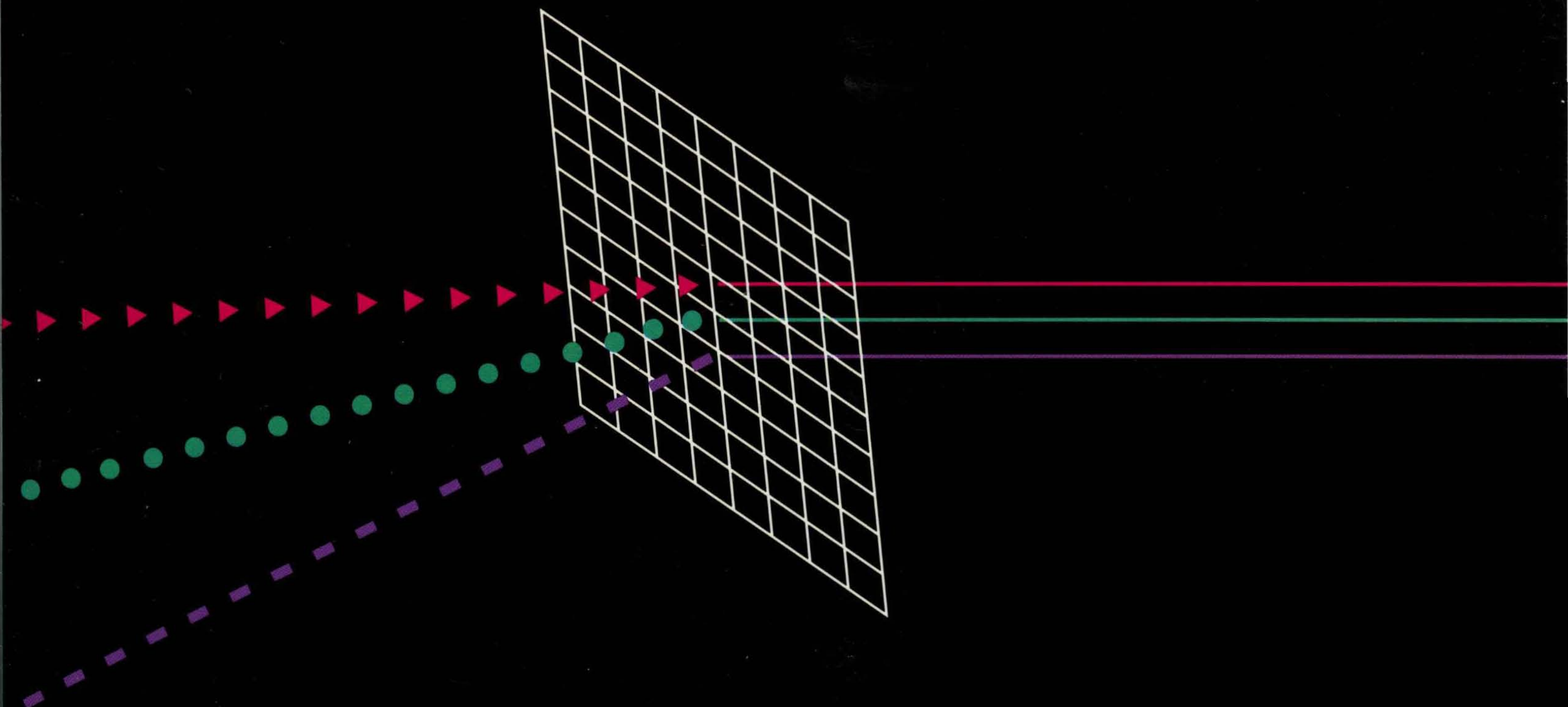
TEKELEC



Chameleon 32

BASIC Simulation Volume III

TEKELEC

902-9038

CHAMELEON 32/20

BASIC SIMULATION MANUAL

Version 5.1

This manual, Version 5.1, corresponds to Standard Software Release 4.3.2.

TEKELEC
26580 Agoura Road
Calabasas, California
91302

Part Number 910–3372
909–3372

October 17, 1991

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES

LIST OF FIGURES

1.1 CHAMELEON SIMULATION CONCEPTS

Why use simulation?

Simulation allows you to emulate either side of the line in an X.25, SNA, Async, BSC, ISDN Q.921/Q.931, or any BOP framed protocol. Using the Chameleon's protocol-specific programming languages, you can establish a testing environment for your specific needs. Chameleon simulation allows you to:

- Create a controlled live environment to test both hardware and software
- Test both common and not-so-common error conditions
- Simulate complex network or individual devices such as:
  - Mainframes or Front End Processors
  - Modems
  - Terminals or Terminal Controllers
  - ISDN Network Terminator (NT) or Terminal Endpoint (TE)
  - Other intelligent communications devices

Beginning with Chameleon 32 system software 4.0 and Chameleon 20 system software 1.2, you can simultaneously monitor the data being transmitted between the Chameleon and the device under test. Refer to Section 2.1 for more information about this capability.

Applications

You can use simulation for the following types of applications:

- Use the simulation languages to write certification packages to test equipment or software functionality by writing protocol-specific scenarios. The Chameleon itself was tested using its own simulators to send and receive worst case data.
- After identifying a specific problem using Chameleon Analysis (SABM collision, for example) you can develop simulation programs to duplicate the problem and continue testing until the hardware or software is able to handle the problem correctly.
- If you are having problems running certification packages (for example, DDN tests), you can copy just the portion of the test package you need, modify it, and run it. This enables you to run a part of the test so that you can focus on that portion without running the entire test package repeatedly.

WHY BASIC?

Introduction

The Chameleon BASIC language is an interpreted test language that looks like standard BASIC. Since BASIC is a widely used language, many Chameleon users are already familiar with its general format and usage and can adapt quickly to Chameleon BASIC and its subsets.

Chameleon BASIC is structured so that you can develop programs quickly, and has the added benefit of providing an interactive interface to the user. You can enter many commands directly at the BASIC prompt, and they will be executed immediately.

The ability to write your programs and run them without compiling means that you can reduce the amount of time required to debug programs.

Chameleon 32 C Development System

There is also a C Development System available for the Chameleon 32. The C package gives you the advantage of working in a familiar C programming environment. It includes special libraries containing protocol-specific functions. These libraries are listed below with their BASIC simulator counterparts:

C Library	Comparable to using BASIC:
BOP Library	FRAMEM
HDLC	SIMP/L HDLC
SDLC	SIMP/L SDLC
LAPD	SIMP/L LAPD
ASYNC	Chameleon ASYNC
BSC	Chameleon BSC
ISDN Basic Rate Interface	Basic Rate Setup Menu
ISDN Primary Rate Interface	Primary Rate Setup Menu

BASIC vs. C

BASIC provides a user friendly interface through the use of set-up menus for configuring various parameters. C does not have menus; the programmer must use the library functions to configure parameters.

BASIC has a shorter development cycle. It can be used to develop simpler program very quickly. It is possible use BASIC to determine your fundamental test design, and then develop the complete test system using C.

1.2 SIMULATION LANGUAGES

Introduction

The Chameleon offers you five programming languages with special protocol-specific commands and extensions.

Four of the simulation languages are part of the Chameleon BASIC family. Chameleon BASIC is the language used for BASIC programming tasks, such as file handling and string and numeric functions. Each of the four protocol-specific languages use Chameleon BASIC commands, plus their own special commands for the applications you need.

Once you learn the Chameleon BASIC language, you have only to learn a few extra commands for the protocol-specific tasks you want to perform. Figure 1.2-1 below shows the relationship between the Chameleon languages.

The fifth protocol-specific language, SITREX, is not a part of the Chameleon BASIC family.

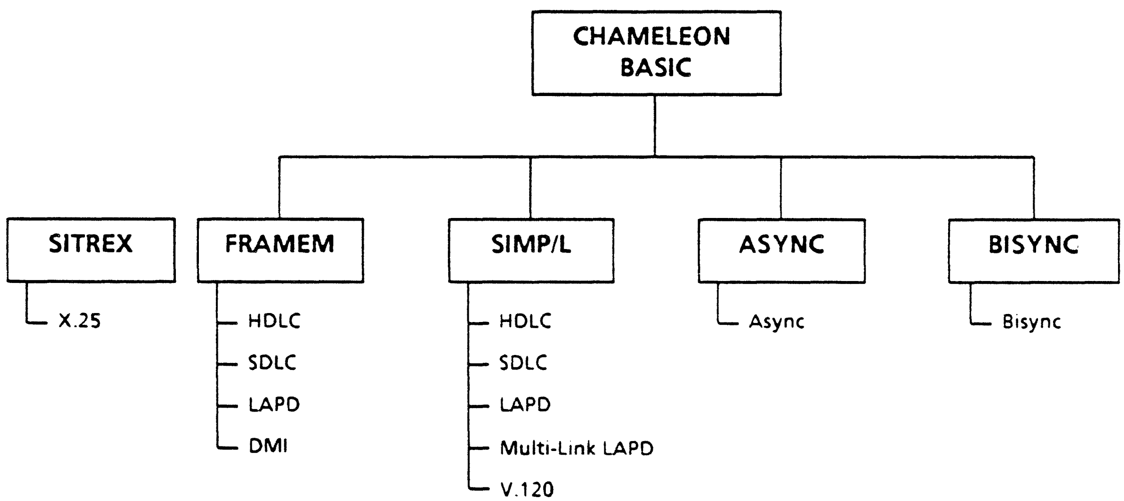


Figure 1.2-1: The Chameleon BASIC Family

FRAMEM

FRAMEM is the Chameleon's flexible **FRAM**e **EM**ulator for the HDLC, SDLC, LAPD, and DMI protocols. FRAMEM includes protocol-specific commands for transmission and reception of these protocols.

SIMP/L

SIMP/L is the Chameleon's **S**imulated **I**nteractive **M**ulti-**P**rotocol **L**anguage for HDLC, SDLC and LAPD. SIMP/L includes automatic support for the link level of these protocols.

ASYNC

Chameleon ASYNC is the Chameleon's Async Simulation Language. It includes specific commands for asynchronous transmission and reception.

BISYNC

Chameleon BISYNC is the Chameleon's Bisync Simulation Language. It includes specific commands and variables for binary synchronous transmission and reception.

SITREX

The fifth protocol specific language, SITREX, provides automatic X.25 simulation for levels 2 and 3. SITREX is not a part of the Chameleon BASIC family.

The table below shows the applications for the protocol-specific simulation languages.

PROTOCOL LEVEL SIMULATED	X.25/HDLC	SNA/SDLC	BISYNC	ASYNC	LAPD
2	FRAMEM HDLC and SITREX	FRAMEM SDLC	CHAMELON BISYNC	CHAMELEON ASYNC	FRAMEM
3 +	SIMP/L HDLC and SITREX	SIMP/L SDLC			SIMP/L

Table 1.2-1: Simulation Languages

SIMULATOR APPLICATIONS

An example of a test application for each simulator is provided below to give you a better understanding of the function of each.

FRAMEM HDLC/SDLC	Test the link establishment connection.
FRAMEM DMI	Test Mode 2 handshaking for DMI.
FRAMEM LAPD	Test TEI assignments for Q.921.
SIMP/L HDLC	Develop a call generator that loads the switch with active X.25 calls.
SIMP/L SDLC	Test a particular type of BIND for SNA.
SIMP/L LAPD	Test call setup procedures for Q.931.
BSC	Test poll times between a cluster controller and terminals for BSC.
ASYNC	Test printer or terminal setups.
SITREX	You need *full* X.25 simulation to place a call to determine if the X.25 line is active.

FILE NAME EXTENSIONS

When you create a simulation program, a file name extension is automatically assigned to the program file, using the conventions shown in the table below. Do not modify the file extension or you will be unable to run the program from the simulator.

FILE TYPE	DIRECTORY	FILE EXTENSION
FRAMEM SDLC/HDLC	\TEKELEC\SIMULATE\FBOP	.CB
FRAMEM LAPD	\TEKELEC\SIMULATE\FLAPD	.LB
FRAMEM DMI	\TEKELEC\SIMULATE\FDMI	.JB
SIMP/L HDLC	\TEKELEC\SIMULATE\SHDLC	.EB
SIMP/L SDLC	\TEKELEC\SIMULATE\SSDLC	.DB
SIMP/L LAPD	\TEKELEC\SIMULATE\SLAPD	.MB
BISYNC	\TEKELEC\SIMULATE\BISYNC	.HB
ASYNC	\TEKELEC\SIMULATE\ASYNC	.IB
SITREX	\TEKELEC\SIMULATE\SITREX	.BA

Table 1.2-2: Simulation Directories and File Extensions

2.1 STARTING SIMULATION

Introduction

This chapter describes configuring the Chameleon for simulation. If you are unfamiliar with the Chameleon, you should first read the *Chameleon User's Guide, Chapters 1 and 3* before you read this chapter.

To configure the Chameleon for Simulation, do the following:

1. Power up and boot the Chameleon.

2. After the system software is booted, a Configuration menu appears (Figure 2.1-1).

   If this menu is *not* displayed, the arrow cursor will be positioned at the Setup Mode parameter. To display the menu, press ***F1 Menu***.

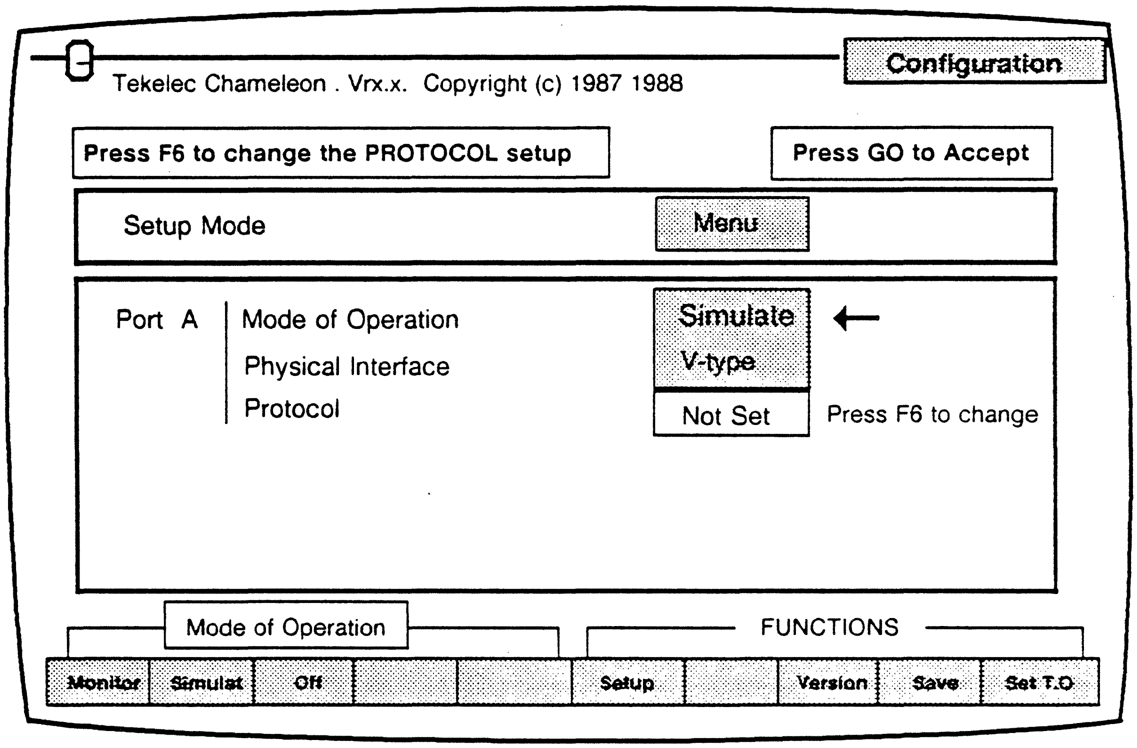


Figure 2.1-1: Menu Setup Mode (Single Port)

3. Move the arrow cursor to the Mode of Operation parameter and press ***F2 Simulate***.

4. Use the function keys to select the appropriate **Physical Interface** for your application.

   If your machine includes a Basic Rate or a Primary Rate Interface, you will have an ***F7 Physicl*** softkey, which displays a menu for configuring the physical interface. Refer to the following for more information:

   - For Primary Rate Interface, refer to the *Chameleon Protocol Interpretation Manual, Chapter 11.*
   - For Basic Rate Interface, refer to the *Chameleon Protocol Interpretation Manual, Chapter 12.*

5. Press ***F6 Setup*** to display the menu of available protocols (Figure 2.1-2).

6. Press the function key that corresponds to the protocol you want to simulate. Use the ***F9 More*** key to display additional protocol options, if needed.

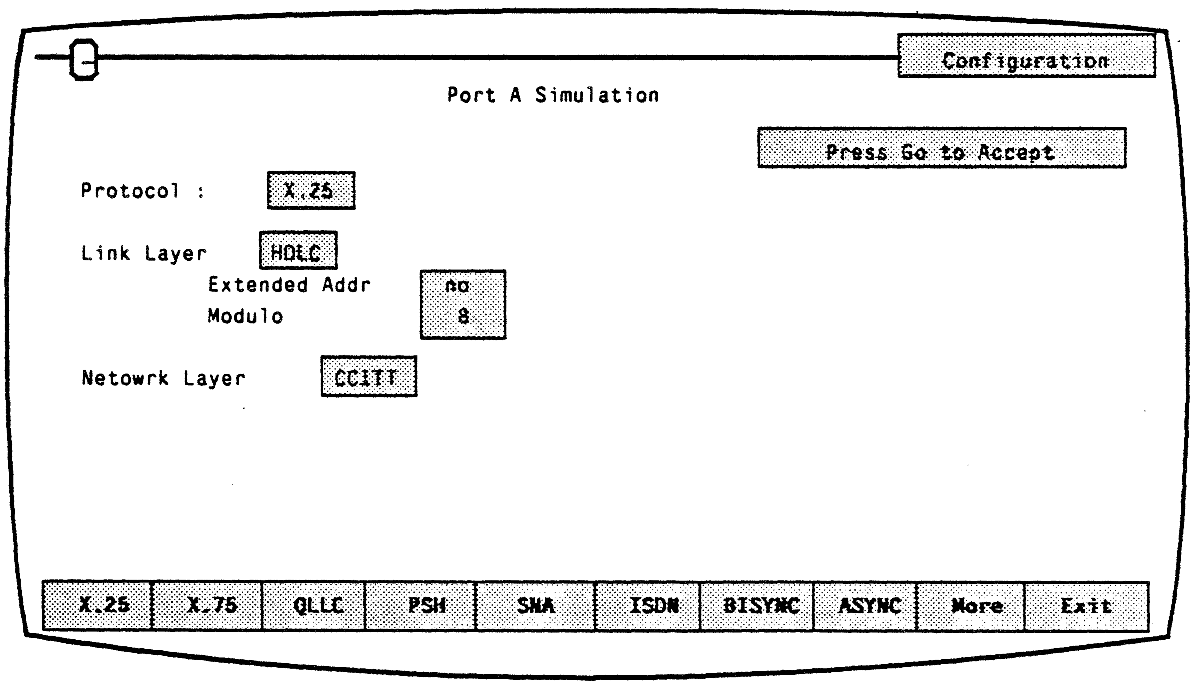


Figure 2.1-2: Chameleon Protocol Setup Menu

7. Each protocol has additional parameters. Press ***Go*** to accept the default values, or modify the parameters, and then press ***Go.*** This returns you to the main configuration menu.

   (To modify a parameter, move the arrow cursor to the parameter and press the desired function key. These parameters are described in the *Chameleon Protocol Interpretation Manual, Volume II* .)

8. Press ***Go*** and the Applications Selection Menu is displayed (Figure 2.1-3). This menu displays the applications that are available for the selected protocol. There are two windows:

   - Simulation, which displays the simulators (languages) available for the selected protocol, and are designated as follows:

SM_HDLC	SIMP/L HDLC
SM_SDLC	SIMP/L SDLC
SM_LAPD	SIMP/L LAPD
SM_MLAPD	Multi-Link SIMP/L LAPD
SM_V120	SIMP/L V.120
ASYNC	ASYNC
BISYNC	BISYNC
FR_HDLC	FRAMEM HDLC
FR_SDLC	FRAMEM SDLC
FR_DMI	FRAMEM DMI
FR_LAPD	FRAMEM LAPD
SITREX	SITREX
T_SITREX	TRANSPAC SITREX

   - Monitoring, which enables you to analyze the data being transmitted between the Chameleon and the device under test during simulation.

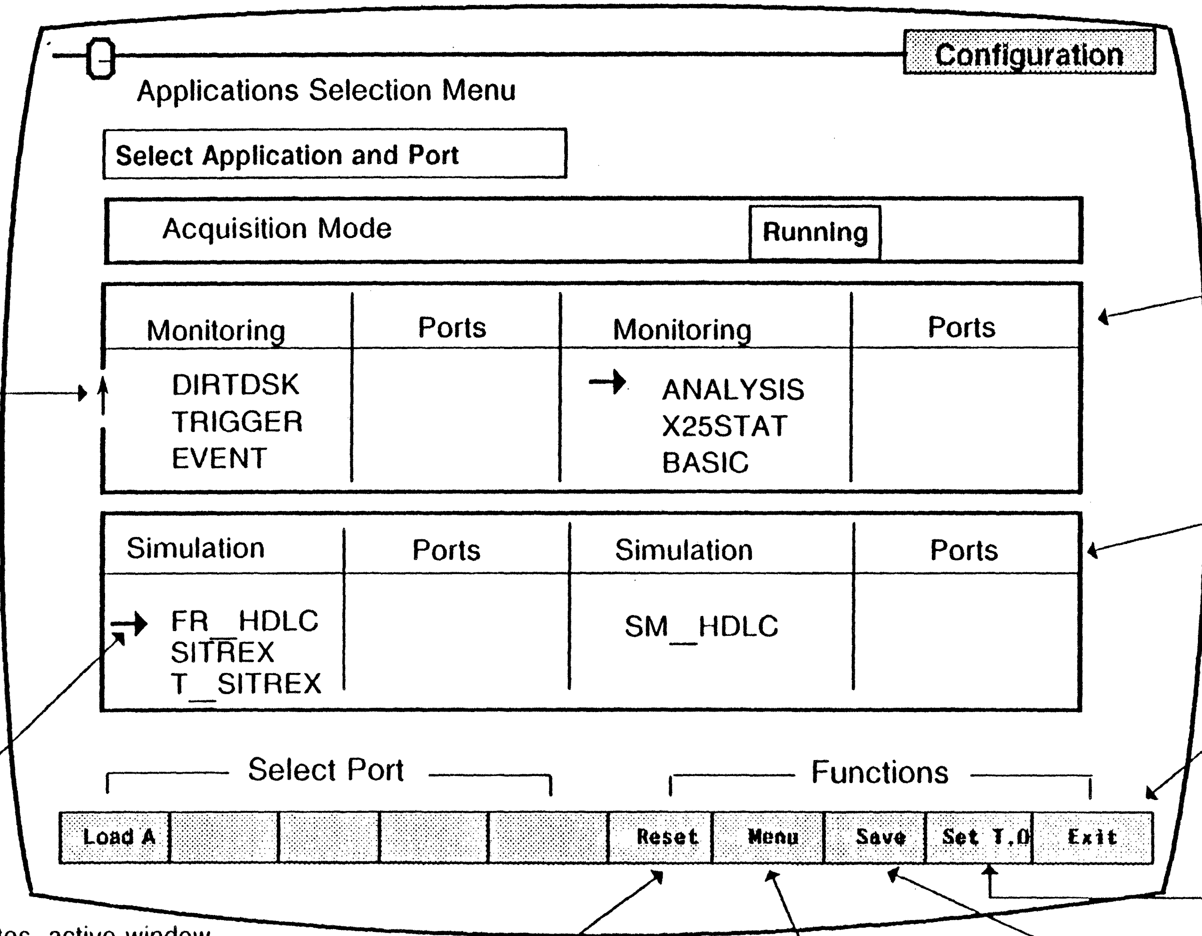
9. To load one of the simulation applications, do the following:

   a. Press ***Shift*** ↓ to Select the Simulation window.

      - On the Chameleon 20, the selected window contains the blinking arrow cursor. The inactive window has a non-blinking arrow cursor.

      - On the Chameleon 32, the selected window contains the red arrow cursor. The inactive window contains a white arrow cursor.

   b. Move the arrow cursor to the desired simulator.



Up/Down Arrow:
Indicates which arrow key to press to display additional applications in that window.

Monitoring Window:
Displayed in Monitoring and in Simulation modes.

Simulation Window:
Displayed in Simulation mode only.
Selects a Simulator, for example:
SM_HDLC = Simp l HDLC

Exit:
Stops all applications and returns to the first configuration menu.

Set T.O:
Sets the value of the autoboot timer.

Arrow cursor:
Red arrow cursor indicates active window.
White arrow cursor indicates inactive window.
Press Shift ↑ or Shift ↓ to change active window.

Reset:
Resets all applications, for example:
Clears History buffer.
Resets all statistics values to 0.

Menu:
Displays the first configuration menu without stopping applications.

Save:
Saves the displayed configuration to a named file.

Figure 2.1-3: Applications Selection Menu

c. Press the function key which loads the simulator on the desired port.

While the application is loading, the port letter (**A** or **B**) appears blinking next to the application name. When loaded, the letter stops blinking.

10. To load Monitoring applications, select the Monitoring window and repeat the procedure in step 9. You can run several Monitoring applications on each port.

11. When all applications are loaded, press ***Go***. This *starts* the applications, as indicated by the appearance of page banners at the bottom of the screen.

12. You are now ready to use the applications that are running. The ***Simulate*** page accesses the Simulator you loaded.

    On a Dual Port machine, if Simulators are running on both ports, the page banner display **Simulate A** or **Simulate B** to indicate the port.

    The other pages are Monitoring applications and are described in the *Chameleon User's Guide*.

13. Select and display the Simulate page. To do this, press the ***Select*** key until the Simulate banner is highlighted. Then use one of the keys below to display the page.

KEY	FUNCTION
Move ↑	Moves the page banner up one line at a time (increases the page size).
Move ↓	Moves the page banner down one line at a time (decreases the page size).
Scroll ↑	Scrolls the data displayed in the page upward one line at a time.
Scroll ↓	Scrolls the data displayed in the page downward one line at a time.
Shift Scroll ↑	Scrolls the data in the page up the number of lines displayed in the page.
Shift Scroll ↓	Scrolls the data in the page down the number of lines displayed in the page.
Shift Hide Page	Hides the active page so that the banner is no longer visible on the screen (the application continues to run).
Show Page	Displays a page that has been hidden with Shift Hide Page.
Replace	Replaces the active page with one that has been hidden using Hide Page.
Shift Move ↑	Displays the page in a special full-screen mode referred to as Blow Mode (indicated by the letter B on the top left side of the banner). Other pages cannot be accessed when the active page is in Blow Mode. Shift Move ↑ again disables Blow Mode, and returns the screen to its previous state.

Figure 2.1-4: Page Manipulation Keys

14. For **BASIC** simulators, the Simulation ! prompt is displayed. At the simulation prompt (!), you can enter commands and run programs.

    A protocol-specific parameter file named DEFAULT is automatically loaded for BASIC simulators. You can view and/or modify the parameters by entering the BASIC command:

    ! setup *<Return>*

    For **SITREX** or **T.SITREX**, a parameter setup menu is displayed. There are three menus of configuration parameters for SITREX. To use the default values that are displayed, press **Z** and you are taken into the simulator.

    The **setup** command is not available in SITREX. For this reason, you are taken to the setup menus before you access the simulator. This gives you the opportunity to modify the setup, or load a different parameter setup file, before you begin your application.

    Parameter setup menus are described in detail in Section 2.2. The specific parameters for each menu are described in the appropriate chapter of the manual. For example, the FRAMEM HDLC parameters (Figure 2.1-5) are described in Chapter 4.4.

```
                                                               Simulation
                 ** FRAMEM PARAMETER SET-UP MENU **

A.- Simulate .......... : DCE
B.- Data Encoding ...... : NRZ
C.- Coupler ........... : HDLC/SDLC
D.- Bit Rate ........... : 56000


=================================================================
SELECT >                                    CHOICES :
INPUT :   SELECT a letter (A-D)
          or type an option shown below



Z = run FRAMEM,     ? = Help,    S = Save parameters,    ESC = Main Menu
```

Figure 2.1-5: FRAMEM Parameter Set-Up Menu

15. To change your port configuration (protocol, simulation language, physical interface) you must first stop the Simulator on the port, as follows:

    - For BASIC simulators, you can stop the Simulator and return to the port configuration menu by entering the following command at the ! prompt:

      ! menu *<Return>*

    - Alternately, for all simulators, you can select the Configuration page, which displays the Applications Selection menu, and press one of the following:

      - Press ***F10 Exit*** to stop *all* applications that are currently running on all ports.

      - In the Simulation window, move the cursor to the Simulator, and press the softkey that stops it on the desired port (***F1 Stop A***, ***F2 Stop B*** or ***F3 Stop AB***).

      If you access the first configuration menu, and the Simulator is still running, the message ***Busy*** appears next to the port parameters. When this message appears, you cannot change any of the port configuration parameters for that port.

16. Figure 2.1-6 summarizes the steps required to move between the simulation prompt (!), the setup menus, and the main configuration menus.

If you are here:	NEXT STEP	
	And you want to:	Do this:
FRAMEM, SIMP/L, BSC, or Async simulation prompt (!)	Return to the Applications Selection menu	Enter: **MENU** <RETURN>
	Access the parameter set-up menu	Enter: **SETUP** <RETURN>
	Write programs	Read Chapter 3 for Chameleon BASIC fundamentals **AND** read the chapter that describes your simulation language.
SITREX SIMULATOR ACTIVE	Return to the port configuration menu	Enter: **PS** <RETURN> **HALT** <RETURN>
	Access the parameter set-up menu	Enter: **PS** <RETURN> **HALT** <RETURN> Press: **F2** **GO**
	Enter command mode (!) Exit command mode	Enter: **PS** <RETURN> Enter: **EXIT** <RETURN>
	Activate the trace buffer Deactivate the trace buffer	Enter: **PP** <RETURN> Enter: **CTRL P**
Any Parameter Set-Up menu	Access the simulation prompt (!) to write programs	Press: **Z**
	Return to the port configuration menu	Press: **ESC**
	Change parameter values	Read Chapter 2.2 for general information about the set-up menus **AND** read the chapter that describes the menu for the simulation language you are using.
	Access the Save Parameters menu	Press: **S**

Table 2.1-6: Simulation Next Steps

2.2 PARAMETER SET-UP MENUS

Introduction

The parameter set-up menus enable you to configure protocol-specific parameters and initialize the Chameleon Front End Processor (FEP) for simulation.

Before you can transmit or receive data during simulation, you must initialize the Chameleon FEP. This is done when a parameter set-up file is loaded.

Each simulator is provided with a parameter setup file named DEFAULT. You can modify the DEFAULT file or create additional setup files with user-specified names. The ability to save more than one set-up file enables you to quickly load and set up the parameters for a given application. (See Save Parameters, Section 2.3.)

When you start a simulator, you are taken directly to the simulation prompt !. If you have a parameter set-up file for that Simulator named DEFAULT, it is automatically loaded, and the FEP is initialized with the values in that file.

If you attempt to transmit traffic and a parameter set-up file has not been loaded, the following message is displayed:

P1 SETUP NOT PERFORMED

This should only occur if you delete the DEFAULT file. If this message is displayed when using a simulator, you can do the following:

a. At the ! prompt, type: **SETUP** to display the menu.
b. Change the settings as needed.
c. Press **Z** to exit the menu and return to the ! prompt

General instructions for using a parameter set-up menu begin on the following page. The menus are described in the protocol-specific sections of the manual.

Using Set-Up Menus

In this section, FRAMEM HDLC will be used as an example to describe the use of the parameter set-up menu. The FRAMEM HDLC Parameter Set-Up Menu is shown in Figure 2.2-1, with the original default values displayed. The menu contains four parameter options (A - D).

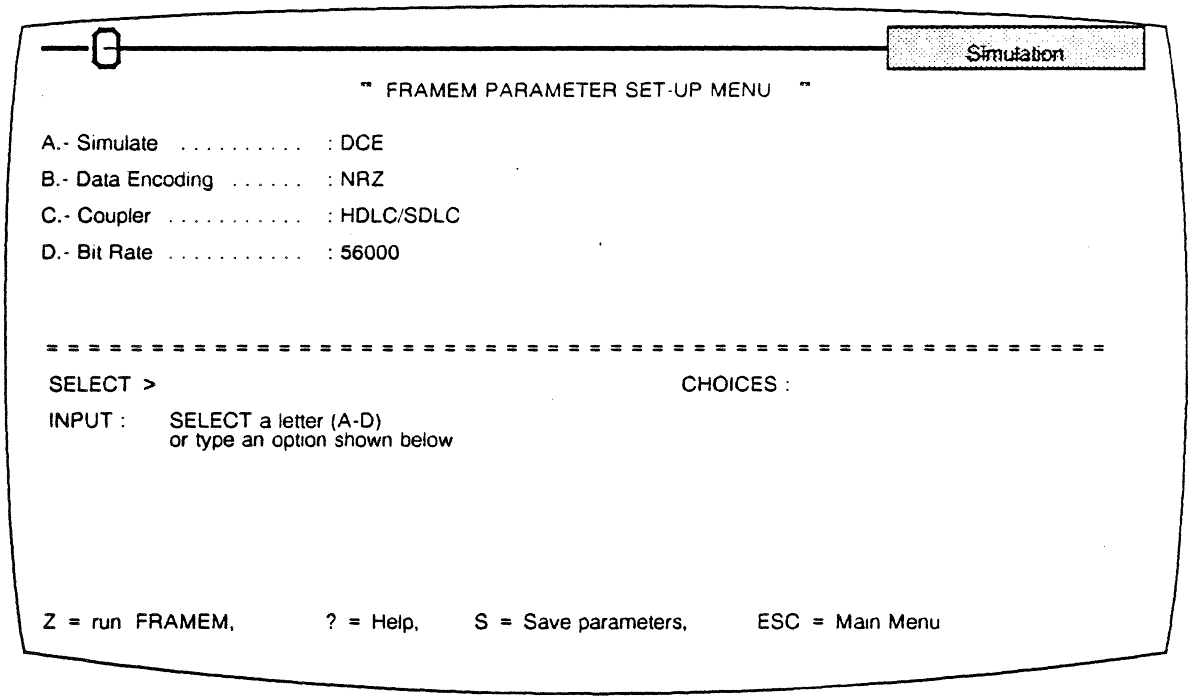


Figure 2.2-1: The FRAMEM Parameter Set-Up Menu

To change a parameter, follow these steps:

1. Type the menu letter (A - D) that corresponds to the parameter you want to change.

   The parameter name is displayed after SELECT on the lower left half of the screen. Acceptable values are listed after CHOICES on the lower right half of the screen.
   The figure below shows how the screen would look if you selected the A. - Simulate option from the menu. The parameter and the current choice are displayed in reverse video.

   If the parameter requires a numeric value, a message describing the required input is displayed. For these parameters, you are not given a range of valid options. Enter a value within the specified range.

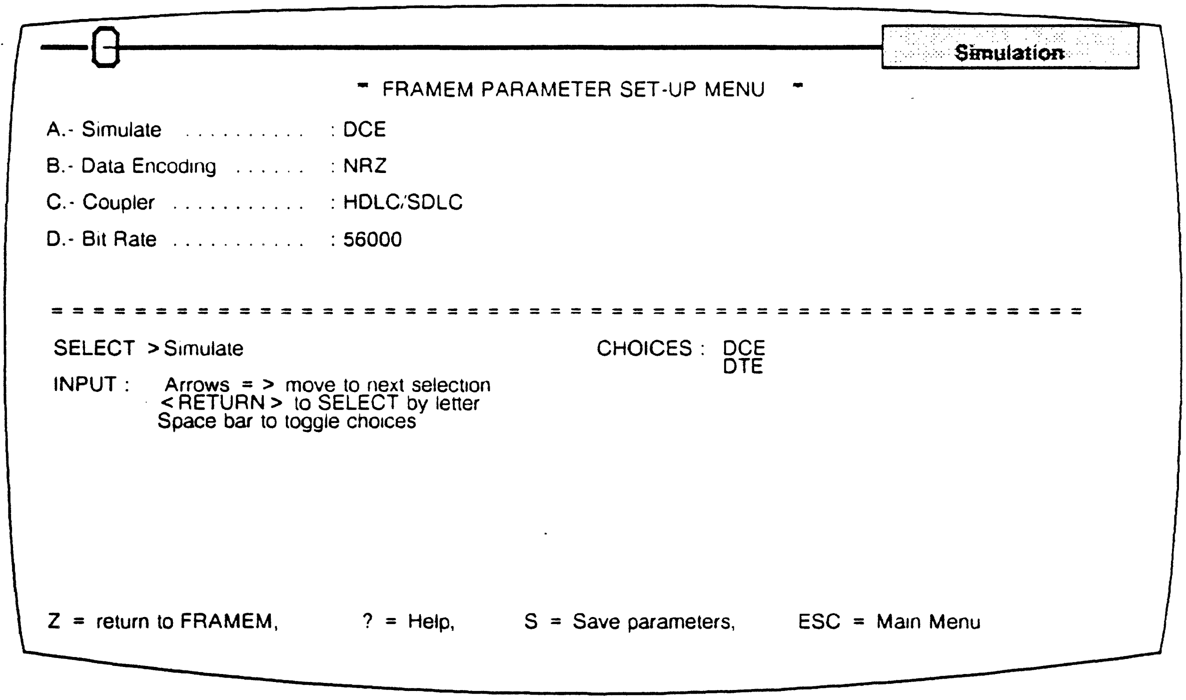


Figure 2.2-2: FRAMEM HDLC Simulation Parameter

2. Press the *space bar* to move the highlight to the new choice. Each time you press the space bar the highlight moves to the next choice on the list.

3. When the desired choice is highlighted, press RETURN. You can then select another parameter by entering the menu letter.

   Optionally, when the desired choice is highlighted, you can use the *up* and *down* arrow keys to select another parameter. When you use the arrow keys, the new value for the current parameter is automatically entered before the new parameter is selected.

Other Options

The bottom of the parameter set-up page lists other keys with special functions. A description of each option is provided below.

Z = Run {simulator}

Option **Z** passes control to the simulator and displays the ! prompt for entering direct commands and program code. The currently displayed parameters are saved automatically in a file called DEFAULT. This file is executed automatically, unless you designate a different set-up file using the COUPLER command at the ! prompt.

? = Help

Once a parameter is selected, press the **?** key to display a definition of the current parameter. A help message is displayed on the lower half of the screen. Some messages may be displayed in two or more parts. Press **C** to display the next section. Press any other key to leave help.

ESC = Main Menu

The **ESC** key returns control to the Chameleon main menu. From the main menu, you can select a different simulator or switch to the Analysis mode.

S = Save Parameter

Option **S** takes you to the Save Parameters Menu, which is described in the Section 2.3. This menu enables you to load other parameter set-up files, or save the current settings in a new file.

2.3 SAVE PARAMETERS MENU

The Save Parameters Menu can be accessed from any of the parameter set-up menus. This menu enables you to save one or more parameter set-up files on either the hard or floppy disk drive. By doing this, you do not have to re-enter your settings each time you run your simulation programs; you simply load the desired file from the disk.

Note that you can also use the COUPLER command at the ! prompt to load and execute a parameter set-up file.

Each of the Save Parameter options is described below.

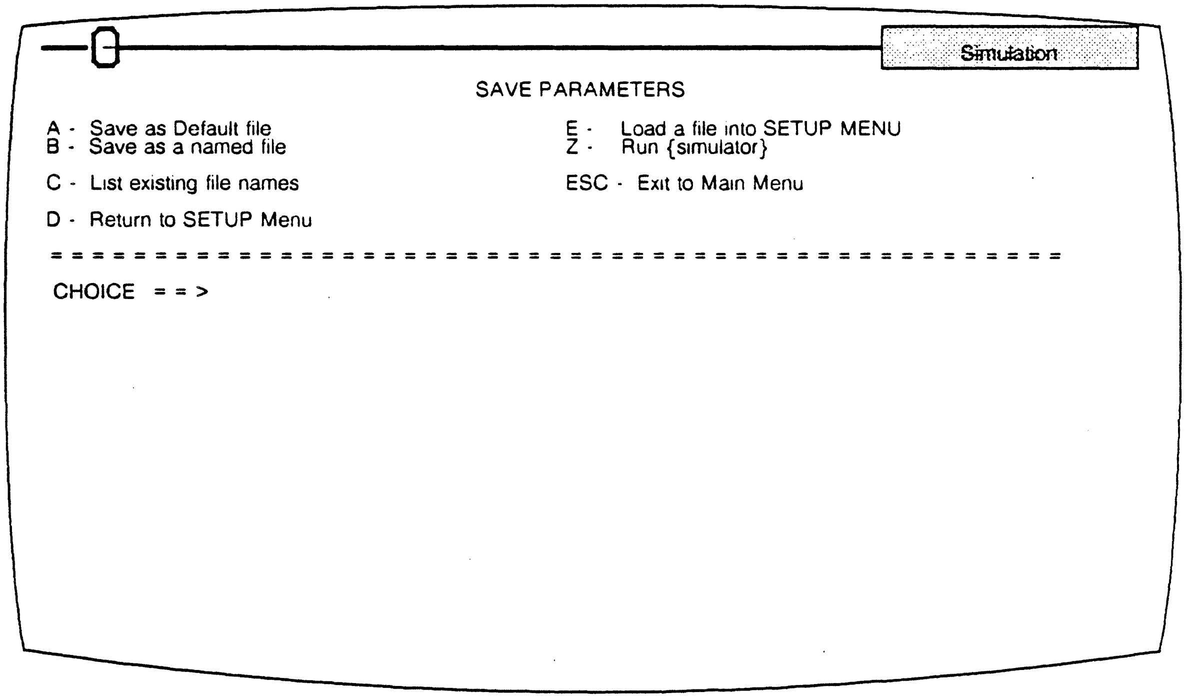


Figure 2.3-1: Save Parameters Menu

A - Save as Default File

Option **A** saves the parameters in a file named DEFAULT on the hard disk drive (A). DEFAULT is the parameter file that is automatically used, unless option E, Load a file into SETUP MENU, is selected.

B - Save as a Named File

Option **B** saves the parameters in a specified file. When you press B, the prompt asks for the drive specification (A for the hard disk drive or B for the floppy disk drive) and the filename. Filenames must be between one and eight alphanumeric characters.

C - List Existing File Names

Option **C** displays a list of the existing parameter files on a specified disk drive. Use the *down* arrow key to display more filenames. Use the *up* arrow key to display the previously listed filenames.

D - Return to SETUP Menu

Option **D** returns you to the parameter set-up menu.

E - Load a File into SETUP Menu

Option **E** loads a parameter set-up file from disk into the set-up menu. Loading files into the set-up menu is not related to executing them with the COUPLER command, although the setup will be passed to the simulator through the DEFAULT file.

Z - Run {simulator}

Option **Z** runs the simulator and displays the simulation prompt (!). At the ! prompt you can enter commands and run programs. This command automatically saves the parameters in the DEFAULT parameter file.

ESC - Exit to Main Menu

The **ESC** key returns you to the main configuration page. From this page you can select a protocol, simulation language, or the Analysis mode.

3.1 CHAMELEON BASIC INTRODUCTION

Introduction

This section introduces some of the features of Chameleon BASIC. It also references sections in the manual that provide more information about specific features.

Commands

In general, Chameleon BASIC commands enable you to:

- Create programs
- Execute programs
- Save files, traffic, and programs

Program Development

An editor allows you to enter, edit and display your program. There is a debug mode which displays line numbers during execution to check loops and GOTO statements. Refer to Section 3.4 for a list of these commands.

File Management

File management commands save programs to disk, load programs from disk to memory, display disk directories, and delete files from disk. Refer to Section 3.4 for a list of these commands.

Data Files

You can also create and control disk-based data files. Refer to Section 3.4 for a list of these commands.

Program Control and Subroutines

Program execution can be started at specific line numbers or subroutines. You can chain programs together for sequential execution or nest them to be called as subroutines. You can also call a program from a disk as a subroutine. Sixteen levels of calling are supported.

Refer to Section 3.4 for a list of these commands.

Variables

Chameleon BASIC has numeric variables, string variables and read-only variables for you to use. You can assign and enter strings and numeric variables from the keyboard, including assigning and printing variables in hex. Refer to Sections 3.2 and 3.4 for more informaiton about variables.

Printing

There are a number of BASIC commands that enable you to print programs, messages, strings, and numeric values. Refer to Section 3.4 for a list of these commands. In addition, you can use the Print Page/Print Scrn key on the Chameleon keyboard.

Refer to the Volume I of the User's Manual for information about configuring the Chameleon to output to your printer.

String Functions

Chameleon BASIC provides you with code conversion string functions that convert from:

- ASCII to EBCDIC
- ASCII to numeric
- ASCII to BCD
- EBCDIC to ASCII
- ASCII to hexadecimal

Refer to Section 3.4 for a list of these commands.

Timers

A realtime clock provides time stamps and can be accessed using special commands. There are four Chameleon BASIC timers: two that count up and two that count down. Refer to Section 3.2 for more information about timers.

Programming Memory

There are eight Kbytes of user program memory. The read-only variable SIZE displays the amount of programmable memory available.

Video Effects

You can create custom video screen formats within programs using the video effects commands. Refer to Section 3.4 for a list of these commands.

Program Logic

You can perform logical manipulation of data with Boolean operators such as:

- AND
- OR
- XOR (exclusive or)
- # (not)

Refer to Section 3.2 for more information about arithmetic and logical operators.

Mnemonics

Chameleon BASIC includes built-in tables of standard mnemonics for communications. You can also define and save your own mnemonic tables. Refer to Section 3.2 for more information about mnemonic commands.

Trace Buffer

A record of each frame transmitted and received is stored in a special buffer called the *trace*. You can view the trace at any time. Refer to Section 3.2 for more information about simulation buffers.

3.2 BASIC FEATURES

Introduction

This section describes the major features of Chameleon BASIC in greater detail. The features that are described are:

- Simulation Buffers
- Mnemonics
- Timers
- Arithmetic and Logical Operators
- Variables
- Arrays

SIMULATION BUFFERS

Introduction

There are several buffers that are used to store the traffic that is transmitted and received during simulation. These buffers are:

- Acquisition buffer
- Trace buffer
- DISPF buffer

Acquisition Buffer

The Acquisition buffer stores the data received from the line. This is where the traffic is first stored and uses a FIFO (first-in, first-out) system.

You do not have direct access to the data in the acquisition buffer, although you can clear it using the FLUSH command.

If the acquisition buffer becomes full, the message:

```
P1 OVERFLOW HIT ANY KEY TO RESET
```

is displayed. When you press a key, the buffer is flushed automatically. To display the data in the acquisition buffer, it must be transferred to the trace buffer, as described below.

Trace Buffer

When you enter a REC command, data in the acquisition buffer is transferred to the trace buffer and the frame length, status (CRC), and a timestamp are added to each frame.

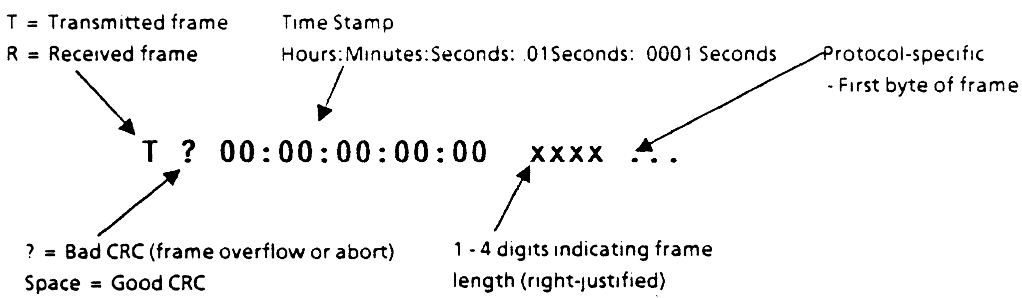
Data is moved from the acquisition buffer to the trace buffer only when there is sufficient space available in the trace buffer. (To determine the amount of space available in the trace buffer, use the TFREE variable.)

Once data is in the trace buffer, you can use the trace buffer commands to access the data. These commands give you the ability to:

- Display the information in the trace (TPRINT)
- Save the information in the trace to a trace file (TSAVE)
- Print the trace information to the printer (LTPRINT)
- Load a trace file into memory (TLOAD)
- Clear all data from the trace buffer (CLEAR)

For example the TPRINT command displays the contents of the trace buffer. In addition to the data the trace buffer display also includes a timestamp, frame length, and status (CRC).

The general format of a trace buffer display is shown below. The display following the frame length is protocol-specific. Refer to the appropriate protocol chapter for more information.



DISPF Buffer

The DISPF buffer stores the last frame that was transmitted or received. Following a REC command, the DISPF buffer is emptied. If a frame is received, it is put into the buffer. The length of the buffer varies with the protocol being used.

The contents of the DISPF buffer is displayed using the DISPF command. The contents can be output to a printer using LDISPF.

In SIMP/L there are two DISPF buffers. The RDISPF buffer contains the last frame received and the TDISPF buffer contains the last frame built for transmission. To display the contents of these buffers use RDISPF and TDISPF, respectively.

MNEMONICS

Introduction

A mnemonic is a named variable and/or constant that is used to refer to protocol elements. Each simulator includes a table of standard mnemonics and values that you can use without modification. Instead of defining variables in your program for the various protocol elements, you can use the pre-defined mnemonics in the default table.

The default mnemonic tables are described in each of the protocol-specific chapters.

Mnemonic Commands

You can also develop custom mnemonic tables for specific applications using the BASIC mnemonic commands. The mnemonic commands allow you to:

- Define new mnemonics or redefine existing mnemonics (DEFINE)
- List the entries in the current mnemonic table (MLIST)
- Load a specific mnemonic table file from disk (MLOAD)
- Save a user-defined mnemonic table (MSAVE)

Implementation

There is some variation in the way that the mnemonic tables have been implemented in the BASIC simulators.

In FRAMEM, BSC, and Async mnemonics are used as constant values.

In SIMP/L mnemonics are used as variables and are associated with a field length.

Application Note

Heavy use of mnemonics causes the simulator to slow down because of the time required for mnemonics to be looked up in the table. A mnemonic table may contain a maximum of 255 mnemonic entries; however, to maximize the speed of the simulator, it is recommended that you restrict your mnemonic tables to approximately 20 entries.

If you have developed a program that uses many mnemonics and you want to increase the speed of its execution, you may want to replace your mnemonics with variables.

CHAMELEON BASIC TIMERS

There are four timers in Chameleon BASIC. You can use these timers anywhere a normal variable is valid. The four timers are:

- **TIM0** Counts down in ten millisecond (.01) intervals
- **TIM1** Counts up in ten millisecond (.01) intervals
- **TIM2** Counts down in seconds
- **TIM3** Counts up in seconds

Assignment

Timers can be assigned a starting value. For example:

```
TIM2 = 120
TIM1 = 1000
```

Terminal Values

The timers stop when they reach their terminal values. Timers TIM0 and TIM2 (which count down) have terminal values of zero. TIM1 and TIM3 (which count up) have terminal values of FFFF in hex or -1 in decimal.

Example

The following sample program uses the TIM2 timer to test receiving a transmission from the line.

`10 CLEAR`	Clears the trace buffer.
`20 TIM2 = 120`	Sets the timer to count down by seconds for two minutes.
`30 REC`	Receives a frame from the line.
`40 IF RXFRLEN # 0 GOTO 80`	If the frame length does not equal zero, continues with the program.
`50 IF TIM2 > 0 GOTO 30`	If timer has not expired, tries to receive another frame.
`60 PRINT "TIMED OUT"`	Timer expired, prints message.
`70 STOP`	Terminates program.
`80 REM`	Continues processing.

ARITHMETIC AND LOGICAL OPERATORS

Introduction

Arithmetic and logical operators manipulate numric variables. Operators add, subtract, divide, multiplay, etc. The arithmetic and logical operators in Chameleon BASIC can be used as expressions in many commands, such as LET and IF.

Arithmetic Operators

There are four valid arithmetic operators. These are:

- + Add
- - Subtract
- * Multiply
- / Divide

Integers are 16-bit signed integers in the range -32767 through +32768.

Logical Operators

There are 11 logical (Boolean) operators. These operate on 16-bit integer variables and are listed below. A Boolean logical operation that is evaluated as true, returns a value of 1. A Boolean logical operation that is evaluated as false, returns a value of 0.

The Boolean logical operators are:

- = Equal
- # Not equal
- > Greater than
- > = Greater than or equal
- < Less than
- < = Less than or equal

The Bitwise logical operators are:

- AND Logical AND
- OR Logical OR
- XOR Logical exclusive OR
- SHLxx Shift left **xx** bits (maximum 15)
- SHRxx Shift right **xx** bits (maximum 15)

Example: In this example, **A** is set equal to the hex value of 10 shifted right by two places.

A = 16 SHR02

This returns a value of **4**.

Precedence of Operators

The order of precedence of arithmetic operators is:

*, /	Multiplication and division
+, -	Addition and subtraction

To change the order in which the operations are performed, use parentheses. Operations within parentheses are performed first. Inside parentheses, the usual order of operations is maintained.

When arithmetic and relational operators are combined in one expression, the arithmetic is always performed first.

The order of precedence of logical operators is:

AND
OR
XOR

Logical operations are performed after arithmetic and relational operations.

Examples

The following examples demonstrate the way Chameleon BASIC handles precedence of operators. The two examples have different results because of the way they are grouped and the way the arithmetic operators are given priority.

Example1:

```
10 LET A = 1
20 B = 1+2>A
```

In Example 1, B returns a value of 1. The arithmetic operation **1+2** has precedence over the logical operation **>**. Since 1+2 = 3, and **3** is greater than the value of **A** (1), the statement is true. Since the result is true, the value of B becomes 1.

Example 2:

```
LET A = 1
B = 1 + (2>A)
```

In Example 2, B returns a value of 2 because parentheses are used to change the precedence of operators. The parentheses around the operation **(2>A)** give the logical operator precedence, and it is evaluated first.

Since **2** is greater than the value of **A** (1), the operation is true and results in a value of 1. Now the arithmetic operation **1 + 1** is performed, resulting in a value of 2 for B.

VARIABLES

Introduction

This section covers the three types of variables that you can use in Chameleon BASIC:

- Numeric variables
- String variables
- Read-Only variables

NUMERIC VARIABLES

Numeric variables have the following characteristics:

- 16-bit signed quantities
- Range: -32767 to 32768
- Can be represented in hex or decimal
  -An ampersand (&) before the number indicates that number is in hex representation. For example &10 is hex 10
- Allowable variable names: A - Z

Numeric variables in Chameleon BASIC are referred to by a single character in the range A to Z. Arithmetic is integer only; use of decimal points results in incorrect results or syntax errors.

You can assign values to numeric variables in either decimal or hexadecimal. Decimal values are acceptable in the range from -32768 to 32767 and are integer only.

Hex Values

Hexadecimal values may range between zero and FFFF. Note that 8000 hexadecimal is equal to -32768 in decimal, and FFFF hexadecimal is equivalent to -1 in decimal. To assign a hexadecimal value to a variable, precede the value with the ampersand symbol (&).

Example: To assign variable Z a hexadecimal value of 1A, enter:

Z = &1A

This is equivalent to 26 in decimal.

STRING VARIABLES

Introduction

Chameleon BASIC string variables have the following characteristics:

- Strings of characters of ASCII
- Characters are 8 bits
- One dimensional arrays
- Allowable variable names are $A - $Z

You can use 26 string variables in Chameleon BASIC. As with the numeric variables, you use characters in the range A - Z for the variable name, preceded by the dollar sign symbol ($). For example: $A, $B, $C.

Assigning Values

The value you assign to a string variable must be enclosed in double quotation marks (""). The maximum length of a string is 255 characters.

Example: To assign a value of ABCDEF to the variable $A, enter:

$A = "ABCDEF"

String Commands

There are a number of Chameleon BASIC string commands that convert and manipulate strings. These are listed in Section 3.4.

String commands cannot be used directly inside an IF statement as demonstrated in the example below:

INCORRECT:

```
10 IF MID$($A,2,1) # MID$ ($B,2,1) GOTO 1000
```

CORRECT:

```
10  $A = MID$ ($A,2,1)
20  $B = MID$ ($B,2,1)
30  IF $B # $A GOTO 1000
```

READ-ONLY VARIABLES

There are five read-only variables in Chameleon BASIC, as described briefly in the figure below. For a complete description of each read-only variable, refer to Section 3.5. There are also protocol-specific read-only variables, which are described in the relevant chapters.

READ-ONLY VARIABLES

VARIABLE	FUNCTION
EOF	Indicates an end-of-file condition has been detected in an input file.
FREE	Returns the number of free mnemonic table entries.
SIZE	Returns the size of free program area in bytes.
TFREE	Returns the length of the unused trace buffer in bytes.
TIME	Returns one byte of real time, in specified unit.

ARRAYS

Chameleon Basic has one array available. It is referenced using the @ symbol. The maximum number of values allowed is 256. Subscripts start at zero. Like timers, array elements can be used anywhere that normal variables are valid. It uses the syntax:

- @(exp)

where: @ is the symbol for the array, and **exp** is any valid expression that will be used as a subscript in the array.

Example 1: To fill the array with decreasing values, you could enter:

```
10  FOR A=0 TO 255
20  @(A)=255-A
30  NEXT A
```

Example 2: To access elements in the array, you use the subscript to assign the element of the array to a variable, as shown below:

```
B = @(8)
```

Example 3: To print the elements of the array, use the PRINT command as in the example below:

```
10  FOR A=0 TO 255

20  PRINT "Array(";A;")=";@(A)

30  NEXT A
```

3.3 INTRODUCTION TO BASIC PROGRAMMING

Introduction

This section describes the fundamentals of BASIC programming. If you are an experienced BASIC programmer, you can skip this section and continue with Section 3.4.

A program is a sequence of logically-ordered statements that are stored in a file. For example, a program can cause the Chameleon to act as a specific type of device to test the effectiveness of communications hardware or software you are developing.

To write a program, you must be familiar with the Chameleon BASIC commands, general syntax rules, and the Chameleon editor. This section provides that information.

Command Types

In general, Chameleon BASIC commands enable you to create programs, execute programs, save files, traffic, and programs. There are three different types of BASIC commands:

- Direct commands
- Statement commands
- Commands that are used as either Direct or Statement

Direct commands are entered at the ! prompt and do not have line numbers. They are executed immediately after you press the RETURN key and therefore are not used within programs. Generally, direct commands enable you to:

- Enter programs
- Load program files from disk
- Save programs to disk
- Debug programs

Some examples of direct commands are:

- AUTO Provides automatic line numbering
- LOAD Loads a program from disk
- RUN Runs a program
- SAVE Saves a program to disk

When entering commands interactively at the ! prompt, there is a history buffer that stores the last command line that you entered. You can restore the line in the buffer to the ! input line by pressing CTRL Q. This enables you to correct syntax errors more quickly.

Statement commands have line numbers and are used in programs. If a statement command is entered at the ! prompt, a **Syntax error** message is displayed.

Statement commands are combined with other commands to create BASIC programs. For example:

- Assignment
- Arithmetic
- Program flow control

A program is simply a logically-ordered sequence of statement commands that are saved in a file.

Two examples of Statement commands are:

- GOTO x   Executes the command on line x.
- RETURN   Returns to a specific location in a program

Many BASIC commands can be used as **Direct or Statement** commands and can be entered either in programs or at the ! prompt. Often these commands are most useful when used in programs, since they often depend on other commands to be effective.

For example, the PRINT command, which displays text, values or strings on the Chameleon screen, can be used as either a statement or direct command.

The command descriptions in Section 3.5 indicate whether the command is used as Direct, Statement, or either.

General Syntax Rules

Follow these guidelines for using direct and statement commands:

- Commands can be entered in upper or lower case letters
- Press RETURN to enter a command
- Line numbers are in the range 1 - 9999
- A blank space follows a line number

Command Line Editing

When entering commands interactively at the ! prompt, there is a history buffer that stores the last command line that you entered. You can restore the line in the buffer to the ! input line by pressing CTRL Q. This enables you to correct syntax errors more quickly.

Exiting from the ! Prompt

You can exit from the ! prompt, by entering one of the commands below:

- MENU (Displays the main configuration page)
- SETUP (Displays the parameter set-up menu)

Abort Program Execution

To stop a program while it is running, press the ESC key. This immediately stops the program and returns you to the ! prompt.

Pause Program Execution

If a program is running, you can pause program execution by pressing CTRL S. To continue program execution, press any key.

Abort Program Execution

If a program is running, but has paused to wait for input, you can abort the program by pressing CTRL C or CTRL Z. A program pauses for input as a result of an INPUT, READ, or $INPUT command. Refer to these commands for more information.

Autoexecuting Programs

If you want to have a program that executes automatically, give it the file name DEFAULT. When the simulator is started, the file will automatically load and execute.

COMMAND ABBREVIATIONS

One of the special features of Chameleon BASIC is that you can abbreviate commands, thus shortening the time it takes to write and execute programs.

In general, commands are abbreviated by entering enough letters to identify the command uniquely, and typing a period (.) at the end of the word.

For example, you can enter the AUTO command as:

- AUTO
- AUT.
- AU.
- A.

Since there are no other commands that can be abbreviated that begin with the letter **A**, the single letter **A** uniquely identifies the AUTO command. Note that the abbreviation must end with a period.

Use caution when abbreviating similar commands, such as LLIST and LIST. Acceptable abbreviations are:

- LLI. (for LLIST)

- LI. (for LIST)

Since they both begin with the letter **L**, you cannot use **L.** as the abbreviation since this would be ambiguous.

Abbreviations for each command are listed as part of the command description in Section 3.5.

Note

Abbreviations are subject to change without notice when new commands are added to the simulators.

Be aware that the use of abbreviations in a program can make a program difficult to read. However, it is helpful to use abbreviations in the following circumstances:

- You are using commands as direct commands at the ! prompt. The use of abbreviations enables you to type fewer characters to achieve the same functions.

- The program you are writing is getting too large for the amount of programming memory available. Using abbreviations decreases the number of characters in the program file, and therefore decreases the amount of memory used.

COMMAND ERRORS

When an error is encountered in a program, or when entering commands at the ! prompt, the command line is displayed with an arrow pointing to the location of the error. For example, if the CLS (clear screen command) were entered as CSL, the following message appears:

C→SL

When entering commands interactively at the ! prompt, there is a history buffer that stores the last command line that you entered. You can restore the line in the buffer to the ! input line by pressing CTRL Q. This enables you to correct syntax errors more quickly.

Another common error message is:

FILE NOT FOUND

This indicates that you attempted to access a file that could not be located on the indicated disk drive. If this message occurs, check the spelling of the file name and make sure that you are referencing the correct drive. (A is the hard drive and B is the floppy drive.) You can use the FILES command or the File Management menu to list your files.

BRIEF HANDS-ON TUTORIAL

The following is a hands-on tutorial to give you practice entering direct and statement commands. If you want more information about any of the commands that are used, look the command up in the alphabetical listing in Section 3.5.

You can write a simple program, following these steps:

1. Make sure you are at one of the BASIC simulation prompts. (If you don't know how to get to a simulation prompt, read Section 2.1, Selecting a Simulator.)

2. At the ! prompt, type:

   !auto <RETURN>

   This is the direct command that provides automatic line numbering for you. It begins at line number 10 and increments each line number by 10.

3. Enter the next two commands:

   ```
   10 PRINT "HELLO"
   20 GOTO 10
   ```

   When this program is executed, the PRINT command will print the text between the quotation marks to the screen. The GOTO command will send control back to line 10 to repeat the HELLO message forever.

4. At line 30, press RETURN. This exits the auto numbering mode and returns you to the ! prompt.

5. To execute the program, type:

   !RUN <RETURN>

   The RUN command executes the program that is currently in memory. The word "HELLO" should be displayed repeatedly on the Chameleon screen.

6. To stop the program, press the ESCape key. Generally, you include the STOP command in your program to stop program execution.

7. After writing a program, you should save it to disk using the SAVE command. If you do not save a program to disk, it is erased when you turn the Chameleon off, load a different program from the disk, or write a new program.

To save this program in a file called SAMPLE on the hard disk, enter:

!SAVE"A:SAMPLE" <RETURN>

8. To see the list of files on the disk, enter:

   !FILES A <RETURN>

   SAMPLE should be listed as a program file.

9. To erase the current program from memory so that you can write a different program, enter:

   !NEW <RETURN>

10. To see the program lines currently in memory, enter:

    !LIST <RETURN>

    Since the NEW command clears the program in memory, there should be no program lines listed.

11. To load and list the SAMPLE program, enter:

    !LOAD"A:SAMPLE"
    !LIST

    The 2-line program should be displayed on the screen.

12. There is a history buffer which stores the last command line entered at the ! prompt. The command line can be restored to the current ! prompt by using CTRL Q.

    Enter, the following remark command, including the misspelled word:

    !REM This contains an arrow. <RETURN>

    The ! prompt is displayed and the command is stored in the history buffer. To restore the command, press:

    CTRL Q

The line is displayed at the ! prompt. Use the left arrow key to delete the word **arrow** and then replace it with the word **error**. Press RETURN to enter the command. At the ! prompt, enter:

!REM Hello (do not press RETURN)

To replace the current line with the line in the history buffer, press CTRL Q again. The current command line now reads:

!REM This contains an error.

3.4 BASIC COMMAND INDEX

Introduction

This section lists, by function, the commands that are common to all the Chameleon BASIC languages: FRAMEM, SIMP/L, BSC and ASYNC. You can use the commands listed in this section regardless of the BASIC simulation language that you are using.

There are also commands that are specific to a simulation language or protocol. These commands are used in addition to the commands in this section, when you are using the appropriate language and protocol. Refer to the protocol-specific sections for more information.

Index

In this section, the commands are listed in a series of tables by function. This enables you to locate the BASIC command that performs a particular function that you need. For example, if you need for a command that converts a string from ASCII to EBCDIC, you could scan the STRING COMMANDS table and quickly locate the **EBC$** command.

The tables list the commands, a brief description, and type of command (**S**tatement, **D**irect, Variable). For more information about a command, refer to the page number indicated.

Program Development

Note that the program development commands on page 3.4-5 cannot be used within a program. They are valid only interactively at the simulation ! prompt.

The functional tables are:

TABLE 3.4-1: BASIC MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
@	3.5-2	Variable	Accesses the array.
ABS	3.5-3	S	Returns the absolute value of a variable.
COUPLER	3.5-20	S or D	Initializes the Chameleon for transmission and reception using a specified parameter file.
FLUSH	3.5-38	S or D	Clears the acquisition buffer.
LET	3.5-59	S or D	Assigns values to numeric or string variables.
MENU	3.5-67	D	Exits simulation and displays the Chameleon main menu.
REC	3.5-81	S	Attempts to receive a frame.
REM	3.5-82	S	Programmer's remark in a program file.
RND	3.5-90	S or D	Returns a random number within a specified range.
SET	3.5-93	S or D	Sets a specified physical interface signal to 1 or 0.
SETUP	3.5-94	D	Exits simulation prompt (!) and displays the parameter set-up menu.
STOP	3.5-96	S	Unconditionally stops program execution.
TEST	3.5-97	S or D	Tests a specified physical interface signal for 1 or 0.

TABLE 3.4-2: BASIC DATA FILE COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
CLOSE	3.5-18	S or D	Closes a data file that was opened for input or output.
EOF	3.5-29	Read-only Variable	Indicates if end-of-file has been reached in a data file.
OPEN	3.5-76	S or D	Opens a new or existing data file for input or output.
READ	3.5-80	S	Reads the next record from an input file.
WRITE	3.5-108	S	Writes a string to an output file.

TABLE 3.4-3: BASIC DISPLAY AND PRINT COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
DISPF	3.5-25	S or D	Displays last frame transmitted or received. (Not available in SIMP/L. See RDISPF and TDISPF in SIMP/L chapter.)
FILES	3.5-35	D	Displays a list of the files on the hard or floppy disk.
FLIST	3.5-36	S or D	Displays the current function key assignments.
INPUT	3.5-51	S	Displays a prompt and stores reponse in a variable.
LFILES	3.5-60	D	Outputs a list of the BASIC files to a printer or remote device.
LFLIST	3.5-61	S or D	Outputs the current function key assignments to a printer or remote device.
LIST	3.5-62	D	Displays lines from the program in memory.
LLIST	3.5-63	D	Outputs lines from the program in memory to a printer or remote device.
LMLIST	3.5-64	D	Outputs the mnemonic table in memory to a printer or remote device.
LTPRINT	3.5-66	S or D	Outputs the contents of the trace buffer to a printer or remote device.
MLIST	3.5-70	S or D	Displays the mnemonic table in memory.
PRINT	3.5-78	S or D	Displays a string, expression, value, or text.
TPRINT	3.5-102	S or D	Displays the contents of the trace buffer.

TABLE 3.4-4: BASIC FUNCTION KEY COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
FDEFINE	3.5-34	S or D	Assigns one or more commands to a function key.
FLIST	3.5-36	S or D	Displays the current function key assignments.
FLOAD	3.5-37	S or D	Loads a function key definition file into memory.
FSAVE	3.5-41	S or D	Saves the current function key assignments to disk.
LFLIST	3.5-61	S or D	Outputs current function key assignments to printer or remote device.

TABLE 3.4-5: BASIC LOOP, SUBROUTINE, AND CONDITIONAL COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
CALL	3.5-12	S	Calls a program from the disk to be exectued as a subroutine of the current program being executed. See also EXIT.
EXIT	3.5-33	S	Returns control from a CALLed program to the calling program.
FOR	3.5-39	S	Initiates a loop and determines how many times the loop is repeated. See NEXT.
GOSUB	3.5-42	S	Sends program contol to a specific line number in the program to execute a subroutine. See RETURN.
GOTO	3.5-43	S	Sends program contol to a specific line number in the program.
IF	3.5-48	S	Allows program flow to be changed based on a decision (conditional branching).
NEXT	3.5-74	S	Signals the end of a loop and increments the loop counter. See FOR.
RETURN	3.5-85	S	Returns program control from a subroutine to the statement following the GOSUB command. See GOSUB.

TABLE 3.4-6: BASIC MNEMONIC COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
DEFINE	3.5-22	S	Defines a new mnemonic or redefines an existing mnemonic for the mnemonic table.
DELETE	3.5-24	S or D	Deletes a mnemonic from the mnemonic table.
FREE	3.5-40	S or D	Read-only variable that returns the number of free mnemonic table entries.
LMLIST	3.5-64	D	Outputs the mnemonic table in memory to a printer or remote device.
MLIST	3.5-70	S or D	Displays the mnemonic table in memory.
MLOAD	3.5-71	S or D	Loads a mnemonic file from disk into memory.
MSAVE	3.5-72	D	Saves a mnemonic table to disk.

TABLE: 3.4-7: BASIC READ-ONLY VARIABLES

VARIABLE	PAGE	TYPE	FUNCTION
EOF	3.5-29	Variable	Indicates end-of-file in an input file.
FREE	3.5-40	Variable	Returns the number of free mnemonic table entries.
SIZE	3.5-95	Variable	Returns the size of free program area in bytes.
TFREE	3.5-98	Variable	Returns length of the unused trace buffer in bytes.
TIME	3.5-99	Variable	Returns one byte of real time, in specified unit.

TABLE 3.4-8: BASIC PROGRAM DEVELOPMENT COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
AUTO	3.5-6	D	Provides automatic line numbering.
CHAIN	3.5-15	D	Loads and executes a program from disk.
EDIT	3.5-27	D	Edits a line from the program in memory.
ERASE	3.5-32	D	Deletes lines from the program in memory.
FILES	3.5-35	D	Displays a list of the files on the hard or floppy disk.
KILL	3.5-56	D	Deletes a file from disk.
LFILES	3.5-60	D	Outputs file directory to a printer or remote device.
LIST	3.5-62	D	Displays lines from the program in memory.
LLIST	3.5-63	D	Outputs lines from the program in memory to a printer or remote device.
LOAD	3.5-65	D	Loads a program from disk into memory.
MERGE	3.5-68	D	Combines the program lines in memory with a program file on disk.
NEW	3.5-73	D	Deletes the program in memory so that a new program can be entered.
RESEQ	3.5-83	D	Re-numbers line numbers of program in memory to increments of ten.
RUN	3.5-91	D	Executes the program in memory.
SAVE	3.5-92	D	Saves the program in memory to disk.
TROFF	3.5-103	D	Turns program debugging mode off.
TRON	3.5-104	D	Turns program debugging mode on.

TABLE 3.4-9: BASIC STRING COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
ASC$	3.5-4	S	Converts a string from EBCDIC to ASCII.
ATIME$	3.5-5	S	Returns the real time in ASCII.
BCD$	3.5-7	S	Converts a string variable from ASCII numeric values to BCD.
CHR$	3.5-16	S	Converts an ASCII value to binary.
DEC$	3.5-21	S	Creates an ASCII numeric value string of a sufficient length to express the decimal value of exp.
EBC$	3.5-26	S	Converts a string from ASCII to EBCDIC.
HEX$	3.5-44	S	Creates an ASCII four-character string which is the hex representation of any valid expression.
HEX>	3.5-45	S	Assigns the hex representation of an expression to a string.
INKEY$	3.5-50	S	Assigns the value of the last character typed to a specific string.
$INPUT	3.5-53	S	Allows the user to enter a string from the keyboard.
INSTR	3.5-55	S	Returns a numeric value which indicates the offset position of substring str2 within the string str1.
LEFT$	3.5-57	S	Return the leftmost exp number of characters of the string.
LEN	3.5-58	S	Returns the length of the string.
MID$	3.5-69	S	Returns characters from within a string from the position specified by exp1 for the number of characters specified by x.
RIGHT$	3.5-89	S	Returns the rightmost exp number of characters of the string.
TIME$	3.5-100	S	Produces a five-byte real-time value: hours, minutes, seconds, hundredths of seconds and tenths of milliseconds.
VAL	3.5-107	S	Converts the first two characters of a string into their numeric form.

TABLE 3.4-10: BASIC VIDEO DISPLAY COMMANDS

COMMAND	PAGE	TYPE	ACTION
BLK	3.5-8	S or D	Displays text blinking
BLKHLF	3.5-9	S or D	Displays text blinking and double intensity
BLKREV	3.5-10	S or D	Displays text blinking and reverse video
BLKUND	3.5-11	S or D	Displays text blinking,and underlined
CLS	3.5-19	S or D	Clears screen
DEL	3.5-23	S	Deletes line
ERAEOL	3.5-30	S	Erases to end of line
ERAEOS	3.5-31	S	Erases to end of screen
HLF	3.5-46	S or D	Displays text in double intensity
HLFUND	3.5-47	S or D	Displays text underlined in double intensity
INS	3.5-54	S	Inserts line
NRM	3.5-75	S or D	Cancels display effects and returns to normal display.
REV	3.5-86	S or D	Displays text in reverse video
REVHLF	3.5-87	S or D	Displays text in reverse video and double intensity
REVUND	3.5-88	S or D	Displays text underlined in reverse video
UND	3.5-106	S or D	Displays text underlined
XYPLOT(y,x)	3.5-109	S or D	X,Y screen addressing

TABLE 3.4–11: BASIC TRACE BUFFER COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
CLEAR	3.5–17	S or D	Clears the trace buffer.
LTPRINT	3.5–66	S or D	Outputs the contents of the trace buffer to a printer or remote device.
TFREE	3.5–98	Variable	Read–only variable. Returns the length of the unused trace buffer in bytes.
TLOAD	3.5–101	S or D	Loads a trace file from disk.
TPRINT	3.5–102	S or D	Displays contents of the trace buffer.
TSAVE	3.5–105	S or D	Saves a trace file to disk.

TABLE 3.4–12: BASIC CONTROL and EDIT KEY COMMANDS

COMMAND	ACTION
CTRL C	Aborts program execution that is pausing for input.
CTRL Q	Restores line in history buffer to the ! input line and in EDIT mode.
CTRL S	Pauses execution of program. To re–start, press any key.
CTRL Z	Same as CTRL C
ESC	Aborts execution of program; returns to ! prompt.
	EDITING CONTROL KEYS
CTRL D	Deletes character under cursor
CRTL I	Inserts one character space at cursor position.
CTRL L	Moves cursor one character to the right.
CTRL P	Moves cursor to end of line.
CTRL R	Moves cursor one character to the left.
CTRL X	Erases complete line, including line number.
CTRL Z	Exits editing and restores original text.
←/→	Moves cursor to left or right, respectively.

3.5 BASIC COMMANDS

Introduction

This section provides a complete description of the BASIC commands. The commands are organized alphabetically, one command per page.

If you know the name of the command you want to use, you can look up the command in this section. If you are unsure of the command you need, refer to the previous section which lists the commands by function.

The following information is provided in this section:

- Command description
- Type of command (Statement or Direct)
- Syntax
- Command abbreviation
- Related commands (See Also)
- Example(s) of command usage

@ (ARRAY)

Description

There is one array available for the user, which is referenced by the @ symbol. The maximum number of values allowed in an array is 256, with subscripts starting at zero. Array elements can be used anywhere that normal numeric variables (A-Z) are valid.

Type

Variable

Syntax

@(exp)

where: @ is the symbol for the array, and **exp** is any valid expression for the subscript in the array.

Abbreviation

None

See Also

Numeric Variables (See page 3.2-8)

Example 1

This program prints the 256 array elements in descending order.

`10 FOR A=0 TO 255`	Sets up loop to repeat 256 times.
`20 @(A)=255-A`	Assigns descending values to the array.
`30 PRINT "Array(",A,")=",@(A)`	Displays array subscript and assigned value.
`40 NEXT A`	Increments loop counter.

!RUN <RETURN>

(result)

```
Array(    0)=  255
Array(    1)=  254
Array(    2)=  253
Array(    3)=  252
etc.
```

Example 2

To access a specific element in the array, use the subscript to assign the element of the array to a numeric variable.

```
B = @(8)
```

ABS

Description

The ABS command returns the absolute value of a variable. This means that it returns the magnitude of the variable without the sign.

Type

Statement

Syntax

ABS(x)

where: **x** is a number or numeric variable, integer only.

Abbreviation

AB.()

See Also

None

Example 1

To display the absolute value of -10, enter:

```
PRINT ABS(-10)
```

(result) **10**

Example 2

This program displays the absolute value of a numeric variable.

```
10  X = 5
20  PRINT ABS(X)
!RUN  <RETURN>
```

(result) **5**

Example 3

This program displays a numeric variable and its absolute value.

```
10  X = -5
20  Y = ABS(X)
20  PRINT X, Y
!RUN  <RETURN>
```

(result) **-5** **5**

ASC$

Description

ASC$ is a string function that returns the ASCII code character representation of an EBCDIC string.

Type

Statement

Syntax

ASC$($x)

where: $**x** is an EBCDIC string.

Abbreviation

None

See Also

EBC$

Example 1

This example displays an EBCDIC value and its ASCII value in hex. and string variable

`10 $A=CHR$(&F0)`	String variable $A is assigned an EBCDIC value.
`20 $B=ASC$($A)`	$B is assigned the ASCII value of $A.
`30 PRINT %$A,"   ",%$B`	Both values are printed in hex.

