NETWORK GENERAL CORPORATION

LM2000 Protocol Analyzer
User's Manual

LM2000
Protocol Analyzer
User's Manual

Network General

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Table of Contents

Preface . . . . . **vii**

About This Manual vii
Organization of This Manual vii
Audience of This Manual viii
Conventions Used in This Manual ix
Terminology ix
Screen Displays ix
Other Sources of Information ix
Online Help ix
Customer Support ix

Introduction . . . . . **xi**

What is the LM2000? xii
Frame Relay and the LM2000 xiii

Chapter 1. Getting Started **1-1**

What You Need to Do 1-2
System Requirements for the LM2000 1-4
How to Install the LM2000 Hardware 1-6
How to Install the LM2000 Software 1-8
Start the LM2000 and Verify Installation 1-10
Checking the LM2000's Operation 1-12
Diagnosing Hardware Conflicts 1-14
How to Select I/O Addresses 1-16
Assigning the Memory Window Segment 1-18

Chapter 2. Connecting the LM2000 to the Network **2-1**

The Network Interface and You 2-2
Connecting the LM2000 to RS-232 (V.24) Circuits 2-4
Connecting the LM2000 to RS-422 and RS-423 Circuits 2-6
Connecting the LM2000 to V.10 and V.11 Circuits 2-8
Connecting the LM2000 to V.35 Circuits 2-10
Connecting the LM2000 to T1 Circuits 2-12

Chapter 3. Operation and Navigation **3-1**

How to Start the LM2000 3-2
Using Batch Files to Start the LM2000 3-4
How to Get HELP!! 3-6
Finding Your Way Using Function Keys 3-8
The Main Menu — An Overview of the LM2000 Functions 3-10

Menu Boxes and Option Fields 3-12
Saving Files 3-14
Loading Files 3-16
The LM2000 Print Functions 3-18
Three Ways to Exit the LM2000 3-20

Chapter 4. System Configuration Reference 4-1

Screen Overview: System Configuration 4-2
Selecting System Configuration Options 4-4
Select Your Com Mode First 4-6
Setting Up the Communication Configuration 4-8
More About Setting Up the Communication Configuration 4-10
Selecting a Protocol Decode 4-12
Selecting a Trap Action 4-14
The Miscellaneous Configuration Options 4-16
Selecting Data Display and Line Display Modes 4-18
Setting Up Data Capture to Disk 4-20
Selecting Media Status Box Options 4-22
Three Methods for Defining an Emulation Message 4-24
Screen Overview: Emulation Message Definition 4-26
Screen Overview: User Character Set Definition 4-28
More About Frame Relay Configuration 4-30
Screen Overview: Circuit Action Map 4-32

Chapter 5. Typical Configuration Settings for the LM2000 5-1

Asynchronous Configuration Settings 5-2
Bisynchronous Configuration Settings 5-4
X.25 Configuration Settings 5-6
V.35 Configuration Settings 5-8
T-Pod Configuration Settings 5-10
Frame Relay Configuration Settings 5-12

Chapter 6. Data Traps and Filters 6-1

Understanding Data Traps and Filters 6-2
Defining Traps: The Basics 6-4
Screen Overview: Trap Definition 6-6
Selecting the Trap Action 6-8
Using Frame Selection to Define Traps 6-10
Manual Trap String Definition 6-12
Using Protocol Macros to Define Traps 6-14
Frame Relay Filters 6-16

Chapter 7. Monitoring Data with the LM2000 7-1

Screen Overview: Monitor 7-2
Controlling Monitor Functions 7-4
Controlling Emulation Functions 7-6
Counters and Activity Indicators 7-8
Selecting the Data Display Mode 7-10
Monitoring Data: Hex, Mnemonic and Character Displays 7-12
Monitoring Data: Modem Lead Display 7-14
Monitoring and Interpreting Data: Level 2 and Level 3 Decode 7-16
Monitoring and Interpreting Data: Expanded Decode 7-18
Analyzing Monitored Data with PowerView 7-20
Capturing Monitored Data to Disk: Snapshots 7-22
Checking Trap Counts 7-24

Chapter 8. Frame Statistics 8-1

X.25 Level 2 and 3 Statistics Screens 8-2
SNA Level 2 and 3 Statistics Screens 8-4
ISDN (Q.921) Level 2 Statistics Screen 8-6
Frame Relay Statistics and the Frame Relay Configuration File 8-8
Frame Relay All Circuit Statistics Screen — Overview 8-10
Frame Relay All Circuit Statistics Fields 8-12
Frame Relay All Circuit Statistics Table — Overview and Fields 8-14
Frame Relay DLCI Statistics Screen — Overview 8-16
Frame Relay DLCI Statistics Fields 8-18
Frame Relay Circuit Status Map — Overview 8-20
Frame Relay Circuit Status Map Fields 8-22
Frame Relay Circuit Action Map — Overview 8-24
Frame Relay Circuit Action Map Fields 8-26

Chapter 9. Analyzing Data in the View Buffer Screen 9-1

Screen Overview: View Buffer 9-2
What is the Capture Buffer? 9-4
Loading Buffer and Snapshot Files for Review 9-6
Saving the Capture Buffer in a Buffer File 9-8
Moving Around in the Buffer 9-10
Where in the Buffer are You? 9-12
Moving Around with Go To 9-14
Locating Specific Data with Find and Find Next 9-16
Entering Search Strings for the Find Function 9-18
Selecting the Data Display Mode 9-20
Analyzing Data: Hex, Character, Mnemonic, and Octal Displays 9-22
Analyzing Data: Modem Lead Display 9-24
Analyzing Data: Level 2 and Level 3 Decode Displays 9-26

Analyzing Data: Expanded Decode Display 9-28
Post Capture Display Filters with Buffer Trace 9-30
Printouts and ASCII Files from the Buffer 9-32
Printing the Expanded Decode Screen 9-34
How to Determine Elapsed Times 9-36
How to Export Frames for Emulation 9-38

Chapter 10. Bit Error Rate Tests 10-1

Screen Overview: BERT/BLERT 10-2
Screen Overview: G.821 BERT/BLERT 10-4
Configuring for BERT/BLERT and G.821 10-6
Configuring for BERT/BLERT and G.821 Tests (continued) 10-8
Controlling Functions: BERT/BLERT and G.821 10-10
Analyzing BERT/BLERT Results 10-12
Analyzing G.821 BERT/BLERT Results 10-14

Chapter 11. The Software Break-Out Boxes 11-1

The RS-232 Software Break-Out Box 11-2
The V.35 Software Break-Out Box 11-4
The V.10/V.11 Software Break-Out Box 11-6
RS-422/RS-423 Software Break-Out Box 11-8
Using the T-Pod with the LM2000 11-10
Using T-Pod Macros 11-12

Chapter 12. The LM2000 Asynchronous Terminal 12-1

Screen Overview: Asynchronous Terminal Emulation 12-2
How to Configure the Async Terminal 12-4

Chapter 13. PowerScript Test Builder and the PowerScript Library 13-1

Overview: PowerScript 13-2
What is a Test Script? 13-4
Loading Test Scripts 13-6
Saving Test Scripts 13-8
Writing Test Scripts 13-10
Editing Test Scripts 13-12
Menus for Test Scripts 13-14
How to Write Test Script Menus 13-16
Using Protocol Macros in Test Scripts 13-18
Running PowerScript Test Scripts 13-20
Using Test Scripts from the PowerScript Library 13-22
PowerScript Command Reference 13-25
Beep 13-26
Comment 13-26

Display 13-28
Emulate 13-30
Goto block 13-31
If 13-31
LoadConfig 13-32
Pause 13-33
Print 13-33
Reset 13-34
Run chldpr 13-35
Set leads 13-35
Snapshot 13-36
Start 13-37
Stop 13-38
Transmit 13-39
Wait Until 13-40

Appendix A. Character Set Code Tables A-1

ASCII and EBCDIC Character Set Code Tables A-2
IPARS Character Set Code Table A-6
BAUDOT Character Set Code Table A-7

Appendix B. LM2000 Messages B-1

Appendix C. LM2000 File Structures C-1

User File (User Character Set) C-2
Capture Buffer C-2
The System Configuration File C-7
The User Decode Module Format C-9

Appendix D. Specifications D-1

Appendix E. Advanced Emulation with Protocol Macros E-1

Introduction E-2
Using Protocol Macros E-5
The Protocol Macro Programming Language E-7
Protocol Macro Commands E-10
Call E-10
Display E-11
Else E-11
Endif E-11
Endjump E-11
Getlong E-11
If E-12

Jump E-13
Pause E-14
Print E-14
Prompt E-14
Resume E-16
Set E-17
Skip E-18
String prompt (Strprmt) E-18
String Set (Strset) E-18

Preface

- About This Manual
- Organization of This Manual
- Audience of This Manual
- Conventions Used in This Manual
  - — Terminology
  - — Screen Displays
- Other Sources of Information
  - — On-line Help
  - — Customer Support

Preface

About This Manual

This manual describes the installation and operation of the LM2000 Protocol Analyzer and provides recommendations on using the analyzer effectively to monitor the network. It also contains information on using the PowerScript custom test builder and protocol macros to perform sophisticated emulation.

The LM2000, a PC-based protocol analyzer designed for diversified Wide Area Networks (WANs), helps network managers and field technicians analyze and troubleshoot both traditional WANs and emerging technologies like frame relay. The LM2000 supports a wide range of protocols at speeds from 50 bps to 2.048 Mbps.

Organization of This Manual

The LM2000 Manual is presented in a task-oriented format that is easy to read and use. You will notice that the organization of this manual differs slightly from a conventional format. Instead of the standard hierarchy of topics within a chapter, all topics are presented at the same level of importance. Typically, there are two pages of information for each topic (each pair of facing pages is referred to as a "spread"): the relevant text explaining the feature or concept is on the left-hand page, and the supporting graphic, a screen or table, is on the righthand page.

Table i lists and describes the chapters and appendixes in this manual.

Chapter/Appendix	Contents
Introduction	Provides an overview of the LM2000's features and cross-references for frame relay networks.
Chapter 1, "Getting Started"	Describes the installation and basic setup of the LM2000's hardware and software.
Chapter 2, "Connecting the LM2000 to the Network"	Describes how to connect the LM2000 to various network interfaces.
Chapter 3, "Operation and Navigation"	Provides an overview of how to operate the LM2000 software, includes a function key menu map.
Chapter 4, "System Configuration Reference"	Describes how to configure the LM2000 to monitor and emulate data. Includes information on configuring for frame relay networks.
Chapter 5, "Typical Configuration Settings"	Builds on information in Chapter 4, describing typical configurations for common network protocols.
Chapter 6, "Data Traps and Filters"	Describes how to define traps and precapture filters to capture specific data. Includes information on DLCI filters for frame relay.

Table i. Chapter and Appendix Descriptions for the LM2000 Manual *(continued on next page).*

Chapter/Appendix	Contents
Chapter 7, "Monitoring Data with the LM2000"	Describes the LM2000's data monitoring functions and how to interpret the monitor display.
Chapter 8, "Frame Statistics"	Describes the LM2000's statistical functions, including frame relay statistics.
Chapter 9, "Analyzing Data in the View Buffer Screen"	Describes how to analyze captured data in the LM2000's capture buffer and from data captured to disk.
Chapter 10, "Bit Error Rate Tests"	Describes the LM2000's physical layer test capabilities.
Chapter 11, "The Software Break-Out Boxes"	Presents more physical layer test capabilities, including T1 testing with the Network General T-Pod.
Chapter 12, "The LM2000 Asynchronous Terminal"	Describes the LM2000's asynchronous terminal emulation functions.
Chapter 13, "PowerScript Test Builder and the PowerScript Library"	Describes the LM2000's sophisticated data emulation and automatic testing capabilities using the PowerScript Custom Test Builder and the extensive library of predefined test scripts.
Appendix A, "Character Set Code Tables"	Provides hex interpretations of ASCII, EBCDIC, IPARS, and BAUDOT character sets.
Appendix B, "LM2000 Messages"	Lists, in alphabetical order, and explains all informational and error messages generated by the LM2000.
Appendix C, "LM2000 File Structures"	Describes the character set, capture buffer, and system configuration file structures. Includes information for developing proprietary protocol decode modules.
Appendix D, "Specifications"	Lists the operating specifications of the LM2000.
Appendix E, "Advanced Emulation with Protocol Macros"	Describes the LM2000's protocol macros, which allow you to define complex frames for data emulation and capture. Includes the protocol macro language, which allows you to define your own macros.

Table i. Chapter and Appendix Descriptions for the LM2000 Manual (continued from previous page).

Audience of This Manual

The LM2000 User's Manual has been prepared with the following assumptions:

- You are a network manager or troubleshooter who understands how your network operates.
- You are familiar with DOS.

Conventions Used in This Manual

Terminology

Hexadecimal numbers mentioned in the manual are indicated with a lowercase "h"; numbers without any notations are decimal. For example, "The maximum number of stations is 75. The default memory address is D8000h."

Screen Displays

The screen displays in this manual may not exactly match what you see on your screen. There may be certain minor differences that do not affect the functions of the displays.

Other Sources of Information

Network General Corporation (NGC) provides other sources of information that can help you get familiar with the LM2000 Protocol Analyzer.

On-line Help

On-line help is available at any time by pressing <Alt> F1.

Customer Support

Network General's customer support staff is available to assist you in answering any questions about the installation or operation of the LM2000. You can help us maintain fast, courteous service if you review the following checklist before calling:

Before You Call Customer Support...

- ✓ Check the accuracy of your hardware configuration. (Refer to the installation information in Chapter 1.)
- ✓ Be sure that data is actually being transmitted on the monitored line. (Refer to Chapter 7.)
- ✓ Verify that the LM2000 is connected to the network properly. (Refer to Chapter 2.)
- ✓ Use the Help screens (press <Alt>F1) and this User's Manual to locate specific program information.

(Customer Support continued on next page)

If you have completed the items in the checklist and still find that you need assistance, please contact Network General's customer support staff:

Phone: 1-800-888-0180
FAX: (708) 574-3703
TLX: 5106018542
Mail: Customer Support
Network General Corp.
Two Mid America Plaza, Suite 500
Oakbrook Terrace, IL 60181

Introduction

- What is the LM2000?
- Frame Relay and the LM2000

What is the LM2000?

The LM2000 protocol analyzer provides network analysis and troubleshooting for complex wide area networks that are evolving to higher speeds using an expanding set of more diverse protocols. In addition to solving problems on conventional SNA, X.25, ISDN, async and bisync wide area networks, the LM2000 protocol analyzer supports emerging technologies such as frame relay.

Powerful Frame Relay Analysis

With its powerful RISC microprocessor, the LM2000 can monitor all channels on frame relay links running at speeds up to 2.048 Mbps. Sophisticated filters are provided, and the LM2000 also tracks statistics for up to 256 DLCIs. Plain language decodes of frame relay headers and management messages are given using terminology from any of six frame relay standards.

Complete WAN Analysis

The LM2000's plain language decodes give a clear and meaningful interpretation of the data in any of a broad range of protocols including X.25, SNA, QLLC and Q.931. Speeds up to 2.048 Mbps are supported, along with statistics and filters.

Physical Layer Testing

Physical layer testing with the LM2000 supports the CCITT G.821 BERT standard at speeds up to 2.048 Mbps. Conformance to the G.821 specification, which is particularly important to European technicians, provides a traceable standard of quality against which frame relay network performance can be measured. The LM2000 also includes software break-out boxes to simplify analyzing lead states.

Powerful Development Tools

The LM2000 provides powerful and easy-to-use development tools that add productivity to protocol analysis. PowerScript is the LM2000 interactive custom test builder. PowerScript uses context-sensitive windows to select commands easily, with a special look-ahead feature that makes writing scripts simple. A library of prewritten test scripts is included for technicians to use as is or modify to meet special needs. The LM2000 also supports standard C languages for advanced programmers.

PC-Based Productivity

The LM2000 takes advantage of the best features available in PC technology. When packaged in a laptop or lunchbox computer, the LM2000 combines power and portability. It features context-sensitive help, which boosts learning and productivity. All data files are DOS compatible, and captured data can be analyzed on a PC even without the LM2000 hardware installed.

Frame Relay and the LM2000

In addition to its WAN protocol analysis capabilities, the LM2000 features a full suite of frame relay testing features, including custom configuration for each DLCI, physical layer testing, two levels of filtering and frame relay statistics. To take advantage of these sophisticated frame relay functions, see the following discussions.

Selecting a Protocol Decode

The LM2000 protocol analyzer supports these frame relay standards:

- CCITT Q.922
- ANSI T1.606, T1.617 and T1.618
- Local Management Interface (LMI)
- Consolidated Link Layer Management (CLLM)

For more about selecting a frame relay decode, see "Selecting a Protocol Decode" in Chapter 4.

Configuring the LM2000 with DLCI parameters

For your convenience, the LM2000 lets you configure how the analyzer monitors each DLCI independently. When a frame relay link begins operating, configuration parameters such as Committed Information Rate (CIR) or Exceeded Burst (B_E) are established. The LM2000 will keep track of these parameters automatically once you have programmed them into the analyzer. For more about configuration parameters, see "More about Frame Relay Configuration" and "Screen Overview: Circuit Action Map" in Chapter 4.

How to Validate Frame Relay Operation at the Physical Layer

To test whether a frame relay link is operating properly at the physical layer, the LM2000 offers BERT testing capabilities at speeds up to 2.048 Mbps. To learn how to run a BERT, see Chapter 10. Once the link is running with end users transmitting data, the LM2000 protocol analyzer automatically keeps track of which DLCIs are active. You can review a matrix showing the status of all 1024 DLCIs on a single screen by using the Status Map. To learn about the frame relay Circuit Status Map, see Chapter 8.

Two Levels of Frame Relay Filtering

For frame relay testing, the LM2000 lets you filter data first by DLCI, then by other characteristics, such as frame type or trap string. For more about filtering frames by DLCI, see "Frame Relay Filters" in Chapter 6. Other types of filters, which are comparable to traps or filters used with conventional WAN protocol analysis, are also discussed in Chapter 6.

Frame Relay Statistics

Detailed statistics–including a bar graph showing line utilization–provide insight into network activity and performance critical to network and capacity planning. The LM2000 tracks statistics for up to 256 DLCIs. It lets the technician configure CIR and other parameters at start-up, so later analysis is fast and simple. For more about frame relay statistics, see Chapter 8.

Chapter 1
Getting Started

- What You Need to do
- System Requirements for the LM2000
- How to Install the LM2000 Hardware
- How to Install the LM2000 Software
- Start the LM2000 and Verify Installation
- Checking the LM2000's Operation
- Diagnosing Hardware Conflicts
- How to Select I/O Addresses
- Assigning the Memory Window Segment

What You Need to Do

The procedures needed to install the LM2000 are outlined below. If you are familiar with PC software and hardware, a brief review of this outline may be all you need to install and begin using the LM2000. If you are not familiar with these procedures, refer to the sections indicated for detailed information.

1) Install the LM2000 line interface card

Record the switch settings on the LM2000 line interface card for future reference, then install the line interface card in a vacant slot in your PC.

- See "How to Install the LM2000 Hardware" in this chapter.

2) Install the LM2000 software

Insert Disk #1 into Drive A:, then change to drive A: and type **install**. Follow the directions on the screen.

- See "How to Install the LM2000 Software" in this chapter.

3) Start the LM2000

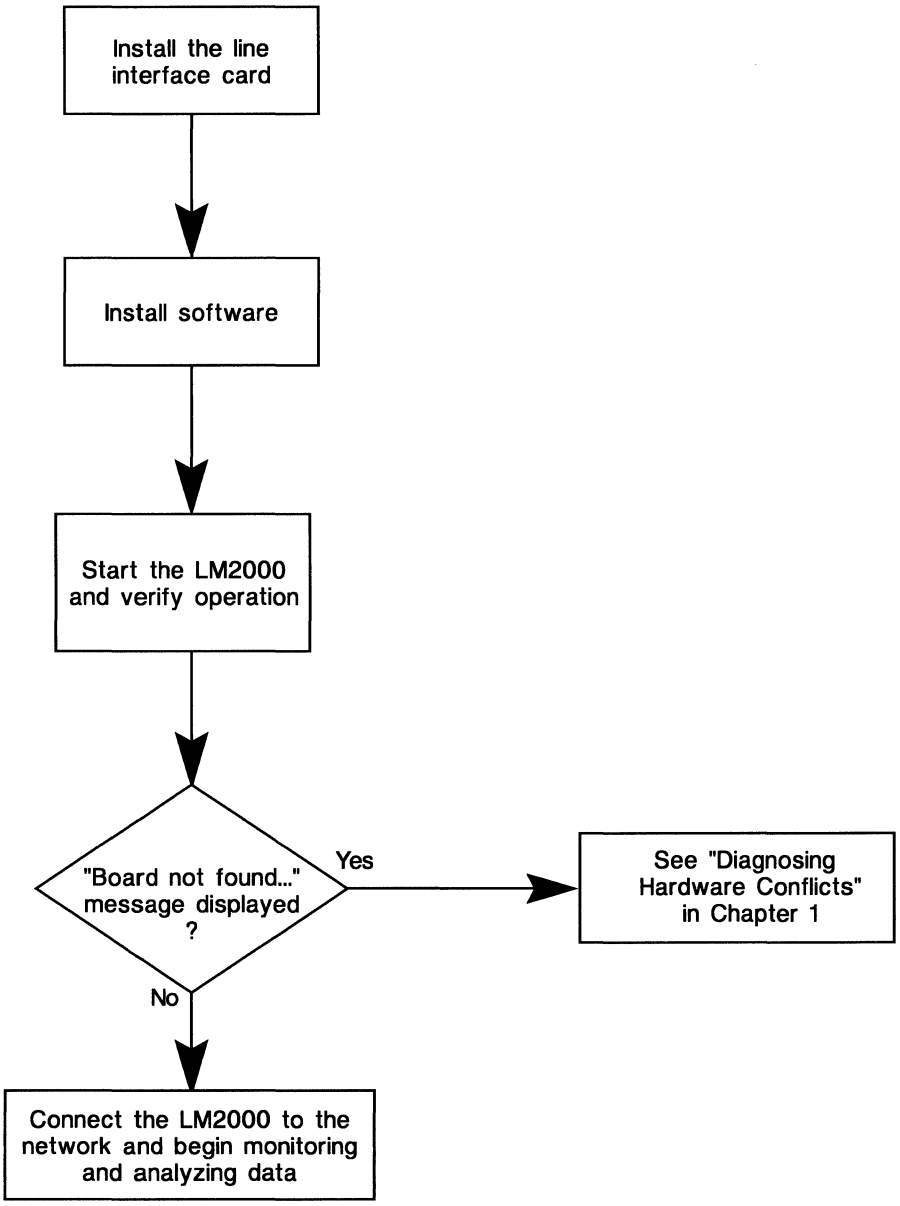
In the LM2000 subdirectory, type LM2000 at the DOS prompt. If the message "Can't communicate with board..." appears, refer to "Diagnosing Hardware Conflicts" later in this chapter.

- See "Start the LM2000 and Verify Installation" in this chapter.

4) Verify installation

Perform a FOX test to verify that the LM2000 is installed properly and working with your PC.

- See "Start the LM2000 and Verify Installation" in this chapter.



LM2000 installation procedure.

System Requirements for the LM2000

To operate properly the LM2000 requires the following minimum system configuration.

The LM2000 requires:

- 386SX CPU or better
- 16MHz or faster CPU clock (Many of the LM2000's functions work better on a faster machine.)
- 1MB RAM
- DOS 5.0
- 2MB of free hard disk space
- One free full-length, 16-bit slot (ISA or EISA bus)

To run the LM2000, you need:

- ✓ CPU: 386SX or better
- ✓ CPU speed: 16MHz or faster
- ✓ RAM: 1MB or more
- ✓ Operating System: DOS 5.0
- ✓ Hard disk space: 2MB or more
- ✓ Card Slot: full-length, 16 bit, ISA or EISA bus

How to Install the LM2000 Hardware

The LM2000 line interface card is installed like any standard add-in card. The following procedure briefly outlines the LM2000 card installation; for details, refer to your PC manufacturer's documentation.

Installing the LM2000 line interface card

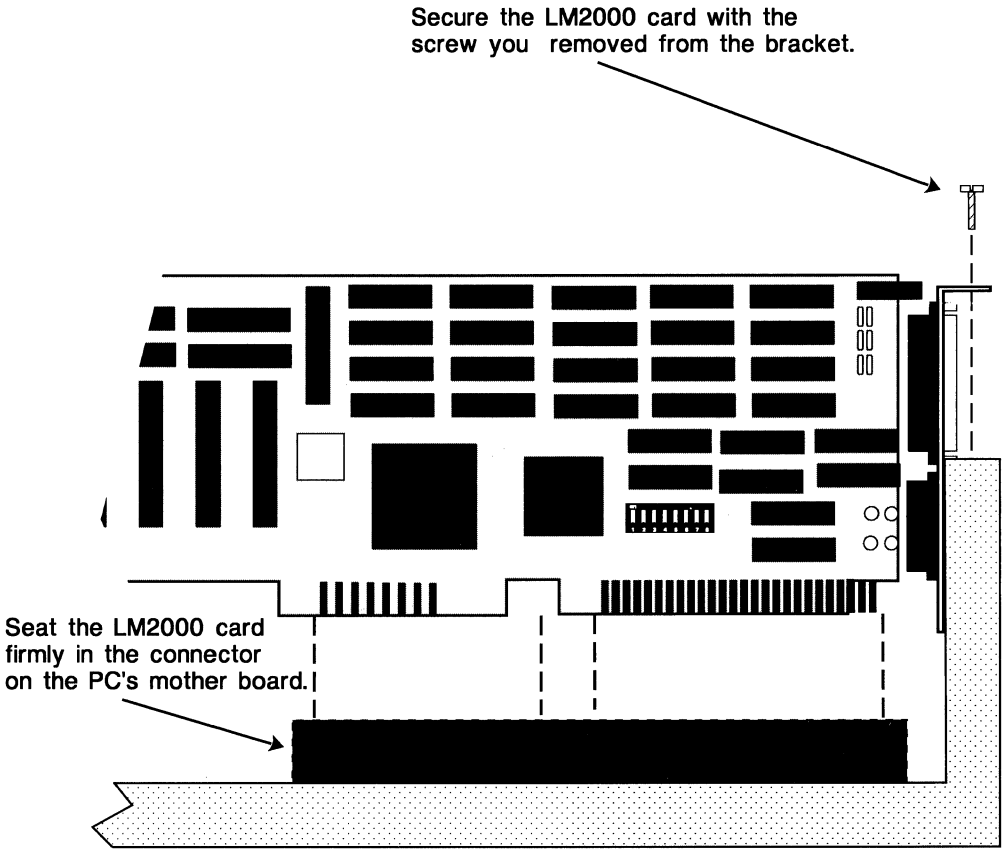
> **Caution:**
>
> The LM2000's line interface card contains static sensitive components. Observe anti-static practices when handling the card.

1) Turn off the computer and your monitor, and disconnect all power and peripheral cables (monitor, printer, etc.) from the computer.
2) Remove the screws that secure the computer's cover to the chassis, and slide the cover off. Refer to the manufacturer's documentation for more information on dismantling the computer.
3) Remove the screw holding the retaining bracket at the back of the selected slot, and lift the bracket out.
4) Record the DIP switch settings on the LM2000 line interface card for future reference, then push the card firmly into a 16-bit connector, ensuring that it is fully inserted.
   - The top of the LM2000 card should be level with the tops of other cards in neighboring slots.
5) Fasten the card's bracket to the chassis using the screw that you removed with the retaining bracket.
6) Reassemble the computer.

When the computer is reassembled, go on to "How to Install the LM2000 Software" and load the software on to your hard disk.

Notes:

- The DIP switches on the line interface card are preset at the factory to work in most IBM compatible personal computers and should not need to be reset. Occasionally, however, there may be conflicts with certain display adapters or add-in cards. Refer to "Start the LM2000 and Verify Installation" later in this chapter for information about detecting and rectifying hardware conflicts.



The LM2000 plugs into the connectors on the PC's mother board.

How to Install the LM2000 Software

The LM2000 software resides in compressed files on the Master Distribution Disks. An automated installation program, located on the master distribution disk labeled LM2000 Disk #1, decompresses the files and loads them on to your hard disk. We recommend that you make working copies of the program disks before installing the software.

Installing LM2000 software

Follow this procedure if: You are installing the complete set of LM2000 software on a PC that does not already have a version of the LM2000 software on it.

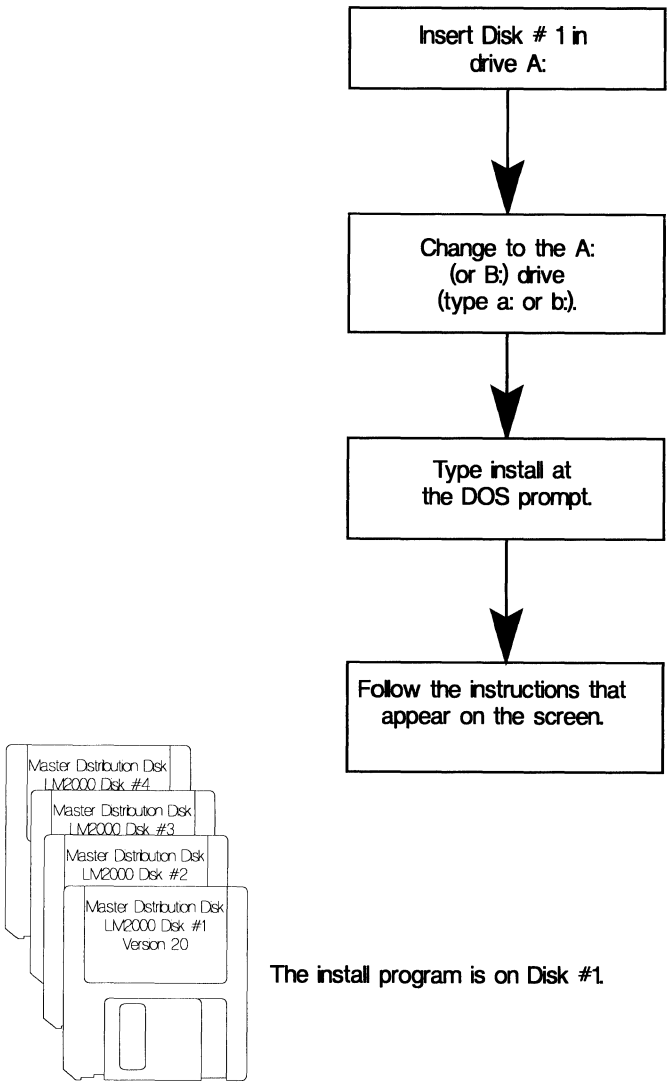
> Note: If you are also installing the LM2000 line interface card, be sure the card is installed in your PC before proceeding with the software installation.

1) Insert disk #1 in the A: drive. (If you use the B: drive, substitute B: for A: in the remainder of this procedure.)
2) Change to the A: drive by typing **a:** and pressing <Enter>.
3) At the A:\> prompt, type **install** and press <Enter>. (When installing the LM2000 software for the first time, be sure you change to the A: drive before typing **install**, that is don't type **a:install**, or the install program won't work properly.)
   - The installation program begins.
4) Follow the instructions that appear on the screen.
   - The DOS prompt reappears when the software installation is complete.

This completes the software installation procedure. Continue with "Start the LM2000 and Verify Installation" later in this chapter to make sure the LM2000 card is installed properly.

Notes:

- The LM2000 install program does not alter your AUTOEXEC.BAT or CONFIG.SYS files.



The LM2000 software installation procedure.

Start the LM2000 and Verify Installation

In order to verify that the LM2000 has been properly installed on your PC, you need to start the program and access the Hardware Configuration Screen. The following procedure provides basic instructions for doing this.

To Start the LM2000 and access the Hardware Configuration Screen

1) Change to the subdirectory containing the LM2000.
   For Example, type:
   C:\>**cd \lm2000**

2) Then type:
   C:\LM2000>**lm2000**
   - If the "Board not found...." message appears, refer to "Diagnosing Hardware Conflicts" later in this chapter.
   - The LM2000 program starts, the Copyright screen is displayed briefly (press any key to bypass this screen) then the Main Menu appears.

3) At the Main Menu, press <Shift>F2 to access the Hardware Configuration Screen.
   - The LM2000 displays the Hardware Configuration Screen.

Verifying installation

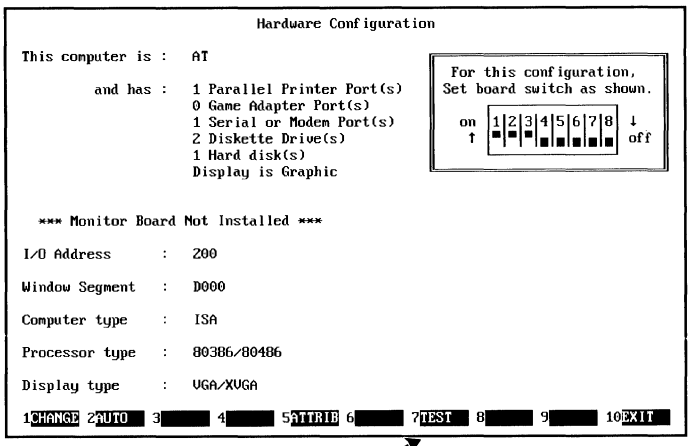
Verify the installation of the LM2000 line interface card by running the hardware test, which confirms that the card is firmly seated in your PC and that the onboard memory, microprocessor, and other key devices are functioning properly.

1) At the Hardware Configuration Screen, press F7 [TEST].
   - The Diagnostic Test Screen appears.

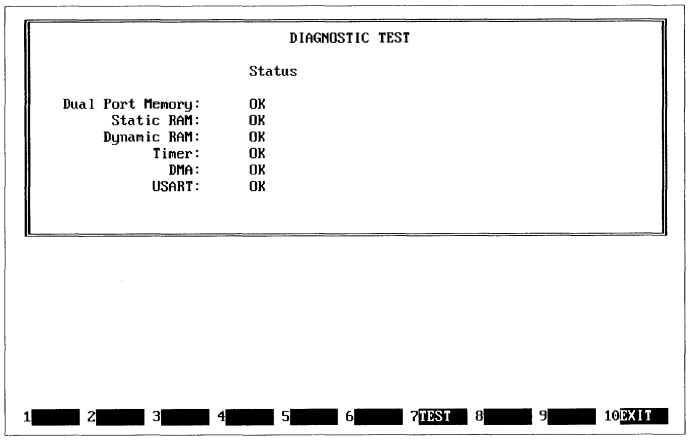
2) When the tests are complete (TEST reappears next to F7), press F10 [EXIT] or <Esc> to return to the Hardware Configuration Screen.
   - If all of the tests passed (OK in the Status column), refer to "Verifying Operation" later in this chapter to make sure the software is running properly. If any of the tests failed (FAIL in the Status column), refer to "Diagnosing Hardware Conflicts" later in this chapter.

See Also:

Chapter 3, Operation and Navigation, for more on starting the program, including using command line switches and batch files. More on the Hardware Configuration Screen and its functions is provided later in this chapter.



At the Hardware Configuration Screen, press F7 [TEST].



OK in all fields indicates a succesful test. Proceed to "Verify Operation."

Use the hardware test to verify your hardware installation.

Checking the LM2000's Operation

Once the LM2000 hardware installation has been verified, verify the software operation by performing an emulation test using the common FOX message.

The FOX test

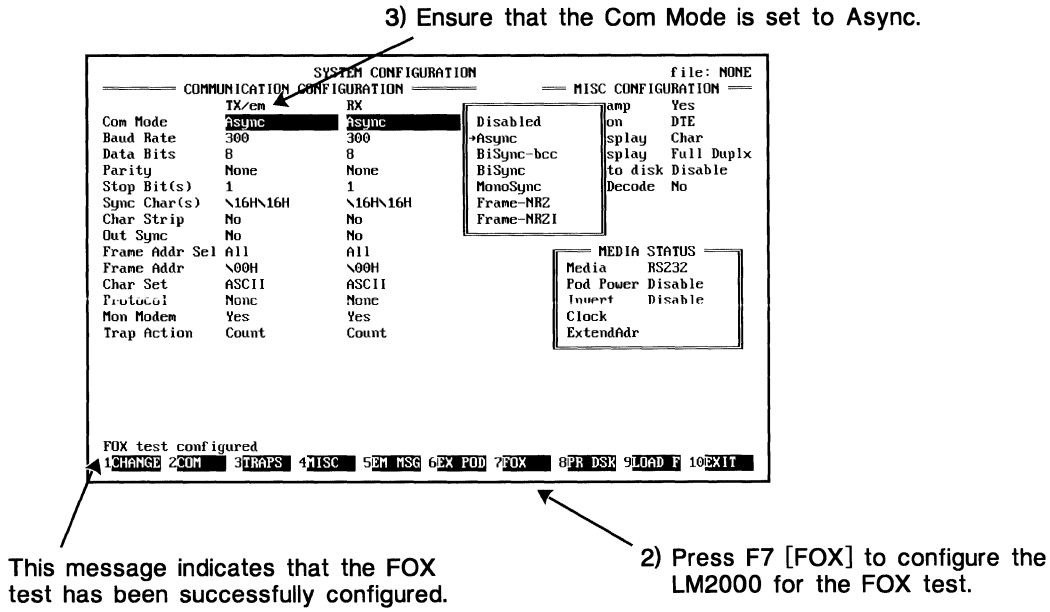
To run the FOX test, use the LM2000's automatic FOX test function.

> **Caution**
>
> Make sure the LM2000 is not connected to a live network while conducting this test.

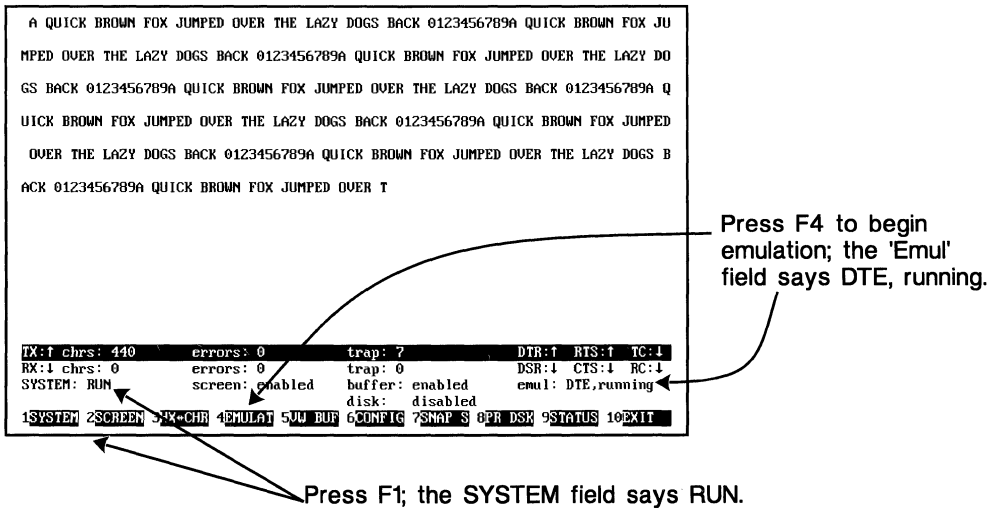
1) From the Main Menu, press F3 to access the Monitor Screen. Then, from the Monitor Screen, press F6 [CONFIG] to access the System Configuration Screen.
2) At the System Configuration Screen, press F7 [FOX] to configure the LM2000 for a FOX test.
   - The LM2000 automatically activates the Emulation mode for DTE and loads the Quick Brown Fox test message. The message "FOX test configured" appears in the lower left corner of the screen.
3) Verify that the Com Mode field in the upper left corner of the screen is set for asynchronous (Async). If not, move the cursor to the Com Mode field and press F1 [CHANGE] until Async appears.
4) Press F10 [EXIT] and <Enter> to activate the FOX test settings and return to the Monitor Screen.
5) At the Monitor Screen, press F1 [SYSTEM] to enable the LM2000 (ensure the SYSTEM field says Run).
6) Press F4 [EMULAT] to begin the FOX test.
   - If the test is successful, you will see the FOX message scroll across the screen.

If the FOX test succeeds, then the installation is complete and you are ready to connect the LM2000 to a data line and begin protocol analysis.

If the FOX test fails, please refer to "Diagnosing Hardware Conflicts" later in this chapter before calling Network General Customer Support.



Configure the FOX test at the System Configuration Screen.



In a successful test, you will see the FOX test message scroll across the Monitor Screen.

Diagnosing Hardware Conflicts

Options in the LM2000 software and on the line interface card determine which I/O address and RAM segment are used to control the line interface card and communicate with the PC's central processing unit. These options are preset at the factory to work with most industry standard PCs. Not all PCs are alike, however, and some may have additional hardware, such as game cards or communications cards, that conflict with the LM2000's factory settings. If this is the case with your PC, you can easily reconfigure the LM2000 to work with your system.

Symptoms of a hardware conflict

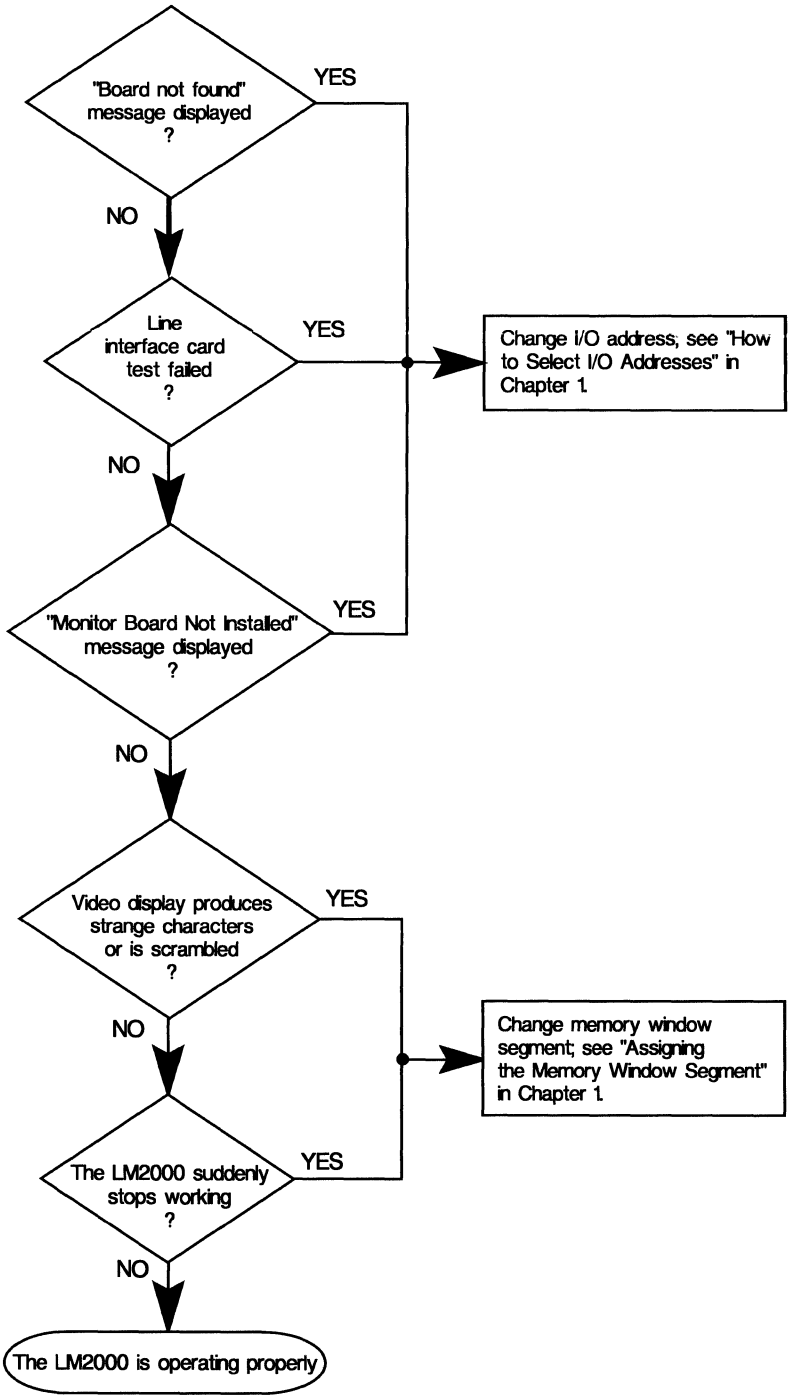
Some things that indicate that the LM2000 has a hardware conflict include:

- The "Board not found..." message appears when you attempt to run the LM2000.
- The *** Monitor Board Not Installed *** message is displayed on the LM2000's Main Menu.
- The card test from the Hardware Configuration Screen produces Error messages.

If any of these symptoms occur, you may need to select a new I/O address. Refer to "How to Select I/O Addresses" later in this chapter.

- The video display produces strange characters or becomes scrambled.
- The LM2000 suddenly stops working properly or hangs your PC.

If either of these symptoms occur, you may need to select a new memory window segment. Refer to "Assigning the Memory Window Segment" later in this chapter.



Hardware conflicts diagnosis procedure.

How to Select I/O Addresses

The LM2000 software communicates with the line interface card through one of eight I/O address ports. Conflicts may arise if other devices installed in your PC use the same I/O address as the LM2000. Changing the I/O address involves resetting switches on the line interface card and making adjustments on the Hardware Configuration Screen.

Changing the I/O setting on the line interface card

To change the I/O setting:

1) Remove the card from your PC.
2) Select a new I/O address by using a small screwdriver or similar tool to set positions 1, 2, and 3 of DIP switch SW1 as shown on the adjacent page.
3) Record the new address settings and reinstall the card in your PC.

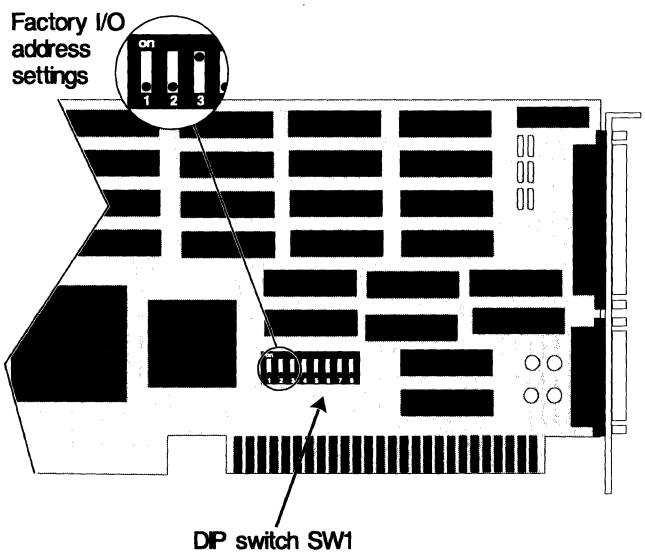
Changing the I/O setting at the Hardware Configuration Screen

You must adjust the I/O setting on the Hardware Configuration Screen to match the new switch settings on the line interface card.

1) Change to the drive and directory containing the LM2000 program and start the LM2000.
   - The LM2000 starts. The message ***Monitor Board Not Installed*** should be displayed at the bottom of the screen.
2) At the LM2000 Main Menu press <Shift>F2 [HW CNF] to access the Hardware Configuration Screen.
   - The Hardware Configuration Screen appears. Again, the message *** Monitor Board Not Installed *** is displayed.
3) If necessary, use the <↓> key to move the cursor to the I/O Address field.
4) Press F1 [CHANGE] to change the I/O address to match the one you set on the line interface card. The DIP switch display on the Hardware Configuration Screen should match the settings on the line interface card.
5) Press F7 [TEST] to verify that the new settings work properly.
   - If the test is successful, the *** Monitor Board Not Installed *** message changes to *** Monitor Board Installed ***.

I/O Address	SW1 Switch Position Settings		
	SW1-1	SW1-2	SW1-3
200h	ON	ON	ON
240h	ON	OFF	ON
280h	OFF	ON	ON
2C0h (factory default)	OFF	OFF	ON
300h	ON	ON	OFF
340h	ON	OFF	OFF
380h	OFF	ON	OFF
3C0h	OFF	OFF	OFF

Line interface card switch settings.



DIP switch SW1 location.

Assigning the Memory Window Segment

The LM2000 uses about 8 kilobytes of a PC's reserved memory to move captured data between the line interface card and the LM2000 software. This memory is referred to as a window segment, and its location is specified using the lowest address of the 8KB segment. The window segment's address can be reassigned by the user to avoid conflicts with other applications. The window segment is assigned in the Hardware Configuration Screen.

Reassigning the memory window segment

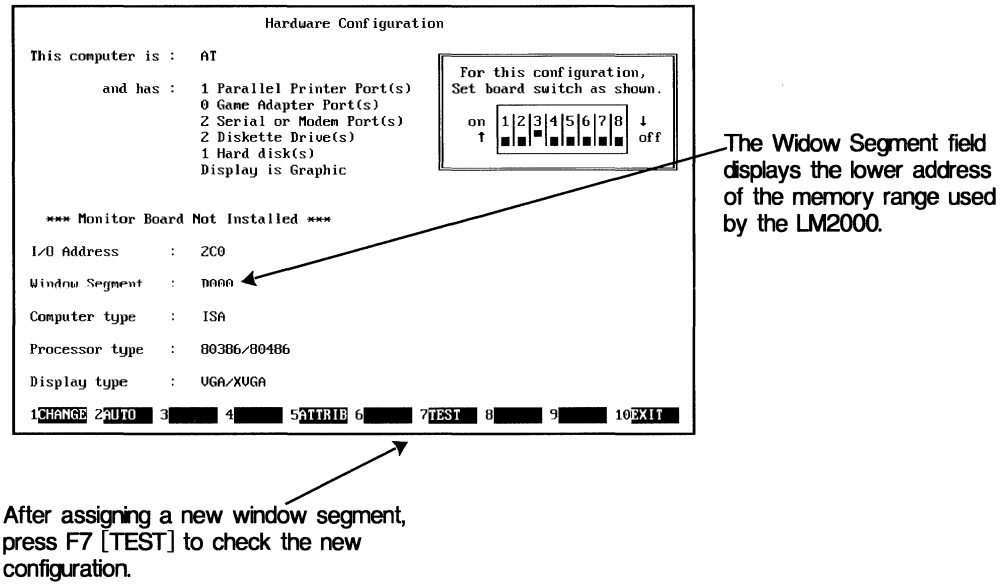
To reassign the window segment used by the LM2000:

1) Change to the drive and directory containing the LM2000 program and start the LM2000.
   - The LM2000 starts.
2) At the LM2000 Main Menu press <Shift>F2 [HW CNF] to access the Hardware Configuration Screen.
   - The Hardware Configuration Screen appears.
3) Use the <↓> key to move the cursor to the Window Segment field.
4) Press F1 [CHANGE] to select a new window segment address from the 16 available addresses.
5) Press F7 [TEST] to verify that the new settings work properly.
   - All fields in the test screen display OK.

A note about extended memory managers

If your machine is equipped with an extended memory manager, you may have to configure the memory manager to prevent it from accessing the memory segment used by the LM2000. The method for doing this depends on the memory manager you are using, but in general, you will need to exclude a memory segment beginning with the address specified in the Window Segment field and ending with an address 8K above that.

The listing on the next page gives the memory segment ranges used by the LM2000. Use this list when configuring your memory manager.



The Window Segment is assigned at the Hardware Configuration Screen.

Address Setting in Window Segment Field	Upper Address of Window Segment	Address Setting in Window Segment Field	Upper Address of Window Segment
A000	A1FF	D000	D1FF
A200	A3FF	D200	D3FF
A400	A5FF	D400	D5FF
A600	A7FF	D600	D7FF
A800	A9FF	D800	D9FF
A100	ABFF	D100	DBFF
AC00	ADFF	DC00	DDFF
AE00	AFFF	DE00	DFFF

For 386/486 PCs with Extended Memory Managers: Exclude memory between the address in the Window Segment field and the upper address of the segment.

Chapter 2
Connecting the LM2000 to the Network

- The Network Interface and You
- Connecting the LM2000 to RS-232 (V.24) Circuits
- Connecting the LM2000 to RS-422 and RS-423 Circuits
- Connecting the LM2000 to V.10 and V.11 Circuits
- Connecting the LM2000 to V.35 Circuits
- Connecting the LM2000 to T1 Circuits

The Network Interface and You

All connections between the LM2000 and the network are made at one of the two connectors on the LM2000 line interface card. These two connectors and the adapter cables shipped with the LM2000 provide an interface to networks using several different CCITT and EIA interface standards.

The LM2000 network interface

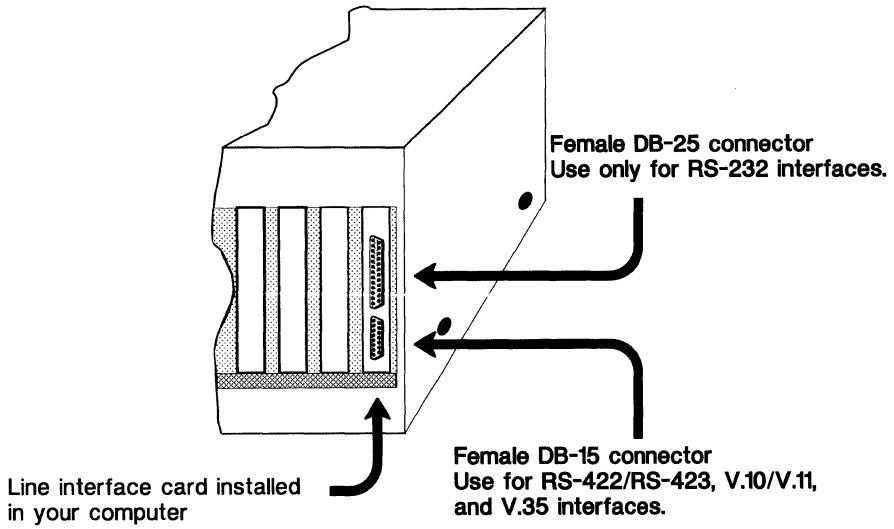
The LM2000 provides an interface to the network through the two female connectors on its back panel. Between them, these two connectors accommodate six different network interfaces. This diversity is accomplished through the use of four adapter cables, which provide all necessary wiring conversions between the network interface and the line interface card connectors.

The connectors

The top connector on the line interface card is a 25-pin, D-type connector (DB-25), and is used only for RS-232 network interfaces. This includes any interface conversion devices (such as the Network General T-Pod) that provide an RS-232 output. The lower connector is a 15-pin, D-type connector (DB15) and is used for RS-449 (RS-422 and RS-423), V.10, V.11, and V.35.

The cables

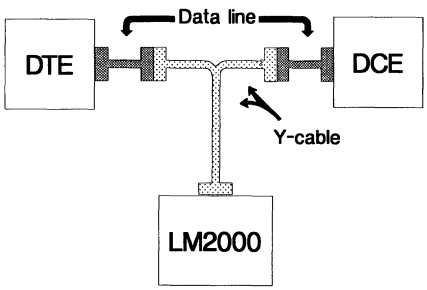
Connections between the LM2000 and the network are made with one of the "Y" cables included with the LM2000. Each Y-cable provides one female and two male connectors. The Y-cables provide two ways to connect the LM2000 to the network: they can be used in-line with your data transmission line, or they can be used with a patch matrix panel. When making an in-line connection, all three connectors are used. When connecting the LM2000 to a patch matrix, one connector is left unused.



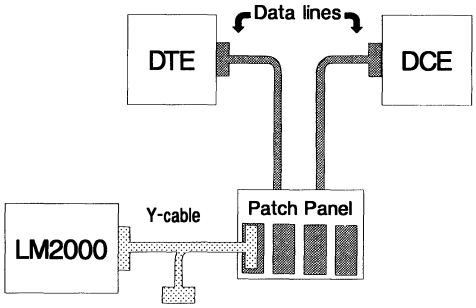
Caution!

Ensure that there are no connections to the LM2000 connectors when changing the media (interface) field in the System Configuration Screen.

Use the connectors on the LM2000's back panel to connect to the network.



In-line Y-cable connections



Patch panel connections

There are two ways to connect the LM2000 to the network.

Connecting the LM2000 to RS-232 (V.24) Circuits

The LM2000 provides a standard RS-232 interface to the network through the DB-25 connector on the line interface card.

RS-232 network connections

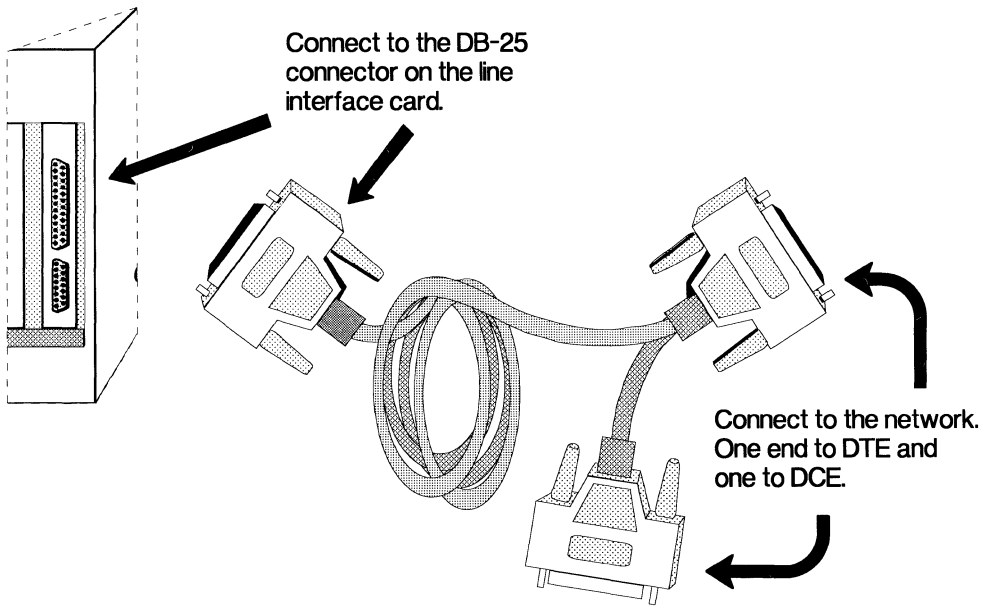
Use the following procedure to connect the LM2000 to the network via an RS-232 interface.

> **Caution!**
>
> The following procedure may require that you disconnect your data line. Before disconnecting the data line:
> - Verify that there is no traffic on the line.
> - Notify the appropriate parties that the network will be down temporarily.
> - Verify that there is no traffic on the line again.

1) Make sure the Media (interface) field on the LM2000's System Configuration Screen is set to RS232. (To check this option, press F1 from the Main Menu or F6 from the Monitor Screen. To change the Media field option, press <Shift>F5 [MEDIA].)
2) Connect the RS-232 adapter cable to the network at a patch panel or monitor port, or connect the adapter cable in-line with the data line by disconnecting the data line and inserting the adapter cable. Plug one of the adapter cable connectors into the DTE side of the line and the other one into the DCE side.
3) Connect the remaining male cable connector to the female DB–25 connector on the LM2000.

Function	Lead	RS-232 Circuit	V.24 Circuit	DB-25 Pin #	Function	Lead	RS-232 Circuit	V.24 Circuit	DB-25 Pin #
Protective Ground	PG	AA	101	1	Equalization	EQ	—	—	11
Transmit Data	TD	BA	103	2	Transmit Clock	TC	DB	114	15
Receive Data	RD	BB	104	3	Receive Clock	RC	DD	115	17
Request To Send	RTS	CA	105	4	Data Terminal Ready	DTR	CD	108.2	20
Clear To Send	CTS	CB	106	5	Ring Indication	RI	CE	125	22
Data Set Ready	DSR	CC	107	6	External Clock	EXTC	DA	113	24
Signal Ground	SG	AB	102	7	Busy	BUSY	—	—	25
Data Carrier Detected	DCD	CF	109	8	—	—	—	—	—

LM2000 RS-232 Adapter Cable Wiring



Use the RS-232 adapter cable for RS-232 interfaces.

Connecting the LM2000 to RS-422 and RS-423 Circuits

The LM2000 provides standard RS-422 and RS-423 interfaces to the network through the DB-15 connector on the line interface card and the RS-449 adapter cable.

RS-422 and RS-423 network connections

Use the following procedure to connect the LM2000 to the network via an RS-422/RS-423 interface.

> **Caution!**
>
> The following procedure may require that you disconnect your data line. Before disconnecting the data line:
> - Verify that there is no traffic on the line.
> - Notify the appropriate parties that the network will be down temporarily.
> - Verify that there is no traffic on the line again.

1) Make sure the Media (interface) field on the LM2000's System Configuration Screen is set to RS422 or RS423. (To check this option, press F1 from the Main Menu or F6 from the Monitor Screen. To change the Media field option, press <Shift>F5 [MEDIA].)

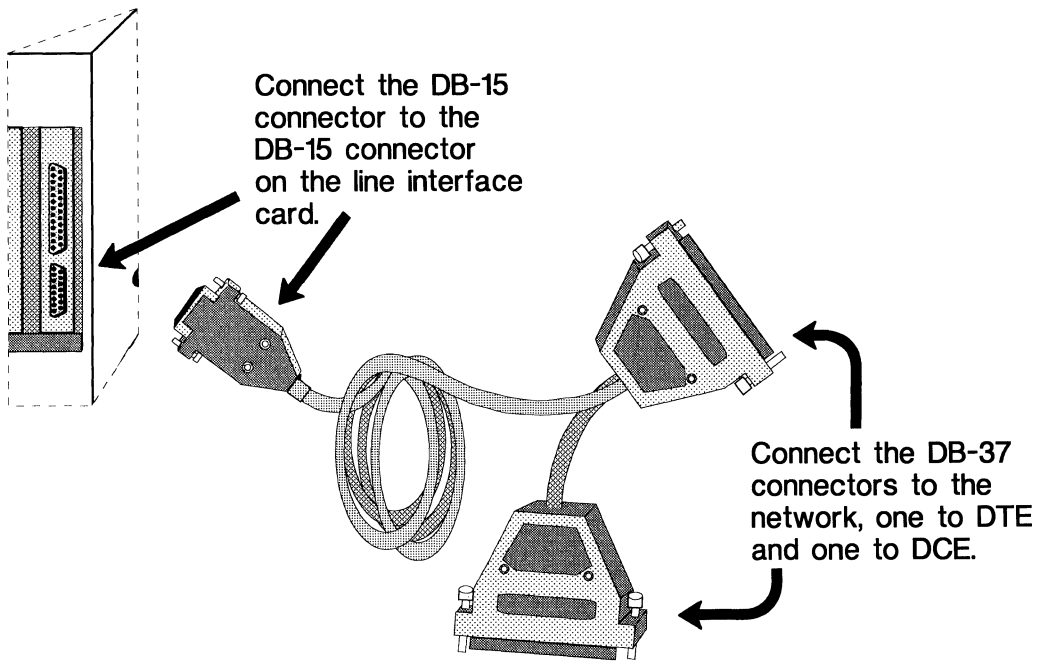
> **Caution!**
>
> Disconnect all cables from the LM2000 before changing the Media option field. When the Media option is set to V.35, ±12Vdc is present on the modem leads of the DB-15 connector. This could disrupt networks using RS-422 or RS-423 interfaces.

2) Connect the RS-422/RS-423 adapter cable to the network at a patch panel or monitor port, or connect the adapter cable in-line with the data line by disconnecting the data line and plugging one of the adapter cable connectors into the DTE side of the line and the other one into the DCE side.

3) Connect one of the male cable connectors to the female DB-15 connector on the LM2000.

Function	Lead	DB-37 Pin #	DB-15 Pin #	Function	Lead	DB-37 Pin #	DB-15 Pin #
Signal Ground	SG	19	1	Request to Send	RS (A) (B)	7 25	3 10
Send Data	SD(A) (B)	4 22	2 9	Receive Timing	RT (A) (B)	8 26	7 14
Receive Data	RD (A) (B)	6 24	4 11	Clear to Send	CS (A) (B)	9 27	5 12
Send Timing	ST(A) (B)	5 23	6 13	—	—	—	—

RS-449 Cable Wiring.



Use the RS-449 adapter cable for RS-422 and RS-423 interfaces.

Connecting the LM2000 to V.10 and V.11 Circuits

The LM2000 provides standard V.10 and V.11 interfaces to the network through the DB-15 connector on the line interface card and the V.10/V.11 adapter cable.

V.10 and V.11 network connections

Use the following procedure to connect the LM2000 to the network via a V.10 or V.11 interface.

> **Caution!**
>
> The following procedure may require that you disconnect your data line. Before disconnecting the data line:
> - Verify that there is no traffic on the line.
> - Notify the appropriate parties that the network will be down temporarily.
> - Verify that there is no traffic on the line again.

1) Make sure the Media (interface) field on the LM2000's System Configuration Screen is set to V.10 or V.11. (To check this option, press F1 from the Main Menu or F6 from the Monitor Screen. To change the Media field option, press <Shift>F5 [MEDIA].)

> **Caution!**
>
> Disconnect all cables from the LM2000 before changing the Media option field. When the Media option is set to V.35, ±12Vdc is present on the modem leads of the DB-15 connector. This could disrupt networks using RS-422 or RS-423 interfaces.

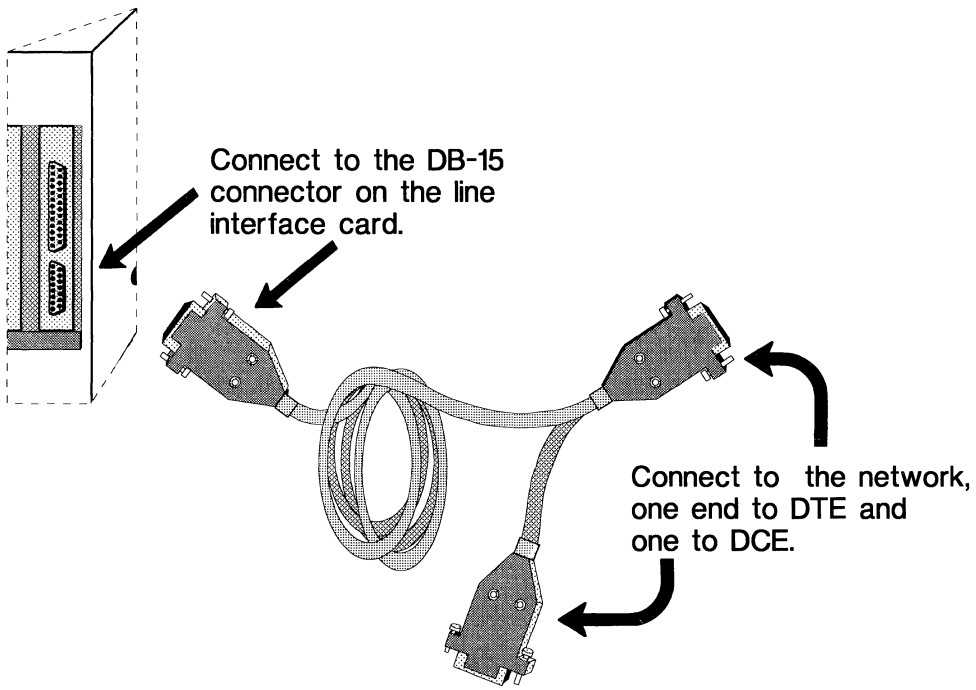
2) Connect the V.10/V.11 adapter cable to the network at a patch panel or monitor port, or connect the adapter cable in-line with the data line by disconnecting the data line and inserting the adapter cable. Plug one of the adapter cable connectors into the DTE side of the line and the other one into the DCE side.

3) Connect the remaining male cable connector to the female DB-15 connector on the LM2000.

Function	Lead	DB-15 Pin #	Function	Lead	DB-15 Pin #
Shield	N/A	1	I Indication	I (A) (B)	5 12
Transmit Data	T (A) (B)	2 9	S Signal Timing	S (A) (B)	6 13
Receive Data	R (A) (B)	4 11	G Ground	G	8
Control	C (A) (B)	3 10	—	—	—

LM2000 V.10/V11 Adapter Cable Wiring.

Note: The LM2000 connects the V.11 return leads (B) to ground in V.10 applications.



Use the V.10/V.11 adapter cable for V.10 and V.11 interfaces.

Connecting the LM2000 to V.35 Circuits

The LM2000 provides a standard V.35 interface to the network through the DB-15 connector on the line interface card and the V.35 adapter cable.

V.35 network connections

Use the following procedure to connect the LM2000 to the network via a V.35 interface.

> **Caution!**
>
> The following procedure may require that you disconnect your data line. Before disconnecting the data line:
> - Verify that there is no traffic on the line.
> - Notify the appropriate parties that the network will be down temporarily.
> - Verify that there is no traffic on the line again.

1) Make sure the Media (interface) field on the LM2000's System Configuration Screen is set to V.35. (To check this option, press F1 from the Main Menu or F6 from the Monitor Screen. To change the Media field option, press <Shift>F5 [MEDIA].)

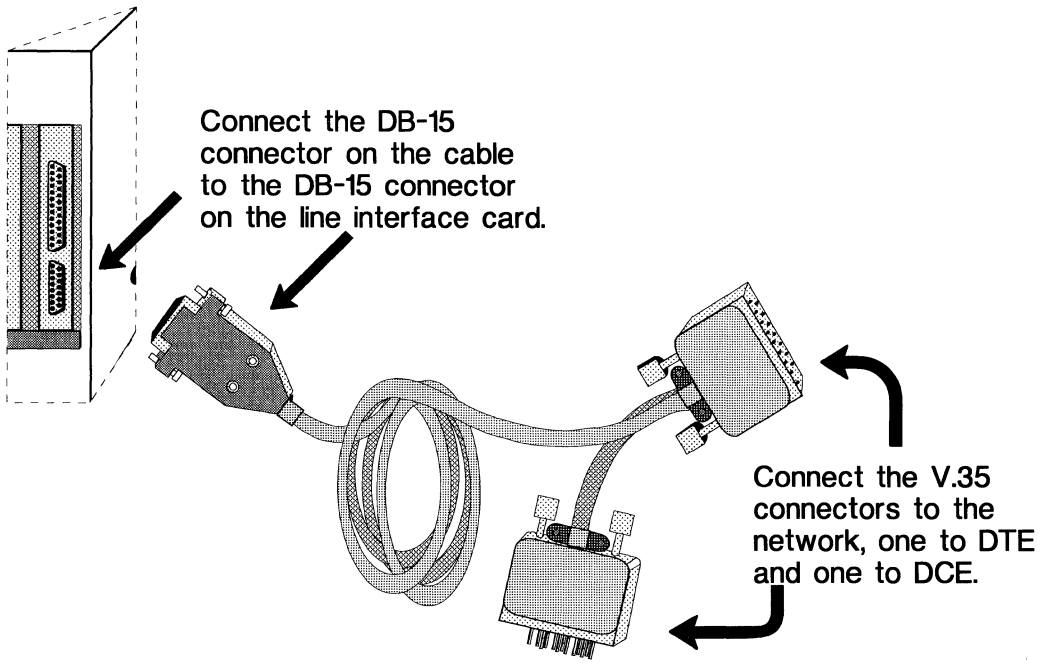
> **Caution!**
>
> Disconnect all cables from the LM2000 before changing the Media option field. When the Media option is set to V.35, ±12Vdc is present on the modem leads of the DB-15 connector. This could disrupt networks using RS-422 or RS-423 interfaces.

2) Connect the V.35 adapter cable to the network at a patch panel or monitor port, or connect the adapter cable in-line with the data line by disconnecting the data line and plugging one of the V.35 cable connectors into the DTE side of the line and the other one into the DCE side.

3) Connect the DB-15 cable connector to the female DB-15 connector on the LM2000.

Function	Lead	V-35 Pin #	DB-15 Pin #	Function	Lead	V-35 Pin #	DB-15 Pin #
Transmit Data	TD (A) (B)	P S	2 9	Transmit Timing	TC (A) (B)	Y AA	6 13
Receive Data	RD(A) (B)	R T	4 11	Receive Timing	RC (A) (B)	V X	7 14
Request to Send	RTS	C	3	Ring Indication	RI	J	15
Data Terminal Ready	DTR	H	10	Receive Line Signal Detect	RLSD	F	8
Clear to Send	CTS	D	5	Ground	GND	A,B	1
Data Set Ready	DSR	E	12	—	—	—	—

V.35 Adapter Cable Wiring



Use the V.35 adapter cable for V.35 interfaces.

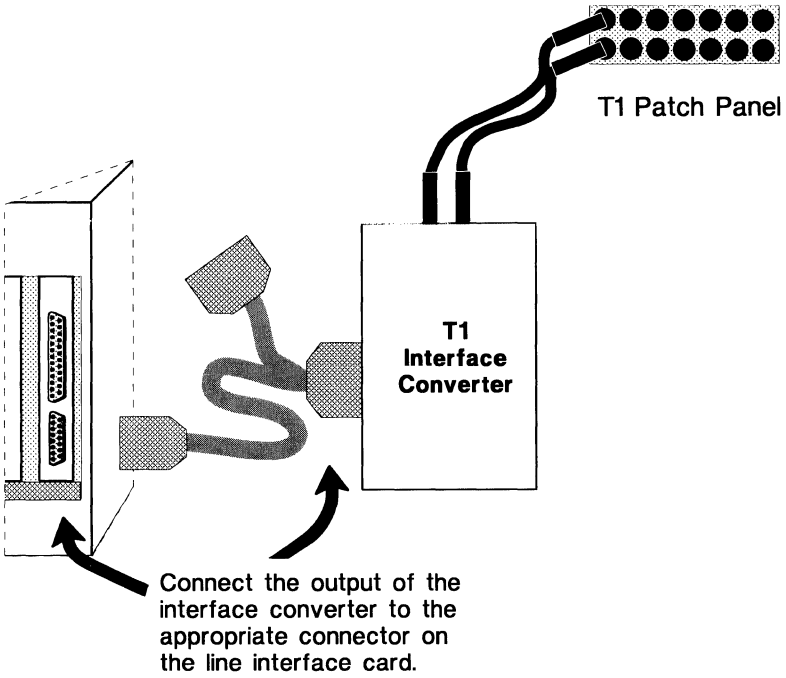
Connecting the LM2000 to T1 Circuits

The LM2000 is capable of monitoring DS0 and DS1 signals, however, these signals must be converted from the physical T1 interface to one of the physical interfaces accommodated by the LM2000. This is typically accomplished with an interface converter such as the T-Pod by Network General Corporation, which converts DS0 signals to RS-232 compatible signals.

