# Distributed Routing Software

# Network Interface Operations Guide

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This manual provides information about configuring and monitoring the network interfaces in the Distributed Routing Software bridging router.

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**Maynard, Massachusetts**

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# Preface

## Objectives

This manual contains information about configuring and monitoring the network interfaces in your bridging router. Specifically, this guide enables you to:

- Configure, monitor, and use the interfaces in the bridging router.
- Configure, monitor, and use the Link Layer software supported by the bridging router.

## Audience

This guide is intended for persons who install and operate computer networks. Although experience with computer networking hardware and software is helpful, you do not need programming experience to use the protocol software.

This preface describes how to use this book and the documentation set to which it belongs.

## Preface

# Using This Guide

The following table helps you locate information in this guide:

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## Preface

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| • Accessing the Configuration and Console Processes<br>• WAN Restoral or WAN Reroute<br>• Configuring for WAN Restoral<br>• Configuring for WAN Reroute<br>• Changing From WAN Restoral to WAN Reroute<br>• Changing From WAN Reroute to WAN Restoral<br>• Configuration and Console Commands<br>• WAN Restoral and GWCON Commands | **12** Configuring and Monitoring WAN Restoral |
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# Using Related Documentation

## Digital Documents

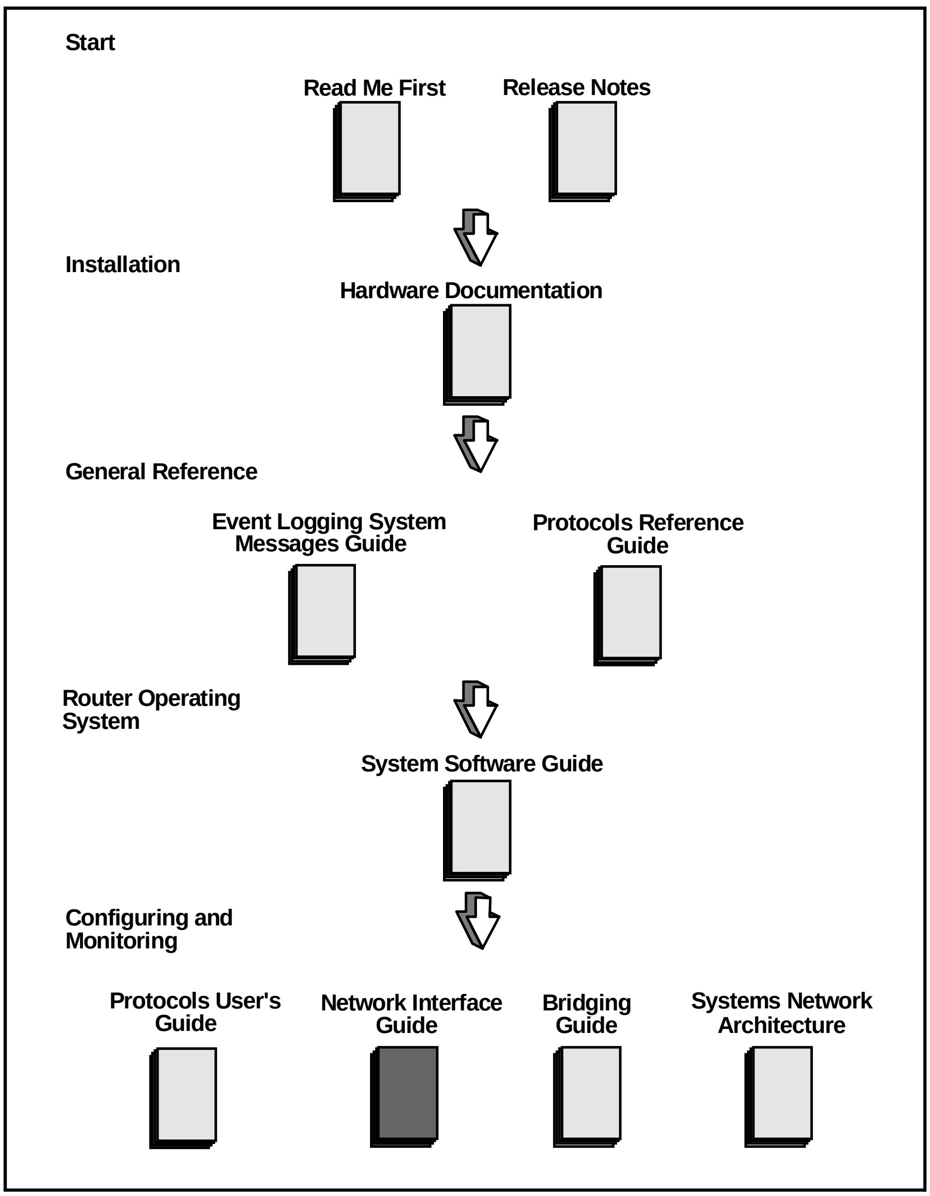
| This Document... | Describes... |
|---|---|
| *RouteAbout Access EI Installation* EK-DEXBR-TE | Installation and use of the RouteAbout Access EI router. |
| *RouteAbout Access EW Installation* EK-DE28R-IN | Installation and use of the RouteAbout Access EW router. |
| *RouteAbout Access TW Installation* EK-DEWTR-IN | Installation and use of the RouteAbout Access TW router. |
| *RouteAbout Central EW Installation* EK-DEZ8R-IN | Installation and use of the RouteAbout Central EW router. |
| *RouteAbout Central EI Installation* EK-DEZBR-IN | Installation and use of the RouteAbout Central EI router. |
| *Bridging Configuration Guide* AA-QL29D-TE | The configuration and monitoring procedures for bridging methods. Bridging features that enhance system performance. |
| *Event Logging System Messages Guide* AA-QL2AD-TE | How events are logged and how to interpret Event Logging System (ELS) messages. Provides a description of each ELS message with a corresponding corrective action. |
| *Routing Protocols Reference Guide,* AA-QL2CD-TE | Reference information about the micro-operating system structure, and the protcols and interfaces that bridging routers support. |

| This Document... | Describes... |
|---|---|
| *Routing Protocols User's Guide*<br>AA-QL2CD-TE | How to configure and monitor the following protocols:<br>• AppleTalk Phase 1<br>• AppleTalk Phase 2<br>• ARP<br>• Bandwidth Reservation<br>• BGP4<br>• DVMRP<br>• IP<br>• IPX<br>• OSPF<br>• OSI/DNA V<br>• PIM<br>• SNMP<br>How to use the Digital Trace Facility. |
| *Protocol Quick Reference Card Set* | Commands used to configure and monitor a protocol, feature, or interface. |
| *Systems Network Architecture Guide*<br>AA-QU5SB-TE | SNA interfaces and protocols for the Distributed Routing Software System. |
| *System Software Guide*<br>AA-QL2ED-TE | Installing, configuring, and operating the Distributed Routing Software system software. |

## Document Set Structure

Figure 1 shows the structure of the documentation set.

**Figure 1 Document Set Structure**



## Conventions

The following conventions are used in this manual:

| | |
|---|---|
| `Monospace type` | Monospace type in examples indicates system output or user input. |
| **Boldface type** | Boldface type in examples indicates user input. Boldface type is also used for filenames and command names within text. |
| *lowercase–italics* | Lowercase italics in command syntax or examples indicate variables for which either the user or the system supplies a value. |
| [ ] | Brackets enclose operands or symbols that are either optional or conditional. Specify the operand and value if you want the condition to apply. Do not type the brackets in the line of code. |
| *key* | A key name enclosed in a box indicates that you press the specified key. |
| CTRL/x | indicates that you hold the Ctrl key while pressing the key specified by the *x*. The server displays the key combination as ^x. |
| underscore | Characters underlined in a command listing represent the fewest number of characters you must enter to identify that command to the interpreter. Characters are also underlined to indicate emphasis, such as notes and cautions. |

## Symbols

**C** **M**

The configuring and monitoring chapters contain a description of all commands you can use to configure and monitor the protocol, feature, or interface.

**C** means you use the command to configure the router. You access configuration commands after you enter **talk 6** at the * prompt. Configuration commands change the router's nonvolatile database; a router restart is necessary to activate the change.

**M** means you use the command to monitor and dynamically configure the router. You access monitoring commands after you enter **talk 5** at the * prompt. Changes made in this mode take effect immediately, but are not made in the router's nonvolatile database (and therefore not preserved after a router restart).

**C** **M** means you use the command both to configure and to monitor the router.

**Note:** **Talk 5** monitoring commands are also referred to as console commands in this guide. **Talk 6** configuration commands are sometimes referred to as just config commands.

## Commands

Figure 2 shows command components.

**Figure 2 Command Components**

# Command Name

Description of commands.

**Syntax:** command name
parameter 1 . . .
parameter 2 . . .

parameter *option*

Description of parameter and options.

```
Example: command name  parameter

         Prompt? options
```

**Syntax:** The command followed by each parameter you can configure using that command. If an ellipsis follows a parameter, you need to enter additional information (*options*). When you enter a command, you can save time by typing only the underlined letters.

parameter Description of each parameter.

*option* (in italics) Information you must enter with the command and parameter.

**Example:** An example of how you enter that command and parameter.

## Entering Commands

Instead of being prompted for options, you can save time by entering the complete command on one line. For example, you can enter the **set framesize** command shown in Figure 3 as follows:

```
set framesize 2048
```

If you abbreviate the command using the underlined letters, you can enter

```
s f 2048
```

**Figure 3 Set framesize command**

# Set

Configure frame size and local address.

**Syntax:** set
framesize . . .

framesize *1024* or *2048* or *4096*

Thes size of the network-layer portion of frames transmitted and received on the interface.

```
Example: set framesize
        Framesize in bytes (1024/2048/4096) [1024]? 2048
```

## Accepting the Current Setting

When the software prompts you for information, the current setting appears in brackets [ ]. To accept the information in the brackets, press RET. In this example, the current setting is 1024.

```
Framesize in bytes (1024/2048/4096) [1024]?
```

## Reader's Comments

If you have comments or suggestions about this document, contact the Network Product Business Group.

- Send Internet electronic mail to: doc_quality@lkg.mts.dec.com
- Send comments via FAX to: 508-486-5655
- Send hardcopy mail to:

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Shared Engineering Services
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Littleton, MA 01460-1289

## How to Order Additional Documentation

To order additional documentation, use the following information:

| To Order: | Contact: |
|---|---|
| By Telephone | USA (except Alaska, New Hampshire, and Hawaii):<br>1-800-DIGITAL (1-800-344-4825)<br>Alaska, New Hampshire, and Hawaii: 1-603-884-6660<br>Canada: 1-800-267-6215 |
| Electronically (USA only) | Dial 1-800-DEC-DEMO<br>(For assistance, call 1-800-DIGITAL) |
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# 1

# Getting Started with Network Interfaces

This manual describes how to configure and monitor the network interfaces and the link layer protocols supported by the Bridging Router. The purpose of this chapter is to provide basic configuration and monitoring guidelines. This chapter also describes the basic procedures and the information needed to monitor the interfaces through the GWCON **interface** command.

## 1.1 Network Interfaces and the GWCON Interface Command

When configuring network interfaces, you may find it necessary to display certain information about specific interfaces. While some interfaces have their own console processes for monitoring purposes, the router displays statistics for *all* installed network interfaces when you use the **interface** command from the GWCON environment. For more information on the **interface** command, refer to the chapter covering the GWCON process and commands in the *System Software Guide*.

### 1.1.1 Accessing Network Interface Configuration Processes

In the chapters that follow, you must access various interface configuration processes. To do this, you must determine the network interface number of the device that you want configure. Then, to access the configuration process, you must activate it from the `Config>` prompt by supplying that interface number.

To access any interface configuration process, perform these steps:

1. Enter the following command at the OPCOM prompt:

   ```
   * talk 6
   ```

   The console displays the CONFIG prompt (`Config>`). Now you can enter CONFIG commands. If the prompt does not appear, press RET again. To exit CONFIG and return to OPCON, enter the OPCON intercept character CTRL/p.

2. Determine the device's network interface number by entering the **list devices** command at the `Config>` prompt. For example:

```
Config> list devices

Ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
Ifc 1 (WAN PPP):  CSR 1001620, CSR2 1000D00, vector 93
Ifc 2 (WAN PPP):  CSR 1001640, CSR2 1000E00, vector 92
config>
```

3. Specify the appropriate number by entering a command of the form **net** *n*, where *n* is the network interface number. For example, to access the Ethernet configuration process, you would enter **net 0**:

```
Config> net 0
Ethernet interface configuration
ETH config>
```

**Note:** Configuration changes that you make to the protocol parameters do not take effect until you restart the router.

The changes you make through CONFIG are retained in a configuration database in non-volatile memory. They are retained during power downs and are recalled when you restart the router.

To restart the router, enter the OPCON **restart** command. For example:

```
* restart
Are you sure you want to restart the router? (Yes or No)[No]: yes
```

### 1.1.2 Accessing Network Interface Console Processes

The interface console processes let you monitor software configurable parameters for the specific network types used in your router.

**Note:** In this manual, the term console process means the same as the term monitoring process. The terms console commands and monitoring commands are interchangeable.

Unlike configuration commands, console commands take effect immediately, but do not become part of the router's non-volatile configuration memory. Thus, while console commands let you make real-time changes to the router's configuration, the changes are only temporary. The configuration memory overwrites them when the router restarts.

The console process is used to:

- Monitor the protocols and network interfaces currently in use by the router.
- Display ELS (Event Logging System) messages relating to router activities and performance.
- Make real-time changes to the configuration without permanently affecting the router's non-volatile configuration memory.

To access any interface console process, perform the following steps:

1. Determine the network interface number by entering the **interface** command at the GWCON (+) prompt. For example,

```
+interface
                                   Self-Test  Self-Test  Maintenance
Nt Nt' Interface       CSR  Vec      Passed     Failed       Failed
0  0   Eth/0      1001600   5E           1          0            0
```

2. Specify the appropriate number by entering a command of the form **net** *n*, where *n* is the network interface number. For example, to access the Ethernet console process, you would enter **net 0**:

```
+ net 0
Ethernet interface console
Eth>
```

## 1.2 Accessing Link Layer Protocol Management Processes

Refer to the *System Software Guide* for complete information about accessing the protocol configuration and console processes. These processes let you change and monitor configurable parameters for the Link Layer protocols supported by your bridging router.

# 2

# Configuring and Monitoring the Ethernet Network Interface

This chapter describes how to configure and monitor the Ethernet interface.

## 2.1 Accessing the Interface Configuration and Console Processes

For information about accessing the configuration and console processes, refer to Chapter 1.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `ETH config>` prompt.

Enter console (monitoring) commands at the `ETH>` prompt.

## 2.2 Ethernet Configuration and Console Commands

Table 2–1 summarizes the Ethernet configuration and console commands. The sections that follow explain these commands.

**Note:** Refer to the hardware documentation for specifics about your router type. Some commands may not apply for your hardware platform.

**Table 2–1 Ethernet Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Displays all the Ethernet commands or lists sub-command options for specific commands. |
| **Collisons** | Monitor | Displays a collisions statistic for the specified Ethernet interface. |
| **Connector-Type** | Configure | Sets the connector type. |
| **IP-Encapsulation** | Configure | Sets the IP encapsulation as Ethernet type 8137 or Ethernet 802.3. |
| **List** | Configure | Displays the connector type, Ethernet version number, NetWare IPX encapsulation, and IP encapsulation. |
| **LLC** | Configure/Monitor | Accesses the LLC configuration or monitoring process and displays the LLC> prompt. |
| **Frame** | Configure | Sets the NetWare IPX encapsulation as Ethernet type 8137, Ethernet 802.3, Ethernet 802.2, or Ethernet SNAP. |
| **Exit** | Configure/Monitor | Exits the config and monitor processes and returns to the previous prompt level. |

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter a **?** after a specific command name to list its options.

**Syntax:** ?

Example: **ETH config> ?**

```
CONNECTOR-LOCATION
CONNECTOR-TYPE
IP-ENCAPSULATION
LIST
LLC
FRAME
VERSION
EXIT
```

Example: **ETH> ?**

```
COLLISIONS
LLC
EXIT
```

### Collisions M

Shows the number of transmissions for packets that incurred collisions before they were successfully transmitted. The counters tally the number of packets successfully sent after the specified number of collisions for the range of 1 to 15 collisions. Increasing numbers of packets transmitting with collisions and higher numbers of collision per packet are signs of transmitting onto a busy Ethernet.

These counters are cleared by the **clear** command in the OPCON process. This data is exported through SNMP as the dot3CollTable.

**Syntax:** collisions

Example: **coll**

```
Transmitted with  1 collisions:                 0
Transmitted with  2 collisions:                 0
Transmitted with  3 collisions:                 0
Transmitted with  4 collisions:                 0
Transmitted with  5 collisions:                 0
Transmitted with  6 collisions:                 0
Transmitted with  7 collisions:                 0
Transmitted with  8 collisions:                 0
Transmitted with  9 collisions:                 0
Transmitted with 10 collisions:                 0
Transmitted with 11 collisions:                 0
Transmitted with 12 collisions:                 0
Transmitted with 13 collisions:                 0
Transmitted with 14 collisions:                 0
Transmitted with 15 collisions:                 0
```

### Connector-Type C

Set the connector-type. Some Digital routers support AUI (10Base5), BNC (10Base2) and RJ45 (10BASET) connectors. Other Digital routers support AUI (10Base5), BNC (10Base2) and Auto-config options.

<u>**Note:**</u> You do not have to use this command because the router automatically senses the connector type.

**Syntax:** connector-type *name*

`Example:` **`connector-type aui`**

### Frame C

Set the NetWare IPX encapsulation type. Refer to Table 2–2 and enter one of the following:

**Table 2–2 NetWare IPX Encapsulation Types**

| Option | Description | Syntax |
|---|---|---|
| Ethernet_II (Ethernet type 8137) | Uses Ethernet type 8137 as the packet format. This format is required if you are using NetWare-VMS on the Ethernet. | frame ethernet_II |
| Ethernet_8023 (IEEE 802.3 'raw' without 802.2) | Uses an IEEE 802.3 packet format without the 802.2 header. This is the command default, and also the default for NetWare versions prior to 4.0. Ethernet 802.3 does not conform to the IEEE 802. standards because it does not include an 802.2 header. It may cause problems with other nodes on the network. | frame ethernet_8023 |
| Ethernet_8022 | Packet format includes an 802.2 header. This is the default for NetWare versions 4.0 and later. | frame ethernet_8022 |
| Ethernet_SNAP | Uses the 802.2 format with a SNAP header. This encapsulation type is meant to be compatible with token ring SNAP encapsulation. However, it violates IEEE standards and is not interoperable across conformant bridges. | frame ethernet_snap |

**Syntax:** frame *encapsulation type*

`Example:` **`frame ethernet_8022`**

### IP-Encapsulation C

Select Ethernet (Ethernet type 8137) or IEEE-802.3 (Ethernet 802.3 without 802.2). Enter **e** or **i**.

**Syntax:** IP-encapsulation *type*

Example: **IP-encapsulation e**

### List M

Display the current configuration for the Ethernet interface including the connector-type, Ethernet version, NetWare IPX encapsulation type, and the IP encapsulation type.

**Syntax:** list all

Example: **list all**

```
Connector type:             BNC (10BASE2)
ETHERNET version:           2
NetWare IPX encapsulation:  Ethernet _II
IP Encapsulation:           ETHER
```

### LLC C M

Access the LLC prompt. LLC commands are entered at this new prompt. See Chapter 6 for an explanation of each of these commands.

**Syntax:** llc

Example: **ETH_Config>llc**

```
LLC user configuration
LLC>
```

Example: **ETH>llc**

```
LLC user monitoring
LLC>
```

**Exit** **C M**

Return to the previous prompt level.

**Syntax:** exit

Example: **exit**

## 2.3 Displaying Ethernet Statistics Through the Interface Command

Use the **interface** command from the GWCON environment to display power-up and operating statistics of the Ethernet interface. The output formats for the various Digital routers differ. The format for the RouteAbout Access EW router is:

```
+interface
                                 Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR   Vec     Passed     Failed       Failed
0  0   Eth/0      1001600   5E           1          1            0
1  1   PPP/0      1001620   5D           0       9451            0
2  2   PPP/1      1001640   5C           0       9451            0


+interface 0
                                 Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR   Vec     Passed     Failed       Failed
0  0   Eth/0      1001600   5E           1          1            0


Ethernet/IEEE 802.3 MAC/data-link on SCC Ethernet interface

Physical address         08002BB19F1D
PROM address             08002BB19F1D

Input statistics:
 failed, frame too long           0   failed, FCS error              0
 failed, alignment error          0   failed, FIFO overrun           0
 internal MAC rcv error           0   packets missed                 0
Output statistics:
 deferred transmission            0   single collision               0
 multiple collisions        1486001   total collisions         1486001
 failed, excess collisions  1486001   failed, FIFO underrun          0
 failed, carrier sense err        0   SQE test error                 0
 late collision                   0   internal MAC trans errors      0
 RISC Microcode Revision          2
```

The format for the RouteAbout Access TW output format is shown below.

```
+interface 1
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
1  1   FR/0       1001620   5D          0          0            0


 Frame Relay MAC/data-link on SCC Serial Line interface

 Adapter cable:           Undefined  RISC Microcode Revision:           2


 Line speed:              unknown
 Last port reset:         15 seconds ago


 Input frame errors:
  CRC error                       0   alignment (byte length)           0
  missed frame                    0   too long (>  2062 bytes)          0
  aborted frame                   0   DMA/FIFO overrun                  0
  L & F bits not set              0
 Output frame counters:
  DMA/FIFO underrun errors        0   Output aborts sent                0
+
```

The fields in the previous examples are explained below.

*Nt* Global interface number.

*Nt'* Reserved for dial circuit use

*Interface* Interface name and its instance number.

*CSR* Command and Status Register address.

*Vec* Interrupt vector.

*Self-Test Passed* Number of times self-test succeeded (state of interface changes from down to up).

*Self-Test Failed* Number of times self-test failed (state of interface changes from up to down).

*Maintenance Failed* Number of maintenance failures.

*Physical address* The ethernet address of the device currently in use. This may be the PROM address or an address overwritten by another protocol.

| | |
|---|---|
| *PROM address* | The permanent unique Ethernet address in the PROM for this Ethernet interface. |
| *Interface type* | This output specifies the connector type as AUI, BNC, or RJ45. |
| *Input statistics:* | |
| *failed, packet too long or failed, frame too long* | The Failed, Packet Too Long counter increments when the interface receives a packet that is larger than the maximum size of 1518 bytes for an Ethernet frame. This data is exported through SNMP as the dot3StatsFrameTooLongs counter. |
| *failed, framing error or failed, alignment error* | The Failed, Framing Error counter increments when the interface receives a packet whose length in bits is not a multiple of eight. |
| *failed, FIFO over-run or failed, FIFO overrun* | The Failed, FIFO (First In, First Out) Over-run counter increments when the Ethernet chipset is unable to store bytes in the local packet buffer as fast as they come off the wire. |
| *collision in packet* | The counter increments when a packet collides as the interface attempts to receive a packet, but the local packet buffer is full. This error indicates that the network has more traffic than the interface can handle. |
| *short frame* | The counter increments when the interface receives a packet with a short frame. |
| *buffer full warnings* | The Buffer Full Warnings counter increments each time the local packet buffer is full. |
| *packets missed* | The Packets Missed counter increments when the interface attempts to receive a packet, but the local packet buffer is full. This error indicates that the network has more traffic than the interface can handle. |
| *internal mac rx errors* | Receive errors that are not late, excessive, or carrier check collisions. This data is exported through SNMP as the dot3StatsInternalMacReceiveErrors counter. |

*Input statistics:*

| | |
|---|---|
| *Internal mac rx errors* | Receive errors that are not late, excessive, or carrier check collisions. This data is exported through SNMP as the dot3StatsInternalMacReceiveErrors counter. |

*Output statistics:*

| | |
|---|---|
| *initially deferred or deferred transmission* | The Initially Deferred counter increments when the carrier sense mechanism detects line activity causing the interface to defer transmission. This data is exported through SNMP as the dot3StatsDeferredTransmissions counter. |
| *single collision* | The Single Collision counter increments when a packet has a collision on the first transmission attempt, and then successfully sends the packet on the second transmission attempt. This data is exported through SNMP as the dot3StatsSingleCollisionFrames counter. |
| *multiple collisions* | The Multiple Collisions counter increments when a packet has multiple collisions before being successfully transmitted. This data is exported through SNMP as the dot3MultipleCollisionFrames counter. |
| *totalcollisions* | The Total Collisions counter increments by the number of collisions a packet incurs. |
| *failed, excess ollisions* | The Failed, Excess Collisions counter increments when a packet transmission fails due to 16 successive collisions. This error indicates a high volume of network traffic or hardware problems with the network. This data is exported through SNMP as the dot3StatsExcessiveCollisions counter. |
| *failed, FIFO under-run* | The Failed, FIFO Under-run counter increments when packet transmission fails due to the inability of the interface to retrieve packets from the local packet buffer fast enough to transmit them onto the network. |

| | |
|---|---|
| *failed, carrier check or failed, carrier sense error* | The Failed, Carrier Check counter increments when a packet collides because carrier sense is disabled. This error indicates a problem between the interface and its Ethernet transceiver. This data is exported through SNMP as the dot3StatsCarrierSenseErrors counter. |
| *CD heartbeat error or SQE test error* | The CD (Collision Detection) Heartbeat Error counter increments when the interface sends a packet but detects that the transceiver has no heartbeat. The packet is treated as successfully transmitted because some transceivers do not generate heartbeats. This data is exported through SNMP as the dot3StatsSQETestErrors counter. |
| *out of window collisions or ate collisions* | The Out of Window Collisions counter increments when a packet collides after transmitting at least 512 bits. This error indicates that an interface on the network failed to defer, or that the network has too many stations. This data is exported through SNMP as dot3StatsLateCollisions counter. |
| *internal mac tx errors or internal MAC trans errors* | Transmit errors that are not late, excessive, or carrier check collisions. This data is exported through SNMP as the dot3StatsInternalMacTransmitErrors counter. |
| *RISC Microcode Version* | This gives the version of the microcode running in the RISC controller of the communications processor module. |

# 3

# Configuring and Monitoring the FDDI Network Interface

This chapter describes the commands that configure the FDDI network interface. Since FDDI does not include a console process for monitoring the interface, the chapter also describes how to use the GWCON interface command.

## 3.1 Accessing the Interface Configuration Processes

For information about accessing the configuration process, refer to Chapter 1.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

## 3.2 Network Interfaces and the GWCON Interface Command

The FDDI interface does not have its own console process that you can use for monitoring. However, you can use the **interface** command from the GWCON environment to display complete statistics for all installed network interfaces. For more information about the **interface** command, refer to the GWCON chapter in the *System Software Guide.* Information about displaying statistics for FDDI interfaces is included in this chapter.

## 3.3 Basic FDDI Configuration Procedures

The FDDI software default configuration supports a dual attach or single attach node on a standard FDDI backbone. There are no required software configuration steps although it is highly recommended that default settings be used. For special configurations, use the following commands, which are described later in this chapter:

- Use the **set config** command to indicate the ports the interface uses to transmit and receive.
- Use the **set policy** command to select the FDDI connection types.

- Use the **set station-type** command to set the FDDI station type as single-attach slave or dual-attach peer.

## 3.4 FDDI Configuration Commands

This section explains the FDDI configuration commands. Enter configuration commands at the `FDDI Config>` prompt. Table 3–1 summarizes the FDDI configuration commands.

**Table 3–1 FDDI Configuration Command Summary**

| Command | Function |
|---|---|
| **? (Help)** | Displays all the FDDI commands or lists subcommand options for specific commands. |
| **Frame** | Sets the NetWare IPX encapsulation type. |
| **List** | Displays FDDI software configurable information such as buffer allocation, timer settings, station types, and connection policies. |
| **Set** | Sets the configuration for the interface including the maximum token rotation time, frequency of NIF information frames, alarms and timers to manage connections and monitor link nodes, the type of FDDI connections, requested token rotation time, and the frequency for the head of a frame. |
| **Exit** | Exits the FDDI configuration process. |

### ? (Help)

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

`Example:` **?**

```
FRAME
LIST
SET
EXIT
```

### Frame

Set the NetWare IPX encapsulation type. Table 3–2 summarizes the options you can use.

**Table 3–2 Frame Command NetWare IPX Encapsulation Types**

| Option | Description | Syntax |
|---|---|---|
| FDDI using 802.2 | Uses the standard 802.2 DSAP/SSAP of E0 for IPX. | frame fddi |
| FDDI using 802.2 with SNAP | Uses the 802.2 with SNAP header for IPX. This is the default for Digital routers. | frame fddi_snap |

**Syntax:** frame *encapsulation type*

`Example:` **`frame fddi`**

### List

Display the FDDI configuration currently in SRAM

**Syntax:** list
all
apple-I-OUI
config
max-trt
phy . . .
policy
req-trt
smt-timer
station-type
tvx-timer

#### all

Displays all FDDI software configurable information such as buffer allocation, timers, station types and connection policies.

Example: **list all**

```
Appletalk Phase I will use Interoperable OUI
Preferred configuration THRU-A or EITHER
TMax: 2097152

Target Rotation Time 100000 (0x186A0) byte clocks = 8.000 msec
PHYA Cutoff = 6
PHYA Alarm = 7
PHYB Cutoff = 6
PHYB Alarm = 7
Policy = reject no connections

SMT notify time (sec): 30
Station type: PEER (default)

Valid transmission expiration timer (ns): 2621440
```

**apple-I-OUI**

Displays whether AppleTalk Phase 1 is using interoperable or proprietary OUI in the header of the Appletalk frames.

Example: **list apple-I-OUI**

```
Appletalk Phase I will use Interoperable OUI
```

**config**

Displays the type of configuration in effect for the interface and shows the ports the interface uses to transmit and receive tokens.

Example: **list config**

```
Preferred configuration THRU-A
```

**max-trt**

Displays the maximum acceptable token rotation time in 80 nanosecond byte clocks.

Example: **list max-trt**

```
TMax: 2097152
```

**phy a b**

Displays alarms and timers the interface uses to manage connections and monitor link errors. The valid ring names are *a* and *b*. The alarm and cutoff display a $-\log_{10}$ rate.

Example: **list phy a**

```
PHYA Cutoff = 6
PHYA Alarm = 7
```

**policy**

Displays the valid types of FDDI connections for the interface.

Example: **list policy**

```
Policy = reject no connections
```

**req-trt**

Displays the requested token rotation time in 80 nanosecond byte clocks.

Example: **list req-trt**

```
Target Rotation Time 100000 (0x186A0) byte clocks = 8.000 msec
```

**smt-timer**

Displays the number of seconds that can pass before the interface generates NIF frames to neighbor nodes.

Example: **list smt-timer**

```
SMT notify time (sec): 30
```

**station-type**

Displays the interface FDDI station type.

Example: **list station-type**

```
Station type: PEER (default)
```

**tvx-time**

Displays the amount of time (in 80 nanosecond byte clocks) that can pass before the interface must see the head of a frame.

Example: **list tvx-time**

```
Valid transmission expiration timer (ns): 2621440
```

## Set

Specify the type of configuration including the maximum token rotation times, alarms, timers, and FDDI station type.

**Syntax:** set apple-I-OUI
config . . .
max-trt . . .
notify-timer . . .
phy a/b . . .
policy . . .
req-trt . . .
station-type . . .
tvx-timer . . .

#### appletalk-I-OUI

Sets AppleTalk Phase 1 using interoperable or proprietary OUI. The valid entries are i (interoperable) or p (proprietary). Proprietary is compatible with AppleTalk Phase 1. The default setting is *proprietary*.

Example: **set Apple-I-OUI p**

#### config *interface*

Selects the type of FDDI configuration in effect for the interface, a peer or a slave. Use this parameter to indicate which ports the interface transmits and receives tokens. *Interface* has five possible variables: a-thru, b-thru, a-wrap, b-wrap, and either. The default configuration is a-thru for dual attach nodes, and either for single attach nodes.

This parameter works in conjunction with the **station-type** parameter. For example, a *slave* station must use the a-wrap, b-wrap, or the either configuration type. A *peer* station must use the a-thru or b-thru configuration type.

- **A-thru** – Configure this for a peer interface port that receives the token in port A and transmits on port B. This is the default setting.
- **B-thru** – Configure this for a peer interface port that receives the token on port B and transmits on port A.
- **A-wrap** – Configure this for a slave interface port that receives the token on port A and transmits on port A.
- **B-wrap** – Configure this for a slave interface port that receives the token on port B and transmits on port B.

- **Either** – Configure this for a slave interface port that used as either an *a-wrap* or *b-wrap*. Use this for stations that are attached to more than one concentrator.

Example: **`set config b-thru`**

**max-trt *#-of-byte-clks***

Selects the maximum acceptable token-rotation time (*#-of-byte-clocks)*. The TRT is a timer used to schedule FDDI ring access. This parameter determines the maximum amount of time that may pass before the interface must see a token. FDDI nodes use token rotation time to claim the token during the negotiation process. During negotiation, each node uses its max-trt to determine how often it must see a token. The default setting is 2097152 and the range is 4-165 milliseconds.

Example: **`set max-trt 2097152`**

**notify-timer *#-of-seconds***

Selects how often (*#-of-seconds*) the interface generates a NIF (neighborhood information frame) to neighbor nodes. This frame includes transmitting node information for use with ring management. The default time is 30 seconds. The range is 2 to 30 seconds.

**Caution:** Do not change this value unless you understand the system-wide consequences to the network.

Example: **`set notify-timer ?`**

```
SMT Notify time in seconds [65535]?
```

**phy *ring type parameter value***

Manages connections and monitors link errors between the A or B ring and neighboring nodes.

| | |
|---|---|
| *Ring Type* | Defines the ring (a or b) that you want to monitor. |
| *Parameter* | Defines the variable that you want to set. The two variables are *alarm* and *cutoff*. |
| *Value* | Sets the alarm and cutoff link error rates. |

*Alarm value* Sets the link error rate (value) the alarm displays. If the link error rate exceeds this level, the system sets a flag causing the SMT management station to note a problem. Set the alarm to a higher value than the cutoff value. The values are: Default = 7, Minimum = 4, Maximum = 12.

*Cutoff value* Sets the link error rate (*value*) at which the neighbor node is cut off. If a connected node is too noisy and exceeds this rate, it is disconnected. The values are: Default = 6, Minimum = 4 , Maximum = 12.

**Caution:** Do not change this value unless you understand the system-wide consequences to the network.

`Example:` **`set phy a alarm 7`**

**policy** ***router-port-type neighbor-node-port-type***

Selects the types of FDDI connections that are valid for the interface. This command allows you to reject connections that neighboring nodes cannot support. It also allows you to prevent illegal or undesirable topologies. The default *router-port-type* policy setting is *reject*, which tells the interface to reject all connections.

The policy type you choose must be compatible with the key setting on the MICs connecting the p4222 interface. Table 3-3 summarizes rules for connections from the router to a neighbor port.

*Router-port-type* Specifies if the router accepts or rejects connections that neighboring nodes cannot support.

*Neighbor-node-port-type* Valid port types are

- **A** = Primary RCV/Secondary XMT
- **B** = Secondary RCV/Primary XMT
- **M** = Single attach to a concentrator
- **S** = Single attach node

Example: **set policy reject ab**

**Table 3–3 FDDI Port Connection Rules**

| Always Valid | Valid Unless You Set Policy To “Reject” | |
|---|---|---|
| A to B<br>B to A<br>S to M<br>M to S | A to A<br>A to S<br>A to M | S to A<br>S to B<br>S to S |
| | B to B<br>B to S<br>B to M | M to A<br>M to B |

**req-trt** ***#-of-byte-clks***

Selects the requested token rotation time (*#-of-byte-clks*). Each FDDI node uses its requested token rotation time when negotiating to claim the token. The node with the lowest req-trt wins the bid for the token. The requested rotation time must be a value between the minimum and maximum rotation times for the interface. The default is 2,066,208 byte clocks. Each byte clock is 80 nanoseconds. Refer to the **max-trt** parameters.

**Caution:** Setting the requested token rotation time too low may cause the ring to become non-operational.

Example: **set req-trt 1000000**

**station-type** ***interface-type***

Selects the interface FDDI station (node) type, *peer* or *slave*. The default setting is *peer*. You can set the software station type independent of its hardware configuration. For example, if an interface is cabled as a dual attach station, you can set its station type to *slave*.

*Peer* — Refers to a single MAC, dual attach topology. The station attaches to main FDDI ring.

*Slave* — Refers to a single MAC, single attach topology. The station attaches to an FDDI concentrator.

Example: **set station-type peer**

**tvx-timer *#-of-bye-clks***

Selects the amount of time (in 80 nanosecond byte clocks) that may pass before the interface must see the head of a data frame. The range is 31125 to 65535 and the default is 32768 byte clocks. A large value in this field allows longer periods of time between transmissions on the ring.

Example: **set tvx-timer 31125**

### Exit

Return to the Config> prompt.

**Syntax:** exit

Example: **exit**

## 3.5 Statistics Displayed For the FDDI Interface

The FDDI interface does not have its own console process that you can use for monitoring. However, you can use the **interface** command from the GWCON environment to display complete statistics for all installed network interfaces. For more information about the **interface** command, refer to the GWCON chapter in the *System Software Guide.*

The following statistics are displayed when you execute the **interface** command from the GWCON environment for the FDDI Interface:

```
+int 0
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
0  0   FDDI/0           0    0          1          0            0
```

```
FDDI/IEEE 802.2 MAC/data-link on FDDI interface
UNA: 08002BA34EE8 -> MLA: 08002BB1E5E8 -> DNA: 08002BA34EE8
Policy = reject A-A B-B M-M
Connection:  AB_FRONT
T_Neg = 0x18600 = 7.987200 msec,   Latency = 0.000000 msec
TVX = 2.621440              T_Max = 167.772160       T_Req = 7.987200 msec
PHYA state:active           PHYB state:connecting
ECM:In                      CFM:c_wrap_a             RMT:Ring_Op
ringinits:0
My bcn:0                    Other beacon:0           Trace rcv:0, xmt:0
PHYA: LEM Alarms:0          LCT Fails:0              LEM Ct:0
          Alarm:10^-8       Cutoff:10^-8             Estimate:10^-15
PHYB: LEM Alarms:0          LCT Fails:0              LEM Ct:0
          Alarm:10^-8       Cutoff:10^-8             Estimate:10^-15
T_Notify: 10 sec
Frames:0                    Errors:0                 Losts:0
Xmts:0                      Xmts failed:0            Xmt underruns:0
Copied:0                    Rcv overruns:0           Rcv no buffer:0
+
```

```
Nt  Nt' Intrfc No  CSR      Vec  Pass Fail Maint: Fail Errs: Input Output
3    3   FDDI  1  2063FC00   42   1     0            0          0      0
```

Shows the configuration and routing statistics including the interface number, CSR address, interface self-test, maintenance-test results, and the number of input and output errors.

```
FDDI interface
PEER Station   Preferred configuration THRU*A
```

Shows the interface station type and configuration. Refer to the **set station-type** and **set config** FDDI commands.

```
UNN: 000093994090 *> MLA: 000093002045 *> DNN: 0000930040B0
```

Displays the upstream neighbor, main address, and downstream neighbor addresses.

```
Policy = reject no connections
```

Shows the interface connection policy. Refer to the **set policy** FDDI command.

```
Neg = 0x18700 byte clocks = 8.0076 msec, Latency = 0.0038 msec
X = 2.621, T_Max = 167.772, T_Req = 8.000 msec
```

Displays the following timer values:

*T_neg* Displays the token rotation time.

*Latency* Displays the amount of time for the capturing of a token and when it is reissued.

*TVX* Displays the number of byte clocks that may expire before the interface must see the head of a frame. See the **set tvx-timer** command.

*T_max* Displays the maximum token rotation time. See the set max-trt command.

*T_req* Displays the requested token rotation time. See the set req-trt number of byte clocks.

```
PHYA state: ACTIVE ILS in 1   PHYB state: ACTIVE ALS in 1
```

Shows the status of the PHY A and B lines states. The line states are as follows:

*ALS* Active line state.

*HLS* Halt line state.

*ILS* Idle line state.

*MLS* Master line state.

*NLS* Noise line state.

*NSD* No signal detect.

*QLS* Quiet line state.

```
ECM:IN     CFM:THRU_A      RMT:RING_OP   Noise:A:1, B:1
Status: RINGOP  278 secs since last RINGOP
ringinits:15   TVX expired ct:5        TRT expired ct:0
```

Represents the ring operating status from the FDDI SMT layer software as follows:

| | |
|---|---|
| *ECM* | Displays the entity connection management state. This is the software controlling the bypass switch. |
| *CFM* | Displays the configuration management state. |
| *RMT* | Specifies the ring management software monitoring the state of the ring. |
| *Noise* | Displays the number of times a noise byte occurred on the PHY A and PHY B connections. |
| *Status* | Displays the last time the ring became operational. |
| *Ringinits* | Displays the number of times initialization of the ring occurred. |
| *TVX expired* | Displays the number of times the valid transmission timer expired. See the **set TVX-timer** command. |
| *TRT expired* | Displays the number of times the target rotation timer expired. |

```
HYA:LEM Alarms:0       Cutoffs:0       LCT fails:0/0     LEM Ct:49
        Alarm:10^*7    Cutoff:10^*6    Estimate:10^*12
HYB:LEM Alarms:0       Cutoffs:0       LCT fails:0/0     LEM Ct:9
        Alarm:10^*7    Cutoff:10^*6    Estimate:10^*12
```

Shows the number of times the interface entered a beacon transmit state, and the number of times the interface saw its own and other beacon frames.

These lines also show the number of times the interface entered the claim state, the number of times it saw its own claim frames, and the number of times it saw frames with higher and lower claim values than its own.

```
HYA:LEM Alarms:0       Cutoffs:0       LCT fails:0/0     LEM Ct:49
        Alarm:10^*7    Cutoff:10^*6    Estimate:10^*12
HYB:LEM Alarms:0       Cutoffs:0       LCT fails:0/0     LEM Ct:9
        Alarm:10^*7    Cutoff:10^*6    Estimate:10^*12
```

Shows the Link Error Monitor (LEM) information for each PHY connection as follows:

| | |
|---|---|
| *Alarms* | Displays the acceptable link error rate and the number of times the link error rate exceeded this value for each interface connection. See the **set phy** alarm command. |
| *Cutoff* | Displays the number of times cutoffs occurred. See the **set phy** cutoff command. |
| *LCT fails* | Displays the number of times the link confidence test failed. |
| *LEM count* | Displays the total number of link error events that occurred. |
| *Estimate* | Displays an estimate of the total error rate for each interface connection. |

```
T_Notify 30 sec, SMT frames in:300    SMT frames out:310
```

Shows the following SMT frame information:

| | |
|---|---|
| *T_notify* | Displays how often the interface generates NIF frames to neighbor nodes. See the **set notify-timer** command. |
| *SMT frames* | Displays the number of SMT frames received and generated by the interface. |

```
Frame:57439, Errors:3, Losts:0, Xmts:1208, Copied:1291, Not Copied:157
```

Shows the number of frames passed on the ring, the total CRC errors for the ring, the total frames lost and the number of frames copied and not copied on the ring.

```
5706 rcvs forwarded, 0 filtered, 0 in error, 0 dropped
rcv buff/stat full:6/00/00/0
```

Shows the following numbers for frames on the network: forwarded, filtered, errors, and dropped.

```
xmts ok:1208, aborted:0, FIFO underrun:6,Ring popped:0
xmt MAC aborted:0, timed out:0, fail:0, reset:0, hdw err:0
```

Shows the number of token errors, the number of missed frames, the number of times the receive buffer was too full to accept incoming frames, and, whether the ring popped due to a bad fiber.

# 4

# Configuring and Monitoring Frame Relay Interfaces

This chapter describes how to configure and monitor Frame Relay interfaces.

Refer to the *Routing Protocols Reference Guide* for more information about the Frame Relay protocol.

## 4.1 Accessing the Interface Configuration and Console Processses

For information about accessing the configuration and console processes, refer to Chapter 1.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `FR config>` prompt.

Enter console (monitoring) commands at the `FR>` prompt.

## 4.2 Frame Relay Basic Configuration Procedure

This section outlines the minimum configuration steps that are required to get the Frame Relay protocol up and running. If you desire any further configuration information and explanation, refer to the configuration commands described in this chapter.

To configure the Frame Relay protocol, perform the following steps:

1. **Set the selected device to frame relay**. You must set up the FR device from the `Config>` prompt using the **set datalink frame-relay** commands. By default the devices are initially configured to be PPP datalinks.

2. **Select FR management**. The FR Local Management Interface protocol defaults to Revision 1. You have the option of connecting to a network using LMI-Rev1 management, ANSI Annex D management, or CCITT management. Use the **enable** and **set** commands at the `FR Config>` prompt to enable and set the required management.
3. **Add a PVC**. Add any required PVCs that are needed if FR management is disabled or orphan circuits are disabled. Use the **add permanent-virtual-circuit** command from the `FR Config>` prompt.

**Note:** Do not use the add permanent-virtual-circuit command to add PVCs for use by PPP encapsulation over frame relay. These PVCs are added when the PPP-FR pseudo device is configured.

4. **Configure FR destination addresses**. If you are running a protocol, such as IP, IPX, and so forth over the FR interface, and are interconnecting with devices not supporting ARP on FR, use the **add protocol-address** command from the `FR Config>` prompt to add the static protocol and address mapping.

## 4.3 Frame Relay Configuration and Console Commands

The Frame Relay configuration commands allow you to create or modify a Frame Relay configuration. Frame Relay console commands let you monitor the status of the interface. This section summarizes and then explains the Frame Relay configuration and console commands. Defaults for any command and its parameters are enclosed in brackets immediately following the prompt.

Table 4–1 summarizes the Frame Relay configuration and console commands.

**Table 4–1 Frame Relay Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/ Monitor | Lists configuration commands and parameters, and console commands and options. |
| **Add** | Configure | Adds PVCs and destination protocol addresses to the Frame Relay interface. |
| **Change** | Configure | Changes PVCs that were added using the Add command. |

**Table 4–1 Frame Relay Configuration and Console Command Summary (Continued)**

| Command | Task | Function |
|---|---|---|
| **Clear** | Monitor | Clears statistical information on the frame relay interface. |
| **Disable** | Configure | Disables any enabled Frame Relay features. |
| **Enable** | Configure | Enables Frame Relay features such as, circuit monitoring, management options, multicast, protocol-broadcast, and orphans. |
| **List** | Configure/ Monitor | Displays the current configuration of the LMI and PVCs. Displays statistics specific to the datalink layer and frame relay management. |
| **Remove** | Configure | Deletes any previously added PVCs or protocol addresses. |
| **Set** | Configure/ Monitor | Configures the properties associated with Frame Relay parameters (framesize, line-speed, N1-parameter, N2-parameter, N3-parameter, P1-parameter, and T1-parameter). Sets the frame relay management options and the physical layer parameters. |
| **Exit** | Configure/ Monitor | Exits the Frame Relay configuration and console processes and returns to the previous prompt level. |

### 4.3.1 Enabling Frame Relay Management

There are three management options under Frame Relay: LMI Revision 1, ANSI Annex D, and LMI CCITT. Frame Relay defaults to management type Rev 1 enabled; if you want to change management types, or if you want to re-enable Rev 1 management, follow the procedure described below. Enabling management over Frame Relay is a two-step process:

1. Enter **enable lmi** at the `FR Config>` prompt to enable all management activity.

2. Enter **set lmi_type** at the `FR Config>` prompt to select the type of management for the interface. Refer to the following table for details of the management types available.

The options available under the **set** command for enabling Frame Relay management are listed below. An example of how to set these management modes is shown in Table 4–2. Refer to the **enable** and **set** command sections in this chapter for more information.

**Table 4–2 Frame Relay Set Commands Options**

| Command | Options | Description | Default |
|---|---|---|---|
| **set** | lmi-type rev1 | Conforms to LMI Revision 1, (Stratacom's Frame Relay Interface Specification) | Enabled |
| | lmi-type ansi | Conforms to ANSI T1.617 USDN-DSS1-Signalling Specification for Frame Relay Bearer Service (known as Annex D) | -N/A- |
| | lmi-type ccitt | Conforms to Annex A of CCITT Recommendation Q.933 - DSS1 Signalling Specification for Frame Mode Basic Call Control. | -N/A- |

```
Example:  enable lmi

          set lmi-type ansi
```

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
ADD
CHANGE
DISABLE
ENABLE
LIST
REMOVE
SET
EXIT
```

Example: **set ?**

```
ENCODING
FRAMESIZE
IDLE
LMI-Type
LINE-SPEED
N1-PARAMETER
N2-PARAMETER
N3-PARAMETER
T1-PARAMETER
TRANSMIT DELAY
```

## Add C

Add a PVC or destination protocol address supported by the Frame Relay interface.

**Syntax:** add permanent-virtual-circuit
protocol-address . . .

### permanent-virtual-circuit

Adds a PVC to the Frame Relay interface beyond the default range of 15. The maximum number of PVCs that can be added is approximately 64, but the actual number of PVCs that can be supported by the interface is affected by the configured size of the receive buffer on the interface.

**Note:** A single LMI status message is used for all PVCs assigned to the interface.

Example: **add permanent-virtual-circuit**

```
Circuit Number [16]?
Committed Information Rate (CIR)in bps [64000]?
Committed Burst Size (Bc) in bits [64000]?
Excess Burst Size (Be) in bits [0]?
Assign Circuit name []?
```

| | |
|---|---|
| *Circuit Number* | Indicates the circuit number in the range of 16 to 1007. |
| *Committed Information Rate* | Indicates the committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 64 Kbps. |
| *Committed Burst (Bc)* | Indicates the maximum amount of committed data that the PVC can transmit, in the range of 300 bps to 2048000 bps. The default is 64 Kbps. |
| *Excess Burst (Be)* | Indicates the maximum allowed amount of uncommitted data for the PVC in the range of 0 bps to 2048000 bps. The default is 0 bps. |
| *Assign Circuit Name* | Indicates the ASCII string that is assigned to describe the circuit. This parameter is optional. It is recommended that you use a name that describes the characteristics of the circuit. The default is *unassigned.* |

**Note:** Do *not* use this command to create a permanent virtual circuit for use by a PPP-FR pseudo device. A PVC is created for this purpose when you use the **set frame-relay** command from the PPP-FR configuration environment. For information about configuring PPP-FR pseudo devices refer to Chapter 8.

**protocol-address** ***protocol-name***

Adds statically configured destination protocol (*protocol-name*) addresses to the Frame Relay interface. Adding protocol name and address mappings (static ARP) alleviates using ARP during the forwarding process. This configuration feature may be necessary when interconnecting to Frame Relay equipment that does not support ARP.

This parameter prompts you for different information depending on the type of protocol that you adding.