!RUN <RETURN>

(result) **F0 30**

Example 2

`10 $A = "ABCDEF"`	String variable $A is assigned an ASCII value.
`20 $B = EBC$($A)`	$B is assigned the EBCDIC value of $A.
`30 $C = ASC$($B)`	$C is assigned the ASCII value of $B.
`40 PRINT %$A, %$B, %$C`	All three values are printed in hex.

!RUN <RETURN>

(result) **41 42 43 44 45 C1 C2 C3 C4 C5 41 42 43 44 45**

ATIME$

Description

ATIME$ is a string function that returns the ASCII value of the realtime stamp, converted from its Binary Coded Decimal format. The time is given in units of hours, minutes, seconds, .1 seconds, .01, seconds, .001 seconds, and .0001 seconds.

Note: The clock interval in simulation is 10 milliseconds. However, when the time is read, it is accurate to one tenth of a millisecond (100 microseconds).

See Volume I, Section x.x for an explanation of time stamping in Analysis mode, in which accuracy is to 20 microseconds.

Type

Statement

Syntax

ATIME$

Abbreviation

None

See Also

TIME, TIME$

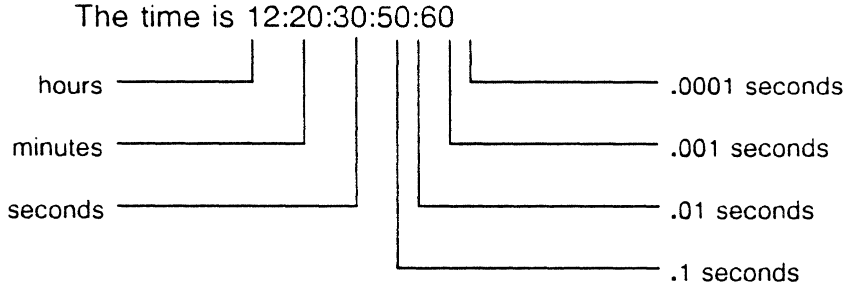
Example

This example displays the current time.

```
10  $B = ATIME$
20  PRINT $B
!RUN  <RETURN>
```

(result) **1220305060**

The time is 12:20:30:50:60



AUTO

Description

The AUTO command provides automatic line numbering while you are entering program code.

Type

Direct

Syntax

AUTO	Starts at line 10 and increments by 10.
AUTO x	Starts at line **x** and increments by 10.
AUTO x,y	Starts at line number **x** and increments by **y**.

Use caution when you have program lines in memory. Any new lines using the same line numbers as existing lines will overwrite the original lines.

To terminate automatic numbering, press the RETURN key or CTRL Z when a line number only is displayed.

Abbreviation

A.

Example 1

To have automatic line numbering beginning with 10 in increments of 10, enter:

```
AUTO
```

(result)
```
10 ...
20 ...
30 ...
etc.
```

Example 2

To have automatic line numbering beginning with 100 in increments of 5, enter:

```
AUTO 100,5
```

(result)
```
100 ...
105 ...
110 ...
etc.
```

BCD$

Description

BCD$ is a string function that converts an ASCII string to Binary Coded Decimal (BCD).

This function is not available in FRAMEM.

Type

Statement

Syntax

BCD$($x)

where: $x is an ASCII string.

Abbreviation

None

See Also

ASC$

Example

This example displays the BCD value of an ASCII string.

```
10 $A="12345"         Assigns ASCII string to $A.
20 $B=BCD$($A)        Assigns the BCD value of $A to $A.
30 PRINT %$B          Displays $B in hex.
!RUN  <RETURN>
```

(result) **12 34 50**

Note that a zero is added to the end of the string to complete the byte.

BLK

Description

The BLK command causes text to blink on the Chameleon screen. Use the NRM command to cancel this and all other special display effects and return to normal display mode.

Type

Direct or Statement

Syntax

BLK

Abbreviation

None

See Also

NRM, BLKHLF, BLKREV, BLKUND

Example 1

This example causes the simulation prompt and subsequent characters to blink.

```
BLK
```

(result) **OK!** (appears blinking on the screen)

Example 2

This example changes to blinking display and then resets the screen to normal display.

```
10  BLK
20  PRINT "I'M BLINKING!"
30  NRM
!RUN   <RETURN>
```

(result) **I'M BLINKING** (appears blinking on the screen)

BLKHLF

Description

The BLKHLF command causes text to blink in double intensity on the Chameleon screen. Use the NRM command to cancel blinking and all other special display effects.

Type

Direct or Statement

Syntax

BLKHLF

Abbreviation

BLKH.

See Also

NRM, BLK, BLKREV, BLKUND

Example 1

This example causes the simulation prompt to blink in double intensity.

```
BLKHLF
```

(result) **OK!** (apppears blinking in double intensity)

Example 2

This example causes text to blink in double intensity and then resets the screen to normal display.

```
10  BLKHLF
20  PRINT "I'M BLINKING!"
30  NRM
!RUN  <RETURN>
```

(result) **I'M BLINKING** (appears blinking in double intensity on the screen)

BLKREV

Description

The BLKREV command causes text to blink in reverse video on the Chameleon screen. Use the NRM command to cancel this and all other special display effects.

Type

Direct or Statement

Syntax

BLKREV

Abbreviation

BLKR.

See Also

NRM, BLK, BLKHLF, BLKUND

Example 1

This example causes the simulation prompt to blink in reverse video.

```
BLKREV
```

(result) **OK!** (appears blinking in reverse video)

Example 2

This example causes text to blink in reverse video and then resets the screen to normal display.

```
10  BLKREV
20  PRINT "I'M BLINKING!"
30  NRM
!RUN  <RETURN>
```

(result) **I'M BLINKING** (appears blinking in reverse video)

BLKUND

Description The BLKUND command causes text to blink and be underlined on the Chameleon screen. Use the NRM command to cancel this and all other special display effects.

Type Direct or Statement

Syntax BLKUND

Abbreviation BLKU.

See Also NRM, BLK, BLKHLF, BLKREV

Example 1 This example causes the simulation prompt to blink and be underlined.

```
BLKUND
```

OK! (appears blinking and underlined)

Example 2 This example causes text to blink and be underlined and then resets the screen to normal display.

```
10  BLKUND
20  PRINT "I'M BLINKING!"
30  NRM
!RUN  <RETURN>
```

(result) **I'M BLINKING** (appears blinking and underlined)

CALL

Description

The CALL command calls a program from the disk as if it were a subroutine. It causes a separate program to be executed as part of the main program.

When a program is called, all variables, string values, and transmission variables retain the values they had in the main program. If the called program alters any variables, they retain these new values when control is returned to the main program. In other words, all of the variables are global.

A called program can call other programs. Chameleon BASIC supports up to 16 levels of calling. The main program is saved automatically in a temporary file. There must be sufficient room on your hard or floppy disk for the main program to be saved.

The EXIT command is used in a called program to return control to the main program.

When calling a program, open data files are automatically closed. To reopen them to append data, use the OPEN command.

Type

Statement

Syntax

CALL "name"

CALL"A:name"

CALL"B:name"

$A = "name"
CALL $A

where: **name** is a valid program filename.

Abbreviation

CA.

See Also

EXIT, OPEN

Example 1

This example demonstrates the use of CALL and EXIT. PROG1 is the main program and calls PROG2, as shown below:

```
10 PRINT "THIS IS THE MAIN PROGRAM"
20 CALL "PROG2"
30 PRINT "BACK AGAIN"
```

PROG2 is called by PROG1, prints a message and returns control to PROG1, as shown below:

```
10 PRINT "THIS IS THE CALLED PROGRAM"
20 EXIT
```

(result) When PROG1 is run, the following messages are displayed:

```
THIS IS THE MAIN PROGRAM
THIS IS THE CALLED PROGRAM
BACK AGAIN
```

Example 2

This example demonstrates how variables retain their values when a program is called or exited. PROG1 prints the value of variable A and calls PROG2, as shown below:

```
10 A = 5
20 PRINT A
30 CALL "PROG2"
40 PRINT A
```

PROG2 prints the value of variable A, which demonstrates that the value of the variable is retained and passed to the called program. The called program then increments variable A and returns control to PROG1. PROG2 is shown below.

```
10 PRINT A
20 A = A + 1
30 EXIT
```

When PROG1 is run, the following results are displayed:

5 (Output from the main program)
5 (Output from the called program)
6 (Output from the main program)

Example 3

This example demonstrates different levels of calling. The main program, shown below, calls 15 different programs.

```
10      REM ******** THIS IS THE MAIN PROGRAM **********
20      A=0
40      XYPLOT(0,0)
50      CLS
60      $Z = "THIS PROGRAM SHOWS MULTI-LEVEL CALLING"
70      B=LEN($Z)/2
80      XYPLOT(0,B)
90      PRINT $Z,\
100     XYPLOT(2,0)
120     PRINT "HERE WE GO"
130     CALL "PROGA"
140     XYPLOT(2,40)
150     PRINT "WE'RE FINISHED"
160     XYPLOT(19,0)
```

The 15 programs that are called are identical, except for their filenames, which are PROGA through PROGO. The code for the called programs is shown below.

```
10    XYPLOT(5+A,1)
20    PRINT "THIS IS SUB-PROGRAM NUMBER",A
30    IF A = 14 EXIT
40    A = A + 1
50    $B = "PROG" + CHR$(A+&41)
60    CALL $B
70    A = A - 1
80    XYPLOT(5+A,40)
90    PRINT "NOW BACK IN PROG", A
100   EXIT
```

When the main program is run, the following series of messages is displayed on the screen. The right side lines are displayed first one by one down the screen, then the left side lines are displayed one by one up the screen.

```
   THIS PROGRAM SHOWS MULTI-LEVEL CALLING

HERE WE GO                              WE'RE FINISHED

THIS IS SUB-PROGRAM NUMBER 0        NOW BACK IN PROG 0
THIS IS SUB-PROGRAM NUMBER 1        NOW BACK IN PROG 1
THIS IS SUB-PROGRAM NUMBER 2        NOW BACK IN PROG 2
THIS IS SUB-PROGRAM NUMBER 3        NOW BACK IN PROG 3
        :                                   :
        :                                   :
        :                                   :
THIS IS SUB-PROGRAM NUMBER 12       NOW BACK IN PROG 12
THIS IS SUB-PROGRAM NUMBER 13       NOW BACK IN PROG 13
THIS IS SUB-PROGRAM NUMBER 14
```

CHAIN

Description

The CHAIN command loads a specified program file from the disk into memory and runs it. This is the same as using a LOAD command and then a RUN command.

Type

Statement or Direct

Syntax

CHAIN"name"	Loads and runs program from the default drive (A).
CHAIN "A:name"	Loads and runs program from the hard disk drive (A).
CHAIN "B:name"	Loads and runs program from the floppy disk drive (B).
$A = "name" **CHAIN $A**	Loads and runs program name strored in $A from the default drive (A).

where: **name** is a the program filename to load and run.

Abbreviation

CH.

See Also

LOAD, RUN

Examples

These examples show two different ways to load and run a file called PROG1 from the floppy disk drive.

```
CHAIN"B:PROG1"
```

```
10 $A = "B:PROG1"
20 CHAIN $A
```

CHR$

Description

CHR$ is a string function that stores the binary equivalent of an ASCII value. When the string variable is printed to the screen, the ASCII character is displayed.

Type

Statement

Syntax

CHR$(exp)

where: **exp** is a number, numeric variable, arithmetic or logical function.

Abbreviation

None

Example 1

This example stores and prints the binary equivalent of the ASCII character 65 as variable $C.

```
10 $C = CHR$(65)
20 PRINT $C
!RUN   <RETURN>
```

(result) **A** (ASCII equivalent of binary 65)

Example 2

This example stores hex values to numeric strings. Logical OR is used to define the value of string variable $C.

```
10 A=&40
20 B=&01
30 $C=CHR$(A OR B)
40 PRINT $C
!RUN   <RETURN>
```

(result) **A**

Example 3

This example uses a FOR loop to store the entire ASCII table from 11 hex to 7E hex in string variable $A.

```
5 $A = ""
10 FOR X = 17 TO 126
20 $A = $A + CHRS$(X)
30 PRINT $A
40 NEXT X
50 STOP
!RUN   <RETURN>
```

The values are stored in binary code, but are displayed in ASCII because PRINT $A converts binary values to ASCII.

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
XYZ[\]^_`abcdefghijklmnopqrstuvwxyz{!}~
```

CLEAR

Description The CLEAR command clears the trace buffer. The trace buffer contains the data after a REC command is executed. See Section 3.2 for more information about simulation buffers.

Type Statement or Direct

Syntax **CLEAR**

Abbreviation CL.

See Also TSAVE, TLOAD, TPRINT

Example This example clears the trace buffer and then displays it.

```
10 CLEAR
20 TPRINT
!RUN <RETURN>
```

(result) !

Nothing is displayed, since the trace buffer was cleared of all data and is now empty.

CLOSE

Description

The CLOSE command closes data files that were opened for input or output. A file opened for input does not need to be closed before returning to the menu system or before powering off the Chameleon. Use of the optional argument I or O will close only that data file opened for input (I) or output (O). With no argument, all open data files will be closed.

Type

Statement or Direct

Syntax

CLOSE	Closes all open data files
CLOSE I	Closes all data input files
CLOSE O	Closes all data output files

Abbreviation

CLO.

See Also

OPEN, READ, WRITE, EOF

Example

To close all open data files, enter:

```
CLOSE
```

To close the data input file, enter:

```
CLOSE I
```

To close the data output file, enter:

```
CLOSE O
```

CLS

Description The CLS command clears the Chameleon screen.

Type Statement or Direct

Syntax **CLS**

Abbreviation None

See Also INS, DEL, ERAEOL, ERAEOS

Example

```
CLS
```

(result) !

The Chameleon screen is cleared of all text and the ! prompt is displayed at the top of the screen.

COUPLER

Description

The COUPLER command loads a parameter set-up file which has been previously saved to disk. When you first start a simulator, the set-up file named DEFAULT is automatically loaded and the Front End Processor (FEP) is initialized using those values. If the FEP is not initialized, when you try to transmit or receive data, the following message is displayed:

```
P1 SETUP NOT PERFORMED
```

If you use the SETUP command to display the parameter set-up menu, the DEFAULT values are loaded into the menu and the FEP is reinitialized with those values. To view the values in a parameter set-up file other than DEFAULT, you must do the following:

1. Type **SETUP** to display the parameter set-up menu.
2. Press **S** to access the Save Parameters menu.
3. Press **E** to load a file into the set-up menu.
4. Enter the disk drive and name of the set-up file.

Notes

CLOSE all data files that are open before executing the COUPLER command, or they may be lost.

The COUPLER command is not available in FRAMEM DMI.

Type

Statement or Direct

Syntax

COUPLER "filename"

$A = "name"
COUPLER $A

where: **name** is the parameter setup filename.

Abbreviation

CO.

See Also

SETUP, CLOSE

Example 1

This example loads the a parameter set-up file named TEST1 from the hard disk.

```
COUPLER "TEST1"
```

DEC$

Description

DEC$ is a string function that converts a valid numeric expression into a string of ASCII decimal characters. Hexadecimal entries return positive ASCII decimal characters in the range of 0 to 7FFF hexadecimal. 8000 to FFFF hexadecimal will return -32768 to - 1 respectively.

Type

Statement or Direct

Syntax

$X = DEC$(exp)

where: **exp** is a number, numeric variable, arithmetic function, or logical function.

Abbreviation

None

Example 1

To assign the ASCII digits "10" to string A, enter:

```
$A = DEC$(10)
PRINT $A
```

(result) **10**

Example 2

To assign the ASCII digits "-10" to string A from an arithmetic expression, enter:

```
$A = DEC$(((10 * 2) - 30))
PRINT $A
```

(result) **-10**

Example 3

```
10 $A = DEC$(&FF)
20 PRINT $A
!RUN  <RETURN>
```

(result) **255**

Example 4

```
10 A = &10
20 B = &01
30 $A = DEC$(A AND B)
40 PRINT $A
!RUN  <RETURN>
```

(result) **0**

DEFINE

Description

The DEFINE command defines a new mnemonic or re-defines an existing mnemonic for the mnemonic table. Refer to Section 3.2 for a general discussion of the use of mnemonic tables in simulation.

The structure and function of mnemonics is protocol specific, therefore you should refer to the appropriate chapter for a description of the DEFINE syntax for the simulator you are using.

DEL

Description The DEL command deletes a line from the Chameleon screen. To erase a line of text without deleting the line, refer to the ERAEOL command.

Type Statement

Syntax **DEL**

Abbreviation None

See Also ERAEOL, ERAEOS, XYPLOT

Example This example displays text on line 20 of the Chameleon screen and then deletes line 0 (top line) of the screen 22 times. As each line is deleted, the message moves toward the top of the screen.

```
10 CLS                     Clears the screen.
20 XYPLOT(20,0)            Positions cursor on line 20 of screen.
30 PRINT "HELLO"           Prints message on line 20.
40 XYPLOT(0,0)             Positions cursor on line 0 of screen.
50 FOR A = 1 TO 22         Sets up loop to repeat 22 times.
60 DEL                     Deletes line 0 from screen.
70 NEXT A                  Increments loop counter.
!RUN  <RETURN>
```

DELETE

Description The DELETE command removes a mnemonic entry from the mnemonic table.

Type Statement or Direct

Syntax **DELETE "name"**

where: **name** is the name of the mnemonic.

Abbreviation D.

See Also DEFINE, MLIST, MSAVE, MLOAD

Example To delete a mnemonic entry named **NEW**, enter:

```
DELETE "NEW"
```

DISPF

Description

The DISPF command displays the last frame transmitted or received. There is a buffer that contains the last frame transmitted or received and the DISPF command displays the contents of that buffer.

After a REC command, the buffer is emptied. If a frame was received, it is put into the buffer; if nothing was received, the buffer will be empty. The length of this buffer varies with the protocol being used.

Refer to section 3.2 for information about simulation buffers.

Notes: DISPF is not available in Async.

SIMP/L uses a variation of the DISPF command as described in the syntax below.

Type

Statement or Direct

Syntax

DISPF Syntax for all BASIC simulators except SIMP/L and Async.

RDISPF In SIMP/L only, RDISPF displays the last frame/packet/message received.

TDISPF In SIMP/L only, TDISPF displays the last frame/packet/message transmitted.

Abbreviation

DISP.

See Also

LDISPF

Example

This FRAMEM LAPD example transmits two strings and displays the contents of the DISPF buffer and the trace buffer.

```
10 $A = "hello"          Assigns string to $A.
20 TRAN $A               Transmits $A.
30 DISPF                 Displays the DISPF buffer ($A).
40 $B = "goodbye"        Assigns string to $B.
50 TRAN $B               Transmits $B.
60 DISPF                 Displays the DISPF buffer ($B).
70 TPRINT                Displays the trace buffer ($A and $B).
!RUN  <RETURN>
```

(result):

```
68656C6C6F
676F6F64627965
T  00:02:52:34:00  5  68  RNR   N(R)=3 6C 6C 6F
T  00:02:52:40:30  7  67  SABME 6F 64 62 79 65
```

EBC$

Description

EBC$ is a string function that converts an ASCII string to EBCDIC. ASCII/EBCDIC conversion charts are in the Chameleon User's Manual, Volume I, Appendix A.

Type

Statement or Direct

Syntax

$A = EBC$($B)

where: $B is an ASCII string.

Abbreviation

None

Example

To assign string A the EBCDIC equivalent of the ASCII characters ABCD, enter:

```
10 $B = "ABCD"
20 $A = EBC$($B)
30 PRINT % $A
```

!RUN <RETURN>

(result) C1 C2 C3 C4

EDIT

Description

The EDIT command allows you to edit a line from the *program* in memory. When you enter the EDIT command, the program line is placed in a buffer and the line number is displayed on the screen. Use the edit commands listed below to make the changes you need to the program line. You can also change a program line by re-entering the line entirely.

Note that the edit command cannot be used with unnumbered commands entered at the ! prompt. However, there is a history buffer that stores the last command entered at the ! prompt. CTRL Q restores the line from the buffer so that you can edit it and enter is again.

Type

Direct

Syntax

EDIT x

where: **x** is the line number to edit.

Abbreviation

E.

See Also

SAVE, ERASE, LOAD

Example

```
EDIT 20
```

Edit Commands

Use the following command to edit a program line after the EDIT command is executed. The editing commands affect either the line as it is displayed on the screen, or the line as it is stored in memory. The description of each command indicates which is affected.

LEFT Arrow and Delete

These keys move the cursor one space to the left and/or hide the character as it appears on the screen. The character remains stored in memory until the new line is saved or until it is deleted using CTRL + D.

RIGHT Arrow and CTRL + L

The RIGHT arrow key displays the next character of the currently stored line and moves the cursor one character to the right.

CTRL + P

CTRL + P displays the entire line to the right of the cursor, as it is currently stored. The cursor moves to the end of the line.

CTRL + X

CTRL + X erases the entire line, including line number, from the screen and returns the cursor to the first column. The line remains in memory although it is not displayed on the screen.

CTRL + D

CTRL + D deletes the next *un-displayed* character from memory. The deleted character cannot be re-displayed. nEtering new code over un-displayed code replaces the old code with the new one in memory.

CTRL + I

CTRL + I inserts a space to hold an additional character. The cursor moves right one character and a space appears on the display. Use the LEFT arrow key or BACKSPACE key to hide the space, then enter the new character.

RETURN

The RETURN key saves the line to the left of the cursor, as it appears on the screen. The text right of the cursor is deleted from memory.

CTRL + Z

CTRL + Z exits from edit mode without saving changes you may have made to the line; only the original code is saved.

Example

The first column shows the editing command that is entered. The caret symbol (ˆ) indicates a control (CTRL) character.

The second column shows the line as it is displayed on the screen after the command is executed. The tilde symbol (˜) indicates the position of the cursor on the display. The third column shows the line in the editing memory.

COMMAND	DISPLAY	MEMORY
20 EDITING COMMANDS	20 EDITING COMMANDS	
!EDIT 20	20 ˜	20 EDITING COMMANDS
ˆP	20 EDITING COMMANDS˜	20 EDITING COMMANDS
Delete	20 EDITING COMMAND˜	20 EDITING COMMANDS
3 left arrows	20 EDITING COMM˜	20 EDITING COMMANDS
ˆL	20 EDITING COMMA˜	20 EDITING COMMANDS
3 right arrows	20 EDITING COMMANDS˜	20 EDITING COMMANDS
Return key	!	20 EDITING COMMANDS
!EDIT 20	20 ˜	20 EDITING COMMANDS
ˆP	20 EDITING COMMANDS˜	20 EDITING COMMANDS
ˆX	˜	20 EDITING COMMANDS
5 NEW LINE	5 NEW LINE˜	5 NEW LINE
Return key	!	20 EDITING COMMANDS

EOF

Description

EOF is a read-only variable that indicates that the end-of-file condition has been detected in an input (I) file. Opening an input file automatically resets the EOF flag. It has the following values:

EOF = 0	End of data file has *not* been reached
EOF = 255	End of data file has been reached.

Type

Statement or Direct

Syntax

(See examples below.)

Abbreviation

None

See Also

OPEN, CLOSE

Example 1

```
PRINT EOF
```

Example 2

```
10 A=EOF
20 PRINT A
!RUN  <RETURN>
```

Example 3

Below are three ways to test for EOF and print a message when the end of file has been reached.

a) `IF EOF PRINT "END OF FILE "`

b) `IF EOF=255 PRINT "END OF FILE"`

c) `IF EOF # 0 PRINT "END OF FILE"`

ERAEOL

Description The ERAEOL command erases text to the end of the current line.

Type Statement

Syntax **ERAEOL**

Abbreviation None

See Also ERAEOS, XYPLOT, DEL

Example This example prints a message and then erases the message.

`10 CLS`	Clears the screen.
`20 XYPLOT(0,0)`	Positions cursor at top of screen.
`30 PRINT "HELLO WORLD"`	Prints message at top of screen.
`40 XYPLOT(0,6)`	Positions cursor in middle of message.
`50 ERAEOL`	Erases from cursor to end of line.

!RUN <RETURN>

ERAEOS

Description The ERAEOS command erases text to the end of the screen.

Type Statement

Syntax **ERAEOL**

Abbreviation ERAE.

See Also ERAEOL, DEL, XYPLOT

Example This example prints messages on two lines, and then erases from the second message to the end of the screen.

`10 CLS`	Clears the screen.
`20 XYPLOT(5,0)`	Positions cursor on line 5.
`30 PRINT "MESSAGE 1"`	Prints a message on line 5.
`40 XYPLOT(10,0)`	Positions cursor on line 10.
`50 PRINT "MESSAGE 2"`	Prints a message on line 10.
`60 XYPLOT(10,0)`	Positions cursor at beginning of line 10.
`70 ERAEOS`	Erases from line 10 to the end of the screen.
`!RUN <RETURN>`	

ERASE

Description

The ERASE command deletes one or more program lines from the program in memory.

Type

Direct

Syntax

ERASE x,y

where: **x** is the first line number and **y** is the last line number you want to erase. All lines between x and y, inclusive, are deleted.

Abbreviation

ER.

See Also

EDIT, LIST, RESEQ

Example 1

To erase all lines between lines 20 and 40, inclusive, enter.

```
ERASE 20,40
```

Example 2

To erase line 100 only, enter:

```
ERASE 100,100
```

Alternately, you can erase a program line, by entering the line number only and pressing RETURN. For example, to erase line 100, you could enter:

```
100   <RETURN>
```

EXIT

Description

The EXIT command returns control to a calling program from a program that has been called using the CALL command.

Type

Statement

Syntax

EXIT

Abbreviation

EX.

See Also

CALL

Example

ProgramA prints a message and then calls ProgramB. ProgramB prints two messages and then executes the EXIT command, returning control to ProgramA to print a final message.

```
10 REM THIS IS PROGRAMA
20 PRINT "HELLO FROM PROGRAMA"
30 CALL"PROGRAMB"
40 PRINT"GOODBYE FROM PROGRAMA"
```

```
10 REM THIS IS PROGRAMB
20 PRINT "HELLO FROM PROGRAMB"
30 PRINT"GOODBYE FROM PROGRAMB"
40 EXIT
```

(result) **HELLO FROM PROGRAMA**
HELLO FROM PROGRAMB
GOODBYE FROM PROGRAMB
GOODBYE FROM PROGRAMA

FDEFINE

Description

The FDEFINE command enables you to define the functions of the 10 keys in the top row of the keyboard (F1 - F10) for special functions.

FDEFINE assigns one or more commands to a function key. Pressing a function key causes thge assigned keystrokes to be played back. This simplifies the task of entering repetitive or complex commands or expressions.

Type

Statement or Direct

Syntax

FDEFINE KEYx = ~statement^statement^~

where: **x** is the key number between 1 and 10. *Do not insert a blank space between the key number and the equal sign.*

The tilde symbol (~) is used to mark the beginning and end of the function key assignment. The caret symbol (^) represents a carriage return and is used between commands. The use of these symbols enables you to include quotation marks and commas as part of the function key assignment.

Abbreviation

FD.

See Also

FSAVE, FLOAD FLIST

Example 1

To have function key F1 list the mnemonic table, the files on the hard disk, and the function key assignments, enter:

```
FDEFINE KEY1=~MLIST^FILES^FLIST^~
```

Example 2

To define function key F2 to load a parameter file called PARA1 and initiate auto line numbering, enter:

```
FDEFINE KEY2=~COUPLER="PARA1"^AUTO^~
```

Example 3

To define function key F3 to display GOOD MORNING on the screen, enter:

```
FDEFINE KEY3=~PRINT"GOOD MORNING"~
```

FILES

Description

The FILES command displays the names of the Chameleon BASIC files on a specified disk drive. The FILES command lists:

- Program Files
- Trace Files
- Mnemonic Table Files
- Data Files
- Setup Files
- Function Key Files

Type

Direct

Syntax

FILES	Lists files on the default drive A (hard disk).
FILES A	Lists files on drive A (hard disk).
FILES B	Lists files on drive B (floppy disk).

Abbreviation

F.

See Also

LFILES, KILL

Example

To list the files on the floppy drive, enter:

```
FILES B
```

(result)

```
Program Files
: PROGA PROGB PROGC  PROGD  PROGE
Trace Files
Mnemonic Table Files
Data Files
: DATA1 DATA2
Setup Files
: DEFAULT  SETUP1SETUP2 SETUP3
Function Key Files
```

FLIST

Description The FLIST command lists the ten function keys and their current assignments on the screen.

Type Statement or Direct

Syntax **FLIST**

Abbreviation FL.

See Also LFLIST, FDEFINE

Example To list the function key assignments in the current function key file, enter:

!FLIST

(result)

```
KEY 1 = MLIST^FILES^FLIST^
KEY 2 = COUPLER=PARA1^AUTO^
KEY 3 = ?"GOOD MORNING"^
KEY 4 = A+B/2^
KEY 5 = LLIST^
KEY 6 = LOAD "B:TEST1"^RUN^
KEY 7 = FLUSH^NEW^AUTO^
KEY 8 = $A="HELLO"^
KEY 9 = TRAN^GOTO10^
KEY 10 = RESEQ^LIST^
```

Note that the tildes that are used to define the keys in the FDEFINE command are not displayed with FLIST.

FLOAD

Description

The FLOAD command loads a function key definition file into memory. The file must already have been saved to disk using FSAVE.

FLOAD redefines all function keys as specified in the loaded function key file, and will redefine keys already FDEFINED.

Type

Statement or Direct

Syntax

FLOAD "name"

FLOAD "A:name"

FLOAD "B:name"

$A = "name"
FLOAD $A

where: **name** is the function key filename.

Abbreviation

FLO.

See Also

FSAVE, FDEFINE

Example

This example loads the function key file named FKEYS1 from the floppy disk drive into memory.

```
FLOAD "B:FKEYS1"
```

FLUSH

Description

The FLUSH command clears the acquisition buffer, the buffer that receives data from the line. For a description of the simulation buffers, refer to section 3.2.

The FLUSH command is not available in FRAMEM DMI.

Type

Statement or Direct

Syntax

FLUSH

Abbreviation

FLU.

See Also

CLEAR, REC

Example

```
FLUSH
```

FOR

Description The FOR command controls looping in programs.

Type Statement

Syntax **FOR x = exp1 TO exp2 [STEP exp3]**

.
.
.

NEXT x

where: **x** is a numeric variable and **exp1**, **exp2,** and **exp3** are any valid numeric expressions. **exp1** defines the beginning value of **x.** **exp2** defines the maximum value for **x** to continue executing the loop. **exp3** defines the amount that **x** is incremented each time the loop is executed. STEP is optional; the default value is 1.

The NEXT command increments **x** by the STEP and marks the end of the loop.

Abbreviation None

See Also NEXT

Example

```
10 FOR x = 1 TO 10 STEP 2
20 PRINT X
30 NEXT X
40 PRINT "GOODBYE"
```

(result)

```
1
3
5
7
9
GOODBYE
```

This assigns the value of one to **x.** When the program reaches the NEXT x command, it increments **x** by two and sends the program back to the FOR command to execute the loop again. When x exceeds 10, the loop terminates and the statement following the NEXT x command is executed.

FREE

Description

FREE is a read-only variable that returns the number of free mnemonic table entries. A mnemonic table can contain a maximum of 255 entries.

Type

Statement or Direct

Syntax

(See examples below.)

Abbreviation

F.

See Also

MLIST, DELETE, DEFINE, MSAVE, MLOAD

Example 1

To display the number of free entries in the mnemonic table in memory, enter:

```
PRINT FREE
```

Example 2

To print a message based on the number of entries available, you could enter:

IF FREE > 0 PRINT "There are ",FREE," entries available."

(result) `There are xxx entries available.`

(xxx is the number of free entries)

FSAVE

Description

The FSAVE command saves function key assignments that have been defined with the FDEFINE command to disk.

Type

Statement or Direct

Syntax

FSAVE "name"

FSAVE "A:name"

FSAVE "B:name"

$A = "name"
FSAVE $A

where: **name** is the function key filename.

Abbreviation

FSA.

See Also

FDEFINE, FLOAD

Example

To saves the current function key assignments in a function key file named FKEYS1 on the floppy disk drive, enter:

```
FSAVE"B:FKEYS1"
```

GOSUB

Description

The GOSUB command transfers program control to a specific line number in the program to execute a subroutine. A subroutine ends with a RETURN command, which returns control to the line number following the GOSUB.

Note: Expressions used as line numbers will not be re-evaluated by the RESEQ command.

Type

Statement

Syntax

GOSUB exp

where: **exp** is the line number, or a valid expression for the line number, of the subroutine.

Abbreviation

GOS.

See Also

RETURN

Example 1

```
10 FOR A = 1 TO 3
20 GOSUB 200
30 NEXT A
40 STOP
200 PRINT "The value of A = ",A
210 RETURN
!RUN   <RETURN>
```

(result)
```
The value of A=   1
The value of A=   2
The value of A=   3
```

Example 2

In this example, the subroutine is defined by the expression A*100.

```
10 FOR A = 1 TO 3
20 GOSUB A*100
30 NEXT A
40 STOP
100 PRINT "SUBROUTINE ON LINE 100"
110 RETURN
200 PRINT "SUBROUTINE ON LINE 200"
210 RETURN
300 PRINT "SUBROUTINE ON LINE 300"
310 RETURN
!RUN   <RETURN>
```

(result)
```
SUBROUTINE ON LINE 100
SUBROUTINE ON LINE 200
SUBROUTINE ON LINE 300
```

GOTO

Description

The GOTO command transfers program control to a specific line number in the program.

Note: Expressions used as line numbers will not be re-evaluated by the RESEQ command.

Type

Statement

Syntax

GOTO exp

where: exp is the line number, or a valid expression for the line number.

Abbreviation

GO.

See Also

GOSUB

Example 1

```
10 FOR A = 1 TO 3
20 GOTO 200
30 NEXT A
40 STOP
200 PRINT "The value of A = ",A
210 GOTO 30
!RUN  <RETURN>
```

(result)

```
The value of A=   1
The value of A=   2
The value of A=   3
```

Example 2

In this example, the line is defined by the expression A*100.

```
10 FOR A = 1 TO 3
20 GOTO A*100
30 NEXT A
40 STOP
100 PRINT "LINE 100"
110 GOTO 30
200 PRINT "LINE 200"
210 GOTO 30
300 PRINT "LINE 300"
310 GOTO 30
!RUN  <RETURN>
```

(result)

```
LINE 100
LINE 200
LINE 300
```

HEX$

Description

HEX$ is a string function that creates an ASCII four-character string which is the hexadecimal representation of any valid expression.

Type

Statement

Syntax

$A = HEX$(exp)

where: **exp** is any valid numeric expression.

Abbreviation

None

See Also

HEX>

Example 1

```
10 $A = HEX$(255)
20 PRINT $A
!RUN   <RETURN>
```

Result **00FF**

Example 2

This program assigns the hexadecimal equivalents of 0 to 255 to string variable $A and values 8000 to 80FF to string variable $B.

```
10 FOR A = 0 TO 255
20 $A = HEX$(A)
30 $B = HEX$(A + &8000)
40 PRINT $A,"  ",$B
50 NEXT A
!RUN   <RETURN>
```

(result)
```
0000 8000
0001 8001
:
:
:
00FF 80FF
```

HEX >

Description

HEX> is a string function that assigns a string variable value in hexadecimal.

Type

Statement

Syntax

$A = HEX>exp

where: **exp** is any valid expression.

Abbreviation

None

See Also

HEX$

Example 1

To assign the ASCII characters "ABCDE" to string A, enter:

```
10 $A=HEX>4142434445
20 PRINT $A
!RUN  <RETURN>
```

(result) **ABCDE**

Example 1

The program below, in SIMP/L HDLC, sends a Restart packet from theChameleon. The HEX> function stores the packet in a string.

```
10  $A = HEX>1000FB00
20  BUILD $A
30  TRAN
!RUN  <RETURN>
```

HLF

Description
The HLF command causes text to be displayed in double intensity (highlight) on theChameleon screen. Use the NRM command to cancel this and all other special display effects.

Type
Statement or Direct

Syntax
HLF

Abbreviation
None

See Also
NRM, HLFUND

Example 1
This example causes a message to be displayed in double intensity on the screen.

```
10 HLF
20 PRINT "THIS IS BRIGHT"
30 NRM
!RUN   <RETURN>
```

(result) **THIS IS BRIGHT** (appears in double intensity)

HLFUND

Description

The HLFUND command causes text to be displayed in double intensity (highlight) and underlined on theChameleon screen. Use the NRM command to cancel this and all other special display effects.

Type

Statement or Direct

Syntax

HLFUND

Abbreviation

None

See Also

NRM, HLF

Example 1

This example displays a message in duble intensity, underlined text.

```
10 HLFUND
20 PRINT "I'M BRIGHT"
30 NRM
!RUN   <RETURN>
```

(result) I'M BRIGHT (appears in double intensity and underlined)

IF

Description

The IF commands allows program flow to be changed based on a decision. The IF command contains an expression and a command. The expression is evaluated as a condition. If the expression is true, the command is executed. If the expression is false, the command is ignored and the next line is executed.

Note: The word THEN is not used. String functions cannot be used directly inside an IF statement.

Type

Statement

Syntax

IF x op y command

where: **x** and **y** are numeric variables
op is a logical or arithmetic operator (=, # >, <, > =, < = AND OR)
command is the command to execute if the statement is true

Abbreviation

None

See Also

Arithmetic operators, logical operators, read-only variables

Example 1

This example tests a string value and prints a message if the test is true.

```
10 $A = "ABCD"
20 IF $A = "ABCD" PRINT "TRUE"
!RUN <RETURN>
```

(result) **TRUE**

Example 2

This example determines if strings are equal and prints a message with the result.

```
10 $A = "ABCD"
20 $B = "ABC"
30 $C = "EFGH"
40 IF $A = $B GOTO 70
50 PRINT "$A IS NOT EQUAL TO $B"
60 GOTO 80
70 PRINT "$A IS EQUAL TO $B"
80 IF $A = $C GOTO 110
90 PRINT "$A IS NOT EQUAL TO $C"
100 GOTO 120
110 PRINT "$A IS EQUAL TO $C"
120 STOP
!RUN <RETURN>
```

(result)
```
$A IS NOT EQUAL TO $B
$A IS NOT EQUAL TO $C
```

Example 3

This example evaluates a variable using two IF statements.

```
10  A = 3
20  IF A # 3 GOTO 50
30  PRINT "A = 3"
50  IF A < 4 PRINT "A IS LESS THAN FOUR"
100 STOP
!RUN <RETURN>
```

(result)
```
A = 3
A IS LESS THAN FOUR
```

INKEY$

Description

INKEY$ is a string function that assigns the next character typed on the keyboard to a string variable. The INKEY$ function assigns a value of zero if no key has been typed.

This function differs from the READ and $INPUT commands because it does not stop program execution until a key is pressed.

Note: To halt program execution while the program is waiting for input, press CTRL C.

Type

Statement

Syntax

$A = INKEY$

Abbreviation

None

See Also

$INPUT

Example

This example prints the message TYPE A LETTER repeatedly until a character is typed. When a character is typed, it is displayed and then the TYPE A LETTER message is displayed repeatedly.

`10 PRINT "TYPE A LETTER"`	Displays a message.
`20 $A=INKEY$`	Check for keyboard input.
`30 IF LEN($A)=0 GOTO 10`	If no key pressed, displays the message again.
`40 PRINT $A`	Displays the character that is input.
`50 GOTO 10`	Displays the message again.

!RUN <RETURN>

INPUT

Description

The INPUT command stores keyboard input in a variable. It allows you to create screen prompts and stores the resulting keyboard input.

Note: To halt program execution while the program is waiting for input, press CTRL C.

Type

Statement

Syntax

INPUT "prompt"x

INPUT "prompt",x

where: **prompt** is the text that you want displayed on the screen (optional) and **x** is the variable that stores the keyboard input resulting from the prompt. In the second syntax form, the comma between the prompt and the variable displays the variable name following the prompt. A colon is automatically displayed at the end of the prompt.

Abbreviation

IN.

See Also

INKEY$

Example 1

```
10 INPUT "Enter your age  "A
!RUN  <RETURN>
```

(result) **Enter your age:**

Example 2

```
10 INPUT "Enter your age  ",A
!RUN  <RETURN>
```

(result) **Enter your age A:**

Example 3

```
10 INPUT "Enter any 3 numbers ",A,B,C
!RUN  <RETURN>
```

(result) **Enter any 3 numbers A:**

The operator enters a number and presses return. He is then prompted for a second number. After entering a second number, he is prompted for a third number. Note that in this case, the variables A, B, and C are displayed in the prompt because they are separated by commas in the INPUT command.

You can also display multiple prompts using a single input command. For example, to prompt for the month, day and year of the user's birthday, you could enter:

```
10 INPUT "Enter month of birth"M,"Day of birth"D,"Year of birth"Y
```

```
!RUN <RETURN>
```

(result) **Enter month of birth:**

The user enters the number of the month and presses return. He is then prompted for the day and then the year. The values are stored in the variables **M**, **D** and **Y**.

If the response to the prompt is invalid, a **Syntax error** message is displayed.

$INPUT

Description $INPUT is a string function that enables you to assign a string variable from the keyboard.

Type Statement

Syntax **$INPUT $A**

Abbreviation None

See Also INKEY$, INPUT

Example This program halts for input. When the user types a response and presses RETURN, the response is displayed on the screen

```
10 PRINT "ENTER YOUR NAME BELOW"
20 $INPUT $A
30 PRINT $A
!RUN   <RETURN>
```

(result)
```
ENTER YOUR NAME BELOW
:ernie   <RETURN>
ernie
```

INS

Description The INS command inserts a blank line on theChameleon screen.

Type Statement

Syntax INS

Abbreviation None

See Also DEL, ERAEOL, ERAEOS, XYPLOT

Example This example displays text on line 0 (top) of theChameleon screen and then inserts a line 22 times. This causes the messages to move toward the bottom of the screen.

`10 CLS`	Clears the screen.
`20 XYPLOT(0,0)`	Positions cursor on top line of screen.
`30 PRINT " HELLO"`	Prints message on line 0. Note that there is a blank space between the opening quotation mark and the H in HELLO.
`40 XYPLOT(0,0)`	Positions cursor on line 0 of screen.
`50 FOR A = 1 TO 22`	Sets up loop to repeat 22 times.
`60 INS`	Inserts a line.
`70 NEXT A`	Increments loop counter.

!RUN <RETURN>

INSTR

Description INSTR is a string function that returns the offset (position) of a substring within the main string.

Type Statement

Syntax **x = INSTR(str1,str2)**

where: **str1** is the main string and **str2** is the substring. If the substring does not exist within the main string, INSTR is zero.

Abbreviation None

See Also MID$

Example This example tests for the offset of **DEF** in the string **ABCDEFGHIJK** and prints the result.

```
10 $A = "ABCDEFGHIJK"
20 $B = "DEF"
30 A=INSTR($A,$B)
40 PRINT A
!RUN   <RETURN>
```

(result) **4**

The string **DEF** starts with the fourth character $A, assigning the value of 4 to A.

KILL

Description

The KILL command deletes a specified file from either the hard or floppy disk drive.

Type

Direct

Syntax

KILL"name",x

KILL"A:name",x

KILL"B:name",x

$A = "name"
KILL $A,x

where: **name** is the filename and **x** is a letter specifying one of the following file types:

P	Program
T	Trace
M	Mnemonic table
D	Data
S	Setup (parameter)
F	Function key definition
A	All types

When you use the A option to delete all file types, message confirm either that a certain file type was not found, or that a it was deleted.

Abbreviation

K.

See Also

FILES

Example 1

This example deletes the program file named TEST23 from the hard disk drive.

```
KILL "TEST23",P
```

Example 2

This example deletes the function key file names FKEYS1 from the floppy disk drive.

```
KILL "B:FKEYS1",F
```

LEFT$

Description

LEFT$ is a string function that assigns a specified number of characters from the left end of one string to another string.

You cannot use the syntax **PRINT LEFT$** to print a result. You must assign values to the string, as shown in Example 2 below.

Type

Statement

Syntax

$A = LEFT$($x,exp)

where: **$x** is the string that contains the characters and **exp** defines the number of characters from the left of $x to be assigned to $A.

Abbreviation

None

See Also

MID$, RIGHT$

Example 1

This example prints the four leftmost characters of a string.

```
10 $A = "ABCDEBFHIJ"
20 $B = LEFT$($A,4)
30 PRINT $B
!RUN  <RETURN>
```

(result) **ABCD**

Example 2

This program uses a FOR loop to assign and print string A using the LEFT$ function.

```
10 $A = "HELLO"
20 FOR A = 1 TO 5
30 $B = LEFT$($A,A)
40 PRINT $B
50 NEXT A
!RUN  <RETURN>
```

(result)
```
H
HE
HEL
HELL
HELLO
```

LEN

Description

LEN is a string function that returns the length of a string variable.

Type

Statement or Direct

Syntax

A = LEN($x)

where: **$x** is a string variable and **A** is the numeric variable assigned the length of **$x**.

Abbreviation

None

See Also

MID$, RIGHT$, LEFT$

Example

This example assigns a string to a variable and then displays the length of the string.

```
10 $A = "ABCD"
20 A = LEN($A)
30 PRINT A
!RUN  <RETURN>
```

(result) **4**

LET

Description

The LET command assigns values to numeric or string variables. LET is optional and may be omitted.

Type

Statement or Direct

Syntax

LET x = exp

LET $A = "xxx"

where: **x** is numeric variable and **exp** is a valid expression. An expression can consist of arithmetic or logical expressions, functions, or mnemonics. $A is a string variable.

An ampersand symbol (&) preceding a number assigns a hexadecimal value.

Abbreviation

None

See Also

Arithmetic operators

Example

This example assigns values ot numeric variables, adds the variables, and displays the result.

```
10 LET X=10
20 LET Y=15
30 LET Z = X+Y
40 LET $A = "THE ANSWER IS:  "
50 PRINT $A, Z
!RUN   <RETURN>
```

(result): **THE ANSWER IS   25**

Optionally, this program could omit the use of LET, as shown below, with the same result.

```
10 X=10
20 Y=15
30 Z = X+Y
40 $A = "THE ANSWER IS:  "
50 PRINT $A, Z
!RUN   <RETURN>
```

LFILES

Description

The LFILES command prints the names of the Chameleon BASIC files found on a specified disk to the printer or remote device. The LFILES command prints:

- Program Files
- Trace Files
- Mnemonic Table Files
- Data Files
- Setup Files
- Function Key Files

Type

Direct

Syntax

LFILES	Prints a list of files on drive A (hard disk).
LFILES A	Prints a list of files on drive A (hard disk).
LFILES B	Prints a list of files on drive B (floppy disk).

Abbreviation

LF.

See Also

FILES

Example

This example lists the files on the floppy disk drive.

```
LFILES B
```

(result)

```
Program Files
: PROGA PROGB PROGC  PROGD  PROGE
Trace Files
Mnemonic Table Files
Data Files
: DATA1 DATA2
Setup Files
: DEFAULT  SETUP1SETUP2 SETUP3
Function Key Files
```

LFLIST

Description The LFLIST command sends the list of current function key assignments to a printer or remote device.

Type Statement or Direct

Syntax **LFLIST**

Abbreviation LFL.

See Also FDEFINE, FLIST, FSAVE

Example !LFLIST

(result)
```
KEY 1 = MLIST^FILES^FLIST^
KEY 2 = COUPLER=PARA1^AUTO^
KEY 3 = ?"GOOD MORNING"^
KEY 4 = A+B/2^
KEY 5 = LLIST^
KEY 6 = LOAD "B:TEST1"^RUN^
KEY 7 = FLUSH^NEW^AUTO^
KEY 8 = $A="HELLO"^
KEY 9 = TRAN^GOTO10^
KEY 10 = RESEQ^LIST^
```

Note that the tildes that are used to define the keys in the FDEFINE command are not displayed with FLIST.Example

LIST

Description

The LIST command displays all or specified lines of a Chameleon BASIC program. To stop the list, use CTRL S. To resume, press any key. Use the ESCape key to abort it entirely.

Type

Direct

Syntax

LIST	Lists the entire program.
LIST x	Lists program from line **x** to end.
LIST x,y	Lists program from line **x** to line **y**.
LIST ,y	Lists program from beginning to line **y**.

Abbreviation

L.

See Also

LLIST

Example 1

To list the entire program in memory, enter:

```
LIST
```

Example 2

To list lines 40 - 60 of the program in memory, enter:

```
LIST 40,60
```

Example 3

To list lines 1 - 60 of the program in memory, enter:

```
LIST ,60
```

LLIST

Description The LLIST command outputs all or specified lines of the program in memory to a printer or remote device.

Type Direct

Syntax

LLIST	Prints the entire program.
LLIST x	Prints program from line **x** to end.
LLIST x,y	Prints program from line **x** to line **y**.
LLIST ,y	Prints program from beginning to line **y**.

Abbreviation LL.

See Also LIST

Example 1 To output the entire program in memory to the printer, enter:

```
LLIST
```

Example 2 To output lines 40 - 60 of the program in memory to the printer, enter:

```
LLIST 40,60
```

Example 3 To output line 60 of the program in memory to the printer, enter:

```
LLIST ,60
```

LMLIST

Description The LMLIST command outputs the mnemonic table in memory to a printer or remote device.

Type Direct

Syntax **LMLIST**

Abbreviation LML.

See Also MLIST, MLOAD, MSAVE

Example To output the mnemonic table in memory to the printer, enter:

```
LMLIST
```

LOAD

Description The LOAD command loads a BASIC program into memory.

Type Direct

Syntax

LOAD "name"

LOAD "A:name"

LOAD "B:name"

$A = "name"
LOAD $A

where: **name** is the program filename.

Abbreviation LO.

See Also CHAIN, RUN, NEW

Example 1 This example loads the BASIC program named TEST1 into memory from the hard disk.

```
LOAD"TEST1"
```

Example 2 This example loads the BASIC program named ANALYZE into memory from the floppy disk.

```
LOAD"B:ANALYZE"
```

LTPRINT

Description	The LTPRINT command sends the contents of the trace buffer to a printer or remote device.
Type	Statement or Direct
Syntax	**LTPRINT**
Abbreviation	LTP.
See Also	TPRINT, TSAVE, TLOAD
Example	`LTPRINT`

MENU

Description	The MENU command exits the simulator and returns to the Chameleon main menu so that you can change simulation languages or switch to the Monitor mode.
Type	Direct
Syntax	**MENU**
Abbreviation	MEN.
See Also	SETUP
Example	`MENU`

MERGE

Description

The MERGE command combines a specified program source file with the program already in memory. The two programs are merged as if the merged one were entered from the keyboard.

This command is especially useful for altering only the main code or just the subroutines of two similar programs.

If the program you are merging has line numbers that do not exist in the program in memory, these lines will be added. Lines with identical line numbers will overwrite the original program. For this reason, use caution when merging programs with GOTO and GOSUB statements.

Type

Direct

Syntax

MERGE"name"
MERGE"A:name"
MERGE"B:name"

$A = "name"
MERGE $A

Abbreviation

M.

Example

Program 1 is in a file called PROG1 and is already in memory as shown below:

```
10 REM PROG 1 LINE 10
15 REM PROG 1 LINE 15
30 REM PROG 1 LINE 30
```

Program 2 is in a file called PROG2 on the B drive. It contains three lines of code as shown below. Note that both PROG1 and PROG2 contain lines numbered 30.

```
8  REM PROG 2 LINE 8
16 REM PROG 2 LINE 16
30 REM PROG 2 LINE 30
```

To merge PROG1 and PROG2, enter:

MERGE "B:PROG2"

(result)

```
8  REM PROG 2 LINE 8
10 REM PROG 1 LINE 10
15 REM PROG 1 LINE 15
16 REM PROG 2 LINE 16
30 REM PROG 2 LINE 30
```

MID$

Description

MID$ is a string function that assigns one or more characters from the middle of a string to a string variable.

Note: You cannot use the syntax **PRINT MID$** to print a result. You must assign the string to a variable, as shown in the example below.

Type

Statement

Syntax

$A = MID$($x,exp1,exp2)

where: **exp1** defines the position of the first character and **exp2** defines the number of characters in **$x** to assign to **$A.**

Abbreviation

None

See Also

LEFT$, RIGHT$, INSTR

Example

```
10 $A = "ABCD"
20 $B = MID$($A,2,1)
30 PRINT $B
!RUN   <RETURN>
```

(result) **B**

MLIST

Description

The MLIST command displays the mnemonic table in memory. Refer to Section 3.2 for a general description of the use of mnemonic tables. For information about a table for a specific language or protocol, refer to the appropriate chapter for the protocol you are using.

To stop the mnemonic table list, type CTRL S. To resume the list, press any key. Press ESC to abort the listing.

Type

Statement or Direct

Syntax

MLIST

Abbreviation

ML.

See Also

LMLIST, MLOAD, MSAVE, DEFINE

Example

```
MLIST
```

MLOAD

Description

The MLOAD command loads a mnemonic table from disk to memory.

Type

Statement or Direct

Syntax

MLOAD"name"

MLOAD"A:name"

MLOAD"B:name"

$A = "name"
MLOAD $A

where: **name** is the mnemonic table filename.

Abbreviation

MLO.

See Also

MSAVE, MLIST, DEFINE

Example 1

To load the mnemonic table file named TABLE1 into memory from the hard disk drive, enter:

```
MLOAD"TABLE1"
```

Example 2

To load the mnemonic table file named TABLE2 into memory from the floppy disk drive, enter:

```
MLOAD"B:TABLE2"
```

MSAVE

Description

The MSAVE command saves the mnemonic table in memory to disk.

Type

Direct

Syntax

MSAVE"name"

MSAVE"A:name"

MSAVE"B:name"

$A = "name"
MSAVE $A

where: **name** is the mnemonic table filename.

Abbreviation

MSA.

See Also

MLOAD, MLIST, LMLIST, DEFINE

Example 1

To save the mnemonic table in memory to the hard disk drive with the filename TABLE1, enter:

```
MSAVE"TABLE1"
```

Example 2

To save the mnemonic table in memory to the floppy disk drive with the filename TABLE2, enter:

```
MSAVE"B:TABLE2"
```

NEW

Description The NEW command deletes the program in memory so that you can enter a new program.

Caution! NEW loses the original program completely. Use the SAVE command to save the current program to disk, before you enter the NEW command.

Type Direct

Syntax **NEW**

Abbreviation N.

See Also SAVE

Example

```
NEW
```

NEXT

Description

The NEXT command increments the counter in a FOR loop. The amount of the increment is determined by the STEP in a FOR statement. If a STEP is not specified, the default of one is used.

Type

Statement

Syntax

NEXT x

where: **x** is the variable that represents the loop counter in the FOR statement.

Abbreviation

NEX.

See Also

FOR

Example

This example prints odd numbers between 1 and 10.

```
10 FOR X = 1 TO 10 STEP 2
20 PRINT X
30 NEXT X
!RUN   <RETURN>
```

(result)

```
1
3
5
7
9
```

NRM

Description

The NRM command cancels special display effects (blinking, underline, double intensity) and returns the Chameleon to normal display.

Type

Statement or Direct

Syntax

NRM

Abbreviation

None

See Also

BLK, BLKREV, BLKUND, HLF, HLFUND, CLS

Example

This example displays the message I'M BLINKING in blinking text and then the message NOW I'M NOT BLINKING in normal display.

```
10 BLK
20 PRINT "I'M BLINKING"
30 NRM
40 PRINT "NOW I'M NOT BLINKING"
!RUN   <RETURN>
```

OPEN

Description

The OPEN command opens a disk data file so that data can be read, written, or appended to the file. You can have one file for input and one file for output opened at the same time.

Caution

If you open a new file in output mode when there is an existing file of the same name on the disk, the original file is deleted from the disk and is replaced with the new data.

Type

Statement or Direct

Syntax

OPEN "I","name" Opens a file for input so that data can be read from the file.

OPEN "O","name" Opens a new file for output so that data can be written to the file.

OPEN "A","name" Opens an existing file for output so that data can be added to it.

where: **name** is the data file name.

Note: When calling a sub-program, the system automatically closes all files. This occurs only when calling a sub-program, and not when exiting a program.

Abbreviation

O.

See Also

CLOSE, READ, WRITE

Example

The example below opens a new data file, adds a record, then closes the file.

Code	Comment
`10 A = 0`	Initializes record counter.
`20 $A = "THIS IS RECORD #"`	
`30 OPEN "O", "B:TEST"`	Creates file named TEST on drive B.
`40 $B = $A+HEX$(A)`	
`50 WRITE $B`	Writes first record which will be 0000.
`60 CLOSE`	Closes file.
`70 FOR A = 1 TO 4000`	Executes following lines 4000 times.
`80 GOSUB 160`	Subroutine to read from file.
`90 PRINT %A`	Prints "FOR" variable in hex.
`100 $B = $A+HEX$(A)`	Assigns incremented number to the string.
`110 OPEN "A", "B:TEST"`	Opens existing file for append.
`120 WRITE $B`	Writes a record.
`130 CLOSE`	Closes file.
`140 NEXT`	Continues loop.
`150 STOP;`	
`160 OPEN "I", "B:TEST"`	Opens file for input.
`170 READ $Z`	Reads from the file.
`180 IF EOF GOTO 210`	If end of line, closes file.
`190 PRINT $Z`	Prints $Z.
`200 GOTO 170`	Reads $Z.
`210 CLOSE`	Closes file.
`220 RETURN`	

PRINT

Description

The PRINT command prints a string, expression, or value of a variable on the screen.

Type

Statement or Direct

Syntax

PRINT"string"	Prints the string.
PRINT $A	Prints the string variable.
PRINT x	Prints the numeric variable.
PRINT %x	Prints the expression **x** in hex.

Options

You can use the following print options.

- A comma (,) acts as a field separator
- A backslash (\) suppresses a line feed
- A semicolon (;) suppresses the carriage return

Numeric Format

You can assign the number of spaces in which to print a numeric variable using the format symbol (#) followed by a valid expression. The valid expression can be a number, numeric variable, or other numeric expression that defines the number of spaces to assign.

The default format specifies six spaces for each numeric variable. If the number of spaces is not adequate for the value, more spaces are added. In other words, short format specifications do not result in truncated values. The format specification is ignored for strings.

Abbreviations

P. or ?

Example 1

This example prints a message.

```
PRINT "HELLO"
```

(result) `HELLO`

Example 2

This example prints a message in hex.

```
10 $A = "HELLO"
20 PRINT %$A
!RUN  <RETURN>
```

(result) `68 65 6C 6C 6F`

Example 3

This example prints a number several times.

```
10 A = 1234
20 FOR B = 3 TO 7
30 PRINT #B, A
40 NEXT B
!RUN   <RETURN>
```

```
(result)   1234
           1234
            1234
             1234
              1234
```

READ

Description

The READ command reads the next record from an input file into a string variable. The file must already be open for input.

Type

Statement

Syntax

READ $A

Abbreviation

REA.

See Also

OPEN, WRITE

Example

`10 OPEN "I","DATA1"`	Opens a file named Data1 for input.
`20 READ $A`	Reads a record from Data1 file into $A.
`30 IF EOF GOTO 50`	If at end of file, goes to line 50.
`40 PRINT $A`	If not at end of file, prints $A.
`50 CLOSE`	Closes the data file.

!RUN <RETURN>

REC

Description

The REC command transfers data from the acquisition buffer to the trace buffer. The frame length, status (CRC) and a timestamp are added to the beginning of each frame. Refer to Section 3.2 for a description of the buffers used in simulation.

The use of the REC command is protocol-specific. Refer to the appropriate chapter for a description of the syntax for the simulator you are using.

REM

Description

The REM commands enables you to place internal comments in your program file. The comments provide program documentation and are ignored by the Chameleon. They are not displayed on the screen when the program is executed.

Type

Statement or Direct

Syntax

REM *comment*

Abbreviation

None

See Also

Example

```
10 REM This routine defines mnemonics and
20 REM Receives a frame
```

RESEQ

Description

The RESEQ command re–numbers (re–sequences) the lines of the program in memory. If the optional expressions {EXPR1} and {EXPR2} are not used to set the re–numbering starting point and increment, re–numbering starts at line 10 and increases in increments of 10.

NOTE:

RESEQ destroys the contents of any strings, arrays, and buffers in use. 'Beginning Line Number' refers to the number assigned to the first program line, NOT to the original line number at which re–numbering begins.

Line numbers within GOTO and GOSUB statements will be changed only when numeric line numbers are used. For numeric expressions, the first number in the expression is used as the instruction and the remainder of the expression is ignored. For example, **GOTO 2+10** is treated the same as GOTO 2, and *not as* GOTO 12.

Three possible messages indicating areas that may require manual numbering changes may appear while the system is re–numbering your program:

- **Number of lines in program** gives you the total number of lines that are in the program.
- **GOTO or GOSUB not resequenced in line #** indicates that a line number within a GOTO or GOSUB command could not be correctly re–sequenced. The message references the new line number of the GOTO or GOSUB command.
- **Non–existent line # found in line #** tells you that your program contained a command that referenced a line number that did not exist in the original numbering. If a non–existent line number is listed, it may exist in the program *after* it is re–sequenced as in the example below.

Type

Direct

Syntax

RESEQ	Re–sequences the program to begin with line number 10, in line number increments of 10.
RESEQ {EXPR1}	An optional expression for setting the number assigned to the first program line.
RESEQ {EXPR1} {EXPR2}	An optional expression for setting the value by which line numbers are incremented.

NOTE: If EXPR1 and EXPR2 are omitted, the default value for each RESEQ command is 10. Also, EXPR1 must be used if EXPR2 is used.

Abbreviation RES.
See Also AUTO, ERASE

Example The original program is shown below:

```
5  GOTO 70
10 REM  ORIGINAL PROGRAM
11 REM  WITH ADDITIONAL LINES
20 FOR A = 1 TO 10
25 PRINT A
40 NEXT A
45 IF A = 10 GOTO 50
46 IF A = 1 GOTO A + 4
47 PRINT "ERROR IN LOOP"
50 STOP
```

To renumber the program to start with line 1000 in increments of 10, enter:

!RESEQ {1000,10}

The following messages are displayed:

Number of lines in program 10
Non–existent line 70 found in line 1000
GOTO or GOSUB not resequenced in line 1070

The program will be re–numbered as follows:

```
1000 GOTO 70
1010 REM  ORIGINAL PROGRAM
1020 REM  WITH ADDITIONAL LINES
1030 FOR A = 1 TO 10
1040 PRINT A
1050 NEXT A
1060 IF A = 10 GOTO 100
1070 IF A = 1 GOTO A + 4
1080 PRINT "ERROR IN LOOP"
1090 STOP
```

RETURN

Description

The RETURN command returns program control from a subroutine called by a GOSUB command to the statement following the GOSUB.

Type

Statement

Syntax

RETURN

Abbreviation

RET.

See Also

GOSUB, GOTO

Example

```
10 PRINT "HELLO"
20 GOSUB 50
30 PRINT "HELLO AGAIN"
40 STOP
50 PRINT "GOODBYE"
60 RETURN
!RUN  <RETURN>
```

(result)

```
HELLO
GOODBYE
HELLO AGAIN
```

REV

Description The REV command displays text in reverse video on the Chameleon screen. The NRM command cancels this and all other display effects and returns the screen to normal mode.

Type Statement or Direct

Syntax **REV**

Abbreviation None

See Also NRM, BLKREV

Example 1

```
10 REV
20 PRINT "I'M IN REVERSE VIDEO"
30 NRM
40 PRINT "I'M BACK TO NORMAL"
!RUN   <RETURN>
```

(result) **I'M IN REVERSE VIDEO** (reverse video)
I'M BACK TO NORMAL (normal text display)

REVHLF

Description

the REVHLF command displays text in reverse video in double intensity on the Chameleon screen. The NRM command cancels this and all other display effects and returns the screen to normal mode.

Type

Statement or Direct

Syntax

REVHLF

Abbreviation

None

See Also

NRM, BLKREV, REV

Example 1

```
10 REVHLF
20 PRINT "I'M IN HIGHLIGHTED REVERSE VIDEO"
30 NRM
40 PRINT "I'M BACK TO NORMAL"
!RUN  <RETURN>
```

(result)

```
I'M IN HIGHLIGHTED REVERSE VIDEO
I'M BACK TO NORMAL
```

REVUND

Description

The REVUND command displays text in reverse video and underlined on the Chameleon screen. The NRM command cancels this and all other display effects and returns the screen to normal mode.

Type

Statement or Direct

Syntax

REVUND

Abbreviation

None

See Also

NRM, BLKREV, REV, REVHLF

Example 1

```
10 REVUND
20 PRINT "I'M IN UNDERLINED REVERSE VIDEO"
30 NRM
40 PRINT "I'M BACK TO NORMAL"
!RUN   <RETURN>
```

(result)

```
I'M IN UNDERLINED REVERSE VIDEO
I'M BACK TO NORMAL
```

RIGHT$

Description

RIGHT$ is a string function that assigns a specified number of characters from the right end of one string to another string.

Note: You cannot use the syntax **PRINT RIGHT$** to print a result. You must assign the string to a variable, as shown in Example 1 below.

Type

Statement or Direct

Syntax

$A = RIGHT$($x,exp)

where: **$x** is the string that contains the characters, **exp** defines the number of characters from the right to be assigned to $A.

Abbreviation

None

See Also

LEFT$, MID$

Example 1

This example assigns a string to a variable and then prints the rightmost four characters.

```
10 $A = "ABCDEFGH"
20 $B = RIGHT$($A,4)
30 PRINT $B
!RUN   <RETURN>
```

(result) **EFGH**

Example 2

This example assigns a string to a variable and then prints parts of it several times.

```
10 $A = "HELLO"
20 FOR A = 1 TO 5
30 $B = RIGHT$($A,A)
40 PRINT $B
50 NEXT A
!RUN   <RETURN>
```

(result)
```
O
LO
LLO
ELLO
HELLO
```

RND

Description The RND command returns a random number between zero and a specified number.

Type Statement or Direct

Syntax **RND(x)**

where: a random number between zero and **x** is returned. The parentheses are optional.

Abbreviation R.(x)

See Also Arithmetic operators.

Example

```
10 A = RND(100)
20 PRINT A
!RUN  <RESULT>
```

(result) **55** (or any random number between 0 and 100)

RUN

Description

The RUN command executes a program in memory, starting at its first line.

Type

Direct

Syntax

RUN

Abbreviation

RU.

See Also

CHAIN, CALL

Example

This example loads a program called PROG1 from the hard disk and then executes it.

```
!LOAD"PROG1"
!RUN
```

Note that you could also use the CHAIN command to load and run a program with a single command. For example, you could accomplish the same as the above example, by entering:

```
!CHAIN"PROG1"
```

SAVE

Description The SAVE command saves the program in memory to disk.

Type Direct

Syntax

SAVE "name"

SAVE "A:name"

SAVE "B:name"

$A = "name"
SAVE $A

where: **name** is the program filename.

Abbreviation SA.

See Also LOAD, KILL, FILES

Example 1 To save the program in memory to a file named PROG1 on the hard disk drive, enter:

```
SAVE"A:PROG1"
```

Example 2 To save the program in memory to a file named TESTPROG on the floppy disk drive, enter:

```
SAVE"B:TESTPROG"
```

Example 3 To save the program in memory to a file named TESTPROG on the floppy disk drive, enter:

```
$A = "B:TESTPROG"
SAVE $A
```

SET

Description

SET sets a specified physical interface signal to either logical 1 or 0. *The SET command is not available in SIMP/L or FRAMEM DMI.*

Type

Statement or Direct

Syntax

SET xxx = y

where: **y** is a 1 or 0 and **xxx** is the physical interface NAME (see table below). Note that the physical interface signals that you can set depends on whether the Chameleon is configured as a DCE or DTE.

NAME	FUNCTION	CCITT	RS232 Pin	SET BY
CTS	Clear To send	106	5	DCE
DSR	Data Set Ready	107	6	DCE
DCD	Data Carrier Detect	109	8	DCE
RI	Ring Indicator	125	22	DCE
SDCD	Secondary Data Carrier Detect	122	12	DCE
DTR	Data Terminal Ready	108	20	DTE
RTS	Request To send	105	4	DTE

Table 3.5-1: SET Physical Interface Options

Abbreviation

None

See Also

TEST

Example

```
10 SET RTS=1              Sets the Request To Send to 1.
20 TEST CTS=0 GOTO 20     Waits until DCE sets CTS = 1.
30 TRAN                   Transmits the data.
40 SET RTS=0              Disconnects the link at the physical
                          level by returning RTS to 0.

!RUN <RETURN>
```

SETUP

Description

The SETUP command exits simulation programming mode (!) and returns to the parameter set-up menu for a particular simulation language.

Refer to Section 2.2 for a general description of parameter set-up menus. For a description of a specific menu, refer to the simulation language chapter you are interested in.

The SETUP command is not available in FRAMEM DMI.

Type

Direct

Syntax

SETUP

Abbreviation

SE.

See Also

MENU

Example

```
SETUP
```

SIZE

Description

SIZE is a read-only variable that returns the size of free program area in bytes. There is a maximum of 8K bytes of programming memory for you to use for your BASIC programs. The SIZE variable enables you to determine how much memory is available.

Type

Variable

Syntax

(See examples below.)

Abbreviation

SI.

See Also

NEW

Example 1

To display the number of bytes of programming memory available, enter:

```
PRINT SIZE
```

Example 2

To test available memory and display a message when it is below 1000 bytes, enter:

```
IF SIZE < 1000 PRINT "GETTING LOW ON MEMORY"
```

STOP

Description

The STOP command terminates program execution whenever encountered.

Type

Statement

Syntax

STOP

Abbreviation

ST.

See Also

EXIT

Example

This example prints a list of numbers, and then executes a stop command to end the program.

```
10 FOR A = 1 TO 10
20 PRINT A
30 IF A > 5 GOTO 50
40 NEXT A
50 STOP
!RUN  <RETURN>
```

(result) **1**
2
3
4
5
6

TEST

Description

The TEST command tests the level of an interface signal for logical 1 or 0. If true, the statement following TEST is executed. *The TEST command is not available in SIMP/L or FRAMEM DMI.*

Type

Statement or Direct

Syntax

TEST xxx = y statement

where: **y** is a logical one or zero, **xxx** is one of the physical interface NAMEs in the table below, and **statement** is any valid program statement that you want to execute when the TEST condition is true.

You cannot use the not equal (#) in a TEST command.

Note that the physical interface signals you can test depend on whether the Chameleon is configured as a DCE or DTE.

NAME	FUNCTION	CCITT	RS232 Pin	TESTED BY
CTS	Clear To send	106	5	DTE
DSR	Data Set Ready	107	6	DTE
DCD	Data Carrier Detect	109	8	DTE
RI	Ring Indicator	125	22	DTE
SDCD	Secondary Data Carrier Detect	122	12	DTE
DTR	Data Termminal Ready	108	20	DCE
RTS	Request To send	105	4	DCE

Table 3.5-2: TEST Physical Interface Options

Abbreviation

TE.

See Also

SET

Example

```
10 TEST RTS=0 GOTO 40      If RTS is zero, go to line 40.
20 PRINT 'RTS = 1'         Otherwise print "RTS = 1."
30 GOTO 10                 Test again.
40 PRINT 'RTS = 0'         Print "RTS = 0."
50 GOTO 10                 Test again.
!RUN  <RETURN>
```

TFREE

Description

TFREE is a read-only variable that returns the length of the unused trace buffer in bytes. There is a maximum of 4K bytes of trace memory available for storing transmitted and received frames.

Type

Statement or Direct

Syntax

(See examples below.)

Abbreviation

TF.

See Also

FREE, SIZE

Example 1

To display the amount of trace buffer available, enter:

```
PRINT TFREE
```

Example 2

To test the available trace memory and print a message when there is less than 100 bytes available.

```
IF TFREE < 100 PRINT "BUFFER IS GETTING FULL"
```

Example3

This example tests for sufficient space in the trace buffer for a received frame.

```
10 REC
```

Receives a frame.

```
20 IF RXFRLEN=0 GOTO 10
```

If no frame received, try to receive again.

```
30 IF TFREE < RXFRLEN + 8  GOTO 100
```

If the trace buffer space available is less than the received frame length (RXFRLEN) and added information, goto line 100. The 8 bytes of added information are 5 bytes for time stamp, 1 byte for status, and 2 bytes for length.

```
100 ...
```

TIME

Description TIME is a read-only variable that returns a specified byte of the system time in BCD digits.

Type Statement or Direct

Syntax **TIME(x)**

where: **x** is in the range 0 to 4 and specifies the unit of time, as follows:

0 - hours
1 - minutes
2 - seconds
3 - 1/100s seconds (.01)
4 - 1/10s of milliseconds (.0001)

Abbreviation None

See Also ATIME$, TIME$

Example 1 To display the current hour according to the system clock, enter:

```
PRINT TIME(0)
```

Example 2 To display the current seconds according to the system clock, enter:

```
PRINT TIME(2)
```

Example 3 To execute a program at midnight (for example, to save traffic for an hour), enter:

```
10 IF TIME(0) = 0 CALL "SAVETRAF"
20 GOTO 10
```

TIME$

Description

TIME$ is a string function that assigns the current time according to the internal realtime clock to a string variable. The display is in BCD in units of hours, minutes, seconds, hundredths of seconds, and tenths of milliseconds.

Type

Statement or Direct

Syntax

TIME$

Abbreviation

None

See Also

ATIME$, TIME

Example 1

This example displays the time.

```
10 $A = TIME$
20 PRINT %$A
```

(result) **10 53 23 23 10** (or current system time)

Example 2

The example below displays the time in hex.

`5 $A = TIME$`	Stores time in $A.
`10 FOR X = 1 TO 5`	Loops five times.
`20 $B = MID$($A,X,1)`	Stores HH, MM, SS, HS and TM in $B according to loop index.
`30 PRINT %VAL($B)`	Prints hexadecimal values.
`40 NEXT X`	Increments loop index X.

!RUN <RETURN>

TLOAD

Description

The TLOAD command loads a trace file into memory. A trace stores the contents of the trace buffer. For general information about simulation buffers, refer to Section 3.2.

Type

Statement or Direct

Syntax

TLOAD"name"

TLOAD"A:name"

TLOAD"B:name"

$A = "name"
TLOAD $A

where: **name** is the trace filename.

Abbreviation

TLO.

See Also

TSAVE, TPRINT, LTPRINT

Example 1

This example loads the trace file named TRFILE1 from the hard disk drive into memory and then prints a copy of the trace file on the printer.

```
10 TLOAD"TRFILE1".
20 LTPRINT
!RUN   <RETURN>
```

Example 2

This example produces the same result as the first example, but specifies the trace file name using a string variable.

```
10 $A="TRFILE1"
20 TLOAD $A
30 LTPRINT
!RUN   <RETURN>
```

TPRINT

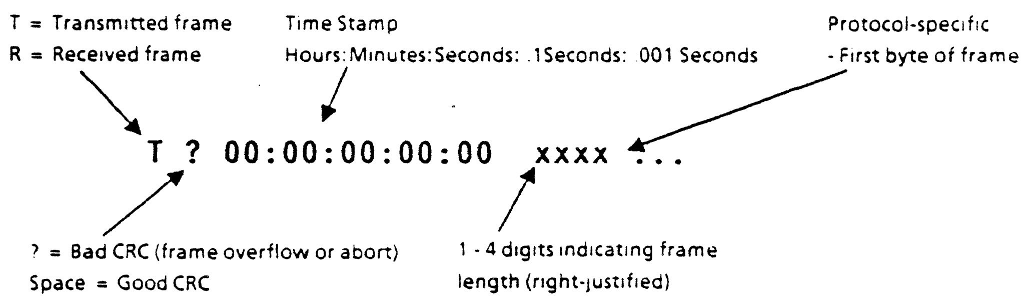
Description

The TPRINT command displays the contents of the trace buffer which stores the transmitted and received traffic (following a REC command). The format of the display is protocol-specific. Refer to the appropriate chapter for more information about the protocol you are using.

You must use a REC command in the program to store the received frames in the trace buffer. The trace does not necessarily display frames in the order that they are transmitted and received. It displays them according to TRAN and REC commands specified in your program.

You can stop the list using CTRL S. Resume the list with CTRL Q. Abort using the ESC key.

The trace buffer display is protocol-specific. The general format of the display is as follows:



Type Statement or Direct

Syntax **TPRINT**

Abbreviation TP.

See Also TLOAD, TSAVE, LTPRINT

Example (See protocol-specific chapters for examples.)

TROFF

Description The TROFF command turns the program trace facility (debug mode) off.

Type Direct

Syntax **TROFF**

Abbreviation TROF.

See Also TRON

Example. To set the debugging facility off and run the program in memory, enter:

```
!TROFF
```

TRON

Description

The TRON command turns the program trace facility (debug mode) on. In program debug mode, the program is traced by line number. Each time a new line is executed, the line number is displayed in brackets.

Type

Direct

Syntax

TRON

Abbreviation

T.

See Also

TROFF

Example

```
TRON
```

When the following program is run:

```
10 FOR A = 1 TO 5
20 PRINT A
30 NEXT A
!RUN   <RETURN>
```

(result)

Line#	Value of A
[10][20]	1
[30][20]	2
[30][20]	3
[30][20]	4
[30][20]	5
[30]	

TSAVE

Description

The TSAVE command saves the contents of the trace buffer to a trace file.

Type

Statement or Direct

Syntax

TSAVE "name"

TSAVE"A:name"

TSAVE"B:name"

$A = "name"
TSAVE $A

where: **$A** is the trace filename.

Abbreviation

TSA.

See Also

TLOAD, TPRINT, LTPRINT

Example

This example saves received traces with a length less than 1000 to a file named NEWTRACE on the hard disk drive.

```
10 $A="NEWTRACE"
20 REC
30 IF TFREE < 1000 GOTO 50
40 GOTO 20
50 TSAVE $A
!RUN   <RETURN>
```

UND

Description

The UND command displays text in underline on the Chameleon screen. Use the NRM command to cancel this and all other display effects and return to normal display.

Type

Statement or Direct

Syntax

UND

Abbreviation

None

See Also

NRM, REVUND, BLKUND

Example 1

This example displays a message in underlined text and then displays a message in normal text.

```
10 UND
20 PRINT "HELP! I'M BEING UNDERLINED!"
30 NRM
40 PRINT "THANK YOU"
!RUN  <RETURN>
```

(result) <u>HELP! I'M BEING UNDERLINED!</u>

THANK YOU

VAL

Description

VAL is a string function that converts the first two characters of a string to their numeric form.

Type

Statement or Direct

Syntax

A = VAL($A)

where: **$A** is an ASCII string.

Abbreviation

None

See Also

CHR$

Example 1

This example converts the string value 12 to its integer equivalent, and then prints the hexadecimal equivalent of the integer variable A.

```
10 $A = "12"
20 A = VAL($A)
30 PRINT %A
!RUN   <RETURN>
```

(result) **3132**

Example 2

This example assigns the decimal equivalent of the rightmost three letters of $A to $B, and then prints the hex equivalent of $A and $B.

```
10 $A="HELLO"
20 $B=RIGHT$($A,3)
30 A=VAL($A)
40 B=VAL($B)
50 PRINT %A
60 PRINT %B
70 STOP
!RUN   <RETURN>
```

(result) **4845**
4C4C

WRITE

Description

The WRITE command writes a string variable to a data file opened for output.

Type

Statement

Syntax

WRITE $A

where: **$A** is the string variable written to the open data file.

Abbreviation

WR.

See Also

OPEN, CLOSE, EOF

Example

This example assigns a string to a string variable and then writes the string to a data file.