T1 network connections

- Follow the manufacturer's instructions to connect the interface converter to the network.
- Depending on the interface provided by the converter, follow the procedures in one of the preceding spreads to connect the LM2000 to the interface converter.

For:	Refer to:
RS-232 interfaces	Connecting the LM2000 to RS-232 (V.24) Circuits
RS-422 or RS-423 interfaces	Connecting the LM2000 to RS-422 and RS-423 Circuits
V.10 or V.11 interfaces	Connecting the LM2000 to V.10 and V.11 Circuits
V.35 interfaces	Connecting the LM2000 to V.35 Circuits



Connecting the LM2000 to T1 circuits.

Chapter 3
Operation and Navigation

- How to Start the LM2000
- Using Batch Files to Start the LM2000
- How to Get HELP!
- Finding Your Way Using Function Keys
- The Main Menu – An Overview of the LM2000 Functions
- Menu Boxes and Option Fields
- Saving Files
- Loading Files
- The LM2000 Print Functions
- Three Ways to Exit the LM2000

How to Start the LM2000

Start the LM2000 high-performance protocol analyzer by typing the appropriate command at the DOS prompt. Configuration files that store various system configuration settings can be loaded automatically from the command line.

To start the LM2000 (basic procedure):

Type the commands shown in boldface to change to the LM2000 subdirectory and start the program. Press <Enter> after typing each command.

1) Type **cd LM2000** and press <Enter> as follows:

   C:\>**cd LM2000**

   - A new prompt is displayed.

2) Type LM2000 and press <Enter> as follows:

   C:\LM2000>**LM2000**

   - The program loads, showing you the Copyright Screen briefly, and then displays the Main Menu.

How to load configuration files automatically:

When you invoke the LM2000 program, you may enter a command line parameter for a configuration file by including it after the name LM2000, such as:

C:\>**LM2000 SNA** <Enter>

- A message appears at the bottom of the Copyright Screen showing you that a configuration file (in this case, SNA.CNF) has been loaded. Then the LM2000 directly enters monitor mode and displays the real-time monitoring screen. (It bypasses the Main Menu.)

Be sure to type a space between **LM2000** and the configuration file name. Do not include the file extension.

Command Syntax:

LM2000 [*config*] Where the item in brackets is optional.

Note:

- The LM2000 will operate only when the subdirectory containing LM2000 files is also the current subdirectory.
- The Stream to Disk option is always reset to disable when a configuration file is loaded. Resetting Stream to Disk ensures that the LM2000 cannot inadvertently overwrite data captured previously just by starting up the analyzer.

See Also:

Chapter 5 for information about some common configuration settings you may wish to use.

Sample LM2000 Command Entry

```
C:\>cd lm2000 <Enter>
C:\LM2000>lm2000 filename <Enter>
```

The command line option *filename* specifies a configuration file which is loaded automatically.

Using Batch Files to Start the LM2000

You can use batch files to simplify loading the LM2000 program. You can also use batch files to load one of several system configuration files automatically using the command line.

To create a batch file to load LM2000:

1) Load a DOS text editor such as Edlin (for DOS 3.3) or Edit (for DOS 5.0) and enter edit mode.
2) On one line in the batch file, type the command to change to the LM2000 subdirectory using the DOS change directory (cd) command. In the example from the opposite page, we call the subdirectory **NGC**.
3) On the next line, type the command to load the LM2000 and any configuration files or command line switches you may wish to use.

To start the LM2000 program using a batch file:

- Type the name of the desired batch file and press <Enter>.
  - ♦ DOS executes the batch file which starts the LM2000 program.

More than one batch file can be written and saved for use:

You may find it convenient to make a batch file to load each system configuration you use. **X25.BAT** for example may contain the single-line command **LM2000 X25**, which would load the configuration file named **X25.CNF**, and **SNA.BAT** may contain **LM2000 SNA**, which would load the configuration file named **SNA.CNF**.

Note:

- You may choose to include a **cd** (change directory) command (or other such DOS commands) so the LM2000 program can be loaded from any subdirectory. You must be in the LM2000 subdirectory to begin the LM2000 program.
- Specifying a configuration file for the command line is optional. See the preceding spread, "How to Start the LM2000," for more about loading a configuration file automatically.

Creating a batch file using EDLIN:

```
C:\NGC>edlin analyzer.bat
New file
*1i
   1:*@ECHO OFF
   2:*CD \NGC
   3:*LM2000 SNA
   4:*^C

*E

C:\NGC>
```

Line 1 turns echo off (for aesthetic reasons).

Line 2 changes to the NGC subdirectory where all LM2000 files are stored.

Line 3 starts the LM2000 and loads the (optional) configuration file **SNA.CNF**.

Line 4 (^C) terminates the editing mode of EDLIN.

To run this batch file, you would type **analyzer** and press <Enter> at the DOS prompt.

How to Get Help

LM2000 provides context sensitive help to assist you with program operation. When you access help, the appropriate help screen for the function you are using is displayed. Items in the help screen with a check mark (√) next to them have additional information available.

To access Help:

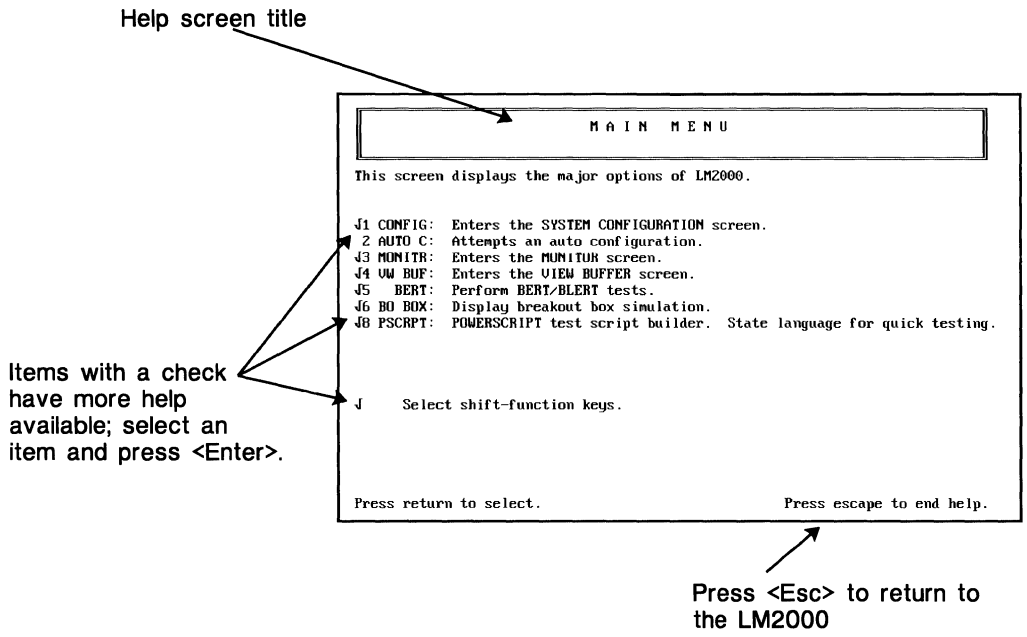
1) Press <Alt>F1 from anywhere in the program.
   - A help screen with appropriate information is displayed.
2) Press <Esc> to clear the help screen and return to the LM2000.

To display additional information:

1) Move the cursor to one of the items appearing with a check mark.
2) Press <Enter>.
   - A second screen appears with information about the highlighted item.
3) Press <Esc> to clear the help screen.

Note:

- If additional help is required, refer to the index or table of contents of this manual. Detailed information is provided for each topic, configuration, and task.
- Context sensitive help is designed to complement this manual with on-line assistance. Read this manual before operating the LM2000 program.



The LM2000's help screens provide an online reference for the programs features.

Finding Your Way Using Function Keys

LM2000 uses function keys for navigation and operation. You move around from screen to screen and activate functions by pressing the appropriate function keys. A function key menu is displayed along the bottom of each screen to label which option is available for each function key. Additional functions are accessed by pressing the <Shift> key.

To access a screen or function:

- Press the appropriate function key to access the desired function. An alternate set of functions is displayed when you press <Shift>. The function key labels appear along the bottom of the display screen.

To exit a screen or cancel a function:

The <Esc> key and F10 always perform exit and cancel functions. The <Esc> key duplicates F10's current function, and F10's label changes to indicate its current function, whether to exit a screen or cancel a function.

- Press F10 [EXIT] or <Esc> once to return to the previous screen.
- Press F10 [CANCEL] or <Esc> to cancel any function currently being performed.

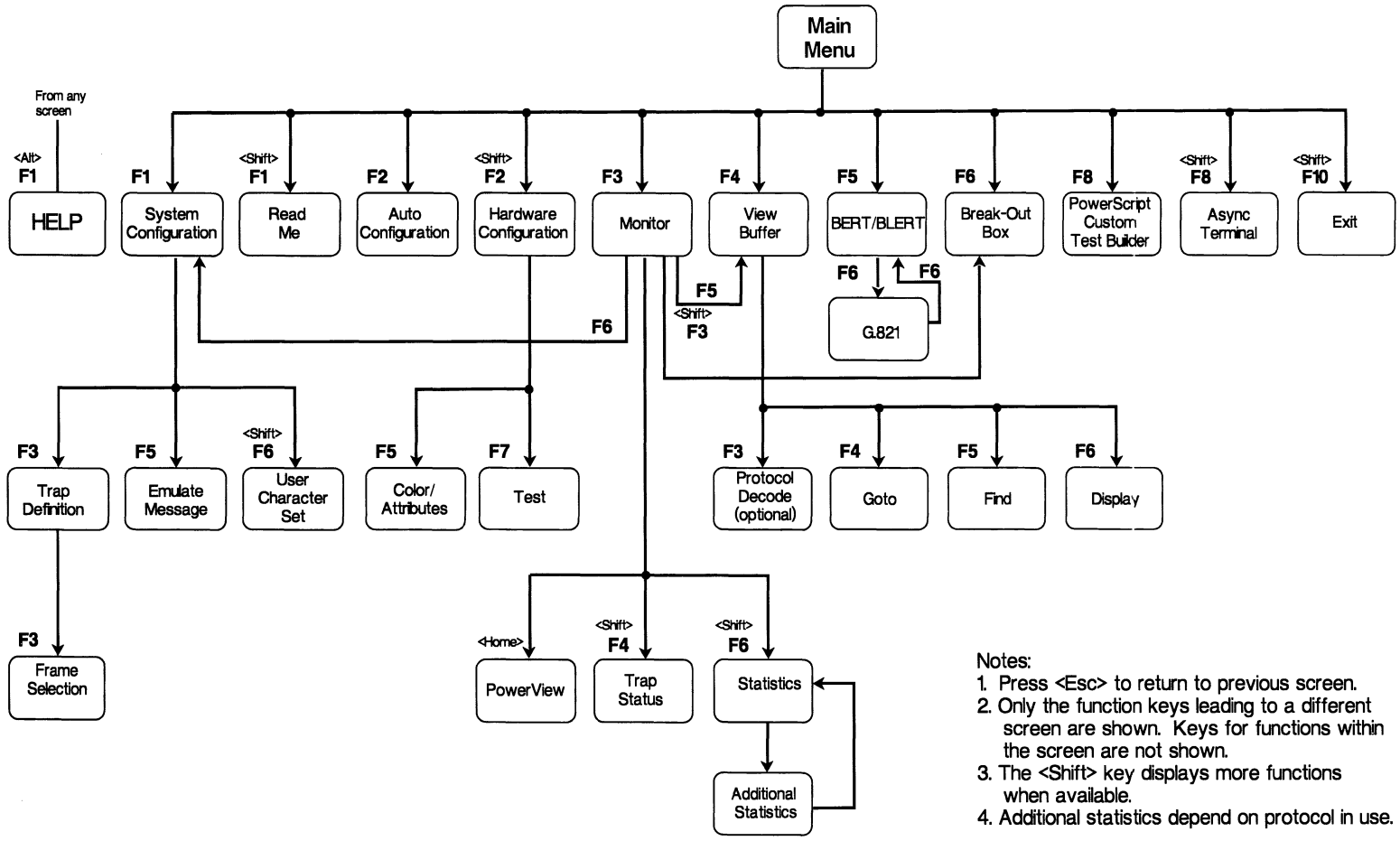
For example:

To access the Trap Definition Screen from the Main Menu:

1) Press F1 [CONFIG] at the Main Menu.
   - ♦ The System Configuration Screen appears.
2) Press F3 [TRAP] at the System Configuration Screen.
   - ♦ The Trap Definition Screen appears.
3) Press <Esc> or F10 [EXIT] as many times as necessary to get back to the Main Menu.
   - ♦ The Main Menu appears.

Note:

- When you select system options at configuration screens, a prompt to confirm any changes will be displayed when you exit the screen. You may take one or three actions:
  1) Type **Y** to accept the changes and return to the previous screen.
  2) Type **N** to ignore the changes and return to the previous screen.
  3) Press F10 [EXIT] or <Esc> and the confirmation query is cancelled. You will remain in the configuration screen.



The LM2000 uses function keys for mavigation and operation.

The Main Menu – an Overview

The Main Menu is the screen from which the LM2000's primary functions are accessed. To access a function, press the function key listed next to the desired item. When you press a function key while at the Main Menu, a new subscreen appears.

To select an item from the Main Menu:

1) Press the function key for the desired item.
   - ♦ A new screen appears.

To return to the Main Menu from another screen:

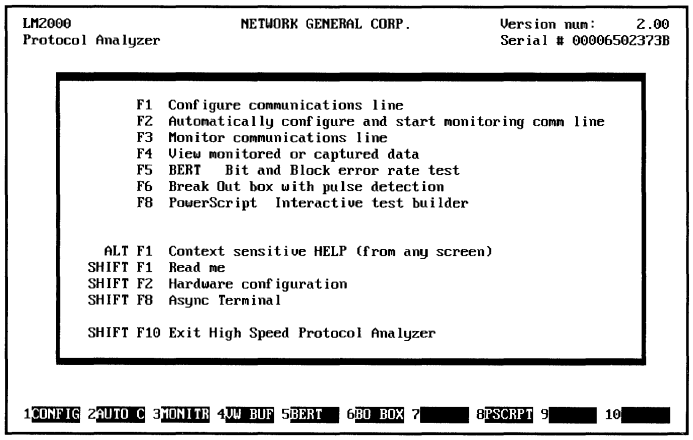
1) Press <Esc> or F10 [EXIT] until the Main Menu appears.

Note:

- See "Finding Your Way Using Function Keys" earlier in this chapter for more about using function keys.
- See the next spread, "Menu Boxes and Option Fields," for additional information on navigating within the LM2000.

Function Key	Label	Description
F1	CONFIG	System Configuration Screen lets you determine line interface board settings and how LM2000 captures and displays data. The screen also lets you define traps.
<Alt> F1	HELP	Context Sensitive Help.
F2	AUTO	Automatic Configuration automatically sets the system's configuration.
<Shift>F2	HW CONF	Hardware Configuration Screen.
F3	MON	Monitor Screen displays data during capture.
F4	VIEW	View Buffer displays data from the capture buffer.
F5	BERT	Bit/Block Error Rate Test screen.
F6	BO BOX	Software Breakout Box.
F8	PSCRPT	PowerScript Custom Test Builder.
<Shift>F8	TERM	Async Terminal Emulator.
<Shift>F10	EXIT	Halt the LM2000 program and return to DOS.

LM2000's Primary Functions



Use the function keys on the Main Menu to access the LM2000's primary functions.

Menu Boxes and Option Fields

Several menus such as those on the System Configuration and Monitor Screens use boxes to display options. There are three ways to select options: by scrolling through the options using the arrow keypad, by typing the initial letter or number of the desired item, or by using function keys F1 [CHANGE] and <Shift>F1 [B CHNG].

To select and change options in a menu:

1) Press <↑> or <↓> to highlight the field you want to change.
2) Press <Enter> to move the cursor into the menu box.
   - The arrow keypad now controls cursor movement within the menu box.
3) Press <↑> or <↓> or type the initial letter of the desired item to move the cursor to that item.
4) Press <Enter> to accept the highlighted option.
   - The field displays the new option and an arrow within the box indicates which option had been selected.

To select an option using F1:

1) Press <↑> or <↓> to highlight the field you want to change.
2) Press F1 [CHANGE] to scroll forward through the options until the arrow indicates the desired selection. Press <Shift>F1 [B CHNG] to scroll backwards.
3) Press <↑> or <↓> to highlight the next desired field.

To accept your selections:

1) Press F10 [EXIT] or <Esc>.
   - A confirmation prompt is displayed.
2) Press **Y** or <Enter> to accept your selections.
   -Or-
   Press **N** to cancel any changes.
   -Or-
   Press <Esc> to cancel the EXIT command.

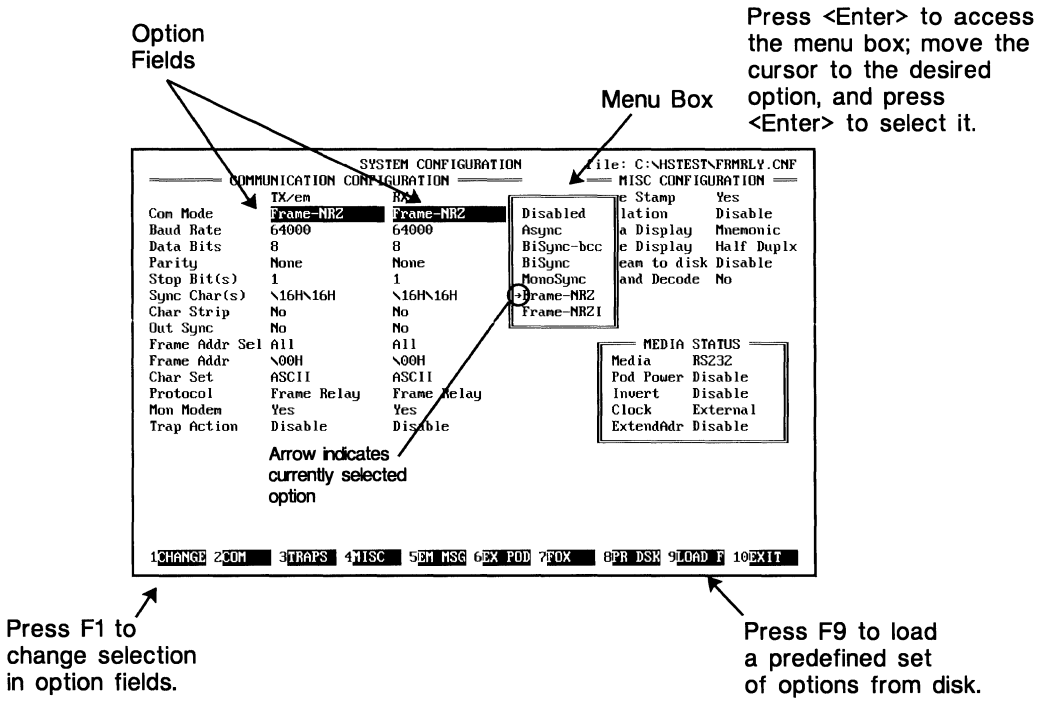
   If you press any keys other than <Esc>, **Y**, or **N**, you will be returned to the previous screen.

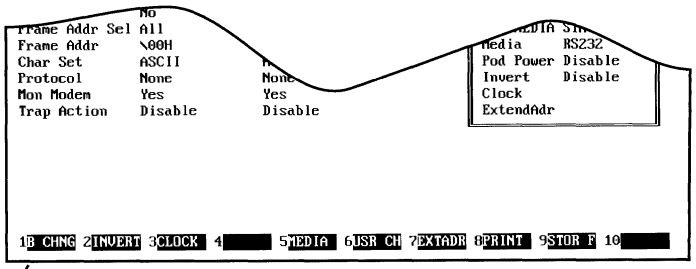
Note:

- The selected field is the one highlighted on the screen, and its menu box displays an arrow next to the current option.
- To save system and BERT configuration screens as well as emulation messages, press <Shift>F9 [SAVE]. See "Saving Files" later in this chapter for more about saving settings.

See Also:

Chapter 4 for more about the System Configuration Screen.





You can select LM2000 options using menu boxes and function keys.

Saving Files

You can define frequently used configurations once, save them, and then reload them as necessary. The LM2000 lets you create custom configurations and save them for system configuration and for BERT and other settings, so they can be reused in the future.

To save a file to disk:

1) Press <Shift>F9 [SAVE] to save the current setting to disk.
   - The LM2000 prompts you for a file name.
2) Type the name of the new file (up to eight characters long; no extension). Press <Enter>.
   - If a file already exists under the selected name, a "File already exists" prompt appears.
3) Press **Y** to overwrite the existing file, or **N** to cancel the save command.

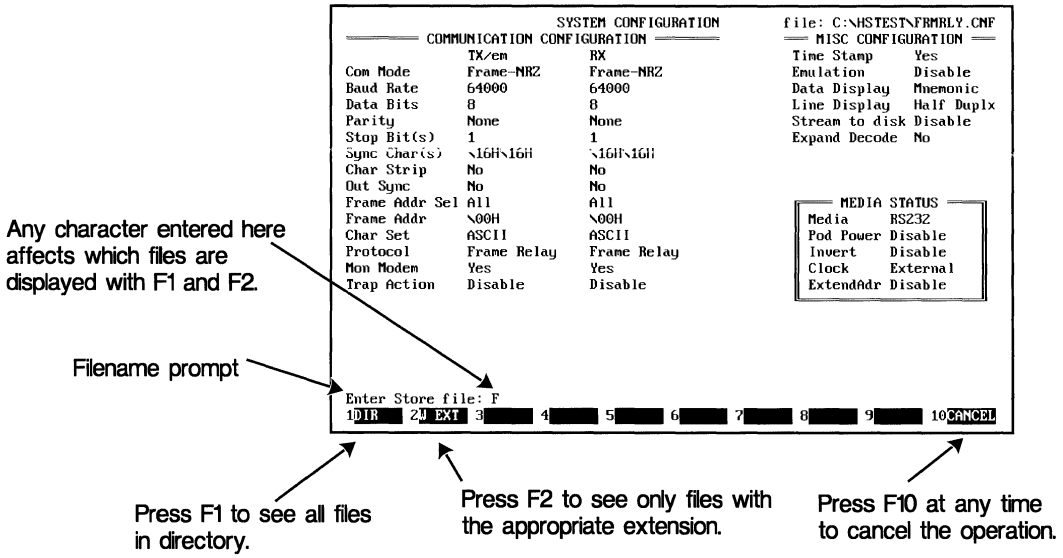
Using F1 and F2 to browse through existing files:

When saving a file, you may wish to see what files already exist on your disk. To do so:

1) Press F1 [DIR] to display all files in the current directory.
2) Press F2 [W EXT] to display only those files in the current directory with names matching the characters displayed in the File Name Box. Files are selected to match the extension that is appropriate for the file to be saved.

Notes:

- See "Menu Boxes and Option Fields" for information on changing options.
- See "How to Start the LM2000" for information on specifying configuration files from the command line.
- LM2000 comes with a system configuration file named **DEFAULT**, which is automatically loaded when the program is started, unless a different configuration file is specified from the command line. To change the default settings, simply overwrite the default file by saving your new settings in a file named **DEFAULT**.



The LM2000 lets you save options and setups to a file for later retrieval.

Loading Files

Custom configuration files created with LM2000's save function can be easily recalled with the load function. Custom system configuration, BERT, and emulation settings can each be loaded from disk. The same mechanism is also used in the View Buffer Screen to load files containing data captured to disk by LM2000.

To load a file:

1) Press F9 [LOAD] to display a list of files with the appropriate extension in the current directory.
2) Press <> or <> to highlight the file you wish to load, or type the initial letter of the file name.
3) Press <Enter> to load the file.
   ♦ The new file is loaded.

Loading files from other directories:

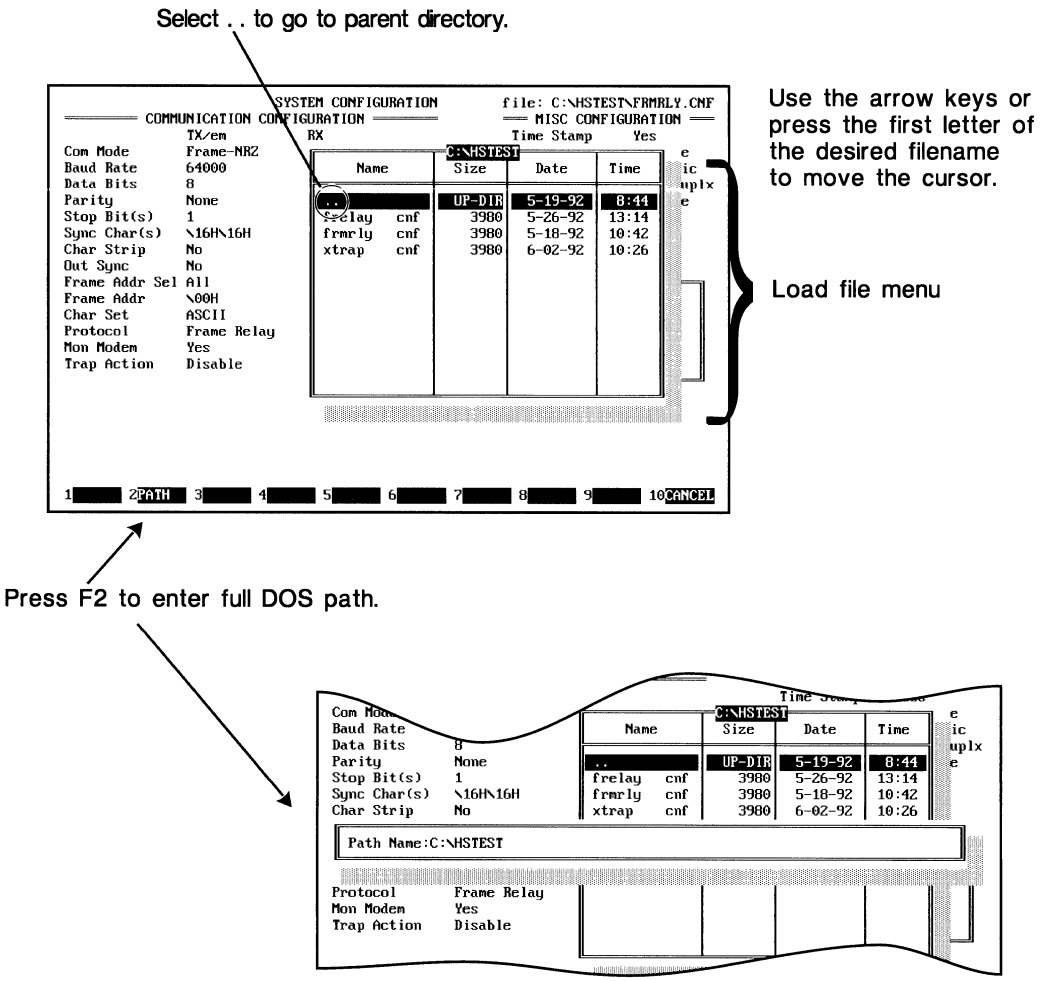
LM2000 provides two ways to locate and load files from other directories:

Use the file menu to change directories.
The file menu that appears when you press F9 lists the parent directory and any subdirectories of the current directory.

- To access a subdirectory, move the cursor to the desired subdirectory name (using the arrow keys or by pressing the initial letter of the directory name) and press <Enter>.
- To access the parent directory, move the cursor to the ".." entry, where "UP-DIR" appears under size, and press <Enter>.

Use F2 [PATH] to change directories and disk drives.
You can change directories and disk drives much like you would in DOS.

- Press F2 [PATH] while the file menu is on the screen. A path entry box appears on the screen displaying the current disk drive and the path to the current directory. Type in the desired path or disk drive and press <Enter>.



Use the file menu or F2 [PATH] to load files.

The LM2000 Print Functions

Many screens of the LM2000 let you print either captured data or other information, such as configuration settings, BERT results, or statistics. These screens let you print data to disk in an ASCII file using F8 [PR DSK] or to a printer using <Shift>F8 [PRINT].

To print captured data to an ASCII file or to a printer:

From either the Monitor Screen or the View Buffer Screen, press F8 [PR DSK] to print to a disk file.

- The LM2000 prompts you to specify a filename and for any accompanying user commentary before printing the data to disk.

-Or-

Press <Shift>F8 [PRINT] to print a copy of the captured data on a printer.

- The LM2000 prompts you to select how much of the data is printed and for any accompanying user commentary.

To print other screen information:

From the configuration, emulation message, BERT, terminal emulation, or statistics screens, press F8 [PR DSK] to print a copy of what is currently on the screen to an ASCII file.

- The LM2000 prompts you to specify a filename before printing the screen to disk.

-Or-

Press <Shift>F8 [PRINT] to print a copy of the current screen to a printer.

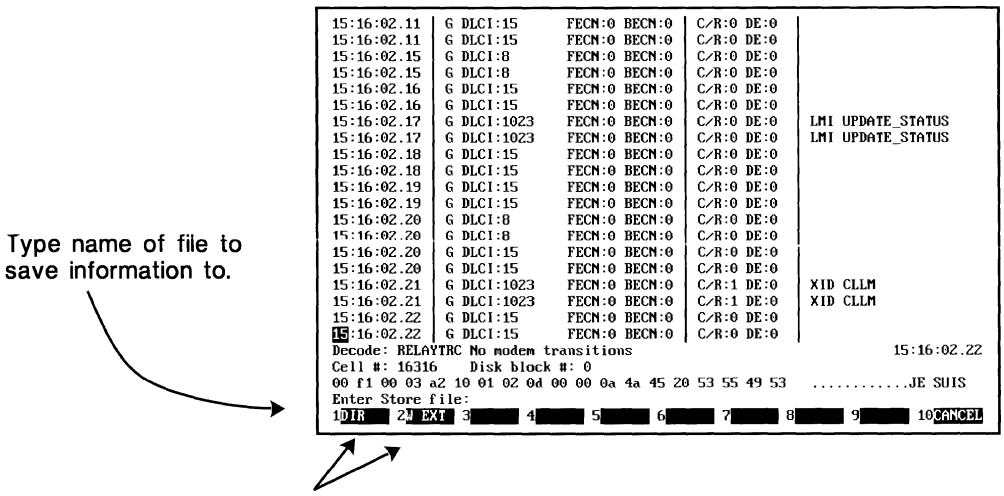
- The LM2000 sends a copy of the screen to the printer.

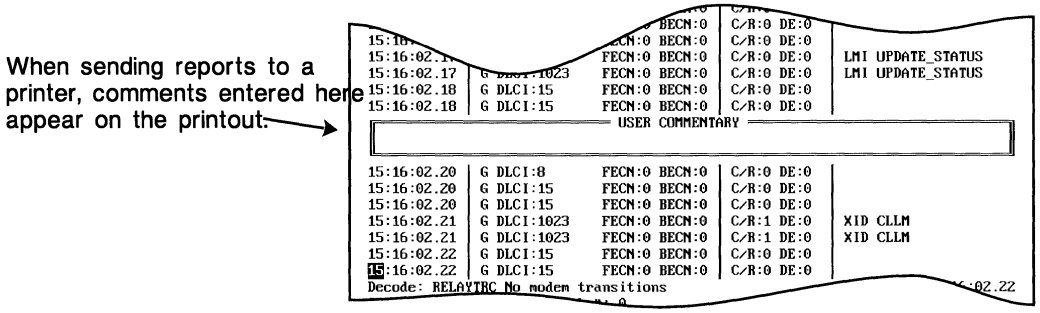
Note:

- Several options exist to determine how much capture buffer data is printed. Refer to the Monitor or View Buffer Chapters for more information.
- User commentary can be up to 64 characters long.

See Also:

Chapter 7 for more information on printing the capture buffer from the Monitor Screen. Chapter 8 for more on statistics. Chapter 9 for more information on printing the capture buffer from the View Buffer Screen. Chapter 10 for more information on the BERT screen. Chapter 12 for more on terminal emulation.





You can send LM2000 information to a printer or a file.

Three Ways to Exit the LM2000

There are three ways to leave the LM2000 program. Two of these terminate the program and return you to DOS. The third method lets you temporarily leave the program while the LM2000 continues operating in background.

To exit from the Main Menu:

1) Press <Esc> or F10 [EXIT] as many times as needed to return to the Main Menu.
2) Press <Shift>F10 [EXIT] to exit the program.
   - The LM2000 program stops and returns control to DOS.

To exit from anywhere in LM2000:

1) Press <Ctrl>C to exit the program.
   - The LM2000 program stops and returns control to DOS.

To exit temporarily to the DOS shell:

1) Press <Ctrl>Z to enter the DOS shell.
   - A message appears reminding you that the LM2000 is running. The DOS prompt also appears.
2) Execute any desired DOS functions.
3) Type **EXIT** and press <Enter> to return to the LM2000 program.
   - The LM2000 returns you to the screen from which you entered the DOS shell.

   If the LM2000 has been configured to capture data to disk, the following message appears:

   Buffer file already exists. Overwrite? (y/n)y
4) Press **Y** to overwrite the buffer file.
   - The LM2000 continues to stream captured data to disk, overwriting the existing buffer file. Data captured to disk before you entered the DOS shell will be lost.

   Or

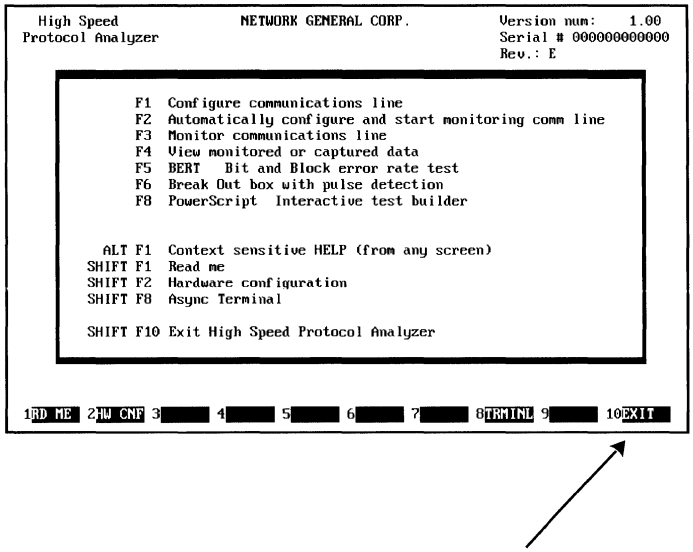
   Press **N** to preserve the existing buffer file.
   - The LM2000 turns off the stream to disk feature. To re-enable stream to disk, go to the System Configuration Screen.

DOS shell mode suspends the stream to disk function:

While in the DOS shell, the LM2000 continues to monitor data, place it in the capture buffer, and update statistics. Data cannot be written to disk, however, using the stream to disk function.

See Also:

Chapter 4 for more about setting the LM2000 to capture data to disk and the System Configuration Screen.



1) Press <Shift>F10 to exit the LM2000 from the Main Menu.

2) Press <Ctrl>C to exit the program from any screen.

3) Press <Ctrl>Z to exit to the DOS shell. From the DOS shell, type "exit" to return to the LM2000.

You can exit the LM2000 using any of three methods.

Chapter 4
System Configuration Reference

- Screen Overview: System Configuration
- Selecting System Configuration Options
- Select Your Com Mode First
- Setting Up the Communication Configuration
- More about setting Up the Communication Configuration
- Selecting a Protocol Decode
- Selecting a Trap Action
- The Miscellaneous Configuration Options
- Selecting Data Display and Line Display Modes
- Setting Up Data Capture to Disk
- Selecting Media Status Box Options
- Three Methods for Defining an Emulation Message
- Screen Overview: Emulation Message Definition
- Screen Overview: User Character Set Definition
- More about Frame Relay Configuration
- Screen Overview: Circuit Action Map

Screen Overview: System Configuration

The System Configuration Screen allows you to set display and monitoring options. This system setup screen consists of three parts: Communication Configuration, Misc Configuration, and the Media Status Box. Selecting options on this screen is the first step in preparing to monitor a data line.

How to access this screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Main functions of this screen:

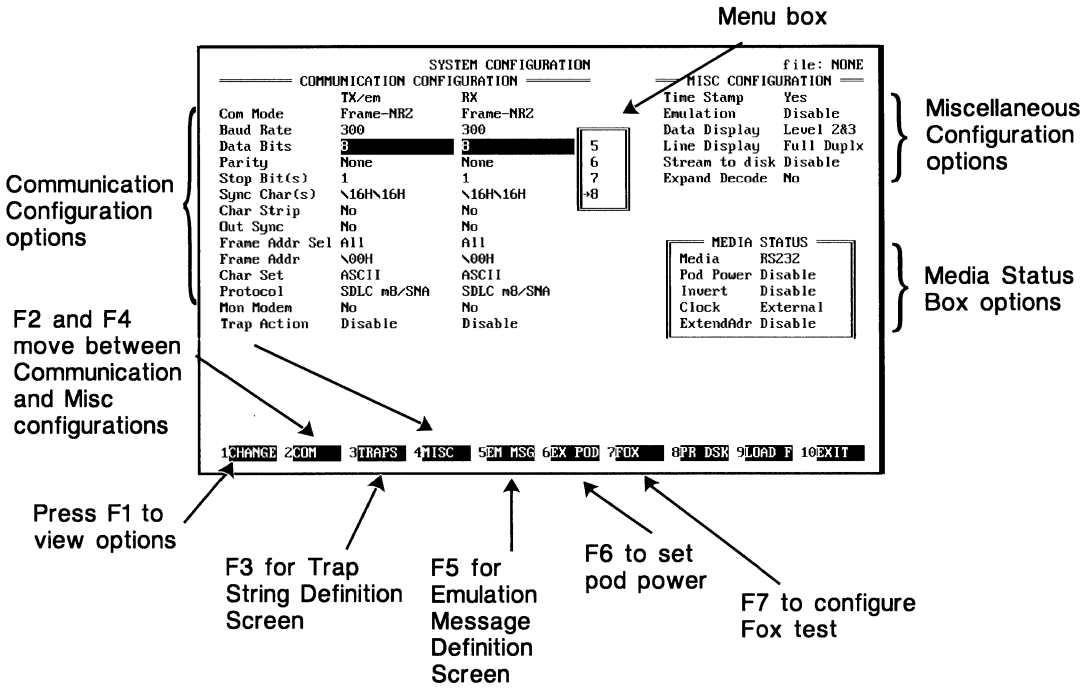
- Defines analyzer characteristics, such as frame and decode formats.
- Selects trap actions and provides access to the Trap String Definition Screen.
- Defines the data line characteristics, such as parity and baud rate.
- Sets up the configuration for a wide selection of protocols (e.g., SNA, X.25, Frame Relay).
- Provides Media (interface) options used by the analyzer and determines the display format of the break-out box.
- Activates stream to disk options to capture incoming data to a DOS file so it can be analyzed later.

Access to other screens and functions:

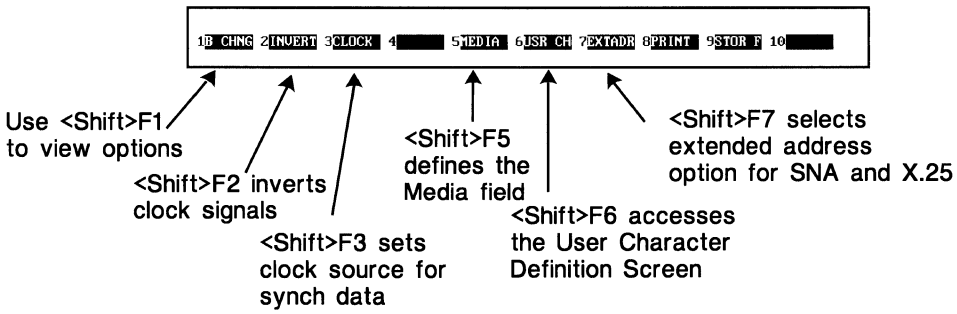
- For the Trap String Definition Screen, press F3 [TRAPS].
- For the Emulation Message Definition Screen, press F5 [EM MSG].
- For the User Character Set Definition Screen, press <Shift>F6 [USR CH].
- To configure the Fox test, press F7 [FOX].
- To load system configuration files, press F9 [LOAD]; press <Shift>F9 [SAVE] to save them.
- To select an option, press F1 [CHANGE] to scroll forward or <Shift>F1 [B CHNG] to scroll backward through the list of options. (Your choice is enabled only when you exit the System Configuration Screen.)
- For Help at any time, press <Alt>F1.

To access options in the Media Status Box:

- To define the Media interface, press <Shift>F5 [MEDIA].
- To set pod power, press F6 [EX POD].
- To invert data and clock signals at the LM2000 connectors, press <Shift>F2 [INVERT]].
- To select clock source (synchronous only), press <Shift>F3 [CLOCK].
- To activate the extended address option for SNA or X.25, press <Shift>F7 [EXTADR].



System Configuration Screen.



<Shift> Function key menu for System Configuration Screen.

To load a file:		To save a file:	
1	Press F9 [LOAD].	1	Press <Shift>F9 [SAVE].
2	Select the desired file from the menu.	2	The desired filename.
3	Press <Enter>.	3	Press <Enter>.

Loading and saving configuration files.

Selecting System Configuration Options

System configuration options allow you to customize the display and monitoring options of the LM2000. You select these options on the System Configuration Screen.

To select configuration options:

After you access the desired field (using <↑> or <↓>), you can select options as follows:

- Use F1 [CHANGE] or <Shift>F1 [B CHNG] to scroll through the list of options and make your selection. (Your choice is enabled only when you exit the System Configuration Screen.)
- Press <Enter> to access the menu box. Use the arrow keys (<↑> or <↓>) or type the first letter of the desired menu item to highlight the option in the menu box. To accept your choice, press <Enter>.

To move between the Communication Configuration and Misc Configuration, use F2 [COM] and F4 [MISC]. The <↑> and <↓> keys also move between these two sections of the screen.

To select Media Status box options:

- Press the appropriate function key as listed at the bottom of the screen, for example, <Shift>F5 [MEDIA] to select options for the Media field.

To implement your selections:

1) Press F10 [EXIT] or <Esc>.
   - ♦ An exit menu box is displayed in the middle of the screen.
2) Select "Save changes and exit" from the exit menu box.
   - ♦ Your system configuration options are enabled; you are returned to the previous screen.

Changing your mind:

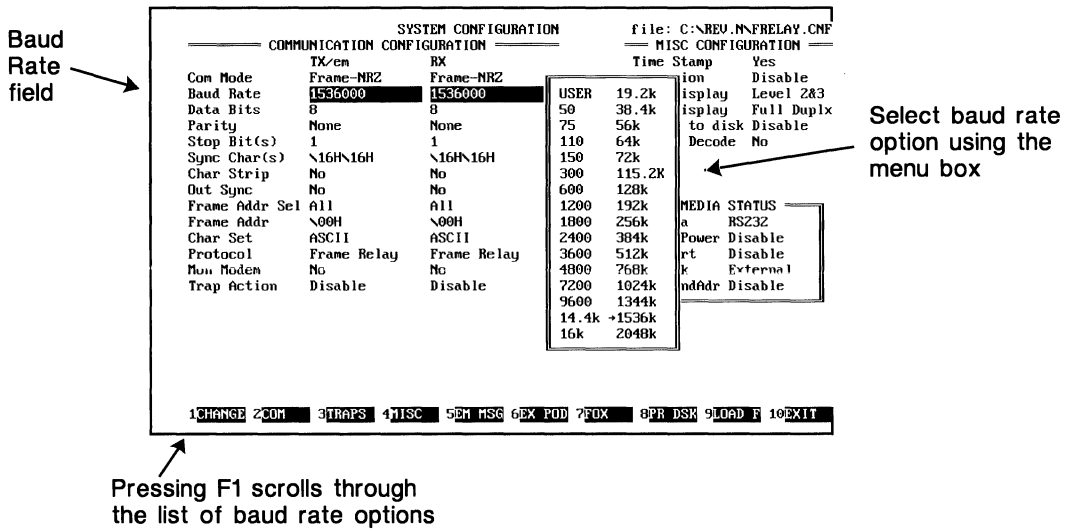
- Select "Exit without saving" from the exit menu box to disable any changes made to the System Configuration Screen; you are returned to the previous screen.
- Select "Don't exit...ESC" from the exit menu box to remain in the System Configuration Screen and continue selecting options. (If you need to clear the exit menu box at any time, press <Esc>.)

Note:

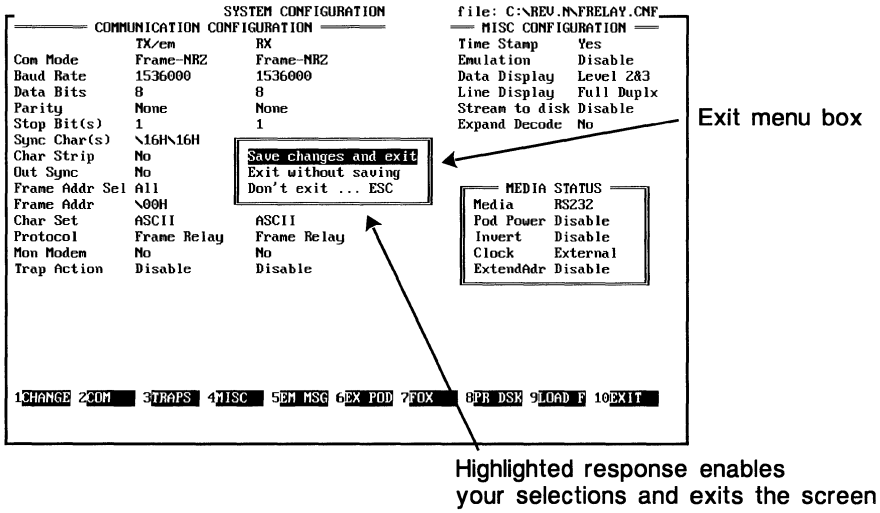
- Configuration files (filename.CNF), customized for your applications, can be saved and loaded later (from this screen or from the DOS command line). This way you do not have to reconfigure the LM2000 each time you use it.

See also:

Chapter 3 for details on loading and saving files.



Using the menu box to select the baud rate.



Exiting the System Configuration Screen.

Select Your Com Mode First

Com Mode is the key field in the Communication Configuration section of the System Configuration Screen. You need to select this option first since it controls the availability of the remaining and relevant communication options for the data line you will be monitoring.

How to access the Communication Configuration:

- Press F2 [COM] from the System Configuration Screen.

Communication Configuration selections

The baud rate, character set, protocol decode, modem lead monitor selection, and trap action are available for *all* communications modes. The remaining fields are unique to certain communication modes.

Select Com Mode options first:

The following Com Mode options are available for both the TX and RX lines; use the right arrow key to define the RX line:

Async	=	Asynchronous
BiSync-bcc	=	Bisynchronous, uses IBM CRC-16 block checking
BiSync	=	Bisynchronous
MonoSync	=	Monosynchronous
Frame-NRZ	=	Frame data; non-return to zero
Frame-NRZI	=	Frame data; non-return to zero inverted

The Com Mode option selected here determines the availability of the remaining communication options; for example, if you choose **Async** for Com Mode, the Sync Char, Char Strip, Out Sync, Frame Addr Sel, and Frame Addr fields are automatically blanked, and the cursor skips these fields.

Moving around the screen:

- Use the up (↑) and down (↓) arrows keys to move from one field to the next.
- Use the right arrow key (→) to access the RX line.
- To access the Misc Configuration options, press F4 [MISC].
- To access the Media Status box options, press the appropriate function key, for example, <Shift>F5 [MEDIA] for the Media field.
- For Help at any time, press <Alt>F1.

Field Name	Com Mode Options*					
Com Mode	**Async**	**BiSync-bcc**	**BiSync**	**MonoSync**	**Frame**	
					NRZ	**NRZI**
Baud Rate	✓	✓	✓	✓	✓	✓
Data Bits	✓		✓	✓	✓	✓
Parity	✓		✓	✓	✓	✓
Stop Bit(s)	✓					
Sync Char(s)		✓	✓	✓		
Char Strip	✓	✓	✓	✓		
Out Sync		✓	✓	✓		
Frame Addr Sel					✓	✓
Frame Addr					✓	✓
Char Set	✓	✓	✓	✓	✓	✓
Protocols	✓	✓	✓	✓	✓	✓
Mon Modem	✓	✓	✓	✓	✓	✓
Trap Action	✓	✓	✓	✓	✓	✓

* - The value you select for Com Mode determines the availability of the remaining field options for the Communication Configuration.
✓- Options available for selected Com Mode.

Communication Configuration - available options.

Setting Up the Communication Configuration

After you select the Com Mode, proceed to enter the remaining communication configuration options, which are presented in two parts. The first part (below) covers the baud rates, bit configurations and parity, and sync specifications; the second part discusses the protocol decodes, trap actions, monitor modes, and frame-address options.

Selecting your baud rate

Baud rate selections range from 50 bits per second (bps) to 2.048 megabits per second (Mbps). You can also enter a user-defined rate. Asynchronous speeds are limited to 115.2 kbps.

When monitoring synchronous lines, the LM2000 will derive the baud rate from the line. However, you will have to set the baud rate if you are emulating DCE.

Selecting Data Bits and Parity

For **Async**, **MonoSync** and **Frame** (**NRZ** and **NRZI**) modes, you must select the number of data bits (5, 6, 7, or 8) and parity. You can specify even, odd, space, mark, or none for parity. For X.25 data you can specify byte size and parity, for example, from a PAD; this is very useful for the Info Char data display.

> **Note:** The parity bit is added to each character when you emulate.

Specifying Stop Bits

For a **Async** line, specify the stop bits as 1 or 2.

Specifying Sync characters

For **MonoSync** and **BiSync** lines, you must specify options for the Sync Char(s), Char Strip, and Out Sync fields.

The Sync Char(s) field requires a user-defined hex value. If the line is configured for parity, your hex entry must also include parity. For example, if the Parity field is set to Even and you want to use 16 hex as the sync character, enter 96 hex in the Sync Char(s) field. (The binary expression for 16 becomes 96 when you set the total number of 1 bits to even, hence, 1001 0110.)

In **BiSync** and **BiSync-bcc** modes, you can enter two different sync characters for each side of the line (TX and RX).

The Char Strip field options are No, Sync, and Hex Byte, which you define. The Out Sync options (1, 2, 4, and No) indicate when to drop sync and go into hunt mode.

Field Name	Options	Description
Baud Rate	50 bps to 2.048 Mbps; USER option	• Monitored data baud rate in bits per second (bps).
Data Bits	5, 6, 7, 8	• Number of bits used to describe a character. (For **Async**, **BiSync**, **MonoSync**, and **Frame-NRZ** and **-NRZI** only.)
Parity	Even Odd Space None Mark	• Checks for even parity (total number of 1 bits is even). • Checks for odd parity (total number of 1 bits is odd). • Checks for parity bit set to 0. • Ignores parity. • Checks for parity bit set to 1. (For **Async**, **BiSync**, **MonoSync**, and **Frame-NRZ** and **-NRZI** only.)
Stop Bit(s)	1, 2	• Number of stop bits used in asynchronous data transmission. (For **Async** only.)
Sync Char(s)	\16H\16H *(User defined)*	• Defines the hex character(s) the LM2000 is to sync on. Normally, hex 16 is the sync character for ASCII and hex 32 for EBCDIC. (For **MonoSync** and **BiSync** only.)
Char Strip	Sync Hex Byte \16H *(User defined)* No	• After the 2nd consecutive sync character (defined above) is captured and displayed, all subsequent sync characters are ignored. Processing resumes with the 1st non-sync character. • After the 2nd consecutive hex value you have entered is captured and displayed, all subsequent matching hex characters are ignored. Processing resumes with the 1st non-matching hex character. • Processes and displays all characters. (For **MonoSync** and **BiSync**.)
Out Sync	1, 2, 4 No	• Indicates number of consecutive pad characters (all bits = 1) that trigger the LM2000 to drop sync and go into hunt mode. Processing resumes after detecting a correct sync sequence. • Processes all pad and noise characters. (For **MonoSync** and **BiSync** only.)

Communication Configuration options.

(continued on next page)

More About Setting Up the Communication Configuration

This discussion covers the remaining communication configuration options--frame address criteria, the line character set, protocol decodes, trap actions, and modem lead monitoring options. (See also "Setting Up the Communication Configuration" immediately preceding.)

Defining frame address criteria

For the **Frame-NRZ** and **-NRZI** modes, you can specify selective monitoring of multidrop SDLC lines. For expanded frame selection options, use F3 [TRAPS] to access the Trap String Definition Screen.

Selecting the line character set

ASCII, EBCDIC, Baudot, and IPARS character sets are available for all Com Modes (**Async**, **BiSync-bcc**, **BiSync**, **MonoSync**, and **Frame-NRZ** and **-NRZI**). You can also define a line character set from the User Character Set Definition Screen, discussed later in this chapter. (Access this screen using <Shift>F6 [USR CH] from the System Configuration Screen.)

Selecting a protocol decode

A wide selection of protocol decodes is available for all Com Modes. They include SDLC m8/SNA, LAPB m8/X25, LAPB, ISDN Primary Rate, and Frame Relay. (For a complete list, see "Selecting a Protocol Decode" next in this chapter.)

In X.25 mode, the multilink address is displayed automatically on the Monitor Screen when the address of the frame is 07h or 0Fh.

Specifying the display option for modem leads changes

You can specify whether or not to display modem lead changes when monitoring data on the Monitor Screen. (The character Δ in the data display indicates a modem lead change.) The DTE (TX) modem leads monitored are DTR, RTS, and TC. The DCE (RX) modem leads monitored are DSR, CTS, and RC.

Defining a trap action

You can define the action the LM2000 will take when it detects on either the TX or RX line. (See "Selecting a Trap Action" later in this chapter.)

See also:

"Analyzing Data: Modem Lead Display" in Chapter 9 and "Monitoring Data: Modem Lead Display" in Chapter 7. And, Chapter 6 for more information about the Trap String Definition Screen.

Field Name	Option	Description
Frame Addr Sel	All Match	• Displays all frames on the line. • Displays only those frames that match the address specified in the Frame Addr field below.
Frame Addr	\00H *(User defined)*	• Specifies the frame address (1st hex byte of frame) to be monitored. **Note:** The Frame Addr Sel field (above) must be set to Match. (For **Frame-NRZ** and **-NRZI** only.)
Char Set	ASCII, EBCDIC, BAUDOT, IPARS0, IPARS1 USER	• Specifies the type of line character set display. • Specifies a unique line character set that you define on the User Character Set Definition Screen (press <Shift>F6 [USR CH] to access). **Note:** Select a character set *before* defining any string-related functions (for example, trap and find strings, emulation messages).
Protocols	Protocol decodes such as X.25, SNA, and Frame Relay are available.	• Specifies the type of Layer 2 and Layer 3 protocol used to decode the frame data. (See "Selecting a Protocol Decode" next in this chapter.)
Mon Modem	Yes No	• Displays modem lead changes on Monitor Screen. • Ignores modem lead changes on Monitor Screen.
Trap Action	Disable Count Before After About About Error Snapshot Snap on err Incl Only Exclude	• Defines the action the LM2000 will take when a trap is detected. (See "Selecting a Trap Action" later in this chapter.)

Communication Configuration options (continued).

Selecting a Protocol Decode

The LM2000 can decode frame data in various protocols. The protocol options are selected in the Communication Configuration section of the System Configuration Screen.

Selecting a Protocol Decode:

The Protocol field specifies the Layer 2 and Layer 3 protocol used to decode frame data.

1) Select the protocol decode from the list of options. In addition to X.25 and SNA protocols, Frame Relay is selected here.
2) Enter your selection in the Protocol field using either the menu box or F1 [CHANGE].
3) Set any other system configuration options at this time.
4) Press F10 [EXIT] or <Esc> to return to the previous screen. If changes have been made, respond to the exit prompts.

Note:

- In X.25 mode, the multilink address is displayed automatically on the Monitor Screen when the address of the frame is 07h or 0Fh.

Option	Description
SDLC m8/SNA	IBM modulo 8
LAPB m8/X25	X.25 modulo 8
LAPB m8/X75	X.75 modulo 8
LAPB m8/QLLC	SNA over X.75 mod 8
LAPB m8/TRANSD	Australian Finance
LAPB m8/SIEMNS	Siemens ISDN mod 8
SDLC m128/SNA	IBM modulo 128
LAPB m128/X25	X.25 modulo 128
LAPB m128/X75	X.75 modulo 128
LAPB m128/QLLC	SNA over X.25 modulo 128
LAPD Q931 CCITT	CCITT ISDN BRI (BlueBook)
LAPD ATT 5E4	AT&T ISDN 5E4
LAPD ATT 5E5	AT&T ISDN 5E5
LAPD ATT 5E6	AT&T ISDN 5E6
LAPD NTI STIM	Northern Telecom ISDN–Stimulus (BCS29)
LAPD NTI FUNC	Northern Telecom ISDN–Functional (BCS32)
LAPD m128/1TR6	German ISDN modulo 128
LAPD m128/FREN	French ISDN modulo 128
LAPD m128/AUS	Australia ISDN modulo 128
LAPD m128/X25	AT&T X.25 on SAPI 0
LAPD ATT PRI	AT&T ISDN Primary Rate Interface
LAPD NTI PRI	Northern Telecom ISDN Primary Rate Interface
LAPD ISDN1	U.S. National ISDN Standard
Frame Relay	CCITT Q.922, ANSI T1.606, ANSI T1.617, ANSI T1.618, LMI, and CLLM

Protocol options.

Selecting a Trap Action

You can select the trap action the LM2000 takes upon detecting a trap in either inbound (RX) or outbound (TX) traffic. The Trap Action field on the System Configuration Screen allows you to define this action.

To select a trap action:

1) Select the trap action you want the LM2000 to take (see the Trap Action options table).
2) Enter your selection in the Trap Action field using either the menu box or F1 [CHANGE].
3) Set any other system configuration options at this time.
4) Press F10 [EXIT] or <Esc> to return to the previous screen. If changes have been made, respond to the exit prompts.

Defining trap strings:

To define the trap strings the LM2000 will be searching for, you need to go to the Trap String Definition Screen; press F3 [TRAPS]. (For details on this screen, see Chapter 6 of this manual.)

Notes:

- Separate trap actions and strings can be defined for each side of the line. You can "**Count** a string" on TX and "stop the buffer **About**" for a different string on RX.
- If both trap actions affect the buffer, the first to be recognized will take effect and disable the other.
- The traps you define on the Trap String Definition Screen are saved when you save a system configuration (.CNF) file. See "Selecting System Configuration Options" earlier in this chapter.

See also:

Chapter 6, "Data Traps and Filters."

Option	Description
Disable	All traps are disabled, even if defined. The actual trap string, however, is retained. (Default)
Count	Counts the number of times frames containing the specified trap(s) are encountered.
Before	Stops data accumulation in the buffer as soon as a match is found.
After	Starts data accumulation in the buffer as soon as the LM2000 recognizes a match. Data accumulation continues until the buffer is full.
About	Fills half of the buffer with traffic occurring before the match, and half of the buffer with traffic occurring after the match.
About Error	Traps on error (parity, framing, or CRC). Once an error is detected, the LM2000 begins searching for the defined trap string. When the string is detected, half the buffer is filled with traffic before the match and half after the match. To trap immediately after an error is detected, define the trap string as a single wildcard.
Snapshot	Saves the most current 2KB (1KB if time-stamping is enabled) of data to a buffer file on disk. The snapshot occurs when a trap string is detected.
Snap on err	Saves the most current 2KB (1KB if time-stamping is enabled) of data to a buffer file on disk. The snapshot occurs when an error is detected.
Incl only	*For frame-type protocols only.* Causes the LM2000 to process only those frames that match the criteria specified on the Trap String Definition Screen.
Exclude	*For frame-type protocols only.* Processes all but those frames that match the criteria specified on the Trap String Definition Screen.

Trap Action options.

The Miscellaneous Configuration Options

The Miscellaneous Configuration consists of additional line monitoring options, including data display and data capture to disk.

Using time-stamping

The LM2000 can time-stamp each character and modem change as they are captured in the buffer. Elapsed time between any two events can be determined in view buffer mode (F5 from the Monitor Screen or F4 from the Main Menu). Time-stamping must be enabled before capturing data; it cannot be set for data already in the buffer.

Specifying Emulation

You can specify the line on which emulation is to occur — either the DCE or the DTE. Although transmission may occur on either line, you define the actual transmission characteristics in the TX/em column of the System Configuration Screen.

When emulating synchronous data the following applies: for DCE, TX and RX clocks (pins 15 and 17) are also driven; for DTE, clock signals are expected on pins 15 and 17. External TX clock signal is provided on pin 24 (ETC).

Specifying the Data Display and Line Display modes

The Data Display field specifies how real-time data is displayed on the Monitor Screen; the format is defined in the Line Display field (see the Miscellaneous Configuration Options table).

Using Stream to Disk

You can capture incoming data directly to a DOS file by specifying the desired Stream to Disk option (see the Miscellaneous Configuration options table).

Using Expand Decode

In Frame mode, you can activate the expand decode feature. Entering **Yes** activates complete Layer 3 decode of the monitored data as viewed on the Monitor Screen.

See also:

"Selecting the Data Display Mode" in Chapter 9.

Field Name	Option	Description
Time Stamp	Yes No	• Activates time-stamping (buffer holds half as many characters when time-stamping is on). • Time-stamping not active. **Note:** Changing this option causes any data currently in the buffer to be lost.
Emulation	Disable DTE DCE	• Emulation disabled. • Transmits data on pin 2. Modem leads DTR and RTS are set high. • Transmits data on pin 3. Modem leads DCD, DSR, and CTS are set high.
Data Display	Hex Char Mnemonic Layer 2 Layer 2&3 Info frame Info char Info hex	• Specifies how real-time data is displayed on the Monitor Screen. (See "Selecting Data Display and Line Display Modes" following in this chapter.)
Line Display	Full Duplex Half Duplex Data/modem	• Specifies how the Monitor Screen is formatted for data display. (See "Selecting Data Display and Line Display Modes" following in this chapter.)
Stream to disk	Disable Stop/Full Stop/Block Wrap/Block	• Allows you to stream incoming data directly to a disk file. (See "Setting Up Data Capture to Disk" later in this chapter.)
Expand Decode	Yes No	• Activates complete Layer 3 decode of the monitored data on the Monitor Screen. (For Frame modes only.)

Miscellaneous Configuration options.

Selecting Data Display and Line Display Modes

You can specify the way the Monitor Screen displays data using the Data Display and Line Display fields on the System Configuration Screen.

Selecting the data display mode:

The Data Display field specifies how real-time data is displayed on the Monitor Screen, for example, you can display data in hex. (You can also specify the data display mode directly from the Monitor Screen.)

1) Select the desired data display mode (see Data Display options table).
2) Enter your selection in the Data Display field using either the menu box or F1 [CHANGE].
3) Proceed to select the Line Display option (below).
4) Press F10 [EXIT] or <Esc> to exit the screen at any time.

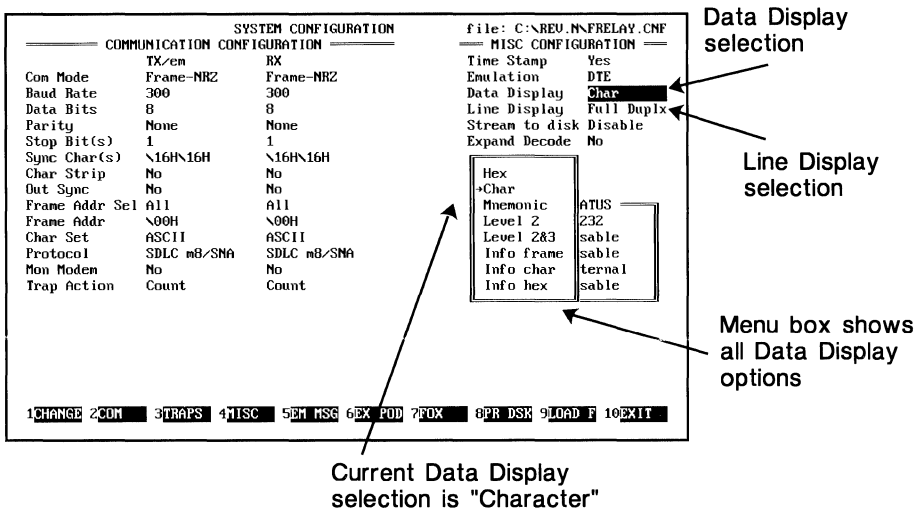
Selecting the line display mode:

The Line Display field specifies how the Monitor Screen is formatted for data display (full duplex, half duplex, or as a graphic display of modem lead data).

1) Select the desired line display mode (see Line Display options table).
2) Enter your selection in the Line Display field using either the menu box or F1 [CHANGE].
3) Continue to set other system configuration options at this time or press F10 or <Esc> to exit the screen and return to the previous screen.

See also:

"Selecting the Data Display Mode" in Chapters 7 and 9.



Selecting the Data Display mode on the System Configuration Screen.

Option	Description
Hex	Displays monitored data as hexadecimal bytes.
Char	Displays monitored data in character mode, depending on current character set (e.g., ASCII).
Mnemonic	Displays control characters of the current character set as standard mnemonics.
Layer 2	Decodes and displays Layer 2 information.
Layer 2&3	Decodes and displays Layer 2 (supervisory or unnumbered) and Layer 3 (information) frames.
Info frame	Displays information frames only, ignoring supervisory and unnumbered frames.
Info char	Displays information frame data in Layer 3 as characters.
Info hex	Displays the specific hex representation of received data in Layer 3.

Data Display options.

Option	Description
Full Duplex	Displays data on two separate lines (one for TX and one for RX) on the Monitor Screen.
Half Duplex	Displays TX and RX data on the same line in order of appearance on the Monitor Screen.
Data/modem	Provides a graphic (oscilloscope-type) display of the modem lead states on the monitored line for both the Monitor and View Buffer screens.

Line Display options.

Setting Up Data Capture to Disk

You can capture incoming data directly to a DOS file. This allows you to analyze it at another time (the file can also be downloaded to another PC). Options include capturing data until all the free disk space is filled; until a certain number of blocks are filled; or saving only the most recently captured data. The LM2000 also provides for data integrity in the event of disk overflow.

Knowing your the stream to disk options:

The following stream to disk options are available:

Stop/Full - Streams to disk until stopped by the user or until all free disk space is filled.

Stop/Block - Streams to disk until a user-defined number of blocks has been captured. Each block contains 32KB of captured data (enabling time-stamping reduces the number of characters by one half).

Wrap/Block - This disk wrap option is similar to **Stop/Block** except that when the captured data exceeds the allocated space, the LM2000 overwrites the disk file, saving only the most recently captured data.

For example, entering **10** in the Wrap on Block field causes the LM2000 to rewrite the disk file when the allocated space is filled, saving only the most recent 320K (10 blocks times 32KB) of captured data.

Disable - No data is written to disk. (Default)

Activating stream to disk options:

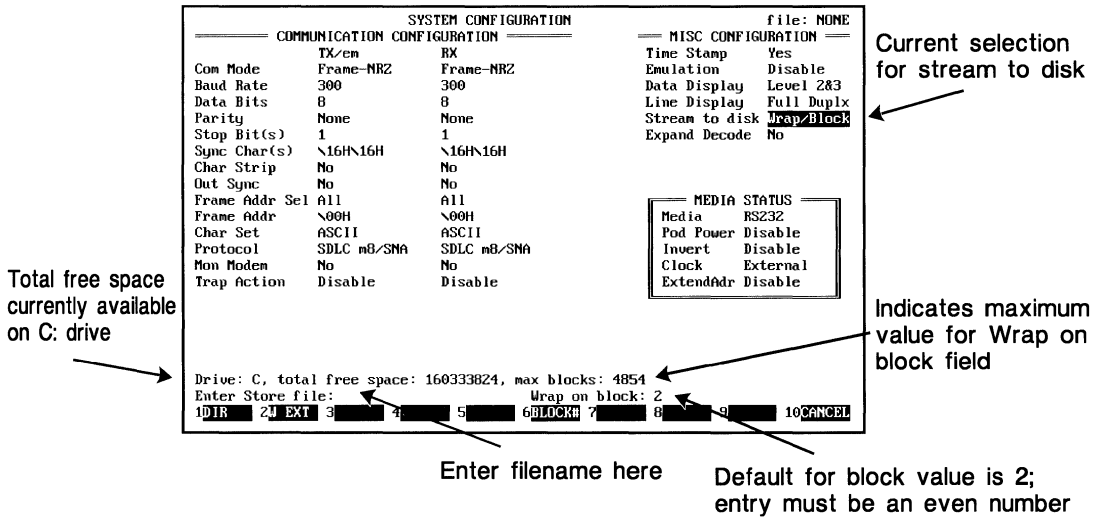
1) Enter your selection (see above) in the Stream to disk field on the System Configuration Screen.
   - The LM2000 displays the total free space and maximum number of available blocks; it prompts you for a filename.
2) Enter any legitimate DOS filename or path, without an extension. The program automatically supplies a .BUF extension.
3) For the **Stop/Block** and **Wrap/Block** options, press F6 [BLOCK#] to enter a value in the BLOCK# field (default is 2). Be sure to enter the block value *before* you enter the filename.

> **Note:** The maximum number of blocks you can enter depends on the size of your hard drive. See the "max blocks:" value directly above the Wrap on block field.

4) Press <Enter> to accept the filename and the block value.
5) Continue to set other system configuration options or press F10 or <Esc> to exit.

Notes:

- When capturing data to disk, the "DSK_OVRN" (overflow) message may occur if your hard disk is too slow or the data rate is too high. Note that the data stream will not be corrupted or inconsistent; the LM2000 captures at least 2MB of data to your hard drive, regardless of the data rate or disk speed.
- The use of filtering reduces the amount of data, thereby reducing the likelihood of disk overrun. (See Chapter 6, "Data Traps and Filters.")
- If stream to disk is active and you exit from the Monitor Screen, the file is closed. Upon returning to the Monitor Screen, the message "Buffer file already exists. Overwrite? (y/n)" is displayed. If the response is **YES**, stream to disk continues (overwrites from the beginning of the file). If **NO**, the data currently in the file is saved, however, you must reactivate the stream to disk option (on the System Configuration Screen).
- When loading a system configuration (.CNF) file, the stream to disk option is *not* automatically enabled. You must reenter your stream to disk option.



Stream to disk setup for Wrap/Block option.

Selecting Media Status Box Options

The Media Status Box allows you to select various system options, such as interface type, data and clock signal inversion, clock source, and extended address. You can also access the T-Pod Remote Control Screen using the interface options.

Using the Media Status Box

Each field in the Media Status Box is accessed using individual function keys as displayed at the bottom of the System Configuration Screen (press <Shift> to view additional selections). The function key labels correspond to the field names in the Media Status Box.

Selecting the interface media:

To define the Media field, press <Shift>F5 [MEDIA]. The Interface Media box displays a list of options: **RS232, V.35, V.10, V.11, RS422, RS423,** and **T-POD.** (When you define the LM2000's interface to the network, you also set the display format for the LM2000's break-out box.)

> **CAUTION!**
>
> Be sure your selected Media interface option matches your actual media interface. An incorrect match may disrupt the network.

T-Pod Remote Control Screen

In order to access the T-Pod Remote Control Screen, you must first select **T-POD** in the Media field.

Setting pod power:

You can either **Enable** or **Disable** power for external interface pods, such as the T-Pod. To select the Pod Power option, press F6 [EX POD].

Inverting data and clock signals:

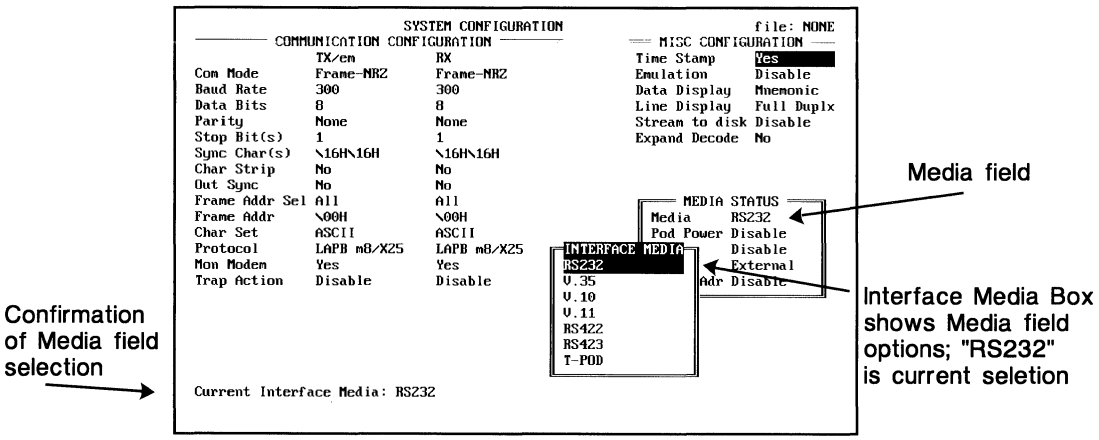
You can invert the data and clock leads at the network connector (DB25) using the <Shift>F2 [INVERT] key. Selecting **Enable** logically inverts the signals on pins 2, 3, 15, and 17.

