Teldat Router

Frame Relay

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Chapter 1
The Frame Relay interface

1. Introduction

This chapter describes the Frame Relay interface software and includes the following sections:

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- Frame Forwarding over the Frame Relay Network.
- Frame Relay Network Management.
- Frame Relay Data Rates.
- Circuit Congestion.
- Frame Relay Interfaces Encryption Data.
- Backup Facilities over Frame Relay Interfaces.
- Switched Circuits in Frame Relay.

2. Frame Relay Overview

The Frame Relay (FR) protocol is a method of transmitting internetworking packets by combining the packet switching and port sharing of X.25 with the high speed and low delay of time division multiplexing (TDM) circuit switching. Frame Relay allows you to connect multiple LANs to a single high-speed (2 Mbps) WAN link with multiple point-to-point permanent virtual circuits (PVCs). Frame Relay offers the following features:

- *High throughput and low delay*. Utilizing the core aspects (error detection, addressing, and synchronization) of the Link Access Protocol, D-channel (LAPD) data link protocol, Frame Relay eliminates all network layer (Layer 3) processing. By using only the core aspects, Frame Relay reduces the delay of processing each frame.

- *Congestion detection.* Upon receiving Backward Explicit Congestion Notification (BECN), the router initiates a controlled slowdown of traffic, thereby avoiding a complete Frame Relay network shutdown.

- *Circuit access and control*. As the router dynamically learns about the availability of non-configured circuits, you can control access to those new circuits.

- *Network management option*. As your networks requires, the Frame Relay protocol can operate with or without a local network management interface.

- *Multiplexing protocols*. The **Teldat Router** supports simultaneous traffic from several protocols in each PVC (IP, SNA, Bridge, etc.).

Frame Relay provides no error correction or retransmission functionality. To provide error free end-to-end transmission of data, Frame Relay relies on the intelligence of the host devices.

2.1. Frame Relay Network

The Frame Relay network consists of the Frame Relay backbone (consisting of Frame Relay switches provided by the Frame Relay carrier) providing the Frame Relay service. The router functions as the Frame Relay connection device.

The router encapsulates Frame Relay frames and routes them through the network based on a Data Link Connection Identifier (DLCI). The DLCI is the Media Access Control (MAC) address that identifies the PVC between the router and the Frame Relay destination device. For example, in Figure 1, a packet destined to go from router B to router D would have a DLCI of 19 to reach router D; however, a packet destined to go from router D to router B would have a DLCI of 16.

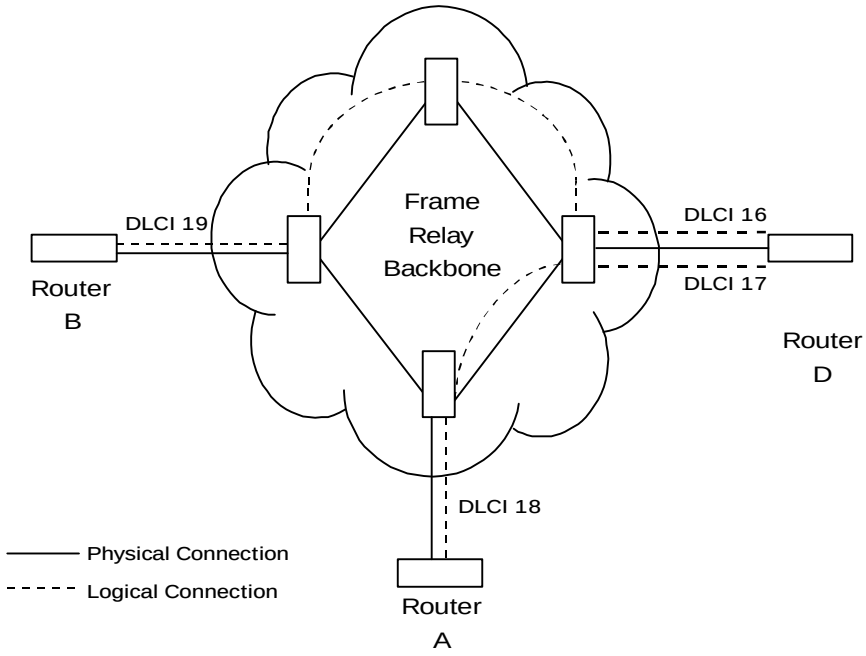

Figure 1 DLCIs in Frame Relay Network

A DLCI can have either local or global significance. Local DLCIs are significant at the point of entry to the network, but global DLCIs are significant throughout the network. To the user, however, the DLCI that the router uses to route a packet is the DLCI that the user associates with the frame's global or local destination. DLCIs are configured through the Frame Relay configuration process or learned through Frame Relay management.

A Frame Relay network has the following characteristics:

- Transports frames transparently. The network can modify only the DLCI, congestion bits, and frame check sequence. High-level Data Link Control (HDLC) flags and zero bit insertion provide frame delimiting, alignment and transparency in communications.
- Detects transmission, format, and operational errors (frames with an unknown DLCI).
- Preserves the ordering of frame transfer on individual PVCs.
- Does not acknowledge or retransmit frames.

2.2. Frame Relay Interface Initialization

The Frame Relay interface is active when successful interaction with Local Management Interface (LMI) occurs; however, no data can be received or transmitted until an active PVC status appears through full status messages.

PVC status appears for all PVCs as either active or inactive. An active PVC has a completed connection to an end system. An inactive PVC does not have a completed connection to an end system because either an end system or a Frame Relay switch is off-line.

For example, in Figure 2 router B has a configured PVC to router D. Router B is successfully interacting with Frame Relay management through Frame Relay switch B. Because either another Frame Relay switch is down or the end system is down, the end-to-end PVC connection is not established. Router B receives an inactive status for that PVC.

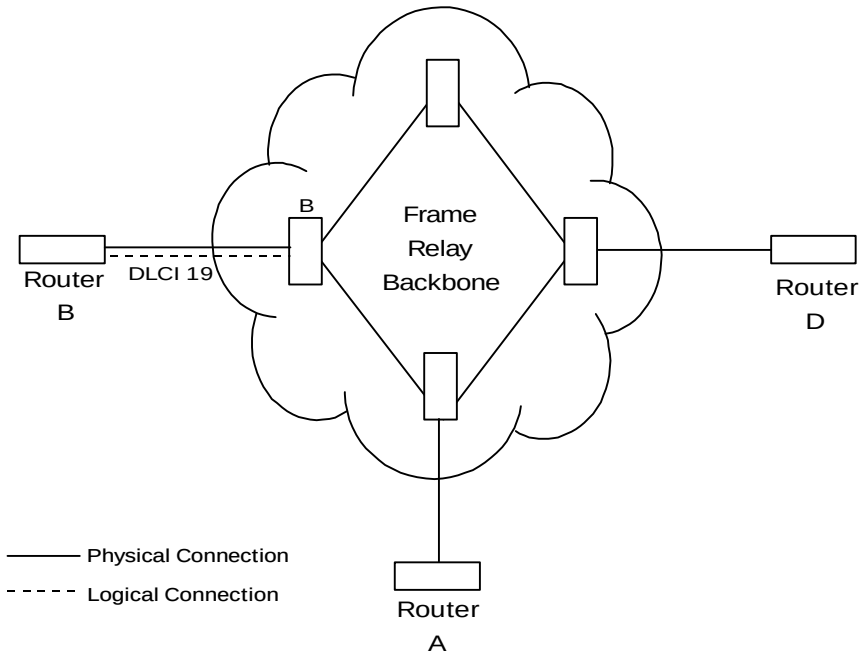

Figure 2 DLCIs in Frame Relay Networks

2.3. Orphan Circuits

An *orphan circuit* is any PVC that is not configured for your router but is learned indirectly through the actions of the network management entity. For example, Figure 3 assumes that router B has a configured PVC to router D, but none to router A. Router A configures a PVC to router B. Router B would then learn about the PVC to router A and classify it as an orphan.

Orphan circuits are treated the same as configured circuits except that you may enable or disable their use with the **ENABLE** and **DISABLE ORPHAN-CIRCUITS** commands.

By disabling orphan circuits, you add a measure of security to your network by preventing any unauthorized entry into your network from a non-configured circuit.

By enabling orphans circuits, you allow the router to forward packets over circuits you did not configure. Packets that would normally be dropped are now forwarded.

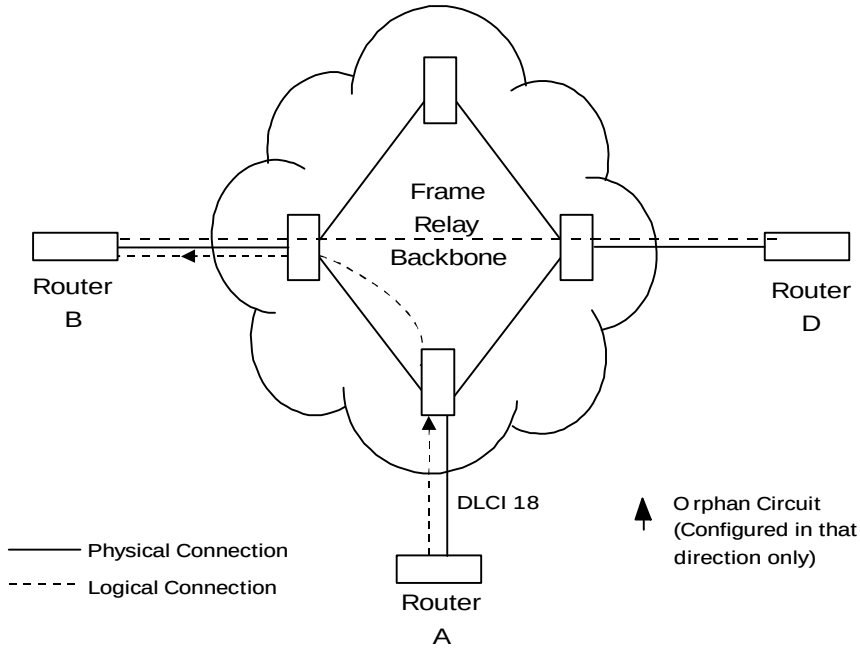

Figure 3 Orphan Circuit

2.4. Frame Relay Frame

A Frame Relay frame consists of a fixed size control field with variable sized encapsulated user data. Figure 4 illustrates an LAPD frame format.

Octet	8	7	6	5	4	3	2	1
1	HDLC Flag = 0x7e							
2	Data Link MSB/LSB (DL)						C/R	EA
3	Connection ID (CI)				FECN	BECN	DE	EA

User data

	Frame Check
	Sequence CRC = 16
N	HDLC Flag = 0x7e

Figure 4 LAPD Frame Format

a) HDLC flags

Located in the first and last octet , these flags indicate the beginning and end of the frame.

b) Data Link Connector Identifier (DLCI)

This 10-bit routing ID resides in bits 3-8 of octet 2 and bits 5-8 of octet 3. The DLCI is the MAC address of the circuit. The DLCI allows the user and network management to identify the frame as being from a particular PVC. The DLCI enables multiplexing of several PVCs over one physical link.

c) Command/Response

This is LAPD specific and is not used by this version of Frame Relay.

d) Extended Address

This version of Frame Relay does not support extended addressing.

e) Forward Explicit Congestion Notification (FECN)

When this bit is set to 1, the Frame Relay backbone network notifies the user receiving the frames that congestion is occurring in the direction the frame is being sent.

f) Backward Explicit Congestion Notification (BECN)

When this bit is set to 1, the Frame Relay backbone network notifies the user sending the frames that congestion is occurring in the opposite direction. The router then initiates a *throttle down* to a rate equal to or less than the user-defined CIR. The CIR for a PVC is supplied by the Frame Relay service provider and is configured using the **ADD PVC-PERMANENT-CIRCUIT** command.

g) Discard Eligibility (DE)

The network may discard transmitted data exceeding the CIR on a PVC. The DE bit is set by the network end-node to indicate discard eligibility.

h) User Data

This field contains the protocol packet being transmitted. This field can contain a maximum of 8,189 octets; however, the Frame Check Sequence (FCS) can effectively detect errors only on a maximum of 4,096 octets of data.

i) Frame Check Sequence (FCS)

This field is the standard 16-bit Cyclic Redundancy Check (CRC) that HDLC and LAPD frames use. This field detects bit errors occurring in the bits of the frame between the opening flag and FCS.

