HEWLETT PACKARD

HP 4972A
LAN
Protocol
Analyzer

HP 4972A LAN Performance Analysis User's Guide

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User's Guide

HEWLETT
PACKARD

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Safety

Prior to operation of the equipment you must examine the instrument and review this document to ensure you are completely familiar with all the safety markings and the operating instructions.

Warnings

The following *WARNINGs* define operating procedures, practices, etc., which, if not correctly followed, could result in personal injury or loss of life.

WARNING

This product is a Safety Class 1 instrument with a protective earth terminal.

WARNING

For protection from electric shock hazard, power cord ground must not be defeated.

Safety

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings in this manual violates safety standards of design, manufacture, and intended use of this instrument. Hewlett-Packard Company assumes no liability for the customer's failure to comply with these requirements.

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Do not replace components with the power cable connected. Dangerous voltages may be present even when the power cable is disconnected.

Do not perform internal servicing or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

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Rough handling or jarring of the instrument can break the CRT (cathode ray tube). The resulting implosion will scatter glass fragments at a high velocity. Removal or installation of the CRT is to be performed only by qualified maintenance personnel using approved safety mask and gloves.

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The installation of substitute parts or the installation of any instrument modification not authorized by Hewlett-Packard is specifically forbidden. The performance of such unauthorized service can negate the instrument warranty or any maintenance agreements.

Return the instrument to a Hewlett-Packard Sales and Service Office for authorized service and repair.

Manufacturer's Declaration

This certification is applicable to products shipped to Germany after June 1, 1985. This is to certify that the equipment

HP 4972A LAN Protocol Analyzer

is in accordance with the Radio Interference Requirements of Directive FTZ 1046/1984. The German Bundespost was notified that this equipment was put into circulation. The right to check this model type for compliance with these requirements was granted.

Additional Information for Test- and Measurement Equipment

Note: If Test and Measurement Equipment is operated with unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the Radio Interference Limits are still met at the border of his premises.

Herstellerbescheinigung

Hiermit wird bescheinigt, daß das Gerät/System

HP 4972A LAN Protocol Analyzer

in Übereinstimmung mit den Bestimmungen der Postverfügung 1046/84 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes/Systems angezeigt und die Berechtigung zur Überprüfung der Serie auf Einhaltung der Bestimmungen eingeräumt.

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Werden Meß- und Testgeräte mit ungeschirmten Kabeln und/oder in offenen Meßaufbauten verwendet, so ist vom Betreiber sicherzustellen, daß die Funk-entstörbestimmungen unter Betriebsbedingungen an seiner Grundstücksgrenze eingehalten werden.

Printing History

New editions are complete revisions of the manual. Update packages (formerly known as "Manual Changes") are issued between editions. They contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition or a new update is published. No information is incorporated into a reprinting unless it appears as a prior update. The edition does not change when an update is incorporated.

Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correlation between product updates and manual updates.

Edition 1...July 1987

Edition 2...November 1988

Edition 3..September 1989

Edition 4...June 1990

Problems? Call for Help

If you have problems operating your HP protocol analyzer or any of the applications, call the CTD Customer HelpLine or use your fax machine to send your questions.

HelpLine - (719) 531-4567
Fax - (719) 531-4505

Conventions

Critical instructions within the text of this publication are preceded by one or more of the following labels.

WARNING	All operating procedures, practices, etc., that must be performed in the specified manner to preclude the possibility of personal injury or loss of life are preceded by a "Warning" label.
CAUTION	All operating procedures, practices, etc., that must be performed in the specified manner to preclude the possibility of damaging the instrument or destroying programs or software are preceded by a "Caution" label.
NOTE	Explanatory comments or supplementary instructions are preceded by a "Note" label.

1

Using This Manual

This chapter describes the organization of this manual.

This manual documents the LAN Performance Analysis Application for the HP 4972A Local Area Network Protocol Analyzer.

If you are not familiar with the HP 4972A LAN Protocol Analyzer, introductory information is provided in the Getting Started manual.

Sections in this chapter include:

- Chapter Descriptions
- Conventions Used in this Manual

NOTE

The manual set refers to the HP 4972A LAN Protocol Analyzer as the HP 4972A, the protocol analyzer, and the analyzer.

The manual set also refers to the LAN Performance Analysis Application as Stats.

Chapter Descriptions

Using This Manual

Chapter 1 describes the purpose of the chapters in this manual. The descriptions group the chapters by functions.

Product Information and Installation

Chapter 2 provides a product description of the LAN Performance Analysis Application.

Chapter 3 describes how to install the application into the analyzer. Chapter 3 also describes how to remove this software application from the protocol analyzer.

Common Operating Considerations for Running Measurements

Chapter 4 provides information that is common to most of the measurements or functions of the Stats application. This chapter describes common features such as starting or stopping tests, changing the time periods for the measurements, or changing the scale of the displays.

Chapter 4 also summarizes running measurements in remote operation.

Common Operating Considerations for Displaying the Measurements

Chapter 5 describes the choices for displaying the measurements provided by the Stats application. Plotter pen assignments are shown for when graphic measurements are plotted.

Description of the Stats Measurements

Chapter 6 introduces you to the measurement classes that are provided by Stats.

Top Level Menu for Stats

Chapter 7 describes the Network Summary Menu. This menu is similar to the Top Level Menu for the analyzer. You can make softkey selections from this menu to control the operation of the Stats. In addition, the Network Summary Menu provides a summary of the activity happening on the network the protocol analyzer is attached to.

Setting up the Statistics Measurements

Chapter 8 describes how to set up the protocol analyzer and the Stats functions before beginning to perform measurements on the network operation.

Network Level Measurements

Chapters 9 through 15 describe measurements that apply to the entire network. This should be the first group of measurements you use when you begin to characterize your network's baseline performance.

Node Level Measurements

Chapters 16 through 22 describe measurements that apply to specific nodes on the network. After you have established your network's base or average performance, you can look at the operation of specific nodes on the network.

Transmitting on the Network

Chapters 23 through 26 describe measurements that let you actively transmit messages on the network and observe the results.

Running Tests Automatically and Logging Measurements

Chapter 27 describes how to create tests sequences to make performance measurements you want. You can automatically control the sequence of tests and the time of day when the tests are to be run.

Chapter 27 also describes logging measurements to a printer, plotter, or disc drive.

Conventions Used in this Manual

The LAN Performance Analysis Application uses softkeys to control its operation similar to the HP 4972A LAN Protocol Analyzer.

Conventions for using softkeys to control the application are the same as the analyzer softkey conventions. See the chapter, Using The Manuals, in the protocol analyzer Getting Started manual.

Topics that are described include:

- Softkey conventions
- Editing with keyboard keys
- Repeating keys
- Text entry conventions

2

Product Information

This chapter provides an introduction to the Stats application for the HP 4972A Local Area Network Protocol Analyzer.

Sections in this chapter include:

- Stats Introduction
- Stats Features
- Equipment Supplied with Stats

Introduction

The LAN Performance Analysis Application for the HP 4972A LAN Protocol Analyzer is an integrated set of Level 1 and Level 2 measurements for the International Standards Organization's (ISO) Open System Interconnect (OSI) reference model that let you analyze and manage your Local Area Network (LAN).

Statistics for higher level protocols can be measured by using some of the more general-purpose menus of the protocol analyzer with the Stats frame analysis measurements.

NOTE

HP 4972A system software, Revision B.03.03 or subsequent release, is required to operate the LAN Performance Analysis Application, Revision A.01.04.

The protocol analyzer requires at least 2.0 Mbytes internal memory the Stats application.

The Stats performance measurements are organized into three basic groups:

- Network Statistics
- Node Statistics
- Transmission Statistics

Measurements for each of these performance classes are described in later chapters.

Alarm Conditions

You can specify test limits for alarm conditions in the following measurement tests:

- Utilization
- Errors and collisions
- Number of connections to a node
- Channel acquisition time
- Network response time

Audible or visual signals can alert you when an alarm event occurs. You can also use the alarm event to make branch decisions when making automatic sequence measurements.

Automatic Sequence Measurements

An automatic sequence menu is provided for unattended network monitoring. This feature lets you program a sequence of measurements to perform. You can specify start and stop times for each measurement, and branch from one measurement to another when alarm conditions occur.

Logging can be used in conjunction with automatic sequence testing so that important network performance information is never lost.

Automatic Logging

Automatic logging lets you periodically copy statistics data that has been copied to a disc, printer, or plotter. Logging may also occur on "alarm" conditions you set up.

Color Monitor Operation

The Stats application supports HP 35741BX color monitor operation. See the "Installation" chapter in the protocol analyzer manual for information to install the color monitor.

Remote Performance Analysis

Stats performance measurements can be made at a remote location by using the protocol analyzer in its master/slave function.

Features

The LAN Performance Analysis Application can be used to:

- Provide visibility of basic network performance.
- Identify most active and problem nodes on the network.
- Provide simplified analysis of network loading problems.
- Provide simplified network response time measurement.
- Provide flexible and understandable display formats.
- Archive network performance information.
- Provide unattended monitoring.
- Provide unattended remote monitoring.

3

Loading the Application

The Stats application is resident on the hard disk of your HP 4972A if you have analyzer operating system software Revision B.01.00 or later. However, sometimes it may be necessary to reload your application due to software updates or if you accidently corrupt your hard disc.

This chapter describes how to install the Stats application software into the HP 4972A LAN Protocol Analyzer.

Sections in this chapter include:

- Loading the Stats Application
- Unloading an Application

Loading the Application

NOTE

HP 4972A system software, Revision B.03.03 or subsequent release, is required to operate the Stats LAN Performance Analysis Application Software, Revision A.01.04.

The protocol analyzer must have at least 2.0 Mbyte internal memory to load the Stats application.

Procedure

1. Install Stats floppy disc in the floppy disc drive.
2. From the analyzer Top Level Menu, press **<Disc Functions>**.
3. Press **<Select Volume>**.
4. Press **<LANAPP #3:>**.
5. Press **<Load File>**.
6. The analyzer displays:

   `Doing directory of #3:`

7. The analyzer prompts:

   `Select a file type to load.`

8. Press <Appl. File>.

9. The analyzer prompts:

   `Select softkey OR enter valid name:`

10. Press <STATS>.

11. The analyzer displays:

    `Loading 'STATS'`

12. After Stats is loaded, the analyzer prompts:

    `Select a file type to load.`

13. Press <EXIT> twice to display the analyzer Top Level Menu.

Starting the Application

1. From the Top Level Menu, press <Run Applic.>.

2. Press <Run Stats> to display the Stats Network Summary Menu.

Operation with Floppy Disc Drive

If the power is turned off and you are using the floppy disc to run the Stats application, the application must be loaded from floppy disc again when power is restored.

Operation with Winchester Disc Drive

You can copy the Stats application to the analyzer's hard disc. Then, if power is interrupted, it is more convenient to reload the application from the hard disc after power is restored.

Procedure

1. Install the Stats floppy disc in the floppy disc drive slot.

2. From the analyzer Top Level Menu, press <Disc Functions>.

3. Press <Copy File>.

4. The analyzer prompts:

   `Copy file FROM which volume?`

5. Press <LANAPP #3:>.

6. Press <All Files>.

7. The analyzer prompts:

   `Copy file TO which volume?`

8. Press <HARDSC #13:>.

9. The analyzer displays a list of files that are to be copied and displays <Begin Copy>.

10. Press <Begin Copy>.

11. When the copy function is complete, the analyzer displays the menu to copy another file.

Starting the Stats Application from HARDSC

1. Press <EXIT> to return to the analyzer Top Level Menu.

2. Press <Disc Functions>.

3. Press <Load File>.

4. The analyzer prompts:

   `Select a file type to load.`

5. Press <Appl. File>.

6. The analyzer prompts:

   `Select softkey OR enter valid name:`

7. Press <Stats>.

8. After Stats is loaded, press <EXIT> to return to the analyzer Top Level Menu.

9. Press <Run Applic>.

10. Press <Run Stats> to start the Stats application.

Unloading an Application

When large programs and node lists have been created, an error message may be displayed that indicates not enough memory is available for some analyzer operation. You may want to remove the Stats application from the analyzer's memory.

To delete the Stats application, use the following procedure:

Procedure

1. From the analyzer Top Level Menu, press **<Run Applic.>**.

2. Press **<Unload Appl.>**.

3. Press **<EXIT>** to return to the analyzer Top Level Menu.

   The memory space previously occupied by the Stats application is now available for other protocol analyzer operations.

4

Running the Tests

Some of the functions used to control or modify the Stats performance tests are common to all the measurements. This chapter describes commonly shared softkeys and functions that can be used to control or modify Stats performance measurement tests.

Functions described in this chapter include:

- What/When Can You Change Tests?
- Setting Test Times
- Setting Display Ranges
- Autoscaling the Graphs
- Choosing Time Scale for Displays
- Starting and Stopping the Tests
- Averaging the Measurements
- Saving a Measurement
- Using Statistics in Remote Mode

What/When Can You Change Tests?

Some of the measurement and display parameters have to be set before starting the test. Other parameters may be changed during or after the measurements. The following list shows some of the measurement and display parameters you can control.

Measurement Parameters you MUST set BEFORE test start:

- Set Test Times
- Enable/Disable Alarm
- Change Alarm Values
- Change Measurement Storage

Display Parameters you can change DURING or AFTER measurements:

- Select autoscale ON/OFF
- Change time display (Elapsed/Absolute)

Display Parameters you can change AFTER tests (post processing):

- Change horizontal axis (time scale) limits
- Change vertical axis Limits
- Change time display (Elapsed/Absolute)

Setting Test Times

Before you begin a test, you can choose how long to let the test run and also how often to update the display. During the test, the display shows what day, month, year and hour, minute, second the start test key was pressed. After the test is stopped, the display shows what day, month year and hour, minute, second the test ended.

The lines shown below are displayed at the bottom of the performance measurements:

```
        / what time the                      /  what time the
       /   test is to start                 /   test is to end
      /                                    /
Start time = DD MM YY  HH:MM:SS      Stop time = DD MM YY  HH:MM:SS
Measurement time = ttt SECONDS        Sample time = XX SECONDS
      \                                    \
       \_ how long to                       \_ how often to update
          run the test                         the display
```

Softkey	Description
<Set Test Time>	displays softkeys for setting how long to run the test, <Set Meas. Time>, and how often to update the display, <Set Samp. Time>.
<Set Meas. Time>	lets you choose how long to run the test.

Press <Set Meas. Time> to display the current measurement time in a highlighted field. Type a new entry for the measurement time you want. To complete the entry, press [RETURN] or press a softkey to select the unit of measurement time. The choices are: seconds, minutes, hours or days. For example:

```
600 Seconds      35 Hours
 75 Minutes      15 Days
```

Softkey	Description
<Set Sample Time>	The sample time is used to control updating the measurement stored and displayed data. The analyzer does not "sample" the network, it sees all the measurement events occurring on the network and calculates an average value for all the measurement events happening during each sample time.

Updating the Display

Line graphs are updated with the new average value for each sample time.

Bar graphs are updated using an average of several sample periods. Use **<Set Test Times>** and **<Set # of Samp/Avg.>** to control how many sample times to use for updating the graph.

Bar graphs with numeric data and Pie graphs are also normally updated using an average of several sample times. The analyzer updates the running display as fast as it can. If it cannot update fast enough to display every sample, it skips displaying some samples and shows the most recent sample. When the measurement stops, you can use the cursor to see each sample period display. This is similar to the analyzer Examine Data display when monitoring the network.

Tabular displays are updated with the new average value for each sample time.

Entering a New Sample Time

Entering a new sample time <Set Sample Time> lets you vary how often the displayed test data is updated. Test sample time must be equal to or less than the test measurement period.

Type a new entry for the sample time you want. Press [RETURN] or press a softkey for a new unit of sample time. Units of time for sample periods are: seconds, minutes, or hours.

For any measurement using a time axis graph, the analyzer can store up to 360 samples. In measurements such as Node List Stats, a time axis is not used. The measurement displays a node list at the end of the test. Similarly, node matrix measurements do not use a time axis. They show an instantaneous measurement.

If you need to store a time axis measurement, the smallest sample time is one second. For 360 samples, the measurement period is six minutes. The longest sample period of four hours requires 60 days for 360 samples.

If you need to run a test for longer than 360 samples, you can use the log to disc function to store your test results.

The following table lists examples of different test sample times and test measurement times to get 360 samples per measurement period.

Table 4-1. Sample Time vs Measurement Time Periods

Sample Time	Measurement Time for 360 Samples	Sample periods in each minute	Sample periods in each hour
-------	---------------	--------------------	------------------
1 sec	6 min	60	3600
2 sec	12 min	30	1800
3 sec	18 min	20	1200
4 sec	24 min	15	900
5 sec	30 min	12	720
6 sec	36 min	10	600
10 sec	1 hr	6	360
20 sec	2 hr	3	180
30 sec	3 hr	2	120
60 sec	6 hr	1	60
80 sec	8 hr	0.75	45
2 min	12 hr	0.5	30
3 min	18 hr	0.3	20
0.25	24 hr	0.25	15
5 min	30 hr	0.20	12
6 min	36 hr	0.10	10
20 min	5 days	0.050	3
28 min	7 days	0.0357	2.14
2 hours	30 days	0.0833	0.5
4 hours	60 days	0.04165	0.25

Setting Display Ranges

While a test is running or stopped, you can change the limits or bounds of the vertical or horizontal axis to display better resolution. You can change the upper limit of an axis as well as the lower limit.

Softkeys are displayed to let you change the upper and/or lower axis bounds. The softkey labels will vary depending on the axis function. Examples of softkeys to change display axis bounds include:

<Set Util. Low Bound>
<Set Util. Hi Bound>

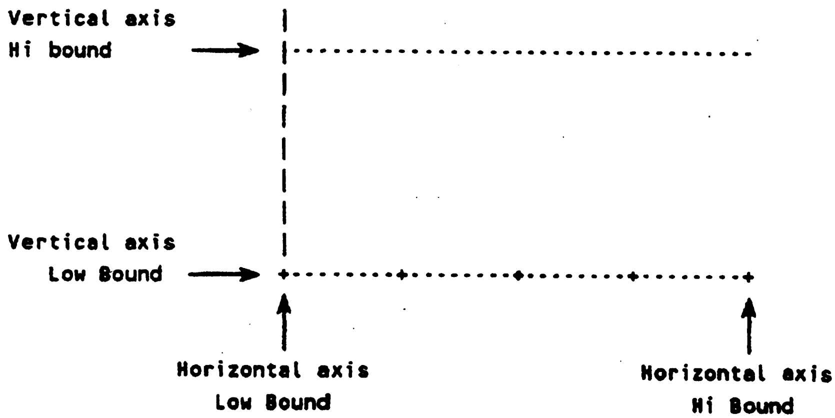
<Set Error Low Bound>
<Set Error Hi Bound>

<Set Len. Low Bound>
<Set Len. Hi Bound>

<Set Time Low Bound>
<Set Time Hi Bound>

<Set % Low Bound>
<Set % Hi Bound>

Softkey	Description
<Set xxxx Low Bound>	lets you set the lower limit for the axis. Try to select lower value than you would expect for the test data.
<Set xxxx Hi Bound>	lets you set the upper limit for the axis. To increase resolution of the displayed test data, try to set the upper bound to the lowest value you expect the test data not to exceed.



Autoscaling the Graphs

The limits or bounds of the data being tested is not always predictable. When major problems occur on the network, it is possible for the test data to exceed the limits on your graph. When test data exceeds the bounds of a graph, the usual display would simply clip the data and show a flattened graph at that region.

A convenient feature of the Stats application lets you choose whether to automatically rescale the graph. You may want to rescale the graph when test data exceeds the graph bounds or the graph bounds are so wide the display does not show enough resolution.

You can select the autoscale function before, during, or after a test.

Softkey	Description
<Autoscale On>	is the default mode for the graphic displays. This softkey lets the protocol analyzer increase or decrease the graph scale. Increasing the graph scale helps to eliminate any peaks or spikes in test data from being clipped on the display. Decreasing the graph scale can provide more resolution. Vertical graph limits cannot be entered when autoscaling is enabled; the message: "WARNING :AUTOSCALE IS ON. GRAPH LIMIT WILL NOT CHANGE." is displayed.
<Autoscale Off>	disables the autoscaling feature. You may not want to use autoscaling if most of the data is within the graph bounds and you do not want to lose resolution of the majority of the data.

Choosing Time Scale for Displays

While a test is running or stopped, you can change the scale for the time axis on graphs to be elapsed time from start of test or to be the time of day.

Softkey	Description
<Set Test Display> **<Set Table Ranges>** **<Set Graph Ranges>**	control selecting the time scale for measurements using a time axis. The choices are **<Elapsed Time>** and **<Absolute Time>**
<Elapsed Time>	shows the time axis on graphs as time from when the test started. The example below shows a time scale for 75 minutes.
<Absolute Time>	shows the time axis on graphs as the time of day. The example below also shows a time scale of 75 minutes for a test that occurred between 3:00 o'clock and 4:15 o'clock on February 15.

Elapsed Time example:

```
+---------+---------+---------+---------+---------+
0.0      15.0      30.0      45.0      60.00     75.0
```

Absolute Time example:

```
+---------+---------+---------+---------+---------+
15 Feb    15 Feb    15 Feb    15 Feb    15 Feb    15 Feb
03:00:00  03:15:00  03:30:00  03:45:00  04:00:00  04:15:00
```

The protocol analyzer automatically scales the clock time period to reflect the measurement time period you have chosen. The measurement time period is divided by the integers: 3, 5, 6, 7, 8 for convenient time intervals on the graph.

Starting and Stopping the Tests

After you select a measurement, **<Start Test>** is displayed. Press **<Start Test>** to begin the test you have selected. The protocol analyzer begins the test and information is displayed.

Displayed softkeys let you control the test progress.

```
Start Test
   Stop Test
   Stop Display
      Resume Display
```

Softkey	Description
<Start Test>	Press this softkey to begin the test you have selected. When you start the test, data is collected for the measurement and stored in the protocol analyzer. As the statistical data is acquired, it is converted into the display format and shown on the screen. When you start a test, the time for the first sample period must occur before the display begins. For example, if you use a 30 second sample period, the analyzer collects data for 30 seconds before the display begins to show the measurement. For four hour sample periods, display does not begin until the first four hours of measurement data has been collected. After you begin a test, softkeys listed above are displayed to control the test. You can end the test, freeze the display while continuing to collect data, change display parameters, and also change the display format without disturbing the test currently in progress.

After a test is started, softkey choices are displayed to let you end the test or freeze the display while continuing to collect data for a test you are currently running.

Softkey	Description
<Stop Test>	This softkey ends the data acquisition. Line graphs show the complete measurement up to the time the test stopped. Bar graphs, pie graphs and tables return to the first sample period display. If you have stopped a test, you cannot continue the test. You must press <Start Test> and begin a new measurement.
<Stop Display>	In bar graphs, pie graphs, and tables, you can freeze the display and at the same time keep acquiring new data. When events are occurring very rapidly, this lets you closely examine data that has already been captured while still letting new data be stored. When <Stop Display> is pressed, the softkey display changes to <Resume Display>.
<Resume Display>	Press <Resume Display> to begin displaying new measurement data.

Averaging the Measurements

Why Average Measurements?

Events occur very rapidly on a Local Area Network. In order to show a measurement that can be interpreted easily, it is often convenient to display an average of events occurring over some small amount of time.

In all the Stats measurements except <Channel Acquis.> and <Response Time>, the default sample period is one second. The analyzer records the measurement events during each sample period and calculates a single average value for that sample period. The analyzer can display a point, bar, or pie graphic display or a table showing an average of all events that occurred during the last sample period.

Point-line graphs show the continuous measurement from the start of the test which makes it easy to follow the activity if events rapidly increase or decrease from one sample period to another. In contrast, bar graphs and pie graphs measurements may not be as easy to interpret if the average of events changes rapidly from one measurement period to the next.

An additional averaging can be used in the Stats to let you smooth or average the measurement data for a variable number of sample periods. This slows down abrupt changes in bar or pie graphs and makes it much easier to interpret a measurement as it occurs.

It is possible to not use averaging and just make the sample time longer. This would let the display change at a slower rate and it would be still be easy to watch a measurement run. The argument against just using longer sample times is that when the measurement ends, you lose resolution if the display is scrolled.

What Types of Additional Averaging are Used?

Average from Start of Test
Average for Fixed Length of Time

The Stats Top Level Menu, the Network Summary Menu, uses these types of averaging. Averaging from the start of a test lets you run a test for a long period of time and get a single average value. Averaging for a fixed length of time is used in the Network Summary Menu since it has a fixed sample period of one second.

Averaging for a Number of Sample Periods

This is the most common averaging you can add to the measurements. **<Set # of Samp/Avg.>** lets you select how many sample periods you want to use for additionally averaging a measurement display.

Averaging by a selected number of samples can be used in the following measurements:

```
All Bar graphs
All Pie Graphs
Tables
        Network Summary Menu
        Network Summary Measurement
        Node/Network Statistics
                Statistics Summary for selected node
```

Averaging by some number of samples is particularly helpful in the **<Node Stats> <Commun. Matrix>** measurement. The dot pattern can change so rapidly that you cannot interpret the information or identify dots to rows and columns. Using only a few sample times to average the display makes it easier to interpret the data.

Averaging from Start

The Network Summary Menu lets you display values that show an average of events since the start of the test. The average value is updated after each sample period.

```
Sample Periods  |...|...|...|...|...|...|...|...|...|...|...|...|

   Average
 from Start     |...........................|
                                            |
                                            |

                          The total count of measurement events since start of test is
                          divided by the total count of frames that occurred since start
                          of test.
```

Moving Average Periods

<Set # of Samp/Avg.> and **<Set Err. Average>** let you calculate and display a "moving" average for the measurement. The moving average measurement value is updated at each sample time.

```
Sample Periods  |...|...|...|...|...|...|...|...|...|...|...|...|

                |...........|
                    |...........|
                        |...........|
                            |...........|
                                        |
                                        |

                          Only events occurring during the last "average" period update
                          the display.  Events from previous "average" periods are
                          dropped.

                          Until the analyzer reaches the specified number of sample
                          periods, it averages however many it has.
```

Averaging after the Measurement Ends

Display averages can be changed after the measurement ends.

For example, after a measurement ends, you can use [NEXT] or [PREV] to find a specific sample time you want to inspect.

The default average time for pie graphs is 10 sample periods. This means that as you scroll through a completed measurement, each separate display is an average of the 10 previous sample periods.

Use <Set # of Samp/Avg.> to change the number of samples for averaging the display. If you set the average for one sample period, each sample time shows the smallest resolution for the measurement as you scroll through the measurement.

You can also change the number of sample periods per average to a larger number to show more of an overall average for the test.

Correlating Tabular Displays to Averaged Graphic Displays

Remember that tabular displays always show a one sample snapshot of the monitored activity (measurements with selectable averaging have a default sample/average of one second).

As you scroll through a measurement and switch between graphs and the table display, the values may not seem to match for a given sample period. The reason is that the "picture" is probably an average over several sample periods and the table is not.

To correlate tabular displays to a pie graph or bar graph, use <Set # of Samp/Avg.> to set the graph display average to one sample period.

Saving a Measurement

After you perform a measurement, you can save that measurement and any other measurements that run simultaneously to your system disc drive. Simultaneous measurements are described in the Classes of Performance Measurements chapter of this manual.

Saving the Measurement File

1. Make the measurement you want to save.

2. Press <EXIT> to return to the Stats Network Summary Menu. DO NOT go to the analyzer's Top Level Menu.

   If you exit the Stats menus, the statistics buffer is erased and the last measurement is removed.

3. To save the measurement(s), press:

   - **<Set Up Stats>**
   - **<Disc Functions>**
   - **<Save File>**
   - **<Stats Data>**

4. The measurement currently in the statistics buffer (and any other simultaneous measurements) is saved to the selected file.

Retrieving the Measurement File

1. From the Stats Network Summary Menu, press the following softkeys to select the statistics data file you want to load into the analyzer:

   - **<Set Up Stats>**
   - **<Disc Functions>**
   - **<Load File>**

NOTE

Up to 360 samples of the last measurement(s) is saved to the disc file. In the Network Summary Measurement, if the test had run longer than 360 samples, the **Total Bytes**, **Total Frames** counts only show the totals for the last 360 samples.

Using Statistics in Remote Mode

The LAN Performance Analysis Application measurements can be performed using the protocol analyzer in remote operation.

This section provides a summary for using the Stats application remote operation. Detailed information about remote operation for the protocol analyzer is in the analyzer's Operating Manual.

Getting Remote Control

For remote operation, you need two protocol analyzers with an RS-232 data communications interface installed in each analyzer. The analyzers must be connected through the RS-232 link.

1. Use <Set Up Analyzer> and <I/O Functions> from the analyzer's Top Level Menu to begin remote operation.

2. At the master analyzer, press <Capture Slave>.

   Messages are displayed to indicate the capture is in process. When the capture is complete, the master analyzer displays:

   `You are now controlling the remote analyzer. IO:    :`

   If the slave analyzer is busy when the master asks for control, the slave finishes its operation before processing the request. If more than 10 seconds elapse with no response from the slave, the master times out. Wait a few minutes and press <Capture Slave> again.

If the master analyzer is not able to gain control of the slave analyzer, several steps are listed below that may help you resolve the problem.

1. Press <I/O Function> at each analyzer.

   Verify the configuration table is the same for each device.

2. Verify <Enable I/O*> is active at each protocol analyzer. An asterisk (*) is displayed in the <Enable I/O> when it is enabled.

   I/O messages are displayed at the lower right corner of the screen. See IO STATUS tables in the Master/Slave chapter of the protocol analyzer Operating Manual.

3. Verify the connections from each protocol analyzer to its modem.

Loading Stats Application in the Remote Analyzer

The Stats application must be loaded from the slave analyzer's disc drive. The application cannot be loaded from the master analyzer's disc drive over the remote link.

Use the Slave Analyzer's Disc Drive

For the Stats application, you must use the slave analyzer's disc drive. This provides the fastest operation for logging measurements and alarms to a disc drive.

Running the Measurements

In remote operation, measurements using <Graphic Format> displays cannot be run. Only measurements using <Tabular Format> displays may be run.

Considerations for remote operation include:

Master	Visual alarm is a message displayed in error message field. Audible alarm is single tone beep.
Slave	Visual alarm is the flashing border of the display. Audible alarm is dual-tone beep.

Automatic Sequence Measurements in Remote Mode

Measurements using table format displays can be run in remote mode with the Automatic Sequence menu.

Ending the Remote Link

To end the link between a master and slave analyzer, press [BREAK] or [STOP] at either analyzer.

5

Displaying the Measurements

This chapter describes the display features provided by the Stats application.

- Types of Display Formats
- Displaying Subsets of the Measurement
- Scrolling the Display
- Plotting Graph Displays
- Test Measurement Time vs Time Axis on Graphs

Types of Display Formats

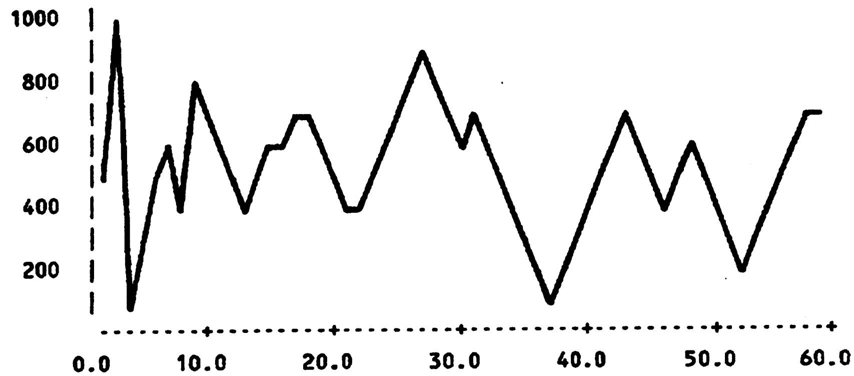
Stats performance measurements usually include two softkeys for choosing the display format. **<Tabular Format>** and **<Graphic Format>** toggle with each other. Only one of these format functions may be enabled at a time.

Softkey	Description
<Graphic Format>	Each graphic display in a measurement group shows a unique measurement. **<Graphic Format>** shows individual measurements in several formats. **<Graphic Format>** displays include: Bar charts Pie charts Line graphs Bar and Pie charts update in a similar manner. That is, a sample time of less than 5 seconds will have an update rate greater than 5 seconds and less than 10 seconds. Conversely, a sample time of greater than or equal to 5 seconds will have an equal update rate.
<Tabular Format>	shows a detailed summary display of the individual measurements made in the graphic format displays.

Displaying Subsets of the Measurement

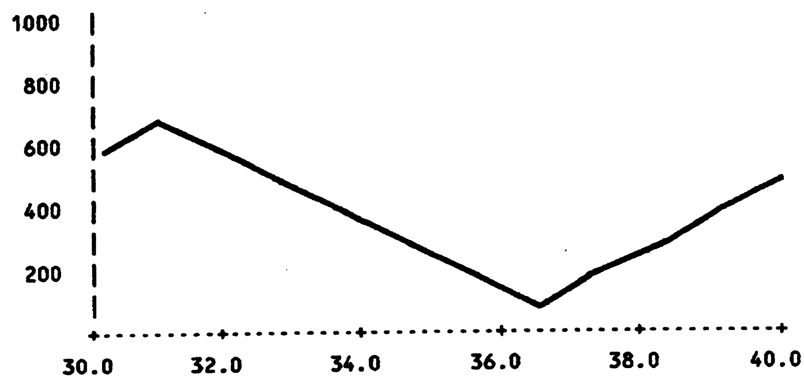
After a measurement is completed, you can display only a portion or subset of the measurement. **<Set Graph Ranges>** lets you change the horizontal axis (time axis) limits to begin and end the display at any points within the measurement.

Normal 60 second measurement



To view only the events during 30 to 40 second time period, press <Set Time Low Bound> and enter 30 seconds. Press <Set Time Bound> and enter 40 seconds. The graph is redisplayed with only sample times between 30 and 40 seconds.

Subset display for 30 to 40 second period



Scrolling the Display

After a measurement is stopped, a cursor function is available to scroll the measurement. Press <Cursor On> to enable the cursor function.

Line Graph Cursor

In line graphs, the cursor position is indicated by a vertical line on the display. Where ever the cursor is located, the numeric value of the sample period marked by the cursor is shown in the left corner of the display below the graph.

You can use the [ARROW] keys to move the cursor from one end of the graph to the other end. You cannot move the cursor to samples beyond the bounds of the displayed samples. You do not see what happened before or after the 360 samples show on the display.

The [PREV] and [NEXT] keys move the cursor in increments of 10 data points left or right respectively.

Tables and Bar and Pie Graphs

In <Tabular Format> or bar and pie graphs, you view a display for a selected sample period.

Use [NEXT] and [PREV] to move the display to the sample period you want to view.

For bar and pie graphs, the Time = 00:00:00 field below the display shows the position of the cursor in the measurement. Press [NEXT] or [PREV] and observe the Time = 00:xx:xx field and the display change.

For table displays, as you press [NEXT] or [PREV], the measurement time on the display increments or decrements.

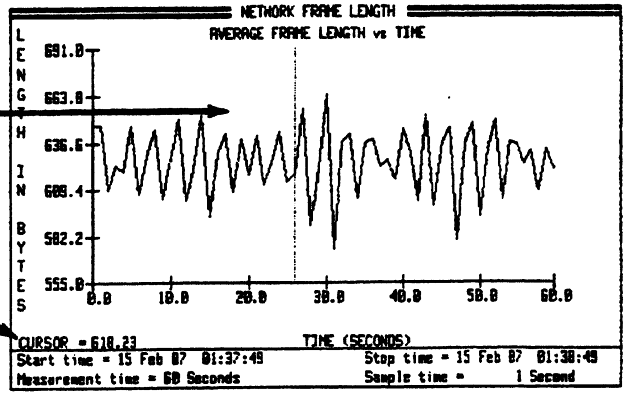
Common Cursor Position

Within a measurement, when you move the cursor for one display, the cursor position is also moved for the other displays of that measurement.

LINE GRAPH

Move cursor with [ARROW] keys.

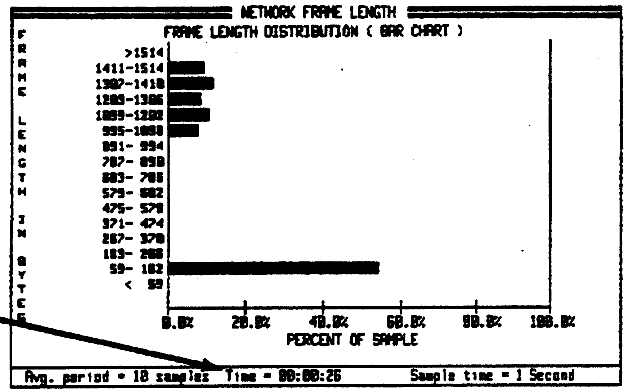
Averaged numeric readout for selected sample period.



BAR GRAPH

Move cursor with [NEXT] or [PREV].

Current selected sample period.



PIE GRAPH

Move cursor with [NEXT] or [PREV].

Current selected sample period.

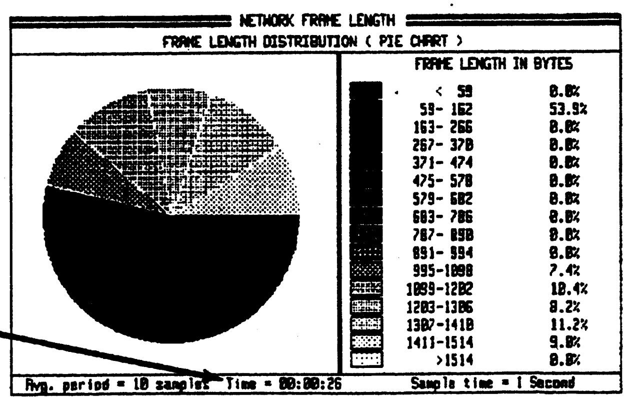


Figure 5-1. Cursor Operation in Graphic Format

NETWORK FRAME LENGTH

15 Feb 87 AVERAGE FRAME LENGTH AND FRAME LENGTH DISTRIBUTION 03:00:19

ELAPSED TIME	AVERAGE LENGTH	FRAME LENGTH DISTRIBUTION BYTES	%	COUNT	BYTES	%	COUNT
00:00:26	618.2	< 59	0.0%	0	787- 890	0.0%	0
		59- 162	54.7%	47	891- 994	0.0%	0
		163- 266	0.0%	0	995-1098	7.0%	6
		267- 370	0.0%	0	1099-1202	9.3%	8
		371- 474	0.0%	0	1203-1306	9.3%	8
		475- 578	0.0%	0	1307-1410	9.3%	8
		579- 682	0.0%	0	1411-1514	10.5%	9
		683- 786	0.0%	0	>1514	0.0%	0

Start time = 15 Feb 87 01:37:49 Stop time = 15 Feb 87 01:38:49

Measurement time = 60 Seconds Sample time = 1 Second

Sample period for current cursor position.

Move cursor with [NEXT] or [PREV].

Figure 5-2. Cursor Operation in Tabular Format

Plotting Graph Displays

Plotters with HP-GL capability can be used to plot the Stats graphic displays. Point-line, bar, and pie graphs can be plotted. <Tabular Format> displays cannot be output to a plotter.

Multiple pens can be used to plot elements of the graphs in different colors. The following figures show what pens are used for the different elements of the graphs.

