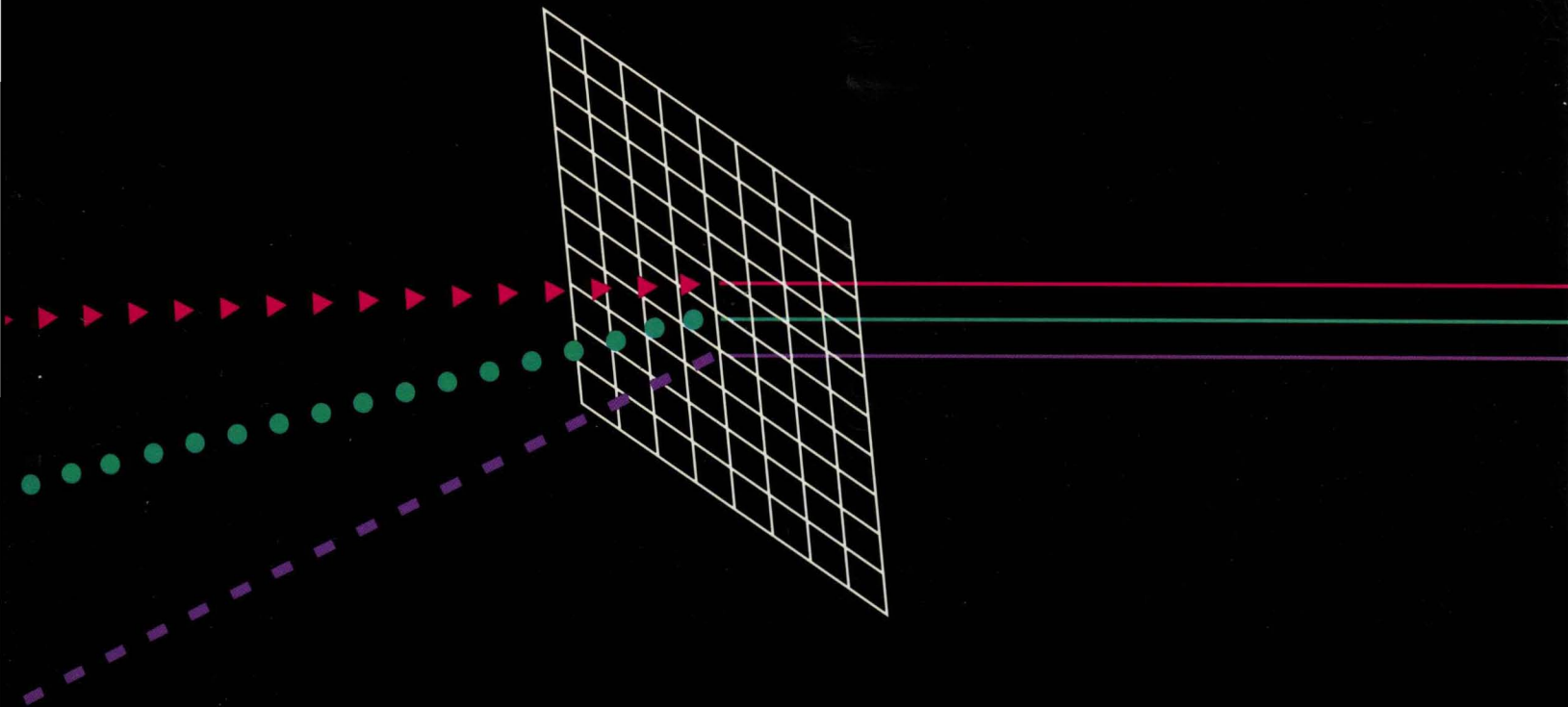TEKELEC

Chameleon 32

Protocol Interpretation
Manual Volume II

TEKELEC

CHAMELEON
PROTOCOL INTERPRETATION
MANUAL

Text Version 2.7

Text Version 2.7 of this manual corresponds to
Standard Software Release 4.5 for the Chameleon 32 and
Standard Software Release 1.5 for the Chameleon 20.

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STANDARD SOFTWARE VERSIONS 4.5 AND 1.5
UPGRADE ADVISORY
FOR PURCHASERS OF THE CHAMELEON 32 AND CHAMELEON 20.

Standard Software versions 4.4 and 4.5 for the Chameleon 32 were released after version 4.3.2 to enable purchasers of TEKELEC's *Ethernet Remote Control* and *Frame Relay Builder* applications software to run on the earlier Standard Software version 4.3.2.

Standard Software version 4.4 corresponds to the *Ethernet Remote Control* application software, and enables Standard Software version 4.3.2 to run that application. Standard Software version 4.5 corresponds to TEKELEC's *Frame Relay Builder* application, and enables Standard Software version 4.3.2 to run both that application and the TEKELEC *Ethernet Remote Control* application.

Standard Software version 1.4 was released after version 1.3.2 to enable purchasers of TEKELEC's *Frame Relay Builder* application to run on version 1.3.2 (the *Ethernet Remote Control* package is not available for the Chameleon 20).

These versions - 4.4, 4.5 and 1.4 - of the Standard Software in no way affect the validity of tthe Protocol Interpretation Manual, version 2.7.

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CHAPTER ONE:
OVERVIEW

Description

This volume, Volume II, provides the information you need to interpret traffic from each of the protocols analyzed by the Chameleon 32, the Chameleon 20I, and the Chameleon 20P. The information will be identical for all three machines unless otherwise specified.

For example, the Chameleon 20I is an ISDN–optimized tester. However, the information presented in this volume for those protocols will be the same for the Chameleon 32 and for the Chameleon 20P (a standard protocol–optimized tester). Likewise, most ISDN–related information will be the same for the Chameleon 32 and the Chameleon 20I.

Note that the Chameleon 20I and the Chameleon 20P have monochrome monitors. Only the Chameleon 32 monitor will display the colors described in this volume. However, if you connect a color monitor to the Chameleon 20 Color Monitor interface, you can view the traffic in color.

Monitoring

In Monitoring Mode, the Chameleon passively monitors the traffic between entities on a data line, without affecting any aspect of the network.

In Monitoring Mode, you can (depending on the Chameleon model):

- Monitor and troubleshoot a data communications line
- Interpret captured traffic
- Capture 10 Mbytes of data to disk
- Analyze traffic between:
  - Network Access (modem)
  - Cluster Controller
  - Front End Processor
  - Intelligent Terminal
  - Process Controller
  - ISDN devices
  - Other intelligent digital communications devices

Figure 1.1 illustrates the flow of data during Monitoring.
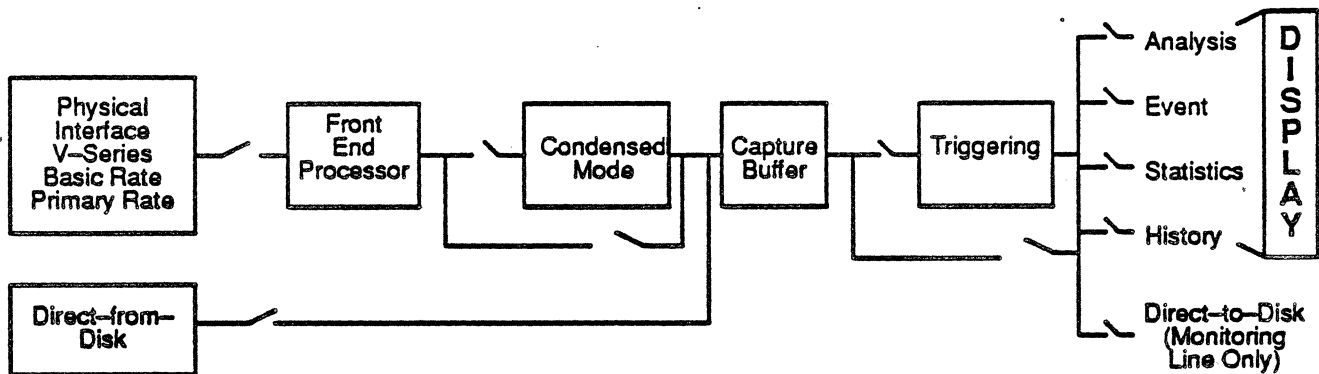
Figure 1.1: Monitoring Data Flow

Applications

When using Monitoring, you have access to several different monitoring applications. These applications include:

- Analysis (Real Time and History)
- Statistics
- Triggering
- Direct–to–Disk
- Event
- User applications in C (optional Chameleon 32 C package or Chameleon 20 C Runtime module only)

Analysis

Analysis provides two pages: Real Time and History. The Analysis pages display the traffic from both sides of the line in a split screen mode, for either one or two ports.

The Real Time page displays traffic as it is acquired from the line or from disk (previously saved traffic).

The History page displays traffic that has been acquired and put in a history buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The Analysis application is available for the following protocols:

- X.25
- X.75
- QLLC
- PSH
- SNA
- ISDN
- ASYNC
- BSC
- DPNSS
- SS#7
- V.120
- DMI Mode 2
- DASS 2
- DDCMP

Analysis also provides a print feature which enables you to output a specified range of events to a printer or print file. Refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter 4: Analysis*, for more information.

Statistics

The Statistics application displays statistical data about acquired traffic for the following protocols:

- X.25
- ISDN
- SNA
- BSC
- SS#7
- Primary Rate Interface

The Statistics application provides you with multiple pages for each protocol, summarizing information about the entire line, or specific devices on the line. You can also display statistics for layer 2 or layer 3 traffic (except for BSC). Using the Print function, you can print a report for any of the Statistics pages. Refer to the *Chameleon 32 or the Chameleon 20 User's Guide, Chapter 7: Statistics*, for more information.

Triggering

The Triggering application filters traffic according to user–defined conditions, enabling you to perform *if/then* and *while* actions. Triggering can be used when analyzing data from the line or from disk. For example, you could write a trigger that counts events which have CRC errors.

For HDLC, Q.921, and Q.931, there are pre—defined key words that are specific to the protocol, and enable you to develop triggers for these protocols with less effort.

Triggering is not available for Async.

Refer to the *Chameleon 32 or the Chameleon 20 User's Guide, Chapter 8: Triggering*, for more information.

Direct—to—Disk

The Direct—to—Disk application saves acquired traffic to the hard disk. This enables you to capture traffic, but perform your analysis at a later date. It also enables you to analyze the same traffic multiple times.

Refer to the *Chameleon 32* or the *Chameleon 20 User's Guide*, Chapter 6: Direct—To—Disk, for more information.

Event

The Event application displays traffic as a series of events. The format enables you to quickly determine the sequence of events on the line. The Event application is available for the same protocols as Analysis.

For example, for bit—oriented protocols, the Event page displays the data in a dual line format (DTE over DCE) using five characters:

- I   Information frame transmitted
- S   Supervisory frame transmitted
- U   Unnumbered frame transmitted
- L   Lead transition
- B   Baud rate change

Refer to the *Chameleon 32 or the Chameleon 20 User's Guide, Chapter 5: Event*, for more information.

User Applications in C

On the Chameleon 32, with the optional C Development System, you can program custom simulation and analysis applications. On the Chameleon 20, with the optional C Runtime module, you can run C applications that have been compiled on the Chamelelon 32. Refer to the *Chameleon 32 C Manual, Volume IV,* for more information.

**Manual
Organization**

This manual contains protocol–specific information for the Chameleon Monitoring software. It is divided into separate chapters for each protocol as follows:

Chapter	Protocol
2	X.25
3	X.75
4	QLLC
5	PSH
6	SNA
7	Async
8	Bisync
9	DPNSS
10	ISDN (Q.921 and Q.931)
11	ISDN ANSI/CEPT Primary Rate Interface
12	ISDN Basic Rate Interface
13	SS#7
14	DASS 2
15	DMI Mode 2
16	V.120
17	DDCMP
18	X.21 Interface
19	ASAI

Related
Documents

Chameleon 32

- *Volume I, Chameleon 32 User's Guide*

  Refer to this manual for a general description of the Chameleon 32, how to use it, a description of the displays and softkey functions, and hardware—specific information.

- *Volume III, Chameleon 32 Simulation Manual*

  Refer to this manual for Chameleon 32 information specific to the Simulation software.

- *Volume IV, Chameleon 32 C Manual*

  Refer to this manual for Chameleon 32 information specific to the C Software Package.

Chameleon 20
(I and P)

- *Volume I, Chameleon 20 User's Guide*

  Refer to this manual for a general description of the Chameleon 20, how to use it, a description of the displays and softkey functions, and hardware—specific information.

CHAPTER TWO:
X.25 MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes X.25 Analysis and Statistics, by focusing on the protocol–specific details of these applications. For a general description of these applications, refer to Chapter One.

This section assumes that you know how to select Monitoring for a port and select X.25 as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or the Chameleon 20 User's Guide, Volume I, Chapter 3.*

Monitor Setup Menu

When you select X.25 as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 2.1. These parameters are described on the following page.

```
┌─────────────────────────────────────────────────────────────┐
│  ─O──────────────────────────────────┌─────────────────┐    │
│                          Port x Monitoring │ Configuration │  │
│                                       └─────────────────┘    │
│                                                              │
│                                       ┌───────────────────┐  │
│                                       │ Press GO to accept│  │
│    Protocol  :    ┌────────┐          └───────────────────┘  │
│                   │  X.25  │                                 │
│                   └────────┘                                 │
│    Link Layer     ┌────────┐  ◄───                          │
│                   │  HDLC  │                                 │
│                   └────────┘                                 │
│          Encoding         ┌────────┐                        │
│          Modulo           │  NRZ   │                         │
│          Extended addr    │   8    │                         │
│                           │  no    │                         │
│                           └────────┘                        │
│    Network Layer  ┌────────┐                                │
│                   │ CCITT  │                                 │
│                   └────────┘                                 │
│                                                              │
│  ┌─────┬────┬────┬────┬────┬────┬────┬────┬────┬────┬─────┐ │
│  │HDLC │    │    │    │    │    │    │    │    │    │Exit │ │
│  └─────┴────┴────┴────┴────┴────┴────┴────┴────┴────┴─────┘ │
└─────────────────────────────────────────────────────────────┘
```

Figure 2.1: X.25 Monitor Setup Menu

Link Layer

Link Layer specifies the link layer protocol to use. There is only one option at this time, HDLC.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Modulo

Modulo determines the packet numbering sequence range that will be used to keep track of the packets that are transmitted and received by the two sides. The options are:

Modulo 8   Packets are numbered from 0 – 7
Modulo 128   Packets are numbered from 0 – 127

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used for transmission. The options are:

Yes   Extended (16–bit) addressing
No   8–bit addressing

Network Layer

Network Layer enables you to select between:

CCITT   Interpretation per CCITT X.25 specification

Italy   Same as CCITT, except that Clear Cause, Reset Cause, Restart Cause, and Diagnostics are shown in Italian

Analysis

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 2.2. The page components are described on the following pages.
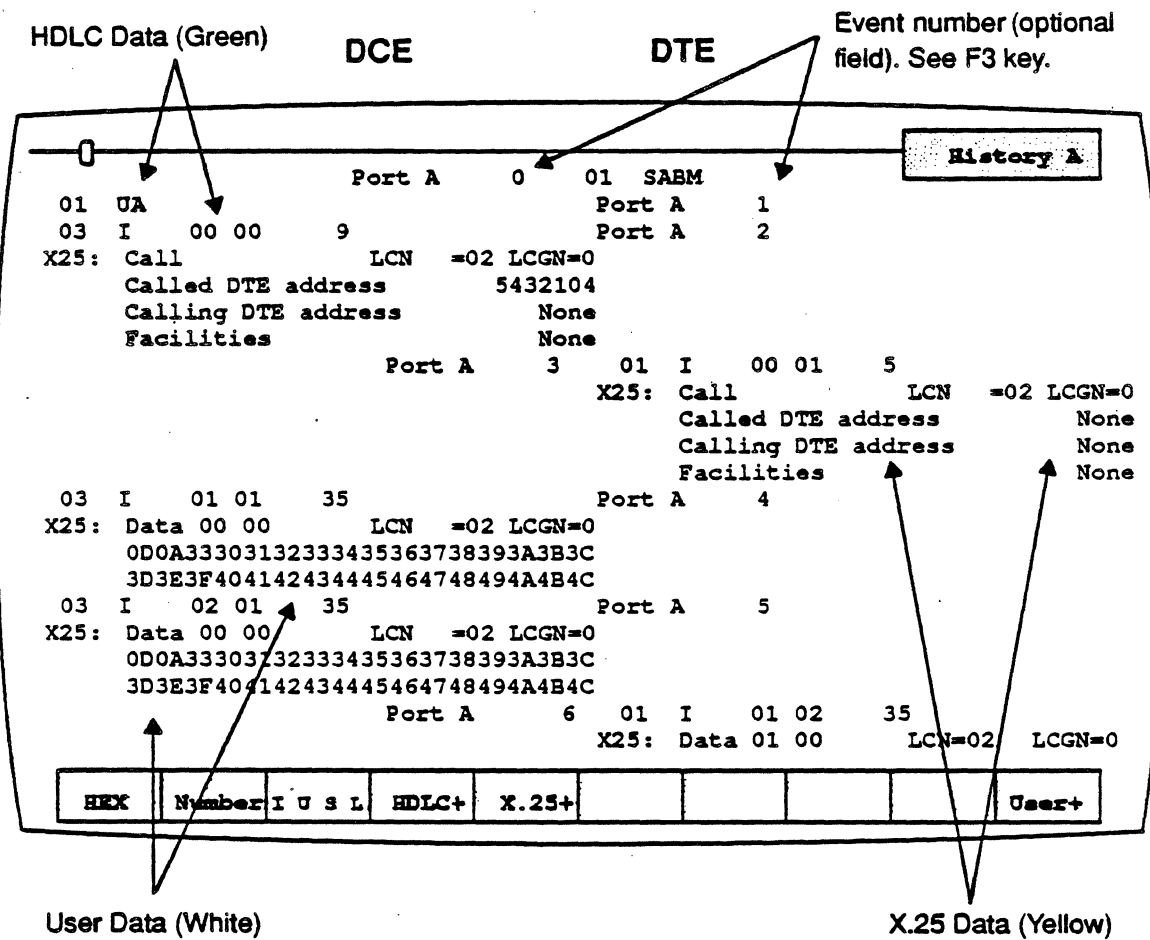
Figure 2.2: Analysis History Page with Sample X.25 Traffic

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames received from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change is as shown below (example: the new baud rate is 9600).

New Baud Rate   9600

Colors

Colors distinguish the different protocol elements:

* Green = Frame level (HDLC)
* Yellow = Packet level (X.25)
* White = User data
* Red = Errors

In addition, the optional field selected using *F2* is displayed in green or white, depending on the event type.

Interface Lead Transitions

Interface lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. Note that all lead transitions for a given event are shown on one line. *F3* controls the display of lead transitions. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The X.25 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press **F1**, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hexdigits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides (See Figure 2.1). The options are:

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed

The port receiving the traffic is also displayed (**Port A** or **Port B**) unless the **None** option is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   *F3* affects the page *display* only. All events are captured, regardless of the *F3* selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Frame Level

F4 determines how the frame level (HDLC) is interpreted and displayed. The options are:

HDLC+   HDLC is displayed interpreted (default)

HDLC*   HDLC is displayed uninterpreted in the code selected in *F1* (ASCII, HEX, HEXS, EBCDIC)

HDLC*   HDLC is displayed interpreted and uninterpreted in the code selected in *F1*

HDLC–   HDLC is acquired but not displayed

The frame level components include the information listed below. See page 2-9 for an example of HDLC interpretation.

F5: Packet Level

F5 determines how the packet level (X.25) is interpreted and displayed. The options are:

X.25+   X.25 is displayed interpreted (default)

X.25"   X.25 is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

X.25*   X.25 is displayed interpreted and uninterpreted in the code selected in **F1**

X.25–   X.25 is acquired but not displayed

Note   For Italian X.25, when X.25+ or X.25* is selected, the following interpretations are shown in Italian:

- X.25 Clear Cause
- X.25 Reset Cause
- X.25 Restart Cause
- X.25 Diagnostics

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic (data, HDLC, X25) is displayed uninterpreted (raw) in the code selected in **F1**

X.25 Analysis Interpretation

This section identifies the components of the X.25 Analysis page display. Figure 2.3 shows a sample X.25 History page. The area of the screen in the box is described in detail in this section.

The first line of data in the box is HDLC data, which is displayed in green. The second line of data in the box is the X.25 data, which is displayed in yellow. The first line of interpreted X.25 data is preceded by the message *X25:*.

The remaining lines are the user data, which is displayed in white. The user data is shown in HEX, since it is the code displayed in the softkey strip for the *F1* key.

```
┌────────────────────────────────────────────────────────────────────────┐
│  ─ O  ·                                          │  History A  │         │
│ ──O─────────────────────────────────────         └───────────┘          │
│                    Port A      0    01  SABM                             │
│  01  UA                               Port A     1                       │
│  03  I     00 00      9                Port A     2                       │
│  X25:  Call            LCN   =02 LCGN=0                                   │
│        Called DTE address        5432104                                 │
│        Calling DTE address       None                                    │
│        Facilities                None                                    │
│                        Port A    3    01  I    00 01    5                 │
│                                       X25:  Call        LCN   =02 LCGN=0  │
│                                             Called DTE address   None     │
│                            ┌───────┐        Calling DTE address  None     │
│                            │       │        Facilities           None     │
│  03  I     01 01     35    └───────┘  Port A     4                        │
│  X25:  Data 00 00       LCN   =02 LCGN=0                                  │
│        0D0A333031323334353637383939393A3B3C                              │
│        3D3E3F40414243444546474849494A4B4C                                │
│ ┌──────────────────────────────────────────┐  Port A    5               │
│ │ 03  I     02 01     35                     │                           │
│ │ X25:  Data 00 00       LCN   =02 LCGN=0    │                           │
│ │       0D0A333031323334353637383939393A3B3C │                           │
│ │       3D3E3F40414243444546474849494A4B4C   │                           │
│ └──────────────────────────────────────────┘                            │
│                        Port A    6    01  I    01 02    35                │
│                                       X25:  Data 01 00     LCN=02  LCGN=0 │
│  ┌─────┬────────┬───────┬───────┬───────┬─────┬─────┬─────┬─────┬──────┐  │
│  │ HEX │ Number │ I U S L│ HDLC+ │ X.25+ │     │     │     │     │User+ │  │
│  └─────┴────────┴───────┴───────┴───────┴─────┴─────┴─────┴─────┴──────┘  │
└────────────────────────────────────────────────────────────────────────┘
```

Figure 2.3: Analysis History Page with Sample X.25 Traffic

HDLC Interpretation

Figure 2.4 is a detail of the HDLC component from Figure 2.3. Each HDLC field in this sample display is described below.
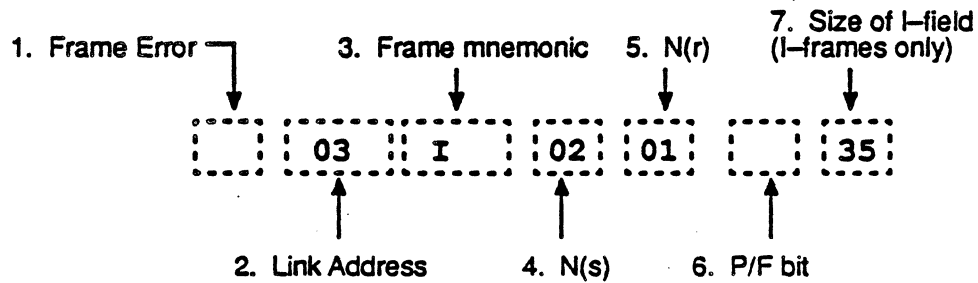
Figure 2.4: Sample HDLC Interpretation

1. Frame Errors

A single letter indicates if a frame error has occurred.

A	Aborted frame received
B	Frame with bad FCS received
(blank)	No frame error

2. Link Address

This field displays the link address.

3. Frame Mnemonic

Field 3 indicates the type of frame received, using the following mnemonics:

Information frame:
    I   I-Frame

Supervisory frames:
    RR   Receiver Ready
    RNR Receiver Not Ready
    REJ Reject

Unnumbered frames:

BCN	Beacon
CFGR	Configure
DISC	Disconnect
DM	Disconnect Mode
FRMR	Frame Reject
RD	Request Disconnect
RIM	Request Initialization Mode
SABM	Set Asynchronous Balanced Mode
SARM	Set Asynchronous Response Mode
SIM	Set Initialization Mode
SNRM	Set Normal Response Mode
TEST	Test Frame
UA	Unnumbered Acknowledge
UI	Unnumbered Information
UP	Unnumbered Poll
XID	Exchange ID
(hex value)	Unknown unnumbered frame type

_4. N(s)_

This field displays the N(s) count.

_5. N(r)_

This field displays the N(r) count.

6. Poll/Final Bit

This field displays the Poll/Final bit setting.

P	Poll/final bit is set
(blank)	Poll/final bit not set

7. Size of I-Field.

This field displays the size of I-field.

(decimal value)	Size in octets
(blank)	0

X.25 Data Packet

Figure 2.5 is a detail of the X.25 component from Figure 2.3, which is a data packet. Each X.25 field in this sample display is described below.
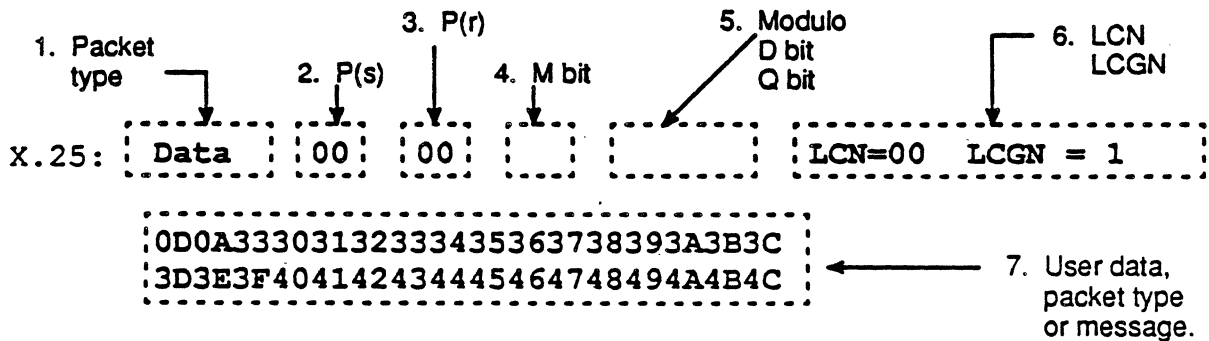
Figure 2.5: Sample X.25 Data Packet Interpretation

1. Packet Type Mnemonic

Data Packet:
   Data

Unnumbered Packets:
   Call
   Call Connected
   Clear
   Clear Confirm
   Diagnostic
   Interrupt
   Interrupt Confirm
   Reset
   Reset Confirm
   Restart
   Restart Confirm

Supervisory Packets:
   REJ
   RNR
   RR

2.   P(s)

This field displays the P(s) count.

3.   P(r)

This field displays the P(r) count.

4.   M Bit

This field displays the More bit (M bit) setting.

M	M bit is set
(blank)	M bit is not set

5.   Modulo, D bit, Q bit

This field indicates the modulo, and the setting of the Delivery bit (D bit), and the Qualifier (Q) bit.

(blank)	Modulo 8
E	Modulo 128
D	Delivery bit (D bit) set
Q	Qualifier bit (Q bit) set

6.   LCN, LCGN

This field displays the Logical Channel Number (LCN) and the Logical Channel Group Number (LCGN).

7.   User Data, Packet Type, or Message

This field displays uninterpreted user data, packet type, or message. Each line displays a maximum of 32 bytes.

Unnumbered and Supervisory Packets

The components of Unnumbered and Supervisory packets varies for each type of packet. For example, Figure 2.6 shows the components of an X.25 Call packet.
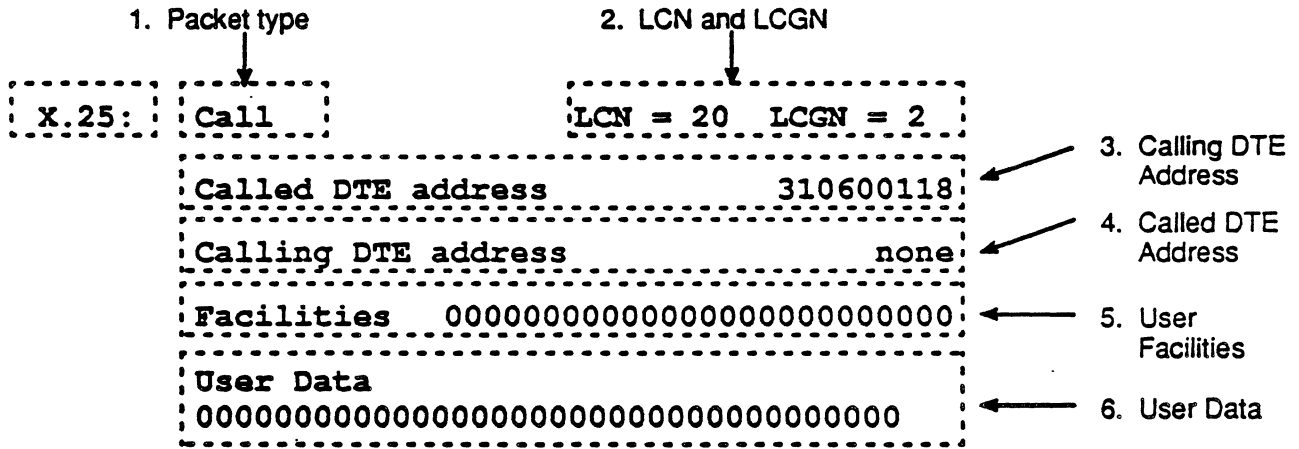
Figure 2.6: Sample X.25 Call Packet Interpretation

X.25 STATISTICS

X.25 Statistics displays and prints statistical information about the traffic on an X.25 application line. You have the ability to activate several pages that show the following statistical information:

- X.25 Line   Displays packet level statistics for all LCNs.
- X.25 LCN   Displays X.25 statistics for individual LCNs.
- HDLC Line   Displays frame level statistics for all LCNs.

When you start X.25 Statistics, the X.25 Line statistics page is displayed as shown in . This page shows X.25 Statistics for all active LCNs on an X.25 line. The format of this page is described on the following page Figure 2.7.

If you do not know how to start the Statistics application, refer to the *Chameleon 32* or the *Chameleon 20 User's Guide, Chapter 3.*

High Density Traffic

When monitoring dense traffic on high speed lines, the following situations may occur:

- The Statistics application might not be able to process all the traffic on the line. When this occurs, the following message appears below the banner, indicating the percentage of traffic that is being processed:

    Data Processed
    xx%

- At times the Statistics display may appear to be frozen; however, it is not. When you terminate the Statistics session by pressing *Run/Stop*, the display will be updated to reflect the data acquired up to that point.

    To then start a new statistics session, press the *Reset* function key. If you resume acquisition by pressing *Run/Stop* (instead of restarting statistics by pressing *Reset*), the maximum response time fields will include the time that acquisition was halted.

```
┌─0─────────────────────────────────────────────────────────────┐
│                         X.25 LINE STATISTICS    ┌X.25 Line Stats A┐
│                                                                    │
│  START TIME: 00:00:00:000 000   AM        LAST TIME: 00:00:00:000 000   AM
│  LCN:  000                                                         │
│                                                                    │
│  STATE:        CALL  CALL CONFIRM  DATA TRANSFER   CLEAR    CLEAR CONFIRM
│  CALLS PLACED:  0                  CALLS ACTIVE:   00               │
│  DCE PACKETS: 0                    DTE PACKETS: 0                   │
│  DATA PKT: 0                       DATA PKT:  0                     │
│  OVERHEAD: 0                       OVERHEAD: 0                      │
│                      DCE:   DTE:                 AVG   LAST   MAX    MIN
│  PACKET RETRIES:      0     0      ACCESS:      0.000 0.000 0.000 0.000
│  RESET:               0     0      CLEAR:       0.000 0.000 0.000 0.000
│  RESTART:             0     0      SESSION:     0.000 0.000 0.000 0.000
│  PRNR:              - 0     0      PACKET RESP: 0.000 0.000 0.000 0.000
│  PREJ:                0     0      DCE LEN:     00000 00000 00000 00000
│  PRR:                 0     0      DTE LEN:     00000 00000 00000 00000
│  DIAG:                0     0      DATA BYTES/SEC: 0                │
│                                                                    │
│  DCE UTILIZATION:    0%            DTE UTILIZATION:    0%           │
│  DCE DATA: 0%                      DTE DATA: 0%                     │
│  DCE OVERHD:  0%.                  DTE OVERHD:  0%                  │
│                                                                    │
│  ░LCNS░░HDLC░░PRINT░░RESET░░TIME░░PACKETS░░░░░░░░░░░░░░░░░░░░░░░░░░ │
└────────────────────────────────────────────────────────────────────┘
```

Displays
active LCNs

Prints a report

Time = Time
Date = Date and time

Determines whether the
number of PACKETS or
number of BYTES is
displayed for DCE/DTE
Packets, Data Packets,
and Overhead

Displays/hides the
HDLC Statistics page

Resets all statistics
values to zero

Figure 2.7: The X.25 Line Statistics Page

Total Processing Time

Several statistical fields are calculated using Total Processing Time, which is defined as:

**(Elapsed time from START TIME to LAST TIME) –
(Total time lost from missed events)**

The fields which are calculated based on Total Processing Time are:

- Utilization fields
- Data Bytes/sec. (X.25 statistics pages only)
- I–Frames/sec. (HDLC statistics pages only
- I–Frame bytes/sec (HDLC statistics pages only)

Time Display

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

The time display also depends on whether you are analyzing data from the line or from disk, since only the time (and not the date) is captured with the Direct–to–Disk application.

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event in   ·
a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Active LCNs

Following the time/date display is the information about the active Logical Channel Number (LCNs), as described below.

LCN   This field displays the Logical Channel Group Number (LCGN) and the Logical Channel Numbers (LCN) of all active LCNs/LCGNs, including LCN 0.

The highlighted LCN indicates the LCN from which the last packet was received.

State   This field displays the possible states of an LCN. The highlighted state is the state of the LCN from which the last packet was received.

CALL	Call Request
CALL CONFIRM	Call Confirm
DATA TRANSFER	Data packet
CLEAR	Clear packet
CLEAR CONFIRM	Clear Confirm

Call Statistics

The next area of the X.25 Statistics page displays information about the calls that have been made.

Call Placed   In the X.25 Line page, this field displays the total number of calls placed on all LCNs. In an LCN page, it displays the number of calls placed on the selected LCN.

Call Active   This field displays the number of LCNs that are in the Data Transfer state.

For the remaining fields in this section, if *F6 Packets* is selected, the number of packets is displayed. If *F6 Bytes* is selected, the number of bytes is displayed.

DCE Packets
DCE Total Bytes   In the X.25 Line page, this field displays the number of packets or bytes received from the DCE on all LCNs. In an LCN page, it displays the number of DCE packets/bytes on the selected LCN.

DTE Packets
DTE Total Bytes   In the X.25 Line page, this field displays the total number of packets or bytes received from the DTE on all LCNs. In an LCN page, it displays the number of DTE packets/bytes on the selected LCN.

Data Pkt.
Data Pkt Bytes   In the X.25 Line page, these fields show the number of data packets or data packet bytes from all LCNs for the DCE or the DTE. In an LCN page, it displays the number of data packets/bytes on the selected LCN. When *F6 Packets* is selected, this information is also shown in a bar graph.

Overhead

Overhead Bytes   In the X.25 Line page, these fields display the number of control (non–data) packets or control bytes received on all LCNs for the DCE or the DTE. In an LCN page, it displays the number of overhead packets/bytes on the selected LCN. When *F6 Packets* is selected, this information is also shown in a bar graph.

Packet Types

The next area of the X.25 Statistics page shows the number of control packets for all LCNs for the DCE and the DTE, as described below.

Packet Retries   This indicates the number of packet retries, which are the packets retransmitted as a result of a RESTART packet.

Reset   The number of DCE/DTE resets received.

Restart   The number of DCE/DTE restarts received.

PRNR   The number of RNRs (Receiver Not Ready) packets received the DCE/DTE.

PREJ   The number of REJect packets received from the DCE/DTE.

PRR   The number of RRs (Receiver Ready) packets received from the DCE/DTE.

DIAG   The number of diagnostic packets received from the DCE/DTE.

Timing Statistics

For the fields below, the average, last, maximum, and minimum times in seconds are displayed.

Access
The time from the transmission/reception of a CALL REQUEST packet to the transmission/reception of a CALL CONFIRMATION packet on the same LCN.

Clear
The time between the transmission/reception of a CLEAR packet and the transmission/reception of a CLEAR CONFIRMATION packet on the same LCN.

Session
The time between the reception of a CALL packet and a CLEAR CONFIRM packet for the same LCN.

Pkt. Response
The time between the *end* of an X.25 DATA packet and the *end* of the packet with the P(R) confirmation for that DATA packet.

Packet Length
The following fields display the average, last, maximum and minimum lengths for the DCE and DTE packets.

DCE Length
This line displays the average, last maximum, and minimum length of DCE packets.

DTE Length
This line displays the average, last maximum, and minimum length of DTE packets.

Data Bytes/ Second

The DATA BYTES/SEC field displays the average number of data bytes per second.

Utilization

The last area of the X.25 Statistics page displays information about line utilization for both the DTE and DCE, in the fields described below.

Note:

The utilization fields will be blank (on both the screen and printed report) if the baud rate is less than 50 bps.

**DCE Utilization
/DTE Utilization**

This field displays a percentage which indicates the total line utilization by DCE/DTE on all LCNs.

Line utilization is determined by calculating the number of bytes that could have been received at the measured baud rate, divided by the actual number of bytes that were received.

For example, if the baud rate was set at 9600, and the elapsed time was one second, the total number of bytes that could have been received is 1200. If only 600 bytes were received, the line utilization was 50%.

**DCE Data
DTE Data**

This field displays a percentage which indicates the amount of time the line is utilized for data transfer by the DCE or DTE. This information is also shown as a bar graph so that you can quickly compare it to the graph of overhead usage.

**DCE Overhead
DTE Overhead**

The percentage of time the line is utilized for the transfer of all non-data traffic. This information is also shown as a bar graph so that you can quickly compare it to the graph of data transfer usage.

Function Keys for X.25 Statistics

There are five function keys available for X.25 Statistics. These are shown and briefly described in Figure 2.7. These keys are available for for all X.25 Statistics pages. A complete description of each key is provided below.

F1: LCNS/FUNCT

You can activate a page which displays statistical information for a specific LCN that is active on the line. *F1 LCNS* displays the active LCNs in the softkey strip at the bottom of the screen, including LCN 0.

In the softkey key strip, if the LCN has + next to it, a page has been activated for that LCN. If the LCN has – next to it, a separate page has not been activated for that LCN.

When the LCNs are displayed in the softkey strip at the bottom of the screen, the *F1* key displays *FUNCT*. If you press *F1 FUNCT*, the softkey strip with the statistics functions is displayed. In other words, *F1* switches you between the Statistics functions and the active LCNs.

To activate a statistics page for an LCN, perform these steps:

1. Make one of the X.25 Statistics pages active. (You can activate and deactivate LCN pages from any X.25 Statistics page.)

2. If the active LCNS are not displayed in the softkey strip, press *F1 LCNS* to display them.

3. Press the function key that corresponds to the desired LCN. This causes a page banner for that LCN to be displayed at the bottom of the screen. The LCN softkey strip should also show a + next to the LCN.

4. You can then make the new page active and use its function keys. A sample LCN display is shown on the following page.

    The function keys are identical to the X.25 Line page. Several of the fields are different from the X.25 Line display, as described on the next page.

```
┌─┰──────────────────────────────────────────────────────────────────┐
│ ╥                                              ┌──────────────────┐ │
│ ╨                     X.25 LCN STATISTICS      │ X25 Line Stats A │ │
│                                                └──────────────────┘ │
│  CALL TIME: 00:00:00:000 000   AM       CLEAR TIME: 00:00:00:000 000   AM │
│  LCN:  000                              CALLED ADDRESS : 5432104    │
│                                         CALLING ADDRESS : 1234501   │
│  STATE:      CALL   CALL CONFIRM  DATA TRANSFER   CLEAR    CLEAR CONFIRM │
│                                                                    │
│  CALLS PLACED:  0                                                  │
│  DCE PACKETS: 0                       DTE PACKETS: 0               │
│  DATA PKT: 0                          DATA PKT:  0                 │
│  OVERHEAD: 0                          OVERHEAD: 0                  │
│                      DCE:   DTE:                 AVG    LAST   MAX    MIN │
│  PACKET RETRIES:     0      0     ACCESS:        0.000  0.000  0.000  0.000 │
│  RESET:              0      0     CLEAR:         0.000  0.000  0.000  0.000 │
│  RESTART:            0      0     SESSION:       0.000  0.000  0.000  0.000 │
│  PRNR:               0      0     PACKET RESP:   0.000  0.000  0.000  0.000 │
│  PREJ:               0      0     DCE LEN:       00000  00000  00000  00000 │
│  PRR:                0      0     DTE LEN:       00000  00000  00000  00000 │
│  DIAG:               0      0     DATA BYTES/SEC:  000                │
│                                                                    │
│  DCE UTILIZATION:    0%                DTE UTILIZATION:   0%        │
│  DCE DATA: 0%                          DTE DATA: 0%                 │
│  DCE OVERHD:  0%                       DTE OVERHD:  0%              │
│ ┌──────┬──────┬──────┬──────┬──────┬───────┬────┬────┬────┬────┐   │
│ │ LCNS │HDLC- │PRINT │RESET │ TIME │PACKETS│    │    │    │    │   │
│ └──────┴──────┴──────┴──────┴──────┴───────┴────┴────┴────┴────┘   │
└────────────────────────────────────────────────────────────────────┘
```

Figure 2.8: The LCN Statistics Page

The LCN display includes CALL TIME and CLEAR TIME to indicate the beginning and ending times of the call. (The X.25 page displays START TIME and LAST TIME for the session.)

The LCN page displays a single LCN in the LCN field, since the statistics are for that LCN only. The LCN display includes the fields CALLED ADDRESS and CALLING ADDRESS, which are not provided in the X25 Line display. The LCN display does not include the CALLS ACTIVE field, since it represents the statistics from a single call.

To deactivate a page for an LCN, perform these steps:

1. Make one of the X.25 statistics pages active.

2. If the active LCNS are not displayed in the softkey strip, press *F1 LCNS* to display them.

3. Press the function key that corresponds to the desired LCN. The LCN softkey strip should show – next to the LCN in the softkey strip and the LCN page should disappear.

F2: HDLC +/–

F2 HDLC activates and deactivates a statistics page with HDLC (frame level) statistics for the line. This enables you to focus on level 2 statistical information.

In the softkey strip, if **HDLC** has + next to it, a page has been activated for frame level statistics. If **HDLC** has – next to it, a separate page has not been activated for HDLC. To activate a statistics page for HDLC, perform these steps:

1. Make one of the X.25 Statistics pages active. (You can activate and deactivate the HDLC statistics page from any X.25 Statistics page.)

2. If HDLC is not displayed as **F2** in the softkey strip, press **F1 FUNCT** to display the X.25 Statistics function keys.

3. Press **F2 HDLC**. This causes an HDLC Line Stats page banner to be displayed at the bottom of the screen. The softkey strip should also show + next to **HDLC**.

4. You can then make the new page active and use its function keys. A sample HDLC Line Statistics page is shown and described on page 2–25. The HDLC Statistics function keys are identical to the X.25 Statistics function keys.

To deactivate a page for an LCN, perform these steps:

1. Make one of the X.25 Statistics pages active.

2. If **HDLC+** is not displayed in the softkey strip, press **F1 FUNCT** to display the X.25 Statistics function keys.

3. Press **F2 HDLC**. The softkey strip should show – next to **HDLC** and the HDLC Line Stats banner should disappear.

F3: Print

F3 Print prints a statistical report that is similar to the screen display format. If you have a printer connected to the Chameleon, you can print a report. If you do not know how to connect a printer to the Chameleon, refer to the *Chameleon User's Guide, Volume I, Chapter 9: Utilities.*

*If you do not have a printer connected to the Chameleon, pressing
F3 Print has no effect.* The report will not be shown on the screen.
An X.25 statistics report is shown below.

```
                    TEKELEC X25 LINE STATISTICS REPORT

START TIME:        00:00:00:000 000
LAST TIME:         00:00:00:000 000


LCNs ACTIVE  :       000    000    000


CALLS ACTIVE :          0
                                        DCE              DTE
CALLS PLACED :                     0000000000       0000000000
PACKET COUNT :                     0000000000       0000000000
DATA PACKETS                       0000000000       0000000000
OVERHEAD PACKETS :                 0000000000       0000000000
FRAME ABORTS :                     0000000000       0000000000
CRC ERRORS :                       0000000000       0000000000
FRAME RETRIES :                    0000000000       0000000000
PACKET RETRIES :                   0000000000       0000000000
FRAME RRs :                        0000000000       0000000000
FRAME RNRs :                       0000000000       0000000000
FRAME REJs :                       0000000000       0000000000
FRAME DMs                          0000000000       0000000000
FRAME SABMs                        0000000000       0000000000
FRAME DISCs                        0000000000       0000000000
FRAME UAs                          0000000000       0000000000
FRAME FRMRs                        0000000000       0000000000
FRAME SABMEs                       0000000000       0000000000
PACKET RRs :                       0000000000       0000000000
PACKET RNRs :                      0000000000       0000000000
PACKET REJs :                      0000000000       0000000000
PACKET CLEARs :                    0000000000       0000000000
PACKEt INTERRUPTs :                0000000000       0000000000
PACKET RESETs :                    0000000000       0000000000
PACKET RESET CONFs                 0000000000       0000000000
PACKET RESTARTs :                  0000000000       0000000000
PACKET RESTART CONFs               0000000000       0000000000
PACKET DIAGs :                     0000000000       0000000000

                                  AVG      LAST      MAX      MIN
ACCESS TIME :                    0.000    0.000    0.000    0.000
CLEAR TIME :                     0.000    0.000    0.000    0.000
SESSION TIME :                   0.000    0.000    0.000    0.000
DCE PACKET LENGTH :              00000    00000    00000    00000
DTE PACKET LENGTH :              00000    00000    00000    00000
DCE PACKET RESPONSE :            0.000    0.000    0.000    0.000
DTE PACKET RESPONSE :            0.000    0.000    0.000    0.000

DCE TOTAL BYTES:                    0
DCE DATA BYTES:                     0
DTE TOTAL BYTES:                    0
DTE DATA BYTES:                     0
DCE LINE UTILIZATION :          00 %
DCE DATA UTILIZATION :          00 %
DCE LINE UTILIZATION :          00 %
DCE DATA UTILIZATION :          00 %
```

Figure 2.9: X.25 Line Statistics Report

F4: Reset

F4 Reset resets the statistics values to zero and resets the times (or dates) displayed at the top of the page. This resets the values on all X.25 statistics pages that are currently activated.

F5: Time/Date

F5 Time/Date affects the format of the time displayed in the START TIME and LAST TIME fields at the top of each X.25 Statistics page.

If *F5 Time* is selected, the times are displayed in the format:

hh:mm:ss:ddd ddd AM/PM

For example: 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format:

dd MMM yyyy hh:mm:ss

For example: 01 JAN 1989 08:06:45.

F6: Packets/Bytes

The *F6 Packets/Bytes* key determines whether the number of packets or the number of bytes is displayed in certain statistics fields.

If *F6 Packets* is selected, the following fields are displayed with the number of packets indicated:

    DCE Packets
    DTE Packets
    Data Packets
    Overhead

If *F6 Bytes* is selected, the following fields are displayed with the number of bytes indicated:

    DCE Total Bytes
    DTE Total Bytes
    Data Packet Bytes
    Overhead Bytes

HDLC Line Statistics Page

An HDLC Line Statistics page is shown in Figure 2.10. Each field of the HDLC Line Statistics page is described on the following pages.

```
┌─0─────────────────────────────────────────────┌──────────────────┐
│                                                │ HDLC Line Stats A │
│                         HDLC STATISTICS                           │
│ START TIME: 00:00:00:000 000  AM        LAST TIME: 00:00:00:000 000 AM │
│ DCE FRAMES:  0                   DTE FRAMES:   00                  │
│ I-FRAMES: 0                      I-FRAMES: 0                       │
│ OVERHEAD: 0                      OVERHEAD: 0                       │
│               DCE:   DTE:                AVG    LAST    MAX    MIN │
│ RR:            0     0     DCE N(R):    0.000  0.000  0.000  0.000 │
│ RNR:           0     0     DTE N(R):    0.000  0.000  0.000  0.000 │
│ REJ:           0     0     DCE RESP:    0.000  0.000  0.000  0.000 │
│ RETRIES:       0     0     DTE RESP:    0.000  0.000  0.000  0.000 │
│ SABM:          0     0     DCE DELTA:   0.000  0.000  0.000  0.000 │
│ DISC:          0     0     DTE DELTA:   0.000  0.000  0.000  0.000 │
│ UA:            0     0     DCE LEN:     00000  00000  00000  00000 │
│ FRMR:          0     0     DCE LEN:     00000  00000  00000  00000 │
│ SABME:         0     0                                            │
│ ABORTS:        0     0     I-FRAMES/SEC: 00                       │
│ CRC ERRORS:    0     0     I-FRAME BYTES/SEC:  0                   │
│                                                                   │
│ DCE UTILIZATION:  0%         DTE UTILIZATION:   0%                │
│ DCE DATA: 0%                 DTE DATA: 0%                         │
│ DCE OVERHD:  0%              DTE OVERHD:  0%                      │
│ LCNS │ HDLC- │ PRINT │ RESET │ TIME │ FRAME │    │    │    │    │  │
└───────────────────────────────────────────────────────────────────┘
```

Figure 2.10: The HDLC Line Statistics Page

Timing Statistics

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

The time display also depends on whether you are analyzing data from the line or from disk, since only the time (and not the date) is captured with the Direct–to–Disk application.

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event (frame) in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event (frame) was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Frame Statistics

The next area of the HDLC Line Statistics page displays information about the frames that have received from the DCE and the DTE and is affected by the *F6 Frame/Bytes* key. If *F6 Frame* is selected, the number of frames is displayed. If *F6 Bytes* is selected, the number of bytes is displayed.

DCE/DTE FRAMES
DCE/DTE TOTAL BYTES   This field displays the total number of frames or bytes received from the DCE or the DTE.

I-FRAMES
I-FRAME BYTES   This field displays the number of information frames or bytes in I-frames received from the DCE or the DTE.

OVERHEAD
OVERHEAD BYTES   This field displays the number of control frames (non I-frames) or bytes in control frames received from the DCE or the DTE.

Frame Types and Errors Received

The next area of the page shows the number of each frame type received from the DCE and the DTE. The next area of the page shows the number of each frame type received from the DCE and the DTE.

RR	Number of Receiver Ready frames received.
RNR	Number of Receiver Not Ready frames received.
REJ	Number of Reject frames received.
RETRIES	Number of retries received.
SABM	Number of Set Asynchronous Balanced Mode frames received.
DISC	Number of Disconnect frames received.
UA	Number of Unnumbered Acknowledge frames received.
FRMR	Number of frame rejects frames received.
SABME	Number of Set Asynchronous Balanced Mode Extended frames received.
ABORTS	Number of frame aborts that have occurred.
CRC ERRORS	Number of Cyclic Redundancy Check errors that have occurred.

Response Time

For the fields below, the average, last, maximum, and minimum times in seconds are displayed.

DCE N(r)	The time between the receipt of an I–frame from the DTE and the receipt of the response to that I–frame from the DCE.
DTE N(r)	The time between the receipt of an I–frame from the DCE and the receipt of the response to that I–frame from the DTE.
DCE RESP	The time between the receipt of a frame from the DTE and the receipt of the response to that frame from the DCE.
DTE RESP	The time between the receipt of a frame from the DCE and the receipt of the response to that frame from the DTE.
DCE DELTA	The time between the receipt of one frame from the DCE and the receipt of the next frame from the DCE.
DTE DELTA	The time between the receipt of one frame from the DTE and the receipt of the next frame from the DTE.

Frame Length

The following fields display the average, last, maximum and minimum lengths for the DCE and DTE frames.

DCE Length   This line displays the average, last maximum, and minimum length of the DCE frames received.

DTE Length   This line displays the average, last maximum, and minimum length of the DTE frames received.

I–Frames/Sec   The total number of I–frames received per second from both DTE and DCE.

I–Frame Bytes/Sec   The average number of bytes in I–frames received per second.

Utilization

The last area of the HDLC Line Statistics page displays information about line utilization for both the DTE and DCE, in the fields described below.

Note: The utilization fields will be blank (on both the screen and the printed report) if the baud rate is less than 50 bps.

DCE UTILIZATION
DTE UTILIZATION   This field displays a percentage which indicates the total line utilization by DCE/DTE on all LCNs.

Line utilization is determined by calculating the number of bytes that could have been received at the measured baud rate, divided by the actual number of bytes that were received.

For example, if the baud rate was set at 9600, and the elapsed time was one second, the total number of bytes that could have been received is 1200. If 600 bytes were received, the line utilization was 50%.

DCE DATA
DTE DATA   This field displays a percentage which indicates the amount of time the line is utilized for data transfer by the DCE or DTE. This information is also shown as a bar graph.

DCE OVERHEAD
DTE OVERHEAD   The percentage of time the line is utilized for the reception of all non–data traffic. This information is also shown as a bar graph so that you can quickly compare it to the graph of data transfer usage.

HDLC LINE FUNCTION KEYS

The HDLC Line Statistics function keys are identical to the X25 Line Statistics function keys, with one exception. In the HDLC Line page, *F6* determines whether the number of frames or the number of bytes is displayed in certain statistics fields. (In X25 Line Statistics, *F6* determines whether the number of *packets* or bytes is displayed.)

If *F6 Frame* is selected, the following fields are displayed with the number of packets indicated:

    DCE Frames
    DTE Frames
    I–Frames
    Overhead

If *F6 Bytes* is selected, the following fields are displayed with the number of bytes indicated:

    DCE Total Bytes
    DTE Total Bytes
    I–Frame Bytes
    Overhead Bytes

CHAPTER THREE:
X.75 MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section focuses on the protocol–specific details of X.75 Analysis. For a general description of Analysis, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port with X.75 as the protocol. It you do not know how to do this, refer to the *Chameleon 32* or the *Chameleon 20 User's Guide, Chapter 3.*

Monitor Setup Menu

When you select X.75 as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 3.1. Each of these parameters is described on the next page.

Figure 3.1: X.75 Protocol Parameters

Link Layer

Link Layer specifies the link layer protocol to use. There is only one option, HDLC.

Modulo

Modulo determines the packets numbering sequence that will be used to keep track of the packets that are transmitted and received. The options are:

Modulo 8	Packets numbered from 0 – 7
Modulo 128	Packets numbered from 0 – 127

U Frame Size

U Frame Size specifies the size of unnumbered frames as either 1 or 2 bytes in length.

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used for transmission. The options are:

Yes	Extended (16–bit) addressing
No	8–bit addressing

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ	Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.
NRZI	Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Network Layer

Network Layer enables you to select between:

CCITT	Interpretation per CCITT X.25 specification
Italy	Same as CCITT, except that Clear Cause, Reset Cause, Restart Cause, and Diagnostics are shown in Italian

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCT/DTE)

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 3.2. The page components are described on the following pages.

HDLC Data (Green)   **DCE**   **DTE**   Event number (optional field). See F3 key.

```
                        Port A    132    03  RR        05    History A
                        Port A    133    01  I     00 05    4
                        X75:  Data 00 07                    LCN=01 LCGN=0
                                        C R
  01  RR       01                        Port A 134
  03  I     05 01      3                  Port A 135
  X75: RR    00         LCN=01 LCGN=0
                        Port A    136    03  RR        06
  03  I     06 01    131               Port A    137
  X75: Data 00 00       LCN=01 LCGN=0
      C L  The NCAA Regionals open Th
       R F
  ursday with 16 games. Top-ranked
      C Nevada-Las Vegas faces Idaho S
       R
  tate in the West Regional at Sal
                        Port A    138    03  RR       07
  03  I     07 01    100               Port A    139
  X75: Data 00 01       LCN=01 LCGN=0
      C L Lake City. C L     Florida's
     t R F            R F
  leading scorer Vernon  Maxwell s
  uffered a sprained  knee in prac
  N
   U
```

ASCII	Number	I U S	HDLC+	X.75						User+

User Data (White)   X. 75 Data (Yellow)

Figure 3.2: Analysis History Page with Sample X.75 Traffic

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames transmitted from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below (example: the new baud rate is 9600)

New Baud Rate . **9600**

Colors

Colors distinguish the different levels of the display:

- Green = Frame level (HDLC)
- Yellow = Packet level (X.75)
- White = User data
- Red = Errors

In addition, the optional field selected using *F2* is displayed in green or white, depending on the event type.

Interface Lead Transitions

Interface lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. Note that all transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The X.75 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC Each byte is displayed as an EBCDIC character

HEX Each byte is displayed as a pair of hex digits

HEXS Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides (see Figure 3.2). The options are:

Number Event number in decimal (default)

Flags Number of flags preceding the frame, in decimal

Time Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime Displays the elapsed time between events

CRC CRC value in hex, and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   **F3** affects the page *display* only. All events are captured, regardless of the **F3** selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Frame Level

F4 determines how the frame level (HDLC) is interpreted and displayed. The options are:

HDLC+   HDLC is displayed interpreted (default)

HDLC"   HDLC is displayed uninterpreted in the code selected in *F1* (ASCII, HEX, HEXS, EBCDIC)

HDLC*   HDLC is displayed interpreted and uninterpreted in the code selected in *F1*

HDLC–   HDLC is acquired but not displayed

The frame level components include the information listed below. See page 3-8 for an example of HDLC interpretation.

- Frame address in hex
- Frame mnemonic
- N(r) and N(s) in hex
- Poll/Final bit
- Indication of bad CRC and aborted frames
- Size of I–field in decimal

F5: Packet Level

F5 determines how the packet level (X.75) is interpreted and displayed. The options are:

X.75+   X.75 is displayed interpreted (default)

X.75"   X.75 is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

X.75*   X.75 is displayed interpreted and uninterpreted in the code selected in **F1**

X.75–   X.75 is acquired but not displayed

The packet level components include the information listed below. See page 3–10 for example of X.75 interpretations.

- · Packet Identification mnemonic, eg., CALL
- Call packet address
- P(r) and P(s)
- Q, D and M bits
- Logical Channel Number (LCN)
- Logical Channel Group Number (LCGN)
- Facilities information
- Clear/restart causes and diagnostics

Note

For Italian X.75, when X.75+ or X.75* is selected, the following interpretations are shown in Italian:

- X.75 Clear Cause
- X.75 Reset Cause
- X.75 Restart Cause
- X.75 Diagnostics

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic (data, HDLC, X.75) is displayed uninterpreted (raw) in the code selected in **F1**

X.75 ANALYSIS INTERPRETATION

This section identifies the components of the X.75 Analysis page display. Figure 3.3 shows a sample X.75 History page. The area in the box is described in detail in this section.

The first line data in the box is HDLC data, which is displayed in green. The second line in the box is the X.75 data, which is displayed in yellow. The first line of interpreted X.75 data is preceded by the message *X.75:*.

The remaining lines are the user data, which is displayed in white. The user data is shown in ASCII, since it is the code displayed in the softkey strip for the *F1* key.
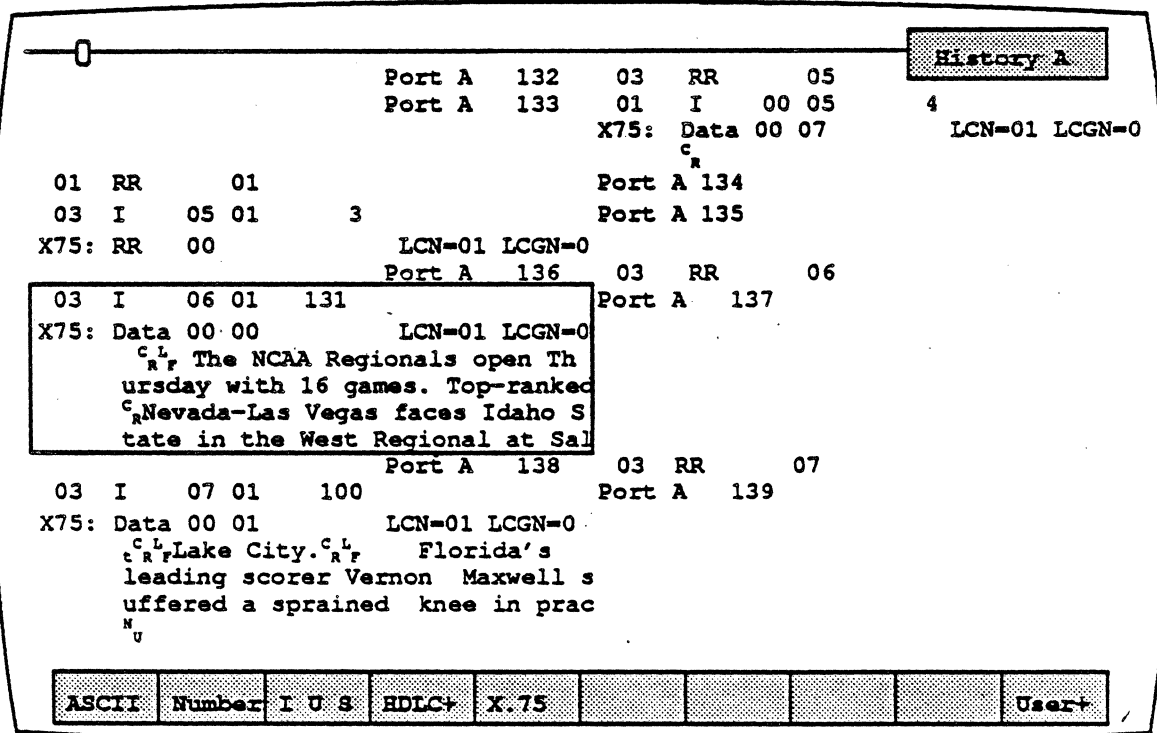
Figure 3.3: Analysis History Page with Sample X.75 Traffic

HDLC

Figure 3.4 is a detail of the HDLC component from Figure 3.3. Each HDLC field in this sample display is described below.
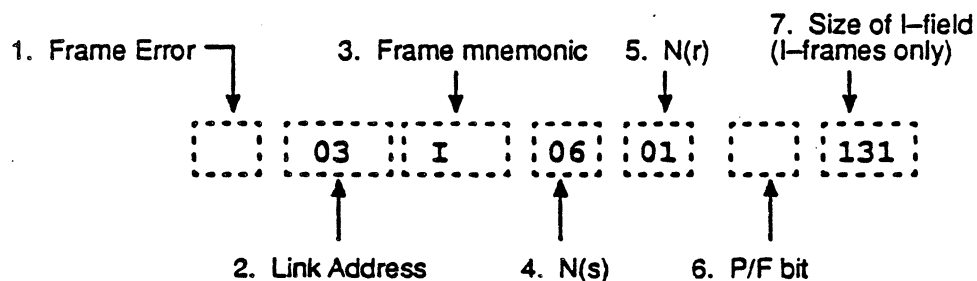
Figure 3.4: Sample HDLC Interpretation

1. Frame Errors

A single letter indicates if a frame error has occurred.

A	Aborted frame received
B	Frame with bad FCS received
(blank)	No frame error

2. Link Address

This field displays the link address.

3. Frame Mnemonic

Field 3 indicates the type of frame received, using the following mnemonics:

Information frame:
I	I-Frame

Supervisory frames:
RR	Receiver Ready
RNR	Receiver Not Ready
REJ	Reject

Unnumbered frames:

BCN	Beacon
CFGR	Configure
DISC	Disconnect
DM	Disconnect Mode
FRMR	Frame Reject
RD	Request Disconnect
RIM	Request Initialization Mode
SABM	Set Asynchronous Balanced Mode
SARM	Set Asynchronous Response Mode
SIM	Set Initialization Mode
SNRM	Set Normal Response Mode
TEST	Test Frame
UA	Unnumbered Acknowledge
UI	Unnumbered Information
UP	Unnumbered Poll
XID	Exchange ID
(hex value)	Unknown unnumbered frame type

4. N(s)

This field displays the N(s) count.

5. N(r)

This field displays the N(r) count.

6. Poll/Final Bit

This field displays the Poll/Final bit setting.

P	Poll/final bit is set
(blank)	Poll/final bit not set

7. Size of I–Field.

This field displays the size of I–field.

(decimal value)	Size in octets
(blank)	0

X.75 Data Packet

Figure 3.5 is a detail of the X.75 component from Figure 3.3, which is a data packet. Each X.75 field in this sample display is described below.
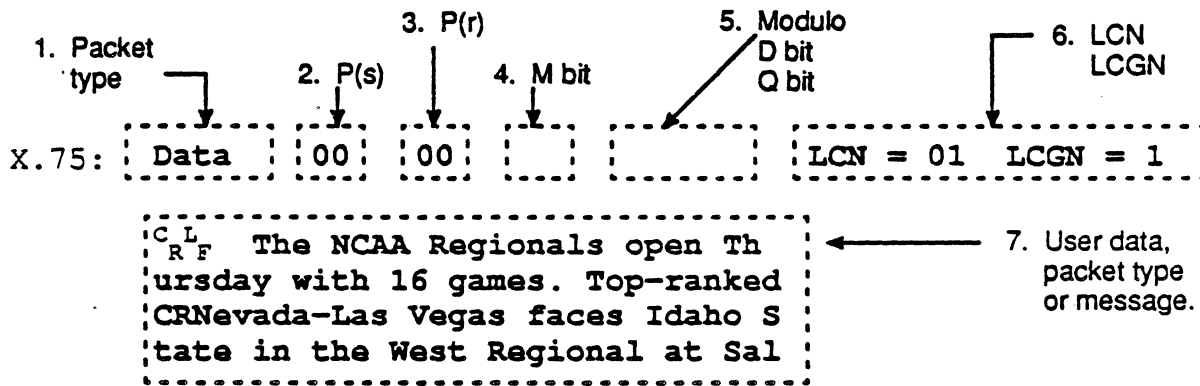
Figure 3.5: Sample X.75 Data Packet Interpretation

1. Packet Type Mnemonic

Data Packet:
    Data

Unnumbered Packets:
    Call
    Call Connected
    Clear
    Clear Confirm
    Diagnostic
    Interrupt
    Interrupt Confirm
    Reset
    Reset Confirm
    Restart
    Restart Confirm

Supervisory Packets:
    REJ
    RNR
    RR

2. P(s)

This field displays the P(s) count.

3. P(r)

This field displays the P(r) count.

4. M Bit

This field displays the More bit (M bit) setting.

M	M bit is set
(blank)	M bit is not set

5. Modulo, D bit, Q bit

This field indicates the modulo, and the setting of the Delivery bit (D bit), and the Qualifier (Q) bit.

(blank)	Modulo 8
E	Modulo 128
D	Delivery bit (D bit) set
Q	Qualifier bit (Q bit) set

6. LCN, LCGN

This field displays the Logical Channel Number (LCN) and the Logical Channel Group Number (LCGN).

7. User data, packet type, or message

This field displays uninterpreted user data, packet type, or message. Each line displays a maximum of 32 bytes.

Unnumbered and Supervisory Packets

The components of the various Unnumbered and Supervisory packets vary by packet type. For example, Figure 3.6 shows the format of an X.75 Call packet.
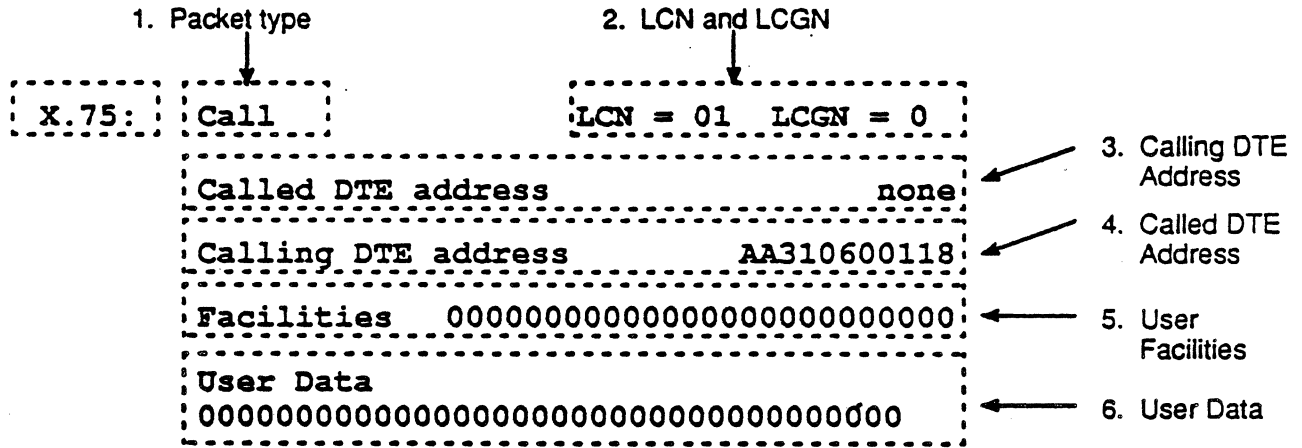
Figure 3.6: Sample X.75 Call Packet Interpretation

CHAPTER FOUR:
QLLC MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section focuses on the protocol–specific details of QLLC (Qualified Logical Link Control) Analysis. For a general description of Analysis, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port with QLLC as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter 3.*

Monitor Setup Menu

When you select QLLC as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 4.1. Each of these parameters is described on the next page.

Figure 4.1: QLLC Monitor Setup Parameters

Link Layer

Link Layer specifies the link layer protocol to use. There is only one option, HDLC.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Modulo

Modulo determines the frame numbering sequence that will be used to keep track of the frames that are transmitted and received. The options are:

Modulo 8   Frames numbered from 0 – 7

Modulo 128   Frames numbered from 0 – 127

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used for transmission. The options are:

Yes   Extended (16–bit) addressing

No   8–bit addressing

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 4.2. The page components are described on the following pages.
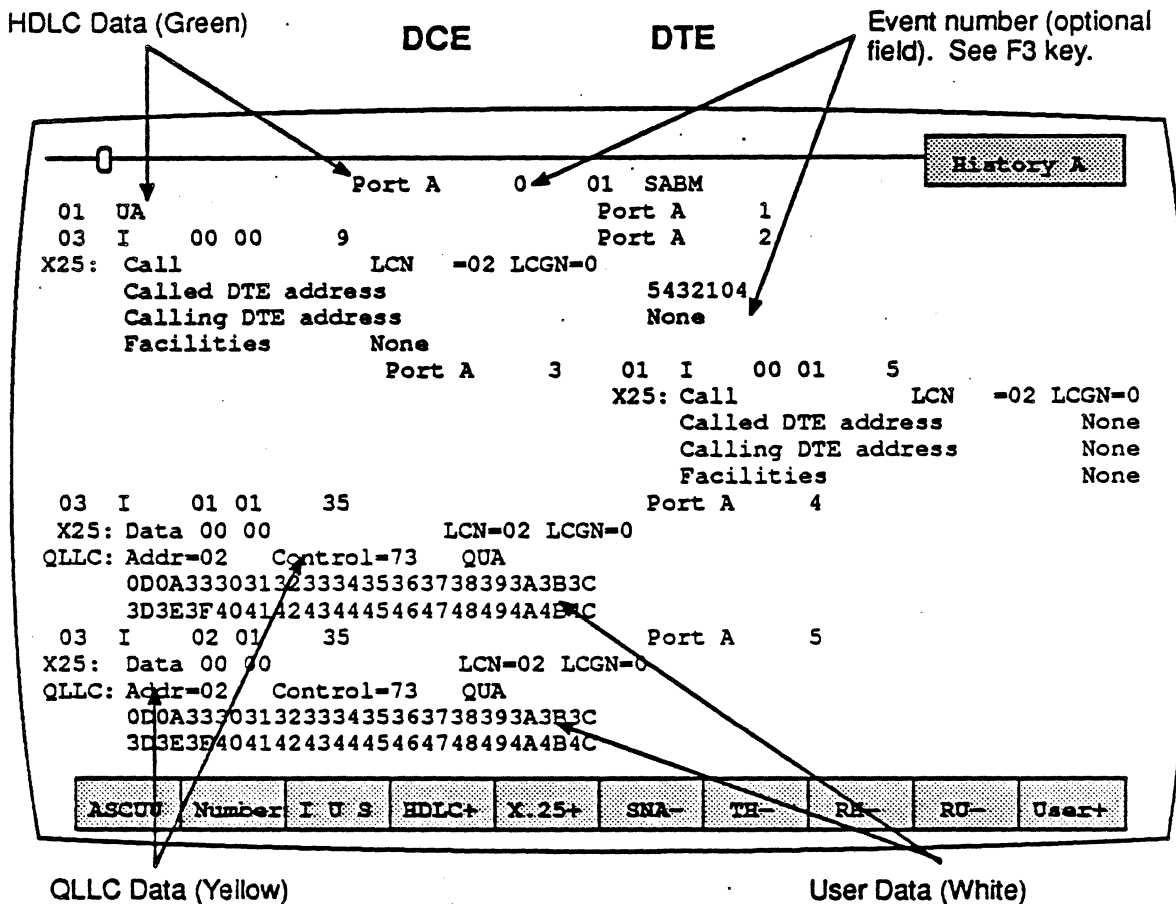
Figure 4.2: Analysis History Page with Sample QLLC Traffic

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames received from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below (example: the new baud rate is 9600)

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Frame level (HDLC)
- Yellow = X.25 and QLLC
- Blue = SNA
- White = User data
- Red = Errors

In addition, the optional field selected using *F2* is displayed in green or white, depending on the event type.

Interface Lead Transitions

Interface lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. Note that all transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages.

Note

When the Qualifier bit is set, the user data portion of a data packet is interpreted as QLLC (see Figure 4.5 on page 4-13). If the Qualifier bit is not set, the user data portion of a data packet is interpreted as SNA (see Chapter 6).

The QLLC Analysis function keys are described on the following pages.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII	Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)
EBCDIC	Each byte is displayed as an EBCDIC character.
HEX	Each byte is displayed as a pair of hex digits
HEXS	Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides (see Figure 4.2). The options are:

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if good CRC, **BAD** if bad CRC

None   No acquisition information is displayed

The port which received the frame (**Port A** or **Port B**) is also displayed as part of the acquisition information, unless the **None** option is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   *F3* affects the page *display* only. All events are captured, regardless of the *F3* selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Frame Level

F4 determines how the frame level (HDLC) is interpreted and displayed. This information is displayed in green. The options are:

HDLC+   HDLC is displayed interpreted (default)

HDLC"   HDLC is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

HDLC*   HDLC is displayed interpreted and uninterpreted in the code selected in **F1**

HDLC–   HDLC is acquired but not displayed

F5: X.25 Data

F5 determines how the X.25 data is interpreted and displayed. This information is displayed in yellow. The options are:

X.25+   X.25 is displayed interpreted (default)

X.25"   X.25 is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

X.25*   X.25 is displayed interpreted and uninterpreted in the code selected in **F1**

X.25–   X.25 is acquired but not displayed

F6: SNA Data

F5 determines how the SNA data is interpreted and displayed. The TH and RH components the SNA data information are displayed in blue. The RU component is displayed in white. The options are:

SNA+   SNA is displayed interpreted (default)

SNA"   SNA is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

SNA*   SNA is displayed interpreted and uninterpreted in the code selected in **F1**

SNA–   SNA is acquired but not displayed

If the SNA data is not displayed (SNA–), the TH, RH and RU displays are also inhibited. When the SNA component is displayed (SNA+, SNA", SNA*), the TH, RH, and RU displays are controlled with **F7**, **F8** and **F9** respectively.

F7: TH Data

F7 determines how the Transmission Header (TH) data is interpreted and displayed. This information is displayed in bright blue. The options are:

TH+   TH is displayed interpreted (default)

TH"   TH is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

TH*   TH is displayed interpreted and uninterpreted in the code selected in **F1**

TH—   TH is acquired but not displayed

F8: RH Data

F8 determines how the Request/Response Header (RH) data is interpreted and displayed. This information is displayed in dim blue. The options are:

RH+   RH is displayed interpreted (default)

RH"   RH is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

RH*   RH is displayed interpreted and uninterpreted in the code selected in **F1**

RH—   RH is acquired but not displayed

F9: RU Data

F9 determines how the Request/Response Unit (RU) data is interpreted and displayed. This information is displayed in dim blue. The options are:

RU+   RU is displayed interpreted (default)

RU"   RU is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

RU*   RU is displayed interpreted and uninterpreted in the code selected in **F1**

RU—   RU is acquired but not displayed

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in **F1**

QLLC ANALYSIS INTERPRETATION

This section identifies the components of the QLLC Analysis page display. Figure 4.3 shows a sample QLLC History page. The area in the box is described in detail in this section.

The first line data in the box is HDLC data, which is displayed in green. The second line in the box is the X.25 data with the QLLC component directly below it. The X.25 and QLLC components are displayed in yellow. The first line of interpreted QLLC data is preceded by the message *QLLC:*.

The remaining lines are the user data, which is displayed in white. The user data is shown in hex, since it is the code displayed in the softkey strip for the *F1* key.

```
 ┌─────0───────────────────────────────────────  History A
 │
 │   03  I    01 01    35              Port A      4
 │   X25: Data 00 00            LCN=02 LCGN=0
 │   QLLC: Addr=02 Control=73 QUA
 │        0D0A33303132333435363738393A3B3C
 │        3D3E3F404142434445464748494A4B4C

     03  I    02 01    35              Port A      5
     X25: Data 00 00         LCN   =02 LCGN=0
     QLLC: Addr            =02      Control=73    QUA
          0D0A33303132333435363738393A3B3C
          3D3E3F404142434445464748494A4B4C




     HEX   Number  I U S  HDLC+  X.75+                    User+
```
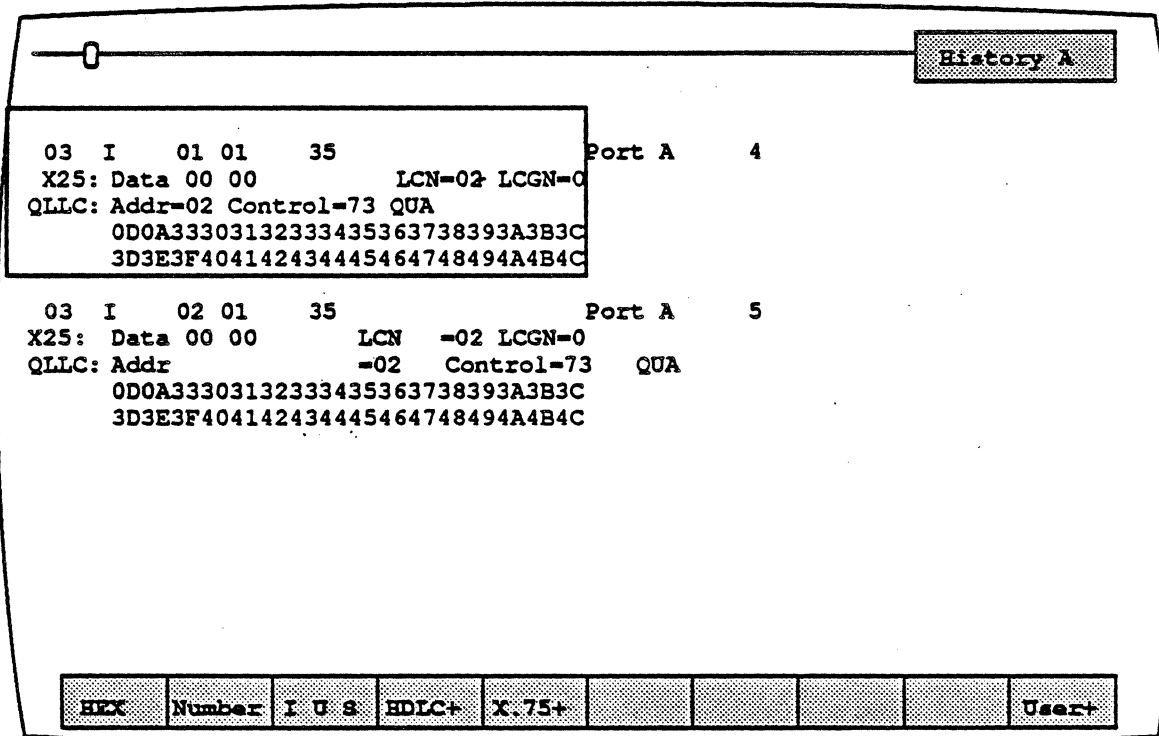
Figure 4.3: Analysis History Page with Sample QLLC Traffic

HDLC   Figure 4.4 is a detail of the HDLC component from Figure 4.3. Each
                   HDLC field in this sample display is described below.
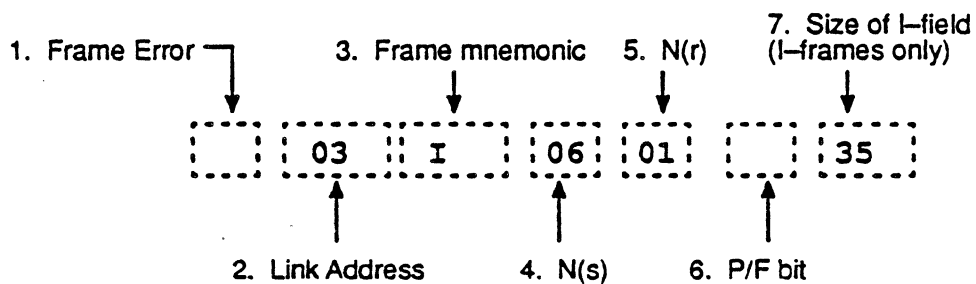
Figure 4.4: Sample HDLC Interpretation

1. Frame Errors

A single letter indicates if a frame error has occurred.

A	Aborted frame received
B	Frame with bad FCS received
(blank)	No frame error

2. Link Address

This field displays the link address.

3. Frame Mnemonic

Field 3 indicates the type of frame received, using the following
mnemonics:

Information frame:
 I   I–Frame

Supervisory frames:
 RR   Receiver Ready
 RNR   Receiver Not Ready
 REJ   Reject

Unnumbered frames:

BCN	Beacon
CFGR	Configure
DISC	Disconnect
DM	Disconnect Mode
FRMR	Frame Reject
RD	Request Disconnect
RIM	Request Initialization Mode
SABM	Set Asynchronous Balanced Mode
SARM	Set Asynchronous Response Mode
SIM	Set Initialization Mode
SNRM	Set Normal Response Mode
TEST	Test Frame
UA	Unnumbered Acknowledge
UI	Unnumbered Information
UP	Unnumbered Poll
XID	Exchange ID
(hex value)	Unknown unnumbered frame type

4. N(s)

This field displays the N(s) count.

5. N(r)

This field displays the N(r) count.

6. Poll/Final Bit

This field displays the Poll/Final bit setting.

P	Poll/final bit is set
(blank)	Poll/final bit not set

7. Size of I–Field

This field displays the size of I–field.

(decimal value)	Size in octets
(blank)	0

QLLC Packet

Figure 4.5 is a detail of the QLLC component from Figure 4.3, which is a data packet. Each QLLC field in this sample display is described below.
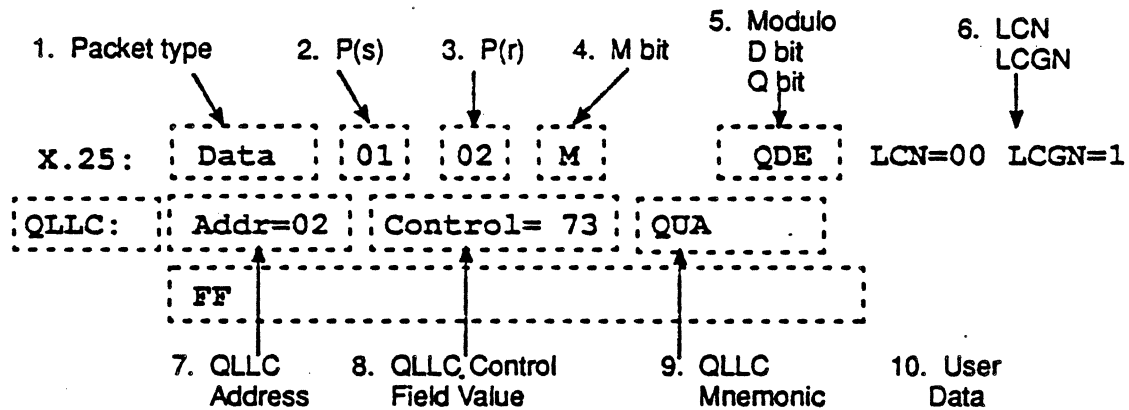
Figure 4.5: QLLC Data Packet Analysis Display

1. Packet Type Mnemonic

Data Packet:
Data

Unnumbered Packets:
Call
Call Connected
Clear
Clear Confirm
Diagnostic
Interrupt
Interrupt Confirm
Reset
Reset Confirm
Restart
Restart Confirm

Supervisory Packets:
REJ
RNR
RR

2. P(s)

This field displays the P(s) count.

3. P(r)

This field displays the P(r) count.

4. M Bit

This field displays the More bit (M bit) setting.

M	M bit is set
(blank)	M bit is not set

5. Modulo, D bit, Q bit

This field indicates the modulo, and the setting of the Delivery bit (D bit), and the Qualifier (Q) bit.

(blank)	Modulo 8
E	Modulo 128
D	Delivery bit (D bit) set
Q	Qualifier bit (Q bit) set

6. LCN, LCGN

This field displays the Logical Channel Number (LCN) and the Logical Channel Group Number (LCGN).

7. QLLC Address Field

This field displays the QLLC address.

8. QLLC Control Field value

This field displays the value of the QLLC control field. These values and their mnemonics are listed in Figure 4.6.

9. QLLC Mnemonic

This field displays the QLLC control field mnemonic. Valid mnemonics and control field values are shown in Figure 4.6 below.

Control Field Value	Control Field Mnemonic
1F	QDM
53	QDISC/QRD
73	QUA
93	QSM
97	QFRMR
BF	QXID
F1	QRR
F3	QTEST
Any other	Unknown

Figure 4.6: QLLC Control Field Mnemonics

10. User Data

This displays uninterpreted user data, packet type, or message. A line of user data, or the Facilities, wrap around to the next line if it is longer than 32 bytes.

CHAPTER FIVE:
PSH MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section focuses on the protocol–specific details of PSH (Physical Service Header) Analysis. For a general description of Analysis, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port with PSH as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter 3.*

Monitor Setup Menu

When you select PSH as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 5.1. Each of these parameters is described on the next page.

```
┌────────────────────────────────────────────────────────┐
│  ─0─────────────────────────────────┌──────────────┐   │
│                   Port x Monitor Setup │Configuration │   │
│                                        └──────────────┘   │
│                                                           │
│                                     ┌──────────────────┐  │
│                                     │ Press GO to accept│ │
│                                     └──────────────────┘  │
│   Protocol  :    ┌─────┐                                  │
│                  │ PSH │                                  │
│                  └─────┘                                  │
│   Link Layer     ┌──────┐  ◄───                           │
│                  │ HDLC │                                 │
│                  └──────┘                                 │
│        Encoding          ┌─────┐                          │
│        Modulo            │ NRZ │                          │
│        Extended addr     │  8  │                          │
│                          │ No  │                          │
│                          └─────┘                          │
│                                                           │
│  ┌─────┬────┬────┬────┬────┬────┬────┬────┬────┬──────┐  │
│  │HDLC │    │    │    │    │    │    │    │    │ Exit │  │
│  └─────┴────┴────┴────┴────┴────┴────┴────┴────┴──────┘  │
└────────────────────────────────────────────────────────┘
```

Figure 5.1: PSH Monitor Setup Parameters

Link Layer

Link Layer specifies the link layer protocol to use. There is only one option, HDLC.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Modulo

Modulo determines the frame numbering sequence that will be used to keep track of the frames that are transmitted and received. The options are:

Modulo 8   Frames numbered from 0 – 7

Modulo 128   Frames numbered from 0 – 127

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used for transmission. The options are:

Yes   Extended (16–bit) addressing

No   8–bit addressing

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 5.2. The page components are described on the following pages.
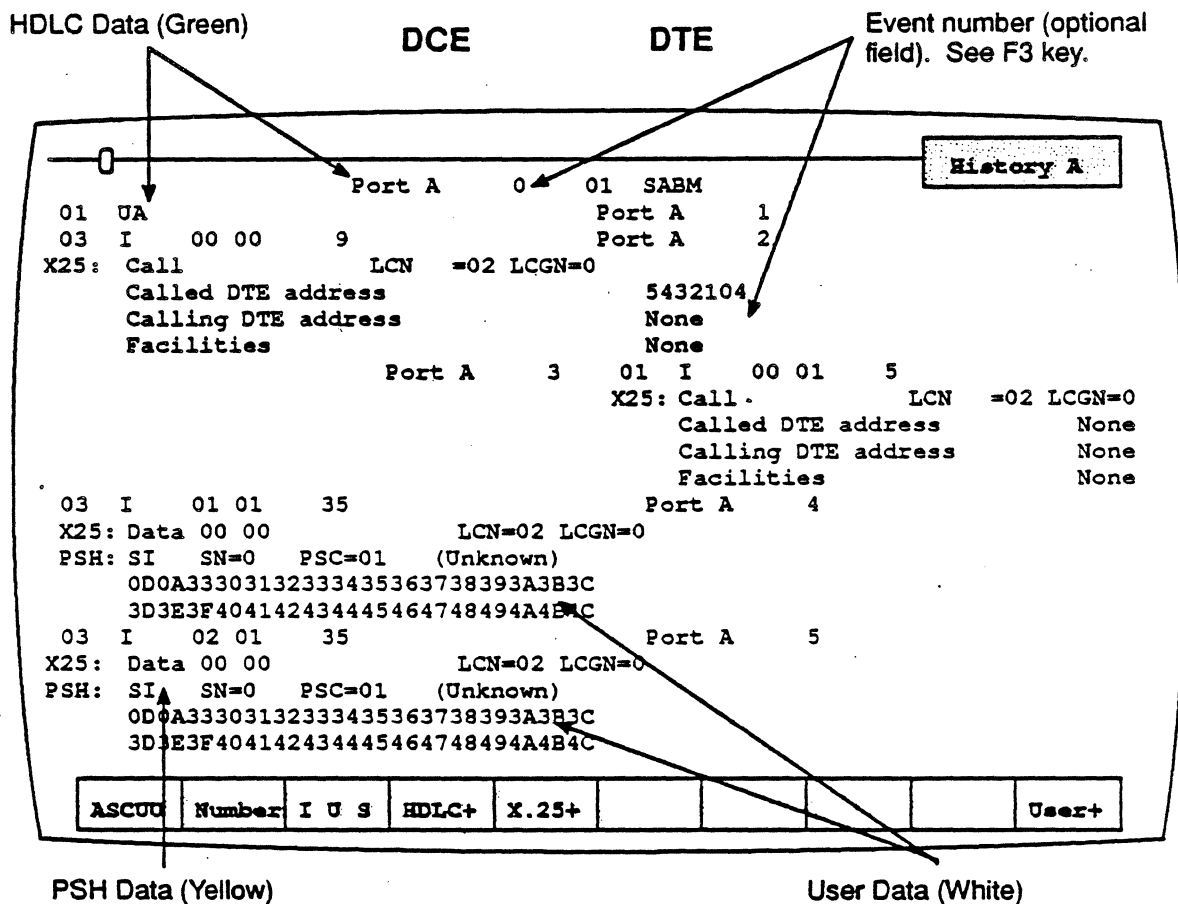
Figure 5.2: Analysis History Page with Sample PSH Traffic

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames received from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below (example: the new baud rate is 9600)

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Frame level (HDLC)
- Yellow = Packet level (PSH)
- White = User data
- Red = Errors

In addition, the optional field selected using *F2* is displayed in green or white, depending on the event type.

Interface Lead Transitions

Interface lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. Note that all transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The PSH Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press **F1**, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII	Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)
EBCDIC	Each byte is displayed as an EBCDIC character
HEX	Each byte is displayed as a pair of hex digits
HEXS	Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides (see Figure 5.2).

Number	Event number in decimal (default)
Flags	Number of flags preceding the frame, in decimal
Time	Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.
dTime	Displays the elapsed time between events
CRC	CRC value in hex, and **OK** if good CRC or **B** if bad CRC
None	No acquisition information is displayed

The port receiving the frame (**Port A** or **Port B**) is also displayed as part of the acquisition information, unless **None** is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I	Information frames only
IU	Information and Unnumbered frames only
IUS	Information, Unnumbered, and Supervisory frames (default)
IUSL	All frames, plus lead transitions

Note

F3 affects the page *display* only. All events are captured, regardless of the **F3** selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Frame Level

F4 determines how the frame level (HDLC) is interpreted and displayed. The options are:

HDLC+   HDLC is displayed interpreted (default)

HDLC"   HDLC is displayed uninterpreted in the code selected in **F1** (ASCII, HEX, HEXS, EBCDIC)

HDLC*   HDLC is displayed interpreted and uninterpreted in the code selected in **F1**

HDLC−   HDLC is acquired but not displayed

The frame level components include the information listed below. See page 5-8 for an example of HDLC interpretation.

- Frame address in hex
- Frame mnemonic
- N(r) and N(s) in hex
- Poll/Final bit
- Indication of bad CRC and aborted frames
- Size of I–field in decimal

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+	User data is displayed (default)
User−	User data is not displayed
Raw	All traffic (data, HDLC, PSH) is displayed uninterpreted (raw) in the code selected in **F1**

PSH ANALYSIS INTERPRETATION

This section identifies the components of the PSH Analysis page display. Figure 5.3 shows a sample PSH History page. The area in the box is described in detail in this section.

The first line data in the box is HDLC data, which is displayed in green. The second display line in the box is the X.25 data with the PSH component directly under it. The X.25/PSH data is displayed in yellow. The first line of interpreted PSH data is preceded by the message *PSH:*.

The remaining lines are the user data, which is displayed in white. The user data is shown in hex, since it is the code displayed in the softkey strip for the *F1* key.


```
                                                          History A

     03   I     01 01      35            Port A      4
     X25: Data 00 00             LCN=02 LCGN=0
      PSH:  SI    SN=0    PSC=01    (Unknown)
            0D0A33303132333435363738393A3B3C
            3D3E3F404142434445464748494A4B4C

     03   I     02 01      35            Port A      5
     X25:  Data 00 00          LCN  =02 LCGN=0
     PSH:  SI    SN=0    PSC=01    (Unknown)
           0D0A33303132333435363738393A3B3C
           3D3E3F404142434445464748494A4B4C




     HEX   Number  I U S  HDLC+                              User+
```
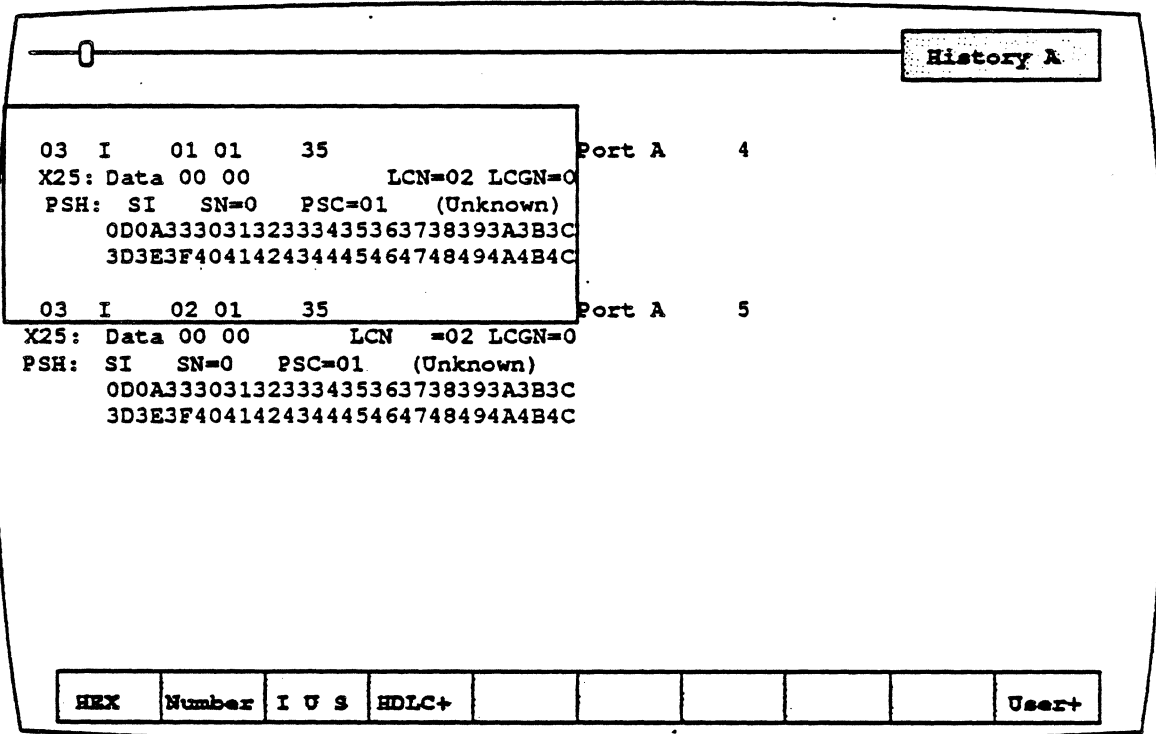
Figure 5.3: Analysis History Page with Sample PSH Traffic

HDLC   Figure 5.4 is a detail of the HDLC component from Figure 5.3. Each
                            HDLC field in this sample display is described below.
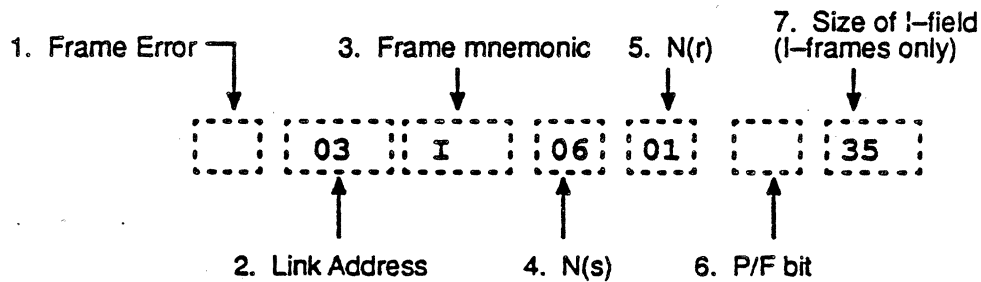
Figure 5.4: Sample HDLC Interpretation

1. Frame Errors

A single letter indicates if a frame error has occurred.

A	Aborted frame received
B	Frame with bad FCS received
(blank)	No frame error

2. Link Address

This field displays the link address.

3. Frame Mnemonic

Field 3 indicates the type of frame received, using the following
mnemonics:

Information frame:
I   I–Frame

Supervisory frames:
RR   Receiver Ready
RNR   Receiver Not Ready
REJ   Reject

Unnumbered frames:

BCN	Beacon
CFGR	Configure
DISC	Disconnect
DM	Disconnect Mode
FRMR	Frame Reject
RD	Request Disconnect
RIM	Request Initialization Mode
SABM	Set Asynchronous Balanced Mode
SARM	Set Asynchronous Response Mode
SIM	Set Initialization Mode
SNRM	Set Normal Response Mode
TEST	Test Frame
UA	Unnumbered Acknowledge
UI	Unnumbered Information
UP	Unnumbered Poll
XID	Exchange ID
(hex value)	Unknown unnumbered frame type

_4. N(s)_

This field displays the N(s) count.

_5. N(r)_

This field displays the N(r) count.

6. Poll/Final Bit

This field displays the Poll/Final bit setting.

P	Poll/final bit is set
(blank)	Poll/final bit not set

7. Size of I–Field.

This field displays the size of I–field.