```
10 $A = "ABCDE"
20 OPEN"O",DATA1
30 WRITE $A
!RUN   <RETURN>
```

XYPLOT

Description

The XYPLOT command moves the cursor to a specified postion on the Chameleon screen.

Type

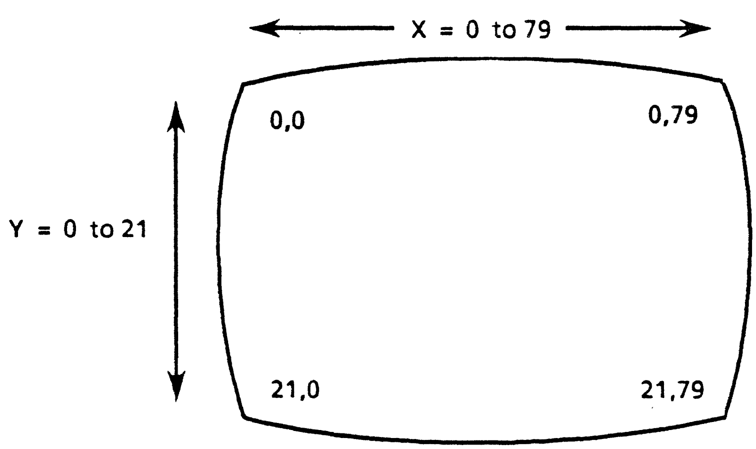
Statement or Direct

Syntax

XYPLOT(y,x)

where: **y** is the y-coordinate (row) in the range 0 - 21 and **x** is the x-coordinate (column) in the range 0 -79. Although the screen is 24 lines by 80 columns, you cannot use lines 22 and 23 because they are reserved for page banners and softkey strips. If you use 22 or 23 as the **y** coordiante, line 21 will be used.

The top left hand corner has the coordinates (0,0). The bottom right hand corner has the coordinates (21,79). as shown in the figure below.



If you use 21 as the y coordinate, a line feed results, unless you suppress the line feed with a comma in the PRINT statement, as follows:

```
10 XYPLOT(21,0)
20 PRINT "HELLO",
```

Abbreviation

None

See Also

BLK, BLKREV, BLKUND, CLS, DEL, ERAEOL, ERAEOS, HLF, HLFUND, INS, NRM, REV, REVHLF, REVUND, UND

Example

This example prompts for user input and then displays the result in reverse video.

`10 CLS`	Clears screen.
`20 PRINT "ENTER NAME:"`	Prints this message on the screen.
`30 $INPUT$A`	Reads string input from the keyboard.
`40 CLS`	Clears screen.
`50 XYPLOT(10,20)`	Positions cursor at row 10, column 20 on the screen.
`60 REV`	Subsequent display will be in reverse video.
`70 PRINT "HELLO", $A`	Prints HELLO.
`80 NRM`	Cancels reverse video and returns to normal screen mode.

!RUN <RETURN>

4.1 INTRODUCTION TO FRAMEM

Introduction

FRAMEM is the Chameleon's flexible **FRAM**e **EM**ulator for simulation of bit-oriented protocols. It uses all of the Chameleon BASIC commands, plus special commands and variables that control reception and transmission of bit-oriented traffic.

Using FRAMEM

Sections 4.2 and 4.3 describe the FRAMEM commands, variables and features that are available for all protocols. For this reason, you should read these sections regardless of the protocol you are using.

In addition, there are four protocol subsets of FRAMEM that make use of commands and variables that are specific to the protocol. You should also read the section that corresponds to the protocol you are using, as follows:

- Section 4.4 - FRAMEM HDLC/SDLC
- Section 4.5 - FRAMEM LAPD
- Section 4.6 - FRAMEM DMI

Remember that the Chameleon BASIC commands and variables are part of FRAMEM. These are described fully in Chapter 3.

FRAMEM I-frame

Special features of FRAMEM allow you to control the events in a frame during bit-oriented communication. FRAMEM automatically knows the correct order of a frame, including the:

- Address
- Control field
- I-field
- Cyclic Redundancy Check (CRC)(ADCCP format)

The control field in an I-frame consists of the number of transmissions received $N_{(r)}$, a poll-final bit, the number of transmissions sent $N_{(s)}$, and a zero.

Figure 4.1-1 illustrates the structure of a standard ADCCP frame. *The number in square brackets [ ] indicates the field width in bits.*

Bits are transmitted least significant bit (LSB) first.

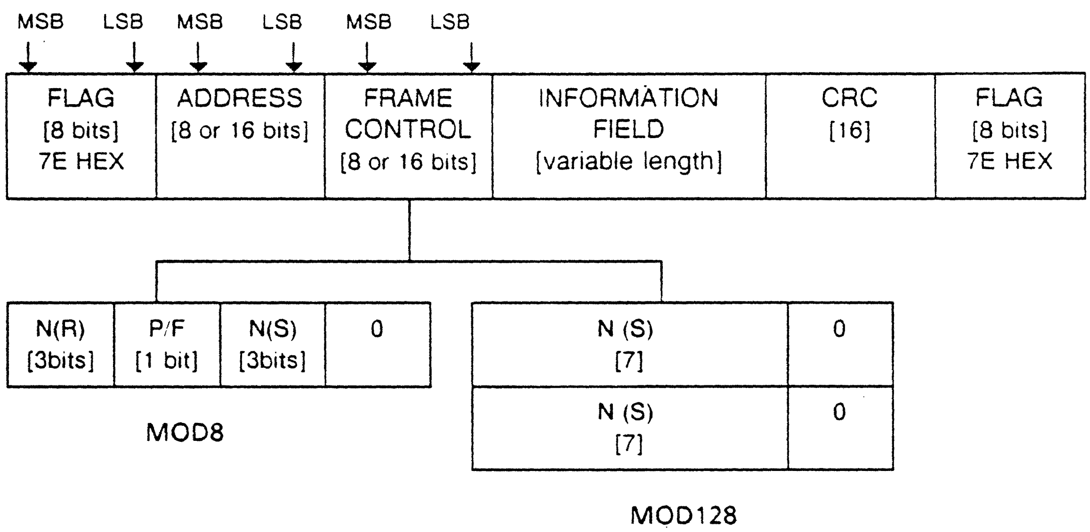


Figure 4.1-1: Standard ADCCP Frame

Addressing FRAMEM is highly flexible. It can handle normal or extended mode addressing, modulo 8 or modulo 128 sequence control fields, and numerous types of data fields.

Mnemonics There are built-in mnemonic tables for FRAMEM HDLC, FRAMEM SDLC and FRAMEM LAPD. You can use commands to define and save your own mnemonic tables.

Deviation FRAMEM also allows you to deviate from standard protocols during hardware/software development, and to compensate for protocol deviations in equipment supplied to you by others.

4.2 FRAMEM COMMAND INDEX

Introduction

Sections 4.2 and 4.3 describe the commands that can be used in all protocol subsets of FRAMEM (except as noted). There are additional commands and variables that are available for a specific protocol subset. These are described in the protocol-specific sections.

Remember that you can also use the Chameleon BASIC commands described in Sections 3.4 and 3.5.

Organization

In this section, the FRAMEM commands are listed by function in the following tables:

- Transmission and Reception Commands
- Mnemonic Commands
- Addressing Commands
- Miscellaneous Commands
- Transmission and Reception Variables

This functional listing provides only the command name and a brief description. For more information, refer to the page number indicated.

TABLE 4.2-1: TRANSMISSION AND RECEPTION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
ABORTRAN	4.3-2	S OR D	Transmits a frame with an abort sequence at the end.
BADTRAN	4.3-3	S OR D	Transmits a frame with a bad CRC.
GET	4.3-8	S OR D	Extracts 2 bytes from the I-field of the last frame received.
PUT	4.3-11	S OR D	Sets a specific byte in an I-field to a specfied value.
REC	4.3-12	S OR D	Receives a frame from the line.
TRAN	4.3-27	S OR D	Transmits a frame with a good CRC.

TABLE 4.2-2: MNEMONIC COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
DEFINE	4.3-5	S OR D	Defines entries for the mnemonic table.
DEFSUB	4.3-6	S OR D	Defines the program line number to execute when the received frame matches a specified mnemonic.

TABLE 4.2-3: ADDRESSING COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
EXTEND	4.3-7	S OR D	Sets 16-bit addressing mode.
MOD	4.3-9	S OR D	Sets modulo 8 or 128 N(s) and N(r).
NORM	4.3-10	S OR D	Sets 8-bit addressing mode.
STATUS	4.3-25	S OR D	Displays modulo and addressing mode.

TABLE 4.2-4: MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
TPRINT	4.3-26	S OR D	Displays the contents of the trace buffer.

TRANSMISSION AND RECEPTION VARIABLES

The variables in the table below are intended for frame transmission and reception. However, you can use them anywhere that a normal numeric variable (A-Z) can be used.

Note the use of **TX** and **RX** to denote transmission or reception of frames, respectively. Note also the use of **V(S)** and **V(R)** for CMDR and FRMR frames, respectively.

TABLE 4.2-5: TRANSMISSION AND RECEPTION VARIABLES

VARIABLE	PAGE	FUNCTION
CRC	4.3-4	If 0, frame = good CRC. If 1, frame = bad CRC.
RXADDR	4.3-13	Received address field.
RXC/R	4.3-14	C/R bit extracted from an FRMR field.
RXDIAG	4.3-15	Last byte (WXYZ bits) of received FRMR.
RXFCTL	4.3-16	Received frame control field with poll/final bit, N(S), and N(R) removed (if applicable).
RXFRLEN	4.3-17	Length of received frame.
RXN(R)	4.3-18	Received N(R) of Supervisory frame or I-Frame.
RXN(S)	4.3-19	Received N(S) of Supervisory frame or I-Frame.
RXP/F	4.3-20	Received poll/final bit.
RXRFCTL	4.3-21	Received rejected frame control field.
RXRP/F	4.3-22	Received poll/final bit of rejected frame control field.
RXV(R)	4.3-23	Received V(R) of rejecting station.
RXV(S)	4.3-24	Received V(S) of rejecting station.
TXADDR	4.3-29	Transmitted address field.
TXC/R	4.3-30	Transmitted C/R bit of an FRMR.
TXDIAG	4.3-31	Transmitted last byte (WXYZ bits) of an FRMR field.
TXFCTL	4.3-32	Transmitted frame control field.
TXIFIELD	4.3-33	Transmitted information field.
TXN(R)	4.3-35	Transmitted N(R).
TXN(S)	4.3-36	Transmitted N(S).
TXP/F	4.3-37	Transmitted poll/final bit.
TXRFCTL	4.3-38	Transmitted rejected frame control field.
TXRP/F	4.3-39	Transmitted poll/final bit of rejected frame control field.
TXV(R)	4.3-40	Transmitted V(R).
TXV(S)	4.3-41	Transmitted V(S).

4.3 FRAMEM COMMANDS

Introduction

This section provides a complete description of the FRAMEM commands.

If you know the name of the command you want to use, you can look up the command in this section. If you are unsure of the command you need, refer to the previous section which lists the commands by function.

The commards are described alphabetically on the following pages. The following information is provided:

- Command description
- Type of command (Statement or Direct)
- Syntax
- Command abbreviation
- Related commands (See Also)
- Example(s) of command usage

ABORTRAN

Description The ABORTRAN command transmits a frame with an abort sequence at the end of the transmission. If the Chameleon is configured for Transparent Bisync mode, ABORTRAN acts like the TRAN command.

Type Statement or Direct

Syntax **ABORTRAN**
ABORTRAN $A

Note: To ensure that ABORTRAN works properly, the transmitted frame must be greater than four bytes in length.

Abbreviation AB.

See Also BADTRAN, TRAN, Transmission variables

Example This example transmits a frame containing the string *TEST* with an abort sequence.

```
10 $A = "TEST"
20 ABORTRAN $A
! RUN
```

BADTRAN

Description

The BADTRAN command transmits a frame with a bad CRC. If the Chameleon is configured for Transparent Bisync mode, BADTRAN acts like the TRAN command.

Type

Statement or Direct

Syntax

BADTRAN
BADTRAN $A

Note:

To ensure that BADTRAN works properly, the transmitted frame must be greater than four bytes in length.

Abbreviation

BA.

See Also

ABORTRAN, TRAN, Transmission variables

Example

This example transmits a frame containing the string HELLO with a bad CRC.

```
10 $A = "HELLO"
20 BADTRAN $A
30 BADTRAN
40 TPRINT
```

(result)

```
T ? 00:15:16:25:30  5   48  RNR     N(R)=2  4C  4C  4F
T ? 00:15:16:27:20  2   00  IFRAME  N(S)=0  N(R)=0
```

In the TPRINT display, the ? indicates a bad CRC. See TPRINT for more information.

CRC

Description

CRC is a reception variable that indicates if the received frame had a good or bad CRC. It has the following valid values:

CRC = 0 Received frame had good CRC.
CRC = 1 Received frame had bad CRC.

Type

Variable

Syntax

(See example below.)

See Also

REC, RXFRLEN

Example

This example receives a frame. If the frame has a bad CRC, it loops to receive again. When it receives a frame with a good CRC, it continues with the scenario.

```
10 REC
20 IF CRC = 1 GOTO 10
30 ...
```

DEFINE

Description

The DEFINE command defines new mnemonics or redefines existing mnemonics for the mnemonic table. DEFINE is protocol specific, as described below.

Type

Statement or Direct

Syntax

DEFINE"name",I = x FRAMEM LAPD syntax.

DEFINE"name" = x All other FRAMEM protocols.

where: **name** is a mnemonic name of one to six characters in length and **x** is a numeric expression of which the lower eight bits are significant. **x** can be entered in decimal or hexadecimal. To enter **x** in hex, precede the value with an ampersand (&).

In FRAMEM LAPD, you can use the I option, which permits a specific mnemonic to have an I-field.

Abbreviation

DEFI.

See Also

DELETE, MLIST, MSAVE, MLOAD

Example 1

This example defines a mnemonic named NEW, with the length defined in hex.

```
DEFINE"NEW" = &8F
MLIST
```

(result) The mnemonic table is displayed with the entry:

Mnemonic	Dec	Hex	Binary	Defsub
NEW	143	8F	10001111	

Example 2

This example defines a FRAMEM LAPD mnemonic named NEW, with the length defined in hex, and I-field permission.

```
DEFINE"NEW",I = &8F
MLIST
```

(result) In FRAMEM LAPD, the mnemonics table is displayed with the entry:

Mnemonic	I-field	Dec	Hex	Binary
NEW	I	143	8F	10001111

DEFSUB

Description

DEFSUB defines the line number in the current program that will be executed when the received frame matches a specific mnemonic table entry.

The mnemonic must already have been defined before DEFSUB can be used.

DEFSUB defines an entry in the DEFSUB column of the mnemonic table for a specific mnemonic. The DEFSUB entry is a line number that the program jumps to when a frame is received that matches the mnemonic. It functions as if a GOSUB had been executed. DEFSUB statements remain in effect from one program to another.

Type

Statement or Direct

Syntax

DEFSUB "name" = xxxx

where: **name** is a mnemonic that has previously been DEFINEd, and **xxxx** is any valid expression that represents the line number of the program to execute if that mnemonic is received.

To remove the DEFSUB assignment, use the following syntax:

DEFSUB "name" = 0

Abbreviation

DEFS.

See Also

DEFINE, MLIST

Example

This example modifies the SABM mnemonic entry so that when the received frame is a SABM, line 100 of the current program is executed.

```
DEFSUB "SABM" = 100
MLIST
```

(result) The mnemonic table includes an entry

Mnemonic	Dec	Hex	Binary	Defsub
SABM	47	2F	00101111	100

EXTEND

Description

The EXTEND command selects extended mode addressing. In EXTEND mode, 16 bits are used for the address. Changing between EXTEND and NORM (8-bit) mode automatically clears the trace buffer.

Type

Statement or Direct

Syntax

EXTEND

Abbreviation

EXT.

See Also

NORM, STATUS

Example

This example selected extended addressing and then displays the status.

```
10 EXTEND
20 STATUS
!RUN   <RETURN>
```

(result) **Modulo128/Extended addressing**

GET

Description

The GET command gets two bytes offset from the beginning of the received I-field. The bytes retrieved are taken as low byte, high byte. The offset is variable (see syntax).

Type

Statement or Direct

Syntax

x = GET exp

PRINT GET exp

where: **exp** is the offset into the I-field, which can be any valid expression that evaluates to a 16-bit value. **x** is any valid variable. You can use the GET command with the PRINT command

Abbreviation

None

See Also

PUT, REC, RXFRLEN

Example 1

This example displays bytes 1 and 2 of an I-field (second and third bytes of the I-field).

```
10 A=GET 1
20 PRINT A
!RUN   <RETURN>
```

(result) If The I-field received is: **01 02 03 04 05 06 07 08** the result **0302** is displayed.

Example 2

This example gets two bytes from an I-field and strips the high order byte, so that only the low order byte is extracted.

`10 MOD128`	Sets modulo 128 sequencing.
`20 EXTEND`	Selects extended addressing.
`30 DEFINE "MODULO" = 1`	Defines mnemonic entry called MODULO, one bit in width.
`40 DEFINE "ADDR" = 1`	Defines mnemonic entry called ADDR, one bit in width.
`50 REC`	Receives a frame.
`60 IF RXFRLEN=0 GOTO 50`	If no frame received (frame length = 0) loop to receive again.
`70 FOR A = 0 TO RXFRLEN-(2+MODULO+ADDR)`	Sets up a loop to repeat for the length of the I-field received.
`80 B = GET A`	Extracts two bytes beginning at byte A.
`90 PRINT %B AND &FF`	Masks the high order byte from B.
`100 NEXT A`	Increments loop counter to extract next two bytes in I-field.

MOD

Description

MOD specifies modulo 8 or modulo 128 $N_{(S)}$ and $N_{(R)}$ sequencing for frame assembly and disassembly. Changing between MOD8 and MOD128 automatically clears the trace buffer. Use the STATUS command to display the current modulo.

Type

Statement or Direct

Syntax

MOD8

MOD128

Abbreviation

None

See Also

STATUS

Example

This example set the sequencing to modulo 8 and then displays the status.

```
10 MOD8
20 STATUS
!RUN   <RETURN>
```

(result) **`Modulo8/Normal addressing`**

NORM

Description

The NORM command selects normal mode addressing. In normal mode, eight bits are used as the received or transmitted address. Changing between NORM and EXTEND addressing modes automatically clears the trace buffer. Use the STATUS command to display the current addressing mode.

Type

Statement or Direct

Syntax

NORM

Abbreviation

NOR.

See Also

EXTEND, STATUS

Example

This example selects normal addressing and then displays the status.

```
10 NORM
20 STATUS
!RUN   <RETURN>
```

(result) **Moduloxx/Normal addressing**

where **xx** is either 8 or 128, depending on the previously defined modulo.

PUT

Description

The PUT command defines a specified byte in an I-field for transmission.

Type

Statement or Direct

Syntax

PUT exp1,exp2

where: **exp1** is the byte number from the start of the I-field, and **exp2** is the value assigned to that byte.

Abbreviation

None

See Also

GET

Example

In this example, a value is inserted into the second byte of the I-field.

`10 TXIFIELD=HEX>0000000000`	Defines an I-field for transmission.
`20 PUT 1,2`	Defines byte 1 (the second byte) of the I-field as the value 2.
`30 DISPF`	Displays the most recently transmitted frame.

!RUN <RETURN>

(result) **0002000000**

REC

Description

The REC command takes the next received frame in sequence from the acquisition buffer and assigns it to zero or more string variables. A string variable can be assigned a maximum of 255 characters. When the 255-character maximum is reached, data is stored in the next string variable indicated. If there is not sufficient data in the buffer for each string variable in the command, the string variable is assigned a null string.

REC resets the RXFRLEN variable to 0, clears the DISPF buffer, and then transfers the frame, if any, to the trace buffer. If RXFRLEN ≠ 0, the reception variables are set depending on the protocol and what is received. For example, receiving a SABM will not affect the RXN(S) variable, which returns the received N(S).

The reception variables are listed in Section 4.2. A description of the simulation buffers is in Section 3.2.

Type

Statement or Direct

Syntax

REC $A, $B...

See Also

DEFSUB

Example

In this example, the scenario receives frames until a SABM is received. When a SABM is received, it transmits a UA with the appropriate poll/final bit set.

`10 REC $A, $B, $C`	Receive a frame.
`20 IF RXFRLEN=0 GOTO 10`	If no frame received (frame length = 0), loop to receive again.
`30 IF CRC=1 GOTO 10`	If bad CRC, loop to receive again.
`40 IF RXFCTL≠SABM GOTO 10`	If received frame is not a SABM, loop to receive again.
`50 TXFCTL = UA`	If SABM received, set the transmission control field to UA.
`60 TXP/F = RXP/F`	Set the transmissionpoll/.final bit to match the received poll/final bit.
`70 TRAN`	Transmit the frame.

```
!RUN <RETURN>
```

RXADDR

Description RXADDR equals the address field of the received frame.

Type Variable

Syntax (See example below.)

Abbreviation RXA.

See Also REC, RXFRLEN

Example In this example, the program receives a frame and displays the address of the recieved frame in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 PRINT %RXADDR
```

RXC/R

Description RXC/R equals the C/R bit extracted fom an FRMR field.

Type Variable

Syntax (See example below.)

Abbreviation RXC.

See Also REC, RXFRLEN, RXFCTL

Example This example receives frames until a frame reject is received, and then displays the C/R bit of the frame in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL ≠ FRMR GOTO 10
40 PRINT %RXC/R
```

RXDIAG

Description RXDIAG equals the last byte of an FRMR (WXYZ bits).

Type Variable

Syntax (See example below.)

Abbreviation RXD.

See Also REC, RXFRLEN, RXFCTL

Example This example receives frames until a frame reject is received, and then displays the last byte of the frame in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL ≠ FRMR GOTO 10
40 PRINT %RXDIAG
```

RXFCTL

Description

RXFCTL equals the control field of the received frame. RXFCTL removes the poll/final bit and N(S), and N(R), if applicable.

Type

Variable

Syntax

(See example below.)

Abbreviation

RXFC.

See Also

REC, RXFRLEN, RXFCTL

Example

This example receives frames until a frame with a length greater than one byte, with a good CRC is received. It then displayes the control field in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFRLEN = 1 GOTO 10
40 IF CRC = 1 GOTO 10
50 PRINT %RXFCTL
60 GOTO 10
```

RXFRLEN

Description RXFRLEN equals the length of the received frame.

Type Variable

Syntax (See example below.)

Abbreviation RXFR.

See Also REC, RXFRLEN, RXFCTL

Example This example loops until it receives a frame and then displays it by displaying the DISPF buffer.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 DISPF
40 GOTO 10
```

RXN(R)

Description

RXN(R) equals the N(R) of the received frame, if the received frame is a supervisory frame or an I-Frame.

Type

Variable

Syntax

(See example below.)

Abbreviation

None

See Also

REC, RXFRLEN, RXFCTL

Example

This example receives frames until an I-frame or supervisory frame is received. When the correct frame type is received, N(R) and N(S) are displayed in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = IFRAME PRINT %RXN(R), %RXN(S)
40 IF RXFCTL = RR PRINT %RXN(R), %RXN(S)
50 IF RXFCTL = RNR PRINT %RXN(R), %RXN(S)
60 IF RXFCTL = REJ PRINT %RXN(R), %RXN(S)
70 GOTO 10
```

RXN(S)

Description

RXN(S) equals the N(S) of received frame, if the received frame is a supervisory frame or an I-Frame.

Type

Variable

Syntax

(See example below.)

Abbreviation

None

See Also

REC, RXFRLEN, RXFCTL

Example

This example receives frames until an I-frame or supervisory frame is received. When the correct frame type is received, N(R) and N(S) are displayed in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = IFRAME PRINT %RXN(R), %RXN(S)
40 IF RXFCTL = RR PRINT %RXN(R), %RXN(S)
50 IF RXFCTL = RNR PRINT %RXN(R), %RXN(S)
60 IF RXFCTL = REJ PRINT %RXN(R), %RXN(S)
70 GOTO 10
```

RXP/F

Description RXP/F equals the poll/final bit of the received frame.

Type Variable

Syntax (See example below.)

Abbreviation RXP.

See Also REC, RXFRLEN, RXFCTL, RXRP/F

Example This example sets the transmit poll/final bit to match the received poll/final bit.

```
10 REC
20 IF RXFRLEN = 0  GOTO 10
30 TXP/F = RXP/F
```

RXRFCTL

Description RXRFCTL equals the rejected frame control field of the received frame.

Type Variable

Syntax (See example below.)

Abbreviation RXRF.

See Also REC, RXFCTL, RXFRLEN

Example This example waits to receive a frame reject and then displays the control field of the frame.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = FRMR PRINT %RXRFCTL
```

RXRP/F

Description RXRP/F equals the poll/final bit of a received rejected frame control field.

Type Variable

Syntax (See example below.)

Abbreviation RXRP.

See Also REC, RXFRLEN, RXRFCTL, RXP/F

Example This example waits to receive a frame reject and then displays the poll/final bit in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = FRMR PRINT %RXRP/F
```

RXV(R)

Description

RXV(R) equals the V(R) of the rejecting station for a rejected frame.

Type

Variable

Syntax

(See example below.)

Abbreviation

None

See Also

REC, RXFRLEN, RXRFCTL, RXRP/F

Example

This example waits to receive a frame reject and then displays the V(R) of the rejecting station in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = FRMR PRINT %RXV(R)
```

RXV(S)

Description RXV(S) equals the V(S) of the rejecting station for a rejected frame.

Type Variable

Syntax (See example below.)

Abbreviation None

See Also REC, RXFRLEN, RXRFCTL, RXRP/F

Example This example waits to receive a frame reject and then displays the V(S) of the rejecting station in hex.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 IF RXFCTL = FRMR PRINT %RXV(S)
```

STATUS

Description The STATUS command displays the current addressing mode and modulo.

Type Statement or Direct

Syntax **STATUS**

Abbreviation ST.

See Also EXTEND, NORM, MOD8, MOD128

Example `!STATUS`

(result) **`Modulo8/Normal addressing`**

TPRINT

Description

The TPRINT command displays the contents of the trace buffer. For a general description of simulation buffers, refer to Section 3.2.

Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TSAVE, TLOAD, FLUSH, TFREE

Example

```
10 $A = "HELLO"
20 TRAN $A
30 REC
40 TPRINT
!RUN   <RETURN>
```

TRAN

Description

The TRAN command transmits a frame with a good CRC. It can be used to send either valid or invalid frames.

To send invalid frames, use the transmission variables to define the frame and then TRAN to transmit the frame. Using the transmission variables (Section 4.2), you can devise numerous types of frames for error testing.

Insertion of $N_{(S)}$, $N_{(R)}$, $V_{(S)}$, $V_{(R)}$, diagnostic byte, rejected frame control byte, and I-field follow ADCCP rules. In other words, if bits 1 and 0 in the Frame Control field are:

- 00 or 10 It is an I-frame.
- 11 It is a non-sequenced (unnumbered) frame
- 01 It is a supervisory frame.

A frame control byte with a value of 87 hex (CMDR/FRMR) causes $V_{(S)}$, $V_{(R)}$, diagnostic byte and rejected frame control byte insertion. Remember, TEST and XID cause I-field insertion.

Note

To maximize the speed of the Chameleon, when a TRAN is executed, control returns to the scenario before the frame is completely transmitted. If another TRAN occurs before the previous frame is transmitted, the Chameleon waits until the previous frame is finished before transmitting the second one. However, if the Chameleon is configured as a DTE and there are no clocks on the line, the second transmission causes the Chameleon to hang up. If a clock is provided the Chameleon will recover

Type

Statement or Direct

Syntax

TRAN
TRAN $A

Abbreviation

TR.

See Also

ABORTRAN, BADTRAN

Example

This example sends an invalid frame by transmitting an RR frame which exceeds the required length.

```
10 $A = CHR$(3) + CHR$(1) + CHR$(1)
20 TRAN $A
```

In the example above, CHR$(3) is the address, the first CHR$(1) is the RR, and the final CHR$(1) is meaningless.

TXADDR

Description TXADDR sets the value of the address field of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXA.

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXADDR = 03
20 TRAN
30 DISPF
```

TXC/R

Description TXC/R sets the value of the command/response bit of the FRMR frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXC.

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXFCTL = FRMR
20 TXC/R = 1
30 TRAN
30 DISPF
```

TXDIAG

Description TXDIAG sets the value of the last byte (WXYZ bits) of an FRMR field.

Type Variable

Syntax (See example below.)

Abbreviation TXD.

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXFCTL = FRMR
20 TXDIAG = &0F
30 TRAN
30 DISPF
```

TXFCTL

Description TXFCTL sets the value of the frame control field of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXF.

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXFCTL = UA
20 TRAN
30 DISPF
```

TXIFIELD

Description

TXIFIELD sets the contents of an I-field for a frame being transmitted. Although it is listed in the table with the transmission and reception variables, it is used like a function, rather than as a variable.

Type

Variable

Syntax

TXIFIELD = $A	Defines an I-field as $A.
TXIFIELD + $A	Adds $A to the end of the existing I-field.
TXIFIELD = HEX>ABCD	Defines the I-field in hex.
TXIFIELD = ASC>ABCD	Defines the I-field in ASCII.
TXIFIELD = EBC>ABCD	Defines the I-field in EBCDIC.
TXIFIELD + HEX>0D0A	Adds a hex string to the end of the existing I-field.
TXIFIELD + ASC>ABCD	Adds an ASCII string to the end of the existing I-field.
TXIFIELD + EBC>ABCD	Adds an EBCDIC string to the end of the existing I-field.

Abbreviation

TXI.

See Also

ABORTRAN, BADTRAN, TRAN

Example 1

`5 CLEAR`	Clears trace buffer.
`10 TXADDR=3`	Sets the address field to 03.
`20 TXFCTL=0`	Sets the frame control field to a sequenced I-frame.
`30 TXN(S)=1`	Sets the number of transmissions sent count to 1.
`40 TXN(R)=2`	Sets the number of transmissions received count to 2.
`50 TXP/F=0`	Sets the poll/final bit to 0.
`55 TXIFIELD=HEX>0000000000000`	Defines the contents of the I-field in hex.
`60 PUT 4, &41`	Sets the fifth byte of the I-field to 41 hexadecimal.
`70 TRAN`	Transmits the frame.
`75 TPRINT`	Displays trace buffer contents.
`80 STOP`	Terminates execution.

This transmits **03 42 00 00 00 00 41.** Notice that unspecified bytes are set to 0.

Example 2

Alter line 60 in the program above to read:

`60 PUT 4,TXN(S) SHL 4`	Sets the fifth byte of the I-field to the value of TXN(S) shifted left four bits.

This transmits **03 42 00 00 00 00 10.**

TXN(R)

Description TXN(R) sets the value of N(R) of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation None

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXFCTL = IFRAME
20 TXN(R) = 6
30 TXIFIELD = HEX>12345678
40 TRAN
50 DISPF
```

TXN(S)

Description TXN(S) sets the value of N(S) of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation None

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXFCTL = IFRAME
20 TXN(S) = 6
30 TRAN
30 DISPF
```

TXP/F

Description TXP/F sets the poll/final bit of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXP.

See Also ABORTRAN, BADTRAN, TRAN

Example This example sets the transmission poll/final bit to match the poll/final bit of the received frame.

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 TXP/F = RXP/F
40 TRAN
50 DISPF
```

TXRFCTL

Description

TXRFCTL sets the rejected frame control field of a frame being transmitted.

Type

Variable

Syntax

(See example below.)

Abbreviation

TXRF.

See Also

ABORTRAN, BADTRAN, TRAN

Example

This example sets the transmission frame control field to match the received frame control field.

```
10 TXRFCTL = RXFCTL
20 TRAN
30 DISPF
```

TXRP/F

Description TXRP/F sets the poll/final bit of a rejected frame control field for the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXRP.

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXRP/F = RXRP/F
20 TRAN
```

TXV(R)

Description TXV(R) sets the value of V(R) for the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation None

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXV(R) = TXN(R)
20 TRAN
30 DISPF
```

TXV(S)

Description TXV(S) sets the V(S) of the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation None

See Also ABORTRAN, BADTRAN, TRAN

Example

```
10 TXV(S) = TXN(S)
20 TRAN
30 DISPF
```

4.4 FRAMEM HDLC/SDLC

Introduction

This section describes the FRAMEM commands, parameter set-up menu and mnemonic table that are specific to FRAMEM HDLC and SDLC. These are described on the following pages.

FRAMEM HDLC AND SDLC PARAMETER SET-UP MENUS

Introduction

This section describes the parameters and valid values for the FRAMEM HDLC and SDLC menus (Figure 4.4-1). These menus enable you to configure and save parameters for running FRAMEM HDLC or SDLC simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu, refer to Section 2.3.

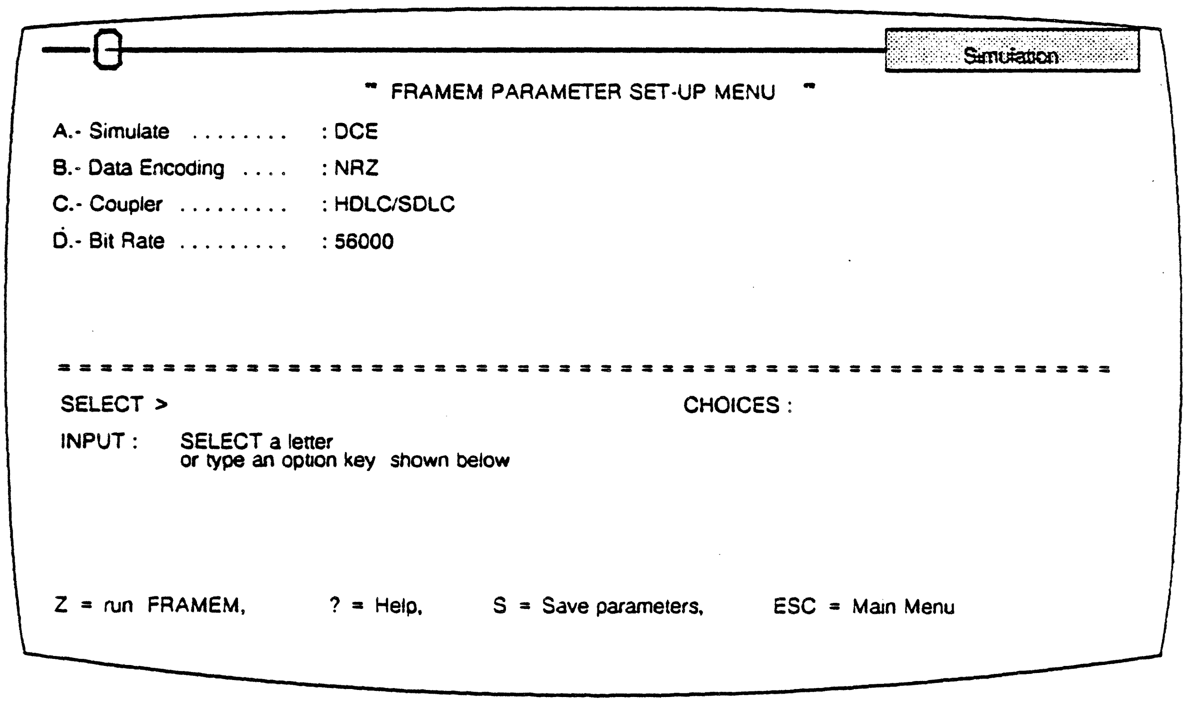


Figure 4.4-1: The FRAMEM (HDLC/SDLC) Parameter Set-Up Menu

A.	Simulate	DCE DTE
B.	Data Encoding	NRZ NRZI
C.	Coupler	HDLC/SDLC XPARENT BISYNC (See additional parameters on page 4.4-4.)
D.	Bit Rate	Decimal bit rate range: 50-64000

If you are unfamiliar with these parameters, use the following guidelines for assistance in selecting the correct settings.

Simulate:
DCE/DTE

The DCE furnishes the clock which determines the data rate. It also determines on which connector pins the data is physically sent and received. For Simulation, one device is designated as the DCE; the other device is designated as a DTE.

If the Unit Under Test (UUT) is supplying the clock, it is the DCE. In this case, the Chameleon must be configured as a DTE. If the UUT is not supplying the clock, it is designated as a DTE. The Chameleon must then be configured as the DCE.

Data Encoding:
NRZ/NRZI

This parameter determines if the data is transmitted in NRZ (Non-Return to Zero) or NRZI (Non-Return to Zero Inverted) format. This is a function of the relative voltage on the data line, representing the 'MARK' and 'SPACE' levels. This parameter determines whether a 'MARK' is represented by a high or low level.

Configure the Chameleon to use the same data encoding format as the (UUT).

Coupler:
HDLC/SDLC or
XPARENT BSC

This parameter enables you to select the HDLC/SDLC coupler or the Transparent BSC coupler. The HDLC/SDLC coupler is for X.25/SNA applications in FRAMEM. The Transparent BSC coupler supports the X.25/ECMA protocol, which is used in some European countries.

Select the coupler option that is appropriate for the protocol you are testing. If you select the Transparent BSC option, 10 additional parameters are displayed in the set-up menu, as described on page 4.4-4.

Bit Rate

The bit rate determines the speed that the Chameleo 32 will transmit data. If the Chameleon is configured as the DTE, the bit rate is automatically set to RECEIVE. This means that the Chameleon will send data at the same rate as the data it receives, thus matching the speed set by the UUT.

If the Chameleon is configured as the DCE, it is responsible for setting the bit rate. The valid range is 50 - 64000 bits per second.

Xparent Bisync Menu

If your choose the Xparent Bisync value for the **C. - Coupler** parameter, 10 additional parameters (E - N) are displayed as shown in the figure below.

This is the Transparent BSC menu that configures the parameters necessary for simulating the X.25/ECMA protocol.

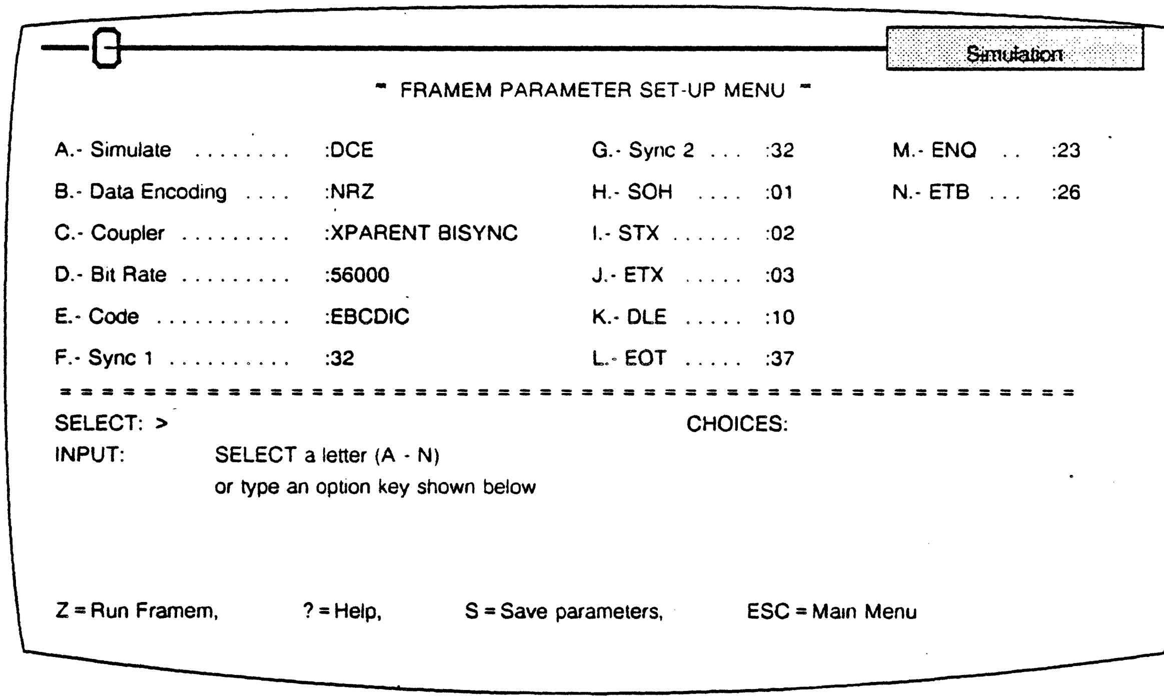


Figure 4.4-2: Xparent Bisync Parameters

The additional Xparent Bisync parameters (E - N) are described below.

E.	Code	EBCDIC ASCII/ NO PARITY ASCII/ EVEN PARITY ASCII/ ODD PARITY
F.	Sync 1	2-digit hex number
G.	Sync 2	2-digit hex number
H.	SOH (Start of Header)	2-digit hex number
I.	STX (Start of Text)	2-digit hex number
J.	ETX (End of Text)	2-digit hex number
K.	DLE (Data Link Escape)	2-digit hex number
L.	EOT (End of Transmission)	2-digit hex number
M.	ENQ (Enquiry)	2-digit hex number
N.	ETB (End of Transmission Block)	2-digit hex number

FRAMEM HDLC/SDLC MNEMONIC TABLE

Introduction

The FRAMEM HDLC/SDLC mnemonic table has five columns:

- Mnemonic name (1-6 characters)
- Decimal value
- Hexadecimal value
- Binary value
- DEFSUB - If this type of frame is received, program control jumps to the program line number specified in this column and executes the subroutine. Refer to the FRAMEM DEFSUB command for more information.

MNEMONIC	DECIMAL	HEX	BINARY	DEFSUB
IFRAME	0	00	00000000	
SNRME	207	CF	11001111	
SARME	79	4F	01001111	
SABME	111	6F	01101111	
SREJ	13	0D	00001101	
SNRM	131	83	10000011	
SARM	15	0F	00001111	
SABM	47	2F	00101111	
DISC	67	43	01000011	
RSET	143	8F	10001111	
FRMR	135	87	10000111	
TEST	227	E3	11100011	
CMDR	135	87	10000111	
RNR	5	05	00000101	
REJ	9	09	00001001	
SIM	7	07	00000111	
XID	175	AF	10101111	
RIM	7	07	00000111	
NSI	3	03	00000011	
RQI	7	07	00000111	
ROL	15	0F	00001111	
NSP	35	23	00100011	
RR	1	01	00000001	
UI	3	03	00000011	
UP	35	23	00100011	
DM	15	0F	00001111	
UA	99	63	01100011	
RD	67	43	01000011	

Table 4.4-3: FRAMEM HDLC/SDLC Mnemonic Table

FRAMEM HDLC/SDLC COMMANDS

There are no FRAMEM commands that are specific to HDLC and SDLC; however, the TPRINT command, which displays the contents of the trace buffer, has a protocol-specific display format. The trace buffer display for FRAMEM HDLC and FRAMEM SDLC is shown on the following page.

Remember that for FRAMEM HDLC/SDLC simulation, you can use the FRAMEM commands listed in Section 4.3 and the Chameleon BASIC commands listed in Section 3.5.

TPRINT

Description

The TPRINT command displays the contents of the trace buffer, which contains the received and transmitted traffic.

The format of the trace buffer display is protocol-specific as shown in the examples below. For more information about the use of the trace buffer in simulation, refer to Section 3.2.

Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TSAVE, TLOAD, REC

Example 1

This is an example of a FRAMEM HDLC/SDLC trace buffer display.

```
R    14:26:06:77:90    4   01      IFRAME  N(S) =2  N(R) =3 00  00
R    14:26:08:77:90    2   01  P   SABM
T    14:26:09:17:90    5   43      FRMR  97 F8 07
```

FRAMEM HDLC/SDLC SAMPLE PROGRAMS

The following sample FRAMEM HDLC/SDLC programs illustrate important concepts for developing applications, but are not valid tests for any particular application.

Program FHDLC1

This program waits for a SABM frame to be received on any channel. After receiving one, it sends a UA frame on channel 03.

`5 CLEAR`	Clears trace buffer.
`10 REM WAIT FOR SABM`	Remark, not executed.
`20 REC`	Receives a frame, if one is available.
`30 IF RXFRLEN=0 GOTO 20`	If no frame is received, RXFRLEN equals 0, loops back to line 20, and tries again.
`40 IF RXFCTL#SABM GOTO 20`	If the received frame is not a SABM, loops back to line 20, and tries again.
`50 TXFCTL=UA`	A SABM was received. Prepares to transmit a UA by setting the transmit frame control field to UA.
`60 TXADDR=03`	Sets transmit address to 03.
`70 TRAN`	Transmits the frame.
`80 STOP`	Terminates execution.

Program FHDLC2

This program receives a number of frames, and displays the frame control field.

`10 REC`	Receives a frame.
`20 IF RXFRLEN = 0  GOTO 10`	If no frame received, loops to receive again.
`30 PRINT "FRAME CONTROL = ",%RXFCTL`	Prints the control field in hex.
`40 STOP`	Terminates execution.

Program FHDLC3

This program waits to receive a SABM or UA and them displays the contents of the DISPF buffer and the trace buffer.

`10 DEFSUB "SABM"=100`	Subroutine if SABM received.
`20 DEFSUB "UA"=100`	Subroutine if UA received.
`25 DEFSUB "SARM"=300`	Subroutine if SARM received.
`30 A = 0`	Sets flag to 0.
`35 REC`	Receives a frame.
`40 IF (RXFRLEN=0) OR (A#0) GOTO 30`	If nothing was received, or if flag still equals 0, goes to 30.
`50 PRINT "NOT A SABM OR UA"`	Displays error message.
`60 GOTO 30`	Tries SABM/UA subroutine again.
`100 DISPF`	Displays last received frame.
`110 TPRINT`	Displays contents of trace.
`120 CLEAR`	Clears trace buffer.
`130 A = 1`	Sets flag to one.
`140 RETURN`	End of subroutine.
`300 PRINT "BYE"`	SARM subroutine.
`320 STOP`	Terminates execution.

Program HDLC4

This program does the following:

- Establishes a link
- Sends and receives a user-specified number of I-frames within a FOR loop
- Disconnects the link

Flow control N(R) and N(S) are monitored. If an error occurs, control exits from the loop, prints an appropriate message, and disconnects the link. This example should be run with the Chameleon simulating the DTE side.

`1 CLS`	Clears screen.
`2 INPUT "ENTER # OF SECONDS OF I-FRAME RECEPTION DELAY" B`	Prompts for timer value and stores result in variable B.
`10 INPUT "ENTER # OF I-FRAMES TO BE SENT" C`	Prompts for I-frames to transmit and stores result in variable C.
`20 CLEAR`	Clears trace buffer.
`30 TXADDR = 01`	Sets transmission address.
`40 TXN(S) = 0`	Sets N(S) for transmitted frame.
`50 TXN(R) = 0`	Sets N(R) for transmitted frame.
`70 TXFCTL = SABM`	Sets control field for transmitted frame.
`90 TRAN`	Transmits frame.
`130 REC`	Receives a frame.
`150 IF (RXFRLEN=0) OR (RXFCTL#UA) GOTO 130`	If no frame received, or received other than UA, loop to receive again.
`155 IF C = 0 GOTO 920`	If all I-frames have been received, leaves loop and sends DISC.
`160 C = C - 1`	Decrements I-frame counter.
`170 FOR A = 0 TO C`	Loop index becomes number of I-frames.
`180 TXADDR = 01`	Sets transmission address.
`190 TXFCTL=IFRAME`	Sets control field to I-frame.
`200 TXIFIELD=HEX>0000000000000000`	Sets I-field value.

`210 TRAN`	Transmits frame.
`250 TXN(S)=TXN(S)+1`	Increments number sent count N(S).
`260 REC`	Receives a frame.
`270 IF (RXFRLEN=0) OR (RXFCTL# RR) GOTO 260`	
	If a frame is not received, or the frame received is not an RR, loops to receive again.
`280 IF RXN(R)#TXN(S) PRINT "RXN(R) IS OUT OF SEQUENCE"`	
	Checks flow control.
`290 TIM2 = B`	Sets timeout counter.
`300 REC`	Receives a frame.
`305 IF TIM2=0 GOTO 900`	If timer expires, goes to 900.
`310 IF (RXFRLEN=0) OR (RXFCTL#IFRAME) GOTO 300`	
	If a frame is not received, or the frame received is not an I-frame, loops to receive again.
`330 IF RXN(S)#TXN(R) PRINT "RXN(S) IS OUT OF SEQUENCE" GOTO 920`	
`340 IF TXN(S) = RXN(R) GOTO 360`	
`350 PRINT "RXN(R) IS OUT OF SEQUENCE": GOTO 920`	
`360 TXADDR=03`	Sets transmit address to 03.
`370 TXFCTL=RR`	Sets control field to RR.
`380 TXN(R)=TXN(R)+1`	Increments received frames count.
`390 TRAN`	Transmits the frame.
`900 NEXT A`	Increases loop index, return to 170.
`920 TXADDR=01`	Builds and transmits DISC frame.
`930 TXFCTL=DISC`	Sets frame contorl field.
`940 TRAN`	Transmits the frame.
`950 REC`	Receives frame.
`960 IF (RXFRLEN=0) OR (RXFCTL#UA) GOTO 950`	
	If no frame received, or frame received is not an UA, loops to receive again.
`970 STOP`	Terminates program.

Program HDLC5

This program is valid only in FRAMEM HDLC. It assembles and transmits every common type of HDLC/X.25 packet. The packets are sent on the primary and secondary addresses, as appropriate, both with and without the poll bit set.

10 IF B=1 GOTO 60	B is a flag.
20 GOSUB 890	Defines strings as packets.
30 GOSUB 460	DCE or DTE? checks addresses.
40 B=1	Sets flag.
50 COUPLER "DEFAULT"	Calls coupler set-up routine.
60 INPUT "HOW MANY TIMES THRU LOOP"Y	Gets loop index.
70 FOR Z=1 TO Y	Begins loop.
80 CLS	Clears screen.
90 PRINT "TESTING SUPERVISORY FRAMES"	
100 TXFCTL=RR	Sets Frame Control Field to RR
110 GOSUB 380	Transmits primary/secondary.
120 TXFCTL=RNR	Sets Frame Control Field to RNR.
130 GOSUB 380	Transmits primary/secondary.
140 TXFCTL=REJ	Sets Frame Control Field to REJ.
150 GOSUB 380	Transmits primary/ secondary.
160 PRINT "TESTING UN-NUMBERED COMMANDS"	
170 TXADDR=P	Sets address to primary.
180 TXFCTL=SARM	Sets control field to SARM.
190 GOSUB 410	Transmits primary only.
200 TXFCTL=SABM	Sets control field to SABM.
210 GOSUB 410	Transmits primary only.
220 TXFCTL=DISC	Sets control field to DISC.
230 GOSUB 410	Transmits primary only.
240 PRINT "TESTING UN-NUMBERED RESPONSES"	
250 TXADDR=S	Sets address to secondary.

`260 TXFCTL=DM`	Sets control field to DM.
`270 GOSUB 410`	Transmits secondary only.
`280 TXFCTL=FRMR`	Sets control field to FRMR.
`290 GOSUB 410`	Transmits secondary only.
`300 TXFCTL=UA`	Sets control Field to UA.
`310 GOSUB 410`	Transmits secondary only.
`320 PRINT "TESTING I-FRAME"`	Displays message.
`330 TXADDR=P`	Sets address to primary.
`340 TXFCTL=I-FRAME`	Sets control field to I-frame.
`350 GOSUB 580`	Transmits I-frames.
`360 NEXT Z`	Increments loop index.
`370 STOP`	Terminates execution.
`380 TXADDR=P`	Sets address to primary.
`390 GOSUB 410`	Transmit routine.
`400 TXADDR=S`	Sets address to secondary.
`410 TXP/F=0`	Sets poll bit to zero
`420 TRAN`	Transmits frame without poll.
`430 TXP/F=1`	Sets poll bit to one.
`440 TRAN`	Transmits frame with poll.
`450 RETURN`	Ends subroutine 410.
`460 CLS`	Clears screen.
`470 XYPLOT(10,20)`	Positions cursor.
`480 PRINT "ARE YOU A DCE? (Y/N)"`	Displays question.
`490 $INPUT $X`	Assigns user input to $X.
`500 IF LEN($X)≠1 GOTO 460`	If user input invalid, try again.
`510 IF $X="Y" GOTO 540`	If DCE, goes to 540.
`520 IF $X="N" GOTO 560`	If DTE, goes to 560.
`530 GOTO 460`	If invalid input, try again.

`540 P=3:S=1`	Assigns address variables.
`550 RETURN`	Ends subroutine 540.
`560 P=1:S=3`	Assigns address variables.
`570 RETURN`	Ends subroutine 560.
`580 TXIFIELD=$A`	Line 580 - 880 assign and transmitI-fields using string variables.
`590 TRAN`	
`600 TXIFIELD=$B`	
`610 TRAN`	
`620 TXIFIELD=$C`	
`630 TRAN`	
`640 TXIFIELD=$D`	
`650 TRAN`	
`660 TXIFIELD=$E`	
`670 TRAN`	
`680 TXIFIELD=$F`	
`690 TRAN`	
`700 TXIFIELD=$G`	
`710 TRAN`	
`720 TXIFIELD=$H`	
`730 TRAN`	
`740 TXIFIELD=$I`	
`750 TRAN`	
`760 TXIFIELD=$J`	
`770 TRAN`	
`780 TXIFIELD=$K`	
`790 TRAN`	
`800 TXIFIELD=$L`	
`810 TRAN`	
`820 TXIFIELD=$M`	
`830 TRAN`	
`840 TXIFIELD=$N`	
`850 TRAN`	
`860 TXIFIELD=$O`	
`870 TRAN`	
`880 RETURN`	End of subroutine 580.
`890 $A=HEX>1001 00`	$A is a data packet.
`900 $A=$A+"ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789"`	
`910 $B=HEX>1001 01`	$B is a RR.
`920 $C=HEX>1001 05`	$C is a RNR.
`930 $D=HEX>1001 09`	$D is a REJECT.
`940 $E=HEX>1001 23`	$E is an Interrupt.
`950 $F=HEX>1001 27`	$F is an Interrupt Confirmation.
`960 $G=HEX>1001 0B 07 5432100000`	$G is a Call.
`970 $H=HEX>1001 0F`	$H is a Call Confirmation.
`980 $I=HEX>1001 13 00`	$I is a Clear.
`990 $J=HEX>1001 17`	$J is a Clear Confirmation.
`1000 $K=HEX>1001 1B 00`	$K is a Reset.
`1010 $L=HEX>1001 1F`	$L is a Reset Confirmation.
`1020 $M=HEX>1001 FB 00`	$M is a Restart.
`1030 $N=HEX>1001 FF`	$N is a Restart Confirmation.
`1040 $O=HEX>1001 F1 12345678`	$O is a Diagnostic Packet.
`1050 RETURN`	End of subroutine 890.

Program HDLC6

This program is valid only for FRAMEM HDLC. It demonstrates the use of the RXRFCTL, RXDIAG, RXRP/F, RXV(S) AND RXV(R) variables, and the DELETE and DEFSUB commands. It should be run on the DTE side in conjunction with Program HDLC7 on the following page.

`5 CLS`	Clears screen
`10 FLUSH`	Clears acquisition buffer.
`20 CLEAR`	Clears trace buffer.
`30 DELETE "SARM"`	DeletesSARM mnemonic.
`40 DELETE "ROL"`	Deletes ROL mnemonic.
`50 DELETE "FRMR"`	Deletes FRMR mnemonic.
`60 DEFSUB "CMDR"=2000`	Jumps to line 2000 if CMDR received.
`70 DEFSUB "SABM"=1000`	Jumps to line 1000 if SABM received.
`75 TXP/F=0`	Sets poll final bit to 0.
`80 REC`	Receives a frame
`90 GOTO 80`	Loops until a CMDR or SABM is received. and then executes subroutine defined in DEFSUB commands in lines 60 and 70.
`1000 TXFCTL=DM`	SetS transmit control field to DM.
`1005 DISPF`	Displays last frame received.
`1010 TXADDR=03`	Sets transmit address to 03.
`1020 TRAN`	Transmits frame.
`1030 RETURN`	Returns from subroutine.
`2000 DISPF`	Displays last frame transmitted.

```
2020 ?"RXRFCTL= ",%RXRFCTL," RXDIAG= ",%RXDIAG,"RXRP/F=",RXRP/F
```

Displays values in hex.

```
2025 ? "RXV(S)=   ",RXV(S),"  RXV(R)=   ",RXV(R)
```

Displays values of RXV(S) and RXV(R).

`2030 TXP/F=1`	Sets poll final bit.
`2040 IF RXRP/F=0 GOTO 2070`	If received frame reject with poll/final bit not set, jump to line 2070.
`2050 TPRINT`	Displays trace buffer contents.
`2060 STOP`	Terminates execution.
`2070 TRAN`	Transmits frame with poll bit.
`2080 DISPF`	Displays last frame transmitted.
`2090 RETURN`	Returns from subroutine.

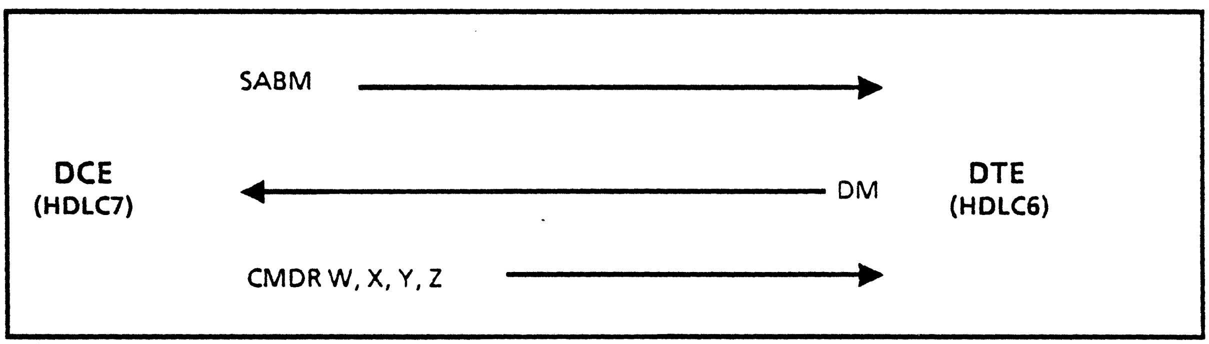
Program HDLC7

This program demonstrates the use of the TXRFCTL, TXDIAG, TXV(S), TXV(R) and TXRP/F variables, which are used to transmit a CMDR or FRMR. This scenario should be run on the DCE side in conjuction with Program HDLC6 on the preceding page.

`1 CLS`	Clears screen.
`2 REM DELETE MNEMONICS WITH SAME VALUE AS ONE YOU ARE`	
`3 REM LOOKING FOR. ROL AND SARM EQUAL &0F AS DOES DM.`	
`4 DELETE "ROL"`	Deletes mnemonic from table.
`5 DELETE "SARM"`	Deletes mnemonic from table.
`6 REM FRMR ALSO HAS THE SAME CODE AS CMDR.`	
`7 DELETE "FRMR"`	Deletes mnemonic from table.
`10 DEFSUB "DM"=500`	if DM received, jumps to line 500 as a subroutine call.
`20 TXP/F=0`	Sets poll final bit to 0.
`30 FLUSH`	Clears receive frame buffer.
`40 CLEAR`	Clears trace buffer.
`45 TXADDR=03`	Sets transmit address to 03.
`50 TXFCTL=SABM`	Sets frame control field to SABM.
`70 TXV(S)=0`	Sets V(S) equal to 0.
`80 TXV(R)=0`	Sets V(R) equal to 0.
`90 TRAN`	Transmits frame.
`95 DISPF`	Displays last frame received.
`100 REC`	Receives frame.
`110 GOTO 100`	Loops until frame is received.
`500 TXRFCTL=RXFCTL`	DM subroutine. Assigns transmit control field (DM) to rejected frame field of CMDR to transmit.
`510 TXRP/F=RXP/F`	Assigns received poll final bit to transmit poll final bit.

`520 TXFCTL=CMDR`	Transmit sframe control is equal to CMDR.
`525 DISPF`	Displays last frame transmitted.
`530 ?"RECEIVED DM.  SENDING CMDR WITH 'W,X,Y AND Z' BITS SET".`	
`540 TXDIAG=&F`	Transmits diagnostic field of F hex.
`560 TRAN`	Transmits CMDR frame.
`570 DISPF`	Displays last frame transmitted.
`580 IF TXRP/F=1 GOTO 610`	If received DM has poll bit set, jumps to line 610.
`590 TXP/F=1`	Sets poll bit to 1.
`600 RETURN`	Ends subroutine.
`610 TPRINT`	Displays trace buffer.
`620 STOP`	Ends program.

The figure below shows the sequence that occurs in programs HDLC6 and HDLC7.



4.5 FRAMEM LAPD

Introduction

This section describes the commands, variables, menus, and mnemonics table that are specific to FRAMEM LAPD.

LAPD Frame

The structure of a LAPD frame is slightly different from a standard ADDCP frame. Specifically, the LAPD address field has several added bits, as shown in Figure 4.5-1. *The number in parentheses ( ) indicates the width of the field in bits.*

Flag (8 bits) 7E hex	Address (16 bits)	Control Field (8 or 16 bits)	Information (variable length)	Frame Check Sequence (16 bits)	Flag (8 bits) 7E hex

8	7	6	5	4	3	2	1	
SAPI						C/R	EA	High order octet
TEI							EA	Low order octet

MODULO 8	8	7	6	5	4	3	2	1
I-frame format	N(R)			P	N(S)			0
S-frame format	N(R)			P/F	S	S	0	1
U-frame format	M	M	M	P/F	M	M	1	1

MODULO 128	8	7	6	5	4	3	2	1
I-frame format	N(S)							0
	N(R)							P
S-frame format	X	X	X	X	S	S	0	1
	N(R)							P/F
U-frame format	M	M	M	P/F	M	M	1	1

SAPI Service Access Point Idenfifier
0 = Call control procedures
16 = Packet communication procedures
32-47 = Reserved for national use
63 = Management procedures
All others = Reserved for future standard

TEI Terminal Endpoint Identifier
0-63 = Non-automatic TEI assignment equipment
64-126 = Automatic TEI assignment equipment
127 = Broadcast (group) TE I

C/R Command/Response bit
From user side: 1 = response; 0 = command
From network side: 1 = command, 0 = response

EA Extended Address
0 = Not final address octet
1 = Final octet of address field.

Figure 4.5-1: LAPD Frame Format

CAPABILITIES OF FRAMEM LAPD

With the FRAMEM LAPD package, you can specify and transmit frames with any combination of the following errors:

- Introduce a frame that is too short, by setting a variable equal to a single hexadecimal character, instead of the normal hexadecimal pair.
- Send a frame or an information field that is too long, by setting the I-field to a value greater than the user-defined N1 (maximum frame length) value.
- Transmit an unknown frame by defining a mnemonic that will not be recognized by the device or the network under test.
- Transmit an invalid first order bit by setting the bit if it should be clear, or clearing the bit if it should be set.
- Send an invalid N(R) or N(S) by setting N(R) to a greater number than N(S), or defining both to be greater than the window.
- Introduce an incomplete frame by sending an I-frame with an empty I-field.
- Send a valid or invalid FCS using the TRAN and BADTRAN commands.
- Specify frame type, content, and component parts of both the control and address fields using standard LAPD or user-defined mnemonics.
- Define control fields by bit pattern and the associated mnemonic identifiers, and specify data content as a series of hexadecimal bytes for frames with I-fields.

FRAMEM LAPD PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the FRAMEM LAPD menu (Figure 4.5-2). This menu enables you to configure and save parameters for running FRAMEM LAPD simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu (option S), refer to Section 2.3.

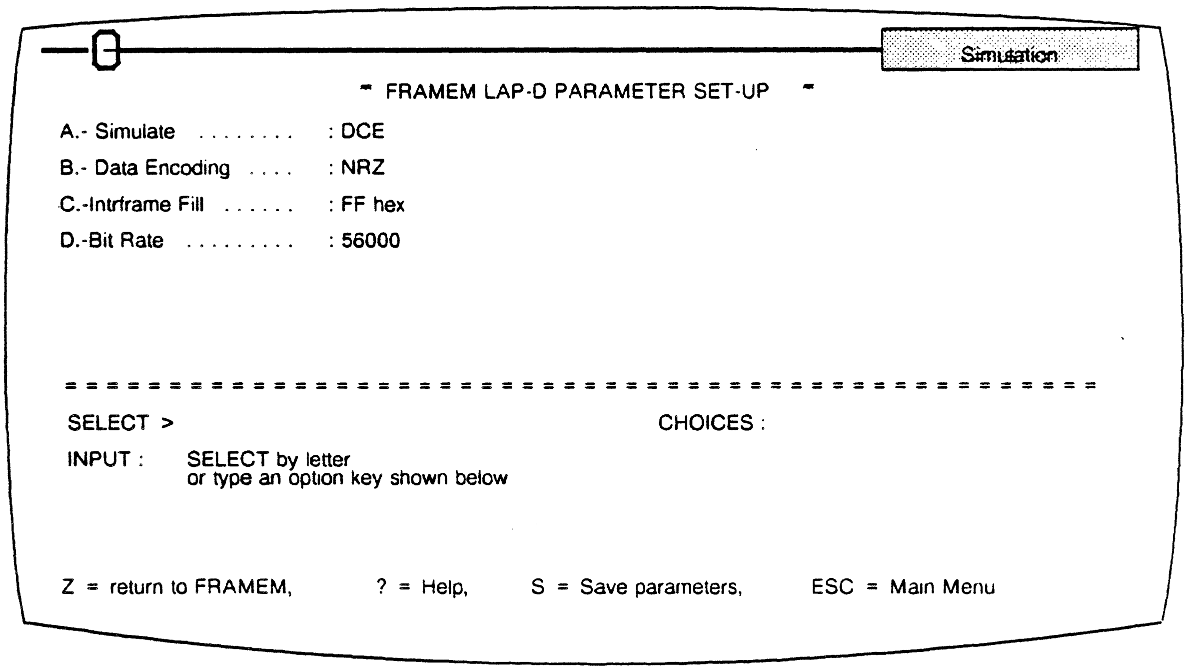


Figure 4.5-2: The FRAMEM LAPD Parameter Set-Up Menu

A. Simulate	DCE DTE
B. Data Encoding	NRZ NRZI
C. Interframe Fill	FF hex 7E hex
D. Bit Rate	Decimal bit rate range: 50 - 64000

If you are unfamiliar with these parameters, use the following guidelines for assistance in selecting the correct settings.

Simulate:
DCE/DTE

The DCE furnishes the clock which determines the data rate. It also determines on which connector pins the data is physically sent and received. For Simulation, one device is designated as the DCE; the other device as a DTE.

If the Unit Under Test (UUT) is supplying the clock, it is the DCE. In this case, the Chameleon must be configured as a DTE. If the UUT is not supplying the clock, it is designated as a DTE. The Chameleon is then configured as the DCE.

Data Encoding:
NRZ/NRZI

This parameter determines if the data is transmitted in NRZ (Non-Return to Zero) or NRZI (Non-Return to Zero Inverted) format. This is a function of the relative voltage on the data line, representing the 'MARK' and 'SPACE' levels. This parameter determines whether a 'MARK' is represented by a high or low level. Configure the Chameleon to use the same data encoding format as the (UUT).

Interframe Fill:
7E/FF

The Interframe fill determines what the Chameleon sends to the UUT when the data line is idle. The original CCITT recomendation specified an all 1's (FF) condition to indicate the line is idle, and 7E ito indicate the line is busy.

Many terminal devices require an interframe fill value of FF, since an interframe fill of 7E can be mistaken as the beginning and ending flags of an endless stram of zero-length frames. If the interframe fill is mistaken in this way, the terminal becomes so busy that it appears to be locked up.

Many switch devices assume that the physical link is disconnected or faulty unless there is a continuous stream of bits, consisting of data or hex 7E flags, on the line.

Bit Rate

The bit rate determines the speed that the Chameleo 32 will transmit data. If the Chameleon is configured as the DTE, the bit rate is automatically set to RECEIVE. This means that the Chameleon will send data at the same rate as the data it receives, thus matching the speed set by the UUT.

If the Chameleon is configured as the DCE, it is responsible for setting the bit rate. The valid range is 50 - 64000 bits per second.

FRAMEM LAPD MNEMONIC TABLE

The FRAMEM LAPD mnemonic table has five fields:

- Mnemonic name (1 - 6 characters)
- I-field permission
- Decimal value
- Hexadecimal value
- Binary value

The default FRAMEM LAPD mnemonic table is shown in the table below. The I-field table in the column indicates whether the mnemonic can have an I-field. If an I-field is permitted, the letter **I** appears in the second column next to the mnemonic name.

MNEMONIC	I-FIELD	DECIMAL	HEX	BINARY
IFRAME		0	00	00000000
SNRME		207	CF	11001111
SARME		79	4F	01001111
SABME		111	6F	01101111
SREJ		13	0D	00001101
SNRM		131	83	10000011
SARM		15	0F	00001111
SABM		47	2F	00101111
DISC		67	43	01000011
RSET		143	8F	10001111
FRMR		135	87	10000111
TEST		227	E3	11100011
CMDR		135	87	10000111
RNR		5	05	00000101
REJ		9	09	00001001
SIM		7	07	00000111
XID		175	AF	10101111
RIM		7	07	00000111
NSI		3	03	00000011
RQI		7	07	00000111
ROL		15	0F	00001111
NSP		35	23	00100011
RR		1	01	00000001
UI		3	03	00000011
UP		35	23	00100011
DM		15	0F	00001111
UA		99	63	01100011
RD		67	43	01000011

Figure 4.5-3: FRAMEM LAPD Mnemonic Table

FRAMEM LAPD COMMAND INDEX

The commands that are available only in FRAMEM LAPD, or have syntax that differs from other BASIC subsets are described in this section. This page lists the FRAMEM LAPD commands and variables in tables by function. It also indicates whether the command is a **S**tatement or **D**irect command. For more information, refer to the page number indicated.

Remember that you can also use the FRAMEM commands listed in Section 4.3 the Chameleon BASIC commands listed in Section 3.5.

TABLE 4.5-4: FRAMEM LAPD TRANSMISSION AND RECEPTION VARIABLES

COMMAND	PAGE	TYPE	FUNCTION
RXCR	4.5-9	Variable	Indicates if received C/R bit is set.
RXSAPI	4.5-10	Variable	Received Service Access Point Identifier.
RXTEI	4.5-11	Variable	Received Terminal Endpoint Identifier.
TXCR	4.5-13	Variable	Indicates if transmitted C/R bit is set..
TXSAPI	4.5-14	Variable	Transmitted Service Access Point Identifier.
TXTEI	4.5-15	Variable	Transmitted Terminal Endpoint Identifier.

TABLE 4.5-5: FRAMEM LAPD MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
DEFINE	4.5-7	S or D	Defines a new mnemonic, or redefines an existing mnemonic for the table
FILL	4.5-8	S or D	Defines the interframe fill as either 7E or FF.
TPRINT	4.5-12	S or D	Displays the contents of the trace buffer.

DEFINE

Description

The DEFINE command defines mnemonic for the mnemonic table in memory. FRAMEM LAPD includes a syntax option for the DEFINE command in the form of **,I**. This option allows you to specify that an I-field is permitted with a pre-defined or user-defined frame type. You cannot define an I-field for the link access frames: SABM, SABME, DISC, DM, and UA.

Type

Statement or Direct

Syntax

DEFINE "name" ,I = x

where: **name** is a mnemonic name, one to six characters in length, and **x** is a numeric expression, of which the lower eight bits are significant. You can enter **x** in decimal or hexadecimal. To define the value in hexadecimal, precede the value with the ampersand (&) symbol.

The I option, if included, permits an I-field for that specific mnemonic. If the **I** is not entered as part of the command, an I-field is not permitted.

Abbreviation

DEFI.

See Also

DELETE, LMLIST,MLIST,MLOAD, MSAVE

Example

This example defines a mnemonic called NEW with I-field permission.

```
DEFINE "NEW",I = 143
MLIST
```

(result) The mnemonic table is displayed, with the entry:

Mnemonic	I-Field	Dec	Hex	Binary
NEW	I	143	8F	10001111

Example 2

To remove an I-field option from the mnemonic, re-define the mnemonic without the I option, as shown below.

```
DEFINE "NEW" = 143
MLIST
```

(result) The NEW mnemonic is redefined, and appears in the mnemonic table as:

Mnemonic	I-Field	Dec	Hex	Binary
NEW		143	8F	10001111

FILL

Description

The FILL command changes the interframe fill pattern. This is the fill pattern, either 7E or FF, that is transmitted when no other data is being transmitted over the line.

The interframe fill can also be set using the FRAMEM LAPD parameter set-up menu. The menu selection for interframe fill is overridden by the FILL command.

Type

Statement or Direct

Syntax

FILL = x

where: **x** is either 7E or FF hexadecimal. A value of 7E indicates that the line is busy and the equipment is idle. A value of FF indicates that the line is idle.

Abbreviation

None

See Also

MENU

Example

This example causes the interframe fill to change repeatedly between FF and 7E, causing the Chameleon Data LED's to flicker.

```
10 FILL = FF
20 FILL = 7E
30 GOTO 10
!RUN <RETURN>
```

RXCR

Description

RXCR is a variable that returns the value of the command/response bit of the received frame. It indicates whether the received frame is a command or a response. It has the following valid values:

	FROM NETWORK	FROM SUBSCRIBER
COMMAND	1	0
RESPONSE	0	1

RXCR Values

Type

Variable

Syntax

(See example below.)

Abbreviation

RXC.

See Also

REC, RXFRLEN, TXCR

Example

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 PRINT RXCR
!RUN   <RETURN>
```

RXSAPI

Description RXSAPI is a variable that returns the Service Access Point Identifier (SAPI) of the received frame.

Type Variable

Syntax See example below.)

Abbreviation RXS.

See Also REC, RXFRLEN

Example

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 PRINT RXSAPI
!RUN   <RETURN>
```

RXTEI

Description RXTEI is a variable that returns the Terminal End Point Identifier (TEI) of the received frame. This is used for extended addressing.

Type Variable

Syntax (See example below.)

Abbreviation RXT.

See Also REC, RXFRLEN, SET

Example

```
10 REC
20 IF RXFRLEN = 0 GOTO 10
30 PRINT RXTEI
!RUN  <RETURN>
```

TPRINT

Description

The TPRINT command displays the contents of the trace buffer, which contains the received and transmitted traffic.

The format of the trace buffer display is protoco-specific as shown in the figure below. For more information about the use of the trace buffer in simulation, refer to Section 3.2.

Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TSAVE, TLOAD, LTPRINT, REC

Example 1

This is an example of a FRAMEM LAPD trace buffer display.

TXCR

Description

TXCR sets the value of the command/response bit of the frame being transmitted.

The value of this varible indicates whether the frame is a command or a response, from a network or a subscriber. It has the following valid values:

	NETWORK	SUBSCRIBER
COMMAND	1	0
RESPONSE	0	1

TXCR Values

Type

Variable

Syntax

(See example below.)

Abbreviation

TXC.

See Also

TRAN, TXFCTL

Example

```
10 TXCR = 1
20 TRAN
!RUN   <RETURN>
```

TXSAPI

Description TXSAPI sets the value of the Service Access Point Identifier (SAPI) for the frame being transmitted.

Type Variable

Syntax (See example below.)

Abbreviation TXS.

See Also TRAN, TXFCTL, SET

Example

```
10 TXSAPI = RXSAPI
20 TRAN
!RUN   <RETURN>
```

TXTEI

Description TXTEI is a variable that defines the Terminal End Point Identifier (TEI) for the frame being transmitted. It is used with extended addressing.

Type Variable

Syntax (See example below.)

Abbreviation TXT.

See Also TRAN, TXFCTL

Example

```
10 TXTEI = 03
20 TRAN
!RUN   <RETURN>
```

FRAMEM LAPD SAMPLE PROGRAMS

FLAPD1

The following sample program is specific to FRAMEM LAPD. It builds and displays LAPD frames.

10 FLUSH	Clears the program buffer.
20 CLEAR	Clears trace buffer.
30 EXTEND	Sets extended addressing.
40 MOD128	Sets modulo to 128.
60 TXSAPI=16	Assigns a SAPI for the frame.
70 TXTEI =03	Assigns a TEI for the frame.
80 TXCR=1	Sets the C/R bit to 1.
90 TXP/F=1	Sets the poll/final bit to 1.
100 TRAN	Transmits the frame.
110 TXFCTL=IFRAME	Start building an I-frame.
120 TXN(R)=1	Sets N(R) to 1.
130 TXN(S)=3	Sets N(S) to 3.
140 TXP/F=0	Sets the poll/final bit to 0
150 TXIFIELD=ASC>IFI	Assigns an ASCII value to the I-field of the frame.
160 BADTRAN	Transmits frame with a bad CRC.
170 TPRINT	Display contents of trace buffer.

!RUN <RETURN>

The result of the TPRINT command is shown below. The first line is the frame transmitted by the TRAN command in line 100. The second line is the frame transmitted by the BADTRAN command in line 160 (shows a ? for the bad CRC).