Setting the clock source:

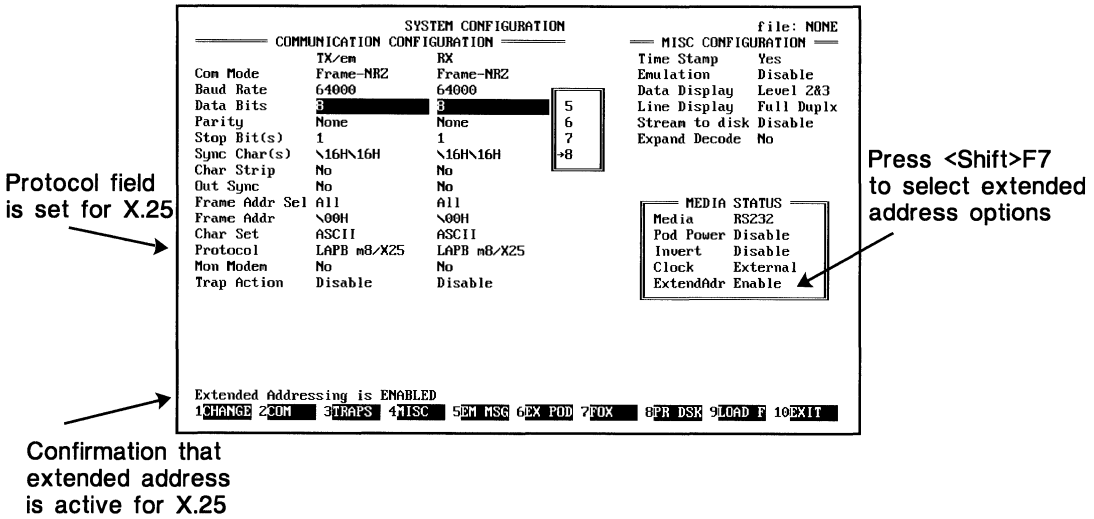
Monitoring synchronous data requires that you set the clock source. Use <Shift>F3 [CLOCK]. If clocking is **Internal**, timing is derived from the data. (You must also set the Baud Rate field.) If clocking is **External**, the timing used from the TX and RX clock signals is provided from the line being monitored.

Activating extended address for SNA and X.25:

To activate the extended address option, press <Shift>F7 [EXTADR]. When you select **Enable** the LM2000 assumes a 2-octet address field for each frame (rather than the 1-octet address field when extended address is set to **Disable**).



Selecting the interface media; <Shift>F5 accesses the Interface Media Box.



Selecting the extended address option.

Three Methods for Defining an Emulation Message

The LM2000 allows you to specify a test message that can be emulated on a line. You can define the emulation message in three different ways: enter the message directly on the Emulation Definition Screen; export it to the Emulation Definition Screen from the View Buffer Screen; or use the Fox test from the System Configuration Screen.

Using the Emulation Message Definition Screen

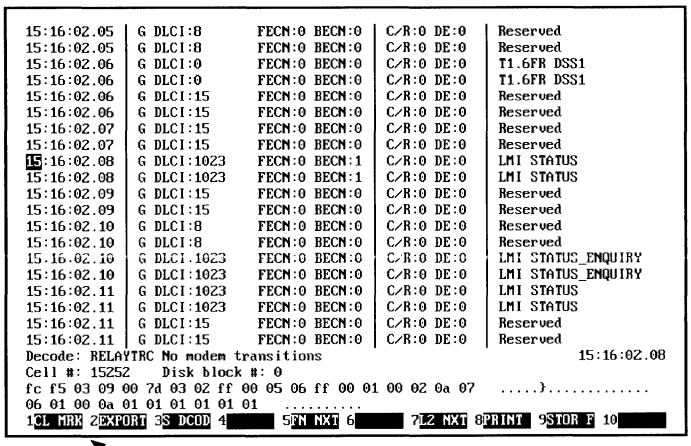
From the System Configuration Screen, press F5 [EM MSG] to access the Emulation Message Definition Screen. You can then enter a test message in any of several formats and select the number of times the message will be transmitted. For more information on defining the message, see "Screen Overview: Emulation Message Definition" next in this chapter.

Using the export function from the View Buffer Screen

Emulation patterns can be based on data captured from live traffic. Any frame in the capture buffer can be copied automatically into the Emulation Message Definition Screen using <Shift>F2 [EMUL] from the View Buffer Screen. For details on using the export function, see "How to Export Frames for Emulation" in Chapter 9.

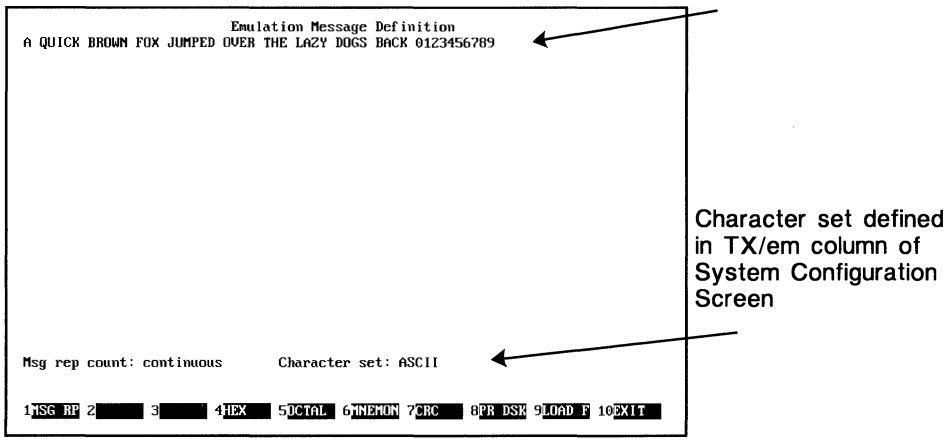
Using the Fox Test

From the System Configuration Screen, press F7 [FOX] to load the "A QUICK BROWN FOX..." message to the Emulation Message Definition Screen and configure the system to emulate DTE. The confirmation message "Fox test Configured" appears at the bottom of the screen, and the Trap Action field is automatically set to **Count**. Press F5 [EM MSG] to view the Fox message on the Emulation Message Definition Screen; also select the number of times the message is to be transmitted (the default is 1).



Press <Shift> F2 to export
a test message to the Emulation
Message Definition Screen

Using the export function from the View Buffer Screen.



Emulation Message Definition Screen with Fox test message defined.

Screen Overview: Emulation Message Definition

The Emulation Definition Screen allows you to define the emulation message and specify the number of times it should be sent.

How to access this screen:

- Press F5 [EM MSG] from the System Configuration Screen.

Main functions of this screen:

- Allows you to specify test messages for emulation. The maximum message length is 512 characters or the end of the screen entry area (20 lines), whichever occurs first.
- Message transmission is based on how certain fields are set on the System Configuration Screen. The message format depends on the baud rate, parity, etc., specified in the TX/em column under Communication Configuration. Transmission occurs on the DCE line (RX) or DTE line (TX) as defined in the Emulation field.
- Message summary information includes length, LRC, and CRC.

Entering your message parameters:

Msg rep count - Number of times the message will be transmitted:
1 through **32767**
0 = continuous

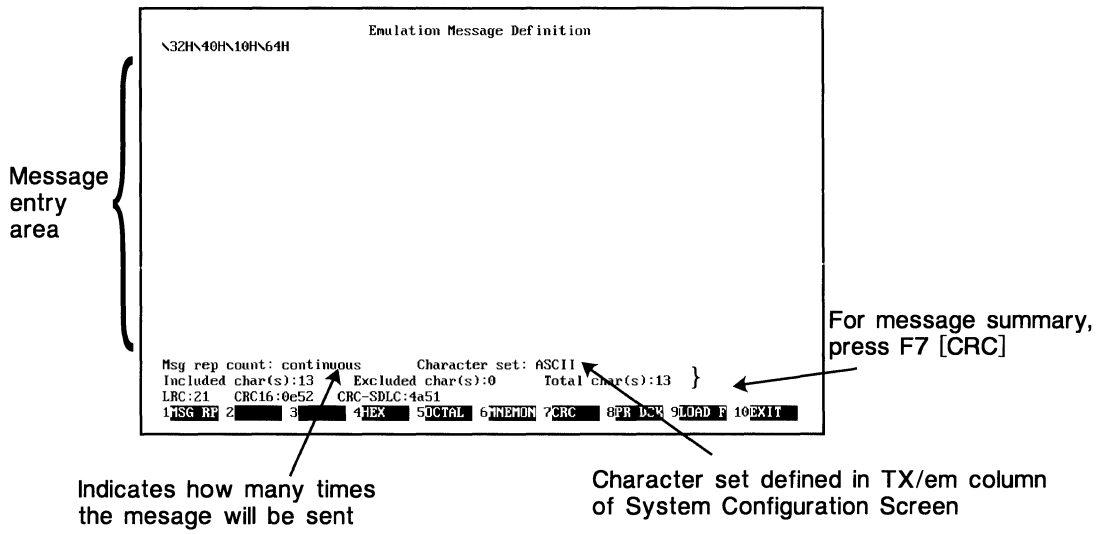
Character set - The currently selected TX/em character set (e.g., ASCII) on the System Configuration Screen.

Access to other screens and functions:

- To load an emulation message from a file, press F9 [LOAD]. To save an emulation message, press <Shift>F8 [STOR F]. The file created, *filename*.EML, can be loaded at another time. This way you do not have to redefine the message.
- To print a copy of the current screen to disk, press F8 [PR DSK].
- Press F10 [EXIT] or <Esc> to exit the screen and return to the previous screen.
- For Help at any time, press <Alt>F1.

See also:

Chapter 13, "PowerScript Custom Test Builder and the PowerScript Library," for more about advanced emulation features.



Emulation Message Definition Screen.

Function Key	Description
F1 [MSG RP]	Prompts you for the number of times the message is to be transmitted; enter a value from **1** through **32767** or **0** for continuous.
<Shift>F2 [CL MSG]	Clears the emulation message displayed on the screen.
F4 [HEX]	Displays **00**H with the cursor positioned on first 0; replace the two zeros with the desired hex value.*
F5 [OCTAL]	Displays **000**O with the cursor positioned on first 0; replace the three zeros with the desired octal value.*
F6 [MNEMON]	Displays **xx**\ with the cursor on the first x; replace the two x characters with the desired mnemonic entry.*
F7 [CRC]	Calculates the CRC from the beginning of the message to the current cursor position and displays it on lines 23 and 24.
<Shift>F7 [CRC EX]	Excludes character(s) from CRC calculations; the character immediately to the left of the cursor is excluded and will appear in reverse video in message transmission.
* - A beep indicates an invalid character was entered.	

Function Keys for defining an emulation message.

Screen Overview: User Character Set Definition

The User Character Set Definition Screen allows you to define a unique character set (other than ASCII, etc.) for the screen display of monitored data.

How to access this screen:

- Press <Shift>F6 from the System Configuration Screen.

Main functions of this screen:

- Defines unique character sets besides ASCII, EBCDIC, IPARS, or Baudot for displaying monitored data on the screen.
- Defines a unique character set for keyboard values (what to use for emulation, trap, and find functions).

How to Define a User Character Set

Use the up (↑), down (↓), left (←), and right (→) arrow keys to position the cursor on the desired hex byte (00-FF). Enter any displayable character; this establishes a mapping between the byte and the character. When the byte is monitored, the mapped character is displayed. When the character is entered from the keyboard, the mapped byte is used.

You can also map the byte as "undefined" or "control." Then the special symbols (µ or Ç) will be displayed upon monitoring the byte.

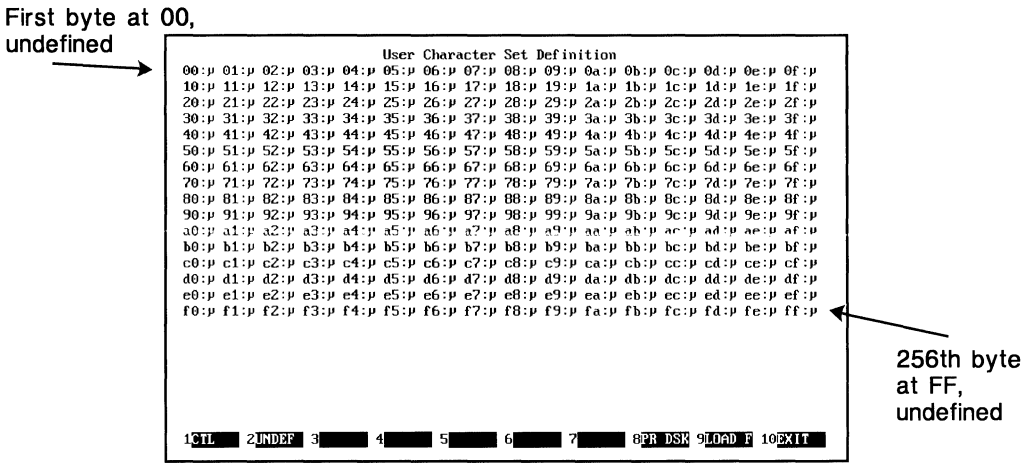
Hexadecimal, octal, and character displays are available from the View Buffer Screen using F6 [DISPLY]. Mnemonic display is not supported for user character sets.

Access to other screens and functions:

- To load a user character set from a file, press F9 [LOAD]. To save a character set that you have defined, press <Shift>F8 [STOR F]. The file created, *filename*.USR, can be loaded at another time. This way you will not have to redefine your character set.
- To print a copy of the current screen to disk, press F8 [PR DSK].
- Press F10 [EXIT] or <Esc> to exit the screen and return to the previous screen.
- For Help at any time, press <Alt>F1.

Note:

- You can specify a character only *once* on the User Character Set Definition Screen. For example, entering **A** in the 00: field (the first byte) negates an **A** in any of the other fields.



User Character Set Definition Screen – undefined.

Function Key	Description
F1 [CTL]	Marks the hex value the cursor is on as a control byte. The control character symbol Ç will be displayed for this value whenever the display is in character mode; in other modes, it displays the hex or octal value.
F4 [UNDEF]	Marks the hex value the cursor is on as an undefined byte. The undefined character symbol µ will be displayed for this value whenever the display is in character mode; in other modes, it displays the hex or octal value.

Function keys for defining a user character set.

More About Frame Relay Configuration

If you select Frame Relay options on the System Configuration Screen, the LM2000 automatically loads the frame relay configuration parameters file (by default *config*.FR). These parameters pertain to data capture and circuit performance of the Data Link Connection Identifiers (DLCIs). The Circuit Action Map allows you to add or modify this information about a DLCI. (See "Screen Overview: Circuit Action Map" following in this chapter.)

Before you begin:

Before attempting to access the Circuit Action Map, be sure to set the following System Configuration Screen fields as shown below.

Field		Option
Com Mode	=	**Frame-NRZ** or **Frame-NRZI**
Protocol	=	**Frame Relay**

How to access the Circuit Action Map:

1) From the System Configuration Screen, press F3 [TRAPS].
   - The LM2000 displays the Trap String Definition Screen.
2) From the Trap String Definition Screen, Press F3 [L 2&3].
   - The LM2000 displays the Circuit Action Map.

Moving around the Circuit Action Map:

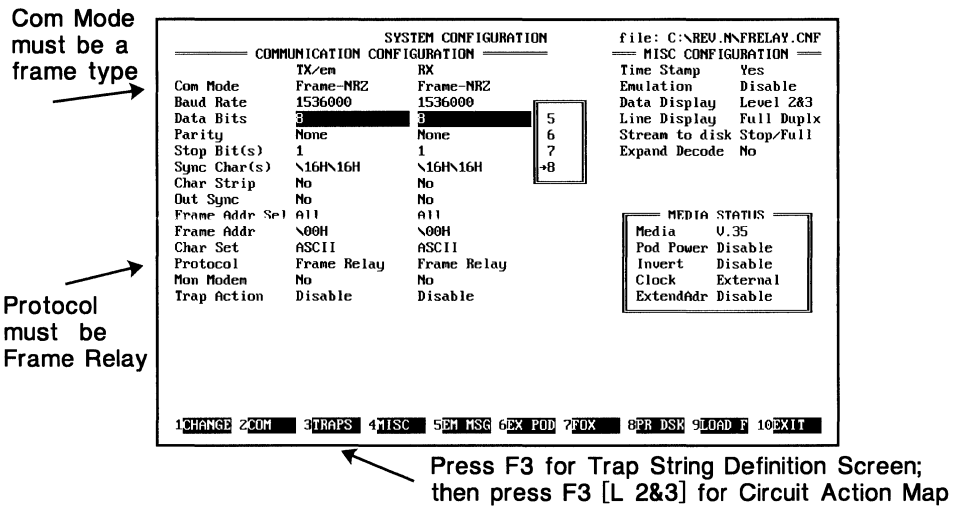
- Position the cursor on the desired DLCI within the Circuit Action Map matrix. Use the arrow keys to move one position or use <Tab> and <Shift><Tab> to move 10 positions at a time.
  - The current DLCI number is displayed in the DLCI field at the bottom section of the screen.
- You can add or modify DLCI configuration parameters using F1 [EDIT].

Notes:

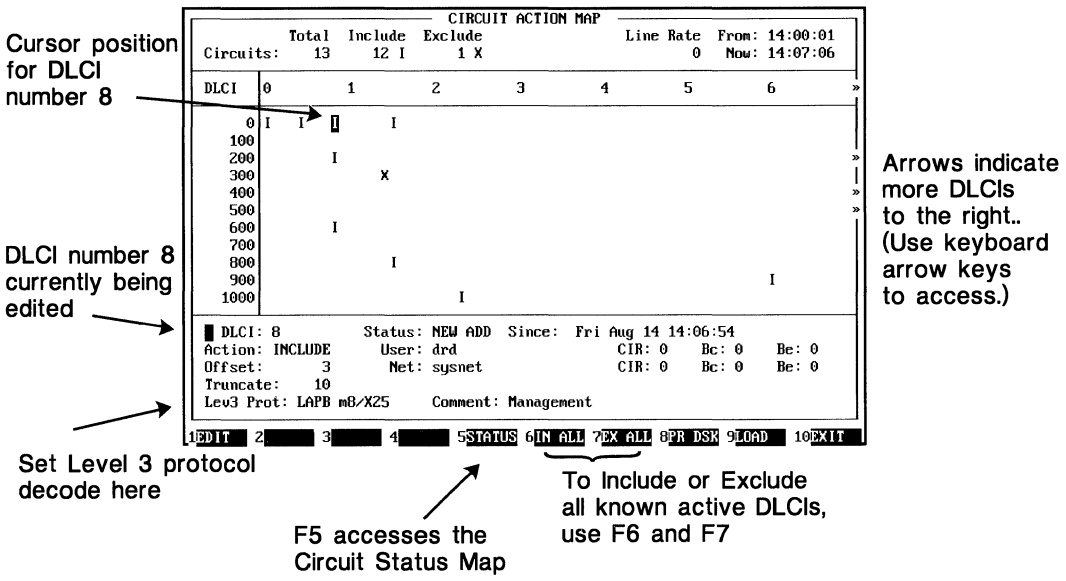
- On the Circuit Action Map, you can change the Action field when the cursor is positioned on the DLCI: either use the spacebar to toggle between **I** and **X** (include and exclude, respectively); or type **I** or **X** at the cursor position.
- Use F5 [STATUS] to access the Circuit Status Map for a quick overview of the status of each configured DLCI.

See also:

"Screen Overview: Circuit Action Map" next in this chapter. Chapter 8, "Frame Statistics," for more on using the Circuit Action Map.



System Configuration Screen setup for Frame Relay.



Circuit Action Map.

Screen Overview: Circuit Action Map

The Circuit Action Map allows you to filter (exclude) DLCIs from data capture or enter information about a DLCI. You can define the location of the Layer 3 user data in the frame, the protocol decode used for that user data, and indicate the Committed Information Rate (CIR) for DLCI CIR utilization statistics.

Selecting a DLCI:

Selecting a DLCI can be done in two ways: a) position the cursor on the desired DLCI within the Circuit Action Map using the arrow keys; or b) use F1 [EDIT] and simply enter the number of the desired DLCI in the field.

Editing Current DLCI information:

You can add or modify a current DLCI configuration. Use F1 [EDIT] to enter the following information:

DLCI = Frame relay's data link connection identifier.

Action = You can either **Include** or **Exclude** a DLCI from data capture.

Offset = Number of octets after the Frame Relay header (DLCI address field) to begin looking for Layer 3 user data (e.g., X.25 and SNA).

Truncate = Number of octets to be included in the data capture for the DLCI. Those octets exceeding the number specified are discarded thereby reducing processing time, stream to disk, etc.

Lev3 Prot = Layer 3 protocol used to measure the performance of Layer 3 user data carried by Frame Relay, for example, LAPB m8/X25.

Status = Current DLCI's status, which can be set or modified by the user and/or will be automatically measured. Status is updated by LM2000 based on live physical line. The options are UNKNOWN, DELETED, ACTIVE, and NEW ADD.

USER = User identification for the circuit.

Net = Network carrier and/or destination identification for the circuit.

Since = Time of last update of the configuration (.FR) file.

CIR = Committed Information Rate (CIR); the number of bits per second that a frame relay network agrees to carry for a DLCI. (See Notes below.)

Bc = Committed Burst Rate; largest number of consecutive bits per second carried by the network without discarding data. (See Notes below.)

Be = Excess Burst Size; largest number of consecutive bits carried by the network with the possibility of some data being discarded. (See Notes below.)

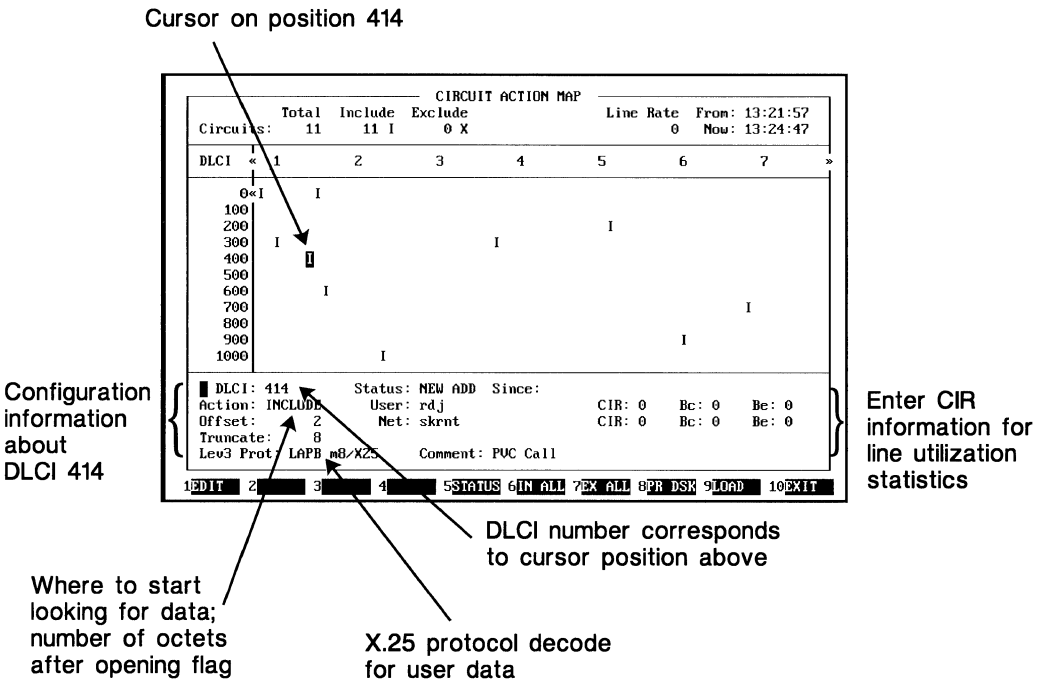
Comments = User information about the current DLCI.

Notes:

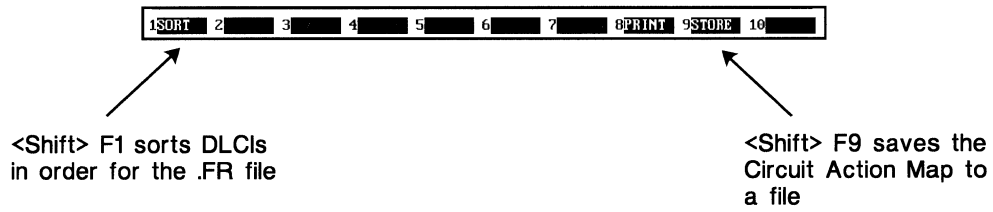
- For asymmetric bandwidth management service, the parameters CIR, Bc, Be on the User side (from user to network) may be different from those on the Network side (from network to user).
- To obtain CIR utilization statistics, you must enter information in the CIR field.
- Frame relay configuration parameters can be loaded from or saved in files (*filename*.FR), using F9 [LOAD] or <Shift> F9 [SAVE].

See also:

"More About Frame Relay Configuration," earlier in this chapter.
Chapter 8, "Frame Statistics," for more on using the Circuit Action Map.



Circuit Action Map displays typical DLCI configuration.



<Shift> Function key menu for Circuit Action Map.

Chapter 5
Typical Configuration Settings for the LM2000

- Asynchronous Configuration Settings
- Bisynchronous Configuration Settings
- X.25 Configuration Settings
- V.35 Configuration Settings
- T-Pod Configuration Settings
- Frame Relay Configuration Settings

Asynchronous Configuration Settings

This discussion provides information about setting up an asynchronous (async) configuration when running the LM2000. You select the options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Setting the Baud Rate:

- Asynchronous speeds are limited to 115.2K bps. The typical async modem speed is 2400 bps.

Assigning the Character Set:

- The Char Set field for asynchronous transmission is typically set to **ASCII** or **USER**.

Selecting the Line Display:

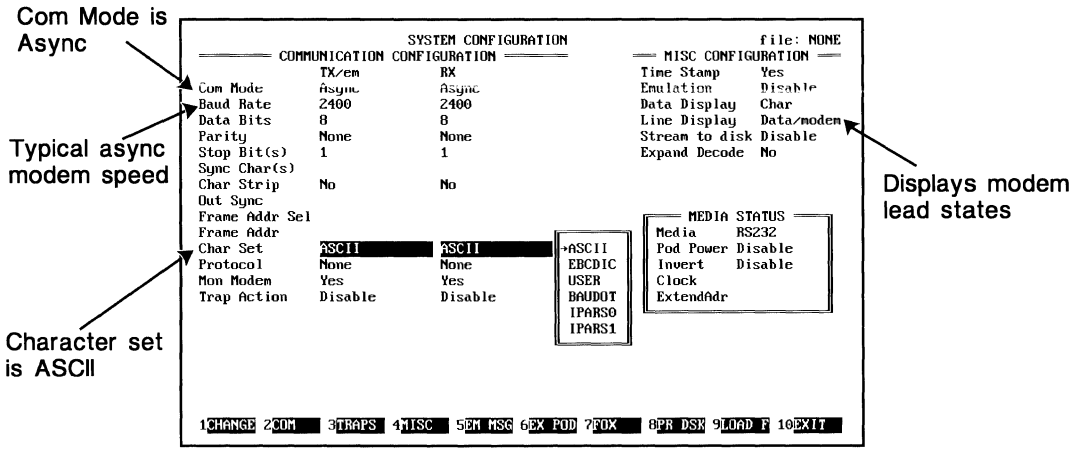
- When the Line Display field is set to Data/modem, the LM2000 provides a graphic (oscilloscope-type) display of the modem lead states on the monitored line for both the Monitor and View Buffer screens.

Notes:

- If you observe many data errors while monitoring the line, this may indicate that parity is defined incorrectly or the ribbon cable you are using is longer than the recommended three feet.

See also:

For details on defining parity, see "Setting Up the Communication Configuration" in Chapter 4.



Setting up an asynchronous configuration on the System Configuration Screen.

Bisynchronous Configuration Settings

This discussion provides information about setting up a bisynchronous (bisync) configuration when running the LM2000. You select the options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Selecting Data Bits and Parity:

- For bisynchronous transmission, the following settings are typical:

  Data Bits = **8**
  Parity = **None**

  Or,

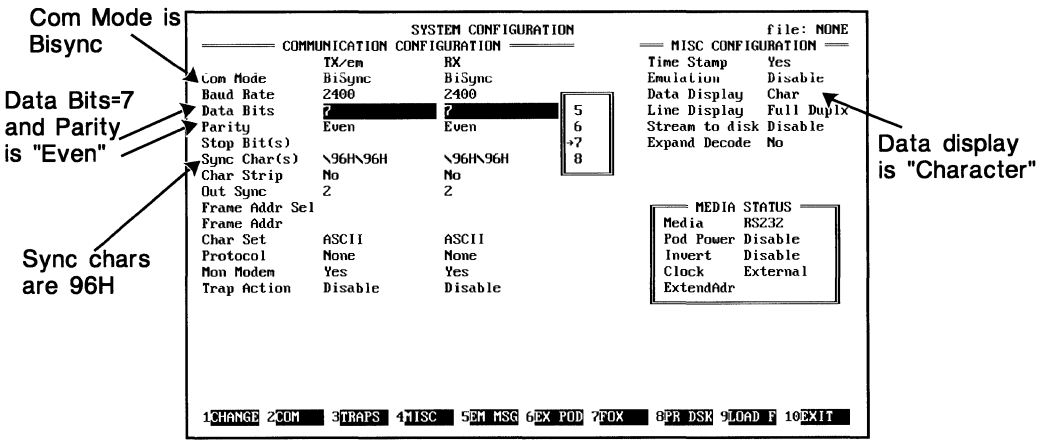
  Data Bits = **7**
  Parity = **Even**

Setting the Sync Char(s):

- The Sync Char(s) field requires a user-defined hex value (\16h\16h is typical); it tells the LM2000 which characters to sync on. If the line is configured for parity, be sure to include the parity bit when you define the Sync Char(s) field. For example, if the Parity field is set to **Even** and you want to use 16 hex as the sync character, enter **96** hex in the Sync Char(s) field. (The binary expression for 16 becomes 96 when you set the total number of 1 bits to even, therefore, 1001 0110.)

Selecting the Data Display:

- The majority of users with VGA/EGA monitors prefer the Data Display field set to **Char** for bisync monitoring.



Setting up a bisynchronous configuration on the System Configuration Screen.

X.25 Configuration Settings

This discussion provides information about configuring for X.25 when running the LM2000. You select the options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Setting the Baud Rate:

- When monitoring synchronous lines, the LM2000 derives the baud rate from the line (on pins 15 and 17). However, you will have to set the baud rate if you are emulating DCE. The typical baud rate setting for X.25 is 19,200 bps.

Setting the Protocol field:

- The typical X.25 setting for the Protocol field is **LAPB m8/X25**. Notice that modulo 8 is specified.

  Hint: If the NR and NS values on the View Buffer Screen range from 0 to 7, you are probably running modulo 8.

Selecting the Data Display:

- When using an X.25 protocol, typically you would set the Data Display type to **Layer 2&3**.

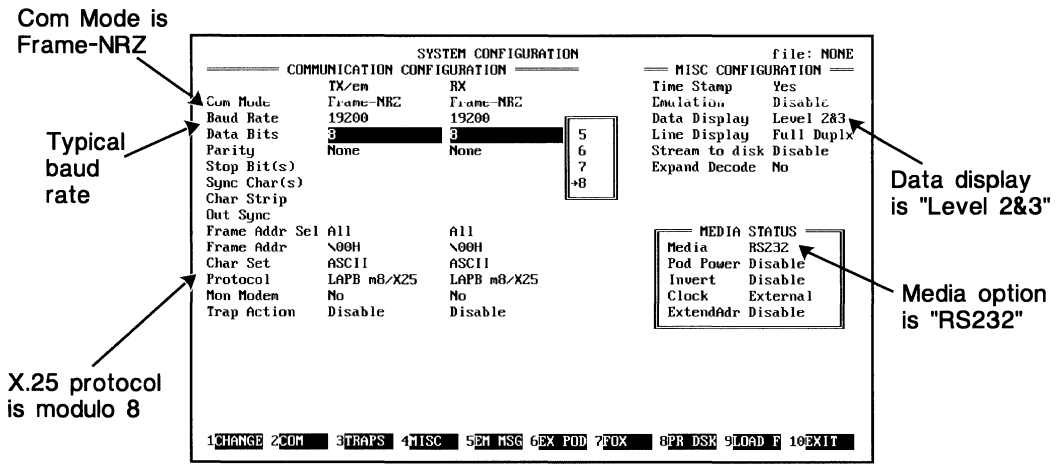
Setting the interface media option:

- For X.25, the typical interface media would be **RS232** or **V.35**. To define the Media field, press <Shift>F5 [MEDIA].

  Remember that when you define the LM2000's interface to the network, you also set the display format for the LM2000's break-out box.)

CAUTION!

Be sure the selected Media interface option (e.g., **RS232**) matches the actual media interface. An incorrect match may disrupt the network.



Setting up for X.25 on the System Configuration Screen.

V.35 Configuration Settings

This discussion provides information for V.35 when running the LM2000. You select the options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Selecting the Com Mode:

- In most V.35 environments, **Frame-NRZ** is the usual Com Mode field selection; **SDLC m8/SNA** is the Protocol field selection.

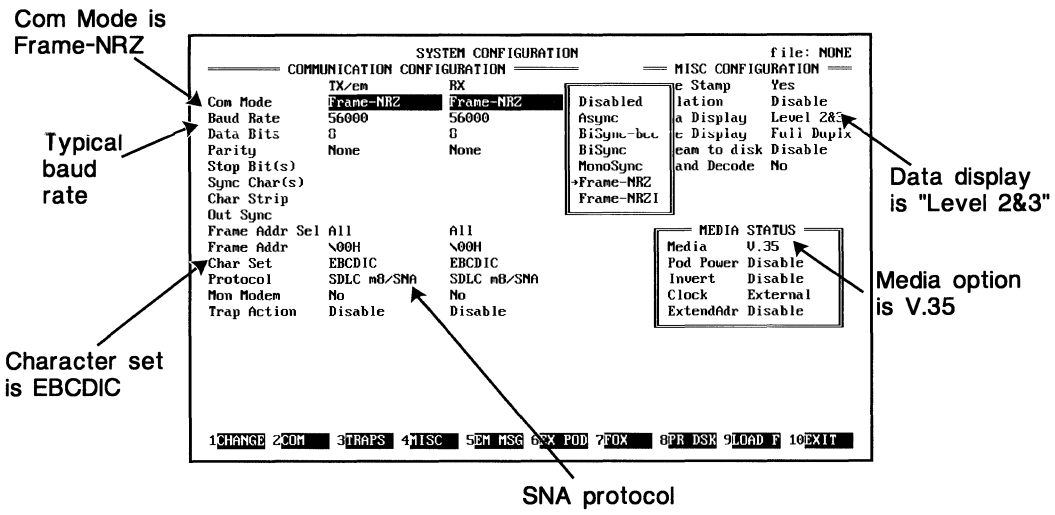
Selecting the character set:

- The Char Set field is typically set to **EBCDIC** in a V.35 environment.

Setting the interface option:

- To define the Media field, press <Shift>F5 [MEDIA]. Select **V.35** from the Interface Media box. Remember that your media field selection also establishes the display format for the LM2000's break-out box.

> **CAUTION!**
>
> Be sure the Interface Media option (**V.35**) you have selected matches the actual media interface you are using. An incorrect match may disrupt the network.



Setting up for V.35 on the System Configuration Screen.

T-Pod Configuration Settings

This discussion provides information about configuring the LM2000 when using T-Pod™ T1 Interface and Tester. You select the setup options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Setting the Com Mode:

- In a T-1 environment, the Com Mode field would typically be set to **Frame-NRZ** or **Frame-NRZI** (which inverts the bits).

Selecting the Data Display:

- For the T-Pod, the Data Display field is usually set to **Level 2&3**.

Before you begin:

- Before using the T-Pod, set the Media field on the System Configuration Screen to **T-POD**; use <Shift>F5 [MEDIA].

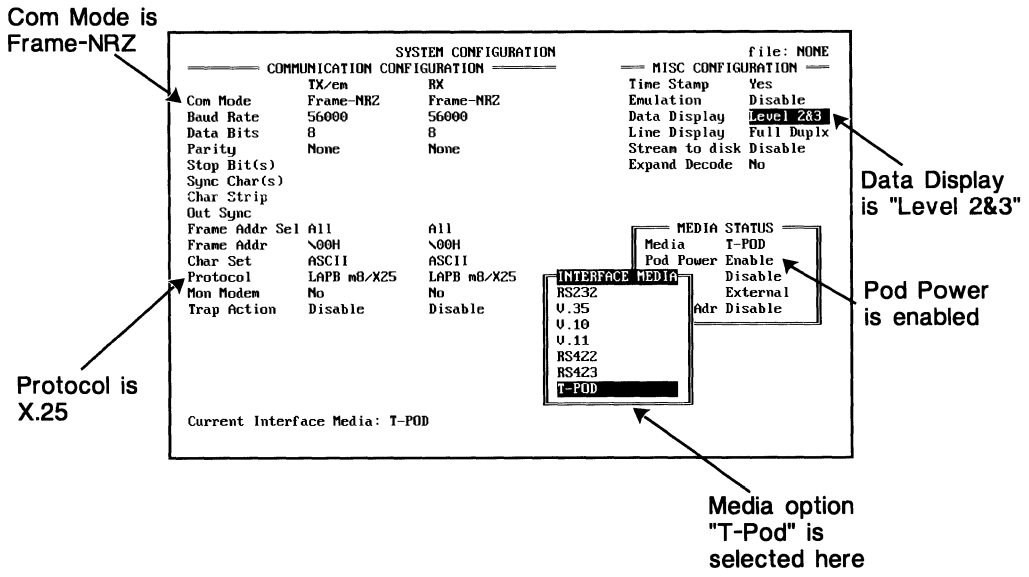
> **CAUTION!**
>
> Be sure the selected Media interface option (**T-POD**) matches the actual media interface. An incorrect match may disrupt the network.

Remember when you define the LM2000's interface to the network, you also set the display format for the break-out box; for the T-Pod it displays the T-Pod Remote Control Screen.

To access the T-Pod Remote Control Screen use F6 [BO BOX] on the Main Menu or <Shift>F3 [BO BOX] on the Monitor Screen.

Important Note about Pod Power:

- After setting the Media field to **T-POD**, be sure pod power is enabled. To set pod power, press F6 [EX POD].



Setting up for T-Pod on the System Configuration Screen.

Frame Relay Configuration Settings

This discussion provides information about configuring the LM2000 when using Frame Relay. You select the setup options on the System Configuration Screen.

How to access the System Configuration Screen:

- Press F1 from the Main Menu.
- Press F6 from the Monitor Screen.

Setting the baud rate:

- Even though baud rates for frame relay are available up to 2.048 Mbps., a typical T1 speed is 1.536 Mbps.

Setting stream to disk:

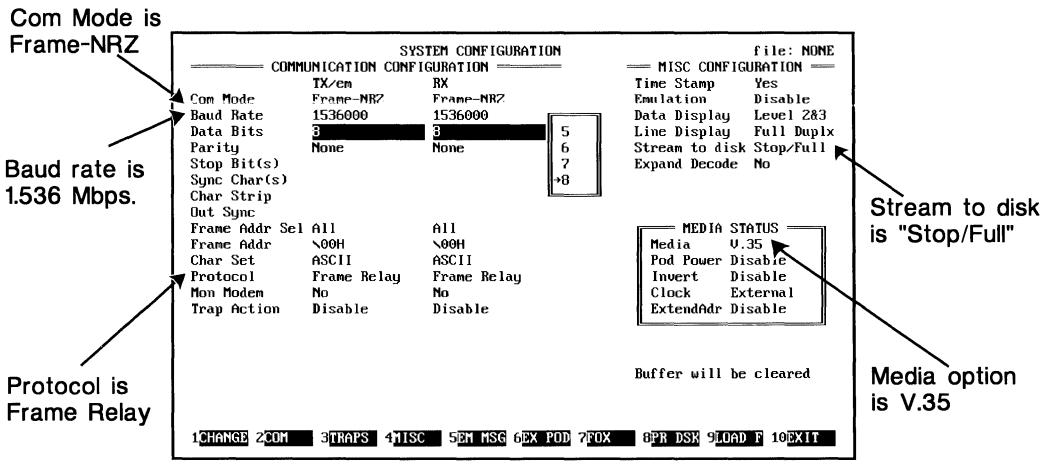
- Stream to disk at T-1 speeds may be machine dependent. Therefore, we suggest using the **Stop/Full** option. This way the LM2000 streams to disk until all free disk space is filled or until stopped by the user.

Setting the interface media option:

- For Frame Relay, the typical interface media would be **V.35**. To define the Media field, press <Shift>F5 [MEDIA].

  Remember that defining the LM2000's interface to the network, also sets the display format for the LM2000's break-out box. For example, selecting **V.35** for the interface media generates a software break-out box showing the V.35 leads.

> **CAUTION!**
>
> Be sure the selected Media interface option (e.g., **V.35**) matches the actual media. An incorrect match may disrupt the network.



Setting up for Frame Relay on the System Configuration Screen.

Chapter 6
Data Traps and Filters

- Understanding Data Traps and Filters
- Defining Traps: The Basics
- Screen Overview: Trap Definition
- Selecting the Trap Action
- Using Frame Selection to Define Traps
- Manual Trap String Definition
- Using Protocol Macros to Define Traps
- Frame Relay Filters

Understanding Data Traps and Filters

The LM2000's trap and filter functions are important tools for analyzing data. They help solve network problems by limiting the amount of data you have to analyze in order to find the problem.

What is a trap?

A **trap** comprises two elements: a **trap string** and a **trap action**. When the LM2000 detects the **trap string** in the monitored data, it performs the **trap action**.

A **trap string** is any pattern of bits that you want the LM2000 to detect and act on. The LM2000 provides three methods of defining trap strings: manually, using frame selection, and using protocol macros. Manual trap string definition lets you use hex, binary, or other formats to enter the string one octet at a time. The frame selection and protocol macro functions use menus and prompts to help you build trap strings without coding each octet. The rest of this chapter focuses on defining trap strings.

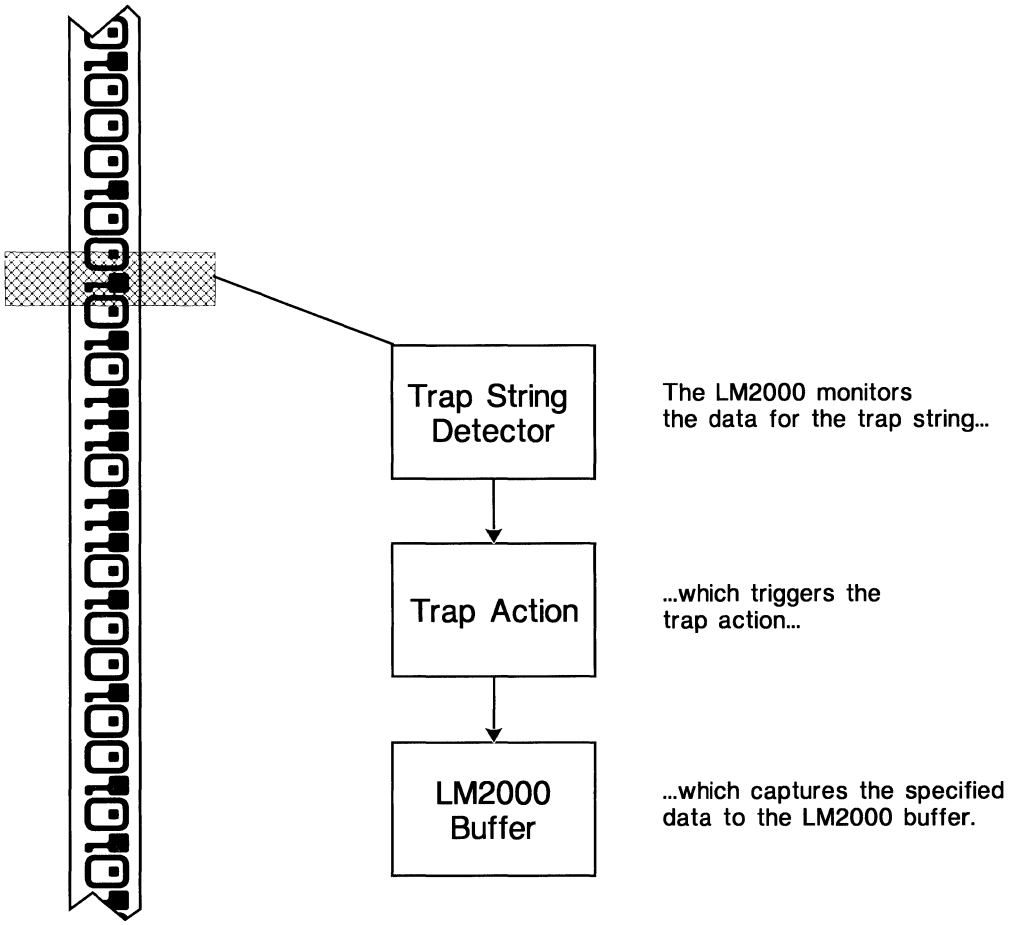
A **trap action** is what you want the LM2000 to do when it detects a trap string. The LM2000 provides trap actions that let you count the occurrences of the trap string; capture the data before, after, or surrounding the trap string; and, for framed data, to include or exclude frames containing the trap string. Trap actions are discussed later in this chapter.

What is a Filter?

Like a trap, a filter consists of a trap string and a trap action. Unlike traps though, filters use only the include or exclude trap action, allowing you to "filter" the monitored data for frames containing the trap string. Trap strings for filters are defined in the same way as for traps. Except where noted, the words trap and filter are used interchangeably in this manual.

Why use traps and filters?

Traps and filters help solve network problems by letting you specify which data you wish to analyze. Traps and filters basically define which data is captured by the LM2000, so you only need to analyze the data most likely to help solve the problem, not everything on the line. This also conserves disk space when capturing data to a file since you don't need to capture everything on the line to find the problem.



Traps and filters help narrow down problem causing areas.

Defining Traps: The Basics

To set a trap you must select a trap action and define one or more trap strings. The basic steps required to do this are outlined below; details for performing each step are provided on the following pages.

Five steps to set data traps

1) At the System Configuration Screen select the Trap Action and, if desired, the Protocol Decode (you should also select any other system configuration options at this time).

2) Press F3 [TRAPS] to access the Trap Definition Screen.
   - ♦ The Trap Definition Screen appears on your monitor.

3) Select the desired settings in the 'Start Tx trap at' and 'Start Rx trap at' fields. These fields determine if the trap string must be at the beginning of the frame to constitute a match or if it can be anywhere in the frame.

4) Move the cursor to one of the six trap definition fields (the ones that display "Pattern Undefined") and define a trap string using one of three methods:
   - Press F1 [CHANGE] to enter the string as a series of bytes in any of several formats. Press <Enter> when you have completed the trap string.
   - Press F1 and then <Shift>F3 [MACROS] to define the string using the LM2000 protocol macros. Press <Enter> when you have completed the trap string.
   - Press F3 [L 2&3] (without pressing F1) to access the Frame Selection Screen(s) and specify frame characteristics for the trap. The Com mode must be set for framed data and a protocol decode module must be selected in the System Configuration Screen to use this method. When using frame selection to define traps for one side of line, the LM2000 automatically duplicates the trap for the other side.

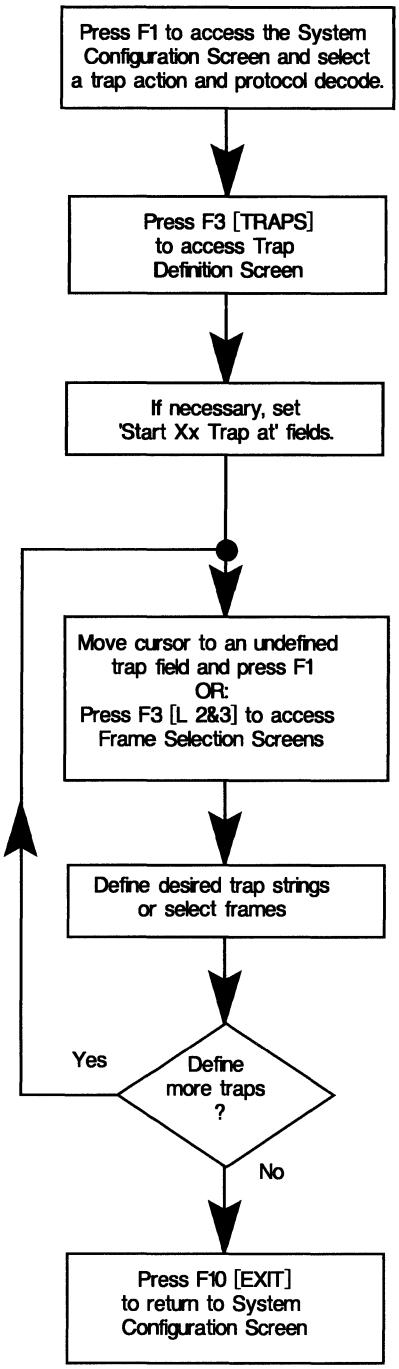
5) After defining the desired traps, press F10 [EXIT] to return to the System Configuration Screen.

Notes

Any traps you set are saved with the system configuration file created from the System Configuration Screen.

See Also:

Chapter 4. "System Configuration Reference" for more on setting up the system configuration and Chapter 3, "Operation and Navigation" for more on system configuration files.



Trap definition procedure.

Overview: Trap Definition Screen

The Trap Definition Screen allows you to define up to six separate trap strings. You can specify which side of the line to monitor for each trap, and the traps can be individually enabled or disabled. The Trap String Definition Screen also provides access to the Frame Selection Screens for Layer 2 and 3 data or to the PVC Action Map Screen for Frame Relay networks.

How to access this screen:

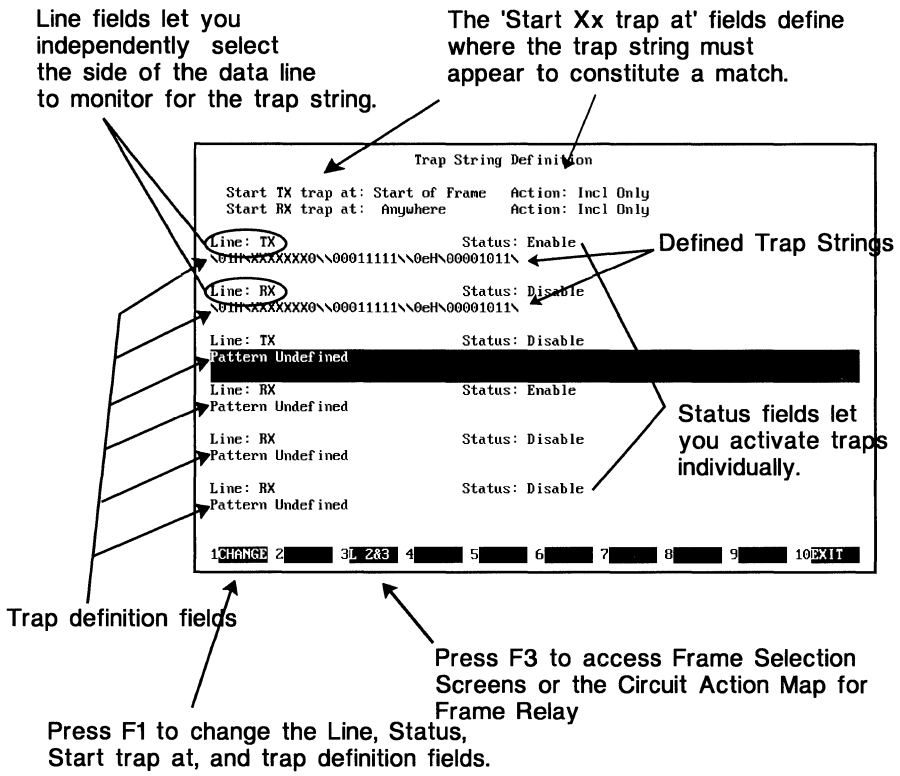
- F3[TRAPS] from the System Configuration Screen

Main functions of this screen:

- Define and edit trap strings
- Specify the expected location of the trap string in the data.
- Specify which side of the data line to monitor for each trap string
- Enable and disable individual trap strings

Access to other screens and functions:

- Layer 2&3 Frame selection screens press F3 [L 2&3]
- Frame Relay Circuit Action Map press F3 [L 2&3] with Frame Relay selected in the L2&3 Proto field on the System Configuration Screen.
- Edit trap strings press F1 [CHANGE] when the cursor is on one of the trap definition fields.
- Protocol macros move the cursor to a trap definition field and press F1 [CHANGE] then <Shift>F3 [MACROS].



You can define six different traps.

Selecting the Trap Action

The action the LM2000 takes when a trap string is detected — called a trap action — is determined by the Trap Action field on the System Configuration Screen. Ten trap actions are available to let the LM2000 capture, count, or exclude data based on the defined trap strings. Include and exclude options allow you to define precapture filters.

To select a trap action:

1) At the System Configuration Screen, move the cursor to the Trap Action field.

2) Press F1 [CHANGE] to cycle through the available options, or press <Enter> to move into the menu box and make your selection using the <↑> and <↓> arrow keys.
   - The setting in the Trap Action field changes to reflect your selection.

3) If you have not already defined trap strings, press F3 [TRAPS] to access the Trap Definition Screen and define your trap strings. If you have already defined your traps, press F10 [EXIT] or <Esc> to save your system configuration and return to the previous screen.

Notes

- Separate trap actions and strings can be defined for each line. Thus you can **Count** one string on TX and stop the buffer **About** a different string on RX. If both trap actions affect data capture, the first to be recognized will take effect and disable the other.

- If you do not define any trap strings, the Monitor Screen will display "Trap Disabled" no matter what action is selected in the System Configuration Screen. This is just to remind you that no trap strings were defined.

Option	Description
Disable*	All traps are disabled (any defined trap strings are retained).
Count	Counts the number of times frames containing the specified string(s) are encountered. Data capture is not affected by this setting.
Before	Stops data accumulation in the buffer as soon as a match is found. Thus data in the buffer was captured before the trap string was detected.
After	Starts data accumulation in the buffer as soon as the LM2000 recognizes a match. Data accumulation continues until the buffer is full. Thus data in the buffer was captured after the trap string was detected.
About	Fills half of the buffer with traffic captured before the match and half of the buffer with traffic captured after the match.
On Error	Any error (parity, framing, or CRC) acts as a precursor to the trap string. That is, when an error is detected,the LM2000 begins searching for the defined trap string. When the string is detected, half the buffer is filled with traffic captured before the match and half the buffer with traffic captured after the match. To trap errors, define the trap string as a single wild card (don't care) byte, or use Snap on err (see below).
Snapshot	Saves the most current 2KB (1KB if time stamping is enabled) of data to a buffer file on disk when the trap string is detected.
Snap on err	Saves the most current 2KB (1KB if time stamping is enabled) of data to a buffer file on disk when an error is detected.
Incl only	For frame-type protocols only. Causes the LM2000 to process only those frames containing the trap string. This option allows you to create precapture filters.
Exclude	For frame-type protocols only. Causes the LM2000 to process all frames except those containing the trap string. This option allows you to create precapture filters.

*Selecting this option will not disable any frame relay DLCI filters. See Frame Relay Filters later in this chapter.

The LM2000 Trap Actions.

Using Frame Selection to Define Traps

The LM2000 frame selection function lets you define traps for specific frame types by selecting parameters from a menu. The menu displayed when you access frame selection is specific to the protocol decode module loaded at the System Configuration Screen. You can create precapture frame filters by using the frame selection function in conjunction with the include or exclude trap action.

Selecting frames for traps

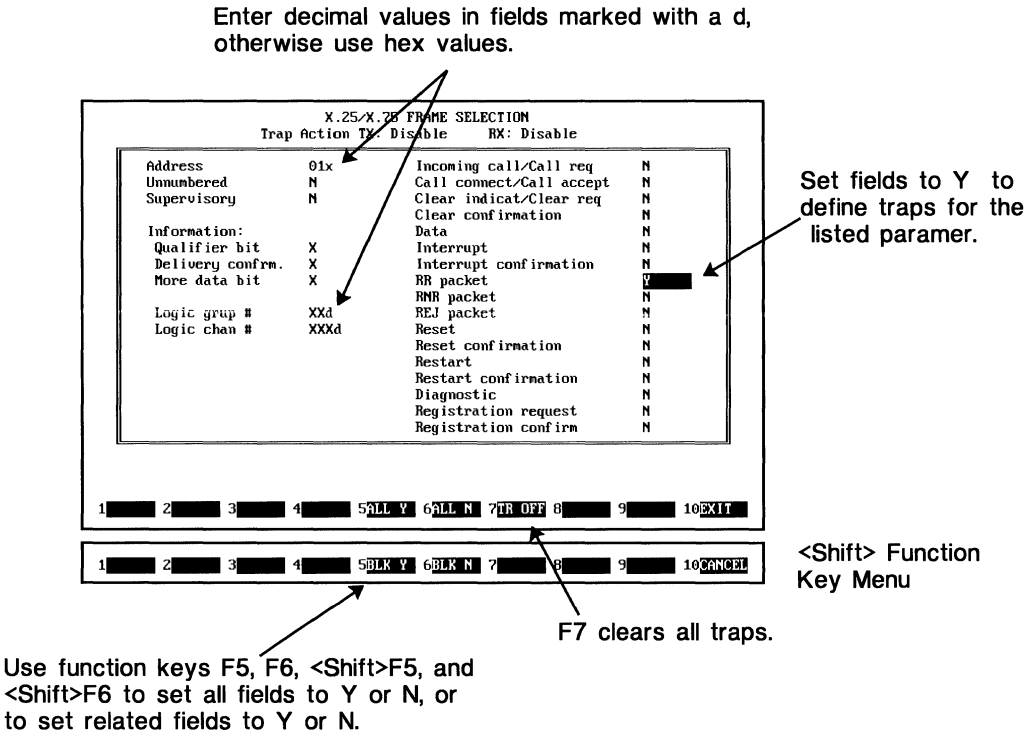
1) In the Trap Definition Screen, press F3[L 2&3] to access the Frame Selection Screen.
   - ♦ The LM2000 displays the Frame Selection Screen appropriate for the selected protocol.

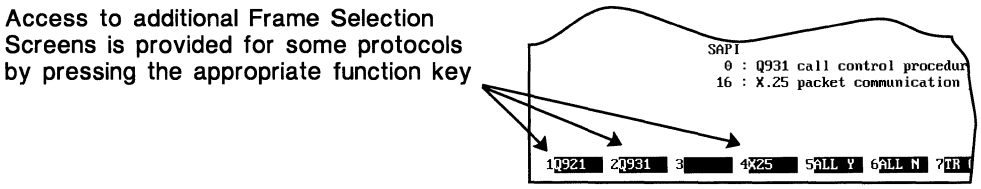
2) When selecting frames:
   - Select a parameter for use as a trap by moving the cursor to the desired field and pressing y.
   - Enter numerical values in fields containing Xs. If the field is followed by a d, the entry is in decimal, otherwise the entry is in hexadecimal.
   - Set all frame parameters to N by pressing F6[ALL N] or to Y by pressing F5[ALL Y]. You can set all parameters in a group to Y or N by pressing <Shift>F5 [BLK Y] and <Shift>F6 [BLK N].
   - Access additional Frame Selection Screens (for ISDN and QLLC protocols) by pressing the appropriate function key as indicated on the function key menu.
   - Reset all parameters to their defaults and clear any defined traps by pressing F7[TR OFF].

3) After you have selected the desired parameters, press F10 [EXIT].
   - ♦ The LM2000 returns to the Trap Definition Screen and displays the selected trap strings. Note that the LM2000 automatically defines traps for both the TX and RX lines.

Notes:

- To access the Frame Selection Screen, two fields on the System Configuration Screen must be set as follows: the Com Mode field must be a Frame-type selection and the Protocol field must have a protocol decode selected.
- If the "All traps used-trap too complex." message appears, you may have selected too many parameters. You will need to simplify your trap or use macros.
- This screen only defines trap strings; it does not select frames or packets for capture.





You can select specific frames for any protocol.

Manual Trap String Definition

Defining trap strings manually consists of specifying one or more octets that you want to trigger the trap action. You can enter each octet in any of six formats, including wild cards (match any octet) and binary bit masks. The methods described here can also be used to edit trap strings defined in the Frame Selection Screens as discussed earlier.

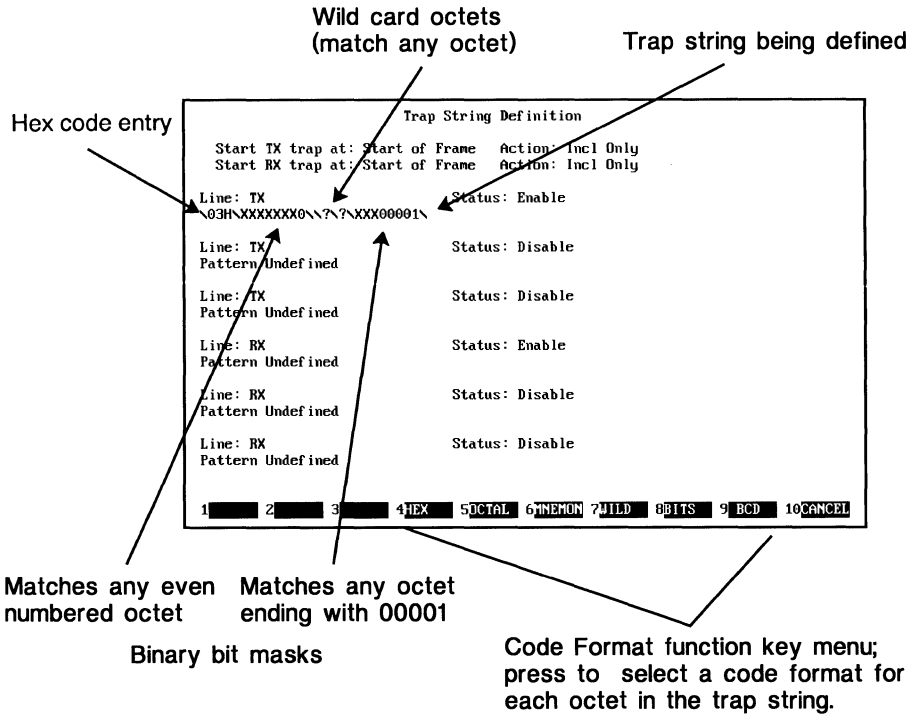
Defining and editing trap strings

Trap strings are created and edited in the string definition areas of the Trap String Definition Screen. Trap strings can contain any combination of text or numerical codes. This procedure can also be used to edit traps defined with the frame selection function.

1) In the Trap Definition Screen, move the cursor to one of the trap string fields (the ones that display "Pattern Undefined") and press F1 [CHANGE].
   ♦ The LM2000 goes into the trap edit mode and the function key menu changes to display the available code formats.
2) When entering or editing a trap string:
   - Enter text strings directly from your keyboard.
   - Enter a numeric code or wild card character by pressing the appropriate function key and entering the desired value. Repeat the process as necessary.
   - Use the left and right arrow keys to move the cursor one character or octet at a time; use <Home> and <End> to go to the beginning or end of the line.
   - Use the <Backspace> and <Del> keys to delete an octet or character.
   - Press <Shift>F2 [CL MSG] to clear the entire trap string.
3) Press <Enter> to save your trap string.
   ♦ The function key menu changes back to the normal trap screen options.
4) Repeat steps 1 through 3 as necessary.

Notes

- The character set (ASCII, EBCDIC, etc.) must be selected on the System Configuration Screen before defining trap strings.
- For the binary format, enter an x in any position for don't care bits (that is, any value in that position will match).
- For the BCD (Binary Coded Decimal) format enter the string as a continuous series of digits from 0 through 9. Each pair of digits is translated into a hex octet.



You can define trap strings bit-by-bit and byte-by-byte.

Using Protocol Macros to Define Traps

The LM2000's protocol macros help you define traps by prompting you to select frame parameters and enter data to construct a trap string. The macro then automatically generates the bits representing the trap string based on your responses. Macros allow you to create highly detailed trap stings without entering them bit-by-bit. The LM2000 comes with a library of macros for you to use, or you can write your own macros for specific applications (see Chapter 14 for details).

Defining traps with macros

Macros describe individual frames or packets. Several macros can be combined to define complex trap strings.

1) In the Trap Definition Screen, move the cursor to one of the trap string fields (the ones that display "Pattern Undefined") and press F1 [CHANGE].
   - The LM2000 goes into the trap edit mode and the function key menu changes to display the available code formats.

2) Press <Shift>F3 [MACRO] to access the macro file menu.
   - The macro file menu appears with a list of all files in the current directory with the macro extension, .PLM.

3) To select a macro, position the cursor on the desired macro file name and press <Enter>. (Move the cursor using the arrow keys or by pressing the first letter of the macro name until the desired macro is highlighted.)
   - A window opens on your screen, displaying instructions for completing the macro.

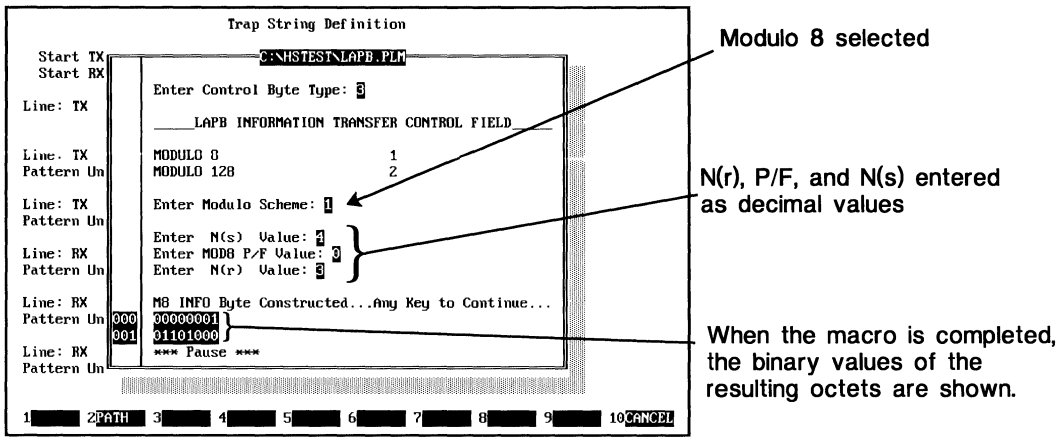
4) Follow the instructions displayed in the macro window to define the trap string.
   - After all the necessary selections and data entries have been completed, the macro displays the binary interpretation of the defined trap.

5) If desired, repeat steps 2 through 4 to define additional macros.

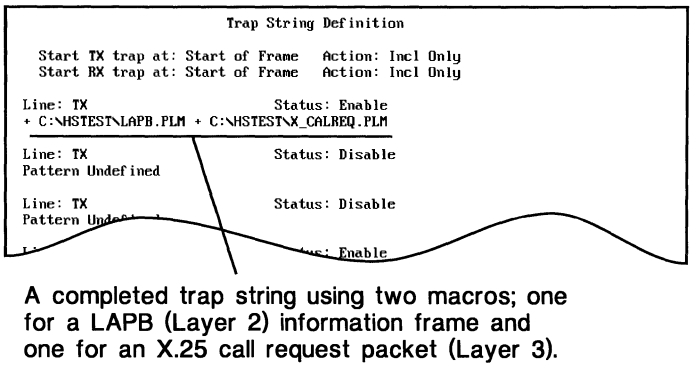
6) When the trap is complete, press <Enter> to save it and leave the edit mode.
   - You can now define additional traps using any of the methods described in this chapter.

Notes

- You may need to set the 'Start Xx trap at' fields for Anywhere when using macros to define traps for Layer 3 and above.



In the macro window, select options and enter any requested data to define trap strings.



A completed trap string using two macros; one for a LAPB (Layer 2) information frame and one for an X.25 call request packet (Layer 3).

The name of macros used in a trap string are shown in the Trap String Definition Screen.

Frame Relay Filters

In addition to the conventional trap functions, the LM2000 provides a DLCI (Data Link Connection ID) filter for use when analyzing frame relay traffic. The DLCI filter allows you to capture or disregard frames based on the DLCI value. DLCI filters are defined with the Circuit Action Map, which uses a matrix to display actions for all 1,024 possible DLCIs. The DLCI filter can be used with conventional traps to further isolate specific data.

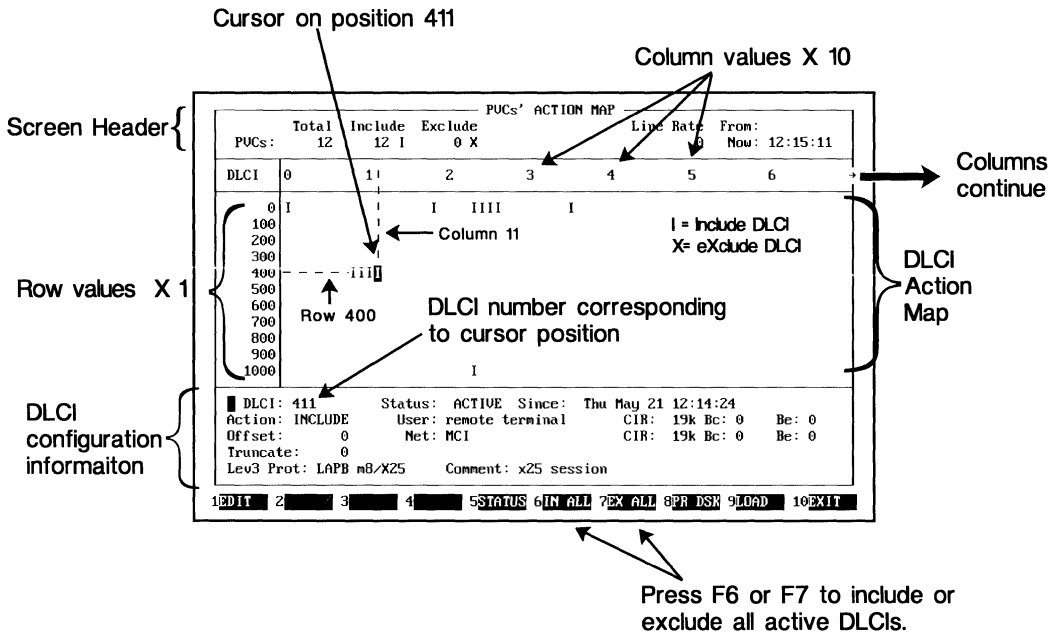
DLCI filters

Unless instructed otherwise, the LM2000 captures data for all active DLCIs. However, by accessing the Circuit Action Map you can choose to exclude frames with specific DLCIs.

1) From the Trap String Definition Screen press F3 [L 2&3] to access the Circuit Action Map (Frame Relay must be selected in the Protocol field of the System Configuration Screen).
   - The Circuit Action Map appears on your screen, displaying the action status (include or exclude) for all known DLCIs.
2) Move the cursor to the position of the action map corresponding to the desired DLCI. Use the arrow keys to move one position at a time, or use the <Tab> and <Shift Tab> keys to move the cursor 10 positions at a time. The action map scrolls horizontally to provide access to all DLCI numbers.
   - The DLCI number at the cursor position is shown in the DLCI field below the action map area.
3) Press the spacebar to toggle the action status of the selected DLCI (an I in the DLCI position means include frames with that DLCI, an X in the position means exclude those frames). You can also set the action status by pressing i for include or x for exclude.
4) When you have set the action status for the desired DLCIs, press F10 [EXIT] to return to the Trap Definition Screen. You can then define trap strings for data within the frame relay frame.

Notes

When using conventional traps with the DLCI filter you will need to insert a sufficient number of wild card (don't care) octets at the beginning of the trap string to get past the Frame Relay header.



The Circuit Action Map displays the status of all DLCIs known to be active on your network.

Chapter 7
Monitoring Data with the LM2000

- Screen Overview: Monitor
- Controlling Monitor Functions
- Controlling Emulation Functions
- Counters and Activity Indicators
- Selecting the Data Display Mode
- Monitoring Data: Hex, Mnemonic and Character Displays
- Monitoring Data: Modem Lead Display
- Monitoring and Interpreting Data: Level 2 and Level 3 Decode
- Monitoring and Interpreting Data: Expanded Decode
- Analyzing Monitored Data with PowerView
- Capturing Monitored Data to Disk: Snapshots
- Checking Trap Counts

Screen Overview: Monitor

The Monitor Screen displays real-time data from the network and provides useful information about the monitored data. The Monitor Screen's data display modes let you change the way data is displayed, from hex bytes to fully decoded Level 3 frames. You can analyze data more closely with the PowerView feature, accessed directly from the Monitor Screen.