(decimal value)	Size in octets
(blank)	0

PSH Packet

Figure 5.5 is a detail of the PSH component from Figure 5.3, which is a data packet. Each PSH field in this sample display is described below.
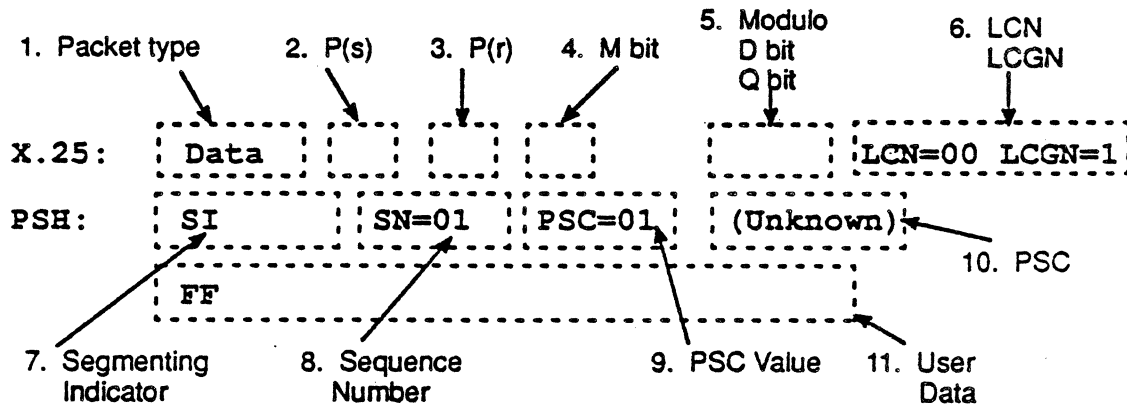
Figure 5.5: PSH Data Packet Analysis Display

1. Packet Type Mnemonic

Data Packet:
Data

Unnumbered Packets:
Call
Call Connected
Clear
Clear Confirm
Diagnostic
Interrupt
Interrupt Confirm
Reset
Reset Confirm
Restart
Restart Confirm

Supervisory Packets:
REJ
RNR
RR

2. P(s)

This field displays the P(s) count.

3. P(r)

This field displays the P(r) count.

4. M Bit

This field displays the More bit (M bit) setting.

M	M bit is set
(blank)	M bit is not set

5. Modulo, D bit, Q bit

This field indicates the modulo, and the setting of the Delivery bit (D bit), and the Qualifier (Q) bit.

(blank)	Modulo 8
E	Modulo 128
D	Delivery bit (D bit) set
Q	Qualifier bit (Q bit) set

6. LCN, LCGN

This field displays the Logical Channel Number (LCN) and the Logical Channel Group Number (LCGN).

7. Segmenting Indicator

8. Sequence Number (SN)

This field displays the data packet Sequence Number (SN) in hex. If the Packet Sequence Indicator (PSI) bit is not set, *None* is displayed.

9. PSC Value

This field displays the Physical Services Command (PSC) value in hex. If the Control Present Indicator (CPI) is not set, *None* is displayed. The PSC Values and commands are listed in Figure 5.6.

10. PSC

The field displays the Physical Services Command, if present. Commands and PSC values are listed in Figure 5.6.

PSC Value	PSC Command
01	Unknown
02	PSDISC
04	PSXID
06	PSTEST
08	PSCONTACT
Any other	Unknown

Figure 5.6: PSC Commands

11. User Data

This field displays uninterpreted user data, packet type, or message. A line of user data, or the Facilities, will wrap around to the next line if it is longer than 32 bytes.

Note

For PSH interpretation to function correctly, the size of the X.25 packet to be interpreted must be larger than the SNA packet size.

CHAPTER SIX:
SNA MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes SNA Analysis and Statistics, by focusing on the protocol–specific details of these applications. For a general description of the applications, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port with SNA as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Volume I.*

Monitor Setup Menu

When you select SNA as your protocol, you are prompted for several configurable parameters, as shown in Figure 6.1 below. Each parameter is described below.

```
┌─0─────────────────────────────────────────────[Configuration]─┐
│                      Port x Monitor Setup                      │
│                                                                │
│                                          ┌──────────────────┐  │
│                                          │ Press GO to accept│  │
│      Protocol  :    ┌─────────┐          └──────────────────┘  │
│                     │   SNA   │                                │
│                     └─────────┘                                │
│                                                                │
│          Address Selection    ┌──────────┐                     │
│          Modulo               │   No     │                     │
│          Extended addr        │   8      │                     │
│          Condensed mode       │   No     │                     │
│                               │   No     │                     │
│                               └──────────┘                     │
│          Encoding             ┌──────────┐                     │
│                               │   NRZ    │   ◄───              │
│                               └──────────┘                     │
│                                                                │
│  ┌─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┐ │
│  │ NRZ │NRZI │     │     │     │     │     │     │     │Exit │ │
│  └─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┘ │
└────────────────────────────────────────────────────────────────┘
```

Figure 6.1: SNA Monitor Setup Menu

Address Selection

Address Selection determines whether the Chameleon monitors all traffic on the line, or monitors only traffic to and from a specific address. The options are:

| | No | Analyzes all traffic on the line, regardless of address. |
| | Yes | Analyzes traffic with the specified address. If you select this option, you are prompted to enter a hex address (00–FF). and press *Return*. |

Modulo

Modulo determines the frames numbering sequence that will be used to keep track of the frames that are transmitted and received. The options are:

Modulo 8   Frames numbered from 0 – 7
Modulo 128   Frames numbered from 0 – 127

Extended
Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is used. The options are:

Yes   Extended (16–bit) addressing
No   8–bit addressing

Condensed Mode

This option enables you to view RR events in two ways:

No   Each RR is displayed as an individual event.

Yes   RRs are shown in a condensed mode. When multiple RRs occur in sequence, one RR is displayed for every 255 RRs. If a non–RR is received, the RR counter is reset, and the next RR is displayed.

This condensed display includes the normal RR fields, and the number of events (RRs) that occurred in the sequence. This enables you to view more non–RR events on a single page.

The number of events is displayed only when the acquisition information function key *F2* is set for the *Flags* option. Refer to page 6-5 for more information about *F2*.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Analysis

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 6.2 below.

```
                                                    History A
01    I   · 03 04      15                      PORT A 0
TH:   FID2   WSeg        D=02  0=00   SNF=0000
RH:   -Response FMD      OIC SDI
   D1      RT
   Sense data                         08010000
   Resource not available
01 I        01 01      12                      PORT A 1
TH:   FID2   WSeg Exp  D=02  0=00   SNF=0011
RH:   Request          SC OIC FI
      D1
 RU:  ACTLU
      Activation type            ERP
      FM Profile                   0
      TS Profile                   1
01    I     02 03 P   9                        Port A 2
TH:   FID2   WSeg        D=00  0=02   SNF-0001
RH:   +Response FMD      OIC
      D1
01    I     03 04  15                          Port A 3
TH:   FID2   WSeg        D=02  0=00   SNF=0000
RH:   -Response FMD      OIC SDI
      D1      RT
```

HEX	Number	I	SDLC+		SNA*	TH+	RH+	RU+	User-

Figure 6.2: Sample SNA Analysis Page

DCE/DTE

Frames transmitted by the DCE are displayed on the left half of the screen. Frames transmitted by the DTE are displayed on the right half of the screen.

Baud Rate Changes

A baud rate change is as shown in the displays, as follows:

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Frame level (SDLC)
- Blue = SNA
- White = User data
- Red = Errors

Interface Lead Transitions

Interface lead transitions are shown as an up arrow character ($\uparrow$) if the specified lead made a transition from low to high, or a down arrow character ($\downarrow$) if the lead made a transition from high to low. All transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The SNA Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press **F1**, the user data (in white) changes to the code indicated in the softkey strip. The options are:

EBCDIC   Each byte is displayed as an EBCDIC character (default)

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.

HEX   Each byte is displayed as a pair of hex digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides.

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   **F3** affects the page *display* only. All events are captured, regardless of the **F3** selection (unless you are running a Triggering application which captures specific traffic or events).

F4: SDLC

F4 determines how the frame level (SDLC) is interpreted and displayed. The options are:

SDLC–   SDLC is acquired, but not displayed
SDLC+   SDLC is displayed interpreted
SDLC"   SDLC is displayed raw
SDLC*   SDLC is displayed interpreted and raw

F6: SNA

F6 determines how the session level (SNA) is interpreted and displayed. The options are:

SNA–   SNA is acquired, but not displayed
SNA+   SNA is displayed interpreted
SNA"   SNA is displayed raw
SNA*   SNA is displayed interpreted and raw

_F7: TH_

F7 determines how the Transmission Header (TH) is interpreted and displayed. The options are:

TH–   TH is acquired, but not displayed
TH+   TH is displayed interpreted
TH"   TH is displayed raw
TH*   TH is displayed interpreted and raw

_F8: RH_

F8 determines how the Request/Response Header (RH) is interpreted and displayed. The RH follows the TH in the information field, and is 3 bytes in length. It functions as the header for the Request/Response Unit (RU). The options are:

RH–   RH is acquired but not displayed
RH+   RH is displayed interpreted
RH"   RH is displayed raw
RH*   RH is displayed interpreted and raw

_F9: RU_

F9 determines how the Request/Response Unit (RU) is interpreted and displayed. The RU contains the user data or network control information that is being transmitted between LUs. The sofkey options are:

RU–   RU is acquired, but not displayed
RU+   RU is displayed interpreted
RU"   RU is displayed raw
RU*   RU is displayed interpreted and raw

F10: User Data

F10 determines if user data is displayed. It also displays the traffic in a raw mode (uninterpreted). The options are:

User+   User data is displayed

User−   User data is not displayed

Raw   All traffic (data, SDLC, SNA) is displayed uninterpreted (raw) in the code selected in *F1*

SNA Display

Figure 6.3 below shows the SNA Analysis display.

TH: | FID2 | | WSEG | | Exp |

| D=0203 | | O=0405 | | SNF=0607 | | DCF=0809 |

RH: | Request | | FMD | | OIC | | SDI | | FI |

| D1 |

| Sense Data | | 08151234 |

| FUNCTION ACTIVE |

| FF |

RU: | | | |
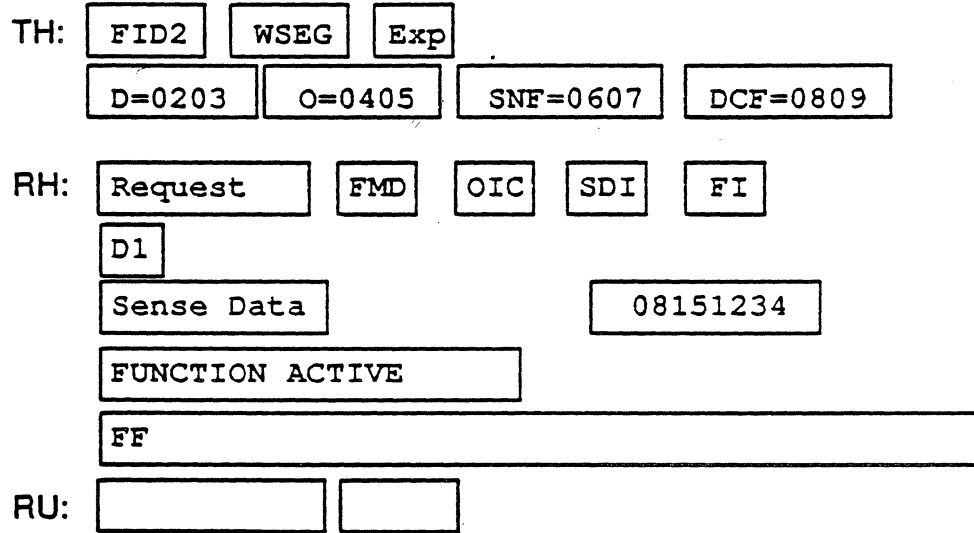
Figure 6.3: Sample SNA Traffic

SDLC Display

Figure 6.4 below shows the fields of the SDLC Analysis display.

Field 1   Field 2   Field 3

| | | 01 | | I | | 01 | | 01 | | 01 | | 01 |

Field 4   Field 5   Field 6   Field 7
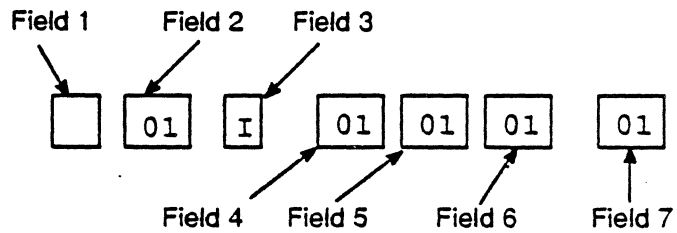
Figure 6.4: SDLC Components Analysis Display

Field 1:   Frame Abort/CRC Errors
            A   Frame abort
            B   Bad FCS (Frame Sequence Check)
            blank   Frame is OK

Field 2:   Address in hexadecimal

Field 3:   Frame type, as follows:
      I   Information Frame
      U   Unnumbered frame and mnemonic:

UI	Unnumbered Information
RIM	Request Initialization Mode
SIM	Set Initialization Mode
TEST	Test frame
SNRM	Set Normal Response Mode
DM	Disconnect Mode
DISC	Disconnect
UP	Unnumbered Poll
UA	Unnumbered Acknowledge
FRMR	Frame Reject
CFGR	Configure
RD	Request Disconnect
XID	Exchange Identification

      S   Supervisory frame and frame mnemonic:

RR	Receiver Ready
RNR	Receiver Non Ready
REJ	Reject

Field 4:   N(S) count (I–Frames only)

Field 5:   N(R) count (I and S frames only)

Field 6:   Poll/ Final Bit
      F   Final bit set (DTE)
      P   Poll bit set (DCE)
      blank   P/F bit not set .

Field 7:   Length of the I–Field in decimal if > 0 (all frame types)

TH Display

The fields of the TH display depend on the type of Transmission Header that was transmitted. The type of TH is referred to by Format Identifier (FID). There are six FID types, as shown in Figure 6.5 below:

Bit 0 1 2 3	FID Type	Length (Bytes)
0 0 0 0	FID 0	10
0 0 0 1	FID 1	10
0 0 1 0	FID 2	6
0 0 1 1	FID 3	2
0 1 0 0	FID 4	26
1 1 1 1	FID F	26

Figure 6.5: TH Types

The TH Option Mnemonics are shown in Figure 6.6 below.

Mnemonic	Description	Mnemonic	Description
IERN	Initial Explicit Route Number	WR–	(Decrement) Window Reply
ERN	Explicit Route Number	WR+	(Increment) Window Reply
VRN	Virtual Route Number	VRSSN	VR Send Sequence Number
Pri	Priority (Lo, Med, Hi)	RWI	Reset Window Indicator
TG	TG Sweep Indicator	PRQ	VR Pacing Response
ERVR	ER and VR Support Indicator	PRS	VR Pacing Request
NSNS	NonSequenced NonSupervisory	TGSNF	Transmission Group Sequence
VRPC	VR Pacing Count Indicator	OSAF	Origin Subarea Field
W–	Decrement Window Size	DSAF	Destination Subarea Field
W+	Increment Window Size	Fmt	Command Format
FIFO	TG FIFO Not Required	Type	Command Type
NPri	Network Priority		

Figure 6.6: TH Option Mnemonics

RH Display

Figure 6.7 below shows the fields of the Request/Response Header (RH) component of the SNA display. The RH contains information about the Request/Response Unit (RU).
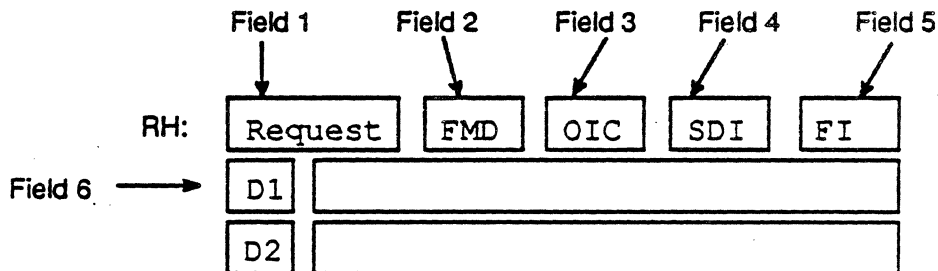
Figure 6.7: RH Component of the SNA Analysis Display

The following information may be contained in the fields shown in Figure 6.7:

Field 1:   Message type:
             Request   RU contains a request
             +Response   RU contains a positive response
             −Response   RU contains a negative response

Field 2:   RU Category:
             FMD   Function Management Data
             NC   Network Control
             DFC   Data Flow Control
             SC   Session Control

Field 3:   Begin/End Chain Indicator (shows which section of the chain has been captured):

             FIC   First In Chain
             MIC   Middle In Chain
             LIC   Last In Chain
             OIC   Only In Chain

Field 4:   Sense Data Indicator (SDI)
             SDI   Sense Data is included
             blank Sense Data not included

Field 5:   Format Indicator (FI) bit setting
               FI   Format Indicator bit is set
               blank   Format Indicator bit is not set

Field 6   Other RH Fields:

               If mnemonic appears, the relevant bit is set.   If
               mnemonic does not appear, the bit is not set.   (See
               Figure 6.8 below for possible mnemonics.)

RH Field	Description
D1	Definite Response 1
D2	Definite Response 2
RT	Exception Response Indicator
QR	Queued Response
PI	Pacing Indicator
BB	Begin Bracket
EB	End Bracket
CD	Change Direction
CS	Code Selector
ED	Enciphered Data
PD	Padded Data
CB	Conditioned End Bracket Indicator

Figure 6.8: RH Field Mnemonics

RU Display

Figure 6.9 below shows the RU component of the SNA display.
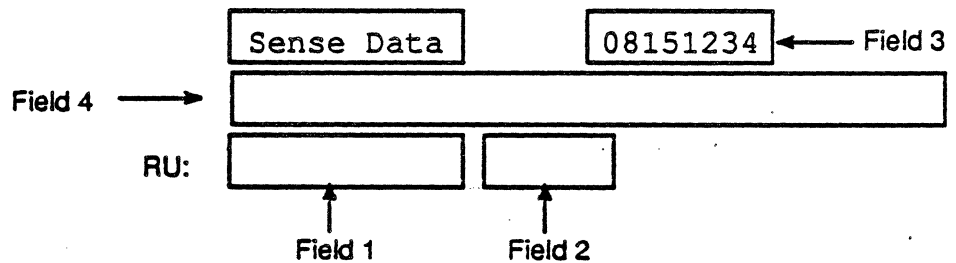
Figure 6.9: RU Component of the SNA Analysis Display

The following information may be contained in the fields shown in Figure 6.9:

Field 1:   RU name (for example BIND)

Field 2:   Value (for example 31)

If there is Sense Data, the following fields will be displayed:

Field 3:   Major Code, as follows:

        First two bytes are the major code:

        08   Request Reject
        10   Request Error
        20   State Error
        40   RH Error
        80   Path Error

        The next two bytes are the Modifier.

        The last four bytes are user sense data.

Field 4:   Meaning of the Major Code+Modifier.

SNA Statistics

SNA Statistics displays and prints statistical information about the traffic on the line. You have the ability to activate six pages that show the following statistical information:

- SDLC Line   SDLC statistics for all PUs
- SNA Session   SNA statistics for all PUs
- SDLC PU   SDLC statistics for one PU
- Session PU   SNA statistics for one PU
- SNA LU   SNA statistics for one LU
- SNA LU Line   SNA Statistics for all LUs

High Density Traffic

When monitoring dense traffic on high speed lines, the following situations may occur:

- The Statistics application might not be able to process all the traffic on the line. When this occurs, the following message appears below the banner, indicating the percentage of traffic that is being processed:

  Data Processed
  xx%

- At times the Statistics display may appear to be frozen; however, it is not. When you terminate the Statistics session by pressing *Run/Stop*, the display will be updated to reflect the data acquired up to that point.

  To then start a new statistics session, press the *Reset* function key. If you resume acquisition by pressing *Run/Stop* (instead of restarting statistics by pressing *Reset*), the maximum response time fields will include the time that acquisition was halted.

Activating SNA Statistics Pages

When you start the SNA Statistics, only the SDLC Line statistics page is activated. (If you do not know how to start the statistics application, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Volume I*, for information.)

From the SDLC Line Statistics page, you can activate the other SNA Statistics pages as shown in Figure 6.10. The function keys that you use to activate and deactivate each page are also shown.
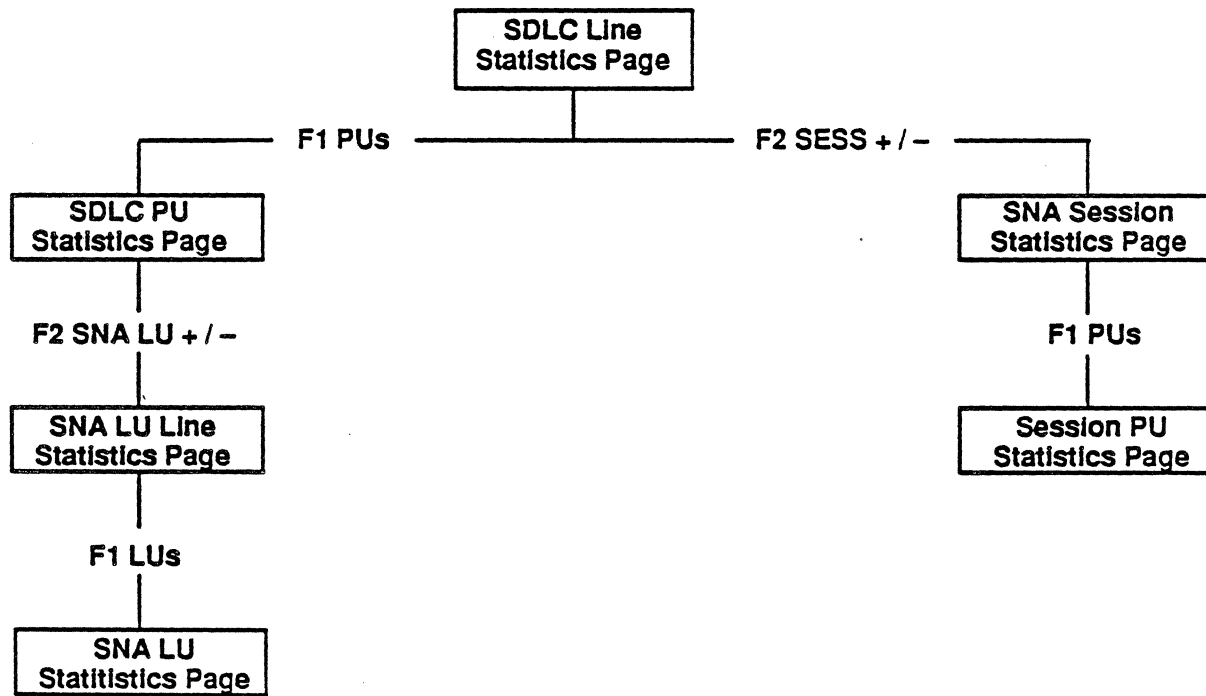
Figure 6.10: Activating SNA Statistics Pages

Each SNA Statistics page can only be activated and deactivated from other specific statistics pages. For example, a Session PU Statistics page can be activated only from an SNA Session page.

Function Keys

Each SNA Statistics page has its own set of function keys. Many of the function keys are the same for all pages. For example, the RESET function key resets all statistical values to zero in that page.

The function keys for all SNA Statistics pages are described on page 6-18.

Page Display

The page displays for the SNA Statistics pages are described on the following pages:

Note:

The following statistical fields are inactive for FID4 frames:

- Number of Polls
- Productive Polls
- Non—productive Polls
- Retries
- Frame Response
- Mean Poll Time
- Poll to Data
- Poll to Poll
- Polls/second

Total Processing Time

Several statistical fields are calculated using Total Processing Time, which is defined as:

(Elapsed time from START TIME to LAST TIME) –
(Total time lost from missed events)

The fields which are calculated using Total Processing Time are:

- Utilization fields (SDLC and SNA LU statistics pages only)
- I–Frames/sec. (SDLC statistics pages only)
- Polls/sec. (SDLC statistics pages only)
- Data bytes/sec. (SDLC statistics pages only)
- FMD bytes/sec. (LU statistics pages only)

Function Keys for SNA Statistics

Each SNA Statistics page has two softkey strips. When an SNA Statistics page is activated, the first softkey strip that appears, will be similar to the figure shown below.
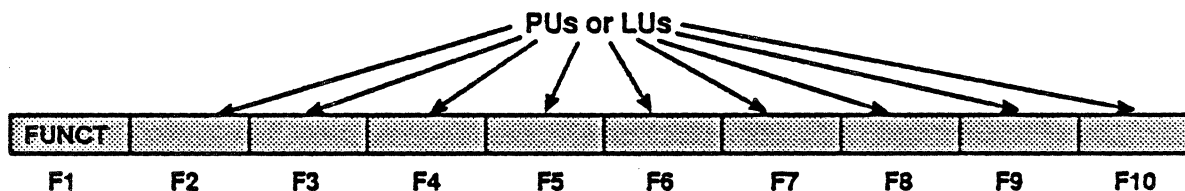
F1 FUNCT

F1 FUNCT appears in the first softkey strip for all SNA Statistics pages. When you press **F1 FUNCT**, it displays the second softkey strip for the active statistics page.

F2 – F10: PUs or LUs

In this first softkey strip, **F2–F10** display the Physical Units (PUs) or Logical Units (LUs) that are active. LUs are displayed for the SNA LU and SNA LU Line Statistics pages. PUs are displayed for the other four SNA Statistics pages.

The number of PUs or LUs that are shown in the softkey strip depends on the traffic you are monitoring. If there are more than eight PUs or LUs active, you can display the additional PUs or CUs by pressing **F9 More**.

This softkey strip enables you to activate a page which displays statistical information for a specific PU or LU. If the PU/LU has + next to it, a page has been·activated for that PU or LU. If the PU/LU has a – next to it, a page is not currently activated for that PU or LU.

To activate or deactivate a PU or LU page, press the function key that corresponds to that PU or LU. This causes the softkey strip to change to + or – for that PU or LU, and a PU or LU page to appear or disappear from the screen.

The second softkey strip displays the functions available for the active SNA statistics page. Several functions are available for all pages and some functions are available only in certain pages. The function key options are described below.

F1

PUs

The *F1 PUs* key displays the softkey strip of active PUs as described on the previous page. It is available in the following SNA statistics pages:

> SDLC Line Statistics
> SNA Session Statistics
> Session PU Statistics

LUs

The *F1 LUs* key displays the softkey strip of active LUs, as described on the previous page. It is available in the following SNA statistics pages:

> SNA LU Statistics
> SNA LU Line Statistics
> SDLC PU Statistics

F2

SNA LU+/−

This function is available in the following SNA statistics pages:

> SNA LU Statistics
> SNA LU Line Statistics
> SDLC PU Statistics

F2 SNA LU activates and deactivates a page for SNA Logical Unit (LU) statistics. If *F2 SNA LU* has + next to it, a page has been activated. If *F2 SNA LU* has a − next to it, a page is not currently activated.

To activate or deactivate an SNA LU page, press *F2*. The softkey strip should then change to *SNA LU+* or *SNA LU−* and the page should appear or disappear from the screen.

SESS+/−

F2 SESS activates and deactivates a page for SNA Session statistics. If *F2 SESS* has + next to it, a page has been activated. If *F2 SESS* has a − next to it, a page is not currently activated for SNA Session Statistics.

To activate or deactivate an SNA Session page, press *F2.* The softkey strip should then change to *SESS+* or *SESS−* and a page banner should appear or disappear from the screen.

This is available in the following SNA statistics pages:

> SDLC Line Statistics
> SNA Session Statistics
> Session PU Statistics

F3

Print

F3 Print prints a statistical report that is very similar to the screen display format. This function is available in all SNA statistics pages. A sample SDLC Line statistics report is shown on the next page.

If you have a printer connected to the Chameleon, you can print a report. *If you do not have a printer, pressing F3 has no effect.* The report is not displayed on the Chameleon screen. Refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter 6: Utilities,* for information about configuring the Chameleon to use your printer.

F4

Reset

F4 Reset resets all fields in the SNA statistics pages to zero. All currently activated SNA statistics pages are reset. This function is available in all SNA statistics pages.

```
                    TEKELEC SNA LINE STATISTICS REPORT

       START TIME:        00:00:00:000 000
       LAST TIME:         00:00:00:000 000


       PUs ACTIVE   :
       NUMBER OF POLLS (RR):     0
       PRODUCTIVE POLLS (RR)     0
       NON-PRODUCTIVE POLLS (RR) 0
                                      DCE               DTE
       I-FRAMES :                0000000000        0000000000
       FRAME RETRANSMISSIONS :    0000000000        0000000000
       RNRs                      0000000000        0000000000
       CRC ERRORS :              0000000000        0000000000
       FRAME ABORTS :            0000000000        0000000000
       FRMR :                    0000000000        0000000000
       SNRM :                    0000000000        0000000000
       UI :                      0000000000        0000000000
       BCN :                     0000000000        0000000000
       CFGR :                    0000000000        0000000000
       UP :                      0000000000        0000000000
       TEST :                    0000000000        0000000000


                              AVG     LAST      MAX       MIN
       DCE PIU LEN :          00000   00000    00000    00000
       DTE PIU LEN :          00000   00000    00000    00000
       FRAME RESPONSE TIME :  0.000   0.000    0.000    0.000
       MEAN POLL TIME :       0.000   0.000    0.000    0.000
       POLL TO DATA TIME :    0.000   0.000    0.000    0.000
       POLL FREQUENCY :       0.000   0.000    0.000    0.000
       I-FRAMES PER SECOND :     0
       POLLS PER SECOND :        0

       LINE TOTAL BYTES :        0
       DATA LINE BYTES :         0
       CONTROL LINE BYTES :      0

       LINE UTILIZATION :      00%
       DATA LINE UTILIZATION : 00%
       CONTROL LINE UTILIZATION : 00%
```

Figure 6.11: SNA Line Statistics Report

F5   Time/Date

F5 *Time/Date* affects the format of the time displayed in the START TIME and LAST TIME fields at the top of all SNA Statistics pages. This function is available in all SNA statistics pages. If *F5 Time* is selected, the time is displayed in the format:

hh:mm:ss:ddd ddd AM/PM

For example: 08:46:25:934 160 AM.

If Date is selected, the time is displayed as:

dd MMM yyyy hh:mm:ss

For example: 01 JAN 1989 08:06:45. If you are monitoring data from disk, the date represents the current system date, but the time indicates the time that the data was originally captured and stored to disk.

F6   Polls/Bytes

F6 *Polls/Bytes* determines whether the number of polls or the number of DCE/DTE bytes will be displayed as part of the statistical information. This function is available in the SDLC Line and SDLC PU pages. See page 6-24 for a description of the specific fields affected by *F6*.

Util/Bytes

F6 *Util/Bytes* determines whether the percentage of line utilization or the total number of bytes will be displayed as part of the statistical information. This function is available in the SNA Session and Session PU pages. See page 6-29 for a description of the specific fields affected by *F6*.

RUs/Bytes

F6 *RUs/Bytes* determines whether the number of Response Units (RUs) or the number of bytes will be displayed as part of the statistical information. This function is available in the SNA LU and SNA LU Line pages. See page 6-33 for a description of the specific fields affected by *F6*.

SDLC Line Statistics Page
SDLC PU Statistics Page

The SDLC Line Statistics page is shown in Figure 6.12. The SDLC PU Statistics page has the same format, except that it does not include several of the SDLC Line fields, as described below.

```
┌─0─────────────────────────────────────────────┌ SNA Line Stats ┐
│                        SDLC LINE STATISTICS
│ START TIME: 03:07:09:600 720  AM            LAST TIME: 03:07:18:352 040
│ AM
│ PU:   [61] 40 c1 c2
│
│ STATE:     POLL   DCE INFO   ┌ DTE INFO ┐  NOT READY    READY    DISCONNECT
│
│ NUMBER OF POLLS(RR):    0
│ PRODUCTIVE POLLS(RR):   0
│ NON-PROD POLLS(RR):     0
│                                             AVG      LAST    MAX      MIN
│
│ I-FRAMES:        0       0    DCE LEN:     00000    00000  00000    00000
│ REJs:            0       0    DTE LEN:     00000    00000  00000    00000
│ RETRIES:         0       0    FRAME RESP:  0.000    0.000  0.000    0.000
│ RNRs:            0       0    MEAN POLL TM: 0.000   0.000  0.000    0.000
│ FRMRs:           0       0    POLL TO DATA: 0.000   0.000  0.000    0.000
│ FRAME ABORTS:    0       0    POLL TO POLL: 0.000   0.000  0.000    0.000
│ CRC ERRORS:      0       0    I-FRAMES/SEC: 00     POLL/SEC:   0
│                              DATA BYTES/SEC: 00
│ DCE UTILIZATION:   0%        DTE UTILIZATION:   0%
│ DCE DATA: 0%                 DTE DATA: 0%
│ DCE OVERHD:  0%              DTE OVERHD:  0%
│
│ ┌──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┐
│ │ FUNCT│  61  │  40  │  c1  │  c2  │      │      │      │      │
│ └──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┘
```

Figure 6.12: SDLC Line Statistics Page

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and **F5 Date** is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM**. For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss**. For example, 01 JAN 1989 08:06:45.

The time display also depends on whether you are analyzing data from the line or from disk, since only the time (and not the date) is captured with the Direct–to–Disk application.

PU   In SDLC Line statistics, this field displays the addresses of the first 16 active PUs. In SDLC PU Statistics, it displays the address in hex of the PU selected for that page.

State   Last activity or current state of each PU. Possible states are:

- Poll
- DCE Info
- DTE Info
- Not Ready
- Ready
- Disconnect

The fields displayed below State depend on whether you select *F6 Polls* or *F6 Bytes*. If you select *F6 Polls*, the following fields are displayed:

**Number of
Polls**   Total number of polls (RRs) during session.

**Productive
Polls**   Polls (RRs) that are responded to with an I–frame. This information is also shown in a bar graph to the right of the number.

Non-productive
Polls   Polls (RRs) that are not responded to with an I-frame. This information is also shown in a bar graph to the right of the number.

If you select *F6 Bytes*, the following fields are displayed:

DCE/DTE TOTAL BYTES   This field displays the total number of bytes received from the DCE or the DTE.

I-FRAME BYTES   This field displays the number of bytes in I-frames received from the DCE or the DTE.

OVERHEAD BYTES   This field displays the number of bytes in control frames (non I-frames) received from the DCE or the DTE.

For the following fields, the statistical information for the DCE and DTE is calculated and displayed separately.

I-Frames   Number of Information frames received.

REJs   Number of Reject frames received.

Retries   Number of re-transmitted frames received.

RNRs   Number of Receive Not Ready frames received.

FRMRs   Number of Frame Reject frames received.

Frame Aborts   SDLC Line Statistics only. Number of frame aborts received.

CRC Errors   SDLC Line Statistics only. Number of DCE/DTE Cyclic Redundancy Check errors received.

**DCE/DTE
Utilization**   Displays line utilization on all PUs. Determined by calculating the number of bytes that could have been transmitted at the measured baud rate, divided by the actual number of bytes that were transmitted.

The bar graph shows the relative proportion of the time the line is utilized for the transfer of data and overhead (control) packets.

Note

The utilization fields will be blank (in both the screen and the printed report) if the baud rate is less than 50 bps.

DCE/DTE Data   Percentage of time there is user data on the line. User data is the information field of an I-frame or Request/Response Unit (RU).

**DCE/DTE
Overhead**   Percentage of time there is non-user data on the line.

For the following parameters, the average, last, maximum, and minimum times in seconds are displayed.

DCE Length   The average, last, maximum, and minimum length of a DCE I-frame.

DTE Length   The average, last, maximum, and minimum length of a DTE I-frame.

**Frame Response
Time**   The time between the end of an I-frame and the end of the frame carrying the N(R) confirmation for that I-frame.

Mean Poll Time   One-half the time between polls to the same PU.

Poll to Data Time   The time from a poll to the completion of the I-frame responding to that poll.

Poll to Poll Time   SDLC Line Statistics only. The time from a poll to the next poll on any address.

I–Frames/Sec   The total number of I–frames, divided by the total number of seconds, rounded down.

Polls/Sec   The total number of polls, divided by the total number of seconds, rounded down.

Data Bytes/Sec   The average number of data bytes per second.

SNA Session Statistics Page

SNA Session PU Statistics Page

The format of the SNA Session and SNA Session PU Statistics pages is shown in Figure 6.13. Each field of the display is described below.

```
——0————————————————————————————————————        SNA Session A

                        SNA SESSION STATISTICS
    START TIME: 00:00:00:000 000   AM        LAST TIME: 00:00:00:000 000    AM

    PU:

    LINE UTILIZATION:   00%

    COMMAND       REQ    +RESP  +RESP                    AVG    LAST   MAX    MIN
    ACTPU:        0      0      0        DCE RESP:       0.000  0.000  0.000  0.000
    DACTPU:       0      0      0        DTE RESP:       0.000  0.000  0.000  0.000
    ACTLU:        0      0      0     .  DCE DELTA:      0.000  0.000  0.000  0.000
    DACTLU:       0      0      0        DTE DELTA:      0.000  0.000  0.000  0.000
    BIND:         0      0      0
    UNBIND:       0      0      0
    SDT:          0      0      0
    CLEAR:        0      0      0
    ACTCDRM:      0      0      0
    DACTCDRM:     0      0      0
    STSN:         0      0      0
    RQR:          0      0      0
    CVR:          0      0      0

    PU#    SESS+   PRINT   RESET   TIME   UTIL
```

Figure 6.13: SNA Session/SNA Session PU Statistics

The SNA Session statistics page contains the session information described below.

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM**. For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss**. For example, 01 JAN 1989 08:06:45.

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

PU   The Physical Units (PUs) active during the session, shown in hex.

**Line
Utilization**   This field appears only if you selected *F6 Util.* It displays the percentage of time the line is being used for all traffic.

Note   The utilization field will be blank (in both the screen and the printed report) if the baud rate is less than 50 bps.

Total Bytes   This field appears only if you selected *F6 Bytes.* It displays the total number of bytes transmitted during the session.

SNA Commands

The SNA Session page indicates the number of Requests (REQ), positive responses (+RESP), and negative responses (-RESP) for the following commands:

ACTPU
Activate Physical Unit.. Establishes the SSCP-PU session, permitting data to flow between the host and a devices. After the PU is activated, session may be established with the LUs.

DACTPU
Deactivate Physical Unit. Sent by the operator to conclude the SSCP-PU session.

ACTLU
Activate Logical Unit. Sets the states and parameters for SSCP-LU sessions.

DACTLU
Deactivate Logical Unit. Sent by an operator to terminate an SSCP-LU session.

BIND
The BIND commands determines the session parameters and protocol options for establishing LU-LU sessions.

UNBIND
The UNBIND command terminates a LU-LU session. It is sent when a terminal logs off, at the conclusion of an application program, or when certain types of errors occur.

SDT
Start Data Traffic. SDT is sent by primary session control to secondary session control to enable the sending and receiving of FMD and DFC requests and responses by both half-sessions.

CLEAR
Clear is sent by primary session control to reset the data traffic FSMs and subtrees (for example, brackets, pacing, sequence numbers) in the primary and secondary half-sessions (and boundary function, if any).

ACTCDRM
Activate Cross-Domain Resource Manager. ACTCDRM is sent from one SSCP to another SSCP to activate a session between them and to exchange information about the SSCPs.

DACTCDRM
Deactivate Cross Domain Resource Manager. DACTCDRM deactivates an SSCP-SSCP session.

STSN   Set and Test Sequence Numbers. STSN is sent by the primary half–session sync point manager to resynchronize the values of the half–session sequence numbers, for one or both of the normal flows at both ends of the session.

RQR   Request Recovery. RQR is sent by the secondary to request the primary to initiate recovery for the session, by sending CLEAR or to deactivate the session.

CRV   Cryptography Verification. CRV is a valid request only when session–level cryptography was selected in BIND. It is sent by the primary LU session control to verify cryptography security, so that both half–sessions can send and receive FMD requests.

Timing Statistics

The remaining fields display the average, last, maximum, and minimum times, as described.

DCE RESP   The time between a frame sent from the DCE side and the acknowledging frame from the DTE side.

DTE RESP   The time between a frame sent from the DTE side and the acknowledging frame from the DCE side.

DCE DELTA   The time between the last two DCE frames received.

DTE DELTA   The time between the last two DTE frames received.

SNA LU Statistics Page
SNA LU Line Statistics Page

The format of the LU Statistics and the LU Line Statistics pages are the same, as shown in Figure 6.14. Each field of the display is described below.

```
 ┌─O─────────────────────────────────────────────┌─SNA LU Line A─┐
 │                          LU LINE STATISTICS    └───────────────┘
 │ START TIME: 03:07:09:600 720        LAST TIME: 03:07:18:352 040
 │ PU: 01
 │ LU: 02
 │
 │
 │ STATE:    BIND  INBOUND   OUTBOUND   UNBIND   SENSE    STATUS
 │
 │ RUs:         305
 │ FMD RUs:     203   ▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭
 │ CONTROL RUs: 102   ▭▭▭▭▭▭▭▭▭
 │                                         AVG    LAST   MAX    MIN
 │ BIND:        0           INBOUND LEN:  00017  00017  00017  00017
 │ TRANSACTIONS: 0          OUTBOUND LEN: 00011  00011  00011  00011
 │ USER REQS:   0           DCE RESP:     0.000  0.000  0.000  0.000
 │ BID:        0            DCE DELTA:    0.018  0.025  0.025  0.011
 │ SENSE DATA:  102         DTE RESP:     0.000  0.000  0.000  0.000
 │ LUSTAT:     0            DTE DELTA:    0.000  0.000  0.000  0.000
 │ NEG RESP:    102         FMD BYTES/SEC: 0
 │ UTILIZATION:   32%
 │ FMD DATA:  4%    ▭▭▭▭▭▭▭▭▭
 │ CONTROL:  28%    ▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭▭
 │
 │ ┌─────┬──────┬──────┬──────┬──────┬──────┬─────┬─────┬─────┬─────┐
 │ │ LUs │SNA LU│PRINT │RESET │TIME  │ RUs  │     │     │     │     │
 │ └─────┴──────┴──────┴──────┴──────┴──────┴─────┴─────┴─────┴─────┘
```

Figure 6.14: SNA LU Line/SNA LU Statistics Page

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

Start Time	If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.
	If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.
Last Time	If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.
	If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.
PU	Address of the PU in hex.
LU	Logical Units currently active in hex.
State	The state of the LU from which the last event was received. Possible states are: BIND, INBOUND, OUTBOUND, UNBIND, SENSE, and STATUS

Response Unit Statistics

The next area of the page displays information about Response Units (RUs) and is affected by the *F6 RUs/Bytes* key. If *F6 RUs* is selected, the following fields are displayed:

RUs	The number of SNA frames with an RU field. The RUs can be Requests or Responses
FMD RUs	All Function Management Data (FMD) RUs:
	Configuration Services
	Maintenance Services
	Measurement Services
	Management Services
	Network Operator Services
	Session Services
Control RUs	Data, Session, and network control Response Units..

If **F6 Bytes** is selected, the following fields are displayed:

RU Total Bytes	The total number of bytes in all RUs.
FMD Bytes	The total number of bytes in all function Management Data (FMD) RUs.
Control Bytes	The total number of bytes in all Data, Session, and network control Response Units.

The remaining fields in the SNA pages are described below.

BIND	The number of BIND sessions on the line. A BIND is sent from a primary LU to a secondary LU to activate a session between the LUs. The secondary LU uses the BIND parameters to determine whether it will respond positively or negatively to BIND.
TRANSACTIONS	The number of all transactions on the line.
USER REQS	The number of all requests on the line.
BID	The number of all BIDs. BID is used by the bidder to request permission to initiate a bracket.
SENSE DATA	The number of response frames containing Sense data (frames with the SDI bit set).
LUSTAT	The number of Logical Unit Status (LUSTAT) on the line. LUSTAT is used by one half-session to send four bytes of status information to its paired half-session.
NEG RESP	The number of negative responses on the line.

Line Utilization

Note:

Utilization	Percentage of total line utilization. The number of bytes that have been sent divided by the number of bytes that could have been
	The utilization field will be blank (in both the screen and the printed report) if the baud rate is less than 50 bps.
FMD Data	Percentage of FMD data frames received. The number of FMD data frames received divided by the total number of frames received.
Control	Percentage of control frames received. The number of control frames received divided by the total number of frames received.

Length and Timing Statistics

These fields display the maximum, minimum, average, and last values as described below.

Inbound Len	The length of all inbound frames.
Outbound Len	The length of all outbound frames.
DCE Resp	The time between a frame sent from the DCE side and the acknowledging frame from the DTE side.
DTE Resp	The time between a frame sent from the DTE side and the acknowledging frame from the DCE side.
DCE Delta	The time between the last two DCE frames received.
DTE Delta	The time between the last two DTE frames received.
FMD Bytes/Sec	The average number of bytes per second received in Function Management Data messages.

CHAPTER SEVEN:
ASYNC MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes protocol-specific information about Async Monitoring. Since the Statistics application is not available for Async, this section describes the Analysis application only. For a general description of Analysis, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port and select Async as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or the Chameleon 20 User's Guide, Chapter 3.*

Monitor Setup Menu

When you select Async as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 7.1. Each parameter is described on the next page.

Figure 7.1: Async Monitor Setup Parameters

Baud Rate

The baud rate specifies the speed of the data transmission (bits per seconds) on the line being monitored. When the red screen arrow is at baud rate, the options are displayed in the softkey strip. *F9 More* displays additional baud rate options. The available baud rates are:

75	2400
110	4800
300	9600
600	19200
1200	

Parity

Parity is the error checking technique used for the Async protocol. A parity bit may follow the data bits. The parity bit is sent by the transmitter and indicates whether an odd number or an even number of 1s were transmitted in the data bits. The receiver determines the number of 1s received, and compares the result to the parity bit. If the parity bit indicates that an odd number of 1s were transmitted, but an even number of 1s were received, the receiver recognizes that an error has occurred. The options are:

Even
Odd
None

Data Bits

Data bits determines how many bits are used to identify a single character. This is determined by the code set being used. For example, ASCII code generally uses 7 data bits to transmit one character. The options are:

5
6
7
8

ANALYSIS

Analysis provides two pages: Real Time and History.

The Real Time page displays traffic as it is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 7.2. The page components are described on the following pages.

Transmitted character in hex

Transmitted character in selected code (See F1 key.)

Optional field: Event Number (See F2 key.)

```
                                              History

    20              Port A   113
    20              Port A   114
    41     A        Port A   115
    53     S        Port A   116
    59     Y        Port A   117
    4E     N        Port A   118
    43     C        Port A   119
    20              Port A   120
    54     T        Port A   121
    41     A        Port A   122
    53     S        Port A   123
    4B     K        Port A   124
    20              Port A   125
    53     S        Port A   126
    54     T        Port A   127
    41     A        Port A   128
    54     T        Port A   129
    55     U        Port A   130
    53     S        Port A   131
    20              Port A   132

  ASCII   Number                                              User+
```

Figure 7.2: Analysis Page with Sample Async Traffic

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The Async Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hexadecimal digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed at the end of each display line. The options are:

Number   Event number in decimal (default)

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

None   No acquisition information is displayed

The port which received the event is displayed (**Port A** or **Port B**) as part of the acquisition information, unless the **None** option is selected.

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in *F1*

CHAPTER EIGHT:
BSC MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes BSC Analysis and Statistics, by focusing on the protocol–specific details of these applications. For a general description of the applications, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port and select BSC as the protocol. If you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Volume I, Chapter 3.*

Note: **The maximum rate at which BSC data can be monitored by the Chameleon is 19.2 kbps.**

Monitor Setup Menu

When you select BSC as your Monitoring protocol, you are prompted for several configurable parameters as shown in Figure 8.1. Each of these parameters is described on the following page.

Figure 8.1: BSC Monitor Setup Page

Coding

Coding enables you to select the code set being monitored. The options are:

ASCII   If you select ASCII coding, you can select a parity setting. Parity is used for error checking when ASCII code is used. The Parity options are None, Odd and Even.

EBCDIC   If you select EBCDIC coding there is no Parity option.

Sync 1 and 2

For EBCDIC coding the default value is 32 hex for both synchronizing characters 1 and 2. For ASCII coding, Sync char 1 and Sync char 2 default value is 16 hex. You can change the Sync 1 ·and Sync 2 character values by entering a two–digit hex string.

Block Check

Block check enables you to specify what type of calculation should be used to determine the Block Check Characters (BCC) for error checking blocks of data. The options are:

LRC   Longitudinal Redundancy Check which uses the polynomial $x^8 + 1$.

CRC16   Cyclic Redundancy Check which calculates a two–byte CRC using the polynomial: $x^{16}+x^{15}+x^2+1$.

CCITT   The CCITT CRC uses the polynomial $x^{16}+x^{12}+x^5+1$.

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 8.2. The page components are described on the following pages.

```
      DCE            Event number (optional           DTE
                     field). See F2 key.
```

```
┌─────────────────────────────────────────────────────────────┐
│  C=60 T=40 Response    2          Port A 2015    History A   │
│  ACK1                                                         │
│  10 61                                                        │
│                        Port A 2016    C=60 T=40 Response    1 │
│                                       EOT                     │
│                                       37                      │
│                        Port A 2017    C=40 T=7F Gn. Poll    5 │
│                                       40 40 7F 7F 2D          │
│  C=40 T=7F Text        11          Port A 2018               │
│  02 40 C1 7D D9 C2 11 D9 C1 82 03                             │
│                        Port A 2019    C=40 T=7F Response    2 │
│                                       ACK1                    │
│                                       10 61                   │
│  C=40 T=7F Response    1          Port A 2020               │
│  EOT                                                          │
│  37                                                           │
│                        Port A 2021    C=40 T=7F Response    1 │
│                                       EOT                     │
│                                       37                      │
│                        Port A 2022    C=60 T=40 Select     5 │
│                                       60 60 40 40 2D          │
│  C=60 T=40 Response    2          Port A 2023               │
│ HEXS  Number                                        User+   │
└─────────────────────────────────────────────────────────────┘
```

Figure 8.2: Analysis Page with Sample BSC Traffic

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The Async Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press **F1**, the user data changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are handled by ignoring the high order bit, making 80 = 00, and interpreting it accordingly.

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hexadecimal digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed at the end of each display line.

Number   Event number in decimal (default)

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

None   No acquisition information is displayed

The port receiving the event (**Port A** or **Port B**) is displayed as part of the acquisition information, unless the **None** option is selected.

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code
                   selected in *F1*

BSC ANALYSIS INTERPRETATION

This section identifies the components of the BSC Analysis page display. Figure 8.3 shows a sample BSC History page. The area in the box is described in detail in this section.

In this example, the user data is shown in hex pairs separated by spaces, since HEXS is the code displayed in the softkey strip for the *F1* key.

```
┌─────────────────────────────────────────────────────────────────────┐
│ ──O──                                              │ History A │     │
│                                                                       │
│   C=60 T=40 Response   2            Port A 2015                       │
│   ACK1                                                                │
│   10 61                                                               │
│                        Port A 2016    C=60 T=40 Response   1          │
│                                       EOT                             │
│                                       37                              │
│                        Port A 2017   ┌C=40 T=7F Gn. Poll   5┐         │
│                                      │40 40 7F 7F 2D        │         │
│   C=40 T=7F Text       11            └Port A 2018───────────┘         │
│   02 40 C1 7D D9 C2 11 D9 C1 82 03                                    │
│                        Port A 2019    C=40 T=7F Response   2          │
│                                       ACK1                            │
│                                       10 61                           │
│   C=40 T=7F Response   1            Port A 2020                       │
│   EOT                                                                 │
│   37                                                                  │
│                        Port A 2021    C=40 T=7F Response   1          │
│                                       EOT                             │
│                                       37                              │
│                        Port A 2022    C=60 T=40 Select   5            │
│                                       60 60 40 40 2D                  │
│   C=60 T=40 Response   2            Port A 2023                       │
│ ┌─────┬──────┬───┬───┬───┬───┬───┬─────┬───┬──────┬───────┐          │
│ │HEXS │Number│   │   │   │   │   │  ƒ  │   │      │ User→ │          │
│ └─────┴──────┴───┴───┴───┴───┴───┴─────┴───┴──────┴───────┘          │
└─────────────────────────────────────────────────────────────────────┘
```
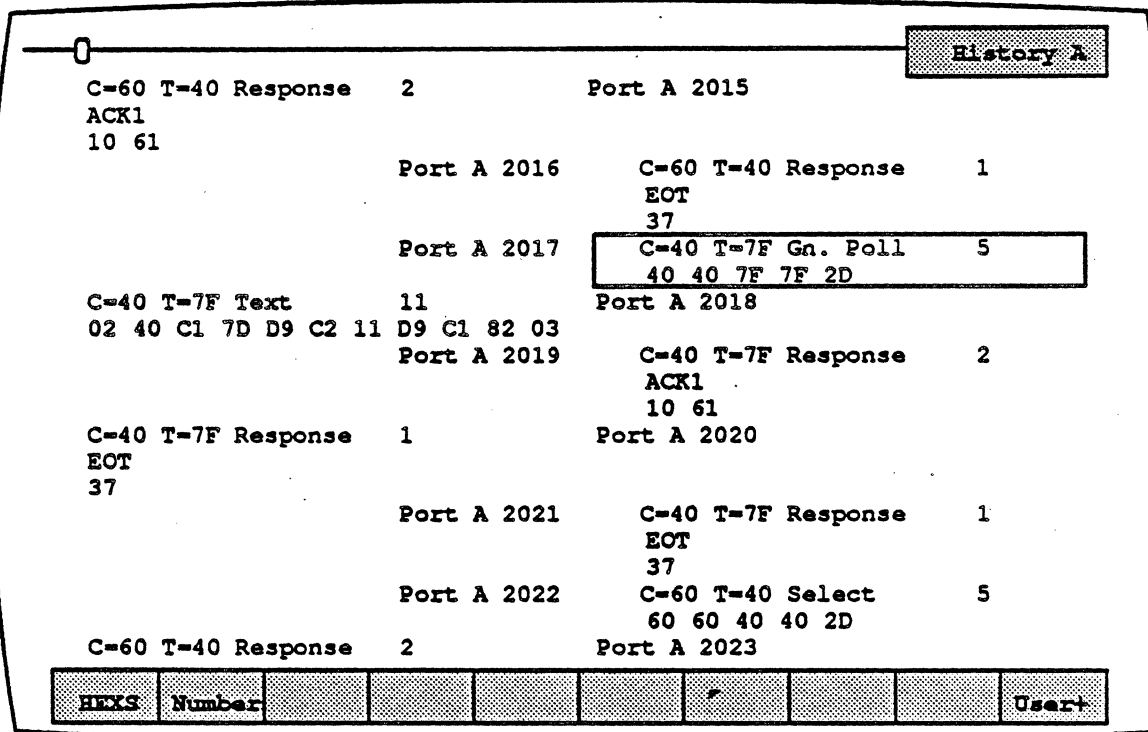
Figure 8.3: Analysis History Page with Sample BSC Traffic

Figure 8.4 is a detail of the BSC display from Figure 8.3. Each field in this sample display is described below.
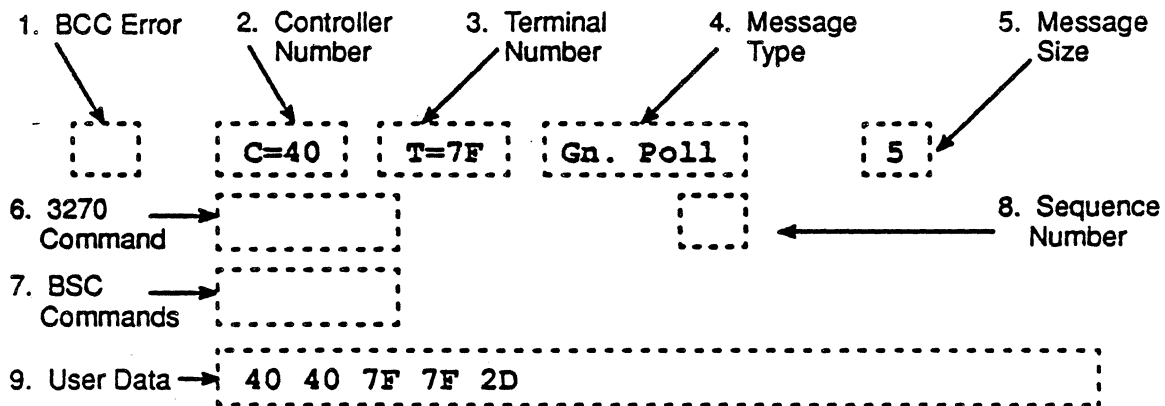
Figure 8.4: BSC Display Components

1. **BCC Errors**

   B   BCC error

   (blank)   No BCC error

2. **Controller Address**

   This field displays the address of the controller, as derived from the acquisition. This can have the select or poll address (C1 or 61)

3. Terminal Address

This field displays the terminal number, as derived from the P1 board. **7F** indicates a General Poll.

4. Message Type

This field displays the message type, as derived from the P1 board, and will be one of the following:

Gn. Poll (General Poll)
Invalid (error)
Poll
Response
Select
Status
Test
Text
Unknown

5. Message Size

This field displays the message size in decimal.

6. 3270 Commands

This field displays the 3270 command, if applicable, as derived from the analysis of message type 021Bxx. For example:

7. BSC Commands

This field displays the BSC commands. It will be one of the following:

ACK0
ACK1
ENQ
EOT
ITB
NAK
RVI
TTD
WACK

8. Status Mnemonic

If the message type (field 4) is **Status**, this field displays one or more of the status mnemonics shown in Figure 8.5.

	Status	
	Mnemonic	**Description**
Sense Status 0	DB	Device Busy
	US	Unit Specify
	DE	Device End
	TC	Transmission Check Bit Set
Sense Status 1	EC	Equipment Check
	DC	Data Check
	CC	Control Check
	OC	Operation Check
	CR	Command Reject
	IR	Intervention Required

Figure 8.5: BSC Status Mnemonics

A second line may appear, depending on the message, containing:

Status   Sense data explanation

Test   Interpretation of 3270 command code

9. User Data

This field displays uninterpreted user data and messages.

BSC STATISTICS

Introduction

BSC Statistics displays and prints statistical information about the traffic on the line. You have the ability to activate pages that show the following statistical information:

- BSC Line   Displays statistics for all Control Units (CUs)
- BSC CU   Displays statistics for specified CUs

When you start BSC Statistics, the BSC Line statistics page is displayed as shown in Figure 8.6. This page displays statistics for all Control Units (CUs) on a BSC line. The format of this page is described on the following page.

If you do not know how to start BSC statistics, refer to the *Chameleon 32* or *Chameleon 20 User's Guide, Chapter 3.*
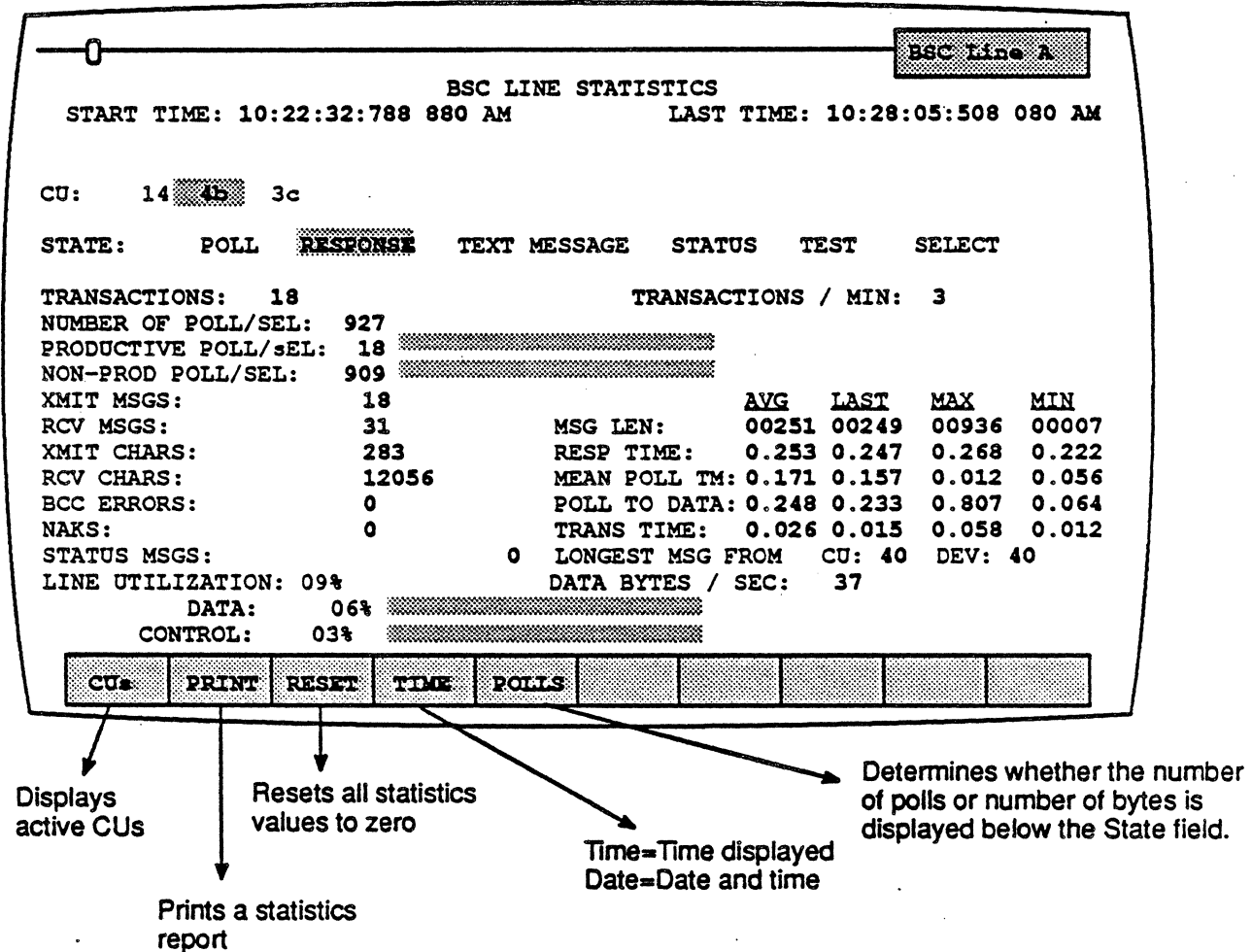
Figure 8.6: BSC Line Statistics Page

Time Display

The format of the START TIME and LAST TIME fields depends on whether you select *F5 Time* or *F5 Date*.

If *F5 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM. **dddddd** is equivalent to .dddddd seconds in decimal.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

The time display also depends on whether you are analyzing data from the line or from disk, since only the time (and not the date) is captured with the Direct–to–Disk application.

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and *F5 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Active CUs/Devices

Following the time/date display is information about the active Control Units (CUs) or devices, as described below.

CU   This field appears in the BSC Line Statistics page. It displays the addresses of the active Control Units (CUs) in hex. The highlighted CU is the CU from which the last message was received.

Note that select addresses are not displayed but accumulated for the CU addresses.

DEV   This field appears in the BSC CU Statistics page. It displays the addresses of the active devices being monitored. **GP** appears if a General Poll was detected. The highlighted device is the device from which the last message was received.

.State · The highlighted field shows the state of the CU from which the last message was received. The possible states are:

A POLL is communication initiated by the host to solicit communication from a device. A specific poll is to a specific device on a CU. A general poll can be to any device on a CU.

A RESPONSE is the CU's or host's acknowledgment of a text message or Poll.

A TEXT MESSAGE is information received from individual CUs or by the host. Text messages are defined as starting with STX or SOH, and ending with ETX, ETB, or ITB.

A STATUS message contains the sense/status information about the active device.

TEST is a TEST Request message.

SELECT indicates that a Selected Poll has been transmitted from the host to a specific device.

Transaction Statistics

Below the CU STATE display are two fields with statistical information about the transactions.

TRANSACTIONS This field displays the number of transactions completed by all devices. A transaction is the completion of a full cycle of communication, started by a device's text message and ended by an acknowledgement from the host to that same device. The sequence begins with a Start of Text (STX) and ends with an Acknowledgment (ACK) from the host, of an End of Text (ETX).

TRANSACTIONS/MIN This field displays the number of transactions divided by the number of minutes. If the number of transactions per minute is less than one, zero is displayed.

Polls/Bytes
Statistics

Below the Transaction display are three fields which display either the number of Polls or the number of bytes transmitted, depending on the selection made with the *F5* key.

If *F5 Polls* is selected, the following fields are displayed:

Number of
Polls/Sel   This field displays the number of Polls (general or specific) and Selects received from the host.

Productive
Polls/Sel   The number of productive Polls and Selects, which are the polls responded to by a Text Message or an Acknowledgement (ACK). This statistic is also shown as a bar graph that represents the proportion of all polls that were productive.

Non—Productive
Polls/Sel   The number of non—productive Polls and Selects, which are polls responded to with an End of Transmission (EOT). This statistic is also shown as a bar graph that represents the proportion of all polls that were non—productive.

If *F5 Bytes* is selected, the following fields are displayed:

Total Bytes   The total number of bytes transmitted in all messages.

Data Bytes   The total number of bytes transmitted in all data messages.

Control Bytes   The total number of bytes transmitted in all control messages.

Transmit/Receive Statistics

The following fields display statistical informaton about the number of transmitted/received messages and characters.

Xmit Messages	This field displays the number of text messages received from the DCE side. This may be the host or the CU, depending on the configuration.
Rcv Messages	This field displays the number of text messages received from the DTE side. This may be the host or the CU, depending on the configuration.
Xmit Chars	This field displays the number of characters in text messages received from the DCE side. This may be the host or the CU, depending on the configuration.
Rcv Chars	This field displays the number of characters in text messages received from the DTE side. This may be the host or the CU, depending on the configuration.

Error and Status Statistics

BCC Errors	This field displays the number of received messages that contained Block Check Character (BCC) errors.
NAKS	This field displays the number of Negative Acknowledgments (NAKS) received.
Status Msgs	This field displays the number of Status Messages received.

Line Utilization Statistics

The bottom of the BSC Line Statistics page displays three fields with information about line utilization.

Note

Utilization fields will be blank (in both the screen and the printed report) if the baud rate is less than 50 bps.

Line Utilization

This field displays the line utilization for all CUs and all message types. The utilization is shown as a percentage.

Data

This field displays the percentage of time the line is used for text messages. Text messages are defined as the number of bytes in a text message, including STX and ETX, but not including BCC characters. This statistic is also shown as a bar graph so that you can quickly compare the proportion of the line being used for data and control.

Control

This field displays the percentage of the time the line is utilized for control messages. Control is defined as Poll and Response messages, including two PAD characters for each message. This statistic is also shown as a bar graph so that you can quickly compare the proportion of the line being used for data and control.

Time and Length Statistics

The remaining fields display statistical information for message lengths and various transmission times. For these fields, the average, last, maximum, and minimum values are displayed.

Msg Len

This field displays the average, last, maximum, and minimum length of text messages received.

Resp Time

This field displays the total response time, which is defined as the sum of the Mean Poll Time, the Poll to Data Time, and the Transaction Time.

Mean Poll Tm   This field displays the mean poll time, which is defined as the mean time to the next Poll (half the time between Polls to a given device).

Poll to Data   This field displays the time from the poll of a given device to the end of the text message from the device.

Trans Time   This field display the time duration of a transaction. A transaction is the completion of a full cycle of communication started by a device's text message and ended by that device's acknowledgement of the host's message to the same device.

The sequence begins with a Start of Text (STX) and ends with an Acknowledgment (ACK) of an End of Text (ETX). Transaction time measurement begins with the end of the text message from the device and ends with the end of the device Acknowledgement of the last message

Longest Message from CU/DEV   This field indicates the CU/device which transmitted/received the longest message. The message could have been transmitted from the CU/device to the host, or from the host to the CU/device.

If the longest message was a General Poll from the host, the DEV field will display GP. This indicates that the message was transmitted to all devices connected to the CU.

Data Bytes/Sec   This field displays the number of text message data bytes received per second.

Function Keys for BSC Statistics

There are four function keys available for BSC Statistics. These are shown and briefly described in Figure 8.6. These keys are available for for all BSC Statistics pages. A complete description of each key is provided below.

F1 CUs / FUNCT

You can activate a page which displays statistical information for a specific Control Unit (CU) that is active on the line. *F1 CUs* displays the active CUs in the softkey strip at the bottom of the screen.

In the softkey strip, if the CU has + next to it, a page has been activated for that CU. If the CU has – next to it, a separate page has not been activated for that CU.

When the CUs are displayed in the softkey strip at the bottom of the screen, the *F1* key displays *FUNCT*. If you press *F1 FUNCT*, the softkey strip with the statistics functions is displayed. In other words, *F1* switches you between the Statistics functions and the active CUs.

To activate a statistics page for an CU, perform these steps:

1. Make one of the BSC Statistics pages active. (You can activate and deactivate CU pages from any BSC Statistics page.)

2. If the active CUs are not displayed in the softkey strip, press *F1 CUs* to display them.

3. Press the function key that corresponds to the desired CU. This causes a page banner for that CU to be displayed at the bottom of the screen. The CU softkey strip should also show a + next to the CU.

4. You can then make the new page active and use its function keys.

   The CU statistics functions keys are identical to the BSC Line page function keys.

   The CU display is similar to the BSC Line display, except that the CU page does not have the Longest Message from CU field, and it includes a DEV field which displays the addresses of the active devices.

To deactivate a page for an CU, perform these steps:

1.   Make one of the BSC statistics pages active.

2.   If the active CUs are not displayed in the softkey strip, press *F1 CUs* to display them.

3.   Press the function key that corresponds to the desired CU. The CU softkey strip should show – next to the CU in the softkey strip and the CU page should disappear.

F2 PRINT

F2 PRINT prints a statistical report that is similar to the screen display format. If you have a printer connected to the Chameleon, you can print a report. If you do not know how to connect a printer to the Chameleon, refer to the *Chameleon 32* or *Chameleon 20 User's Guide, Chapter 9.*

If you do not have a printer connected to the Chameleon, pressing **F2 Print** *has no effect.* The report will not be shown on the Chameleon screen. A sample BSC Line statistics report is shown in Figure 8.7.

```
                    TEKELEC BSC LINE STATISTICS REPORT

   START TIME:        10:22:32:788  880
   LAST TIME:         10:28:05:508  080

   CUs ACTIVE:

   NUMBER OF TRANSACTIONS :   18
   TRANSACTIONS PER MINUTE :  3

   NUMBER OF POLL/SEL :       927
   PRODUCTIVE POLL/SEL :      18
   NON-PRODUCTIVE POLL/SEL:   909

   BCC ERRORS :               0000000000
   STATUS MESSAGES :          0000000000
   TEST REQUESTS :            0000000000

                              DCE             DTE
   TEXT MESSAGES :            0000000018      0000000031
   EOTs  :                    0000000896      0000000073
   ACKs  :                    0000000063      0000000018
   NAKs  :                    0000000000      0000000000
   WACKs  :                   0000000000      0000000000
   RVIs  :                    0000000000      0000000000

   LONGEST MESSAGE FROM    CU : 40            DEV : 40

                              AVG      LAST     MAX      MIN

   MESSAGE LENGTH :           00251    00249    00936    00000
   MEAN POLL TIME :           0.171    0.157    0.012    0.056
   POLL TO DATA TIME :        0.248    0.233    0.807    0.064
   TRANSACTION TIME :         0.026    0.015    0.058    0.012
   OVERALL RESPONSE TIME :    0.253    0.247    0.268    0.222

   DCE CHARACTER COUNT :               1305
   DCE TEXT CHARACTERS :               283

   DTE CHARACTER COUNT :               17025
   DTE TEXT CHARACTERS :               12056

   LINE UTILIZATION :         09%
   DATA LINE UTILIZATION :    06%
   CONTROL LINE UTILIZATION:  03%
```

Figure 8.7: BSC Statistical Report

F3 Reset

F3 Reset resets the statistics values to zero and resets the times (or dates) displayed at the top of the page. This resets the values on all BSC statistics pages that are currently activated.

F4 Time/Date

F4 Time/Date affects the format of the time displayed in the START TIME and LAST TIME fields at the top of each BSC Statistics page.

If *F4 Time* is selected, the times are displayed in the format:

hh:mm:ss:ddd ddd AM/PM

For example: 08:46:25:934 160 AM. **ddd ddd** is equivalent to .dddddd in decimal.

If Date is selected, the time is displayed in the following format:

dd MMM yyyy hh:mm:ss

For example: 01 JAN 1989 08:06:45.

F5 Polls/Bytes

The *F5 Polls/Bytes* key determines whether the number of polls or the number of bytes is displayed below the Transaction fields.

If *F5 Polls* is selected, the following fields are displayed with the number of polls indicated:

    Number of polls
    Productive Polls
    Non–Productive Polls

If *F5 Bytes* is selected, the following fields are displayed with the number of bytes indicated:

    Total Bytes
    Data Bytes
    Control Bytes

CHAPTER NINE:
DPNSS MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes Digital Private Network Signaling System (DPNSS) Analysis, by focusing on the protcol–specific details of the application. For a general description of Analysis, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port and select DPNSS as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Volume I, Chapter 3.*

Monitor Setup Menu

When you select DPNSS as your Monitoring protocol, you are prompted for configurable parameters as shown in Figure 9.1 and described below.
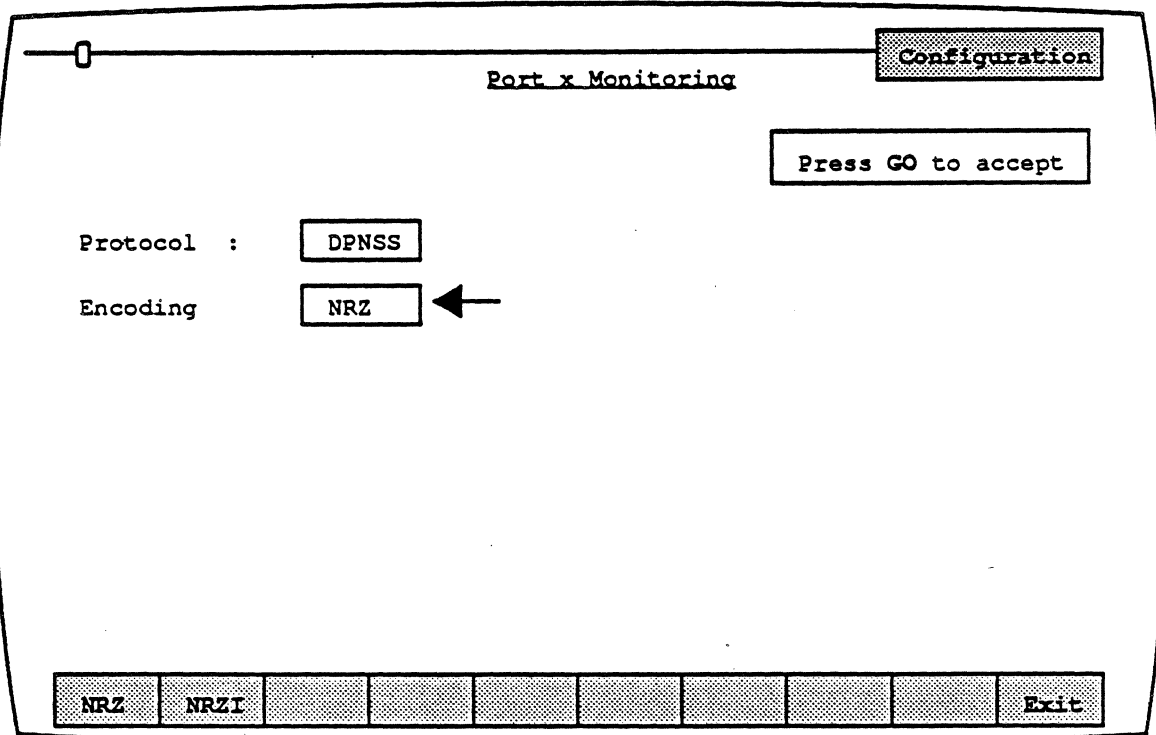
Figure 9.1: DPNSS Monitor Setup Menu

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCT/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it. The components of the display are described on the following pages.

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames transmitted from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below (example: the new baud rate is 9600)

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Layer 2
- Yellow = Layer 3
- White = User data
- Red = Errors (for example, incomplete events)

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The DPNSS Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII	Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)
EBCDIC	Each byte is displayed as an EBCDIC character
HEX	Each byte is displayed as a pair of hex digits
HEXS	Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides.

Number	Event number in decimal (default)
Flags	Number of flags preceding the frame, in decimal
Time	Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.
dTime	Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F4: Layer 2

F4 determines how the Layer 2 is interpreted and displayed. The options are:

Layer 2–   Layer 2 is acquired but not displayed

Layer 2+   Layer 2 is displayed interpreted

Layer 2"   Layer 2 is displayed raw

Layer 2*   Layer 2 is displayed interpreted and raw

F5: Layer 3

F5 determines how the Layer 3 is interpreted and displayed. The options are:

Layer 3–   Layer 3 is acquired but not displayed

Layer 3+   Layer 3 is displayed interpreted

Layer 3"   Layer 3 is displayed uninterpreted (raw)

Layer 3*   Layer 3 is displayed interpreted and uninterpreted (raw)

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code
                selected in *F1*

LAYER 2 INTERPRETATION

Layer 2 interpretation consists of Address and Control information.

Address

Address is interpreted on up to two lines; one line for each byte. If the extension bit is not set on the first byte, then only one line is given. Figure 9.2 shows the first line of Address interpretation.
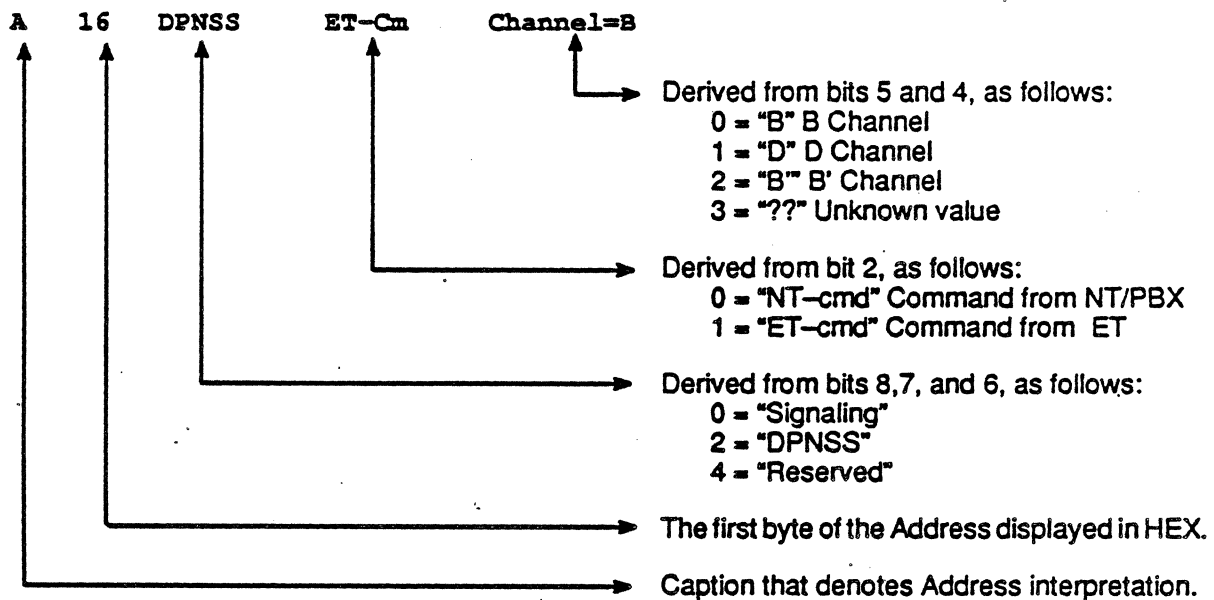
Figure 9.2: The First Line of Address Interpretation

Figure 9.3 is an example of the second line of Address interpretation.

05   Real   2M—Channel=02

The 2Mbit/s link channel number in HEX.

Derived from bit 7, as follows:
   0 = "Real"
   1 = "Virtual"

The second byte of the Address displayed in HEX.
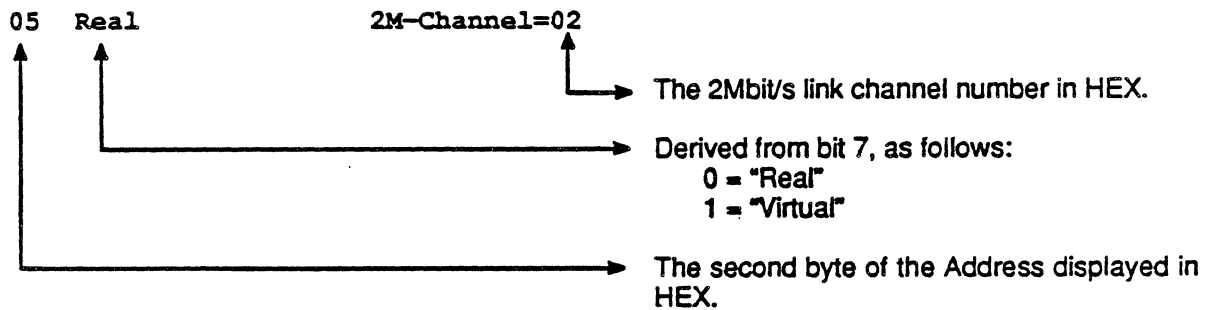
Figure 9.3: The second Line of Address Interpretation

Control

Figure 9.4 shows an example of Control interpretation.

C   03   UI   0   Len: 14

The size of the I—Field in decimal.

The frame type (mnemonic or HEX if unknown) as shown below:
   0x03 = UI
   0x13 = UI
   0x43 = PD
   0x7F = SABMR

The control byte displayed in HEX.

Caption that denotes Control interpretation.
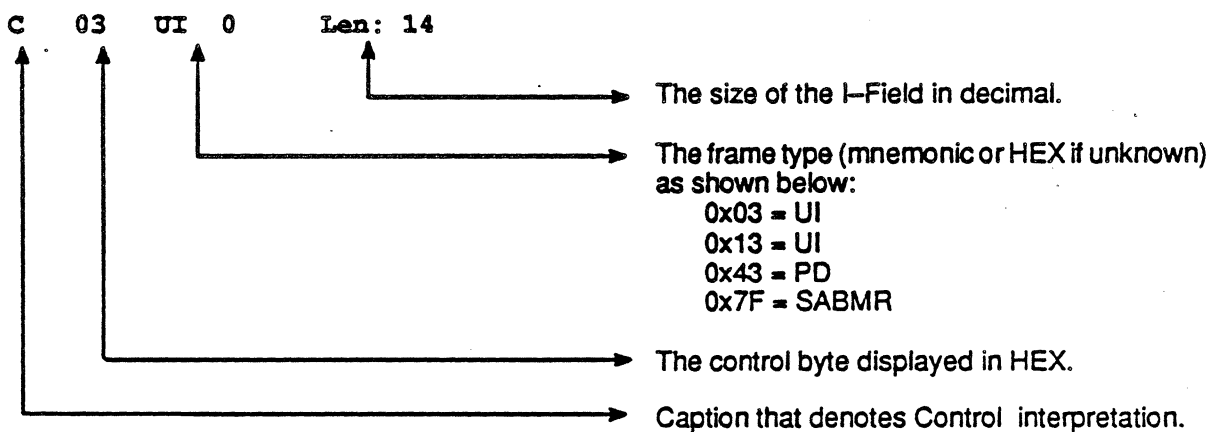
Figure 9.4: Control Interpretation

LAYER 3 INTERPRETATION

The unit of Layer 3 information is called a *message*. Messages can consist of the following sub—components:

- Message Type
- Service Indicator Code (SIC)
- Clear Cause
- Restart Cause
- Indication Block
- Selection Block

Note

Decimal coded data is terminated by the first non—numeric character, and the remainder is ignored. For example, the strings *123# and 123M# will both decode to the same value (123).

IA5 coded binary data is not validated. For example, A decodes to **HEX 1**, however, so does a (and any character with the low 4 bits equal to 1).

Message Type

The Message Type is present in all messages. From the Message Type, the system can predict the sub—components that complete the message, and interpret them accordingly. Figure 9.6 shows the messages recognized by the system. Below is an example of Message Type interpretation.

```
M    01    ISRM (I)
```

The short name of the message. (The long name of the message is displayed on the second line. See Figure 9.6.)

The Message Type byte displayed in HEX.

Caption that denotes message type interpretation.
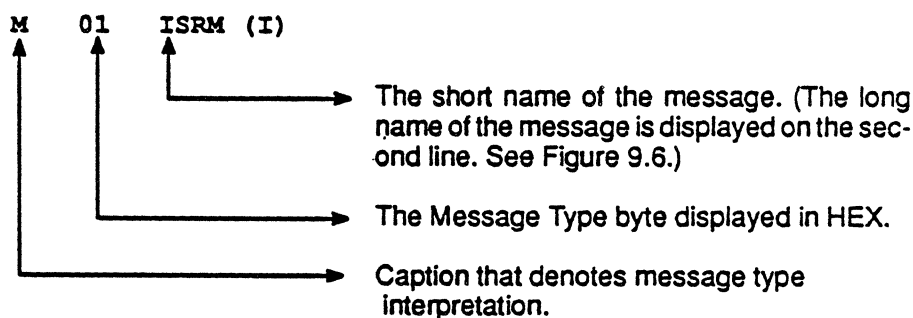
Figure 9.5: Message Type Interpretation

SHORT NAME	LONG NAME
ISRM (C)	INDICATION SERVICE REQUEST (COMPLETE)
ISRM (I)	INDICATION SERVICE REQUEST (INCOMPLETE)
SSRM (C)	SUBSEQUENT SERVICE REQUEST (COMPLETE)
SSRM (I)	SUBSEQUENT SERVICE REQUEST (INCOMPLETE)
NAM	NUMBER ACKNOWLEDGE
NIM	NETWORK INDICATION
CCM	CALL CONNECTED
CRM	CLEAR REQUEST
CIM	CLEAR INDICATION
RM (C)	RECALL (COMPLETE)
RM (I)	RECALL (INCOMPLETE)
RRM	RECALL REJECT
SM	SWAP
EEM (C)	END–TO–END (COMPLETE)
EEM (I)	END–TO–END (INCOMPLETE)
LLM (C)	LINK–BY–LINK (COMPLETE)
LLM (I)	LINK–BY–LINK (INCOMPLETE)
LLRM	LINK–BY–LINK REJECT
SCRM	SINGLE CHANNEL CLEAR REQUEST
SCIM	SINGLE CHANNEL CLEAR INDICATION

Figure 9.6: Message Types

Note   Any unknown messages are displayed in red as **Unknown**.

Service Indicator Code (SIC)

The SIC consists of one or two bytes, depending upon an extension bit in the first byte. The interpretation of the first byte of the SIC is illustrated in Figure 9.7.

SIC 9000 Speech   64K bit/s G.711

Derived from bits 4, 3, 2, and 1. (Dependent on bits 7, 6, and 5.)

The type of data derived from bits 7, 6, and 5, as follows:
    0 = "Invalid"
    1 = "Speech"
    2 = "Data"
    3 = "Data"

The SIC displayed in HEX.

Caption that denotes SIC interpretation.
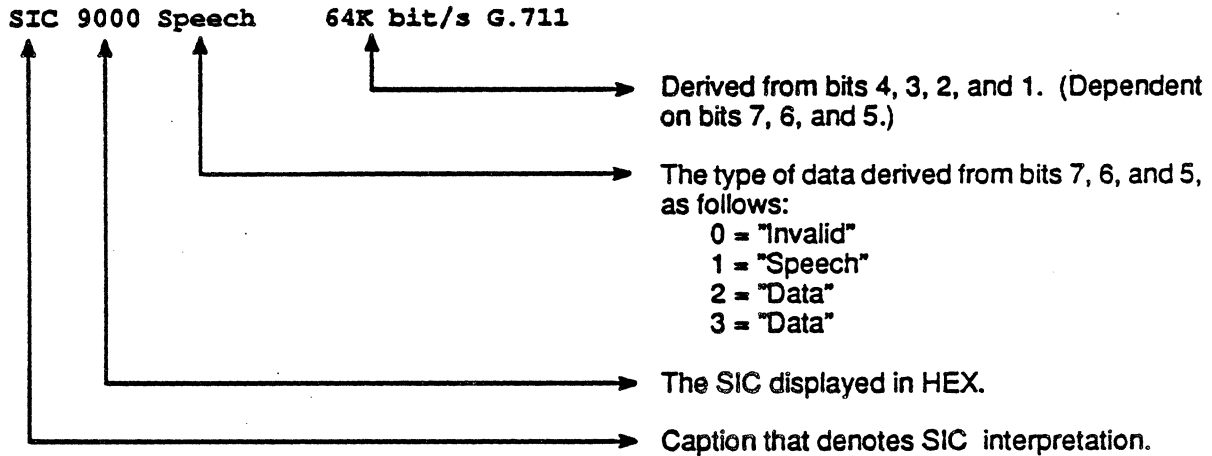
Figure 9.7: Interpretation of the First Byte of the SIC

The interpretation of the second byte of the SIC is only given when the extension bit is set in the first byte. Figure 9.8 shows each caption with its possible values.

SERVICE INDICATOR CODES	
CAPTION	POSSIBLE VALUES
Data Type	3 "Sync V.110" 4 "Sync X.30" 5 "Async 1 stop" 6 "Async 1.5 stop" 7 "Async 2 stop"
Data Mode	FDX/HDX
Byte timing provided	Yes/No
Network independent clock	Yes/No
Data format	Anonymous/DPNSS packet mode
TA has flow control capability	Yes/No

Figure 9.8: Service Indicator Codes

Rejection and Clear Cause

Rejection Cause is displayed on two lines, for example:

Rejection cause   07
CON Congestion

The first line is a standard caption plus value line, with the value displayed in HEX. The second line has the mnemonic and meaning of the Rejection Cause value.

Clear Cause is displayed in the same way as the Rejection Cause, with the appropriate caption.

Indication Block

An Indication Block is a list of Supplementary Information Strings. Any data following the last valid Supplementary Information String is displayed in raw form.

Selection Block

A Selection Block is an Indication Block followed by a Destination Address. Any data following the last valid Supplementary Information String is displayed as a Destination Address.

Supplementary Information String

A Supplementary Information String (SI) consists of a Supplementary Information String Identifier (SID) and zero or more Supplementary Information String Parameters (SIP).

When no SI's are present, the following message is displayed:

No Supplementary Information

The SI is delimited with an asterisk (*) at the start, and a hash sign (#) at the end. Any string not starting with an * terminates the block. If the SI is not well formed, the following message is displayed in red:

Bad SIS format

Note   When the above message is displayed, the rest of the interpretation
                            should be used with care.

                            The interpretation of the SI starts with a line consisting of the
                            complete name. The SI is displayed in ASCII. The next line
                            consists of the short name of the SID. If the SID is unknown, the
                            display is in red.

                            The SID values recognized are as follows:

CLC–ORD	DVT–R	A13
CLC–DEC	BSS–M	A14
CLC–DASS2	BSS–P	A12
CLC–PSTN	BSS–N	A7
CLC–MF5	SU	CBWF–CLB
CLC–OP	RR–SNU	DVT
CLC–NET	IG–SNU	SOD–REQ
CBWF–R	IG–SU	CBWF–CB
CBWF–FN	TEXT	OLICLI
CBWF–CSUI	SIM–A	RTI
CBWF–C	ROP–R	REJ
RO	ROP–CSU	ACK
CBC	ROP–CON	NSI
CBWF–CSUD	EST	HOLD–REQ
EI–PVR	CDIV	RECON
EI–R	RDG	HDG
IPL–R	RCF	SOD–B
IPL	TOV–R	SOD–F
EI–I	TOV–V	SI
CW	SER–R	SPL
CO	SER–C	TWP
DIV–V	SER–E	ENQ
DIV–FM	NS–N	SCE
DIV–BY	NS–DVT	TRFD
DIV–CI	NS–DVG	SHTL
DIV–CR	NS–DVD	COC
DIV–CB	NS–RDVT	AD–RQ
DIV–CA	NS–RDVG	AD–V
DVG–I	NS–RDVD	AD–O
DVG–B	NS–DA	ENH
DVG–R	SW–V	BAS
DVT–I	SW–R	SNU
DVT–B	A2	
DVD–I	A5	
DVD–B	A8	
DVD–R	A10	

Supplementary Information Parameters

For each possible SI, the system knows which parameters may be present. Any unexpected (undocumented) parameters are printed with the generic caption: **parameter**. Missing parameters are not flagged as errors.

Each parameter has an *internal* parameter type that describes the interpretation performed on that parameter. Recognized parameters are listed below by types. The names given are used as captions.

Type **S** is a literal output of uncoded input, for example:

ABCD ⇒ ABCD

- Parameter (generic)
- A party address
- B party address
- C party adress
- HC–CLC
- Call reference number
- Reconnect address
- Signal ID

Type **I** is HEX output of IA5 encoded binary input, for example:

@ABC ⇒ 0123

- SIC
- Clearing Cause

Type **D** is a decimal encoded output of decimal decoded input, for example:

012A ⇒ 12

- Intrusion capability level
- Intrusion protection level

Type **W** is a table lookup output of decimal decoded input, for example:

01 ⇒ PSTN BARRED

- Service Markings:

  1 — PSTN BARRED
  2 — EMERGENCY TELEPHONE
  3 — HUNT GROUP
  4 — HOLDING PSTN
  5 — EXTRAORDINARY EXTENSION

- Routing Information:

  1 — Alternative route
  2 — DASS1 encountering
  3 — DASS2 encountering
  4 — PSTN
  5 — 10pps
  6 — MF5

- Status:

  0 — DDI
  1 — Non DDI
  2 — No release signal

Type **C** is a table lookup output of undecoded input, for example:

M ⇒ Missing Information

- String ID:

  S — Service Indicator Code
  E — Syntax Error
  M — Missing Information
  R — Recall Not Supported
  F — Selection Block Capacity Exceeded

- Location:

  T — Other Terminal
  P — Call Path
  E — Equipment needed
  I — Incompatible due to clash

- CALL–DIR:

    O – Originating PBX
    T – Terminating PBX

- State of Operator:

    N – Night Mode activated
    T – Night Mode deactivated

- Reason for Re–directing:

    A – Awaiting answer
    H – Held
    W – Waiting on busy
    E – Tansferred by extension
    N – Not transferred
    O – Transferred by operator
    R – Transferred by re–directed party

CHAPTER TEN:
ISDN MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the network. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes ISDN Analysis and Statistics, by focusing on the protocol–specific details of these applications. For a general description of the applications, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port, and select ISDN as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide*.

The Physical Interface used for ISDN Monitoring is selected at the Physical Interface parameter on the Main Configuration Menu. When the Physical Interface used for ISDN Monitoring is Basic Rate or Primary Rate, there are two ways of configuring the Physical Layer:

- Active
- Passive

When in Simulation Mode, the Physical Layer signals are active, but no data will be transmitted. The received data is decoded and displayed on the Analysis pages. However, when in Monitor Mode, the Physical Layer, as well as the layers above, are passive. The system is then configured completely for Monitoring.

Monitor Setup Menu

When you select ISDN as your Monitoring protocol, you are prompted for several configurable parameters, as shown in Figure 10.1 below.

```
                          Port x Monitoring

                                              ┌──────────────────────┐
                                              │  Press GO to accept   │
                                              └──────────────────────┘

         Protocol :        ┌────────┐
                           │  ISDN  │
                           └────────┘

         Default Network Layer      ┌────────┐
                                    │ Q.931  │  ◄────
                                    └────────┘

              Alternative Network Layer ┌────────┐
                                        │  X.25  │
                                        └────────┘
                              on SAPI number (0-63)    ▨

              Alternative Network Layer ┌────────┐
                                        │  None  │
                                        └────────┘

         Q.931 standard        ┌────────┐
                               │  AT&T  │
                               └────────┘

              Interface        ┌────────┐
                               │  Basic │
                               └────────┘

         Link Layer       ┌────────┐
                          │ Q.921  │
                          └────────┘
              Modulo          ┌──────────────┐
              Extended addr   │  128         │
              Encoding        │  yes         │
                              │  NRZ         │
                              └──────────────┘

         ┌──────┬──────┬──────┬─────┬─────┬─────┬─────┬─────┬─────┬──────┐
         │Q.931 │ X.25 │UserDat│    │     │     │     │     │     │ Exit │
         └──────┴──────┴──────┴─────┴─────┴─────┴─────┴─────┴─────┴──────┘
```

Figure 10.1: The ISDN Monitor Setup Menu

Default Network Layer

This parameters determines which Network layer protocol you are monitoring. The options are:

- Q.931
- X.25
- User Data

Alternative Network Layer

You also have the option of specifying two Alternative Network Layers. The options for the alternative network layers include:

- Q.931
- X.25
- User Data
- None

However, whichever option you select as the Default Network Layer will not be available as a softkey option for the Alternative Network Layers. For example, in Figure 10.1, Q.931 is the Default Network Layer. Therefore, the softkey options for the Alternative Layers will not include Q.931.

When you configure an Alternative Network Layer, you are prompted for a SAPI number to search on:

On SAPI number (0 – 63)

Specifying a SAPI gives you the option of specifying the same network layer with two different SAPIs as your two Alternative Network Layers. For example, you could configure one Alternative Network Layer as X.25 on **SAPI 16**, and configure the second Alternative Network Layer as X.25 on **SAPI 0**.

Q.931 Standard

There are several different Q.931 standards available on the Chameleon. Currently these standards are:

FUNCTION KEY	SPECIFICATION(S) SUPPORTED
CCITT84	CCITT 1984 Red Book Basic Rate Interface
CCITT88	CCITT 1988 Blue Book Basic Rate Interface
AT&T (Basic)	Supports up to and including AT&T Basic 5E5 specification (Technical Reference AT&TISDN Basic Rate Interface Specification AT&T 801–802–100, June 1988)
AT&T (Primary)	PUB 41449 (Technical References, AT&T ISDN, Primary Rate Interface Specification, 326–272, March 1986) PUB 41459 (PreliminaryTechnical References, ISDN, Primary Rate Interface for AT&TCommunications, 326–201, April 1986) PUB 41449A (Technical Reference, Addendum 1, March 1986) PUB TR 41459 AT&T ISDN Primary Rate Interface and Special Application Specification, July 1989 (See Note on page 10-19)
Siemens	Siemens Basic Rate Interface
N. Tele	Northern Telecom, ISDN Basic Rate Access, User–Network Interface Specification (NISS208–4) 1988
Ger PTT (1R6–86)	German PTT, 1R6–86 Interface
Ger PTT (1TR6)	German PTT, 1TR6 Interface
Austral (Basic)	TPH 1962, Australian ISDN Basic Access Interface, Issue 1, February 1988, Preliminary Release, Revision B.
Austral (Primary)	TPH 1856, Australian ISDN Primary Access Interface, Issue 1, Revision, July 1987

FUNCTION KEY	SPECIFICATION(S) SUPPORTED
NTT	Japanese NTT
V.120	Telecommunications Committee, ANSI T1, ISDN Terminal Adaption Using Statistical Multiplexing, August 5, 1988 This option monitors V.120 on the D–Channel. Refer to Chapter 17: V.120 Monitoring, for information about monitoring V.120 on a B–Channel, and for more information about V.120 interpretation on the Chameleon.)
VN2	Specification Technique, ST/LAA/RSM/133, Edition 2, March 1988 Specification RNIS, Part 4: Access Usage VN2, Chapter 3: Niveau 3 du protocole D
BTNR	CCITT I–Series Interface for ISDN Access (British Telecom Version) BTNR 191 (Issue 1), December 1986, Addendum BTNR 191 September 1987, and Addendum BTNR 191, October 1989

Link Layer

The only Link layer option is Q.921 layer 2, which conforms to the CCITT Q.921 standard.

Modulo

Modulo determines the numbering sequence that will be used to keep track of the frames that are transmitted and received.

Modulo 8   Numbering sequence from 0 – 7
Modulo 128   Numbering sequence from 0 – 127

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used.

Yes   Extended (16–bit) addressing. See page 10–11 for a description of extended addressing interpretation options.

No   8–bit addressing

Encoding

Encoding determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0.

NRZ   Non Return to Zero. A 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. A 1 is represented by no change in level, and a 0 is represented by a change in level.