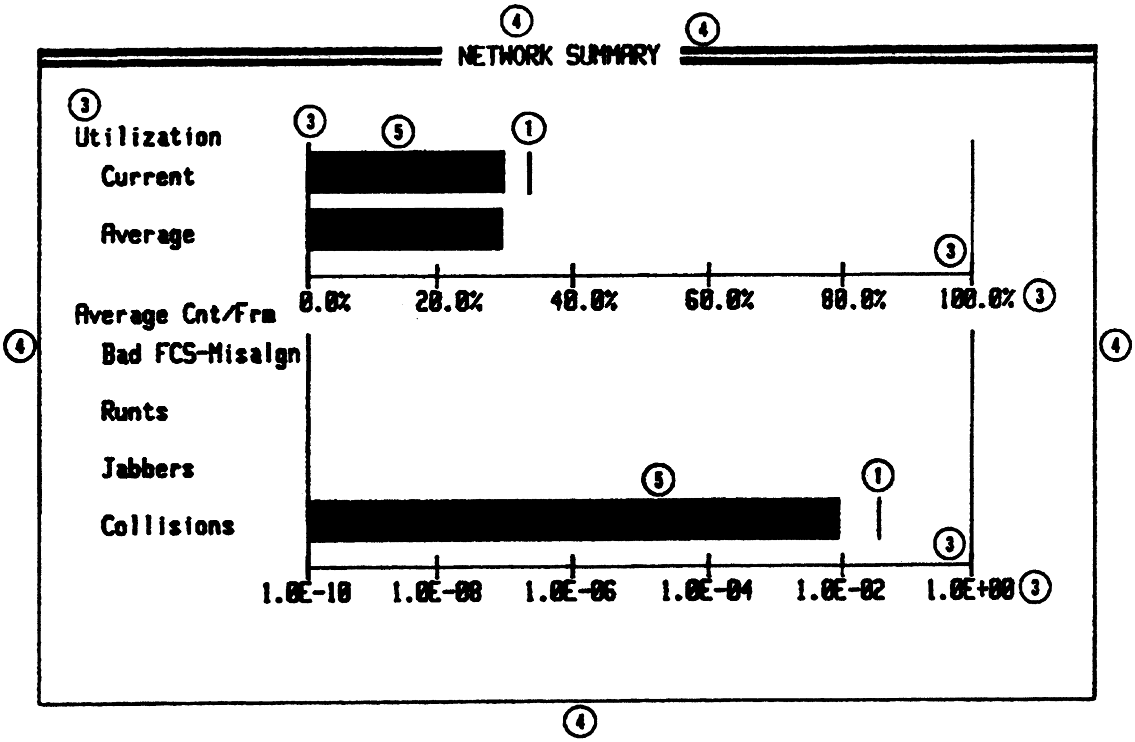


Figure 5-3. Network Summary Bar Graph

PEN NUMBER	COMMENTS
1	-
2	- Not used
3	-
4	-
5	-
6	- Not used

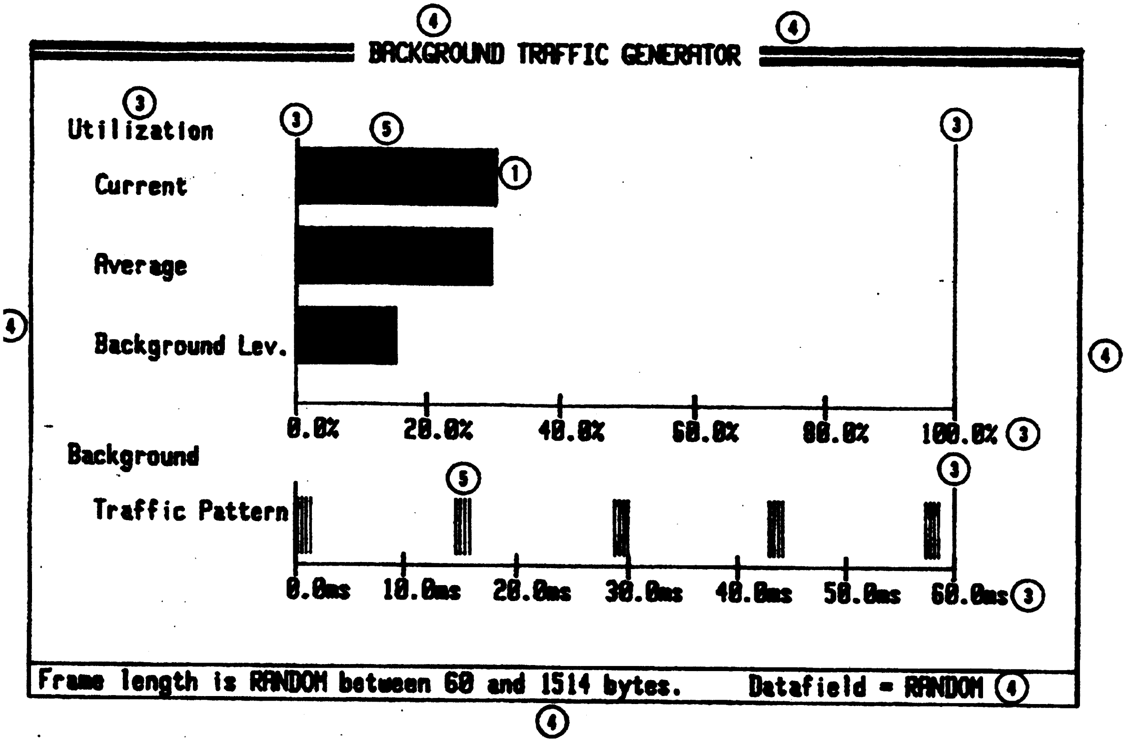


Figure 5-4. Transmit Background Traffic Generator Bar Graph

PEN NUMBER	COMMENTS
1	-
2	- Not used
3	-
4	-
5	-
6	- Not used

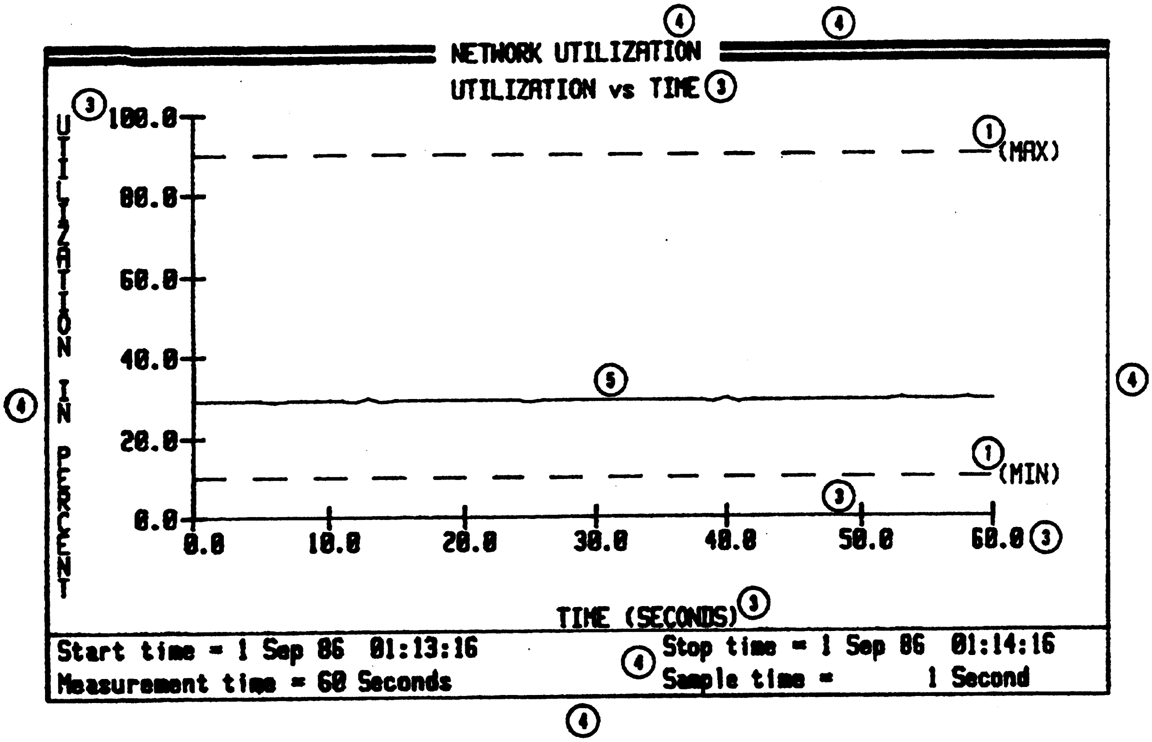


Figure 5-5. Measurement Line Graphs

PEN NUMBER	COMMENTS
1	-
2	- Not used
3	-
4	-
5	-
6	- Not used

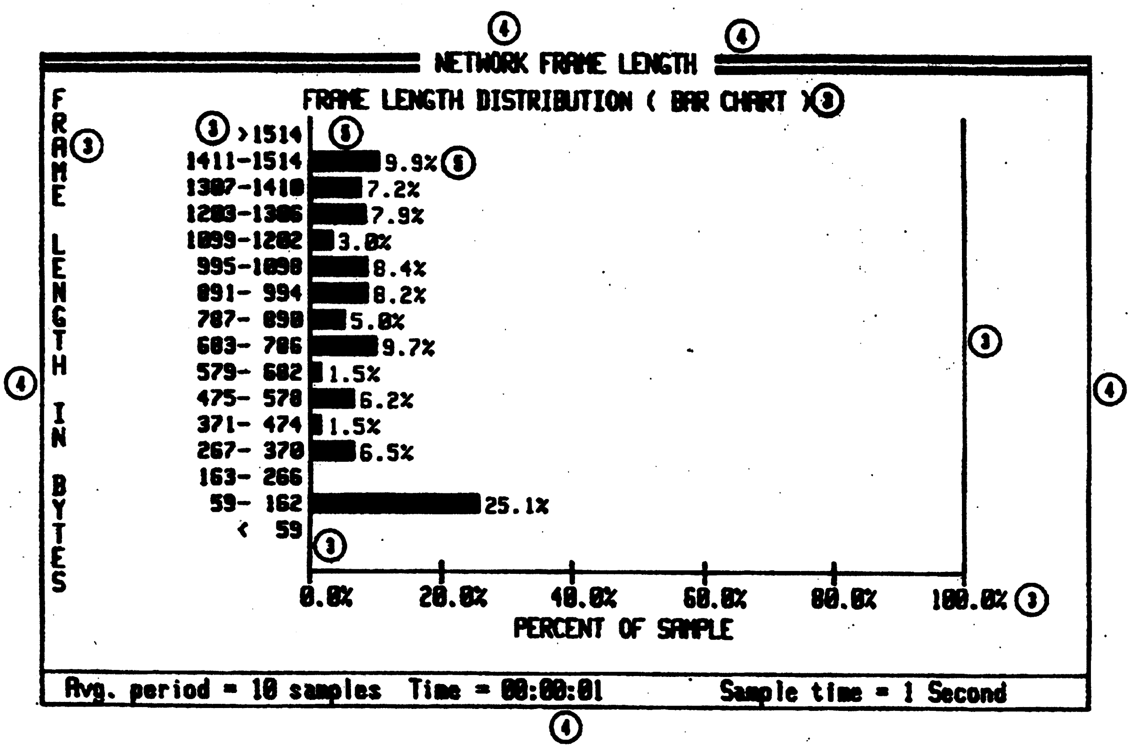


Figure 5-6. Measurement Bar Graphs

PEN NUMBER	COMMENTS
1	- Not used
2	- Not used
3	-
4	-
5	-
6	- Not used

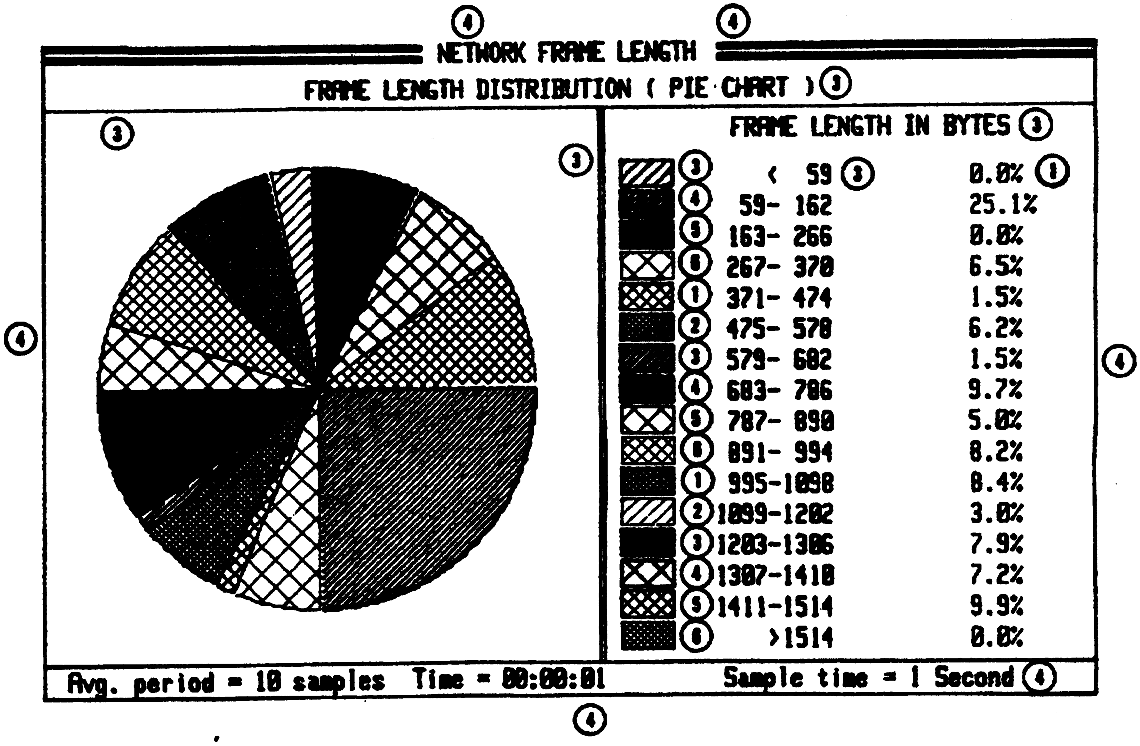


Figure 5-7. Measurement Pie Graphs

PEN NUMBER	COMMENTS
1	-All
2	-pens
3	-are
4	-used
5	-
6	-

Test Measurement Time vs Time Axis on Graph

The default measurement time for all measurements is 60 seconds. However, <Set Meas. Time> lets you change the length of time for a measurement to run.

If you change the measurement time in <Graphic Format> displays, the graph's time-axis limits are automatically set for optimum display of the selected time.

Measure Time Less Than 360 Samples

If the measurement time is set for less than 360 samples, the graph's time axis is set equal to the measurement time period. The length of each sample is adjusted to fill the time axis.

Measurement Time = 360 Samples

If the measurement time is equal to 360 samples, the display shows the complete test.

Measurement Time Greater than 360 Samples

If the measurement time is set for more than 360 samples, the graph's time axis is set to display the first 360 samples. As the measurement passes 360 samples, the display is cleared and the time axis is set to show the next 360 samples. The display updates after each 360 samples until the end of the test.

After the test ends, the display changes to show the last 360 samples.

Color Display with Monochrome Monitor

You can use the HP 4972A with a color monitor. In Hardware Functions Menu, the field, **Display type:**, is displayed when the color monitor option board is installed.

If you select **35741A Color** for the display type, the HP 4972A monochrome display does not show display elements using the red and blue primary colors; only green display elements are displayed.

A color monitor shows all the screen elements.

To view all the display elements on the HP 4972A internal monochrome display, set the Hardware Functions Menu **Display Type:** field to **Monochrome**.

6

Classes of Performance Measurements

This chapter describes the different types or classes of performance measurements you can make with the LAN Performance Analysis Application.

Sections in this chapter include:

- Classes of Performance Measurement
- Network Statistics Performance Measurement Class
- Node Statistics Performance Measurement Class
- Transmit Statistics Performance Measurement Class
- Simultaneous Performance Measurements

Classes of Performance Measurements

Softkeys located at the bottom of the Stats Network Summary Menu let you choose between three different classes of performance measurements. The three classes of measurements are described below.

Softkey	Description
<Network Stats>	measurement class provides a network-wide view of your LAN activity. Activity can be measured for nodes active during the measurement time.
<Node Stats>	measurement class provides measurements concerning a particular node, between a specific node and other nodes, and between pairs or nodes.
<Transmit Stats>	measurement class provides measurements for the time the protocol analyzer needs to acquire the network and the time for other nodes to respond to messages sent by the analyzer. Traffic can be added to the network while performance measurements are taken to see how the network responds to different network loads.

Network Stats Performance Measurement Class

From the Stats Network Summary Menu, press **<Network Stats>** to display the Help Menu shown below. The Help Menu provides a quick reference for each measurement group in the **<Network Stats>** measurement class.

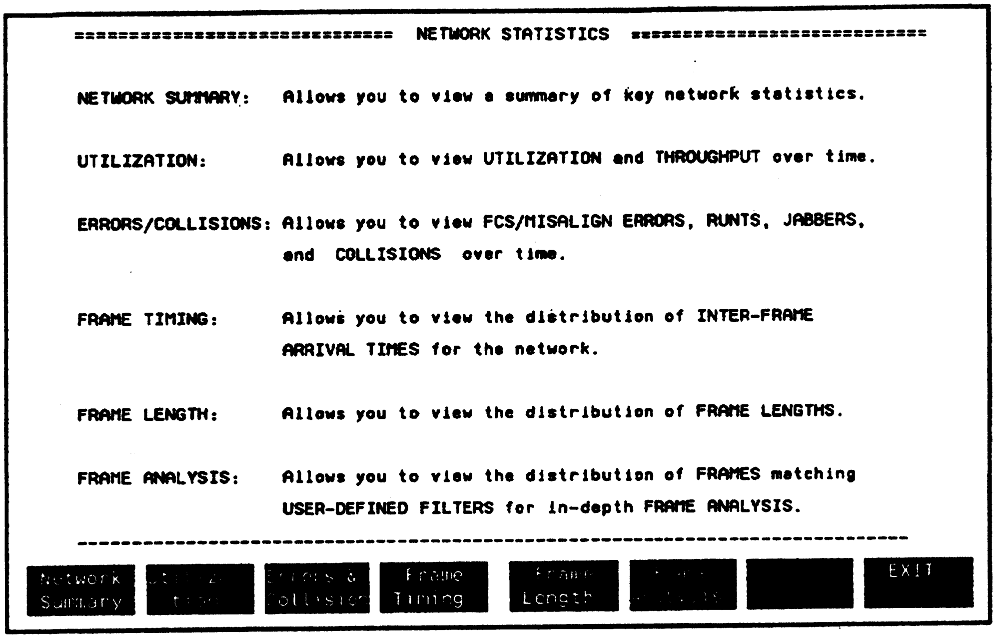


Figure 6-1. <Network Stats> Help Menu

The table below shows the separate measurements you can choose from each group of the <Network Stats> class of measurements.

Table 6-1. Network Statistics Measurement Class

Measurement Group	Graphic Format Measurements	Tabular Format Measurements
Network Summary	NETWORK SUMMARY	NETWORK SUMMARY
Utilization	<Utilization %> <Throughput f/s> <Throughput kb/s>	NETWORK UTILIZATION
Errors & Collisions	<All Errors> <Bad FCS/Misaligns> <Runts> <Jabbers> <Collisions>	NETWORK ERRORS & COLLISIONS
Frame Timing	<Intrfrm Space Bar> <Intrfrm Space Pie>	NETWORK FRAME TIMING
Frame Length	<Avg. Len. vs Time> <Frm Len. Dist Bar> <Frm Len. Dist Pie>	NETWORK FRAME LENGTH
Frame Analysis	<Frame Anal. Dist Bar> <Frame Anal. Dist Pie>	NETWORK FRAME ANALYSIS Analysis Group Distribution

<Node Stats>
Performance Measurement Class

From the Stats Network Summary Menu, press **<Node Stats>** to display brief summaries of the performance measurements in the Node Stats Menu. This menu provides a quick reference for each measurement group in the **<Node Stats>** measurement class.

```
=============================== NODE STATISTICS ===============================

NODE LIST STATS:     This menu allows you to collect transmit and receive
                     statistics for each active node in the NODE LIST.

CONNECTION STATS:    This menu allows you to collect statistics for logical
                     logical connections on the network.

NODE/NET SUMMARY:    This menu allows you to compare individual node
                     statistics to the network as a whole.

FRAME TIMING:        This menu allows you to do node frame timing.

FRAME LENGTH:        This menu allows you to do node frame length statistics.

FRAME ANALYSIS:      This menu allows you to do node frame analysis.

| Node List | Connect  | Node/Net | Frame  | Frame  | Frame    |  | EXIT |
|   Stats   | ion Stat | Summary  | Timing | Length | Analysis |  |      |
```

Figure 6-2. Node Stats Help Menu

The table below shows the types of displays you can choose for each measurement group from the <**Node Stats**> class of measurements.

Table 6-2. Node Statistics Measurement Class

Measurement Group	Graphic Format Measurements	Tabular Format Measurements
Node List Stats	none	Node List Statistics
Connection	<Comm. Matrix> <Source vs Dest>	<Comm. Matrix> <Source vs Dest>
	<Comm. Matrix> <Node Connect>	<Comm. Matrix> <Node Table>
	<Connect. Of A Node> #Connections vs Time <Display % vs Conn>	<Connection Summary> Node Connection Statistics
Node/Net Summary	<Numeric Values> <Percent of Netwrk>	<Numeric Values> <Percent of Ntwrk>
Frame Timing	<Intrfrm Space Bar> <Intrfrm Space Pie>	Node Frame Timing
Frame Length	<Avg Len. vs Time> <Frm. Len. Dist Bar> <Frm Len. Dist Pie>	Node Frame Length
Frame Analysis	<Frm Anal. Dist Bar> <Frm Anal. Dist Pie>	Node Frame Analysis

<Transmit Stats>
Performance Measurement Class

From the Stats Network Summary Menu, press **<Transmit Stats>** to display brief summaries of the three transmission performance measurement groups. This menu provides a quick reference for each measurement group in the **<Transmit Stats>** measurement class.

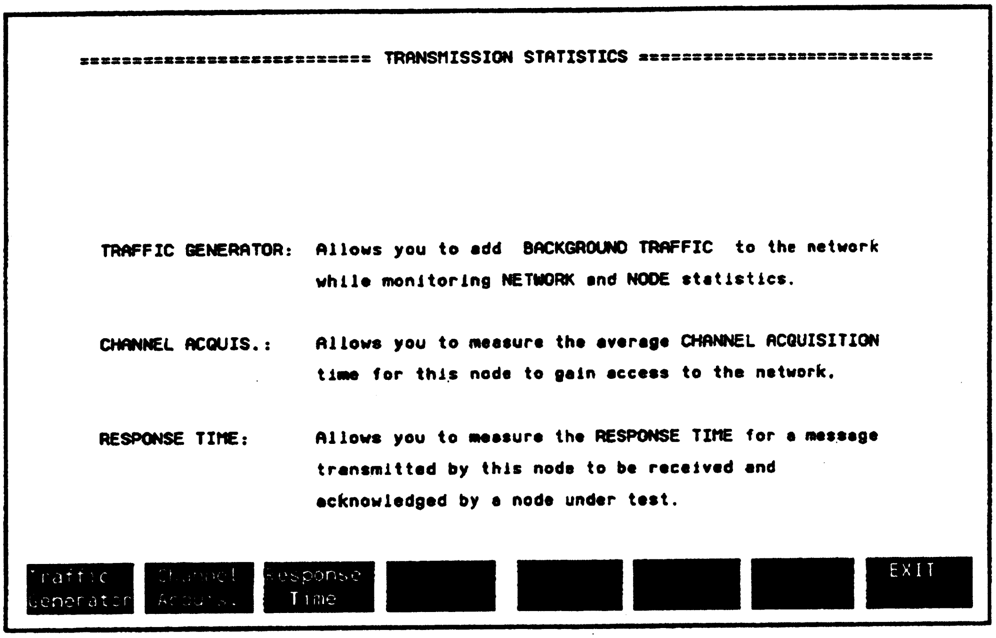


Figure 6-3. Transmit Stats Help Menu

The table below shows the separate measurements you can choose from each group of the <Transmit Stats> class of measurements.

Table 6-3. Transmit Statistics Measurement Class

Measurement Group	Graphic Format Measurements	Tabular Format Measurements
Traffic Generator	BACKGROUND TRAFFIC GENERATOR	BACKGROUND TRAFFIC GENERATOR
Channel Acquisition	<Acquis. Time> <% of Msgs Deferred> <Number of Coll/Msg>	CHANNEL ACQUISITION TIME
Response Time	PROPAGATION DELAY TIME	PROPAGATION DELAY TIME

Simultaneous Performance Measurements

<Start Test> begins collecting data for the selected measurement. At the same time, data collection for other measurements or functions may also begin. During the test, the selected function is displayed, however, when the test is complete, you can go to the other measurements and see measurement data that was collected simultaneously.

You can change displays within a measurement group without disrupting the test. If you press <Exit> to go to another measurement group within the same measurement class or to another measurement class, the current test ends.

- Network Stats
  - Network Summary
  - Utilization
    - Utilization %
    - Throughput f/s
    - throughput kb/s
    - Tabular Format

You can change between measurements within a group without disrupting the tests.

  - Errors & Collisions
  - Frame Timing
  - Frame Length
  - Frame Analysis
- Node Stats
- Transmit Stats

If you press <Exit> to go to another network measurement group or the <Node Stats> or <Transmit Stats> measurement classes, the current measurements end.

In the table below, each highlighted area groups measurements that run simultaneously.

Table 6-4. Table for Simultaneous Measurements

Network Statistics Measurements

- Network Summary
- Utilization
- Errors & Collisions
- Frame Timing
- Frame Length
- Frame Analysis

Node Statistics Measurements

- Node List Stats

Connection Stats

- Communication Matrix

- Connection Summary

- Connections of a Node

- Node/Network Summary
- Node Frame Timing
- Node Frame Length
- Node Frame Analysis

Transmit Statistics Measurements

- Channel Acquisition

- Response Time

NOTE

The <**Transmit Stats**> traffic generator can be run with all measurements except Transmit <**Channel Acquis.**> and <**Response Time**>.

7

Network Summary Menu

This chapter introduces you to the Network Summary Menu of the LAN Performance Analysis Application. This summary menu is similar to the Top Level Menu of the analyzer in that all functions of the software application are selected from its top menu.

This chapter also describes how you can change this Network Summary Menu display.

Sections in this chapter include:

- Using the Network Summary Menu
- Network Summary Display -- Tabular Format
- Changing the Network Summary Display
- Network Summary Display -- Graphic Format

After the LAN Performance Analysis Application is loaded, the Network Summary Menu shows a summary table of network activity and the softkeys listed below. These softkeys let you choose the Stats performance measurements and application functions.

Table 7-1. Part of Stats Measurements and Functions

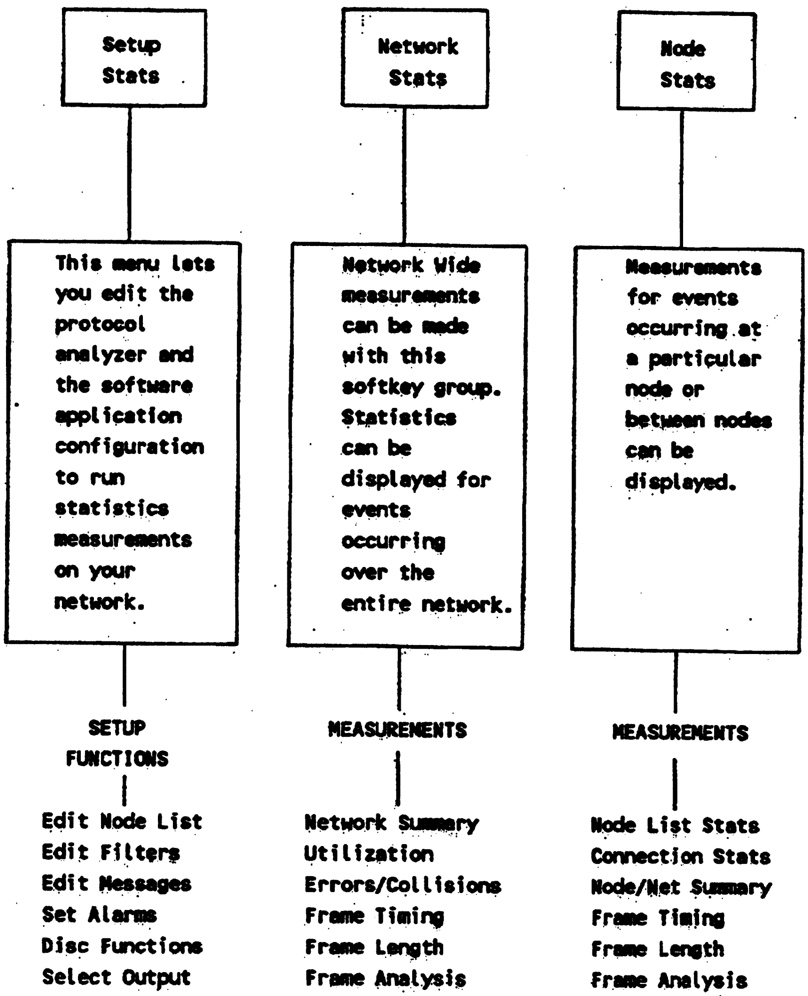
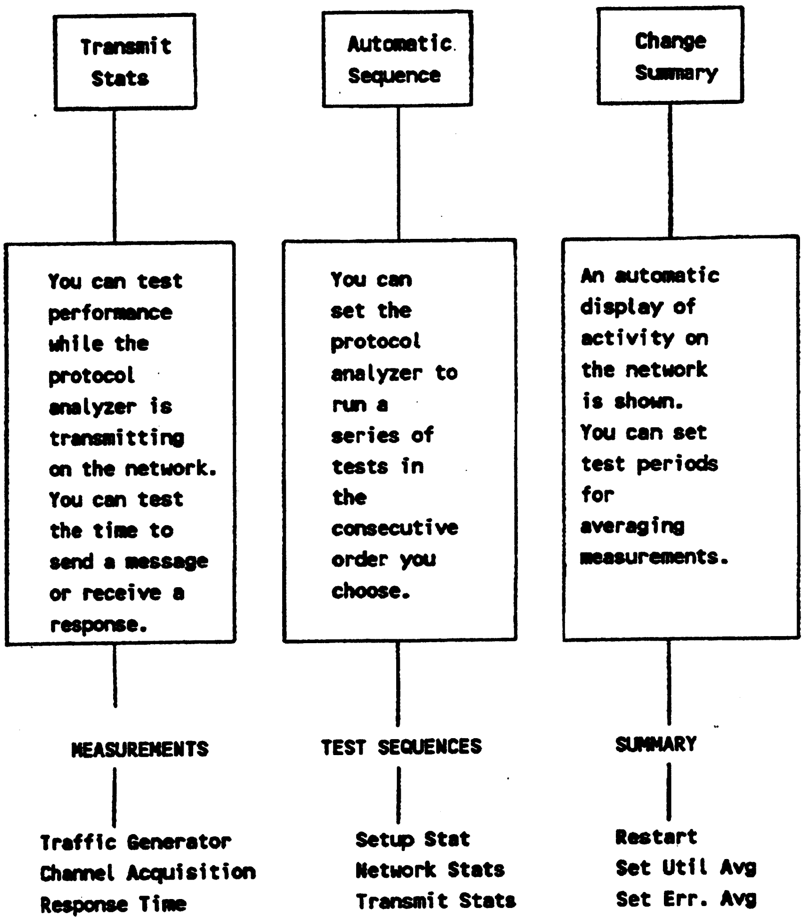


Table 7-2. Part of Stats Measurements and Functions



Using the Network Summary Menu as a Top Level Menu

Just as the protocol analyzer Top Level Menu presents softkeys to let you go to other menus to setup or initialize the protocol analyzer, the Stats Network Summary Menu also serves as a Top Level Menu.

The two previous pages show the softkey choices that are available for setting up the Stats and protocol analyzer functions, making performance measurement tests, and creating test sequences that can be run automatically.

Selecting a Softkey Function

After the application is loaded, you can select different performance measurements or other functions to be performed.

1. Select the performance measurement or function you want.

2. After you are done with a particular function or measurement, press <EXIT> to return to the Stats Network Summary Menu.

It is important that you understand how to get to the Network Summary Menu and how to select performance measurements or other functions. Practice getting to this menu, making selections for performance measurements, and finally returning to the Network Summary Menu.

From the Network Summary Menu, you can choose the measurements or functions you need for more detailed viewing of the network performance. Tables 7-1 and 7-2 show the softkey choices and give a brief description of the functions. The Change Summary Menu is explained later in this chapter.

Exiting from the Stats Application

To quit a Stats performance measurement:

1. Press <EXIT> to go to the current measurement class Help Menu.
2. Press <EXIT> again to go to the Stats application Network Summary Menu.
3. Press <EXIT> again to go to the Run Application menu.
4. Press <EXIT> again to go to the protocol analyzer Top Level Menu.

Returning to the Stats Application

After the Stats application has been loaded, you can exit to the normal protocol analyzer operations and then easily return to the Stats application by pressing the <Runs Applic> and choosing the <Run Stats> application.

If you exit the Stats application and then return without powering off or unloading the application, all configuration information such as test times, auto sequence, etc. are retained.

If power is turned off, you must reconfigure the Stats application.

Network Summary Display – Tabular Format

When the Stats application is loaded, the protocol analyzer automatically begins to monitor the network and display a summary of the activity. The Network Summary Menu shows activity from a network-wide view.

```
============================== NETWORK SUMMARY ==================================
| 15 Feb 87                                                           09:15:00 |
|                                                                              |
|==== Utilization and Throughput ===   ============= Frame Parameters =========|
|            (30 sec)              | |                                         |
| Current    Average     Peak      | |     Average Size      312  bytes        |
| -------    -------     -------   | |     Maximum Size    1,514  bytes        |
| 22.00      17.00       37.00 %   | |     Minimum Size       60  bytes        |
| 2,184      1,8888      3,872 kbits/s | | Total Frames    458,535             |
| 931        676         1,320 frms/s  | | Total Bytes   5.673E+7              |
|----------------------------------   -----------------------------------------|
|========================== Errors and Collisions =============================|
|                                                                              |
|                Bad FCS/Misalign   Runts      Jabbers     Collisions          |
|                     --------    --------    --------     --------            |
| Total Count               8         235          0         1,345             |
| Average (30 sec)   2.759E-6    8.103E-5          0      4.638E-4 Cnt/frm     |
| Peak               5.679E-5    2.674E-2          0      9.637E-3 Cnt/frm     |
|                                                                              |
 ------------------------------------------------------------------------------

                              Monitoring network.
 Set Up   Network   Node    Transmit  Automatic   Change                EXIT
 Stats    Stats     Stats   Stats     Sequence    Summary
```

Figure 7-1. Network Summary Menu

The status message, **Monitoring network** is displayed to indicate the data is only being monitored, not stored as in performance measurements.

The Network Summary Menu provides a "snapshot" of network activity. The performance measurements listed below are displayed in an easily interpreted format:

- Utilization and Throughput
- Frame Parameters

In default mode, the measurements are updated every second with the Utilization and Errors display showing an average for 30 second intervals. You can use <Change Summary> to change the time period for averaging the measurements.

NOTE

When Network Summary Menu is running, the data is not retained or stored in the protocol analyzer measurement buffer. The measurement buffer remains intact with what ever data it had when the Network Summary Menu was selected.

NOTE

There are two displays labeled Network Summary. The Network Summary display shown as you enter the Stats application automatically monitors the network and runs continuously until you exit the display. The Stats Network Summary Menu cannot be logged to a disc, printer, or plotter. You can use the [SHIFT], [PRINT] keyboard keys to output the screen to the ThinkJet or the PaintJet printer.

The <Network Stats> <Network Summary> measurement shows the same information. However, <Network Summary> measurement times can be controlled and the measurement can be logged to an external device.

Utilization and Throughput Measurements

```
Utilization and Throughput
           (30 sec)
 Current  Average      Peak

   5.67     9.33      84.98%
  19.00    23.00      168 kbits/s
  33.00    37.00      252 frms/s
```

The first line of this part of this measurement shows how much the whole network is being utilized as a percentage of the network's 10 Mbps bandwidth. The following two lines display the same network traffic in kbits/second and in frames/second.

The section in this chapter called Change Summary describes how to change the time for averaging the measurements.

Current

In the example above, during the last sample period, the network was utilized at 5.67% of the network bandwidth. This was equivalent to 19 kilobits/second or 33 frames/second.

Average

The average time period shows utilization for a moving average. In default mode, the time period for measurement averages is the last 30 seconds from the current sample. In the example above, the last average utilization of the network was 9.33%.

Peak

The peak measurement displays the highest utilization measured during any sample period since the start of the test. In the example above, the peak utilization since the test start was 84.98%.

Frame Parameters Measurements

Frame Parameters

Average Size	85 bytes
Maximum Size	6535 bytes
Minimum Size	15 bytes
Total Frames	123 frames
Total Bytes	11,931 bytes

The Frame Parameters portion of the Network Summary display shows the size of frames occurring on the network as well as how many frames are occurring.

Frame Parameters display is updated every second. You cannot change the sample time for Frame Parameters.

Frame parameters accuracy is +0 to -1. Max size, min size, and total bytes counts are rounded up to an even number by the analyzer hardware.

Average Size display calculates the average frame length in bytes excluding the preamble and FCS bytes. The average is determined by dividing the sum of frame lengths by the number of frames occurring.

Maximum Size shows the longest frame length to occur since start of test. The largest frame length the analyzer can report is 65,635 bytes.

Minimum Size shows the shortest frame length to occur since start of test.

With the protocol analyzer **Runt Frame filter:** enabled in the analyzer Hardware Functions Menu, frames as short as 53 bytes can be counted. With the **Runt Frame filter:** disabled, frames as short as 15 bytes can be counted.

Total Frames
Total Bytes display how much traffic has occurred since the start of the test. The Total Bytes count includes Preamble and FCS bytes.

Errors and Collisions Measurements

	Errors and Collisions			
	Bad FCS/Misalign	Runts	Jabbers	Collisions
Total Count	12	12	13	14
Average (30 sec)	1.477E-1	1.555E-1	1.633E-1	1.711E-1 Cnt/frm
Peak	1.788E+1	1.866E+1	1.944E+1	2.022E+1 Cnt/frm

The Errors and Collisions display counts collisions occurring on the network in addition to the error types: misaligns, runts and jabbers.

Total Count displays how many of each error type and how many collisions have occurred since the start of the test. The Total Count quantities are updated after each sample period.

Average This display shows the average number of errors per frame that have occurred during the selected average test period. The default value for the averaging time period is 30 seconds. Press <Change Summary> and then <Set Err. Average> to select other average time periods.

The average for "specified" time periods is a moving average.

The <Avg Err. From Strt> of test is a total average found by dividing the total times an error has happened by the total quantity of frames occurring since the start of the test.

Peak shows the maximum error rate per sample period encountered by each error type since the start of the test. Peak quantities are displayed as events(errors)/frame for each error type.

Changing the Network Summary Display

<Change Summary> lets you restart the Network Summary Menu, change the length of time used to determine measurement averages for **<Utilizations>** and **<Errors & Collisions>** and change the display to graphic format.

```
Change Summary
        Restart Meas.
        Set Util. Average
              Util. Avg 10 Sec
              Util. Avg 30 Sec
              Util. Avg  1 Min
              Util. Avg  5 Min
              Avg Util. From Strt
              EXIT
        Set Err. Average
              Err. Avg 10 Sec
              Err. Avg 30 Sec
              Err. Avg  1 Min
              Err. Avg  5 Min
              Avg Err. From Strt
              EXIT
      Graphic Format
      Tabular Format
      Exit
```

Restarting the Measurement

This feature lets you start a test over without changing the current setup selections.

<Restart Meas.> lets you reset internal registers and then continue monitoring the network to make performance measurements for the Network Summary display.

All the "total count" and "average" registers are reset to zero and the performance measurements are enabled to begin again.

Measurement Time Periods

<Set Util. Average>
<Set Err. Average>

In the Utilization and Throughput tests and the Errors and Collisions tests, you can select the time period for averaging the measurements.

	Utilization and Throughput	Errors and Collisions
Moving Averages	Util. Avg 10 Sec	Err. Avg 10 Sec
	Util. Avg 30 Sec	Err. Avg 30 Sec
	Util. Avg 1 Min	Err. Avg 1 Min
	Util. Avg 5 Min	Err. Avg 5 Min
Avg Entire Measurement	Avg Util. from Strt	Avg Err. from Strt

For a moving average, the analyzer calculates a new average using some specified amount of time. The average is calculated each sample period.

For an average from the start of test, the analyzer calculates an average using all measurements since the beginning of the test. The average is updated each sample period.

Network Summary Display -- Graphic Format

Press <Graphic Format> to display the graphic Network Summary Menu.

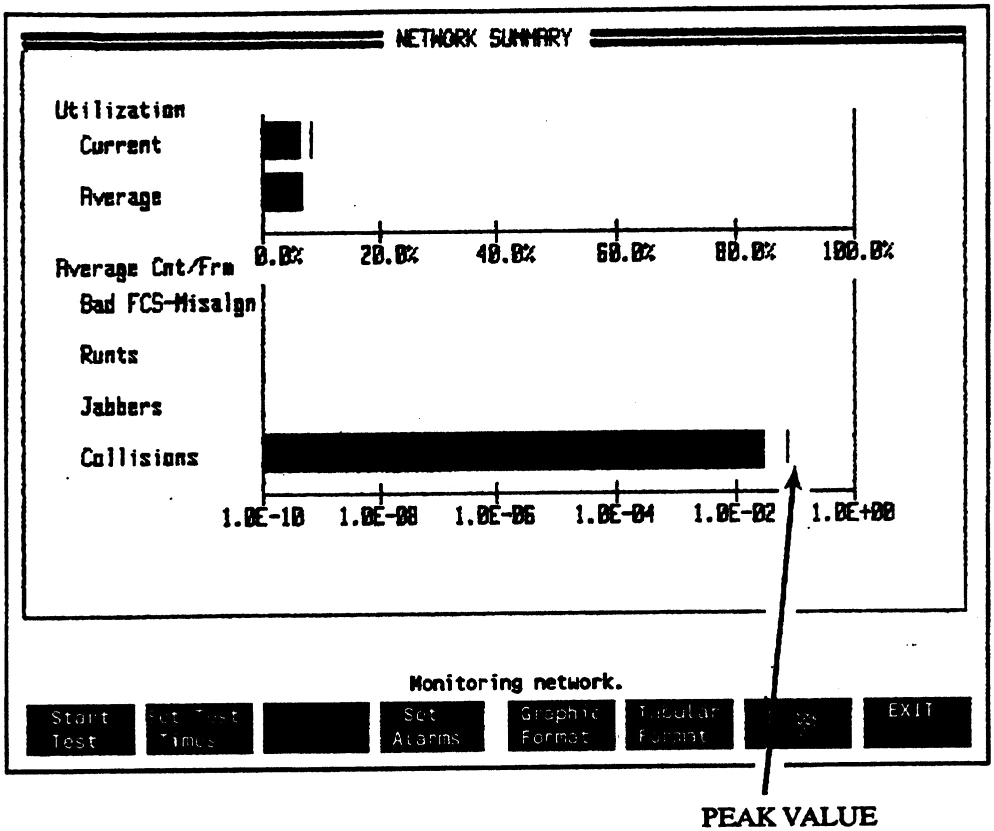


Figure 7-2. Network Summary Menu - Graphic Display

This graphic display shows percentage of utilization and the total errors occurring on the network. The graph is updated each second. Peak values encountered since the start of the test are indicated by a vertical line on each of the measurement bars.

When <Graphic Format> is chosen for the Network Summary display, network utilization measurements and frame error measurements are displayed. Frame parameter measurements, shown in the table format, are not displayed in the graphic format.

Just as in table format, you can use softkeys to change the time periods for averaging measurements in the graphic format.

Network Utilization in Graphic Format

The current, average and peak network utilization is shown.

Network Errors in Graphic Format

Average and peak errors for Bad FCS/Misaligned, Runts, Jabbers, and Collisions are all displayed in a single bar chart. You can change the time period used to determine the measurement average.

The time periods that you can change in this network summary graph display are the same time periods displayed in the summary display in table format.

8

Setting Up Statistics

This chapter describes the functions available for setting up or editing menus to use with Stats measurements.

