64000

HP64000 Logic Development System

Software Performance Analyzer Reference Manual

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Attached to this software notice is a summary of problems and solutions for the Software Performance Analyzer that you may or may not encounter. Use this summary with the manual you received with the product. In the one-line description at the top of each problem and solution, there is a software topic or manual chapter reference.

KPR #: 2700005470 Product: SOFT PERF ANAL M64310-90902 01.01

Keywords: MANUAL

One-line description:
Softkeys only cmds allowed once measurement started.(See Ch 10, pg 10-2)

Problem:
When using the S/W Perf Analyzer with any processor, once a measurement is started, the only commands that will work are the softkey commands. It is impossible to leave a measurement running and use a command file to get out of SPA, or print or anything. Command File names are accepted only after halt.

Solution:
Once a S/W analysis is running, it will run to completion unless halted. After halting, a command file may be entered.

KPR #: D200024067 Product: SOFT PERF ANAL M64310-90902 01.01

Keywords: MANUAL

One-line description:
Can't pass numeric value to CMD file on one line. (See Ch 10, pg 10-2)

Problem:
When using a command file in SPA, you must put the parameter to be passed on the second line after the invocation of the command file instead of all on one line.

There is also a problem with specifying a command file with more than one parametez. The only valid syntax is <CMDFILE> <PARM> and not <CMDFILE> <PARM> <PARM>....

Solution:
Use only valid syntax: <CMDFILE><PARM>

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Software Performance Analyzer Reference Manual
64310-90902, April 1983

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3. The information in this book is easy to find:

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4. The Index and Table of Contents are useful:

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5. What about the "how-to" procedures and examples:

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Too many now	1 2 3 4 5	I'd like more

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Software Performance Analyzer

Printing History

Each new edition of this manual incorporates all material updated since the previous edition. Manual change sheets are issued between editions, allowing you to correct or insert information in the current edition.

The part number on the back cover changes only when each new edition is published. Minor corrections or additions may be made as the manual is reprinted between editions. Vertical bars in a page margin indicates the location of reprint corrections.

First Printing..... April 1983

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Chapter 1

GENERAL INFORMATION

INTRODUCTION

This manual describes how to operate the software performance analyzer when it is installed in the 64000-series Hewlett-Packard Logic Development System.

MANUAL CONTENT

As an aid in locating information, the contents of this manual are briefly summarized as follows:

Chapter 1 defines the content and organization of this manual. It also provides an overview of the software life cycle and how the software performance analyzer fits within this environment.

Chapter 2 describes the measurement capabilities of the analyzer. It is intended to show, from a practical standpoint, the value of the different measurement modes and the specific use for each mode. Also discussed are the symbolic interface and automatic configuration to emulation features of the analyzer.

Chapter 3 describes the procedures for installation of the software performance analyzer and the procedures for making duplicate copies of the operating software for backup.

Chapter 4 provides a step-by-step operating procedure for using the analyzer for a simple, basic measurement. It is designed to help the user become familiar with system and analysis operation.

Chapter 5 provides information for defining events to be measured.

Chapter 6 provides information for setting up and qualifying a measurement.

Chapter 7 provides a definition of the measurement modes available and describes the use of each mode.

Chapter 8 provides information for selecting and optimizing the display.

Chapter 9 describes how to manually or automatically configure the analyzer.

Chapter 10 identifies and describes system software conventions, utility commands, utility keyboard keys, and softkey prompts.

Chapter 11 describes how two or more analyzers are configured to trigger or accept a trigger from one another to perform a specific measurement(s).

Chapter 12 contains the theory of operation from a functional point of view. It covers the sampling techniques, measurement considerations, IMB interaction, and statistical theory.

Appendices A through D provide the operating syntax diagrams, status and error messages and softkey prompts, glossary of softkey labels, and the software performance analyzer specifications, respectively.

An index is also provided for quick reference to specific items.

USING THE SOFTWARE PERFORMANCE ANALYZER THROUGHOUT THE SOFTWARE LIFE CYCLE

The software performance analyzer is a tool that can be used throughout the software life cycle of a microprocessor-based product to provide a nonintrusive view of software as it executes in real time. It is a single board subsystem that monitors program flow on the emulation bus to aid in software characterization, testing, debugging, and optimization.

There are four major phases of the software life cycle where the software performance analyzer can aid designers in their development. (1) investigation phase, (2) prototype phase, (3) production phase, and (4) maintenance phase.

INVESTIGATION PHASE

During the investigation phase of a project market needs are assessed, performance criteria are established, and feasibility studies are done. Portions of software, such as operating systems or critical algorithms may be tested. It is possible that if data cannot be displayed within a certain period of time to a user of the product, that the product is not viable. With the performance analyzer, these sections of software can be quickly verified and optimized to achieve the desired performance. Also at this time in the development, a choice of processors may be considered and benchmarked to determine the best one for the job.

PROTOTYPE PHASE

Current programming philosophies break an overall software effort down into many independent modules with well-defined interfaces. Each module must be implemented, tested, debugged, and integrated with the other

modules. The software performance analyzer can be used during this phase to assure that each module is meeting its specifications and to locate any anomalies. Having a visual picture of executing software can provide insights and understanding of the system as it is being developed. Using an emulation system during the prototype phase provides a real execution environment before target hardware is available, and as a result software can eventually be integrated in the target with less difficulty.

PRODUCTION PHASE

Getting the product characterized and thoroughly tested for product release is the next phase where the software performance analyzer can play a major role. Benchmarking for competitive reasons may also be important at this time. Providing tools for field service personnel where they can quickly determine with a graphical presentation whether the system is operating correctly or not could be valuable.

MAINTENANCE PHASE

The maintenance phase of the software life cycle is rapidly becoming the most consuming in terms of time and resources. A large part of the maintenance phase is involved with fixing bugs and making enhancements to released products. Software inefficiencies often go undetected, resulting in performance degradation. The software performance analyzer can possibly reveal an easy way to speed up system interaction, make better use of memory, or shorten a measurement algorithm. Many times software engineers find themselves responsible for undocumented software that they know nothing about and are expected to make enhancements. The software performance analyzer can provide the insight and knowledge they need to understand what the interactions are between the modules and to locate the inefficiencies.

The software performance analyzer gives a designer a nonintrusive view of software while it executes in real time and can be used during all phases of development. The next chapter will provide an insight into the six measurement modes, how they are used and why. You should also obtain an understanding of the high level symbolic interface and how the software performance anaylzer is automatically configured for the emulator subsystem.

Chapter 2

PREVIEWING MEASUREMENT CAPABILITIES

INTRODUCTION

This chapter provides information pertaining to the measurement capabilities of the software performance analyzer. It is intended to show, from a practical standpoint, the value of the different measurement modes and the specific use for each mode. The symbolic interface and automatic configuration to emulation are also discussed.

It is important to note, at this point, that prior to making a measurement it is necessary to define the events that you will be using as a basis for your measurements. An event can be defined as a specific address, an address label, a range of addresses, a range of source line numbers, a module, a contiguous range of modules, or a time range. If you want to use symbology for defining events, you must set up an absolute file before those type of events can be defined. Event groups can be defined to include up to twelve previously defined address, module, or time events. A discussion of the define functions and the method used to define events and event groups is given in chapter 5.

It is also important to note, at this point, that parameters can be implemented for setting up and qualifying a measurement. A measurement may be stopped on either a number of termination conditions or using the measurement disable function. The measurement can be qualified using the internal windows or enable/disable terms of the analyzer. The software performance analyzer can also either qualify or be qualified by an external analyzer over the intermodule bus with the trigger enable line. In addition, the setup command provides you with the ability to control the event period in the scanning mode. Finally, the setup capability allows you to set up an absolute file so that you can interact symbolically with the analyzer (as noted above). A discussion of the setup functions and their uses is given in chapter 6.

After the events to be measured (and setup parameters, if desired) have been defined, you can then begin your measurements. There are six different measurement modes in which the analyzer operates. These modes are as follows:

1. memory activity mode,

2. program activity mode,

3. module duration mode,

4. module usage mode,

5. intermodule duration mode, and

6. intermodule linkage mode.

These modes are basically divided into three different types of measurements: activity, duration, and linkage. Each of these types of measurements are discussed in the following paragraphs.

ACTIVITY MEASUREMENT MODES

The activity measurement modes are the memory and program activity modes. In both of these modes, either time or occurrences can be selected for display by pressing the appropriate softkey. You can also elect to observe either relative or absolute data (also by using the appropriate softkey). Relative data is defined as data that is currently being displayed on the screen. The percentages shown will total 100% since the data shown is relative only to that data currently being displayed. Absolute data, on the other hand, is defined as the data as it relates to the total program being analyzed, not to just the displayed data. Absolute data can, therefore, total less than 100% if the total program is not included in the displayed data.

The activity measurements also provide for a maximum of two real-time activity measurements per software performance analyzer board. A total of four boards may be used at any one time (depending on the measurement system configuration), so a total of eight real-time activity measurements may be taken. When making real-time measurements, no window or disable functions are allowed. The data for each event is gathered in parallel. There is an approximate 40 usec break (dead time) approximately every second for the hardware to be unloaded. Any previously set event period is ignored.

A prefetch into an events range will register as activity within that event if it is currently being monitored. This may cause confusion if no activity is expected. If this becomes a problem, adding code "pads" in front of each event is suggested.

MEMORY ACTIVITY MODE

The memory activity mode provides measurements of accesses to memory space. It provides an accurate picture of memory accesses throughout your software program and thereby gives you the capability to make the best possible use of available memory space.

Both time and occurrences can be measured for activity in selected ranges across the user system memory space. Up to twelve user-defined ranges can be viewed simultaneously in histogram form. These histograms provide a graphic view of how the user system memory space is being used and can quickly point you to memory activity bottlenecks and system inefficiencies.

To focus on specific areas of interest, you can qualify memory activity according to status information provided by your system's processor.

For example, you can view (individually or in combination) memory reads, memory writes, I/O operations, DMA transactions, opcode fetches, stack pops, stack pushes, etc. A memory activity measurement display is shown in figure 2-1. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

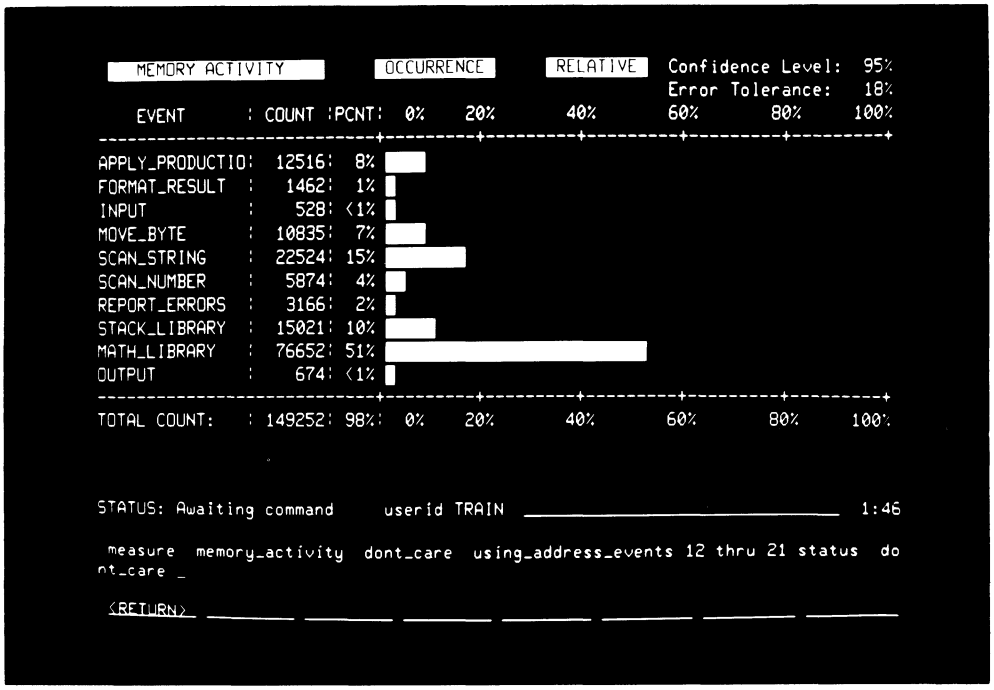


Figure 2-1. Memory Activity Measurement Display

PROGRAM ACTIVITY MODE

The program activity mode can be used to reveal software modules that create bottlenecks by spotlighting those that cause the majority of activity within the program.

This measurement mode provides measurements of all activity caused by a block of code (including reads, writes, stack pops and pushes, etc.) as part of an event, even when this memory activity is out of that particular event's address range. These out-of-module events, such as reads, writes, stack accesses, etc., are shown as time or occurrences within the initiating module.

You can simultaneously view up to twelve separate software modules, blocks of code, functions, procedures, etc. in histogram form. Each bar of the histogram represents one event that you can define and label.

A program activity measurement display is shown in figure 2-2. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

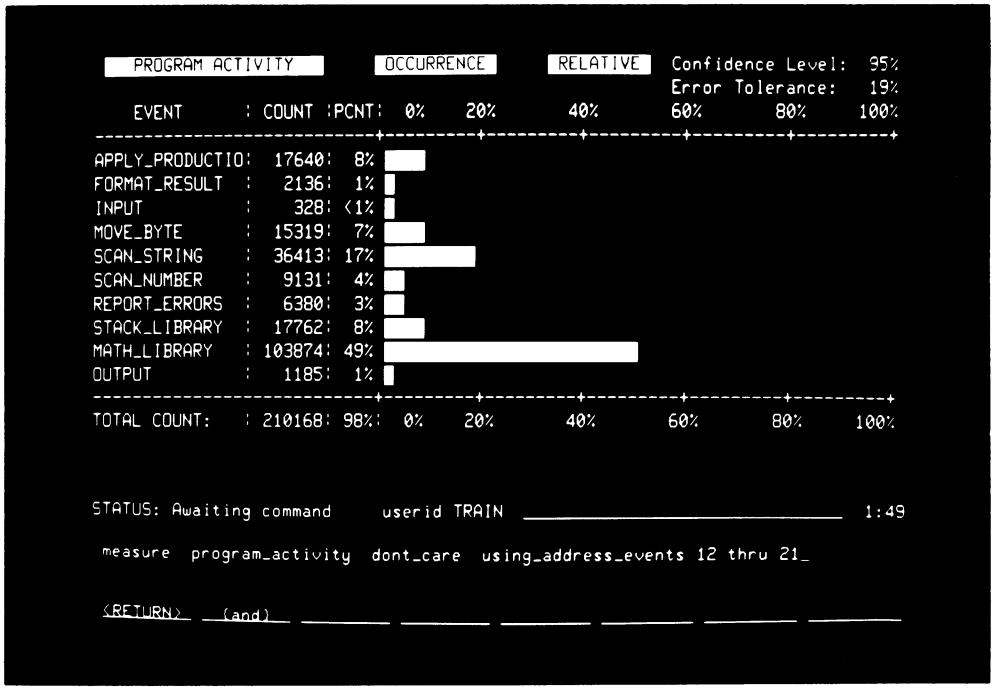


Figure 2-2. Program Activity Measurement Display

DURATION MEASUREMENT MODES

The duration measurement modes are the module duration, module usage, and intermodule duration modes. These measurements produce a time distribution histogram of code execution, with the histogram bars representing time events (buckets, ranges, etc.). The duration measurement modes are used to measure time distribution during execution of a given block of code, time distribution between successive accesses to a module of code, and time distribution of transitions between any two code modules.

MODULE DURATION MODE

The module duration mode provides measurements of time distribution during execution of a given block of code (from entry to exit). The entry point is defined as the address of the first executable instruction. The exit point is defined as the address of the last executable instruction. As your program is monitored, the analyzer measures each execution time of the selected module and provides a histogram display showing time distribution of measured data. You can elect to include or exclude the time involved in calls to other modules as part of the measured time. This can help you to spot problems, such as excessive interrupts.

A module duration measurement display is shown in figure 2-3. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

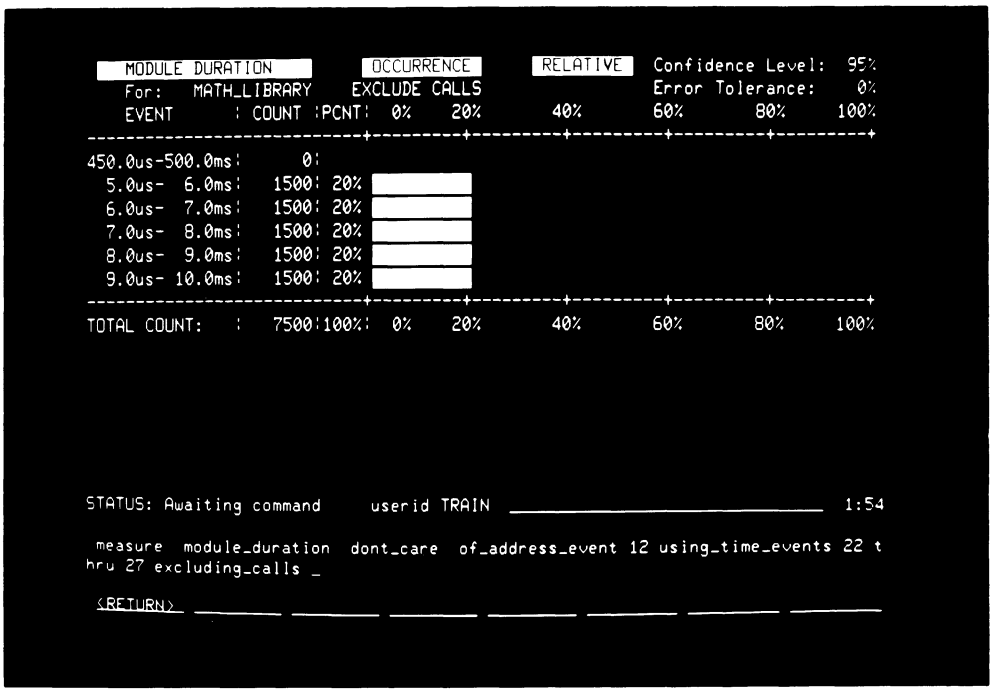


Figure 2-3. Module Duration Measurement Display

MODULE USAGE MODE

The module usage mode provides measurements of time distribution between successive accesses to a module of code (from exit to entry). Exit is defined as the last opcode in the procedure and entry is defined as the first. This measurement is essentially the inverse of the module duration measurement. It shows the time interval distribution between the time a specific module is exited and the time it is entered again, hence it is a measurement of the intensity of demand for that module. An occurrence in this mode is defined as one execution from exit to entry in the procedure. By comparing module usage and module duration measurements, you can spot conflicts and system inefficiencies.

A module usage measurement display is shown in figure 2-4. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

INTERMODULE DURATION MODE

The intermodule duration mode provides measurements of time distribution of transitions between any two code modules (exit from one procedure to eventually entering another. Exit is defined as the last opcode in the

"from" procedure. Entry is defined as the first opcode in the "to" procedure. If the time interval between transitions is too high, system delays may result.

An intermodule duration measurement display is shown in figure 2-5. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

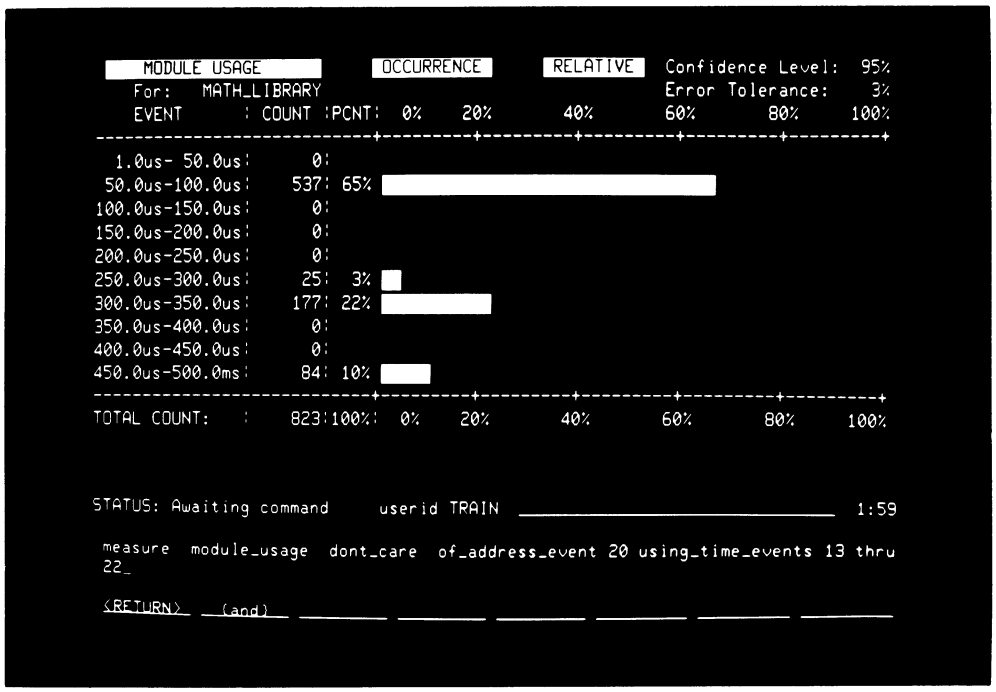


Figure 2-4. Module Usage Measurement Display

INTERMODULE LINKAGE MODE

The intermodule linkage mode provides occurrence measurements of the number of direct transfers between code segments. The tranfers occurring between up to six pairs of events can be displayed in histogram form on the screen at any one time. Occurrences for linkage measurements are defined as immediate transfers out of the "from" events range. Intermodule linkage measurements reveal software traffic problems. They show which modules are called most often, providing clues to more efficient software.

An intermodule linkage measurement display is shown in figure 2-6. For purposes of clarity the measurement is shown in the halted state and the measurement specification is shown on the command line.

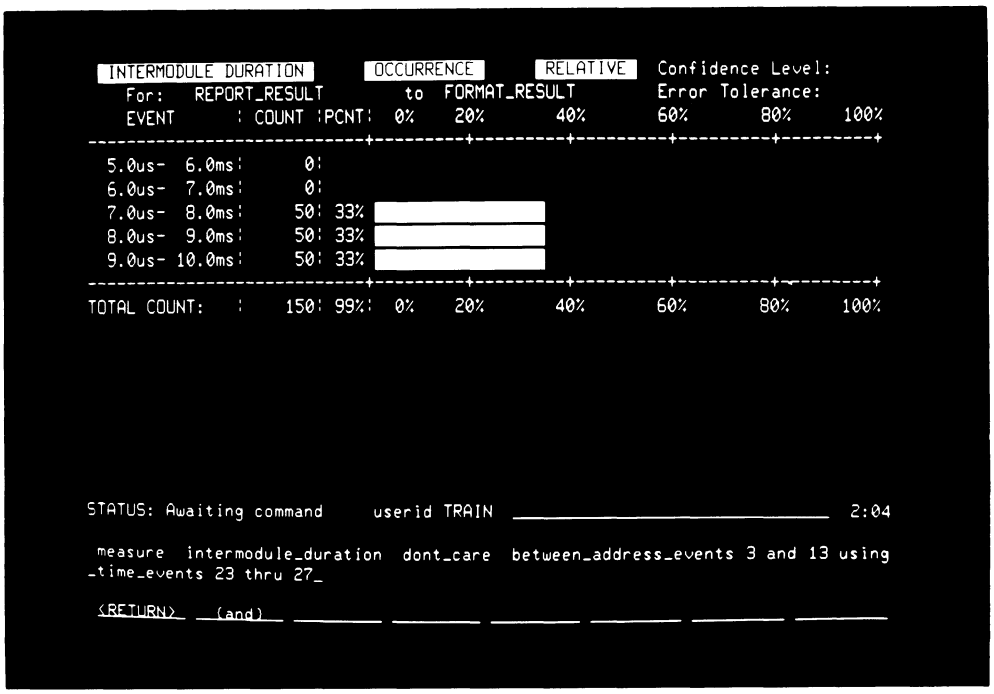


Figure 2-5. Intermodule Duration Measurement Display

SYMBOLIC INTERFACE

The software performance analyzer provides the capability for the user who has developed programs using the HP64000 Logic Development System (compilers, assemblers, and linker) to specify measurements in terms of the symbols used in the programs. This is possible because the compilers, assemblers, and the linker produce symbol tables that provide the software perfromance analyzer with the information necessary to determine the physical addresses associated with the user's symbols.