```
Example:  add protocol-address

   Protocol name or number [0]?
```

The protocol-address parameter prompts you for different information depending on the type of protocol that you add. Possible prompts are listed in Table 4–3.

**Table 4–3 Protocol-address Prompts for the Add Command**

| Protocol | First Prompt | Second Prompt |
|---|---|---|
| IP protocol | IP Address [0.0.0.0]? | Circuit Number [16]? |
| DN protocol | Node address [0.0]? | Circuit Number [16]? |
| IPX protocol | Host Number (in hex) []? | Circuit Number [16]? |
| APL protocol | Host Number (in hex) []? | Circuit Number [16]? |
| AP2 protocol | Host Number (in hex) []? | Circuit Number [16]? |

*Protocol name or number* — Defines the name or number of the protocol that you are deleting. If you try to delete an unsupported protocol the system prompts you with the supported protocols and their numbers:

```
Prot #       Name
   0          IP
   4          DN
   7         IPX
  14         APL
  15         AP2
```

*IP Address* — Defines the 32-bit Internet address in dotted-decimal notation.

*Node Number* — Defines the area and node number of the interface attached to the DNA network.

*Host Number* — Defines the 48-bit MAC address of the IPX host. Note that this address can be substituted or changed at run time if IPX is configured on Ethernet interfaces as well as Frame Relay.

*Circuit Number* — Defines the PVC in the range of 16 to 1007 that this protocol is to run over.

### Change Permanent-Virtual-Circuit C

Change any previous PVCs that were added with the **add permanent-virtual-circuit** command.

**Syntax:** change permanent-virtual-circuit

Example: **change permanent-virtual-circuit**

```
Circuit Number [16]?
Committed Information Rate (CIR) in bps [64000]?
Committed Burst Size (Bc) in bits [64000]?
Excess Burst Size (Be) in bits [0]?
Assign Circuit Name: []?
```

| | |
|---|---|
| *Circuit Number* | Indicates the circuit number in the range of 16 to 1007. |
| *Committed Information Rate* | Indicates the committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 64000 bps. |
| *Committed Burst (Bc)* | Indicates the maximum amount of committed data that the PVC can transmit, in the range of 300 bps to 2048000 bps. The default is 64000 bps. |
| *Excess Burst (Be)* | Indicates the maximum allowed amount of uncommitted data for the PVC in the range of 0 bps to 2048000 bps. The default is 0 bps. |
| *Assign circuit Name* | Indicates the ASCII character string designation for the circuit that you want to change. |

### Clear M

Use the **clear** command to remove all statistics on the frame relay interface.

**Note:** Statistics may also be cleared by using the OPCON **clear** command.

**Syntax:** clear

`Example:` **`clear`**

### Disable C

Disable those features previously enabled using the **enable** command.

**Syntax:** disable cir-monitor
congestion-monitor
dn-length-field
lmi
multicast-emulation
orphan-circuits
protocol-broadcast

#### cir-monitor

Disables the circuit monitoring feature that maintains the transmission rate at the CIR that was previously configured using the **add permanent-virtual-circuit** command. The default setting for this feature is disabled.

`Example:` **`disable cir-monitor`**

#### congestion-monitor

Disables the congestion monitoring feature that checks for the BECN bit set on packets received and adjusts transmission rate accordingly. The default setting for this feature is enabled.

`Example:` **`disable congestion-monitor`**

#### dn-length-field

Disables the feature that controls whether a length field is included within DECnet packets sent over Frame Relay. The default for this parameter is disabled.

`Example:` **`disable dn-length-field`**

#### lmi

Disables all management activity. All circuits that were statically added are marked as present and active from the network perspective. The system sets lmi rev 1 to *enabled* as the default.

**Note:** Disabling this parameter allows for normal operation or end-to-end Frame Relay testing in the absence of a real network or management interface. With end-to-end Frame Relay testing it is necessary to add like PVCs (that is, the same number like 16 and 16) on both ends of the link.

`Example:` **`disable lmi`**

#### multicast-emulation

Disables the multicast emulation on each active PVC. The default setting for this feature is enabled. If you disable this feature, you must add protocol static address maps.

`Example:` **`disable multicast-emulation`**

#### orphan-circuits

Prohibits the use of all nonconfigured orphan circuits at the interface. The default setting for orphan circuits is enabled.

`Example:` **`disable orphan-circuits`**

#### protocol-broadcast

Prohibits protocols such as RIP, to function over the Frame Relay interface. The default setting for this feature is enabled.

`Example:` **`disable protocol-broadcast`**

### Enable C

Enable Frame Relay features such as cir-monitor, management, multicast-emulation, protocol-broadcast, and orphan-circuits.

**Syntax:** enable cir-monitor
congestion-monitor
dn-length-field
lmi
multicast-emulation
orphan-circuits
protocol-broadcast

#### cir-monitor

Enables the circuit monitoring feature that maintains the transmission rate at the CIR that was previously configured using the **add permanent-virtual-circuit** command. The default setting for this feature is disabled.

Example: **enable cir-monitor**

#### congestion-monitor

When this feature is enabled the router will slow its transmission rate on the reception of a packet with the BECN bit set. It increases its transmission rate whilst incoming packets do not have the BECN bit set. The default setting for this feature is enabled.

Example: **enable congestion-monitor**

#### dn-length-field

This feature controls whether a length field is included within DECnet packets sent over Frame Relay. Control of the inclusion of this field allows compatibility with other router vendors. The default for this parameter is disabled.

Example: **enable dn-length-field**

#### enable lmi

Enables management activity. All circuits that were statically added are marked as present and active from the network perspective.

After issuing the **enable lmi** command, use the **set** command to select the management mode for your frame relay interface. See the section in this chapter, “Enabling Frame Relay Management,” or the **set** command for more information. The system defaults to LMI Revision 1.

Use the **enable lmi** command to resume LMI Revision 1 management if you have previously disabled frame relay management or if you want to return to this management mode from another. To set the default of *rev1* management mode, you need only enter **enable lmi**.

Example: **enable lmi**

**multicast-emulation**

Enables multicast emulation on each PVC when a protocol multicast is forwarded. The default for this parameter is enabled.

Example: **enable multicast-emulation**

**orphan-circuits**

Enables the use of all nonconfigured orphan circuits. The default for this feature is enabled and the CIR values default to 64000 bps.

Example: **enable orphan-circuits**

**protocol-broadcast**

Allows protocols such as RIP to function over the Frame Relay interface. The multicast parameter must be enabled for the protocol-broadcast to function properly. The default setting for this feature is enabled.

Example: **enable protocol-broadcast**

## List C

Display currently configured management and PVC information.

**Syntax:** list
- all
- hdlc
- lmi
- permanent-virtual-circuits
- protocol-address

**all**

Displays the current configuration of the Frame Relay interface. The output display for this command is a combination of the **list hdlc**, **list lmi**, **list permanent virtual circuits** and **list protocol address** commands.

Example: **list all**

#### hdlc

Displays Frame Relay HDLC configuration.

Example: **list hdlc**

```
      FRAME RELAY HDLC CONFIGURATION

   Encoding= NRZ     Idle           = Flag
   Clocking= External
   Cable Type= V.35 DTE
   Line access rate bps = 64000    Interface MTU in bytes = 2048
   Transmit Delay= 0
```

| | |
|---|---|
| *Encoding* | Indicates the encoding type: NRZ or NRZI. |
| *Idle* | Indicates the idle type configured, either flag or mark. |
| *Cable type* | Indicates the cable type configured, either RS-232, RS-423, V.35, V.36, or X.21. |
| *Line Access Rate bps* | Indicates the physical rate for the Frame Relay interface. |
| *Interface MTU bytes* | Indicates the maximum transmission unit (amount of user data per frame) that can be transmitted or received over the network at any given time. |
| *Transmit Delay* | Indicates the delay configured between transmitted packets. |

#### lmi

Displays logical management and related configuration information about the Frame Relay interface.

```
Example:  list lmi

      Frame Relay Configuration

   LMI enabled = Yes              LMI DLCI        = 1023
   LMI type    = REV1             LMI Orphans OK  =  Yes
   Protocol Broadcast     = Yes   Congestion monitoring  = Yes
   Emulate Multicast      = Yes   CIR monitoring         =  No
   PVCs P1 Allowed        = 64    DECnet length field          =  No
   Timer T1 seconds       = 10    Counter N1 increments        =   6
   LMI N2 error threshold = 3     LMI N3 error threshold window =   4
```

*LMI enabled* Indicates whether the management features are enabled on the Frame Relay interface, yes or no.

*LMI DLCI* Indicates the management circuit number. This number reflects the LMI type, 0 for ANSI or 1023 for LMI.

*LMI Type* Indicates the LMI type: one of the configured management modes: Rev1, ANSI, or CCITT.

*LMI Orphans OK* Indicates if nonconfigured circuits are available for use, yes or no.

*Protocol Broadcast* Indicates whether protocols such as RIP may function over the Frame Relay interface, yes or no.

*Congestion monitoring* Indicates if the router will monitor congestion and adjust transmission rate, yes or no.

*Emulate multicast* Indicates whether the multicast emulation is enabled on each active PVC, yes or no.

*CIR monitoring* Indicates whether the circuit monitoring feature that maintains the transmission rate at the CIR is enabled, yes or no.

*PVCs P1 allowed* Indicates the number of allowable PVCs for use with this interface.

*DECnet length field* Indicates whether a length field is included within DECnet packets, yes or no.

*Timer T1 seconds* Indicates the frequency that the Frame Relay interface performs a sequence number exchange with management.

*Counter N1 increments* Indicates the interval (in seconds) that the Frame Relay interface queries the management for complete PVC status enquiry.

*LMI N2 error threshold* Indicates the amount of management event errors occurring within the N3 window causing a reset of the frame relay interface.

*LMI N3 error threshold window* Indicates the number of monitored events that count for measuring N2.

#### permanent-virtual-circuits

Displays all the configured PVCs on the Frame Relay interface, including PVCs in use by PPP-FR pseudo devices.

Example: **list permanent-virtual-circuit**

```
Maximum PVCs Allowable = 64
Total PVCs Configured  = 3

    Circuit    Circuit    Circuit    CIR      Burst    Excess
    Name       Number     Type       in bps   Size     Burst

Boston           16       Permanent  2400      2400    0
Unassigned       20       Permanent  4800      4800    0
PPP Circuit     100       Permanent 64000     64000    0
```

*Maximum PVCs allowable* Indicates the number of PVCs that can exist for this interface. This number includes any PVCs that you added with the **add permanent-virtual-circuit** command and dynamically learned through the management interface.

*Total PVCs configured* Indicates the total number of currently configured PVCs for this interface.

*Circuit Name* Indicates the ASCII designation of the configured PVC.

**Note:** The Circuit Name of PVCs in use by PPP-FR pseudo interfaces is always set to *PPP Circuit*.

*Circuit Number* Indicates the number of a currently configured PVC.

| | |
|---|---|
| *Circuit Type* | Indicates the type of virtual circuit currently configured. This release of Frame Relay supports only permanent virtual circuits. |
| *Committed Information Rate* | Indicates the information rate guaranteed over the interface. |
| *Committed Burst (Bc)* | Indicates the maximum amount of committed data that the PVC can transmit, in the range of 300 bps to 2048000 bps. |
| *Excess Burst (Be)* | Indicates the maximum allowed amount of uncommitted data for the PVC in the range of 0 bps to 2048000 bps. |

#### protocol-addresses

Displays all the statically configured protocol addresses circuit mappings at the Frame Relay interface.

```
Example:  list protocol-addresses

   Protocol Type            Protocol Address   Circuit Number

        IP                   128.185.121.10         40
        Ip                   128.185.136.43         41
        IP                   128.185.115.70         109

        IPX                  0000930b234f           34
        IPX                  0000930b235f           35
        IPX                  0000930b236f           36
```

| | |
|---|---|
| *Protocol Type* | Displays the name of the protocol running over the interface. |
| *Protocol Address* | Displays the address of the protocol running over the interface. |
| *Circuit Number* | Displays the PVC that is handling the protocol. |

### List M

Display statistics specific to the datalink layer and the frame relay interface.

**Syntax:** list all
circuit
lmi
permanent-virtual-circuit

**all**

Displays circuit, management, and PVC statistics on the frame relay interface. The output display for this command is a combination of the **list lmi** and **list permanent-virtual-circuit** commands.

Example: **list all**

**circuit *pvc#***

Displays detailed PVC configuration and statistical information for the specified PVC (*pvc#*).

Example: **list circuit 100**

```
Circuit name = PPP Circuit

Circuit state        =    Active  Circuit is orphan   =        No
Frames transmitted   =      6918  Bytes transmitted   =   1143758
Frames received      =       196  Bytes received      =     11594
Total FECNs          =         0  Total BECNs         =         0
Times congested      =         0  Times Inactive      =         0
CIR in bits/second   =     64000  Current Info Rate   =     64000
Committed Burst (Bc) =     64000  Excess Burst (Be)   =         0

Xmit frames dropped due to queue overflow             =      0
```

*Circuit name* Indicates the ASCII designation of the configured PVC.

*Circuit state* Indicates the state of the circuit: active, inactive, or congested. *Inactive* indicates waiting for management. *Active* indicates that data is being transferred. *Congested* indicates that data flow is being controlled.

*Circuit is orphan* Indicates whether the circuit is a non-configured circuit learned through management.

| | |
|---|---|
| *Frames/Bytes transmitted* | Indicates how many frames and bytes this PVC has transmitted. |
| *Frames/Bytes received* | Indicates how many frames and bytes that this PVC has received. |
| *Total FECNS* | Indicates the number of times that this PVC was notified of inbound or downstream congestion. |
| *Total BECNS* | Indicates the number of times that this PVC was notified of outbound or upstream congestion. |
| *Times congested* | Indicates the number of times that this PVC was congested. |
| *Times inactive* | Indicates the number of times that this PVC was inoperable. |
| *CIR in bits/sec* | Indicates the information rate of the PVC in the range of 300 bps to 2048000 bps. |
| *Committed Burst (Bc)* | Indicates the maximum amount of committed data that the PVC can transmit, in the range of 300 bps to 2048000 bps. |
| *Excess Burst (Be)* | Indicates the maximum allowed amount of uncommitted data for the PVC in the range of 0 bps to 2048000 bps. |
| *Xmit Frames dropped* | Indicates the number of frames that this PVC has dropped. |

**lmi**

Displays statistics relevant to the logical management on the frame relay interface.

Example: **list lmi**

```
Management Status:

LMI enabled   = Yes            LMI DLCI                      = 1023
LMI type      = REV1           LMI Orphans OK                =  Yes
LMI sequence interval seconds                                =   10

Protocol broadcast   = Yes      Congestion monitoring         = Yes
Emulate multicast    = Yes      CIR monitoring                = No
PVCs allowed         = 64       Interface MTU bytes           = 2048
Line access rate bps = 1544000  DECnet length field           = No
Timer T1 seconds     = 10       Counter N1 increments         = 6
LMI N2 threshold     =  3       LMI N3 error threshold window = 4

Current receive sequence  = 0
Current transmit sequence = 1
Total status enquiries    = 1   Total status responses        = 0
Total sequence requests   = 0   Total responses               = 0

PVC Status:

Total Allowed   = 64                Total configured = 1
Total Active    = 0                 Total Congested  = 0
Total Left Net  = 0                 Total Join Net   = 0
```

*LMI enabled* Indicates if frame relay management is active, yes or no.

*LMI DLCI* Indicates the management circuit number. This number is either 0 (ANSI default) or 1023 (interim LMI).

*LMI type* Indicates the type of frame relay management being used, ANSI or LMI.

*LMI orphans OK* Indicates if all non-configured circuits made known by management are available for use, yes or no.

*LMI seq interval seconds* Indicates the interval that management uses when exchanging keep alive information with an end station.

*Protocol broadcast* Indicates if protocols such as RIP are able to operate over the frame relay interface.

*Congestion monitoring* Indicates if the router will monitor congestion and adjust transmission rate, yes or no.

| | |
|---|---|
| *Emulate multicast* | Indicates whether the multicast emulation is enabled on each active PVC, yes or no. |
| *CIR monitoring* | Indicates whether the circuit monitoring feature that limits the router transmission rate is enabled, yes or no. |
| *PVCs allowed* | Indicates the number of allowable PVCs for use with this interface. |
| *Interface MTU bytes* | Indicates the size of user data contained in the frame relay frame. |
| *Line access rate bps* | Indicates the physical data rate of the frame relay interface. |
| *DECnet length field* | Indicates whether a length field is included within DECnet packets, yes or no. |
| *Timer T1 seconds* | Indicates the rate that the frame relay interface performs a sequence number exchange with management. |
| *LMI N2 threshold* | Indicates the amount of management event errors that resets the frame relay interface. |
| *LMI N3 error threshold window* | Indicates the number of events that the management window monitors. |
| *Counter N1 increments* | Indicates the time when the frame relay interface queries the management for PVC status. |
| *Current receive sequence* | Indicates the current receive sequence number that the frame relay interface received from management. |
| *Current transmit sequence* | Indicates the current transmit sequence number that the frame relay interface sent to management. |
| *Total status enquiries* | Indicates the total number of inquiries that management made concerning the status of the frame relay interface. |
| *Total status responses* | Indicates the total number of responses that frame relay interface received from management in response to management status enquiries. |

| | |
|---|---|
| *Total sequence requests* | Indicates the total number of sequence number exchanges that the frame relay interface made with management. |
| *Total sequence responses* | Indicates the total number of sequence number responses received in response to management sequence number exchange. |
| *Total PVC allowed* | Indicates the number of allowable PVCs (including orphans) for use with this interface. |
| *Total PVC configured* | Indicates the total number of currently configured PVCs for this interface. |
| *Total PVC active* | Indicates the number of active PVCs on this interface. |
| *Total PVC congested* | Indicates the number of PVCs that are throttled down because of congestion within the network. |
| *Total PVC left net* | Indicates the total number of PVCs that are no longer on the network. |
| *Total PVC join net* | Indicates the total number of PVCs that joined the network. |

#### permanent-virtual-circuit

Displays general link layer statistics and configuration information for all configured PVCs on the frame relay interface.

Example: **list permanent-virtual-circuit**

```
Maximum PVCs allowable  =    64
Total PVCs configured   =     3

              Circuit   Orphan    Type/     Frames     Frames
Circuit#        Name    Circuit   State  Transmitted  Received
    16       Unassigned    No      P/A       7782        1924
    20         Boston      Yes     P/A       589         4563
   100       PPP Circuit   No      P/A       9629        270

    A - Active    I - Inactive
    P - Permanent  M - Multicast  C - Congested
```

| | |
|---|---|
| *Circuit#* | Indicates the number of the PVC. |
| *Circuit name* | Indicates the ASCII designation of the configured PVC. |
| *Orphan Circuit* | Indicates whether the PVC is a non-configured circuit (yes or no). |
| *State* | Indicates the state of the circuit: A (active), I (inactive), P (Permanent), M (Multicast), or C (congested). |
| *Frames/Bytes Transmitted* | Indicates how many frames and bytes this PVC has transmitted. |
| *Frames/Bytes Received* | Indicates how many frames and bytes this PVC has received. |

### Remove C

Delete any PVC or protocol-address previously added using the **add permanent-virtual-circuit** command.

**Syntax:** remove permanent-virtual-circuit . . .
protocol-address

#### permanent-virtual-circuit *pvc#*

Deletes any configured PVC in the range of 16 to 1007.

`Example:` **`remove permanent-virtual-circuit 20`**

**Note:** You should not remove a PVC which is in use by a PPP-FR pseudo device unless you delete the PPP-FR pseudo device as well. (For more information on the **delete** command, refer to the CONFIG chapter in the *System Software Guide*.)

#### protocol-address

Deletes any configured protocol addresses (static ARP entries). This parameter prompts you for different information depending on the type of protocol that you are adding.

Example: **remove protocol-address**

```
Protocol name or number [IP]?
```

The protocol-address parameter prompts you for different information depending on the type of protocol that you delete. Possible prompts are listed in Table 4–4.

**Table 4–4 Protocol-address Prompts for the Remove Command**

| Protocol | First Prompt | Second Prompt |
|---|---|---|
| IP protocol: | IP Address [0.0.0.0]? | Circuit Number [16]? |
| DN protocol: | Host Number (in hex)[]? | Circuit Number [16]? |
| IPX protocol: | Host Number (in hex)[]? | Circuit Number [16]? |
| APL protocol: | Host Number (in hex)[]? | Circuit Number [16]? |
| AP2 protocol: | Host Number (in hex)[]? | Circuit Number [16]? |

*Protocol name or number* — Defines the name or number of the protocol that you are deleting. If you try to delete an unsupported protocol the system prompts you with the supported protocols and their numbers:

```
Prot #      Name
  0         IP
  4         DN
  7         IPX
 14         APL
 15         AP2
```

*IP Address* — Defines the 32-bit internet address in dotted-decimal notation.

*Host Number* — Defines the 48-bit MAC address of the IPX or XNS host.

*Circuit Number* — Defines the PVC in the range of 16 to 1007 that the protocol runs over.

### Set C

Configure the interface to run the Frame Relay protocol.

### Set Command Considerations

Two parameters, the n2-parameter and the n3-parameter, require further explanation before you configure them. The n2 parameter sets the error threshold for management events, and the n3-parameter sets the number of events that are monitored in the event window. If the number of management errors in the event window equals n2, the frame relay interface resets. For example:

**set n3-parameter 4**
**set n2-parameter 3**

You now have a window size of 4 (n3 = 4) and an error threshold of 3 (n2 = 3). That means the system is monitoring 4 management events and checking to determine if any of those are in error. If the number of events in error equals 3 (the n2 parameter), the frame relay interface is reset and the status of the network is considered “network down.”

For the status of the network to be considered “network up,” the number of events in error within the window must be less than n2 prior to any change in status.

**Note:** The options indicated with * (asterisks) may or may not appear, depending on which type of serial interface is in use.

**Syntax:** set encoding *
frame-size
idle . . . *
line-speed
lmi-type
n1-parameter
n2-parameter
n3-parameter
p1-parameter
t1-parameter
transmit delay . . .*

**encoding *NRZ* or *NRZI***

Sets the HDLC transmission encoding scheme as NRZ (Non-return to zero) or NRZI (Non-return to zero inverted). Most configurations use NRZ which is the default.

Example: **set encoding nrz**

**frame-size *value***

Sets the size of the network layer portion of frames transmitted and received on the data link. Data link and MAC layer headers are not included. The default value is 2048.

Example: **set frame-size 2000**

**idle *flag* or *mark***

Sets the transmit idle state for HDLC framing. The default is flag, which provides continuous flags (7E hex) between frames. The mark option puts the line in a marking state (OFF, 1) between frames.

Example: **set idle flag**

**line-speed**

Sets the access rate for the line. Use this command to inform the router of the actual speed of the modem that the line is using. This information is required for the Congestion Monitoring function to operate correctly.

**Note:** This command does not affect the actual speed of the line.

```
Example:  set line-speed

   Access rate in bps   [64000]?
```

*Access rate in bps* Indicates the actual speed of the line to which the router is connected, in the range of 300 bps to 2048000 bps. The default is 64000 bps.

#### lmi-type *management type*

Sets the management type for the interface. See the section, "Enabling Frame Relay Management" for details about setting Frame Relay management. The default is type *Rev 1* enabled. Table 4–5 lists the Frame Relay set command options.

**Table 4–5 Frame Relay Set Commands Options**

| Command | Options | Description | Default |
|---|---|---|---|
| **set** | lmi-type rev1 | Conforms to LMI Revision 1, (Stratacom's Frame Relay Interface Specification). | Enabled |
| | lmi-type ansi | Conforms to ANSI T1.617 USDN-DSS1-Signalling Specification for Frame Relay Bearer Service (known as Annex D). | -N/A- |
| | lmi-type ccitt | Conforms to Annex A of CCITT Recommendation Q.933 - DSS1 Signalling Specification for Frame Mode Basic Call Control. | -N/A- |

```
Example:  enable lmi

          set    lmi-type rev1 (default)
                 lmi-type ansi
                 lmi-type ccitt
```

#### n1-parameter *count*

Configures the number of T1 timer intervals that must expire before a complete PVC status enquiry is made. *Count* is the interval in the range of 1 to 255. The default is 6.

```
Example:  set n1-parameter

   Parameter N1 [6]?
```

**n2-parameter *max#***

Configures the number of errors that can occur in the management event window monitored by the n3-parameter before the frame relay interface resets. This parameter is used for certification purposes only. *Max#* is a number in the range of 1 to 10. The default is 3. This parameter must be less than or equal to the n3-parameter or you receive an error message.

Example: **set n2-parameter**

```
Parameter N2 [3]?
```

**n3-parameter *max#***

Configures the number of monitored management events for measuring the n2-parameter. This parameter is used for certification purposes only. *Max#* is a number in the range of 1 to 10. The default is 4.

Example: **set n3-parameter**

```
Parameter N3 [4]?
```

**p1-parameter *max#***

Configures the maximum number of PVCs supported by the Frame Relay interface. *Max#* is a number in the range of 0 to 64. The default is 64. A 0 (zero) implies that the interface supports no PVCs.

Example: **set p1-parameter**

```
Parameter P1 [64]?
```

**t1-parameter *time***

Configures the interval (in seconds) that the Frame Relay interface takes to perform a sequence number exchange with Frame Relay management. The management's T2 timer is the allowable interval for an end station to request a sequence number exchange with the manager. The T1 interval must be less than the T2 interval of the network. *Time* is the number in the range of 5 to 30. The default is 10.

Example: **set t1-parameter**

**transmit-delay #**

Allows the insertion of a delay between transmitted packets. The purpose of this command is to slow the serial line so that it is compatible with older, slower serial devices at the other end. It can also prevent the loss of serial line hello packets between the lines.

If you have problems missing frames at the remote end, then increase the transmit delay on the side that is not missing frames.

```
Example:  set transmit 1
```

### Set M

Change the configuration of a permanent virtual circuit on the Frame Relay interface.

**Note:** Changes you make to the configuration are not maintained across restarts.

**Syntax:** set circuit

#### circuit

Changes the configuration of a permanent virtual circuit.

```
Example:  set circuit

    Circuit Number [16]?
    Committed Information Rate (CIR) in bps [64000]?
    Committed Burst Size (Bc) in bits [64000]?
    Excess Burst Size (Be) in bits [0]?
```

| | |
|---|---|
| *Circuit Number* | Indicates the circuit number in the range of 16 to 1007. |
| *Committed Information Rate* | Indicates the committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 64000 bps. |
| *Committed Burst (Bc)* | Indicates the maximum amount of committed data that the PVC can transmit, in the range of 300 bps to 2048000 bps. The default is 64000 bps. |
| *Excess Burst (Be)* | Indicates the maximum allowed amount of uncommitted data for the PVC in the range of 0 bps to 2048000 bps. The default is 0 bps. |

**Exit** **C M**

Return to the `previous` prompt level.

**Syntax:** exit

`Example:` **`exit`**

# 5

# Configuring and Monitoring ISDN Interfaces

This chapter describes how to configure and monitor an ISDN interface on the router.

## 5.1 Before You Begin

Before you configure ISDN, you need the following information:

- The telephone number of the local ISDN port.
- The destination telephone numbers, including any telephone extensions.
- The type of switch to which the ISDN interface is connected: NET3, INS64, VN3, 5ESS, DMS100, or NI1.
- The TEI (Terminal Endpoint Identifier) of the switch to which the ISDN interface is connected. The TEI is required when the switch does not support automatic TEI assignment.
- The SPID (Service Profile Identifier) of the switch. The SPID is only needed for NI1 and DMS100 switches.

**Note:** The AW900EI supports only one switch type and frame size for all twelve ISDN ports.

## 5.2 Configuration Procedures

This section describes how to configure your ISDN interface. The tasks you need to perform are as follows:

1. Adding ISDN addresses.
2. Adding dial circuits.
3. Configuring dial circuit parameters.
4. Configuring ISDN parameters.

You must restart the router for configuration changes to take effect.

### 5.2.1 Adding Dial Circuits

Dial circuits are mapped to serial line interfaces. You can map multiple dial circuits to one serial line interface.

To add a dial circuit, use the **add device dial-circuit** command from the `Config>` process. The software assigns an interface number to each circuit. You will use this number to configure the dial circuit.

```
Example:  Config>add device dial-circuit
Adding device as interface 6
```

**Note:** Dial circuits default to the PPP protocol. You can change the protocol to the Proteon Serial Link (PSL) protocol using the **set data-link psl** command at the `Config>` prompt. Other data-link types (Frame Relay, X.25, V.25 *bis*, SDLC, and SRLY) are not supported at this time.

### 5.2.2 Configuring Dial Circuit Parameters

You configure dial circuits from the `Circuit Config>` process. To enter the `Circuit Config>` process, use the **network** command followed by the interface number of the dial circuit. You can use the **list dev** command at the `Config>` prompt to display a list of the dial circuits that you added.

```
Example:  Config>network 6

   Circuit configuration
   Circuit Config>
```

Use the dial circuit configuration commands described in the next section to configure the dial circuit.

## 5.3 Dial Circuit Configuration Commands

This section summarizes and explains the dial circuit configuration commands. These commands allow you to display, create, or modify a dial circuit configuration. Enter the dial circuit configuration commands at the `Circuit Config>` prompt.

Table 5–1 lists the dial circuit configuration commands.

**Table 5–1 Dial Circuit Configuration Commands Summary**

| Command | Function |
|---|---|
| **? (Help)** | Lists the configuration commands or lists the options associated with that command. |
| **Delete** | Deletes the inbound call settings from the dial circuit configuration. |
| **Encapsulator** | Allows you to change the data-link protocol configuration. |
| **List** | Displays the dial circuit configuration parameters. |
| **Set** | Configures the dial circuit for inbound or outbound calls, maps the dial circuit to a serial line interface, and sets addresses, idle timeout, and self-test delay. |
| **Exit** | Exits the dial circuit configuration process and returns to the `Config>` prompt. |

### ? (Help)

List the available commands. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

`Example:` **?**

```
DELETE
ENCAPSULATOR
LIST
SET
EXIT
```

Example: **Set ?**

```
NET
CALLS
DESTINATION
INBOUND DESTINATION
ANY_INBOUND
IDLE
SELFTEST-DELAY
SEND_LINE_ID
```

### Delete

Remove the inbound call settings from the dial circuit configuration.

**Syntax:** <u>d</u>elete <u>i</u>nbound destination

#### delete inbound destination

Removes both the inbound destination and the any_inbound settings from the dial circuit configuration. This causes the dial circuit to accept calls only from callers that have a phone number that matches the destination parameter.

Example: **delete inbound**

### Encapsulator

Enter the configuration process for the link-layer protocol that is running on the dial circuit. The default protocol for dial circuits is PPP (`SLC Config>` prompt). You can change the protocol to PSL using the **set data-link** command at the `Config>` prompt.

**Syntax:** <u>en</u>capsulator

Example: **encapsulator**

```
SLC serial user configuration
SLC Config>
```

Be aware of the following when you configure PSL or PPP:

- The serial interface predefines clocking as external and encoding as NRZ. The DCE controls the clock speed. The V.25 *bis* interface ignores those parameters in the PPP or PSL configuration.
- The serial interface does not enforce transmit delay counters that you set in the PSL or PPP configurations.

- Make sure that the PSL frame size of the dial circuits on all routers is set to at least 602. (The default is 2048.) The PSL protocol requires an initial exchange of messages of this size.
- Do not enable pseudo-serial-ethernet on the dial circuit.

To return to the `Circuit Config>` prompt, use the **exit** command.

### List

Display the current dial circuit configuration.

**Syntax:** list

Example: **list**

```
Base net:                    6
Destination name:            remote-site-baltimore
Inbound dst name:            * ANY *
Inbound dst name:            local-1
Outbound calls               allowed
Inbound calls                allowed
Idle timer                   = 60 sec
SelfTest Delay Timer = 0 ms
```

| | |
|---|---|
| *Base net:* | Name of the serial line interface to which this dial circuit is mapped. |
| *Destination name:* | Network address name to be called for outbound circuits, and the default comparison address used by the caller-ID mechanism for inbound calls. |
| *Inbound dst name:* | This parameter appears only if the circuit is configured to accept inbound calls that do not match any other addresses. |
| *Inbound dst name:* | Alternate comparison address name used by the caller-ID mechanism for inbound calls. |
| *Outbound calls* | Displays this parameter when the circuit is configured to initiate outbound calls. |
| *Inbound calls* | Displays this parameter when the circuit is configured to accept inbound calls. |

| | |
|---|---|
| *Idle timer* | Displays the idle timer setting in seconds. The range is 0 to 65535; 0 indicates that this is a dedicated circuit (leased line). |
| *SelfTest Delay Timer* | Displays the self-test delay timer setting in milliseconds. The range is 0 to 65535; 0 indicates no delay. |

### Set

Map the dial circuit to a serial line interface; configure the dial circuit for inbound and/or outbound calls; and set destination addresses, inbound addresses, idle timeout, and self-test delay.

**Syntax:** set net...
calls...
destination...
inbound destination...
any_inbound
idle...
selftest-delay...
send_line_id...

**net** ***# of serial line interface***

Specifies the number of the serial line interface to which you want to map this circuit.

```
Example:  set net 2
```

**calls** ***outbound*** **or** ***inbound*** **or** ***both***

Restricts this dial circuit to initiating outbound calls only, accepting inbound calls only, or both initiating and accepting calls. The default is both.

```
Example:  set calls outbound
```

**destination** ***address name***

This parameter is required for the dial circuit to operate. It specifies the network dial address of the remote router to which this dial circuit will connect. The caller-ID protocol uses this parameter as the default comparison address for incoming calls.

Example: **set destination remote-site-baltimore**

**inbound destination** ***address name***

Set this parameter if the dial circuit is set up for both inbound and outbound calls and if this router's local dial address is different from the destination dial address that the remote router dials. For example, the numbers are different if one of the routers goes through a PBX, international, or inter-LATA exchange. This parameter overrides the default comparison address that the caller-ID protocol uses for incoming calls.

Example: **set inbound remote-site-1**

**any_inbound**

Specifies that inbound calls that do not match any other dial circuit are mapped to this circuit and accepted as inbound calls.

Example: **set any_inbound**

**idle** ***# of seconds***

Specifies a timeout period for the circuit. If there is no protocol traffic over the circuit for this specified time period, the dial circuit hangs up. The range is 0 to 65535, and default is 60 seconds. A zero setting specifies that there is no timeout period and that this is a dedicated circuit (leased line).

**Note:** For WAN-Restoral operations, you must set the idle timeout to 0.

Example: **set idle 60**

**selftest-delay** ***# of milliseconds***

You can use this parameter to delay the time between when the call is established and the initial packet is sent. The range is 0 to 65535, and the default is 150. If your modems take extra time to synchronize, adjust this setting.

**send_line_id** ***yes*** **or** ***no***

Specifies whether proprietary local id messages are sent. Options are yes or no. The default is no.

Example: **set send_line_id**

**Exit**

Return to the `Config>` prompt.

**Syntax:** exit

`Example:` **`exit`**

### 5.3.1 Adding ISDN Addresses

You need to add an ISDN address for each ISDN interface as well as for each destination. The ISDN address includes

- **Address name**. Description of the address. You can use any string of up to 23 printable ASCII characters. Address names are case sensitive.
- **Network dial address**. Telephone number of the local or destination port. You can enter up to 15 numbers as well as 16 other characters, including spaces and punctuation. The router uses only the numbers.
- **Network subdial address**. Optional. Additional part of the telephone number, such as an extension, that gets interpreted once the interface connects to a PBX. You can enter up to 20 numbers as well as 11 additional spaces and punctuation. The router uses only the numbers.

To add an ISDN address, enter **add isdn-address** at the `Config>` prompt.

```
Config>add isdn-address
Assign address name [1-23] chars []? baltimore
Assign network dial address [1-15 digits][]? 1-555-0983
Assign network subdial address [0-20 digits] []? 23
```

To see a list of your ISDN addresses, enter **list isdn-address** at the `Config>` prompt.

To delete an ISDN address from your list, enter **delete isdn-address** at the `Config>` prompt.

### 5.3.2 Configuring ISDN Parameters

This section describes how to configure the ISDN parameters.

1. Display the `ISDN Config>` prompt.

   Enter **network** followed by the interface number of the ISDN interface.
   You can enter **list devices** at the `Config>` prompt to see a list of interface numbers configured on the router.

```
Config>network 2
ISDN user configuration
ISDN Config>
```

2. Specify the network address name of the local port.

   Use the **set local-address-name** command. Enter one of the address names you defined using **add isdn-address**.

```
ISDN Config>set local-address-name
Assign local address name []? balitmore
```

3. Specify the type of switch to which this ISDN interface is connected.

   Use the **set switch-variant** command. The options are NET3, INS64, VN3, 5ESS, DMS100, and NI1..

```
ISDN Config>set switch-variant
Switch-Variant-Model []? net3
```

4. If you set the switch-variant to NET3 or VN3, set the directory number of the local port.

   Use the **set dn0** (directory number 0) command. Enter the network dial address (telephone number) of the ISDN address that you entered using **set local-address-name** in Step 2.

```
ISDN Config>set dn0
Enter DN0 (Directory-Number-0) [ ]?1-555-0983
```

5. Set the TEI to match the signalling TEI number of your ISDN switch. The default TEI is automatic. If the switch to which your ISDN interface is connected does not support automatic TEI signalling, you must set the TEI to a value between 0 and 63. Some switches use two TEI's.

   The **set tei** command prompts for a B-channel number if you do not enter it with the command. Check with your service provider to find out what TEI signalling the switch supports.

   Use the **set tei** command.

```
ISDN Config>set tei
Enter B-channel Number []
TEI [AUTO]? 10
```

   You can enter all the information on one command line using the syntax **set tei** *n xxx* where *n* is the B-channel number and *xxx* is the TEI number.

6. Set the frame size so that it is greater than or equal to the frame size of the data-link protocol (PSL or PPP) running on the link.

   Use the **set framesize** command. The options are 1024, 2048, or 4096 bytes. The default is 2048.

```
ISDN Config>set framesize
Framesize in bytes (1024/2048/4096) [1024]? 2048
```

### 5.3.3 Optional ISDN Parameters

This section describes optional ISDN parameters. For a complete description of these commands, see the section, "ISDN Configuration Commands," on page 5-11.

- If you are using a NET3 or VN3 ISDN switch, you can limit the number of calls to an address that does not respond or that rejects those calls. Use **set retries-call-address** to set the number of calls to a non-responding destination. Use **set timeout-call-address** to set the time period to wait before trying the call again.
- If your ISDN telephone service provides accounting information, you can use the **add accounting entry** command to keep track of telephone charges.
- If your ISDN switch supplies Power Source 1 (PS1), you should enable PS1 on the interface. Enabling PS1 causes the interface to detect when the switch shuts down and to clear all information about the last call before it re-establishes the connection. Use the **enable ps1** command.
- If your ISDN switch does not supply PS1, you should disable PS1 on the interface. Use the **disable ps1** command.
- If you are using an NI1 or DMS100 switch, you must specify service profile identifiers (SPIDs) for each channel. The SPID may contain a maximum of 20 alphanumeric characters. To set the SPID, use the command **set service-profile-id** *n xxx* where *n* is the B-channel number and ***xxx*** is the identifier.

When you have finished configuring the ISDN interface, you can use the **list** command to display your configuration.

## 5.4 Displaying the ISDN Console Prompt

To display the ISDN console prompt:

- Enter **interface** at the GWCON (+) prompt to display a list of interfaces configured on the router.

- Enter **network** followed by the number of the ISDN interface. For example:

```
+network 2
ISDN Console
ISDN>
```

ISDN console commands allow you to view the accounting entries, calls, circuits, parameters, and statistics of the ISDN interfaces.

There is no console prompt for dial circuits, but you can monitor the dial circuits that are mapped to the ISDN interface.

## 5.5 ISDN Configuration and Console Commands

Table 5–2 summarizes and the following sections explain the ISDN configuration and console commands.

Enter configuration commands at the `ISDN Config>` prompt.

Enter console (monitoring) commands at the `ISDN>` prompt.

**Table 5–2 ISDN Configuration and Console Commands Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Displays all the ISDN commands or lists subcommand options for specific commands. |
| **Accounting** | Monitor | Displays accrued telephone charges for addresses added using the ISDN add accounting entries command. |
| **Add** | Configure | Adds accounting entries to the ISDN configuration. |
| **Calls** | Monitor | Lists the number of completed and attempted connections made for each dial circuit mapped to this interface since the last time statistics were reset on the router. |
| **Circuits** | Monitor | Shows the status of all data circuits configured on the ISDN interface. |
| **Conf_test_cmds** | Monitor | Do not use these commands. They are for use in a development environment only. They can disable the ISDN interface, requiring a router reset. |
| **Disable** | Configure | Disables Power Source 1 detection. |
| **Enable** | Configure | Enables Power Source 1 detection. |

**Table 5–2 ISDN Configuration and Console Commands Summary (Continued)**

| Command | Task | Function |
|---|---|---|
| **List** | Configure | Displays the ISDN configuration. |
| **Parameters** | Monitor | Displays the current parameters for the ISDN interface. |
| **Remove** | Configure | Removes accounting entries from the ISDN configuration. |
| **Set** | Configure | Sets the frame size, local address, no answer timeouts, number of retries after no answer, type of ISDN switch, directory numbers, TEI, and SPID. |
| **Statistics** | Monitor | Displays the current statistics for the ISDN interface. |
| **Exit** | Configure/Monitor | Returns to the previous prompt level. |

### ? (Help) C M

Lists available commands or lists the command's options.

**Syntax:** ?

Example: **set switch-variant ?**

```
Valid switch variants are NET3, INS64, VN3, 5ESS, DMS100, and NI1.
```

### Accounting M

Displays accrued telephone charges for each network address that you added with the **add accounting entries** ISDN command.

**Syntax:** accounting

Example: **accounting**

```
                Address         SubAddress          Charge
vl2-31          21              1                    0.0
vl2-33          20              1                    0.0
vl_2-31         021             001                  0.0
vl_2-33         020             001                  0.0
All others:                                          0.0
```

### Add C

Adds accounting entries to the ISDN configuration.

**Syntax:** add accounting-entry . . .

**accounting entry** ***network address name***

If your ISDN telephone service provides accounting information, you can use accounting entries to track telephone charges for specific network addresses. You can add up to eight entries for each ISDN interface. The accounting entry name must match one of the ISDN addresses you entered using **add isdn-address** at the `Config>` prompt.

Example: **add accounting-entry**

```
Assign accounting entry name []? baltimore
```

To display accrued telephone charges, enter **accounting** at the ISDN monitoring prompt (`ISDN>`).

### Calls M

Lists the number of completed and attempted connections made for each dial circuit mapped to this interface since the last time statistics were reset on the router.

**Syntax:** calls

Example: **calls**

```
Net Interface  Site Name           In    Out   Rfsd  Blckd
1     SL/0     v403                 2      0      0      0
2     PPP/1    v1238                0      2      0      0
Unmapped connection indications:    0
```

| | |
|---|---|
| *Net* | Network number of the dial circuit mapped to this interface. |
| *Interface* | Type of interface and its instance number. |
| *Site Name* | Network address name of the dial circuit. |
| *In* | Inbound connections accepted for this dial circuit. |

*Out* Completed connections initiated by this dial circuit.

*Rfsd* Connections initiated by this dial circuit and refused by the network or the remote destination port.

*Blckd* Connection attempts the router blocked. The router blocks connection attempts if the local port is already in use or the maximum number of retries to a non-responding address is reached.

*Unmapped connection indications:* Connection attempts the router refused because there were no enabled dial circuits configured to accept the incoming calls.

### Circuits M

Shows the status of all dial circuits configured on the ISDN interface.

**Syntax:** circuits

Example: **circuit**

```
Net Interface  MAC/Data-Link    State     Reason      Duration
1     SL/0     Proteon Serial    Avail     Rmt Disc     1:02:25
4     PPP/1    Point to Point    Up B1     SelfTest    91:24:03
5     PPP/2    Point to Point    Up B2     Inbound     91:24:00
```

*Net* Network number of the dial circuit mapped to this interface.

*Interface* Type of interface and its instance number.

*MAC/Data-Link* Type of data-link protocol configured for this dial circuit.

*State* Current state of the dial circuit:

- **Up B1 or B2** - Currently connected using the B-channel that is indicated.
- **Available -** Not currently connected, but available.
- **Disabled** - Dial circuit disabled.
- **Down -** Failed to connect because of a busy dial circuit or because the link-layer protocol is down.

*Reason* Reason for the current state:

- **nnn_Data** (where *nnn* is the name of a protocol) - The circuit is Up because a protocol had data to send.
- **Rmt Disc** -Remote Disconnect. The circuit is either Down or Available because the remote destination disconnected the call.
- **Opr Req -** Operator Request. The circuit is Available because the last call was disconnected by a monitoring command.
- **Inbound -** The circuit is Up because the circuit answered an inbound call.
- **Restoral -** The circuit is Up because of a WAN-Restoral operation.
- **Self Test -** The circuit was configured as static (idle time=0)

*Duration* Length of time that the circuit was in the current state.

### Disable C

Disables Power Source 1 detection. PS1 is disabled as the default.

**Syntax:** disable ps1

Example: **`disable ps1`**

**Note:** PS1 sensing is not available on the AW900EI.

### Enable C

Enables Power Source 1 (PS1) detection. If your ISDN switch supplies PS1, enable PS1 on the interface. This causes the interface to detect when the switch shuts down and to clear all information about the last call before it re-establishes the connection.

Do not enable PS1 if your switch does not supply Power Source 1.

**Syntax:** enable ps1

Example: **enable ps1**

**Note:** PS1 sensing is not available on the AW900EI.

### List C

Displays the current ISDN configuration.

**Syntax:** list

Example: **list**

```
                                   ISDN Configuration

Local Network Address Name    = line-1-local
Local Network Address         = 1-508-898-1234
Local Network Subaddress      = 21

Maximum frame size in bytes   = 1024
Outbound call address Timeout =    0  Retries =  0
Switch Variant                = ETSI NET3
DN0 (Directory Number 0)      = 1-508-898-1234
DN1 (Directory Number 1)      = 1-508-898-3456
TEI                           = Automatic
PS1 detect                    = Disabled
Accounting information kept for the following network destinations:

Address assigned name      Network Address  Network Subaddress
---------------------      ---------------  ------------------
remote-ny1                     100              100
remote-ny2                     200              200
```

### Parameters M

Displays the current ISDN configuration.

**Syntax:** parameters

Example: **parameters**

```
ISDN Port parameters:

Local Address Name:        vl233
Local Network Address:     20
Local Network Subaddress:
Frame Size:         2048
TEI:                Automatic
Switch Variant:     France Telecom VNx     PS1 detect:   Disabled
Directory Number 0: 20
Directory Number 1: 21
Outbound call address Timeout:     0        Retries:      0

Accounting Name           Network Address   Network Subaddress
---------------           ---------------   ------------------
vl215                     22
vl218                     22
vl231                     21
vl233                     20
```

### Remove C

Removes accounting entries you set using **add accounting-entry**.

**Syntax:** remove    accounting-entry . . .

Example: **remove accounting-entry**

```
Remove accounting entry name []? baltimore
```

### Set C

Configures frame size, addresses, and timeouts, and specifies the switch-variant and TEI number.

**Syntax:** set
framesize . . .
local-address-name . . .
multipoint-selection . . .
retries-call-address . . .
timeout-call-address . . .
switch-variant . . .
dn0 (directory number 0) . . .
dn1 (directory number 1) . . .
service-profile-id . . .
tei (terminal endpoint identifier) . . .

**framesize** ***1024*** **or** ***2048*** **or** ***4096***

The size of the network layer portion of frames transmitted and received on the ISDN interface. Does not include data link and MAC layer headers. Set the frame size so that it is greater than or equal to the frame size of the data-link protocol (PSL or PPP) running on the link.

For PPP, you can change the frame size using the **set hdlc frame-size** command at the `PPP Config>` prompt.

For PSL, you can change the frame size using the **set frame-size** command at the `SLC Config>` prompt.

`Example:` **`set framesize`**

```
Framesize in bytes (1024/2048/4096) [1024]? 2048
```

**local-address-name** ***address name***

The network address name of the local ISDN interface. This address name must match one of the names that you defined using **add isdn-address** at the `Config>` prompt.

`Example:` **`set local-address-name`**

```
Assign local address name []? line-1-local
```

**multipoint-selection** ***off*** or ***on***

Applies only to switch variant 5ESS. Default is *off* (point-to-point operation). Specifying *on* selects multipoint operation.

Example: **set multipoint-selection on**

**retries-call-address** ***value***

If you set the switch-variant to INS64, you cannot change **retries-call address**. It is fixed at 2.

Some telephone service providers impose restrictions on automatic recalling devices to limit the number of successive calls to an address that is inaccessible or that refuses those calls. **Retries-call-address** specifies the maximum number of calls the router attempts to make to a non-responding address during the timeout period. The range is 0 to 10, and the default is 2. Setting **retries-call-address** to 0 causes the router to retry until the call is established.

Example: **set retries-call-address**

```
Outbound call address retries [0]? 2
```

**timeout-call-address** ***# of seconds***

If you set the switch-variant to INS64, you cannot change **timeout-call address**. It is fixed at 180.

After the router reaches the maximum number of **retries-call-address** to a non-responding address, it does not make further calls to that address until this time has expired. The timeout period begins when the router attempts the first call to an address. The range is 0 to 65535 seconds, and the default is 180. Setting **timeout-call-address** to 0 causes the router to retry until the call is established.

Example: **set timeout-call-address**

```
Outbound call address Time-out (secs) [0]? 180
```

**switch-variant** ***net3*** or ***ins64*** or ***vn3*** or ***5ess*** or ***dns100*** or ***ni1***

Specifies the model of the switch to which this ISDN interface is connected. The default is NET3.

Example: **set switch-variant**

```
Switch-Variant-Model []? net3
```

**dn0** ***network dial address***

If you set the switch-variant to NET3 or VN3, set the directory number of the local port. **Dn0** must match the network dial address (telephone number) you configured using **set local-address-name**.

Example: **set dn0**

```
Enter DN0 (Directory-Number-0) [ ]? 1-508-898-1234
```

**dn1** ***network dial address***

Directory number 1 (dn1) is a second directory number supported by NET3 and VN3 switch variants. This implementation does not currently support **dn1**, and the router ignores the **dn1** setting.

**tei** ***auto*** **or** ***value***

Sets the signalling TEI for the ISDN interface. This setting must match the signalling TEI of your switch. Check with your service provider for the correct TEI signal. The default is automatic. Change this setting only if your switch does not support automatic TEI signalling. The choices are auto, or a value between 0 and 63. Setting the TEI to none disables the ISDN interface. For 5ESS, DMS100, and NI1 switch types, the **set tei** command also prompts for a B-channel number (1 or 2). The TEI is associated with the B-channel you specify.

Example: **set tei**

```
Enter B-channel Number [1]?
TEI  [AUTO]? 60
```

**service-profile-id** ***SPID string***

Sets the service profile identifier (SPID) for a specified B-channel. The SPID value is ignored if the switch variant is not DMS100, NI1, or 5ESS multipoint. This setting must match the SPID assigned by your ISDN service provider. The *SPID string* is an alphanumeric containing from 1 to 20 characters. There is no default value.

Example: **set service-profile-id**