Sections in this chapter include:

- Setting up Menus Before Starting Tests
- <Set Up Stats> Functions
- Setting Alarm Conditions
- Selecting Output Devices
- Logging Measurements and Alarms to a Disc

Setting Up Menus Before Starting Tests

<Set Up Stats> lets you set up or edit menus from the protocol analyzer that can also be used when running performance measurements with the Stats application.

If you plan to use the following functions, protocol analyzer menus need to be edited via the Stats application.

- Are you using node names for Destination and Source Addresses?
- Are you going to use filters for higher level "frame analysis" tests?
- Are you going to send user defined messages for adding traffic to the network?
- If you are going to log to the disc, which disc will you use?
  How much disc space is available?

Stats functions listed below must be edited before being used by the software application.

- Select alarm conditions for starting or ending automatic test sequences.
- Select an output device for automatic logging.

Set Up Stats Menu

The following list shows the setup functions you can choose from the Setup Stats Menu.

```
Set Up Stats

          Edit Lists

          Edit Filters

          Edit Messages

          Set Alarms

                    On
                    Off
                    Cursor in "Alarm type" field
                              Audible
                              Visual
                              Audible & Visual


          Disc Functions

          Select Output
                    No Device
                    Printer
                    Plotter
                    Disc
```

Setting Up Protocol Analyzer Functions

The following menus are standard in the protocol analyzer and may also be used by the Stats application. A convenient feature of the Stats lets you edit the setup of the analyzer menus without having to exit the application, edit the menus, and then return to the application.

Softkey	Description
<Edit Lists>	provides access to <Phys Addr list> and other node lists on the system, which allows you to define or edit names for nodes. The Physical Address List names are used to specify addresses for <Node Stats> performance measurements. Using names to identify a node on the LAN provides easier node recognition than the six byte Destination or Source Address fields.
<Edit Filters>	lets you define or edit filters to be used by the Stats application in Network <Frame Analysis> and Node <Frame Analysis> measurements.
<Edit Messages>	lets you define or edit messages used in the standard analyzer. These messages can be used for background traffic generation in the Transmit Stats Menu.
<Disc Functions>	lets you access the protocol analyzer mass storage functions. You can review previously stored Stats measurements. Press <Disc Functions> to access the normal protocol analyzer disc operations. After you finish the disc operations, press <EXIT> to return to the Set Up Stats Menu.

Setting up Statistics Functions

<Set Up Stats> <Select Output>	These softkeys let you setup functions for statistics measurements. The following sections in this chapter describe setting up statistics functions.

Setting Alarm Conditions

<Set Alarms> displays the menu shown below.

Alarms provide two primary functions:

1. Alert the user when alarm events occur on the network.
2. Provide a trigger to initiate alarm logging in Automatic Sequence Menu.

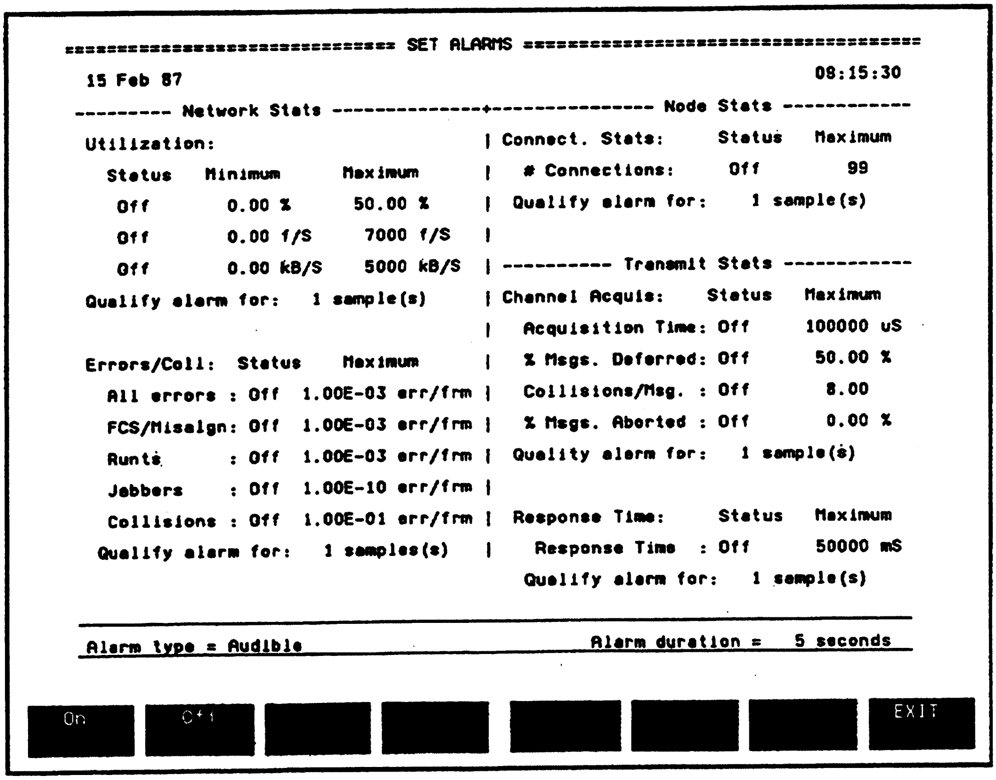


Figure 8-1. Set Alarms Menu

Setting <Network Stats> Alarms

Use the following steps to set alarm conditions for the <Utilization> and <Errors & Collisions> measurement groups.

<Utilization> Alarms

1. Move the cursor to each Utilization Status field you want to enable and press the <ON> status softkey to enable the alarm.

2. Move the cursor to the following utilization fields and enter a numeric value from the keyboard.

Status	Minimum	Maximum	
_____	_____%	_____%	(<Utilization %>)
_____	_____f/s	_____f/s	(<Throughput f/s>)
_____	_____kb/s	_____kb/s	(<Throughput kb/s>)

<Errors & Collisions> Alarms

1. Move the cursor to each Errors & Collisions Status field you want to enable and press the <ON> status softkey.

2. Move the cursor to the desired error or collision field and enter a numeric value from the keyboard. No minimum field is given since the optimum value would be zero errors.

	Status	Maximum
All errors :	_____	_____ err/frm
FCS/Misalign:	_____	_____ err/frm
Runts :	_____	_____ err/frm
Jabbers :	_____	_____ err/frm
Collisions :	_____	_____ col/frm

Setting <Node Stats> Alarms

Use the following steps to set alarm conditions for <Node Stats> measurement group.

1. Move the cursor to the Node Stats Status field for **# Connections:** and press **<ON>** to enable the alarm.

2. Move the cursor to the **Maximum** field for **# Connections:** and enter a numeric value from the keyboard.

```
                  Status  Maximum
# Connections:    _____   _____
```

Setting <Transmit Stats> Alarms

Use the following steps to set alarm conditions for <Transmit Stats> measurement group.

1. Move the cursor to the status field for the alarm(s) you want enabled. Press **<ON>** to enable the alarm.

2. For the measurement(s) that you want to set an alarm, move the cursor to the **Maximum** field for a measurement and enter a numeric value from the keyboard.

```
Channel Acquis:          Status  Maximum
  Acquisition Time:      _____   _____
  % Msgs. Deferred:      _____   _____
  Collisions/Msg.:       _____   _____
  % Msgs. Aborted:       _____   _____
  Qualify alarm for:     _____   sample(s)

Response Time:            Status  Maximum
  Response Time:          _____   _____
  Qualify alarm for:      _____   sample(s)
```

Qualifying the Alarm

The alarm condition can be triggered with only one alarm event in a sample period, or you can trigger the alarm only if its specified condition occurs during some number of consecutive sample periods.

Alarms can be qualified separately for each of the measurement groups.

Setting the Number of Samples

To qualify an alarm, move the cursor to the **Qualify alarm for: __** field below each alarm measurement group. Enter a numeric value for how many sample consecutive periods you want the condition to occur in before the alarm is enabled.

Choosing the Type of Alarm

The alarm type can be either a beeper, a flashing display, or both. To select the type of alarm, move the cursor to the **Alarm type** field near the bottom of the display. Select **<Audible>**, **<Visual>**, or **<Audible & Visual>** to select your alarm function.

Softkey	Description
<Audible>	causes the beeper in the analyzer to sound during the specified alarm duration period.
<Visual>	alarm causes the display border to flash during the specified alarm duration period.
<Audible & Visual>	causes the beeper to sound and the display border and to flash during the alarm period.

Choosing the Alarm Duration

Field	Description
Alarm duration = ___ Seconds	This field lets you set how long the alarm warning occurs. The default alarm duration is five seconds. Move the cursor to the **Alarm Duration** field near the lower right corner of the display and enter a number from the keyboard. Press [RETURN] to complete the entry. The range of time for the alarm is from one second to 999 seconds (approximately 16.5 minutes).

Selecting Output Devices

Press <**Set Up Stats**> and <**Select Output**> to display the following menu.

This menu lets you select output devices for three different functions:

- Printing the display screen
- Logging measurements
- Logging alarms

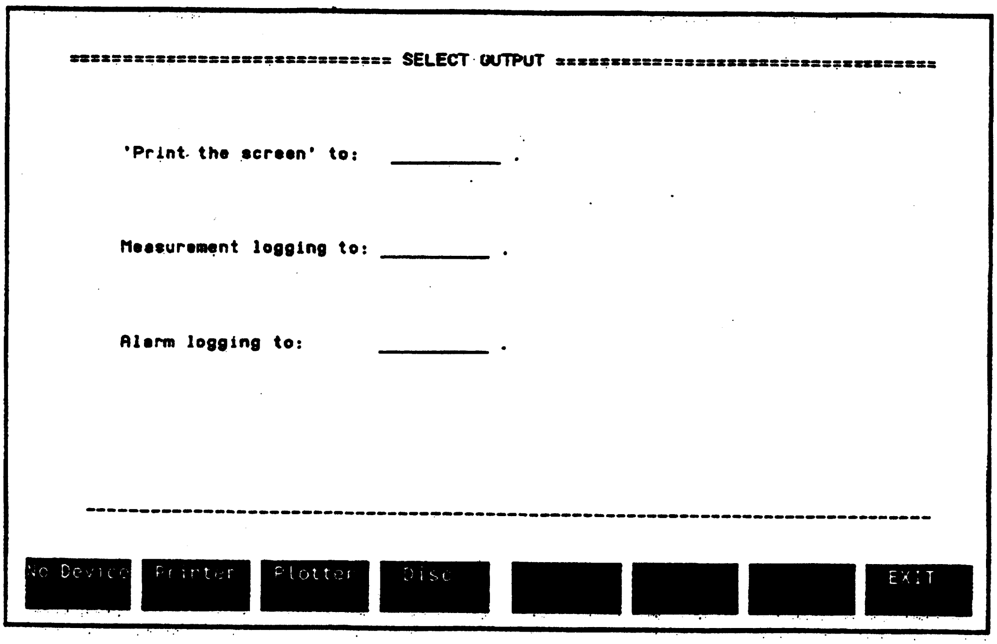


Figure 8-2. Menu for Selecting Output Devices

Printing the Screen

Field	Description
'Print the screen' to:	This selection field lets you choose the device for printing the display screen. The choices are the HP ThinkJet Printer, the HP PaintJet Printer, or an HP-GL plotter. Press [SHIFT] and [PRINT] simultaneously to output the screen display to the selected device. During a measurement, if [SHIFT] and [PRINT] keys are pressed, the analyzer immediately freezes the display and begins printing the measurement to the output device. The analyzer continues collecting data while the screen is being printed. After the screen output is printed or plotted, the analyzer updates the measurement to the screen.
Printing to the plotter	When the output device is a plotter, only graphic displays can be output. Graphic displays include: bar graphs, pie graphs, and point line graphs. Help menus and <Tabular Format> displays cannot be plotted.

Selecting the Measurement Logging Device

Field	Description
Measurement logging to:	This field lets you assign an output device for logging performance measurements. To begin logging a measurement, you must use the Automatic sequence menu.
Printer or Plotter	causes the analyzer to print or plot a selected measurement display to the selected device. The measurement is shown on the analyzer display until the measurement is completed. After the measurement is complete, the display is output to the selected device. When you log to a printer or plotter, only the single measurement you select in Automatic Sequence menu is output.
Disc	causes the analyzer to save the measurement selected in Automatic Sequence Menu. In addition, other measurements common to the selected measurement class are also saved to disc. The table below shows the measurements within a measurement class that are saved when any single measurement is selected.

Selecting the Alarm Logging Device

Field	Description
Alarm logging to:	This field lets you assign an output device for logging performance measurements when an alarm event occurs. To begin logging measurements when alarm events occur, you must use the Automatic Sequence Menu.
Printer or Plotter	causes the analyzer to print or plot a selected measurement display to the selected device. The measurement is shown on the analyzer display until the measurement is completed. After the measurement is complete, the display is output to the selected device. When you log to a printer or plotter, only the single measurement you select in Automatic Sequence Menu is output.
Disc	causes the analyzer to save the measurement selected in Automatic Sequence Menu to a selected disc volume. In addition, other measurements common to the selected measurement class are also saved to the volume. When alarm thresholds are exceeded, alarm logging to a disc causes measurements common to the selected measurement class to be logged to the disc.

Recalling Log Files

Measurement files logged to a disc can be loaded back into the analyzer at some later time for evaluation. See the chapter named **<Automatic Sequence>** for information about recalling log files.

Logging Measurements and Alarms to a Disc

When a disc is selected as the output device for measurement or alarm logging, the fields shown below are added to the Select Output display.

```
Log File Destination: _____   file #__: ______

Maximum File Size:    _____   bytes

Logging mode:         ___________
```

Selecting the Log File Destination

```
Log File Destination:  _______    file #__: _____
                             |          |    |__file name
    <New File>               |          |
    <Existing File>__________|          |_______volume
                                                number
```

Log File Destination:

Move the cursor to the **Log File Destination:** field to display softkey choices for selecting a new or existing volume.

Press <**New File**> if you want to save a measurement or alarm to a new log file.

Press <**Existing File**> if you want to save a measurement or alarm to a log file that already exists.

Volume Number

After the file destination selection is made for <**New File**> or <**Existing File**>, the cursor moves to the **file #** __: field.

Softkeys display the disc volumes available for your protocol analyzer system. Press the for the volume number where you want to log the measurement.

Softkey or Field	Description
Selecting the File Name	To assign a name to the log-file, move the cursor to the **File Name** field.

<New File>	If **<New File>** was selected in the **Log File Destination** field, enter the new file name from the keyboard. File names may be up to seven characters. Leading spaces are deleted. Spaces between characters are replaced with an underscore (_). Characters not valid for file names are:
	`@  =  . (period)`
	`#  /  [CTRL] X (control characters)`
	`$  :`

<Existing File>	If **<Existing File>** is selected, softkeys are displayed to let you select a file already existing on the volume.
Setting Volume File Size	You must set the size of the file for storing the logging events.
Maximum file size:	Sets the file size. When the cursor is moved to this field, the analyzer reads the selected directory and determines the maximum amount of contiguous file space available.
<Max file size>	Press **<Maximum Size>** to set the file size to the maximum contiguous file space available on the selected volume.

Softkey or Field	Description
Manually Set File Size	If you want a file size smaller than the maximum available space, enter the file size you want. Press [RETURN] to complete the entry. The minimum file size that can be entered is 10819 bytes. During a log-to disc measurement the analyzer displays the message `END OF FILE INDEX HAS BEEN REACHED` when the file size is too small to hold the entire log-to-disc measurement. If you see this message displayed, declare a larger file size in the `Maximum file size:` field of the Select Output menu.
Setting Logging Mode	Two methods exist for storing measurement data to your disc: **<Nonstop Mode>** lets the disc file act as a circular storage file. If enough data is saved to fill the file, the disc begins to overwrite the oldest information in the file. **<Until Full>** mode lets the disc file act as linear storage file. When the file is filled, data storage ends, no data is overwritten.

9

Network Statistics Measurements

This chapter introduces the measurements that can be made in the <Network Stats> measurement class.

Network performance measurements you can make with the LAN Performance Analysis Application include:

- Network Summary Measurement
- Network Utilization
- Network Errors and Collisions
- Network Frame Timing
- Network Frame Length
- Network Frame Analysis

The first step in the analysis of your network is to understand its base line performance. Key parameters such as the daily utilization (both average and peak), its variations over time, and the occurrences of different types of low-level errors are all important in determining your network's basic performance.

It is important to remember that the performance of every network is different due to the different devices connected, the types of traffic (terminal traffic versus file transfer traffic), and people's work habits. The best way to understand your network is to make a series of performance measurements and to understand the information collected.

Network Summary Measurement

When you begin to collect information about your network, you want to get a snapshot or overview of network activity. The <Network Summary> measurement shows the same information that the Network Summary Menu displays at the top of the Stats application. The displayed information includes:

- Utilization and Throughput
- Frame Parameters
- Errors and Collisions

It is important to realize the difference between Network Summary Menu and Network Summary Measurement. The Network Summary Menu is a passive monitor operation with limited user control. The only test parameters that can be controlled are:

- Utilization average
- Setting Errors & Collisions average
- Changing between table and bar graph display

The <Network Stats> <Network Summary> measurement is a controllable measurement similar to all the other <Network Stats> measurements. Operations you can control in the <Network Summary> measurement include:

- Setting times for measurement and sample periods
- Sensing alarm conditions
- Logging to a disc
- Use in <Automatic Sequence>

Network Utilization

Network utilization is defined as the actual number of bits transmitted on the network at any instant divided by the maximum possible number of bits that can be transmitted at the same instant. Therefore, 100% network utilization in one second is defined as sending as many bits as possible in one second without violating the interframe timing specification of the network.

The LAN Performance Analysis Application provides the means to gather network utilization information over a day, a week, a month or longer. The information can be plotted, printed or stored on a disc and then compared periodically.

Network utilization can vary drastically depending on the activities of the nodes on the network. If the network has a large number of computer-aided-design work stations connected to it, then the traffic tends to be bursty and the frames are long as images are transferred from one work station to another or to storage. People's work habits also influence network utilization. On networks that support a large number of users doing interactive work, peak traffic times may occur in mid-morning and mid-afternoon. Additional utilization peaks may occur if network backups or file synchronizations take place in the evening. It is always useful to know the largest instantaneous peak occurring over a minute's time throughout a day. This information can be used to correlate trouble reports or user complaints of slow response time.

Utilization cycles on administrative networks may occur over longer periods of time. Peaks may occur on financial cycles, at the end of a month, a quarter or a year. On engineering networks, the utilization may increase at a project deadline. On manufacturing networks, utilization cycles may correspond to the start and stop of a process.

The utilization cycle information, especially the peaks, can be used to correlate trouble reports and poor response time on the network. With this information, you can take measurements to improve response time during peak times by altering the utilization cycle or by splitting the network. If network troubles were reported around the peak time, the analysis system can be set up to further diagnose the performance problem.

Network Errors & Collisions

The amount of errors occurring on your network also gives an indication of its performance. In Ethernet and IEEE 802.3 networks, errors that occur in levels one and two of the International Standards Organization (ISO) Open System Interconnection (OSI) Reference Model include: bad frame check sequences, misaligned frames, and jabbers. Other parameters of interest include runts and collisions.

Bad Frame Check Sequences (Bad FCS)

A frame check sequence is used for error checking, to ensure that the bits of a frame are transmitted correctly across the network. The frame check sequence is calculated by the source node and transmitted with the frame. The receiving node then re-calculates the FCS and compares it with the original FCS to determine if an error exists. In Ethernet and IEEE 802.3 networks, the FCS is the last four bytes of a frame.

Misaligned Frames

A misaligned frame has a frame check sequence error and the total number of bits in the frame is not divisible by eight. Misaligned frames are sometimes caused by repeaters or media access units (MAUs) that add or subtract bits from a frame. It is sometimes difficult to distinguish between a frame with a bad FCS and one that is misaligned because the error detection is dependent upon the MAU which can sometimes contribute to the error.

Jabbers

Jabber frames exceed the maximum allowable length for a frame on the network and is usually an indication of transmitter failure. When a transmitter continuously sends out bits, it is the MAU's responsibility to cut off the illegal transmission. If a MAU has to exercise its jabber control circuitry, it would have to be power-reset to function again. It is sometimes difficult to isolate the faulty node, even though the jabber frames are logged to disc, because the frames may not contain any information indicating where they came from. A jabber frame may contain all 1's even in the address fields. In that situation, you may have to resort to more tedious troubleshooting methods, such as a binary search, to find the fault.

Runts

Runt frames are shorter than the minimum allowable length for a frame and are usually the result of collisions on the network. A runt frame is a frame with less than 64 bytes. Runt frames generated by collisions vary in size (all less then 64 bytes) depending on many factors. A runt is sometimes so small that it does not contain enough information to indicate its origin. Therefore, it is not always possible to determine which node participated in the collision.

Collisions

Collisions are not errors, but a part of the normal media access operation. Surprisingly enough, most networks do not have many collisions because the CSMA/CD access method used in Ethernet and IEEE 802.3 networks works very well under most network conditions. It is a good idea to measure network utilization as well as collisions over a period of time to see if there is a correlation.

Network Frame Timing

A parameter that influences the efficiency of a network is the burstiness of the traffic. Frames addressed to some nodes may be missed if they arrive too close together. This occurs when the node or its network interface is not able to process the incoming frames fast enough. These errors are often masked from the user by the upper layer protocols causing the frames to be retransmitted until they are properly received by the node. Retransmission of messages wastes network capacity and affects node response time.

You can measure interframe spacing over a work shift or day to see the percentage of frames with different interframe spacing. On busy networks, the frames occur very close together and on a lightly loaded network, frames occur further apart. However, if a lightly loaded network has small interframe spacing for most of its frames, the frames appear as bursts on the network.

Network Frame Length

Frame size is an important parameter in understanding the base line performance of your network. A network with very small frame size is not fully utilizing the bandwidth of the network since time is lost for the required spacing between frames.

Parameters that affect frame size in a network include:

- the protocol used
- the type of end-user function supported
- internet connections

Xerox Network System (XNS) transport protocols affect the frame size since it supports a data field of less than 600 bytes while IEEE 802.3/Ethernet supports a maximum data field of 1500 bytes.

End-user devices such as terminal servers tend to generate small, minimum length frames which allow the network to be very responsive but wastes capacity. File transfer applications generate maximum length frames which use the network efficiently but block network access under some conditions. Asynchronous terminal servers communicating to host computers tend to generate small frames whereas host computers tend to generate larger frames since larger amounts of information are returned to the terminal.

Inter-network traffic, that is, traffic between different networks, also affects frame size. If an internet connected to a LAN supports short frames, a message may be split into several small frames before it is forwarded to its destination node.

Network Frame Analysis

The network <Frame Analysis> measurement lets you see a network wide view of functions being implemented in the data field of frames being transmitted on your LAN. You can set up filters to match any particular data content that you want and then measure the filter occurrences.

As long as you know where a function is located in your frames, you can filter on the information. Network <Frame Analysis> lets you view the percentage of total network traffic occurring for selected frame information.

10

Network Summary Measurement

This chapter describes the measurements used to show a summary of network traffic.

Performance measurements in this chapter include:

- Network Summary Measurement
- Setting Alarms

MEASUREMENTS	DISPLAY	COMMENT
<Network Summary>		From the Network Stats Menu, press <Network Summary> to view performance measurements showing a "snapshot" or overview of traffic on the network.
Network Summary Measurement		
<Tabular Format>	Table	
<Graphic Format>	Bar Graph	

Network Summary Measurement

- Network Stats
  - Network Summary
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds Minutes Hours Days
      - Set Samp. Time
        - Seconds Minutes Hours
      - Set # of Samp/Avg.
        - Samples per average period?
    - Set Alarms
      - Status field
        - On Off
      - Qualify Alarm field
      - Alarm Type field
      - Alarm Duration
    - Graphic Format
    - Tabular Format
  - Utilization
  - Errors & Collisions
  - Frame Timing
  - Frame Length
  - Frame Analysis

Network Summary Measurement - Tabular Format

```
=============================== NETWORK SUMMARY ==================================
 15 Feb 87                              08-00-0A-00-12-04                09:15:00

 ==== Utilization and Throughput ====    =========== Frame Parameters ===========

  Current   Average   Peak              | |    Average Size      185  bytes
  -------   -------  --------           | |    Maximum Size    1,524  bytes
    19.34     19.27    19.54 %          | |    Minimum Size       46  bytes
    1,919     1,912    1,839 kbit/s     | |    Total Frames   40,515
    1,351     1,350    1,358 frms/s     | |    Total Bytes   7.177E+8
 -------------------------------------   -----------------------------------------
 ========================== Errors and Collisions ================================
                  Bad FCS/Misalign  Runts     Jabbers     Collisions
                       --------   --------   --------     --------
 Total Count                  0          0         15          761
 Average              0.000E+0   0.000E+0   3.704E-4     1.841E-2 Cnt/frm
 Peak                 0.000E+0   0.000E+0   7.424E-4     2.821E-2 Cnt/frm

 Start time = 15 Feb 87    09:15:00          Stop time = 15 Feb 87    09:16:00
 Measurement time = 80 Seconds               Sample time =  1 Second
                           Collecting statistics.

 Set Up    Network   Node     Transmit   Automatic   Change               EXIT
 Stats     Stats     Stats    Stats      Sequence    Summary
```

Figure 10-1. Table Display for Network Summary Measurement

The **<Network Stats>** **<Network Summary>** measurement shows activity from a network-wide view. The status message, **Collecting Statistics** is displayed above the softkeys to indicate this is a performance measurement.

The Network Summary Measurement provides a "snapshot" or overview of network activity. The performance measurements listed below are displayed in the tabular format display:

- Utilization and Throughput
- Frame Parameters
- Errors and Collisions

In default mode, the measurements are updated every second with a running average of the last 10 sample periods. You can use **<Set Test Times>** **<Set # of Samp/Avg.>** to change the time period for averaging the measurements.

Differences Between Network Summary Measurement and Network Summary Menu

There are two displays labeled Network Summary. The Network Summary Menu is shown as you enter the Stats application. It automatically monitors the network and runs continuously until you exit the display. The Stats Network Summary Menu can not be logged to a disc, printer, or plotter.

Network Summary Menu displays **Monitoring network** message above the softkeys.

The **<Network Stats>** **<Network Summary>** measurement shows the same information as Network Summary Menu. However, the **<Network Summary>** measurement can be started and stopped manually or under **<Automatic Sequence>** control. Measurement and sample times can be changed and the measurement can be logged to an external device.

Network summary measurement displays **Collecting statistics** message above the softkeys.

Utilization and Throughput Measurements

Utilization and Throughput

Current	Average	Peak	
19.34	19.27	19.54	%
1,919	1,912	1,939	kbits/s
1,351	1,350	1,358	frms/s

The first line of this part of this measurement shows how much the whole network is being utilized as a percentage of the network's 10 Mbps bandwidth. The following two lines display the same network traffic in kilobits/second and in frames/second.

Current Measurement

In the example above, during the last sample period, the network was utilized at 19.34 % of the network bandwidth. This was equivalent to 1,919 kilobits/second or 1,351 frames/second.

Average Measurement

The average time period shows utilization for a moving average. In default mode, the time period for measurement averages is 10 sample periods. In the example above, the last average utilization of the network was 19.27%.

Peak Measurement

The peak measurement displays the highest utilization value measured during any sample period since the start of the test. In the example above, the peak utilization since the test start was 19.54%.

Frame Parameters Measurements

Frame Parameters

Average Size	165	bytes
Maximum Size	1,524	bytes
Minimum Size	46	bytes
Total Frames	40,515	frames
Total Bytes	7.177E+6	bytes

The Frame Parameters portion of the Network Summary display shows the size of frames occurring on the network as well as how many frames are occurring.

Average Size display calculates the average frame length in bytes excluding the preamble and FCS bytes. The average is determined by dividing the sum of frame lengths by the number of frames occurring each sample period.

The average is calculated and displayed each sample period. The **<Set # of Samp/Avg.>** function does not control the frame parameter average size measurement.

Maximum Size shows the longest frame length to occur in the last sample period.

Minimum Size shows the shortest frame length to occur during the last sample period.

With the protocol analyzer **Runt Frame filter:** enabled in the analyzer Hardware Functions Menu, frames as short as 54 bytes can be counted. With the **Runt Frame filter:** disabled, frames as short as 15 bytes can be counted.

Total Frames
Total Bytes
Total Frames and Total Bytes display how much traffic has occurred since the start of the test. The Total Bytes count includes Preamble and FCS bytes.

Errors and Collisions Measurements

Errors and Collisions

	Bad FCS/Misalign	Runts	Jabbers	Collisions
Total Count	0	0	15	761
Average	0.000E+0	0.000E+0	0.000E+0	0.000E+0 Cnt/frm
Peak	0.000E+0	0.000E+0	7.424E-4	2.821E-2 Cnt/frm

The Errors and Collisions Menu counts collisions occurring on the network in addition to the error types: misaligns, runts and jabbers.

Total Count

This measurement shows how many of each error type and how many collisions have occurred since the start of the test. The Total Count quantities are updated each sample period.

Average

This measurement shows the average number of errors per frame that have occurred during the selected average test period. The default value for averaging is 10 sample periods. Press **<Set Test Times>** and then press **<Set # of Samp/Avg.>** to select other time periods for averaging.

Peak

This measurement shows the maximum error rate per sample period encountered by each error type since the start of the test. Peak quantities are displayed as events (errors)/frame for each error type.

Network Summary Measurement - Graphic Format

Press **<Graphic Format>** to display the graphic Network Summary Menu.

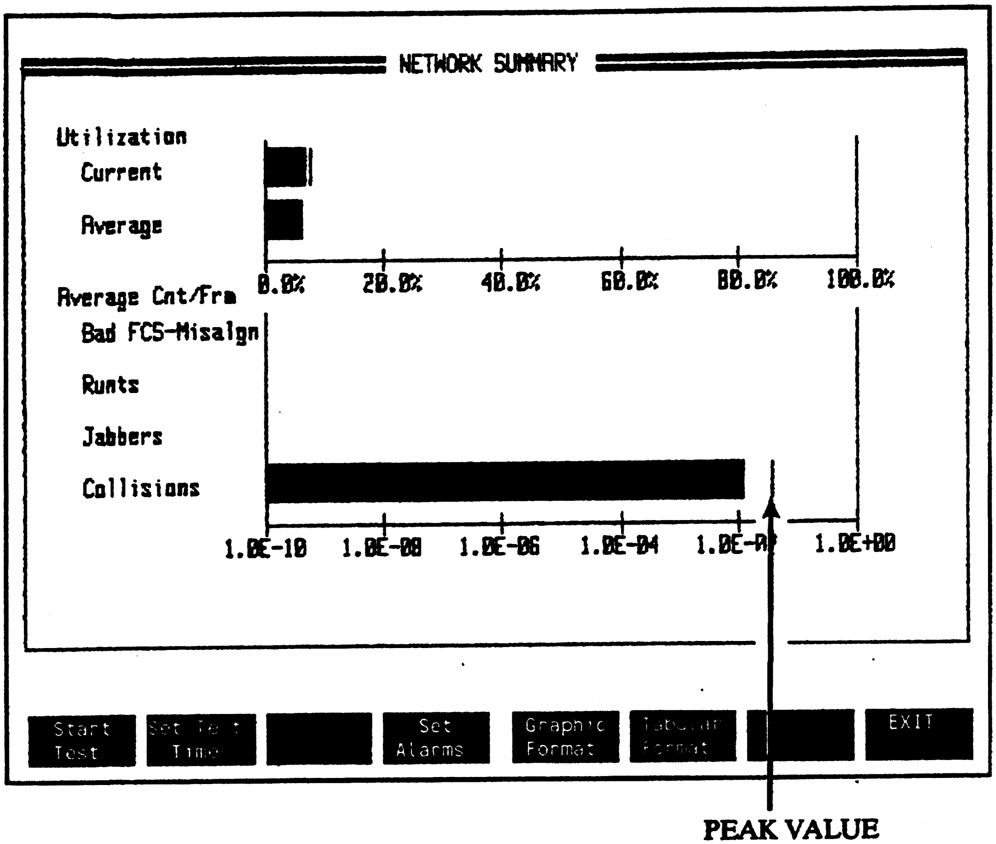


Figure 10-2. Graphic Display for Network Summary Measurement

This graphic display shows percentage of utilization and the total errors occurring on the network. The graph is updated each sample period.

Peak values encountered since the start of the test are indicated by a vertical line on each of the measurement bars.

When <Graphic Format> is chosen for the Network Summary measurement, only network utilization measurements and frame error measurements are displayed. Frame parameter measurements, shown in the table format, are not displayed.

Just as in table format, you can use softkeys to change the measurement test times. You can change the measurement time, the sample time, and the test average time.

Network Utilization in Graphic Format

The current network utilization and the average utilization are displayed in bar graph format.

Network Errors in Graphic Format

The frame errors: Bad FCS/Misaligned, Runts, Jabbers, and Collisions are all displayed in bar chart format.

Setting Alarms

<Set Alarms> in <Network Summary> measurement and in the <Set Up Stats> <Set Alarms> Menu are the same. You can set an alarm condition in either menu and both menus change to show the new condition. <Set Alarms> functions are described in the Set Up Stats chapter of this manual.

11

Network Utilization Measurement

This chapter describes Stats measurements you can use to view how your network is being used.

Utilization performance measurements in this chapter include:

- Network Utilization
- Network Throughput in Frames/Second
- Network Throughput in Kilobits/Second
- Network Utilization Summary

MEASUREMENT	DISPLAY	COMMENTS
<Utilization>		From the Network Stats Menu, press <Utilization> to view performance measurements about selected nodes on the network.
Network Utilization Percentage		
<Utilization %>	**Line Graph**	
Network Throughput In Frames/Second		
<Throughput f/s>	**Line Graph**	
Network Throughput In Kilobits/Second		
<Throughput kb/s>	**Line Graph**	
Network Utilization Summary		
<Tabular Format>	**Table**	

Softkey Selections for Utilization Graphic Displays

Use the highlighted softkeys shown below to make Network Utilization Graphic measurements.

- **Network Stats**
  - **Utilization**
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds, Minutes, Hours, Days
      - Set Samp. Time
        - Seconds, Minutes, Hours
    - **Select Graph**
      - **Utilization %**, **Through-put f/S**, **Through-put kB/S**
    - Set Graph Ranges
      - Set Util. Low Bound, Set Util. Hi Bound, Set Time Low Bound, Set Time Hi Bound, Elapsed Time, Absolute Time
    - Graphic Format
    - Tabular Format
    - OTHER CHOICES
    - Cursor On
    - Cursor Off
    - Set Alarms
    - Autoscale On
    - Autoscale Off
  - Errors/Collisions
  - Frame Timing
  - Frame Length
  - Frame Analysis

Network Utilization

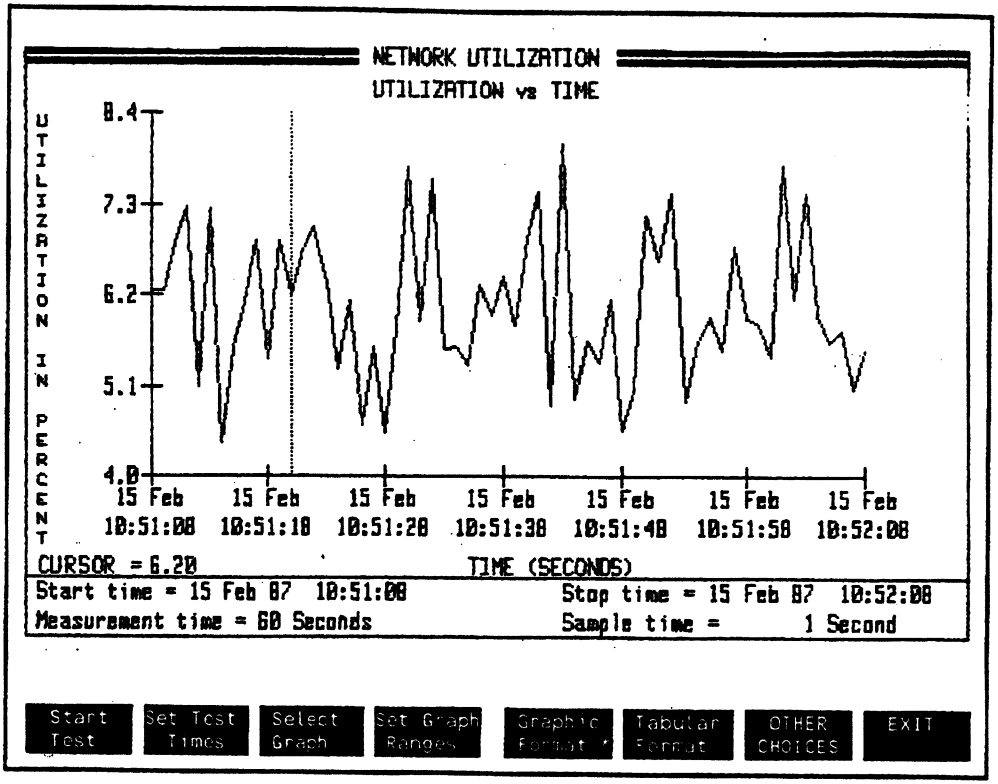


Figure 11-1. Network <Utilization %> Measurement

The default Utilization Menu measures how much a network is being used as a percentage of the network bandwidth. IEEE 802.3/Ethernet networks are specified as transmitting at 10 Mbits/second.

The definition of 100% utilization in one second is: Being able to send as many bits as possible in one second without violating maximum legal frame length specification.

The calculation for 100% utilization using maximum legal frame length is:

```
Frame length in bytes =          1526 bytes         8 bytes   Preamble
                                                +   14 bytes   Header
                                                + 1500 bytes   Data
                                                +    4 bytes   FCS

Frame length in bits =          (1526 bytes) * (8 bits/byte) = 12208 bits

Time period per bit =           1/(10,000,000 bits/sec) = 100 nsec/bit

Time period per max frame =     (12208 bits) * (100 nsec/bit) = 1220800 nsec

                                 1220800 nsec = 1,220.8 usec

Frame time + interframe space = 1,220.8 usec + 9.6 usec = 1230.4 usec

                                 1230.4 usec = 1.23 msec

Max number of frames =           1/1.23 ms =  812.74 frames
```

There are 812 slots of dead time (9.6 usec interframe spacing) in each second. To calculate the actual number of bits that can be transmitted in one second, subtract the interframe spacing time.

```
Bits per interframe space =    (9.6 usec)/(100 nsec/bit) = 96 bits

Interframe space bits  =       (96 bits) x (812 frames/second) = 77,952 bits
   (in one second)

Max possible xmit bits  =      10,000,000 - 77,952 = 9,922,048 bits
```

Typical Range of Network Utilization

The amount of traffic on a network will vary from one network to another. The utilization depends on the application. Are large numbers of file servers on the network? Does the network mostly handle personal computers performing individual tasks and only occasionally using file servers? Is the network used with CAD/CAM applications where large files are moved regularly?

Network Throughput in Frames/Second

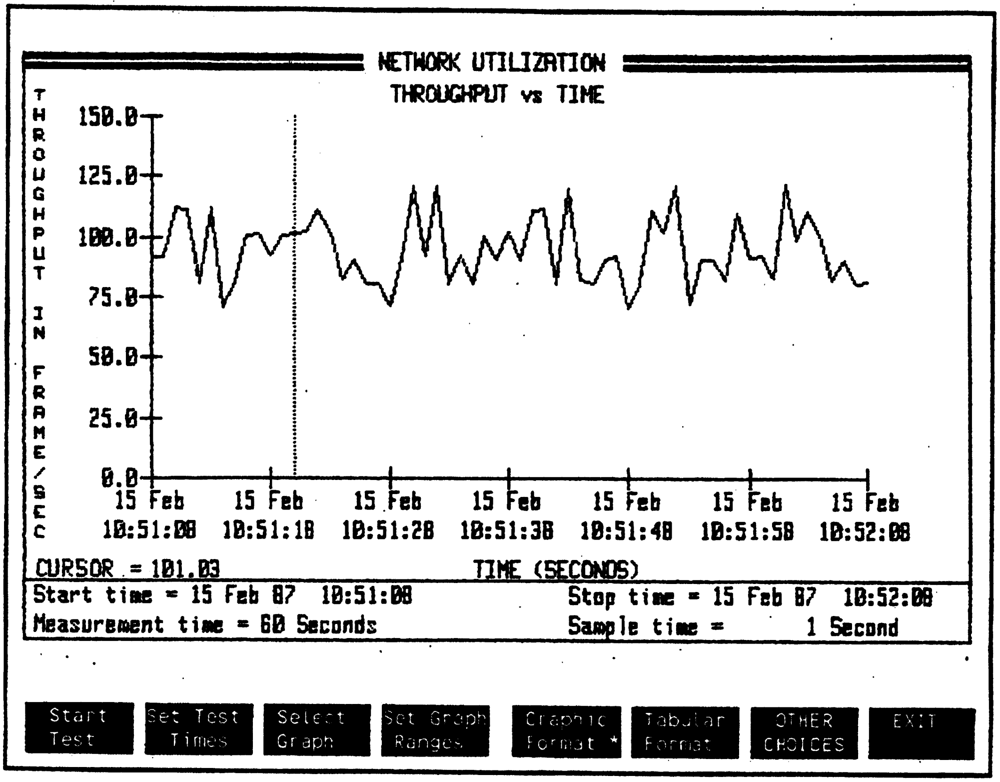


Figure 11-2. Network <Throughput f/s> Measurement

This display shows how many frames are occurring on the network during each sample period.

<Throughput f/s> measures the total or raw number of frames going across the network. All frames occurring on the network are measured, not just the error frames.

Network utilization measured in frames/second is a convenient measure for judging the type of activity on a network. Measuring frames/second could be useful to someone having many terminal servers on their network and wanting to know how many minimum length frames are being sent. Networks using bridges or gateways operate on more of a frame by frame level. The <Throughput f/s> measurement lets you see how many frames/sec are occurring for particular time periods.

What is the Maximum Frame/sec Rate?

There is no absolute quantity for maximum throughput in frames/sec. If frames with the shortest legal frame length of 72 bytes (includes preamble and FCS fields) could constantly be transmitted with no more than 9.6 usec interframe spacing for one second, 14,880 frames/second would occur.