3. Frame Forwarding over the Frame Relay Network

When the Frame Relay protocol receives a packet for encapsulation, it compares the packet's network address to the entries in the Address Resolution Protocol (ARP) cache. If the ARP cache contains the DLCI number that matches the network address, the Frame Relay protocol encapsulates that packet into a frame and transmits the frame over its specified local DLCI. If the ARP cache does not contain a match, the frame is discarded.

3.1. Protocol Addresses

Protocol addresses can be mapped to Frame Relay network PVC addresses either statically or dynamically though ARP.

> ***Note: Static protocol addresses are also referred to as static ARP entries. A static ARP entry is added to the configuration with the ADD PROTOCOL-ADDRESS command.***

3.2. Multicast Emulation

Multicast Emulation is an optional feature that allows protocols requiring multicast such as ARP to function properly over the Frame Relay interface.

With multicast emulation, a frame is transmitted on each active PVC. By using the **ENABLE** and **DISABLE MULTICAST** commands, you can turn this feature on or off.

4. Frame Relay Network Management

The supplier of the Frame Relay network backbone provides Frame Relay network management. It is management's responsibility to provide Frame Relay end-stations (routers) with status and configuration information concerning PVCs available at the physical interface.

The Frame Relay protocol supports the ANSI Annex D management, CCITT and the Interim Local Management Interface (LMI). You can turn these entities on or off using the **ENABLE** and **DISABLE LMI** configuration commands. Specifically, Frame Relay network management provides the following information:

- Notification of additional PVC's (orphans) and whether they are active or inactive or of any PVC deletions.
- Notification of PVC status separate from a router's polled status request.
- Notification of flow control through the FECN and BECN bit settings.
- Notification of the availability of a configured PVC. The availability of a PVC is indirectly related to the successful participation of a PVC end-point in the *heartbeat polling* process, which is detailed in the 4.3 "Link Integrity Verification Report" section.
- Verification of the integrity of the physical link between the end station and network by using a *keep alive* sequence number interchange.
- Inclusion of CIR as part of the PVC status information.

Although the Frame Relay interface supports both types of network management, it is not necessary for management to run on the Frame Relay backbone for the interface to operate over the Frame Relay backbone. For example, you may want to disable management for back-to-back testing.

4.1. Management Status Reporting

Upon request, Frame Relay management provides two types of status reports, a full status report and a link integrity verification report. A full status report provides information about all PVCs the interface knows about. A link integrity verification report verifies the connection between a specific end station and a network switch. All status inquiries and responses are sent over DLCI 0 for ANSI Annex D and CCITT or DLCI 1023 for interim LMI management.

4.2. Full Status Report

When the Frame Relay interface requires a full status report, the Frame Relay interface on the router sends a status inquiry message to management requesting a full status report. A status inquiry message is a request for the status of all PVCs on the interface. Upon receiving this request, Frame Relay management must respond with a full status report consisting of the link integrity verification element

and a PVC status information element for each PVC. (The link integrity verification element is discussed in the next section).

The PVC status information element contains the following information: the local DLCI number for the particular PVC; the state of the PVC (active or inactive); and whether the PVC is new or an existing PVC that management already knows about.

> ***Note : The number of PVCs supplied at the Frame Relay interface is restricted by the network frame size and the amount of individual PVC information elements that can fit into a full status report. For example, 202 is the maximum number of PVCs for a network with a 1K frame size.***

4.3. Link Integrity Verification Report

The link integrity verification report, sometimes referred to as *"heartbeat polling"* , contains the link integrity verification element.

This element is where the exchange of the send and receive sequence number takes place. By exchanging sequence numbers, management and the end station can evaluate the integrity of the synchronous link. The send sequence number is the current send sequence number of the message originator. The receiver looks at this number and compares it to the last send sequence number to verify that this number is incrementally correct. The receive sequence number is the last send sequence number that the originator sent out over the interface. It is the receiver's responsibility to place a copy of the send sequence number into the receive sequence number field. This way the originator can ensure that the receiver receives and interprets the frames correctly.

When an end station fails to participate in this polling process, all remote end-stations with logically attached PVCs are notified through management's full status report mechanism.

5. Frame Relay Data Rates

This section introduces data rates for Frame Relay permanent virtual circuits (PVCs).

5.1. Committed Information Rate (CIR)

The CIR is the data rate that the network commits to support for the PVC under normal, uncongested conditions. Any PVC that is configured or is learned is provided a CIR (by the Frame Relay service provider). The CIR is a portion of the total throughput for the physical link between 300 bits per second (bps) and 2 Megabits per second (Mbps), where 64 Kilobits per second (Kbps) or a single DS0 channel is most common. The CIR is defined with the **ADD PVC-PERMANENT-CIRCUIT** command.

5.2. Orphan Circuit CIR

When an orphan circuit is learned, the router assigns it a CIR of 64,000. If you are relying on the orphan circuit to route important data, it is recommended that you add a PVC in place of the orphan. Doing this, you can assign a CIR that the network commits to support.

5.3. Committed Burst Size

Committed data is what the network agrees to transmit for the PVC under normal, uncongested conditions. The committed burst size is the maximum amount of committed data (in bits) that the PVC can transmit during a given time interval. This parameter is an expression of the CIR applied over a time interval. For example, if you set a PVCs CIR to 9,600 bps, and the committed burst size to 14,400 bits, the time period is 1.5 sec. (14,400 bits /9,600 bps = 1.5 sec.). This means that the PVC is allowed to transmit a maximum of 14,400 bits in 1.5 seconds.

This parameter is important because of the relationship between the committed burst size and the maximum frame size. If the maximum frame size in bits is greater than the committed burst size, the network may discard frames whose size exceeds the committed burst size. Therefore, the committed burst size should be greater than or equal to the maximum frame size. It should also equal to the burst size set up with the network provider.

5.4. Excess Burst Size

During a given time interval, the router can transmit frames on a PVC in excess of the committed burst size. The maximum allowed amount of uncommitted data (in bits) is the excess burst size. The network delivers this excess data with a lower probability of success than the committed burst size data. It is eligible to be discarded by the network.

You should set the excess burst size to a value greater than zero only if you are willing to accept the risk of discarded data and its effect on higher layer protocol performance. The excess burst size value should equal the value set up with the network provider.

Use the **ADD PVC-PERMANENT-CIRCUIT** command during Frame Relay configuration to set the excess burst size. A default of 0 applies to orphan PVCs.

6. Circuit Congestion

Circuit congestion occurs because either the sender is transmitting faster than the allowable throughput, the receiver is too slow when processing the frames, or an intermediate backbone link is congested resulting in the sender transmitting faster than the resulting throughput. When circuit congestion happens, the network must drop packets and/or shut down.

In response to circuit congestion, the router implements a throttle down, which is a stepwise slowing of packet transmission to a rate not less than 0.25 times the CIR. Throttle down occurs during the following conditions:

- Circuit congestion is occurring.
- The router is the sender of frames.
- CIR monitoring or congestion monitoring is enabled.

6.1. CIR Monitoring

CIR monitoring is an optional Frame Relay feature that you can set for each interface. It prevents the information rate of each PVC on the interface from exceeding its maximum value of the committed burst rate plus the excess burst rate.

The information rate is called the Variable Information Rate (VIR). Depending on the current network congestion, it ranges from a minimum of 0.25 times the CIR to a maximum of the committed burst size plus the excess burst size.

To avoid impulse loading of the network, the VIR is initially set to CIR when the network starts up.

The VIR can actually exceed the maximum value in one case. If the length of a frame in bits is greater than the committed plus excess burst sizes, Frame Relay transmits the frame anyway.

CIR monitoring is configured with the **ENABLE CIR-MONITOR** configuration command and is disabled by default. CIR monitoring, when enabled, overrides congestion monitoring.

6.2. Congestion Monitoring

Congestion monitoring is an optional feature, set per interface, that allows the VIR of PVCs to vary in response to network congestion. The VIR assumes values between a minimum of 0.25 times CIR and a maximum of line speed. Congestion monitoring is enabled by default. It can be disabled with the **DISABLE CONGESTION-MONITOR** configuration command and re-enabled with the **ENABLE CONGESTION-MONITOR** command.

CIR monitoring, if enabled, overrides congestion monitoring. If both CIR monitoring and congestion monitoring are disabled, the VIR for each PVC on the interface is set to line speed and does not decrease in response to network congestion.

6.3. Congestion Notification and Avoidance

When congestion occurs, management is responsible for notifying the sender and receiver by sending out a FECN or a BECN. FECN and BECN are bits that are set in the frame to notify the receiver and the sender, respectively, that congestion is occurring.

The example in Figure 5 shows a congestion condition at switch B. Management notifies the downstream node (switch C) and the end station (router) that congestion is occurring by setting the FECN bit on all outgoing frames. Management must also notify switch A and the other end station that congestion is occurring by setting the BECN bit.

When the router receives a frame containing BECN, it is the router responsibility to throttle down the PVC's VIR (Variable Information Rate) if either CIR monitoring or congestion monitoring is enabled. The router does this gradually as it receives consecutive frames with BECN until either the minimum VIR is reached or a frame without BECN arrives. As consecutive frames without BECN are received, the VIR gradually rises to its maximum value.

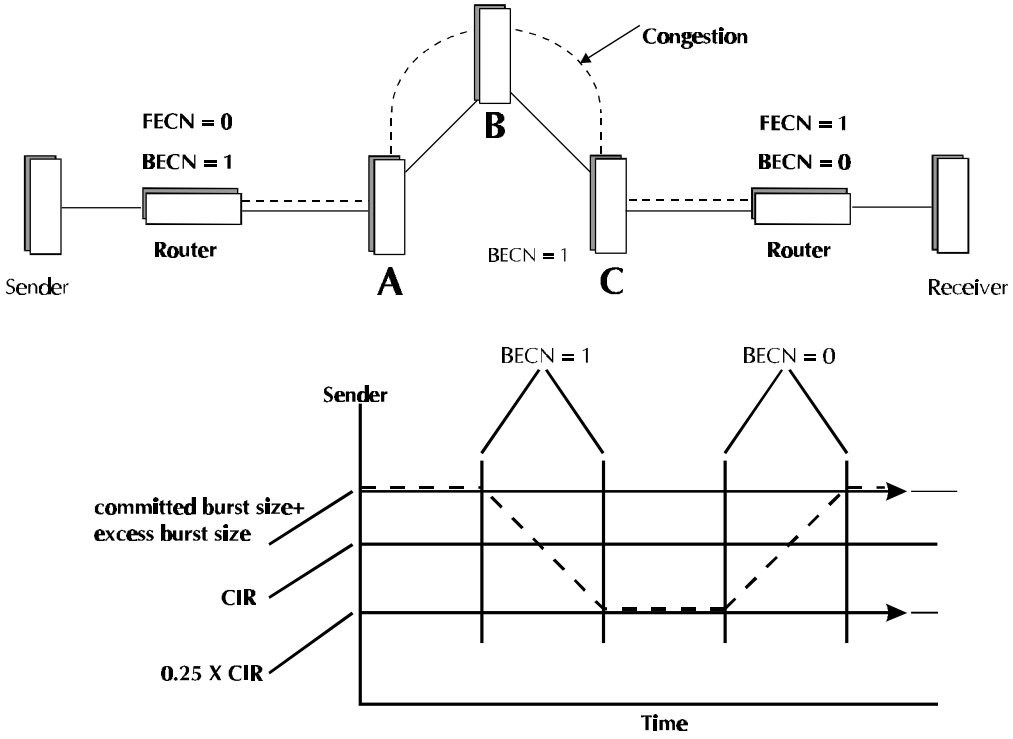

Figure 5 Congestion Notification and Throttle Down

Note: If multiple DLCIs are configured between two end-stations when congestion occurs, it is possible that a second DLCI may be used to transmit data at a higher throughput until the congestion condition on the first DLCI is corrected.