```
T   00:28:04:60:10    4   C/R=01  SAPI=10  TEI = 03  P  IFRAME  N(S)=0  N(R)=0
T ? 00:28:04:60:10    7   C/R=01  SAPI=10  TEI = 03     IFRAME  N(S)=3  N(R)=1  49  46  49
```

FLAPD2

The following sample program receives frames and determines whether or not they are valid commands or response frames.

`10 DEFINE "NET" = 1`	Define mnemonic for network.
`20 REC`	Receive a frame.
`30 IF RXFRLEN = 0 GOTO 20`	If no frame received, loop to receive again.
`40 IF CRC = 1 GOTO 20`	If bad CRC, loop to receive again.
`50 IF RXCR = NET GOTO 140`	If C/R bit is 1, check for command type. Otherwise, check for type of response frame received.
`60 IF RXFCTL = RR GOTO 240`	If frame received is a response, display message on line 240.
`70 IF RXFCTL = RNR GOTO 240`	
`80 IF RXFCTL = REJ GOTO 240`	
`90 IF RXFCTL = FRMR GOTO 240`	
`100 IF RXFCTL = UA GOTO 240`	
`110 IF RXFCTL = DM GOTO 240`	
`120 PRINT "INVALID RESPONSE"`	
`130 GOTO 20`	Loop to receive again.
`140 IF RXFCTL=SABM GOTO 220`	If frame received is a command, display message on line 220.
`150 IF RXFCTL = SABME GOTO 220`	
`160 IF RXFCTL = DISC GOTO 220`	
`170 IF RXFCTL = UI GOTO 220`	
`180 IF RXFCTL = XID GOTO 220`	
`190 IF RXFCTL = IFRAME GOTO 220`	
`200 PRINT "INVALID COMMAND"`	
`210 GOTO 20`	
`220 REM Display message to command`	
`230 REM...`	
`240 REM Display message to response`	
`250 REM...`	

4.6 FRAMEM DMI

Introduction

This section contains specific information about FRAMEM DMI. FRAMEM DMI includes special commands and variables that allow you to test the Digital Multiplexed Interface (DMI) using the Chameleon in conjunction with *TEKELEC*'s TE820A T1/DS1 Frame Simulator/Analyzer.

Using FRAMEM DMI, you can configure your Chameleon to look like a host or a PBX, and simulate DMI Mode 0 communications.

This section assumes that you are familiar with the DMI interface and its operation. For additional information, refer to the appropriate AT&T publication.

Remember that in addition to the commands and variables described in this section, you can also use the BASIC commands described in Section 3.5 and the FRAMEM commands described in Section 4.3.

Setting Up FRAMEM DMI

When you select FRAMEM DMI from the Chameleon main menu, the following screen is displayed:

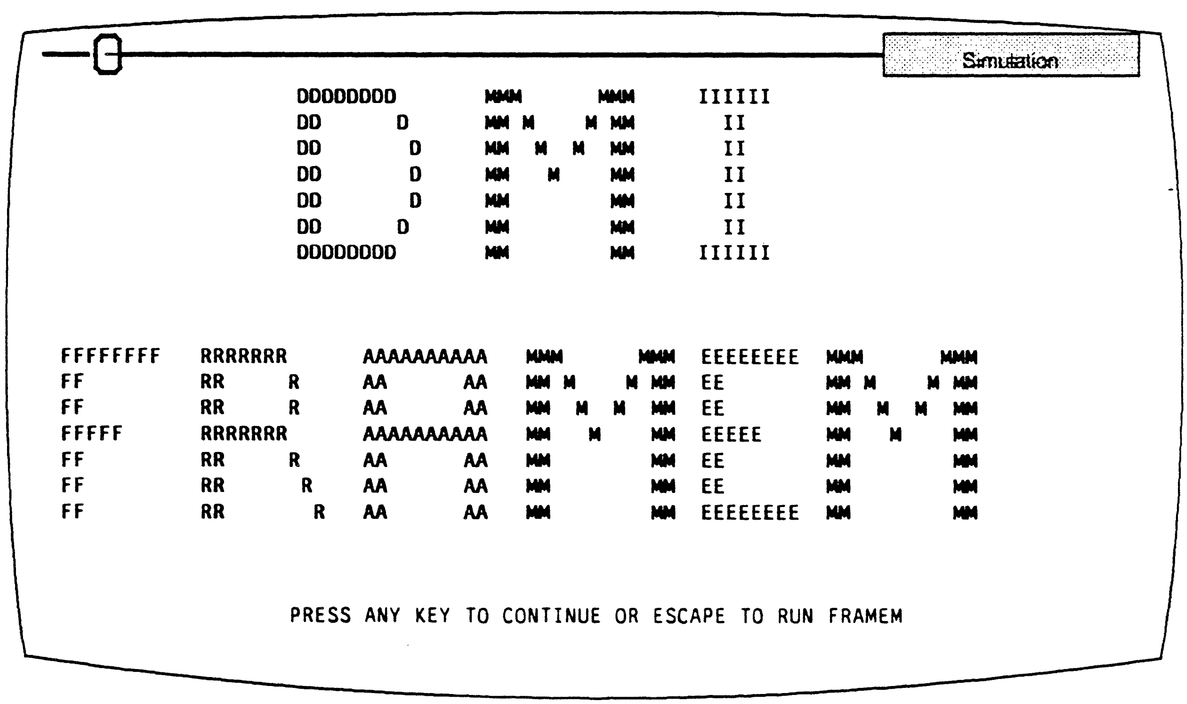


Figure 4.6-1: DMI Screen

1. To run FRAMEM DMI immediately, press the ESC key.

2. To access the on-line help for setup procedures, press any key (other than ESC) when the DMI FRAMEM screen is displayed. This displays on-line documentation for setting up the DMI-BOS dialog. For additional information, refer to the Tekelec 820A User's Manual.

   There are three consecutive screens that describe the equipment you will need for your simulation or analysis application. These screens also provide detailed test setup instructions.

   The bottom of the screen gives you instructions for moving from screen to screen within DMI setup. You can use the following keys:

   - Press **F** to move forward to the next screen
   - Press **B** to move back to the previous screen
   - Press **ESC** to run FRAMEM DMI

3. When you are ready to run FRAMEM DMI, press ESC and the following message is displayed:

   DMI FRAMEM V X.X Copyright 1987 TEKELEC

   This gives you the opportunity to check the software version you are running, where x.x.x is the version number.

4. The FRAMEM simulation prompt (!) appears, indicating that the system is ready to accept commands.

   The FRAMEM DMI commands are listed on the following pages. The first page lists the commands by function. Following that, the commands are listed in alphabetical order, one command per page.

FRAMEM DMI COMMAND INDEX

The commands that are available only in FRAMEM DMI are described in this section. This page lists the FRAMEM DMI commands and variables in tables by function. For a complete description of a command, refer to the page number indicated.

If you are using FRAMEM, you should also read Section 4.3, which contains the commands that are available for all FRAMEM subsets, and Section 3.5, which lists the Chameleon BASIC commands.

TABLE 4.6-2: FRAMEM DMI READ-ONLY VARIABLES

VARIABLE	PAGE	TYPE	FUNCTION
CAUSE	4.6-5	Variable	Returns cause of an on-hook state.
DCALLED	4.6-8	Variable	Returns phone number to be called.
DCALLING	4.6-9	Variable	Returns phone number of received call.
DMATCH	4.6-11	Variable	Returns phone number that will be accepted for incoming calls in Wink mode.
GLARE	4.6-15	Variable	Indicates if a glare condition exists.
RESPTIME	4.6-19	Variable	Determines how busy the switch is.
STATE	4.6-20	Variable	Returns the state of a call and the operating mode.
STATUS	4.6-21	Variable	Returns state of the call, call setup, modulo, addressing, and whether a glare condition exists.

TABLE 4.6-3: FRAMEM DMI COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
CHADMIN	4.6-6	S or D	Defines the call setup mode to use.
CONNECT	4.6-7	S or D	Performs call setup procedures and seizes selected channel on the TE820A.
DISCONNECT	4.6-10	S or D	Causes Chameleon/TE820A to go on-hook.
DTIMERS	4.6-12	S or D	Sets the value of one of the eight DMI timers.
MATCH	4.6-16	S or D	Defines the phone number that will be accepted for incoming calls Wink mode.
OUTNUM	4.6-17	S or D	Defines the number to be dialed.
TPRINT	4.6-22	S or D	Displays the contents of the trace buffer.

CAUSE

Description

CAUSE is a read-only variable that determines the cause of an on-hook state. The valid values and their associated meanings are:

0	Start of simulation
1	Call rejected, no match on address digits
2	No wink received before T1 timeout
3	No off-hook (incoming) before T7 timeout
4	Local disconnect
5	Remote disconnect

Type

Read-only Variable

Syntax

(See example below.)

Abbreviation

C.

See Also

STATUS

Example

```
PRINT CAUSE
```

(result) **4** (The on-hook state was caused by a local disconnect.)

CHADMIN

Description

CHADMIN defines which call setup mode to use. You can only change CHADMIN when you are in a disconnected state. Use the commands PRINT CHADMIN or STATUS to determine the current value of CHADMIN.

Type

Statement or Direct

Syntax

CHADMIN = x

where: **x** is a number between 0 and 3 that represents the call setup mode options, as follows:

0 = Wink-start in/Wink-start out
1 = Auto-start in/Wink-start out
2 = Wink-start in/Auto-start out
3 = Auto-start in/Auto-start out

These setup modes are determined using Table 4.6-3.

BIT #	7	6	5	4	3	2	1(OUT)	0(IN)
	X	X	X	X	X	X	0	0
	X	X	X	X	X	X	0	1
	X	X	X	X	X	X	1	0
	X	X	X	X	X	X	1	1

X = DON'T CARE
0 = WINK-START
1 = AUTO-START

Figure 4.6-4: Setup Mode Bit Values

Abbreviation

CHAD.

See Also

STATUS

Example

```
10 CHADMIN=2
20 STATUS
!RUN
```

(result)
```
DISCONNECTED      START OF SIMULATION
WINK-START-IN      AUTO-START-OUT
Modulo8/Normal addressing
```

CONNECT

Description

The CONNECT command performs call setup procedures and seizes the channel selected on the TE820A. If required, it also transmits the dial pulses that are defined by the OUTNUM variable. It refers to bit zero of the CHADMIN variable to determine the appropriate setup mode.

Type

Statement or Direct

Syntax

CONNECT

Abbreviation

CON.

See Also

OUTNUM, CHADMIN

Example

CONNECT

DCALLED

Description The DCALLED command displays the phone number to be outpulsed (dialed) when a CONNECT command is executed. The outpulsed number is assigned using the OUTNUM command.

Type Read-Only Variable

Syntax **DCALLED**

Abbreviation DC.

See Also CONNECT, OUTNUM, DCALLING

Example

```
DCALLED
```

(result) **NUMBER TO BE CALLED** = 8188805656

DCALLING

Description The DCALLING command displays the numbers inpulsed (received).

Type Read-only Variable

Syntax **DCALLING**

Abbreviation DCALLI.

See Also DCALLED

Example `DCALLING`

(result) **`NUMBER RECEIVED =8188805656`**

DISCONNECT

Description DISCONNECT causes the Chameleon/TE820A to go on-hook. The DISCONNECT command resets the acquisition buffer.

Type Statement or Direct

Syntax **DISCONNECT**

Abbreviation DI.

See Also CONNECT

Example DISCONNECT

DMATCH

Description

DMATCH displays the number the Chameleon will accept for incoming calls in Wink mode. The number is defined using the MATCH variable.

Type

Read-only Variable

Syntax

DMATCH

Abbreviation

DM.

See Also

DCALLING

Example 1

```
DMATCH
```

(result) **NUMBER TO BE MATCHED =ANY NUMBER IS ACCEPTABLE**

Example 2

This example defines the number to accept for incoming calls and then displays the number using DMATCH.

```
10 MATCH"8188805656"
20 DMATCH
!RUN  <RETURN>
```

(result) **NUMBER TO BE MATCHED =8188805656**

DTIMERS

Description

The DTIMERS command displays the current timer settings. FRAMEM DMI has eight timers that you can program while you are in a disconnected state. These timers are:

TIMER	FUNCTION
T1	Time between an incoming seizure and the start of the outgoing wink, or the maximum time allowed in waiting for an incoming wink.
T2	Duration of the wink signal.
T3	Time between the end of the wink signal and the first dial pulse.
T4	The duration of a break pulse (used in dialing).
T5	The duration of a make pulse (used in dialing).
T6	Inter-digit time (used in dialing).
T7	Dialing timeout. The time between the last dial pulse and the issue of an outgoing offhook, or the maximum time allowed in waiting for an incoming offhook signal once the last dial pulse is sent.
T8	Minimum disconnect time.

Figure 4.6-5: FRAMEM DMI Timers

Figures 4.6-6, 4.6-7, and 4.6-8 illustrate the time periods associated with the eight DMI timers.

Type

Read-only Variable

Syntax

DTIMERS

To set a timer value, use the following syntax:

Tx = yy

where: **x** is the timer number in the range 1 - 8 and **yy** is the timer value in the range 1 - 99. T1 - T6 and T8 are in units of tens of milliseconds (.0001). T7 is in units of seconds.

Abbreviation

DT.

Example

This example sets values for the T1 and T2 timers and then displays the values of all timers.

```
10 T1=15
20 T2=25
30 DTIMERS
!RUN   <RETURN>
```

(result)

```
T1 - TIME BETWEN SEIZURE & START OF WINK                  =15
T2 - DURATION OF WINK SIGNAL                              =25
T3 - TIME BETWEEN END OF WINK & FIRST DIAL PULSE          =07
T4 - DURATION OF BREAK PULSE                              =06
T5 - DURATION OF MAKE PULSE                               =04
T6 - INTER-DIGITAL INTERVAL                               =60
T7 - DIALING TIME-OUT INTERVAL (seconds)                  =10
T8 - MINIMUM DISCONNECT TIME                              =42
```

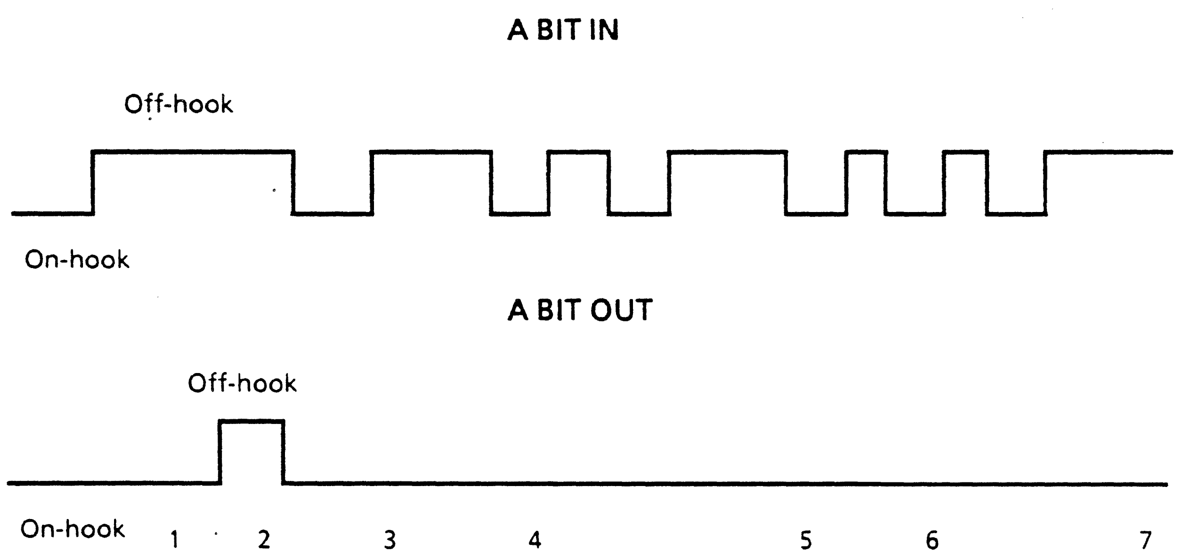


Figure 4.6-6: Wink (Normal)

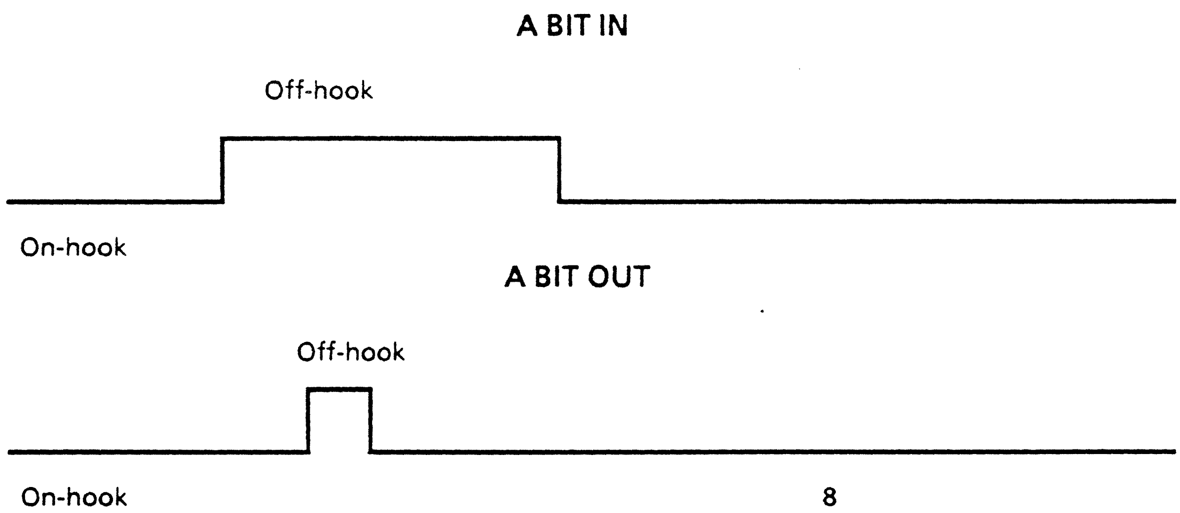


Figure 4.6-7: Wink (Abnormal) Time Period

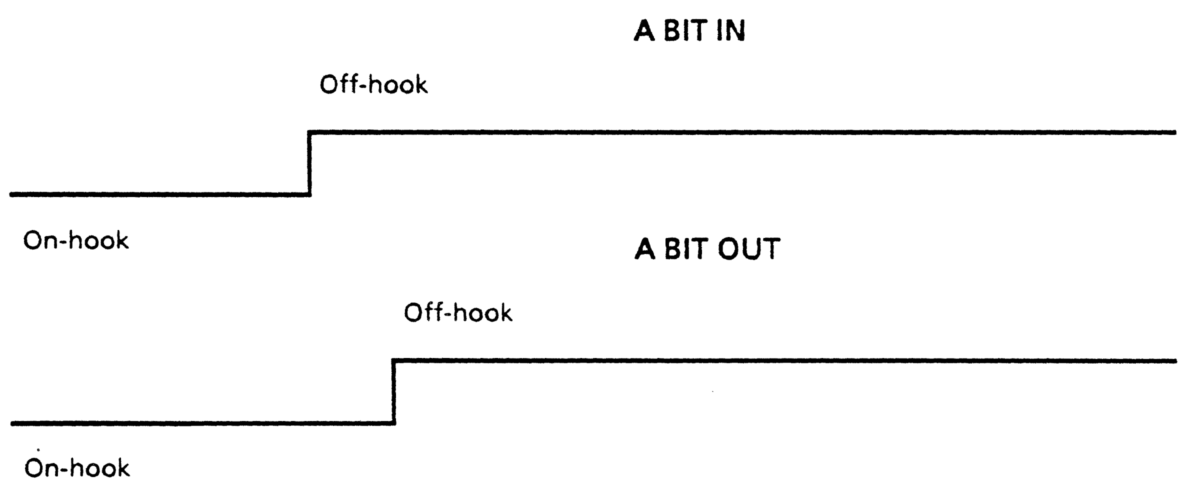


Figure 4.6-8: Auto (Normal) Time Period
*In auto-start, if no off-hook is received after T1, disconnect

GLARE

Description

GLARE is a read-only variable that determines whether a glare condition exists. This variable is relevant only when the system is in a CONNECTED state. The Chameleon automatically handles glare resolution according to the DMI specifications.

GLARE has the following values:

GLARE = **0**	No glare condition exists.
GLARE = **1**	Glare condition exists.

The GLARE variable is reset to 0 after DISCONNECT.

Type

Read-only Variable

Syntax

(See example below.)

Abbreviation

G.

See Also

STATUS

Example 1

```
PRINT GLARE
```

(result) **0**

Example 2

```
IF GLARE = 0 PRINT "NO GLARE CONDITION"
```

MATCH

Description

MATCH specifies which incoming calls will be accepted. It is only relevant when you have wink start-in mode.

Type

Statement or Direct

Syntax

MATCH = "x"

where: **x** is a valid incoming telephone number.

To accept any call enter double quotation marks without specifying a number:

MATCH = ""

Abbreviation

MA.

See Also

DMATCH

Example 1

This example assigns 880-5656 as the number which will be accepted for incoming calls.

```
10 MATCH="8805656"
20 DMATCH
!RUN   <RETURN>
```

(result) **NUMBER TO BE MATCHED =8805656**

Example 2

This example allows any number to be accepted for incoming calls.

```
10 MATCH = ""
20 DMATCH
!RUN   <RETURN>
```

(result) **NUMBER TO BE MATCHED =ANY NUMBER IS ACCEPTABLE**

OUTNUM

Description

OUTNUM sets the number to be outpulsed (dialed).

Type

Statement or Direct

Syntax

OUTNUM = "x"

$A = "x"
OUTNUM = $A

where: **x** is the phone number to be dialed, with a maximum of 30 digits in length.

Abbreviation

OU.

See Also

DCALLED

Example

```
10 OUTNUM="8805656"
20 DCALLED
!RUN   <RETURN>
```

(result) **NUMBER TO BE CALLED =8805656**

RESET

Description The RESET command clears the acquisition buffer, the buffer that receives data from the line. It also resets the state of the call to its start of simulation disconnected state.

Type Statement or Direct

Syntax **RESET**

Abbreviation None

See Also CLEAR, REC

Example

```
RESET
```

RESPTIME

Description

RESPTIME is a read-only variable that determines how busy your switch is. In wink-start mode, it displays the time between an outgoing seizure and the start of an incoming wink signal. In Auto-Start mode, it displays the time from the outgoing seizure and the incoming off-hook.

Type

Read-only Variable

Syntax

(See example below.)

Abbreviation

RE.

Example 1

```
PRINT RESPTIME
```

Example 2

```
IF RESPTIME>50 PRINT "SLOW RESPONSE TIME."
```

STATE

Description

STATE is a read-only variable that determines the state of a call (connected or disconnected) and the operating mode (wink-start in/wink-start out, auto-start in/wink-start out, wink-start in/auto-start out or auto-start in/auto-start out).

The valid values for STATE and their meaning are:

1 Disconnected (on-hook) xxxxxx (**xxxxxx** is the cause)
2 Outgoing setup (i.e. exchanging winks)
3 Incoming setup
4 Dial pulses being received
5 Dial pulses being sent
6 Connected

You can display the state of the call and the call setup mode using the STATUS.

Type

Read-only Variable

Syntax

(See examples below.)

Abbreviation

ST.

See Also

STATUS

Example 1

```
PRINT STATE
```

(result) **5**

Example 1

```
IF STATE = 6 PRINT "CALL CONNECTED"
```

(result) **CALL CONNECTED**

STATUS

Description

STATUS displays the state of the call, the call setup mode, the modulo (8 or 128), and type of addressing (normal or extended). It also indicates if a glare condition exists.

Type

Read-only Variable

Syntax

STATUS

Abbreviation

STA.

See Also

STATE

Example

```
!STATUS
```

(result)

```
DISCONNECTED  NO OFF HOOK BEFORE T7
WINK-START-IN   AUTO -START-IN
Modulo8/Normal Addressing
```

TPRINT

Description TPRINT displays the contents of the trace buffer. The format of the trace buffer display is shown below.

Type Statement or Direct

Syntax **TPRINT**

Abbreviation TP.

See Also TSAVE, TLOAD

Example

```
!TPRINT
```

(result)

FRAMEM DMI SAMPLE PROGRAMS

Program DMI1

This program sets up and transmits a call, using the OUTNUM command.

`10 $A = "123456"`	Assigns number to $A.
`20 OUTNUM = $A`	Specifies $A as number to be outpulsed.
`30 CONNECT`	Seizes channel and transmits the dial pulses defined above.
`40 IF STATE#6 GOTO 40`	Stays here until connected.
`50 TXFCTL = SABM`	Defines SABM to be transmitted.
`60 TRAN`	Transmits the frame.

Program DMI2

This program places a call and sends a string of decimal numbers to be transmitted down the line.

`10 FOR A = 0 TO 9`	Sets up loop A to repeat 10 times, to genrate 10 telephone numbers.
`20 $A = ""`	Initializes string variable $A.
`30 FOR B = 1 TO 9`	Sets up loop B to repeat A 9 times to generate a 9-digit phone number.
`40 $A = $A+DEC$(A)`	Assigns number to $A.
`50 NEXT B`	Increments loop B counter.
`60 OUTNUM = $A`	Number to be outpulsed is $A.
`70 GOSUB 1000`	Executes subroutine at line 1000.
`80 NEXT A`	Increments A to generate a different telephone number.
`90 STOP`	Stops program when A > 9.
`1000 CONNECT`	Seizes a channel and transmits.
`1010 IF STATE#6 GOTO 1010`	Waits until connected.
`1020 DISCONNECT`	Disconnects call.
`1030 RETURN`	Ends subroutine. Returns to line 80.

Program: DMI3

This program checks and displays the status of the line.

`10 A=0`	Sets A to 0.
`20 CLS`	Clears the screen.
`30 IF A = STATE GOTO 30`	If state doesn't change, stays at 30.
`40 A = STATE`	Sets A to the value of state.
`50 XYPLOT(10,1)`	Positions cursor on line 10.
`60 ERAEOL`	Erases to end of line.
`70 XYPLOT(9,1)`	Positions cursor on line 9.
`80 STATUS`	Displays state of line.
`90 GOTO 30`	Determines if the state has changed.

Program DMI4

This program accepts and displays incoming numbers.

`10 A = 0`	Sets A to 0.
`20 CLS`	Clears the screen.
`30 IF STATE=4 GOTO 70`	If dial pulse being received, go to 70.
`40 IF A=STATE GOTO 40`	If state doesn't change, stays at 40.
`50 A=STATE`	Sets A to the value of state.
`60 GOSUB 100`	Executes subroutine starting at 100.
`70 GOSUB STATE*1000`	Execute subroutine depending on state of call.
`80 GOTO 30`	After subroutine, returns to this line which goes to line 30.
`100 XYPLOT(5,1)`	Positions cursor on line 5.
`110 ERAEOL`	Erases text on line 5.
`120 RETURN`	Ends subroutine.
`1000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`1010 PRINT "Disconnected"`	Prints message
`1020 GOTO 3020`	Goes to line 3020.
`2000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`2010 PRINT "OUTGOING SETUP"`	Prints message
`2020 RETURN`	Ends subroutine.
`3000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`3010 PRINT "INCOMING SETUP"`	Prints message.
`3020 XYPLOT(7,0)`	Positions cursor on line 7, column 0.
`3030 ERAEOL`	Erases text on line 7.
`3040 RETURN`	Ends subroutine.
`4000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`4010 PRINT "RECEIVING DIAL PULSES"`	Prints message.
`4020 XYPLOT(6,1)`	Positions cursor on line 6, column 1.
`4030 DCALLING`	Displays the inpulsed number.
`4040 RETURN`	Ends subroutine.
`5000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`5010 PRINT "SENDING DIAL PULSES"`	Prints message.
`5020 XYPLOT(6,1)`	Positions cursor on line 6, column 1.
`5030 DCALLED`	Displays the outpulsed number.
`5040 RETURN`	Ends subroutine.
`6000 XYPLOT(5,5)`	Positions cursor on line 5, column 5.
`6010 PRINT "CONNECTED"`	Prints message.
`6020 RETURN`	Ends subroutine.

5.1 INTRODUCTION TO SIMP/L

Introduction

Simulated Interactive Multi-Protocol Language (SIMP/L) is a highly flexible programming language designed for engineers working in SNA/SDLC, X.25/HDLC, LAPD, or developing non-standard hybrid protocols.

SIMP/L Function

SIMP/L allows you to create mnemonic tables with automatic level 1 and 2 support. The sophisticated SIMP/L software handles frame level specifications automatically, including:

- Address and control fields
- CRC generation
- Lower level physical interface
- Link control
- Frame generation and reception
- Command and response generation

Link Level

You can use SIMP/L to emulate any protocol which uses an HDLC, SDLC, or LAPD link level. You configure the automatic link level by using the parameter set-up menu and SIMP/L commands. This allows you to concentrate on higher levels without investing large amounts of time on the link level.

Using SIMP/L

Sections 5.2 and 5.3 describe the commands and variables that are available for all SIMP/L protocol subsets. For this reason, you should read Sections 5.2 and 5.3 regardless of the protocol you are using.

In addition there are three protocol subsets of SIMP/L that make use of commands and variables that are specific to the protocol. You should also read the section that corresponds to the protocol you are using, as follows:

- Section 5.4 - SIMP/L HDLC
- Section 5.5 - SIMP/L SDLC
- Section 5.6 - SIMP/L LAPD
- Section 5.7 - Multi-Link SIMP/L LAPD
- Section 5.8 - SIMP/L V.120

Remember that the Chameleon BASIC commands and variables are part of SIMP/L. These are described in Section 3.5.

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

5.2 SIMP/L COMMAND INDEX

Introduction

This section lists by functionthe commands and variables that are common to all protocol subsets of SIMP/L. For more information about a particular SIMP/L command, refer to the page number indicated.

There are also commands and variables that are specific to each protocol subset of SIMP/L. Refer to the appropriate section for a description of these.

TABLE 5.2-1: SIMP/L MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
DEFINE	5.3-5	S or D	Defines a mnemonic for the mnemonic table in memory.
SET	5.3-12	S or D	Assigns values to protocol-specific timers and parameters.
SLOF	5.3-13	S or D	Sets the link off.
SLON	5.3-14	S or D	Sets the link on.

TABLE 5.2-2: SIMP/L PRINT AND DISPLAY COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
LRDISPF	5.3-8	S or D	Outputs the last data field received to a printer or remote device.
LTDISPF	5.3-9	S or D	Outputs the last data field built to a printer or remote device.
RDISPF	5.3-10	S or D	Displays the last data field received.
TDISPF	5.3-16	S or D	Displays the last data field built.
TPRINT	5.3-17	S or D	Displays the contents of the trace buffer.

TABLE 5.2-3: SIMP/L TRANSMISSION AND RECEPTION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
BREAK	5.3-2	S or D	Breaks a message into mnemonics and/or strings.
BUFFER	5.3-3	S or D	Assembles a message in hex.
BUILD	5.3-4	S or D	Assembles a message from mnemonics and/or strings.
REC	5.3-11	S or D	Receives a message.
TRAN	5.3-18	S or D	Transmits a message.

TABLE 5.2-4: SIMP/L READ-ONLY VARIABLES

VARIABLE	PAGE	TYPE	FUNCTION
LENGTH	5.3-6	Variable	Returns the length of the received frame.
LNKSTAT	5.3-7	Variable	Returns a value that indicates the status of the link.
STATUS	5.3-15	Variable	Returns status of the link, timer values, and protocol-specific parameter settings.

5.3 SIMP/L COMMANDS

Introduction

This section provides a complete description of the SIMP/L commands. The commands are organized alphabetically, one command per page.

If you know the name of the command you want to use, you can look up the command in this section. If you are unsure of the command you need, refer to the previous section which lists the commands by function.

The following information is provided in this section:

- Command description
- Type of command (Statement or Direct)
- Syntax
- Command abbreviation
- Related commands (See Also)
- Example(s) of command usage

BREAK

Description

BREAK disassembles an I-field into its component strings and/or user-defined mnemonics.

Type

Statement or Direct

Syntax

BREAK udm,udm,udm

BREAK $A,$B,$C...

BREAK udm,$A,$B,udm,$C...

where: **udm** is a user-defined mnemonic. Refer to Chapter 3.2 for general information about the use of mnemonics. Refer to the protocol chapter for a description of the mnemonic table for a particular SIMP/L protocol.

Abbreviation

BR.

See Also

BUILD

Example

This example breaks an I-field into General Format Identifier (GFI), Logical Channel Group Number (LCGN), Logical Channel Number (LCN) and Packet Identifier (PKIDNT).

`10 GFI=4`
`20 LCGN=4`
`30 LCN=8`
`40 PKID=8`
	Lines 10-40 defines the mnemonics that will be used to disassemble the frame.

`50 SLON`	Sets the link on to establish link level.
`60 REC`	Attempts to receive a frame.
`70 IF LENGTH=0 GOTO 60`	Loops until an I-frame is received.
`80 BREAK GFI,LCGN,LCN,PKID`	Disassembles the received frame using the defined mnemonics.
`90 PRINT GFI,LCGN,LCN,PKID`	Displays the mnemonic values.
`100 SLOF`	Disconnects the link.

BUFFER

Description

BUFFER defines a message for the transmission buffer in hexadecimal code.

Type

Statement or Direct

Syntax

BUFFER = xxx

where: **xxx** is the message. You can enter blank spaces between every two characters without affecting the transmission in hexadecimal. Spaces added elsewhere cause single digits to be interpreted independently (see Example 2 below).

Abbreviation

BUF.

See Also

TRAN, TPRINT

Example 1

To assign 12 34 56 78 09 to the transmission buffer, you can enter either of the examples below:

```
BUFFER = 123456789

BUFFER = 12 34 56 78 9
```

Example 2

To transmit 01 02 34 56 78 9, you would enter:

`10 BUFFER = 1 2 34 56 78 9`	Defines the message to be transmitted.
20 TRAN	Passes the contents of the buffer to link level for transmission.

BUILD

Description

BUILD assembles a message in the transmission buffer using the information defined in strings and/or user-defined mnemonics.

Refer to Section 3.2 for general information about using mnemonics. Refer to the appropriate section in this chapter for a description of the mnemonic table for a particular SIMP/L protocol.

Type

Statement or Direct

Syntax

BUILD udm,udm,udm...

BUILD $A,$B,$C...

BUILD udm,$A,$B,udm,$C...

where: **udm** is a user-defined mnemonic.

Abbreviation

BU.

See Also

BREAK

Example

This example builds a message using two strings.

`10 $A = "HELLO"`	Assigns a value to string $A.
`20 $B = "GOODBYE"`	Assigns a value to string $B.
`30 BUILD $A,$B`	Builds a message using $A and $B.
`40 TRAN`	This will pass the string HELLOGOODBYE to the link level for transmission.

DEFINE

Description

DEFINE defines a new frame control mnemonic or redefines an existing mnemonic. Refer to Section 3.2 for a general description of the use of menmonics in simulation. Refer to the appropriate section in this chapter for a description of the default mnemonic table for the protocol you are using.

Type

Statement or Direct

Syntax

DEFINE"name" = x

where: **name** is a mnemonic name of one to six characters and **x** is any valid expression that defines the field width in bits. The maximum value of **x** is 16.

Abbreviation

DEF.

See Also

DELETE, MLIST, MSAVE, MLOAD

Example

This example defines a mnemonic named NEW with a length of 16 bits. The table is then displayed to verify the new entry.

```
10 DEFINE"NEW" = 16
20 MLIST
```

The mnemonic table is displayed, including the entry:

```
NEW          16
```

The mnemonic can then be used to assemble messages for transmission or disassemble received messages. Refer to the Example for the BREAK command on page 5.3-2.

LENGTH

Description

LENGTH is a read-only variable that returns the length of the received frame. It is updated following the REC command. If no frame is available, the length is zero.

Type

Variable

Syntax

(See examples below.)

Abbreviation

LENG.

See Also

REC

Example 1

This example displays the current value of LENGTH.

```
PRINT LENGTH
```

Example 2

This example attempts to receive a frame. If no frame is available, it loops to receive again.

```
10 REC
20 IF LENGTH = 0 GOTO 10
30 REM The following statements process the received data
40...
50...
```

LNKSTAT

Description

LNKSTAT is a read-only variable that returns a value that indicates the current status of the link. The status indicated by the value is protocol-specific. For more information, refer to the SIMP/L section that corresponds to the protocol you are using.

LRDISPF

Description
LRDISPF outputs the last data field received to a printer or remote device. The last data field received is stored in a special reception buffer. For more information about simulation buffers, refer to Section 3.2.

Type
Statement or Direct

Syntax
LRDISPF

Abbreviation
LRD.

See Also
RDISPF, TDISPF, LTDISPF

Example
```
LRDISPF
```

LTDISPF

Description

LTDISPF outputs the last data field built to a printer or remote device. The last data field built is stored in a special transmission buffer. For more information about simulation buffers, refer to Section 3.2.

Type

Statement or Direct

Syntax

LTDISPF

Abbreviation

LTD.

See Also

TDISPF, RDISPF, LRDISPF

Example

```
LTDISPF
```

RDISPF

Description

RDISPF displays the last data field received. The last data field received is stored in a special reception buffer. For more information about simulation buffers, refer to Section 3.2.

Type

Statement or Direct

Syntax

RDISPF

Abbreviation

RDIS.

See Also

LRDISPF, TDISPF, LTDISPF

Example

```
RDISPF
```

REC

Description

REC transfers the next message in sequence from the reception buffer to the trace buffer. It also updates the read-only variable LENGTH, which returns the length of the received message.

Refer to Section 3.2 for a description of simulation buffers.

Type

Statement or Direct

Syntax

REC

Abbreviation

None

See Also

TPRINT, RDISPF, LRDISPF, LENGTH

Example

This example receives a frame, disassembles it using mnemonics, and prints the mnemonic values.

`10 GFI=4`	
`20 LCGN=4`	
`30 LCN=8`	
`40 PKIDNT=8`	Lines 10-40 defines mnemonics for X.25 protocol elements.
`50 SLON`	Sets the link on to establish link level.
`60 REC`	Attempts to receive a frame.
`70 IF LENGTH=0 GOTO 60`	Loops until an I-frame is received.
`80 BREAK GFI,LCGN,LCN,PKIDNT`	Disassembles received frame using defined mnemonics.
`90 PRINT GFI,LCGN,LCN,PKIDNT`	Displays mnemonic values.
`100 SLOF`	Disconnects the link.

SET

Description

The SET command sets the value of SIMP/L variables, counters, and timers. Since the variables, counters, and timers are protocol-specific, refer to the SIMP/L section that describes the protocol you are using for a description of the syntax.

SLOF

Description

The SLOF (Set Link Off) command disconnects the link by sending a disconnect (DISC) frame.

Type

Statement or Direct

Syntax

SLOF

Abbreviation

None

See Also

SLON

Example

This example sets the link on, receives a frame, disassembles the frame, and then sets the link off.

`10 GFI=4`	
`20 LCGN=4`	
`30 LCN=8`	
`40 PKIDNT=8`	Lines 10-40 defines mnemonics for X.25 protocol elements.
`50 SLON`	Sets the link on to establish link level.
`60 REC`	Attempts to receive a frame.
`70 IF LENGTH=0 GOTO 60`	Loops until an I-frame is received.
`80 BREAK GFI,LCGN,LCN,PKIDNT`	Disassembles the received frame into the protocol elements.
`100 SLOF`	Disconnects the link.

SLON

Description	The SLON (Set Link On) command attempts to set the frame level link by sending a SABM (HDLC or LAPD), SABME (LAPD Mod 128), or SNRM (SDLC).
Type	Statement or Direct
Syntax	**SLON**
Abbreviation	SL.
See Also	SLOF
Example	`SLON`

STATUS

Description

The STATUS command displays the current link status and the values of the variables, counters, and timers. Since the variables, counters, and timers are protocol-specific, refer to the SIMP/L section that describes the protocol you are using for a description of the STATUS display.

TDISPF

Description

The TDISPF command displays the last data field built. The last data field built is stored in a special transmission buffer. For more information about simulation buffers, refer to Section 3.2

Type

Statement or Direct

Syntax

TDISPF

Abbreviation

TDIS.

See Also

LTDISPF, RDISPF, LRDISPF, BUILD

Example

```
10 $A="HELLO"
20 $B="GODBYE"
30 BUILD $A,$B
40 TDISPF
```

Result: 48454C4C4F474F4F44425945

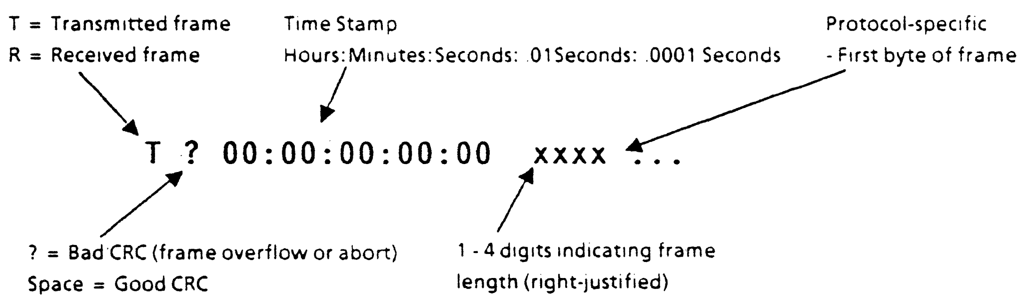
TPRINT

Description

The TPRINT command displays the contents of the trace buffer, which stores the transmitted and received traffic (following a REC command). The format of the display is protocol-specific. Refer to the appropriate SIMP/L for a description of the TPRINT display for the protocol you are using.

You can stop the list using CTRL S. Resume the list with CTRL Q. Abort using the ESC key.

The trace buffer display is protocol-specific. The general format of the trace buffer display is as follows:



Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TLOAD, TSAVE, LTPRINT

Example

(See protocol-specific sections for examples.)

TRAN

Description

The TRAN command transmits a message which was built using the BUILD command. The link must be established (using SLON) before you use TRAN.

Type

Statement or Direct

Syntax

TRAN

Abbreviation

TR.

See Also

BUILD, SLON

Example

```
10 $A="HELLO"
20 BUILD $A
30 TRAN
```

5.4 SIMP/L HDLC

General Characteristics

The general characteristics for SIMP/L HDLC are as follows:

- Full duplex
- Bit rate up to 64 Kbps with clocks received or supplied
- Maximum frame length of 512 bytes
- Maximum number of outstanding frames is 7
- Line code is NRZ or NRZI
- Simulation of DCE or DTE
- CRC CCITT standards
- The frame level conforms to the CCITT X.25 standard of June 1980 (LAPB only)
- Emulate a network or subscriber

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

There are eight possible states in the frame level which can be displayed using the STATUS command or the LNKSTAT command. The LNKSTAT command (page 5.4-6) describes each of these states.

HDLC Frame Format

Figure 5.4-1 illustrates the format of an HDLC frame.with the field widths in bits indicated.

FLAG	ADDRESS	CONTROL FIELD	I-FIELD	FRAME CHECK SEQUENCE	FLAG
8	8 or 16	8 or 16		16	8

Figure 5.4-1: Frame Format

The opening and closing **flags** signal the end of the preceding frame and the beginning of the next frame, or is transmitted as fill time between multiple frames. A flag has the unique bit pattern: 0111 1110.

The **Address Field** contains the address of the station that is receiving a command or sending a response to a command.

The **Frame Check Sequence** (FCS) determines if the data in the packet was received without error. It is a16-bit Cyclic Redundancy Check (CRC) that is calculated from the data.

The **Control Field** contains 8 bits which identify the type of frame being transmitted, as indicated in the figure below.

Format	Commands	Responses	Encoding							
			1	2	3	4	5	6	7	8
Information transer	I (information)		0	N(S)			P	N(R)		
Supervisory	RR (receive ready)	RR (receive ready)	1	0	0	0	P/F	N(R)		
	RNR (receive not ready)	RNR (receive not ready)	1	0	1	0	P/F	N(R)		
	REJ (reject)	REJ (reject)	1	0	0	1	P/F	N(R)		
Unnumbered	SARM (set asynchronous response mode)	DM (disconnected mode)	1	1	1	1	P/F	0	0	0
	SABM (set asynchronous balanced mode)		1	1	1	1	P	1	0	0
	DISC (disconnect)		1	1	0	0	P	0	1	0
		UA (unnumbered acknowledgement)	1	1	1	1	F	1	1	0
		CMDR (command reject) FRMR (frame reject)	1	1	1	0	F	0	0	1

Table 5.4-2: HDLC Frame Formats

SIMP/L HDLC PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the SIMP/L HDLC menu. This menu (see figure below) enables you to configure and save parameters for running SIMP/L HDLC simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu (option S), refer to Section 2.3.

```
                                                                    Simulation
                     - SIMP/L HDLC PARAMETER SET-UP MENU -
A.- Simulate. . . . . . . . .  :  DCE                  F.- T1  . . . . .  : 200  Seconds
B.- Data Encoding  . . . .     :  NRZ                  G.- N1  . . . .    : 404
C.- Bit Rate . . . . . . . . . :  2400                 H.- N2  . . . .    : 1
D.- Station Type  . . . . .    :  NETWORK
E.- Frame Window  . . . .      :  1

= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
SELECT: >                                       CHOICES:
INPUT:    SELECT a letter (A-H)
          or type an option key shown below

   Z = Run SIMP/L HDLC      ? = Help,      S = Save parameters,      ESC = Main Menu
```

Figure 5.4-3: The SIMP/L HDLC Parameter Set-Up Menu

The eight parameters and valid settings are listed below. Each parameter is described on the next page.

A. Simulate	DCE DTE
B. Data Encoding	NRZ NRZI
C. Bit Rate	Received (if DTE) Range: 50 - 64000 bits (if DCE)
D. Station Type	NETWORK SUBSCRIBER
E. Frame Window	Range: 1 - 7 frames
F. T1	Range: 1 - 255 seconds
G. N1	Range: 1 - 512 bytes
H. N2	Range: 1 - 255 retransmissions

If you are unfamiliar with these parameters, use the following guidelines for assistance in selecting the correct settings.

Simulate:
DCE/DTE

The DCE furnishes the clock which determines the data rate. It also determines on which connector pins the data is physically sent and received. For Simulation, one device is designated as the DCE; the other device is designated as a DTE.

If the Unit Under Test (UUT) is supplying the clock, it is the DCE. In this case, the Chameleon must be configured as a DTE. If the UUT is not supplying the clock, it is designated as a DTE. The Chameleon must then be configured as the DCE.

Data Encoding:
NRZ/NRZI

This parameter determines if the data is transmitted in NRZ (Non-Return to Zero) or NRZI (Non-Return to Zero Inverted) format. This is a function of the relative voltage on the data line, representing the 'MARK' and 'SPACE' levels. This parameter determines whether a 'MARK' is represented by a high or low level.

Configure the Chameleon to use the same data encoding format as the (UUT).

Bit Rate

The bit rate determines the speed that the Chameleo 32 will transmit data. If the Chameleon is configured as the DTE, the bit rate is automatically set to RECEIVE. This means that the Chameleon will send data at the same rate as the data it receives, thus matching the speed set by the UUT.

If the Chameleon is configured as the DCE, it is responsible for setting the bit rate. The valid range is 50 - 64000 bits per second.

Station Type:
Network/
Subscriber

This parameter determines if the Chameleon is acting as a subscriber (terminal) or as a network device. One device (either the UUT or the Chameleon) is designated the network device and the other device is designated the subscriber device.

This setting determines the value of the Command/Response (C/R) bit. The C/R bit is set to 1 for commands from and responses to the network side of the link. The C/R bit is set to 0 for commands from and responses to the subscriber side of the link.

If the UUT is acting as a network device, configure the Chameleon as a subscriber device. If the UUT is acting as a subscriber device, configure the Chameleon as a network device. This parameter can be changed under program control using the SET command so that you can test the ability of the UUT to ignore commands from like devices.

Frame Window:
1-7 Frames

The Frame Window determines the maximum number of sequentially numbered I-frames which the Chameleon can have outstanding (unacknowledged) at any given time.

This parameter can be overridden under program control using the SET WINDOW command.

T1:
1 - 255 Seconds

T1 is the TI timer that is started by the station when it sends a command frame. If T1 expires before the station receives a response, it retransmits the message and restarts the timer. The maximum number of retransmissions is determined by the value of N2. Following an N2 re-transmission, the station will take an appropriate recovery action.

T1 is in units of seconds, in the range 1 - 255. This parameter can be overridden under program control using the SET T1 command.

N1:
1 - 512 Bytes

N1 defines the maximum number of bytes that can be in a transmitted or received frame.

When the Chameleon transmits or receives a frame from the line, it checks the value of N1. If the Chameleon receives a frame longer than N1, it automatically sends an FRMR. If you attempt to BUILD a frame which is longer than the value of N1, an error message is displayed.

N1 is within the range 2 to 512 bytes. This parameter can be overridden under program control using the SET N1 command.

N2: 1 - 255
Retransmissions

N2 defines the maximum number of frame re-transmissions that can occur after successive lapses of the T1 timer, before deciding that the receiving device is not going to respond.

N2 is within the range 1 - 255. This parameter can be overridden under program control using the SET N2 command.

SIMP/L HDLC MNEMONICS

Introduction

This section describes the default mnemonic table for SIMP/L HDLC (see figure below). For a general description of the use of mnemonics in simulation, refer to Section 3.2.

Entries

The SIMP/L HDLC mnemonic table has two columns:

- Mnemonic name (1 - 6 characters)
- Field width in bits

The default SIMP/L HDLC mnemonic table is shown below. You can also create and save additional mnemonic tables using the mnemonic commands described in Section 3.5.

MNEMONIC	FIELD WIDTH (BITS)
LCGN	4
PKID	8
P(S)	3
P(R)	3
PAD1	1
MBIT	1
DBIT	1
QBIT	1
PAD2	2
GFI	4
LCN	8

Table 5.4-4: SIMP/L HDLC Mnemonics

SIMP/L HDLC COMMAND INDEX

Introduction

This section lists the commands that are specific to SIMP/L HDLC by function. For more information about a command, refer to the page number indicated.

Remember that you can also use the SIMP/L commands listed in Section 5.3 and the Chameleon BASIC commands listed in Section 3.5.

TABLE 5.4-5: SIMP/L HDLC MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
SET	5.4-10	S or D	Assigns values to HDLC timers and parameters.
TPRINT	5.4-13	S or D	Displays the contents of the trace buffer.

TABLE 5.4-6: SIMP/L HDLC READ-ONLY VARIABLES

COMMAND	PAGE	TYPE	FUNCTION
LNKSTAT	5.4-8	S or D	Returns a value that indicates the status of the link.
STATUS	5.4-12	S or D	Displays the values of HDLC timers and parameters.

LNKSTAT

Description

LNKSTAT is a read-only variable that returns a value between zero and seven indicating the status of the link.

The value returned by LNKSTAT indicates the link status as displayed in the figure below. These values are valid for HDLC whether the Chameleon is configured as a network or subscriber.

LNKSTAT VALUE	LINK STATUS	DESCRIPTION
0	Link Disconnected	The DCE received a DISC and returned a UA. In this state, the DCE reacts to the receipt of a SABM and transmits a DM respone in answer to a received DISC command.
1	Link Connection Requested	A SABM has been transmitted, but a UA has not yet been received.
2	Frame Rejected	A FRMR or CMDR has been transmitted to report an error condition not recoverable by retransmission of an identical frame.
3	Disconnect Requested	A DISC has been transmitted, requesting that operation be suspended.
4	Information Transfer	A SABM has been transmitted, and a UA received. The DCE will accept and transmit I-frames and S-frames.
5	Local Station Busy	The local station transmitted an RNR.
6	Remote Station Busy	The remote station transmitted an RNR.
7	Local and Remote Stations Busy	Both the local and the remote stations transmitted RNRs.

Table 5.4-7: Link Status Values

Type Read-Only Variable

Syntax (See examples below.)

Abbreviation LN.

See Also STATUS

Example 1 This example displays the current value of LNKSTAT.

```
PRINT LNKSTAT
```

Example 2 This example displays a message with the link status.

```
IF LNKSTAT = 5 PRINT "LOCAL STATION BUSY"
```

SET

Description

In SIMP/L HDLC, the SET command sets the values of the following variables:

- N1
- N2
- T1
- Network or Subscriber
- Window

Each of the variables is described below. Use the STATUS command to display the current values of the variables.

N1

N1 defines the maximum number of bytes in a frame to transmit or receive, within the range 2 to 512 bytes.

When the Chameleon transmits or receives a frame from the line, it checks the value of N1. If the Chameleon receives a frame longer than N1, it automatically sends an FRMR. If you attempt to BUILD a frame which is longer than the value of N1, an error message is displayed.

N2

N2 defines the maximum number of frame re-transmissions that can occur after successive lapses of the T1 timer, before deciding that the receiving device is not going to respond. N2 is within the range 1 - 255 and may not be set to 0.

T1

The TI timer is started by the Chameleon when it sends a command frame. If T1 expires before the Chameleon receives a response, it retransmits the message and restarts the timer. The maximum number of retransmissions is determined by the value of N2. Following an N2 re-transmission, the station will take an appropriate recovery action.

T1 is in units of seconds, in the range 1 - 255.

Network

You may choose to simulate a network or subscriber under program control, thereby overriding the selection made in the parameter set-up menu. When simulating a network, the Chameleon sends commands using the address 03 and sends responses using the address 01.

Subscriber

You may choose to simulate a network or subscriber under program control, thereby overriding the selection made in the parameter set-up menu. When simulating a subscriber, the Chameleon sends commands using the address 01 and sends responses using the address 03.

Window Window defines the maximum number of sequentially numbered I-frames which the DCE or DTE can have outstanding (unacknowledged) at any given time. Window must be in the range 1 - 7.

Type Statement or Direct

Syntax

SET N1 = x	x = 2 - 512 bytes
SET N2 = x	x = 1 - 255 bytes
SET T1 = x	x = 1 - 255 bytes
SET WINDOW = x	x = 1 - 7 bytes
SET NETWORK	
SET SUBSCRIBER	

Abbreviation None

See Also STATUS

Example 1 This example sets the HDLC parameters and then displays their status.

```
10 SET N1 = 128
20 SET N2 = 5
30 SET T1 = 50
40 SET WINDOW = 3
50 SET NETWORK
60 STATUS
!RUN
```

Result

```
Link-Disconnected
Timer T1 Value - 50
Maximum frame size (n1) - 128
Number of Re-transmissions (N2) - 5
Window - 3
Simulating a network.
```

Example 2 This program sets the value of N1 to 10 and then attempts to build a frame that exceeds 10 characters.

```
10 $A = "ABCDEFGHIJKLMNOP"
20 SET N1 = 10
30 BUILD $A
!RUN
```

Result `Overflow!`

STATUS

Description

The STATUS command displays the status of the link and the current values of the HDLC parameters and timers. These timers and parameters are described on the previous page (SET command).

Sub-states such as *waiting acknowledgement* or *reject sent* are also included in the SIMP/L software, but are not displayed by the command STATUS.

Type

Statement or Direct

Syntax

STATUS

Abbreviation

ST.

See Also

SET

Example

```
STATUS
```

Result:

```
Link Disconnected
Timer T1 Value - 200
Maximum frame size (N1) - 404
Number of Re-transmissions - 100
Window - 1
Simulating a network
```

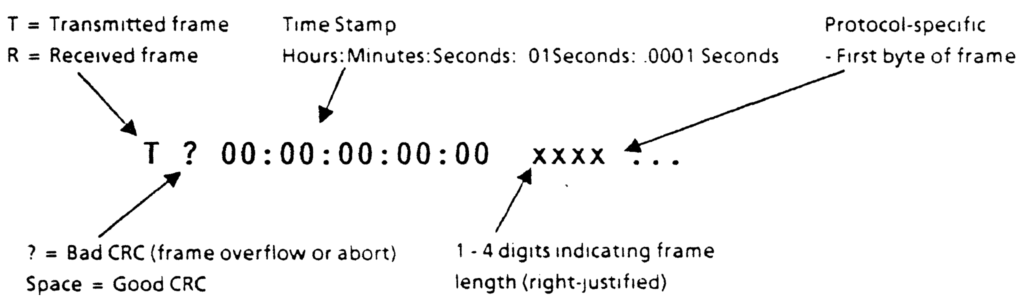
TPRINT

Description

The TPRINT command displays the contents of the trace buffer, which stores the transmitted and received traffic (following a REC command). The format of the display is protocol-specific. Refer to the appropriate SIMP/L for a description of the TPRINT display for the protocol you are using.

You can stop the list using CTRL S. Resume the list with CTRL Q. Abort using the ESC key.

The trace buffer display is protocol-specific. The general format of the trace buffer display is as follows:



Type Statement or Direct

Syntax **TPRINT**

Abbreviation TP.

See Also TLOAD, TSAVE, LTPRINT

Example

SAMPLE SIMP/L HDLC PROGRAMS

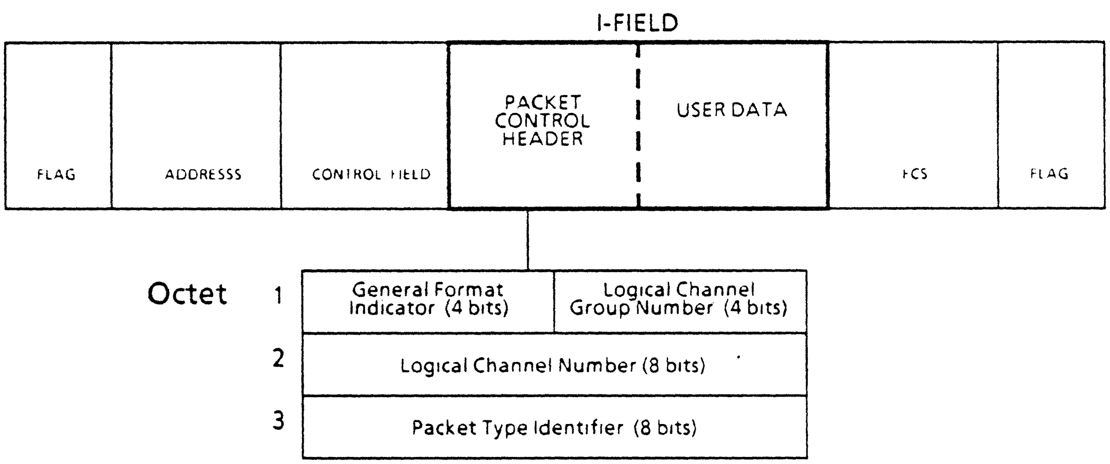
Introduction

These sample SIMP/L HDLC programs demonstrate several major concepts to consider when developing applications, but should not be considered valid tests for any particular application.

SHDLC1

You can use the transmission and reception commands described in the SIMP/L section to transmit, receive, and analyze the HDLC frame level.

The diagram below shows a sample X.25 packet, with the packet control header fields and their widths. Mnemonics will be used in the sample program to break a received frame into these fields.



Packet Control Header Detail

The sample program does the following:

- Defines the lengths of the mnemonics
- Assigns values to the mnemonics
- Assembles the mnemonics for transmission
- Transmits the mnemonics

The sample program receives a response, analyzes it, and displays a message that indicates the success of the test.

The following sample program demonstates using these commands to send a RESTART packet and attempting to receive a RESTART CONFIRMATION.

`10 DEFINE "GFI"=4`
`20 DEFINE "LCGN"=4`
`30 DEFINE "LCN"=8`
`40 DEFINE "PKID"=8`
	Lines 10-40 define mnemonics for assembling and disassembling frames. The numbers indicates the field width in bits.

`60 SLON`	Establishes a linkat level 2.

`80 GFI = 1`
`90 LCGN = 0`
`100 LCN = 0`
`110 PKID=&FB`
	Lines 80-110 assign values to the mnemonics. PKID = Restart packet.

`120 $C=CHR$(0)+CHR$(0)`	$C is the restart cause and diagnostic.
`140 BUILD GFI,LCGN,LCN,PKID,$C`	Defines the message in the transmission buffer.
`150 TRAN`	Transmits the contents of the transmission buffer.
`170 TIM2=120` `180 REC`	Waits 120 seconds for a response. Attempts to receive a frame.
`190 IF LENGTH > 0 GOTO 230`	Executes line 230 if frame received.
`200 IF TIM2 > 0 GOTO 180`	If timer has not expired and nothing was received, loop to receive again.
`210 PRINT "TIMER ELAPSED"`	If timer elapsed and nothing was received, displays message.
`220 STOP`	Stops program execution after displaying message.
`230 REM`	Executes remaining lines if something was received.
`240 BREAK GFI,LCGN,LCN,PKID`	Disassembles received frame into indicated elements.
`250 IF PKID = &FF GOTO 280`	Tests Packet ID for Restart Confirmation packet.

```
260 PRINT "WRONG PACKET TYPE RECEIVED....ERROR CONDITION"
270 STOP
280 PRINT "TEST WAS SUCCESSFUL....CONGRATULATIONS"
290 STOP
```

SHDLC2

This program takes string A from the file named DATAFILE, builds it into a frame, and then transmits it.

`10 CLEAR`	Clears trace buffer.
`20 OPEN "I", "DATAFILE"`	Opens an input file.
`30 READ $A`	Reads a record and assigns it to $A.
`40 BUILD $A`	Assembles string A for transmission.
`50 SLON`	Sets the link level on.
`60 TRAN`	Transmits contents of transmission buffer.
`70 TPRINT`	Displays the trace buffer contents.
`80 CLOSE`	Closes the data file
`90 STOP`	End of program.

SHDLC3

This program receives string A and writes it into the file named DATAFILE.

`10 OPEN,"O","DATAFILE"`	Opens an output file.
`20 REC`	Receives.
`30 BREAK $A`	Disassembles received string.
`40 WRITE $A`	Writes $A to the file.
`50 CLOSE`	Closes the file.

SHDLC5

This program is a SIMP L HDLC call generator. It transmits, checks and receives X.25 packets.

`200 DEFINE "CDLEN" = 4`	
`210 DEFINE "CGLEN" = 4`	
`220 DEFINE "GFI" = 4`	
`230 DEFINE "LCGN" = 4`	
`231 DEFINE "PAD" = 1`	
`232 DEFINE "LCN" = 8`	Lines 200-232 define mnemonics. Numbers represent field width in bits.
`240 PAD = 0`	
`241 $C = CHR$(&1B) + "T"`	$C will be used to position the cursor on the screen.
`250 CLS`	Clear the screen.
`260 XYPLOT(3,30)`	Position cursor at line 30, column 3.
`270 BLKREV`	Causes subsequent text to blink in reverse video.
`280 ?"CALL TESTER V1.0"`	Displays message.
`290 NRM`	Return to normal text display.
`300 ?`	Print a blank line.
`310 ?`	Print a blank line.
`320 INPUT "ENTER GFI" GFI`	
`340 INPUT "ENTER LCGN" LCGN`	
`360 INPUT "ENTER STARTING LCN" S`	
`380 INPUT "ENTER ENDING LCN" E`	
`400 INPUT "ENTER LCN INCREMENT" I`	Lines 320-400 prompt for mnemonic values and store result in numeric variables.
`420 PRINT "MESSAGE TO TRANSMIT"`	
`430 $INPUT $M`	
`440 PRINT "CALLING ADDRESS"`	
`450 $INPUT $G`	
`460 PRINT "CALLED ADDRESS"`	
`470 $INPUT $D`	Lines 420-470 prompt for message and addresses and store result in string variables.
`480 CGLEN = LEN($G)`	Stores length of calling address in numberic variable CGLEN.
`490 CDLEN = LEN($D)`	Stores length of called address in numberic variable CDLEN.
`500 PRINT "PLEASE WAIT..."`	Display message while

```
510 REM Break down addresses for reassembly into BCD
550 $A = $G + $D
560 $A = BCD$($A)
800 REM $A = addresses.
801 REM Prints headings.
802 GOSUB 10000
805 $A = $A + CHR$(0)
```

830 FOR LCN = S TO E STEP I	Set up loop to set the LCN according to the previously input values.
831 XYPLOT(10,44)	Position cursor at line 10 column 44.
832 ?%LCN	Display hex value of current LCN.
835 CLEAR	Clear the trace buffer.
840 PKID = &0B	Assign value to packet ID mnemonic.
850 BUILD GFI,LCGN,LCN,PKID,CGLEN,CDLEN,$A	Build call packet.
851 XYPLOT(12,44)	Position cursor at line 12 column 44.
852 ? "ESTABLISH CALL"	Display message
853 NRM	Normal video text display.
854 ? $C,	
860 TRAN	Transmit contents of buffer.
880 GOSUB 6000	Execute subroutine that gets call confirmation.
890 REM	Ready to transmit data.
891 XYPLOT(12,44)	Position cursor at line 12 column 44.
892 ? "DATA TRANSFER"	Display message.
893 NRM	Normal video text display.
894 ? $C	
900 P(S) = 0	Set P(S) value.
910 P(R) = 0	Set P(R) value.
911 $R = $M + "LCN =" + HEX$(LCN) + CHR$(&0D) + CHR$(&0A)	Assemble data for message.
920 BUILD GFI,LCGN,LCN,P(R),MBIT,P(S),PAD,$R	Build message in buffer.
930 TRAN	Transmit contents of buffer.
940 P(S) = P(S) + 1	Increment P(S).
941 $R = $M+" LCN= " + HEX$(LCN) + CHR$(&0D) + CHR$(&0A)	Assemble data for second message.
950 BUILD GFI, LCGN, LCN P(R), MBIT, P(S), PAD, $R	Build message in buffer.
960 TRAN	Transmit contents of buffer.
980 GOSUB 5000	Execute subroutine that gets RR.
990 P(S) = P(S) + 1	Increment P(S).
991 $R = $M+"LCN= " + HEX$(LCN) + CHR$(&0D) + CHR$(&0A)	Assemble data for second message.
1000 BUILD GFI, LCGN, LCN, P(R), MBIT, P(S), PAD, $R	Build message in buffer.
1010 TRAN	Transmit contents of buffer.
1030 PKID = &13	Packet ID = CLEAR.
1031 $X = CHR$(0)	
1040 BUILD GFI,LCGN,LCN,PKID,$X	Build CLEAR packet.
1050 TRAN	Transmit CLEAR packet.
1051 XYPLOT(12,44)	Position cursor at line 12 column 44.
1052 ? "CLEARING"	Display message.
1053 NRM	Normal video text display.
1054 ? $C	
1070 GOSUB 7000	Execute subroutine to get CLEAR

	CONFIRMATION.
`1080 NEXT LCN`	Increment LCN loop counter and jump to top of loop (line 830).
`1083 XYPLOT(14,35)`	Position cursor at line 34 column 35
`1084 BLKREV`	Sets text to blink in reverse video.
`1085 ?"T E S T  O K!"`	Display message.
`1086 NRM`	Sets normal text mode.
`1087 STOP`	Stops program e ecution.
`1090 STOP`	
`5010 GOSUB 9000`	Execute subroutine to get RR2 packet.
`5020 IF PKID = &41 GOTO 5040`	
`5021 REM If an old packet RR, have a window of 2.`	
`5022 Z = PKID AND 1`	
`5023 IF Z = 1 GOTO 5010`	
`5030 ? "PACKET RR NOT RECEIVED"`	Display message.
`5035 GOTO 5010`	
`5040 RETURN`	End of subroutine 5000.
`6000 REM Get Call Confirmation.`	
`6001 REM First determine if there is an old packet RR outstanding.`	
`6010 GOSUB 9000`	Execute subroutine to get call confirmation.
`6020 IF PKID = &0F GOTO 6030`	
`6021 Z = PKID AND 1`	
`6022 IF Z = 1 GOTO 6010`	
`6025 ? "CALL CONF NOT RECEIVED"`	Displays message.
`6026 GOTO 6010`	
`6030 RETURN`	
`7010 GOSUB 9000`	Subtrouine to get clear confirmation.
`7020 IF PKID = &17 GOTO 7030`	
`7021 REM Checks for old packet RR.`	
`7022 Z = PKID AND 1`	
`7023 IF Z = 1 GOTO 7010`	
`7025 ? "CLEAR CONF NOT RECEIVED"`	Displays message.
`7026 GOTO 7010`	
`7030 RETURN`	Ends subroutine.
`9000 REM Receives something from the line with 3 minute timer`	
`9020 TIM2 = 180`	Set timer 2 to 180 seconds.
`9030 IF TIM2 = 0 GOTO 9090`	If timer expires, go to line 9090.
`9035 REC`	Attempts to receive.
`9040 IF LENGTH = 0 GOTO 9030`	If nothing received, resets timer, and attempts to receive again.
`9050 BREAK GFI,LCGN,LCN,PKID,$X`	Disassembles received packet.
`9060 RETURN`	Ends subroutine.
`9090 ? "RECEIVER TIMED OUT"`	If timer expires, displays message.
`9091 STOP`	Stops program execution.
`10000 CLS`	Clears the screen.
`10010 XYPLOT(1,30)`	Position cursor at line 1, column 30.
`10020 BLKREV`	Sets text to blink in reverse video.

`10030 ? "CALL TESTER V1.0"`	Displays message.
`10040 NRM`	Normal video text display.
`10050 XYPLOT(2,5)`	Position cursor at line 2, column 5.
`10060 PRINT REV "GFI = "`	Prints message in reverse video.
`10080 PRINT NRM %GFI`	Prints value of variable. in normal display.
`10100 XYPLOT(2,20)`	Position cursor at line 2, column 20.
`10110 PRINT REV "LCGN = "`	Prints message in reverse video.
`10130 PRINT NRM %LCGN`	Prints value of variable. in normal display.
`10150 XYPLOT(2,40)`	Position cursor at line 2, column 40.
`10160 PRINT REV "LCN = "`	Prints message in reverse video.
`10180 PRINT NRM %S,`	Prints value of variable. in normal display.
`10911 PRINT "  "`	Inserts two blank spaces.
`10200 PRINT REV "TO"`	Prints message in reverse video.
`10220 PRINT NRM %E`	Prints value of variable. in normal display.
`10240 XPLOT(3,5)`	Position cursor at line 3, column 5.
`10250 PRINT REV "MESSAGE = "`	Prints message in reverse video.
`10270 PRINT NRM $M`	Prints string M. in normal text.
`10290 XYPLOT(4,1)`	Position cursor at line 4, column 1.
`10300 FOR A = 1 TO 79`	Set up loop to repeat 79 times.
`10310 ? "="`	Print equal sign.
`10320 NEXT A`	Increment loop counter A.
`10330 ?`	
`10340 XYPLOT(10,30)`	Position cursor at line 10, column 30.
`10350 ? "CURRENT LCN ="`	
`10360 PRINT REV %LCN`	Print message in reverse video.
`10371 NRM`	Normal text display.
`10380 XYPLOT(12,27)`	Position cursor at line 12, column 27.
`10390 PRINT "CURRENT STATUS ="`	Print message.
`10400 PRITN REV "INITIALIZING"`	Print message in reverse video.
`10420 NRM`	Normal text display.
`10430 RETURN`	Returns from GOSUB.

5.5 SIMP/L SDLC

General Characteristics

The general characteristics for SIMP/L SDLC are as follows:

- Point-to-point, half duplex
- Bit rate up to 64 Kbps with clocks received or supplied
- Maximum frame length 512 bytes
- Maximum number of outstanding frames is seven
- Line Code is NRZ or NRZI
- Simulation of DCE or DTE
- Simulation of Primary or Secondary stations
- CRC CCITT standards

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

SDLC Frame Format

The format of an SDLC frame is shown below with the field widths in bits indicated.

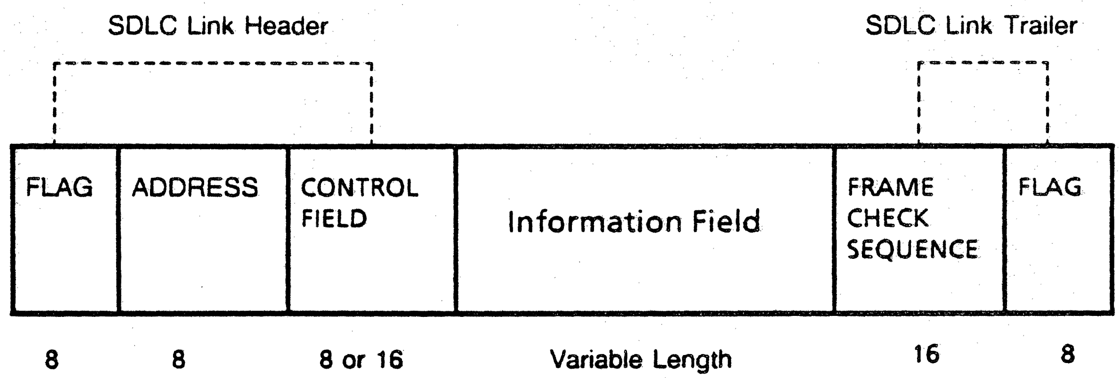


Figure 5.5-1: SDLC Frame Format

The opening and closing **flags** signal the end of the preceding frame and the beginning of the next frame, or is transmitted as fill time between multiple frames. A flag has the unique bit pattern: 0111 1110.

The **Address Field** contains the address of the station that is receiving a command or sending a response to a command.

The **Frame Check Sequence** (FCS) determines if the data in the packet was received without error. It is a16-bit Cyclic Redundancy Check (CRC) that is calculated from the data.

The **Control Field** contains 8 or 16 bits and identifies the type of frame being transmitted. The following figure lists the frames for 8-bit control fields.

Format	Commands	Responses	Encoding 1 2 3 4	5	6 7 8
Information transer	I (information)		0 N(S)	P/F	N(R)
Supervisory	RR (receive ready)	RR (receive ready)	1 0 0 0	P/F	N(R)
	RNR (receive not ready)	RNR (receive not ready)	1 0 1 0	P/F	N(R)
	REJ (reject)	REJ (reject)	1 0 0 1	P/F	N(R)
Unnumbered	UI (unnumbered information) NSI (non sequenced I-frame)	UI (unnumbered information) NSI (non sequenced I-frame)	1 1 0 0	P/F	0 0 0
		RIM/RQI (request initialization mode)	1 1 1 0	F	0 0 0
	SIM (set initialization mode)		1 1 1 0	P	0 0 0
		DM (disconnect mode)	1 1 1 1	F	0 0 0
	UP (unnumbered poll)		1 1 0 0	P	1 0 0
	RD (request disconnect)		1 1 0 0	F	1 0 1
	DISC (disconnect)		1 1 0 0	P	1 0 1
		UA (unnumbered acknowledgement)	1 1 0 0	F	1 1 0
	SNRM (set normal response mode		1 1 0 0	P	0 0 1
		FRMR (frame reject)	1 1 1 0	F	0 0 1
	XID (exchange identification)	XID (exchange identification)	1 1 1 1	P/F	1 0 1
	CFGR (configure)	CFGR (configure)	1 1 1 0	P/F	1 1 0
	TEST (test)	TEST (test)	1 1 0 0	P/F	1 1 1
		BCN (beacon)	1 1 1 1	F	1 1 1

Figure 5.5-2: HDLC Frame Formats (8-bit Control Field)

SIMP/L SDLC PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the SIMP/L SDLC menu. This menu enables you to configure and save parameters for running SIMP/L SDLC simulation. For gengeral information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu (option S), refer to Section 2.3.

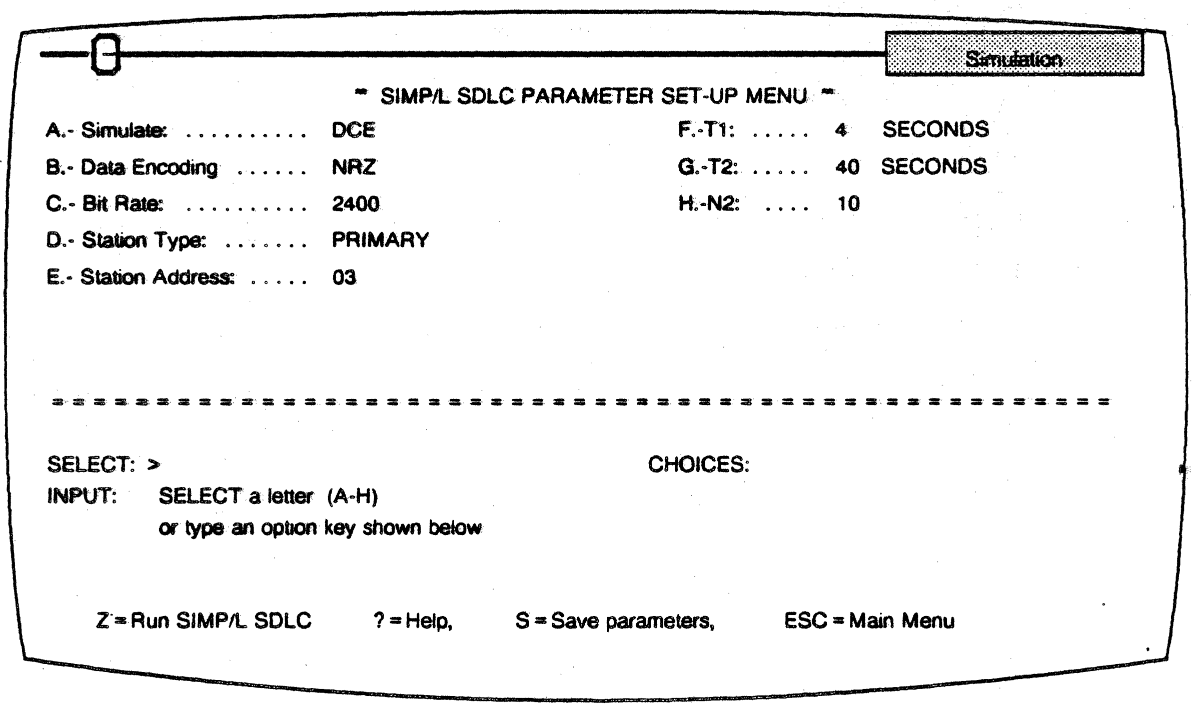


Figure 5.5-3 : SIMP/L SDLC Parameter Set-Up Menu

Menu Options

The choices for the SIMP/L SDLC parameters are listed below. Each parameter is described on the next page.

A. Simulate	DCE DTE
B. Data Encoding	NRZ NRZI
C. Bit Rate	Range: 50 - 64000 bits (DCE) Received (DTE)
D. Station Type	Primary Secondary
E. Station Address	Range: 00-FF hex
F. T1	Range: 1 - 255 seconds
G. T2	Range: 1 - 255 seconds
H. N2	Range: 0 - 99 re-transmissions

If you are unfamiliar with these parameters, use the following guidelines for assistance in selecting the correct settings.

Simulate:
DCE/DTE

The DCE furnishes the clock which determines the data rate. It also determines on which connector pins the data is physically sent and received. For Simulation, one device is designated as the DCE; the other device is designated as a DTE.

If the Unit Under Test (UUT) is supplying the clock, it is the DCE. In this case, the Chameleon must be configured as a DTE. If the UUT is not supplying the clock, it is designated as a DTE. The Chameleon must then be configured as the DCE.

Data Encoding:
NRZ/NRZI

This parameter determines if the data is transmitted in NRZ (Non-Return to Zero) or NRZI (Non-Return to Zero Inverted) format. This is a function of the relative voltage on the data line, representing the 'MARK' and 'SPACE' levels. This parameter determines whether a 'MARK' is represented by a high or low level.

Bit Rate

The bit rate determines the speed that the Chameleo 32 will transmit data. If the Chameleon is configured as the DTE, the bit rate is automatically set to RECEIVE. This means that the Chameleon will send data at the same rate as the data it receives, thus matching the speed set by the UUT.

If the Chameleon is configured as the DCE, it is responsible for setting the bit rate. The valid range is 50 - 64000 bits per second.

Configure the Chameleon to use the same data encoding f

Station Type:
Primary/
Secondary

In SDLC, one side of the link is the Primary, or commanding station. The other side of the link is referred to as the Secondary (responding) station. If the UUT is the Primary station, configure the Chameleon as the Secondary. If the UUT is the Secondary station, configure the Chameleon as the Primary station.

Station Address:
00-FF HEX

ADDR is the station address of either the Secondary station. Any frame that is received with a different address is discarded. The address must be within the range of 00 to FF hexadecimal. This parameter can be overridden under program control using the SET ADDR command.

T1:
1 - 255 Seconds

T1 is the Tl timer that is started by the station when it sends a command frame. If T1 expires before the station receives a response, it retransmits the message and restarts the timer. The maximum number of retransmissions is determined by the value of N2. Following an N2 re-transmission, the station will take an appropriate recovery action.

T1 is in seconds, in the range 1 - 255. This parameter can be overridden under program control using the SET T1 command.

T2:
1-255 Seconds

T2 defines the amount of time that can elapse between sending polled frames. It is used by the primary to poll the secondary in the absence of traffic, usually by sending a polled RR, or if the local station is busy, a polled RNR.

T2 is in seconds, with a valid range from 1 to 255, inclusive. This parameter can be overridden under program control using the SET T2 command.

N2: 1 - 255
Retransmissions

N2 defines the maximum number of frame re-transmissions that can occur after successive lapses of the T1 timer, before deciding that the receiving device is not going to respond.

N2 is within the range 0 - 99 retransmissions. This parameter can be overridden under program control using the SET N2 command.

SIMP/L SDLC MNEMONICS

There is no default mnemonic table for SIMP/L SDLC, but you can define and save your own mnemonic tables using the mnemonic commands described in Section 3.5.

Refer to Section 3.2 for a general description of the use of mnemonic tables in simulation.

SIMP/L SDLC COMMAND INDEX

Introduction

This section lists the commands by function that are specific to SIMP/L SDLC. For more information about a command, refer to the page number indicated.

Remember that you can also use the SIMP/L commands listed in Section 5.3 and the Chameleon BASIC commands listed in Section 3.5.

TABLE 5.5-4: SIMP/L SDLC READ-ONLY VARIABLES

VARIABLE	PAGE	TYPE	FUNCTION
LNKSTAT	5.5-9	Variable	Returns a value that indicates the status of the link between the primary and secondary stations.
STATUS	5.5-12	S or D	Displays the status of the link and the values of SDLC timers and parameters.

TABLE 5.5-5: SIMP/L SDLC TRANSMISSION AND RECEPTION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
NSI	5.5-10	S or D	Transmits an NSI frame assembled using the BUILD command.
TEST	5.5-13	S or D	Transmits a test frame assembled using the BUILD command.
XID	5.5-15	S or D	Transmits an XID frame defined using the XIDFLD command.
XIDFLD	5.5-16	S or D	Sets the data field of an XID frame.

TABLE 5.5-6: SIMP/L SDLC MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
SET	5.5-11	S or D	Assigns values to SDLC timer and parameters.
TPRINT	5.5-14	S or D	Displays the contents of the trace buffer.

LNKSTAT

Description

LNKSTAT is a read-only variable that displays the status of the link between the primary and the secondary stations. The value returned by this variable ranges from 0 to 6, as shown in the tables below.

PRIMARY	LINK STATUS
0	Normal Disconnected Mode
1	Link Request State
2	Disconnect Request State
3	Information Transfer State
4	Local Station Busy
5	Remote Station Busy
6	Local and Remote Stations Busy

Table 5.4-7: Chameleon Configured as Primary

SECONDARY	LINK STATUS
0	Normal Disconnected Mode
1	Initialization Mode
2	Frame Reject Mode
3	Information Transfer State
4	Local Station Busy
5	Remote Station Busy
6	Local and Remote Stations Busy

Table 5.4-8: Chameleon Configured as Secondary

Type

Read-Only Variable

Syntax

(See examples below.)

Abbreviation

LN.

See Also

STATUS, SLON, SLOF

Example 1

This example displays the value of LNKSTAT.