Analysis

Analysis provides two pages: Real Time and History. Both pages display the traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 10.2.
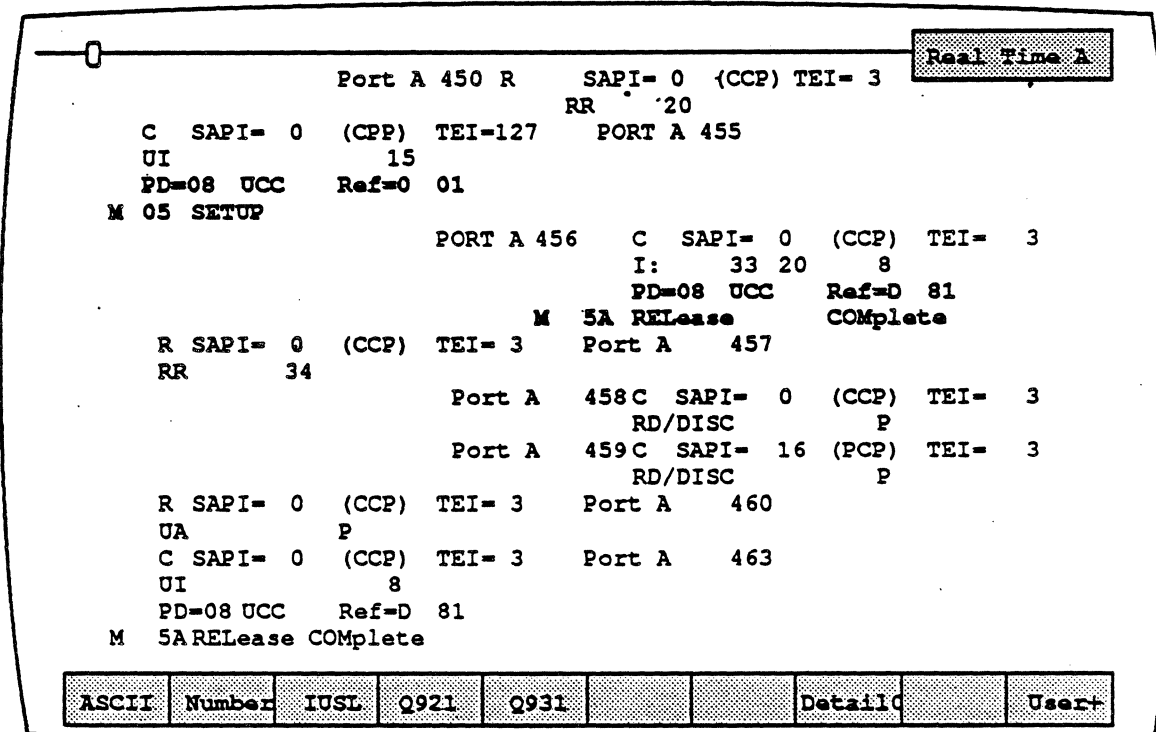
Figure 10.2: Real Time Page with Sample ISDN Traffic

DCE/DTE

Frames transmitted by the DCE are displayed on the left half of the screen. Frames transmitted by the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below:

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Level 2 (Q.921)
- Blue = Message Type
- Yellow = Q.931 detail
- White = User Data
- Red = Errors (Incomplete/Unknown event)

Interface Lead Transitions

Interface Lead transitions are displayed if the IUSL option is selected for the F2 key. Lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. All transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS ·	RTS
DSR	DTR
· DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The ISDN Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press **F1**, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hex digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides. The options are:

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if CRC is good or **Bad** if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   *F3* affects the page *display* only. All events are captured, regardless of the *F3* selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Level 2

F4 determines how the Level 2 is interpreted and displayed. Level 2 information is displayed in green. The options are:

Q.921–   Q.921 is acquired but not displayed
Q.921+   Q.921 is displayed interpreted
Q.921"   Q.921 is displayed raw
Q.921*   Q.921 is displayed interpreted and raw

F5: Level 3

F5 determines how the packet level (Q.931) is interpreted and displayed. Level 3 information is displayed in blue and yello. The options are:

Q.931–   Q.931 is acquired but not displayed
Q.931+   Q.931 is displayed interpreted
Q.931"   Q.931 is displayed raw (in yellow)
Q.931*   Q.931 is displayed interpreted and raw

F8: Detail

F8 determines the level of interpretation detail for Q.931. If Q.931 traffic is not being displayed (F8 = Q931−) this key has no effect. The options are:

Detail0   This option displays the Q.931 message interpretation in blue. This level of detail does not include an analysis of the Information Elements included in the message. Detail0 displays the following Q.931 information:

> Protocol Discriminator value
> Protocol Discriminator mnemonic
> Call Reference value
> Caption
> Message Type Value
> Message Type Mnemonic

See page 10–14 and 10–15 for a description of the Q.931 Detail0 interpretation.

Detail1   This option displays the Information Element detail directly below the information described above. This interpretation is displayed in yellow and varies according to the type of Information Element included in the message. Sample Information Element displays are shown on pages 10-16 and 10-17.

Note that the *F5 Q931* key determines if the Q.931 data is shown interpreted, uninterpreted, or both ways.

F10: User Data

F10 determines if user data is displayed. It also displays the traffic in a raw mode (uninterpreted). The options are:

User+   User data is displayed

User−   User data is not displayed

Raw   All traffic is displayed raw (uninterpreted) in the code selected in *F1*

ISDN Layer 2 Interpretation

Figure 10.3 below shows a sample Layer 2 interpretation.
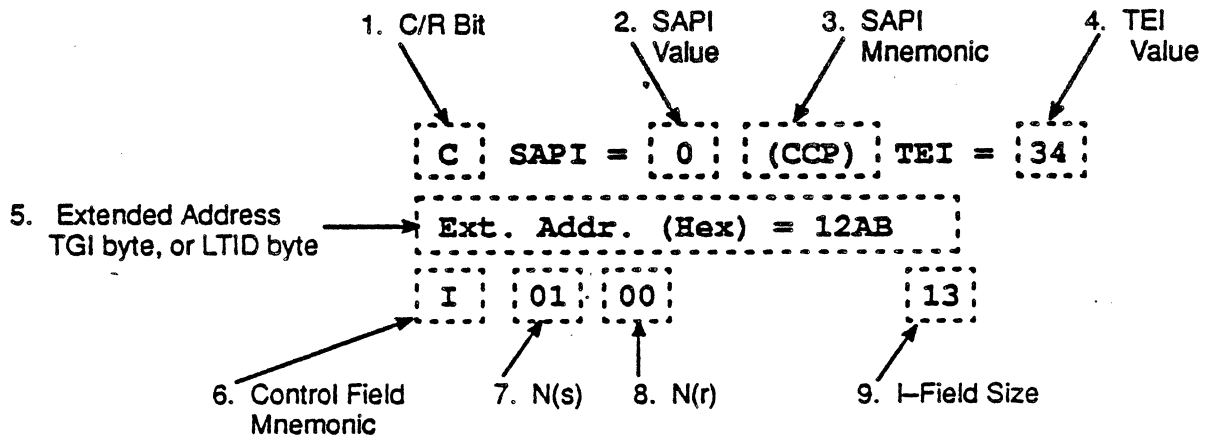
Figure 10.3: ISDN Layer 2 Interpretation

1.   C/R Bit

This field displays the setting of the Command/Response (C/R) bit, as follows:

C	Command bit set
R	Response bit set
(blank)	C/R bit not set

2.   SAPI Value

This field displays the value of the Service Access Point Identifier (SAPI) in decimal.

00	Call Control Procedures
16	Packet Communications Procedures
63	Managment Procedures

3.   SAPI Mnemonic

This field displays the Service Access Point Identifier (SAPI) mnemonic, as follows:

CCP	Call Control Procedures
PCP	Packet Communications Procedures
MP	Management Procedures

4.   TEI

This field displays the Terminal Endpoint Identifier in decimal.

5.   Extended Address

This field appears only when extended addressing is being used. It displays the value of the extended address in hex, in the following format:

Ext. Addr. (Hex) = xxxx

Ctrl N toggles the display between the extended address (as shown above) and the following interpretations:

- If you selected Northern Telecom as your ISDN protocol, *Ctrl N* displays the LTID interpretation in place of the Extended Address. (See page 10-12 for a description of the LTID byte.) The LTID byte is displayed in both hex and decimal in the following format:

  LTID:Hex = xx   Decimal=xxx

- For all other ISDN protocols, *Ctrl N* displays the TGI (Terminal Group Identifier) interpretation in place of the Extended Address. The TGI byte is displayed in both hex and decimal in the following format:

  TGI:Hex = xx   Decimal=xxx

6.   Control Field Mnemonic

This field displays the control field mnemonic, for example: I–Frame.

7.   N(s)

This field displays N(s) in hex.

8.   N(r)

This field displays N(r) in hex.

9.   Size of I–Field

This field displays the size of the I–Field in decimal.

LTID Byte Interpretation

For the Northern Telecom version of ISDN, there are two additional layer 2 bytes that form a 14–bit word:

- LTID high byte
- LTID low byte


```
     Byte 1              Byte 2              Byte 3              Byte 4
 8 7 6 5 4 3 2 1     8 7 6 5 4 3 2 1     8 7 6 5 4 3 2 1     8 7 6 5 4 3 2 1
 ┌─────────┬─┬─┐     ┌───────────┬─┐     ┌─────────┬───┐     ┌─────────┬───┐
 │         │C│0│     │           │ │     │         │   │     │         │   │
 │  SAPI   │/│ │     │    TEI    │0│     │  LTID   │ 0 │     │  LTID   │ 1 │
 │         │R│ │     │           │ │     │  HIGH   │   │     │  LOW    │   │
 └─────────┴─┴─┘     └───────────┴─┘     └─────────┴───┘     └─────────┴───┘
```

If least significant bit = 0, indicates the LTID bytes follow.

Seven bits from each LTID byte form one 14–bit word.
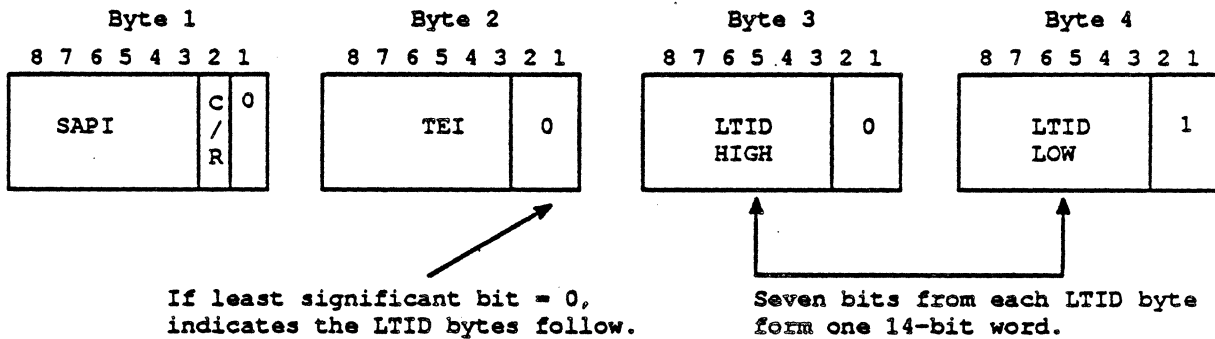
Figure 10.4: Northern Telecom LTID High and Low Order Bytes

The LTID bytes are interpreted only after *CTRL N* is pressed. The least significant bits from each LTID byte are stripped. The remaining bits are combined into a single 14–bit word that is represented in decimal and hex on the Chameleon display. A sample display is shown in Figure 10.5 below.

```
          C SAPI = 0(CCP)   TEI = 8
      ┌────────────────────────────────────┐
      ┊ LTID: Hex=040F ┊ Decimal = 263   ┊
      └────────────────────────────────────┘

              I    00 20 P 35
          Q.921:0210040F0041
```

Figure 10.5: Chameleon 32 LTID Byte Interpretation

To disable LTID byte interpretation, press *CTRL N* again.

ISDN Layer 3 Interpretation

The Q.931 message structure consists of the following parts:

- Protocol Discriminator
- Call Reference
- Message Type
- Information Elements

The first three components are present in all messages, and are displayed in blue. Information elements can be either optional or mandatory, according to the message type, and are displayed in yellow. The *F8* function key enables you to display or inhibit the display of the information elements, as described on page 10-9.

The general structure of a Q.931 message is shown in Figure 10.6 below.

8	7	6	5	4	3	2	1	
Protocol Discriminator								Octet 1
0	0	0	0	Length of Call Reference Value (bytes)				Octet 2
0/1		Call Reference Value						Octet 3
Call Reference Value								Octet 4
0		Message Type						Octet 5
Other Information Elements as required								Octet 6
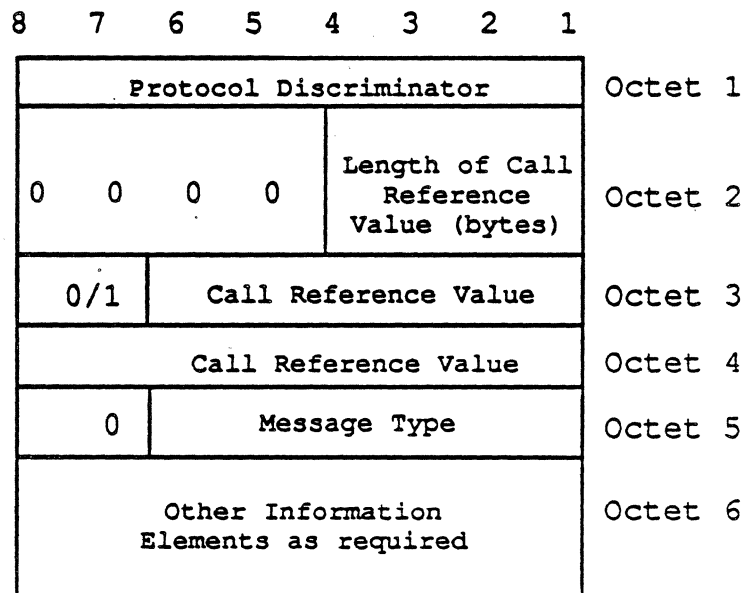
Figure 10.6: Message Structure

ISDN Layer 3 Interpretation

In Q.931, values which have no interpretation in any of the implemented protocols are shown as *Unknown*. Values which are not valid for the selected manufacturer specific protocol (including *Unknown* values) are displayed in red.

Figure 10.7 below shows an example of the first line of the Q.931 display. This information is displayed in blue.

```
PD  =  : 08 :   : UCC :    REF  =  : 0  0102 :
          |        |                 |
          |        |                 |
1. Protocol      2. Protocol      3. Call Reference
   Discriminator    Discriminator
   Value            Mnemonic
```
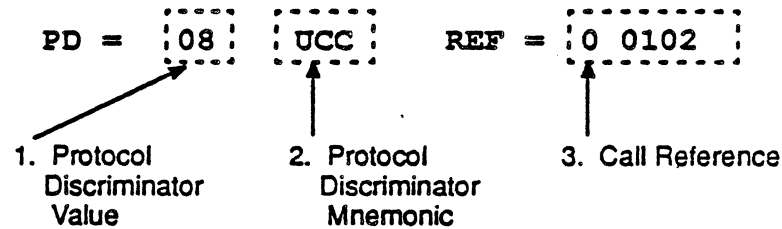
Figure 10.7: First Line of Q.931 Interpretation

1.   Protocol Discriminator Value

This field displays the Protocol Discriminator value in hex.

2.   Protocol Discriminator Mnemonic

3.   Call Reference Value

This field displays the Call Reference value, shown as a series of hex digits. The example above is interpreted as follows:

Ref	Caption
O	Origin (or D – Destination)
0102	Hex value of call reference (variable length)

Message Type

The next line of Q.931 interpretation is the message type. This is illustrated in Figure 10.8 below. This information is displayed in blue.

```
.------. .----.    .-----------.
: M    : :01:      :Alerting   :
:......: :..:.     :...........:
```

1. Caption   2. Message   3. Message
                  Type Value   Type Mnemonic
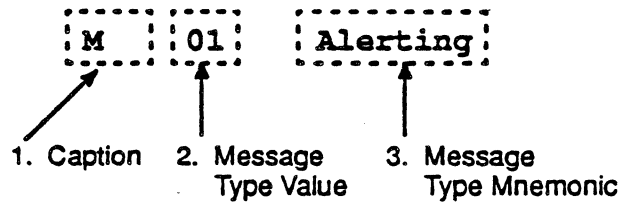
Figure 10.8: Second Line of Q.931 Interpretation

1.   Caption

This field displays the caption, in this case, *M* indicates message type follows.

2.   Message Type

This field displays the Message type value in hex.

Certain Q.931 implementations sometimes require two message type bytes. These are displayed on two consecutive lines.

3.   Message Type Mnemonic

This field displays the Message Type mnemonic, or *Unknown*.

Information Elements

The rest of the Q.931 message consists of a number (possibly zero) of structures called information *elements*. These can be either single octet (byte) or multiple octet information elements.

Each of the information elements is interpreted in a manner outlined below, and is displayed in yellow. Interpretation of information elements is repeated until the end of the message is reached.

The first line of the information element interpretation is as shown in Figure 10.9.
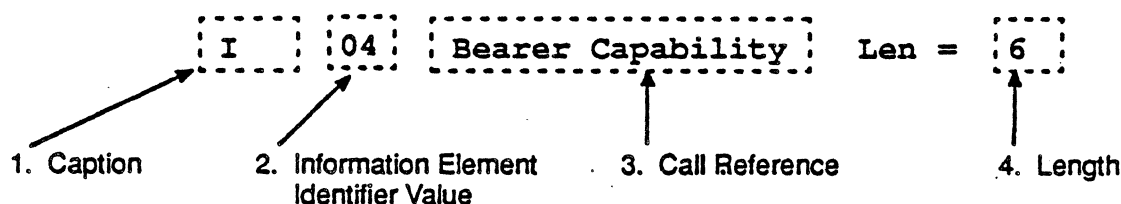
Figure 10.9: First Line of Information Element

1.   Caption

This field displays the caption.

I	Indicates the start of information element interpretation.
I+	Indicates that the information element was not expected (according to the protocol) in the message.

2.   Information Element Identifier Value

This displays the Information Element Identifier value in hex.

3.   Information Element Mnemonic

This field displays the Information Element Identifier mnemonic, or *Unknown*.

4.   Length

This field displays the length of the information element.

Single Octet Information Elements

Single octet information elements do not have Field 4, and may have alternate information.

Shift

Figure 10.10 below shows a sample Shift information element.
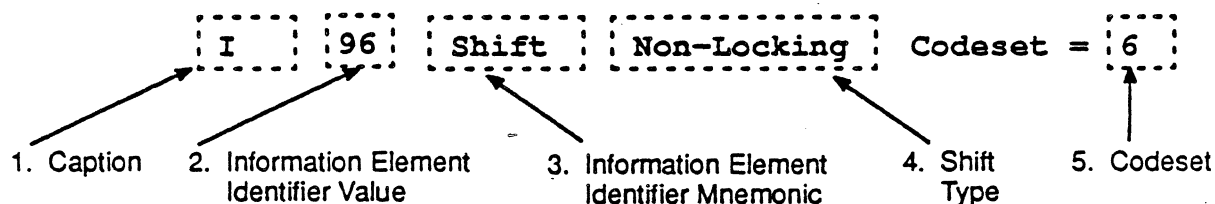
Figure 10.10: Shift Information Element

1.   Caption

This field shows the Caption, which in this example, is I (Information element).

2.   Information Element Identifier Value

This field shows the Information Element Identifier value in hex, which in this example, is 96.

3.   Information Element Mnemonic

This field shows the Information Element Identifier mnemonic, which in this example, is Shift.

4.   Shift Type

Locking
Non–Locking

5.   Codeset

This field displays the new codeset in decimal.

Congestion Level

Figure 10.11 shows a sample of a Congestion Level information element.
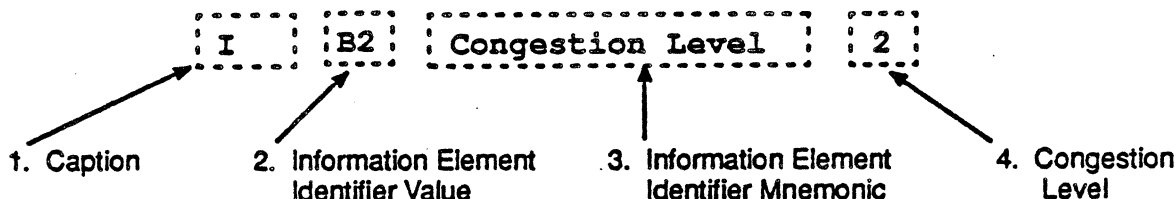
Figure 10.11: Congestion Level Information Element

1.   Caption

This field shows the Caption, which in this example, is *I* (Information element).

2.   Information Element Identifier Value

This field shows the Information Element Identifier value in hex, which in this example, is B2.

3.   Information Element Mnemonic

This field shows the Information Element Identifier mnemonic, which in this example, is Congestion Level.

4.   Congestion Level

This field displays the new congestion level in decimal, which in this case, is 2.

Diagnostic Information Elements

The Cause Information Element is of variable length, and can have special diagnostic information elements embedded within them. This is indicated in Field 1 of the Information Element display.

If the Field 1 displays a D (instead of I), it indicates a diagnostic information element. The remaining fields are identical to the non-diagnostic information elements.

Information Element Parameters

Figure 1.1 below provides an example of the complete interpretation of a Bearer Capability information element.

```
 I     04      Bearer Capability              Len=6   ◄── Line    1
       11      Coding Standard                  CCITT              2
               Transfer capability        7kHz Audio              3
 1  ↗          Transfer mode                  Circuit             4
       10      Transfer rate               64 Kbits/s             5
       50      Structure                         (05)             6
               Configuration          Point-to-Point             7
               Establishment                   Demand             8
       10      Symmetry                        Bi/Sym             9
               Dest. Transfer rate        64 kbits/s            10
```

Figure 1.1: Bearer Capability Information

Field 1 shows the value (in hex) of the next byte to be interpreted.

In all lines, except line 1, the structure of the line is caption, followed by value. On these lines, when text is shown, it is the text description, or mnemonic, derived from the value. When digits are shown, it is the value itself.

When a line appears in red, it indicates that the value is not legal for this protocol implementation. The value may correspond to a textual description in another implementation, in which case the textual description is shown.

**Note on SIE
interpretation for
AT&T PRI vs Others.**

When analyzing traffic for AT&T Primary Rate Interface SNC–Tandem Signal Information Elements (SIEs) are defined. Their nterpretation is displayed in yellow. This is customary for defined elements. For other traffic, SIEs are undefined and, as such, would normally be displayed in red. In ISDN Monitoring, this is not the case – these undefined elements are also displayed in yellow and should be disregarded.

Error Messages

Error messages are displayed when the Monitoring applications detects a problem with the structure of the Q.931 message. The error messages are described below.

Information element out of sequence

This message is displayed at the end of the message, when it is determined that one or more of the information elements were found in the incorrect sequence.

Missing

This message is displayed at the end of the message interpretation when mandatory information elements are missing.

Information element too short

This message is displayed when the value of the length octet in a variable length information element is less than the required minimum.

+

The plus sign, when tagged to an IE flag, has one of three meanings:

- Multiple, identical IEs for a given message type
- The IE does not belong to this message type
- The IE does not conform to the standard of the selected protocol.

ISDN Statistics

The Chameleon ISDN Statistics is based on the CCITT Redbook Q.921 Recommendations of October 1984, and includes information on the following:

- SAPI Service Access Point Identifier, as defined in the CCITT Recommendation Q.921. SAPIs identify a point at which data link layer services are available.

- TEI Terminal End Point Identifier, as defined in the CCITT Recommendation Q.921. TEIs are used for point to point data link connections. Each TEI is associated with a single terminal.

- SI Sequenced Information frames as defined in the CCITT Recommendation Q.921. SI frames transfer information between data link entities using sequentially acknowledged frames. SI commands may or may not contain user data.

- N(R) N(S) Sequence numbers used for flow control and error recovery in HDLC.

High Density Traffic

When monitoring dense traffic on high speed lines, the following situations may occur:

- The Statistics application might not be able to process all the traffic on the line. When this occurs, the following message appears below the banner, indicating the percentage of traffic that is being processed:

  Data Processed
  xx%

- At times the Statistics display may appear to be frozen; however, it is not. When you terminate the Statistics session by pressing *Run/Stop*, the display will be updated to reflect the data acquired up to that point.

  To then start a new statistics session, press the *Reset* function key. If you resume acquisition by pressing *Run/Stop* (instead of restarting statistics by pressing *Reset*), the maximum response time fields will include the time that acquisition was halted.

To access the ISDN Statistics, start the application Q921STAT in the Applications Selection menu. There are two types of ISDN Statistics pages available. These are:

- Q.921 Line Statistics
- Q.921 SAPI Statistics

The Q.921 Line Statistics page displays information for all SAPIs and is automatically displayed when Q921STAT is started. The SAPI pages can be activated from the Q.921 Line page as described on page 10-27. There are four SAPI Statistics pages available:

•	SAPI 0	Call control procedures
•	SAPI 16	Packet communications procedures
•	SAPI 63	Management procedures
•	All others	SAPIs 32–47 are reserved for national use. All others are undefined at this time.

Q.921 Line Statistics Page

Figure 10.13 below shows the Q.921 Line Statistics display. The fields are described below.
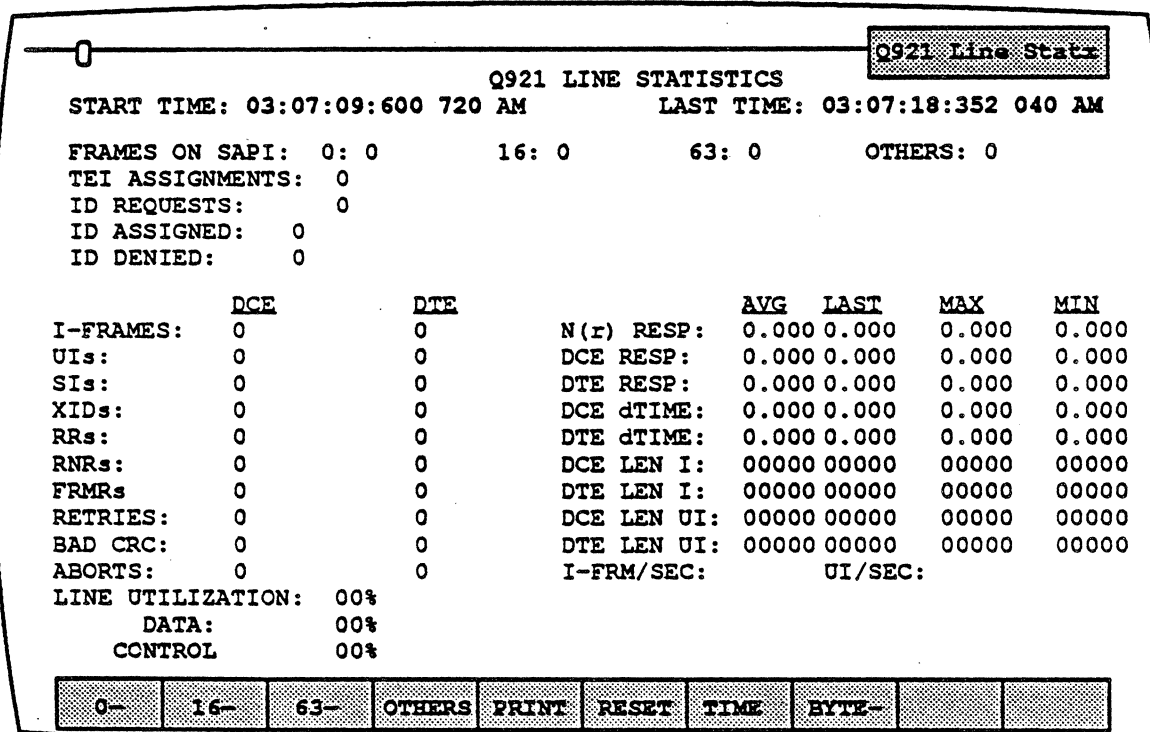
Figure 10.13: Q921 Line Statistics Page

Total Processing Time

Several statistical fields are calculated using Total Processing Time, which is defined as:

**(Elapsed time from START TIME to LAST TIME) –
(Total time lost from missed events)**

The fields which are calculated using Total Processing Time are:
- Utilization fields
- Data bytes/sec.
- UI frames/sec.

The format of the START TIME and LAST TIME fields depends on whether you select *F7 Time* or *F7 Date*.

If *F7 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

Start time	If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.
	If you are analyzing data from disk and *F7 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.
Last Time	If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.
	If you are analyzing data from disk and *F7 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.
Frames on SAPI	The number of frames received for SAPI 0, SAPI 16, SAPI 63, and all other SAPIs.

The next four fields depend on the selection you make with the *F8 Byte* key. If *F8 Byte–* is displayed, the following fields appear in the Q921 Line and SAPI 63 pages. (In other SAPI pages, when *F8 Byte–* is selected, no fields are displayed in this section.)

TEI Assignments   The total number of UI frames with a SAPI value of 63, a TEI value of 127, and a mes–sage type concerning TEI assignments. These message types include:

ID request   ID check response
ID assigned   ID remove
ID denied   ID verify
ID check request

ID Requests   The number of TEI assignment frames with MEIs = 0FH and Message Type = 1 (Identity request – user to network).

ID Assigned   The number of TEI assignment frames with MEIs = 0FH and Message Type = 2 (Identity assigned – network to user).

ID Denied   The number of TEI assignment frames with MEIs = 0FH and Message Type = 3 (Identity denied – network to user).

If *F8 Byte+* is displayed, the following four fields appear in both the Q921 Line and SAPI pages.

Total Bytes   The total number of bytes in all frames received from the DCE and the DTE.

Data Bytes   The total number of bytes in all data frames received from the DCE and the DTE.

Control Bytes   The total number of bytes in all control frames received from the DCE and the DTE.

Data Bytes/Sec   The average number of data bytes received per second from the DCE and the DTE.

The following fields indicate the number of frames of the specified type received from the DCE and the DTE.

I-Frames	The number of information frames (the low order bit of the control field is set to 0).
UIs	The number of Unnumbered Information frames.
SI0s	The number of Sequenced Information 0 frames.
XIDs	The number of Exchange ID frames.
RRs	The number of Receiver Ready frames.
RNRs	The number of Receiver Not Ready frames.
FRMRs	The number of Reject frames received.
Retries	The number of frames that have been retransmitted.
CRC Errors	The number of frames received with an incorrect Frame Check Sequence.
Aborts	The number of frame aborts on the line.
Line Utilization	The percentage of time there is any traffic on the line. The utilization field will be blank (in both the screen and the printed report) if the baud rate is less than 50 bps.
Data	The percentage of time that there is user data on the line.
Control	The percentage of time that there is non-user data on the line.
I-Frames Per second	The total number of I-frames divided by the total number of seconds expired. This number is truncated to the nearest whole number.
Frame Response	The time from the end of an I-frame to the end of N(R) confirmation for that I-Frame.
Frame Length	Displays the last, average, maximum, and minimum lengths of I-frames.

Q.921 Statistics
Function Keys

F1 – F4: SAPI Pages

The F1 to F4 function keys enable you to activate a page that displays statistical information for SAPI 0, 16, 63, or all other SAPIs. The softkey strip at the bottom of the screen displays the SAPI page options.

If the SAPI has + next to the number, a page has been activated. If the SAPI has – next to it, a page is not currently activated for that SAPI.

To activate a SAPI Statistics page, perform these steps:

1. Make one of the ISDN Statistics pages active. (You can activate and deactivate SAPI pages from any ISDN Statistics page.)

2. Press the function key that corresponds to the desired SAPI. This causes a page banner for that SAPI to be displayed at the bottom of the screen. The softkey strip should also show a + next to the SAPI.

3. You can then make the new page active and use its function keys.

    The SAPI function keys are the same as the Q.921 Line Statistics function keys page. The differences between the Q.921 Line Statistics and SAPI Statistics pages are:

    •   The SAPI 0, 16, and others pages do not display TEI Assignment, ID Request, ID Assigned and ID Denied.

    •   Only the number of SAPIs for that specific SAPI number are displayed. For example, the SAPI 16 page displays the number of SAPI 16 frames that have been received. The number of frames received with SAPIs other than 16 are not shown.

To deactivate a page for an SAPI, perform these steps:

1. Make one of the ISDN Statistics pages active.

2. Press the function key that corresponds to the SAPI page you want to deactivate. The softkey strip should show — next to the SAPI number and the SAPI banner disappears from the screen.

F5: Print

F5 Print prints a statistical report that is very similar to the screen display format. If you have a printer connected to the Chameleon, you can print a report. If you do not know how to connect a printer to the Chameleon, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter Nine: Utilities.*

If you do not have a printer, the Print function key has no effect. The report will not be displayed on the Chameleon screen. A sample Q.921 Line statistics report is shown in Figure 10.14 on the following page.

F6: Reset

F4 Reset resets the statistics values to zero and resets the times (or dates) displayed at the top of the page. This resets the values on all ISDN statistics pages that are currently activated.

F7: Time/Date

F5 Time/Date affects the format of the time displayed in the START TIME and LAST TIME fields at the top of each X.25 Statistics page.

If **F5 Time** is selected, the times are displayed in the format:
   hh:mm:ss:ddd ddd AM/PM

For example: 08:46:25:934 160 AM.

If Date is selected, the time is displayed in the following format:
   dd MMM yyyy hh:mm:ss

For example: 01 JAN 1989 08:06:45.

```
                TEKELEC Q921 LINE STATISTICS REPORT

    START TIME:        00:00:00:000  000
    LAST TIME:         00:00:00:000  000

                                    DCE              DTE
    FRAMES ON SAPI 0 :           0000000000       0000000000
    FRAMES ON SAPI 16 :          0000000000       0000000000
    FRAMES ON SAPI 63 :          0000000000       0000000000
    FRAMES ON OTHER SAPIs:       0000000000       0000000000
    TEI ASSIGNMENTS :            0000000000       0000000000
    ID REQUESTS :                0000000000       0000000000
    ID ASSIGNED :                0000000000       0000000000
    ID DENIED:                   0000000000       0000000000
    ID CHECK REQUESTS:           0000000000       0000000000
    ID CHECK RESPONSES:          0000000000       0000000000
    FRAME ABORTS :               0000000000       0000000000
    CRC ERRORS :                 0000000000       0000000000
    RETRANSMISSIONS :            0000000000       0000000000
    I-FRAMES :                   0000000000       0000000000
    RRs :                        0000000000       0000000000
    RNRs :                       0000000000       0000000000
    REJs :                       0000000000       0000000000
    FRMRs :                      0000000000       0000000000
    SABMs :                      0000000000       0000000000
    UAs :                        0000000000       0000000000
    DISCs :                      0000000000       0000000000
    DMs :                        0000000000       0000000000
    SIOs :                       0000000000       0000000000
    SI1s :                       0000000000       0000000000
    UIs :                        0000000000       0000000000
    SABMEs :                     0000000000       0000000000
    XIDs :                       0000000000       0000000000

                                AVG      LAST      MAX       MIN
    N(s)-N(r) RESPONSE:         0.000    0.000    0.000     0.000
    DCE RESPONSE TIME :         0.000    0.000    0.000     0.000
    DTE RESPONSE TIME :         0.000    0.000    0.000     0.000
    DCE DELTA TIME :            0.000    0.000    0.000     0.000
    DTE DELTA TIME :            0.000    0.000    0.000     0.000
    DCE I-FRAME LENGTH :        00000    00000    00000     00000
    DTE I-FRAME LENGTH :        00000    00000    00000     00000
    DCE UI LENGTH :             00000    00000    00000     00000
    DTE UI LENGTH :             00000    00000    00000     00000
    LINE TOTAL BYTES :      0
    TOTAL DATA BYTES :      0

    LINE UTILIZATION :      OO %
    DATA UTILIZATION :      OO %
```

Figure 10.14: Sample Q921 Print Display

F8: Bytes+/−

The **F8 Bytes** key determines whether the TEI Assignment fields or the number of bytes fields are displayed in the ISDN Statistics pages.

If **F8 Bytes−** is selected, the following fields are displayed in the Q921 Line and SAPI 63 pages:

TEI Assignments
ID Requests
ID Assigned
ID Denied

For all other SAPI pages, if **F8 Bytes−** is selected no fields appear in this section of the page.

If **F8 Bytes+** is selected, the following fields appear in the Q921 Line and SAPI pages, indicating the number of bytes received in each of the categories:

Total Bytes
Data Bytes
Control Bytes
Data Bytes/ Second

CHAPTER ELEVEN:
ISDN PRIMARY RATE INTERFACE

Introduction

The Primary Rate Interface (PRI) enables the Chameleon to monitor a DS1 service (two DS1 signals), or to simulate a DS1 TE/NT or CO/ET. The Primary Rate Interface can also be used to drop and insert a selected channel of a DS1 signal.

Voice frequency signals can also be inserted into or extracted from a selected DS0 channel using Codec. A handset is provided to allow a conversation through the channel. The Chameleon Primary Rate Interface also generates a digital milliwatt tone which can be inserted into a selected channel.

Note:

The monitoring of two selected DS1 channels is handled by any one of the Chameleon Monitoring applications, and is displayed in separate pages.

Details on the physical level performance of the received DS1 signals are derived, and then presented, on the Chameleon LED front panel display.

The CCITT has defined two ways of accessing ISDN Primary Rate:

- ANSI 1.544Mbs version, popular in the United States
- CEPT 2.048Mbs version, popular in Europe

Although the Chameleon software user–interface is the same for both options, the signaling and framing techniques used in ANSI and CEPT are quite different, and require different hardware. CCITT Recommendations G.703, G.704, G.732 (CEPT), and G.733 (ANSI) specify the physical layer characteristics for Primary Rate.

On the Chameleon 32, the handset is connected through a jack on the I/O Module, on the Chameleon 20–I, the handset jack is located on the front panel.

Statistics

The Primary Rate Interface Statistics package (PRISTAT) is described beginning on page 11-24.

ANSI PRI

The ANSI version of Primary Rate, developed and installed in the United States, is specified in CCITT Recommendation G.733. There is no pre–assigned channel for sending signaling information.

Level 1 information is presented on the Chameleon front panel LED display for both DS1 signals includes:

- No Frame Synchronization
- Yellow Alarm

For the Chameleon 32 LED display, see the *Chameleon 32 User's Guide, Appendix E.* For the Chameleon 201 LED display, see the *Chameleon 20 User's Guide, Appendix D.*

The DS1 Interface complies with the following specifications:

- Signal Format: SF and ESF
- Zero Suppression: B8ZS ON/OFF
- WECO 310 type jacks

The DS1 Receiver complies with the following specifications::

- Dual Receiver
- Input Impedance:

    — Terminate: 100 ohms balanced nominal

    — Bridge: Greater than 1K ohms balanced (use Bridge input at Monitor Jack)

- Received Signal Level—DSX–1 in accordance with CB No. 119 or bridged at Monitor Jack
- Received Signal Frequency – 1.544 MBPS130 PPM

The DS1 Transmitter complies with the following specifications::

- Dual Transmitter
- Signal Level: 30.3 volt peak pulse in accordance with CB No. 119 and T1X1 specifications
- Output Impedance: 100 ohms balanced nominal
- Signal Frequency: 1.544 MBPS 50 PPM
- Digital Milliwatt Tone Generator (0 dBm, 1004Hz)

CEPT PRI

The CCITT Recommendation G.732 contains the specifications for the CEPT Primary Rate Interface at 2.048 Mbps or CEPT PCM–30. The CEPT Primary Rate Interface can handle 30 data or voice channels. CEPT PCM–30 has 32 time slots (8–bit positions in a frame). Two time slots are used for signaling and framing. The remaining 30 time slots are available for user data.

The two frequencies available in the Digital Milliwatt Tone Generator are 820Hz and 1020Hz.

Details on the physical level performance of the received DS1 signals are derived, and then presented, on the Chameleon's LED front panel display.

Level 1 information presented on the Chameleon LED front panel display for both DS1 signals includes:

- No Frame Synchronization

- Remote Alarm

For the Chameleon 32 LED display, see the *Chameleon 32 User's Guide, Appendix E.* For the Chameleon 201 LED display, see the *Chameleon 20 User's Guide, Appendix D.*

The DS1 Interface complies with the following specifications:

- Signal Format: With or without signaling

- Zero Suppression: HDB3 ON/OFF

- BNC Connector (75?, 120?)

The DS1 Receiver complies with the following specifications:

- Dual Receiver

- Input Impedance:

    - Terminate: 100 ohms balanced nominal

    - Bridge: Greater than 1K ohms balanced (use Bridge input at Monitor Jack)

- Received Signal Level—DSX–1 in accordance with CB No. 119 or bridged at Monitor Jack

- Received Signal Frequency – 2.048 MBPS130 PPM

The DS1 Transmitter complies with the following specifications:

- Dual Transmitter

- Signal Level: 30.3 volt peak pulse in accordance with CB No. 119 and T1X1 specifications

- Output Impedance: 100 ohms balanced nominal

- Signal Frequency: 2.048 MBPS 50 PPM

- Digital Milliwatt Tone (820Hz and 1020Hz)

PRI Hardware

The ANSI and CEPT versions of the Primary Rate Interface hardware include:

- The Primary Rate Interface module (installed in one of the I/O module slots on the rear of the Chameleon)

- The Primary Rate Interface Boards (installed in the card cage of the Chameleon) with handset

- A DS1 LED overlay for the Chameleon front panel LED display. These are discussed in detail in Volume 1 of the User's Manual. For the Chameleon 32, the information is in Appendix E, for the Chameleon 20l, it is in Appendix D.

NOTE: For information on how to install the Primary Rate Interface hardware, refer to the installation instructions which accompanied the Primary Rate Interface package.

Interface Modules

The Chameleon ANSI and CEPT Primary Rate Interface modules provide four jacks:
- Two for transmitting (T1,T2) .
- Two for receiving (R1,R2)

Each of these interface jacks carry half–duplex signals. T1 and R1 constitute a full–duplex line (Line 1). Similarly, T2 and R2 make up Line 2.

The ANSI and CEPT Primary Rate Interface modules for the Chameleon 32 are shown in Figures 11.1 and 11.2. The ANSI and CEPT Primary Rate Interface modules for the Chameleon 20l are similar. The only difference being that the handset jack for the Chameleon 20 is not located on the I/O Module, it is on the front panel.

The selectors and indicators on the PRI module are:

- The **BRIDGE/TERM** switch that allows you to either bridge the Receivers at greater than 1K ohms, or terminate the Receivers at 100 ohms.

- The **NO SIG** (no signals) LEDs that are lit when no signal is present on the Receive lines.

NOTE: Line 1 receive signal (R1) must always be present in Simulation and Monitoring while receiving on Line 2 (R2).

The Handset jack will not be on the Chameleon 20–I I/O Module. It utilizes the jack located on the front panel.

The CEPT Interface module is the same, except for the jacks, as shown in Figure 11.2.
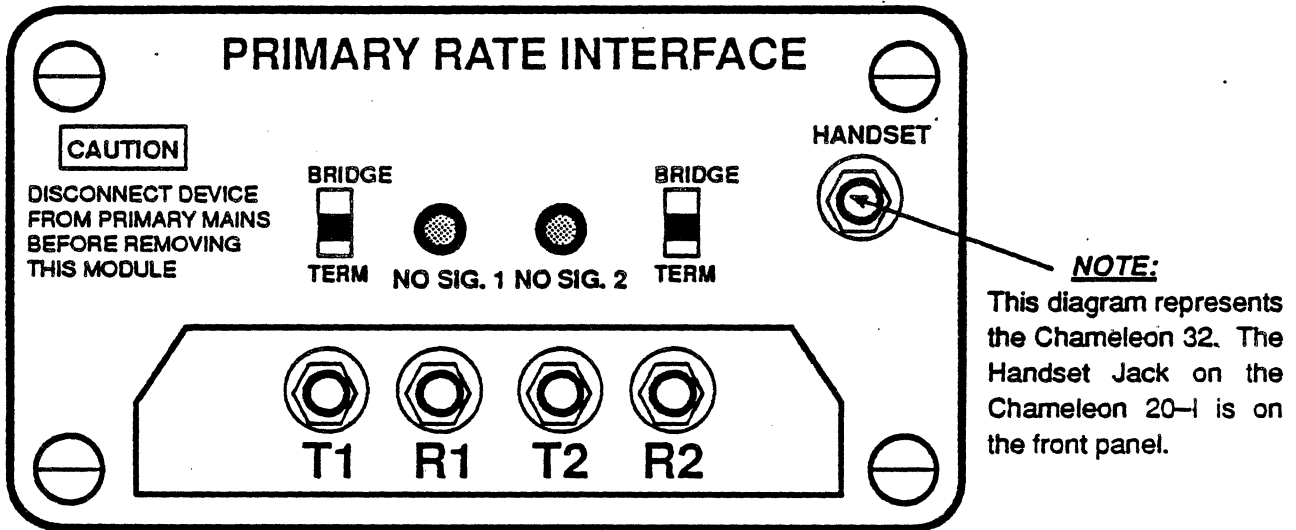
Figure 11.1: The ANSI Primary Rate Interface Module (Chameleon 32)
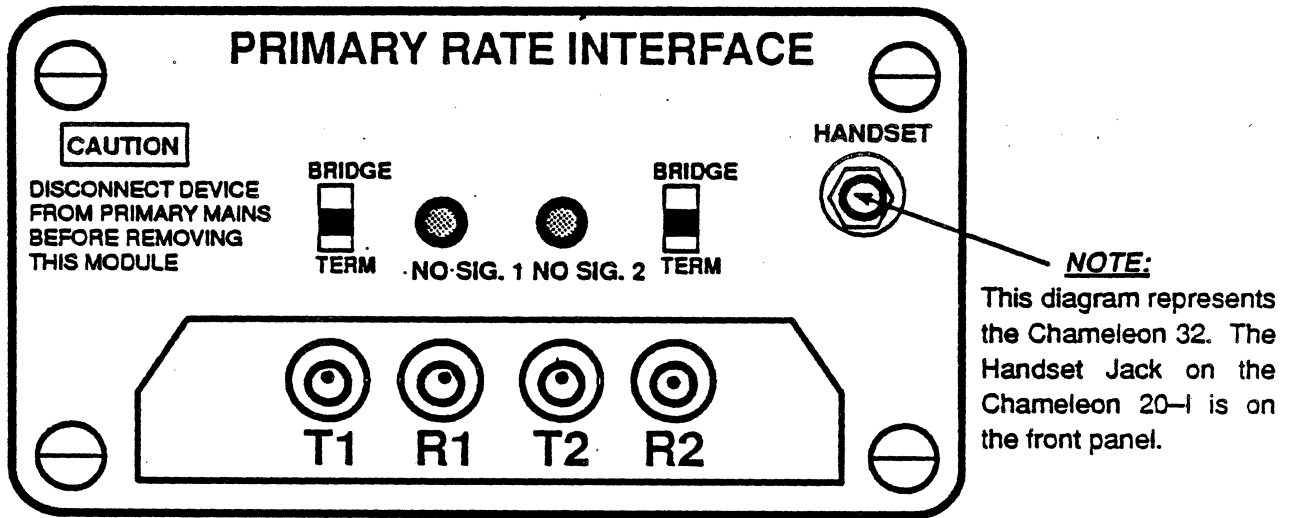
Figure 11.2: The CEPT Primary Rate Interface Module (Chameleon 32)

PRI Configuration

When the Primary Rate Interface pod is installed, the Chameleon displays Primary Rate Interface options in the configuration menus. To configure the Primary Rate Interface, perform the steps below.

NOTE:

The term *channel* refers to the use of the ANSI PRI. The term *time slot* refers to the use of the CEPT PRI.

1. Connect the devices you are monitoring to the Chameleon Primary Rate Interface.

Important!

You must connect the lines before configuring the PRI or starting your testing applications. If a receive channel /time slot is selected when a cable is not connected to receive lines R1 or R2, the receive selection may not work.

If a cable is not connected to R2, the data on T2 will be looped back to R2.

2. Power up your Chameleon and display the main Configuration menu (Figure 11.3). Note that the display shown is for the Chameleon 32. The display for a Chameleon 201 will be similar with the exception of the Physical Interface options.


```
┌──Ѳ─────────────────────────────────────────┐ Configuration
│   Tekelec CHAMELEON XX. Version x.x. Copyright (c) 1988
│   ┌──────────────────────────────────────┐
│   │ Press F7 to set the PRIMARY Interface default │
│   └──────────────────────────────────────┘   ┌─────────────────────┐
│                                               │ Press GO to Accept  │
│   ┌───────────────────────────────────┐       └─────────────────────┘
│   │ Setup Mode                   Menu  │
│   └───────────────────────────────────┘
│   ┌───────────────────────────────────────────────────┐
│   │ Port A    Mode of Operation            Monitor     │
│   │                                                    │
│   │           Physical Interface           Primary     │
│   │                                                    │
│   │           Setup                        ISDN        │
│   │                                                    │
│   │   Monitoring PORT A Data Source        Line        │
│   │   Capture Mode                         Cycle       │
│   └───────────────────────────────────────────────────┘
│   ┌──Physical Interface──┐      ┌──FUNCTIONS──┐
│   │V-type│Basic│Primary│  │  │  │Setup│Physicl│Version│Save│SetT.O│
└─────────────────────────────────────────────────────────────────────┘
```
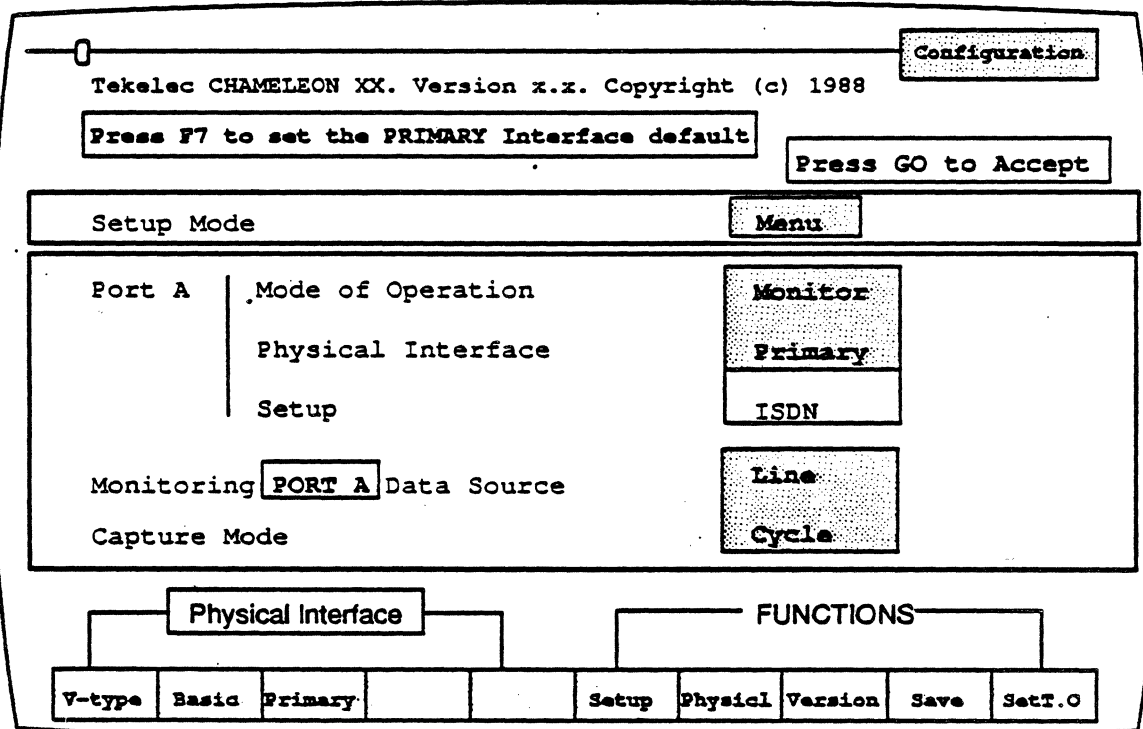
Figure 11.3: Main Configuration Menu (Chameleon 32)

3. Select *Monitor* or *Simulate* as the Mode of Operation for the port with the PRI. The option you select depends on your testing application.

   If you are monitoring the traffic between two devices, select *Monitor.* If you are emulating a device so that you can test a second device, select *Simulate.*

4. Select *Primary* for the Physical Interface parameter.

5. Press *F7 Physicl* to display the Primary Rate Interface setup. menu. This menu enables you to configure the Primary Rate Interface and is described on page 11-10.

6. When you have the desired setup values displayed in the PRI setup menu, press *Go* to accept the values and return to the main configuration menu.

7. Press *F6 Setup* to display the protocol selection menu. This menu enables you to select an upper layer protocol.

   Use the function keys to select the desired protocol and additional protocol–specific parameters as displayed. For example, if you select ISDN as the upper layer protocol, you are prompted for a Q.931 standard, as well as other parameters. If you are not familiar with a particular parameter, refer to the appropriate protocol chapter of this volume for a description.

8. When you have the desired values displayed in the protocol selection menu, press *Go* to accept the values and return to the main Configuration menu.

9. If your Mode of Operation is Monitor, select a **Data Source** and **Capture Mode** to suit your testing application. (These parameters are not displayed if the Mode of Operation is Simulate.) If you are not familiar with these parameters, refer to the *Chameleon User's Guide, Chapter 3.*

10. From the main Configuration menu, press *Go.*

11. The Applications Selection menu is displayed. This menu enables you to select the testing applications you want to run. The applications that are displayed depend on the configuration and protocol selected.

If your Mode of Operation is Monitor, only the Monitoring applications will be displayed for the selected protocol.

If your Mode of Operation is Simulate, you will have a window containing Monitoring applications, and a window containing Simulation applications for the selected protocol.

When the Primary Rate Interface is selected as the Physical Interface, the PRIMARY application is listed with the Monitoring applications. This application provides a runtime display which enables you to monitor and modify your Primary Rate Interface configuration without stopping the other testing applications.

12. Load the PRIMARY application and the other desired applications. If you are not familiar with the applications, refer to the *Chameleon User's Guide, Chapter 3*.

   To load an application, do the following:

   a. Move the arrow cursor to the application.

   b. Press the function key (F1, F2, or F3) to load the application on the desired port.

   c. The port letter (A, B or AB) will blink next to the application name. When the letter stops blinking, the application is loaded.

   d. Use this same method to load all desired applications.

       You can move between the Monitoring and Simulation windows by pressing Shift↑ or Shift↓.

   e. Press *Go* to start the selected applications. As each application is started, a page banner appears at the bottom of the screen.

13. The **ISDN Primary** page banner is the PRI runtime display. It is described on page 11-16.

   If you select **Monitor** as the Mode of Operation, a page banner for each of the selected Monitoring applications is displayed (except Direct–to–Disk, which does not have a page display). Refer to the appropriate *Chameleon User's Guide* for information about using Monitoring application pages.

   If you select **Simulate** as the Mode of Operation, there should be a **Simulate** page banner displayed. Refer to the *Chameleon 32 Simulation Manual* for information about Simulation.

PRI Setup Menu

When you press *F7 Physicl* from the main configuration page, the setup menu is displayed. The parameters displayed in the menu vary depending on whether you are in Monitor or Simulate Mode, and whether you are using ANSI or CEPT framing. These variations are NOTE:d in the description of the menu, which begins on the next page.

```
┌─────────────────────────────────────────────────────────────────┐
│  ╔═╗                                              ┌─Configuration─┐│
│ ─╢ ╟──────────── ISDN Primary Rate Interface (1.544Mbps) ─┘│
│  ╚═╝  ┌─Setup─┐                                               │
│       └───────┘                                               │
│  Mode        Simulate              Framing    D4 ◄───         │
│                          Line 1                    Line 2     │
│  Signal Coding           B8ZS                      B8ZS       │
│  Signaling               On                        On         │
│  Transmit Mode           Idle                      Idle       │
│  Data Rate               64Kbs                     64Kbs      │
│  Idle Channel (LSB..MSB) 01010101                            │
│  Idle Signal    (AB)     01                                  │
│                                                               │
│        DSO                                                     │
│                     Channel [1..24]         Channel [1..24]   │
│  Receive Data X          00                        00        │
│         Codec            00                                   │
│  Receive Data Y          00                                   │
│         Codec            00                                   │
│         Miliwatt         00                                   │
│  Milliwatt Tone 1004Hz                                        │
│  DSO Inversion     Off                                        │
│                                                               │
│              After making selections Press GO                 │
│  ┌─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬────┐ │
│  │ D4  │ ESF │CEPT │     │     │     │     │     │     │    │ │
│  └─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴────┘ │
└─────────────────────────────────────────────────────────────────┘
```

Figure 11.4: ANSI Primary Rate Interface Setup Menu

Default settings are automatically displayed when the setup menu first appears. The arrow cursor indicates the selected parameter. The values for the selected parameter are shown in the softkey strip at the bottom of the page.

NOTE: **If Line 1 and Line 2 are configured identically, the data transmitted over Line 1 is also transmitted over Line 2.**

To change a parameter, use the arrow keys to move the arrow cursor to the parameter you want to change, and then press the function key that corresponds to the desired value. Several parameters require you to type in a value rather than select a value using the function keys.

Mode

Selects the mode to use. If you selected Simulate as the Mode of Operation when configuring the port, *Simulate* is the only valid option for this parameter.

If you selected Monitor for the Mode of Operation when configuring the port, you may select either *Simulate* or *Monitor* for this parameter.

Simulate   This option enables you to generate data from the Chameleon 32, and send it on the line.

If you selected Monitor for Mode of Operation, the Chameleon simulates the physical layer, while monitoring layers 2 and above. This does not include inserting Chameleon generated data.

Monitor   The Chameleon monitors the line only.

Framing

Selects the type of framing to be used. The options depend on whether you have an ANSI or CEPT interface installed.

D4   D4 Framing. This is displayed only for ANSI.

ESF   Extended Super–Frame. This is displayed only for ANSI.

SL96   SLC–96 framing. This is displayed only for ANSI. When selected, the Signaling parameter is automatically set to OFF and cannot be altered.

CEPT   CEPT recommended framing. This is displayed only for CEPT.

Note:

For Loss of Frame alarms, see page 11–16.

Signal Coding

Selects the Zero Suppression scheme to be used. The ANSI options are:

B8ZS   Bipolar 8 Zero Suppression

AMI   Alternate Mark Inversion (no zero suppression)

The CEPT options are:

HDB3   High Density Bipolar 3 (HDB3) is a coding scheme that provides sufficient 1s density when there is a stream of continuous zeros. This is done by substituting the zero sequence with a signal sequence containing bipolar violations.

Note: AMI   Although AMI (Alternate Mark Inversion) can be selected for CEPT, it is recommended that it not be selected. CEPT and AMI are fundamentally incompatible; however, this incompatilibity will not cause the Chameleon to hang up. Rather, the message *"Loss of Signal Line 1, Port A (or Port B)"* will be displayed.

Signaling   For ANSI, this enables/disables signaling information for the line. In D4 framing, this is done using robbed–bit signaling (8–bit, least significant bit, on every sixth frame). With ESF framing, the signaling bits are transmitted using F–bits from the frames in the ESF (24 frames). For SL96 framing, Signaling is automatically set to OFF and cannot be altered. When set to ON in conjunction with a data rate of 64 kbs, CRC errors are created as a normal consequence of this configuration, and not as a result of software error.

For CEPT, this enables signaling information in time slot 16. When ON, time slot 16 contains the current signaling information. When OFF, time slot 16 is available for other uses. (When OFF, the time slot parameter changes to [1–31]).

Note: For both ANSI and CEPT, Signaling must be set the same for both Lines 1 and 2. That is, both lines must be on, or both lines must be off. For Loss of Signalling alarm, see page 11–16.

Transmit Mode   This parameter has five selections:

Resync   Re–synchronizes the line. This function is required to resynchronize the framing before you run any test and can also be used to resynchronize the line at any time.

Idle   Transmits an idle sequence on the line while the receiver is synchronizing to the incoming signal. The idle pattern is specified in the Idle Channel parameter.

Repeater   Synchronizes the Tx clock to the Rx clock and re–transmits the received data.

Remote Alarm   Transmits the Remote Alarm signal. Available only for CEPT.

Yellow Alarm   Transmits the Yellow Alarm signal. Available only for ANSI.

Transparency   Available for Line 1 only. All channels/time slots, except those for which selections are made, are looped from the Receive line to the Transmit line. The data provided by the Transmit Mode options (Codec, Data Y, and Milliwatt) replace the incoming traffic on those channels/time slots.

Data Rate   Available only when ANSI (D4 or ESF) framing is selected. This parameter allows you to set Data X and Data Y for either 56Kbps or 64Kbps. When set to 64kbs in conjunction with Signalling set to ON, CRC errors are created as a normal consequence of this configuration, and not as a result of software or hardware error.

The Data Rate must be set the same for both Lines 1 and 2. That is, both lines must be 56Kbps, or both lines must be 64Kpbs.

CRC   Available only when CEPT framing is selected. Enables/disables the Cyclic Redundancy Check in the signal stream by selecting On or Off.

Idle Channel   This parameter specifies the idle sequence to be sent on the channels for which no other functions have been selected (for example, DS0 or Codec). Enter the 8–bit sequence in the following format:

LSB . . . . . . MSB
x x x x x x x x

Note: If the default setting of 01010101 is used and AMI is selected for Signal Coding under CEPT, the message *"Loss of Signal Line 1, Port A (or Port B)"* will be displayed.

Idle Signal

When Signaling is enabled (ON), this parameter specifies the sequence of bits sent on the signaling channel when idle. For D4 or ESF framing, enter two bits. For CEPT framing, enter four bits.

DS0

The remaining parameters allow you to make selections for a specific channel/time slot. A value of 00 de–selects the current selection.

For ANSI, these parameters accept a value for the channel number (1–24). For CEPT, these parameters accept a value for the time slot (1 – 31). If Signaling is On, time slot 16 is reserved for signaling information and is not available for these parameters.

Receive Data X

Selects the receive channel/time slot for Simulation or Monitoring packages. Data can be received on either Line 1 or Line 2, but not on both simultaneously.

Receive Codec

Selects the channel/time slot to enable the Codec Receiver (available on Line 1 only).

Receive Data Y

Selects the channel/time slot to enable the Data Y Receiver (Monitor Mode only, Line 1 only).

Transmit Data Y

Simulate mode on the Chameleon 32 only. Selects the channel/time slot to be used with the DS0 Y Receiver in Monitor Mode. In Simulation Mode, this parameter takes the channel/time slot for the Line 1 Transmitter.

Transmit Codec

Simulate mode only. Selects the channel/time slot for the Codec Transmitter.

Transmit Milliwatt

Simulate mode only. Selects the channel/time slot to enable the Digital Milliwatt Tone Generator. The tone generated in ANSI (D4/ESF) is 1004Hz at 0 dBm. In CEPT, the tone can be either 820Hz or 1020Hz.

**Milliwatt
Tone**   Simulate mode only. For CEPT framing, selects the
                Milliwatt Tone of 820Hz or 1020Hz. For ANSI framing,
                displays 1004Hz.

**DS0
Inversion**   Inverts the data on the specified channels (ANSI), or
                time slots (CEPT) in Data X and Data Y.

PRIMARY RUNTIME PAGE

When you load and run the PRIMARY application from the Applications Selection menu, the **ISDN Primary** page is displayed. This page displays the Primary Rate Interface configuration and enables you to modify parameters without stopping any other applications which are running. However, you cannot modify the **Mode** and **Framing** parameters. All other parameters can be modified. The changes take effect as soon as you press the function key (for softkey selections) or press *Return* (for values entered from the keyboard).

The format of the runtime page (Figure 11.6) is the same as the Primary Rate Interface setup menu, except that it displays the *Running* in the upper left corner of the page.

Alarms

Loss of Frame and Loss of Signalling are announced by two alarms. Upon detecting an alarm condition, the Chameleon flashes a red alarm message at the bottom of the Run Time page. Simultaneously, an audible alarm is sounded at three-second intervals. This audible alarm sounds even if the Run Time page is not visible, although this page must be open.

```
┌─────────────────────────────────────────────────────────────────────┐
│  ──O──────────────────────────────────────────────┌ Configuration ┐  │
│                                                                       │
│  ┌──────────┐   ISDN Primary Rate Interface (1.544Mbps - Vx.xx)       │
│  │ Running  │                                                         │
│  └──────────┘                                                         │
│                                                                       │
│  Mode         Simulate                    Framing     D4              │
│                              Line 1                    Line 2         │
│                                                                       │
│  Signal Coding         B8ZS      ◄───               B8ZS              │
│  Signaling             On                           On               │
│  Transmit Mode         Idle                         Idle             │
│  Data Rate             64Kbs                        64Kbs            │
│  Idle Channel (LSB..MSB)  01010101                                    │
│  Idle Signal  (AB)        01                                          │
│                                                                       │
│           DS0        Channel [1..24]             Channel [1..24]      │
│  Receive Data X         00                            00             │
│         Codec           00                                            │
│  Receive Data Y         00                                            │
│         Codec           00                                            │
│         Miliwatt        00                                            │
│  Milliwatt Tone 1004Hz                                                │
│  DS0 Inversion   Off                                                  │
│                                                                       │
│  ┌──────┬──────┬────┬────┬────┬────┬────┬────┬────┬────┐              │
│  │ B8ZS │ AMI  │    │    │    │    │    │    │    │    │              │
│  └──────┴──────┴────┴────┴────┴────┴────┴────┴────┴────┘              │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 11.6: ISDN PRI Run-Time Page.

Application Notes

Figure 11.6 below illustrates several Primary Rate Interface testing configurations using the Chameleon.
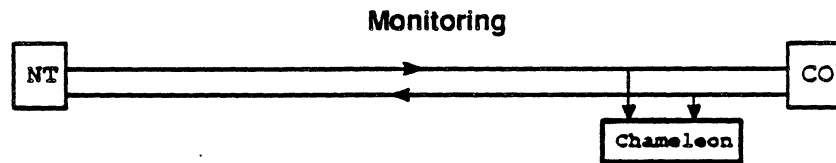
Monitoring

The Chameleon provides full duplex monitoring capability of the Primary Rate.
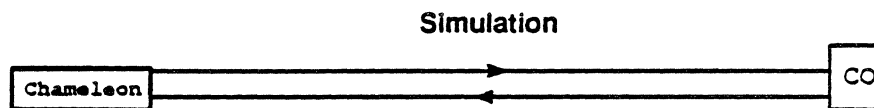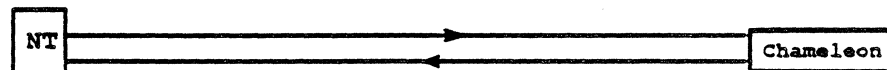
Simulation

The Chameleon simulating a subscriber.

The Chameleon simulating a network.
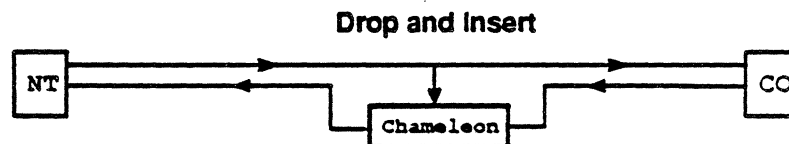
Drop and Insert

The drop and insert application allows you to insert your own data or voice communication on a single channel, and then monitor the response on the other half of the span without affecting the other channels (24 for ANSI and 30 for CEPT.)

Figure 11.6: Primary Rate Interface Applications

You can perform two types of Monitoring:

- In-line Monitoring (with or without Drop and Insert)
- Bridge Monitoring (at Monitor Jack or equivalent)

Figure 11.7 below shows the In-line Monitoring cable connections.
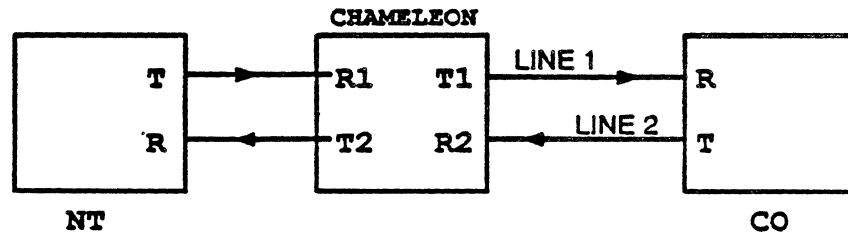
Note: BRIDGE TERM switch is in the TERM position.

Figure 11.7: Chameleon with the Primary Rate Interface

You must stop acquisition before making changes to the DS0 Channel selections.

To stop acquisition,

.press *RUN/STOP*.

To resume acquisition,

press *RUN/STOP*.

NOTE:

You cannot simultaneously listen to both sides of a conversation on the Codec Receiver.

<u>*Monitoring Channels From Both Lines*</u>

Figure 11.8 below shows the following setup:

- D4 Framing

- B8ZS Zero Suppression

- Signaling ON

- Channel 8 enabled on the DS0 x Receiver, Line 2

- Codec Receiver enabled on Channel 2, Line 1

- DS0 y Receiver enabled on Channel 5, Line 1

The Data Rate for DS0 x and DS0 y Channels is 64Kbps. The data received on DS0 x and DS0 y (displayed by the Monitoring package) is inverted.

```
┌─────────────────────────────────────────────────────────────────┐
│  ─O───────────────────────────────────────────┌─────────────┐   │
│                                                │Configuration│   │
│                                                └─────────────┘   │
│       Setup            ISDN Primary Rate Interface (1.544Mbps - Vx.xx)│
│                                                                  │
│     Mode        Monitor  ◄───        Framing      D4             │
│                               Line 1                  Line 2     │
│                                                                  │
│   Signal Coding           B8ZS                      B8ZS         │
│   Signaling               On                        On           │
│   Transmit Mode           Idle                      Idle         │
│   Data Rate               64Kbs                     64Kbs        │
│   Idle Channel (LSB..MSB) 01010101                              │
│   Idle Signal  (AB)       01                                    │
│                                                                  │
│         DSO         Channel [1..24]           Channel [1..24]    │
│   Receive Data X        00                          08          │
│         Codec           02                                      │
│   Receive Data Y        05                                      │
│                                                                  │
│   DSO Inversion  On                                             │
│              After making selection Press GO                    │
│  ┌──────┬───────┬───┬───┬───┬───┬───┬───┬───┬──────┐           │
│  │Simulat│Monitor│   │   │   │   │   │   │   │ Exit │           │
│  └──────┴───────┴───┴───┴───┴───┴───┴───┴───┴──────┘           │
└─────────────────────────────────────────────────────────────────┘
```

Figure 11.8: Primary Rate Interface Monitoring Setup

Figure 11.9 below illustrates one of the possible cabling configurations used for this setup.
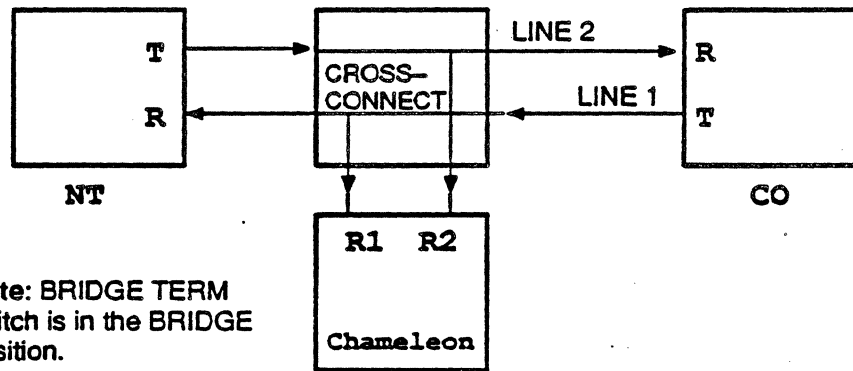
Figure 11.9: Chameleon Set Up for Dual Line Monitoring

Figure 11.10 shows the following setup:

- Extended Superframe Format
- Signaling off
- Codec selected on Channel 2, Line 1
- DS0 y selected for Channel 5, Line 1

```
┌─────────────────────────────────────────────────────────────────────┐
│                                                        ┌───────────────┐ │
│ ──O───────────────────────────────────────────────────│ Configuration │ │
│                                                        └───────────────┘ │
│                                                                         │
│     Setup              ISDN Primary Rate Interface (1.544Mbps - Vx.xx)  │
│                                                                         │
│                                                                         │
│   Mode          Monitor  ◄───          Framing     ESF                  │
│                              Line 1                    Line 2           │
│                                                                         │
│   Signal Coding           B8ZS                    B8ZS                  │
│   Signaling               Off                     Off                   │
│   Transmit Mode           Idle                    Idle                  │
│   Data Rate               56Kbs                   56Kbs                 │
│   Idle Channel (LSB..MSB) 01010101                                      │
│   Idle Signal  (AB)       01                                            │
│                                                                         │
│            DSO         Channel [1..24]            Channel [1..24]        │
│   Receive Data X           00                          00               │
│            Codec           02                                           │
│   Receive Data Y           05                                           │
│                                                                         │
│   DS0 Inversion  Off                                                    │
│                   After making selection Press GO                       │
│  ┌────────┬────────┬───┬───┬───┬───┬───┬───┬───┬───┬──────┐            │
│  │Simulat │Monitor │   │   │   │   │   │   │   │   │ Exit │            │
│  └────────┴────────┴───┴───┴───┴───┴───┴───┴───┴───┴──────┘            │
└─────────────────────────────────────────────────────────────────────┘
```

Figure 11.10: ISDN PRI Extended Superframe Monitoring Setup

Monitoring One Line Only

To Monitor one line only, set up the hardware as shown in Figure 11.11:
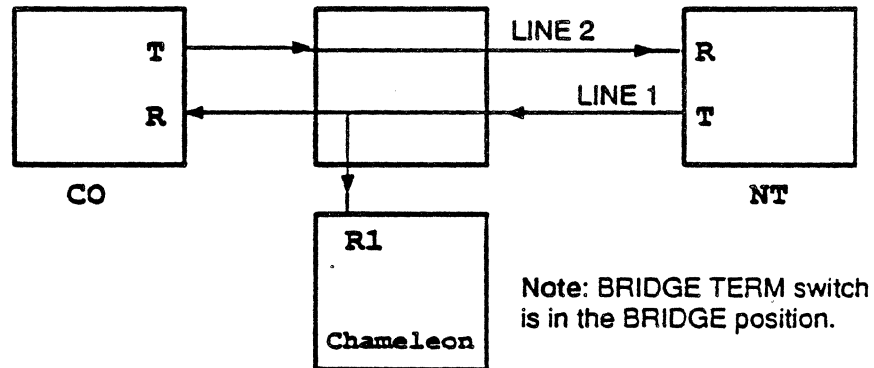
Figure 11.11: USDN PRI Single—Line Monitoring Setup.

Drop and Insert

The drop and insert application allows you to insert your own data or voice communication on a single channel, and then monitor the response on the other half of the span without affecting the other channels (24 for ANSI and 30 for CEPT). Figure 11.12 below illustrates the physical configuration for this application..
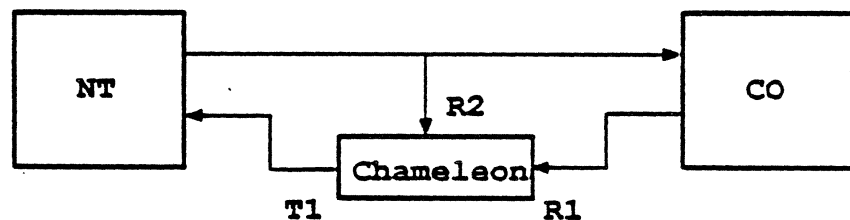
Figure 11.12: Drop—and—Insert Physical Configuration.

Figure 11.13 below shows the following Drop—and—Insert software configuration:

- Codec Receiver ON (Line 1), Channel 2
- DS0 x Receiver ON (Line 2), Channel 5

- DS0 y Transmitter inserted (Line 1), Channel 5
  (available on Chameleon 32 only)

- Codec Transmitter inserted signal (Line 1), Channel 3

- Digital Milliwatt Tone inserted (Line 1), Channel 7

All Channels, except 3, 5, and 7 pass through without modification.

```
┌─0─────────────────────────────────────────┤Configuration│
│                                                            │
│             ISDN Primary Rate Interface (1.544Mbps - Vx.xx)│
│        Setup                                               │
│                                                            │
│  Mode          Simulate              Framing     D4 ◄──    │
│                            Line 1                 Line 2    │
│  Signal Coding             B8ZS                   B8ZS      │
│  Signaling                 On                     On        │
│  Transmit Mode             Transparent            Idle      │
│  Data Rate           .     56Kbs                  56Kbs     │
│  Idle Channel (LSB..MSB)   01010101                         │
│  Idle Signal  (AB)         01                               │
│                                                            │
│          DS0         Channel [1..24]        Channel [1..24] │
│  Receive Data X                                      05     │
│          Codec             02                               │
│  Receive Data Y            05                               │
│          Codec             03                               │
│          Miliwatt          07                               │
│  Milliwatt Tone 1004Hz                                      │
│  DS0 Inversion    Off                                       │
│                                                            │
│              After making selections Press GO              │
│  ┌─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬───┐│
│  │ D4  │ ESF │     │     │     │     │     │     │     │   ││
│  └─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴───┘│
└────────────────────────────────────────────────────────────┘
```

Figure 11.13: Drop—and—Insert Software Configuration.

PRIMARY RATE INTERFACE STATISTICS

Introduction

The Primary Rate Interface Statistics (PRISTAT) application enables you to monitor the errors that occur over the Primary Rate Interface. This application is available for both the ANSI and CEPT Primary Rate Interface options.

Starting Statistics

To run the PRI Statistics package, perform the following steps:

1. If necessary, turn on and boot the Chameleon.

2. When the Configuration menu is displayed, complete the configuration parameters for the port you are using, as follows:

    - . Mode of Operation   **Monitoring**

    - Physical Interface   **Primary Rate Interface**

    The remaining parameters can be set to the requirements of your testing application.

3. Press *F7 Physicl* to configure the Primary Rate Interface for your application. When complete, press *Go* to return to the main Configuration menu.

4. Press *Go* when the Configuration menu is complete. This displays the Applications Selection menu.

5. Move the arrow cursor to PRISTAT and press the function key which loads the application for the port you are using. This is the Primary Rate Interface Statistics application.

6. Load additional applications as desired. It is recommended that you load the **PRIMARY** application which enables you to monitor and change the Primary Rate Interface configuration during runtime.

7. When all desired applications are loaded, press *Go* to start the loaded applications.

8. The page banners for the running applications appear at the bottom of the screen. The PRISTAT banner displays the PRI Statistics, and is described on the next page.

PRI Page Format

When you display the PRI Statistics page, a screen similar to that shown in Figure 11.14 below, is displayed. The ANSI and CEPT PRI Statistics pages are the same except for the function keys, which are described on page 11-27.

ANSI PRIMARY ERROR STATISTICS				
	LINE 1		LINE 2	
Error Type	BPV	FE	BPV	FE
Cumulative Error	0	0	0	0
Error Free Seconds	0	0	0	0
Errored Seconds	0	0	0	0
Unavailable Seconds	0	0	0	0
Severely Errored Seconds	0	0	0	0
Degraded Minutes	0	0	0	0

Function keys: Zero, CRC6_1, CRC6_2, FE_1, FE_2, FREEZE

Figure 11.14: PRI Statistics Page

Error Types

The Error types displayed in the first column are:

Cumulative Errors   The total of all errors that have occurred. This field is incremented by one, each time an error occurs.

Every second, one of the following three fields is incremented:

Error Free Seconds   This field is incremented if the second had completely unerrored data.

Errored Seconds   This field is incremented if the second contained at least one error, excluding Unavailable Seconds.

Unavailable
Seconds (US)

This is the number of 1–second intervals that the connection is deemed to be un–available. This field is incremented when more than 10 consecutively 'Severely Errored Seconds' occur.

In addition, the following errors are also displayed:

Severely
Errored
Seconds (SES)

This field is incremented by 1 for each second (excluding Unavailable Seconds) with the error characteristics as shown in Figure 11.15 below.

PRI TYPE	ERROR RATE
ANSI	$BPV \geq 1544s^{-1}$ $FE \geq 2s^{-1}$ $CRC6 \geq 320s^{-1}$
CEPT	$BPV \geq 2048s^{-1}$ $FA \geq 28s^{-1}$ $CRC4 \geq 100s^{-1}$ $MFA \geq 2s^{-1}$

Figure 11.15: Error Rate Characteristics

Degraded
Minutes

Exclude the 'Severely Errored Seconds' and 'Unavailable Seconds' and consecutively group the remaining second intervals into packets of 60 (expressed as minutes). This field is incremented when one of these minutes contains more than 4 errors.

Function Keys

There are two columns of error statistics provided for each line. The first column always indicates the number of Bipolar Violations (BPV) for each line.

The second column for each line displays the following:

- For CEPT and ANSI ESF framing, the second column can be toggled between CRC and Frame Errors by using the function keys.

- For ANSI D4 framing, the second column is not used for CRC error counting.

The function keys vary depending on whether you have a CEPT or ANSI Primary Rate Interface, as described below.

ANSI Function Keys

The software automatically detects if the framing type is D4 or ESF. If D4 framing is being used, the second column for each line changes to N/A (Not Applicable), since only BPVs exist in D4 framing. The ANSI function keys are:

F1 Zero   Resets all statistical values to zero.

F2 CRC6_1	This displays the CRC bit error rate in the right column for Line 1. This function is not available for D4 framing. In Extended Super Frame (ESF) framing, pressing *F2*, resets all statistics values and causes the CRC6 bit error rate to be displayed in the right column of Line 1 statistics.
F3 CRC6_2	This is the same as *F2*, except that it displays the CRC bit error rate for Line 2 in ESF framing. This function is not available for D4 framing.
F4 FE_1	This displays Frame Errors in the right column for Line 1 in ESF framing. This function is not available for D4 framing.
F5 FE_2	This is the same as *F4*, except that it displays Frame Errors in the right column for Line 2. This function is not available for D4 framing.
F6 FREEZE *F6 UNFREZ*	*F6* freezes the statistics display so that the current values are not updated (although the application continues to calculate them).

When the page is frozen, the only function key available is *F6 UNFREZ*, which unfreezes the display, updates it, and resumes in normal mode. This function is available for both ESF and D4 framing.

CEPT Function Keys

The CEPT PRI Statistics function keys provide you with the following capabilities:

F1 Zero   Resets all statistical values to zero.

F2 CRC4_1   This displays CRC error statistics in the right column for Line 1. When you press *F2*, it resets all statistics values and causes CRC4 errors to be displayed in the right column of the Line 1 statistics.

F3 CRC4_2   This is the same as *F2*, except that it displays CRC errors for Line 2.

F4 FA_1   This displays Frame Alignment errors in the right column for Line 1. When you press *F4*, you must select one of the following:

                          F1 FA   Frame Alignment errors
                          F2 MFA   Multi–Frame Alignment errors

                          If both Lines 1 and 2 are displaying Frame Alignment errors, they will automatically be set to the same (either FA or MFA). You cannot have one line displaying MFA and the other line displaying FA.

F5 FA_2   This is the same as *F4*, except that it displays Frame Errors in the right column for Line 2.

F6 FREEZE   *F6* freezes the statistics display so that the
F6 UNFREZ   current values are not updated (although the application continues to calculate them). When the page is frozen, the only function key available is *F6 UNFREZ*, which unfreezes the display, updates it, and resumes in normal mode.

CHAPTER TWELVE:
ISDN BASIC RATE INTERFACE

Introduction

The Basic Rate Interface allows the Chameleon 32 or the Chameleon 20I to monitor a Basic Rate Interface (S/T), or simulate a Basic access as a TE or NT.

Voice frequency signals can also be inserted into or extracted from a selected Basic Rate Interface channel. A handset is provided to allow a voice conversation through the channel. On the Chameleon 32, the handset is connected through a jack on the I/O Module, on the Chameleon 20-I, the handset jack is located on the front panel.

The Chameleon Basic Rate Interface also generates a digital Milliwatt (0dBm, 1004 Hz μ–law or 1020 Hz A–law) which can be inserted into a selected channel.

S/T Transmitter and Receivers are compatible with the I.430 CCITT Red Book 1984 recommendation. The S/T Interface includes:

- Line Code: Pseudo–ternary inverted per I.430 CCITT Red Book 1984
- Frame Structure: 48 bit NT to TE and TE to NT formats
- Connectors: 8 pin RJ45 Type
- Switchable Terminating Resistor: 100 ohms ± 1%
- Surge Protection Provided on Transmit and Receive Pairs

The B1, B2, or D channel can be selected to run any of the available synchronous Monitoring or Simulation packages.

The LAPD package has been developed specifically for ISDN testing, but other Chameleon packages are available for specific applications (for example, X.25 Analysis, SNA/SDLC Analysis, and BISYNC Monitoring).. Likewise, LAPD, X.25, SNA/SDLC, and BISYNC Simulation packages are available for the Chameleon.

For one B Channel, features include:

- Availability at the external RS422 compatible interface, and the RS449 Adapter Cable (the 15–pin connector on the back panel of the Chameleon.)

- Connection to a handset using CODEC

- Generation of a 1004 Hz μ–law tone or 1020 Hz A–law tone (Milliwatt Tone Generator).

- Idle capability (the selected channel has no signal and is sending continuous 1s).

For the D Channel, features include:

- Availability at the external RS422 compatible interface, and the RS449 Adapter Cable (at the 15–pin connector on the back panel of the Chameleon.

- Idle capability (the selected channel has no signal, and is sending continuous 1s).

There is also an Interactive Mode for sending synchronizing information signals interactively.

BRI Module

The Basic Rate Interface Module for the Chameleon is shown in Figure 12.1. The interface for the Chameleon 20I is similar. The difference is that the handset jack for the Chameleon 20 is not located on the I/O Module, it is on the front panel.

The features of the I/O Module are described below and on the following page.

NOTE:

This diagram represents the Chameleon 32. The Handset Jack on the Chameleon 20–I is on the front panel
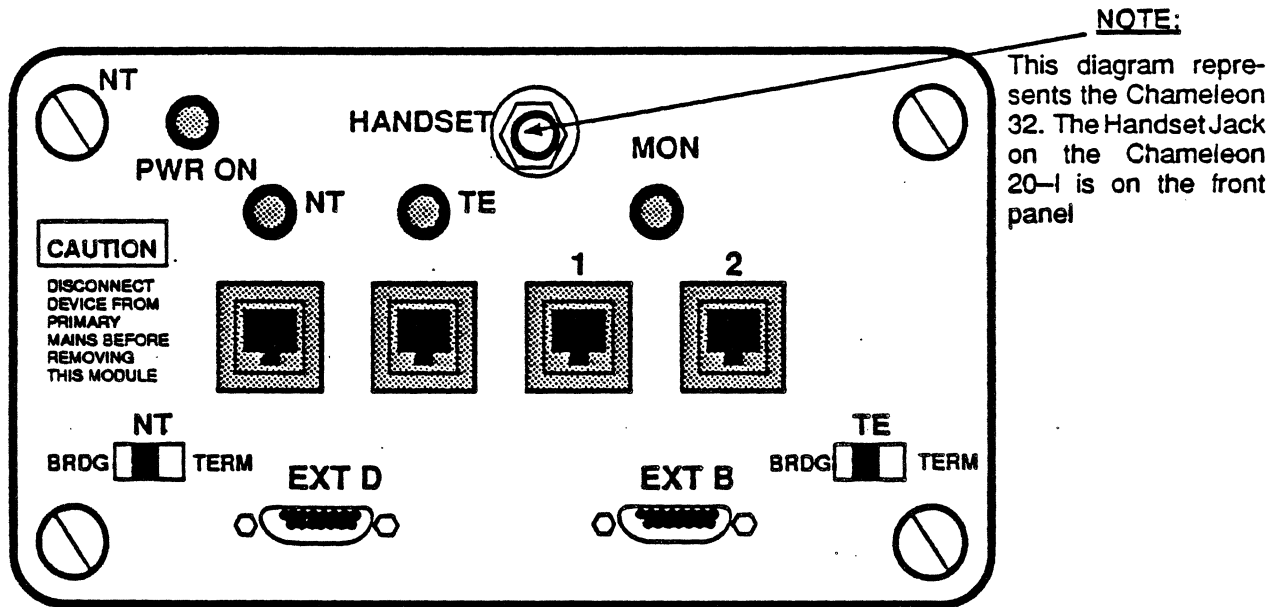
Figure 12.1: The Chameleon 32 Basic Rate Interface Module

FEATURE	DESCRIPTION
BRDG/TERM	This switch allows you to either bridge the received signal, or terminate the signal.
NT,TE, and MON	These LEDs are lit to indicate the operating state of the Chameleon. It can be either NT Simulation, TE Simulation, or Monitor.
NT /PWR ON	This LED is lit to indicate that the Chameleon is providing the power feed (40 volts) in NT Simulation.

RJ45 JACKS

The RJ45 (ISO8877/) jack labeled NT is used for NT Simulation. The RJ45 jack labeled TE is used for TE Simulation. The RJ45 jack labeled 1 or 2 is used for monitoring the Basic Rate Interface. The RJ45 jack labeled 2 is wired in parallel with jack 1 to allow the Basic Rate Interface to be connected to another device (NT or TE). (See Figure 12.2.)

Note

Do not insert an RJ11 connector into the RJ45 jack. While it is physically possible to do this, it may result in damage to pins 1 and 8 of the RJ45 jack. The problem may appear as either a constant or intermittent connection failure.

The RJ45 connector has a limited life and is rated for 750 insertions. This is a limitation of the type of connector. If the number of insertions exceeds this limit, the received and transmitted information may become intermittent.

If either of these problems occurs, the BRI I/O Module should be removed and returned to Tekelec for service.

EXT D

This 15-pin connector is used to connect the Basic Rate Interface D Channel (16K bps) to another test set or device. The interface signals are RS422 compatible. (An adapter cable is provided to allow connection to an RS449 device.)

EXT B

This 15-pin connector is used to connect one of the Basic Rate Interface B Channels (64K bps) to another test set or device. The interface signals are RS422 compatible. (An adapter cable is provided to allow connection to an RS449 device.)

HANDSET

This jack is used to attach the handset (provided by Tekelec) to the Chameleon, thus allowing conversations through a selected B Channel. On the Chameleon 20-I, the handset is connected through the jack on the Front Panel

BRI LED Overlay

The Basic Rate Interface LED overlay is described in detail in Appendix E of the *Chameleon 32 User's Manual* and in Appendix D of the *Chameleon 20 User's Manual.*
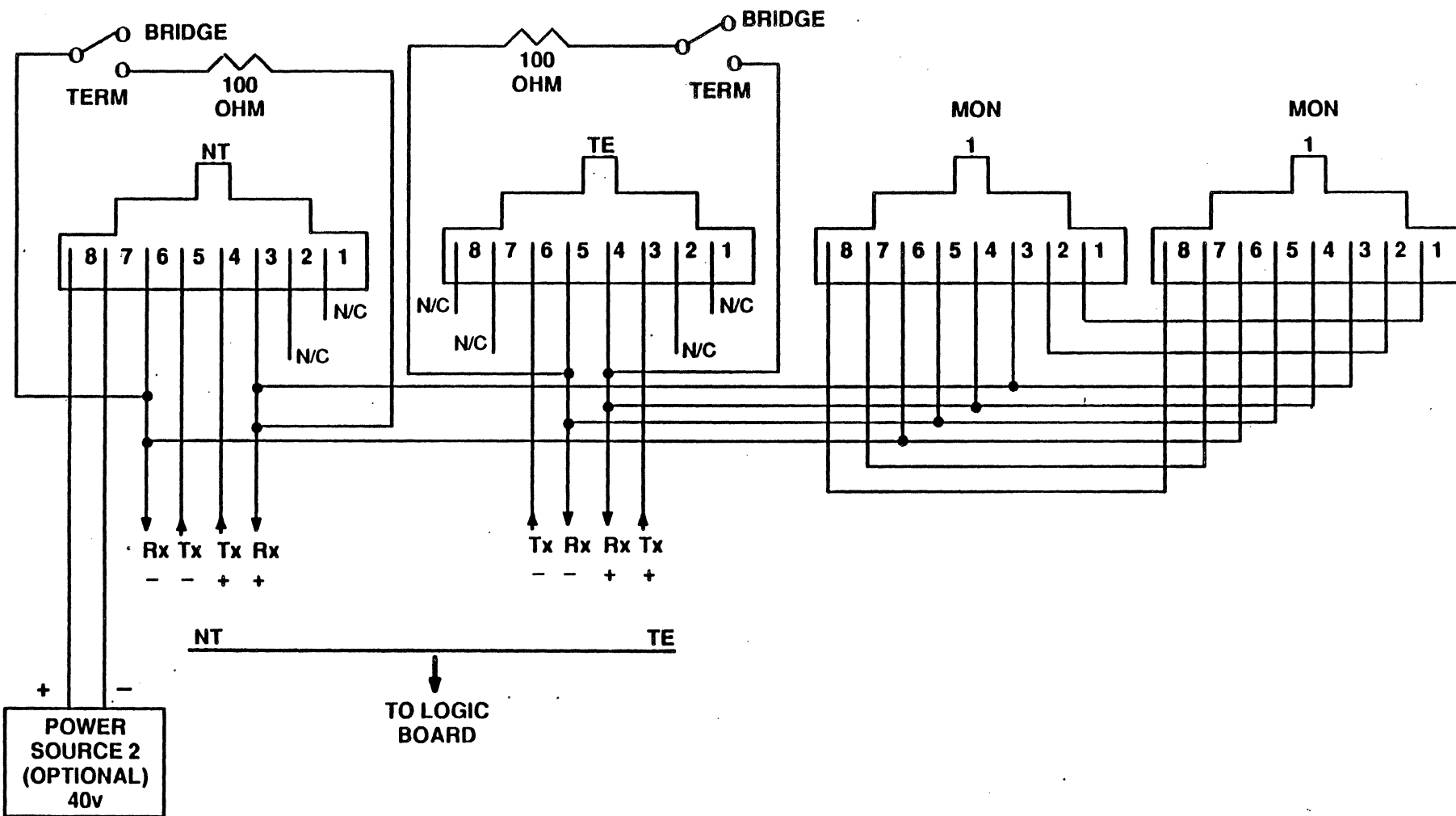
Figure 12.2: RJ45 Jacks Wiring for ISDN

BRI Configuration

When the Basic Rate Interface option is installed, the Chameleon detects its presence and includes Basic Rate Interface options in the configuration menus. To configure the Basic Rate Interface, perform the steps below.

1. Connect the devices you are monitoring to the Chameleon Basic Rate Interface.

2. Power up your Chameleon and display the main Configuration menu (Figure 12.3). Note that the display shown is for the Chameleon 32. The display for a Chameleon 201 will be similar with the exception of the Physical Interface options.
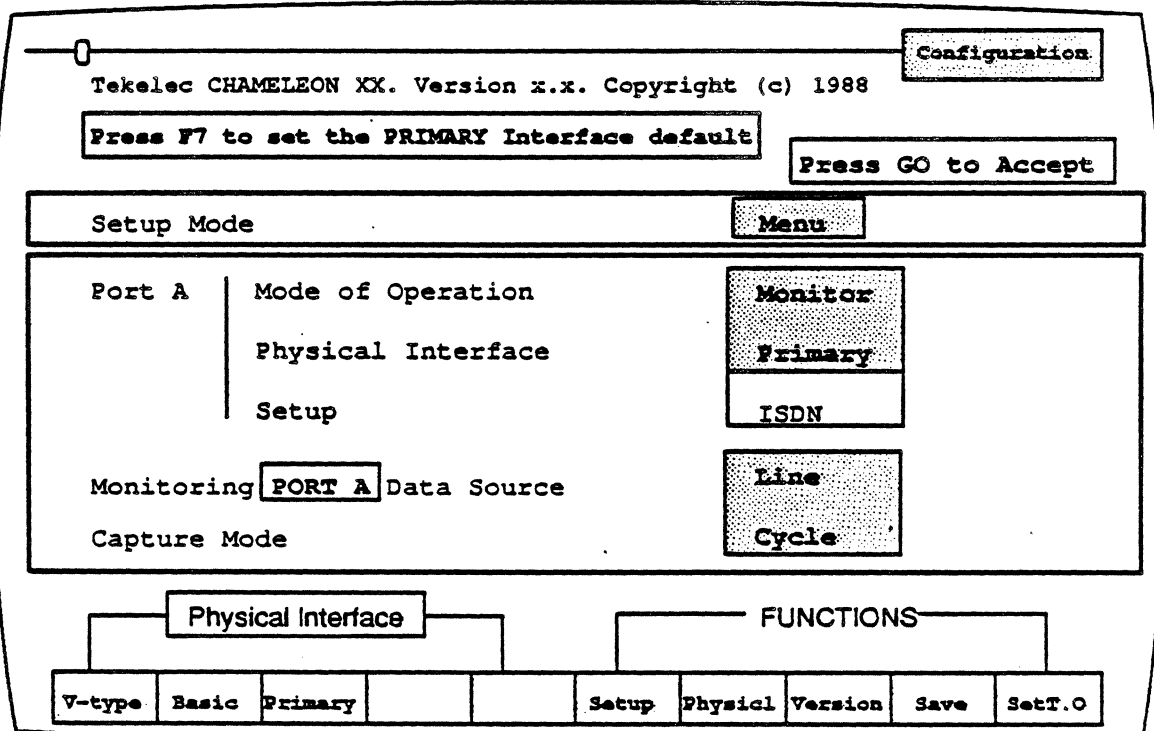
Figure 12.3: Main Configuration Menu

3. Select *Monitor* or *Simulate* as the Mode of Operation for the port with the BRI. The option you select depends on your testing application.

    If you are monitoring the traffic between two devices, select *Monitor*. If you are emulating a device so that you can test a second device, select *Simulate*.

4. Select *Basic* for the Physical Interface parameter.

5. Press *F7 Physicl* to display the Basic Rate Interface setup menu. This menu enables you to configure the Basic Rate Interface and is described on page 12-9.

6. When you have the desired setup values displayed in the BRI setup menu, press *Go* to accept the values and return to the main configuration menu.

7. Press *F6 Setup* to display the protocol selection menu. This menu enables you to select an upper layer protocol.

    Use the function keys to select the desired protocol and additional protocol–specific parameters are displayed. For example, if you select ISDN as the upper layer protocol, you are prompted for a Q.931 standard, as well as other parameters. If you are not familiar with a particular parameter, refer to the appropriate protocol chapter of this volume for a description.

8. When you have the desired values displayed in the protocol selection menu, press *Go* to accept the values and return to the main Configuration menu.

9. If your Mode of Operation is Monitor, select a **Data Source** and **Capture Mode** to suit your testing application. (These parameters are not displayed, if the Mode of Operation is Simulate.) If you are not familiar with these parameters, refer to the *Chameleon User's Guide, Chapter 3*.

10. From the main Configuration menu, press *Go*.

11. The Applications Selection menu is displayed. This menu enables you to select the testing applications you want to run. The applications that are displayed depend on the configuration and protocol selected.

If your Mode of Operation is Monitor, only the Monitoring applications will be displayed for the selected protocol.

If your Mode of Operation is Simulate, you will have a window containing Monitoring applications, and a window containing Simulation applications for the selected protocol.

When the Basic Rate Interface is selected as the Physical Interface, the BASIC application is listed with the Monitoring applications. This application provides a runtime display which enables you to monitor and modify your Basic Rate Interface configuration without stopping the other testing applications.

12. Load the BASIC application and the other desired applications. If you are not familiar with the applications, refer to the *Chameleon User's Guide, Chapter 3.*

To load an application, do the following:

a.   Move the arrow cursor to the application.

b.   Press the function key (F1, F2, or F3) to load the application on the desired port.

c.   The port letter (A, B or AB) will blink next to the application name. When the letter stops blinking, the application is loaded.

d.   Use this same method to load all desired applications.

You can move between the Monitoring and Simulation windows by pressing Shift↑ or Shift↓.

e.   Press *Go* to start the selected applications. As each application is started, a page banner appears at the bottom of the screen.

13. The BRI page banner is the BRI runtime display. It is described on page 12-13.

If you selected **Monitor** as the Mode of Operation, there should also be a page banner for each of the selected Monitoring applications (except Direct–to–Disk, which does not have a page display). Refer to the appropriate *Chameleon User's Guide* for information about using Monitoring application pages.

If·you selected Simulate as the Mode of Operation, there should be a **Simulate** page banner displayed. Refer to the *Chameleon 32/20 Basic Simulation Manual* for information about Simulation.

Setup Menus

When you press *F7 Physicl* from the main configuration page, the setup menu (Figure 12.4) is displayed. The parameters displayed in the setup menu vary depending on the selections you choose in the menu.

For example, if **D** is selected for Channel Selection, the parameter displayed under it will be **Channel B1**. But, if **B1** is selected for Channel Selection, the parameter displayed under it will be **Channel B2**. This way, each channel need be specified only once.

When the Channel Selection is **B1** or **B2**, the D channel is automatically available at the External D Interface. However, this is not the case with the External Channel B Interface, where only one of the B Channels is available for selection.