The types of symbols which the software performance analyzer will accomodate are:

1. Global symbols found in the link_sym files created by the linker,

2. Local symbols found in the asmb_sym files created by the compilers and assemblers, and

3. Line numbers, also found in the asmb_sym files created by the compilers.

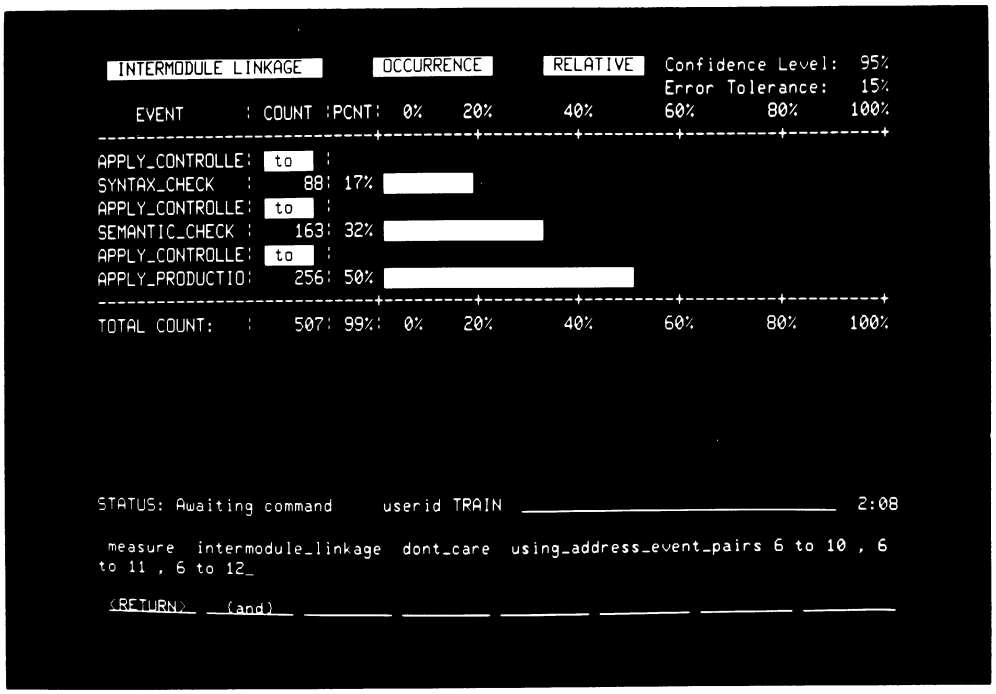


Figure 2-6. Intermodule Linkage Measurement Display

Due to the broad variety of coverage provided by the software performance analyzer, the symbolic interface was designed to refer to the types of symbols as discussed below (in a rather generic sense).

Symbols are broken up into two forms: labels (which are handled as a single address), and modules (which are considered to be an address range, both limits of which may or may not be the same physical address). In terms of the high level languages of Pascal and "C", a module may be considered synonymous with the procedures and functions of Pascal and the functions of "C". The key ingredients of a module, as required by the software performance analyzer, are that the module must be a contiguous segment of code with a single entry point and a single exit point, and all the code for the module must fall within the range of the entry and exit points. The entry point is defined as the first executable instruction of the code segment (the address of this instruction becomes the lower boundary of the address range for that module). The exit point is defined as the last executable instruction of the code segment (the address of which becomes the upper boundary of the address range for that module). The entry point must have a label associated with it and this label must be the module name (i.e.; function MAIN). In addition, the exit point must also have a label associated with it which is identical in the first 14 characters to the entry point label except that an "R" is appended to the front of the label (i.e.: RMAIN). It is these labels, found in the symbol files, that the software performance analyzer keys off of to perform a table lookup of the

physical address range associated with the module, as well as its entry and exit points. The compilers follow these design rules and provide the necessary labels, and if the assembly language designer follows these same rules and provides the labels, the software performance analyzer will operate properly on modules from assembly language programs. A word of **CAUTION** ; The compilers may, under certain conditions, create identical labels. These conditions are as follows:

1. procedures and functions on different levels (i.e.; nested procedures) may have identical names, and

2. due to the creation of the "R" or exit point labels, procedures and functions identical in the first 14 characters on any level will produce identical "R" labels.

The software performance analyzer will always use the first label it encounters that matches the specified label. So, in order to avoid the possibility of having the software performance analyzer pick up the wrong label, it is recommended that you always make your procedure and function names unique within the first 14 characters when using software performance analysis.

The software performance analyzer also provides symbolic lookup of line numbers. These line numbers are found in the asmb_sym files for compiled programs. The line numbers correspond to the line numbers found in the compiled listing file. It should be noted that not all of these line numbers have executable instructions associated with them, and the ones that do, may have several instructions associated with a single line number. The software performance analyzer only accepts line numbers that have executable code associated with them. It always associates the address for the line number with the physical address of the first executable instruction associated with that line number.

AUTOMATIC CONFIGURATION TO EMULATORS

An additional feature of the software performance analyzer is that it will automatically configure its hardware and the softkeys to work with, and provide a user interface to, all of the emulators available in the HP64000 Logic Development System environment. When the software performance analyzer is combined with more than one emulator in the card cage of a 64100A or 64110A mainframe, the emulator to be used with the analyzer must be identified. This is accomplished beginning at the measurement system level of software. When you press the *meas_sys* softkey and the RETURN key at the system monitor level, the display will change to show the measurement system current configuration (i.e.; the modules installed in the card cage and their slot numbers). The softkey label line will contain the labels associated with each emulator and the software performance analyzer (each with its unique slot number). Press the *sw_perf_<NUMBER>* softkey and the RETURN key. The screen will display the slot number and description of the emulators installed in the card cage. The message "ENTER: Slot # of Emulator connected to Analyzer" will appear on the status line of the display. Type in the slot number of the emulator you have connected to the software

performance analyzer and press the RETURN key. You are now in the software performance analyzer software, ready to begin your analysis session. You need only identify the emulator being used the first time you enter an analysis session. Except for the selection of the emulator to be used in the session, everything else pertaining to configuring to the emulator is automatic.

Chapter 3
INSTALLATION

INTRODUCTION

This chapter provides preinstallation and installation procedures to be followed prior to and during installation of the software performance analyzer board into a 64000-series Logic Development System mainframe.

A set of floppy discs or a tape which contains the analyzer software is required for operation. Prior to operating the analyzer, an extra (duplicate) set of the discs should be made for use in operating the analyzer. The originals should be saved as a master set in the event that the duplicate copy is accidentally lost or destroyed. Procedures for making duplicate copies of the floppy discs are described in the rear sections of this chapter.

PREINSTALLATION PROCEDURE

Upon receipt of the software performance analyzer board, proceed as follows to make sure that your equipment shipment is complete, that no damage was incurred during shipment, and the board is ready for installation.

a. Unpack the software performance analyzer board (and cables, if ordered) and inspect them for any damage that might have occurred in shipping.

b. Compare the contents of the package with the parts list contained in the package to make sure you have received a complete shipment. If any equipment is missing contact your nearest Hewlett-Packard representative as soon as possible.

c. Make sure that service switches 1 through 10 (SU34), located on the middle, left side of the board are positioned correctly. Refer to table 3-1 for the correct position of the switches for use during normal operation.

INSTALLATION PROCEDURE

The following procedure assumes that the installation of the software performance analyzer board will be within a complete emulation system, and that the emulation system has been installed in accordance with instructions given in the emulation reference operation manual.

Table 3-1. Switch SU34 Normal Operating Positions

Switch	Position
1	Pressed to open position
2	Pressed to open position
3	Pressed to closed position
4	Pressed to closed position
5	Pressed to closed position
6	Pressed to closed position
7	Pressed to closed position
8	Pressed to closed position
9	Pressed to closed position
10	Pressed to closed position

The software performance analyzer board has the same connector configuration as the emulation internal analysis board. It is designed to be installed beside the emulation internal analysis board, in the next lower slot number of the 64100A mainframe or the next higher slot in the 64110A mainframe. If there is no emulation internal analysis board installed in the emulation system, the software performance analyzer should be installed in the slot next to the emulation control board, (where the emulation internal analysis board would have been installed). When installed in this location, the memory control board and all adjacent boards must be moved one card slot location to allow space for installation of the software performance analyzer board.

Figure 3-1 shows typical installation details for a 64100A mainframe and figure 3-2 shows typical installation details for a 64110A mainframe.

Install the software performance analyzer board in the mainframe in accordance with the following procedure.

CAUTION

Make sure all power is off prior to performing the installation procedures.

a. Remove the cover from the card cage.

b. Remove the two emulation bus cables and the memory bus cable from the board edges.

c. Using the ejector handles on the boards, remove the memory control board and any memory boards from the card cage. Do not remove the emulation control board or the internal analysis board from the card cage. Note the arrangement of the boards that are removed.

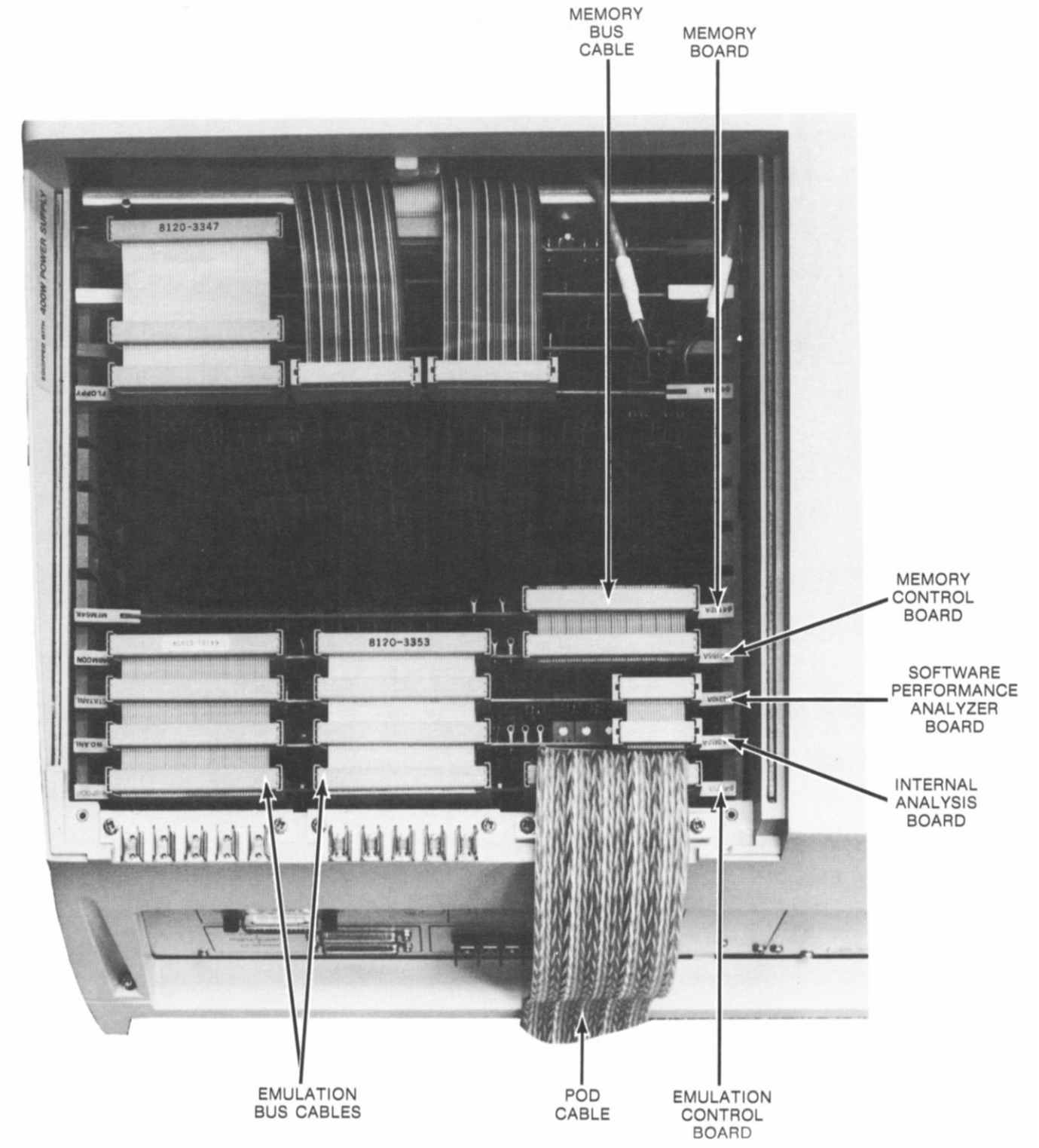


Figure 3-1. Installation Details for a 64100A Mainframe

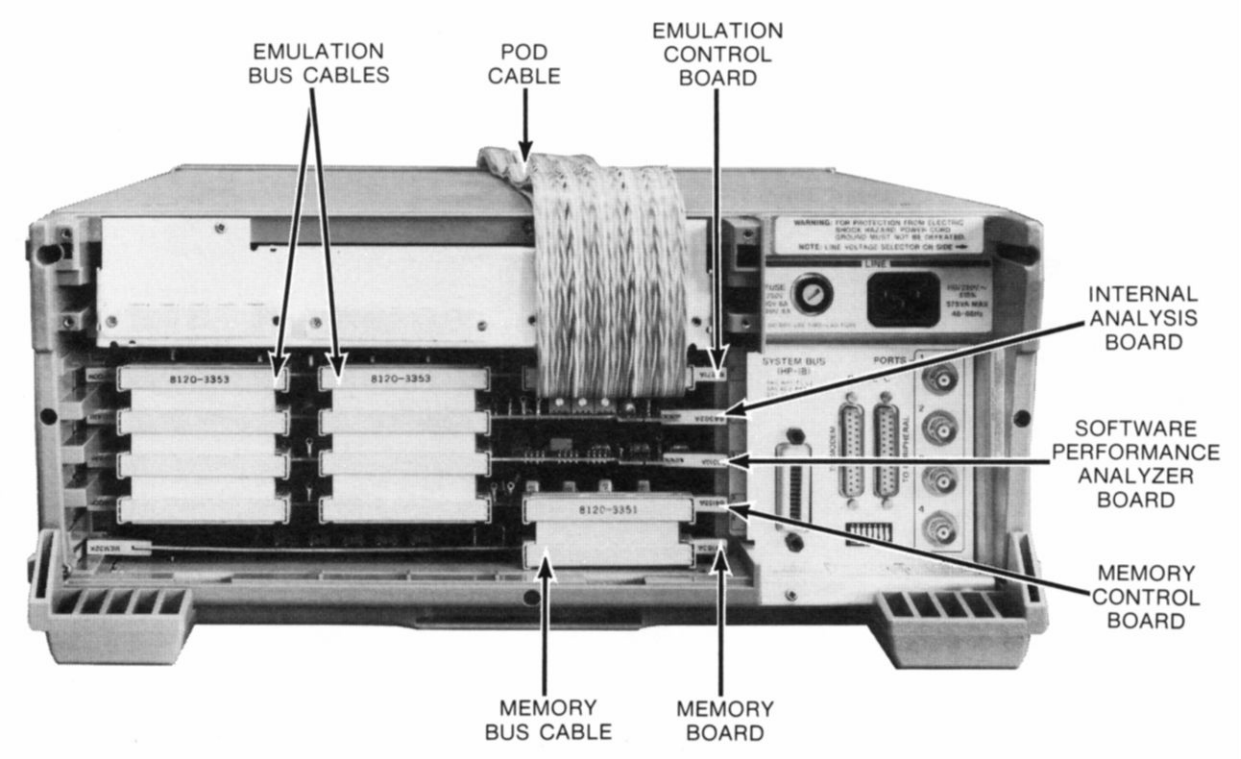


Figure 3-2. Installation Details for a 64110A Mainframe

d. Install the software performance analyzer board into the slot beside the emulation internal analysis board (or the emulation control board if the emulation internal analysis board is not present), with the component side facing away from the emulation internal analysis board. Apply a gentle inward pressure until the board seats in the connectors. The ejector handles should be parallel with the board edge when the software performance analyzer board reaches full inward travel.

e. Reinstall the memory control board, memory board(s), and any other boards that were removed during this procedure. Make sure that they are reinstalled in the same order that they were removed. Make sure that each board seats fully into the card cage connectors.

f. Install the emulation bus cables on the top of the boards. See figure 3-1 or figure 3-2 for locations of the emulation bus cables. Be sure to align pin 1 of the cable connectors with pin 1 of each of the board connectors. Pin 1 on the cable assemblies is identified by three indicators: a number 1 molded into the connector face, a color dot pasted on the end of the connector, and the heaviest blue wire on the side of the cable.

g. To verify correct installation, run the performance verification checks contained in the software supplied with the software performance analyzer (refer to the service manual for procedures for running the performance verification checks).

REAR-PANEL ADDRESS SWITCH SETTINGS

NOTE

Most mainframes contain seven rear panel switches. However, some earlier models contain only five switches on the rear panel. Instructions for setting the five switches are contained in the following instructions with switch selections shown in parentheses.

The address switches are a set of seven (or five) switches on the mainframe rear panel. Refer to the label located beside the address switches, and set the switches as follows:

1. If you are operating this instrument as part of a system, set switches one through five (or three) to select the system address for your mainframe. Set switches six and seven (or four and five) to select SYSTEM BUS operation.

2. If operating as a stand-alone instrument, switches one through five (or three) are not used. In this case, set switches six and seven (or four and five) to one of the local mass storage (LMS) positions.

MAKING DUPLICATE COPIES OF FLOPPY DISC SOFTWARE

If your software performance analyzer was shipped with a set of floppy discs containing your software, you should make another set of floppies for your use and protect the original set that you received with your system. In your original set is the software to run the software performance analyzer, to operate the system functions, to do performance verifications, etc. The procedures in the following paragraphs will show you how to make a duplicate set of floppy discs so that the originals may be stored for safekeeping.

The result of using these procedures will be the production of one floppy disc with all of your system operating routines and all of the software performance analyzer operating software. This floppy disc will have all of the routines that you need for software performance analysis. When you have finished making the duplicate set of floppy discs, store the master discs that you received from HP and use the master set only when you need to make a new set of user floppy discs.

The floppy disc that you are going to make will contain the measurement-system routines, the monitor routines, and the software performance analyzer routines.

When you have performed the procedures described, you will be familiar enough with the copying of discs to make any other disc arrangements you desire. You should also make user floppy discs to contain the performance verification procedures and backup operating system discs.

To make a user set of floppy discs, proceed as follows:

1. Remove one new blank floppy disc from its container and label it SOFTWARE PERFORMANCE ANALYZER. Do not write directly on the floppy disc; this can damage the floppy. Use stick-on labels, if available, or a felt-tip pen. This will become your working floppy disc when the formatting is done.

2. Install the master floppy disc for the operating system (operating system disc #3) in disc drive 0 of your mainframe.

3. Install the new blank SOFTWARE PERFORMANCE ANALYZER disc in disc drive 1.

4. Turn on the LINE power switch. The system monitor software will execute the boot-up routines and perform the instrument self test.

5. Press the following softkeys in the sequence shown:

---ETC--- ---ETC--- BACKUP floppy utilities

Now press the RETURN key.

6. The CRT will show an explanation of the floppy utilities routines. A floppy disc must be formatted prior to use. Formatting initializes

the disc, preparing it to receive information. To format the disc, press the *format* and *1* softkeys, then press the RETURN key.

7. When disc 1 formatting is completed, open disc drive 1 and remove the SOFTWARE PERFORMANCE ANALYZER disc. Press the *end* softkey and the RETURN key. Install operating system disc #4 in disc drive 1 and press the following softkeys, in the sequence shown:

floppy sys_gen

Now press the RETURN key.

8. Remove operating system disc # 4 from disc drive 1 and reinstall the SOFTWARE PERFORMANCE ANALYZER disc in its place. Press the following softkeys, in the sequence shown:

copy OP_SYS from local_disc 0 to local_disc 1

Now press the RETURN key.

9. When the copy initiated in step 8 is completed, press the following softkeys in the sequence shown:

copy MEAS_SYS from local_disc 0 to local_disc 1

Now press the RETURN key.

10. Remove operating system disc #3 from disc drive 0, install the master software performance analyzer disc in its place, and press the following softkeys in the sequence shown:

copy SW_PERF_ANALYZER from local_disc 0 to local_disc 1

Now press the RETURN key.

11. Open disc drive 0 and remove the master software performance analyzer floppy disc. Press the *end* softkey and the RETURN key. Store the disc in a safe place.

12. To copy one floppy in its entirety (e.g.; to back up the operating system disc #3), proceed as follows; install operating system disc #3 in disc drive 0, remove the SOFTWARE PERFORMANCE ANALYZER disc from disc drive 1, install a blank disc (labelled OPERATING SYSTEM DISC #3 BACKUP) in its place, and press the following softkeys in the sequence shown:

floppy utilities

Now press the RETURN key, then the *format* and *1* softkeys and the RETURN key again. Next, press the following softkeys, in the sequence shown:

copy local_disc 0 to local_disc 1

Now press the RETURN key again.

13. After the copy is complete, remove operating system disc #3 from disc drive 0 and the operating system disc #3 backup from disc drive 1. Store the discs in a safe place.

14. Install your user SOFTWARE PERFORMANCE ANALYZER disc in disc drive 0 and press the *end* softkey, then the RETURN key. This disc will be part of the software performance analyzer operating discs.

This completes the procedures for making a user set of floppy discs. Your instrument is now ready to perform software peformance analysis from your user set of discs.

If you have enough spare floppy discs, you might consider making a second user copy using floppy-utilities copy. In this way, you would always have a SOFTWARE PERFORMANCE ANALYZER disc formatted to your needs. Making future copies of these discs would be easier than using the master discs because you would only be making copies of two discs instead of selective copies of several discs.

NOTE

The user copy of the SOFTWARE PERFORMANCE ANALYZER disc cannot be write protected because temporary configuration files must be written to the disc.

CHAPTER 4

GETTING STARTED

INTRODUCTION

This chapter contains information that will help you to become familiar with the software performance analyzer. You will learn something about the first level of analyzer softkeys and their use in specifying a measurement. In addition, you will learn to enter measurement specifications in the software performance analyzer and to gather data as a result of the measurement specifications you have set up. You will also learn to save a configuraton to a file and reload that configuration back into the measurement setup at a later time.

MAJOR SOFTKEY LEVELS

The software performance analyzer is a user-friendly instrument designed to provide the user with easily definable options to examine software programs to determine if the program is as efficient as design constraints and future expansion possibilities require. The method used for friendly-user interface is that of logical structural breakdown and progression which is accomplished by the use of convenient and easily definable softkeys. The softkey structure and a brief functional description of the higher level softkeys are given below.

The major softkey levels of the software performance analyzer are the *define, setup, measure, copy, configure, show, execute,* and *end* softkeys. These softkeys are discussed briefly in the following paragraphs. This brief account of each, will allow the user to become familiar enough with them to perform the familarization exercises detailed later in this chapter. A detailed explanation of all the softkeys used in, and under, the major softkey levels is given in later chapters. Syntax diagrams for the major softkey level functions are given in appendix A.

DEFINE SOFTKEY

The *define* softkey allows the user to define events to be measured. These events may be a single event or a series of events grouped under a single label. Grouping events allows rapid and easy recall of high-usage measurement event configurations. An event may be described using actual program labels or compiled source program listing line numbers. The analyzer will then set up address range information automatically from this source information. The user also has the option to describe an event by entering address and address range information directly in binary, octal, decimal, or hexadecimal format, if desired.