If only frames with the longest legal length (1526 bytes, including Preamble and FCS) are constantly transmitted with no more than 9.6 microseconds interframe spacing, a maximum of 818.5 frames could occur.

For a given utilization, the frame/second rate is inversely proportional to average frame length. If the transmitted frame length is reduced, the number of frames that can be throughput in one second increases.

What is an Average Frame/Second Rate?

Just as there is no absolute maximum frame/second rate, there is no single average frame/second rate. To establish an average throughput in frames/second for your network, you need to run the <Throughput f/s> measurement for different times to establish an average. You can establish frame/second rates for different work shifts or for when different type of operations occur.

You may want to establish a safety range for your network depending on your average frame lengths. For example, if your average frame length is long, approaching 1500 bytes, your frame/second rate may approach 200 f/s. If your average length is shorter, approaching 70 bytes, your frames/second rate may go up to 5000 with still good throughput.

Network Throughput in Kilobits/Second

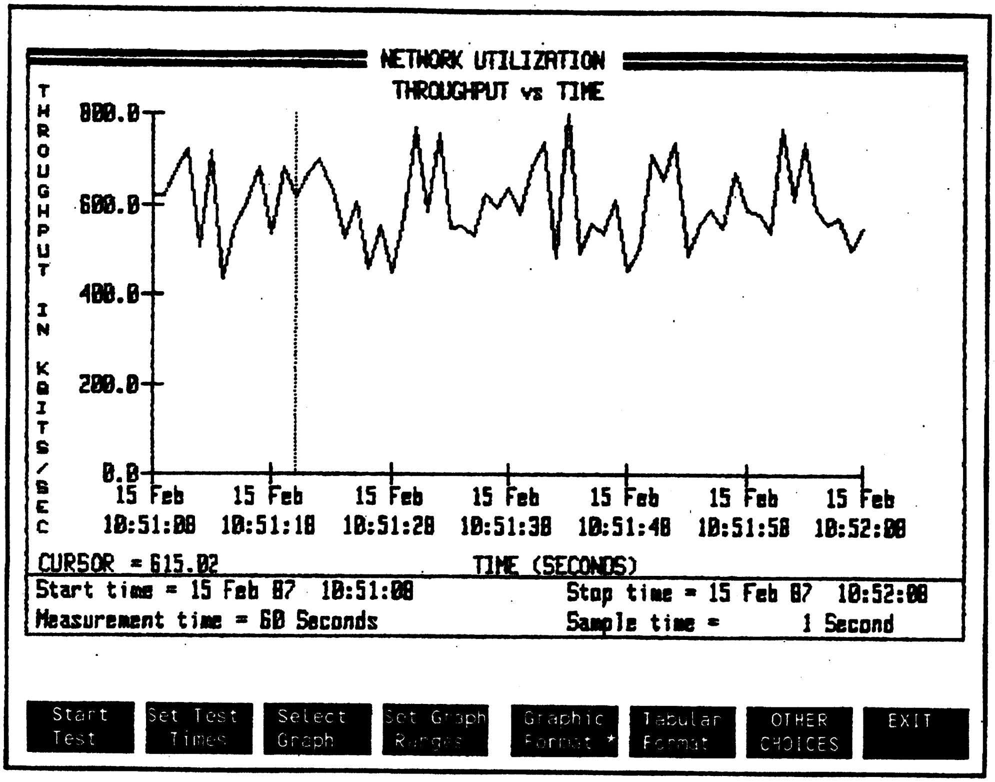


Figure 11-3. Network <Throughput kb/s> Measurement

This display shows the current network utilization by measuring throughput in kilobits/second.

<Throughput kb/s> measurement shows a network's level 2 operation for the OSI model. The measurement counts the total raw traffic crossing the network, including error frames.

What is the Maximum kb/s Throughput?

This measurement relates very closely with the <Utilization %> measurement. While IEEE 802.3/Ethernet is considered a 10 Mb/s network, the actual maximum number of bits that can occur for one second is 9,922,048. This throughput could occur if a node on the network could repetitively transmit 1526 byte frames (includes Preamble and FCS fields) with the minimum interframe spacing of 9.6 useconds.

So, 100% utilization is equivalent to approximately 9,922 kb/s.

Just as it is not practical to achieve 100% utilization due to collisions resulting in backing off and limitations of different hardware on the network, you probably will never see a maximum throughput kb/s rate of 9,922.

Network Utilization Summary

Press the highlighted softkeys shown below to display a summary table of network utilization.

- **Network Stats**
  - **Utilization**
    - Start Test
      - Stop Test
        - Stop Display
          - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds Minutes Hours Days
      - Set Samp. Time
        - Seconds Minutes Hours
    - Set Time Display
      - Elapsed Time Absolute Time
    - Set Alarms
    - Graphic Format
    - **Tabular Format**
  - Errors/Collisions
  - Frame Timing
  - Frame Length
  - Frame Analysis

Network Utilization Summary -- Tabular Format

==================================== NETWORK UTILIZATION ====================

15 Feb 87 09:15:00

ELAPSED TIME	% TRAFFIC	FRAMES/SEC	KBITS/SEC
00:00:01	10.02	158	994
00:00:02	9.93	157	985
00:00:03	9.96	157	989
00:00:04	10.01	157	993
00:00:05	9.95	157	987
00:00:06	10.01	157	994
00:00:07	10.02	158	994
00:00:08	10.03	158	995
00:00:09	9.93	157	985
00:00:10	9.94	157	987
ALARMS (MIN-MAX) :	(0.00-50.00)	(0.00- 7,000)	(0.00- 5,000)

Start time = 15 Feb 87 09:15:00 Stop time = 15 Feb 87 09:16:00

Measurement time = 60 Seconds Sample time = 1 Second

Start Test | Set Test Times | Set Test Display | Set Alarms | Graphic Format | Tabular Format * | | EXIT

Figure 11-4. Network Utilization Summary Table

Press <**Tabular Format**> to display the Utilization Summary Menu.

The Network Utilization Menu above shows a summary of the three measurements used in the utilization graph displays. Usage in percent of network time and traffic throughput on the network are displayed. Seeing all the measurements together can help you to correlate the information about network activity.

The KBITS/SEC column corresponds proportionally to the % TRAFFIC COLUMN. As % TRAFFIC increases, throughput in KBITS/SEC or also increases.

It is harder to make a generalized correlation between % TRAFFIC and FRAMES/SEC. If % TRAFFIC increases, you expect more frames to be transmitted. However, if the % TRAFFIC gets too high, collisions cause the nodes to back off resulting in reduced throughput. If % TRAFFIC is high, you may be getting many fragment or runt frames.

Display Characteristics

During the test, if your network has a heavy traffic load, you may see the table display time periods appear to skip sample times. In order to try to display the latest activity, the protocol analyzer jumps to the latest sample period when it updates the display. When you stop the test, the display recovers and the sample time periods will be displayed consecutively.

12

Network Errors & Collision

This chapter describes the measurements you can use to view errors and collisions that occur on your network.

Error and collision measurements in this chapter include:

- All Errors
- Bad Frame Check Sequence and Misalign Errors
- Runt Errors
- Jabber Errors
- Collisions
- Errors & Collisions Summary Measurement

MEASUREMENTS	DISPLAY	COMMENTS
<Errors & Collisions>		From the Node Stats Menu, press <Errors & Collisions> to view performance measurements about errors and collisions on the network.
Error Measurements		
<All Errors>	**Line Graph**	
<Bad FCS Misalign>	**Line Graph**	
<Runts>	**Line Graph**	
<Jabbers>	**Line Graph**	
Collision Measurement		
<Collisions>	**Line Graph**	
Errors & Collision Summary Measurement		
<Tabular Format>	**Table**	

Softkey Selections for Errors & Collisions Graphic Displays

- Network Stats
  - Network Summary
  - Utilization
  - Errors/Collisions
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds | Minutes | Hours | Days
      - Set Samp. Time
        - Seconds | Minutes | Hours
    - Select Graph
      - All Errors | Bad FCS Misalign | Runts | Jabbers | Collisions
    - Set Graph Ranges
      - Set Error Low Bound | Set Error Hi Bound | Set Time Low Bound | Set Time Hi Bound | Elapsed Time | Absolute Time
    - Graphic Format
    - Tabular Format
    - OTHER CHOICES
    - Cursor On
    - Cursor Off
    - Set Alarms
    - Autoscale On
    - Autoscale Off
  - Frame Timing
  - Frame Length
  - Frame Analysis

All Network Errors

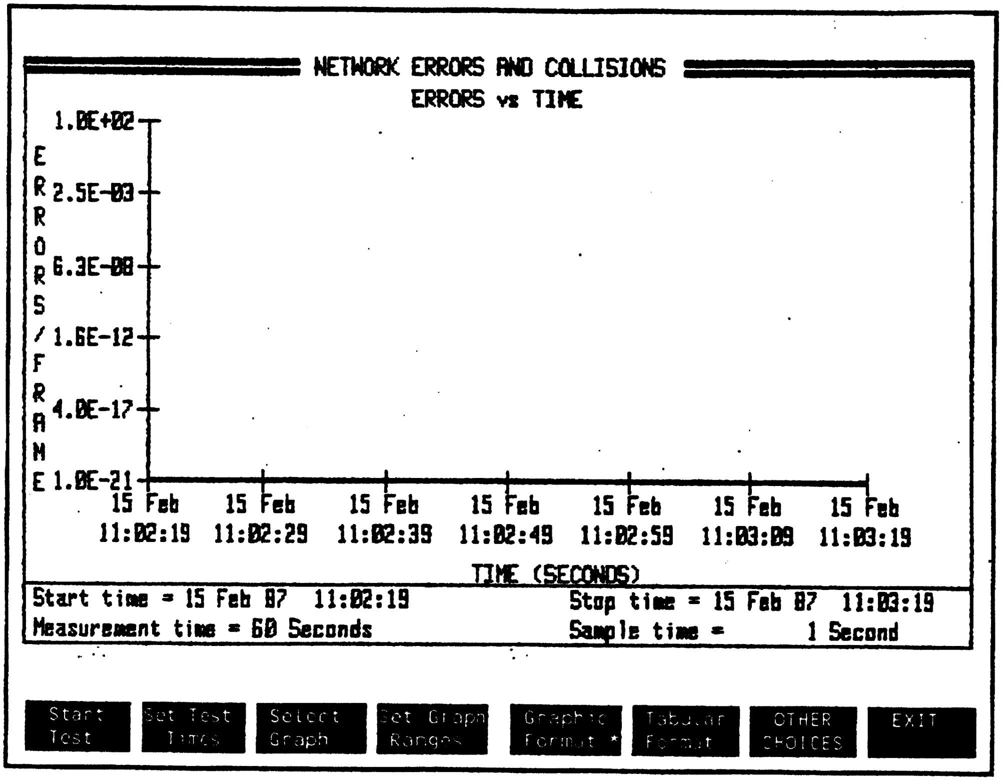


Figure 12-1. All Network Errors Measurement

This display shows all frame errors occurring on the entire network. Statistics for frame errors of a specific node can be viewed by using the Node Stats Menu.

The errors/frame measurement lets you develop an overview of all errors occurring on your network. As more nodes are added to a network, the probability for errors increases. If you measure the average or "normal" error rate for your current network, you can use that data for comparison when more nodes are added.

Using the <Automatic Sequence> feature, you can detect alarm conditions in the <All Errors> measurement and then branch to specific error measurements.

Normally, you expect the error rate to be a fraction of an error per frame. The maximum error rate you would expect is two errors per frame. An example of two errors per frame would be when a jabber frame and a bad FCS/misalign occur in the same frame.

What Is Included In "All Errors?"

Errors in this display include:

- Bad FCS/Misaligns
- Runts
- Jabbers

This measurement does not include collisions. Collisions are not an error, they are part of the normal operation for Carrier Sense Multiple Access (CSMA) network protocol. Collisions are a problem only if the quantity becomes unusually large thereby reducing network throughput.

Logarithmic Vertical Axis Display

The vertical axis of this graph is logarithmic. This allows the display to cover potentially large ranges of errors without losing too much resolution.

Bad Frame Check Sequence and Misalign Errors

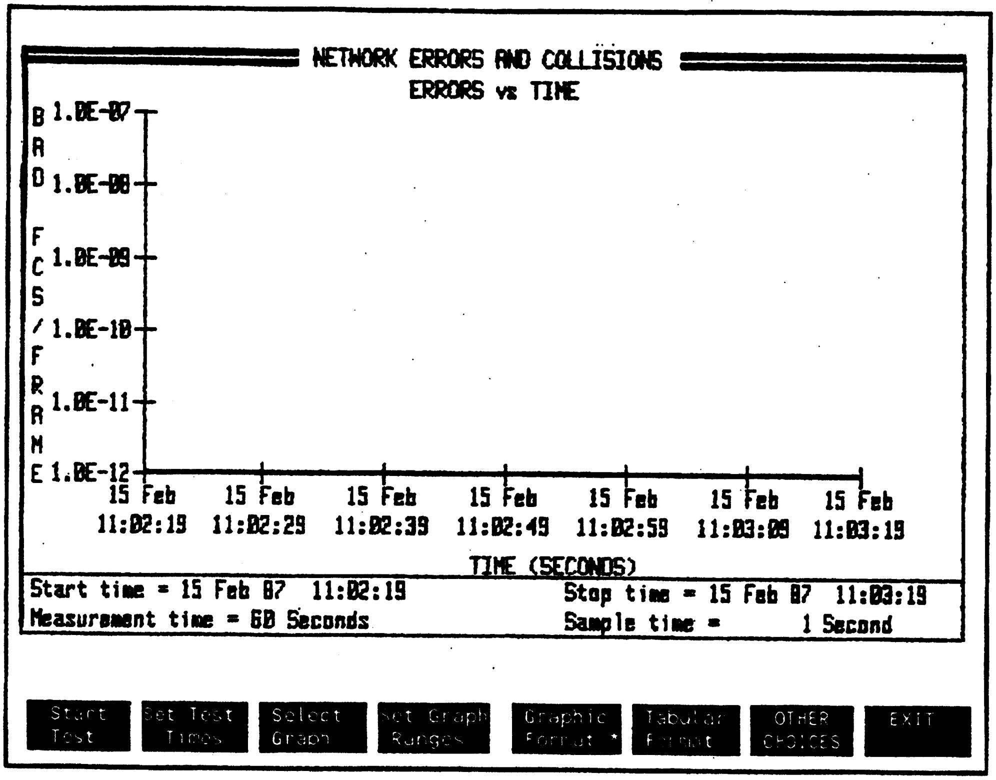


Figure 12-2. Network Bad FCS and Misalign Errors

This measurement graph shows frames with either bad FCS errors or misalign errors. Both error conditions are grouped together for this display.

What are Bad FCS Errors?

The analyzer labels a frame as having a Bad Frame Check Sequence (FCS) error when a frame is received and the FCS calculated by the protocol analyzer on the received data does not match the FCS field transmitted in the frame.

What are Misalign Errors?

The analyzer labels a frame as a Misalign when it receives a frame that has a total number of bits that are not divisible by 8 and also has an FCS error. The FCS error is usually caused by the uneven number of bits.

Why are FCS and Misalign Errors Combined?

You can get different error indications depending on what Media Access Unit (MAU) you use to connect the analyzer to your LAN. One MAU may indicate FCS error while another model or brand MAU would indicate misalign errors. Since it would be misleading to try to distinguish between these types of errors because of this problem, the analyzer combines them in this measurement. The measurement says you had this many of these errors without making a distinction between the errors.

What Affects the Error Rate for FCS/Misaligns?

The FCS/Misalign error rate is affected by the number of nodes on the network. As more nodes are added, more attempts are made to transmit and the probability of more errors increases.

Physically longer networks tend to have more errors. Longer propagation delay may cause late collisions to appear as an CS/Misalign error.

Runt Errors

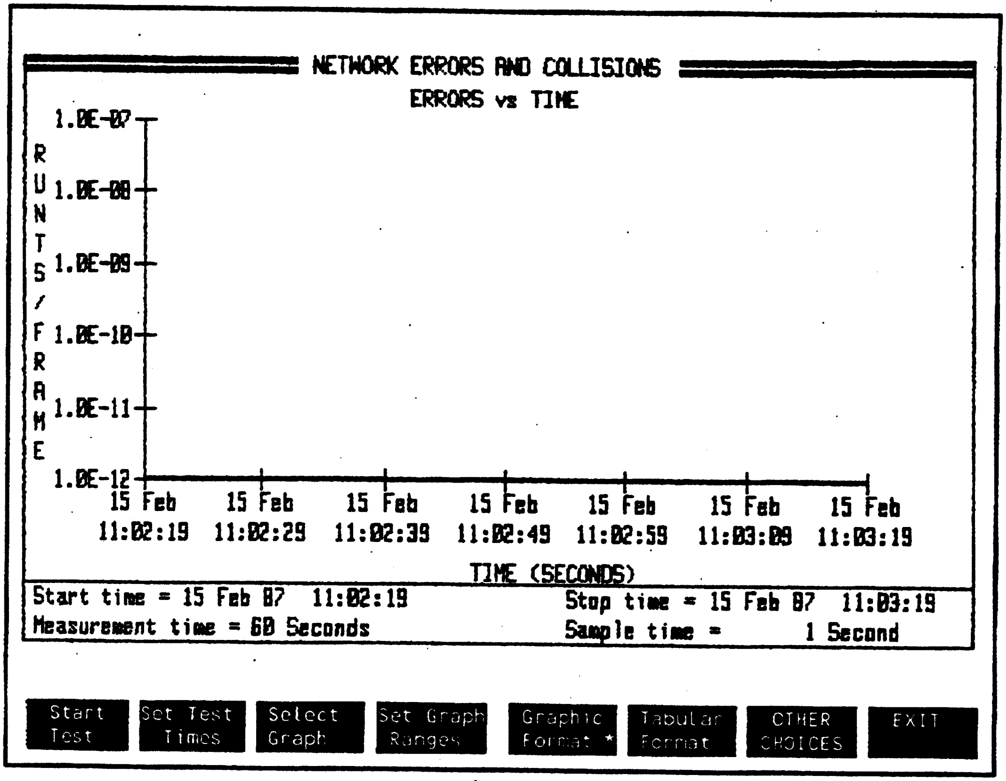


Figure 12-3. Network Runt Errors

This measurement shows runt errors occurring on the network. A runt frame is a frame that is too short. IEEE 802.3/Ethernet specifies a minimum length frame as having at least 60 bytes in the combined **Destination Address, Source Address, Type/Length**, and **Data** fields.

Possible Causes

Frame collisions can cause runt frames. If the network is operating properly, frame collisions should occur within the first 512 bit times of the frame.

Runt Frame Function

In the Hardware Functions Menu of the analyzer, you can enable or disable a **Runt Frame filter:** function.

Runt Filter ON

In default mode, the Runt Frame filter function is enabled and only frames of 54 bytes or longer are captured by the protocol analyzer. Frames with length of 54 to 59 bytes are labeled as runt frames by the protocol analyzer.

Runt Filter OFF

When the Runt Frame filter is disabled, the Stats can record frames as short as 13 bytes (the analyzer rounds 13 byte frames up to 14 bytes). Frames with lengths of 15 to 59 bytes are labeled as runt frames by the protocol analyzer.

What is Normal Runt Error Rate?

Frequency of runts varies depending on the network load. If many stations are trying to transmit on a network, the chance for collisions is greater and more runts may occur. Monitor your network at different time periods to establish you network's normal operation levels.

Jabber Errors

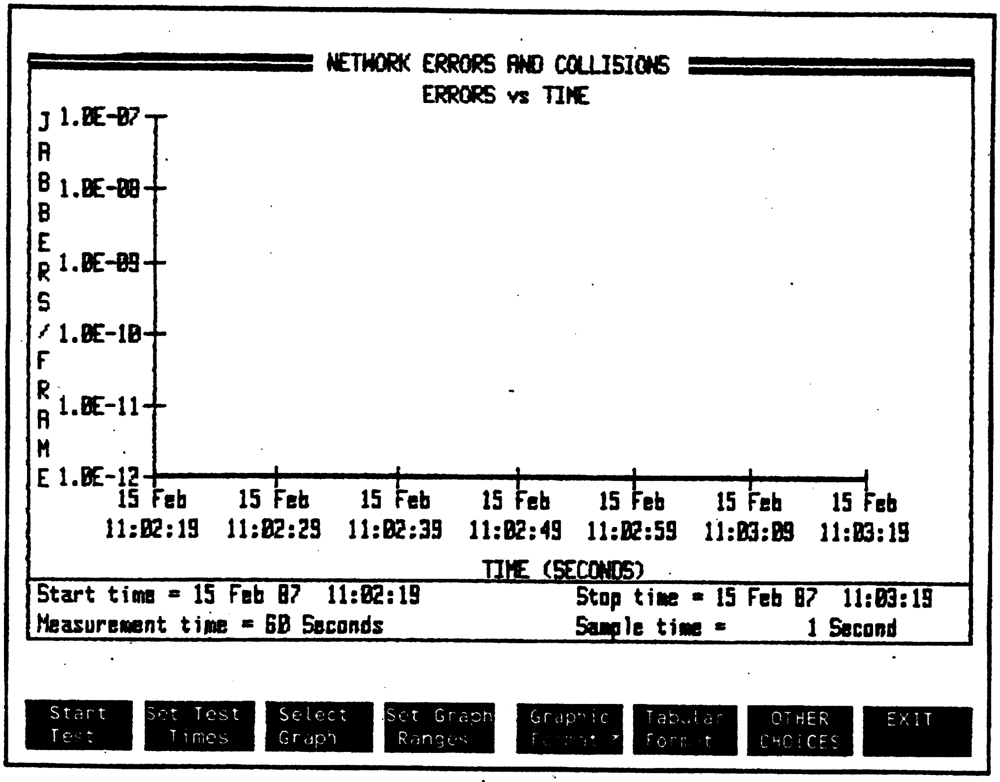


Figure 12-4. Network Jabber Errors

This measurement shows the amount of jabbers occurring on the network. A Jabber frame is longer than 1514 bytes (not including Preamble and FCS bytes) and is usually an indication of a transmitter failure.

Collisions

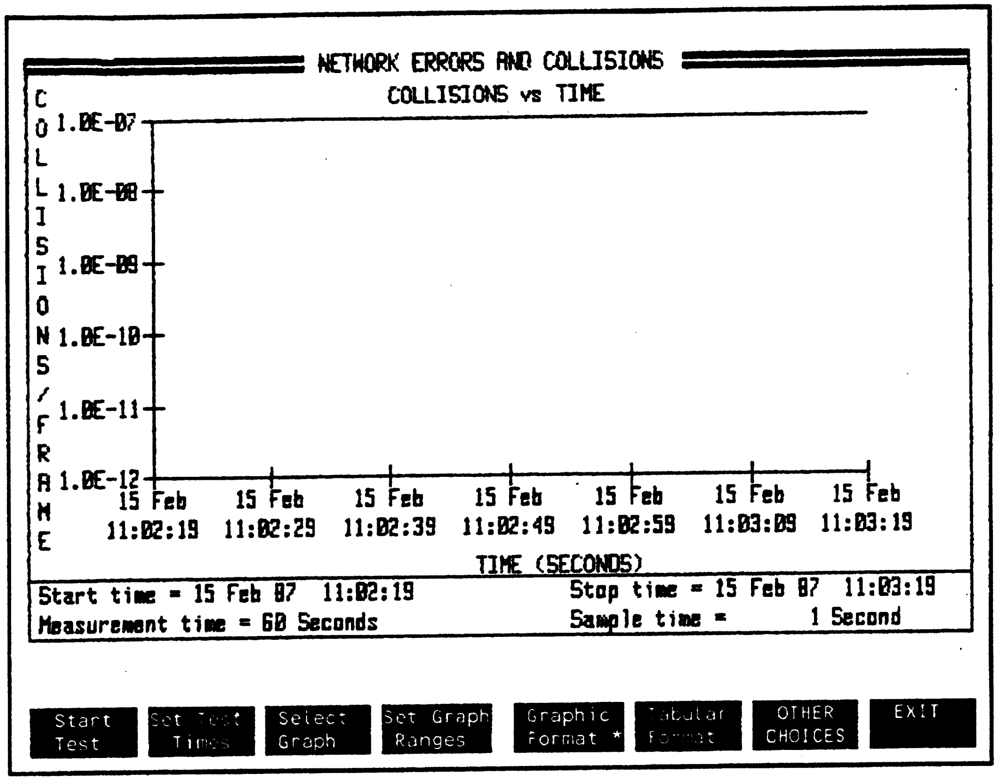


Figure 12-5. Network Collision Errors

This measurement shows the rate of collisions occurring on the network. Collisions are part of the normal operation for CSMA/CD protocol networks. You may want to see if there is a correlation between collisions and your network utilization.

Errors & Collisions Summary Measurement

Use the highlighted softkeys shown below to display a summary table of network errors and collisions.

- **Network Stats**
  - Utilization
    - **Errors/Collisions**
      - Start Test
        - Stop Test
          - Stop Display
            - Resume Display
      - Set Test Times
        - Set Meas. Time
          - Seconds Minutes Hours Days
        - Set Samp. Time
          - Seconds Minutes Hours
      - Set Time Display
        - Elapsed Time Absolute Time
      - Set Alarms
      - Graphic Format
      - **Tabular Format**
  - Frame Timing
  - Frame Length
  - Frame Analysis

Errors & Collisions Summary

NETWORK ERRORS AND COLLISIONS

15 Feb 87 — 09:15:00

ABSOLUTE TIME	ALL ERRORS	FCS/ALGN	RUNTS	JABBERS	COLLISIONS
15 Feb 87 09:15:01	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:02	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:03	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:04	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:05	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:06	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:07	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:08	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:09	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
15 Feb 87 09:15:10	0.000E+0	0.000E+0	0.000E+0	0.000E+0	0.000E+0
ALARMS (MAX) :	(1.000E-3)	(1.000E-3)	(1.000E-3)	(1.00E-10)	(1.000E-1)

Start time = 08 Feb 87 09:15:00 — Stop time = 15 Feb 87 09:18:00

Measurement time = 60 Seconds — Sample time = 1 second

Start Test | Set Test Times | Set Time Display | Set Alarms | Graphic Format | Tabular Format * | | EXIT

Figure 12-6. Summary Table for Network Errors & Collisions

This table display summarizes the four error measurements as well as the number of collisions for frames occurring on the entire network.

In default mode, the time for the table is shown in absolute time from the start of the test. Press <**Set Time Display**> and <**Absolute Time**> to change the time axis to elapsed time labels.

13

Network Frame Timing

This chapter describes Stats measurements you can use to view the timing relationships of frames transmitted on the network.

Frame timing measurements in this chapter include:

- Timing Between Frames Measurement
- Interframe Timing Summary Measurement

MEASUREMENT	DISPLAY	COMMENT
<Frame Timing>		From the Node Stats Menu, press <Frame Timing> to view performance measurements about spacing between frames occurring on the network.
Timing Between Frames Measurement		
<Interfrm Space Bar>	Bar Graph	
<Interfrm Space Pie>	Pie Graph	
Interframe Timing Summary Measurement		
<Tabular Format>	Table	

Timing Between Frames Measurement

Use the softkeys highlighted below to make measurements about the time or spacing between frames.

```
Network Stats
        Utilization
        Errors/Collisions
        Frame Timing
                Start Test
                      Stop Test
                      Stop Display
                           Resume Display
                Set Test Times
                      Set Meas. Time
                           Seconds   Minutes   Hours   Days
                      Set Samp. Time
                           Seconds  Minutes  Hours
                      Set # of Samp/Avg.
                Select Graph
                      Interfrm     Interfrm
                      Space Bar    Space Pie
                Set Graph Ranges
                      |-------------------------- Bar ------------------------|
                      |------- Pie ------|                      |------ Pie -----|
                      Set Time   Set Time   Set %      Set %     Elapsed  Absolute
                      Low Bound  Hi Bound   Low Bound  Hi Bound  Time     Time
                Graphic Format
                Tabular Format
                OTHER CHOICES
                      |----------------  Bar Graph  -------------------|
                      Numeric    Numeric   Numeric   Autoscale  Autoscale
                      Data Off   Data On   Data Cnt  On         Off
        Frame Timing
        Frame Length
        Frame Analysis
```

Interframe Space Bar Graph Measurements

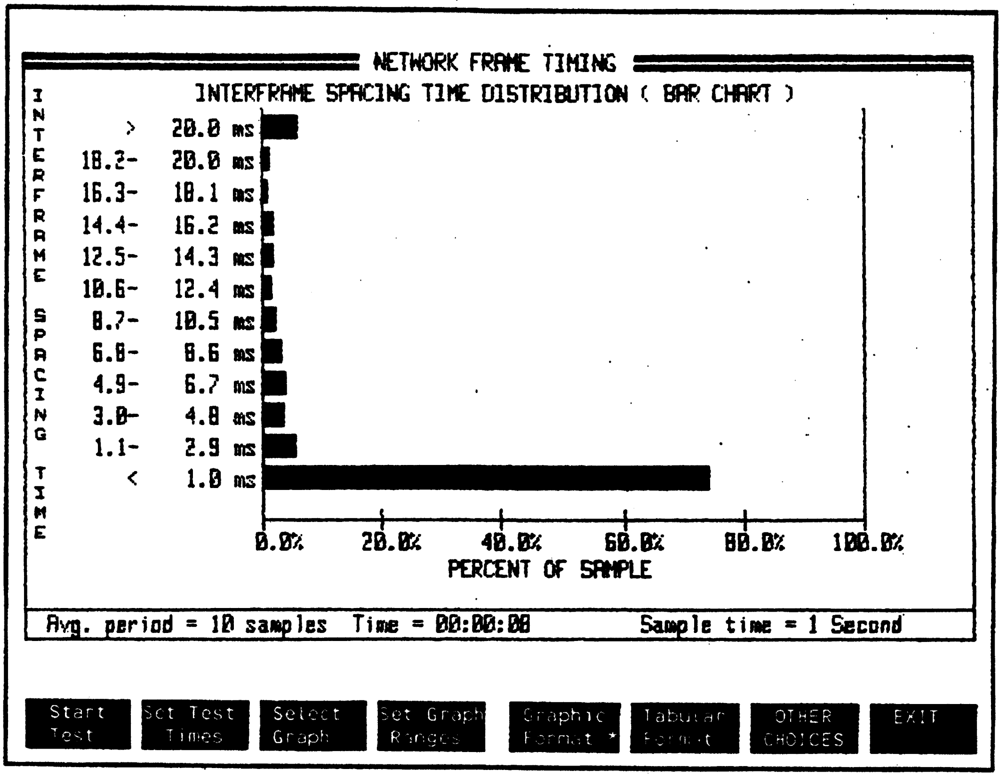


Figure 13-1. Bar Graph Measurement for Timing Between Frames

This bar graph measurement shows the distribution of time spaces occurring between frames.

Interframe space is defined as the time from the end of one frame's FCS field to the beginning of the Preamble field of the next frame. IEEE 802.3 protocol specifies a minimum of 9.6 microseconds must occur between frames on the network.

Bar Graph Display Averaging

The display is updated each sample period using a moving average of sample periods. Use **<Set Test Times>** **<Set # of Samp/Avg.>** to set the number of sample periods to use for averaging the display.

Cursor Operation

After the measurement is ended, you can use [NEXT] or [PREV] to increment the display to different sample periods of the measurement.

The cursor position is indicated by the highlighted bar on the tabular frame timing measurement display. As you switch displays between the bar, pie, or tabular measurements, the display remains at the current cursor position.

Interframe Timing Pie Graph Measurement

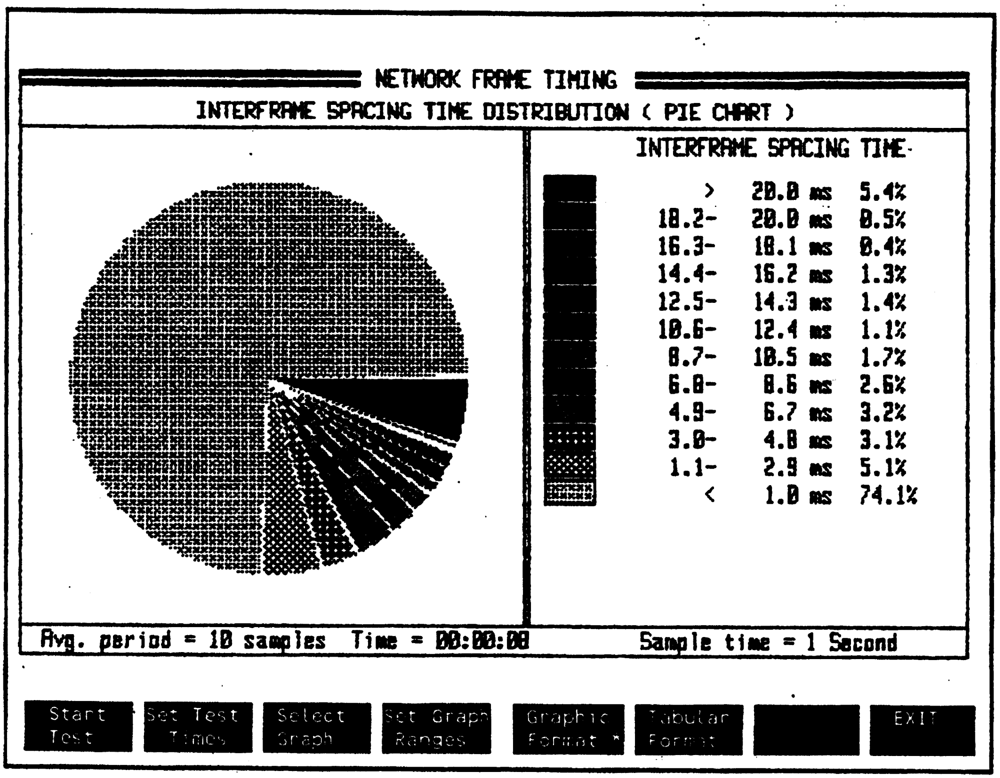


Figure 13-2. Pie Graph for Interframe Timing

This pie graph measurement provides a different view of the same information as the interframe arrival bar chart. The pie graph provides an easy way to compare the percentage of frames occurring within the different interframe space ranges.

<Set Graph Ranges> lets you change the range values for this pie graph. The values are changed for the bar graph display at the same time.

Interframe Timing Summary Measurement

Use the highlighted softkeys shown below to make a summary measurement of timing between frames occurring on the network.

- **Network Stats**
  - Utilization
  - Errors/Collisions
  - **Frame Timing**
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
      - Set Time Display
        - Elapsed Time
        - Absolute Time
    - Set Test Time
      - Set Meas. Time
        - Seconds
        - Minutes
        - Hours
        - Days
      - Set Samp. Time
        - Seconds
        - Minutes
        - Hours
      - Set # of Samp/Avg.
    - Set Table Ranges
      - Set Time Low Bound
      - Set Time Hi Bound
      - Elapsed Time
      - Absolute Time
    - Graphic Format
    - **Tabular Format**
  - Frame Length
  - Frame Analysis

Interframe Timing Summary

============================== NETWORK FRAME TIMING ==========================

15 Feb 87 INTERFRAME SPACING TIME DISTRIBUTION 09:15:00

ELAPSED TIME	SPACING TIME		%	COUNT
00:00:01	> 1000.0	ms	0.0%	0
	1000.0- 900.1	ms	0.0%	0
	900.1- 800.2	ms	0.0%	0
	800.2- 700.3	ms	0.0%	0
	700.3- 600.4	ms	0.0%	0
	600.4- 500.5	ms	0.0%	0
	500.5- 400.6	ms	0.0%	0
	400.6- 300.7	ms	0.0%	0
	300.7- 200.8	ms	0.0%	0
	200.8- 100.9	ms	0.0%	0
	100.9- 1.0	ms	0.0%	0
	< 1.0	ms	0.0%	0

Start Time = 15 Feb 87 09:15:00 Stop time = 12 Feb 87 09:16:00

Measurement time = 60 Seconds Sample time = 1 Second

Start Test | Set Test Times | | Set Table Ranges | Graphic Format | Tabular Format * | | EXIT

Figure 13-3. Table Display for Interframe Spacing

This display summarizes the interframe arrival measurement.

The **%** column shows the percentage of frames occurring in the different time ranges for each sample period. The **COUNT** column shows the actual number of frames occurring in the different time ranges for the sample period.

14

Network Frame Length

This chapter describes measurements used to show a network-wide view of frame lengths occurring on the network.

Performance measurements in this chapter include:

- Average Frame Length vs Time
- Frame Length Distribution
- Frame Length Summary

MEASUREMENT	DISPLAY	COMMENTS
<Frame Length>		From the Node Stats Menu, press <Frame Timing> to view performance measurements about spacing between frames occurring on the network.
Average Frame Length vs Time		
<Avg. Len. vs Time>	Line Graph	
Frame Length Distribution		
<Frm Len. Dist Bar>	Bar Graph	
<Frm. Len. Dist Pie>	Pie Graph	
Frame Length Summary		
<Tabular Format>	Table	

Frame Length Graphic Measurement Softkeys

```
Network Stats
     Utilization
     Errors/Collisions
     Frame Timing
     Frame Length
           Start Test
                 Stop Test
                 Stop Display
                       Resume Display
           Set Test Times
                 Set Meas. Time
                       Seconds   Minutes   Hours   Days
                 Set Samp. Time
                       Seconds   Minutes   Hours
           Select Graph
                 Avg. Len.      Frm Len.     Frm. Len.
                 vs Time *      Dist. Bar    Dist. Pie
           Set Graph Ranges
                 |------------------Avg Len. vs Time --------------------|
                 |---------------- Dist Bar -------------|
                 |--- Dist. Pie ----|
                 Set Len.    Set Len.   Set Time    Set Time   Elapsed   Absolute
                 Low Bound   Hi Bound   Low Bound   Hi Bound   Time      Time

           Graphic Format
           Tabular Format

           OTHER CHOICES
           ------Avg len. vs Time ----      ----- Dist Bar ----
              Cursor On                        Numeric Data Off
              Cursor Off                       Numeric Data %
              Autoscale On                     Numeric Data Cnt
              Autoscale Off                    Autoscale On
                                               Autoscale Off
     Frame Analysis
```

Average Frame Length vs Time

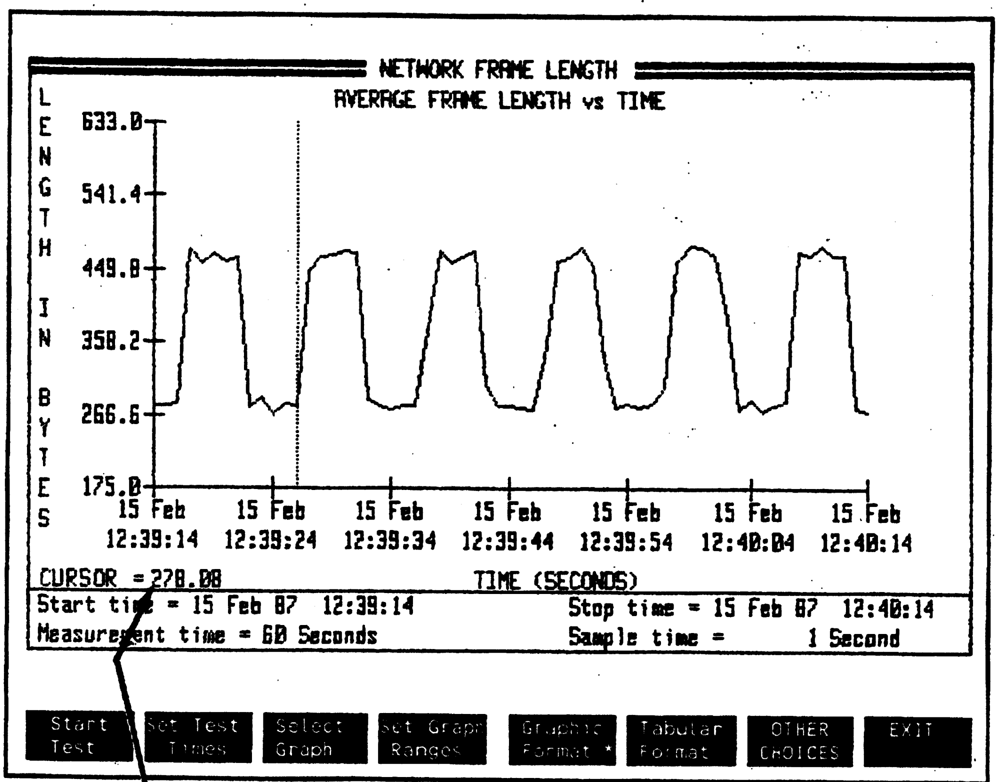


Figure 14-1. Line Graph for Frame Length vs Time

CURSOR SAMPLE VALUE

This graph shows the average frame length of frames occurring on the network over a period of time. The average length of frames is shown on the vertical axis and measurement time is shown on the horizontal axis.

CURSOR SAMPLE VALUE

This measurement is not intended to show absolute values of frame length. It lets you see the changes in frame lengths over time.

Knowing the average length of frames is important. For instance when only small frames are transmitted, several thousand frames would have to be transmitted in a second to generate 100% utilization. If most of the frames transmitted are short, you are not fully utilizing the bandwidth of the network. When long frames are transmitted, you are using more of the network bandwidth. For someone doing a terminal session on the network, short frames are normal since many transmissions are simple responses or data input. You can use this measurement to see the average frame length for your network during normal operation periods.