```
PRINT LNKSTAT
```

Example 2

This example displays a link status message.

```
IF LNKSTAT = 4  PRINT "LOCAL STATION BUSY"
```

NSI

Description

The NSI command transmits an NSI frame (non-sequenced I-frame) that was assembled using the BUILD command. Refer to Table 5.4-1 for a description of an NSI frame.

Type

Statement or Direct

Syntax

NSI

Abbreviation

NS.

See Also

BUILD, TPRINT

Example

```
10 $A = "HELLO"
20 BUILD $A
30 NSI
40 TPRINT
!RUN
```

SET

Description

In SIMP/L SDLC, the SET command sets the value of the following SIMP/L SDLC variables: T1, T2, N2, station address.

Each variable is described below.

ADDR ADDR is the station address of either the primary or secondary station. Any frame that is received with a different address is discarded. The addresses must be within the range of 0 to FF hexadecimal.

N2 N2 defines the maximum number of frame re-transmissions that can occur after successive lapses of the T1 timer, before deciding that the receiving device is not going to respond. It is used by the primary station only. The range of N2 is 1 to 99 tries.

T1 The Tl timer is started by the station when it sends a command frame. If T1 expires before the station receives a response, it retransmits the message and restarts the timer. The maximum number of retransmissions is determined by the value of N2. Following N2 re-transmissions, the station will take an appropriate recovery action.

T1 is in units of tenths of seconds, with a valid range from 1 and 255, inclusive. T1 cannot be set to zero.

T2 T2 defines the amount of time that can elapse between sending polled frames. It is used by the primary to poll the secondary in the absence of traffic, usually by sending a polled RR, or if the local station is busy, a polled RNR.

T2 is in units of tenths of seconds, with a valid range from 1 to 255, inclusive.

Type

Statement or Direct

Syntax

SET ADDR = x	**x** is in the range 00 - FF hex
SET N2 = x	**x** is in the range 1 - 99
SET T1 = x	**x** is in the range 1 - 255
SET T2 = x	**x** is in the range 1 - 255

where: **x** is a valid numeric value or variable.

Example

```
SET N2 = 10
SET T2 = 50
SET T1 = 50
SET ADDR = 96
```

STATUS

Description The STATUS command gives the status of the link and the values of the SIMP/L SDLC timers and parameters. These timers and parameters are described on the previous page (SET command).

Type Statement or Direct

Syntax STATUS

Abbreviation STA.

See Also SET

Example

```
!STATUS

Normal Disconnect Mode (NDM)
Timer T1 Value - 10
Timer T2 Value - 10
Number of Re-transmissions - 10
Station address - 96
```

TEST

Description

The TEST command sends a test frame that was assembled using the BUILD command. Refer to Table 5.4-1 for a description of the TEST frame format.

Type

Statement or Direct

Syntax

TEST

Abbreviation

TE.

See Also

TRAN, BUILD, NSI

Example

```
10 $A = "HELLO"
20 BUILD $A
30 TEST
40 TPRINT
```

TPRINT

Description

The TPRINT command displays the contents of the trace buffer, which contains the received and transmitted traffic.

The format of the trace buffer display for SIMP/L SDLC is shown below. For more information about the use of the trace buffer in simulation, refer to Section 3.2.

Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TSAVE, TLOAD, REC

Example

```
TPRINT
```

XID

Description

The XID command transmits an XID frame defined using the XIDFLD command. It is only valid when the Chameleon is configured as a primary station.

In the interest of high-speed operation, the Chameleon ignores certain frame types such as XID. Therefore, a frame transmitted using XID will not appear in the trace buffer.

Refer to Table 5.4-1 for a description of the XID frame format.

Type

Statement or Direct

Syntax

XID

Abbreviation

None

See Also

TRAN, NSI, TEST

Example

This example assigns an XID data field and then transmits the frame.

```
10 $A = "123456"
20 XIDFLD=$A
30 XID
```

XIDFLD

Description The XIDFLD command sets the data field of an XID frame.

Type Statement or Direct

Syntax **XIDFLD = $A**

where: **$A** is the data field with a required length of 6 bytes. If you attempt to set an XID field with a string less than 6 bytes long, the following message appears:

```
String not long enough.  XID field must be six bytes.
```

If you attempt to set the XID field with a string that is longer, than 6 bytes, only the first six bytes of the string are used.

Abbreviation XI.

See Also XID

Example This example assigns an XID data field and then transmits the frame.

```
10 $A = "123456"
20 XIDFLD=$A
30 XID
```

SIMP/L SDLC SAMPLE PROGRAMS

The following examples of SIMP/L SDLC programs are for demonstration only. They demonstrate major concepts to consider when developing applications, but should not be considered valid tests for any particular application.

SSDLC1

You can use the SIMP/L transmission and reception commands described in Section 2 to transmit, receive, and analyze the SDLC frame level. This program demonstrates how an SNA I-field can be transmitted, received, and analyzed.

The figure below illustrates an SNA frame with a FID type 2 transmission header. Each mnemonic is defined with the field width in bits indicated.

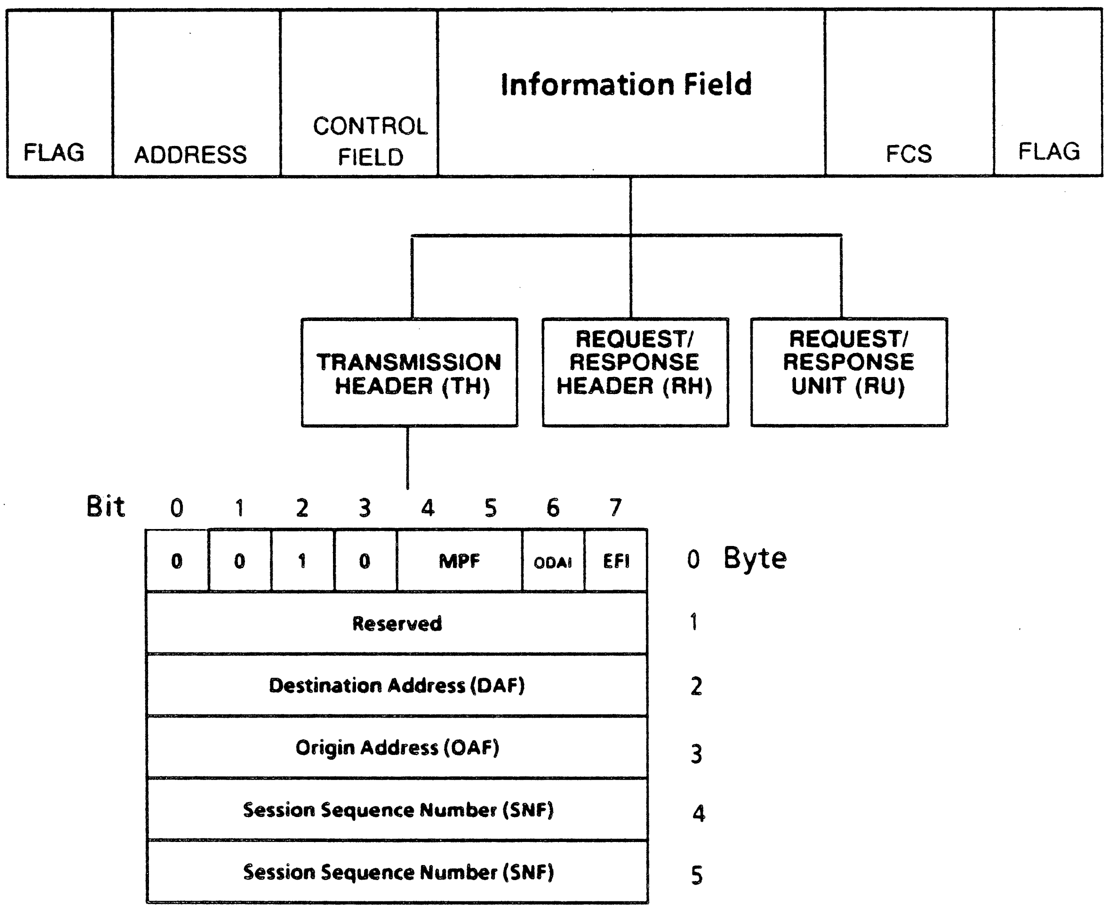


Figure 5.5-9: SNA FID type 2 Transmission Header

`10 DEFINE "FID" = 4`
`20 DEFINE "MPF" = 2`
`30 DEFINE "EFI" = 1`
`40 DEFINE "DAF" = 8`
`50 DEFINE "OAF" = 8`
`60 DEFINE "SNF" = 16`
	Lines 10-60 defines mnemonics for the transmission header fields.

`110 FID = 2`
`120 MPF = 1`
`130 EFI = 0`
`140 DAF = &0F`
`150 OAF = 16`
`160 SNF = 3456`
	Assigns values to mnemonic. The ampersand symbol (&) assigns hexadecimal values.

`200 BUILD FID,MPF,EFI,DAF,OAF,SNF`	Assembles transmission header in buffer.
`210 SLON`	Sets the link on.
`270 TRAN`	Transmits the contents of the transmission buffer.
`280 TDISPF`	Displays the block in hexadecimal. The result is 24 1E 20 1B 00.
	To demonstrate analyzing data, the program receives the same block that was transmitted above and uses the BREAK command to disassemble it.
`450 REC`	Receives the block.
`480 IF RXLENGTH=0 GOTO 450`	If nothing received, tries again.
`500 BREAK FID,MPF,EFI,DAF,OAF,SNF`	Disassembles the received frame using mnemonics.
`550 RDISPF`	Displays last received block on screen.
`580 PRINT FID,MPF,EFI,DAF,OAF,SNF`	Displays mnemonics of received block.

SSDLC2

This program establishes a link, and transmits three I-frames on addresses C0 through C8.

5 CLEAR	Clears trace buffer.
10 GOSUB 2000	Sets string values for $A, $B, $C.
20 FOR A = &C0 TO &C8	Loops to send messages on each channel.
30 GOSUB 1000	Executes subroutine.
40 NEXT A	Increments A from C0 to C8 hex.
50 STOP	Terminates program.

100 REM SUBROUTINE BUILDS & TRANSMITS STRINGS

1000 SET ADDR = A	Sets address to loop index value.
1010 SLON Sets link on.	
1020 BUILD $A	Assembles and transmits first message.
1030 TRAN	
1035 TPRINT	Displays trace buffer contents.
1040 BUILD $B	Assemble and transmits second message.
1050 TRAN	
1055 TPRINT	Displays trace contents.
1060 BUILD $C	Assembles and transmits third message.
1070 TRAN	
1075 TPRINT	Displays trace contents.
1080 SLOF	Disconnects link.
1090 RETURN	End of subroutine line 1000.

1100 REM THIS SUBROUTINE DEFINES STRINGS

```
2000 $A = "MESSAGE NO. 1" + CHR$(&D)+CHR$(&A)
2010 $B = "MESSAGE NO. 2" + CHR$(&D)+CHR$(&A)
2020 $C = "MESSAGE NO. 3" + CHR$(&D)+CHR$(&A)
```

2030 RETURN	End of subroutine line 2000

SSDLC3

This program takes $A from the file named DATAFILE, builds it into a frame, and then transmits it.

`10 CLEAR`	Clears trace buffer.
`20 OPEN "I","DATAFILE"`	Opens a file for input.
`30 READ $A`	Reads a record and assigns it to $A.
`40 BUILD $A`	Assembles $A for transmission.
`45 SLON`	Sets the link on.
`50 TRAN`	Transmits.
`55 SLOF`	Sets the link off.
`60 TPRINT`	Displays trace buffer contents.
`70 CLOSE`	Closes file opened in line 10.
`80 STOP`	Terminates execution.

SSDLC4

This program opens an output file, receives $A, and writes it into the file named DATAFILE.

`10 CLEAR`	Clears trace buffer.
`15 SLON`	Set the link on.
`20 OPEN "O","DATAFILE"`	Opens an output file.
`30 REC`	Receive.
`40 TPRINT`	Displays contents of trace buffer.
`50 BREAK $A`	Disassembles string A.
`60 WRITE $A`	Writes $A to the file.
`70 IF RXLENGTH=0 GOTO 70`	End of file, so closes data file.
`80 CLOSE`	Closes data file.
`85 SLOF`	Sets link off.
`90 STOP`	

SSDLC5

In this program, the Chameleon simulates an SDLC 3274 with one terminal attached (FID 2). The Chameleon may simulate the DTE alone (in which case one line and two modems must be available) or the DTE and DCE simultaneously.

The Chameleon is the secondary station, with a 3705 being the primary station. The host computer access method (in this case, ACF/VTAM) activates the simulated 3274 and terminal. After the simulated terminal notifies the host of its existence, the access method will send a welcome message to the terminal.

```
5  REM *****AUTHOR ELIZABETH  WALLING:  WRITTEN JULY  1983***
10  L = 0
20  TIM2 = 60                              Sets timeout counter.
100 REC                                    Checks for received frame.
105 IF TIM2 = 0 GOTO 900                   Checks if time has expired.
110 IF LENGTH = 0 GOTO 100                 If no data, checks again.

112 REM  ******BREAK DOWN RECEIVED FRAME  *********

113  REM   A MNEM. TABLE MUST BE WRITTEN FOR THE FOLLOWING

115 BREAK FID,MPF,EFI,PAD2,DAF,OAF,SNF,RH,RUC,PAD,PAD,SDI,
    BCI,PAD2,PAD2,$R                       $R is the rest of the frame.

118 REM  ****IF FIRST BIT OF RH = 1 ******

120 IF RH = 1 GOTO 20                      It's a response, so go back.

140 REM  ***OTHERWISE IT'S A REQUEST-WE MUST RESPOND *****
150 IF RUC = 0 GOTO 350                    Check RU category, if 0 it's
                                           a message.
160 IF RUC = 3 GOTO 180                    If it isn't 0 or 3, displays the
                                           category and stop.
170 GOTO 950
180 $D = LEFT$($R,1)                       Gets first byte of RU.
190 $G = CHR$(&0D)                         3705 must activate devices.
200 IF $D =$G GOTO 280                     Is it hex 0D - ACTLU?
210 $G = CHR$(&11)
220 IF $D = $G GOTO 250                    Is it hex 11 - ACTPU?
230 GOTO 990                               No. Display it and stop.

250 REM  ****RESPOND TO ACTPU  ***********
255 RH = 1                                 Set sbit 0 of RH to 1,
                                           indicates a response.
```

```
256 REM ******BUILD STRINGS FOR TRANSMISSION *******

257 $G = CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)

260 $E = "        "                        Eight spaces.

265 $E=$D+CHR$(&11)+EBCS($E)+CHR$(0)+CHR$(0)+CHR$(7)+CHR$(1)+$G

266 REM **RU IN HEX = 1111404040404040404000000701000000000000

270 GOSUB 800                              Go to transmit routine.
275 GOTO 20                                Then get another
                                           frame.

280  REM   *****RESPOND TO ACTLU *****
281  RH = 1                                Sets bit 0 of RH to 1,
                                           indicates a response.

282  REM  ****BUILD STRING FOR TRANSMISSION ****

285  $G = CHR$(0) + CHR$(0) + CHR$(0)
290  $H = CHR$(1)
295  $E=$D+$H+$H+CHR$(0)+CHR$(&85)+$G+CHR$(&0C)+CHR$(6)+$H+CHR$
       (0)+$H+$G
296 REM **RH IN HEX = 0D010100850000000C06010001000000
300  GOSUB  800                            Go to transmit routine.
305  IF L = 1 GOTO 20                      Get another frame if
                                           L=1.

306  REM  **** IF L IS STILL = 0 THEN *****

307  REM   **LET FIRST TERMINAL ACTIVATE AND SEND NOTIFY **
308  REM  ****SO IT CAN RECEIVE THE WELCOME MESSAGE  ****
310  EFI = 0
315  SNF = 0
320  RQH = &0B                             First byte of RH is hex
                                           0B.
325  $E=CHR$(&81)+CHR$(6)+CHR$(&20)+CHR$(&0C)+CHR$(6)+
      CHR$ (3)+ CHR$(0)+$H+$G

327  REM **RU IN HEX = 8106200C06030001000000  *****
329  REM ****BUILD THE WHOLE PIU (FRAME)  ****
330  BUILD FID,MPF,EFI,PAD2,OAF,DAF,SNF,RQH,PAD2,PAD2,$E

331   REM  **** NOTE:  REMEMBER TO SWAP DAF AND OAF  ****

335  TRAN                                  Transmits it.
340  L = L + 1                             Increments L to show
                                           that notify was sent.
345  GOTO 20                               Gets another frame.
```

`350 REM ** WE COULD CHECK TO SEE WHAT MESSAGE THIS IS ****`	
`351 REM* * BUT WE'LL JUST ASSUME IT'S THE WELCOME MESSAGE **`	
`355 PRINT "THIS MUST BE THE WELCOME MESSAGE"`	
`360 RDISPF`	Display it to make sure.
`365 STOP`	
`800 REM * SUBROUTINE TO BUILD AND TRANSMIT A PIU (FRAME) **`	
`805 BUILD FID,MPF,EFI,PAD2,OAF,DAF,SNF,RH,RUC,PAD,PAD,SDI,BCI, PAD2,PAD2,$E`	
`810 TRAN`	Transmit sit.
`820 RETURN`	End of subroutine.
`900 PRINT "TIMED OUT"`	Time out if line idle for 60 seconds.
`905 STOP`	
`950 PRINT "RUC = ", %RUC`	Print the RU category.
`955 STOP`	
`990 PRINT "THE RU RECEIVED = " %$R`	
`991 RDISPF`	Display the whole PIU.
`995 STOP`	

The user-defined mnemonics for the program above are listed in the table below.

NAME	NO. OF BITS	EXPLANATION
FID	4	Format Identifier
MPF	2	Mapping Field (middle, last, first or segment only)
EFI	2	Expedited Flow Indicator
PAD2	8	Rest of TH or RH not needed for breakdown
DAF	8	Destination Address Field
OAF	8	Origin Address Field
SNF	16	Sequence Number Field
RH	1	First bit of RH byte. Zero indicates requestor response.
RUC	2	RU category (part of the RH)
PAD	1	Fields not needed for breakdown.
SDI	1	Sense Data Indicator
BCI	2	Begin and End Chain Indicators (BCI + ECI)
RHQ	8	Byte 0 of the RH.

Figure 5.5-10: Sample Program Mnemonics

5.6 SIMP/L LAPD

Introduction

This section includes commands, variables, and sample programs for SIMP/L LAPD. You can use SIMP/L LAPD to emulate any protocol that uses a LAPD link level and to configure the LAPD link parameters.

Important!

There are two versions of the SIMP/L LAPD software on your simulator diskette. These two versions are:

- SIMP/L LAPD
- Extendable SIMP/L LAPD

The Extendable SIMP/L LAPD software requires the extended RAM that became available with newer Chameleons. When you load SIMP/L LAPD, the software checks for the extended RAM and automatically loads the version that is appropriate for your Chameleon. If you do not have extended RAM, the regular version of SIMP/L LAPD is loaded, and this is the only version you can use.

If you have extended memory, Extendable SIMP/L LAPD is loaded. However, the parameter set-up menu has an option which enables you to select between the extended and non-extended mode. Additionally, the EXTEND and UNEXTEND commands available in Extendable SIMP/L LAPD enable you to select extended or non-extended mode.

Extendable SIMP/L LAPD has features that are not available in the other version. These features are marked with asterisks (*) in this section.

To determine which version of SIMP/L LAPD start the SIMP/L LAPD simulator, as described in Section 2.1. If you do not have extended memory SIMP/L LAPD software is loaded and the screen displays **SIMPL LAPD Version x.xx.**

If you have the extended memory, Extendable SIMP/L LAPD software is loaded and the screen displays **Extendable SIMPL LAPD Version x.xx.**

If you want to upgrade your Chameleon to include extended memory, please call TEKELEC Customer Support.

General Characteristics

The general characteristics of SIMP/L LAPD are as follows:

- Full duplex
- Bit rate up to 64 Kbps with clocks received or supplied
- Maximum frame length of 512 bytes
- Maximum frame window of seven
- NRZ/NRZI encoding
- Simulation of DCE or DTE
- CRC CCITT Standard
- Frame level conforming to CCITT Q.921 (May 1984)
- Single SAPI (SIMP/L LAPD) or 3 SAPIs (Extendable SIMP/L LAPD)
- Dual TEIs (SIMP/L LAPD) or 4 TEIs (Extendable SIMP/L LAPD

*Control Features

The Extendable SIMP/L LAPD package enables you to configure a control status byte that enable you to:

- Poll SABM(E) and DISC frames on the first transmission
- Monitor the physical link at any time using XID frames
- Control XID frame polling (all polled, none polled, polled with I-fields, polled without I-fields)
- Respond to received SABM(E)s with a UA only or with a UA and a SABM(E)
- Transmit XID frames by program control with or without I-fields.
- Accept response frames matching any combination of user-defined receive SAPIs and TEIs, or restrict response frames accepted to those matching transmit values.

Two Extendable SIMP/L LAPD commands enable you to configure the status control byte:

- SET {fnctn}
  This command enables you to select individual control options using pre-defined mnemonics. For example, the command SET SBMCOL selects the control option that generates SABM(E) collisions.

- SET CONFIG
  This command enables you to set all control options with a single command by inserting a hex value into a bit-mapped configuration byte.

Refer to the SET {fnctn} and SET CONFIG commands in this section for more information.

***Multiple Addressing**

In Extendable SIMP/L LAPD, three user-defined SAPIs and TEIs can be active at any given time. Frames received with a SAPI and TEI matching any of the user-defined values, or a user-defined SAPI and a broadcast TEI (127), are accepted. Any response automatically has a matching SAPI and TEI.

To use fewer than three SAPIs and/or TEIs, you disable those you do not want to use. To disable a SAPI or TEI:

- Set the unused SAPI or TEI value to an invalid value, for example, a SAPI =128.
- Set the unused SAPI or TEI value to the same value as a SAPI or TEI in use.

Refer to the SET RSAPI and SET RTEI commands for information about setting user-defined values. Refer to page 5.6-34 for more information about using multiple addressing.

***Frame Status Byte**

In Extendable SIMP/L LAPD, a frame status byte at the beginning of each received packet gives status information on frames received by the level 2 processor. It provides the following:

- Frame type
- SAPI and TEI that were matched
- Command or response frame
- Poll/Final bit value

If you are using Extendable SIMP/L LAPD, this byte is included in the trace buffer, which is displayed using the TPRINT command. You can also access the frame status byte using the FRSTAT variable. Refer to these commands for more information.

*XID Frames

XID command and response frames can contain information fields with content that varies widely depending on the application in use. In Extendable SIMP/L LAPD, the transmit buffer is appended as an information field to any XID frame so that you can transmit information in any format, in both XID command and response frames. This is true except for those XID frames automatically transmitted as a physical link monitor when configured for XID exchange.

Note:

Many implementations of LAPD use XID command and response frames to exchange setup parameters, and then exchange XID frames without I-fields to monitor the condition of the line.

Transmission of an XID frame with an I-field does not alter the contents of the data buffer. Therefore, you must clear the buffer before exchanging non-data XID frames by program or manual control. Two ways to clear the buffer are:

1. Build a null string.

500 $A=""	Clears string $A to null value.
510 BUILD $A	Clears transmit data buffer.

2. Enter the BUFFER command without a value.

BUFFER = <RETURN>

Refer to the TRXIDC and TRXIDR commands in this section for information about transmitting XID frames.

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

Frame Format

The figure below illustrates the format of an LAPD frame with the field widths in bits indicated.

FLAG	ADDRESS	CONTROL FIELD	I-FIELD	FRAME CHECK SEQUENCE	FLAG
8	8 or 16	8 or 16		16	8

Figure 5.6-1: Frame Format

The opening and closing **flags** signal the end of the preceding frame and the beginning of the next frame, or can be transmitted as fill time between multiple frames. A flag has the unique bit pattern: 0111 1110.

The **Address Field** contains the address of the station that is receiving a command or sending a response to a command.

The **Frame Check Sequence** (FCS) determines if the data in the packet was received without error. It is a16-bit Cyclic Redundancy Check (CRC) that is calculated from the data.

The **Control Field** contains 8 bits which identify the type of frame being transmitted, as indicated in the tables on the following pages.

Format	Commands	Responses	Encoding 8	7	6	5	4	3	2	1	Octet
Information transfer	I (information)		N(R)			P	N(S)			0	4
Supervisory	RR (receive ready)	RR (receive ready)	N(R)			P/F	0	0	0	0	4
	RNR (receive not ready)	RNR (receive not ready)	N(R)			P/F	0	1	0	1	4
	REJ (reject)	REJ (reject)	N(R)			P/F	1	0	0	1	4
Unnumbered	SABM (set asynchronous balance mode)		0	0	1	P	1	1	1	1	4
		DM (disconnect mode)	0	0	0	F	1	1	1	1	4
	*SIO (sequenced information 0)	*SIO (sequenced information 0)	0	1	1	P/F	0	1	1	1	4
	*SI1 (sequenced information 1)	*SI1 (sequenced information 1)	1	1	1	P/F	0	1	1	1	4
	UI (unnumbered information)		0	0	0	P	0	0	1	1	4
	DISC (disconnect)		0	1	0	P	0	0	1	1	4
		UA (unnumbered acknowledge)	0	1	1	F	0	0	1	1	4
		FRMR (frame reject)	1	0	0	F	0	1	1	1	4
	XID (exchange identification)	XID (exchange identification)	1	0	1	P/F	1	1	1	1	4

Figure 5.6-2: SIMP/L LAP/D Frame Specifications (MOD8)

Format	Commands	Responses	Encoding 8	7	6	5	4	3	2	1	Octet
Information transfer	I (information)		N(S)							0	4
			N(R)							P	5
Supervisory	RR (receive ready)	RR (receive ready)	0	0	0	0	0	0	0	1	4
			N(R)							P/F	5
	RNR (receive not ready)	RNR (receive not ready)	0	0	0	0	0	1	0	1	4
			N(R)							P/F	5
	REJ (reject)	REJ (reject)	0	0	0	0	1	0	0	1	4
			N(R)							P/F	5
Unnumbered	SABME (set asynchronous balance mode extended)		0	1	1	P	1	1	1	1	4
		DM (disconnect mode)	0	0	0	F	1	1	1	1	4
	DISC (disconnect)		0	1	0	P	0	0	1	1	4
		UA (unnumbered acknowledge)	0	1	1	F	0	0	1	1	4
		FRMR (frame reject)	1	0	0	F	0	1	1	1	4
	XID (exchange identification)	XID (exchange identification)	1	0	1	P/F	1	1	1	1	4

Figure 5.6-3: SIMP/L LAP/D Frame Specifications (MOD 128)

*The SI0 and SI1 commands and responses are not yet supported by the Chameleon.

SIMP/L LAPD PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the SIMP/L LAPD menu. This menu enables you to configure and save parameters for running SIMP/L LAPD simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu (option S), refer to Section 2.3.

```
                                                              Simulation
                     - SIMP/L LAPD PARAMETER SET-UP -
A.- Simulate .......... : DCE
B.- Data Encoding ...... : NRZ
C.- Bit Rate ........... : 2400
D.- Simulate: .......... : NETWORK
E. - Interframe fill ....... : 7E
F. - SIMP/L Type ....... : Extended

= = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = = =
SELECT: >                                          CHOICES:
INPUT:    SELECT a letter (A - E)
          or type an option key shown below

   Z = Run SIMP/L LAPD   ? = Help,   S = Save parameters,   ESC = Main Menu
```

Figure 5.6-4: SIMP/L LAPD Parameter Set-Up Menu

The SIMP/L LAPD parameters and listed below. A description of each parameter is on the next page.

A. Simulate	DCE DTE
B. Data Encoding	NRZ NRZI
C. Bit Rate	Range: 50 - 64000 bits (DCE) RECEIVED (DTE)
D. Simulate	Network Subscriber
E. Interframe fill	7E hex FF hex
F. SIMP/L Type	Extended Non-extended

If you are unfamiliar with these parameters, use the following guidelines for assistance in selecting the correct settings.

Simulate: DCE/DTE

The DCE furnishes the clock which determines the data rate. It also determines on which connector pins the data and clocks are physically sent and received. For Simulation, one device is designated as the DCE; the other device is designated as a DTE.

If the Unit Under Test (UUT) is supplying the clock, it is the DCE. In this case, the Chameleon must be configured as a DTE. If the UUT is not supplying the clock, it is designated as a DTE. The Chameleon must then be configured as the DCE.

Data Encoding: NRZ/NRZI

This parameter determines if the data is transmitted in NRZ (Non-Return to Zero) or NRZI (Non-Return to Zero Inverted) format. This is a function of the relative voltage on the data line, representing the 'MARK' and 'SPACE' levels.

Configure the Chameleon to use the same data encoding format as the (UUT).

Simulate: Network Subscriber

This parameter determines if the Chameleon is acting as a subscriber (terminal) or as a network device. One device (either the UUT or the Chameleon) is designated the network device and the other device is designated the subscriber device.

This setting determines the value of the Command/Response (C/R) bit. The C/R bit is set to 1 for commands from and responses to the network side of the link. The C/R bit is set to 0 for commands from and responses to the subscriber side of the link.

A device can function as both a network and a subscriber device depending on its communications function with the other devices in the network. For example, a PBX is a subscriber device in the link between the PBX and the local switch. The same PBX is a network device in the link with a users terminal.

If the UUT is acting as a network device, configure the Chameleon as a subscriber device. If the UUT is acting as a subscriber device, configure the Chameleon as a network device. This parameter can be changed under program control using the SET command so that you can test the ability of the UUT to ignore commands from like devices.

Interframe Fill:
7E/FF

The Interframe fill determines what the Chameleon sends to the UUT when the data line is idle. The original CCITT recommendation specified an all 1's (FF) condition to indicate the line is idle and 7E if the line is busy.

Many terminal devices require an interframe fill value of FF since an interframe fill of 7E can be mistaken as the beginning and ending flags of an endless stream of zero-length frames. If the interframe fill is mistaken in this way, the terminal becomes so busy that it appears to be locked up.

Many switch devices assume that the physical link is disconnected or faulty unless there is a continuous stream of bits consisting of data or hex 7E flags on the line.

Note

This parameter is displayed for both Extendable and Non-extended SIMP/L LAPD; however, it functions *only* in Extendable SIMP/L LAPD.

For *both* Extendable and Non-Extended SIMP/L LAPD, this parameter can be changed under program control using the `SET FILL=FF` or `SET FILL=7E` commands. Refer to page 5.6-21 for more information.

SIMP/L Type:
Extended/
Non-Extended

This option is displayed only if you have a Chameleon with extended memory. If you have a Chameleon with extended memory, the Extendable version of SIMP/L LAPD is automatically loaded. If you access the parameter set-up menu, this parameter appears in the menu. It gives you the option of using the Extendable SIMP/L LAPD in an extended or non-extended mode.

If you do not have extended memory, Non-extended SIMP/L LAPD is automatically loaded. This menu option does not appear in the parameter set-up menu, because you can only use the Non-extended version of the software.

Note

SIMP/L LAPD and Multi-Link SIMP/L LAPD files reside in the same hard disk directory and use the same file extensions. This was done to simplify the task of modifying programs to work with either simulator. However, you will want to create separate parameter set-up files for your SIMP/L LAPD and Multi-Link LAPD programs.

If a Multi-Link parameter set-up file is used in SIMP/L LAPD, this parameter may be modified to Non-Extended. This may result in errors if that same parameter set-up file is then used with the Multi-Link LAPD simulator.

SIMP/L LAPD COMMAND INDEX

Introduction

This section lists the SIMP/L LAPD commands by function. For more information about a specific command, refer to the page number indicated.

Remember that you can also use the SIMP/L commands in Section 5.3 and the BASIC commands in Section 3.5.

TABLE 5.6-5: SIMP/L LAPD READ-ONLY VARIABLES

VARIABLE	PAGE	TYPE	FUNCTION
FRSTAT	5.6-14	Variable	Returns the frame status byte.
LNKSTAT	5.6-15	Variable	Returns a value that indicates the status of the link.
STATUS	5.6-26	Variable	Displays values of variables and status of the link.

TABLE 5.6-6: SIMP/L LAPD PARAMETER COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
EXTEND	5.6-13	S or D	Selects Extended version of SIMP/L LAPD simulator if extended memory is present.
MOD	5.6-17	S or D	Sets either MOD8 or MOD128 sequencing.
SET	5.6-18	S or D	Assigns values to variables and timers.
SET {fnctn}	5.6-21	S or D	Sets individual control options in the control configuration byte.
SET CONFIG	5.6-22	S or D	Inserts a value into the control configuration byte.
SET RSAPI	5.6-24	S or D	Assigns values to user-defined SAPIs.
SET RTEI	5.6-25	S or D	Assigns values to user-defined TEIs.
UNEXTEND	5.6-32	S or D	Selects non-extended version of SIMP/L LAPD simulator if extended memory is present.

TABLE 5.6-7: SIMP/L LAPD TRANSMISSION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
TPRINT	5.6-27	S or D	Displays contents of trace buffer.
TRUI	5.6-29	S or D	Transmits an unnumbered I-frame.
TRXIDC	5.6-30	S or D	Transmits an XID command frame.
TRXIDR	5.6-31	S or D	Transmits an XID response frame.

*EXTEND

Description

Extendable SIMP/L LAPD only. The EXTEND command enables you to change from the non-extended to the Extendable version of the SIMP/L LAPD simulation software.

Extendable SIMP/L LAPD requires extended RAM and has additional features that are not available in the non-extended version. See pages 5.6-1 through 5.6-4 for a general description of these features.

If you attempt to use the EXTEND command (or any other Extendable SIMP/L LAPD command) and you do not have extended memory in your Chameleon, the command will be ignored.

Type

Statement or Direct

Syntax

EXTEND

Abbreviation

EXT.

See Also

UNEXTEND

Example

```
EXTEND
```

FRSTAT

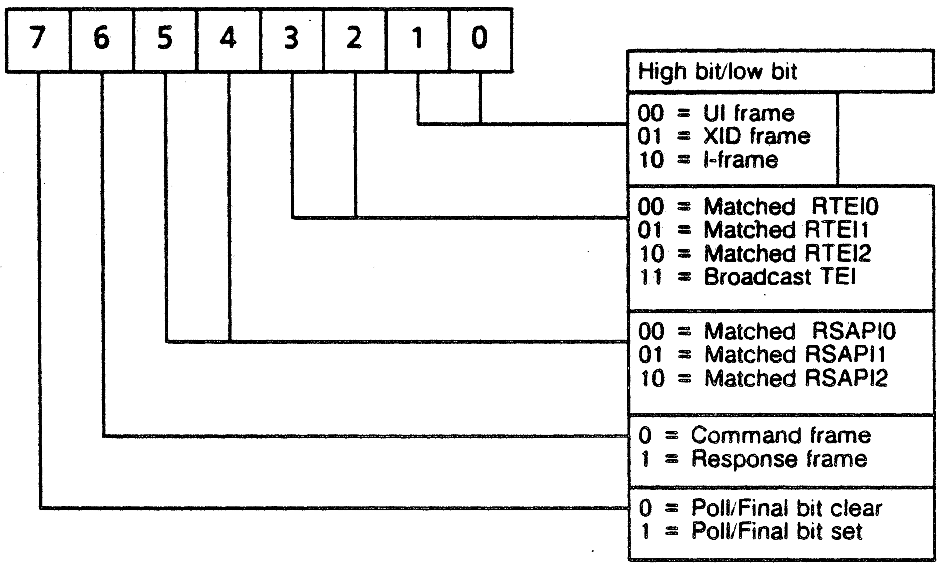
Description

FRSTAT is a read-only variable that returns the frame status byte of the last received data packet. The frame status byte is added to the beginning of each received data packet and provides the following information:

- Frame type
- SAPI and TEI that were matched
- C/R bit value
- Poll/Final bit value

Using FRSTAT is easier than using the BREAK command when you need to extract only the frame status byte. If you are using SIMP/L LAPD in the UNEXTEND mode, you must use FRSTAT to access the frame status byte, since in this mode it is hidden from the program. In EXTEND mode, the frame status byte is displayed in using the TPRINT command.

The figure below shows the status byte interpretation.



Type Read-only variable

Syntax (See example below.)

Abbreviation FRS.

See Also BREAK, TPRINT, EXTEND, UNEXTEND

Example PRINT FRSTAT

LNKSTAT

Description

LNKSTAT is a read-only variable that returns a value between 0 and 8 indicating the status of the link, as shown in the table below. Note that state 8 (Remote Station Not Responding) is in Extendable SIMP/L LAPD only.

LNKSTAT	LINK STATUS
0	Link Disconnected Mode
1	Link Connection Requested
2	Frame Rejected
3	Disconnect Requested State
4	Information Transfer State
5	Local Station Busy
6	Remote Station Busy
7	Local and Remote Stations Busy
8*	Remote Station Not Responding

Table 5.6-8: SIMP/L LAPD Link Status Values

Since an XID frame can be used to monitor the physical link in single frame mode, state 8 occurs when N200 XID frames have not been answered when XID monitor mode is selected.

Internally, state 8 is treated the same as state 0, with recovery occurring when any acceptable frame is received from the remote station. If the Chameleon is in state 4 - 7 when the remote station stops responding, the following process occurs:

1. N200 attempts are made to exchange XID frames with the remote station.
2. State 1 is entered and N200 attempts are made to re-establish the link.
3. State 0 is entered and a final N200 XIDs are sent as a last attempt to re-establish the link.
4. State 8 is entered.

Type

Read-only variable

Syntax (See examples below.)

Abbreviation LN.

See Also STATUS

Example 1 This example displays the current LNKSTAT value.

```
PRINT LNKSTAT
```

Example 2 This example prints a message indicating the link status.

```
10 IF LNKSTAT=4 PRINT "INFORMATION TRANSFER STATE"
```

MOD

Description

The MOD command sets the modulus of the N(R) and N(S) fields to either MOD 8 or MOD 128. MOD 8 uses a range from 0 - 7. MOD 128 uses a range from 0 - 127.

Type

Statement or Direct

Syntax

MOD8

MOD128

Abbreviation

None

See Also

STATUS

Example

This example set the modulo to 128.

```
MOD128
```

SET

Description

In SIMP/L LAPD, the SET command can set the following variables:

- N200
- N201
- Network or Subscriber
- SAPI
- TEI
- T200
- T203
- Window

Each of these variables is described below.

N200

The N200 variable defines the maximum number of frame retransmissions that can occur after successive lapses of the T201 timer before declaring the link unattainable, and sending polled disconnects. N200 must not be set to zero.

N201

The N201 variable defines the maximum number of bytes in a frame. The N201 variable has a valid ranges from 2 - 512 bytes, inclusive. When the system receives or transmits a frame, it checks the value of the N201 variable.

If the system receives a frame longer than N201, it automatically sends a frame reject (FRMR).

NETWORK/ SUBSCRIBER

You can simulate either a network or subscriber device.

When the Chameleon emulates a LAPD network, it sends commands with the C/R bit set to one, and responds with the C/R bit set to zero. It sends the selected SAPI and TEI with the C/R bit automatically set in accordance with CCITT Q. 921.

When the Chameleon emulates a LAPD subscriber, it sends commands with the C/R bit set to zero, and responds with the C/R bit set to one. It sends the selected SAPI and TEI with the C/R bit automatically set in accordance with CCITT Q. 921.

SAPI

The SAPI (Service Access Point Identifier) indicates the layer two service type requested or supported. Normal values are:

- 0 Call Control procedures
- 16 Packet communication procedures
- 63 Management procedures

TEI The TEI (Terminal Endpoint Identifier) is a value assigned to and may be associated with a single terminal and a given point-to-point data link connection. At any time, a given terminal endpoint (TE) may contain one or more TEIs.

This value may be assigned by the carrier at the time of equipment installation, or may be automatically assigned on a call-by-call basis. The broadcast value is associated with all user-side data link entities with the same SAPI, regardless of other assigned value(s).

Normal values are:

- 0 - 63 Non-Automatically assigned values
- 64 - 126 Automatically assigned values
- 127 Broadcast value

T200 The T200 variable defines the maximum timeout period that can elapse between sending a frame and receiving an acknowledgment. The timer is started by the station when it sends any command frame requiring a response.

If T200 expires before the station receives the expected response, it retransmits the message and restarts the timer. The transmission of an I-frame also restarts the T200 timer.

When T200 expires, the frame is retransmitted N200 times at T200 intervals. Following an N200 number of retransmissions, the station takes the appropriate recovery action.

If T200 expires and outstanding frames remain unacknowledged, the station re-arms T200 and sends an appropriate Supervisory Command Frame with the poll bit set.

T200 is expressed in tenths of seconds. The T200 timer can be disabled by setting it to zero. Disabling the T200 timer enables you to test a device without receiving a retransmitted frame while performing a manual operation or test measurement.

T203 The T203 variable defines the maximum amount of time allowed between the transmission of frames. If this timer expires, the Chameleon tests the link conditions by transmitting an RR, RNR, REJ or XID command, depending on the current state and configuration.

The T203 timer can be disabled by setting it to zero. Disabling the T203 timer enables you to test a device without receiving a link status check while performing a manual operation or test measurement.

Window The WINDOW variable defines the maximum number of sequentially numbered I-frames that the DCE or DTE can have outstanding (unacknowledged) at any given time. WINDOW has a range of 1 - 7.

Type Statement or Direct

Syntax

SET N200 = x	**x** is in the range 1 - 255
SET N201 = x	**x** is in the range 2 - 512
SET SAPI = x	**x** is in the range 0 - 63
SET TEI = x	**x** is in the range 0 - 127
SET T200 = x	**x** is in the range 0 - 255
SET T203 = x	**x** is in the range 0 - 255
SET Window = x	**x** is in the range 1 - 7

SET {NETWORK or SUBSCRIBER}

where: **exp** is a number, variable or expression that is valid for that variable.

Abbreviation None

See Also STATUS

Example 1 This example sets several variables and then displays their values using the STATUS command.

```
10 SET N201 = 20
20 SET SUBSCRIBER
30 SET NETWORK
40 SET WINDOW = 3
50 STATUS
```

Example 2 This example sets the value of N201 (maximum frame size) and then attempts to build a frame using a string that exceeds the maximum. This results in an error message.

```
10 $A = "ABCDEFGHIJKLMNOP"
20 SET N201 = 10
30 BUILD $A
```

Result **Overflow!**

*SET {fnctn}

Description Extendable SIMP/L LAPD only. The SET {fnctn} command sets individual control options in the control configuration byte.

Type Statement or Direct

Syntax **SET fnctn**

where: **fnctn** is a MNEMONIC in the table below that selects a specific control option. Note that spaces are not allowed within a mnemonic.

Abbreviation None

See Also SET CONFIG

Example To Poll only XID frames with I-fields, enter:

```
SET POLIXID
```

MNEMONIC	CONTROL FUNCTION
RESTRICT	Restrict received responses to the transmit SAPI and TEI values.
UNRESTRICT	Accept responses matching user-defined SAPIs and TEIs and broadcast TEI.
SBMCOL	Generate SABM(E) collisions.
NOSBMCOL	Stop generating SABM(E) collisions.
XIDEXCH	Transmit XID command on T203 timeout.
NOXIDEXCH	Stop transmitting XID's on T203 timeout.
POLLSTCH	Set poll bit on status changing frames SABM(E) and DISC.
NORMSTCH	Set poll bit normal on status changing frames SABM(E) and DISC.
POLALXID	All XID frames polled.
ALXIDNPL	All XID frames not polled.
POLIXID	Poll only XID frames with I-fields.
POLNIXID	Poll only XID frames without I-fields.
FILL = 7E	Set interframe fill to value 7E.
FILL = FF	Set interframe fill to value FF.

Figure 5.6-9: User Control Mnemonics

*SET CONFIG

Description

Extendable SIMP/L LAPD only. SET CONFIG sets all control option values using a single command. It inserts a hex value into the bit-mapped control configuration byte shown in the figure below.

The default setting is as follows:

A. Poll bit normal on state change frames.
B. Poll bit normal on XID frames.
C. SABM(E) collisions not generated.
D. Exchange polled RR (RNR) frames as physical link test.
E. Accept response frames matching any receive SAPI/TEI combination.
F. Set the interframe fill as selected in the setup menu.

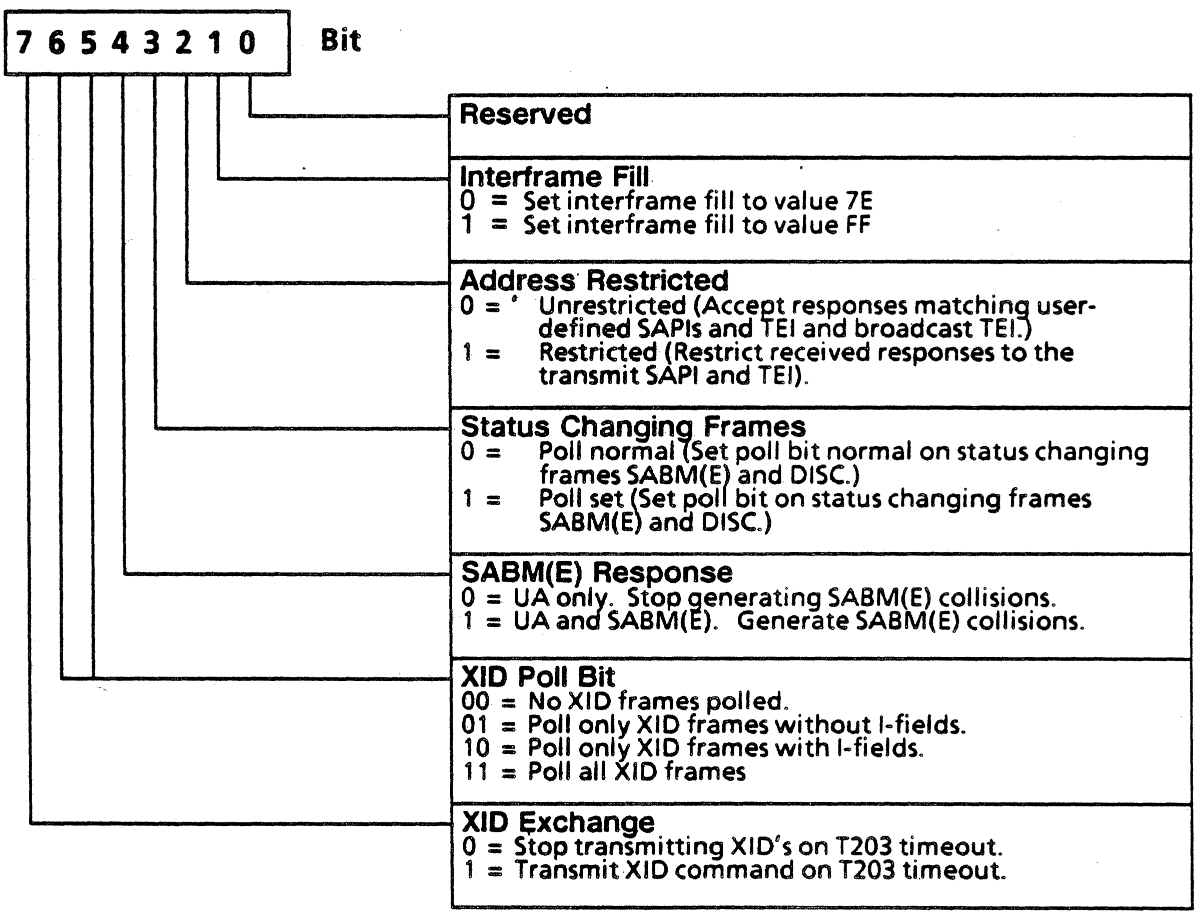


Figure 5.6-10: Control Configuration Byte

Type Statement or Direct

Syntax **SET CONFIG = xx**

where: **xx** is a hex value.

Abbreviation None

See Also SET {fnctn}

Example This example sets the value of the control configuration byte to 7A hex.

```
SET CONFIG =7A
```

The hex value 7A is represented in binary as:

0111,1010

which sets the status configuration byte as follows:

Bit 7	=	0	Stop transmitting XID frames on T203 timeout
Bit 6,5	=	11	Poll all XID frames
Bit 4	=	1	Generate SABM(E) collisions
Bit 3	=	1	Poll set
Bit 2	=	0	Unrestricted address
Bit 1	=	1	Interframe fill = FF
Bit 0			Reserved

*SET RSAPI

Description

Extendable SIMP/L LAPD only. The SET RSAPI command sets the values of a user-defined receive SAPI. Three user-defined receive SAPIs can be active at any one time.

Type

Statement or direct

Syntax

SET RSAPIn = x

where: **n** is the SAPI number in the range 0 - 2 and **x** is the SAPI value in the range 0 - 255. User-defined SAPIs have the following default values:

- RSAPI0 = 0 (Call control procedures)
- RSAPI1 = 16 (Packet communications procedures)
- RSAPI2 = 63 (Management procedures)

To disable a user-defined SAPI, use the SET RSAPI command to assign an invalid value to the SAPI, or assign a SAPI value that is already in use. Note that the SET SAPI command sets the SAPI for transmitted commands.

See Also

SET RTEI, SET SAPI

Example

This example sets user-defined SAPI 1 to a value of zero.

```
SET RSAPI1 = 0
```

*SET RTEI

Description

Extendable SIMP/L LAPD only. The SET RTEI command sets the values of a user-defined receive TEI. Three user-defined receive TEIs can be active at any one time.

Type

Statement or Direct

Syntax

SET RTEIn = x

where: **n** is the TEI number in the range 0 - 2 and **x** is the TEI value in the range 0 - 255 decimal. The default value for all user-defined TEIs is 127 (broadcast). Note that the SET TEI command sets the TEI for transmitted commands.

See Also

SET RSAPI, SET TEI

Example

This example sets the user-defined receive TEI number 0 to a value of 100.

```
SET RTEI0 = 100
```

STATUS

Description

The STATUS command displays the following information:

- Link status
- T200
- T203
- Program Mode (Extended/Non-extended)
- Current SAPI
- Current TEI
- N201
- N200
- WINDOW
- Modulo
- Subscriber or Network
- Active SAPIs: values of RSAPI0, RSAPI1, and RSAPI2 (Extendable SIMP/L LAPD only)
- Active TEIs: values of RTEI0, RTEI1, RTEI2, and broadcast TEI (Extendable SIMP/L LAPD) or last received TEI matched/broadcast (SIMP/L LAPD)

Type

Statement or Direct

Syntax

STATUS

Abbreviation

STA.

See Also

SET, SET RSAPI, SET RTEI, MOD

Example

In Extendable SIMP/L LAPD, the STATUS command results in a display with the following format:

```
!STATUS

Link-Disconnected
Timer T200 Value - 10  Timer T203 Value - 20
Program Mode-Extended
Current SAPI Value - 0
Current TEI Value - 0
Maximum frame size (N201) - 260
Number of Re-transmissions (N200) - 3
Window - 3  MOD128
Simulating a network.
Accepting frames with these SAPI's
0 , 16 , 63
And these TEI's
115 , 27 , 102 , 127
```

TPRINT

Description

TPRINT displays the contents of the trace buffer, which contains the frames transmitted and received. Refer to Section 3.2 for a general description of the trace buffer.

The contents of the trace buffer depends on whether you are using Extendable SIMP/L LAPD or non-extended SIMP/L LAPD. The Extendable SIMP/L LAPD trace buffer includes the frame status byte which indicates the type of frame received.

The format of the trace display for both SIMP/L LAPD versions is illustrated in the examples below.

Type

Statement or Direct

Syntax

TPRINT

Abbreviation

TP.

See Also

TSAVE, TLOAD, FLUSH, TFREE

Example

T = Transmitted frame
R = Received frame

Frame Status Byte
(Received frames only)

Frame Length
4 digit, right justified

Contents of received data packet
in hex

```
R 00:00:00:00:00 FRSTAT 02 LEN 1234 08 01 A3 05 04 88 90 80 80
T 00:00:00:00:00           LEN 4321 08 01 A3 0D
```

Time Stamp:
Hours: Minutes: Seconds:.01 Seconds: .0001 Seconds

Extandable SIMP/L LAPD Trace Display

T = Transmitted frame
R = Received frame

Frame Length
4 digit, right justified

Contents of received data packet
in hex

```
R 00:00:00:00:00 LEN 1234 08 01 A3 05 04 88 90 80 80
T 00:00:00:00:00 LEN 4321 08 01 A3 0D
```

Time Stamp:
Hours: Minutes: Seconds:.01 Seconds: .0001 Seconds

Non-Extended SIMP/L LAPD Trace Display

TRUI

Description TRUI transmits an unnumbered I-frame (UI frame) built using the BUILD command. Refer to Tables 5.6-1 and 5.6-2 for descriptions of UI frame formats.

Type Statement or Direct

Syntax **TRUI**

Abbreviation TRU.

See Also BUILD

Example This example builds and transmits a UI frame.

```
10 $A = "HELLO"
20 BUILD $A
30 TRUI
```

*TRXIDC

Description

Extendable SIMP/L LAPD only. TRXIDC transmits an XID command frame built using the BUILD command. Refer to Tables 5.6-1 and 5.6-2 for descriptions of UI frame formats.

Type

Statement or Direct

Syntax

TRXIDC

Abbreviation

None

See Also

TRXIDR, BUILD

Example

This example builds and transmits a frame using TRXIDC.

```
10 $A = "HELLO"
20 BUILD $A
30 TRXIDC
```

*TRXIDR

Description

Extendable SIMP/L LAPD only. TRXIDR transmits an XID response frame built using the BUILD command. Refer to Tables 5.6-1 and 5.6-2 for descriptions of UI frame formats.

This TRXIDR command transmits an XID response frame with a copy of the last received SAPI and TEI. In this way, the process of preparing the SAPI-C/R combination takes less time and the remote unit receives the response it is expecting.

In light of this, it is highly recommended that SIMP/L LAPD application programs be designed to monitor received frames and respond immediately when an XID command is received. If an XID response is sent at a different time, the remote unit may treat it as a command, if the last received frame was a response.

If an XID command is received without an I-field, it is assumed to be a link monitor frame. In this case, an XID response with matching SAPI and TEI is automatically transmitted without an I-field. This relieves the programmer of having to generate responses in applications which use XID frames to test the physical link.

Type

Statement or Direct

Syntax

TRXIDR

Abbreviation

None

See Also

TRXIDC, BUILD

Example

This example builds and transmits a frame using TRXIDR.

```
10 $A = "HELLO"
20 BUILD $A
30 TRXIDR
```

*UNEXTEND

Description

Extendable SIMP/L LAPD only. The UNEXTEND command enables you to change from the Extended to the non-extended mode when Extendable SIMP/L LAPD is loaded on your Chameleon.

Extendable SIMP/L LAPD requires extended RAM and has additional features that are not available in the non-extended version. See pages 5.6-1 through 5.6-4 for a general description of these features.

If you attempt to use the UNEXTEND command (or any other Extendable SIMP/L LAPD command) and you do not have extended memory in your Chameleon, the command will be ignored.

Type

Statement or Direct

Syntax

UNEXTEND

Abbreviation

UNE.

See Also

EXTEND

Example

```
UNEXTEND
```

SIMP/L LAPD MNEMONICS

Introduction

This section describes the default mnemonic table for SIMP/L LAPD. For a general description of the use of mnemonic tables refer to Section 3.2.

Q.931 Message

The general format of a Q.931 message is illustrated in the figure below.

8 7 6 5 4 3 2 1	OCTET	
Protocol Discriminator	1	
0 0 0 0 Call Ref Length	2	
Call Reference Value	3	
0 Message Type	4	(If call Red Length = 1)
0/1 Mandatory and optional information elements	etc.	

Figure 5.6-11: General Q.931 Message Format

Entries

The SIMP/L LAPD mnemonic table (shown below) has two columns:

- Mnemonic name (1 - 6 characters)
- Field width in bits

The figure below also provides mnemonic definitions and locations in the Q.931 message. Using the BASIC mnemonic commands described in Section 3.5, you can manipulate the default table or define and save your own mnemonic tables.

MNEMONIC	FIELD WIDTH (BITS)	DEFINITION/ Q.931 MESSAGE OCTET
MESTYP	7	Message type/fourth octet
SHFTID	3	Shift 10/fourth octet (Shift info. element)
LOKBIT	1	Shift lock bit/fourth octet (Shift info. element)
CODSET	3	Code set/fourth octet (Shift info. element)
CRLEN	4	Call reference length/second octet
CREF7	7	Call reference/third octet
CREF8	8	Call reference/third octet
NOEXT	1	No extended bit/fourth octet filler
PDIS	8	Protocol discriminator/first octet
FIL4	4	Four bit filler/second octet
PAD1	1	One bit filler/fourth octet filler
PAD2	2	Two bit filler
EXT	1	Extend bit
RI	16	Reference number/TEI field
AI	7	Action indicator/TEI field

Table 5.6-12: SIMP/L LAPD Mnemonics

FRAME LEVEL CONFIGURATION

This section provides an introduction to SIMP/L LAPD frame level configuration and is organized into the following sections, for easier reference:

- Physical link monitoring
- Information Transfer state
- SAPI and TEI control
- Packet Status Byte

Physical Link Monitoring

If no frames are exchanged within the time established by the T203 timer, a supervisory frame is exchanged to determine if the physical link is still established. The type of supervisory frame that is exchanged is determined by the conditions described below.

Polled RR command and response frames are exchanged when in Information Transfer mode. This occurs automatically unless another mode is selected.

You can inhibit link monitoring frames from being generated by the Chameleon by disabling the T203. This is done by setting the T203 timer to 0. The Chameleon will still respond to link monitoring frames sent by the Unit Under Test (UUT).

XID command and response frames can be exchanged in all link states except state value 8 (remote unit not responding). The command SET XIDEXCH initiates transmission of XID commands without I-Fields each T203 timeout.

If the UUT fails to respond to the XIDEXCH command, it is repeated N200 times. If the UUT has still not responded, and the link was in Information Transfer mode, the Chameleon attempts to re-establish the link by sending SABM(E)s.

If the UUT still does not respond, the Chameleon goes to disconnected state, tries again to establish contact with XID frames, then enters the remote unit not responding state (8). Frames are handled the same in state 8 as in state value 0 (disconnected) and any received frame sets the state to 0.

If the UUT requires an XID command and response to be exchanged in the Information Transfer state, you can write a program similar to the following:

10 SLON	Attempts to establish Information Transfer mode (Sets Link ON).
20 IF LNKSTAT = 1 GOTO 20	Waits while the link is established.
30 IF LNKSTAT#4 GOTO 100	Determines if link is in Information Transfer state.
40 SET XIDEXCH	Selects XID supervisory frame to exchange instead of RR's.
...more program steps...	
100 PRINT "LINK NOT ESTABLISHED"	Displays a message if the attempt was not successful

The following program illustrates a technique that can be used if the UUT requires XID exchanges only in the TEI assigned state, and RR exchanges to monitor the link in the Information Transfer state.

These lines follow the program lines that request or assign a TEI. See page 4.8-25 for a sample program that does this.

100 REM TEI IS ASSIGNED	Remark indicating what has been done up to this point.
110 SET XIDEXCH	Selects XID supervisory frame to exchange instead of RR's.
...more program steps...	
300 SLON	Attempts to establish Information Transfer mode (Sets Link ON).
310 IF LNKSTAT = 1 GOTO 310	If in Link Connection Requested state, waits until finished.

320 IF LNKSTAT#4 GOTO 1000	Determines if link is in Information Transfer state.
330 SET NOXIDEXCH	Switches to RR exchange.

Information Transfer State

The following parameters are described in this section:

- Poll bit control
- Poll/Final bit control in XID frames
- SABM(E) Collisions

Poll Bit Control

The poll bit is set to 0 on the first transmission of a SABM(E) and retransmissions polled. This is the normal mode, which occurs when the SLON (Set Link ON) command is used.

The poll bit is set to 1 on all transmissions of SABM(E) and polling DISC frames when the SET POLSTCH command is used. The command SET NORMSTCH cancels this feature.

You can configure the Poll bit in XID command frames for all possible combinations using the following commands:

SET POLALXID	Polls all XID frames
SET ALXIDNPL	Does not poll any XID frames
SET POLIXID	Polls XID frames with I-fields
SET POLNIXID	Polls XID frames without I-Fields

The SET SBMCOL commands enables you to generate SABM(E) collisions. Some devices will not enter Information Transfer state after sending a SABM(E) unless a SABM(E) frame and a UA frame are received. That is, each side must receive a SABM(E) and a UA in answer to its SABM(E) to set up Information Transfer.

The SET NOSBMCOL command cancels this feature.

SAPI and TEI Control

You can program the Chameleon to accept frames matching as many as three SAPIs and three TEIs and the broadcast TEI.

If fewer than three SAPIs or TEIs are needed, the unused SAPIs and TEIs are disabled, using one of two methods:

1. Set more than one SAPI or TEI to the same value
2. Set unused SAPIs and TEIs to invalid values, for example:

   SET RSAPI2 = 200

To accept *command* frames matching any combination of user defined SAPI and TEI, but restrict accepted *response* frames to the transmitted SAPI and TEI values, use the command SET RESTRICT. This feature is canceled by the SET UNRESTRICT command.

The SAPI and TEI values transmitted in command frames are set independently from the accepted (receive) values. Use the following commands to set SAPI and TEI values for command frames:

```
SET SAPI = nn   (nn = 0 - 63)
SET TEI = nn    (nn = 0 - 127)
```

If a command is received with a TEI and SAPI matching the acceptable receive values, and the command requires an automatic response (for example, a SABME is received), the response automatically sets the SAPI and TEI to match the received command.

No automatic response is generated for XID commands with I-fields because the format and content of such frames varies depending on the implementation. It is recommended that your programs closely monitor frame reception and respond appropriately when an XID frame with an I-field is received.

Packet Status Byte

Received data packets are passed to your program with a status byte prefix which contains the following information:

- Type of frame received
- SAPI and TEI used,
- State of the poll/final bit

In many applications, XID commands and responses are used for handshaking to set up layer 2 parameters. In these cases, it is important to know if an XID was a command or response.

The following program uses the frame status byte. It looks for an XID command frame matching RSAPI0 and RTEI1 and performs a special action when a frame that matches is received.

10 DEFINE "FSTAT" = 8	Defines FSTAT as a mnemonic for an 8 bit value.
20 REC	Receives a packet.
30 IF LENGTH = 0 GOTO 10	If no data is received, loops to try again.
40 BREAK FSTAT,$A	Breaks the received packet into two parts. The first 8 bits (the status byte) goes into FSTAT; the packet contents go into $A.
50 A = FSTAT AND &7F	Logically ANDs the status byte with hex 7F to remove the Poll/Final indicator, and stores the result in numeric variable A.
60 IF A = &05 GOTO 1000	Tests the status byte for a binary value 0000 0101 (hex 05) to determine if the following condition exists, and goes to line 1000 if true: BIT 7 = 0 Forced true by line 50 BIT 6 = 0 = Command frame BIT 5,4 = 00 RSAPI0 matched BIT 3,2 = 01 RTEI1 matched BIT 1,0 = 01, Frame = XID
70 GOTO 20	Loops back to receive another frame if this was not the desired one.

CONFIGURATION CHECKLIST

Table 5.6-9 summarizes the SIMP/L LAPD parameters.

IF THE UNIT UNDER TEST IS:	SET THE Chameleon TO:	CONFIGURE FROM:	COMMAND
DTE	DCE	MENU	
DCE	DTE	MENU	
NRZ	NRZ	MENU	
NRZI	NRZI	MENU	
SUBSCRIBER	NETWORK	MENU/ PROGRAM	SET NETWORK
NETWORK	SUBSCRIBER	MENU/ PROGRAM	SET SUBSCRIBER
SABM(E) COLLISION REQUIRED	SABM(E) COLLISION MODE	PROGRAM	SET SBMCOL
SABM(E) COLLISION CAUSES TROUBLE	NO SABM(E) COLLISIONS	PROGRAM	SET NOSBMCOL
XID EXCHANGE ON T203 TIMEOUT	XID EXCHANGE	PROGRAM	SET XIDEXCH
RR EXCHANGE ON T203 TIMEOUT	NORMAL LINK	PROGRAM	SET NOXIDEXCH
ALL STATUS CHANGING FRAMES POLLED	POLL STATUS CHANGING FRAMES	PROGRAM	SET POLLSTCH
ALL STATUS CHANGING FRAME NOT POLLED	NORMAL STATUS CHANGING FRAMES	PROGRAM	SET NORMSTCH
XID FRAMES NOT POLLED	XID FRAMES NORMAL POLL	PROGRAM	SET ALXIDNPL
XID FRAMES POLLED	XID FRAMES ALWAYS POLLED	PROGRAM	SET POLALXID
XID FRAMES POLLED WITH I-FIELD	XID FRAMES POLLED IF INFO BEARING	PROGRAM	SET POLIXID
XID FRAMES POLLED WITH NO I-FIELD	XID FRAMES POLLED IF NOT INFO BEARING	PROGRAM	SET POLNIXID
MUST NOT RECEIVE LINK STAUS TEST EXCHANGE	DISABLE T203	PROGRAM	SET T203 = 0
MUST NOT RECEIVE RETRANSMITTED FRAMES	DISABLE T200	PROGRAM	SET T200 = 0

Table 5.6-9: Configuration Checklist

SIMP/L LAPD SAMPLE PROGRAMS

Introduction

The following examples of SIMP/L LAPD programs demonstrate major concepts to consider when developing applications. They are not valid tests for a particular application.

SLAPD1

The program demonstrates transmitting, receiving, and analyzing a Q.931 I-field with SIMP/L LAPD. It builds and transmits a message, asking the network for a TEI assignment. If the message is received, the TEI is assigned, and a congratulatory message is displayed. If the wrong message is received, an error message is displayed and the program stops.

All messages used for TEI assignment procedures are carried in the information field of UI command frames with a SAPI value set to 63 and TEI value set to 127.

Specifically, the program example does the following:

- Defines the lengths of the mnemonics
- Assigns values
- Assembles values for transmission
- Transmits values
- Checks the message type

`5 CLEAR`	Clears the trace buffer.
`10 DEFINE "MEI" =8`	Sets Management Entity Identifier to 8 bits.
`20 DEFINE "RI"= 16`	Sets Reference Number to 16 bits.
`30 DEFINE "MESTYP" = 8`	Sets Message Type to 8 bits.
`40 DEFINE "AI" = 8`	Sets Action Indicator to 8 bits.
`50 SET TEI = 127`	Sets Terminal End Point Identifier to 127.
`60 SET SAPI = 63`	Sets Service Access Point Identifier to 63.
`70 A = RND&FF`	Assigns a random number to A.
`80 MEI = 15`	Sets Management Identifier to 15.
`90 RI= A`	Sets Reference number to random number A.
`100 MESTYP= 0`	Requests a TEI from the network.
`110 AI = &FF`	Sets Action Indicator to 127 and message end bit, indicating that any TEI is acceptable.
`120 BUILD MEI, RI, MESTYP, AI`	Builds the frame.
`130 TRUI`	Transmits the frame.
`140 REC`	Receives a block.
`150 IF LENGTH = 0 GOTO 140`	If a block is received, analyzes it. If not, tries to receive again.
`160 BREAK MEI, RI, MESTYP, AI`	Breaks the received frame into mnemonics and bit widths.

```
170 IF MESTYP = 2  GOTO 200

180 PRINT "WRONG PACKET RECEIVED...ERROR CONDITION"

190 STOP

200 PRINT "TEI ASSIGNED...CONGRATULATIONS"

210 STOP
```

SLAPD2

This program builds information frames for transmission. It checks the link status continually, transmitting only when in the proper state. When not in the proper state, it attempts to correct the problem and sets the link back to information transfer.

After going through all the transmission loops, it sets the link off, and prints an appropriate message.

```
10     SET TEI=100
20     SET SAPI=16
```

Assign values to the address, enabling the link to be set to ON. Refer to Sample program 1 for a TEI request procedure.

```
30     MOD8
40     ?"mod8?(y,n)"
50     $INPUT$A
60     A=VAL($A) AND &DF
70     IF A= &4E MOD128
```

Prompts the operator for modulo and converts response to uppercase.

```
80     $A="abc"
90     $B="def"
100    BUILD $A,$B
```

Builds a frame using two string variables.

```
110    FOR B=1 to 7
120    SET WINDOW=B
```

Changes the window value each time the transmission test is run.

```
130    SLON
```

Set link on for information transfer.

```
140    FOR A=1 to 20
```

Creates a loop for the transmission of I-Frames twenty times.

```
150    IF LNKSTAT=4 GOTO 250
```

If I-Transfer state, transmits and increments the loop.

```
160    STATUS
```

If it is not an I-Transfer state, prints the status of the link.

```
170    REC
```

Receives from the line, clearing the buffer of the local station, if necessary.

```
180    IF (LNKSTAT=5)or((LNKSTAT=6)or(LNKSTAT=7)) GOTO 200
```

Checks the status of the link. If local station remote station , or local and remote station busy, enters the receive loop until the situation is corrected.

190	GOTO 230	Stations not busy--does not enter receive loop.
200	IF LENGTH=0 GOTO 170	
210	TPRINT	Displays the contents of the trace buffer.
220	GOTO 170	Check frame length. If empty, receives again. If not empty, it prints before receiving another frame.
230	IF LNKSTAT=0 SLON	If link status is disconnected, it attempts to set the link on.
240	GOTO 150	Keeps the program out of the transmit section, unless the link is an in I-Transfer state.
250	TRAN	Transmits the built frame.
260	NEXT A	Increments the transmit loop.
270	NEXT B	Increments the window loop.
280	SLOF	Sets the link off.
290	IF LNKSTAT #0 GOTO 290	Waits until the link is disconnected to continue.
300	?"Test complete-link disconnected"	Displays message that the link has been disconnected.
310	STATUS	Displays status of the link proving that it has been disconnected.
320	STOP	Ends program.

SLAPD3

This is an example of Q.931 simulation of sending messages. It uses the DEFINE command to set up named variables, or mnemonics, to simplify setting up the message overhead and interpreting received messages.

`10 DEFINE "PRODIS" = 8`	Defines an 8-bit mnemonic to store the Protocol Discriminator.
`20 DEFINE "CRFLEN" = 8`	Defines an 8-bit mnemonic to store the Call Reference Length.
`30 DEFINE "CRF1BY" = 8`	Defines a 1-byte mnemonic for a Call Reference value.
`40 DEFINE "CRF2BY" = 16`	Defines a 2-byte mnemonic for a longer Call Reference value.
`50 DEFINE "MESTYP" = 8`	Defines an 8-bit mnemonic to store the Message Type.
`60 PRODIS = 8`	Assigns a value of 8 to the Protocol Discriminator.
`70 CRFLEN = 1`	Assigns a value of 1 to the Call Reference Length.
`80 CRF1BY = V`	Assigns the value of the numeric variable V to the Call Reference value.
`90 MESTYP = N`	Assigns the value of the numeric variable N to the Message Type.
`100 $A=CHR$(&56)`	Defines $A as an information element, indicating a locking shift to codeset 6. The predefined string variables $A through $Z are useful for setting up information elements.

```
200 BUILD PRODIS,CRFLEN,CRF1BY,MESTYP,$A,$B,$C
```

All parts are linked in the transmit buffer using the BUILD command.

`210 TRAN`	Transmits an I-Frame.
`220 TRUI`	Transmits a UI frame.
`230 TRXIDC`	Transmits an XID command frame.
`240 TRXIDR`	Transmits an XID response frame.

SLAPD4

This is a example of Q.931 smulation which receives a message. When a message is received, the packet is preceded by a status byte that indicates the frame type. Once the frame type is identified, you can use the BREAK command to disassemble a message into its component parts.

In the example below, the status byte is stripped and interpreted, and the message is broken into appropriate components. It assumes that the mnemonics from sample program SLAPD3 have been defined in the mnemonic table.

`10 DEFINE "FSTAT" = 8`	Defines FSTAT as a mnemonic for an 8 bit value.
`20 REC`	Receives a packet.
`30 BREAK FSTAT,$A`	Breaks the received packet into two parts. The first 8 bits (the status byte) goes into FSTAT; the packet contents goes into $A. Assuming that you received a Q.931 message, you can then use the BREAK with appropriate variables (see SLAPD3 sample program).

```
40 BREAK FSTAT PRODIS,CRFLEN,CRF1BY,MESTYP,$Z
```

Separates the protocol discriminator, call reference parameters and message type so that they may be tested and acted upon. The actual message contents are stored in the string variable $Z.

Use pointers and the string functions to examine the contents of $Z. This example tests whether all the required information elements were included in the message.

`90 T=0`	Initializes variable T to count the total number of information elements.
`100 P=1`	Initializes variable P as a pointer to keep track of our place in the message.
`110 C=0`	Initializes variable C to count the number of correct information elements.
`120 $X=MID$($Z,P,1)`	Extracts the information element ID value into $X using the MID$ function.
`130 GOSUB 1000`	Calls a subroutine to determine if the information element is one of those required by the message type.

`140 P=P+1`	Moves the pointer to the information element length.
`150 $X=MID$($Z,P,1)`	Extracts the information element length into $X using the MID function.
`160 L=VAL($X)`	Converts the length value to numeric variable L.
`170 P=P+L+1`	Moves the pointer P to the next information element.
`180 T=T+1`	Increments the total number of information elements.
`190 IF P< LEN($Z) GOTO 120`	If pointer has not reached end of message, loops back.

```
200 ? "THERE WERE",C,"CORRECT INFO ELEMENTS, AND
"
210 ? T-C,"INCORRECT INFO ELEMENTS."
```

Print a message displaying the test result.

`220 STOP`	Stops the program. Lines 1000 to 1080 form the loop which tests whether the information element ID's are on the list of those required.