SETUP SOFTKEY

The *setup* softkey allows the user to establish (1) the condition which will cause completion of the measurement, (2) the period that data is acquired at each event during an event scan, (3) an enable or disable event condition which allows the user to start, stop, or window the performance measurement to a certain location or condition within the software being analyzed, (4) an external trigger to define interaction with other 64000 subsystems and external instrumentation, and (5) an absolute file to be used for symbolic definitions and displays within the software performance analyzer.

MEASURE SOFTKEY

The *measure* softkey allows the user to select a series of measurements for the software performance analyzer measurement activities. These measurement activities are (1) program activity, (2) memory activity, (3) module duration, (4) module usage, (5) intermodule duration, and (6) intermodule linkage. Once a given type of measurement has been selected, softkeys are available to allow rapid selection of the events to be analyzed (by name or by number as previously established under the define mode). Where a group of events have been defined with a single group name, the complete measurement may be quickly and easily specified simply by typing in that group name.

Also, where complete real-time acquisition is important (studying the total and detailed interaction between two points, for instance), it is possible to select up to two event resources of the analyzer to "lock" on two events of interest for complete real-time measurements.

COPY SOFTKEY

The *copy* softkey allows the user to copy the different address and time definitions (event assignments), group definitions, the measurement setup, and the display, to either a file or to the printer.

CONFIGURATION SOFTKEY

The *configure* softkey allows the user to either save or load the complete analyzer configuration (i.e.; event definitions, group definitions, measurement specifications, and measurement set up) in to or from a file.

SHOW SOFTKEY

The *show* softkey allows the user to display the different definitions established previously for address events, time events, and group events. Also available for display are the measurement setup conditions and the current measurement histogram or data list.

EXECUTE SOFTKEY

The *execute* softkey causes execution of a measurement. It allows execution of a single measurement, where execution continues until a measurement completion condition is reached, or a repetitive measurement, which causes the analyzer to cycle through the measurement sequence continuously.

END SOFTKEY

Pressing the *end* softkey one time causes the subsystem to temporarily suspend the current measurement session and places the software program back into the measurement system monitor. The software performance analysis session can be reentered from this point simply by pressing the *sw_perf* softkey. Unless the setup terminate conditions have been met, the measurement will still be running when the session is reentered. If the setup terminate conditions have been met, the final measurement data will have been retained in memory and will be displayed in histogram form.

MODIFY SOFTKEY

The *modify* softkey will appear throughout the softkey interface to the analyzer when a parameter has previously been selected for a particular function. Selecting this key allows the user to recall the configuration of the function presently in use. Changes can then be made easily to single or multiple parameters within that function. This saves the time and inconvenience of having to redefine the complete function when only a simple change may be required.

PREPARING THE SYSTEM FOR MEASUREMENTS

Information contained in this section is provided to help you become familiar with, and feel at ease with, the basic operation of the software performance analyzer. You will be asked to have a program loaded and running in your emulator so that you can perform some basic software performance measurements. You will learn how to gain access to the analysis functions and how to setup the analyzer to make memory activity and module duration measurements.

INITIAL TURN ON

NOTE

The following procedure assumes that you have installed an emulation system and a software performance analyzer in your mainframe and you have configured a set of user software as described in the installation sections of the manual.

1. Connect operating power to the mainframe.

2. Turn on the power switch. The associated indicator lamp (on some mainframes) will light.

3. In a hard disc based system, boot in the software performance analyzer software. In a floppy disc based system, install the SOFTWARE PERFORMANCE ANALYZER floppy disc that you created in chapter 2, in drive 0 (left side or top, depending on the mainframe). If analysis boards, other than the software performance analyzer, are also installed in the mainframe, the software performance analyzer software must be contained on the operating system floppy disc in drive 0.

4. The message "Self-test Completed" will come up on the screen in floppy disc based systems. In hard disc based systems, the units connected to the bus are identified. In either case, the system monitor software is loaded and the monitor level of softkeys is displayed on the bottom of the screen.

5. You may, at this time, wish to assign a user identity code to your activity with the instrument. The software records your userid and assigns any files you may make to your userid. The userid must start with an upper case alphabetic character and is limited to six characters. After the first letter, the other five characters may be alphanumeric. To assign your userid press the *---ETC---* softkey twice, press the *userid* softkey, type in the userid you have selected, and press the RETURN key. If no userid is selected, the default condition is a blank userid.

LOADING AND EXECUTING A PROGRAM IN EMULATION

Once the instrument has been turned on and "Self-test Complete" is displayed on the screen, the softkey label line at the bottom of the screen will contain the *meas_sys* softkey label. When you press the *meas_sys* softkey and the RETURN key, the *sw_perf* softkey will appear on the softkey label line, along with the name(s) of any emulation system in the mainframe. This is the measurement system level of softkeys. From here, you will need to select to enter the emulation system so that you can load your program into the emulator and get the program running.

NOTE

The sw_perf softkey label will be followed by a number (e.g.; sw_perf _8). The number denotes the slot in the mainframe that contains the software performance analyzer board. The slot number of the emulator board(s) will also appear with the emulator softkey label(s).

A program can either be loaded and executed using the emulator before the software performance analyzer is set up to make a measurement or the analyzer can be set up first and then the program loaded and executed. For the purposes of this exercise, it is assumed that the program has been loaded and is currently executing. In order to load a program into emulation for execution, you must have previously either compiled or assembled the source code, linked the program, and have an absolute file ready for loading.

GAINING ACCESS TO THE SOFTWARE PERFORMANCE ANALYZER

After you have the software executing in the emulator or in the target system, you are now ready to gain access to the software performance analyzer. Leave the emulation system running and press the *end* softkey and the RETURN key. This will bring you out to the system monitor level of softkeys. Press the *meas_sys* softkey and the RETURN key. You are now at the measurement system level of softkeys. Now you can gain access to the software performance analysis functions by pressing the *sw_perf* softkey and the RETURN key if only one emulator is in the card cage. If more than one emulator is in the card cage, the display will show a prompt which asks you to enter the slot number of the emulator connected to the analyzer. Type in the slot number and press the RETURN key. You are now in the software performance analyzer software, ready to start your analysis session.

Figure 4-1 shows the syntax used for gaining access to the software performance analyzer and how to end out of the analyzer and go all the way back to the system monitor level of softkeys. By using the *end* softkey once, the analyzer will retain its present measurement setup and will continue its present measurement if you have a measurement in progress. You are now in the measurement system level of software. To go to the system monitor level of software press the *end* again. It is now possible to perform operations at this level (edit, copy, etc.) while analysis measurements are retained or while analysis continues to run. You can reenter the software performance analyzer level later and either continue the run or read the results of the measurement that was being run when the *end* softkey was pressed. To reenter the analyzer, and still retain the current measurement, press the *meas_sys* and *continue* softkeys, then the RETURN key. This brings you to the measurement system level of software. Now press the *sw_perf* softkey and then the RETURN key. If you had a measurement running, your measurement will now be on the display.

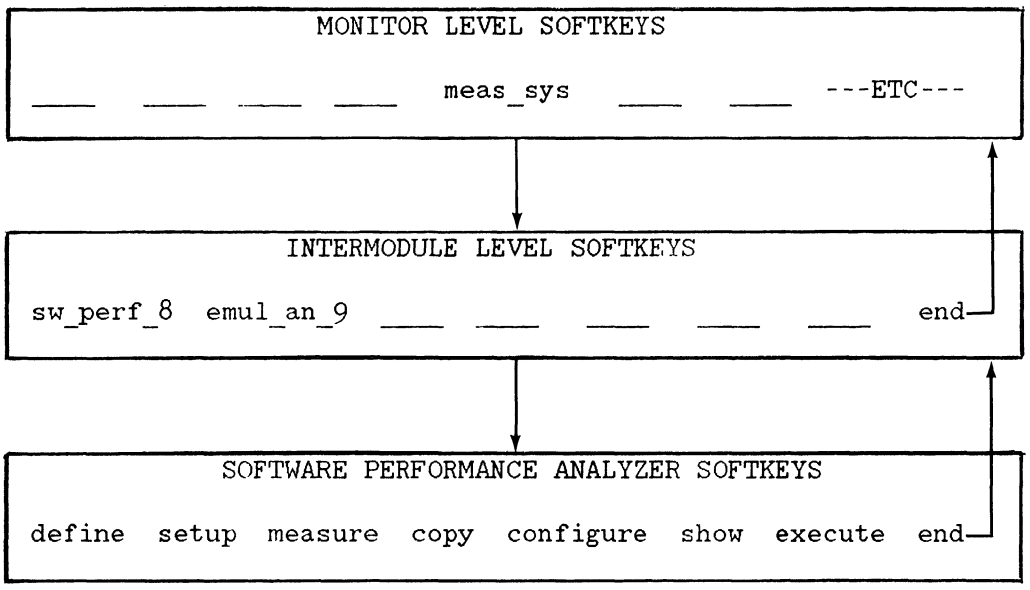


Figure 4-1. Utility Keys Used For Transportation

You have now gained access to the software performance analyzer. Proceed with the instructions in the following paragraphs to perform some basic measurements.

PERFORMING A BASIC MEMORY ACTIVITY MEASUREMENT

This measurement session is intended to get you familiar with the performance analyzer as well as make a meaningful measurement on the software that is executing in your system. The memory activity measurement will show you how memory is being utilized and the relationship between different sections of memory. We will be defining events as address ranges, putting them in a group, and measuring memory activity.

DEFINING EVENTS AS ADDRESS RANGES

In this example we are assuming that the area of memory we desire to look at is the range from address 0 through FFFF hex. Since we do not know where the activity is, we will divide the memory space into 8 ranges. The ranges are: (1) 0 to 3000H, (2) 3001H to 4FFFH, (3) 5000H to 6FFFH, (4) 7000H to 8FFFH, (5) 9000H to AFFFH, (6) B000H to CFFFH, (7) D000H to EFFFH, and (8) F000H to FFFFH.

To assign an event number to a range of addresses, press the following softkeys in the sequence shown.

define address address range

Now type in 0H, press the *thru* softkey, type in 3000H, and press the RETURN key.

Continue this procedure until all 8 events have been defined. Remember that when you enter the addresses beginning with a letter (as in (5) through (8), above) you must preceed the letter with a zero (0).

When you have defined the entire range using the above procedure, you can verify the definitions by pressing the following softkeys in the sequence shown:

show event_asn

Now press the RETURN key. The event assignments that you have made will now appear on the display as shown in figure 4-2.

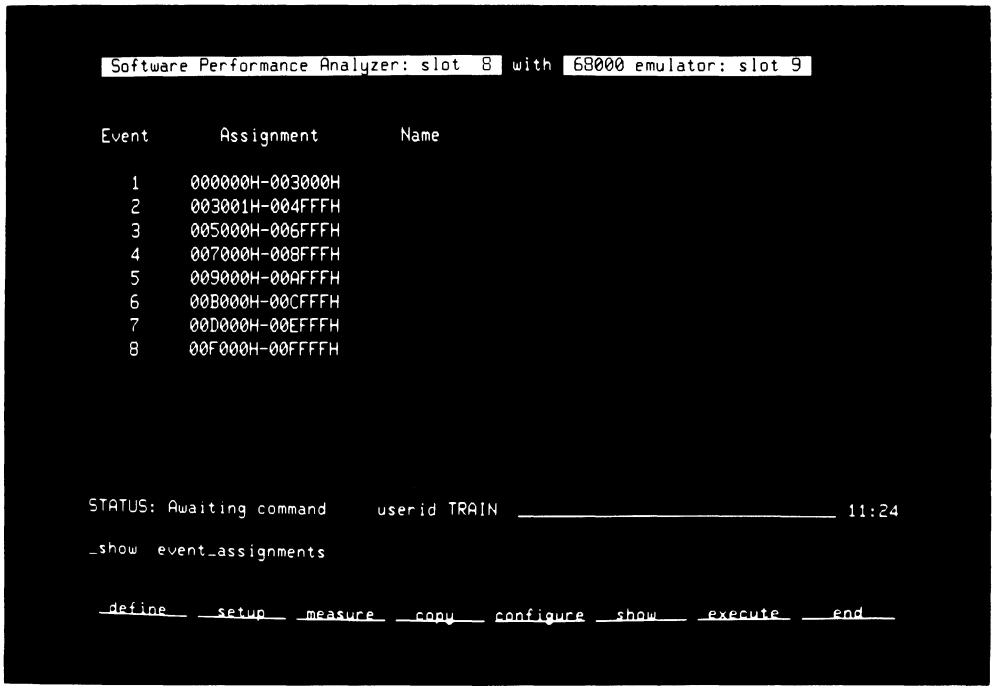


Figure 4-2. Show Event Assignments Display

We are now going to combine all eight of the present event assignments into a group and give it a single name for convenient referencing.

DEFINING AN ADDRESS GROUP

The group name that we will use for the eight address events previously defined is MEMSPACE. To assign a name to this group, press the following softkeys in the sequence shown:

define group

Now type in the group name MEMSPACE, press the *address* softkey, type in 1, press the *thru* softkey, type in 8, and then press the RETURN key.

The name MEMSPACE can now be used whenever you are referring to address events 1 through 8.

When you have several groups assigned and need to refresh your memory as to what events go in what group, all you have to do is press the *show* and *groups* softkeys and then the RETURN key. The group name and type will be displayed, along with the event numbers of the events included in each group. See figure 4-3 for an example of this display.

Also, you can recall the address assignments of the events in any of the groups you have made (such as MEMSPACE), as well as the event numbers. Just press the *show* softkey, type in the group name (in this case; MEMSPACE), and press the RETURN key. The event number, assignment, and the name of each single event (if assigned) will be displayed as well as the group name. See figure 4-4 for an example of this display.

MEASURING MEMORY ACTIVITY

We are now going to measure memory activity of the event group that we previously have defined as MEMSPACE. To specify a memory activity measurement, press the following softkeys in the sequence shown:

measure memory dont__care addr__grp

Now type in the name MEMSPACE and press the RETURN key. The memory activity measurement specification will be displayed on screen. See figure 4-5 for an example of this display.

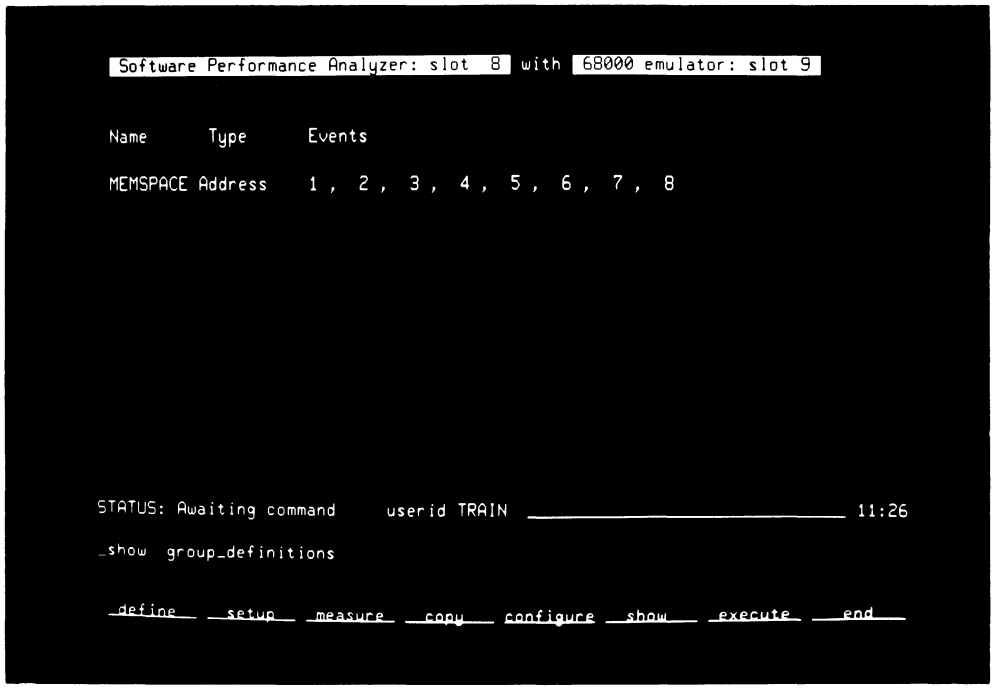


Figure 4-3. Example of a Group Definition Display

Figure 4-4. Example of a Definition of a Group Display

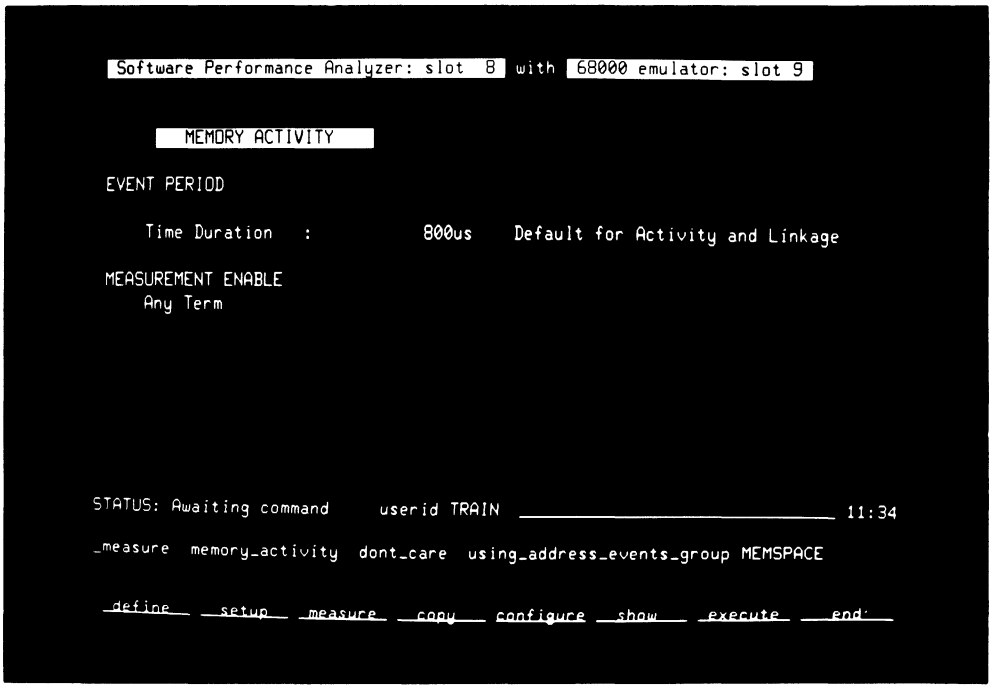


Figure 4-5. Memory Activity Specification Display

You are now ready to "execute" the memory activity measurement. To initiate the measurement, press the *execute* softkey, then the RETURN key. This causes the analyzer to begin a measurement based on your specification. A histogram will appear on the display after all the specifications have been satisfied. See figure 4-6 for an example of the histogram display.

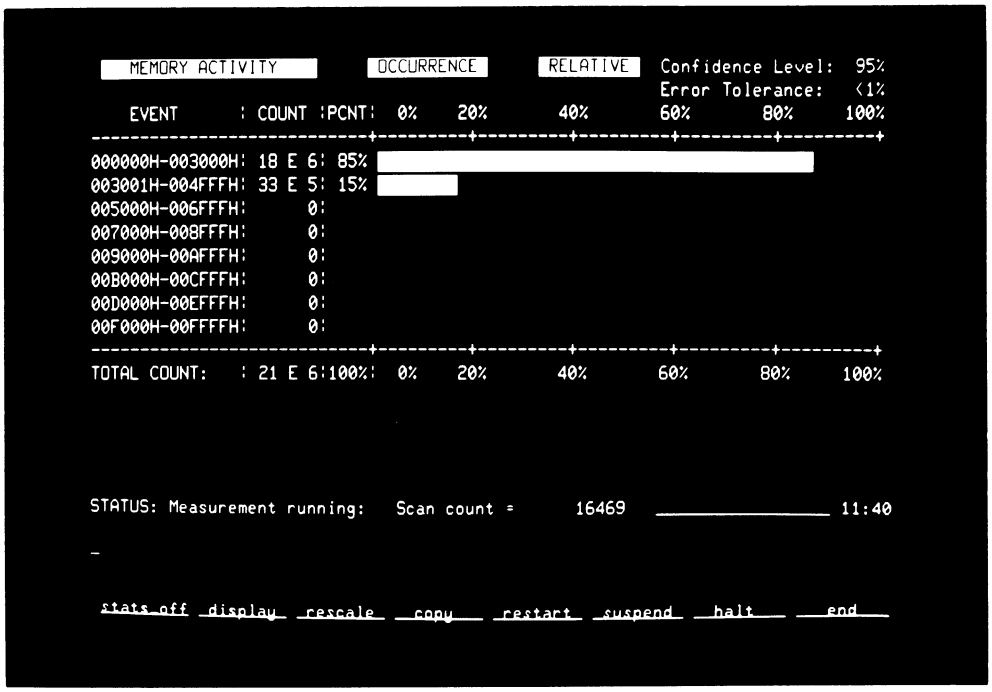


Figure 4-6. Memory Activity Histogram Display

INTERPRETING THE RESULTS

At the top of the display (see figure 4-6) you will see MEMORY ACTIVITY in the left most inverse video field, followed by OCCURRENCE in the next field. MEMORY ACTIVITY indication shows the type of measurement being performed. The OCCURRENCE indicator means that the analyzer is counting the number of times the events that you have defined are accessed over a known period of time. The next field shows that you are in RELATIVE mode. This means that the measurements being displayed are based on the events that are being displayed on the screen at the present time, relative to each other, as opposed to being compared with the total system activity.

The events that you previously defined as being included in the group named MEMSPACE are shown below the inverse video fields with the event name on the left, followed by the count of the actual number of occurrences, the percentage of occurrences of each of the displayed events as related to the total number of event occurrences in the total display, and finally a bar that pictorially represents this percentage. The

bottom of the measurement field contains a total count of the accesses in all of the events that are currently being measured.

In the upper right hand corner are indicators of the confidence level and error tolerance of the data that is being accumulated. The analyzer defaults to a 95% confidence level. The analyzer software will continue to calculate the error tolerance and update the display with any new calculations of error tolerance. The analyzer will continue to accumulate and display data since we have not specified a termination or disable condition in the memory activity measurement we set up earlier. In this case, when no such conditions were specified, simply press the *halt* softkey to terminate the current analysis measurement.

PERFORMING A MODULE DURATION MEASUREMENT

In this session you will be defining time events and time groups, setting up an absolute file to access a module name symbolically, and measuring the time distribution of a module.

DEFINING TIME EVENTS

Since we do not know how long the module takes to execute, we will define the following 8 time ranges. The time ranges that we will use for this session are: (1) 100ms to 200ms, (2) 201ms to 300ms, (3) 301ms to 400ms, (4) 401ms to 500ms, (5) 501ms to 600ms, (6) 601ms to 700ms, (7) 701 ms to 800 ms, and (8) 801ms to 1 second. In order to define time events, press the following softkeys in the sequence shown and continue the procedure until all 8 time events have been defined.

define time as_range

Now type in 100, press the *msec* and *thru* softkeys, type in 200, press the *msec* softkey and then the RETURN key.

When you have defined the entire range using the above procedure, you can verify the definitions by pressing the following softkeys in the sequence shown:

show event_asn

Now press the RETURN key. The event assignments that you have made will now appear on the display similar to that shown in figure 4-2.

We are now going to combine all eight of the present time events we just assigned into a group and give it a single name for convenient referencing (just as we did for the address events).

DEFINING A TIME GROUP

The group name that we will use for the eight time events previously defined is TIME_1. To assign a name to this group, press the following softkeys in the sequence shown:

define group

Now type in the group name TIME_1, press the *time* softkey, type in 1, press the *thru* softkey, type in 8, and press the RETURN key. The name TIME_1 can now be used whenever you are referring to time events 1 through 8.