```
┌─0─────────────────────────────────────────  ┌──────────┐
│                                              │ Basic I.F.│
│  ┌───────┐                                   └──────────┘
│  │ Setup │
│  └───────┘
│            ISDN Basic Rate Interface (Vx.xx)  Board - x
│
│   Mode              Simulate ◄──      Device       NT
│
│   Channel Selection  D                Layer 1      Interactive
│
│   Channel B1         Idle             Channel B2   Idle
│
│   Bit Inversion      Off              NT Power     Off
│
│   DTMF Number        0
│
│
│   ┌────────┬────────┬───┬───┬───┬───┬───┬───┬───┬───┐
│   │Simulat │Monitor │   │   │   │   │   │   │   │   │
│   └────────┴────────┴───┴───┴───┴───┴───┴───┴───┴───┘
```
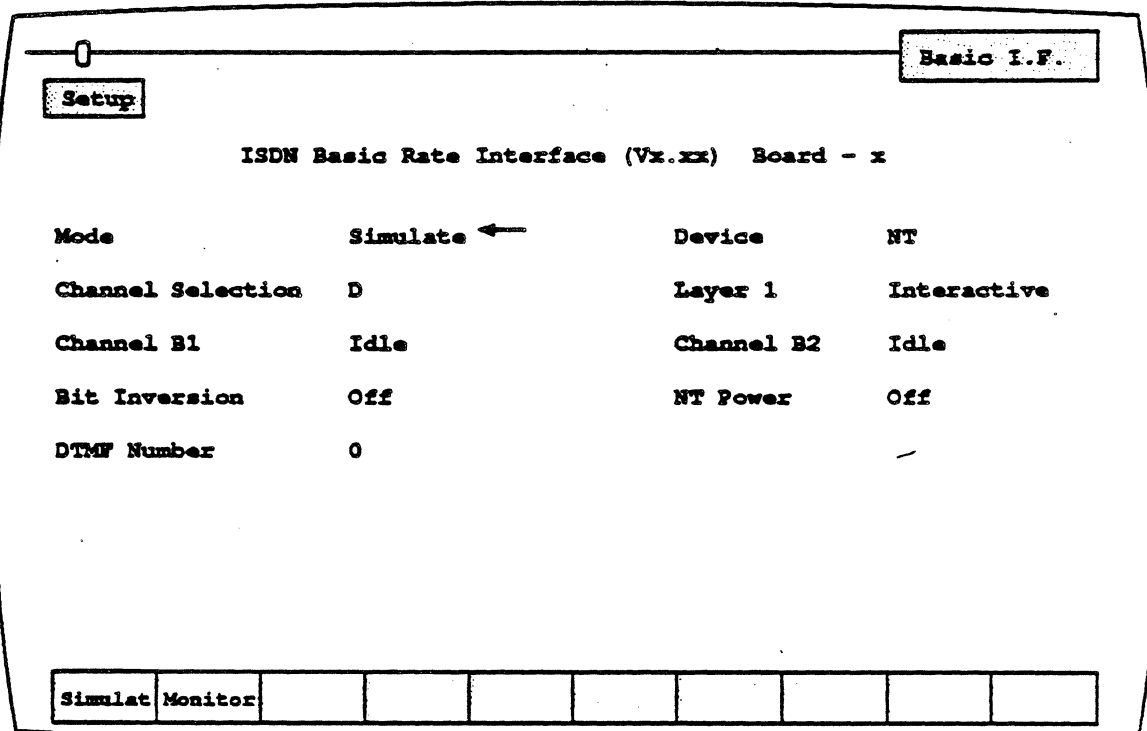
Figure 12.4: Basic Rate Setup Menu (Simulate)

Default settings are automatically displayed when the setup menu first appears. The arrow cursor indicates the selected parameter. The available settings for the selected parameter are shown in the softkey strip at the bottom of the page.

To change a parameter, use the arrow keys to move the arrow cursor to the parameter you want to change, and then press the function key that corresponds to the desired value. Several parameters require you to type in a value rather than select a value using the function keys.

The Basic Rate Interface menu setup menu parameters are described below.

Mode   Selects the mode to use for layer 1.

Note

Simulate   Selects the layer 1 operation mode. Simulates layer 1 as an NT or as a TE. (default)

When simulating a TE D–Channel, you can use only the BOP or LAPD C libraries for upper layer simulation. You must specify an interframe fill of FF using the appropriate function from one of these libraries.

Monitor   Monitors layer 1.

Channel Selection   Selects the channel to be used for running the upper level (above layer 1) protocol software, which can be any of the standard simulation or analysis packages available for the Chameleon 32. On the Chameleon 201, only Monitoring packages are available. The options are:

B1
B2
D (default)

Device   This parameter appears only when in Simulation mode. Selects the type of device to be simulated.

NT   Network Termination (default)
TE   Terminal Endpoint

Channel B2
Channel B1   Selects an option for the B1 or B2 channel.

Milliwatt   Allows a digital milliwatt (0dBm,1004 Hz μ–law or 1020 Hz A–law) to be inserted in the selected channel (B2 or B1). (Available only in Simulation.)

Codec   Allows a handset using Codec to be connected to the Chameleon.

Idle   Idles the channel with all ones data. (default)

Ext B   Selected B channel available at the Chameleon rear panel Basic Rate Interface (RS422 compatible).

Layer 1   Selects an option for layer 1 activation.

Interactive   At runtime, interactive transmission of signals is possible. (No automatic activation is done.) (default)

Automatic   Whenever Layer 1 is deactivated, or goes to error state, the system automatically activates.

Note   **The Basic Rate Interface setup menu displays the NT Power, Bit Inversion, and Dual Tone Multi–Frequency (DTMF) Number parameters, although they are supported only on machines with Basic Rate Interface Board (805–0259) Revision F.**

Bit
Inversion   This parameter allows you to invert the data bits when a B channel is selected for the Channel Selection parameter. The selections are:

OFF   Data transmitted is *not* inverted.

ON   Data transmitted *is* inverted.

For the Chameleon 20I, the inversion is performed prior to analyzing the data.

NT Power   This parameter enables you to specify the type of power provided from the TE to the NT. This selection affects the voltage, amount of power available, and the lines that are used to carry the power to the NT.

The Chameleon supports power source 1 and power source 2 in two modes: Normal Mode and Emergency Mode.

F1SCR1Nor   Power source 1 under normal conditions.

F2 SCR1Rev   Power source 1 under emergency conditions (reverses polarity).

F3 SCR2Nor   Power source 2 under normal conditions.

F4 SCR2Rev   Power source 2 under emergency conditions (reverses polarity).

. Off   The NT power lines are turned off.

When NT Power is enabled, the NT Power LED is illuminated. This LED is located in the Basic Rate Interface module in the rear of the machine.

Note: To disable Reversed NT Power (either *F2 SCR1Rev* or *F4 SCR2Rev*), you must first press Off, then press the new power source.

DTMF Number   This parameter is relevant when the Codec unit is selected for a B–channel. It causes the Chameleon to generate the Dual Tone Multi–Frequency (DTMF) tones corresponding to the numbers entered in this field.

You can enter a maximum of 20 digits in the DTMF Number field. Only digits are allowed.

The Chameleon generates the DTMF tones when the arrow cursor is moved from the DTMF field. For this reason, the following is recommended:

● Enter the DTMF number after all other parameters have been set up

● If the DTMF feature is not being used, leave the DTMF field blank

BRI RUNTIME PAGE

When you load and run the BASIC application from the Applications Selection menu, a page is displayed with the banner **BRI**.

The BRI page provides a runtime display which enables you to view or modify the Basic Rate Interface configuration without stopping the other Monitoring applications.

The format of the runtime page is basically the same as the BRI setup menu. The differences are the following:

- The message **Running** appears in the upper left corner of the runtime page

- In Simulate mode, the **Transmit Signal** parameter appears in the runtime page. This parameter is described on the next page.

- In Simulate mode, either an NT or TE **Status** line appears at the bottom of the page to indicate the current status of the Chameleon BRI

- In Monitor mode there are **NT Status** and **TE Status** lines which display the status of the devices being monitored.

Most of the BRI setup parameters can be modified during runtime. Those parameters which cannot be changed are displayed in red on the Chameleon 32 and highlighted on the Chameleon 20I. The remaining parameters can be changed by moving the arrow cursor to the parameter and pressing the appropriate softkey or entering a value.

The runtime pages for both the Simulate mode and the Monitor mode are described on the following pages.

Simulate
Runtime Page

A sample runtime screen for the Chameleon simulate mode is shown in Figure 12.5 below.

```
┌──O─────────────────────────────────────────┌─Basic I.F.─┐
│ ┌─Running─┐                                 └────────────┘
│ └─────────┘
│
│              ISDN Basic Rate Interface (Vx.xx)  Board - x
│
│     Mode              Simulate          Device        NT
│
│     Channel Selection  D                Layer 1       Interactive
│
│     Channel B1         Idle             Channel B2    Idle
│
│     Bit Inversion      Off              NT Power      Off
│
│     DTMF Number        0
│
│                   Transmit Signal  Activate_NT
│
│     NT STATUS
│     Receiver_Synchronized
│
│  ┌──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┐
│  │  DR  │ ARM  │  AI  │ NTA  │ DIAG │ SSp  │ RYSD │ ARL  │ AIL  │      │
│  └──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┘
```

Figure 12.5: BRI Runtime Display (Simulate NT)

In Simulate mode, the runtime page enables you to control the action of the physical layer by selecting a Transmit Signal command which performs one or more actions. The status of the Chameleon (as NT or TE) is displayed in the lower left (NT) or lower right (TE) corner of the screen.

The Transmit Signal commands and Status messages depend on whether the Chameleon is simulating an NT or a TE as described on the following page.

The Transmit Signal commands and Status messages are based on the capabilities of the Siemen's PEB 2080 S–Bus Transceiver.

Transmit Signal

When the arrow cursor is at Transmit Signal, you have the softkey options listed below. The command sequence needed to make the action is issued to the ISDN Transceiver. However, the action will only be effected if the Transceiver is in the proper state. (For more information, refer to the *Siemens Catalog*.)

If the Chameleon is simulating an NT, the Transmit Signal commands are:

Softkey	Message	Action
DR	Deact_Request	Deactivates the link (Layer 1).
ARN	Send_Info_2	Sends an Info 2 signal.
AI	Send_Info_4	Sends Info 4 signal.
NTA	Activate_NT	Executes activation sequence.
DIAG	Diagnostics	Toggle that displays or undisplays thefollowing, less common commands.
SSp	Send_Single_pulses	Sends a test signal (4 KHZ).
RSYD	Resynchronization	Tries to re–synchronize the line.
ARL	Send_I2_Test_loop2	Sends a test sequence, plus a loopback (96 *KHZ*).
AIL	Send_I4_Test_loop2	Sends a test sequence, plus a loopback (96 *KHZ*).

Note: If the NT is reactivated, done by first deactivating the link then activating it, the channel selection must also be reselected. This can be done from the Run Time Page by moving the arrow cursor to that field and making the selection again.

If the Chameleon is simulating a TE, the Transmit Signal commands are:

Softkey	Message	Action
DIU	Deactivate	Module interface is shut down.
AR8	Activate _Priority 8	Activation instruction, D Channel priority equals 8.
AR10	Activate_Priority10	Activation instruction, D Channel priority equals 10.
TEA	Activate_TE	Executes activation sequence.
DIAG	Diagnostics	Toggle that displays or undisplays additional, less common commands.
TIM	Timing	Clocks Module Interface.
RS	Reset	Resets.
SSP	Send_Single_Pulses	Transmits single pulses.
TM	Test_Mode	Transmits continuous pulses.
ARL	Activate_Test_Loop3	Activates Test Loop 3.

Status Messages

If the Chameleon is simulating an NT, the Status messages are displayed in the lower left corner of the BRI runtime page. The possible messages are:

Siemen's Reference	Message	Note
RIM	No_Clock_Signal	
LSL	Lost_Signal_Level	
RSYUN	Resynchronization	
EI	Error	
ARU	Receiving Info_1	
AIU	Receiver_Synchronized	(Status when Layer 1 activation iscompleted.)
UNDF	Undefined	

If the Chameleon is simulating a TE, the Status messages are displayed in the lower right corner of the BRI runtime page. The possible messages are:

Siemen's Reference	Message	Note
PU	Power_up	
DR	Deactivate_Request	
SD	Slip_Detected	
DIS	Disconnected	
EI	Error	
RSYD	Resynchronizing	
ARD	Receiving_Info_2	
TI	Test_Mode	
ATI	Level_Received_Test_Loop	
AI 8	Info—4_Priority 8/9	(This is the status when Layer 1 activation is completed.)
AI 10	Info—4_Priority 10/11	(This is the status when Layer 1 activation is completed.)
DID	Quiescent _State	
UNDF	Undefined	

Signal Diagrams

The following diagrams illustrate signals on the line when selections are chosen as Transmit Signal parameters.
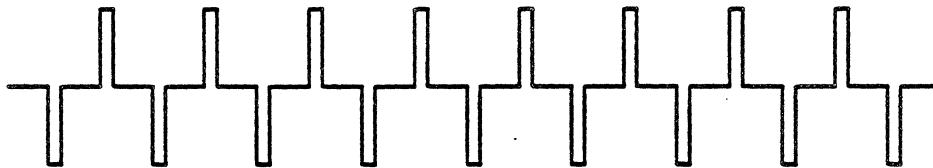
Single Pulse — NT and TE (SSp)
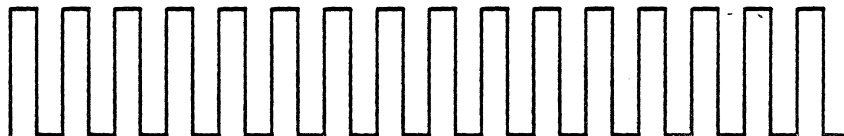
Resynchronization — NT and TE (RSYD)

Info 2 —NT (ARN)
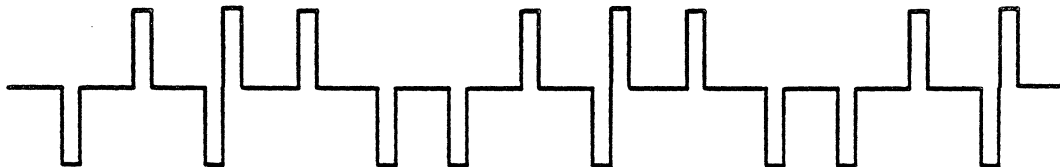
Info 4 — NT (AI)

Info 4 — TE ((AI)

Monitor
Runtime Page

In Monitor mode, the runtime page (Figure 12.6) enables you to change certain setup parameters. The arrow cursor can be moved only to those parameters that can be modified during runtime.

The status of the NT and the TE are shown at the bottom of the page. The possible status messages for NT and TE are shown on the previous page.

```
┌─────────────────────────────────────────────────────────┐
│  ──O───────────────────────────────────┐ ┌─Basic I.F.─┐ │
│                    ISDN Basic Rate Interface │         │ │
│  ┌─────────┐                            └─────────────┘ │
│  │ running │                                            │
│  └─────────┘                                            │
│                                                         │
│    Mode               .  Monitor                        │
│                                                         │
│    Channel Selection     B1                             │
│                                                         │
│    Channel B2            Codec                          │
│                                                         │
│                                                         │
│                                                         │
│    Nt Status                          TE Status         │
│    Lost_Signal_Level                  Quiescent_state   │
│                                                         │
│   ┌────┬────┬────┬────┬────┬────┬────┬────┬────┬────┐   │
│   │ B1 │ B2 │ D  │    │    │    │    │    │    │    │   │
│   └────┴────┴────┴────┴────┴────┴────┴────┴────┴────┘   │
└─────────────────────────────────────────────────────────┘
```
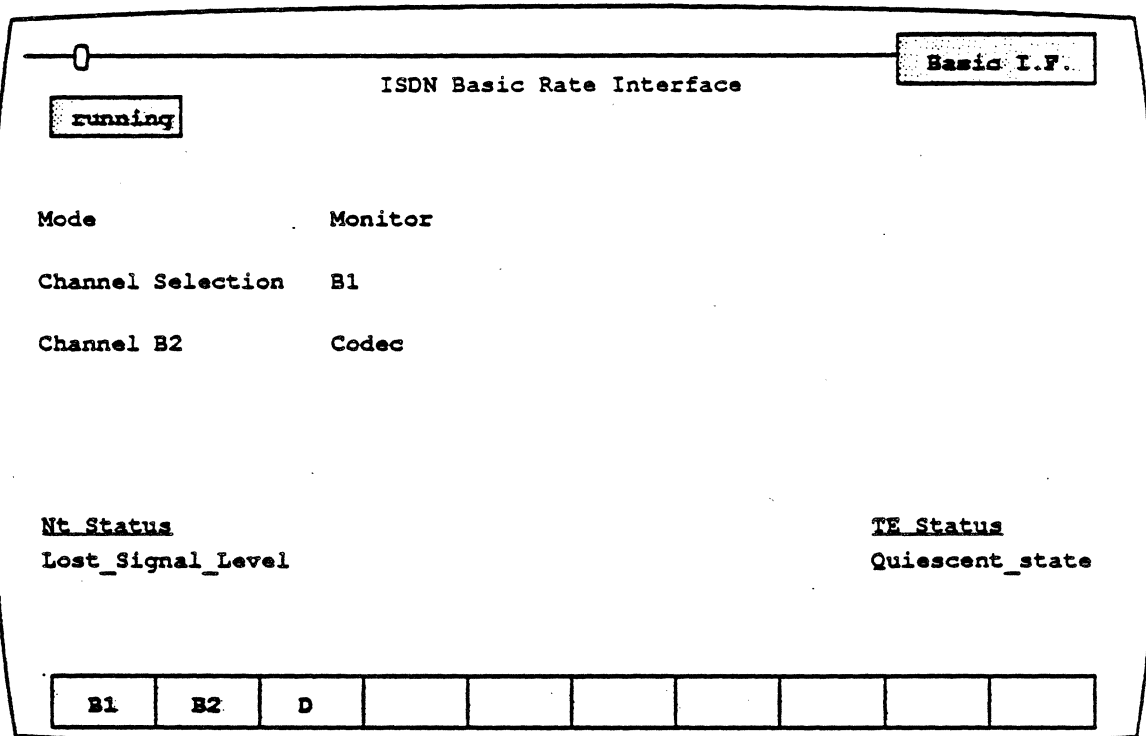
Figure 12.6: ISDN Basic Rate Monitor Mode Runtime Page

Chameleon
Basic Rate Interface
Applications

Applications are illustrated below. Data Simulation applications are not available for the Chameleon 201 but the physical layer (Layer 1) can be simulated.

Monitoring (Analysis Packages)
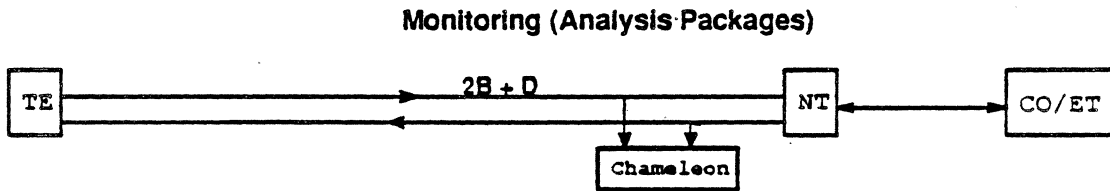
Chameleon Monitoring the 2B + D Line by Extracting the Two 64K and the One 16K Channels

Simulation (Analysis & Simulation Packages)
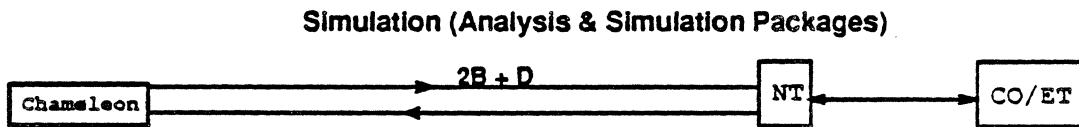
Chameleon Simulating a Subscriber (TE)
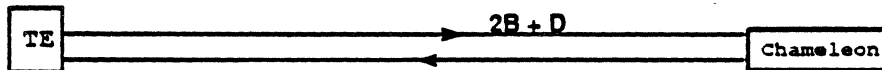
Chameleon Simulating a Network (NT)

Figure 12.7: Chameleon Basic Rate Interface Applications

Testing
Configurations

This section shows testing configuration examples using the Chameleon 32.

In Configuration A, LAPD software is running on **Channel D** of the Basic Rate Interface. The handset is connected to the jack located on the back panel of the machine for monitoring voice communication on **Channel B1**. The Milliwatt Tone Generator (at 1004 Hz) is sent on **Channel B2**.

In Configuration B, LAPD software is running on **Channel D** of the Basic Rate Interface. The handset is connected to the jack located on the back panel of the machine for monitoring voice communication on **Channel B1**. **Channel B2** is available on the External B Interface (RS422–compatible) located on the back panel of the machine.

In Configuration C, X.25 Simulation or Analysis is running on **Channel B2**. **Channel B1** is available on the External B Interface (RS422–compatible) located on the back panel of the machine. **Channel D** is available on the External D Interface (RS422–compatible) located on the back panel of the machine.

BRI (Configuration A)   BRI (Configuration B)   BRI (Configuration C)

Running LAPD – D   Running LAPD – D   Running X.25 – B2
Handset – B1   Codec/Headset – B1   External Interface – B1
Milliwatt Tone   External Interface – B2   External Interface – D
 Generator – B2
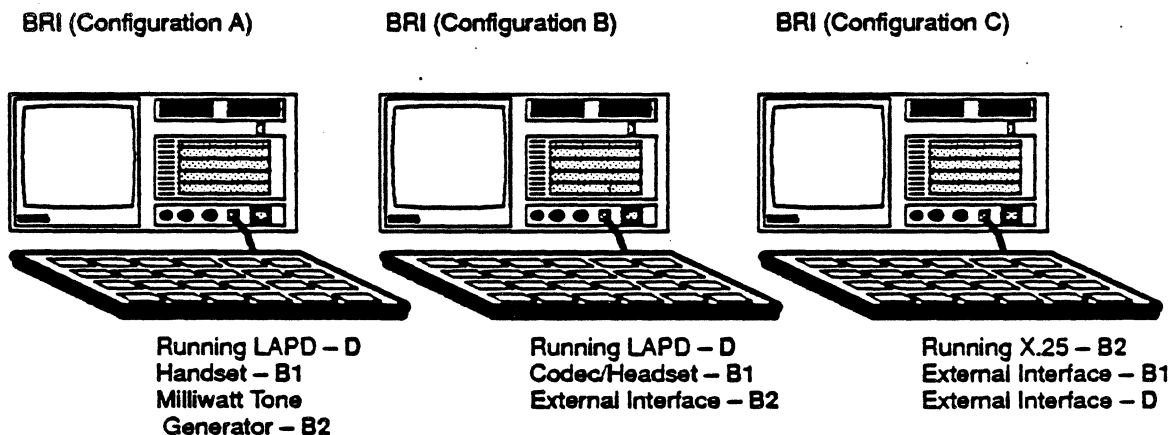
Figure 12.8: Single Chameleon Configurations

In Figure 12.9 below, three Chameleon 32s are used to run extensive Simulation on **Channels B1, B2, and D**. The Basic Rate Interface is installed on Machine 1. **Channel B1** is running X.25 Simulation. **Channel B2** is selected for the External B Interface (RS422–compatible). **Channel D** is selected for the External D Interface (RS422–compatible).

Channel B2 is connected to Machine 2 using the RS449 Interface and is running X.25 Simulation or Analysis. **Channel D** is connected to Machine 3 using the RS449 Interface. It is running LAPD Simulation.
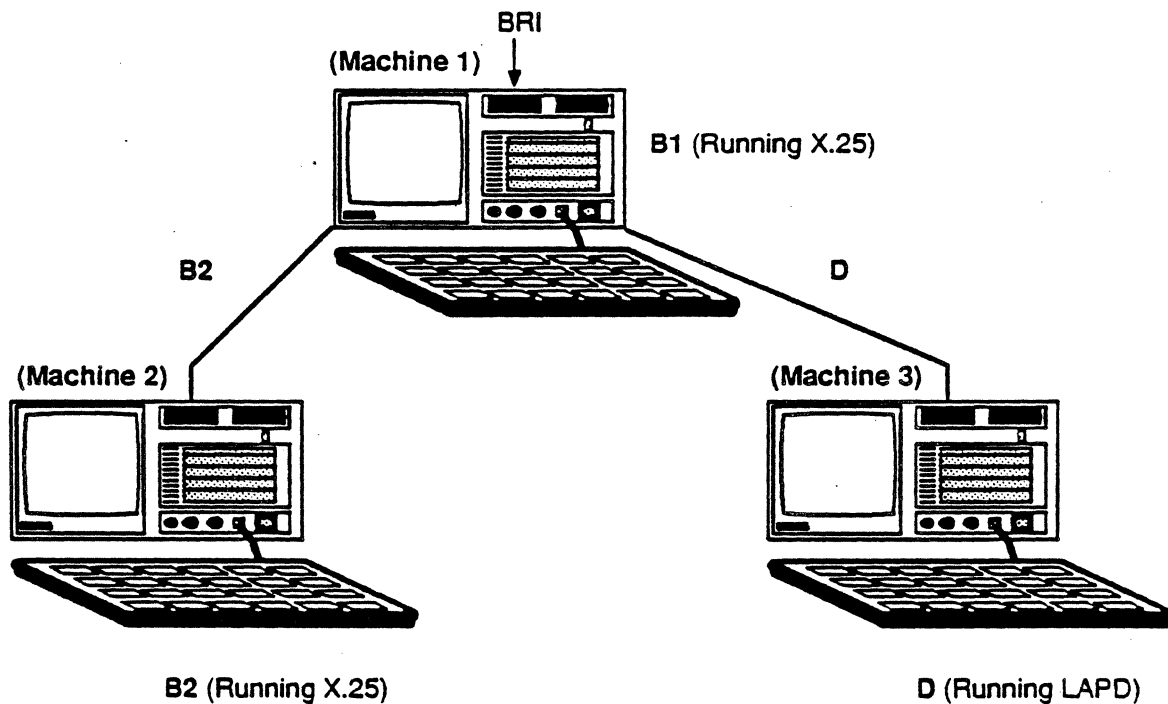
Figure 12.9: Three Chameleon Configuration

Basic Rate
Access
Information

There are currently two ways to access ISDN — Basic Rate Access
and Primary Rate Access. Basic Rate Access is part of the CCITT
I–Series Recommendations. The relationship between various
I–Series Recommendations are shown in Figure 12.10 below.

I–Series Recommendations (ISDN)   Other Recommendations

Operations
and Other
Aspects

1,200–*Series*
Service
Aspects

1,100–*Series*

– General ISDN
– Structure of Recs.
– Terminology
– General Methods

1,600–*Series*
Maintenance
Principles

1,300–*Series*
Network
Aspects

1,500–*Series*
Internet
Work
Interfaces

1,400–*Series*
User–Network
Interface Aspects

Recommendations in the
D, F, G, M, Q, S, V, and X on
Series covering character-
istics of particular existing
and future networks and
elements.

Note: Models, Reference Configurations, Tools, and Methods are contained in the appropriate I–Series
            Recommendations.

Figure 12.10: Structure of I–Series Recommendations (ISDN)

The 1984 CCITT ISDN Recommendations are shown in Figure 12.11 below.

Part I: General

NO.   **TITLE**

I.110   General structure of the I–Series Recommendations
I.111   Relationship with other Recommendations relevent to ISDNs
I.1112   Vocabulary of terms for ISDNs
I.130   Integrated Services Digital (ISDNs) (was G.705)
I.130   Attributes for characterization of telecommunications services supported by an ISDN and network capabilities of an ISDN

Part II: Service Capabilities

I.210   Principles of Telecommunication Services supported by an ISDN
I.211   Bearer Services supported by an ISDN
I.212   Tele–Services supported by an ISDN

Part III: Overall Network Aspects and Functions

I.310   ISDN—Network functional principles
I.320   ISDN protocol reference model
I.330   ISDN numbering and addressing principles
I.331   (E.164) The numbering plan for the ISDN
I.340   ISDN connection types

Part IV: User–Network Interfaces

I.410   General aspects and principles relating to recommendations on ISDN user–network interfaces
I.411   ISDN user–network interfaces — reference configurations
I.412   ISDN user–network interfaces — channel structures and access capabilities
I.420   Basic user–network interface
I.421   Primary rate user–network interface
I.430   Basic user–network interface — Layer 1 specification
I.431   Primary rate user–network interface — Layer 1 specification
I.440   (Q.920) ISDN user–network interface data link layer — general aspects
I.441   (Q.921) ISDN user–network interface data link layer specification
I.450   (Q.930) ISDN user–network interface Layer 3 general aspects
I.451   (Q.931) ISDN user–network interface Layer 3 specifications
I.460   Multiplexing, rate adaption, and support of existing interfaces
I.461   (X.30) Support of X.21 and X.21bis based DTEs by an ISDN
I.462   (X.31) Support of Packet Mode Terminal equipment by an ISDN
I.463   V.110) Support of DTEs with V–series type interfaces by an ISDN
I.464   Rate adaption, multiplexing, and support of existing interfaces for restricted 64 kb/s transfer capability

Figure 12.11: 1984 CCITT ISDN Recommendations

The Basic Rate Access, as defined by the CCITT, has the following reference points, as shown in Figure 12.12 :

- S
- T
- R
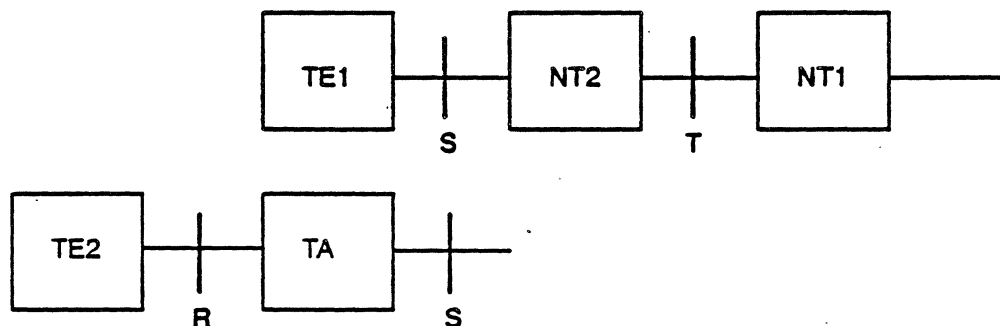
Figure 12.12: Customer Access to Services Supported by an ISDN

Note

In many applications, NT2 is absent. TA is used when using a non-ISDN device.

Basic Rate Access is a Layer 1 interface for ISDN. It makes available digital communication for integrated data, voice, and video interfaces at a customer site. Those customers who have larger traffic can use the Primary Rate Access for ISDN applications.

The rest of this section gives a brief technical introduction to Basic Rate Access.
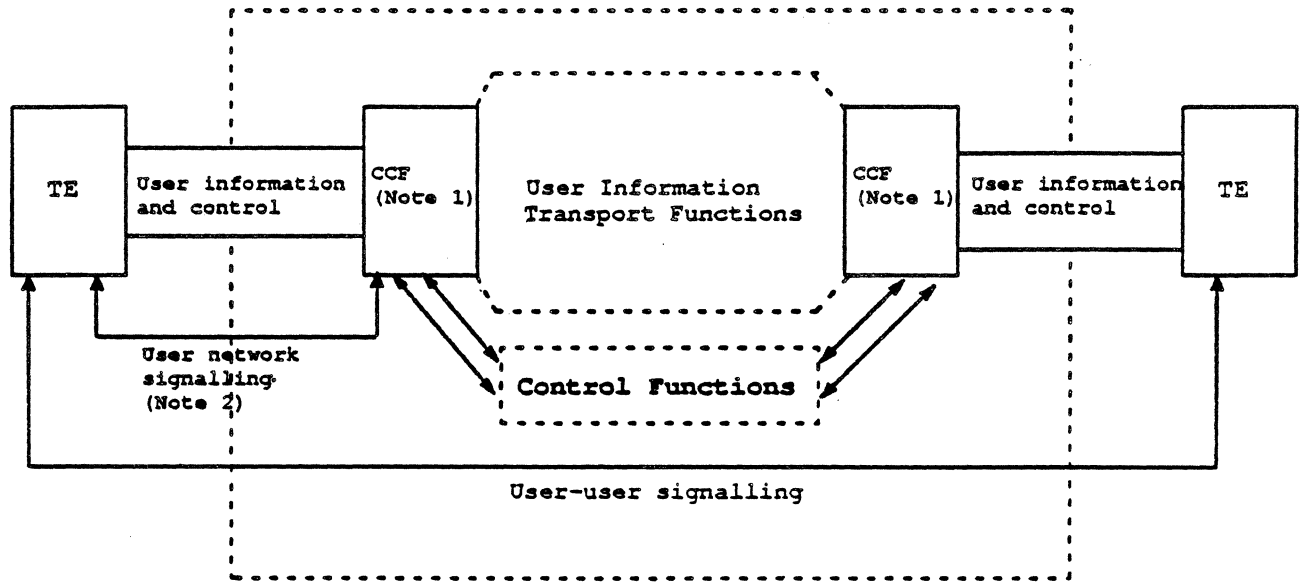
Note 1:   CCF - Connection Control Function
Note 2: •Includes connection control and communication with operations centers

Figure 12.13: Information Flows

With the Basic Rate Interface, three channels are available:

- Two B channels at 64 Kbps
- One D channel at 16 Kpbs

The effective data rate of the Basic Rate Interface is 144K bps. With the additional line frame overhead, the line rate is 192K bps.

Line Code

For both directions of transmission, pseudoternary coding is used with 100–percent pulsewidth as shown in Figure 12.14 below. Coding is performed in such a way that a binary 1 is represented by no line signal, whereas a binary 0 is represented by a positive or negative pulse.

The first binary 0 following the framing signal balance bit is of the same polarity as the framing signal balance bit. Subsequent binary 0s must alternate in polarity, for example Alternate Space Inversion (ASI).

A balance bit is a binary 0 if the number of binary 0s following the previous balance bit is odd. A balance bit is a binary 1 if the number of binary 0s following the previous balance bit is even.

Binary Value   1   0   1   0   0   1   1   0   0   0   1
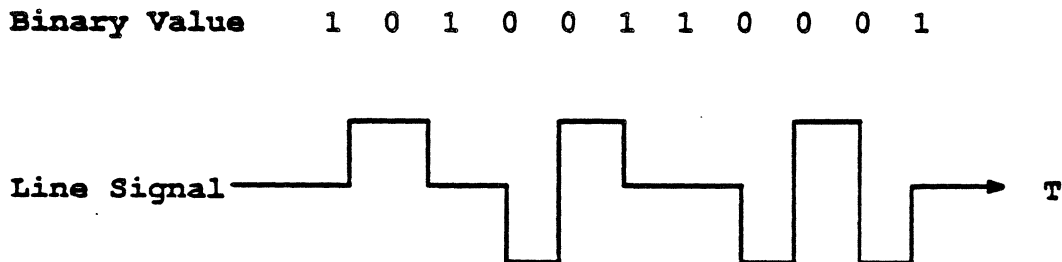
Line Signal

Figure 12.14: Pseudoternary Line Signal

2B+D Frame Structure

There are two frame structures — one for NT–to–TE transmission, and another for TE–to–NT transmission. Figure 12.15 on the next page shows the frame structures.

Figure 12.15: 2B+D Frame Structure
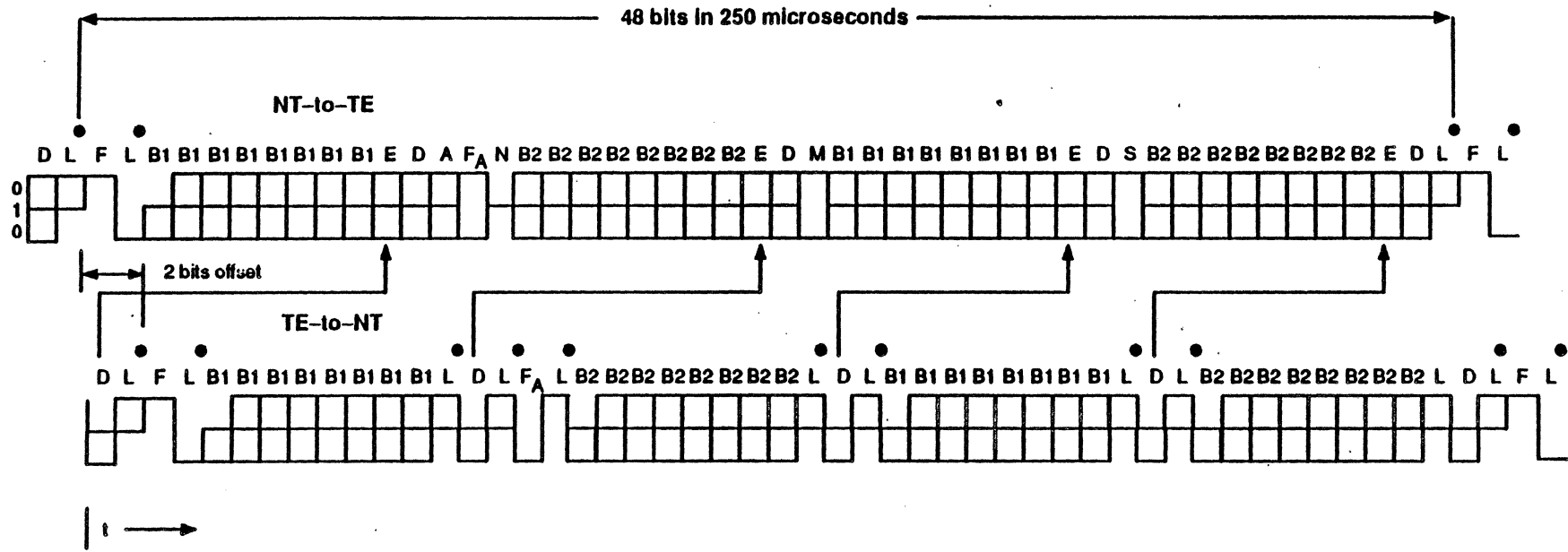
F = framing bit
L = DC balancing bit
D = D-channel bit
E = D-echo bit
F_A = Auxiliary framing or Q-bit (= 0)
M = Multiframing bit

N = bit set to a binary value N = F_A
B1 = bit within B channel 1
B2 = bit within B channel 2
A = bit used for activation
S = Reserved for future standardization

Note: Dots demarcate those parts of the frame that are independently DC-balanced.

Each frame consists of the following groups of bits. Each individual group is DC—balanced by its last bit (L—bit). The bits are grouped as follows:

**Network to
Terminal**

Bit Position	Bit Symbol	Group
1 and 2	F, L	Framing signal with balance bit.
3–10	B1	B1—channel (first octet).
11	E	E, D—echo—channel bit.
12	D	D—channel bit.
13	A	Bit A used for activation.
14	FA	FA auxiliary framing bit.
15	N	N bit.
16–23	B2	B2 channel (first octet).
24	E	E, D—echo—channel bit.
25	D	D—channel bit.
26	M	Multiframing bit.
27–34	B1	B1 channel (second octet).
35	E	E, D—echo channel bit.
36	D	D—channel bit
37	S	S, reserved for future standardization (set to 0).
38–45	B2	B2 channel (second octet).
46	E	E, D—echo channel bit.
47	D	D—channel bit.
48	L	Frame balance bit.

Terminal to Network Bit Position	Bit Symbol	Group
1 and 2	F, L	Framing signal with balance bit.
3–11	B1, L	B1 channel with balance bit (first octet).
12 and 13	D, L	D channel bit with balance bit.
14 and 15	FA, L	Auxiliary framing or Q–bit with balance bit.
16–24	B2	B2 channel with balance bit (first octet).
25 and 26	D, L	D channel bit with balance bit.
27–35	B1,L	B1 channel with balance bit (second octet).
36 and 37	D, L	D channel bit with balance bit.
38–46	B2,L	B2 channel with balance bit (second octet).
47 and 48	D, L	D channel bit with balance bit.

Frames transmitted by the network (NT) contain an echo channel (E–bits) used to re–transmit the D–bits received from the terminals. The D–echo Channel is used for D Channel access control. The last bit of the frame (L–bit) is used for balancing each complete frame.

At the terminals, timing in the direction TE–to–NT is derived from the frames received from the NT.

The first bit of each frame transmitted from a TE towards the NT is delayed by two bit periods with respect to the first bit of the frame received from the NT.

Framing Signals

The first bit of each frame is the framing bit—F. The framing bit is binary 0. The frame alignment procedure makes use of the fact that the framing bit is represented by a pulse having the same polarity as the preceding binary 0 pulse (an Alternate Space Inversion (ASI) violation). This allows rapid re–framing.

According to the coding rule, both the framing signal and the first binary 0 bit following the framing signal balance bit (in the same frame) produce an ASI violation.

To guarantee secure framing, the auxiliary framing bit pair F_A and N in the direction NT to TE, or in the auxiliary framing bit F_A with the associated balancing bit L in the direction TE to NT, are introduced (with the F_A bit in the 14th bit position in both cases).

This ensures that there is always an ASI violation at 14 bits, or less, from the framing bit F, due to F_A or N being a binary 0 bit (NT to TE), or to F_A always being a binary 0 bit (TE to NT). The framing procedures do not depend on the polarity of the framing bit F, and thus are not sensitive to wiring polarity.

The coding rule for the auxiliary framing bit pair F_A and N, in the direction NT to TE is such that N is binary opposite of F_A (N=F_A (inverted)). The F_A and L bits in the direction TE to NT are always coded such that the binary values of F_A and L are equal.

Frame Alignment Procedure (NT to TE)

Loss of frame alignment may be assumed when a time period equivalent to two 48—bit frames has elapsed without detection of valid pairs of code (ASI) violations obeying the ≤14—bit criterion. The TE ceases transmission immediately (for example, transmit Info 0).

Frame re—alignment can be assumed to occur when three consecutive pairs of line ASI violations obeying the ≤14—bit criterion have been detected.

Frame Alignment Procedure (TE to NT)

The criterion of an ASI violation at 13 bits or less from the framing bit (F) applies.

The NT assumes loss of frame alignment if a time period equivalent to two 48—bit frames have elapsed since detecting consecutive violations according to the 13—bit criterion. On detection of loss of frame alignment, the NT continues transmitting towards the TE.

D Channel Access Control

The following procedures allow a number of terminals connected in a multipoint configuration to gain access to the D—channel in an orderly fashion. The procedure ensures that even in cases where two or more TEs attempt to access the D—channel simultaneously, one TE will always be successful in completing transmission of its information.

This procedure relies on the use of Layer 2 frames delimited by flags consisting of the binary pattern 01111110 and the use of 0 bit insertion to prevent flag imitation. The procedure also permits terminals to operate in a point—to—point manner.

Interframe Time Fill (Layer 2)

When a TE has no Layer 2 frames to transmit, it sends binary 1s on the D–channel. For example, interframe time fill is at all binary 1s. When an NT has no Layer 2 frames to transmit, it sends either binary 1s or continuous HDLC flags 01111110 on the D–channel. Interframe time fill is all binary 1s or flags.

Note

The permission for interframe time fill being continuous flag in the NT to TE direction is not presently covered in the I.430 CCITT Red Book 1984.

D–Echo Channel

The NT, on receipt of a D–channel bit from TE, reflects the binary value in the next available D–echo channel bit position towards the TE.

D–channel Monitoring

A TE, while in active condition, monitors the D–echo channel, counting the number of consecutive binary 1 bits. If the TE detects a binary 0 bit, the TE restarts counting the number of consecutive binary 1 bits. The current value of the count is called C. C need not be incremented after TE reached the value 11 (decimal).

Priority Mechanism

Layer 2 frames are transmitted in such a way that signaling information receives priority (priority Class 1) over all other types of information (priority Class 2).

Furthermore, to ensure that within each priority calls all competing TEs are given a fair access to the D–channel, once a TE has successfully completed the transmission of a frame, it is given a lower level of priority within that class. The TE is given back its normal level within a priority class when all TEs have had an opportunity to transmit information at the normal level within that priority class.

The priority class of a particular Layer 2 frame can be a characteristic of the TE that is preset or set at installation time. It can be passed down from Layer 2 as a parameter for each data transmit request.

The priority mechanism is based on the requirement that a TE can only start Layer 2 frame transmission when C is equal to, or exceeds the value of X_1 for priority Class 1, or is equal to or exceeds the value of X_2 for priority Class 2. The value X_1 is 8 for the normal level and 9 for the lower level of priority. FOr Class 1, the value of X_2 is 10 for the normal level and 11 for the lower level of priority for Class 2.

Each TE starts with the normal priority level (8 or 10). When a terminal (TE) has successfully transmitted a complete frame, the X_1 is incremented by one, for example, to 9 or 11.

In a priority Class, the value of the priority (X_1) is changed into the value of the normal level of priority when C equals the value of the lower level (higher value) of priority.

Collision Detection

While transmitting information in the D—channel, a TE monitors the received D—echo channel and compares the last transmitted bit to the next available D—echo bit. If the transmitted bit is the same as the received echo, the TE continues its transmission. However, if the received echo is different from the transmitted bit, the TE ceases transmission immediately and returns to the D—channel monitoring state.

Signals

Figure 12.16 on page 12-35 gives the identification of specific signals that are passed across the S/T interface, and includes the coding for these signals. The signals are important for the specification (I.430 CCITT Red Book 1984) of procedures for activation/de—activation.

Activation Procedure

Activation of the link can be initiated by either the Terminal (TE) or by the exchange. By sending *Info 1*, the activation procedure is initiated by the Terminal (TE). The opposite end of the connection responds by sending *Info 2*.

All Terminals (TEs) (for example, TE2 through TE8) connected to this bus receive *Info 2*, and respond by sending back *Info 3*. After the confirmed reception of *Info 3*, Channels B1, B2, and D are switched into Transparent State in the direction of the exchange.

After the reception of *Info 4* by the terminals (TEs), Channels B1, B2, and D are switched into a Transparent Mode in the direction towards the Terminal (TE). Furthermore, the echoing E–Bit is active. Activating the Interface from the switch initiates the procedure by sending *Info 2* from the Network Terminations (NT) to the Terminal (TE).
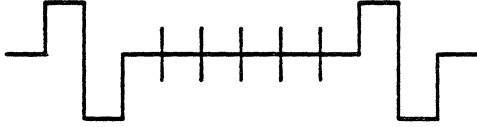
Signals from NT to TE	Signals from TE to NT
Info 0: No signal	**Info 0: No signal**
	Info 1: A continuous signal with the following pattern: – Positive binary 0 – Negative binary 0 – Six binary 1s **Nominal bit rate = 192 Kbps**
Info 2: Frame with all bits of B, D, and D–echo channels set to binary 0. Bit A is set to binary 0. N and L bits are set according to the normal coding rules.	
Info 4: Frames with operational data on B, D, and D–echo channels. Bit A is set to binary 1.	**Info 3: Synchronized frames with operational data on the B and D Channels.**

Figure 12.16: Definition of Info Signals
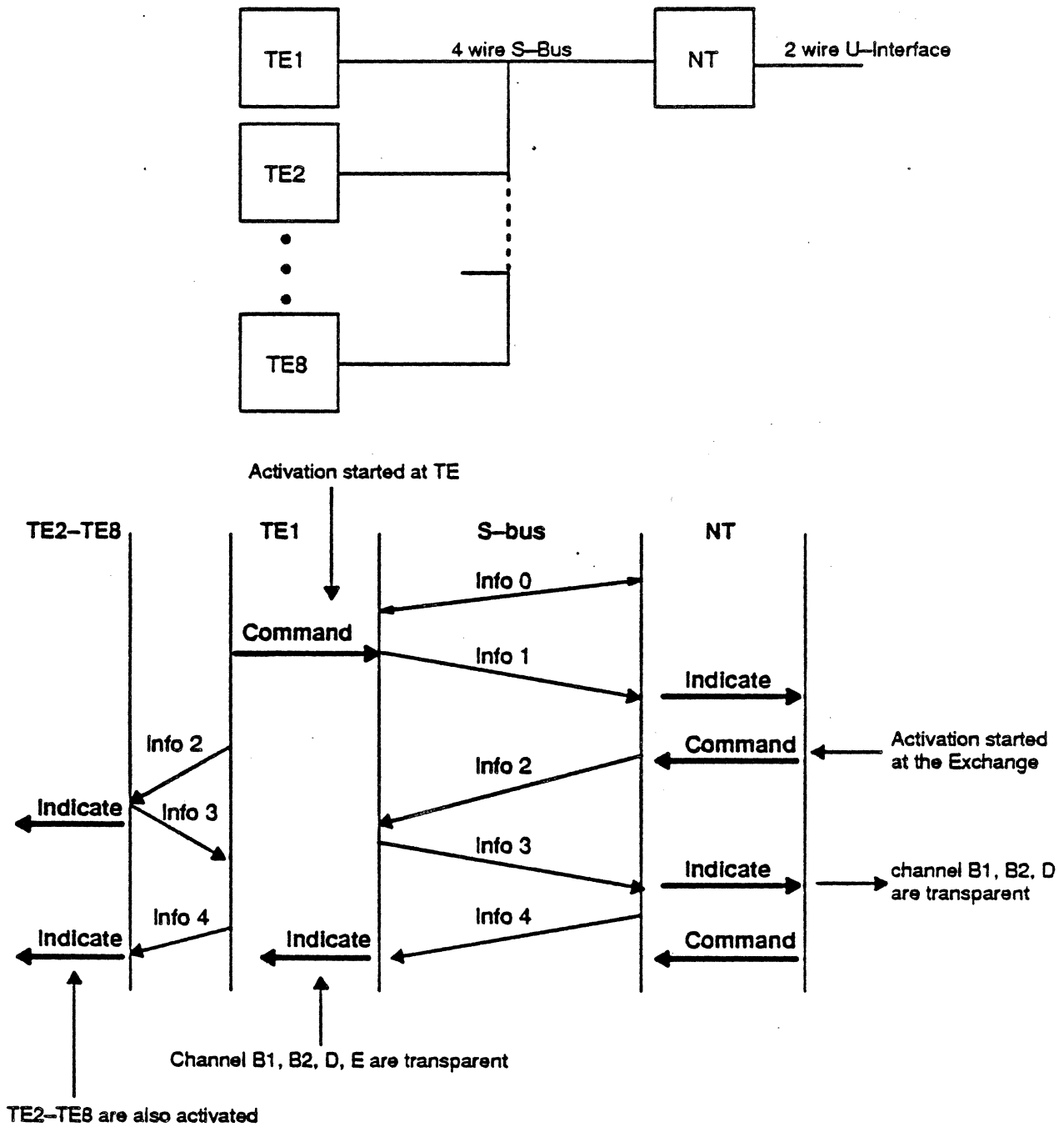
Figure 12.17: Activation Procedure

EXT B and EXT D
Connector Pinout

The Chameleon Basic Rate Interface **EXT B** and **EXT D** connectors are 15–pin, D–subminature socket (female, DA15S) connectors. The pinout is shown below:
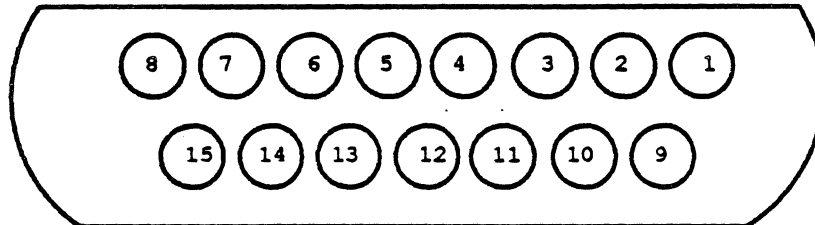
All signals are standard RS422 voltage levels.

DA15 Pin Number	DC37 Pin Number	Signal Name
1	1	Chassis Ground
9	4	(SDCA) Send Data A
11	6	(RDCA) Receive Data A
13	5	(STCA) Signal or Send Timing A
2	22	(SDCB) Send Data B
4	24	(RDCB) Receive Data B
6	23	(STCB) Signal or Send Timing B
15	8	(RTCA) Receive Timing A
7	26	(RTCB) Receive Timing B
8	19	Signal Ground

A cable is provided with the Basic Rate Interface that attaches to the DA15S connector. This provides an RS449 interface. The cable connector is a 37–pin D–subminature pin (male, DC37P) connector.

CHAPTER THIRTEEN:
SS#7 MONITORING

Introduction

This chapter focuses on the protocol–specific details of Signalling System 7 (SS#7) Monitoring. For a general description of Chameleon Monitoring, refer to Chapter 1.

This section assumes that you know how to select Monitoring for a port with SS#7 as the protocol. If you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Chapter 3.*

Signalling System 7

The objective of Signalling System 7 (SS#7) is to provide an *internationally* standardized general purpose common channel signalling system.

Common channel signalling is a method in which a single channel conveys signalling information relating to a multiplicity of circuits or other information used for network management. It can be regarded as a specialized form of data communications for signalling and information transfer between processors in telecommunications networks.

The signalling system uses signalling links for transfer of signalling messages between exchanges or other nodes in the telecommunications network. The protocol includes the ability to detect and correct errors on each signalling link. The system is normally applied with redundancy of signalling links and includes functions for automatic rerouting of signalling traffic to alternate paths in case of link failures.

A major characteristic of the signalling system is that it is specified with a functional structure to ensure flexibility and modularity for diverse applications within one system concept. This allows the system to be realized as a number of functional modules. However, as a consequence of its modularity and its intended use as a standard base for national applications, the protocol may be implemented in many forms.

SS#7 is one common channel signalling system. The signalling system is optimized for operation over 64 kbps digital channels. It is also suitable for operation over analog channels and at lower speeds. The system is suitable for use on point–to–point terrestrial and satellite links.

Message Transfer Parts

The fundamental principle of the SS#7 structure is the division of functions into a common Message Transfer Part (MTP) and separate User Parts for different users on the other. This is illustrated in Figure 13.1 below.
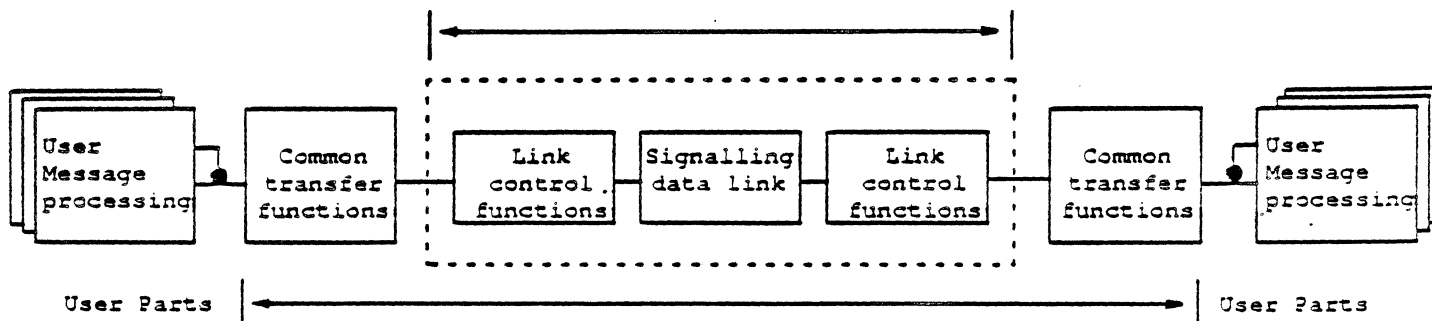
Figure 13.1: Relation of MTP and User Parts in SS#7

The overall function of the MTP is to serve as a transport system providing reliable transfer of signalling messages between the locations of communicating user functions. The term *user* refers to any functional entity that utilizes the transport capability provided by the MTP. A User Part comprises those functions of, or related to, a particular type of user that are part of the common channel signalling system, typically because those functions needed to be specified in a signalling context.

The functions of the MTP are separated into three functional levels. The User Parts constitute parallel elements at the fourth functional level. This is illustrated on the next page.
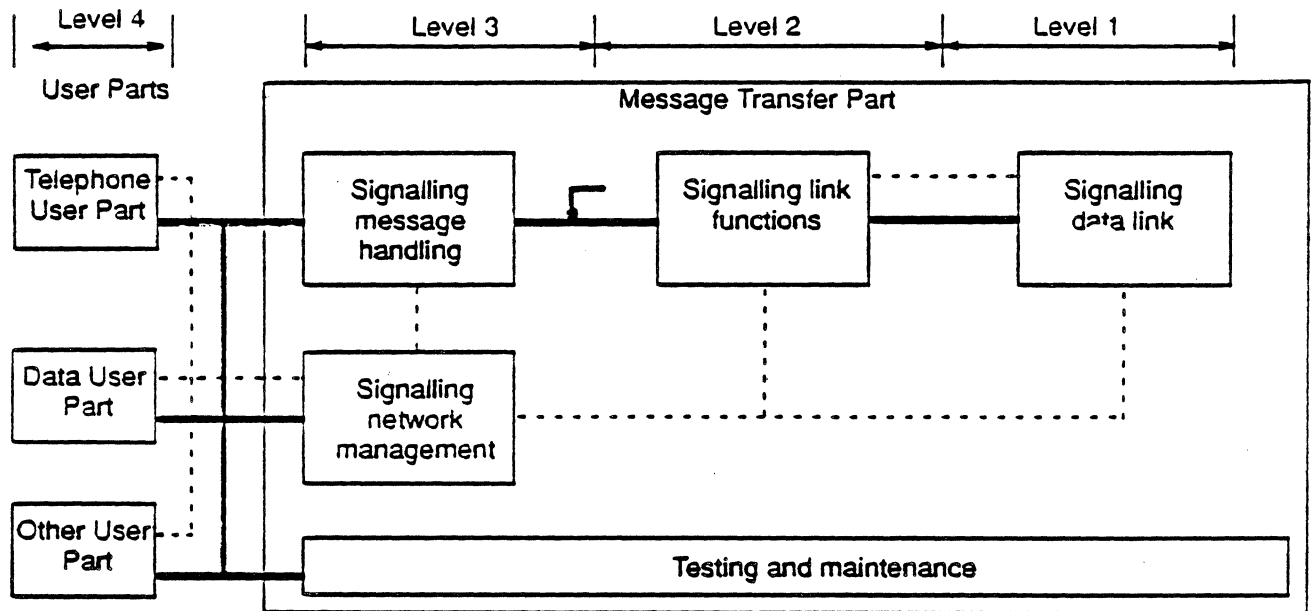
Figure 13.2: MTP Functional Levels

Briefly the functions of the MTP are:

Level 1   The Signalling Data Link Functions define the physical, electrical and functional characteristics of a signalling data link, and the means to access it.

Level 2   The Signalling Link Functions defines the functions and procedures for the transfer of signalling messages over one individual signalling data link.

Level 3   The Signalling Network Functions defines those transport functions and procedures that are common to and independent of the operation of individual signalling links. The two major categories of functions at this level are signalling message handling functions and signalling network management functions.

Level 4   Level 4 consists of the different User Parts. Each User Part defines the functions and procedures of the signalling system that are particular to a certain type of user of the system.

Signal Units

Signalling and other information originating from a User Part is transferred over the signalling link by means of signal units. There are three different types of Signal Units as shown in Figure 13.3 below:

First bit transmitted →

Fill In Signal Unit (FISU) Frame

Flag 01111110	Check Bits	⊠	LI	F I B	FSN	B I B	BSN	Flag 01111110
8	16	2	6	1	7	1	7	8

Link Status Signal Unit (LSSU) Frame

Flag 01111110	Check Bits	SF	⊠	LI	F I B	FSN	B I B	BSN	Flag 01111110
8	16	8 or 16	2	6	1	7	1	7	8

Message Signal Unit (MSU)

Flag 01111110	Check Bits	SIF	SIO	⊠	LI	F I B	FSN	B I B	BSN	Flag 01111110
8	16	8n, n > 2	8	2	6	1	7	1	7	8
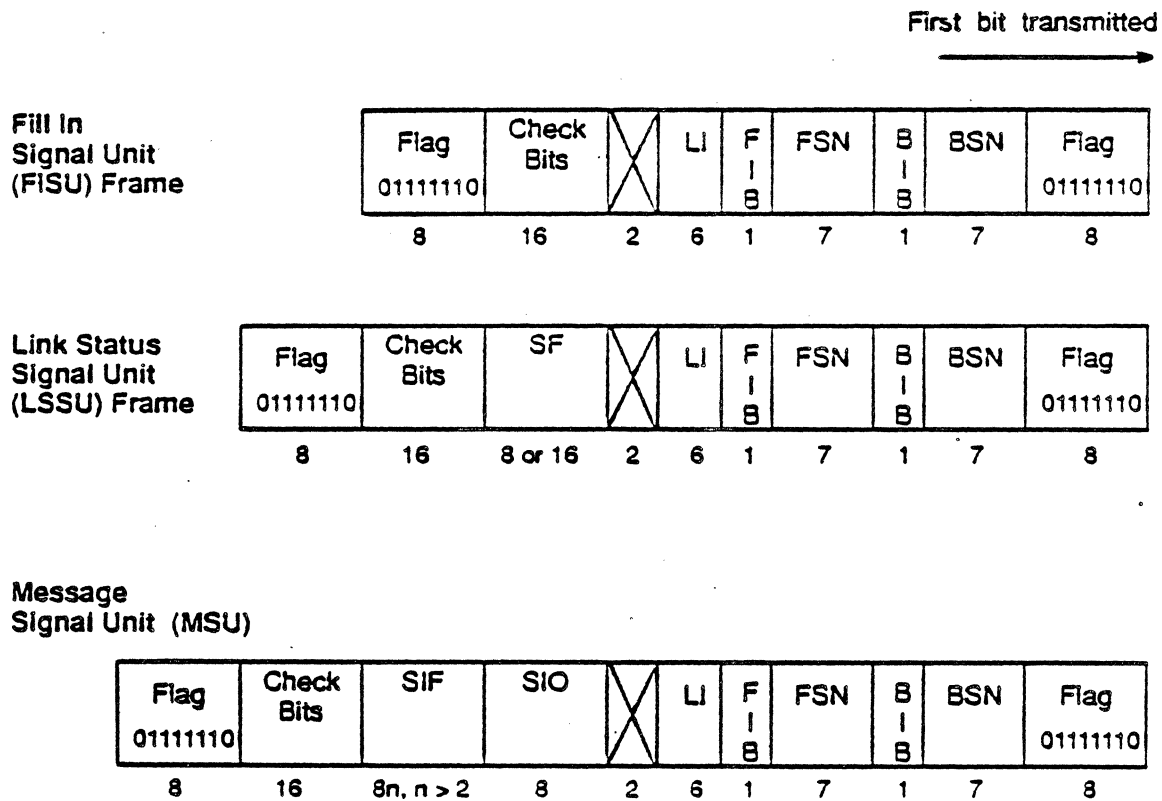
Figure 13.3: SS#7 Signal Unit Formats

The following elements are in all Signal Units.

The Backward Sequence Number (BSN) is the sequence number of a signal unit being acknowledged.

The Forward Sequence Number (FSN) is the sequence number of the signal unit in which it is carried.

The Backward Indicator Bit (BIB) and Forward Indicator Bit (FIB) are used with the BSN and FSN in the basic error control method to perform the signal unit sequence control and acknowledgement functions.

The Length Indicator (LI) indicates the number of octets following the LI octet and is a number in binary code in the range 0 – 63. The LI differentiates between the three types of signal units, as follows:

- LI = 0   Fill In Signal Unit (FISU)
- LI = 1 or 2   Link Status Signal Unit (LSSU)
- LI > 2   Message Signal Unit (MSU)

Link Status Signal Units (LSSU) contain the Status Field (SF).

Message Signal Units (MSU) contain the Service Information Octet (SIO) which is divided into the Service Indicator and the Subservice Field. The Service Indicator associates signalling information with a particular User Part.

MSUs also contain the Signalling Information Field (SIF) which consists of an integral number of octets, greater than or equal to 2 and less than or equal to 62. The format and codes of the SIF are defined for each User Part.

In national signalling networks, the SIF may consist of up to 272 octets. If the SIF is 62 or more octets, the Length Indicator is set to 63.

Monitor Setup Menu

When you select SS#7 as your Monitoring protocol, you are prompted for the configurable parameters described below (refer to Figure 13.4).

Figure 13.4: SS#7 Protocol Parameters

SS–7 Standard

The SS7 standard determines how acquired traffic is interpreted. Press *F9 More* to display ITALY. The available standards are:

CCITT84	CCITT 1984 specification (Red Book)
NCC	Nippon Common Carrier
NTT	Nippon Telephone and Telegraph SS#7
ANSI	Displays four TCAP decode options:

  None   **AT&T**   **Bellcore**   **800DBAS**

CCITT88	CCITT 1988 specification (Blue Book)
1TR7	German SS#7
BTNR	British SS#7
5EE5	Displays three ISUP decode options:

  Singapore Spain   Netherlands

ITALY	Displays three TUP decode options:

  TUP/N   TUP/I   TUP/E

Condensed Mode Acquisition

This option enables you to view FISU and LSSU events in two ways:

OFF
With this option, each FISU or LSSU is shown on the screen as an individual event.

Note: In this mode of acquisition, the History lock does not detect that interpreted data has been overwritten.

ON
In this mode, FISUs and LSSUs are shown in a condensed mode, enabling you to view more events on a single page.

When multiple identical FISUs or LSSUs occur in sequence, only the first of each 255 FISUs/LSSUs is displayed as an event. Each 256th identical FISU/LSSU is displayed as a new event.

If a different type of frame is received, the new event is displayed, the FISU/LSSU counter is reset, and the next FISU/LSSU that occurs is displayed as a new event.

See page 13-13 for a description of FISU and LSSU interpretation for both non—condensed and condensed modes.

Note
This parameter affects Monitoring from the line only. If you save traffic using the Direct—to—Disk application, this parameter determines how FISU and LSSU events are saved, and how they appear when the traffic is replayed. For example, Direct—to—Disk traffic saved in condensed mode, will only be shown in condensed mode when replayed.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ
Non—Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI
Non—Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

SS#7 Analysis

SS#7 Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

The History page displays traffic acquired by a history buffer. You can move back and forth through the traffic in the buffer independently of line activity. However, if SS7 traffic is in the PCR mode, this history buffer may soon fill to capacity with redundant MSUs, all of which are then displayed on the History page. In such cases, *Ctrl A* clears the buffer and the History page of all but one these MSUs.

The display format and function keys are the same for both pages, as described below.

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The SS#7 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character (default). Data item values cannot be shown in ASCII.

EBCDIC   Each byte is displayed as an EBCDIC character. Data item values cannot be shown in EBCDIC.

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

HEX   Each byte is displayed as a pair of hex digits with no spaces between pairs.

F2: Acquisition Information:

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides. The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

Number   Event number in decimal (default)

Flags   If condensed mode is off, this displays the number of flags between events, in the format *xx*flags, where *xx* is the number of flags.

               If condensed mode is on, for FISUs and LSSUs, it indicates the number of identical sequential FISUs or LSSUs that have occurred since the preceding displayed event. This is indicated by the message ***xxx*events**, where *xxx* is the number of identical FISUs or LSSUs. In this mode, each FISU/LSSU event represents a maximum of 255 events.

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value and *OK* if the CRC is good, or *B* if the CRC is not good

None   No acquisition information is displayed

F3: Event Type

F3 determines what types of events will be displayed on the Analysis page. *F3* affects the page *display* only. All events are captured, regardless of the *F3* selection. The options are:

M   MSUs are shown

MS   MSUs and LSSUs are shown

MSF   MSUs, LSSUs and FISUs are shown

MSFL   MSUs, LSSUs, FISUs, and lead changes are shown

F4: Message Transfer Part (MTP)

F4 determines how the Message Transfer Part (MTP) is interpreted.

For MSUs, the MTP includes the following fields: BSN, BIB, FSN, FIB, LI, SIO (Sub–Service Field and Service Indicator).

For LSSUs, the MTP includes the following fields: BSN, BIB, FSN, FIB, LI and SF.

For FISUs, the MTP includes the Length Indicator field.

MTP+   Message Transfer Part is displayed interpreted (default).

MTP"   Message Transfer Part is displayed uninterpreted in the code selected in *F1*.

MTP*   Message Transfer Part is displayed interpreted and uninterpreted.

MTP–   Message Transfer Part is acquired but not displayed.

F5: User Part (UP)

F5 determines how the User Part is interpreted. The UP is relevant for MSUs only.

UP+   User Part is displayed interpreted (default).

UP"   User Part is displayed uninterpreted in the code selected in *F1*.

UP*   User Part is displayed interpreted and uninterpreted.

UP–   User Part is displayed is acquired but not displayed.

F6: TCAP (Transaction Capabilities Application Protocol)

F6 is available only when ANSI is the selected SS#7 Standard. It determines how the TCAP is interpreted. The TCAP is relevant for MSUs only. See page 13-25 for more information.

TCAP+   TCAP is displayed interpreted (default).

TCAP"   TCAP is displayed uninterpreted in the code selected in *F1*.

TCAP*   TCAP is displayed interpreted and uninterpreted.

TCAP–   TCAP is acquired but not displayed.

F8: Detail Level

F8 determines the detail level for each interpreted data item. The options are:

Detail0   Signaling unit type (MSU, LSSU, FISU) and Message Type

Detail1   Routing Label and Parameter names

Detail 2   Parameter details

Detail 3   (Currently identical to Detail 2)

F9: Data Item Display

Each data item is composed of a number of consecutively acquired bits, which are built into bytes and stored in acquisition memory. These bits can be interpreted as *values* or *patterns*.

A *value* is up to 32 bits, can start at any offset in a byte, and can span byte boundaries. The first acquired bit is the least significant bit. For example, if the bytes 01,02,03 are acquired, the value of the first 16 bits is hex 0201 (decimal 513). Values cannot be shown in ASCII or EBCDIC.

A *pattern* has any length and alignment. However, a pattern is always displayed aligned on a byte boundary, and is always an integral number of bytes long. No numerical significance is placed on any bit in a pattern. For example, the bytes 41,42,43 form the string *ABC*.

F9 determines the display format of data item values. Each data item is normally displayed with a caption which identifies the data item, and a value which represents the acquired data. The format of the value part is determined by this option, as described on the next page.

Meaning   Documented interpretation of the data item value. When selected, Address Signaling digits are displayed as follows:

0 – 9 hex   Displayed as 0 – 9

A – E hex   Displayed as blank space

F hex   Displayed as * (star) or blank

Offset   Offset of the item from the start of the acquired data is shown in the format *n.m*, where *n* is the number of bytes and *m* is the number of bits. Items derived from a combination of other data items cannot be shown in this format.

Length   Length is the size of the data item, in the format *n.m*, where *n* is the number of bytes and *m* is the number of bits. Items derived from a combination of other data items cannot be shown in this format.

Hex   Data is shown in hexadecimal. Hex displays for values and patterns appear similar, but there are two differences. First, values are shown with the first acquired (least significant) bytes on the right, whereas patterns are shown in order of acquisition, i.e the first acquired bytes on the left. Second, patterns are shown as an integral number of byte aligned bytes; however, Offset and Length still show the actual length and alignment.

When Hex is selected, the Address Signal display is in reverse nibbles.

Decimal   Data is shown in decimal. Patterns cannot be displayed in decimal.

Binary   Data is shown in binary. Patterns cannot be displayed in binary.

Where a value cannot be shown in a specific mode, a dash (–) is displayed.

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode.

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in *F1*

SS#7 Interpretation

This section describes how the Signal Units are interpreted and displayed on the History and Real Time pages. Remember that the functions keys affect which Signal Units are displayed, and the level of interpretation.

Note

In SS#7 the bytes are interpreted from right to left, with the first byte numbered 0. This is important to remember when viewing uninterpreted SS#7 data in History or Real Time. It also affects triggering, as described in the *Chameleon User's Manual, Chapter 8.*

Common Fields

The following information is displayed for all Signal Units:

BSN=xx   BIB=xx   FSN=xx   FIB=xx   LI=ccc

where: *BSN* is the Backward Sequence Number
BIB is the Backward Indicator Bit
FSN is the Forward Sequence Number
FIB is the Forward Indicator Bit
LI is the Length Indicator (*ccc* indicates the Signal Unit type: FISU, LSSU, or MSU)

FISU Display

FISUs can be interpreted in regular or condensed mode (see page 13-7). If condensed mode is *off*, each FISU is displayed as an individual event in the format shown above (*ccc*=FISU).

If condensed mode is *on*, only the first of every 255 sequential FISUs is shown as an event. If you select *F2 Flags*, the interpretation includes the field **xxx events** which indicates the number of FISUs that have occurred since the preceding event. Each 256th sequential FISU is displayed as a new event.

LSSU Display

Link Status Signal Units (LSSUs) include the information described above (LI = LSSU), with the addition of the Link Status mnemonic, shown as follows:

Link Status cc

where *cc* is the status of the link using these mnemonics:

O	Out of Alignment (SIO)
N	Normal Alignment (SIN)
E	Emergency Alignment (SIE)
OS	Out of Service (SIOS)
RO	Processor Outage (SIPO)
B	Busy (SIB)

LSSUs can be interpreted in regular or condensed mode (see page 13-7). If condensed mode is *off*, each LSSU is displayed as an individual event in the format described on the previous page (*ccc*=LSSU).

If condensed mode is *on*, only the first of every 255 sequential identical LSSUs is shown as an event. If you select *F2 Flags*, the interpretation includes the field **xx events** which indicates the number of identical LSSUs that have occurred since the preceding event. Every 256th, identical, sequential LSSU is displayed as a new event.

**MSU
Interpretation**

Message Signal Unit interpretation includes the *BSN, BIB, FSN, FIB,* and *LI* display as described above. Level 4 interpretation is determined by the SS#7 Standard selected in the SS#7 menu (CCITT, NTT, NCC, ANSI, etc.) and the User Part that the MSU corresponds to. MSU interpretation includes:

- Service Information Octet (SIO)
- Service Information Field (SIF*)

The location of these components within an MSU (CCITT specification) is shown in Figure 13.5. Although they are always present, the format depends on the User Part the MSU corresponds to.

CTRL A

When the PCR mode is *on*, a continuous stream of identical MSUs may quickly fill the History buffer and page. Use CTRL A to clear the buffer and screen of all but one of these MSUs.
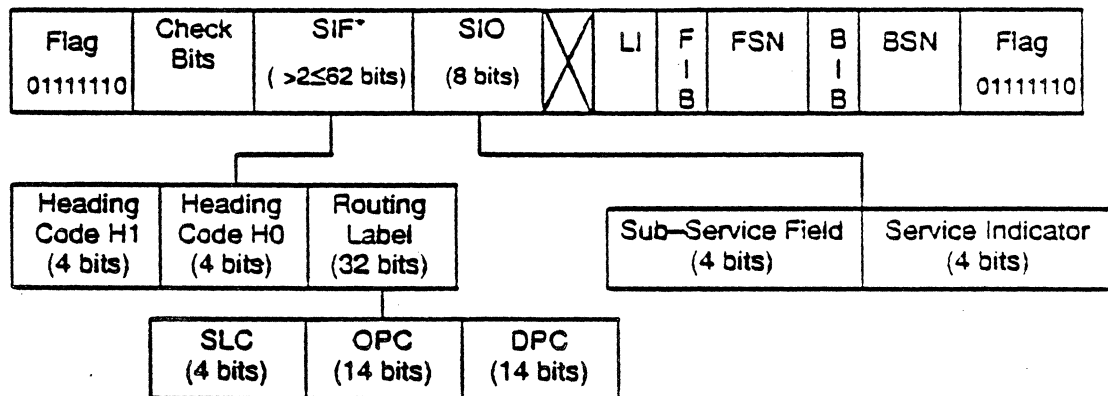
Figure 13.5: MSU Components (CCITT Specification)

*Note

- In national signalling networks, the SIF may be up to 272 octets. If the SIF is 62 or more octets, the Length Indicator is set to 63.

The Service Information Octet (SIO) is interpreted as follows:

SIC=cccc   SSF=x

where:

- *SIC* is the Service Indicator Code
- *cccc* is the name of the corresponding User Part
- *SSF* is the Sub–Service Field.

The Service Information Field (SIF) has two major components: Routing Label and Message Type. The Routing Label specifies:

- The Destination Point Code (DPC)
- The Origination Point Code (OPC)
- The Signal Link Code (SLC)

These three codes can be configured for your particular SS#7 implementation using the Chameleon User Parts Editor. See page 13–16.

OPC/DPC Format

The DPC and OPC are displayed according to the format selected with the *F9* key. If *F9 Meaning* is selected, the OPC and DPC are displayed in the format:

x yyy z

This format corresponds to the three OPC/DPC sub–fields. (The exception to this is NCC SS#7, which displays the OPC/DPC as a single field.)

When *F9 Hex* is selected, the OPC/DPC is shown as three hex fields. For CCITT SS#7, when *F9 Hex* is selected, the OPC/DPC is displayed as a single hex string.

Message Type

The Message Type has two 4–bit fields: Heading Code H0 and Heading Code H1. The Message Type can also be configured for your particular SS#7 implementation using the Chameleon User Parts Editor. The Message Type is displayed in the following format:

Message Type   xx
User mnemonic   ccc
Internal mnemonic   ccc

The User mnemonic field is not shown if no user mnemonics have been created with the User Parts Editor. The internal and user defined mnemonic may not be the same, but the internal one is always shown, as are any internally defined contents for that message.

Spare Bits

The :merge command causes Spare bits (see list below) to be included in the adjacent field.   For example, the Calling Party Category is the six low order bits of an octet with the two remaining bits defined as Spare. With merge on, the Calling Party Category is shown as 8 bits; with merge off, it is displayed as 6 bits. The syntax for merge is:

:merge or :merge on	Spare bits included
:merge off	Spare bits excluded

The Spare bits listed below are affected by merge. The CCITT reference is indicated in parentheses, if applicable.

Spare following Point code (3.5)
Spare following ConnReq Point code (3.15)
Spare following SignalPC Point code (3.30)
Spare following Destination (14.7)
Spare following Signalling data link id (14.12)
Spare preceding Test pattern length indicator (5.4)
Spare following Calling party category (3.3.1)
Spare following CUG call indicator (3.3.2j)
Spare following Address Nature (3.3.2n)
Spare following Transit exchange id (3.4.1)
Spare following Presentation restricted (3.11.7)
Spare following Signalling point code (3.7.2)
Spare following Length Indicator (2.2.1)
Spare preceding Nature of address (3.6)
Spare following LSSU Line status =
For NTT PRI, backspae interpreted spare

User Part Editor

Since User Parts are specific to a user, the Chameleon Monitoring application gives you the ability to configure two aspects of the User Parts:

- Heading Code Mnemonic
- Routing Label Structure

When the SS#7 Analysis application is first started, the built–in User Parts configuration is loaded. This information is hard–coded into the Chameleon system. Once these built–in values are loaded, you can invoke a User Parts Editor, configure the User Parts for your application, and save the information in a file. This file can then be loaded, as needed.

To invoke the User Parts Editor, select the SS7 page and press *Ctrl Z.* This displays the User Part Selection Menu which enables you to select a specific User Part for configuration (Figure 13.6).

```
                        Selection

                  0    MGT
                  1    TMR
                  2    TMS
                  3    SCCP
                  4    TUP
                  5   [ISDN]
                  6    DUPC
                  7    DUPF
                  8    USR8
                  9    USR9
                 10    USRA
                 11    USRB
                 12    USRC
                 13    USRD
                 14    USRE
                 15    USRF


   | Load | Save | Table | RtLabel |   |   |   |   |   |   |
```
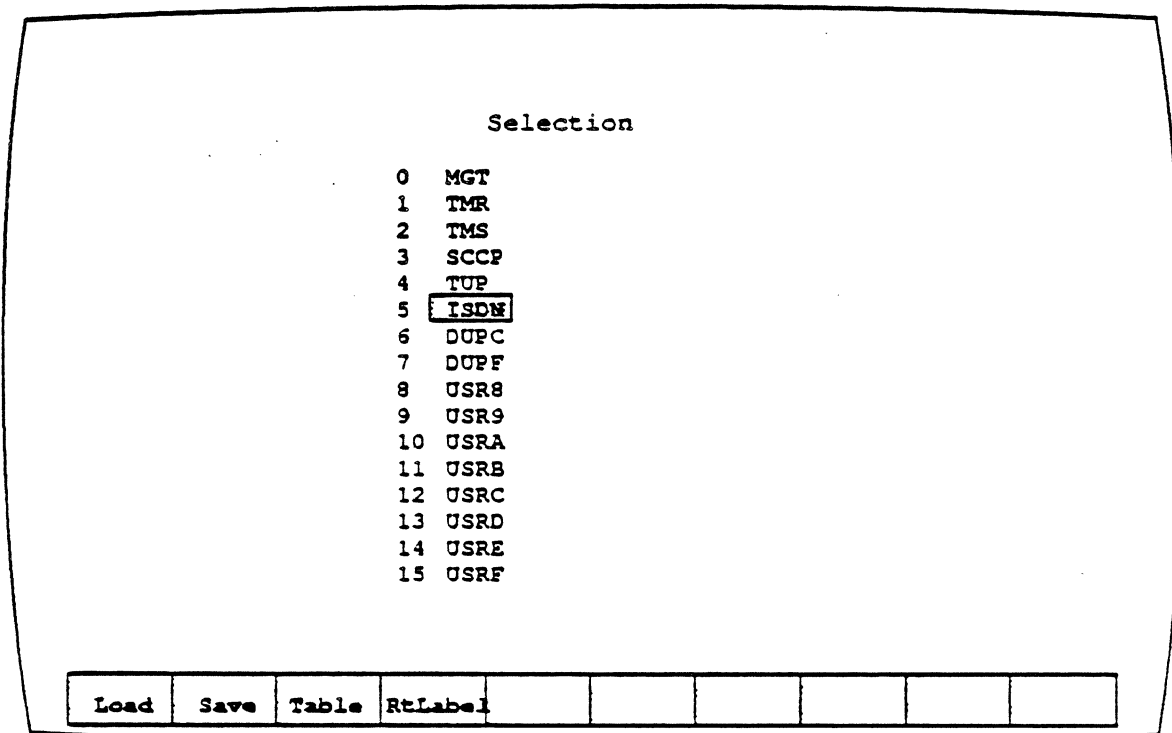
Figure 13.6: User Parts Selection Menu

There are 16 User Parts numbered 0 – 15. The defined User Parts are as follows:

0   MGT   Signalling network management
1   TMR   Signalling network testing and maintenance

2	TMS	Signalling network testing and maintenance
3	SCCP	Signalling Connection Control Part
4	TUP	Telephone User Part
5	ISDN	Integrated Services Digital Network
6	DUPC	Data User Part (call and circuit related)
7	DUPF	Data User Part (facility registration and cancellation)

The unused User Parts are listed in the format *USRn*, where *n* is the Service Indicator Code associated with that User Part.

To configure a specific User Part, use the arrows keys to highlight the desired User Part, and then select the appropriate menu option, as described below. The User Part Selection Menu has four softkey options for each User part:

F1 Load This option enables you to specify a file that contains the configuration for the selected User Part. When you press *F1 Load*, the User Part name is displayed in blue, indicating that it is now an editable field. Enter the file name and press *Go* to load the file. Refer to the next page for a list of editing keys that you can use when editing the field.

F2 Save This option saves the displayed configuration of the selected User Part to a named file. When you press *F2 Save*, the User Part name is displayed in blue, indicating that it is now an editable field. Enter a file name and then press *Go* to create the file. Refer to the next page for a list of editing keys that you can use when editing the field.

F3 Table This option displays the Mnemonic Table screen (Figure 13.8) for the selected User Part. The use of this screen is described on the following page. To exit from this screen and return to the User Parts Selection Menu, press *Go* or *Cancel*. Refer to the next page for a list of editing keys that you can use when editing the field.

F4 RTLabel This option displays the Routing Label Structure screen (Figure 13.9) for the selected User Part. To exit from this screen and return to the User Parts Selection Menu, press *Go* or *Cancel*. Refer to the next page for a list of editing keys that you can use when editing the field.

This message contents parameters are always interpreted according to built—in definitions, but you can use the *F8 Detail* function key to set the detail level to suppress the display of these interpretations if they do not apply.

Editing the
Menu Fields

Figure 13.7 lists the keys that are available for editing user input in the User Parts Editor. These keys function in each of the screens when the field is editable.

When a field is read, it is validated according to the required data type. If validation fails, the user will hear a beep. The field is reselected for input until valid data is read.

EDITING KEY	FUNCTION
Cancel	Exits the field, generally without being read. Usually CANCEL will exit the entirefunction, and return to the previous activity without carrying out the function.
Go	Reads the field, and usually the entire function is activated. If successful, the function is exited, returning to the previous activity.
↑ ↓ Return	These keys read and exit the field. The next field to be selected is whatever is appropriate to the particular key, and the result of the read.
→	Non—destructive space, moves the cursor one column to the right. On certain fields, if pressed when the cursor is at the right boundary, the field is read and exited.
←	Non—destructive backspace, moves the cursor one column to the left. On certainfields, if pressed when the cursor is at the left boundary, the field is read and exited.
Delete	Destructive backspace, moves the cursor one column to the left (if possible), anddeleting a single character at the new cursor position. DELETE does not exit thefield.
Ctrl C	The field is erased.
Ctrl O	Inserts a single space at the cursor position, moving the remainder of the field to the right of the cursor one column to the right.
Ctrl V	The next key is taken as a data key, regardless of its possible meaning as a control key. For example, to enter the DELETE key into a data entry field.
F1 – F10	These keys may be interpreted as data or control keys depending upon the application. No fixed meaning is attached to these keys

Figure 13.7: User Parts Editor Editing Keys

Heading Code
Mnemonic

To configure the Heading Code Mnemonic, highlight the desired User Part from the Selection menu and press *F3 Table*. This displays the Mnemonic Table for the Selected User Part. For example, Figure 13.8 shows a sample mnemonic table for the MGT User Part.

The Mnemonic Table Menu allows the user to enter the desired mnemonics in the fields formed at the intersections of the rows and columns. If the user presses *F1 Init*, the built—in mnemonics are displayed. To change a field, highlight the desired field, press *F2 Clear* to clear the field, and then enter the new mnemonic using the editing keys.

```
                      Mnemonic Table for MGT
  0   1    2    3    4    5    6    7    8    9    A    B    C    D    E    F
0
1     COO  COA            CBD  CBA
2     ECO  ECA
3     RCT  TFC
4     TFP  TCP  TFR  TCR  TFA  TCA
5     RSP  RSR  RCP  RCR
6     LIN  LUN  LIA  LUA  LID  LFU  LLT  LRT
7
8     DLC  CSS  CNS  CNP
9
A
B
C
D
E
F

  Init  Clear
```

Figure 13.8: Heading Code Mnemonics

Routing Table Configuration

To configure the Routing Label, highlight the desired User Part from the Selection menu and press *F4 RtLabel*. This displays the Routing Label screen for the Selected User Part. For example, Figure 13.9 shows a sample mnemonic table for the DUPF User Part.

```
                Routing label structure edit for DUPF




               Length              Display
               14                  DPC
               14                  OPC
               4                   SLC
               0
```

Black	Red	Green	Yellow	Blue	Purple	LtBlue	White		

Figure 13.9: Message Type Mnemonics

Use the arrow keys to move the highlight to the desired field. The information in the field can then be edited using the keys listed in Figure 13.6.

You can then edit the following Routing label information:

DPC   Destination Point Code
OPC   Origination Point Code
SLC   Signalling Link Code

You can configure two aspects of the Routing label, which affect how it is displayed in the History and Real time pages. You can configure:

Length   This affects the length of the field display. To configure the length, highlight the desired field and then enter the new length using the editing keys.

Display   This determines the caption that is displayed and the color of the display. To configure the Display, highlight the desired field and then enter the new caption using the editing keys. When a Display field is highlighted, the functions keys enable you to select a color for the display of that field.

For example, if the Routing Label screen displays the following for a User Part

        14   DPC
        14   OPC
        4   SLC

the first 14 bits following the SIC will be displayed with the caption DPC, the next 14 bits will be displayed with the caption OPC, and the next 4 will be displayed with the caption SLC. The fourth field is unused in this example, but is available if required. The display looks like this:

        DPC   0001
        OPC   0203
        SLC   4

The actual values displayed will be dependent upon acquired data. If you were to change the length of the fields to the following:

        16   DPC
        8   OPC
        8   SLC

the display would be more like:

        DPC   0001
        OPC   02
        SLC   03

Remember that the User Parts Editor also allows you to select the color of the display for each item.

Routing Label
Correlations

You can customize the SS#7 Monitoring routing label interpretations by using the RTLABL.DAT file which is in the following directory:

A:\tekelec\analysis\ss7

The RTLABL.DAT file enables you to specify names to correlate to specific routing labels (OPC, DPC, SLS, etc).

If RTLABL.DAT does not contain an entry for a particular OPC, DPC or SLS, the Real Time and History pages display a single line of interpretation in the format:

mnemonic   value

For example, a DPC not included in RTLABL.DAT is shown as:

DPC   2 201 6

If RTLABL.DAT contains an entry for a routing label, the interpretation is shown as two lines in the format:

mnemonic   value
RTLABL value   RTLABL name

For example, a DPC included in RTLABL.DAT is shown as:

DPC   248 211 0
248–211–0   SEATTLE STP

On the Chameleon 32 you can use the optional C package vi editor to modify the RTLABL.DAT file to customize it for your routing label values. For the Chameleon 20, use a text editor to modify the file. The format of an entry in the file is as follows:

value;   name

where: value is one or more decimal values in a format valid for your SS#7 implementation. (For example, an ANSI OPC/DPC is three decimal values delimited by dashes.) name is the name that will be correlated with that routing label. If you make an invalid entry, it will be discarded.

The RTLABL.DAT file illustrates a routing label file for ANSI, with the three values representing Network–Node–Member.

248–11–0;	DENVER STP
248–112–0;	ST PAUL MINN STP
248–111–0;	MINN BEARD STP
284–113–0;	OMAHA DOUGLAS STP
248–114–0;	OMAHA 84TH ST STP
248–211–0	SEATTLE STP
248–212–0;	PORTLAND STP

248-2-1;	TEMPE AZ STP
248-3-1;	TEMPE STP
248-5-1;	THORNTON CO STP
248-6-1;	THORNTON CO STP
248-34-1;	PHOENIX 1 STP
248-34-2;	PHOENIX 2 STP
248-34-3;	PRESCOTT STP
248-35-1;	TUCSON STP
248-32-1;	COLD SPRINGS STP
248-31-1;	DENVER 1 STP
248-31-2;	DENVER 2 STP
248-31-3;	DENVER 3 STP
248-28-1;	BOISE STP
248-27-1;	BILLINGS WEST STP
248-26-1;	HELENA STP
248-33-1;	ALBUQUERQUE 1 STP
248-33-2;	ALBUQUERQUE 2 STP
248-30-1;	SALT LAKE CITY STP
248-20-2;	PROVO STP
248-29-1;	CHEYENNE STP
248-226-1;	SEATTLE #1 STP
248-226-2;	SEATTLE #2 STP
248-226-3;	SEATTLE #3 STP
248-227-1;	SPOKANE STP
248-227-2;	YAKIMA STP
248-228-1;	PORTLAND A STP
248-228-2;	PORTLAND B STP
248-228-3;	PORTLAND C STP
248-229-1;	EUGENE STP
248-229-2;	ASHLAND STP
248-130-1;	MINN STP
248-129-1;	ST CLOUD STP
248-131-1;	OWATONNA STP
248-131-2;	WINDOM STP
248-131-3;	ROCHESTER STP
248-128-1;	DULUTH STP
248-127-1;	FARGO STP
248-127-2;	GRAND FORKS STP
248-127-3;	WADENA STP
248-126-1;	BISMARK STP
248-132-1;	SIOUX FALLS STP
248-132-1;	RAPID CITY STP
248-136-1;	DES MOINES STP
248-136-2;	MASON CITY STP
248-133-1;	SIOUX CITY STP
248-133-2;	SPENCER STP
248-134-1;	CEDAR RAPIDS STP
248-135-1;	DAVENPORT STP
248-137-1	OMAHA STP
248-137-2;	NORFOLK STP
248-138-1;	GRAND ISLAND STP
248-138-2;	SIDNEY STP

LATA/Carrier
Correlation File

You can customize the SS#7 Monitoring to correlated digit values with actual LATA/Carrier entities for TCAP History and Real Time interpretation. This is done by using the file named DIG.DAT which is located in the directory:

A:\tekelec\analysis\ss7

In the normal History/Real Time display, the LATA/Carrier digits are displayed as follows:

```
Type of digits        Carrier
Nature of number      Not Applicable
Encoding scheme       BCD
Numbering Plan        Unknown
Number of digits      3
Digits                101 ◄──────────── LATA/Carrier ID digits.
```

The DIG.DAT file enables you to enter the LATA/Carrier digits and specify a name that identifies the LATA/Carrier associated with those digits.

If DIG.DAT contains an entry for specific LATA/Carrier digits, and those digits are encountered in the traffic, an additional line of interpretation (**Correlation**) appears below the Digits line.

For example, if Carrier digits 101 were correlated with the name CARRIER101, the interpretation of the Carrier information would include **Correlation** as shown below.

```
Type of digits        Carrier
Nature of number      Not Applicable
Encoding scheme       BCD
Numbering Plan        Unknown
Number of digits      3
Digits                101        ◄───── LATA/Carrier ID digits.
Correlation           CARRIER101◄───── This line appears only
                                       when a matching entry
                                       appears in the DIG.DAT
                                       file.
```

On the Chameleon 32 you can use the optional C package vi editor to modify the DIG.DAT file. For the Chameleon 20, use a text editor to modify the file.

Entries in the file must be in the following format:

xN;name

where: **x**   **L**   (LATA)
                          C   (Carrier)

         N   The LATA/Carrier digits value
                         (digits only allowed)

         ;   Delimiter

         name   The name to correlate with the
                         specified digits

Sample valid entries are:

L001;LATA001   (If LATA 001 is encountered, it displays the
                         correlation *LATA001* as part of the LATA
                         interpretation.)

C101;CARRIER101   If Carrier 101 is encountered, it displays the
                         correlation *CARRIER101* as part of the
                         Carrier interpretation.)

TCAP INTERPRETATION

Introduction

When you select ANSI as the SS#7 standard, you can select a Transaction Capabilities Application Protocol (TCAP) standard. There are four TCAP options:

- F1 None   TCAP is not interpreted
- F2 AT & T
- F3 Bellcore
- F4 800DBAS

From an end—user point of view, Transaction Capabilities lie above the Network layer of the OSI model. Within SS#7 it is located between the SCCP and an application specific entity, as shown in Figure 13.10.