7. Frame Relay Interfaces Encryption Data

The **Teldat Router**, in addition to offering all the functions required to support networks with Frame Relay traffic, allows you to encrypt the content of the data field of Frame Relay frames. In this way the privacy of the data transmission in private communications on public networks is guaranteed, meaning that staff and devices outside the aforementioned private network are unable to gain access to the real content of the data being transmitted.

The only requisite needed in order to carry out an encrypted transmission between two terminal devices in the Frame Relay network consists of configuring the same encryption key in both devices.

The data encryption is not performed on all the Frame Relay interface, it is associated with each of the defined circuits in the device, in other words, it is possible to configure the circuits (PVCs) in such way that transmission on it can be done in plain or encrypted form, independent of how transmission is being carried out in the rest of the circuits.

8. Backup Facilities over Frame Relay Interfaces

The possibility of doing a back up of the Frame Relay lines allows us to guarantee the transmission of Frame Relay data when a fault is produced on the interface of the device or on the network lines. There are two ways of performing a backup in the Frame Relay interfaces in the **Teldat Router**.

1. Backup from one PVC to another PVC (both from the same Frame Relay interface).

2. Backup from one Frame Relay interface to an ISDN interface.

The implementation of these two types of backup are associated with the seriousness of the problems that may occur in communications on Frame Relay networks.

Through messages with LMI negotiation the network provides us with information about the state and configuration of the PVCs available on a physical interface. Based on these messages we can detect what type of problem we have on the network and switch to the type of backup required to continue transmitting data.

At any time communications on a circuit can fall, either if they have been deleted by the network or if they have become idle, which would mean that we are unable to continue transmitting frame through this circuit. In order to guarantee that we can carry on sending and receiving the data that was directed to this circuit (called the main circuit) we can associate it with another circuit (called the secondary or backup circuit) through which data from the main circuit will be transmitted. The only requisite needed to be able to perform a backup from PVC to PVC, which as we can see allows us to configure pairs of PVCs so that if it is not possible to use the main PVC we are able to use the back up PVC to maintain communications.

The second backup case is reserved for the most adverse situations, which basically consist of two. On the one hand, it may be that the two configured circuits (the main one and its associated backup) are not available at a specific time (a circumstance which can be deduced from the negotiation messages), and on the other, the physical interface may fall. In either of these two cases we are unable to carry on transmitting data through circuits configured on this Frame Relay interface. The solution is to opt for an alternative back up network, which at the present time is the ISDN network.

In order to carry out this type of backup it is necessary to have configured the aforementioned ISDN backup network, for this consult the relevant documentation on backup networks.

9. Switched Circuits in Frame Relay

The function of Switched Virtual Circuits (SVC) in devices with switched Frame Relay is similar to Permanent Virtual Circuits (PVC). The main difference between them is:

- The DLCI value assigned to a PVC is fixed. This is determined when the device is configured. The DLCI value to be used is already known.
- The DLCI value assigned to a SVC is variable. This value is unknown both when the device is configured and the circuit is contracted. The DLCI value is obtained through signaling based on the UIT-T Q933 norm (former CCITT) or the Frame Relay Forum, FRF.4. This is the Q933 abbreviated and slightly modified. The transmission of the signaling messages is carried out through DLCI 0. A call is established in a similar way to ISDN. A Network Number is assigned to each outgoing circuit to be configured. This number has to be called in order to establish the call which also corresponds to the extreme connection. Once the call packet is sent, the network assigns a DLCI which is used until the call is disconnected.

The assigning of the circuits is not permanent i.e. when you wish to sent traffic via a switched circuit, it is assigned to you at the time. The established connection or circuit is released in absence of traffic. Releasing a circuit due to absence of traffic is a time programmable parameter.

Chapter 2
Configuring Frame Relay Interfaces

1. Introduction

This chapter describes the Frame Relay configuration commands and includes the following sections:

- Displaying the Frame Relay Configuration Prompt.
- Frame Relay Basic Configuration Procedure.
- Enabling Frame Relay Management.
- Frame Relay Configuration Commands.

If you need more information on Frame Relay, refer to Chapter 1 “The Frame Relay Interface”.

2. Displaying the Frame Relay configuration prompt

To access the Frame Relay configuration environment, do the following:

1. At the GESTCON prompt (*), type **PROCESS 4** (or **P 4**).

2. At the configuration prompt (Config>), type **NETWORK #,** # is the number of the interface over which you want to run Frame Relay.

3. At the Frame Relay interface configuration prompt (FR Config>), use the configuration commands discussed in this chapter to configure the Frame Relay parameters.

3. Frame Relay Basic Configuration Procedure

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

- *Adding the Frame Relay device*. You must add the Frame Relay device at the Config> prompt using the **SET DATA-LINK FRAME-RELAY** command.

- *Selecting Frame Relay management*. The Frame Relay Local Management Interface protocol defaults CCITT. You have the option of connecting to a network using LMI-Rev.1 management, ANSI Annex D management, or CCITT management. Use the **ENABLE** and **SET** commands to enable and set the required management.

- *Adding a PVC*. Add any required permanent virtual circuits (PVCs) that are needed if Frame Relay management is disabled or orphan circuits are disabled. Use the **ADD PVC-PERMANENT-CIRCUIT** command.

- *Configuring Frame Relay destination addresses*. If you are running a protocol, such as the Internet Protocol (IP) over the Frame Relay interface, and are interconnecting with devices not supporting the Address Resolution Protocol (ARP) on Frame Relay, use the **ADD PROTOCOL-ADDRESS** command to add the static protocol and address mapping.

4. Enabling Frame Relay Management

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

1. Enter **ENABLE LMI** command at the FR Config> prompt to enable all management activity.

2. Enter **SET LMI-TYPE** command 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 Frame Relay management are listed below. An example of how to set these management modes is shown below the table. Also, refer to the **ENABLE** and **SET** command sections in this chapter for more information.

Command	Options	Description	Default value
SET	LMI-TYPE REV1	Conforms to LMI Revision 1(Stratacom's Frame Relay Interface Specification)	N/A
	LMI-TYPE ANSI	Conforms to ANSI T1.617USDN-DSS1-Signalling Specification for Frame Relay Bearer Service (known as Annex D)	N/A
	LMI-TYPE CCITT	Conforms to Annex A of ITU (former CCITT) Recommendation Q.933 - DSS1 (Signaling Specification for Frame Mode Basic Call Control)	Enabled

Example:

```
FR config> ENABLE LMI
```

```
FR config> SET LMI-TYPE ANSI
```

5. Frame Relay Configuration Commands

This section summarizes and then explains the Frame Relay configuration commands. Enter all the Frame Relay configuration commands at the Frame Relay prompt. The letters typed in **bold** are the minimum number of characters which need to be keyed in order to activate the command.

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

Command	Function
? (HELP)	Lists available commands or lists a command's options .
ADD	Adds PVCs, SVCs and destination protocols addresses to Frame Relay interface.
CHANGE	Changes PVCs or SVCs that were added using the **ADD** command.
DISABLE	Disables any enabled Frame Relay features.
ENABLE	Enables Frame Relay features, such as CIR and congestion monitoring, management options, multicast, protocol-broadcast, orphan circuits, point to point line, Nucleox like BIR, protocol discard bit, fragmentation and compression.
LIST	Displays the current configuration of the LMI and PVCs, HDLC information, protocol addresses, backup configuration and the protocol discard bit.
DELETE	Deletes any previously added PVCs, SVCs or protocol addresses.
SET	Configures the properties associated with Frame Relay parameters (frame size, line-speed, n1 parameter, n2 parameter, n3 parameter, p1 parameter, and t1 parameter). Also sets Frame Relay management options and the physical layer parameters for the serial interface.
EXIT	Returns to the *Config>* prompt .

Frame Relay Configuration Commands

Note: In this section, the terms circuit number and PVC are synonymous with the term "DLCI (Data Link Circuit Identifier)".

5.1. ? (HELP)

Lists available commands or lists the command's options.

Syntax:

```
FR config> ?
```

Example:

```
FR config> ?
ADD
CHANGE
DISABLE
ENABLE
LIST
DELETE
SET
EXIT
FR config>
```

5.2. ADD

Adds a PVC, SVC or destination protocol address supported by the Frame Relay interface.

Syntax:

```
FR config> ADD ?
PVC-PERMANENT-CIRCUIT
PROTOCOL-ADDRESS
SVC-SWITCHED-CIRCUIT
NUMBER- ADDRESS
```

a) ADD PVC-PERMANENT-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 991, 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.

Example:

```
FR config> ADD PVC-PERMANENT-CIRCUIT
Circuit number [16]?
Outgoing Committed Information Rate (CIR) in bps [16000]?
Outgoing Committed Burst Size (Bc) in bits [16000]?
Outgoing Excess Burst Size (Be) in bits[0]?
Encrypt information? [No]:(Yes/No)?
Assign circuit name []?
Inverse ARP (0-Default, 1-Off, 2-On): [0]?
FR config>
```

Circuit number — The circuit number in the range of 16 and 1,007.

Committed Information Rate — The committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 16,000 bps.

Committed Burst Size — The maximum amount of data in bits, that the network agrees to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds. Range is 300 to 2048000 bits. Default is 16 Kbits.

Excess Burst Size — The maximum amount of uncommitted data in bits in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds. Range is 0 to 2048000 bits. Default is 0.

Encrypt information — Indicates whether the Frame Relay data field frame is encrypted, yes or not.

Assign circuit name — The ASCII string that is assigned to describe the circuit. This parameter is optional, but you must assign a circuit name to do bridging over the Frame Relay interface. It is recommended that you use a name that describes the characteristics of the circuit. The default is *Unassigned*. The maximum length is 23 characters.

Inverse ARP — Permits you to define the Inverse ARP protocol as enabled or disabled for each circuit as you wish. The default value is 0, this means that the value set in the DEFAULT-VALUE parameter is taken. Orphan circuits always take the value configured in the DEFAULT-VALUE.

b) ADD PROTOCOL-ADDRESS

Adds statically configured destination protocol (protocol name) addresses to Frame Relay interface. Adding these address alleviates using ARP during the forwarding process. This 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 are adding.

Example:

```
FR config> ADD PROTOCOL-ADDRESS
Protocol name or number [0]?
IP Address [0.0.0.0]?
Circuit number [16]?
FR config>
```

IP Address — The 32 bit Internet address in dotted-decimal notation.

Circuit number — The PVC in the range of 16 to 1,007 that this protocol is to run over.

c) ADD SVC-SWITCHED-CIRCUIT

Adds a SVC to the Frame Relay interface beyond the default range of 15. The maximum number of SVCs that can be added is approximately 991, but the actual number of SVCs that can be supported by the interface is affected by the configured size of the receive buffer on the interface.