As with the address events, when you have several groups assigned and need to refresh your memory as to what events go in what group, all you have to do is press the *show* and *groups* softkeys and then the RETURN key. The group name and type will be displayed, along with the event numbers of the events included in each group. Figure 4-3 is an example of the address events group. The display for time events is similar to this display.

You can also recall the assignments of the time events in any of the groups you have made (such as TIME_1), as well as the event numbers. Just press the *show* softkey, type in the group name (in this case; TIME_1), and press the RETURN key. The event number, assignment, and the name of each single event (if assigned) will be displayed, as well as the group name. See figure 4-4 for an example of this display for address events, which is similar to the display showing time events.

SETTING UP AN ABSOLUTE FILE

As we discussed earlier, in the paragraph entitled "Loading and Executing a Program in Emulation", it was necessary to load an absolute file into the emulator. For the following exercise, we will assume that an absolute file named MAIN1 has been loaded and is executing in the emulator. We are now going to set up the absolute file in the software performance analyzer so that we may refer symbolically to module names in our system. In this case our absolute program to be measured is called MAIN1 (the same as the absolute file running in the emulator).

To set up an absolute file named MAIN1 in the software performance analyzer, press the following softkeys in the sequence shown:

setup abs_file

Now type in MAIN1 and press the RETURN key. Assume we have a module named MATHLIB in the program MAIN1. We can now define that module (as discussed in chapter 5). After we have defined the module, we are then prepared to measure the duration of the module called MATHLIB that is in the program MAIN1.

MEASURING MODULE DURATION

We are now going to measure the time distribution of the module MATHLIB using the time events that we have previously defined. In order to measure the duration of this module and exclude any calls made external to the module, press the following softkeys in the sequence shown.

measure duration addr_evnt

Now type in the module name MATHLIB, press the *time_evnt* softkey, type in 1, press the *thru* softkey, type in 8, press the *excluding* softkey, then the RETURN key. You are now ready to execute the measurement. Press the *execute* softkey, then the RETURN key. You should see a histogram that is similar to the one you saw for memory activity. Instead of the events being address ranges, the events on the left hand side are time events. The histogram is interpreted in the same way.

SAVING YOUR CONFIGURATION

By this time you have specified quite a few test setups and event definitions. In order to retrieve these specifications for use at a later time, you may want to save these in a configuration file. In this way you can begin to build a library of configurations and save a great deal of time in future measurement sessions. Press the following softkeys in the sequence shown to save a configuration in a file you will name CONFIG1:

configure save_in

Now type in CONFIG1 and press the RETURN key. The system will save your present configuration in a file named CONFIG1. This allows you to change your configuration (or end the session) with the assurance that you can retrieve your current configuration at a later time, if desired.

This completes your introduction to the software performance analyzer. You have loaded and executed a program with the emulation system and performed a few simple measurements. For more specific and detailed measurements, refer to the information contained in the following chapters.

Chapter 5

DEFINING EVENTS

INTRODUCTION

This chapter provides information pertaining to the "define" function of the software performance analyzer. The define function of the analyzer is a convenience feature of the analyzer that allows you to assign numbers (and names, if desired) to specific address, module, or time events and to assign names to event groups. The number or name is then used, in place of the more detailed description of the event or event group, to set up specific measurements for analysis.

An event can be defined as (1) a specific address, (2) an address label, (3) a range of addresses, (4) a range of compiled source listing line numbers, (5) a module, (6) a contiguous range of modules, or (7) a time range. Event groups can be defined to include up to twelve previously defined address, module, or time events. A discussion of the define functions and the method used to define events and event groups is given in this chapter. Examples are also given for further clarification.

USING THE DEFINE FUNCTIONS

When you analyze your program there will be certain key areas that you will want to look at. You will want to know how much time is being spent in certain areas of your program so you can make the program run smoothly and efficiently. Most of these areas of your program will be functionally constant, and as analysis progresses you will want to measure the same areas of code frequently. Rather than spend the time reentering the same data into the analyzer each time you need to look at a particular portion of code, the define feature allows you to predefine portions of your code that you will be measuring frequently. You can also predefine the time ranges in which you want to look at the code you have defined. It allows you to assign numbers (and names, if desired) to those items you have defined. It also allows you to group individual events together under an event group name. The event or event group can then be called out, by number or name, when you wish to use it to define a measurement specification.

The first level of softkeys which are available after the define softkey is pressed are the *address*, *time*, and *group* softkeys. The syntax for using the define softkeys is shown in appendix A, figure A-1. The use of these softkeys is discussed in detail in the following paragraphs.

EVENT DEFINITIONS

You can define address, time, and group events by number and/or name. The following paragraphs describe the capabilities and restrictions for assigning the numbers and/or names.

EVENT DEFINITION TOTAL CAPACITY

A combination of up to 99 total address and time event definitions can be assigned for each job you are running. If you try to add more than 99 event definitions, an error message reading "Auto increment of event # is not possible" will appear on the STATUS line.

You can save the definitions you have defined for each job by using the "configuration save_in" feature of the analyzer. When your definitions have been assigned, save the configuration by pressing the *configure* and *save_in* softkeys, then typing in a file name, and pressing the RETURN key. This will store the present configuration in the file you have named. You can call up this configuration file any time you start a new session on that particular job. You can make up and save configuration files for a number of different jobs as you work on them. In this way the definitions are always available when you start a new session on a job you have previously set up.

DELETING EVENTS

Events are deleted by writing over them. To write over an event to be deleted, simply assign the same event number to another event to be defined. The new event definition will then be recognized. Refer to the paragraph titled "EVENT NUMBERS" which follows for further information concerning assignment of event numbers.

EVENT NUMBERS

Event numbers are automatically assigned as a default condition. (The default condition can be overridden, however, as discussed later.) Both address and time event numbers (as shown on the display when the *show* and *event_asn* softkeys are pressed), are assigned in ascending order starting at event number 1 (i.e.; 1, 2, 3, etc.). Therefore, there will be duplication of event numbers in the address and time event definitions. They will, however, be in different locations in the event array.

The event array is transparent to the user. It consists of 99 total locations. The location of an address or time event in the event array is determined internally as follows: address events are assigned locations in ascending order starting at event number 1 (i.e.; 1, 2, 3,

etc.) while time events are assigned locations in descending order starting at event number 99 (i.e.; 99, 98, 97, etc.). The location of a time event in the event array as it correlates to the time event number is calculated as: (100) -(time event number) = time event location in the event array). For example; time event number 6 would be (100) -(6) = 94 in the event array.

To override the default event numbering system simply add the event number to the command when the command is being constructed. Be aware, however, that you will cancel any event that already exists if that number has previously been assigned. Also, once you begin assigning numbers to events and you want to go back to a default condition, the default condition will continue in sequence from the last number you assigned. For example; say you had defined events by the default method up to event number 10. Now you want a specific event to be assigned as event number 45, so you type in that number during the process of defining the event. After that it doesn't particularly matter to you what the event number is, so you leave it unnumbered (defaulted). The next number to be assigned by default will be 46 (not 11) since the software now recognizes 45 as being the last number assigned. By the same token, if you assign event number 99 to an event, then try to define another event by defaulting the number, the software will cause the error message "Auto increment of event # is not possible" to be displayed on the STATUS line regardless of how many blank spaces there are in the event array.

CAUTION

Be careful when you assign event numbers out of sequence unless you intend to assign all of the event numbers. If you do assign a number out of sequence and then set up the default to begin again back at its former location sequence, when you reach your assigned number in the default condition your assigned number will be overwritten by a new default number.

EVENT NAMES

You can assign names to any of the individual address or time events; or to a group of predefined address events or a group of predefined time events. The software in the analyzer will not accept two address events with the same name or two time events with the same name. If you try to assign the same name to two address events or to two time events, an error message reading "Event of this name already exists" will appear on the STATUS line. The analyzer software will accept two address events or two time events with the same software label, provided they are given different names when they are defined. It will also accept an address event and a time event with the same name. It will not, however, assign the same name to an address group and/or a time group. If you assign a name that is currently in use to an address group and/or a time group, the current definition will be overwritten and the new name will replace it as the defined name.

DEFINING ADDRESS EVENTS

This section provides information pertaining to the "define address" capabilities of the software performance analyzer. These capabilities allow the you to define specific events, by event number (and name, if desired), to the following;

a. an address

b. a range of addresses

c. an address label

d. a range of source line numbers

e. a module

f. a contiguous range of modules

In addition, a through c (above) may be assigned with an offset. Items d through f (above) must either be defined within an absolute file that has previously been set up (refer to chapter 6) or they must be identified by typing in the name of the source they are taken from following their entry on the command line.

The following paragraphs provide examples for defining the parameters listed above. Unless otherwise noted, the examples given are with the event numbers defaulted (automatically assigned). Refer to the previous paragraphs for a description of the event numbering system.

CAUTION

Addresses being defined are addresses in the linked absolute file. If any of your files are reworked and have to be reassembled/recompiled and relinked, the addresses you have defined prior to relinking may no longer be valid.

DEFINING AN ADDRESS

To assign an event number to address 1000H, press the following softkeys in the sequence shown:

define address address

Now type in 1000H and press the RETURN key.

DEFINING A RANGE OF ADDRESSES

To assign an event number to an address range of 1000H through 2000H, press the following softkeys in the sequence shown:

define address address range

Now type in 1000H, press the *thru* softkey, type in 2000H, and press the RETURN key.

NOTE

The address range may consist of labels in lieu of address numbers. In that case, substitute the labels in place of the numbers in the above example. Refer to the paragraph below that discusses label assignment procedures.

DEFINING A RANGE OF ADDRESSES WITH AN OFFSET

To assign an event number to an address range of 1000H through 2000H offset by 50H at either end, press the following softkeys in the sequence shown:

define address address range

Now type in 1000H - 50H, press the *thru* softkey, type in 2000H + 50H, and press the RETURN key.

DEFINING AN ADDRESS LABEL

NOTE

In order to use a label, the absolute file to be analyzed must be set up and entered (refer to chapter 6). The label, if it is a global symbol, must be contained in linker symbol file that has the same name as the absolute file. If the label is not a global symbol, the assembler symbol file (having the same name as the source file that contains the label) must be defined. This file must be shown by either typing in a colon (:) or by pressing the *file* softkey after the label has been entered, then typing in the file name. This becomes the default file. If a label is used and no file name is entered, the software will first look in the linker symbol (global) file. If the label cannot be found in the global file, the software will then look in the default file.

To assign an event number to an address label in your software program, press the following softkeys in the sequence shown:

define address address

Now type in the address label to be defined and press the RETURN key.

DEFINING A RANGE OF SOURCE LINE NUMBERS

NOTE

In order to use a line range, the absolute file to be analyzed must be set up and entered (refer to chapter 6).

To assign an event number to a range of source line numbers in a listing file from a compiled source, press the following softkeys in the sequence shown:

define address lin_range

Next type in the first line number from the compiled source listing, press the *thru* softkey, type in the last line of the range being defined, press the *in_file* softkey, type in the name of the listing file from the compiled source, then press the RETURN key.

DEFINING A MODULE

NOTE

In order to use a module name, the absolute file to be analyzed must be set up and entered (refer to chapter 6).

To assign an event number to a module of your software, press the following softkeys in the sequence shown:

define address module

Now type in the module (procedure) name, then press the RETURN key.

If the module has to be identified by its source file, press the following softkeys in the sequence shown:

define address module

Now type in the module name, press the *file* softkey, type in the source filename, and press the RETURN key.

If you wish to, you can type in a colon (:) in place of pressing the *file* softkey.

DEFINING A MODULE RANGE

To assign an event number to a module range, press the following softkeys in the sequence shown:

define address module range

Now type in the name of the first module in the range, press the *thru* softkey, type in the name of the last module in the range, and press the RETURN key.

If both modules have to be identified by their source files, press the following softkeys in the sequence shown:

define address module range

Now type in the name of the first module in the range, press the *file* softkey, type in the source file name, and press the *thru* softkey. Next, type in the name of the last module in the range, press the *file* softkey, type in the source file name, and press the RETURN key.

If you wish to, you can type in a colon (:) in place of pressing the *file* softkey.

DEFINING TIME EVENTS

This section provides information pertaining to the "define time" capabilities of the software performance analyzer. These capabilities allow you to define specific time ranges, by event number (and name, if desired).

To assign an event number to a specific time range, press the following softkeys in the sequence shown:

define time as_range

Now type in 1, press the *u_sec* and *thru* softkeys, type in 2, press the *usec* softkey, then press the RETURN key.

If you want the same time range defined, but you wish to name it so that it is more easily identified, press the following softkeys in the sequence shown:

define time named

Now type in the name you have chosen for the time range, press the *as_range* softkey, type in 1, and press the *u_sec* and *thru* softkeys. Next, type in 2, press the *usec* softkey, and press the RETURN key.

DEFINING EVENT GROUPS

This section provides information pertaining to the "define group" capabilities of the software performance analyzer. These capabilities allow the you to define and name groups of address or time events that have been previously defined.

DEFINING AN ADDRESS GROUP

To assign a name to a group of previously numbered or named address events, press the *define* and *group* softkeys, type in the name you have chosen for the address event group, and press the *address* softkey. Next, type in the number or name of the first address event to be included in the definition. Now press the *thru* and *and* softkeys (in combination, as required) to include the rest of the address events you want defined as part of the name.

DEFINING A TIME GROUP

To assign a name to a group of previously numbered or named time events, press the *define* and *group* softkeys, type in the name you have chosen for the time event group, and press the *time* softkey. Next, type in the number or name of the first time event range to be included in the definition. Now press the *thru* and *and* softkeys (in combination, as required) to include the rest of the time event ranges you want defined as part of the name.

Chapter 6

SETTING UP AND QUALIFYING A MEASUREMENT

INTRODUCTION

This chapter provides information pertaining to setting up and qualifying a measurement. A measurement may be stopped on either a number of termination conditions or using the measurement disable function. The measurement can be qualified using the internal windows or enable/disable terms of the analyzer. The software performance analyzer can also either qualify or be qualified by an external analyzer over the intermodule bus with the trigger enable line. In addition, the setup command provides you with the ability to control the event period in the scanning mode. Finally, the setup capability allows you to set up an absolute file so that you can interact symbolically with the analyzer. The setup syntax diagrams (except "setup absolute file") are given in appendix A, figures A-2 through A-7. The setup absolute file syntax is explained in text at the end of this chapter.

SETTING UP TERMINATION CONDITIONS

This section provides information on how to use termination conditions to tell the analyzer when to stop gathering data. These capabilities allow you to terminate the measurement on (1) a confidence level, (2) a percent error, (3) a total event count, (4) a total event time, and/or (5) a scan count. The setup terminate syntax diagram is given in appendix A, figure A-2. A measurement disable can be set up along with termination conditions, and they both will be active. The status message will indicate which complete condition was found.

TERMINATING ON A CONFIDENCE LEVEL

The analyzer will stop gathering data based upon a specified confidence level. The confidence level must be an integer and be in the range of 51 to 99. This confidence level is based on the Student's t distribution since the standard deviation of the population is unknown. By using randomizing techniques in sampling (refer to chapter 12 for a more detailed discussion on sampling) and a large number of samples, a normal distribution is assumed.

To set up a termination condition on a 97% confidence level, press the following softkeys in the sequence shown:

setup terminate confidenc

Now type in 97, then press the RETURN key.

At this point other termination conditions can be entered using the *or* softkey. An error tolerance can also be set up in conjunction with the confidence level. If only a confidence level is entered, the error tolerance will be defaulted to 5%. In order for a statistical termination condition to be recognized, you cannot be outside of the performance analyzer (i.e.; in measurement system) or the display may not be suspended.

TERMINATING ON AN ERROR TOLERANCE

You can use this termination condition to stop the measurement on a given error tolerance. The error is dependent on the confidence level and is an indication of the amount of error between samples. The error tolerance must be an integer value between 1% and 99%.

To terminate a measurement on an error tolerance of 10%, press the following softkeys in the sequence shown.

setup terminate error

Now type in 10 and press the RETURN key. If only an error tolerance is entered, then the confidence level is defaulted to 95%.

TERMINATING ON TOTAL EVENT COUNT

This termination condition allows you to stop the measurement based upon the fact that the total event count reached a specified value. The total event count must be an integer and less than 4,294,967,295.

To set up a total event count of 300 as a termination condition, press the following softkeys in the sequence shown:

setup terminate total_cnt

Now type in 300 and press the RETURN key.

TERMINATING ON TOTAL EVENT TIME

The analyzer will also stop gathering data on a total event time. This allows you to stop a measurement when the total event time reaches a specified value. The valid times that can be sepcified are: (1) any integer value of usec between 1 and 999 and (2) any value between 0.001

msec to 671.0 seconds with four digits (three digits if no decimal point is entered).

To set up the analyzer to terminate on a total event time of 5 seconds, press the following softkeys in the sequence shown:

setup terminate totl_time

Now type in 5, press the *seconds* softkey, and then press the RETURN key.

TERMINATING ON SCAN COUNT

You can terminate the measurement on the number of times the set of events is scanned (refer to chapter 12). The scan count must be an integer value less than 4,294,967,295.

To set up a scan count of 10000 as a termination condition, press the following softkeys in the sequence shown.

setup terminate scan_cnt

Now type in 10000, and press the RETURN key.

TERMINATING ON MULTIPLE CONDITIONS

The analyzer can be set up with multiple termination conditions. The first condition found will terminate the measurement.

To set up the analyzer to terminate on a confidence level of 95% or a total event count of 500, or a scan count of 1000, press the following softkeys in the sequence shown:

setup terminate confidenc

Now type in 95, press the *or* and *total_cnt* softkeys, type in 500, press the *or* and *scan_cnt* softkeys, type in 1000, then press the RETURN key.

CLEARING TERMINATION CONDITIONS

This command allows you to clear termination conditions that have been previously set up. The confidence level is defaulted to 95%, and the analyzer will continue to calculate the error tolerance for this level, but will not terminate a measurement. To clear the termination conditions, press the following softkeys in the sequence shown.

setup terminate default

Now press the RETURN key.

SETTING UP AN EVENT PERIOD

This command gives you the ability to control the event period using an occurrence count or a time duration. The event period can be defined as the amount of time the analyzer will continue to look for an event. The valid times that can be specified are: (1) any integer value of usec between 40 and 999 and (2) any value between 0.040 msec and 671.0 second with four digits (three if no decimal point is entered. The setup period syntax diagram is given in appendix A, figure A-3.

To set up an event period of 20.55 msec, press the following softkeys in the sequence shown:

setup period time

Now type in 20.55, press the *msec* softkey, and then press the RETURN key.

The event period can also be defined as the number of occurrences of a given event. The occurrence count must be an integer between the value 4 and 4,294,967,295.

To set up an event period as an occurrence count of 467, press the following softkeys in the sequence shown:

setup period occur

Now type in 467 and press the RETURN key.

EVENT PERIOD DEFAULT

The event period will be set to the defaulted values if no other event period has been specified. The default event period for duration measurements is an occurrence count of 25. This says that the analyzer will look for a module to be called 25 times for module duration measurements before it moves to the next time event. For intermodule duration measurements, the count of 25 is the number of times one module is exited and another is entered. The default value for activity and linkage measurements is 800 usec. This means that the analyzer collects data on each event for 800 usec, then moves to collect data on the next event for 800 usec, and continues in this manner until the measurement becomes complete.

To reset the event period back to the default values, after other event periods have been set up, press the following softkeys in the sequence shown:

setup period default

Now press the RETURN key.

SETTING UP A WINDOW QUALIFICATION

A window is defined as an enable/disable (or disable/enable) pair and it can be used to qualify the conditions under which the data will be acquired. In other words, no data is acquired until the enable condition is satisfied. After the enable is found, data will be acquired until the disable condition is found. At this point no data is acquired until the enable condition is found again. When the measurement begins, the window element can be in either the enable or the disable condition. However, as stated, data is only gathered during the enabled state. The setup window syntax diagram is given in appendix A, figure A-4.

A window enable or disable can be specified in a manner similar to the event definitions. The enable or disable can be one of the following and used in any combination.

a. an address,

b. a range of addresses,

c. an address label,

d. a source line number,

e. a range of source line numbers,

f. a module, or

g. a contiguous range of modules.

In addition, a through c (above) may be assigned with an offset. Items d through g (above) must either be defined within an absolute file that has already been set up or they must be identified by typing in the name of the source file that contains them.

Windows can be used with any measurement except the real-time measurements, intermodule duration measurements, and the intermodule linkage measurements. The time within a given event is important for the windows to work correctly. The minimum time that an event must be active for an activity measurement and the minimum number of occurrences required for module duration measurements is discussed in chapter 12.

USING SINGLE ADDRESSES FOR WINDOW QUALIFICATION

Using single addresses for a window will cause data to be collected whenever the enable address is found and data will continue to be collected until the disable address is found. The analyzer will continue in this manner until some other termination condition is met.

To specify the address 2005H as an enable condition and address 3007H as a disable condition, press the following softkeys in the sequence shown:

setup window enable address

Now type in 2005H, press the *disable* softkey and the *address* softkey, then type in 3007H, and press the RETURN key.

The window setup made above will start in the disabled state. If it is desired to have the window start in the enabled state, the window disable condition must be specified before the window enable condition is specified.

USING MODULES FOR WINDOW QUALIFICATION

Modules may be used for both the window enable and disable conditions. This means that any time an address is executed within the address range of the module, the analyzer will collect data until the disable condition is found. In a similar manner, any time an address is executed within the address range of the module specified as the disable condition, data will no longer be collected until the next enable condition is found.

To specify a window enable on a module named CLEAR (ie. Pascal procedure name), and a window disable on a module named RESET, press the following softkeys in the sequence shown.

setup window enable module

Now type in the module name CLEAR, press the *disable* and *module* softkeys, then type in RESET and press the RETURN key. This example assumes the absolute file has been set up previously and the module CLEAR is a global module.

USING SOURCE LINE RANGES FOR WINDOW QUALIFICATION

A source line number in a listing file can be used as either a window enable or a window disable. This source line must be an executable statement. Whenever the address of the first instruction of a given source line is recognized, the analyzer will collect data until the address of the first instruction of the disable source line is found. The analyzer will begin to collect data as soon as the source line used as an enable is encountered. It will continue to collect data until the source line used as the disable is encountered. That is, data is collected *between* the enable and disable conditions. The measurement can be set up to start in either condition. The enable and disable conditions can also be ranges of source line numbers. To use the line range 36 through 46 as a window enable condition and the line range 568 through 720 as a window disable condition, press the following softkeys in the sequence shown. (All of the source lines are in the file MATH.)

setup window enable line range

Now type in 36, press the *thru* softkey, type in 46, press the *file* softkey, type in MATH, press the *disable* and *line* and *range* softkeys, then type in 568, press the *thru* softkeys, type in 720, and press the RETURN key.

CLEARING WINDOW QUALIFICATION

Any windows that have been previously set up can be cleared using this command. To clear the window, press the following softkeys in the sequence shown.

setup window default

Now press the RETURN key.

SETTING UP MEASUREMENT ENABLE/DISABLE TERMS

The measurement enable and disable qualifications are very similar to the window qualification such that items a through g (above) can also be used for enable and disable terms. The biggest difference between the two is that data will no longer be collected when the disable condition is found. Therefore, data will be collected when the enable term is recognized and the measurement will be stopped when the disable condition is found. The analyzer will not look for the enable condition again. The measurement enable qualification also gives you the ability to qualify on a more complex term. This could be a two deep sequence or the number of times that an event is executed.

The measurement enable/disable conditions have the same restrictions as the windows (refer to the paragraph entitled "Setting up a Window Qualification" for an explanation of the restrictions). If you have an external trigger enable set up with a measurement enable condition, the external trigger enable must be satisfied first and then the internal enable will become active. The setup enable and setup disable syntax diagrams are given in appendix A, figures A-5 and A-6, respectively.