```
Enter B-channel Number [1]?2
Enter SPID (Service Profile ID) [] 0555200001
```

### Statistics M

Displays the current statistics for this ISDN interface.

**Syntax:** statistics

Example: **statistics**

```
Link:   Active    ISDN Firmware:   0.0    Handler State: Running

                    D Channel     B1 Channel     B2 Channel

Total Transmits         32788         230217         164336
Total Receives          32789         164342         208255
Transmit Bytes         196767       22797579        6572177
Receive Bytes          196785        6572411        9517221
Invalid Interrupts          0              0              0

Transmit:     D       B1       B2    Receive:        D       B1       B2

Error         0        0        0    Error           0        5        0
Overflow      0        0        0    Overflow        0        0        0
Underrun      0        0        0    Overrun         0        0        0
Abort         0        0        0    Abort           0        5        0
                                     CRC Error       0        0        0
```

This display shows the current state of the link, the firmware revision, and the state of the dial circuit. It also shows statistics on what was transmitted and received on the interface.

**Exit** **C M**

Returns to the previous prompt level.

**Syntax:** exit

Example: **example**

## 5.6 ISDN and the GWCON Commands

The router also displays configuration information and statistics for interfaces and circuits when you use the **interface**, **statistics**, and **error** commands at the GWCON (+) prompt. You can also use the GWCON **test** command to test ISDN interfaces and dial circuits.

**Note:** Issuing the **test** command to the ISDN interface causes the current call to be dropped and re-dialed.

### Interface

Enter the **interface** command at the GWCON prompt (**+**) to display statistics for ISDN interfaces and dial circuits.

To display the following statistics for a ISDN interface, enter **interface** followed by the interface number of the ISDN interface.

Example: **interface 2**

```
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
2  2   ISDN/0     1001640   5C         10          9            0

  ISDN Base Net MAC/data-link on ISDN Basic Rate Interface interface
  Link:   Active    ISDN Firmware:   1.0    Handler State: Running

                      D Channel     B1 Channel     B2 Channel

Total Transmits            673          55900          21689
Total Receives             675          47549          17063
Transmit Bytes            4088       24659589        7389026
Receive Bytes             4134        8549622        5643732
Invalid Interrupts           0              0              0

Transmit:       D       B1       B2    Receive:        D       B1       B2
Error           0        0        0    Error           0        0        1
Overflow        0        0        0    Overflow        0        0        0
Underrun        0        0        0    Overrun         0        0        0
Abort           0        0        0    Abort           0        0        1
                                       CRC Error       0        0        0
```

To display the following statistics for a dial circuit, enter **interface** followed by the interface number of the dial circuit.

Example: **interface 3**

```
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
3  2   SL/0       1001640   5C          1          1            0

  Point to Point MAC/data-link on ISDN Basic Rate Interface interface

  Line Speed            : ~64.000 Kbps
  Last port reset : 0 seconds ago
```

The following describes the output for both ISDN interfaces and dial circuits.

*Nt* ISDN interface number or dial circuit interface number.

| | |
|---|---|
| *Nt'* | If "Nt" is a dial circuit, this is the interface number of the ISDN interface to which the dial circuit is mapped. |
| *Interface* | Interface type and instance number. |
| *CSR* | Command and status register addresses of base network. |
| *Vec* | Interrupt vector address. |
| *Self-Test Passed* | Number of successful self-tests. |
| *Self-Test Failed* | Number of unsuccessful self-tests. |
| *Maintenance Failed* | Number of maintenance failures. |
| *Line speed* | Transmit clock speed (approximate). |
| *Last port reset* | Length of time since the port was reset. |
| *Input frame errors:* | |
| *Error* | Errors other than one of the following error types. |
| *Overflow* | Packets that are larger than the defined frame size. |
| *Overrun* | Packets received before previously received packets were processed. |
| *Abort* | Packets aborted by the sender or a line error. |
| *CRC error* | Packets received with checksum errors and as a result were discarded. |
| *Output frame counters:* | |

| | |
|---|---|
| *Error* | Errors other than one of the following error types. |
| *Overflow* | Packets that are too large for the device buffer. |
| *Underrun* | Data was not available when it was needed for the next octet transmission. |
| *Abort* | Packets aborted by upper-level software. |

### Configuration

Enter **configuration** at the GWCON (+) prompt to display information about the router hardware and software. It includes a section that displays the interfaces configured on the router along with the state of the interface.

Note that if a dial circuit is configured to dial on demand, the state of the dial circuit is always displayed as Up whether or not it is connected. In this case Up means that the dial circuit is either connected or available.

If a dial circuit is configured as a static circuit, the state of the displays as Up only if the dial circuit is connected.

Example: **configuration**

```
RtAbt Acces EI/IP, Access: 1 Enet 1T1 1BRI,HW=1,RO=1,#2804,SW=T01.5.002
Hostname: [not configured]
Boot ROM version  2.5   Watchdog timer enabled     Auto-boot switch enabled
Console baud rate: 9600

Num Name  Protocol
0   IP    DOD-IP
3   ARP   Address Resolution
7   IPX   NetWare IPX
11  SNMP  Simple Network Management Protocol
12  OSPF  Open SPF-Based Routing Protocol

Num Name  Feature
1   BRS   Bandwidth Reservation
2   MCF   MAC Filtering

8 Networks:
Net Interface  MAC/Data-Link        Hardware                     State
0   Eth/0      Ethernet/802.3       SCC Ethernet                 Up
1   SL/0       Proteon Serial       SCC Serial Line              Up
2   V.25/0     V.25bis Base Net     SCC Serial Line              Up
3   ISDN/0     ISDN Base Net        ISDN Basic Rate Interface    Up
4   PPP/0      Point to Point       ISDN Basic Rate Interface    Up
5   PPP/1      Point to Point       ISDN Basic Rate Interface    Up
6   PPP/2      Point to Point       ISDN Basic Rate Interface    Disabled
7   PPP/3      Point to Point       V.25bis Dial Circuit         Up
```

# 6

# Configuring and Monitoring Logical Link Control

This chapter describes how to configure and monitor logical link control (LLC) for LAN interfaces (Token-ring and Ethernet) in the router.

## 6.1 Accessing the LLC Configuration or Console Process

Access the LLC configuration process by issuing the LLC command from the LAN interface configuration process. Access the LLC console process by issuing the LLC command from the LAN interface console process. Refer to Chapter 2 for more details about Ethernet interfaces or Chapter 10 for more details about Token-ring interfaces.

`Example:` **`ETH Config>LLC`**

```
LLC user configuration
LLC config>?
```

`Example:` **`ETH>LLC`**

```
LLC user monitoring
LLC>?
```

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `LLC config>` prompt.

Enter console (monitoring) commands at the `LLC>` prompt.

## 6.2 LLC Configuration and Console Commands

This section explains all of the LLC configuration and console commands. These commands let you configure the LLC when you need to pass packets over a local area network such as Token-ring or Etherenet. Table 6–1 lists LLC configuration and console commands.

**Table 6–1 LLC Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Displays all the LLC commands or lists subcommand options for specific commands. |
| **Clear-counters** | Monitor | Clears all statistical counters. |
| **List** | Configure/Monitor | Displays interface, SAP, and session information. |
| **Set** | Configure/Monitor | Allows the user to configure SAP timers and thresholds. |
| **Exit** | Configure/Monitor | Exits the config and monitor processes and returns to the previous prompt level. |

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter a **?** after a specific command name to list its options.

**Syntax:** ?

Example: **LLC Config>?**

```
LIST
SET
EXIT
```

Example: **LLC>?**

```
CLEAR-COUNTERS
LIST
SET
EXIT
```

### Clear-Counters M

Clear all the LLC statistical counters.

**Syntax:** clear-counters

Example: **clear-counters**

### List C

Display Service Access Point (SAP) information.

**Syntax:** list

Example: **list**

```
Reply Timer(T1):                 1 seconds
Receive ACK Timer(T2):           1 100miliseconds
Inactivity Timer(Ti):            30 seconds
Max Retry value(N2):             8
Rcvd I-frames before Ack(N3):    1
Transmit Window(Tw):             2
Receive Window(Rw):              2
Acks needed to increment Ww(Nw): 1
```

### List M

Display Interface, Service Access Point (SAP), and session information.

**Syntax:** list interface
sap . . .
session

**interface**

Displays all SAPs opened on this interface.

Example: **list interface**

```
SAPNumber of Sessions
F4 1
```

**SAP** ***sap_number***

Displays information for the specified SAP on the interface. Use the **list interface** command to see the SAPs opened on this interface.

Example: **list sap 7e**

```
Interface:                      00,Eth/0
Reply Timer(T1):                1 sec
Receive ACK Timer(T2):          1 100milisec
Inactivity Timer(Ti):           30 sec
MAX Retry Value(N2):            8
MAX I-Field Size(N1):           1500
Rcvd I-frames before Ack(N3):   7
Transmit Window Size(Tw):       127
Acks Needed to Inc Ww(Nw):      1

Frame Type          Xmt      Rcvd
UI-frames:            0         0
TEST-frames:          0         0
XID-frames:           2         2
I-frames:             3         3
RR-frames:         6372      6371
RNR-frames:           0         0
REJ-frames:           0         0
SABME-frames:         2         0
UA-frames:            0         2
DISC-frames:          0         0
DM-frames:            0         0
FRMR-frames:          0         0
I-frames Discarded by LLC:      0
I-frames Refused by LLC user:   0

Cumulative number of sessions:  2
Number of active sessions:      2
Session ID                                                Remote
(int-sap-id)  Local MAC          Remote MAC         SAP     State
00-7E-0000    08-00-2B-B6-D8-E4  AA-00-04-00-6B-A5  7E      LINK_OPENED
00-7E-0001    08-00-2B-B6-D8-E4  AA-00-04-00-F6-F5  7E      LINK_OPENED
```

*SAP value in hex (0-FE)* The SAP value of the session.

*Interface* The interface number and type over which the session is running.

*Reply Timer (T1)* Indicates the time it takes for this timer to expire when the LLC fails to receive an acknowledgment or response from the other LLC station.

*Receive ACK Timer (T2)* Indicates the time delay the LLC uses before sending an acknowledgment for a received I-frame.

| | |
|---|---|
| *Inactivity Timer (Ti)* | Indicates the time the LLC waits during inactivity before issuing an RR. |
| *MAX Retry Value (N2)* | The maximum number of retries by the LLC protocol. |
| *MAX I-Field Size (N1)* | Maximum amount of data (in bytes) allowed in the I-field of an LLC2 frame. |
| *Rcvd I-frame before ACK (N3)* | Indicates the value that is used with T2 timer to reduce acknowledgment traffic for received I-frames. |
| *Transmit Window Size (Tw)* | Indicates the maximum number I-frames that can be sent before receiving an RR. |
| *Acks Needed to Inc Ww (Nw)* | Indicates the number of I-frames that the LLC must receive before incrementing Ww by 1. |
| *Frames - Xmt and Rcvd* | Counter that displays the total number of frame types transmitted (Xmt) and (Rcvd). |
| *I-frames discarded by LLC* | Counter that displays the total number of I-frames discarded by the LLC, usually because the sequence number is out of sequence. |
| *I-frames refused by LLC user* | Counter that displays the number of I-frames discarded by the software above the LLC. For example, LNM (LAN Network Manager) and DLSw (Data Link Switching). |
| *Cumulative number of sessions* | The total number of sessions opened over this SAP. |
| *Number of active sessions* | The total number of currently active sessions that are running over the interface. |
| *Session ID (int-sap-id)* | The session ID for the console interface. |

*Local MAC* The router's LLC MAC address.

**Note:** Ethernet and Token-ring MAC addresses are displayed differently. For example, 08-00-2B-B6-D8-E4 is an Ethernet MAC address and 10:00:D4:6D:1B:27 is a Token-ring MAC Address.

*Remote MAC* The remote system's LLC MAC address.

*Remote SAP* The Service Access Point address of the remote LLC station.

*Remote State* The finite state(s) that results from interaction between the LLC peers. There are 21 states that are described below.

*Link_Closed* The remote LLC peer is not known to the local LLC peer and is considered as not existing.

*Disconnected* The local LLC peer is known to the other peer. This LLC peer can send and receive XID, TEST, SABME, and DISC commands; and XID TEST, UA, and DM responses.

*Link_Opening* The state of the local LLC peer after sending a SABME or UA in response to a received SABME.

*Disconnecting* The state of the local LLC after sending a DISC command to the remote LLC peer.

*FRMR_Sent* The local LLC peer entered the frame reject exception state and sent a FRMR response across the link.

*Link_Opened* The local LLC peer is in the data transfer phase.

*Local_Busy* The local LLC peer is unable to receive additional I-frames.

*Rejection* An local LLC peer that received one or more out-of-sequence I-frames.

| | |
|---|---|
| *Checkpointing* | The local LLC peer sent a poll to the remote LLC peer and is waiting for an appropriate response. |
| *KPT_LB* | A combination of checkpointing and local busy states. |
| *CKPT_REJ* | A combination of the checkpointing and rejection states. |
| *Resetting* | The local LLC peer received a SABME and is reestablishing the link. |
| *Remote_Busy* | The state that occurs when an RNR is received from the remote LLC peer. |
| *LB_RB* | A combination of local_busy and remote_busy states. |
| *REJ_LB* | A combination of rejection and local_busy states. |
| *REJ_RB* | A combination of rejection and remote_busy states. |
| *CKPT_REJ_LB* | A combination of checkpointing, rejection, and local_busy states. |
| *CKPT_CLR* | A combination state resulting from the termination of a local_busy condition while the LLC peer is CKPT_LB. |
| *CKPT_REJ_CLR* | A combination state resulting from the transfer of an unconfirmed local busy clear while the link station is in the CKPT_REJ_LB state. |
| *REJ_LB_RB* | A combination of the rejection, local_busy, and remote_busy states. |
| *FRMR_Received* | The local LLC peer has received an FRMR response from the remote LLC peer. |

**Session**

Displays information on the specified LLC session that is open on the interface. Use the **list SAP** command to find the Session Id for an open SAP.

Example: **list session**

```
Session Id: [0]? 0-F4-000
Interface:                   0, TKR /0
Remote MAC addr:             10:00:5A:F1:02:37
Source MAC addr:             00:00:C9:08:35:47
Remote SAP:                  F4
Local SAP:                   F4
RIF:                         (089E 0101 0022 0010)
Access Priority:             0
State:                       LINK_OPENED
Reply Timer:                 1 sec
Receive ACK Timer(T2):       1 100milisec (note: not used when N3=1)
Inactivity Timer (Ti):       30 sec
MAX I-Field Size (N1):       2052
MAX Retry Value (N2):        8
Rcvd I-frames before ACK (N3) 1
Transmit Window Size (Tw):   2
Working Transmit Size (Ww):  2
Acks Needed to Inc Ww (Nw):  1
Current Send Seq (Vs):       9
Current Rcv Seq (Vr):        7
Last ACK'd sent frame (Va):  9
No. of frames in ACK pend q: 0
No. of frames in Tx pend q:  0
Local Busy:                  NO
Remote Busy:                 NO
Poll Retry count:            8
Appl output flow stopped:    NO
Send process running:        YES

Frame          Xmt           Rcvd
I-frames       1456          2678
RR-frames      502           403
RNR-frames     0             0
REJ-frames     0             0
I-frames discarded by LLC    0
I-frames Refused by LLC user 0
```

*Session Id* Indicates the session ID number.

*Interface* Indicates the number of the interface over which this session is running.

*Remote MAC addr* Indicates the MAC address of the remote LLC peer.

*Source MAC addr* Indicates the MAC address of the local LLC.

| | |
|---|---|
| *Remote SAP* | The remote side SAP of the LLC connection. |
| *Local SAP* | The local side SAP of the LLC connection. |
| *RIF* | The actual RIF of the frame on a Token-ring interface. This field is not used on an Ethernet interface and is set to 0. |
| *Access Priority* | Priority of the packet. 0-7 for upper layer control. |
| *State* | The finite state(s) that results from interaction between the LLC peers. Refer to the **list sap** command previously described in this chapter for more information. |
| *Receive ACK timer (T2)* | Indicates the time delay the LLC uses before sending an acknowledgment for a received I-frame. |
| *Inactivity timer (Ti)* | Indicates the time the LLC waits during inactivity before issuing an RR. |
| *MAX I-field size (N1)* | Maximum size of the data field (in bytes) of a frame. Default is the size of the interface. |
| *MAX Retry Value (N2)* | The maximum number of times the LLC transmits an RR without receiving an acknowledgment |
| *Rcvd I-frames before ACK (N3)* | Indicates the value that is used with T2 timer to reduce acknowledgment traffic for received I-frames. |
| *Transmit window size (Tw)* | Indicates the maximum number of I-frames that can be sent before receiving an RR. |
| *Working transmit size (Ww)* | The maximum number of I-frames that are sent before receiving an RR. This can be less than Tw during the dynamic window algorithm. |
| *Acks Needed to Inc Ww (Nw)* | Indicates the number of I-frames that the LLC must receive before incrementing Ww by 1. |

| | |
|---|---|
| *Current send seq (Vs)* | Send state variable (Ns value for the next I-frame to be transferred). |
| *Current Rcv seq (Vr)* | Receive state variable (next in-sequence Ns to be accepted). |
| *Last ACK'd sent frame (Va)* | Acknowledged state variable (last valid Nr received). |
| *No. of frames in ACK pend q* | Number of transmitted I-frames waiting for acknowledgment. |
| *No. of frames in transmit pend q* | Number of frames waiting to be transmitted. |
| *Local Busy* | The local side of the LLC connection is sending RNRs. |
| *Remote Busy* | The remote side of the LLC is receiving RNRs. |
| *Poll Retry count* | Indicates the current value of the retry of the counter (counts down) in the LLC protocol. |
| *Appl output flow stopped* | The LLC told the application to stop sending outgoing data frames. |
| *Send process running* | Runs concurrently with all other frame actions and takes I-frames in the transmit queue and sends them. |
| *Frames - Xmt and Rcvd* | Displays the total number of frame types transmitted (Xmt) and (Rcvd). |
| *I-frames discarded by LLC* | Counter that displays the total number of I-frames discarded by the LLC, usually because the sequence number is out of sequence. |
| *I-frames refused by LLC user* | Counter that displays the number of I-frames discarded by the software above the LLC. For example, LNM (LAN Network Manager) and DLSw (Data Link Switching). |

### Set C M

Configure the LLC timer and threshold parameters.

**Caution:** Changing LLC parameters from the default can affect how the LLC protocol works.

From the `LLC config>` prompt, the set command sets the parameters for the interface being configured. In the monitoring process (at the `LLC>` prompt) the set command affects the parameters for a specified session. The LLC2 session must be running before you can modify any of the timer or threshold values.

**Syntax:** set n2-max_retry *count*
n3-frames-rcvd-before-ack *count*
nw-acks-to-inc-ww *count*
t1-reply-timer *seconds*
t2-receive-ack-timer *seconds*
ti-inactivity-timer *seconds*
tw-transmit-window *count*

#### n2-max_retry

The maximum number of retries by LLC protocol. For example, N2 is the maximum number of times the LLC transmits an RR without receiving an acknowledgment when the inactivity timer expires. Default is 8. Minimum is 1. Maximum is 127.

Example: **LLC config>set n2-max_retry *count***

Example: **LLC>set n2-max_retry *session-ID count***

#### n3-frames-rcvd-before-ack

This value is used with the T2 timer to reduce acknowledgment traffic for received I-frames. Set this counter to a specified value. Each time an I-frame is received, this value is decremented. When this counter reaches 0 or the T2 timer expires, an acknowledgment is sent. Default is 1. Minimum is 1. Maximum is 255.

Example: **LLC config>set n3-frames-rcvd-before-ack** ***count***

Example: **LLC>set n3-frames-rcvd-before-ack** ***session-ID count***

**nw-acks-to-inc-ww**

When the ability to send I-frames is not working, the LLC protocol goes into a mode where the working window (Ww) is set back to 1, and is then slowly increased back to its normal size (Tw). This is known as the dynamic window algorithm. This value is the number of I-frames that the LLC must receive before incrementing Ww by 1. Default is 1. Minimum is 1. Maximum is 127.

Example: **LLC config>set nw-acks-to-inc-ww** ***count***

Example: **LLC>set nw-acks-to-inc-ww** ***session-ID count***

**t1-reply-timer**

This timer expires when the LLC fails to receive a required acknowledgment or response from the other LLC station. When this timer expires, an RR is sent with the poll bit set and T1 is started again. If the LLC receives no response after the configured maximum number of retries (N2), the link underneath is declared inoperative. Default is 1. Minimum is 1. Maximum is 256.

Example: **LLC config>set t1-reply-timer** ***count***

Example: **LLC>set t1-reply-timer** ***session-ID count***

**t2-receive-ack-timer**

This timer is used to delay sending of an acknowledgment for a received I-format frame. This timer is started when an I-frame is received and reset when an acknowledgment is sent. If this timer expires, LLC2 sends an acknowledgment as soon as possible. Set this value so that it is less than that of T1. This ensures that the remote LLC2 peer receives the delayed acknowledgment before the T1 timer expires. Default is 1 (100 ms). Minimum is 1. Maximum is 2560.

Example: **LLC config>set t2-receive-ack-timer** ***seconds***

Example: **LLC>set t2-receive-ack-timer** ***session-ID seconds***

**Note:** If this timer is set to 1 (the default), it does not run (for example, **n3-frames-rcvd-before-ack=1**).

**ti-inactivity-timer**

Expires when the LLC does not receive a frame for a specified time period. When this timer expires, the LLC transmits an RR until the other LLC responds or the N2 timer expires. Default is 30 seconds. Minimum is 1 second. Maximum is 256 seconds.

Example: **LLC config>set ti-inactivity-timer** ***seconds***

Example: **LLC>set ti-inactivity-timer** ***sessions-ID*** ***seconds***

**tw-transmit-window**

Sets the maximum number of I-frames that can be sent before receiving an RR. Assumes that the other end of the LLC session can actually receive this many consecutive I-frames, and that the router has enough heap memory to keep copies of these frames until an acknowledgment is received. Increasing this value may increase the throughput. Default is 2. Minimum is 1. Maximum is 127.

Example: **LLC config>set tw-transmit-window** ***count***

Example: **LLC>set tw-transmit-window** ***session-ID*** ***count***

### Exit C M

Return to the previous prompt level.

**Syntax:** exit

Example: **exit**

# 7

# Configuring and Monitoring Point-to-Point Protocol Interfaces

This chapter describes how to configure and monitor Point-to-Point Protocol (PPP) interfaces in the router.

For more information about PPP interfaces and configurations, refer to the *Routing Protocols Reference Guide* and the *Routing Protocols User's Guide*.

## 7.1 Accessing the Interface Configuration and Console Processes

Follow the procedures described in Chapter 1 to access the interface configuration and console processes for the interface described in this chapter.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `PPP config>` prompt.

Enter console (monitoring) commands at the `PPP>` prompt.

## 7.2 Point-to-Point Configuration and Console Commands

Table 7–1 summarizes the PPP configuration and console commands. The sections that follow explain these commands.

**Table 7–1 Point-to-Point Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/ Monitor | Displays all the Point-to-Point commands or lists the options for specific commands. |
| **List** | Configure/ Monitor | Lists all information related to the point-to-point interface protocols, parameters, options, and statistics. |
| **Set** | Configure | Sets HDLC parameters, LCP options and parameters, IPCP options, BNCP options, PAP parameters, PAP IDs/passwords, CHAP parameters, CHAP IDs/ passwords, and NCP and CCP parameters. |
| **Clear** | Monitor | Clears all statistics from PPP interfaces. |
| **Delete** | Configure | Deletes local and remote identifiers and passwords. |
| **Exit** | Configure | Exits the PPP configuration process and returns to the previous prompt level. |

### Help (?) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
LIST
SET
EXIT
```

Example: **list ?**

```
ALL
HDLC
LCP
IPCP
BNCP
CCP
MP
PARAMETERS
AUTHENTICATION
```

### List C

Display information related to the point-to-point interface and its protocol parameters and options.

**Syntax:** list
all
authentication
bncp
ccp
hdlc
ipcp
lcp
mp
parameters

**all**

Lists all options and parameters related to the point-to-point interface.

**Note:** This example shows all possible options and parameters.

Example: **list all**

```
Maximum frame size in bytes = 2048
Encoding: NRZ
Idle State: Flag
Internal Clock Speed:      0

Transmit Delay Counter:    0

LCP Parameters
---------------
Config Request Tries:      20   Config Nak Tries:  10
Terminate Tries:           10   Retry Timer:       3000

LCP Options
-----------
Max Receive Unit:          2048   Magic Number:    Yes
Authentication:            none

PAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Author Timer        5
```

```
PAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none

CHAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Authent Timer       5

CHAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none
MP Options
-------------
Base Links:                  1
Max Links:                   2
BoD threshold:               70
BoD sample time:             30
BoD base link line speed:    64000
BoD add link persistence:    5
BoD delete link persistence: 10
Default destination address name:

NCP Parameters
---------------
Config Request Tries:    20   Config Nak Tries:  10
Terminate Tries:         10   Retry Timer:       3000

IPCP Options
------------
IPCP Compression:        None
IP Address:              Send, Request

CCP Options
-----------
Data Compression: enabled
Algorithm: Stac-LZS
Stac: histories 1
Stac: check_mode SEQ
```

This section explains the information displayed by the **list all** command.

| | |
|---|---|
| *Maximum frame size in bytes* | Maximum frame size that can be sent over the point-to-point link. |
| *Encoding* | HDLC transmission encoding scheme, either NRZ (non-return to zero) or NRZI (non-return to zero inverted). |
| *Idle State* | Bit pattern, either Flag or Mark, transmitted on the point-to-point link when the interface is not transmitting data. |
| *Internal Clock Speed* | Speed of the transmit and receive clock lines. |
| *Transmit Delay Counter* | Period of time set to elapse between the transmission of each frame. |
| *LCP Parameters* | |
| *Config Request Tries* | Number of times LCP sends *configure-request* packets to a peer station while attempting to open a PPP link. |
| *Terminate Tries* | Number of times LCP sends *terminate-request* packets to a peer station to close a PPP link. |
| *Config Nak Tries* | Number of times LCP sends c*onfigure-nak* (nak=not acknowledged) packets to a peer station while attempting to open a PPP link. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before LCP attempts to authenticate the remote station again. |
| *LCP Options* | |
| *Max Receive Unit* | Maximum packet size that the link handles. |
| *Magic Number* | Indicates whether the "magic number" loopback detection option was enabled or disabled. |

| | |
|---|---|
| *Authentication* | Specifies which authentication protocol is used by the router to authenticate the link. CHAP, PAP, None, or Either are valid options. *Either* attempts to use CHAP first, and if not acceptable it selects PAP. The default is None. |

*PAP Parameters*

| | |
|---|---|
| *Authentication Request Tries* | Number of times PAP sends *authentication_request* packets to a peer station while attempting to authenticate the remote station. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before PAP attempts to authenticate the remote station again. |
| *Request Timer* | Amount of time, in milliseconds, that elapses before PAP assumes that an authentication request is considered to have failed and PAP terminates the link. |

*PAP Ids/ Passwords*

| | |
|---|---|
| *Local ID* | A text string that specifies the identifier of the local station. PAP sends this string to the remote station to identify itself. |
| *Local Password* | A text string that specifies the password of the local station. PAP sends this string to the remote station to authenticate its identifier. |
| *Remote ID* | A text string that specifies the identifier of the remote station. When PAP receives an identifier string from the remote station, it compares the received string with this string. A mismatch results in authentication failure. |
| *Remote Password* | A text string that specifies the password of the local station. When PAP receives a password string from the remote station, it compares the received string with this string. A mismatch results in authentication failure. |

*CHAP Parameters*

| | |
|---|---|
| *Authentication Request Tries* | Number of times CHAP sends *authentication_request* packets to a peer station while attempting to authenticate the remote station. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before CHAP attempts to authenticate the remote station again. |
| *Request Timer* | Amount of time, in milliseconds, that elapses before CHAP assumes that an authentication request is considered to have failed and CHAP terminates the link. |
| *Repeat Authentication Timer* | Amount of time, in minutes, that elapses before CHAP repeats authentication. The default is zero (no repeat authentication). |

*CHAP Ids/ Passwords*

| | |
|---|---|
| *Local ID* | A text string that specifies the identifier of the local station. CHAP sends this string to the remote station to identify itself. |
| *Local Password* | A text string that specifies the password of the local station. CHAP compares the peer reply message to this string to authenticate the identifier. |
| *Remote ID* | A text string that specifies the identifier of the remote station. |
| *Remote Password* | A text string that specifies the password of the remote station. When CHAP receives a challenge from the authenticating station, it generates a reply based on the string. |

*MP Options*

| | |
|---|---|
| *Base Links* | Number of links the router uses in a session. The default is one. |

| | |
|---|---|
| *Max Links* | Number of channels the router uses for the connection. |
| *BoD threshold* | The level at which the router adds or subtracts bandwidth from the line. The default is 70% utilization. |
| *BoD sample time* | The number of seconds the router uses as a basis for establishing a history of line usage. The default is 30. |
| *BoD base link line speed* | The router's line speed for the base link. The default is 64, indicating that the router is using a single 64 KB/s B channel as the base link. |
| *BoD add link persistence* | Number of seconds the router waits after determining that the bandwidth threshold has been exceeded on the base link before adding a secondary link. The default is five seconds. |
| *BoD deletelink persistence* | Number of seconds the router waits after determining that the bandwidth has fallen below the threshold on the base link. The default is ten seconds. |
| *Default destination address name* | The network dial address of the remote router to which the dial circuit will connect. |

*NCP Parameters*

| | |
|---|---|
| *Config Request Tries* | Number of times NCP sends *configure-request* packets to a peer station while attempting to open a PPP link. |
| *Terminate Tries* | Number of times NCP sends *terminate-request* packets to a peer station to close a PPP link. |
| *Config Nak Tries* | Number of times NCP sends c*onfigure-nak* (nak=not acknowledged) packets to a peer station while attempting to open a PPP link. |

| | |
|---|---|
| *Retry Timer* | Amount of time, in milliseconds, that elapses before LCP's transmission of *configure-request* (to open the link) and *terminate-request* (to close the link) packets times out. Expiration of this timer causes a "timeout" and the halting of *configure-request* and *terminate-request* packet transmission. |

*IPCP Options*

| | |
|---|---|
| *IPCP Compression* | Displays whether or not the PPP handler accepts compressed data. PPP supports Van Jacobson Compressed TCP/IP. Enable this option when the point-to-point link is running at a low baud rate. |
| *IP Address* | Displays whether or not IPCP is configured to send the local IP address to the remote end of the link. Also displays whether or not IPCP is configured to request the IP address from the remote end of the link. |

*CCP Options*

| | |
|---|---|
| *Data Compression* | Indicates whether the data compression option has been enabled or disabled. |
| *Algorithm* | Identifies the data compression algorithm that is in use. CCP currently uses Stac-LZS compression. |
| *Stac: histories* | Indicates the number of compression histories that CCP can keep track of. CCP is currently limited to 1 history. |
| *Stac: check_mode* | Indicates the form of data checking that is in use. CCP uses sequence number checking (SEQ), to ensure that compressed packets arrive in the correct order. |

**authentication**

Both CHAP (Challenge Handshake Authentication Protocol) and PAP (Password Authentication Protocol) are authentication protocols for PPP interfaces. Local and remote authentication can be set to CHAP, PAP, either, or none. You can configure authentication parameters for both CHAP and PAP, including request attempts and timers used by the corresponding protocol. Enter the command at the `PPP config>` prompt.

These fields are described under the **list all** command.

Example: **`list authentication`**

```
PAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Author Timer        5

PAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none

CHAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Authent Timer       5

CHAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none
```

#### bncp

Lists the Bridging Network Control Protocol options.

Example: **`list bncp`**

```
BNCP Options
------------
Tinygram Compression: DISABLED
```

*BNCP Options*

| | |
|---|---|
| *Tinygram Compression* | Indicates whether BNCP Tinygram compression is enabled or disabled. |

**ccp**

Lists parameters and options for the Compression Control Protocol. These fields are described under the **list all** command.

Example: **list ccp**

```
CCP Options
-----------
Data Compression enabled
Algorithm: Stac-LZS
Stac: histories 1
Stac: check_mode SEQ
```

**hdlc**

Lists parameters related to the High-level Data Link Control (HDLC) protocol. These fields are described under the **list all** command.

Example: **list hdlc**

```
Maximum frame size in bytes = 2048
Encoding: NRZ
Idle State: Flag
Internal Clock Speed: 0

Transmit Delay Counter:  0
```

**ipcp**

Lists the Internet Protocol control protocol options. These fields are described under the **list all** command.

Example: **list ipcp**

```
IPCP Options
------------
IPCP Compression:  None
IP Address:        Don’t Send or Request
```

#### lcp

Lists parameters and options for the Link Control Protocol. These fields are described under the **list all** command.

Example: **list lcp**

```
LCP Parameters
--------------
Config Request Tries:       20   Config Nak Tries:     10
Terminate Tries:            10   Retry Timer:        3000

LCP Options
-----------
Max Receive Unit:         2048   Magic Number:        Yes
Authentication Protocol:  none                        Yes
```

#### mp

Lists options for the Multilink Protocol and Bandwidth on Demand (BoD). These fields are described under the **list all** command.

Example: **list mp**

```
MP Options
-------------
Base Links:                     1
Max Links:                      2
BoD threshold:                  70
BoD sample time:                30
BoD base link line speed:       64000
BoD add link persistence:       5
BoD delete link persistence:    10
Default destination address name:
```

#### parameters

Lists parameters for all Network Control Protocols. These parameters are described under the **list all** command.

Example: **list parameters**

```
NCP Parameters
---------------
Config Request Tries:    20   Config Nak Tries:   10
Terminate Tries:         10   Retry Timer:        3000
```

## List M

Display information and counters related to the point-to-point interface and PPP parameters and options. The **list all** command displays all information related to PPP. You can display specific groups of information by listing the information for that group only.

**Syntax:** list all
ap2
atcp
bncp
control . . .
dn
dncp
errors
ip
ipcp
ipx
ipxcp
lcp
osi
osicp
pap
chap
ccp
mp
compression

**all**

Lists all information and counters related to the point-to-point interface and PPP options and parameters. While the output displayed is shown following the command example that follows, specific fields are defined under the **list** command that displays that specific statistical group. For example, Error Type fields are explained under the **list error** command.

Example: **list all**

```
Version:              1
LCP State:            Req Sent
Previous State:       Listen
Time Since Change:    18 seconds

LCP Option            Local             Remote
----------            -----             ------
Max Receive Unit:     2048              1500
Async Char Mask:      FFFFFFFF          FFFFFFFF
Authentication:       None              None
Magic Number:         8F202AE1          None
Protocol Compr:       No                No
Addr/Cntl Compr:      No                No
32-Bit Checksum:      No                No

PAP State:            Closed
Previous State:       Closed
Time Since Change:    53 minutes and 30 seconds

PAP Ids/Passwords
-----------------
Local ID:             FOO
Local Password:       BAR

Remote ID:            FOO
Remote Password:      BAR

CHAP State:           Closed
Previous State:       Closed
Time Since Change:    53 minutes and 30 seconds

CHAP Ids/Passwords
-----------------
Local ID:             FOO
Local Password:       BAR

Remote ID:            FOO
Remote Password:      BAR

IPCP State:           Open
Previous State:       Ack Sent
Time Since Change:    2 hours, 15 minutes and 53 seconds
```

```
IPCP Option           Local             Remote
-----------           -----             ------
IP Address            128.189.209.20    None
Compression Slots     None              None
DNCP State:           Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 55 seconds

IPXCP State:          Open
Previous State:       Request Sent
Time Since Change:    3 hours, 15 minutes and 55 seconds
BNCP State:           Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 56 seconds

BNCP Option           Local              Remote
-----------           -----              ------
Tinygram Compression  DISABLED           DISABLED

Source-route Info:
Remote side does not support source-route bridging

ATCP State:           Open
Previous State:       Request Sent
Time Since Change:    5 hours, 15 minutes and 57 seconds
AppleTalk Address Info:
Common network number = 12
Local node ID = 49
Remote node ID = 86

OSICP State:          Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 58 seconds

LCP Statistic         In                Out
-------------         --                ---
Packets:              226               2880
Octets:               6780             40320
Cfg Req:              0                 2880
Cfg Ack:              0                 0
Cfg Nak:              0                 0
Cfg Rej:              0                 0
Term Req:             0                 0
Term Ack:             0                 0
Echo Req:             113               113
Echo Resp:            113               113
Disc Req:             0                 0
Code Rej:             0                 0
```

```
MP Options
-------------
Base Links:                 1
Max Links:                  2
Active Links:               1
Endpoint Class:             3
Remote Endpoint ID:         08002BB3A973
Send sequence:              99
Receive sequence:           93
Max Rcv Reconst Unit:       2048
BoD sample time:            30
BoD base link line speed:   64000
BoD add link persistence:   5
BoD delete link persistence: 10

MP Statistic
------------
Packets:              95              101
Octets:               7507            7329
Prot Rejects:         0               0

BOD Statistic
-------------
Calls                 Bandwidth      Bandwidth
                      Added          Deleted
-----                 --------       --------
                         0             0
Current Bandwidth Usage:  0

PAP Statistic        In                   Out
-------------        --                   ---
Packets:             0                    0
Octets:              0                    0
Auth Req:            0                    0
Auth Ack:            0                    0
Auth Nak:            0                    0

CHAP Statistic       In                   Out
-------------        --                   ---
Packets:             0                    0
Octets:              0                    0
Auth Challenge:      0                    0
Auth Resp:           0                    0
Auth Success:        0                    0
Auth Failure:        0                    0
```

```
IPCP Statistic      In                  Out
--------------      --                  ---
Packets:            5                   0
Octets:             100                 170
Prot Rejects:       0                   -

IP Statistic        In                  Out
------------        --                  ---
Packets:            3456                3456
Octets:             27648               27648
Prot Rejects:       0                   -

CCP State:               Open
Previous State:          Ack Sent
Time Since Change:       10 minutes and 19 seconds
Local (transmit) compressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ

Remote (receive) decompressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ
 CCP State:               Open
Previous State:          Ack Sent
Time Since Change:       10 minutes and 19 seconds

CCP Statistic            In                          Out
-------------            --                          ---
Packets:                 2                           2
Octets:                  18                          18
Reset Reqs:              0                           0
Reset Acks:              0                           0
Prot Rejects:            0                           -
Max size of transmit compression dictionary: 20368
Local (transmit) compressor: Stac-LZS
Local (transmit) compressor statistics:
    Recent compression ratio: 1.3:1
Size of receive decompression dictionary: 4152
Remote (receive) compressor: Stac-LZS
Remote (receive) decompressor statistics:
    Recent compression ratio: 1.4:1

Compression Statistic    In                          Out
---------------------    --                          ---
Packets:                 1                           1
Octets:                  54             56
Compressed Octets:       38             39
Incompressible Packets:  0               0
Discarded Packets:       0               0
Prot Rejects:                            -
```

```
DNCP Statistic        In              Out
--------------        --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -

DN Statistic          In              Out
------------          --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -

IPXCP Statistic       In              Out
---------------       --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -

IPX Statistic         In              Out
---------------       --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -
BNCP Statistic        In              Out
---------------       --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -

ATCP Statistic        In              Out
---------------       --              ---
Packets:              349             351
Octets:               128488          129412
Prot Rejects:         0               -

AP2 Statistic         In              Out
-------------         --              ---
Packets:              349             351
Octets:               128488          129412
Prot Rejects:         0               -

OSICP Statistic       In              Out
---------------       --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -

OSI Statistic         In              Out
-------------         --              ---
Packets:              0               0
Octets:               0               0
Prot Rejects:         0               -
```

```
Error Type            Count              Last One
----------            -----              --------
Bad Address:          0                  0
Bad Control:          0                  0
Unknown Protocol:     0                  0
Invalid Protocol:     0                  0
Config Timeouts:      145                -
Terminate Timeouts:   0                  -
```

**ap2**

Lists AppleTalk Phase 2 statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ap2**

```
AP2 Statistic        In         Out
------------         --         ---
Packets:             349        351
Octets:              128488     129412
Prot Rejects:        0
```

**atcp**

Lists statistics for the AppleTalk Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list atcp**

```
ATCP Statistic           In       Out
---------------          --       ---
Packets:                 0         0
Octets:                  0         0
Prot Rejects:            0         -
```

**bncp**

Lists statistics for the Bridging Network Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list bncp**

```
BNCP Statistic           In                     Out
---------------          --                     ---
Packets:                 0                      0
Octets:                  0                      0
Prot Rejects:            0                      -
```

**ccp**

Lists statistics for the Compression Control Protocol.

Example: **list ccp**

```
CCP Statistic             In                         Out
-------------             --                         ---
Packets:                  2                          2
Octets:                   18                         18
Reset Reqs:               0                          0
Reset Acks:               0                          0
Prot Rejects:             0                          -
Max size of transmit compression dictionary: 20368
Local (transmit) compressor: Stac-LZS
Local (transmit) compressor statistics:
    Recent compression ratio: 1.3:1
Size of receive decompression dictionary: 4152
Remote (receive) compressor: Stac-LZS
Remote (receive) decompressor statistics:
    Recent compression ratio: 1.4:1
```

*CCP Statistic*

*Packets* Displays the total number of CCP control packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes (in octets) of data in the CCP control packets transmitted and received over the current point-to-point interface.

*Reset Reqs* Displays the total number of reset request packets transmitted and received over the current point-to-point interface. CCP issues a Reset Request when a compressed packet is lost.

*Reset Acks* Displays the total number of reset acknowledgement packets transmitted and received over the current point-to-point interface. CCP issues a Reset Acknowledgement in response to a Reset request. The sequence numbers are then reset. Intervening packets are lost.

| | |
|---|---|
| *Prot Rejects* | Displays the total number of protocol-reject packets transmitted and received over the current point-to-point interface. |
| *Max size of transmit compression dictionary* | Memory allocated to the compressor for maintaining transmitted data compression history. |
| *Local (transmit) compressor* | The algorithm being used for data compression. CCP currently only uses Stac-LZS data compression. |
| *Local (transmit) compressor statistics* | The compression ratio that has been observed in the recent sequence of packets. The ratio is calculated by comparing the number of compressed octets transmitted to the original number of octets to be transmitted. |
| *Size of receive decompression dictionary* | Memory allocated to the decompressor for maintaining received data compression history. |
| *Remote (receive) compressor* | The algorithm being used for data decompression. CCP currently only uses Stac-LZS data decompression. |
| *Remote (receive) decompressor statistics* | The compression ratio that has been observed in the recent sequence of packets. The ratio is calculated by comparing the number of compressed octets received to the number of decompressed octets. |

### chap

Lists statistics for the Challenge Handshake Authentication Protocol (CHAP).

Example: **list chap**

```
CHAP Statistic      In          Out
-------------       --          ---
Packets:            0           0
Octets:             0           0
Auth Req:           0           0
Auth Ack:           0           0
Auth Nak:           0           0
```

*CHAP Statistic*

*Packets* Displays the total number of CHAP packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes of CHAP data, in octets, transmitted and received over the current point-to-point interface.

*Auth Req* Displays the total number of authentication packets transmitted and received over the current point-to-point interface.

*Auth Ack* Displays the total number of acknowledgement packets transmitted and received over the current point-to-point interface.

*Auth Nak* Displays the total number of negative acknowledgement packets transmitted and received over the current point-to-point interface.

**compression**

Lists statistics for the compressed packets that have been exchanged.

Example: **list compression**

```
Compression Statistic      In                          Out
---------------------      --                          ---
Packets:                   1                           1
Octets:                    54                          56
Compressed Octets:         38                          39
Incompressible Packets:    0                           0
Discarded Packets:         0                           0
Prot Rejects:              0                           -
```

*Compression Statistic*

*Packets* Displays the total number of compressed packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes (in octets) of data before being compressed for transmission and after being decompressed when received over the current point-to-point interface.

*Compressed Octets* Displays the total number of bytes (in octets) of compressed data in the packets transmitted and received over the current point-to-point interface.

*Incompressible Packets* Displays the total number of packets that could not be compressed. If data that has already been compressed is being transmitted, then compression can actually make the data grow. If the packet size exceeds the Max Receive Unit for the LCP, then CCP sends the data uncompressed.

If this counter increases, no data is lost, but performance is reduced because of the Reset Requests.

*Discarded Packets* Displays the total number of bytes (in octets) of discarded packets transmitted and received over the current point-to-point interface.

*Prot Rejects* Displays the total number of *protocol-reject* packets transmitted and received over the current point-to-point interface.

**control lcp**
**pap**
**chap**
**ipcp**
**dncp**
**ipxcp**
**bncp**
**atcp**
**osicp**
**ccp**
**mp**

Lists information and counters related to the specified control protocol.

Example: **list control atcp**

```
ATCP State:            Closed
Previous State:        Closed
Time Since Change:     6 hours, 27 minutes and 7 seconds
AppleTalk Address Info:
Common network number = 12
Local node ID = 49
Remote node ID = 76
```

The ATCP State fields are the same as those described under the **list control lcp** command.

*AppleTalk Address Info*

*Common network number* Displays the network number of the two ends of the point-to-point link. (You must statically configure both ends of the link to have the same network number.)

*Local node ID* Displays the unique node number of the local end of the link.

*Remote node ID* Displays the unique node number of the remote end of the link.

Example: **list control bncp**

```
BNCP State:            Closed
Previous State:        Closed
Time Since Change:     5 hours, 25 minutes and 3 seconds

BNCP Option            Local                    Remote
-----------            -----                    ------
Tinygram Compression   DISABLED                 DISABLED
Source-route Info:
Remote side does not support source-route bridging
```

The BNCP State fields are the same as those described under the **list control lcp** command.

*BNCP Option*

*Tinygram Compression* Displays whether or not Tinygram Compression is enabled or disabled on the local and remote ends of the link.

*Source-route Info* Displays whether or not source route bridging is enabled for the local and remote ports that correspond to this interface.

Example: **list control ccp**

```
CCP State:                 Open
Previous State:            Ack Sent
Time Since Change:         10 minutes and 19 seconds

Local (transmit) compressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ

Remote (receive) decompressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ
```

The CCP State fields are the same as those described under the **list control lcp** command.

| | |
|---|---|
| *Local (transmit) compressor* | The algorithm being used for data compression. CCP currently only uses Stac-LZS data compression. |
| *Negotiated histories* | The number of Stac-LZS data compression histories that CCP can keep track of at any one time. CCP currently supports only 1 history per PPP link. |
| *Negotiated check mode* | The data validation method in use by CCP. CCP adds a sequence number (SEQ) to each packet to ensure that compressed packets arrive in the correct order. |
| *Remote (receive) decompressor* | The algorithm being used for data decompression. CCP currently supports only Stac-LZS data decompression. |
| *Negotiated histories* | The number of Stac-LZS data decompression histories that CCP can keep track of at any one time. CCP currently supports only 1 history per PPP link. |
| *Negotiated check mode* | The data validation method in use by CCP. CCP checks the sequence number (SEQ) of each received packet to ensure that compressed packets arrive in the correct order. |

Example: **list control chap**

```
State:              Closed
Previous State:     Closed
Time Since Change:  53 minutes and 30 seconds

CHAP Ids/Passwords
-----------------
Local ID:           FOO
Local Password:     BAR

Remote ID:          FOO
Remote Password:    BAR
```

*State* — Displays the current state of the authentication protocol. These states include the following:

- **Closed** – Indicates that the link is down and there is no attempt being made to open it. This state indicates that authentication is not in progress.
- **Closing** – Indicates that authentication has failed and the link is in the termination process.
- **Listen** – Indicates that the local station is waiting for an authentication challenge from the remote station.
- **Challenge Sent** – The local station has sent a challenge and is waiting for a response.
- **Response Sent** – The local station has sent a response and is waiting for a success/failure.
- **Success Sent** – The local station has verified authentication.
- **Success Received** – The local station has received verification.
- **Opened** – Authentication is complete and link establishment is proceeding.

*Previous State* — Displays the state of the protocol prior to the state displayed in the State field. These states are the same as those described in CHAP *State* above.

*Time Since Change* — Displays the amount of time the link is in the present state.

*CHAP Ids/Passwords*

*Local ID* — A text string that specifies the identifier of the local station. CHAP sends this string to the remote station to identify itself.

| | |
|---|---|
| *Local Password* | A text string that specifies the password of the local station. CHAP compares the peer reply message to this string to authenticate the identifier. |
| *Remote ID* | A text string that specifies the identifier of the remote station. |
| *Remote Password* | A text string that specifies the password of the remote station. When CHAP receives a challenge from the authenticating station, it generates a reply based on the string. |

Example: **list control dncp**

```
DNCP State:           Closed
Previous State:       Closed
Time Since Change:    6 hours, 23 minutes and 37 seconds
```

The DNCP State fields are the same as those described under the **list control lcp** command.

Example: **list control ipcp**

```
IPCP State:                Listen
Previous State:            Closed
Time Since Change:         20 seconds

IPCP Option                Local            Remote
-----------                -----            ------
IP Address                 128.189.209.20   None
Compression Slots          None             None
```

The IPCP State fields are the same as those described under the **list control lcp** command.

*IPCP Option*

| | |
|---|---|
| *IPCP Address* | The IP address of the local and remote ends of the link, if available. |
| *Compression Slots* | The number IP headers saved for reference to determine the type of compression that is enabled. |

Example: **list control ipxcp**

```
IPXCP State:          Closed
Previous State:       Closed
Time Since Change:    2 hours, 9 minutes and 2 seconds
```

The IPXCP State fields are the same as those described under the **list control lcp** command.

Example: **list control lcp**

```
LCP State:                 Listen
Previous State:            Req Sent
Time Since Change:         8 seconds

LCP Option          Local                       Remote
----------          -----                       ------
Max Receive Unit:   2048                        1500
Async Char Mask:    FFFFFFFF                    FFFFFFFF
Authentication:     None                        None
Magic Number:       B87DA37F                    None
Protocol Compr:     No                          No
Addr/Cntl Compr:    No                          No
32-Bit Checksum:    No                          No
```

*LCP State*

Displays the current state of the point-to-point link. These states include the following:

- **Open** – Indicates that a connection was made and data can be sent. The retry timer does not run in this state.
- **Closed** – Indicates that the link is down and there is no attempt being made to open it. In this state, all connection requests from peers are rejected.
- **Listen** – Indicates that the link is down and there is no attempt being made to open it. In contrast to the CLOSED state, all connection requests from peers are accepted.