Frame Length Distribution

Bar Graph Measurement

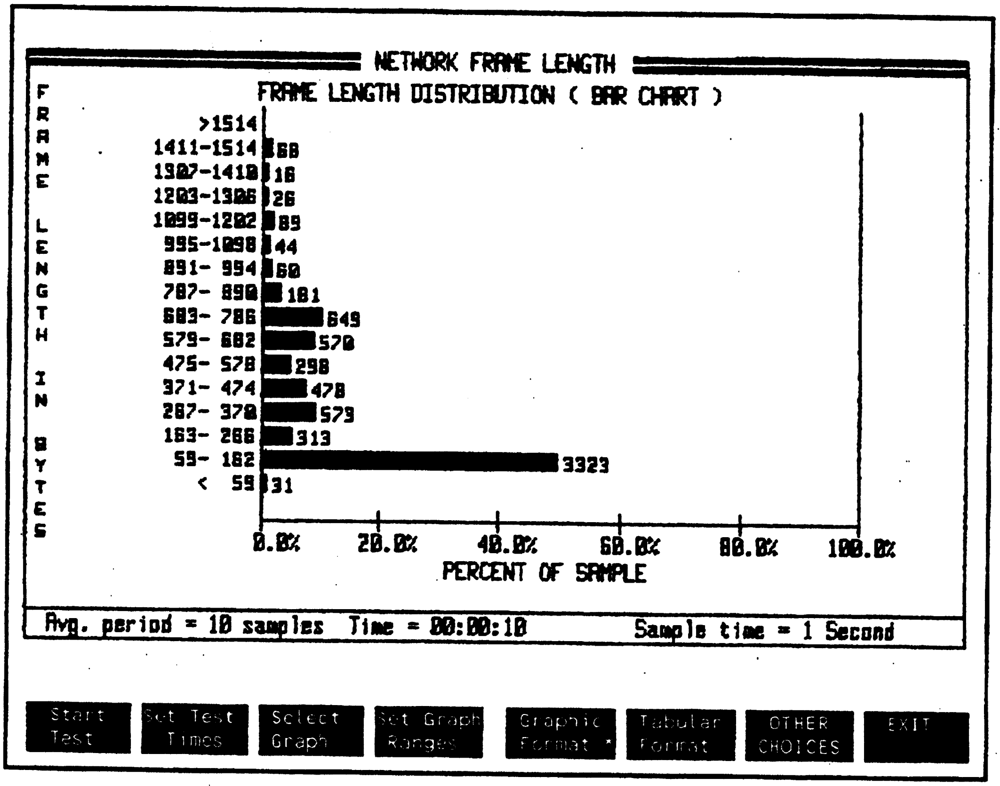


Figure 14-2. Bar Graph for Network Frame Length Distribution

This measurement shows the distribution of frame lengths for all frames occurring on the network. The display shows frame length on the vertical axis and the percentage of sample on the horizontal axis.

If most of the traffic on your network is terminal server or virtual terminal traffic, then you can expect to find short frames on your network. The **Network Frame Length Distribution** measurement displays the exact percentage of the different size frames on your LAN.

You can switch the display to the frame length graph or pie chart without disturbing the current test. Use **<Select Graph>** to change the display format.

Adding Bar Labels

Press **<OTHER CHOICES>** and **<Numeric Data %>** to make the graph label the percentage of frames transmitted in each range of frame lengths.

Press **<Numeric Data Cnt>** to label each bar with the actual number of frames occurring in each range of frame lengths.

Setting the Frame Length Scale

The frame length scale on the vertical axis can be changed. Press **<Set Graph Ranges>** and then use **<Set Len. Low Bound>** and **<Set Len. Hi Bound>** to enter the graphic limits you want.

Only the top and bottom values may be changed. The vertical axis ranges are scaled so that 14 middle ranges are always displayed.

Number entry for the top limit must always be an even number. The lower limit must always be an odd number.

Entering new ranges does not affect an existing measurement display. The new ranges are used when you start a new measurement.

Frame Length Distribution Pie Chart

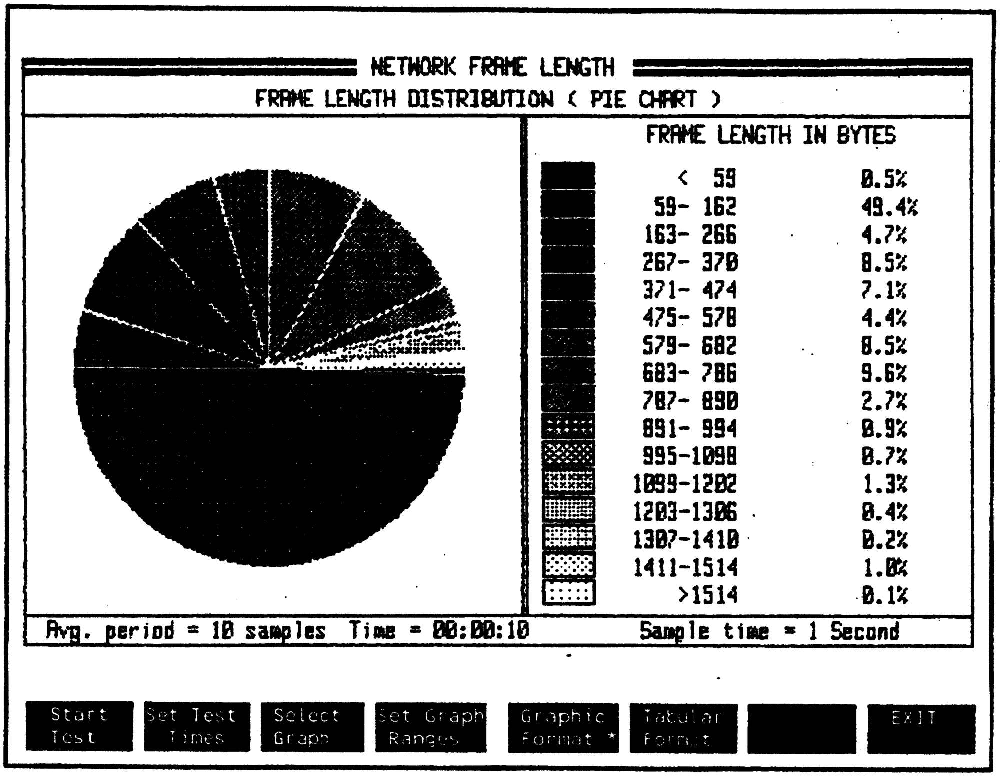


Figure 14-3. Pie Graph for Network Frame Length Distribution

This measurement shows the distribution of frame lengths occurring on the network. The legend on the right of the display lists the frame distribution in percentage of frame lengths occurring for each range of frames.

Frame Length Summary

- Network Stats
  - Utilization
  - Errors/Collisions
  - Frame Timing
  - Frame Length
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
      - Set Time Display
        - Elapsed Time
        - Absolute Time
    - Set Test Times
      - Set Meas. Time
        - Seconds
        - Minutes
        - Hours
        - Days
      - Set Samp. Time
        - Seconds
        - Minutes
        - Hours
    - Set Table Ranges
      - Set Len. Low Bound
      - Set Len. Hi Bound
      - Elapsed Time
      - Absolute Time
    - Graphic Format
    - Tabular Format
  - Frame Analysis

Frame Length Summary Table

```
============================ NETWORK FRAME LENGTH ============================
15 Feb 87      AVERAGE FRAME LENGTH AND FRAME LENGTH DISTRIBUTION      09:15:00

 ELAPSED    AVERAGE                  FRAME LENGTH DISTRIBUTION
  TIME      LENGTH     BYTES     %      COUNT       BYTES     %      COUNT
---------   ------   --------- ------ --------   --------- ------ ---------
00:14:30    478.8      < 60    0.0%        0      788- 891  0.0%         0
                     60- 163   0.0%        0      892- 995  0.0%         0
                    164- 267   0.0%        0      996-1099  0.0%         0
                    268- 371   0.0%        0     1100-1203  0.0%         0
                    371- 475   0.0%        0     1204-1307  0.0%         0
                    476- 579   0.0%        0     1308-1411  0.0%         0
                    580- 683   0.0%        0     1412-1514  0.0%         0
                    684- 787   0.0%        0         >1514  0.0%         0

 Start time = 15 Feb 87   09:15:00          Stop time = 15 Feb 87    09:16:00
 Measurement time = 60 Seconds              Sample time =  1 Second

 Start    Set Test         Set Table  Graphic   Tabular             EXIT
 Test      Times            Ranges    Format    Format *
```

Figure 14-4. Table Summary for Frame Length Distribution

This display shows a summary of the distribution of frames occurring during the measurement period. For each sample period, the table shows the percentage and actual count of frames occurring for each range of frame lengths.

15

Network Frame Analysis

This chapter describes measurements used to show the distribution of frames matching filters you specify.

Frame Analysis performance measurements in this chapter include:

- Network Frame Analysis Distribution
- Network Frame Analysis Summary

MEASUREMENT	DISPLAY	COMMENT
<Frame Analysis>		From the Network Stats Menu, press <Frame Analysis> to view performance measurements about frames matching filters you specify.
Network Frame Analysis Distribution		
<Frm Anal. Dist Bar>	Bar Graph	
<Frm Anal. Dist Pie	Pie Graph	
Network Frame Analysis Summary		
<Tabular Format>	Table	

Network Frame Analysis Distribution

- **Network Stats**
  - Utilization
  - Errors/Collisions
  - Frame Timing
  - Frame Length
  - **Frame Analysis**
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
      - Set Test Times
        - Set Samp. Time
          - Seconds Minutes Hours Days
        - Set Meas. Time
          - Seconds Minutes Hours
        - Set # of Samp/Avg.
      - Select Graph
        - Frm Anal. Dist Bar
        - Frm Anal. Dist Pie
      - Edit Filters
      - **Graphic Format**
      - Tabular Format
      - OTHER CHOICES

-- Frm Anal. Dist Bar --	-- Frm Anal. Dist Pie --
Numeric Data Off	--
Numeric Data %	--
Numeric Data Cnt	--
Autoscale On	--
Autoscale Off	--

Frame Analysis Distribution Bar Graph

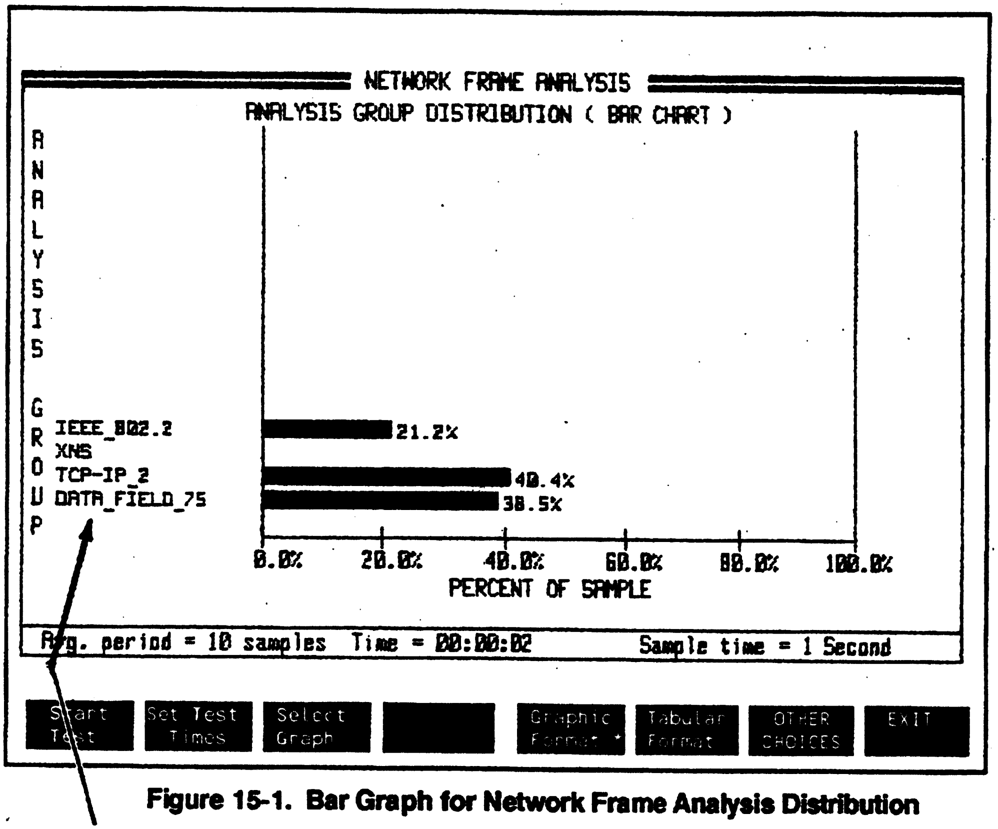


Figure 15-1. Bar Graph for Network Frame Analysis Distribution

DEFINED FILTER LABELS

This displays shows the percentage of frames matching filters defined in the Edit Filters Menu. You can create filters to match frame contents in the address fields, type/length fields, or the data field. As long as you know the location for some specific frame content, you can filter on the information.

Up to 16 filters can be defined in the Edit Filters Menu. All of the defined filters are compared to incoming frames from the network.

The label for each define filter is displayed on the left side of the graph.

When a frame matches more than one filter, only the first filter match is counted. For example, if you have five filters defined and an incoming frame matches three of the defined filters, only the first filter matched in the frame is counted. Counters for the other filters are not incremented.

"All Pass" Filters

When you are trying to measure filter distribution for frames on the network, do not use an "all pass" filter. Only the all pass filter match is counted and subsequent filter matches within a frame are ignored.

Frame Analysis Distribution Pie Graph

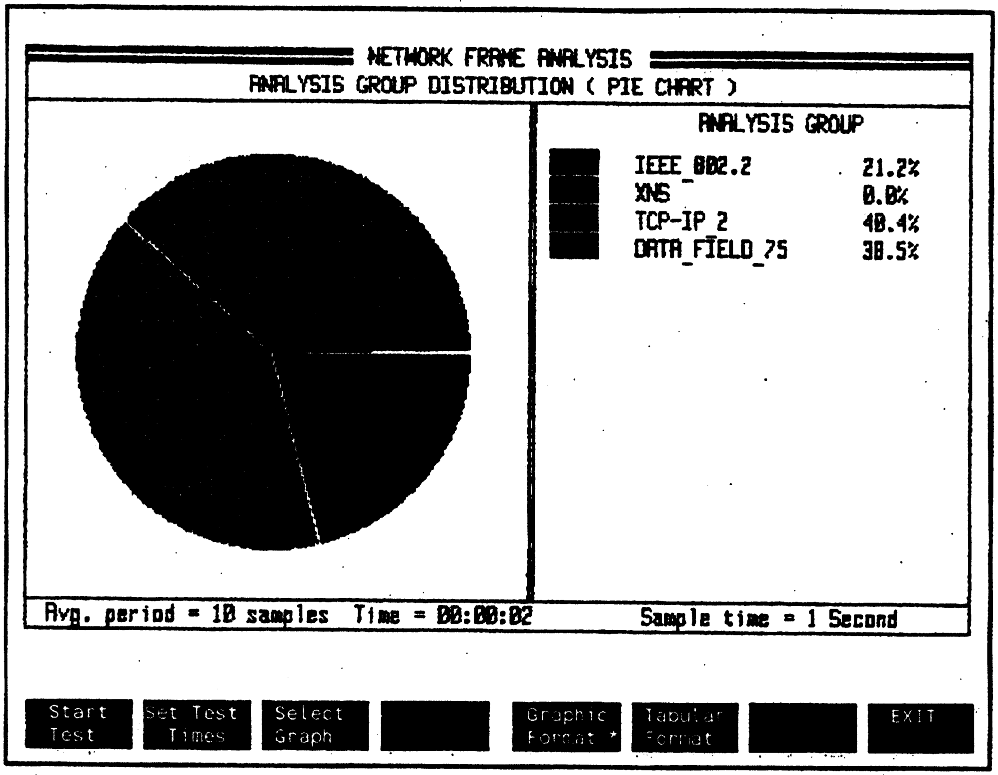


Figure 15-2. Pie Graph for Network Frame Analysis Distribution

Similar to the previous bar chart measurement, this pie chart graph shows the distribution of frames matching filters defined in the protocol analyzer.

Network Frame Analysis Summary

```
Network Stats
        Utilization
        Errors/Collisions
        Frame Timing
        Frame Length
        Frame Analysis
                Start Test
                        Stop Test
                        Stop Display
                                Resume Display
                Set Test Time
                        Set Meas. Time
                                Seconds  Minutes  Hours  Days
                        Set Samp. Time
                                Seconds  Minutes  Hours
                        Set # of Samp/Avg.
                Set Time Display
                        Elapsed    Absolute
                         Time        Time
                Edit Filters
                Graphic Format
                Tabular Format
```

Network Frame Analysis Summary Display

```
============================= NETWORK FRAME ANALYSIS ===========================
 15 Feb 87                 ANALYSIS GROUP DISTRIBUTION                 09:15:00

 ELAPSED
  TIME          GROUP           %      COUNT      GROUP            %      COUNT
---------  ----------------  ------  -------  ----------------  ------  -------
00:00:10   Filter_0          18.4%      156   Filter_8           0.0%        0
           Filter_1           0.0%        0   Filter_9           0.0%        0
           Filter_2           0.0%        0   Filter_10          0.0%        0
           Filter_3           0.0%        0   Filter_11          0.0%        0
           Filter_4           0.0%        0   Filter_12          0.0%        0
           Filter-5           0.0%        0   Filter_13          0.0%        0
           Filter_6           0.0%        0   Filter_14          0.0%        0
           Filter-7           0.0%        0   Filter_15          0.0%        0

--------------------------------------------------------------------------------
 Start time = 15 Feb 87  09:15:00              Stop time = 15 Feb 87  09:16:00
 Measurement time = 60 Seconds                 Sample time = 15 seconds
--------------------------------------------------------------------------------

 Start   Set Samp.  Set Time  Edit     Graphic  Tabular             EXIT
 Test    Time       Display   Filters  Format   Format *
```

Figure 15-3. Summary Display for Network Frame Analysis

This table summarizes the frames that match filters defined in the protocol analyzer Edit Filters Menu. The display shows the percentage of frames on the network that matched defined filters as well as the actual quantity of frames matching each defined filter.

16

Node Statistics Measurement

This chapter introduces the measurements that can be made in the <Node Stats> class of measurements.

Node performance measurements you can make with the LAN performance Analysis Application include:

- Node List Statistics
- Node Connection Statistics
- Node/Network Statistics
- Node Frame Timing
- Node Frame Length
- Node Frame Analysis

In the preceding chapters, measurements using the <Network Stats> measurement class were described that let you establish the baseline performance of your network.

The next step is to use the <Node Stats> class of measurements to determine the sources of the network traffic. It is important to know which nodes are generating most of the traffic on the network because when a problem occurs, the busiest nodes are the most likely to be involved.

Knowing the sources of traffic on your network lets you configure and segment your network based on network load. You also need to identify the nodes that are traffic concentrators because they may be critical devices on the network such as routers, bridges, file servers and printers. The overloading of such devices degrades network performance.

Some network devices, such as file servers, gateways, routers and bridges, may need regular monitoring. For bridges, the number of frames handled every second is critical. As the number of frames approach the bridge's performance limit, steps need to be taken to optimize the situation. For file servers, the number of requests to be handled at any time is critical. If the number of requests to be processed continually exceeds the file server's capability, then additional file servers may be needed.

You can use node measurements to characterize sources of your network traffic. Node characteristics you may want to look for include:

- Which are your busiest nodes?
- Which nodes generate the most errors?
- Which node pairs are your busiest level 2 node connections?
- What percentage of your network traffic is broadcast frames?
- What percentage of your network traffic is multicast frames?
- If your network uses more than one type of protocol, what percentage of the traffic is each type?

The next six chapters describe the Stats <Node Stats> measurements available to help you determine the sources of your network traffic. A summary of these node measurements is listed below.

Node List Statistics

<Node List Stats> measurement lets you create a list of the most active nodes on your network. In addition, network activity for selected nodes can be sorted by:

- Quantity of frames transmitted and received
- Error count
- Error rate
- Average frame size

Node Connection Statistics

<Connection Stats> measurements let you gather statistics about connections to a particular node. You can view traffic among a group of nodes as well as between node pairs.

Node/Network Statistics

<Node/Net Summary> measurements let you view traffic statistics for frames transmitted and received by a particular node. You can measure the utilization of the network bandwidth by a single node.

Node Frame Timing

<Frame Timing> measurements let you measure the time occurring between frames received by a selected node. You can measure the distribution of frames occurring with different time spaces between frames received by the node. You can also count how many frames occur in different ranges of time periods between frames.

Node Frame Length

<Frame Timing> measurements let you measure the length of frames transmitted and received by a selected node. You can see the average frame length as well as a distribution of frame lengths occurring during a sample period.

Node Frame Analysis

<Frame Analysis> measurements let you measure how many frames received by a selected node match filters defined in the protocol analyzer. You can measure the matched frames as a percentage of total network traffic. You can also count the number frames received that match selected filters.

17

Node List Measurements

This chapter describes measurements used to show traffic to/from nodes you select.

Performance measurements and function descriptions in this chapter include:

- Node List Statistics
- Selecting the Node List
- Sorting the Measurement Display
- Sorting by XMT/RCV Stats

MEASUREMENT	DISPLAY	COMMENT
<Node List Stats>		From the Node Stats Menu, press <Node List Stats> to view performance measurements about the node list of a selected node.
Node List Statistics Measurement		
Node List Statistics	Table	

Node List Statistics

- Node Stats
  - Node List Stats
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds Minutes Hours Days
      - Set Samp. Time
        - Seconds Minutes Hours
    - Create A Node List
    - Add Nodes To List
    - Use Nodes In List
    - Sort Nodes
      - Sort By Frm Cnt
      - Sort by KByte Cnt
      - Sort By Error Cnt
      - Sort By Error Rate
    - OTHER CHOICES
    - Running Sort On
    - Running Sort Off
    - XMT & RCV Stats
    - XMT Stats Only
    - RCV Stats Only
    - Edit Lists
  - Connection Stats
  - Network/Node Stat
  - Frame timing
  - Frame Length
  - Frame Analysis

Node List Statistics Measurements

============================ NODE LIST STATISTICS ============================

15 Feb 87 09:15:00

Node #	Node Name or Address	Last Sample Frame Cnt.		Frame Count	KByte Count	Error Count	Error Rate	Avg.Frm Size
1	PC_8	XMT	78	852	672	0	0.00E+0	776
		RCV	18	83	165	0	0.00E+0	423
2	CPU_4	XMT	45	485	315	0	0.00E+0	721
		RCV	11	37	76	0	0.00E+0	225

Start time = 15 Feb 87 09:15:00 Stop time = 15 Feb 87 09:16:00

Measurement time = 60 Seconds Sample time = 1 Second

Start Test | Set Test Times | Create a Node List | Add Nodes To List | Use Nodes In List | Sort Nodes | OTHER CHOICES | EXIT

Figure 17-1. Node List Statistics Menu

This menu shows what nodes are transmitting or receiving frames on the network. The analyzer can monitor up to 1000 active nodes. It observes the network and records all nodes receiving or transmitting messages during each sample time. While the measurement is running, the nodes can be sorted by the number of frames transmitted and received.

After the measurement is ended, you can easily see which nodes are most active for different categories. You should take note of the busiest nodes and the nodes with high error rates because these are most likely to be the problem nodes on the network.

Measurement Field Descriptions

Field	Description
Node #	Indicates the activity level of the nodes. Node #1 has the most activity, Node #2 has the next highest level of activity, and so on. The order of the node display depends on whether you choose **<Running Sort On>** or **<Running Sort Off>** and which sort mode you select. **<Running Sort On>** During measurement - shows order of frame count. After measurement - shows order of selected sort. **<Running Sort Off>** During measurement - shows order by address number. After measurement - shows order by selected sort.
Node Name or Address	This node six byte hex address or equivalent name is displayed in this column. When you **<Create A List>**, a default node name is assigned in the node list menu for each address. The default name is **New_stats_node xxx.** In default mode, the six byte hex address is displayed. A node name is displayed only if a user assigned name is manually entered in the Physical Address List.
Last Sample Frame Cut	This column shows how many transmit or receive frames occurred during the last sample period.
Frame Count	This column shows how many total transmit or received frames have occurred since the start of the measurement period.

Field	Description
KByte Count	shows the total number of kilobytes that have occurred in the measurement period.
Error Count	shows the total of errors that have occurred in the measurement period. Errors that are counted include: bad FCS/Misaligns, runts, and jabbers.
Error Rate	shows the rate of errors, in errors/frame, that has occurred in the measurement period. The largest number you should expect would be one error per frame. If one error per frame happens, your network cable may not be terminated properly.
Avg. Frm Size	shows the average frame size in bytes that occurred in the current measurement period.

Selecting the Node List

Two separate node lists are referenced by the Stats **<Node List Statistics>** measurement.

```
      Analyzer
   Edit Lists Menu
Physical Address List
   Num Name Addrs
   --- ---- -----
   --- ---- -----
   --- ---- -----
   --- ---- -----
```

```
Measurement Display
     Node List

Node Frame  Err  Err
Name  Cnt   Cnt  Rate
---- ----  ---- ----
---- ----  ---- ----
---- ----  ---- ----
```

You can measure performance for the following combinations of nodes:

- Any nodes active during the measurement
- Analyzer Node List and new active nodes
- Only nodes defined on the analyzer Node List

CAUTION

Node List Measurements can change the contents of the analyzer Node List.

Use the protocol analyzer **<Disc Functions> <Save File>** softkeys to save an existing Node List if it contains a unique list of nodes you want to keep.

<Create A Node List>

CAUTION: This softkey deletes the current analyzer Node List.

The analyzer uses only nodes active during the measurement to build and display a measurement list.

At the end of the measurement, the Physical Address List in the Edit Lists Menu is deleted and replaced with the measurement list. The default **HP_LAN_Analyzer** node always appears in the list regardless of activity.

Measurement List

	Node Name	Frm Cnt	Err Cnt	Err Rate
New	----	----	----	----
New	----	----	----	----
New	----	----	----	----
New	----	----	----	----
New	----	----	----	----
New	----	----	----	----

Analyzer Node List

	Node Num	Node Name	Node Address
New	---	----	-----
New	---	----	-----
New	---	----	-----
New	---	----	-----
New	---	----	-----
New	---	----	-----

After the measurement, the analyzer Node List is deleted and replaced by the current measurement list.

If any of the measurement list node addresses already exist on the current analyzer Node List, the existing node name is assigned to the "new" node address.

<Add Nodes To List>

The analyzer collects and displays information about nodes that exist on the analyzer Node List as well as nodes not on the list but which are active during the measurement.

If an existing node has "don't cares" in its address definition, it is ignored for the **<Node List Stats>** measurement. The name remains on the node list.

Analyzer Node List

	Node Num	Node Name	Node Addrs
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----

Performance is measured for nodes already existing on the Node List as well as new nodes active during the measurement.

Measurement List

	Node Name	Frm Cnt	Err Cnt	Err Rate
New	----	----	----	----
New	----	----	----	----
New	----	----	----	----
Old	----	----	----	----
Old	----	----	----	----
Old	----	----	----	----

New nodes are displayed at the beginning of the measurement list. Nodes are displayed in the order of the display sort mode.

Analyzer Node List

	Node Num	Node Name	Node Addrs
New	---	----	-----
New	---	----	-----
New	---	----	-----
Old	---	----	-----
Old	---	----	-----

After the measurement, the analyzer Node List is updated only with new nodes active during the measurement.

New nodes are added at the beginning of the analyzer Node List in the order of the measurement sort mode.

<Use Nodes in List>

This softkey lets the analyzer gather information about transmitted and received frames only for nodes currently defined in the Physical Address List.

If an existing node has "don't cares" in its address definition, it is ignored for the node list stats measurement. The name remains on the node list.

Analyzer Node List

	Node Num	Node Name	Node Addrs
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----

Only activity for nodes existing on the analyzer Node List is collected and displayed in the measurement list.

Measurement List

	Node Name	Frm Cnt	Err Cnt	Err Rate
Old	----	----	----	----
Old	----	----	----	----
Old	----	----	----	----
Old	----	----	----	----
Old	----	----	----	----

Analyzer Node List

	Node Num	Node Name	Node Addrs
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----
Old	---	----	-----

After the measurement, the analyzer Node List remains unchanged.

Sorting the Measurement Display

Softkey	Description
<Sort Nodes>	You can use the following measurement statistics to reorder the displayed nodes: <Sort By Frame Cnt> <Sort By KByte Cnt> <Sort By Error Cnt> <Sort By Err Rate> The Communication Matrix measurement analyzes traffic on the first 31 nodes in the Node List. You can sort the Node List and then monitor the busiest nodes (frames/sec, kbytes/sec) or the nodes with most errors (counts, errors/frame). Node List statistics sorts can be used to re-order the Node List stored internally. This feature is very useful since the Communication Matrix measurement analyzes the traffic on the first 31 nodes in the Node List. Now the 31 busiest nodes (frames/sec, kbytes/sec) or those with the most errors (counts or errors/frame) can be easily monitored in the Communication Matrix measurement. Whenever <Create A Node List> is active, a sort on the measurement node list will sort that list and then transfer it to the Node List. This occurs in the stopped mode so that an old Node List can be used to gather the data, then <Create A Node List> can be selected to transfer the measurement node list into the Node List. **TEST RUNNING** During the test, the measurement list is sorted by frame count using both XMT and RCV frames. After the test ends, the list is sorted and displayed using the selected sort mode. **TEST STOPPED** After the measurement stops, if a different sort is selected, the list is sorted in the new order and the display returns to the top of the list.

In stopped mode, <Create A Node List> has a different function than in run mode. If <Create A Node List> is selected while in stopped mode and a measurement list exists, the measurement list is transferred to the analyzer Node List every time a sort is done. This lets you run a measurement on an existing analyzer Node List using <Use Nodes In List>. After the measurement is stopped, you can sort the measurement list any way you want and then select <Create A Node List> to transfer the sorted measurement list into the analyzer Node List.

Sorting by XMT/RCV Stats

You can sort and display statistics for different combinations of receive and transmit frames events. The list is sorted based on the display mode selected.

Softkey	Description
<XMT & RCV Stats>	Displays a count for frames transmitted from and received by each node.
<XMT Stats Only>	Displays a count for only the frames transmitted by each node.
<RCV Stats Only>	Displays a count for only the frames received by each node.

You can collect statistics for both transmitted and received frames or for only transmitted or received frames. In the examples below, the nodes are sorted by total frame count during the measurement. After the test, the list is sorted by the selected sort mode.

```
                         XMT frames are counted but are not actually displayed during
                         the run if <RCV Stats Only> is selected.  They are shown here
                         to illustrate total frame count.

Display = <RCV Stats Only>
Sort by total Frame Count during the test
        1  PC_8          XMT     150    1206    1189      0  0.00E+0    776
                         RCV     105     118     234      0  0.00E+0    423
        2  CPU_4         XMT      45     465     315      0  0.00E+0    721
                         RCV     137     175     123      0  0.00E+0    225

Display = <RCV Stats Only>
Sort by RCV Frame Count after the test
        1  CPU_4         RCV     137     175     123      0  0.00E+0    225

        2  PC_8          RCV     105     118     234      0  0.00E+0    423
```

Sorting During/After the Run

You can sort the display either during the run or after the run is completed.

Softkey	Description
<Running Sort On>	In this mode, the analyzer records both the XMIT and RCV frames for each node active during the measurement. During the run, the default display sorts nodes by combined XMIT and RCV frames. When the measurement stops, the analyzer shows the nodes sorted by the selected sort mode. If any frame is missed during the measurement, the analyzer displays a warning message, stops and resets the measurement and continues.
<Running Sort Off>	In this mode, the analyzer also records and displays both the XMIT and RCV frames for each node active during the measurement. During the run, the list is not sorted, the modes are shown in the order of address number. In <Running Sort Off> mode, the measurement can operate with a higher frame rate present on the network for a given size of node list before missing any frames. If frames are missed, the analyzer displays a warning message, stops, resets the measurement and continues.

18

Node Connection Measurements

This chapter describes measurements for connections between nodes. The measurements are for Ethernet/IEEE 802.3 level 2 operation of the International Standards Organization's OSI reference model.

Performance measurements in this chapter include:

- Communication Matrix Measurements
- Connection Summary Measurement
- Connections of a Node Measurements

MEASUREMENTS	DISPLAY	COMMENTS
Connection Stats		From the Node Stats Menu, press <Connection Stats> to view performance measurements about selected nodes on the network.
Communication Matrix Measurements		
<Source vs Dest> <Graphic Format>	**Matrix Graph**	
<Source vs Dest> <Tabular Format>	**Table**	
<Node Connect> <Graphic Format>	**Matrix Graph**	
<Node Connect> <Tabular Format>	**Table**	
Connection Summary Measurement		
<Connection Summary>	**Table**	
Connections Of A Node Measurements		
<Connect Of A Node> (default)	**Line Graph**	
<Connect Of A Node> <Display % vs Conn>	**Bar Graph**	
<Connect Of A Node> <Tabular Format>	**Table**	

Communication Matrix Graphs

Press the highlighted softkeys shown below to make <Comm. Matrix> graphic measurements.

- Node Stats
    - Node List Stats
    - Connection Stats
        - Comm. Matrix
            - Start Test
                - Stop Test
                - Stop Display
                    - Resume Display
            - Set Test Times
                - Set Meas. Time
                    - Seconds Minutes Hours Days
                - Set Samp. Time
                    - Seconds Minutes Hours
                - Set # of Samp/Avg.
            - Change Graph
                - Source vs Dest Node Connect
                - Change Legend
                    - Set Range 1-6 Maximum
            - Edit Lists
            - Graphic Format
            - Tabular Format
            - OTHER CHOICES
            - Cursor On
            - Cursor Off
            - Show Node Names
            - Show Hex Addresses
        - Connect. Summary
        - Connect. Of A Node
    - Network/Node Stat
    - Frame Timing
    - Frame Length
    - Frame Analysis

Communication Matrix Tables

Select the softkeys highlighted below to make **<Source vs Dest>** and **<Node Connect.>** summary measurements.

- Node Stats
  - Node List Stats
  - Connection Stats
    - Comm. Matrix
      - Start Test
        - Stop Test
        - Stop Display
          - Resume Display
      - Set Test Times
        - Set Samp. Time
          - Seconds Minutes Hours
        - Set # of Samp/Avg.
      - Change Table
        - Source vs Dest.
        - Node Connect
        - Change Legend
          - Set Range 1-6 Maximum
      - Edit Lists
      - Graphic Format
      - Tabular Format
      - OTHER CHOICES
      - Show Sources
      - Show Dest.
      - Next Node
      - Previous Node
    - Connect. Summary
    - Connect. Of A Node
  - Network/Node Stat
  - Frame Timing
  - Frame Length
  - Frame Analysis

Source vs Destination Matrix

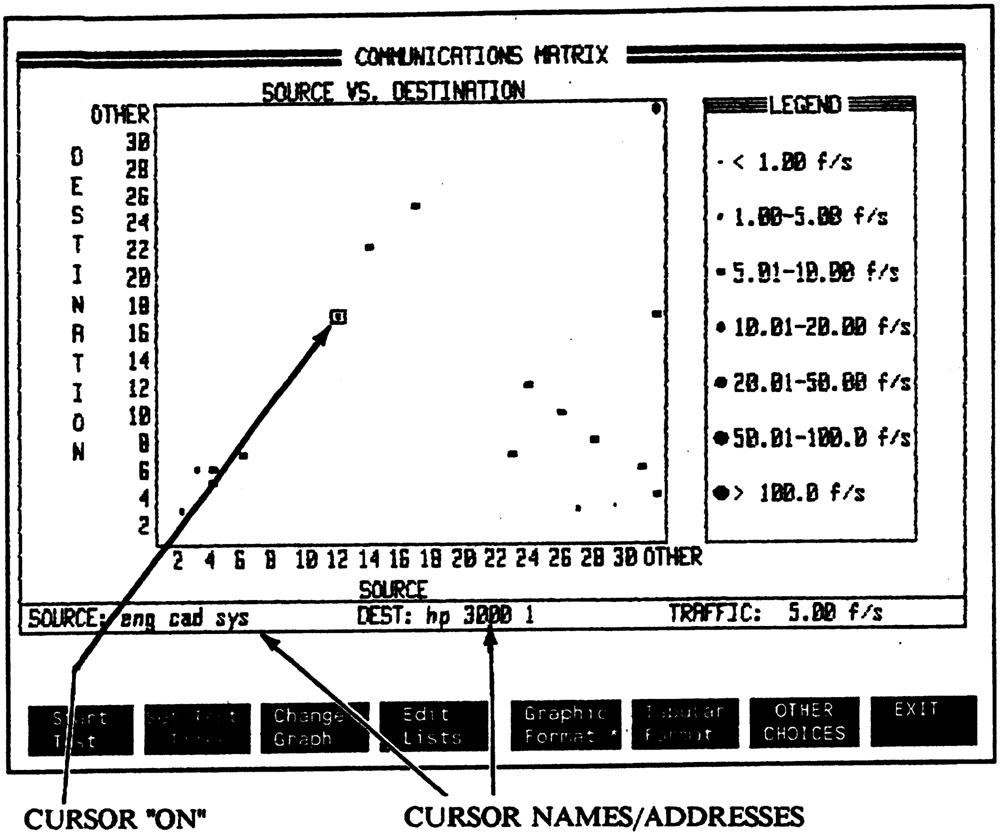


Figure 18-1. Node Communications Matrix <Source vs Dest>

This measurement shows the traffic level between the first 31 nodes from the Physical Address List. Following nodes from the node list are summarized as **OTHER**.

In the example above, the cursor marks the connection between node 2 (eng_cad_sys) and node 17 (hp_3000_1). The size of the dot indicates the range of transmissions that occurred between these nodes. The **TRAFFIC:** field at the lower right corner displays a numeric value for traffic rate between these two nodes.

Only nodes not containing "don't cares" are included in the measurement. The analyzer skips nodes whose address contains the characters xx-xx in the Physical Address List. For example:

```
    <Phys Addr List>          Communication Matrix Node #

1.  08-00-09-1C-15  ------>  1.  08-00-09-1C-15
2.  15-30-42-D3-06  ------>  2.  15-30-42-D3-06
3.  08-00-09-00-A4  ------>  3.  08-00-09-00-A4
4.  03-1B-13-XX-XX       /-> 4.  12-12-45-0A-A2
5.  12-12-45-0A-A2 -----/    5.  32-67-00-2F-1A
6.  45-10-53-XX-XX      /->  6.  :
7.  32-67-00-2F-1A ----/     7.  :
```

Measurement Display Legend

Use **<Change Legend>** to change the range of frames/second represented by each matrix dot. The relative activity level between nodes is indicated by the size of the dots. Higher activity is indicated by larger dots.

Using the Cursor

When **<Cursor On>** is selected, you can use the [LEFT/RIGHT] and [UP/DOWN] arrow keyboard keys to position the cursor over a point marking a connection between a node pair. The nodes marked by the cursor are displayed when you press **<Source vs Dest>** **<Tabular Format>**.

At the bottom of the display, the Source and Destination names/addresses are displayed for the node pair marked by the cursor. **TRAFFIC:** field displays an average numeric value for the traffic level of the selected node pair for the last sample period.

Setting Measurement Times

<Set Test Times> lets you control the measurement test time. If the measurement is changing too rapidly for you to evaluate the data, use **<Set # of Samp/Avg.>** to smooth the measurement display by using an average of several samples.

The Communication Matrix shows the most recent sample. If the update rate is slower than the sample time, some samples are not displayed.

<Source vs Dest> <Show Sources> Table

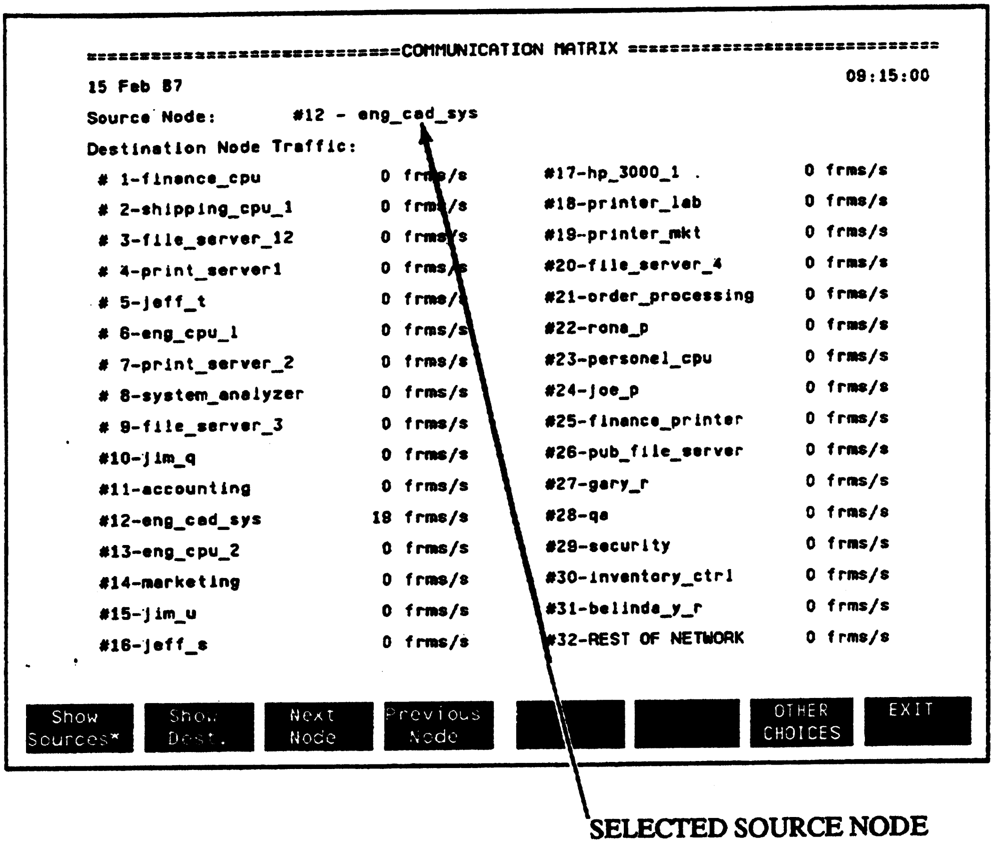


Figure 18-2. Source vs Destination <Show Sources> Table

While you are in the **<Source vs Dest>** Table display, you can select between two softkeys to change the table display. The first selection is the **<Show Sources>** display.