Example:

```
FR config> ADD SVC-SWITCHED-CIRCUIT
Called number []?
Release time without data [0-65000] [60]?
Outgoing Committed Information Rate (CIR) in bps [16000]?
Outgoing Committed Burst Size (Bc) in bits [16000]?
Outgoing Excess Burst Size (Be) in bits[0]?
Incoming Committed Information Rate (CIR) in bps [16000]?
Incoming Committed Burst Size (Bc) in bits [16000]?
Incoming Excess Burst Size (Be) in bits[0]?
Encrypt information [No] (Yes/No)?
Assign circuit name []?
FR config>
```

Called number — This is the NN value called to establish the switched circuit under configuration. The NN serves to identify the circuit.

Release time without data — This refers to the time (measured in seconds) waited before releasing the connection due to lack of data transmission on the line.

Outgoing CIR — The committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 16,000 bps. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Outgoing Bc — The maximum amount of data in bits that the network agrees to deliver during a measurement interval equal to (Outgoing Committed Burst Size/Outgoing CIR) seconds. This value is requested from the network during the circuit establishment process. Range is from 300 to 2048000 bits. Default is 16 Kbits. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Outgoing Be — The maximum amount of uncommitted data in bits in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Outgoing Committed Burst Size/Outgoing CIR) seconds. This value is requested from the network during the circuit establishment process. Range is from 0 to 2048000 bits. Default is 0. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming CIR — The committed information rate (CIR) (suggested by our device for the device located at the other extreme) in a range from 300 bps to 2048000 bps. The default is 16,000 bps. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming Bc — The maximum amount of data in bits (suggested by our device for the device located at the other extreme), that the network agrees to deliver

during a measurement interval equal to (Incoming Committed Burst Size/Incoming CIR) seconds. This value is requested from the network during the circuit establishment process. Range is from 300 to 2048000 bits. Default is 16 Kbits. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming Be — The maximum amount of uncommitted data in bits (suggested by our device for the device located at the other extreme) in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Incoming Committed Burst Size/Incoming CIR) seconds. This value is requested from the network during the circuit establishment process. Range is from 0 to 2048000 bits. Default is 0. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Encrypt information — Indicates whether the Frame Relay data field frame is encrypted or not.

Assign circuit name — The ASCII string that is assigned to describe the circuit. This parameter is optional, but you must assign a circuit name to do bridging over the Frame Relay interface. It is recommended that you use a name that describes the characteristics of the circuit. The default is *Unassigned*. The maximum length is 23 characters.

d) ADD NUMBER-ADDRESS

Adds static configured destination protocol (protocol name) addresses to Frame Relay interface. Adding these addresses avoids the use of ARP during the forwarding process. This feature may be necessary when interconnecting to Frame Relay equipment that does not support ARP. Consequently, a corresponding protocol address is associated with an NN and this is used to request a DLCI. The resulting circuit serves to transmit all packets with that address. Using an **ADD PROTOCOL-ADDRESS** command, we associate a protocol address with a specific PVC (identified by its DLCI). As this is a permanent circuit, it has a fixed assigned DLCI.

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

Example:

```
FR config> ADD NUMBER-ADDRESS
IP Address [0.0.0.0]?
Called number []?
FR config>
```

IP Address — The 32 bit Internet address in dotted-decimal notation.

Called number This is the NN value called to establish a SVC (previously configured and identified by the NN). This will be used by the protocol.

5.3. CHANGE

Changes PVCs or SVCs that were added previously with the **ADD PVC-PERMANENT-CIRCUIT** or **ADD SVC-SWITCHED-CIRCUIT** commands.

Syntax:

```
FR config> CHANGE ?
PVC-PERMANENT-CIRCUIT
SVC-SWITCHED-CIRCUIT
```

a) CHANGE PVC-PERMANENT-CIRCUIT

Changes the characteristics of a PVC that was configured with **ADD PVC-PERMANENT-CIRCUIT**.

Example:

```
FR config> CHANGE PVC-PERMANENT-CIRCUIT
Circuit number [16]?
Outgoing Committed Information Rate (CIR) in bps [16000]?
Outgoing Committed Burst Size (Bc) in bits[16000]?
Outgoing Excess Burst Size (Be) in bits[0]?
Encrypt information [No] (Yes/No)?
Assign circuit name []?
Inverse ARP (0-Default, 1-Off, 2-On): [0]?
FR config>
```

Circuit number The circuit number in the range of 16 to 1,007.

Committed Information Rate The CIR in a range of 300 bps to 2048000 bps. The default is 16 Kbps.

Committed Burst Size The maximum amount of data in bits that the network agrees to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds. Range is 300 to 2048000 bits. Default is 16 Kbits.

Excess Burst Size The maximum amount of uncommitted data in bits in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds. Range is 0 to 2048000 bits. Default is 0.

Encrypt information Indicates whether the Frame Relay data field frame is encrypted, yes or not.

Assign circuit name — The ASCII character string designation for the circuit that you want to change.

Inverse ARP — Permits you to define the Inverse ARP protocol as enabled or disabled for each circuit as you wish. The default value is 0, this means that the value set in the DEFAULT-VALUE parameter is taken. Orphan circuits always take the value configured in the DEFAULT-VALUE.

b) CHANGE SVC-SWITCHED-CIRCUIT

Changes the characteristics of a SVC that was configured with **ADD SVC-SWITCHED-CIRCUIT**.

Example:

```
FR config> CHANGE SVC-SWITCHED-CIRCUIT
Called number []?
Outgoing Committed Information Rate (CIR) in bps [16000]?
Outgoing Committed Burst Size (Bc) in bits [16000]?
Outgoing Excess Burst Size (Be) in bits[0]?
Incoming Committed Information Rate (CIR) in bps [16000]?
Incoming Committed Burst Size (Bc) in bits [16000]?
Incoming Excess Burst Size (Be) in bits[0]?
Encrypt information [No] (Yes/No)?
Assign circuit name []?
FR config>
```

Called number — This is the NN value called to establish the switched circuit under configuration. The NN serves to identify the circuit.

Outgoing CIR — The committed information rate (CIR) in a range of 300 bps to 2048000 bps. The default is 16,000 bps. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Outgoing Bc — The maximum amount of data in bits, that the network agrees to deliver during a measurement interval equal to (Outgoing Committed Burst Size/Outgoing CIR) seconds. This value is requested from the network during the circuit establishment process. Range is 300 to 2048000 bits. Default is 16 Kbits. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Outgoing Be — The maximum amount of uncommitted data in bits in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Outgoing Committed Burst Size/Outgoing CIR) seconds. This value is requested from the network during the circuit establishment process. Range is 0 to 2048000 bits. Default is 0. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming CIR — The committed information rate (CIR) (suggested by our device for the device located at the other extreme) in a range of 300 bps to 2048000 bps. The default is 16,000 bps. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming Bc — The maximum amount of data in bits (suggested by our device for the device located at the other extreme) that the network agrees to deliver during a measurement interval equal to (Incoming Committed Burst Size/Incoming CIR) seconds. This value is requested from the network during the circuit establishment process. Range is 300 to 2048000 bits. Default is 16 Kbits. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Incoming Be — The maximum amount of uncommitted data in bits (suggested by our device for the device located at the other extreme) in excess of Committed Burst Size that the network attempts to deliver during a measurement interval equal to (Incoming Committed Burst Size/Incoming CIR) seconds. This value is requested from the network during the circuit establishment process. Range is 0 to 2048000 bits. Default is 0. The network or the device located on the other extreme can reduce this rate through the parameter negotiation process.

Encrypt information — Indicates whether the Frame Relay data field frame is encrypted or not.

Assign circuit name — The ASCII string that is assigned to describe the circuit.

5.4. DISABLE

Disables those features previously enabled using the **ENABLE** command.

Syntax:

```
FR config> DISABLE ?
CIR-MONITOR
CONGESTION-MONITOR
LMI
MULTICAST-EMULATION
ORPHAN-CIRCUITS
PROTOCOL-BROADCAST
POINT-TO-POINT-LINE
NUCLEOX-LIKE-BIR
BIT-DISCARD-PROTOCOL
COMPRESSION
FRAGMENTATION-FRF12
```

a) DISABLE CIR-MONITOR

Disables the circuit monitoring feature that enforces the transmission rate that was previously configured using the **ADD PVC-PERMANENT-CIRCUIT** or **ADD-SVC-SWITCHED-CIRCUIT** commands. The default setting for this feature is disabled.

Example:

```
FR config> DISABLE CIR-MONITOR
FR config
```

b) DISABLE CONGESTION-MONITOR

Disables the congestion monitoring feature. It prevents varying of the circuit's information rate 0.25 times CIR to the line speed in response to network congestion. The default is enabled.

Example:

```
FR config> DISABLE CONGESTION-MONITOR
FR config
```

c) DISABLE 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 CCITT 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 (i.e., the same number like 17 and 17) on both ends of the link.

Example:

```
FR config> DISABLE LMI
FR config>
```

d) DISABLE MULTICAST-EMULATION

This disables the multicast emulation option in this interface. All broadcast or multicast packets that reach this interface are discarded. This option is enabled by default.

Example:

```
FR config> DISABLE MULTICAST-EMULATION
FR config>
```

e) DISABLE ORPHAN-CIRCUITS

Prohibits the use of all non configured orphan circuits at the interface. The default setting for orphan circuits is enabled. If this feature remains enabled, you are required to add PVCs.

Example:

```
FR config > DISABLE ORPHAN-CIRCUITS
FR config>
```

f) DISABLE PROTOCOL-BROADCAST

Prevents broadcast or multicast packets arriving at this interface. This option is enabled by default.

Example:

```
FR config > DISABLE PROTOCOL-BROADCAST
FR config>
```

g) DISABLE POINT-TO-POINT-LINE

The interface acting as a point-to-point line option is disabled. This option is disabled by default.

Example:

```
FR config > DISABLE BIT-DISCARD-PROTOCOL
FR config>
```

h) DISABLE NUCLEOX-LIKE-BIR

The Nucleox Plus acting as a BIR option is disabled. This option is disabled by default.

Example:

```
FR config> DISABLE NUCLEOX-LIKE-BIR
FR config>
```

NOTE. The NUCLEOX-LIKE-BIR option is valid for the following Teldat Routers: Nucleox Plus, Nucleox 20 and Cbra 20.

i) DISABLE BIT-DISCARD-PROTOCOL

If this option is disabled, all frames are transmitted with the DE bit set on zero. This option is disabled by default.

Example:

```
FR config> DISABLE BIT-DISCARD-PROTOCOL
FR config>
```

j) DISABLE COMPRESSION

This disables the compression of data chosen for a specific DLCI.

Example:

```
FR config> DISABLE COMPRESSION
Circuit number [16]?
FR config
```

Circuit number This is the DLCI corresponding to the PVC where data compression is applied. The PVC must be pre-configured.

k) DISABLE FRAGMENTATION-FRF12

Permits you to disable fragmentation according the FRF.12 norm.

Example:

```
FR config> DISABLE FRAGMENTATION-FRF12
Circuit number[16]? 16
FR config>
```

5.5. ENABLE

Enables Frame Relay features such as CIR-monitor, management and orphan-circuits.

Syntax:

```
FR config> ENABLE ?
CIR-MONITOR
CONGESTION-MONITOR
LMI
MULTICAST-EMULATION
ORPHAN-CIRCUITS
PROTOCOL-BROADCAST
POINT-TO-POINT-LINE
NUCLEOX-LIKE-BIR
BIT-DISCARD-PROTOCOL
COMPRESSION
FRAGMENTATION-FRF12
```

a) ENABLE CIR-MONITOR

Enables the circuit monitoring feature that enforces the transmission rate that was previously configured using the **ADD PVC-PERMANENT-CIRCUIT** or **ADD SVC-SWITCHED-CIRCUIT** commands. The default is disabled.