How to access this screen:

- F3 from the Main Menu

Main functions of this screen:

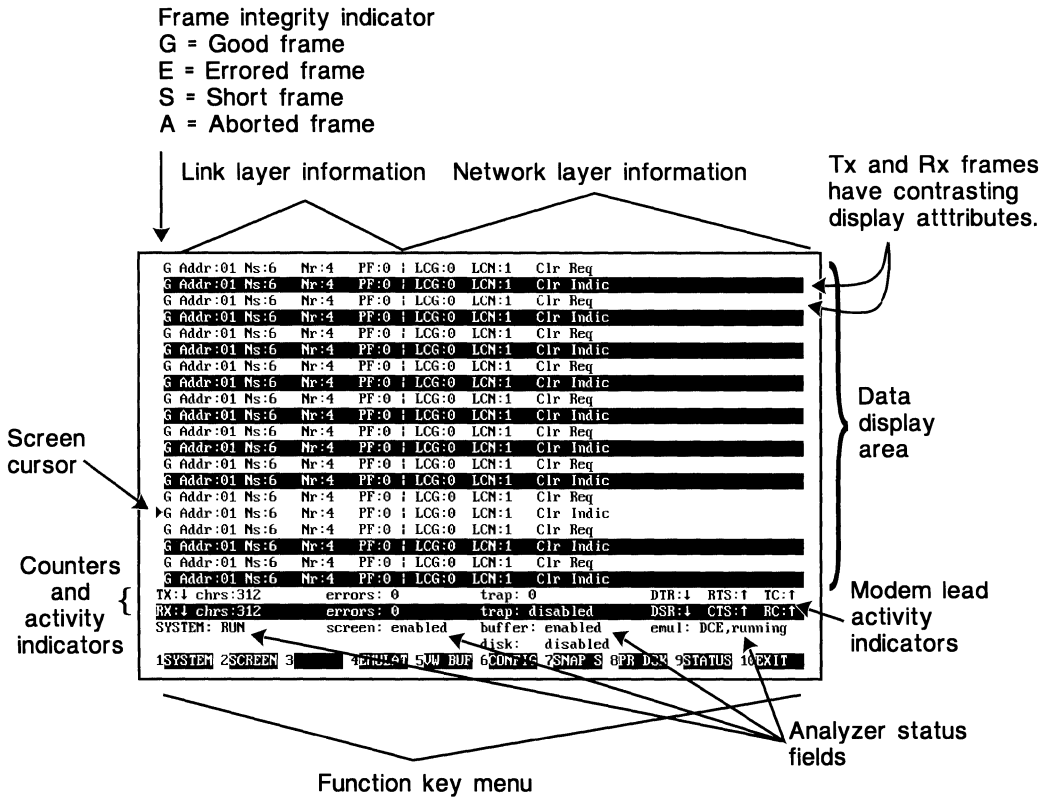
- Displays data in real-time
- Displays character, error, and trap counts
- Displays the analyzer's current operating status
- Controls the analyzer's status and data display

Access to other screens and functions:

- Toggle display between hex and mnemonic or hex and character – Press F3 [HXNME]
- Access the View Buffer Screen – Press F5 [VW BUF]
- Access the System Configuration Screen – Press F6 [CONFIG]
- Access the Software Break-Out Box Screen – Press <Shift>F3 [BO BOX]
- Access the Trap Status Screen – Press <Shift>F4 [TRAPS]
- Access the data display mode menu – Press <Shift>F5 [DISPLY]
- Access the Level 2 and 3 Statistics Screens – Press <Shift>F6 [STATS]

See Also:

Chapter 4 for information on the System Configuration Screen; Chapter 8 for information on the Frame Level Statistics; Chapter 9 for information on the View Buffer Screen; Chapter 11 for information on the Software Break-Out Boxes.



Pressing <Shift> displays more function key options.

The Monitor Screen displays real-time data.

Controlling Monitor Functions

You can control several key analyzer functions from the Monitor Screen with the function keys. The status of these functions is displayed at the bottom of the Monitor Screen.

System Operating Mode – F1 [SYSTEM]

The system operating mode determines whether or not the analyzer is monitoring and processing data. Processing data includes reading it into the buffer, time stamping each byte (if time stamping is enabled), and updating statistics. The system operating mode toggles between Run and Halt.

Screen Mode – F2 [SCREEN]

The screen mode allows you to "freeze" the data display to review data on the screen without halting data monitoring. When the screen is frozen, the analyzer continues to monitor and process data, but the data displayed on the Monitor Screen does not change. The screen mode toggles between Enabled and Frozen. When unfrozen, data display begins with the next captured frame, that is, frames captured during the time the screen was frozen are not displayed.

Buffer Mode – <Shift>F2 [BUFFER]

The analyzer's capture buffer is frozen when a trap is tripped with Trap Action set to Before, After, or About. No new data is read into the capture buffer while it is frozen. You can unfreeze the buffer when this occurs by pressing <Shift>F2 [BUFFER]. You can also freeze the buffer manually by pressing <Shift>F2.

Notes

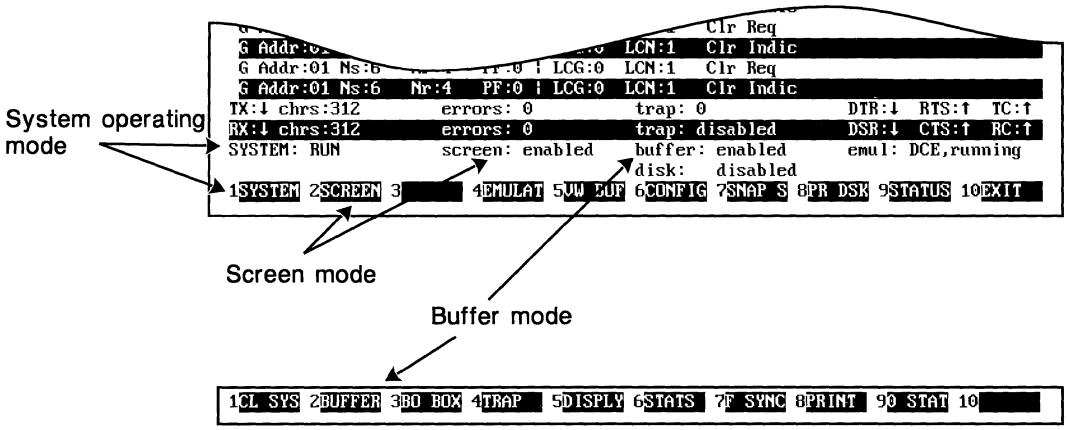
- The system operating mode automatically changes to Halt when you exit the Monitor Screen.
- <Shift>F1 [CL SYS] toggles the system operating mode between Run and Halt. When going from Halt to Run, <Shift>F1 [CL SYS] provides a general system reset; it clears the buffer and resets all statistics to zero.

See Also:

Chapter 4 for more on the Trap Action field of the System Configuration Screen.

Function	Status Field	Function Key	Status
System Operating Mode	SYSTEM:	F1 [SYSTEM]	Run. Analyzer is monitoring and processing data.
			Halt. All functions are halted; analyzer is not monitoring or processing data.
Screen Mode	Screen:	F2 [SCREEN]	Enabled. Normal operation; data is displayed in real-time.
			Frozen. Data display is frozen; data is still being monitored and processed, but the display is not updated.
Buffer Mode	Buffer:	<Shift>F2 [BUFFER]	Enabled. Normal operation; data is read into the buffer as it is monitored.
			Frozen. Buffer state after a trap is tripped or <Shift>F2 is pressed; no new data is read into the buffer.

Analyzer functions controlled from the Monitor Screen



The System operating mode, screen mode and buffer mode are controlled from the Monitor Screen.

Controlling Emulation Functions

The LM2000 can emulate either DTE or DCE, allowing you to transmit test messages to the network. The emulation function is enabled at the System Configuration Screen and controlled at the Monitor Screen. The test message is defined in the Emulation Message Screen, which is accessed from the System Configuration Screen. More advanced emulation functions are available with PowerScript, the LM2000's interactive test builder.

Controlling the emulation function

Once enabled on the System Configuration Screen, the emulation function is controlled by pressing F4 [EMULAT] on the Monitor Screen. The current state is displayed in the Emul field.

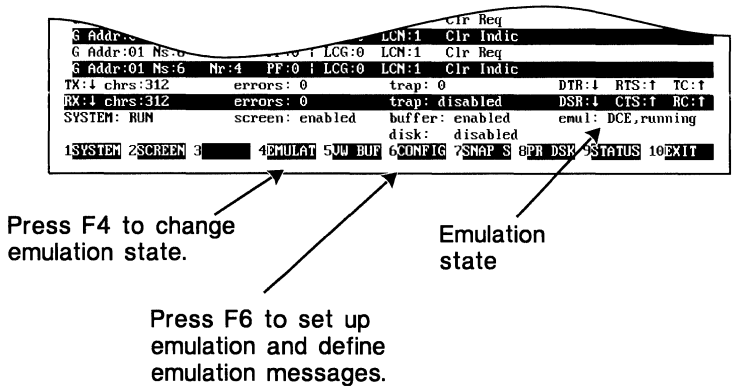
Emulation states

- Enabled* – Emulation has been enabled on the System Configuration Screen but is not actively running. Press F4 to begin transmitting the test data defined in the Emulation Message Screen.
- Running* – The LM2000 is actively transmitting data to the network. The test message can be transmitted a set number of times or continuously, as selected in the Emulation Message Screen. Press F4 to stop transmitting data.
- Stopped* – The LM2000 is no longer actively transmitting data because F4 was pressed. Press F4 again to return to the Enabled state.
- Completed* – The test message has been sent the number of times specified in the Emulation Message Screen and transmission has halted. To repeat the test, press F4 twice to cycle through the Enabled and Running states.
- Halted* – The system operating mode was set to Halt (F1 [SYSTEM] was pressed). Pressing F1 a second time (returning the system operating mode to Run) returns the emulation state to Enabled; press F4 to begin sending the test message again.

See Also:

Chapter 4 for more on setting up emulation tests.

* The emulation state is prefixed with DTE or DCE, indicating the emulation mode selected on the System Configuration screen.



The LM2000's emulation function allows you to transmit test messages.

Counters and Activity Indicators

The fields on the two lines below the data display area provide a useful gauge of data activity. The fields on the top line provide information for Tx (send data), and the fields on the bottom line provide information for the Rx (receive data) side of the data line.

Characters, errors, and traps

The chrs and trap fields provide information about what the LM2000 is reading into its capture buffer, while the errors fields give an idea of the overall integrity of the data on the line.

- The chrs fields display a count of bytes that have been read into the LM2000's capture buffer from the monitored line. The chrs fields provide a cumulative indication of data activity during a monitoring session.
- The errors fields display a count of data errors detected on the monitored line. The errors fields count all errors detected on the monitored line, not just those captured to the buffer.
- Depending on the trap action selected in the System Configuration Screen the trap fields can list the number of times a trap has been tripped or display the status of the current trap action.

Setting and resetting the counters

The counter fields are automatically updated at 5 second intervals; you can force an update at any time by pressing F9 [STATUS]. Press <Shift>F9 [0 STAT] to reset the counters to 0. This action also resets the frame level statistics.

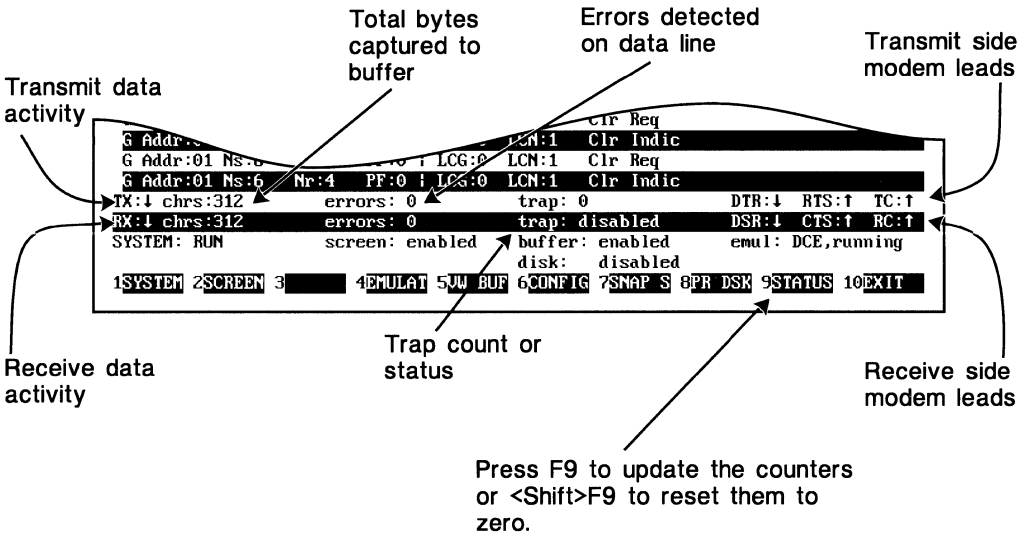
The counter fields will also be reset to 0 when the SYSTEM field is set to HALT and a general reset is issued by pressing <Shift>F1 [CL SYS].

Modem lead activity

The state of eight modem leads, including send data and receive data, is monitored and displayed in the TX, RX, DTR, RTS, TC, DSR, CTS, and RC fields. The state of each lead is indicated by arrows: ↑ for high and ↓ for low. Watch the TX, RX, TC, and RC fields to verify the presence of traffic on the monitored line.

Notes:

- For more statistical information on the monitored data, press <Shift>F6 [STATS]. Additional trap statistics are available by pressing <Shift>F4 [TRAP].



The counters and activity indicators provide a useful gauge of data activity.

Selecting the Data Display Mode

The LM2000 provides several different ways of looking at data to help with your analysis tasks. You can change the data display mode on the fly at the Monitor Screen, without interrupting data monitoring, or you can select the data display mode at the System Configuration Screen when you set up the LM2000.

Changing the data display mode

1) From the Monitor Screen, press <Shift>F5 [DISPLY].
   - The function key menu changes to show the data display mode choices.
2) Select the desired data display mode by pressing the appropriate function key.
   - The data display on the Monitor Screen changes to the selected mode.

The lead state display mode

The lead state display mode, which displays both the monitored data (as hex or mnemonic bytes) and the modem lead states, must be set at the System Configuration Screen. To change to the lead state display mode:

1) From the Monitor Screen, press F6 [CONFIG].
   - The analyzer stops monitoring data (the system operating mode changes to Halt) and the System Configuration Screen is displayed.
2) Move the cursor to the Line Display field and select **Data/Modem**.
3) Press F10 and <Enter> to return to the Monitor Screen.
   - The Monitor Screen is in the lead state data display mode.
4) Press F1 [SYSTEM] to begin monitoring data again.
   - You can use F3 [HXNME] to toggle the data display between hex and mnemonic.

Notes:

- When monitoring byte oriented protocols (async, bisync, etc.), only hex, character, and mnemonic displays are available.
- When the hex, mnemonic, or character display modes are active, you can switch between hex and character or hex and mnemonic by pressing F3 [HXNME](for hex and mnemonic modes) or F3 [HXCHR] (for hex and character modes).
- You must turn off the lead state display mode at the System Configuration Screen before you can select other data display modes.

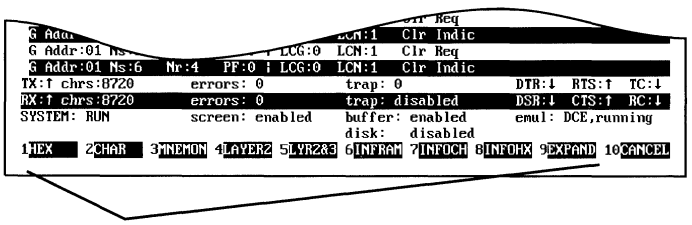
See also:

Chapter 4 for information on selecting data display modes at the System Configuration Screen.

Data Display Mode	Function key (after pressing <Shift>F5 [DISPLY])	Description
Hex	F1 [HEX]	Individual bytes displayed in hexadecimal
Character	F3 [CHAR]	Individual bytes displayed as characters
Mnemonic	F2 [MNEMON]	Individual bytes displayed as standard mnemonics
Level 2	F4 [LEVEL2]	Displays link layer information for each frame
Level 2 and 3	F5 [LVL2&3]	Displays link and network layer information for each frame
Information Frames	F6 [INFRAM]	Displays link and network layer information for Info frames only*
Information Frames – Character	F7 [INFOCH]	Displays link and network layer information for Info frames only*. Network layer data displayed as characters.
Information Frames – Hex	F8 [INFOHX]	Displays link and network layer information for Info frames only*. Network layer data displayed in hex.
Expanded Decode	F9 [EXPAND]	All frames decoded and interpreted to the network layer

* Supervisory and Unnumbered frames are disregarded.

Monitor Screen Data Display Modes



Select the desired data display mode.

Press <Shift>F5 to see the data display mode function key menu.

Monitoring Data: Hex, Mnemonic, and Character Displays

In the hex, mnemonic, and character data display modes, each byte is displayed in the selected format. In the hex mode, the hex value of each byte is displayed. In the mnemonic and character modes, each byte is displayed as its equivalent ASCII or EBCDIC (or whichever character set you are using) character. Transmit and receive data is distinguished through display attributes.

Frame boundaries and modem transitions

Because bytes are displayed serially in these data display modes, you need to know where one frame ends and the next begins. The LM2000 indicates the end of a frame by displaying the Greek character Φ (phi). (The Φ character will blink if the frame contains a CRC error.)

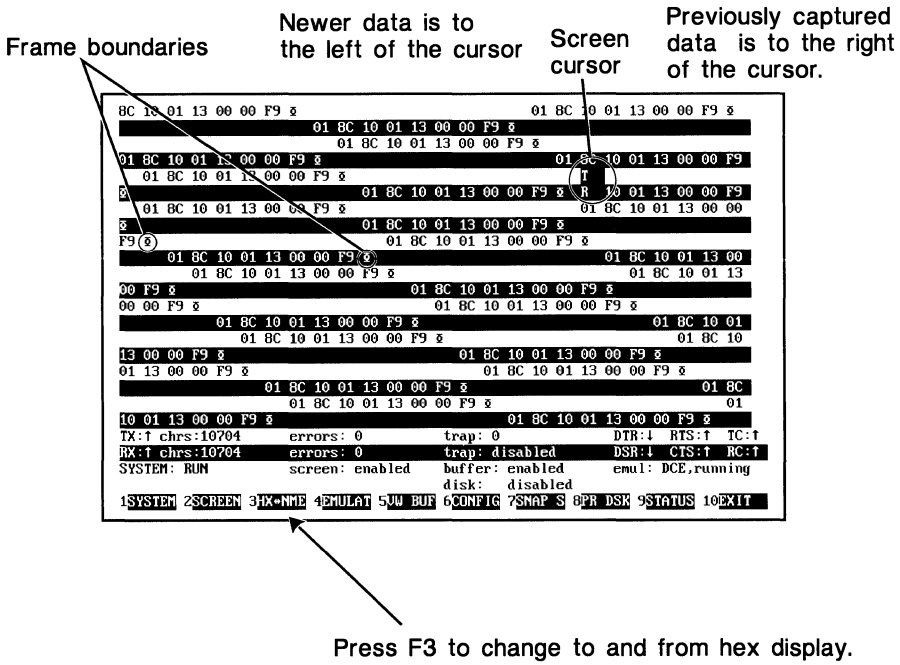
Modem lead transitions are also shown with a special character. A is displayed whenever any of the six modem leads monitored by the LM2000 changes state.

Character and Mnemonic displays

Both the character and mnemonic modes display the monitored bytes using the appropriate character set. The main difference between the mnemonic and character modes is that the mnemonic mode displays control bytes as the standard mnemonic equivalent (for example, SH is displayed for start of header, NU for null), while the character mode displays control characters as the character Ç. Also, the character mode takes advantage of EGA and VGA monitor capabilities to display more data.

Note

- Only the first byte of the CRC information is displayed for each frame; the second byte is hidden by the frame boundary character. To calculate the 2-byte CRC, go to the View Buffer Screen.



Monitor Screen hex data display.

Monitoring Data: Modem Lead Display

The modem lead, or lead state, data display mode displays the data as hex bytes or as standard mnemonic characters and provides an oscilloscope-type display of the modem leads for both transmit and receive lines.

The lead state display shows both data and modem leads

The lead state display provides a graphic display of the modem lead states on the monitored line. The TX and RX data lines are equivalent to those shown in the normal monitor mode, displaying data in either hex or mnemonic. Each line of TX and RX data is accompanied by RTS, CTS, DSR, DCD, DTR, and RI modem lead states. (The bottom half of the screen is a continuation of the top half.)

Old data to the right, new to the left

The cursor position is indicated by a blank column, with the most recently captured data displayed to the cursor's left and the oldest data in the buffer displayed to the cursor's right.

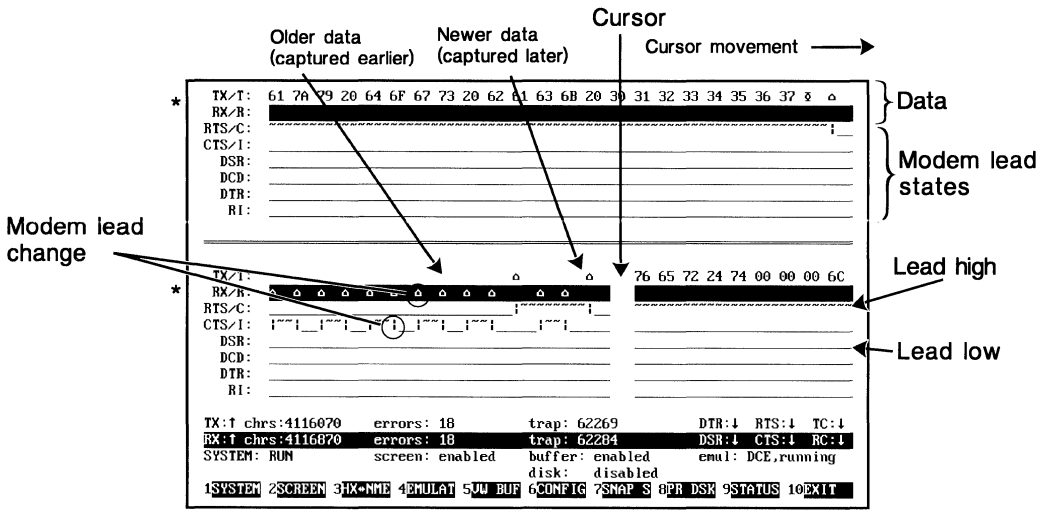
You can switch from hex to mnemonic display

To toggle the data display between hex and mnemonic display, press F3 [HXNME] (character display mode is not available with the lead state display active).

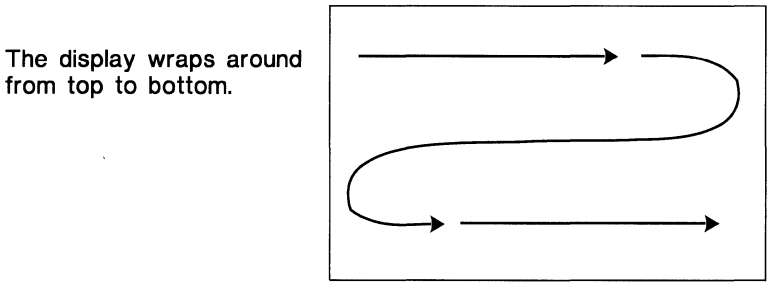
Selecting the lead state display

The lead state display mode must be set at the System Configuration Screen. To change to the lead state display mode:

1) From the Monitor Screen, press F6 [CONFIG].
   - The analyzer stops monitoring data (the system operating mode changes to Halt) and the System Configuration Screen is displayed.
2) Move the cursor to the Line Display field and select **Data/Modem**.
3) Press F10 and <Enter> to return to the Monitor Screen.
   - The Monitor Screen is in the lead state data display mode.
4) Press F1 [SYSTEM] to begin monitoring data again.



* TX/T, RX/R, RTS/C, and CTS/I are combinations of the EIA and CCITT lead designations (e.g., RTS=EIA designation, C=CCITT designation).



The modem lead display shows both data and the modem lead states.

Monitoring and Interpreting Data: Level 2 and 3 Decode

The LM2000 can decode and interpret the monitored data and display the information from each frame on a separate line. The LM2000 has five frame level data display modes, each showing a different level or aspect of the data. All of the frame level data display modes, except for Level 2, require that a protocol decode module be loaded by the LM2000.

The frame integrity indicator points out bad frames

The frame integrity indicator, located in the far left column, provides a quick indication of potential transmission problems.

- G = Good frames — CRC OK.
- E = Errored frames — CRC not OK.
- S = Short frames — Frame too short to decode reliably.
- A = Aborted frame — Transmission failed, seven or more 0s detected on data line.

The frame level data display modes

Level 2 – Displays link level information (address and control bytes) for all frame types (Unnumbered, Supervisory, and Info).

Level 2 and Level 3 – Displays link level information (address and control bytes) for all frames and network level information for information frames.

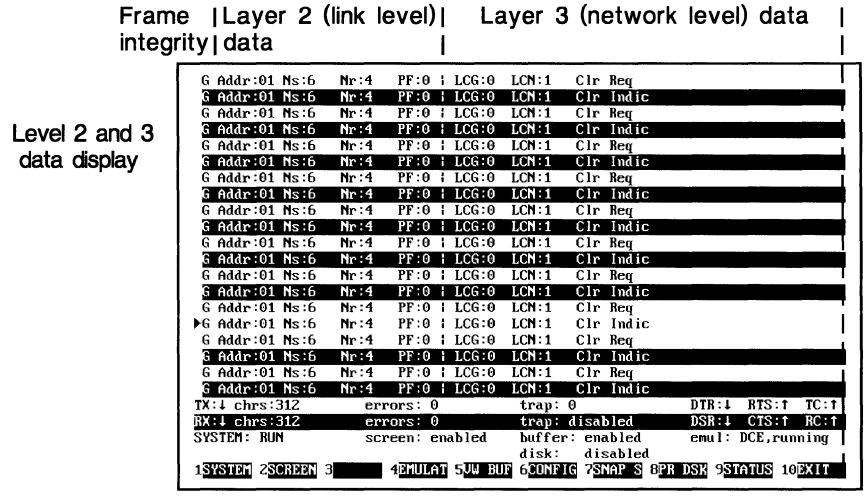
Info Frame – Displays link level and network level information for information frames only. Unnumbered and Supervisory frames are disregarded.

Info Character – Displays link level and network level information for information frames only. Network level information is displayed as characters. Unnumbered and Supervisory frames are disregarded.

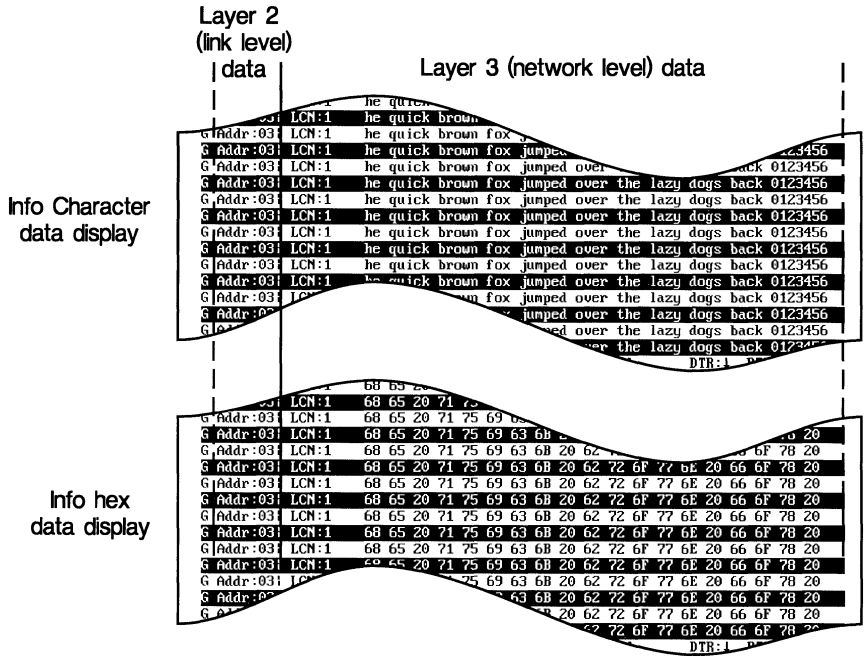
Info Hex – Displays link level and network level information for information frames only. Network level information is displayed in hex code. Unnumbered and Supervisory frames are disregarded.

See also:

Chapter 4 for more on the protocol decode modules.



Press <Shift>F5 to change the data display mode.



Information for each frame is displayed on separate lines.

Monitoring and Interpreting Data: Expanded Decode

Expanded Decode lets the user view, in nearly real-time, plain English interpretations of all monitored frames. It decodes and displays every meaningful bit in each frame. The binary value of each byte is given along with its interpretation in language taken from the relevant standard.

Expanded Decode provides additional information about the data

- The source of the packet or frame is displayed on the first line of each decoded frame.
- Level 2 information is displayed on the second line of the decoded frame. This line is the same as the normal Monitor Screen Level 2&3 data display.
- When present, all Level 3 information is interpreted and displayed, including the binary code of each byte and the Blue book interpretation of each bit.
- The same display attributes are used to distinguish transmitted and received frames as in frame level data display.

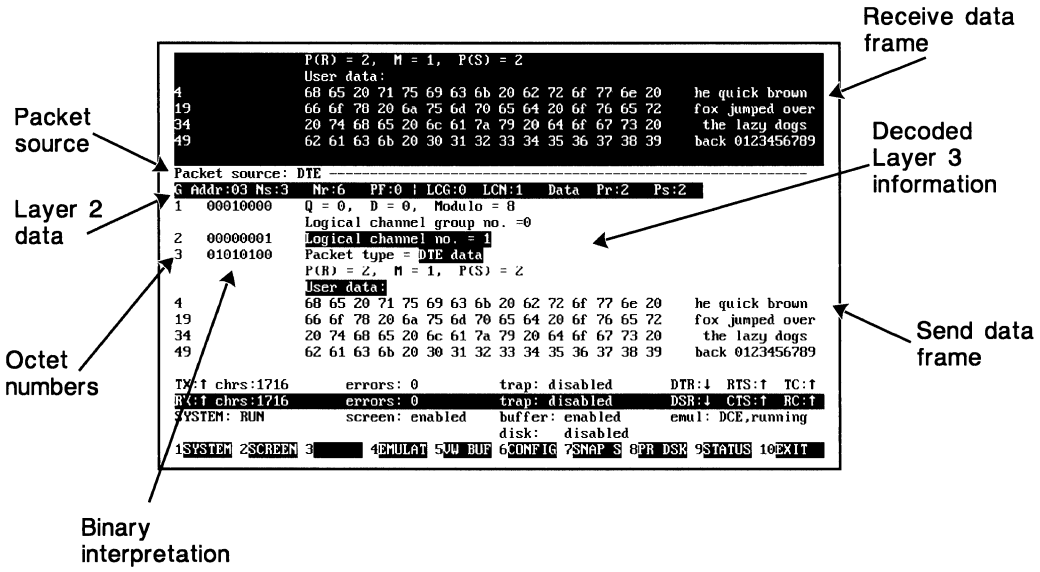
You can insert pauses between screen rewrites

At high speeds, the decoded frames flash by on the screen faster than you can read them. To alleviate this problem, the LM2000 provides a delay function when using Expanded Decode data display. To activate or deactivate the delay function:

1) Press the <Home> key to access the PowerView Screen (make sure Num Lock is off if you are using the numerical keypad).
   - ♦ The PowerView Screen appears.
2) Press F2 [DELAY].
   - ♦ The message "Delay is: Enabled" (or "Disabled") appears on your screen.
3) Press F10 [EXIT] to return to the Monitor Screen.
   - ♦ The LM2000 pauses for a moment before displaying the next screen full of data.

Notes

- When using Expanded Decode, the display of data may not be able to keep up with the actual data being captured to the buffer and some of the buffer data may be overwritten before it gets displayed. To ensure that you are able to examine all the traffic in the buffer, you should activate stream to disk.



Expanded Decode interprets every bit in the frame.

Analyzing Monitored Data with PowerView

PowerView provides a temporary buffer for displaying recently captured data while normal monitoring functions continue. PowerView allows you to take a closer look at recently captured data while the LM2000 continues to read data into the capture buffer.

To activate PowerView:

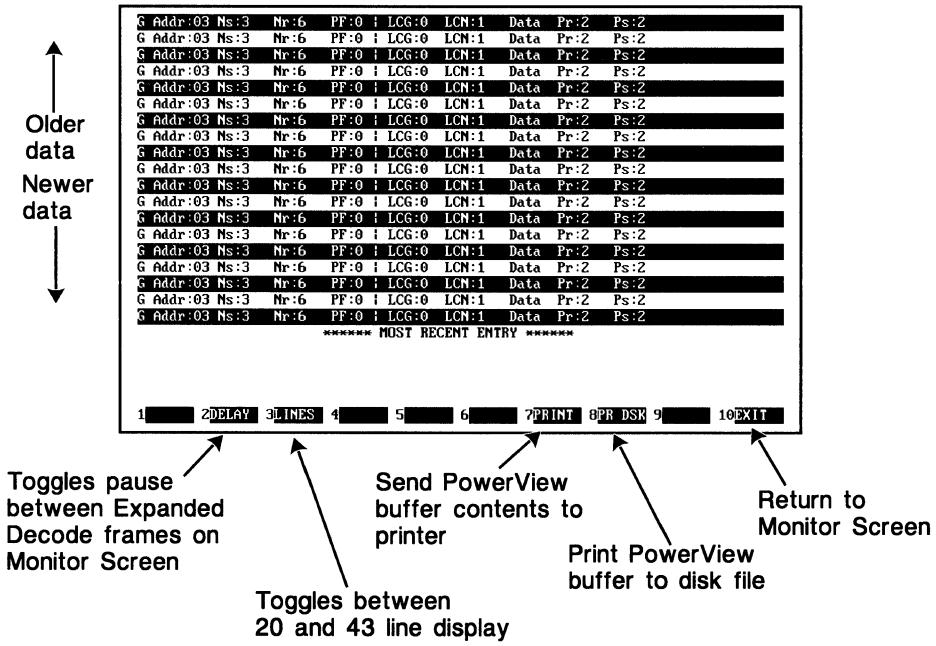
- Press any key on the directional keypad (for example, <Home>, or <Pg Up>) while monitoring data.
- Press F10 [EXIT] to return to the Monitor Screen.

PowerView functions

- Press <Pg Dn>, <Pg Up>, <Home>, <End>, <↑>, and <↓> to scroll through the temporary buffer.
- Press F3 [LINES] to change between 20 and 43 line display modes. (Available only with an EGA or VGA monitor.)
- Press F7 [PRINT] to send a copy of the PowerView buffer to a printer, or F8 [PR DSK] to print the buffer to disk as an ASCII file. When sending output to a printer, be sure a printer is connected and ready, or the system will lock up.

Notes

- The analyzer continues to monitor and process data while in PowerView.
- You must be in one of the frame level data display modes to access PowerView.
- PowerView displays older data (captured earlier) toward the top of the screen and newer data (captured later) toward the bottom.
- Data is displayed in PowerView using the display mode currently active in the Monitor Screen.



PowerView provides a temporary buffer to analyze recently captured data.

Capturing Monitored Data to Disk: Snapshots

Taking a snapshot is perhaps the easiest way to record a particular segment of data in a format accessible by the LM2000. The snapshot feature allows you to capture a 2KB (1KB if time stamping is enabled) segment of the data stream to a DOS file on command, for example when you see something interesting in the real-time display and want to store it for later analysis. Snapshots can be reviewed in the View Buffer Screen.

To take snapshots

- Press F7 [SNAP S] at the Monitor Screen. A message, displaying the snapshot number, appears briefly while the snapshot is written to disk.

Naming snapshot files

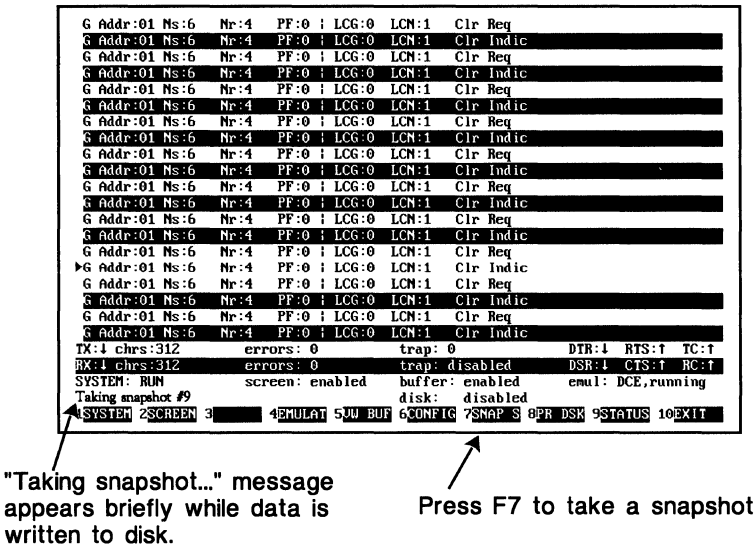
- You don't have to name your snapshot file until you exit the Monitor Screen. When you do, a message appears, prompting you for a filename.
- Type in a filename. The LM2000 allows eight characters or less and automatically appends the snapshot extension. The snapshot extension is a single digit representing the numerical order of the snapshots taken during the session (*filename*.1 for the first, *filename*.2 for the second, etc.).
- While naming snapshot files, you can use the function keys F1 [DIR], F2 [W EXT], and F10 [ABORT], respectively, to list all files in the current directory, to list only the files with the snapshot extension, or to abort the operation.

How many snapshots can you take?

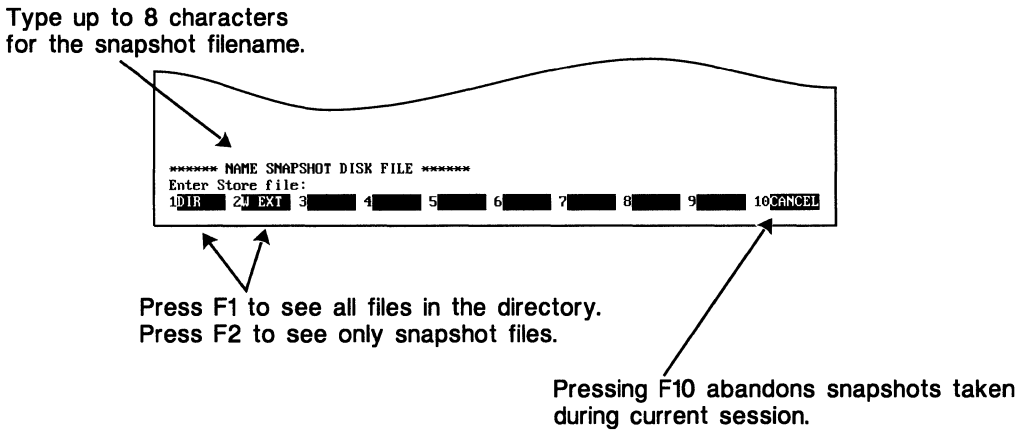
Take as many data snapshots as your disk can hold – each snapshot uses about 4KB of disk space and holds 2KB of monitored data with time stamping disabled or 1KB with time stamping enabled.

See Also:

Chapter 9 for information about loading and viewing snapshot files in the View Buffer Screen; Chapter 4 for information about activating and deactivating time stamping; and Chapter 3 for information about saving and naming files with the LM2000.



Snapshots let you capture a 1 or 2KB segment of data to a disk file.



Type up to 8 characters for the snapshot filename.

Checking Trap Counts

The Trap Status Screen lets the user view the status of traps defined in the Trap Definition Screen.

To access the Trap Status Screen:

- Press F4 at the Monitor Screen.
- Press F10 or <Esc> at the Trap Status Screen to return to the Monitor Screen.

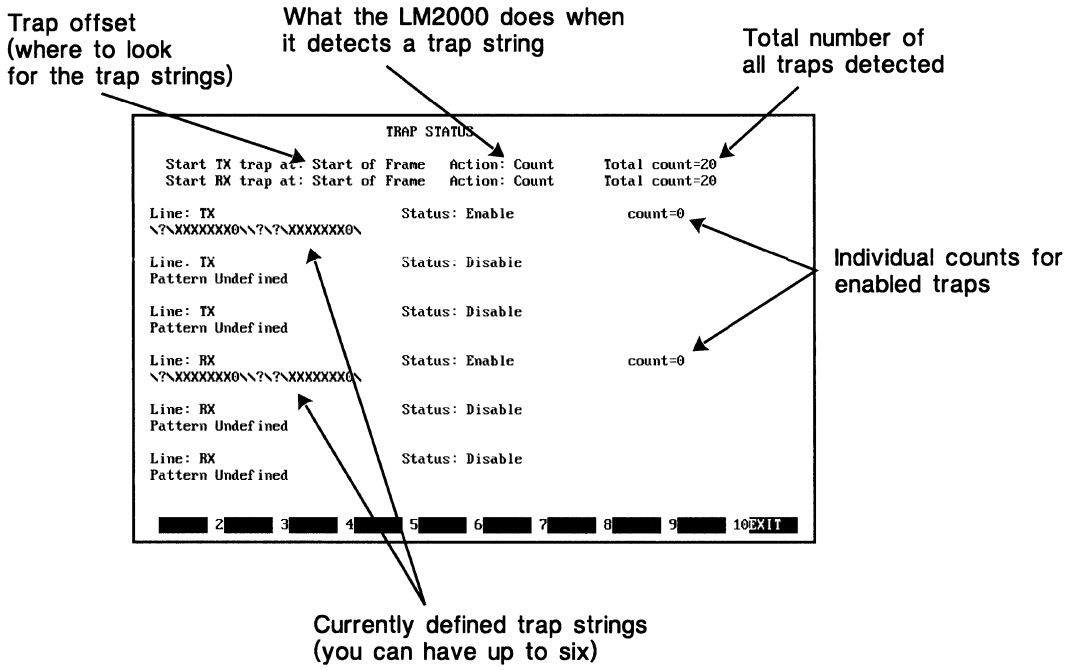
Main functions of the Trap Status Screen:

Four trap indicators are reported on the Trap Status Screen:

- Where in the frame the search for the trap string begins – Anywhere or at Start of Frame.
- What action is taken when a trap is detected (include, exclude, count, etc.).
- All defined traps along with the status of each. (Up to six traps are allowed.)
- Counts and totals are also provided:
  - For each trap
  - For all traps, individually, on the TX and RX lines

See Also:

Chapter 4 for information on selecting the trap action. See Chapter 6 for information about defining traps.



The Trap Status Screen shows the status of all defined traps.

Chapter 8
Frame Statistics

- X.25 Level 2 and 3 Statistics Screens
- SNA Level 2 and 3 Statistics Screens
- ISDN (Q.921) Level 2 Statistics Screen
- Frame Relay Statistics and the Frame Relay Configuration File
- Frame Relay All Circuit Statistics Screen Overview
- Frame Relay All Circuit Statistics Fields
- Frame Relay All Circuit Statistics Table Overview and Fields
- Frame Relay DLCI Statistics Screen Overview
- Frame Relay DLCI Statistics Fields
- Frame Relay Circuit Status Map Overview
- Frame Relay Circuit Status Map Fields
- Frame Relay Circuit Action Map Overview
- Frame Relay Circuit Action Map Fields

X.25 Level 2 and 3 Statistics Screens

Level 2 and 3 statistics for X.25 networks are provided in the LAPB Statistics Screen (Level 2) and the X.25 Packet ID Statistics Screen (Level 3). The statistics on these screens are updated once every second and are displayed for both transmitted and received data.

How to access this screen:

- <Shift>F6 from the Monitor Screen (when a LAPB/X.25 protocol decode is loaded).
- F6 [LEV2&3] from the Frame Relay DLCI Statistics Screen (when LAPB/X.25 protocol is specified in the frame relay configuration).

Main functions of this screen:

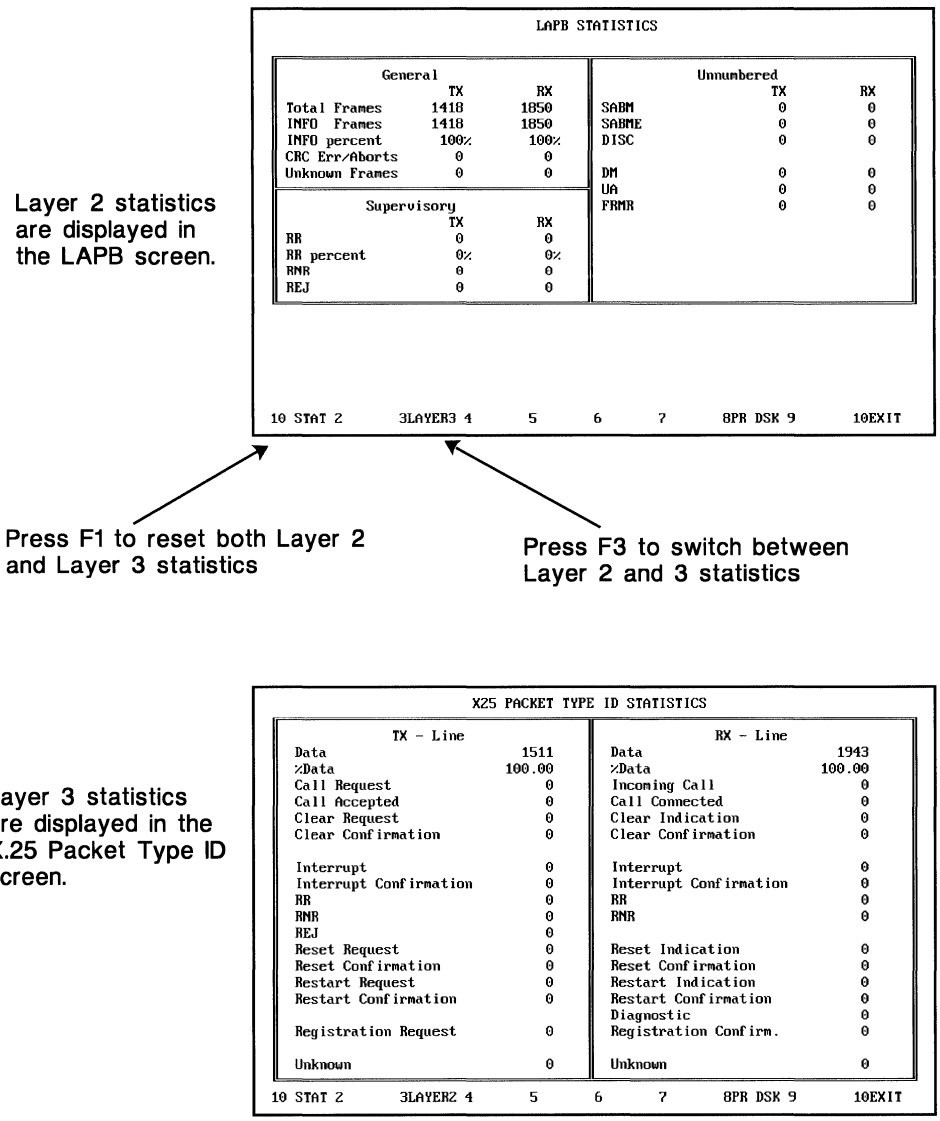
- Display counts of LAPB frame and X.25 packet types monitored by the LM2000.
- Display percentages of all frames that are information frames and of all packets that are data packets. Also displays the percentage of all LAPB frames that are Receiver Ready (RR) frames.

Access to:

- Press F3 to switch between the LAPB Statistics Screen and the X.25 Packet Type ID Statistics Screen.

Other functions:

- To set all statistics to zero, press F1 [0 STAT].
- Press F8 [PR DSK] to print a copy of the screen to an ASCII file on disk, or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- Press F10 [EXIT] to return to the Monitor Screen.



Frame and packet level statistics are provided for X.25 networks.

SNA Level 2 and 3 Statistics Screens

Level 2 and 3 statistics for SNA networks are provided in the SDLC Statistics Screen (Level 2) and the SNA RU Codes Statistics Screen (Level 3). The statistics on these screens are updated once every second and are displayed for both transmitted and received data.

How to access this screen:

- <Shift>F6 from the Monitor Screen (when an SDLC/SNA protocol decode is loaded).
- F6 [LEV2&3] from the Frame Relay DLCI Statistics Screen (when SDLC/SNA protocol is specified in the frame relay configuration).

Main functions of this screen:

- Display counts of SDLC frame and SNA RU types monitored by the LM2000.
- Display percentages of all frames that are information frames and of all RUs that are data packets. Also displays the percentage of all SDLC frames that are Receiver Ready (RR) frames.

Access to:

- Press F3 to switch between the SDLC Statistics Screen and the SNA RU Codes Statistics Screen.

Other functions:

- To set all statistics to zero, press F1 [0 STAT].
- Press F8 [PR DSK] to print a copy of the screen to an ASCII file on disk, or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- Press F10 [EXIT] to return to the Monitor Screen.

Layer 2 statistics are displayed in the SDLC screen.

SDLC STATISTICS

General	TX	RX
Total Frames	2180	5249
INFO Frames	252	606
INFO percent	12%	12%
CRC Err/Aborts	0	0
Unknown Frames	84	202

Supervisory	TX	RX
RR	1760	4239
RR percent	81%	81%
RNR	0	0
REJ	84	202

Unnumbered	TX	RX
UI	0	0
UA	0	0
UP	0	0
RIM/SIM	0	0
RD/DISC	0	0
SNRM	0	0
FRMR	0	0
DM	0	0
XID	0	0
CFGR	0	0
TEST	0	0
BCN	0	0
LPDA	0	0

10 STAT 2 3LAYER3 4 5 6 7 8PR DSK 9 10EXIT

Press F1 to reset both Layer 2 and Layer 3 statistics

Press F3 to switch between Layer 2 and 3 statistics

Layer 3 statistics are displayed in the SNA RU codes screen.

SNA RU CODES STATISTICS

TX - Line				RX - Line			
NEG RESP	1	BIND	0	NEG RESP	0	BIND	0
Data	97	UNBIND	0	Data	174	UNBIND	0
%Data	33.11	SWITCH	0	%Data	33.33	SWITCH	0
		BIS	0			BIS	0
NCIPLFINAL	0	SBI	0	NCIPLFINAL	0	SBI	0
NCIPLINIT	97	QEC	0	NCIPLINIT	174	QEC	0
LUSTAT	0	QC	0	LUSTAT	0	QC	0
RTR	0	RELQ	0	RTR	0	RELQ	0
NCIPLABORT	0	CANCEL	0	NCIPLABORT	0	CANCEL	0
NCERINOP	0	CHASE	0	NCERINOP	0	CHASE	0
NCERTEST	0	SDT	0	NCERTEST	0	SDT	0
NCERTSTRPL	0	CLEAR	0	NCERTSTRPL	0	CLEAR	0
NCERACT	0	STSN	0	NCERACT	0	STSN	0
NCERACTRPL	0	RQR	0	NCERACTRPL	0	RQR	0
NCEROP	0	SHUTD	0	NCEROP	0	SHUTD	0
ACTLU	0			ACTLU	0		
DEACTLU	0	SHUTC	0	DEACTLU	0	SHUTC	0
ACTPU	0	RSHUTD	0	ACTPU	0	RSHUTD	0
DEACTPU	0	BID	0	DEACTPU	0	BID	0
ACTCDRM	0	SIG	0	ACTCDRM	0	SIG	0
DEACTCDRM	0	Unknwn	98	DEACTCDRM	0	Unknwn	174

10 STAT 2 3LAYER2 4 5 6 7 8PR DSK 9 10EXIT

Frame and RU statistics are provided for SNA networks.

ISDN (Q.921) Level 2 Statistics Screen

Level 2 statistics for ISDN (Q.921) networks are provided in the LAPD Statistics Screen. The statistics on this screen are updated once every second and are displayed for both transmitted and received data.

How to access this screen:

- <Shift>F6 from the Monitor Screen (when a LAPD/ISDN protocol decode is loaded).
- F6 [LEV2&3] from the Frame Relay DLCI Statistics Screen (when a LAPD/ISDN protocol is specified in the frame relay configuration).

Main functions of this screen:

- Display counts of LAPD frame types monitored by the LM2000.
- Display percentage of all LAPD frames that are information frames or Receiver Ready (RR) frames.

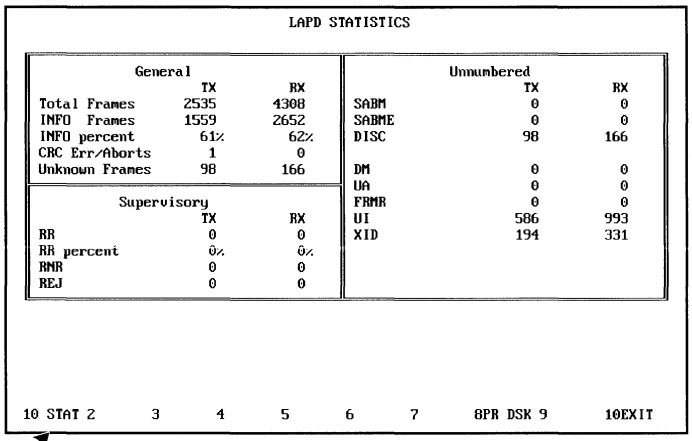
Access to:

- The LAPD Statistics Screen does not provide access to any other screens.

Other functions:

- To set all statistics to zero, press F1 [0 STAT].
- Press F8 [PR DSK] to print a copy of the screen to an ASCII file on disk, or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- Press F10 [EXIT] to return to the Monitor Screen.

Layer 2 statistics are displayed in the LAPD screen.



Press F1 to reset Layer 2 statistics

Frame level statistics are provided for Q.921 networks.

Frame Relay Statistics and the Frame Relay Configuration File

The LM2000 automatically compiles statistics for any virtual circuit it detects traffic on (up to 256). However, in order to provide accurate readings — and to compile statistics for currently idle virtual circuits — each virtual circuit you wish to monitor must be listed in the frame relay configuration file. Information is entered in this file via the Circuit Action Map or Circuit Status Map Screens.

Entering configuration information for virtual circuits

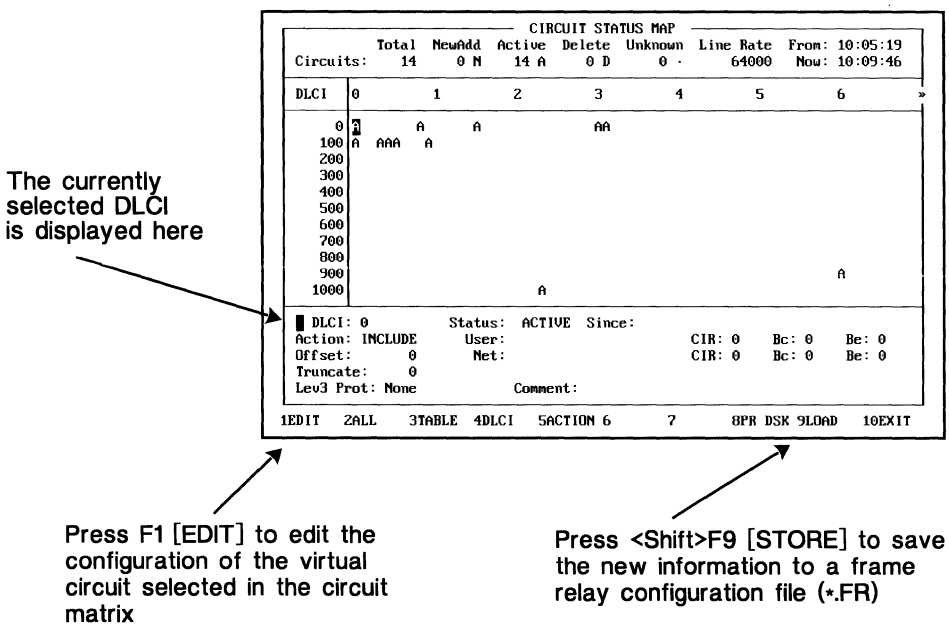
1) Press F5 [MAPS] from any frame relay statistics screen to access the Circuit Status Map Screen.
   - The Circuit Status Map appears.
2) Press F1 [EDIT] and enter the DLCI of the virtual circuit you want to configure. (You can also select a virtual circuit in the circuit matrix in the middle of the screen. Just move the cursor to the desired position and press F1.)
3) Fill in each field as it is presented to you, either typing in requested information or making selections from a menu. Press <Enter> to accept each entry and move to the next field.
4) Any configuration information you enter is immediately valid and remains so until you exit the LM2000. To save configuration information to a file so you don't have to reenter it, press <Shift>F9 [STORE]. You can then accept the default configuration file name (CONFIG.FR) or enter a new one. (CONFIG.FR is automatically loaded each time you load the frame relay protocol decode at the System Configuration Screen.)

Note:

- You can also edit the frame relay configuration file directly using any text editor. Information for each virtual circuit is entered on a single line, which must begin with the DLCI of the circuit. Look at CONFIG.FR for the proper syntax. A colon (:) separates each field name from the field entry. Lines in the CONFIG.FR file can be "commented" out so they are temporarily disregarded, by typing REM at the beginning of the line.

See also:

For detailed information on virtual circuit configuration fields, see Chapter 4 under "More about Frame Relay Configuration" and "Screen Overview: Circuit Action Map."



Configuration information for each DLCI is entered at the Circuit Status Map Screen.

Frame Relay All Circuit Statistics Screen Overview

The All Circuit Statistics Screen presents statistics for all virtual circuits on a frame relay link. The statistics on this screen are updated once every second and are displayed for both transmission directions: from the user to the network and from the network to the user. The top section of the screen provides information about the status of circuits on the link. The lower portion of the screen displays the accumulated statistics for all circuits.

How to access this screen:

- <Shift>F6 from the Monitor Screen
- F2 [ALL] from other statistics screens. (Also, you are returned to the All Circuit screen when you press F10 [EXIT] from any of the other statistics screens.)

Main functions of this screen:

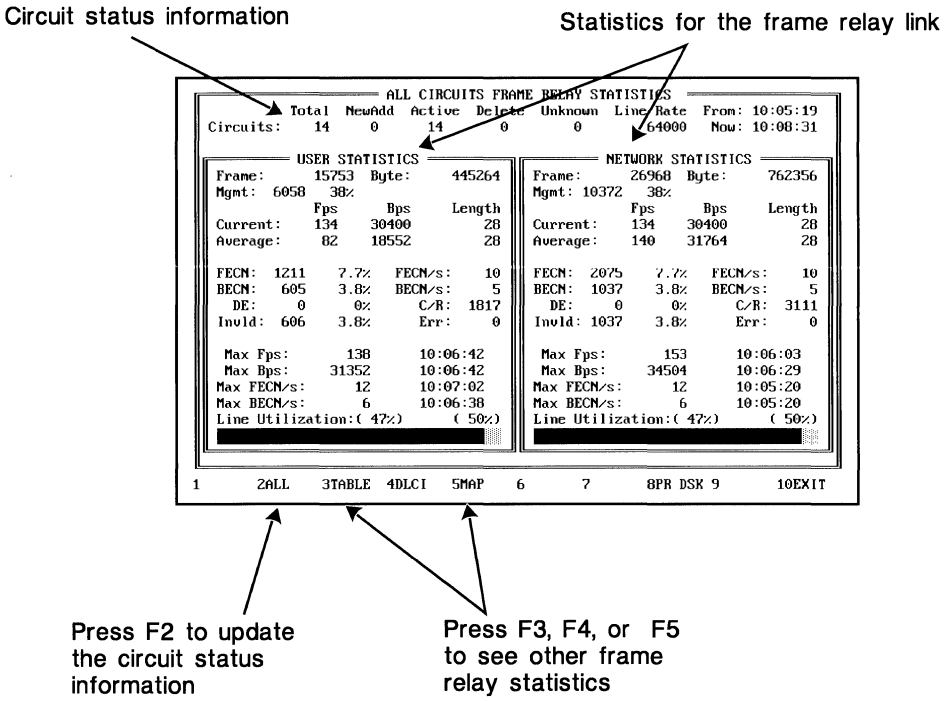
- Display statistics for all virtual circuits on a frame relay link.
- Display line utilization for a frame relay link.
- Provide access to all other frame relay statistics screens.

Access to:

- All Circuit Statistics Table — Press F3 [TABLE]
- DLCI Statistics Screen — Press F4 [DLCI]. (You will be prompted for the value of the DLCI for which you wish to see statistics.)
- Circuit Status Map — Press F5 [MAP]. (You can access the Circuit Action Map from the Circuit Status Map Screen.)

Other functions:

- To set all statistics to zero, press <Shift>F1 [RESET]. This also resets the time in the **From:** field.
- To update the status information to include all DLCIs that have had activity since the last reset, press F2 [ALL] while in the All Circuits Screen. (When you first access this screen, statistics are displayed only for DLCIs listed in the frame relay configuration file [*.fr].)
- Press F8 [PR DSK] to print a copy of the All Circuits Statistics Screen to an ASCII file on disk, or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- Press F10 [EXIT] to return to the Monitor Screen.



Statistics for all virtual circuits on a frame relay link are displayed on the All Circuit Statistics Screen.

Frame Relay All Circuit Statistics Fields

The following are field descriptions for the All Circuits Statistics Screen.

Circuit status fields

The **Total** field displays the number of currently configured virtual circuits on the link. The **NewAdd**, **Active**, **Delete**, and **Unknown** fields provide a breakdown of the virtual circuits on the link according to their status. The values in these fields are initially taken from the frame relay configuration file (*.fr) and are updated periodically.

The **From:** field displays the time when the LM2000 began compiling statistics (this field is reset when you press <Shift>F1). The **Now:** field displays the current PC clock time. Together these fields give the elapsed time during which the statistics were compiled.

The **Line Rate:** field displays the baud rate selected in the LM2000's System Configuration Screen.

Frame statistics fields

The left side of the screen displays the statistics for traffic going from the user (DTE) to the network and the right side displays the statistics for traffic going from the network (DCE) to the user. The fields in both areas are identical and are described below.

The **Frame:** and **Byte:** fields display the total number of frames and bytes monitored since the last reset.

The **Mgmt:** fields display the total number of frames monitored on the management circuits (DLCIs 0 or 1023) and the percentage of all frames that were management frames (i.e., management overhead).

The **Current:** fields display the current frames per second (**Fps**) and bits per second (**Bps**) rates (measured over the last second). Also displayed is the average frame length in bytes (**Length**).

The **Average:** fields give the average frame per second (**Fps**) and bits per second (**Bps**) rates calculated since the last reset. Also displayed is the average frame length as calculated using averaged figures.

The **FECN:** fields display the total number of frames with the FECN bit set and the percentage of all frames that had the FECN bit set.

The **FECN/s:** fields display the FECN per second rate (FECN frequency).

The **BECN:** fields display the total number of frames with the BECN bit set and the percentage of all frames that had the BECN bit set.

The **BECN/s:** fields display the BECN per second rate (BECN frequency).

The **DE:** fields display the total number of frames with the Discard Eligibility bit set and the percentage of all frames that had the DE bit set.

The **C/R:** fields display the total number of frames with the command/response bit set.

The **Invld:** fields display the total number of invalid frames (that is, frames that were rejected for reasons other than a bad CRC) and the percentage of all frames that were invalid.

The **Err:** fields display the total number of errored frames (that is, frames that were rejected because of bad CRCs).

The **Max** fields (**Fps, Bps, FECN**, and **BECN**) display the peak measurements for their respective units since the last reset. These fields are updated as higher measurements are recorded. The time each peak was recorded is also displayed.

The **Line Utilization** graphs display the percentage of available bandwidth currently in use. Line utilization is calculated with the formula:

(**Current Bps** ÷ **Line Rate**) x 100

There are two figures listed above the bar graph. The figure on the left is the actual value shown on the graph. The figure on the right is the graph's current maximum value. If the graph exceeds 100%, you may be able to increase your line rate.

Frame Relay All Circuit Statistics Table – Overview and Fields

The Frame Relay All Circuit Statistics Table Screen gives statistics for all configured circuits, listed by DLCI value. The statistics on this screen are updated once every second.

How to access this screen:

- F3 [TABLE] from any other frame relay statistics screen.

Main functions of this screen:

- Display current, average, and peak Frames per second and Bits per second rates for all active circuits. Also displays number of FECN and BECN frames monitored.

Access to:

- All Circuit Statistics Screen — Press F2 [ALL]
- DLCI Statistics Screen — Press F4 [DLCI] or <Enter>. (You will be shown statistics for the currently selected circuit.)
- Circuit Status Map — Press F5 [MAP]

Other functions:

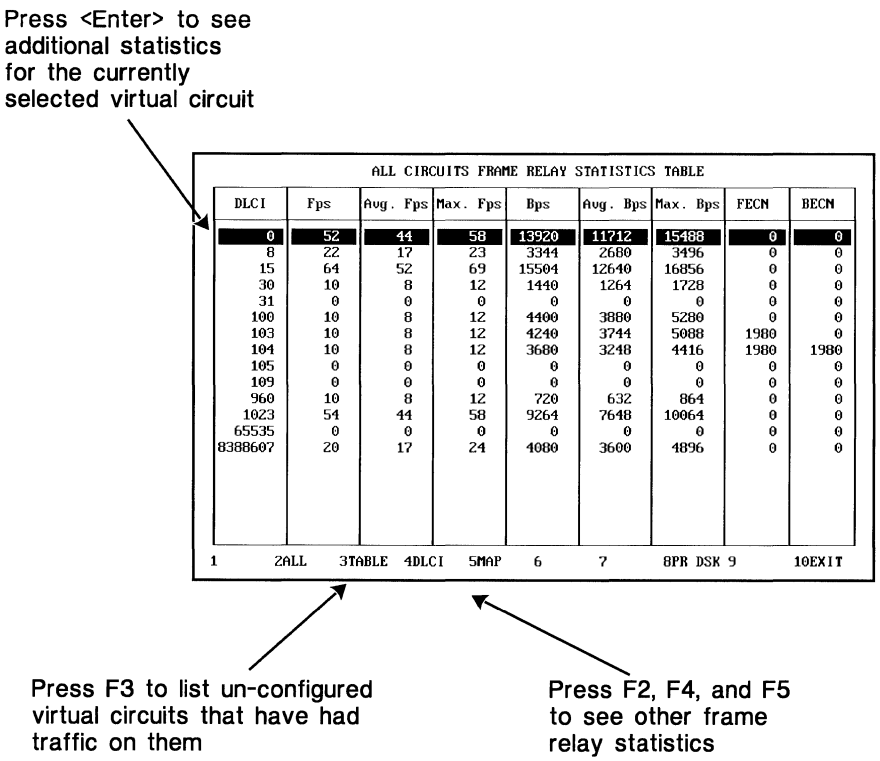
- To set the statistics for the currently selected circuit to zero, press <Shift>F1 [RESET].(Resetting these statistics does not affect the statistics on the All Circuits Statistics Screen).
- To update the screen to list newly active DLCIs, press F3 [TABLE].
- To print a copy of this screen to an ASCII file on disk, press F8 [PR DSK] or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- Press F10 [EXIT] to return to the All Circuit Statistics Screen. Press <Esc> to return directly to the Monitor Screen.

Fields

Fps: – Frames per second
Avg. Fps – Average Frames per second
Max. Fps – Maximum Frames per second
Bps – Bits per second
Avg Bps – Average Bits per second
Max. Bps – Maximum Bits per second
FECN – Frames with the FECN bit set
BECN – Frames with the BECN bit set

Notes:

- When you first access this screen, statistics are displayed only for DLCIs listed in the frame relay configuration file (*.fr). To see statistics for all DLCIs that have had activity since the last reset, press F3 [TABLE].
- The statistics in the table include traffic from the user to the network and from the network to the user.



Statistics for all configured circuits are listed by DLCI value.

Frame Relay DLCI Statistics Screen – Overview

This screen presents statistics for individual virtual circuits on a frame relay link. The statistics on this screen are updated once every second and are displayed for both transmission directions: from the user to the network and from the network to the user. The top part of the screen displays the DLCI value of the current circuit and the configuration information for that circuit. The lower portion of the screen displays the accumulated statistics for the current circuit.

How to access this screen:

- F4 [DLCI] from any other frame relay statistics screen. (When accessing this screen from the All Circuits Statistics Screen you will be prompted for a DLCI value. When accessing this screen from the All Circuits Statistics Table or status map screens, you will be shown statistics for the circuit currently selected in that screen.)

Main functions of this screen:

- Display statistics for a single virtual circuit.
- Display Committed Information Rate utilization information.

Access to:

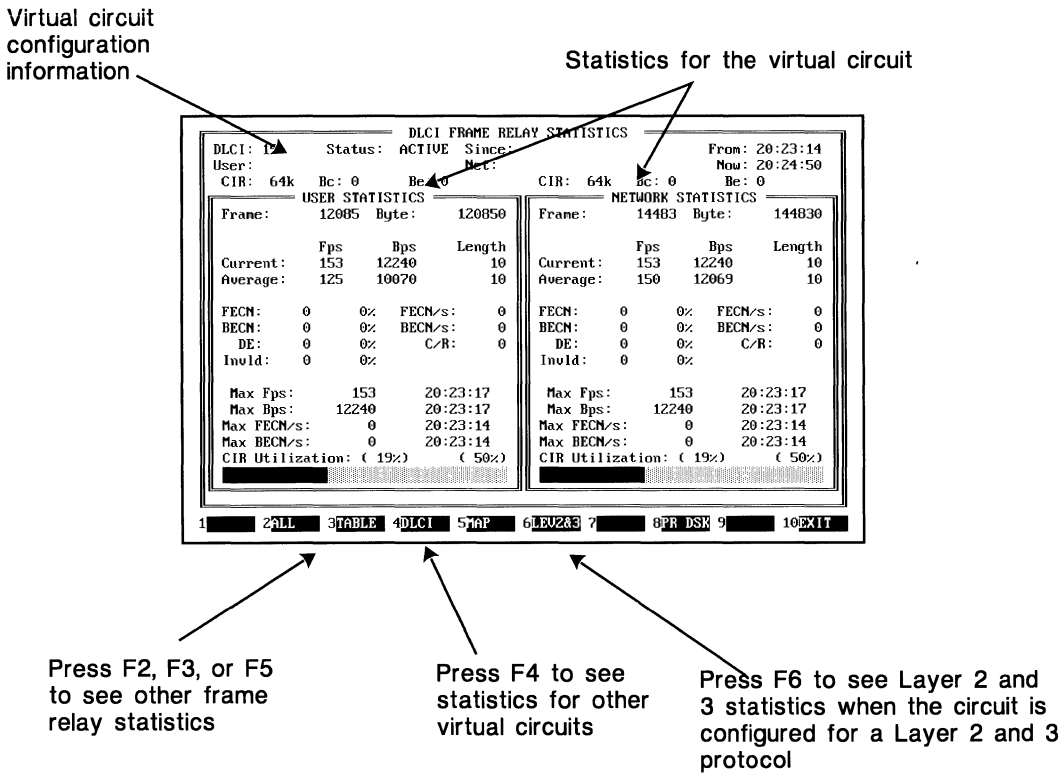
- All Circuit Statistics Screen — Press F2 [ALL]
- All Circuit Statistics Table — Press F3 [TABLE]
- Circuit Status Map — Press F5 [MAP]
- Level 2 and 3 Decode — Press F6 [LEV2&3]. If no Level 2 and 3 protocol is specified in the frame relay configuration, a menu appears from which you can select one. You will also be prompted for an offset (the number of bytes in the frame before the Level 2 and 3 information begins).

Other functions:

- To set the statistics for the currently selected circuit to zero, press <Shift>F1 [RESET].
- To view statistics for other circuits, press F4 [DLCI]. You will be prompted for the new DLCI value.
- To print a copy of this screen to an ASCII file on disk, Press F8 [PR DSK], or press <Shift>F8 [PRINT] to send a copy of the screen to a printer.
- To return to the All Circuit Statistics Screen, press F10 [EXIT]; to return directly to the Monitor Screen, press <Esc>.

Notes:

- When you leave this screen, you will be prompted to save any Level 2 and 3 protocol and offset changes you made. This only saves the setting temporarily; to save it permanently, you must reconfigure the circuit at the Circuit Status Map Screen.
- If the CIR value is not entered in the frame relay configuration file or is set to zero, the CIR Utilization graph will show 0% CIR utilization.



The DLCI Statistics Screen presents statistics for individual virtual circuits.

Frame Relay DLCI Statistics Fields

The following are field descriptions for the Frame Relay DLCI Statistics Screen.

Configuration information fields

The configuration information, derived from the frame relay configuration file (*.fr), is entered by the user at the Circuit Action Map Screen or the Circuit Status Map Screen. If there is no entry in a field for a given DLCI, that field will be blank.

The **DLCI:** field displays the DLCI value of the currently selected circuit.

The **Status:** field displays the virtual circuit's status.

The **Since:** field displays the time and date when the circuit's configuration was last changed.

The **User:** and **Net:** fields display, respectively, the user and network identifications entered in the circuit's configuration information.

The **CIR:** fields display the Committed Information Rate for the user (on the left of the screen) and network (on the right of the screen) sides of the link.

The **Bc:** and **Be:** fields display, respectively, the Committed Burst size and the Excess Burst size for the user (on the left of the screen) and network (on the right of the screen) sides of the link.

The **From:** field displays the time when the LM2000 began compiling statistics for the current virtual circuit. (This field is reset when you press <Shift>F1.) The **Now:** field displays the current PC clock time. Together these fields give the elapsed time during which the statistics were compiled.

Circuit statistics fields

The left side of the screen displays the statistics for traffic from the user (DTE) to the network and the right side displays the statistics for traffic from the network (DCE) to the user. The fields in both areas are identical and are described below.