USING MODULE OCCURRENCES FOR MEASUREMENT ENABLE

You may want to use the number of times that a module is called as the enable qualification for your measurement. This occurrence count can also be used on addresses, address ranges, source lines, and contiguous module ranges. The occurrence count must be between the value 1 and 65535. To specify a measurement enable on the 7th occurrence of an access in module CLEAR, press the following softkeys in the sequence shown:

setup enable module

Now type in CLEAR, press the *occurrs* softkey, type in 7, and then press the RETURN key.

USING A SEQUENCE FOR MEASUREMENT ENABLE

A two term sequence may be used as an enable condition. The measurement will be enabled only after the first term in the sequence is found eventually followed by the second term. That is to say, the sequence terms may be separated by many other states in the program flow and the specification will be satisfied as long as the terms are found in order.

The terms may be specified using any of the items a through g listed for setting up a window qualification, and in any combination. To specify a sequence of a module CLEAR eventually followed by a write to the address 135H, press the following softkeys in the order shown:

setup enable module

Now type in CLEAR -it is assumed that the file containing CLEAR has already been set up and used once before. Press the *followed* and *address* softkeys, type in 135H, press the *status* softkey and the *write_mem* softkey (for the 8086 microprocessor), and then press the RETURN key.

USING AN ADDRESS RANGE FOR MEASUREMENT DISABLE

You can disable the measurement on any of the items a through g noted above as well as any processor status. To stop the measurement whenever an address is recognized within the address range 4000H through 5000H, press the following softkeys in the sequence shown:

setup disable address range

Now type in 4000H, press the *thru* softkey, then type in 5000H, and press the RETURN key.

SETTING UP AN EXTERNAL TRIGGER ENABLE

The performance analyzer can either receive or drive the trigger enable line on the intermodule bus (refer to chapter 12 for more details). This gives you the ability to control another instrument using the performance analyzer or to have the performance analyzer measurements qualified by it. The setup external trigger enable syntax diagram is given in appendix A, figure A-7.

RECEIVING TRIGGER ENABLE

You may want to use another analyzer to enable measurements. The performance analyzer can receive the trigger enable signal from any instrument that is on the intermodule bus. The performance analyzer cannot search for its own window or enable conditions until it receives its trigger enable from some other analyzer on the bus. To set up the analyzer to receive trigger enable, press the following softkeys in the sequence shown:

setup trig_en received

Now press the RETURN key.

DRIVING TRIGGER ENABLE ON MEASUREMENT START

Another analyzer can be controlled on the condition of the performance analyzer recognizing an internal measurement qualification. Such qualifications as a measurement enable or a window enable can be used as a trigger enable for another analyzer. To set up the analyzer to drive the trigger enable line whenever it recognizes its own measurement enable condition, press the following softkeys in the sequence shown:

setup trig_en drv_only start

Now press the RETURN key.

DRIVING TRIGGER ENABLE ON MEASUREMENT COMPLETE

The trigger enable line can also be driven by a complete condition found internally within the performance analyzer. A complete condition can be any of the termination conditions such as total event time, scan count, a confidence level, etc. The measurement disable can also be a complete condition. To set up the analyzer to drive the trigger enable line whenever the complete condition is found, press the following softkeys in the sequence shown:

setup trig_en drv_only complete

Now press the RETURN key.

CLEARING THE TRIGGER ENABLE CONDITIONS

Any trigger enable conditions that have been previously specified can be cleared using this command. To set up the analyzer to always be enabled on any condition, press the following softkeys in the sequence shown:

setup trig_en always

Now press the RETURN key.

SETTING UP AN ABSOLUTE FILE

This command gives you the ability to interact symbolically with the analyzer by specifying an absolute file. Setting up the absolute file provides the following information to the analyzer software:

1. physical addresses of global symbols and modules,
2. the load addresses of the relocatable sections of the users code,
3. link_sym where the analysis software obtains the rest of

   the required information,
4. processor related information, such as the number of address bits (i.e.; 1 or 2 words for each address),
5. segment information for the 8086 family, and
6. the format for line numbers in asmb_sym files.

Additional information is required when the user desires to specify non-global symbols, modules, or line numbers. In that case, the source file must be specified. This source provides the following information:

1. the name of the asmb_file, and
2. the name of the relocatable file.

The name of the relocatable file is the same as the name of the source file. The relocatable file is used to get the load address from the link_sym file where that segment of code is loaded in memory.

RELOCATABLE FILE. The relocatable files are linked together by specifing their file names to the linker. These file names (which are the same name as the source files) are then used by the software performance analyzer to look up the load address of that relocatable code in the link_sym file generated by the linker.

ASMB_SYM FILE. The assembler symbol file (of the same name as the source file) is generated by the compiler/assembler and provides the software performance analyzer with relative offsets from the beginning of the relocatable code to the symbol, module, or line number that the user specifies. It should be noted that line numbers are only valid when they are present in the asmb_sym file (i.e.; typically only when from a compiled Pascal or C source and as they would appear in the associated listing file. It might further be noted that the offset found in the asmb_sym file is then added to the load address of the relocatable (found in the link_sym file) to produce the physical address required by the software performance analyzer.

To set up an absolute file named PROGRAM1, press the following softkeys in the sequence shown:

setup abs_file

Now type in PROGRAM1 and press the RETURN key.

Chapter 7

MEASUREMENT MODES

INTRODUCTION

This chapter provides information pertaining to the measurement modes of the software performance analyzer. The measurement modes are defined as the (1) program activity, (2) memory activity, (3) module duration, (4) module usage, (5) intermodule duration, and (6) intermodule linkage modes. The uses of these modes are discussed in detail in chapter 2 and the syntax diagrams for each measurement mode is given in appendix A, figures A-8 through A-13. This chapter also provides general information concerning the measurement modes, discusses the softkeys used to initiate each measurement mode, and details the options for each mode. Also discussed are the softkeys that are microprocessor dependent. Examples to be used to set up measurements for each mode are also given for further clarification.

GENERAL

Prior to setting up any of the measurement configurations discussed in this chapter, the events to be measured must first be defined. Refer to chapter 5 for a discussion relating to defining events.

If you have assigned labels to the addresses you want to look at, and if those labels have been defined as discussed in chapter 5, you may use the address label instead of an event number. You may also use combinations of event numbers and event labels to construct the measurement command.

The analyzer software allows up to 12 events to be measured at any one time. Activity measurements specified as real-time can be made on two events in a non-scanned mode. Refer to the theory of operation given in chapter 12 for a description of sampling techniques.

The measurement syntax examples given in this chapter do not include the syntax for the protection level softkeys. These softkeys can vary from processor to processor as discussed later in the chapter. Include the protection level softkey command in your measurement, as required (refer to the "measure" syntax diagrams given in appendix A and the discussion of the protection level softkeys given below).

MICROPROCESSOR DEPENDENT SOFTKEYS

The software performance analyzer contains software which looks at the emulator microprocessor in the system being analyzed. Recognizing the processor, the analyzer will then display the softkeys related to that particular processor. The softkeys affected are the protection level softkeys and the status softkeys. These softkeys are discussed in the following paragraphs.

PROTECTION LEVEL SOFTKEYS

The protection level softkeys are defined as those softkeys that are used to select the "don't care", "user", or "supervisor" option for those microprocessors containing the user and supervisor state capabilities. Not all microprocessors contain the user and supervisor state capabilities. The software performance analyzer recognizes this and causes the protection level softkeys to be present only for those microprocessors containing this capability. For example; the syntax for an 6809 microprocessor is used in the examples for the "measure" syntax diagrams given in appendix A. There are no protection level softkeys for this processor. However, the 68000 microprocessor does have the protection level capability and the syntax for that processor would be as follows:

	program memory		(Etc. See appendix A,
measure	duration usage	dont_care user	figures A-8 through A-13 for the remainder
	imod_dura linkage	suprvis	of the syntax)

The protection level softkeys for some of the microprocessors utilizing the user and supervisor states do not have the "dont_care" option. Either the "user" or the "suprvis" option must then be selected.

STATUS SOFTKEYS

Since different microprocessors have different status definitions, the analyzer software is designed to detect which microprocessor is being used and to then display the correct status information for that particular microprocessor. For example; the measure memory activity syntax diagram shown in appendix A, figure A-9 shows the status words for an

6809 microprocessor. Other microprocessors may show different status words. The status words for an 8086 microprocessor, for instance, would show the following softkey selection:

```
code_acc        write_io
write_mem       read_io
read_mem        halt_ack
```

PROGRAM ACTIVITY MODE

In the program activity mode, the system counts all opcode generated activity (including reads, writes, stack pops and pushes, etc.) as part of the event in which the opcode occurred, even if they are out of that particular event's address range. These out-of-module activity events are shown as time or occurrences within the initiating module. This measurement mode shows which modules cause the majority of the activity within the program. The following paragraphs discuss program activity measurements. The measure program activity syntax diagram is given in appendix A, figure A-8.

MEASURING PROGRAM ACTIVITY USING ADDRESS EVENTS

A maximum of 12 events may be measured at any one time. To set up the analyzer to measure program activity during specific address events, press the following softkeys in the sequence shown:

measure program addr_evnt

Now type in the number or name of the first address event you want to look at. Press the *{and}* softkey and type in the number or name of the next address event. Continue this sequence until you have entered all of the events (up to a maximum of twelve) you want to look at. If the numbers of the events are sequential, you can use the *thru* softkey to enter them. After all the events have been entered, press the RETURN key.

MEASURING PROGRAM ACTIVITY USING ADDRESS GROUPS

A predefined address group (refer to chapter 5) including a maximum of 12 address events may be measured at any one time. To set up the analyzer to measure program activity during a specific address group, press the following softkeys in the sequence shown:

measure program addr_grp

Now type in the name of the address group you want to look at and press the RETURN key.

MEASURING REAL-TIME PROGRAM ACTIVITY

A maximum of two events (per software performance analyzer board) may be measured in real-time at any one time. To set up the analyzer to measure two real time address events simultaneously, press the following softkeys in the sequence shown:

measure program real_time addr_evnt

Now type in the name of the address group you want to look at and press the RETURN key.

MODIFYING A PROGRAM ACTIVITY MEASUREMENT

Once a program activity measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *program* softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure program modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

MEMORY ACTIVITY MODE

In the memory activity mode, the system counts all memory accesses in selected ranges across your system's memory space. Memory activity can be counted as time or occurrences. Memory activity can be qualified according to status information provided by your system's processor. For example, you may want to view only memory reads, memory writes, or I/O operations. This allows you to further focus on the specific activities of interest.

The histogram of memory activity allows you to selectively view the activity within your system's memory space. It can quickly point you to bottlenecks and system inefficiencies. The following paragraphs discuss memory activity measurements. The measure memory activity syntax diagram is given in appendix A, figure A-9.

MEASURING MEMORY ACTIVITY USING ADDRESS EVENTS

A maximum of 12 events may be measured at any one time. To set up the analyzer to measure memory activity during specific address events, press the following softkeys in the sequence shown:

measure memory addr_evnt

Now type in the number or name of the first address event you want to look at. Press the *{and}* softkey and type in the number or name of the next address event. Continue this sequence until you have entered all of the events (up to a maximum of twelve) you want to look at. If the numbers of the events are sequential, you can use the *thru* softkey to enter them. After all the events have been entered, press the RETURN key.

MEASURING MEMORY ACTIVITY USING ADDRESS GROUPS

A predefined address group (refer to chapter 5) including a maximum of 12 address events may be measured at any one time. To set up the analyzer to measure memory activity of a specific address group, press the following softkeys in the sequence shown:

measure program addr_grp

Now type in the name of the address group you want to look at and press the RETURN key.

If you want to look at only the write i/o or halt acknowledge activity performed during the execution time of the same address group you can press the *status, write_io, or,* and *halt_ack* softkeys prior to pressing the RETURN key.

MEASURING REAL-TIME MEMORY ACTIVITY

A maximum of two events (per software performance analyzer board) may be measured such that all activity is recorded and the events are not scanned. To set up the analyzer to measure two events simultaneously, press the following softkeys in the sequence shown:

measure memory real_time addr_evnt

Now type in the number or name of the first address event, press the *{and}* softkey, type in the number or name of the second address event, and press the RETURN key.

MODIFYING A MEMORY ACTIVITY MEASUREMENT

Once a memory activity measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *memory* softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure memory modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

MODULE DURATION MODE

In the module duration mode the analyzer measures each execution time of a selected module and provides a display showing the cumulative time distribution. The measurement lets you see this distribution while your software is running within the selected module. The measurement can be made with or without interaction with external sources or destinations (calls). It lets you confirm that the module is operating within expected limits, or it may reveal an unsuspected circumstance in which execution time is excessive. Module duration measurements are discussed in the following paragraphs. The measure module duration syntax diagram is given in appendix A, figure A-10.

MEASURING MODULE DURATION

You can measure the duration of an address event defined as a module (see chapter 5) using time events or a time group. You can request the measurement to either include or exclude calls external to the module. Calls are defined as requests by the software program to access another portion of the same program or to access an external (but linked) program. To measure module duration, in this case excluding calls, press the following softkeys in the sequence shown:

measure duration addr_evnt

Now type in the number or name of the module, press the *time_grp* softkey, type in the name of the time group, press the *excluding* softkey, and press the RETURN key.

MODIFYING A MODULE DURATION MEASUREMENT

Once a duration measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *duration*

softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure duration modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

MODULE USAGE MODE

The module usage measurement is essentially the inverse of the module duration measurement. This measurement shows the time-interval distribution between the times a specific module is accessed. You now have a measure of the intensity of the demand for that module. By comparing module usage and module duration measurements, you can detect potential conflicts and system inefficiencies. Module usage measurements are discussed in the following paragraphs. The measure module usage syntax diagram is given in appendix A, figure A-11.

MEASURING MODULE USAGE

You can measure the usage of an address event defined as a module (see chapter 5) using time events or a time group. To measure module usage, press the following softkeys in the sequence shown:

measure usage addr_evnt

Now type in the number or name of the module, press the *time_grp* softkey, type in the name of the time group, and press the RETURN key.

MODIFYING A MODULE USAGE MEASUREMENT

Once a module usage measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *usage* softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure usage modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

INTERMODULE DURATION MODE

The intermodule duration measurement will measure the time interval distribution between any two code segments in your program, such as; modules, routines, procedures, etc. Intermodule duration measurements are discussed in the following paragraphs. The measure intermodule duration syntax diagram is given in appendix A, figure A-12.

MEASURING INTERMODULE DURATION

You can measure the intermodule duration of an address event defined as a module (see chapter 5) using time events or a time group. To measure intermodule duration, press the following softkeys in the sequence shown:

measure imod_dura addr_evnt

Now type in the number or name of the module, press the *and* softkey, type in the number or name of the second module, press the *time_grp* softkey, type in the name of the time group, and press the RETURN key.

MODIFYING AN INTERMODULE DURATION MEASUREMENT

Once an intermodule duration measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *imod_dura* softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure imod_dura modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

INTERMODULE LINKAGE MODE

The intermodule linkage measurement will measure the number of direct transfers between any two different modules in your program. You can measure up to six pairs of modules during one measurement (6 bars on the histogram). Intermodule linkage measurements are discussed in the following paragraphs. The measure intermodule linkage syntax diagram is given in appendix A, figure A-13.

MEASURING INTERMODULE LINKAGE

You can measure the intermodule linkage of up to six address event pairs defined as modules (see chapter 5). The number of transfers made can be counted as from one module "to" another module. To measure intermodule linkage, press the following softkeys in the sequence shown:

measure linkage addr_pair

Now type in the number or name of the first module, press the *to* softkey, type in the name or number of the second module, and press the *{and}* softkey. Continue entering the pairs you want to measure. When all the pairs are entered, press the RETURN key.

MODIFYING AN INTERMODULE LINKAGE MEASUREMENT

Once an intermodule linkage measurement has been established, the *modify* softkey will appear on the softkey label line after the *measure* and *linkage* softkeys have been pressed. To modify the current measurement, press the following softkeys in the sequence shown:

measure linkage modify

Now press the RETURN key. The current measurement command will appear on the command line and the event number(s) and label(s) will appear on the display. Using the utility keyboard keys (refer to chapter 10) you can modify the measurement command to your new requirements.

Chapter 8

SELECTING AND OPTIMIZING THE DATA DISPLAY

INTRODUCTION

This chapter provides information pertaining to the selection of data to be displayed on the CRT and the methods used to optimize the display of this data. The commands used to accomplish these purposes are discussed and examples are given for their general use. These commands are available only during the execution of a measurement (after the execute softkey has been pressed).

SELECTING THE DATA DISPLAY

When you first execute a measurement, the display selected is a default condition. You can change the display by using the *display* softkey options. You can suspend the display to look at selected areas of interest and then resume the display, with no loss of measurement continuity. These options are explained in the following paragraphs.

DEFAULT SETUP

The default display is the first display shown when a measurement is initiated. It is a measurement of event occurrences. These occurrences are shown in histogram form, with each histogram bar representing the percentage of occurrences in relation to the percentage of occurrences of the rest of the bars in the histogram. The bars in the histogram are viewed in the order that they are called out in the event group definition or in the order in which they were listed when the measurement was specified.

DISPLAY COMMAND SETUPS

The *display* softkey provides the operator with the capability to select the type of information that will be displayed on the CRT in regard to the current measurement. The softkey allows the operator to use any of the default options, as well as options to view data (1) relative to event time (as opposed to event occurrences), (2) as absolute data (relative to the total program as opposed to only the data shown on the display), and (3) data displayed in a data list, as opposed to data in histogram form.

There are six commands that are used specifically to select the data that will be displayed during a measurement cycle. These commands are available when the *display* softkey is pressed. They are the *occur, time, relative, absolute, histogram* and *data_list* softkey commands.

The options listed above may be used in any arrangement you desire. For example, you can set up the display to view data event occurrences, as absolute data, in histogram form. You can then view the same data as relative data, then later as time events (instead of occurrence events), etc.

NOTE

The "display occurrences" option is valid during any of the measurement specifications. However, the "display time" option is only valid during program activity and memory activity measurements.

The purpose of each of the display commands is defined in the following paragraphs. Examples of each are also given for clarity.

OCCUR COMMAND. The occur command is used to cause the analyzer to display the occurrence information accumulated in the measurement. This information is presented in graph form as bars on a histogram and in statistical form on the data list. Displaying occurrences is the default mode of operation. To display occurrences, press the *display* and *occur* softkeys then the RETURN key.

TIME COMMAND. The time command is used to cause the analyzer to display the amount of time that is spent by the program in specified segments of code over a known period of time. This information is presented in graph form as bars on a histogram and in statistical form on the data list. To display time, press the *display* and *time* softkeys then the RETURN key.

RELATIVE COMMAND. The relative command is used to cause the analyzer to display the measurement based on the rest of the elements in the measurement (as opposed to the total program). This information is presented in graph form as bars on a histogram and in statistical form on the data list. The relative display is the default mode of operation. To display measurement results in relative mode, press the *display* and *relative* softkeys then the RETURN key.

ABSOLUTE COMMAND. The absolute command is used to cause the analyzer to display the measurement based on the total program (as opposed to the rest of the elements in the measurement). This information is presented in graph form as bars on a histogram and in statistical form on the data list. To display measurement results in absolute form, press the *display* and *absolute* softkeys then the RETURN key.

HISTOGRAM COMMAND. The histogram command is used to cause the histogram to be displayed on the screen (as opposed to the data list). The histogram display is the default mode of operation. To display the histogram if the data list is currently being displayed, press the *display* and *histogram* softkeys and then the RETURN key.

DATA LIST COMMAND. The data_list command is used to cause the data list to be displayed on the screen (as opposed to the histogram). To display the data list if the histogram is currently being displayed, press the *display* and *data_list* softkeys and then the RETURN key.

SUSPEND/RESUME COMMANDS

SUSPEND COMMAND. The suspend command is used to momentarily stop the display update. It will not halt the measurement in progress. It will cause the display to "freeze" at the point that the suspend command was entered. When the *suspend* softkey and the RETURN key are pressed, the *resume* softkey label will appear in place of the *suspend* softkey label on the softkey label line on the display. Suspending the measurement allows you to access the accumulated measurement data at any particular moment you may wish to, without interfering with the measurement in progress. You can display the data in all forms available through the *display* softkeys and use the *rescale* softkey features to further enhance the data you are viewing. You can also use the *copy, halt, end,* and *restart* softkey commands. If you restart the measurement, the *resume* softkey label will be replaced with the *suspend* softkey label on the softkey label line.

RESUME COMMAND. The resume command is used to initiate the resumption of the display update after the display has been "frozen" by the suspend command. If the measurement is still in progress, the display will again show the current measurement parameters. When the *resume* softkey and the RETURN key are pressed, the *suspend* softkey label will appear in place of the *resume* softkey label on the softkey label line on the display. The display and rescale options that were in effect last will remain in effect (e.g.; if you were viewing the histogram prior to suspending the measurement, then, during the suspend mode used the display data_list option, the data list display would still be displayed when you resumed the measurement).

OPTIMIZING THE DATA DISPLAY

The rescale and stats_on/stats_off commands provide the operator with a convenient way to optimize the histogram display. The rescale command allows you to set the boundaries of the display scale. This gives you a better perspective of the actual measurement being performed. The stats_on and stats_off commands give you the option of speeding up the display update of the histogram. The *rescale* and *stats_on/stats_off* softkey command options are discussed in the following paragraphs.

RESCALE COMMANDS

The options available under the rescale command are; (1) rescale automatically to peak, (2) rescale lower limit to <PERCENT>, (3) rescale upper limit to <PERCENT>, (4) rescale to limits, and (5) rescale. These options are discussed in the following paragraphs.

RESCALE UPPER LIMIT AND RESCALE LOWER LIMIT COMMANDS. The rescale upper limit and rescale lower limit commands allow you to set the resolution of the display. You can delete the upper and/or lower portions of the display so that you have an expanded view of only that portion of the display that is relevant to your specific area of interest. To rescale the upper limit of the histogram display, press the *rescale* and *upper_lmt* softkeys, type in the upper limit percentage you want the scale to be set at, then press the RETURN key. To rescale the lower limit of the histogram display, press the *rescale* and *lower_lmt* softkeys, type in the lower limit percentage you want the scale to be set at, then press the RETURN key.

RESCALE AUTOMATICALLY TO PEAK COMMAND. The rescale automatically to peak command provides a display that has the upper limit automatically calculated by internal software. The software continually monitors the measured data. When the data representing the longest bar on the histogram changes, either higher or lower, the histogram scale changes in proportion to the change in data. To rescale the histogram display automatically to peak, press the *rescale* and *auto_peak* softkeys and the RETURN key.

RESCALE TO LIMITS COMMAND. The rescale to limits command automatically causes the display to be rescaled to the approximate lowermost and the uppermost limits of all of the bars on the histogram display as calculated by internal software. For example, if the shortest bar is at 10 percent and the longest bar is at 70 percent, using the rescale to limits option will cause the scale to start at approximately 9 percent and end at approximately 71 percent (the actual percentages are calculated and will depend on the actual values being scaled). To rescale the histogram display to the limits calculated by internal software, press the *rescale* and *to_limits* softkeys, then press the RETURN key.

RESCALE COMMAND. The rescale command option (when used alone) automatically causes the scale to be returned to read from 0 to 100 percent, fullscale. To use this option, press the *rescale* softkey and then the RETURN key.

STATS_ON/STATS_OFF COMMANDS

STATS_ON COMMAND. The stats_on command is used to cause the analyzer to compute the standard deviation, mean, and error tolerance statistical information. When the *stats_on* softkey and the RETURN key are pressed, the *stats_off* softkey label will appear in place of the *stats_on* softkey label on the softkey label line on the display. The stats_on mode is the default mode of operation of the analyzer.

STATS_OFF COMMAND. The stats_off command is used to cause the analyzer to stop computing standard deviation, mean, and error tolerance statistical information. This will speed up the histogram display update time since the statistics are no longer computed. When the *stats_off* softkey and the RETURN key are pressed, the *stats_on* softkey label will appear in place of the *stats_off* softkey label on the softkey label line on the display.