Example:

```
FR config> ENABLE CIR-MONITOR
FR config>
```

b) ENABLE CONGESTION-MONITOR

Enables congestion monitoring. This feature allows a circuit's information rate to vary in response to network congestion from a minimum of 0.25 times the CIR to a maximum of the line speed. The default is enabled.

Example:

```
FR config> ENABLE CONGESTION-MONITOR
FR config>
```

c) 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. Refer to the 4 "Enabling Frame Relay Management" section of Chapter 2 or the **SET** command section for more information. The system defaults to CCITT.

Use the **ENABLE LMI** command to resume CCITT management if you have previously disabled Frame Relay management or if you want to return to this management mode from another mode. To set the default of CCITT management mode, you need only enter **ENABLE LMI** command.

Example:

```
FR config> ENABLE LMI
FR config>
```

d) ENABLE MULTICAST-EMULATION

This enables the multicast emulation option in this interface. All broadcast or multicast packets that reach this interface are transmitted via all active circuits. This option is enabled by default.

Example:

```
FR config> ENABLE MULTICAST-EMULATION
FR config>
```

e) ENABLE ORPHAN-CIRCUITS

Enables the use of all non configured orphan circuits. The default for this feature is enabled. The CIR defaults to 16 Kbps, the Committed Burst Size to 160 Kbits and the Excess Burst Size to 0.

Example:

```
FR config> ENABLE ORPHAN-CIRCUITS
FR config>
```

f) ENABLE PROTOCOL-BROADCAST

Marks this interface as capable of transmitting broadcast packets. This option is enabled by default. Both this option and the **MULTICAST-EMULATION** option must be enabled in order to transmit broadcast packets. If the latter is disabled, broadcast packets can arrive from higher level entities, but they are discarded at the interface. If the **MULTICAST-EMULATION** is enabled but not the **PROTOCOLO-BROADCAST**, the higher level entity does not forward the broadcast packets to the interface.

Example:

```
FR config> ENABLE PROTOCOL-BROADCAST
FR config>
```

g) ENABLE POINT-TO-POINT-LINE

The interface acting as a point-to-point line option is enabled. When enabled all IP packets towards this interface are transmitted by the DLCI. This must be configured on enabling. It is unnecessary to configure static destination addresses (inputs which associate a DLCI with a protocol address). This option is only applicable for IP and is disabled by defect.

Example:

```
FR config> ENABLE POINT-TO-POINT-LINE
Point to point DLCI:[0]?
FR config>
```

Point to point DLCI All packets that arrive at this interface are transmitted by the DLCI. This must be compatible with the pre-configured PVC.

h) ENABLE NUCLEOX-LIKE-BIR

Nucleox Plus acting as BIR option is enabled. This option is useful when the Nucleox Plus confronts a BIR device. The device jumps to backup if the traffic is from the BIR even if the PVC is active. The BIR therefore controls backup activation. This option is disabled by default.

Example:

```
FR config> ENABLE NUCLEOX-LIKE-BIR
FR config>
```

NOTE. The NUCLEOX-LIKE-BIR option is valid for the following Teldat Routers: Nucleox Plus, Nucleox 20 and Cbra 20.

i) ENABLE BIT-DISCARD-PROTOCOL

If this option is disabled, all frames (in the enabled protocol) are transmitted with the DE bit set on one. This allows the network to discard all frames corresponding to traffic whose protocols have less priority. This option is disabled by default.

Example:

```
FR config> ENABLE BIT-DISCARD-PROTOCOL
Protocol name to be configured:[]?
FR config>
```

Protocol name to be configured — This is the protocol name where the protocol discard bit is enabled. All frames with packets containing this protocol leave with the DE bit set on one.

j) ENABLE COMPRESSION

Enables data compression for a specific DLCI. You can choose between the following: **ADAPTATIVE** or **PREDICTOR**, **CONTINUOUS** or **PKT_BY_PKT** and **OWNER** or **COMPATIBLE**.

At the same time as compressing data, you can enable the CRTP compression (RFC-2508) for Voice over IP. This permits you to configure the **WITH-UDP-CHECKSUM** or **WITHOUT-UDP-CHECKSUM** options.

Example:

```
FR config> ENABLE COMPRESSION ADAPTIVE PKT_BY_PKT COMPATIBLE
Circuit number [16]?
FR config>
```

Circuit number — This is the DLCI corresponding to the PVC where data compression is applied. The PVC must be pre-configured.

adaptative/predictor/crtp — This is the type of compression algorithm to be applied.

Continuous/pkt_by_pkt — This allows you to choose the data set used in calculating the necessary symbols dictionary for compression. If the compression is CONTINUOUS, the algorithm takes into account all data from previously received frames. With PKT_TO_PKT compression, the dictionary is recalculated with every packet which makes it quicker if not as efficient.

Proprietor/compatible — This allows you to choose between Cisco compatible or proprietor compression.

With-Udp-Checksum/ Without-Udp-Checksum — This only applies for CRTP compression and allows you to decide if. the Udp checksum is transmitted in the compressed header or not.

k) ENABLE FRAGMENTATION-FRF12

Permits you to enable fragmentation according to the FRF.12 norm, specifying the fragment size in bytes.

Example:

```
FR config> ENABLE FRAGMENTATION-FRF12
Circuit number[16]? 16
Fragment Size[256]? 256
FR config>
```

5.6. LIST

Displays currently configured management and PVC information.

Syntax:

```
FR config> LIST ?
ALL
HDLC
INVERSE-ARP
LMI
CIRCUITS
PROTOCOL-ADDRESSES
BACK UP
RETURN-TIME-BACK-UP
BIT-DISCARD-PROTOCOL
COMPRESSION
FRAGMENTATION-FRF12
```

a) LIST ALL

Comprehensively displays the output of the other **LIST** command options.

b) LIST HDLC

Displays Frame Relay High-level Data Link Control (HDLC) configuration.

Example:

```
FR config> LIST HDLC
Frame Relay HDLC Configuration
Encoding              =   NRZ          IDLE                    = Flag
Clocking              =   External
Interface Direction   =   DTE
Line access rate bps  =   2048000      Interface MTU in bytes = 2048
Transmit delay        =   0
FR config>
```

Note: Depending on the device type, the Encoding, Clocking, and Interface Direction may not appear.

Encoding The encoding type, either NRZ or NRZI.

IDLE	The idle type configured, either flag or mark.
Clocking	The clocking type configured, external or internal.
Interface Direction	The device working mode, either DCE or DTE.
Line access rate bps	The physical rate for the Frame Relay interface.
Interface MTU in bytes	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.	The delay configured between transmitted packets.

c) LIST INVERSE-ARP

Displays the Inverse ARP protocol configuration by interface.

Example:

```
FR config> LIST INVERSE-ARP
Inverse ARP: default
Inverse ARP Default Value: on
FR config>
```

d) LIST LMI

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

Example:

```
FR config> LIST LMI

          Frame Relay LMI Configuration

Back Up like BIR        =  No
Point to point line     =  No     Point to point DLCI           = 0

LMI enabled             =  No     LMI  DLCI                     = 0
LMI type                =  ANSI   LMI Orphans  OK              = Yes

Protocol broadcast      =  Yes    Congestion monitoring         = Yes
Emulate multicast       =  Yes    CIR monitoring                = Yes

PVCs P1 allowed         =  64     CIR monitor adjustment        = 1
Timer T1 seconds        =  10     Counter N1 increments         = 6
LMI N2 error threshold  =  3      LMI N3 error threshold window  = 4
IR % Increment          =  12     IR % Decrement                = 25
MIR % of CIR            =  5
FR config>
```

Back Up like BIR	Indicates if the Nucleox Plus acting as BIR option is enabled.

Point to point line	Indicates if the interface acting as a point to point line option is enabled (routing all traffic via the configured DLCI).
Point to point DLCI	All traffic output is via the DLCI when the interface acting as a point to point line option is enabled.
LMI enabled	Indicates whether the management features are enabled on the Frame Relay interface, yes or no.
LMI DLCI	The management circuit number. This number reflects the LMI type, 0 for ANSI and CCITT or 1023 for Rev.1.
LMI type	The LMI type, either Rev. 1, ANSI or CCITT.
LMI Orphans OK	Indicates if non configured 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.
Emulate multicast	Indicates whether the multicast emulation is enabled on each active PVC, yes or no.
Congestion monitoring	Indicates whether the congestion monitoring feature is enabled to let the circuit information rate vary with network congestion, yes or no.
CIR monitoring	Indicates whether the circuit monitoring feature that enforces the transmission rate is enabled, yes or no.
PVCs P1 allowed	The number of allowable PVCs for use with this interface.
CIR monitor adjustment	The maximum burst transmission speed allowed over a PVC when CIR monitoring is enabled. The range is 1 to 100. The maximum burst transmission speed is the configured CIR value times the CIR monitor adjust entry. The value is ignored by all PVCs for which Committed Burst Size is specified.
Timer T1 seconds	The frequency that the Frame Relay interface performs a sequence number exchange with management.
Counter N1 increments	The interval (in seconds) that the Frame Relay interface queries the management for complete PVC status inquiry.
LMI N2 error threshold	The amount of management event errors occurring within the N3 window causing a reset of the Frame Relay interface.
LMI N3 err. threshold window	The number of monitored events that count for measuring N2.

IR% Increment — When the congestion monitoring feature is enabled, this indicates the upward movement size (CIR percentage). A variable information rate (VIR) is applied when congestion level falls.

IR% Decrement — When the congestion monitoring feature is enabled, this indicates the size of the downward movement (CIR percentage). A VIR is applied when congestion level rises.

MIR% of CIR — Indicates the minimum value of the VIR when congestion levels remain high for a long time.

e) LIST CIRCUITS

Displays all the configured PVCs and SVCs on the Frame Relay interface.

Example:

```
FR config> LIST CIRCUITS
Maximum PVCs allowed    = 64
Total PVCs configured   = 1

Circuit   Circuit   Circuit     CIR      Burst   Excess
Name      Number    Type        in bps   Size    Burst      Encrypt
--------  --------  ---------   ------   ------  ------     -------
c16       16        Permanent   1200     1200     56000     Yes
Inverse ARP: default
c17       17        Permanent   1200     1200     56000     Yes
Inverse ARP: off

Maximum number of SVC that are allowed   = 20
Total SVCs configured                    = 2

Circuit  Cir.  Switched Cir.   CIR        Burst        Excess         Rel
Name     Num   Called Number   in bps     Size         Burst     En   Tim
-------  ---   -------------   ---------  ---------    --------  ---  -----
cvc-1    0     214511111111    64000/O    64000/O      0/O       No   60
                               64000/I    64000/I      0/I
cvc-2    0     214522222222    204000/O   2048000/O    0/O       No   60
                               64000/I    64000/I      0/O
FR config>
```

Maximum PVCs allowed — The number of PVCs that can exist for this interface. This number includes any PVCs that you added with the **ADD PVC-PERMANENT-CIRCUIT** command and dynamically learned through the management.

Total PVCs configured — The total number of currently configured PVCs for this interface.

Circuit Name — The ASCII designation of the configured PVC or SVC.

Circuit Number — The number of a currently configured PVC or SVC.

