoing calls from the **Teldat Router** change parameters.

(3) The closed user group can be Normal (N), Bilateral (B) or Outgoing(O): closed user group with exit access. The value should be digits from 0 to 9.

(4) ASCII Characters.

c) ADD ROUTING

Permits you to associate X.25 addresses with physical ports.

Example:

```
ISDN Config> ADD ROUTING

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
---      9 XOT                                  0             0
ISDN 1   5 ISDN D channel: X25             A000000            1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00   9C
ISDN 2   6 ISDN D channel: X25             A200000            1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Ethernet                        9000000            1C
WAN1     3 X25                             F001600  F000C00   9E
WAN2     4 X25                             F001620  F000D00   9D

Number of routing port   Ports(3-9) Router(2):7
Write priority(0-9)[0]                              (*)
Write rerouting(Y,N,E)[N]                           (**)
Value of NA? 123456
Protocol identifier (hex): [0]?                     (***)
ISDN Config>
```

(*) The routing with the highest priority corresponds to the lowest number.

(**) The rerouting option allows you to carry out rerouting if the routing or route with the highest priority is unavailable or all their logical channels are busy. The possible values are:

Y: Yes, carries out rerouting.

N: No, does not carry out rerouting.

E: Exclusively rerouting: This option prevents an X.25 call being routed towards the same port that it entered by, i.e. if the highest priority routing routes the call towards an SVC from the same port which it entered by, a search to see if there are other routes towards other ports is carried out.

(***) The Protocol identifier field allows you to carry out routing depending on the first octet of the user data field which identifies the protocol. If this field is not programmed, it is ignored.

2.3. APPLY

Allows dynamic updating of the changes entered in the routing commands.

Syntax:

```
ISDN Config> APPLY
```

Example:

```
ISDN Config> APPLY
ISDN Config>
```

2.4. CHANGE

Syntax:

```
ISDN Config> CHANGE ?
ADDRESS
```

a) CHANGE ADDRESS

Permits you to change the IP address parameters associated to X.25 addresses.

Example:

```
ISDN Config> CHANGE ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
New NA? 20444
NA calling? 20001
Time release without data(0-65000)[60]? 30
Encapsulation (IP, Null)[IP]? IP
Compression(Yes/No)? N
ISDN Config>
```

2.5. DELETE

Permits you to delete some of the X.25 and ISDN protocol configuration parameters.

Syntax:

```
ISDN Config> DELETE ?
ADDRESS
AUTHCALLER-PH
CALLED-PH
CALLER-PH
FACILITY
NA-CALLING
ROUTING
```

a) DELETE ADDRESS

Deletes the configuration of an IP address associated with X.25 addresses.

Example:

```
ISDN Config> DELETE ADDRESS
IP Address [0.0.0.0]? 192.100.4.4
Value of NA? 20004
ISDN Config>
```

b) DELETE AUTHCALLER-PH

Deletes the authorized caller telephone number from the indicated B channel.

Example:

```
ISDN Config> DELETE AUTHCALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Deleted AU-CALLED port 7
ISDN Config>
```

c) DELETE CALLED-PH

Deletes the called telephone number. This parameter is programmed for the B channels only.

Example:

```
ISDN Config> DELETE CALLED-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
Deleted TL-CALLED port 7
ISDN Config>
```

d) DELETE CALLER-PH

Deletes the caller telephone number. This parameter is programmed for the B channels only.

Example:

```
ISDN Config> DELETE CALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
Deleted TL-CALLER port 7
ISDN Config>
```

e) DELETE FACILITY

Deletes some of the configured facilities.

Example:

```
ISDN Config> DELETE FACILITY
Entry number:2
num P Prt NA              NNA             Wcd Wcr Lcd Lcr  RC   CUG      NUI/UD
2   1  7  123456          999SXX           7   7   SI 256  256  YES---- test/C0
Delete this entry?(Yes/No)(N)? y
Facility deleted
ISDN Config>
```

f) DELETE NA-CALLING

Deletes the NA configured in some of the X.25 ports.

Example:

```
ISDN Config> DELETE NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8): 7
Deleted NA-CALLING port 7
ISDN Config>
```

g) DELETE ROUTING

Deletes a routing, i.e. the associated between an X.25 address and a port.

Example:

```
ISDN Config> DELETE ROUTING
Entry number:2
Entry        Port      priority     routing              NA        UD
 2           7            1            N       XXXXXXXXXXXXXXX
Delete this entry?(Yes/No)(N)? y
Routing deleted
ISDN Config>
```

2.6. DISABLE

Allows you to disable some of the X.25 and ISDN protocol options.

Syntax:

```
ISDN Config> DISABLE ?
CHECK-INPUT-CALLING
EXT-FRAME-MODE
EXT-PACKET-MODE
SABM-ACTIVE
SEMIPERMANENT-D-CHANNEL
```

a) DISABLE CHECK-INPUT-CALLING

Disables the NA calling check. This parameter should always be *Enabled* if you are going to route IP over X.25.

Example:

```
ISDN Config> DISABLE CHECK-INPUT-CALLING
ISDN Config>
```

b) DISABLE EXT-FRAME-MODE

Specifies the NS field module at the X.25 network, i.e. the module used to consecutively number the sent X.25 packets. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled). This parameter is configured for B channels only.