- **Request-Sent** – Indicates that an active attempt is being made to open the link. A *configure-request* packet was sent but a *configure-ack* was not yet received nor was one sent. The retry timer is running at this time.
- **Ack-Received** – Indicates that a *configure-request* packet was sent and a *configure-ack* packet was received. The retry timer is still running since a *configure-ack* packet was not transmitted.
- **Ack-Sent** – Indicates that a *configure-ack* packet and a *configure-request* packet were sent but a *configure-ack* packet was not received. The retry timer always runs in this state.
- **Closing** – Indicates that an attempt is being made to close the connection. A *terminate-request* packet was sent but a *terminate-ack* packet was not received. The retry timer is running in this state.

*Previous State* Displays the state of the point-to-point link prior to the state displayed in the LCP State field. These states are the same as those described in the LCP State field.

*Time Since Change* Displays the amount of time the link is in the present state.

*LCP Option*

*Max Receive Unit* Displays the maximum packet size set for both the local and remote end of the link.

*Async CharMask* Not currently supported. PPP accepts this option but ignore it.

*Authentication* Displays the authentication protocol that is used.

*Magic Number* The current magic number for both the local and remote end of the link.

| | |
|---|---|
| *ProtocolCompr* | Not currently supported. PPP rejects this option if it is received. |
| *Address/ Cntl Compr* | Not currently supported. PPP rejects this option if it is received. |
| *32-Bit Checksum* | Not currently supported. PPP rejects this option if it is received. |

Example: **list control mp**

```
MP Options
--------------
Base Links:                          1
Max Links:                           2
Active Links:                        1
Endpoint Class:                      3
Remote Endpoint ID:                  08002BB3A973
Send Sequence:                       124
Receive Sequence:                    118
Max Rcv Reconst Unit:                2048
BoD sample time:                     30
BoD base link line speed:            64000
BoD add link persistence:            5
BoD delete link persistence:         10
```

| | |
|---|---|
| *Base Links* | Number of static links the router uses in a session. The default is one. |
| *Max Links* | Maximum number of lines the router uses for the connection. If the maximum number is greater than the base links, BoD adds/deletes links. |
| *Active Links* | Number of links presently assigned. |
| *Endpoint Class* | Number representing the type of endpoint. |
| *Remote Endpoint ID* | Specific remote ID number of the system transmitting packets. |

| | |
|---|---|
| *Send Sequence* | A 24-bit field (LCP option) that is incremented for every fragment transmitted. |
| *Receive Sequence* | A 24-bit field (LCP option) that is incremented for every fragment received. |
| *Max Rcv Recont Unit* | The maximum number of octets in the information fields of reassembled packets. |
| *BoD sample time* | The number of seconds the router uses as a basis for establishing a history of line usage. The default is 30. |
| *BoD base link line speed* | The router's line speed for the base link. The default is 64. |
| *BoD add link persistence* | Number of seconds the router waits after determining that the bandwidth threshold has been exceeded on the base link before adding a secondary link. The default is five seconds. |
| *BoD delete link persistence* | Number of seconds the router waits after determining that the bandwidth has fallen below the threshold on the base link. The default is ten seconds. |

`Example:` **`list control osicp`**

```
OSICP State:          Closed
Previous State:       Closed
Time Since Change:    6 hours, 28 minutes and 32 seconds
```

The OSICP State fields are the same as those described under the **list control lcp** command.

Example: **list control pap**

```
State:              Closed
Previous State:     Closed
Time Since Change:  53 minutes and 30 seconds

PAP Ids/Passwords
-----------------
Local ID:           FOO
Local Password:     BAR

Remote ID:          FOO
Remote Password:    BAR
```

*PAP State* — Displays the current state of the authentications protocol. These states include the following:

- **Closed** – Indicates that the link is down and there is no attempt being made to open it. This state indicates that authentication is not in progress.
- **Closing** – Indicates that authentication has failed and the link is in the termination process.
- **Listen** – Indicates that the local station is waiting for an authentication request from the remote station.
- **Req Sent** – The local station has sent the authentication request containing the local ID and password. The remote station has not responded.
- **Ack Rcvd** – local station has received positive acknowledgement for its ID and password.

*Previous State* — Displays the state of the pap protocol prior to the state displayed in the PAP State field. These states are the same as those described in *PAP State* above.

*Time Since Change* — Displays the amount of time the link is in the present state.

*PAP Ids/Passwords*

| | |
|---|---|
| *Local ID* | The identifier string sent by the local station in an authentication request packet. |
| *Local Password* | The password string sent by the local station in an authentication request packet. |
| *Remote ID* | The identifier string expected by the local station when an authentication request packet is received. |
| *Remote Password* | The password string expected by the local station when an authentication request packet is received. |

**dn**

Lists statistics related to DECnet packets for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list dn**

```
DN Statistic          In        Out
------------          --        ---
Packets:              0         0
Octets:               0         0
Prot Rejects:         0         -
```

**dncp**

Lists statistics for the DECnet Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list dncp**

```
DNCP Statistic          In                  Out
--------------          --                  ---
Packets:                0                   0
Octets:                 0                   0
Prot Rejects:           0                   -
```

**errors**

Lists information related to all error conditions tracked by the PPP software.

Example: **list error**

```
Error Type                Count          Last One
----------                -----          --------
Bad Address:                 0                0
Bad Control:                 0                0
Unknown Protocol:            0                0
Invalid Protocol:            0                0
Config Timeouts:             0                0
Terminate Timeouts:          0                0
```

*Error Type*

*Bad Address* Displays the total number of bad addresses encountered over the point-to-point link.

*Bad Control* Displays the total number of bad control packets encountered over the point-to-point link.

*Unknown Protocol* Displays the total number of unknown protocol packets encountered by the current link.

*Invalid Protocol* Displays the total number of invalid protocol packets encountered by the current link.

*Config Timeouts* Displays the total number configuration timeouts experienced by the link.

*Terminate Timeouts* Displays the total number of link termination timeouts experienced by the link.

**ip**

Lists all information related to IP packets over the point-to-point link.

Example: **list ip**

```
Ip Statistic         In         Out
------------         --         ---
Packets:             349        351
Octets:              128488     129412
Prot Rejects:        0
```

*Ip Statistic*

*Packets* Displays the total number of IP packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes of IP data, in octets, transmitted and received over the current point-to-point interface.

*Prot Rejects* Displays the total number of *protocol-reject* packets transmitted and received over the current point-to-point interface.

**ipcp**

Lists IPCP statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ipcp**

```
Ipcp Statistic       In         Out
--------------       --         ---
Packets:             0           0
Octets:              0           0
Prot Rejects:        0
```

**ipx**

Lists IPX statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ipx**

```
IPX Statistic          In        Out
------------          --        ---
Packets:              0          0
Octets:               0          0
Prot Rejects:         0          -
```

**ipxcp**

Lists statistics for the IPX control protocol. These fields are the same as those described under the **list ip** command.

Example: **list ipxcp**

```
IPXCP Statistic          In                Out
--------------          --                ---
Packets:                0                 0
Octets:                 0                 0
Prot Rejects:           0                 -
```

**lcp**

Lists statistics for the Link Control Protocol.

Example: **list lcp**

```
LCP Statistic          In              Out
-------------          --              ---
Packets:               0               3833
Octets:                0               53662
Cfg Req:               0               3833
Cfg Ack:               0               0
Cfg Nak:               0               0
Cfg Rej:               0               0
Term Req:              0               0
Term Ack:              0               0
Echo Req:              0               0
Echo Resp:             0               0
Disc Req:              0               0
Code Rej:              0               0
```

*LCP Statistic*

| | |
|---|---|
| *Packets* | Displays the total number of packets transmitted (out) and received (in) over the current point-to-point interface. |
| *Octets* | Displays the total number of bytes in octets transmitted and received over the current point-to-point interface. |
| *Cfg Req* | Displays the total number of *configure-request* packets transmitted and received over the current point-to-point interface. |
| *Cfg Ack* | Displays the total number of *configure-ack* (acknowledged) packets transmitted and received over the current point-to-point interface. |
| *Cfg Nak* | Displays the total number of *configure-nak* (not acknowledged) packets transmitted and received over the current point-to-point interface. |
| *Cfg Rej* | Displays the total number of *configure-reject* packets transmitted and received over the current point-to-point interface. |
| *Term Req* | Displays the total number of *terminal-request* packets transmitted and received over the current point-to-point interface. |
| *Term Ack* | Displays the total number of *terminal-ack* (acknowledged) packets transmitted and received over the current point-to-point interface. |
| *Echo Req* | Displays the total number of *echo-request* packets transmitted and received over the current point-to-point interface. |

| | |
|---|---|
| *Echo Resp* | Displays the total number of *echo-response* packets transmitted and received over the current point-to-point interface. |
| *Disc Req* | Displays the total number of *discard-request* packets transmitted and received over the current point-to-point interface. |
| *Code Rej* | Displays the total number of *code-reject* packets transmitted and received over the current point-to-point interface. |

#### mp

Lists all information related to MP packets over the point-to-point link.

Example: **list mp**

```
mp Statistic          In          Out
------------          --          ---
Packets:              0            0
Octets:               0            0
Prot Rejects:         0
```

#### osi

Lists OSI statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list osi**

```
OSI Statistic             In                Out
-------------             --                ---
Packets:                  0                 0
Octets:                   0                 0
Prot Rejects:             0                 -
```

#### osicp

Lists statistics for the OSI Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list osicp**

```
OSICP Statistic         In              Out
---------------         --              ---
Packets:                0                0
Octets:                 0                0
Prot Rejects:           0                -
```

**pap**

Lists statistics for the Password Authentication Protocol (PAP).

Example: **list pap**

```
PAP Statistic          In              Out
-------------          --              ---
Packets:                0               0
Octets:                 0               0
Auth Req:               0               0
Auth Ack:               0               0
Auth Nak:               0               0
```

*PAP Statistic*

| | |
|---|---|
| *Packets* | Displays the total number of PAP packets transmitted (out) and received (in) over the current point-to-point interface. |
| *Octets* | Displays the total number of bytes of PAP data, in octets, transmitted and received over the current point-to-point interface. |
| *Auth Req* | Displays the total number of authentication packets transmitted and received over the current point-to-point interface. |
| *Auth Ack* | Displays the total number of acknowledgement packets transmitted and received over the current point-to-point interface. |

*Auth Nak* Displays the total number of negative acknowledgement packets transmitted and received over the current point-to-point interface.

### Set C

Sets HDLC parameters, LCP options and parameters, IPCP options, BNCP options, MP options, PAP and CHAP parameters and ID's/Passwords, and NCP parameters. Parameters affect only the interface that you are configuring. Options are active across the entire link.

**Note:** Values immediately following the command option prompts reflect the current setting of that option. They are not always the default values.

**Syntax:** set authentication
bncp
hdlc encoding . . .
hdlc idle . . .
hdlc transmit delay . . .
ipcp . . .
lcp . . .
ccp . . .
mp . . .
parameters . . .
hdlc cable . . .

#### authentication

Sets the authentication parameters and ID's/Passwords for the CHAP and PAP authentication protocols. Use the **set authentication** command to set up records for both the local and remote devices. Enter the command at the `PPP config>` prompt.

**Syntax:** set authentication
local ...
remote ...
parameters ...

Sets the Password Authentication Protocol local and remote IDs/passwords. IDs and passwords affect only the specific interface.

Example: **set authentication local chap**

```
Local ID: [default]: new ID
Local Password:      none
```

Example: **set authentication local pap**

```
Local ID: [default]: new ID
Local Password: [none]
```

*Local ID* — A text string that specifies the identifier of the local station. CHAP and PAP send this string to the remote station to identify itself. The string can contain any combination of up to 255 alphanumeric characters.

*Local Password* — A text string that specifies the password of the local station. CHAP and PAP send this string to the remote station to authenticate its identifier. CHAP uses the string to compare with the remote's response. The string can be any combination of up to 255 alphanumeric characters.

Example: **set authentication remote chap**

```
Remote ID []:
Remote Password []:
```

Example: **set authentication remote pap**

```
Remote ID []:
Remote Password []:
```

*Remote ID* — A text string that specifies the identifier of the remote station. CHAP and PAP send this string to the remote station to identify itself. The string can contain any combination of up to 255 alphanumeric characters.

| | |
|---|---|
| *Remote Password* | A text string that specifies the password of the remote station. PAP sends this string to the remote station to authenticate its identifier. CHAP uses this string to generate a response to a challenge. The string can be any combination of up to 255 alphanumeric characters. |

`Example:` **`set authentication parameters pap`**

Sets the Password Authentication Protocol parameters. These parameters affect only the specific interface for which you are setting them.

```
Request tries   [20]?
Retry timer (mSec)   [3000]?
Request timer (mSec)   [15000]?
```

| | |
|---|---|
| *Request tries* | Sets the number of *authentication-request* packets PAP sends to a peer station to attempt to authenticate the remote station. The range is 1 to 100. The default is 20. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before PAP attempts to authenticate the remote station again. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |
| *Request timer* | Sets the amount of time, in milliseconds, that elapses before PAP assumes an authentication request is considered to have failed and PAP terminates the link. The range is 200 to 150000 milliseconds. The default is 15000 milliseconds. |

`Example:` **`set authentication parameters chap`**

Sets the Challenge Handshake Authentication Protocol parameters. These parameters affect only the specific interface for which you are setting them.

```
Request tries   [20]?
Retry timer (mSec)   [3000]?
Request timer (mSec)   [15000]?
Repeat Authentication Timer (min) [0]?
```

| | |
|---|---|
| *Request tries* | Sets the number of *authentication-request* packets CHAP sends to a peer station to attempt to authenticate the remote station. The range is 1 to 100. The default is 20. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before CHAP attempts to authenticate the remote station again. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |
| *Request timer* | Sets the amount of time, in milliseconds, that elapses before CHAP assumes an authentication request is considered to have failed and CHAP terminates the link. The range is 200 to 150000 milliseconds. The default is 15000 milliseconds. |
| *Repeat Authentication Timer* | Amount of time, in minutes, that elapses before CHAP repeats authentication. The default is zero (no repeat authentication). |

**bncp**

Sets Bridging Network Control Protocol (BNCP) parameters.

Example: **set bncp**

```
TINYGRAM COMPRESSION [no]:
```

| | |
|---|---|
| *TINYGRAM COMPRESSION* | Specifies whether or not Tinygram Compression is used. This options is useful for some protocols, such as Local Area Terminal (LAT), that are prone to problems when bridged over low-speed (64 KB/s and below) lines. In these protocols, zeroes are added between the data and the frame checksum to pad the Protocol Data Unit (PDU) to the minimum size. Tinygram compression removes the zeroes and preserves the frame checksum at the transmitting end. At the receiving end, it restores the packet to the minimum length. |

**hdlc encoding *NRZ* or *NRZI***

Sets the HDLC transmission encoding scheme for this interface (or port) to either NRZ (non-return to zero) or NRZI (non-return to zero inverted). The default is NRZ.

Example: **set hdlc encoding nrz**

**hdlc idle *flag* or *mark***

Sets the data link idle state to either Flag or Mark. The default is Flag.

Example: **set hdlc idle flag**

**hdlc transmit-delay *microseconds***

Sets the period of time, in microseconds, between the transmission of each frame. For all platforms, the default is 0.

Example: **set hdlc transmit-delay 30**

**ipcp**

Sets all Internet Protocol control protocol options for the link. Options are settings that are active across the entire link.

Example: **set ipcp**

```
IP COMPRESSION [no]:
Send our IP address [no]:
Request their IP address [no]:
```

| | |
|---|---|
| *IP COMPRESSION* | Selects whether or not the PPP handler accepts compressed data. PPP supports Van Jacobson Compressed TCP/IP (RFC 1144). Enable this option when the point-to-point link is running at a low baud rate.<br>Setting this value to Yes enables compression. Setting this value to No disables compression. The default is No. |
| *Send our IP address* | Specifies whether or not to send the local IP address to the remote end of the link. Set this option to Yes if the other end of the link requires the IP address. In either case, the PPP software sends the local IP address if the other end of the link requests it. |
| *Request their IP address* | Specifies whether or not to request the IP address from the remote end of the link. If the PPP software receives the remote IP address, it displays the address with the PPP monitoring statistics. |

#### lcp *options* or *parameters*

Sets the Link Control Protocol options and parameters for the PPP link. Options are active across the entire link. Parameters affect only the specific interface.

Example: **set lcp options**

```
Maximum Receive Unit (bytes) [2048]?
Magic Number [yes]:
Password Authentication [none, pap, chap, either]:
```

| | |
|---|---|
| *Maximum receive unit* | Sets the maximum packet size of the information field that can be transferred in a single datagram. The range is 576 to 4089 bytes. The default is 2048. |
| *Magic Number* | Specifies whether or not the magic number option is enabled. Magic number provides a way to detect looped-back links in serial line configurations. When this option is enabled, the link uses the system clock as a random number generator.<br>When the LCP receives a *configure-request* with a magic number present (the magic number option is enabled), it compares the received magic number with the magic number in the last *configure-request* sent to the peer. If the two magic numbers are different, the link is not considered looped back. If the two magic numbers are the same, the PPP handler attempts to bring the link down and up again to renegotiate magic numbers.<br>Setting this value to Yes enables the magic number option. Setting this value to No disables the option. The default is |
| *Authentication Protocol* | Specifies which authentication protocol is used by the router to authenticate the link. CHAP, PAP, None, or Either are valid options. *Either* attempts to use CHAP first, and if not acceptable it selects PAP. The default is None. |

Example: **set lcp parameters**

```
Config tries  [20]?
NAK tries  [10]?
Terminate tries  [10]?
Retry timer (mSec)  [3000]?
```

| | |
|---|---|
| *Config tries* | Sets the number of configure-request packets that LCP sends to a peer station to attempt to open a PPP link. The range is 1 to 100. The default is 20.<br>The retry timer starts after the first *configure-request* packet is transmitted. This is done to guard against packet loss. |
| *NAK tries* | Sets the number of *configure-nak* (*nak* = not acknowledged) packets that LCP sends to a peer station while attempting open a PPP link. The range is 1 to 100. The default is 10.<br>Upon receiving *configure-request* packets with unacceptable configuration options, LCP sends configure-nak packets. These packets are sent to refuse the offered configuration options and to suggest modified, acceptable values. |
| *Terminate tries* | Sets the number *terminate-request* packets that LCP sends to a peer station to close a PPP link. The range is 1 to 100. The default is 10.<br>The retry timer starts after the first terminate-request packet is transmitted. This is done to guard against packet loss. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before LCP's transmission of *configure-request* (to open the link) and *terminate-request* (to close the link) packets is timed out. Expiration of this timer causes a timeout and the halting of *configure-request* and *terminate-request* packet transmission. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |

**ccp *state***

Allows you to specify whether Compression Control Protocol (CCP) is enabled or disabled at startup. You must enable CCP at both ends of the link in order to use CCP compression.

*State* is either enabled or disabled. The default is disabled.

Example: **set ccp enable**

```
CCP compression was disabled, now enabled.
```

**mp**

Sets Multilink Protocol (MP) and Bandwidth on Demand (BoD) options.

Example: **set mp**

```
Base Links:                   [1]?
Max Links:                    [2]?
BoD threshold:                [70]?
BoD sample time:              [30]?
BoD base link line speed:     [64000]?
BoD add link persistence:     [5]?
BoD delete link persistence: [10]?
Default destination address name:
```

| | |
|---|---|
| *Base Links* | Number of links the router uses in a session. The default is one. |
| *Max Links* | Number of channels the router uses for the connection. |
| *BoD threshold* | The level at which the router adds or subtracts bandwidth from the line. The default is 70% utilization. |
| *BoD sample time* | The number of seconds the router uses as a basis for establishing a history of line usage. The default is 30. |
| *BoD base link line speed* | The line speed in bits/sec for the base link of the MP bundle. The default is 64000, indicating the router is using a single 64 Kbps channel as the base link. |
| *BoD add link persistence* | Number of seconds the router waits after determining that the bandwidth threshold has been exceeded on the base link before adding a secondary link. The default is five seconds. |

| | |
|---|---|
| *BoD delete link persistence* | Number of seconds the router waits after determining that the bandwidth has fallen below the threshold on the base link. The default is ten seconds. |
| *Default destination address name* | The network dial address of the remote router to which the dial circuit will connect. |

**parameters**

Sets parameters for all Network Control Protocols.

Example: **set parameters**

```
Config tries  [20]?
NAK tries  [10]?
Terminate tries  [10]?
Retry timer (mSec)  [3000]?
```

### Clear M

Clear all statistics from point-to-point interfaces.

**Syntax:** clear

Example: **clear**

### Delete C

Delete local and remote identifiers and passwords. Delete affects only the interface that you are configuring.

**Syntax:** delete chap
pap

**chap**

Deletes remote CHAP identifiers and passwords (if they exist).

`Example:` **`delete chap`**

```
Delete Remote ID/Password 789/012? [Yes]:
```

**pap**

Deletes local PAP identifiers and passwords.

`Example:` **`delete pap`**

**Exit** **C M**

Returns to the `previous` prompt level.

**Syntax:** exit

`Example:` **`exit`**

## 7.3 PPP Interfaces and the GWCON Interface Command

While point-to-point interfaces have their own console processes for monitoring purposes, bridging routers also display complete statistics for installed network interfaces when you use the **interface** command from the GWCON environment.

`Example:` **`interface 2`**

```
                                 Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec      Passed     Failed       Failed
4  4   PPP/0     80002000   4C           0         10            0

  Point to Point MAC/data-link on Serial Line interface

  Level converter:          RS-232/V.35   Adapter cable:             V.35 DTE

   V.24 circuit: 105 106 107 108 109 125 141
   Nicknames:    RTS CTS DSR DTR DCD RI
   PUB 41450:    CA  CB  CC  CD  CF  CE
   State:        ON  ON  ON  ON  ON  OFF OFF

  Line speed:              unknown
  Last port reset:         1 minute, 11 seconds ago
```

```
Input frame errors:
   CRC error                0     alignment (byte length)       0
too short (< 2 bytes)       0     too long (>  2180 bytes)      0
aborted frame               0     DMA/FIFO overrun              0
Output frame counters:
  DMA/FIFO underrun errors   0   Output aborts sent             0
```

The following list describes the output:

| | |
|---|---|
| *Nt* | Indicates the serial line interface number. |
| *Nt'* | Indicates the serial line interface number. |
| *Interface* | Indicates the interface type and its instance number. |
| *CSR* | Indicates the command and status register addresses of base network. |
| *Vec* | Indicates the interrupt vector address. |
| *Self-Test Passed* | Indicates the number of self-tests that succeeded. |
| *Self-Test Failed* | Indicates the number of self-tests that failed. |
| *Maintenance Failed* | Indicates the number of maintenance failures. |
| *Adapter cable* | Indicates the type of adapter cable that the level converter is using. |
| *V.24 circuit* | Indicates the circuit numbers as identified by V.24 specifications. |
| *Nicknames* | Indicates the common names for the circuits. |
| *PUB 41450* | Indicates the PUB 41450 names for the circuits. |
| *State* | Indicates the current state of the circuits (ON or OFF). |
| *Line speed* | Indicates the transmit clock speed (approximate). |
| *Last port reset* | Indicates the length of time since the port was reset. |

*Input frame errors:*

| | |
|---|---|
| *CRC error* | Indicates the number of packets received that contained checksum errors and as a result were discarded. |
| *alignment (byte length)* | Indicates the number of packets received that were not an even multiple of 8 bits in length and as a result were discarded. |
| *too short (<2 bytes)* | Indicates the number of packets received that were less than 2 bytes in length and as a result were discarded. |
| *too long (>2180 bytes)* | Indicates the number of packets received that were greater than the configured frame size and as a result were discarded. |
| *aborted frame* | Indicates the number of packets received that were aborted by the sender or a line error. |

*Output frame counters:*

| | |
|---|---|
| *DMA/FIFO underrun errors* | Indicates the number of times the serial interface card did not retrieve data fast enough from the system packet buffer memory to transmit them onto the network. |
| *Output aborts sent* | Indicates the number of transmissions that were aborted as requested by upper-level software. |

Example: **+ interface 1**

```
                                    Self-Test  Self-Test  Maintenance
Nt Nt' Interface       CSR  Vec     Passed     Failed       Failed
1  1   PPP/0      1001620   5D           1        705            0

  Point to Point MAC/data-link on SCC Serial Line interface

  Adapter cable:          V.35 DTE  RISC Microcode Revision:           2

   V.24 circuit: 105 106 107 108 109 125 141
   Nicknames:    RTS CTS DSR DTR DCD RI  LL
   PUB 41450:    CA  CB  CC  CD  CF  CE
```

```
 State:        ON  ON  ON  ON  ON  OFF OFF

Line speed:              unknown
Last port reset:         18 minutes, 19 seconds ago

Input frame errors:
 CRC error                     0   alignment (byte length)           2
 missed frame                  0   too long (>  2182 bytes)          0
 aborted frame                 0   DMA/FIFO overrun                  0
 L & F bits not set            0
Output frame counters:
 DMA/FIFO underrun errors      0   Output aborts sent                0
```

## 7.4 Multilink Protocol Examples

This section includes two examples for configuring the Multilink Protocol. The first example shows you how to configure a dial circuit; the second example shows you how to configure Multilink over a leased line with a V.25 *bis* secondary link.

### 7.4.1 Configuring an MP Bundle (Dial Circuit)

This section provides an example of how to configure a Multilink Protocol dial circuit. You configure dial circuits from the `Circuit Config>` prompt. To display the `Circuit Config>` prompt, use the **network** command followed by the interface number of the dial circuit. You can use the **list dev** command at the `Config>` prompt to display a list of the dial circuits that you added.

Use these hints to help get a working configuration for the MP/BoD bundle:

- Configure the MP bundle so that only one router of a connected pair originates the calls.
- Since the BoD code monitors data transmissions over the bundle, configure the router with the heavier expected transmission load to dial via the dial circuit and configuration commands.
- If you use a leased line as the base link, make sure you accurately enter the line speed in the BoD base link line speed parameter in the set mp command.

The following is an example for configuring a Multilink dial circuit:

Example: **Config>list dev**

```
ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
ifc 1 (WAN MP): CSR 1001620, CSR2 1000D00, vector 93
ifc 2 (ISDN): CSR 1001640, CSR2 1000E00, vector 92

Config>add-ISDN-ADDRESS
Assign address name [1-23] chars []? 8842008
Assign network dial address [1-15 digits] []? 8842008
Assign network subdial address [0-20] digits []?

Config>list ISDN-ADDRESS
Address assigned name             Network Address  Network Subaddress

44444                             44444
98842007                          98842007
98842008                          98842008
8842007                           8842007
5551212                           5551212
8842008                           8842008

Config>add device dial-circuit
Adding device as interface 3
Defaulting Data-link protocol to PPP
Use ”net 3” command to configure circuit parameters

Config>set DATA-LINK ?
PROTEON
FRAME-RELAY
MULTILINK-PPP
PPP
SDLC
SRLY
V25BIS
X25
Config>set DATA-LINK MULTILINK-PPP
Interface Number [0]? 3
Config>list dev
ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
ifc 1 (WAN MP): CSR 1001620, CSR2 1000D00, vector 93
ifc 2 (ISDN): CSR 1001640, CSR2 1000E00, vector 92
ifc 3 (MP Dial Circuit): CSR   0, vector 0

Config>network 3
Circuit configuration
```

```
Circuit Config>list
Base net:            2
Destination name:    98842008
Inbound dst name:    ANY
Outbound calls       allowed
Inbound calls        allowed
Idle timer           = 60 sec
SelfTest Delay Timer = 0 ms
Send Line ID:        NO

Circuit Config>set ?
NET
CALLS
DESTINATION
INBOUND Destination
ANY_INBOUND
IDLE
SELFTEST-DELAY
SEND_LINE_ID

Circuit Config>
Send Line ID? (Yes, No): [No]
Circuit Config>
```

**Note:** After you issue the **encapsulator** command that follows, the session displays the `MP Config` prompt. `MP Config` is the same as `PPP Config`, except that you can configure multiple links.

```
Circuit Config>encapsulator
Multilink PPP Protocol user configuration

MP Config>?
LIST
SET
LINK
DELETE
EXIT

MP Config>list ?
ALL
LCP
IPCP
BNCP
CCP
MP
PARAMETERS
AUTHENTICATION

MP Config>list all
```

```
LCP Parameters
--------------
Config Request Tries:     20   Config Nak Tries:   10
Terminate Tries:          10   Retry Timer:        3000

LCP Options
-----------
Max Receive Unit:                 2048   Magic Number: Yes
Password Authentication:            No

PAP Parameters
--------------
Authent Request Tries:              20
Retry Timer:                      3000
Request Timer:                   15000

PAP Ids/Passwords
-----------------
Local ID:                       (None)
Local Password:                 (None)

Remote ID:                      (None)
Remote Password:                (None)

MP Options
--------------
Base Links:                          1
Max Links:                           2
BoD threshold:                      70
BoD sample time:                    30
BoD base link line speed:        64000
BoD add link persistence:            5
BoD delete link persistence:        10
Default destination address name:

NCP Parameters
---------------
Config Request Tries:     20   Config Nak Tries:   10
Terminate Tries:          10   Retry Timer:        3000

IPCP Options
------------
IPCP Compression:                 None
IP Address:      Don’t Send or Request
```

```
CCP Options
-----------
Data Compression enabled
Algorithm: Stac-LZS
Stac: histories 1
Stac: check_mode SEQ

MP Config>list mp

MP Options
--------------
Base Links:                        1
Max Links:                         2
BoD threshold:                     3
BoD sample time:                  30
BoD base link line speed:      64000
BoD add link persistence:          5
BoD delete link persistence:      10
Default destination address name:    98842008

MP Config>link
Link 301 (MP Dial Circuit): CSR   0, vector 0

MP Config>link 301
Link configuration

Link Config>?
DELETE
LIST
SET
EXIT


Link Config>list all

Base net:             2
Destination name:     98842008
Inbound dst name:     * ANY *
Outbound calls        allowed
Inbound calls         allowed
SelfTest Delay Timer = 150 ms
Send Line ID:         NO
```

```
Link Config>exit

MP Config>set mp
Base Links  [1]?
Max Links  [2]?
BoD threshold:  [70]?
BoD sample time  [30]?
BoD base link line speed  [64000]?
BoD add link persistence  [5]?
BoD delete link persistence  [10]?
Assign default destination address name []? 98842008
```
(remote ISDN address)

```
MP Config>
```

### 7.4.2 Configuring MP with a V.25*bis* Secondary Link

This example shows you how to configure Multilink Protocol as a leased line with a V.25*bis* secondary link. In this example, configure interface 1 (Ifc 1) as the V.25*bis* base network, and interface 2 (Ifc 2) as a leased line running PPP Multilink.

Refer to Chapter 11, "Configuring and Monitoring the V.25*bis* Network Interface" for information about configuring a V.25*bis* network interface.

```
*t 6
Gateway user configuration
Config>list dev
Ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
Ifc 1 (WAN V.25bis): CSR 1001620, CSR2 1000D00, vector 93
Ifc 2 (WAN PPP): CSR 1001640, CSR2 1000E00, vector 92


Config>add V25-BIS-ADDRESS
Assign address name [1-23] chars []? 5551214
Assign network dial address [1-30 digits] []? 5551214


Config>set data-link multilink
Interface Number [0]? 2
Config>net 2
```

```
PPP Multilink Protocol user configuration
MP Config>set mp
Base Links  [1]?
Max Links  [1]? 2
BoD threshold:  [70]?
BoD sample time  [30]?
BoD base link line speed  [64000]? 56000
BoD add link persistence  [5]?
BoD delete link persistence  [10]?
Assign default destination address name []? 5551214

MP Config>link 201
Link configuration
Link Config>list all


Base net:            0
Destination name:
Outbound calls       allowed
Inbound calls        allowed
SelfTest Delay Timer = 150 ms
Send Line ID:        NO


Link Config>set net 1
Link Config>set dest 5551214
Link Config>list all


Base net:            1
Destination name:    5551214
Outbound calls       allowed
Inbound calls        allowed
SelfTest Delay Timer = 150 ms
Send Line ID:        NO


Link Config>exit
MP Config>list mp


MP Options
--------------
Base Links:                          1
Max Links:                           2
BoD threshold:                      70
BoD sample time:                    30
BoD base link line speed:        56000
BoD add link persistence:            5
BoD delete link persistence:        10
Default destination address name:   5551214
```

```
MP Config>ex
Config>list dev
Ifc 0 (Ethernet): CSR 1001600, CSR2 1000C00, vector 94
Ifc 1 (WAN V.25bis): CSR 1001620, CSR2 1000D00, vector 93
Ifc 2 (WAN MP): CSR 1001640, CSR2 1000E00, vector 92
```

# 8

# Configuring and Monitoring PPP over Frame Relay Pseudo Interfaces

This chapter describes how to configure and monitor the Point-to-Point Protocol over Frame Relay (PPP-FR) pseudo-interfaces in the router.

For more information about PPP-FR and Frame Relay interfaces and configurations, refer to the *Routing Protocols Reference Guide*.

## 8.1 Accessing the Interface Configuration and Console Processes

Follow the procedure described in Chapter 1 to access the configuration and console processes for the interface described in this chapter.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `PPP-FR Config>` prompt.

Enter console (monitoring) commands at the `PPP-FR>` prompt.

## 8.2 Configuration Procedures

This section describes how to configure your router for Point-to-Point Protocol over Frame Relay. Specifically, the tasks you need to perform are:

1. Setting up a frame relay interface
2. Adding a PPP-FR pseudo interface
3. Configuring the PPP-FR pseudo interface to use a specific PVC on the frame relay interface

The rest of this section describes tasks 1 through 3. To configure a PPP-FR pseudo interface, use the PPP-FR configuration commands described in this chapter.

**Note:** You must restart the router for changes to the PPP-FR configuration to take effect.

### 8.2.1 Adding a Frame Relay Interface

Follow the procedure described in Chapter 1 to add and configure a frame relay interface.

### 8.2.2 Adding PPP-FR Pseudo Interfaces

PPP-FR pseudo interfaces are mapped to permanent virtual circuits over a frame relay interface. You can map multiple PPP-FR pseudo interfaces to one frame relay interface, but each has its own PVC. The DEC RouteAbout 90 supports a maximum of 8 PPP-FR pseudo interfaces, and the DEC RouteAbout 900 can support up to 32.

To add a PPP-FR pseudo device, use the **add device ppp-fr** command from the `Config>` process. The software assigns an interface number to each PPP-FR pseudo interface. You will use this number to configure the PPP-FR pseudo interface.

```
Example:  Config>add device ppp-fr
Adding device as interface 3
```

### 8.2.3 Configuring PPP-FR Pseudo Interface Parameters

You configure PPP-FR pseudo interfaces from the `PPP-FR Config>` process. To enter the PPP-FR `Config>` process, use the **network** command followed by the interface number of the PPP-FR pseudo interface. You can use the **list dev** command at the `Config>` prompt to display a list of the PPP-FR pseudo interfaces that you added.

```
Example:  Config>network 3

   PPP-FR configuration
   PPP-FR Config>
```

Use the PPP-FR configuration commands described in the next section to configure the PPP-FR pseudo device.

## 8.3 PPP-FR Configuration and Console Commands

Table 8–1 summarizes the commands for configuring PPP-FR pseudo interfaces. The sections that follow explain these commands. Enter configuration commands at the `PPP-FR config>` prompt. Enter console commands at the `PPP-FR>` prompt.

**Table 8–1 PPP-FR Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/ Monitor | Displays all the PPP-FR commands or lists the options for specific commands. |
| **List** | Configure/ Monitor | Lists all information related to the interface protocols, parameters, options, and statistics. |
| **Set** | Configure | Sets LCP options and parameters, IPCP options, BNCP options, PAP parameters, PAP IDs/passwords, CHAP parameters, CHAP IDs/passwords, and NCP and CCP parameters. |
| **Clear** | Monitor | Clears all statistics from PPP-FR interfaces. |
| **Delete** | Configure | Deletes local and remote identifiers and passwords. |
| **Exit** | Configure | Exits the PPP-FR configuration process and returns to the previous prompt level. |

### Help (?) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
LIST
SET
EXIT
```

Example: **list ?**

```
ALL
LCP
IPCP
BNCP
CCP
PARAMETERS
AUTHENTICATION
FRAME-RELAY
```

### List C

Display information related to the point-to-point interface and its protocol parameters and options.

**Syntax:** list all
authentication
bncp
ccp
frame-relay
ipcp
lcp
parameters

**all**

Lists all options and parameters related to the point-to-point interface.

**Note:** This example shows all possible options and parameters.

Example: **list all**

```
LCP Parameters
---------------
Config Request Tries:      20   Config Nak Tries:  10
Terminate Tries:           10   Retry Timer:       3000

LCP Options
-----------
Max Receive Unit:          2048   Magic Number:    Yes
Authentication:            none

PAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Author Timer        5
```

```
PAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none

CHAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Authent Timer       5

CHAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none

NCP Parameters
---------------
Config Request Tries:    20   Config Nak Tries:  10
Terminate Tries:         10   Retry Timer:       3000


IPCP Options
------------
IPCP Compression:        None
IP Address:              Send, Request

PPP Over Frame Relay Parameters
--------------------------------
Frame Relay interface number:          2
Frame Relay PVC DLCI number:         100

CCP Options
-----------
Data Compression: enabled
Algorithm: Stac-LZS
Stac: histories 1
Stac: check_mode SEQ
```

This section explains the information displayed by the **list all** command.

*LCP Parameters*

| | |
|---|---|
| *Config Request Tries* | Number of times LCP sends *configure-request* packets to a peer station while attempting to open a PPP-FR link. |
| *Terminate Tries* | Number of times LCP sends *terminate-request* packets to a peer station to close a PPP-FR link. |
| *Config Nak Tries* | Number of times LCP sends c*onfigure-nak* (nak=not acknowledged) packets to a peer station while attempting to open a PPP-FR link. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before LCP attempts to authenticate the remote station again. |

*LCP Options*

| | |
|---|---|
| *Max Receive Unit* | Maximum packet size that the link handles. |
| *Magic Number* | Indicates whether the “magic number” loopback detection option was enabled or disabled. |
| *Authentication* | Indicates the type of authentication [none, pap, chap, or either]. |

*PAP Parameters*

| | |
|---|---|
| *Authentication Request Tries* | Number of times PAP sends *authentication request* packets to a peer station while attempting to authenticate the remote station. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before PAP attempts to authenticate the remote station again. |
| *Request Timer* | Amount of time, in milliseconds, that elapses before PAP assumes that an authentication request is considered to have failed and PAP terminates the link. |

*PAP Ids/ Passwords*

| | |
|---|---|
| *Local ID* | A text string that specifies the identifier of the local station. PAP sends this string to the remote station to identify itself. |
| *Local Password* | A text string that specifies the password of the local station. PAP sends this string to the remote station to authenticate its identifier. |
| *Remote ID* | A text string that specifies the identifier of the remote station. When PAP receives an identifier string from the remote station, it compares the received string with this string. A mismatch results in authentication failure. |
| *Remote Password* | A text string that specifies the password of the local station. When PAP receives a password string from the remote station, it compares the received string with this string. A mismatch results in authentication failure. |

*CHAP Parameters*

| | |
|---|---|
| *Authentication Request Tries* | Number of times CHAP sends *authentication request* packets to a peer station while attempting to authenticate the remote station. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before CHAP attempts to authenticate the remote station again. |
| *Request Timer* | Amount of time, in milliseconds, that elapses before CHAP assumes that an authentication request is considered to have failed and CHAP terminates the link. |
| *Repeat Authentication Timer* | Amount of time, in minutes, that elapses before CHAP repeats authentication. The default is zero (no repeat authentication). |

*CHAP Ids/ Passwords*

| | |
|---|---|
| *Local ID* | A text string that specifies the identifier of the local station. CHAP sends this string to the remote station to identify itself. |
| *Local Password* | A text string that specifies the password of the local station. CHAP compares the peer reply message to this string to authenticate the identifier. |
| *Remote ID* | A text string that specifies the identifier of the remote station. |
| *Remote Password* | A text string that specifies the password of the remote station. When CHAP receives a challenge from the authenticating station, it generates a reply based on the string. |
| *Default destination address name* | The network dial address of the remote router to which the dial circuit will connect. |

*NCP Parameters*

| | |
|---|---|
| *Config Request Tries* | Number of times NCP sends *configure-request* packets to a peer station while attempting to open a PPP-FR link. |
| *Terminate Tries* | Number of times NCP sends *terminate-request* packets to a peer station to close a PPP-FR link. |
| *Config Nak Tries* | Number of times NCP sends c*onfigure-nak* (nak=not acknowledged) packets to a peer station while attempting to open a PPP-FR link. |
| *Retry Timer* | Amount of time, in milliseconds, that elapses before LCP's transmission of *configure-request* (to open the link) and *terminate-request* (to close the link) packets times out. Expiration of this timer causes a "timeout" and the halting of *configure-request* and *terminate-request* packet transmission. |

*IPCP Options*

| | |
|---|---|
| *IPCP Compression* | Displays whether or not the PPP-FR handler accepts compressed data. PPP-FR supports Van Jacobson Compressed TCP/IP. Enable this option when the point-to-point link is running at a low baud rate. |
| *IP Address* | Displays whether or not IPCP is configured to send the local IP address to the remote end of the link. Also displays whether or not IPCP is configured to request the IP address from the remote end of the link. |

*PPP Over Frame Relay Parameters*

| | |
|---|---|
| *Frame Relay Interface Number* | Indicates the interface number of the Frame Relay device that the PPP-FR device is using. |
| *Frame Relay PVC DLCI Number* | Indicates the circuit number of the Frame Relay PVC that the PPP-FR device is using. |

*CCP Options*

| | |
|---|---|
| *Data Compression* | Indicates whether the data compression option has been enabled or disabled. |
| *Algorithm* | Identifies the data compression algorithm that is in use. CCP currently uses Stac-LZS compression. |
| *Stac: histories* | Indicates the number of compression histories that CCP can keep track of. CCP is currently limited to 1 history. |
| *Stac: check_mode* | Indicates the form of data checking that is in use. CCP uses sequence number checking (SEQ), to ensure that compressed packets arrive in the correct order. |

### authentication

Both CHAP (Challenge Handshake Authentication Protocol) and PAP (Password Authentication Protocol) are authentication protocols for PPP-FR interfaces. Local and remote authentication can be set to CHAP, PAP, either, or none. You can configure authentication parameters for both CHAP and PAP, including request attempts and timers used by the corresponding protocol. Enter the command at the `PPP-FR config>` prompt.

These fields are described under the **list all** command.

Example: **`list authentication`**

```
PAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Author Timer        5

PAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none

CHAP Parameters
--------------
Authent Request Tries:     20
Retry Timer:               3000
Request Timer:             15000
Repeat Authent Timer       5


CHAP Ids/Passwords
-----------------
Local ID:                  none
Local Password:            none

Remote ID:                 none
Remote Password:           none
```

### bncp

Lists the Bridging Network Control Protocol options.

Example: **list bncp**

```
BNCP Options
------------
Tinygram Compression: DISABLED
```

*BNCP Options*

| | |
|---|---|
| *Tinygram Compression* | Indicates whether BNCP Tinygram compression is enabled or disabled. |

#### ccp

Lists parameters and options for the Compression Control Protocol. These fields are described under the **list all** command.

Example: **list ccp**

```
CCP Options
-----------
Data Compression enabled
Algorithm: Stac-LZS
Stac: histories 1
Stac: check_mode SEQ
```

#### ipcp

Lists the Internet Protocol control protocol options. These fields are described under the **list all** command.

Example: **list ipcp**

```
IPCP Options
------------
IPCP Compression:  None
IP Address:        Don’t Send or Request
```

#### lcp

Lists parameters and options for the Link Control Protocol. These fields are described under the **list all** command.

Example: **list lcp**

```
LCP Parameters
--------------
Config Request Tries:       20   Config Nak Tries:     10
Terminate Tries:            10   Retry Timer:        3000

LCP Options
-----------
Max Receive Unit:          2048   Magic Number:        Yes
Authentication Protocol:   none                        Yes
```

#### parameters

Lists parameters for all Network Control Protocols. These parameters are described under the **list all** command.

Example: **list parameters**

```
NCP Parameters
---------------
Config Request Tries:    20   Config Nak Tries:   10
Terminate Tries:         10   Retry Timer:        3000
```

#### frame-relay

Lists parameters related to the frame relay interface and permanent virtual circuit which are associated with this PPP-FR pseudo interface. These fields are described under the **list all** command.

Example: **list frame-relay**

```
PPP Over Frame Relay Parameters
--------------------------------
Frame Relay interface number:          2
Frame Relay PVC DLCI number:         100
```

### List M

Display information and counters related to the point-to-point interface and PPP-FR parameters and options. The **list all** command displays all information related to PPP-FR. You can display specific groups of information by listing the information for that group only.

**Syntax:** list
all
ap2
atcp
bncp
control . . .
dn
dncp
errors
frame-relay
ip
ipcp
ipx
ipxcp
lcp
osi
osicp
pap
chap
ccp
compression

**all**

Lists all information and counters related to the point-to-point interface and PPP-FR options and parameters. While the output displayed is shown following the command example that follows, specific fields are defined under the **list** command that displays that specific statistical group. For example, Error Type fields are explained under the **list error** command.

Example: **list all**

```
Version:              1
LCP State:            Req Sent
Previous State:       Listen
Time Since Change:    18 seconds

LCP Option            Local              Remote
----------            -----              ------
Max Receive Unit:     2048               1500
Async Char Mask:      FFFFFFFF           FFFFFFFF
Authentication:       None               None
Magic Number:         8F202AE1           None
Protocol Compr:       No                 No
Addr/Cntl Compr:      No                 No
32-Bit Checksum:      No                 No

PAP State:            Closed
Previous State:       Closed
Time Since Change:    53 minutes and 30 seconds

PAP Ids/Passwords
-----------------
Local ID:             FOO
Local Password:       BAR

Remote ID:            FOO
Remote Password:      BAR

CHAP State:           Closed
Previous State:       Closed
Time Since Change:    53 minutes and 30 seconds

CHAP Ids/Passwords
-----------------
Local ID:             FOO
Local Password:       BAR

Remote ID:            FOO
Remote Password:      BAR

IPCP State:           Open
Previous State:       Ack Sent
Time Since Change:    2 hours, 15 minutes and 53 seconds

IPCP Option           Local             Remote
-----------           -----             ------
IP Address            128.189.209.20    None
Compression Slots     None              None
DNCP State:           Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 55 seconds
```

```
IPXCP State:          Open
Previous State:       Request Sent
Time Since Change:    3 hours, 15 minutes and 55 seconds
BNCP State:           Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 56 seconds

BNCP Option           Local              Remote
-----------           -----              ------
Tinygram Compression  DISABLED           DISABLED

Source-route Info:
Remote side does not support source-route bridging

ATCP State:           Open
Previous State:       Request Sent
Time Since Change:    5 hours, 15 minutes and 57 seconds
AppleTalk Address Info:
Common network number = 12
Local node ID = 49
Remote node ID = 86

OSICP State:          Closed
Previous State:       Closed
Time Since Change:    5 hours, 15 minutes and 58 seconds

LCP Statistic         In                Out
-------------         --                ---
Packets:              226               2880
Octets:               6780             40320
Cfg Req:              0                 2880
Cfg Ack:              0                 0
Cfg Nak:              0                 0
Cfg Rej:              0                 0
Term Req:             0                 0
Term Ack:             0                 0
Echo Req:             113               113
Echo Resp:            113               113
Disc Req:             0                 0
Code Rej:             0                 0


PAP Statistic         In                  Out
-------------         --                  ---
Packets:              0                   0
Octets:               0                   0
Auth Req:             0                   0
Auth Ack:             0                   0
Auth Nak:             0                   0
```

```
CHAP Statistic       In                 Out
-------------        --                 ---
Packets:             0                  0
Octets:              0                  0
Auth Challenge:      0                  0
Auth Resp:           0                  0
Auth Success:        0                  0
Auth Failure:        0                  0

IPCP Statistic       In                 Out
--------------       --                 ---
Packets:             5                  0
Octets:              100                170
Prot Rejects:        0                  -

IP Statistic         In                 Out
------------         --                 ---
Packets:             3456               3456
Octets:              27648              27648
Prot Rejects:        0                  -

CCP State:                Open
Previous State:           Ack Sent
Time Since Change:        10 minutes and 19 seconds
Local (transmit) compressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ

Remote (receive) decompressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ
 CCP State:                Open
Previous State:           Ack Sent
Time Since Change:        10 minutes and 19 seconds

CCP Statistic             In                         Out
-------------             --                         ---
Packets:                  2                          2
Octets:                   18                         18
Reset Reqs:               0                          0
Reset Acks:               0                          0
Prot Rejects:             0                          -
Max size of transmit compression dictionary: 20368
Local (transmit) compressor: Stac-LZS
Local (transmit) compressor statistics:
    Recent compression ratio: 1.3:1
Size of receive decompression dictionary: 4152
Remote (receive) compressor: Stac-LZS
Remote (receive) decompressor statistics:
    Recent compression ratio: 1.4:1
```

```
Compression Statistic      In                         Out
---------------------      --                         ---
Packets:                   1                          1
Octets:                    54             56
Compressed Octets:         38             39
Incompressible Packets:    0               0
Discarded Packets:         0               0
Prot Rejects:                              -

DNCP Statistic        In                  Out
--------------        --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

DN Statistic          In                  Out
------------          --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

IPXCP Statistic       In                  Out
---------------       --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

IPX Statistic         In                  Out
---------------       --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -
BNCP Statistic        In                  Out
---------------       --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

ATCP Statistic        In                  Out
---------------       --                  ---
Packets:              349                 351
Octets:               128488              129412
Prot Rejects:         0                   -

AP2 Statistic         In                  Out
-------------         --                  ---
Packets:              349                 351
Octets:               128488              129412
Prot Rejects:         0                   -
```

```
OSICP Statistic       In                  Out
---------------       --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

OSI Statistic         In                  Out
-------------         --                  ---
Packets:              0                   0
Octets:               0                   0
Prot Rejects:         0                   -

Error Type            Count               Last One
----------            -----               --------
Bad Address:          0                   0
Bad Control:          0                   0
Unknown Protocol:     0                   0
Invalid Protocol:     0                   0
Config Timeouts:      145                 -
Terminate Timeouts:   0                   -

Frame Relay PVC Statistics
--------------------------

Frame Relay Interface Number: 2
                                                             Frames        Frames
 Circuit#        Circuit Name         State       Transmitted    Received
 --------   ---------------------  ------------  ----------   ----------
    100     PPP Circuit               Active         2380503        71717
```

**ap2**

Lists AppleTalk Phase 2 statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ap2**

```
AP2 Statistic        In         Out
------------         --         ---
Packets:             349        351
Octets:              128488     129412
Prot Rejects:        0
```

**atcp**

Lists statistics for the AppleTalk Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list atcp**

```
ATCP Statistic          In      Out
---------------         --      ---
Packets:                0        0
Octets:                 0        0
Prot Rejects:           0        -
```

**bncp**

Lists statistics for the Bridging Network Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list bncp**

```
BNCP Statistic          In                   Out
---------------         --                   ---
Packets:                0                    0
Octets:                 0                    0
Prot Rejects:           0                    -
```

**ccp**

Lists statistics for the Compression Control Protocol.

Example: **list ccp**