The **Frame:** and **Byte:** fields display the total number of frames and bytes monitored since the last reset.

The **Current:** fields give the current rates for frames per second (**Fps**) and bits per second (**Bps**). Also displayed is the average frame length in bytes (**Length**).

The **Average:** fields give the average frame per second (**Fps**) and bits per second (**Bps**) rates calculated since the last reset. The average frame length as calculated using averaged figures is also displayed.

The **FECN:** fields display the total number of frames with the FECN bit set and the percentage of all frames that had the FECN bit set.

The **FECN/s:** fields display the FECN per second rate (FECN frequency).

The **BECN:** fields display the total number of frames with the BECN bit set and the percentage of all frames that had the BECN bit set.

The **BECN/s:** fields display the BECN per second rate (BECN frequency).

The **DE:** fields display the total number of frames with the Discard Eligibility bit set and the percentage of all frames that had the DE bit set.

The **C/R:** fields display the total number of frames with the command/response bit set.

The **Invld:** fields display the total number of invalid frames (frames rejected for reasons other than a bad CRC) and the percentage of all frames that were invalid.

The **Max** fields (**Fps**, **Bps**, **FECN**, and **BECN**) display the peak measurements for their respective units since the last reset. These fields are updated as higher measurements are recorded. The time each peak was recorded is also displayed.

The **CIR Utilization** graphs display the percentage of available bandwidth currently in use. CIR utilization is calculated as:

(**Current Bps** ÷ **CIR**) x 100

There are two figures listed above the bar graph. The figure on the left is the actual value shown on the graph. The figure on the right is the graph's current maximum value. If the graph exceeds 100%, you may need to increase your CIR.

Frame Relay Circuit Status Map – Overview

The Circuit Status Map Screen displays the status of all virtual circuits and allows you to enter configuration information for individual circuits. The top section of the screen gives a summary count of circuits on the link and their status. The middle section is a matrix that displays the status of all configured DLCIs (with non-extended addresses). This section also allows you to select individual circuits to access configuration information or view statistics. The bottom section of the screen displays the configuration fields for the selected circuit.

How to access this screen:

- F5 [MAP] from the All Circuit Statistics Screen, All Circuit Statistics Table, and DLCI Statistics Screen; or F5 [STATUS] from the Frame Relay Circuit Action Map Screen.

Main functions of this screen:

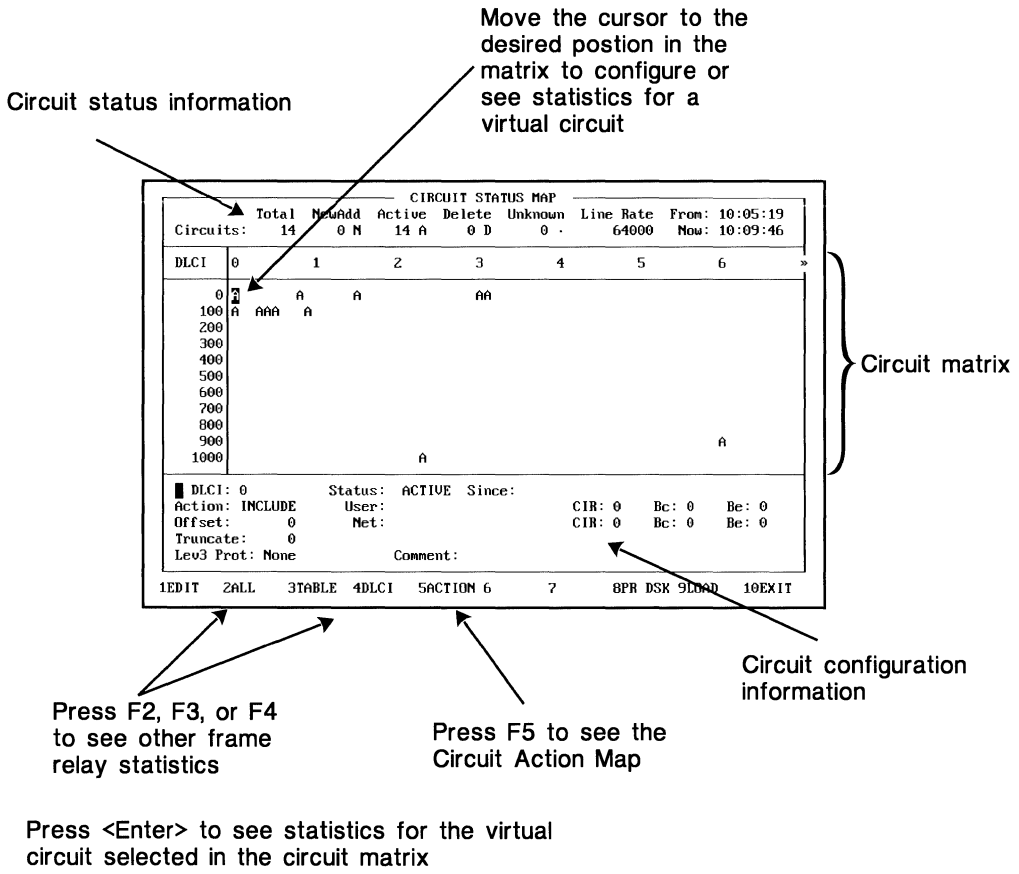
- Display the status of all configured circuits.
- Provide access to the frame relay configuration file (*.fr).

Access to:

- All Circuit Statistics Screen — Press F2 [ALL]
- All Circuit Statistics Table — Press F3 [TABLE]
- DLCI Statistics Screen — Press F4 [DLCI] or <Enter>. (When you access the DLCI Statistics Screen from the Circuit Status Map, you will be shown the statistics for the circuit currently selected in the circuit matrix.)
- Circuit Action Map — Press F5 [ACTION]

Other functions:

- To enter or change configuration information for the currently listed circuit, press F1 [EDIT]. (Select a circuit to enter configuration information for by moving the cursor to the desired position in the circuit matrix and pressing F1, or by pressing F1 first and then entering the DLCI value for the desired circuit.)
- To arrange the entries in the frame relay configuration file (*.fr) in numerical order by DLCI, press <Shift>F1 [SORT]. (To save the sorted file, press <Shift>F9 [STORE].)
- To print a copy of this screen to an ASCII file on disk, press F8 [PR DSK]; to send a copy of the screen to a printer, press <Shift>F8 [PRINT].
- To retrieve a frame relay configuration file, press F9 [LOAD]; to save the current configuration settings in a file, press <Shift>F9 [STORE].
- To return to the All Circuit Statistics Screen, press F10 [EXIT]; to return directly to the Monitor Screen, press <Esc>.



The Circuit Status Map displays the status of all configured virtual circuits.

Frame Relay Circuit Status Map Fields

The following are field descriptions for the Frame Relay Circuit Status Map Screen.

Circuit summary counts

The top section of the screen displays the total number of known circuits and a breakdown of the status for all known circuits.

The **Total** field displays the number of currently configured virtual circuits. The **Active**, **NewAdd**, **Delete**, and **Unknown** fields provide a breakdown of the configured circuits according to their status. The values in these fields are initially taken from the frame relay configuration file (*.fr) and are updated periodically.

The **Line Rate** field displays the baud rate selected in the LM2000's System Configuration Screen.

The **From:** field displays the time when the LM2000 began compiling statistics for the current virtual circuit (this field is reset when you press <Shift>F1 at the All Circuits Statistics Screen). The **Now:** field displays the current PC clock time. Together these fields give the elapsed time during which the statistics were compiled.

The circuit matrix

The middle section of the screen is a matrix that displays all 1,024 DLCI values. The circuit matrix displays the status for each virtual circuit and provides a means of accessing the configuration information for each circuit.

When the status of a virtual circuit is known (either because it was entered in the configuration information or because traffic has been detected), it is displayed at the appropriate position in the matrix. The status of a circuit is represented as follows

Unknown - . (dot)
Deleted - D
Active - A
Newly added - N

The circuit matrix also provides a means of accessing the configuration information for each circuit. Simply move the cursor (using the arrow keys to move one position at a time or the <Tab> and <Shift><Tab> keys to move 10 positions at a time) to the desired position and press F1 [EDIT].

Virtual circuit configuration information

The bottom section of the Circuit Status Map screen displays the configuration information for the currently selected circuit and lets you enter or change this information.

Note

- The circuit matrix has 100 columns, 0 through 99, each representing the tens (10^1) value of a DLCI (multiply the column number by 10). There are 11 rows, 0 through 1000, each representing the hundreds value (10^2) of a DLCI. To select a specific DLCI value, move the cursor to the appropriate row and column. (The DLCI value for the current cursor position is displayed in the **DLCI:** field in the bottom section of the screen.) For example, to select DLCI 410, you would move the cursor to the 400 row and the 10 column (the column labeled 1).

See also:

"Frame Relay Statistics and the Frame Relay Configuration File" earlier in this chapter and Chapter 4, "System Configuration Reference," for more on entering and changing circuit configuration information.

Frame Relay Circuit Action Map – Overview

The Circuit Action Map Screen lets you set up filters for virtual circuits on a frame relay link, and, like the Circuit Status Map Screen, allows you to enter configuration information for individual circuits. The top section of the screen gives a summary count of circuits on the link and their currently selected filter actions. The middle section is a matrix that displays the filter actions selected for all possible DLCIs (with non-extended addresses). This section also allows you to select individual circuits to access configuration information or view statistics. The bottom section of the screen displays the configuration fields for the selected circuit.

How to access this screen:

- F5 [ACTION] from the Circuit Status Map Screen.
- F3 [L 2&3] from the Trap String Definition Screen.

Main functions of this screen:

- Display the selected filter action for all known circuits.
- Provide access to the frame relay configuration file (*.fr).

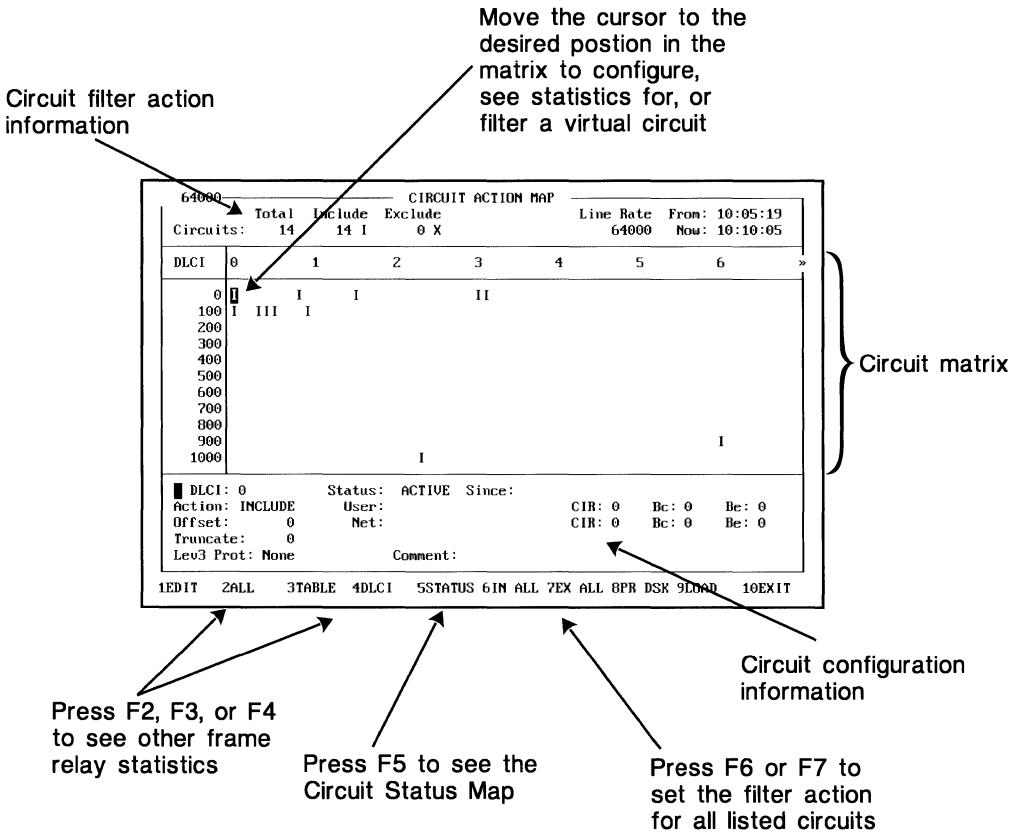
Access to:

- All Circuit Statistics Screen — Press F2 [ALL]
- All Circuit Statistics Table — Press F3 [TABLE]
- DLCI Statistics Screen — Press F4 [DLCI]. (When you access the DLCI Statistics Screen from the Circuit Action Map, you will be shown the statistics for the circuit currently selected in the circuit matrix.)
- Circuit Status Map — Press F5 [STATUS]

Other functions:

- To enter or change configuration information for the currently listed circuit, press F1 [EDIT]. (Select a circuit to enter configuration information for by moving the cursor to the desired position in the circuit matrix and pressing F1, or by pressing F1 first and then typing in the DLCI value for the desired circuit.)
- To arrange the entries in the frame relay configuration file in numerical order by DLCI, press <Shift>F1 [SORT]
- To set the filter status for all circuits to Include, press F6 [IN ALL].
- To set the filter status for all circuits to eXclude, press F7 [EX ALL].
- To print a copy of this screen to an ASCII file on disk, press F8 [PR DSK]; to send a copy of the screen to a printer, press <Shift>F8 [PRINT].

- To retrieve a frame relay configuration file, press F9 [LOAD]; to save the current configuration settings in a frame relay configuration file, press <Shift>F9 [STORE]
- To return to the All Circuit Statistics Screen, press F10 [EXIT]; to return directly to the Monitor Screen, press <Esc>.



You can set up filters for virtual circuits on a frame relay link.

Frame Relay Circuit Action Map Fields

The following are field descriptions for the Frame Relay Circuit Action Map Screen.

Circuit summary counts

The top section of the screen displays the total number of known circuits and a breakdown of the filter status for all known circuits.

The **Total** field is updated every five seconds and provides a count of circuits that have had traffic on them during a monitoring session.

The remaining fields, **Include** and **Exclude**, display the number of circuits that currently have the include or exclude filter action selected.

The **Line Rate** field displays the baud rate selected in the LM2000's System Configuration Screen.

The **From:** field displays the time when the LM2000 began compiling statistics for the current virtual circuit. (This field is reset when you press <Shift>F1 at the All Circuits Statistics Screen.) The **Now:** field displays the current PC clock time. Together these fields give the elapsed time during which the statistics were compiled.

The circuit matrix

The middle section of the screen is a matrix that displays all 1,024 DLCI values. The circuit matrix displays, and allows you to change, the filter action for each circuit, and it provides a means of accessing the configuration information for each circuit.

Virtual circuit (DLCI) filters

The virtual circuit filter action allows you to capture or disregard frames based on the DLCI value. To change the filter action for a circuit, move the cursor to the desired position in the matrix and press i to Include or x to eXclude that virtual circuit (the filter action can also be toggled between I and X by pressing the spacebar). You can assign the same filter action to all known circuits by pressing F6 [IN ALL] to include all circuits or F7 [EX ALL] to exclude all circuits. Excluded circuits are not captured to the LM2000 buffer, but they are counted in the Frame Relay statistics.

Virtual circuit configuration information

The bottom section of the Circuit Action Map Screen displays the configuration information for the currently selected circuit and lets you enter or change this information.

Note:

- The matrix has 100 columns, 0 through 99, each representing the tens (10^1) value of a DLCI (multiply the column number by 10). There are 11 rows, 0 through 1000, each representing the hundreds value (10^2) of a DLCI. To select a specific DLCI value, move the cursor to the appropriate row and column. (The DLCI value for the current cursor position is displayed in the DLCI: field in the bottom section of the screen.) For example, to select DLCI 410, you would move the cursor to the 400 row and the 10 column (the column labeled 1).

See also:

"Frame Relay Statistics and the Frame Relay Configuration File" earlier in this chapter and Chapter 4, "System Configuration Reference," for more on entering and changing DLCI configuration information.

Chapter 9
Analyzing Data in the View Buffer Screen

- Screen Overview: View Buffer
- What is the Capture Buffer?
- Loading Buffer and Snapshot Files for Review
- Saving the Capture Buffer in a Buffer File
- Moving Around in the Buffer
- Where in the Buffer are you?
- Moving Around with Go to
- Locating Specific Data with Find and Find Next
- Entering Search Strings for the Find Function
- Selecting the Data Display Mode
- Analyzing Data: Hex, Character, Mnemonic, and Octal Displays
- Analyzing Data: Modem Lead Display
- Analyzing Data: Level 2 and Level 3 Decode Displays
- Analyzing Data: Expanded Decode Display
- Post Capture Display Filters with Buffer Trace
- Printouts and ASCII Files from the Buffer
- Printing the Expanded Decode Screen
- How to Determine Elapsed Times
- How to Export Frames for Emulation

Screen Overview: View Buffer

The View Buffer Screen allows you to perform detailed analysis of data captured by the LM2000. The View Buffer Screen gives you access both to the LM2000 capture buffer and to data captured to disk. Several tools in this screen facilitate analysis, such as the post capture display filters and Expanded Decode.

How to access this screen:

- F4 from the Main Menu
- F5 from the Monitor Screen

Main functions of this screen:

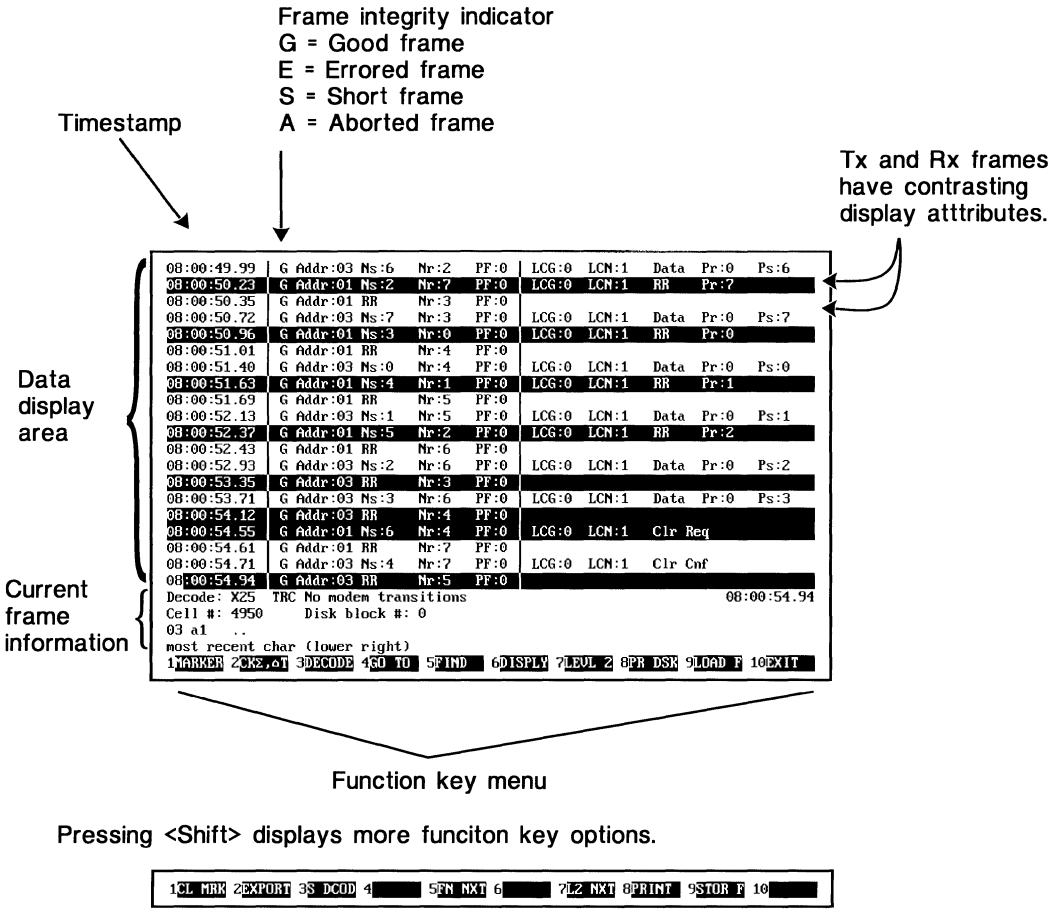
- Analyze data in the LM2000 capture buffer
- Analyze data saved to disk in buffer and snapshot files
- Locate specific data or frame types using Go To and Find
- Select one of eleven data display modes, including Expanded Decode, for flexible analysis
- Define post capture filters using the buffer trace function to display only frames of immediate interest
- Print data on a printer with your own comments about protocol implementation or performance
- Print data to an ASCII file where it can be printed or accessed by other personal computer software

Access to other screens and functions:

- Layer 2 & 3 Decodes – Press F3 [DECODE]
- Change display modes – Press F6 [DISPLY]
- Post capture display filters – Press F6 [DISPLY]

See Also:

Chapter 4 for more about the System Configuration Screen; Chapter 7 for more about the Monitor Screen and Snapshots; Chapter 8 for more about the Frame Level Statistics; Chapter 11 for more about the Software Break-Out Boxes.



Pressing <Shift> displays more funciton key options.

The View Buffer Screen helps perform detailed analysis of captured data.

What Is the Capture Buffer?

Data monitored with the LM2000 is initially written to the capture buffer, a 64KB segment of random access memory (RAM) which can be accessed via the View Buffer Screen. The capture buffer is used to examine data that has just been monitored and to review data from buffer or snapshot files captured previously and stored on the PC's disk.

What is in the capture buffer?

The capture buffer's 64KB of RAM contains monitored data and, if time stamping is enabled, information about when the data was captured. With bit oriented protocols, precapture filters may be specified to limit the type of data, by address or frame type, that will be saved in the buffer, and post capture display filters can similarly select certain frames for display.

How much does it hold?

The capacity of the capture buffer is 32KB with time stamping disabled, 16KB with it enabled. The capture buffer may be expanded, using the stream to disk feature, so that it is limited essentially by the size of the system's hard disk.

When in the Monitor Screen, the capture buffer overwrites itself

When the 64KB capture buffer becomes full and you are at the Monitor Screen, the LM2000 begins overwriting the oldest data. The capture buffer always has the most recent 64KB of data in memory.

When in the View Buffer Screen, data is not overwritten

When you enter the View Buffer Screen from the Monitor Screen, the LM2000 system operating mode is set to halt. Data already in the capture buffer will not be overwritten while you are reviewing that data.

You can save data in the buffer to a disk file

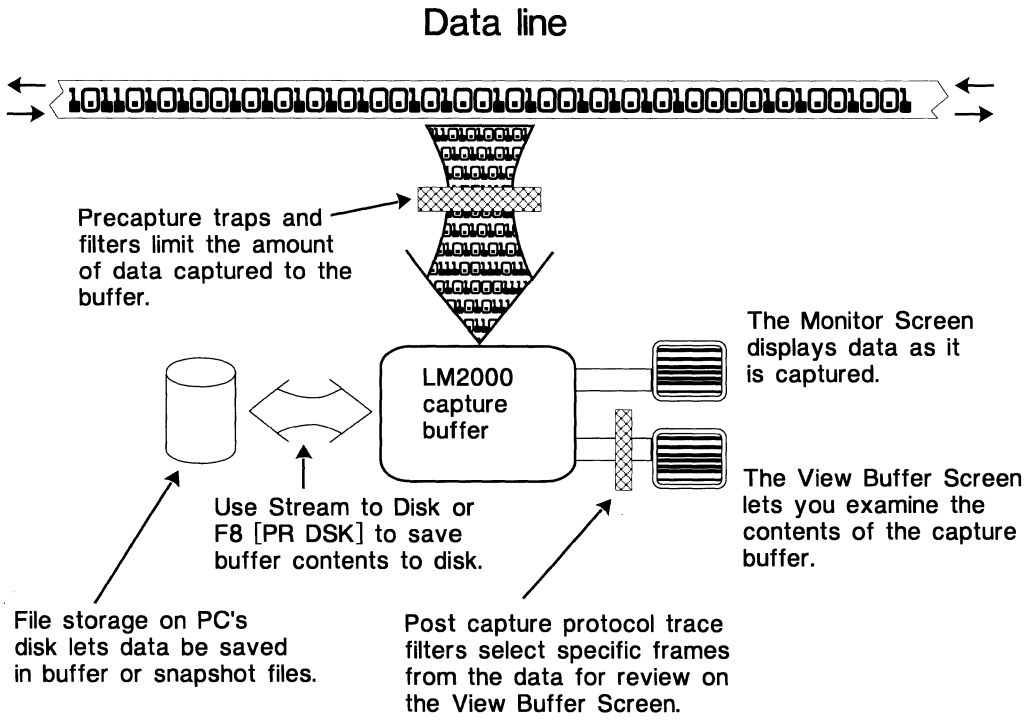
The current contents of the capture buffer can be saved to and later loaded from disk as a buffer file. See the following spread, "Loading Buffer and Snapshot Files for Review," and the subsequent spread, "Saving the Capture Buffer in a Buffer File," for more information.

Capture buffers not saved to disk will be lost

When you exit the LM2000 program, the capture buffer is cleared. If you have saved the data to a disk file, you will be able to reload it later, whenever you need it.

See Also:

Chapter 4 for more about streaming data to disk; Chapter 7 for more about saving snapshots; and Appendix C for information about the format of buffer files.



Data can be placed in the capture buffer directly from the data line or by loading a buffer or snapshot file.

Loading Buffer and Snapshot Files for Review

You can load data from buffer or snapshot files into the capture buffer for review at any time. After a file is loaded, you can examine the data using the View Buffer Screen. The cursor is positioned at the character that was captured most recently (that is, at the end of the file).

How to load a buffer or snapshot file:

1) Press F9 [LOAD F].
   - The buffer file menu appears.
2) Use the arrow keys or press the initial letter of a filename to select the desired file.
3) Press <Enter>.
   - The LM2000 loads the selected buffer or snapshot file into the View Buffer Screen.
4) If the current system configuration values don't match those in the buffer file, the LM2000 displays the following message:

   Current configuration doesn't match file. Override (y/n)?:y

   Press <Enter> and the LM2000 will change the system configuration as necessary to match the values in the buffer file. Press **n** and the buffer file will not be loaded.

Buffer files are handled blocks at a time

The LM2000 reads data to and from buffer files in blocks, each block containing 32KB of data, modem lead state, and time stamp information. Blocks are read into the capture buffer from the disk a pair at a time. When a file larger than 64KB is being examined in the View Buffer Screen, the current disk block number is displayed.

Snapshot files are accessed in groups by filename

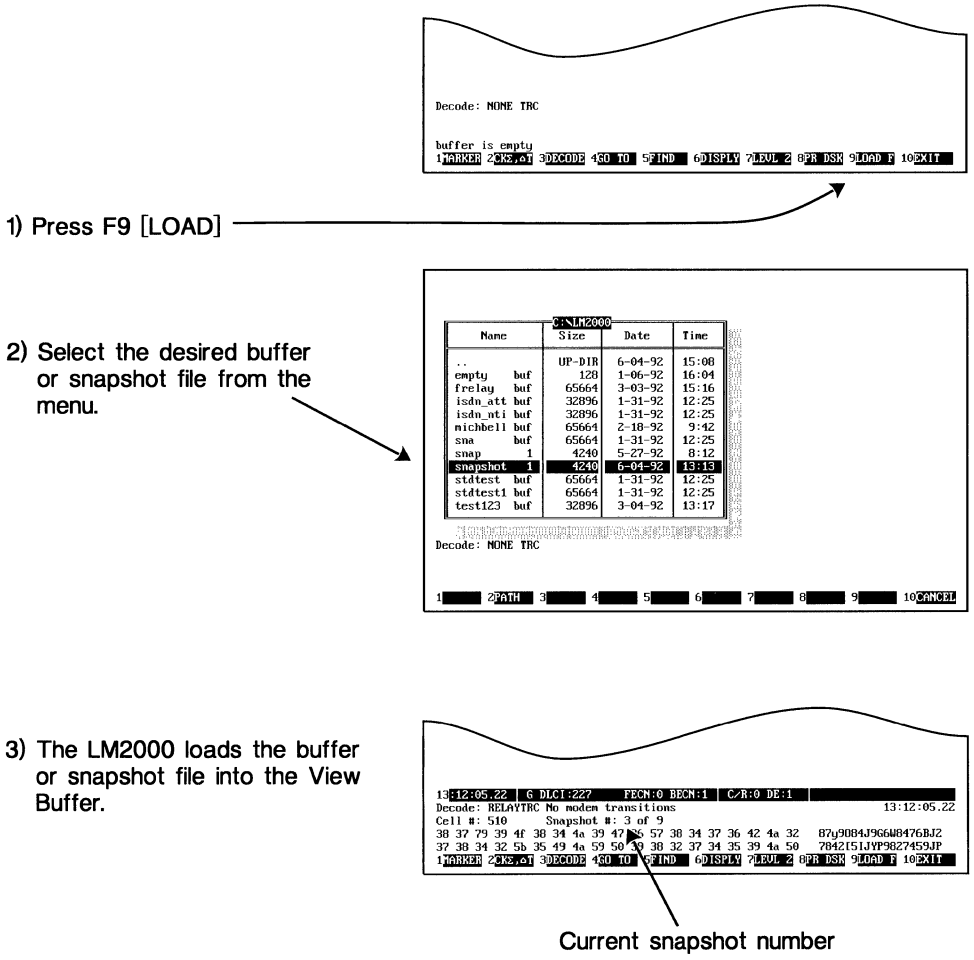
- Snapshot files are listed along with the other buffer files, but only the first file (*.1) in each series is displayed. When you select the first file (*.1) the LM2000 has access to all of the snapshots in the series.
- Use <Pg Up> and <Pg Dn> to move sequentially through the snapshot series.
- The View Buffer Screen displays the total number of snapshots in the series and the number of the currently loaded snapshot. You can use the Go To function to move to a specific snapshot.

Note:

When viewing buffer or snapshot files, the cursor movement keys operate on the entire file. <Home> moves you to the oldest data in the file and <End> goes to the newest data in the file.

See Also:

Chapter 7 for more about capturing monitored data to disk with snapshots, and Chapter 4 for more on system configuration.



You can load buffer or snapshot files for review.

Saving the Capture Buffer in a Buffer File

You can save a copy of the contents of the capture buffer in a buffer file, which can be reloaded later so you can re-examine the captured data. With stream to disk *enabled,* the LM2000 automatically places captured data in a buffer file.

How to save a buffer file to disk:

1) Press <Shift>F9 [STOR F].
   - The message "Enter store file:" appears on your screen.
2) Type the desired filename. (LM2000 automatically supplies a .BUF extension.)
3) Press <Enter>.

Pathname can be included with the filename

The LM2000 lets you specify a path along with the filename, as long as path and filename together are no longer than 25 characters.

Using F1 and F2 to review directories:

Before naming a new filename for the buffer file, you may want help recalling what filenames are already in use. You can do this by examining the directory. Use the function keys – F1 [DIR] and F2 [W EXT] – and LM2000 automatically sends a list of the files in the default directory to the screen.

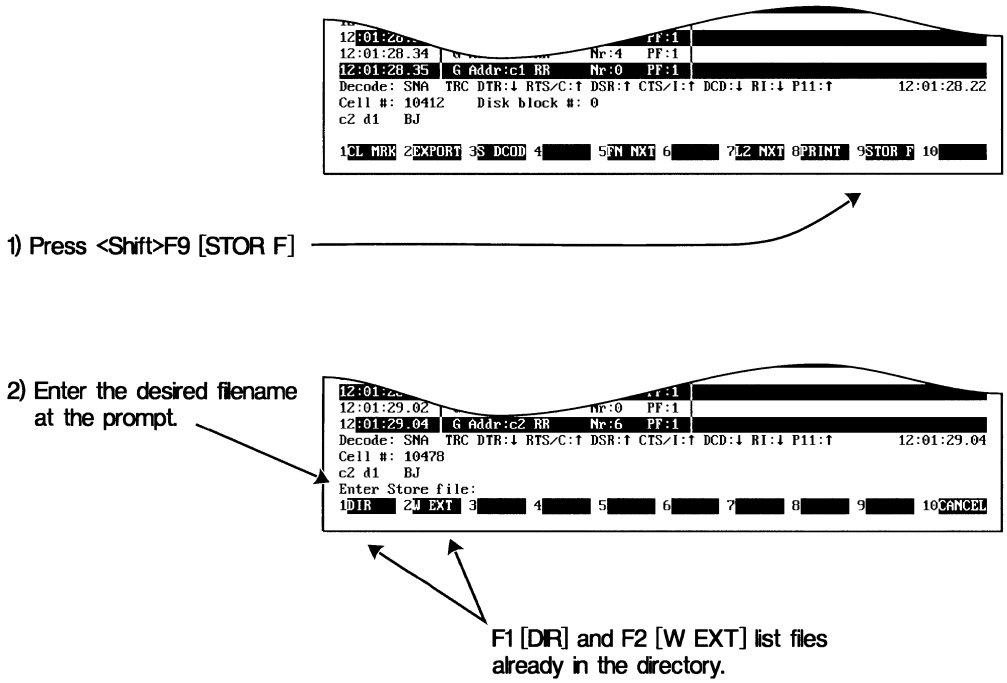
- F1 [DIR] includes all files in the directory.
- F2 [W EXT] limits the list to those files with theBUF extension.

To reload data from a buffer file:

See the preceding spread, "Loading Buffer and Snapshot Files for Review."

See Also:

Chapter 4 for more about the stream to disk function; Appendix C for more about the buffer file format.



You can save the buffer to a file.

Moving Around in the Buffer

The View Buffer Screen allows you to analyze data one frame or byte at a time. Frames and bytes are selected for analysis by moving the View Buffer's cursor to the desired frame or byte. In the View Buffer Screen the cursor is a flashing area two characters wide that is highlighted to stand out from the surrounding display.

Use the arrow keys to move the cursor

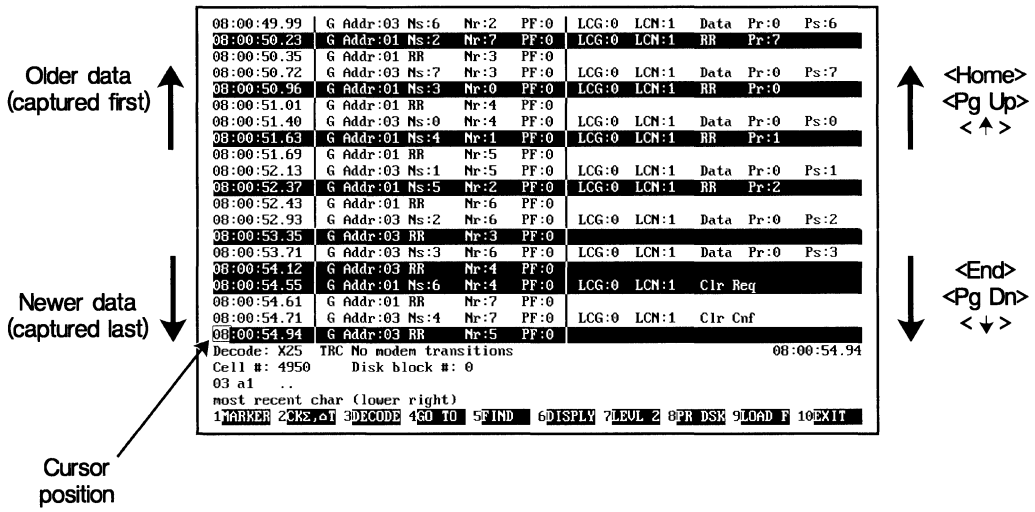
- The arrow keys <↑> and <↓> move the cursor one line up or down on the screen.
- In frame mode, the arrow keys <→> and <←> move the cursor two frames up or two frames down. In character display modes, the arrow keys <→> and <←> move the cursor one character right or left.

Other keys help you move through the buffer

- The <Pg Up> and <Pg Dn> keys move the cursor one screen (20 lines) at a time.
- The <Home> and <End> keys move the cursor, respectively, to the beginning and the end of the buffer.
- <Tab> and <BackTab> (Shift tab) also support cursor movement in ways that you'll find useful, but which vary depending on the data display mode.

Data displayed at the top is "older," bottom is "newer"

Data displayed toward the top of the View Buffer Screen was captured before (has an earlier time stamp than) data at the bottom of the screen.



Use the cursor movement keys to view all the data in the buffer.

Where in the Buffer Are You?

Current frame information gives you several ways to determine the relative location of the cursor within the buffer or file. As each byte of data is read into the buffer, it is assigned a cell number. It may also be given a time stamp. The time stamp and cell number are displayed on lines 21 and 22 of the View Buffer Screen. When reviewing buffer or snapshot files, disk block numbers are also displayed.

Cell Number:

A cell number is assigned to each byte of data as it is read into the buffer. The cell numbers begin at 0 for the oldest byte in the buffer and increase by one for each byte.

Block Number:

The disk block field is only displayed when you are reviewing a buffer or snapshot file. Each disk block is equal to 32KB, and only even block numbers are displayed.

Time Stamp:

The time stamp tells you the time of day the frame was written to the buffer. Time stamp is given to the nearest hundredth (.01) of a second. For time stamps to appear in the capture buffer or a buffer file, the time stamp feature must be enabled on the System Configuration Screen while capturing the data.

You can mark your place in the buffer

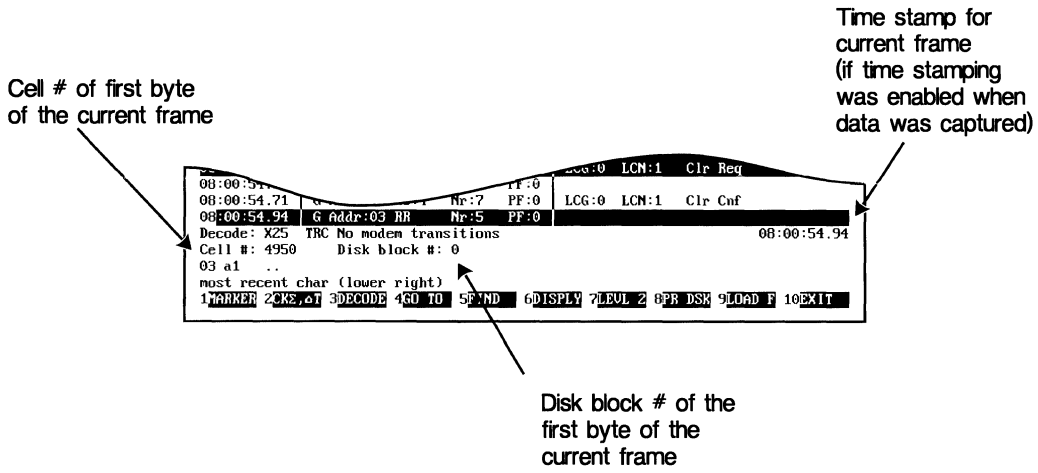
Press F1 [MARK] to mark a specific location in the buffer that you may return to or use for comparison. When you do this, the marker character (↔) is displayed at the cursor position. For information on using the marker to determine elapsed times, see "How to Determine Elapsed Times" later in this chapter.

Note:

- Except in hexadecimal, octal, mnemonic, or character display mode, the cell number, time stamp, and disk block number fields apply only to the first byte of the current frame. In these character-oriented display modes, the values apply to the byte the cursor is on.

See Also:

Chapter 4 for more about enabling the time stamp feature on the System Configuration Screen.



Your location in the buffer is shown by cell #, block #, and time stamp.

Moving Around with Go To

The Go To function provides seven options that let you jump to a specific location in the buffer. The Go To function is global, that is, the specified location can be ahead of or behind the initial position of the cursor in the buffer.

How to use Go To:

1) Press F4 [GO TO] at the View Buffer Screen.
   - The Go To Menu appears.
2) Select the desired option (see below).
   Or:
   Press F10 [CANCEL] or <Esc> to clear the Go To Menu and return to the View Buffer Screen.
3) Press <Enter>.
   - If you selected the marker or trap option, the View Buffer Screen is redisplayed with the cursor at the specified location.

   Or:
   - If you selected the cell, disk block, time, next time, or snapshot option, you are prompted for a Go To parameter.
4) Enter any required parameters (for example, a time stamp or a cell number).
5) Press <Enter>.
   - The View Buffer Screen is redisplayed with the cursor at the specified location.

Note:

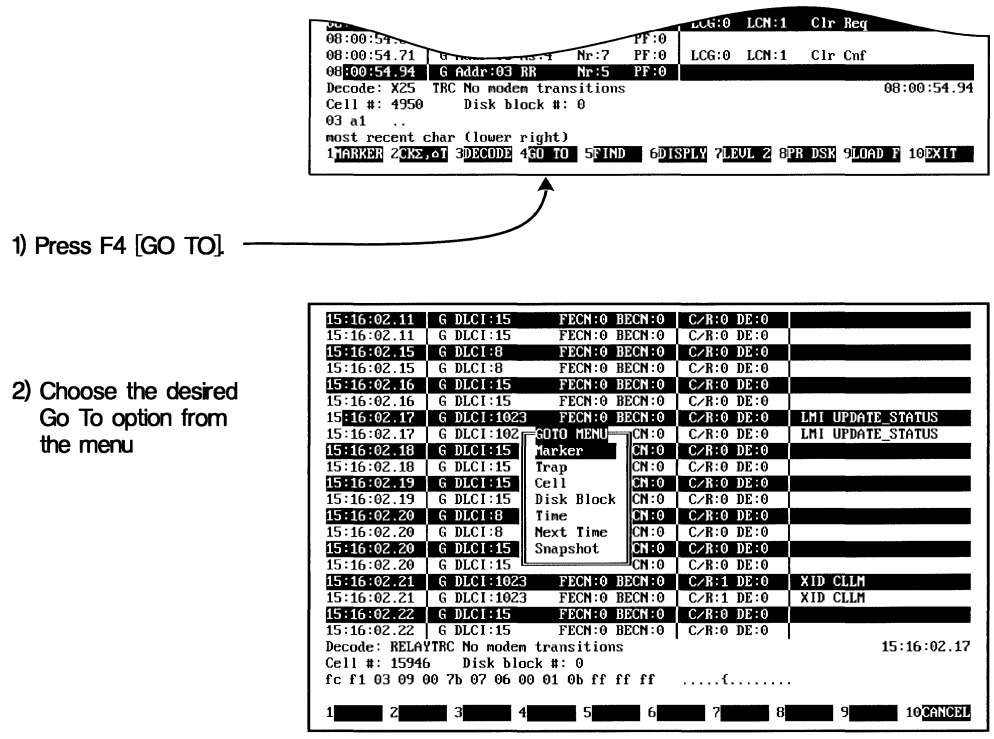
- Use Find (see the following spread) to locate specific strings of data or errors.

See Also:

Chapter 6 for more about setting data traps; Chapter 7 for more about taking snapshots.

Option	Description
Marker	Moves the cursor to a previously placed marker, indicated by a <↔> character. Place a marker by pressing F1 [MARKER] from the View Buffer Screen
Trap	Moves the cursor to a the frame or characters that tripped a trap.
Cell	Moves the cursor to a specific cell in the buffer or file. Each cell is one byte of captured data. The oldest byte in each block of data is numbered 0, the next oldest 1, and so on.
Disk Block	Moves the cursor to a specific block of data in a buffer or snapshot file. This option is only available when you are viewing buffer or snapshot files. To Go To a block other than the current one, only even block numbers (0, 2, 4, etc.) are accepted.
Time	Moves the cursor to a frame with a specific time stamp. The LM2000 searches the buffer from the beginning for a frame with a time value closest to the entered time.
Next Time	This option is similar to the Time option described above except that Next Time searches the buffer for the specified time stamp beginning at the current cursor position.
Snapshot	Moves the cursor to the beginning of the specified snapshot file. This option is available only when viewing data snapshots in the View Buffer Screen.

The GoTo Options



Use Go To to move to specific places in the buffer.

Locating Specific Data with Find and Find Next

You can locate a specific string of bytes anywhere within the capture buffer or within a buffer or snapshot file by using the Find function. You can also use the Find function to locate data errors. Unless otherwise specified, the Find function searches from the current cursor position forward to the end of the buffer. The following spread, "Entering Search Strings for the Find Function," explains how to specify search strings.

How to access the Find screen:

1) Press F5 [Find] from the View Buffer Screen.
   - The Find Subscreen replaces the bottom lines of the View Buffer screen.
2) Select any desired Find options (see table).
3) Press <Enter> to begin the search.
   Or:
   Press F10 [CANCEL] or <Esc> to return to the View Buffer Screen without initiating the search.

Successful searches place the cursor at the start of the string

An unsuccessful search, where the search string is not found, returns a "String not found" message.

Use Find Next to repeat or continue searches

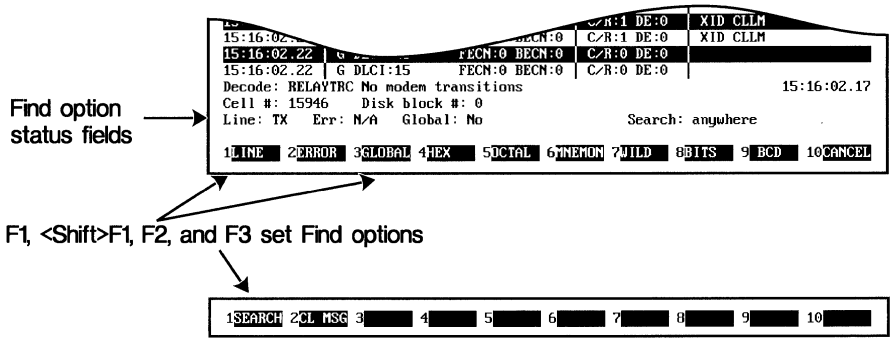
Press <Shift>F5 [FN NXT] from the View Buffer Screen to activate Find Next. The LM2000 searches the buffer from the current cursor position for the next occurrence of the specified conditions. Find Next always starts from the current cursor position.

Note:

- Use Go To (see previous spread) to locate specific cells, blocks, and time stamps.

Find Option	Function Key	Description
LINE	F1	Selects transmit or receive data in a search. The default value is the line the cursor is on when Find was selected. You can change this by pressing F1.
SEARCH	<Shift>F1	Limits a search to the start of frames only. Set Search to "start of frame" to limit the search, or to "anywhere" to match strings found anywhere in a frame.
ERROR	F2	Includes data errors such as parity. Enabling Error lets you find any data errors on either line. With error disabled, data errors are ignored.
GLOBAL	F3	Begins searches at the start of the buffer. With Global enabled (Yes in the Global field) the search begins with the oldest data and checks the entire buffer. With Global disabled (No in the Global field) the search begins at the current cursor position.

The Find Options



The Find Subscreen lets you enter a search string and select Find options.

Entering Search Strings for the Find Function

You can use the Find function to locate a string of bytes in the buffer. The desired string can be specified by entering hex, octal, binary, binary coded decimal (BCD), and wild card (don't care) values. Text strings may also be entered. The maximum length of a search string is 79 characters.

How to enter a search string:

1) Press F5 [FIND] to access the Find Subscreen.
   The Find Subscreen replaces the bottom lines of the View Buffer Screen.
2) Enter the search string (this can be done before or after selecting the search options). The search string can contain any combination of text, wild card characters, or numerical codes. To enter a numeric code or wild card character, press the appropriate function key:
   - F4 [HEX] for hexadecimal
   - F5 [OCTAL] for octal
   - F7 [WILD] for wild card (don't care) characters
   - F8 [BITS] for binary
   - F9 [BCD] for binary coded decimal

How to clear the entire search string field:

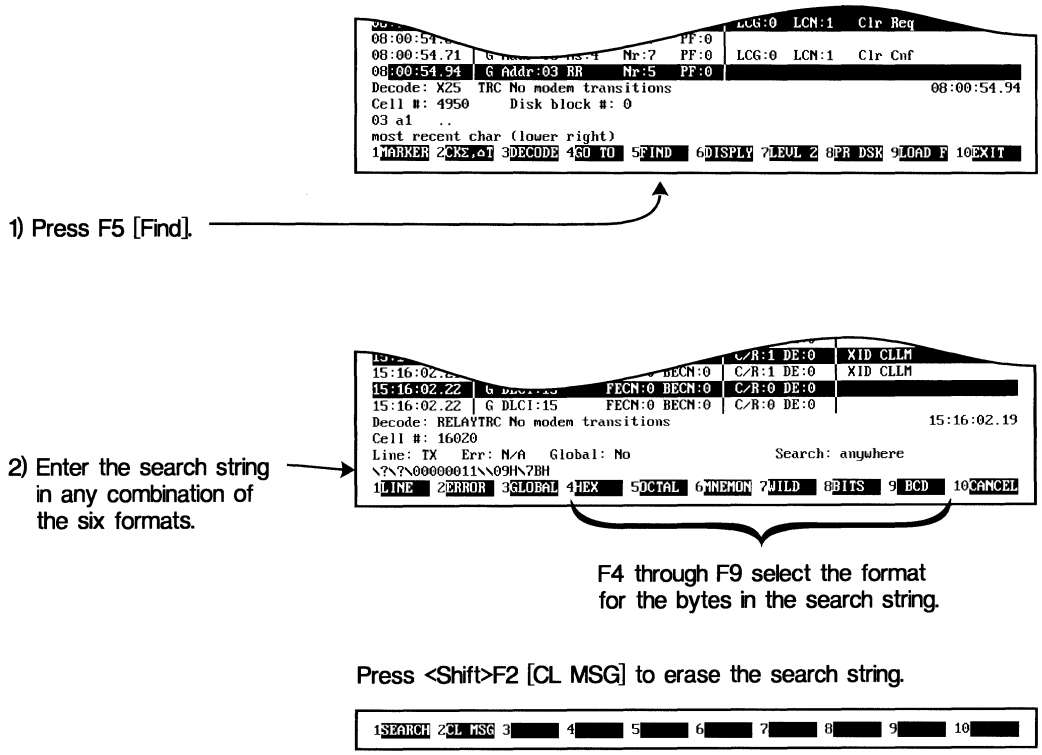
Press <Shift>F2 [CL MSG] to clear the entire search string field.

How to use the BCD format:

Enter the pattern as a continuous string of digits from 0 through 9. Each pair of digits is translated to a hexadecimal byte.

How to create a bit mask in binary:

When using binary format, you can enter an x in any position for "don't care" bits (that is, any value in that position will satisfy the search) and create a bit mask.



Enter Search strings for the Find function at the Find Subscreen.

Selecting the Data Display Mode

You can choose one of eleven different ways to look at data with the LM2000. RX and TX data are differentiated by the use of display attributes, such as reverse video. Subsequent spreads cover details on each type of data display mode.

How to change the data display mode:

1) Press F6 [DISPLY].
   - The Display Menu appears.
2) Use the arrow keys to select the desired display mode.
3) Press <Enter> to accept the selection and return to the View Buffer Screen.
   Or:
   Press F10 [CANCEL] or <Esc> to return to the View Buffer Screen without changing the data display mode.

Changing the mode may change what is displayed

After a new display format is chosen, the screen is redisplayed with the frame or character previously at the cursor position shifted to the top or upper-left corner of the screen. The start and end points of the screen may therefore be different.

Access to post capture display filters:

Press F6 [DISPLY] and select Protocol Trace from the selection menu. Buffer trace is available only with bit oriented protocols. See "Post Capture Display Filters with Buffer Trace," later in this chapter for information about Protocol Trace.

See Also:

Chapter 1 for more about setting display attributes in the Hardware Configuration Screen. Chapter 7 for more about post capture display filters.

Data Display Mode	Description
Hex	Individual bytes displayed in hexadecimal
Hex & Modem	Modem lead display with data bytes given in hexadecimal
Character	Individual bytes displayed as characters
Mnemonic	Individual bytes displayed as standard mnemonics
Mnem & Modem	Modem lead display with data bytes given in mnemonics
Octal	Individual bytes displayed in octal
Frame	Level 2 (supervisory or unnumbered) and Level 3 (information) frames displayed
Info Frame	Level 3 (information) frames only displayed
Info Char	Level 3 frames only displayed with information in character format
Info Hex	Level 3 frames only displayed with information in hexadecimal format

Buffer Review Data Display Modes.

Analyzing Data: Hex, Character, Mnemonic, and Octal Displays

You can view captured data one byte at a time in hexadecimal, character, mnemonic, and octal display modes. Each byte is displayed serially in the order monitored. When viewing SDLC/HDLC framed data in one of these character-oriented display modes, the byte or octet highlighted by the cursor is redisplayed at the bottom of the screen in mnemonic, binary, octal, and hexadecimal forms, along with the source of the byte, whether DTE or DCE.

Frame boundaries shown with a special character

Because bytes are displayed serially in these data display modes, you need to know where one frame or block ends and the next one begins. The LM2000 indicates the end of a frame by displaying the Greek character ϕ (phi). Undefined or unrecognized characters appear as the Greek character μ (mu).

Character and mnemonic displays:

Data in character or mnemonic display looks the same, but control bytes in mnemonic mode will be shown using standard mnemonic equivalents, SH for start of header, NU for null, etc. In character display mode, control characters appear as a Ç.

EGA/VGA displays can be changed via <Shift>F6

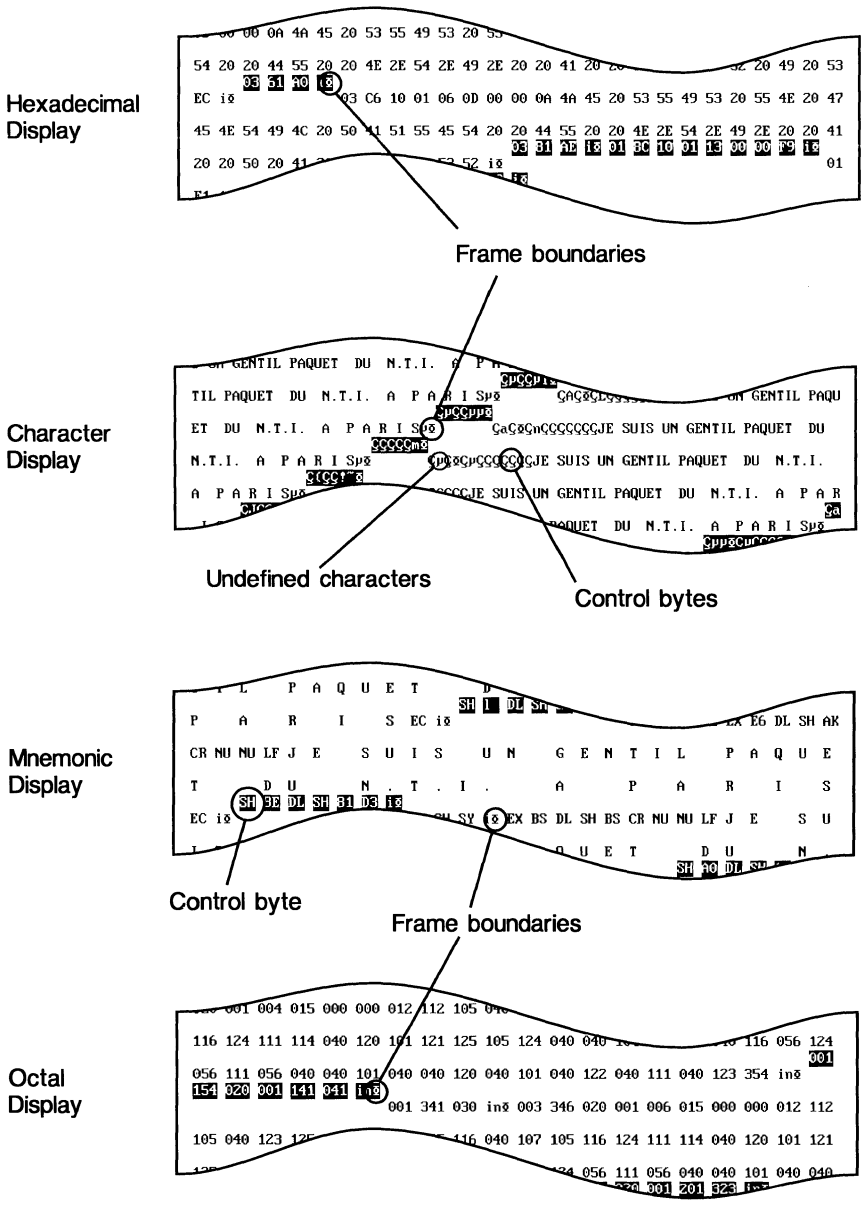
If you have configured the LM2000 for an EGA or VGA card, and **Char** mode has been selected on the System Configuration Screen, you can toggle the display between **Character** and **Hexadecimal** using <Shift>F6 [HXCHR].

You can unpack Level 2 frame information with one keystroke

Pressing F7 [LEVL 2] unpacks the address and control field of an SDLC/HDLC frame. The LM2000 assumes the cursor is on the first byte (address field) of the frame. If so, the function will interpret the frame header, breaking out address, flow control numbering, and other information.

Note:

- Only the first byte of the CRC information is displayed for each frame; the second byte is hidden by the frame boundary character.



The LM2000 provides four character-based data displays.

Analyzing Data: Modem Lead Display

The modem lead display mode shows you the data and provides an oscilloscope-type display of the modem lead states for both transmit and receive lines. You can view data either in hexadecimal form or as standard mnemonic characters.

The lead-state display shows both data and modem leads

The lead state display provides a graphic display of six modem leads on the monitored line. Data lines for TX and RX are the same as those shown in the normal monitor mode, displaying data either in hex or mnemonic. The six modem leads are RTS, CTS, DSR, DCD, DTR, and RI. (The bottom half of the screen is a continuation of the top half.)

Data is written from left to right

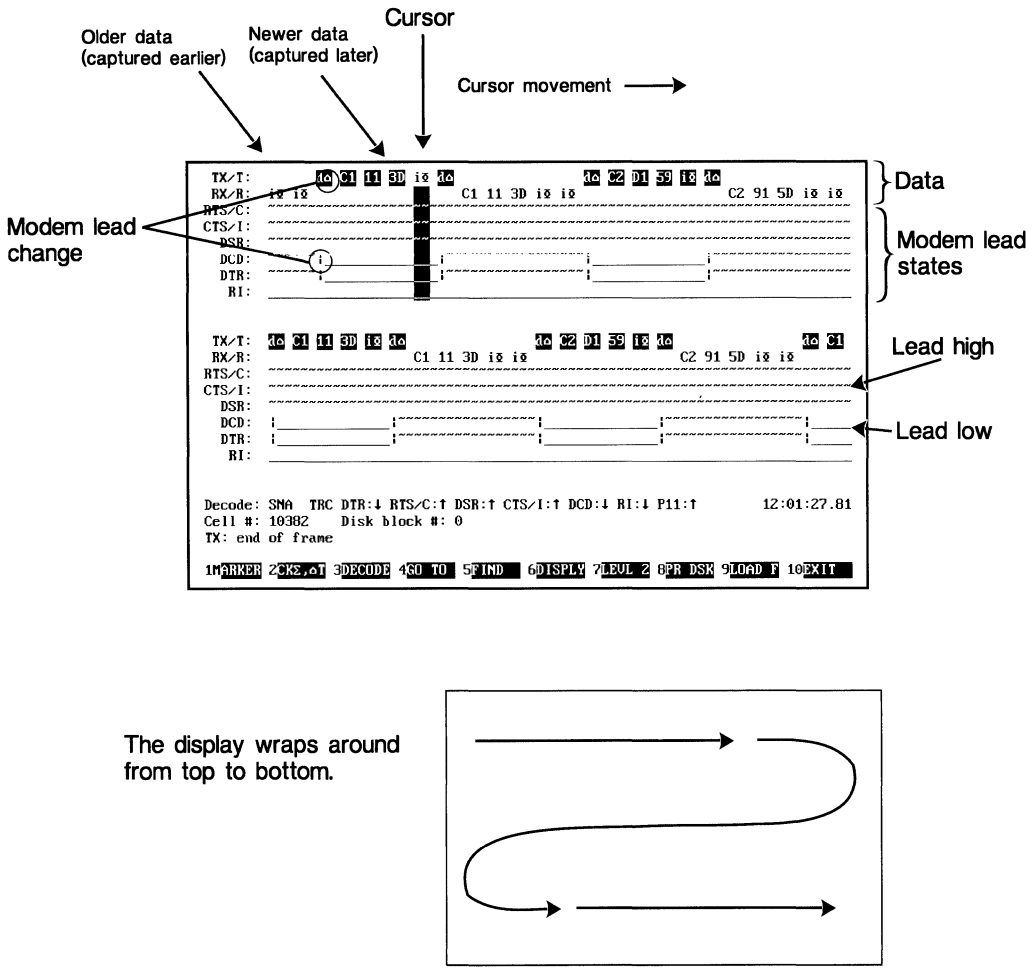
Data appearing in the modem lead-state display is written on the screen from left to write, with the oldest data to the left.

Note:

- To change from Hex and Modem to Mnem and modem, press F6 [DISPLY] and select the appropriate item from the menu.

See Also:

Chapter 7 for more about monitoring data with the modem lead display.



The display wraps around from top to bottom.

The modem lead display shows both data and modem lead states.

Analyzing Data: Level 2 and Level 3 Decode Displays

In the Level 2 and Level 3 decode display modes, each line in the data display area contains information decoded from a single frame. The display is divided to show data from lower layers to the left, higher layers to the right.

First column shows time stamp

The first column of the Level 2 and 3 Display shows the time stamp (the time the frame was monitored), only when the time stamp was enabled during data capture.

Subsequent columns show frame and packet information

- A frame integrity indicator appears at the left of the second column.
- The rest of the second column displays link level information, such as that used for flow control.
- The third column displays network level information, in character or hexadecimal notation, depending on which display mode is selected.

Selecting User-Defined Decode Modules:

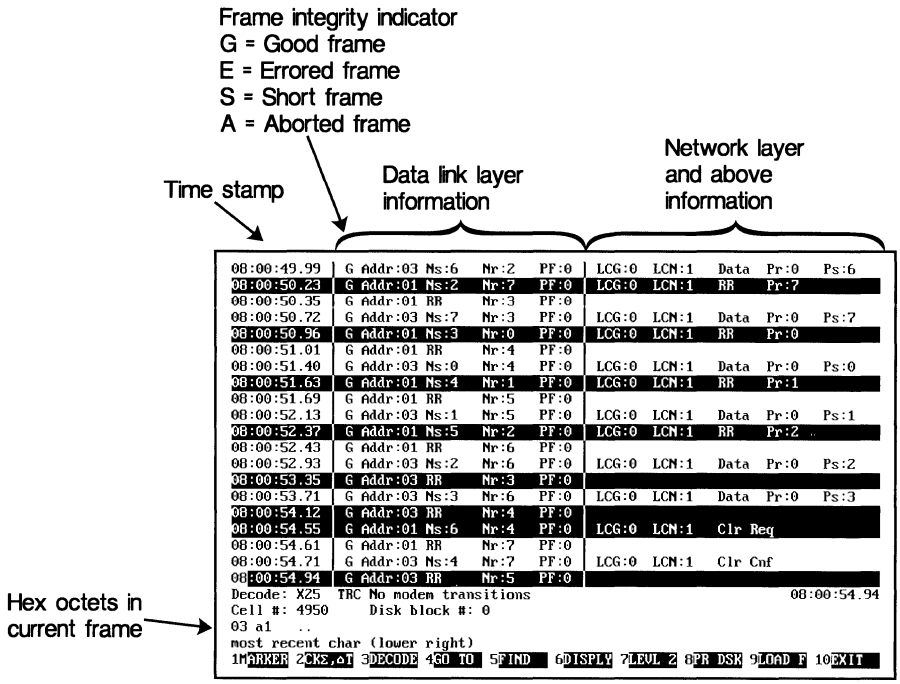
User-defined decode modules can be selected for analyzing proprietary protocols. You can toggle through the options using <Shift>F3 [S DCOD]. Options are: DDCMP (Digital Data Communications Message Protocol), User, None, and default. The default decode is the one specified on the System Configuration Screen.

Note:

- Framed display formats are available only with frame-type protocols. The display formats – **Frame, Info Frame, Info Char** and **Info Hex** – can be selected only when the data captured was transmitted in a bit oriented protocol.

See Also:

Chapter 4 for more on selecting decode protocols on the System Configuration Screen; Appendix C for more on writing your own decode module for unique or proprietary protocols.



The frame display formats let you see Level 2 and Level 3 information

Analyzing Data: Expanded Decode Displays

You can analyze buffer data using the plain language interpretations of the LM2000's protocol decode modules. Expanded Decode lets the user review data from bit oriented protocols using automatic interpretations in plain language taken from the relevant standard. Expanded Decode in the View Buffer Screen decodes and displays every bit in each frame.

Key information is highlighted, so the screen is easy to read

Frames are broken down into their major parts. Each byte is numbered and its binary value given along with its plain language interpretation. Interpretations of key information appear in highlighted display attributes.

How to access and exit Expanded Decode:

1) Place the cursor on the frame you wish to decode.
2) Press F3 [DECODE].
   - The View Buffer Screen is replaced with the Expanded Decode display for the selected frame.
3) To return to the previous frame display mode, press F10 [EXIT] or <Esc>.

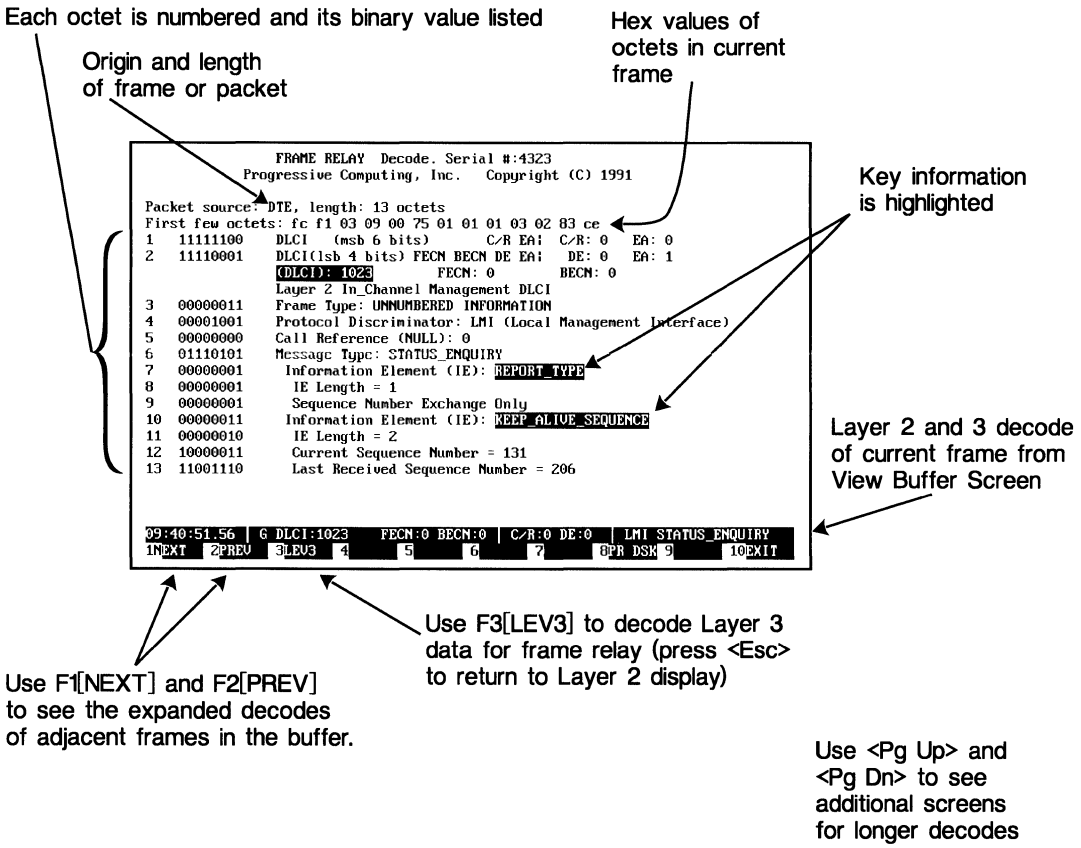
Some frames require more than one screen

When a frame requires more than one screen to display its information, use the cursor movement keys to view all of the screens.

- <↑> and <↓>: Scroll through the decoded frame one line at time.
- <Pg Up> and <Pg Dn>: Scroll through the decoded frame a full screen at a time.
- <Home> and <End>: Display the first or last screen of the decoded frame.

Navigating to other frames while in Expanded Decode:

- Press F1 [NEXT] to see the expanded decode of the next frame in the buffer.
- Press F2 [PREV] to see the expanded decode of the previous frame in the buffer.
- If you are using the post capture display filters, the next or previous frame matching the trace definition will be displayed.



Expanded Decode provides complete interpretation of every bit in the frame.

Post Capture Display Filters with Buffer Trace

The buffer trace function acts as a filter, allowing you to select specific frames for display in the View Buffer Screen. The trace function does not remove any data from the buffer; it only determines which frames are displayed. You can turn the trace function off and resume displaying all frames from the buffer or change the filter specification to display a different set of frames.

How to set or change the buffer trace:

1) Press F6 [DISPLY] from the View Buffer Screen.
   - The Display Menu appears.
2) Select Protocol Trace from the Display Menu.
   - A Frame Selection menu appears with fields specially selected for use with the protocol being monitored.
3) Specify how you would like frames filtered using the protocol specific menus. (See "Note" below.)
4) Press F10 [EXIT] or <Esc> to accept the selections and return to the View Buffer Screen.
   - Only frames that match the selection criteria are displayed.

   Or:

   Press <Shift>F10 [CANCEL] to return to the View Buffer Screen and ignore any changes made to the selection criteria.

How to turn trace off:

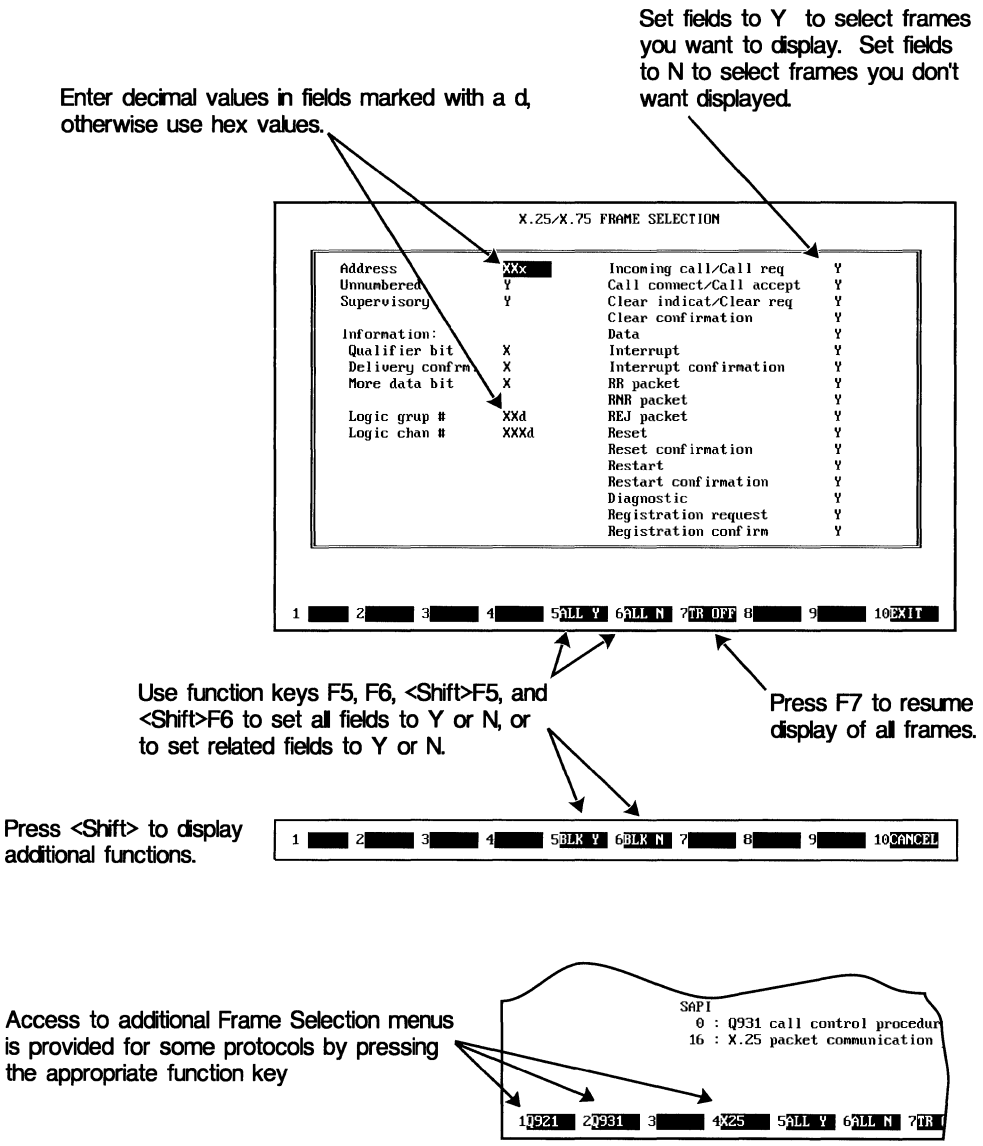
1) Press F6 [DISPLY] from the View Buffer Screen. The Display Menu appears.
2) Select Protocol Trace from the Display Menu.
3) Press F7 to cancel the trace function and return to the View Buffer Screen. All frames are displayed.