Example:

```
ISDN Config> DISABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
ISDN Config>
```

c) DISABLE EXT-PACKET-MODE

Specifies the PS field module at the X.25 network, i.e. the module used to consecutively number the sent X.25 packets. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
ISDN Config> DISABLE EXT-PACKET-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):7
ISDN Config>
```

d) DISABLE SABM-ACTIVE

On disabling this option, the X.25 layer 2 entity waits as it is the remote entity which establishes the link. This parameter is configured for B channels only.

Example:

```
ISDN Config> DISABLE SABM-ACTIVE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
ISDN Config>
```

e) DISABLE SEMIPERMANENT-D-CHANNEL

Disables the communications through the D channel.

Example:

```
ISDN Config> DISABLE SEMIPERMANENT-D-CHANNEL
ISDN Config>
```

2.7. ENABLE

Permits you to enable certain X.25 and ISDN protocol configuration parameters.

Syntax:

```
ISDN Config> ENABLE ?
CHECK-INPUT-CALLING
EXT-FRAME-MODE
EXT-PACKET-MODE
SABM-ACTIVE
SEMIPERMANENT-D-CHANNEL
```

a) ENABLE CHECK-INPUT-CALLING

Enables the NA calling check: ensures that the router verifies that a determined NA calling is in its tables. This parameter should always be *Enabled* if you are going to route IP over X.25.

Example:

```
ISDN Config> ENABLE CHECK-INPUT-CALLING
ISDN Config>
```

b) ENABLE EXT-FRAME-MODE

Specifies the NS field module of the X.25 link layer, i.e. the module used to consecutively number the sent LAPB frames. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled). This parameter is configured for B channels only.

Example:

```
ISDN Config> ENABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
ISDN Config>
```

c) ENABLE EXT-PACKET-MODE

Specifies the PS field module at the X.25 network, i.e. the module used to consecutively number the sent X.25 packets. This can have a value of 8 or 128, corresponding to the Disabled and Enabled values for this parameter. The default value is 8 (Disabled).

Example:

```
ISDN Config> ENABLE EXT-PACKET-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):7
ISDN Config>
```

d) ENABLE SABM-ACTIVE

On enabling this option, the X.25 layer 2 entity constantly tries to establish the link transmitting SABM (Enabled). The default value is enabled. This parameter is configured for B channels only.

Example:

```
ISDN Config> ENABLE SABM-ACTIVE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
ISDN Config>
```

e) ENABLE SEMIPERMANENT-D-CHANNEL

Enables the communication through the D channel.

Example:

```
ISDN Config> ENABLE SEMIPERMANENT-D-CHANNEL
ISDN Config>
```

2.8. LIST

Lists the X.25 and ISDN protocol configuration parameters.

Syntax:

```
ISDN Config> LIST ?
ADDRESS
ALL
FACILITY
GLOBAL
PORT
ROUTING
```

a) LIST ADDRESS

Lists the IP addresses associated to X.25 addresses.

Example:

```
ISDN Config> LIST ADDRESS
LIST ADDRESS
IP Address         X25 clld Address   X25 clng Address Idle Time Encapsulation
192.100.3.1                 345820                          60        IP
192.100.4.4                  20004             20001      60        IP
ISDN Config>
```

b) LIST ALL

Lists the X.25 ports configuration parameters (over D and B channels) and the global configuration parameters.

Example:

```
ISDN Config> LIST ALL
Port information 5(R1D) :
Semipermanent D Channel : Enabled
TEI: 50
Layer 3 Window: 2
Packet ext mode:  Enabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Layer 2 Window: 3

Port information 6(R2D) :
Semipermanent D Channel : Enabled
TEI: 50
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Layer 2 Window: 3

Port information 7(R1B) :
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
```

```
NA Calling:
Tl Caller:
Tl Called:
Auth Caller:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Interface address: DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Type of connection: N
Release time without call: 60
Channel: 0

Port information 8(R2B) :
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
Tl Caller:
Tl Called:
Auth Caller:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Interface address: DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Type of connection: N
Release time without call: 60
Channel: 0

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
---      9 XOT                                  0             0
ISDN 1   5 ISDN D channel: X25             A000000            1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00   9C
ISDN 2   6 ISDN D channel: X25             A200000            1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Ethernet                        9000000            1C
WAN1     3 X25                             F001600  F000C00   9E
WAN2     4 X25                             F001620  F000D00   9D

Entry        Port      priority     routing              NA        UD
 1           3(X25)       1            N       XXXXXXXXXXXXXXX

No address

X.25 global data:
Max. datagram length: 1500
Backup recover attempt time: 0
Max dynamically added addresses: 10
Check input call:  Enabled

Packet facilities:
num P Prt NA              NNA             Wcd Wcr Lcd  Lcr  RC  CUG   NUI/UD

1   7  3  XXXXXXXXXXXXXXX XXXXXXXXXXXXXXX  -   -   -    -   NO ----
ISDN Config>
```

c) LIST FACILITY

Lists the configured facilities.

Example:

```
ISDN Config> LIST FACILITY
Packet facilities:
num P Prt NA              NNA             Wcd Wcr Lcd  Lcr  RC   CUG    NUI/UD

1   1  7  123456          999XXX          7   7   256  256  YES B 0401  teldatnet/C0
ISDN Config>
```

d) LIST GLOBAL

Lists the global parameters, i.e. the parameters common to all the ports supporting X.25.

Example:

```
ISDN Config> LIST GLOBAL
X.25 global data:
Max. datagram length: 1500
Backup recover attempt time: 0
Max dynamically added addresses: 10
Check input call:  Enabled
ISDN Config>
```

e) LIST PORT

Lists the specific parameters for an X.25 port over channels D or B.

Example:

```
ISDN Config> LIST PORT
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Port information 5(R1D) :
Semipermanent D Channel : Enabled
TEI: 50
Layer 3 Window: 2
Packet ext mode:  Enabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Layer 2 Window: 3
ISDN Config>
```

```
ISDN Config> LIST PORT
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8): 7
Port information 7(R1B) :
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
Tl Caller:
Tl Called:
Auth Caller:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Interface address: DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Type of connection: N
Release time without call: 60
Channel: 0
ISDN Config>
```

f) LIST ROUTING

List all the X.25 routes configured.

Example:

```
ISDN Config> LIST ROUTING

Con    Ifc Type of interface                  CSR     CSR2  int
---      1 Router->Node                         0             0
---      2 Node->Router                         0             0
---      9 XOT                                  0             0
ISDN 1   5 ISDN D channel: X25             A000000            1B
ISDN 1   7 ISDN B channel: X25             F001640  F000E00   9C
ISDN 2   6 ISDN D channel: X25             A200000            1B
ISDN 2   8 ISDN B channel: X25             F001660  F000F00   9B
LAN      0 Ethernet                        9000000            1C
WAN1     3 X25                             F001600  F000C00   9E
WAN2     4 X25                             F001620  F000D00   9D

Entry        Port      priority     routing             NA        UD
 1           3(X25)       1            N       XXXXXXXXXXXXXXX
ISDN Config>
```

2.9. RESTORE

Permits you to restore the default configurations.

Syntax:

```
ISDN Config> RESTORE ?
ALL
PORT
```

a) RESTORE ALL

Restores the default values for the configuration of X.25 ports over channels B and D, the routings and the global parameters.

Example:

```
ISDN Config> RESTORE ALL
B Channel restored
D Channel restored
Restored default values for routing
Restored default global values
ISDN Config>
```

b) RESTORE PORT

Restores the configuration default values for a selected X.25 port over channels B or D.

Example:

```
ISDN Config> RESTORE PORT
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):5
ISDN port restored: 5(R1D)
ISDN Config>
```

2.10. SET

Allows you to configure the following parameters:

Syntax:

```
ISDN Config> SET ?
AUTHCALLER-PH
CALLED-PH
CALLER-PH
CHANNEL-DIRECTION
CONNECTION-TYPE
FRAME-WINDOW
INTERFACE-DIRECTION
ISDN-CHANNEL
MAX-DATAGRAM-LENGTH
N1
N2
NA-CALLING
PACKET-SIZE
PACKET-WINDOW
PROCESS-NA-CALLING
REL-WTH-CALL-TIME
SVC
T1
T3
TEI
```

a) SET AUTHCALLER-PH

Configures the channel B authorized caller telephone number indicated. If you program this number in the field, only those calls which have this caller number will be accepted.

Example:

```
ISDN Config> SET AUTHCALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Authorized caller? 913846895
ISDN Config>
```

b) SET CALLED-PH

Configures the called number. In the channel B ports where this parameter is configured with a value distinct to zero, it will be used as the call destination number of the Q931 call. On the other hand if this is configured as zero, the number called from the NA of the X.25 call packet that starts the call request through B channel will be taken. The NA of the X.25 call packet is taken by default.

Example:

```
ISDN Config> SET CALLED-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Called TL? 918076566
ISDN Config>
```

c) SET CALLER-PH

Configures the caller telephone number which exits in the request packet of the ISDN call establishment.

Example:

```
ISDN Config> SET CALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Caller TL? 913847070
ISDN Config>
```

d) SET CHANNEL-DIRECTION

Allows you to configure is the logical channel numbers are used in order from the lowest to the highest or vice versa. The possible values are *DECREASING* y *INCREASING*. *DECREASING* is configured by default.

Syntax:

```
ISDN Config> SET CHANNEL-DIRECTION ?
DECREASING
INCREASING
```

SET CHANNEL-DIRECTION DECREASING

The logical channels are used in decreasing order with this value.

Example:

```
ISDN Config> SET CHANNEL-DIRECTION DECREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

SET CHANNEL-DIRECTION INCREASING

The logical channels are used in increasing order with this value.

Example:

```
ISDN Config> SET CHANNEL-DIRECTION INCREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

e) SET CONNECTION-TYPE

This enables communication through a B port. You must choose between the B channel operation modes for this: Transparent (T), Switched (C), Packets (P), Semi-permanent (S), None (N). This is disabled by default (N).

Example:

```
ISDN Config> SET CONNECTION-TYPE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Choose type of connection(S,P,T,C)[N]:N
ISDN Config>
```

f) SET FRAME-WINDOW

Configures the window used by the LAPB layer 2 protocol under X.25. The default value is 7. The range of values is between 1 and 128.

Example:

```
ISDN Config> SET FRAME-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Frame window size(1-128)[3]
ISDN Config>
```

g) SET INTERFACE-DIRECTION

Specifies for the X.25 layer 2 LAPB, the performance as terminal (DTE) or modem (DCE). By default. this acts as a terminal (DTE). If the value of the parameter is incorrectly configured, the **Teldat Router** automatically changes the operating mode, adapting itself to the layer 2 performance of the device it is connected to. This parameter is configured for B channels only.

Example:

```
ISDN Config> SET INTERFACE-DIRECTION
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Interface address(DTE o DCE)[DTE]DTE
ISDN Config>
```

h) SET ISDN-CHANNEL

Specifies the basic access B channel though which you wish to implement X.25. The default value is 0. Value 1 is used to request the B1 channel and value 2, B2.

Example:

```
ISDN Config> SET ISDN-CHANNEL
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Channel(0,1,2)[0]:0
ISDN Config>
```

i) SET MAX-DATAGRAM-LENGTH

Configures the maximum datagram length, i.e. the maximum length of the data unit (a string of packets with M bit).

Example:

```
ISDN Config> SET MAX-DATAGRAM-LENGTH
Maximum datagram length(256-18000)[1500]?
ISDN Config>
```

j) SET N1

Configures the maximum frame length permitted at reception of the information I frames.

Please note that the maximum N1 frame length is imposed by the maximum packet length plus the layer 2 and 3 header length. This is 7 bytes.

This parameter must be configured when you wish the router to accept calls containing features with packet size at reception greater than that configured in the port.

If a call requesting packet size greater than that configured for this port arrives at reception (this is the N1 value less the 7 header bytes), the **Teldat Router** reduces the size value of the requested packet in the response packet features to the maximum value supported by the device for the configured N1. This is only configured for the B channels.

Example:

```
ISDN Config> SET N1
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
Frame length(1-4096)[263]?
ISDN Config>
```

k) SET N2

Configures the maximum number of retransmissions for a non validated frame. The default value is 10 and the range of values is between 1 and 100. This is only configured for the B channels.

Example:

```
ISDN Config> SET N2
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
Maximum number of transmt.(1-100)[10]
ISDN Config>
```

l) SET NA-CALLING

Configures the NA which is the X.25 calling address for the call request packets that exit from the port independently of the NA with which they've been received in the **Teldat Router**.

Example:

```
ISDN Config> SET NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
NA calling?348001
ISDN Config>
```

m) SET PACKET-SIZE

Specifies the maximum length that an X.25 packet can have. For X.25 over B channels, the ITU-T (former CCITT) limits this value to a maximum of 256 octets and this is the default value.

Example:

```
ISDN Config> SET PACKET-SIZE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Write packet length(1-256)[256]?
ISDN Config>
```

n) SET PACKET-WINDOW

Configures the layer 3 window, i.e. the maximum number of X.25 packets pending acknowledgment. The window is contracted through your carrier and can take values between 1 and 128. The default value is 2.

Example:

```
ISDN Config> SET PACKET-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Packet window(1-128)[2]
ISDN Config>
```

o) SET PROCESS-NA-CALLING

This option allows you to add or suppress the NA of the calling packets processed by the **Teldat Router**. The values that can be taken are:

T (Two-way calls): Adds the NA to all the calls.

S (Suppress): Suppress the NA in all the calls which pass through the port.

O (Outgoing Calls): Adds the NA to all the outgoing calls.

I (Incoming Calls): Adds the NA to all the incoming calls.

A (Automatic): Depending on the interface, if it is a DCE the NA is added to all the calls entering through the port, if it is a DTE, the NA is added to all the outgoing calls.

The default value is "O".

Example:

```
ISDN Config> SET PROCESS-NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Calling NA process [T,S,I,O,A]:
ISDN Config>
```

p) SET REL-WTH-CALL-TIME

If through the B channel, there have not been any X.25 calls during the time specified in this parameter, the Q.931 call is released. The default value is 30 seconds and the range of values is between 0 and 1.000. A 0 value means that the call is not released.

Example:

```
ISDN Config> SET REL-WTH-CALL-TIME
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer without call(0-1000)[60]?30
ISDN Config>
```

q) SET SVC

Allows you to configure the SVC numbers used in the X.25 communications. The SVC range used by your device will be negotiated with your carrier. The permitted values range between 0 and 4.096.

Syntax:

```
ISDN Config> SET SVC ?
HIGH
LOW
```

SET SVC HIGH

Configures the highest SVC number that can be used in X.25 communications. The default value is 100.

Example:

```
ISDN Config> SET SVC HIGH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC high(0-4096)[100]?
ISDN Config>
```

SET SVC LOW

Configures the lowest SVC number that can be used in X.25 communications. The default value is 100.

Example:

```
ISDN Config> SET SVC LOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC low(0-4096)[100]?
ISDN Config>
```

r) SET T1

Configures T1, this is the maximum wait time in tenths of seconds for frame acknowledgement. Once this has elapsed and if no frames have been exchanged, the **Teldat Router** retransmits the frame awaiting acknowledgement. The default value is 10. The permitted range of values is between 1 and 100. This is configured for the B channels only.

Example:

```
ISDN Config> SET T1
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer T1(1-100)[10]? 10
ISDN Config>
```

s) SET T3

Configures T3, this is the maximum time for inactivity on the line in tenths of seconds. Once this has elapsed and if no frames have been exchanged, the **Teldat Router** sends an RR with a poll bit. The default value is 60. The permitted range of values is between 1 and 100. This is configured for the B channels only.

Example:

```
ISDN Config> SET T3
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer T3(1-100)[60]?
ISDN Config>
```

t) SET TEI

Permits you to configure the TEI value. In cases of semi-permanent communications through D channel, the TEI is fixed and assigned by your carrier. The values should be between 0 and 63.

Example:

```
ISDN Config> SET TEI
Terminal Equipment Identifier(TEI)(0-63)[50]
ISDN Config>
```

2.11. EXIT

The **EXIT** command is used to return to the previous prompt.

Syntax:

```
ISDN Config> EXIT
```

Example:

```
ISDN Config> EXIT
Config>
```

3. Configuration example of the ISDN lines

This section describes how to configure the ISDN interfaces.

The tasks to carry out are:

1. To choose the type of connection.
2. Configure the ISDN parameters of a D port.
3. Configure the ISDN parameters of a B port.

Before configuring the ISDN, you need to know the following information:

- If you're going to use a semi-permanent service through a D channel, you need to know the device TEI.
- The number of logical channels you are going to use.

3.1. Choosing the type of connection

From each basic access the **Teldat Router** can use a D and a B channel for X.25 transmission.

From a logical viewpoint, it is considered that there are four ports, two corresponding to the D channels and two for the B channels.

These four ports can be used independently and therefore are configured separately as shown below.

3.2. Configuration of the ISDN parameters in a D channel

In order to configure the X.25 protocol over an ISDN D channel, proceed as described below:

- Access at the ISDN prompt

From the user configuration *Config>* prompt enter **NODE ISDN** in order to access the ISDN port configuration *ISDN Config>*. You can examine the list of interfaces configured in the **Teldat Router** by entering the command **LIST DEVICES** at the user configuration *Config>* prompt.

```
Config> NODE ISDN
ISDN Config>
```

- The currently configured values of the port you wish to use, viewed on-screen

To do this enter the **LIST PORT** [Port number] command at the *ISDN Config>* prompt, the port number is obtained as indicated in the paragraph above, using the command **LIST DEVICES** at the user configuration *Config>* prompt.

```
ISDN Config> LIST PORT 5
Port information 5(R1D) :
Semipermanent D Channel : Enabled
TEI: 50
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Layer 2 Window: 3
ISDN Config>
```

The meaning of the parameters and the commands they modify are as follows:

a) Semipermanent in channel D

Enables the communication for the chosen port.

Example:

```
ISDN Config> ENABLE SEMIPERMANENT-D-CHANNEL
ISDN Config>
```

b) Terminal Equipment Identifier

In cases of semi-permanent communication through a D channel, the TEI is fixed and assigned by your carrier. The values should be between 0 and 63.

Example:

```
ISDN Config> SET TEI
Terminal Equipment Identifier (TEI) (0-63) [50]
ISDN Config>
```

c) Layer 3 Window

Specifies the maximum number of X.25 packets that can be waiting for an acknowledge. The window is negotiated with your carrier, and can have values which range between 1 and 128. The default value is 2.

Example:

```
ISDN Config> SET PACKET-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Packet window (1-128)[2]
ISDN Config>
```

d) Extended packet mode

Specifies the NS field module of the X.25 network layer i.e. the module used to consecutively number the X.25 packets sent. It can have a value of 8 or 128, corresponding to the Disabled and Enabled value of this parameter. The default value is 8 (Disabled).

Example:

```
ISDN Config> ENABLE EXT-PACKET-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number (5-8):
ISDN Config>
```

or:

```
ISDN Config> DISABLE EXT-PACKET-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number (5-8):
ISDN Config>
```

e) Packet Size

Specifies the maximum length that an X.25 packet can have. For X.25 over D channels, the ITU-T (former CCITT) limits this value to a maximum of 256 octets and this is the default value.

Example:

```
ISDN Config> SET PACKET-SIZE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number (5-8):
Write packet length (1-256)[256]?
ISDN Config>
```

f) NA Calling

The NA (Network Number) is the X.25 calling address of the call request packets that exit through the port, independently of the received NA to the **Teldat Router**. No default is programmed.

Example:

```
ISDN Config> SET NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number (5-8):
NA calling?
ISDN Config>
```

The number can consist of a maximum of 15 ASCII characters. In order to delete use the command **DELETE NA-CALLING**.

g) Process NA-Calling

This option allows you to add or suppress the NA of the calling packets processed by the **Teldat Router**. The values that can be taken are:

T (Two-way calls): Adds the NA to all the calls.

S (Suppress): Suppress the NA in all the calls which pass through the port.

O (Outgoing Calls): Adds the NA to all the outgoing calls.

I (Incoming Calls): Adds the NA to all the incoming calls.

A (Automatic): Depending on the interface, if it is a DCE the NA is added to all the calls entering through the port, if it is a DTE, the NA is added to all the outgoing calls.

The default value is “O”.

Example:

```
ISDN Config> SET PROCESS-NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number (5-8):
Calling NA process [T,S,I,O,A]:
ISDN Config>
```

In cases where the call packet already has an NA, if the length if greater than the programmed NA, only the first digits are changed so allowing it to conserve the sub-addressing in the call packet.

h) SVC low

Indicates the lowest SVC that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4096. The default value is 100.

Example:

```
ISDN Config> SET SVC LOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC low(0-4096)[100]?
ISDN Config>
```

i) SVC high

Indicates the highest SVC number that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4096. The default value is 100.

Example:

```
ISDN Config> SET SVC HIGH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC high(0-4096)[100]?
ISDN Config>
```

j) Channel direction

Specifies the logical channel numbers which will be used in order from the lowest to the highest or vice versa. The possible values are *INCREASING* and *DECREASING*. The default configuration is *DECREASING*.

Example:

```
ISDN Config> SET CHANNEL-DIRECTION DECREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

or

```
ISDN Config> SET CHANNEL-DIRECTION INCREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

k) Layer 2 Window

Configures the window that uses LAPB layer 2 protocol under X.25. The default value is 7. The range of values is between 1 and 128.

Example:

```
ISDN Config> SET FRAME-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Frame window size (1-128)[7]
ISDN Config>
```

3.3. Configuration of ISDN parameters in a B channel

In order to configure the X.25 protocol over an ISDN D channel, proceed as described below:

- Access at the ISDN prompt

From the user configuration prompt *Config>* enter **NODE ISDN** in order to access the ISDN port configuration. You can examine the list of interfaces configured in the **Teldat Router** by entering the command **LIST DEVICES** at the user configuration prompt *Config>*.

```
Config> NODE ISDN
ISDN Config>
```

- The currently configured values of the port you wish to use, viewed on-screen

To do this enter the **LIST PORT** [Port number] command at the *ISDN Config>* prompt, the port number is obtained as indicated in the paragraph above, using the command **LIST DEVICES** at the user configuration *Config>* prompt. If you enter this command without the port number, you will be asked to choose a number from among the possible values.

```
ISDN Config> LIST PORT
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8): 7
Port information 7(R1B) :
Layer 3 Window: 2
Packet ext mode:  Disabled
Packet length: 256
NA Calling:
Tl Caller:
Tl Called: 913847070
Auth Caller: 913846895
NA calling process: Outgoing calls
SVC Low: 100
SVC High: 100
Channels direction:  DEC
Interface address: DTE
Layer 2 Window: 7
Frames ext mode:  Disabled
T1: 10
T3: 60
N1: 263
N2: 10
SABM:  Enabled
Type of connection: N
Release time without call: 60
Channel: 0
ISDN Config>
```

The meaning of the parameters and the commands they modify are as follows:

a) Layer 3 Window

Specifies the maximum number of X.25 packets that can be waiting for an acknowledgment. The window is negotiated with your carrier, and can have values which range between 1 and 128. The default value is 2.

Example:

```
ISDN Config> SET PACKET-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Packet window(1-128)[2]
ISDN Config>
```

b) Extended packet mode

Specifies the NS field module of the X.25 network layer i.e. the module used to consecutively number the X.25 packets sent. It can have a value of 8 or 128, corresponding to the Disabled and Enabled value of this parameter. The default value is 8 (Disabled).

Example:

```
ISDN Config> ENABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

or:

```
ISDN Config> DISABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):7
ISDN Config>
```

c) Packet size

Specifies the maximum length that an X.25 packet can have. For X.25 over B channels, the ITU-T (former CCITT) limits this value to a maximum of 256 octets and this is the default value.

Example:

```
ISDN Config> SET PACKET-SIZE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Write packet length[(1-256)[256]?
ISDN Config>
```

d) NA calling

The NA (Network Address) is the X.25 calling address of the call request packets that exit through the port, independently of the received NA in the **Teldat Router**. No default is programmed.

Example:

```
ISDN Config> SET NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
NA calling?
ISDN Config>
```

The number can consist of a maximum of 15 ASCII characters. In order to delete use the command **DELETE NA-CALLING**.

e) Caller Telephone

Permits the configuration of the calling telephone number and it will appear in the setup request packet. If this number is programmed it will verify if the called telephone coincides with the calling programmed in the incoming call packets.

Example:

```
ISDN Config> SET CALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Caller TL? 918076566
ISDN Config>
```

f) Called Telephone

In the B channel ports in which this parameter is configured to a different value from zero, it will be used as the call destination number of the Q931 call. On the other hand, if it is configured at zero the number called from the NN of the X.25 call packet that starts the call request through B channel will be taken. By default it is taken from the NR of the X.25 call packet.

Example:

```
ISDN Config> SET CALLED-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Called TL? 918076566
ISDN Config>
```

g) Authorized calling

If a number is entered in this field, then only calls with this calling telephone number are accepted.

Example:

```
ISDN Config> SET AUTHCALLER-PH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
Authorized caller?
ISDN Config>
```

h) Process NA calling

This option permits you to add or suppress the NA in the call packets processed by the **Teldat Router**. The values can be:

T (Two-way calls): Adds the NA to all the calls.

S (Suppress): Suppress the NA in all the calls which pass through the port.

O (Outgoing Calls): Adds the NA to all the outgoing calls.

I (Incoming Calls): Adds the NA to all the incoming calls.

A (Automatic): Depending on the interface, if it is a DCE the NA is added to all the calls entering through the port, if it is a DTE, the NA is added to all the outgoing calls.

The default value is “O”.

Example:

```
ISDN Config> SET PROCESS-NA-CALLING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Calling NA process [T,S,I,O,A]:
ISDN Config>
```

In cases where the call packet already has an NA, if the length if greater than the programmed NA, only the first digits are changed so allowing it to conserve the sub-addressing in the call packet.

i) SVC low

Indicates the lowest SVC that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4.096. The default value is 100.

Example:

```
ISDN Config> SET SVC LOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC low(0-4096)[100]?
ISDN Config>
```

j) SVC high

Indicates the highest SVC that can be used in X.25 communications. The range of SVCs your equipment uses will be negotiated with your carrier. The range of values permitted is from 0 to 4.096. The default value is 100.