```
CCP Statistic             In                         Out
-------------             --                         ---
Packets:                  2                          2
Octets:                   18                         18
Reset Reqs:               0                          0
Reset Acks:               0                          0
Prot Rejects:             0                          -
Max size of transmit compression dictionary: 20368
Local (transmit) compressor: Stac-LZS
Local (transmit) compressor statistics:
    Recent compression ratio: 1.3:1
Size of receive decompression dictionary: 4152
Remote (receive) compressor: Stac-LZS
Remote (receive) decompressor statistics:
    Recent compression ratio: 1.4:1
```

*CCP Statistic*

| | |
|---|---|
| *Packets* | Displays the total number of CCP control packets transmitted (out) and received (in) over the current point-to-point interface. |
| *Octets* | Displays the total number of bytes (in octets) of data in the CCP control packets transmitted and received over the current point-to-point interface. |
| *Reset Reqs* | Displays the total number of reset request packets transmitted and received over the current point-to-point interface. CCP issues a Reset Request when a compressed packet is lost. |
| *Reset Acks* | Displays the total number of reset acknowledgement packets transmitted and received over the current point-to-point interface. CCP issues a Reset Acknowledgement in response to a Reset request. The sequence numbers are then reset. Intervening packets are lost. |
| *Prot Rejects* | Displays the total number of protocol-reject packets transmitted and received over the current point-to-point interface. |
| *Max size of transmit compression dictionary* | Memory allocated to the compressor for maintaining transmitted data compression history. |

| | |
|---|---|
| *Local (transmit) compressor* | The algorithm being used for data compression. CCP currently only uses Stac-LZS data compression. |
| *Local (transmit) compressor statistics* | The compression ratio that has been observed in the recent sequence of packets. The ratio is calculated by comparing the number of compressed octets transmitted to the original number of octets to be transmitted. |

| | |
|---|---|
| *Size of receive decompression dictionary* | Memory allocated to the decompressor for maintaining received data compression history. |
| *Remote (receive) compressor* | The algorithm being used for data decompression. CCP currently only uses Stac-LZS data decompression. |
| *Remote (receive) decompressor statistics* | The compression ratio that has been observed in the recent sequence of packets. The ratio is calculated by comparing the number of compressed octets received to the number of decompressed octets. |

#### chap

Lists statistics for the Challenge Handshake Authentication Protocol (CHAP).

Example: **list chap**

```
CHAP Statistic      In          Out
-------------       --          ---
Packets:            0           0
Octets:             0           0
Auth Req:           0           0
Auth Ack:           0           0
Auth Nak:           0           0
```

*CHAP Statistic*

| | |
|---|---|
| *Packets* | Displays the total number of CHAP packets transmitted (out) and received (in) over the current point-to-point interface. |
| *Octets* | Displays the total number of bytes of CHAP data, in octets, transmitted and received over the current point-to-point interface. |
| *Auth Req* | Displays the total number of authentication packets transmitted and received over the current point-to-point interface. |

*Auth Ack* Displays the total number of acknowledgement packets transmitted and received over the current point-to-point interface.

*Auth Nak* Displays the total number of negative acknowledgement packets transmitted and received over the current point-to-point interface.

**compression**

Lists statistics for the compressed packets that have been exchanged.

Example: **list compression**

```
Compression Statistic      In                          Out
---------------------      --                          ---
Packets:                   1                           1
Octets:                    54                          56
Compressed Octets:         38                          39
Incompressible Packets:    0                           0
Discarded Packets:         0                           0
Prot Rejects:              0                           -
```

*Compression Statistic*

*Packets* Displays the total number of compressed packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes (in octets) of data before being compressed for transmission and after being decompressed when received over the current point-to-point interface.

*Compressed Octets* Displays the total number of bytes (in octets) of compressed data in the packets transmitted and received over the current point-to-point interface.

*Incompressible Packets* Displays the total number of packets that could not be compressed. If data that has already been compressed is being transmitted, then compression can actually make the data grow. If the packet size exceeds the Max Receive Unit for the LCP, then CCP sends the data uncompressed.

If this counter increases, no data is lost, but performance is reduced because of the Reset Requests.

*Discarded Packets* Displays the total number of bytes (in octets) of discarded packets transmitted and received over the current point-to-point interface.

*Prot Rejects* Displays the total number of *protocol-reject* packets transmitted and received over the current point-to-point interface.

**control** **lcp**
**pap**
**chap**
**ipcp**
**dncp**
**ipxcp**
**bncp**
**atcp**
**osicp**
**ccp**

Lists information and counters related to the specified control protocol.

Example: **list control atcp**

```
ATCP State:            Closed
Previous State:        Closed
Time Since Change:     6 hours, 27 minutes and 7 seconds
AppleTalk Address Info:
Common network number = 12
Local node ID = 49
Remote node ID = 76
```

The ATCP State fields are the same as those described under the **list control lcp** command.

*AppleTalk Address Info*

| | |
|---|---|
| *Common network number* | Displays the network number of the two ends of the point-to-point link. (You must statically configure both ends of the link to have the same network number.) |
| *Local node ID* | Displays the unique node number of the local end of the link. |
| *Remote node ID* | Displays the unique node number of the remote end of the link. |

Example: **list control bncp**

```
BNCP State:            Closed
Previous State:        Closed
Time Since Change:     5 hours, 25 minutes and 3 seconds

BNCP Option            Local                    Remote
-----------            -----                    ------
Tinygram Compression   DISABLED                 DISABLED
Source-route Info:
Remote side does not support source-route bridging
```

The BNCP State fields are the same as those described under the **list control lcp** command.

*BNCP Option*

| | |
|---|---|
| *Tinygram Compression* | Displays whether or not Tinygram Compression is enabled or disabled on the local and remote ends of the link. |
| *Source-route Info* | Displays whether or not source route bridging is enabled for the local and remote ports that correspond to this interface. |

Example: **list control ccp**

```
CCP State:                 Open
Previous State:            Ack Sent
Time Since Change:         10 minutes and 19 seconds

Local (transmit) compressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ

Remote (receive) decompressor: Stac-LZS
    Negotiated histories: 1
    Negotiated check mode: SEQ
```

The CCP State fields are the same as those described under the **list control lcp** command.

*Local (transmit) compressor* The algorithm being used for data compression. CCP currently only uses Stac-LZS data compression.

*Negotiated histories* The number of Stac-LZS data compression histories that CCP can keep track of at any one time. CCP currently supports only 1 history per PPP-FR link.

*Negotiated check mode* The data validation method in use by CCP. CCP adds a sequence number (SEQ) to each packet to ensure that compressed packets arrive in the correct order.

*Remote (receive) decompressor* The algorithm being used for data decompression. CCP currently supports only Stac-LZS data decompression.

*Negotiated histories* The number of Stac-LZS data decompression histories that CCP can keep track of at any one time. CCP currently supports only 1 history per PPP-FR link.

*Negotiated check mode* The data validation method in use by CCP. CCP checks the sequence number (SEQ) of each received packet to ensure that compressed packets arrive in the correct order.

Example: **list control chap**

```
State:              Closed
Previous State:     Closed
Time Since Change:  53 minutes and 30 seconds

CHAP Ids/Passwords
-----------------
Local ID:           FOO
Local Password:     BAR

Remote ID:          FOO
Remote Password:    BAR
```

*State*
Displays the current state of the authentication protocol. These states include the following:

- **Closed** – Indicates that the link is down and there is no attempt being made to open it. This state indicates that authentication is not in progress.
- **Closing** – Indicates that authentication has failed and the link is in the termination process.
- **Listen** – Indicates that the local station is waiting for an authentication challenge from the remote station.
- **Challenge Sent** – The local station has sent a challenge and is waiting for a response.
- **Response Sent** – The local station has sent a response and is waiting for a success/failure.
- **Success Sent** – The local station has verified authentication.
- **Success Received** The local station has received verification.
- **Opened** – Authentication is complete and link establishment is proceeding.

*Previous State*
Displays the state of the protocol prior to the state displayed in the State field. These states are the same as those described in CHAP *State* above.

*Time Since Change* — Displays the amount of time the link is in the present state.

*CHAP Ids/Passwords*

*Local ID* — A text string that specifies the identifier of the local station. CHAP sends this string to the remote station to identify itself.

*Local Password* — A text string that specifies the password of the local station. CHAP compares the peer reply message to this string to authenticate the identifier.

*Remote ID* — A text string that specifies the identifier of the remote station.

*Remote Password* — A text string that specifies the password of the remote station. When CHAP receives a challenge from the authenticating station, it generates a reply based on the string.

Example: **list control dncp**

```
DNCP State:           Closed
Previous State:       Closed
Time Since Change:    6 hours, 23 minutes and 37 seconds
```

The DNCP State fields are the same as those described under the **list control lcp** command.

Example: **list control ipcp**

```
IPCP State:                Listen
Previous State:            Closed
Time Since Change:         20 seconds

IPCP Option                Local             Remote
-----------                -----             ------
IP Address                 128.189.209.20    None
Compression Slots          None              None
```

The IPCP State fields are the same as those described under the **list control lcp** command.

*IPCP Option*

| | |
|---|---|
| *IPCP Address* | The IP address of the local and remote ends of the link, if available. |
| *Compression Slots* | The number IP headers saved for reference to determine the type of compression that is enabled. |

Example: **list control ipxcp**

```
IPXCP State:          Closed
Previous State:       Closed
Time Since Change:    2 hours, 9 minutes and 2 seconds
```

The IPXCP State fields are the same as those described under the **list control lcp** command.

Example: **list control lcp**

```
LCP State:                 Listen
Previous State:            Req Sent
Time Since Change:         8 seconds

LCP Option           Local                      Remote
----------           -----                      ------
Max Receive Unit:    2048                       1500
Async Char Mask:     FFFFFFFF                   FFFFFFFF
Authentication:      None                       None
Magic Number:        B87DA37F                   None
Protocol Compr:      No                         No
Addr/Cntl Compr:     No                         No
32-Bit Checksum:     No                         No
```

*LCP State* Displays the current state of the point-to-point link. These states include the following:

- **Open** – Indicates that a connection was made and data can be sent. The retry timer does not run in this state.
- **Closed** – Indicates that the link is down and there is no attempt being made to open it. In this state, all connection requests from peers are rejected.
- **Listen** – Indicates that the link is down and there is no attempt being made to open it. In contrast to the CLOSED state, all connection requests from peers are accepted.
- **Request–Sent** – Indicates that an active attempt is being made to open the link. A *configure-request* packet was sent but a *configure-ack* was not yet received nor was one sent. The retry timer is running at this time.
- **Ack–Received** – Indicates that a *configure-request* packet was sent and a *configure-ack* packet was received. The retry timer is still running since a *configure–ack* packet was not transmitted.
- **Ack–Sent** – Indicates that a *configure-ack* packet and a *configure-request* packet were sent but a *configure-ack* packet was not received. The retry timer always runs in this state.
- **Closing** – Indicates that an attempt is being made to close the connection. A *terminate-request* packet was sent but a *terminate-ack* packet was not received. The retry timer is running in this state.

*Previous State* Displays the state of the point-to-point link prior to the state displayed in the LCP State field. These states are the same as those described in the LCP State field.

*Time Since Change* Displays the amount of time the link is in the present state.

*LCP Option*

| | |
|---|---|
| *Max Receive Unit* | Displays the maximum packet size set for both the local and remote end of the link. |
| *Async Char Mask* | Not currently supported. PPP-FR accepts this option but ignore it. |
| *Authentication* | Displays the authentication protocol that is used. |
| *Magic Number* | The current magic number for both the local and remote end of the link. |
| *Protocol Compr* | Not currently supported. PPP-FR rejects this option if it is received. |
| *Address/ Cntl Compr* | Not currently supported. PPP-FR rejects this option if it is received. |
| *32-Bit Checksum* | Not currently supported. PPP-FR rejects this option if it is received. |
| *Base Links* | Number of links the router uses in a session. The default is one. |
| *Max Links* | Number of channels the router uses for the connection. |
| *Active Links* | Number of links presently assigned. |
| *Endpoint Class* | Number representing the type of system transmitting packets. |
| *Remote Endpoint ID* | Specific remote ID number of the system transmitting packets. |
| *Send Sequence* | A 12 or 24-bit field (LCP option) that is incremented for every fragment transmitted. |
| *Receive Sequence* | A 12 or 24-bit field (LCP option) that is incremented for every fragment received. |

Example: **list control osicp**

```
OSICP State:          Closed
Previous State:       Closed
Time Since Change:    6 hours, 28 minutes and 32 seconds
```

The OSICP State fields are the same as those described under the **list control lcp** command.

Example: **list control pap**

```
State:              Closed
Previous State:     Closed
Time Since Change:  53 minutes and 30 seconds


PAP Ids/Passwords
-----------------
Local ID:           FOO
Local Password:     BAR

Remote ID:          FOO
Remote Password:    BAR
```

*PAP State* — Displays the current state of the authentications protocol. These states include the following:

- **Closed** – Indicates that the link is down and there is no attempt being made to open it. This state indicates that authentication is not in progress.
- **Closing** – Indicates that authentication has failed and the link is in the termination process.
- **Listen** – Indicates that the local station is waiting for an authentication request from the remote station.
- **Req Sent** – The local station has sent the authentication request containing the local ID and password. The remote station has not responded.
- **Ack Rcvd** – The local station has received positive acknowledgement for its ID and password.
- **Ack Sent** – The local station has received the remote station's ID and password and has sent acknowledgement.
- **Opened** – Authentication is complete and link establishment is proceeding.

*Previous State* — Displays the state of the pap protocol prior to the state displayed in the PAP State field. These states are the same as those described in *PAP State* above.

*Time Since Change* — Displays the amount of time the link is in the present state.

*PAP Ids/Passwords*

*Local ID* — The identifier string sent by the local station in an authentication request packet.

*Local Password* — The password string sent by the local station in an authentication request packet.

| | |
|---|---|
| *Remote ID* | The identifier string expected by the local station when an authentication request packet is received. |
| *Remote Password* | The password string expected by the local station when an authentication request packet is received. |

**dn**

Lists statistics related to DECnet packets for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list dn**

```
DN Statistic           In         Out
------------           --         ---
Packets:              0          0
Octets:               0          0
Prot Rejects:         0          -
```

**dncp**

Lists statistics for the DECnet Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list dncp**

```
DNCP Statistic           In                   Out
--------------           --                   ---
Packets:                 0                    0
Octets:                  0                    0
Prot Rejects:            0                    -
```

**errors**

Lists information related to all error conditions tracked by the PPP-FR software.

Example: **list error**

```
Error Type                 Count          Last One
----------                 -----          --------
Bad Address:                  0                0
Bad Control:                  0                0
Unknown Protocol:             0                0
Invalid Protocol:             0                0
Config Timeouts:              0                0
Terminate Timeouts:           0                0
```

*Error Type*

| | |
|---|---|
| *Bad Address* | Displays the total number of bad addresses encountered over the point-to-point link. |
| *Bad Control* | Displays the total number of bad control packets encountered over the point-to-point link. |
| *Unknown Protocol* | Displays the total number of unknown protocol packets encountered by the current link. |
| *Invalid Protocol* | Displays the total number of invalid protocol packets encountered by the current link. |
| *Config Timeouts* | Displays the total number configuration timeouts experienced by the link. |
| *Terminate Timeouts* | Displays the total number of link termination timeouts experienced by the link. |

#### frame-relay

Lists status information for the frame relay PVC associated with the PPP-FR pseudo interface.

Example: **`list frame-relay`**

```
Frame Relay PVC Statistics
--------------------------

Frame Relay Interface Number: 2
                                                  Frames        Frames
  Circuit#        Circuit Name        State     Transmitted    Received
  --------  ---------------------  ------------  ----------  ----------
     100    PPP Circuit               Active        2380503       71717
```

| | |
|---|---|
| *Frame Relay Interface Number* | Indicates the network number of the frame relay interface. |
| *Circuit Number* | Indicates the DLCI number of the configured PVC at the local frame relay interface. |

*Circuit Name* — Indicates the ASCII designation of the configured PVC at the local frame relay interface. This name is set to *PPP Circuit* for all PPP-FR circuits.

*State* — Indicates the current state of the circuits (*Active*, *Inactive* or *Congested*).

*Frames Transmitted* — Indicates the total number of frames transmitted over the current PPP-FR pseudo interface.

*Frames Received* — Indicates the total number of frames received over the current PPP-FR pseudo interface.

#### ip

Lists all information related to IP packets over the point-to-point link.

Example: **list ip**

```
Ip Statistic         In         Out
------------         --         ---
Packets:             349        351
Octets:              128488     129412
Prot Rejects:        0
```

*Ip Statistic*

*Packets* — Displays the total number of IP packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* — Displays the total number of bytes of IP data, in octets, transmitted and received over the current point-to-point interface.

*Prot Rejects* — Displays the total number of *protocol-reject* packets transmitted and received over the current point-to-point interface.

#### ipcp

Lists IPCP statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ipcp**

```
Ipcp Statistic       In         Out
--------------       --         ---
Packets:             0           0
Octets:              0           0
Prot Rejects:        0
```

**ipx**

Lists IPX statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list ipx**

```
IPX Statistic           In        Out
------------           --         ---
Packets:               0          0
Octets:                0          0
Prot Rejects:          0          -
```

**ipxcp**

Lists statistics for the IPX control protocol. These fields are the same as those described under the **list ip** command.

Example: **list ipxcp**

```
IPXCP Statistic           In                 Out
--------------           --                 ---
Packets:                 0                  0
Octets:                  0                  0
Prot Rejects:            0                  -
```

**lcp**

Lists statistics for the Link Control Protocol.

Example: **list lcp**

```
LCP Statistic         In              Out
-------------         --              ---
Packets:              0               3833
Octets:               0               53662
Cfg Req:              0               3833
Cfg Ack:              0               0
Cfg Nak:              0               0
Cfg Rej:              0               0
Term Req:             0               0
Term Ack:             0               0
Echo Req:             0               0
Echo Resp:            0               0
Disc Req:             0               0
Code Rej:             0               0
```

*LCP Statistic*

*Packets* — Displays the total number of packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* — Displays the total number of bytes in octets transmitted and received over the current point-to-point interface.

*Cfg Req* — Displays the total number of *configure-request* packets transmitted and received over the current point-to-point interface.

*Cfg Ack* — Displays the total number of *configure-ack* (acknowledged) packets transmitted and received over the current point-to-point interface.

*Cfg Nak* — Displays the total number of *configure-nak* (not acknowledged) packets transmitted and received over the current point-to-point interface.

*Cfg Rej* — Displays the total number of *configure-reject* packets transmitted and received over the current point-to-point interface.

*Term Req* — Displays the total number of *terminal-request* packets transmitted and received over the current point-to-point interface.

| | |
|---|---|
| *Term Ack* | Displays the total number of *terminal-ack* (acknowledged) packets transmitted and received over the current point-to-point interface. |
| *Echo Req* | Displays the total number of *echo-request* packets transmitted and received over the current point-to-point interface. |
| *Echo Resp* | Displays the total number of *echo-response* packets transmitted and received over the current point-to-point interface. |
| *Disc Req* | Displays the total number of *discard-request* packets transmitted and received over the current point-to-point interface. |
| *Code Rej* | Displays the total number of *code-reject* packets transmitted and received over the current point-to-point interface. |

**osi**

Lists OSI statistics for the point-to-point interface. These fields are the same as those described under the **list ip** command.

Example: **list osi**

```
OSI Statistic           In              Out
-------------           --              ---
Packets:                0               0
Octets:                 0               0
Prot Rejects:           0               -
```

**osicp**

Lists statistics for the OSI Control Protocol. These fields are the same as those described under the **list ip** command.

Example: **list osicp**

```
OSICP Statistic         In              Out
---------------         --              ---
Packets:                0                0
Octets:                 0                0
Prot Rejects:           0                -
```

**pap**

Lists statistics for the Password Authentication Protocol (PAP).

Example: **list pap**

```
PAP Statistic          In              Out
-------------          --              ---
Packets:                0               0
Octets:                 0               0
Auth Req:               0               0
Auth Ack:               0               0
Auth Nak:               0               0
```

*PAP Statistic*

*Packets* Displays the total number of PAP packets transmitted (out) and received (in) over the current point-to-point interface.

*Octets* Displays the total number of bytes of PAP data, in octets, transmitted and received over the current point-to-point interface.

*Auth Req* Displays the total number of authentication packets transmitted and received over the current point-to-point interface.

*Auth Ack* Displays the total number of acknowledgement packets transmitted and received over the current point-to-point interface.

*Auth Nak* Displays the total number of negative acknowledgement packets transmitted and received over the current point-to-point interface.

### Set C

Set Frame Relay parameters, LCP options and parameters, IPCP options, BNCP options, MP options, PAP and CHAP parameters and ID's/Passwords, and NCP parameters. Parameters affect only the interface that you are configuring. Options are active across the entire link.

You must use the **set frame-relay** command to establish the frame relay interface and PVC that the PPP-FR pseudo interface will use before you can make use of the PPP-FR circuit.

**Note:** Values immediately following the command option prompts reflect the current setting of that option. They are not always the default values.

**Syntax:** set authentication
bncp
frame-relay
ipcp . . .
lcp . . .
ccp . . .
parameters . . .

#### authentication

Sets the authentication parameters and ID's/Passwords for the CHAP and PAP authentication protocols. Use the **set authentication** command to set up records for both the local and remote devices. Enter the command at the `PPP-FR config>` prompt.

**Syntax:** set authentication
local ...
remote ...
parameters ...

Sets the Password Authentication Protocol local and remote IDs/passwords. IDs and passwords affect only the specific interface.

Example: **set authentication local chap**

```
Local ID: [default]: new ID
Local Password:      none
```

Example: **set authentication local pap**

```
Local ID: [default]: new ID
Local Password: [none]
```

*Local ID* A text string that specifies the identifier of the local station. CHAP and PAP send this string to the remote station to identify itself. The string can contain any combination of up to 255 alphanumeric characters.

*Local Password* A text string that specifies the password of the local station. CHAP and PAP send this string to the remote station to authenticate its identifier. CHAP uses the string to compare with the remote's response. The string can be any combination of up to 255 alphanumeric characters.

Example: **set authentication remote chap**

```
Remote ID []:
Remote Password []:
```

Example: **set authentication remote pap**

```
Remote ID []:
Remote Password []:
```

*Remote ID* A text string that specifies the identifier of the remote station. CHAP and PAP send this string to the remote station to identify itself. The string can contain any combination of up to 255 alphanumeric characters.

*Remote Password* A text string that specifies the password of the remote station. PAP sends this string to the remote station to authenticate its identifier. CHAP uses this string to generate a response to a challenge. The string can be any combination of up to 255 alphanumeric characters.

Example: **set authentication parameters pap**

Sets the Password Authentication Protocol parameters. These parameters affect only the specific interface for which you are setting them.

```
Request tries   [20]?
Retry timer (mSec)   [3000]?
Request timer (mSec)   [15000]?
```

| | |
|---|---|
| *Request tries* | Sets the number of *authentication-request* packets PAP sends to a peer station to attempt to authenticate the remote station. The range is 1 to 100. The default is 20. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before PAP attempts to authenticate the remote station again. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |
| *Request timer* | Sets the amount of time, in milliseconds, that elapses before PAP assumes an authentication request is considered to have failed and PAP terminates the link. The range is 200 to 150000 milliseconds. The default is 15000 milliseconds. |

Example: **set authentication parameters chap**

Sets the Challenge Handshake Authentication Protocol parameters. These parameters affect only the specific interface for which you are setting them.

```
Request tries   [20]?
Retry timer (mSec)   [3000]?
Request timer (mSec)   [15000]?
Repeat Authentication Timer (min) [0]?
```

| | |
|---|---|
| *Request tries* | Sets the number of *authentication-request* packets CHAP sends to a peer station to attempt to authenticate the remote station. The range is 1 to 100. The default is 20. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before CHAP attempts to authenticate the remote station again. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |
| *Request timer* | Sets the amount of time, in milliseconds, that elapses before CHAP assumes an authentication request is considered to have failed and CHAP terminates the link. The range is 200 to 150000 milliseconds. The default is 15000 milliseconds. |
| *Repeat Authentication Timer* | Amount of time, in minutes, that elapses before CHAP repeats authentication. The default is zero (no repeat authentication). |

### bncp

Sets Bridging Network Control Protocol (BNCP) parameters.

Example: **set bncp**

```
TINYGRAM COMPRESSION [no]:
```

| | |
|---|---|
| *TINYGRAM COMPRESSION* | Specifies whether or not Tinygram Compression is used. This options is useful for some protocols, such as Local Area Terminal (LAT), that are prone to problems when bridged over low-speed (64 KB/s and below) lines. In these protocols, zeroes are added between the data and the frame checksum to pad the Protocol Data Unit (PDU) to the minimum size. Tinygram compression removes the zeroes and preserves the frame checksum at the transmitting end. At the receiving end, it restores the packet to the minimum length. |

#### frame-relay

This command is **mandatory**. It creates a Frame Relay PVC which it associates with the PPP-FR pseudo interface, and sets the Frame Relay options and parameters. You cannot make a PPP link over the PPP-FR pseudo interface until you have issued this command.

`Example:` **`set frame-relay`**

```
Frame Relay interface number?  [0]? 2
Frame Relay PVC DLCI number?  [0]? 333
Committed Information Rate (CIR) in bps [64000]?
Committed Burst Size (Bc) in bits [64000]?
Excess Burst Size (Be) in bits [0]?
```

*Frame Relay interface number*
Indicates the number of the Frame Relay Interface which the PPP-FR interface is to use.

*Frame Relay PVC DLCI Number*
Indicates the circuit number in the range of 16 to 1007. This circuit number must not be already allocated. The PVC will be created and dedicated for use by the PPP-FR pseudo interface.

The default value shows the current setting for this PPP-FR pseudo interface. It is initially set to 0, which is an illegal value, so you must define a valid circuit number.

*Committed Information Rate (CIR)*
Indicates the committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 64000 bps.

*Committed Burst Size (Bc)*
Indicates the number of the committed burst size (Bc) in a range of 300 bps to 2048000 bps. The default is 64000 bps.

*Excess Burst Size (Be)*
Indicates the number of the excess burst size (Be) in a range of 0 bps to 2048000 bps. The default is 0 bps.

#### ipcp

Sets all Internet Protocol control protocol options for the link. Options are settings that are active across the entire link.

Example: **set ipcp**

```
IP COMPRESSION [no]:
Send our IP address [no]:
Request their IP address [no]:
```

*IP COMPRESSION* Selects whether or not the PPP-FR handler accepts compressed data. PPP-FR supports Van Jacobson Compressed TCP/IP (RFC 1144). Enable this option when the point-to-point link is running at a low baud rate.

Setting this value to Yes enables compression. Setting this value to No disables compression. The default is No.

*Send our IP address* Specifies whether or not to send the local IP address to the remote end of the link. Set this option to Yes if the other end of the link requires the IP address. In either case, the PPP-FR software sends the local IP address if the other end of the link requests it.

*Request their IP address* Specifies whether or not to request the IP address from the remote end of the link. If the PPP-FR software receives the remote IP address, it displays the address with the PPP-FR monitoring statistics.

#### lcp *options* or *parameters*

Sets the Link Control Protocol options and parameters for the PPP-FR link. Options are active across the entire link. Parameters affect only the specific interface.

Example: **set lcp options**

```
Maximum Receive Unit (bytes) [2048]?
Magic Number [yes]:
Password Authentication [none, pap, chap, either]:
```

| | |
|---|---|
| *Maximum receive unit* | Sets the maximum packet size of the information field that can be transferred in a single datagram. The range is 576 to 4089 bytes. The default is 2048. |
| *Magic Number* | Specifies whether or not the magic number option is enabled. Magic number provides a way to detect looped-back links in serial line configurations. When this option is enabled, the link uses the system clock as a random number generator.<br>When the LCP receives a *configure-request* with a magic number present (the magic number option is enabled), it compares the received magic number with the magic number in the last *configure-request* sent to the peer. If the two magic numbers are different, the link is not considered looped back. If the two magic numbers are the same, the PPP-FR handler attempts to bring the link down and up again to renegotiate magic numbers.<br>Setting this value to Yes enables the magic number option. Setting this value to No disables the option. The default is Yes. |
| *Authentication Protocol* | Specifies which authentication protocol is used by the router to authenticate the link. CHAP, PAP, None, or Either are valid options. *Either* attempts to use CHAP first, and if not acceptable it selects PAP. The default is None. |

Example: **set lcp parameters**

```
Config tries  [20]?
NAK tries  [10]?
Terminate tries  [10]?
Retry timer (mSec)  [3000]?
```

| | |
|---|---|
| *Config tries* | Sets the number of configure-request packets that LCP sends to a peer station to attempt to open a PPP-FR link. The range is 1 to 100. The default is 20.<br>The retry timer starts after the first *configure-request* packet is transmitted. This is done to guard against packet loss. |
| *NAK tries* | Sets the number of *configure-nak* (*nak* = not acknowledged) packets that LCP sends to a peer station while attempting open a PPP-FR link. The range is 1 to 100. The default is 10.<br>Upon receiving *configure-request* packets with unacceptable configuration options, LCP sends configure-nak packets. These packets are sent to refuse the offered configuration options and to suggest modified, acceptable values. |
| *Terminate tries* | Sets the number *terminate-request* packets that LCP sends to a peer station to close a PPP-FR link. The range is 1 to 100. The default is 10.<br>The retry timer starts after the first terminate-request packet is transmitted. This is done to guard against packet loss. |
| *Retry timer* | Sets the amount of time, in milliseconds, that elapses before LCP's transmission of *configure-request* (to open the link) and *terminate-request* (to close the link) packets is timed out. Expiration of this timer causes a timeout and the halting of *configure-request* and *terminate-request* packet transmission. The range is 200 to 30000 milliseconds. The default is 3000 milliseconds. |

**ccp *state***

Allows you to specify whether Compression Control Protocol (CCP) is enabled or disabled at startup. You must enable CCP at both ends of the link in order to use CCP compression.

*State* is either enabled or disabled. The default is disabled.

Example: **set ccp enable**

```
CCP compression was disabled, now enabled.
```

**parameters**

Sets parameters for all Network Control Protocols.

Example: **set parameters**

```
Config tries  [20]?
NAK tries  [10]?
Terminate tries  [10]?
Retry timer (mSec)  [3000]?
```

### Clear M

Clear all statistics from point-to-point interfaces.

**Syntax:** clear

Example: **clear**

### Delete C

Delete local and remote identifiers and passwords. Delete affects only the interface that you are configuring.

**Syntax:** delete chap
pap

**chap**

Deletes remote CHAP identifiers and passwords (if they exist).

Example: **delete chap**

```
Delete Remote ID/Password 789/012? [Yes]:
```

**pap**

Deletes local PAP identifiers and passwords.

```
Example:  delete pap
```

**Exit** **C M**

Returns to the `previous` prompt level.

**Syntax:** exit

```
Example:  exit
```

## 8.4 PPP-FR Pseudo Interfaces and the GWCON Interface Command

While PPP-FR pseudo interfaces have their own console processes for monitoring purposes, bridging routers also display complete statistics for installed network interfaces when you use the **interface** command from the GWCON environment.

```
Example:  interface 3

                                      Self-Test Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
3  3   PPP/1            0    0          1          0            0

  Point to Point MAC/data-link on PPP-FR Pseudo Device interface

Frame Relay PVC Statistics
--------------------------

Frame Relay Interface Number: 2
                                                       Frames        Frames
 Circuit#        Circuit Name         State      Transmitted     Received
 --------   ----------------------  ------------  -----------  ----------
    100    PPP Circuit               Active             3133          89
```

The following table describes the output.

| | |
|---|---|
| *Nt* | Indicates the serial line interface number. |
| *Nt'* | Indicates the serial line interface number. |
| *Interface* | Indicates the interface type and its instance number. |

| | |
|---|---|
| *CSR* | Not applicable to a PPP-FR pseudo device. |
| *Vec* | Not applicable to a PPP-FR pseudo device. |
| *Self-Test Passed* | Indicates the number of self-tests that succeeded. |
| *Self-Test Failed* | Indicates the number of self-tests that failed. |
| *Frame Relay Interface Number* | Indicates the network number of the frame relay interface. |
| *Circuit Number* | Indicates the DLCI number of the configured PVC at the local frame relay interface. |
| *Circuit Name* | Indicates the ASCII designation of the configured PVC at the local frame relay interface. This name is set to *PPP Circuit* for all PPP-FR circuits. |
| *State* | Indicates the current state of the circuits (*Active*, *Inactive* or *Congested*). |
| *Frames Transmitted* | Indicates the total number of frames transmitted over the current PPP-FR pseudo interface. |
| *Frames Received* | Indicates the total number of frames received over the current PPP-FR pseudo interface. |

# 9

# Configuring and Monitoring Serial Line Interfaces

This chapter describes the commands that configure serial interfaces. Since serial interfaces do not have their own console process, the chapter also describes how to use GWCON to monitor the interface.

**Important:** To configure Frame Relay, PPP, X.25, and SDLC for DLSw on the serial interface, use the commands in this chapter and then refer to the commands in the chapters that describe the specific protocol.

## 9.1 Accessing the Interface Configuration Process

Follow the procedure described in the Chapter 1 to access the interface configuration process. When you are done configuring the serial interface, enter the **restart** command after the OPCON prompt (`*`) and respond **yes** to the prompt to enable the new configuration.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

## 9.2 Network Interfaces and the GWCON Interface Command

While serial line interfaces do not have their own console process for monitoring purposes, routers may display complete statistics for all installed network interfaces when you use the **interface** command from the GWCON environment.

## 9.3 Serial Line Configuration Commands

This section explains the serial line configuration commands. Enter these commands at the `SLC Config>` prompt.

Table 9–1 lists the serial configuration commands.

**Table 9–1 Serial Configuration Command Summary**

| Command | Function |
|---|---|
| **? (Help)** | Displays all the serial commands or lists subcommand options for specific commands. |
| **Disable** | Disables pseudo-serial-ethernet. |
| **Enable** | Enables pseudo-serial-ethernet. |
| **List** | Displays the current serial interface configuration. |
| **Set** | Sets the clock rate, encoding scheme, frame-size, data link idle state, pseudo-serial-ethernet MAC address and IPX encapsulation, line speed, and the time that elapses between the transmission of each frame. |
| **Exit** | Exits the serial config process. |

### ? (Help)

List the commands that are available from the current prompt level. You can also enter a **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
DISABLE
ENABLE
LIST
RESERVE
SET
EXIT
```

Example: **set ?**

```
ENCODING
FRAME-SIZE
IDLE
PSEUDO-SERIAL-ETHERNET
SPEED
TRANSMIT-DELAY
```

### Disable

Disable pseudo-serial-ethernet.

**Syntax:** disable pseudo-serial-ethernet

Example: **disable ps**

### Enable

Use the **enable** command to send and receive routed frames in the Ethernet bridged packet format. This allows the pseudo-serial-ethernet end to be a serial line router, and the other end to be a bridge to Ethernet (only).

**Note:** Before you can enable pseudo-serial-ethernet, set the MAC address using the **set pseudo-serial-ethernet** command.

**Syntax:** enable pseudo-serial-ethernet

Example: **enable ps**

### List

Display the current configuration for the serial interface.

**Syntax:** list

Example: **list**

```
Synchronous serial line interface configuration:

Maximum network layer frame size:           18000
Transmit delay counter:                     0 units
HDLC Data Encoding:                         NRZ
HDLC Idle State:                            Flag
Speed:                                      0

Pseudo Serial  Ethernet :                   Enabled
          Ethernet  MAC address:            200931234567
          Ethernet  IPX encapsulation:      Ethernet _II
```

The two lines in italic appear only when pseudo serial Ethernet is enabled.

| | |
|---|---|
| *Maximum network layer frame size* | The maximum size of the frames transmitted on the data link, as specified by the **set frame-size** command. |

| | |
|---|---|
| *Transmit delay counter* | The minimum time that elapses between the transmission of each frame. |
| *HDLC Data Encoding* | The transmission encoding scheme for the serial interface. Scheme is NRZ (non-return to zero) or NRZI (non-return to zero inverted). |
| *HDLC Idle State* | The data link idle state: flag or mark. |
| *Speed* | The rate generated on the transmit and/or receive lines. |
| *Pseudo Serial Ethernet* | Indicates whether pseudo-serial-ethernet is enabled or disabled. If it is enabled, the next two lines appear as output. |
| *Ethernet MAC address* | A 12-digit hexadecimal value. |
| *Ethernet IPX encapsulation* | The configured IPX encapsulation. |

### Set

Configure the encoding scheme, frame-size, data link idle state, pseudo-serial-Ethernet MAC address and IPX encapsulation, speed, and the time that elapses between the transmission of each frame.

**Syntax:** set encoding
frame-size
idle
pseudo *MAC-address*
pseudo frame *encapsulation-type*
transmit-delay

#### encoding *NRZ* or *NRZI*

Sets the HDLC transmission encoding scheme as NRZ (Non-return to zero) or NRZI (Non-return to zero inverted). Most configurations use NRZ which is the default.

Example: **set encoding nrz**

**frame-size** ***#***

Sets the size of the network layer portion of frames transmitted and received on the data link. Data link and MAC layer headers are not included. The valid entries for # for the serial interface is fixed at 2046.

Example: **set frame-size 2000**

**idle** ***flag*** **or** ***mark***

Sets the transmit idle state for HDLC framing. The default is flag which provides continuous flags (7E hex) between frames. The mark option puts the line in a marking state (OFF, 1) between frames.

Example: **set idle flag**

**pseudo** ***MAC-address***

Specifies a 12-digit hexadecimal MAC address. Interfaces use this as the "Ethernet " MAC address when frames are sent as bridged Ethernet.

Example: **set pseudo MAC 203456345567**

**pseudo frame** ***encapsulation-type***

Specifies the Ethernet IPX encapsulation. The choices include:

| | |
|---|---|
| *Ethernet _8022* | Packet format includes an 802.2 header. This is the default for NetWare versions 4.0 and later. |
| *Ethernet _8023* | Uses an IEEE 802.3 packet format without the 802.2 header. This is the command default, and also the default for NetWare versions prior to 4.0. Ethernet 802.3 does not conform to the IEEE 802. standards because it does not include an 802.2 header. It may cause problems with other nodes on the network. |
| *Ethernet _II* | Uses Ethernet type 8137 as the packet format. This format is required if you are using NetWare-VMS on the Ethernet. |

| | |
|---|---|
| *Ethernet_ SNAP* | Uses the 802.2 format with a SNAP header. This encapsulation type is meant to be compatible with token-ring SNAP encapsulation. However, it violates IEEE standards and is not interoperable across conformant bridges. |

Example: **set pseudo frame Ethernet _8022**

**transmit-delay #**

Allows the insertion of a delay between transmitted packets. The purpose of this command is to slow the serial line so that it is compatible with older, slower serial devices at the other end. It can also prevent the loss of serial line hello packets between the lines.

A value of 0 transmits frames separated by as few as one HDLC flag. A value of 1 causes a minimum of two HDLC flags between transmitted frames.

For the RouteAbout Access EW serial interface, # is between 0 and 65535. Zero disables and 1 to 65535 allows you to select the delay between frames, independent of line speed. This delay is produced in units of 5 milliseconds.

Table 9-2 lists the starting transmit delay values for each type of interface. If you have problems with frames missing in the interface card counters, increase the transmit delay value.

Example: **set transmit 1**

**Table 9–2 Transmit Delay Values**

| Model Number | Transmit-Delay Value |
|---|---|
| RouteAbout Access EW | 6 |
| RouteAbout Access TW | 40 |

**Exit**

Return to the previous prompt level.

**Syntax:** exit

Example: **exit**

## 9.4 Statistics for the Serial Interfaces

This section describes the statistics for the serial interfaces. To view these statistics, enter the **interface** command at the GWCON prompt (+). Refer to Chapter 1 for more information about entering the GWCON process.

### 9.4.1 Serial Interface Line Interface Example

The following example shows the output for the serial interface.

```
                                          Self-Test  Self-Test   Maintenance
Nt Nt'  Interface       CSR     Vec      Passed     Failed        Failed
0  0    SL/0       80001000      44           1          2             1
1  1    v25        80002000      48           1          0             0
2  1    SL         80002000      48           2          0             0
3  1    SL         80002000      48           2          9             0

Line Speed:  ~2.20 Mbps
Last port reset:  4 days, 5 hours, 4 minutes, 55 seconds ago

Interface Type:  V.35

Active Signals (DCD/CTS/DSR): DSR  CTS  DCD

Total Transmits              179235          Total Receives          102372

Tx Abort Requested                0          Tx Abort (No CTS)            0
Tx FIFO Underruns                 0

Rcv CRC/Frame Errors              0          Rcv FIFO Overruns            0
Rcv Buffer Overruns               0          Rcv Packets Dropped          0

DDLC Bus/Addr Faults              0          T1/E1 Intf ROM Rev         1.7
DDLC Rcv Overruns                 0
```

The next section describes the preceding output.

| | |
|---|---|
| *Self-Test: Passed* | Number of self-tests that succeeded. |
| *Nt* | Global network number. |
| *Nt'* | Number for `Nt'` is identical to the number for `Nt`. |
| *Interface* | Interface name and its port number. |
| *CSR* | Command and status register addresses. |
| *Vec* | Interrupt vector address. |
| *Self-Test: Failed* | Number of self-tests that failed. |
| *Maintenance: Failed* | Number of maintenance failures. |
| *Line speed* | Calculated. |
| *Last port reset* | The days, hours, minutes, and seconds since the last port reset. |
| *Interface type* | Physical type of the interface. |
| *Active signals (DCD/CTS/ DSR)* | Active signals on the interface: Data Carrier Detect (DCD), Clear-to-Send (CTS), and Data Set Ready (DSR). |
| *Total transmits* | Number of packets transmitted over the interface. |
| *Tx abort requested* | Number of local requests for aborting a packet transmission. |
| *Tx FIFO Underruns* | Number of times that data was not provided for transmission because the processor and transmitter were not in sync. The packets are discarded. |

| | |
|---|---|
| *Rcv CRC/ Frame errors* | Number of checksum and frame errors received on all incoming packets. The packets are discarded. |
| *Rcv Buffer Overruns* | Number of times that a packet was to long to fit into the buffer. The packets are discarded. |
| *DDLC Bus/ Addr faults* | Number of times the DDLC (Dual Data-Link Controller) attempted an illegal access. These faults indicate a hardware problem. |
| *DDLC Rcv Overruns* | Number of times the DDLC chip ran out of internal buffers. |
| *Total receives* | Number packets received over the interface. |
| *Tx abort (no CTS)* | Number of transmits that were aborted because a clear-to-send signal was not received. |
| *Rcv FIFO Overruns* | Number of times that the local system bus was unavailable to transfer packets. The packet is then discarded. |
| *Rcv packets dropped* | Number of receive (Rcv) packets that were dropped. |
| *T1/E1 Intf ROM Rev* | PROM revision level of the serial interface. |

### 9.4.2 RouteAbout Access EW Serial Line Interfaces

The following example shows output for the RouteAbout Access EW serial interface. Descriptions of the output start on the next page.

```
+ interface
                                          Self-Test  Self-Test   Maintenance
Nt  Nt'   Interface       CSR  Vec      Passed      Failed        Failed
0   0     TKR/0     80001000   44            1           2             1
1   1     v25       80002000   48            1           0             0
2   1     SL        80002000   48            2           2             0
3   1     SL        80002000   48            2           9             0


+ interface 2
```

```
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
2  2   SL/0       1001640   5C          0          5            0

  Proteon Serial MAC/data-link on SCC Serial Line interface

  Adapter cable:            V.35 DTE  RISC Microcode Revision:         2


   V.24 circuit: 105 106 107 108 109 125 141
   Nicknames:    RTS CTS DSR DTR DCD RI  LL
   PUB 41450:    CA  CB  CC  CD  CF  CE
   State:        ON  ON  ON  ON  ON  OFF OFF



  Line speed:              ~1.859 Mbps
  Last port reset:         11 seconds ago

  Input frame errors:
   CRC error                      0   alignment (byte length)          2
   missed frame                   0   too long (>  2052 bytes)         0
   aborted frame                  0   DMA/FIFO overrun                 0
   L & F bits not set             0
  Output frame counters:
   DMA/FIFO underrun errors       0   Output aborts sent               0
+
```

*Nt* Global network number.

*Nt'* Network on which a V.25 circuit is configured. The previous output indicates the following:

`Nt 0` is a standard token-ring network.

`Nt 1` is the network on which the base V.25 device is configured.

`Nt 2` and `Nt 3` are V.25 circuits configured for serial lines. This is indicated because the `Nt'` number is identical to the number in the `Nt` field for the base V.25 interface. Also, the `CSR` and `Vec` fields are identical to `Nt 1`. Refer to the following example.

| Nt | Nt' | Interface | CSR | Vec |
|---|---|---|---|---|
| 0 | 0 | TKR/0 | 80001000 | 44 |
| 1 | 1 | v25 | 80002000 | 48 |
| 2 | 1 | SL | 80002000 | 48 |
| 3 | 1 | SL | 80002000 | 48 |

*Interface* Interface name and its port number.

*CSR* Command and status register addresses.

*Vec* Interrupt vector address.

*Self-Test Passed* Number of self-tests that succeeded.

*Self-Test Failed* Number of self-tests that failed.

*Maintenance Failed* Number of maintenance failures.

*Adapter cable* Adapter cable type.

*V.24 circuit Nicknames Pin Assignments State* Circuits, control signals, pin assignments and their state (ON or OFF). describes the output for each adapter cable type.

**Note:** The symbol - - - in console output indicates that the value or state is unknown.

*Line speed* Transmit clock rate.

*Last port reset* Length of time since the last port reset.

*Input frame errors*

| | |
|---|---|
| *CRC error* | Number of packets received that contained checksum errors and as a result were discarded. |
| *alignment (byte length)* | Number of packets received that were not an even multiple of 8 bits in length and a result were discarded. |
| *missed frame* | Number of packets that were less than 2 bytes in length and as a result were discarded. |
| *too long (> 2052 bytes)* | Number of packets that were greater than the configured size, and as a result were discarded. |
| *aborted frame* | Number of packets received that were aborted by the sender or a line error. |
| *DMA/FIFO overrun* | Number of times the serial interface could not send data fast enough to the system packet buffer memory to receive them from the network. |
| *L & F bits not set* | Internal consistency check failed. |

*Output frame counters*

| | |
|---|---|
| *DMA/FIFO underrun errors* | Number of times the serial interface card could not retrieve data fast enough from the system packet buffer memory to transmit them onto the network. |
| *Output aborts sent* | Number of transmissions that were aborted as requested by upper-level software. |

Table 9–3 lists the V.24 circuits, nicknames, nickname descriptions, cable types and cable circuit function descriptions.

**Table 9–3 V.24 Circuits and States**

| | | ***Cable Type: RS-232 DTE*** | | |
|---|---|---|---|---|
| **V.24Circuit** | **Nickname** | **Description** | **RS-232** | **Description** |
| 105 | RTS | Request to Send | CA | Request to Send |
| 106 | CTS | Clear to Send | CB | Clear to Send |
| 107 | DSR | Data Set Ready | CC | Data Set Ready |
| 108 | DTR | Data Terminal Ready | CD | Data Terminal Ready |
| 109 | DCD | Data Channel Received Line | CF | Received Line |
| 125 | RI | Signal Detector Ring Indicator | CE | Signal Detector Ring Indicator |

| | | ***Cable Type: RS-422 DTE*** | | |
|---|---|---|---|---|
| **V.24 Circuit** | **Nickname** | **Description** | **EIA RS-449** | **Description** |
| 105 | RTS | Request to Send | RS | Request to Send |
| 106 | CTS | Clear to Send | CS | Clear to Send |
| 107 | DSR | Data Set Ready | DM | Data Mode |
| 108/2 | DTR | Data Terminal Ready | TR | Terminal Ready |
| 109 | DCD | Data Channel Received Line Signal Detector | RR | Receiver Ready |
| 111 | | | SR | Signaling Rate Selector |
| 116 | | | SS | Select Standby |
| 125 | RI | Ring Indicator | IC | Incoming Call |

**Table 9–3 V.24 Circuits and States (Continued)**

| ***Cable Type: V.35 DTE*** | | | | |
|---|---|---|---|---|
| **V.24 Circuit** | **Nickname** | **Description** | **PUB 41450** | **Description** |
| 105 | RTS | Request to Send | CA | Request to Send |
| 106 | CTS | Clear to Send | CB | Clear to Send |
| 107 | DSR | Data Set Ready | CC | Data Set Ready |
| 108 | DTR | Data Terminal Ready | CD | Data Terminal Ready |
| 109 | DCD | Data Channel Received Line Signal Detector | CF | Received Line Signal Detector |
| 125<br>141 | RI | Ring Indicator | CE | Ring Indicator |

| ***Cable Type: X.21 DTE*** | |
|---|---|
| **Field** | **Description** |
| Control: | Control from DTE to DCE. |
| Indication: | Indication from DCE to DTE. |

| ***Cable Type: 75 Ohm Coax*** | | | | |
|---|---|---|---|---|
| **V.24 Circuit** | **Nickname** | **Description** | **PUB 41450** | **Description** |
| 109 | DCD | Data Channel Received Line Signal Detector | CF | Received Line Signal Detector |
| 140 | L-Loop | Local loopback | CE | Ring Indicator |
| N/A | R-Loop | Provide remote Loop-back | | |

**Table 9–3 V.24 Circuits and States (Continued)**

| *Cable Type: 120 Ohm Pair* | | | | |
|---|---|---|---|---|
| **V.24 Circuit** | **Nickname** | **Description** | **PUB 41450** | **Description** |
| 109 | DCD | Data Channel Received | CF | Received Line Signal Detector |
| 140 | L-Loop | Line Signal Detector Local loopback | CE | Ring Indicator |
| N/A | R-Loop | Provide remote Loop-back | | |
| ***Cable Type: Undefined*** | | | | |
| The software has not yet detected the cable type, or no cable is connected. | | | | |

# 10

# Configuring and Monitoring IEEE 802.5 Token-Ring Network Interfaces

This chapter describes how to configure and monitor token-ring interfaces in the router.

## 10.1 Accessing the Interface Configuration Process

For information about accessing the configuration and console processeses, refer to Chapter 1.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `TKR config>` prompt.

Enter console (monitoring) commands at the `TKR>` prompt.

## 10.2 Token-Ring Configuration and Console Commands

This section explains the token-ring configuration and console commands. The sections that follow explain these commands.

Table 10–1 summarizes the token-ring configuration and console commands.