Note:

- Fields containing a "Y" or an "N" (for Yes or No) indicate whether frames with that characteristic are displayed under trace. Press F5 [ALL Y] or F6 [ALL N] to set all Y/N fields in a screen to "Y" or "N."
- Some fields allow values to be entered. You may, for example, specify that only those X.25 packets addressed to LCN 10 be displayed when using the X.25 post capture display filter.

Some frame selection menus require more than one screen

For SNA and X.25, frame selection can be specified on a single screen, but Q.931 and QLLC use more screens.



Buffer trace lets you display specific frames from the buffer.

Printouts and ASCII Files from the Buffer

You can create an accessible record of the data stored in the capture buffer in several ways. The contents of the buffer can be output directly to a printer or written to disk. Printouts may include user comments. Data written to disk is saved as an ASCII file. One option lets you save the ASCII file in a format that preserves character status, which can be very useful as input to other communications programs or to a BASIC or C program.

How to print the View Buffer Screen on your PC's printer:

1) Press <Shift>F8.
   - The message "Print (S)creen, (B)uffer, or (C)har status: S" is displayed.
2) Press **S**, **B** or **C** for the desired option.
   S (or <Enter>) prints only the information currently displayed on the screen.
   B prints the buffer from the current cursor position to the end.
   C prints the entire contents of the buffer in the character status format.

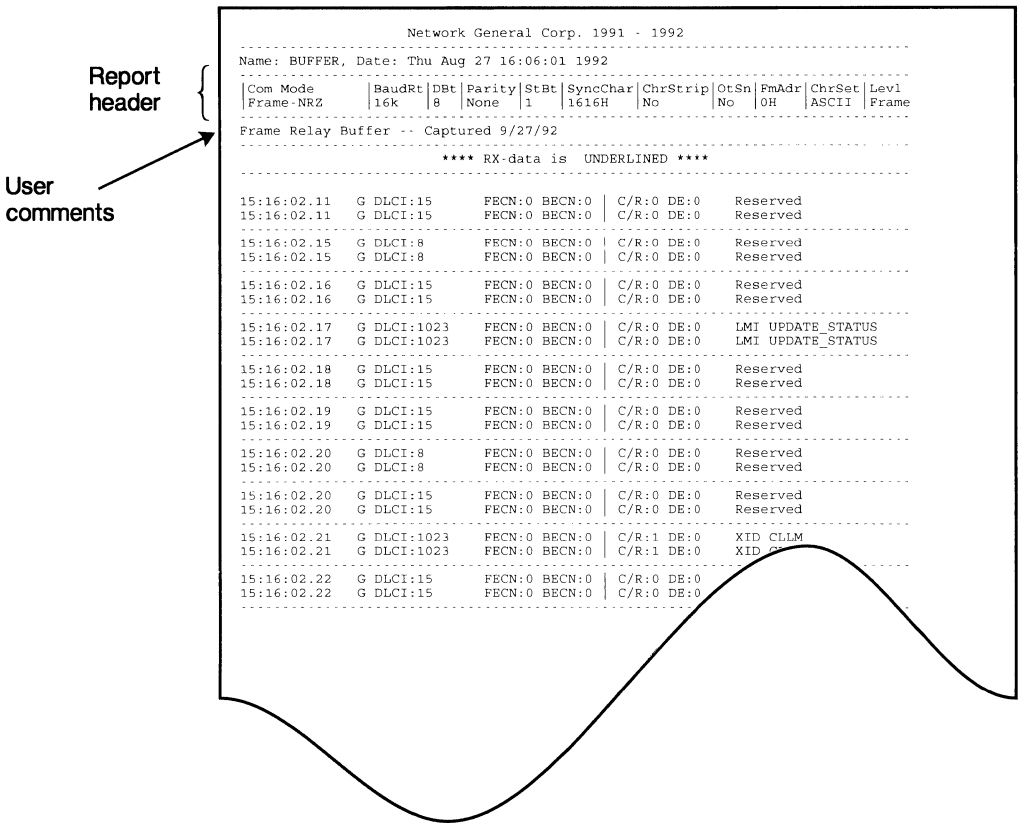
How to save a copy of the Capture Buffer on disk:

1) Press F8 [PR DSK].
   - An "Enter Store File:" prompt appears.
2) Type the desired filename and press <Enter>.
   - The message "Print (S)creen, (B)uffer, or (C)har status?: S" is displayed.
3) Press **S**, **B** or **C** for the desired option.
   S (or <Enter>) saves only the information currently displayed on the screen.
   B saves the buffer from the current cursor position to the end.
   C saves the entire contents of the buffer in the character status format.

You can enter comments right on the printed reports

- Printouts include a report header which lists the origination of the report as well as the communications configuration in effect when the data was captured.
- Additional user commentary, up to 64 characters long, can be specified. To print the report without any comment, press <Enter>.

Buffer screen display as it appears when printed



You can obtain a printout of the buffer contents as a permanent record.

Printing the Expanded Decode Screen

A record of the information displayed with Expanded Decode can be created via the same methods available when printing the contents of the capture buffer, written to disk or output directly to a printer. Some options that determine how much information will be printed are different from the options available when printing the capture buffer.

How to print the Expanded Decode Screen on your PC's printer:

1) Press <Shift>F8.
   - The message "Print (S)creen, (F)rame, or(D)ecode?: S" is displayed.

2) Press **S**, **F** or **D** for the desired option.
   S (or <Enter>) prints only the information currently displayed on the screen.
   F prints all of the decode screens for the current frame.
   D prints all of the decode screens for the current frame as well as for all frames forward to the end of the buffer. (Press any key to stop this process at any time.)

How to save a copy of the Expanded Decode on disk:

1) Press F8 [PR DSK].
   - An "Enter Store File:" prompt appears.

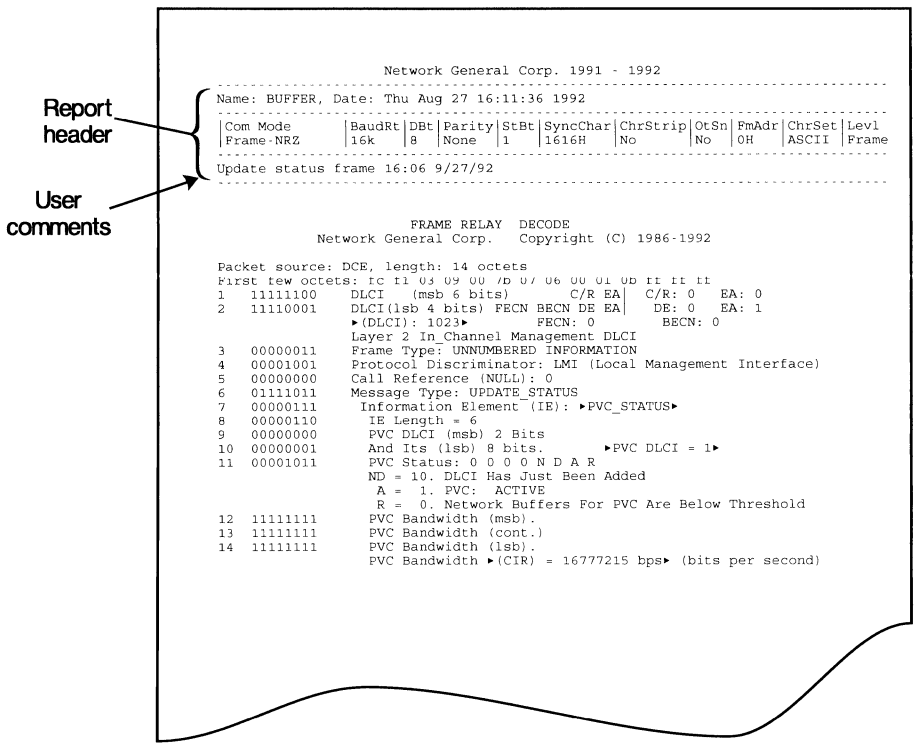
2) Type the desired filename and press <Enter>.
   - The message "Print (S)creen, (F)rame, or (D)ecode?: S" is displayed.

3) Press **S**, **F** or **D** for the desired option.
   S (or <Enter>) saves only the information currently displayed on the screen.
   F saves all of the decode screens for the current frame.
   D saves all of the decode screens for the current frame as well as for all frames forward to the end of the buffer. (Press any key to stop this process at any time.)

You can enter comments right on the printed reports

- Printouts include a report header which lists the origination of the report as well as the communications configuration in effect when the data was captured.
- Additional user commentary, up to 64 characters long, can be specified. To print the report without any comment, press <Enter>.

Expanded decode as it appears when printed



You can obtain a printout of the Expanded Decode for a single screen, a complete frame, or the entire buffer.

How to Determine Elapsed Times

You can measure the elapsed time between any two points in the buffer using the marker and check sum functions. The check sum function also provides a character count and calculates the effective baud rate, as well as calculating LRC, CRC-16, and CRC-frame values.

How to measure elapsed time:

To measure the elapsed time and calculate the check sums for pairs of frames or characters in the buffer:

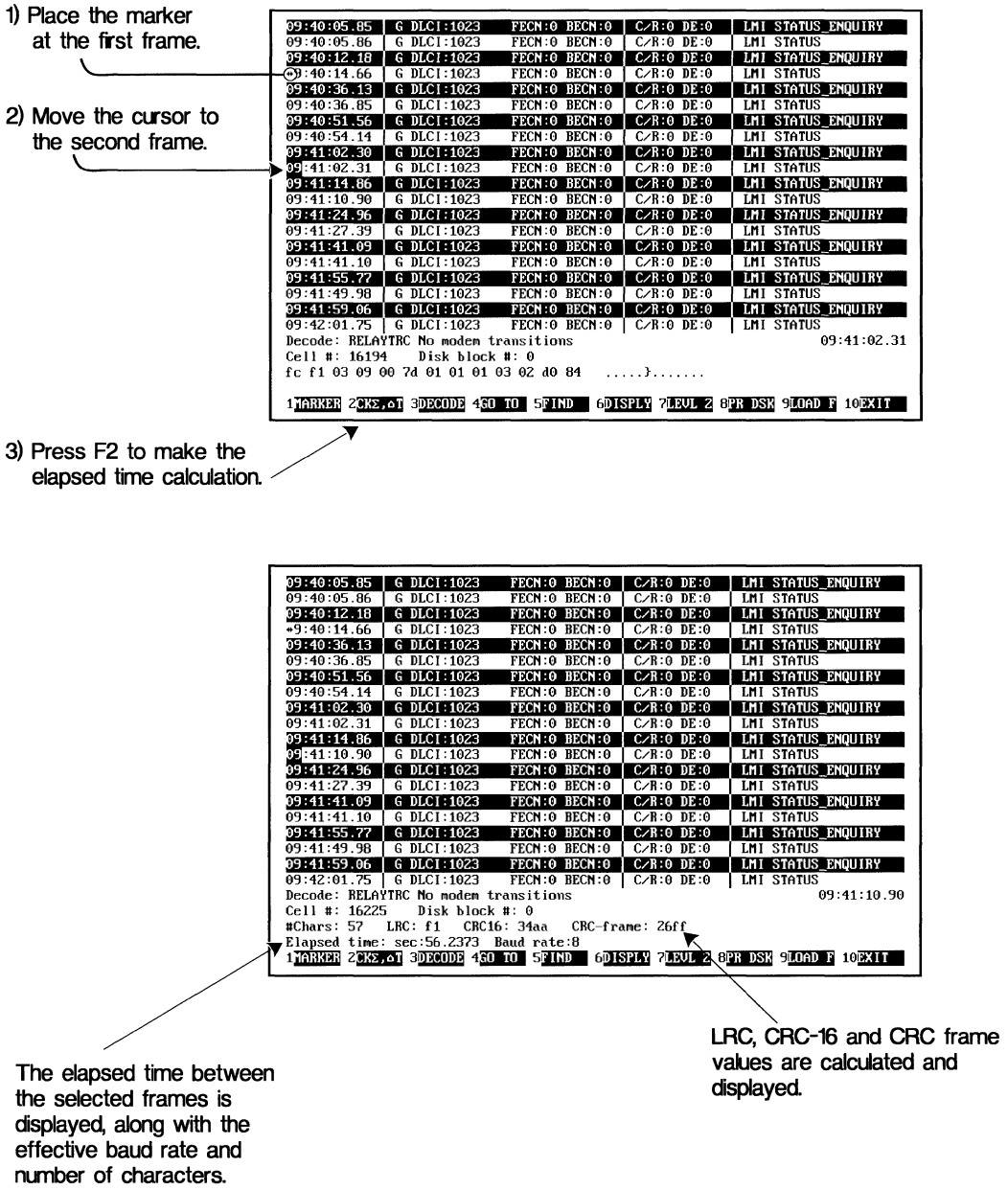
1) Press F1 [MARKER] to place a marker at one of the two frames or characters you wish to check.
   - The marker character (↔) is displayed at the marked position.
2) Move the cursor to the other frame or character.
3) Press F2 [CKΣ,ΔT] to make the elapsed time calculation.

Moving the cursor to the second frame:

Use any of the arrow keys or the <Home>, <End>, <Pg Up>, or <Pg Dn> keys to move the cursor to the second frame or character. You can also use the Find or Go To functions to move to the second frame.

Note:

- The timer accuracy is about 500 microseconds and the maximum elapsed time you can measure is 119 hours.
- CRC stands for Cyclic Redundancy Check; LRC for Longitudinal Redundancy Check.



You can measure the elapsed time between any two frames in the buffer.

How to Export Frames for Emulation

Exporting frames makes it easy to create emulation patterns based on data captured from live traffic. Any frame in the capture buffer can be copied automatically into the Emulation Message Definition Screen, where the content of emulation messages is defined.

How to export frames for emulation:

1) Move the cursor to the frame you would like to export to the Emulation Message Definition Screen.

2) Press <Shift>F2 [EMUL].
   - The selected frame is automatically copied into the Emulation Message Definition Screen.

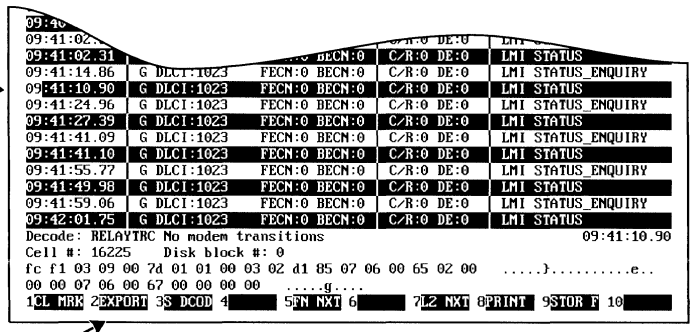
Note:

- To select and export an entire frame, the display must be in a frame oriented mode.

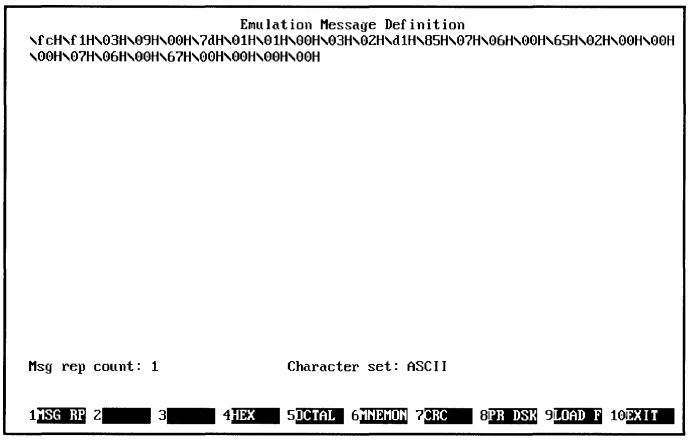
See Also:

Chapter 4 for more about defining an emulation message.

1) Place the cursor on the frame to be exported.



2) Press <Shift>F2 [EXPORT].



The selected frame is automatically converted to hex and copied into the Emulation Message Definition Screen.

The export function lets you create emulation messages from captured data.

Chapter 10
Bit Error Rate Tests

- Screen Overview: BERT/BLERT
- Screen Overview: G.821 BERT/BLERT
- Configuring for BERT/BLERT and G.821
- Controlling Functions: BERT/BLERT and G.821
- Analyzing BERT/BLERT Results
- Analyzing BERT/BLERT G.821 Results

Screen Overview: BERT/BLERT

The BERT/BLERT Screen allows you to set up and run the basic Bit Error Rate Test (BERT) and Block Error Rate Test (BLERT). It also displays the line performance test results.

How to access this screen:

- Press F5 [BERT] on the Main Menu.

Main functions of this screen:

- Measures the quality of a point-to-point communications link.
- Displays the line performance results, which include bit error rate, block error rate, and error free time.
- Allows you to set up the BERT/BLERT configuration

Access to other screens and functions:

- For the G.821 BERT/BLERT Screen, press F6 [G.821].
- To access the Interface Media options (RS-232, V.10/V.11, V.35, RS-422/RS-423, and T-Pod), press F5 [MEDIA].

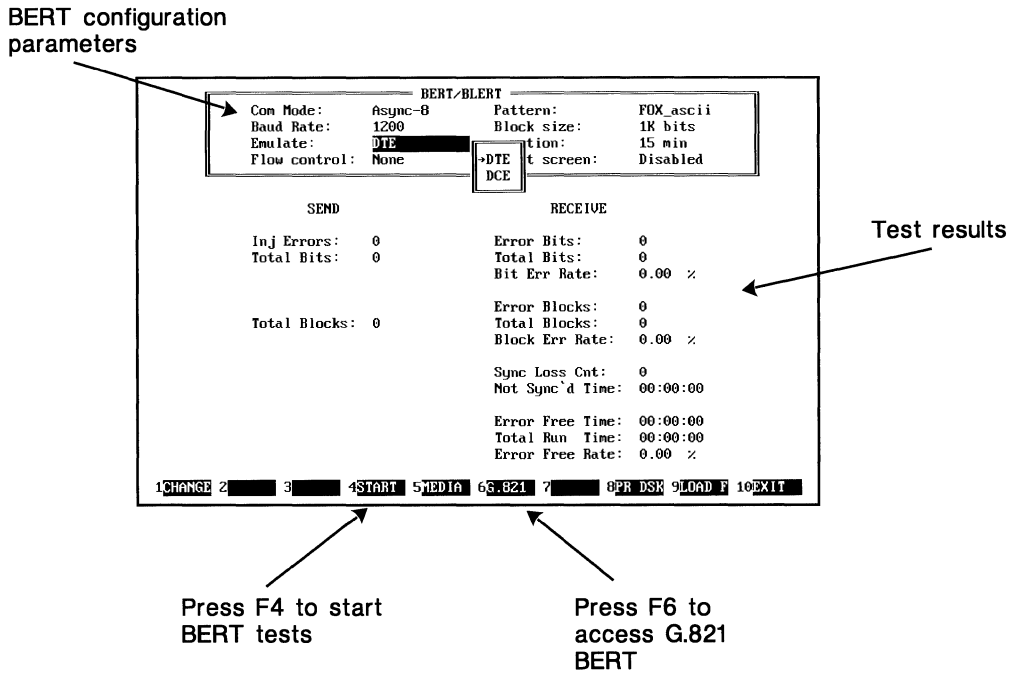
> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

- To start the BERT/BLERT test, press F4 [START].
- To change a configuration option, press F1 [CHANGE] to scroll forward or <Shift> F1 [B CHNG] to scroll backward through the list of options.
- To print a copy of the current screen to disk, press F8 [PR DSK]; to generate a printed copy, press <Shift> F8 [PRINT].
- To load a previously saved BERT configuration file, press F9 [LOAD F]. To save the current BERT configuration to disk, press <Shift>F9 [STOR F].

Understanding Error Rates:

- **Bit Error Rate** - The ratio of error bits to total bits received. While receiving data, the LM2000 compares the received data with referenced data, detecting any single error bit and counting the bits received. The ratio indicates the error rate for the line. Among the three methods of error measurement, the bit error ratio is the most accurate, regardless of the quantity of data transmitted or the duration of the test.

- **Block Error Rate** - The ratio of block errors received to total blocks received. For testing purposes, AT&T and the North American area define a block as 1000 bits for pseudo-random patterns, or the length of the message for alphanumeric test messages.
- **Error Free Rate** - The ratio of error free time (in seconds) to total time (in seconds). When an error is detected, the second during which the error was received is considered bad. Thus, if a data line produced one error bit each second, there would be no error free time and the Error Free Rate would be 0%. For statistical validity, the BERT/BLERT should be run for at least 15 minutes.



The BERT/BLERT Screen helps test the physical layer.

Screen Overview: G.821 BERT/BLERT

The G.821 BERT/BLERT Screen allows you to set up and run the BERT/BLERT test under G.821 requirements. The screen also displays the results of the test. Formulas and terminology used are defined according to CCITT documents.

How to access this screen:

- F6 [G.821] on BERT/BLERT Screen

Main functions of this screen:

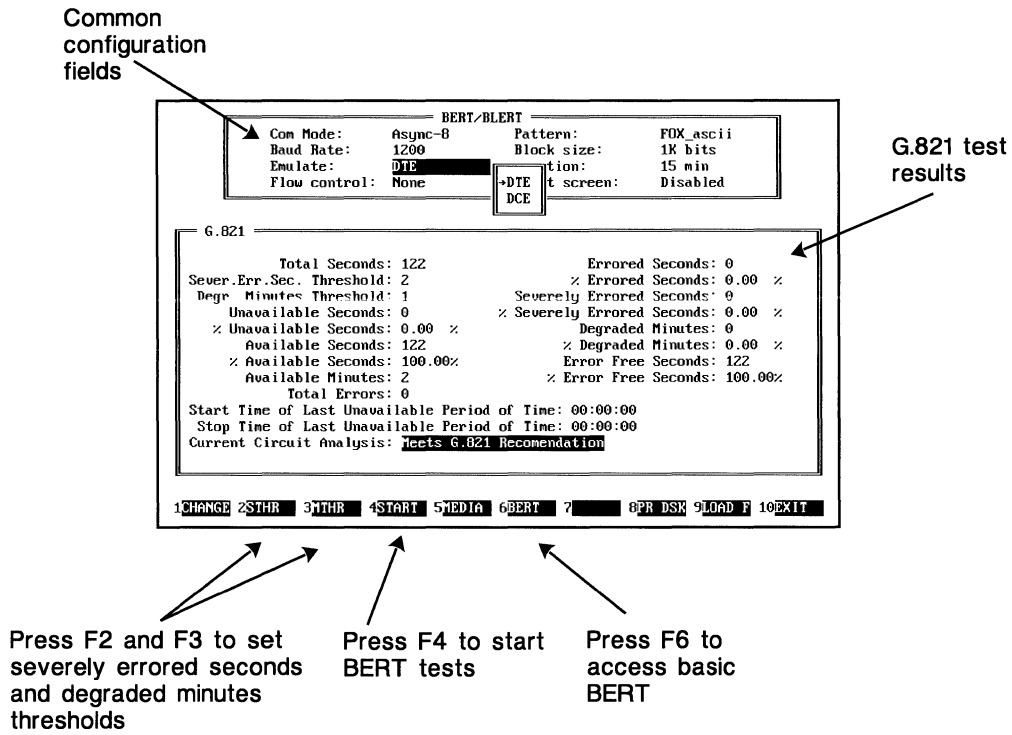
- Measures the quality of a point-to-point communications link according to G.821 requirements.
- Allows you to set error thresholds based on CCITT G.821 recommendation.
- Allows you to set up the G.821 BERT configuration.

Access to other screens and functions:

- To access the BERT/BLERT Screen, press F6 [BERT].
- To access the Interface Media options (RS-232, V.10/V.11, V.35, RS-422/RS-423, and T-Pod), press F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

- To set the threshold for Severely Errored Seconds, press F2 [STHR].
- To set the threshold for Degraded Minutes, press F3 [STHR].
- To start the G.821 BERT/BLERT test, press F4 [START].
- To change a configuration option, press F1 [CHANGE] to scroll forward or <Shift> F1 [B CHNG] to scroll backward through the list of options.
- To print a copy of the current screen to disk, press F8 [PR DSK]; to generate a printed copy, press <Shift> F8 [PRINT].
- To load a previously saved BERT configuration file, press F9 [LOAD F]. To save the current BERT configuration to disk, press <Shift>F9 [STOR F].



The G.821 BERT/BLERT Screen tests to CCITT requirements.

Configuring for BERT/BLERT and G.821 Tests

You select configuration options for both the BERT/BLERT and G.821 test in the boxed areas at the top of their respective screens. Error thresholds for G.821 are defined in the body of the screen.

Common configuration fields:

The fields listed below are common configuration fields for the basic BERT/BLERT and G.821 tests.

Com Mode — Defines the communication mode you are using:

Async (5, 6, 7, 8)
Sync

Baud Rate — Defines the monitored data rate in bits per second. Possible values are:

USER	19.2K
50	38.4K
75	56K
110	64K
150	72K
300	115.2K (maximum async rate)
600	128K
1200	192K
1800	256K
2400	384K
3600	512K
4800	768K
7200	1024K
9600	1344K
14.4K	1536K
16K	2048K

The User option allows you to input from the keyboard any numerical value for Baud Rate.

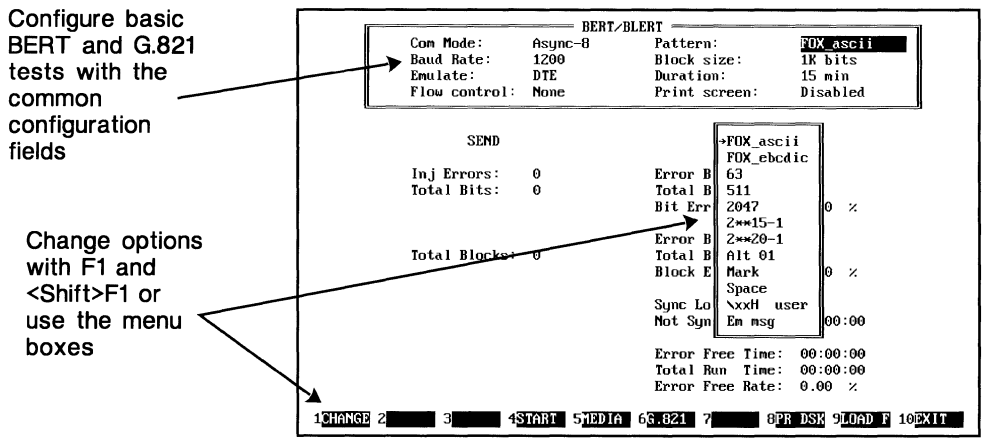
Emulate — Specifies on which line emulation is to occur:

DCE — Causes data transmission to occur on pin 3. Modem leads DCD, DSR, and CTS are set high. Tx and Rx clocks (pins 15 and 17) are also driven if emulating a synchronous line.

DTE — Causes data transmission to occur on pin 2. Modem leads DTR and RTS are set high. If a synchronous line, clock signals are expected on pins 15 and 17. External Tx clock signal is provided on pin 24 (ETC).

Flow Control — *For Async only.* Allows you to select a flow control protocol. With flow control active, the LM2000 stops transmitting the BERT pattern when the selected flow control signal is detected. Transmission is resumed when the flow control signal is released. Line monitoring (data reception) is not affected by flow control. Options are:

None	No flow control.
XON/XOFF	Uses XON/XOFF for flow control. BERT transmission stops when XOFF is detected and resumes when XON is detected.
CTS	Monitors the CTS lead for flow control. BERT transmission stops when CTS goes low, and resumes or begins when CTS goes high.
DSR	Monitors the DSR lead for flow control. BERT transmission stops when DSR goes low, and resumes or begins when DSR goes high.
DCD	Monitors the DCD lead for flow control. BERT transmission stops when DCD goes low, and resumes or begins when DCD goes high.
RI	Monitors the RI lead for flow control. BERT transmission stops when RI goes low, and resumes or begins when RI goes high.



Configuration options for BERT/BLERT and G.821 are displayed at the top of the screen.

Configuring for BERT/BLERT and G.821 Tests (continued)

Pattern — Selects the test message that will be transmitted and also determines the reference with which received data is compared. Options are:

FOX ascii	The standard Fox message ("A QUICK BROWN FOX..") in ASCII.
FOX ebcdic	The standard Fox message ("A QUICK BROWN FOX..") in EBCDIC.
63	Pseudo-random bit pattern.
511	Pseudo-random bit pattern.
2047	Pseudo-random bit pattern.
2**15-1	Pseudo-random bit pattern.
2**20-1	Pseudo-random bit pattern.
Alt 0	Alternating mark (high) and space (low) bits.
Mark	All high bits.
Space	All low bits.
\xxH user	A test pattern defined by the user. You will be prompted for a two-digit hexadecimal value (00-FF).
Em msg	The BERT/BLERT will use the message defined in the Emulation Message Definition Screen.

Block size — Value, in bits per block, used for Block Error Rate (BLERT) calculations. Possible values are:

256 bits	
512 bits	
1K bits	
2K bits	
3K bits	
5K bits	
10K bits	
CCITT	Defines the Block size as the length of the pattern. For patterns such as Alt, Mark, Space, or user-defined, the LM2000 will set the Block size to 16384 bits.

Duration — Defines the period of time for BERT. Options are:

Continuous	Test proceeds until you stop it by pressing F4.
10 min	
15 min	
20 min	
25 min	
Till error	Test proceeds until an error is detected.

Print Screen	Controls the automatic BERT/BLERT report printout. Options are:	
	Disabled	No automatic printing.
	On error	Prints on error detection.
	On completion	Prints when duration time has elapsed.
	On err/comp	Prints when either of the above two conditions occur.
	Every min Every 5 min Every 10 min Every 30 min Every hour	

Other G.821 BERT/BLERT configuration fields:

In addition to the configuration fields listed above, for the G.821 test you need to set the following:

Sever.Err.Sec. Threshold	Specifies the threshold for severely errored seconds. Use F2 [STHR] to set the threshold.
Degr. Minutes Threshold	Specifies the threshold for degraded minutes, which are based on an averaging period of one minute. Use F3 [MTHR] to set the threshold.

Note:

- Configuration files (filename.BRT), customized for your applications, can be saved and loaded at another time (from this screen or from the DOS command line). Use F9 [LOAD] and <Shift> F9 [STOR F].

Controlling Functions: BERT/BLERT and G.821

This discussion features the functions keys used for both BERT/ BLERT and G.821—during the test setup and when the test is running.

Test Setup:

F1 [CHANGE]	Cycles through the possible values for the field. You can also use the menu box to make a selection. <Shift>F1 [B CHNG] Cycles through the possible field values in reverse order.
F2 [STHR]	*For G.821 only.* Sets a threshold for Severely Errored Seconds. The default is based on the baud rate selected.
F3 [MTHR]	*For G.821 only.* Sets a threshold for Degraded Minutes. The default value is based on the baud rate selected.
F4 [START]	Starts the BERT/BLERT. (F4 changes to STOP when the BERT/BLERT is running.)
F6 [BERT]	Toggles between the basic BERT/BLERT screen and the G.821 screen.
F8 [PR DSK]	Prints a copy of the screen, as an ASCII file, to disk. The LM2000 will prompt you for a filename and append the extensionPDK.
<Shift>F8 [PRINT]	Causes the BERT/BLERT screen to be printed. The message "Printer ready (y/n)?: y" will be displayed. If printing is desired, press <Enter>. If printing is not desired or the printer is not ready, type n and press <Enter>. Be sure a printer is attached and ready, otherwise the system will lock up.
F9 [LOAD F]	Allows a previously saved BERT configuration file to be loaded. The LOAD/STORE subscreen (Chapter 15) will be displayed. Pathnames may be used, but not extensions. The extensionBRT will be supplied for BERT files.
<Shift>F9 [STOR F]	Saves the current BERT configuration file to disk. The extensionBRT will be supplied.
F10 EXIT or <ESC>	Exits the BERT/BLERT screen and returns to the Main Menu.

Test Running:

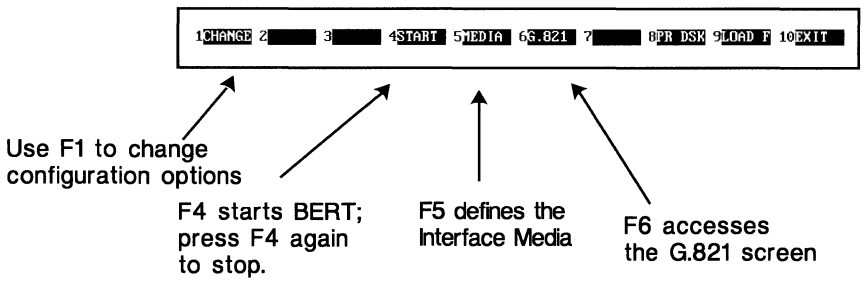
F4 [STOP]	Stops the BERT/BLERT. (F4 changes to START when the BERT/BLERT is not running.)
F5 [INJ ER]	The LM2000 injects one error bit into the transmitted data stream each time this function key is pressed. The Inj Errors counter keeps track of the number of injected errors.
F6 [BERT]	Toggles between the basic BERT/BLERT screen and the G.821 screen.
F7 [RESYNC]	Forces the LM2000 to resynchronize on the received data stream. The **Sync loss cnt** field is incremented by 1.
F9 [STATUS]	Updates all analysis fields instantly.
<Shift>F9 [0 STAT]	Resets all analysis fields to 0.

Note:

- While receiving data and counting error bits, if the error rate is unusually high for a single block of data, the line may be completely out of synchronization. The LM2000 will detect this condition and attempt to synchronize with the incoming data stream. When this happens, the Sync Loss Counter is incremented. You can force the LM2000 to synchronize during the BERT/BLERT by pressing F7.

Note on G.821 Function Keys:

The BERT/BLERT Screen function keys parallel those of the G.821 BERT/BLERT Screen with two exceptions--F2 [STHR] and F3 [MTHR].



Available function keys for test setup on BERT and G.821 Screen.

Analyzing BERT/BLERT Results

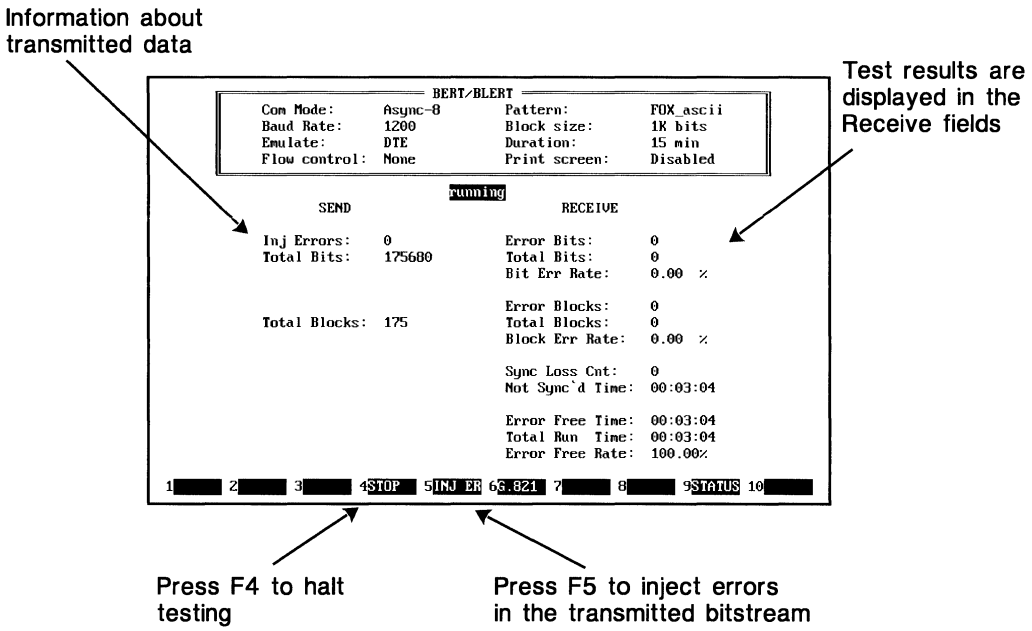
You can analyze the results of the BERT/BLERT using the SEND and RECEIVE fields listed below.

Analysis Fields - SEND

Inj Errors	Counts the number of errors you injected into the transmitted data stream by pressing F5.
Total Bits	Counts the total number of bits transmitted.
Total Blocks	Counts the total number of blocks transmitted.

Analysis Fields - RECEIVE

Error Bits	Counts the number of error bits received.
Total Bits	Counts the total number of bits received.
Bit Err Rate	The ratio of Error Bits to Total Bits, expressed as a percentage.
Error Blocks	Counts the number of blocks received containing at least one error.
Total Blocks	Counts the total number of blocks received.
Block Err Rate	The ratio of Error Blocks to Total Blocks, expressed as a percentage.
Sync loss cnt	Counts the number of times the protocol analyzer re-synchronized on the received data stream, either automatically (because the number of received error bits was abnormally high) or because you forced re-synchronization by pressing F7.
Not sync'd Time	Counts the number of seconds (minutes, hours) that the received data stream was not synchronized.
Error Free Time	Counts the number of seconds (minutes, hours) that the received data stream was error free.
Total Run Time	Counts the total number of seconds (minutes, hours) the BERT/BLERT ran, either equal to the Duration field value, or less if you stopped the test prematurely by pressing F4.
Error Free Rate	The ratio of the Error Free Time to Total Run Time, expressed as a percentage.



The BERT/BLERT Screen with testing in progress.

Analyzing G.821 BERT/BLERT Results

You can analyze the results of the G.821 BERT using the time availability, error reporting, and informational fields.

Analysis Fields - Time Availability

Total Seconds — Active count of the number of elapsed seconds after you press F4 [START]. When the "Running" message is displayed, the counter is incremented every five seconds.

Unavailable Seconds — Sum of the number of one-second intervals that the connection was deemed to be not available, i.e., periods of time when more than x errors occur in one second for 10 consecutive seconds (x is based on the line speed).

% Unavailable Seconds — Ratio of Unavailable Seconds to Total Seconds, expressed as a percentage.

Available Seconds — Total Seconds minus Unavailable Seconds.

% Available Seconds — Ratio of Available Seconds to Total Seconds, expressed as a percentage.

Available Minutes — Active count of the number of elapsed minutes after you press F4 [START].

Analysis Fields - Error Reporting

Errored Seconds — Actual count of the number of seconds that had errors, within Available Seconds.

% Errored Seconds — Ratio of Errored Seconds to the Total Seconds, expressed as a percentage.

Severely Errored Seconds — Count of errored seconds that have surpassed the value in the **Sever. Err. Sec. Threshold** field.

% Severely Errored Seconds — Ratio of Severely Errored Seconds to the Total Seconds, expressed as a percentage.

Degraded Minutes — Determined by excluding the Severely Errored Seconds from Available Seconds and consecutively grouping the remaining second intervals into packets of 60. This field counts the number of these packets (expressed as minutes), which contain more than x errors. (x is based on the line speed).

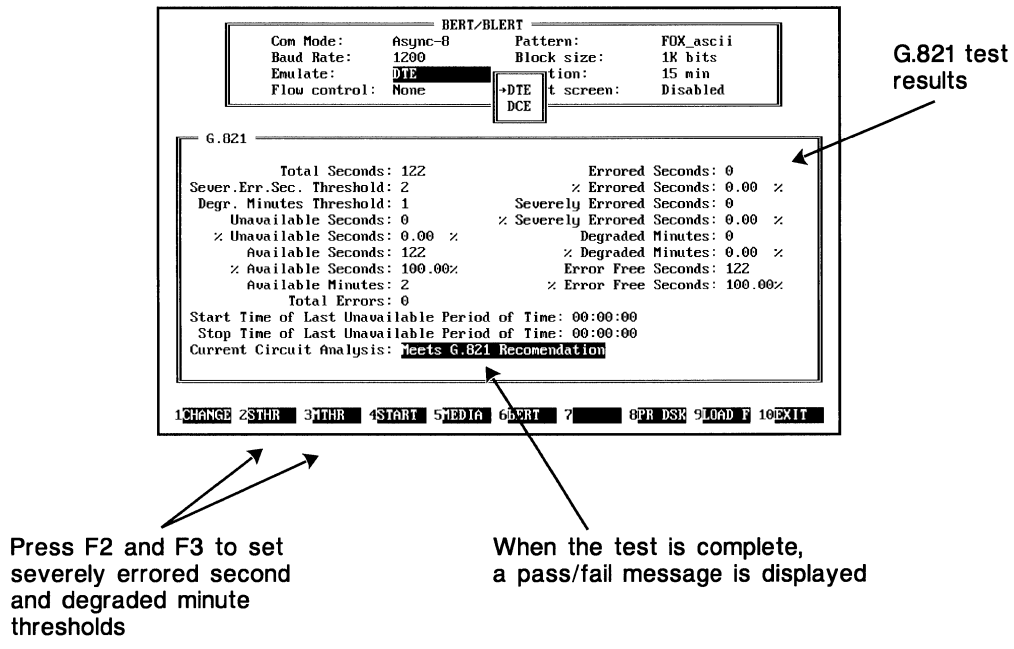
% Degraded Minutes — Ratio of Degraded Minutes to total time.

Error Free Seconds — Total Seconds minus Errored Seconds.

% Error Free Seconds	Ratio of the number of Error Free Seconds to the Total Seconds, expressed as a percentage.
Total Errors	Count of the total number of errors.

Analysis Fields - Informational

Start Time of Last Unavailable Period of Time	The start time and date of the most recent period of time that was unavailable because of errors.
Stop Time of Last Unavailable Period of Time	The stop time and date of the most recent period of time that was unavailable because of errors.
Current Circuit Analysis	The message "Unavailable" will be displayed if insufficient statistics are available within the first 120 seconds of the test. Then, at 125 seconds, either the message "Meets G.821 Recommendation" or "Doesn't meet G.821 Recommendation" will be displayed.



The G.821 BERT/BLERT Screen displays a pass/fail message after 125 seconds.

Chapter 11
The Software Break-Out Boxes

- The RS-232 Software Break-Out Box
- The V.35 Software Break-Out Box
- The V.10/V.11 Software Break-Out Box
- RS-422/RS-423 Software Break-Out Box
- Using the T-Pod with the LM2000
- Using T-Pod Macros

RS-232 Software Break-Out Box

The RS-232 software break-out box emulates the function of a real break-out box for selected RS-232 leads. It also detects lead transitions, which can help you detect spikes and noise.

Before you begin:

- Before accessing the RS-232 Software Break-Out Box Screen, you must set the Media field to **RS232** on the System Configuration Screen; use <Shift>F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

To access the RS-232 Software Break-Out Box Screen:

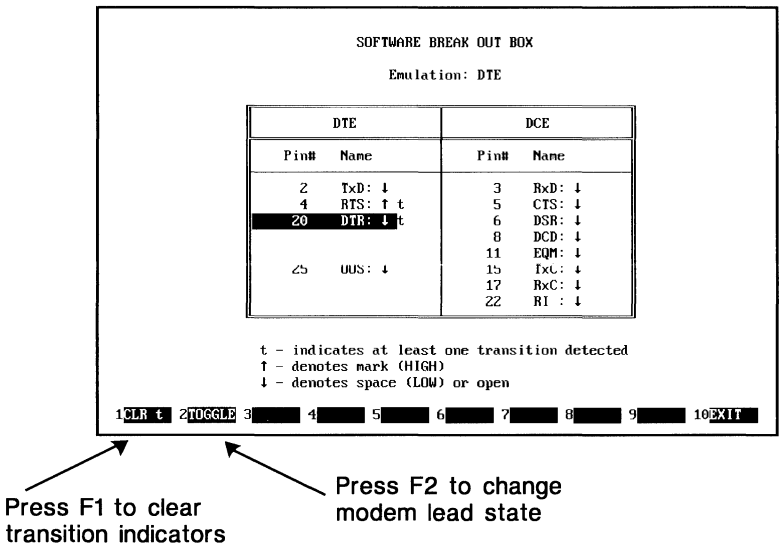
- Press F6 [BO BOX] on the Main Menu.
- Press <Shift>F3 [BO BOX] on the Monitor Screen.

Main functions of this screen:

The RS-232 break-out box displays all major data communications leads (RX, TX, RTS, DTR, CTS, DSR, DCD, RI, TX clock, RX clock, and pin 25). When a lead changes state (from high to low or from low to high or open), a "**t**" for transition is displayed.

When emulating, you can manually change the state of the modem leads using the F2 [TOGGLE] key. Use the <↑> and <↓> arrow keys to select the desired lead.

In the DCE emulation mode, you can drive the CTS, DSR, DCD, and RI leads. In DTE emulation mode, you can drive the RTS and DTR leads.



RS232 Software Break-Out Box Screen.

Function Key	Definition
F1 [CLR t]	Clears all transition (t) indicators.
F2 [TOGGLE]	Toggles the highlighted modem lead between high (logical 1) and low (logical 0) states.
F10 [EXIT] or <Esc>	Returns to the previous screen.

Function keys for RS-232 Software Break-Out Box Screen.

V.35 Software Break-Out Box

The V.35 Software Break-Out Box emulates the function of a real break-out box for selected V.35 leads. It also detects lead transitions, which can help you detect spikes and noise.

Before you begin:

- Before accessing the V.35 Software Break-Out Box Screen, you must set the Media field to **V.35** on the System Configuration Screen; use <Shift>F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

To access the V.35 Software Break-Out Box Screen:

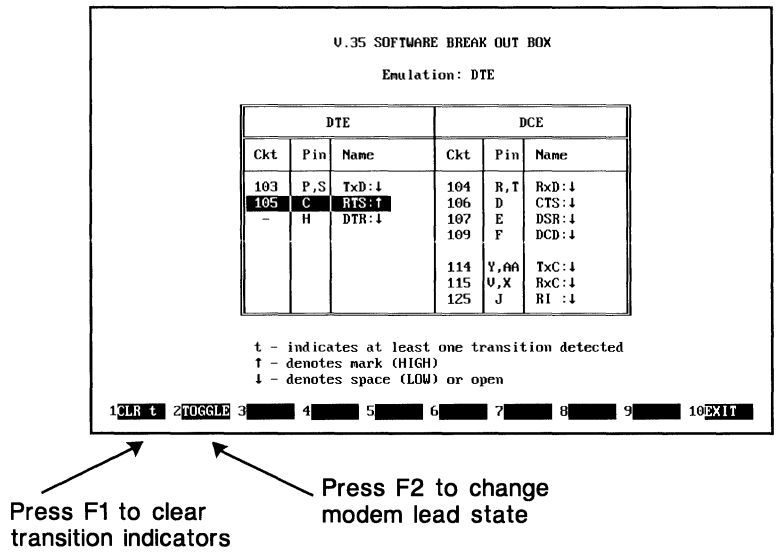
- Press F6 [BO BOX] on the Main Menu.
- Press <Shift>F3 [BO BOX] on the Monitor Screen.

Main functions of this screen:

The V.35 break-out box screen displays all major data communications leads (RX, TX, RTS, DTR, CTS, DSR, DCD, TX clock, RX clock, and RI). When a lead changes state (from high to low or from low to high or open), a "**t**" for transition is displayed.

When emulating, you can manually change the state of the modem leads using the F2 [TOGGLE] key. Use the <↑> and <↓> arrow keys to select the desired lead.

In the DCE emulation mode, you can drive the CTS, DSR, DCD, and RI leads. In DTE emulation mode, you can drive the RTS and DTR leads.



V.35 Software Break-Out Box Screen.

Function Key	Definition
F1 [CLR t]	Clears all transition (t) indicators.
F2 [TOGGLE]	Toggles the highlighted modem lead between high (logical 1) and low (logical 0) states.
F10 [EXIT] or <Esc>	Returns to the previous screen.

Function keys for V.35 Software Break-Out Box Screen.

V.10/V.11 Software Break-Out Box

The V.10/V.11 Software Break-Out Box emulates the function of a real break-out box for selected V.10 and V.11 leads. It also detects lead transitions, which can help you detect spikes and noise.

Before you begin:

- Before accessing the V.10/V.11 Software Break-Out Box Screen, be sure the Media field on the System Configuration Screen is set to the desired interface media, either **V.10** or **V.11**; use <Shift>F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

To access the V.10/V.11 Software Break-Out Box Screen:

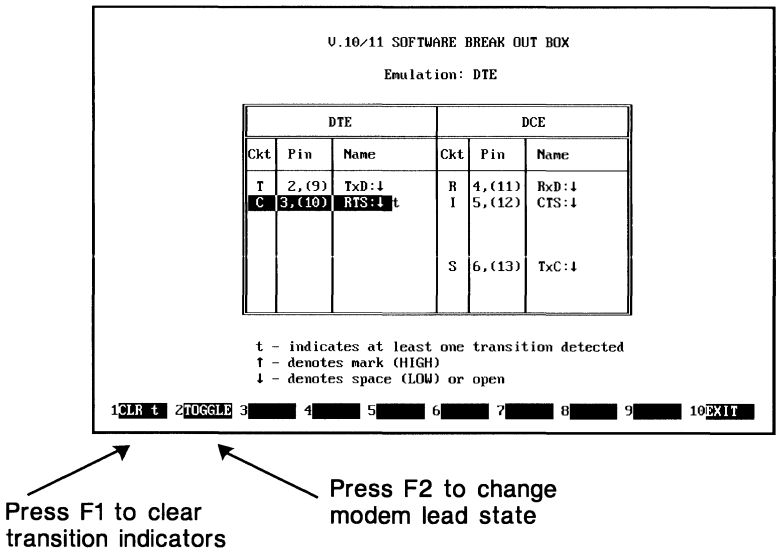
- Press F6 [BO BOX] on the Main Menu.
- Press <Shift>F3 [BO BOX] on the Monitor Screen.

Main functions of this screen:

The V.10/11 break-out box screen displays all major data communications leads (RX, TX, RTS, CTS, and TX clock). When a lead changes state (from high to low or from low to high or open), a "**t**" for transition is displayed.

When emulating, you can manually change the state of the modem leads using the F2 [TOGGLE] key. Use the <↑> and <↓> arrow keys to select the desired lead.

In the DCE emulation mode, you can drive the CTS lead; in DTE, you can drive the RTS lead.



V.10/V.11 Software Break-Out Box Screen.

Function Key	Definition
F1 [CLR t]	Clears all transition (t) indicators.
F2 [TOGGLE]	Toggles the highlighted modem lead between high (logical 1) and low (logical 0) states.
F10 [EXIT] or <Esc>	Returns to the previous screen.

Function keys for V.10/V.11 Software Break-Out Box Screen.

RS-422/RS-423 Software Break-Out Box

The RS-422/RS-423 software break-out box emulates the function of a real break-out box for selected RS-422 and RS-423 leads. It also detects lead transitions, which can help you detect spikes and noise.

Before you begin:

- Before accessing the RS-422/RS-423 Software Break-Out Box Screen, be sure the Media field on the System Configuration Screen is set to the desired interface media, either **RS422** or **RS423**; use <Shift>F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

To access the RS-422/RS-423 Software Break-Out Box Screen:

- Press F6 [BO BOX] on the Main Menu.
- Press <Shift>F3 [BO BOX] on the Monitor Screen.

Main functions of this screen:

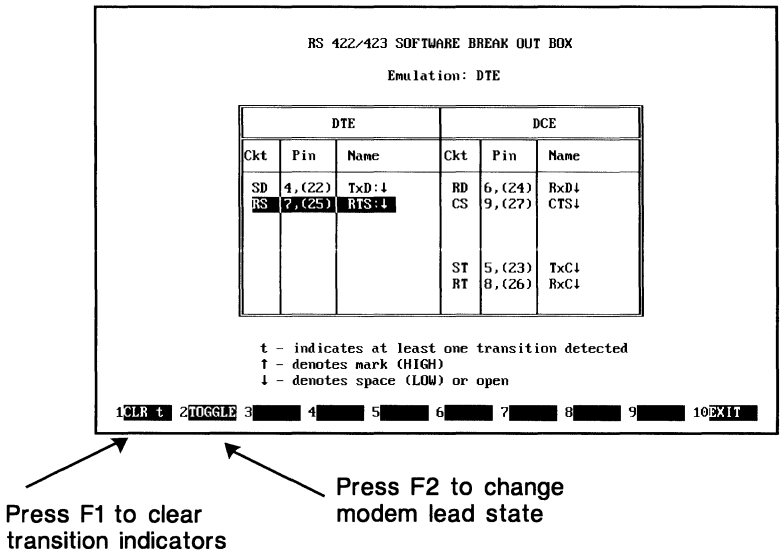
The RS-422/RS-423 break-out box screen displays all major data communications leads. The leads monitored are RX, TX, RTS, CTS, TX clock, and RX clock. When a lead changes state (from high to low or from low to high or open), a "**t**" for transition is displayed.

When emulating, you can manually change the state of the modem leads using the F2 [TOGGLE] key. Use the <↑> and <↓> arrow keys to select the desired lead.

In the DCE emulation mode, you can drive the CTS lead; in DTE, you can drive the RTS lead.

Note:

- If you are using an RS-449 interface, the RS-422/RS-423 breakout box applies.



RS-422/RS-423 Software Break-Out Box Screen.

Function Key	Definition
F1 [CLR t]	Clears all transition (t) indicators.
F2 [TOGGLE]	Toggles the highlighted modem lead between high (logical 1) and low (logical 0) states.
F10 [EXIT] or <Esc>	Returns to the previous screen.

Function keys for RS-422/423 Software Break-Out Box Screen.

Using the T-Pod with the LM2000

The T-Pod T1 Interface and Tester provides channel-by-channel access to T1 traffic. You can perform all control and test functions of the T-Pod™ T1 Interface and Tester remotely while using the LM2000. This is done using the T-Pod Remote Control Screen.

Before you begin:

- Before accessing the T-Pod Remote Control Screen, be sure the Media field on the System Configuration Screen is set to **T-POD**; use <Shift>F5 [MEDIA].

> **CAUTION!**
>
> Be sure the selected Media interface option matches the actual media interface. An incorrect match may disrupt the network.

To access the T-Pod Remote Control Screen:

- Press F6 [BO BOX] on the Main Menu.
- Press <Shift>F3 [BO BOX] on the Monitor Screen.

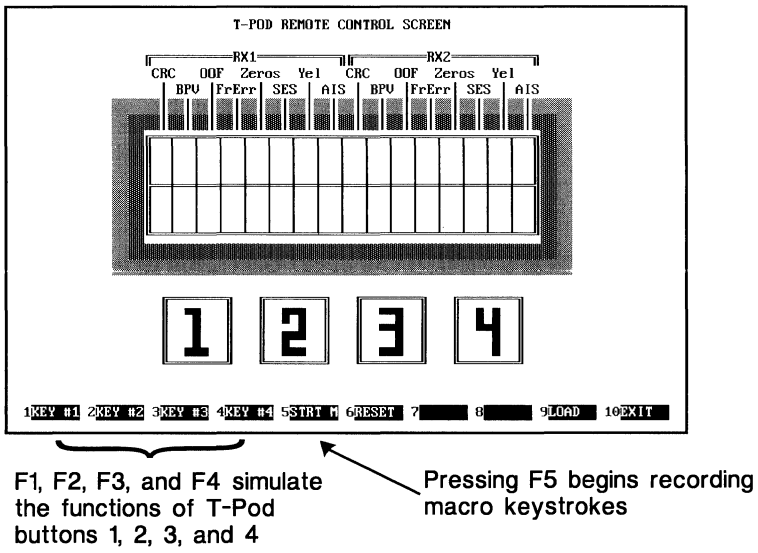
Note:

The T-Pod buttons 1, 2, 3, and 4 are simulated by function keys F1, F2, F3, and F4, respectively. The functions vary depending on which menu–SET, ALARM, RUN–you select from the T-Pod's Main Menu.

For example, button 1 on the SET menu allows you to select the test mode, whereas button 1 on the ALARM menu allows you to activate audible alarms. Remember that only the highlighted buttons shown on the screen are active.

See also:

For T-Pod installation and setup information, see the *T-Pod™ T1 Interface and Tester User's Manual.*



T-Pod Remote Control Screen.

Using T-Pod Macros

You can configure the T-Pod using macros created on the T-Pod Remote Control Screen. Macros record the actual keystrokes you use to configure the T-Pod and run tests. In creating a macro, the keystrokes you enter are stored in a file that can be replayed at another time.

To define T-Pod macros:

1) Press F5 [STRT M] to begin recording your keystrokes.
2) Use the appropriate function keys, F1 [KEY #1] through F4 [KEY #4] to configure the T-Pod. If desired, you can include extra keystrokes to start monitoring data. For complete details on configuring the T-Pod and monitoring data, see the *T-Pod T1 Interface and Tester User's Manual.*
3) Press F5 [STOP M] to stop recording your keystrokes.
4) Press <Shift>F9 [STORE] to save the macro you just created. The program prompts you for a filename and appends theTPD extension.
5) To load and run a previously created macro, press F9 [LOAD] and select the desired macro from the menu. The macro is run automatically when it is loaded.

Hint:

When recording a macro, it is good practice to make the first keystroke a reset function (use F6 [RESET]). In programming, this is similar to clearing the registers before a program starts to generate code.

Function Key	Definition
F1 [KEY#1]	Simulates the functions of button 1 on the T-Pod, as defined by the current menu selection.
F2 [KEY#2]	Simulates the functions of button 2 on the T-Pod, as defined by the current menu selection.
F3 [KEY#3]	Simulates the functions of button 3 on the T-Pod, as defined by the current menu selection.
F4 [KEY#4]	Simulates the functions of button 4 on the T-Pod, as defined by the current menu selection.
F5 [STRT M]	Allows you to create a T-Pod configuration macro. Press F5 [STRT M] to begin recording your keystrokes; press F5 again to stop recording (the function key label changes to [STOP M].
F6 [RESET]	Clears the T-Pod configuration and returns to the T-Pod's Main Menu.
F9 [LOAD]	Allows you to load and run a previously created T-Pod configuration macro.
<Shift>F9 [STORE]	Allows you to save a macro containing a T-Pod configuration. The program prompts you for a filename and appends theTPD extension.
F10 [EXIT] or <Esc>	Returns you to the previous screen.
Note: Function keys F1, F2, F3, and F4 are also available during regular T-Pod operation. For more information on using function keys, see "Using the T-Pod with the LM2000" earlier in this chapter.	

T-Pod function keys for defining macros.

Chapter 12
The LM2000 Asynchronous Terminal

- Asynchronous Terminal Emulation Overview
- How to Configure the Async Terminal

Screen Overview: Asynchronous Terminal Emulation

The LM2000 asynchronous terminal lets you emulate a DTE or DCE device. It also lets you communicate via the personal computer's serial communications port. Data passing through the LM2000 communications port is logged into the buffer for future analysis. Time stamping can be enabled, and the XMODEM file transfer protocol is supported.

How to access the async terminal emulation screen:

- Press <Shift>F8 from the Main Menu.

Main functions of this screen:

- Configure the asynchronous terminal.
- Load or save a terminal configuration file.
- Print a copy of the current screen either to disk or to a printer.
- Begin or end a terminal emulation session.

How to begin and end a terminal emulation session:

- Press F4 [START] to begin terminal emulation.
- Press <Shift>F10 [STOP] to end terminal emulation.

Special features to use during terminal emulation

- Press <Shift>F9 to send a break character.
- Press <Ctrl><PgUp> to upload an XMODEM or XMODEM-CRC file.
- Press <Ctrl><PgDn> to download an XMODEM or XMODEM-CRC file.

How to print the configuration settings on your PC's printer:

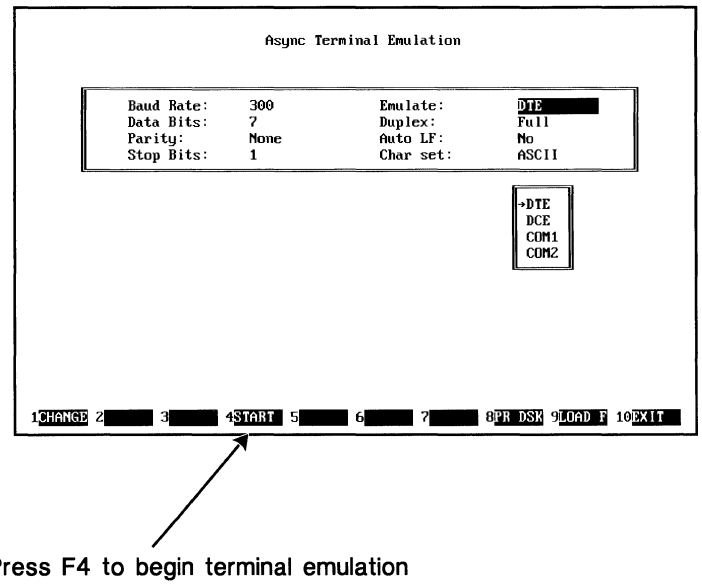
1) Press <Shift>F8 [PRINT].
   - The message **Printer ready (y/n)?:y** will be displayed.
2) Press <Enter> if the printer is ready and you desire to print the screen.
   -or-
   Press **n** and <Enter> to return to the terminal emulation screen.

How to print the settings to disk as an ASCII file:

1) Press F8 [PR DSK].
   - The LM2000 will prompt you for a file name.
2) Type the name of the file and press <Enter>.
   - The LM2000 automatically appends the appropriate .PDK file extension.

Loading Files		Saving Files	
1	Press F9 [LOAD F].	1	Press <Shift>F9 [STOR F].
2	Select the desired file from the menu. The LM2000 will supply the .TRM file extension automatically.	2	Enter the desired filename. The LM2000 will automatically supply theTRM file extension.
3	Press <Enter>.	3	Press <Enter>.

Loading and saving configurations for async terminal emulation.



Async terminal emulation lets you communicate via the PC's serial port.

How to Configure the Async Terminal

Async terminal configuration lets you set the speed, data bits, parity and other parameters for asynchronous communications.

How to select configuration options:

1) Move the cursor to the parameter to be changed.
   - The LM2000 displays a window showing the available options for the selected communications parameter.
2) Use the arrow keys to select the desired option, or press F1 [CHANGE] to cycle forward through the options and <Shift>F1 [B CHNG] to cycle backward through the options.

Notes

The LM2000 ASCII terminal emulator is a "glass teletype." For cursor control, install ANSI.SYS on your computer.

Field Name	Options	Description
Baud Rate	50 bps to 64 kbps	Communication rate in bits per second (bps).
Data Bits	5, 6, 7, 8	Number of bits used to describe a character. Data bits do not include parity or start and stop bits.
Parity	None, Even, Odd, Space	Type of parity used to detect errors in asynchronous transmissions.
Stop Bits	1, 2	Number of stop bits used for asynchronous transmission.
Emulate	DTE, DCE, COM1, COM2	Type of async terminal to be emulated. While in DTE or DCE emulation, the LM2000 monitors data traffic, allowing you to review the async terminal session on the View Buffer screen. For more information on the View Buffer screen, see Chapter 9.
Duplex	Full, Half	In half duplex mode, characters are echoed locally. In full duplex mode, no echo takes place locally.
Auto LF	Yes, No	If set to Yes, a line feed character will automatically be generated after a carriage return character is detected. If set to No, the carriage return action returns to the start of the same line.
Char Set	ASCII	Character set is always ASCII for async terminal emulation.

Async terminal configuration options.

Chapter 13
PowerScript Test Builder and the PowerScript Library

- Overview: PowerScript
- What is a test script?
- Loading Test Scripts
- Saving Test Scripts
- Writing Test Scripts
- Editing Test Scripts
- Menus for Test Scripts
- How to Write Test Script Menus
- Using Protocol Macros in Test Scripts
- Running PowerScript Test Scripts
- Using Test Scripts from the PowerScript Library
- PowerScript Command Reference
  - Beep
  - Comment
  - Counter
  - Display
  - Emulate
  - Goto block
  - If
  - LoadConfig
  - Pause
  - Print
  - Reset
  - Run chldpr
  - Set leads
  - Snapshot
  - Start
  - Stop
  - Transmit
  - Wait Until

Overview: PowerScript

The PowerScript custom test builder is a sophisticated scripting language that allows you to create automated test routines for the LM2000 analyzer. PowerScript test scripts let you monitor live data lines; emulate DTE and DCE data; trap, count, and time various events; and perform many other network analysis functions. The LM2000 is shipped with the PowerScript library, a collection of predefined test scripts written with the PowerScript language. You can use these test scripts as is or as a base for your own customized test routines.

How to access this screen:

- F8 from the Main Menu

Main functions of this screen:

- Create PowerScript test scripts
- Load, edit, and run existing test scripts
- Access the library of predefined test scripts

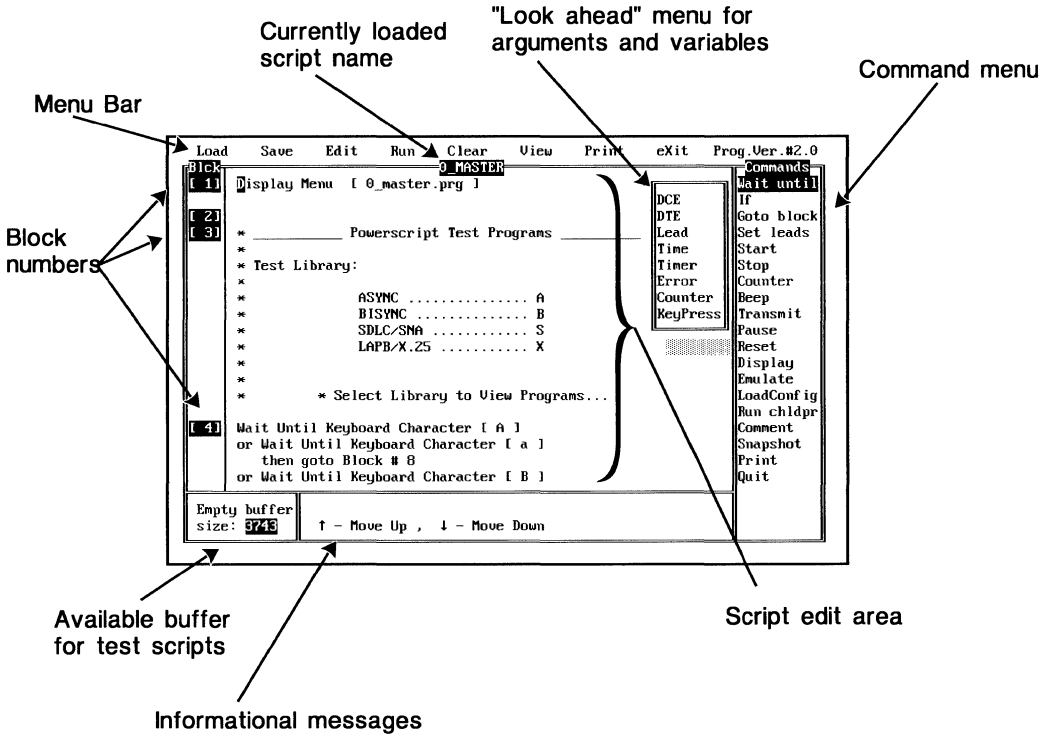
Access to other screens and functions:

You can access all PowerScript functions from this screen by selecting the desired function from the menu bar at the top of the screen.

- To load test scripts for execution or editing, select **L**oad.
- To save new or edited test scripts, select **S**ave.
- To edit or create test scripts, select **E**dit.
- To return to the menu bar after editing a test script, press **<Esc>**.
- To execute test scripts, select **R**un.
- To remove test scripts from the PowerScript buffer, select **C**lear.
- To examine the contents of test scripts, select **V**iew.
- To print the contents of test scripts, select **P**rint.
- To exit PowerScript and return to the LM2000 Main Menu, select e**X**it

Notes

- You can select items in the menu bar with the arrow keys or by typing the capital letter in the desired item's name.



The PowerScript Edit Screen lets you write, edit and run test scripts for the LM2000.

What is a test script?

A test script is a set of instructions, called *statements*, specifying a series of actions to be taken by the LM2000. Test scripts are created using a proprietary language and editor, which is an integral part of the LM2000 analyzer.

Statements, Commands, Arguments, and Variables

- Each test script consists of one or more statements; each statement contains a command and its arguments and variables.
- Commands instruct the LM2000 to perform a specific action. Some commands initiate analyzer functions such as monitoring the network for a certain event (Wait Until), transmitting test data (Transmit, Emulate), or capturing data to a disk file (Snapshot). Other commands perform programming operations such as logical tests (If), branching (Goto), setting timers and counters (Start, Counter, Reset), and calling subroutines (Run chldpr).
- Arguments refine the commands, telling them what to act on. For example, which data events to monitor for, which test data to transmit, and which conditions to test. Variables, when used, tell commands how much, how long, or where to go.

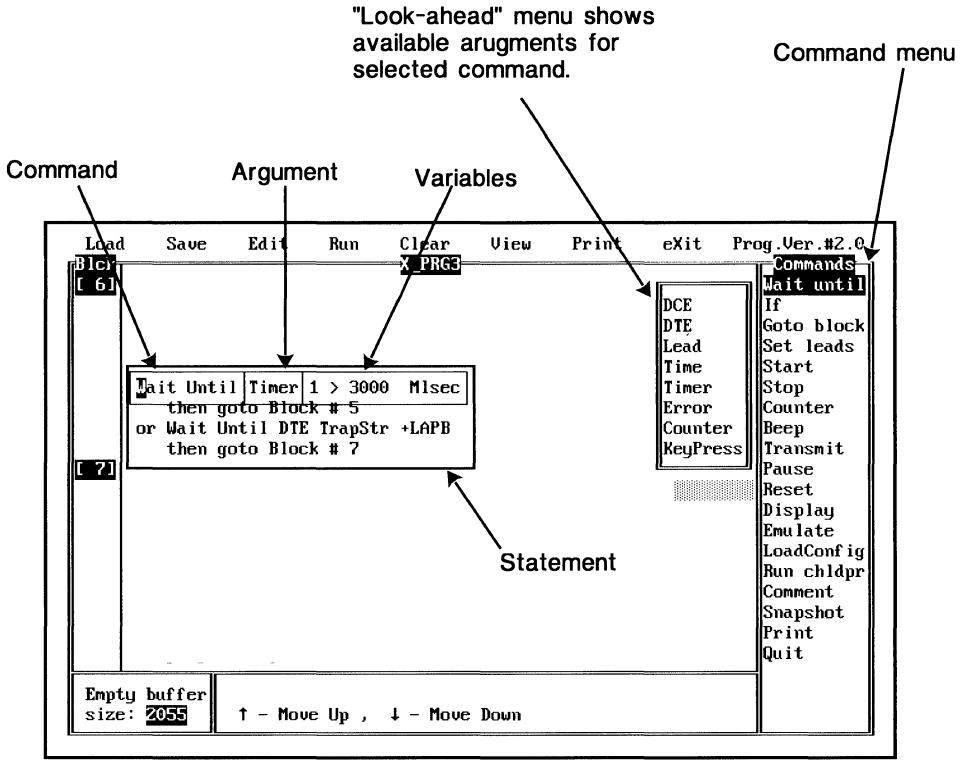
How test scripts are organized

Test scripts are organized in blocks, which are roughly equivalent to lines in other programming languages, providing a reference for branching instructions such as goto. A test script can contain up to 64 blocks (you can chain test scripts together to create scripts longer than 64 blocks).

A block can contain any number of statements, but it is better to keep the number of statements in any one block to a minimum. Blocks can also be left blank to aid in organizing a test script.

The size of the PowerScript buffer limits the size of test scripts

The size of a test script (that is, how many statements it can have) is limited by the size of the PowerScript buffer, which is divided into 4000 units. Sixty-four of the buffer units are used for block numbers, leaving 3936 units available for test script statements. The number of unused buffer units is listed as the Empty buffer size in the bottom left corner of the PowerScript edit screen.



A PowerScript test script is a series of instructions called statements.

Loading Test Scripts

Before you can execute or edit a test script, for example one of the PowerScript Test Library scripts, you must get it into the PowerScript buffer. The Powerscript buffer is a temporary storage area reserved by the LM2000 for PowerScript test scripts. For long term storage, test scripts are stored as files with a PRG extension, which can be loaded into the PowerScript buffer.

Loading test scripts

Test scripts can be loaded at the PowerScript Edit Screen or from the DOS command line when you start the LM2000. When a test script is loaded from DOS, the LM2000 automatically goes to the PowerScript Edit Screen and begins running the test script.

From the PowerScript Edit Screen

1) With the cursor in the menu bar, press L to select Load. (If you are in the script edit window or the command menu, press <Esc> to move the cursor to the menu bar.)
   - The cursor moves to Load.
2) Press <Enter>.
   - The test script menu appears on your screen.
3) Move the cursor to the desired test script. You can do this by pressing the initial letter of the desired test script's name, or use the <↑>, <↓>, <Pg Up>, and <Pg Dn> keys to scroll through the menu.
4) With the cursor on the desired test script's name, press <Enter>.
   - The test script is loaded into the PowerScript buffer.

From the DOS command line

1) At the DOS prompt type the LM2000 command followed by the -l (the letter "L") command switch and the name of the test script you wish to run (do not type the .PRG extension).