Chapter 9

CONFIGURING THE ANALYZER

INTRODUCTION

This chapter provides information pertaining to configuration of the software performance analyzer. The analyzer can be configured manually each time it is used to measure software performance or it can be configured automatically.

There are three measurement configurations which you can have the analyzer load automatically when you first activate it: (1) the measurement setup you used to perform the last tests, (2) any measurement setup that was previously configured and stored in disc memory, and (3) any measurement system command file. Each of these methods are discussed in the following paragraphs.

CAUTION

If any of your programs that were used in a configuration you have set up are reworked (then reassembled and relinked), the configuration file may no longer be valid since the address and label data may not remain the same after relinking has occurred.

GETTING THE MEASUREMENT CONFIGURATION USED LAST

When you are running a measurement session and you press the *end* softkey the first time, the analyzer will automatically store the measurement configuration presently in use. If you have a test in progress when the *end* softkey is pressed, it will continue to run. You are now at the measurement system software level. You can enter the other analysis functions available at this level if you wish, but you cannot make any other independent measurements at this time unless you halt the software performance analyzer measurement now in progress. To return to the software performance analyzer softkey level, press the *sw_perf* softkey, then the RETURN key. If you had a measurement in progress when you pressed the *end* softkey, the analyzer may have finished the measurement and stored the data. In that case the display will show the end results of the measurement. If the measurement is not finished when you reenter, the display will continue to update until the measurement is finished.

Pressing the *end* softkey a second time brings you out of the measurement system level software to the system monitor level software. Here you can use the system monitor level softkey functions without disturbing the measurement you ended out of as long as you do not press the *opt_test* softkey at the monitor level. You can reenter the software performance analyzer measurement session at any time and observe the results, or the progression, of your measurement by pressing the *meas_sys* and *continue* softkeys, and then the RETURN key.

NOTE

If you do not include the options continue statement in your command, your present measurement configuration will be purged along with all data collected.

The options continue function will not perform the function described above after the reset key has been pressed twice, or after a power down or power fail, or after running performance verification. You can recover the configuration that was being used when you ended the last time by loading file Spa<slot><HP-IB address>:HP.

GETTING A MEASUREMENT CONFIGURATION FROM A CONFIGURATION FILE

The analyzer can store complete measurement configurations in disc memory so that you can keep a library of test setups and event definitions on hand for your measurement needs. You can then load a selected measurement configuration to suit your current need. This keeps you from having to build a new configuration for each measurement session. If you have a configuration file which is close to the configuration you need you can load it, then modify it, thus saving a great deal of time by eliminating the requirement to enter some of your basic parameters. The following paragraphs describe the procedures used to store and recover these measurement configurations. The syntax for saving or loading a configuration is given in Appendix A, figure A-4.

SAVING A MEASUREMENT CONFIGURATION

1. Set up any desired measurement configuration in your software performance analyzer. It is a good idea to set up a good basic configuration that can be stored, then loaded and used as a building block for other measurement configurations.

2. Press the *configure* and *save_in* softkeys, then type in an A in answer to the *<FILE>* softkey prompt. Now press the RETURN key. The analyzer will now save its present measurement configuration in the trace file you have just named A. The file will be stored under the current USERID.

3. Now you can change the setup any way you like. Your original measurement configuration will still be saved exactly as you stored it in file A. You can use this procedure to make as many configurations as you may require. These, in turn, can also be stored in configuration files for access at a later time.

If you used the "write_protected" option when you saved your configuration and you ever want to purge that file, you must return to the system monitor level software to accomplish the purge. To accomplish this press the *end* softkey, then the RETURN key (in that sequence) two times. This will bring you to the system monitor level software. Purge the unwanted file, then return to the software performance analyzer by using the options continue commands or entering a command file name with the sw_perf or meas_sys command. If desired, you can also use the default setup by just pressing the *sw_perf* or *meas_sys* softkey to enter the measurement session.

LOADING A MEASUREMENT CONFIGURATION

If you are starting a session (or are at the measurement system monitor level) and want to load a configuration you have previously stored in a file proceed as follows: press the *sw_perf* softkey, type in the name of the configuration file you want to use, and press the RETURN key. You will gain access to the software performance analyzer and it will automatically search the disc and load the configuration you stored in the file you requested.

If you are operating the software performance analyzer in a measurement session and you want to load a configuration you have stored in a file without ending out of the analyzer proceed as follows: press the *configure* and *load_from* softkeys, type in the name of the file you want to use, and press the RETURN key. This will cause the analyzer to purge the present measurement setup and load the configuration from the file you requested.

GETTING A MEASUREMENT CONFIGURATION FROM A COMMAND FILE

The command file must contain the sequence of command lines required to create the setup from the monitor level. Using the parameter passing feature of command files will allow the slot number of the control board to be given to the sw_perf_(slot #) command. An example is shown below:

```
PARMS &SPA_SLOT &EM_SLOT
measurement_system
em_XXXX &EM_SLOT <CMDFILE>
load_memory <FILENAME 1>
run from start
end_emulation
sw_perf &SPA_SLOT
setup absolute_file <FILENAME 2>
<FILENAME 3>
measure program_activity using_address_events 19 thru 22
execute
```

Where:
- XXXX is the emulation microprocessor
- <CMDFILE> is the emulation command file
- <FILENAME 1> is the linked absolute file
- <FILENAME 2> is the link symbol file (link_sym)
- <FILENAME 3> is a "define events" command file

The command file can be run from the monitor level. To run the command file, type in the file name, and if the slot numbers need to be passed, type in the numbers after the file name; e.g.,

```
<CMDFILE> 8 9
```

If the slot numbers are not entered and are required, the prompt:

```
Define parameter &SLOTNUMBER:
```

will appear on the command line.

Chapter 10

USING SUPPORT COMMANDS

INTRODUCTION

This chapter discusses the software conventions used to make keyboard entries for operating the software performance analyzer and how the analyzer directs the entries you make. Also discussed are the utility softkeys, the utility keyboard keys, and the prompt softkeys.

SYSTEM SOFTWARE CONVENTIONS

This section contains information concerning the system software as it relates to any of the subsystems installed in a particular mainframe.

USER IDENTIFICATION

The user identification (userid) is the means of identifying yourself to the 64000 system software as a unique individual who will be using the system for your own analysis/development projects. Signing onto the system with your own userid immediately identifies which group of files the system is to work with.

The userid syntax is a string of up to six (6) alphanumeric characters which start with an upper case alpha character. If you select a userid with more than six characters, the system will recognize only the first six. If you do not select a userid, the default condition is a blank userid. A blank userid limits your ability to designate a file because if more than one file is given the same name, and that file is called up, the system will recognize the first one it sees (which may or may not be the one you want).

DIRECTED SYNTAX

The system software causes a row of softkey labels to be displayed across the bottom line of the CRT display. These softkey labels identify the functions to be obtained by pressing corresponding keys in the row at the top of the keyboard. When you press one of the softkeys (selecting a parameter), the names of all the softkey labels change. The new softkey names offer selections that can be made to complete the command entry.

By directing the syntax of your entries, syntactical errors are virtually eliminated. The softkey label line always identifies appropriate entries to be made at any point during the process of formulating a command. The software performance analyzer level softkeys always prompt the user with a *<RETURN>* softkey label when a valid command statement has been entered. If the softkey label line contains more labels than the *<RETURN>* softkey prompt, then the command statement may either continue or be terminated by pressing the RETURN key, as determined by the specific requirement of the command being formulated.

ENTERING NUMERIC VALUES

You can enter numbers into an analysis specification in any of the four standard number bases. Place the applicable letter symbol (B, O or Q, D, H) at the end of your number to define its base. Refer to the following examples:

```
1000B = 1000 binary
10000 or 1000Q = 1000 octal
1000H = 1000 hexadecimal
1000D or 1000 = 1000 decimal
```

NOTE

Decimal is assumed if you do not specify the base when you enter a number.

Hexadecimal numbers beginning with a letter must be preceded with a numeric zero. For example:

3FAH, 0FFH, but not F44H (but 0F44H)

You can use decimal points when defining time events. For example:

define time_event <NUMBER> as_range 1.5 *msec thru* 2.9 *msec*

COMMAND FILES

A command file is a source file containing a sequence of commands as they would appear on the command line if entered manually from the softkeys or keyboard. A command file is used to create a particular measurement configuration on disc for future use. A command file provides a self-documenting record of a measurement setup and allows easy editing and modification.

A semicolon (;) is used in the command file to denote comments. The analyzer software will not read any material following a ";" in any line of a command file. It will start loading new instructions only after it finds the next carriage return.

LOGGING COMMANDS

The HP64000 Logic Development System has the capability to log commands to a command file. This feature is especially useful for building command files that will carry out the entire measurement setup automatically. To log commands for a measurement setup session from the system monitor level software, press the *log* and *to* softkeys, type in the name of the file you want to use, and press the RETURN key. From this point until you are once again back in the system monitor software and press the *log* and *off* softkeys, and the RETURN key, all of the valid commands you entered are logged into the log file. You may then conduct a software performance analysis session which will build a command file for later use or for modification.

FILENAMES

Filenames may consist of from one to nine alphanumeric characters, starting with an upper case letter. Underscores (_) are also permissible. Alpha characters, after the first character, may be upper or lower case.

UTILITY COMMANDS AVAILABLE PRIOR TO MEASUREMENT EXECUTION

The utility commands that are available prior to a measurement execution are available by using the *execute*, *copy*, *show*, and *end* softkeys. These softkeys allow the user to execute a measurement, copy and display information concerning the current session, and to end the analysis session without losing the current measurement specification or stopping the measurement in progress. The utility softkey commands are described in detail below.

EXECUTE SOFTKEY

The *execute* softkey causes the analyzer to initiate a measurement based on the parameters defined in the setup and measurement specifications. Pressing the *execute* softkey, then the RETURN key causes the analyzer software to search for a setup enable condition. While the search is in progress, the STATUS line will read "Waiting for enable". When the condition set up in the setup specification is satisfied, the measurement defined in the measurement specification will begin and the histogram will be displayed on the screen. The STATUS line will read "Measurement running: Scan count = ". The scan count will update as the measurement progresses. If the setup enable specification cannot be satisfied, no histogram will appear on screen and the STATUS line will continue to read "Waiting for enable".

If no enable conditions were specified in the setup specification, the analyzer defaults to a "don't care" condition and the enable condition is considered satisfied. When all requirements of the setup and measurement specifications are satisfied, the measurement will begin and a histogram display will appear on the screen.

The *repeat* softkey is used with the *execute* softkey to cause the current measurement to be repeated each time the measurement complete setup conditions are satisfied. When the measurement complete setup conditions are satisfied, the measurement will stop and the analyzer will again search for the setup enable conditions. When these conditions are met, the measurement will begin again. This cycle will continue for as long as the repeat option is in effect. If the *repeat* softkey is not used, the *execute* softkey must be pressed each time a new measurement is desired.

COPY SOFTKEY

The *copy* softkey allows you to copy the current event assignments (individually, by groups, and within groups), measurement parameters, setup parameters, or the display to a file which you name or to a printer. If the display is being copied to a file, the copy may be enhanced (i.e., contain all the enhancement characters contained in the display such as the inverse video, bars, etc.). The display may also be appended to an existing file. The copy syntax diagram is given in appendix A, figure A-14.

SHOW SOFTKEY

The *show* softkey allows you to select the current event assignments (individually, by groups, and within groups), the current measurement histogram or data list, or the measurement setup, for display on the screen. To view all the data available, use the ROLL UP and ROLL DOWN keyboard keys. The show syntax diagram is given in appendix A, figure A-15.

END SOFTKEY

The *end* softkey is used for transportation from the present software level to the next higher level. When you press the *end* softkey, the system will exit the software performance analyzer and return to the measurement system level software. When you leave the analyzer by use of the *end* softkey, the measurement configuration will be stored on the disc. If the analyzer has a test in progress, it will continue the test without interruption after you press the *end* softkey. Your data will be collected automatically. Pressing the *end* softkey a second time causes the software to enter the system monitor level of software. You can make use of the system monitor level softkey functions without disturbing the measurement you ended from as long as you do not press

the *opt_test* softkey at the monitor level. You can reenter the software performance analysis module at any time and observe the results of your test. If you pressed the *end* softkey only once, the instrument is at the measurement system software level. From here you can reenter the analysis module by pressing the *sw_perf* softkey and the RETURN key. If you pressed the *end* softkey twice the instrument is at the system monitor software level. From here you can reenter the analysis module by pressing the *meas_sys* and *continue* softkeys and the RETURN key.

NOTE

If you do not include the options continue statement in your command to return from the system monitor level software, your present measurement configuration will be purged along with all data collected.

UTILITY COMMANDS AVAILABLE DURING A MEASUREMENT

The utility commands that are available during a measurement are obtained by using the *restart, copy, halt,* and *end* softkeys. These softkeys allow the user to restart the measurement from the beginning, copy the display to a file or printer, halt the current session, and to end the analysis session without losing the current measurement specification or stopping the measurement in progress. The utility softkey commands are described in detail below.

RESTART SOFTKEY

The *restart* softkey is used to stop the current measurement, reset all counters to zero, and restart the measurement that was in progress when the restart was initiated. The scale factors and display options previously set up with the *rescale* and *display* softkeys will remain in effect when the measurement is restarted. The restart is accomplished by pressing the *restart* softkey, then the RETURN key.

COPY SOFTKEY

The *copy* softkey is used to copy the current display to a file or to a printer. Optionally, if copied to a file, the display can be copied with special characters included (enhanced), and it can be appended to the file in lieu of overwriting the file. The syntax diagram for the copy command is shown in appendix A, figure A-16.

HALT SOFTKEY

The *halt* softkey is used to halt execution of the current measurement. This function is most likely to be used when no provision has been made for a "setup measurement complete" parameter. The halt function is accomplished by pressing the *halt* softkey, then the RETURN key.

END SOFTKEY

The *end* softkey performs the same functions when used during a measurement as it does when used prior to a measurement. Refer to the paragraph entitled "Utility Commands Available Prior to Measurement Execution" for a description of the *end* softkey functions.

UTILITY KEYBOARD KEYS

The following keyboard keys are used to help you to make entries in the software performance analyzer command lines shown on the display.

RECALL KEY

The RECALL key will cause the analysis module to return the preceeding command line to the screen. The analysis module has a command line memory which the RECALL key accesses. Each time you press the RECALL key, the analyzer steps one execution further back into its memory of command lines.

TAB KEY

The TAB key is used to move the cursor rapidly through the command line on screen. This key is useful when you are making modifications to long specifications. By pressing TAB, you step the cursor from entry to entry forward through the specification on the command line. By pressing the SHIFT key and then the TAB key, you step the cursor backwards through the specification.

INSERT CHAR AND DELETE CHAR KEYS

The INSERT CHAR and DELETE CHAR keys are used to edit the content of the command line. The INSERT CHAR key will open a space before the present position of the cursor so that you can add entries in the command line. The remainder of the line will automatically shift to the right with each new entry that you make. The INSERT CHAR key function will remain

in effect until it is pressed again or until any other utility key is pressed (except <-, ->, or CAPS LOCK). The DELETE CHAR key is used to elimimate entries from the the command line without losing the entire specification. When you press the DELETE CHAR key, the entry directly over the cursor will be eliminated and the remainder of the specification will shift left. Holding the DELETE CHAR key down will cause multiple character deletions as characters are shifted left, over the cursor position.

PROMPT SOFTKEYS

Any softkey name enclosed in angle-brackets "<>" is a prompt for the operator. If you press a prompt softkey, the STATUS line of the display will explain the meaning of the prompt. The software performance analyzer softkey label prompts and their corresponding status line prompt messages are given in appendix B, table B-3.

Chapter 11

CONDUCTING INTERMODULE MEASUREMENTS

INTRODUCTION

Intermodule measurements are measurements involving coordination between two or more analysis modules. This coordination uses high-speed communication between all analysis modules. It coordinates triggering, windowing of functions, and synchronization of execute and halt commands for all modules involved in a measurement.

This chapter describes the intermodule measurement capabilities of the software performance analyzer. It describes the way that the software performance analyzer uses the intermodule bus. The command syntax for setting up intermodule measurements is located in chapter 6 in the paragraph entitled "Setting up an External Trigger Enable". Finally, two example measurements are described: one combining two software performance analyzers, and the other using a software performance analyzer and an emulation internal analysis board together. Refer to the Measurement System Reference Manual for information concerning overall measurement system interaction.

GENERAL INFORMATION

Intermodule measurements are coordinated measurements made with two or more analyzers. Intermodule measurements are made through the intermodule bus cable connected to the IMB connectors on each analyzer control board. At power-up, there is no intermodule specification between the software performance analyzer(s) and any other analysis modules. In order to obtain intermodule measurements, the software performance analyzer must be set up initially to send or receive the intermodule trigger signal.

You can have the software performance analyzer receive a trigger enable from other analyzers in the system. You can also have the software performance analyzer drive the trigger enable and provide a trigger enable for other analyzers.

INTERMODULE SIGNALS

The software performance analyzer can participate in intermodule activity on two of the intermodule control lines. The signals of the intermodule control lines are described in the following paragraphs.

MASTER ENABLE

The master enable line is shared by all analysis instruments included in a measurement. When master enable is true, it enables all instruments that receive it. When it is false, it freezes all these same instruments. There can be only one driver for the master enable line: either the *execute / halt* softkey or a subsystem other than the software performance analyzer, which has been designated to participate in the measurement.

The primary purpose of the master enable line is to synchronize measurement start in all analyzers. At measurement start (the *execute* softkey pressed or true state from designated master enable driver), all analyzers try to start. As each analyzer gets ready to start, it allows the master enable line to go true, but the master enable line remains false until the last analyzer tries to start. Then the master enable line switches true, releasing all analyzers to start together.

When the master enable line is driven by one of the analyzers, it can alternate between true and false to window the activity in the interactive measurement. The software performance analyzer will always be set to, both drive and receive master enable. At the start of a measurement, the software performance analyzer will drive master enable true.

TRIGGER ENABLE

The trigger enable line carries a logic level. When the trigger enable line is true, it enables the receiving instruments to recognize their triggers, if they occur. When it is false, it disables trigger recognition in the receiving subsytems. The trigger enable line can alternate between true and false during a measurement to allow the controlling analyzer to window the measurement activity in other analyzers where trigger recognition can occur. The software performance analyzer can drive this line, or receive it from some other instrument on the intermodule bus. If no analyzer is designated to drive this line, it defaults to a true condition.

TYPES OF INTERMODULE MEASUREMENTS

There are four basic ways that the software performance analyzer can be used in conjunction with other analyzers in the system.

1. Intermodule measurements with a 64302 Internal Analyzer

This may be useful for enabling the software performance analyzer when a data pattern is recognized by the 64302. The software performance analyzer can only look at the emulation address and status buses.

2. Intermodule measurements with a state or timing analyzer.

This may be useful if the area of interest for the software performance analyzer can only be seen after executing a complex sequence of operations. In addition, a measurement start or measurement complete condition can trigger a state or timing analyzer.

3. Intermodule measurements using more than one software performance analyzer.

There are three ways that use can be made of one software performance analyzer triggering the other. 1) You can use one software performance analyzer as external windows for the intermodule duration measurement. It can also be used to window when the other software performance analyzer is making real-time measurements. 2) If you want to measure more than two real-time events at one time and be sure that no data is lost, you can have four software performance analyzers, maximum, in a system (with internal analysis you can have a maximum of three). A total of two real-time events are allowed per analyzer board. It is, therefore, possible to display up to eight real-time event measurements using four software performance analyzer boards. These eight real-time event measurements cannot be displayed simultaneously. They can be displayed two at a time (two bars on the histogram). To view all eight events requires "ending" out to the measurement system monitor software and selecting each software performance analyzer board separately. In this manner two measurements can be viewed at a time until all eight have been displayed. 3) One software performance analyzer can be used to enable another software performance analyzer to either extend the counters or to extend the termination conditions (with the exception of the statistic terminations).

4. Intermodule measurements using two sets of emulation and software performance analyzer combinations.

This would give you the ability to make measurements involving more than one processor system.

MAKING INTERMODULE TESTS WITH TWO OR MORE SOFTWARE PERFORMANCE ANALYZERS

The following paragraphs describe how to set up two software performance analyzers to make an interactive measurement.

1. From the monitor level of softkeys, press the *meas_sys* softkey and the RETURN key. This will gain access to the measurement system display. Add "continue" to your command if you want the software

performance analyzers to continue using their former test setups. The softkey label line will identify both software performance analyzers by name and by the slot numbers where their cards are installed.

2. Your identifiers will be similar to those shown in the following example of a softkey label line:

```
sw_perf_1  sw_perf_4   _____   _____   _____   end
```

3. Press one of the *sw_perf* softkeys (such as *sw_perf_1*) to select the software performance analyzer you want to set up first. Add the file name if you want to load a configuration from a file. Then press the RETURN key. The monitor of the software performance analyzer whose card is installed in the selected mainframe slot (slot 1 in this example) will appear on screen.

4. Make any desired modifications to the configuration. Add the desired interaction for this software performance analyzer. Then press the *end* softkey and the RETURN key. The CRT will again show the measurement system display and will identify the interaction you assigned to your software performance analyzer.

5. Press the softkey for the other software performance analyzer (such as *sw_perf_4*). Again, decide whether you want to use the default test setup or load a configuration from memory (by adding the name of the file). Press the RETURN key. This activates the other software performance analysis module and brings its monitor to the screen.

6. Make any desired changes to the measurement setup for this software performance analyzer. Add the desired interaction to the specification.

7. Press the *end* softkey and the RETURN key to return to the measurement system level of display. This display will now show the interactions you specified for both software performance analyzers.

NOTE

You can execute or halt interactive measurements while the system displays the measurement system monitor or while it displays specifications from any one any one of the analyzers that will be included in the measurement.

8. Press the *execute* softkey and the RETURN key. This starts both software performance analyzers running according to their own measurement configurations.

CAUTION

If you execute a trace from within emulation while the software performance analyzer is making a measurement, the software performance analyzer will be halted.

NOTE

You can select any of the other analyzers in your mainframe and look at their present specifications, but you cannot execute any measurements with them as long as your interactive measurement is in process.

9. Press the *end* softkey again. This returns you to the system monitor level of display. You can use the mainframe for non-analysis activity (edit, assembly, etc) while the analyzers execute their measurements. Both software performance analyzers will continue to run their measurements according to their specifications and save data in their memories.

10. To look at the results of the software performance analyzer measurements, press the *meas_sys* and *continue* softkeys, then press the RETURN key. This command line returns the system to the measurement system display without changing the analyzer setups.

11. Now press the *sw_perf<number>* softkey and the RETURN key. This regains access to the software performance analyzer you select without reloading the module. The measurement you assigned to the software performance analyzer will still be running or already completed. You can select displays and use the capabilities of the software performance analyzer as though it were the only analyzer in the mainframe.

12. When you have finished with that software performance analyzer, press the *end* softkey and the RETURN key.

13. You can check the status of the measurement in the other software performance analyzer. Press the *sw_perf<number>* softkey and the RETURN key.

MAKING INTERACTIVE MEASUREMENTS USING A SOFTWARE PERFORMANCE ANALYZER AND A 64302A ANALYZER TOGETHER

We are going to assume in this example that the data word of A000H on the emulation bus is an event that we want the internal analyzer to recognize. This event will signal the software performance analyzer to begin acquiring data.

64302A INTERNAL ANALYZER SETUP

You can set up the internal analyzer to drive the trigger enable line when it detects a pattern match of data = A000H. Use a setup such as the following (setup in the emulator software):

```
Modify interactive measurement specification? yes
  .
  .
Trigger enable? drive
  .
  .
Specify trace after data 0A000H.
  .
  .
End
```

NOTE: The above setup assumes that the emulator is already running.