Circuit Type	The type of virtual circuit currently configured. This release of Frame Relay supports either permanent virtual circuits (PVC) and switched virtual circuits (SVC).
CIR in bps	The information rate at which the network agrees to transfer data under normal conditions. If the circuit is switched, two values appear which are used when establishing the circuit for parameter negotiation. The value following the '/O' is the suggested parameter value for our device. The value following the '/I' is the suggested parameter value for the device at the other end.
Committed Burst Size	The maximum amount of data in bits that the network agrees to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds. If the circuit is switched, two values appear which are used when establishing the circuit for parameter negotiation. The value following the '/O' is the suggested parameter value for our device. The value following the '/I' is the suggested parameter value for the device at the other end.
Excess Burst Rate	The maximum amount of uncommitted data in bits in excess of Committed Burt Size that the network attempts to deliver during a measurement interval equal (Committed Burst Size/CIR) seconds. If the circuit is switched, two values appear which are used when establishing the circuit for parameter negotiation. The value following the '/O' is the suggested parameter value for our device. The value following the '/I' is the suggested parameter value for the device at the other end.
Encrypt	Indicates whether the Frame Relay data field frame is encrypted, yes or not.
Max. number of SVC that are allowed	The number of SVCs that can exist for this interface. This number includes only the SVCs that you added with the **ADD SVC-SWITCHED-CIRCUIT**. When there are both switched and permanent circuits at the same time, the maximum total value allowed is 992.
Total SVCs configured	The total number of currently configured SVCs for this interface.
Called number	This is the NN value called to establish the switched circuit under configuration. The NN serves to identify the circuit.
Rel. Tim.	This refers to the time (measured in seconds) waited before releasing the connection due to lack of data transmission on the line.

Inverse ARP — Permits you to define the Inverse ARP protocol as enabled or disabled for each circuit as you wish. The default value is 0, this means that the value set in the DEFAULT-VALUE parameter is taken. Orphan circuits always take the value configured in the DEFAULT-VALUE.

f) LIST PROTOCOL-ADDRESSES

Displays information about the configured protocol addresses.

Example:

```
FR config> LIST PROTOCOL-ADDRESSES

Frame Relay Protocol Address Translations

Protocol Type   Protocol Address       Circuit Number
-------------   ----------------       --------------
IP              172.16.4.1             16
DN              20.233                 16
IPX             000011223344           16

Protocol      Protocol       Called Number     Circuit
Type          Address        of SVC            Number
--------      -----------    -------------     -------
IP            12.12.12.12    214533333333      0
Calling Number for the interface: 214544444444
FR config>
```

Protocol Type — The name of the protocol running over the interface.

Protocol Address — The address of the protocol running over the interface.

Circuit Number — The PVC that is handling the protocol.

Called Number of SVC — This is the NN value called to establish the switched circuit under configuration. The NN value serves to identify the circuit.

Calling Number for the interface — This is the NN value which identifies our Frame Relay interface. This is the value that all other devices must call in order to connect with our device.

g) LIST BACK-UP

Displays information on all the configured PVCs on the Frame Relay interface and its associated backup circuits.

Example:

```
FR config> LIST BACK UP
Maximum PVCs allowed    = 64
Total PVCs configured   = 2
Name       Circuit   Circ.      Circ.         Back-ISDN   Encrypt
Circuit    Main      Back-FR    Back-ISDN     always      Back-ISDN
--------   --------  -------    ---------     ---------   ---------
c16        16        17         20            Yes         Yes
c17        17        0          0             No          No
FR config>
```

Maximum PVCs allowed — This is the number of PVCs that can exist on the interface. This number includes the PVCs added through the Command **ADD PVC-PERMANENT-CIRCUIT** as well as the ones learnt in a dynamic form by the negotiating interface.

Total PVCs configured — This is the number of PVCs that have been configured in the interface.

Name Circuit — This is the ASCII name of the PVC configured.

Circuit Main — This is the number corresponding to a main PVC configured.

Circ. Back-FR — This is the number corresponding to the PVC of a backup PVC to a configured PVC. If the value is zero it means that the main circuit does not have an associated Frame Relay backup circuit.

Circ. Back-ISDN — This is the number corresponding to the back-up PVC of the ISDN configured. If the value is zero it means that the main circuit does not have an associated ISDN back-up circuit.

Back-ISDN always — If the field of value is *YES* it implies that, whenever the two Frame Relay circuits (the main one and the secondary one) are idle, we switch to transmitting through the ISDN back-up circuit. If the value of the field is *NO* then we only switch to transmitting through the ISDN circuit if the interface falls.

Encrypt Back-ISDN — This is the data transmission mode being applied on the ISDN back-up circuit: plain or encrypted.

h) LIST RETURN-TIME-BACK-UP

Displays information about the time configured for returning from the PVC backup.

Example:

```
FR config> LIST BACK-UP RETURN TIME
PVC Back Up return time:
        Hour: 17
        Minute: 53
PVC BACK UP return:       ENABLED
FR config>
```

Hour This is the hour programmed for the return of the PVC backup.

Minute This is the minute programmed for the return of the PVC backup.

PVC BACK UP return It tells us if the return of a PVC backup at a specified hour is enabled or not.

i) LIST BIT-DISCARD-PROTOCOL

This indicates if the protocol discard bit is enabled in each protocol. If it is enabled for a specific protocol, this means that the corresponding frames are transmitted with the discard bit set on one.

Example:

```
FR config> LIST BIT-DISCARD-PROTOCOL
Protocol Name  Discard Eligib. Bit
-------------  ----------------------
IP             Yes
X28            No
ARP            No
SNMP           No
OSPF           No
RIP            No
FR config>
```

j) LIST COMPRESSION

Displays the compression options enabled for each circuit:

Data compression: **ADAPTATIVE** or **PREDICTOR**, **CONTINUOUS** or **PKT_BY_PKT** y **OWNER** or **COMPATIBLE**.

Voice over IP compression: CRTP , **WITH-UDP-CHECKSUM** or **WITHOUT-UDP-CHECKSUM.**

Example:

```
FR config> LIST COMPRESSION
DLCI    COMPRESSION     MEMORY       CONTROL
----    -----------     ----------   ----------
16      ADAPTATIVE      PKT_BY_PKT   COMPATIBLE
16      CRTP            WITH-UDP-CHECKSUM
FR config>
```

DLCI — This is the DLCI which corresponds to the PVC where the data compression is applied. The PVC must be pre-configured.

COMPRESSION — This is the type of compression algorithm to be applied. It can be ADAPTIVE or PREDICTOR.

MEMORY — This allows you to choose the data set used in calculating the necessary dictionary symbols for compression. If the compression is CONTINUOUS, the algorithm takes into account all data from previously received frames. With PKT_BY_PKT compression, the dictionary is recalculated with every packet which makes it quicker if not as efficient.

CONTROL — This allows you to choose between Cisco COMPATIBLE or PROPRIETOR compression.

k) LIST FRAGMENTATION-FRF12

Shows if the FRF.12 fragmentation is enabled for each circuit.

Example:

```
FR config>LIST FRAGMENTATION-FRF12

DLCI    FRAGMENTATION    SIZE
 16         enabled       256

FR config>
```

5.7. DELETE

Deletes any PVC, SVC or protocol address previously added using the **ADD PVC-PERMANENT-CIRCUIT** or **ADD SVC-SWITCHED-CIRCUIT** commands.

Syntax:

```
FR config> DELETE ?
PVC-PERMANENT-CIRCUIT
PROTOCOL-ADDRESS
SVC-SWITCHED-CIRCUIT
NUMBER-ADDRESS
```

a) DELETE PVC-PERMANENT-CIRCUIT

Deletes any previously configured PVC.

Example:

```
FR config> DELETE PVC-PERMANENT-CIRCUIT
Circuit number [16]?
FR config>
```

b) DELETE 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 removing.

Example:

```
FR config> DELETE PROTOCOL-ADDRESS
IP Address [0.0.0.0]?
Circuit number [16]?
FR config>
```

IP Address The 32-bit internet address in dotted-decimal notation.

Circuit Number The PVC in the range of 16 to 1,007 that the protocol runs over.

c) DELETE SVC-SWITCHED-CIRCUIT

Deletes any previously configured SVC.

Example:

```
FR config> DELETE SVC-SWITCHED-CIRCUIT
Called number []?
FR config>
```

d) DELETE NUMBER-ADDRESS

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

Example:

```
FR config> DELETE NUMBER-DIRECTION
IP Address [0.0.0.0]?
Called number []?
FR config>
```

IP Address The 32-bit internet address in dotted-decimal notation.

Called Number This is the NN which identifies the configured circuit.

5.8. SET

Configures 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.

Example:

```
FR config> SET N3-PARAMETER 4
FR config> SET N2-PARAMETER 3
```

You now have a window size of 4 (N3 = 4) and an error threshold of 3 (N2 = 3). This mean 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 to be "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:

```
FR config> SET ?
ENCODING*
FRAME-SIZE
IDLE*
IR-ADJUSTMENT
INVERSE-ARP
LINE-SPEED
LMI-TYPE
N1-PARAMETER
N2-PARAMETER
N3-PARAMETER
P1-PARAMETER
T1-PARAMETER
TRANSMIT-DELAY*
ENCRYPTION-KEY
CIRCUITS-BACK- UP
RETURN-TIME-BACK-UP
S1-PARAMETER
CALLING-ADDRESS
```

a) SET ENCODING

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 default.

Syntax:

```
FR config> SET ENCODING ?
NRZ
NRZI
```

SET ENCODING NRZ

Example:

```
FR config> SET ENCODING NRZ
FR config>
```

SET ENCODING NRZI

Example:

```
FR config> SET ENCODING NRZI
FR config>
```

b) *SET 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. Default value is 2,048.

Example:

```
FR config> SET FRAME-SIZE 2000
FR config>
```

c) *SET IDLE*

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

Syntax:

```
FR config> SET IDLE ?
FLAG
MARK
```

SET IDLE FLAG

Example:

```
FR config> SET IDLE FLAG
FR config>
```

SET IDLE MARK

Example:

```
FR config> SET IDLE MARK
FR config>
```

d) SET IR-ADJUSTMENT

The configuration of this parameter is significant only when the congestion monitoring feature is enabled. This allows you to define the size of the downward (when entering congestion) and upward movement (when congestion level falls) of the variable information rate. The VIR minimum value is fixed for cases when the congestion levels remain high for a long time. All these values are given as configured CIR percentages.

Example:

```
FR config> SET IR-ADJUSTMENT
IR adjustment % increment [12]?
IR adjustment % decrement [25]?
Minimum IR as % of CIR [25]?
FR config>
```

e) SET INVERSE-ARP

The configuration of this group of parameters only makes sense when the Inverse ARP protocol is globally enabled (for further information please consult manual Dm501-I). Changes make through this command only take effect in this interface.

Syntax:

```
FR config> SET INVERSE-ARP ?
DEFAULT-VALUE
GLOBAL-VALUE
```

SET INVERSE-ARP DEFAULT-VALUE

Through this command you can modify the value taken by the DEFAULT-VALUE parameter in the Inverse ARP configuration by interface. The possible values are OFF (disabled) and ON (enabled). The default value is ON. Orphan circuits always take the value configured in DEFAULT-VALUE parameter. The default value for the PVC's created through configuratión is also taken from the DEFAULT-VALUE parameter.

Syntax:

```
FR config> SET INVERSE-ARP DEFAULT-VALUE ?
OFF
ON
```

Example:

```
FR config> SET INVERSE-ARP DEFAULT-VALUE ON
FR config>
```

SET INVERSE-ARP GLOBAL-VALUE

You can enable or disable the Inverse ARP protocol by interface through this command. By default, GLOBAL-VALUE is set to "DEFAULT": this takes the value set in the DEFAULT-VALUE parameter.

Syntax:

```
FR config> SET INVERSE-ARP GLOBAL-VALUE ?
DEFAULT
OFF
ON
```

Example:

```
FR config> SET INVERSE-ARP GLOBAL-VALUE DEFAULT
FR config>
```

f) SET LINE-SPEED

Establishes the physical data rate in bits per second for the interface. This rate is used by the CIR monitor to regulate transmit traffic and for calculating transmit and receive statistics.