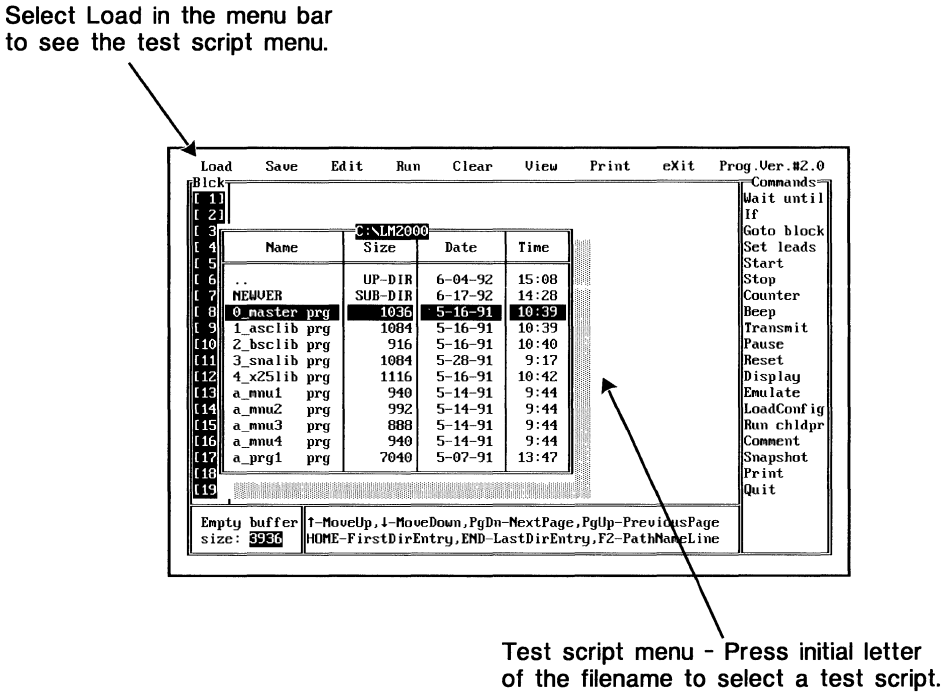
   C:\LM2000>**lm2000 -l*scriptname***

   - The named test script is automatically loaded and executed. The LM2000 goes directly to the PowerScript run screen when started in this manner.

Loading test scripts from the DOS command line: an example

To load and run the master menu script for the PowerScript Test Library, type the following command at the DOS prompt *exactly as shown*.

C:\LM2000>**lm2000 -l0_master**



Select the test script you wish to load from the menu.

Saving Test Scripts

After you have written a new test script or edited an existing one, you may want to save it to a disk file for later use. Test script files are identified by aPRG extension.

Saving test scripts

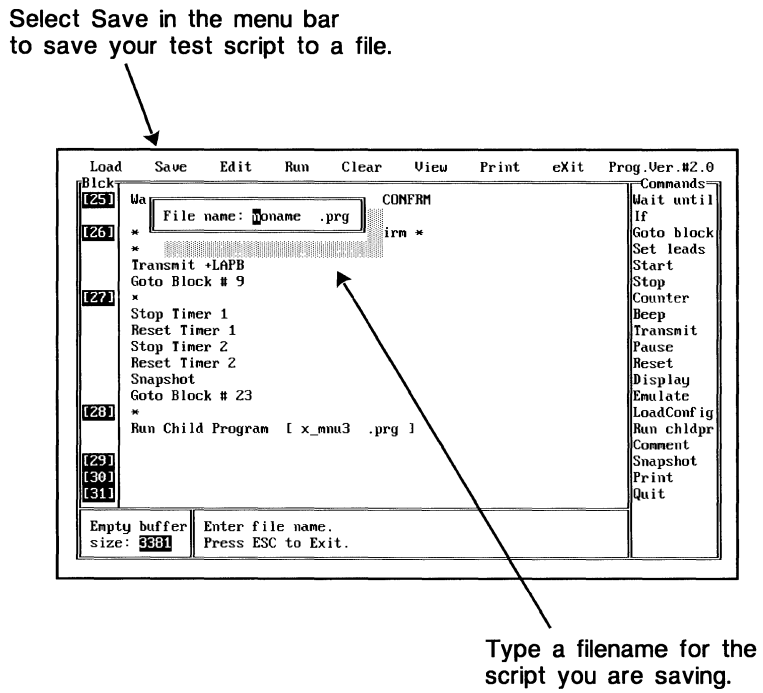
1) If you are in the script edit window or the command menu, press <Esc> to move the cursor to the menu bar. Otherwise, go to step 2.
   - The cursor moves to the menu bar.

2) Press S to select Save.
   - A window with a filename listed in it opens on the screen.

3) **If you are saving a newly created file:** The window displays NONAME.PRG. Type in a name for your test script — up to eight characters, the .PRG extension is supplied automatically — and press <Enter>.
   - The script is saved under the name you entered.

   If you are saving an edited script: The window contains the original name of the script. To save the changes under the original name, just press <Enter> twice. To save the changes to a new file, press <Enter> once, type in the new script name, and press <Enter> again.

   - The script is saved under the name you entered, and the original script is overwritten.



You can save test scripts to disk for later use.

Writing Test Scripts

Writing test scripts consists of building a series of statements that describe the steps you want your test script to perform. Each statement consists of a command and any necessary arguments and variables, which are entered by making selections from the command and argument menus.

Building statements

The following procedure gives the basic steps for building a PowerScript statement. To construct a test script, repeat this procedure for each statement, as needed, until the test script is finished.

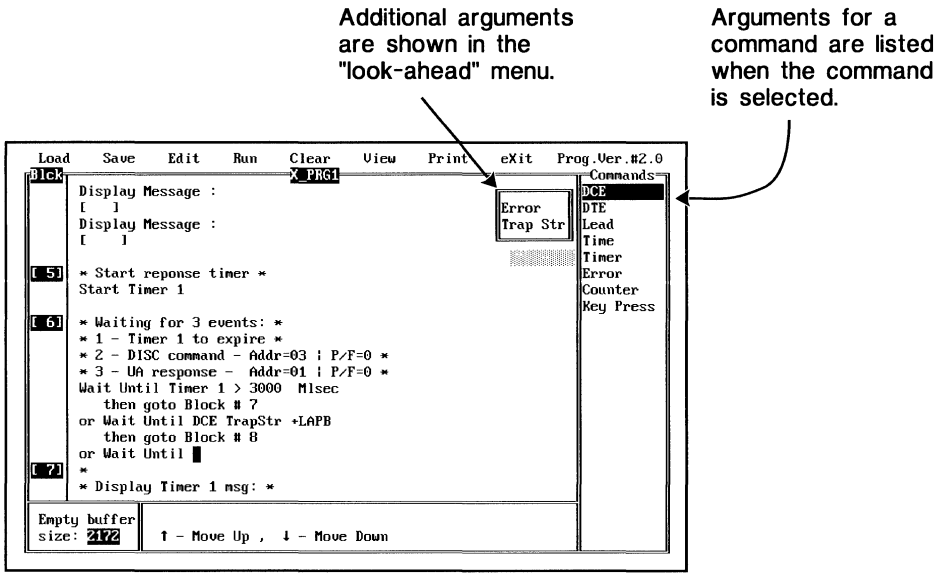
1) Select Edit from the menu bar and press <Enter>.
   - The cursor moves into the script edit area.
2) Move the cursor to the desired block number and press the space bar or the <→> key.
   - The cursor moves to the Command menu.
3) Select the desired command and press <Enter>. (You can select commands using the cursor keys or by pressing the first letter of a command name.)
   - The selected command is entered in the script edit area and, when appropriate, arguments for the command are listed in the Command menu.
4) If necessary, select arguments and enter variable values for the command.
   - As each argument or variable is selected, it is entered in the statement.
5) When the statement is complete, the command menu returns to its initial state. You can now enter another statement, or move to the script edit area (by pressing the space bar or the <←> key) to select a new block number.
6) When the test script is complete, press <Esc> or select Quit in the Command menu to return to the menu bar, where you can save or run the test script.

Correcting mistakes

Use the <Esc> key to delete arguments while you are entering a statement (it acts like a backspace). Pressing <Esc> repeatedly will delete the entire statement.

Notes

- To quickly select a command or argument, press the initial letter of the command's name, repeatedly if necessary.
- Remember to save your test script frequently while writing it so you don't lose any work.



Writing test scripts consists of building a series of statements describing the steps you want the test script to perform.

Editing Test Scripts

In addition to creating test scripts, the Edit function is used to change existing test scripts and to debug newly written scripts.

Moving the cursor

- To move the cursor between the script editing area and the command menu, use the space bar or the <→> and <←> keys.
- To move the cursor one statement at a time, use the <↑> and <↓> keys.
- To move the cursor one block at a time, use the <Pg Up> and <Pg Dn> keys.
- To go to Block #1, press <Home>.
- To go to the block following the last statement in the script, press <End>. To go to Block # 64, press <End> twice.

Inserting new blocks

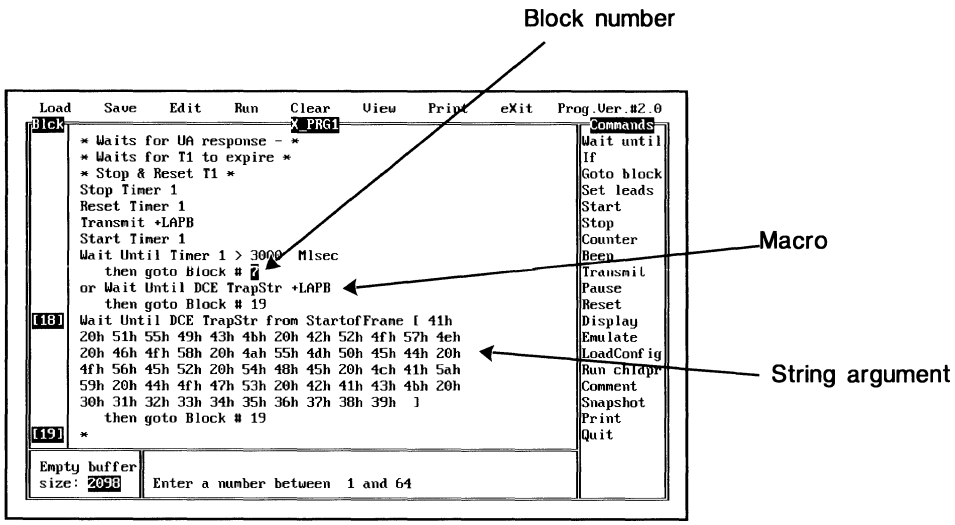
- To insert a new block above the current block, place the cursor on the first statement in the block and press the <Ins> key. All subsequent block numbers are incremented by one, and all **Goto block**, **If**, and **Wait until** statements are automatically updated.

Deleting statements

- You can delete individual statements within any block by placing the cursor on the statement and pressing the <Del> key.

Editing statements — changing strings, block numbers, and macros

You can change these elements without deleting and rewriting the entire statement. With the cursor on the desired statement, press the <Tab> key to advance to the element you wish to edit (use <Shift><Tab> to move backwards). To edit string arguments or block numbers, type in the desired changes and press <Esc>. To edit macros, move the cursor to the macro and press <Enter>. Make the desired changes, then press <Esc>.



You can change block numbers, strings, and macros without deleting statements.

Menus for Test Scripts

PowerScript's Display Menu command allows you to present a list of options to the user from within a test script and continue script execution based on the user's choice.

Test script menus

A test script menu has three components: a Display Menu statement, a menu script file, and one or more Wait Until Keypress statements.

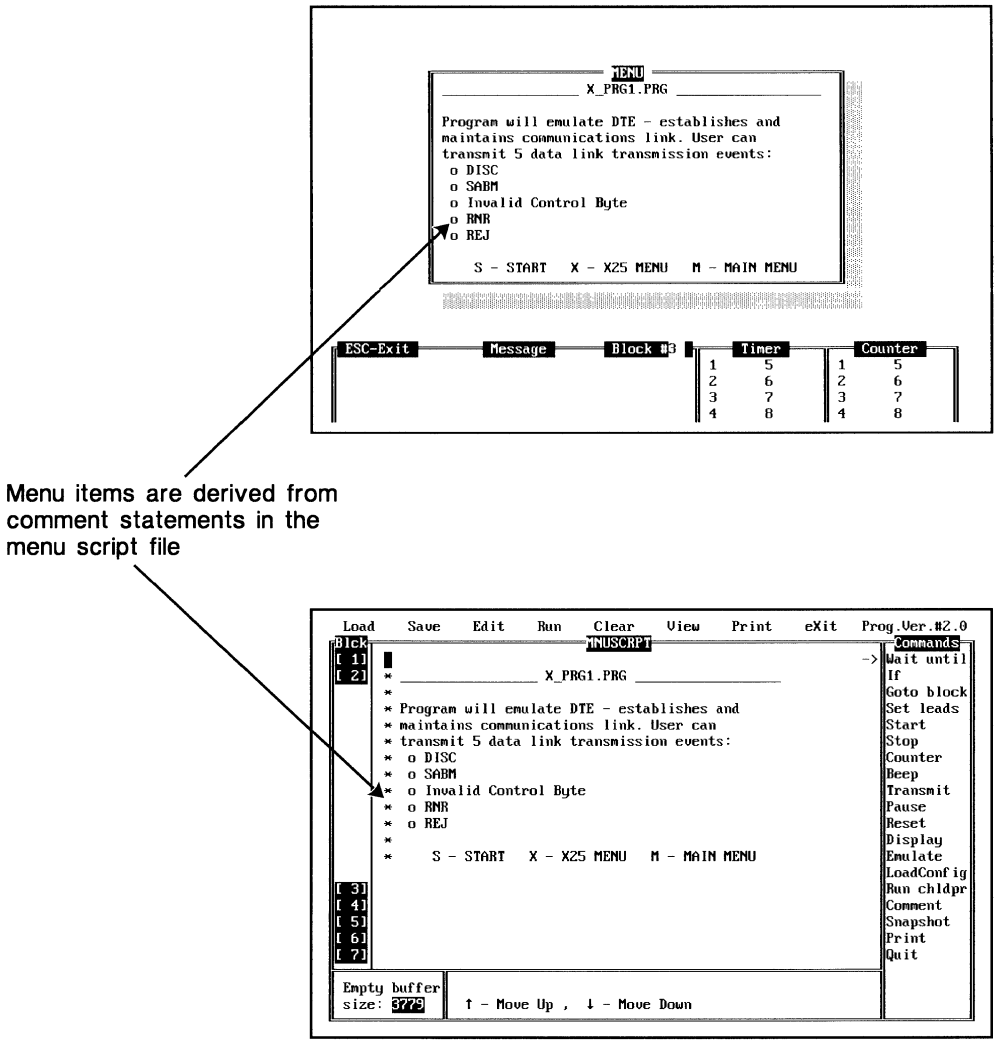
When PowerScript encounters a Display Menu statement, it displays the contents of a second test script, called a menu script, on the Run screen.

The menu script file is created just like any other script file. The difference is that a menu script file contains only Comment statements. The text in the Comment statements are the elements of the menu.

The Wait Until Keypress statements capture the user's menu selection, and redirect test script execution accordingly. Typically, a series of Wait Until Keypress statements are "ORed" together, one statement for each selection on the menu. Redirection is accomplished by a "then goto Block X" argument to the Wait Until Keypress statement.

See Also:

"How to Write a Test Script Menu," next in this chapter; and the Display and Wait Until descriptions in the PowerScript Command Reference at the end of this chapter.



PowerScript Display Menu statements let you create interactive menus for use in test scripts.

How to Write Test Script Menus

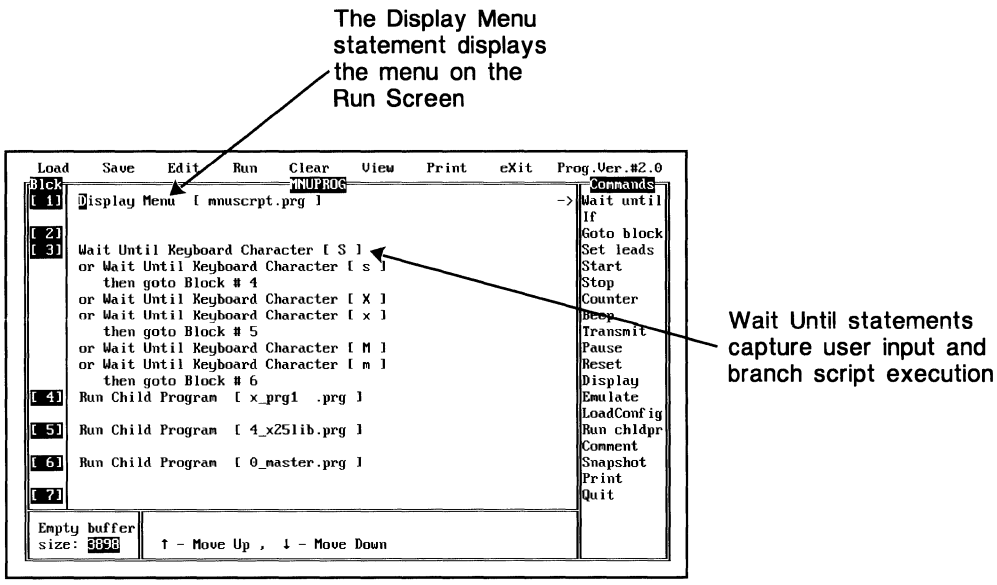
The procedure for writing menus for use in test scripts is outlined below. For details on any of the steps provided here, please refer to the appropriate entries in the Command Reference at the end of this chapter.

To write a test script menu:

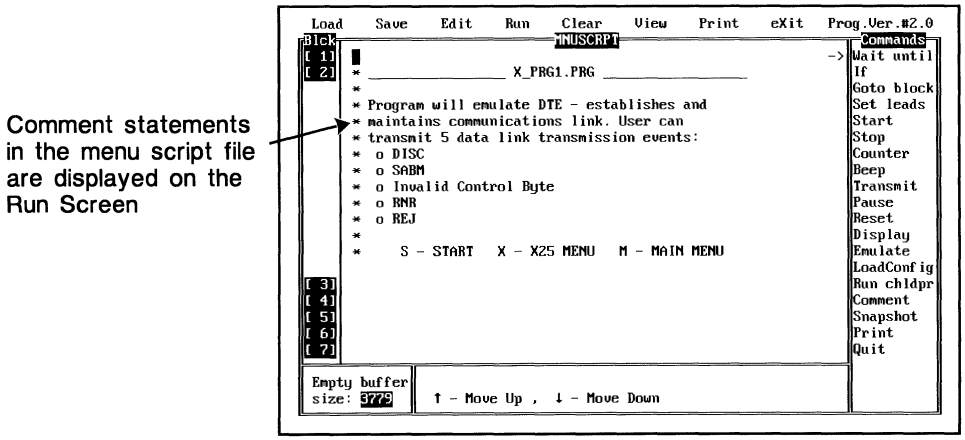
1) Create a menu script file.
   Use the Comment command to enter text for the menu. The menu should include instructions to the user and a list of selections, usually designated with a single character (for example, A 1st selection, B 2nd selection, and so on). A menu script file is limited to 12 lines, each 48 characters long.
2) Save the menu script under a separate filename.
3) Access the test script you wish to use the menu in and enter a Display Menu statement.
   Select Display from the Command Menu, then select the Menu argument and enter the name of the menu script created in step 1.
4) In the block following the Display Menu statement, enter a Wait Until Keypress statement to capture input from the keyboard and branch script execution accordingly.
   Select Wait Until from the Command Menu, then select the Key Press and Character arguments and enter the desired character. Select the Or Wait argument and write additional Wait Until Key Press statements for the remaining menu selections. Each Wait Until Key Press statement should include a Go To Block command to branch script execution.
5) Write the necessary subroutines to carry out the actions specified in the menu script.

Notes

- When writing menu script files, remember that the maximum width is 48 characters, and the maximum length is 12 lines.
- To leave blank lines in menus, enter a Comment statement with no text in it.
- The entire text of a menu may be contained in a single block of the menu script file; they are much more convenient to write like this.
- Menu scripts can be self-contained, like those in the PowerScript Test Library. That is, a Display Menu statement can name the file it is in as the menu script. Wait Until statements are then combined with Run Child Program (Runchldprg) statements to load and run test scripts selected from the menu.



Use Display Menu and Wait Until Key Press statements to create a test script menu.



All Comment Statements in the menu script file are displayed when called by the Display Menu statement.

Using Protocol Macros in Test Scripts

The protocol macros provided with the LM2000 are powerful emulation tools that help you define complex data messages without building frames bit-by-bit. In PowerScript, macros are available in Transmit and Wait Until statements. Macros in Transmit statements help you emulate data messages in any of several protocols. Macros in Wait Until statements let you select specific frames to trigger script actions, including capturing data with the Snapshot command.

To use a protocol macro in a PowerScript statement:

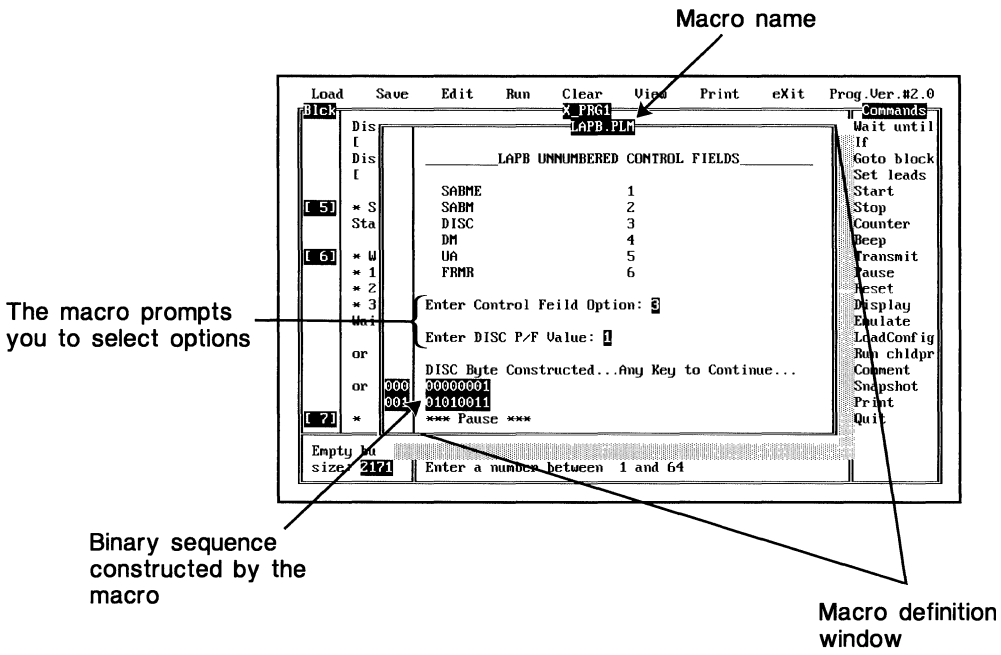
1) Select the Macro argument for the desired command (either Transmit, or Wait Until DTE/DCE TrpStrng).
   - A list of available macros appears.
2) Select the desired macro from the list using the arrow keys, or by pressing the initial letter of the macro name, and pressing <Enter>.
   - The macro definition window opens on the screen.
3) Depending on the macro you select, you may be prompted to enter values or select options for the frame or packet you are defining.
   - When the necessary selections have been made, the bytes of the frame are displayed in binary form for confirmation.
4) Press any key to close the macro definition window.
5) Choose +Macro to define additional frames or packets, or choose Exit Macro to continue with the test script.

Note

- To access protocol macros for the Wait Until command, follow this sequence: 1) Select the Wait Until command. 2) Select the DTE or DCE argument. 3) Select the Trap Strng argument.

See also:

Chapter 14 for more on protocol macros, including how to write your own.



Protocol macros define data messages without building frames bit-by-bit.

Running PowerScript Test Scripts

You can run test scripts from the PowerScript screen or from the DOS command line. When you run a test script, PowerScript switches to the Run screen, which displays monitored and emulated data, as well as providing status information about script execution and any timer or counter values specified in the test script.

Running test scripts from PowerScript

1) The test script you wish to run must be in the PowerScript buffer. It can be an existing script that you loaded from disk, or one you just finished writing or editing.

2) Make sure the cursor is in the PowerScript menu bar (if the cursor is in the script edit area or Command menu, press <Esc>). Then press R (for Run) and <Enter>.
   - PowerScript switches to the Run screen and runs the test script.

Running test scripts from the DOS command line

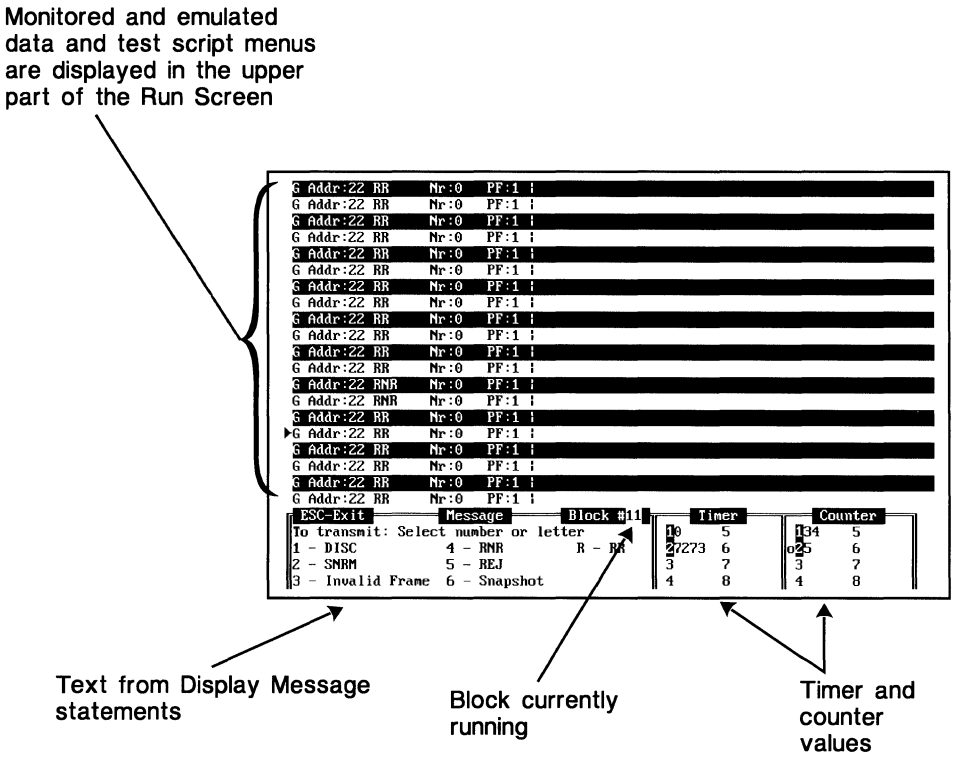
1) At the DOS prompt type the LM2000 command followed by the -l (the letter "L") command switch and the name of the test script you wish to run (do not type thePRG extension). For example:

   C:\LM2000>lm2000 -lscriptname

   - The named test script is automatically loaded and executed. The LM2000 goes directly to the PowerScript run screen when started in this manner.

Notes

- Monitored and emulated data is displayed in the format currently active in the LM2000's System Configuration screen unless a different configuration is loaded using the Load Config statement. Settings activated by the Load Config statement override settings in the System Configuration screen.
- If the value in a timer or counter register exceeds 65535, the register is reset to 0 and continues counting. A lowercase "o" appears next to the timer or counter number to indicate an overflow.



The PowerScript Run Screen with a test script running.

Example: Running test scripts from the DOS command line

To load and run the master menu script for the PowerScript Test Library, type the following command at the DOS prompt *exactly as shown*.

```
C:\LM2000>lm2000 -l0_master
```

Using Test Scripts from the PowerScript Library

The PowerScript Test Library is a collection of predefined test scripts linked by a series of menus that provide access to the entire library. The scripts in the Test Library are no different from any other scripts developed with PowerScript; they even have the samePRG extension. You can load and run them from the PowerScript screen just like test scripts you develop. These scripts can also be edited to suit your particular applications.

Accessing the PowerScript Test Library

The test scripts in the PowerScript Library are arranged in a hierarchial structure, with a single master menu script providing access to four libraries of test scripts. Each of these libraries contains menu and test scripts for a particular protocol.

To access any of the test scripts provided in the PowerScript Test Library just load and run the master menu script (0_master.prg) using one of the methods described below. When the master test library appears, follow the directions displayed on the screen to load and run the desired test scripts.

To access the test library from the PowerScript edit screen:

1) Press F8 from the LM2000 Main Menu to access the PowerScript edit screen.
2) Press L and <Enter> to invoke the PowerScript load menu.
3) Move the cursor to the master menu script (0_MASTER.PRG) and press <Enter> to load it.
4) Press R to execute the master menu script.
5) Follow the directions on the screen to select and run the desired tests.

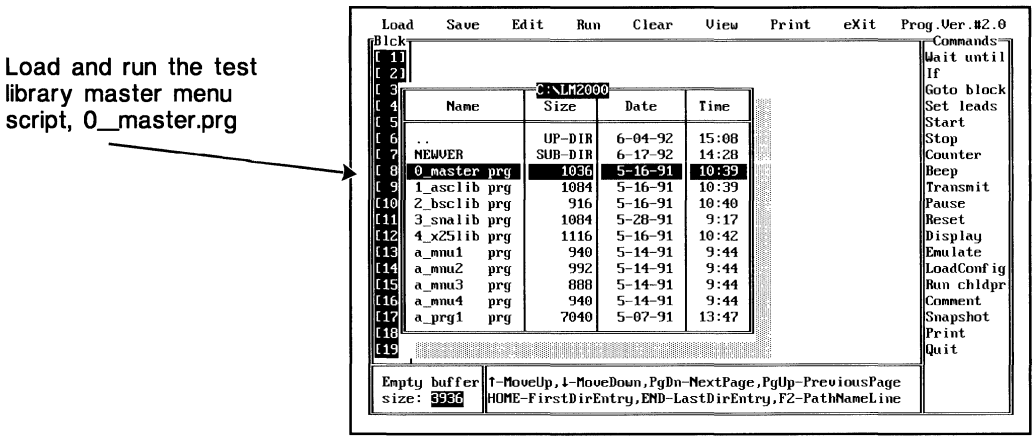
To access the test library from the DOS command line:

1) At the DOS prompt, type the commands shown in bold type.

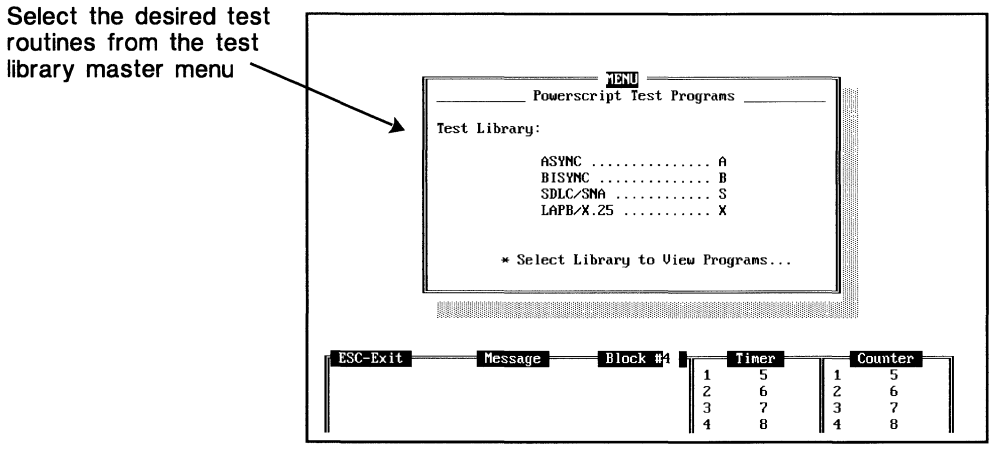
   C:\>**cd lm2000**
   C:\lm2000>**lm2000 -l0_master**

   - The master menu script for the test library is automatically loaded and executed.

2) Follow the directions on the screen to select and run the desired tests.



Load and run the test library master menu script, 0_master.prg.



Select the desired test routines from the Test Library Master Menu.

PowerScript Command Reference

This command reference provides explanations for all PowerScript commands in alphabetical order. For each command you will find a description, the syntax, and an example; crossreferences to related PowerScript commands are provided when appropriate. The syntax for each command is listed as it appears in the PowerScript Command menu. The following conventions are used: the command is shown in boldface type, followed by any arguments or variables. The arguments are also shown in boldface type. The variables are shown in italics and enclosed in braces (you must enter the type of information specified within the braces). Arguments and variables are listed in the order in which they are entered when creating a statement.

An example accompanies each entry in the reference. These examples are intended to illustrate how the command and its arguments and variables appear in the test script rather then specific applications of the command. To see examples of specific applications, load any of the test scripts in the PowerScript library.

Beep

The Beep command provides an audible signal at specified points in a PowerScript test script. The frequency and amplitude are fixed at those of the default warning tone of your PC.

Syntax

Beep

Example

```
[1]  If Time of day < 12:00:00
     then goto Block # 1
     * Test for time of day. If less than 12pm repeat test, else
     * goto next block.
[2]  Beep
     Display Message :
     [ T i m e  f o r  L u n c h ]
```

Comment

Use the Comment command to document your PowerScript test routines. Comments do not affect script execution. Comments reside on a single line and can be up to 48 characters long. To create multiple line comments, use multiple comment statements. When used in menu scripts, comments are displayed in the PowerScript Run screen. Comments do consume memory, so you may need to keep them to a minimum if memory is at a premium. Comments are indicated in test scripts by an asterisk (*) at the beginning of the line.

See also:

Display

Syntax

Comment{*comment text*}

Example

```
[1]  * This is a comment in a test script
```

Counter

Counter statements increment, decrement, or set a counter to a specific value. The Counter command can be used to count particular events and to specify the number of repetitions for a particular action.

PowerScript can maintain up to eight counters, each of which can hold values from 0 to 65535. The value in a counter can only be changed with the Counter or Reset commands. Counter commands can be used in If commands as part of the tested condition, and their value can be displayed with the Display command.

When you select the Counter command, a list of the eight available counters is displayed. To select a counter, enter the desired counter number and press <Enter>.

See also:

Display, Stop, Reset, and If.

Syntax

Counter{*counter #*} **Incr**
Decr
Set to{*value*}

Arguments

Incr	Increments the selected counter by one.
Decr	Decrements the selected counter by one.
Set to	Sets the selected counter to a specific value. The value can be any number from 0 to 65535.

Example

```
[1]  Counter 1 Increment
     * Add 1 to the value in counter #1
[2]  Counter 2 Set to 35
     * Set the value in counter #2 to 35
[3]  Counter 2 Decrement
     * Subtract 1 from the value in counter #2
```

Display

The Display command is used to construct menus, to show the values currently contained in timers or counters, and to display a text in the message window of the PowerScript run screen.

See also:

Wait Until, Comment, Start, Stop, Reset

Syntax

Display **Timer** **All**
Number{*timer number*}
Counter **All**
Number{*counter number*}
Message{*message text*}
Menu{*menu script file name*}

Arguments

Timer Displays the value in all timers or in a specific timer. To display the value in a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Counter Displays the value in all counters or in a specific counter. To display the value in a specific counter, select Number then select the desired counter number from the list that appears and press <Enter>.

Message Displays a text message in the message window of the PowerScript run screen. Each single line message can contain up to 44 characters. The message window in the PowerScript run screen displays up to four messages simultaneously, so you can construct multiline messages by using multiple Display Message statements.

Menu Display a menu in the upper part of the PowerScript run screen (as opposed to the message window where Display Message text is displayed). When used in conjunction with Wait Until Keypress statements, Display Menu statements create interactive menus that allow you to select test options during execution of the script (see example below).

When PowerScript encounters a Display Menu statement, it access the file named in the statement and displays its contents on the PowerScript run screen. The contents of the file, referred to as a menu script, define the menu you wish to display. A menu script is simply a PowerScript file that contains only comments (see example below). When you select the Menu argument, you are prompted for the name of

the menu script. You can type the name of the desired menu script (select Keyboard, thePRG extension is supplied), or you can select the menu script from a list of files with the PRG extension (select Directory). To select a menu script from the listed files, place the cursor on the desired file and press <Enter>.

Examples

```
[1]  Display Timer 1
     * Display value in timer #1
[2]  Display All Timers
     * Display values in all timers
[3]  Display Counter 1
     * Display value in counter #1
[4]  Display All Counters
     * Display values in all counters
[5]  Display Message :
     [ All Timers and Counters Active. ]
     * Display text in message window
```

The following two test scripts illustrate the method for constructing a menu that lets the user select and run one of several test routines. The first test script invokes the menu script file, captures the user's choice, and redirects script execution accordingly. The second test script is the menu script file, which contains Comment statements that define the text for the menu. Please note that the comments (indicated by *'s) in the first script are not interpreted as menu items, only comments in the second (menu) script are treated as such.

```
[1]  Display Menu [ testmenu.prg ]
     * Calls menu script, testmenu
[2]  Wait Until Keyboard Character [ 1 ]
        then goto Block # 7
     or Wait Until Keyboard Character [ 2 ]
        then goto Block # 6
     or Wait Until Keyboard Character [ 3 ]
        then goto Block # 5
     or Wait Until Keyboard Character [ 4 ]
        then goto Block # 4
     or Wait Until Keyboard Character [ M ]
     or Wait Until Keyboard Character [ m ]
        then goto Block # 3
     * Wait until selection is made, then run child program
[3]  Run Child Program [ x25tests.prg ]
     * Runs the menu program when M is pressed
[4]  Run Child Program [ x_prg4.prg ]
     * Runs test routine # 4 when 4 is pressed
[5]  Run Child Program [ x_prg3.prg ]
     * Runs test routine # 3 when 3 is pressed
```

```
[6]   Run Child Program [ x_prg2.prg ]
      * Runs test routine # 2 when 2 is pressed
[7]   Run Child Program [ x_prg1.prg ]
      * Runs test routine # 1 when 1 is pressed
```

Menu Script

```
[1]
[2]   * _____ LAPB/X.25 TEST LIBRARY _____
      * [1] X_PRG1: DTE - user can XMIT 5 LAPB events.
      * [2] X_PRG2: DCE - user can XMIT 5 LAPB events.
      * [3] X_PRG3: DCE - user can XMIT 5 X.25 events.
      * [4] X_PRG4: DTE - user can XMIT 5 X.25 events.
      *
      * Select Test Number or press M for Main Menu...
```

Emulate

The Emulate command allows you to simulate either DTE or DCE transmissions on the monitored data line. The Emulate command is used with the Transmit and Set leads commands (described below) to configure the LM2000 for data transmission as either DTE or DCE.

See also:

Transmit, Set leads.

Syntax

Emulate **DCE**
DTE
Reset

Arguments

DCE Configures the LM2000 to send data on the RX lead.

DTE Configures the LM2000 to send data on the TX lead.

Reset Disables emulation, that is, returns all emulation functions to their initial states.

Example

```
[1]   Emulate DCE
      Set Lead CTS High
      Set Lead DSR Low
      Set Lead DCD High
      Set Lead RI Low
      Transmit String [ T h e q u i c k b r o w n f o x ]
      * Configure to emulate DCE, set modem lead states, and
      * transmit quick brown fox test message
```

```
[2]  Emulate Reset
     * Turn emulation off
```

Goto block

The Goto block command is an unconditional branch command used to change script flow.

Syntax

Goto block #{*block***}**

Block can be any block number from 1 to 64. If you specify a block that has no statement, the script searches each successive block until it finds one with a statement and continues execution. If a block with a statement is not found, script execution stops just as if the end of the script had been reached.

Example

```
[1]  If Lead CTS High
                    then goto Block # 3
     * Test state of CTS, if high, go to block 3
[2]  Goto Block # 5
     * Go to block 5 unconditionally
[3]  Display Message [ CTS is High ]
[4]  Goto Block # 64
     * Goto end of script after executing Block #3
[5]  Display Message [ CTS is Low ]
```

If

The If command is a conditional branch command; if the condition is satisfied, script execution branches to the indicated block.

See also:

Counter (command), Start, Stop, and Reset

Syntax

IF{*condition***}Then goto Block**

Condition can be a lead state, a specific time of day, the expiration of a timer, or a counter value. The If command tests the condition, and, if it is true, branches script execution to the specified block. If the condition is not true, execution continues with the block immediately following the If command.

Arguments

Lead Tests the state of a given modem lead. You can select one of six modem leads: CTS, DSR, DCD, RI, DTR, or RTS. After you have specified the lead, you can select either Low or High states as the test condition.

Time Tests for a specific time of day. The time is specified in the 24-hour format, with 00:00:00 representing midnight.

Timer Tests for a specific interval. The timer interval is specified in milliseconds. To test the value in a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Counter Tests for a specific counter value. As long as the counter value is less than the value selected in the If command, the condition will be true. To test the value in a specific counter select Number, then select the desired counter number from the list that appears and press <Enter>.

Example

```
[1]  If Lead CTS High
                then goto Block # 2
     * Test CTS, if high, go to block 2
[2]  If Time of day < 16:30:15
                then goto Block # 3
     * If time of day is 4:30:15 or later, go to block 3
[3]  If Timer 2 < 12345 Mlsec
                then goto Block # 4
     * Test timer #2, if less than 12.345 seconds, go to block 4
[4]  If Counter 3 < 12345
                then goto Block # 5
     * Test counter #3, if value is less than 12345, go to block 5
```

LoadConfig

The LoadConfig command allows you to specify the characteristics of the data and the data line in either monitor or emulation modes by loading configuration files created in the LM2000's System Configuration screen.

Syntax

LoadConfig{*configuration file name*}

When entering LoadConfig statements, select Directory to display a list of all files in the current directory with theCNF extension. To select one of the listed files, place the cursor on the desired file and press <Enter>. Select Keyboard to enter the name of the desired configuration file from the keyboard. TheCNF extension is supplied automatically.

Example

```
[1]  Load Configuration File [ sna.cnf ]
     * Load the configuration in the file called SNA.CNF
```

Pause

The Pause command provides a delay in execution of the test script. The delay can be up to 65,535 milliseconds (65.5 seconds).

Syntax

Pause{*length of delay in milliseconds*}

Example

[1] Pause 10000 Mlsec
* Pause 10 seconds

Print

The Print command is similar to the Display command in that it generates an output from the PowerScript test script. However, while the Display command directs its output to the PowerScript run screen, the Print command directs its output to the PC's printer port. The Print command can printout text messages or the values contained in timers and counters.

See also:

Start, Stop, Reset, Wait Until

Syntax

Print	**Timer**	**All**
		Number{*timer number*}
	Counter	**All**
		Number{*counter number*}
	Message{*message text*}	

Arguments

Timer Prints the value in all timers or in a specific timer. To print the value in a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Counter Prints the value in all counters or in a specific counter. To print the value in a specific counter, select Number, then select the desired counter number from the list that appears and press <Enter>.

Message Use the Message argument to print out a text message. Each single line message can contain up to 44 characters. Construct multiline messages by using multiple Print Message statements.

Example

```
[1]  Print Message:
         [ The value in Counter #1 is: ]
     Print Counter 1
     * Print-out the indicated message along with the
     * current value in counter #1
[2]  Print Message:
         [ The value in Timer #1 is: ]
     Print Timer 1
     * Print-out the indicated message along with the
     * current value in timer #1
```

Reset

The Reset command resets the value of specific counters or timers to zero.

See also:

Start, Stop, Display

Syntax

Reset **Timer**{*timer number*}
Counter{*counter number*}

Arguments

Timer Sets one or all timers to 0. To reset the value of a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Counter Sets one or all counters to 0. To reset the value of a specific counter, select Number, then select the desired counter number from the list that appears and press <Enter>.

Example

```
[1]  Reset Counter 1
     * Set the value in counter 1 to 0
[2]  Reset Timer 2
     * Set the value in timer 2 to 0
```

Run chldpr

The Run chldpr (run child program) command allows you to transfer execution from one PowerScript test script to a second one. The Run chldpr command provides a way to organize your test scripts by allowing you to define common routines in different scripts and then calling those scripts as needed. It also provides a way to write scripts that exceed the buffer size by "continuing" a long script in a second file.

When the Run chldpr command is encountered in a test script, execution of the initial routine halts, the called program is loaded and executed beginning at block 1.

Syntax

Run chldpr{*test script filename*}

> **Note:** Script execution will not return to the original script; you must use another Run chldpr command to return to the original script, and then execution will begin at block 1.

When entering Run chldpr statements, select Directory to display a list of all files in the current directory with thePRG extension. To select one of the listed files, place the cursor on the desired file and press <Enter>. Select Keyboard to enter the name of the desired script file from the keyboard. ThePRG extension is supplied automatically.

Example

```
[1]   Run Child Program [ script2.prg ]
      * Transfer execution to script2.prg
```

Set leads

The Set leads command allows you to set the modem leads to a specified state. You can select one of six modem leads: CTS, DSR, DCD, RI, DTR, or RTS. After you have specified the lead, you can set it to either the Low or High state. Set leads statements are only effective following an Emulate statement.

See also:

Emulate, Transmit

Syntax

Set leads{*lead*}{*state*}

Example

```
[1]  Emulate DCE
     Set Lead CTS High
     Set Lead DSR Low
     Set Lead DCD High
     Set Lead RI Low
     * Configure to emulate DCE, set modem leads CTS and DCD
     * high, and leads DSR and RI low
```

Snapshot

The Snapshot command allows you to capture a 2 kbyte (1 kbyte with time stamping) "snapshot" of the monitored data in a disk file. The captured files can then be examined using the LM2000's view buffer functions (see Chapter 9 "Analyzing Data in the View Buffer Screen" for details).

Typically, the Snapshot command is used in conjunction with a Wait Until statement to capture specific events. When triggered, the Snapshot command captures the data surrounding the trigger event.

The files created by the Snapshot command are named SNAP.?, where ? is a number indicating the sequence in which the files were captured.

Syntax

```
Snapshot
```

Example

```
[1]  Load Configuration File [ sna.cnf ]
     * Load configuration file SNA.CNF
[2]  Wait Until DCE Error
     or Wait Until DTE Error
          Then goto Block # 3
     * Wait until error on Tx or Rx, then go to block 3
[3]  Snapshot
     * Capture data around detected error to disk
[4]  Goto Block # 2
     * Go to block 2 and continue monitoring for errors
```

Start

The Start command is used to start timers or activate the display of data in the PowerScript run screen.

See also:

Display (command), Stop, Reset, If, and Wait Until.

Syntax

Start **Timer**{*timer #*}
Display

Arguments

Timer Starts or restarts PowerScript timers. Timers can measure elapsed time between events, total time for an event, or they can specify an interval before certain actions occur. Timer values are maintained in milliseconds and are initially set to zero. Once started, a timer's value increases until a Stop statement is encountered, at which point its current value is saved. When restarted, the timer begins timing from where it was stopped. Use the Reset command to set a timer's value to 0. To start a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Timer values can be used in the Wait Until and If commands, and can be displayed with the Display command. Up to eight separate timers can be set in a test script.

Display Re-starts the display of data after a Stop Display statement has been encountered.

Example

```
[1]  Start Timer 1
     * Start timer 1 to measure elapsed time
[2]  Start Display
     * Display emulated or monitored data on the run screen
```

Stop

The Stop command is used to halt timers, to halt the display of data in the PowerScript run screen, and to terminate test script execution.

See also:

Start, Reset, If, and Wait Until

Syntax

Stop **Timer**{*timer #*}
Display
Program

Arguments

Timer Halts PowerScript timers while maintaining their current value. Once stopped, the timer's current value is stored until a Start or Reset command is encountered. If a Start command is encountered, the timer resumes timing from the stored value. If a Reset command is encountered, the timer's value is set to zero.

To stop a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Display Halts the display of data in the PowerScript run screen. This command is typically used to allow faster processing of data when it is not necessary to view it. The display of data can be turned on with a Start statement.

Program Halts script execution and returns to the PowerScript edit screen. The Stop Program statement is normally used to halt script execution within a loop.

Example

```
[1]  Stop Timer 1
     * Freeze timer 1 value
[2]  Stop Display
     * Halt display of monitored or emulated data on the
     * PowerScript run screen
[3]  If Counter 1 < 65
                then goto Block # 5
     * If counter 1 value is less than 65, goto block 5,
     * else goto block 4
[4]  Stop program
     * Stop script execution when counter 1 value = 65
[5]  Counter 1 Increment
     Goto Block # 3
     * Increment counter 1 and goto block 3
[6]  * Blocks 3, 4, and 5 set up a loop that will execute 65
     * times and then terminate the script
```

Transmit

The Transmit command allows you to transmit characters and control codes on the monitored data line. Transmit statements are only effective following an Emulate statement.

See also:

Emulate, Set leads.

Syntax

Transmit **String**{*text or code string*}
Character{*single character*}
Macro{*macro(s)*}
Str/bCRC{*text or code string*}

Arguments

String Transmits a string of up to 500 bytes on the selected line. When you select this argument, you are presented with the "enter string" menu. You can enter text characters directly from your keyboard simply by typing them without selecting a character code. You can also enter the string in any of the character codes listed hex, octal, mnemonic, or binary. You must select ExitString to end string entry, <Enter> is used to select character codes.

The CRC 16 option for the String argument automatically calculates the CRC 16 value for the entered string and appends the CRC bytes to the end of the string. The CRC value is calculated for all characters in the string. This option is most useful in asynchronous and bisynchronous communications applications. Note that it is not necessary to use the CRC 16 option for HDLC applications.

The Import Str option for the String argument imports the contents of the protocol analyzer's emulation message buffer into the transmit string statement. Use the Import Str option with the View Buffer Screen's export function (<Shift>F2 [EXPORT]), to define emulation messages based on captured data events.

Kybd Character Transmits a single character on the selected line. When you select this argument, the character select menu is displayed. If you select Any Char, PowerScript transmits a single arbitrary character. If you select Character, you can enter any single character from the keyboard. Only text characters can be entered with the Kybrd Character argument, use the String argument to enter control codes.

Macro Loads one or more protocol macros as part of the transmit string. The macros allow you to create sophisticated data messages simply by making a few selections from a menu. (Macros are discussed in detail in Appendix E, Advanced Emulation with Protocol Macros.)

When you select the Macro argument, a list of all macros in the current directory is displayed (macro files are designated by the .PLM extension). Select a macro by placing the cursor on the desired macro name and pressing <Enter>. Follow the instructions that appear in the macro window to select the macro options. You can concatenate protocol macros to build complete frames (select +Macro), or you can return to the script edit mode after selecting a single macro (select Exit Macro).

Str/bCRC This argument is similar to the String argument, except that the Str/bCRC argument causes a bad CRC value to be transmitted in the FCS bytes. The string can contain up to 500 bytes. When you select this argument, the program displays the "enter string" menu. You can enter text characters directly from your keyboard simply by typing them, without selecting a character code. You can also enter the string in any of the character codes listed hex, octal, mnemonic, or binary. Select the Import Str option to import a string from the capture buffer. Select ExitString to end string entry, pressing <Enter> selects the character codes.

Example

```
[1] Emulate DTE
    Transmit Keyboard Character [ Any Key ]
    * Transmit a single random character on Tx
[2] Emulate DCE
    Transmit Keyboard Character [ a ]
    * Transmit the ASCII character "a" on Rx
[3] Emulate DTE
    Transmit String [ T h i s  i s  a  t e s t  1eh 137o
    SHm 11110000b ]
    * Transmit the test string on Tx
[4] Emulate DTE
    Transmit +LAPB_I+X_ACEPT
    * Transmit an X.25 call accept packet on Tx
[5] Emulate DCE
    Transmit String w/bad CRC [ T h e q u i c k b r o w n f o x ]
    * Transmit the test string on Rx, append an
    * intentionally bad CRC in the FCS bytes
```

Wait Until

The Wait Until command provides a trigger mechanism for test scripts, allowing a test script to "wait until" a specific event occurs and continue execution based on the event. Wait Until commands must always end with a Then Goto or Next Blck argument. The Then Goto argument allows you to branch to any other block in the script. The Next Blck argument branches to the block immediately after the Wait Until command.

See also:

Start, Stop, Reset, Display

Syntax

Wait Until{*trigger condition*} **Or Wait**
Then Goto
Next Blck

The *trigger condition* can be an error, a trap string, a lead transition, a specific time of day, the expiration of a timer, or a keyboard entry. When a Wait Until command is encountered in a test script, the test script waits until the condition is satisfied. When the condition is satisfied, execution branches to the specified block.

You can specify multiple conditions in a Wait Until statement by following each condition with an Or Wait argument. Multiple conditions are logically "ORed," that is, the trigger is tripped when any one of the conditions is satisfied.

When using multiple conditions, each condition can direct script execution to a different block. This allows you to construct "case" statements, which specify different actions for different conditions.

Arguments

DCE and DTE Instructs the protocol analyzer to monitor the RX line (DCE) or the TX line (DTE) for the desired trigger condition(s). The selected data line can be monitored for errors or trap strings.

Trap Strings If you elect to monitor for trap strings (Trap Str), you can indicate whether to match the string only at the start of frames (for bit-oriented protocols) or anywhere in the line data.

After you have chosen the location of the trap string, you are presented with the "enter string" menu. You can enter the trap string in any of the character codes listed hex, octal, mnemonic, or binary. You can mask characters in the trap string with Don't care characters. Don't care characters are indicated as a double X (XX). When entering characters in binary, you can mask individual bits by entering x instead of 1 or 0. You must select ExitString to end string entry, <Enter> is used to select character codes.

The CRC 16 option for the Trap Str argument automatically calculates the CRC 16 value for the entered string and appends the CRC bytes to the end of the string. This option is most useful in asynchronous communications applications. Note that it is not necessary to use the CRC 16 option for HDLC applications.

The Import Str option imports the contents of the protocol analyzer's emulation message buffer into Wait Until statements as a trap string. Use the Import Str option with

the View Buffer Screen's export function (<Shift>F2 [EXPORT]), to define traps based on captured data events.

The Macro option for the Trap Str argument allows you to use one or more protocol macros as part of trap strings in Wait Until statements. The protocol macros allow you to write sophisticated trap strings simply by making a few selections from an interactive menu. (Protocol macros are discussed in detail in Appendix E, Advanced Emulation with Protocol Macros.)

When you select the macro option, a list of all protocol macros in the current directory is displayed (macro files are designated by thePLM extension). Select a macro by placing the cursor on the desired macro name and pressing <Enter>. Follow the instructions that appear in the macro window to select the macro options. You can concatenate macros to build complete frames (select +Macro), or you can return to the script edit mode after selecting a single macro (select Exit Macro).

Lead Selects a lead state as a trigger condition. You can select the CTS, DSR, DCD, RI, DTR, or RTS lead. After you have specified the lead, you can select either Low or High states as the trigger condition. Using the Lead argument to specify both states for the same lead in a single Wait Until statement is not allowed by PowerScript.

Time Designates a specific time of day as the trigger condition. The time is specified in the 24-hour format, with 00:00:00 representing midnight. Press <Enter> after each set of digits, for example, to set Time for midnight (the default) press <Enter> three times.

Timer Designates a specific interval as the trigger condition. The timer interval is specified in milliseconds. Using the Timer argument to specify different times for the same timer number in a single Wait Until statement is not allowed by PowerScript. To measure the interval of a specific timer, select Number, then select the desired timer number from the list that appears and press <Enter>.

Error Selects an error condition on either data line as the trigger condition. (Use the Error condition for the DTE and DCE arguments if you wish to trigger on an error on a specific data line.)

KeyPress Use the KeyPress argument to select input from the keyboard as the trigger condition. You can designate a single specific character as the trigger, or you can trigger when any key on the keyboard is pressed. Using the KeyPress argument twice in the same Wait Until statement is not allowed by

PowerScript. Use Wait Until KeyPress statements in conjunction with Display Menu statements to create menus for test scripts.

Counter Allows you to input a value on the keyboard that is stored in one of PowerScript's eight counters. When used in conjunction with a Display Message or Display Menu statement, Wait Until Counter statements allow you to request input from the user (in the form of a numerical value) and store the response for use in other operations. When a Wait Until Counter statement is encountered, the test script halts operation until a value is entered from the keyboard.

Example

```
[1]  Wait Until DCE Error
        then goto Block #12
     * Go to block 12 when an error is detected on DCE
[2]  Wait Until Error
        then goto Block # 13
     * Go to block 13 when an error is detected on either line
[3]  Wait Until Lead CTS High
        then goto Block # 14
     * Go to block 14 when CTS lead goes high
[4]  Wait Until Time of day < 16:30:15
        then goto Block # 15
     * Go to block 15 at 16:30:15
[5]  Wait Until Timer 8 < 12345 Mlsec
        then goto Block # 16
     * Go to block 16 when timer 8 has counted 12.345 seconds
[6]  Wait Until Keyboard Character [ Any Key ]
        then goto Block # 17
     * Go to block 17 when any key on the keyboard is pressed
[7]  Wait Until Keyboard Character [ a ]
        then goto Block # 18
     * Go to block 18 when the "a" key is pressed
[8]  Wait Until DCE TrapStr from StartofFrame
     [ T h i s  i s  a  t e s t  1eh 137o SHm 11xxx000b XX ]
     or Wait Until DTE TrapStr from StartofFrame
     [ T h i s  i s  a  t e s t  1eh 137o SHm 11xxx000b XX ]
        then goto Block # 19
     * When the string beginning with "This is a test..." is detected at
     * the start of a frame on either line, go to block 19
[9]  Wait Until DCE TrapStr from Anywhere +LAPB+X_DATAPK
        then goto Block # 20
     * When a LAPB frame containing a data packet is
     * detected from the DCE, go to block 20
[10] Display Message:
     [Enter a value]
     Wait Until Counter 1
        then goto Block # 21
     * Request user input, when the value is entered on the
     * keyboard, store it in counter 1 and go to block 21
```

Appendix A
Character Set Code Tables

- ASCII and EBCDIC Character Set Code Tables
- IPARS Character Set Code Table
- BAUDOT Character Set Code Table

ASCII and EBCDIC Character Set Code Table

This table lists the hex, character, and mnemonic displayed for ASCII and EBCDIC bytes. Ç denotes a control byte and µ denotes an undefined byte in the character set. Where the mnemonic might be confused with hex, for example form feed (FF), the first character of the mnemonic is displayed in lower case (fF).

RX, Hex Dsply	ASCII Char,Mnem Displayed	EBCDIC Char, Mnem Displayed	RX, Hex, Dsply	ASCII Char,Mnem Displayed	EBCDIC Char, Mnem Displayed
00	Ç, NU	Ç, NU	28	(, (	µ, 28
01	Ç, SH	Ç, SH	29	),)	µ, 29
02	Ç, SX	Ç, SX	2A	*, *	Ç, SM
03	Ç, EX	Ç, EX	2B	+, +	Ç, c2
04	Ç, ET	Ç, PF	2C	,, ,	µ, 2C
05	Ç, EQ	Ç, HT	2D	-, -	Ç, EQ
06	Ç, AK	Ç, LC	2E	., .	Ç, AK
07	Ç, BL	Ç, DT	2F	/, /	Ç, BL
08	Ç, BS	µ, 08	30	0, 0	µ, 30
09	Ç, HT	µ, 09	31	1, 1	µ, 31
0A	Ç, LF	Ç, MM	32	2, 2	Ç, SY
0B	Ç, VT	Ç, VT	33	3, 3	µ, 33
0C	Ç, fF	Ç, fF	34	4, 4	Ç, PN
0D	Ç, CR	Ç, CR	35	5, 5	Ç, RS
0E	Ç, SO	Ç, SO	36	6, 6	Ç, UC
0F	Ç, SI	Ç, SI	37	7, 7	Ç, ET
10	Ç, DL	Ç, DL	38	8, 8	µ, 38
11	Ç, d1	Ç, d1	39	9, 9	µ, 39
12	Ç, d2	Ç, d2	3A	:, :	µ, 3A
13	Ç, d3	Ç, d3	3B	;, ;	Ç, c3
14	Ç, d4	Ç, RE	3C	,	Ç, d4
15	Ç, NK	Ç, NL	3D	=, =	Ç, NK
16	Ç, SY	Ç, BS	3E	,	µ, 3E
17	Ç, eB	Ç, IL	3F	?, ?	µ, SB
18	Ç, CN	Ç, CN	40	@, @	space(s)
19	Ç, EM	Ç, EM	41	A, A	µ, 41
1A	Ç, SB	Ç, cC	42	B, B	µ, 42
1B	Ç, EC	Ç, c1	43	C, C	µ, 43
1C	Ç, FS	Ç, IF	44	D, D	µ, 44
1D	Ç, GS	Ç, IG	45	E, E	µ, 45
1E	Ç, RS	Ç, IR	46	F, F	µ, 46
1F	Ç, US	Ç, US	47	G, G	µ, 47
20	space(s)	Ç, DS	48	H, H	µ, 48
21	!, !	Ç, SS	49	I, I	µ, 49
22	", "	Ç, FS	4A	J, J	¢, ¢
23	#, #	µ, 23	4B	K, K	., .
24	$, $	Ç, BP	4C	L, L	<, <
25	%, %	Ç, LF	4D	M, M	(, (
26	&, &	Ç, eB	4E	N, N	+, +
27	', '	Ç, eC	4F	O, O	µ, 4F

RX, Hex Dsply	ASCII Char,Mnem Displayed	EBCDIC Char,Mnem Displayed	RX, Hex, Dsply	ASCII Char,Mnem Displayed	EBCDIC Char,Mnem Displayed
50	P, P	&, &	78	x, x	µ, 78
51	Q, Q	µ, 51	79	y, y	‘, ‘
52	R, R	µ, 52	7A	z, z	:, :
53	S, S	µ, 53	7B	{, {	#, #
54	T, T	µ, 54	7C	|, |	@, @
55	U, U	µ, 55	7D	}, }	z, z
56	V, V	µ, 56	7E	~, ~	=, =
57	W, W	µ, 57	7F	Ç, DT	", "
58	X, X	µ, 58	80	µ, 80	µ, 80
59	Y, Y	µ, 59	81	µ, 81	a, a
5A	Z, Z	!, !	82	µ, 82	b, b
5B	[, [	$, $	83	µ, 83	c, c
5C	\, \	*, *	84	µ, 84	d, d
5D	],]	),)	85	µ, 85	e, e
5E	^, ^	;, ;	86	µ, 86	f, f
5F	_, _	’	87	µ, 87	g, g
60	‘, ‘	-, -	88	µ, 88	h, h
61	a, a	/, /	89	µ, 89	i, i
62	b, b	µ, 62	8A	µ, 8A	µ, 8A
63	c, c	µ, 63	8B	µ, 8B	µ, 8B
64	d, d	µ, 64	8C	µ, 8C	µ, 8C
65	e, e	µ, 65	8D	µ, 8D	µ, 8D
66	f, f	µ, 66	8E	µ, 8E	µ, 8E
67	g, g	µ, 67	8F	µ, 8F	µ, 8F
68	h, h	µ, 68	90	µ, 90	µ, 90
69	i, i	µ, 69	91	µ, 91	j, j
6A	j, j	|, |	92	µ, 92	k, k
6B	k, k	,, ,	93	µ, 93	l, l
6C	l, l	%, %	94	µ, 94	m, m
6D	m, m	_, _	95	µ, 95	n, n
6E	n, n	>	96	µ, 96	o, o
6F	o, o	?, ?	97	µ, 97	p, p
70	p, p	µ, 70	98	µ, 98	q, q
71	q, q	µ, 71	99	µ, 99	r, r
72	r, r	µ, 72	9A	µ, 9A	µ, 9A
73	s, s	µ, 73	9B	µ, 9B	µ, 9B
74	t, t	µ, 74	9C	µ, 9C	µ, 9C
75	u, u	µ, 75	9D	µ, 9D	µ, 9D
76	v, v	µ, 76	9E	µ, 9E	µ, 9E
77	w, w	µ, 77	9F	µ, 9F	µ, 9F

RX, Hex Dsply	ASCII Char,Mnem Displayed	EBCDIC Char,Mnem Displayed	RX, Hex, Dsply	ASCII Char,Mnem Displayed	EBCDIC Char,Mnem Displayed
A0	µ, A0	µ, A0	C8	µ, C8	H, H
A1	µ, A1	~, ~	C9	µ, C9	I, I
A2	µ, A2	s, s	CA	µ, CA	µ, CA
A3	µ, A3	t, t	CB	µ, CB	µ, CB
A4	µ, A4	u, u	CC	µ, CC	µ, CC
A5	µ, A5	v, v	CD	µ, CD	µ, CD
A6	µ, A6	w, w	CE	µ, CE	µ, CE
A7	µ, A7	x, x	CF	µ, CF	µ, CF
A8	µ, A8	y, y	D0	µ, D0	}, }
A9	µ, A9	z, z	D1	µ, D1	J, J
AA	µ, AA	µ, AA	D2	µ, D2	K, K
AB	µ, AB	µ, AB	D3	µ, D3	L, L
AC	µ, AC	µ, AC	D4	µ, D4	M, M
AD	µ, AD	[,]	D5	µ, D5	N, N
AE	µ, AE	µ, AE	D6	µ, D6	O, O
AF	µ, AF	µ, AF	D7	µ, D7	P, P
B0	µ, B0	µ, B0	D8	µ, D8	Q, Q
B1	µ, B1	µ, B1	D9	µ, D9	R, R
B2	µ, B2	µ, B2	DA	µ, DA	µ, DA
B3	µ, B3	µ, B3	DB	µ, DB	µ, DB
B4	µ, B4	µ, B4	DC	µ, DC	µ, DC
B5	µ, B5	µ, B5	DD	µ, DD	µ, DD
B6	µ, B6	µ, B6	DE	µ, DE	µ, DE
B7	µ, B7	µ, B7	DF	µ, DF	µ, DF
B8	µ, B8	µ, B8	E0	µ, E0	\, \
B9	µ, B9	µ, B9	E1	µ, E1	µ, E1
BA	µ, BA	µ, BA	E2	µ, E2	S, S
BB	µ, BB	µ, BB	E3	µ, E3	T, T
BC	µ, BC	µ, BC	E4	µ, E4	U, U
BD	µ, BD	],]	E5	µ, E5	V, V
BE	µ, BE	µ, BE	E6	µ, E6	W, W
BF	µ, BF	µ, BF	E7	µ, E7	X, X
C0	µ, C0	{, {	E8	µ, E8	Y, Y
C1	µ, C1	A, A	E9	µ, E9	Z, Z
C2	µ, C2	B, B	EA	µ, EA	µ, EA
C3	µ, C3	C, C	EB	µ, EB	µ, EB
C4	µ, C4	D, D	EC	µ, EC	µ, EC
C5	µ, C5	E, E	ED	µ, ED	µ, ED
C6	µ, C6	F, F	EE	µ, EE	µ, EE
C7	µ, C7	G, G	EF	µ, EF	µ, EF

RX, Hex Dsply	ASCII Char,Mnem Displayed	EBCDIC Char,Mnem Displayed
F0	μ, F0	0, 0
F1	μ, F1	1, 1
F2	μ, F2	2, 2
F3	μ, F3	3, 3
F4	μ, F4	4, 4
F5	μ, F5	5, 5
F6	μ, F6	6, 6
F7	μ, F7	7, 7
F8	μ, F8	8, 8
F9	μ, F9	9, 9
FA	μ, FA	μ, FA
FB	μ, FB	μ, FB
FC	μ, FC	μ, FC
FD	μ, FD	μ, FD
FE	μ, FE	μ, FE
FF	μ, FF	μ, FF

IPARS Character Set Code Table

Code	Hex	Mnem.	Code	Hex	Mnem.
00	3F	00	20	3E	@
01	1F	1	21	1E	J
02	2F	2	22	2E	K
03	0F	3	23	0E	L
04	37	4	24	36	M
05	17	5	25	16	N
06	27	6	26	26	O
07	07	7	27	06	P
08	3B	8	28	3A	Q
09	1B	9	29	1A	R
0A	2B	0	2A	2A	:
0B	0B	*	2B	0A	<
0C	33	<CR>	2C	32	+
0D	13	EI	2D	12	EU
0E	23	=	2E	22	)
0F	03	GA	2F	02	(
10	3D	10	30	3C	$
11	1D	/	31	1C	A
12	2D	S	32	2C	B
13	0D	T	33	0C	C
14	35	U	34	34	D
15	15	V	35	14	E
16	25	W	36	24	F
17	05	X	37	04	G
18	39	Y	38	38	H
19	19	Z	39	18	I
1A	29	-	3A	28	?
1B	09	#	3B	08	.
1C	31	<SP>	3C	30	%
1D	11	EC	3D	10	EP
1E	21	[	3E	20	S2
1F	01	'	3F	00	S1

Notes:

IPARS is configured as bisync, 6 bits/char,. sync S1 S2. Characters are transmitted and displayed (in hex) with least significant bit first and no inversion.

EI = End of message - Incomplete
EC = End of message - Complete
EU = End of message - Unsolicited
EP = End of message - Push button
GA = Go Ahead
S1 = 1st Sync character
S2 = 2nd Sync character

BAUDOT Character Set Code Table

Code	Letter	Communications
00	NU	NU
01	E	3
02	LF	LF
03	A	-
04	<SP>	<SP>
05	S	'
06	I	8
07	U	7
08	<CR>	<CR>
09	D	$
0A	R	4
0B	J	BL
0C	N	,
0D	F	!
0E	C	:
0F	K	(
10	T	5
11	Z	"
12	L	)
13	W	2
14	H	#
15	Y	6
16	P	0
17	Q	1
18	O	9
19	B	?
1A	G	&
1B	SO	SO
1C	M	.
1D	X	/
1E	V	;
1F	SI	SI

Notes:

BAUDOT is configured as async, 5 bits/char.

NU = Null
LF = Line Feed
SO = Shift Out
SI = Shift In
BL = Bell

Appendix B
LM2000 Messages

This section provides a list and explanation of the messages generated by the LM2000; they are presented in alphabetical order.

Abort line monitor

You have entered <Ctrl>C. The screen is cleared; you exit the LM2000 and control returns to DOS. Any information not saved is lost.

ABORT, RETRY or IGNORE

You have attempted to start the LM2000 from the DOS prompt, and there is an error on the disk drive. See your DOS manual.

<filename> already exists, overwrite (y/n)?:y

The *<filename>* entered matches an existing file. If <Enter> or **y** is pressed, the current selection will replace the original file. If **n** is pressed, *<filename>* can be edited.

At marker (upper left)

In the View Buffer Screen, the display has been returned to the character previously marked with F1 [MARKER].

At trap trip (upper left)

You have selected the **Trap** option on the GOTO Menu (F4 from the View Buffer Screen). A trap has tripped, and the buffer has not been altered. The cursor is on the last byte of the trap trip string.

Bad block number

You have selected the **Disk Block** option on the GOTO Menu (F4 from the View Buffer Screen), but entered an invalid block number: It was either greater than the number of blocks in the file, or was an odd number. (You can only specify *even* block numbers because the LM2000 reads two blocks at a time.)

Bad cell number

You have selected the Cell option on the GOTO Menu (F4 from the View Buffer Screen), but entered an invalid cell number. Valid cell numbers are 0-32767.

Bad config file name

The system configuration file name specified is too long. Maximum length is 25 characters, including any path names. Do not include an extension; it is supplied by the LM2000.

Board is not found. Press any key to continue...

The LM2000 software is installed, however, the LM2000 board is either not present or not recognized by the software. Verify board installation and the settings (I/O Address and Window Segment) on the Hardware Configuration Screen. For more information on installation settings, see Chapter 1, "Getting Started." If you are unable to solve this problem, contact Network General Customer Support at 1-800-888-0180.

***** Buffer cleared *****

The load file function (F9) failed. Any data in the buffer before the load was lost.

Buffer file already exists. Overwrite? (y/n)

When stream to disk is active and you exit from the Monitor Screen, the buffer file is closed. Upon returning to the Monitor Screen, the LM2000 needs to know what action to take regarding the current buffer file. If the response is **Yes**, stream to disk continues (overwrites from the beginning of the file). If **No**, the data currently in the buffer file is saved and stream to disk is deactivated. You must then reactivate the Stream to disk option on the System Configuration Screen.

Buffer is empty

No data is in the capture buffer; this disables most buffer operations. F9 [LOAD F] can be used to recall a previously stored DOS captured buffer file.

Buffer or screen full

The emulation buffer is full (512 characters) or the Emulation Message Definition Screen is full (20 lines of message).

Buffer will be cleared

The Stream to disk option is active. Upon exit from the System Configuration Screen, the data capture buffer will be cleared. If this is not desired, set Stream to disk to **Disabled**. This message also displays if you change the Time Stamp option with data in the buffer.

Calculating...

While in the View Buffer Screen, the calculate checksum (F2) key was pressed. The LM2000 has started calculating information between endpoints (marked by F1 and the cursor). Time required depends on number of bytes, but should not exceed 15 seconds (end-to-end of full buffer).

Can't allocate memory

You have attempted to run the LM2000; there is not enough DOS memory to run the program. Determine what other programs may be resident at this time; exit these programs and try to start the LM2000 again.

Can't free memory

You have attempted to exit a resident program to free memory, however, the memory pointers are corrupt. Reboot your computer and try again.

Can't open file

An attempt to open (load) a file was unsuccessful. The LM2000 could not find the file specified, or if found, the file was corrupted. Check the filename or path or restore from backup.

Can't open file hspwb01g.bin
or
Can't open file hspwc01g.bin
or
Can't open file hspwd01g.bin
Board is not found. Press any key to continue...

The LM2000 could not find the listed file(s) during initialization, or if found, the file was corrupted. Be sure that you are in the LM2000 directory or restore from backup.

Can't print hi-res chars, use mnemonic display

A print screen command (<Shift>F8) was issued while the display was in EGA (high-resolution) mode. The high- resolution characters cannot be printed. Change your display mode to mnemonic or hex.

Can't read config file

The system configuration file was found but it is corrupt. Restore from backup or recreate the file. If recreating, be sure there is no LMDFAULT.CNF file in the current directory, then restart the program.

Can't read file

An attempt to read a file was unsuccessful. This is the result of a DOS error or a bad file. Restore from backup. The current buffer is not lost unless a message to that effect is displayed.