```
1000 IF $X=CHR$(&02) C=C+1
1010 IF $X=CHR$(&08) C=C+1
1020 IF $X=CHR$(&12) C=C+1
1030 IF $X=CHR$(&18) C=C+1
1040 IF $X=CHR$(&22) C=C+1
1050 IF $X=CHR$(&28) C=C+1
1060 IF $X=CHR$(&32) C=C+1
1070 IF $X=CHR$(&38) C=C+1
1080 RETURN
```

Using the same techniques, the information elements can be tested for correct content or stored in separate strings to be built into transmitted messages later.

Using the program fragment from above as an example, you can store the entire information element, including ID value and length in $A, by entering the following command:

165 $A = MID$($Z,P-1,L + 2)

This command would appear immediately after the information element length is moved into the numeric variable L, and the pointer P is pointing to the length byte.

The MID$ function enables you to copy a designation part of a string.

An explanation of the MID$ function in line 165 is:

a. In string Z, count from the beginning of the string to character number p - 1. For example, if the value of p is 10, count from the beginning of the string to the ninth character in the string.

b. Beginning with this character, copy the number of characters equal to L + 2 into string $A. Continuing with our example, assume that L = 15. Therefore, starting with the ninth character, copy the next 15 +2 (17) characters into string $A.

In the programming example above, since P is pointing to the length octet, we start at p-1, the information element identifier. Next, as the identifier and length octets are not counted in the length value, we must transfer length + 2 octets.

CONVERTING PROGRAMS TO EXTENDABLE SIMP/L LAPD

The purpose of this section is to suggest some ways to upgrade non-extended SIMP/L LAPD programs to use the features available in Extendable SIMP/L LAPD.

Modifying program to include three of the Extendable SIMP/L LAPD features that are not available in non-extended SIMP/L LAPD are addressed in this section:

- Status control byte
- Multiple receive SAPIs and TEIs
- Frame status byte is added

Status Control Byte

If it is important to the test program to accept only responses with a SAPI and TEI that matches those transmitted in commands. In Extendable SIMP/L LAPD you can configure the Status Control Byte to a restricted address mode using the SET or SET CONFIG commands.

Most programs start with lines similar to these:

```
10 $A="MESSAGE TO BE BUILT INTO A PACKET"
20 SET SAPI=16
30 SET TEI=127
40 REM GO GET TEI ASSIGNMENT
50 GOSUB 500
60 SET TEI=A
70 SLON
```

In this program fragment, you could add a line 15 to use the SET command for address restriction:

```
15 SET RESTRICT
```

the configuration byte is now set by the program. Refer to the SET {fnctn} and SET CONFIG commands for more information.

Multiple Receive SAPIs and TEIs

It is a frequent practice to have a skeleton program with standardized setup procedures which can be added to, or merged with a particular test. For these programs, the SAPI and TEI are set to a fixed value by keyboard input or automatic assignment routine.

When this is the case, they are always set in the same line number by the same constant or variable. This means that the assignment of the receive values can be included in an update program which is then merged with each test program.

If, for example, you have a number of programs which all start the same as the above program fragment, you would create the program below:

```
15 SET RESTRICT
25 SET RSAPI0=16
35 SET RTEI0=127
65 SET RTEI0=A
```

This update can be saved to disk and MERGEd into the desired programs. Refer to the MERGE command in Section 3.5 for more information.

If programs were developed without a skeleton framework, use the edit function to change line numbers, so that new lines are created, leaving the original lines unchanged.

For example, your program contains the following lines:

```
100 PRINT "INPUT TEI TO USE IN THIS TEST";
110 INPUT T
120 SET SAPI=16
130 SET TEI=T
140 SLON
150 IF LINKSTAT=1 GOTO 150
160 IF LINKSTAT=4 GOTO 190
170 PRINT "THE LINK CANNOT BE ESTABLISHED."
180 STOP
190 BUILD PRODIS,CRLEN,CREF,METYP,$A,$C,$D
```

You can edit line 120 to create a new line 125 to read:

```
125 SET RSAPI0=16
```

The steps are as follows (the * represents the cursor position):

`!EDIT 120`	
`120 *`	Press the left arrow to move the cursor to the 0 in the line number.
`12*`	Type **5** to set the new line number.
`125*`	There is now a line 125 in the edit buffer which is identical to line 120. Press the right arrow five times.
`125 SET *`	Press CTRL I to insert a blank.
`125 SET  *`	Press the left arrow to move the cursor back to the new blank and type the letter **R**.
`125 SET R*`	Press the right arrow 5 times and press CTRL I to insert a blank.
`125 SET RSAPI *`	Press the left arrow to move the cursor back to the new blank and type the number **0** .
`125 SET RSAPI0*`	Press CTRL P to display the rest of the line in the edit buffer.
`125 SET RSAPI0=16*`	Press RETURN to enter the new line into the program.

Refer to the EDIT command in Section 3.5 for more information about editing BASIC commands.

In the preceding example, it would have been just as easy to type in the new line, but time would have been saved if a calculation was made, such as in the following:

```
120 IF LINKSTAT=0    SET SAPI=63
```

Once line 125 is entered, each time the program sets the SAPI value, it is a simple matter to edit line 125, change the line number, CTRL P to the end of the line, and put in the new value.

Frame Status Byte is Added

In Extendable SIMP/L LAPD received data packets are passed to your program with a frame status byte prefix which contains the following information:

- Type of frame received
- SAPI and TEI used
- Poll/Final bit
- C/R bit

If you are converting a non-Extendable SIMP/L LAPD program to Extendable SIMP/L LAPD, you have several options available to you for handling the frame status byte:

- Use the UNEXTEND command at the beginning of your program to invoke the unextended version of Extendable SIMP/L LAPD. This will cause the frame status byte to be hidden and therefore require no additional modification to your program.

- If you want to access the frame status byte you must stay in EXTEND mode of Extendable SIMP/L LAPD.

  When using the BREAK command, you must define a mnemonic that breaks the frame status byte from the beginning of the packet.

  For example, to define a mnemonic for the frame status byte, you could use the following command:

  ```
  DEFINE "FRST" = 8
  ```

  Note You cannot use the word *FRSTAT* as the mnemonic, since this is a SIMP/L LAPD variable.

  Once the mnemonic is defined, it can be used with the BREAK command to break the frame status byte as the first element. For example:

  ```
  BREAK FRST, $A
  ```

- You can also access the frame status byte using the FRSTAT read-only variable. Using FRSTAT is easier than using the BREAK command when you need to extract only the frame status byte. Refer to FRSTAT on page 5.6-14 for a description of the variable and an interpretation of the frame status.

5.7 MULTI-LINK SIMP/L LAPD

Introduction

Multi-Link SIMP/L LAPD supports a total of 64 logical links. To access the SIMP/L Multi-Link Simulator, select the **SM_MLAPD** application from the Simulation window of the Applications Selection Menu. If you do not know how to configure the Chameleon for simulation or select a simulator, refer to Chapter 1 of this manual.

TGI Byte

Multi-Link SIMP/L LAPD includes the ability to use the TGI (Terminal Group Identifier) address byte. (If used, the TGI is the third byte of the LAPD Address field.) The SET TGI command assigns a TGI value to the currently selected link in the range 0 - 14. The TGI byte is handled as follows:

- If a valid TGI value (0 - 14) is assigned to a link, the TGI byte is used.
- If a TGI value > 14 is assigned to a link, the TGI byte is not used.
- If an invalid TGI value is assigned to a link (0 or 14, depending on LAPD implementation), it enables you to test the recovery of the Device Under Test to an invalid TGI value.

Link Selection

Multi-Link SIMP/L LAPD includes commands and variables which enable you to control the use of 64 logical links. Each of the 64 links is referred to by a unique link number in the range 0 - 63. Each of the 64 logical links has its own SAPI and TEI value, which are assigned as follows:

1. Select one of the 64 links (0 - 63) using the SET LINK command. For example: SET LINK = 1.

   Note that all links default to state 9, disabled.

2. Assign the link a SAPI value using the SET SAPI command. For example: SET SAPI = 16.
3. Assign the link a TEI value using the SET TEI command. For example: SET TEI = 127.
4. If applicable, Assign the link a TGI value using the SET TGI command. For example: SET TGI = 1.
5. When you select a link using SET LINK, you can then use the SIMP L commands (shown on page 5.7-3) to set the link on (SLON), set the link off (SLOF), and transmit messages.

General Notes

If two or more links have the same address (SAPI/TEI or SAPI/TEI TGI combination), received frames will be considered to belong to the highest link number matching that address.

A link is disabled by selecting the link and setting the SAPI or TEI to an invalid value. You should ensure that the link is in the disconnected state before you disable it. If a link is disabled while in a connected (multi-frame) state, the device under test will see it as a Layer 1 failure. This can be useful for testing recovery procedures.

The state of the selected link can be determined using the LNKSTAT command. The STATUS command also returns the state of the selected link as part of its display. The STATE command displays the states of all 64 links.

Setting the SAPI and/or TEI value to an invalid value sets the link to the disabled state (9). This provides an easy means of testing lost link recovery and providing a means of ignoring unused links.

Two read-only variables are provided in Multi-Link LAPD to simplify link selection. FRELNK returns the number (0-63) of the lowest numbered disabled link, or -1 if no links are disabled. This enables you to select the next available disabled link, as follows:

```
SET LINK = FRELNK
```

RECLNK returns the link number of the last received message. This enables you to transmit a response to the last received message without knowing the link number. For example:

```
SET LINK = RECLNK
TRAN
```

The use of the Multi-Link commands and variables is demonstrated in the sample program on page 5.7-15.

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

Commands

Multi-Link SIMP/L LAPD includes all common SIMP/L commands described in Section 5.3. It also includes the SIMP/L LAPD commands listed in Figure 5.7-1 below. The commands and variables specific to Multi-Link simulation are described beginning on the next page.

SIMP/L LAPD Commands

The following SIMP/L LAPD commands are available in Multi-Link SIMP/L LAPD without modification. The page number which describes the command in detail is provided for your reference.

COMMAND/ VARIABLE	PAGE	DESCRIPTION
LNKSTAT	5.6-15	Returns the status of the selected link. Note the addition of state 9 (disabled) which is valid in Multi-Link SIMP/L LAPD.
SET N200	5.6-18	Sets the value of N200 (maximum number of frame retransmissions) in the range 1 - 255
SET N201	5.6-18	Sets the value of N201 (maximum number of bytes in a frame) in the range 2 - 512
SET T200	5.6-19	Sets the value of the T200 timer in the range 0 - 255
SET T203	5.6-19	Sets the value of the T203 timer in the range 0 - 255
SET WINDOW	5.6-20	Sets the window size in the range 1-7
SET CONFIG	5.6-22	Sets the control configuration byte
TRUI	5.6-29	Transmits an unnumbered I-Frame
TRXIDC	5.6-30	Transmits an XID command frame
TRXIDR	5.6-31	Transmits an XID response frame

Figure 5.7-1: SIMP/L LAPD Commands Available in Multi-Link

SIMP/L Multi-Link Commands

Figure 5.7-2 lists the commands and variables that are specific to Multi-Link SIMP/L LAPD. They are described in detail on the indicated pages.

COMMAND/ VARIABLE	PAGE	DESCRIPTION
FRELNK	5.7-5	Returns the number (0 - 63) of the lowest disabled link
FRSTAT	5.7-6	Returns the frame status byte. This variable is also available in SIMP/L LAPD, but the byte has a special Multi-Link interpretation
RECLNK	5.7-7	Returns the link number (0 - 63) of the last received message
SET LINK	5.7-8	Selects the link (0 - 63) under user control
SET SAPI	5.7-9	Assigns a SAPI value to the link under user control
SET TEI	5.7-10	Assigns a TEI value to the link under user control
SET TGI	5.7-11	Assigns a TGI value to the link under user control
STATE	5.7-12	Displays the states of all 64 links
STATUS	5.7-13	Displays the status of the link under user control
TPRINT	5.7-14	Displays the contents of the trace buffer. This command is also available in SIMP/L LAPD, but has a special Multi-Link interpretation

Figure 5.7-2: Multi-Link SIMP/L Commands and Variables

FRELNK

Description

FRELNK is a read-only variable that returns the number of the lowest disabled link (0 - 63). If FRELNK returns -1, there are no disabled links.

Type

Read-only Variable

Syntax

See examples below

Abbreviation

None

Example

PRINT FRELNK

IF FRELNK....

SET LINK = FRELNK

FRSTAT

Description FRSTAT is a read-only variable that returns a 2-byte value. The first byte contains the link number. The second byte is interpreted as shown in the diagram below.

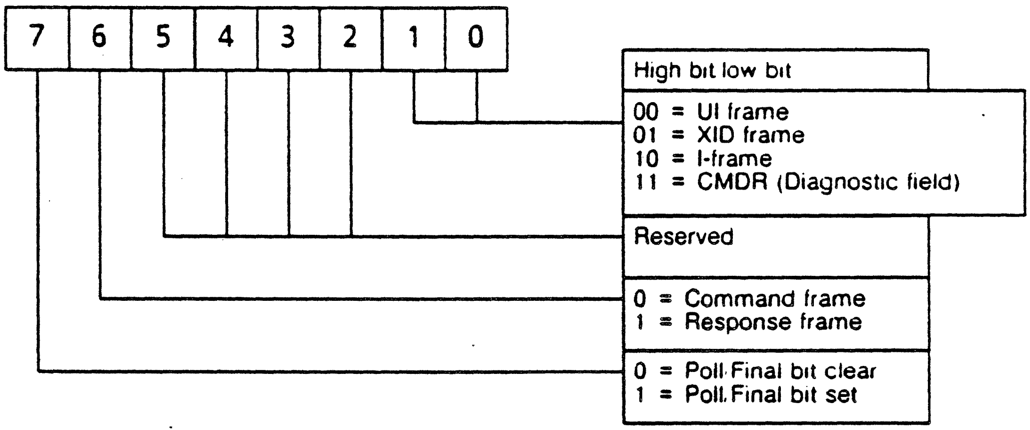


Figure 5.7-3: Multi-Link Frame Status Byte Interpretation (Second Byte)

Type Read-only variable

Syntax (See example below.)

Abbreviation FRS.

See Also RECLNK

Example PRINT FRSTAT

RECLNK

Description RECLNK is a read-only variable that returns the number of the link from which the last data was received. It returns one byte.

Type Read-only Variable

Syntax See examples below

Abbreviation None

Example PRINT RECLNK

IF RECLNK....

SET LINK = RECLNK

SET LINK

Description

The SET LINK command places one of the 64 available links under user control. You can then use SIMP L commands to set the link on or off, or transmit messages over the link.

Type

Statement or Direct

Syntax

SET LINK = exp

where exp is any valid expression with a value in the range 0 - 63.

Abbreviation

None

See Also

STATUS, FRELNK, RECLNK

Examples

SET LINK = A

SET LINK = 7

SET LINK = 2 * B

SET LINK = FRELNK

SET LINK = RECLNK

SET SAPI

Description

The SET SAPI command sets the Service Access Point Identifier (SAPI) value for the selected link. Normal values are:

0	Call Control procedures
16	Packet communication procedures
63	Management procedures

Type

Statement or Direct

Syntax

SET SAPI = x

where x is the SAPI value in the range 0 - 63.

To disable the selected link (STATE=9), set the SAPI to a value outside the range. Normally the link should be in the disconnected state before you disable it.

Abbreviation

None

See Also

SET LINK, SET TEI, SET TGI

Example

SET SAPI = 0

SET TEI

Description

The SET TEI command sets the Terminal Endpoint Identifier (TEI) value for the selected link. Normal values are:

0 - 63	Non-Automatically assigned values
64 - 126	Automatically assigned values
127	Broadcast value

Type

Statement or Direct

Syntax

SET TEI = x

where x is the TEI value in the range 0 - 127.

To disable the selected link (STATE = 9), set the TEI to a value outside the range. Normally the link should be in the disconnected state before you disable it.

Abbreviation

None

See Also

SET LINK, SET TGI, SET SAPI

Example

SET TEI = 0

SET TGI

Description

The SET TGI command sets the Terminal Group Identifier (TGI) address byte for the selected link. The simulator handles the TGI byte as follows:

- If a valid TGI value (1 - 14) is assigned to a link, the TGI byte is used.
- If a value >15 is assigned to a link, the TGI byte is not used.
- If an invalid TGI value is assigned to a link (0 or 14, depending on LAPD implementation), it enables you to test the recovery of the Device Under Test to an invalid TGI value.

Type

Statement or Direct

Syntax

SET TGI = x

where x is the TGI value in the range 0 - 255, as described above. A value greater than 14 does not disable the link; it causes the selected link to transmit and accept frames with a 2-byte (SAPI/TEI) address field.

Abbreviation

None

See Also

SET LINK, SET TEI, SET SAPI

Example

SET TGI = 1

STATE

Description STATE displays the state of all 64 links in a 4 x 16 matrix corresponding to the link number. The STATE display uses the following format:

```
LINK   0  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15
STATE  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

LINK   16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
STATE  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

LINK   32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47
STATE  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0

LINK   48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
STATE  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
```

The STATE values are as follows:

STATE	LINK STATUS
0	Link Disconnected
1	Link Connection Requested
2	Frame Rejected
3	Disconnect Requested
4	Information Transfer
5	Local Station Busy
6	Remote Station Busy
7	Local and Remote Station Busy
8	Remote Station not Responding
9	Link Disabled

Figure 5.7-4: Multi-Link SIMP'L LAPD Link States

Type Statement or Direct

Syntax STATE

Abbreviation None

Example STATE

STATUS

Description

The STATUS command displays the following information about the currently selected link:

- Link number
- SAPI, TEI, and TGI values
- State
- T200 and T203 timers
- N201
- N200
- Window
- Modulo
- Network or Subscriber

Type

Statement or Direct

Syntax

STATUS

Abbreviation

STA.

Example

In Multi-Link SIMP L LAPD, the STATUS display is in the following format:

```
!STATUS

LINK        SAPI        TEI        TGI        STATE
0           16          127        1          4

Timer T200 Value - 10
Timer T203 Value - 20
Maximum frame size (N201) - 260
Number of Re-transmissions (N200) - 3
Window - 3   MOD128
Simulating a network
```

The top line displays the link number, SAPI value, TEI value, TGI value, and state of the link currently under user control. (If the TGI address byte is not being used, no value will be displayed for TGI.) Refer to page 5.7-12 for a list of STATE values and their meanings.

A blank space under the SAPI or TEI heading indicates that an invalid (disabling) value has been selected for that link.

TPRINT

Description

The TPRINT command displays the contents of the trace buffer. For Multi-Link SIMP L LAPD, the TPRINT display includes a 2-byte frame status for received frames. In Extendable SIMP L, frame status is a single byte. The second byte in Multi-Link is used to indicate the link number.

Since Multi-Link frame status is two bytes, you must take this into account if you are adapting an existing Extendable SIMP L LAPD program to run on Multi-Link SIMP/L.

The recommended procedure is to redefine the mnemonic used to break the frame status byte to be 16 bits long. This eliminates the need to modify each BREAK statement that you may have in existing SIMP/L LAPD programs.

Example:

DEFINE FRST = 8	(Defines mnemonic to break the 1-byte frame status in Extendable SIMP L LAPD)

change to

DEFINE FRST = 16	(Defines mnemonic to break the 2-byte frame status in Multi-Link SIMP/L LAPD)

Type Statement or Direct

Syntax TPRINT

Example TPRINT

The format of the TPRINT display for Multi-Link SIMP/L is:

T = Transmitted frame
R = Received frame

Time stamp

Frame status (2 bytes-received frame only)
00 = Link number
41 = (See page 5.7-6 for interpretation)

```
R 00:00:00:00:00 FRSTAT  0041  LEN 1234 08 01 A3 05 04 88 90 80 80
```

Frame length

Contents of received data packet in hex

Sample Program

The sample below illustrates a typical startup procedure for Multi-Link simulation.

10 SET LINK = FRELNK	Puts the lowest numbered disabled link under user control.
15 SET TEI = 126	Assigns selected link the TEI of 126.
20 SET SAPI = 16	Assigns selected link a SAPI = 16.
25 SET TGI = 2	Assigns selected link the TGI of 2. If the TGI byte is not being used, omit this line.
30 SLON	Sets the link on.
40 IF LNKSTAT = 1, GOTO 40	Waits while link request is being processed.
50 IF LNKSTAT = 4 GOTO 80	If link enters information transfer state, jumps to line 80 to build and transmit a message.
60 PRINT "CAN'T ESTABLISH LINK"	If status of link is other than Connect Requested or information transfer, displays message.
70 STOP	Stops program if link cannot be established.
80 $A = "hello "	Assigns a string to string variable $A.
90 $B = "world"	Assigns a string to string variable $B.
100 BUILD $A, $B	If link is in information transfer, builds a transmission message from string variables A and B.
110 TRAN	Transmits the message.
120 REC	Attempts to receive a message.
130 IF LENGTH = 0 GOTO 120	Loops until a message is received.
140 SET LINK = RECLNK	Selects the link from which the message was received.
150 BUILD "MESSAGE RESPONSE"	Builds a response message to the selected link.
160 GOTO 110	Loops to transmit the response message and wait for another message.

5.8 SIMP/L V.120

Introduction

SIMP/L V.120 provides 64 independent links and adheres to the following V.120 protocol requirements:

- The C/R bit is set to 0 for all commands, and to 1 for all responses, regardless of the sending station
- I-Frames can be command or response frames
- When a command reject (CMDR) occurs the link is automatically restarted

To access the SIMP/L V.120 Simulator, select the **SM_V120** application from the Simulation window of the Applications Selection Menu. If you do not know how to configure the Chameleon for simulation or select a simulator, refer to Chapter 1 of this manual.

V.120 Address

The format of the V.120 address field can be viewed as a single 13-bit Logical Link Identifier (LLI) field or as two separate fields (LLI0 and LLI1). This is shown as follows:

8	7	6	5	4	3	2	1	**Bits**
LLI0						**C/R**	**EA0**	**Octet 2 (Address Octet 1)**
LLI1							**EA1**	**Octet 2 (Address Octet 1)**

The LLI0 is the high order 6 bits of the LLI. The LLI1 is the low order 7 bits of the LLI. The LLI is a 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 (In Decimal)	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 5.8-1: LLI Values

EA0 is the octet 2 address extension bit, which is set to 0. EA1 is the octet 3 address extension bit, which is set to 1 for two octet address field.

With SIMP/L V.120, you select one of the 64 links (0 - 63) using the SET LINK command. You then assign the link an LLI with the SET LLI command as a single decimal value as shown in Figure 5.8-1 on the previous page. All links default to state 9, disabled.

When you select a link using SET LINK, you can then use the SIMP/L commands (shown on the next page) to set the link on (SLON), set the link off (SLOF), and transmit messages.

A link is disabled by selecting the link and setting the LLI to an invalid value. You should ensure that the link is in the disconnected state before you disable it. If a link is disabled while in a connected (multi-frame) state, the device under test will see it as a Layer 1 failure. This can be useful for testing recovery procedures.

The state of the selected link can be determined using the LNKSTAT command. The STATUS command also returns the state of the selected link as part of its display. The STATE command displays the states of all 64 links.

Two read-only variables are provided in V.120. FRELNK returns the number (0-63) of the lowest numbered disabled link, or -1 if no links are disabled. This enables you to select the next available disabled link, as follows:

SET LINK = FRELNK

RECLNK returns the link number of the last received message. This enables you to transmit a response to the last received message without knowing the link number. For example:

SET LINK = RECLNK
TRAN

In V.120, sequenced I-Frames can be either commands or responses. To determine the C/R bit of received frames, use the FRSTAT variable, which returns a frame status byte indicating the C/R bit value. Response I-frames can be transmitted using the command RTRAN.

The use of the V.120 commands and variables is demonstrated in the sample program on page 5.8-13.

Flow Control

Flow control occurs at the frame level, and depends on the amount of buffer space available on the Chameleon to receive data. If the receive buffer becomes full, the Chameleon declares the station busy and sends an RNR to the device under test. When the buffer is cleared, the Chameleon sends an RR to indicate that the busy condition has cleared.

To keep the receive buffer clear and avoid a station busy condition from disrupting your test, it is recommended that your program include a number of REC commands.

Commands

SIMP/L V.120 includes all common SIMP/L commands described in Section 5.3. It also includes the SIMP/L LAPD commands listed in Figure 5.8-2 below. The commands and variables specific to V.120 simulation are described beginning on the next page.

SIMP/L LAPD Commands

The following SIMP/L LAPD commands are available in SIMP/L V.120 without modification. The page number which describes the command in detail is provided for your reference.

COMMAND/ VARIABLE	PAGE	DESCRIPTION
LNKSTAT	5.6-15	Returns the status of the selected link
SET N200	5.6-18	Sets the value of N200 (maximum number of frame retransmissions) in the range 1 - 255
SET N201	5.6-18	Sets the value of N201 (maximum number of bytes in a frame) in the range 2 - 512
SET T200	5.6-19	Sets the value of the T200 timer in the range 0 - 255
SET T203	5.6-19	Sets the value of the T203 timer in the range 0 - 255
SET WINDOW	5.6-20	Sets the window size in the range 1-7
SET CONFIG	5.6-22	Sets the control configuration byte
TRUI	5.6-29	Transmits an unnumbered I-Frame
TRXIDC	5.6-30	Transmits an XID command frame
TRXIDR	5.6-31	Transmits an XID response frame

Figure 5.8-2: SIMP/L LAPD Commands Available in V.120 LAPD

SIMP/L V.120 Commands

Figure 5.8-3 lists the commands and variables that are specific to SIMP/L V.120. They are described in detail on the indicated pages.

COMMAND/ VARIABLE	PAGE	DESCRIPTION
FRELNK	5.8-5	Returns the number (0 - 63) of the lowest disabled link
FRSTAT	5.8-6	Returns the frame status byte. This variable is also available in SIMP/L LAPD, but the byte has a V.120-specific interpretation
RECLNK	5.8-7	Returns the link number (0 - 63) of the last received message
RTRAN	5.8-8	Transmits an I-Frame response
SET LINK	5.8-9	Selects the link (0 - 63) under user control
SET LLI	5.8-10	Sets the Logical Link Identifier of the link under user control
STATE	5.8-11	Displays the state of all 64 links
STATUS	5.8-12	Displays the status of the link under user control

Figure 5.8-3: V.120 SIMP/L Commands and Variables

FRELNK

Description

FRELNK is a read-only variable that returns the number of the lowest disabled link (0 - 63). If FRELNK returns -1, there are no disabled links.

Type

Read-only Variable

Syntax

See examples below

Abbreviation

None

Example

PRINT FRELNK

IF FRELNK....

SET LINK = FRELNK

FRSTAT

Description FRSTAT is a read-only variable that returns a 2-byte value. The first byte contains the link number. The second byte is interpreted as shown in the diagram below.

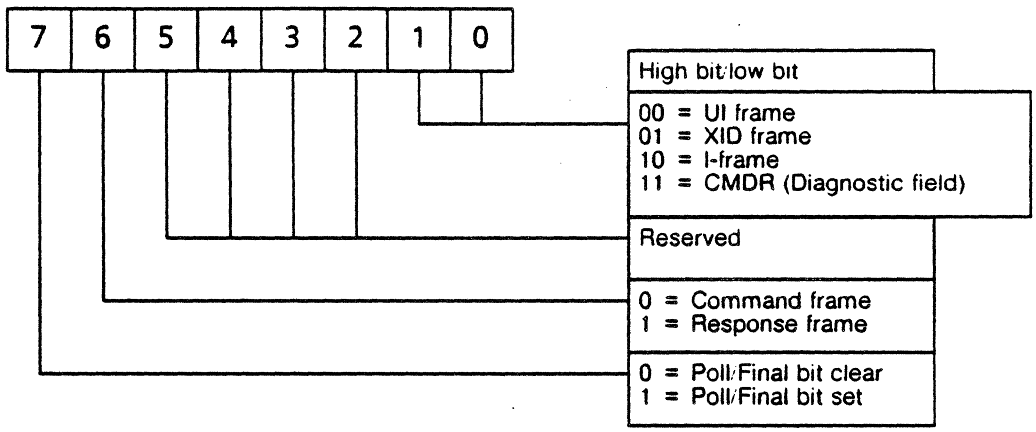


Figure 5.8-4: V.120 Frame Status Byte Interpretation (Second Byte)

Type Read-only variable

Syntax (See example below.)

Abbreviation FRS.

See Also RECLNK, FRSTAT

Example PRINT FRSTAT

RECLNK

Description RECLNK is a read-only variable that returns the link number (0 - 63) of the last received message.

Type Read-only Variable

Syntax See examples below

Abbreviation None

Example

```
PRINT RECLNK
IF RECLNK
SET LINK = RECLNK
```

RTRAN

Description

The RTRAN command transmits an I-Frame response. It sets the C/R bit to the response value and transmits the frame.

Sequenced I-Frames can be commands or responses. Received frame C/R bits can be determined using the FRSTAT variables which returns the frame status byte. In V.120 the C/R bit is set as follows:

- Command frame C/R bit is set to 0
- Response frame C/R bit is set to 1

Type

Statement or Direct

Syntax

RTRAN

Abbreviation

None

Example

RTRAN

SET LINK

Description

The SET LINK command places one of the 64 available links under user control. You can then use SIMP/L commands to set the link on or off, or transmit messages over the link.

Type

Statement or Direct

Syntax

SET LINK = exp

where exp is any valid expression with a value in the range 0 - 63.

Abbreviation

None

See Also

STATUS, FRELNK, RECLNK

Examples

SET LINK = A

SET LINK = 7

SET LINK = 2 * B

SET LINK = FRELNK

SET LINK = RECLNK

SET LLI

Description

The SET LLI command sets the Logical Link Identifier value for the selected link. The LLI specifies the layer two service type requested or supported, as shown in the table below.

Type

Statement or Direct

Syntax

SET LLI = x

where x is the Logical Link Identifier value, within the following range:

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

To disable the selected link (STATE = 9), set the LLI to a value outside the range 0 - 8191. Normally the link should be in the disconnected state before you disable it.

Abbreviation

None

See Also

SET LINK

Example

SET LLI = 0

STATE

Description STATE displays the state of all 64 links, using the following values:

STATE	LINK STATUS
0	Link Disconnected
1	Link Connection Requested
2	Frame Rejected
3	Disconnect Requested
4	Information Transfer
5	Local Station Busy
6	Remote Station Busy
7	Local and Remote Station Busy
8	Remote Station not Responding
9	Link Disabled

Figure 5.8-5: V.120 Link States

Type Statement or Direct

Syntax STATE

Abbreviation None

Example STATE

STATUS

Description

The STATUS command displays the following information about the currently selected link:

- Link number
- LLI Value
- State
- T200 and T203 timers
- N201
- N200
- Window
- Modulo

Type

Statement or Direct

Syntax

STATUS

Abbreviation

STA.

Example

In SIMP/L V.120 LAPD, the STATUS command display is in the following format:

```
!STATUS

LINK       LLI         STATE
  3        147           4
Timer T200 Value - 10
Timer T203 Value - 20
Maximum frame size (N201) - 260
Number of Re-transmissions (N200) - 3
Window - 3  MOD128
```

Refer to page 5.8-10 for a list of LLI values and their meanings. Refer to page 5.8-11 for a list of STATE values and their meanings.

A blank space under the LLI heading indicates that an invalid (disabling) value has been selected for the LLI.

Sample Program

The sample below illustrates a typical startup procedure for V.120 simulation.

10 SET LINK = FRELNK	Puts the lowest numbered disabled link under user control.
20 SET LLI = 0	Assigns selected link the LLI of 0.
30 SLON	Sets the link on.
40 IF LNKSTAT = 1, GOTO 40	Waits while link request is being processed.
50 IF LNKSTAT = 4 GOTO 80	If link enters information transfer state, jumps to line 80 to build and transmit a response.
60 PRINT "CAN'T ESTABLISH LINK"	If status of link is other than Connect Requested or information transfer, displays message.
70 STOP	Stops program if link cannot be established.
80 $A = "hello"	Assigns a string value to string variable $A.
90 $B = "world"	Assigns a string value to string variable $B.
100 BUILD $A, $B	If link is in information transfer, builds a transmission message from string variables A and B.
110 TRAN	Transmits the message.
120 REC	Attempts to receive a message.
130 IF LENGTH = 0 GOTO 120	Loops until a message is received.
140 SET LINK = RECLNK	Selects the link from which the message was received.
150 BUILD " MESSAGE RESPONSE"	Builds a response message to the selected link.
160 GOTO 110	Loops to transmit the response message and wait for another message.

6.1 CHAMELEON BSC FUNDAMENTALS

Introduction

With Tekelec's Chameleon Binary Synchronous software, you can emulate and perform testing on a Bisynchronous device. Chameleon BSC is flexible, allowing you to deviate from standard protocols during hardware/software development and to compensate for protocol deviations in equipment supplied to you by others.

Chameleon BSC has special commands for transmission, reception, timing control, and pin level interrogation and setting. In addition, all of the Chameleon BASIC commands are available in BSC.

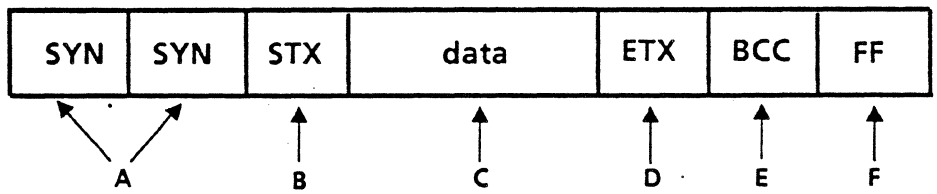
BSC Applications

You can use Chameleon BSC for the following types of tasks:

- Use Chameleon BSC control characters, data strings, and other features to derive and finish your own particular BSC protocol.
- Emulate a specific device or an entire network, enabling you to develop your own devices, networks, software and systems into a working model of a live environment.
- Perform positive testing by supplying your device or network with correct information to see if all procedures are working correctly.
- Perform negative testing by deliberately sending incorrect data in order to test error recovery and system/device susceptibility to failure induced by invalid data.
- Handle ACKs and NAKs, create multiple data blocks, transmit and receive data in a controlled environment, and perform block checks.

BSC Frame

The diagram below illustrates a sample BSC frame, with a brief description of its components.



A. Synchronizing Characters announce that data is arriving.
B. Start of Text indicates beginning of data.
C. Data
D. End of Text indicates end of the data.
E. Block Check Characters check accuracy of data transmission.
F. Padding characters (FF hex) that fill the line when data is not being transmitted.

Transmission

In Chameleon BSC, a transmission buffer is used to build a frame for transmission. There are three commands that affect the BSC transmission buffer.

The TXBUFFER command assigns the contents of the transmission buffer; that is, the data that will be transmitted. Refer to page 6.5-9 for more information.

The TXSTATUS command assigns a status control byte that defines how the contents of the transmission buffer will be transmitted. For example, the control status byte determines start and end framing characters, use of transparent or text mode, and whether a good or bad CRC is sent. Refer to page 6.5-10 for more information.

The TRAN command transmits the contents of the transmission buffer according to the status control byte. Refer to page 6.5-8 for more information.

Reception

The trace buffer gives you access to the frames received. The REC command transfers information from the acquisition buffer to the trace buffer. The TPRINT command displays the contents of the trace buffer.

Refer to Section 3.2 for more information about simulation buffers and their usage.

6.2 CHAMELEON BSC PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the BSC menu. This menu enables you to configure and save parameters for running BSC simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu (option S), refer to Section 2.3.

```
                                                                      Simulation

                   **  BISYNC PARAMETER SET-UP  **
A.- Simulate      : DCE          G.- SOH        : 01          M.- ETB      : 26
B.- Bit Rate      : 9600         H.- STX        : 02          N.- ITB      : 1F
C.- Code          : EBCDIC       I.- ETX        : 03
D.- BCC           : CRC-16       J.- DLE        : 10
E.- Sync 1        : 32           K.- EOT        : 37
F.- Sync 2        : 32           L.- ENQ        : 2D
================================================================================
SELECT >                                    CHOICES :

INPUT :   SELECT a letter
          or type an option key shown below


Z = run BISYNC,    ? = Help,  S = Save parameters,  ESC = Main Menu
```

BSC Parameters

The BSC parameter fields and legal values are as follows:

A. Simulate	DTE DCE
B. Bit Rate	50 - 64000
C. Code	EBCDIC ASCII/no parity ASCII/even parity ASCII/odd parity

D. BCC (Block Control Char.)	CRC-16 CCITT
E. Sync 1	2-digit hex number
F. Sync 2	2-digit hex number
G. SOH (Start of Header)	2-digit hex number
H. STX (Start of Text)	2-digit hex number
I. ETX (End of Text)	2-digit hex number
J. DLE (Data Link Escape)	2-digit hex number
K. EOT (End of Transmission)	2-digit hex number
L. ENQ (Enquiry)	2-digit hex number
M. ETB (End of Text Block)	2-digit hex number
N. ITB (IntermediateText Block)	2-digit hex number

6.3 CHAMELEON BSC MNEMONICS

Introduction

This section describes the default mnemonic table for Chameleon BSC. For a general description of the use of mnemonic tables, refer to Section 3.3.

Entries

The BSC mnemonic table has four columns:

- Mnemonic name (1-6 characters)
- Decimal value
- Hexadecimal value
- Binary value

Table 6.3-1 shows the default BSC mnemonic table. You can define and save additional BSC mnemonic tables using the BASIC mnemonic commands described in Section 3.4.

MNEMONIC	DECIMAL	HEX	BINARY
ACK0	112	70	01110000
ACK1	97	61	01100001
WABT	127	7F	01111111
SOH	1	01	00000001
STX	2	02	00000010
ETB	38	26	00100110
ETX	3	03	00000011
ITB	31	1F	00011111
EOT	55	37	00110111
ENQ	45	2D	00101101
DLE	16	10	00010000
SYN	50	32	00110010
ACK	46	2E	00101110
NAK	61	3D	00111101

Table 6.3-1: BSC Default Mnemonic Table

6.4 BSC COMMAND INDEX

In this section, the BSC commands are listed by function in two tables. This functional listing provides only the command name, a brief description, and the command type (**S**tatement or **D**irect). For more information about a command, refer to the page number indicated.

Remember that you can also use the Chameleon BASIC commands that are described in Section 3.5.

TABLE 6.4-1: BSC TRANSMISSION AND RECEPTION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
REC	6.5-5	S or D	Receives a block or character.
RXLENGTH	6.5-6	Variable	Read-only variable that returns the length of the last received block.
TRAN	6.5-8	S or D	Transmits the contents of the transmission buffer.
TXBUFFER	6.5-9	S or D	Defines the contents of the transmission buffer (assembles data in the specified order to be transmitted).
TXSTATUS	6.5-10	S or D	Defines the control status byte that determines how the data in the transmission buffer will be transmitted.

TABLE 6.4-2: BSC MISCELLANEOUS COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
CRC16	6.5-2	S or D	Calculates the two-byte CRC of a string and stores the result in another string.
IDLE	6.5-3	S or D	Transmits continuous SYNs or FFs to mark the line when not transmitting data.
LRC	6.5-4	S or D	Calculates the one-byte LRC of a string and stores the result in another string.
TPRINT	6.5-7	S or D	Displays the contents of the trace buffer.

6.5 BSC COMMANDS

Introduction

This section provides a complete description of the BSC commands. The commands are organized alphabetically, one command per page.

If you know the name of the command you want to use, you can look up the command in this section. If you are unsure of the command you need, refer to the previous section which lists the commands by function.

The following information is provided in this section:

- Command description
- Type of command (Statement or Direct)
- Syntax
- Command abbreviation
- Related commands (See Also)
- Example(s) of command usage

CRC16

Description

This function calculates the two byte polynomial CRC (Cyclic Redundancy Check) characters for a string of data. The CRC polynomial is:

$$x^{16} + x^{15} + x^2 + 1$$

Type

Statement or Direct

Syntax

CRC16($A)

where: **$A** is the data.

Abbreviation

None

See Also

LRC, TXSTATUS, REC, LEFT$

Example 1

In this example, the two CRC bytes are extracted from a received frame and checked for accuracy. This assumes that the following string is received:

$A = HEX > 02C1C2C3C4C5C6 03 ba 93 FF

`10 REC $A`	Receives a frame.
`20 IF RXLENGTH=0 GOTO 10`	If no frame received, loops to try again.
`30 DISPF`	Displays the received frame.
`40 $B=RIGHT$($A,3)`	Extracts the 3 rightmost characters of the frame.
`50 $B=LEFT$($B,2)`	Extracts the the 2 leftmost characters of $B (CRC).
`60 $C=MID$($A,2,LEN($A)-3)`	Stores the frame (without the CRC bytes and STX) to $C.
`70 $D=CRC16($C)`	Calculates the CRC of $C and stores it in $D.
`80 IF $D=$B PRINT "GOOD CRC"`	If calculated CRC matches extracted CRC, prints message.
`90 PRINT "BAD CRC"`	If calculated CRC does not match extracted CRC, prints message.

!RUN <RETURN>

IDLE

Description

The IDLE command determines what is transmitted when the line is idle. The default condition is for the Chameleon to mark the line by sending continuous FFs.

The IDLE command may not be used while data is being transmitted, so be sure to allow time for outstanding transmissions to be cleared before using it.

Type

Statement or Direct

Syntax

IDLE = SYNC	Idles the line by sending continuous SYNs.
IDLE = MARK	Idles the line by sending continuous FFs.

Abbreviation

ID.

Example

This example causes the Data LEDs on the Chameleon to flash continuously as the idle character changes between the SYN and FF.

```
10 IDLE=SYNC
20 IDLE=MARK
30 GOTO 10
!RUN   <RETURN>
```

LRC

Description

This function calculates the LRC (Longitudinal Redundancy Check) for a string of data. The LRC polynomial is:

$x^8 + 1$

Type

Statement or Direct

Syntax

LRC($A)

where: **$A** is the data.

Abbreviation

None

See Also

CRC16

Example

In this example, the LRC byte is extracted from a received frame and checked for accuracy. This assumes that the following string is received:

$A = HEX > 02C1C2C3C4C5C6 03 ba 93 FF

`10 REC $A`	Receives a frame.
`20 IF RXLENGTH=0 GOTO 10`	If no frame received, loops to try again.
`30 DISPF`	Displays the received frame.
`40 $B=RIGHT$($A,2)`	Extracts the 2 rightmost characters of the frame.
`50 $B=LEFT$($B,1)`	Extracts the the leftmost character of $B (LRC).
`60 $C=MID$($A,2,LEN($A)-2)`	Stores the frame (without the LRC byte and STX) to $C.
`70 $D=LRC($C)`	Calculates the LRC of $C and stores it in $D.
`80 IF $D=$B PRINT "GOOD LRC"`	If calculated LRC matches extracted LRC, prints message.
`90 PRINT "BAD LRC"`	If calculated LRC does not match extracted LRC, prints message.

!RUN <RETURN>

REC

Description

REC takes the next received block in sequence from the buffer and assigns it to one or more string variables. A string variable can be assigned a maximum of 255 characters. When the 255-character maximum is reached, data is stored in the next string variable indicated in the command.

If string variables included in the REC command are not needed for reception, the previous contents of the string are unaffected.

Refer to Section 3.2 for a description of the Simulation buffers. Remember to FLUSH the reception buffer before receiving and storing traffic, if necessary.

Type

Statement or Direct

Syntax

REC $A, $B...

Abbreviation

None

See Also

TPRINT, DISPF

Example

This example waits to receive a frame and then displays it.

`10 REC $A`	Receives a frame.
`20 IF RXLENGTH=0 GOTO 10`	If no frame received, loops to try again.
`30 DISPF`	Displays the received frame.

```
!RUN  <RETURN>
```

RXLENGTH

Description

RXLENGTH is a read-only variable that returns the length of the last received block. If the value returned is 0, no data was received.

Type

Variable

Syntax

(See example below.)

Abbreviation

RX.

See Also

REC

Example

This example waits until a block is received and then prints the length of the block.

```
10 REC $A
20 IF RXLENGTH=0 GOTO 10
30 PRINT "THE LENGTH OF THIS BLOCK IS ",RXLENGTH
!RUN <RETURN>
```

TPRINT

Description

The TPRINT command displays the contents of the trace buffer. Refer to Section 3.2 for a description of the Simulation buffers.

Type

Statement or Direct

Syntax

TPRINT	Displays the trace buffer in hex.
TPRINT ASCII	Displays the trace buffer in ASCII.
TPRINT EBCDIC	Displays the trace buffer in EBCDIC.

Abbreviation

TP.

See Also

REC, LTPRINT

Example

This example builds and transmits a block of data and displays the trace buffer in hex, ASCII and EBCDIC.

`10 $A="THIS IS DATA"`	Assigns a string to $A.
`20 TXBUFFER=$A`	Assigns $A to the transmission buffer.
`30 TXSTATUS=128`	Assigns a value to the transmission control status byte.
`40 TRAN`	Transmits the block in the transmission buffer.
`50 TPRINT`	Displays the trace buffer in hex.
`60 TPRINT ASCII`	Displays the trace buffer in ASCII.
`70 TPRINT EBCDIC`	Displays the trace buffer in EBCDIC.

!RUN <RETURN>

TRAN

Description

The TRAN command transmits a block from the transmission buffer (TXBUFFER), according to the framing defined by the transmission control status byte (TXSTATUS). Generally, TXBUFFER, TXSTATUS, and TRAN are used together in a program.

Type

Statement or Direct

Syntax

TRAN

Abbreviation

TR.

See Also

TXBUFFER, TXSTATUS

Example

This example builds and transmits a block of data and displays the trace buffer in hex.

`10 $A="THIS IS DATA"`	Assigns a string to $A.
`20 TXBUFFER=$A`	Assigns $A to the transmission buffer.
`30 TXSTATUS=128`	Assigns a value to the transmission control status byte.
`40 TRAN`	Transmits the block in the transmission buffer.
`50 TPRINT`	Displays the trace buffer in hex.

!RUN <RETURN>

TXBUFFER

Description

The TXBUFFER command defines the contents of the transmission buffer which assembles the data to be transmitted in a specified order. The data is stored in the transmission buffer prior to transmission and is transmitted according to the transmission control status byte (TXSTATUS).

The transmission buffer data can be a string, data that has been read from a disk-based data file, or other types of user-defined data.

Type

Statement or Direct

Syntax

TXBUFFER = DLE **TXBUFFER = ACK** **TXBUFFER = 0**	Stores the indicated control character in the transmission buffer.
TXBUFFER = $A	Stores a string value in the transmission buffer.
TXBUFFER = &10, &70	Stores one or more hexadecimal values in the transmission buffer.
TXBUFFER = DLE, $A, &70	Stores a combination of control characters, strings and hex values.

Abbreviation

TXB.

See Also

TXSTATUS, TRAN, TPRINT

Example

This example assigns a string to the transmission buffer, transmits it, and displays the trace in hex.

```
10 $A = "ABCDE"
20 TXBUFFER =$A
30 TXSTATUS = &BC
40 TRAN
50 TPRINT
!RUN   <RETURN>
```

(result) **T 00:00:00:00:00 5**

41 42 43 44 45

TXSTATUS

Description

TXSTATUS is a bit-mapped transmission control status byte that defines how the data in the transmission buffer will be transmitted. The contents of the transmission buffer is defined with the TXBUFFER command.

Each bit of the transmission control byte regulates a specific aspect of the protocol as illustrated in Figure 6.5-1 on the next page.

NOTE: Bit seven must always be set to one.

Type

Statement or Direct

Syntax

TXSTATUS = &xx

where: **xx** is the hexadecimal value for the transmission control byte. The ampersand (&) assigns the value in hex.

Abbreviation

TXS.

See Also

TXBUFFER

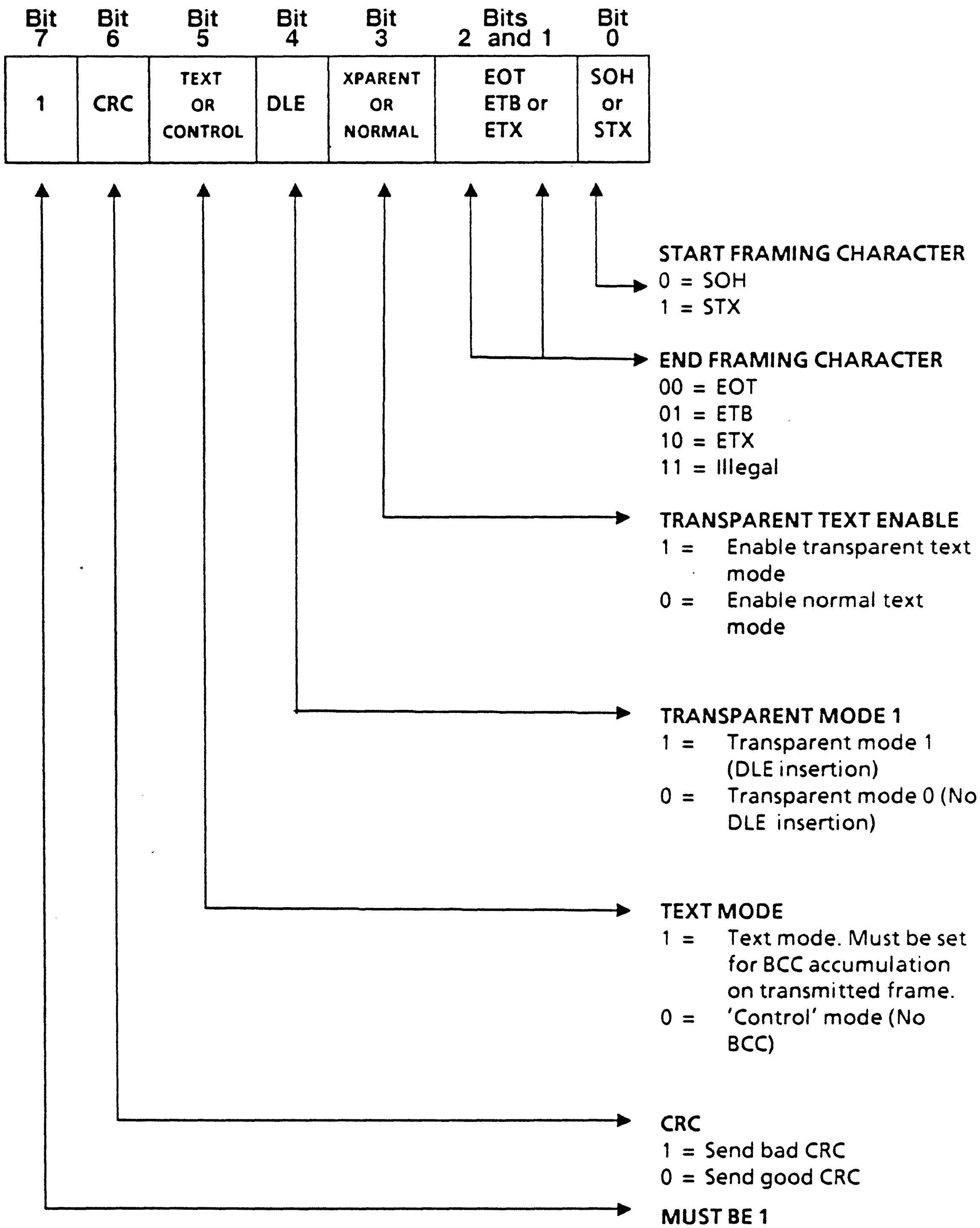


Figure 6.5-1: TXSTATUS Byte Bit Map

Example 1

TXSTATUS = &B5

A TXSTATUS value of B5 hexadecimal is represented in binary is:

1 0 1 1 0 1 0 1

Referring to Figure 6.5-1, this defines the transmission control byte as:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bits 2 and 1	Bit 0
1	Good CRC	TEXT	DLE	NORMAL	ETX	SOH

If the data in the transmission buffer is ABCDE, the data is transmitted as follows:

SYN SYN	DLE STX	ABCDE DLE DLE	DLE ETX	CRC1 CRC2

Example 2

TXSTATUS = &AD

In binary this is represented by:

1 0 1 0 1 1 0 1

Referring to Figure 6.5-1, this defines the transmission control byte as:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bits 2 and 1	Bit 0
1	Good CRC	TEXT	No DLE	XPARENT	ETX	SOH

If the data in the transmission buffer is ABCD DLE, the data is transmitted as follows:

SYN SYN	DLE STX	ABCD DLE	DLE ETX	CRC1 CRC2

Example 3

TXSTATUS = &A1

In binary this is represented by:

1 0 1 0 0 0 0 1

Referring to Figure 6.5-1, this defines the transmission control byte as:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bits 2 and 1	Bit 0
1	Good CRC	TEXT	No DLE	NORMAL	EOT	SOH

If the data in the transmission buffer is ABCD DLE, the data is transmitted as follows (the DLE included is from the block of data in the transmission buffer):

SYN SYN	STX	ABCD DLE	ETX	CRC1 CRC2

Example 4

This program uses TXBUFFER to assign the data ABCDE in EBCDIC to the transmission buffer. It then transmits the data three different ways using different TXSTATUS bytes.

`10 $A = "ABCDE"`	Stores ABCDE in string A.
`20 $A = EBC$($A)`	Converts string A to EBCDIC.
`25 TXBUFFER = $A`	Stores string A in the transmission buffer.
`30 TXSTATUS = &A4`	Defines the transmission control byte as A4 in hex.
`40 TRAN`	Transmits the contents of the buffer using the TXSTATUS specification.
`50 TXSTATUS = &80`	Defines the transmission control byte as 80 in hex.
`60 TRAN`	Transmits the contents of the buffer using the TXSTATUS specification.
`70 TXSTATUS = &BC`	Defines the transmission control byte as BC in hex.
`80 TRAN`	Transmits the contents of the buffer using the TXSTATUS specification.

(result)　Line 40　TXSTATUS = &A4 = 1010,0100

SYN SYN SOH C1 C2 C3 C4 C5 ETX CRC PAD

Line 60　TXSTATUS = &80 = 1000,0000

SYN SYN C1 C2 C3 C4 C5 PAD

Line 80　TXSTATUS = &BC = 1011,1100

SYN SYN DLE SOH C1 C2 C3 C4 C5 DLE ETX CRC PAD

6.6 SAMPLE BSC PROGRAMS

The following BSC programs are for demonstration only. They show some major concepts to bear in mind when developing applications, but are not to be considered as tests for any particular application.

BSC1

This example polls a 3270, receives a poll. If there is no text to send, it replies with an EOT. Otherwise it sends the message, waits for an ACK, and closes transmission. Station addresses are: C1, C2, and C3.

```
10 DEFINE "POLL"=&40                          Defines POLL mnemonic.
20 DEFINE "ADDR"=&C0                          Defines ADDR mnemonic.
30 $F=CHR$(EOT)
40 GOSUB 290                                  Execute subroutine at 290.
50 $P=LEFT$($P,1)
60 IF $P=$F GOTO 80
70 GOTO 40
80 GOSUB 290                                  Execute subroutine at 290.
90 IF LEN($P) >=5 GOTO 120
100 PRINT "NO POLLING RECEIVED-ABORTED"       Print message, stop program.
110 STOP
120 $F = CHR$(POLL) + CHR$(ADDR) + CHR$(ADDR) + CHR$(ENQ)
130 $P=LEFT$($P,5)
140 IF $P=$F GOTO 160
150 GOTO 100
155 REM                                       Poll received, send some data.
160 $A="THIS IS SOME EBCDIC DATA"
170 $A=EBC$($A)
180 TXSTATUS=&A2
190 TXBUFFER=$A
200 TRAN                                      Data transmitted, wait for an
                                              ACK.
210 GOSUB 290                                 Receive subroutine.
215 REM                                       What have we received?
220 $P=LEFT$($P,2)
230 $F=CHR$(DLE)+CHR$(ACK0)
240 IF $F=$P GOTO 270
250 PRINT "NO ACK RECEIVED"
260 GOTO 210
270 PRINT "END"
280 STOP                                      Terminates execution.
290 TIM2=20                                   Reception subroutine.
300 REC $P, $Y, $Z
310 IF RXLENGTH # 0 GOTO 350
320 IF TIM2#0 GOTO 300
330 PRINT "RX TIME OUT"
340 STOP                                      If unable to receive, stop.
350 RETURN
```

BSC2

This program simulates a 3274 device. It receives polls and data, and sends the appropriate responses.

```
1   REM********AUTHOR ELIZABETH WALLING
5   L = 0
110  TIM2 = 60                          Sets timer for one minute.
120  REC $A, $B                         Receive from the line.
130  IF TIM2 = 0 GOTO 900               Display and stop.
140  IF RXLENGTH =0 GOTO 120  Try again
150  IF RXLENGTH < 5 GOTO 440

160  REM                                Look for general poll.

170  $G = CHR$(&40)+CHR$(&40)+CHR$(&7F)+CHR$(&7F)+CHR$(&2D)
180  $D = LEFT$($A,5)
190  IF $D = $G GOTO 500                Respond to general poll.
205  REM                                Look for specific poll.

210  $G = CHR$(&60)+CHR$(&60)+CHR$(&40)+CHR$(&40)+CHR$(&2D)

220  IF $D = $G GOTO 400                Respond to specific poll.
230  REM                                Must be data.
235  $G = CHR$(&02)
240  $D = LEFT$($A,1)
245  IF $D = $G GOTO 250
246  GOTO 900                           Display last block and stop.

250  IF RXLENGTH <14 GOTO 550           Acknowledge the data
255  $D = MID$($A,10,7)
260  $G = "SIGN ON"
265  $G = EBC$($G)
270  IF $D = $G GOTO 275
271  GOTO 310
275  REM                                This is the sign-on.
280  $D = MID$($A,10,39)
285  $D = ASC$($D)
290  PRINT $D
300  L = 1
305  GOTO 550                           Acknowledge the data.
310  IF L = 1 GOTO 900
315  DISPF                              Display.

320  GOTO 550                           Acknowledge the data
400  REM                                Respond to specific poll.
401  $S = CHR$(&10)+CHR(&70)

405  TXBUFFER = $S
410  TXSTATUS = &80
415 TRAN                                Transmit response.

420  GOTO 110                           Receive again.
440  REM                                Check for acknowledgement
                                        or end
441  REM                                     of text. Is it an EOT?
```

7.1 INTRODUCTION TO CHAMELEON ASYNC

With Chameleon Async software, you can emulate and perform testing on an Asychronous device. Programming commands specificially applicable to Async testing are a standard part of the software package and extend the Chameleon's BASIC command library.

All of the Chameleon BASIC commands are available in Async. In addition, Async includes special transmission, reception, timing control, and pin level interrogation and setting commands.

With Chameleon Async you can do the following:

- Emulate devices or networks to develop and test your software and systems in a working model of a live environment.
- Test a specific device or network by supplying either valid or invalid stimuli or responses.
- Perform positive testing by supplying your device or network with correct information to see if all procedures are working correctly.
- Perform negative testing by deliberately sending incorrect data in order to test error recovery and system/device susceptibility to failure induced by invalid data.
- Deviate from standard protocols during hardware/software development and compensate for protocol deviations in equipment supplied to you by others.

7.2 ASYNC PARAMETER SET-UP MENU

Introduction

This section describes the parameters and valid values for the Async menu. this menu enables you to configure and save parameters for running Async simulation. For general information about using a parameter set-up menu, refer to Section 2.2.

For information about using the Save parameters menu, refer to Section 2.3.

```
                                                                   Simulation
                    **  CHAMELEON ASYNC PARAMETER SET-UP  **
A.- Simulate:             : DCE                F.- Baud Rate:         : 9600
B.- Parity:               : EVEN               G.- Reception Mode:    : Block
C.- No. of Stop Bits:     : 1                  H.- End of Block Char: : 0D
D.- No. of Data Bits:     : 7
E.- Mode:                 : Full Duplex
==================================================================================
 SELECT >                             CHOICES :

 INPUT : SELECT by letter (A - H)
         or type a control key shown below



Z = return to ASYNC,    ? = Help,  S = Save parameters,  ESC = Main Menu
```

The Async parameter fields and legal values are as follows:

Simulate	DCE DTE
Parity	EVEN NONE ODD
No. of Stop Bits	1 1.5 2

No. of Data Bits	5 6 7 8
Mode	Full Duplex Half Duplex Do not use full duplex mode to transmit data from both sides of the line. This will cause problems since full duplex echoes back what it receives. Normal async usage is in half duplex mode.
Baud Rate	50 1200 75 2400 110 4800 150 9600 300 19200 600
Reception Mode	Block Character
End of Block Character	Enter a 2 digit hex number

7.3 ASYNC MNEMONIC TABLE

Introduction

This section describes the default mnemonic table for Chameleon Async. For a general description of the use of mnemonic tables, refer to Section 3.3.

Entries

The Async mnemonic table has four columns:

- Mnemonic name (1-6 characters)
- Decimal value
- Hexadecimal value
- Binary value

Table 7.3-1 on the next page shows the default Async mnemonic table. You can define and save your own mnemonic tables using the BASIC mnemonic commands described in Section 3.4.

MNEMONIC	DECIMAL	HEX	BINARY
SPACE	32	20	00100000
BELL	7	07	00000111
NULL	0	00	00000000
SOH	1	01	00000001
STX	2	02	00000010
ETX	3	03	00000011
EOT	4	04	00000100
ENQ	5	05	00000101
ACK	6	06	00000110
DLE	16	10	00010000
DC1	17	11	00010001
DC2	18	12	00010010
DC3	19	13	00010011
DC4	20	14	00010100
NAK	21	15	00010101
SYN	22	16	00010110
ETB	23	17	00010111
CAN	24	18	00011000
SUB	26	1A	00011010
ESC	27	1B	00011011
DEL	127	7F	01111111
BS	8	08	00001000
HT	9	09	00001001
LF	10	0A	00001010
VT	11	0B	00001011
FF	12	0C	00001100
CR	13	0D	00001101
SO	14	0E	00001110
SI	15	0F	00001111
EM	25	19	00011001
FS	28	1C	00011100
GS	29	1D	00011101
RS	30	1E	00011110
US	31	1F	00011111

Table 7.3-1: Async Mnemonic Table

7.4 COMMAND INDEX

Introduction

This section lists the Chameleon Async commands by function. If you need a command that performs a specific function, but you do not know the name of the command, you should be able to locate the command by referring to one of these tables.

The tables contain a brief description of the command and the command type (Statement or Direct). For more information about a command, refer to the page number indicated.

TABLE 7.4-1: ASYNC READ-ONLY VARIABLES

COMMAND	PAGE	TYPE	FUNCTION
FRAMING	7.5-5	Variable	Indicates if stop bits encountered.
LENGTH	7.5-6	Variable	Indicates length of received block.
PARITY	7.5-8	Variable	Detects parity errors.
RXBREAK	7.5-10	Variable	Indicates if break sequence encountered.

TABLE 7.4-2: ASYNC TRANSMISSION AND RECEPTION COMMANDS

COMMAND	PAGE	TYPE	FUNCTION
BREAK	7.5-2	S or D	Transmits a break sequence.
CRC16	7.5-3	S or D	Calculates the 2-byte CRC for a string.
FOXMESS	7.5-4	D	Transmits the standard FOX message.
LRC	7.5-7	S or D	Calculates a 1-byte LRC for a string.
REC	7.5-9	S or D	Receives a block or character.
TPRINT	7.5-11	S or D	Displays the contents on the trace buffer.
TRAN	7.5-12	S or D	Transmits string and characters

7.5 ASYNC COMMANDS

Introduction

This section provides a complete description of the Async commands. The commands are organized alphabetically, one command per page.

If you know the name of the command you want to use, you can look up the command in this section. If you are unsure of the command you need, refer to the previous section which lists the commands by function.

The following information is provided in this section:

- Command description
- Type of command (Statement or Direct)
- Syntax
- Command abbreviation
- Related commands (See Also)
- Example(s) of command usage

BREAK

Description	The BREAK command transmits a BREAK sequence.
Type	Statement or Direct
Syntax	**BREAK**
Abbreviation	B.
See Also	RXBREAK
Example	BREAK

CRC16

Description

The CRC16 function calculates the CRC (Cyclic Redundancy Check) characters for a string of data. The polynomial used is:

$$x^{16} + x^{15} + x^2 + 1$$

Type

Statement or Direct

Syntax

$B = CRC16($A)

where: $A is the string of data and $B returns two bytes which are the CRC characters for the data in $A.

Abbreviation

None

See Also

LRC

Example

```
10 $A = "HELLO"
20 $B = CRC16($A)
30 PRINT $B
```

(result) **Aa**

FOXMESS

Description

This command transmits the standard FOX message and repeats it until the operator hits any key.

The fox message that is transmitted is:

> **(STX)THE QUICK BROWN FOX JUMPS OVER THE LAZY DOGS BACK 0123456789**
> **(CR)(LF)(ETX)**

To allow the greatest possible density and the fastest possible transmission, data transmitted does not appear in the trace buffer and therefore cannot be displayed using the TPRINT command.

Type

Direct

Syntax

FOXMESS

Abbreviation

F.

Example

FOXMESS

(result) `HIT ANY KEY TO STOP FOX MESSAGE`

FRAMING

Description

FRAMING is a numeric read-only variable that detects the presence of stop bits at the end of the received block. FRAMING has the following valid values:

- FRAMING = 0 One or more valid stop bits detected.
- FRAMING = 1 No stop bits detected.

Type

Variable

Syntax

(See examples below.)

Abbreviation

FRA.

See Also

REC

Example 1

```
PRINT FRAMING
```

Example 2

```
IF FRAMING = 1 PRINT "NO STOP BITS"
```

LENGTH

Description LENGTH is a numeric read-only that returns the number of characters received in a block. If LENGTH = 0, it indicates that nothing has been received.

Type Statement or Direct

Syntax (See examples below.)

Abbreviation L.

See Also REC

Example 1

```
PRINT LENGTH
```

Example 2

```
10 REC
20 IF LENGTH = 0 GOTO 10
```

LRC

Description

LRC is a function that calculates the LRC (Longitudinal Redundancy Check) for a string of data. The LRC computation command checks the parity selection chosen in the Async Parameter Set-Up menu. It uses the polynomial:

$$x^8 + 1$$

Type

Statement or Direct

Syntax

$X = LRC($Y)

where: **$Y** is the string of data and **$X** returns a single character that equals the LRC for the data in $Y.

Abbreviation

None

See Also

CRC16

Example 1

This example prints the hex value of the LRC of the string HELLO.

```
10 $A = "HELLO"
20 $B=LRC($A)
30 PRINT %$B
```

(result) **42**

Example 2

This example prints the hex value of the LRC of the string GOODBYE.

```
10 $A = "GOODBYE"
20 $B=LRC($A)
30 PRINT %$B
```

(result) **DD**

PARITY

Description

PARITY is a numeric read-only variable that indicates whether a parity error has occurred. PARITY has the following valid values:

- PARITY = 0 No parity error detected.
- PARITY = 1 parity error detected.

Type

Variable

Syntax

(See examples below.)

Abbreviation

P.

See Also

REC

Example 1

```
PRINT PARITY
```

Example 2

```
IF PARITY = 0 PRINT "NO PARITY ERROR DETECTED"
```

REC

Description

REC assigns the next character (if in character mode) or block of characters (if in block mode) to the string variables as specified in the command. A string variable can be assigned a maximum of 255 characters. When the 255-character maximum is reached, data is stored in the next string variable indicated.

After a REC command, these Async numeric read-only variables are updated: LENGTH, PARITY, FRAMING, RXBREAK.

Type

Statement or Direct

Syntax

REC $A, $B,...

where: **$A, $B**, are the string variables that the received data is assigned to.

Abbreviation

None

See Also

FRAMING, LENGTH, PARITY, RXBREAK

Example

```
10 REC $A, $B
20 IF LENGTH = 0 GOTO 10
```

RXBREAK

Description

RXBREAK is a numeric read-only variable that indicates if a break sequence has been received. It has the following valid values:

- RXBREAK = 0 No break sequence received.
- RXBREAK = 1 Break sequence received.

Type

Variable

Syntax

(See examples below.)

Abbreviation

RX.

See Also

REC

Example 1

```
PRINT RXBREAK
```

Example 2

```
IF RXBREAK = 1 PRINT "BREAK SEQUENCE RECEIVED"
```

TPRINT

Description

TPRINT prints the contents of the trace buffer to the screen. The trace buffer contains the data received or transmitted in ASCII.

Type

Statement or Direct

Syntax

TPRINT	Prints the trace in ASCII.
TPRINT HEX	Prints the trace in hexadecimal.

Abbreviation

TP.

See Also

REC, TSAVE, TLOAD, TPRINT, LTPRINT

Example 1

This example displays the contents of the trace buffer in ASCII.

TPRINT

(result)

```
T    15:09:38:31:60    61
          THE QUICK BROWN FOX JUMPS OVER THE LAZY DOGS BACK 0123456789
           CR
```

Example 2

This example displays the contents of the trace buffer in hex.

TPRINT HEX

(result)

```
T     15:09:38:31:60    61
          54 48 45 20 51 55 49 43 4B 20 42 52 4F 57 4E 20 46 4F 58 20
          4A 55 4D 50 53 20 4F 56 45 52 20 54 48 45 20 4C 41 5A 59 20
          44 4F 47 53 20 42 41 43 4B 20 30 31 32 33 34 35 36 37 38 39
          0D
```

TRAN

Description TRAN transmits string data, mnemonics or literal data.

Type Statement or Direct

Syntax

TRAN $A...	Transmits $A.
TRAN CR, LF...	Transmits the mnemonics CR (carriage return) and LF (line feed).
TRAN "ABCD"...	Transmits ABCD.
TRAN $A, CR, LF, "ABCD"	Transmits a combination of the above.

Abbreviation TR.

See Also REC

Example

```
10 $A = "HELLO"
20 $B = "GOODBYE"
30 TRAN $A, ",", $B, CR, LF
```

7.6 ASYNC SAMPLE PROGRAMS

Async 1

The program transmits the fox message that is being rotated as data.

```
10 $A="THE QUICK BROWN FOX JUMPS OVER THE LAZY DOGS BACK 0123456789"
```

`20 GOTO 90`	Transmission subroutine.
`30 $B=RIGHT$($A,(LEN($A)-1))`	Deletes first character of $A and stores the rest in $B.
`40 $B= $B+LEFT$($A,1)`	Adds first character to end of $B.
`50 $A = $B`	Stores new string in $A.
`60 RETURN`	End of rotation, returns to line 115.
`70 FOR Y = 1 TO 23`	Complete rotation is done 23 times.
`80 FOR X = 0 TO LEN($A)`	One rotation depends on length of $A.
`90 TRAN $A,CR`	Transmits current string and carriage return.
`100 GOSUB 30`	Goes to rotation subroutine.
`110 NEXT X`	Increments X.
`120 TRAN LF`	Transmits line feed.
`130 NEXT Y`	Increments Y.

Async2

This program transmits a fox message that is being rotated as data and then writes the data to a file.

`10 OPEN "O","B:DATA"`	Opens file for output called DATA.
`20 TRAN SUB`	
`30 $A="THE QUICK BROWN FOX JUMPS OVER THE LAZY DOGS BACK0123456789"`	
`40 GOTO 90`	Transmits and writes sub-routine.
`50 $B=RIGHT$($A,(LEN($A)-1))`	Deletes the first character of $A and stores the rest in $B.
`60 $B=$B+LEFT$($A,1)`	Adds the first character to end of $B.
`70 $A = $B`	Places new string in A.
`80 RETURN`	End of rotation; returns to line 115.
`90 FOR Y = 1 TO 23`	Complete rotation is done 23 times.
`100 FOR X = 0 TO LEN($A)`	One rotation depends on the length of string A.
`110 TRAN $A, CR`	Transmits current string and carriage return.
`120 WRITE $A`	Writes $A to output file, DATA.
`130 GOSUB 30`	Rotation sub-routine.
`140 NEXT X`	Increments X.
`150 TRAN LF`	Transmits line feed.
`160 NEXT Y`	Increments Y.

Async3

This program demonstrates the use of the Async mnemonic table. It shows the results of checking the mnemonic table prior to transmitting a one-character string converted to its ASCII equivalent.

`5 $A = ""`	Initializes string A to zero characters.
`10 FOR X = 0 TO &20`	Sets up a loop, incrementing X from 0 to 20 Hex.
`20 $A = $A + CHR$(X)`	CHR$ returns the ASCII value of the loop index X and stores it in string A.
`30 NEXT X`	Increments loop index.
`40 TRAN $A`	Transmits string A, the ASCII value of X, according to the mnemonic table.
`50 TPRINT`	Displays the string as stored in the trace after transmission.
`60 TPRINT HEX`	Displays the trace in hexadecimal.

The results of the sample program are:

```
T   13:46:58:41:30      33
          NULL  SOH  STX  ETX  EOT  ENQ  ACK  BELL  BS HT  LF  VT  FF
          CR  SO  SI  DLE  DC1  DC2  DC3  DC4  NAK  SYN  ETB  CAN  EM
          SUB ESC FS GS RS US