```
+-----------------------+
|     APPLICATION       |
|   SPECIFIC ENTITY     |
+-----------------------+
            |
+-----------------------+
|         TCAP          |
+-----------------------+
            |
+-----------------------+
|         SCCP          |
+-----------------------+
            |
+-----------------------+
|         MTP           |
+-----------------------+
```
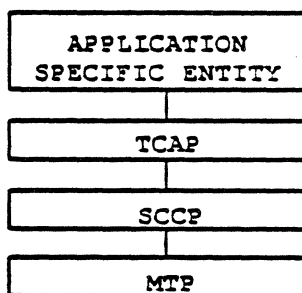
Figure 13.10: Location of TCAP in SS#7

The objective of TCAP is to provide for the transfer of information between nodes and to provide facilities common to a number of supported applications, while being independent of any of these. In an SS#7 network, TCAP is considered for use between exchanges, an exchange and a network service center, or between network service centers.

The Chameleon supports the 800 Query Message portion within TCAP, which is based on a connectionless network service. In this case, TCAP interfaces directly with the Signalling Connection Control Part (SCCP), and since SS#7 is used as the network service, the addressing options supported by the SCCP are used.

The ANSI 800 Query message will be used to illustrate the Chameleon TCAP interpretation.

All 800 Services Messages are encoded in SCCP UDT messages in MSUs. Since SCCP procedures depend on the application data transported, the SCCP message parameters may vary between 800 MSUs.

Routing Label

The Routing Label for an ANSI 800 Query Message has the format shown in Figure 13.11 below. (The other MSU components shown in the figure are described on page 13-4.) The first octet is the first transmitted. Bits in an octet are labeled, as shown, with bit 0 the least significant and the first transmitted.

First bit transmitted

Flag 01111110	Check Bits	SIF	SIO	✕	LI	F I B	FSN	B I B	BSN	Flag 01111110

Bits   7   6   5   4   3   2   1   0

Heading Code
Routing Label DPC OPC SLS

Message Type	→	See Figure 13.12.

Option	Protocol Class

Called Address Parameter Pointer	→	See Figure 13.13.
Calling Address Parameter Pointer	→	See Figure 13.13.
Data Parameter Pointer	→	See NO TAG.
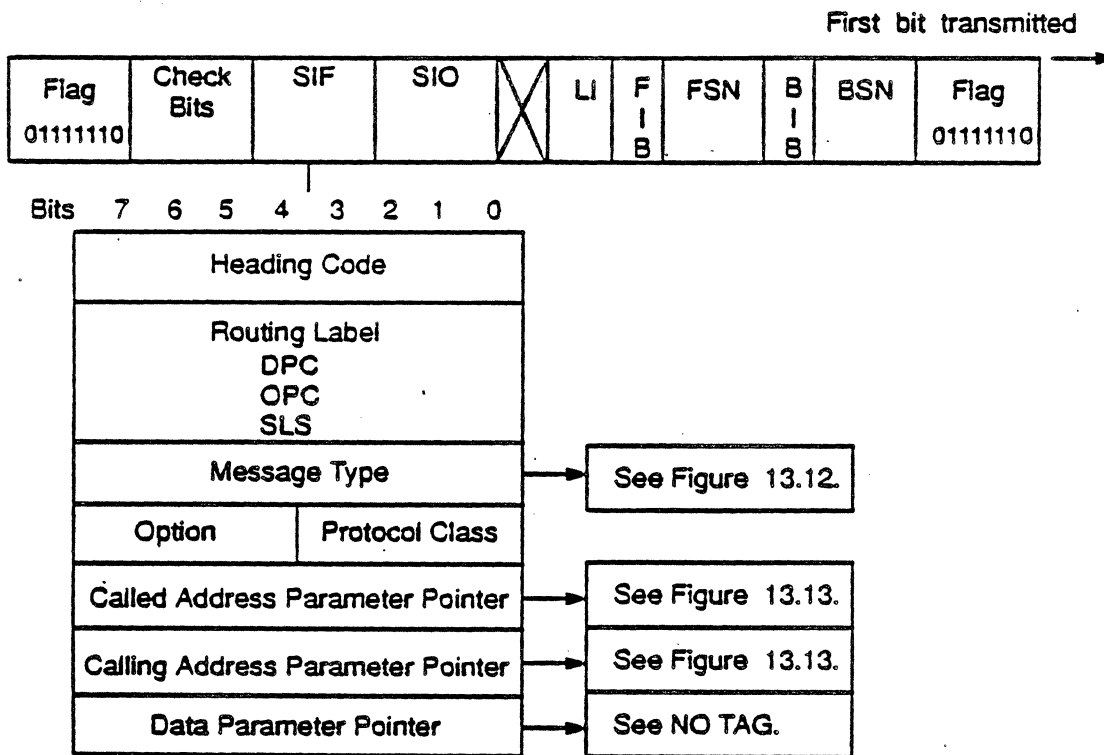
Figure 13.11: ANSI 800 Query Message Routing Label Format

The Routing Label has the following fields:

● The Destination Point Code (DPC) is the SS#7 address of the node receiving the MSU.

● The Origination Point Code (OPC) is the SS#7 address of the node sending the MSU.

● The Signalling Link Selection (SLS) is the code that directs the MSU to a particular signalling link for transmission.

- The ANSI 800 message types are listed in Figure 13.12.

- The Protocol Class must be Class 0 (connectionless service, no message sequencing required) for all 800 service messages.

- The Option field indicates any options that should be used with the Protocol Class.

- Pointers identify the location of the beginning of variable length SCCP parameters. The pointer indicates how many octets from the octet containing the pointer, the variable length parameter begins.

  For example, if the Called Address Parameter Pointer is 0000 0011, it indicates that the Called Party Address field begins in the third octet following its pointer.

Figure 13.12 on the following page lists the SCCP message types and the protocol classes associated with each. The TCAP message is carried within a Unitdata (UDT) message of the SCCP.

	SCCP Message Type	Protocol Classes	7 6 5 4 3 2 1 0
CR	Connection Request	2 3 4	0 0 0 0 0 0 0 1
CC	Connection Confirm	2 3 4	0 0 0 0 0 0 1 0
CREF	Connection Refused	2 3 4	0 0 0 0 0 0 1 1
RLSD	Released	2 3 4	0 0 0 0 0 1 0 0
RLC	Release Complete	2 3 4	0 0 0 0 0 1 0 1
DT1	Data Form 1	2	0 0 0 0 0 1 1 0
DT2	Data Form 2	3 4	0 0 0 0 0 1 1 1
AK	Data Acknowledgement	3 4	0 0 0 0 1 0 0 0
UDT	Unitdata	0 1	0 0 0 0 1 0 0 1
UDTS	Unitdata Service	0 1	0 0 0 0 1 0 1 0
ED	Expedited Data	3 4	0 0 0 0 1 0 1 1
EA	Expedited Data Ack.	3 4	0 0 0 0 1 1 0 0
RSR	Reset Request	3 4	0 0 0 0 1 1 0 1
RSC	Reset Confirmation	3 4	0 0 0 0 1 1 1 1
ERR	Error	2 3 4	0 0 0 0 1 1 1 1
IT	Inactivity Test	2 3 4	0 0 0 1 0 0 0 1

Figure 13.12: ANSI 800 Query Message Types

Called Party
Address

The Called Party address indicates the functional component of the SS#7 protocol that is the basis for decoding information in the data field. The ANSI format is shown in Figure 13.13 below for Translation Type 1. The location of the Called Party Addresses is indicated by the Called Address Parameter Pointer in the Routing Label (Figure 13.11). The pointer indicates how many octets from the pointer octet, the Called Party Address begins.

Calling Party
Address

The Calling Party Address has the same format as the Called Party Address and provides information about the user that originated the message. The location of the Calling Party Address is determined by the Calling Address Parameter Pointer in the Routing Label (Figure 13.11). The pointer indicates how many octets from the pointer octet, the Calling Party Address begins.
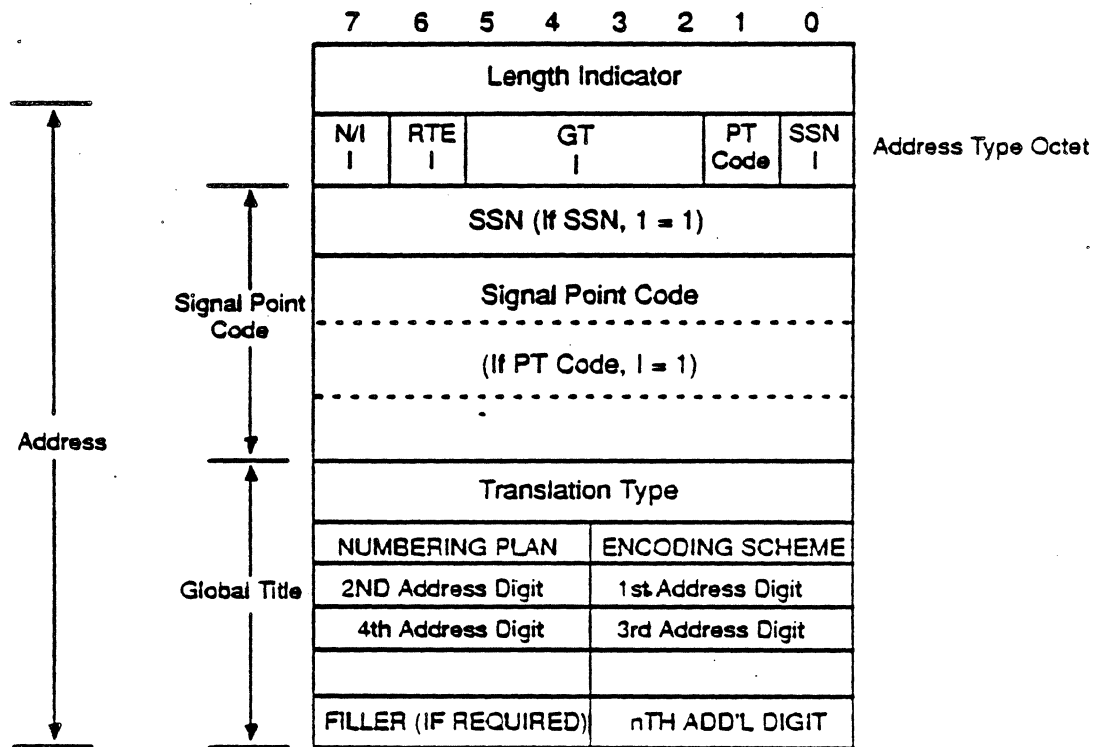
Figure 13.13: ANSI Called/Calling Party Address Field Format (Translation Type 1)

The Called/Calling Address has the following fields:

- The Length Indicator, which identifies the number of octets in the Called/Calling Address, not including the Length Indicator octet, or the parameter name octet, if used. .

- Address—Type octet, as follows:

—N/I Indicator	Indicates if the Called/Calling party address is coded according to National (1) or International (0) specifications.
—RTE Indicator	Identifies Routing based on Global Title (0) or on Point Code (1)
—GT Indicator	Indicates whether a Global Title is present, and how the Global Title is coded, if present. A Global title is a non—signalling network address that identifies an SCCP user.
—PT Code Indicator	Indicates whether a Point Code is present.
—SSN Indicator	Indicates presence of a subsystem number. If present, the subsystem number identifies the SCCP user that will receive the message.

- The Translation Type octet identifies which translation table to use for SCCP routing information, based on the Global Title.

- The Global Title value is in a multi—octet field in binary—coded form of the 800—NXX digits dialed by the caller.

Data Parameter   A TCAP messsage is structured as a single constructor information element, which consists of a number of information elements. The types of elements are:

- A Transaction Portion which contains information elements used by the Transaction sub-layer

- A Component Portion which contains information elements used by the Component sub-layer.

One of the Transaction Portion elements is the Component Sequence, which contains the Component sub-layer information elements.

Each information element (Figure 13.14) consists of three fields, appearing in the following order:

- Tag   Identifies the type of information element and the interpretation of the contents

- Length   Specifies the length (number of octets) of the contents (does not include the Tag or the Length).

- Contents   Contains the information the element is intended to convey. Its length is variable, but is always an integral number of octets.
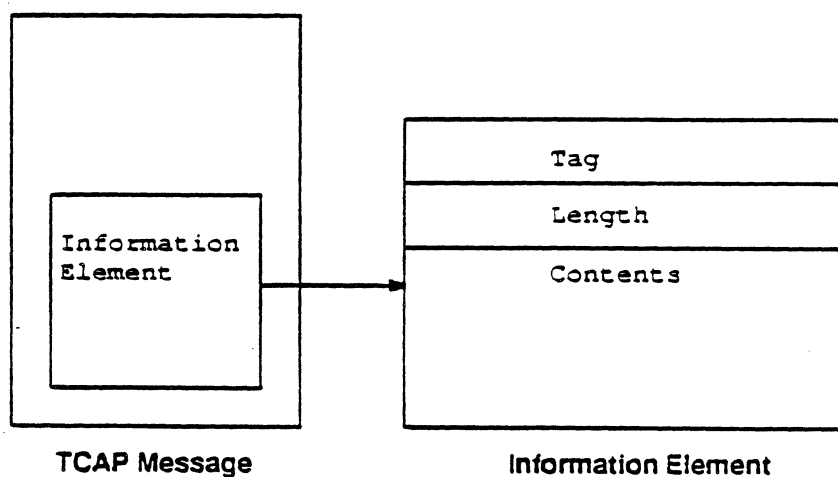
Figure 13.14: TCAP Information Element

These information elements are nested as shown in Figure 13.15.
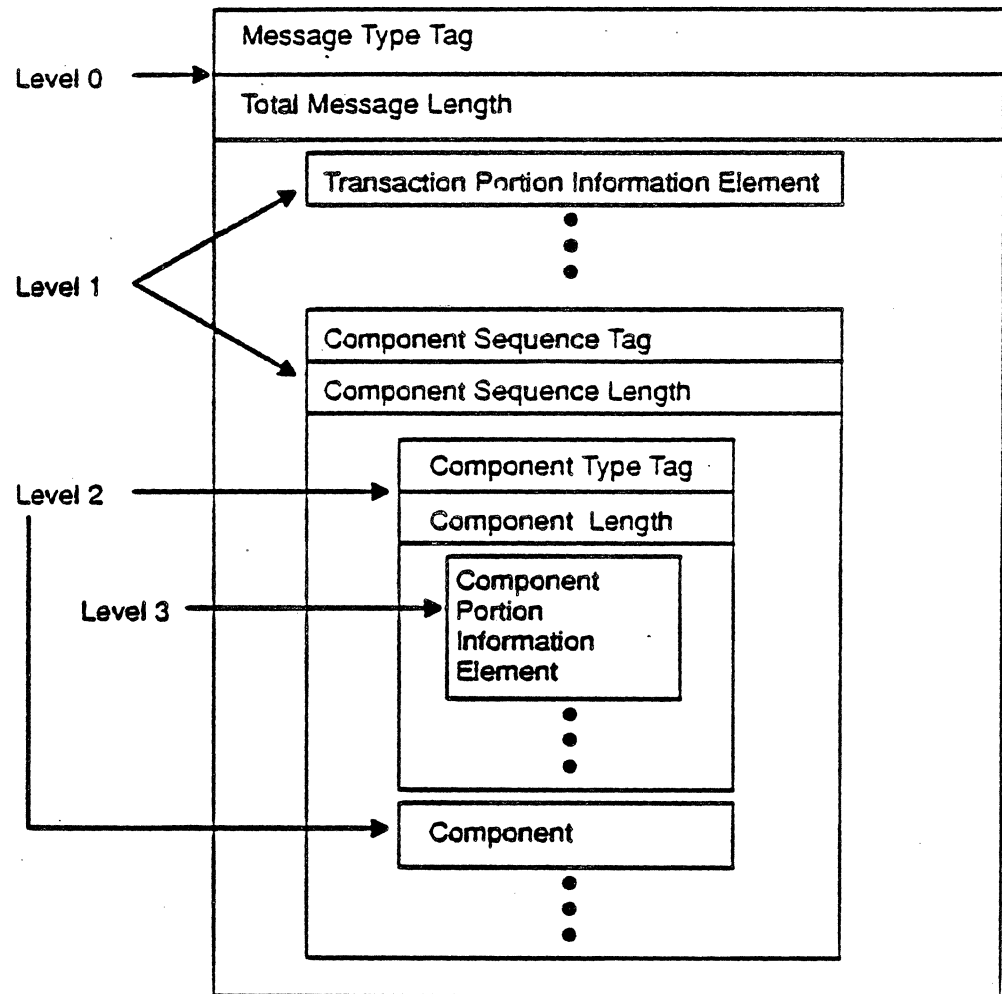
Figure 13.15: Information Element Nesting

NO TAG illustrates a typical data field for an 800 Query message from an SSP to the STP. The location of the Data Parameter is determined by the Data Parameter Pointer in the Routing Label (Figure 13.11). The pointer indicates how many octets from the pointer, the Data Parameter begins.
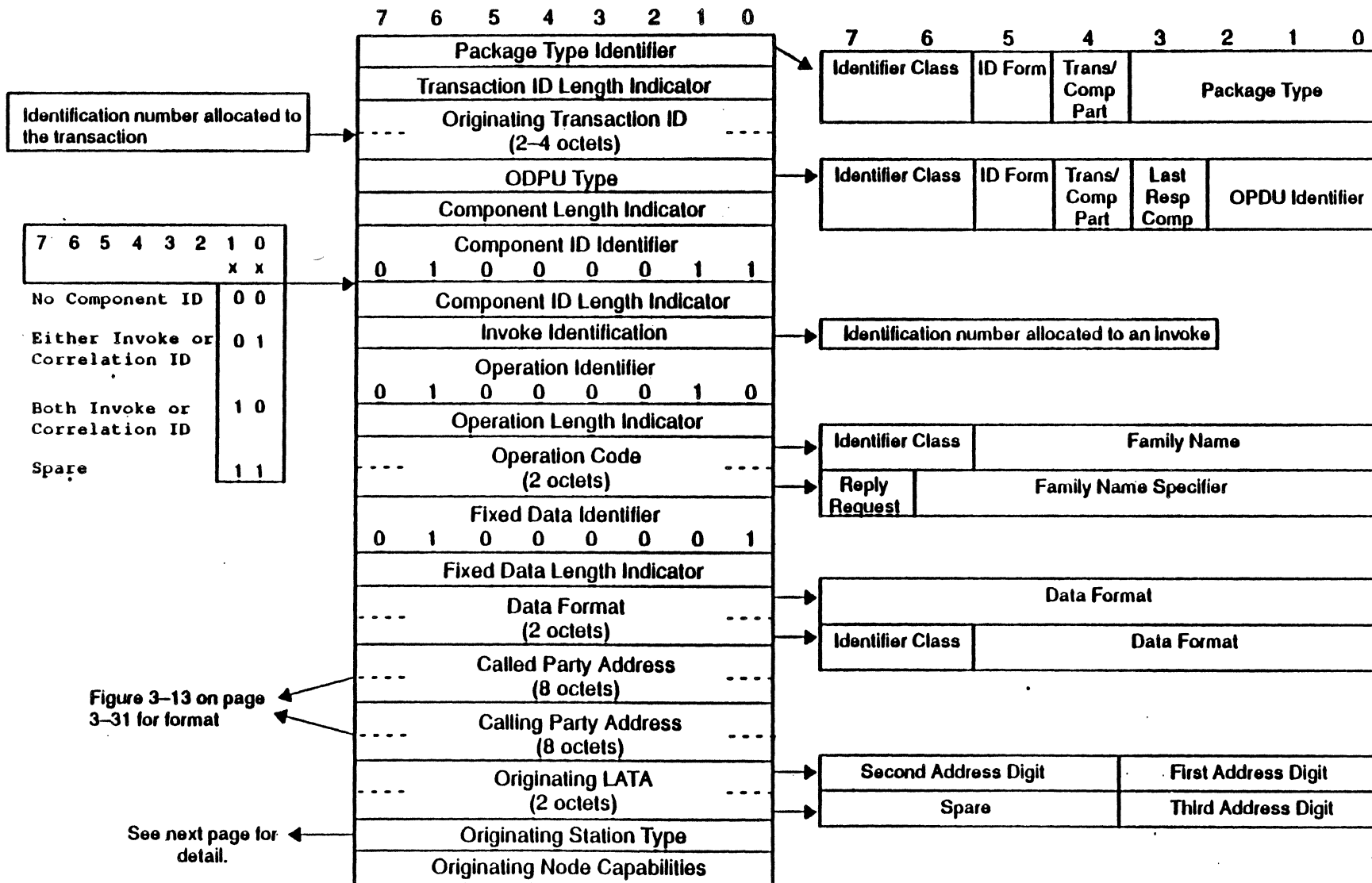
Figure 13.16: Data Parameter Field Format

Originating
Station Type

The Originating Station Type octet in NO TAG on the previous page is interpreted as shown in Figure 13.17.

7 6 5 4 3 2 1 0	INTERPRETATION
0 0 0 0 0 0 0 0	Identified Line (No SPL Treatment)
0 0 0 0 0 0 0 1	ONI (Multi–Party)
0 0 0 0 0 0 1 0	ANI Fail
0 0 0 0 0 0 1 1 ↓ 0 0 0 0 0 1 0 0	Spare
0 0 0 0 0 1 1 0	Hotel without Room Identification
0 0 0 0 0 1 1 1	Coinless, Hospital Inmate, etc.
0 0 0 0 1 0 0 0	Inter Data Restricted
0 0 0 0 1 0 0 1	Spare
0 0 0 0 1 1 0 0 ↓ 0 0 0 1 0 0 1 1	Reserved
0 0 0 1 0 1 0 0	AIOD–Listed DN Set
0 0 0 1 0 1 0 1	Reserved
0 0 0 1 0 1 1 0	Reserved
0 0 0 1 0 1 1 1	Identified Line (Coin or Non–Coin)
0 0 0 1 1 0 0 0	Spare
0 0 0 1 1 0 0 1	Spare
0 0 0 1 1 0 1 0	Spare
0 0 0 1 1 0 1 1	Coin Call
0 0 0 1 1 1 0 0	Spare
0 1 0 0 0 0 1 1	Spare
0 1 0 0 0 1 0 0	Interlata Restricted (Hotel Line)
0 1 0 0 0 1 0 1 ↓ 0 0 0 0 1 1 0 1	Spare
0 0 0 0 1 1 1 0	Interlata Restricted (Coinless Line, etc)
0 0 0 0 1 1 1 1 ↓ 0 1 0 1 1 1 1 0	Spare
0 1 0 1 1 1 1 1	Test Call
0 1 1 0 0 0 0 0 1 1 1 1 1 1 1 1	Spare

Figure 13.17: Originating Station Type Interpretation

TCAP
Interpretation

NO TAG illustrates a sample History page interpretation of an SS#7 message containing TCAP data. This is using the *800DBAS* option as the TCAP Application layer. The area enclosed in the dotted box is described on the following page.

```
    BSN=31      BIB=1       FSN=88      FIB=1
    LI=MSU      SIC=SCCP    SSF=9
    DPC                             F  00000
    OPC                             F  0630B
    SLS                                13
    Message type                       09
    Internal mnemonic                  UDT
    Unitdata
F   05 01 Protocol class               80
    Pointers                         030B10
V   03 08 Called party address
                           8900FE0840884100
V   04 05 Calling party address  C3FE0B63F0
V   0F 39  Data
           E237C7046003D18CE82FE92DCF0100D0
           028301F224AA0B84090100210A084088
           410084090200210A1233619114840607
           0001033700DF450100
┌─────────────────────────────────────────┐
│ 0 E2         55 Query with permission    │
│ 1 C7          4 Transaction ID           │
│   value               6003D18C           │
│ 1 E8         47 Component Sequence       │
│ 2 E9         45 Invoke (Last)            │
│ 3 CF          1 Component ID             │
│   value                     00           │
└─────────────────────────────────────────┘
  3 D0          2 Operation Code(National)
    Family           Provide Instructions
    Reply required                    Yes
    Specifier                        Start
  3 F2         36 Parameter Set
  4 AA         11 Service Key
  5 84          9 Digits (National)
  Type of digits        Dialed (Called)
    Nature of number    Not Applicable
    Encoding scheme                  BCD
    Numbering plan            Telephony
    Number of digits                  10
    Digits                    8004881400
  4 84          9 Digits (National)
    Type of digits        ANI (Calling)
    Nature of number    Not Applicable
    Encoding scheme                  BCD
    Numbering plan            Telephony
    Number of digits                  10
    Digits                    2135550778
  4 84          6 Digits (National)
    Type of digits                  LATA
    Nature of number    Not Applicable
    Encoding scheme                  BCD
    Numbering plan              Unknown
    Number of digits                   3
    Digits                           730
  4 45DF         1 Orig. Station type
    value                             00
```

Message Transfer Part
Interpretation controlled by F4 key.
See   page
NO TAG.

User Part
Interpretation controlled by F5 key.
See   page
NO TAG.

Data portion of User Part
corresponds to TCAP interpretation
which follows.

TCAP
Interpretation controlled by F6 key.
See page NO TAG.
The area enclosed in the dotted box
is described on the following page.

Figure 13.18: TCAP Analysis Interpretation

Figure 13.19 below shows a sample interpretation of a portion of a TCAP History page display. Refer to the previous page for the complete display.
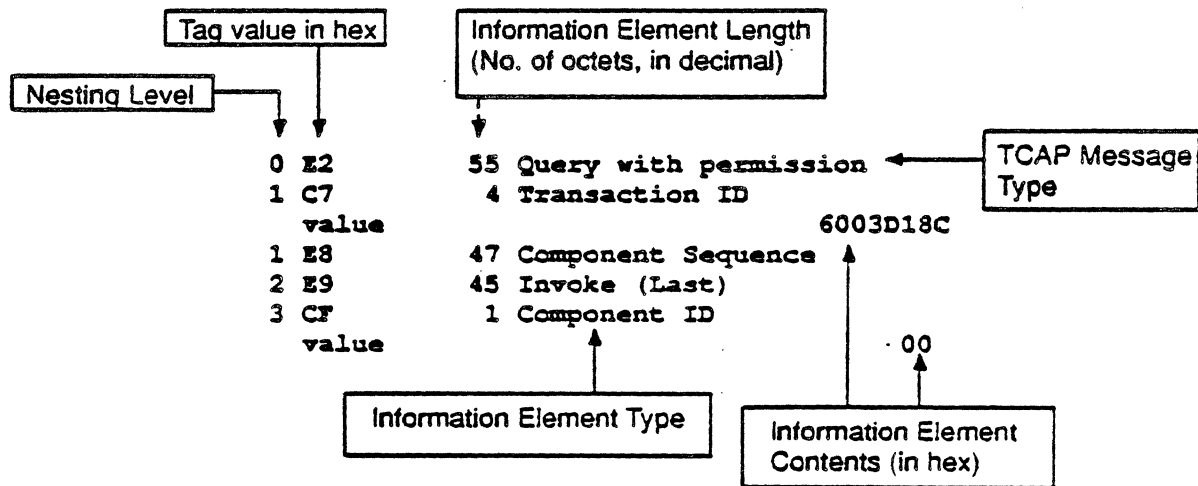
Figure 13.19: Sample TCAP Interpretation

SS#7 STATISTICS

SS#7 Statistics displays and prints statistical information about contiguous traffic on a single SS#7 link. SS#7 is a high performance protocol running dense traffic on high speed lines. For this reason, it is recommended that you run SS#7 Statistics as follows:

- It is suggested that when you use SS#7 Statistics, that no other applications are run on the same port, or on the second port (of a Dual Port machine).

- Although you can run SS#7 Statistics in either condensed mode or non–condensed mode, it is recommended that you use condensed mode. If run in non–condensed mode, the SS#7 Statistics application might not be able to process all the traffic on the line. When this occurs, the following message appears, indicating the percentage of traffic that is being processed:

    Data Processed
    xx%

    When the Data Processed is less than 100%, all state counters, data transfer fields (except RETRY(PCR)) and error transmission statistical values are calculated only from the data which has been processed. The remaining SS#7 Statistical fields are calculated on a sampling basis and remain consistent regardless of the percentage of traffic being processed.

    In non–condensed mode, if the Data Processed drops below 60%, the following message appears periodically above the **Data Processed** field:

    Try condensed mode?

    This suggests that you reconfigure the Chameleon for SS#7 in condensed mode and restart statistics.

- With high density data or in non–condensed mode, at times the SS#7 Statistics display may appear to be frozen; however, it is not. When you terminate the statistics session by pressing *Run/Stop*, the display will be updated to reflect the data acquired up to that point.

    To then start a new statistics session, press the *Reset* function key. If you resume acquisition by pressing *Run/Stop* (instead of restarting statistics by pressing *Reset*), the maximum response time fields will include the time that acquisition was halted.

When you start SS#7 Statistics, the SS#7 Line statistics page is displayed as shown in Figure 13.20. The SS#7 fields are described on the following pages.

Current state of DCE and DTE is highlighted.

Appears only under certain conditions. See page 13-46.

```
 ┌─0─────────────────────────────────────────────────┌─SS7 Line. Stats 1─┐

  START TIME: 00:00:00:000 000   AM      LAST TIME: 00:00:00 000 000   AM
  DCE STATE:  [OUT SVC] OUT ALN  NRM  EMG  RDY  IN SVC  BUSY  NOT RDY  PRO OUT
  DTE STATE:  [OUT SVC] OUT ALN  NRM  EMG  RDY  IN SVC  BUSY  NOT RDY  PRO OUT

                AVG       LAST          MIN           MAX        ┌Data Processed:┐
  DCE RESP:     0.000     0.000         0.000         0.000      │           95% │
  DTE RESP:     0.000     0.000         0.000         0.000      └───────────────┘
  DCE LEN:      00000     00000         00000         00000
  DTE LEN:      00000     00000         00000         00000
                DCE       DTE                         DCE    DTE
  MSU:          0         0             OUT SVC:      0      0
  NEG ACKS:     0         0             OUT ALN:      0      0
  RETRY (PCR):  0         0             NRM ALN:      0      0
  ABORT SU:     0         0             EMG ALN:      0      0
  CRC ERRS:     0         0             ALN RDY:      0      0
  SU ERRS:      0         0             IN SVC:       0      0
  SU-ERM:       0         0             BUSY:         0      0
  MSU/SEC:      0         0             NOT RDY:      0      0
  MSU BYTE/SEC: 0         0             PRO OUT:      0      0

  DCE DATA:  45%  [            ]        DTE DATA:  55%  [            ]
  OVERHEAD:  55%  [   ]                 OVERHEAD:  45%  [   ]

  ┌──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┬──────┐
  │ PRINT│ RESET│ TIME │ MSU  │      │      │      │      │      │      │
  └──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┴──────┘
```

Prints a report.

Resets all statistics fields to zero.

Time = Time
Date = Date and time

Bar graph representation of data.

Determines whether the number of MSUs or the number of bytes in MSUs is displayed in the MSU field.
It also affects the SU—ERM field when an excess error condition occurs (see page 13-47).

Figure 13.20: The SS#7 Line Statistics Page

Total Processing Time

Several SS#7 statistical fields are calculated using Total Processing Time, which is defined as:

(Elapsed time from START TIME to LAST TIME) – (Total time lost from missed events)

The Line Performance fields and the RETRY(PCR) field are calculated using Total Processing Time. When calculating these fields, it is assumed that the characteristics of the missed traffic are the same as the traffic that is processed.

Time Display

The top line of the SS#7 Statistics page displays the time. The time format depends on whether *F3 Time* or *F3 Date* is selected.

If *F3 Time* is selected, the times are displayed in the format **hh:mm:ss:ddd ddd AM/PM.** For example, 08:46:25:934 160 AM.

If *F3 Date* is selected, the time is displayed in the following format **dd MMM yyyy hh:mm:ss.** For example, 01 JAN 1989 08:06:45.

The time display also depends on whether you are analyzing data from the line or from disk, since only the time (and not the date) is captured with the Direct–to–Disk application.

Start Time   If you are analyzing data from the line, this field displays the system time of the *end* of the first event in a statistics session.

If you are analyzing data from disk and *F3 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

Last Time   If you are analyzing data from the line, this field displays the system time of the *end* of the last event in a statistics session.

If you are analyzing data from disk and *F3 Date* is selected, this field displays the current system date, but the time at which the event was originally captured to disk.

DCE/DTE State

The states of the DCE and DTE are indicated below the time/date display. The nine possible states are listed across the page, with the current state of the DCE/DTE highlighted. The nine possible states are defined as follows:

OUT SVC   Out of Service.
                The DCE/DTE is sending SIOS.

OUT ALN   Out of Alignment.
                The DCE/DTE is sending SIO.

NRM   Normal Alignment.
                The DCE/DTE is sending SIN.

EMG   Emergency Alignment.
                The DCE/DTE is sending SIE.

RDY   Aligned Ready
                This state is entered when the DCE/DTE starts sending FISUs while in the NOT RDY, NRM or EMG state.

IN SVC   In Service
                This state is entered when one of the following occurs:

                —   The current side receives a FISU or MSU while in the RDY state.

                —   The other side has recovered from PRO OUT state, while the current side is sending FISUs.

                —   When an MSU is detected while not in the IN SVC state.

BUSY   Busy
                Busy is always highlighted in combination with **IN SVC**, indicating that a busy LSSU has been detected.

Note: The Chameleon does not monitor the actual beginning and end of a Busy state. The Chameleon determines if the line is currently in the Busy state by comparing the **Busy** state counter between the current and previous SS#7 Statistics page, which is updated each millisecond. If the current and previous Busy counters are the same, the Chameleon indicates that the Busy state has ended.

NOT RDY   Aligned Not Ready
This state is entered when the DCE/DTE begins
sending SIPOs while in the NRM, EMG or RDY state.

PRO OUT   Processor Outage
This state is entered when one of the following
occurs:

—   The current side sends a SIPO while in the In
Service state.

—   The current side receives a SIPO while in the IN
SVC or RDY state.

—   The current side receives a FISU, MSU, or SIPO
while in the NOT RDY state.

When the SS#7 Statistics application is started, the initial state of
the DCE and DTE is determined by the type of signaling unit first
transmitted, as shown in Figure 13.21 below.

If the first Signaling Unit transmitted by the side is:	The Chameleon indicates its initial state as:
FISU	Aligned Ready (RDY) (assumed)
MSU	In Service (IN SVC)
LSSU: SIOS	Out of Service (OUT SVC)
LSSU: SIO	Out of Alignment (OUT ALN)
LSSU: SIN	Normal Alignment (NRM)
LSSU: SIE	Emergency Alignment (EMG)
LSSU: SIPO	Aligned Not Ready (NOT RDY) (assumed)
LSSU: BUSY	In Service (Busy state counter is incremented)

Figure 13.21: Initial DCE/DTE States

State Counters

The SS#7 Statistics page includes state counters, which display
the number of times the DCE and the DTE have been in each of the
eight states described above. This information is provided in the
center of the screen on the right side.

Note   If the initial state is assumed (RDY or NOT RDY), the state is
highlighted as the current DCE/DTE State, but is not included in the
corresponding state counter total.

The following state counters are displayed:

OUT SVC   Out of Service
OUT ALN   Out of Alignment
NRM ALN   Normal Alignment
EMG ALN   Emergency Alignment
ALN RDY   Aligned Ready
IN SVC   In Service
NOT RDY   Aligned Not Ready
PRO OUT   Processor Outage

The DCE/DTE BUSY counter indicates the number of BUSY LSSUs sent from the DCE or the DTE. See page 13-42 for a description of the method used by the Chameleon to determine the BUSY state.

Data Transfer Fields

These counters indicate the number of events that have occurred from the DCE or the DTE for data transfer events:

**DCE/DTE
Response**

These fields indicate the time it takes the DCE/DTE to acknowledge an MSU sent from the other side. The average, minimum, maximum, and last times are displayed for both the DCE and the DTE.

**DCE/DTE
Length**

This field displays the length of MSUs transmitted by the DCE and the DTE. The average, minimum, maximum, and last MSU lengths are displayed for both the DCE and the DTE.

**MSU
MSU BYTES**

This field displays the number of MSUs of valid length, which had no transmission errors. An invalid length is defined as:

$$\text{length} < 3 \quad \text{or} \quad \text{length} > 276$$

If *F4 MSU* is selected, the number of MSUs is displayed. If *F4 Bytes* is selected, the number of bytes in the MSUs is displayed.

NEG ACKS

This field is relevant only for the Basic Retransmission method. It displays the number of NACKs received by the DCE or DTE. For example, DCE NEG ACKS is incremented by one if the DTE inverts its BIB.

RETRY (PCR)
RETRIES
PCR RETRY/SEC

This displays the number of retries (unacknowledged MSUs with the same FSN sent from the DCE/DTE). Both the field name (RETRY, RETRIES, or PCR RETRY/SEC) and the count depend on the retransmission method in use, as follows:

The field is initialized with the name **RETRY (PCR)**. When retries are detected, the Chameleon identifies the retransmission method being used, and does one of the following:

—   If **Preventive Cyclic Retransmission** is being used, the field displays the cumulative retry rate, calculated as:

$$\frac{\textbf{Number of RETRIES during the Total Processing Time}}{\text{Total Processing Time}}$$

See page 13-40 for a definition of Tota Processing time.

If the rate is zero, the field name remains RETRY (PCR). If the rate is greater than zero, the field name changes to PCF RETRY/SEC and displays the calculated value.

—   If **Basic Retransmission** method is used, the field name changes to RE TRIES, and the field displays the number of retries.

Data Processed

Because of the high baud rate in SS#7, the SS#7 Statistics application might not be able to process all the traffic on the line. When this occurs, the following message appears on the upper right side of the page:

Data Processed
xx%

This message warns the user that less than 100% of the traffic on the line is being processed, and indicates the percentage of traffic that is being processed.

In non—condensed mode, if the Data Processed percentage drops below 60%, the following message appears periodically above the Data Processed field:

Try condensed mode?

This message suggests that you reconfigure the Chameleon for SS#7 condensed mode and restart the statistics application. Condensed mode is described on page NO TAG.

Error Transmission Fields

The following counters indicate the number of events from the DCE or the DTE for error transmission events:

ABORT SU

This displays the number of aborted Signal Units (SUs) transmitted from the DCE or the DTE.

CRC ERRS

This displays the number of SUs with CRC errors transmitted from the DCE or DTE.

SU ERRS

This displays the number of SUs transmitted from the DCE or DTE which were of invalid length.

SU_ERM

This is a self—maintained Signal Unit Error Rate Monitor which displays a message when an excessive error rate occurs, warning the user that the link is bad and should be taken out of service. The SU_ERM is calculated as follows:

— The monitor is initialized to zero.

— It is decremented by 1 for every 256 SUs received, if SU_ERM is greater than zero. If SU_ERM equals zero, it is not decremented, and remains zero.

— If a bad SU is received, SU_ERM is incremented as as shown in Figure 13.22.

Type of SU Error	SU_ERM is incremented:
Aborted SU	SU_ERM + 1
Length < 3	SU_ERM + 1
CRC error	SU_ERM + 1 + (bad SU length +3) / 16 This is the octet counting mode.
Length > m	SU_ERM + (bad SU length +3) / 16 This is the octet counting mode.

Figure 13.22: SU Error Rate Monitor Algorithms

If SU_ERM >= 64, indicating that excessive errors have occurred, the SU_ERM field displays the following:

— If *F4 MSU* is selected, the flashing message **EXCESS** appears as a warning to the user (the SU_ERM continues monitoring errors).

— If *F4 Bytes* is selected, the current SU_ERM value is displayed in the field.

Note: SU_ERM may not be decremented accurately since some FISUs will not be detected in condensed mode.

Line Performance

The Line Performance fields are calculated using Total Processing Time which is defined on page 13-40.

MSU/SEC

This field displays the average number of MSUs transmitted by the DCE or the DTE each second. This is calculated as follows:

$$\frac{\text{Number of MSUs transmitted during the Total Processing Time}}{\text{Total Processing Time}}$$

MSU BYTE/SEC

This field displays the average number of MSU bytes transmitted by the DCE or the DTE each second. This is calculated as follows:

$$\frac{\text{Number of MSU bytes transmitted during the Total Processing Time}}{\text{Total Processing Time}}$$

DCE/DTE DATA

Displays the actual time the line is utilized for data transfer as a percentage of the maximum capacity of the line. This is calculated as follows:

$$\frac{\text{Number of data (MSU) bytes transmitted during the Total Processing Time}}{\text{Total number of bytes that could possibly be transmitted during the Total Processing Time}}$$

This information is also shown as a bar graph so that you can easily compare it to the graph of overhead usage.

OVERHEAD

This displays the percentage of time the line is utilized for the transfer of all non-MSU traffic. This information is displayed for both the DCE and the DTE. This is calculated as follows:

$$\frac{\text{Number of non-MSU bytes transmitted during the Total Processing Time}}{\text{Total number of bytes that could possibly be transmitted during the Total Processing Time}}$$

This information is also shown as a bar graph so that you can easily compare it to the graph of data transfer utilization.

SS#7 Statistics Function Keys

There are four function keys available for SS#7 Statistics. These are shown and briefly described in Figure 13.20. A complete description of each key is provided below.

F1: Print

F1 Print prints a statistical report that is similar to the screen display format. If you have a printer connected to the Chameleon, you can print a report. If you do not know how to connect a printer to the Chameleon, refer to the *Chameleon 32* or the *Chameleon 20 User's Guide, Chapter 9: Utilities*.

If you do not have a printer connected to the Chameleon, pressing **F1 Print** has no effect. The report will not be shown on the Chameleon screen. A sample SS#7 statistics report is shown in Figure 13.23.

```
                    TEKELEC SS7 STATISTICS REPORT

    START TIME:                 00:00:00:000 000
    LAST TIME:00:00:00:000 000

                                DCE             DTE
    NEG ACKS :                  0000000000      0000000000
    FRAME RETRIES (PCR):        0000000000      0000000000
    FRAME ABORTS :              0000000000      0000000000
    CRC ABORTS :                0000000000      0000000000
    MSU ERRORS :                0000000000      0000000000
    SU-ERM :                    0000000000      0000000000
    OUT SERVICE :               0000000000      0000000000
    OUT ALIGNMENT :             0000000000      0000000000
    NORMAL ALN :                0000000000      0000000000
    EMERGENCY ALN :             0000000000      0000000000
    ALN READY :                 0000000000      0000000000
    IN SERVICE :                0000000000      0000000000
    BUSY :                      0000000000      0000000000
    ALN NOT RDY :               0000000000      0000000000
    PRO OUT :                   0000000000      0000000000

                                AVG     LAST    MAX     MIN
    DCE MSU LENGTH :            00000   00000   00000   00000
    DTE MSU LENGTH :            00000   00000   00000   00000
    DCE FRAME RESPONSE :        0.000   0.000   0.000   0.000
    DTE FRAME RESPONSE :        0.000   0.000   0.000   0.000

    DCE MSU:                    0
    DTE MSU:                    0
    DCE MSU BYTES:              0
    DTE MSU BYTES:              0

    DCE DATA UTILIZATION :      00 %
    DTE DATA UTILIZATION :      00 %
```

Figure 13.23: SS#7 Statistics Report

F2: Reset

F2 Reset resets the statistics values to zero and resets the times (or dates) displayed at the top of the page.

F3: Time/Date

F3 Time/Date affects the format of the time in the START TIME and LAST TIME fields at the top of the display.

If *F3 Time* is selected, the times are displayed in the format:

hh:mm:ss:ddd ddd AM/PM

For example: 08:46:25:934 160 AM.

If *F3 Date* is selected, the time is displayed in the following format:

dd MMM yyyy hh:mm:ss

For example: 01 JAN 1989 08:06:45.

F4: MSU/Bytes

The *F4 MSU/Bytes* key determines whether the number of MSUs or the number of bytes in MSUs is displayed in the MSU field.

The *F4 MSU/Bytes* key also affects the SU_ERM field when an excessive error rate occurs. If *F4 MSU* is selected, the message EXCESS is displayed when an excessive error rate occurs. When *F4 Bytes* is selected, the current value of the SU_ERM is displayed. Refer to page 13-47 for more information.

CHAPTER FOURTEEN:
DASS 2 MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes British Telecom's Digital Access Signaling System No. 2 (DASS 2) Analysis, by focusing' on the protocol—specific details of the application. For a general description of Analysis, refer to Chapter 1.

The current DASS 2 Monitoring supports the specifications:

- Digital Access Signalling System No 2, DASS2 (BTNR 190), Part 1, Volume 1, Core Document, Issue 1, April 1985

- Digital Acecss Signalling System No 2, DASS2 (BTNR 190), Part 1, Volume 2, Supplementary Services, Issue 1, April 1985

This includes analysis of the DASS 2 Supplementary Services:

- User to User Signalling
- Closed User Group
- Calling or Called Line Identification
- Call Charge Indication
- Network Address Extension

This section assumes that you know how to select Monitoring for a port and select DASS 2 as the protocol. It you do not know how to do this, refer to the *Chameleon 32 or Chameleon 20 User's Guide, Volume I, Chapter 3.*

Monitor Setup Menu

When you select DASS 2 as your Monitoring protocol, you are prompted for configurable parameters, as shown in Figure 14.1 and described below.

```
┌──────────────────────────────────────────────────────────────┐
│ ─O───────────────────────────────────────┌─Configuration─┐   │
│                          Port x Monitoring └───────────────┘   │
│                                                                │
│                                          ┌────────────────────┐│
│                                          │ Press GO to accept ││
│                                          └────────────────────┘│
│                                                                │
│     Protocol  :    ┌────────┐                                  │
│                    │ DASS 2 │                                  │
│                    └────────┘                                  │
│     Encoding       ┌────────┐                                  │
│                    │  NRZ   │   ◄───                           │
│                    └────────┘                                  │
│                                                                │
│                                                                │
│   ┌─────┬──────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┐│
│   │ NRZ │ NRZI │     │     │     │     │     │     │     │ Exit││
│   └─────┴──────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┘│
└──────────────────────────────────────────────────────────────┘
```

Figure 14.1: DASS 2 Monitoring Menu

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it. The components of the display are described on the following pages.

The display format and function keys are the same for both pages, as shown in the sample display in Figure 14.2.

The area shown in the box is described on page 14-3.

Layer 2 displayed in green. Interpretation controlled by the F4 key.

Layer 3 displayed in brown. Interpretation controlled by the F5 key. (The F8 key controls whether decode is for Layer 3 only or is a full decode.)

```
                                                              Real Time A

  A   44  DPNSS      PBX-cm      Channel=B      Port B 135
      3F  Real                   LAP=IF
  C   03  UI  0            3
  M   00  ISRM (C)
          INITIAL SVC REQ (COMPLETE)
  SIC     E877    Facsimile              9600 bits/s
                  Data type        Async 2 stop
                  Data mode                 FDX
                  Data format        8 data bits
                  TA has flow control capability Yes
                  No supplementary Information

  A   44  DPNSS      PBX-cm      Channel=B      Port B 135
      3F  Real                   LAP=IF
  C   03  UI  0            3
  M   00  ISRM (C)
          INITIAL SVC REQ (COMPLETE)
  SIC     E877    Facsimile 9600 bits/s
                  Data type Async 2 stop
                  Data mode FDX
                  Data format   8 data bits
                  TA has flow control capability Yes
```

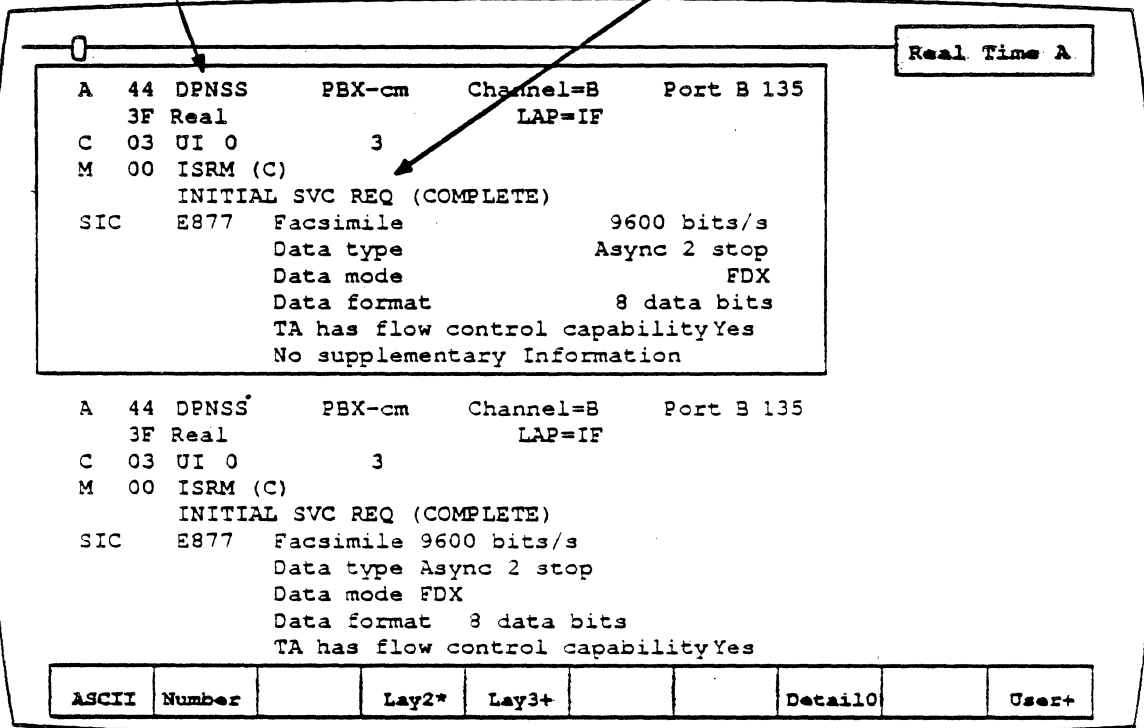| ASCII	Number		Lay2*	Lay3+			Detail0		User+

Figure 14.2: Real Time Page with Sample DASS 2 Traffic

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames transmitted from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below (example: the new baud rate is 9600)

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Layer 2
- Yellow = Layer 3
- White = User data
- Red = Errors (for example, incomplete events)

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The DASS 2 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol-specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hex digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides. The options are:

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed -

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F4: Layer 2

F4 determines how the Layer 2 is interpreted and displayed. The options are:

Lay2–   Layer 2 is acquired but not displayed ·

Lay2+   Layer 2 is displayed interpreted

Lay2"   Layer 2 is displayed raw

Lay2*   Layer 2 is displayed interpreted and raw

F5: Layer 3

F5 determines how the Layer 3 is interpreted and displayed. The options are:

Lay3–   Layer 3 is acquired but not displayed

Lay3+   Layer 3 is displayed interpreted

Lay3"   Layer 3 is displayed uninterpreted

Lay3*   Layer 3 is displayed interpreted and uninterpreted

F8: Detail

F8 determines whether the full DASS 2 decode is displayed, or only Layer 3 is displayed.   The options are:

Detail0   Full DASS 2 decode is provided

Detail1   Layer 3 decode only is provided

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in *F1*

DASS 2 INTERPRETATION

Figure 14.3 shows the format of a DASS 2 frame. It contains the following fields:

- Address (two octets)

- Control (one octet)

- Information Field (0 – 45 octets). The length of the information field in all frames, except UI Command frames, is zero.

- FCS (Frame Check Sequence, two octets)

Address	Control	Information Field	FCS

Figure 14.3: V.120 Frame Format
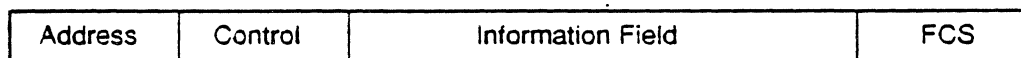
All fields, except the FCS, are transmitted an octet at a time, low order bit first. The FCS is transmitted high order bit first.

Address   The address field consists of two octets, interpreted as shown in
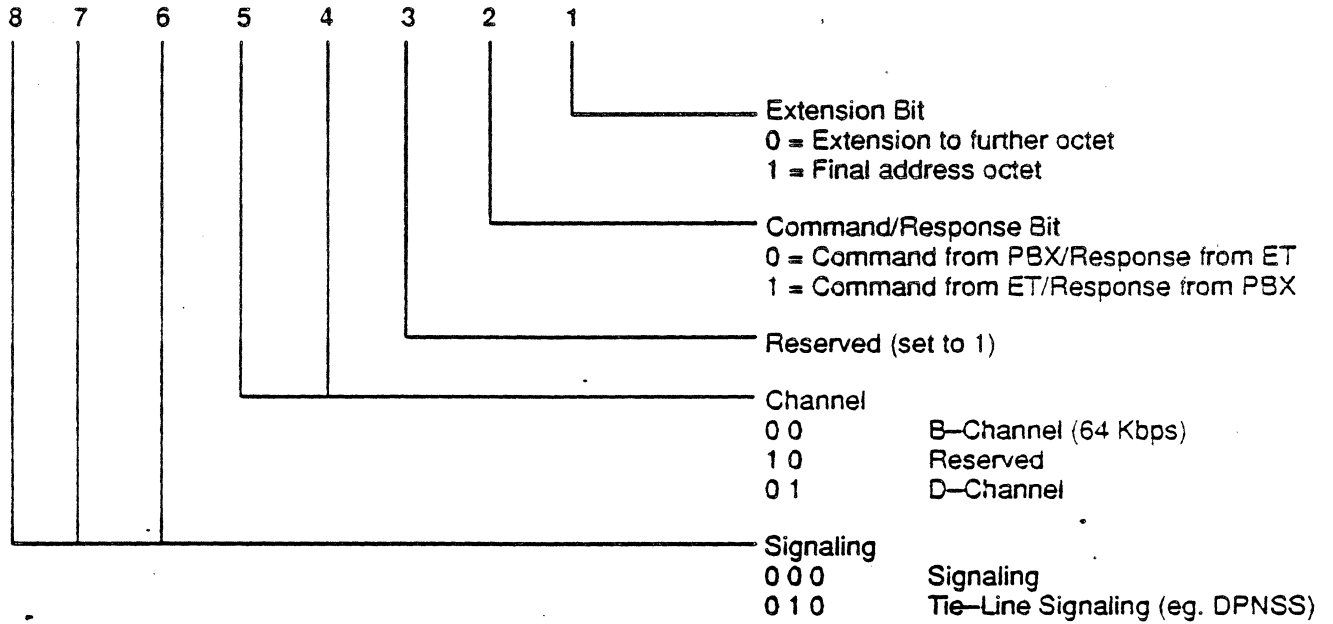   Figure 14.4 and Figure 14.5, respectively.
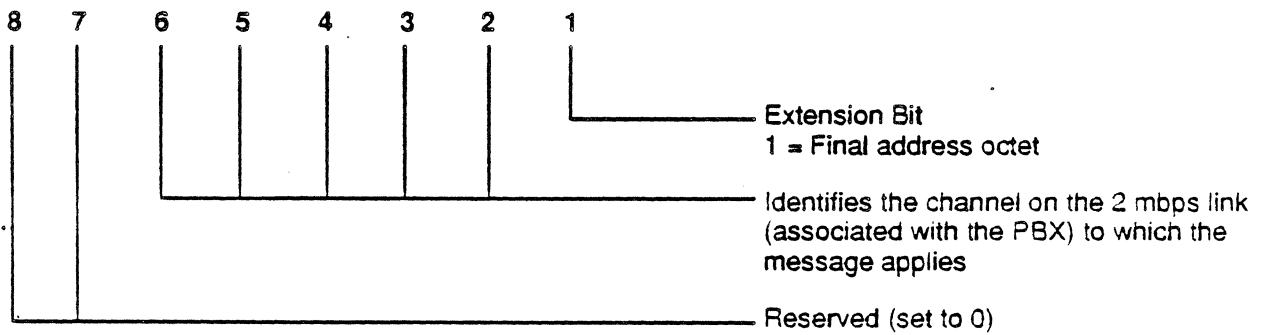

Figure 14.4: Address Field — First Octet

Figure 14.5: Address Field — Second Octet

Figure 14.6 and Figure 14.7 list the valid address field combinations that can be used at Layer 2 of DASS 2. Frames received with other addresses are invalid, and are discarded.

Frame Type	8 7 6 5 4 3 2 1	Channel
SABMR from PBX	0 0 0 0 1 1 0 0	D—Channel Signaling
UA from PBX	0 0 0 0 1 1 1 0	D—Channel Signaling
UI(C) from PBX	0 0 0 0 0 1 0 0	B—Channel Signaling (64kbps)
UI(R) from ET	0 1 0 0 0 1 0 0	B—Channel Tie—Line (64kbps)
SABMR from ET	0 0 0 0 1 1 1 0	D—Channel Signaling
UA from ET	0 0 0 0 1 1 0 0	D—Channel Signaling
UI(C) from ET	0 0 0 0 0 1 1 0	B—Channel Signaling (64kbps)
UI(R) from PBX	0 1 0 0 0 1 1 0	B—Channel Tie—Line (64kbps)

Figure 14.6: Valid DASS 2 Addresses (First Octet)

Time Slot	8 7 6 5 4 3 2 1
Time Slot 1	0 0 0 0 0 0 1 1
Time Slot 2	0 0 0 0 0 1 0 1
Time Slot 3	0 0 0 0 0 1 1 1
Time Slot 31	0 0 1 1 1 1 1 1

Figure 14.7: Valid DASS 2 Addresses (Second Octet)

Control Field

A frame is transmitted as a command or a response, according to the setting of the C/R bit in the address field. Command frames carry information and control the link. Response frames are used for acknowledgement and contain no information field.

A SABMR frame constitutes a reset signal, indicating that the sending PBX/ET will reset its state variables upon receipt of a UA or SABMR frame from the receiving PBX/ET. The ET/PBX receiving a SABMR, resets its state variables and responds with a UA.

A UA frame is a reset acknowledgement signal, that confirms that a reset signal (SABMR) has been received and acted upon.

The control field consists of one octet which indicates the frame type, as shown in Figure 14.8. In the figure, N indicates the sequence number of a UI frame. The sequence number in each UI command frame is defined as the send sequence number, $N(P)$. The sequence number in each UI response frame is defined as the receive sequence number, $N(F)$.

Frame Type	Command /Response	8 7 6 5 4 3 2 1
Unnumbered Information (UI) Frame	Command: UI(C) Response: UI(R)	0 0 0 N 0 0 1 1
Set Asynchronous Balanced Mode Restricted (SABMR)	Command frame only	1 1 1 0 1 1 1 1
Unnumbered Acknowledge (UA) Frame	Response frame only	0 1 1 0 0 0 1 1

Figure 14.8: DASS 2 Control Field Formats

Message

A typical message is shown in Figure 14.9. The first octet is included in all messages, and identifies the message type. In the Figure, bit 1 is the low order bit and is transmitted first. Octets of a message are numbered consecutively, and are transmitted in this order. The additional information in octets 2 − N depends on the type of message being transmitted.
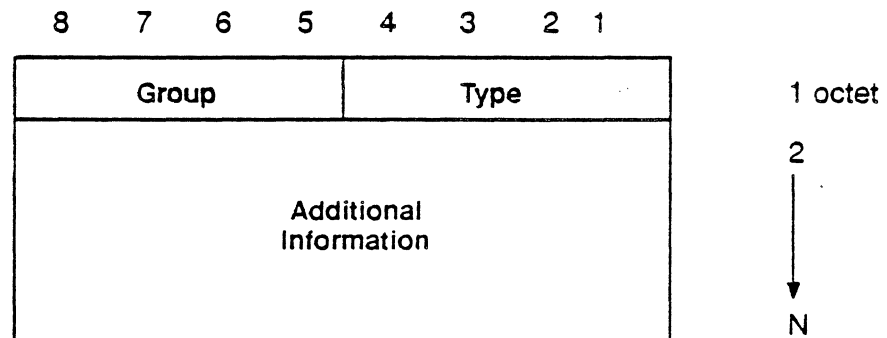

Figure 14.9: DASS 2 General Message Format

Figure 14.10 lists the message types. For a complete description of DASS 2 message types and formats refer to the British Telecom document *Digital Access Signalling System No 2 , DASS 2 (BTNR 190), Part 1, volume 1, Core Document, Issue 1, April 1985.*

Octet 1								Transmitted From	Message Mnemonic	Message Type
8	7	6	5	4	3	2	1			
0	0	0	0	0	0	0	0	PBX	ISRM (C)	Initial Service Request (Complete)
0	0	0	0	0	0	0	1	PBX	ISRM (I)	Initial Service Request (Incomplete)
0	0	0	0	1	0	1	1	PBX	SSRM(I)	Subsequent Service Request (Incomp.)
0	0	0	0	1	1	0	0	PBX	SSRM(C)	Subsequent Service Request (Complete)
0	0	0	0	0	1	0	0	ET	CS	Channel Seized
0	0	0	0	0	0	0	0	ET	ICI (C)	Incoming Call Indication (Complete)
0	0	0	0	0	0	0	1	ET	ICI(I)	Incoming Call Indication (Incomplete)
0	0	0	0	1	0	1	1	ET	SCI(I)	Subsequent Call Indication (Incomplete)
0	0	0	0	1	1	0	0	ET	SCI(C)	Subsequent Call Indication (Complete)
0	0	0	0	1	0	0	1	PBX	CAM	Call Accepted Message
0	0	0	0	0	1	1	1	ET	CA	Call Arrival
0	0	0	0	1	0	0	1	ET	NAM	Number Acknowledge Message
0	0	0	0	0	1	1	0	ET	NIM	Network Indication Message
0	0	0	0	0	1	0	1	PBX or ET	CCM	Call Connected Message
0	0	0	0	1	0	0	0	PBX	CRM	Clear Request Message
0	0	0	0	1	0	0	0	PBX	CCF	Clear Confirmation
0	0	0	0	1	0	0	0	ET	CIM	Clear Indication Message
0	0	0	0	0	0	1	0	PBX	RM (C)	Recall Message (Complete)
0	0	0	0	0	0	1	1	PBX	RM (I)	Recall Message (Incomplete)
0	0	0	0	1	0	1	0	ET	RRM	Recall Rejection Message
0	0	0	0	1	1	1	0	ET	WSR	Withhold Service Request Message
0	0	0	0	1	1	1	0	PBX	SRW	Service Request Withheld
0	0	0	0	1	1	0	1	ET	SeSR	Send Service Request Message
0	0	1	0	0	0	0	0	PBX or ET	SM	Swat Message
0	0	1	0	0	0	1	0	PBX or ET	UUD(C)	User to User Data (Complete)
0	0	1	0	0	0	1	1	PBX or ET	UUD(I)	User to User Data (Incomplete)
0	0	1	0	0	0	0	1	ET	UDC	User Data Control
0	1	0	0	0	0	1	1	PBX or ET	MIM(C)	Maintenance Information Mess. (Comp.)

Figure 14.10: DASS 2 Message Types

Service Indicator
Code   In some messages, a Service Indicator Code (SIC) is included
                        following the first octet. When included, this octet has the format
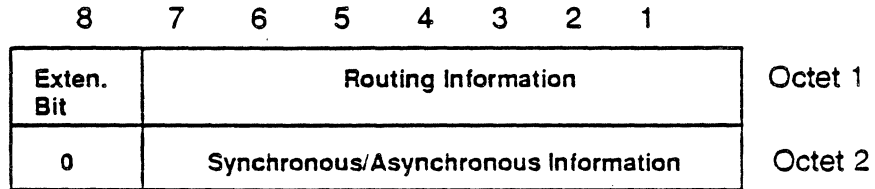   shown in Figure 14.11.

8	7	6	5	4	3	2	1	
Exten. Bit	Routing Information							Octet 1
0	Synchronous/Asynchronous Information							Octet 2

Figure 14.11: DASS 2 Service Indicator Code (SIC) Format

Figure 14.12 and Figure 14.13 show the format of Octet 1 and Octet
2 of the SIC.

Speech Characteristics/Data Rate

Type of Information
0 0 0	Speech
0 0 1	Speech
0 1 0	Data
0 1 1	Data
1 0 0	Teletex
1 0 1	Videotex
1 1 0	Facsimile
1 1 1	SSTV

Extension Bit
0	No additional octets
1	Additional octet
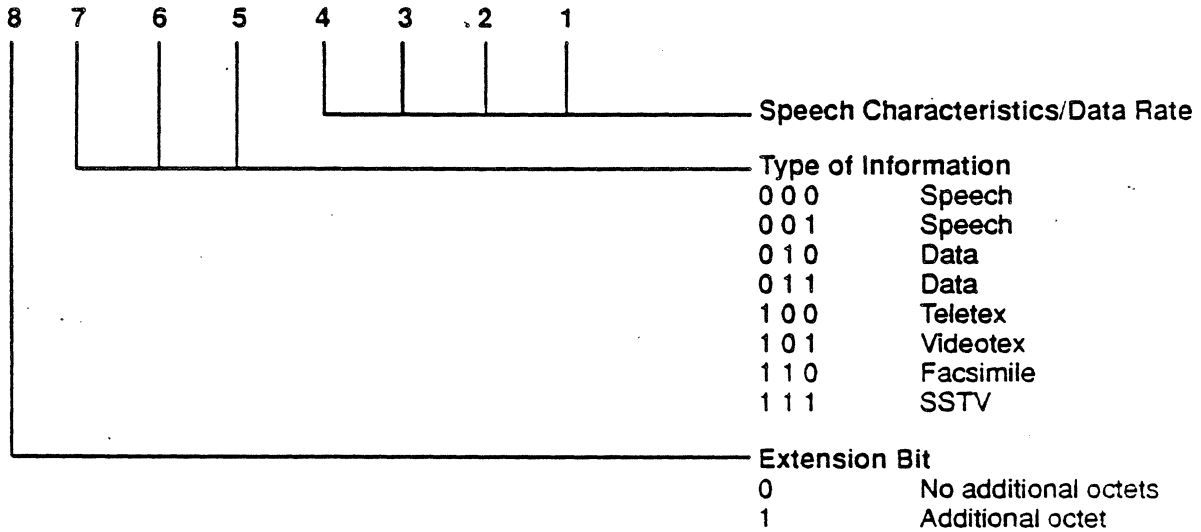
Figure 14.12: Service Indicator Code (SIC) — Octet 1

```
 8   7   6   5   4   3   2   1
```

Terminal Attributes
0 0 0	Multisampled Async
0 0 1	Reserved
0 1 0	Reserved
0 1 1	Reserved
1 0 0	Synchronous
1 0 1	Async with 1 stop bit
1 1 0	Async with 1.5 stop bits
1 1 1	Async with 2 stop bits

Duplex Mode
0	Full Duplex (FDX)
1	half Duplex (HDX)

Data Identification

Reserved (Set to 0)
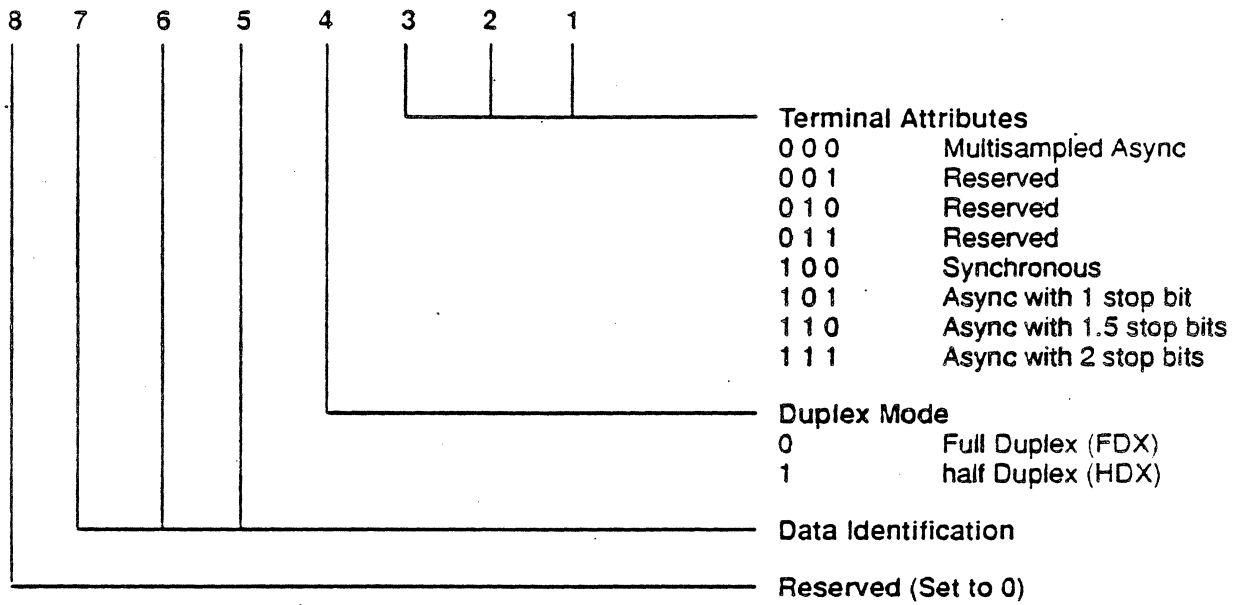
Figure 14.13: Service Indicator Code (SIC) — Octet 2

ANALYSIS
DISPLAY   Figure 14.14 shows a sample DASS 2 event as displayed in the
                           Chameleon Analysis page.   Figure 14.15 shows the interpretation
                           of the Layer 2 information. Figure 14.16 shows the interpretation of
                           the Layer 3 information.

```
            ┌──    A   44  DPNSS      PBX-cm      Channel=B      Port B 135
  Layer 2   │          3F  Real                   LAP=IF
            └──    C   03  UI  0           3
            ┌──    M   00  ISRM (C)
            │          INITIAL SVC REQ (COMPLETE)
  Layer 3   │      SIC     E877   Facsimile               9600 bits/s
            │                     Data type         Async 2 stop
            │                     Data mode                  FDX
            │                     Data format       8 data bits
            │                     TA has flow control capabilityYes
            └──                   No supplementary Information
```
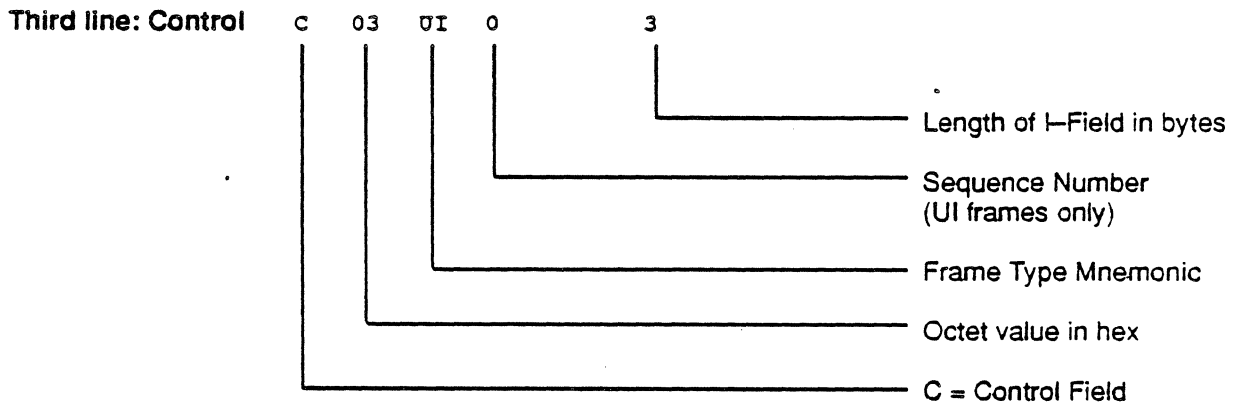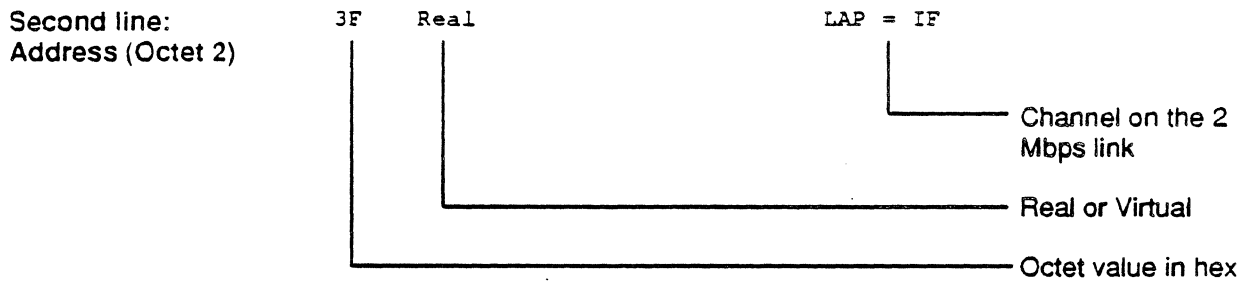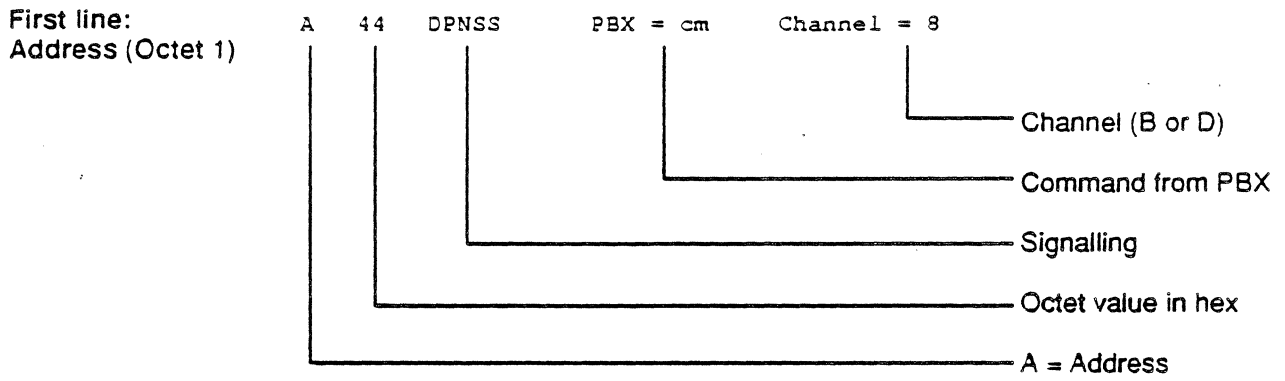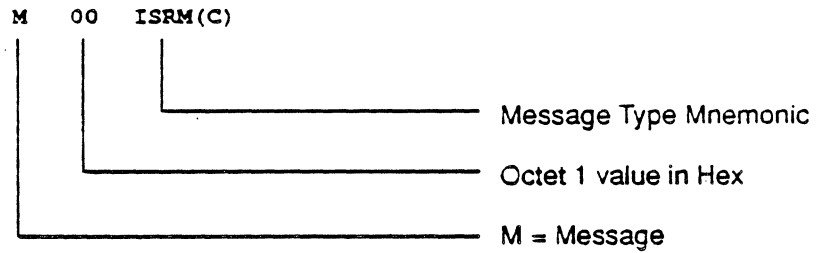
Figure 14.14: Sample DASS 2 Event Display

First line: A   44   DPNSS   PBX = cm   Channel = 8
Address (Octet 1)

Channel (B or D)

Command from PBX

Signalling

Octet value in hex

A = Address

Second line: 3F   Real   LAP = IF
Address (Octet 2)

Channel on the 2
Mbps link

Real or Virtual

Octet value in hex

Third line: Control C   03   UI   0   3

Length of I-Field in bytes

Sequence Number
(UI frames only)

Frame Type Mnemonic

Octet value in hex

C = Control Field

Figure 14.15: DASS 2 Layer 2 Interpretation

First line: Message   M   00   ISRM(C)
(octet 1)

──────────── Message Type Mnemonic

──────────── Octet 1 value in Hex

──────────── M = Message

Second line: INITIAL SVC REQ (COMPLETE) ─── Message Type
Message (octet 1)

Third line: SIC   E877   Facsimile   9600 bits/s
SIC (or other   Data type   Async 2 stop
message-dependent   Data mode   FDX
elements)   Data format   8 data bits
                                      TA has flow control capability   Yes
                                      No supplementary Information

──────────── Message-dependent element values

──────────── Message-dependent elements

──────────── SIC value in hex

──────────── SIC = Service Indicator Code
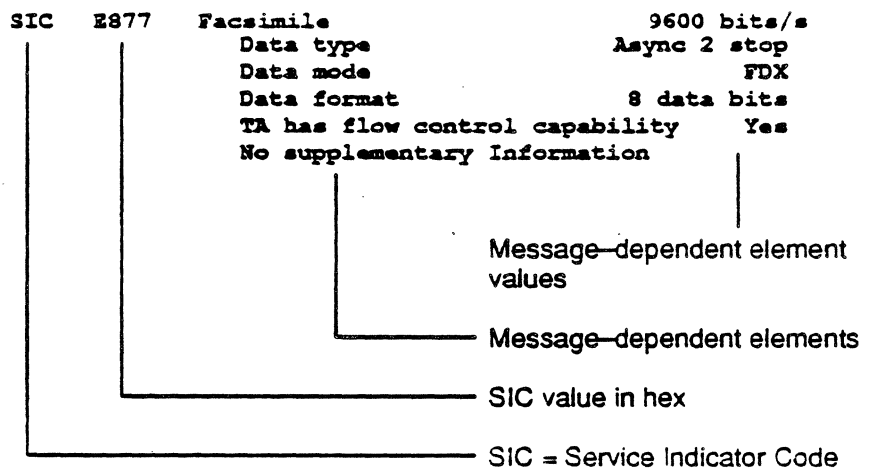
Figure 14.16: Sample DASS 2 Layer 3 Interpretation

CHAPTER FIFTEEN:
DMI MODE 2 MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes Digital Multiplexed Interface (DMI) Analysis, which is based on *AT&T Digital Multiplexed Interface Technical Specification, Issue 3.0, April 1985.*

This section assumes that you know how to select Monitoring for a port and select DMI Mode 2 as the protocol. It you do not know how to do this, refer to the *Chameleon 32 User's Guide* or the *Chameleon 20 User's Guide.*

Overview

DMI specifies the interface requirements for multiplexed data communication over digital facilities between a host computer and a PBX. DMI provides a number of 64 kbps data channels, plus one 64 kbps channel for common channel call setup and tear–down signaling. Within the data channels, DMI provides control information exchange and data formats to provide data transport at all standard rates. Mode 2 is one of the data transport formats rate adaption functions that applies in a circuit–switched environment.

DMI Mode 2 provides general data transmission at rates up to 19.2 kbps. It supports asynchronous or synchronous data, full or half duplex operation, and fully supports existing data terminal interfaces.

The DMI Mode 2 formats are described beginning on page 15-6. Sample Chameleon screen interpretations are provided on page 15-14.

Monitor Setup Menu

When you select DMI Mode 2 as your Monitoring protocol, you are prompted for configurable parameters as shown in Figure 15.1 and as described below.
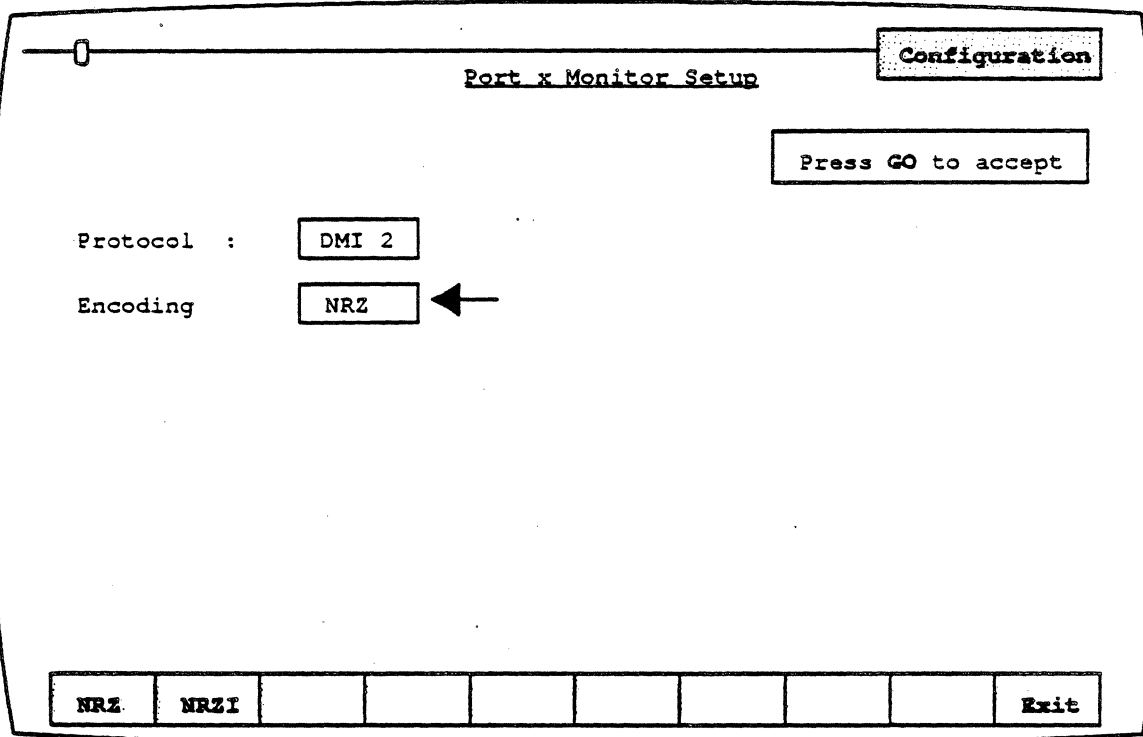

Figure 15.1: DMI Mode 2 Monitor Setup Menu

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer independent of line activity. The components of the display are described below.

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames transmitted from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below:

New Baud Rate   9600

Colors

The interpreted DMI data is displayed in green. Uninterpreted data, including user data, is displayed in white.

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The DMI Mode 2 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII	Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)
EBCDIC	Each byte is displayed as an EBCDIC character.
HEX	Each byte is displayed as a pair of hex digits
HEXS	Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in the center of the screen, between the DCE and DTE sides. The options are:

Number	Event number in decimal (default)
Flags	Number of flags preceding the frame, in decimal
Time	Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.
dTime	Displays the elapsed time between events
CRC	CRC value in hex, and OK if CRC is good or B if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F4: DMI

F4 determines how the DMI traffic is interpreted and displayed. The options are:

DMI–   DMI is acquired but not displayed; the screen will be blank

DMI+   DMI is displayed interpreted

DMI"   DMI is displayed raw

DMI*   DMI is displayed interpreted and raw

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in **F1**

DMI MODE 2 FORMAT

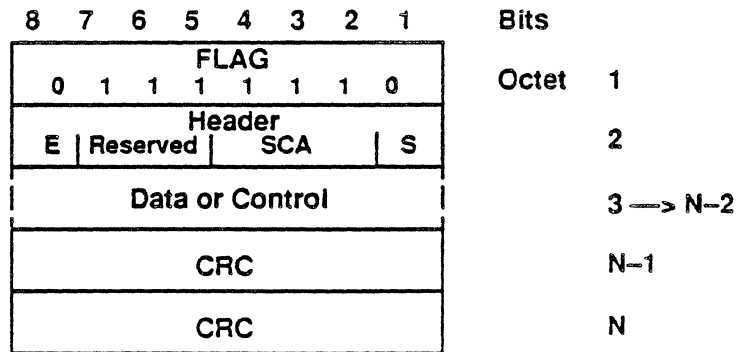The format of a DMI Mode 2 frame is shown in Figure 15.2.

8	7	6	5	4	3	2	1	Bits

Figure 15.2: DMI Mode 2 Format

Flag

User information is divided into blocks of variable length which are delimited by a special bit pattern (01111110) known as a flag. A single flag may serve both to terminate a block and to begin the next block. The ability to transmit information which is the same bit pattern as a flag is preserved by bit stuffing.

Flags are also used during an active connection to fill the channel when there is no information to send.

Header

The Header is one octet which follows the opening flag and contains information about the data/control field. The Header contains the following information.

Status Bit (S)

The Status bit (S) indicates the type of information in the data/control field, as follows:

Status bit = 1   Data Field
Status bit = 0   Control Field

Synchronous Clock Adjustment (SCA) Bits

Bit 2 – 5 of the header provide Synchronous Clock Adjustment (SCA) for synchronous data or control information. For asynchronous data or control information, these bits are reserved.

Extension Bit (E)

The Extension bit (E) indicates whether there is a header extension, as follows:

Extension bit = 1   No header extension
Extension bit =0   Header extension

Reserved

The remaining bits in the Header are reserved.

Cyclic Redundancy Check (CRC)

The final field of 16 bits contains a CRC value calculated on the contents of the block after the opening flag and is used to detect line bit errors caused by insertion or deletion of information.

Data/Control Field

The Data/Control field is a variable length field of integral octets containing either data or control information.

Data Field

If the field contains data, the following constraints apply:

- For Asynchronous operation the maximum number of data octets per block is 9 (9600 bps and more) or 4 (4800 bps and less).

- For synchronous operation the maximum number of data octets per block is 6 (9600 bps or more) or 2 (4800 bps or less).

Control Field

If the field contains control information, the two types of messages are:

- Handshake messages (see page 15-8)

- Update messages (see page 15-11)

Control Field:
Handshake

Handshake Messages are sent after call setup signaling is complete and a connection is established. A handshake message is 8–octets which exchange information, such as bit rate, DCE or DTE endpoint definition, and Synchronous or Asynchronous operation.

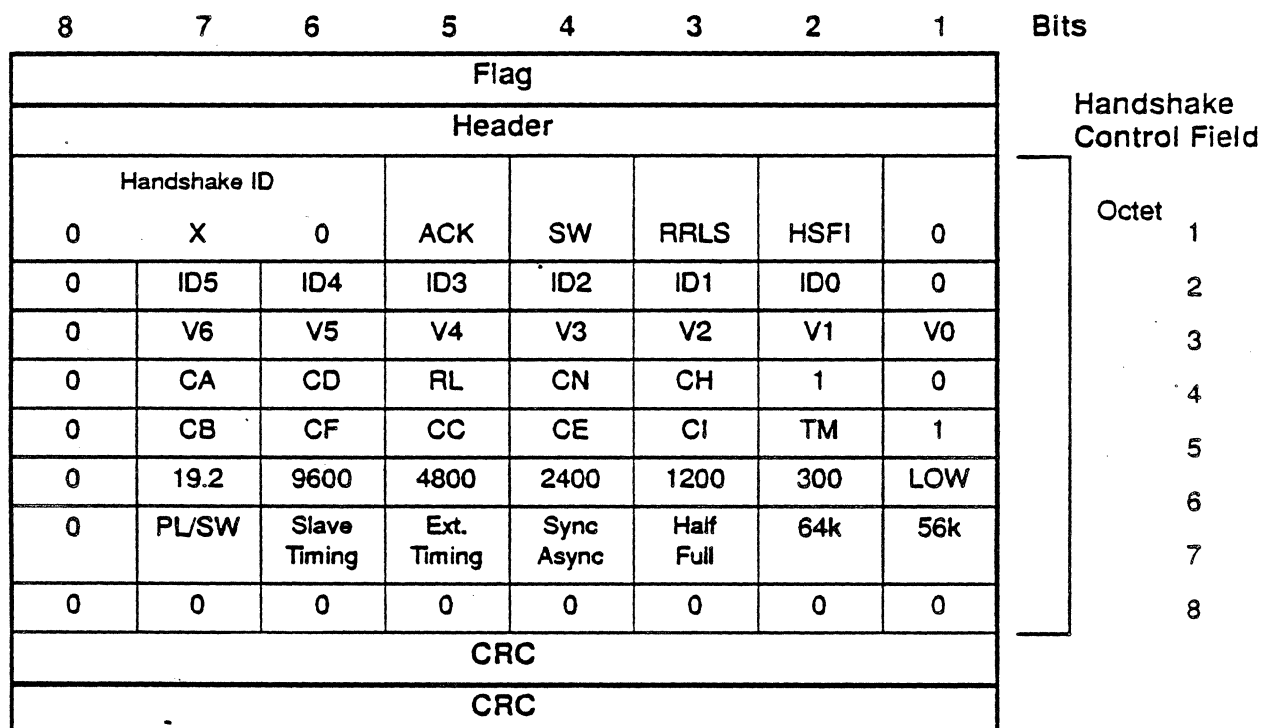The Handshake message format is shown in Figure 15.3.

8	7	6	5	4	3	2	1
Flag							
Header							
Handshake ID							
0	X	0	ACK	SW	RRLS	HSFI	0
0	ID5	ID4	ID3	ID2	ID1	ID0	0
0	V6	V5	V4	V3	V2	V1	V0
0	CA	CD	RL	CN	CH	1	0
0	CB	CF	CC	CE	CI	TM	1
0	19.2	9600	4800	2400	1200	300	LOW
0	PL/SW	Slave Timing	Ext. Timing	Sync Async	Half Full	64k	56k
0	0	0	0	0	0	0	0
CRC							
CRC							

Bits

Handshake Control Field

Octet 1
2
3
4
5
6
7
8

Figure 15.3: Handshake Message Format

Note

A Handshake message contains the bits described below. All bits shown in the above figure as 0 or 1, are reserved for future use.

Octet 1

Bit 2 is the Handshake Fail Indicator Bit (HSFL). If set to 1, it indicates a handshake failure.

Bit 3 is the Remote Loop Back Bit (RRLS), which is used for a Mode 0 or Mode 1 call.

Bit 4 is the Handshake to Data Mode Switch Bit (SW). If set to 1, it indicates that the data endpoint is entering the requested data mode.

Bit 5 is the Handshake Acknowledge Bit (ACK). If set to 1, it acknowledges a correct handshake.

Bits 6 – 8 make up the Handshake Identifier, with the following possibilities:

000	indicates a normal handshake message.
010	indicates a pseudo–handshake message. In this case, the remaining octets are not interpreted, but are displayed in white in the code selected with the *F1* key.
100	indicates an update message.

Octet 2

Bits 2 – 7 are Data Endpoint Type ID bits 0 – 5. ID3 indicates whether the endpoint is a DCE (ID3=1) or a DTE (ID3=0).

Octet 3

Bits 1 – 7 indicate the Vintage code.

Octet 4

Indicates the state of the following leads. If set to 1, the interface lead is on; if set to 0, the interface lead is off.

Bit 3 (CH) is the Speed Select Bit (RS232 circuit CH or V.24 circuit 111).

Bit 4 (CN) is the Make Busy Bit (RS232 circuit CN).

Bit 5 (RL) is the Remote loop bit (RS232 circuit RL or V.24 circuit 140).

Bit 6 (CD) is the Data Terminal Ready Bit (RS232 circuit CD or V.24 circuit 108/2).

Bit 7 (CA) is the Request to Send Bit (RS232 circuit CA or V.24 circuit 105).

Octet 5

Indicates the state of the following leads. If set to 1, the interface lead is on; if set to 0, the interface lead is off.

Bit 2 (TM) is the Test Mode Bit (RS232 circuit TM or V.24 circuit 142).

Bit 3 (CI) is the Speed Indicate Bit (RS232 circuit CI or V.24 circuit 112).

Bit 4 (CE) is the Ring Indicator Bit (RS232 circuit CE or V.24 circuit 125).

Bit 5 (CC) is the Data Set Ready Bit (RS232 circuit CC or V.24 circuit 107).

Bit 6 (CF) is the Received Line Signal Detector Bit (RS232 circuit CF or V.24 circuit 109).

Bit 7 (DB) is the Clear to Send Bit (RS232 circuit CB or V.24 circuit 106).

Octet 6

If one of the following bits is set to 1, it indicates the ability of the data endpoint to operate at the indicated speed.

Bit 1 (LOW) indicates the ability to operate at a data rate from zero to 1800 bps.

Bits 2 – 7 (300– 19.2) indicates the ability to operate the the specific data rate.

Octet 7

These bits indicate if the data endpoint has the ability to operate at the indicated speed/mode.

Bit 1 (56K) indicates the ability to operate at 56 kbps (Mode 1), if set to 1.

Bit 2 (64K) indicates the ability to operate at 64 kbps (Mode 0) if set to 1.

Bit 3 (Half/Full) indicates half duplex (=1) or full duplex (=0) operation.

Bit 4 (Sync/Async) indicates Asynchronous (=0) or Synchronous (=1) operation.

Bit 5 (Ext Timing) indicates if the DCE endpoint is in External mode (=0) or Internal mode (=1).

Bit 6 (Slave Timing) indicates if the DTE endpoint is in Slave mode (=1) or Internal mode (=0).

Bit 7 (PL/SW) indicates if the DTE endpoint is operating in the Switched Network (=1) or Private Line (=0) configuration.

Octet 8

The last octet is not used by DMI and is sent as all zeroes by the host endpoint. These bits are ignored by the host receiver, regardless of their settings.

Control Field: Update

An Update message is sent immediately after completion of a successful handshake sequence and should be sent approximately every two seconds thereafter. An update message is also sent when lead state changes are detected on either end of the connection. There are two types of Update messages:

- *DCE Updates* are sent by host data endpoints, and by PBX data endpoints with devices connected to them which require a DCE interface. The format of a DCE Update is shown in Figure 15.4.

- *DTE Updates* are sent by PBX data endpoints when the devices connected to them require a DTE interface. The format of a DTE Update is shown in Figure 15.5.
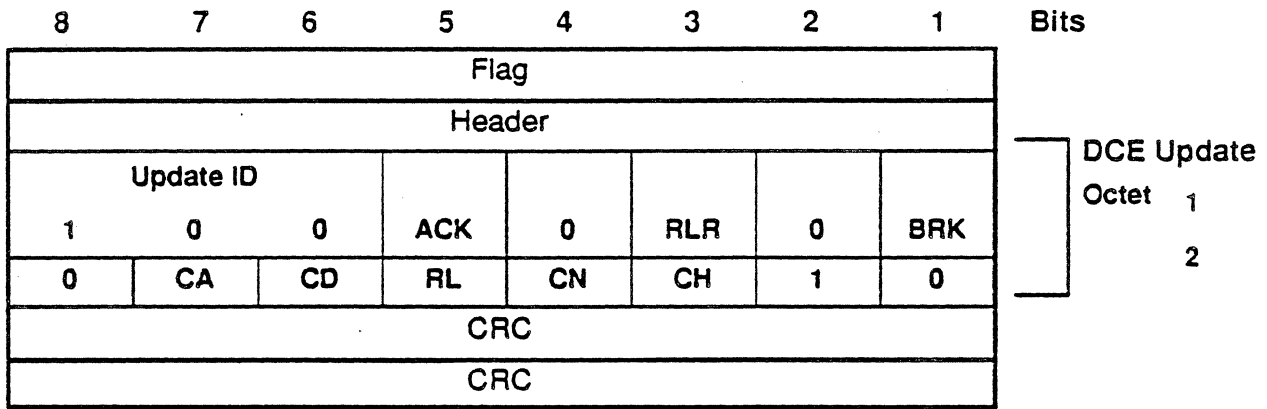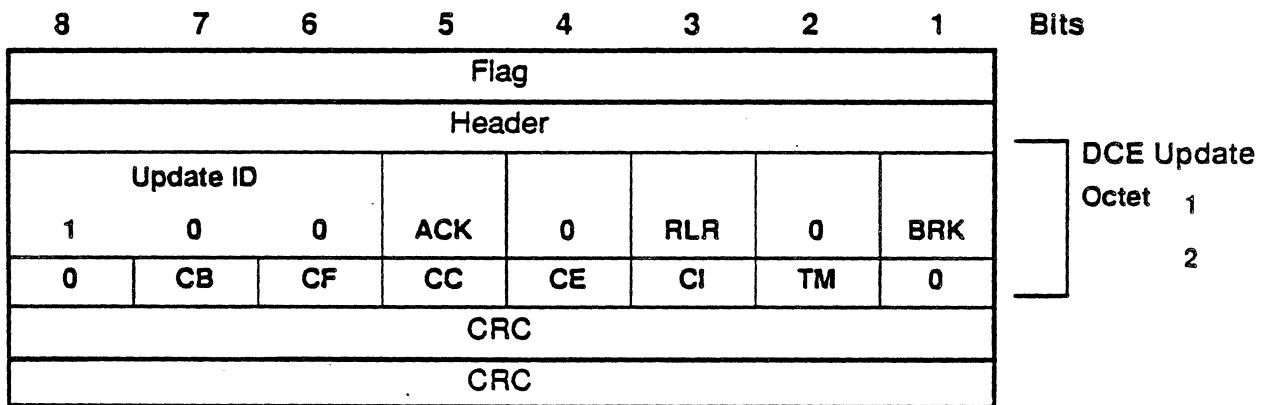
8	7	6	5	4	3	2	1	Bits
Flag								
Header								
Update ID			ACK	0	RLR	0	BRK	
1	0	0						
0	CA	CD	RL	CN	CH	1	0	
CRC								
CRC								

DCE Update
Octet 1
2

Figure 15.4: DCE Update Message Format

8	7	6	5	4	3	2	1	Bits
Flag								
Header								
Update ID			ACK	0	RLR	0	BRK	
1	0	0						
0	CB	CF	CC	CE	CI	TM	0	
CRC								
CRC								

DCE Update
Octet 1
2

Figure 15.5: DTE Update Message Format

Update messages are two octets, as described below.

Octet 1

Bit 1 (BRK) is the Remote Break Indicator bit. If set to 1, it identifies the break condition.

Bit 3 (RLR) is the Remote Loop Request Bit. This bit is set to 1 to request a remote digital loop back.

Bit 5 (ACK) is the Remote Loop Acknowledge Bit. If set to 1, it acknowledges that a remote loop back is in effect.

Bits 2 and 4 are reserved for future use and are set to zero.

Octet 2

The bits in the second octet, indicate the state of the leads. If set to 1, the interface lead is on; if set to 0, the interface lead is off. The mnemonics used in these figures are defined on page 15-8. Note that the leads are different in the DTE and DCE Update messages.

DMI Mode 2 Display

The History/Real Time interpreted display for DMI Mode 2 messages is described in this section. Samples of the following message displays are provided:

- Data Message
- Pseudo–Handshake Control Message
- Handshake Control Message
- Update Control Message

Data Message

A data message contains user data. The header is interpreted in the first line of the display. The user data is displayed on subsequent lines in the code chosen with the F1 key.

Note

The Header interpretation is the same for all DMI Mode 2 messages.

Header byte in hex   Extension bit   SCA bit   Status bit   Message type: Data or Ctrl

```
                              Header=00  E=0   SCA=0   S=1  (Data)
User data:                    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Displayed                     00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
uninterpreted in              00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
code selected                 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
with F1.
```
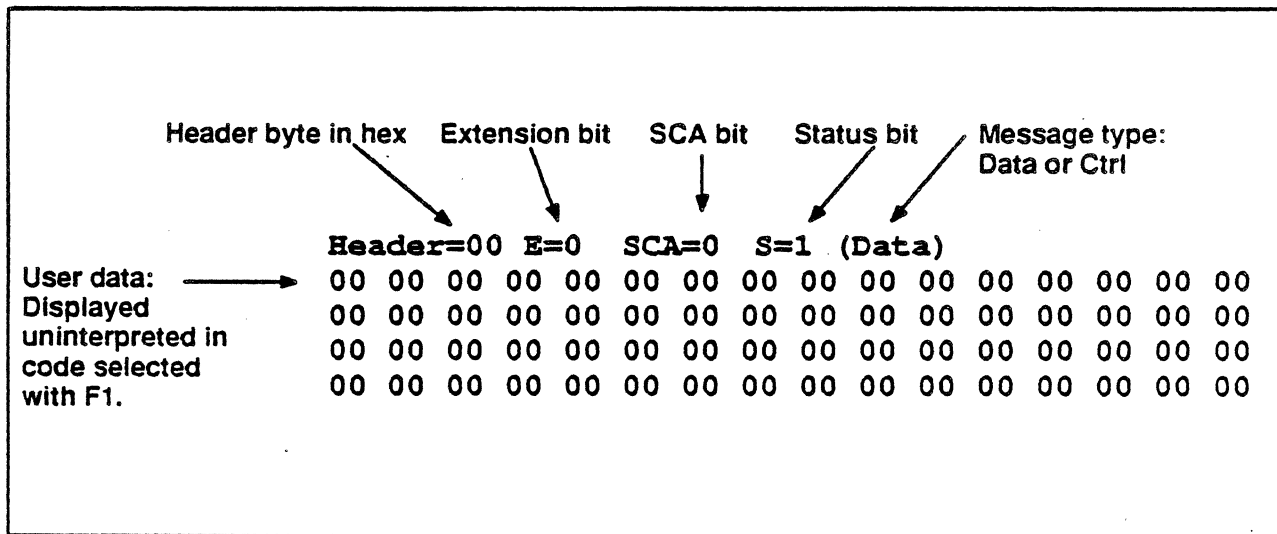
Figure 15.6: DMI Mode 2 Data Message Interpretation

Pseudo–Handshake Message

The format of a Pseudo–Handshake interpretation is shown in Figure 15.7.

```
1     Header=00  E=0   SCA=0  S=1  (Ctrl)
2     ID=02 Pseud-Hnd
```

Figure 15.7: DMI Mode 2 Data Message Interpretation

1.   The first line of the display is the Header which is the same format as described on the previous page.

2.   The second line is the control field identification value in hex (ID=02) and the interpretation (Pseud–Hnd).

Handshake Message

Figure 15.8 shows a sample DCE Handshake message interpretation.

```
1    Header=00 E=0   SCA=0 S=1 (Ctrl)
2    ID=00 Handshake ACK=0 SW=0 RRLS=0 HSFL=0
3    Data Endpoint type ID           00
4    Vintage code                       00
5    CA=0 CD=0 RL=0 CN=0  CH=0
6    Supported baud rates
7    19.2  9.6  4.8  2.4  1.2  300  LOW

8    PL   SLV  EXT  SYNC      HDX   64K   56K
9    SW                       ASYNC FDX
```

Figure 15.8: DMI Mode 2 Handshake Message Interpretation (DCE)

1.   The header interpretation is the same as the Data message header shown on the page 15-14.

2.   The second line of the interpretation displays the following information:

ID=00   The hex value of the ID bits (bits 6–8 of the first octet of the Control Field) identifying it message as a Handshake.

Handshake   Interpretation of the above hex value.

ACK=0   Handshake Acknowledge bit (0 or 1)

SW=0   Data Mode Switch bit (0 or 1)

RRLS=0   Remote Loop Back bit (0 or 1)

HSFL=0   Handshake Fail Indicator bit (0 or 1)

3.   The third line displays the Data Endpoint Type ID in hex.

4.   The fourth line displays the Vintage code in hex.

5.   The fifth line displays the states of individual interface leads as 0 (off) or 1 (on). The leads displayed depend on whether this is a DTE or DCE Handshake message. The lead mnemonics are described on page 15-9.

6–7.   Lines 6 – 7 displayed the supported baud rates. If the baud rate appears in the display, it is supported. If not supported, the baud rate does not appear.

8–9.   Lines 8 – 9 indicate additional speeds and modes that are supported, as follows:

PL
SW   Either PL (Private Line) or SW (Switched Network) is displayed to indicate the DTE operating configuration.

SLV   SLV is displayed if the DTE endpoint is in Slave mode.

EXT   EXT is displayed if the DCE endpoint is in External Timing mode.

SYNC
ASYNC   Either SYNC or ASYNC is displayed to indicate the mode of operation.

HDX
FDX   Either HDX (Half Duplex) or FXD (Full Duplex) is displayed.

64K   64K is displayed if 64kbps is supported.

56K   56K is displayed if 56kbps is supported.

Update Message

Figure 15.9 shows a sample DCE Update message interpretation.

```
1     Header=04 E=0   SCA=0 S=1  (Ctrl)
2     ID=04 Update ACK=0 RLR=0 BRK=0
3     CA=0 CD=0 RL=0 CN=0   CH=0
```

Figure 15.9: DMI Mode 2 Update Message Interpretation (DCE)

1. The first line is the header interpretation, which is the same as the Data message header shown on page 15-14.

2. The second line of the interpretation displays the following information:

    ID=04   The hex value of the ID bits (bits 6–8 of the first octet of the Control Field), identifying the message as an Update.

    Update   Interpretation of the above hex value.

    ACK=0   Remote Loop Acknowledge bit (0 or 1)

    RLR=0   Remote Loop Request bit (0 or 1)

    BRK=0   Remote Break Indicator bit (0 or 1)

3. The third line displays the states of individual interface leads as 0 (off) or 1 (on). The leads displayed depend on whether this is a DTE or DCE Update message. The lead mnemonics are described on page 15-9.

CHAPTER SIXTEEN:
V.120 MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the network. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes the protocol specific features of V.120 Analysis. For a general description of the Monitoring applications, refer to Chapter 1.

The following V.120 specification is supported:

- Telecommunications Committee
  ANSI T1
  ISDN Terminal Adaptation Using Statistical Multiplexing
  August 5, 1988

Selecting V.120 Analysis

The Chameleon provides two V.120 Analysis options:

- To monitor V.120 on a B–Channel, select V.120 as your Monitoring protocol. Read this chapter for a description of the V.120 setup menu, function keys, and Analysis displays.

- To monitor V.120 on the D–Channel, select ISDN as your Monitoring protocol. Then, when the ISDN Monitoring Setup menu is displayed, select V.120 as the Q.931 Standard. ISDN configuration is described in *Chapter 10: ISDN Monitoring.* You can refer to this chapter for a description of the V.120 Analysis interpretation.

Monitor Setup Menu

When you select V.120 as your Monitoring protocol, you are prompted for several configurable parameters, as shown in Figure 16.1 below.

Figure 16.1: The V.120 Monitoring Setup Menu

V.120 Mode

This parameter selects the mode you want to use while monitoring V.120 on a B–Channel. The options are:

- Sync   Synchronous Mode of Operation.

- Async   Asynchronous Mode of Operation

- BitXpnt   Bit Transparent Mode. The TA breaks synchronous data stream into fixed sized frames and sends if over the channel as it is received from the TE2.

Encoding

Encoding is a level 1 (physical) parameter that determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0. The options are:

NRZ   Non Return to Zero. In NRZ encoding, a 1 is represented by a high level, and a 0 is represented by a low level.

NRZI   Non Return to Zero Inverted. In NRZI encoding, a 1 is represented by no change in level, and a 0 is represented by a change in level.

Analysis

Analysis provides two pages: Real Time and History. Both pages display the traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys are the same for both pages, as shown in Figure 16.2.

The area shown in the box is described on page 16-14.

Layer 2 displayed in green. Interpretation controlled by the F4 key.

Header displayed in blue. Interpretation controlled by the F5 key.

Data displayed in brown. Interpretation controlled by the F6 key.