**Table 10–1 Token-Ring Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Displays all the token-ring commands or lists subcommand options for specific commands. |
| **Connector-location** | Configure | Displays all the token-ring commands or lists subcommand options for specific commands. |
| **Dump** | Monitor | Displays a dump of the RIF cache. |
| **Frame** | Configure | Sets the NetWare IPX encapsulation type. |
| **List** | Configure | Displays the selected token-ring interface configuration. |
| **LLC** | Configure/Monitor | Accesses the LLC configuration or monitoring process and displays the LLC> prompt. |
| **Media** | Configure | Sets the media-type as shielded or unshielded. |
| **Packet-Size** | Configure | Changes packet-size defaults for this token-ring network. |
| **Set** | Configure | Sets the aging timer for the RIF cache and the MAC address. |
| **Source-routing** | Configure | Enables or disables source-routing on the interface. |
| **Speed** | Configure | Sets the interface speed in MB/sec. |
| **Srt-stat** | Monitor | Displays statistical information for transparent bridging. |
| **Exit** | Configure/Monitor | Exits the config and monitor processes and returns to the previous prompt level. |

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **TKR Config>?**

```
CONNECTOR-LOCATION
FRAME
LIST
LLC
MEDIA
PACKET-SIZE
SET
SOURCE-ROUTING
SPEED
EXIT
```

Example: **TKR>?**

```
DUMP
LLC
SRC-STAT
EXIT
```

### Connector-Location C

Specify the Ethernet or token ring interface location in your hub module. This command is used in certain interface configurations where the enhanced module supports the backplane. The options available for *location* are FRONT and BACK. All backplane (BACK) interfaces must be located in Slot 0. The default setting is FRONT.

If the backplane is not supported in an interface's configuration (for example, an Ethernet interface is in slot 1) then the **connector-location** command is not present from that interface's configuration process.

**Syntax:** connector-location *location*

Example: **connector-location front**

### Dump M

Request a dump of the RIF cache contents when source routing is enabled in the `tkr config>` process.

**Syntax:** dump

Example: **dump**

```
MAC addressStateUsageRIF
0000C90B1A57ON_RING Yes0220
```

*MAC address* Displays the MAC address of the Token-ring interface.

*State* Displays one of the five interface states:

- **On_ring** indicates that a RIF was found for a node on the ring.
- **Have_route** indicates that a RIF was found for a node on a remote ring.
- **No_route** is displayed for a brief period of time as an explorer frame is sent out and the router is waiting for a return.
- **Discovering** indicates that the router sent an explorer frame to rediscover the RIF.
- **St_route** indicates a route obtained from a Spanning tree explorer.

*Usage* Indicates that a RIF was used in a packet. The number is arbitrary and has no functional significance.

*RIF* Displays a code that indicates the Routing Information Field in hexadecimal.

### Frame C

Set the NetWare IPX encapsulation type. Table 10–2 lists the encapsulation types you can use.

**Table 10–2 Frame Command NetWare IPX Encapsulation Types**

| Option | Description | Syntax |
|---|---|---|
| **Token ring using MSB** | Uses the standard 802.2 IPX header with the non-canonical token ring address bit ordering (MSB). | frame token_ring msb |
| **Token ring using LSB** | Uses the 802.2 IPX header with the canonical address bit ordering (LSB). | frame token_ring lsb |
| **Token ring with 802.2 SNAP using MSB** | Uses the 802.2 format with a SNAP header and non-canonical address bit ordering. This encapsulation is used primarily in bridging environments. | frame token_ring_snap msb |
| **Token ring with 802.2 SNAP using LSB** | Uses the 802.2 format with a SNAP header and canonical address bit ordering. | frame token_ring_snap lsb |

**Syntax:** frame *encapsulation type*

Example: **frame token_ring msb**

**Note:** You cannot use the **frame** command in a network configuration process to set an encapsulation until you have properly configured the interface through the IPX configuration process.

**List** C

Display the current configuration for the token ring interface.

**Note:** If the MAC address is 0, the default station address is used.

**Syntax:** list

```
Example:  list


   Token-Ring configuration:

   Packet size (INFO field):2052
   Speed:                   16 Mb/sec
   Media:                   Unshielded
   Connector Location:      Front

   RIF Aging Timer          120
   Source Routing:          Disabled
   MAC Address:             000000000000
```

*Packet size* Indicates the size of the token ring packet.

*Speed* Indicates the speed of the network.

*Media* Indicates the type of media the network uses: shielded or unshielded.

May display **auto-config** as a media setting. This indicates that media type is selected automatically.

*Connector Location* Indicates whether connector used the front panel (front) or back plane (back)

*RIF Aging Timer* Indicates the amount of time that the router holds the information contained in the Routing Information Field (RIF).

*Source Routing* Indicates the status of the source-routing feature: enabled or disabled.

*MAC Address* Indicates the configured MAC address that was set with the **set physical-address** command. If all zeros are displayed, the MAC address is the default address.

### LLC C M

Access the LLC prompt. LLC commands are entered at this new prompt. See Chapter 6 for an explanation of each of these commands.

**Syntax:** llc

Example: **TKR_Config>llc**

```
LLC user configuration
LLC>
```

Example: **TKR>llc**

```
LLC user monitoring
LLC>
```

### Media C

Change network media type. The default media type is STP cable. Valid media type values are *shielded* and *unshielded.* Enter the **media** command followed by the *media-type*.

**Note:** The bridging routers may also use **auto-config** as a media setting. This setting automatically selects the media type.

**Syntax:** media *media-type*

Example: **media unshielded**

### Packet-Size C

Change packet-size defaults for all token-ring networks. Enter the **packet-size** command followed by the desired number of bytes.

**Note:** Changing packet size can greatly increase buffer memory requirements.

**Syntax:** packet-size *#bytes*

Example: **packet-size 4399**

### Set C

Set the Routing Information Field (RIF) timer and the physical (MAC) address.

**Syntax:** set physical-address
rif-timer

#### physical address

Sets the MAC address that is placed in the RIF by nodes running DNA phase IV with AMA.

Example: **set physical-address**

```
MAC address in 00:00:00:00:00:00 []?
```

**Note:** Pressing **RETURN** leaves the value the same. Entering **0** causes the router to use the factory station address. The default is to use the factory station address.

#### rif-timer

Sets the maximum amount of time (in seconds) that the information in the RIF is maintained before it is refreshed. The default is 120.

Example: **set rif-timer**

```
RIF aging timer value [120]? 120
```

### Source-routing C

Enable or disable endstation source routing. This is the process by which end stations determine the source route to use to cross source routing bridges. This allows the IP, IPX, AppleTalk Phase 2, and DNA Phase IV protocols to reach nodes on the other side of the source routing bridge.

This switch is completely independent of whether this interface is providing source routing through the SRT forwarder. The default setting is enabled.

Some stations cannot properly receive frames with a Source Routing RIF on them. This is especially common among NetWare drivers. Disabling source routing in this situation allows you to communicate with these stations.

Enable source routing only if there are source routing bridges on this ring that you want to bridge IP, IPX, AppleTalk Phase 2, or DNA Phase IV packets through.

**Syntax:** source-routing enable
disable

`Example: ` **`source-routing enable`**

### Speed C

Change data speed. The default speed is 4 Mbps. Enter the **speed** command followed by the *speed-value* (in Mb/sec).

**Syntax:** speed *speed-value*

`Example: ` **`speed 16`**

### SRT-STAT M

Use the **srt-stat** command to display information specific to transparent bridging configured on this interface.

**Syntax:** srt-stat

`Example: ` **`srt-stat`**

### Exit C M

Use the **exit** command to return to the previous prompt level.

**Syntax:** exit

`Example: ` **`exit`**

## 10.3 Token-Ring Interfaces and the GWCON Interface Command

While Token-ring interfaces have their own console processes for monitoring purposes, bridging routers also display complete statistics for installed network interfaces when you use the **interface** command from the GWCON environment.

### 10.3.1 Statistics Displayed for 802.5 Token-Ring Interfaces

The following statistics display when you enter the **interface** command from the GWCON environment for the Token-ring interfaces.

```
                                    Self Test     Maint      Errors
Nt  Nt’  Intrfc No      CSR    Vec    Pass   Fail    Fail   Input Output
2   2    TKR     0   80002000  4C       1      0       0       0     0


Token-Ring /802.5  MAC/data-link on DEC Token-Ring interface

Physical address       000C90820C7
Network speed              16 MBps
Max packet size (INFO)        2052
Handler state            Ring open
Interface Restarts               0

# times Signal lost                  0          # times Beaconing          0
Hard errors                          0          Lobe wire faults           0
Auto-removal errors                  0          Removes received           0
Ring recovery actions                0

Line errors                          0          Burst errors               0
ARI/FCI errors                       0          Inputs dropped             0
Frame copy errors                    0          Token errors               0
Lost frames                          0
```

The following section describes general interface statistics:

| | |
|---|---|
| *Nt* | Global interface number |
| *Intrfc* | Interface name |
| *No* | Number of this interface within interfaces of type “intrfc” |
| *CSR* | COMM and Status Registers address |

| | |
|---|---|
| *Vec* | Interrupt vector |
| *SlfTst: Pass* | Number of times self-test succeeded |
| *SlfTst: Fail* | Number of times self-test failed |
| *Maint: Fail* | Number of maintenance failures |
| *Errs: Input* | Number of input errors |
| *Errs: Output* | Number of output errors |

The following section describes the statistics displayed that are specific to the Token-ring interfaces:

| | |
|---|---|
| *Physical address* | Specifies the physical address of the token-ring interface. |
| *Network speed* | Specifies the speed of the token-ring network that connects to the interface. The Network Speed counter displays the number of packets that the interface can pass per second. |
| *Max packet size (info)* | Displays the maximum packet size configured for that interface. The Max Packet Size counter displays the maximum length, in bytes, of a packet that the interface transmits or receives. This counter is user-defined. |
| *Handler state* | Displays the current state of the token-ring handler. The Handler state counter displays the state of the handler after the self-test runs. |
| *# of times signal lost* | Specifies the total number of times that the router was unable to transmit a packet due to loss of signal. |
| *Hard errors* | Displays the number of times the interface transmits or receives beacon frames from the network. |

*Auto-removal errors* Displays the number of times the interface, due to the beacon auto-removal process, fails the lobe wrap test and removes itself from the network.

*Ring recovery actions* Displays the number of times the interface detects claim token medium access control (MAC) frames on the network.

*Line errors* The Line Errors counter increments when a frame is repeated or copied and the Error Detected Indicator (EDI) is zero for the incoming frame:

One of the following conditions must also exist:

- A token with a code violation exists.
- A frame has a code violation between the starting and ending delimiter.

A Frame Check Sequence (FCS) error occurs.

*ARI/FCI errors* The ARI/FCI (Address Recognized Indicator/Frame Copied Indicator) Errors counter increments if the interface receives either of the following:

An Active Monitor Present (AMP) MAC frame with the ARI/FCI bits equal to zero and a Standby Monitor Present (SMP) MAC frame with the ARI/FCI bits equal to zero.

More than one SMP MAC frame with the ARI/FCI bits equal to zero, without an intervening AMP MAC frame.

This error indicates that the upstream neighbor copied the frame but is unable to set the ARI/FCI bits.

*Frame copy errors* Displays the number of times the interface in receive/repeat mode recognizes a frame addressed to its specific address but finds the address recognize indicator (ARI) bits not equal to zero. This error indicates a possible line hit or duplicate address.

*Lost frames* — Displays the number of times the interface is in transmit mode (stripping) and fails to receive the end of a transmitted frame.

*# times beaconing* — Displays the number of times the interface transmits a beacon frame to the network.

*Lobe wire faults* — Displays the number of times the network detects an open or short circuit in the cable between the interface and the wiring concentrator.

*Removes received* — Displays the number of times the interface receives a remove ring station MAC frame request and removes itself from the network.

*Burst errors* — Displays how many times the interface detects the absence of transitions for five half-bit times between the start delimiter (SDEL) and the end delimiter (EDEL) or between the EDEL and the SDEL.

*Inputs dropped* — Displays the number of times an interface in repeat mode recognizes a frame addressed to it but has no buffer space available to copy the frame.

*Token errors* — The token errors counter increments when the active monitor detects a token protocol with any of the following errors:

- The MONITOR_COUNT bit of token with non-zero priority equals one.
- The MONITOR_COUNT bit of a frame equals one. No token or frame is received within a 10-ms window.
- The starting delimiter/token sequence has a code violation in an area where code violations must not exist.

# 11

# Configuring and Monitoring the V.25*bis* Network Interface

The V.25*bis* interface allows Digital routers to establish serial connections over switched telephone lines using V.25*bis* modems. This chapter describes how to configure and monitor a V.25*bis* interface.

For more information about V.25*bis*, see the *Routing Protocols Reference Guide*.

## 11.1 Accessing the Interface Configuration and Console Processes

For information about accessing the configuration process, refer to Chapter 1.

To access the interface console process for V.25*bis*, use the **network** command at the GWCON (+) prompt followed by the number of the V.25*bis* serial line interface. (You cannot directly access the V.25*bis* console process for dial circuits, but you can monitor the dial circuits that are mapped to the serial line interface.) Once you have accessed the desired interface console process, you can begin entering console commands.

Enter configuration commands at the `V25bis config>` prompt.

Enter monitoring (console) commands at the `V25bis>` prompt.

## 11.2 Configuration Procedures

This section describes how to configure your router for V.25*bis*. Specifically, the tasks you need to perform are:

1. Setting up a serial line interface
2. Adding a network address name and network address
3. Adding dial circuits
4. Configuring dial circuit parameters
5. Configuring V.25*bis* interface parameters

The rest of this section describes tasks 1 through 4. To configure V.25*bis*, use the V.25*bis* configuration commands described in this chapter.

**Note:** You must restart the router for changes to the V.25*bis* configuration commands to take effect.

### 11.2.1 Adding a Network Address Name and Network Address

You need to add a network address name and a network dial address name for each local port (serial line interface) as well as for each destination port. The network dial address is the telephone number of the local or destination port. The network address name can be anything, such as a description of the port.

To add a network address and network address name:

1. At the `Config>` prompt type the **add v25-bis-address** command, and then press **RETURN**.
2. When prompted, type the address name of the port, and then press **RETURN**. You can use any string of up to 23 printable ASCII characters.
3. When prompted, type the network dial address of the port, and then press **RETURN**. You can enter up to 32 characters that are in the valid format of the connected V.25*bis* modem.

```
Example:  Config>add v25-bis-address

    Assign address name [1-23] chars []? remote-site-baltimore
    Assign network dial address [1-20 digits] []? 1-909-555-0983
```

### 11.2.2 Adding Dial Circuits

Dial circuits are mapped to V.25*bis* serial line interfaces. You can map multiple dial circuits to one serial line interface.

To add a dial circuit, use the **add device dial-circuit** command from the `Config>` process. The software assigns an interface number to each circuit. You will use this number to configure the dial circuit.

```
Example:  Config>add device dial-circuit
Adding device as interface 6
```

**Note:** Dial circuits default to the PPP protocol. You can change the protocol to the Proteon Serial Link (PSL) protocol using the **set data-link psl** command at the `Config>` prompt. Other data-link types (Frame Relay, X.25, V.25*bis*, SDLC, and SRLY) are not supported at this time.

### 11.2.3 Configuring Dial Circuit Parameters

You configure dial circuits from the `Circuit Config>` process. To enter the `Circuit Config>` process, use the **network** command followed by the interface number of the dial circuit. You can use the **list dev** command at the `Config>` prompt to display a list of the dial circuits that you added.

Example: **Config>network 6**

```
Circuit configuration
Circuit Config>
```

Use the dial circuit configuration commands described in the next section to configure the dial circuit.

## 11.3 Dial Circuit Configuration Commands

This section summarizes and explains the dial circuit configuration commands. These commands allow you to display, create, or modify a dial circuit configuration. Enter the dial circuit configuration commands at the `Circuit Config>` prompt.

Table 11–1 lists the dial circuit configuration commands.

**Table 11–1 Dial Circuit Configuration Commands Summary**

| Command | Function |
|---|---|
| **? (Help)** | Lists the configuration commands or lists the options associated with that command. |
| **Delete** | Deletes the inbound call settings from the dial circuit configuration. |
| **Encapsulator** | Allows you to change the data-link protocol configuration. |
| **List** | Displays the dial circuit configuration parameters. |
| **Set** | Configures the dial circuit for inbound or outbound calls, maps the dial circuit to a serial line interface, and sets addresses, idle timeout, and self-test delay. |
| **Exit** | Exits the dial circuit configuration process and returns to the `Config>` prompt. |

#### ? (Help)

List the available commands. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
DELETE
ENCAPSULATOR
LIST
SET
EXIT
```

Example: **Set ?**

```
NET
CALLS
DESTINATION
INBOUND DESTINATION
ANY_INBOUND
IDLE
SELFTEST-DELAY
```

### Delete

Remove the inbound call settings from the dial circuit configuration.

**Syntax:** delete inbound destination

#### delete inbound destination

Removes both the inbound destination and the any_inbound settings from the dial circuit configuration. This causes the dial circuit to accept calls only from callers that have a phone number that matches the destination parameter.

Example: **delete inbound**

### Encapsulator

Enter the configuration process for the link-layer protocol that is running on the dial circuit. The default protocol for dial circuits is PPP (`SLC Config>` prompt). You can change the protocol to PSL using the **set data-link** command at the `Config>` prompt.

**Syntax:** encapsulator

Example: **encapsulator**

```
SLC serial user configuration
SLC Config>
```

Be aware of the following when you configure PSL or PPP:

- The V.25*bis* interface predefines clocking as external and encoding as NRZ. The DCE controls the clock speed. The V.25*bis* interface ignores those parameters in the PPP or PSL configuration.
- The V.25*bis* interface does not enforce transmit delay counters that you set in the PSL or PPP configurations.
- Make sure that the PSL frame size of the dial circuits on all routers is set to at least 602. (The default is 2048.) The PSL protocol requires an initial exchange of messages of this size.
- Do not enable pseudo-serial-ethernet on the dial circuit.

To return to the `Circuit Config>` prompt, use the **exit** command.

### List

Display the current dial circuit configuration.

**Syntax:** list

Example: **list**

```
Base net:       6
Destination name:    remote-site-baltimore
Inbound dst name:    * ANY *
Inbound dst name:    local-1
Outbound calls       allowed
Inbound calls        allowed
Idle timer           = 60 sec
SelfTest Delay Timer = 0 ms
```

| | |
|---|---|
| *Base net:* | Name of the serial line interface to which this dial circuit is mapped. |
| *Destination name:* | Network address name to be called for outbound circuits, and the default comparison address used by the caller-ID mechanism for inbound calls. |
| *Inbound dst name:* | This parameter appears only if the circuit is configured to accept inbound calls that do not match any other addresses. |

| | |
|---|---|
| *Inbound dst name:* | Alternate comparison address name used by the caller-ID mechanism for inbound calls. |
| *Outbound calls* | Displays this parameter when the circuit is configured to initiate outbound calls. |
| *Inbound calls* | Displays this parameter when the circuit is configured to accept inbound calls. |
| *Idle timer* | Displays the idle timer setting in seconds. The range is 0 to 65535; 0 indicates that this is a dedicated circuit (leased line). |
| *SelfTest Delay Timer* | Displays the self-test delay timer setting in milliseconds. The range is 0 to 65535; 0 indicates no delay. |

### Set

Map the dial circuit to a V.25*bis* serial line interface; configure the dial circuit for inbound and/or outbound calls; and set destination addresses, inbound addresses, idle timeout, and self-test delay.

**Syntax:** set net...
calls...
destination...
inbound destination...
any_inbound
idle...
selftest-delay...

#### net *# of serial line interface*

Specifies the number of the V.25*bis* serial line interface to which you want to map this circuit.

Example: **set net 2**

**calls** ***outbound*** **or** ***inbound*** **or** ***both***

Restricts this dial circuit to initiating outbound calls only, accepting inbound calls only, or both initiating and accepting calls. The default is both.

`Example:` **`set calls outbound`**

**destination** ***address name***

This parameter is required for the dial circuit to operate. It specifies the network dial address of the remote router to which this dial circuit will connect. The caller-ID protocol uses this parameter as the default comparison address for incoming calls. This parameter must match an address name that you assigned at the `Config>` prompt using the **add v25-bis address** command.

`Example:` **`set destination remote-site-baltimore`**

**inbound destination** ***address name***

Set this parameter if the dial circuit is set up for both inbound and outbound calls and if this router's local dial address is different from the destination dial address that the remote router dials. For example, the numbers are different if one of the routers goes through a PBX, international, or inter-LATA exchange. This parameter overrides the default comparison address that the caller-ID protocol uses for incoming calls. This parameter must match an address name that you assigned at the `Config>` prompt using the **add v25-bis address** command.

`Example:` **`set inbound remote-site-1`**

**any_inbound**

Specifies that inbound calls that do not match any other dial circuit are mapped to this circuit and accepted as inbound calls.

`Example:` **`set any_inbound`**

**idle** ***# of seconds***

Specifies a timeout period for the circuit. If there is no protocol traffic over the circuit for this specified time period, the dial circuit hangs up. The range is 0 to 65535, and default is 60 seconds. A zero setting specifies that there is no timeout period and that this is a dedicated circuit (leased line).

**Note:** For WAN-Restoral operations, you must set the idle timeout to 0.

`Example:` **`set idle 60`**

**selftest-delay** ***# of milliseconds***

You can use this parameter to delay the time between when the call is established and the initial packet is sent. The range is 0 to 65535, and the default is 150. If your modems take extra time to synchronize, adjust this setting.

### Exit

Return to the `Config>` prompt.

**Syntax:** exit

`Example:` **`exit`**

## 11.4 V.25*bis* Configuration and Console Commands

This section explains the V.25*bis* configuration and console (monitoring) commands. These commands allow you to display, create, or modify a V.25*bis* configuration. Enter the V.25*bis* configuration commands at the `V.25bis Config>` prompt. Enter the V.25*bis* console commands at the `V.25bis>` prompt.

Table 11–2 summarizes the V.25*bis* configuration and console commands.

**Table 11–2 V.25*bis* Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Lists the configuration and console commands, or lists the options associated with that command. |
| **Calls** | Monitor | List the number of completed and attempted connections made for each dial circuit mapped to this interface since the last time statistics were reset on the router. |
| **Circuits** | Monitor | Shows the status of all data circuits configured on the V.25*bis* interface. |
| **Parameters** | Monitor | Displays the current parameters for the V.25*bis* interface. (This command is similar to the `V.25bis Config>` **`list`** command.) |
| **Satistics** | Monitor | Displays the current statistics for the V.25*bis* interface. |
| **List** | Configure | Displays the V.25*bis* configuration. |

**Table 11–2 V.25*bis* Configuration and Console Command Summary (Continued)**

| Command | Task | Function |
|---|---|---|
| **Set** | Configure | Sets the local address, connect, disconnect, and no answer timeouts, number of retries after no answer, and command delay timeout. |
| **Exit** | Configure/Monitor | Exits the V.25*bis* configuration or console process and returns to the previous prompt level. |

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
LIST
SET
EXIT
```

Example: **Set ?**

```
COMMAND-DELAY-TIMEOUT
CONNECT-TIMEOUT
DISCONNECT-TIMEOUT
LOCAL-ADDRESS
RETRIES-NO-ANSWER
TIMEOUT-NO-ANSWER
```

### Calls M

List the number of completed and attempted connections made for each dial circuit mapped to this interface since the last time statistics were reset on the router.

**Syntax:** calls

Example: **calls**

```
Net Interface  Site Name           In    Out   Rfsd  Blckd
  1     SL/0   v403                 2      0      0      0

Unmapped connection indications:    0
```

| | |
|---|---|
| *Net* | Number of the dial circuit mapped to this interface. |
| *Interface* | Type of interface and its instance number. |
| *Site Name* | Network address name of the dial circuit. |
| *In* | Number of inbound connections accepted for this dial circuit. |
| *Out* | Number of completed connections initiated by this dial circuit. |
| *Rfsd* | Number of connections initiated by this dial circuit that were refused by the network or the remote destination port. |
| *Blckd* | Number of connection attempts that the router blocked. The router blocks connection attempts if the local port is already in use, the maximum number of retries to a non-responding address is reached, or a modem is not responding. |
| *Unmapped connection indications:* | Number of connection attempts that were refused by the router because there were no enabled dial circuits that were configured to accept the incoming calls. |

### Circuits M

Shows the status of all dial circuits configured on the V.25*bis* port.

**Syntax:** circuits

Example: **circuit**

```
Net Interface  MAC/Data-Link    State     Reason      Duration
1       SL/0    Proteon Serial  Avail     Rmt Disc     1:02:25
```

*Net* — Number of the dial circuit mapped to this interface

*Interface* — Type of interface and its instance number.

*MAC/Data-Link* — Type of data-link protocol configured for this dial circuit.

*State* — Current state of the dial circuit:

- **Up** – Currently connected
- **Available** – Not currently connected, but available
- **Disabled** – Dial circuit disabled
- **Down** – Failed to connect because of a busy dial circuit or because the link-layer protocol is down

*Reason* — Reason for the current state:

- **nnn_Data** – (where *nnn* is the name of a protocol) The circuit is Up because a protocol had data to send.
- **Remote Disconnect** – The circuit is either Down or Available because the remote destination disconnected the call.
- **Operator Request** – The circuit is Available because the last call was disconnected by a console command.
- **Inbound** – The circuit is Up because the circuit answered an inbound call.
- **Restoral** – The circuit is Up because of a WAN-Restoral operation.
- **Self Test** – The circuit was configured as static (idle time=0) and successfully connected once it was enabled.

*Duration* — Length of time that the circuit was in the current state.

### Parameters M

Display the current V.25*bis* serial line configuration. Note that this is the same information displayed at the `V.25bis Config>` prompt using the **list** command.

**Syntax:** parameters

Example: **parameters**

```
         V.25 bis port Parameters

Local Network Address Name    = v402
Local Network Address         = 1-508-898-2402

Non-Responding addresses:
Retries             = 1
Timeout             = 0 seconds

Call timeouts:
Command Delay       = 0 ms
Connect             = 0 seconds
Disconnect          = 0 seconds
```

*Local Network Address Name:* Network address name of the local port.

*Local Network Address:* Network dial address of the local port.

*Non-responding addresses:*

*Retries* Maximum number of calls the router attempts to make to a non-responding address during the timeout period.

*Timeout* If the router reaches the maximum number of retries to a non-responding address, it does not attempt to establish the call until this time has expired. This timeout period begins when the router attempts the first call to an address.

*Call timeouts:*

*Command Delay* — Amount of time, in milliseconds, that the router waits to initiate or answer a call after it turns on DTR (Data Terminal Ready). If you set this parameter to 0, the router waits for the modem to respond to DTR with the CTS (Clear to Send) signal before it issues commands.

*Connect* — Number of seconds allowed for a call to be established. If this parameter is set to 0, the modem controls the connection establishment timeout.

*Disconnect* — After the routers drops DTR it waits this amount of time before it initiates further calls. If you set this parameter to 0, the router waits for the modem to respond to the DTR drop by dropping CTS and DSR before it initiates the next call.

### Statistics M

Display the current statistics for this V.25*bis* interface.

**Syntax:** statistics

Example: **statistics**

```
  V.25bis Port Statistics

Level converter:      RS-232/V.35   Adapter cable: V.35 DTE

   V.24 circuit: 105 106 107 108 109 125
   Nicknames:    RTS CTS DSR DTR DCD RI
   PUB 41450:    CA  CB  CC  CD  CF  CE
   State:        OFF OFF OFF OFF OFF OFF

Line speed:               ~56.000 Kbps
Last port reset:          1 hour, 28 minutes, 25 seconds ago
```

```
Input frame errors:
   CRC error                0    alignment (byte length)   0
   too short (< 2 bytes)    0    too long (> nnnn bytes)   0
   aborted frame            0    DMA/FIFO overrun          0
Output frame counters:
   DMA/FIFO underrun errors 0    Output aborts sent        0
```

*Level converter:* Type of level converter connected to the V.25*bis* interface.

*Adapter cable:* Type of adapter cable that the level converter is using.

*V.24 circuit:* Circuit numbers as identified by V.24 specifications.

*Nicknames:* Common names for the circuits.

*PUB 41450:* PUB 41450 names for the circuits.

*State:* Current state of the circuits (ON, OFF, or “---,” which means that the state is undefined for this type of interface.

*Line speed:* The transmit clock speed (approximate).

*Last port reset:* Length of time since the port was reset.

*Input frame errors:*

*CRC error* Number of packets received that contained checksum errors and were discarded.

*Alignment (byte length)* Number of packets received that were not an even multiple of 8 bits in length and were discarded.

*too short (<2 bytes)* Number of packets received that were less than 2 bytes in length and were discarded.

*too long (>nnnn bytes)* Number of packets received that were greater than the configured frame size (*nnnn*) and were discarded.

| | |
|---|---|
| *aborted frame* | Number of packets received that were aborted by the sender or a line error. |

*Output frame counters:*

| | |
|---|---|
| *DMA/FIFO underrun errors* | Number of times the serial interface card did not retrieve data fast enough from the system packet buffer memory to transmit them onto the network. |
| *Output aborts sent* | Number of transmissions that were aborted as requested by upper-level software. |

### List C

Display the current V.25*bis* configuration.

**Syntax:** list

Example: **list**

```
  V.25bis Configuration

Local Network Address Name    = v403
Local Network Address         = 1-508-898-2403

Non-Responding addresses:
Retries             = 1
Timeout             = 0 seconds

Call timeouts:
Command Delay       = 0 ms
Connect             = 60 seconds
Disconnect          = 2 seconds
```

*Local Network Address Name:* Displays the network address name of the local port.

*Local Network Address:* Displays the network dial address of the local port.

*Non-responding addresses:*

*Retries* Maximum number of calls the router attempts to make to a non-responding address during the timeout period.

*Timeout* If the router reaches the maximum number of retries to a non-responding address, it does not attempt to establish the call until this time has expired. This timeout period begins when the router attempts the first call.

*Call timeouts:*

*Command Delay* Amount of time, in milliseconds, that the router waits to initiate or answer a call after it turns on DTR (Data Terminal Ready). If you set this parameter to 0, the router waits for the modem to respond to DTR with the CTS (Clear to Send) signal before it issues commands.

*Connect* Number of seconds allowed for a call to be established. If this parameter is set to 0, the modem controls the connection establishment timeout.

*Disconnect* After the routers drops DTR it waits this amount of time before it initiates further calls. If you set this parameter to 0, the router waits for the modem to respond to the DTR drop by dropping CTS and DSR before it initiates the next call.

### Set C

Configure local addresses, timeouts and delays for calls, and retries and timeouts for non-responding addresses.

**Syntax:** set command-delay-timeout . . .
connect-timeout . . .
disconnect-timeout . . .
local-address . . .
retries-no-answer . . .
timeout-no-answer . . .

**command-delay-timeout** ***# of milliseconds***

After the router turns on DTR (Data Terminal Ready), it waits this specified amount of time before it initiates or answers a call. If you set this parameter to 0, the router waits for the modem to respond to DTR with the CTS (Clear to Send) signal before it issues commands. The range is 0 to 65535 milliseconds, and the default is 0.

Example: **set command-delay-timeout 0**

**connect-timeout** ***# of seconds***

Sets the number of seconds allowed for a call to be established. The range is 0 to 65535 seconds, and the default is 60. If you set this parameter to 0, the modem controls the connection timeout. Initially set this parameter to 0 and then use ELS event V25B.027 to find out how long it takes to establish connections to various destinations. You can then set this parameter to a number slightly higher than the longest connect time.

**Note:** Normally government regulation limits modem manufacturers to a maximum length for call setup. This value is merely an optimization, although interoperation with some DSUs may require that you change this parameter.

Example: **set connect-timeout 10**

**disconnect-timeout** ***# of seconds***

Specifies the amount of time, in seconds, that the router waits after dropping DTR before it initiates further calls. The range is 0 to 65535 seconds, and the default is 2. If you set this parameter to 0, the router waits for the modem to respond to the DTR drop by dropping CTS and DSR before it initiates the next call.

Example: **set disconnect-timeout 500**

**local-address** ***address name***

This is the network address name of the local port. This address name must match one of the names that you defined at the `Config>` prompt using the **add V25-bis-address** command.

Example: **set local-address line-1-local**

**retries-no-answer** ***value***

Some telephone service providers impose restrictions on automatic recalling devices to limit the number of successive calls to an address that is inaccessible or that refuses those calls. This parameter specifies the maximum number of calls the router attempts to make to a non-responding address during the timeout period. The range is 0 to 10, and the default is 1.

**Note:** Government regulation may also impose limits on the modem manufacturer that supersede this parameter.

Example: **set retries-no-answer 2**

**timeout-no-answer** ***# of seconds***

After the router reaches the maximum number of retries-no-answer to a non-responding address, it inhibits any further calls to that address until this time has expired. This timeout period begins when the router attempts the first call to an address. The range is 0 to 65535 seconds, and the default is 0. If you set this parameter to 0, the modem controls the timeout period.

Example: **set timeout-no-answer 180**

### Exit C M

Return to the `Config>` prompt.

**Syntax:** exit

Example: **exit**

# 12

# Configuring and Monitoring WAN Restoral

This chapter describes how to configure and monitor the WAN Restoral feature for WAN restoral or for WAN reroute.

## 12.1 Accessing the Interface Configuration and Console Processes

Follow the procedures described in Chapter 1 to access the interface configuration and console processes for the interface described in this chapter.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the `WRS Config>` prompt.

Enter console (monitoring) commands at the `WRS>` prompt.

## 12.2 WAN Restoral or WAN Reroute

You can configure a dial circuit to be a backup for a *primary* serial interface. The back up circuit may either dial in to the same remote router that the primary circuit connects to, or it may connect to a third router.

You should use WAN Restoral and configure the back up circuit as a *secondary* interface, if:

- The back up dial circuit connects to the same router as the primary circuit, and
- The datalink protocol for the primary circuit and the back up circuit are both PPP, or both PSL.

If the back up dial circuit connects to a third router, or if the primary circuit is using PPP over Frame Relay (PPP-FR pseudo interface) then you must use WAN Reroute and configure the back up circuit as an *alternate* interface.

# 12.3 Configuring for WAN Restoral

## 12.3.1 Before You Begin

Before you can use WAN restoral you must have the following connections between two routers:

- A leased line connection configured as the primary serial interface on both routers. The primary interface must be running either PPP or PSL.
- A dial-up connection with dial circuits configured as the secondary interface on both routers. The dial circuits may be V.25 *bis* or ISDN circuits.

The routers must be configured with:

- The idle timer on the secondary dial circuits set to zero. Use the **set idle** command at the `Circuit Config>` prompt.
- A secondary dial circuit at one end of the link configured to send calls only. Use the **set calls outbound** command at the `Circuit Config>` prompt.
- The secondary dial circuit at the other end of the link configured to receive calls only. Use the **set calls inbound** command at the `Circuit Config>` prompt.

This ensures that when the primary interface goes down, one router will call the other overthe secondary circuit to re-establish the connection. Routing is not involved in the change since the back-up link connects the same routers as the primary link.

**Note:** Do not configure any protocol addresses on the secondary interface or the dial circuit. The protocol assignments for the primary interface are used on the secondary link (dial circuit) when it is active.

## 12.3.2 Data-Link Layer Configuration

The primary and secondary links must be configured for the same data-link layer protocol, either PPP or PSL. The default is PPP. To determine which link layer protocol is being used on a link, enter **list devices** at the `Config>` prompt. To change the link layer protocol, use the **set data-link** command at the `Config>` prompt.

The only parameter of significance for PSL is frame-size, which must be the same for both the primary link and the secondary link.

All of the upper layer PPP configuration should be exactly the same between the primary link and the secondary link.

For information on PPP, PSL, ISDN or V.25 *bis* see the appropriate chapters in this guide.

## 12.3.3 WAN Restoral Configuration Procedure

This section describes the steps required to configure WAN restoral. It assumes that you have two routers connected by a serial leased line (the primary interface) with a back up connection over a dial circuit (the secondary interface).

Before you begin, enter **list device** at the `Config>` prompt to list the interface numbers of all the different devices.

The following steps assume that interface 1 has already been configured as the primary interface using PPP. The steps you should follow depend on whether the secondary circuit is an ISDN link or a V.25 *bis* link.

### 12.3.3.1 Setting Up a V.25 *bis* Dial Circuit as a Secondary Circuit

Follow these steps on the routers at each end of the link to configure the V.25 *bis* dial circuit as the secondary circuit.

1. Set the data link of the serial interface to V.25 *bis*. For example to set interface 2 to V.25 *bis* enter the following:

   ```
   Config>set data v25bis 2
   Config>
   ```

2. Enable the interface.

   ```
   Config>enable interface 2
   Config>
   ```

3. Add a Dial circuit (for example on interface 3). The protocol will be PSL by default.

   ```
   Config>add device dial-circuit
   Config>
   ```

4. Enable the new dial circuit interface.

   ```
   Config>enable interface 3
   Config>
   ```

5. Add a V.25 *bis* network address, entering the name and phone number at the prompts for both local and remote routers.

   ```
   Config>add v25-bis-address locaddrname locdialaddr
   Config>add v25-bis-address remaddrname remdialaddr
   Config>
   ```

6. Configure the V.25 *bis* serial line (in this example network 2). At the `Config>` prompt enter **network 2** to display the `V.25bis Config>` prompt.

```
Config>network 2
V.25bis Configuration
V.25bis Config>
```

7. Set the local address to the network address name of the local port (this must match the **local** name you specified at the `Config>` prompt).

```
V.25bis Config>set local-address locaddrname
V.25bis Config>
```

8. Return to the `Config>` prompt.

```
V.25bis Config>exit
Config>
```

9. At the `Config>` prompt enter **network 3** to display the `Circuit Config> prompt so you can` configure the dial circuit (network 3 in our example).

```
Config>network 3
Circuit configuration
Circuit Config>
```

10. At the `Circuit Config>` prompt map the dial circuit (network 3) to the V.25 *bis* circuit (network 2).

```
Circuit Config>set network 2
Circuit Config>
```

11. At the `Circuit Config>` prompt set the idle timer to 0.

```
Circuit Config>set idle 0
Circuit Config>
```

12. At the `Circuit Config>` prompt, set the call direction. You must set calls **inbound** at one end of the secondary link, and **outbound** at the other end.

```
Circuit Config>set calls direction
Circuit Config>
```

13. On the **inbound** router, you must allow incoming calls from the remote destination. Use the set inbound command and specify either the **remote** name you specified at the `Config>` prompt, or **any** to accept all incoming calls.)

```
Circuit Config>set inbound remote-destination
Circuit Config>
```

14. On the **outbound** router define the number to call. Set the destination address of the remote router (this must match the **remote** name you specified at the `Config>` prompt).

15. Set the destination address of the remote router (this must match the **remote** name you specified at the `Config>` prompt). .

```
Circuit Config>set destination remaddrname
Circuit Config>
```

16. Return to the `Config>` prompt.

```
Circuit Config>exit
Config>
```

#### 12.3.3.2 Setting Up an ISDN Dial Circuit as a Secondary Circuit

Follow these steps on the routers at each end of the link to configure an ISDN dial circuit as a secondary circuit.

1. If the protocol on the Primary circuit is PPP, set the buffer size (maximum receive unit size) to 1800.

```
Config>network 1
PPP Config>set lcp opt
Maximum Receive Unit (bytes) [2048]? 1800
Authentication Protocol (None, Pap, Chap, Either) [none]:
PPP Config>exit
```

2. Ensure that the ISDN interface is enabled. For example enter the following command:

```
Config>enable interface 2
Config>
```

3. Add a Dial circuit (for example on interface 3). The protocol will be PPP by default.

```
Config>add device dial-circuit
Config>
```

4. Enable the new dial circuit interface.

```
Config>enable interface 3
Config>
```

5. Configure the ISDN interface with the network address names, address ISDN dial numbers and subdial addresses for the local reouter and the remote router.

```
Config>add isdn
Assign address name [1-23] chars  []? local-name
Assign network dial address [1-15 digits] []? local-address
Assign network subdial address [0-20 digits]  []? local-subdial
Config>add isdn
Assign address name [1-23] chars  []? remote-name
Assign network dial address [1-15 digits] []? remote-address
Assign network subdial address [0-20 digits]  []? remote-subdial
Config>
```

6. Configure the ISDN serial line (in this example network 2). At the `Config>` prompt enter **network 2** to display the ISDN `Config>` prompt.

```
Config>network 2
ISDN Configuration
ISDN Config>
```

7. Set the local address to the network address name of the local port (this must match the **local name** you specified in step 5.

```
ISDN Config>set local-address local-name
ISDN Config>
```

8. Return to the `Config>` prompt.

```
ISDN Config>exit
Config>
```

9. At the `Config>` prompt, enter **network 3** to display the `Circuit Config> prompt so you can` configure the dial circuit (network 3 in our example).

```
Config>network 3
Circuit configuration
Circuit Config>
```

10. At the `Circuit Config>` prompt, map the dial circuit (network 3) to the ISDN circuit (network 2).

```
Circuit Config>set network 2
Circuit Config>
```

11. At the `Circuit Config>` prompt, set the idle timer to 0.

```
Circuit Config>set idle 0
Circuit Config>
```

12. At the `Circuit Config>` prompt, set the call direction. You must set calls **inbound** at one end of the secondary link, and **outbound** at the other end.

```
Circuit Config>set calls direction
Circuit Config>
```

13. On the **inbound** router, you must allow incoming calls from the remote destination. Use the set inbound command and specify the **local name** you specified in step 5. Alternatively, you can specify **any** to accept all incoming calls.

```
Circuit Config>set inbound local-name
Circuit Config>
```

14. On the **outbound** router, define the number to call. Set the destination address of the remote router. This must match the **remote name** you specified in step 5.

```
Circuit Config>set destination remote-name
Circuit Config>
```

15. Return to the `Config>` prompt.

```
Circuit Config>exit
Config>
```

#### 12.3.3.3 Setting Up the WAN Restoral Feature

When you have configured the dial circuits you use the WAN restoral feature to configure and enable WAN restoral on each router. Follow these steps on the routers at each end of the link to configure the WAN restoral.

1. At the `Config>` prompt, enter **feature wrs** to display the `WRS Config>` prompt.

```
Config>feature wrs
WAN Restoral user configuration
WRS Config>
```

2. Assign a secondary dial circuit to the primary interface. In our example the secondary dial circuit (interface 3) will back up the primary interface (interface 1).

```
WRS Config>add secondary-circuit
Secondary interface number  [0]? 3
Primary interface number  [0]? 1
```

3. Enable WAN restoral on the secondary dial circuit that you added.

```
WRS Config>enable secondary-circuit
Secondary interface number  [0]? 3
```

4. Globally enable WAN restoral on the router. For example:

```
WRS Config>enable wrs
```

5. Restart the router for configuration changes to take effect.

# 12.4 Configuring for WAN Reroute

## 12.4.1 Before You Begin

Before you can use WAN reroute your routers must have the following connections:

- A leased line connection configured as the primary serial interface between two routers. The primary interface must be running PPP, PPP over Frame Relay or PSL.
- A dial-up connection on one of these two routers with a dial circuit configured as the alternate circuit.
- A dial-up connection on another router with a dial circuit configured to receive incoming calls.

In this example we will assume that Router A has a primary circuit to Router B, and an alternate circuit to Router C. The routers must be configured as follows:

- Router A must have an alternate dial circuit with the idle timer set to zero. Use the **set idle** command at the `Circuit Config>` prompt.
- The alternate dial circuit at router A configured to send calls only. Use the **set calls outbound** command at the `Circuit Config>` prompt.
- Router C must have a dial circuit configured to receive calls only. Use the **set calls inbound** command at the `Circuit Config>` prompt.

**Note:** For WAN reroute you must configure routing on the alternate interface for the dial circuit. The network address that you assign to the alternate interface must be different from the address assigned to the primary interface. The other protocol assignments for the primary interface are used on the alternate link when it is active.

## 12.4.2 Data-Link Layer Configuration

The link layer protocols on the primary and alternate circuits must be configured as one of these combinations:

- PPP over both the primary and alternate interfaces.

- PSL over both the primary and alternate interfaces.
- PPP over Frame Relay over the primary interface and PPP over the alternate interface.

To determine which link layer protocol is being used on a link, enter **list devices** at the `Config>` prompt. To change the link layer protocol, use the **set data-link** command at the `Config>` prompt.

The only parameter of significance for PSL is frame-size, which must be the same for both the primary link and the alternate link.

All of the upper layer PPP configuration should be exactly the same between the primary link and the alternate link.

For information on PPP, PPP over Frame Relay, PSL, ISDN or V.25 *bis* see the appropriate chapters in this guide.

### 12.4.3 WAN Reroute Configuration Procedure

This section describes the steps required to configure WAN reroute. Before you begin, enter **list device** at the `Config>` prompt to list the interface numbers of different devices.

In the following steps we assume that Router A has a primary link to Router B, and you are setting up an alternate link from Router A to Router C. Interface 1 on each router has already been configured as the primary interface using PPP, and no other interfaces have been configured. The procedure to configure the three routers can be summarized as follows:

- Router A. Configure the leased line to Router B as the primary circuit. Configure the dial circuit to make outgoing calls to Router C. Configure and enable WAN Reroute on router A to use the dial circuit as an *alternate* circuit.
- Router B. Configure the leased line circuit to Router A.
- Router C. Configure the dial circuit to accept incoming calls from Router A.

**Note:** You do not need to configure WAN Reroute on routers B or C. Router A will manage the WAN Reroute processes.

Follow these detailed steps on the routers A and C to configure the alternate circuit for WAN reroute.

#### 12.4.3.1 Setting Up a V.25 *bis* or ISDN Dial Circuit as an Alternate Circuit

To set up a V.25 *bis* or ISDN dial circuit for use as an alternate circuit follow the set procedures as described for WAN Restoral. The only difference is that when you set the call direction it is important to ensure that you set calls **inbound** at the alternate router (Router C) and **outbound** at the router which has the primary link (Router A).

```
Circuit Config>set calls direction
Circuit Config>
```

When you have configured these dial circuits you can use the WAN restoral feature to configure WAN reroute on router A.

#### 12.4.3.2 Setting Up the WAN Reroute Feature

Follow these steps on the router with both the primary and alternate circuits (Router A) to configure WAN reroute.

1. At the `Config>` prompt enter **feature wrs** to display the `WRS Config>` prompt.

```
Config>feature wrs
WAN Restoral user configuration
WRS Config>
```

2. Assign an alternate dial circuit to the primary interface. The alternate dial circuit will back up the primary interface.

```
WRS Config>add alternate-circuit
Alternate interface number  [0]? 3
Primary interface number  [0]? 1
```

3. Set the first stabilization interval for the primary interface if you want to override the inital default of 0 seconds.

```
WRS Config>set first-stabilization
Primary interface number  [0]? 1
First primary stabilization time  (0 - 3600 seconds -1 = default) [-1]? 30
```

4. Set the subsequent stabilization interval for the primary interface if you want to override the inital default of 0 seconds.

```
WRS Config>set stabilization
Primary interface number  [0]? 1
First primary stabilization time  (0 - 3600 seconds -1 = default) [-1]? 20
```

5. Enable WAN reroute on the alternate dial circuit that you added.

```
WRS Config>enable alternate-circuit
Alternate interface number  [0]? 3
```

6. Globally enable WAN reroute on the router. For example:

```
WRS Config>enable wrs
```

7. Restart the router for configuration changes to take effect.

## 12.5 Changing from WAN Restoral to WAN Reroute

If you have been using WAN Restoral with a primary connection between Routers A and B and a secondary dial-circuit as back up you may decide to back up the primary connection by a dial circuit to a third router (Router C). To make this change you must:

1. Disable the secondary circuits and disable WAN Restoral at Routers A and B.
2. Configure an appropriate routing protocol on the dial circuit at Router A and Router C.
3. Configure the dial circuit as an alternate circuit on Router A. Ensure that it is set to make outgoing calls, and that Router C is set to receive those calls.
4. Enable WAN Reroute on Router A.

## 12.6 Changing from WAN Reroute to WAN Restoral

If you have been using WAN Reroute with a primary connection between Router A and Router B with an alternate interface from Router A to Router C, you may decide to back-up the primary connection using WAN Restoral from Router A to Router B instead. You will have configured at least one routing protocol on the back-up dial circuit interface (for example IP or OSI) at Router A. You must:

1. Disable the alternate circuit and disable WAN Reroute at Router A.
2. Delete all routing protocols on the circuit which was the alternate interface at Router A.
3. Configure the dial circuit as a secondary circuit on Routers A and B. Ensure that one is set to make ougoing calls, and the other is set to receive those calls.
4. Enable WAN Restoral on Routers A and B.

## 12.7 WAN Restoral and Reroute Configuration and Console Commands

Table 12-1 lists the WAN restoral and WAN reroute configuration and console commands. The sections that follow explain the commands in more detail.

Enter configuration commands at the `WRS Config>` prompt. Enter console (monitoring) commands at the `WRS>` prompt.

**Table 12–1 WAN Restoral Configuration and Console Commands**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/Monitor | Displays all WAN restoral commands or lists subcommand options for specific commands. |
| **Add** | Configure | Assigns a dial circuit as the secondary or alternate (backup) circuit to a primary interface. |
| **Clear** | Monitor | Clears the monitoring information/statistics on all restoral circuits. |
| **Disable** | Configure/Monitor | Disables WAN restoral on the router or it disables the restoral of a primary interface by disabling its associated secondary or alternate interface. |
| **Enable** | Configure/Monitor | Enables WAN restoral on the router or it enables a secondary or alternate dial circuit. |
| **List** | Configure/Monitor | Displays the current WAN restoral/reroute configuration, or monitor information on one or all restored circuits. |
| **Remove** | Configure | Removes the assignment of a secondary or alternate (backup) circuit to the primary interface. |
| **Set** | Configure | Sets the stabilization intervals for the primary interface. |
| **Exit** | Configure/Monitor | Exits the WAN restoral and returns to the previous prompt level. |

### ? (Help) C M

Lists available commands. You can also enter **?** after a command to list its options.

**Syntax:** ?

Example: **enable ?**

```
alternate-circuit
secondary-circuit
wrs
```

### Add C

Assigns a dial circuit as the secondary or alternate (backup) circuit to a primary interface. Both interfaces must have been previously configured. You can assign only one secondary interface or alternate interface to a primary interface. Any dial circuit is an eligible secondary or alternate interface.

**Syntax:** add alternate-circuit . . .
secondary-circuit . . .

Example: **add secondary-circuit**

```
Secondary interface number  [0]? 3
Primary interface number  [0]? 0
```

### Clear M

Clears WAN restoral statistics that are displayed using the **list** command. This command clears *Longest restoral period*, but does not clear the *Most recent restoral period*.

**Syntax:** clear

Example: **clear**

### Disable C M

Globally disables WAN reroute or WAN restoral on the router, or disables the restoral of a primary interface by disconnecting its associated alternate circuit or secondary circuit.

**Syntax:** disable
alternate-circuit . . .
secondary-circuit . . .
wrs

**alternate-circuit** ***interface #***

Disconnects active call on the alternate circuit. The circuit remains disabled until you restart or reload the router or until you enter the **enable alternate** command. Both interfaces must have been previously configured and bound together in the WRS configuration.