T   13:46:58:41:30      33
        00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10 11 12 13
        14 15 16 17 18 19 1A 1B 1C 1D 1E 1F 20
```

In the first display, the results of TPRINT are shown as the standard Async protocol mnemonics from the table. The second display shows the transmitted mnemonics displayed in hexadecimal. **T 13:46:58:41:30 33** indicates the time of the transmission and that the transmission block is 33 bytes long.

Async4

The example program below illustrates how these variables can be tested following reception. The program uses the shift left operation to calculate the line number for the GOTO statement based on the values in the variables.

`10 REC $A`	Receive from the line.
`20 IF LENGTH = 0 GOTO 10`	If nothing was received, try again.
`30 GOTO 1000 + (10 * ((PARITY OR (FRAMING SHL 1)) OR (RXBREAK SHL 2)))`	
.	
.	
.	
`1000 PRINT "RECEIVED O.K."`	All variables = 0; no errors detected. Print line number 1000.
`1005 GOTO 10`	
`1010 PRINT "PARITY ERROR"`	Parity error detected. Print line number 1010.
`1015 GOTO 10`	
`1020 PRINT "FRAMING ERROR"`	Framing error detected. Print ine number 1020.
`1025 GOTO 10`	
`1030 PRINT "PARITY & FRAMING ERROR"`	Parity and Framing errors. Print line number 1030.
`1035 GOTO 10`	
`1040 PRINT "BREAK DETECTED"`	Break sequence detected. Print line number 1040.
`1045 GOTO 10`	
`1050 PRINT "BREAK & PARITY ERRORS"`	Break and parity errors. Print line number 1050.
`1055 GOTO 10`	
`1060 PRINT "BREAK & FRAMING ERRORS"`	Break and framing errors. Print line number 1060.
`1065 GOTO 10`	
`1070 PRINT "BREAK, FRAMING & PARITY ERRORS"`	Break, framing and parity errors. Print line number 1070.
`1075 GOTO 10`	

8.1 INTRODUCTION TO SITREX

Introduction

SITREX is the Chameleon X.25 Simulator. It can simulate an X.25 Network or Subscriber and provide a live, certified environment for the development and testing of X.25 products.

This software package can handle all X.25 procedures automatically, including:

- Flow control at the frame and packet levels
- Error detection and error recovery
- Data generation and reception
- All protocol timers and counters

X.25 is a very specific, well-defined protocol. The Chameleon's X.25 Simulator complies entirely with the CCITT specifications and allows you to control levels one (Physical interface), two (Link level), and three (Packet level) independently.

Note

This chapter assumes that you have a thorough understanding of the X.25 protocol.

Standards

SITREX supports the CCITT 1984 X.25 standard, including the three network-specific implementations: NTT, DATAPAC, and TRANSPAC.

TRANSPAC SITREX is identical to CCITT SITREX, except you can transmit and receive calls on LCN 0.

SITREX ENVIRONMENT

Sitrex has a multi-tasking operating system that provides the following features and capabilities:

- Automatic X.25 Simulator
- Trace Buffer Function
- Command Language

You can also use the three set-up menus to configure physical level parameters, frame/packet level parameters, and user facilities for SITREX simulation. Refer to Section 8.3 for a description of these menus.

This section describes how the three major SITREX features interact to provide you with a comprehensive X.25 simulation environment. Each of the features is described briefly, as an overview. The sections that contain detailed information about each feature are referenced.

Automatic X.25 Simulator

The Automatic X.25 Simulator responds automatically to received traffic at packet and/or frame level, or not at all, according to CCITT specifications.

The Automatic X.25 Simulator can be used without any programming to create and monitor normal data communications traffic on the line. It produces valid X.25 responses to all incoming data, and updates counters and timers.

There are three possible idle states for the Automatic X.25 Simulator, as configured in the Mode parameter in the Sitrex Physical Level Parameter Set-Up menu:

- Initiative - The Simulator attempts to initiate an X.25 link, by sending a DISc or DM on the idle line.
- Standby - The Simulator reacts to incoming traffic.
- Manual - The Simulator is inactive; frame level is off.

Section 8.2 describes actions of the Automatic X.25 Simulator in detail.

Trace Buffer

The Trace Buffer stores and displays the transmitted and received traffic. You can specify that the traffic be interpreted at frame level, frame and packet level, or not at all.

You can turn the trace buffer on and off from the Automatic X.25 Simulator or by using the command language. Traffic is stored in the trace buffer only if the trace is on and there is space available in the buffer.

The information in the trace buffer can be saved to disk, displayed on the screen, or output to a printer. Refer to Section 8.4 for more information about the trace buffer.

Command Language

The SITREX command language provides you with additional control over the X.25 simulation environment. The command language can be used in conjunction with the Automatic X.25 Simulator to override the Simulator's automatic functions.

For example, frame and packet level processing can be turned ON or OFF independently. This ability to manipulate the Simulator enables you to check error response and recovery procedures in an X.25 environment.

You can generate scenarios that work with or without the Automatic X.25 Simulator to create normal or abnormal situations to troubleshoot an X.25 Subscriber or Network, or deviate from the X.25 standards.

Sections 8.5 - 8.7 describe the use of the Sitrex command language.

Interactions

Figure 8.1-1 illustrates the major features of the Sitrex X.25 simulation environment. It illustrates how to access each of the Sitrex features, and how to turn them on and off. The text that follows the illustration describes how the features interact with each other to process incoming traffic.

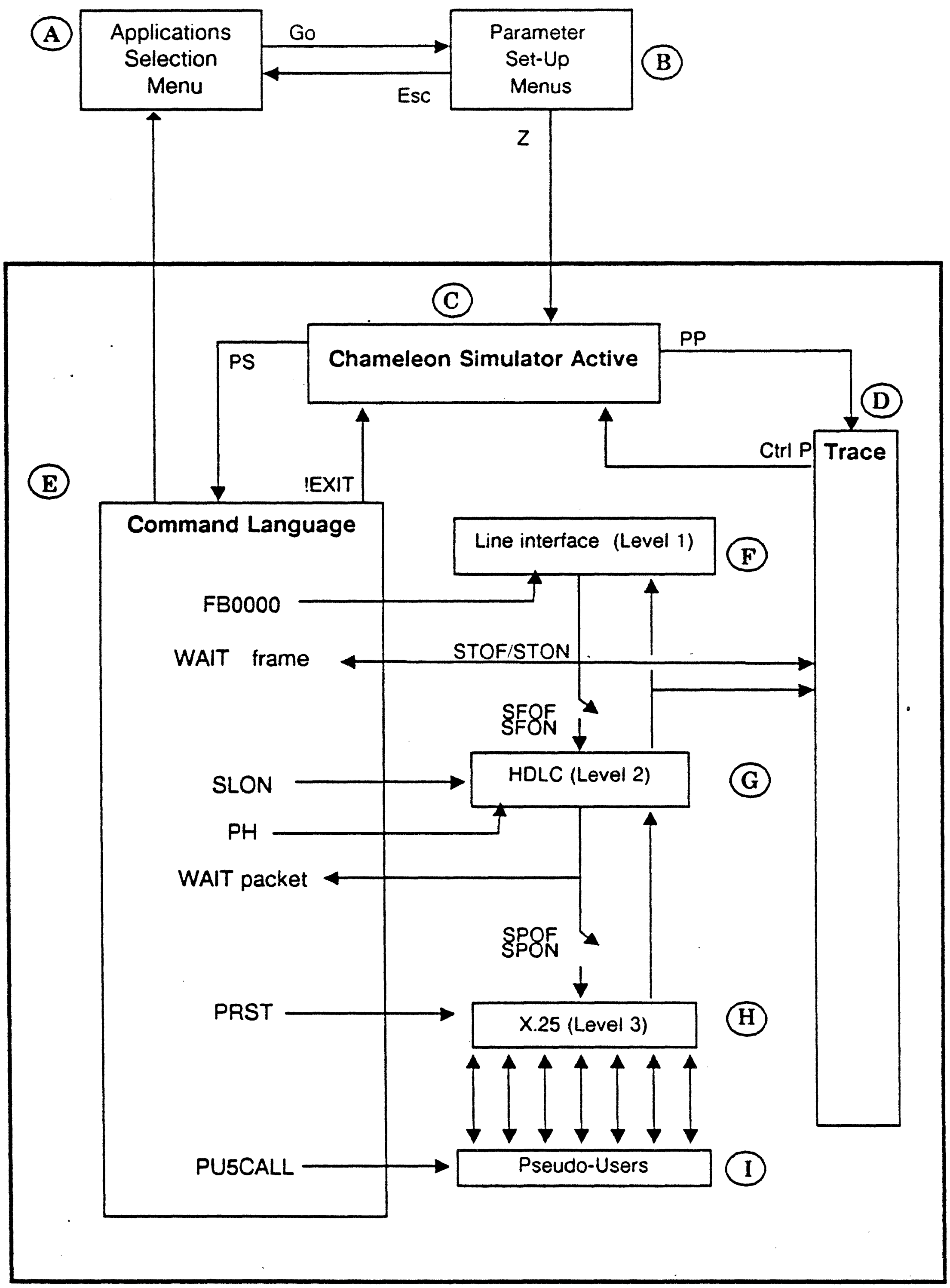


Figure 8.1-1: Sitrex Simulation Environment

A. Applications Selection Menu

In the Applications Selection Simulation window, load SITREX or T_SITREX (Transpac Sitrex) on the desired port. Press ***Go*** to start the simulator and access the Parameter Set-Up Menus.

B. Parameter Set-Up Menus

These menus enable you to configure Physical (level 1) parameters, Frame and Packet (level 2 and 3) parameters and User Facilities. See Section 2.2 and 2.3 for general instructions for the set-up menus. See Section 8.3 for a description of the Sitrex set-up menus.

These parameter settings affect the Automatic X.25 Simulator. They also affect scenarios you write in the Sitrex command language, unless a parameter command overrides the menu setting. Refer to the parameter commands in Section 8.7 for more information.

From any of the set-up menus, press ***Z*** to access Simulation or press ***Esc*** to return to the Main Menu.

C. Chameleon Simulator Active

This message indicates that you can begin your simulation activities. The Mode option in the Physical Parameters Set-up menu (B) determines whether the Automatic X.25 Simulator is active. Mode options are:

- Initiative - Automatic X.25 Simulator attempts to set up an X.25 link.
- Standby - Automatic X.25 Simulator reacts to incoming frames.
- Manual - Automatic X.25 Simulator is off. There is no automatic reaction to incoming frames, except through the use of the command language.

When active (Initiative or Standby mode), you can impose control over the reactions of the Automatic X.25 Simulator using the command language. See F - H, below for more information.

There are a limited number of commands that can be entered at this prompt. These commands enable you to turn the trace mode and command language mode on and off. See Section 8.4 for a list of these commands.

D. Trace Buffer

The Trace buffer can be turned on and off from the Simulator. To turn the trace on, type PP and press RETURN. (Note that the first character you type appears as % on the screen.) This causes the traffic received and transmitted on the line to be stored and displayed in an interpreted format in the trace buffer.

Traffic is stored in the trace buffer only if the trace is active and there is adequate space available in the buffer. To make the trace buffer idle (stop displaying traffic) type CTRL P.

You can also turn the trace buffer on and off using the command language. Refer to the STON (set trace on) and STOF (set trace off) commands in Section 8.7 for more information.

Refer to Section 8.4 for a more detailed description of the trace buffer and interpreting the display.

E.Command Language

To access the command language from the SITREX simulator, type PS and press RETURN. (Note that the first character you type appears as % on the screen.) This displays the ! prompt, at which you can enter commands and write scenarios. Refer to Sections 8.5 - 8.7 for a description of the command language.

A scenario reacts to incoming traffic only if it is WAITing for a frame or packet. Refer to the WAIT commands in Section 8.7 for more information.

You can use the command language to control the Automatic X.25 Simulator. Specifically, you use commands that control whether the Automatic X.25 Simulator processes frame level only, frame level and packet level, or neither level. Refer to Section 8.3 for a description of the commands that affect the Automatic X.25 Simulator.

To exit the command language mode, but remain in the Simulator, use the EXIT command. To leave SITREX and return the main menu, use the HALT command.

F. Line Interface Level 1

Level 1 acquires and transmits data to and from the line. The Physical Parameter Set-Up menu controls the parameters relevant to this level. For example, you can determine the baud rate and control whether the Chameleon is a DCE or DTE. The settings in the Physical Level Parameter Set-Up menu (B) affect this level of simulation.

You can use the command language to send various types of frames. For example, Figure 8.1-1 shows the FB command which transmits a user-defined frame in binary. Refer to the Frame Level Commands in Section 8.7 for more information.

G. Level 2 HDLC

HDLC is frame level. The following actions can occur:

The Automatic X.25 Simulator processes the frame, sends an appropriate response to the frame if the mode is Initiative or Standby, and the frame level is on (SFON command). If frame level is off (SFOF command), the frame is ignored.

Scenario. If a scenario has a WAIT (frame) command, the received traffic is compared to the frame specified in the WAIT command. This determines the next action in the scenario. If there is no WAIT command, the scenario does not react to incoming traffic.

The SFOF and SFON commands determine whether the Automatic X.25 Simulator processes incoming frames.

You can also control the link using the SLON (set link on) and SLOF (set link off) commands.

H. Level 3 X.25

X.25 is packet level. The following actions occur:

Automatic X.25 Simulator processes the packet, sends an appropriate response to the frame if Mode is Initiative or Standby, and the packet level is on (SPON command). If packet level is off (SPOF command), the packet is ignored.

Scenario. If a scenario has a WAIT (packet) command, the received traffic is compared to the packet specified in the WAIT command. This determines the next action in the scenario. If there is no WAIT command, the scenario does not react to incoming traffic.

The SPOF and SPON commands determine whether the Automatic X.25 Simulator processes incoming packets.

You can use the command language to send various types of packets. For example, Figure 8.1-1 shows the PRST command which transmits a RESTART packet. Refer to the Packet Level Commands in Section 8.7 for more information.

I. Pseudo-Users

Pseudo-Users. SITREX supports up to seven pseudo-users. Each pseudo user simulates a network device connected to a logical channel. You can use the command language to place calls from a pseudo-user to any network address. For example, Figure 8.1-1 places a call from pseudo-user number 5.

OTHER SITREX FEATURES

Memory Management

SITREX uses a dynamic memory allocation scheme to maximize the efficiency of the Chameleon. These SITREX features affect the amount of memory available to you:

- Trace buffer
- Active Pseudo-Users
- Scenario length
- Buffers (frame, retransmission, etc.)

You can control the amount of memory you are using by managing the length of your scenarios.

You can also control the size of the trace buffer using the trace buffer commands in Section 8.7. Specifically, these commands can be used to control the size of the trace buffer:

- Clear the trace (TRACE command)
- Turn the trace off/on (STOF/STON commands)
- Limit the length of the data (STR command)

Timers and Counters

SITREX allows you to set timers and counters using either the parameter set-up menu or command language. For example, both the T1 timer and the N2 counter can be set from the parameter set-up menu or using a set command.

State Variables

There are several variables in X.25, such as timeouts and frame window size, that control the flow of traffic. The State variable refers to the current value of these variables. State variables are controlled by the Automatic X.25 Simulator.

SITREX continually updates the state variables and the Automatic X.25 Simulator takes corrective action depending on their values.

For example, the high-level command, SLON, transmits a SABM and waits for a response. If a valid response is not received within the T1 time limit, the Automatic X.25 Simulator transmits a polled SABM and decrements N2. This continues until N2 is 0, at which time the Automatic X.25 Simulator attempts to set the link off.

SITREX Circuit Management

You can choose the number of Switched Virtual Circuits (SVC) and Permanent Virtual Circuits (PVC) for your application using the parameter set-up menu. You can assign addresses to SVCs in command mode. You can also assign a logical channel for both PVCs and SVCs.

SITREX will assign a channel for SVCs only. The Automatic X.25 Simulator assigns a Logical Channel Number (LCN) based on whether the Chameleon is configured as a Network or a Subscriber, according to the CCITT specifications.

To enable you to reassign a PVC, a PVC is removed by sending or receiving a CLEAR.

Note

It is possible for PVC's and SVC's to overlap. However, this is not recommended. Also, SITREX will automatically handle only seven PVCs or SVCs at one time (out of a maximum of 16 groups of 255).

8.2 SITREX AUTOMATIC X.25 SIMULATOR

Introduction

This section describes the Automatic X.25 Simulator. The Automatic X.25 Simulator can be used without any programming to create and monitor normal data communications traffic on the line. It produces valid X.25 responses to all incoming data, and updates counters and timers.

Accessing SITREX

To access the Automatic X.25 Simulator, follow these steps:

1. From the Chameleon main menu, use the softkeys to select SITREX. (To use the TRANSPAC implementation of SITREX, select T.Sitrex from the menu.)
2. Press F2 (Menu) to access the set-up menus.
3. In the Physical Parameter Set-Up menu, select the Mode setting that corresponds to the desired Automatic X.25 Simulator mode. The options are:
   - Initiative - Automatic X.25 Simulator attempts to set up an X.25 link.
   - Standby - Automatic X.25 Simulator reacts to incoming frames.
   - Manual - Automatic X.25 Simulator is off. There is no automatic reaction to incoming frames, except through the use of the command language.
4. If you want to select the NTT or DATAPAC implementations of SITREX, change the value of the Sitrex Version parameter in the Frame & Packet Level Parameter Set-Up menu.
5. Change any other parameters as required and press Z to load the simulator. (Refer to Section 8.3 for a description of the menus.)

6. The message SITREX SIMULATOR ACTIVE appears and the blinking cursor is displayed. The Automatic X.25 Simulator is now active according to the mode you selected in the Physical Set-Up menu.

   From here, you can activate the trace buffer, enter command language mode, or exit Simulation using the commands in Table 8.2-1. (Note that the first character you type appears as a % on the screen.)

   Refer to Section 8.4 for a description of the trace buffer. Refer to Sections 8.5 - 8.7 for a description of the SITREX command language.

COMMAND	FUNCTION
P1	Sets Simulator to echo Called and Calling Addresses in Call Confirmation packets.
PP	Activates Trace Buffer so that traffic is stored and displayed. (Once the trace is active, use CTRL P to make the trace idle.)
PS	Enters command language mode and displays ! prompt enabling you to enter Sitrex commands and write scenarios. (From the ! prompt, you can exit SITREX using the HALT command or exit command language mode using EXIT.)

Table 8.2-1: Automatic X.25 Simulator Options

Pseudo-Users

A pseudo-user is a logical subscriber supported by SITREX. SITREX can support up to seven pseudo-users. Each pseudo-user simulates a physical device connected to a logical channel.

Two of these are internally reserved and pre-assigned by SITREX for the local terminals and cannot be programmed. Their default conditions are the following:

01 Associated with the Chameleon *Trace* page (pink window)

02 Associated with the Chameleon *Simulation* page (blue window)

You can program pseudo-users 03 - 07 to re-configure them as one of the following:

- Traffic generators (Sends a continuous stream of ASCII data packets)
- Data absorbers (Normal terminals)
- Echo generators (Retransmits all the user data received on the same logical channel)

The default configuration for these pseudo-users is:

03 Traffic generator
04 Echo generator
05 Data absorber
06 Second traffic generator
07 Third traffic generator

Pseudo-User Addressing

According to the CCITT X.25 specifications, one byte of address information providing specific local terminal addressing can be added to a transmitted address in a CALL packet. This byte is used to address a specific pseudo-user.

For example, if the PAD address is **12345**, and one terminal (pseudo-user) is **07**, the terminal is addressed as **12345 07.**

CONTROLLING X.25 LEVELS

You can control whether the X.25 frame and packet levels are processed by the Automatic X.25 Simulator using the following SITREX commands:

- SET FRAME LEVEL ON (**SFON**)
- SET FRAME LEVEL OFF (**SFOF**)
- SET PACKET LEVEL ON (**SPON**)
- SET PACKET LEVEL OFF (**SPOF**)

SET FRAME LEVEL ON (**SFON**)

When frame level is ON, the Automatic X.25 Simulator processes incoming frames and updates frame level state variables accordingly. The Automatic X.25 Simulator can send frames in response to incoming frames or when a timer has expired. You can also send frames manually using SITREX commands in command mode. Frame level must be on if packet level is on.

SET FRAME LEVEL OFF (**SFOF**)

When frame level is OFF, the Automatic X.25 Simulator does not process incoming frames, and the frame level state variables do not get updated with incoming traffic. You can process incoming frames using SITREX commands in command mode.

SET PACKET LEVEL ON (**SPON**)

When packet level is ON, the Automatic X.25 Simulator processing incoming packets and updates packet level state variables accordingly.

SET PACKET LEVEL OFF (**SPOF**)

When packet level is OFF, the Automatic X.25 Simulator does not process incoming packets, but you can process them using SITREX commands in command mode. .

Setting the frame or the packet level OFF does not make the Automatic X.25 Simulator inactive. It affects it so that the reception of frames or packets is disabled. SITREX's automatic actions will continue to be occur.

The example below shows the result of a TPRINT (trace print) command when the frame level is off. It indicates the frames that were transmitted and received, but shows that any frames received were ignored by the Automatic X.25 Simulator.

TPRINT		
	⇐	**SLON**
T-002 03 SABM		
	⇐	**SFOF**
R-002 03 UA		
	⇐	**Received a UA, but with frame level off the frame is ignored.**
T-002 03 PSABM	⇐	**Since Simulator never sees the UA, it again attemps to establish the link.**

Applications

Using the SFOF/SFON and SPOF/SPON commands, there are three possible cases that can occur during SITREX simulation:

- Frame level OFF/Packet level OFF
- Frame level ON/Packet level OFF
- Frame level ON/Packet level ON

Note that Frame level OFF/Packet level ON is not valid, since packets cannot be processed if frames are ignored.

Each of these cases is described on the following pages.

Case 1: FRAME LEVEL OFF (**SFOF**) / PACKET LEVEL OFF (**SPOF**)

With both the frame and packet level OFF, the Automatic X.25 Simulator is disabled. None of the State variables are updated, and none of the incoming frames or packets are processed by the Automatic X.25 Simulator. However, incoming frames and packets can be processed by a SITREX scenario.

For example, if you establish the link with the SLON command, and then turn OFF the frame level with the SFOF command, the Automatic X.25 Simulator thinks that the link is established, but does not process incoming frames.

If you *transmit* I-Frames (FIPH command), the Automatic X.25 Simulator inserts the correct N(s) for each frame sent.

When the DUT sends an RR, the Automatic X.25 Simulator does not process it because the frame level is off.

SITREX COMMAND	SIMULATOR SENDS	DUT SENDS
SLON	*SABM* →	
		← *UA*
SFOF FIPH	*I-FRAMES* →	
		← ***RRs*** (Not processed by SITREX)

Case 2: FRAME LEVEL ON (**SFON**) / PACKET LEVEL OFF (**SPOF**)

With the frame level ON and the packet level OFF, incoming frames are processed by the automatic Simulator at the frame level only. For example, frame level State variables (N(s) and N(r) are updated.

The packet portion of an *incoming* frame is not processed by the Automatic X.25 Simulator and packet level state variables, such as P(r), are not updated. However, packet level State variables relevant to *outgoing* packets are updated.

When transmitting packets with the packet level OFF, only low-level commands, such as PHh1h2 can be used. In the example below, SITREX sends a RESTART packet and the DUT sends a RESTART CONFIRMATION packet in return. If the packet level is OFF, SITREX does not process the RESTART CONFIRMATION. After the timeout period, SITREX sends another RESTART.

Incoming packets can be processed using SITREX commands in command mode. So in this example, you could override the Automatic X.25 Simulator using a command that causes SITREX to wait for and process a RESTART CONFIRMATION packet. (WPCRST)

SITREX COMMAND	SIMULATOR SENDS	DUT SENDS
PRST	*RESTART* →	
	←	*RESTART CONFIRMATION*
PRST	*RESTART* →	
SPOF		
WPCRST		
	←	*RESTART CONFIRMATION*
(180 seconds)	*RESTART* →	

Case 3: FRAME LEVEL ON (**SFON**) / PACKET LEVEL ON (**SPON**)

With both the frame and packet level ON, all incoming frames and packets are processed, and all of the State variables are updated.

In the example below, SITREX sends a RESTART and the DUT responds with a RESTART CONFIRMATION.

Since both packet level and frame level are on, SITREX processes the RESTART CONFIRMATION and sends a CALL. The DUT responds with a CALL CONFIRMATION. SITREX continues the communication by sending an RR.

SITREX COMMAND	SIMULATOR SENDS	DUT SENDS
PRST	*RESTART* →	
	←	*RESTART CONFIRMATION*
PU1CALL2	*CALL* →	
	←	*CALL CONFIRMATION*
	RR →	

Set Link ON/OFF Commands

The Set Link ON/OFF commands (SLON/SLOF) affect the internal state of SITREX, while the Frame commands send specified frames, without updating the internal State variables of SITREX. This leads to the following situation:

COMMAND	Chameleon	USER'S EQUIPMENT
SLON	SABM ⟶	
		⟵ UA
Chameleon IN INFORMATION TRANSFER STATE		
FDISC	DISC ⟶	
		⟵ UA
	FRMR ⟶	

In the above case, the FDISC command entered through SITREX will be transmitted, but the internal State variables will not be updated. Consequently, when the user's equipment transmits a UA, the frame will be rejected, because the automatic Simulator sees it as *unsolicited* UA.

To allow SITREX to enter the down state, the SLOF command should have been used as shown below. This is true for all user-defined frames.

COMMAND	Chameleon	USER'S EQUIPMENT
SLON	SABM ⟶	
		⟵ UA
Chameleon IN INFORMATION TRANSFER STATE		
SLOF	DISC ⟶	
		⟵ UA
Chameleon IN DOWN STATE		

Consider the following case (assuming SLON was used):

COMMAND	Chameleon	USER'S EQUIPMENT
PH10011300	CLEAR ⟶	
		⟵ CLEAR CONF.
	CLEAR ⟶	
		⟵ CLEAR CONF.

At first, this may appear to be incorrect because the Chameleon should not have transmitted the second CLEAR. What actually happened is that the user-defined frame is transmitted without updating the Chameleon's State variables. Consequently, the received CLEAR CONFIRMATION is cleared by the automatic Simulator.

Set Packet Commands

The figure below provides an additional example of the SITREX Automatic X.25 Simulator in action.

Further control over the automatic Simulator is affected through SPON, SPOF, SFON, and SFOF commands. These commands affect how SITREX handles incoming frames and packets. For example:

COMMAND	Chameleon	USER'S EQUIPMENT
SLON	SABM ⟶	
		⟵ UA
Chameleon IN INFORMATION TRANSFER STATE		
PRST	RESTART ⟶	
		⟵ RESTART CONF.
		⟵ RESTART
	RESTART CONF. ⟶	
SPOF		⟵ RESTART
	RR ⟶	
ELAPSED TIME (RESTART TIMER)		
		⟵ RESTART
	RR ⟶	

ETC. . . .

8.3 SITREX MENUS

Introduction

This section describes the SITREX menus that are available for configuration. There are three SITREX menus:

- Physical Level Parameter Set-Up Menu
- Frame and Packet Level Set-Up Menu
- User Facilities Menu

The options in each of the SITREX menus are described in this section. General instructions for using set-up menus are in Section 2.2.

Each SITREX menu has an **N** (Next screen) or **P** (Previous screen) option so that you can switch between the three menus.

There is also a Save Parameters menu that you can access directly from any of the menus. The Save Parameters menu enables you to save and load parameter files and is described in Section 2.3.

Physical Level Menu

The SITREX Physical Level Set-Up menu enables you to change values for level one parameters. This menu is displayed below, with the valid values for each parameter.

```
                                                                   Simulation
                    ** SITREX PHYSICAL LEVEL PARAMETER SET-UP **
A.- Simulate . . . . . . .     : DCE
B.- Data Encoding  . . . .     : NRZ
C.- Framing  . . . . . . .     : HDLC
D.- Bit Rate . . . . . . .     : 56000
E.- Mode . . . . . . . . .     : Standby
F.- User Facilities  . . .     : NO

===============================================================================
SELECT: >                                   CHOICES:

INPUT:       SELECT a letter
             or type an option key shown below


   Z=Run SITREX,       ?=Help,       S=Save parameters,       ESC=Main Menu
N=Next Screen -> Set-up Frame and Packet level parameters
```

Figure 8.3-1: SITREX Physical Level Parameter Set-Up Menu

A. Simulate	**DCE** **DTE**	
B. Data Encoding	**NRZ** **NRZI**	
C. Framing	**HDLC**	
	Xparent Bisync	Displays additional menu option, G. Code, described below.
D. Bit Rate	**50 to 64000**	

E. Mode	**Standby**	The Automatic Simulator waits on the line for incoming frames and packets, and responds accordingly. SITREX will not send outgoing frames or packets until it receives something.
	Initiative	The Automatic Simulator tries to establish a link without any user input. In other words, it initiates the communication.
	Manual	The Automatic Simulator will not respond to incoming frames or packets, nor will it send any outgoing frames or packets until you command it to do so. This is the same as using the SFOF (set frame level off) command.
F. User Facilities	**NO**	You cannot access the SITREX Facilities menu.
	YES	You can access the SITREX Facilities menu to select the user facilities you want.
G. Code (Xparent Bisync only)	**ASCII/EVEN PARITY** **ASCII/ODD PARITY** **ASCII/NO PARITY** **EBCDIC**	

Frame & Packet Level Menu

Introduction

The SITREX Frame and Packet Level Set-up Menu enables you to change values for level two and three parameters. It is displayed when you press **N** for Next Screen from the Physical Level Parameter Set-up Menu.

```
                                                                     Simulation
                  ** SITREX FRAME & PACKET LEVEL PARAMETER SET-UP **
A.- Simulate . . . . . . . . : NETWORK          G.- Packet Window     : 2
B.- Link Access  . . . . . . : LAPB             H.- Calling Address   : 12345
C.- Frame Window . . . . . . : 2                I.- Called Address    : 54321
D.- Frame Size N1  . . . . . : 1024             J.- No. of SVCs   .   : 007
E.- Frame Timer T1 . . . . . : 00100 m s        K.- No. of PVCs   .   : 001
F.- Re-transmissions N2  . . : 10               L.- Sitrex Version    : CCITT

=================================================================================
SELECT: >                                       CHOICES:

INPUT:  SELECT a letter
        or type an option key shown below


  Z=Run SITREX,     ?=Help,     S=Save parameters,    ESC=Main Menu
P=Previous Screen -> Set-up Physical Level Parameters, N = Next Screen -> Facilities
```

Figure 8.3-2: SITREX Frame & Packet Level Parameter Set-Up Menu

The choices for the SITREX Frame and Packet Level Parameter Set-up Menu are:

A. Simulate:

Network - If your system is configured as a Network, the automatic Simulator assigns the lowest available LCN (which you have specified as the number of PVCs), and *increments* from that point.

Subscriber - If your system is configured as a Subscriber, the automatic Simulator assigns the highest available LCN (which you have specified as the number of SVCs and PVCs), and *decrements* from that point.

B. Link Access:	LAP LAPB
C. Frame Window:	Range 1 - 3 frames Note: Although the Chameleon screen prompt indicates that the acceptable range is 1 - 7 frames, SITREX will not function correctly if the frame window exceeds three frames.
D. Frame Length:	Range 1 - 2040 bits
E. Frame Timer:	Time to acknowledge frame (0 - 64,000 milliseconds)
F. Retransmissions:	Range 1- 99 Retransmissions
G. Packet Window:	Range 1 - 7 packets
H. Calling Address:	Address of Calling Station (Up to 15 digits)
I. Called Address:	Address of Called Station (Up to 15 digits)
J. SVCs:	**S**witched **V**irtual **C**ircuits (SVCs) connect one location to many possible locations. (Range 0 - 255 circuits)
K. PVCs:	**P**ermanent **V**irtual **C**ircuits (PVCs) are SVCs that have been assigned *permanently* between two points. (Range 0 - 255 circuits)
L. SITREX Version:	CCITT DATAPAC NTT

SITREX Facilities Menu

Introduction

The SITREX Facilities menu (Figure 8.3-3) enables you to select the user facilities you need. The Facilities menu can be accessed only when the the **User Facilities** parameter in the SITREX Physical Level menu is set to **YES**.

Each of the Facilities is described below. To select a facility, set the value to YES. When the fields are properly coded, the Automatic Simulator (at the packet level) accepts and responds to incoming calls with the appropriate facilities.

```
                                                          Simulation
                        ** SITREX FACILITIES **
A. Fast Select . . . . . . . . . . .     : NO

B. Extended Packet Sequencing   . . .    : NO

C. Closed User Group Selection . . .     :

D. Packet Retransmission . . . . . .     : NO

E. Flow Control Negotiation   . . . .    : NO

F. Throughput Class Negotiation   . .    : NO
================================================================================
SELECT>                                           CHOICES:

INPUT:    Select a letter
          or type an option key shown below

  Z = Run SITREX,     ? = Help,     S = Save parameters,     ESC = Main Menu
P=Previous Screen --> Frame and Packet level parameters
```

Figure 8.3-3: SITREX Facilities Menu

A. Fast Select

This facility is a type of datagram service. Fast Select allows you to put data into a CALL packet and receive a CALL or CLEAR CONFIRMATION in return. SITREX supports incoming calls with data and turns the data field around on an outgoing call.

B. Extended Packet Sequencing

If you select this facility, calls received with extended sequencing will be accepted. All future calls accepted on that channel will have modulo 128 sequencing, as indicated by the GFI.

C. Closed User Group Selection

This field accepts a 2-digit or 4-digit decimal number or a blank space (none).

If you enter a value, only calls having this same CUG in the facility field as selected here are accepted. SITREX will accept only one CUG at a time.

If this field is blank, (no Closed User Groups - CUG's), all CALL packets with the correct calling address are accepted.

D. Packet Retransmission

If YES, the subscriber can request the network to retransmit data packets. This is done by transmitting a packet REJ (reject) on the relevant Logical Channel Group Number and Logical Channel Number.

E. Flow Control Negotiation

If YES, this facility allows you to request packet length and window size on a call-by-call basis. This parameter is only relevant for incoming calls. For outgoing calls, use the SITREX Physical Parameter Set-up Menu.

F. Throughput Class Negotiation

If YES, SITREX accepts incoming calls with properly coded throughput facilities fields, but does not change the bit rate if acting as a network.

SITREX will verify that the incoming calls asking for Throughput Class Negotiation conform to the correct subscriber profile (refer to the CCITT specifications, Page 127, paragraph 7.4.2.6.2 - Table 17/X.25). This facility is not supported for packets transmitted by SITREX.

8.4 SITREX TRACE BUFFER

Introduction

The SITREX trace buffer stores and displays transmitted and received traffic from the line with control over frame and packet level interpretation. It captures all the traffic generated from the Automatic X.25 Simulator, a SITREX scenario, or traffic received from the line.

Section 8.2 describes how the trace buffer interacts with the Automatic X.25 Simulator and the command language for X.25 simulation. This section describes specific information about using the trace buffer, including:

- Activating and deactiving the trace function
- Displaying the trace contents
- Using trace commands to control what and how information is displayed
- Intrepreting a trace display

Activating the Trace

The STON and STOF commands determine whether traffic is stored in the trace buffer. If the trace is on (STON), received and transmitted traffic is stored in the trace buffer. If the trace is off (STOF), traffic is *not* stored in the trace buffer. The default condition is for the trace buffer to be on. These commands can be used only at the ! command mode prompt.

If the trace is on (STON) you can control whether the contents of the buffer is displayed. To display the buffer you activate it, as follows:

1. Once you have selected SITREX simulation, the screen displays the message **CHAMELEON SIMULATOR ACTIVE** and the Trace banner is displayed (in pink) at the bottom of the screen.

2. You can only activate and deactivate the trace when you are in the Automatic X.25 Simulator mode at the blinking cursor. (You cannot activate the trace buffer from command mode at the ! prompt.)

3. To activate the trace function, type:

   PP <RETURN>

   and the message **SITREX TRACE ACTIVE** appears. Note that the first letter you type is shown as **%** on the SITREX screen.

4. To view the contents of the trace, you need to display the trace page, as follows:

   a. Press SELECT until the Trace banner is highlighted.

   b. Press the MOVE ↑ key several times until the page is displayed. (You can also press SHIFT + MOVE ↑ once to make the Trace page fill the entire screen.)

   To hide the trace page, SELECT the Trace page and use the MOVE ↓ key several times until it is hidden. (If you used SHIFT +MOVE ↑ to display the page, you must use it *again* to restore the screen and hide the Trace page.)

5. While the SITREX trace is active, you can use special commands to control what is displayed on the Trace page. These commands are listed in the table below.

COMMAND	FUNCTION
0-9	Modifies the scrolling speed. Fastest = 1, Stop = 0
A	Toggles between ASCII and hex as format of displayed data.
F	Toggles display of frame level interpretation on/off.
P	Toggles display of packet level interpretation on/off.
R	Re-displays the contents of the trace.
CTRL C	Clears the trace memory.
CTRL P	Exits the trace mode and returns to the base Simulator level.

Table 8.4-1: Trace Commands

Commands F, A, and P are toggle commands. Press the key once to perform the action and again to discontinue the action.

For example, to display the Trace with packet level interpretation, but without frame level interpretation, you must type **F**, and then **R**.

6. To deactivate the trace so that data is no longer displayed, type:

   CTRL P

   The message **SITREX TRACE IDLE** appears on the Simulation page. You must be in the Trace Mode (and not at the command mode prompt !) to deactivate the trace function.

7. To turn the trace buffer off, so that data is not stored in the buffer, enter STOF at the command mode prompt (!).

Trace Intrepretation

This section illustrates a sample trace display and intreprets five lines of the display.

The example, shown below, has the data displayed in hex, with both the frame and packet levels on. The lines that are intrepreted on the following pages, are marked **LINE A - E** for easy reference.

```
LINE A    T * 002  01  P SABM
          R * 002  01  P UA
LINE B    T * 006  01  I 0 0 /2000 RESTART 80
          R * 005  03  I 0 1 /2000 RESTART C.
          T * 002  03  RR  1
LINE C    T * 019  01  I 1 1 /2007 CALL  1234504 D 41 42 43 44 45 46
          R * 013  03  I 1 2 /2007 CALL C.    F 43 07 07 42 06 06
          T * 002  03  RR  2
          T * 007  01  I 2 2 /2007 CLEAR 84 00
          R * 005  03  I 2 3 /2007 CLEAR C.
          T * 002  03  RR  3
LINE D    T * 017  01  I 3 3 /2007 CALL  1234504  F 43 07 07 42 06 06
          R * 007  03  I 3 4 /2007 CLEAR 03 42
          T * 005  01  I 4 4 /2007 CLEAR C.
          R * 002  01  RR  5
          T * 010  01  I 5 4 /2007 CALL  12345
          R * 013  03  I 4 6 /2007 CALL C.    F 43 07 07 42 06 06
          T * 002  03  RR  5
LINE E    T * 030  01  I 6 5 /E007 DA QD 000 M 000 48 45 4C 4C 4F 20
                                                46 52 4F 4D 20 50 53
          R * 006  03  I 5 7 /6007 RR P. 001
          T * 002  03  RR  6
          T * 010  01  I 7 6 /E007 DA QD 001 000
          R * 000  03  I 6 0 /6007 RR P. 002
          T * 002  03  RR  7
          T * 002  01  DISC  /  RD
          R * 002  01  UA
```

LINE A indicates that a SABM has been transmitted.

T * 002 01 P SABM

T = Transmit
R = Receive

Good CRC = *
Bad CRC = ?

Frame length
in decimal.

Space = correct length.
> = Too long
< = Too short

Frame Mnemonic.

P indicates that a poll/final bit has been set to 1.
A space here indicates that it is set to 0.

Frame address in HEX.

LINE B indicates that an I-Frame has been transmitted.

T * 006 01 I 0 0 / 2 0 00 RESTART 80

Information frame.

N(s)sequencing
number in decimal.

N(r) sequencing
number in decimal.

/ indicates start
of packet level.

General Format
Indicator (GFI).

Indicates a cause code
for the RESTART packet.

Packet mnemonic.

Logical Channel Number.

Logical Channel Group
Number (LCGN).

LINE C, contains user data in a Call packet, as shown below.

T* 019 01 I 1 1 /2007 CALL 1234504 D 41 42 43 44 45 46

Transmitted

Good CRC

Frame Length

Address

I-Frame

N(R)

N(S)

Data in hex

D - Indicates data

Calling Address

Call Packet

GFI = Mod128
LGCN = 0
LCN = 07

/ = Packet Level

LINE D indicates a transmitted Call packet with facilities.

T* 017 01 I 3 3 /2007 CALL 1234504 F 43 07 07 42 06 06

Called and/or
Calling address,
Max. of 15 digits.

F indicates Facility.

Facility in HEX pairs.

LINE E indicates a transmitted data packet.

T * 030 01 I 6 5 /E007 DA Q D 000 M 000 48 45 4C 4C 4F 20 46 52

- DA — Indicates a data packet.
- Q — Q bit set.
- D — D bit set.
- 000 — P(r) Mod 128
- M — M bit set.
- 000 — P(s) - Mod 128, (1 digit for Mod 8)
- 48 45 4C 4C 4F 20 46 52 — Data in hex pairs or ASCII characters.

The example below shows what a Frame Reject would look like in the trace.

T * 005 03 CMDR/FRMR 3E 3 C 1 W X Y Z

- 3E — Rejected control field in hex.
- 3 — V(s)-rejected frame state variable.
- C — **C** indicates a command; **R** indicates a response.
- 1 — V(r)-rejected frame state variable.
- W X Y Z — Additional variables. (If the variable bit is set, the letter W - Z is displayed. If variable bit is not set, no letter is displayed.)

Inhibit Packet Level

The example below shows the trace display for the same events as shown on page 8.4-3. The difference is that the packet level interpretation has been inhibited. You use the trace commands listed on page 8.4-2 to control what is displayed.

To redisplay the trace in this format, you type **P** to toggle the packet level off, and then type **R** to redisplay.

```
T * 002  01  SABM
R * 002  01  UA
T * 006  01  I 0 0 /20 00 FB 80
R * 005  03  I 0 1 /20 00 FF
T * 002  03  RR  1
T * 019  01  I 1 1 /20 07 0B 07 12 34 50 40 41 42 43 4445
R * 013  03  I 1 2 /20 07 0F 00 06 43 07 07 42 06 06
T * 002  03  RR  2
T * 007  01  I 2 2 /20 07 13 84 00
R * 005  03  I 2 3 /20 07 07 17
T * 002  03  RR  3
T * 017  01  I 3 3 /20 07 0B 07 12 34 50 40 06 43 07 07 42 06 06
R * 007  03  I 3 4 /20 07 13 03 42
T * 005  01  I 4 4 /20 07 17
R * 002  01  RR  5
T * 010  01  I 5 4 /20 07 0B 05 12 34 50 00
R * 013  03  I 4 6 /20 07 0F 00 06 43 07 07 42 06 06
T * 002  03  RR  5
T * 030  01  I 6 5 /E0 07 00 01 48 45 4C 4C 4F 20 46 52 4F 20 46
                 52 4F 4D 20 50 53 45 55 44 4F 20 55
R * 006  03  I 5 7 /60 07 01 02
T * 002  03  RR  6
etc.
```

8.5 SITREX COMMAND MODE

Introduction

SITREX command mode allows you to write and execute test scenarios that override the actions of the Automatic X.25 Simulator. The SITREX commands provide you with the control to:

- Send frames and packets
- Wait for specified events
- Set and change parameters
- Perform other protocol and error checking routines

Chapter 8.2 describes how the command language interacts with the Automatic X.25 Simulator and the Trace function. This section describes specific information about the command mode, including:

- Accessing command mode
- Command groups
- General syntax rules
- Controlling X.25 levels

SITREX is a highly flexible programming tool, designed specifically for X.25 Simulation. The large number of commands and the different ways of achieving the same result mean that care is needed when programming scenarios.

Line protocols, in general, are time critical, and SITREX commands take time to execute. Therefore, long print statements and excessive jumping should be avoided.

SELSE and WAIT commands should be separated by at least one command line. Also, remarks (REM statements) take up considerable space in the 4K bytes allocated to SITREX scenario memory.

Command Mode Access

To access the SITREX command mode, you must first select SITREX simulation. If you do not know how to do this, refer to Section 2.1 for instructions.

Once you have selected SITREX simulation, the screen displays the message **CHAMELEON SIMLATOR ACTIVE** and the Trace banner is displayed at the bottom of the screen.

Note that the first letter you type is shown as % on the SITREX screen. To exit the base Simulator mode and enter command mode, type:

PS <RETURN>

The following message and the ! prompt appear:

```
        Chameleon X.25 SIMULATION
        SITREX VERSION X.XX
!
```

Command Groups

SITREX commands are divided into three major groups:

- Low-Level Commands
- Mid-Level Commands
- High-Level Commands

These three groups are described below, with a examples of each.

Low-Level Commands

Low-level commands transmit individual frames or packets. These commands are independent of the Automatic X.25 Simulator.

For example, the command **FH012F**, sends a user-defined frame in hex, where **012F** is the frame address. This command does not expect a response.

Mid-Level Commands

Mid-level commands allow you to use mnemonics to transmit frames or packets. Additionally, SITREX provides missing information, such as the frame address.

For example, the command **FSABM** sends a **SABM** at the frame level. SITREX supplies the frame address, depending upon your position as a Subscriber or a Network. This command does not expect a response.

High-Level Commands

High-level commands are instructions to the Automatic X.25 Simulator to perform certain actions and wait for proper responses.

For example, the **SLON** command Set Link ON. **SLON** tells the Automatic X.25 Simulator to go to an Information transfer state. At this point, the automatic X.25 Simulator transmits a **SABM** with the primary address. It then decrements **N(2)** and starts the **T1** timer.

The Automatic X.25 Simulator expects a **UA.** If there is no response within the **T1** timeout, the Automatic X.25 Simulator looks at **N(2).** If it is not 0, it sends another **SABM**, otherwise SITREX automatically sets the link off.

General Syntax Rules

The following are rules to follow when using SITREX commands. The specific syntax of the commands is described in Chapter 8.7.

1. The maximum size of a SITREX program is 4K bytes.
2. A command line is a chain of one or more commands terminated by a carriage return. The most common structure of a command is:

   (LINE NUMBER) COMMAND (VARIABLES): <RETURN>

   Additional spaces shown here in the syntax of a command are for clarity only, and should not be entered.
3. Commands can be followed by variables and terminated by a colon (:) or carriage return. Do not use a colon in a PRINT command, because the colon will be taken literally and printed.
4. If more than one command is used in a line, delimit the commands with a colon (:).
5. Commands can be entered in upper or lower case letters.
6. Variables are separated from commands by **one** space.
7. A command can include optional parameters or fields. In the syntax descriptions, optional parameters are shown in parentheses ( ), but the parentheses should not be entered.

8. The maximum size of a command line is 255 characters, including the line number, spaces, and carriage returns.

9. The following rules apply to line numbers:

   - Command lines used in programs (statement commands) must have line numbers.
   - Commands executed immediately at the ! prompt (direct commands) do not have line numbers.
   - A line number is a decimal number between 1 and 9999 that is the first entry on a command line.
   - A single blank space follows a line number.

10. Commands of the same group generally have one letter in common. For example, **FDISC** and **FSABM** are in the Frame Level group.

11. You should carefully determine that the commands in your program are coherent and consistent. For example, the **PRST** (Packet Restart) command has no effect unless a link has been established.

12 N(s), N(r), P(s), P(r), V(r), V(s), F, M, P, Q, W, X, Y, and Z represent the conventional parameters of the X.25 protocol. When these parameters appear in parentheses ( ) in the command syntax, they are optional. If they are omitted, their values are automatically determined by the Automatic X.25 Simulator, depending on the status of the link.

13. In the syntax description, the following conventions apply:

   b = Enter binary digits. Binary strings are split into 8 bit groups to be converted into bytes.

   h = Enter hexadecimal characters. Hex strings are split into groups of 2 characters.

   a = Enter printable ASCII characters

   - Lower order digits are on the right
   - A space, if present, indicates the end of a byte
   - The preceding binary digit (or hex character) is the lower order digit of the preceding byte
   - Missing elements are assumed to be all zeros

Substitution

Some higher-level commands have optional fields that are lower-level commands. In other words, you can have a command within a command.

For example, the WAIT command synchronizes a test scenario to wait for the arrival of a specific frame. One form of syntax for the WAIT command is listed as:

```
W(FRAME)
```

The Wait comand is the letter **W**, optionally followed by a Frame Level command. (Frame Level commands are one of the functional groups of commands.) If you wanted to wait for an I-frame, you could use `FI` (a frame level command). The `FI` command, takes a packet level command, as indicated by the syntax description of the `FI` command:

```
FI(PACKET)
```

The optional field **PACKET** can be replaced by any of the Packet Level commands. For example, you could indicate a Restart Packet with the PRST command, which uses the following syntax:

```
PRST(h1h2)(h3h4)
```

In the PRST syntax, h1h2 is an optional 2-digit hex cause code and h3h4 is an optional 2-digit hex diagnostic code.

Using this process of substitution, if you wanted to enter a command that waits until it receives an I-frame containing a Restart packet with a cause code of 34, you would enter:

WFIPRST34

W = Wait for the following item.

FI = I-Frame

PRST34 = Restart Packet with cause code 34

Syntax Errors

When SITREX detects a violation of the syntax rules, the line is re-displayed. The cursor stops before the first illegal character, and SITREX emits a beep.

You must type the correct characters following the error detected. The word **error** is not displayed. If the first character is incorrect, or not recognized, only the cursor is re-displayed.

For example, if you entered a line number and a command, but omitted the space between them, such as:

100SLON <RETURN>

This command is displayed as

100

The line number must be be followed by a blank space.

8.6 SITREX COMMAND INDEX

Introduction

The SITREX programming commands are listed in Section 8.7, grouped by function. To help you locate a specific command in Section 8.7, this section contains two indexes:

- Alphabetical Command Index
- Functional Command Index

If you know the name of a command, you can use the Alphabetical Command Index to determine which page in Section 8.7 contains the complete command description.

If you need a command that performs a particular function, but you do not know which command to use, refer to the Functional Command Index to locate the command.

Alphabetical Index

The Alphabetical Command Index begins on the following page. It provides the command name, a brief description of its function, and a page reference.

The complete syntax is not listed in this index. The only part of the command which is shown in this table, is that part which uniquely identifies it. Where additional information is required by the syntax, an ellipsis is inserted. For example, the entry:

FA...

indicates that additional letters or fields (optional or required) will follow the letters FA. Ellipses may be shown in one or more places within a single command. For a complete description of the syntax, you must refer to the indicated page in Section 8.7.

Many frame level commands can include an optional Poll or Final bit, which is shown in the index as (F) or (P). For example:

F(P)DISC

indicates that this command (which sends a Disconnect frame), may be entered as:

FDISC or FPDISC

depending on whether the poll bit is to be set.

TABLE 8.6-1: SITREX ALPHABETICAL COMMAND INDEX

COMMAND	SEE PAGE	FUNCTION
&...	8.7-49	Chains programs.
*... ... ;	8.7-44	* begins a loop. ...Command lines executed within loop. ; ends the loop.
DISP(X)	8.7-75	Displays values of timers, counters, variables or contents and length of message buffer.
EXIT	8.7-2	Exits command mode and return to the Automatic X.25 Simulator.
FA..	8.7-2	Sends user-defined frame in ASCII.
FB...	8.7-2	Sends user-defined frame in binary.
F(F)CMDR...	8.7-4	Sends a CMDR frame.
F(P)DISC	8.7-3	Sends DISC frame.
F(F)DM	8.7-4	Sends a DM frame.
FH...	8.7-2	Sends user-defined frame in hex.
F(P)I...	8.7-7	Sends an I-frame.
FM	8.7-65	Transmits the message buffer .
FPREJ...	8.7-5	Sends supervisory polled command REJ frame.
FPRNR...	8.7-5	Sends supervisory polled command RNR frame.
FPRR...	8.7-5	Sends supervisory polled command RR frame.
F(F)REJ...	8.7-6	Sends a REJ frame.
F(F)RNR...	8.7-6	Sends a RNR response frame.
F(F)RR...	8.7-6	Sends a RR response frame.
F(P)SABM	8.7-3	Sends SABM on primary address
F(F)UA	8.7-4	Sends an UA frame.
GOSUB	8.7-46	Unconditionally jumps to specified subroutine..
GOTO...	8.7-46	Unconditionally jumps to specified line.
HALT	8.7-47	Returns to Chameleon main menu.
IF1... ± ...	8.7-29	Tests specified lead for mark or space and jumps to specified line when true.
IFC...	8.7-45	Tests counter and jumps to specified line when true.

TABLE 8.6-1: SITREX ALPHABETICAL COMMAND INDEX (cont.)

COMMAND	SEE PAGE	FUNCTION
IFT...	8.7-45	Tests timer and jumps to specified line when true.
INPUT X...	8.7-58	Waits for user input and stores it to a variable.
IS...	8.7-64	Compares message buffer to specified byte and mask configuration. If true, jumps to specified line.
IX...	8.7-59	Tests a variable for a value. If true, jumps to specified line number.
LDISP(X)	8.7-75	Outputs timers, counters, variables or contents of message buffer to a remote terminal or printer.
LIST	8.7-78	Displays the program lines in memory.
LLIST	8.7-79	Outputs the program lines in memory to a remote terminal or printer.
LNKUP	8.7-21	Forces Simulator to assume that the link is up.
LOAD	8.7-50	Loads a program file into memory.
LPRINT	8.7-80	Outputs a user-specified message to a printer or remote terminal.
LTPRINT	8.7-69	Outputs the contents of the trace buffer to a printer or remote terminal.
NEW	8.7-52	Erases current program in memory.
PA...	8.7-9	Sends a user-defined packet in ASCII.
PCRST	8.7-12	Sends a Restart Confirmation packet.
PDIAG...	8.7-15	Sends a Diagnostic packet.
PH...	8.7-9	Sends a user-defined packet in hex.
PM	8.7-65	Transmits the frame, assigning the contents of the messge buffer to the I-field.
PRINT	8.7-77	Displays a user-specified message to the screen.
PRST...	8.7-12	Sends a Restart packet.
PU...CALL	8.7-10	Sends a Call packet.
PU...CCALL	8.7-10	Sends a Call Confirmation packet.
PU...CCLEAR...	8.7-13	Sends a Clear Confirmation packet.
PU...CINT...	8.7-13	Sends an Interrupt Confirmation packet.

TABLE 8.6-1: SITREX ALPHABETICAL COMMAND INDEX (CONT.)

COMMAND	SEE PAGE	FUNCTION
PU...CLEAR...	8.7-13	Sends a Clear packet.
PU...CRSET...	8.7-13	Sends a Reset Confirmation packet.
PU...D...	8.7-14	Sends a data packet.
PU...DS	8.7-65	Transmits a frame, assigning the contents of the message buffer to the data portion of the I-field, from a specified pseudo-user.
PU...INT...	8.7-13	Sends an Interrupt packet.
PU...REJ...	8.7-11	Sends a REJ packet.
PU...RNR...	8.7-11	Sends a RNR packet.
PU...RR...	8.7-11	Sends a RR packet.
PU...RSET	8.7-13	Sends a Reset packet.
REM	8.7-51	Programmer's remark.
RETURN	8.7-46	Returns control from a subroutine called by a GOSUB, to the command following the GOSUB command.
RUN	8.7-53	Executes the program in memory.
S1... ±	8.7-28	Sets specified interface lead to space (+) or mark (-).
SADRWT...	8.7-41	Sets jump address for Watch-dog timer.
SAVE	8.7-54	Saves the program in memory to disk.
SC...	8.7-31	Increments, decrements or sets user-defined counter.
SCRC ±	8.7-22	Specifies that frames include good (+) or no (-) CRC.
SELSE...	8.7-41	Sets jump address for WAIT command.
SFOF	8.7-17	Sets frame level off.
SFON	8.7-17	Sets frame level on.
SGT...	8.7-25	Sets length of data packet sent by a traffic generator.
SK...	8.7-24	Sets frame window size.
SLG...	8.7-27	Sets the Logical Channel Group Number for next call.
SLOF	8.7-20	Sets the link off.
SLON	8.7-20	Sets the link on.
SM...	8.7-60	Writes the specified values into the message buffer.

TABLE 8.6-1: SITREX ALPHABETICAL COMMAND INDEX (CONT.)

COMMAND	SEE PAGE	FUNCTION
SNR(±)	8.7-26	Increments (+) or decrements (-) N(r).
SNS(±)	8.7-26	Increments (+), decrements, or sets value of N(s).
SPA...	8.7-23	Sets Primary address in hex.
SPOF	8.7-19	Sets packet level off.
SPON	8.7-19	Sets packet level on.
SPU...	8.7-32	Sets or alters attributes of specified pseudo-user.
SSA...	8.7-23	Sets Secondary address in hex.
ST...	8.7-30	Sets timer T', T" or user-defined timer.
STOF	8.7-71	Sets the trace off (idle).
STON	8.7-71	Sets the trace on (active).
STR...	8.7-73	Sets number of data bytes displayed by trace.
STU...	8.7-30	Sets timer TU.
SU...LR	8.7-25	Sets maximum length of received data packet.
SU...LT	8.7-25	Sets maximum length of transmitted data packet.
SU...PR(±)	8.7-26	Increments (+), decrements, (-) or sets value of P(r).
SU...PS(±)	8.7-26	Increments (+), decrements (-), or sets value of P(s).
SU...VC...	8.7-33	Set up a Switched Virtual Circuit (SVC).
SU...VP...	8.7-33	Set up a Permanent Virtual Circuit (PVC).
SU...WR...	8.7-24	Sets receive packet window size.
SU...WT...	8.7-24	Sets transmit packet window size.
SWT...	8.7-42	Sets the Watch-Dog timer.
SX...	8.7-56	Assigns a value to a numeric variable using arithmeic or logical operations.
SX...D...	8.7-57	Shifts the contents of the variable to the right (D).
SX...G...	8.7-57	Shifts the contents of the variable to the left (G).
SX...I...	8.7-60	Inserts a value in the message buffer at a specified location.
SX...I00	8.7-63	Extracts message buffer length.

TABLE 8.6-1: SITREX ALPHABETICAL COMMAND INDEX (CONT.)

COMMAND	SEE PAGE	FUNCTION
SX...L...	8.7-57	Rotates the contents of the variable to the left.
SX...O...	8.7-62	Stores a specified byte from the message buffer in a variable.
SX...O00	8.7-63	Sets message buffer length.
SX...R...	8.7-57	Rotates the contents of the variable to the right.
TLOAD	8.7-68	Loads a trace file from disk to memory.
TSAVE	8.7-70	Save the trace file in memory to disk.
TPRINT	8.7-67	Displays the contents of the trace buffer.
TRACE	8.7-72	Clears the trace buffer.
WF...	8.7-36	Waits for a specific frame before continuing scenario.
WP...	8.7-36	Waits for a specific packet before continuing scenario.
WSF...	8.7-36	Waits for a specific frame stores it in the message buffer.
WSP...	8.7-36	Waits for a specific packet and stores it in the message buffer.
WST	8.7-38	Waits for a specific byte mask configuration and stores it in the message buffer.
WT...	8.7-38	Waits for a specific byte mask and jumps to specified address if not received.

Functional Command Index

The Functional Command index lists the SITREX command in these functional groups:

- Frame Level
- Packet Level
- Parameter
- Wait
- Loop, Jump, and Reintialization
- Program Management
- Numeric Variable
- Message Buffer
- Trace Buffer
- Display and Print

Frame Level

This group of command transmits any type of HDLC frame.

Packet Level

This group of commands transmits any type of X.25 packet.

Parameter

Set commands allow you to define the value of X.25 global parameters, such as frame window size.

Wait

Wait Command enable you to wait for a specific type of frame, packet, or byte mask. The timers associated with the WAIT commands are also included in this group.

Loop, Jump and Reinitialization

These commands enable you to jump to a specified line in your scenario, or set up a loop. The reinitialization commands enable you to exit from SITREX, access parameter set-up menus, or stop program execution.

Program Management

This group includes loading, running, saving, chaining, listing and printing scenario files.

Numeric Variable

This group enables you to initialize and manipulate numeric variables.

Message Buffer

This group includes commands that define messages for the buffer, transmit messages, and extract information about the data in the message buffer.

Trace Buffer

This group allows you to manipulate the trace buffer.

Display and Print Commands

This group includes commands that display information to the screen or output the information to a printer or remote device.

TABLE 8.6-2: SITREX FRAME LEVEL COMMANDS

TABLE 8.6-3: SITREX PACKET LEVEL COMMANDS

TABLE 8.6-4: SITREX PARAMETER COMMANDS

TABLE 8.6-5: SITREX WAIT COMMANDS

TABLE 8.6-6: SITREX LOOP, JUMP AND REINITIALIZATION COMMANDS

TABLE 8.6-7: SITREX PROGRAM MANAGEMENT COMMANDS

TABLE 8.6-8: SITREX NUMERIC VARIABLE COMMANDS

TABLE 8.6-9: SITREX MESSAGE BUFFER COMMANDS

TABLE 8.6-10: SITREX TRACE BUFFER COMMANDS

TABLE 8.6-11: SITREX DISPLAY AND PRINT COMMANDS

FRAME LEVEL COMMANDS

Introduction

Frame level commands allow you to transmit any type of HDLC frame. This enables you to bypass the Automatic X.25 Simulator with specific frame commands. Refer to Section 8.2 for a description of how the frame level commands interact with the Automatic X.25 Simulator.

Examples:

The command **FUA** tells SITREX to send an unnumbered acknowledgment.

The command **FPRR3** sends a polled **RR** with an N(r) equal to 3 on a transmitted frame.

Poll/Final Bit

The following conventions apply to the frame Level commands:

- (**P**) indicates that an optional poll bit can be set and the command sent on a primary address. The primary address is the address the particular unit, whether Network or Subscriber, uses to send a command.
- (**F**) indicates that an optional final bit can be set and the response sent on a secondary address. The secondary address refers to the address the unit uses to send a response.

Send User-Defined Frame

Description

These commands send a user-defined frame in binary, ASCII, or hex.

Type

Statement or Direct

Syntax

FBb........b Sends frame defined in binary. Multiple spaces are interpreted as one space. Enter data in 8-bit bytes, separated by spaces.

FAa........a Sends frame defined in ASCII.

FHh........h Sends frame defined in hexadecimal. Multiple spaces are interpreted as one space.

You can combine ASCII and hex in the same line. To switch between ASCII and hex, press the **Esc**ape key. The Chameleon display a tilde (~) each time you press the **Esc**ape key.

Example 1

In this example, ASCII data is placed in the data field of a data packet. The corresponding frame is transmitted whether it is valid or invalid.

```
FH0100100000~THIS PART IS IN ASCII
```

Example 2

This example sends a frame with data in binary. When using binary, enter data in 8-bit bytes, separated by spaces.

```
FB00000001 00011111
```

Send Unnumbered Commands

Description These commands send either a DISC or SABM.

Type Statement or Direct

Syntax

F(P)DISC	Sends a polled or unpolled DISC on the primary address.
F(P)SABM	Sends a polled or unpolled SABM on the primary address.

Example 1 This example sends an unpolled disconnect command frame.

```
FDISC
```

Example 2 This example sends a polled SABM command frame.

```
FPSABM
```

Send Unnumbered Responses

Description These commands send either a UA, DM or CMDR frame.

Type Statement or Direct

Syntax

F(F)UA Sends a UA frame.

F(F)DM Sends a DM frame.

F(F)CMDRh1h2(Vs)(,Vr)(B)(W)(X)(Y)(Z) Sends a CMDR frame.

CMDR is followed by two hex characters **h1h2**, which are the control fields of the rejected frame.

Vs is the **Ns** of the last valid frame received. **Vr** is the **Nr** of the last valid frame received. **Vs** and **Vr** vary from 0 to 7.

B is the Command/Response bit (C/R) of the frame. It is set to 1 if rejecting a response, and set to 0 if rejecting a command.

W, X, Y, Z represent the 17th to the 20th bits, respectively, of the CMDR frame according to the X.25 protocol.

B, W, X, Y, Z are literals. If these letters are entered in a command, the corresponding bit is set to 1. If they are not entered, the bit is set to 0.

Example 1 This example sends a CMDR frame with a rejected control field equal to 34, Vs unspecified, Vr = 3, W and Z equal to 1, and X and Y equal to 0.

```
FCMDR 34,3WZ
```

Example 2 This example sends a Command Reject with the final bit set (the second F in the command specifies the final bit). The control field of the rejected frame = 3E, Vs = 1, Vr = 2, and the literals BWXY and Z are all set to 1.

```
FFCMDR 3E1,2BWXYZ
```

Send Numbered Commands

Description

These commands send the supervisory polled command frames: Receiver Ready (RR), Receiver Not Ready (RNR), or Frame Reject (REJ) .

Note: To send unpolled supervisory command frames, refer to the commands FH, FB, SPA and SSA.

Type

Statement or Direct

Syntax

FPRR(Nr) Sends the supervisory polled command frame RR.

FPRNR(Nr) Sends the supervisory polled command frame RNR.

FPREJ(Nr) Sends the supervisory polled command frame REJ.

where: **Nr** is in the range 0 to 7.

Since this is a command, and not a response, the poll bit is required. If **P** is omitted, SITREX assumes this is a response and sends the frame out on a secondary address.

Example

This example sends a Receiver Not Ready supervisory command frame. The Subscriber would send this command on primary address 01. The Network would send it on primary address 03.

```
FPRNR
```

Numbered Responses

Description

These commands send either a RNR, RR, or REJ response frame.

Type

Statement or Direct

Syntax

F(F)RNR(Nr)	Sends a Receiver Not Ready frame.
F(F)RR(Nr)	Sends a Receiver Ready frame.
F(F)REJ(Nr)	Sends a Reject frame.

where: **Nr** is in the range 0 to 7 and **F** is an optional final bit.

Example

This example sends a Receiver Ready indicating that the simulator has received a frame with Nr equal to 3. The Subscriber sends this response on secondary address 03, the Network on 01.

FRR3

Send Information Frame

Description

This command (FI) sends an I-frame. FI commands should be used only when the frame level has been established. The internal State variables are updated automatically; however, the values that are sent over the link may be overridden by specifying Ns and Nr.

Type

Statement or Direct

Syntax

F(P)I(Ns)(,Nr)(PACKET)	Sends I-Frame with packet mnemonic. The I-Field is specified by the optional PACKET field. PACKET is defined using the Packet Level commands, which are described in the next section.
F(P)I(Ns)(,Nr)(PHh1h2...)	Sends I-Frame with packet in hex.
F(P)I(Ns)(,Nr)(PAabcd...)	Sends I-Frame with packet in ASCII.

Example 1

This example sends an unpolled I-Frame using the Packet Level command PRST (Restart packet) as the I-field. The automatic simulator provides the missing information.

```
FIPRST
```

Example 2

This example sends an unpolled user-defined I-Frame in hex.

```
FIPH010041424344
```

Example 3

This example sends a polled user-defined I-Frame in hex.

```
FPIPH010041424344
```

PACKET LEVEL COMMANDS

Introduction

Packet level commands allow you to transmit any type of X.25 packet. The Automatic X.25 Simulator is continually updating packet level counters and timers. However, as with the frame level commands, you can override this function with specific packet commands.

For example, the command **PRST** tells SITREX to send a packet level restart down to the link and wait for a restart confirmation.

Refer to Section 8.2 for a description of how packet level commands interact with the Automatic X.25 Simulator.

Send User-Defined Packet

Description

These commands send a user-defined packet in hex or ASCII. The link must be established at the frame level using frame level commands before these commands are used. These commands are useful for sending a packets without specifying F(P)I (send I-frame) commands.

Type

Statement or Direct

Syntax

PHh........h Sends packet in hex, where h....h is the contents of the packet, in hex.

PAa........a Sends packet in ASCII, where a....a is the contents of the packet, in ASCII.

Example

This example sends a call to pseudo-user 5 in hex.

```
PH10010B071234505000
```

Send Call/Call Confirmation Packet

Description

These commands send either a call or call confirmation packet. If a call is received and no sub-address has been defined (no pseudo-user called), the default sub-address will be pseudo-user 2 (local keyboard and screen).

Type

Statement or Direct

Syntax

PUnCALL(D)(Na or V)(,Nb)(,Fh.........h)(,DHh.........h)	Sends a Call packet with the call data in hex.
PUnCALL(D)(Na or V)(,Nb)(,Fh.........h)(,DAa.........a)	Sends a Call packet with the call data in ASCII.
PUnCCALL(D)	Sends a Call Confirmation packet.

n is the pseudo-user sending the call, in the range 1 - 7.
D is an optional delivery confirmation bit.
Na is the called address in decimal (15 digits maximum). The called address is the destination.
V is the called number entered when initially configuring the SITREX Menu.
Nb is the calling number in decimal (15 digits maximum).
F is the called facilities followed by an even number of bytes (64 maximum).
DH or **DA** is the call data in hex or ASCII (128 bytes maximum).

Example 1

This example sends a call packet to address 12345, sub-number 03 from the Chameleon's keyboard and screen (CCITT version). U2 is the pseudo-user number of the Chameleon keyboard.

```
PU2CALL1234503
```

Example 2

This example calls 12345, sub-number 03 from the Chameleon keyboard. The sub-unit address 03 is put into the 5th byte of data sent with the call request packet as specified by DATAPAC. "D" specifies data, "H" Hexadecimal.

```
PU2CALL12345,DH00 00 00 00 03
```

Send Supervisory Packet

Description

These commands send a Receiver Ready (RR), Receiver Not Ready (RNR) or Reject (REJ) packet. The internal state variables are updated automatically; however, the values that are sent over the link may be overridden by specifying **Pr**.

The packet is sent if the current status of the unit allows it to do so, unless:

- A call has not been established.
- A call is in the process of being established.
- A call is in the process of being cleared.

Type

Statement or Direct

Syntax

PUnRR(Pr)	Sends a Receiver Ready packet.
PUnRNR(Pr)	Sends a Receiver Not Ready packet.
PUnREJ(Pr)	Sends a Reject packet.

n is the pseudo-user unit which is sending the packet, in the range 1 - 7.

For Modulo 8, **Pr** is in the range of 0 to 7. For Modulo 128, **Pr** is in the range of 000 to 127.

Example 1

This example sends an RR from pseudo-user unit 1 with Pr set to 0, in Modulo 8.

```
PU1RR0
```

Example 2

This example sends an RR from pseudo-user unit 1 with Pr set to 000, in Modulo 128.

```
PU1RR000
```

Send Restart/Restart Confirmation Packet

Description

These commands send a Restart or Restart Confirmation packet. These packets are always sent on logical channel 0.

Type

Statement or Direct

Syntax

PRST(h1h2)(h3h4)	Sends a Restart packet, where **h1h2** specifies the cause code and **h3h4** specifies the diagnostic code. Clears every pseudo-user state.
PCRST	Sends a Restart Confirmation packet.

Example

This example sends a Restart packet with restart cause code 00.

PRST00

Send Clear/Reset/Interrupt Confirmation Packets

Description

These commands send Clear, Clear Confirmation, Reset, Reset Confirmation, Interrupt and Interrupt Confirmation packets. You must be in X.25 flow control ready state to send CLEAR commands.

Type

Statement or Direct

Syntax

PUnCLEAR(h1h2)(h3h4)(,DHh...h)	Sends a Clear packet with data in hex.
PUnCLEAR(h1h2)(h3h4)(,DAa...a)	Sends a Clear packet with data in ASCII.
PUnCCLEAR	Sends a Clear Confirmation packet.
PUnRSET (h1h2)(h3h4)	Sends a Reset packet.
PUnCRSET	Sends a Reset Confirmation packet.
PUnINT(h1h2)(h3h4)	Sends an Interrupt packet.
PUnCINT	Sends an Interrupt Confirmation packet.

where: **D** is an optional delivery confirmation bit, **h1h2** specifies the cause code, and **h3h4** specifies the diagnostic code. Although two bytes can be entered, normally a Subscriber sends only the cause code byte, while a Network sends both the cause code and diagnostic code bytes.

In a Clear packet, data can be sent in a combination of hex and ASCII. Press the **Esc**ape key to switch between hex and ASCII data, as shown in the example below. A tilde (˜) indicates where the **Esc**ape key was pressed.

Example 1

This example sends a Call Confirmation Packet from pseudo-user unit 1.

```
PU1CCALL
```

Example 2

This example sends a CLEAR packet from pseudo-user unit 1 containing a combination of hex and ASCII data.

```
PU1CLEAR01 02,DA DATA IN A CLEAR PACKET˜0D 0A
```

Send Data Packets

Description These commands send a data packet with the data in hex or ASCII.

Type Statement or Direct

Syntax

PUnD(Ps)(Pr)(Q)(M)(D)Hh........h Sends a data packet with the data in hex.

PUnD(Ps)(Pr)(Q)(M)(D)Aa......a Sends a data packet with the data in ASCII.

n is the pseudo-user number, in the range 1 - 7.

Q is the optional Qualifier bit.

M is the optional More Data bit.

D is the optional Delivery confirmation bit.

Example 1 This example sends a data packet containing hex 41 42 43 on the logical channel associated with pseudo-user unit 1.

```
PU1DH414243
```

Example 2 This example sends a data packet with the Q, M and D bits, and five bytes of ASCII characters (HELLO) set on the logical channel associated with pseudo-user unit 4.

```
PU4DQMDAHELLO
```

Send Diagnostic Packet

Description This command sends a diagnostic packet on logical channel 0.

Type Statement or Direct

Syntax **PDIAGh1h2h3h4h5h6h7h8**

where: **h1h2** is the diagnostic byte, and **h3h4h5h6h7h8** are the first three bytes of the header information from the packet (GFI, LCGN, LCN, Packet Type Identifier), in hex.

Example In this example, **aa** is the diagnostic byte, and **bb**, **cc**, **dd** are the first three bytes of the header information from the erroneous packet.

```
PDIAGaabbccdd
```

PARAMETER COMMANDS

Introduction

Parameter (set) commands enable you to define the value of X.25 global parameters, such as frame window size. They also allow you to control the Automatic X.25 Simulator.

For example, the command **SK3** sets the maximum frame window size to 3.

Refer to Section 8.2 for a description of how the command language interacts with the Automatic X.25 Simulator.

Set Frame Level

Description

The SFOF and SFON commands set the frame level off or on, respectively. If the Chameleon is configured in Initiative, or Stand-by mode, the default is frame level ON. If configured in Manual mode, the default will be frame level OFF.

Type

Statement or Direct

Syntax

SFON Sets frame level ON.

SFOF Sets frame level OFF.

The **SFOF** (frame level off) command puts the Simulator into Frame Manual (FM) mode, which is equivalent to Manual mode. It forces the Simulator to ignore the frames received, while maintaining automatic frame level mechanisms. Only SITREX commands will be executed.

In FM mode, outgoing frames are still processed by the automatic Simulator, and State variables relevant to outgoing frames are updated. The frame level State variables for received frames remain unchanged. Incoming frames can be processed by SITREX using WAIT commands.

If SITREX is in any frame level state other than Disconnect (without any outstanding frame or packet), and you turn the frame level OFF, the automatic Simulator will stay in the same state of transmission, taking actions relevant to that state.

The **SFON** (frame level on) command reactivates the processing of incoming frames. Outgoing frames are still processed by the automatic Simulator.

If numbered frames and packets are received in Frame Manual (FM) mode, **SFON** will reactivate the frame level Simulator with outdated State variables. These variables can be updated in two ways:

1. With a SITREX SET command, for example **SNR+** or **SNR-**, increment or decrement **Ns**, or **SUn PRx**, set **Pr** of Pseudo-User *n* to value *x*.

2. By allowing the Simulator to restart with wrong State variables, thus forcing the other device to initiate recovery procedures.

Note

If you enter the **SLON** (Set Link ON) command, an implicit **SFON** will be executed.

Example 1

This example sets frame level on.

```
SFON
```

Example 2

This example sets frame level off.

```
SFOF
```

Set Packet Level

Description

The SPOF and SPON commands set the packet level off and on, respectively. If the Chameleon is configured in Initiative or Stand-by mode, the default is packet level ON. If configured in Manual mode, the default is packet level OFF.

Type

Statement or Direct

Syntax

SPON	Set packet level ON.
SPOF	Set packet level OFF.

SPOF forces the Simulator to ignore the packets received, while maintaining automatic frame level mechanisms. In this mode (Frame Automatic - Packet Manual = **FA-PM**), the frame level State variables are automatically updated.

The packet level State variable for received packets remain unchanged, but the packet level State variables for transmitted packets are updated.

SPOF does not disable the packet level completely, only the automatic processing of incoming packets is suppressed. Incoming packets can be processed by SITREX with WAIT commands.

SPON will reactivate the Simulator's packet level. The frame level must be set ON before this command will take effect.

Example 1

This example sets packet level on.

```
SPON
```

Example 2

This example sets packet level off.

```
SPOF
```

Set Link Level

Description

The SLOF and SLON commands set the link level off or on, respectively.

Type

Statement or Direct

Syntax

SLON	Sets Link ON.
SLOF	Sets Link OFF.

SLON sends a SARM or a SABM to establish the link. The system waits for a UA until T1 expires, then sends polled SARMs or SABMs N2-1 times. If a UA is still not received, one DISConnect and then N2-1 number of polled DISConnects will be sent.

SLON must be used in program mode to establish a link *before* using any of the SITREX packet level commands. **SLON** activates the automatic frame level (**SFON**), which can be disabled using **SFOF**.

SLOF attempts to disconnect the line. Upon reception of a UA, the automatic Simulator enters the disconnected phase. (Refer to CCITT Red Book, Recommendation X.25, Section on Link Layer, paragraph on Link Set-ups: 2.4.5.3 and 2.4.5.4, for more information.)

Example 1

This example sets the link off.

```
SLOF
```

Example 2

This example sets the link on.

```
SLON
```

Force Link On

Description

The LNKUP command forces the Simulator to assume that the link has already been established. It assumes that a SABM has been sent and a UA has been received in response.

However, unlike the **SLON** command above, **LNKUP** does not actually send or receive the appropriate frames. Also, **LNKUP** activate the automatic frame level (**SFON**), which can be disabled using **SFOF**

Note: After the first transmission, if an answer is not received, SITREX will attempt to set the link on.

Type

Statement or Direct

Syntax

LNKUP

Example

This example forces the Simulator to assume that the link is up.

LNKUP

Transmit CRC

Description

The SCRC command enables you to specify if subsequent frames should be sent with a good CRC or without a CRC. The default condition is that frames will be sent with a good CRC.

If the Simulator is sending frames without the CRC calculation, the last bytes are considered to be the CRC.

Instead of transmitting a frame with a calulated CRC, you may use the memory buffer to store the CRC at the final position, and later transmit the entire buffer. Basically, this feature allows you to build your own CRC.

The operations on variables allow you to calculate the CRC. It can be stored at the end of the message buffer using the commands **SXAIhh** and **SXAIXB** (see example below).

Type

Statement or Direct

Syntax

SCRC+	Specifies that subsequent frames include a good CRC.
SCRC-	Specifies that subsequent frames will be sent without a CRC.

Example

This example transmits the frame **01 02 03 04** with the **CRC 39 91**, where variable **A = 39** and variable **B = 91**.

SXAH39:SXBH91	Variable A = 39 (MSB) of CRC, B to (LSB) of CRC
SCRC-	Specifies to send aframes without a CRC.
SXCH02	Initializes C to equal CRC length.
SMH01020304	Stores the message to be transmitted.
SXL000	Extracts the length of the message buffer (byte 00) and put into variable L.
SXL+XC	Adjust sthe length of the buffer.
SXLI00	Insert sthe new length into byte 0 of the buffer.
SXIH01	Assigns variable I to 1.
SXBIXL	Assigns variable B to last postion of the buffer.
SXL-XI	Decrements the length in variable L.
SXAIXL	Assigns variable A to position before the last in the buffer.
FM	Transmits the frame.
SCRC+	Resumes sending frames with CRC.

Set Primary/Secondary Address

Description The SPA and SSA commands set the primary and secondary addresses, respectively.

Type Statement or Direct

Syntax

SPAh1h2	Sets the Primary Address.
SSAh1h2	Sets the Secondary Address.

where: **h1h2** is the address. If **h1** is absent, it is set to 0.

Example This example sets the primary address to 03.

```
SPA03
```

Set Frame and Packet Window Size

Description These commands set the frame window and packet window sizes.

Type Statement

Syntax

SKx Sets the frame window size, where **x** is in the range 1 - 3.

SUnW(R or T)x Sets the packet window size, where **x** is the window size in the range 1 - 7.
T specifies the Transmit window size.
R specifies the Receive window size.
n is the pseudo-user number in the range 1 - 7.

Example 1 This example sets the packet window size to 7 for pseudo-user unit 1.

SU1W7

Example 2 This example sets the frame window size to 2.

SK2

Set Data Packet Length

Description

These commands set the maximum length of the transmitted or received data packet for the logical channel. These values must be (re)set before call set-up and transmission. These parameters can be modified only by clearing the channel and returning to a ready state.

The packet length is recognized only if the initial length specified for the Frame Size (N1) parameter in the Frame & Packet Level Parameter Set-up Menu is sufficient.

Type

Statement

Syntax

SUnLTnnn Sets the maximum length of the transmitted data packet.

SUnLRnnn Sets the maximum length of the received data packet.

SGTh1h2 Sets the length of the data in the data packet sent by a traffic generator, where **h1h2** can be any value between 00 and F8. (Since the frames have a maximum length of 255 bytes, **h1h2** cannot equal a value from F9 to FF.)

where: **n** is the pseudo-user number in the range 1 - 7 and **nnn** is one of the packet lengths supported by SITREX: 016, 032, 064, and 128.

Example

This example sets the maximum length of a data packet transmitted from pseudo-user unit 2 to 64 bytes.

```
SU2LT064
```

Set Frame and Packet State Variables

Description

These commands increment, decrement, or set the values of N(s), N(r), P(s) and P(r). To use the commands which affect modulo 8 or modulo 128, you must initialize the SITREX User Facilities Menu. (See Section 8.3 for information.) If the sequence numbering method chosen at the packet level is modulo 128, all the commands must be for modulo 128.

Type

Statement or Direct

Syntax

SNS	Increments N(s).
SNS-	Decrements N(s).
SNSx	Sets N(s) to a value between 0 and 7.
SNR +	Increments N(r).
SNR-	Decrements N(r).
SNRx	Sets N()r to a value between 0 and 7.
SUnPR +	Increments P(r).
SUnPR-	Decrements P(r).
SUnPRx(xx)	Sets value of P(r). The range of **x** is 0 - 7 for Mod 8 and 000 - 127 for Mod 128. **n** is the pseudo-user number.
SUnPS +	Increments P(s).
SUnPS-	Decrements P(s).
SUnPSx(xx)	Sets the value of P(s). The range of **x** is 0 - 7 for Mod 8 and 000 - 127 for Mod 128. **n** is the pseudo-user number.

Example 1

This example decrements N(s).

```
SNS-
```

Example 2

This example sets the value of P(s) using Mod 128 at 000.

```
SU3PS000
```

Set Logical Channel Group Number

Description

Ths SLG command assigns a Logical Channel Group Number (LCGN) as a default value to the the next placed call.

Type

Statement or Direct

Syntax

SLGh1

where: **h1** is the default LCGN in hex, in the range 0 to F.

Example

This example assigns hex 5 as the default Logical Channel Group Number.

SLG5

Set Interface Leads

Description This command sets a specific interface lead to logical 1 or 0.

Type Statement or Direct

Syntax

Snnn + Sets interface lead **nnn** active (space).

Snnn- Sets interface lead **nnn** inactive (mark).

where: **nnn** is one of the signal numbers in the chart below.

Chameleon	INTERFACE LEADS		
	SIGNAL	**FUNCTION**	**V.24 PIN NO.**
Simulating a DCE	106	CTS	5
	107	DSR	6
	109	DCD	8
	122	SDCD	12
	125	RI	22
Simulating a DTE	105	RTS	4
	108	DTR	20

Example This example sets the DCD (signal 109) to space.

```
S109+
```

Test Interface Leads

Description

This command tests an interface lead for logical 1 or 0. If the test is true, a specified program line is executed. During the execution of a scenario, this command permits different actions depending on the status of the interface signal. All the signals in the table below can be tested for both the DTE and DCE.

Type

Statement or Direct

Syntax

IFnnn + dddd If interface signal is active, goes to line number **dddd**. **nnn** is a signal number in the table below.

IFnnn- dddd If interface signal **nnn** is inactive, goes to line number **dddd**. **nnn** is a signal number in the table below.

Chameleon	INTERFACE LEADS		
	SIGNAL	**FUNCTION**	**V.24 PIN NO.**
Simulating a DCE	106	CTS	5
	107	DSR	6
	109	DCD	8
	122	SDCD	12
	125	RI	22
Simulating a DTE	105	RTS	4
	108	DTR	20

Example

`10 IF 106+40`	If interface lead 106 is active, the scenario branches to line number 40.
`20 PRINT 106`	Displays status of CTS (106) if inactive.
`30 GOTO 50`	If inactive, branches to line 50.
`40 PRINT 106`	Displays status of CTS (106), if active.
`50 REM STOP`	Stops program execution.

Set Timers

Description

These commands enable you to set the value of various SITREX timers. All of the SITREX timers count down to a terminal value of 0.

Timer T' and T" are used internally by SITRES and are initialized automatically.

Type

Statement

Syntax

ST'h1h2h3h4	Sets timer **T'**, the timer associated with sending command frames (not I-Frames). It counts in tens of milliseconds. It is used for command re-transmission only. **T'** does not change the value of T1.
ST"h1h2	Sets timer **T"**, the timer associated with sending I-Frames from the Simulator. It is used for pacing transmission of I-Frames. It counts in units of seconds.
SWTh1h2h3h4	Sets the Watch-dog Timer, which is associated with the WAIT commands. It counts in tens of milliseconds.
STUh1h2h3h4	Sets timer **TU**, a user-defined timer. Timer **TU** is set to **h1h2h3h4** * 10 milliseconds and counts down in tens of milliseconds.

h1h2h3h4 indicates that four hex numbers must be entered as the timer value, in tens of milliseconds. **h1h2** indicates that two hex numbers must be entered as the timer value in units of seconds.

Example

```
ST'1234
```

Set Counters

Description

The SC command increments, decrements, or sets the values of a user-defined counter. You can use up to 8 counters. Refer to the IFC command to test the value of counters.

Type

Statement

Syntax

SCnh1h2	Sets counter where, **n** is the counter number in the range 0 - 7 and **h1h2** is the value in hex.
SCn +	Increments counter, where **n** is the counter number in the range 0 - 7.
SCn-	Decrements counter, where **n** is the counter number in the range 0 - 7.

Example

This example decrements counter 2.

```
SC2-
```

Set Pseudo-User Type

Description

This command sets or alters the attributes of a pseudo-user. SITREX supports seven pseudo-users, but two of these are internally reserved and cannot be altered using this command.

This command also associates a particular pseudo-user with a Logical Channel Group Number (LCGN) and a Logical Channel Number (LCN).

The type of a pseudo-user can be changed at any time. For example, a pseudo-user can be changed after a call has been placed, or after several data packets have been transferred. The default settings for the 7 pseudo-users are:

Pseudo-User	Default Setting
1	First Local Screen/Keyboard (Reserved for Trace page)
2	Second Local Screen/Keyboard (Reserved for Simulation page)
3	Traffic Generator (continuously transmits characters)
4	Echo Generator (returns received packets on same LCN)
5	Data Absorber (normal terminal)
6	Traffic Generator
7	Traffic Generator

Type

Statement or Direct

SPUnA Defines the pseudo-user as a Data Absorber (a normal terminal).

SPUnE Defines the pseudo-user as an Echo Generator, which returns received data packets on the same logical channel.

SPUnT Defines the pseudo-user as a Traffic Generator, which continuously transmits characters.

where: **n** is the pseudo-user number in the range of 3 to 7, identified by the sub-number or port identification of the X.25 address. Pseudo-users 1 and 2 cannot be changed.

Example

This example defines pseudo-user 4 as a traffic generator.

SPU4T

Set Up PVCS and SVCS

Description

These commands set up a Permanent Virtual Circuit (PVC) or a Switched Virtual Circuit (SVC).

You must set PVC's before the link is established. A PVC is removed by sending or receiving a CLEAR. This enables you to reassign a PVC.

Type

Statement or Direct

Syntax

SUnVPh1h2h3 Sets up a Permanent Virtual Circuit (PVC).

SUnVCh1h2h3 Sets up a Switched Virtual Circuit (SVC). It also associates the Logical Channel with the pseudo-user for the next call set-up.

where: **n** is the physical unit number, **h1** the Logical Channel Group Number, and **h2h3** is the Logical Channel Number.

Example

This example sets up a PVC with pseudo-user 5:

```
SU5VP001
```

WAIT COMMANDS

Introduction

The **WAIT** commands analyze the next item received and compare the incoming data to a frame, packet, or byte mask configuration specified in the command.

The WAIT commands enable you to do the following:

- Wait for a specific frame or packet command before the scenario proceeds
- Wait for a specific bit configuration before the scenario proceeds
- Wait for a specific frame or packet command and store the item in the message buffer
- Wait for a specific bit configuration and store the item in the message buffer

If the trace buffer has been switched OFF (**STOF**), a **WAIT** command will start the trace capture again. Only one **WAIT** command can be used at a time. For multiple triggering, refer to the WS and WST (WAIT and STORE) commands.

WAIT Timers

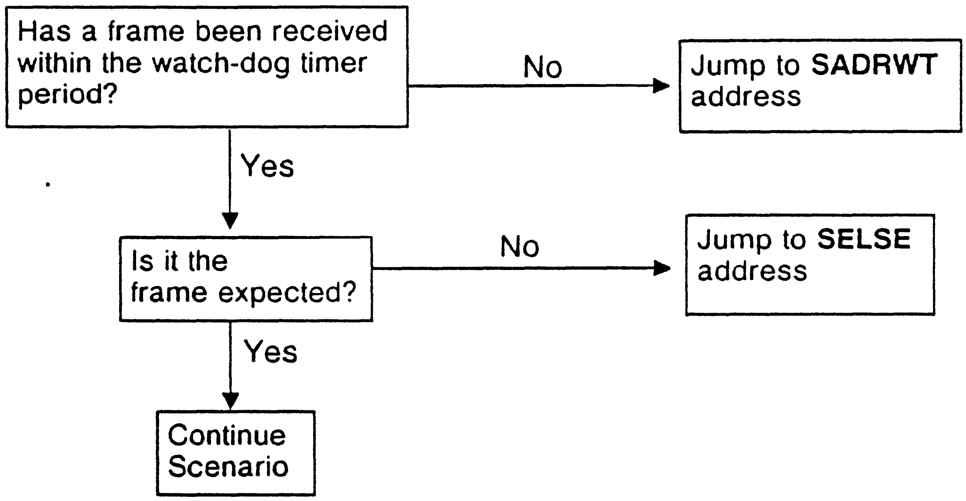
The WAIT commands depend on the value of a watch-dog timer, the address of the watch-dog timer, and a jump address. The **WAIT** command should not be executed until these three values are assigned, using the following commands:

- Set Watch-Dog Timer using the **SWT** command. If the timer expires before a frame or packet is received, it causes the scenario to jump to the Watch-Dog address set with the SADRWT command.

- Set Watch-Dog address using the **SADRWT** command. If no frame is received within the time set by the Watch-dog Timer, execution continues at the line number in the **SADRWT** command. If there is no **SADRWT**, the Watch-dog Timer will be inactive. Therefore, if no frame is received within the required time, an unpredictable error will result.

- Set the jump address using the **SELSE** command. SELSE specifies which line number to execute if something other than the item specfied in the WAIT command is received. If a SELSE command is not executed before a WAIT command, an error results.

The **WAIT** commands are executed as follows:



WAIT FOR FRAME OR PACKET

Description

These commands cause the scenario to wait for the reception of a specific type of frame or packet. If the received item matches the item specified in the WAIT command, either the scenario continues, or the item is stored in the message buffer.

If no item is received within the time specified in the SWT command, the line specified in the SADRWT command is executed. If something other than the specified item is received, the line specified in the SELSE command is executed.

Type

Statement

Syntax

WF(command) Waits for a specified type of frame before executing next line of scenario. **command** is any SITREX Frame Level command.

WSF(command) Waits for a specified type of frame and stores it in the message buffer. **command** is any SITREX Frame Level command.

WP(command) Waits for a specified type of packet before executing next line of scenario. **command** is any SITREX Packet Level command except a Call or Call Confirmation.

WSP(command) Waits for a specified type of packet and stores it in the message buffer. **command** is any SITREX Packet Level command except a Call or Call Confirmation.

You cannot wait for a Call, Call Confirmation, or any frame or packet from pseudo-user 7. However, you can synchronize on these packets using the following syntax:

WPHh1h2h3h4 h......h

which causes the scenario to wait for a user-defined packet in hex.

Example 1

This example waits for a user-defined frame in hex, in this case, a SABM on address 03.