Example:

```
ISDN Config> SET SVC HIGH
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
SVC high(0-4096)[100]?
ISDN Config>
```

k) Channel direction

Specifies the logical channel numbers which will be used in order from the lowest to the highest or vice versa. The possible values are *INCREASING* and *DECREASING*. The default configuration is *DECREASING*.

Example:

```
ISDN Config> SET CHANNEL-DIRECTION DECREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

or:

```
ISDN Config> SET CHANNEL-DIRECTION INCREASING
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
ISDN Config>
```

l) Interface direction

Specifies for the X.25 layer 2 LAPB protocol, performance as terminal (DTE) or as modem (DCE). By default it acts as a terminal (DTE). If the value of this parameter is incorrectly configured the **Teldat Router** automatically changes operating mode, adapting itself to layer 2 performance of the device to which it is connected.

Example:

```
ISDN Config> SET INTERFACE-DIRECTION
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Interface address(DTE o DCE)[DTE]DTE
ISDN Config>
```

m) Layer 2 Window

Configures the window which uses the layer 2 LAPD protocol under X.25. The default value is 7. The range of values is between 1 and 128.

Example:

```
ISDN Config> SET FRAME-WINDOW
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(5-8):
Frame window size(1-128)[7]
ISDN Config>
```

n) Extended frame mode

Specifies the modules in the X.25 link layer NS field, in other words, the module used to number consecutively the LAPB frames sent. It can have the value of 8 or 128, corresponding to the Disabled or Enabled value of this parameter. The default value is 8 (Disabled).

Example:

```
ISDN Config> ENABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
ISDN Config>
```

or:

```
ISDN Config> DISABLE EXT-FRAME-MODE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
ISDN Config>
```

o) T1

T1 is the maximum wait time in tenths of seconds for frame acknowledgement. Once this has lapsed and if no frames have been exchanged, the **Teldat Router** retransmits the frame awaiting acknowledgement. The default value is 10. The range of values permitted is between 1 and 100.

Example:

```
ISDN Config> SET T1
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer T1(1-100)[10]? 10
ISDN Config>
```

p) T3

This is the maximum time for inactivity on the line in tenths of seconds. Once this has lapsed and if no frames have been exchanged, the **Teldat Router** sends a RR with poll bit. The default value is 60, and the range of values permitted is between 1 and 100.

Example:

```
ISDN Config> SET T3
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer T3(1-100)[60]?
ISDN Config>
```

q) N1

This is the maximum frame length in reception including headers and flags. The default value is 263 which corresponds to a packet length of 256. The range of values is between 128 and 1024.

If you wish to modify the value, enter:

Example:

```
ISDN Config> SET N1
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
Frame length(1-4096)[263]?
ISDN Config>
```

r) N2

This is the maximum number of retransmissions for a non validated frame. The default value is 10, and the range of values permitted is between 1 and 100.

Example:

```
ISDN Config> SET N2
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):7
Maximum number of transmt.(1-100)[10]
ISDN Config>
```

s) SABM

Determines if the X.25 layer 2 entity will try to establish continually the link transmitting SABM (Enabled) or if it will wait for the remote entity to establish the link (Disabled). The default value is enabled.

Example:

```
ISDN Config> ENABLE SABM-ACTIVE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
ISDN Config>
```

or:

```
ISDN Config> DISABLE SABM-ACTIVE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
ISDN Config>
```

t) Type of connection

It enables communication through a B port. You must choose between the B channel operating modes for this: Transparent (T), Switched (C), Packets (P), Semi-permanent (S), None (N). By default it is disabled (N).

Example:

```
ISDN Config> SET CONNECTION-TYPE
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Choose type of connection(S,P,T,C)[N]:N
ISDN Config>
```

u) Release time without call

If through the B channel there has not been any X.25 call during the time specified in this parameter, the Q.931 call hangs up. The default value is 30 seconds, and the range of values permitted is between 0 and 1.000. The value 0 means that the call is not hung up.

Example:

```
ISDN Config> SET REL-WTH-CALL-TIME
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8): 7
Timer without call(0-1000)[60]?30
ISDN Config>
```

v) Channel

Specifies the basic access B channel through for implementing the X.25 protocol. The default value is 0. The value 1 is used to request the B1 channel and 2 to request B2.

Example:

```
ISDN Config> SET ISDN-CHANNEL
ISDN Ports [5(R1D),6(R2D),7(R1B),8(R2B)]
Port number(6-8):
Channel(0,1,2)[0]:
ISDN Config>
```

4. ISDN Monitoring Commands

To enter in the X.25 monitoring, you access through the main menu in the following way:

1. At the (*) prompt, enter **PROCESS 3** (or **P 3**).
2. At the monitoring prompt (+), enter **NODE ISDN**.
3. At the X.25 monitoring prompt (ISDN>), use the monitoring commands which are described in this chapter to monitor the X.25 parameters.

The X.25 monitoring commands are numerated and described. The letters written in **bold** are the minimum number of characters that have to be entered to make the command effective.

Command	Functions
? (HELP)	Lists the available commands or their options.
ACTIVATE	Allows you to try to manually activate the line.
CLEAR	Permits you to delete the ISDN statistics.
DISPLAY	Displays information on the ISDN interface.
LIST	Allows you to list some of the statistics.
EXIT	Returns to previous prompt.

ISDN Monitoring Commands

4.1. ? (HELP)

Displays a list of available commands or their options.

Syntax:

```
ISDN> ?
```

Example:

```
ISDN> ?
ACTIVATE
CLEAR
DISPLAY
LIST
EXIT
ISDN>
```

4.2. ACTIVATE

This allows you to try and manually activate the line. The status is displayed after a few seconds. You can use this to test the lines.

Syntax:

```
ISDN> ACTIVATE
```

Example:

```
ISDN> ACTIVATE

Line number(1-2): 1
Activating...
 Physical Status: F7
 Lapd Status: Active Line. Multiple frame established
              TEI assigned = 65
ISDN>
```

4.3. CLEAR

Permits you to delete the ISDN statistics.

Syntax:

```
ISDN> CLEAR ?
FRAMES
RELEASED-CALLS
```

a) CLEAR FRAMES

This command returns the counters to zero where the number of detected errors in the sequence number (***N(s)***) and the number of the various types of frames are kept: (***I, RR, RNR, REJ, FRMR, UI*** (only LAPD)) which are transmitted and received by each port. You need to indicate the number of the port where you wish to return the counters to zero.

Example:

```
ISDN> CLEAR FRAMES

Line number(1-2):1
ISDN>
```

b) CLEAR RELEASED-CALLS

This command deletes the buffer where the released calls information is stored.

Example:

```
ISDN> CLEAR RELEASED-CALLS
ISDN>
```

4.4. DISPLAY

Displays information on the line status or the release causes.

Syntax:

```
ISDN> DISPLAY ?
CAUSES
PORT-STATUS
```

a) DISPLAY CAUSES

Permits you to interpret the release causes.

Example:

```
ISDN> DISPLAY CAUSES

Cause code (in dec)(0-255): 21
Cause (21):  Call rejected

ISDN>
```

b) DISPLAY PORT-STATUS

Allows you to see the general state of the ISDN line.

Example:

```
ISDN> DISPLAY PORT-STATUS

Line number(1-2):1

ISAC status: F7 Active
Tx Bytes:            847  Rx Bytes:           787
Tx underrun:           0  Rx overflow:          1
D collisions:          0

Lapd Status: Active Line. Multiple frame established
             TEI assigned = 65
Q931 Status: 0

ISDN>
```

Where the following information is given:

ISAC status Gives the physical layer status, in accordance with the I.430 norm.

Lapd Status This is the status of the link layer in accordance with the Q.931 norm. In cases where this assigns the TEI (Terminal Equipment Identifier), this will be indicated.

Q931 Status Status of the call component in accordance with this norm.

4.5. LIST

Permits you to list the following statistics:

Syntax:

```
ISDN> LIST ?
ACTIVE-CALLS
RELEASED-CALLS
FRAMES
```

a) LIST ACTIVE-CALLS

Lists all calls which are active in this moment.

Example:

```
ISDN> LIST ACTIVE-CALLS

TYPE  CALLED NUMBER     CALLING NUMBER REF CHAN   T/START  D/START   CHARGE

OUT           5100               6100  001  1-B1 12:12:57 11/06/99   000000

ISDN>
```

The meaning of the distinct fields is:

TYPE Incoming (IN) or outgoing(OUT).

CALLED NUMBER Number of called TE.

CALLING NUMBER Number of calling TE.

REF Reference value of call in use.

CHAN Line and channel through which the call has been established.

T/START Indicates the time the call is established.

D/START Indicates the day the call is established.

CHARGE Cost of the call (should the network provide this).

b) LIST RELEASED-CALLS

This gives you the information on the connections that have been released. Relative data on the last 100 calls released is stored and is displayed in the same order as these were released.

If you only wish to consult information on a certain number of the last calls, enter the number of calls you wish to see after the command.

Example:

```
ISDN> LIST RELEASED-CALLS

L T    CALLED N.  CALLING N. CC  DC  T/START    T/END  D/START    D/END CHARGE
1 O        5200        6200 016 000 12:03:08 12:03:20 11/06/99 11/06/99 000000
2 O        5201        6201 016 000 12:03:09 12:03:20 11/06/99 11/06/99 000000

ISDN>
```

The meaning of the distinct fields is as follows:

L	Line through which the released call has been received.
T	Incoming (I) or outgoing (S).
CALLED N.	Called TE number.
CALLING N.	Calling TE number.
CC	Causes of call release (in decimal).
DC	Diagnoses the call release (in decimal).
T/START	Indicates the time the call is established.
T/END	Indicates the time the call is released.
D/START	Indicates the date the call is established.
D/END	Indicates the date the call is released.
CHARGE	Cost at the end of the call (should the network provide this).

c) LIST FRAMES

This command list the statistics on the number of different types of frames transmitted or received through a line, classing them by type. You need to enter the number of the line which you wish to view these statistics.

Example:

```
ISDN> LIST FRAMES

Line number(1-2):1

I Frames   : transmitted  =        0    received  =        0
RR Frames  : transmitted  =      538    received  =      538
RNR Frames : transmitted  =        0    received  =        0
REJ Frames : transmitted  =        0    received  =        0
FRMR Frames: transmitted  =        0    received  =        0
UI Frames  : transmitted  =        0    received  =        0

Errors in N(S):        0

ISDN>
```

4.6. EXIT

The **EXIT** command is used to return to the previous prompt.

Syntax:

```
ISDN> EXIT
```

Example:

```
ISDN> EXIT
+
```