<Source vs Dest> <Show Sources> display shows the traffic transmitted from a specified node to the other first 31 nodes on the Physical Address List. Connections to the following nodes on the list are summarized in the **REST OF NETWORK** field.

<Source vs Dest.> <Show Dest.> Table

The second table display for **<Source vs Dest>** is shown below. The **<Show Dest.>** measurement shows the amount of frames transmitted from the first 31 nodes to a selected node.

```
============================COMMUNICATION MATRIX ============================
15 Feb 87                                                          09:15:00
Dest. Node:        #17 - hp_3000_1
Source Node Traffic:
 # 1-finance_cpu          0 frms/s      #17-hp_3000_1          0 frms/s
 # 2-shipping_cpu_1       0 frms/s      #18-printer_lab        0 frms/s
        :
        :
 #11_accounting           0 frms/s      #26-pub_file_server    0 frms/s
 #12-eng_cad_sys         19 frms/s      #27-gary_r             0 frms/s
        :
        :
  Show      Show      Next    Previous                   OTHER     EXIT
 Sources   Dest. *    Node      Node                    CHOICES
```

Selecting the Source Node

The selected node on this table corresponds to the node marked by the cursor in the **<Graphic Format> <Source vs Dest>** measurement. Use **<Next Node> <Previous Node>** or [NEXT/PREV] keyboard keys to select another node for the **Source Node:** field.

Using the Cursor

The cursor can be moved in tabular displays regardless of whether **<Cursor On>** is on or off. Use the [UP/DOWN] and [LEFT/RIGHT] arrow keys to move the cursor.

Node Connection Matrix

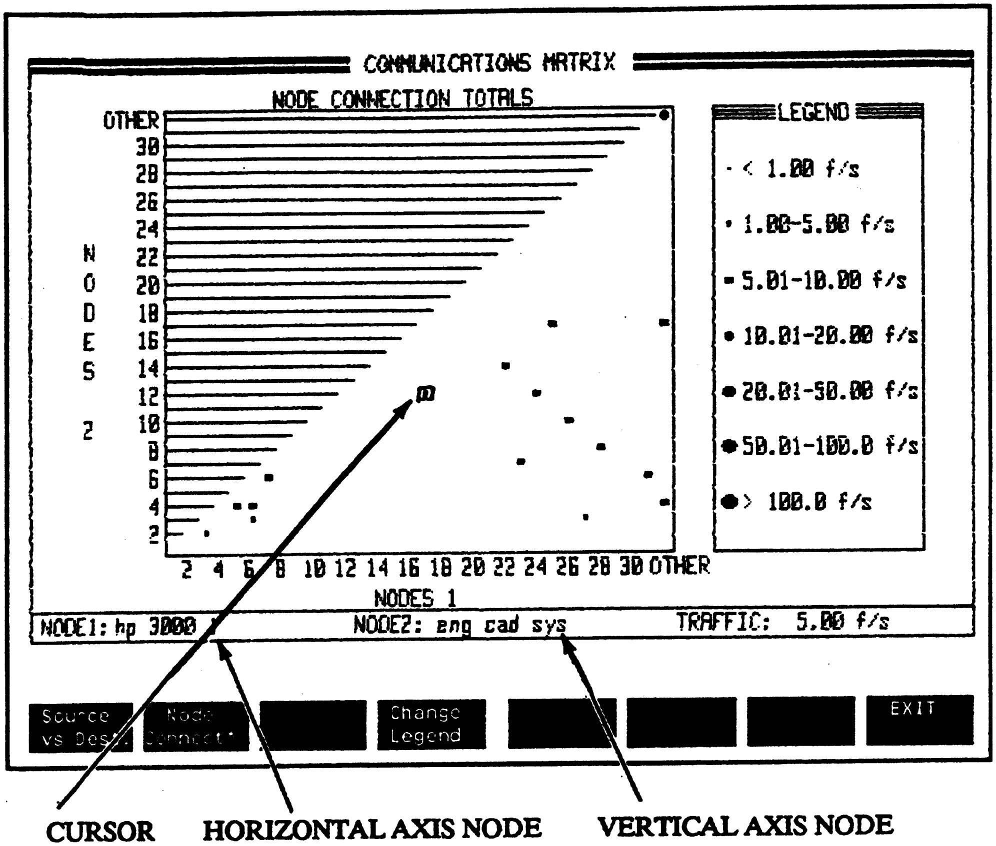


Figure 18-3. Node Communication Matrix <Node Connect>

This node connection matrix shows the combined traffic between the first 31 nodes on the Physical Address List. Traffic between following nodes on the node list are summed in the **OTHER** row/column.

Connections to a node are displayed on both the vertical axis and the horizontal axis.

Differences Between Matrix Measurements

The <Node Connect> matrix is different from the <Source vs Dest> matrix. Notice that the <Node Connect> matrix shows traffic between node pairs while the <Source vs Dest> matrix shows traffic from a source node to other destination nodes.

Measurement Display Legend

The legend at the right side of the display shows the traffic rate in frames/second.

<Change Legend> lets you change the range of frames/second represented by each matrix dot. The relative activity level between two nodes is indicated by the size of the dots. Higher activity is indicated by larger dots.

Using the Cursor

When <Cursor On> is selected, use the [UP/DOWN] and [LEFT/RIGHT] keyboard arrow keys to position the cursor.

When the cursor is positioned over a node pair, the name/address for each node is shown at the bottom of the matrix. The TRAFFIC: field at the bottom of the display shows a numeric value for the traffic level during the last sample period.

The node pair connection marked by the cursor in this matrix display is highlighted in the <Node Connect> <Tabular Format> display.

Setting Measurement Times

<Set Test Times> lets you control the measurement test time. If the measurement is changing too rapidly for you to easily interpret the data, use <Set # of Samp/Avg.> to smooth the measurement display by using an average of several samples.

Node Connection Table

```
=============================COMMUNICATION MATRIX ============================
16 Feb 87                                                            06:07:57
Connect Node1:      #17 - hp_3000_1
Connect Node2 Traffic:
 # 1-finance_cpu            0 frms/s     #17-hp_3000_1           0 frms/s
 # 2-shipping_cpu_1         0 frms/s     #18-printer_lab         0 frms/s
 # 3-file_server_12         0 frms/s     #19-printer_mkt         0 frms/s
 # 4-print_server1          0 frms/s     #20-file_server_4       0 frms/s
 # 5-jeff_t                 0 frms/s     #21-order_processing    0 frms/s
 # 6-eng_cpu_1              0 frms/s     #22-rona_p              0 frms/s
 # 7-print_server_2         0 frms/s     #23-personel_cpu        0 frms/s
 # 8-system_analyzer        0 frms/s     #24-joe_p               0 frms/s
 # 9-file_server_3          0 frms/s     #25-finance_printer     0 frms/s
 #10-jim_q                  0 frms/s     #26-pub_file_server     0 frms/s
 #11-accounting             0 frms/s     #27-gary_r              0 frms/s
 #12-eng_cad_sys            6 frms/s     #28-qa                  0 frms/s
 #13-eng_cpu_2              0 frms/s     #29-security            0 frms/s
 #14-marketing              0 frms/s     #30-inventory_ctrl      0 frms/s
 #15-jim_u                  0 frms/s     #31-belinda_y_r         0 frms/s
 #16-jeff_s                 0 frms/s     #32-REST OF NETWORK    46 frms/s

 Start   Set Test  Change   Edit       Graphic  Tabular   OTHER     EXIT
 Test    Times     Graph    Node List  Format   Format *  CHOICES
```

SELECTED CONNECTION NODE

Figure 18-4. Communication Matrix <Node Connec.> Table

This **<Node Connect>** measurement shows the combined traffic (transmit and receive frames) between a selected node and the other first 31 nodes from the Physical Address List. Connections to the following nodes on the list are summarized in the **REST OF NETWORK** field.

Selecting the Connection Node

The selected connection node for this table corresponds to the node marked by the cursor in the **<Graphic Format> <Node Connect>** measurement.

Use **<Next Node>**/**<Previous Node>** or [NEXT/PREV] keyboard keys to select another node for the **Connect Node1:** field.

Using the Cursor

The cursor can be moved in this tabular display regardless of whether **<Cursor On>** is on or off. Use the [UP/DOWN] or [LEFT/RIGHT] arrow keys to move the cursor.

Connection Summary Measurement

Only one measurement is used for the <Connec. Summary> measurement. The single measurement is a table display.

- Node Stats
  - Node List Stats
  - Connection Stats
    - Comm. Matrix
    - Connect. Summary
      - Start Test
        - Stop Test
        - Stop Display
          - Resume Display
      - Set Test Times
        - Set Meas. Time
          - Seconds Minutes Hours Days
        - Set Samp. Time
          - Seconds Minutes Hours
      - Sort Connections
        - Sort By Frame Cnt
        - Sort By KByte Cnt
        - Sort By Error Cnt
        - Sort By Err Rate
    - Connect. Of A Node
  - Network/Node Stat
  - Frame Timing
  - Frame Length
  - Frame Analysis

Connection Summary

```
============================== CONNECTION SUMMARY ========================
16 Feb 87                                                        06:13:23
    Connection Node    Last Sample    Frame    KByte    Error   Error    Avg. Frm
    Name or Address    Frame Cnt.     Count    Count    Count   Rate     Size
    ---------------    -----------  -------  -------  ------  -------  -----
    eng_cpu_1          XMT       0        0        0       0  0.00E+0      0
    print_server1      XMT      46      170      127       0  0.00E+0    734

    eng_cpu_1          XMT       0        0        0       0  0.00E+0      0
    file_server_12     XMT      46      170       20       0  0.00E+0    106

    print_server1      XMT       0        0        0       0  0.00E+0      0
    system_backup      XMT      46      170       20       0  0.00E+0    172

    qa                 XMT      46      170       25       0  0.00E+0    136
    system_analyzer    XMT       0        0        0       0  0.00E+0      0

----------------------------------------------------------------------------
Start time = 16 Feb 87   06:13:31          Stop time = 16 Feb 87   06:14:31
Measurement time =  60 Seconds             Sample time =  1 Second

Start    Set Test   Sort Con-                                  EXIT
Test     Times      nections
```

Figure 18-5. Connection Summary Table

This Connection Summary measurement shows the busiest level 2 (Ethernet/IEEE 802.3) connections on your network, monitors the total number of frames passed between two nodes, the error count or error rate, as well as the frame size.

Activity can be measured for up to 50 node pairs.

Softkey	Description
<Sort Connections>	lets you sort the measurement. The default display lists the nodes by most active frame count. Use **<Sort Connect.>** to display frames by the following orders: **<Sort By Frame Count>** **<Sort By Error Count>** **<Sort By KByte Count>** **<Sort By Error Rate>** Run-time sorting is a combination of traffic (f/s between nodes) and "age." If a connection stops sending, it slips further down the list until it drops off the bottom. This lets the most recent, most active connections be displayed.

Measurement Display Fields

Field	Description
Last Sample Frame Count	display column shows how many frames were transmitted by each node in the last sample period.
Frame Count	display column shows the total frame count occurring since the start of the current measurement period.
Kbyte Count	display column shows how much traffic has been transmitted in kilobytes since the start of the measurement.
Error Count	shows how many total errors have transmitted by each frame since the start of the measurement. Error Count includes: Bad FCS/Misaligns, Jabbers Collisions, Runts
Error Rate	displays the percentage of frames transmitted with an error.
Avg. Size	column displays the average size of frames transmitted by each node since the start of the measurement.

Connection of a Node Measurement

Press the highlighted softkeys shown below to make **# Connect vs Time** (default display) and **<Display % vs Conn>** graphic display measurements.

```
Node Stats
   Node List Stats
  Connection Stats
      Comm. Matrix
      Connect. Summary
     Connect. Of A Node
           Start Test
                 Stop Test
                 Stop Display
                        Resume Display
           Set Test Time
                 Set Meas. Time
                        Seconds  Minutes  Hours  Days
                 Set Samp. Time
                        Seconds  Minutes  Hours
           Select Node
                 Select By     Select By     Set
                   Name         Address      Time
           Set Graph Ranges
                 Set #       Set #      Set Time    Set Time    Elapsed    Absolute
               Low Bound   Hi Bound   Low Bound   Hi Bound     Time*       Time
           Edit Lists
           Graphic Format
           Tabular Format
           OTHER CHOICES
           Cursor On
           Cursor Off
           Display % vs Conn
                Numeric     Numeric     Numeric      Return To
                Data Off    Data %      Data Cnt       Meas.
           Set Alarms
           Autoscale On
           Autoscale Off
   Network/Node Stat
   Frame Timing
```

of Connections to a Node

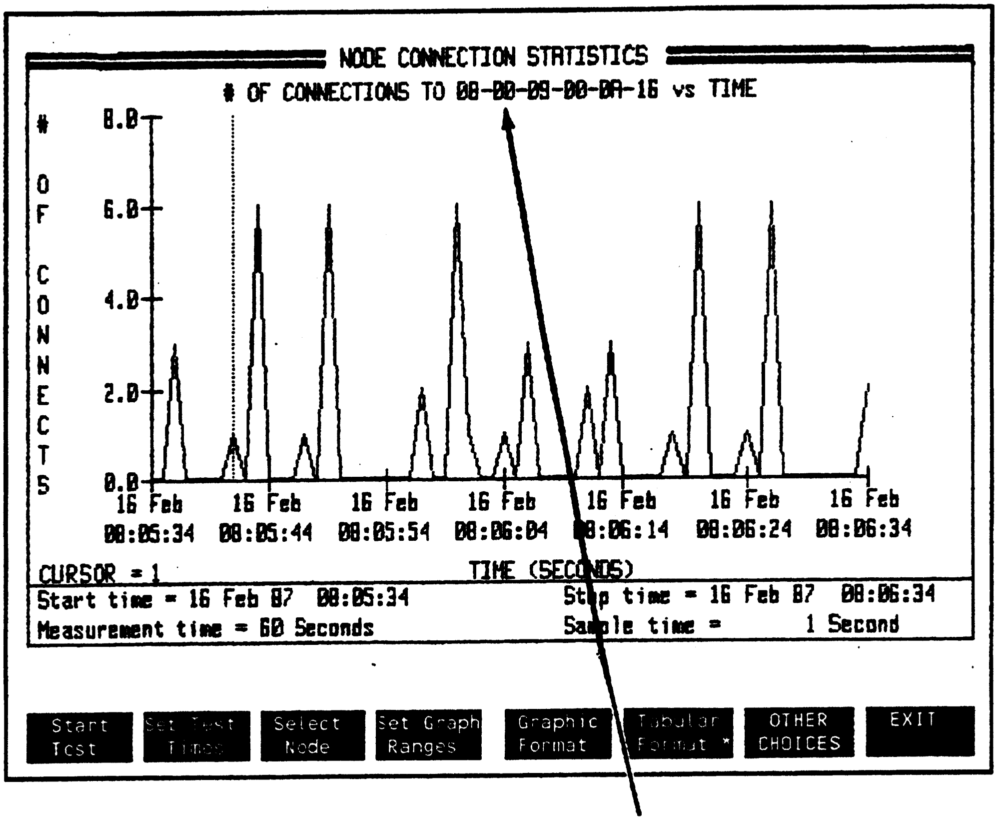


Figure 18-6. Number of Connections to a Node vs Time

This figure is the default display for <**Connect. Of A Node**>. This measurement shows the number of different addresses transmitting to a specific node during a sample time.

All nodes on your network that transmit to the selected destination address are counted; not just the nodes on the protocol analyzer's <**Phys Addr List**>. The analyzer can measure up to 100 connections in a given sample period.

This measurement is for level 2 connections only. The analyzer detects the existence of a connection rather that the initiation of one. If a connection is established, terminated, and established again all in one sample period, the analyzer counts only one connection rather than two connections.

Selecting the Node

Softkey	Description
<Select Node>	The node you select as a destination is identified at the top of the display. You can use a node's name or address to specify which node's connections you want to examine. **<Select By Name>** lets you enter a name from the node list. Softkeys showing existing node names are displayed. **<Select By Address>** Lets you enter a node address. You can use don't care characters (xx) to select a group of related nodes. For example, if you enter 08-00-09-00-0A-XX, you would count connections to all nodes having the common first five pairs of hex characters in their address.

Vertical Axis Scale

<Set # Low Bound> <Set # High Bound>	The vertical scale can be changed to show different resolution <Set # High Bound> for the measurement. However, the scale must contain at least four connections.

Percentage of Connections

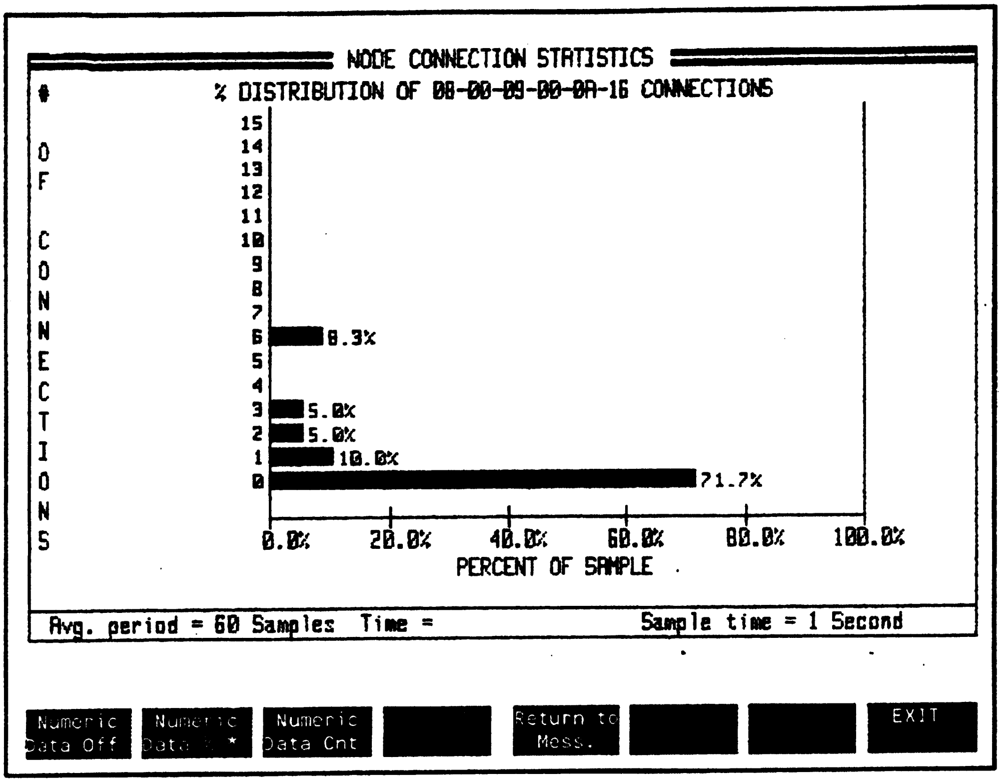


Figure 18-7. Percentage Distribution of Connections to a Node

After **<Connect. of a Node>** measurement ends, press **<OTHER CHOICES>** and **<Display % vs Conn>**.

This bar graph shows the percentage of time that different numbers of connections were made to a selected node. This display is shown in a post processing mode only. It is not shown in real time. The graph is automatically scaled.

Labeling the Numeric Data

Softkey	Description
<Numeric Data Off>	This softkey removes the label for how much data occurred for each bar.
<Numeric Data %>	This softkey labels each bar with the percentage of time that each number of connections occurred during the measurement period.
<Numeric Data Cnt>	This softkey labels each bar with how many times each number of connections occur during the measurement.

of Connections to a Node Summary

The softkey tree below applies to the summary table for **<Connec. Of A Node>** measurement.

```
Node Stats
     Node List Stats
    Connection Stats
          Comm. Matrix
          Connect. Summary
         Connect. of a Node
                  Start Test
                          Stop Test
                          Stop Display
                               Start Display
                  Set Test Times
                          Set Meas. Time
                               Seconds   Minutes   Hours   Days
                          Set Samp. Time
                               Seconds   Minutes   Hours
                  Select Node
                          Select By    Select By    Set
                           Name        Address      Time
                  Set Alarms
                  Graphic Format
                  Tabular Format
                  OTHER CHOICES
                  Set Time Format
                          Elapsed    Absolute
                           Time        Time
     Network/Node Stat
     Frame Timing
     Frame Length
     Frame Analysis
```

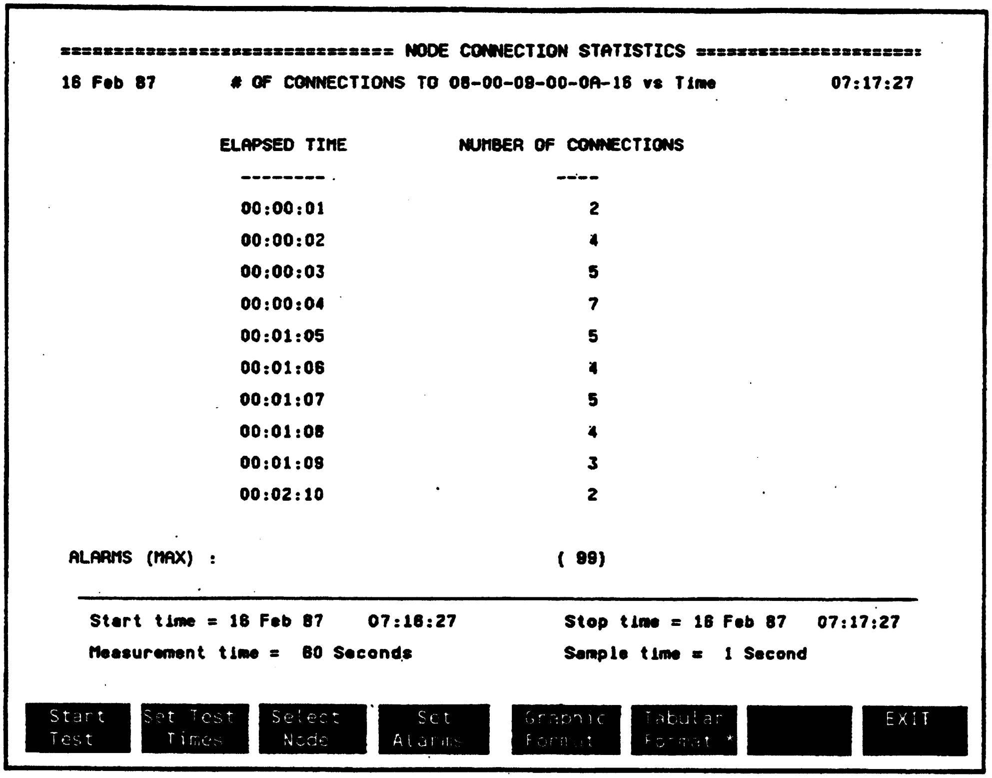


Figure 18-8. Table Display for Connections of a Node

This table summarizes the number of connections made to a selected node during each sample time. The table summary offers the convenience of numeric values displayed for each sample period rather than having to interpret a graph display.

19

Node/Network Summary

This chapter describes the measurements used to show a traffic summary for a selected node.

Performance measurements in this chapter include:

- Node/Network Measurement
- Node/Network Summary Table

MEASUREMENTS	DISPLAY	COMMENT
<Node/Net Summary>		From the Node Stats Menu, press <Node/Net Summary> to view performance measurements about a selected node's utilization and percentage of network traffic.
Node/Network Summary Measurement		
<Numeric Values>	Bar Graph	
<Percentage Of Network>	Bar Graph	
Node/Network Summary Table		
<Numeric Values>	Table	
<Percentage Of Network>	Table	

Node/Network Summary Measurement

- Node Stats
  - Node List Stats
  - Connection Stats
  - Node/Net Summary
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds Minutes Hours Days
      - Set Samp. Time
        - Seconds Minutes Hours
      - Set # of Samp/Avg.
        - Select Samples per avg period
    - Select Node
      - Select By Name | Select By Address
    - Graphic Format
    - Tabular Format
    - OTHER CHOICES
    - Select Graph
      - Numeric Values | Percent Of Ntwrk
    - Set Graph Ranges
      - Set % Low Bound | Set % Hi Bound | Set Err. Low Bound | Set Err. Hi Bound
    - Auto Scale On
    - Auto Scale Off
  - Frame Timing
  - Frame Length
  - Frame Analysis

Node Network Summary Measurement

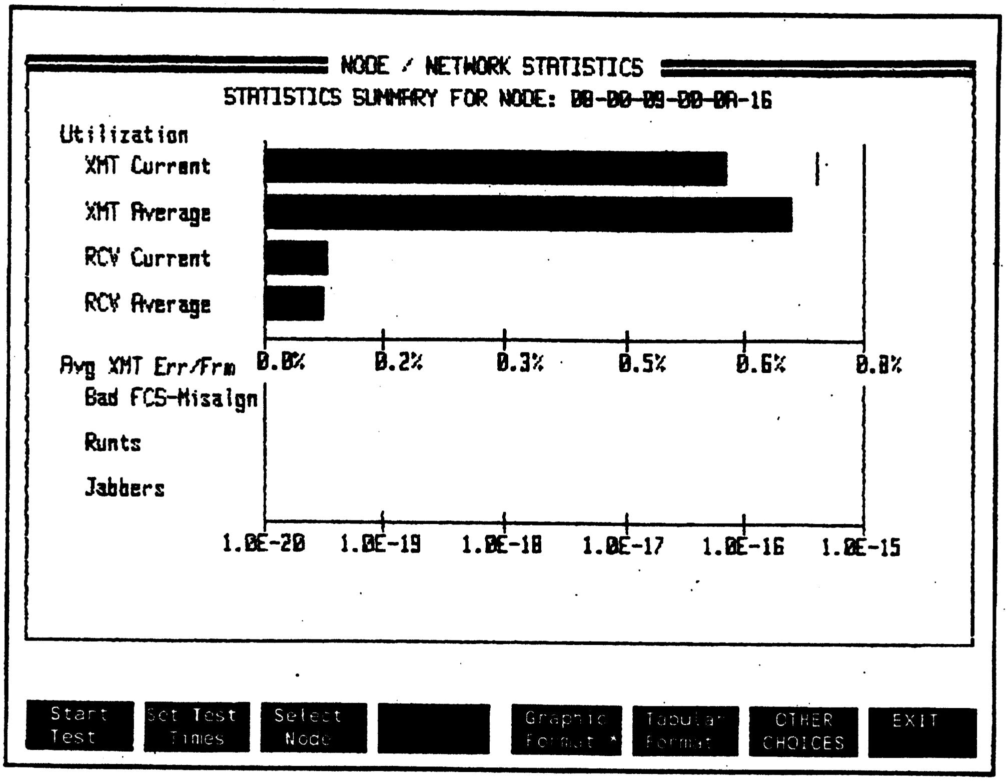


Figure 19-1. Node Summary Measurement Graph Display

The **<Node/Net Summary>** measurement shows the utilization for a selected node's transmitted and received frames as well as a summary of frame errors transmitted by the selected node. Measurement averages are calculated by using 10 sample periods.

You can use **<Numeric Values>** and **<Percent Of Network>** to change the horizontal scale of the graphs.

Node Utilization

Node utilization can be shown as a percentage of network bandwidth or as a percentage of actual network traffic.

<u>Softkey</u>	<u>Description</u>
<Numeric Values>	When **<Numeric values>** display is chosen, the selected node's utilization is shown as a percentage of the network bandwidth (10 Mbits/second).
<Percent Of Network>	When **<Percent Of Network>** is selected, the display shows the selected node's utilization as a percentage of the activity actually occurring on the network.

Node Average Transmitted Errors/Frame

The lower half of the **<Node/Net Summary>** display shows the number of errors occurring per frame transmitted by a selected node.

<Numeric Values>	In **<Numeric Values>** mode, the display shows an average of how many errors the selected node transmits for each frame transmitted. Since worst case for transmitted errors is an error transmitted in each frame, the display typically shows fractions of errors/frame.
<Percent Of Network>	In **<Percent of Network>** mode, the display shows the percentage of errors occurring on the network that are transmitted by the selected node.

Node/Network Summary -- Tabular

Node Stats
- Node List Stats
- Connection Stats
- Node/Net Summary
  - Start Test
    - Stop Test
    - Stop Display
      - Resume Display
  - Set Test Times
    - Set Samp. Times
      - Seconds   Minutes   Hours
    - Set # of Samp/Avg.
  - Select Table
    - Numeric Values   Percent Of Ntwrk
  - Select Node
    - Select By Name   Select By Address   Set Time
  - Graphic Format
  - Tabular Format
- Frame Timing
- Frame Length
- Frame Analysis

Node/Network Summary Table

```
========================== NETWORK AND NODE STATISTICS =======================
18 FEB 87        STATISTICS SUMMARY FOR NODE: 08-09-00-00-1A-34           08:38:30

----- Utilization and Throughput -----------+---------- Frame Parameters --------
         Current   Average     Peak         |                     RCV     XMT
XMT       0.00     0.0000      0.00  %      |  Average Size        0       0
RCV       0.00     0.0000      0.00  %      |  Maximum Size        0       0
XMT        0        0.00        0  kbits/s  |  Minimum Size        0       0
RCV        0        0.00        0  kbits/s  |  Total Frames        0       0
XMT        0        0.00        0  frms/s   |  Total Bytes         0       0
RCV        0        0.00        0  frms/s   |
                                            |
--------------------------- Transmission Errors ------------------------------
                     Bad FCS/Misalign     Runts        Jabbers
    Total Count              0              0             0
    Average Err/frm     0.000E+0        0.000E+0      0.000E+0    Err/frm
    Peak err/frm        0.000E+0        0.000E+0      0.000E+0    Err/frm

 Start time =  5 Feb 87  00:02:08          Stop time =  5 Feb 87  00:03:00
 Measurement time = 60 Seconds             Sample time = 1 Second

 Start   Set Test           Select   Graphic   Tabular     OTHER     EXIT
 Test    Times              Node     Format    Format *    CHOICES
```

Figure 19-2. Statistics Summary for a Selected Node

This summary measurement summarizes the Node/Net measurement and also shows frame parameter measurements for a selected node.

<OTHER CHOICES> <Select Graph> let you change the display. In **<Numeric Values>** mode, the display shows actual values for statistics reported for a specific node. **<Percent Of Network>** mode shows the selected node's frame statistics as a percentage of the total network traffic.

The display summarizes the Utilization/Throughput, Frame Parameters, and the Transmission Errors measurements.

Utilization and Throughput

Utilization Percentage

	<Numeric Values>					<Percentage Of Network>			
	Current	Average	Peak			Current	Average	Peak	
XMT	4.98	4.33	5.13	%	XMT	25.16%	23.87%	27.22%	%
RCV	2.12	3.44	3.78	%	RCV	13.14%	14.44%	16.54%	%

In the example above, notice that depending on the display selection, you can see the actual quantity of frames transmitted and received by the selected node, or, you can view the selected node's traffic as a percentage of total network traffic.

Throughput kbits/s and frms/s

The throughput part of the display shows how much traffic the selected node has transmitted and received in the last sample period. The traffic count is shown in both kilobits/second and in frames/second.

The display also shows the average transmitted and received traffic for the last 10 sample times and finally what the peak or highest traffic rate has been for any sample period during this measurement time.

<Percentage Of Network> displays the throughput data as a percentage of the total network traffic.

Frame Parameters

The <Numeric Values> display shows the size and quantities of frames transmitted and received by the selected node. The average frame size is calculated from the start of the measurement.

<Percent Of Network> shows the frame parameters as an percentage of the total frame parameters occurring on the network.

Transmission Errors

<Numeric Values> shows the numeric value of how many errors occur for each frame transmitted by the selected node. The errors that are counted are: Bad FCS/Misalign, Runts and Jabbers. Average errors are calculated using the last 10 sample times.

Peak errors show the largest number of errors occurring in any sample time for the current measurement period.

<Percentage Of Network> shows the selected node's transmission errors as a percentage of the total errors occurring on the network.

20

Node Frame Timing

This chapter describes the measurements you can make about timing relationships between frames received by a selected node.

Node frame timing measurements in this chapter include:

- Node Interframe Timing Measurements
- Node Interframe Timing Summary

MEASUREMENTS	DISPLAY	COMMENTS
<Frame Timing>		From the Node Stats Menu, press <Frame Timing> to view performance measurements about the time between frames for a selected node.
Node Interframe Timing Measurements		
<Interfrm Space Bar>	**Bar Graph**	
<Interfrm Space Pie>	**Pie Graph**	
Node Interframe Timing Summary		
<Tabular Format>	**Table**	

Node Interframe Timing Measurements

Softkeys preceded by an asterisk (*) are only used in bar graph displays.

Node Stat
- Node List Stats
- Connection Stats
- Node/Net Summary
- Frame Timing
  - Start Test
    - Stop Test
    - Stop Display
      - Resume Display
  - Set Test Times
    - Set Meas. Time
      - Seconds   Minutes   Hours   Days
    - Set Samp. Time
      - Seconds   Minutes   Hours
    - Set # of Samp/Avg.
      - Select number of samples for average
  - Select Graph
    - Interfrm Space Bar   Interfrm Space F[illegible]
  - Select Node
    - Select By Name   Select By Address
  - Graphic Format
  - Tabular Format
  - OTHER CHOICES
  - * Numeric Data Off
  - * Numeric Data %
  - * Numeric Data Cnt
  - Set Graph Ranges
    - Set Time Low Bound   Set Time Hi Bound   * Set % Low Bound   * Set % Hi Bound
  - * Autoscale On
  - * Autoscale Off
- Frame Length
- Frame Analysis

<Interfrm Space Bar> Graph Display

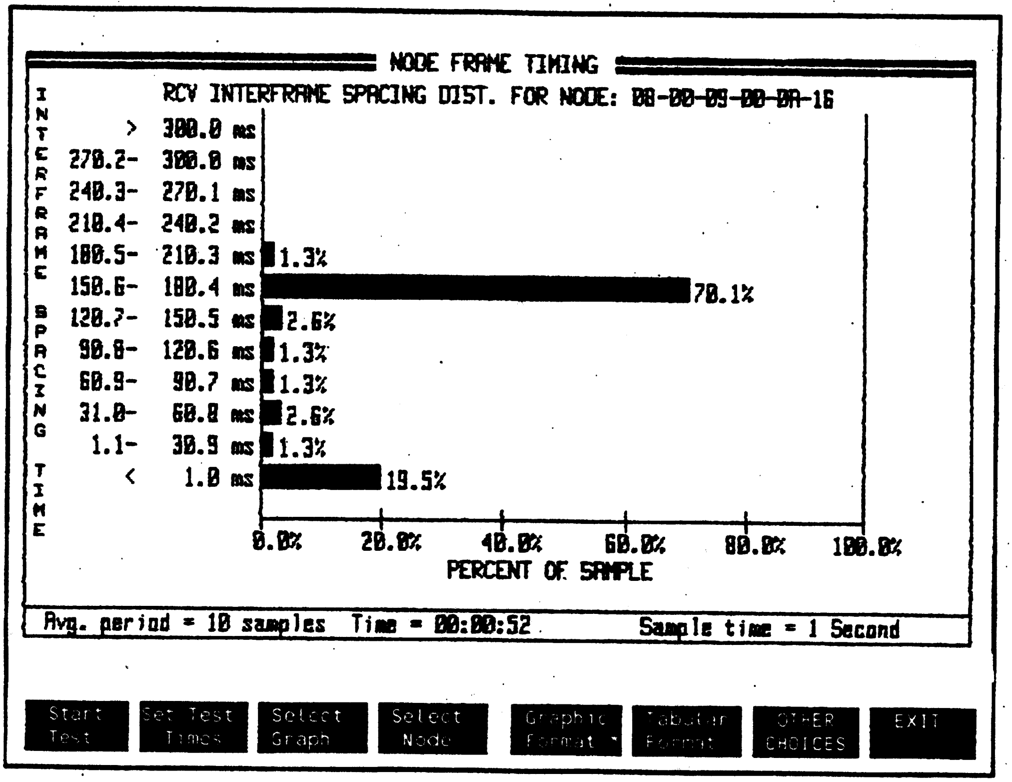


Figure 20-1. Bar Graph for Time Between Received Frames

This display shows the distribution of time occurring between frames received by a selected node. Interframe spacing is defined as the time from the end of the FCS field of one frame to the beginning of the Preamble field of the next frame.

Just as it is important to know how many nodes are talking to a selected node, you may want to see how much time occurs between frames communicating with the node. This traffic pattern display gives you an idea of how bursty the traffic is.

Questions you have about interframe space may include:

- Does most of the traffic occur with very small spacing between frames?
- Is the traffic distributed evenly over several time ranges?

Devices such as personal computers may not be able to receive frames closely spaced together. If frames are too close to each other, the computer can miss some of the frames. The upper level protocols take care of retransmitting the message. However, retransmissions are a waste of network bandwidth. You may want to have devices wait or delay some amount of time before transmitting to a PC.

<Interfrm Space Pie> Graph Display

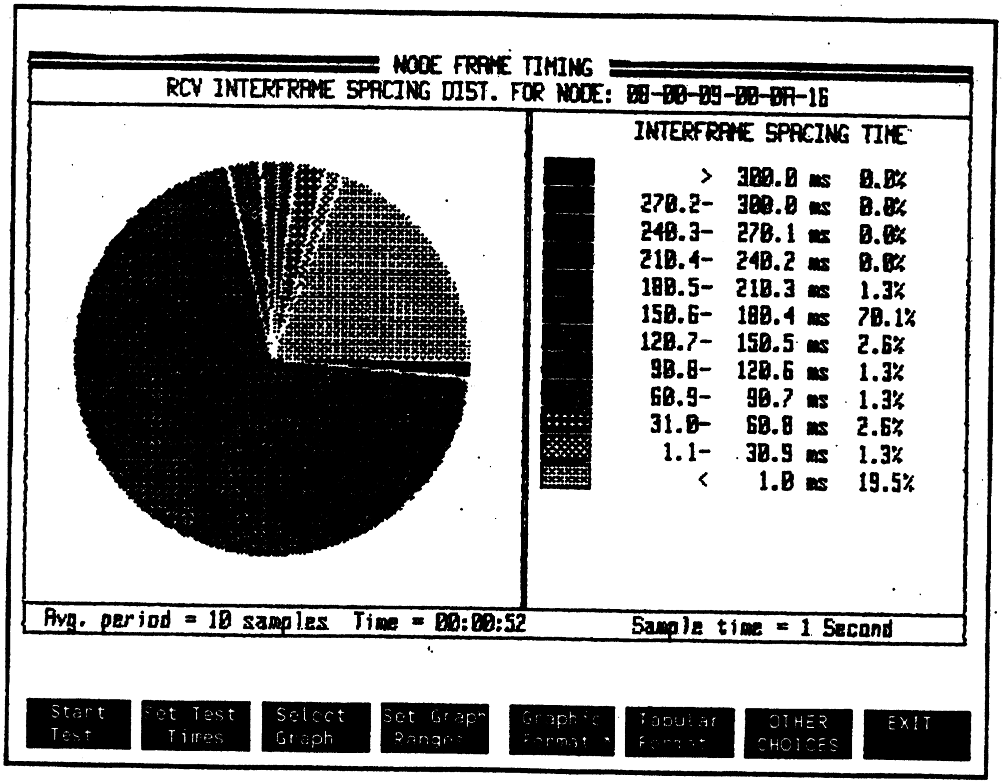


Figure 20-2. Pie Graph for Time Between Frames

This pie graph shows the distribution of time occurring between frames received by a selected node.

The time ranges in this pie chart are the same as the **<Interfrm Space Bar>** display shown in figure 20-1. The pie chart provides a different presentation of the distribution of time ranges between frames. The legend at the right of the display shows what background pattern is used for each of the time ranges used in the pie chart.

Node Interframe Timing Summary

- Node Stats
  - Node List Stats
  - Connection Stats
  - Node/Net Summary
  - Frame Timing
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Time Display
      - Elapsed Time | Absolute Time
    - Set Test Times
      - Set Meas. Time
        - Seconds | Minutes | Hours | Days
      - Set Samp. Time
        - Seconds | Minutes | Hours
      - Set # of Samp/Avg.
        - Select samples per average period
    - Select Node
      - Select By Name | Select By Address | Set Time
    - Set Table Ranges
      - Set Time Low Bound | Set Time Hi Bound
    - Graphic Format
    - Tabular Format
  - Frame Length
  - Frame Analysis

Node Interframe Timing Summary

```
================================ NODE FRAME TIMING ============================
15 Feb 87  RCV INTERFRAME SPACING DIST. FOR NODE: 08-00-09-00-1A-34  16:38:30
    ELAPSED TIME            SPACING TIME              %         COUNT
 ------------------     -----------------        -------    ---------
     00:00:15                > 1000.0    ms         0.0%             0
                        1000.0- 900.1    ms         0.0%             0
                         900.1- 800.2    ms         0.0%             0
                         800.2- 700.3    ms         0.0%             0
                         700.3- 600.4    ms         0.0%             0
                         600.4- 500.5    ms         0.0%             0
                         500.5- 400.6    ms         0.0%             0
                         400.6- 300.7    ms         0.0%             0
                         300.7- 200.8    ms         0.0%             0
                         200.8- 100.9    ms         0.0%             0
                         100.9-    1.0   ms         0.0%             0
                           <     1.0     ms         0.0%             0

Start time = 15 Feb 87  01:33:29          Stop time = 15 Feb 87  01:33:41
Measurement time = 12 Seconds             Sample time =  1 Second
```

Start Test	Set Test Times	Select Node	Set Table Ranges	Graphic Format	Tabular Format *		EXIT

Figure 20-3. Tabular Display for Time Between Frames

This figure summarizes measurements for time between frames to a specific node. The table shows the percentage of time each time range is occurring between frames in the current measurement period. A number count is shown for how many times each time range occurs between frames during the measurement.

Setting the Time Display

You can set the time display to show the actual time of day or the elapsed time since the start of the test.

After a measurement ends, the display stops and keeps the final values of the measurement.

Softkey	Description
<Elapsed Time>	In default mode, the display is updated showing the elapsed time since the start of the test.
<Absolute Time>	test time mode shows the actual time of day. the Day, month, year, hour, minute, and second are updated during the measurement.