SOFTWARE PERFORMANCE ANALYZER SETUP

Set up your software performance analyzer to receive an external trigger enable with the following softkeys.

setup trig_en received

Now press the RETURN key.

ANALYSIS EXECUTION

Press the *execute* softkey, then the RETURN key to start measurement. When a data word of A000H appears on the bus the internal analyzer will drive trigger enable and the software performance analyzer will begin to collect data.

Chapter 12

THEORY OF OPERATION

INTRODUCTION

This chapter contains the theory of operation for the software performance analyzer. This theory of operation is based on operator requirements rather than troubleshooting. For the theory of operation pertaining to troubleshooting, refer to the software performance analyzer service manual.

SAMPLING TECHNIQUE

The sampling technique used by the software performance analyzer deals with address ranges and time ranges. Each range (range type depends on measurement) is monitored for a unit of time. This unit of time is referred to as an event period. A discussion of address and time ranges, and event periods, is given in the following paragraphs.

ADDRESS RANGES

The software performance analyzer accomplishes sampling of an address range by performing the following functions:

1. It monitors a range (address event) for a fixed unit of time or number of states, then switches to the next range (event). This fixed unit of time is known as the event period. It is set to default values for each measurement but can also be adjusted by the user.

2. It gathers the following data for each address event (activity measurement):

    a. all states (32-bit counter),

    b. qualified states (32-bit counter),

    c. time while monitoring range (32 bit), and

    d. time while in range (32 bit).

3. It completes a scan after all ranges (events) have been monitored.

Dead time (nothing being looked at) provides time to load the next address range and restart the measurement (synchronous), and time to dump data to the host processor (asynchronous).

A different event is randomly selected as the starting point for each scan.

TIME RANGES

The software performance analyzer accomplishes sampling of time ranges by performing the following functions:

1. It monitors the execution of a code segment (entry to exit) within a time boundary (event). Each time event is monitored for a fixed number of segment executions or a time interval. These executions or time intervals are known as the event period.

2. It monitors all executions of a segment while monitoring the time event.

    a. counts all executions of a segment

    b. counts executions of a segment within time boundary (event)

3. It completes a scan after all ranges (events) have been monitored.

Dead time (nothing being looked at) provides time to load the next time range and restart a measurement (synchronous), and time to dump data to the host processor (asynchronous).

A different event is randomly selected as the starting point for each scan.

EVENT PERIOD

An event period is defined as time or occurrences, as follows:

1. Time

    a. amount of time spent monitoring each event (accuracy is plus 35 usec).

    b. the default time period is 800 usec. (this applies only to nonreal-time activity measurements and linkage measurements)

    c. scan time is approximately equal to period plus dead time, times the number of events

2. Occurrences - definition depends on measurement type

    a. activity - state clocks (emulation bus cycles)

    b. duration, usage, and intermodule duration - an occurrence of the code segment (i.e.; for module duration an occurrence can be defined as a procedure call).

c. linkage - a transition from within a segment.

3. The default period 25 segment occurrences.

ACTIVITY MEASUREMENTS

The activity measurement modes are the memory and program activity modes. In both of these modes, either time or occurrences can be selected for display by pressing the appropriate softkey. You can also elect to observe either relative or absolute data (also by using the appropriate softkey). Relative data is defined as only that data that is presently displayed on the screen. Absolute data is defined as the data presently displayed on the screen, but as it relates to the total program being analyzed, not to just the displayed data.

MEMORY ACTIVITY

Memory activity measures the amount of time and number of occurrences which occur within each event. An event for memory activity is defined as an address or address range. Occurrences (emulation bus cycles) and time are recorded by 32-bit counters when addresses with the correct status occur within the event range. The status can be selected by the user (selection depends on the emulator). Status is defaulted to don't care if none is selected. Counters are also kept on all time and occurrences during the event period.

PROGRAM ACTIVITY

Program activity measures the amount of time and number of occurrences which are caused by each event. An event for program activity is defined as an address or address range. Occurrences (emulation bus cycles) and time are recorded by 32-bit counters when an opcode is fetched from within the event range. Occurrence and time will continue to be counted until an opcode is fetched from outside the event range. In this way activity caused by the opcode, such as a stack push outside of the event range, will be recorded as activity within the event which caused it. Counters are also kept on all time and occurrences during the event period.

REAL-TIME PROGRAM ACTIVITY AND MEMORY ACTIVITY

Real-time measurements provide for a maximum of two real-time activity measurements per software performance analyzer board with a minimum sampling error. A total of four boards may be used at any one time, so a total of eight real-time activity measurements may be made. When making real-time measurements, no window or disable functions are allowed. The data for each event is gathered in parallel. There is a 40 usec break

(dead time) approximately once every second for the hardware to be unloaded. Any previously set event period is ignored.

PREFETCH CONSIDERATIONS FOR ACTIVITY MEASUREMENTS

A prefetch into an events range will register as activity within that event if it is currently being monitored. This may cause confusion if no activity is expected. If this becomes a problem, then adding code "pads" in front of each event is suggested.

DURATION MEASUREMENTS

Duration measurements produce a time distribution histogram of code execution. The distribution is measured from entry to exit. The histogram bars now represent time events (buckets, ranges, etc.). Occurrences for duration type measurements are executions of the code segment (i.e.; procedure) being observed. The hardware records the number of occurrences within each time event and all the occurrences that happen. The controlling of the timing hardware is done by the state machine and is dependent on which of the three duration measurements is being executed.

The default event period for all duration measurements is set to 25 occurrences. In other words, the segment must execute 25 times for each time event being measured before the scan counter will increment. The user can also set the event period to be a unit of time. It should be noted that if the user sets the period to a unit of time the analyzer cannot measure a segment execution longer than that interval. Also sampling error increases for any module execution which is greater than one half the event period time.

NOTE

Duration measurements require code segments to have a minimum length of four opcodes. Also, the minimum limit for a time event must be two times T_{cy}; where T_{cy} = worst case processor bus cycle time.

MODULE DURATION MEASUREMENTS

This measurement produces a time distribution graph for the execution time of a module from entry to exit. Entry is defined as the address of the first executable instruction and exit point is defined as the address of the last. If an entry is made into a module by any path other than the entry point, no time is logged. Also, if the module is exited by any path other than the exit point, no time is logged.

Module duration has two measurement modes; including calls and excluding calls. If the measurement is in an including calls mode, the time spent in any segment called by the one being measured will be included in the result. If the measurement is in an excluding calls mode, this time will be ignored. An occurrence in module duration is defined as an execution of the module.

Prefetch and recursion considerations for module duration measurements are as follows:

The module duration measurement attempts to correct for prefetch errors in the following ways:

1. If a module is entered, then exited via a point other than the defined exit point, and re-entered (both entries are via the defined entry point) a prefetch into the module is assumed to have occurred on the first entry. The hardware is then reset and no occurrences of the module are logged. While the hardware is being reset, no measurement is running. This may cause a problem if the true entry into the module ALWAYS occurs within typically 150 usec (260 usec worst case) of the prefetched entry. In this case the true entry into the module will never be observed and no occurrences logged. Also, if a module is recursively called, only the last recursive call will be timed.

2. When leaving the module via the exit point, the timers are only disabled. If the state machine detects that the module is then re-entered without going through the entry point the timers are re-enabled. The timers are reset and occurrences logged when state machine detects the entry point to the procedure.

MODULE USAGE MEASUREMENTS

Module usage produces a time distribution graph for the execution time spent outside of a module from exit to entry. Exit is defined as the last opcode in the module and entry is defined as the first. If exit from the module is by any path other than the exit point, no time is logged. This measurement is designed to give an indication on how often the module is being used.

In the module usage mode an occurrence is defined as one execution from exit to entry of the module.

Module usage prefetch correction is such that if the state machine detects an exit from the module, and a reentry by way of a path other than the original entry point is detected, then no occurrences are logged.

INTERMODULE DURATION MEASUREMENTS

Intermodule duration measurements produce a time distribution graph for the execution time spent from exit of one module to eventually entering

another. Exit is defined as the last opcode in the "from" module. Entry is defined as the first opcode in the "to" module. If exit from the "from" module is by any path other than the exit point, no occurrences are logged.

Intermodule duration prefetch correction is such that if the state machine detects exiting the "from" module and re-entering it without passing the entry point of the "to" module, the state machine assumes the "from" module was prefetched out of. No provision is made for prefetching into the "to" module.

LINKAGE MEASUREMENTS

Linkage measurements produce a transfer distribution histogram. Each bar on the histogram represents immediate transfers from one event to another. Occurrences for linkage measurements are defined as immediate transfers out of the "from" events range. A count of the transitions for each event pair are logged as well as transitions out of the "from" events range. No transitions are recorded for the "from" event leaving its range via its upper address. Also, transitions to the "to" events exit address are not recorded (exit address is the event's upper address).

MEASUREMENT QUALIFICATION

The analyzer allows the qualification of the measurement on address and status. (Up to two terms for enable and one term for disable.) This is accomplished by programming the measurement hardware to interrupt the microcontroller after the condition has been met. The controller then reprograms the hardware for the measurement. This causes a delay between the time the enable condition is found and the measurement starts. (See table 12-1 for delay times.) This delay causes no problems unless a disable condition is also requested. This is because the hardware can only be programmed for the disable condition after the enable condition has been found. The effect of this delay on the measurement is that if the disable condition occurs within approximately 19 msec it will not be recognized.

NOTE

Disable terms require one range resource and therefore are not valid for real-time, intermodule duration, and linkage measurements.

Windows also have limitations because of the time required to reprogram the hardware. However, since windows use the same status for both enable and disable the time is greatly reduced. The time required to reprogram for the disable is approximately 400 usec. Another condition must also be taken into account when using windows. Since the hardware measures

(samples) one event at a time, the scan may not be complete when the window closes. If the window closes (disables) when the hardware is acquiring data on an event, that data will be thrown out. This is because it takes a small amount of time (approximately 35 usec) to shut down the hardware after the disable is found. When the window opens (enables) again, the measurement will resume, starting with the event that was interrupted. If the window is not open for at least one event period, the scan can never complete. This presents itself to the user as a scan count that never increments.

Table 12-1. Measurement Qualification Timing Specification

Delay between the time the measurement enable term is found and the time the measurement starts:

Program or Memory Activity Measurement	208 usec
Program or Memory Activity Measurement (Real-Time)	610 usec
Module Duration, Module Usage, and Intermodule Duration Measurements	439 usec
Intermodule Linkage Measurements	535 usec

Minimum time required to recognize a disable term after a measurement enable term is found:

Program or memory activity measurement	19.1 msec
Module duration or module usage measurement	19.71 msec

Minimum time required to recognize a window disable term after a window enable term is found:

Program or memory activity measurement	314 usec
Module duration or module usage measurement	506 usec

NOTE:
The windowed range must be valid for the above length of time plus one event period for data to be collected.

IMB INTERACTION

The analyzer has the ability to drive or receive the trigger enable line on the InterModule Bus (IMB). When the analyzer drives this line, it does so via the microcontroller. This means that trigger enable does not go true at the exact moment the measurement starts or at the exact moment it completes. If the analyzer receives trigger enable, it will act in the same manner as it would when a setup enable condition is received, and the same delay prior to measurement start will be encountered. If the analyzer is running and the trigger enable line goes false, data acquisition is stopped. The timers, however, continue to run. The effect of this differs, depending on the type of event period

selected. If the event period is based on time, the scan counter will continue to run. If the period is based on occurrence, then the scan counter will freeze.

If windows are enabled and the analyzer is requested to drive trigger enable, the effects are as follows:

drive on measurement start

Trigger enable will be driven true when the window enable condition is met. It will be driven false when the window disable condition is met.

drive on measurement complete

Trigger enable will be driven true when the window disable condition is met. It will be driven false when the window enable condition is met.

STATISTICS

Statistics calculated by the software performance analyzer are based on mean and standard deviation terms. These terms are defined in the following paragraphs. Error tolerance and level of confidence calculations are also discussed.

MEAN

The mean is defined as occurrences or time, as follows:

1. average number of occurrences which occurred for a given event within the period that it was being monitored.

2. average amount of time that an event executed during the period that it was being monitored.

The following equation is used to calculate the mean:

$$\text{mean} = \frac{*\text{qualified counts}}{\text{scan counts}}$$

*Count can be qualified occurrences or qualified time for activity measurements. The *display* softkey is used to define which is used. For measurements other than activity measurements, only qualified occurrences (no qualified time) are allowed.

STANDARD DEVIATION

Standard deviation is defined as occurrences or time, as follows:

1. deviation from the mean of occurrences

2. deviation from the mean of time

The following equation is used to calculate the standard deviation:

$$\text{standard deviation} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N} S_{sumq} - N(mean)^2}$$

Where:

N = scan count
S_{sumq} = sum of squares of the qualified counts
mean = mean as described above

ERROR TOLERANCE AND CONFIDENCE LEVEL

Error tolerance for a level of confidence are calculated using the mean of the standard deviations and the mean of the means. The Student's T distribution is used. The Student's T table is stored in memory for this purpose. Three scans are needed before the error can be calculated. The error is updated at each graph update. The confidence level is defaulted to 95% unless otherwise changed.

The following equation is used to calculate the error percentage:

$$\text{error percentage} = \frac{\sigma_m \, t}{N \, P_m} * 100$$

Where:

σ_m = mean of the standard deviations
N = scan count
P_m = mean of the means
t = table entry in Student's "T" table for given confidence level

The error tolerance gives an indication of how stable the graph has become. For example, if the error is 5% for a confidence level of 95%, the user can be 95% confident that the graph has an error of 5% or less. The Student's "T" distribution is used because it provides a more accurate result for small sample sizes. As the sample size increases, the Student's "T" distribution approaches the normal distribution.

Appendix A

OPERATING SYNTAX DIAGRAMS

INTRODUCTION

This appendix contains the operating syntax diagrams for the software performance analyzer. These diagrams are based on softkeys that appear when the analyzer is being used with an 6809 microprocessor based system. Protection level softkeys and status softkeys will vary with different microprocessors, but the general syntax will remain the same. The analyzer software recognizes the different microprocessors, so the softkeys will automatically change, as required, for the different microprocessors.

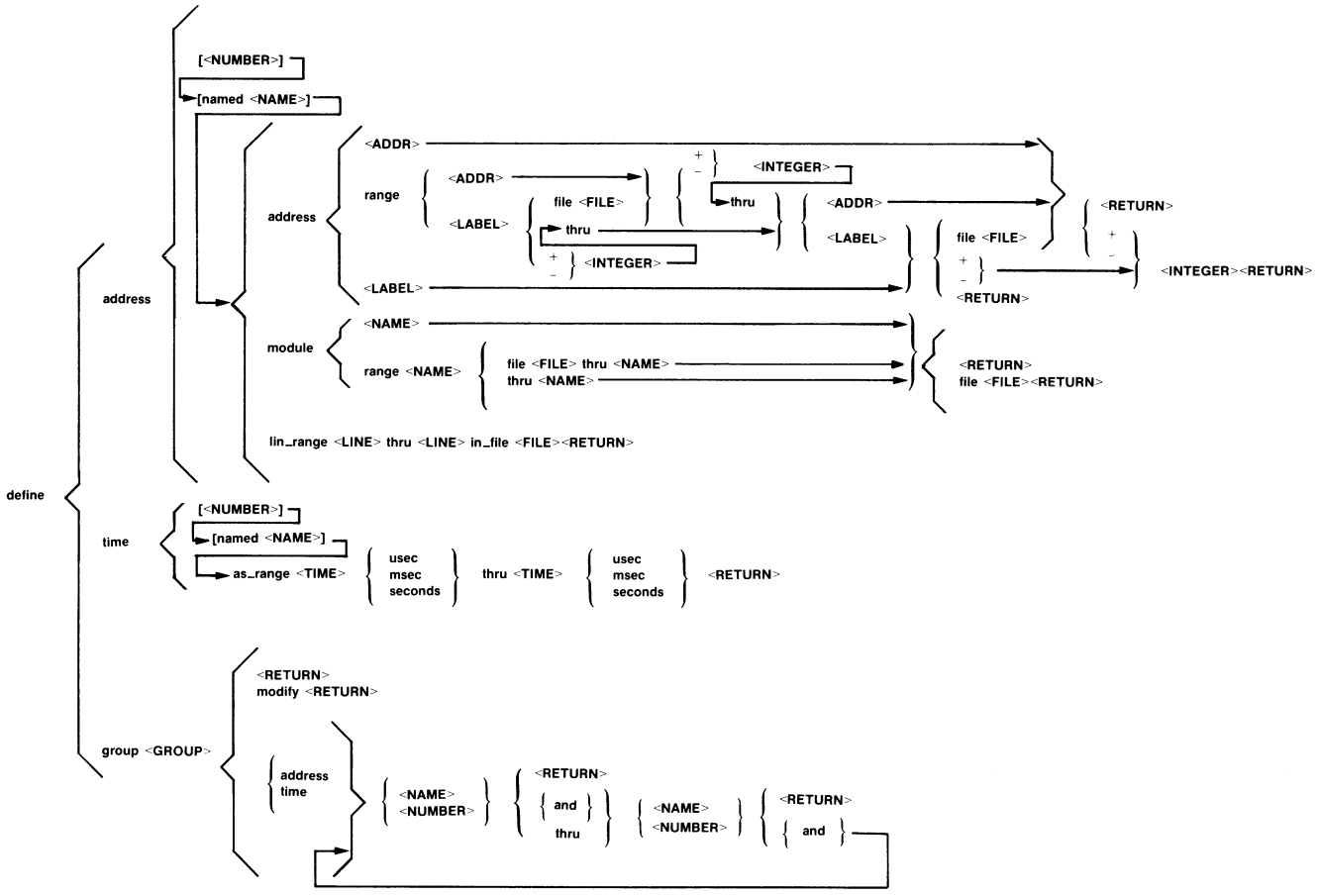
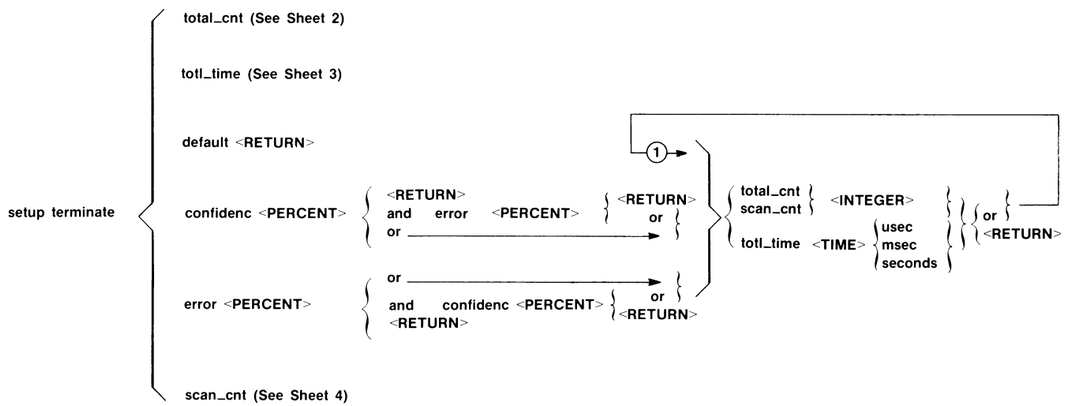


Figure A-1. Define Syntax Diagram



NOTE:
(1) Softkey selected once will not be present the next time(s) through.

Figure A-2. Setup Terminate Syntax Diagram (Sheet 1 of 4)

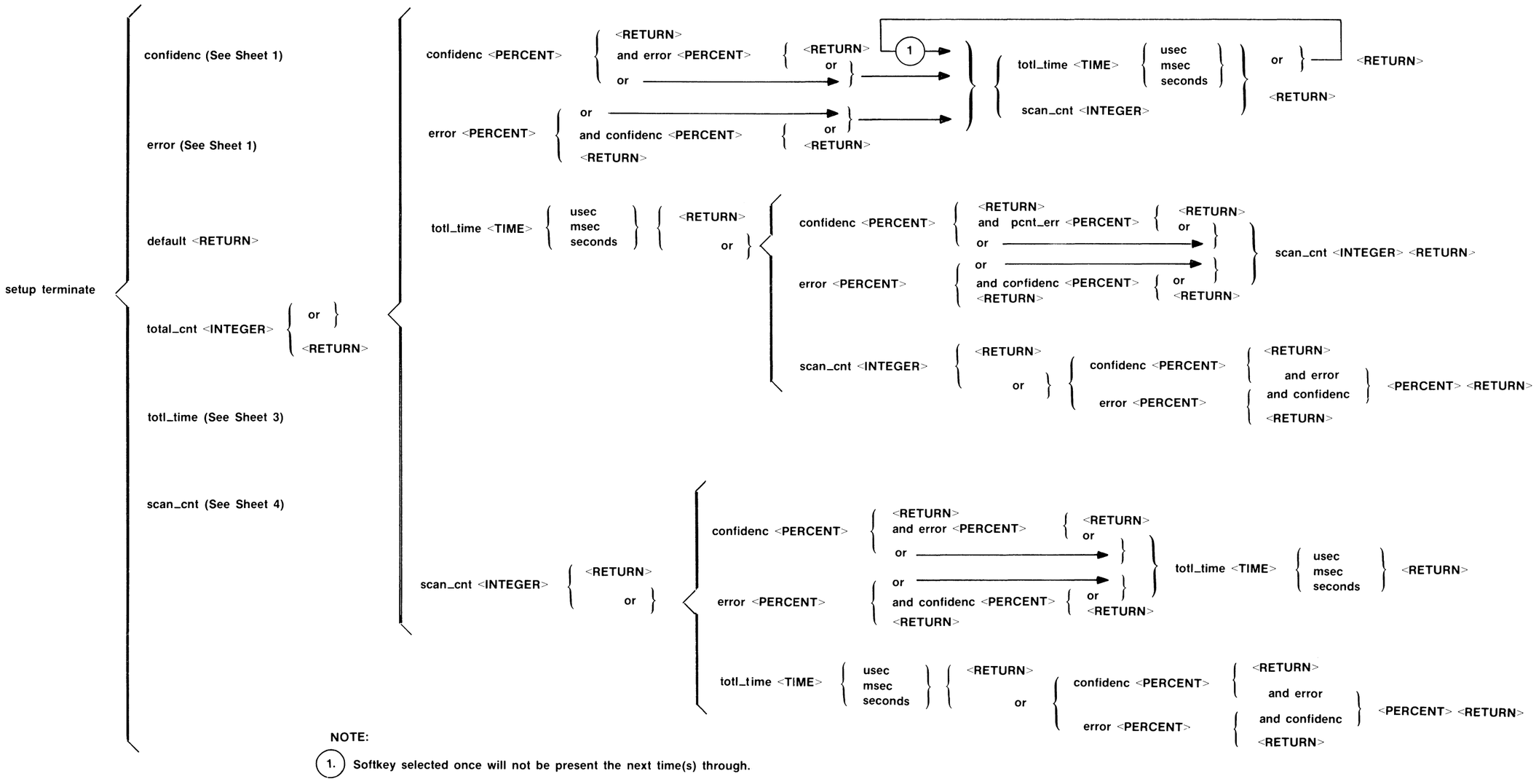
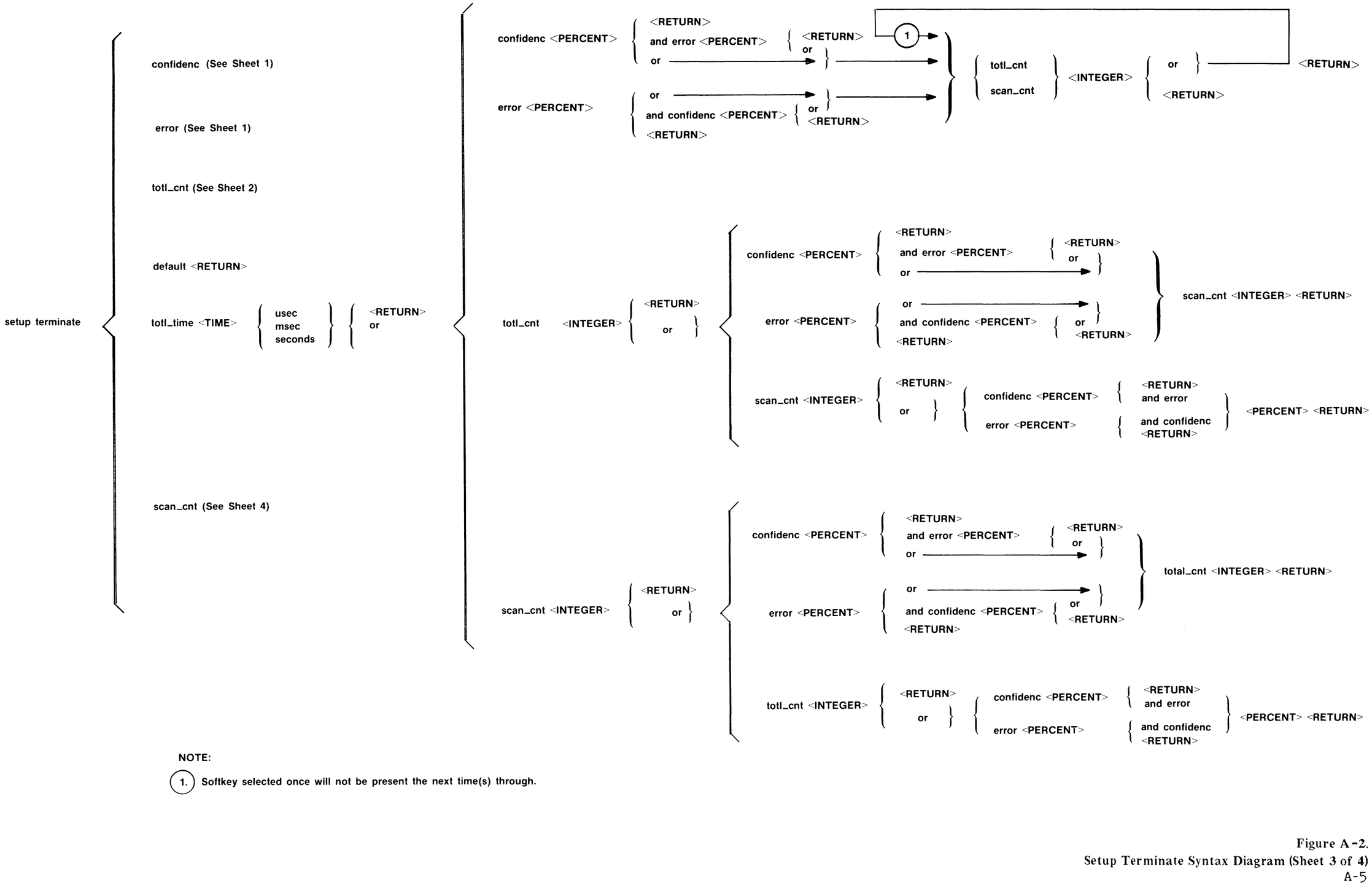


Figure A-2.
Setup Terminate Syntax Diagram (Sheet 2 of 4)



NOTE:

(1.) Softkey selected once will not be present the next time(s) through.