Example: **disable alternate-circuit**

```
Alternate interface number  [0]? 3
```

**Note:** To disable the alternate circuit, enter **disable alternate** at the WAN restoral configuration prompt (`WRS Config>`).

**secondary-circuit** ***interface #***

Disconnects active call on the secondary circuit. The circuit remains disabled until you restart or reload the router or until you enter the **enable secondary** command. Both interfaces must have been previously configured and bound together in the WRS configuration.

Example: **disable secondary-circuit**

```
Secondary interface number  [0]? 3
```

**Note:** To disable the secondary circuit, enter **disable secondary** at the WAN restoral configuration prompt (`WRS Config>`).

**wrs**

Disables WAN reroute or WAN restoral on the router until you restart or reload the router or enter the **enable wrs** command.

Example: **disable wrs**

## Enable C M

Enables WAN reroute or WAN restoral on the router or enables the restoral of a primary link by enabling its associated backup circuit, which is either an alternate circuit (WAN reroute) or a secondary circuit (WAN restoral).

**Syntax:** enable alternate-circuit . . .
secondary-circuit . . .
wrs

**alternate-circuit** ***interface #***

Enables the restoral of a primary interface by enabling its associated alternate dial circuit. The dial circuit must have been previously assigned using the **add alternate** command.

Example: **enable alternate-circuit**

```
Alternate interface number  [0]? 3
```

**secondary-circuit** ***interface #***

Enables the restoral of a primary interface by enabling its associated secondary dial circuit. The dial circuit must have been previously assigned using the **add secondary** command.

Example: **enable secondary-circuit**

```
Secondary interface number  [0]? 3
```

**wrs**

Globally enables WAN restoral or WAN reroute on the router.

Example: **enable wrs**

### List C

Displays the current WAN restoral or WAN reroute configuration. If WAN restoral has been configured this command lists each primary and secondary interface and whether or not WAN restoral is enabled. If WAN reroute has been configured this command lists each primary and alternate interface and whether or not WAN reroute is enabled.

**Syntax:** list

This is an example with WAN Restoral configured on the router.

Example: **list**

```
WAN Restoral is enabled.
Default Stabilization Time:       0 seconds
Default First Stabilization Time: 0 Seconds

                                          Secondary
Primary Interface    Secondary Interface   Enabled
-----------------    --------------------  ---------
1 - WAN PPP          4 - PPP Dial Circuit      Yes
```

This is an example with WAN Reroute configured on the router.

Example: **list**

```
WAN Restoral is enabled.
Default Stabilization Time:       0 seconds
Default First Stabilization Time: 0 Seconds

[No Primary-Secondary pairs defined]
                                               Alternate   1st  Subseq
  Primary Interface      Alternate Interface   Enabled     Stab  Stab
---------------------  ----------------------- --------    ----  ----
 1 - WAN PPP            3 - PPP Dial Circuit      Yes      dflt  dflt
```

### List M

Displays the current WAN restoral or WAN reroute configuration. If WAN restoral has been configured this command lists each primary and secondary interface and whether or not WAN restoral is enabled. If WAN reroute has been configured this command lists each primary and alternate interface and whether or not WAN reroute is enabled.

**Syntax:** list
- alternate-circuit . . .
- circuit
- secondary-circuit . . .
- status

#### alternate-circuit

Provides statistics for individual alternate circuits and their associated primary interfaces.

Example: **list alternate-circuit**

```
Alternate interface number  [0]? 3
Primary    1:PPP/0 Point to Point SCC Serial Line
Alternate  3:PPP/1 Point to Point V.25bis Dial Circuit
Enabled, re-route currently active
Primary first stabilization time: default (0 seconds)
Primary stabilization time: default (0 seconds)
```

| | |
|---|---|
| *Alternate Interface number* | Identifier of the Interface that is being used for the back up circuit. |
| *Primary* | Interface that is being backed up. |
| *Alternate* | Dial circuit that is being used to back up the associated primary. |
| *Enabled* | Indicates whether or not WAN reroute is currently enabled on these interfaces, and whether it is currently active |
| *Primary first stabilization time* | Indicates the current setting for the first stabilization time. If it is set to *default* then the default value is shown in parentheses. |

*Primary stabilization time* — Indicates the current setting for the subsequent stabilization time. If it is set to *default* then the default value is shown in parentheses.

**circuit**

Provides statistics for all alternate or secondary dial circuits and their associated primary interfaces.

Example: **list circuit**

```
The WRS feature is enabled with 1 circuit configured
  Total restoral/reroute attempts =          5 completions   =          3
  Total packets forwarded         =        346
  Longest completed restoral period in hrs:min:sec     0:08:22

   Primary       Secondary    Restoral  Restoral   Current/Longest
Net Interface  Net Interface  Enabled    Active       Duration
-------------  -------------  --------  --------   ---------------
[No WAN Restoral circuits configured]

   Primary       Alternate    Re-route  Re-route   Current/Longest
Net Interface  Net Interface  Enabled    Active       Duration
-------------  -------------  --------  --------   ---------------
  1  PPP/0       3  PPP/1       Yes        No           0:08:22
```

*The WRS feature is . . .* — Indicates the status of WRS (**enabled** or **disabled**), and the number of circuits configured as secondary or alternate circuits.

*Total restoral/ reroute attempts* — Number of times the primary failed, causing the router to try to bring up a secondary (or alternate) link.

*Completions* — Number of successful restoral (or reroute) attempts.

*Total packets forwarded* — Packets forwarded across the secondary (or alternate) interface. It is the sum of both directions, and is cumulative until you restart the router or enter the **clear** command.

| | |
|---|---|
| *Longest completed restoral period* | Longest amount of time a restoral (or reorute) was in operation not counting any current usage. |
| *WAN Restoral Circuits* | |
| *Primary Net Interface* | Interface that is being backed up. |
| *Secondary Net Interface* | Dial circuit that is being used to back up the associated primary, using WAN restoral. |
| *Restoral Enabled* | Indicates whether or not WAN restoral is currently enabled on these interfaces. |
| *Restoral Active* | Indicates whether or not WAN restoral is currently active on these interfaces. |
| *Current/ Longest Duration* | Length of time the restoral has been in operation, if the backup circuit is currently in use, otherwise it is the longest amount of time a restoral was in operation. |
| *WAN Reroute Circuits* | |
| *Primary Net Interface* | Interface that is being backed up. |
| *Alternate Net Interface* | Dial circuit that is being used to back up the associated primary, using WAN reroute. |
| *Re-route Enabled* | Indicates whether or not WAN reroute is currently enabled on these interfaces. |
| *Re-route Active* | Indicates whether or not WAN reroute is currently active on these interfaces. |

*Current/ Longest Duration* — Length of time the reroute has been in operation, if the backup circuit is currently in use, otherwise it is the longest amount of time a reroute was in operation.

#### secondary-circuit

Provides statistics for individual secondary circuits and their associated primary interfaces.

Example: **list secondary-circuit**

```
   Secondary interface number  [0]? 1
                                                                        Restoral
    Primary Interface      Secondary Interface                          Enabled
-------------------------  ------------------------                     ---------
  0 - Dual Serial Line       3 - Proteon Dial Circu                           Yes


       Router primary interface state = Up
       Router secondary interface state = Available
       Restoral Statistics:

          Primary restoral attempts =       6 completions =         5
          Restoral packets forwarded =    346
          Most recent restoral period in hrs:min:sec        00:08:20
```

*Primary Net Interface* — Interface that is being backed up.

*Secondary Net Interface* — Dial circuit that is being used to back up the associated primary, using WAN restoral.

*Router primary Interface state* — Indicates that the primary interface state is one of the following:

- **Up** – The link is up.
- **Down** – The link is down.
- **Disabled** – The operator has disabled the link.
- **Not present** – The link is configured but there is a hardware problem.

*Restoral Enabled* — Indicates whether or not WAN restoral is currently enabled on these interfaces.

| | |
|---|---|
| *Router secondary Interface state* | Indicates that the associated secondary interface state is one of the following:<br>• **Up** – The link is up.<br>• **Down** – The link is down. This also occurs when the base network for the secondary is disabled, either at the `Config>` prompt or at the `+` prompt.<br>• **Available** – The link is in the waiting mode. |
| *Restoral Statistics:* | |
| *Primary Restoral Attempts* | Number of times the primary failed, causing the router to try to bring up this secondary link. |
| *Restoral Packets forwarded* | Packets forwarded over the secondary link. |
| *Most recent Restoral Period* | How long the secondary was up, the last time it was used, or currently in use. |

**status**

Provides status information for individual secondary circuits (or alternate circuits) and their associated primary interfaces.

Example: **list status**

```
The WRS feature is enabled with 1 circuit(s) configured

  Total restoral/reroute attempts =          5 completions   =         1
  Total packets forwarded         =          8

  Longest completed restoral period in hrs:min:sec     0:00:14

Restoral State   Primary Interface & State   Secondary Interface & State
--------------   -------------------------   ---------------------------
Available         1  PPP/0  - Up              3  PPP/1  - Available

Reroute State    Primary Interface & State   Alternate Interface & State
-------------    -------------------------   ---------------------------
[No WAN Reroute circuits configured]
```

*The WRS feature is* Indicates the status of WRS (**enabled** or **disabled**), and the number of circuits configured as secondary or alternate circuits.

*Total restoral/ reroute attempts* Number of times the primary failed, causing the router to try to bring up a secondary (or alternate) link.

*Completions* Number of successful restoral (or reroute) attempts.

*Total packets forwarded* Packets forwarded across the secondary (or alternate) interface. It is the sum of both directions, and is cumulative until you restart the router or enter the **clear** command.

*Longest completed restoral period* Longest amount of time a restoral (or reorute) was in operation not counting any current usage.

*WAN Restoral Circuits*

*Restoral State* Indicates the current state of WAN Restoral

- **Available** – The primary circuit is up and the secondary circuit is down, but available when required.
- **Starting** – The primary link has gone down and the router is attempting to connect the secondary circuit.
- **Restoring** – The secondary circuit has come up and is active while the primary circuit remains down.
- **Recovering** – The primary circuit has come back up but the secondary circuit has not gone down yet. The router is in the process of switching from the secondary circuit to the primary.

**Starting** and **Recovering** are transition states.

*Primary Interface & State* Identifies the interface that is being backed up, and its current state.

*Secondary Interface & State* Identifies the dial circuit that is being used to back up the associated primary, using WAN restoral, and its current state.

*WAN Reroute Circuits*

*Reroute State* Indicates the current state of WAN Reroute

- **Available** – The primary circuit is up and the secondary circuit is down, but available when required.
- **Starting** – The primary link has gone down and the router is attempting to connect the alternate circuit.
- **Restoring** – The alternate circuit has come up and is active while the primary circuit remains down.
- **Recovering** – The primary circuit has come back up but the alternate circuit has not gone down yet. The router is in the process of switching from the alternate circuit to the primary.

**Starting** and **Recovering** are transition states.

*Primary Net Interface* Identifies the interface that is being backed up, and its current state.

*Alternate Net Interface* Identifies the dial circuit that is being used to back up the associated primary, using WAN reroute, and its current state.

### Remove C

Deletes the assignment of a secondary (backup) dial circuit (or alternate dial circuit) to the primary interface. The dial circuit must have been previously assigned using the **add secondary** command or the **add alternate** command.

**Syntax:** remove alternate-circuit . . .
secondary-circuit . . .

Example: **remove secondary-circuit**

```
Secondary interface number  [0]? 3
```

### Set C

Globally sets the first and subsequent stabilization intervals for WAN reroute on the router.

If the primary circuit is down after power-up the router waits for the period defined as the *first-stabilization interval* before activating the alternate circuit.

When the alternate circuit is active and the primary circuit comes back on-line, the router waits for the period defined as the subsequent *stabilization interval* before activating the primary circuit and taking the back-up circuit down. If the primary circuit fails during the stabilization time, the alternate circuit continues to run.

These parameters can be used to reduce the amount of line switching if the primary circuit is unstable.

**Syntax:** set default first-stabilization. . .
default stabilization. . .
first-stabilization . . .
stabilization . . .

**default first-stabilization**

Sets the interval that will be used by WAN Reroute as a default value for the first-stabilization time. The value is the number of seconds, in the range 0 through 3600. The default value is 0.

Example: **set default first-stabilization**

```
Default primary first stabilization time  (0 - 3600 seconds)  [0]? 20
```

**default stabilization**

Sets the interval that will be used by WAN Reroute as a default value for the subsequent stabilization time. The value is the number of seconds, in the range 0 through 3600. The default value is 0.

Example: **set default stabilization**

```
Default primary stabilization time  (0 - 3600 seconds)
[0]? 15
```

**first-stabilization**

Sets the interval that will be used by WAN Reroute as the first-stabilization time. The value is the number of seconds, in the range 0 through 3600. The default value is initially -1, which means that the value of the default first-stabilization interval will be used. If you set first-stabilization again, the default will be the last value specified.

Example: **set first-stabilization**

```
Primary interface number  [0]?  1
Primary first stabilization time  (0 - 3600 seconds, -1 = default)  [-1]?
30
```

**stabilization**

Sets the interval that will be used by WAN Reroute as the stabilization time. The value is the number of seconds, in the range 0 through 3600. The default value is initially -1, which means that the value of the default stabilization interval will be used. If you set stabilization again, the default will be the last value specified.

Example: **set stabilization**

```
Primary interface number  [0]?  1
Primary stabilization time  (0 - 3600 seconds, -1 = default)  [-1]? 25
```

**Exit** C M

Returns to the previous prompt level.

**Syntax:** exit

Example: **exit**

## 12.8 WAN Restoral and GWCON Commands

You can test the WAN restoral secondary circuit or WAN reroute alternate circuit by entering **test** at the GWCON (+) prompt. This command brings up the link briefly and then takes it back down.

If you use the **disable** command at the GWCON (+) prompt, the router disconnects the current call, but the secondary (or alternate) circuit remains available for WAN restoral. To disable the WAN restoral feature, enter **disable** at the `WRS Config>` prompt.

# 13

# Configuring and Monitoring the X.25 Network Interfaces

This chapter describes the X.25 configuration and console commands for both the X.25 network interface and the X.25-LLC2 pseudo interface.

The X.25 network interface connects a router to an X.25 virtual circuit switched network. The X.25 network interface software and hardware allows the router to communicate over a public X.25 network. The X.25 network interface complies with CCITT 1980 and 1984 specifications for X.25 interfaces offering multiplexed channels and reliable end-to-end data transfer across a wide area network.

The X.25-LLC2 pseudo interface connects a router to an LLC DTE over a local area network. The X.25-LLC2 pseudo interface software allows the router to communicate using X.25 protocol over a LAN by using the LLC2 protocol for message transfer.

## 13.1 Accessing the Interface Configuration and Console Processes

Follow the procedure described in Chapter 1 to access the configuration and console processes for the interfaces described in this chapter.

**Note:** After you access the interface configuration process, you may begin entering configuration commands. Whenever you make a change to a user-configurable interface parameter, you must restart the router for this change to take effect.

Enter configuration commands at the configuration process prompt for X.25 interfaces (`X.25 Config>`) or for X.25 LLC2 pseudo interfaces (`X.25-LLC2 Config>`).

Enter console (monitoring) commands at the `X.25>` or `X.25-LLC2>` prompt.

**Note:** The X.25-LLC2 pseudo interface does not use the X.25 level 2 (frame level) protocol, and it does not support data compression or permanent virtual circuits. Commands which relate to these features do not apply to the X.25-LLC2 interface and are clearly indicated in this chapter.

## 13.2 Basic Configuration Procedures

This section outlines the minimal configuration steps required to get the X.25 interface up and running.

**Note:** You must restart the router for new configuration changes to take effect.

- **Setting the data link to X.25**. If you are using a synchronous line to connect to a remote DTE across a WAN interface you must set the data link to X.25 by entering the **set data-link x25** command at the Config> prompt.

Example: **Config> set data-link x25 2**

or

- **Adding an X.25-LLC2 pseudo device.** If you are connecting to a remote DTE over a local area network you must add an X.25-LLC2 pseudo device and associate it with the LAN interface and the MAC address of the remote DTE. Use the **add device X25-LLC2** command at the Config> prompt.

  For example, to configure an X.25LLC2 device which connects to a DTE at MAC address 08002BB19F1D using the device Eth/0 use this command:

Example: **Config> add device x25-llc2**

```
LAN ifc [0]?
Remote MAC address []? 08002BB19F1D
Adding device as interface 3
Use ”net 3” command to configure paramters
```

**Note:** Refer to the *System Software Guide* for more details about the **set data-link** and **add device** commands. For more information about configuring an Ethernet interface, refer to Chapter 2.

- **Setting the local X.25 address**. After setting the data link, you must set the router’s local X.25 address using the **set address** command. The X.25 address is a unique X.121 address that is used during call establishment. Failure to set the network address prevents the X.25 interface from joining the attached network.

- **Setting DCE/DTE equipment type**. You must specify whether the frame and packet levels act as DCE or DTE using the **set equipment-type** command. The default for this command is DTE.

**Note:** Keep the following restrictions in mind when defining PVCs and SVCs:

1. You must define the range of PVCs starting from 1 to *n*.
2. SVCs may follow the defined PVCs. If SVCs follow PVCs, they *must not* overlap.
3. The total number of SVC channel numbers and PVC channel numbers cannot exceed 239.
4. Virtual circuit identifiers can be defined between 1 and 4095.

- **Defining the high and low SVCs**. Define the lower and upper range of the SVCs that you are using. Use the **set svc low** and **set svc high** commands. You can choose from three SVC types: two-way, inbound, and outbound. The default is svc low-two = 1 and svc high-two = 64. All other SVC types default to 0.
- **Defining PVCs**. If you are using PVCs over an X.25 network interface, you must define the range of PVCs that you are using. Use the **set pvc low** and **set pvc high** commands. The range of PVCs *must not* over-lap the SVC ranges. You must also define the PVCs individually using the **add pvc** command.

**Note:** X.25-LLC2 pseudo devices *do not* support the use of PVCs.

- **Adding a protocol**. Add the protocols to run over the X.25 interface: IP, IPX, or DN. Use the **add protocol** command. Note that you only need to add the protocols once for all X.25 networks on router.
- **Adding a protocol address**. Add an address translation for each protocol's destination address reachable over this interface. Use the **add address** command.

### 13.2.1 Addressing

You must assign a unique X.121 network address to each X.25 network interface. Failure to set the network address prevents the X.25 interface from joining the attached network. This address is used during call establishment and also used by the remote DTE for mapping the destination protocol addresses to the X.121 call addresses. The source address of one DTE is the destination for another, thus facilitating the piggybacking of protocol return traffic on previously established circuits. The mapping between the destination protocol address and the destination DTE address is configured using the X.25 configuration **add address** command. (This command is described in more detail later in this chapter). You can assign different protocol destination addresses to a single destination DTE address.

The mapping of the protocol to the X.121 call address is static (SRAM) and is configured on a per protocol and a per network interface basis. The exception is DDN addresses (IP HostTableFormat Addresses), which can also be configured as static permanent entries or dynamically instantiated in parallel to the IP protocol packet send sequence. Dynamic translations of IP HTF addresses to X.121 addresses are not saved over router restarts and are not displayed through the **list** option in the configuration command because they are not saved in SRAM.

The Call User Data (CUD) field is used for IPX to X.25 address mapping only. It determines how the CUD field is filled in when call request packets are received for IPX. The CUD Field can be either Standard or Proprietary. Standard indicates that the usage is protocol multiplexing used in RFC 1356. The default is Standard.

### 13.2.2 Setting the X.25 Node Address

Specify an X.25 node address for each interface by entering the X.25 configuration **set address** command.

### 13.2.3 Configuring Data Compression on X.25 Network Interfaces

Data compression is available on X.25 network interfaces, but is *not* available for use over the LAN by X.25-LLC2 pseudo devices. Refer to the *Routing Protocols Reference Guide* for details about how data compression operates over switched virtual circuits.

You can use the Stac LZS data compression algorithm to compress the data before it is packetized for transmission over SVCs or OSI/DNA V DA or DLM circuits. Each type of router has a maximum number of compression dictionaries allowed. You must enable compression on each X.25 interface, using the **enable compression** command. This command lets you configure the number of dictionaries allocated per interface, up to the maximum number allowed for the router.

One dictionary is allocated to each call on the interface to record the data history for the call and compression is calculated based on the recorded history. If there are no more dictionaries available when a new call is made, compression for that call is on a per-message basis.

For X.25 supported protocols other than DNA V/OSI, you configure compression for an outgoing call to a particular destination when using the **add address** command. A prompt asks if compression is to be negotiated for calls to the specified destination address.

**Note:** Compression on OSI/DNA V DA and DLM circuits is configured from the OSI console when using the **add template** command. Refer to the *Routing Protocols Users Guide* for details about configuring OSI/DNA V circuits.

For calls *without* a dictionary, the overhead of compressing and decompressing small data messages may be excessive, so routing packets below the minimum threshold are not compressed. You can modify the threshold for the smallest message to compress using the **set minimum-compression-message-size** command. Since compression occurs before packetization this size represents the minimum-sized routing packet which will be compressed.

**Note:** The minimum-compression-message-size value only affects calls using compression WITHOUT a dictionary. Calls using a dictionary will compress all packets.

If the data being transmitted is already in a compressed format (for example, JPEG format image data), then the compression algorithm may cause the data to expand. If there is a long sequence of data which cannot be compressed then compression is suspended dynamically. By default, compression is disabled after a sequence of 5000 bytes of data which cannot be compressed. You can change this threshold using the **set compression-disable-threshold** command. Data is then transmitted uncompressed, however the compressor continues to attempt to compress data in order to detect whether the data is no longer expanding. When expansion has stopped compression resumes.

### 13.2.4 Setting the National Personality

Each public data network, such as GTE's Telenet or DDN's Defense Data Network, has its own standard configuration. The term *National Personality* specifies a group of variables used to define a public data network's characteristics. The configuration information in the National Personality provides the router with control information for packets being transferred over the link. The National Personality option defines 28 default parameters for each public data network.

To view the configuration values that are in your X.25 National Personality, execute the X.25 configuration **list detailed** command. Configure each public data network connected to the router by executing the X.25 configuration **set national personality** command.

The National Personality is a generalized template for network configuration. If necessary, you can individually configure each frame and packet layer parameter.

## 13.3 X.25 Configuration and Console Commands

This section summarizes and explains all the configuration and console commands for X.25 network interfaces and X.25-LLC2 pseudo devices.

Table 13–1 lists the commands, which allow you to specify and monitor network parameters for router interfaces that transmit X.25 packets. The information you specify with the configuration commands activates when you restart the router.

Enter the X.25 configuration commands at the `X.25 Config>` prompt, or at the `X.25-LLC2 Config>` prompt.

Enter console (monitoring) commands at the `X25>` prompt

**Table 13–1 X.25 Configuration and Console Commands Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/ Monitor | Lists the interface commands or lists the options associated with specific commands. |
| **Add** | Configure | Adds an address translation, a protocol encapsulation, or a PVC definition. |
| **Change** | Configure | Changes an address translation, a protocol encapsulation, or a PVC definition. |
| **Delete** | Configure | Removes an address translation, a protocol encapsulation, or a PVC definition. |
| **Disable** | Configure | Disables interface-resets, incoming-calls-barred, outgoing-calls-barred feature, data compression or dynamic DDN address translations. |
| **Enable** | Configure | Enables interface-resets, incoming-calls-barred, outgoing-calls-barred features, data compression or dynamic DDN address translations. |

**Table 13–1 X.25 Configuration and Console Commands Summary (Continued)**

| Command | Task | Function |
|---|---|---|
| **List** | Configure/ Monitor | Lists the defined address translations, National Personality Parameters, protocol encapsulation, data compression or PVC definitions. From the console level, lists individual PVC or SVC statistics and general information. |
| **National Disable** | Configure | Disables features defined by the National Personality configuration. |
| **National Enable** | Configure | Enables features defined by the National Personality configuration. |
| **National Restore** | Configure | Restores the National Personality configuration to its default values. |
| **National Set** | Configure | Sets parameters defined by the National Personality configuration. |
| **Parameters** | Monitor | Displays the current parameters for any level of the X.25 configuration. |
| **Set** | Configure | Sets the local and DDN X.25 node addresses, window size for frame and packet levels, identifies the National personality, and the maximum number of calls out less the PVCs. Defines the PVC and SVC channel ranges, the number of seconds that a switched circuit can be idle before it is cleared, and specifies whether the frame and packet levels act as DCE or DTE. Defines data compression thresholds |
| **Statistics** | Monitor | Displays the current statistics for any level of the X.25 configuration. |
| **Exit** | Configure/ Monitor | Exits the X.25 configuration and monitor processes and returns to the previous prompt level. |

### ? (Help) C M

List the commands that are available from the current prompt level. You can also enter **?** after a specific command name to list its options.

**Syntax:** ?

Example: **?**

```
ADD
CHANGE
DELETE
DISABLE
ENABLE
LIST
NATIONAL-PERSONALITY
SET
EXIT
```

### Add C

Add an X.25 address, a DDN X.25 address, a protocol configuration, or a PVC definition.

**Syntax:** add address
htf-address
protocol
pvc

#### address

Adds a PDN (Public Data Network) X.25 address translation for a protocol supported in the configuration of the router. The prompts that appear depend on the protocol address that you are adding (see following examples). The protocol address and X.25 address being entered represent the protocol and X.25 address at the remote end of the X.25 link. The **set address** command is used to set the local X.25 address.

Example: **add address**

**IP Example:**

```
Protocol [IP]? IP
IP Address [0.0.0.0]?
X.25 Address []?
Compression? [DISABLED]?
```

**IPX Example:**

```
Protocol [IP]? IPX
CUD Field Usage (Proprietary or Standard) [Standard]?
IPX Host Number (in hex) []?
X.25 Address []?
Compression? [DISABLED]?
```

**DN Exampel:**

```
Protocol [IP]? DN
Decnet Address [0.0]?
X.25 Address []?
Compression? [DISABLED]? enabled
```

*Protocol* Specifies the protocol type of the address mapping you are adding: IP, IPX, or DN. The default is IP.

*IP Address* Specifies the destination's IP address.

*IPX Host Number* Specifies the IPX host number of the destination.

*CUD Field Usage* This field is for IPX to X.25 address mapping only. It determines how the Call User Data (CUD) field is filled in when call request packets are received for IPX. If an invalid choice is made (that is, something other than Proprietary or Standard), the following error message appears:

```
Invalid CUD usage type
Standard default will be used
```

*Decnet Address* Specifies the area and node of the DECnet address that you want to add.

*X.25 Address* Specifies the PDN interface's X.25 address that connects to the router. The maximum address length is 15 digits.

*Compression* Specifies whether compression will be negotiated when making an outgoing call to this destination. The default is disabled.

**Note:** This parameter only applies to X.25 network interfaces. Compression is not available on X.25-LLC2 pseudo interfaces.

#### htf-address

Adds a DDN (Defense Data Network) X.25 address translation.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **add htf-address**

```
Protocol [IP]
Current HTF address
```

| | |
|---|---|
| *Protocol* | Specifies the protocol that you are running over the X.25 interface. DDN supports IP only. |
| *Current HTF address* | Specifies the destination PDN address in Host Table Format (HTF) format. Also refer to ddn-address-translations in the Enable/Disable commands section. |

#### protocol

Enables a protocol encapsulation and defines associated parameters.

Example: **add protocol**

```
Protocol [IP]
Window Size [2]
Default Packet Size [128]
Maximum Packet Size [256]
Circuit Idle Time [30]
Maximum SVCs [6]
```

| | |
|---|---|
| *Protocol* | Specifies which protocol's encapsulation parameters you want to add: IP, IPX, or DN. The default is IP. |
| *Window Size* | Specifies the number of packets that can be outstanding before an adjacent circuit is established to the same destination. The default is 2. |

*Default Packet Size* Specifies the default requested packet size for SVCs. This value must be equal to or less than the maximum packet size specified with the **national set packet-size** command. The default value is 128 bytes.

*Maximum Packet Size* Specifies the maximum negotiated packet size for SVCs. This value must be equal to or less than the maximum packet size specified with the **national set packet-size** command. The default is 256.

*Circuit Idle Time* Specifies the number of seconds that an SVC can be idle before it is cleared. The range is 0 to 65365. The default is 30 seconds. A 0 (zero) specifies that the circuit is never cleared.

*Maximum SVCs* Specifies the maximum number of SVCs that are open to a given destination for a protocol. Use this parameter where parallel paths can result in misordering of forwarder packets. Setting this parameter to the proper number helps to eliminate this problem (at the cost of lower bandwidth). The default is 4.

### pvc

Adds a PVC definition. The prompts that appear depend on the protocol that you are adding to the PVC.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`add pvc`**

**IP Example:**

```
Protocol [IP]? IP
Packet Channel [1]?
Destination X.25 Address[]?
Window Size [2]?
Packet Size [128]?
```

**IPEample:**

```
Protocol [IP]? IPX
Packet Channel [1]?
Destination X.25 Address []?
Window Size [2]?
Packet Size [128]?
```

| | |
|---|---|
| *Protocol* | Specifies which protocol’s encapsulation parameters you want to modify: IP or IPX. The default is IP. |
| *Packet Channel* | Specifies the circuit number of the PVC. |
| *Destination X.25 Address* | Specifies the address of the PVCs destination. |
| *Window Size* | Specifies the number of packets that can be transmitted before an acknowledgment is needed. If this number of packets are transmitted no further packets can be sent until an acknowledgement is received. The default is 2. |
| *Packet Size* | Specifies the number of bytes in the data portion of the packet. The default packet size is 128 bytes. This value must be equal to or less than the maximum set by the **national set packet-size** command. |

### Change C

Modify a PDN X.25 address, DDN X.25 address, protocol configuration, or a PVC definition.

**Syntax:** change address
htf address
protocol
pvc

#### address

Modifies a PDN X.25 address translation. The prompts that appear depend on the protocol that you are changing.

```
Example:  change address
```

**IP Example:**

```
Protocol [IP]? IP
IP Address [0.0.0.0]?
X.25 Address [00000124040000]?
Compression [DISABLED]?
```

**IPX Exampel:**

```
Protocol [IP]? IPX
CUD Field Usage (Proprietary or Standard) [Standard]?
IPX Host number (in hex) []?
X.25 Address [00000124040000]?
Compression [DISABLED]?
```

**DN Example:**

```
Protocol [IP]? DN
Decnet Address [0.0]?
X.25 Address [00000124040000]?
Compression [ENABLED]?
```

| | |
|---|---|
| *Protocol* | Specifies the protocol type of the address mapping you want to change: IP, IPX, or DN. The default is IP. |
| *IP address* | Specifies the destination protocol interface's IP address. |
| *CUD Field Usage* | This field is for IPX to X.25 address mapping only. It determines how the Call User Data field is filled in when call request packets are received for IPX. If an invalid choice is made (that is, something other than Proprietary or Standard), the following error message appears:<br>`Invalid CUD usage type`<br>`Standard default will be used` |
| *X.25 address* | Specifies the destination's new PDN X.25 address. The default is current PDN X.25 address. |
| *Decnet Address* | Specifies the area and node of the DECnet address that you want to change. |
| *IPX Host number* | Specifies the IPX host number that you want to change. The default is current host number. |

| | |
|---|---|
| *Compression* | Specifies whether compression will be negotiated when making an outgoing call to this destination. The default is the current setting.<br>**Note:** This parameter only applies to X.25 network interfaces. Compression is not available on X.25-LLC2 pseudo interfaces. |

#### hft address

Changes a DDN X.25 address translation.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **change htf-address**

```
Protocol [IP]
Change HTF address [0.0.0.0]?
New HTF address [10.4.0.124]?
```

| | |
|---|---|
| *Protocol* | Specifies the protocol that you are running over the X.25 interface. DDN supports IP only. |
| *Change HTF address* | You must specify the current Host Table Format (HTF) address that you want to change. |
| *New HTF address* | Specify the new HFT address. The default is current HFT address. |

#### protocol

Changes a protocol configuration definition.

Example: **change protocol**

```
Protocol [IP]
Window Size [2]
Default Packet Size [128]
Maximum Packet Size [256]
Circuit Idle Time [30]
Maximum VCs [6]
```

| | |
|---|---|
| *Protocol* | Specifies which protocol's encapsulation parameters you want to change: IP, IPX, or DN. The default is IP. |
| *Window Size* | Specifies the number of packets that can be outstanding before an adjacent circuit is established to the same destination. The default is the currently defined window size. |
| *Default Packet Size* | Specifies the default requested packet size for SVCs. This value must be equal to or less than the maximum packet size specified with the **national set packet-size** command. The default is the previous value. |
| *Maximum Packet Size* | Specifies the maximum negotiated packet size for SVCs. This value must be equal to or less than the maximum packet size specified with the **national set packet-size** command. The default is the previous value. |
| *Circuit Idle Time* | Specifies the number of seconds that a circuit can be idle before it is cleared. The range is 0 (zero) to 65365. The default is the currently defined circuit idle time in seconds. A 0 specifies that the circuit is never cleared. |
| *Maximum SVCs* | Specifies the maximum number of SVCs that are open to a given destination for a protocol. This parameter can be used where parallel paths can result in misordering of forwarder packets. Setting this parameter to the proper number helps to eliminate this problem (at the cost of lower bandwidth). The default is the previous value. |

**pvc**

Changes a PVC definition. The prompts that appear, depend on the protocol's PVC that you are changing.

**Note:** This command is not available on X.25-LLC2 pseudo interfaces since they do not support the use of PVCs.

Example: **change pvc**

**IPExample:**

```
Protocol [IP]? IP
Packet Channel [1]?
Destination X.25 Address[]?
Window Size [2]?
Packet Size [128]?
```

**IPX Example:**

```
Protocol [IP]? IPX
Packet Channel [1]?
Destination X.25 Address []?
Window Size [2]?
Packet Size [128]?
```

| | |
|---|---|
| *Protocol* | Specifies which protocol's encapsulation parameters you want to change: IP or IPX. The default is IP. |
| *Packet Channel* | Specifies the circuit number of the PVC. The default is currently defined circuit number. |
| *Destination X.25 Address* | Specifies the address of the PVCs destination. The default is the currently defined X.25 address. |
| *Window Size* | Specifies the maximum number of packets that can be transmitted before an acknowledgment is received. The default is the currently defined window size. |
| *Packet Size* | Specifies the number of bytes in the data portion of the packet. The default packet size is 128 bytes. This value must be equal to or less than the maximum set by the **national set packet-size** command. The default is the currently defined packet size. |

### Delete C

Delete a X.25 address, a protocol configuration definition, or a PVC definition.

**Syntax:** delete address
protocol . . .
pvc

#### address

Deletes an X.25 address translation.

Example: **delete address**

**IPExample:**
```
Protocol [IP]?
IP Address [0.0.0.0]?
```

**IPX Example:**
```
Protocol [IP]?
IPX Host Number (in hex) [2]?
```

| | |
|---|---|
| *Protocol* | Specifies the protocol type of the address mapping you are deleting. The default is IP. |
| *IP Address* | Specifies the destination protocol interface's IP address. |
| *IPX Host Number* | Specifies the IPX host number. |

#### protocol *prot-type*

Deletes a protocol encapsulation configuration definition. *Prot-type* is the name or number of the protocol encapsulation that is currently defined in the router's configuration.

Example: **delete protocol IPX**

#### pvc

Deletes a PVC definition.

**Note:** This command is not available on X.25-LLC2 pseudo interfaces since they do not support PVCs.

```
Example:  delete pvc

     Protocol [IP]?
     Destination X.25 Address []?
```

| | |
|---|---|
| *Protocol* | Specifies the protocol that you are running over the X.25 interface. DDN supports IP only. |
| *Destination X.25 Address* | Specifies the address of the PVCs destination. |

### Disable C

Disable DDN address translations, interface resets as part of network certification, or the incoming-calls-barred or the outgoing-calls-barred features.

**Syntax:** disable compression
ddn-address-translations
interface-resets
incoming-calls-barred
outgoing-calls-barred

#### compression

Disables data compression on this X.25 interface.

**Note:** Data compression is not available on X.25-LLC2 pseudo interfaces.

```
Example:  disable compression
```

#### ddn-address-translations

Specifies that the DDN host table format (IP) addresses are not dynamically converted to X.121 call addresses.

**Note:** This command is not available on X.25-LLC2 pseudo interfaces.

Example: **disable ddn-address-translations**

**interface-resets**

Specifies that both the packet layer restarts and frame layer link establishment is initiated by the network interface. This feature is used during certification testing to enable the network to control packet and frame layer restarts.

Example: **disable interface resets**

**incoming-calls-barred**

Specifies that the router accepts incoming calls.

Example: **disable incoming-calls-barred**

**outgoing-calls-barred**

Specifies that the router allows outgoing calls.

Example: **disable outgoing-calls-barred**

## Enable C

Enable data compression, DDN address translations, interface resets, or to enable the incoming-calls-barred or the outgoing-calls-barred features.

**Syntax:** enable compression
ddn-address-translations
interface-resets
incoming-calls-barred
outgoing-calls-barred

**compression**

Enables data compression and specifies the number of data dictionaries which will be allocated to this interface. The default is Disabled.

**Note:** Data compression is not available on X.25-LLC2 pseudo interfaces.

Example: **enable compression**

```
Maximum number of compression dictionaries [5]?
Compression enabled with 5 dictionaries
```

| | |
|---|---|
| *Maximum number of compression dictionaries* | Specifies the maximum number of data dictionaries which will be permitted on this interface. The total number of data dictionaries allocated cannot exceed the maximum for this router.<br>The default is 5 dictionaries. |

#### ddn-address-translations

Specifies that the DDN host table format (IP) addresses are dynamically converted to X.121 call addresses. The default is Disabled.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`enable ddn-address-translations`**

#### interface-resets

Specifies that both the packet layer restarts and the frame layer link establishment can be initiated by either the router or the network interface. This feature is used during normal operation. The default is Enable.

`Example:` **`enable interface-resets`**

#### incoming-calls-barred

Specifies that the router does not accept incoming calls. The default is Enable.

`Example:` **`enable incoming-calls-barred`**

#### outgoing-calls-barred

Specifies that the router does not allow outgoing calls. The default is Enable.

`Example:` **`enable outgoing-calls-barred`**

### List C

Display the current configuration for the specified parameter.

**Syntax:** list addresses
all
detailed
protocols
pvc
summary

#### addresses

Lists all the X.25 address translations.

Example: **list addresses**

```
X.25 address translation configuration

IF#    Prot #  Compression  Protocol -> X.25 address
1       0      Enabled      10.1.2.1 -> 1238765742
1       4      Enabled      1.10     -> 9910
1       7      Disabled     10       -> 12389    CUD Field = Standard
```

*IF#* Displays the current interface number. You accessed this at the `Config>` prompt using the **net <number>** command. All addresses listed belong to this network.

*Prot#* Displays the identification of the protocol that this mapping is defined for.

*Compression* Displays whether compression negotiation has been enabled for outgoing calls made to this destination address.

**Note:** This field only applies to X.25 network interfaces. It is not displayed for X.25-LLC2 pseudo interfaces.

*Protocol* Displays the destination address of the protocol.

*X.25 address* Displays the protocol X.25 address corresponding to that protocol address.

*CUD Field* This field is for IPX to X.25 address mapping only. It determines how the Call User Data field is filled in when call request packets are received for IPX. The CUD Field can be either Standard or Proprietary. Standard indicates that the usage is the protocol identification specified in RFC 1356. The default is Standard.

**all**

Lists all the X.25 addresses, National Personality parameters, all defined protocols and their values, and all defined PVC's.

Example: **list all**

```
X.25 Configuration Summary

Node Address: 23785763
Max Calls Out: 15        Inter-Frame Delay:       0
Speed:         9600      Clocking:      External
MTU:           1500 Default Window: 4   SVC idle: 25 seconds
National Personality: GTE Telenet (DTE)
PVC             low: 1  high: 2
Inbound         low: 0  high: 0
Two-Way         low: 5  high: 64
Outbound        low: 0  high: 0
Throughput Class in bps Inbound:  2400
Throughput Class in bps Outbound: 2400

X.25 National Personality Configuration

Follow CCITT: on   OSI 1984:     on      OSI 1988:        off
Clear w/diag: on   Reset w/diag: on      Restart w/diag:  on
Request Reverse Charges:  on  Accept Reverse Charges:     on
Allow Packet Restarts:    on  Suppress Calling Addresses: off
Suppress Cause Fields:    on  Suppress Frame Idle RRs:    off
Frame Extended seq mode:  off Packet Extended seq mode:   off
Use Multi-link Addresses: off Disable Interface Resets:   off
Incoming Calls Barred:    off Outgoing Calls Barred:      off
Throughput Negotiation:   on  Flow Control Negotiation:   on
DDN Address Translation   off
Call Request Timer:     20 decaseconds
Clear Request Timer:    18 decaseconds (1 retries)
Reset Request Timer:    18 decaseconds (1 retries)
Restart Request Timer:  18 decaseconds (1 retries)
T1 Timer: 4.00 seconds     N2 timeouts: 20
```

```
T2 Timer: 2.00 seconds     DP Timer:    500 milliseconds
Standard Version:  1984    Network Type: CCITT
Disconnect Procedure: passive
Window Size     Frame:   7      Packet:  2
Packet Size     Default: 128    Maximum: 256

Compression enabled with 5 available dictionaries
Disable Threshold 5000
Min Compress Message Size (for calls without dictionary)  500

X.25 protocol configuration

Prot         Window        Packet-size             Idle
Number        Size           Default Maximum       Time
 0              7            128     256              3


X.25 PVC configuration

Prtcl   X.25_address    Window  Pkt_len L3_chan
0       21309001122330    7       128     1

X.25 address translation configuration

IF #    Prot #  Compression       Protocol -> X.25 address
 4       0      Enabled     128.185.184.26 -> 21309001122330
 4       0      Enabled     128.185.184.21 -> 21309445566770
```

**detailed**

Lists the value of all the default parameters that the **national set** command modifies. Descriptions of the screen display are listed in the **national set** command described later in this chapter.

Example: `X.25 Config>`**`list detailed`**

```
X.25 National Personality Configuration

Follow CCITT: on           OSI 1984: on   OSI 1988: off
Clear w/diag: on       Reset w/diag: on    Restart w/diag: on
Request Reverse Charges: on   Accept Reverse Charges:     on
Allow Packet Restarts:   on   Suppress Calling Addresses: off
Suppress Cause Fields:   on   Suppress Frame Idle RRs:    off
FrameExtended seq mode:  off  PacketExtended seq mode:    off
UseMulti-linkAddresses:  off  Disable Interface Resets:   off
Incoming Calls Barred:   off  Outgoing Calls Barred:      off
Throughput Negotiation:  on   Flow Control Negotiation:   on
DDN Address Translation: off
```

```
Call Request Timer:     20 decaseconds
Clear Request Timer:    18 decaseconds (1 retries)
Reset Request Timer:    18 decaseconds (1 retries)
Restart Request Timer:  18 decaseconds (1 retries)
T1 Timer: 4.00 seconds     N2 timeouts: 20
T2 Timer: 2.00 seconds     DP Timer:    500 milliseconds
Standard Version:     1984      Network Type: CCITT
Disconnect Procedure: passive
Window Size     Frame:   7      Packet:  2
Packet Size     Default: 128    Maximum: 256

Compression enabled with 5 available dictionaries
Disable Threshold 5000
Min Compress Message Size (for calls without dictionary)  500
```

Example: X.25-LLC2 Config>**list detailed**

```
X.25 National Personality Configuration

Follow CCITT: on        OSI 1984:     off       OSI 1988:       on
Clear w/diag: on        Reset w/diag: on        Restart w/diag: on
Request Reverse Charges:  on    Accept Reverse Charges:     on
Allow Packet Restarts:    on    Suppress Calling Addresses: off
Suppress Cause Fields:    on    Packet Extended seq mode:   off
Disable Interface Resets:   off
Incoming Calls Barred:    off   Outgoing Calls Barred:      off
Throughput Negotiation:   on    Flow Control Negotiation:   on
Call Request Timer:     20 decaseconds
Clear Request Timer:    18 decaseconds (1 retries)
Reset Request Timer:    18 decaseconds (1 retries)
Restart Request Timer:  18 decaseconds (1 retries)
Standard Version:     1984      Network Type: CCITT
Window Size     Packet:  7
Packet Size     Default: 128    Maximum: 1024
```

**protocols**

Lists all the defined protocol configurations.

Example: **list protocols**

```
X.25 protocol configuration

ProtocolWindowPacket-Size    Idle   Max
 Number SizeDefault Maximum    Time   VCs

   0  4    128   256     10     6
   5  2    128   256     30     6
```

*Protocol Number* Displays the protocol's encapsulation parameters for that protocol: IP, IPX, or DN.

*Window Size* Displays the number of packets that can be outstanding before an acknowledgment is sent.

*Packet-Size* Displays the default and maximum packet sizes that are configured for the router.

*Idle Time* Displays the number seconds that a circuit can be idle before it is cleared. The range is 0 (zero) to 65365. A 0 specifies that the circuit is never cleared.

*Maximum VCs* Displays the maximum number of VCs that are open to a given destination for a protocol.

**pvc**

Lists all the defined PVCs.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`list pvc`**

```
X.25 PVC configuration

Prtcl    X.25 Address   Window    Pkt_len   Pkt_chan
0        8383838383     4         1024      3
```

*Prtcl* Displays the identifier of the protocol running over this PVC, IP, IPX, or DN.

*X.25 Address* Displays the destination X.25 address.

*Window* Displays the window size of the PVC.

*Pkt_len* Displays the maximum length of a packet transmitted over the PVC.

*Pkt_chan* Displays the circuit number of the PVC.

#### summary

Lists all the values established by the **set** and **enable** commands. These values modify the X.25 configuration.

Example: X.25 Config>**list summary**

```
X.25 Configuration Summary

Node Address: 23785763
Max Calls Out: 15                                Inter-Frame Delay:  1
Default Window: 4                                SVC idle: 25 seconds
National Personality: GTE Telenet (DTE)
PVC            low: 1  high: 2
Inbound        low: 0  high: 0
Two-Way        low: 3  high: 64
Outbound       low: 0  high: 0
Throughput Class in bps Inbound:   2400
Throughput Class in bps Outbound:  2400
```

Example: X.25-LLC2 Config>**list summary**

```
X.25 Configuration Summary

Node Address:      21309776655330
Max Calls Out:      4
Default Window:     2          SVC idle:     30 seconds
National Personality: ISO 8881 (DTE)
Inbound         low: 0    high: 0
Two-Way         low: 1    high: 64
Outbound        low: 0    high: 0
Throughput Class in bps Inbound:  2400
Throughput Class in bps Outbound: 2400
```

*Node Address* Displays the local X.25 interface address.

*Max Calls Out* Displays the default maximum number of SVC's initiated by the router to a given destination for a given protocol. The range is 0 to 227.

*Inter-Frame Delay* Displays the minimum number of flags set to be transmitted between frames.

| | |
|---|---|
| *Default Window* | Displays the window size assumed for the packet layer. The range is determined by the National Personality packet-extended-sequence-mode. In the absence of any facilities in the SVC call setup, this is the assumed value. |
| *SVC idle* | Displays the number of seconds that a switched circuit can be idle before it is cleared. The range is 1 to 255. |
| *Max-retries* | Displays the maximum number of reset request transmissions permitted before the call is cleared. |
| *National Personality* | Displays the *GTE-Telenet* or *DDN* National Personality. GTE-Telenet is the default setting. |
| *PVC (low, high)* | Displays the lowest to the highest permanent virtual circuit channel numbers. Zero indicates no PVCs. The range is 0 through 4095. |
| *Inbound (low, high)* | Displays the lowest to the highest inbound switched virtual circuit channel numbers. The default setting is 0; therefore, by default, there are no inbound-only SVCs. The range is 0 through 4095. |
| *Two-way (low, high)* | Displays the lowest to the highest 2-way switched virtual circuit channel numbers. The default setting is 1 for the low parameter and 64 for the high parameter. By default, there are 64 two-way SVCs. The range is 0 through 4095. |
| *Outbound (low, high)* | Displays the lowest to the highest outbound switched virtual circuit channel numbers. The default setting is 0; therefore, by default, there are no outbound-only SVCs. The range is 0 through 4095. |
| *Throughput Class in bps (inbound, outbound)* | Displays default throughput capacity (in bits per second) for inbound and outbound traffic. |

### List M

Display the current active PVCs and SVCs.

**Syntax:** list pvcs
svcs

#### pvc

Displays the configured permanent virtual circuits.

Example: **list pvcs**

#### svc

Displays the active switched virtual circuits.

Example: **list svcs**

```
LCN/  Destination    Call      Out Out  In           Totals   Compression
State Address        Dir Prot Win Pkt  Pkt  Xmts  Rcvs Resets  Tx    Rx

1   D 31            In    IP  7  128  128    77    73     0  Off    Off
2   D 31            In    IP  7  128  128    29    35     0  Off    Off
3   D 50            In    IP  7  128  128    46    48     0  On/H  On/H
4   D 31            In    IP  7  128  128    16    18     0  Off    Off
5   D               In  X25S  7  128  128     6     1     0  Off    Off
63  D              Out  X25S  7  128  128     1     6     0  Off    Off
64  D 31           Out    IP  7  128  128     5     7     0  Off    Off

D  - Data Transfer    P  - Call Progressing
C  - Call Clearing    H  - Compression History
```

### National Disable C

Disable a feature defined by the National Personality configuration.

**Syntax:** national disable accept-reverse-charges
ccitt
clear-w/diag
flow-control-negotiation
frame-ext-seq-mode
multi-link-addresses
osi-84

osi-88
packet-ext-seq-mode
packet-layer-restarts
request-reverse-charges
reset-w/diag
restart-w/diag
suppress-calling-addresses
suppress-idle-frame-rr
suppress-non-zero-cause
throughput-class-negotiation

**accept-reverse-charges**

Disables the accepting of reverse charges for calls during call establishment. This option is not available for DDN.

Example: **national disable accept-reverse-charges**

**ccitt**

Disables the use of the CCITT convention, rather than ISO convention, that is followed for timer retry expiration. CCITT acts as if the confirmation packet for the restart or clear requests had arrived. ISO leaves the request unconfirmed.

Example: **national disable ccitt**

**clear-w/diag**

Does not allow the clear request packets to include the diagnostic field.

Example: **national disable clear-w/diag**

**flow-control-negotiation**

Disables negotiation of packet and window size during call setup of SVCs.

Example: **national disable flow-control-negotiation**

**frame-ext-seq-mode**

Disables the frame layer from using extended sequence numbers 0 to 127. Sets the frame layer sequence numbering to 0 to 7.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national disable frame-ext-seq-mode`**

#### multi-link-addresses

Sets the frame level addresses back to A (03) and B (01).

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national disable multi-link-addresses`**

#### osi-84

Disables CCITT OSI facilities as defined by the 1984 standard.

`Example:` **`national disable osi-84`**

#### osi-88

Disables CCITT OSI facilities as defined by the 1988 standard.

`Example:` **`national disable osi-88`**

#### packet-ext-seq-mode

Disables the packet layer from using extended sequence numbers 0 to 127. Sets the packet layer sequence numbering to 0 to 7.