```
                                                            ┌─────────────┐
 ═══════▯═══════════════════════════════════════════════   │ Real Time A │
 ┌──────────────────────────────────────────────────────┐  └─────────────┘
 │ C   LLI=   8191   LLIO = 63 LLI1 = 127    PORT A 455   │
 │ I     0        0            27                         │
 │ FSC error (interface at R)             RR             │
 │ Begin Frame                       DR SR RR            │
 │ Info: 08 01 01 01 08 02 01 10 7C 0B DF 37             │
 │       08 01 01 01 08 02 01 10 7C 0B DF 37             │
 │       08 01 01 01 08 02 01 10 7C 0B DF 37             │
 └──────────────────────────────────────────────────────┘
   C   LLI=   8191   LLIO = 63 LLI1 = 127    PORT A 456
   I     0        0            27
   FSC error (interface at R)
   Begin Frame
 Info: 08 01 01 01 08 02 01 10 7C 0B DF 37
       08 01 01 01 08 02 01 10 7C 0B DF 37
       08 01 01 01 08 02 01 10 7C 0B DF 37
   C   LLI=   8191   LLIO = 63 LLI1 = 127    PORT A 457
   I     0        0            27
   FSC error (interface at R)
   Begin Frame
 Info: 08 01 01 01 08 02 01 10 7C 0B DF 37
       08 01 01 01 08 02 01 10 7C 0B DF 37
       08 01 01 01 08 02 01 10 7C 0B DF 37
   C   LLI=   8191   LLIO = 63 LLI1 = 127    PORT A 458
```

ASCII	Number	I U S	Lay2*	Header*	Info*				User+

Figure 16.2: Real Time Page with Sample V.120 Traffic

DCE/DTE

Frames transmitted by the DCE are displayed on the left half of the screen. Frames transmitted by the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below:

New Baud Rate   9600

Colors

Colors distinguish the different levels of the display:

- Green = Level 2 Interpretation
- Blue = Header Interpretation
- Brown = Information Field display
- White = Raw (uninterpreted data)
- Red = Errors

Interface Lead Transitions

Interface Lead transitions are displayed if the IUSL option is selected for the F2 key. Lead transitions are shown as an up arrow character (↑) if the specified lead made a transition from low to high, or a down arrow character (↓) if the lead made a transition from high to low. All transitions for a given event are shown on one line. The leads are:

DCE Leads	DTE Leads
CTS	RTS
DSR	DTR
DCD	
SDCD	
RI	

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The V.120 Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hex digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides.

Number   Event number in decimal (default)

Flags   Number of flags preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and **OK** if CRC is good or **B** if CRC is bad

None   No acquisition information is displayed

              The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F3: Event Types

F3 determines what types of events will be displayed on the Analysis page. The options are:

I   Information frames only

IU   Information and Unnumbered frames only

IUS   Information, Unnumbered, and Supervisory frames (default)

IUSL   All frames, plus lead transitions

Note   **F3** affects the page *display* only. All events are captured, regardless of the **F3** selection (unless you are running a Triggering application which captures specific traffic or events).

F4: Layer 2

F4 determines how the Layer 2 is interpreted and displayed. The options are:

Lay2–   Layer 2 is acquired but not displayed
Lay2+   Layer 2 is displayed interpreted
Lay2"   Layer 2 is displayed raw
Lay2*   Layer 2 is displayed interpreted and raw

F5: Header

F5 determines how the Header is interpreted and displayed. For a description of the header, refer to page 16–11. The options are:

Header–   Header is acquired but not displayed
Header+   Header is displayed interpreted
Header"   Header is displayed raw
Header*   Header is displayed interpreted and raw

F6: Info

F6 determines whether or not the information field (excluding the Header) is displayed. For a description of the Information field, refer to page 16-9. The options are:

Info–   Information field is acquired but not displayed

Info"   Information field is displayed raw

F10: User Data

F10 determines if user data is displayed. It also displays the traffic in a raw mode (uninterpreted). The options are:

User+   User data is displayed

Raw   All traffic is displayed raw (uninterpreted) in the code selected in *F1*

V.120
Interpretation

Figure 16.3 shows the format of a V.120 frame. It contains the following fields:

- HDLC flag

- Address (default is 2 octets). See detail below.

- Control (HDLC format)

- FCS (Frame Check Sequence)

- Information Field with the data and the following optional header components:

  - Header octet (optional for bit transparent mode)

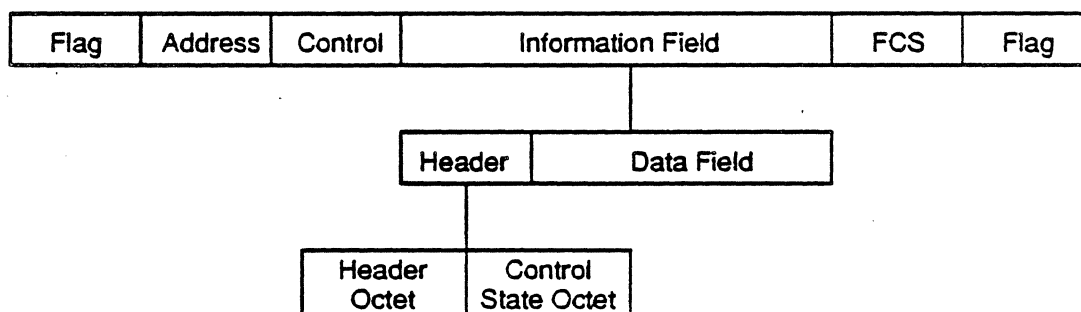 - Control State octet (optional header extension for control state information)

Flag	Address	Control	Information Field	FCS	Flag

Header	Data Field

Header Octet	Control State Octet

Figure 16.3: V.120 Frame Format

All fields, except the FCS, are transmitted an octet at a time, low order bit first. The FCS is transmitted high order bit first.

Address Field   The format of the address field is shown in Figure 16.4.   The fields
                                 are as follows:

- **LLI0**   High order 6 bits of LLI

- **LLI1**   Low order 7 bits of LLI

- **C/R**   Command/Response bit.

- **EA0**   Octet 2 address extension bit (set to 0)

- **EA1**   Octet 3 address extension bit (set to 1 for
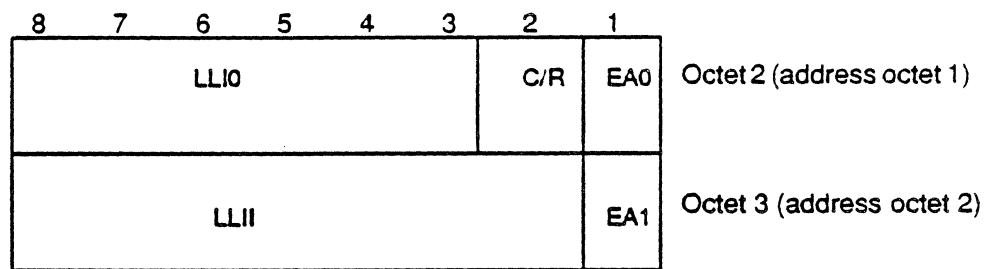   2-octet address field)

8	7	6	5	4	3	2	1	
LLI0						C/R	EA0	Octet 2 (address octet 1)
LLII							EA1	Octet 3 (address octet 2)

Figure 16.4: Address Field Detail

LLI0/LLI1   The LLI0 and LLI1 fields can be considered as a single 13-bit
                                 Logical Link Identifier (LLI) field, or as two separate fields. The LLI is
                                 considered to be the concatenation of the LLI0 field with the LLI1
                                 field. The LLI can take on values in the range 0 – 8191, with the
                                 following reserved values:

LLI	FUNCTION
0	In-Channel signaling
1–255	Reserved for future standardization
256	Default LLI
257–2047	For LLI assignment
2048–8190	Reserved for future standardization
8191	In-Channel layer management

Figure 16.5: LLI Reserved Values

EA Bits

The address extension (EA) bits indicate the final octet of the address field. The presence of a 1 in bit 1 of an address field octet indicates that it is the final octet of the address field.

C/R Bit

The C/R bit identifies a frame as either a command or as a response. It is employed symmetrically for the two directions of transmission, and is coded as follows:

- 0   Command
- 1   Response

Header Octet

The Header octet is mandatory for the Synchronous and Asynchronous modes of operation, but is optional for the Bit Transparent mode. It has the format shown in Figure 16.6.

8	7	6	5	4	3	2	1
Extension Bit	Break/ HDLC Idle Bit	0 (Reserved)	0 (Reserved)	Error Control Bit 2	Error Control Bit 1	Segmenta- tion Bit (B Bit)	Segmenta- tion Bit (F Bit)

Figure 16.6: Header Octet Format

The Header octet contains the following fields:

- **Extension Bit**   If 0, it indicates that a control state (CS) information octet follows the Header octet.

- **Break/HDLC Idle Bit**   In Asynchronous applications, a 1 indicates the invocation of the BREAK function by the TE2.

    In protocol sensitive operation for synchronous HDLC application, a 1 indicates that the interface at the R reference point is receiving an HDLC idle condition.

- **Error Control**   These two bits are used for TA error detection and transmission, as shown in Figure 16.7.

Error Control		Mode		
Bit 1	Bit 2	Synchronous	Asynchronous	Bit Transparent
0	0	No error detected	No error detected	No error detected
0	1	FCS error	Stop Bit error	Not applicable
1	0	Abort	Parity error on last character in frame	Not applicable
1	1	TA overrun	Stop Bit and Parity error	Not applicable

Figure 16.7: Error Control Bits Coding

- Segmentation Bits

Bits 2 and 1 are used for segmenting and reassembling messages in Synchronous mode applications, as shown in Figure 16.8.

Segmentation Bit		Mode		
B	F	Synchronous	Asynchronous	Bit Transparent
1	0	Beginning Frame	Not applicable	Not applicable
0	0	Middle Frame	Not applicable	Not applicable
0	1	Final Frame	Not applicable	Not applicable
1	1	Single Frame	Required	Required

Figure 16.8: Segmentation Bits Coding

Control State
Octet

When present, the Control State information is contained in the second octet of the header. For TAs, this field generally serves as a Physical Status/Interface Control field for the interface at the R reference point. The Control State octet has the format shown in Figure 16.9.

8	7	6	5	4	3	2	1
Extension Bit	Data Ready	Send Ready	Receive Ready	Reserved	Reserved	Reserved	Reserved
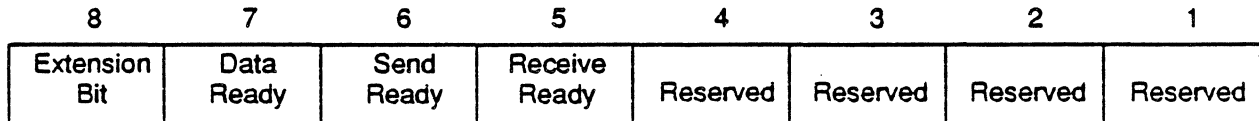
Figure 16.9: Control State Octet Format

The Control Status octet contains the following bits:

- **Extension Bit** — If set to 1, it indicates there is no additional extension of the header.

- **Data Ready** — If set to 1, it indicates that the interface at the R reference point is activated. For TE1s, it implies that the terminal interface is activated.

- **Send Ready** — If set to 1, it indicates that the TE is ready to send data.

- **Receive Ready** — If set to 1, it indicates that the TE is ready to receive data.

- **Reserved Bits** — Bits 4, 3, 2, and 1 are reserved for future standardization and are set to 0.

Figure 16.10 is the interpretation of a V.120 event as shown in an Analysis page display. The components of each line of display are described in Figure 16.11.

Address	C LLI= 8191 LLI0 = 63 LLI1 = 127	
Control Field	I 0 0 27	
Header	FCS error (interface at R) BR	
	Begin Frame DR SR RR	
Information Field	Info: 08 01 01 01 08 02 01 10 7C 0B DF 37	
	08 01 01 01 08 02 01 10 7C 0B DF 37	
	08 01 01 01 08 02 01 10 7C 0B DF 37	

Figure 16.10: Sample V.120 Interpretation

First line (Address)   C   LLI= 8191   LLI0 = 63 LLI1 = 127

                                                                    └─── LLI1 Value

                                                              └──────── LLI0 Value

                                                         └───────────── LLI Value

                              └────────────────────────────────────── C/R Bit

Second line (Control)   I   0   0   27

                                                            └──────── I-field size in bytes
                                                                      (excluding Header)

                                                   └──────────────── N(r)

                                        └───────────────────────── N(s)

                              └──────────────────────────────────── Frame Type
                                                                     Mnemonic

Third line (Header)   FCS error (interface at R)   BR

                                                                └──── BREAK/Idle bit (if set)

                              └─────────────────────────────────── Error Control

Fourth line (Header)   Begin Frame   DR SR RR

                                                               └──── Receive Ready (RR) if
                                                                     set.

                                                          └───────── Send Ready (SR) if set.

                                                       └──────────── Data Ready (DR) if set.

                              └─────────────────────────────────── Segmentation Bits
                                                                     interpretation

Remaining lines   Info: 08 01 01 01 08 02 01 10 7C 0B DF 37   Information Field
                                08 01 01 01 08 02 01 10 7C 0B DF 37   (excluding
                                08 01 01 01 08 02 01 10 7C 0B DF 37   Header)
                                                                        In code selected
                                                                        with F1 key.

Figure 16.11: Sample V.120 Interpretation

CHAPTER SEVENTEEN:
DDCMP MONITORING

Introduction

Monitoring allows you to passively monitor the traffic on a data line without affecting the traffic. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes Digital Data Communications Message Protocol (DDCMP), which was developed by Digital Equipment Corporation.

This section assumes that you know how to select Monitoring for a port and select DDCMP as the protocol. If you do not know how to do this, refer to the *Chameleon 32 User's Guide* or the *Chameleon 20 User's Guide*.

Overview

DDCMP provides a data link control procedure that ensures a reliable data communication path between communication devices connected by data links. It has been adopted as a Digital Equipment Corporation standard for inter-computer data communications.

DDCMP has been designed to operate over full duplex and half duplex synchronous and asynchronous channels in both point-to-point and multipoint modes. It can be used in a variety of applications such as distributed computer networks, host front-end processors, remote terminal concentrators, and remote job entry-exit systems.

Note

Chameleon DDCMP Analysis curently supports synchronous links only.

This chapter briefly describes the format of each DDCMP message type. For a complete description of the DDCMP protocol refer to the Digital Equipment Corporation document *DDCMP Specification, Version 4.0*, dated March 1, 1978.

ANALYSIS

Analysis provides two pages: Real Time and History. Both pages display traffic in a split screen format (DCE/DTE).

The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as the traffic is acquired.

History displays traffic that has been acquired and put in a buffer. You can move back and forth through the traffic in the buffer independent of line activity. The components of the display are described below.

Note

When you start DDCMP Analysis, the Real Time and History pages will be blank until the Chameleon receives (and displays) the baud rate. This also occurs each time you restart acquisition using the *Run/Stop* key.

Once the baud rate is received, the DDCMP traffic will then be analyzed and displayed.

DCE/DTE

Frames received from the DCE are displayed on the left half of the screen. Frames transmitted from the DTE are displayed on the right half of the screen.

Baud Rate Changes

The interpretation of a baud rate change event is as shown below:

New Baud Rate   9600

Function Keys

The function keys control how the traffic is interpreted and displayed. These functions are available for both the History and Real Time pages. The DDCMP Analysis function keys are described below.

F1: Code

F1 determines the format of the user data display. This is the data which does not belong to a protocol specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII   Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as ':'.(default)

EBCDIC   Each byte is displayed as an EBCDIC character.

HEX   Each byte is displayed as a pair of hex digits

HEXS   Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.

F2: Acquisition Information

F2 determines the acquisition information display format, which is displayed in the center of the screen, between the DCE and DTE sides. The options are:

Number   Event number in decimal (default)

Syncs   Number of sync characters preceding the frame, in decimal

Time   Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.

dTime   Displays the elapsed time between events

CRC   CRC value in hex, and OK if CRC is good or B if CRC is bad

None   No acquisition information is displayed

The port receiving the packet (**Port A** or **Port B**) is displayed as part of the acquisition information unless **None** is selected.

F10: User Data

F10 determines if user data is displayed. It also controls the display of traffic in an uninterpreted (raw) mode. The options are:

User+   User data is displayed (default)

User–   User data is not displayed

Raw   All traffic is displayed uninterpreted (raw) in the code selected in *F1*

DDCMP MESSAGE FORMATS

DDCMP has three types of messages:

- Data messages carry user data over DDCMP links.

- Control messages carry channel control information, transmission status, and initialization notification between the protocol modules.

- Maintenance messages are used for basic diagnostic testing and simple operating procedures, when the network is off–line.

The format of each message type as defined in the DDCMP specification is described below. Sample Chameleon interpretations of each message type begin on page 17-12.

Data Messages

Data messages carry user data over DDCMP links and are numbered. The format of a Data message is shown in Figure 17.1 below.

ID	Count	Flags	Resp	Num	Addr	Blkck1	Data	Blkck2
8 bits	14 bits	2 bits	8 bits	8 bits	8 bits	16 bits	Count bytes	16 bits

Figure 17.1: Data Message Format

The **ID** field identifies the type of DDCMP message. A value of 129 decimal indicates a Data message.

The **Count** specifies the number of bytes in the Data field. The value zero is not allowed.

The **Flags** are two 1–bit link flags. They control link ownership and message synchronization, as follows:

- Bit 0 is the QUICK SYNC flag (Q Bit) that notifies the receiver that the next message will not abut this message, and resynchronization should follow this message. This flag reduces the length of sync sequences on synchronous links.

- Bit 1 is the SELECT flag (S bit) that controls transmission ownership on multipoint and half–duplex links. It reverses link direction on half–duplex links. It invites a tributary to send and signals end of tributary selection on multipoint links.

Note that the Count and Flags form a 2–octet quantity. The first octet contains the 8 low–order bits of the Count. The second octet contains the 6 high–order bits of the Count, the Q bit, and then the S bit (as the highest order of the most significant bit of the octet).

Resp is the response number which acknowledges correctly received messages (piggybacked ACK). It is the number of the last consecutive message correctly received from the addressed station by the station transmitting this message. It implies that all unacknowledged messages between the one acknowledged in the last **Resp** field received and the one acknowledged by this **Resp** field (modulo 256) have been received correctly.

Num is the transmit number of the data message.

Addr is the station address. It designates the address of tributary stations on multipoint links. Stations on point–to–point links use the address value of 1.

Blkck1 is a block check on the numbered message header. It is computed on the SOH through the Addr using the CRC–16 polynomial: $X^{16} + X^{15} + X^2 + 1$. **Blkck1** is initialized to zero prior to computation and transmitted X^{15} bit first. On reception, the inclusion of **Blkck1** in the computation will result in a zero remainder or CRC if no errors exist.

Data is the message data field. This field is transparent to the protocol and has no restrictions on bit patterns, groupings, or interpretations. The only requirement is that it contain the number of bytes specified in the **Count** field.

Blkck2 is the block check on the data field. It is computed on the Data field only, using the polynomial and technique described above for Blkck1.

Control Messages

DDCMP has five different Control message types:

- **ACK**   Acknowledge message. An ACK acknowledges the correct receipt of numbered data messages. It conveys the same information as the Resp field in numbered data messages. It is used when an acknowledgement is required, but a numbered message is not being sent in the reverse direction.

- **NAK**   Negative Acknowledge message. A NAK passes error information from the slave (data receiver) to the master (data sender). The error reason is included in the message. The NAK message also includes the same information as the ACK message, so that it also acknowledges previously received messages.

- **REP**   Reply to Message Number. A REP requests received message status from the slave . It is usually sent when the master has transmitted data messages and has not received a reply within a timeout period. The response to a REP is either an ACK or a NAK depending on whether the slave has or has not received all messages previously sent by the master.

- **STRT**   Start Message. The STRT message establishes the initial contact and synchronization on a DDCMP link. It is used only on link startup or reinitialization. It operates with the start acknowledge message (STACK) described below. The start sequence resets message numbering at the transmitter and addressed receiver.

- **STACK**   Start Acknowledge message. The STACK message is returned in response to a STRT when the station has completed initialization and reset message numbering.

The format of the each type of Control message is shown in Figure 17.2 on the following page.

ID	Type	Sub	Flags	Resp	Fill	Addr	Blkck3
8 bits	8 bits	6 bits	2 bits	8 bits	8 bits	8 bits	16 bits

ACK Message Format

ID	Type	Reason	Flags	Resp	Fill	Addr	Blkck3
8 bits	8 bits	6 bits	2 bits	8 bits	8 bits	8 bits	16 bits

NAK Message Format

ID	Type	Sub	Flags	Fill	Num	Addr	Blkck3
8 bits	8 bits	6 bits	2 bits	8 bits	8 bits	8 bits	16 bits

REP Message Format

ID	Type	Sub	Flags	Fill	Fill	Addr	Blkck3
8 bits	8 bits	6 bits	2 bits	8 bits	8 bits	8 bits	16 bits

STRT Message Format

ID	Type	Sub	Flags	Fill	Fill	Addr	Blkck3
8 bits	8 bits	6 bits	2 bits	8 bits	8 bits	8 bits	16 bits

STACK Message Format

Figure 17.2: DDCMP Control Message Formate

The fields common to one or more Control messages are:

ID   Identifies the type of DDCMP message. A value of 5 decimal is a Control message.

Type   Identifies the type of Control message:

> 1 = ACK
> 2 = NAK
> 3 = REP
> 6 = STRT
> 7 = STACK

Sub   The subtype or type modifier field. It provides additional information for some Control messages.

Flags   The link flags (see description under Data Messages). For STRT and STACK messages, both flags are 1's (flag value of 3).

Resp   The response number which acknowledges correctly received messages (piggybacked ACK). It is the number of the last consecutive message correctly received from the addressed station by the station transmitting this message. It implies that all unacknowledged messages between the one acknowledged in the last **Resp** field received and the one acknowledged by this **Resp** field (modulo 256) have been received correctly.

When used in a NAK message, it usually implies an error in a message with number RESP+1 (modulo 256) or beyond.

Fill   A fill byte with value 0.

Addr   The station address field. It designates the address of tributary stations on multipoint links. Stations on ·point–to–point links use the address value of 1.

Blkck3   The control message block check. It is computed on fields Enq through Addr, using the CRC–16 polynomial: $X^{16} + X^{15} + X^2 + 1$. **Blkck3** is initialized to zero prior to computation and transmitted X!% bit first. On reception, the inclusion of **Blkck3** in the computation will result in a zero remainder or CRC if no errors exist.

NAK messages also contain the Reason field which identifies the error reason and source, using the following values:

Errors usually due to transmission medium:

1	Header block check error (Data message Blkck1 or Control message Blkck3)
2	Data field block check error (Data message Blkck2)
3	REP response

Errors usually due to computer/interface:

8	Buffer temporarily unavailable
9	Receive overrun
16	Message too long
17	Message header format error

REP messages also contain the **Num** field, which is the number of the last sequential numbered data message, not including retransmissions, sent by the master. This is compared against the number of the last sequential message received by the slave. It the results agree, an ACK is returned; if the results do not agree, a NAK is returned. The NAK will contain the number of the last sequential message that was received.

Maintenance Messages

The DDCMP protocol operates in two basic modes:

- on–line (normal running mode)
- off–line (maintenance mode)

The maintenance mode may be used for basic diagnostic testing and simple operating procedures such as bootstrapping, down–line loading, or dumping.

It provides a basic envelop compatible with DDCMP framing, link management, and the CRC check for bit errors, but does not include any error recovery, retransmission timeouts, or sequence checks. All these functions, if necessary, are handled by the user within the data field.

The Maintenance message is similar in format to the Data message, as shown in Figure 17.3 below:

ID	Count	· Flags	Fill	Fill	Addr	Blkck1	Data	Blkck2
8 bits	14 bits	2 bits	8 bits	8 bits	8 bits	16 bits	Count bytes	16 bits

Figure 17.3: Data Message Format

ID identifies the type of DDCMP message. A value of 144 decimal indicates a Maintenance message.

The Count specifies the number of octets in the Data field. It is coded in binary. The value zero is not allowed.

The Flags are two 1–bit link flags (see description under Data messages on page 17-6). They control link ownership and message synchronization. Both flags are 1s in Maintenance messages (flag value of 3).

Note that the Count and Flags form a 2–octet quantity. The first octet contains the 8 low–order bits of the Count. The second octet contains the 6 high–order bits of the Counts, the Q bit and then the S bit as the highest order of the most significant bit of the octet.

Fill is a fill byte with a value of 0.

Addr is the station address.

Blkck1 is a block check computed on fields DLE through Addr using the CRC–16 polynomial: $X^{16} + X^{15} + X^2 + 1$. Blkck1 is initialized to zero prior to computation and transmitted X^{15} bit first. On reception, the inclusion of Blkck1 in the computation will result in a zero remainder or CRC is no errors exist.

Data is the message data field. This field is transparent to the protocol and has no restrictions on bit patterns, groupings, or interpretations. The only requirement is that it contains the number of bytes specified in the Count field.

Blkck2 is the block check on the data field. It is computed on the Data field only, using the polynomial and technique described above for Blkck1.

DDCMP Analysis Display

Sample DDCMP Analysis displays for each type of DDCMP message are shown below.

Data Messages

A Data message is displayed in the following format in the Real Time and History pages:

```
                    Data count discrepancy

          blkck2=0EFF

          id=129 Data count=5            S=1 Q=1

          resp=199 num=199 addr=122 blkck1=4C4E

          01 02 03 04 05
```

First Line of Display:

The first line of the Data message display indicates if the Count field (indicating the number of user data bytes transmitted) matches the number of user data bytes received. The following messages may appear on the first line:

Data count discrepancy	The count does not match the number of data bytes received in the message.
(blank)	The count matches the number of data bytes in the message.

Second Line of Display:

The second line of the Data message interpretation displays the value of Blkck2 in hex, which is the block check value of the user data.

Third Line of Display:

The third line of the Data message interpretation displays five fields of information:

id=xxx	The value of the ID field in decimal, which indicates the type of DDCMP message. For Data messages, id = 129.

Data	The interpretation of the id value, indicating the type of DDCMP message.
count=xxx	The count field. This indicates the number of bytes of user data transmitted in the message.
S=x	The value of the S bit as 1 or 0. This is the SELECT flag.
Q=x	The value of the Q bit as 1 or 0. This is the QUICK SYNC flag.

Fourth Line of Display:

The fourth line of the Data message interpretation displays four fields of information:

resp=xxx	The response number which acknowledges correctly received messages. It is the number of the last consecutive message correctly received from the addressed station by the station transmitting this message.
num=xxx	The transmit number of the data message.
addr=xxx	The station address.
blkck1=4C4E	The value of Blkck1 in hex, which is the block check value of the Data message header.

User Data:

The remaining lines display the uninterpreted user data transmitted in the Data message. The data is displayed in the format selected with the *F1* key.

Maintenance Messages

A Maintenance message is displayed in the following format in the Real Time and History pages:

```
                        Data count discrepancy

            blkck2=0EFF

            id=144 Main count=5                    S=1 Q=1

                                        addr=199  blkck1=4C4E

            01 02 03 04 05
```

First Line of Display:

The first line of the Data message display indicates if the Count field (indicating the number of user data bytes transmitted) matches the number of user data bytes received. The following messages may appear on the first line:

Data count discrepancy	Count does not match number of data bytes in message
(blank)	Count field matches number of data bytes in message

Second Line of Display:

The second line of the Data message interpretation displays the value of Blkck2 in hex, which is the block check value of the user data.

Third Line of Display:

The third line of the Data message interpretation displays five fields of information:

id=xxx	The value of the ID field in decimal, which indicates the type of DDCMP message. For Maintenance messages, id = 144.
Main	The interpretation of the id value, indicating the type of DDCMP message. For Maintenace messages this is indicated with the entry **Main**.

count=xxx	The count field. This indicates the number of bytes of user data transmitted in the message.
S=x	The value of the S bit as 1 or 0. This is the SELECT flag.
Q=x	The value of the Q bit as 1 or 0. This is the QUICK SYNC flag.

Fourth Line of Display:

The fourth line of the Data message interpretation displays two fields of information:

addr=xxx	The station address.
blkck1=xxxx	The value of Blkck1 in hex, which is the block check value of the Data message header.

User Data:

The remaining lines display the uninterpreted user data transmitted in the Data message. The data is displayed in the format selected with the *F1* key.

Control Messages

The format of a Control message varies by the type of message, as shown below:

ACK Message

```
id= 5 Ctrl type= 1,0  (ACK)  S=1 Q=1
resp=1              addr=199 blkck3=91F9
```

NAK Message

```
id= 5 Ctrl type= 2,0  (NAK)  S=1 Q=1
resp=1              addr=199 blkck3=654C
Reason=2                    Data BLKCK error
```

REP Message

```
id= 5 Ctrl type= 3,0  (REP)  S=1 Q=1
          num=3    addr=199 blkck3=C8E0
```

STRT Message

```
id= 5 Ctrl type= 6,0  (STRT)  S=1 Q=1
                  addr=199 blkck3=D77E
```

STACK Message

```
id= 5 Ctrl type= 7,0  (STACK)  S=1 Q=1
                  addr=199 blkck3=7AD2
```

First Line of Display:

The first line of the Control message interpretation displays five fields of information:

id=xxx　　　　　　　　　The value of the ID field in decimal, which indicates the type of DDCMP message. For Control Messages, id=5.

Ctrl	The interpretation of the id value, indicating the type of DDCMP message.
type=x,y (zzz)	The Control message type (x) and subtype (y) values. The type identifies which type of Control message it is, with one of these Control message types displayed in parentheses following the values:

1=ACK
2=NAK
3=REP
6=STRT
7=STACK

S=x	The value of the S bit as 1 or 0. This is the SELECT flag.
Q=x	The value of the Q bit as 1 or 0. This is the QUICK SYNC flag.

Second Line of Display:

Depending on the type of control message, the second display line contains one or more of the following fields:

resp=xxx	The response number which acknowledges correctly received messages. It is the number of the last consecutive message correctly received from the addressed station by the station transmitting this message. Relevant only for ACK and NAK messages.
num=xxx	The transmit number of the data message. Relevant only ofr REP messages.
addr=xxx	The station address.
blkck3=xxxx	The value of Blkck1 in hex, which is the block check value of the Data message header.

Third Line of Display (NAKs only):

For NAK Control messages, a third line of interpretation provides the following information:

Reason=x   The value of the reason field, indicating the reason/source for the NAK. The value is followed by the interpretation, as follows:

1	Header block check error (Data message Blkck1 or Control message Blkck3)
2	Data field block check error (Data message Blkck2)
3	REP response
8	Buffer temporarily unavailable
9	Receive overrun
16	Message too long
17	Message header format error

CHAPTER 18:
X.21 INTERFACE

Introduction

The X.21 Interface is a combined hardware/software package that provides a physical interface for simulation and monitoring. It can be used on a Chameleon 20 or either port of a Chameleon 32.

Note: This option is only available on Chameleon 32s containing Software Version 4.2 or subsequent releases, and Chameleon 20s containing Software Version 1.2 and subsequent releases.

The P3 PROM's installed in the machine must be version 3.4 or a subsequent release.

The X.21 interface conforms to the following CCITT recommendations:

CCITT recommendation X.21 1984
CCITT recommendation V.11 1984
CCITT recommendation X.4 1980

The X.21 Interface can be used in two types of testing situations:

- The X.21 Interface will simulate and analyze all X.21 information on a single port system, either port of a dual port system or on both ports of a dual port system. This provides for testing of all X.21 (or Level 1) information.

- The X.21 Interface is used to setup and maintain the Physical layer of a call. When the call is in the Data Transfer phase, X.25 data, generated either through one of the basic simulators or through a C application, can be transmitted transparently through the X.21 interface.

Both of these types of testing will be discussed in detail throughout this chapter.

In any type of testing, the Level 1 processing is performed through State and Timer tables. These tables define the actions, response and next state for the Interface. The standard CCITT State and Timer tables, as defined in Appendix A, are provided with the X.21 software. These values can either be used as is or altered to provide complete X.21 testing.

The four leads used in X.21 processing, transmit (T), receive (R), control (C) and indication (I), are defined in Table 18.1.

LEAD	DIRECTION	PHASE OF CALL CONNECTION	
		DURING DATA TRANSFER	CALL SETUP or CLEAR-DOWN
TRANSMIT (T)	DTE -> DCE	DATA	Call Control Information
RECEIVE (R)	DCE -> DTE	DATA	Call Control Information
CONTROL (C)	Controlled by DTE – indicates the meaning of the T circuit	State = ON	State = ON or OFF as defined by Protocol
INDICATION (I)	Controlled by DCE – indicates the meaning of the R circuit	State = ON	State = ON or OFF as defined by Protocol

Table 18.1: LEAD Definitions

Specifications

Level 1 information for the X.21 Interface is presented on the front panel LED display of the Chameleon. This information includes:

- the Mode of Operation

- the Data being Transferred

- the Signal Element Timing

- X.21 Lead Status

For the Chameleon 32 LED display, see the *Chameleon 32 User's Guide, Volume I, Appendix E*. For the Chameleon 20 LED display, see the *Chameleon 20 User's Guide, Volume I, Appendix D*.

The X.21 Interface conforms to the electrical characteristics as specified in CCITT V.11/X.27. This type of interface is discussed in detail in Volume I of the User's Manual. For the Chameleon 32 it is discussed in Appendix H, for the Chameleon 20, this information is found in Appendix G.

On either machine, the connector pinout provided in this chapter represents the actual X.21 Interface. The connector information found in the appendix should be used only for the V–Type interface.

X.21 Hardware

The X.21 Interface hardware includes:

- The X.21 Interface module (installed in one of the I/O module slots on the rear of the Chameleon)

- The X.21 Interface Board (installed in the card cage of the Chameleon)

- An X.21 LED Overlay for the Chameleon front panel LED display.

Note: For information on installing the X.21 Interface hardware, refer to the installation instructions which accompanied the X.21 Interface package.

Interface Modules

The Chameleon X.21 Interface Module is shown in Figure 18.1.
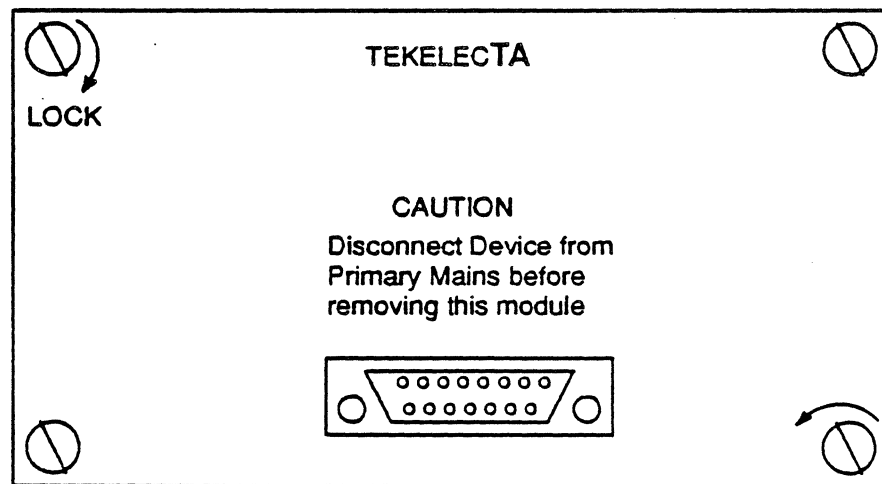
Figure 18.1: The Chameleon X.21 Interface Module

The 15 Pin Connector provides two line input and output for the Chameleon. The connector pin out is shown in Table 18.2. Note that two modules are required for dual port operation.

PIN No.	DESCRIPTION
1	Shield
2	T(A) Transmit (A)
3	C(A) Control (A)
4	R(A) Receive (A)
5	I(A) Indication (A)
6	S(A) Signal Element Timing (A)
7	B(A) Byte Timing (A)
8	Ground
9	T(B) Transmit (B)
10	C(B) Control (B)
11	R(B) Receive (B)
12	I(B) Indication (B)
13	S(B) Signal Element Timing (B)
14	B(B) Byte Timing (B)
15	Reserved

Table 18.2: X.21 Connector Pin–out

X.21 Configuration

When the X.21 Interface option is installed, the Chameleon detects its presence and includes X.21 options in the configuration menus. These steps outline the procedure for configuring your Chameleon with the X.21 Interface.

1. Connect the device(s) you are monitoring to the Chameleon X.21 Interface Module.

2. Power up your Chameleon and display the main Configuration menu (Figure 18.2). Note that the display shown is for the Chameleon 32. The display for a Chameleon 20 will be similar with the exception of the Physical Interface options.

```
Tekelec CHAMELEON XX    Rel x.xx  Copyright (C) 1986 - 1989

+------------------------------------------+    +---------------------+
| Press F7 to set the X.21 Interface default|    | Press GO to Accept  |
+------------------------------------------+    +---------------------+

+--------------------------------------------------------------------+
| Setup Mode                              Menu                        |
+--------------------------------------------------------------------+

+--------------------------------------------------------------------+
| Port A Mode of Operation                Monitor                    |
|         Physical Interface              X.21      <---             |
|         Setup                           X.25    Press F6 to change |
| Monitoring [ PORT A ] Data Source       Line                       |
| Capture Mode                            Cycle                      |
+--------------------------------------------------------------------+

   +------ Physical Interface------+        +---- FUNCTIONS----+
+--------+------+----+----+----+  +------+-------+-------+------+-------+
| V-Type | X.21 |    |    |    |  |Setup |Physicl|Version| Save |SetT.O |
+--------+------+----+----+----+  +------+-------+-------+------+-------+
```
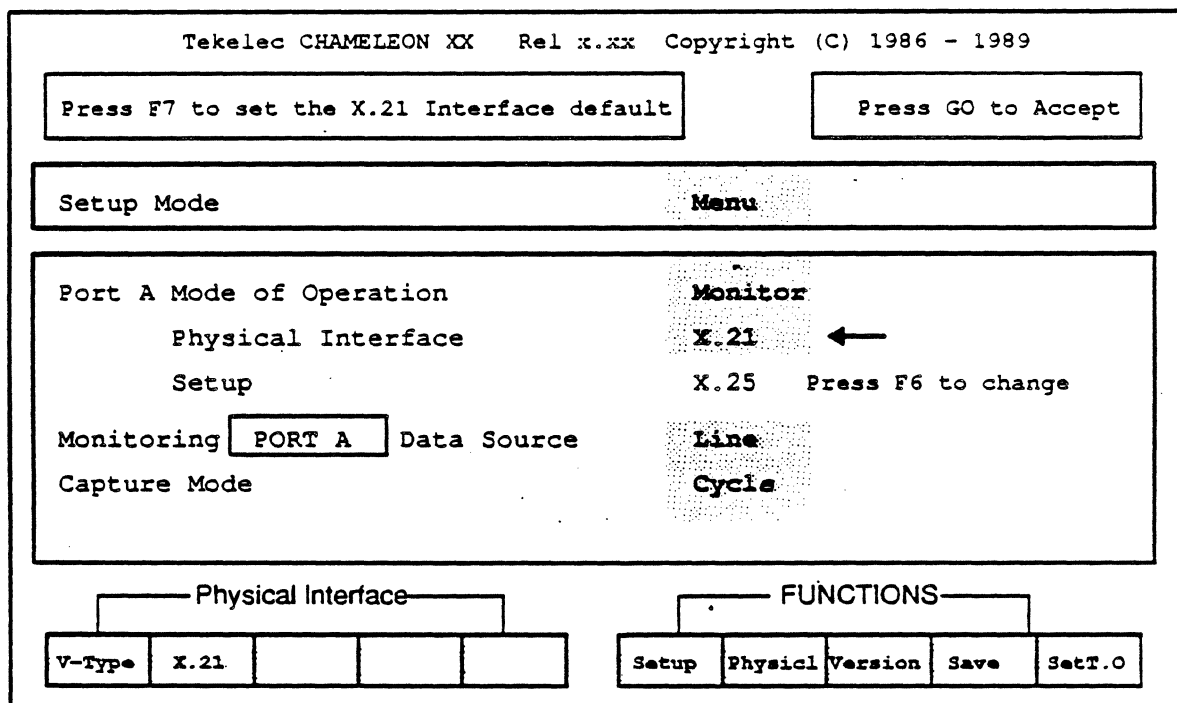
Figure 18.2: Main Configuration Menu (Chameleon 32)

3. Select *Monitor* or *Simulate* as the Mode of Operation for the Port containing the X.21 Interface. This determines the higher layer functions. If you select simulate, you cannot configure X.21, layer 1, for monitoring.

    *   If you are simply testing the X.21 interface and will not be transmitting X.25 data across the interface, this can be set to *Monitor.*

    *   If you will be transmitting X.25 data across the interface, through either a C application or a basic simulation program, this parameter must be set to *Simulate.* Note that in this case, the X.21 mode must also be set to simulate.

4.   Select *X.21* for the Physical Interface parameter.

5.   If you intend to create a new State Timer Table, you must first copy and rename one of the existing files using either the C shell or File Management. This copy can then be loaded from within the X.21 application, edited and saved to that same new name. The appropriate file should be copied and renamed now, before configuring the interface.

The files provided with the X.21 option are located in the directory **A:\TEKELEC\SETUP\X21**. The files are called:

- CCITTCKT.STT

- CCITTENH.STT

- CCITTPKT.STT

6.   Press *F7 Physicl* to display the X.21 Interface setup menu. This menu is used to configure the X.21 Interface and is described on page 18-9. Be sure to select a State/Timer Table.

7.   When you have the desired setup values displayed in the X.21 setup menu, you can either:

- Press *F6 Save* to save the X.21 configuration to the file named in the Setup parameter, then press *GO* or *F10 EXIT* to return to the main configuration menu and continue processing.

- Press *GO* to temporarily save the X.21 configuration file, return to the main configuration menu and continue processing.

Note that this saves the configuration only temporarily. If the power is shut off, any changes made will be lost.

8.   Press *F6 Setup* to display the protocol selection menu. This menu is used to select an upper layer protocol. *X.25* is most commonly used with the X.21 Interface.

Use the function keys to select the desired protocol and the additional protocol—specific parameters. If you are not familiar with a particular parameter, refer to the appropriate protocol chapter of this volume for a detailed description of each parameter.

9. When the upper layer configuration is complete, press *GO* to accept the values and return to the main Configuration menu. You can then save the combined configuration, Chameleon and X.21, by pressing *F9 Save*.

    Note that you must have used *F6 Save* in Step 7 to save the configuration at this point.

10. If your Mode of Operation is Monitor, select a Data Source and Capture Mode to suit your testing application. (These parameters are not displayed if the Mode of Operation is Simulate.) If you are not familiar with these parameters, refer to the *Chameleon User's Guide, Volume I, Chapter 3*.

11. From the main Configuration menu, press *GO* to load the Application Selection Menu.

12. The Applications Selection menu is used to select the testing applications you want to run. The applications that are displayed depend on the configuration and protocol selected.

    When the X.21 Interface is selected as the Physical Interface, the X.21 application is listed with the Monitoring Applications. This application provides the runtime display, described later in this chapter, which enables you to simulate and monitor the information passing through the X.21 Interface.

    During the Data Transfer phase of the call, the X.25 (or other layer 3) information is passed through to the BOP Analyzers. If you wish to monitor the higher level data, load the **Analysis** application as well. The **Real Time** and **History** pages will display the analysis of information received during Data Transfer.

13. Load the applications that will provide the information you want to simulate or monitor. The following applications have been discussed:

- **X.21**   This should only be loaded if you want to monitor the X.21 information or manually simulate X.21.

                    If the X.21 Interface is being used simply as the Level 1 protocol, and you will not be monitoring or manually simulating the information, it is not necessary to load the X.21 application. This helps to optimize the display processing for the applications that are running.

- **Analysis**   This should be loaded if you want to monitor the BOP data being received during Data Transfer.

- **Simulators**   An appropriate Simulator, either a Basic Simulator or a C Application, can be loaded to simulate the data sent out during Data Transfer.

If you are not familiar with these and other available applications, refer to the *Chameleon User's Guide, Volume I, Chapter 3.*

The following steps provide a brief procedure for loading applications:

a. Move the arrow cursor to the application.

b. Press the function key (F1 or F2) to load the application on the desired port.

c. The port letter will blink next to the application name. When the letter stops blinking, the application is loaded.

d. Use this same method to load all desired applications.

   Shift ↓ and **Shift ↑** are used to move between the Monitoring and Simulation windows.

14. Press *GO* to start the selected applications. As each application is started, a page banner appears at the bottom of the screen.

The **X21 A** or **B** banner is the X.21 runtime display for the respective ports. It is described on page 18-23.

X.21 Setup Menus

General Information

There are three setup menus for either port. Note that selecting Monitor will generate an error if the Mode of Operation on the configuration menu is set to Simulate. If this occurs, hit cancel to exit.

- Monitor – for monitoring and analysis applications
- DTE Simulation – for simulating a DTE
- DCE Simulation – for simulating a DCE

Each of the three setup menus are accessible from the others using the softkeys. The softkeys are used to provide valid entries for each of the displayed parameters except where alphanumeric entries are required. The selection signal and timer values are entered via the keyboard.

The function keys, or softkeys, are divided into two groups. F1 through F5 are the valid entries for each parameter. They are unique to each parameter. F6 through F10 are constant throughout the setup menus. These are defined as follows:

F6 Save   This saves the parameters shown on the setup menu to the filename in **SETUP**. This is the only method of permanently saving the X.21 configuration. To save a default file, simply press **F1 Default** within the **SETUP** parameter, then press **F6 Save**.

F7 Load   This loads the file which is named in **SETUP**. If the file does not exist, then an attempt is made to load the default file for the port. If this is not possible, standard initialization values are used. These values are shown as the defaults on Figure 18.3, Figure 18.4, and Figure 18.5.

F8 Revert   This un–does any changes made to the screen since the last *Load, Save* or *Init* operations.

F9 Init   This sets the parameters shown on the screen to the standard initialization values specified as the default throughout this manual and shown in Figure 18.3. Note that this will always initialize the system to Monitor Mode.

F10 Exit   This exits from the screen, back to the main menu, without saving the changes to the temporary file.

GO   This exits from the program and saves the parameters in a temporary working file for that port.

This does not permanently save the file. If power is lost or shut off, any changes will be lost.

Monitor Setup Menu

The Monitor setup menu is used to load the state/timer tables and configure the interface for the use or non—use of byte timing and X.25 data.

Figure 18.3: Monitor Setup

To change any of the configuration parameters, or to configure the equipment for DTE or DCE simulation, move the arrow cursor to the parameter you want to change. If specific values are valid, use the function keys to change the value, if a range of values are acceptable, enter the value.

The values displayed on the softkeys, the range of acceptable values or any limitations on the parameter are shown below for each of the Monitor Setup parameters.

Simulate/Monitor

- Monitor: displays the Monitor Setup Menu (no change)
- Sim DTE: displays the Simulate DTE Setup Menu
- Sim DCE: displays the Simulate DCE Setup Menu

Immediately after selection, the screen is repainted to show the parameters of the selected function. The default value is the Monitor Setup Menu.

<u>BOP Data</u>

- Data: X.25 data can be simulated or analyzed on the link set up by the X.21 Interface.

- No Data: The X.21 interface is running alone, X.25 data can not be simulated or analyzed. This is the test mode that is used to test Level 1, the X.21 information itself.

The default is Data.

<u>Byte Timing</u>

- Inactive: No byte timing information is transmitted, received byte timing information is ignored.

- Active: Byte timing information is transmitted and any received timing is used to align the character boundary.

The default value is Inactive.

<u>State/Timer</u>

This field shows the name of a file containing a previously constructed state/timer table. The filename can be up to 8 characters in length with no file extension. This is the State/Timer Table that is loaded when you press *F7 Load*. These tables are edited through the Run Time page.

To create a new file, you must copy one of the existing files using either the C Shell or File management, rename it, then enter the new filename here. The filename is entered by pressing *CTRL + X* or *Cancel* to clear the current value, then entering the new filename.

There are three default files included with the package. These, along with a user configuration are accessible through the softkeys. They are:

- **CCITTCKT –** (F1) This contains the Standard CCITT State and Timer Tables as defined in Appendix A. These are used with circuit switched protocols.

- **CCITTPKT –** (F2) This contains the Standard CCITT State and Timer Tables as used with Packet Switched (leased line) protocols.

- **CCITTENH –** (F3) This contains the State and Timer Tables for circuit switched protocols with Enhanced Sub–addressing .

- **USER –** (F4) This clears the field and enables you to enter a user defined filename.

Bit Rate

This field is for information purposes only. It cannot be accessed from this screen. It indicates that the bit rate is 'Received' from a connected DCE.

SYN Filter

The SYN Filter, at this time, is automatically set to OFF. In this mode, extra SYN characters are not shown and the IA5 characters are displayed in a horizontal format. The character string 1234567+ will be displayed as:

1
2
3
4
5
6
7
+

Setup

Once the machine is configured for your test session, the configuration parameters can be stored as the default or under a user-defined filename by pressing *F6 Save*. This saves all the configuration parameters to the file named in *SETUP*. The filename must be no more than 8 character and have no file extension. The softkeys provide the options as shown below.

The softkey *F7 Load* is used to load the file name specified in *SETUP*. If the file name is not found, the machine attempts to load the default parameters. If the default file cannot be found then the 'hard coded' initialization values are used. These are the values as shown in Figure 18.3, Figure 18.4, and Figure 18.5.

The softkeys allow the following selections:

• Default   Enters the filename **DEFAULT**. This saves or loads the default file for that port.

• User   Clears the entire field to allow user entry of the filename.

DTE Simulation Setup Menu

The DTE Simulation setup menu is used to configure the simulation parameters and the format of information displayed on the run–time screen.

```
                                              Press GO to Accept

Simulate/Monitor    │Sim DTE │    BIT Rate      │Received│  Hz

BOP Data            │Data │

Byte timing         │Inactive │   Resistive Term  │No Term │

State/Timer         │CCITTCKT │   DTE- prov info  │+                    │

Selection Signal    │1234567+                                          │

SYNchar             0              SYN filter        Off

                                   Called Response   Accept

Auto Call Key    │c│  Time │Off│  Auto Rel Key   │X│  Time │Off│
Triggering       Off           Setup            │Default │
Start        t= │1│ c= │Off│   Stop        t= │0│ c= │Off│

│Monitor│SimDTE│SimDCE│     │     │     │Save│Load│Revert│Init│Exit│
```

Figure 18.4: DTE Simulation Setup

To change any of the configuration parameters, or to configure the equipment for Monitoring or DCE simulation, move the arrow cursor to that parameter. If specific values are valid, use the function keys to change the value, if a range of values are acceptable, enter the value.

The values displayed on the softkeys, the range of acceptable values or any limitations on the parameter are shown below for each of the Monitor Setup parameters.

Simulate/Monitor

- Monitor: displays the Monitor Setup Menu
- Sim DTE: displays the Simulate DTE Setup Menu
- Sim DCE: displays the Simulate DCE Setup Menu

Immediately after selection, the screen is repainted to show the parameters of the selected function.   The default value is the Monitor Setup Menu.

BOP Data

- Data: X.25 data will be sent across the link set up by the X.21 Interface.

- No Data: The X.21 Interface is running alone, X.25 data is not required. This is the test mode that is used to test Level 1, the X.21 information itself.

The default is Data.

Byte Timing

- Inactive   No byte timing information is transmitted and received byte timing information is ignored.

- Active   Byte timing information is transmitted and any received timing is used to align the character boundary.

The default value is Inactive.

State/Timer

This field shows the name of a file containing a previously constructed state/timer table. The filename can be up to 8 characters in length with no file extension. This is the State/Timer Table that is loaded when you press *F7 Load*. These tables are edited through the Run Time page.

To create a new file, you must copy one of the existing files using either the C Shell or File management, rename it, then enter the new filename here. The filename is entered by pressing *F4 User* to clear the current value, then entering the new filename.

There are three default files included with the package. These are accessible through the softkeys. They are:

- **CCITTCKT –**   This contains the Standard CCITT State and Timer Tables as defined in Appendix A. These are used with circuit switched protocols.

- **CCITTPKT –**   This contains the Standard CCITT State and Timer Tables as used with Packet Switched (leased line) protocols.

- **CCITTENH –**   This contains the State and Timer Tables for circuit switched protocols with Enhanced Sub–addressing

SYN Char

This parameter is always set to 0. It indicates that only one character will be displayed preceding each call control sequence or IA5 character regardless of the number of synchronization characters received.

SYN Filter

The SYN Filter is automatically set to OFF. In this mode, extra SYN characters are not shown and the IA5 characters are displayed in a vertical format.

Automatic and Manual Call Requests

Two parameters, the **Auto Call Key** and **Auto Call Time**, are used to define how and when a call request is automatically initiated by the simulator.

The **Auto Call Key** parameter defines the key which sets the outgoing state to Call Request. This key can be used either automatically or manually;

- The specified key, or state, is automatically initiated when the timer set by Auto Call Time has timed out.

- When Auto Call Time is set to OFF, or before the timer has expired, the key can be used manually to initiate a Call Request.

Any single printable character can be used as the Auto Call Key, but the CCITT table require that the letter C be used.

The **Auto Call Time** parameter is the amount of time that the simulator will remain in State 1 (*Ready*) before automatically initiating a Call Request. The status of this parameter can be seen on the run–time display by the color of the two left key definitions.

- They are green if the Auto Call Time contains a value and a Call Request will automatically be sent.

- They are yellow when Auto Call Time is set to OFF and a Call Request can only be initiated manually.

'Auto Call Time is set to OFF by clearing the current numerical value, either by using *DELETE* or *CTRL X*, and moving the cursor to another parameter.

The defaults are: Auto Call Key = C, Time = Off

Note: If Auto Call Time and Auto Rel Time are set to specific times (anything other than off), the interface will setup a call whenever it is in the *Ready* state and the Auto Call Time is expired. Then, after reaching Data Transfer, it will release the call when the Auto Rel Time is expired. Auto Rel Time is defined on the following page.

With this setup, the machine will continually initiate, complete, then terminate a series of calls.

Start Conditions

The two fields, **Start t** and **c**, are used to define the status of the DTE leads when simulation is started via the softkey *START*. Before pressing *START*, the leads indicate the state *DTE Controlled not ready*.

Valid **t** states are: 0, 1, 01

Valid **c** states are: ON and OFF

The defaults are: t = 1, c = OFF

Automatic and Manual Call Release

Two parameters, the **Auto Rel Key** and **Auto Rel Time**, are used to define how and when a call release is automatically initiated by the simulator.

The **Auto Rel Key** parameter defines the key which sets the outgoing state to Clear Request. This key can be used either automatically or manually;

• The specified key, or state, is automatically initiated when the timer set by Auto Rel Time has timed out.

• When Auto Rel Time is set to OFF, or before the timer expires, the key can be used manually to initiate a Clear Request.

Any single printable character can be used as the Auto Rel Key, but the CCITT tables require the letter X be used.

The **Auto Rel Time** parameter is the amount of time that the simulator will remain in the Data Transfer state before automatically initiating a *Clear Request*. The status of this parameter can be seen on the run–time display by the color of the two right key definitions.

- They are green if the Auto Rel Time contains a value and a Clear Request will automatically be sent.

- They are yellow when Auto Rel Time is set to OFF and a Clear Request can only be initiated manually.

Auto Call Time is set to OFF by clearing the current numerical value, either by using *DELETE* or *CTRL X*, and moving the cursor to another parameter.

The defaults are: Auto Rel Key = X, Time = Off

Stop Conditions

The two fields, **Stop t** and **c**, are used to define the status of the DTE leads when simulation is stopped via the softkey *STOP*.

Valid **t** states are: 0, 1, 01

Valid **c** states are: ON and OFF

The defaults are: t = 0, c = Off

Triggering

The triggering parameter will work in conjunction with the triggering parameter on the State Tables. At this time, this field is read only and is set to OFF.

DTE–Prov Info

This field contains the DTE–provided information. The format for entry is a string of up to 17 characters plus a terminating character, +.

The softkeys allow the following selections:

- Default   Inserts the default value (+)

- User   Clears the field to allow user entry of the information. Remember to terminate the statement with the character +.

The default value is +.

Selection Signal

Any printable characters can be used to make up the Selection Signal. The field has a maximum length of 58 characters plus the terminating character. The string can be cleared by pressing *CTRL X* or *Cancel.*

The format used is a string of characters with two delimiters:

+   used to separate individual selection signals and

,   used to separate the main selection signal from the enhanced sub–address.

Multiple selection signals are only significant when automatic calling is selected. If the Auto Call Time has a value other than OFF then each of the selection signals in turn is used when a call is initiated.

The default value is 1234567+

Bit Rate

This field is for information purposes only. It cannot be selected on this screen. It indicates that the bit rate is 'Received' from a connected DCE.

Called Response

This field, when implemented, will allow you to select the DTE response or lack of response to an incoming call. At this time, this field is read only.

Resistive Termination

The Resistive Termination parameter determines the terminating load for the receivers. The available values are:

● Terminate   Provides a 100 ohm balanced nominal terminating load.

● No Term   Provides a terminating load of 300 ohms.

The default value is No Term.

Setup

Once the machine is configured for your test session, the configuration parameters can be stored as the default or under a user–defined filename by pressing *F6 Save*. This saves all the configuration parameters to the file named in *SETUP*. The filename must be no more than 8 character and have no file extension. The softkeys provide the options shown below.

The softkey *F7 Load* is used to load the file name specified in *SETUP*. If the file name is not found, the machine attempts to load the default parameters. If the default file cannot be found then the values shown in Figure 18.3, Figure 18.4, and Figure 18.5 are used.

The softkeys allow the following selections:

- Default   Enters the filename **DEFAULT**.
- User   Clears the entire field to allow user entry of the filename.

DCE Simulation Setup Menu

The DCE Simulation setup menu is used to configure the simulation parameters and the level of information displayed on the run–time screen.

```
                                    Press GO to Accept

  Simulate/Monitor   │ Sim DCE │    BIT Rate      │ 19200 │    Hz

  BOP Data           │ ·Data │

  Byte timing        │ Inactive │   Resistive Term   │ Terminate │

  State/Timer        │ CCITTCKT │    DTE- prov info    │ + │

                                    Call Information  │ + │

  SYNchar            0            SYN filter        Off

  Call prog signal  │ 01+ │       Call Response      Accept

  Auto Call Key     │ C │ Time │Off│  Auto Rel Key    │ X │ Time │Off│

  Triggering         Off          Setup            │ Default │

  Start         r= │ 1 │ i= │Off│  Stop      r= │ 0 │  i= │Off│

  │Monitor│SimDTE│SimDCE│    │    │     │ Save │ Load │ Revert │ Init │ Exit │
```

Figure 18.5: DCE Simulation Setup

To change any of the configuration parameters, or to configure the equipment for Monitoring or DTE simulation, move the arrow cursor to the parameter you want to change and use the function keys to change the value.

Most of the parameters on the DCE Simulation Setup menu are identical to those on the DTE Simulation Setup menu. The softkey options and guidelines for those parameters can be found in the *DTE Simulation Setup Menu* pages.

The parameters common to both the DTE and DCE Simulation Setup Menus are as follows:

Simulate/Monitor	Resistive Term
BOP Data	Triggering
Byte Timing	SYN Filter
State/Timer	Call Response
SYN Character	Auto Rel Key
Auto Call Key	Auto Rel Time
Auto Call Time	Setup

The softkey options and guidelines for DCE Simulation unique parameters follows.

Call Prog Signal

This field contains the Call progress signal. It is made up of any printable characters with a field length of up to 4 characters plus a terminating character, +.

The default value is 01+.

Start Conditions

The two fields, **Start r** and **i**, are used to define the status of the DCE leads when simulation is started via the softkey *START*. Before pressing *START*, the leads indicate the state *DCE not ready*.

Valid **r** states are: **0, 1, 01**

Valid **i** states are: **ON and OFF**

The default values are: r = 1, i = Off

Stop Conditions

The two fields, **Stop r** and **i**, are used to define the status of the DCE leads when simulation is stopped via the softkey *STOP*.

Valid **r** states are: **0, 1, 01**

Valid **i** states are: **ON and OFF**

The default values are: r = 0, i = Off.

Bit Rate

This field is used to specify the bit rate of information both transmitted and received by the DCE.   Acceptable values are between 50 and 64000, inclusive. Any other values will revert to the default rate when you select another field. Currently, for dual port X.21 operation, the maximum rate for 100% performance is 32000 bps.

The default rate is 19200 bps.

Note: If you are simulating X.25 data, the transmission clock will always be received a clock either from the X.21 Interface or the external 19200 bps clock.

DCE–Prov Info

This field contains the DCE–provided information. The format for entry is a string of up to 17 characters plus a terminating character, +.

The softkeys allow the following selections:

- Default   Inserts the default value (+)

- User   Clears the field to allow user entry of the information. Remember to terminate the statement with the character +.

The default value is +.

Call Information

This field contains the Call Information. It is made up of any printable characters with a field length of up to 17 characters. It must be terminated with the character +.

The softkeys provide the options:

- Default   Inserts the default value (+)

- User   Clears the field to allow user entry of the information. Remember to terminate the statement with the character +.

The default value is +.

X.21 Runtime Page

When you load and run the X.21 application from the Applications Selection menu, a page is displayed with the banner X21 A or X21 B, depending on the port housing the X.21 Interface.

This page displays the four lead states, the time stamp or event number, the current state number and name. The format of the DTE Simulation screen is shown in Figure 18.6.

```
+-------------------------------------------------------------------------------+
| | Key: C→2       Key: N→14            Key: U→24         Key: →          |  |
| +------------------------------------------------------------------------+  |
|                                                                   t   c   r   t |
|    Time/event    No  Ch              State/Data                                  |
|  ─────────────────────────────────────────────────────────────── 0-1─ N-F─ 0-1─ N-F |
|  14:31:24 625 620 14          DTE controlled not ready, DCE ready                |
|  14:34:10 200 460 1           Ready                                              |
|  14:34:20 589 200 2           Call request                                       |
|  14:36:49 732 060 3      +    Proceed-to-select                                  |
|  14:36:49 763 600 4    s/γ   Selection signal                                   |
|  14:36:49 764 420      1                                                         |
|  14:36:49 764 820-     +                                                         |
|  14:36:49 765 640 5           DTE waiting                                        |
|  14:36:49 820 500 6A   s/γ   DCE waiting                                        |
|  14:36:49 870 860 7    0      Call progress signal                               |
|  14:36:49 871 280      1                                                         |
|  14:36:49 871 680      +                                                         |
|  14:36:49 872 100 6A   s/γ   DCE waiting                                        |
|  14:36:49 999 020 11          Connection in progress                            |
|  14:36:50 040 360 12          Ready for data                                    |
|  14:36:50 057 040 13          Data transfer                                     |
|                                                                                  |
|  14:37:00 497 480 16          DTE clear request                                 |
|  14:37:00 497 900 17          DCE clear confirmation                            |
|  14:37:00 547 020 21          DCE ready                                         |
|  14:37:00 562 180 1           Ready                                             |
| +------------------------------------------------------------------------+  |
| | Stop    |     | Restart |     | Review |     |     |     | Time | ScrHld |  |  |
+-------------------------------------------------------------------------------+
```

Figure 18.6: DTE Simulation, (DCE identical)

If less than 100 state changes are recorded since starting the test session, this will display all state changes from the beginning of the history buffer. This allows you to see the state changes that occurred before the X.21 page was displayed.

In this mode, the LEDs will not match the status on the bottom of the display until it catches up with real time.

For DCE Simulation, the screen is identical. For Monitoring, the screen contains all of the same information but does not display the simulation key strip along the top edge of the page.

The State and Timer Editors are accessed from this menu when the interface is not active.

Function Keys

The screen shown in Figure 18.6 is not the first screen shown when the X.21 Application is first run. It shows the screen in an active state. Initially, the screen does not contain any information and has slightly different softkeys. These initial softkeys are defined as follows:

F1 Start/Stop   This toggle switch has slightly different functionality in Monitoring and Simulation Modes.

- In Monitor Mode, it starts and stops the display of data.

- In Simulate Mode, either DTE or DCE, it not only starts and stops the display of data, it starts and stops simulation. Note that Layer 1 was initially activated when you pressed *GO* at the main configuration menu.

  When *Start* is pressed, the leads are set to the Start conditions from the initial setup menu.

  Stop sets the leads to the Stop conditions.

  When the application has not been started, the softkey indicates *Start*, the softkeys provide access to the State and Timer Tables through the following two softkeys.

F3 DTE edt   Pulls up the DTE State and Timer Table Editors. Refer to the section *State/Timer Table Editors* for more information on those menus.

F4 DCE edt   Pulls up the DCE State and Timer Table Editors. Refer to the section *State/Timer Table Editors* for more information on those menus.

When *F1 Start/Stop* shows Stop, the interface is active. In simulate mode, the simulators are running. In monitor mode, all incoming information is being displayed. The softkeys take on new functions as follows:

F3 Restart

Clears the buffer data and allows a new capture to take place.

F5 Review

The contents of the buffer are scrolled up over the screen with a banner at the top indicating the date the information was stored and the type of information being displayed, for example **DCE Simulation**. *Review* will display any type of information regardless of the present mode of operation.

F8 Time

This softkey toggles between several values. It allows you to mark each state change in the following ways:

None: No Marker

Event: A sequentially numbered marker starting with 1.

Time: An absolute (real–time) time stamp

dTime: A relative time stamp giving the time since the previous change.

**F9 Scr Hld/
   Scr Run**

A toggle switch which alternately holds the screen and allows it to run with real–time acquisition. It allows you to hold the screen for examination while new data is written to the buffer.

When the screen is released, it will scroll smoothly to real time provided the data has not been overwritten.

If the data has been overwritten, the display will revert immediately to real time. When the data overwrite occurs, a BEL character will be generated.

Reading the Runtime Screen

The Runtime screen from Figure 18.6 is shown here broken down by sections to simplify explanation of the screen. This figure does not show the Function Keys which were described on the previous page. Each of these sections are described on the following pages.

Simulation Key Definitions

Time/event	No	Ch	State/Data
Key: C→2	Key: N→14	Key: U→24	Key: →
14:31:24 625 620	14		DTE controlled not ready, DCE ready
14:34:10 200 460	1		Ready
14:34:20 589 200	2		Call request
14:36:49 732 060	3	+	Proceed-to-select
14:36:49 763 600	4	$^s/_r$	Selection signal
14:36:49 764 420		1	
14:36:49 764 820		+	
14:36:49 765 640	5		DTE waiting
14:36:49 820 500	6A	$^s/_r$	DCE waiting
14:36:49 870 860	7	0	Call progress signal
14:36:49 871 280		1	
14:36:49 871 680		+	
14:36:49 872 100	6A	$^s/_r$	DCE waiting
14:36:49 999 020	11		Connection in progress
14:36:50 040 360	12		Ready for data
14:36:50 057 040	13		Data transfer
14:37:00 497 480	16		DTE clear request
14:37:00 497 900	17		DCE clear confirmation
14:37:00 547 020	21		DCE ready
14:37:00 562 180	1		Ready

Time Stamp
or Event Number

State Number
or Previous State

Character Information

State Names
or Data

Graphical Lead Status

Figure 18.7: Reading the Runtime Screen

Simulation Key Definitions

This top line of the window shows the active keys for the present state. These are defined for each state within the State Tables. As an example, using CCITTCKT for a circuit switched protocol, Key C is used to initiate a *Call Request*, Key X initiates a *Clear Request*. Any other defined keys will initiate a change of state.

The color of these keys will also show if *Call Requests* and *Clear Requests* are automatically sent after a timer expires as set up on the Physical Setup menu.

- The two left keys indicate Auto Call Time status. They will be *green* if Auto Call Time contains a value for automatic calling. They will be *yellow* if Auto Call Time is set to OFF for manual calling.

- The two right keys indicate Auto Rel Time status. They will be *green* if Auto Rel Time contains a value for automatic call release. They will be *yellow* if Auto Rel Time is set to OFF for manual call release.

Note:

When you are using CCITTPKT.STT, Packet Mode, in state – or –, the simulation keys show keys that will initiate the transition to another state. At times, when you press these keys, it will not transition to the specified state. This is because the simulator will only change the leads controlled by the device being simulated and actual transition depends on the status of the other two leads.

The following example is for DCE Simulation. If you are in State –, DCE controlled, not ready, and press Key S – 13S, you may not transition to State 13S. The DCE leads (R and I) will change as expected to 1 – OFF, but if the T and C leads are not D – ON, the machine will not transition to 13S, but instead to the state that has that lead status.

Time Stamp or Event Number

The information displayed in this field is determined by the current *F8* definition. As defined previously, this can display:

- An Event Number, sequentially numbered from one.

- A real–time stamp, taken from the Chameleon Real–Time clock.

- A relative time stamp, giving the time since the previous change.

In this case, the real–time stamp is shown.

State Number or Previous State

This field displays the present state of the connection.

Character Information

This field shows the SYN or iA5 characters received with each event.

State Names or Data

This field contains the text description of what is happening within the simulator. It can contain any of the following types of information:

- The name of the present state when a state change is made.

- Any Automatic key strokes and any other actions taken by the Chameleon to change the state, including timeouts, are shown in reverse video. The message will follow the format *Auto Key C.*

- Any Manual key strokes that are acted on. If a key is pressed that is not currently an active key, no action occurs and the key stroke is not displayed. This message is also shown in Reverse Video and follows the format *Manual Key C.* Note that these keys can also be controlled through a C application. Refer to the Programmed Control section of this chapter for more information.

- A message showing a timeout will be displayed any time one of the defined timers expires. The timers are defined through the State/Timer Tables.

- On the Chameleon 32, the messages and states are color coded as follows:

  - Ready   Green
  - Unknown State   Red
  - Data Transfer   Yellow
  - Keystrokes and Timers   White Reverse Video
  - All other states   Blue

- Call Control information is displayed in ASCII for numbers. Note that Call Control information can be letters as well. This is controlled by the SYN Filter parameter in the configuration parameter. (See the note on dual port operation on the following page.)

Note: In dual port operation, duplicate sequence of the selection signal (e.g. 12222234567+) may occur. This is due to hardware interrupt intervention of the task on the other port. The transmitter will repeat the character in the middle of a string until the task resumes from the interrupt. In this example, you should read this as 1234567+.

Graphical Lead Status

This area shows the state of each of the leads at any point. The top edge of this shows the meaning of the graphic positions. For the t and r leads, 0–1 indicates the actual lead state. For the c and i leads, N–F indicates ON–OFF.

The symbols in this section relate to the CCITT symbols as follows:

CH32	CCITT		CH32	CCITT
$^s/_Y$ —	SYN		+ —	+
i —	IA5		B_L —	BEL
▨ —	▨		* —	*
▤ —	01			

Note: When the selection signal is set to '+', the lead status shows '*'. If there are any digits preceding the terminating signal, it will display '+'.

State /
Timer Tables

The State/Timer Tables are the backbone of the simulator. They are used to define:

- the lead states that indicate a specific state

- the keys that can be used to exit a state

- timers and the response to timeouts

- the lead states that are valid incoming events

- the response to an unknown incoming state.

The Standard CCITT State/Timer Tables are provided with the X.21 software package. They are selected through softkeys on the configuration menu by entering:

- **CCITTCKT** for circuit–switched protocols

- **CCITTPKT** for packet–switched protocols

- **CCITTENH** for a circuit switched protocol with enhanced sub–addressing

Once loaded, these values can be used as is for testing standard CCITT responses. If your test environment calls for negative testing or non–standard situations, the CCITT State/Timer Tables can be copied and renamed, using either the C Shell or File Management, then used as a basis for new State/Timer Tables.

It is important to note that when the State/Timer Tables are edited and you press *GO* to accept the changes and continue testing, the file you were editing (either DTE or DCE) will be overwritten in memory but the changes will not be saved to the hard disk. Use *F6 Save* to permanently save the changes.

This section will describe the DTE State/Timer Tables found in CCITTCKT. These will also be the tables used in the example that follows. The DCE State/Timer Tables function exactly the same.

The State Table Editor

The State Table Editor is entered from the run time screen by pressing either *F3 DTE edt* or *F4 DCE edt.* When the editor is called, a new window is opened and the cursor waits in the State parameter field. The State Table Editor is shown in Figure 18.8.

When first called up, the screen will display the contents of the file loaded on the configuration menu. If there is no valid default file, the states and timers will be null and the screen fields will be blank.

The State Table Editor can contain up to 99 states at any time. You can therefore, add only as many states as not filled by the current CCITT State/Timer Table. For example, if CCITTCKT is loaded, the 37 standard states are loaded. You can then add up to 62 additional states.

```
                        DTE state editor
    State = 1        Name = Ready                        Trg = Off

    Lead States      t = 1  c = Off  r = 1  l = Off    Press GO to Accept

    Time-out = Key C  Exit state = 2   Cancel =
    Time-out = Key N  Exit state = 14  Cancel =
    Time-out = Key U  Exit state = 24  Cancel =
    Time-out =        Exit state =     Cancel =

     t     c    · r    l     State                  Name
    01    Off    1    Off     14    DTE controlled not ready, DCE ready
     0    Off    1    Off     24    DTE uncontrolled not ready, DCE ready
     1    Off    0    Off     18    DTE ready, DCE not ready
     0    On     1    Off      2    Call request
     1    Off    0    Off      8    Incoming Call
                 01   Off     --    DCE controlled not ready
     0    On    Bel   Off     15    Call collision

     1    Off    1    Off      1    Ready
                               ???  Unknown State


        [    ] [    ] [    ] [Prev] [Next]   [Save] [Load] [Print] [    ] [Exit]
```

Figure 18.8: DTE State Editor

The Function Keys ·

The softkeys, with the exception of F1, remain constant throughout the editing session. F1 is displayed only when the cursor is in one of the Time—out fields. These are defined as follows:

F1 Timers   *Timers* is used to access the Timer Editor Menu.

F4 Prev   In all parameters other than the present state number shown in the top line, this displays the previous valid option. It allows you to cycle through:

- Lead states in the lead status field
- Timers in the Time—out field
- States in all other accessible fields.

The key combination *Shift* + ↑ provides the same function.

F5 Next   Similar to *F4 Prev*, this selects the next valid option. The key combination *Shift* + ↓ and the space bar provide the same function.

F6 Save   Saves the state and timer tables (both DTE and DCE) to the file named in the State/Timer parameter on the Physical Setup menu.

F7 Load   Loads the state and timer tables (both DTE and DCE) from the default file named in the State/Timer parameter on the Physical Setup menu.

F8 Print   Prints the state and timer tables in their current configuration.

F10 Exit   Exits from the editor back to the Runtime page without saving any changes. Use *Go* to save the changes and return to the Runtime page.

GO   Accepts the currently edited state table and writes over the existing default. This replaces the default file only for the table being edited. Use *F6 Save* to save the entire set of state/timer tables.

State Table Fields

When the State Table Editor is called, the cursor waits in the State field. This is the field used to locate and display the state information. This is where we will begin the description of State Table Editor fields.

State
Enter the number of a State you want to see displayed on the State Table or the number for a new State to be created. This parameter has a field length of up to four characters, with leading spaces not accepted. The State number is case sensitive. That is, a state indicated as 6a is different from the state 6A. Also note that once a state number is added (and accepted by pressing *GO*) it cannot be removed.

This case sensitivity is important in view of the 99 state limitation. If a state is entered as 6a, then a second time as 6A, two of the available states are taken.

When the number is entered, there are two methods of searching for the details of the specified state:

- Press any of the four arrow keys to begin the search for a state with that number. Once it is found, the new information is displayed and the arrow cursor advances to *Name*.

- Press **RETURN** to begin the search. The information is displayed and the cursor remains in the *State* field.

If state information is not found for the specified State Number, the screen is cleared for the creation of a new state.

If a new state is accidentally created, simply delete the state number before pressing *GO*.

Name
This contains the user defined name of the state. It can contain any printable characters with a maximum length of 42 characters. This is the name of the state that will be displayed in the State Names or Data section of the Runtime display.

TRG
The triggering parameter is used to indicate the states that will activate a trigger set on the configuration menu. Note that Triggering is not implemented at this time.

The valid responses are:

- OFF   to Select no event triggering

- ON   to select event triggering when the state is entered and the Physical Setup triggering parameter contains **Set** or **? + Set**.

Lead States

The Lead States (T, C, R and I) are the parameters that actually define the state. As an example, in Figure 18.8, State 1 is defined by $t = 1$, c = OFF, $r = 1$ and i = OFF. Any time the unit recognizes that lead pattern, it is in State 1.

Note: An exception to this occurs when the current state and the next state have the same lead status. In this case, the Chameleon will not change state.

The value for each lead is selected by using *PREV* and *NEXT* to cycle through the available list. The value null is shown as a Blank field. The list of values is as follows:

T lead	C lead	R lead	I lead
null	null	null	null
0	Off	0	Off
1	On	1	On
01		01	
•		+	
IA5		IA5	
D		Bel	
		Syn	
		D	

Time—Out

In a typical connection, state transitions are made in response to an event received from the other device (either the DCE or DTE). A Time—out defines another way to exit the current state. Each state can have up to four Time—out functions. They can be selected in two ways:

- using *PREV* and *NEXT* to select the time—out value from the list of valid options.

- using the Timer table, follow these steps
    1. Set the cursor in the time—out you want to change
    2. Press *Timers* to display the Timer editor
    3. When the cursor is pointing to the appropriate time—out function, press *F10 Exit.*
    4. The selected time—out function will be in the time—out pointed to by the cursor.

To delete a time—out, use either method to select the null or blank state.

The *Null* time—out field indicates a non—operative time—out. The time—out, or change of state can be triggered in three ways. The methods of initiating a state change are as follows:

- **Timers**

  If you enter the name of one of the timers defined in the Timer Tables into the time—out parameter, the machine waits for the specified timer to expire, then transitions to the state specified in *Exit State*.

  This will only happen if:

  - none of the specified Cancel functions occur
  - no events are received from the other device which initiate a change of state and reset the timer.

- **Goto**

  This function causes an immediate transition to the state specified in the Exit State field. This is the highest priority timeout function. It operates like an instantaneous time—out. In this case, the cancel field is used to modify the Exit field of the table that it jumps to. See the application at the end of this section for a detailed example of this.

- **Key**

  The **Key** function is used to define key strokes, or *hot keys* that will initiate a state transition. When the specified key is pressed, the state will transition to the state specified in the Exit State field.

  If the same key is selected to make a transition to more than one state, the first state in the list, starting from the top, will be used.

  The function **KEY** is not case sensitive in its spelling or in the selected key. You can create as many key functions as space will allow within the Timer Table Editor.

Each of these time—out methods are created and edited using *Timers* to enter the Timer Table Editor

Exit State

Each time—out has an exit state associated with it. If a specified key is pressed, a timer expires or the Goto function is activated, the Exit State indicates the next state. These are chosen from the list of valid states using *PREV* and *NEXT.*

Note: If the next state has the same lead status as the current lead status, no state change will occur

You cannot enter a state into the Exit State field until a timer or function is selected in the Time—out field.   To *null* or *blank* a time—out field, first delete the Exit State and Cancel fields, then go to the Timer Editor and select a blank field.

Cancel

Each timer has up to four cancellation states associated with it. These are the states which cancel the associated timer. The Cancel state is selected using the *PREV* and *NEXT* softkeys to choose from the states within that state editor.

If the time—out function used is the GOTO, the Cancel state is used slightly differently. It effectively modifies the Exit field of the next state. An example of how this can be used in an application is at the end of this section.

You cannot enter anything in the cancel field until a timer or function is selected in the Time—out field.   To *null* a time—out field, first delete the Exit State and Cancel fields.

t/ c/ r/ i/ State and Name

The bottom section of the State Editor screen shows the state transitions that are acceptable from the current state, this is also referred to as the Valid Transition List. In this section of the State Editor screen, only the State can be changed by the user. Once a state is selected, the Chameleon displays the corresponding lead pairs (t, c, r and i) and the name. All states defined as an **exit** or **cancel state** must be included in this list.

Use *PREV* and *NEXT* to cycle through the list a valid transition states.

A special option, '???', enables the detection of Unknown or Invalid transitions and behaves as a 'default' case. Any lead change that is not specified in this area (the valid transition list) becomes the unknown state.

The Unknown State, ???

The machine recognizes an unknown state as any state whose lead status is not found within the Valid Transition List for the current State. The Unknown State, identified as **???** in the State Editor, must be defined to provide a recovery procedure from unexpected lead changes.

In our table, if you are simulating a DTE, on the state **???**, State 16 in the Valid Transition List is used as the GOTO Exit State. Any time an unknown state is received, the machine will then attempt to recover by sending *State 16, DTE Clear Request* when performing Circuit Mode testing. *State 1, Ready* is used when performing Packet Mode testing.

Similarly, *hot keys* and timers can be used to recover from the unknown state. If no recovery action is specified, you can only press *STOP*, to leave the simulator.

The Unknown State in the DCE Simulator is used in the same way. The exit route for the DCE Simulator is *State 19, DCE Clear Confirm* for Circuit Mode testing and *State 1, Ready* for Packet Mode testing.

Creating New States

The X.21 Application provides three standard State/Timer tables, **CCITTCKT** and **CCITTENH** for circuit–switched protocols and **CCITTPKT** for packet–switched protocols. In the course of your testing, you may want to add additional unique states to the tables. If you do want to keep the standard files provided, follow the steps below. If you want to alter those files, skip directly to step 4.

1. Copy the file, using either the C Shell or File Management.

2. Rename the file.

3. On the X.21 configuration menu, load the new state timer table.

4. In the DTE State/Timer Editor, enter a new State Number, if that state does not already exist, the State Table Editor will be cleared for entry of the new State information.

Notes:

- A non–blank State Name must be included in the state information to add, create or accept a new state. If the name is not included, the state data will be cleared but the state number will remain. These state numbers do not appear in the State List. No error is reported.

- Once a state is saved, by pressing *GO*, the state number cannot be changed.

When you are creating a new state,

- The State Table Editor limits the total number of states to 99. This allows for 62 states in addition to the CCITTCKT or CCITTENH standard states. The additional number of states varies depending on the CCITT Standard loaded.

- As States are added, they are either inserted in the first hole in the State List or appended to the end of the list. They are not listed sequentially. When you are using *PREV* and *NEXT* to edit fields within other states, the states will be listed in the order they are entered into the system, not sequentially.

Special Application of the GOTO Time—out

The GOTO Time—out can be seen as an immediate time—out, giving you the ability to immediately change to the specified Exit State any time the original state is entered. It can not, however, be used to jump to a different state each time it enters the original state.

An example of when this would be beneficial is using the DCE Simulator, when it is necessary to follow this state path:

    5, 6A, 7, 6A, 10A, 6A, 11, 12, 13

In this case, the 6A State table has to jump to State 7 in the first instance, State 10A in the second and State 11 in the third. The Cancel State can be used in the State 7 and 10A State Tables to redirect the next jump from State 6A.

Remember, when using a GOTO, the cancel field is used to modify the Exit field of the State it is transitioning to.

In the example shown above, the State Tables will include the GOTOs as shown in Table 18.3.

STATE PATH	SPECIFIED EXIT STATE (from GOTO)	GOTO CANCEL FIELD
5	6A	—
6A	7	—
7	6A	10A
10A	6A	11
11	12	—
12	13	—

Table 18.3: Special Application of the GOTO Function

With the State Table set up as shown, the Chameleon will then follow this state path:

- From State 5, the unit immediately jumps to the state indicated in the Exit State, State 6A.

- From State 6A, the unit immediately jumps to the state indicated in the Exit State, State 7. Note that this was not modified by a GOTO in the previous state, State 5.

- From State 7, the unit immediately jumps to State 6A as indicated in the Exit State. The GOTO Cancel Field instructs the Exit State, State 6A to modify its Exit State of 7 by replacing it with 10A.

- From State 6A, the unit jumps to State 10A as specified by the GOTO Cancel Field in the previous state, State 7.

- From State 10A, the unit immediately jumps to State 6A as indicated in the Exit State. The GOTO Cancel Field instructs the Exit State, State 6A to modify its Exit State of 7 by replacing it with 11.

- From State 6A, the unit jumps to State 11 as specified by the GOTO Cancel Field in the previous state, State 10A.

- From State 11, the unit jumps to State 12 as indicated in the Exit State.

- From State 12, the unit jumps to State 13 as indicated in the Exit State.

This method allows you to use the GOTO function to perform linear jumps through the desired State path.

The Timer Table Editor

The Timer Table Editor is entered from the State Table Editor screen by pressing *Timers* when the cursor is in a Time—out field. When the editor is called, a new window is opened and the cursor is positioned at the time—out function that was selected (pointed to by the cursor) on the State Table.

If there is no valid default file, the timers will be null and the screen fields will be blank except for the standard functions which are always provided, these are:

- Null Timer, provided at the top of the Timer column. This allows you to return to the State Editor without altering the Time—out function you called the timers from.

- Goto function, provided at the bottom of the Timer column. This is used in the State Table to provide an automatic transition to the next state. The function cannot be edited or created anywhere else. There is no field available for a value or comment.

- Key function, which allows the user to define keys that will be used to continue or alter execution. For example, when a specified state has been entered, execution will pause until the user—defined key is pressed. The scenario will then continue with the next state defined by the state tables.

The Timer Table Editor screen shown in Figure 18.9 is for DTE simulation, with circuit switched protocols. Refer to Appendix A for packet mode and DCE State / Timer tables .


```
                          DTE timer editor

    Timer    Value                    .  Description
   T1       3.0      St: Call request      2        Te:  Pro-to-sel 3
   T2       20.0     St: End-of-selection 5         Te:  7,10a,12,19
   T3A      6.0      St:                  7,10A      Te:  12,19
   T3B      60.0     St:                  7,10A      Te:  12,19
   T4A      2.0      St:                  9B,10C     Te:  19,6C,10C
   T4B      6.0      St:                  9,9C,10B   Te:  12,19,10B
   T5       2.0      St:                  16         Te:  21
   T6       2.0      St:                  20         Te:  21
   T7       .2       St:                  1          Te:  8

   Key X             State 16,    Clear request
   Key R             State 1,     Ready
   Key U             State 24,    DTE uncontrolled not ready
   Key C             State 2,     Call request
   Key N             State 14,    DTE controlled not ready


   Goto

      |      |      | Prev | Next |     |     |     |     | Exit |
```

Figure 18.9: DTE Timer Editor for CCITTCKT/ENH

The softkeys on either the DTE or DCE menus are defined as follows:

F4 Prev   Selects the previous valid option.   The key combination *Shift +* ↑ provides the same function.

F5 Next   Selects the next valid option. The key combination *Shift +* ↓ and the space bar provide the same function.

F10 Exit   Returns to the State Editor and enters the currently selected timer (selected by the cursor) into the time—out field that *Timers* was called from.

                For example, if the cursor is at the second time—out field and you press *Timers*, this time—out field will contain the timer or key that the cursor is pointing to when the Timer Editor is exited.

The fields on this editor are defined as follows:

Timer

This field names the timer, key, or goto function being defined. In this example, all of the timers begin with T. Any function not preceded by **Key** or **goto** is recognized as a timer. The **Key** definitions must begin with **Key** and the **goto** function is simply **goto**. The user defined names can be up to 5 characters in length. Leading zeros are not allowed.

Value

This field provides the timer expiration value in seconds. The time is a maximum of 5 digits (including decimal points). This field is not used when defining keys.

Description

This optional field gives you 53 characters to help identify the timer. It serves as a notepad for the user and has no affect on the timer.

State/Timer Table Example

This section will illustrate how to follow the State/Timer Tables in relation to the signalling sequence and state diagrams found in the CCITT Red Book, Annex A and B. This example will provide the detail of the Ready State, as shown in Figure 18.10, and continue to the State Editor for *Call Request*.

```
                          DTE state editor
State = 1        Name = Ready                              Trg = Off

Lead States     t = 1   c = Off   r = 1   l = Off    Press GO to Accept

Time-out = Key C  Exit state = 2    Cancel =
Time-out = Key N  Exit state = 14   Cancel =
Time-out = Key U  Exit state = 24   Cancel =
Time-out =        Exit state =      Cancel =

  t     c     r     l    State               Name
 01    Off    1    Off    14    DTE controlled not ready, DCE ready
  0    Off    1    Off    24    DTE uncontrolled not ready, DCE ready
  1    Off    0    Off    18    DTE ready, DCE not ready
  0    On     1    Off     2    Call request
  1    Off    0    Off     8    Incoming Call
              01   Off    --    DCE controlled not ready
  0    On     Bel  Off    15    Call collision

  1    Off    1    Off     1    Ready
                          ???   Unknown State

              Prev  Next        Save   Load   Print        Exit
```

Figure 18.10: DTE State Editor, State = *Ready*

State = Ready

The top portion of the Editor screen, the state, name and lead states, are used to define the State. For example, the Chameleon recognizes that it is in the Ready State any time the leads are in the states defined in the State Editor:

- $t = 1$
- $c = OFF$
- $r = 1$
- $i = OFF$

Triggering = OFF indicates that this state is not used as a trigger.

The Time–out section contains the keys that can be used to automatically or manually initiate a change of state. This state (*Ready*) does not use any timers or GOTOs to initiate a change of state. When in the *Ready* state, the available keystrokes are:

- **Key C***   Press *C* to initiate a *Call Request*. The machine will recognize the key and the leads immediately change to the specified Exit State, *State 2* or *Call Request*.

    *   Note that this key can be automatically controlled with the Auto Call key and Auto Call Time parameters on the setup menu. The timer used for automatic call request is not part of the State/Timer tables.

- **Key N**   Press *N* to initiate the state, *DTE controlled not ready, DCE ready*. The machine recognizes the key and the leads immediately change to the specified *Exit State, State 14*.

- **Key U**   Press *U* to initiate the state, *DTE uncontrolled not ready, DCE ready*. The leads will change to indicate the new state as specified in the Exit state, *State 24*.

Note that none of these Time–out parameters use the Cancel field. This will be discussed for the next state.

The bottom section, showing several state numbers, names and lead states, is used to define all acceptable state changes from the current state, *Ready*.

- Three of the eight states, States 2, 14 and 24, have already been defined as user initiated states. These are the three Exit States from the time–out keys defined above.

- The remaining states are changes that will be initiated by the device under test, in this case the DCE. If the lead states defined in this section are seen, the machine will change to the state specified. For *Ready*, the available incoming states changes are:

    - State 18:   DTE ready, DCE not ready
    - State 8:   Incoming Call
    - State 15:   Call Collision

- The last state shown on this and all State Editors is the Unknown State. Any time the leads are in a state not included in this list, the state will change to the Unknown State.

    The Unknown State, identified as **???**, must be defined within the State/Timer Tables to allow for unexpected lead changes.

If a *Call Request* has gone out, either automatically, using the Auto Call Time, or manually by pressing *C*, the machine will be in the *Call Request* state. The state editor for a second state can be displayed by the following steps:

1. Move the cursor to the State field.

2. Press *delete, Cancel* or *Ctrl X* to erase the presently displayed state number .

3. Enter the number of the state to be displayed, in this case **2**.

4. Press either **RETURN** or one of the arrow keys to search for and display the new state.

The Call Request State Editor is shown in Figure 18.11.

Figure 18.11: DTE State Editor, State = *Call Request*

State = Call Request

As with the previous State Editor, the state (*Call Request*) is defined by the State Number, Name and Lead States. The machine will always recognize the Call Request state when the leads are in these states.

- t = 0

- c = ON

- r = 1

- i = OFF

The Time—out section provides the timer (T1) that is started when a call request is issued, and the key that can be used to initiate a DTE Clear Request. A complete description of these functions follow.

- The timer T1 is setup on the Timer Editor Table as a 3 second timer which begins counting down when the *Call Request* is initiated.

  If the timer expires before any response is received (indicated by a change in the lead states), the Chameleon will initiate a change to the Exit State, *State 1* or *Ready*.

  The Cancel field is used in the *Call Request* State Editor to specify that the timer, T1, will be stopped if *State 3*, *Proceed–to–select*, is received.

- The second time—out function defined is a key function. The key **X**, which is defined in the Timer Editor as a *Clear Request*, can be used to terminate the *Call Request*. When *X* is pressed, the lead states change to initiate the specified Exit State, *State 16*.

The bottom section again defines all the valid transitions from the present *Call Request* state. These are as follows:

- The two states used with the timer, the Exit State, *State 1* and the Cancel state, *State 3*.

- State 15, *Call Collision*, which can be caused by both the DTE and the DCE.-

- States 16 and 19, *DTE clear request* and *DCE clear indication*, are valid transitions from all states except *Ready*. They should be on all State Editor Tables as either device can initiate a disconnect at any time.

- The Unknown State is provided on all State Tables except States 16 and 19 to allow the processing of unexpected states.

  On States 16 (DTE Clear Request) and 19 (DCE Clear Confirm) the other device may continue to process states after receiving the clear request. Under these conditions, the Chameleon must wait for one of the states shown as a valid transition.

For more information on the CCITT Standard State/Timer Tables, refer to Appendix A of this volume and the CCITT Red Book, Volume VIII, Fascicle VIII.3, *Data Communication Networks Interface*.

CHAPTER NINETEEN:
ASAI MONITORING

Introduction

The *Tekelec* ASAI Monitoring Application allows you to passively monitor ASAI data without affecting the network. By doing this, you can interpret captured traffic and troubleshoot the line. This section describes ASAI analysis by focusing on the protocol–specific details.

This chapter assumes that you know how to configure your Chameleon to monitor protocols over either port A, port B, or ports A and B. If you do not know how to do this, refer to the *Chameleon 32* or *Chameleon 20 User's Guide, Volume I.*

This ASAI monitoring function conforms to the AT&T Adjunct/Switch Application Interface specification 555–025–203, Issue 1.0, December, 1989.

Application Setup Menu

When you configure your Chameleon to monitor ASAI, the screen illustrated in Figure 19.1 displays the noted default parameters.

```
┌─O─────────────────────────────────────┌──────────────┐
│                                         │ Configurations│
│                                         └──────────────┘
│                 Port .. Monitoring
│                                          Press GO to Accept
│   Protocol :        ASAI ◄───
│
│   Link Layer        Q.921
│           Modulo              8
│           Extended  Addr      No
│           Encoding            NRZ
│
│
│
│
│
│
│
│  ┌─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┬─────┐
│  │ Yes │ No  │     │     │     │     │     │     │     │Exit │
│  └─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┴─────┘
```
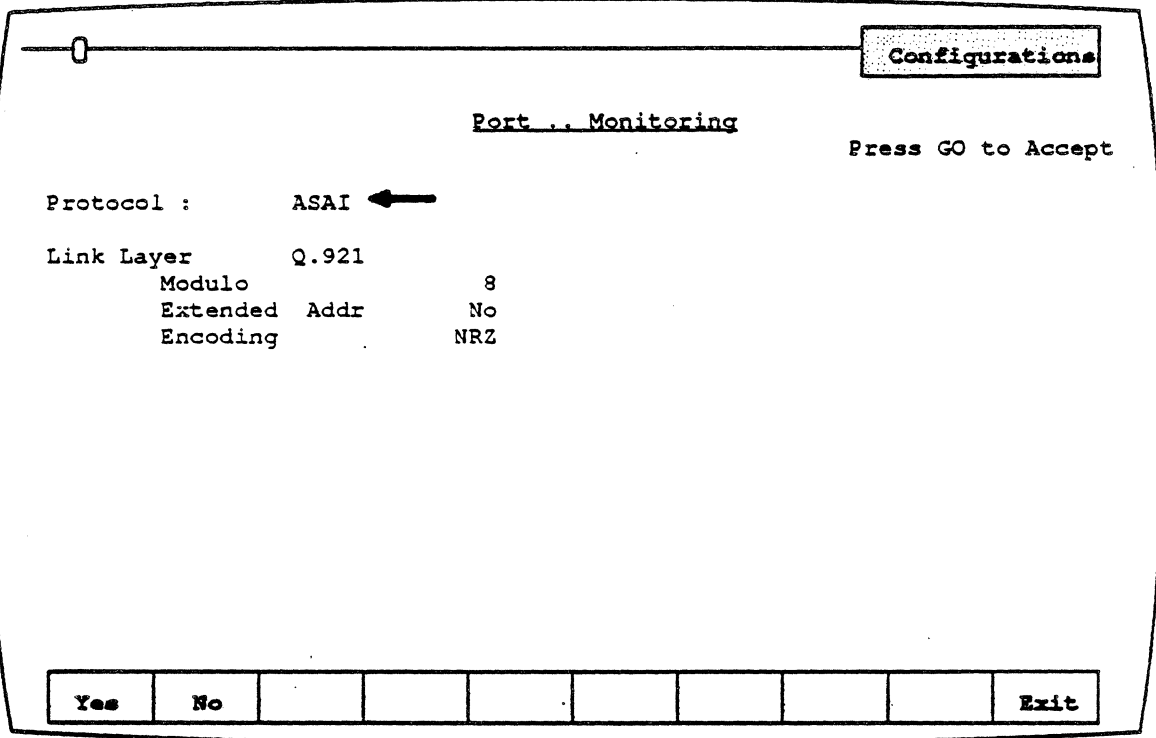
Figure 19.1: ASAI Setup Menu

Link Layer   -

The only link layer option is Q.921, which conforms to the CCITT Q.921 standard.

Modulo

Modulo determines the numbering sequence that will be used to keep track of the frames that are transmitted and received.

Important!   **This must be set to Mod128 for ASAI analysis. Modulo 8 is not supported.**

Extended Addressing

Extended Addressing determines whether 8–bit addressing or 16–bit (extended) addressing is being used. The options are:

Yes   Extended, 16–bit addressing.
No   8–bit addressing.

Important!   **Extended Addressing must be set to YES (16–bit addressing) for ASAI analysis. 8–bit addressing is not supported.**

Encoding

Encoding determines how the Chameleon interprets the electrical signal to distinguish between binary 1 and 0.

NRZ   Non–Return to Zero
          '1' = a high level
          '0' = a low level

NRZI   Non–Return to Zero Inverted
          '1' = no change in level
          '0' = a change in level.

Analysis

Analysis is displayed on two pages: **Real Time** and **History**. Both pages display the traffic in a split–screen format. Frames transmitted by the DCE are displayed on the left half of the screen; those transmitted by the DTE are displayed on the right half of the screen. The Real Time page displays traffic from both sides of the line as it is acquired. The data scrolls as traffic is acquired. History displays traffic that has been captured in a buffer. You can move back and forth through the traffic in the buffer to display specific parts of it.

The display format and function keys, as shown in Figure 19.2, are the same for both pages.

```
─────────────O───────────────────────────────────────┌──────────────┐
                                                      │  Real Time A │
      PD=08   UCC   Ref=0  01                         └──────────────┘
M 5A RELease   COMplete
A2   id:   returnResultLast  (ReturnResult)
03   len:  3 octets
   02   id:   invokeID  (INTEGER)
   01   len:   1 octets
   03
        val:  3
                              PORT A     456       C SAPI=  0 (CCP) TEI=   0
                                                   I     1   3       33
                                                     PD=08   UCC   Ref=D 81
                                          M 64 REGister
                                          I+96 Shift                Locking  Codeset=6
                                          I 1C Facility                      Len=26
                                             91 Service discriminator                 17
                                          A1   id:   invoke (Invoke)  (SEQUENCE)
                                          17   len:   23 octets
                                                02   id:   invokeID  (INTEGER)
                                                01   len:   1 octets
                                                14
                                                     val:  20
                                                02   id:   (OPERATION)  (INTEGER)
┌───────┬────────┬──────┬──────┬──────┬──────┬──┬────────┬──┬────────┐
│ ASCII+│ Number │ IUSL │ Q921+│ Q931+│ ASAI+│  │ Detaild│  │ User+  │
└───────┴────────┴──────┴──────┴──────┴──────┴──┴────────┴──┴────────┘
```

Figure 19.2: Real Time Page with Sample ASAI Traffic (in boldface)

Baud Rate Changes

The interpretation of a baud rate change event is displayed as:

New Baud Rate   16000

Colors

Colors distinguish the different protocol layers of the display. Figure 19.3 itemizes the data types displayed and their respective colors.

DATA TYPE	COLOR
ASAI	White
Q.921	Green
Q.931	Yellow/Blue
Message Type	Cyan
Event Error	Red

Figure 19.3: ASAI/ISDN Display Colors

Function Keys

The function keys control how, and whether, the traffic is interpreted and displayed. These functions are displayed on both the History and Real Time pages. The ASAI Analysis function keys are:

F1 Code

F1 determines the format of the user–data display. This is the data which does not belong to a protocol–specific format. Each time you press *F1*, the user data (in white) changes to the code indicated in the softkey strip. The options are:

ASCII	Each byte is displayed as an ASCII character. Characters in the range 0 – 1F hex are shown as single character mnemonics. Characters above 80 hex are shown as '.' (default).
EBCDIC	Each byte is displayed as an EBCDIC character.
HEXS	Each byte is displayed as a pair of hexadecimal digits, with a space between each pair.
HEX	Each byte is displayed as a pair of hex digits.

F2 Acquisition Information

F2 determines the acquisition information display format, which is displayed in green or white in the center of the screen, between the DCE and DTE sides. The options are:

Number	Event number in decimal (default)
Flags	Number of flags preceding the frame, in decimal
Time	Event time stamp at the end of the event, in the format hh:mm:ss ddd ddd. Displays hours, minutes, seconds, and microseconds (accurate to within 20 microseconds). **ddd ddd** is equivalent to .dddddd in decimal. For example, 999 999 = .999999 seconds.
dTime	Displays the elapsed time between events
CRC	CRC value in hex, and **OK** if CRC is good or **Bad** if CRC is bad
None	No acquisition information is displayed

The port receiving the packet (Port A or Port B) is displayed as part of the acquisition information unless **None** is selected.

F3 Event Type

F3 determines what types of events will be displayed on the Analysis page. *F3* affects the page display only. All events are captured, regardless of the *F3* selection. The options are:

I	Information frames only
IU	Information and Unnumbered frames only
IUS	Information, Unnumbered, and Supervisory frames (default)
IUSL	All frames, plus lead transitions

F4 Q921

F4 determines how Q.921 data is displayed. This data is displayed in green. The options are:

Q.921–	Q.921 is acquired but not displayed
Q.921+	Q.921 is displayed interpreted
Q.921"	Q.921 is displayed raw
Q.921*	Q.921 is displayed interpreted and raw

For analysis and interpretation of Q.921 data, see Chapter 10: ISDN Monitoring, page 10–10 through 10–12.

F5 Q931

F5 determines how Q.931 data is displayed. This data is displayed in cyan and yellow. *F5* selections take precedence over *F6*. Q.931 data must be displayed in order to display ASAI data. If the *F5* selection is Q.931–, then no ASAI data will be displayed regardless of the *F6* selection.

The options are:

Q.931–	Q.931 is acquired but not displayed
Q.931+	Q.931 is displayed interpreted
Q.931"	Q.931 is displayed raw (in yellow)
Q.931*	Q.931 is displayed interpreted and raw

For analysis and interpretation of Q.931 data, see Chapter 10: ISDN Monitoring, pages 10–13 through 10–20..

F6 ASAI

See page 19-9 for further details.

F8 Detail

F8 determines the level of detail of interpretation for Q.931. If Q.931 traffic is not being displayed (*F5* = Q931–) this key has no effect. Also, with Q.931 traffic displayed, Detail selections

2 through 6 have no effect. Both Detail options are displayed in cyan. The available options are:

Detail0   Detail0 displays any information elements which follow the ASAI interpretation. These elements can be one, or all, of the following:

- Protocol Discriminator value
- Protocol Discriminator mnemonic
- Call Reference value
- Caption
- Message Type Value
- Message Type Mnemonic

An example of *Detail0* interpretation is:

```
        PD=08 UCC Ref=0 01
    M 64 REGister
```

Detail1   This option displays the Information Element detail directly below the information described above. This interpretation is displayed in yellow and varies according to the type of Information Element included in the message. An example of *Detail1* interpretation is:

```
        PD=08 UCC Ref=0 01
    M 64 REGister
    I+96 Shift              Locking Codeset=6
    I 1C Facility                       Len=19
       91 Service discriminator             17
```

F10 User Data

F10 determines how, and if, user data is displayed. When user data is not present, shifting from *User+* to *User-* has no effect on displayed data. The options are:

User+   User data, if present, is displayed
User-   User data, if present, is not displayed
Raw   All traffic is displayed raw (uninterpreted) in the code selected with *F1*

ASAI
Interpretation

Figure 19.4 below shows a sample ASAI History page, where the ASAI data is in boldface type. The ASAI data, (in white on the Chameleon 32 monitor) begins below the Q.921 data, which is shown in yellow. The number of lines of ASAI data varies depending upon the complexity of the ASAI component. For a complete description of the various ASAI message structures, see AT&T ASAI Specification 555–025–203, Issue 1.0, December 1989.