Selected rate is a value in the following range: 300 to 2048000 bps. The default value is 64 Kbps.

Example:

```
FR config> SET LINE-SPEED
Access rate in bps [64000]?
FR config>
```

g) SET LMI TYPE

Sets the management type for the interface. Refer to the 4 "Enabling Frame Relay Management" section of Chapter 2. The default is CCITT.

Command	Options	Description	Default
SET	LMI-TYPE REV1	Conforms to LMI Revision 1, (Stratacom's Frame Relay Interface Specification)	N/A
	LMI-TYPE ANSI	Conforms to ANSI T1.617USDN-DSS1-Signalling Specification for Frame Relay Bearer Service (know as Annex D)	N/A
	LMI-TYPE CCITT	Conforms to Annex A of ITU (former CCITT) Recommendation Q.933 - DSS1 (Signaling Specification for Frame Mode Basic Call Control)	Enabled

Example:

```
FR config> SET LMI-TYPE ANSI
FR config>
```

h) SET N1- PARAMETER count

Configures the number of T1 timer intervals that must expire before a complete PVC status inquiry is made. *Count* is the interval in the range of 2 to 30. The default is 6.

Example:

```
FR config> SET N1-PARAMETER
Parameter N1 [6]?
FR config>
```

i) SET N2- PARAMETER Max#

Configures the number of errors that can occur in the management event window monitored by he 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 will receive an error message.

Example:

```
FR config> SET N2-PARAMETER
Parameter N2 [3]?
FR config>
```

j) SET 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:

```
FR config> SET N3-PARAMETER
Parameter N3 [4]?
FR config>
```

k) SET 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 992. The default is 64. A 0 (zero) implies that the interface supports no PVC.

Example:

```
FR config> SET P1-PARAMETER
Parameter P1 [64]?
FR config>
```

l) SET T1-PARAMETER

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:

```
FR config> SET T1-PARAMETER
Parameter T1 [10]?
FR config>
```

m) SET 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.

Example:

```
FR config> SET TRANSMIT-DELAY
Transmit Delay Counter [0]?
FR config>
```

n) SET ENCRYPTION-KEY

Allows to configure the Frame Relay interface encryption key, and the associated circuits one.

Example:

```
FR config> SET ENCRYPTION-KEY
New Password (8 characters):
Rewrite New Password:
FR config>
```

New Password Consisting of eight alphanumeric characters.

Rewrite New Password Consisting of eight alphanumeric characters. The value of the key must be the same in the two requests.

o) SET CIRCUITS-BACK-UP

Allows to add back up circuits to a main circuit that was previously configured with **ADD PVC-PERMANENT-CIRCUIT** command.

Example:

```
FR config> SET CIRCUITS-BACK-UP
Circuit number [16]?
Frame Relay Back Up circuit number [17]?
ISDN Back Up circuit number [16]?
Always Back Up to ISDN [16]?
Encrypt Back up information [No]?
FR config>
```

Circuit number	This is the number corresponding to a main PVC configured.
Frame Relay Back Up circuit number	This is the number corresponding to the PVC backup from PVC to configured PVC. If the value is zero it means that the main circuit has no associated PVC to PVC backup circuit.
ISDN Back Up circuit number	This is the number corresponding to the PVC from ISDN. If the value is zero it means that the main circuit has no associated ISDN circuit.
Always Back Up to ISDN	If this field value is *YES* this indicates that when both the Frame Relay circuits (primary and secondary) are inactive, data is transmitted via the ISDN backup circuit. If the field value is *NO*, then the date is transmitted via the ISDN backup circuit if the interface falls.
Encrypt Back up information	This is the data transmission mode which is applied over the ISDN backup circuit: clear or encrypted.

p) SET RETURN-TIME-BACK-UP

Permits the configuration of the hour and minute from which we want the PVC backup circuits to return traffic to their corresponding main circuits.

Example:

```
FR config> SET RETURN-TIME-BACK-UP
Enable PVC BACK UP return time? [No]:(Yes/No)? Y
Hour[17]? 17
Minute[53]? 54
FR config>
```

Enable PVC BACK UP return time	Permits the enabling and disabling of the PVC back-up return from the time that is configured.
Hour	Hour of return.
Minute	Minute of return.

q) SET S1-PARAMETER Max#

Configures the maximum number of SVCs supported by the Frame Relay interface. *Max#* is a number in the range of 0 to 992. The default is 20. A 0 (zero) implies that the interface supports no SVC.

Example:

```
FR config> SET S1-PARAMETER
S1 Parameter [20]?
FR config>
```

r) SET CALLING NUMBER

This is the NN value which identifies our Frame Relay interface. This is called by all devices which need to connect to one of the switched circuits configured in our device.

Example:

```
FR config> SET CALLING ADDRESS
Calling number []?
FR config>
```

5.9. EXIT

Returns to the ***Config>*** prompt.

Syntax:

```
FR config> EXIT
```

Example:

```
FR config> EXIT
Config>
```

Chapter 3
Monitoring Frame Relay Interfaces

1. Introduction

This chapter describes the Frame Relay monitoring commands and includes the following sections:

- Displaying the Frame Relay Monitoring Prompt.
- Frame Relay Monitoring Commands.
- Frame Relay Interfaces and the GWCON Interface command.

If you need more information on Frame Relay, refer to Chapter 1 “The Frame Relay Interface”.

2. Displaying the Frame Relay monitoring prompt

To access Frame Relay monitoring commands and to monitor Frame Relay, do the following:

1. At the GESTCON prompt (*), type **PROCESS 3** (or **P 3**).

2. At the MONITOR prompt (+), type **NETWORK #**. This is the interface for Frame Relay.

3. At the Frame Relay monitoring prompt (FR>), type the appropriate monitoring command.

4. Refer to the "Frame Relay Monitoring Commands" section for an explanation of the commands.

3. Frame Relay Monitoring Commands

This section summarizes and then explains the Frame Relay monitoring commands. Use these commands to gather information from the Frame Relay interface. The letters typed in **bold** are the minimum number of characters which need to be keyed in order to activate the command.

Command	Function
? (HELP)	Lists available commands or lists a command's options.
CLEAR	Clears statistical information on the Frame Relay interface.
DISABLE	Disables CIR Monitoring for the Frame Relay interface.
ENABLE	Enables CIR Monitoring and congestion monitoring for the Frame Relay interface and allows the possibility of return from backup circuit.
LIST	Displays statistics specific to the data link layer and Frame Relay management.
SET	Sets CIR, Committed Burst Size, and Excess Burst Size for a Frame Relay PVC.
ACTIVE	Activates a PVC.
INACTIVE	Deactivates a PVC .
EXIT	Returns to the (+) prompt.
COMPRESSION	Allows you to view the compression statistics and software version.
CRTP	Allows you to view the CRTP compression statistics and software version.

Frame Relay Monitoring Commands

Note: In this section, the terms circuit number and PVC are synonymous with the term "DLCI (Data Link Circuit Identifier)".

3.1. ? (HELP)

Lists available commands or lists the command's options.

Syntax:

```
FR> ?
```

Example:

```
FR> ?
CLEAR
DISABLE
ENABLE
LIST
SET
ACTIVE
INACTIVE
EXIT
COMPRESSION
CRTP
FR>
```

3.2. CLEAR

Removes all statistics on the Frame Relay interface.

Syntax:

```
FR> CLEAR
```

Example:

```
FR> CLEAR
FR>
```

3.3. DISABLE

Use the **DISABLE** command to disable the Frame Relay CIR monitoring and congestion monitoring features.

Syntax:

```
FR> DISABLE ?
CIR-MONITORING
CONGESTION-MONITOR
```

a) DISABLE CIR-MONITORING

Example:

```
FR> DISABLE CIR-MONITORING
FR>
```

b) DISABLE CONGESTION-MONITOR

Example:

```
FR> DISABLE CONGESTION-MONITOR
FR>
```

3.4. ENABLE

Use the **ENABLE** command to enable Frame Relay CIR monitoring and congestion monitoring features. You can also return the PVC backup to leave the secondary circuits useless and traffic is routed to the principal circuits (it produce an immediate backup return).

Syntax:

```
FR> ENABLE ?
CIR-MONITORING
CONGESTION-MONITOR
RETURN-TIME-BACK-UP
```

a) ENABLE CIR-MONITORING

Example:

```
FR> ENABLE CIR-MONITORING
FR>
```

b) ENABLE CONGESTION-MONITOR

Example:

```
FR> ENABLE CONGESTION-MONITOR
FR>
```

c) ENABLE RETURN-TIME-BACK-UP

Example:

```
FR> ENABLE RETURN-TIME-BACK-UP
FR>
```

3.5. LIST

Use the **LIST** command to display statistics specific to the data link layer and Frame Relay interface.

Syntax:

```
FR> LIST ?
ALL
CIRCUIT-NUMBER
LMI
CIRCUITS
PROTOCOL-ADDRESSES
CALLS
```

a) LIST ALL

Displays circuit, management, and PVCs statistics on the Frame Relay interface. The output display for this command is a combination of the **LIST LMI** and **LIST CIRCUITS** commands.

b) LIST CIRCUIT-NUMBER

Displays detailed PVC configuration and statistical information for the specified PVC (*pvc#*). This is valid for all PVC's which have a DLCI assigned (other than zero).

Example:

```
FR> LIST CIRCUIT-NUMBER 16

Circuit name = cir234

Circuit state        = Active   Circuit is orphan  = No
Frames transmitted   = 2        Bytes transmitted  = 86
Frames received      = 0        Bytes received     = 24897
Total FECNs          = 0        Total BECNs        = 1
Times congested      = 0        Times Inactive     = 1
CIR in bits/second   = 1200     Current Info Rate  = 56000
Committed Burst (Bc) = 1200     Excess Burst (Be)  = 54800

Xmit frames dropped due to queue overflow = 0
FR config>
```

Circuit state	Indicates the state of the circuit: Active, Idle or Congested. *Idle* indicates waiting for management. *Active* indicates that data is being transferred. *Congested* indicates that the data flow is being controlled.
Circuit is orphan	Indicates if the circuit is a non-configured circuit learned through management.
Frames/Bytes transmitted	Indicates how many frames and bytes that this PVC has transmitted.
Frames/Bytes received	Indicates how many frames and bytes that this PVC has received.
Frames dropped	Indicates the number of frames that this PVC has dropped.
Total FECNs	Indicates the number of times that this PVC has been notified of inbound or downstream congestion.

Total BECNs	Indicates the number of times that this PVC has been notified of outbound or upstream congestion.
Times congested	Indicates the number of times that this PVC has become congested.
Times Inactive	Indicates the number of times that this PVC was inoperable.
CIR in bits/second	Indicates the information rate of the PVC in the range 300 to 2048000 bps.
Current Info Rate	The rate in bits per second at which information is currently being transmitted for the circuit.
Committed Burst Size (Bc)	The maximum amount of data in bits that the network agrees to deliver during a measurement interval equal to (Committed Burst Size/CIR) seconds.
Excess Burst Rate (Be)	The maximum amount of uncommitted data in bits in excess of Committed Burt Size that the network attempts to deliver during a measurement interval equal (Committed Burst Size/CIR) seconds.

Note: If the circuit is switched (SVC) the CIR parameters* Committed Burst Size (Bc) *and* Excess Burst Rate (Be) *appear repeated under the heading "INCOMING PARAMETERS". These are the negotiated values for the device on the other end during the circuit establishment process.

c) LIST LMI

Displays statistics relevant to the logical management on the Frame Relay interface.