21

Node Frame Length

This chapter describes measurements used to show statistics about the length of frames transmitted by a selected node. Node frame length performance measurements in this chapter include:

- Average Frame Length vs Time
- Frame Length Distribution
- Node Frame Length Summary

MEASUREMENTS	DISPLAY	COMMENTS
<Frame Length>		From the Node Stats Menu, press <Frame Length> to view performance measurements about lengths of frames transmitted by a selected node.
Average Frame Length vs Time		
<Avg Len. vs Time>	Line Graph	
Frame Length Distribution		
<Frm. Len. Dist Bar>	Bar Graph	
<Frm. Len. Dist Pie>	Pie Graph	
Node Frame Length Summary		
<Tabular Format>	Table	

Average Frame Length vs Time

This softkey tree applies for all the <**Frame Length**> graph measurements. Differences between selections for different graphs are indicated.

- **Node Stats**
  - Node List Stats
  - Connection Stats
  - Network/Node Stat
  - Frame Timing
  - **Frame Length**
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds | Minutes | Hours | Days
      - Set Samp. Time
        - Seconds | Minutes | Hours
    - **Select Graph**
      - **Avg. Len. vs Time** | **Frm. Len. Dist. Bar** | **Frm. Len. Dist. Pie**
    - Select Node
      - Select By Name | Select By Address
    - Graphic Format
    - Tabular Format
    - OTHER CHOICES
      - (see next page)
    - Set Graph Ranges
      - (see next page)
  - Frame Analysis

Other Choices (from previous page)

Other Choices

Avg Len. vs Time	Frm. Len. Dist. Bar	Frm. Len. Dist. Pie
Cursor On	Numeric Data Off	NA
Cursor Off	Numeric Data %	NA
	Numeric Data Cnt	NA

Set Graph Ranges (from previous page)

Set Graph Ranges

Set Len. Low Bound	Set Len. Hi Bound	Set Time Low Bound	Set Time Hi Bound	Elapsed Time	Absolute Time

Avg Len. vs Time	Frm. Len. Dist. Bar	Frm. Len. Dist. Pie
Autoscale On	Autoscale On	NA
Autoscale Off	Autoscale Off	NA

<Avg. Len. vs Time> Bar Graph

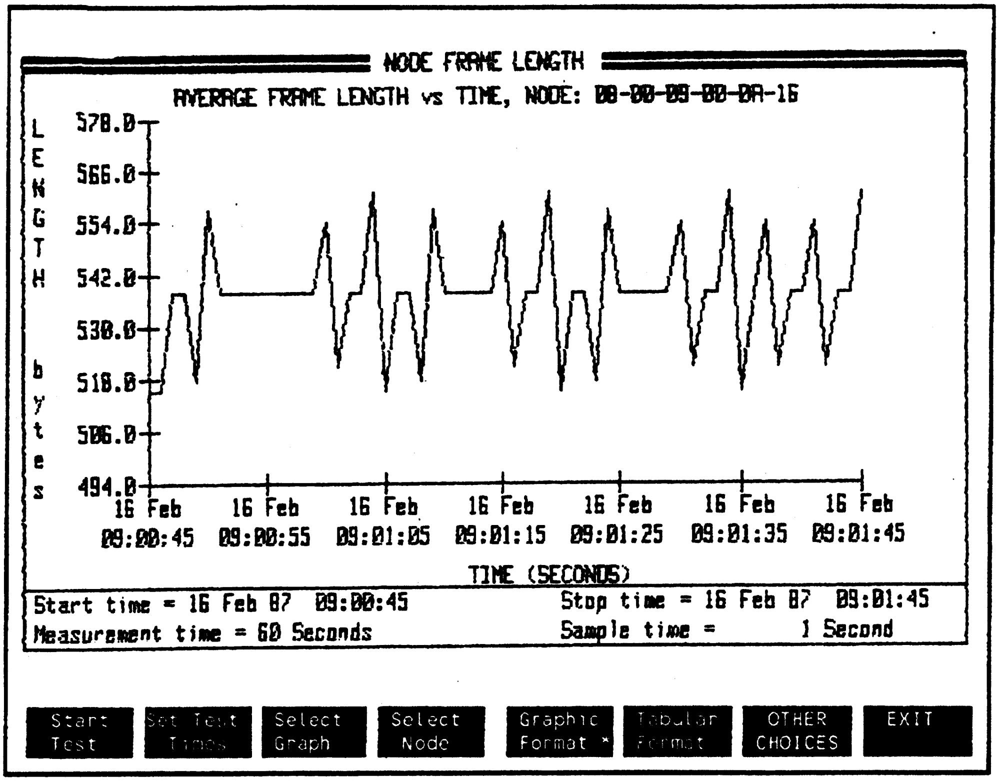


Figure 21-1. Frame Length vs Time Graph Display

This measurement shows the average length of frames transmitted by a selected node during each sample period.

Knowing the length of frames received by a particular node can help you to understand the current rate of traffic.

If the network utilization measurement shows a low utilization, you may want to check the frame length of frames addressed to a particular node. Average frame length to a node primarily depends on how random the traffic spacing is, not necessarily on how short the frames are. Random traffic spacing typically comes from terminals or virtual circuit traffic because of interactive sessions between users and the computer.

You may expect to see longer frames occur at times when network file backups are performed. Shorter frames may occur on transaction servers.

Using the Cursor to See Sample Period Details

In the <Avg. Len vs Time> display, move the cursor to any sample period of interest and then switch to bar, pie, or tabular measurements to see details about frame length distribution for that selected sample period.

While in bar, pie, or tabular measurements, use [NEXT] or [PREV] to move the cursor.

Frame Length Distribution

Bar Graph

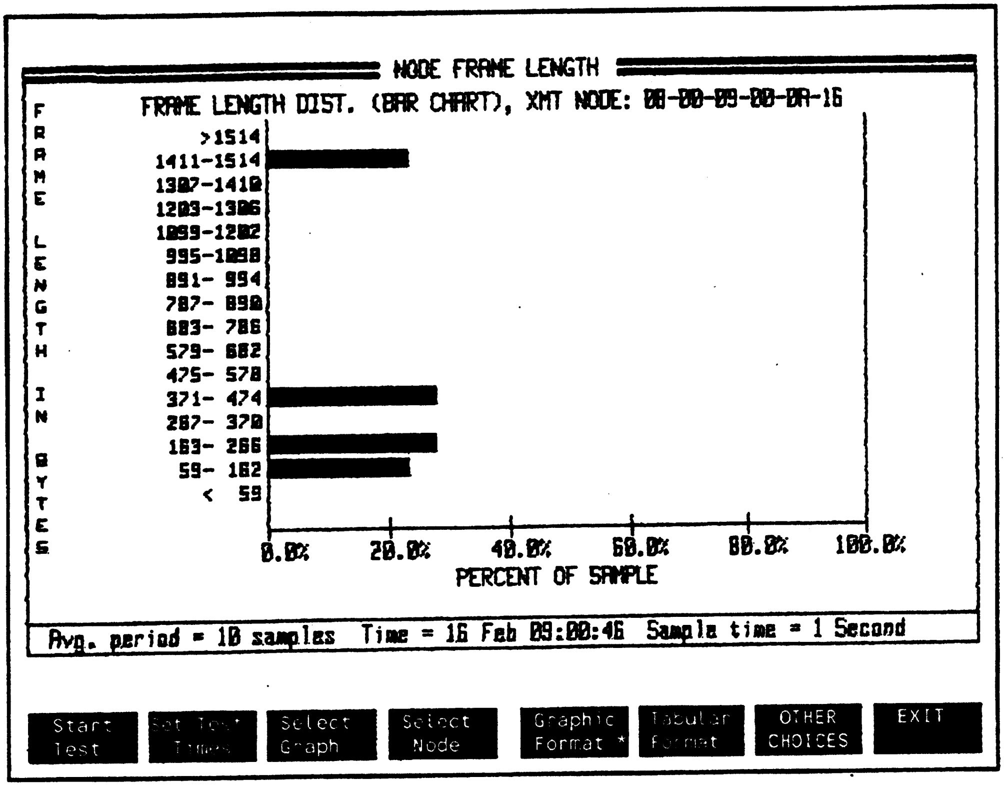


Figure 21-2. Frame Length Distribution Bar Graph

<Avg. Len. vs Time> shows distribution by frame length of frames sent by a selected node. You can easily recognize patterns of frame transmissions to a selected node.

Statistics Questions about File Servers

Some common questions you may have about frame length of traffic to a file server may include:

- Are most of the frames transmitted by a file server greater than 1000 bytes?
- Are the majority of frames transmitted by the file server close to the minimum frame length?
- Does the distribution of frame lengths change between day shift and night shift?

Frame Length Distribution Pie Graph

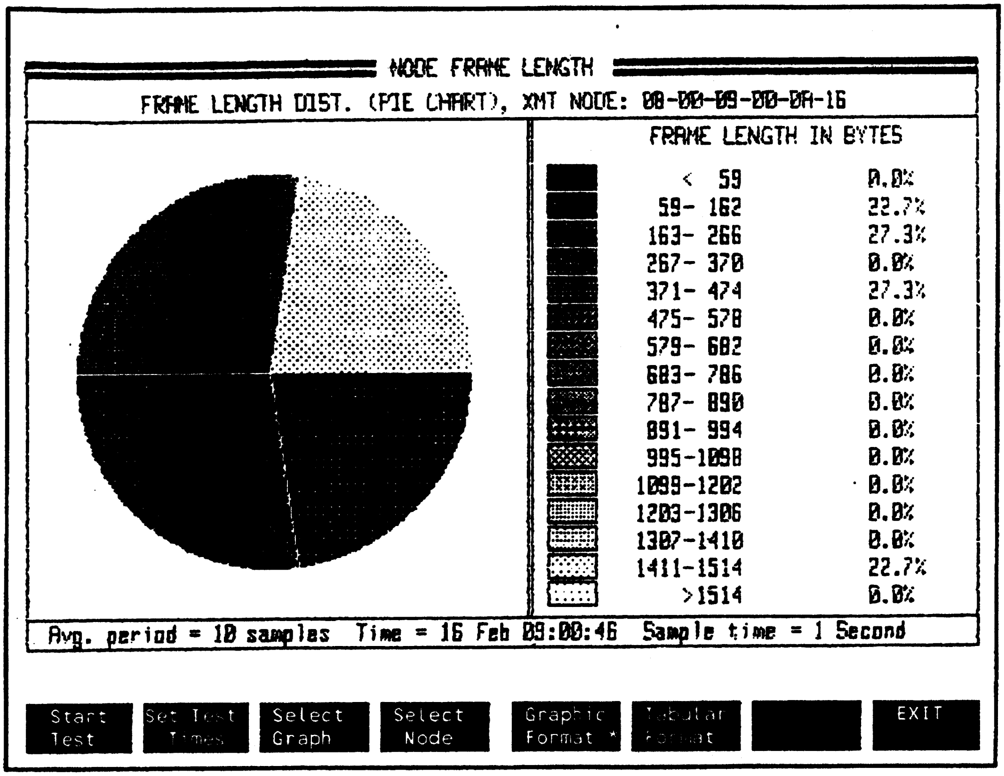


Figure 21-3. Frame Length Distribution Pie Graph

Similar to Figure 21-2, this measurement shows the frame length distribution for frames transmitted by a selected node. The analyzer uses a running average of the last "N" samples to update the display every five seconds. You can select the number of samples to average the display. The default average is for 10 sample times.

The legend at the right of the display shows the different backgrounds used to indicate different ranges of frame lengths.

Node Frame Length Summary

- Node Stats
  - Node List Stats
  - Connection Stats
  - Network/Node Stat
  - Frame Timing
  - Frame Length
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Set Test Times
      - Set Meas. Time
        - Seconds
        - Minutes
        - Hours
        - Days
      - Set Samp. Time
        - Seconds
        - Minutes
        - Hours
    - Select Node
      - Select by Name
      - Select by Address
    - Set Table Ranges
      - Set Len. Low Bound
      - Set Len. Hi Bound
      - Elapsed Time
      - Absolute Time
    - Graphic Format
    - Tabular Format
  - Frame Analysis

Node Frame Length Summary

NODE FRAME LENGTH

16 Feb 87 AVERAGE FRAME LENGTH AND FRAME LENGTH DISTRIBUTION 08:30:00

NODE: 08-00-09-00-1A-34

ELAPSED TIME	AVERAGE LENGTH	FRAME LENGTH DISTRIBUTION BYTES:	%	COUNT	BYTES:	%	COUNT
00:00:01	515.2	< 58	0.0%	0	787- 890	0.0%	0
		59- 162	22.7%	5	891- 994	0.0%	0
		163- 266	27.3%	6	995-1098	0.0%	0
		267- 370	0.0%	0	1099-1202	0.0%	0
		371- 474	27.3%	6	1203-1306	0.0%	0
		475- 578	0.0%	0	1307-1410	0.0%	0
		579- 682	0.1%	0	1411-1514	27.7%	5
		683- 786	000%	0	>1514	0.0%	0

Start time = 16 Feb 86 08:15:00 Stop time = 16 Feb 87 08:16:00

Measurement time = 60 Seconds Sample time = 1 Second

Start Test | Set Test Time | Select Node | Set Table Ranges | Graphic Format | Tabular Format * | | EXIT

Figure 21-4. Summary Table for Node Frame Length

This measurement summarizes the frame length distribution measurements for a selected node. The table shows the average frame length for each sample time as well as the percentage of distribution and the number of frames occurring for each range of frames.

22

Node Frame Analysis

This chapter describes measurements about filters matched by frames transmitted and received by a selected node.

Performance measurements in this chapter include:

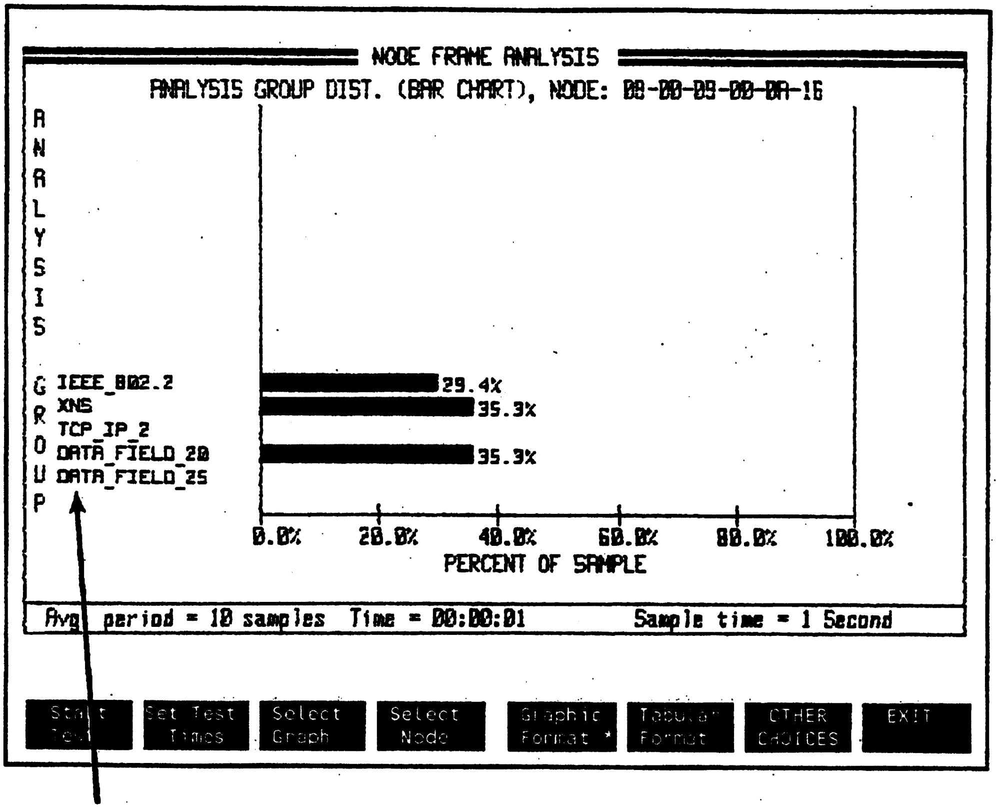
- Node Frame Distribution
- Node Frame Distribution Summary

MEASUREMENT	DISPLAY	COMMENTS
<Frame Analysis>		From the Node Stats Menu, press <Frame Analysis> to view performance measurements about fames matching filters you specify.
Node Frame Distribution		
<Frm Anal Dist Bar>	Bar Graph	
<Frm Anal. Dist Pie>	Pie Graph	
Node Frame Distribution Summary		
<Tabular Format>	Table	

Node Frame Distribution

- Node Stats
  - Node List Stats
  - Connection Stats
  - Network/Node Stat
  - Frame Timing
  - Frame Length
  - Frame Analysis
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Setup Test Times
      - Set Samp. Time
        - Seconds   Minutes   Hours   Days
      - Set Avg. Time
    - Select Graph
      - Frm. Anal Dist Bar   Frm. Anal Dist Pie
    - Select Node
      - Select by Name   Select by Address
    - Graphic Format
    - Tabular Format
    - OTHER CHOICES
      - Frm. anal. Dist Bar
        - Numeric Data On
        - Numeric Data %
        - Numeric Data Cnt
        - Edit Filters
        - Autoscale On
        - Autoscale Off
      - Frm. anal. Dist Pie
        - Edit Filters

Node Frame Analysis Distribution Bar Graph



DEFINED FILTER LABELS

Figure 22-1. Node Frame Analysis Distribution - Bar Graph

This measurement shows the percentage of frames transmitted and received by a selected node that match filters defined in the Edit Filters Menu. The defined filters should be mutually exclusive since only the first filter match in each frame is counted. "Pass filters" exclude all other filters from being counted when they match within the same frame.

You can average the display for a selected number of sample periods. The default average period is 10 sample times.

Node Frame Analysis Distribution Pie Graph

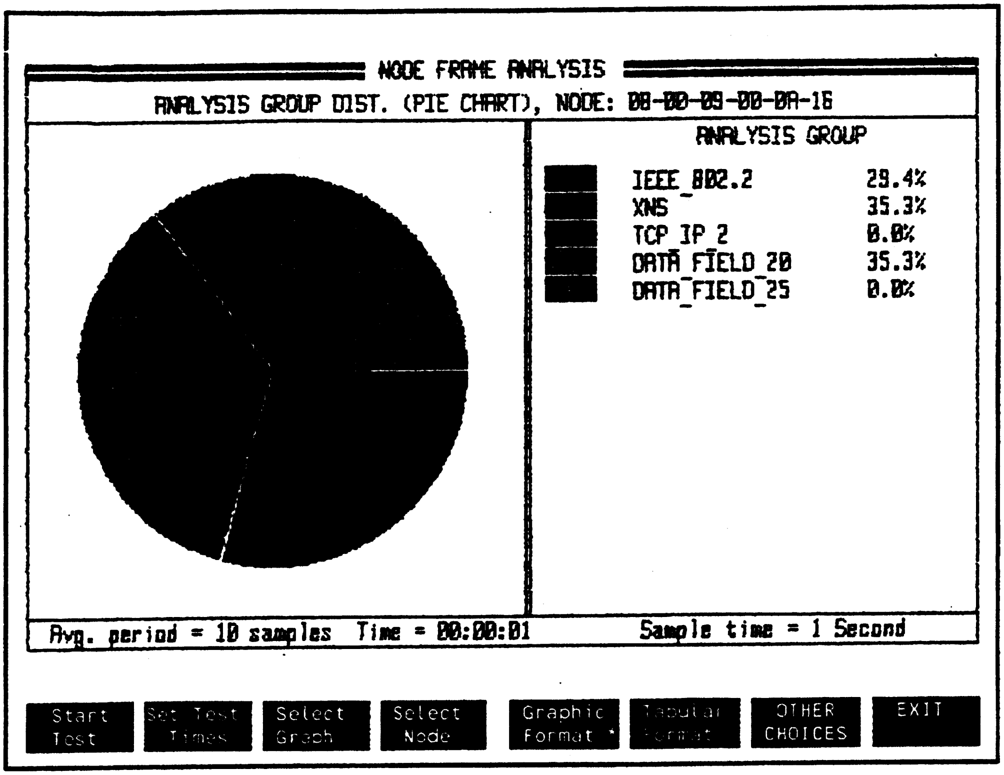


Figure 22-2. Pie Graph for Node Frame Analysis

This pie graph measurement shows the percentage of frames transmitted and received by a selected node that match filters defined in the Edit Filters Menu. The defined filters should be mutually exclusive since only the first filter match in each frame is counted. "Pass filters" exclude all other filters from being counted when they match within the same frame.

You can average the display for a selected number of sample periods. The default average period is 10 sample times.

Node Frame Analysis Summary

- Node Stats
    - Node List Stats
    - Connection Stats
    - Network/Node Stat
    - Frame Timing
    - Frame Length
    - Frame Analysis
        - Start Test
            - Stop Test
            - Stop Display
                - Resume Display
    - Setup Samp. Test
        - Set Meas. Time
            - Seconds Minutes Hours Days
        - Set Samp. Time
            - Seconds Minutes Hours
        - Edit Filters
            - Select Mode
                - Select by Name Select by Address
        - Graphic Format
        - Tabular Format
        - OTHER CHOICES
        - Set Time Format
            - Elapsed Time Absolute Time

Node Frame Analysis Summary Table

```
============================== NODE FRAME ANALYSIS ========================
15 Feb 87     ANALYSIS GROUP DISTRIBUTION, NODE: HP_LAN_Analyzer        09:15:00

ELAPSED                          ANALYSIS GROUP DISTRIBUTION
 TIME         GROUP            %      COUNT          GROUP          %     COUNT
--------   ---------------  ------   -------   ---------------  ------   -----
00:00:01   XNS............   38.0%      76
           DECNET.........    8.3%      19
           TCP_IP.........   30.0%      68
           OTHER..........   23.7%      54

00:00:02   XNS............   18.0%      38
           DECNET.........    8.3%      19
           TCP_IP.........   15.0%      35
           OTHER..........   23.7%      48

-------------------------------------------------------------------------------
Start time = 15 Feb 87 09:15:00              Stop time = 15 Feb 87 09:16:00
Measurement time = 60 seconds                Sample time = 1 Second
-------------------------------------------------------------------------------

Start   Set Samp.  Editt    Select  Graphic  Tabular   OTHER    EXIT
Test    Time       Filters  Node    Format   Format *  CHOICES
```

Figure 22-3. Summary Table for Node Frame Analysis

This measurement shows the distribution of filters matched by frames transmitted or received by a selected mode.

Each sample time display shows the defined filter(s) and the percentage of frames that matched each filter during the sample period. The numerical count of frames matching each filter is also displayed. Up to 16 filters can be defined and displayed for each sample time.

23

Transmit Statistics Measurements

This chapter introduces measurements that can be made in the <Transmit Stats> class of measurements.

Transmit performance measurements that you can make with the LAN Performance Analysis Application include:

- Transmit Traffic Generator
- Transmit Channel Acquisition
- Transmit Response Time

In the previous chapters, measurements in the <Network Stats> measurement class were described to characterize your Local Area Network (LAN). Measurements from the <Node Stats> class of measurements were described than can be used to characterize individual nodes on your network.

Using the <Network Stats> and <Node Stats> measurement classes, you can establish the baseline performance of your network and selected nodes.

The next step in managing your network is to understand the delay characteristics on your network. As your network grows in number of nodes, traffic level, or geographical size, delay measurements become important because network delay affects the response time of the network. The important timing measurements on the network are channel acquisition time and network response time measurements.

You can now easily measure network response time and channel acquisition times with the LAN Performance Analysis Application.

Using Passwords in Transmit Statistics Measurements

You can use a passwords feature in the protocol analyzer to secure or disable the analyzer from transmitting frames or displaying data fields of received frames.

When the protocol analyzer's transmitter function is secured with a password, all the functions in the Transmit Stats Menu are also disabled.

Transmit Stats Measurements

The next three chapters describe the <Transmit Stats> measurements available to help you determine the acquisition and response time for your network.

Transmit Traffic Generator

You can use the protocol analyzer's independent traffic generator to add up to 94% traffic onto the network. All network, connection and node level performance measurements are simultaneously operational to show you the network response to the additional traffic.

Transmit Channel Acquisition

In a CSMA/CD network, such as Ethernet or IEEE 802.3 networks, the channel acquisition time is measured from the time a node's network interface is presented with the message for transmission to the time the message is successfully placed on the network.

Transmit Response Time

Network response time is the time it takes a node to send a message to some destination and receive a response message back.

24

Transmit Traffic Generator

This chapter describes the measurement displays you can use to generate different levels of traffic on the network.

Performance measurements and functions in this chapter include:

- Introduction
- Traffic Generator Measurements
- Setting Background Traffic Percentage
- Selecting Messages
- Setting Message Length
- Selecting Message Headers
- Setting Burst Size

MEASUREMENTS	DISPLAY	COMMENTS
<Traffic Generator>		From the Traffic Stats Menu, press <Traffic Generator> to view measurements for viewing and adding background traffic.
Traffic Generator Measurements		
<Graphic Format>	Bar Graph	
<Tabular Format>	Table	

Introduction

When evaluating the growth of your network, you can use the Traffic Generator function to model proposed changes. You can create a controlled independent network load and then measure the effects on your network performance.

When adding simulated traffic, it is important that the characteristics of the expected traffic growth are maintained. The Traffic Generator function in the LAN Performance Analysis Application lets you have flexibility in defining the characteristics of the traffic. While the traffic generator is in operation, you can simultaneously make all the other network or node level performance measurements to determine the effects of the added traffic.

You can control the following traffic generator functions:

- Percentage increase of network utilization
- Frame lengths
- Frame headers
- Frame data contents
- Transmitting groups or bursts of frames

Traffic Generator Password

You can use the Password Menu from the protocol analyzer's Top Level Menu to enter a password that prevents anyone from using the protocol analyzer as a transmitter.

See the section "Setting Background Traffic Percentage" in this chapter for more information about passwords.

Traffic Generator Measurements

- Transmit Stats
  - Traffic Generator
    - Set Added % Traffic
    - Select Messages
      - Random Lengths
      - Constant Length
      - Defined Messages
      - Set Length
        - Set Min Length
        - Set Max Length
      - Select Header
        - Ethernet (Type)
        - IEEE 802
        - Mixed
      - Select Datafield
        - Datafield =0000...
        - Datafield =0101...
        - Datafield =1010...
        - Datafield =1111...
        - Datafield Random
    - Set Burst Size
    - Graphic Format
    - Tabular Format

Traffic Generator Graph Measurement

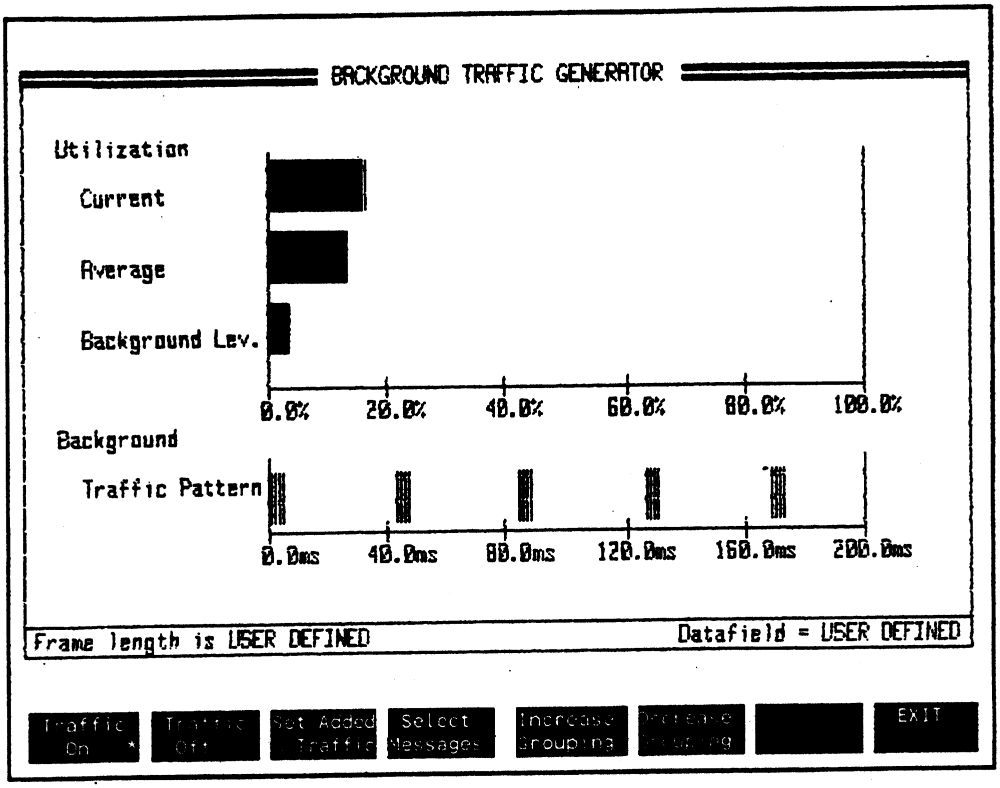


Figure 24-1. Traffic Generator Bar Graph Measurement

This measurement shows the percentage level of background traffic added to the network. You can view statistics for the background traffic you add combined with the current regular network traffic. Both current and average utilization is displayed.

The display also shows a representation of the frame burst pattern used to transmit your added messages.

Traffic Generator Summary Table

```
====================== BACKGROUND TRAFFIC GENERATOR ========================
 15 Feb 87                                                         16:38:30

====  Network Activity Summary  ========= Background Traffic Settings  ========
           (30 sec)                                    Minimum
   Current  Average   Peak                   Setting   Programmable Range
   -------  -------  -------                   ---         ---------
     16.28    15.76   16.97 %      Level:    3 %        ( 1- 87 ) %
     1,615    1,563   1,684 kbits/s  Burst:  4 f/burst  ( 1- 16 ) f/burst
       295      292     310 frms/s

===================== Background Traffic Pattern ==========================

                 Frame transmission rate  =      92 frms/s
                 Data transmission rate   =     298 kbits/s
                 Inter-burst spacing time =  42,004 us

_____________________________________________________________________________
Frame length is RANDOM between 60 and 1514 bytes.    Datafield = RANDOM
-----------------------------------------------------------------------------

 Start    Setup    Select   Set Graph  Graphic    Tabular   OTHER     EXIT
 Test     Test     Graph    Ranges     Format *   Format    CHOICES
```

Figure 24-2. Table Display for Transmit Traffic Generator

This measurement shows a summary of background traffic you are adding combined with the existing network traffic. The display shows the combined network activity as well as statistics for the added background traffic.

Network Activity Summary

```
                Network Activity Summary
                        (30 sec)
                Current  Average    Peak

Utilization =    16.28    15.76    16.97 %
Throughput  =    1,615    1,563    1,684 kbits/s
Throughput  =      295      292      310 frms/s
```

In the network activity summary, the total traffic appearing on the network is summarized. This includes the real network traffic as well as the traffic added by the protocol analyzer.

Utilization

Utilization is displayed in the first line of numbers. Utilization for the last one second sample period is shown in the **Current** column. The **Average** column displays a moving average using the same average time selected in the Top Level or Network Summary Menu. The peak measurement is the highest utilization that has occurred in any sample time for the current measurement period.

Throughput kbits/s

The second line of the measurement shows throughput in kilobits per second. The current, average, and peak measurements for the current measurement period are also displayed.

Throughput frms/s

The third line of the Network Activity Summary display shows throughput measured in frames per second.

Background Traffic Settings

The background parameters you can control are summarized in this part of the display.

```
              Background Traffic Settings

              Setting      Programmable Range

   Level:  3 %            ( 1- 87 ) %
   Burst:  4 f/burst      ( 1- 16 ) f/burst
```

Level

The **Level:** setting shows the current percentage added background traffic you have selected. Also displayed is the range of background traffic level you can select with the current selected message length and burst combination.

The range for the **Level:** of added traffic is affected by the length of frames to be transmitted. Longer frame lengths let you transmit higher levels of traffic.

Burst

The **Burst:** setting shows the current number of frames per burst you have selected. The burst display also shows the range of frames/burst you can select.

The range for the **Burst:** of added traffic is affected by the length of frames to be transmitted. Increasing frame length decreases how many frames/burst you can transmit.

Background Traffic Pattern

This portion of the tabular format display summarizes measurements about traffic throughput and timing between bursts.

```
                Background Traffic Pattern

Frame transmission rate  =      92 frms/s
Data transmission rate   =     298 kbits/s
Inter-burst spacing time =  42,004 us
```

Frame transmission rate

This measurements shows the rate of transmission for the added background traffic in frames per second.

Data transmission rate

This measurement shows the rate of transmission for the added background traffic in kilobits per second.

Inter-burst spacing time

This measurement shows the time that occurs between bursts of frames.

Setting Background Traffic Percentage

Transmitter Password

The protocol analyzer Password function can disable the transmitter from sending frames to the network.

Transmitter Secured

If a password has been used to secure the transmitter, when you use **<Set Added % Traffic>** and try to enter a value to add network traffic, the analyzer displays the following message:

"WARNING: UNABLE TO TRANSMIT WITHOUT REQUIRED PASSWORD."

To unsecure the transmitter, you must exit the Stats application and return to the protocol analyzer Top Level Menu. Select **<Passwords>** and press **<Enter Xmt Password>** . Enter the password to unsecure the transmitter function.

See the chapter on Passwords in the protocol analyzer Operator Manual for more information.

Transmitter On

When the **<Set Added % Traffic>** entry field is set to any value other than 0%, the protocol analyzer transmits traffic onto the network.

While the traffic generator is in operation, you can simultaneously perform all performance class measurements in the LAN Performance Analysis Application.

Transmitter Off

To stop the traffic generator function, press **<Set Added % Traffic>** and enter 0% traffic level.

The traffic generator also stops transmitting when you leave the Stats application. Transmitting automatically starts again when you re-enter the application.

How Much Traffic Can You Add?

In the Traffic Generator Menu, press <Set Added % Traffic> to display the menu to add traffic to the network. In <Tabular Format>, the display shows a range of percentage of traffic you can add to the network.

Factors that affect the percentage of traffic you can transmit:

- Current Network Utilization
- Message Length

Current Network Utilization

Messages transmitted by the protocol analyzer are added to the current network load. The percent of added background traffic combined with the actual network traffic can never exceed 100% network utilization.

The analyzer lets you enter a value for adding traffic to the network, depending on your message length. If other network traffic is occurring, the analyzer adds as much of its assigned traffic as it can. The analyzer displays an error message only if you enter a transmission level that is more than the network could do if the line were empty.

Message Length

In general, when the message length you are transmitting increases, the % of traffic you can add increases.

Longer frames result in less time waiting between frames for network access. Fewer collisions occurring when long frames are transmitted also allow higher utilization percentage.

In the example below, the added % of background traffic is 12 %. With the current selected frame length, the percentage of added background traffic can be changed over the range of 0-67 %.

	Setting	Programmable Range
Level:	12 %	(0- 67) %
Burst:	5 f/burst	(1- 11) f/burst

Selecting Messages

Transmitting Defined Messages

When you want to add frames to the network as background traffic, you have a choice for the data field of the frames transmitted. You can choose between fixed character data fields, random data fields, or user defined messages.

Softkey	Description
<Defined Messages>	You can transmit background traffic using messages created in the Edit Messages Menu of the protocol analyzer. Up to 16 messages can be created at a time. When you press <Defined Messages>, the transmitted message length is the actual length of the messages defined in the Edit Messages Menu. <Set Length> is disabled. Defined messages can be transmitted by the traffic generator either one at a time or in bursts. Defined messages transmitted in bursts are sent sequentially. When the number of defined messages is not evenly divisible by the number of bursts/frame, the remainder of defined frames are sent in a burst with less than the declared bursts/frame. For example:

```
Sixteen messages are defined.  You want to send 5 frames/burst.

      |||||________|||||________|||||________|________|||||__...
        ^            ^            ^           ^         ^
        |            |            |           |         |
     Messages     Messages     Messages     Message   Messages
     0,1,2,3,4    5,6,7,8,9    A,B,C,D,E    F         0,1,2,3,4
```

Transmitting Repeating Datafield Patterns

When <Random Length> or <Constant Length> messages are selected, you can choose the pattern for the frame data field.

Softkey	Description
<Select Datafield>	lets you select a fixed character pattern for the data field of each frame that is transmitted.

The choices for fixed data field patterns are:

<Datafield =0000...>	transmits a data field all 0's.
<Datafield =0101...>	transmits a data field containing the pattern 01010101 (55 in hex code).
<Datafield =1010...>	Transmits a data field containing the pattern 10101010 (AA in hex code).
<Datafield =1111..>	transmits a data field containing the pattern 11111111 (FF in hex code)>
<Datafield Random>	transmits a datafield containing a randomly generated bit pattern. Depending on your message setup, the analyzer repeatedly transmits some fixed number of frames.

Setting Message Length

<Random Length> or **<Constant Length>** enable the **<Set Length>** function. You can use **<Set Length>** to set the frame data field length. You can control the length of message you want the traffic generator to send with **<Set Length>**.

When the datafield is chosen to be **<Defined Messages>** from the Edit Messages Menu, the set length function is disabled. The defined messages are transmitted with the length defined in the Edit Messages Menu.

Softkey	Description
<Random Length> **<Set Min Length>**	lets you set the minimum frame length that is transmitted. The minimum frame length is 60 bytes. This includes the Destination Address, Source Address, Type/Length, and Data fields.
<Set Max Length>	lets you set the maximum frame length that is transmitted by the traffic generator. The maximum frame length is 1514 bytes. This includes the Destination Address, Source Address, Type/Length, and Data fields.
<Constant Length>	You can set a single length that is used for all the frames to be transmitted. The minimum length is 60 bytes and the maximum length is 1514 bytes. This includes the destination Address, Source Address, Type/Length, and Data fields.

Selecting Message Headers

<Select Header> is enabled when **<Random Length>** or **<Constant Length>** function is chosen. **<Select Header>** lets you select the format for the header of each frame to be sent by the traffic generator. **<Select Header>** is disabled when **<Defined Messages>** is selected. Each defined message is transmitted with the header created in the Edit Messages Menu.

Softkey	Description
<Ethernet (Type)>	sets the header for each frame to the Ethernet format. This format used bytes 13-14 for a **Type** field. The traffic generator sends 00-00 for the contents of the **Type** field.
<IEEE 802 (Length)>	sets the header for each frame to the IEEE 802.3 format. This format uses bytes 13-14 for a **Length** field. The traffic generator sets the bytes in this field to represent the number of significant bytes in the following data field.
<Mixed>	The traffic generator sends frames alternating bytes 13-14 between Ethernet and IEEE 802.3 protocol.

Setting Burst Size

Background Traffic Settings

	Setting	Programmable Range
Level:	12 %	(0- 67) %
Burst:	5 f/burst	(1- 11) f/burst

In the example above, the traffic generator is sending messages in bursts with five frames occurring in each burst. For the specified level of traffic, the number of bursts per frame can be changed over the range of 1-11 f/burst.

Transmitting in Bursts

You can transmit a single frame repeatedly or you can transmit several frames in groups or bursts.

The frame length you are using for the added traffic affects the amount of frames per burst you can transmit. As the frame length increases, the maximum frames/bursts decreases. When the traffic generator is set to transmit frames with a fixed length of 60 bytes, the burst of frames can be set from one to 132.

The spacing between frames within a burst remains constant. The time or spacing between bursts changes to meet the level or percentage of added traffic you specify.

```
Send 5 f/burst at a 10 % utilization level.

|||||________________|||||_______________|||||______...


Send 5 f/burst at a 20 % utilization level.

|||||_______|||||_______|||||_______|||||_______||
  ^              ^
  |              |___ Space between bursts decreased.
  |
  |_____ Space between frames within
         a burst remains constant.
```

25

Transmit Channel Acquisition

This chapter describes measurements used to generate statistics about the time it takes to acquire access to the network media for transmitting a message.

Channel acquisition performance measurements in this chapter include:

- Introduction
- Channel Acquisition Time
- Percent of Messages Deferred
- Number of Collisions per Message
- Channel Acquisition Summary

MEASUREMENTS	DISPLAY	COMMENTS
<Channel Acquis.>		From the Transmit Stats Menu, press <Channel Acquis.> to view measurements about transmitting messages on a network.
Channel Acquisition Time		
<Acquis. Time>	Line Graph	
Percentage of Messages Deferred		
<% of Msgs Deferred>	Line Graph	
Number of Collisions Per Message		
<Number of Coll/msg>	Line Graph	
Channel Acquisition Summary		
<Tabular Format>	Table	

Introduction

As your network grows in number of nodes, traffic level, or geographical distance, delay measurements become important because network delay affects the response time of your network.

Disabling Background Traffic

During <Channel Acquis.> measurements, the background traffic added by the <Set Added % Traffic> measurement in <Traffic Generator> mode is disabled.

After the <Channel Acquis.> measurement is completed, any background traffic added by <Set Added % Traffic> is resumed.

Averaging the Measurements

The <Channel Acquisition> measurement group includes three different measurements. You can measure the time to acquire the network, percentage of messages deferred, and number of collisions per message.

The measurements are made by transmitting a message and observing results. The displays show an average of the measurements made each sample period.

You can control how many messages are to be sent each second. If the network activity is high, the protocol analyzer may not be able to transmit all the messages/second you have entered. When this happens, the analyzer calculates an average of the number of messages actually transmitted during the sample time.