Can't read LMHARDWA.RE...creating

The hardware configuration file (LMHARDWA.RE) was not found in the current directory. Or, if found, the file is corrupt. A default file is created; verify the settings in the Hardware Configuration Screen.

Can't write file

An attempt to write to a file was unsuccessful. Possibly there is a disk or DOS error.

Can't write LMHARDWA.RE

Upon exit from the Hardware Configuration Screen, the LM2000 attempted to write the new LMHARDWA.RE configuration file into the current directory. The write failed, and the program returned to DOS. Make sure the disk is good, not write protected, and has room for a 256 byte file.

...Char set(s) NE

The buffer file to be loaded does not match the current configuration character set. The control buffer, if any, is not lost.

...Char sets NE. File char set: <*name*>

The character set of the file does not match the current character set. For example, you loaded an ASCII message, and the current (TX/em) character set is EBCDIC.

Character sets must be the same and not USER.

The Char Set field on the System Configuration Screen is set to USER, and you pressed F7 [FOX] to configure the Fox test. The LM2000 either does not recognize the USER option or the TX character set differs from the RX. Select one of the other Char Set field options: ASCII, EBCDIC, BAUDOT, IPARS0, and IPARS1; be sure that the TX selection is the same as the RX.

Close error

After doing a load or store operation (F9 or <Shift>F9), the LM2000 was unable to close the disk file. This is a DOS error, possibly a full disk. The file loaded or stored should be considered defective.

...Completed

The requested operation was successful.

Current configuration doesn't match file. Override (y/n)? y

You have attempted to load a buffer or snapshot file whose configuration doesn't match the current values set on the System Configuration Screen. If you type **y** or press <Enter>, the file will be loaded, and the LM2000's configuration will be changed to match the file's. If you type **n**, the load procedure will be terminated.

Cursor not on char

The cursor is in the wrong position for the requested command. Position the cursor on a character before reentering the command.

Data error found

The F5 [FIND] or <Shift>F5 [FN NXT] function key has the error option enabled, and an error was found while searching for a string. The cursor is on the error byte.

Decode or level 2 protocol undefined

You are in the View Buffer Screen and have pressed F3 [DECODE] or <Shift>F3 [S DCOD]. However, the user decode module is not defined or supported.

Disk file already open

You are trying to save a data file that has already been saved.

Disk file not open

You have specified a Disk Block number for the Go To command, but no data file has been loaded.

DLCIs in file *.fr larger than MAX DLC**

The number of DLCI lines in the file *.fr must *not* be greater than 256. If you exceed that number, the system will read only the first 256 DLCI lines; a beep will be heard.

DSK_OVRN

An overflow occurred while capturing data to disk. Either your hard disk is too slow or the data rate is too high.

> **Note:** At the time this message occurs, the LM2000 has captured at least 2MB of data to your hard drive, regardless of the data rate or disk speed.

Emulation message (or msg) undefined

When displayed on System Configuration Screen:
You have selected either the DTE or DCE emulation option, but no test message was defined. Go to the Emulation Message Definition Screen (press F5) to define a message or use F7 [FOX] to load the Fox message. Emulation will be disabled if you exit the System Configuration Screen without defining a test message.

When displayed on Emulation Message Definition Screen:
The message entry portion of the screen is blank. (You will see the LM2000 message when first entering the Emulation Message Definition Screen.)

Endpoints on different lines; unable to provide checksum info

You have requested a checksum (F2) while in the View Buffer Screen, however, the marker is on the opposite line (TX or RX) than the cursor. Reposition the cursor or the marker so both are on the same line (TX or RX).

Enter 0 for continuous, 1-32767 for count:

You pressed the F1 [MSG RP] key while in the Emulation Definition Message Definition Screen. Specify how many times the message should be sent: Enter either 0 for continuous or a number from 1-32767.

Enter load file:

You have pressed F9 [LOAD F], and the system prompts you for a filename. Enter the name of the file to be loaded.

Enter store file:

You have pressed <Shift>F9 [STOR F], and the system prompts you for a filename. Enter the name of the file to be stored. Function keys F1 [DIR], F2 [W EXT], and F10 [CANCEL] are also available.

Error '?' already defined

The character enclosed in quotes has already been defined in another byte on the User Character Set Definition Screen.

Error return from decode

The LM2000's attempt to load the user decode module failed for one of the following reasons:

1) Requested module USER.EXE is not in the current directory.
2) Not enough memory.
3) DOS problem. Some 2.X versions of DOS have problems executing an overlay program. Try using DOS 3.0 or higher.

Exit line monitor

The <Shift>F10 [EXIT] key was pressed. Control is returned to DOS. Any information not saved has been lost.

*****.fr has invalid format at line #NNN**

The frame relay configuration file, *filename*.FR, has an invalid format. The system attempted to read the file and detected either a missing DLCI parameter or duplicate DLCI. (The system will beep when this message is displayed.) Review the input in your *filename*.FR file and edit it accordingly.

Fail to open file <filename>, press any key to continue.....

An attempt was made to open a file whose configuration did not match the current configuration.

Feature not yet implemented. Press any key to return.

You have attempted to use an LM2000 feature that has not yet been implemented. Press any key to continue.

File not found

You pressed F9 [LOAD] and entered a filename. However, the file specified was not found. Reenter a valid filename.

Frame type not found

While searching for a frame on the View Buffer Screen, the LM2000 was unable to detect the frame type specified on the System Configuration Screen (see the Com Mode and Protocol field options).

Internal error *n*. Hit any key to return!

An internal system error has occurred. Please call Network General Customer Support at 1-800-888-0180. Note the error number *n* in the message.

Invalid snapshot number

A snapshot file was loaded on the View Buffer Screen, and you have requested a snapshot number that was invalid.

Level 2&3 protocol type not supported

The configuration you have defined on the System Configuration Screen does not support a Layer 2 and 3 protocol. Reenter the appropriate system configuration options.

Line not frame protocol

You have attempted to unpack an SDLC/HDLC frame while in the View Buffer Screen (you pressed <Shift>F7). However, the line on which the cursor is positioned is not an SDLC/HDLC line.

****** LM2000 is resident and running. *****
Type EXIT to return.

You have accessed the DOS shell by pressing <Ctrl>Z. The LM2000 remains resident and continues processing any monitored data. You can now execute DOS commands. Return to the LM2000 by typing EXIT at the DOS prompt.

LMDFAULT.CNF bad

No filename was specified on the command line; the LMDFAULT file was found but it is corrupt. Restore from backup or recreate. If recreating, erase the current (corrupted) LMDFAULT.CNF file, then restart the program.

Loading data into the LM2000 card memory:
X bytes of hspwb01g.bin is copied
X bytes of hspwc01g.bin is copied
X bytes of hspwd01g.bin is copied

Message is displayed while the CPU on the LM2000's circuit board is initialized or updated.

Loading Decode module <program name>...

The F3 [DECODE] key was pressed while in the View Buffer Screen. The external program *<program name>* is being invoked, and the data pointed to by the cursor is being decoded. The decoded information should be displayed shortly.

Marker cleared

Confirms that <Shift> F1 was pressed while in the View Buffer Screen. The previously placed marker is cleared, and the marker symbol (↔) is removed from the screen.

Marker not placed

You have issued a return to marker command (F4), but no marker has been placed.

Marker placed

Confirms that F1 [MARKER] was pressed, defining the marker location as the data the cursor is positioned on. The marker symbol (↔) replaces the character on the View Buffer Screen.

***** Monitor Board Not Installed *****

The monitor board failed to respond to an I/O request during initialization for one of the following reason(s):

1) The LM2000 circuit board is not installed in the PC. It is possible to review previously captured data and operate on all LM2000 files without the board installed. The license agreement permits up to five copies of the program.
2) If the LM2000 circuit board is installed:
   a) It may not be properly seated.
   b) Switch position 1 on the DIP switch may be set incorrectly. Refer to Chapter 1, "Getting Started."
   c) Widow Segment is incorrect.
   d) I/O Address is incorrect.
   e) The circuit board has failed.

If you are unable to solve this problem, contact Network General Customer Support at 1-800-888-0180.

Most recent character (lower right)

You are at the end of the buffer file and make another attempt to move there (e.g., using <Page Down>). The cursor is already at the end of the buffer file, therefore on the most recent character.

Need DOS 3.0 or greater. Press any key to return.

You have attempted to access the DOS shell by pressing <Ctrl>Z with the LM2000 running. This feature requires DOS version 3.0 or higher.

No answer from card. Please, check hardware configuration.
Press any key to continue...

The monitor board failed to respond to an I/O request during initialization for one of the following reason(s):

1) The LM2000 circuit board is not installed in the PC. It is possible to review previously captured data and operate on all LM2000 files without the board installed. The license agreement permits up to five copies of the program.
2) If the LM2000 circuit board is installed:
   a) It may not be properly seated.
   b) Switch position 1 on the DIP switch may be set incorrectly.
   c) The Widow Segment is incorrect.
   d) I/O Address is incorrect.
   e) The circuit board has failed.

For more information on installation settings, see Chapter 1, "Getting Started." If you are unable to solve this problem, contact Network General Customer Support at 1-800- 888-0180.

No frame control byte

The first byte (addr) of the SDLC/HDLC frame has been found, but the 2nd byte (control) is not in the buffer. This would occur if the buffer wrapped or the message was truncated.

Nothing displayed at cursor

F1 [MARKER] was pressed when there was no data at the cursor position; or when you requested another command that requires something displayed at cursor.

Not enough memory or can't find COMMAND.COM
Press any key to return

You have attempted to access the DOS shell by pressing <Ctrl>Z with the LM2000 running. Either your computer hasn't enough memory or the file COMMAND.COM can't be found. Either copy COMMAND.COM to the disk or subdirectory containing the LM2000 program, or use a PATH command to tell DOS where to find COMMAND.COM. You will need 550K of RAM to do this.

Oldest char (upper left)

You are at the beginning of the buffer file and make another attempt to move there (e.g., using <Page Up>). The cursor is already at the beginning of the file, therefore on the oldest character in the buffer file.

Open error

An attempt to open (load) a file was unsuccessful. The LM2000 could not find the file specified, or if found, the file was corrupted. Check the path and filename or restore from backup.

Overflow - greater than ~119 hours

An elapsed time calculation was requested (F2 was pressed) on the View Buffer Screen. The time between selected endpoints is greater than 119 hours. If possible, work with closer endpoints and add the subtotals. If not, the elapsed time was at least 119 hours.

PowerScript is about to be overlaid. The PowerScript program in memory (if any) will be lost. Continue (y/n)?: y

You have requested a function (Level 3 Decode, Async Terminal, Read Me or Hardware Configuration) that uses the same space in memory as PowerScript. If you have a program in PowerScript that has been changed but not saved (and you want to keep it), type **n**, then return to PowerScript and SAVE the program. Otherwise, type **y** or <Enter>.

Press any key to abort print

The print function has already started, and you wish to cancel it. Press any key, and printing should stop within half a page.

Print (S)creen, (B)uffer, or (C)har status?: S

While in the View Buffer Screen, you issued a print request using either F8 [PR DSK] or <Shift> F8 [PRINT]. To print only the current screen, press <Enter> or **S**. To print a listing of the entire buffer, press **B**. The buffer will be printed from the cursor forward (toward the more recent data). To print the entire buffer in ASCII, press **C**.

PRINT ABORTED

Confirms that a key was pressed to stop print in progress.

Printer ready (y/n)?: y

You have requested printing of the current screen (<Shift> F8 was pressed). The LM2000 is confirming that the printer is ready. To start printing, just press <Enter>. Be sure your printer is ready, otherwise the system will lock up. If the printer isn't ready or printing is not desired, type **n**.

PSCRPT.OVL not in current directory

You attempted to use PowerScript and were unsuccessful because the PSCRPT.OVL file was not found. Copy the PSCRPT.OVL file into your current LM2000 directory.

...Read error

An attempt to read a file was unsuccessful. This is either a DOS error or a bad file. Restore from backup. The current buffer is not lost unless a message to that effect is displayed.

Reading...<*result*>

The requested read operation has started. The <*result*> should be filled in shortly. For example, "Reading...completed." (See also the "...Completed" message earlier in this appendix.)

Search string undefined

You entered a Find Next command (<Shift>F5) before a Find command (F5) or a search string was defined.

Snapshot file not open

While in the View Buffer Screen, you entered a Go To snapshot number, however, a snapshot file was not loaded. Load a snapshot file and reenter a valid snapshot number.

START OF FRAME not found

You entered a skip to the next frame command (<Shift>F7), but the end of the buffer was reached before finding the next frame.

String found

The string specified on the View Buffer Screen using F5 [FIND] or <Shift>F5 [FN NXT] was found. The cursor is on the last character of the matched string.

String not found

The string specified on the View Buffer Screen using F5 [FIND] or <Shift>F5 [FN NXT] was not found between the current cursor position and the most recent data in the buffer.

Time not found

You have selected the **Time** option on the GOTO Menu (F4 from the View Buffer Screen), but the LM2000 was unable to find a frame with the designated time stamp. All data in the buffer has a time earlier than the time specified.

Timer options not equal

The buffer file to be loaded does not match the current System Configuration Screen time-stamping option. A file captured with this option **Disabled** cannot be loaded when time-stamping is **Enabled**, or vice versa. The current buffer, if any, is not lost.

Time stamping disabled

You have entered a Go To time of day command, but time- stamping was disabled when the data in the buffer was captured.

Time stamping disabled and endpoints not on same line

Either time-stamping was disabled when data was captured; or the cursor and the endpoint marker are on different lines.

Trap not tripped or buffer state change

You have selected the **Trap** option on the GOTO Menu, but a trap has not tripped yet. (The Monitor Screen trap state is **Completed** or **Trapping**.) Or, the trap has tripped but the buffer state has been altered. For example, a new buffer was loaded or HALT was pressed.

TX mode must equal RX. Async not supported.

You have entered system configuration options that conflict with the protocol you are using. Review the current selections on the System Configuration Screen. Be sure the entry in the TX column is the same as the entry in the RX column.

Undefined

You have selected **Emulation Message** as the BERT pattern, and the emulation message is undefined. Define it on the Emulation Message Definition Screen (press F5 from the System Configuration Screen).

'?' Undefined in char set

You tried to enter a character from the keyboard that is not defined in the current character set.

Warning: Change will erase main screen

You have selected a display format that requires clearing the Monitor Screen. No data in the buffer will be lost.

Warning: Com line not SDLC/HDLC

You issued an SDLC unpack command (F7 or <Shift>F7) on a line that is not configured as a **Frame** line in the System Configuration Screen. The unpack is executed anyway.

Write error

An attempt to write to a file was unsuccessful. Possibly a disk or DOS error.

Writing...<*result*>

The requested write operation has started. The <*result*> will be displayed shortly. For example, "Writing...Write error." (See also the "...Write error" message above.)

Appendix C
LM2000 File Structures

- User File (User Character Set)
- Capture Buffer
- The System Configuration File
- The User Decode Module Format

These formats are provided so users can write programs to further analyze captured data. The C language was used for most routines, so much of what follows has a C tint. All files are written in "raw" mode. This means they are binary files and not terminated with end of file (0x1a). The formats are subject to change, so contact Network General Customer Support for the latest information. There is some subtlety here; so if you have problems using these file formats, give us a call. We would also like to hear of successful analysis programs.

User File (User Character Set)

This file contains the mapping between display and keyboard characters, and a unique user character set. The size is 384 bytes, and the extension is <filename>.USR

Bytes 0 - 0FFh	Contain the ASCII display character for received data. Display=USER[rx byte]. The received character is used as an index. The indexed location will contain an ASCII displayable character, or 0E0h if the byte has been defined as 'control', or 0E6h if the byte has been defined as 'undefined'.
Bytes 100h-17Fh	Contain the keyboard to user character map. This map is used for emulation, trap and find messages. Char=USER[256+ keyboard]. Keyboard is ASCII displayable (32h-7Fh). A value of 0FFh means the keyboard character is not defined for this character set.

Assignments are made as follows:

USER[rx byte]=keyboard char
USER[256 + keyboard char]=rx byte

Capture Buffer

The capture buffer file contains captured data, either from real-time stream to disk or from saving a captured buffer file in memory. Depending on the configuration at the time of capture, it may also contain modem lead changes and inter-character timing. The extension used is <filename>.BUF.

An optional C-language package is available that reads buffer files directly into simulation programs.

The captured DOS buffer file begins with a 128 byte header as follows:

Byte 0	Contains the file's status, using the standard DOS return codes, when closed (e.g., 0=good, etc.). One non-standard DOS code is used: 19=end of file (disk full).
Bytes 1-2	Contain the number of 32K data blocks in the file.
Bytes 3-4	Contain the value of in_ptr, a variable that marks the end of data in the last 32K block.

Bytes 5-127 Contain a memory image of the F_VAL table. This table describes the line configuration when the data was captured.

This 128-byte header is followed by one or more 32K blocks of monitored data. Each 32K block contains either 8K or 16K data characters ("data events"), depending on whether the timing feature was enabled when the data was originally captured.

The format of each data event is the same. If timer was enabled during capture (F_VAL[14][0]=1), each data event consists of 4 bytes. The format is:

<TIMER (Bytes 0-1)> <DATA (byte 2)> <CONTROL (byte 3)>

If timer was not enabled, each data event consists of 2 bytes. The format is:

<DATA (byte 0)> <CONTROL (byte 1)>

Each of the three types of data event bytes (TIMER, CONTROL, DATA) is described below.

Timer

This unsigned integer is present only if F_VAL[14][0]=1 (timer enabled). It contains the time stamp of the character, SDLC end of frame, or modem change. The timer counts down from 0FFFFh to 0. Each tick of the timer is 1/(1.2288mz * 123) = 100.09766 micro seconds, although software overhead limits accuracy to about 500 microseconds.

If this is an informational timer 0 entry (see CONTROL), TIMER has the number of times the timer went to zero between adjacent events. The following section of code shows how to calculate elapsed time between events. tbas_val and tend_val are the TIMER values at each endpoint. The function, zeros(), returns the number of times the timer went to 0 between events (it scans and adds values of informational timer 0 entries).

```
z_cnt=zeros();
printf("Elapsed time: ");
if (z_cnt == 65536) { /*timer overflow*/
printf("OVERFLOW - greater than ~119 hours");
    break;
}
/*calculate. tricky here. handle all cases of timer
value order, wrap around and zero timer count*/
zed=(z_cnt-1)*65536L;
et=(double) abs(tbas_val+zed+(65536-tend_val)) *
    (double) ((123*0.813802)/100.0);
if (work_l=et/(60*60*10000L)) { /*hour count*/
    printf("hrs:%-ld ",work_l);
    et=et-(work_l*(60*60*10000L));
}
```

. . . for minute and seconds. Time of day entry is also available for each block.

Control

Defines how to interpret the DATA byte, as well as com line, error and display framing.

bits 0-1	Define type of DATA
00	Captured character
01	Modem change
10	Informational
bit 2	Com line DATA was monitored on. 0=RX, 1=TX.
bits 3-6	Usage depends on type of DATA.
bit 7	Displays time frame. If the bit's value is 1, this data event occurred within about 400 micro seconds of previous data event (used for display).

Data

This byte contains the captured character, modem change, or internal information, depending on the CONTROL byte.

If CONTROL bits 0-1 = 00 (captured character), DATA contains the character, and bits 3-6 of CONTROL contain any error information.

If CONTROL bits 0-1 = 01 (modem change), DATA bits 0-3 and CONTROL bits 3-6 contain data set lead status.

If CONTROL bits 0-1 = 11 (informational), there are several possibilities:

If bit 3 of CONTROL = 1, then TIMER bytes contain how many times the timer went to 0 (in between events). The DATA byte is present, but contains nothing relevant.

If bit 4 of CONTROL = 1, then an SDLC end of frame was received.

If bit 6 of the DATA byte = 1, then an SDLC frame has a checksum error. If not, the DATA byte is present, but is ignored.

The following pseudo code shows the meaning of fields, and a reasonable way to parse CONTROL and DATA bytes.

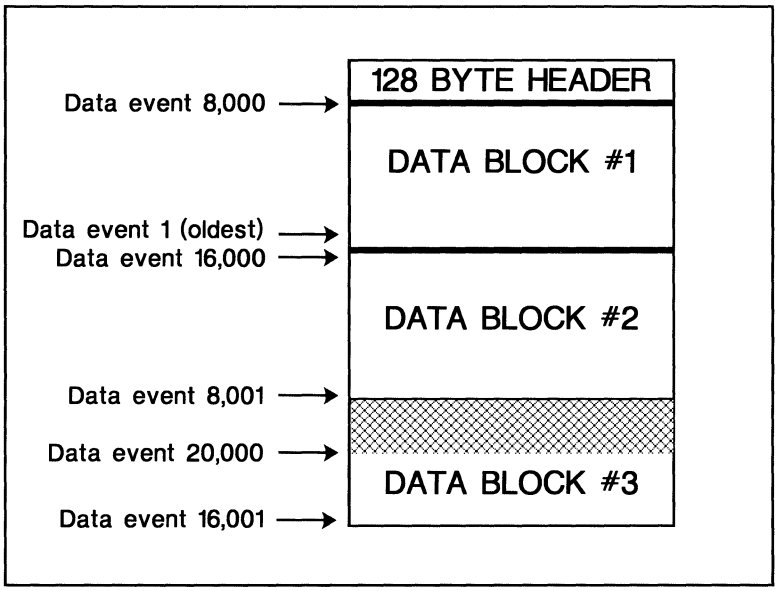
```
switch (b_ctl & 0x03) {
    case 0: /*char*/
                if(b_ctl & 0x08) /*start of frame*/
                if(b_ctl & 0x10) /*parity*/
                if(b_ctl & 0x20) /*overrun*/
                if(b_ctl & 0x40) /*framing/crc*/);
                  break;
```

```
        case 1: /*data set transition*/
                    if (!(b_chr | (b_ctl & 0x78))) /*all leads low*/
                      break;
                    if(b_ctl & 0x08) /*DSR*/
                    if(b_ctl & 0x10) /*RTS*/
                    if(b_ctl & 0x20) /*CTS*/
                    if(b_ctl & 0x40) /*DTR*/
                    if(b_chr & 0x01) /*DCD*/
                    if(b_chr & 0x02) /*RI */
                    if(b_chr & 0x04) /*P11*/
                    if(b_chr & 0x08) /*P25*/
                      break
        case 2: /*information entry*/
                    if(b_ctl & 0x08) /*TIMER has timer 0 count*/
                    if(b_ctl & 0x10) /*sdlc end of frame*/
                    if(b_chr & 0x40) /*CRC error*/
                      break;
    } /*end switch*/
```

It is important to understand the order in which data is stored in each 32K block. The first data event in the buffer is the most recent (last acquired), and the last event in the buffer is the oldest (first acquired). Consider a buffer file that contains 20K bytes of timer-enabled data. Each of these 20K data events would require 4 bytes, therefore this capture buffer file would consist of the 128-byte header plus three 32K data blocks.

The first data block would contain the first 8K data events, starting with the 8,000th event and ending with the 1st event. The second data block would start with the 16,000th data event, and end with the 8,001st event. The third (and last) data block would be about half full of null characters, leading up to the 20,000th data event. The block would end with the 16,001st event. The location of the 20,000th data event in block three would be the value of in_ptr (bytes 3-4 of the 128-byte header).

Figure C-1 is diagram of the capture buffer file structure.



Data Storage in Capture Buffer File (Timer Enabled).

The last four bytes of each odd-numbered block contain DOS time-of-day and pointer information.

Additional information on the capture buffer file structure is provided in the C *Programmer's Tool Kit Manual*. If you have not ordered this optional package, the capture buffer file description is available by calling Network General.

System Configuration File

The System Configuration file contains the data defined by the System Configuration Screen. The file name extension is <filename>.CNF. Information in this file can be used to help analyze the captured data buffer.

The file contains the following array:

```
int f_val[NC+1][3] = { /* index to f?, index to f?, max array index*/
    {5,5,COM_LEN-1}, /*0 com mode. COM_LEN=7 */
    {5,5,31}, /*1 baud rate */
    {3,3,3}, /*2 word size */
    {3,3,4}, /*3 parity */
    {0,0,1}, /*4 stop bits */
    {0x1616,0x1616,1}, /*5 sync char(s) - special handling */
    {0,0,2}, /*6 char strip */
    {0,0,3}, /*7 outsync*/
    {0,0,1}, /*8 sdlc addr sel */
    {0,0,1}, /*9 sdlc addr 0-ff*/
    {0,0,5}, /*10 char set */
    {0,0,LEV2_P_LEN-1}, /*11 level 2 protocol*/
    {0,0,1}, /*12 monitor modem */
    {0,0,9}, /*13 trap enables */
    {1,0,1}, /*14 time stamp enable*/
    {0,0,2}, /*15 emulation mode*/
    {4,0,7}, /*16 display hex, char, mnemonic or level 2 + media*/
    {0,0,2}, /*17 display: full/half duplex, lead state, pod power[1]*/
    {0,0,3}, /*18 stream to disk and Clock source[1]*/
    {0,0,1}, /*19 EXPAND and mill 188[1]*/
    {300,300,0} /*20 user defined baud rate*/
};
```

The values of each entry are explained in the next section. The values shown above are the power on defaults.

The data array in the configuration file can be easily unpacked. f_val[i][] selects the option. For example, f_val[3][] is parity. Parity on the TX line is f_val[3][0], RX line is f_val[3][1]. f_val[][2] is the maximum value of the RX, TX entry. Each option value is defined by the following arrays. For example, if f_val[3][1] is 2, then f3[2] indicates the parity is NONE. In summary, f3[f_val[3][1]] is parity on the RX line.

```
char const *cnf_str[NC+1][MAX_SEL]={
/*0*/{"Disabled","Async","BiSync-bcc","BiSync","MonoSync",
"Frame-NRZ","Frame-NRZI"
}, /*end string list*/
/*1*/ {"USER","50","75","110","150","300","600","1200","1800","2400","3600",
      "4800","7200","9600","14.4k","16k","19.2k","38.4k","56k","64k",
      "72k","115.2K","128k","192k","256k","384k","512k","768k","1024k",
      "1344k","1536k","2048k"},
/*2*/ {"5 ","6 ","7 ","8 "},
/*3*/ {"Even","Odd","Space","None","Mark"},
```

```
/*4*/ {"1","2"},
/*5*/ {0}, /*5*/
/*6*/ {"No","Sync","Hex Byte" /***,"\\xxH" ****/},
/*7*/ {"No","1","2","4"},
/*8*/ {"All","Match"},
/*9*/ {0},
/*10*/ {"ASCII","EBCDIC","USER","BAUDOT","IPARS0","IPARS1"}, /*used in
        emulate.c*/
/*11*/ {"None",
    "SDLC m8/SNA",
    "LAPB m8/X25",
    "LAPB m8/X75",
    "LAPB m8/QLLC",
    "LAPB m8/TRANSD",
    "LAPD m8/SIEMNS",
    "SDLC m128/SNA",
    "LAPB m128/X25",
    "LAPB m128/X75",
    "LAPB m128/QLLC",
    "LAPD Q931CCITT",
    "LAPD ATT 5E4",
    "LAPD ATT 5E5",
    "LAPD ATT 5E6",
    "LAPD NTI STIM",
    "LAPD NTI FUNC",
    "LAPD m128/1TR6",
    "LAPD m128/FREN",
    "LAPD m128/AUS",
    "LAPD m128/X25",
    "LAPD ATT PRI",
    "LAPD NTI PRI",
    "LAPD ISDN1",
    "Frame Relay"
},
/*12*/ {"No","Yes"},
/*13*/{"Disable","Count","Before","After","About","About
       Error","Snapshot","Snap on err",
       "Incl Only","Exclude"},
/*14*/ {"No","Yes"},
/*15*/ {"Disable","DCE","DTE" },
/*16*/ {"Hex","Char","Mnemonic","Level 2","Level 2&3","Info frame",
       "Info char","Info hex" },
/*17*/ {"Full Duplx","Half Duplx","Data/modem"},
/*18*/{"Disable","Stop/Full","Stop/Block","Wrap/Block"},
/*19*/ {"No","Yes"},
/*20*/ {"RS232","V.35 ","V.10 ","V.11 ","RS422","RS423","T-POD"}};
```

User Decode Module Format

The protocol analyzer is written in Lattice C, large model. To invoke the external routines, forkl() is used. The only parameter passed to the invoked program is the address of the parameter block.

The maximum buffer size is 1024. If on an SDLC/HDLC line, data is loaded into the buffer from the cursor to the end of frame (to a max of 1024). If not an SDLC/HDLC line, the 1024 bytes from the cursor are passed (unless end of buffer).

```
struct parms {
    unsigned flags; /*bit 0 - 0=TX line 1=RX line */
                    /*bit 1 - 0=ASCII 1=EBCDIC */
                    /*bits 15-14 00=SDLC/LAPB mod 8 */
                    /* 01=LAPD mod 8 */
                    /* 10=SDLC/LAPB mod 128 */
                    /* 11=LAPD mod 128 */
    int frame_length; /*total number of data (frame) bytes*/
    char *buf_ptr; /*pointer to data (frame)*/
    char *str_ptr; /*unused in external decodes*/
    char display_code; /*unused in external decodes*/
} *parameter;
long atol();
unsigned char *framebyte;
int maxbyte;
unsigned vid_bas;
main(argc, argv)
int argc;
char *argv[];
{
    parameter = (struct parms *)atol(argv[1]);
    /*convert passed address of parms lattice pointer*/
    maxbyte = parameter-frame_length;
    vid_bas=parameter-video_attr;
    framebyte = (parameter-buffer+2);

    /* Place your decode software here. */

} /*graceful exit returns control to lm1*/
```

Appendix D
Specifications

Operating Characteristics

- Data communications modes include asynchronous, byte and bit synchronous, and frame-NRZ. Clock can be selected to internal or external.
- Character sets include ASCII, EBCDIC, user-defined, Baudot, IPARS0, IPARS1.
- Data Bits can be set to 5, 6, 7, or 8.
- Parity can be set to none, even, odd, mark, or space.
- Error checking includes CRC-16 and CRC-CCITT.
- Modem leads can be monitored for DTE and DCE.
- Each character and modem lead change is time stamped as it is placed in the buffer.

Hardware Description:

- One line-interface circuit board incorporating RISC processor.
- On-board DB25 and DB15 edge connectors.
- Interface cables (U.S. and Canada): RS232, V.35.
- Interface cables (Outside U.S. and Canada): RS232, V.35, V.10/V.11.

Interface Options

- T1 Interface Pod with DS0 drop and insert capability.
- RS-449 (RS-422/RS-423) interface cable.
- V.10/V.11 interface cable.

System Requirements

- IBM or compatible 386SX or higher.
- 4MB or more recommended (640Kb required).
- One free full-size ISA slot required.
- DOS 5.0 recommended (DOS 3.3 or higher required).
- Free I/O address.
- One free 8K byte minimum high memory, segment above 640K at A000 or D000 segments.

Appendix E
Advanced Emulation with Protocol Macros

- Introduction
- Using Protocol Macros
- The Protocol Macro Programming Language
- Protocol Macro Commands
  - Call
  - Display
  - Else
  - Endif
  - Endjump
  - If
  - Jump
  - Pause
  - Print
  - Prompt
  - Resume
  - Set
  - Skip
  - String prompt (Strprmt)
  - String Set (Strset)

Introduction

The protocol macros provided with the LM2000 are powerful emulation tools that allow you to create complex data messages without having to build frames bit-by-bit. Macros, written in a proprietary macro language, describe individual Layer 2 and Layer 3 elements, which can be combined to build up complete frames for emulation and data capture in PowerScript test scripts. Macros can also be used to define precapture filters in the Trap String Definition Screen of the LM2000.

As shown in Table E-1, macros are available to define data events for frame relay, BSC (bisync), SDLC, SNA, LAPB, and X.25 protocols. You can also write your own macros, or edit existing ones, using a text editor and the macro definition language described at the end of this section. This capability allows you to create macros tailored to unique or proprietary protocols.

Macros and PowerScript

In PowerScript, macros are used with the **Transmit** and **Wait Until** commands. In **Transmit** statements, macros help you emulate data messages in any of several protocols. In **Wait Until** statements, macros let you select specific frames to trigger script actions, including capturing data via the **Snapshot** command. Refer to the PowerScript Command Reference in Chapter 13, under Transmit and Wait Until for details on using macros in PowerScript.

Macros	Description
Bisynchronous Macros	
B_GENPOL	BSC General poll
B_DE-SEL	BSC line de-select
B_ACK0	BSC acknowledge 0 (odd ACK)
B_TXTMSG	BSC data (text A-Z) message
B_NAK	BSC negative acknowledgement (NAK)
B_EOT	BSC end of transmission (EOT)
B_SELPOL	BSC select poll
B_RVI	BSC reverse interrupt (RVI)
B_ACK1	BSC acknowledge 1 (even ACK)
B_WACK	BSC positive wait acknowledgement (WACK)
Frame Relay Header Macros	
F_DLCI	Frame relay header
F_LMI	Frame relay header and LMI management messages (DLCI 1023)
F_ANNEXD	Frame relay header and ANSI T1.617 Annex D management messages (DLCI 0)
F_CLLM	Frame relay header and CLLM management messages (DLCI 1023)
F_OFFSET	Insert an offset of up to 5 octets between the frame relay header and the user data
SDLC Macros	
SDLC	SDLC address definition and frame-type selection. (This macro calls the remaining SDLC macros as required.)
SDLC_I	SDLC information frame definition (called by SDLC macro)
SDLC_S	SDLC supervisory frame definition (called by SDLC macro)
SDLC_U	SDLC unnumbered frame definition (called by SDLC macro)
SDLC_O	SDLC user-defined frame definition sets all 8 bits of the control byte as specified (called by SDLC macro)
SNA Macros	
S_FID0-1	SNA FID type 1 & 0 transmission header
S_FID2	SNA FID type 2 transmission header
S_FID3	SNA FID type 3 transmission header
S_FID4	SNA FID type 4 transmission header
S_FIDF	SNA FID type F transmission header
S_BIND_1	SNA RU: BIND session request (Part 1 of 2; this macro calls the S_BIND_2 macro.)
S_BIND_2	SNA RU: BIND session request accommodates LU 6.2. (Part 2 of 2; this macro is called by the S_BIND_1 macro.)

Table E-1. Currently Available Protocol Macros

Macros	Description
SNA Macros (cont.)	
S_ACTLU	SNA RU: activate Logical Unit
S_ACTPU	SNA RU: activate Physical Unit
S_RH	SNA RH: request/response header
S_SDT	SNA RU: start data traffic request
S_DACTLU	SNA RU: deactivate Logical Unit
S_DACTPU	SNA RU: deactivate Physical Unit
S_UNBIND	SNA RU: UNBIND session request
S_INFO	SNA data ("A Quick Brown Fox...")
LAPB Macros	
LAPB	Address definition and frame-type selection. (This macro calls the remaining LAPB macros as required.)
LAPB_I	LAPB information frame definition (called by LAPB macro)
LAPB_S	LAPB supervisory frame definition (called by LAPB macro)
LAPB_U	LAPB unnumbered frame definition (called by LAPB macro)
LAPB_O	LAPB user-defined frame definition sets all 8 bits of the control byte as specified (called by LAPB macro)
G_INFO	LAPB macro for reusing bits from network INFO command (called by X.25 macros)
G_L2RR	LAPB macro for reusing bits from network RR response (called by X.25 macros)
S_L2RR_C	LAPB macro for converting DCE RR to DTE RR command (called by X.25 macros)
S_L2RR_R	LAPB macro for converting DCE RR to DTE RR response (called by X.25 macros)
X.25 Macros	
X_ACEPT	X.25 call accept packet definition
X_CALREQ	X.25 call request packet definition
X_CLRREQ	X.25 clear request packet definition
X_CNFRM	X.25 confirm define/packet selection
X_DATAPK	X.25 data packet definition
X_PKTRNR	X.25 receiver not ready packet definition
X_PKTRR	X.25 receiver ready packet definition
X_REJ	X.25 reject packet definition
X_RESTRQ	X.25 reset request packet definition
X_RSTRTR	X.25 restart request packet definition
X_LCN-IN	X.25 macro for using the LCN value in a specific counter
S_L3RR	X.25 macro for converting DCE INFO to DTE RR commands reusing N(r) values

Table E-1. Currently Available Protocol Macros

Macros and Traps

In the Trap String Definition Screen, macros let you define specific frames as trap strings. The resulting trap strings are much like those created using the Frame Definition Screens, except that macros allow you to define a trap string by selecting the desired macro from a menu. Macros are especially useful for trap definition when the Frame Selection screens don't provide adequate flexibility, for example, when your network uses a proprietary protocol.

Using Protocol Macros

Selecting Macros: The Macro Menu

Whether using macros in PowerScript commands or in the Trap String Definition Screen, the macros are selected the same way: via the macro menu. The macro menu works like the other file selection menus in the LM2000; when invoked, the macro menu displays a list of all files in the current directory with the macro extension, .PLM. Like the menus used to load PowerScript test scripts and system configuration files, you can select an item from the macro menu by moving the cursor to the desired item and pressing <Enter>. (You can move the cursor to the desired item using the arrow keys, or by pressing the initial letter of the macro name.)

In PowerScript, the macro menu is accessed by selecting the Macro option when entering **Transmit String** or **Wait Until DCE/DTE Trap Str** statements. In the Trap String Definition Screen, the macro menu is accessed by pressing <Shift>F3 [MACRO] while defining a trap string.

Building Frames with Macros

Macros help you build frames by presenting a series of menus from which you select various protocol parameters. The macro then automatically constructs the binary string for the frame based on your menu selections. For example, when using the LAPB or SDLC macros, you will be offered the choice of defining a supervisory, unnumbered, or information frame. If you select a supervisory frame, you will be prompted to enter the desired N(r) and P/F bit values (in decimal). The macro will then construct the binary string for the address and control fields based on your selections.

When building supervisory or unnumbered frames, you will only need to use a single Layer 2 macro (LAPB or SDLC). When building information frames, you will need to concatenate Layer 2 and Layer 3 macros (X.25 or SNA) to define the complete frame. (You can also combine LAPB and SNA macros to define QLLC frames.) When building frame relay frames, you will need to use frame relay macros to define the frame relay header, and then use Layer 2 and Layer 3 macros to define the data being transported over the frame relay network. The following procedures outline the steps required to build frames using protocol macros.

To construct frame relay frames:

1) Define the frame relay header by selecting F_DLCI.PLM from the macro menu. (To define management frames using the LMI, Annex D, or CLLM protocols, select F_LMI.PLM, F_ANNEXD.PLM, or F_CLLM.PLM, respectively.)
2) Follow the instructions displayed in the macro window to define the header fields for the frame you wish to construct.
3) After you have entered any required variables, the binary and hexadecimal interpretations of the defined frame are displayed for verification; check your entries and press any key to return to the previous screen.
4) If you wish to include user data in the frame relay frame, access the macro menu again and follow the procedure below for the desired protocol. (To include an offset between the frame relay header and the user data, select F_OFFSET.PLM from the macro menu and follow the directions presented in the macro window for F_OFFSET before going to the other procedures.)

To construct LAPB and X.25 frames:

1) Define the Layer 2 frame by selecting LAPB.PLM from the macro menu.
2) Follow the instructions displayed in the macro window to define the address and control fields for the frame you wish to construct. (Please Note: The macros LAPB_I.PLM, LAPB_S.PLM, LAPB_U.PLM, and LAPB_O.PLM are called as required, depending on the choices you make for LAPB.PLM. Do not select these macros to define LAPB frames.)
3) After you have entered any required variables, the binary and hexadecimal interpretations of the defined frame are displayed for verification; check your entries and press any key to return to the previous screen.
4) If you selected an information frame in step 2, access the macro menu again and select one of the X.25 macros (any macro prefixed by X_, see Table E-1) to define the information field.
5) Once again, follow the instructions displayed in the macro window. After the required entries have been made, the binary and hexadecimal interpretations of the defined packet are displayed for verification; check your entries and press any key to return to the previous screen.

To construct SDLC and SNA frames:

1) Define the SDLC frame by selecting SDLC.PLM from the macro menu.
2) Follow the instructions displayed in the macro window to define the address and control fields for the frame you wish to construct. (Please Note: The macros SDLC_I.PLM, SDLC_S.PLM, SDLC_U.PLM, and SDLC_O.PLM are called as required, depending on the choices you make for SDLC.PLM. Do not select these macros to define SDLC frames.)
3) After you have entered any required variables, the binary and hexadecimal interpretations of the defined frame are displayed for verification; check your entries and press any key to return to the previous screen.
4) If you selected an information frame in step 2, access the macro menu again and select one of the SNA FID macros (any macro prefixed by S_FID, see Table E-1) to define the Transmission Header (TH) field.

5) Once again, follow the instructions displayed in the macro window. After the required entries have been made, the binary and hexadecimal interpretations of the defined FID are displayed for verification; check your entries and press any key to return to the previous screen.
6) Repeat Steps 4 and 5 to define the Request/Response Header (RH, select the S_RH macro) and the Request/Response Unit (RU, select any other S_ macro).

To construct Binary Synchronous Communication (BSC or Bisync) frames:

1) Define a bisync frame by selecting any macro prefixed by B_ (see Table E-1) from the macro menu.
2) Follow the instructions displayed in the macro window to define the frame you wish to construct.
3) After you have entered any required variables, the binary and hexadecimal interpretations of the defined frame are displayed for verification; check your entries and press any key to return to the previous screen.
4) Repeat Steps 1 through 3 as necessary to construct a complete bisync transaction.

Protocol Macro Programming Language

The basic purpose of the protocol macros is to load a predefined string of bits into a PowerScript program or a trap string. Typically, the string of bits represents a specific frame as defined by a specific protocol. The macro programming language allows you to define the string of bits either directly using fixed values or indirectly using input requested from the user or captured from a monitored data stream. Other features of the macro programming language include:

- Logical structures for decision branching
- Logical structures can be nested
- The ability to call and execute other macros
- The ability to store and retrieve values in the PowerScript counters

Each macro consists of a text file containing a series of commands and their arguments, which are described on the following pages. (Table E-2 provides a complete listing of the protocol macro commands and their arguments.) You can use any DOS text editor or word processor (if it is capable of generating ASCII text files) to create macros. You can assign any legitimate DOS file name to macros you create, but they must have a .PLM extension for the protocol analyzer to identify them as macros.

Command Syntax	Description
CALL ("*path\filename*",N)	Calls macro identified by *path\filename*
_____	Inserts comment in macro
DISPLAY (N)	Displays octet N on screen in binary and hex
ELSE	Branch point for IF; see IF
ENDIF	End point for IF; see IF
ENDJUMP	End point for JUMP; see JUMP
GETLONG (N,"____",A,N',start_bit,stop_bit,start_bit,stop_bit,...)[1]	Prompts user for input; set bits in octets N through N+N', start_bit through stop_bit, to value entered on keyboard.

IF (N,start_bit,stop_bit,*value*)
ELSE
ENDIF
	If *value* equals bits in octet N, start_bit through stop_bit, execute statements from IF to ELSE. Otherwise, go to ELSE and execute statements from ELSE to ENDIF.

JUMP ("_____") ENDJUMP	Displays prompt in "_____", if user responds with y, execution branches to ENDJUMP. Otherwise, execution continues with next statement.
PAUSE	Inserts pause in execution. Press any key to continue.
PRINT ("_____")	Prints string in "_____" to screen.
PROMPT (N,"_____",A,start_bit,stop_bit,min,max)	Prompts user for input; set bits in octet N, start_bit through stop_bit, to value entered on keyboard.
RESUME (*N*)	Pointer location for variables in SET statement values-(N)1 and (N)p.
SET (N,start_bit,stop_bit,*value*)	Sets bits in octet N, start_bit through stop_bit, to *value*.
SKIP (N)	Skips N octets.
STRPRMT (N,"_____",*length*)	Solicits text input from user and inserts it in octets N through N+*length*.
STRSET (N,"_____")	Sets octets beginning with N to the ASCII values for the characters in "_____".

[1]The number of start_bit/stop_bit pairs must equal N'.

Table E-2. Macro Programming Language Command Syntax

Macro Command Syntax and Conventions

Each command in a macro must reside by itself on a single line. The last line of the file must be an end-of-file marker (<Ctrl>Z).

The macro command syntax is:

```
IF   (N,start_bit,stop_bit,value)
COMMAND      ARGUMENTS
```

Arguments are enclosed in parentheses; when multiple arguments are used, they are separated by commas. Text strings are enclosed by double quotes ("). Spaces are not necessary between commands and arguments but may be used for clarity, as may indentations for nested commands (e.g., IF).

Defining Octet and Bit Positions

Many of the commands described here place a given value in specific bit positions of the frame you are building. The macro commands that do so use the octet number and start (first) bit and stop (last) bit numbers to define bit positions. The position of octets and bits is specified in the command arguments.

Octet positions begin with 0 for the first octet after the flag (which is supplied by hardware); in most protocols this is the address field. Start and stop bit numbers begin with 0 for the first bit transmitted, and can go as high as 15. For example, to specify the last 3 bits in octet 1, you would enter 1 for the octet number, 5 for the start bit position, and 7 for the stop bit position.

You can also specify relative values for the octet number. The current octet is indicated by the letter o, for old; the octet immediately following the current octet (the current octet plus one) is specified by the letter n, for next (see Figure E-1). Use plus (+) and minus (-) signs in conjunction with o and n to increment or decrement the octet number. For example, o+1 indicates the current octet plus 1 (equivalent to the next octet); n+1 indicates the next octet plus one, or two octets from the current octet.

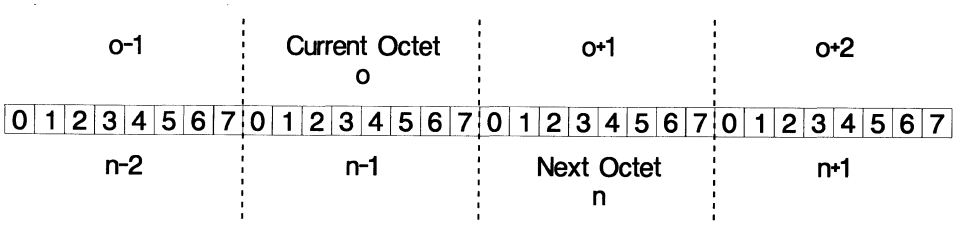


Figure E-1. Specifying relative octet numbers in macro command arguments.

Protocol Macro Commands

In the command descriptions on the following pages, the command appears in all uppercase letters (e.g., PRINT), arguments follow in lowercase letters (e.g., start_bit). Please note, however, that you can use either uppercase or lowercase letters when writing macros. Variable text strings are indicated by underscores surrounded by double quotes ("_____"). N (uppercase N) is used to indicate any whole number; *value* indicates any whole number or a value to be supplied from a counter or other variable. Numbers and values can be entered in any of the formats listed in Table E-3.

Format and Range	Entry Form
Decimal (from 0 to 255)	26
Hexadecimal (from 0 to 255)	1ah
Octal (from 0 to 255)	32o
Binary (from 0 to 255)	11010b
Don't care value for any whole number	x or X
Don't care values for bit masks	11xx0b

Table E-3. Numerical Entry Formats

Brief examples follow each command definition. These are intended to illustrate the command syntax rather then specific uses of the command. To see specific usage examples, use any text editor to view the *.PLM files supplied with your protocol analyzer.

CALL ("*path\filename*",N)

Call (execute) the macro identified by *path\filename*. *path\filename* is the path and filename of the desired macro; you must specify the .PLM extension. N is the octet number upon which you want the called macro to operate.

N = o for the current octet (use + or - for values relative to o).
N = n for the next octet (use + or - for values relative to n).
N = any whole number for a specific octet number.

Comments

CALL statements can be nested up to ten deep, i.e., you can call up to ten macros in a series.

Example

```
  if(2,0,2,01)
  call("mac_1.plm",o)
* If octet 2 is odd, run macro mac_1.plm and begin processing at current octet.*
  else
  call("mac_2.plm",o)
* If octet is even, run macro mac_2.plm, begin processing at current octet.*
```

_____

Comment for internal documentation of macros. Enter the desired text string enclosed by asterisks.

Example

```
* the next command generates a LF/CR on screen*
  print("")
```

DISPLAY (N)

Displays the specified octet on the screen in binary and hexadecimal formats. Used for verification purposes.

N = o to display the current octet (use + or - for values relative to o).
N = n to display the next octet (use + or - for values relative to n).
N = any whole number to display a specific octet.

Example

```
  display(0)
  display(1)
* Display contents of octets 0 and 1 in binary and hex.*
  display(o)
* Display contents of current octet in binary and hex.*
  display(n)
* Display contents of next octet in binary and hex.*
```

ELSE

See IF below.

ENDIF

See IF below.

ENDJUMP

See JUMP below.

GETLONG (N,"_____",A,N',start_bit,stop_bit,start_bit,stop_bit,....)

Similar to the PROMPT command, GETLONG solicits numerical input from the user. Like PROMPT, the value entered in response to GETLONG is used to set bit values. Unlike PROMPT, however, GETLONG lets you split the MSB and LSB of a value over several octets. For example, GETLONG can be used to specify DLCI values in Frame Relay protocols where irrelevant bits intervene between the MSB and LSB. When using GETLONG to set bit values, N' specifies the number of octets, beginning with N, that you wish to set bit values in; and each start_bit/stop_bit pair specifies the bits you wish to set values for in each octet.

N = o to operate on the current octet (use + or - for values relative to o).
N = n to operate on the next octet (use + or - for values relative to n).
N = any whole number to operate on a specific octet number.

"_____" = Any text string.

A =d for decimal
h for hex
o for octal
b for binary
This argument tells GETLONG which base to expect for the requested input (decimal, hex, binary, etc.). For example, if *A* = d, PROMPT will interpret any value entered at the keyboard as a decimal number, which is then converted to binary before being placed in the bit positions specified by N+N′ and the start_bit/stop_bit pairs.

N′ = any whole number from 1 to 4, representing the number of octets (including N) you wish to set bit values in. The number of start_bit/stop_bit pairs should equal N′.

start_bit,stop_bit = the range of bits you wish to set in an octet. Each start_bit/stop_bit pair represents the bits to set in one octet. The first pair corresponds to octet N, the next to octet N+1, etc. You can specify up to four pairs, and the number of pairs cannot exceed N′. The values in start_bit and stop_bit can be any whole number from 0 to 7, but the start_bit value must be less than or equal to the corresponding stop_bit value.

Comments

If GETLONG is soliciting input for an octet, the input value will be converted to or from the base specified by A to binary.

See also:

PROMPT, SET

Example

```
  if (o,1,1,1)
        prompt(3,"** Enter DL-CORE Number (<=63): ",d, 2,7,0,63)
        getlong(0,"** Enter DLCI (<=131071 ):", d,3, 2,7, 4,7, 1,7)
* If bit 1 of current octet = 1, load DL-CORE number in octet *
*  3, bits 2-7, and load DLCI value in bits 2-7, 4-7 and *
*  1-7, of the 3 octets starting with the current octet.*
        else
        getlong(0,"** Enter DLCI ( <= 8388607 ):", d,4, 2,7, 4,7, 1,7, 2,7)
*  Else load the DLCI value in bits 2-7, 4-7, 1-7, and 2-7 of *
*  the 4 octets starting with the current octet.*
endif
```

IF (N,start_bit,stop_bit,*value*)
ELSE
ENDIF

If *value* is equal to the value of the bit positions specified by N, start_bit, and stop_bit, execute the statements between IF and ELSE. If the values are not equal, execute the statements between ELSE and ENDIF.

N = o to compare *value* to the current octet (use + or - for values relative to o).
N = n to compare *value* to the next octet (use + or - for values relative to n).
N = any whole number to compare *value* to a specific octet number.

start_bit = start bit position, any whole number from 0 to 7.
Must be less than or equal to stop_bit.

stop_bit = stop bit position, any whole number from 0 to 15.
Must be greater than or equal to start_bit.

value = value to compare

ELSE If the values in the IF statement are not equal, execute the statements between ELSE and ENDIF.

ENDIF Indicates the end of IF/ELSE statements.

Example

```
print("Command/Response: User = 0")
print("Command/Response: Net = 1")
*Display selections for command/response address*
prompt(o,"** Enter C/R Address: ",d,1,1,0,1)
*Prompt user to select 0 for User C/R address, or 1 for*
*net C/R address*
*store selection in bit 1 of current octet*
set(o,2,7,0)
*set bits 2-7 of current octet to 0*
print("")
if(o,1,1,0)
  print("Command/Response Address User: 01")
  display(o)
*if bit 1 of current octet = 0, print string and display *current octet*
else
  if(o,1,1,1)
    print("Command/Response Address Net: 03")
    display(o)
*if bit 1 of current octet = 1, print string and display *current octet*
else
  endif
endif
*otherwise, end if statement*
```

JUMP ("_____")
ENDJUMP

Displays a user prompt for yes/no (y/n) decisions. If the user responds with y, execution branches to ENDJUMP. If the user responds with n, execution continues with the statement following JUMP. Responses other then y or n are illegal and will cause no action.

"_____" = Any text string. For JUMP to work correctly, the text string should be a yes/no question.

ENDJUMP

If the user responds to the JUMP prompt with y, execution branches to ENDJUMP. Otherwise, the statements between JUMP and ENDJUMP are executed.

Example

```
  display(o)
* Display current octet on screen*
  jump("Continue without User Information =Y or N= ")
* Prompt user for Y or N response*
  call("S_INFO.PLM",n)
* If user response = Y, call macro S_INFO.PLM*
* If user response = N, execute commands following endjump*
  endjump
```

PAUSE

Insert pause in execution. The message "press any key to continue." is displayed. Execution continues when the user presses any key.

Example

```
  display(0)
  display(1)
  display(2)
  pause
* Display 1st 3 octets and pause while viewing*
```

PRINT ("_____")

Prints the defined text string on the screen.

"_____" = Any text string.

Example

```
  print("MODULO 128                2")
* Display string MODULO 128 2*
  print("")
* Display blank line*
```

PROMPT (N,"_____",*A*,start_bit,stop_bit,min,max)

Solicits numerical input from the user. The value entered in response to PROMPT can be used to set the bit values specified by N, start_bit, and stop_bit, or it can refer to one of the PowerScript counters. In the latter case, the value in the bit positions specified by N, start_bit, and stop_bit can be set from or written to the indicated counter.

N = o to operate on the current octet (use + or - for values relative to o).
N = n to operate on the next octet (use + or - for values relative to n).
N = any whole number to operate on a specific octet number.

"_____" = Any text string.

A =d for decimal
h for hex
o for octal
b for binary
g for get (to get a value from an octet and store it in a counter)
v for variable (to place a value from a counter in an octet).

When *A* = d, h, o, or b, this argument tells PROMPT which base to expect for the requested input (decimal, hex, binary, etc.). For example, if A = d, PROMPT will interpret any value entered at the keyboard as a decimal number, which is then converted to binary before being placed in the bit positions specified by N, start_bit, and stop_bit.

When *A* = v or g, this argument tells PROMPT that the requested input refers to a PowerScript counter, and that the input should be a decimal number from 1 to 8.

If *A* = v, the value in the counter indicated by the user's response is placed in the bit positions specified by N, start_bit, and stop_bit. For example, if the user responds to PROMPT with 1, the value in counter 1 is placed in the specified bit positions.

If *A* = g, the value in the bit positions specified by N, start_bit, and stop_bit are stored in the counter indicated by the user's response. For example, if the user responds to PROMPT with 1, the value in the specified bit positions is stored in counter 1.

start_bit = start bit position, any whole number from 0 to 7. Must be less than or equal to stop_bit.

stop_bit = stop bit position, any whole number from 0 to 15. Must be greater than or equal to start_bit.

min = any whole number. This argument specifies the minimum value allowed for the requested input. Set min to 0 if *A* = v or g.

max = any whole number. This argument specifies the maximum value allowed for the requested input. Set max to 0 if *A* = v or g.

Comments

If PROMPT is soliciting input for an octet, the input value will be converted to or from the base specified by A to binary. When A = v or g, min and max must be set to 0.

See also:

GETLONG, SET

Example

```
   prompt(o,"Enter N(s) Value: ",d,1,3,0,7)
* Prompt user to enter decimal number for N(s) value*
* minimum allowed value is 0, max is 7*
* Place entered value in bits 1-3 of current octet*
   prompt(o,"Enter MOD8 P/F Value: ",d,4,4,0,1)
* Prompt user to enter decimal number for P/F value*
* minimum allowed value is 0, max is 1*
* Place entered value in bit 4 of current octet*
   prompt(o,"Enter N(r) Value: ",d,5,7,0,7)
* Prompt user to enter decimal number for N(r) value*
* minimum allowed value is 0, max is 7*
* Place entered value in bits 5-7 of current octet*
   display(o)
* Display newly constructed octet*
```

RESUME (N)

Pointer location for variables in SET statement values–(N)l and (N)p.

N = pointer number, equal to N in corresponding SET statement.

See also:

SET

Examples

```
   set(1,0,7,(1)l)
* Set all bits of octet 1 to value =
* number of octets between octet 1 and pointer to length 1*
.
.
.
         set(7,?,?,value)
* Octet number (7) in this set command sets value of*
* current octet number (o) in following commands*
.
.
   resume(1)
* Pointer to length 1*
* Returns value of 8 (octet 1 + octet 7) to set statement*
.
.

   set(8,0,7,(2)p)
* set all bits of octet 8 to value =
* octet number at pointer to pointer 2*
.
.
         set(16,?,?,value)
* Octet number in this set command sets value of*
* current octet number (o) in following commands*
```

.
.
resume(2)
* Pointer to pointer 2*
* Returns value of 16 (value of octet at resume command)*
* to set statement*

SET (N,start_bit,stop_bit,value)

Sets the bit positions specified by N, start_bit, and stop_bit to *value*.

N = o to set the current octet to value (use + or - for values relative to o).
N = n to set the next octet to value (use + or - for values relative to n).
N = any whole number to set a specific octet to *value*.

start_bit = start bit position, any whole number from 0 to 7.
Must be less than or equal to stop_bit.

stop_bit = stop bit position, any whole number from 0 to 15.
Must be greater than or equal to start_bit.

value = any whole number in any format, i.e., decimal, hex, octal, or binary. You can also use don't care values; see Table E-3.

Four variables are available for use in *value*: (*N*)l, (*N*)p, (*N*)v, and (*N*)g.

(*N*)l = Pointer to Length. Returns a value equal to the number of octets between the octet specified in the SET statement (N, start_bit, and stop_bit) and the octet preceding the corresponding RESUME statement. N is the pointer number, from 0 to 31, and is equal to *N* in the corresponding RESUME statement.

(*N*)p = Pointer to Pointer. Returns a value equal to the octet number of the octet preceding the corresponding RESUME statement. *N* is the pointer number, from 0 to 31, and is equal to N in the corresponding RESUME statement.

(*N*)v = Set Counter Value. Sets the octet specified in the SET statement to the value stored in PowerScript Counter *N* (*N* must be a value from 1 to 8).

(*N*)g = Get Counter Value. Stores the value of the octet specified in the SET statement (N, start_bit, and stop_bit) in PowerScript counter *N* (*N* must be a value from 1 to 8).

See also:

RESUME, PROMPT

Example

set(o,0,1,10b)
* Set bits 0 and 1 of current octet to 10 binary*
set(2,0,3,1)
* Set bits 0 - 3 of octet 2 to value of 1*
set(o,4,7,0)
* Set bits 4 - 7 of current octet (2) to 0*

```
  set(n,0,7,(1)v)
* Set all bits of next octet (3) to the value in*
* PowerScript counter 1*
  set(3,0,7,(2)g)
* Stores the value of the third octet monitored*
* by the protocol analyzer in PowerScript counter 2*
```

SKIP (N)

Skip the specified number of octets.
N = Any whole number.

Example

```
  skip(3)
* Skip the next 3 octets*
```

STRPRMT (N,"_____",length)

Solicits text input from the user for use as test or trap messages. The value of octets beginning with N is set to the ASCII values of the entered characters. The entered text string can contain up to *length* characters.

N = o to begin the text string at the current octet (use + or for values relative to o).
N = n to begin the text string at the next octet (use + or - for values relative to n).
N = any whole number to begin the text string at a specific octet number.

"_____" = Any text string. Displayed as a prompt.

length = The maximum number of characters that can be entered for the test or trap message. The number of characters entered can be less than but cannot exceed *length*.

Example

```
  strprmt(n,"Enter User Data - 60 Characters Max:",60)
* Prompt user to enter test message up to 60 characters long*
```

STRSET (N,"_____")

Set octets beginning with N to the ASCII values for the characters in "_____". Used to specify text messages for tests or traps.

N = o to begin the text string at the current octet (use + or for values relative to o).
N = n to begin the text string at the next octet (use + or - for values relative to n).
N = any whole number to begin the text string at a specific octet number.

"_____" = Any text string.

Example

```
  strset(o,"THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG")
* Place quick brown fox message in octets beginning with*
* current octet*
```

Index

Index

A

Aborted frames, 7-16
ASCII characters, 4-10—4-11, 5-2, 19-7, A-1—A-6
ASCII files, 3-18, 9-32, 9-34, 10-10
Async terminal emulation, 12-2—12-5
    access to, 3-11
Async, typical system settings, 5-2—5-3
Automatic line configuration, 3-11

B

Batch files
    for starting the LM2000, 3-4—3-5
BAUDOT, 4-10—4-11, A-2
Beep (PowerScript) command, 13-26
BERT/BLERT, 10-2—10-15
    analyzing results, 10-12—10-15
    configuration, 10-6—10-9
    configuration files, 3-16, 10-9
    flow control, 10-7
    functions, 10-10—10-11
    parameters, 10-4—10-5
    printing reports, 10-9
BERT screen, access to, 3-11
Bisync, typical system settings, 5-4—5-5
Bisynchronous macros, list of, E-3
Block number, in View Buffer, 9-12
Blocks in PowerScript, 13-4
Board not found error message, 1-10, 1-14, B-2
Break-Out Box, access to, 3-11
    RS-232, 11-2—11-3
    RS-422/RS-423, 11-8—11-9
    V.10/V.11, 11-6—11-7
    V.35, 11-4—11-5
Buffer Trace, 9-30—9-31

C

Can't communicate with board... error message, 1-2
Capture buffer, *SEE VIEW BUFFER*
Cell number, 9-12
Character sets, 4-10—4-11
Circuit Action Map, 8-8, 8-24—8-27
    for DLCI filters, 6-16—6-17
    frame relay config., 4-32—4-33
Circuit Status Map, 8-8, 8-20—8-23
Clock source, 4-2, 4-22—4-23
Com mode, 6-4
Comment (PowerScript) command, 13-26
Configuration files
    BERT/BLERT, 3-16, 10-2, 10-9
    DEFAULT system, 3-14
    frame relay, 8-8
    loading, 3-16—3-17
    loading automatically, 3-2
    saving, 3-14—3-15
    system, 3-2—3-5
Connecting LM2000
    to RS-232 (V.24) circuits, 2-4—2-5
    to RS-422/RS-423 circuits, 2-6—2-7
    to T1 circuits, 2-12—2-13
    to V.10 and V.11 circuits, 2-8—2-9
    to V.35 circuits, 2-10—2-11
Context sensitive help screens, 3-6—3-7, 3-11
Counter (PowerScript) command, 13-4, 13-27
Counters, 7-8—7-9, E-7
    in PowerScript, 13-20, 13-27, 13-43
CRC values, in PowerScript tests, 13-40

D

DDCMP, 9-26
Diagnostic test screen, 1-10—1-13
DIP switch settings, 1-6, 1-16—1-17
Display (PowerScript) command, 13-28—13-30
Display Menu (PowerScript) command, 13-14
Display Modes
    lead state, 7-10
    modem lead state, 7-8, 7-10, 7-14— 7-15
    monitor screen, 7-10—7-17
    selection, 7-10—7-11, 9-20—9-21
    view buffer, 9-22—9-29
DLCI filters, 6-16—6-17
DOS shell, 3-20

E

EBCDIC, 4-10—4-11, 5-8, 10-7, A-1—A-6
Emulate (PowerScript) command, 13-30— 13-31
Emulation, 4-24—4-25, E-2
  in the Monitor Screen, 7-6—7-7
Emulation Message Definition Screen, 4-26—4-27
Error messages, B-2—B-13
Error trap
    in PowerScript, 13-42
Errored Frames, 7-16
Exiting the LM2000, 3-11, 3-20—3-21
Expanded Decode
    in Monitor Screen, 7-18—7-19
    in View Buffer, 9-28—9-29
    printouts, 9-34—9-35
Extended address, 4-2, 4-22—4-23

F

Filters
    include and exclude, 6-2—6-3, 6-9
    usage, 6-2
    what they are, 6-2
FOX test, 1-2, 1-12—1-13
Frame Definition Screen, E-5
Frame integrity indicator, 7-16
Frame relay and the LM2000, xiii
Frame relay
    Circuit Action Map, 8-8, 8-20—8-27
    configuration, 4-30—4-33
    configuration files, 8-8
    header macros, list of, E-3
    statistics, 8-8—8-14
    typical configuration settings, 5-12—5-13
Frame Selection Screens, 6-10—6-11
Freezing the Capture Buffer, 7-4
Freezing the Data Display, 7-4
Function key menu, 3-8—3-9

G

G.821 BERT, 10-2, 10-4—10-15
Good frames, 7-16
Goto block (PowerScript) command, 13-4, 13-12, 13-31

H

Hardware Configuration Screen
    access to, 3-11
    I/O address, 1-16
    window segment 1-18—1-19
Hardware conflicts, 1-14—1-15

I

I/O address, 1-14—1-17
If (PowerScript) command, 13-4, 13-12, 13-31—13-32
Installation
    hardware, 1-6—1-7
    software, 1-8—1-9
Invert signals, 4-2, 4-22—4-23
IPARS, 4-10—4-11, A-6

K

KeyPress argument
    in PowerScript, 13-42

L

LAPB macros, list of, E-4
Lead state display mode, selection, 7-10
Lead states
    in PowerScript, 13-42
Line interface card, 1-6
Load Config (PowerScript) command, 13-20, 13-32—13-33

M

Macros, 13-18—13-19, E-2—E-18
    in traps, 6-14—6-15
Macros and PowerScript, E-2
Main Menu, 3-10—3-11
Marker character, 9-12
Media status, 4-4
Media Status Box, 4-2, 4-22—4-23
Menus, in PowerScript, 13-14—13-17, 13-28
Modem lead state display mode, 7-14—7-15
Modem lead states, 7-8
Monitor board error message, 1-14, 1-16, B-9
Monitor Screen
  access to, 3-11
  display mode selection, 7-10—7-11
  display modes, 7-10—7-17
  EGA/VGA and character mode, 7-12
  Expanded Decode, 7-18—7-19

functions, 7-4—7-5
overview, 7-2—7-3
PowerView, 7-20—7-21
trap status, 7-24—7-25

O

Offset
frame relay macros, E-6
frame relay statistics, 8-16

P

Pause (PowerScript) command, 13-33
Pod power, 4-2, 4-22—4-23
for T-Pod, 5-10
PowerScript, 13-2—13-43
access to, 3-11
protocol macros, E-2
PowerScript Test Library, 13-25
access to, 13-22—13-23
PowerView, Monitor Screen, 7-20—7-21
Print (PowerScript) command, 13-33—13-34
Print functions, 3-18—3-19
Printing
emulation messages, 3-18
BERT results, 3-18
configuration settings, 3-18
statistics, 3-18
terminal setup, 3-18
Protocol macros, 13-18—13-19, 13-40, E-2—E-18
commands, E-10—E-18
in traps, 6-14—6-15
programming language, E-7—E-18
syntax, E-9
using, E-5—E-7
Protocol Trace, 9-30

R

Reset (PowerScript) command, 13-4, 13-34
RS-232 interface, 2-2—2-5, 2-12
RS-422/423 interface, 2-2, 2-8, 2-2, 2-6—2-7, 2-10, 2-12
RS-449 adapter cable, 2-2, 2-6—2-7
Run Chldpr (PowerScript) command, 13-4,13-35

S

SDLC macros, list of, E-3
Selecting configuration options, 3-12—3-13
Set leads (PowerScript) command, 13-35—13-36
Short frames, 7-16
SNA macros
list of, E-3
Snapshot (PowerScript) command, 13-36
Snapshot files
in View Buffer, 9-6—9-7
Snapshot with Goto, 9-15
Snapshots
in PowerScript, 13-4
naming snapshots, 7-22
taking snapshots, 7-22
using traps, 6-9
Software Break-Out Box, see Break-Out Box
Start (PowerScript) command, 13-4, 13-37
Starting the LM2000, 1-10—1-11, 3-2—3-3
Statistics
All Circuits Screen (frame relay), 8-10—8-13
All Circuits Table (frame relay), 8-14—8-17
DLCI, 8-16—8-19
frame relay, 8-8—8-19
ISDN Level 2, 8-6—8-7
LAPB, 8-2
LAPD, 8-6
SDLC, 8-4
SNA Level 2 and 3, 8-4—8-5
SNA RU codes, 8-4
X.25 Level 2 and 3, 8-2—8-3
X.25 packet ID, 8-2
Stop (PowerScript) command, 13-38
Stream to disk, 3-2, 3-20, 4-16—4-17, 4-20—4-21
System configuration settings, typical
async, 5-4—5-5
bisync, 5-6—5-7
frame relay, 4-32—4-33, 5-14—5-15
T-Pod, 5-12—5-13
V.35, 5-10—5-11
X.25, 5-8—5-9
System Configuration File
format, C-6—C-8
System Configuration Screen, 4-2—4-33, 6-4, 7-8, 7-14
access to, 3-11
Break-Out Box access, 11-2—11-8
character set selection, 4-10 -4-11
Circuit Action Map, 4-32—4-33
clock source, 4-22
Com Mode, 4-6—4-7
communication options, 4-8—4-9
data display, 4-16—4-19

System Configuration Screen (cont.)
DLCI filtering, 4-32—4-33
emulation, 4-16—4-17, 4-24—4-27
exiting, 4-5
Expanded Decode, 4-16—4-17
Extended Address, 4-23
frame address selection, 4-10 -4-11
frame relay, 4-30—4-33
inverting signals, 4-22
loading files, 4-3
Media Status Box, 4-4—4-5, 4-22—4-23
miscellaneous options, 4-16—4-17
modem leads selection, 4-10—4-11
pod power, 4-22
protocol selection, 4-10—4-13
saving files, 4-3
selecting options, 4-4
Stream to Disk, 4-16—4-17
T-Pod remote access, 11-10
T-Pod Remote Control Screen, 4-22
time stamp, 4-16—4-17
trap action, 4-10—4-15
typical settings, 5-2—5-15
user character set, 4-28—4-29
System operating mode, 7-4
System requirements, 1-4—1-5, D-2

T

T-Pod, 4-22
macros for configuration, 11-12—11-13
Remote Control Screen, 11-10— 11-13
RESET function, 11-12
typical configuration settings, 5-10—5-11
T-Pod converter, 2-2, 2-12
T1 interface, 2-2, 2-12—2-13
Terminal emulation, 12-2—12-5
Test scripts, 13-2—13-5
editing, 13-12—13-13
loading, 13-6—13-7
running, 13-20—13-21
saving, 13-8—13-9
writing, 13-10—13-11
Time of Day
in PowerScript, 13-42
Time stamp, 9-12, 9-26
Timers, in PowerScript, 13-20, 13-38, 13-41, 13-42
Transmit (PowerScript) command, 13-18, 13-39—13-40
Trap action, 4-14—4-15
Trap String Definition Screen, 6-6—6-7, 6-10—6-13, E-5
Trap strings, 4-14, 13-41
and protocol macros, E-5
in PowerScript, 13-41
Traps, 6-2—6-3
definition 6-4—6-5
editing, 6-11—6-13
for frame relay, 6-16—6-17
frame selection, 6-10—6-11
macro definition, 6-14—6-15
set up, 6-4—6-5
status, 7-24—7-25
trap action, 6-8—6-9
Triggers, *SEE TRAP STRINGS*

U

User character set definition, 4-2, 4-10—4-11, 5-2, C-2
User-defined decode, 9-26, C-8—C-9

V

V.10 interface, 2-2, 2-8—2-9, 2-12
V.11 interface, 2-2, 2-8—2-9, 2-12
V.24 interface, 2-2—2-5
V.35 interface, 2-2, 2-6, 2-8, 2-10—2-12
typical configuration settings, 5-8—5-9
Verifying hardware installation, 1-10—1-11
Verifying software installation, 1-12—1-13
View Buffer, 9-2—9-39
access to, 3-11, 9-2
analyzing data, 9-22—9-29
ASCII files, 9-32, 9-34
Buffer Trace, 9-20, 9-30—9-31
current frame information, 9-12—9-13
definition, 9-4
display mode selection, 9-20—9-21
display modes, 9-22—9-29
elapsed time, 9-36
Expanded Decode, 9-28—9-29
exporting frames, 9-38—9-39
filters, 9-20, 9-30—9-31
Find and Find Next, 9-16—9-17
Find search strings, 9-18—9-19
format of buffer files, C-2—C-6
Goto, 9-14—9-15
loading files, 9-6—9-7
marker character, 9-12
moving around in, 9-10—9-11, 9-14—9-19
printouts, 9-32—9-35
saving files, 9-8—9-9

W

Wait until (PowerScript) command, 13-12, 13-18, 13-4, 13-43
Wait until keypress (PowerScript)
    command, 13-14
Window segment, 1-14; 1-18—1-19

X

X.25
    macros, list of, E-4
    typical configuration settings, 5-6—5-7
XMODEM file transfer, 12-2

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