```
┌──────0───────────────────────────────────────────────┌─────────┐
                                                        │History B│
                                                        └─────────┘

   I+96 Shift                 Locking Codeset=6
   I 1C Facility                       Len=34
      91 Service discriminator              1
   A2 id:                     returnResultLast(ReturnResult)
   1F len:                    31 octets
    02 id: invokeID (INTEGER)
    01 len: 1 octets
    01
      val:1
    30 id: (SEQUENCE)
    1A len:                   26 octets
     02 id: (INTEGER)
     01 len:                  1 octets
     B6
      val:182
     40 id: (q931_information_element)
     15 len: 21 octets



┌──────┬──────┬─────┬──────┬──────┬──────┬──┬───────┬──┬──────┐
│HEXS  │Number│IUS  │Q921+ │Q931+ │ASAI+ │  │Detail1│  │User+ │
└──────┴──────┴─────┴──────┴──────┴──────┴──┴───────┴──┴──────┘
```
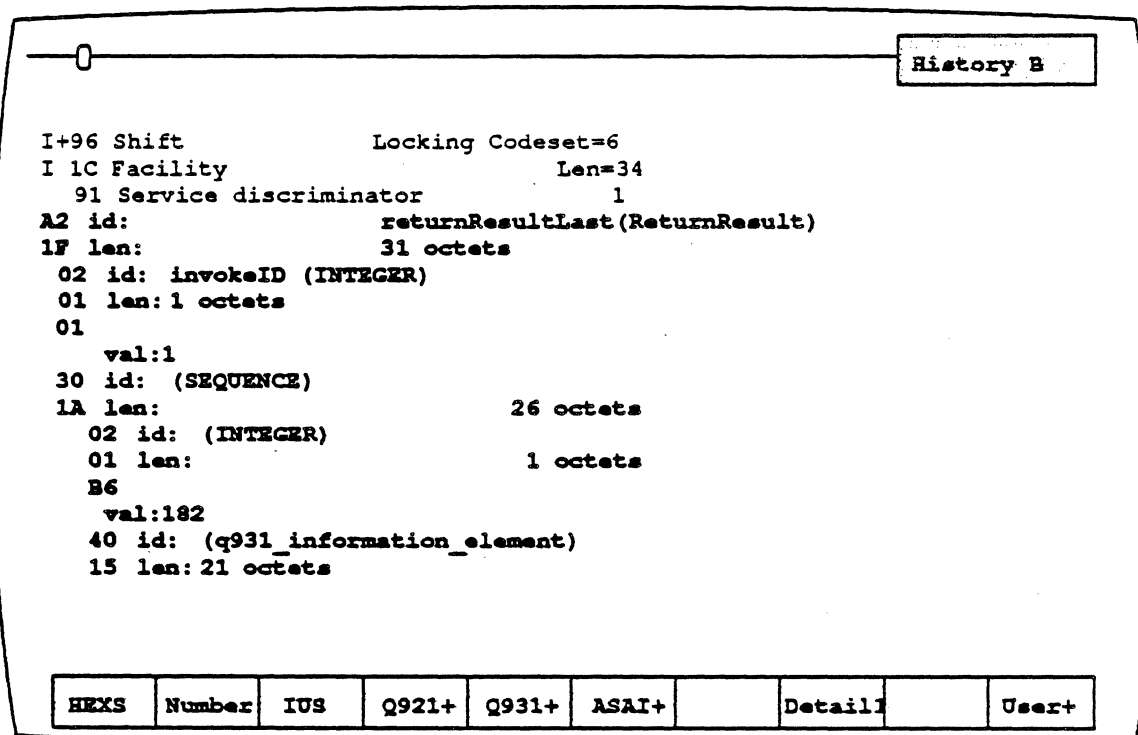
Figure 19.4: Sample ASAI Display

The *F6 ASAI* key controls the display of ASAI data using the following conventions:

ASAI –   ASAI is acquired but not displayed; no effect if ASAI is embedded in a Q.931 message.

ASAI+   ASAI is displayed interpreted

ASAI "   ASAI is displayed raw; no effect if ASAI is embedded in a Q.931 message.

ASAI *   ASAI is displayed both interpreted and raw

ASAI interpretation decodes the four components of Facility Information Elements (FIE). These four components are:

- Invoke
- Return result
- Return error
- Reject

Each FIE component further consists of three octet groups: a Tag, a Length, and a Contents. The Contents group can, in turn, consist of additional, embedded FIE components. The basic FIE component is called a 'Primitive'; FIE components having additional, embedded FIE components are called 'Constructors'. Figure 19.5 illustrates these two types and their structures.

PRIMITIVE   CONSTRUCTOR

TAG
LENGTH
CONTENTS

TAG
LENGTH
TAG
LENGTH
CONTENTS
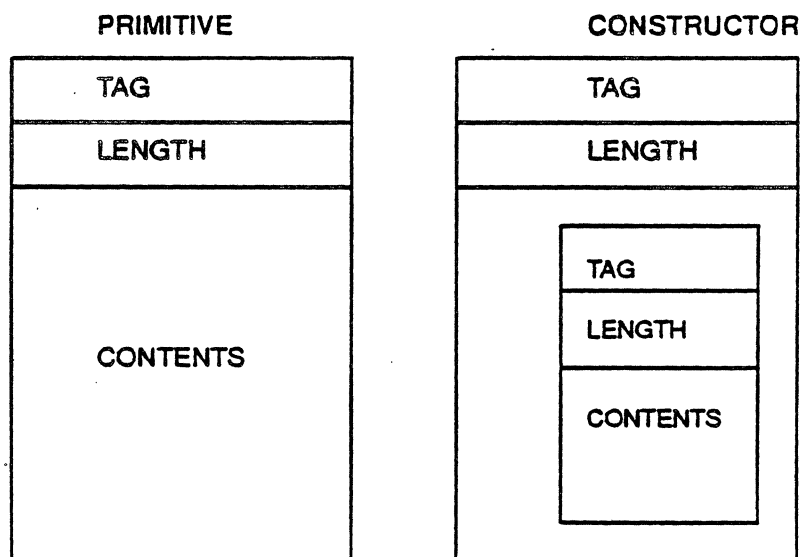
Figure 19.5: FIE Components and their Structures

The TAG group distinguishes data elements and governs the interpretation of the CONTENTS. LENGTH specifies the length in octets of the FIE component inclusive of the TAG and CONTENTS groups. This group cannot itself be more than two octets in length. The CONTENTS group contains a Component Type tag, Invoke ID tags, Invoke ID, Linked ID, Operations Value tag, Error Value tag, Error value, Problem tag and Problem, and Parameters. As a Constructor type, it may also contain additional Q.931 Information Elements.

Three of the four FIE components have mandatory and optional octet groups. These three, with their mandatory and optional groups, are:

Invoke Component

Mandatory	Optional
Component type tag & length	Linked id tag, length,
Invoke id tag, length, & id	& id
Operation/error value tag, length, & value.	Argument

Return result Component

Mandatory	Optional
Component type tag & length	Sequence tag &
Invoke id tag, length & id	length
Operation/error value tag, length, & value	Result

Return error Component

Mandatory	Optional
Component type tag & length	Parameter
Invoke id tag, length, & id	
Error value tag, length, & value.	

Table 19.1 lists the four categories of problems encountered in monitoring these three FIE components. Within each problem category there are subordinate component or byte structure problems. These are listed by type, with the octet structure and detailed description of each problem given in the parallel columns.

The one component having mandatory groups only is the

Reject Component

Component type tag & length
Invoke id tag, length & id
Problem value tag, length, & problem

The data of Mandatory groups is always displayed; data of Optional groups is displayed only when such data exists.

Figure 19.6 shows a sample of ASAI data when it is displayed in ASAI+ format. Indentation is used to indicate nested (recursive) components.

```
A2   id:   returnResultLast (ReturnResult)
1F   len:   31 octets
   02 id:   invokeID (INTEGER)
   01 len:   1 octets
   01
      val:1
   30 id:   (SEQUENCE)
   1A len:   26 octets
   02  id:    (INTEGER)
   01 ·len:   1 octets
   B6
         val: 182
   40 id:   (q931_information_element)
   15 len:   21 octets
```

Figure 19.6: Sample ASAI Interpretation

Each data element has three components, which appear in the following order:

- The Tag, which designates the data type and governs the interpretation of the Contents. This is shown in the format:

  xx   id: *description*

  xx = Identifier value in hex.
  id: (Identifier) points to the *description* of the identifier.

- Length displays in octets the length of the Contents component. 'Length' is shown in the format:

  xx   len: *y* octets

  xx = number of octets in hex.
  len: = Length.
  y = number of octets in decimal.

- Operation Value Tag, a 1–octet tag, and Operation Value. The Operation Value specifies the supplementary service application and operation being requested or replied to. This is shown in the format:

  val: *n*

  val = value field header

n = decimal equivalent of binary value assign—ed to one of 55 specific service applications. For example, '182' means 'third party take control'.

- The Contents is the substance of the data element and consists of one or more octets. As noted above, if there is one octet only in this component, the FIE displayed is a Primitive; if there are more than one octet, the FIE is a Constructor.

Triggering   Triggering on ASAI—specific data is not supported.

Table 19–1: Problem Codes Descriptions

PROBLEM CATEGORY & TYPE	OCTET STRUCTURE Bit Numbers: 7 6 5 4 3 2 1 0	DESCRIPTION OF PROBLEM
GENERAL PROBLEM	1 0 0 0 0 0 0 0	
Unrecognized component	0 0 0 0 0 0 0 0	The component type tag does not conform to one of the four following values: 1 0 1 0 0 0 0 1 1 0 1 0 0 0 1 0 1 0 1 0 0 0 1 1 1 0 1 0 0 1 0 0
Mistyped component	0 0 0 0 0 0 0 1	A mandatory part of the component structure is missing.
Badly structured component	0 0 0 0 0 0 1 0	The structure of the component does not conform to the standard notation and encoding as defined in Recommendations X.208 and X.209.
INVOKE PROBLEM	1 0 0 0 0 0 0 1	
Duplicate invocation	0 0 0 0 0 0 0 0	The Invoke_id in an *invoke* component is already active.
Unrecognized operation	0 0 0 0 0 0 0 1	The operation/error value does not conform to any of the 55 valid values for that structure.
Mistyped argument	0 0 0 0 0 0 1 0	The form of the argument does not conform to the permissible Information Element Identifier coding conventions.
Resource limitation	0 0 0 0 0 0 1 1	The performing client or server cannot do the invoked operation due to resource limitations.

Table 19–1: Problem Codes Descriptions

PROBLEM CATEGORY & TYPE (cont'd)	OCTET STRUCTURE (cont'd)	DESCRIPTION OF PROBLEM (cont'd)
INVOKE PROBLEM (cont'd)		
Linked response unexpected	0 0 0 0 0 1 1 0	A linked invoke_id was received, but not expected.
Unexpected child operation	0 0 0 0 0 1 1 1	The invoked operation is not one that can be linked to the operation identified by linked invoke_id.
RETURN RESULT PROBLEM	1 0 0 0 0 0 1 0	
Unrecognized invocation	0 0 0 0 0 0 0 0	No operation with the specified invoke identifier is in progress; there is no such operation in progress. The invoke_id in a *return result* component is not active.
Result response unexpected	0 0 0 0 0 0 0 1	The invoked operation does not report a result; the invoke_id in a *return result* is not expected.
Mistyped result	0 0 0 0 0 0 1 0	The *result* argument does not conform to the permissible Information Element Identifier coding conventions; the type of *result* parameter supplied is not of the type agreed upon by the client and the server.
RETURN ERROR PROBLEM	1 0 0 0 0 0 1 1	
Unrecognized invocation	0 0 0 0 0 0 0 0	No operation with the specified invoke identifier is in progress.
Error response unexpected	0 0 0 0 0 0 0 1	The invoked operation does not report failure.

Table 19–1: Problem Codes Descriptions

PROBLEM CATEGORY & TYPE (cont'd)	OCTET STRUCTURE (cont'd)	DESCRIPTION OF PROBLEM (cont'd)
RETURN ERROR PROBLEM (cont'd)		
Unrecognized error	0 0 0 0 0 0 1 0	The reported error is not one of those agreed upon by the client and the server; the error value is not recognized.
Unexpected error	0 0 0 0 0 0 1 1	The reported error is not one that the invoked operation may report; the error value is recognized, but is not expected for the operation identified by invoke_id.
Mistyped parameter	0 0 0 0 0 1 0 0	The type of error parameter supplied is not of a type agreed upon by the client and the server.

CHAPTER TWENTY:
2B1Q U-Interface

Introduction

The 2B1Q U-Interface Simulation software for the Chameleon 32 and Chameleon 20 provides all the tools and functions you need for LT/NT simulation. The software meets all pertinent Layer 1 parameters as listed in ANSI T1.601–1988. At the physical interface level, all bit–oriented protocols (X.25, ISDN, etc.) are supported. You can also insert voice–frequency signals into a selected U–Interface channel, or extract such signals from that channel (A handset is provide for this purpose). The other capabilities supported by this software are listed below.

Level 1 Capabilities:

- Framing/synchronization detection

- Network activation/deactivation control

- Power generation for the S/T interface

- External and internal clocking in the LT mode

- User–accessible External Frame Sync. Output capability in the NT mode.

Simulation Capabilities:

- Both NT and LT devices

- B–Channel simulation from the Idle Pattern Register, or Analog Signal Source or Handset

- D–Channel simulation from the Idle Pattern Register

- Simultaneous protocol analysis on ports A and B (each B or D Channel on the NT or LT interfaces can be routed to either Port A or Port B).

2B1Q Error Statistics Capabilities:

- Recording/reporting Errored Seconds and Severely Errored Seconds

- Far–End Block Error and Near–End Block Error detection and counting

- CRC Error insertion

M—Channel Capabilities:

- Simulation of NT and LT M—channel contents

- Simulation and detection of all other M—Channel bits, including reserved bits.

- The capacity to simulate and recognize all Embedded Operations Channel (EOC) messages in accordance with ANSI T1.601—1988

- Split—screen display of data traffic in both directions

- Full and summary display modes

Additional Capabilities:

- User—controlled 'Full Reset' of the transceivers

- Self—testing capabilities.

- System operation status indicators.

U—Interface 2B1Q Overview

The U Interface employs a distinct line code called '2B1Q', defined by ANSI Specification T1.601—1988. 2B1Q stands for 'Two Binary, One Quaternary'. The 'Quaternary' portion refers to the four signal voltage levels defined for the U—Interface line code: +5/6v, +2.5v, —5/6v, and —2.5v. Each of these voltage levels is assigned a quaternary symbol of 1, 3, —1, or —3, respectively. Furthermore, each signal level represents 2 bits of information (the 'Two Binary' portion of 2B1Q). So, in actual transmission over a U interface, each time slot is occupied by 1 quaternary symbol (i.e., one voltage level) representing 2 bits of information.

The bit stream on the U Interface is formatted into 240 bit frames. Each of these frames contains a 9—bit Synchronization Word, 2B+D information, and 6 'M' bits. Eight of these 240—bit frames comprise one superframe. The eight 6—bit 'M' fields comprise the 48—bit M channel of a superframe.

The M channel has three major functions: Error monitoring, line operations and maintenance, and network (LT)—to—terminal (NT) testing operations.

- In error monitoring, 12 CRC bits are used. These 12 bits are the M5/M6 bits. See page 20-29 through 20-36.

- In line operations and maintenance, overhead bits M4, M5 and M6 are used. See pages 20-28 and 20-29.

- In LT—to—NT testing operations, the network sends a message to the terminal to initiate specific testing operations. See page 20-30.

U Interface
I/O Module

The U Interface I/O module is shown in Figure 1.1. The features of this module are described below and on the following pages.

ISDN PHYSICAL INTERFACE
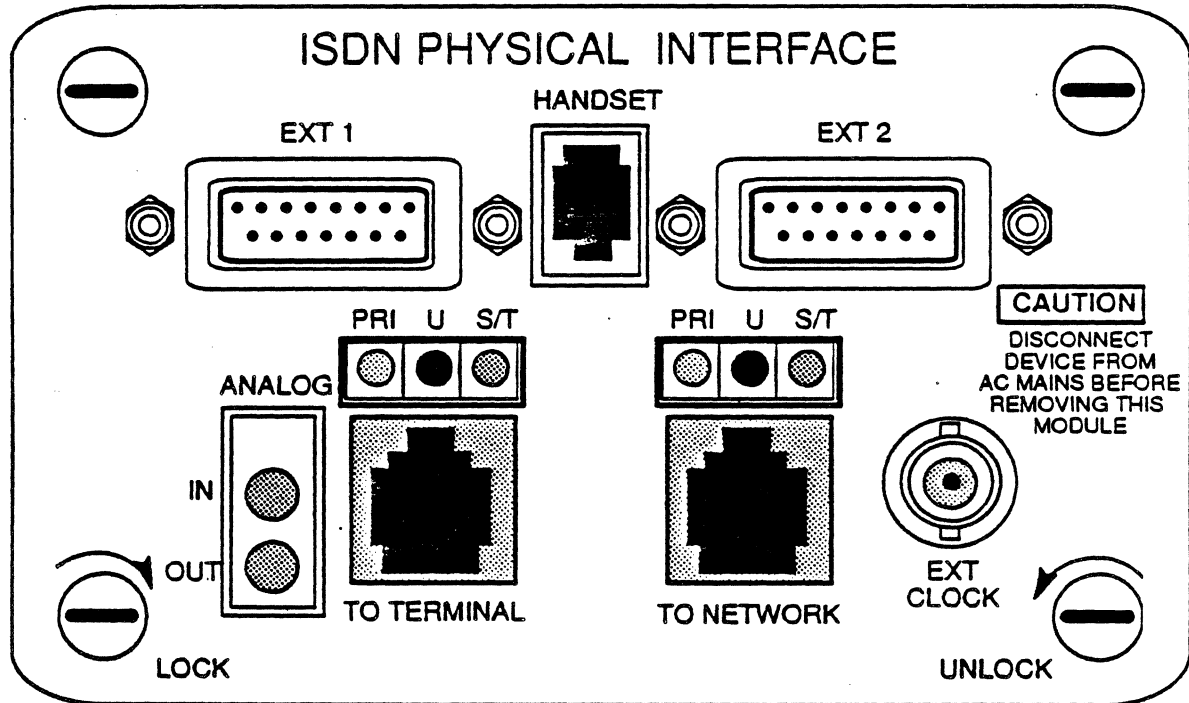
Figure 1.1: The U–Interface Module

FEATURE	DESCRIPTION
EXT 1	A 15–pin connector to connect the U–Interface (16 kbps) to another test set or device. This connector can be configured to function as a B1–, B2– or D–Channel interface for either LT or NT simulation. In simulation, it functions as a bidirectional interface; in monitoring, it functions as an output interface.
HANDSET	A standard modular handset connector. This connector is bi–directional in network or terminal configurations, but functions an output interface only when in a monitoring configuration.

EXT 2 (See the description for EXT 1 above.)

EXT. CLOCK An 8–kHz clock for frame synchronization. You must use it when you have selected *Ext.* for the clock in the 2B1Q Setup Menu (See Figure 20.4 and page 20-10). In all other cases, its use is optional.

TO NETWORK An RJ45 connector having two applications:

- In LT Simulation, to connect your Chameleon to a network interface

- In monitoring, to function as an input/output port for the bit stream being monitored. (In this case, the TO TERMINAL connector provides the other input/output port.)

In either application, this connector can only be configured as an LT.

The RJ45 connector has a limited life and is rated for 750 insertions. This is a limitation of the type of connector. If the number of insertions exceeds this limit, the received and transmitted bit stream may be corrupted. If this problem occurs, return the module to Tekelec for service.

PRI U S/T Yellow, red and green LEDs that indicate the type of interface in use for the bit stream being carried over the TO TERMINAL or TO NETWORK lines. Yellow designates the Primary Rate Interface; red designates the U–Interface; and, green designates the S/T interface.

WARNING

Do not use this module for PRI or BRI (S/T) applications. This design is in anticipation of future design changes to Tekelec hardware and software, but is not compatible with current PRI and BRI software.

TO TERMINAL An RJ45 connector having the two applications described above for the TO NETWORK connector. However, in a monitoring configuration the TO NETWORK connector functions as the second input/output port. In either the simulation or monitoring application, this connector can only be configured as an NT.

ANALOG IN

A connector for attaching a device generating analog input in either the B1 or B2 channels and having an impedance of 600Ω. Such a device may be a phone handset, microphone, or any other device meeting the impedance requirement and having the appropriate connector.

ANALOG OUT

A connector for attaching a device generating analog output in either the B1 or B2 channels and having an impedance of 600Ω. Such a device may be a phone handset, earphones, or any other device meeting the impedance requirement and having the appropriate connector.

U Interface
LED Overlay

The U–Interface LED overlay is described in detail in Appendix E of the *Chameleon 32 User's Manual*, and Appendix D of the *Chameleon 20 User's Manual*.

U Interface Configuration

When the U—I/F Simulation package is installed and the Chameleon turned on, the Chameleon detects the presence of the U—Interface and includes U—Interface configuration options in the Chameleon configuration menus. The following procedure assumes that you have installed the U—Interface module and software and have turned your Chameleon on. All accompanying illustrations represent the Chameleon 32 display.

Steps 1 through 14 of the procedure for configuring U—Interface simulation require that you set parameters in the following system Configuration screens:

- Setup Mode

- Port A/B Simulation (the actual port to which this screen applies will depend upon the port you are presently configuring in the Setup Mode screen)

- 2B1Q Setup Menu

- BOP Protocol Setup (X.25, ISDN, etc.)

- Applications Selection Menu

After you have configured the system and have the 2B1Q Simulation page displayed (step 15), you are ready to configure the NT or LT U transceivers. You do this while simulation is in progress. Any changes are reported immediately in the Status window at the bottom of the 2B1Q Simulation page (see Figure 1.6, page 20-18). The effect(s) these changes have on sent/received traffic is displayed in the 2B1Q Analysis page. Any effect(s) the changes have on the link are reported immediately in the 2B1Q Statistics page.

Figure 1.2 shows the settings you must enter for 2B1Q simulation. This figure shows the settings for Port A only. However, if you are also using Port B, the settings for that port will be the same as for Port A. (You may, of course, use Port B alone.)

Figure 1.2: The Setup Mode Screen – Port A configured for 2B1Q Simulation

To set the parameters for 2B1Q simulation:

1.   Select Mode of Operation and press *F2* to enter *Simulate*.

2.   Select Physical Interface and enter *2B1Q*.

3.   Press *F7 Physicl* to display the 2B1Q Setup Menu (see page 20-10, Figure 1.4). This menu enables you to configure the U Interface and is described in detail on page 20-10. The *Device* setting that you enter here may be overridden by the selection you make later in the Configuration menu of the 2B1Q Simulation screen. See page 20-16 for further details.

4.   Configure the 2B1Q as required by your testing purpose(s).

5.   Press *Go* to accept the configuration and return to the main Configuration menu.

6.   Press *F6 Setup* to display the protocol configuration screen.

7.   Set the parameters as required.

8. Press *Go* to accept the settings and return to the Setup Mode screen.

9. Press *Go* again. The Applications Selection Menu appears (Figure 1.3).
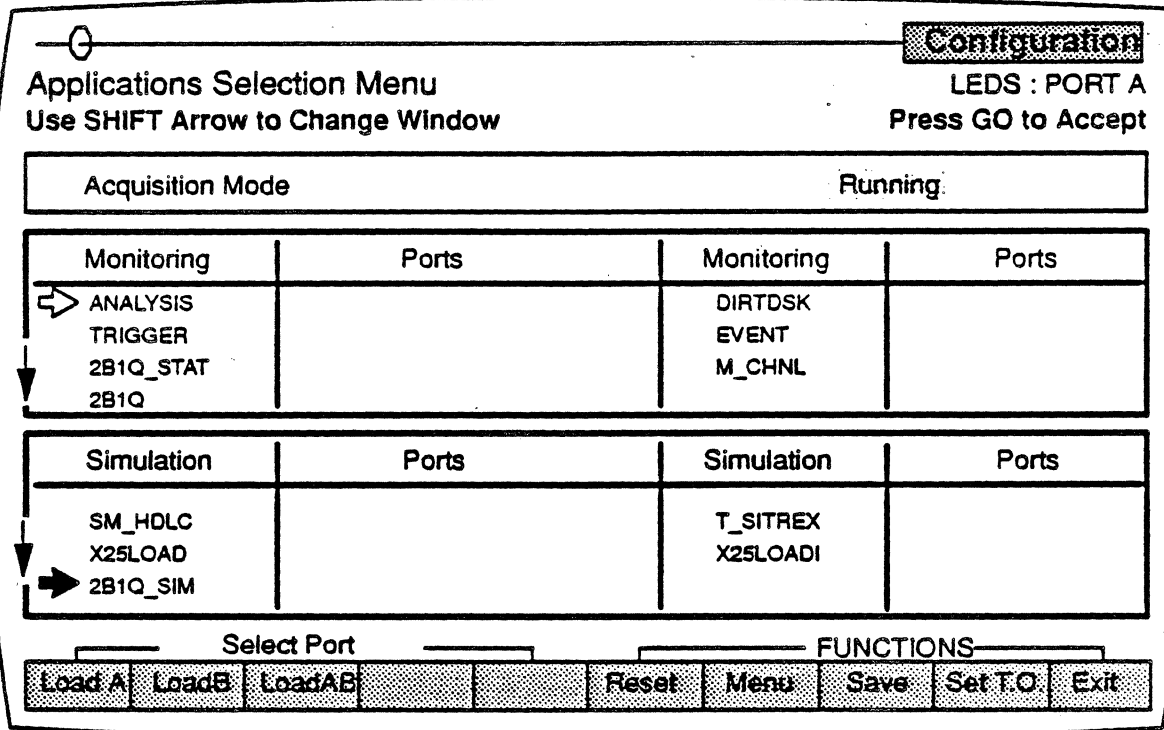
Figure 1.3: The Applications Selection Menu with 2B1Q Applications

Note: In step 11, if you want to display M–Channel analysis data and/or 2B1Q statistical data, you MUST have a 2B1Q link established. Loading M_CHNL alone results in the display of a blank page. You must then return to the Applications Selection Menu (step 10), load 2B1Q_SIM, and activate the 2B1Q link.

10. Move the arrow to *2B1Q_Sim*. (See Figure 1.3.)

11. Press *F1, F2,* or *F3* to load the application on the desired port. The port letter (A, B or AB) will blink next to the application name. When the letter stops blinking, the application is loaded. (It makes no difference for purposes of U–interface simulation whether you load applications on ports A, B, or AB.)

12. If desired, move the arrow to M_CHNL and/or 2B1Q_Stat and repeat step 12 to load each application.

13. Press *GO* to start the application(s). The *2B1Q Simulation* page banner appears at the bottom of the screen.

Note:

As a result of step 14, the M_CHNL and/or 2B1Q_Stat page banners will also appear if these applications were loaded in step 13. However, as these are read—only pages, the remaining steps address only the 2B1Q Simulation Configuration page. For detailed descriptions of the M_CHNL and 2B1Q_Stat pages, see pages 20-22 ff.

14. Bring the 2B1Q Simulation Configuration page into full view. (See page 20-16 for a full description of this page).

15. Proceed to implement 2B1Q simulation as follows:

    a.   In the Configuration menu, select the desired options. Your NT or LT selection here overrides the selection made in the Physical Setup screen. See pages 20-27 through 20-29 for further details.

    b.   In the Function menu, set the basic functions of the NT or LT device. If you are going to send messages, first bring up the 2B1Q link by selecting *Activate* and pressing *GO*. Then, select any other function(s) – except Deactivate. See pages 20-30 through 20-31 for further details.

    c.   In the Message menu, select the EOC, M4, or M5/M6 message. You cannot select and send more than one message at a time. See pages 20-32 through 20-36 for further details.

    d.   In the SEND menu, send the message built in step 15c. You can re—execute your SEND repeatedly. But, if you want to send different messages between SENDs, you must go back to the MESSAGES menu, select the desired message, return to the SEND menu, and execute the new SEND. See page 20-37 for further details.

16. To end simulation, press *ESC* twice; or, in the Configuration menu, select EXIT and press *Return*.

2B1Q Setup

When you press *F7 Physicl* in the Configuration Setup Mode screen, the 2B1Q Setup Menu (Figure 20.4) appears. Use this screen to assign the system—component functions described below.

When making assignments, the channel assignments for Ports A or B, the analog interface, and idle pattern destination MUST be mutually exclusive. If they are not, you will get the message *Duplicated Channel Assignment* when you try to implement the setup. For example:

If Port A =	B1 and
Analog Interface =	Handset, then;
Port B may be	B2, D, or off
Idle Pattern Destination may be	D, B2, or off.

If Port A =	B2 and
Analog Interface =	600 Ohm, then;
Port B may be	B1, D, or off
Idle Pattern Destination may be	D, B1, or off.
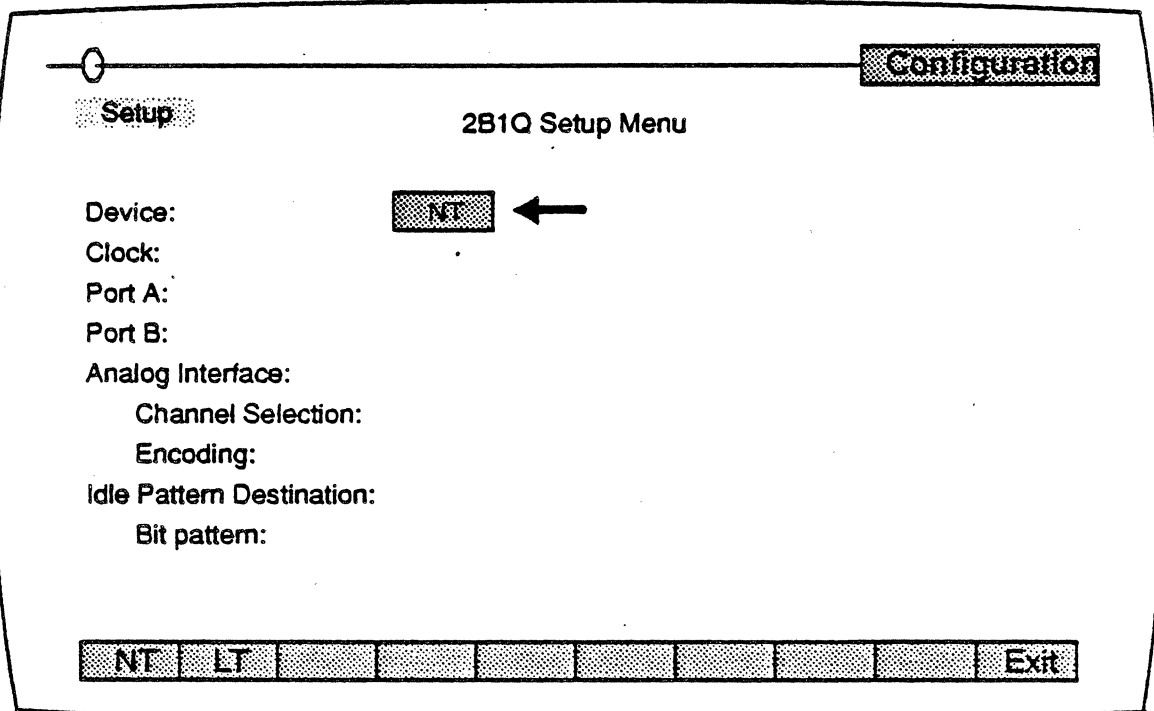
Figure 1.4: The 2B1Q Configuration Setup Menu

To configure the system for 2B1Q simulation:

1. In turn, move the arrow to each parameter and press the function key that corresponds to the desired setting for each parameter.

2. Select the desired Idle Pattern Destination.

3. Enter the desired bit pattern.

Device   Using either the *F1* or *F2* key, you set the Chameleon to function as either an NT or LT device.

Clock   Using the *F1* through *F3* keys, you set the clock to function in one of three modes:

- Ext. — The clock is derived from an external source.

- Int. — The clock is taken from the Chameleon 8—kHz internal oscillator.

- NT Rec. — Used in LT Simulations when the clocking for the LT is to be derived from the clock of an external NT source coming in over the NT port.

Port A   Using *F1* through *F4*, you set the port to route the selected channel data; or, you disable the port altogether.

Port B   Using *F1* through *F4*, you set the port to route the selected channel data; or, you disable the port altogether.

Analog Interface   Using *F1* or *F2*, you set the Chameleon to accept analog input over the B1 or B2 channel from either a standard handset or from a device having a 600—Ohm impedance. Use *F3* to turn this interface off.

This parameter has subordinate parameters for selecting the channel to be routed to the analog interface and the type of encoding to be employed.

- Channel Selection — allows you to route the B1 or B2 channel to the analog interface.

- Encoding — allows you to set the encoding to either A—Law or μ—Law.

Idle Pattern Destination   The three channel selections allow you to choose the channel to which you want the idle bit pattern entered in the next line sent. The fourth option — *Off* — allows you to turn bit—pattern transmission off.

Bit Pattern   An 8–bit field for keying in the desired idle
                                        pattern for the destination already selected.

RUN—TIME PAGES

When you load and run the 2B1Q, 2B1Q_SIM, M_CHNL, and/or 2B1Q_Stat applications from the Applications Selection menu, the following pages are displayed:

- For 2B1Q_SIM — the 2B1Q Simulation page containing the simulation menus. For further details, go to page 20-16.

- For 2B1Q — the 2B1Q run—time page for changing operational U—board settings while other 2B1Q applications are running. For further details, go to page 20-21.

- For M_CHNL — the M_CH RTime (Real Time) page and the M_CHNL (History) page. For further details, go to page 20-22.

- For 2B1Q_Stat — the 2B1Q Statistics page. For further details, go to page 20-24.

User Interface Conventions

Certain conventions are followed in assigning key functions and displaying menus and sub—menus in the 2B1Q Simulation Configuration page. These conventions are described below. In these descriptions, colors apply only to the displays of the Chameleon 32, not to those of the Chameleon 20, which uses a monochrome display. For F—key functions, see page 20-40.

Keyboard

The following keys are used to select and execute tests and perform other functions. In these descriptions, 'input box' refers to the following sub—menus:

- In the CONFIGURATION menu, the windows displaying the EOC, M4 and M5/6 control options. See page 20-27 for an illustration of these sub—menus and detailed discussions of the options.

- In the MESSAGES menu, the windows displaying the EOC, M4 and M5/6 messages bit values. See pages 20-32 through 20-36 for an illustration of these sub—menus and detailed discussions of the options.

→ ←   Use these arrow keys to:

- Select main menus by moving the cyan frame and magenta highlight from menu to menu, left–to–right or right–to–left.

- Close sub–menus and return you to corresponding main menus.

↓ ↑   Use these arrow keys to:

- Select first–level menu items and sub–menu items by moving the > and highlight (▨▨▨) or red arrow cursor (←) up and down within those menus.

   The > and the highlight indicate the sub–menu, message or operation selected for further action.

Esc   Two quick, consecutive 'Escapes' close the selected page and stop the 2B1Q Simulation application.

Return   Use this key to:

- Open sub–menu(s), if there are any.

- Implement a selected option; or, in an input box, acts as a ↓ (down arrow).

Go   Use this key to:

- Open sub–menu(s), if there are any.

- Implement a selected option.

Cancel   Use this key to:

- Close sub–menus and return you the the main menu without implementing any selected options or inputs.

Ctrl + D   In an input box, use this command to delete entries from the cursor position to the end of a field.

Space bar   In Configuration sub–menus, use this key to:

- Display the EOC, M4 or M5/6 control mode you want to implement; or,

- Display the M4 or M5/M6 message you want to build and send.

ASCII Numerics   Enter numeric values in the SEND times input box.

Display

The following colors are used for the display of main menus, sub–menus, and other items:

- Green for main menu headings and first–level items.

- Magenta for the main–menu highlight and sub–menu frames

- Yellow for sub–menu options and corresponding HELP messages.

- Cyan for main menu frames, and for options and numerical values in sub–menus.

- Red for the arrow cursor in the Configuration and Messages sub–menus.

2B1Q Simulation
Configuration Page

The 2B1Q Simulation Configuration page allows you to:

- Initiate the activation/deactivation process

- Set the U transceiver for:
  - 2B+D Loopback

  - B1 Loopback

  - B2 Loopback

  - Corrupted CRC

  - Normal operation

- Set a software reset of the U transceivers

- Clear the error counters

- Build and send M–channel messages.

A sample simulation page is shown in Figure 1.5. The Configuration menu and its options are shown in plain text since they are displayed by default upon opening the 2B1Q Simulation page. The other menus are shown in italics and with dash–line frames for illustrative purposes only.
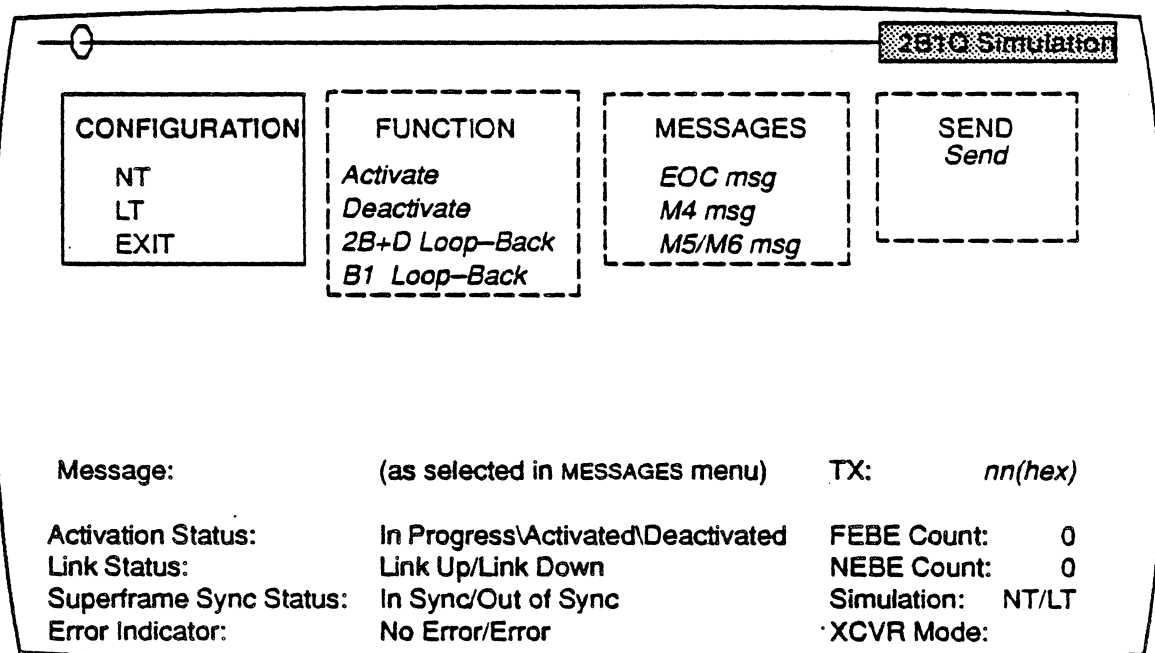
Figure 1.5: 2B1Q Simulation CONFIGURATION Screen

Except for the FUNCTION menu, the other three menus of this page have sub—menus. These open upon selecting any one of the options listed in an associated main menu. (This does not apply to the EXIT option in the CONFIGURATION main menu, however.)

Each main menu and the sub—menus associated with it is described in detail beginning on page 20-27. The Status window at the bottom of the screen is associated with all of the main menus and sub—menus, and is described below.

Status Window

In simulation, the current operating status of the transceiver is displayed in the Status window (Figure 1.6) at the bottom of the screen. The 10 items listed in this window are explained below.

Message:	(as selected in MESSAGES menu)	TX:	nnnn
Activation Status:	In Progress/Activated/Deactivated	FEBE Count:	0
Link Status:	Link Up/Link Down	NEBE Count:	0
Superframe Sync Status:	In Sync/Out of Sync	Simulation:	NT/LT
Error Indicator:	No Error/Error	XCVR mode:	(as configured)

Figure 1.6: The U—Transceiver Status Window

Message   Displays one of the following 10 messages from the MESSAGES menu:

> *Operate 2B+D Loopback*
> *Operate B1 Loopback*
> *Operate B2 Loopback*
> *Request Corrupted CRC*
> *Notify of Corrupted CRC*
> *Return to Normal*
> *Hold State*
> *Unable to comply*
> *M4 message*
> *M5/M6 message*

The message displayed here will change as your message selection in the MESSAGES main menu changes. Messages are not transmitted when selected. Transmission is a function of the SEND menu.

TX   Displays the hex value of the transmitted message. The value shown here does not change every time you change the message displayed on the Message line. Rather, it changes when that message is actually sent via the SEND menu.

Activation Status   Depending upon the status of the U transceiver at the time, displays one of three messages:

In Progress
> 2B1Q transceiver activation is occurring.

Activated
> Activation is successfully completed and transmission is in process. Upon displaying this status, Link Status displays *Link Up.*

Deactivated
> Either activation failed, or transmission is ended. Upon displaying this status, Link Status displays *Link Down.* Error Indicator changes to *Error* if deactivation occurred as a result of one of the three conditions for an Error message were met. (See the description for *Error* under Error Indicator below).

Link Status   Displays whether the link is up or down. *Link Down* appears when one of the following occurs:

- Receive framing is lost or severely in error, and remains lost or in error for 480 milliseconds.

- A hardware or software reset occurs. These resets may be of the following types:

  - Deactivate was selected in the FUNCTION menu

  - Reset XCVR was selected in the FUNCTION menu

  - The Chameleon RESET button was pressed.

  In LT Simulation, the Deactivate Reset bit is set.

- In NT Simulation, receive framing is lost after Deactivate Request is set, or the Verified DEA sets to one during the M4 control mode.

Superframe Sync Status   Displays whether the superframe is synchronized (in sync) or un—synchronized (out of sync).

Error Indicator   Displays *Error* or *No Error* under the following circumstances:

Error   When 1) loss of frame or signal occurs for 480 milliseconds or more, 2) there is a fialure to get an NT1 response to a TL signal;

or, 3) the 15—second activation timer expires.

No Error When 1) activation occurs before the 15—second Activation Timer expires; 2) a frame or signal is detected before 480 milliseconds expires; or, 3) there is a fialure to get an NT1 response to a TL signal.

FEBE Count

Displays the number of Near—End Block Errors(NEBEs) detected by the far end of the loop. This count is updated whenever the received superframe has a Far—End Block Error (FEBE) bit equal to 0. For a more detailed discussion of the FEBE count, see the paragraphs following NEBE count.

NEBE Count

Displays the number of Far—End Block Errors detected by the near end of the loop. This count is updated whenever the received superframe has a CRC error. For a more detailed discussion of the NEBE count, 'see the following paragraphs.

If the far end of the loop does not detect a CRC error, the far—end NEBE count is unaffected, and — for the next out—going superframe — the FEBE bit remains a 1. When the near end receives this superframe with the FEBE bit at 1, its FEBE count is not incremented.

If the far end detects a CRC error, it registers this change as a NEBE and increments the NEBE count. The next out—going superframe will have its FEBE bit set to 0, meaning that the CRC was corrupted en route to the far end. When the near end receives this superframe with the FEBE bit at 0, its FEBE count is incremented.

Simulation

Displays the mode in which the Chameleon is functioning as selected in the CONFIGURATION main menu.

XCVR Mode

Displays the way in which the U transceiver is currently operating as set in the FUNCTION menu. Not all of the options of that menu are displayed here. Only the following five selections are displayed:
Normal
2B+D Loopback
B1 Loopback
B2 Loopback
Corrupt CRC.

2B1Q Run—Time

When you load and run the 2B1Q application, a page with the banner *2B1Q* appears (see Figure 1.7). The format of this page is identical to that of the 2B1Q Setup Menu (Figure 1.4), but differs from that page in allowing you to modify the U—interface system configuration without stopping the simulation in progress. There are two other differences:

- *Running* appears in the upper—left corner of the page to show that the 2B1Q application is being executed

- The *F10 Exit* key is not available.
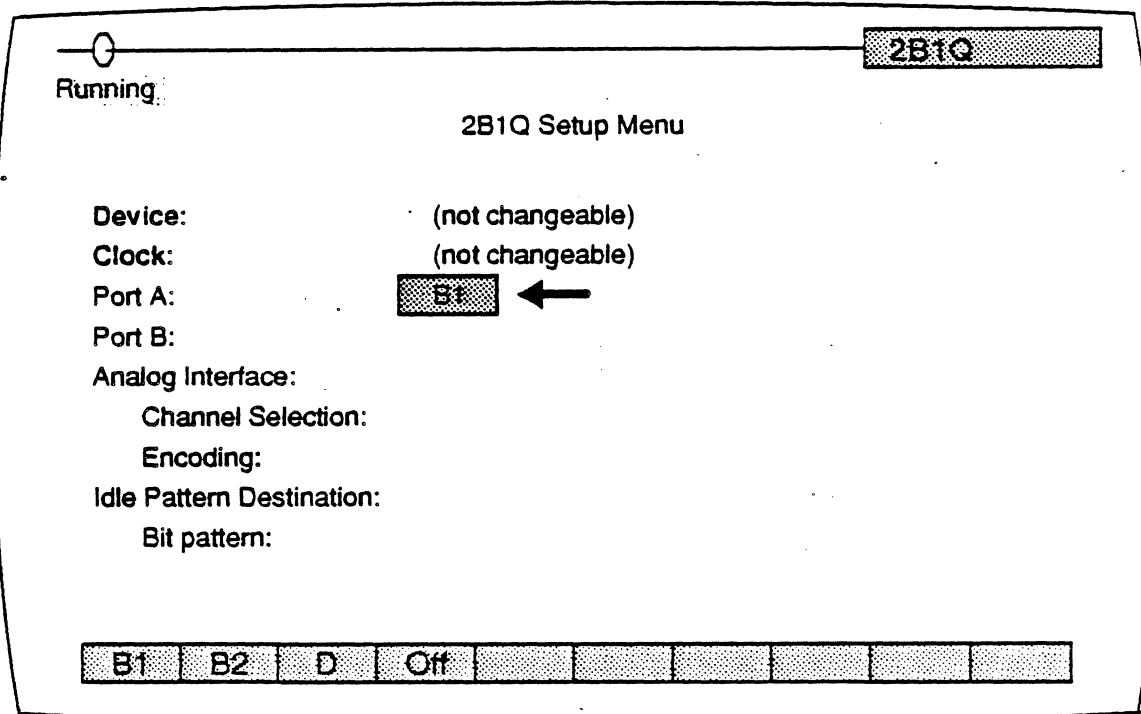
Figure 1.7: The 2B1Q Run—Time Page

You can change all but two system assignments. You cannot change *Device* and *Clock* assignments. The Chameleon 32 displays these two parameters in red; the Chameleon 20 displays them with highlights.

To change and implement an assignment:

1. Move the arrow to the desired system component.

2. Press the appropriate F—key.

3. Press *GO.*

M–Channel Analysis

The M–Channel Analysis application is loaded from the Applications Selection Menu. When this application is started (i.e. *GO* is pressed), a Real Time page (M_CH RTime) and History page (M_CHNL) are opened.

The Real Time page displays transmission events (Event–buffer traffic) between NT and LT as they occur. The History page displays previously–acquired data that has been placed in a history buffer. For more detailed explanations of these two functions, see Chapter Four: Analysis in the *Chameleon 32* or *Chameleon 20 User's Manuals*.

Decoding of the 2B1Q M–channel is done per superframe. Each LT superframe includes two EOC frames, ACT, DEA, UOA, AIB, FEBE, and four reserved bits; each NT superframe includes two EOC frames, ACT, PS1, PS2, NTM, CSO, SAI and two reserved bits for NT. The display of each superframe has the following attributes:

- Time Stamping:

  Event time stamp with an accuracy of ± 20 microseconds. Time stamps are displayed in the following format: *hh:mm:ss ddd ddd*, where:
  hh = hours
  mm = minutes
  ss = seconds
  ddd ddd = microseconds

- Screen Format:

  Split–screen format displays the NT data on the left half of the screen and the LT data on the right half of the screen.

- Colors:

  White = Time Stamp and Event buffer ports
  Yellow = Summary M–channel message
  Green = Detail M–channel message
  Red   = Error messages, warnings, advisories

- Function Keys:

  F1 – PHYS (Time stamp and the raw data)
  F2 – M_CH (M–Channel message)
  F9 – toggles Summary and Full Displays.
  F10 – Display Format

Figure 1.8 and Figure 1.9 below show sample M–Channel analysis pages in Summary and Full formats.

```
┌─────────────────────────────────────────────────────────────┐
│  ─O─────────────────────────────────────────▒M CHNL A▒       │
│                                                               │
│        LT MESSAGE                      NT MESSAGE             │
│        ──────────^  0  ^─────                                 │
│  PortA 02:58:37 677 000  fl=0  FCS=0000                       │
│  EOC Msg #1 : addr=0  dm=1  i=AA                              │
│  EOC Msg #2 : addr=0  dm=1  i=AA                              │
│  M4 bits = BC                                                 │
│   ACT DEA RSV RSV RSV RSV UOA AIB                             │
│    1   0   1   1   1   1   1   1                              │
│  M5/M6 bits = 0                                               │
│     M51  M61  M52  FEBE                                       │
│      0    0    0    0                                         │
│  ─────────────^ 1 ^───────     ─────────────^ 0 ^─────────    │
│                             PortA 02:58:37 677 357  fl=0  FCS=0000 │
│                             EOC Msg #1 : addr=0  dm=1  i=AA   │
│                             EOC Msg #2 : addr=0  dm=1  i=AA   │
│                             M4 bits = BC                      │
│                             ACT PS1 PS2 NTM CSO RSV SAI RSV   │
│                              1   0   1   1   1   1   1   1    │
│                             M5/M6 bits = 0                    │
│                                M51  M61  M52  FEBE            │
└─────────────────────────────────────────────────────────────┘
```
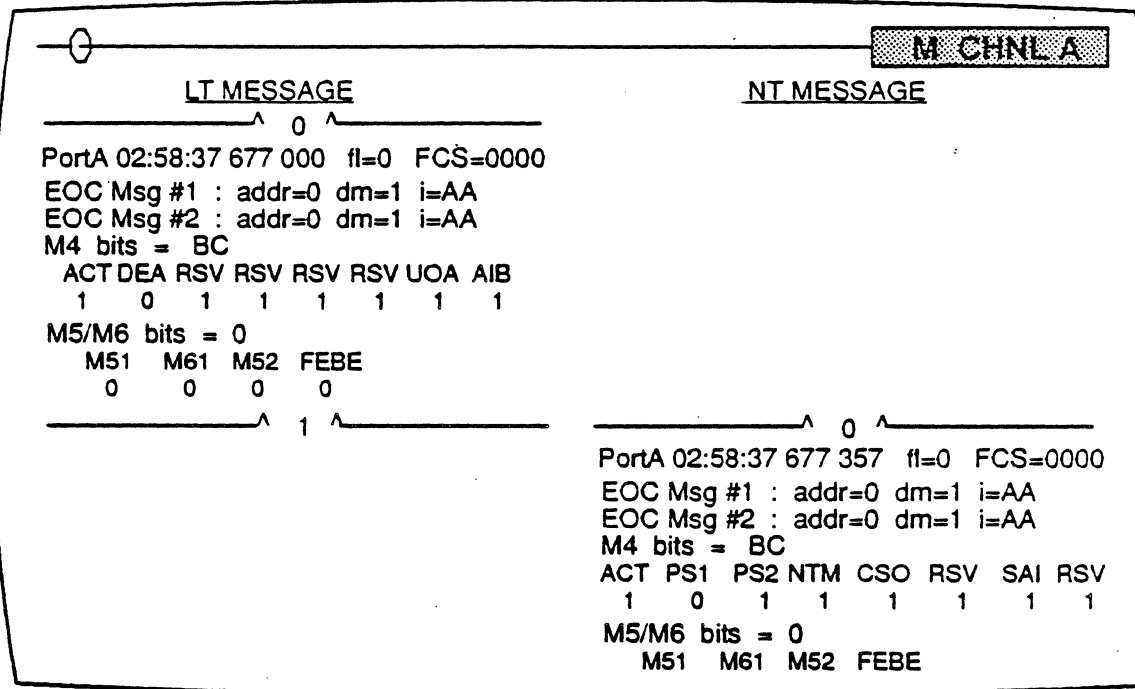
Figure 1.8: M—Channel Analysis Summary Display

```
┌─────────────────────────────────────────────────────────────┐
│  ─O─────────────────────────────────────────▒M CHNL A▒       │
│                                                               │
│     LT MESSAGE                      NT MESSAGE               │
│                             ──────────^ 0 ^─────              │
│                          PortA 02:58:37 677 357  fl=0  FCS=0000 │
│                          EOC Msg #1 : addr=0  dm=1  i=AA   .  │
│                             EOC address              NT      │
│                             EOC dm                   msg     │
│                             EOC i          Unable to Comply  │
│                          EOC Msg #2 : addr=0  dm=1  i=AA     │
│                             EOC address              NT      │
│                             EOC dm                   msg     │
│                             EOC i          Unable to Comply  │
│                          M4 bits = BC                        │
│                          ACT PS1 PS2 NTM CSO RSV SAI RSV     │
│                           1   0   1   1   1   1   1   1      │
│                             ACT        Activation in progress │
│                             DEA        No deactivation process │
│                             UOA               S/T activity  │
│                             AIB           no alarm indication │
│                          M5/M6 bits = 0                      │
│                             M51  M61  M52  FEBE              │
│                              0    0    0    0               │
│                             FEBE        Errored Superframe   │
│                          ─────────────^ 1 ^─────            │
└─────────────────────────────────────────────────────────────┘
```

Figure 1.9: M—Channel Analysis Full Display (NT Superframe only

2B1Q Line Error Statistics

The 2B1Q Line Error Statistics application is loaded from the Applications Selection Menu. When this application is started (i.e. *GO* is pressed), a 2B1Q Statistics page (Figure 1.10) is opened. All error statistics counters are started when this screen is opened.

The display of 2B1Q line error statistics conforms to the T1M1.2/89–028R1 standard. Each reported error is explained below.

```
 ┌──────────────────────────────────────────────────────────────────┐
 ├─O──────────────────────────────────────────────┤2B1Q Statistics├──┤
 │                                                                    │
 │   Start Time:        23 APR 1991 18 15 05                          │
 │   Last Sample Time: 24 APR 1991 07 38 55                           │
 │                                                                    │
 │              ES–NEBE   SES–NEBE   ES–FEBE   SES–FEBE        LUS     │
 │   Current Hour   421       16        2         0             0      │
 │   Previous Hour  632       23        4         0             0      │
 │   Current Day   5209      210       21         0             0      │
 │   Previous Day  4354      173       18         0             0      │
 │                                                                    │
 │              NEBE Count     FEBE Count    No Sync Count            │
 │   Current Hour:    526          2              0                   │
 │   Previous Hour:   778          4              0                   │
 │                                                                    │
 │   Most Recent Hours:  1      2      3      4      5      6      7   │
 │   ES–NEBE           688    683    655    708    664    758    786  │
 │   ES–FEBE             4      2      1      4      2      2      2   │
 │   FREEZE    RESET                                                  │
 └────────────────────────────────────────────────────────────────────┘
```
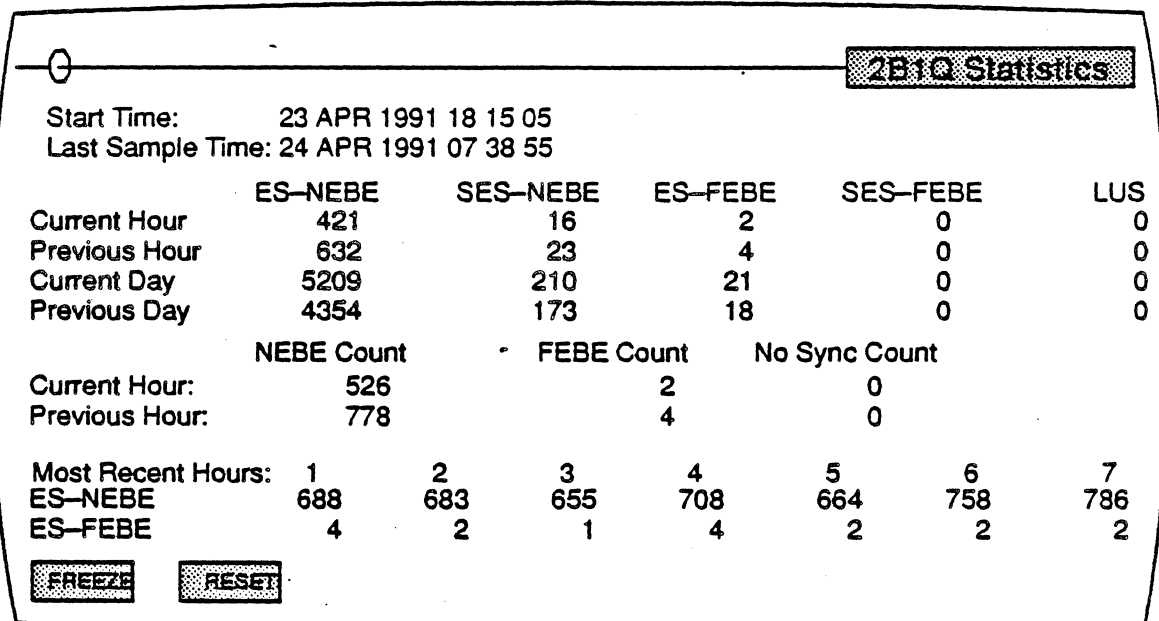
Figure 1.10: A Sample 2B1Q Line Error Statistics Page

Start Time	The date, month, year and time at which the 2B1Q Statistics screen was opened, or the RESET key was pressed.
Last Sample Time	The date, month, year and time at which the error statistics screen was last updated.
Current Hour/Day	The current hour or 24–hour day in which error counts have been or are being registered. When that 1 hour or day expires, the error count for that time is moved from the current–hour/day register to the previous–hour/day register and the current–hour/day register is set to zero. Old data in the previous–hour/day register is then discarded.

**Previous
Hour/Day**

The hour or 24–hour day prior to the Current Hour/Day in which error counts were registered. At the end of each hour or day, counts from the current–hour/day registers are transferred to the previous–hour/day registers, and old data in the previous–hour/day registers is moved to the first Most Recent Hours register. See *Most Recent Hours*.

**Most Recent
Hours**

A stack of seven, 1–hour registers tracks the ES–NEBE and ES–FEBE counts for the 7 hours prior to the Previous Hour. At the end of each hour, the ES count from the Previous Hour register is transferred to the first Most Recent Hours register and the values in the six successive registers are pushed down one register in the stack. Counts from the oldest hour (at the bottom of the stack) are discarded.

These 7 registers, along with the Previous Hour and Current Hour registers, constitute a total ES–NEBE and ES–FEBE reporting period of nine hours. Any Errored Second NEBE and/or FEBE data registered prior to a nine–hour period is discarded. This does not apply, however, to NEBE and FEBE counts.

ES–NEBE

Errored Second – Near–End Block Error. A second in which one or more Near–End CRC violations were detected by the far end.

SES–NEBE

Severely Errored Second – Near–End Block Error.
A second in which 3 or more Near–End CRC violations were detected.

ES–FEBE

Errored Second – Far–End Block Error. A second in which one or more Far–End CRC violations were detected.

SES–FEBE

Severely Errored Second – Far–End Block Error. A second in which 3 or more Far–End CRC violations were detected.

LUS

The *Link—Unavailable Second*. A second in which either synchronization or a signal was lost for more than 480 milliseconds. This count is updated whenever the 2B1Q link is not up at the time the screen is displayed.

**NEBE
Count**

The cumulative number of near—end CRC violations measured over the period of time reported in the Start Time and Last Sample Time lines.

**FEBE
Count**

The cumulative number of far—end CRC violations measured over the period of time reported in the Start Time and Last Sample Time lines.

NO—SYNC

The number of individual counts of *No Superframe Synchronization* indications.

**F1 FREEZE/
UNFREZ**

Toggles between two settings:

- **Freeze** halts the display of newly—acquired error counts at the time it is pressed, but does not stop the error count operation.

- **Unfreeze** cancels a Freeze action and updates the screen with the latest count values acquired while the screen was frozen.

F2 RESET

Resets all counters to zero and the Start Time to the current system time.

2B1Q Simulation
Menus

Each of the main menus of the 2B1Q Simulation screen is described in detail in the following pages. In practice, the Status window is displayed at the bottom of the screen even when the sub–menus of each main menu are opened. However, as the Status window is illustrated and explained above, it is not reproduced or dealt with further below.

The CONFIGURATION
Main Menu

The CONFIGURATION main menu (Figure 1.11) and its associated sub–menus allow you to designate your Chameleon as an NT or LT. The setting you choose here overrides the setting you may have entered in the Physical Setup screen. The sub–menu selections of this menu also allow you to set the U–transceiver control of EOC messages and M4 or M5/M6 bits.
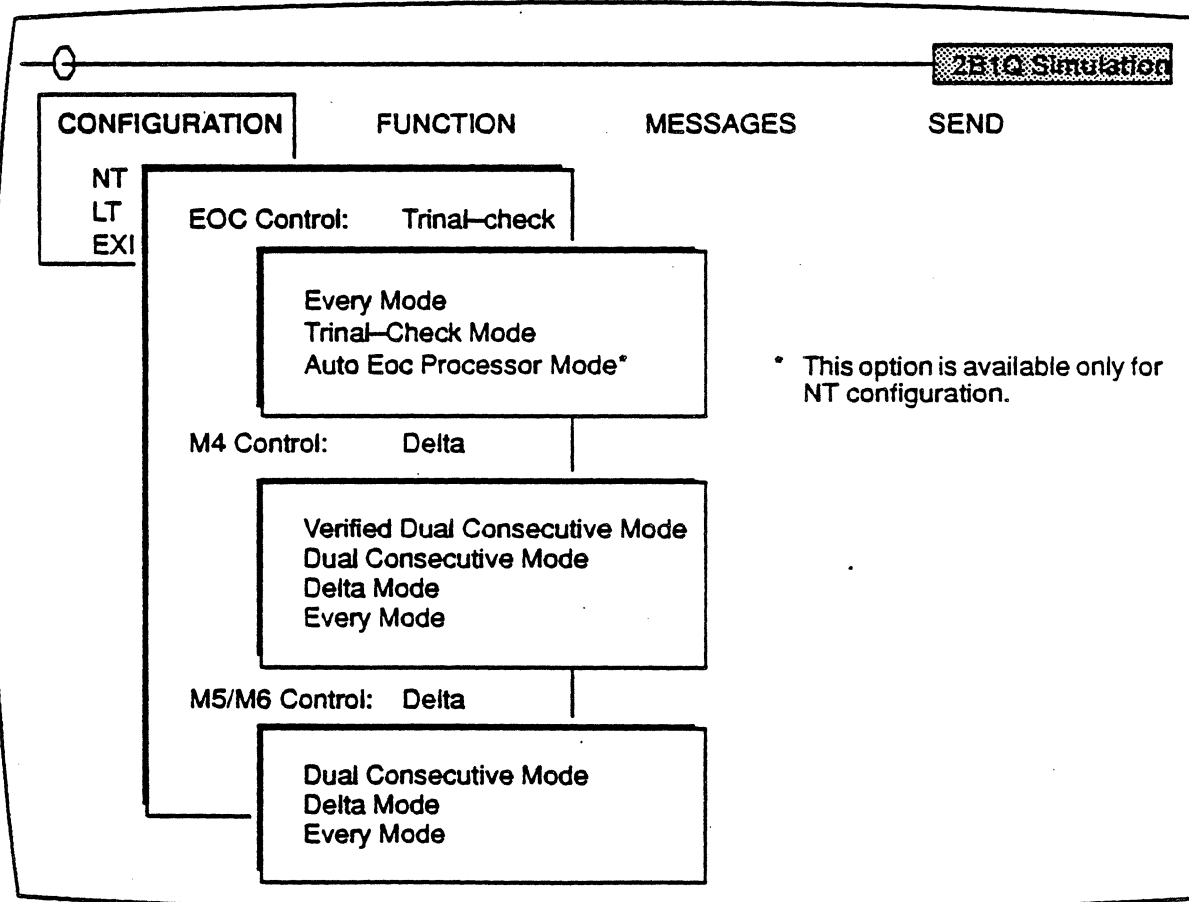
Figure 1.11: The 2B1Q Simulation CONFIGURATION Sub–Menus

**EOC
Control**   Determines how the U transceiver handles EOC messages. There are 3 options:

Every Mode

Each EOC message updates the EOC register of the U transceiver and is displayed in the M—channel analysis window.

Trinal Check Mode

This mode tests the ability of the NT/LT components to implement EOC functions as defined by ANSI. For further details, see May 1 1990 DRAFT ADDENDUM TO T1.601—1988.

In the LT configuration, the U transceiver sends a continuous stream of EOC messages to the NT until the latter responds with three consecutive EOC messages identical to that received from the U transceiver.

In the NT configuration, the U transceiver responds to LT EOC messages with three consecutive EOCs identical to that received from the LT. However, if the NT U transceiver does not support the function requested by the LT, it responds with three Unable—to—Comply messages.

Automatic EOC Processor Mode

This option, available for the NT configuration, enables the automatic EOC processor. This processor operates the EOC messages in accordance with ANSI T1.601—1988. M—channel messages generated by the Automatic EOC processor are not displayed in M—Channel Analysis. Whenever operating in this mode, the EOC trinal check is in effect.

**M4
Control**   Determines how the U transceiver handles the M4 bit. There are 4 options:

Dual Consecutive Mode

Changes in M4 data are displayed in the M_CHNL analysis page when an M4 bit has changed state and has remained in that state for two consecutive superframes.

Verified Dual Consecutive Mode
> In addition to enabling the M4 Dual Consecutive mode, this option also enables the Verified ACT and Verified DEA operations.

Delta Mode
> This option sets the U transceiver to compare M4 data from the previous superframe against the current, received M4 data. If there is a difference in at least one bit, the current M4 data will be displayed in the M_CHNL analysis window.

Every Mode
> This option determines that each received superframe of M4 data is displayed in the M_CHNL analysis page.

M5/M6 Control

Determines how the U transceiver handles the M5 and M6 bits. This control operates in the same manner as for M4 control, except that it applies to bits M50, M51, and M60. There are 3 options:

Dual Consecutive Mode
> See the description above for M4 Dual Consecutive Mode.

Delta Mode
> See the description above for M4 Delta Mode.

Every Mode
> See the description above for M4 Every Mode.

The FUNCTION
Main Menu

The FUNCTION main menu (Figure 1.12) lists the options for configuring the local U transceiver. (The local transceiver may be either an NT or LT, depending upon the selection you made in the Configuration menu.) Your FUNCTION selection dictates how the local transceiver operates. For example, if you have configured your Chameleon to function as an NT, and you then select *Activate* and *Corrupt CRC* from the FUNCTION menu, the Chameleon will simulate customer equipment bringing the link up and generating inverted CRCs in transmissions to the LT.

```
 ─O───────────────────────────────────────  2B1Q Simulation

 CONFIGURATION    FUNCTION        MESSAGES        SEND

                  Activate
                  Deactivate
                  2B+D Loop–back
                  B1 Loop–back
                  B2 Loop–back *
                  Corrupt CRC     *  The options in italics are
                  Return to Normal   brought into view by
                  Reset U–Transceiver pressing the ↓ key.
                  Clear Err Counters Press Shift ↓ to go direct-
                                     ly to the end of the menu.
                                     Press Shift ↑ to go directly
                                     to the beginning of the
                                     menu.
```
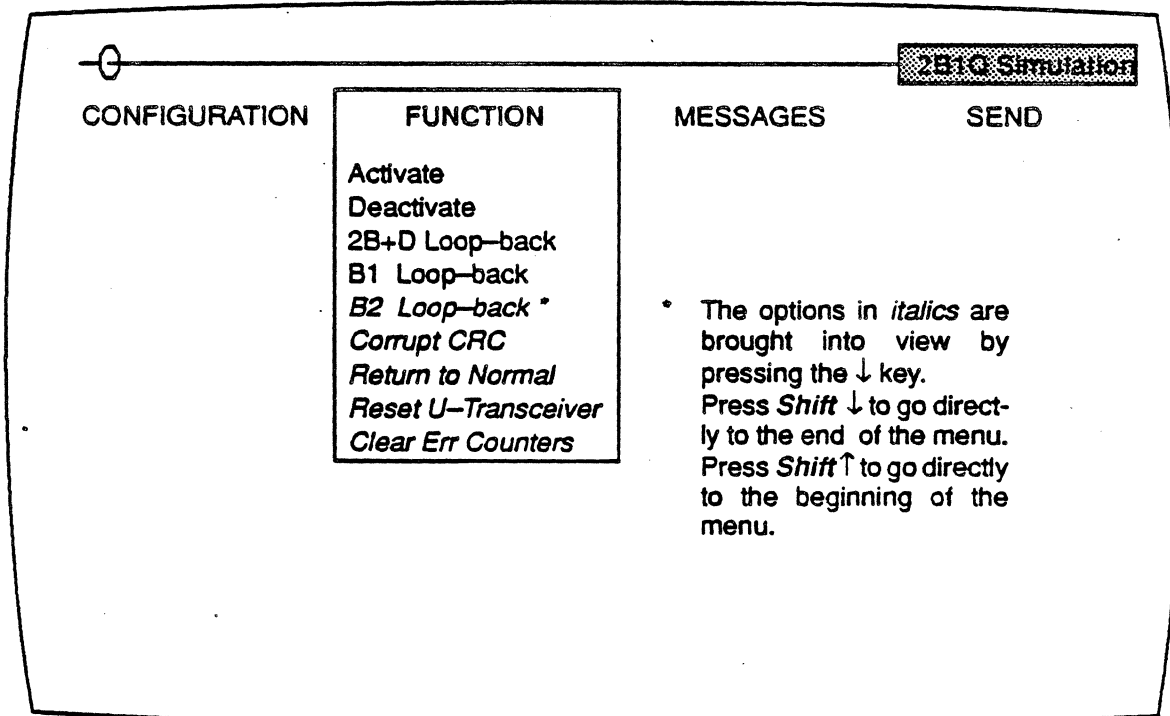
Figure 1.12: The Near–End Transceiver FUNCTION Menu

Activate   Activates the U transceiver to begin the start–up sequence and communicate readiness for Layer 2 communication.

Deactivate   Deactivates the U transceiver.

Note: For the three loopback options below, transmission between NT and LT is non–transparent. For a discussion of transparency, see the May 1 1990 DRAFT ADDENDUM TO T1.601–1988.

2B+D
Loop–back

Sets the device (as determined by the Configuration main menu selection) to loop the B1, B2, and D channels back to the U Interface.

B1
Loop–back

Sets the device (as determined by the Configuration main menu selection) to loop the B1 channel back to the U Interface.

B2
Loop–back

Sets the device (as determined by the Configuration main menu selection) to loop the B2 channel back to the U Interface.

Corrupt CRC

Sets the device to generate an inverted CRC.

Return to
Normal

Resets the EOC processor to its initial state and releases all outstanding EOC–controlled operations.

Reset
U–transceiver

Resets the U transceiver chip. After selecting and executing this function, you must reset all control modes in the Configuration sub–menus.

Clear
Err Counts

Clears the FEBE and NEBE counters of the U transceiver to zero (0).

The MESSAGE
Main Menu

In the MESSAGE main menu, you select the ANSI M—Channel message to be transmitted to the far—end device directing how that device is to function. Your selection in this menu dictates how the far end is to operate. There are separate message menus for NT and LT configurations (see Figure 1.13). Selecting *NT* in the Configuration menu results in the display of NT message options. Similarly, selecting *LT* in the Configuration menu results in the display of LT message options. The selected message is then displayed in the Status window.

All the EOC messages defined in ANSI specification T1.601—1988 are available for selection. For M4 and M5/M6 messages, a dialog box is opened in which you may change any value by positioning the cursor and pressing the Space Bar to toggle to the desired bit value. In Figure 20.13, the bit values for the NT and LT M4 and M5/M6 options are the default settings.

You cannot select and send more than one message at a time. After sending a message, you must — in order to send another, different one — exit the SEND menu, return to the MESSAGE menu, select the new message, return to the SEND menu, and execute a SEND for that message.

Note:

The EOC message in the data mode is not supported. Also, the EOC address field is set to NT node = 000. You cannot change it.

NT CONFIGURATION

Unable
to Comply   Select this message to confirm that the NT has received an EOC message that it cannot find in its menu.

Hold
State   Select this message to indicate to the LT that the NT has received an EOC frame with an improper address.

ACT   The ACTIVATE bit allows you to set the NT to initiate the start—up sequence and communicate its readiness for Layer 2 communication.

PS1/PS2   Because the settings for the POWER SUPPLY 1 and 2 function together, this description addresses both of these bits. PS1 is the first bit of the two—bit Power Supply field; PS2 is the second bit of this same field. The table below illustrates and explains the four possible bit combinations of this field.

NT Status	PS$_1$	PS$_2$	Definitions
All power normal	1	1	Primary and secondary power supplies are both normal.
Secondary power out	1	0	Primary power is normal. Secondary power is marginal, unavailable, or not provided.
Primary power out	0	1	Primary power is marginal or unavailable. Secondary power is normal.
Dying gasp	0	0	Both primary and secondary power are marginal or unavailable. The NT may soon cease normal operation.

NTM   Set the NT TEST MODE INDICATOR bit to 1 to simulate normal operation. Set it to 0 to simulate being in a customer–initiated test mode. When the NT is in the test mode (set to 0), the D channel, or either of the B channels are involved in a customer, locally–initiated maintenance operation. This setting stays constant until a change in the status of the NT occurs.

CSO   The COLD START ONLY bit is used to indicate the start–up capabilities of the NT transceiver. Set the bit to 1 to simulate a cold–start only. Set it to 0 to simulate another type of start.

RSV6   A reserved bit.

SAI   The S/T–INTERFACE ACTIVITY–INDICATOR bit indicates to the LT when there is activity at the S/T reference point (bit 238 in frame #7) transmitted by the NT. A value of 1 indicates that there is activity at that reference point. A value of 0 indicates that there is no such activity at that point.

RSVn   Two reserved bits.

FEBE   Set the FAR–END BLOCK ERROR bit to 0 if you want to indicate that you received a superframe having a corrupted CRC. When the far end receives this bit, it increments its FEBE counter. Leave this bit at 1 to indicate that you received a superframe not having a corrupted CRC. When the far end receives this bit, it does not increment its FEBE counter.

LT CONFIGURATION

**Operate 2B+D
Loopback**

Select this message to direct the NT to loop user–data bit streams back to the network while providing enough signal to allow the LT to maintain synchronization with the NT.

**Operate B1
Loopback**

Select this message to direct the NT to loop the B1 channel back to the network without completely disrupting service to the customer.

**Operate B2
Loopback**

Select this message to direct the NT to loop the B2 channel back to the network without completely disrupting service to the customer.

**Request
Corrupted CRC**

Select this message to request the NT to send corrupted CRCs to the network until such transmission is cancelled by *Return to Normal.*

**Notify of
Corrupted CRC**

Select this message to notify the NT that the network will send intentionally–corrupted CRCs until such transmission is cancelled by *Return to Normal.*

**Return
to Normal**

Select this message to release all outstanding EOC–controlled operations and reset the EOC processor to its initial state.

Hold State

Select this message to maintain the NT EOC processor and any active EOC–controlled operations in their present state.

ACT

The ACTIVATE bit allows you to set the LT to initiate the start–up sequence and communicate its readiness for Layer 2 communication.

DEA

The DEACTIVATE bit allows you to set the LT to communicate its intention to discontinue transmission to the NT.

RSVn

Four reserved bits.

UOA

The U INTERFACE ONLY ACTIVATION bit directs the LT to request the NT to activate or deactivate the S/T interface reference point. Set the bit to 1 to indicate activity at the reference point. Set it to 0 to indicate no activity at the reference point.

AIB

The ALARM INDICATION BIT directs the LT to send an Alarm Indication Bit to the NT to announce a loss of signal, loss of frame synchronization, or transmission terminal failure. Setting this bit to 1 cancels the alarm function; setting it to 0 enables it.

RSVnn

Three reserved bits.

FEBE

(See the explanation for NT Configuration FEBE on the preceding page).

O ———————————————————————————— 2B1Q Simulation

CONFIGURATION
*> NT

                                        MESSAGES

                                        EOC msg

                                        ┌─────────────────────────────┐
                                        │ Unable to Comply   │
                                        │ Hold State   │
                                        └─────────────────────────────┘

                                        M4 msg

*   The bit values shown for M4 and   ┌──────────────────────────────────────┐
    M5/M6 messages are the default   │ ACT: 0*   CSO: 0   │
    settings.   │ PS1:   1   RSV6:   1   │
                                         │ PS2:   1   SAI: 0   │
                                         │ NTM: 1   RSV8:   1   │
                                         │   │
                                         │ (HELP message displayed here)   │
                                         └──────────────────────────────────────┘

                                        M5/M6 msg

                                         ┌──────────────────────┐
                                         │ RSV51:   1   │
                                         │ RSV61:   1   │
                                         │ RSV52:   1   │
                                         │ FEBE: 1   │
                                         │ (HELP msg.)   │
                                         └──────────────────────┘

    *> LT

                                        EOC msg

                                         ┌──────────────────────────────┐
                                         │ Operate 2B+D Loopback   │
                                         │ Operate B1 Loopback   │
                                         │ Operate B2 Loopback   │
                                         │ Request Corrupted CRC   │
                                         │ Notify of Corrupted CRC   │
                                         │ Return to Normal   │
                                         │ Hold State   │
                                         └──────────────────────────────┘

                                        M4 msg

*   The bit values shown for M4 and   ┌──────────────────────────────────────┐
    M5/M6 messages are the default   │ ACT: 0*   RSV5:   1   │
    settings.   │ DEA: 1   RSV6:   1   │
                                          │ RSV3:   1   UOA: 0   │
                                          │ RSV4:   1   AIB: 1   │
                                          │   │
                                          │ (HELP message displayed here)   │
                                          └──────────────────────────────────────┘

                                        M5/M6 msg

                                          ┌──────────────────────┐
                                          │ RSV51:   1   │
                                          │ RSV61:   1   │
                                          │ RSV52:   1   │
                                          │ FEBE: 1   │
                                          │ (HELP msg.)   │
                                          └──────────────────────┘

Figure 1.13: The MESSAGES Menus for NT and LT Configurations

The SEND
Main Menu

Use this menu (Figure 1.14) to send the message selected in the MESSAGE menu.

You cannot send more than one message at a time. To send different messages, you must exit the SEND menu, return to the MESSAGE menu, select a new message, return to the SEND menu, and execute a SEND for that message.
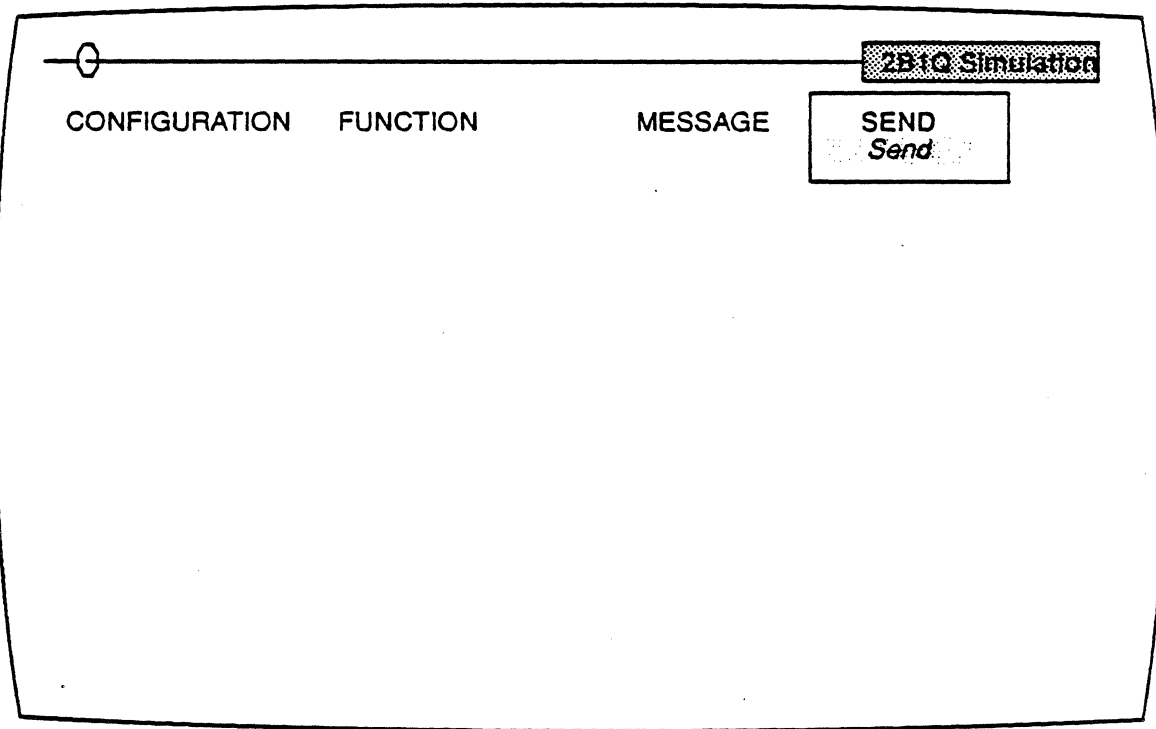
Figure 1.14: The U—Transceiver Message SEND Menu and Dialog Box

Send   This is the default selection for this menu. Press **Return** to send the message built in the MESSAGE menu.

·U–Interface Applications

Figure 1.15 and Figure 1.16 below illustrate the monitoring and simulation applications of *TEKELEC'S* Chameleon 32 using the ISDN 2B1Q U–INTERFACE software.
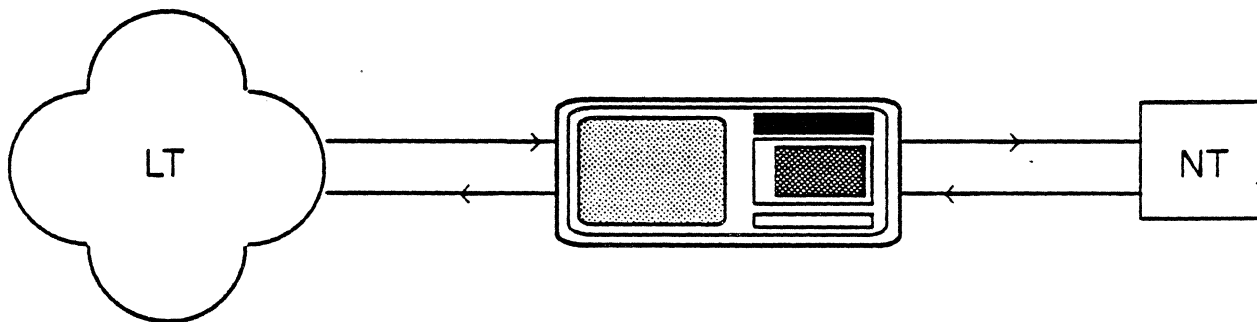
Figure 1.15: The Chameleon 32 in the Monitoring Application
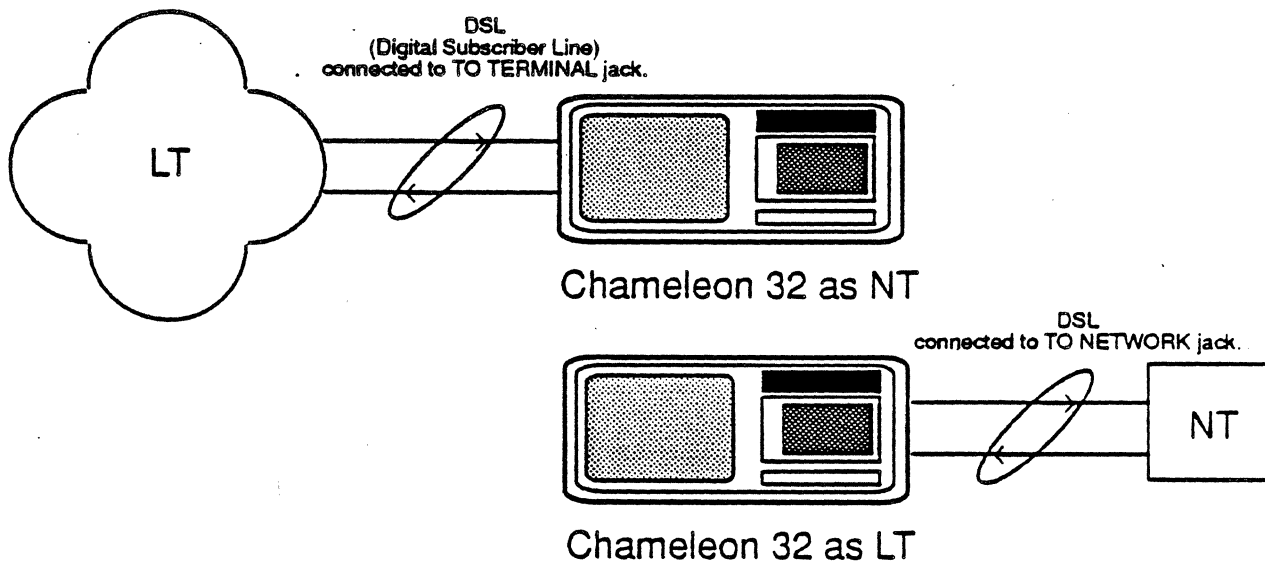
Figure 1.16: The Chameleon 32 in NT and LT Simulation Applications

**Testing
Configurations**

Figure 1.17 and Figure 1.18 show the hardware and cabling configurations for NT and LT simulation using the Chameleon 32. Figure 1.17 illustrates the configuration for NT Simulation. Figure 1.18 illustrates the configuration for LT simulation. Use of a handset is optional.
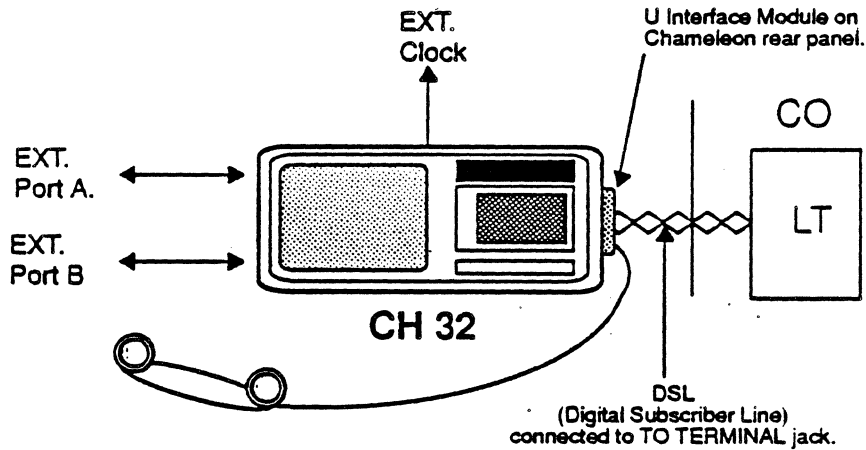
Figure 1.17: NT Simulation Configuration
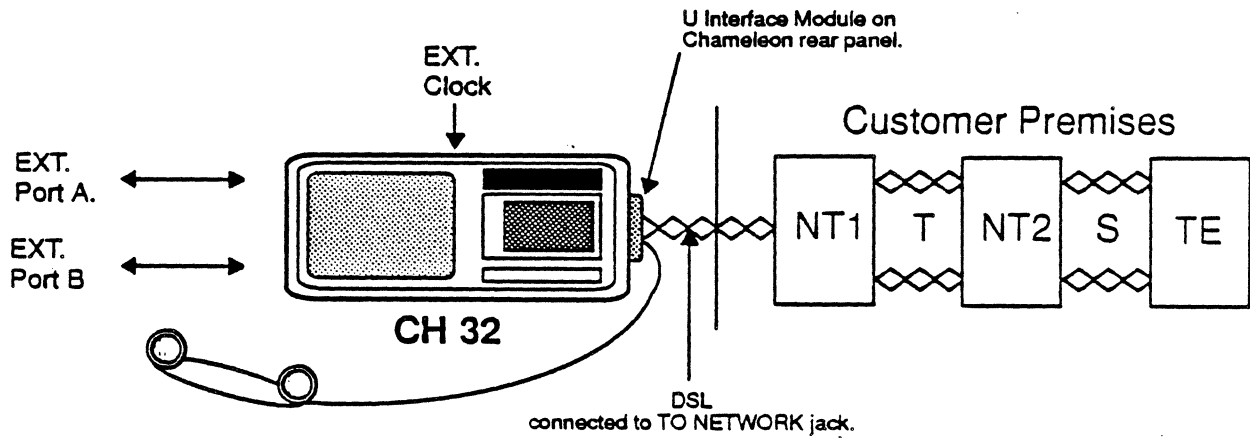
Figure 1.18: LT Simulation Configuration

Function Keys

The functions of keys *F1* through *F10* were created using the *Tekelec* Protocol Monitoring Development System (PMDS), providing control over each protocol layer. For detailed discussion of the PMDS and the function keys, see the *Chameleon Protocol Monitoring Development System* manual, Chapter 7.

Each function key (F–key) is assigned several options. Each time you press an F–key, the next option for that key is selected. If you press *Shift / F–key*, the previous option for that key is selected. The Function Key strip at the bottom of the Chameleon scree displays the current selection.

Included in this description of function keys is a section explaining the use of other keys used for the control of the M–Channel Analysis page. This section begins on page 20-41.

Note:

For the operation of the F1 and F2 keys in 2B1Q Line Error Statistics, see page 20-26.

F1 through F8

For keys *F1* through *F8*, the following conventions are used:

+   The data for the current layer is displayed in an interpreted mode.

"   The data for the current layer is displayed in an un–interpreted mode.

*   The data for the current layer is displayed in both interpreted and un–interpreted modes.

—   The data for the current lay is acquired, but not displayed.

F9

The F9 key determines how upper–layer (Layers 3 and above) data is displayed. There are two options:

SUMMARY

This is the default setting, and displays user–defined summary interpretations for each layer. For further details, see Chapter 2 of your *Chameleon Protocol Monitoring Development System* manual.

FULL

This selection displays complete interpretations of all the data of the current layer.

F10

The F10 key determines the format in which the bit—values of acquired data is displayed. Data is displayed with a caption identifying the data item, and a value representing the acquired data. There are eight formats in which the bit values can be displayed:

Meaning   When possible, the *interpretation* of the value is displayed rather than the value itself. If the current protocol does not define the meaning, the value is displayed in hexidecimal.

Hex   Displays the value(s) in hexidecimal code.

Decimal   Displays the value(s) in decimal.

Binary   Displays the value(s) in binary code.

ASCII   Displays the value(s) in ASCII code.

EBCDIC   Displays the value(s) in EBCDIC code.

Offset   Displays the offset of the data item from the start of the acquired event in the format *n.m*, where:
n = number of octets
m = number of bits.

Length   Displays the length of the data item in the format *n.m*, where::
n = number of octets
m = number of bits.

M—Channel Analysis Control Keys

The M—Channel Analysis pages is a read—only page displaying data taken from a real—time bit stream and stored in a history buffer. The display of this data can be manipulated using the keys illustrated and explained in Figure 1.19 below.

Note: When you first display the M—Channel Analysis page is may be blank. To bring data on—screen, press any arrow key. You can then use the keys described below to manipulate the display.

KEY	FUNCTION
←	Displays the oldest event.
→	Displays the most—recent event.
↑	Scrolls the page up; reverses or slows the page when scrolling down. Controls speed of page—up scrolling: pressing successively up to three times increases scrolling speed.
↓	Scrolls the page down; reverses or slows the page when scrolling up. Controls speed of page—down scrolling: pressing successively up to three times in creases the scrolling speed.
Space Bar	Stops scrolling.
Scroll ↑	Displays the next page of data.
Shift Scroll ↓	Displays the previous page of data.
Scroll ↓	Moves displayed data down one line each time you press the key.
Shift Scroll ↑	Moves displayed data up one line each time you press the key.
N	Displays the next event.
P	Displays the previous event.

Figure 1.19: The M—Channel Analysis Display Control Keys

Error Messages

Figure 1.20 lists the error messages you may be given in the course of running 2B1Q simulations. Each message is explained and corrective action(s) given. The messages are grouped according to the level of operation at which they occur: System, 2B1Q physical setup, 2B1Q simulation, and M—Channel analysis.

In Figure 1.20, error messages and menu selections are in italics; message explanations are indented below the messages; and, corrective action(s) are indented below the explanations.

System Software:

U Interface Monitor is not supported in Phase One.

> You selected *Monitor* for the Mode of Operation in the Configuration Setup Mode Menu and *2B1Q* for the Physical Interface.
>
> > In the Configuration Setup Menu, return to Mode of Operation and enter *Simulat* (press *F2*).

Cannot allocate memory for 2B1Q.

> Your Chameleon has run out of hardware memory for the 2B1Q Event and Data buffers.
>
> > Contact Customer Support at 1—800—441—9990.

2B1Q Physical Setup Software

Duplicated Channel Assignment

> Each channel selection for Ports A and B, Analog Inter face, and Idle Pattern Destination is not unique.
>
> > In the 2B1Q Setup Menu (See page 20—10), re—assign channels so that they are mutually exclusive.

2B1Q Simulation Software:

Cannot allocate memory for simulation; Press CANCEL.

> Internal software error.
>
> > Contact Customer Support at 1—800—441—9990.

Bad parameters to U driver; Press CANCEL.

> Internal software error.
>
> > Contact Customer Support at 1—800—441—9990.

(Continued on the next page.)

Figure 1.20: 2B1Q Simulation Error Messages

2B1Q Simulation Software — continued:

Time-out in U driver; Press CANCEL.
> Internal software error.
>> Contact Customer Support
>> at 1–800–441–9990.

Physical error detected in U driver; Press CANCEL
> Internal software error.
>> Contact Customer Support
>> at 1–800–441–9990.

Unknown error in U–driver call; Press CANCEL.
> Internal software error.
>> Contact Customer Support
>> at 1–800–441–9990.

Undefined message; Press CANCEL
> You tried to send a message without first selecting and/
> or building one in the MESSAGES menu.
>> Return to the MESSAGES menu and
>> select and/or build one. Then go to
>> the SEND menu and re—execute your
>> SEND.

Link is down; Press CANCEL.
> You tried to send a message when the U–link was
> down.
>> Open the FUNCTION menu, select
>> Activate, and press *GO*. The Status
>> window messages for Activation Status
>> and Link Status change to Activated
>> and Link Up, respectively.

M—Channel Analysis Software:

data overwritten
> The M—Channel or Real Time application tried to ac-
> cess an event that was overwritten in the NT/LT data
> buffer.
>> No corrective action needed.

Figure 20.20: 2B1Q Simulation Error Messages (continued)

EXT1 / EXT2
Pinouts

Tekelec's ISDN 2B1Q U–INTERFACE EXT1 and EXT2 connectors are 15–pin, D–subminiature females, DA15S type. Figure 1.21 and Figure 1.22 below give the pinouts for these bi–directional connectors. All signals are standard RS422 voltage levels. SEND data signals are ignored in the Monitor mode of operation.

A cable providing an RS449 interface is provided with the U–I/F Simulation package. The chart below correlates the pins of this cable with those of the DA15S connectors.