Channel Acquisition Softkey Selections for Graphs

- Transmit Stats
  - Traffic Generator
  - Channel Acquis.
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Setup Test
      - Set Meas. Time
        - Seconds Minutes Hours Days
      - Set Samp. Time
        - Seconds Minutes Hours
      - Set Numb Msg/sec.
      - Set Length
      - Select Header
        - Ethernet (Type) IEEE 802 (Length) Mixed
      - Select Datafield
        - Datafield -0000... Datafield =0101... Datafield =1010... Datafield =1111... Datafield Random
    - Select Graph
      - Acquis. Time
      - % of Msgs Deferred
      - Number of Coll/msg
    - Set Graph Ranges

Set A.T.	% of Msg Deferred	Number of Coll/Msg
Set A.T. Low Bound	Set % Msg Low Bound	Set C/Msg Low Bound
Set A.T. Hi Bound	Set % Msg Hi Bound	Set C/Msg Hi Bound

Set Time Low Bound	Set Time Hi bound	Elapsed Time	Absolute Time

- Graphic Format
- Tabular Format
- OTHER CHOICES
- Cursor On
- Cursor Off
- Set Alarms
- Autoscale On
- Autoscale Off

Prop Delay

Channel Acquisition Time

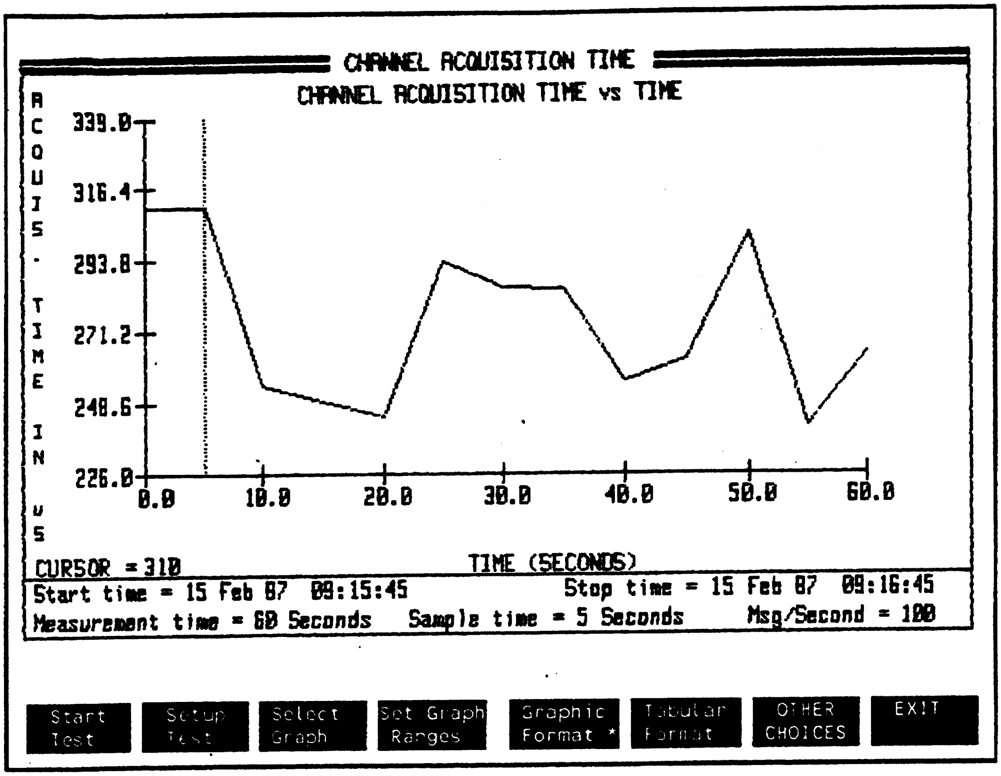


Figure 25-1. Channel Acquisition Time Measurement

In the example above, the analyzer transmits up to 100 messages each second. The analyzer then calculates the average time for the number of messages transmitted each sample time and displays the results.

You can control the measurement time, sample time, and number of messages to send during each sample period.

Channel Acquisition Time

In a CSMA/CD network, such as Ethernet or IEEE 802.3, channel acquisition time is measured from the time the control interface is presented with the message for transmission to the time the message is successfully placed on the network. This is a measurement of the delay in transmission due to the physical network and takes into account all aspects of the specific media access control system such as possible collisions, deferrals and backoffs. Measuring the variation of the channel acquisition time over a period of time indicates the response of the network to different types and amounts of network load.

To measure how long it takes to acquire the channel, the protocol analyzer transmits its own frame. The frame is created by the protocol analyzer and does not require definition by the user.

Low Acquisition Time Measurement

When the network has very low or 0% utilization, the analyzer acquires the network very quickly. The acquisition time may appear as just the baseline on the graph and you may not be able to interpret the graph. The tabular format display for <Channel Acquis.> shows the actual measurement numbers.

Percent of Messages Deferred

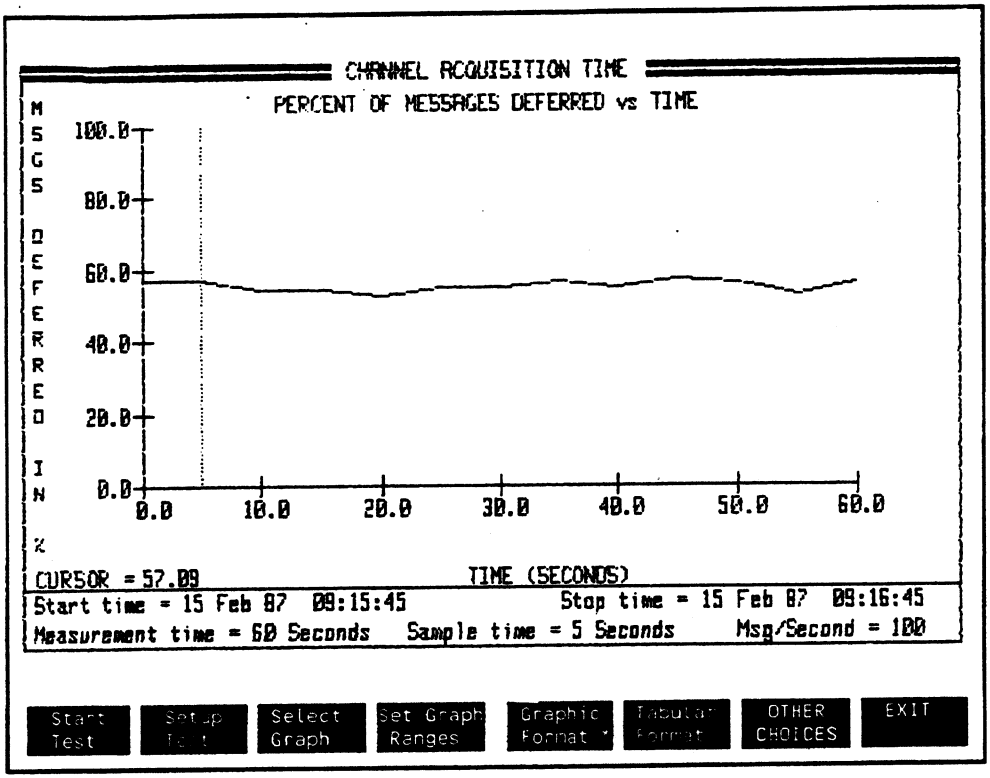


Figure 25-2. Graph Display for % of Messages Deferred

This measurement shows the percentage of frames that could not be sent on the first attempt (deferred) in each sample period. Deferrals occur when one station is already transmitting and another station tries to access the network.

Number of Collisions per Message

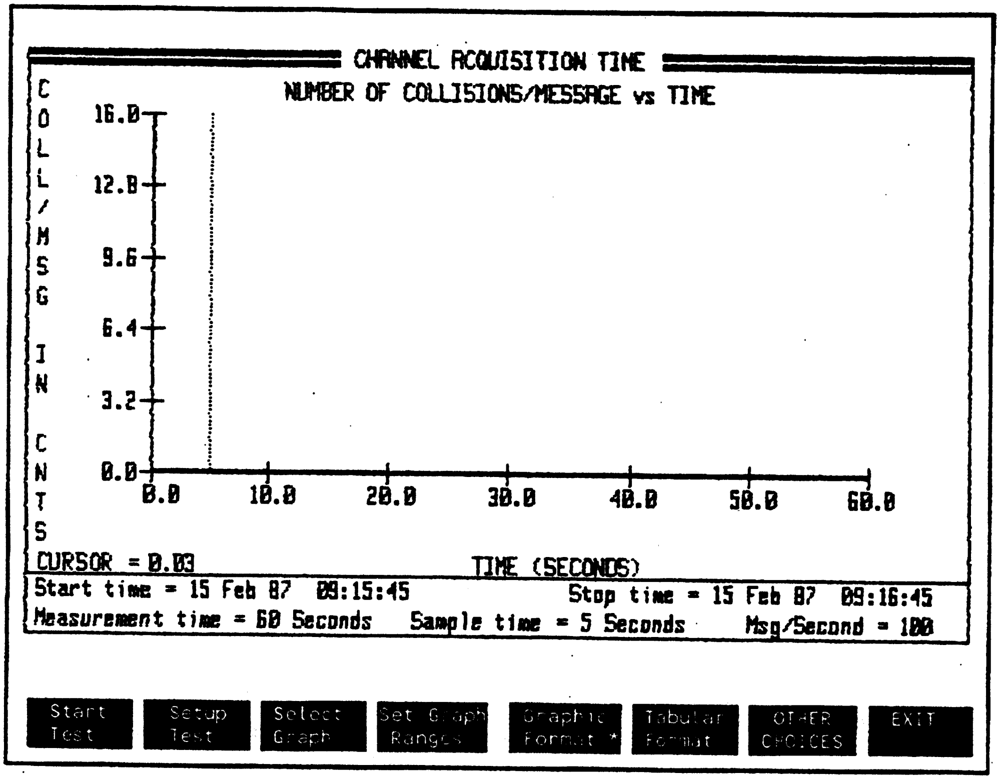


Figure 25-3. Graphic Display for Collisions/Message

This measurement shows how many of the messages transmitted by the analyzer collided with messages being transmitted by other stations.

When more than one station attempts to transmit at the same time, the signals interfere with each other, causing a collision. If a collision is detected, each colliding station initiates a jam signal to warn the other nodes on the network. The stations quit transmitting, backoff and wait for a moment, and then try to send the message again. An algorithm in the protocol analyzer generates a random backoff period as defined by the IEEE 802.3 specification.

Channel Acquisition Summary

- Transmit Stats
  - Traffic Generator
  - Channel Acquis.
    - Start Test
      - Stop Test
      - Stop Display
        - Resume Display
    - Setup Test
      - Set Meas. Time
        - Seconds | Minutes | Hours | Days
      - Set Samp. Time
        - Seconds | Minutes | Hours
      - Set Numb Msg/sec.
      - Set Length
      - Select Header
        - Ethernet (Type) | IEEE 802 (Length) | Mixed
      - Select Datafield
        - Datafield -0000... | Datafield =0101... | Datafield =1010... | Datafield =1111... | Datafield Random
    - Set Time Display
      - Elapsed Time | Absolute Time
    - Set Alarms
      - On | Off
    - Graphic Format
    - Tabular Format
  - Prop Delay

Channel Acquisition Summary Table

========================== CHANNEL ACQUISITION TIME ==========================

15 Feb 87 09:15:45

ELAPSED TIME	ACQUISITION TIME	% DEFERRED	COLL/MSG	% ABORTED
00:00:05	310 us	57.09	0.03	0.00
00:00:10	254 us	54.20	0.03	0.00
00:00:15	249 us	54.20	0.01	0.00
00:00:20	244 us	52.89	0.02	0.00
00:00:25	283 us	54.80	0.04	0.00
00:00:30	285 us	55.09	0.03	0.00
00:00:35	285 us	56.40	0.03	0.00
00:00:40	255 us	54.89	0.02	0.00
00:00:45	262 us	57.09	0.00	0.00
00:00:50	302 us	56.00	0.05	0.00
00:00:55	241 us	52.89	0.01	0.00
ALARMS (MAX) :	(100,000 uS)	(50.00)	(8.00)	(0.00)

Start time = 15 Feb 87 08:15:30 Stop time = 15 Feb 87 08:16:30

Measurement time = 60 SECONDS Sample time = 1 SECOND Msg/Sample = 100

Start Test | Setup Test | Set Time Display | Set Alarms | Graphic Format | Tabular Format * | | EXIT

Figure 25-4. Summary Table for Channel Acquisition

This summarizes the preceding measurements for channel acquisition. The table lists the average acquisition time, % of frames deferred in each sample, and the number of collisions per message in each sample. In addition, the table lists the percentage of frames aborted.

Percentage of Frames Aborted - If the transmitter tries to send a message and a collision occurs, the analyzer backs off and then tries to send the same frame again. If the transmitter tries to send the same frame 16 times and collisions occur each time, the frame is aborted.

26

Transmit Response Time

This chapter describes measurements used to generate statistics about the round trip delay to transmit a message and receive a response.

Response time performance measurements in this chapter include:

- Introduction
- Response Time vs Time
- Response Time Summary

MEASUREMENT	DISPLAY	COMMENTS
<Response Time>		From the Transmit Stats Menu, press <Response Time>.
Response Time vs Time		
<Graphic Format>	Line Graph	
Response Time Summary		
<Tabular Format>	Table	

Introduction

As your network grows in number of nodes, traffic level, or geographical distance, delay measurement becomes important because network delay affects the response time of your network.

Network Response Time

Network response time measures the time it takes the protocol analyzer to send a message to some destination and to receive a response back. If two networks are connected through a satellite or any wide area network, then it is useful to know the delays due to these connections. If you establish a session with a computer across town and are having response problems, the network response time measurement is able to help you determine if the delay is caused by the long distance connection. You can compare the measure delay with an established average delay to determine your next course of action.

Response Time vs Time

- Response Time
  - Start Test
    - Stop Test
    - Stop Display
      - Resume Display
  - Setup Test
    - Set Meas. Time
      - Seconds   Minutes   Hours   Days
    - Set Samp. Time
      - Seconds   Minutes   Hours
    - Set Numb. Msg/Samp.
    - Edit Messages
      - (See Edit Messages Menu in protocol analyzer manual.)
    - Select Messages
  - Set Graph Ranges
    - Set R.T. Low Bound   Set R.T. Hi Bound   Set Time Low Bound   Set Time Hi Bound   Elapsed Time   Absolute Time
  - Graphic Format
    - Tabular Format
    - OTHER CHOICES
    - Cursor On
    - Cursor Off
    - Set Alarms
      - On   Off
    - Autoscale On
    - Autoscale Off

Response Time vs Time Measurement

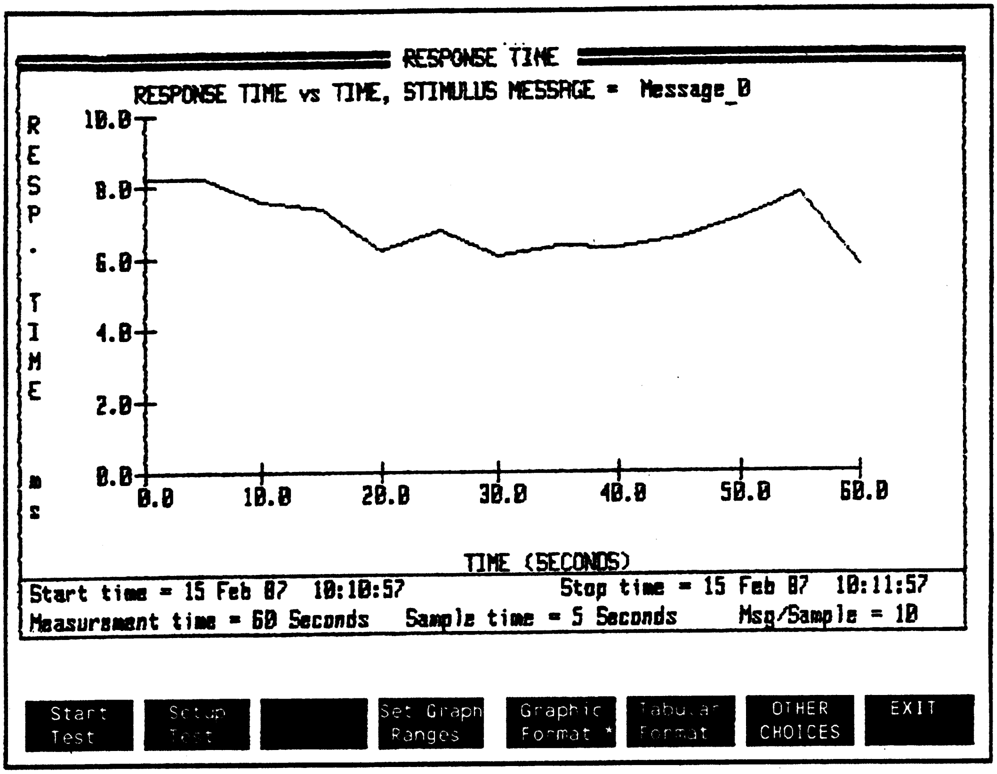


Figure 26-1. Network Response Time Measurement

This measurement shows the time required for another node to respond to messages from the protocol analyzer.

The average response time is shown for messages sent during each sample time. You can send up to 100 messages in a sample period. You can average the display for a selected number of sample periods.

Softkey	Description
<Setup Test>	lets you set the length of time for the measurement and the sample period. You can also control how many messages to send during each sample period.
<Set Numb. Msgs/samp.>	Transmitted messages are sent each sample period. If no reply is received, only one message is sent in each sample period. If a response is received, the message is repeated and the analyzer waits again for a response. Up to 100 messages can be sent in a sample period.
<Edit Message>	branches to the protocol analyzer's Edit Message Menu. You must edit or create a message to pass through the network an cause a node under test to send a response back. This could be an Ethernet, IEEE 802, XID, or upper level loopback.

Destination Address

The default message is Message_0 and contains Destination Address 00-00-00-00-00-00. You must edit a message so that the Destination Address field identifies a specific node whose response time you want to measure.

Data Field

You must edit the Data Field to contain a message that causes the addressed node to transmit a reply. If more than one response is transmitted, the last response must occur within the sample period of the analyzer's transmitted message.

If the response comes after the sample time of the transmitted message, the analyzer interprets the response as occurring for the transmitted message in the next sample period. A gap or discontinuous line is shown for the previous sample period.

Valid Response

The protocol analyzer only checks the source and destination addresses on received frames when it is looking for a response frame. No special message has to be included in the data field.

Response Time Summary

- Response Time
  - Start Test
    - Stop Test
    - Stop Display
      - Resume Display
  - Setup Test
    - Set Meas. Time
      - Seconds Minutes Hours Days
    - Set Samp. Time
      - Seconds Minutes Hours
    - Set Numb. Msg/Samp.
    - Edit Messages
      - (See Edit Messages in analyzer Operating Manual.)
    - Select Messages
  - Set Time Display
    - Elapsed Time Absolute Time
  - Set Alarms
    - On Off
  - Graphic Format
  - Tabular Format

Transmit Response Time Summary

```
================================ RESPONSE TIME ================================
15 Feb 87          STIMULUS MESSAGE = Message_0                        09:56:48
        ELAPSED TIME                           RESPONSE TIME
        -------------------                    -------------
          00:00:05                                 8.24 ms
          00:00:10                                 7.56 ms
          00:00:15                                 7.37 ms
          00:00:20                                 6.21 ms
          00:00:25                                 6.76 ms
          00:00:30                                 6.03 ms
          00:00:35                                 6.34 ms
          00:00:40                                 6.29 ms
          00:00:45                                 6.55 ms
          00:00:50                                 7.10 ms
          00:00:55                                 7.83 ms
ALARMS (MAX) :                                 ( 50,000.00 mS)
-------------------------------------------------------------------------------
 Start time = 15 Feb 87  09:15:30          Stop time = 15 Feb 87   09:16:30
 Measurement time =  60 SECONDS   Sample time =  1 SECOND   Msg/Sample =  100
-------------------------------------------------------------------------------
```

Start Test	Setup Test	Set Time Display	Set Alarms	Graphic Format	Tabular Format *		EXIT

Figure 26-2. Summary Table for Network Response Time

This table shows the period is 10 sample times average response time for how long it takes a node on the network to respond to messages during one sample period.

You can control all the fields of messages transmitted by the analyzer, message length, and how many messages/sample periods to send.

27

Automatic Sequence

This chapter describes the softkeys and display that you can use to automatically perform a sequence of measurement tests with the protocol analyzer.

This chapter includes:

- What Is Automatic Sequencing?
- Automatic Sequence Measurements
- Starting Automatic Sequences
- Saving an Automatic Sequence Configuration File
- Example for Automatic Sequence Menu
- Alarm Logging Summary
- Measurement Logging Summary

What Is Automatic Sequencing?

The Automatic Sequence Menu lets you arrange a group of measurements and logging requests in different sequences to meet your test needs. You may need to measure network activity and performance at different times of the day to establish a record of your network's typical or average operation. Does your network have peak loads at certain times of the day, week, month, or during periods for quarterly reports?

For example, you could have a particular sequence of measurements made immediately before or after a personnel shift change, or, you could use a different series of tests to observe network performance after midnight. You can use the Automatic Sequence Menu to create "canned" tests to perform the same measurements at the same time of day in order to establish your network average performance levels.

<Automatic Sequence> measurements can be started at a specified time of day or when some condition or limit you specify is exceeded. You can automatically log information to your analyzer system disc drive, to a plotter, to an HP ThinkJet printer or to an HP PaintJet Printer.

You can set up a test sequence for regular monitoring and branch to a specific set of more in-depth tests if a certain network condition measured by alarms occurs.

Automatic Sequence Softkeys

- **Automatic Sequence**
  - Start Sequence
    - Stop Sequence
    - Stop Display
      - Resume Display
  - Start At Set Time
  - Set Start Date
    - Current Date
    - Every Day
  - Set Start Time
    - Current Time
  - Set Start Seq. #
  - Edit Sequence
    - Network Stats
      - Network Summary
      - Utiliza-tion
      - Errors & Collision
      - Frame Timing
      - Frame Length
      - Frame Analysis
    - Node Stats
      - Node List Stats
      - Connect-ion Stats
        - Comm. Matrix
        - Connect. Summary
        - Connect. Of A Node
      - Node/Net Summary
      - Frame Timing
      - Frame Length
      - Frame Analysis
    - Transmit Stats
      - Traffic Generator
      - Channel Acquis.
      - Response Time
    - Logging Commands
      - Meas. Log On
      - Meas. Log Off
      - Alarm Log On
      - Alarm Log Off
    - Control Commands
      - Display Comment
      - Wait
      - End Sequence
  - EXIT

Automatic Sequence Measurements

From the Stats Network Summary Menu, press <**Automatic Sequence**> to display the menu shown below.

```
============================== AUTOMATIC SEQUENCE ============================
 15 Feb 87                                                            09:15:30
  SEQ. MEAS    MEASUREMENT       MEAS. TIME   ALARM  ELSE        COMMENTS
   #   CLASS   OR FUNCTION       OR SETTING   GO TO  GO TO
  ---- ----  ----------------   -----------   ---    ---   ------------------
    1. CTRL  END SEQUENCE           N/A        N/A    N/A  End of sequence.

------------------------------------------------------------------------------
 Start time = 15 Feb 87   09:15:30                   Start at sequence #   1
------------------------------------------------------------------------------
```

Start Sequence	Start at Set Time	Set Start Date	Set Start Time	Set Start Seq. #	Edit Sequence		EXIT

Figure 27-1. Automatic Sequence Menu

The Automatic Sequence Menu uses a combination of softkeys and menu fields to control the display. When the cursor is moved to different fields, the softkeys change to show selections available for that field.

Field	Description
SEQ. #	(Sequence number) provides a reference number for identifying the different measurements in a sequence. The **SEQ. #** is used in the **ALARM GO TO** and **ELSE GO TO** columns for conditional branch commands. **Adding Sequences** The next **SEQ. #** is automatically created when the cursor is in the **COMMENTS** field and you press [RETURN]. You can also press [INS LINE] to insert a new sequence field above the current cursor location. Up to 999 automatic sequence events can be created. **Deleting Sequences** Press [DEL LINE] to delete the line marked by the cursor.
MEAS CLASS	Lets you choose the measurement class you want to perform. Move the cursor to the **MEAS CLASS** field to display these softkeys:

SOFTKEY CHOICES	MEAS CLASS FIELD DISPLAY
<Network Stats>	NET
<Node Stats>	NODE
<Transmit Stats>	XMIT
<Logging Commands>	LOG
<Control Commands>	CTRL

Field	Description
MEASUREMENT OR FUNCTION	field lets you choose a measurement group within the measurement class you chose in the MEAS CLASS field.

Move the cursor to the MEASUREMENT OR FUNCTION field. Depending on what you selected in the MEAS CLASS field, the following measurement or function softkeys are displayed:

MEAS CLASS SELECTED	MEASUREMENT OR FUNCTION
Network Stats	Network Summary
	Utilization
	Errors & Collisions
	Frame Timing
	Frame Length
	Frame Analysis
Node Stats	Node List Stats
	Connection Stats
	Comm. Matrix .
	Connect. Summary
	Connect. Of A Node
	Node/Net Summary
	Frame Timing
	Frame Length
	Frame Analysis
Transmit Stats	Traffic Generator
	Channel Acquis.
	Response Time
Logging Commands	Meas. Log On
	Meas. Log Off
	Alarm Log On
	Alarm Log Off
Control Commands	Display Comment
	Wait
	End Sequence

Measurement or Function (cont.)

Softkey	Description
<Network Stats> <Node Stats> <Transmit Stats>	The performance measurements available in Network Stats, Node Stats, and Transmit Stats are described separately in preceding chapters in this manual. In Stats autosequencing, you can dynamically change the selected node in <Node Stats> and the selected message in <Transmit Stats>, <Response Time>. To change the selected node, enter one of the following in the comment field for the Node Stats measurement. @ HH-HH-HH-HH-HH-HH (HH = Hex address of new node) @ NNNNNNNNNNNNNNNNNN (NNN... = Phys Addr List node name) @#XXX (XXX = Phys Addr List node number) @+ (to use the next node in the node list) @= (to use the most recently selected node) The above can also be used in the Response Time measurement to reprogram the destination address of the stimulus message. To change the selected message, enter the following in the Response Time measurement. ~MMMMMMMMMMMMMMMMMM (MMM... = name of desired message)
<Logging Commands>	Logging commands let you log or store measurements or alarm events. You can log events to the plotter, printer, or disc drive selected in the menu you get after pressing <Set Up Stats> and <Select Output>. If the logging command is used in a series of automatic measurements, all logging goes to the single selected output device.
<Meas. Log On>	turns on the logging function selected in the <Set Up Stats> <Select Output> display.

Measurement or Function (cont.)

Softkey	Description
	After turning on the logging function, the analyzer continues to the next sequence number. If the next sequence is a measurement, the complete measurement is logged for the specified measurement time or until the specified disc file is filled when **log until full** mode is chosen.
	For example, if Network **<Frame Length>** is the measurement to be logged, measurement data for the line graph, bar graph, pie graph and summary table is saved.
	The logging function continues through the following sequences until a **<Meas. Log Off>** command is used or a **<Control Command><End Sequence>** command is used.
<Meas. Log Off>	turns off the logging measurements function.
<Alarm Log On>	The analyzer logs a measurement when alarm conditions specified in the **<Set Up Stats>** and **<Set Alarms>** menu occur.
	When an alarm occurs, the measurement is logged from the start of the test, not just after the alarm event.
	Alarm conditions can not be changed for different measurements within a sequence of tests.
	Similar to logging measurements, the device used to log alarm events is controlled by the selections made in **<Set Up Stats><Select Output>** menu.
	After alarm logging is turned on, the analyzer continues to the next test sequence.
	When **<Alarm Log On>** is active, alarm logging continues until:
	1. **<Alarm Log Off>** command is used in an automatic sequence field. 2. Volume file is filled in **Log until full** mode. 3. **<End Sequence>** command is used to stop automatic sequence.

Measurement or Function (cont.)

Softkey	Description
<Alarm Log Off>	turns of the alarm logging function.

Control Commands

<Display Comment>	You can display the contents of the comment field at the bottom of the automatic sequence menu. The comment field can be used for what ever you want. For example, you could display a message about alarms in the previous measurement or an explanation about the next measurement to be run. You can concatenate or link consecutive comment fields. Consecutive display comment lines are linked automatically.

```
SEQ. MEAS   MEASUREMENT      MEAS. TIME   ALARM  ELSE        COMMENTS
 #   CLASS  OR FUNCTION      OR SETTING   GO TO  GO TO
.... ....  ...............  ...........   ...    ...   .................
  1.  NET  FRAME LENGTH       5 Seconds   N/A     2
  2. CTRL  DISPLAY COMMENT       N/A      N/A     3    NOW IS THE TIME FO
  3. CTRL  DISPLAY COMMENT       N/A      N/A     4    R YOU TO LEARN
  4. CTRL  DISPLAY COMMENT       N/A      N/A     5      ABOUT DISPLAYING
  5. CTRL  DISPLAY COMMENT       N/A      N/A     6      USER CREATED
  6. CTRL  DISPLAY COMMENT       N/A      N/A     7         STATEMENTS!!
  7. CTRL  WAIT              10 Seconds   N/A     8
  8. CTRL  END SEQUENCE          N/A      N/A    N/A   End of sequence.
...........................................................................
Start time = 15 Feb 87    09:15:30                Start at sequence #   1
...........................................................................
NOW IS THE TIME FO R YOU TO LEARN ABOUT DISPLAYING USER CREATED STATEMENTS!!
                   |            |                 |
                   |            |                 |
               Inserted      Deleted           Deleted
                 Space        Spaces            Spaces
```

Only one trailing or leading space in comment fields is left in the displayed comment. A single space is inserted in front of leading characters.

(continued)

<Display Comment> (cont.)

Length of Display Time

A **<Display Comment>** control command is shown for the duration of the following measurement. A **<Wait>** control command can follow a **<Display Comment>** sequence to set the length of display time.

If no measurement or **<Wait>** command follows the **<Display Comment>** sequence, the message only flashes on the display.

<Wait>

You can use a **<Wait>** command to pause or delay between measurements. The **<Wait>** command can also be used after a **<Display Comment>** function to let the message be displayed for a fixed amount of time.

<End Sequence>

This control command ends or stops the automatic sequence. All measurement and alarm logging functions are turned off.

Measurement Time or Setting

Measurement Time

This field lets you set the length of time for the measurement to occur.

NUMBER ENTRY
Move the cursor to the number field and enter a numeric value from the keyboard. Press a displayed softkey to select the unit of time.

NOTE

There is no way to change sample time or other measurement parameters in the Automatic Sequence Menu. **<Automatic Sequence>** measurements use the current parameters set up in the regular measurement menus.

Setting

Time is not displayed in the **MEAS. TIME** field when the measurement is:

<Transmit Stats> **<Traffic Generator>**
<Logging Commands> **<Control Commands>**

<Transmit Stats><Traffic Generator> displays the percentage of utilization for background traffic assigned in Transmit Stats Menu.

Logging and Control commands display **N/A** for Not Applicable.

Field	Description
ALARM GO TO	This is a numeric entry field for entering what SEQ # you want to branch to if an alarm condition occurs during the current test. Current alarm conditions are displayed in the <Set Up Stats> <Set Alarms> menu. If this field is set to anything but the current Seq #, branching takes place immediately on discovering the alarm condition (the assigned measurement time is pre-empted).
ELSE GO TO	Use this numeric entry field for entering what SEQ # you want to branch to when the current measurement or function ends.
COMMENTS	Use this field for comments to document the automatic sequence function. Up to 18 ASCII characters may be entered.

Starting Automatic Sequences

At the bottom of the Automatic Sequence Menu, you can choose which sequence number to start the automatic sequence and what day and time to begin.

Softkey	Description
<Set Start Date>	This field lets you enter the date when you want the test to start. You can start a test when the system is unattended, such as during the night or on a weekend.
<Current Date>	starts the sequence at the selected time on the current date. For this entry to be useful, it is important that the protocol analyzer's date and time be set accurately in its Top Level Menu.
<Every Day>	restarts the sequence at the start Seq # every day.
Selected Date Entry	Date entry must use the following format:

day month year

Separate each entry with a space. Use three letters for month. The values that may be entered for day and year must be within the range listed below:

years	=> 0	days	=> 1
	=< 99		=< 31

For example:

15 FEB 87 = February 15, 1987

Softkey	**Description**
<Set Start Time>	lets you select the time of day to begin the automatic sequence.

HH:MM:SS
hour:minute:second
Separate entry with a colon (:). Use 24 hour entry to denote AM and PM.

Values that may be entered for the time must be within the ranges listed below:

Hours	=> 0	Seconds	=> 0	Minutes	=> 0
	=< 23		=< 59		=< 59

For example:

9:30:00	=	9:30 AM
21:30:00	=	9:30 PM

<Set Start Seq #> — This field lets you select the sequence number you want to begin a test series. The default selection is **Seq #1**. Press **<Set Start Seq #>** and enter the Seq # you want to begin the sequence.

Saving a Configuration File

You can store the Automatic Sequence setup or configuration file on your protocol analyzer disc drive. This feature lets you have several automatic sequence files created for different network performance measurements. Then, you can quickly load the automatic sequence file you need into the protocol analyzer.

In addition to saving the automatic sequence menu, the protocol analyzer saves the following Stats application menus:

```
Set Up Stats Menu
        Set Alarms Menu
        Select Output Menu

All measurement softkey selections
        Selected Display
                Graph
                Table
        Selected Test Times
                Sample Time
                Measurement Time
        Graph Ranges
        Traffic Generator Settings
                Selected Message # (Response Time)
        Selected Node (Node Stats Menu)
```

NOTE

Node list, filters, and messages are not saved with the automatic sequence file. Use the Disc Functions Menu to save these functions separately as a Network File.

Use the following procedure to save your automatic sequence file to your system disc drive.

Procedure

1. From the protocol analyzer Top Level Menu, press <**Disc Functions**>.

2. Press <**Save File**>.

3. Analyzer prompts:

   `Select a file type to save.`

4. Press <**Stats Config**>.

   If your volume does not have a statistics configuration file, you must create a new file. If the volume has an existing statistics configuration file, you can create a new file or rewrite an existing file.

Create a New File

5. Analyzer prompts:

   `Enter a file name - 7 characters maximum:______`

6. Enter up to seven keyboard characters for the new file name.

7. Press [RETURN] to complete the entry.

Re-write To An Existing File

8. Analyzer prompts:

   `Select softkey OR enter valid name : ______`

   The analyzer displays softkeys for statistics configuration files currently on the selected volume.

9. Press a displayed softkey or enter up to seven keyboard characters for an existing statistics configuration file.

Example for Automatic Sequence Menu

```
============================== AUTOMATIC SEQUENCE ==============================
| 14 Feb 87                                                            16:38:30
| SEQ. MEAS    MEASUREMENT      MEAS. TIME   ALARM  ELSE         COMMENTS
|  #   CLASS   OR FUNCTION      OR SETTING   GO TO  GO TO
| ---- ----  ----------------  -----------   ---    ---   ------------------
|   1. LOG   MEAS. LOG ON          N/A        N/A     2
|   2. LOG   ALARM LOG ON          N/A        N/A     3
|   3. NET   UTILIZATION         5 Minutes     5      4    Base measurement
|   4. NET   ERRORS AND COLL.    5 Minutes     5      6    for network stats
|   5. NODE  NODE LIST STATS     5 Minutes    N/A     6
|   6. LOG   MEAS. LOG OFF         N/A        N/A     7
|   7. LOG   ALARM LOG OFF         N/A        N/A     8
|   8. CTRL  END SEQUENCE          N/A        N/A    N/A   End of sequence.
|
|
|------------------------------------------------------------------------------
| Start time = Every Day   09:00:00                 Start at sequence #    1
 -------------------------------------------------------------------------------

 Start     | Start at | Set Start | Set Start | Set Start | Edit     |   | EXIT
 Sequence  | Set Time | Date      | Time      | Seq. #    | Sequence |   |
```

Figure 27-2. Automatic Sequence Example

The automatic sequence example shown above records statistics about your network's baseline performance. The information is gathered every day at 9:00 A.M.

If an alarm condition occurs during sequences 3 or 4, the analyzer goes to Seq #5 and records the busiest nodes on the network. If no alarm occurs during sequences 3 or 4, Seq #5 is skipped.

Starting the Automatic Sequence

Line 17 of figure 27-2 indicates this group of measurements starts at measurement sequence #1 every day at 9:00 o'clock in the morning.

SEQ #1

SEQ #1 turns the measurement logging function on. The device selected in the **<Set Up Stats> <Select Output>** menu begins to log the following measurement sequences. Logging of sequences continues until a sequence step turns the logging off.

SEQ #2

SEQ #2 turns the alarm logging function on. The alarm logging device selected in the **<Set Up Stats> <Select Output>** menu logs a measurement when an alarm in the measurement occurs. Measurements can be "logged on alarm" only during automatic sequences that contain the alarm function. These sequences are:

```
Network Stats
      Utilization
      Errors & Collisions

Node Stats
      Connection Stats

Transmit Stats
      Channel Acquisition
      Response Time
```

SEQ #3

In SEQ #3, the analyzer automatically starts to perform the Utilization measurement from the **<Network Stats>** measurement class. If an alarm occurs during the measurement time, the protocol analyzer immediately branches to SEQ #5 to measure and log the busiest nodes on the network. If no alarm condition occurs before the end of Seq #3, the protocol analyzer branches to SEQ # 4 and automatically begins that test.

SEQ #4

After SEQ #3 ends, SEQ #4 automatically starts to perform Errors & Collisions measurements from the **<Network Stats>** measurement class. If an alarm occurs during the measurement, the protocol analyzer immediately branches to SEQ #5 to measure and log the busiest nodes on the network. If no alarm occurs during Seq #4, the protocol analyzer branches to SEQ # 6 to begin turning off the logging functions and end the test sequence.

SEQ #5

If an alarm condition occurs during SEQ #3 or SEQ #4, the protocol analyzer branches to SEQ #5. This sequence causes the protocol analyzer to log the busiest nodes on the network. The busiest nodes on a network are often the source of error conditions occurring on the network.

SEQ #6

This sequence turns off the measurement logging function.

SEQ #7

This sequence turns off the alarm logging function.

SEQ #8

This sequence ends the automatic test sequence.

NOTE

Where no additional measurements follow steps 6 and 7, you do not need to manually turn off measurement and alarm logging. The Sequence End step automatically turns off the log functions.

If sequence measurements are added after SEQ #7, they are not logged until the logging functions are turned on again.

Displaying Multiple Measurement Logs

When you perform an automatic measurement, you can log more than one type of measurement during the automatic sequence. For example, you may want to log network measurements and then log connection summary and channel acquisition measurements during peak traffic periods.

After you load the log of an automatic sequence measurement that includes more than one type of test, a list of the different measurement classes is displayed to let you choose which one of the measurements to display.

For example, in the automatic sequence measurement list shown below, three different measurement classes are defined to be logged during an automatic sequence measurement.

```
                              AUTOMATIC SEQUENCE
14 Feb 87                                                      12:45:00

SEQ.  MEAS   MEASUREMENT       MEAS. TIME   ALARM  ELSE        COMMENTS
 #    CLASS  OR FUNCTION       OR SETTING   GO TO  GO TO
----  ----  ---------------   -----------   ---    ---   ----------------
  1.  LOG   MEAS. LOG ON          N/A        N/A     2
  2.  NET   NETWORK SUMMARY    1 Minutes      2      3
  3.  NODE  CONNECT. SUMMARY   1 Minutes     N/A     4
  4.  XMIT  CHANNEL ACQUIS.    1 Minutes      4      5
  5.  CTRL  END SEQUENCE          N/A        N/A    N/A  End of sequence.


          Network   Node    Transmit  Logging   Control            EXIT
________   Stats    Stats    Stats    Commands  Commands  ________ ________
```

After you have defined the measurement, press <Start Sequence> to begin logging the measurement to the disc file you specified in Select Output menu.

After the measurement is logged to a disc, use the following steps to display the logged measurements:

1. In the Automatic Sequence menu, press <**EXIT**>.

2. Press <**Setup Stats**>.

3. Press <**Disc Functions**>.

4. Press <**Load File**>.

5. Press <**Stats Data**> to select a file type to load.

6. Press the softkey for the log file that you want to load.

7. Press <**EXIT**>.

8. Press <**EXIT**>.

9. A list of the measurements logged to the disc file is displayed.

   Use the cursor to highlight a measurement you want to view.

DISC FUNCTIONS

MEASUREMENT	TIME	DATE	MEASUREMENT NAME	ALARMS
---	--------	---------	-------------------	---
1	12:46:25	14 Feb 87	NETWORK MEASUREMENTS	0
2	12:47:27	14 Feb 87	CONNECTION SUMMARY	0
3	12:48:29	14 Feb 87	CHANNEL ACQUISITION	0

Display the Meas.		Next Alarm	Previous Alarm	Disc Functions			EXIT

10. Press <**Display the Meas.**> to display a selected measurement.

Alarm Logging Summary

Alarm logging can be implemented only from <Automatic Sequence> measurements. The following steps summarize the alarm logging function.

<Set Up Stats> <Select Output> Menu

1. In <Set Up Stats> <Select Output> menu, select a logging device: printer, plotter, or disc.

2. If a disc is selected as the logging device, assign the file name, file size and storage mode.

<Set Up Stats> <Set Alarm> Menu

1. In Set Alarms Menu, set the alarm status On for each alarm to be logged.

2. Set the alarm condition limits.

3. Set the alarm type and duration.

4. Qualify how many samples the alarm needs to occur.

<Automatic Sequence> Menu

1. Press <Logging Commands> and then <Alarm Log On> to enable logging the measurement.

2. Select a measurement that contains an alarm condition. For example:

```
Network Stats        Node Stats       Transmit Stats
  Utilization         # Connections     Response Time
     :                                    :
```

Output Device Display

If a printer or plotter is used, the output is a copy of the measurement display.

If a disc is used to log the alarm, when you use <Disc Functions> and <Load File> to load the log-file, the analyzer displays the measurement.

Measurement Logging Summary

Measurement logging can be implemented only from <Automatic Sequence> measurements. The following steps summarize the measurement logging operation.

<Set Up Stats> <Select Output> Menu

1. In <Set Up Stats> <Select Output> menu, select an output device: printer, plotter, or disc.

2. If a disc is selected as the logging device, assign the file name, file size and storage mode.

<Automatic Sequence> Menu

1. Press <Logging Commands> and <Meas. Log On> to enable logging a measurement.

2. Select a test sequence that contains a measurement.

Output Device Display

If a printer or plotter is used, the output is a copy of the measurement display.

If a disc is used to log the measurement, when you use <Disc Functions> and <Load File> to load the log-file, the analyzer displays the measurement.

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