```
WFH032F
```

Example 2

This example waits for a UA response frame with the final bit set to 1.

```
WFFUA
```

Example 3

This example waits for a RR3 packet sent to pseudo-user 1.

```
WPU1 RR3
```

WAIT FOR BYTE MASK CONFIGURATION

Description

This command causes the Chameleon to wait for a specific byte mask configuration. A byte mask configuration is a string of bytes associated with 8-bit masks.

The WT command is a more general syntax than WP or WF. Its use is recommended when waiting for frames and packets, such as RR*n*, RNR*n*, where *n* is not known. When waiting for these frames, the command WFRR will wait for the currently expected Nr.

The Chameleon remains idle until a frame is received. If the frame matches the configuration in the WAIT command, either the next line is executed (WT) or the item is stored in the message buffer (WST). If something other than the specified item is received, the line specified in the SELSE command is executed.

Type

Statement

Syntax

WTXX/YY(,XX/YY)(...) Waits for specified byte mask and executes next line of scenario when received.

WSTXX/YY(,XX/YY)(...) Waits for a byte mask and stores it in the message buffer when received.

The first **XX/YY** pair corresponds to the first byte in the received frame, the second pair corresponds to the second byte, and so on. An **XX/YY** pair is separated with a slash(/). Two successive **XX/YY** pairs are separated by a comma (,).

XX is two hex characters that define the expected binary configuration after masking. **YY** is the 8-bit mask. Use **X** to indicate that you do not care what is received.

YY is logically **AND**ed with its corresponding byte position in the receive buffer. The result is compared to **XX**. An exact match indicates that the condition is true, and the next comparison is performed.

You cannot use the WP (wait for packet) or WF (wait for frame) commands to wait for a Call, Call Confirmation packet, or any frame or packet from pseudo-user 7.

You can use the WT command to synchronize on these, using the following syntax:

WT 00/00,00/00,00/00/,00/00,0B/FF

Example 1

This example waits for a polled or unpolled SABM on any address.

```
WT00/00,2F/EF
```

Example 2

The following example shows the mask configuration used when waiting for a polled or unpolled SABM on any address.

```
10   SWT1000
20   SADRWT 200
30   SELSE 40
40   WST00/00,00/00,00/00,00/00,0B/FF
50   IS00/00,00/00,00/00,07/FF 100
60   PRINT THE LOGICAL CHANNEL NUMBER IS NOT 7
70   GOTO 210
100  PRINT THE LOGICAL CHANNEL NUMBER IS CORRECT
200  PRINT TIMER EXPIRED
210  REM END OF SCENARIO
1000 REM STOP
```

XXXXXXXX 001X1111	Expected Result in Binary (SABM).

X indicates that you do not care what is received. The **X** in the second byte is the Poll/Final bit.

00000000	**00101111**	Expected Result in Binary.
00	**2F**	Expected Result in HEX.
0000000	**11101111**	Mask in Binary.
00	**EF**	Mask in HEX.

WT00/00,2F/EF	SITREX command used to specify this particular byte mask.

00000001 00111111	Incoming Data -- Polled SABM on address 01.

The Mask is **AND**ed with the incoming data and the intermediate result is:

00000000	**00101111**	In Binary.
00	**2F**	In HEX.

This is compared with the expected result shown above. The condition specified by the **WAIT** command is evaluated as *TRUE*.

When writing scenarios, remember that SITREX commands take time to execute. Therefore, if a frame is received while SITREX is setting up its internal parameters, that frame may not be caught by SITREX. For example:

```
5  SFOF
6  FSABM
10 SELSE 20
20 WFH0363
30 FH0363
40 SELSE 50
50 WFH0363
```

While SITREX is executing line 10 or line 40, an incoming frame will not be caught because SITREX is setting the wait address. The same scenario would be better written as:

```
5  SFOF
10 SELSE 20
15 FSABM
20 WFH0363
35 FDISC
30 SELSE 50
40 FH0363
50 WFH0363
```

The SELSE command will be completed before the next frame is transmitted, and a frame received during the execution of line 50 will be caught.

SET WAIT JUMP ADDRESSES

Description

These commands set the addresses that are used in conjunction with all WAIT commands. SADRWT specifies the line number to execute if a frame is not received within the time specified by the Watch-Dog Timer (SWT). SELSE specifies the line number to execute if something is received, but it is not the item specified in the WAIT command.

Type

Statement

Syntax

SADRWT dddd	Sets the jump address for the Watch-Dog Timer. Causes the scenario to jump to line **dddd** if the Watch-dog Timer elapses before an item is received from the line.
SELSE dddd	Causes the scenario to jump to line **dddd** if the next received item is not the one specified in the **WAIT** command.

Example

10 SWT1000	Sets Watchdog Timer to wait for approximately 4 seconds.
20 SADRWT 90	If the Watch-dog Timer expires before a frame is received, jumps to line 90.
30 SELSE 70	If the received frame/packet is not the one defined in WAIT, jumps to line 70.
40 WFSARM	WAIT for a SARM. If a SARM is received, proceed to the next line; otherwise go to the address set by SELSE (line 70).
50 PRINT SARM Rec'd	Prints message when SARM is received.
60 GOTO 100	Ends scenario if SARM received.
70 PRINT NOT A SARM	If frame other than SARM is received, displays message.
80 GOTO 100	Ends scenario if frame other than SARM received.
90 PRINT TIMER ELAPSED	If Watch-Dog Timer expires without receiving a frame, displays message.
100 REM SCENARIO END	Ends scenario execution.

SET WATCHDOG TIMER

Description

The SWT command sets the length of the Watch Dog Timer for WAIT commands. It must be set before any of the WAIT commands are executed. If the Watch Dog Timer expires before an item is received from the line, the scenario executes the line number specified in the SADRWT command.

Type

Statement

Syntax

SWTxxxx

where: **xxx** is in units of tens of milliseconds (.0001)

Example

```
SWT1000
```

Sets the Watchdog Timer to wait for approximately 4 seconds. Note that the SADRWT command must be used to specify the line number to jump to when this timer expires.

LOOP, JUMP, AND REINITIALIZATION COMMANDS

Introduction

This section contains commands that do the following:

- Set up loops to execute a list of commands a specific number of times
- Conditional jump commands (IF commands) that enables you to jump to a specified line number based on the value of a timer or counter
- Unconditional jump command (GOTO, GOSUB)
- Reinitialization commands that enable you to:
  - Stop program execution
  - Exit from Sitrex command mode and return to the main menu
  - Exit from Sitrex command mode and return to the Automatic X.25 Simulator

SET UP PROGRAM LOOP

Description

These commands set up a loop that executes a list of commands a specified number of times. Nested loops are not allowed.

Type

Statement

Syntax

***h1h2**	Signals the beginning of the loop, where **h1h2** specifies the number of times to execute the following commands, within the range 1 to FF.
;	Signals the end of the loop. ; must occur on a line by itself.

The symbols * and ; must each appear at the beginning of the line. The program lines between * and ; are repeated h1h2 times. When the loop is completed, the first command following ; is executed.

Example

This example sets up a loop that sends four SARMs followed by one DISC.

```
10 *04        Sets loop to repeat 4 times.
20 FSARM      Send a SARM.
30 ;          Ends loop segment.
40 FDISC      Send a DISC.
```

CONDITIONAL JUMP (IF)

Description Tests a timer or counter for 0. If test is true, jumps to specifed line number. Otherwise, the next command will be executed.

Type Statement

Syntax

IFT' dddd Tests timer T'.

IFT" dddd Test timer T".

IFTU dddd Tests user-defined timer TU.

IFCn dddd Tests counter, where **n** is the coutner number in the range 0 - 7.

where: **dddd** is the line number to jump to, if the value of the timer or counter is zero.

Example 1 This example checks the user timer and prints a message when it expires.

10 STU0300	Sets user timer to 300(Hex) milliseconds.
20 IFTU 40	If timer TU equals 0, go to 40.
30 GOTO 20	If timer TU is not equal to 40, jumps to line 20 and tests again.
40 PRINT TIME UP	When timer expires, display message.

UNCONDITIONAL JUMP (GOTO, GOSUB)

Description

The GOTO and GOSUB commands enable you to unconditionally jump to a specified line number in a SITREX scenario. GOSUB jumps to a line number that executes a subroutine that ends with the RETURN command. When a RETURN is encountered, the program jumps to the line following the the GOSUB.

Type

Statement

Syntax

GOTO dddd	Unconditionally jump to line number **dddd**. **Do** not use GOTO within a repeated loop.
GOSUB dddd	Unconditionally jump to line number **dddd**, execute the subsequent lines as a subroutine. Return to the instruction following the **GOSUB** after encountering a RETURN.
RETURN	Signals end of subroutine. Causes scenario to jump to the instruction following the GOSUB. If a RETURN is encountered without a preceding GOSUB, an error 18 will result.

Example

This example waits for frames and executes subroutines when received.

`10 SELSE 20`	If frame specified in WAIT command (line 20) is not received, jump to line 20.
`20 WT00/00`	Waits for any incoming frame.
`30 GOSUB 100`	Executes a subroutine beginning at line 100.
`40 SELSE 10`	If frame specified in WAIT command (line 50) is not received, jump to line 10.
`50 WFCMDR34`	Waits for CMDR frame.
`60 GOTO 10`	Unconditionally jumps to line 10.
`100 PRINT OK`	Subroutine. Print OK.
`101 RETURN`	Returns from subroutine to .

REINITIALIZATION

Description These three commands enable you to reinitialize SITREX by stopping program execution or exiting from SITREX command mode.

Type Direct

Syntax

HALT Exits SITREX and returns to the Chameleon main menu.

EXIT Exits SITREX command mode and returns to the SITREX Automatic X.25 Simulator.

ESCape key Interrupts a scenario during execution. The system displays the following message:

***** JOB CANCELLED *****

Example 1 This example exits command mode and displays the Chameleon main menu.

```
HALT
```

Example 2 This example exits SITREX command mode and displays the message **SITEX IDLE.**

```
EXIT
```

PROGRAM MANAGEMENT COMMANDS

Introduction

This secion contains the command that enable you to develop your SITREX scenarios. Many of the commands in this section are direct commands. That is, they can be used only at the ! prompt and cannot be included in a scenario.

The commands in this section enable you to:

- Save scenarios to disk
- Load scenarios into memory
- Run programs
- Clear programming memory so that you can enter a new program

CHAIN PROGRAMS

Description

The & command clears the current scenario from memory, loads a specified scenario into memory, and executes it.

Type

Statement

Syntax

&xfilename

where: **filename** is the name of the scenario to be loaded and **x** is either 0 (hard drive) or 1 (floppy drive) and specifies the drive where the scenario is stored.

Example

This example sends a SABM and waits for a UA. When the response is received, it clears the memory, and loads and executes the scenario TEST1510.

`10 SWTFFFF`	Set watch-dog timer to FFFF.
`20 SADRWT 100`	Set watchdog jump address to 1000.
`30 SELSE 50`	Set WAIT jump address to 50.
`40 FSABM`	Transmit a SABM.
`50 WFUA`	Wait for a UA.
`60 PRINT TEST OK`	Print TEST OK if received UA.
`70 GOTO 200`	Jump to 2000.
`100 PRINT WT ELAPSED`	If UA is not received, and the timer elapses, print error message.
`110 GOTO 300`	Jumps to line 300 if watch-dog timer expires.
`200 &0TEST1510`	Loads and executes program file TEST1510 from the hard disk.
`300 REM STOP`	

LOAD PROGRAM

Description
This command loads a scenario file into memory.

Type
Direct

Syntax
LOAD

The system will respond with the prompt:

Filename:

Enter the filename using the format:

xfilename

where: **filename** is the name of the scenario to load and **x** is either 0 (hard drive) or 1 (floppy drive) and specifies the drive where the scenario is stored.

Example
This example loads the scenario named PROGRAM from the hard drive.

```
LOAD

Filename: 0PROGRAM
```

REMARK

Description

The REM command enables you to enter programming remarks in a scenario file.

Type

Statement

Syntax

REM *(text)*

Example

```
10 REM Written by Tekelec
20 REM January 1988
30 REM Example remarks
```

NEW PROGRAM

Description

This command erases the scenario in memory so that a new program can be written.

Type

Direct

Syntax

NEW

Example

```
!10 REM This is a remark.
!LIST
```

Result: `10 REM This is a remark.`

```
!NEW
!LIST
```

Result: `!`

RUN PROGRAM

Description

This command executes the scenario in memory. This is only applicable to a scenario with labeled commands which has been loaded from disk using the LOAD command, or entered through the keyboard.

Pressing the ESCape key aborts scenario execution. While the scenario is running, you can view the trace by pressing T.

Type

Direct

Syntax

RUN

Example

This example executes the program currently in memory.

```
!LIST
!10 PRINT I'm a heavy SITREX user.
!RUN
```

Result:

```
I'm a heavy SITREX user.
!
```

SAVE PROGRAM

Description This command saves the scenario in memory to disk.

Type Direct

Syntax **Save**

The system responds with the prompt:

Filename:

Enter the filename using the format:

xfilename

where: **filename** is the name of the scenario to save and **x** is either 0 (hard drive) or 1 (floppy drive) and specifies the drive.

Example This example saves the scenario in memory to a file named PROGRAM on the hard drive.

Save

```
Filename: 0PROGRAM
!
```

NUMERIC VARIABLE COMMANDS

Introduction

This section contains the commands that enable you to define, manipulate, and test SITREX numeric variables.

You can define and store up to 26 numeric variables designated as XA - XZ and manipulate them as follows:

- Assign values directly or through user input
- Perform arithmetic operations
- Perform logical operations
- Shift and rotate the contents of a variable
- Test the contents of a variable

VARIABLE OPERATIONS

Description

SITREX allows you to define and store up to 26 numeric variables (XA through XZ). The following commands enable you to assign values to variables, and perform arithmetic and logical operations using them.

Variables cannot contain hex values greater than FF. All calculations are Modulo 256 with the result of the operation stored in the leftmost variable.

Type

Statement

Syntax

SXAHh1h2	Assigns a value to XA, where h1h2 is the value in hex.
SXA+XB	Adds XA and XB and stores the result in XA.
SXA-XB	Subtracts XB from XA and stores the result in XA.
SXA.XB	Logical AND between XA and XB.
SXA/XB	Logical OR between XA and XB.
SXA@XB	Logical Exclusive OR (XOR) between XA and XB.

where:
S is the command
XA and **XB** are variables
H, **+**, -, ., /, and @ indicate the operation to be performed

Example

This example assigns values to two variables and then adds them together.

10	**SXAH23**	Stores 23H in variable XA.
20	**SXBH7B**	Stores 7BH in variable XB.
30	**SXA+XB**	Adds variables AX and XB and stores result in XA.

Result XA contains the value 9E hex.

SHIFT AND ROTATE VARIABLE CONTENTS

Description

These commands enable you to shift or rotate the contents of a numeric variable to the right or left. You can define up to 26 SITREX numeric variables using XA - XZ.

In shift commands, shifted bits fall outside the byte boundary and are discarded. This means that bits that are shifted will be 0.

In rotate commands, rotated bits are rotated at the other end of the byte. This causes bits that fall outside of one end to be rotated in at the other end.

Type

Statement

Syntax

SXADn	Shifts the contents of XA **n** times to the right.
SXAGn	Shifts the contents of XA **n** times to the left.
SXARn	Rotates the contents of XA **n** times to the right.
SXALn	Rotates the contents of XA **n** times to the left.

where: **n** is in the range 1 to 7.

Example

This example shifts XA three times left. XA contains the value 08H.

SXAG3

Result: XA = 10H

KEYBOARD INPUT

Description

The INPUT command causes a scenario to wait for the user to enter a two-digit hex value and then assigns the value to a numeric variable. If you are displaying the trace when an INPUT command is executed, it will pause until you enter a correct value.

Note: CTRL Z clears the screen.

Type

Statement

Syntax

INPUT XA

The following prompt appears:

XA = ?

The scenario will not continue until you enter two hex digits and the input value is stored in variable XA.

If you input an illegal response, the system will continue to ask for a new value until you enter a correct value, or terminate the scenario by pressing **ESC**ape.

Example

This example prompts for a value for variable XA and then shifts the contents.

10 INPUT XA	Request user to enter value for XA.
20 SXAD2	Shift variable XA two places right.

TEST VARIABLES

Description

These commands test numeric variables against other variables or specified values and causes the scenario to jump to a specified line number if the test result is true.

Type

Statement

Syntax

`IXA=XB dddd`	If XA equals XB, go to line dddd.
`IXA=h1h2 dddd`	If XA equals h1h2, go to line dddd.
`IXA#XB dddd`	If XA is not equal to XB, go to line dddd.
`IXA#h1h2 dddd`	If XA is not equal to h1h2, go to line dddd.
`IXA<XB dddd`	If XA is less than XB, go to line dddd.
`IXA<h1h2 dddd`	If XA is less than h1h2, go to line dddd.
`IXA>XB dddd`	If XA is greater than XB, go to line dddd.
`IXA>h1h2 dddd`	If XA is greater than h1h2, go to line dddd.
`IXA(XB dddd`	If XA is less than or equal to XB, go to line dddd.
`IXA(h1h2 dddd`	If XA is less than or equal to h1h2, go to line dddd.
`IXA)XB dddd`	If XA is greater than or equal to XB, go to line dddd.
`IXA)h1h2 dddd`	If XA is greater than or equal to h1h2, go to line dddd.

where:
- `I` is the command (if)
- `XA` and `XB` are variables
- `h1h2` represents two hex digits
- `=, #, <, >, (, )` indicate the test to be performed

Example

This example tests whether variables XA and XB are equal. If so, it prints **OK!**; if not, it prints **ERROR!**.

```
10 IXA=XB 40
20 PRINT ERROR!
30 GOTO 50
40 PRINT OK!
50 REM END OF TEST
```

MESSAGE BUFFER COMMANDS

DEFINE MESSAGE FOR MESSAGE BUFFER

Description

These commands modify the contents of the message buffer. The message buffer can contain up to 64 bytes, numbered 1 through 40 hexadecimal. Byte 0 contains the length of the message in the buffer. This is illustrated in the figure below.

If you assign the contents of the buffer with the commands **SMH** or **SMA**, the system assigns the length (byte 0) automatically. If you assign data that exceeds 64 (40 hex) bytes, only the first 64 bytes will be accepted.

The **DISPM** command allows you to see the contents and the length of the message buffer.

Type

Statement

SMHh...h Writes hexadecimal values into the buffer, where **h...h** is a maximum of 128 hex digits.

SMAa...a Writes the ASCII characters into the buffer, where **a...a** is a maximum of 64 ASCII bytes.

SXAIXB Inserts the value of variable **XA** in the byte of the buffer indicated by the value contained in variable **XB**.

SXAIh1h2 Inserts the value of **XA** in the byte of the buffer indicated by the 2-digit hex value **h1h2**.

Example

10	GOSUB 1000	Sub-routine line 1000.
20	SXDH01	Set XD for variable increment.
30	SXBH03	Set XB to current length.
40	SM010203	Set memory with length updated.
50	GOSUB 1000	Subroutine line 1000.
60	PRINT INPUT 0 TO STOP, 1 TO ADD BYTES	
70	INPUT XE	Input choice for XE.
80	IXE=00 5000	
85	IXB>40 5000	If length = maximum, STOP. Note that 40 hex = 64 decimal)
100	PRINT INPUT NEW BYTE TO ADD TO MEMORY.	
110	INPUT XA	
120	SXB+XD	Increment variable.
130	SXBI00	Adjust length.
140	SXAIXB	New position = length
150	GOTO 50	Unconditional jump to line 50.
1000	DISPM	Display result of last update.
1010	DISPX	
1020	RETURN	End of subroutine.
5000	PRINT BYE BYE!	

MESSAGE BUFFER BYTE EXTRACTION

Description

These commands enable you to extract one byte from the message buffer by specifying the location of the byte using a numeric variable or 2-digit hex value.

These commands can be used with the WAIT and STORE (WS) command to extract a byte from a frame received and stored by the Simulator.

Type

Statement

Syntax

SXAOXB	Extracts the byte at the location in the buffer indicated by the value contained in variable **XB**, and stores the byte in **XA**. **XB** cannot exceed 40 hex (64 decimal).
SXAOh1h2	Extracts the byte at the location in the buffer indicated by the 2-digit hex value **h1h2**, and stores the byte in **XA**. **h1h2** cannot exceed 40 hex.

Example

This example stores the value in the message **SXAO02** buffer. It also extracts the value at the second position in the message buffer and stores it in variable A. The variable A contains the value 06.

```
SMH45063269F54C
```

ASSIGN MESSAGE BUFFER LENGTH

Description

These commands enable you to assign the value of byte 0, which indicates the length of the message buffer. By setting the buffer length, you can control how many bytes of the buffer are transmitted.

Type

Statement or Direct

Syntax

SXAI00 Sets the message buffer length to the value of variable **XA**. This is a special use of the **S...I** (define message) command, in that it defines only byte 0 (00) of the message buffer contents.

SXAO00 Extracts the current buffer length and stores the length in variable **XA**. This is a special use of the **S...O** (byte extraction) command, in that it extracts only byte 0 (00) of the message buffer contents.

Example

This example assigns the value 12 to variable XA, uses the variable to set the buffer length, and then displays the memory.

```
10 SXAH12
20 SXAI00
30 DISPM
```

Result:

```
L = 018
M = 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00
```

TEST MESSAGE BUFFER CONTENTS

Description

This command compares the contents of the message buffer to the byte and mask configuration in the command. If they are identical, control jumps to a specified line number. Otherwise, execution continues with the next statement.

Type

Statement

Syntax

ISXX/YY(,XX/YY)(....) dddd

This command is used in a scenario where **dddd** is the line number to branch to if the test is true.

The first **XX/YY** pair corresponds to the first byte in the message buffer. The second pair corresponds to the second byte, and so on. **XX** is two Hexadecimal characters defining the expected binary configuration after masking.

YY is the 8 bit mask compared to its corresponding position in the frame. **YY** is **AND**ed with its corresponding byte position in the buffer. The result is compared to **XX.**

Example

This example checks the message buffer for a CALL packet.

```
100   IS00/00,00/00,00/00,00/00,0B/FF 130
110   PRINT NOT A CALL PACKET
120   GOTO 140
130   PRINT IT WAS A CALL PACKET
140   REM  END OF SCENARIO
```

TRANSMIT MESSAGE

Description

These commands transmit the frame, packet or data packet, as described below.

Type

Statement or Direct

Syntax

FM

Transmits the frame, assigning the first byte of the message buffer (byte 1) to the first byte of the frame, and each successive byte of the buffer to the next bytes of the frame.

Buffer byte 1 ---> TX frame byte 1
Buffer byte N ---> TX frame byte N

There is no automatic control. The buffer becomes the entire frame.

PM

Assigns the contents of the message buffer, excluding the message buffer length (byte 0), to the I-Field of a frame (byte 3 and following) and transmits it with an automatically controlled 8 bit address field, and modulo 8 N(S) and N(R).

Buffer byte 1 ---> TX frame byte 3
Buffer byte N ---> TX frame byte N + 3

There are automatic frame controls, but no automatic packet controls. The buffer becomes the packet level and data, depending on buffer length.

PUnDS

Assigns the contents of the message buffer (beginning with byte 1) to the data portion of the I-Field, and transmits it from the pseudo-user n (n must be between 1 and 7) with automatic control of P(S) and P(R). If the pseudo-user **n** is not activated, **ERROR 22** will be displayed.

Buffer byte 1 --->TX frame byte 6
Buffer byte N --->TX frame byte N + 6

Automatic frame and packet level controls. Buffer becomes data only.

Example

```
FM
```

TRACE BUFFER COMMANDS

Introduction

This section contains the commands that enable you to manipulate and use the trace buffer. Refer to Section 8.4 for a description of the SITREX trace buffer. Refer to Section 8.2 for a description of how the trace buffer interacts with the Automatic X.25 Simulator.

The trace buffer commands enable you to:

- Display the contents of the trace buffer
- Clear the trace buffer
- Save the contents of the trace buffer to disk
- Load a trace buffer file into memory

DISPLAY TRACE BUFFER

Description

The TPRINT command displays the transmitted and received frames by displaying the current contents of the trace memory. The command suffix allows you to change the interpretation of the trace as described below.

Notes

It is not recommended that you use these commands when a traffic generator is active, because the display slows the Simulator.

The data length of the trace capture is initialized to a value with the **STRnn** command.

Type

Statement

Syntax

TPRINT	Displays all X.25 levels interpreted, with the data shown in hex.
TPRINTA	Displays all X.25 levels interpreted, with the data shown in ASCII.
TPRINTF	Displays all X.25 levels unintrepreted, with the frames shown entirely in hex.
TPRINTP	Only the frame level is interpreted. The I-Field of the I-Frames is shown in hex.

Example

This examples displays the contents of the trace buffer in hex.

```
TPRINTF
```

Result: `T * 018 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00`

The trace indicates T for transmission, * for good CRC, 018 for the length of 18 bytes, and then data (all zeros).

LOAD TRACE FILE FROM DISK

Description The TLOAD command loads a trace file from disk to memory.

Type Statement or Direct

Syntax **TLOAD**

When you enter the TLOAD command, you are prompted for the drive and filename:

File Name:

Enter the name of the trace file in this format:

xfilename

where: **x** = 0 to load a trace file from the hard disk or **x** = 1 to load a file from the floppy drive.

Example This example loads a trace file named TRACE A from the floppy drive.

```
TLOAD
File Name: 1TRACEA
```

PRINT TRACE BUFFER

Description

The LTPRINT outputs the current contents of the trace memory to a printer or remote terminal. The command suffix allows you to change the interpretation of the trace as described below.

Notes

It is not recommended that you use these commands when a traffic generator is active, because the display slows the Simulator.

The data length of the trace capture is initialized to a value with the **STRnn** command.

Type

Statement

Syntax

LTPRINT	Displays all X.25 levels interpreted, with the data shown in hex.
LTPRINTA	Displays all X.25 levels interpreted, with the data shown in ASCII.
LTPRINTF	Displays all X.25 levels *un*intrepreted, with the frames shown entirely in hex.
LTPRINTP	Only the frame level is interpreted. The I-Field of the I-Frames is shown in hex.

Example

This example outputs the contents of the trace buffer in ASCII.

```
LTPRINTA
```

SAVE TRACE TO DISK

Description This command saves the contents of the trace buffer to a file.

Type Statement or Direct

Syntax

TSAVE"0*filename*" Saves the trace file to the hard disk drive. Note that a blank space is not allowed between the 0 and the filename.

TSAVE"1*filename*" Saves the trace file to the floppy disk drive. Note that a blank space is not allowed between the 1 and the filename

Example This example saves the contents of thecurrent trace buffer to a file named TRAFFIC on the floppy disk drive

```
TSAVE"1TRAFFIC"
```

SET TRACE BUFFER ON/OFF

Description

These commands enable you to make the trace buffer active or idle. For a complete description of the function of the trace buffer in SITREX, refer to Section 8.4.

Type

Statement or Direct

Syntax

STON Sets the trace buffer ON. Stores transmitted and received frames in the trace buffer.

STOF Sets trace buffer OFF. Stops the storage of transmitted and received frames in the trace buffer. This command does not clear the trace buffer.

Example 1

This example turns the trace buffer on so that it stores transmitted and received frames.

```
STON
```

Example 2

This example turns the trace buffer off. It becomes idle and does not store transmitted and received frames.

```
STOF
```

CLEAR TRACE BUFFER

Description The TRACE command clears the trace buffer.

Type Statement or Direct

Syntax **TRACE** Clears the trace buffer.

Example 1 In this example, TRACE is executed every 10 seconds, resulting in a circular trace.

`10 STU0390`	Sets user timer to 0390 hex.
`20 IFTU 40`	If timer expires, go to line 40.
`30 GOTO 20`	Returns to 20, checks timer again.
`40 TRACE`	Clears trace when time expires.
`50 GOTO 10`	Returns to 10, reset timer.

Example 2 This example uses TRACE with STON and STOF to capture transmitted and received I-frames in the trace buffer. This scenario captures only 10 frames after receiving a UA.

`5 SWT FFFF`	Sets watch-dog timer to FFFF.
`6 SADRWT 130`	Sets watch-dog jump address to line 130.
`10 SC009`	Set counter 0 to 9.
`20 STOF`	Set trace off.
`30 TRACE`	Clear trace buffer.
`40 SELSE 50`	Set WAIT jump address to 50.
`45 SLON`	Sets the link on.
`50 WFUA`	Wait for a UA.
`60 SELSE 80`	Set WAIT jump address to 80.
`70 STON`	Set trace on.
`80 WT00/01`	Wait to receive an I-frame.
`90 SC0-`	Decrement counter 0.
`100 IFC0 120`	If counter 0 is elapsed, go to 120.
`110 GOTO 80`	Return to line 80.
`120 STOF`	Set trace off.
`130 REM STOP`	

SET TRACE LENGTH

Description

This command defines the number of data bytes (0 - 255) displayed by the trace buffer. It is relevant only for the data portion of frames. It truncates the data field, enabling more frames to be displayed on the screen, and more to be stored in the trace buffer.

Type

Statement or Direct

Syntax

STRh1h2

where: **h1h2** is a hexadecimal value in the range 0 to FF.

Example

This example displays only the first four bytes of data from each frame in the trace buffer.

STR04

DISPLAY AND PRINT COMMANDS

Introduction

This section contains the commands you use to display information on the screen or output it to a printer or remote device. The following types of information can be displayed and/or printed:

- Timer values
- Counter values
- Variable values
- Screen message and prompts
- Program files

See the Trace Buffer commands for information about displaying and printing the contents of the trace.

DISPLAY USER PARAMETERS

Description

The DISP command displays timers, user-counters, numeric variables, or the contents of the message buffer. The LDISP is the same as the DISP command, but output is to a printer or remote terminal.

Type

Statement or Direct

Syntax

DISPT Displays the following timers in decimal: TU (User Timer), WT (current value of Watch-Dog Timer), and WDTOR (initial value of Watch-Dog Timer)

If you set TU to an initial value of FFFF (using **STU h1h2h3h4**), DISPT displays the time elapsed between the execution of the **STU** command and the **DISPT** command, in decimal.

LDISPT Outputs timer values to a printer or a remote terminal.

DISPC Displays the values of the seven user-defined counters in hex.

LDISPC Outputs counter values to a printer or a remote terminal.

DISPV Displays the values of the following variables:

K (Frame Window size)
N1 (Frame size)
N2 (Number of retransmissions)
T1 (Frame level timer)
LCGN (Logical Channel Group Number)

LDISPV Outputs above variable values to a printer or a remote terminal.

DISPX Displays the current values of the 26 numeric variables (XA - XZ) in hex.

LDISPX Outputs numeric variable values (XA - XZ) to a printer or a remote terminal.

DISPM	Display the length and contents of the message buffer. The length is shown in decimal; the contents in hexadecimal.
LDISPM	Outputs message buffer length and contents to a printer or a remote terminal.

Example

This example assigns values ot variables and then displays the message buffer.

```
10 SMH010203
20 SXAH4C
30 SXAI02
40 DISPM
```

Result

L= 003
M= 01 4C 03

DISPLAY SCREEN MESSAGES AND PROMPTS

Description

The PRINT command displays a user-defined message on the Chameleon screen. During a SITREX scenario, these messages can be used to inform you of the status of a simulation.

This command cannot be used to display the value of variables. Refer to DISP.

Type

Statement

Syntax

PRINT *text*

This command must be terminated with a carriage return and not a colon (:), to avoid interpreting the colon as part of the printed string.

Example

This example waits for a SARM to be received and then displays the message **SARM RECEIVED** on the Chameleon screen.

```
10  SELSE 20
20  WFSARM
30  PRINT SARM RECEIVED
```

LIST PROGRAM FILE

Description

This command displays the program lines from the scenario currently in memory.

If the scenario is too long to fit on the screen, the display can be stopped by typing CTRL + S. To restart the listing, type CTRL + Q. The listing can be aborted by pressing **ESC**ape.

Type Direct

Syntax **LIST**

Example `LIST`

PRINT PROGRAM FILE

Description This command outputs the program lines from the scenario currently in memory to a remote I/O device, terminal, or printer. The listing can be aborted by pressing **ESC**ape.

Type Direct

Syntax **LLIST**

Example `LLIST`

OUTPUT MESSAGE TO PRINTER OR REMOTE DEVICE

Description

The LPRINT command outputs a user-defined message to a printer or remote terminal. During a SITREX scenario, these messages can be used to inform you of the status of a simulation.

This command cannot be used to print the value of variables. Refer to LDISP.

Type

Statement

Syntax

LPRINT

This command must be terminated with a carriage return and not a colon (:), to avoid interpreting the colon as part of the printed string.

Example

This example waits for a SARM to be received and then outputs the message **SARM RECEIVED** to a configured printer or remote terminal.

```
10  LPRINT This is being sent to the printer.
!RUN
```

8.8 SITREX ERROR CODES

Introduction

This section lists the error codes that may occur during SITREX simulation. The error messages are listed with their codes and interpretations.

ERROR NUMBER

The message *ERROR NUMBER with a two-digit code indicates that a user input error has occurred. The two-digit codes can be interpreted as follows:

00	First character incorrect.
04	Illegal Line number (valid range is 0 to 9999).
15	Attempt to re-assign a new LCN to a previously set pseudo-user.
16	Attempt to give a previouly assigned LCN to a new pseudo user.
18	RETURN without GOSUB.
20	Incomplete Loop (; before * nn).
21	Line number specified does not exist.
22	Attempt to send a data packet on a logical channel that has not been set up.
26	Error in the call facility field of a call packet.
81-83	No space for scenarios (memory full).

T *nn*

The message **T** with a two-digit code occurs when the frame level is on. Frame Error Coding is from the Automatic X.25 Simulator.

T00	Reception of a frame with an I-field that exceeds N1.
T01	Address unknown, frame ignored (Not Primary or Secondary address).
T02	Response with poll final bit set when not solicited.
T03	Response with poll final bit not set when solicited.
T04	Response unknown, results in sending CMDR.
T05	Incorrect length of response frame, results in CMDR.
T08	Received unsolicited UA.
T09	Incorrect Nr received.
T10	Reject frame received.
T11	RNR frame received.
T14	Unknown command received.
T15	Incorrect Ns received.

T16	I-Frame out of sequence and station not busy and no Tx.RNR requested and no prior Tx.REJ OR Tx.P/F set.
T17	I-frame out of sequence and station not busy and no Tx.RNR requested and no prior Tx.REJ and no Tx.P/F set.
T18	Received frame out of sequence with Tx.RR request.
T19	Received frame out of sequence.
T20	Internal error.
T21	Error which occurs when SITREX sends a disconnect and the device under test gives an unexpected response.
T22-24	Internal errors.

P *nn*

The message **P** followed by a two-digit code indicates that the packet level is on. The Packet Error Coding is from the Automatic X. 25 Simulator.

P00	Restart at the packet level.
P01	Internal error.
P02	Flow control anomaly (bad $P_{(s)}$ or $P_{(r)}$).
P03	Call or interrupt collision on a logical channel.

TABLE ERROR NUMBER

The message **TABLE ERROR NUMBER** followed by a two-digit code indicates an internal error:

01,02
06,07
0A,0B

16	This error is associated with high density traffic.

8.9 SITREX SAMPLE PROGRAMS

Introduction

This section contains examples of SITREX programs. In the samples, the Chameleon simulates a DTE and is connected to a modem line.

After establishing a connection at the frame level by typing SLON, virtual circuits can be established.

SITREX1

The first example is a series of commands that sends various types of packets. You will enter these commands, and then use the program managment commands to save the program to disk, erase it from memory, load it from disk and list it on the screen, and run it.

!10 PU1CALL1234567801	Places a CALL from pseudo user 1 (PU1) to address 12345678, with a sub-address or port ID 01.
!20 PU1DAABCDEFGHJ	Sends Data "ABCDEFGHJ" in ASCII.
!30 PU1DH01 A0 A0 A0 FE	Send Data, "01 A0 A0 A0 FE" in hex.
!40 PU1DAABCDE~ABCD45	Send Data, "ABCDE" in ASCII and "ABCD45" in hex. The tilde (~) indicates that the Esc key was pressed to switch to hex data.
!50 PU1DA HELLO	Sends Data, " HELLO" in ASCII.
!60 PU1RSET0 0	Sends a RESET packet.
!70 PU1INT3 1	Sends an INTERRUPT packet.
!80 PU1CLEAR	Sends a CLEAR packet.
!	SITREX prompt.

!SAVE	Saves program entered above to disk.
FILENAME : ?1SITREX	System requests name for program file. You respond with 1 (Drive B) and SITREX.
!NEW	Clears program from memory.
!LIST	Since nothing is displayed, memory is cleared.
!LOAD	Loads a program from disk to memory.
FILENAME : ? 1 SITREX	System requests name of file to load. You respond with 1 (Drive B) and SITREX
!LIST	Displays program currently in memory.
!RUN	Runs programs. Error message 22 may result, indicating that the LCN was not set up prior to sending packets (see error codes in Section 8.8).

SITREX2

This scenario sets up a CALL, transfers data, and sends a CLEAR. Each line is typed in when the ! prompt is displayed. The line numbers indicate that the command is to be stored in memory and executed in sequence. Lines can be entered in any order, as they will be re-ordered automatically according to the line number.

Entry Error Recovey

The command entered in line 70 contains a syntax error. When the RETURN key is pressed after the erroneous command, the line is re-displayed up to the occurrence of the error. The rest of the line can be re-entered correctly, or the fragment displayed may be deleted by using the back space key.

!10 REM CALL REQUEST, DATA TRANSFER AND CLEAR.

!20 REM	You can enter comments here.
!30 PU2CALL19200039701	Place a CALL from Psuedo-User 2.
!40 STU01F4	Set user timer to 01 F4 Hex.
!50 IFTU 70	If TU equals 0 go to line 70.
!60 GOTO 50	Unconditional jump to line 50. Keep checking TU timer.
!70 PU2D1234567890	Send data: syntax error.
70 PU2DA1234567890	Syntax error corrected. Send data, "1234567890" in ASCII.
!80 STU01F4	Set user timer to 01 F4 again.
!90 IFTU 110	If TU equals 0 go to line 110.
!100 GOTO 90	Unconditional jump to line 90. Keep checking TU timer. Awaiting a response.
!110 PU2CLEAR	Send a CLEAR packet.

Note

Timers are used to ensure that a response is received, as in this scenario. If the call in line 30 is cleared, and line 70 is then executed, an error will appear.

SITREX3

This scenario measures the time required to set up a call. Each time a WAIT command is executed, the Watch-dog Timer is set, allowing you to examine a specified logical channel during a user determined time.

Notes

For the Packet WAIT commands, the logical channel related to the Pseudo-User should be established *before* execution of the WAIT command. When a packet WAIT command is run, the use of Pseudo-User 7 is prohibited.

60 SWT1000	Set watchdog timer to 1000.
70 SADRWT 800	Jump to 800 if Watch-dog timer expires.
90 SELSE 110	Set ELSE to 110. Jump to 110 if frame expected by WAIT is incorrect.
100 PU5CALL19200039705	Set user timer to FFFF. Place a CALL from Psuedo-User 5.
110 WT00/00,00/00,00/00,00/00,0F/FF	
	Wait for a CALL CONFIRMATION.
120 DISPT	Display timers.
150 STU01F4	Set user timer to 01 F4 Hex.
160 IFTU 180	If TU equals 0 go to line 180.
170 GOTO 160	Unconditional jump to 160. Keep checking timer.
190 SELSE 210	Set jump address of next WAIT to 210.
200 PU5CLEAR0 0	Send a CLEAR packet.
210 WPU5CCLEAR	Wait for a CLEAR CONFIRMATION.
230 PRINT "" OK ""	Arrive here if correct response is received.
250 GOTO 60	Unconditional return to line 60. Arrive here (ADRWT) if Watch-dog timer expires.

800 PRINT "Watch-dog timer elapsed**"**
1000 REM End of scenario

The following display shows a possible result of this scenario:

```
!RUN
TU = 000340MS   WDTOR = 005000MS   WDT = 004940MS
*** OK **
TU = 000350MS   WDTOR = 005000MS   WDT = 004950MS
*** OK **
TU = 000350MS   WDTOR = 005000MS   WDT = 004940MS
*** OK **
TU = 000340MS   WDTOR = 005000MS   WDT = 004950MS
*** OK **
*** JOB CANCELLED ***
!
!
!PU1CLEAR
```

The User Timer (TU) is initialized to FFFF while a CALL packet is transmitted. After the next command in the scenario, **WT00/00,00/00,00/00,00/00,01/FF** (with bit masks corresponding to a CALL CONFIRMATION packet), the timers are displayed (DISPT).

The TU is displayed when a CALL CONFIRMATION packet is received. The TU shows the time elapsed between a CALL packet transmission and the time a confirmation is received.

This scenario allows you to make several measurements. It is neccessary to CLEAR the logical channel before returning the CALL. The scenario transmits the CLEAR, and waits for a CLEAR CONFIRMATION. It displays *** **OK** ** when it is received, indicating that the flow control is normal.

SITREX4

This scenario tests the DTE's ability to deal with invalid commands and responses.

```
2  PRINT START OF TEST. PLEASE SEND SABM.

5  GOTO 50                  Go to line 50.
10 SELSE 20                 Sub-routine.
15 REM                      Set jump address for wait.
20 WFPSABM                  Wait for polled SABM.

30 PRINT POLLED SABM RECEIVED, WAITING FOR ANOTHER.

40 RETURN                   End of sub-routine.
50 TRACE                    Clear trace buffer.
60 SWTFFFF                  Set watchdog timer to 11 minutes.
70 SELSE 90                 Set jump address for watchdog.
80 SADRWT 1000              Set jump address for wait.
90 WFSABM                   Wait for SABM.

100 PRINT SABM RECEIVED. WAITING FOR POLLED SABM.

110 FH030000                Send I-frame.
120 GOSUB 10                Go to subroutine line 10.
130 FRR                     Send Receive Ready.
140 GOSUB 10
150 FH0373                  Send improper command.
160 GOSUB 10                Go to subroutine line 10.
170 FREJ                    Send Reject.
180 GOSUB 10
190 FH01010                 Send RR frame exceeding.
200 GOSUB 10                Maximum length.

210 PRINT TEST OK. LET DTE EXPIRE N2 VALUE.

220 GOTO 1500               End of test message.
1000  PRINT WT ELAPSED      Arrive here if watchdog expires.

1500  PRINT END OF TEST. LINK DOWN.

2000  STU1000               Set user timer to 40 seconds.
2010  IFTU 2020             If TU equals 0 go to line 2020.
2015  GOTO 2010             Check TU again.
2020  &1TEST2CF             Load next test.
```

8.10 SIMULATOR REACTIONS

Introduction

Table 8.10-1 shows the actions performed by the DCE upon receiving packets in a given state of the DTE/DCE interface.

PACKET FROM THE DTE	ANY STATE
PACKET LENGTH SHORTER THAN 2 BYTES	DIAGNOSTIC #38 (26H)
INCORRECT FORMAT TYPE IDENTIFIER	DIAGNOSTIC #40 (28H)
OTHER	SEE TABLE 8.10-2

Table 8.10-1

- The DIAGNOSTIC packets are transmitted only by the DCE.
- The diagnostics are given in Hexadecimal coded values.
- The causes of a CLEAR transmitted by the DTE always have bit 7 of the CLEAR DIAGNOSTIC Field set to 1.
- None of the intermediate steps are shown for table clarity.
- The table indicates which state the Simulator will be in depending upon the previous events.

Packet Level

Table 8.10-2 shows the actions performed by the network in READY or RESTART state. The packet is received from the subscriber with an assigned logical channel number (LCN).

STATE OF THE SIMULATOR: PACKET RECEIVED:	READY (R1)	RESTART ALREADY SENT (R3)
RESTART	RESTART CONFIRMATION --> R1	NO ACTION --> R1
RESTART CONFIRMATION	NETWORK RESTART 01 --> #11	READY STATE (R1)
INVALID PACKET	CLEAR 13 #21 --> TABLE (3,4)	NO ACTION DISCARD PACKET --> R3
PACKET OTHER THAN: DIAGNOSTIC RESTART RESTART CONFIRMATION IF LCN = 0	DIAGNOSTIC 24 --> R1	DIAGNOSTIC 24 --> R3
OTHER	TABLE 8.10-3	NO ACTION DISCARD PACKET --> R3
DIAGNOSTIC	NO ACTION -->READY STATE(R1)	NO ACTION --> R3

Table 8.10-2

DISCARD — The Simulator will ignore the incoming packets and wait for PACKET RESTART time-out.

Table 8.10-3 shows the actions performed by the network in virtual CALL set-up or clear logical channel state.

STATE OF THE SIMULATOR: PACKET RECEIVED:	READY P1	CALL ALREADY SENT P3	DATA TRANSFER P4	CLEAR ALREADY SENT P7
CALL	PROCESS RECEIVED CALL (P2)-->P4	PROCESS RECEIVED CALL	CLEAR 13 #17 --> P7	DISCARD 2 --> P7
CALL CONFIRMATION	CLEAR 13 #14 --> P7	PROCESS RECEIVED CALL CONF. --> P4	CLEAR 13 #17H --> P7	DISCARD 2 --> P7
CLEAR	CLEAR CONF. --> P1	CLEAR CONFIRMATION --> P1	CLEAR CONF. --> P1	CLEAR CONFIRMATION --> P1
CLEAR CONFIRMATION	CLEAR 13 #14 --> P7	CLEAR 13 #16 --> P7	CLEAR 13 #17 --> P7	-->READY STATE (P1)
DATA RESET INTERRUPT FLOW CONTROL	CLEAR 13 #14 --> P7	CLEAR 13 #16 --> P7	Table 8.10-4	DISCARD 2 --> P7
RESTART RESTART CONFIRMATION IF LCN # 0	CLEAR 13 #29 --> P7	CLEAR 13 #29 --> P7	Table 8.10-4	DISCARD 2 --> P7

Table 8.10-3

DISCARD 1: The simulator waits CALL time out.

DISCARD 2: The simulator waits CLEAR time out.

Table 8.10-4 shows the actions performed by the network upon data transfer and flow control on established logical channels.

STATE OF THE SIMULATOR: PACKET RECEIVED:	DATA TRANSFER D1	RESET ALREADY SENT D3
RESET	RESET CONFIRMATION --> D1	RESET CONFIRMATION --> D1
RESET CONFIRMATION	RESET 05 #1B --> D3	--> DATA TRANSFER (D1)
DATA INTERRUPT FLOW CONTROL	PROCESS FLOW CONTROL --> D1	DISCARD --> D3
RESTART RESTART CONFIRMATION IF LCN # 0	RESET 05 #29 --> D3	DISCARD --> D3

Table 8.10-4

DISCARD: The simulator waits for RESET timer to elapse.

Timer Charts

This section describes the Network and Subscriber Time-outs.

NETWORK TIME OUTS:

TIMER VALUE	START TIMER	END TIMER	1ST TIME OUT	2ND TIME OUT	NUMBER
T10	60 s	TRANSMIT RESTART	RESTART CONF. --> READY STATE	TRANSMIT RESTART 01	DIAG #34. --> READY STATE
T11	180 s	TRANSMIT CALL	RECEIVE CALL CONF. CALL CLEAR	TRANSMIT CLEAR 13 #31	NONE
T12	60 s	TRANSMIT RESET	RECEIVE RESET CONF. RESET	TRANSMIT RESET 05 #33	TRANSMIT CLEAR 13 #33
T13	60 s	TRANSMIT CLEAR	RECEIVE CLEAR CONF. CLEAR	TRANSMIT CLEAR 13 #32	TRANSMIT DIAG #32

SUBSCRIBER TIME OUTS:

TIMER VALUE	START TIMER	END TIMER	1ST TIME OUT	2ND TIME OUT	NUMBER
T20	180 s	TRANSMIT RESTART	RECEIVE RESTART CONF. --> READY STATE	TRANSMIT RESTART 01 #34	NONE
T21	200 s	TRANSMIT CALL	RECEIVE CALL CONF. CALL CLEAR	TRANSMIT CLEAR 13 #31	NONE
T22	180 s	TRANSMIT RESET	RECEIVE RESET CONF. RESET	TRANSMIT RESET 05 #33	TRANSMIT CLEAR 13 #33
T23	60 s	TRANSMIT CLEAR	RECEIVE CLEAR CONF. CLEAR	TRANSMIT CLEAR 13 #32	DIAG #32

8.11 FLOW CHARTS

Overview

The flow charts on the following pages provide a general overview of SITREX. The code numbers for the packets shown represent both the cause and diagnostic.

For example: **RESET 05 #01**

where **05** is the cause code and **01** is the diagnostic code.

For more information, see the CCITT *X.25 Specifications*.

CALL RECEIVED PROCESS
CALLED ADDRESS

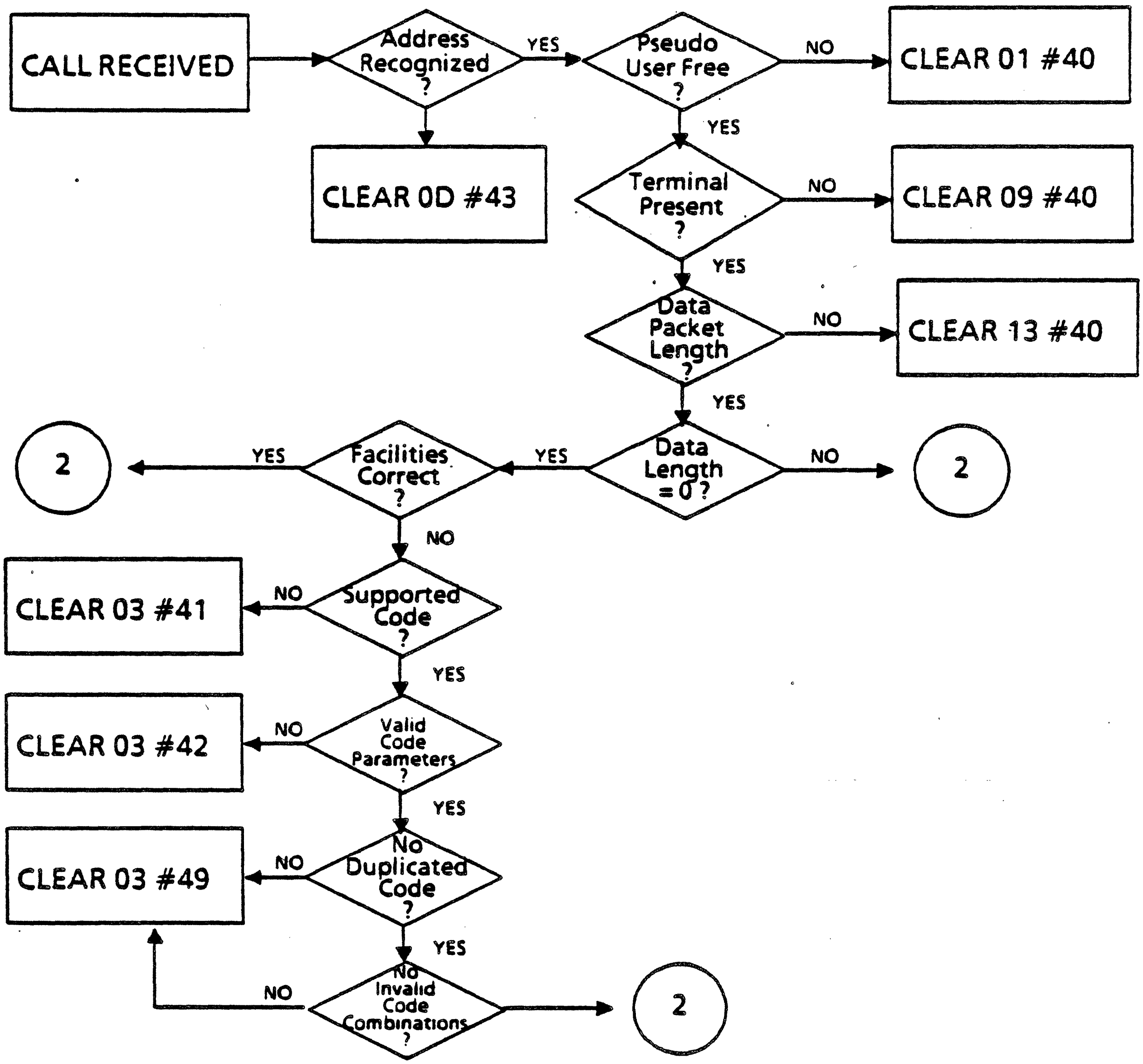


Figure 8.11-1: Flow Chart 1.

CALL RECEIVED PROCESS
CLOSED USER GROUP SELECTION

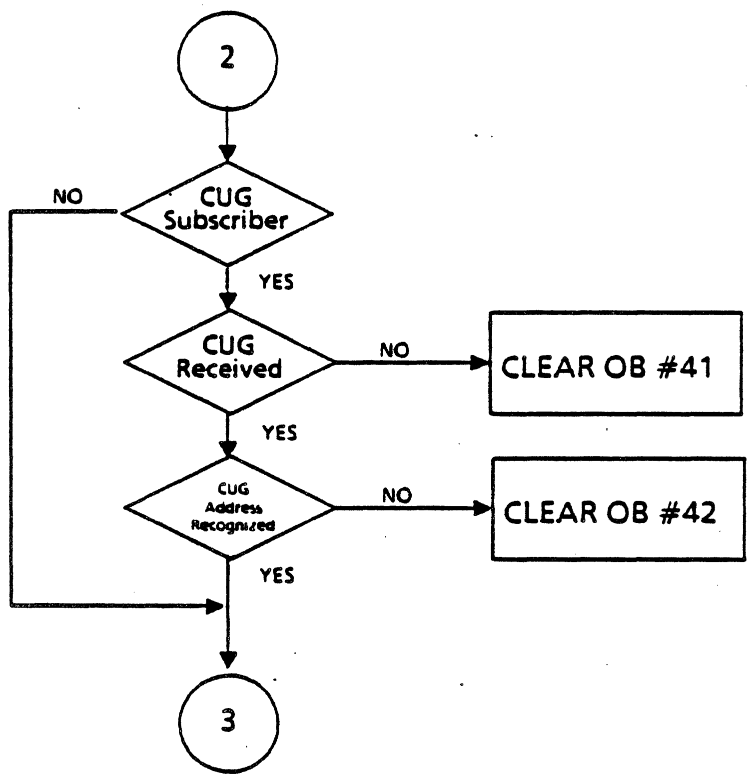


Figure 8.11-2. Flow Chart 2

CALL RECEIVED PROCESS
FAST SELECT

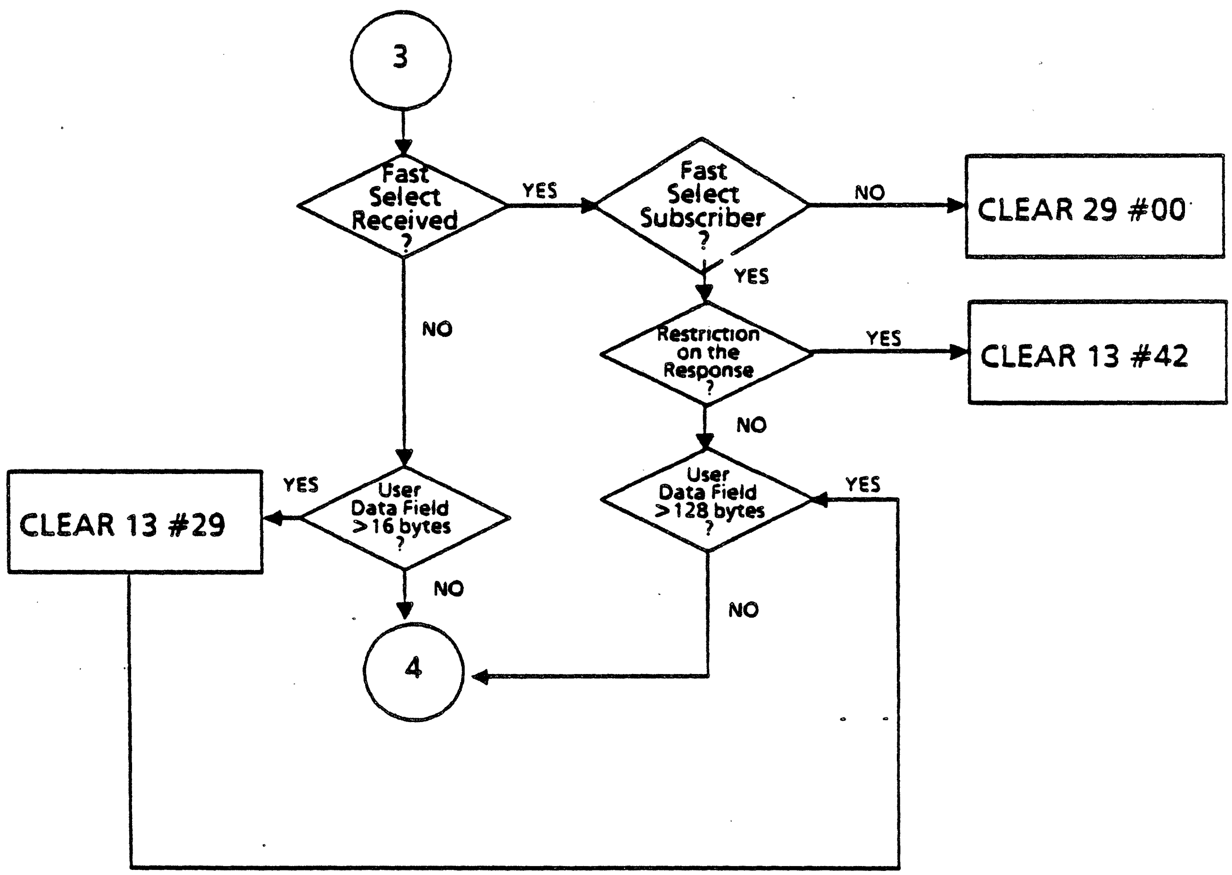


Figure 8.11-3: Flow Chart 3

RECEIVED CALL PROCESS
WINDOW SIZE PARAMETERS

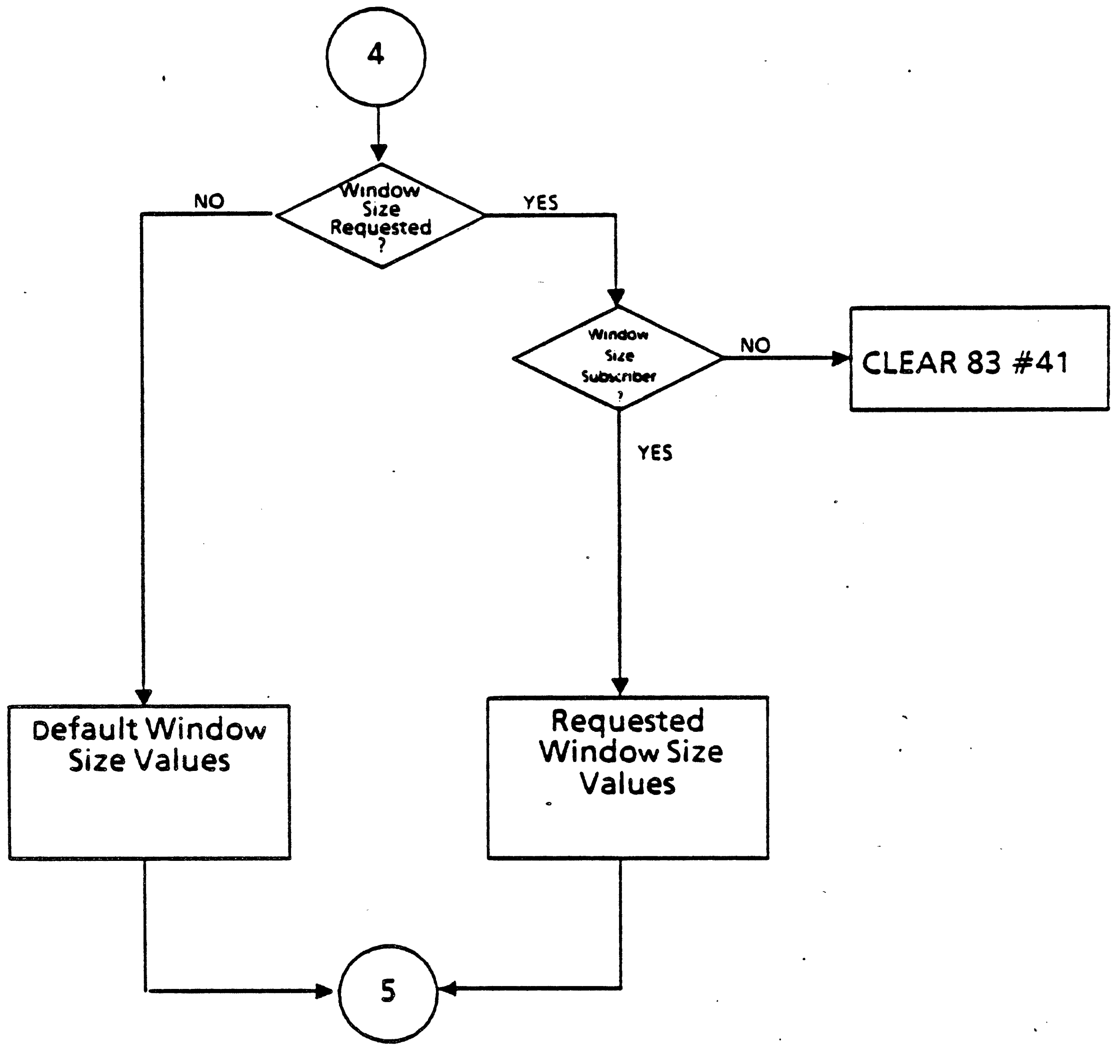


Figure 8.11-4: Flow Chart 4

RECEIVED CALL PROCESS
PACKET LENGTH PARAMETERS

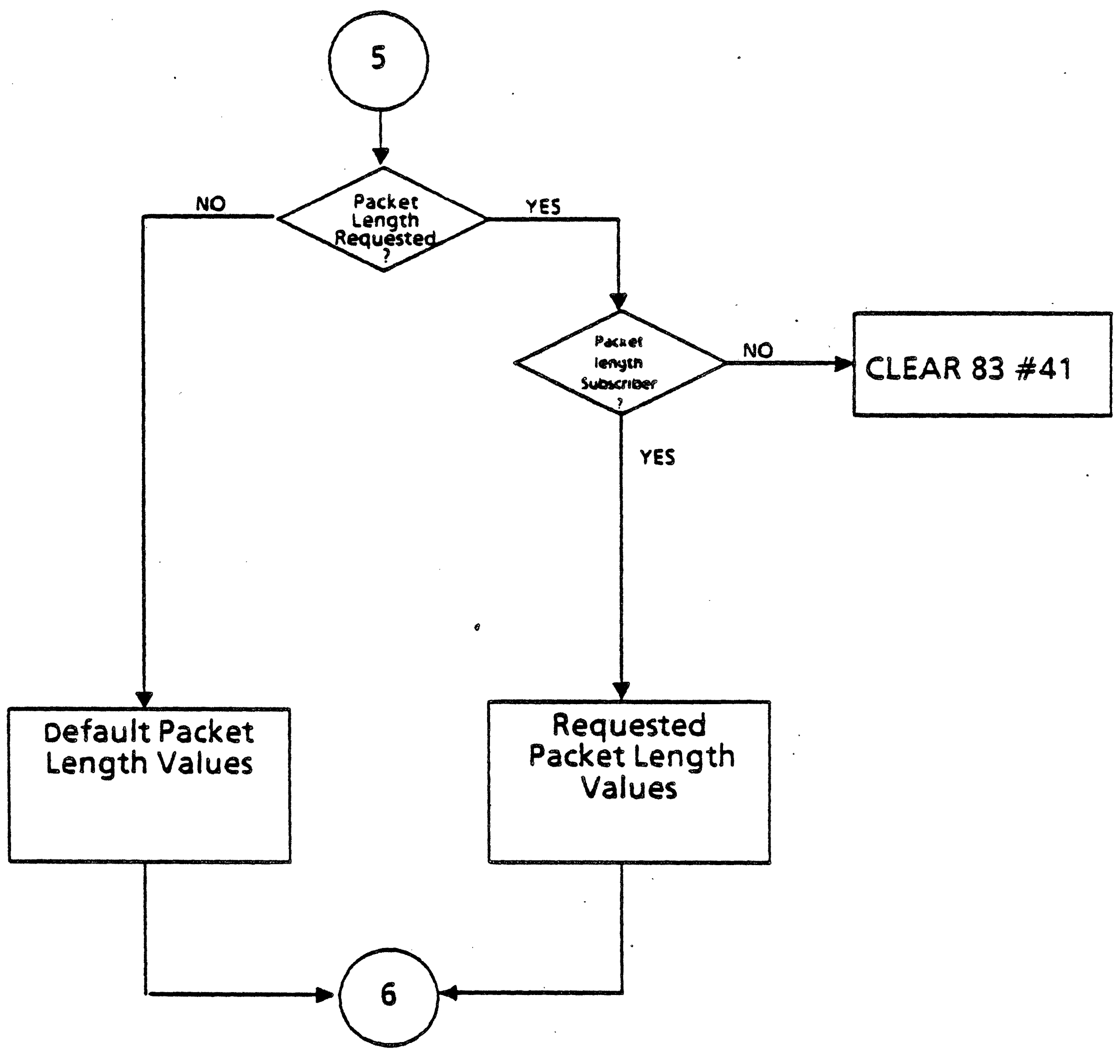


Figure 8.11-5: Flow Chart 5

CALL RECEIVED PROCESS
TRANSMISSION OF CALL CONFIRMATION

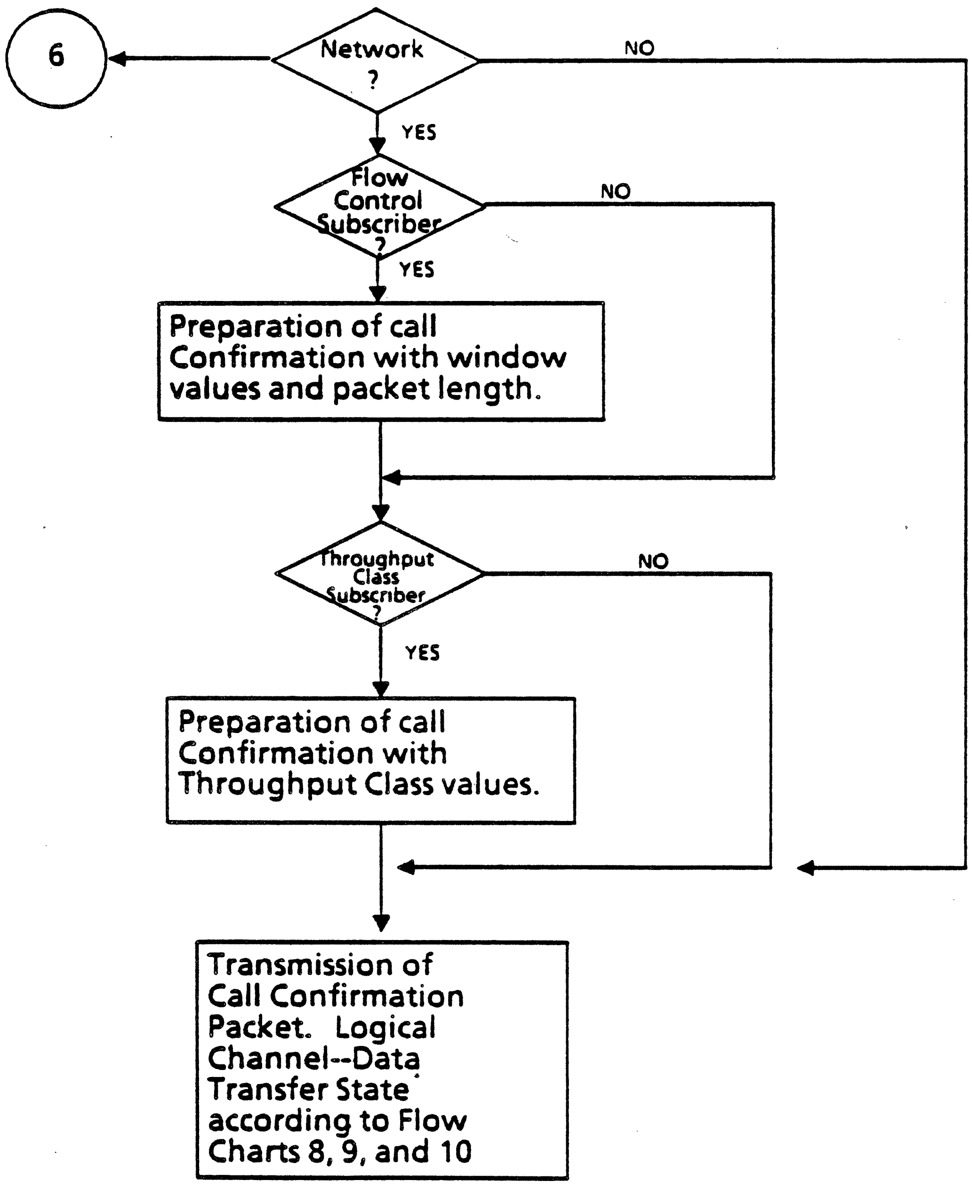


Figure 8.11-6: Flow Chart 6

RECEPTION OF CALL CONFIRMATION

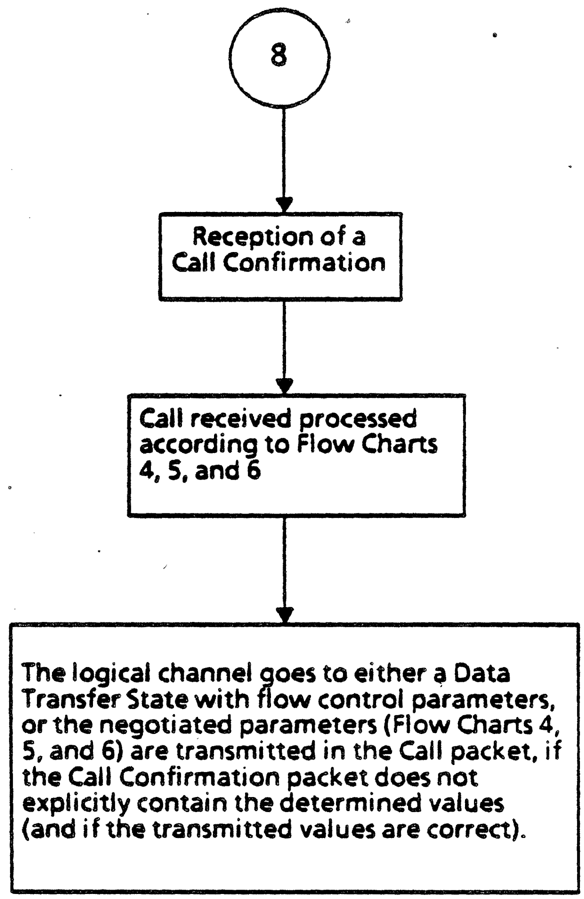


Figure 8.11-7: Flow Chart 7

DATA RECEIVED PROCESS

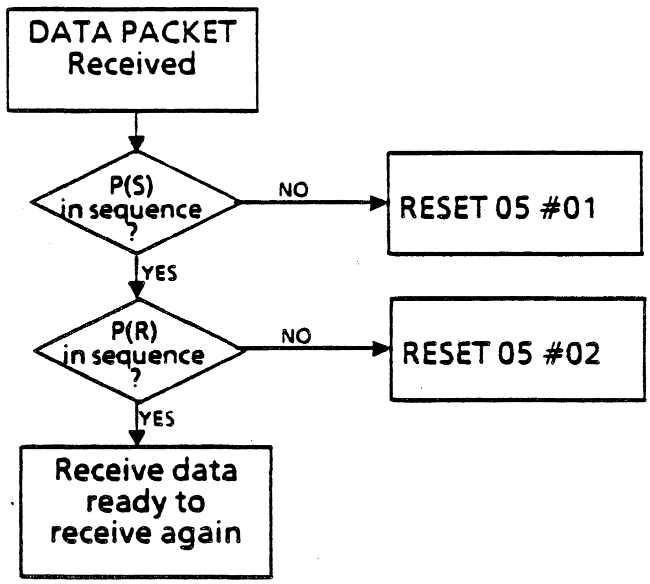


Figure 8.11-8: Flow Chart 8

RECEIVE FLOW CONTROL PROCESS
PACKET RECEIVE READY

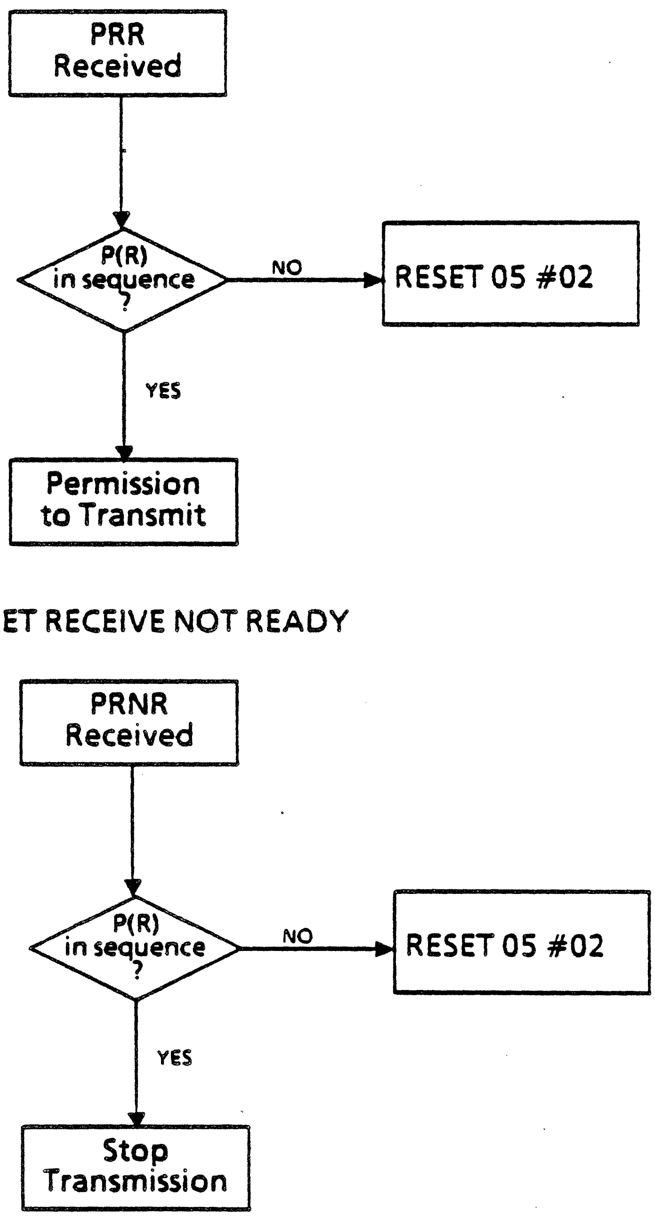


Figure 8.11-9: Flow Chart 9

RECEIVE FLOW CONTROL PROCESS
REJECT PACKET

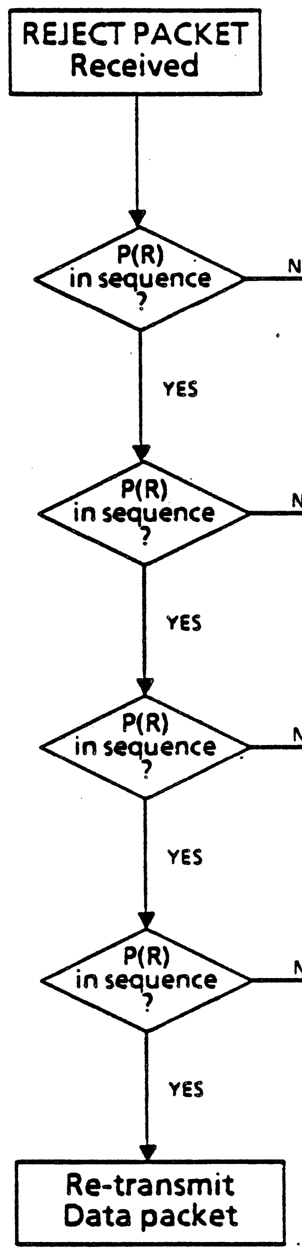


Figure 8.11-10: Flow Chart 10

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX

INDEX