`Example:` **`national disable packet-ext-seq-mode`**

#### packet-layer-restarts

Disables the packet layer from sending a restart request packet when the router restarts. The default for this feature is ON. Disable this feature only if the switch you are connecting to requires that this be disabled.

**Note:** If this feature is disabled on both sides of the line, the line does not come up. If this feature is only disabled on one side of the line, the line still comes up.

`Example:` **`national disable packet-layer-restarts`**

#### request-reverse-charges

Disables the requesting of reverse charges for all outgoing calls.

`Example:` **`national disable request-reverse-charges`**

**reset-w/diag**

Disables the inclusion of diagnostic fields in reset request packets.

`Example:` **`national disable reset-w/diag`**

**restart-w/diag**

Disables the inclusion of diagnostic fields in restart request packets.

`Example:` **`national disable restart-w/diag`**

**suppress-calling-addresses**

Disables the suppression of the source address in call packets.

`Example:` **`national disable suppress-calling-addresses`**

**suppress-idle-frame-rr**

Enables the sending of idle receiver ready frame layer frames.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national disable suppress-idle-frame-rr`**

**suppress-non-zero-cause**

Disables the inclusion of non-zero values in the packet layer's cause fields.

`Example:` **`national disable suppress-non-zero-cause`**

**throughput-class-negotiation**

Disables the negotiation of through-put class during call setup of SVCs

`Example:` **`national disable throughput-class-negotiation`**

## National Enable C

Enable a feature defined in the National Personality configuration.

**Syntax:** national enable accept-reverse-charges
ccitt
clear-w/diag
flow-control-negotiation

frame-ext-seq-mode
multi-link-addresses
osi-84
osi-88
packet-ext-seq-mode
packet-layer-restarts
request-reverse-charges
reset-w/diag
restart-w/diag
suppress-calling-addresses
suppress-idle-frame-rr
suppress-non-zero-cause
throughput-class-negotiation

**accept-reverse-charges**

Accepts reverse charge calls during call establishment. This option is not available for DDN.

Example: **national enable accept-reverse-charges**

**ccitt**

Specifies that the CCITT convention, rather than ISO convention, is followed for timer retry expiration. CCITT acts as if the confirmation packet for the restart or clear requests had arrived. ISO leaves the request unconfirmed.

Example: **national enable ccitt**

**clear-w/diag**

Allows clear request packets to include the diagnostic field.

Example: **national enable clear-w/diag**

**flow-control-negotiation**

Enables the negotiation of packet and window size during call setup of SVCs.

Example: **national enable flow-control-negotiation**

**frame-ext-seq-mode**

Sets the frame layer sequence numbering to modulus 128 (that is, 0 through 127).

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national enable frame-ext-seq-mode**

**multi-link-addresses**

Allows the frame level to use addresses C (0F) and D (07) rather than A (03) and B (01).

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national enable multi-link-addresses**

**osi-84**

Allows CCITT OSI facilities defined by the 1984 standard.

Example: **national enable osi-84**

**osi-88**

Allows CCITT OSI facilities defined by the 1988 standard.

Example: **national enable osi-88**

**packet-ext-seq-mode**

Sets the packet layer sequence numbering modulus 128 (that is, 0 through 127).

Example: **national enable packet-ext-seq-mode**

**packet-layer-restarts**

Specifies that the packet layer sends a restart packet when the router restarts.

Example: **national enable packet-layer-restarts**

**request-reverse-charges**

Requests reverse charges for all outgoing calls.

Example: **national enable request-reverse-charges**

**reset-w/diag**

Allows reset request packets to include the diagnostic field.

Example: **national enable reset-w/diag**

**restart-w/diag**

Allows restart request packets to include the diagnostic field.

`Example:` **`national enable restart-w/diag`**

**suppress-calling-address**

Suppresses the source address in call packets.

`Example:` **`national enable suppresses-calling-addresses`**

**suppress-idle-frame-rr**

Suppresses the sending of idle receiver ready frame layer frames.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national enable suppress-idle-frame-rr`**

**suppress-non-zero-cause**

Suppresses packet layer's cause fields.

`Example:` **`national enable suppress-non-zero-cause`**

**throughput-class-negotiation**

Enables the registration of throughput class.

`Example:` **`national enable throughput-class-negotiation`**

### National Restore C

Restore one or all of the default values made to the National Personality configuration with the **national set** command, the **national enable** command, or **national disable** command.

**Syntax:** national restore all
accept-reverse-charges
call-req
ccitt
clear-req . . .
clear-w/diag

disconnect-procedure . . .
dp-timer
flow-control-negotiation
frame-ext-seq-mode
frame-window-size
multi-link-addresses
network-type . . .
n2-timeouts
osi-84
osi-88
packet-size . . .
packet-ext-seq-mode
packet-layer-restarts
request-reverse-charges
reset . . .
reset-w/diag
restart . . .
standard-version
suppress-calling-addresses
suppress-idle-frame-rr
suppress-non-zero-cause
throughput-class-negotiation
t1-timer
t2-timer

**all**

Restores all the default values to the National Personality configuration.

Example: **national restore all**

**accept-reverse-charges**

Restores the accept-reverse-charges feature for calls during call establishment. This option is not available for DDN.

Example: **national restore accept-reverse-charges**

**call-req**

Resets the number of ten second intervals permitted before clearing an unaccepted call to the national default.

`Example:` **`national restore call-req`**

**ccitt**

Restores the feature that specifies that the CCITT convention, rather than ISO convention, is followed for timer retry expiration. CCITT acts as if the confirmation packet for the restart or clear requests had arrived. ISO leaves the request unconfirmed.

`Example:` **`national restore ccitt`**

**clear-req** ***retries timer***

Resets the number of clear request transmissions (*retries*) and the number of ten second intervals (*timer*) to wait before retransmitting to the national default.

**clear-w/diag**

Restores the feature that allows clear request packets to include the diagnostic field.

`Example:` **`national restore clear-w/diag`**

**disconnect-procedure** ***passive active***

Specifies the type of disconnect procedure to use when disconnecting.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national restore disconnect-procedure`**

| | |
|---|---|
| *Passive* | Specifies that there are no DISC frames used when disconnecting. |
| *Active* | Specifies that there are DISC frames used when disconnecting. |

**dp-timer**

Specifies the number of milliseconds that the frame level remains in a disconnected state. Zero indicates immediate transition from disconnected phase to link setup state.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore DP-timer**

**flow-control-negotiation**

Restores the feature that determines the frame's packet size and window size; suitable for call set-up negotiation.

Example: **national restore flow-control-negotiation**

**frame-ext-seq-mode**

Restores the frame layer sequence numbering modulus.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore frame-ext-seq-mode**

**frame-window-size**

Restores the default number of frames.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore frame-window-size**

**multi-link-addresses**

Restores the default value for frame layer addressing.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore multi-link-addresses**

**network-type** ***CCITT DDN***

Specifies the network convention.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national restore network-type`**

| | |
|---|---|
| *CCITT* | Specifies the CCITT convention. |
| *DDN* | Specifies the DDN convention. |

**n2-timeouts**

Restores the default value for the number of times the T1 timer can expire before a state change.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

`Example:` **`national restore N2-timeouts`**

**osi-84**

Restores the default value for CCITT OSI facilities defined by the 1984 standard.

`Example:` **`national restore osi-84`**

**osi-88**

Restores the default value for CCITT OSI facilities defined by the 1988 standard.

`Example:` **`national restore osi-88`**

**packet-size *default* OR *maximum* OR *window***

Restores the default value for these packet layer values.

`Example:` **`national restore packet-size default`**

| | |
|---|---|
| *Default* | Number of bytes in the data portion of the packet. The value is restored to 128. |
| *Maximum* | Maximum number of bytes in the data portion of the packet. The value is restored to 256. |

| | |
|---|---|
| *Window* | Number of outstanding I-frames permitted before acknowledgement is required. The value is restored to 2. |

**packet-ext-seq-mode**

Restores the default value for the packet layer sequence numbering.

Example: **national restore packet-seq-mode**

**packet-layer-restarts**

Restores the default value for packet layer sending of restart packet when the router restarts.

Example: **national restore packet-layer-restarts**

**request-reverse-charges**

Restores the default value for reverse charges request for all outgoing calls.

Example: **national restore request-reverse-charges**

**reset *retries timer***

Restores the default value for the number of reset retransmissions.

Example: **national restore reset**

| | |
|---|---|
| *Retries* | Number of reset request transmissions permitted before the call is cleared. The range is 0 to 255. |
| *Timer* | Number of ten second intervals to wait before retransmitting a reset request packet. The range is 0 - 255. A zero in the *timer* value indicates an indefinite wait. |

**reset-w/diag**

Restores the default feature that allows a reset request packet to include the diagnostic field.

Example: **national restore reset-w/diag**

#### restart-retries

Restores the default value for the number of restart request retransmissions.

Example: **national restore restart retries**

#### restart-timer

Restores the timeout value for the number of restart request transmissions.

Example: **national restore restart timer**

#### standard-version

Restores default OSI facilities settings.

Example: **national restore standard-version**

#### suppress-calling-address

Restores the default value for this national personality and determines whether to enable the suppression of the source address in call packets. The default is disabled.

Example: **national restore suppress-calling-address**

#### suppress-idle-frame-rr

Restores the default value for this national personality and determines whether to suppress the sending idle receiver ready frame layer frames. The default is disabled.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore suppress-idle-frame-rr**

#### suppress-non-zero-cause

Restores the default value for this national personality and determines whether to suppress of the packet layer's cause fields. The default is disabled.

Example: **national restore suppress-non-zero-cause**

#### throughput-class-negotiation

Restores the default state (enable/disabled) determined by personality whether to negotiate the throughput class on SVC setup. The default is enable.

Example: **national restore throughput-class-negotiation**

#### t1-timer

Restores the default value for the frame retransmit time. The default is 4.00 seconds.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore T1-timer**

#### t2-timer

Restores the default value for the maximum number of seconds to wait before sending an I-frame received acknowledgement. This is an optimization parameter. If this value is non-zero, the router defers acknowledging received I-Frames. In this case, it expects to transmit an I-Frame that performs this acknowledgment. It can improve link utilization. It results in T2 timeouts.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national restore T2-timer**

### National Set C

Set one or all of the default values made to the National Personality configuration.

**Syntax:** national set call-req
clear-req . . .
disconnect-procedure . . .
dp-timer
frame-window-size
network-type . . .
n2-timeouts
packet-size . . .
reset . . .
restart . . .
standard-version
t1-timer
t2-timer

**call-req**

Specifies the number of ten second intervals permitted before giving up on a call request and clearing it. A zero indicates an indefinite wait.

Example: **national set call-req**

**clear-req** ***retries timer***

Specifies the number of clear request retransmissions.

| | |
|---|---|
| *Retries* | Number of clear request transmissions permitted before action is taken. |
| *Timer* | Number of ten second intervals to wait before retransmitting a call request packet. A zero in the *timer* value indicates an indefinite wait. |

Example: **national set clear-req**

**disconnect-procedure** ***passive active***

Specifies the type of disconnect procedure to use when disconnecting.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national set disconnect-procedure active**

| | |
|---|---|
| *Passive* | Specifies that DISC frames are not used when disconnecting. |
| *Active* | Specifies that DISC frames are used when disconnecting. |

**dp-timer**

Specifies the number of milliseconds that the frame level remains in a disconnected state. Zero indicates immediate transition from disconnected phase to link setup state.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **`national set dp-timer`**

#### frame-window-size

Specifies the number of frames that can be outstanding before acknowledgement.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **`national set frame-window-size`**

#### network-type *CCITT DDN*

Specifies the type of network being supported.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **`national set network-type`**

| | |
|---|---|
| *CCITT* | Specifies the CCITT convention. |
| *DDN* | Specifies the DDN convention. |

#### n2-timeouts

Specifies the number of times the T1 timer can expire before a state change.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **`national set n2-timeouts`**

#### packet-size *default-size max-size window-size*

Specifies the size of the packet.

Example: **`national set packet-size`**

| | |
|---|---|
| *Default-size* | Number of bytes in the data portion of the packet. Possible options include 128, 256, 512, 1024, 2048, and 4096. This value must be less than or equal to the maximum size. This value is used when and if flow control negotiation is enabled. *Default-size* cannot be greater than *max-size*. |

| | |
|---|---|
| *Max-size* | Maximum number of bytes in the data portion of the packet. Possible options include 128, 256, 512, 1024, 2048, and 4096. |
| *Window-size* | Number of outstanding I-frames permitted before acknowledgement is required. The range is 1 to 7. When extended sequence numbers are in use, the range is 1 to 127. This value is used when and if flow control negotiation is enabled. |

**reset *retries timer***

Specifies the number of reset request retransmissions.

`Example:` **`national set reset`**

| | |
|---|---|
| *Retries* | Number of reset request transmissions permitted before the call is cleared. The range is 0 to 255. |
| *Timer* | Number of ten second intervals to wait before retransmitting a reset request packet. The range is 0 to 255. A zero in the *timer* value indicates an indefinite wait. |

**restart *retries timer***

Specifies the number of restart request transmissions.

`Example:` **`national set restart`**

| | |
|---|---|
| *Retries* | Number of restart request transmissions permitted before the call is cleared. The range is 0 to 255. |
| *Timer* | Number of ten second intervals to wait before retransmitting a restart request packet. The range is 0 to 255. A zero in the *timer* value indicates an indefinite wait. |

**standard-version**

Determines some of the default settings. Options are 1980, 1984, and 1988.

Example: **national set standard-version**

**t1-timer**

Specifies the frame retransmit time in hundredths of a second. The range is 0.05 to 255.99. The default is 4.00 seconds.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national set t1-timer**

**t2-timer**

Specifies the amount of time to delay before acknowledging an I-frame. This is an optimization parameter. Setting the timer to 0.00 disables it. The range is 0.00 to 255.99. The default is 2.00.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **national set t2-timer**

## Parameters M

Use the **parameters** command to display the current parameters for any level of the X.25 configuration.

**Syntax:** parameters all
frame
packet
physical

**all**

Displays the parameters for the packet, frame, and physical levels.

Example: **parameters all**

**frame**

Displays the frame layer parameters for an X.25 network interface or the LAN interface and the MAC addresses of the remote DTE and local port for an X.25-LLC2 pseudo interface..

Example: X.25>**parameters frame**

```
Frame Layer Parameters:

  Maximum Frame Size  = 262 Maximum Window Size  =     7
  Protocol Enabled    = YES Equipment Type       =   DTE
  T1 Retransmit Timer =   4 T2 Acknowledge Timer =     2
  N2 Retry Counter    =  20 Disconnect Procedure = PASSIVE
  Disconnect Timer    = 500 Network Type         =   GTE

  Protocol Options: Inhibit Idle RRs NO  MOD 128      NO
                    A/B Addressing  YES  Enable SARM  NO
```

Example: X.25-LLC2>**parameters frame**

```
Frame Layer Parameters:
  LAN Interface       = 0, Eth/0
  Remote MAC Address  = 08002BB19F1D
  Local MAC Address   = AA55EE0BB900
```

**packet**

Displays the parameters for the packet level.

Example: **parameters packet**

```
Packet Layer Parameters:
  Default Packet Size = 128  Maximum Packet Size =   256
  Log 2 Packet size   =   2  Acknowledge Delay  =      0
  Layer Enabled       = YES Default Window Size =      2
  Lowest SVC          =   1  Highest SVC        =     64
  Lowest PVC          =   0  Highest PVC        =      0
  Clear Diagnostic    = YES  Reset Diagnostic   =    YES
  Restart Diagnostic  = YES  T21 (Call)         =     20
  T20 (Restart)       = 18  R20 (Retry)         =      1

  T22 (Reset)         = 18  R22 (Retry)         =      1
  T23 (Clear)         = 18  R23 (Retry)         =      1

  Network Type        = GTE  Equipment Type     =    DTE
```

#### physical

Displays the parameters for the physical level.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **parameters physical**

```
Physical Layer Parameters:
  Interface Type      =    RS-449

  Maximum Frame Size  =  1030   InterFrame Delay    =        0
  Configured Speed    =     0   Clocking            = External
  Protocol Enabled    =   YES
```

### Set C

Configure local X.25 node addresses, maximum number of calls, frame and packet level window size, lowest to highest PVC and SVC channels, compression disable threshold, minimum packet size for data compression on calls with no dictionary and the idle time for a switched circuit.

**Syntax:** set address . . .
calls-out . . .
compression-disable-threshold . . .
default-window-size . . .
equipment-type . . .
htf addr . . .
inter-frame-delay . . .
max-retry . . .
minimum-compression-message-size . . .
mtu . . .
national-personality . . .
pvc . . .
svc low . . .
svc high . . .
throughput-class . . .
vc idle . . .

**address** ***X.25-node-addr***

Sets the local X.25 interface address *(x.25-node-addr)*. Set the X.25 node address to 0, not to 00, to delete the local X.25 address.

Example: **set address 8982800**

**calls-out** ***value***

Sets the maximum number of locally initiated simultaneously active SVCs. The range is 0 to 227. The default is 4.

Example: **set calls-out 3**

**compression-disable-threshold** ***value***

Sets the threshold number of incompressible data bytes at which compression is dynamically disabled. If this number of incompressible bytes are sent in sequence, compression is disabled and the data is transmitted in uncompressed packets. Once disabled, when this number of *compressible* bytes are sent, compression is re-enabled and the data is transmitted in compressed packets again. The range is 1 to 65,535. The default is 5000.

**Note:** Data compresion is not available on X.25-LLC2 pseudo interfaces.

Example: **set compression-disable-threshold 1000**

**default-window-size** ***value***

Sets the window size for the packet level assigned by the router if there is no window-size facility in the Call-Request-Packet. The range is determined by the National Personality packet modulus (PACKET-EXT-SEQ-MODE). The default is 2.

Example: **set default-window-size 3**

**equipment-type** ***DCE DTE***

Specifies whether the frame and packet levels act as *DCE* or *DTE*. DTE is the default setting. This has no relation to the cable type in use.

Example: **set equipment-type DCE**

**hft addr** ***x.25-node-addr***

Sets the local DDN X.25 address translation (*x.25-node-addr)*. Set the X.25 node address to 0, not to 00, to delete the local X.25 address.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set htf-address 11.42.0.137**

**inter-frame-delay** ***value***

This parameter defines the minimum delay between transmitted frames. Setting this parameter is useful when interfacing directly to older equipment that may not be able to consistently handle consecutive frames separated by one flag resulting in receive errors (for example, T1 timeouts). This parameter functions as follows:

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set inter-frame-delay 1**

**max-retry** ***value***

Sets the maximum number (*value*) of physical layer retransmissions attempted.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set max-retry 4**

**minimum-compression-message-size *value***

Sets the minimum size of a routing packet which will be compressed for calls with no compression dictionary assigned. The range is 1 to 65,535. The default is 500.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set minimum-compression-message-size 200**

**mtu *value***

Sets the Maximum Transmit Unit (MTU) in bytes. This is the maximum packet size that will be delivered to the X.25 interface for packetization and transmission over the serial line. The range is 576 to 4096. The default is 1500.

If you encounter packet re-assembly timeouts on the X.25 interface, you should determine what the minimum packet size is for all LAN or serial interfaces that lead to the end point, then calculate a more suitable X.25 MTU. You should not directly consider the actual X.25 packet size in this calculation because X.25 tends to use a smaller packet size. X.25 usually sends up to 7 packets at one time before waiting for an acknowledgement.

For example, with a network topology that includes a Token Ring LAN having a packet size of 4000, an X.25 serial line having a packet size of 128 with a window size of 7 and a bit rate of 9600 bps, and an Ethernet LAN with a packet size of 1500, you should probably set the X.25 MTU to 1500. That means that about 12 packets will be sent over the X.25 interface. (MTU / X.25 packet size = number of X.25 packets to be sent)

When using an MTU of 4096, 32 packets must be sent over the X.25 interface. (4000 /128 = 31.25) In this case, packet reassembly timeouts will probably occur if the X.25 modem speed is 9600 bps. Using an X.25 modem speed of 56 Kbps should solve this problem.

Example: **set mtu 2048**

**national-personality *GTE-Telenet or DDN***

Sets the 28 default parameters for either *GTE-Telenet* or *DDN* National Personality. GTE-Telenet is the default setting.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set national-personality DDN**

**pvc low/high** ***value***

Defines the lowest to the highest permanent virtual circuit channel number (*value*). Zero indicates no PVCs. The default for the **PVC low** parameter is 0 and the default for **PVC high** is 0. Therefore, by default there are no PVCs. The range is of 0-4095. These values are setting the boundaries of a given VC range. The values of boundaries can range between 0 and 4095, however, the actual range is limited by memory (for example, if **set PVC low** is set to **1** and **set PVC high** is set to **4095**, these are valid boundary ranges but there is not enough memory to support this range.)

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **set PVC low 40**

**svc low/high** ***inbound two-way outbound***

Defines the lowest to the highest switched virtual circuit channel number (*value*).

Example: **set SVC low two-way 1**

| | |
|---|---|
| *Inbound* | Specifies a range of 1 - 255. The default setting is 0; therefore, by default, there are no inbound only SVCs. |
| *Two-way* | Specifies a range of 1 - 255. The default setting is 1 for the **SVC low** parameter and 64 for the **SVC high** parameter. By default, there are 64 2-way SVCs. |
| *Outbound* | Specifies a range of 1 to 255. The default setting is 0; therefore, by default, there are no outbound only SVCs. |

**throughput-class inbound/outbound** ***bit-rate***

Defines the throughput class requested when making a call request while throughput negotiation is enabled. The default bit-rate setting is 2400 bps.

Example: **set throughput-class inbound**

```
throughput class inbound (2400)?
```

**vc-idle** ***value***

Defines the number of seconds (*value*) that a switched circuit can be idle before it is cleared. The value is 1 to 255. Zero indicates that the circuit is never cleared. The default is 30 seconds.

Example: **set vc-idle 40**

## Statistics M

Display the current statistics of any level of the X.25 configuration, or the current data compression statistics.

**Syntax:** statistics all
compression
frame
packet
physical

**all**

Displays the statistics for the packet, frame, and physical levels.

Example: **statistics all**

**compression**

Displays the statistics for data compression.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **statistics compression**

```
Destination         Bytes         Compr-        Ratio     On/Off
Address                            essed                  count

123456781       TX: 32896         3971          8.2:1     0
                RX: 31868         3631          8.7:1     0
```

**frame**

Displays the statistics for the frame level. Note that only I-frames are counted over an X.25-LLC2 pseudo interface.

Example: X.25>**statistics frame**

```
Frame Layer Counters:      Received            Transmitted
  Information Frames        1097234                1091944
  RR Command                    309                    241
  RR Response                   267                   1395
  RNR Command                     0                      0
  RNR Response                    0                      0
  REJ Command                     0                      0
  REJ Response                    0                      0
  SABM                            0                     11
  SABME                           0                      0
  UA                              6                      0
  DISC                            0                      0
  DM                              4                      0
  FRMR                            0                      0

  T1 Timeouts    1    T2 Timeouts         1086    N2 Timeouts    1
  Bad Address    0    Unsolicited F-Bit      0    Invalid Ctl    0

Frame Layer Miscellaneous:
  Queued Output Frames =  0   Protocol Layer State  =  Data Transfer
  Send Sequence N(S)   =  4   Receive Sequence N(R) =  6
```

Example: X.25-LLC2>**statistics frame**

```
Frame Layer Counters:      Received            Transmitted
  Information Frames        1101448                1100893

Frame Layer Miscellaneous:
  Queued Output Frames =  10    State = Data Transfer
```

**packet**

Displays the statistics for the packet level.

Example: **statistics packet**

```
Packet Counters:          Received             Transmitted
  Call Request                5673                    5669
  Call Accepted               5669                    5673
  Clear Request               5664                    5659
  Clear Confirm               5659                    5664
  Interrupt Request              0                       0
  Interrupt Confirm              0                       0
  RR Packet                 665972                  403117
  RNR Packet                     0                       0
  REJ Packet                     0                       0
  Reset Request                  0                       0
  Reset Confirm                  0                       0
  Restart Request                4                       6
  Restart Confirm                0                       0
  Diagnostic                     0                       0
  Data Packet               408432                  665991
  Data Bytes              21254031                40392356
  Buffers Queued                 0                       4
  Invalid Packets Received =     0
  Switched Circuits Opened =    19
```

**physical**

Displays the statistics for the physical level.

**Note:** This command only applies to X.25 network interfaces. It is not available on X.25-LLC2 pseudo interfaces.

Example: **statistics physical**

```
X.25 Physical Layer Counters:
  Rx Bytes                    23   Tx Bytes                    300

  Adapter cable:         RS-449 DTE  RISC Microcode Revision:            2

  Line speed:              19.2kbs
  Last port reset:         4 hours, 24 minutes, 20 seconds ago

  Input frame errors:
   CRC error                     0   alignment (byte length)            0
   missed frame                  0   too long (>     0 bytes)           0
   aborted frame                 0   DMA/FIFO overrun                   0
   L & F bits not set            0
  Output frame counters:
   DMA/FIFO underrun errors      0   Output aborts sent                 0
```

**Exit** **C M**

Return to the previous prompt level.

**Syntax:** exit

`Example:` **`exit`**

## 13.4 X.25 Network Interfaces and the GWCON Interface Command

While X.25 interfaces have their own console processes for monitoring purposes, bridging routers also display complete statistics for installed network interfaces when you use the **interface** command from the GWCON environment. (For more information on the **interface** command, refer to the GWCON chapter in this guide.)

### 13.4.1 Statistics Displayed for X.25 Interfaces

The following statistics display when you run the **interface** command from the GWCON environment for X.25 interfaces:

```
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
1  1   X25/0      1001620   5D          0          0            0

  X.25 MAC/data-link on SCC Serial Line interface
Interface State:  DCD  CTS   Packet Layer    Frame Layer   RomRev  0.0
                  OFF  OFF       DOWN           DOWN       X25Rel  3.7

Packet Counters:           Received             Transmitted
  Data Packet                     0                       0
  Data Bytes                      0                       0
  Buffers Queued                  0                       0
  Invalid Packets Received =      0
  Switched Circuits Opened =      0

Frame Layer Counters:      Received             Transmitted
  Information Frames              0                       0

X.25 Physical Layer Counters:
  Rx Bytes                        0   Tx Bytes            0

  Adapter cable:            RS-232 DTE  RISC Microcode Revision:     2
   V.24 circuit: 105 106 107 108 109
   Nicknames:    RTS CTS DSR DTR DCD
   RS-232:       CA  CB  CC  CD  CF
   State:        --- ON  --- --- ON

  Line speed:              unknown
  Last port reset:         2 minutes, 16 seconds ago

Input frame errors:
 CRC error                    0   alignment (byte length)           0
 missed frame                 0   too long (>     0 bytes)          0
 aborted frame                0   DMA/FIFO overrun                  0
 L & F bits not set           0
Output frame counters:
 DMA/FIFO underrun errors     0   Output aborts sent                0
Interface buffer pool: Total = 30, Free = 30
```

The following statistics display when you run the **interface** command from the GWCON environment for X.25-LLC2 pseudo interfaces:

```
                                Self-Test  Self-Test  Maintenance
Nt Nt' Interface      CSR  Vec     Passed     Failed       Failed
3  3   X25/1            0    0          0          3            0

  X.25 MAC/data-link on X.25 LLC2 interface
Interface State:  Packet Layer  Frame Layer  LAN Interface (Eth/0)
                       DOWN         DOWN        UP
```

```
Packet Counters:           Received             Transmitted
  Data Packet                     0                       0
  Data Bytes                      0                       0
  Buffers Queued                  0                       0
  Invalid Packets Received =      0
  Switched Circuits Opened =      0

Frame Layer Counters:      Received             Transmitted
  Information Frames              0                       0
Interface buffer pool: Total = 60, Free = 60
```

The following table describes these general interface statistics:

| | |
|---|---|
| *Nt* | Global interface number. |
| *Nt '* | Reserved for future dial circuit use. |
| *Intrfc* | Interface name. |
| *No* | Number of this interface within interfaces of type "intrfc." |
| *CSR* | COMM and Status Registers address. |
| *Vec* | Interrupt vector. |
| *Self-Test: Passed* | Number of times self-test succeeded. |
| *Self-Test: Failed* | Number of times self-test failed. |
| *Maintenance: Failed* | Number of maintenance failures. |
| *Interface state* | Display the current state of the input modem control signals, the packet layer (X.25 layer 3), the frame layer (X.25 layer 2), and the current ROM revision and X.25 code revision. |
| *Packet Counters* | Provides statistics on packets received and transmitted. |
| *Data Packets* | Displays the number of data packets the interface transmits receives on the network. |
| *Data Bytes* | Displays the number of data bytes the interface transmits receives on the network. |

| | |
|---|---|
| *Buffers Queued* | Displays the number of buffers currently queued for transmission over the network. These may be frame or packet layer supervisory messages as well as forwarder packets. |
| *Invalid Packets Received* | Displays the number of invalid X.25 packets received from the network. |
| *Switched Circuits Open* | Displays the number of switched circuits currently open. |
| *Frame Layer Counters* | Provides statistics generated from Frame Layer counters. |
| *Information Frames* | Displays the number of X.25 Information frames the interface has transmitted and received. |
| *X.25 Physical Layer Counters* | Provides statistics generated from Physical Layer counter. |
| *RX Bytes* | Display the number of bytes received by the Physical layer. |
| *TX Bytes* | Display the number of bytes transmitted by the Physical layer. |
| *Input frame errors:* | |
| *Adapter cable* | Type of cable. |
| *CRC error* | Received cyclic redundancy check does not match transmitted CRC. |
| *alignment byte length)* | Count of frame alignment errors. |
| *missed frame* | Count of missed frames. |
| *too long (> 0 bytes)* | Count of frames longer than 2062 bytes. |
| *aborted frame* | Count of aborted frames. |

| | |
|---|---|
| *DMA/FIFO overrun* | Number of times the router was unable to keep up with data being received because the receive buffer was full. |
| *L & F bits not set* | Count of last and first bits not set. |
| *DMA/FIFO underrun errors* | Number of times the router failed to transmit characters when the transmitter was ready and previously started transmitting a frame. |

*Interface buffer pool* Displays the total number of buffers preallocated for this interface and the number of remaining free buffers.

# 14

# Configuring and Monitoring the X.25 Switching Feature

This chapter describes how to configure and monitor the X.25 Switching feature.

For more information on the X.25 Switching feature refer to the *Routing Protocols Reference Guide*.

## 14.1 Accessing the X.25 Switching Feature Configuration and Console Environments

You configure X.25 Switching using the X.25 switching feature.

To access the X.25 switching feature configuration environment, use the **feature x25s** command at the `Config>` prompt.

**Note:** After you access the X.25 Switching feature configuration process, you may begin entering configuration commands. Whenever you make changes to a user-configurable feature parameter, you must restart the router for this change to take effect.

To display the `X25S>` prompt enter **feature x25s** at the GWCON (+) prompt. Any modifications made using the monitoring (console) commands are not maintained across restarts.

```
Example:  +feature x25s

     X25 Switching console
     X25S>
```

Refer to Chapter 1 for information about accessing the configuration and console processes.

# 14.2 X.25 Switching Basic Configuration Procedure

## 14.2.1 Before You Begin

Before you can use X.25 Switching you must have the following:

- An interface configured to receive the incoming X.25 calls which you want to switch. This may be an X.25 network interface or an X.25-LLC2 pseudo interface.
- An interface configured for an X.25 connection to the target DTE. This may be an X.25 network interface or an X.25-LLC2 pseudo interface.

Refer to Chapter 13 for information about configuring an X.25 network interface, or an X.25-LLC2 pseudo interface.

#### 14.2.1.1 Setting Up the X.25 Switching Feature

When you have configured the X.25 network interfaces you use the X.25 Switching feature to configure and enable X.25 switching. Follow these steps to configure the X.25 Switching feature:.

1. At the `Config>` prompt enter **feature x25s** to display the `X25S Config>` prompt. For example:

```
Config>feature x25s
X.25 Switching user configuration
X25S Config>
```

2. Create a filter for each incoming X.25 call, or set of related calls, that is to be switched. Each filter must have a unique name. The filter parameters can identify the incoming call by the interface it arrived on, closed user group membership, the called or calling DTE address, the call data, the NUI string or the called or calling NSAP address. For example:

```
X25S Config>add filter
Filter name  []? xfilter1
Priority (1-65535) [1]?
Ifc  []? 1
Closed User Group  []?
Called DTE address  []?
Calling DTE address  []? 123000456321
Call user data  []?
NUI  []?
Called NSAP  []?
Calling NSAP  []?
```

**Note:** If all of the filter options, except the name and priority, are left empty the filter will match all incoming calls.

3. Create clients for the target DTEs and associate filters with clients. The clients identify the target DTE for incoming X.25 calls which match the associated filter parameters. A client may be associated with multiple filters, for example:

```
X25S Config>add client
Name []?  xclient1
Ifc []?  0
Destination DTE address  []? 123000654321
Local DTE subaddress  []? 12
Filter name  []? xfilter1
Filter name  []? xfilter2
Filter name  []?
```

4. By default the filters, clients and X.25 switching are enabled. If any component has been disabled using the **disable** command, it will not be active unless you re-enable it. For example:

```
X25S Config>enable x25-switching
```

**Note:** If a filter is disabled, then it is not checked against incoming calls. If a client is disabled then calls matching an associated filter will be blocked. If you create a low priority catch-all filter and assign it to a disabled client, then you can exclude all calls which do not match the other defined filters.

5. Exit from the X25 Switching configuration environment. For example:

```
X25S Config>exit
```

## 14.3 X.25 Switching Configuration and Console Commands

Table 14–1 lists and the rest of the section explains the X.25 Switching configuration and console commands.

Enter configuration commands at the `X25S Config>` prompt.

## 14.3 X.25 Switching Configuration and Console Commands

Enter console commands at the `X25S>` prompt.

**Table 14–1 X.25 Switching Configuration and Console Command Summary**

| Command | Task | Function |
|---|---|---|
| **? (Help)** | Configure/ Monitor | Displays all the X.25 switching commands or lists subcommand options for specific commands. |
| **Add** | Configure | Adds a new filter or client. |
| **Change** | Configure | Modifies the configuration of an existing filter or client. |
| **Delete** | Configure | Deletes a filter or client. |
| **Disable** | Configure/ Monitor | Disables the use of a filter or client or globally disables the X.25 switching feature. |
| **Enable** | Configure/ Monitor | Enables the use of a filter or client or globally enables the X.25 switching feature. |
| **List** | Configure/ Monitor | Displays the current information of all filters and clients. |
| **Set** | Configure/ Monitor | Sets a priority for the implicit filters used for routing calls and the maximum number of circuits. |
| **Show** | Configure/ Monitor | Displays the configured settings of a selected filter or client or X.25 switching. |
| **Exit** | Configure/ Monitor | Exits the config and monitor processes and returns to the previous prompt level. |

### ? (Help) C M

Lists available commands. You can also enter **?** after a command to list its options.

**Syntax:** ?

Example: **X25S Config>?**

```
SHOW
LIST
ADD
CHANGE
DELETE
ENABLE
DISABLE
SET
EXIT
```

Example: **enable ?**

```
FILTER
CLIENT
X25-SWITCHING
```

### Add C

Creates a new filter or client definition. Filters are used to identify the incoming X.25 calls which must be switched. Clients are used to identify the target DTE for calls which match their associated filters.

An incoming X.25 call is compared with the profiles of the defined filters. If the call matches a filter, it is switched to the target DTE identified by the client associated with the matching filter.

**Syntax:** add client . . .
filter . . .

#### client

Defines a new client profile.

Example: **add client**

```
Name []? xclient1
Ifc []? 0
Destination DTE address []? 123000654321
Local DTE subaddress []? 12
Filter name []? xfilter1
Filter name []?
```

| | |
|---|---|
| *Name* | Specifies the unique name for this client profile. This parameter is mandatory. |
| *Ifc* | Specifies the interface which connects to the destination DTE. This parameter is mandatory.<br>The interface must be configured for X.25 or X.25-LLC2. |
| *Destination DTE address* | The X.25 address of the target DTE that calls will be switched to. The DTE address has a maximum of 15 digits. |
| *Local DTE subaddress* | The DTE subaddress which will be used for calls switched to the destination DTE. The subaddress has a maximum of 15 digits. |
| *Filter name* | Specifies the name of the filter which the client is associated with. You cannot associate a filter with more than one client.<br>**Note:** You can associate multiple filters with one client. The system repeatedly prompts for the next filter name in the list. Press the Return key without entering a name to complete the list. |

#### filter

Adds a new filter. An incoming call matches a filter if its profile matches all of the parameters which have been defined for the filter. If all of the filter parameters are empty, the filter will match *all* incoming calls.

```
Example:  add filter

     Name []? xfilter1
     Priority (1-65535) [1]?
     Ifc []? 1
     Closed User Group []?
     Called DTE address []?
     Calling DTE address []? 123000456123
     Call user data []?
     NUI []?
     Called NSAP []?
     Calling NSAP []?
```

*Name* — Specifies the unique name for this incoming call filter profile. This parameter is mandatory.

*Priority* — Specifies the relative priority of this filter. Call profiles are compared with the filters with the highest priority value first, and the first matching filter is the one which is used.

Range: 1 (lowest priority) through 65,535 (highest priority).

Default: 1

*Ifc* — The network interface number of the DTE on which to look for incoming calls.

*Closed User Group* — Specifies the name of a Closed User Group. The Closed User Group name consists of up to 4 digits.

*Called DTE address* — Specifies the X.25 address of the destination DTE. Incoming calls addressed to this DTE will match this filter parameter, and will be switched to the associated client.

The X.25 address is a string of up to 15 digits or wildcard characters. The wildcard character **'?'** matches any single character, and **'*'** matches any string of any length. For example, **12300065432?** matches all DTE addresses from 123000654320 through 123000654329**,** and **123*** matches all DTE addresses which begin with 123.

| | |
|---|---|
| *Calling DTE address* | Specifies the X.25 address of the sending DTE. The X.25 address is a string of up to 15 digits or wildcard characters. |
| *Call user data* | Specifies the contents of the Call User Data field, and consists of up to 128 pairs of hexadecimal digits. Each pair of digits defines one byte. |
| *NUI* | Specifies the Network User Identification (NUI) code. The NUI consists of up to 128 pairs of hexadecimal digits. Each pair of digits defines one byte. |
| *Called NSAP* | Specifies the NSAP address of the destination DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |
| *Calling NSAP* | Specifies the NSAP address of the sending DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |

### Change C

Modifies a filter or client definition which was created using the **add** command.

**Note:** Values immediately following the command option prompts reflect the current setting of that option. They are not always the initial default values.

**Syntax:** change client . . .
filter . . .

#### client

Modifies the definition of an existing client profile. The prompts that appear depend on the current settings of the client you are modifying, and which parameters you choose to modify. The prompts display the current setting of each parameter, and ask you to confirm the value. If you answer **No**, the next prompt asks for the new setting.

```
Example:  change client

    Name []? xclient1
    Ifc [0]?
    Called DTE address = 123000654321? [Yes]:
    Local DTE subaddress = 12? [Yes]: No
    Local DTE subaddress []?  14
    Filter: xfilter1?  [Yes]:
    Filter name []?
```

*Name* Specifies the name of the client profile you want to modify. This parameter is mandatory.

*Ifc* Specifies the interface which connects to the destination DTE. This parameter is mandatory.

The interface must be configured for X.25 or X.25-LLC2.

*Destination DTE address* The X.25 address of the target DTE that calls will be switched to. The DTE address has a maximum of 15 digits.

*Local DTE subaddress* The DTE subaddress which will be used for calls switched to the destination DTE. The subaddress has a maximum of 15 digits.

*Filter name* Specifies the name of the filter, or filters, which the client is associated with.

**Note:** You can associate multiple filters with one client. The system repeatedly prompts for the next filter name in the list. Press the Return key without entering a name to complete the list.

#### filter

Modifies the definition of an existing filter profile. The prompts that appear depend on the current settings of the filter you are modifying, and which parameters you choose to modify. If a parameter has already been set the prompts display the current setting, and ask you to confirm the value. If you answer **No** the next prompt asks for the new setting.

Example: **change filter**

```
Name []? xfilter1
Priority (1-65535) [1]?
Ifc = 1? [Yes]:
Closed User Group []?
Called DTE address []?
Calling DTE address = 123000456123? [Yes]: No
Calling DTE address []? 123000456*
Call user data []?
NUI []?
Called NSAP []?
Calling NSAP []?
```

*Name* — Specifies the name of the incoming call filter profile which you want to modify. This parameter is mandatory.

*Priority* — Specifies the relative priority of this filter. Call profiles are compared with the filters with the highest priority value first, and the first matching filter is the one which is used.

Range: 1 (lowest) through 65,535 (highest priority).
Default: 1

*Ifc* — The network interface number of the DTE on which to look for incoming calls.

*Closed User Group* — Specifies the name of a Closed User Group. The Closed User Group name consists of up to 4 digits.

*Called DTE address* — Specifies the X.25 address of the destination DTE. Incoming calls addressed to this DTE will match this filter parameter, and will be switched to the associated client.

The X.25 address is a string of up to 15 hexadecimal digits or wildcard characters.

*Calling DTE address* — Specifies the X.25 address of the sending DTE. The X.25 address is a string of up to 15 hexadecimal digits or wildcard characters.

| | |
|---|---|
| *Call user data* | Specifies the contents of the Call User Data field, and consists of up to 128 pairs of hexadecimal digits. Each pair of digits defines one byte. |
| *NUI* | Specifies the Network User Identification (NUI) code. The NUI consists of up to 128 pairs of hexadecimal digits. |
| *Called NSAP* | Specifies the NSAP address of the destination DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |
| *Calling NSAP* | Specifies the NSAP address of the sending DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |

### Delete C

Deletes a client or a filter.

**Note:** The **delete** command does *not* prompt for confirmation before deleting the named client or filter.

**Syntax:** delete client . . .
filter . . .

#### client *client-name*

Deletes the named client.

```
Example:  delete client

     Name []? xclient1
```

#### filter *filter-name*

Deletes the named filter.

```
Example:  delete filter

     Name []? xfilter1
```

### Disable C M

Disables a named client or filter, or globally disables X.25 switching on the router.

**Note:** If you disable a client, filter or X25 Switching from the `X25S>` prompt it remains disabled until you restart or reload the router, or enable it again using the **enable** command.

**Syntax:** disable client . . .
filter . . .
x25-switching

#### client *client-name*

Disables the named client. When the client is disabled, calls which match an associated filter are blocked. The client remains disabled until you enter the **enable client** command.

```
Example:  disable client

     Name []? xclient1
```

#### filter *filter-name*

Disables the named filter. Incoming calls are not checked against filters which are disabled. The filter remains disabled until you enter the **enable filter** command.

```
Example:  disable filter

     Name []? xfilter1
```

#### x25-switching

Globally disables the X.25 switching feature on the router. The feature remains disabled until you enable it again using the **enable x25-switching** command.

```
Example:  disable x25-switching
```

## Enable C M

Enables X.25 Switching on the router or enables individual clients or filters which have previously been disabled using the **disable** command.

**Syntax:** enable client . . .
filter . . .
x25-switching

**client** ***client-name***

Enables the named client which was previously disabled using the **disable client** command. When a client is enabled, calls which match an associated filter are switched to the destination DTE. Clients are enabled by default when they are created using the **add client** command.

```
Example:  enable client

      Name []? xclient1
```

**filter** ***filter-name***

Enables the named filter which was previously disabled using the **disable filter** command. When you create a filter using the **add filter** command it is enabled by default.

Incoming calls are checked against enabled filters. The filter remains enabled until you enter the **disable filter** command.

```
Example:  enable filter

      Name []? xfilter1
```

**x25-switching**

Globally enables the X.25 switching feature on the router, previously disabled using the **disable x25-switching** command. X.25 switching is enabled by default.

```
Example:  enable x25-switching
```

### List C M

Displays the configuration options and status of all of the X.25 Switching clients or X.25 Switching filters. The **list** command only displays values for options which have been configured.

**Syntax:** list client
filter

**client**

Provides a list of all of the configured clients, and indicates whether they are enabled or disabled.

In the example below, calls matching the filter **xfilter1** are switched to DTE 123000654321 with subaddress 14, and calls matching filter **xfilter2** or **xfilter3** are switched to DTE 123000654322 with subaddress 15:

Example: **list client**

```
xclient1        ENABLED  Ifc = 0
                Called DTE address   = 123000654321
                Local DTE subaddress = 14

                Filters:
                    xfilter1


xclient2        ENABLED  Ifc = 0
                Called DTE address   = 123000654322
                Local DTE subaddress = 15

                Filters:
                    xfilter2
                    xfilter3
```

| | |
|---|---|
| *Name* | Displays the unique name for this client profile. |
| *Enabled* | Indicates whether or not this client is currently ENABLED or DISABLED |
| *Ifc* | Displays the interface which connects to the destination DTE. |

| | |
|---|---|
| *Called DTE address* | Displays the X.25 address of the target DTE that calls will be switched to. The DTE address has a maximum of 15 digits. |
| *Local DTE subaddress* | Displays the DTE subaddress which is used for calls switched to the destination DTE. The subaddress has a maximum of 15 digits. |
| *Filter name* | Displays the name of the filter, or filters, which the client is associated with. |

#### filter

Provides a list of the filters and indicates whether they are enabled or disabled.

**Note:** From the `X.25S>` prompt, this command only displays the filters which are associated with clients. From the `X.25S config>` prompt it displays *all* configured filters.

In the example below, **xfilter1** has the lowest priority, and matches all incoming calls on interface 1 from DTEs with addresses which begin 123000456, **xfilter2** has a higher priority and matches all calls for the closed user group 5432 (this overrides xfilter1), and **xfilter3** has the highest priority and matches any calls addressed to DTE 123000654322:

Example: **list filter**

```
xfilter1          ENABLED  Priority = 1
                 Ifc = 1
                 Calling DTE address = 123000456*


xfilter2          ENABLED  Priority = 100
                 Ifc = 1
                 Closed User Group  = 5432


xfilter3          ENABLED  Priority = 200
                 Ifc = 1
                 Called DTE address  = 123000654322
```

| | |
|---|---|
| *Name* | Displays the unique name for this incoming call filter profile. |
| *Enabled* | Indicates whether or not this filter is currently ENABLED or DISABLED |
| *Priority* | Displays the relative priority of this filter. Call profiles are compared with the filters with the highest priority value first, and the first matching filter is the one which is used.<br>Range: 1 (lowest priority) through 65,535 (highest priority)<br>Default:1 |
| *Client* | Displays the name of the client that this filter is associated with. |
| *Ifc* | Displays the network interface number of the DTE on which to look for incoming calls. |
| *Closed User Group* | Displays the name of a Closed User Group. The Closed User Group name consists of up to 4 digits. |
| *Called DTE address* | Displays the X.25 address of the destination DTE. |
| *Calling DTE address* | Displays the X.25 address of the sending DTE. The X.25 address is a string of up to 15 digits or wildcard characters (*). |
| *Call user data* | Displays the contents of the Call User Data field, and consists of up to 128 pairs of hexadecimal digits. Each pair of digits defines one byte. |
| *NUI* | Displays the Network User Identification (NUI) code. The NUI consists of up to 128 pairs of hexadecimal digits. |
| *Called NSAP* | Displays the NSAP address of the destination DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |
| *Calling NSAP* | Displays the NSAP address of the sending DTE. The NSAP address consists of 2 to 42 hexadecimal digits. |

**Set** **C M**

Sets the priority of the implicit filters used for routing calls, and the maximum number of X.25 circuits that can be switched.

**Syntax:** set x25-switching

**x25-switching**

```
Example:   set x25-switching

     Routing Priority (1-65535)  [255]? 20
     Maximum Circuits (1-65535)  [100]? 50
```

*Routing Priority* Specifies the priority of the implicit filters which are used to handle routing calls (as opposed to switching calls).

Range: 1 (lowest priority) through 65,535 (highest priority).

Default: 255.

*Maximum Circuits* Specifies the maximum number of X.25 circuits that can be switched at any one time.

Range: 1 through 65,535
Default: 100

**Show** **C M**

Displays the configuration options and status of the X.25 Switching feature or a selected client or filter. The **show** command only displays values for options which have been configured. The options displayed are described under the **add** command.

**Syntax:** show client
filter
x25-switching

**client *client-name***

Displays the configuration and status of the named client.

Example: **show client**

```
Name  []? xclient1

                ENABLED  Ifc = 0
                Called DTE address   = 123000654321
                Local DTE subaddress = 14

                Filters:
                    xfilter1
```

**filter *filter-name***

Displays the configuration and status of the named filter.

Example: **show filter**

```
Name  []? xfilter3

xfilter3         ENABLED  Priority = 200
                Ifc = 1
                Called DTE address  = 123000654322
```

**x25-switching**

Displays the status, routing priority and maximum circuits settings of the X.25 switching feature.

Example: **X25S Config>show x25-switching**

```
ENABLED   Routing Priority =   255  Maximum Circuits =   100
```

Example: **X25S>show x25-switching**

```
ENABLED  Routing Priority =  255  Circuits:Active/Maximum =  0/  100
```

| | |
|---|---|
| *Enabled* | Displays the status of X.25 Switching, either ENABLED or DISABLED. |
| *Routing Priority* | Displays the priority of the implicit filters which are used to handle routing calls. |
| *Circuits:* | |
| `Active` | Displays the number of X.25 circuits that are currently being switched. This field is only displayed from the X.25 switching console process. |
| `Maximum` | Displays the maximum number of X.25 circuits that can be switched at any one time. |

### Exit **C M**

Returns to the previous prompt level.

**Syntax:** exit

`Example:` **`exit`**

# A

# X.25 National Personalities

This appendix lists the default settings for GTE-Telenet and DDN.

## A.1 GTE-Telenet

The following parameters are the default settings for GTE-Telenet:

- Call-req: 20
- Clear-req:
  - Retries: 1
  - Timer: 18
- Disconnect: Passive
- DP-timer: 500 milliseconds
- Frame window size: 7
- Network Type: CCITT
- N2 timeouts: 20
- Packet:
  - Default size: 128
  - Maximum size: 256
  - Window size: 2
- Reset
  - Retries: 1
  - Timer: 18

- Restart
  - Retries: 1
  - Timer: 18
- Standard: 1984
- T1-timer: 4
- T2-timer: 2

## A.2 DDN

The following parameters are the default settings for DDN:

- Call-req: 20
- Clear-req:
  - Retries: 1
  - Timer: 18
- Disconnect: Passive
- DP-timer: 500 milliseconds
- Frame window size: 7
- Network Type: CCITT
- N2 timeouts: 20
- Packet:
  - Default size: 128
  - Maximum size: 256
  - Window size: 2
- Reset
  - Retries: 1
  - Timer: 18

- Restart
  - Retries: 1
  - Timer: 18
- Standard: 1984
- T1-timer: 4
- T2-timer: 2

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