```
  8 7 6 5 4 3 2 1
 ┌─────────────────┐
 │ o o o o o o o o │
 │  o o o o o o o  │
 └─────────────────┘
  15 14 13 12 11 10 9
```
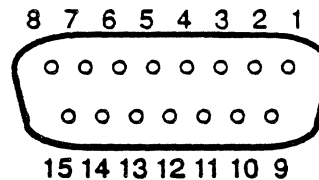
Figure 1.21: The DA15S Connector for EXT1 and EXT2

DA15S Pin Number	RS449 Pin Number	Description	Direction
1	1	Chassis Ground	
2	22	Send Data B	Input
3	–	Unused	–
4	24	Receive Data B	
5	–	Unused	–
6	23	Send Timing B	Output
8	19	Signal Ground	–
9	4	Send Data A	Inputs
10	–	Unused	–
11	6	Receive Data A	Output
12	–	Unused	–
13	5	Send Timing A	Output
14	–	Unused	–
15	8	Receive Timing A	Output

Figure 1.22: DA15 and RS449 Pinouts

CHAPTER 21
National ISDN-1 Monitoring

INTRODUCTION

Tekelec's *National ISDN -1 Monitoring* software enables you to monitor ISDN line traffic and create statistical reports upon which to base analyses of Layer 2 and Layer 3 transmission reliability and integrity. This software conforms to the *Bellcore* specifications SR–NWT–001953, Issue 1, June 1991 and National ISDN-1 SR–NWT–001937, Issue 1, February 1991.

In Monitoring, you passively view the traffic on a data line without affecting the network. This data can be viewed in the Real-Time page as it passes over the line. However, the rate at which data passes over the line is usually too great to be viewed in detail. For more detailed and deliberate viewing, the traffic is captured in an 'acquisition buffer'. This data is then displayed in the History page.

In Statistics, you are given statistical reports on data captured in the acquisition buffer. These reports are based on the CCITT Redbook Q.921 Recommendations of October 1984, and include statistics on Service Access Point Identifier (SAPI), as defined in the CCITT Recommendation Q.921. SAPIs identify the points at which data link layer services are available.

National ISDN-1

National ISDN-1 was developed to take advantage of the full capabilities of ISDN in transmitting not only voice, but also data and graphics over standard twisted—pair media. Prior to its implementation, ISDN networks could only carry voice, data and graphics in a limited environment; for example, a large corporation which could bear the cost of developing the necessary software and pay others to develop the necessary hardware. The consequence of all this was to create 'pockets' of ISDN, none of which could communicate with the others.

National ISDN-1 overcomes this restriction. With its implementation, these 'pockets' will be able to communicate with one another in all three modes: Voice, data and graphics. Furthermore, not only will these pockets be 'opened' to one another, but the full capabilities of ISDN will be available to everyone – right down to the home.

National ISDN-1 standardizes the signalling protocols and messages used for setting up and disconnecting calls and invoking service between customer equipment and the network. These standards address protocol Layers 1, 2 and 3.

Layer 1 standards are called '2B1Q' and define how digital communications over twisted—pair media between user equipment and a CO is to be done. (See Chapter 20 of this manual for Tekelec's 2B1Q Monitoring application.)

Layer 2 standards define how a network is to be managed. The protocol specification of Layer 2 is also known as Q.921. Interpretation of this layer is described on page 21-21.

Layer 3 standards define how signals are to be directed and delivered by providing functional call control. The protocol specification of Layer 3 is also known as Q.931. Interpretation of this layer is described on page 21-24.

With National ISDN-1, these three layers will now deliver data and graphics, as well as 'plain old telephone service', to anyone having a phone and a computer.

SETUP

The general procedure for setting up your Chameleon for monitoring and analysis is found in Chapter 3 of your User's Manual, pages 3-1 through 3-11. Exceptions to the directions found in those pages are given below.

Chameleon Configuration

In the Configuration Setup Mode window:

- Set *Protocol* to *ISDN*

  All other Setup parameters are set by software: Modulo is set to *128,* Extended Address Mode is set to *Ext.* These settings can be changed, however, in one of two ways:

  - Through the Configuration files *histrc.* and *realrc.* in the A:\tekelec\analysis\isdn directory;
  - Through the SET command of the Run–Time page. See Chapter 7.5 of the Protocol Monitoring Development System manual for details.

In the Configuration Acquisition Mode window:

- Select *N I 1.*
- Press *Go.*

DISPLAY PAGES

There are three types of data display page: Real-Time, History, and Statistics. Each of these is discussed beginning on page 21-5. However, as the Real-Time and History pages are very much like those for other ISDN monitoring applications, these two pages are discussed only in terms of the differences found in National ISDN-1. The Statistics pages are discussed in greater depth, with greater attention given to the SAPI pages. Following the discussions of these pages, you will find a section on INTERPRETATION. Here, the conventions used in decoding and interpreting protocol data are discussed in detail.

For a more general discussion of data analyses provided by the *Real-Time* and *History* pages, see Chapters 4 and 7 of your User's Manual, and *Chapter 10: ISDN Monitoring* in your Chameleon Protocol Interpretation Manual..

Error Messages

Error messages are displayed when the Monitoring application detects a problem with the structure of the Q.931 message. The error messages are described below.

Information Element out of sequence

- One or more of the IEs were found in the incorrect sequence.

Missing

- Mandatory IEs are missing.

Information Element too short

- The value of the *Length* octet in a variable-length IE is less than that required by the protocol.

Incomplete event   Len:nn

- A received event contains fewer bytes than the number required by the protocol.

Real-Time
Data Display

The Real-Time page displays data from both sides of the line as this data is acquired or – if stored on disk – as it is replayed from disk. Traffic, whether 'live' or from disk, is displayed as a continuous stream of data. However, you can freeze the screen display at any point.

To freeze the Real-Time display,

- Press *Ctrl D*.

Display Format

Data is displayed in a split–screen format: DCE data is displayed on the left half of the screen and DTE data is displayed on the right half of the screen.

Display Colors

The Chameleon 32 uses colors to distinguish the different levels of data:

- Green = Level 2 (Q.921)
- Blue = Message Type
- Yellow = Q.931 detail
- White = User Data
- Red = Errors (Incomplete/Unknown event)

The Chameleon 20 has only a monochrome display, and cannot display data using these colors.

Function Keys

The function keys (*F*-keys) control how the traffic is interpreted and displayed. These functions are available for both the History and Real-Time pages. The ISDN Analysis function keys are described below.

For general explanations of the *Real-Time* and *History* Function keys, see Chapters 4 and 7 of your User's Manual. However, for National ISDN-1, the following differences should be noted:

- *F2* = LAPD
- *F3* = Q.931
- *F4* = Appl
- *F5* = (no function)
- *F6* = (no function)
- *F9* = Level of Detail: *Full* – which displays all Message Types and Information Elements; and *Summary* – which displays Message Types only.

In all pages, levels of data interpretation are selected with Function Keys 1 through 4 and indicated by +, ", * or -.

+ (The default setting). Data is displayed in the interpreted mode.

" Data is displayed un-interpreted and in one of the conventions selected with *F10*: ASCII, Hex, and EBCDIC.

* Data is displayed both interpreted and un-interpreted, with the latter mode displayed below the former.

– Data is not displayed at all, but continues to be acquired in the acquisition buffer. For an explanation of data acquisition by this buffer, see your *Chameleon User's Manual*, Chapter 4.

F9 Summary/Full

This key determines the level of detail displayed on-screen. There are two toggled settings:

- Summary (The default setting.) Displays either *Message Type Identifier* or *Information Element.*

- Full   The complete, detailed content of all octets and IEs of a given message is displayed.

F10

This key determines the coding used in displaying message content. There are seven options:

- Meaning The content of the message is displayed in plain English and numerical values. If the protocol does not permit this type of coding to be displayed, hex values are used.

- Hex   All message/protocol content is displayed in hexadecimal code.

- Decimal All message/protocol content is displayed in decimal code.

- Binary   All message/protocol content is displayed in binary code.

- ASCII   All message/protocol content is displayed in ASCII code.

- EBCDIC All message/protocol content is displayed in EBCDIC code.

- Offset   The offset of the given item from the start of the acquired event is shown in the format

n.m,

where :

n = number of octets

m = number of bits within the octet

History
Data Display

A History page displays data taken from the Acquisition buffer. Therefore, the data shown will not be current, but you will be able to examine traffic in detail and draw conclusions as to the proper performance of a device-under-test (DUT) or network in transmitting data.

History Page
Control Keys

Figure 21.1 lists and explains the keys you use to control the display of History data.

KEY	FUNCTION
←	Displays the oldest event in the Acquisition buffer.
→	Displays the most–recent event in the Acquisition buffer.
↑	Scrolls upward. To increase scrolling speed, press quickly in succession. To reduce speed of rapidly-scrolling data, press quickly in succession.
↓	Scrolls downward. To increase scrolling speed, press quickly in succession. To reduce speed of rapidly-scrolling data, press quickly in succession.
Space bar	Stops scrolling.
Scroll ↑	Moves data up one line each time keys are pressed.
Scroll ↓	Moves data down one line each time keys are pressed.
Shift Scroll ↑	Displays next page.
Shift Scroll ↓	Displays previous page.
N	Moves to next event.
P	Moves to previous event.

Figure 21.1: History Page Control Keys.

History Display
Commands

The commands described in Figure 21.2 give you additional control over the manner in which data is displayed and access to it. These commands are entered at the Command line. This line appears as the last line of the History page.

To enter a command at the Command line:

1. Press : *(colon)* to display the Command line.

2. Enter the desired command using the syntax shown in Figure 21.2.

3. Press *Return.*

For further details on these commands and their use, see the *Chameleon Protocol Monitoring Development System* Manual, Chapter 7.4.

COMMAND	FUNCTION
?	Displays the current software version and OSI monitoring mode.
\	Used only within a configuration file. Executes a Function Key command from within a configuration file.
:close	Closes the currenly-selected History page.
:data	Analyzes the data in a text file. Valid only when the Chameleon is in internal mode. See :setcham 32.
:filter	Displays only those events in the acquisition buffer which match user–defined criteria.
:freeze *n n*	Stops the acquisition of new data for the History display.
:jump *nn*	Displays a specified event at the top of the page.
:open *COLOR name PORT*	Opens a new History page if the maximum number of pages is not already open.
:print *"filename" first last*	Saves the specified range of events to 'filename' in the directory a:\tekelec\data\hist\
:print *.PRT first last*	Prints the range of events indicated by 'first' and 'last'. NOTE: .PRT must be uppercase.
:quit	Closes all Applications pages and exits the current Monitoring Application.
:read	Executes a configuration file.
:restore	Loads a triggering criteria file into the triggering editor.
:save	Saves specified event(s) to a disk file in un-interpreted format.
:set option	Selects values for protocol–specific parameters.
:set cham32	Selects internal or external monitoring mode.
:set separator	Toggles the Event separator On/Off. When ON, a white line separates displayed events. The Event number is also displayed within that line.
:show	Displays the current filter/scan criteria in use.
:store	Saves a set of triggering criteria to a disk file.

Figure 21.2: History Page Commands.

PROTOCOL
INTERPRETATION

The following pages explain the conventions used in interpreting Q.921 (Layer 2) and Q.931 (Layer 3) data.

Q.921

As noted earlier, the Q.921 (Layer 2) protocol defines how network management is to be effected. It is at this layer that 'intelligence' is built into a network. This intelligence constantly monitors the line to ensure that ISDN service is always available. If such service is broken for whatever reason, the user is notified and measures taken to minimize the loss of information.

Figure 21.3 below illustrates the display of Q.921 traffic as it appears on-screen and with the F2 key set to LAPD * .

```
┌──────────────────────────────────────────────────────────┐
│ ─Q B───────────────────────────────────────────NET A      │
│                                                           │
│      R SAPI=16    (RSV)   TEI=2                            │
│        RR          F       NR=9    4                       │
│    LAPD                             30050113               │
│ ──────────────────^  2   ^────────                        │
│      R SAPI=16    (RSV)   TEI=2                            │
│        RR          F       NR=9    4                       │
│    LAPD                             30050113               │
│ ──────────────────^  3   ^────────                        │
│      R SAPI=63    (MP)    TEI=127                          │
│        I    NS=0          NR=0   113                       │
│    LAPD                           FCFF0000                 │
│                                                           │
└──────────────────────────────────────────────────────────┘
```
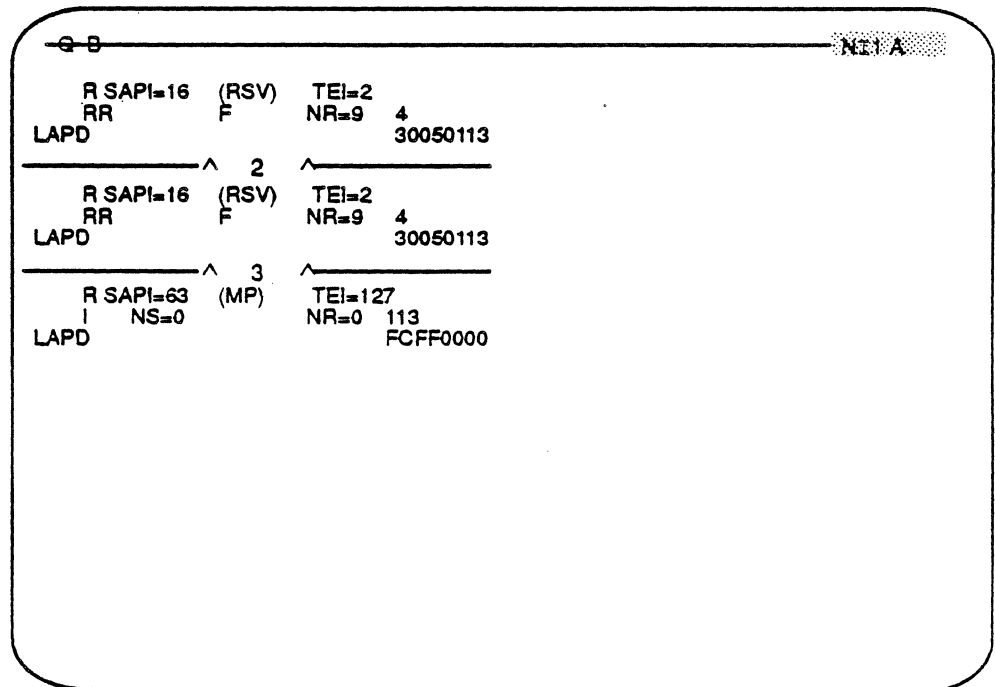
Figure 21.3: Q.921 (LAPD) Fully Interpreted.

Figure 21.4 below identifies the displayed Q.921 data fields. In this figure, the fields as displayed for messages 2 and 3 are identified.
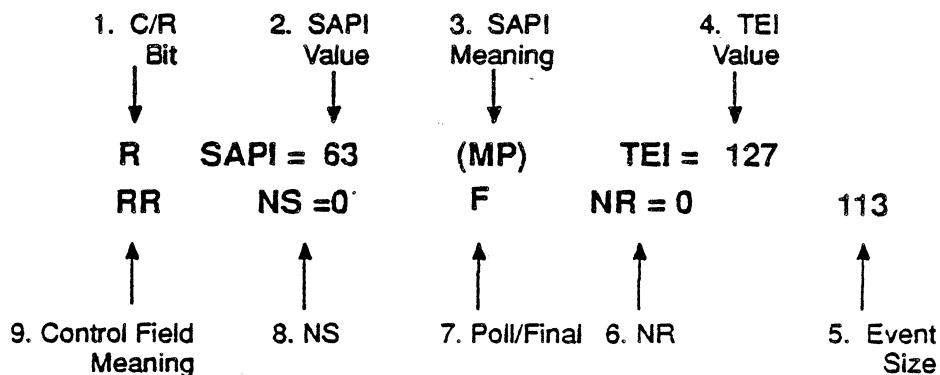
Figure 21.4: N ISDN-1 Q.921 Interpretation

1. *C/R Bit*   displays the setting of the Command/Response (C/R) bit, as follows:

- C (command) Set to 1 if the network sends the event.
  Set to 0 if the user sends the event.

- R (response) Set to 0 if the network sends the event.
  Set to 1 if the user sends the event.

2. *SAPI Value*   displays the decimal value of the Service Access Point Identifier (SAPI). The four possible values are:

- **00**   Call Control Procedures

- **16**   Packet Control Procedures

- **63**   Management Procedures

- **Others**   SAPI values other than 00, 16 or 63.

3. *SAPI Meaning* displays the abbreviation for the SAPI meaning as defined by the protocol. The four possible displays are:

- **CCP** Call Control Procedures

- **PCP** Packet Control Procedures

- **MP**   Management Procedures

- **RSV** Reserved

4. *TEI* displays the Terminal Endpoint Identifier in decimal.

5. *Size of Event* displays the number of bytes in the data event..

6. *NR* displays NR in decimal.

7. *NS* displays the decimal value of the 'Now Sending' sequence number.

8. *Poll / Final Bit* When set to 1, this field displays 'P' for COMMAND frame and 'F' for RESPONSE frame. When set to 0, nothing is displayed in this field.

9. *Control Field
   Meaning* displays the control field meaning; for example, I-Frame.

Q.931

As noted earlier, the Q.931 (Layer 3) protocol provides functional call control for routing and delivering information in a standard manner and format. This routing and delivery employs ISDN features between the user and the CO, ensuring that the information is transmitted between other COs and its destination without loss of ISDN functionality. It is these functional standards that form the keystone of the National ISDN-1 capability.

A Q.931 (Layer 3) message has four major parameters:

- Protocol Discriminator
- Call Reference
- Message Type
- Information Elements

Figure 21.5 illustrates the general structure of a Q.931 message.

To display the detailed contents of IEs and Message Headers,

- Press *F9*.

8	7	6	5	4	3	2	1	
Protocol Discriminator								Octet 1
0	0	0	0	Length of Call Reference Value (bytes)				Octet 2
0/1	Call Reference Value							Octet 3
Call Reference Value								Octet 4
0	Message Type							Octet 5
Other Information Elements, as required								Octet 6
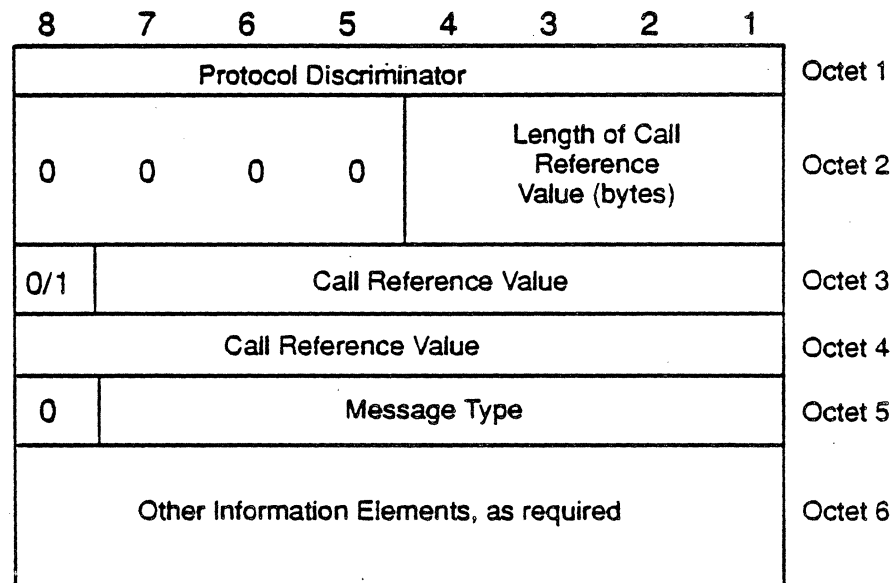
Figure 21.5: Message Structure

The Protocol Discriminator, Call Reference and Message Type octets constitute the Message Header. All messages contain these three parameters, which - on the Chameleon 32 - are displayed in blue. (The Chameleon 20 does not display data in color). All other IEs can be either optional or mandatory, according to the message type. These are displayed in yellow. Values which have no interpretation in any of the implemented protocols are shown as *Unknown*. Values which are not valid for the selected, manufacturer-specific protocol (including *Unknown* values) or are reserved for future implementation, are displayed in red.

Figure 21.6 illustrates a Q.931 frame in which I+74 elements contain unknown and reserved values

```
┌─────────────────────────────────────────────────────────────┐
│ ─Q─B─────────────────────────────────────────────────  Nr1 A │
│ ───────────────^  3   ^─────────────                         │
│           PD=08 UCC          O  Ref. Len=1                   │
│           Call Reference                    01               │
│ M 01 ALERTing                                                │
│ I  18 Channel Identification         Len=1                   │
│           Contents:                     80                   │
│           Channel selection           None                   │
│           Channel indicator      Not D—Channel               │
│           Indicated channel exclusive     no                 │
│           Interface type              Basic                  │
│           Interface        Implicitly identified             │
│                                                              │
│                                                              │
│ I+34 Signal                          Len=1                   │
│           Contents:                     4F                   │
│                                    Alerting off              │
│ I+74  Redirecting number             Len=2                   │
│           Contents:                   802B                   │
│           Num type/plan          .  Unknown                  │
│           Digits                       "+"                   │
│ I+74  Redirecting number             Len=3                   │
│           Contents:                 118032                   │
│           Num type/plan      International/ISDN               │
│           Presentation/Screen       Reserved                 │
│           Digits                       "2"                   │
└─────────────────────────────────────────────────────────────┘
```

Figure 21.6: A Q.931 Message Displayed in *Full* Interpretation.

Figure 21.7 below illustrates the first two lines of the Q.931 display. Each field is explained on the next page.

1. Protocol
   Discriminator Value

2. Protocol
   Discriminator
   Meaning

3. Call Reference
   Length

PD = 08   UCC   O Ref. Len. = 1

Call reference   01

4. Call Reference
   Value
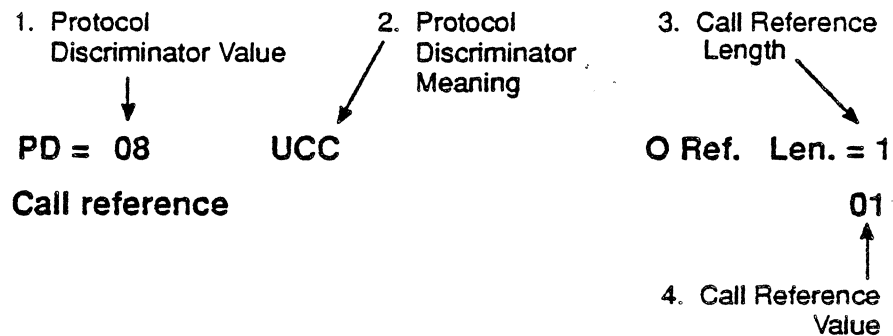
Figure 21.7: First Line of Q.931 Interpretation

1. *Protocol Discriminator Value*

displays the hexadecimal value for the Protocol Discriminator setting. The possible settings for the Protocol Discriminator are:

08	Q.931 User–Net Messages
03	Maintenance Messages

2. *Protocol Discriminator Meaning*

displays the abbreviation or acronym of the Protocol Discriminator as defined by the protocol specification.

3. *Call Reference Length*

displays the number of bytes in the Call Reference value to follow. The example above is interpreted as follows:

- O   *O* for Originator, *D* for Destination

- **Ref. Len** Abbreviation for *Reference Length*.

- 1   The length, in bytes, of the call reference value to follow. The possible values here are 0, 1, or 2.

4. *Call Reference*

displays the call reference value. In Figure 21.7, this is *01*.

Message Type

The next line of Q.931 interpretation is the Message Type. This is illustrated in Figure 21.8 below. This information is displayed in blue.

M   01   Alerting

1. Caption   2. Message   3. Message
                       Type Value   Type
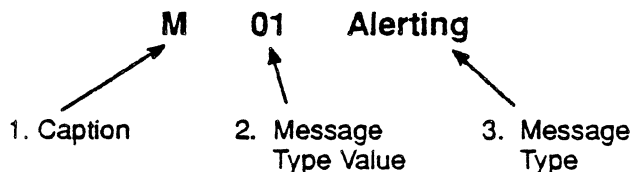
Figure 21.8: Second Line of Q.931 Interpretation

1. *Caption*   A letter indicating the type of signal data/information. In this case, *M* is for *'Message Type'*.

2. *Message Type Value*   displays the hexadecimal value of the Message type. Certain Q.931 implementations require two Message Type bytes (for example, network-specific message types). These are displayed on two consecutive lines.

3. *Message Type*   displays the Message Type, or – if the type is not known – *Unknown*. There are 24 possible Message Type IEs:

Alerting	Call Proceeding
Connect	Connect Acknowledge
Disconnect	Hold
Hold Acknowledge	Hold Reject
Information	Key Hold
Key Release	Key Setup
Key Setup Acknowledge	Notify
Progress	Release
Release Complete	Retrieve
Retrieve Acknowledge	Retrieve Reject
Setup	Status
Status Enquiry	

Information Elements

The rest of the Q.931 message consists of structures called *Information Elements (IEs)*. (It is possible, however, that a given message will have no IEs.) These can vary in length from one octet to 127 octets.

Each IE is interpreted in a manner shown in Figure 21.9, and is displayed in yellow. Interpretation of multiple IEs is repeated until the end of the message is reached. Single-octet IEs do not have the *Length* field,.

The meaning of a displayed value is determined by the *F10*–key, and may be Hex, ASCII, EBCDIC, etc. When the *F10* selection is "Meaning", the plain-English equivalent of the value is usually shown. Illegal values (for example, those reserved by the protocol) are displayed in red.

I+	34	Signal	Len = 1

1. Caption   2. IE Identifier   3. Meaning   4. Length
Value
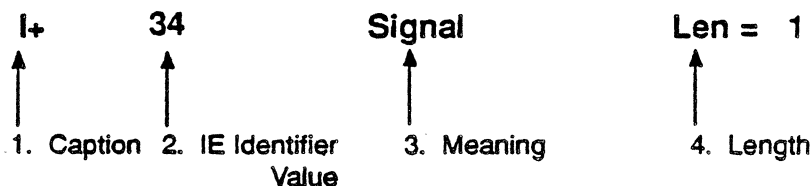
Figure 21.9: First Line of a *SIGNAL* Message.

1. *Caption*   A letter indicating the type of signal data/information. In this case, *I* is for *'Information Element'*.

- I   Indicates the start of IE interpretation.

- I+   Indicates one of three conditions:

  - That the IE was not expected (according to the protocol) in the message

  - That the same IE has appeared more than once in a message

  - That the IE is not allowed by the implemented protocol..

2. *IE Identifier Value*   displays the IE Identifier value in hex. The number of possible values depends on the codeset being used at the time. These, along with the corresponding type, are listed in Figure 21.10.

3. *Meaning*   displays he meaning of the IE Identifier Value as defined by the protocol, or – if the meaning is not known – *Unknown.*

4. *Length*   displays the octet length of the IE (not found in single–octet interpretations, but may be filled by other types of information.)

Codeset 0	Codeset 5	Codeset 6
	All Coding found in Codeset 0, but including:	All Coding found in Codeset 0, but including:

Codeset 0		Codeset 5		Codeset 6	
96	Locking Shift				
04	Bearer Capability				
08	Cause				
14	Call state				
18	Channel identification				
1C	Facility				
1E	Progress indicator	1D	Operator System Access		
27	Notification indicator				
2B	Softkey Control*	2A	Display Text		
2C	Keypad facility				
32	Information Request				
34	Signal				
38	Feature activation				
39	Feature indication				
3A	Service Profile identification				
3B	Endpoint Identification				
40	Information rate				
42	End–to–end transit delay				
43	Transit delay selection and indication				
44	Packet layer binary parameters				
45	Packet layer window size				
46	Packet size				
47	Closed User Group				
4A	Reverse Charging Indication				
6C	Calling party number				
6D	Calling party subaddress				
70	Called party number				
71	Called party subaddress				
74	Redirecting number			75	Redirecting Subaddress
76	Redirection Number				
78	Transit network selection			7B	Call Appearance
7C	Low layer compatibility				
7D	High layer compatibility				
7E	User–user Information				

* For future implementation.

Figure 21.10: Information Element Identifier Values and Types by Codeset.

Single-Octet IEs

Figure 21.11 illustrates the manner in which single—octet IEs are interpreted by your Chameleon. Here, the *Locking Shift* IE is shown.

I   96   Shift   Locking   Codeset = 6

1. Caption   2. IE Identifier   3. IE Identifier   4. Shift   5. Codeset
                  Value   Meaning   Type
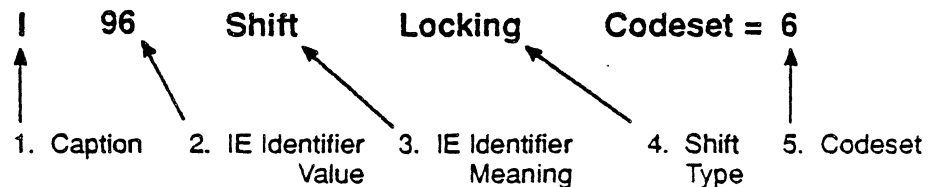
Figure 21.11: The Interpretation of Single—Octet IEs.

The Locking Shift IE is used to shift between two codesets: The national—specific (codeset 5) and the network—specific (codeset 6).

1. *Caption*	See the explanation for Information Elements, page 21-27.
2. *IE Value*	displays the hexadecimal equivalent of the binary value of the complete octet. In this example, is *96* is the hexadecimal equivalent of *10010110*
3. *IE Meaning*	displays the meaning of bit 4 through 7 as defined by the protocol. In this example, the meaning is *Shift.*
4. *Type*	displays the function performed by the IE
5. *Codeset*	displays the codeset in use. There are two possible values for N ISDN-1:

5 – for the national-specific codeset
6 – for the network-specific codeset

For further details on codesets, see CCITT Blue Book Vol. VI, Fascicle VI.11, page 76.

Variable-Length IEs

Figure 21.12 illustrates the manner in which variable—length IEs are interpreted. Here, the *Full* interpretation of a Signal IE is shown. In this interpretation, line 2 displays the hexadecimal representation of the IE contents. Line 3 displays the plain—English equivalent of the signal value. Line 4 *(Extra)* displays in hex the contents of extra octets in the IE. In this illustration, there is one extra octet having a value of 10.

```
1. Caption     2. IE Identifier    3. IE Identifier           4. Length
                  Value               Value Meaning

I   34            Signal                           Len=2
                                                           5. Content of bytes

                  Contents:                        0010
                                                           6. Meaning of
                                                              "Value" octet(s)

                  Value              Dial tone on
                                                           7. Content of any
                                                              additional bytes
                  (Extra)                          10
```
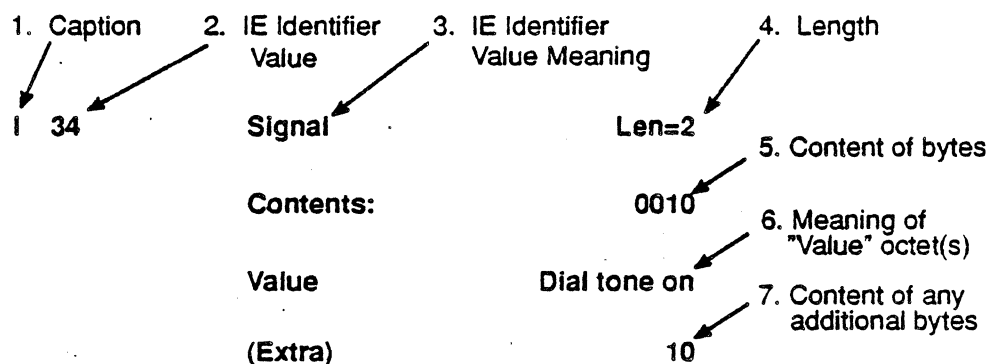
Figure 21.12: The Full Interpretation of Variable—Length IEs.

This mode of interpretation gives the following information about the IE:

1. *I*   See the explanation for Information Elements, page 21-27.

2. *IE Identifier Value*   See the explanation for Information Elements, page 21-27.

3. *Meaning*   See the explanation for Information Elements, page 21-28.

4. *Len = 2*   See the explanation for Information Elements, page 21-28.

5. *Contents:*   The content of bytes in the IE, expressed as a hexadecimal value. In this illustration, the IE contains two bytes, the value of which is 0010. And, since Signal is normally a single-octet IE, the second byte (value 10) is extra.

6. *Value*   The meaning of the third (and additional, if applicable) byte of the IE as defined by the protocol. In this case, *Dial tone on* is the meaning of the Signal value octet and corresponds to a binary value of 00000000.

7. *(Extra)*   The content of any extra byte, expressed as a hexadecimal value.

CHAPTER TWENTY TWO:
ISDN U-Interface (2B1Q) Monitoring

Introduction

The ISDN U-Interface (2B1Q) Monitoring software for the Chameleon 32 and Chameleon 20 provides all the tools and functions you need for Link Monitoring. The software meets all pertinent Layer 1 parameters as listed in ANSI T1.601–1988. At this same level, all bit–oriented protocols (X.25, ISDN, etc.) are supported. You can also insert voice–frequency signals into a selected 2B1Q channel, or extract such signals from that channel (A handset is provide for this purpose). The other capabilities supported by this software are listed below.

Level 1 Capabilities:

- Framing/synchronization detection

- Network activation/deactivation control

2B1Q Error Statistics Capabilities:

- Recording/reporting Errored Seconds and Severely Errored Seconds

- Far-End Block Error and Near–End Block Error detection and counting.

M-Channel Capabilities:

- Monitoring of NT and LT M—channel contents

Although repeater techniques employed by this application prevent monitoring from being 100% passive, line data read and captured by software is not corrupted or otherwise altered.

Prerequisites

Tekelec's ISDN U-Interface (2B1Q) Monitoring application requires the following system software and hardware:

- Standard Software Version 4.4, Part Number 930-3001

- U-Interface Monitoring Application disk, Part Number 930–4021-01, Rev. 1.0

- U-Interface Board, Part Number 930-2522-01, Rev. E (or later).

Basic Rate U-Interface Overview

The Basic Rate U-Interface employs a distinct line code called '2B1Q', defined by ANSI Specification T1.601–1988. 2B1Q stands for 'Two Binary, One Quaternary'. 'Quaternary' refers to the four voltage levels defined for the 2B1Q line code: +5/6v, +2.5v, –5/6v, and –2.5v. Each of these voltage levels is assigned a quaternary symbol of 1, 3, –1, or –3, respectively. Furthermore, each signal level represents 2 bits of information (the 'Two Binary' portion of 2B1Q). So, in actual transmission over a U interface, each time slot is occupied by 1 quaternary symbol (i.e., one voltage level) representing 2 bits of information.

The 2B1Q bit stream consists of 240 bit frames. Each of these frames contains a 9–bit Synchronization Word, 2B+D information, and 6 'M' bits. Eight of these 240–bit frames comprise one superframe. The eight, 6–bit 'M' fields comprise the 48–bit M channel of a superframe.

The M channel has three major functions: Error monitoring, line operations and maintenance, and network (LT)–to–terminal (NT) testing.

- In EOC Messages monitoring, the transmitted and received Address (addr), Data/Management Indicator (dm) and Information (i) fields are decoded

- In error monitoring, the 12 CRC bits of the M5/M6 frames are decoded.

- In line operations and maintenance, overhead bits of the M4, M5 and M6 frames are decoded

- In LT–to–NT testing, the network sends a message to the terminal to initiate specific testing operations.

For further details on M-channel monitoring, see page 22-21.

ISDN U-Interface
I/O Module

The module used for ISDN U-Interface monitoring is shown in Figure 22.1. The features of this module are described below and on the following pages.
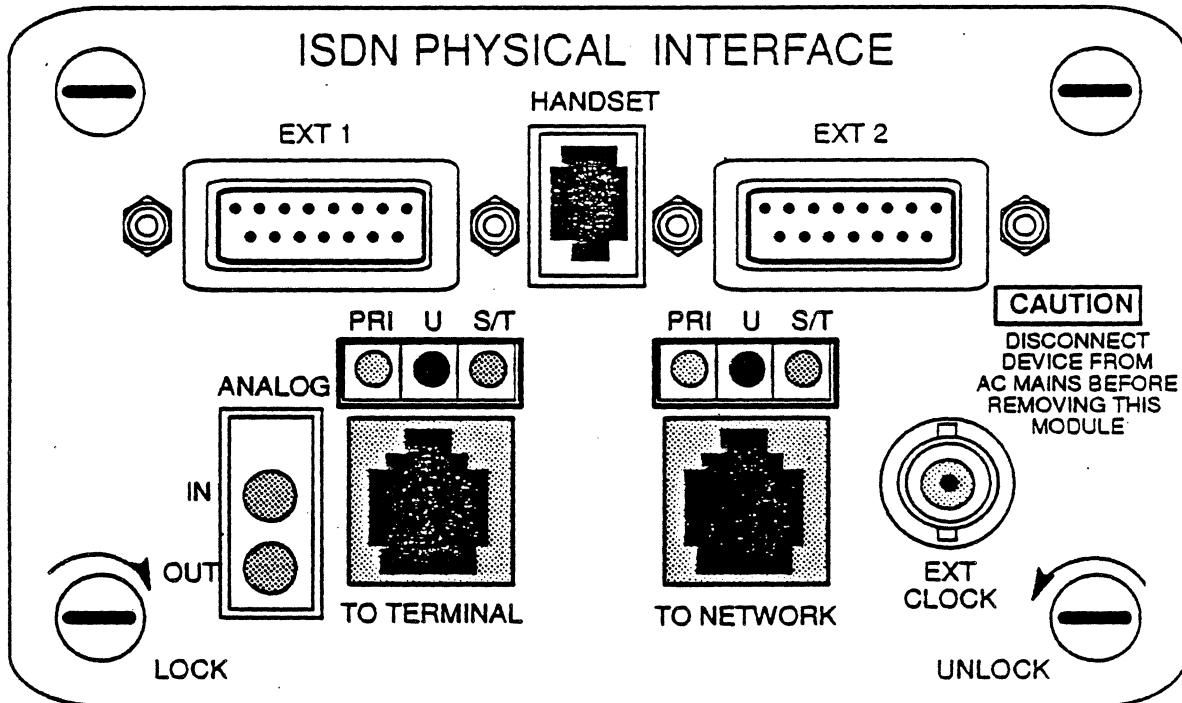
Figure 22.1: The 2B1Q Module.

FEATURE	DESCRIPTION
EXT 1/EXT 2	A 15–pin connector to connect the 2B1Q (16 kbps) to another test set or device. This connector can be configured to function as a B1–, B2– or D–Channel and functions as an output interface.
HANDSET	A standard modular handset connector. This connector is bi-directional in network or terminal configurations, but functions only as an output interface.
EXT. CLOCK	An 8–kHz clock for frame synchronization. You must use it when you have selected *Ext.* for the clock in the 2B1Q Monitoring Setup

Menu (See Figure 20.4 and page 22-13). In all other cases, its use is optional.

TO NETWORK

An RJ45 connector acting as an input/output port for the bit stream being monitored. This port can only be configured as an LT. See Figure 22.2.

PRI U S/T

Yellow, red and green LEDs that indicate the type of interface in use for the bit stream being carried over the TO TERMINAL or TO NETWORK lines. Yellow designates the Primary Rate Interface; red designates the 2B1Q; and, green designates the S/T interface.

> ## WARNING

Do not use this module for PRI or BRI (S/T) applications. This design is in anticipation of future design changes to Tekelec hardware and software, but is not compatible with current PRI and BRI software.

TO TERMINAL

An RJ45 connector acting as an input/output port for the bit stream being monitored. This connector can only be configured as an NT. See Figure 22.2.

ANALOG IN

A connector for attaching an analog-to-digital device for input having an impedance of 600Ω. This input can then be injected into either the B1 or B2 channels. Such a device may be a phone handset (see Figure 22.2), microphone, or any other device meeting the impedance requirement and having the appropriate connector.

ANALOG OUT

A connector for attaching a digital-to-analog device for output to either the B1 or B2 channels and having an impedance of 600Ω. Such a device may be a phone handset, earphones, or any other device meeting the impedance requirement and having the appropriate connector.

U-Interface
LED Overlay

The 2B1Q LED overlay is described in detail in Appendix E of the *Chameleon 32 User's Manual*, and Appendix D of the *Chameleon 20 User's Manual.*

Hardware Setup

Figure 22.2 illustrates the correct setup for 2B1Q monitoring. Only one ISDN PHYSICAL INTERFACE module is required. The use of the telephone handset is optional.
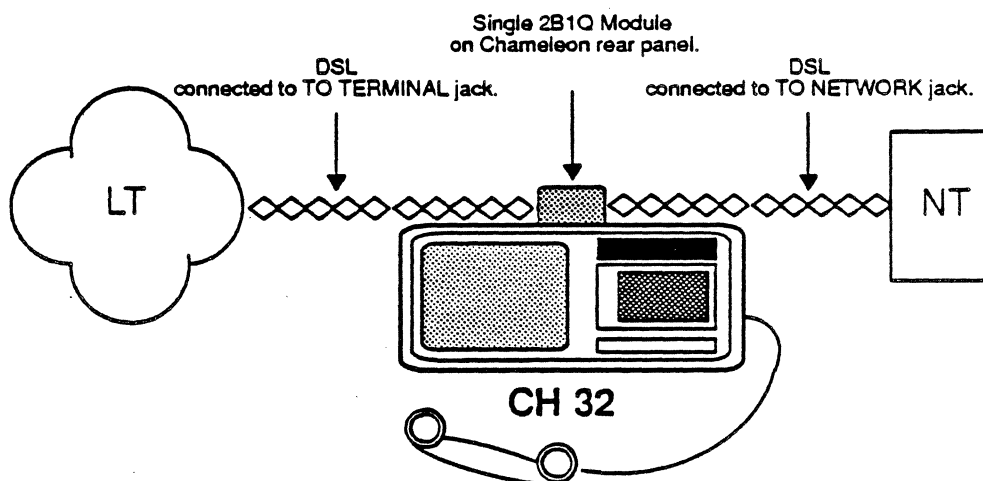
Figure 22.2: The Chameleon 32 in the Monitoring Application.

U-Interface
Configuration

When the ISDN U-Interface (2B1Q) Monitoring package is installed and the Chameleon turned on, the Chameleon detects the presence of the ISDN PHYSICAL INTERFACE module and includes 2B1Q configuration options in the Configuration Setup. The following procedure assumes that you have installed the ISDN PHYSICAL INTERFACE module and ISDN U-Interface (2B1Q) Monitoring software, and have turned your Chameleon on. All accompanying illustrations represent the Chameleon 32 display.

Steps 1 through 14 of the procedure for configuring ISDN U-Interface (2B1Q) Monitoring require that you set parameters in the following Configuration menus:

- Configuration Setup Mode Menu

- 2B1Q Monitoring Setup Menu

- BOP Protocol Setup (X.25, ISDN, etc.)

- Configuration Applications Selection Menu

After you have configured the system and have the 2B1Q Setup page displayed (step 15), you must wait for the link to come up before monitoring the NT or LT lines. Any link status changes are reflected immediately in the Status window at the bottom of the page (see , page 22-17). The effect these changes have on sent/received traffic is displayed in the M_CHNL Analysis and 2B1Q Statistics pages. (Sent and received M-channel messages are displayed in the M-CHNL Analysis page (see page 22-23.)

You have two modes to choose from for link activation: Automatic (AUTO) and semi-automatic (SEMI-AUTO). Your choice is made from the 2B1Q Monitoring Setup Menu. For further details, see page 22-15.

CONFIGURATION PROCEDURE

The procedure for 2B1Q monitoring is outlined here.

1. Install the ISDN PHYSICAL INTERFACE module in an available port.

2. Connect your Chameleon to the 2B1Q line as shown in Figure 22.2.

3. In the Configuration Setup Mode window, set Setup Mode to *Menu*.

4. Set the Port, Data Source and Capture Mode parameters as shown in Figure 22.3.
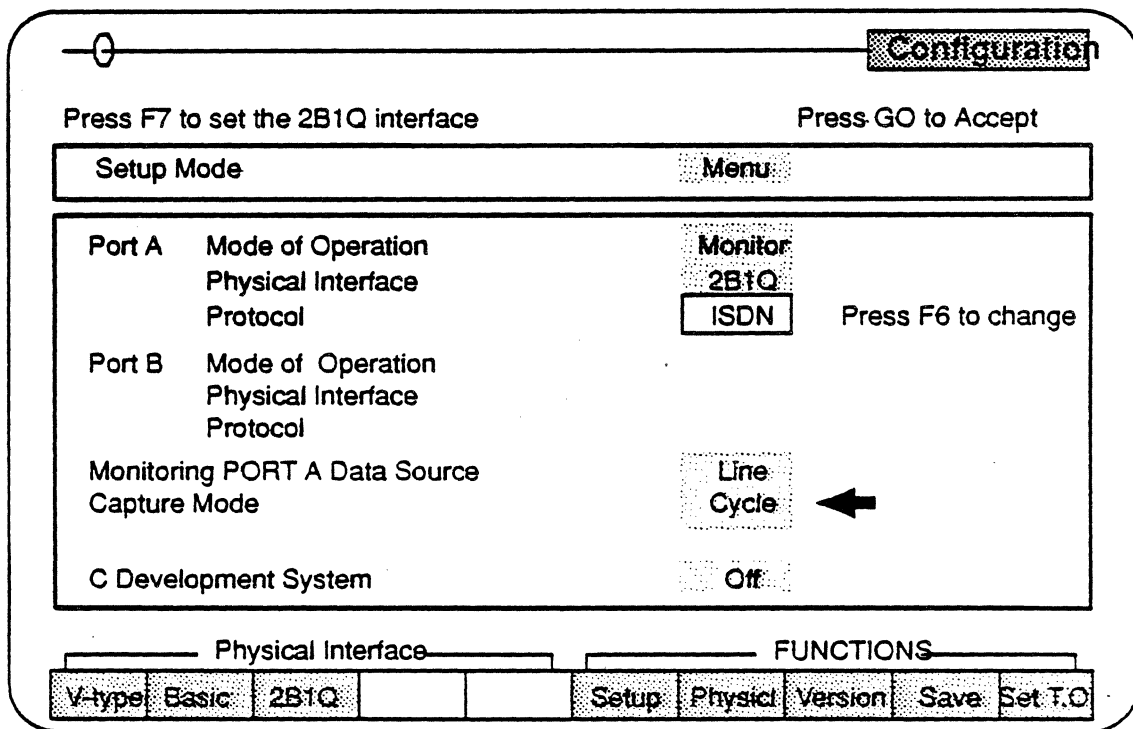
Figure 22.3: The Setup Mode Screen – Port A configured for ISDN U-Interface (2B1Q) Monitoring

5.   Press *F7* to call up the 2B1Q Monitoring Setup Menu (see Figure 22.4). You MUST set the parameters of the physical interface in order for the link to be established.

6.   Set the Physical Interface parameters in the 2B1Q Monitoring Setup Menu as required by your monitoring purposes.

2B1Q Setup Menu

Press GO to Accept

Port A: B1   ◀

Port B: D

Analog Interface:
    Channel Selection: Handset
    Encoding: B1   *Channel Selection* and *Encoding* appear
                                A-Law   only when Analog Interface is set to either
                                            Handset or 600 Ohm.

M Channel Control: Count
    Frequency Count   *Frequency Count* appears only when you
                                            set M Channel Control to Count.
Activation mode: Auto

[B1] [B2] [D] [OFF] [ ] [ ] [ ] [ ] [ ] [Exit]
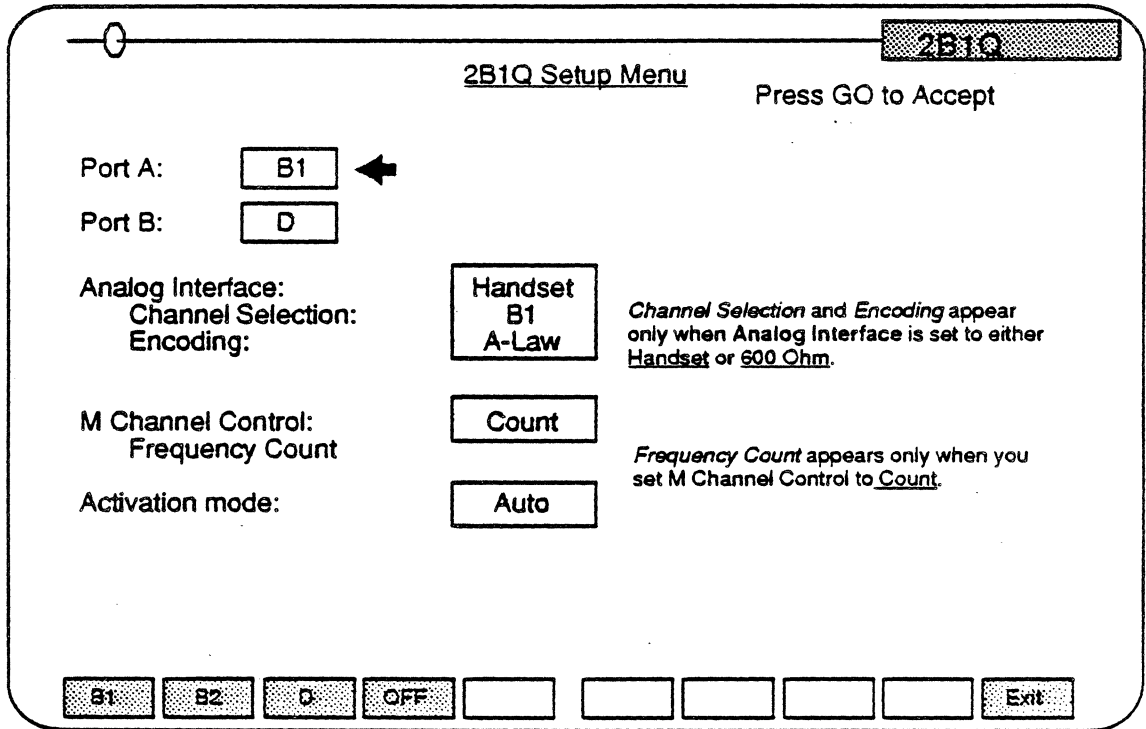
Figure 22.4: The ISDN U-Interface (2B1Q) Monitoring Setup Menu.

7.   Open the Applications Selection window.

8.   Load the 2B1Q, 2B1Q STAT and M_CHNL applications (see Figure 22.5) and press *Go*. You may, of course, load fewer than these three applications.


```
 ─⊘──────────────────────────────────────  Configuration

Applications Selection Menu                         LEDS : PORT A
Use SHIFT Arrow to Change Window          Press GO to Accept

 ┌────────────────────────────────────────────────────────────┐
 │  Acquisition Mode                              Running       │
 └────────────────────────────────────────────────────────────┘

 ┌─────────────┬──────────┬──────────────┬──────────┐
 │  Monitoring │  Ports   │  Monitoring  │  Ports   │
 ├─────────────┼──────────┼──────────────┼──────────┤
 │  ANALYSIS   │          │  DIRTDSK     │          │
 │  TRIGGER    │          │  DUALLINE    │          │
 │  X25STAT    │          │  2B1Q        │  A       │
 │⮕ 2B1QSTAT   │  A       │  M_CHNL      │  A       │
 └─────────────┴──────────┴──────────────┴──────────┘



          ─── Select Port ───            ─── FUNCTIONS ───
 ┌───────┬────────┬────────┬──────┬───┬────────┬──────┬──────┬────────┬──────┐
 │Load A │ LoadB  │ LoadAB │      │   │ Reset  │ Menu │ Save │ Set T.O│ Exit │
 └───────┴────────┴────────┴──────┴───┴────────┴──────┴──────┴────────┴──────┘
```
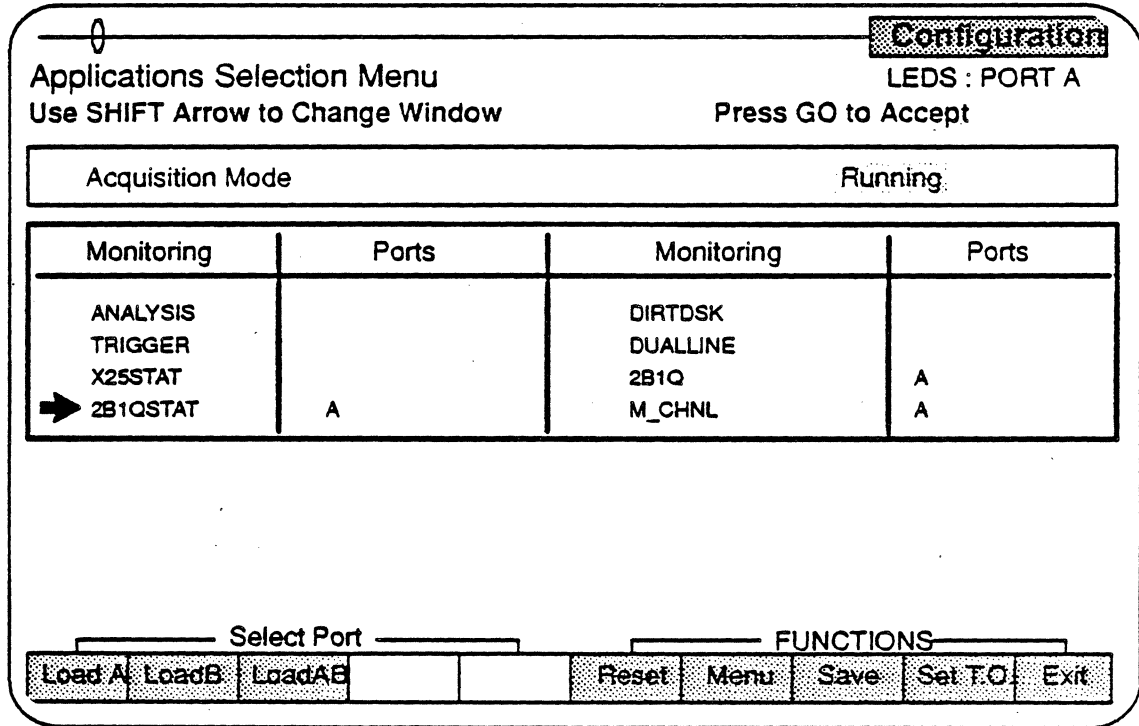
Figure 22.5: ISDN U-Interface (2B1Q) Monitoring and Statistics Applications Loaded.

Note: As the M_CHNL and/or 2B1Q_Stat pages are read—only pages, the re-
maining step addresses only the 2B1Q Monitoring Setup Menu. For
detailed descriptions of the M_CHNL and 2B1Q_Stat pages, see pages
22-22 ff.

9.   As monitoring is occurring, change the setup as you wish. For
further details, see page 22-13.
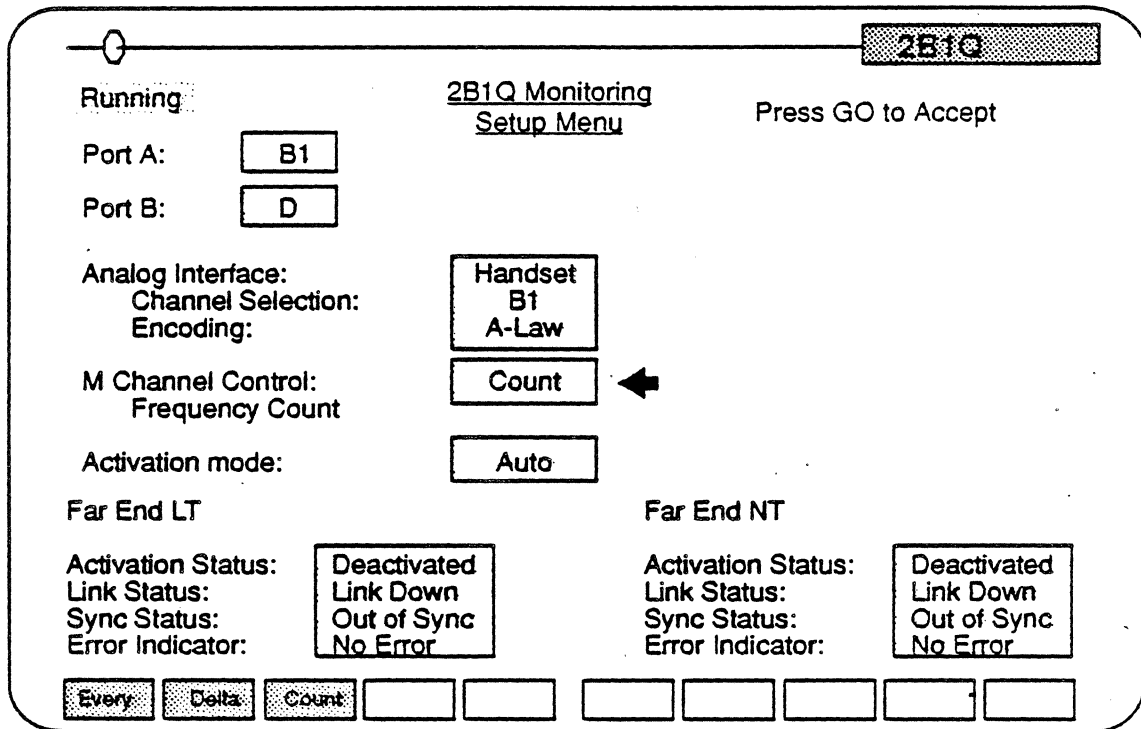
Figure 22.6: A 2B1Q Monitoring Setup Window.

Terminating
Monitoring

To terminate Monitoring:

1.   Open the Applications Selection Menu

2.   Select a 2B1Q application

3.   Press *Stop A* (or, if using Port B, *Stop B*).

4.   Repeat steps 2 and 3 for any other 2B1Q applications.

BASIC RATE U-INTERFACE MONITORING PAGES

The 2B1Q Monitoring Setup Menu, 2B1Q Statistics and M_CHNL pages comprise the three ISDN U-Interface (2B1Q) Monitoring pages.

The 2B1Q Monitoring Setup Menu serves two functions: To allow you to re—set run-time parameters while monitoring is in progress; and, to report on the status of the far end LT and NT links. run-time parameters are re-set using the *F* keys. Link status reports are given in the read-only, bottom portion of the page. This part of the page displays the status of the link between the Chameleon 32/Chameleon 20 and the NT and LT interfaces. It is not directly affected by the parameters you set in the 2B1Q Monitoring Setup Menu. This page is explained in greater detail beginning on page 22-12.

The 2B1Q Statistics page can be toggled between the NT and LT sides of the line. This read-only page gives hourly and daily counts of Near- and Far-End FEBEs and NEBEs, and the number of seconds a link is unavailable. This page is explained in greater detail beginning on page 22-16.

The M_CHNL analysis pages display M-Channel traffic in both real time and from a buffer called the 'history' buffer. The real-time page displays traffic as it passes through the Chameleon en-route to the LT or NT, respectively. The History page displays traffic that has been captured by the history buffer, permitting you to more-closely examine this data than is possible with the real-time page. These pages are explained in greater detail beginning on page 22-19.

2B1Q Monitoring
Setup Menu

When you load the 2B1Q application, a page with the banner *2B1Q Monitoring* appears (see Figure 22.7). The format of this page is similar to that of the 2B1Q Monitoring Setup Menu elicited by the *F7* key (Figure 22.4), but differs from that page in allowing you to modify the U–interface system configuration without stopping the monitoring in progress and in reporting in real time the status of the Far End LT and Far End NT links. There are two other differences:

- *Running* appears in the upper–left corner of the page to show that the 2B1Q application is being executed

- The *F10 Exit* key is not available.

  When setting parameters, the channel assignments for Ports A or B and the analog interface MUST be mutually exclusive. If they are not, you will get the message *Duplicated Channel Assignment* when you try to implement the setup. For example:

    If Port A   =   B1 and
    Analog Interface =   Handset, then;
                    Port B may be   B2, D, or off

    If Port A   =   B2 and
    Analog Interface =   600 Ohm, then;
                    Port B may be   B1, D, or off

To change a setting:

1.   Move the arrow to the desired system component.

2.   Press the appropriate *F*–key.

3.   Press *GO.*
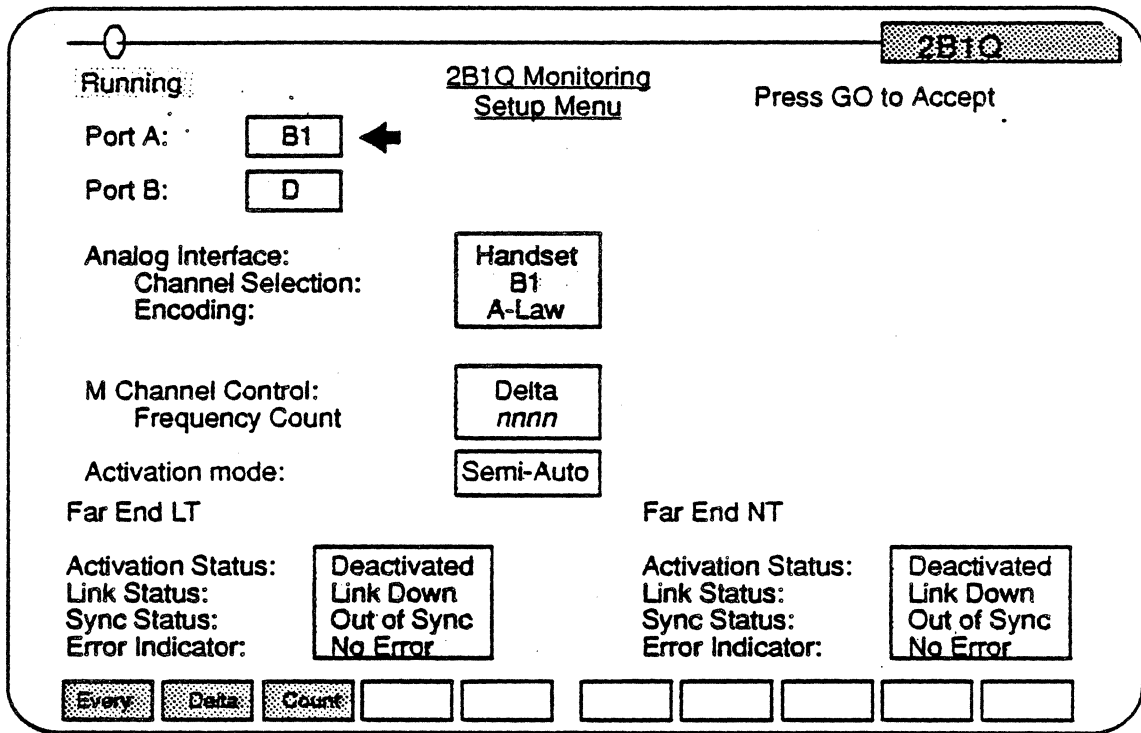
Figure 22.7: The 2B1Q Monitoring Setup Menu Monitoring Page.

Running This indicator flashes to tell you that the Chameleon is monitoring live 2B1Q data. While monitoring, either port accepts incoming data from both sides of the line

Port A Using *F1* through *F4*, you set the port to route the selected channel data; or, you disable the port altogether.

Port B Using *F1* through *F4*, you set the port to route the selected channel data; or, you disable the port altogether.

Analog Interface Using *F1* or *F2*, you set the Chameleon to accept analog input over the B1 or B2 channel from either a standard handset or from a device having a 600–Ohm impedance. Use *F3* to turn *Analog Interface* off.

This parameter has subordinate parameters for selecting the channel to be routed to the analog interface and the type of encoding to be employed.

- Channel Selection – allows you to route the B1 or B2 channel to the analog interface.

- Encoding – allows you to set the encoding to either A–Law or μ–Law.

Port A / Port B Using *F1* through *F4*, you set the port to route the selected channel data; or, you disable the port altogether.

**Analog
Interface**

Using *F1* or *F2*, you set the Chameleon to accept analog input over the B1 or B2 channel from either a standard handset or from a device having a 600–Ohm impedance. Use *F3* to turn this interface off.

This parameter has subordinate parameters for selecting the channel to be routed to the analog interface and the type of encoding to be employed.

- Channel Selection – allows you to route the B1 or B2 channel to the analog interface.

- Encoding – allows you to set the encoding to either A–Law or μ–Law.

**M Channel
Control**

Using *F1* through *F3*, you select the M-Channel messages to be displayed in the M_CH Analysis page. There are three options:

- Every – Every M-Channel message will be displayed.

- Delta – Only changes in M-Channel messages will be displayed.

- Count – Every change in message, or every number of messages determined by the count value, will be displayed. This selection elicits the *Frequency counter* line in the Setup menu.

  Frequency counter is a data–entry field in which you enter the count value to be used by software in displaying M-Channel messages in the M_CHNL Analysis page. For example, entering a value of 150 means that every 150th M-Channel message will be displayed in the M_CHNL Analysis page.

**Activation
Mode**

Using *F1* or *F2*, you establish how the NT - LT link is activated. There are two options: Auto and Semi-Auto.

Note: In the following discussion of link activation, the NT link is that part of the link from the Chameleon to the far-end NT interface. The LT link is the part of the link from the Chameleon to the far-end LT device.

Auto   The Chameleon activates both the NT and LT links as soon as the 2B1Q Run-Time Menu is loaded.

Semi-Auto   After the 2B1Q Run-Time Menu is loaded, the Chameleon waits for an activation request from the far-end interfaces before proceeding. Figure 22.8 illustrates this process from the LT end of the link and how the Chameleon reacts to a failure to establish a link.

Far-end LT sends
Activation Request

Chameleon waits for
Activation Request.

Chameleon receives
Activation Request.

Chameleon starts
activating link to NT.

Attempt to establsih
CH-to-NT link fails.

Chameleon de-activates
link to LT.
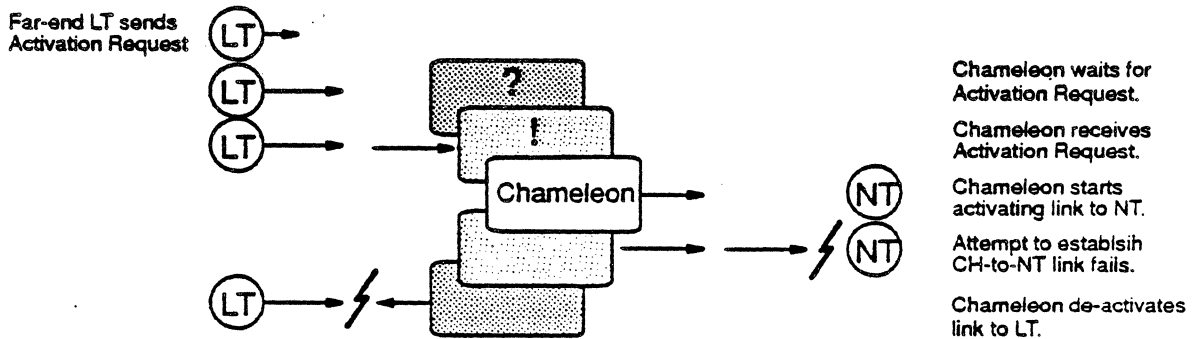
Figure 22.8 LT-initiated Link Establishment in the Semi-Auto Mode.

When the link is operating normally (without failure). the deactivation process can only be initiated from the far-end LT device. The Chameleon then initiates deactivation of the NT side of the link.

However, whenever the Chameleon detects a failure in on side of the link, it immediately takes down the other side.

Status Window

The Link Status Window (Figure 22.9) reports the current operating status of the Far End LT and Far End NT links. () at the bottom of the screen.

```
┌─────────────────────────────────────────────────────────────────────────┐
│                                                                          │
│  Far End NT                                Far End LT                     │
│ ·····································································      │
│  Activation Status:   In Progress         Activation Status:   Deactivated │
│  Link Status:         Link Up             Link Status:         Link Down  │
│  Sync Status:         In Sync             Sync Status:         Out of Sync │
│  Error Indicator:     No Error            Error Indicator:     Error      │
│                                                                          │
└─────────────────────────────────────────────────────────────────────────┘
```

Figure 22.9: The U–Transceiver Status Window

Activation Status

Depending upon the status of the U transceiver at the time, displays one of three messages:

- In Progress – 2B1Q transceiver activation is occurring.

- Activated – Activation is successfully completed and transmission is in process. Upon displaying this status, Link Status displays *Link Up*.

- Deactivated – Either activation failed, or transmission is ended. Upon displaying this status, Link Status displays *Link Down*. Error Indicator changes to *Error* if deactivation occurred as a result of one of the three conditions for an Error message were met. (See the description for *Error* under Error Indicator below).

Link Status

Displays whether the link is up or down. *Link Down* appears when one of the following occurs:

- Receive framing is lost or severely in error, and remains lost or in error for 480 milliseconds.

- A hardware or software reset occurs. These resets may be of the following types:

Sync Status

Displays whether the superframe is synchronized (in sync) or un-synchronized (out of sync).

**Error
Indicator**

Displays *Error* or *No Error* under the following circumstances:

- *Error* – When 1) loss of frame or signal occurs for 480 milliseconds or more, 2) there is a failure to get an NT1 response to a LT signal; or, 3) the 15–second activation timer expires.

- *No Error* – When 1) activation occurs before the 15–second Activation Timer expires; 2) a frame or signal is detected before 480 milliseconds expires; or, 3) there is a failure to get an NT1 response to a LT signal.

2B1Q Statistics

When the 2B1Q Statistics application is loaded,, a 2B1Q Statistics page (Figure 22.10) is opened and all error statistics counters are started. The display of 2B1Q line error statistics conforms to the T1M1.2/89–028R1 standard. Each reported error is explained below.


```
─○──────────────────────────────────────────  2B1Q Statistics

  NT


  Start Time:          09 OCT 1990 10:16:50
  Last Sample Time: 09 OCT 1990 10:16:50

              ES–NEBE   SES–NEBE     ES–FEBE    SES–FEBE        LUS
  Current Hour      0          0           0           0          0
  Previous Hour     0          0           0           0          0
  Current Day       0          0           0           0          0
  Previous Day      0          0           0           0          0

              NEBE Count       FEBE Count      No Sync Count
  Current Hour:      0              0                0
  Previous Hour:     0              0                0

  Most Recent Hours:  1     2     3     4       5      6      7
  ES–NEBE             0     0     0     0       0      0      0
  ES–FEBE             0     0     0     0       0      0      0


  FREEZE  RESET   LT  ┌──┐ ┌──┐  ┌──┐ ┌──┐ ┌──┐ ┌──┐ ┌──┐
```
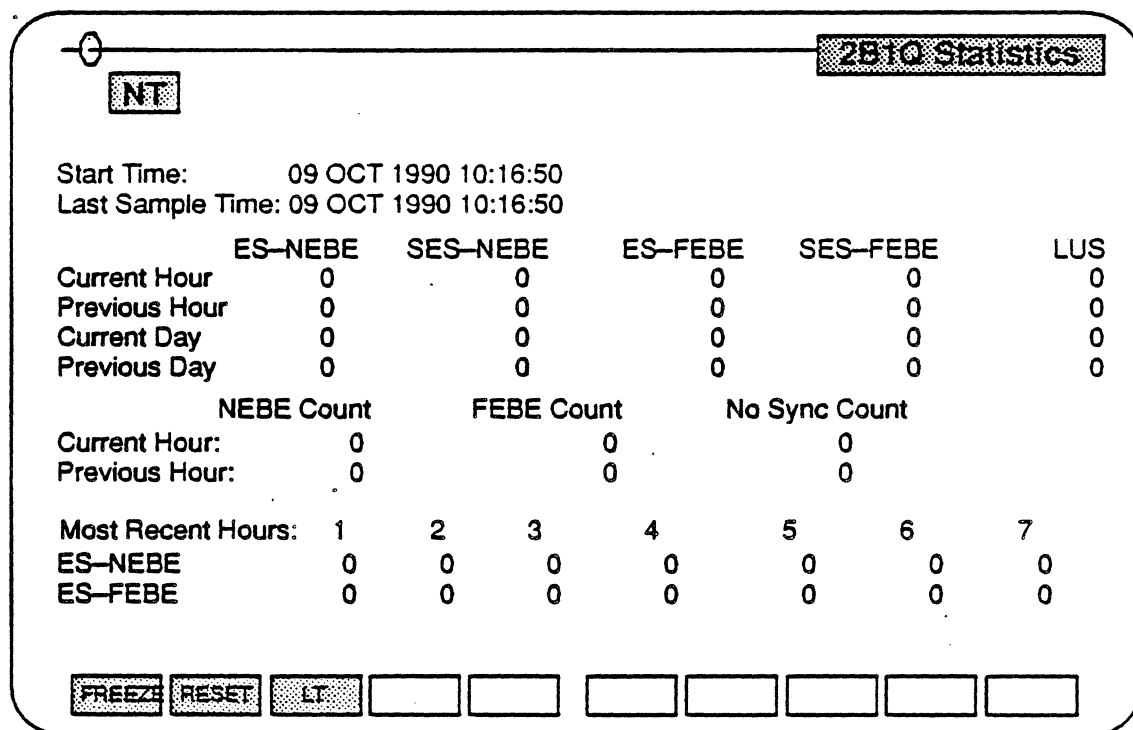
Figure 22.10: A Sample 2B1Q Line Statistics Page.

NT (LT)   NT displays the link statistics of the Chameleon-to-NT interface. LT displays the link statistics of the Chameleon-to-LT interface. *F3* toggles the screen display between NT and LT.

Start Time   The date, month, year and time at which the 2B1Q Statistics screen was opened, or the RESET key was pressed.

**Last Sample
Time**   The date, month, year and time at which the error statistics screen was last updated.

**Current
*Hour/Day***   The current hour or 24–hour day in which error counts have been or are being registered. When that 1 hour or

day expires, the error count for that time is moved from the current—hour/day register to the previous—hour/day register and the current—hour/day register is set to zero. Old data in the previous—hour/day register is then discarded.

Previous Hour/Day

The hour or 24—hour day prior to the Current Hour/Day in which error counts were registered. At the end of each hour or day, counts from the current—hour/day registers are transferred to the previous—hour/day registers, and old data in the previous—hour/day registers is moved to the first Most Recent Hours register. See *Most Recent Hours*.

Most Recent Hours

A stack of seven, 1—hour registers tracks the ES—NEBE and ES—FEBE counts for the 7 hours prior to the Previous Hour. At the end of each hour, the ES count from the Previous Hour register is transferred to the first Most Recent Hours register and the values in the six successive registers are pushed down one register in the stack. Counts from the oldest hour (at the bottom of the stack) are discarded.

These 7 registers, along with the Previous Hour and Current Hour registers, constitute a total ES—NEBE and ES—FEBE reporting period of nine hours. Any Errored Second NEBE and/or FEBE data registered prior to a nine—hour period is discarded. This does not apply, however, to NEBE and FEBE counts.

ES—NEBE

Errored Second — Near—End Block Error. A second in which one or more Near—End CRC violations were detected by the far end.

SES—NEBE

Severely Errored Second — Near—End Block Error. A second in which 3 or more Near—End CRC violations were detected.

ES—FEBE

Errored Second — Far—End Block Error. A second in which one or more Far—End CRC violations were detected.

SES—FEBE

Severely Errored Second — Far—End Block Error. A second in which 3 or more Far—End CRC violations were detected.

LUS

The *Link–Unavailable Second*. A second in which either synchronization or a signal was lost for more than 480 milliseconds. This count is updated whenever the 2B1Q link is not up at the time the screen is displayed.

NEBE
Count

The cumulative number of near–end CRC violations measured over the period of time reported in the Start Time and Last Sample Time lines.

FEBE
Count

The cumulative number of far–end CRC violations measured over the period of time reported in the Start Time and Last Sample Time lines.

NO–SYNC

The number of individual counts of *No Superframe Synchronization* indications.

F1 FREEZE/
UNFREZ

Toggles between two settings:

- *Freeze* – halts the display of newly–acquired error counts at the time it is pressed, but does not stop the error count operation.

- *Unfreeze* – cancels a Freeze action and updates the screen with the latest count values acquired while the screen was frozen.

F2 RESET

Resets all counters to zero and the Start Time to the current system time.

M—Channel Analysis

When the M—Channel Analysis application is is started, a Real Time page (M_CH RTime) and History page (M_CHNL) are opened.

The Real Time page displays transmission events (Event—buffer traffic) between NT and LT as they occur. The History page displays previously—acquired data that has been placed in a history buffer. For more detailed explanations of these two functions, see Chapter Four: Analysis in the *Chameleon 32* or *Chameleon 20 User's Manuals.*

Decoding of the 2B1Q M—channel is done for each superframe. Each LT superframe includes:

- Two EOC frames
- ACT, DEA, UOA, AIB, FEBE bits
- Four reserved bits

Each NT superframe includes:

- Two EOC frames,
- ACT, PS1, PS2, NTM, CSO, SAI
- Two reserved bits for NT.

The display of each superframe has the following attributes:

- Time Stamping:

  Event time stamp with an accuracy of ± 20 microseconds. Time stamps are displayed in the following format: *hh:mm:ss ddd ddd,* where:
  hh = hours
  mm = minutes
  ss = seconds
  ddd ddd = microseconds

- Screen Format:

  Split—screen format displays the LT data on the left half of the screen and the NT data on the right half of the screen.

- Colors:

  White = Time Stamp and Event buffer ports
  Yellow = Summary M—channel message
  Green = Detail M—channel message
  Red = Error messages, warnings, advisories

- Function Keys:

  F1 – PHYS (Time stamp and the raw data)
  F2 – M_CH (M–Channel message)
  F9 – toggles Summary and Full Displays.
  F10 – Display Format

Figure 22.11 and Figure 22.12 below show sample M–Channel analysis pages in Summary and Full formats.

```
 ─O─                                                    ▒▒M CHNL A▒▒
              LT MESSAGE                        NT MESSAGE
        ─────────────────^ 0 ^─────────
 PortA 02:58:37 677 000  fl=0  FCS=0000
 EOC Msg #1 : addr=0  dm=1  i=AA
 EOC Msg #2 : addr=0  dm=1  i=AA
 M4  bits  =  BC
  ACT DEA RSV RSV RSV RSV UOA AIB
    1   0   1   1   1   1   1   1

 M5/M6  bits  =  0
    M51   M61   M52   FEBE
     0     0     0     0
        ─────────────────^ 1 ^─────────      ─────────────────^ 0 ^─────────
                                             PortA 02:58:37 677 357  fl=0   FCS=0000

                                             EOC Msg #1 : addr=0  dm=1  i=AA
                                             EOC Msg #2 : addr=0  dm=1  i=AA
                                             M4  bits  =  BC
                                             ACT PS1 PS2 NTM CSO RSV  SAI RSV
                                              1   0   1   1   1   1    1   1

                                             M5/M6  bits  =  0
                                                M51   M61   M52   FEBE
```
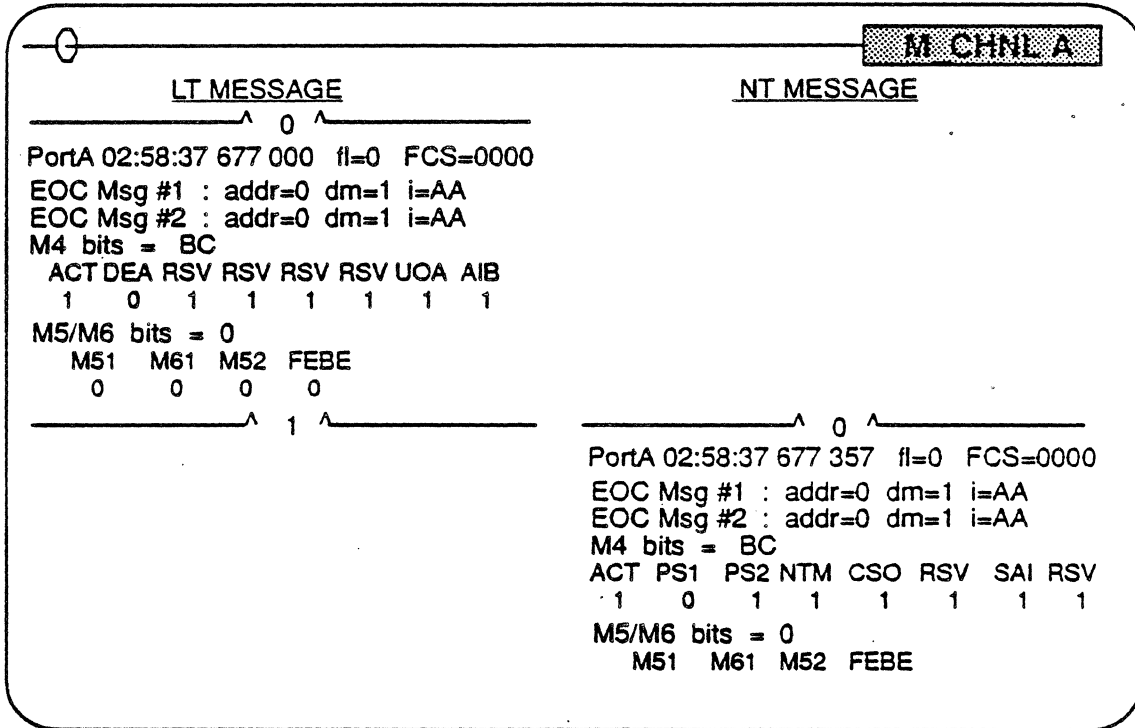
Figure 22.11: M–Channel Analysis Summary Display.

```
 ─O─                                                    ▒▒M CHNL A▒▒
         LT MESSAGE                          NT MESSAGE
                                       ─────────────────^ 0 ^─────────
                                       PortA 02:58:37 677 357  fl=0  FCS=0000
                                       EOC Msg #1 : addr=0  dm=1  i=AA
                                            EOC address                  NT
                                            EOC dm                       msg
                                            EOC i             Unable to Comply
                                       EOC Msg #2 : addr=0  dm=1  i=AA
                                            EOC address                  NT
                                            EOC dm                       msg
                                            EOC i             Unable to Comply
                                       M4  bits  =  BC
                                       ACT PS1 PS2 NTM CSO RSV  SAI RSV
                                        1   0   1   1   1   1    1   1
                                            ACT          Activation in progress
                                            DEA          No deactivation process
                                            UOA                    S/T activity
                                            AIB              no alarm indication
                                       M5/M6  bits  =  0
                                          M51   M61   M52   FEBE
                                           0     0     0     0
```
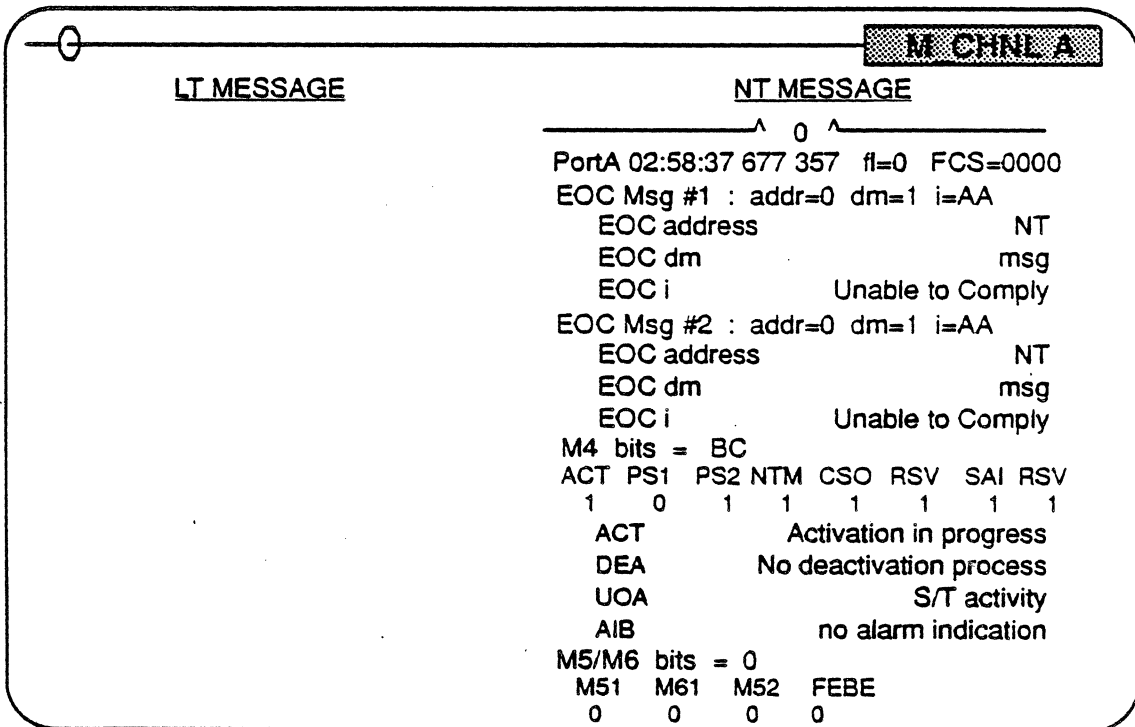
Figure 22.12: M–Channel Analysis Full Display (NT Superframe only.

Function Keys

The functions of keys *F1* through *F10* were created using the *Tekelec* Protocol Monitoring Development System (PMDS), providing control over each protocol layer. For detailed discussion of the PMDS and the function keys, see the *Chameleon Protocol Monitoring Development System* manual, Chapter 7.

Each function key (F–key) is assigned several options. The Function Key strip at the bottom of the Chameleon screen displays the current F–key selection.

Included in this description of F-keys is a section explaining other keys used for the control of the M–Channel Analysis page. This section begins on page 22-26.

Note:

For the operation of the F1 and F2 keys in 2B1Q Line Error Statistics, see page 22-19.

F1 through F8

For keys *F1* through *F8*, the following conventions are used:

+ The data for the current layer is displayed in an interpreted mode.

" The data for the current layer is displayed in an un-interpreted mode.

* The data for the current layer is displayed in both interpreted and un-interpreted modes.

— The data for the current lay is acquired, but not displayed.

F9

The F9 key determines how upper–layer (Layers 3 and above) data is displayed. There are two options:

SUMMARY
This is the default setting, and displays user–defined summary interpretations for each layer. For further details, see Chapter 2 of your *Chameleon Protocol Monitoring Development System* manual.

FULL
This selection displays complete interpretations of all the data of the current layer.

F10

The F10 key determines the format in which the bit–values of acquired data is displayed. Data is displayed with a caption identifying the data item, and a value representing the acquired data. There are eight formats in which the bit values can be displayed:

Meaning When possible, the *interpretation* of the value is displayed rather than the value itself. If the current protocol does not define the meaning, the value is displayed in hexidecimal.

Hex Displays the value(s) in hexidecimal code.

Decimal Displays the value(s) in decimal.

Binary Displays the value(s) in binary code.

ASCII Displays the value(s) in ASCII code.

EBCDIC Displays the value(s) in EBCDIC code.

Offset Displays the offset of the data item from the start of the acquired event in the format $n.m$, where:
n = number of octets
m = number of bits.

Length Displays the length of the data item in the format $n.m$, where::
n = number of octets
m = number of bits.

M–Channel Analysis Control Keys

The M–Channel Analysis pages is a read–only page displaying data taken from a real–time bit stream and stored in a history buffer. The display of this data can be manipulated using the keys illustrated and explained in Figure 22.13 below.

Note: When you first display the M–Channel Analysis page is may be blank. To bring data on–screen, press any arrow key. You can then use the keys described below to manipulate the display.

KEY	FUNCTION
←	Displays the oldest event.
→	Displays the most—recent event.
↑	Scrolls the page up; reverses or slows the page when scrolling down. Controls speed of page—up scrolling: pressing successively up to three times increases scrolling speed.
↓	Scrolls the page down; reverses or slows the page when scrolling up. Controls speed of page—down scrolling: pressing successively up to three times in creases the scrolling speed.
Space Bar	Stops scrolling.
Scroll ↑	Displays the next page of data.
Shift Scroll ↓	Displays the previous page of data.
Scroll ↓	Moves displayed data down one line each time you press the key.
Shift Scroll ↑	Moves displayed data up one line each time you press the key.
n	Displays the next event.
p	Displays the previous event.

Figure 22.13: The M—Channel Analysis Display Control Keys.

Error Messages

Figure 22.14 lists the error messages you may be given in the course of running ISDN U-Interface (2B1Q) Monitoring. Each message is explained and corrective action(s) given. The messages are grouped according to the level of operation at which they occur: System, 2B1Q physical setup, ISDN U-Interface (2B1Q) Monitoring, and M–Channel analysis.

In Figure 22.14, error messages and menu selections are in italics; message explanations are indented below the messages; and, corrective action(s) are indented below the explanations.

System Software:

2B1Q Monitor is not supported in Phase One.
> You selected *Monitor* for the Mode of Operation in the Configuration Setup Mode Menu and *2B1Q* for the Physical Interface.
> > In the Configuration Setup Menu, return to Mode of Operation and enter *Simulat* (press *F2*).

Cannot allocate memory for 2B1Q.
> Your Chameleon has run out of hardware memory for the 2B1Q Event and Data buffers.
> > Contact Customer Support at 1–800–441–9990.

2B1Q Physical Setup Software

Duplicated Channel Assignment
> Each channel selection for Ports A and B, Analog Inter face, and Idle Pattern Destination is not unique.
> > In the 2B1Q Monitoring Setup Menu (See page 22–10), re–assign channels so that they are mutually exclusive.

U Monitoring requires U-board Version A6 or higher.
> Your Chameleon does not have U-Board Rev. E higher installed.
> > Install the required board in your Chameleon.

U Monitoring software is not installed.
> You are selecting 2B1Q Monitoring without having first installed the 2B1Q Monitoring software.
> > Install the required software.

Figure 22.14: ISDN U-Interface (2B1Q) Monitoring Error Messages.

EXT1 / EXT2
Pinouts

Tekelec's ISDN PHYSICAL INTERFACE EXT1 and EXT2 connectors are 15–pin, D—subminiature females, DA15S type. Figure 22.15 and Figure 22.16 below give the pinouts for these bi-directional connectors. All signals are standard RS422 voltage levels. SEND data signals are ignored in the Monitor mode of operation.

A cable providing an RS449 interface is provided with the U–I/F Monitoring package. Figure 22.16 correlates the pins of this cable with those of the DA15S connectors.
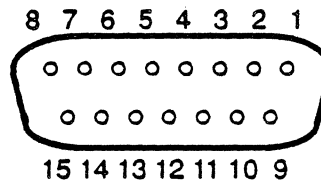
Figure 22.15:: The DA15S Connector for EXT1 and EXT2.

DA15S Pin Number	RS449 Pin Number	Description	Direction
1	1	Chassis Ground	-
2	22	Send Data B	Input
3	–	Unused	–
4	24	Receive Data B	
5	–	Unused	–
6	23	Send Timing B	Output
8	19	Signal Ground	–
9	4	Send Data A	Inputs
10	–	Unused	–
11	6	Receive Data A	Output
12	–	Unused	–
13	5	Send Timing A	Output
14	–	Unused	–
15	8	Receive Timing A	Output

Figure 22.16:: DA15 and RS449 Pinouts.

APPENDIX A:
CCITT X.21 STANDARD STATE and TIMER TABLES

Introduction

This appendix provides the State and Timer Tables, based on the CCITT standard as they are implemented in the X.21 software. These may differ from the CCITT standard at some points due to errors or inconsistencies in the standard.

The tables are organized as follows:

- Table A.1   State Transition Table for Circuit and Enhanced sub–addressing modes, the files CCITTCKT.STT and CCITTENH.STT. Note that State 8 is shown twice, once for the CKT file and again for the ENH file. The only difference between Circuit and Enhanced sub–addressing modes is this one state.

- Table A.2   State Transition Table for Packet mode, the file CCITTPKT.STT.

- Table A.3   DTE Timer Table Editor, for the CCITTCKT and CCITTENH files. This table provides the timers and keys defined for circuit switched protocols.

- Table A.4   DTE Timer Table Editor, for CCITTPKT. This table provides the timers and keys defined for packet switched protocols.

- Table A.5   DCE Timer Table Editor, for the CCITTCKT and CCITTENH files. This table provides the timers and keys defined for circuit switched protocols.

- Table A.6   DCE Timer Table Editor, for CCITTPKT. This table provides the timers and keys used in packet switched protocols.

- Table A.7   CCITT Timer Table

For any further information on the CCITT Standards not provided in this appendix, refer to the CCITT Red Book, Volume VIII, Fascicle VIII.3, *Data Communication Networks Interface.*

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
1	Ready	1	OFF	1	OFF	Key C Key N Key U	2 14 24		Key C Key N Key U	8 18 —		1, 2, 8, 14, 15, 18, 24, —, ???
2	Call request	0	ON	1	OFF	T1 Key X	1 16	3	goto Key X	3 19		1, 3, 15, 16, 19, ???
3	Proceed to select	0	ON	+	OFF	goto Key X	4 16		T11 T12 Key X	19 19 19	5 4, 5	4, 5, 16, 19, ???
4	Selection signal	IA5	ON	+	OFF	goto Key X	5 16		T13 Key X	19 19	5	5, 16, 19, ???
5	DTE waiting	1	ON	+	OFF	T2 Key X	16 16	7, 10A, 12, 19	goto Key X	6A 19		6A, 11, 12, 16, 19, ???
6A	DCE waiting	1	ON	SYN	OFF	Key X	16		goto Key X	7 19		7, 10A, 11, 12, 16, 19, ???
6B	DCE waiting	1	ON	SYN	OFF	Key X	16		goto Key X	10B 19		10B, 11, 12, 16, 19, ???
6C	DCE waiting	•	OFF	SYN	OFF	goto Key X	25 16		T14C Key X	19 19	9C, 25	6D, 9C, 16, 19, 25, ???
6D	DCE waiting	1	OFF	SYN	OFF	goto Key X	9C 16		Key X	19		9C, 16, 19, ???

Table A.1: State Transition Table, CCITTCKT.STT and CCITTENH.STT

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
7	Call progress signal	1	ON	IA5	OFF	T3A Key X	16 16	10A, 12. 19	goto Key X	6A 19	10A	6A, 7, 10A, 11, 12, 19, ???
8* (CKT)	Incoming call	1	OFF	BEL	OFF	goto Key X	9 16		T14A Key X	1 19	9, 9B, 15	1, 9, 9B, 15, 16, 19, ???
8* (ENH)	Incoming call	1	OFF	BEL	OFF	goto Key X	9B 16		T14A Key X	1 19	9, 9B, 15	1, 9, 9B, 15, 16, 19, ???
9	Call accepted	1	ON	BEL	OFF	T4B Key X	16 16	10B, 12, 19	goto Key X	6B 19		6B, 11, 12, 16, 19, ???
9B	Proceed with call information	*	OFF	BEL	OFF	T4A Key X	16 16	10C, 6C, 19	goto Key X	10C 19		10C, 16, 19, ???
9C	Call accepted	1	ON	SYN	OFF	T4B Key X	16 16	10B, 12. 19	goto Key X	10B 19		6B, 10B, 16, 19, ???
10A	DCE-provided information	1	ON	IA5	OFF	T3A Key X	16 16	7, 10C, 12, 19	goto Key X	6A 19	11	6A, 7, 10A, 11, 12, 16, 19, ???

Table A.1: State Transition Table, CCITTCKT.STT and CCITTENH.STT (continued)

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
10B	DCE-provided information	1	ON	IA5	OFF	T4B Key X	16 16	10B, 12. 19	goto Key X	6B 19	11	6B, 11, 12, 16, 19, ???
10C	Call information	*	OFF	IA5	OFF	T4A Key X	16 16	6C, 19	goto Key X	6C 19		6C, 16, 19, ???
11	Connection in progress	1	ON	1	OFF	Key X	16		goto Key X	12 19		12, 16, 19, ???
12	Ready for Data	1	ON	1	ON	Key X	16		goto Key X	13 19		13, 16, 19, ???
13	Data transfer	Data	ON	Data	ON	Key X	16		Key X	19		13, 16, 19, ???
14	DTE controlled not ready	01	OFF	1	OFF	Key R Key U	1 24		Key N Key U	23 —		1, 23, 24, —, ???
15	Call collision	0	ON	BEL	OFF	Key X	16		goto Key X	3 19		3, 15, 16, 19, ???
16	DTE clear request	0	OFF	X	X	T5	18	21	goto	17		17, 18, 21, ???
17	DTE clear confirmation	0	OFF	0	OFF				goto	21		21, ???
18	DTE ready, DCE not ready	1	OFF	0	OFF	Key U	22		Key R Key U	1 —		1, 22, —, ???
19	DCE clear indication	X	X	0	OFF	goto	20		T15	24	20	20, 24, ???

Table A.1: State Transition Table, CCITTCKT.STT and CCITTENH.STT (continued)

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
20	DTE clear confirmation	0	OFF	0	OFF	T6	18	21	goto Key X	21 19		18, 21, ???
21	DCE ready	0	OFF	1	OFF	goto	1		T16	24	1	1, 24, ???
22	DTE uncontrolled not ready, DCE not ready	0	OFF	0	OFF	Key R	18		Key R Key U	24 —		18, 24, —, ???
23	DTE controlled not ready, DCE not ready	01	OFF	0	OFF	Key R Key U	18 22		Key R Key U	14 —		14, 18, 22, —, ???
24	DTE uncontrolled not ready, DCE ready	0	OFF	1	OFF	Key R	1		Key N Key U	22 —		1, 22, —, ???
25	DTE provided infor-mation	IA5	OFF	SYN	OFF	goto Key X	6D 16	'	T14C Key X	19 19	9C, 25	6D, 9C, 16, 19, 25, ???
???	Unknown State	X	X	X	X	Key X	16		Key X	19		1, 16, 19, ???
—	DCE controlled not ready	X	X	01	OFF				Key R	1		1, 14, 18, 22, 23, 24, ???

Table A.1: State Transition Table, CCITTCKT.STT and CCITTENH.STT (continued)

Notes: State 8 is the only state different with or without enhanced sub–addressing. These are marked to show which is in effect for either test mode.

If the current state and next state have the same lead status, the state of the tester will not change.

In enhanced sub–addressing, state 9C will go to 10B instead of 6B since 9C and 6B have the same lead status.

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
1	Ready	1	OFF	1	OFF	Key C Key N Key U	13S 14 24		Key C Key N Key Y Key Z	13R 18 – —		1, 13R, 13S, 14, 18, 24, –, —, ????
13	Data transfer	Data	ON	Data	ON	Key X	13R		Key X Key Y	13S –		13, 13R, 13S, –, ???
13R	Receive Data	1	OFF	Data	On	Key D	13		Key R Key Y	1 –		1, 13, 13R, 18, –, ????
13S	Send Data	Data	On	1	OFF	Key D	1		Key R Key Y	13 –		1, 13, 13S, –, ???
14	DTE controlled not ready, DCE ready	01	OFF	1	OFF	Key R Key U Key S	1 24 13S		Key N Key Z	23 —		1, 13S, 23 24, —, ???
18	DTE ready, DCE not ready	1	OFF	0	OFF	Key U	22		Key R Key V Key Z	1 13R —		1, 13R, 22, —, ???
22	DTE uncontrolled not ready, DCE not ready	0	OFF	0	OFF	Key R	18		Key R Key Z	24 —		18, 24, —, ???
23	DTE controlled not ready, DCE not ready	01	OFF	0	OFF	Key R Key U	18 22		Key R Key Z	14 —		14, 18, 22, —, ???
24	DTE uncontrolled not ready, DCE ready	0	OFF	1	OFF	Key R Key S	1 13S		Key N Key Z	22 —		1, 13S, 22, —, ???

Table A.2: State Transition Table, CCITTPKT.STT

STATE No.	STATE NAME	DTE LEADS		DCE LEADS		DTE TIMEOUT FUNCTIONS			DCE TIMEOUT FUNCTIONS			VALID TRANSITION LIST
		T	C	R	I	TIME-OUT	EXIT STATE	CANCEL STATE	TIME-OUT	EXIT STATE	CANCEL STATE	
–	DCE Not Ready	Data	ON	0	OFF				Key R Key S Key D Key V	1 13S 13 13R		1, 13, 13R, 13S, 18, ???
—	DCE controlled not ready	X	X	01	OFF				Key R Key H Key I	1 14 24		1, 14, 18, 22, 23, 24, ???
???	Unknown State	X	X	X	X	Key R	1		Key R	1		1, ???

Table A.2: State Transition Table, CCITTPKT.STT

Notes: When testing in Packet Mode:

If the current state and next state have the same lead status, the state of the tester will not change.

When you are in State – or —, the simulation keys shown at the top will not always initiate the transit state shown. This is because the machine can only control the leads related to the device being simulated. The actual outcome will be determined by the lead change initiated and the current status of the other device leads.

The transition from 13R or 13S to 13 is controlled manually through a key. You can add a goto or timer to make these transitions automatic.

TIMER	VALUE	DESCRIPTION				
T1	3.0	St:	Call request	2	Te:	Pro–to–sel 3
T 2	20.0	St:	End–of–selection	5	Te:	710A, 12, 19
T3A	6.0	St:		7, 10A	Te:	12, 19
T3B	60.0	St:		7, 10A	Te:	12, 19
T4A	2.0	St:		9B, 10C	Te:	19, 6C, 10C
T4B	6.0	St:		9, 9C, 10B	Te:	12, 19, 10B
T5	2.0	St:		16	Te:	21
T6	2.0	St:		20	Te:	21
T7	0.2	St:		1	Te:	8
Key X	n/a	State 16,	Clear request			
Key R	n/a	State 1,	Ready			
Key U	n/a	State 24,	DTE uncontrolled not ready			
Key C	n/a	State 2,	Call request			
Key N	n/a	State 14,	DTE controlled not ready			
Goto	n/a	n/a				

Table A.3: DTE Timer Table, for CCITTCKT and CCITTENH

TIMER	VALUE	DESCRIPTION	
Key S	n/a	State 13S,	Send data
Key D	n/a	State 13,	Data transfer
Key Z	n/a	State —,	DCE controlled not ready
Key Y	n/a	State –,	DCE not ready
Key X	n/a	State 16,	Clear request
Key R	n/a	State 1,	Ready
Key U	n/a	State 24,	DTE uncontrolled not ready
Key C	n/a	State 2,	Call request
Key N	n/a	State 14,	DTE controlled not ready
Goto	n/a	n/a	

Table A.4: DTE Timer Table, for CCITTPKT

TIMER	VALUE	DESCRIPTION				
T11	36.0	St: Proceed–to–select	3	Te:	DTE waiting	5
T12	6.0	St: Proceed–to–select	3	Te:	DTE waiting	4, 5
T13	6.0	St: Nth selection char		Te:	N+1 selection char	5
T14A	0.5	St: Incoming call (auto)	8	Te:	Call Info	9, 9B, 15
T14B	60.0	St: Incoming call (mn)	8	Te:	Call Info	9, 9B, 15
T14C	20.0	St: End of Call Info	6C, 25	Te:	Call Accepted	9C
T15	0.5	St: Clear Indication	19	Te:	Clear Confirmation	20
T16	0.1	St: DCE Ready	21	Te:	Ready	1
Key X	n/a	Change DCE to 'Clear Indication'				
Key C	n/a	Change DCE to 'Incoming Call'				
Key U	n/a	Change DCE to 'DCE controlled not ready'				
Key R	n/a	Change DCE to 'Ready'				
Key N	n/a	Change DCE to 'DCE not Ready'				
Goto	n/a	n/a				

Table A.5: DCE Timer Table, for CCITTCKT and CCITTENH

TIMER	VALUE	DESCRIPTION	
Key C	n/a	State 13R,	Receive data
Key S	n/a	State 13S,	Send data
Key H	n/a	State 14,	DTE controlled not ready, DCE ready
Key I	n/a	State 24,	DTE uncontrolled not ready, DCE ready
Key Z	n/a	State —,	DCE controlled not ready
Key Y	n/a	State –,	DCE not ready
Key X	n/a	State 13S,	Send data
Key V	n/a	State 13R,	Receive data
Key D	n/a	State 13,	Data transfer
Key R	n/a	State 1,	Ready
Key N	n/a	State 22,	DTE uncontrolled not ready, DCE not ready
Goto	n/a	n/a	

Table A.6: DCE Timer Table, for CCITTPKT

STATE No.	STATE NAME	TIME–OUT TRANSITIONS		
		EXIT STATE	TIME–OUT	CANCEL STATE
1	Ready	1	T7	8
2	Call request	1	T1	3
3	Proceed to select	19	T11 T12	4 4, 5
4	Selection signal	19	T13	End of Selection
5	DTE waiting	16	T2	7, 10A, 12, 19
6C	DCE waiting	19	T14C	9C, 25
7 & 10A	Call progress signal Manual answering DTE	16 16	T3A T3B	7, 10A, 12, 19
8	Incoming call Manual answering DTE	1 1	T14A T14B	9, 9B, 15 9, 15
9, 9C & 10B	Call accepted	16	T4B	10B, 12, 19
9B	Proceed with call information	16	T4A	10B, 6C, 19
9C	Call accepted	16	T4B	10B, 12, 19
10C	Call information	16	T4A	6C, 19
16	DTE clear request	18	T5	21
19	DCE clear indication	24	T15	20
20	DTE clear confirmation	18	T6	21
21	DCE ready	24	T16	1
25	DTE provided information	19	T14C	9C

Table A.7: CCITT Timer Table

Notes on Table A.7

- The time–out transitions for T3B, T7 and T14B are not implemented at this time.

- State 7 is not in the cancel state of State 7. It should be added.

- The transitions terminated at End of Call information or End of Selection characters are implemented to terminate at State 6C or 5, respectively.

- Currently, T13 is terminated only at the signalling of state 5. It should be terminated at N+1 or End of Selection character.

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