Example:

```
FR> LIST LMI
Management Status:
-----------------------
LMI enabled   =   No     LMI DLCI        = 0
LMI type      =   ANSI   LMI Orphans OK  = Yes
LMI  sequence interval seconds           = 10

Protocol broadcast     =  Yes    Congestion monitoring     =  No
Emulate multicast      =  Yes    CIR monitoring            =  No
PVCs P1 allowed        =  64     Interface MTU in byte     =  2048
Line access rate bps   =  9600   CIR monitor adjustment    =  1
Timer T1 seconds       =  10     Counter N1 increments     =  6
LMI N2 threshold       =  3      LMI N3 threshold window   =  4

Current receive sequence    =   0
Current transmit sequence   =   0
Total status inquiries      =   0   Total status responses      = 0
Total sequence requests     =   0   Total sequence responses    = 0
```

```
PVC Status :
---------------
Total allowed     =    64   Total configured   =   1
Total active      =    1    Total congested    =   0
Total left net    =    0    Total join net     =   0
FR>
```

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 and CCITT 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 sequence 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 whether the congestion monitor feature that responds to network congestion is enabled, 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 P1 allowed	Indicates the number of allowed PVCs for use with this interface.
Interface MTU in byte	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.
CIR monitor adjustment	Indicates the information rate value that is used to calculate the burst rate above the configured CIR when CIR monitoring is enabled.
Timer T1 (seconds)	Indicates the rate that the Frame Relay interface performs a sequence number exchange with management.
Counter N1 increments	Indicates the time the Frame Relay interface queries the management for PVC status.

LMI N2 threshold	Indicates the amount of management event errors that will reset the Frame Relay interface.
LMI N3 threshold window	Indicates the number of events that the management window monitors.
Current receive sequence	Indicates the current receive sequence number that the Frame Relay interface has received from management.
Current transmit sequence	Indicates the current transmit sequence number that the Frame Relay interface has sent to management.
Total status inquiries	Indicates the total number of inquiries that management has made as to the status of the Frame Relay interface.
Total status responses	Indicates the total number of responses that the Frame Relay interface has received from management in response to management status inquiries.
Total sequence requests	Indicates the total number of sequence number exchanges that the Frame Relay interface has made with management.
Total sequence responses	Indicates the total number of sequence number responses received in response to management's sequence number exchange.
Total PVC allowed	Indicates the number of allowable PVCs (including orphans) for use with 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 configured	Indicates the total number of currently configured PVCs for this interface.
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 have joined the network.

d) LIST CIRCUITS

Displays (general link) layer statistics and configuration information for all configured PVCs on the Frame Relay interface.

Example:

```
FR>LIST CIRCUITS
                          Orphan   Type/  Frames       Frames
Circuit  Circuit Name     Circuit  State  Transmitted  Received  Encrypt
-------------------------------------------------------------------------
   16    Unassigned       Yes      A      7782         1924      Yes
   20    Boston           No       P/A    589          4563      No
      A - Active       I - Inactive    R - Removed
      P - Permanent    M - Multicast   C - Congested
FR>
```

Circuit — Indicates the number of the 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), C (Switched), M (Multicast), C (Congested), or R (Removed).

Frames/Bytes Transmitted — Indicates how many frames and bytes that this PVC has transmitted.

Frames/Bytes received — Indicates how many frames and bytes that this PVC has received.

Encrypt — Indicates if the data sent through this circuit are encrypted, yes or no.

e) LIST PROTOCOL-ADDRESSES

Shows the relative interface protocol addresses information. If the interface is down, then the configured protocol addresses do not appear.

Example:

```
FR> LIST PROTOCOL ADDRESSES
Frame Relay Protocol Address Translations
Protocol Type    Protocol Address   Circuit Number
-------------    ----------------   --------------
IP               192.3.3.2          16
IP               192.1.1.2          0
IP               192.2.2.2          0
FR>
```

Protocol Type — Indicates the address's protocol type which appears in the following field.

Protocol Address — This is the protocol address. All packets destined for this address are transmitted by the circuit number which appears in the following field.

f) LIST CALLS

Shows the relative information on the calls generated for the establishment of the SVCs. Both the active and released calls can be listed. A call is considered active for the interval the SVC has a DLCI assigned.

Syntax:

```
FR> LIST CALLS ?
ACTIVE
RELEASED
FR>
```

LIST CALLS ACTIVE

Example:

```
FR> LIST CALLS ACTIVE
ACTIVES CALLS
Circuit Name   Dlci   Called Number   Calling Number   REF   H/START
------------   ----   -------------   --------------   ---   --------
Test1          55     1111            2222             2     12:48:15
Unassigned     103    1112            1111             1     12:48:15
Test2          56     1111            3332             3     12:48:42
FR>
```

Circuit Name — This is the name assigned to the circuit. If the circuit has no assigned name, it is labeled "Unassigned".

DLCI — This is the network assigned DLCI for this switched circuit. This is used by the circuit while calls are active and referred to when calls are released.

Called Number — This is the NN called in order to establish the switched circuit.

Calling Number — This is the interface NN which initiated the call establishing the switched circuit.

REF — This is the call reference value used for this circuit. Only active calls appear.

H/START — Indicates the time the call was initialized.

LIST CALLS RELEASED

Example:

```
FR> LIST CALLS RELEASED
RELEASED CALLS
Circuit Name  Dlci  Called Number  Calling Number  C/L  D/L  H/START   H/END
------------  ----  -------------  --------------  ---  ---  -------   -----
Test1         53    1111           1112            038  000  12:37:12  12:45:50
FR>
```

Circuit Name — This is the name assigned to the circuit. If the circuit has no assigned name, it is labeled "Unassigned".

DLCI — This is the network assigned DLCI for this switched circuit. This is used by the circuit while calls are active and referred to when calls are released.

Called Number — This is the NN called in order to establish the switched circuit.

Calling Number — This is the interface NN which initiated the call establishing the switched circuit.

C/L — This is the release code. This indicates why the call has been released. Only released calls appear.

D/L — Indicates the released call diagnosis. Only released calls appear.

H/START — Indicates the time the call was initialized.

H/END — Indicates the time the call was released. Only released calls appear.

3.6. SET

Use the **SET** command to set the values for Committed Information Rate (CIR), Committed Burst Rate, and Excess Burst Rate for the specified PVC.

Syntax:

```
FR> SET ?
CIRCUIT-NUMBER
IR-ADJUSTMENT
```

a) SET CIRCUIT-NUMBER

Example:

```
FR> SET CIRCUIT-NUMBER
Circuit number [16]?
Outgoing Committed Information Rate (CIR) in bps [1200]?
Outgoing Committed Burst Size (Bc) in bits[1200]?
Outgoing Excess Burst Size (Be) in bits[56000]?
FR>
```

Circuit number	Circuit number in the range of 16 to 1,007.
Outgoing Committed Information Rate	Committed Information Rate (CIR) in a range of 300 bps to 2048000 bps. The default is the current value.
Outgoing Committed Burst Size	Maximum amount of data in bits that the network agrees to deliver during a measurement interval of a number of seconds equal to (Committed Burst Size/CIR) seconds. Range from 300 to 2048000 bits. The default is the current value.
Outgoing Excess Burst Size	Maximum amount of uncommitted data in bits in excess of Committed Burst Size that the network attempts to deliver during a measurement interval of a number of seconds equal to Committed Burst Size divided by CIR. Range from 0 to 2048000. The default is the current value.

b) SET IR-ADJUSTMENT

This option allows you to dynamically change the increase and decrease values of the VIR during congestion periods. The configuration of these parameters is significant only when the congestion monitoring feature is enabled. This allows you to define the size of the downward (when entering congestion) and upward movement (when congestion level falls) of the variable information rate. The delivered VIR minimum value is also fixed when the congestion levels remain high for a long time. All these values are given as configured CIR percentages

Example:

```
FR> SET IR-ADJUSTMENT
IR adjustment % increment [12]?
IR adjustment % decrement [25]?
Minimum IR as % of CIR [25]?
FR>
```

3.7. ACTIVE

Any PVC can be activated via this command.

Syntax:

```
FR> ACTIVE
```

Example:

```
FR> ACTIVE
Circuit number [16]?
FR>
```

Circuit number The circuit number in the range of 16 and 1,007.

3.8. INACTIVE

Any PVC or SVC with assigned DLCI (other than zero) can be deactivated with this command.

Syntax:

```
FR> INACTIVE
```

Example:

```
FR> INACTIVE
Circuit number [16]?
FR>
```

Circuit number The circuit number in the range of 16 and 1,007.

3.9. EXIT

Use the **EXIT** command to return to the previous prompt level.

Syntax:

```
FR> EXIT
```

Example:

```
FR> EXIT
+
```

3.10. COMPRESSION

Syntax:

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

a) COMPRESSION RESTART-STATISTICS

Restarts the compression statistics counters. This command can be applied to any one specific circuit or to all of them.

Example:

```
FR> COMPRESSION RESTART-STATISTICS
Compression statistics for dlci (<INTRO>= all)?
FR>
```

b) COMPRESSION STATISTICS

Print the compression and decompression statistics

Example:

```
FR> COMPRESSION STATISTICS
FRAMES         COMPRESSION (bytes)  DECOMPRESSION (bytes)
------------   -------------------  ---------------------
MANAGED        127 (5735)           34 (3810)
PROCESSED      127 (3245)           34 (2097)
NOT PROCESSED  0 (0)                0 (0)
ERROR          0                    0
OUT OF SEQ.    0                    0
STATISTICS BEGINING 09/10/98 10:36:08
FR>
```

c) COMPRESSION VERSION

This tells you which version of compression software you have installed.

Example:

```
FR> COMPRESSION VERSION
Revision: 1.1.1.4   $$Name: $
NoCard             Interrupt Mode NOT ACTIVE
FR>
```

3.11. CRTP

Syntax:

```
FR> CRTP
Circuit number[16]?
List 1, Clear 2 : [1]?
```

a) CRTP clear

Starts the CRTP compression statistic counters. This command can be applied to a specific circuit.

Example:

```
FR> CRTP
Circuit number[16]?
List 1, Clear 2 : [1]?2
```

b) CRTP list

Displays the CRTP compression statistic counters for a circuit.

Example:

```
FR> CRTP
Circuit number[16]?
List 1, Clear 2 : [1]?1
CRTP Compression Statistics
-----------------------------------
Outbound RTP packets:                    837006
Outbound RTP compressed packets:         769259
Searches for connection state:          1223124
Times couldn't find conn. state:          67740
Inbound RTP uncompressed packets:           269
Inbound RTP compressed packets:         1152843
Inbound RTP unknown type packets:            67
Inbound RTP Context State packets:           67
```

4. Frame Relay Interfaces and the MONITOR procedure DEVICE command

You can also display complete statistics for Frame Relay interfaces when you use the **DEVICE** command from the MONITOR procedure prompt (+).

4.1. DEVICE

Statistics similar to the following are displayed when you execute the **DEVICE** command from the prompt (+):

Example:

```
+DEVICE
                                        Self-Test  Self-Test  Maintenance
Nt  Nt'   Interface   CSR        Vec    Passed     Failed     Failed
5   5     FR/0        80780000   3      1          0          0

Physical Driver        DTE

V.24 circuits:      105   106   107   108   109
Circuits RS-232-C:  RTS   CTS   DSR   DTR   DCD
State:              ---   ---   ON    ---   ---

Line speed :         64000 Kbps
Last port reset :    23 hours, 52 minutes, 22 seconds ago

Input frame errors :
CRC error             0    alignment (byte length)  0
too short (<2 bytes)  0    too long (> 0 bytes)     0
aborted frame         0    DMA/FIFO overrun         0

Output frame counters :
DMA/FIFO under run errors  0  Output aborts sent  0
+
```