Figure A-2.
Setup Terminate Syntax Diagram (Sheet 3 of 4)

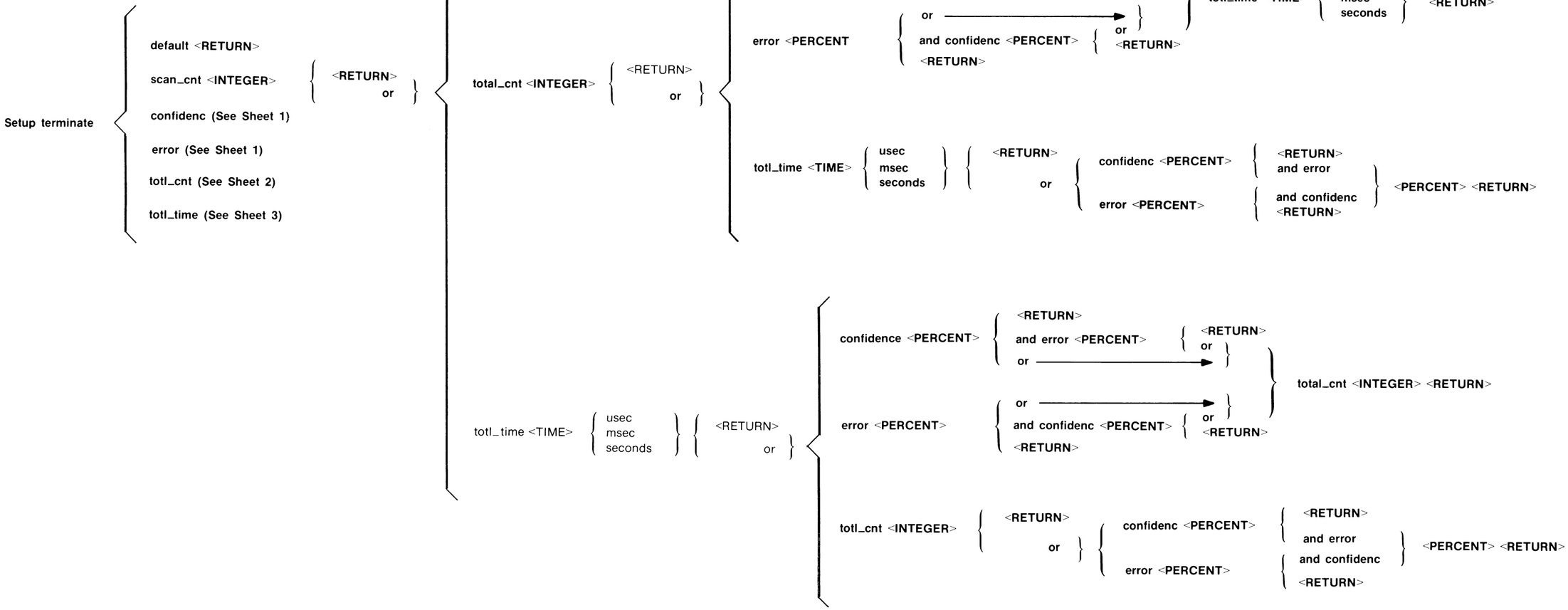


Figure A-2. Setup Terminate Syntax Diagram (Sheet 4 of 4)

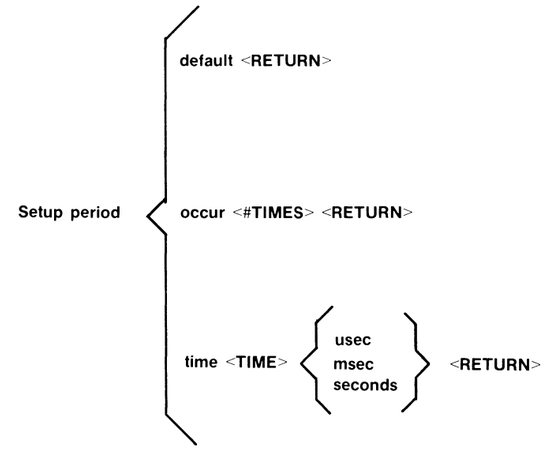


Figure A-3.
Setup Period Syntax Diagram

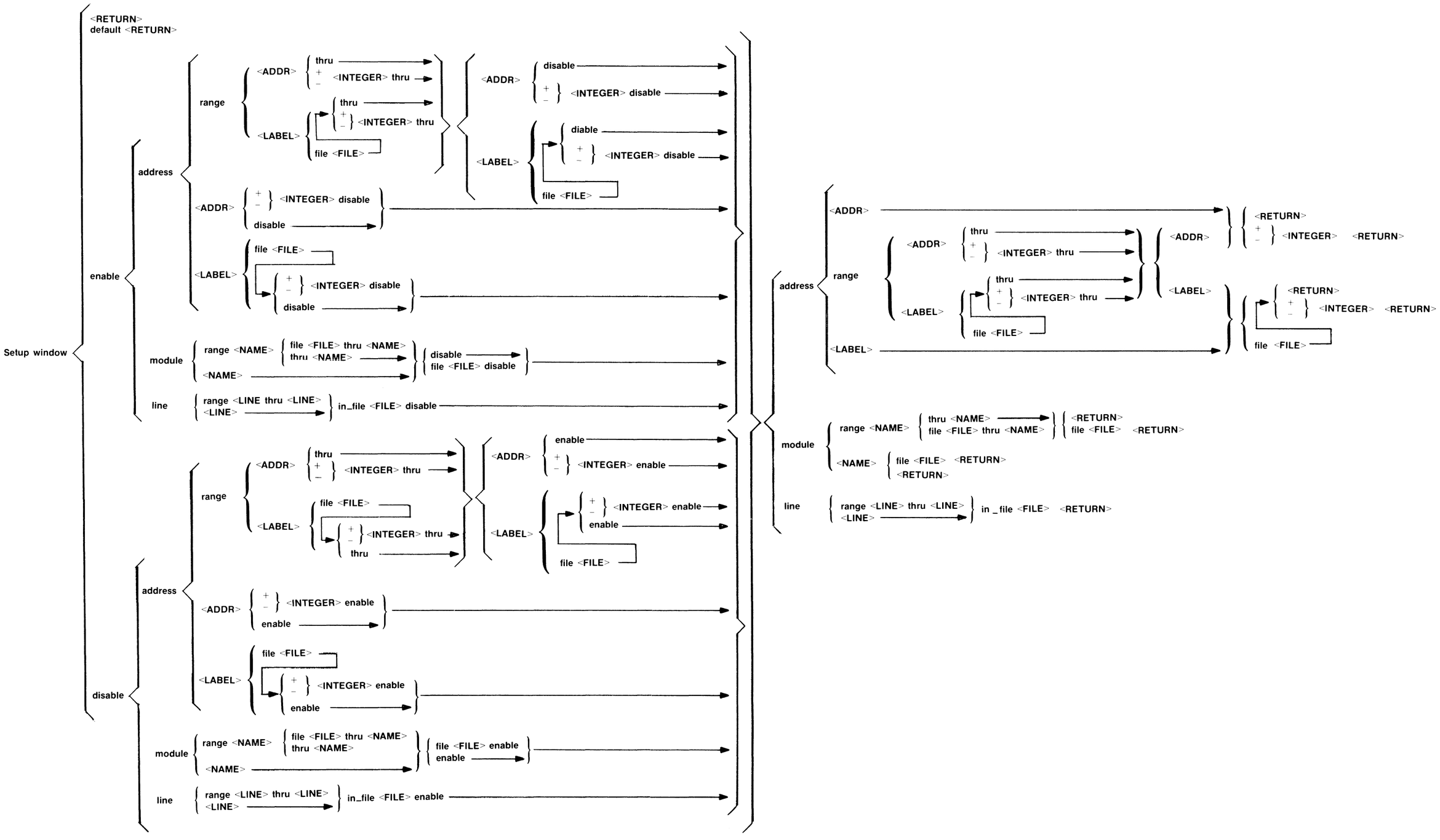
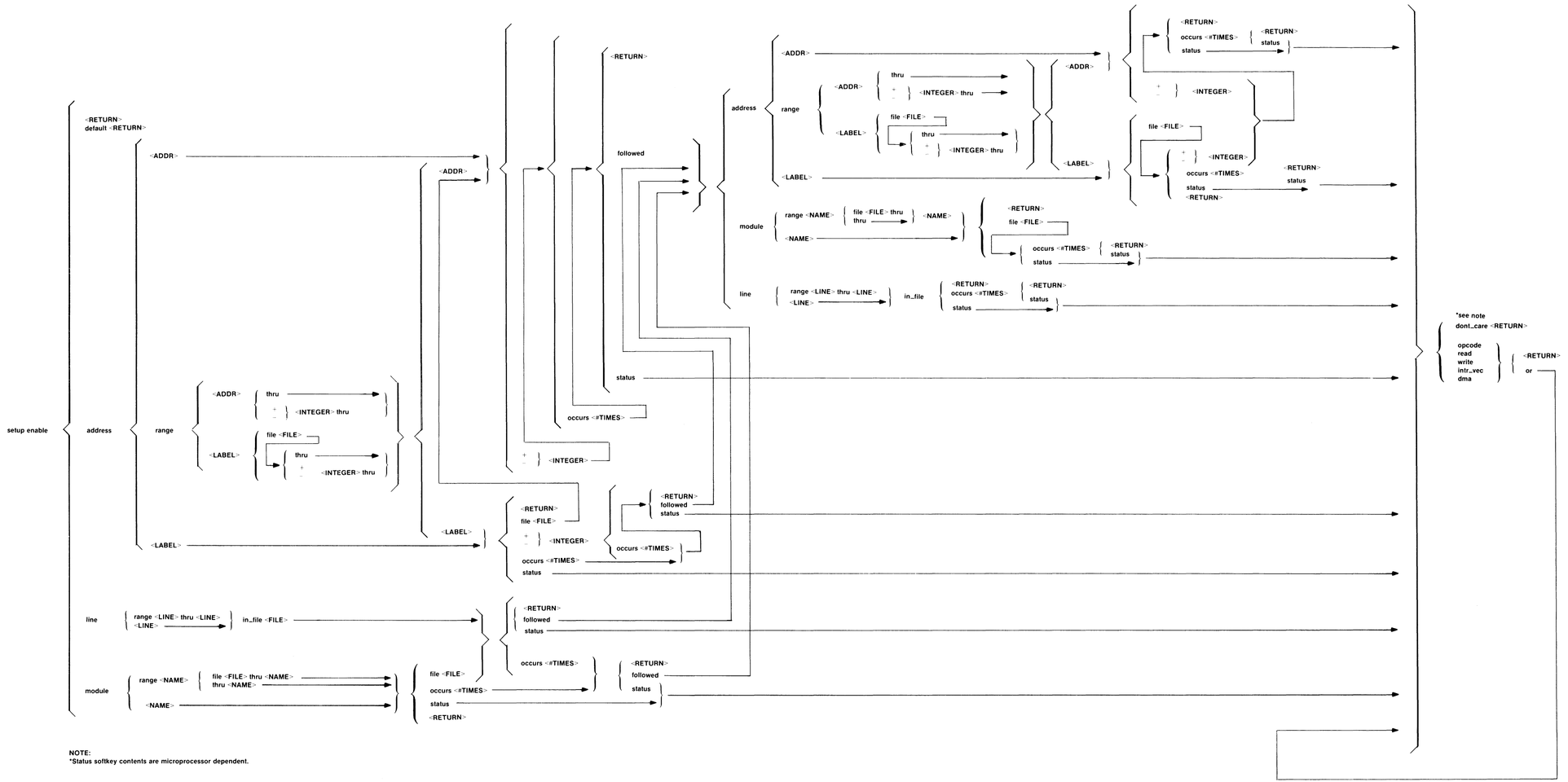


Figure A-4. Setup Window Syntax Diagram



NOTE:
*Status softkey contents are microprocessor dependent.

Figure A-5.
Setup Enable Syntax Diagram

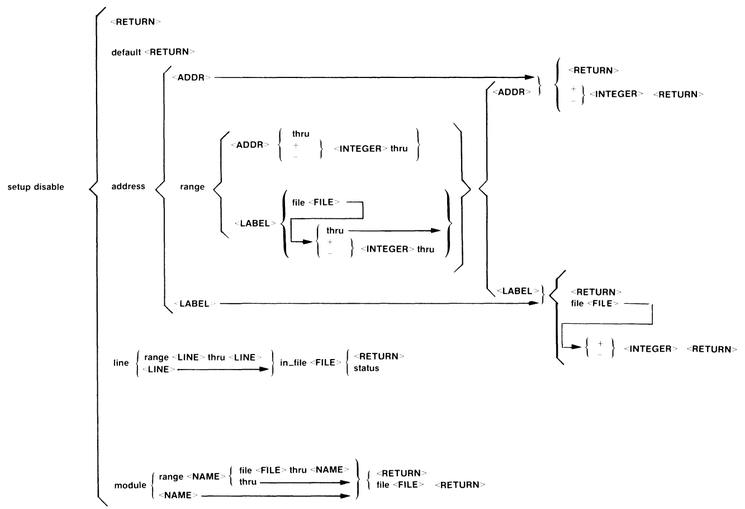


Figure A-6. Setup Disable Syntax Diagram

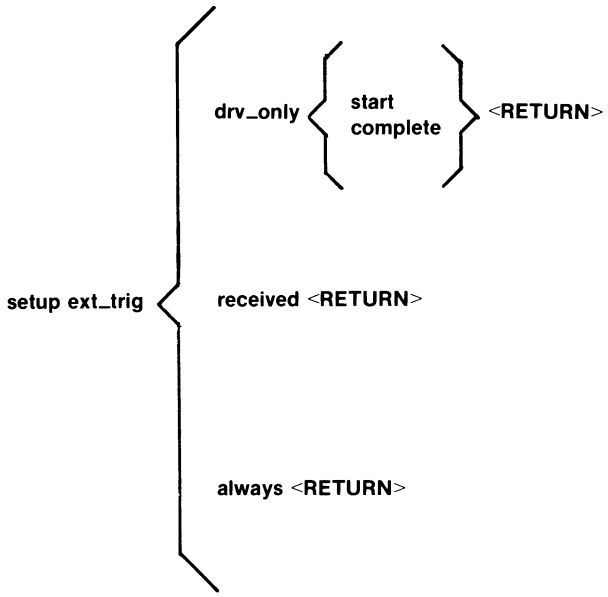
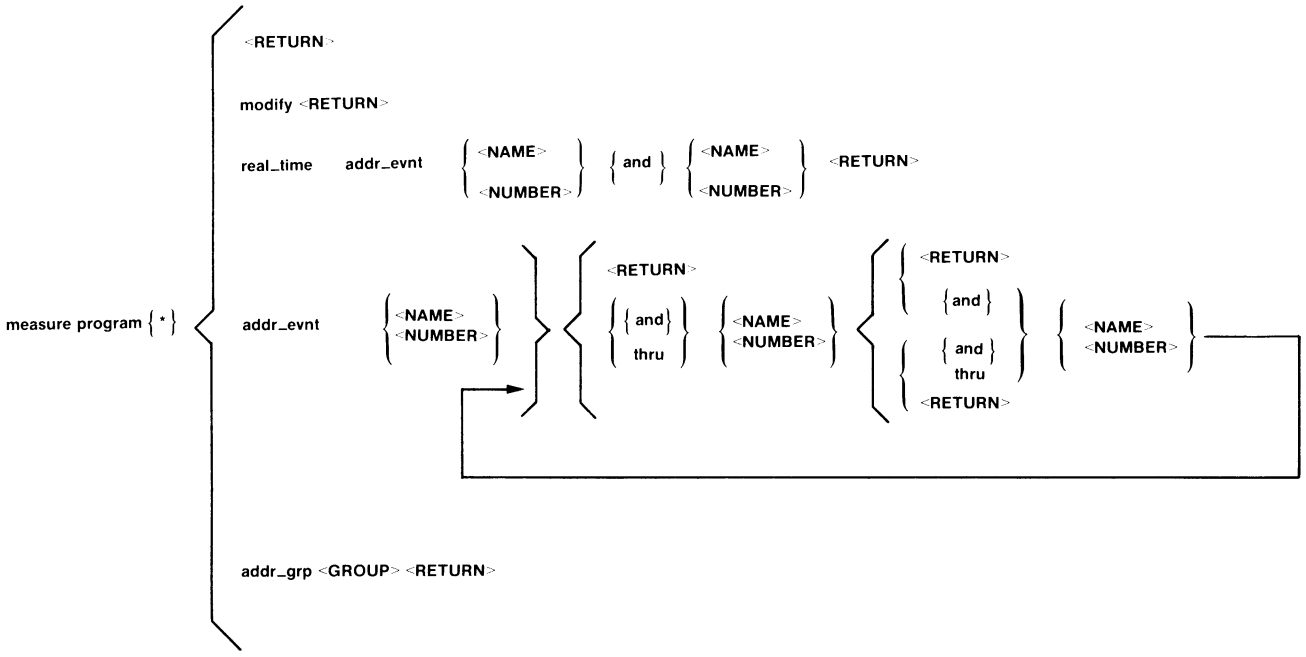
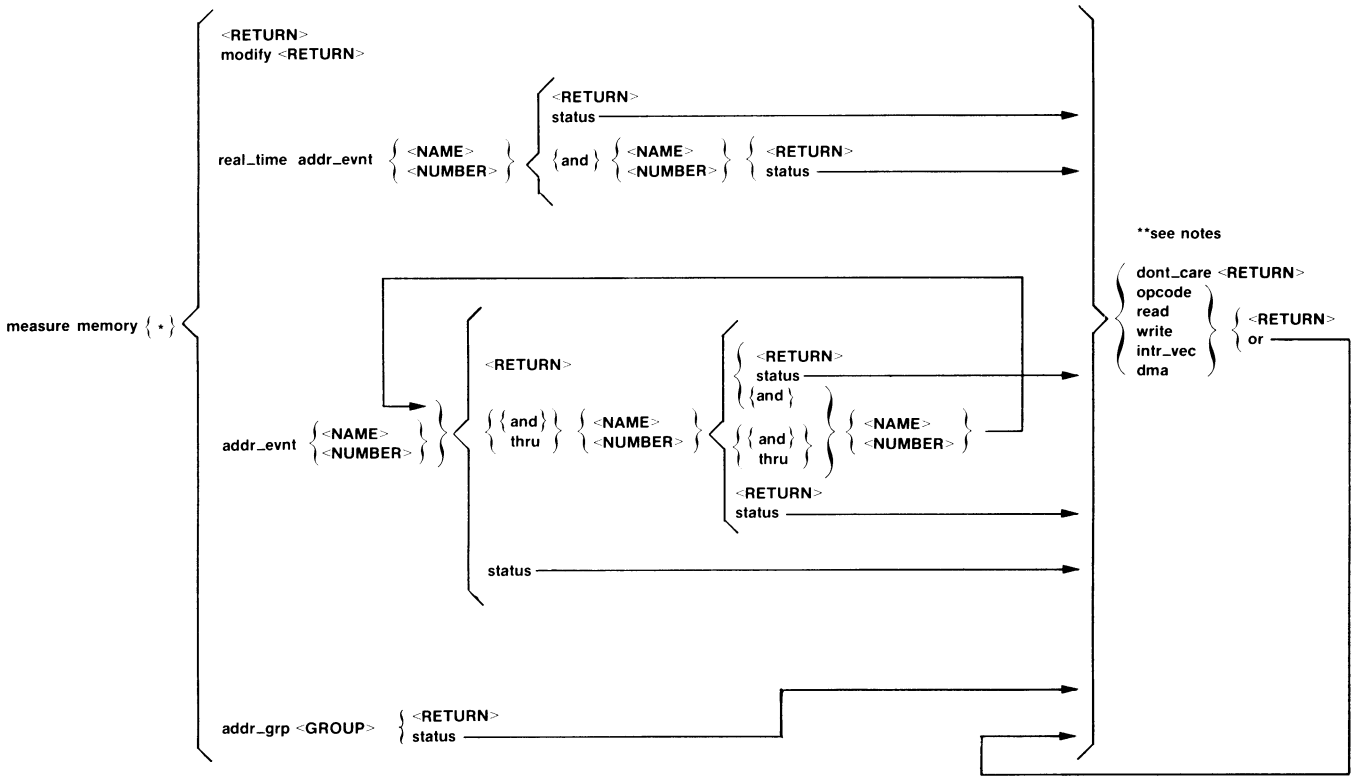


Figure A-7. Setup External Trigger Enable Syntax Diagram



NOTE:
* denotes protection level softkeys. These softkeys are present for some microprocessors. The softkey grammar, when present, is microprocessor dependent.

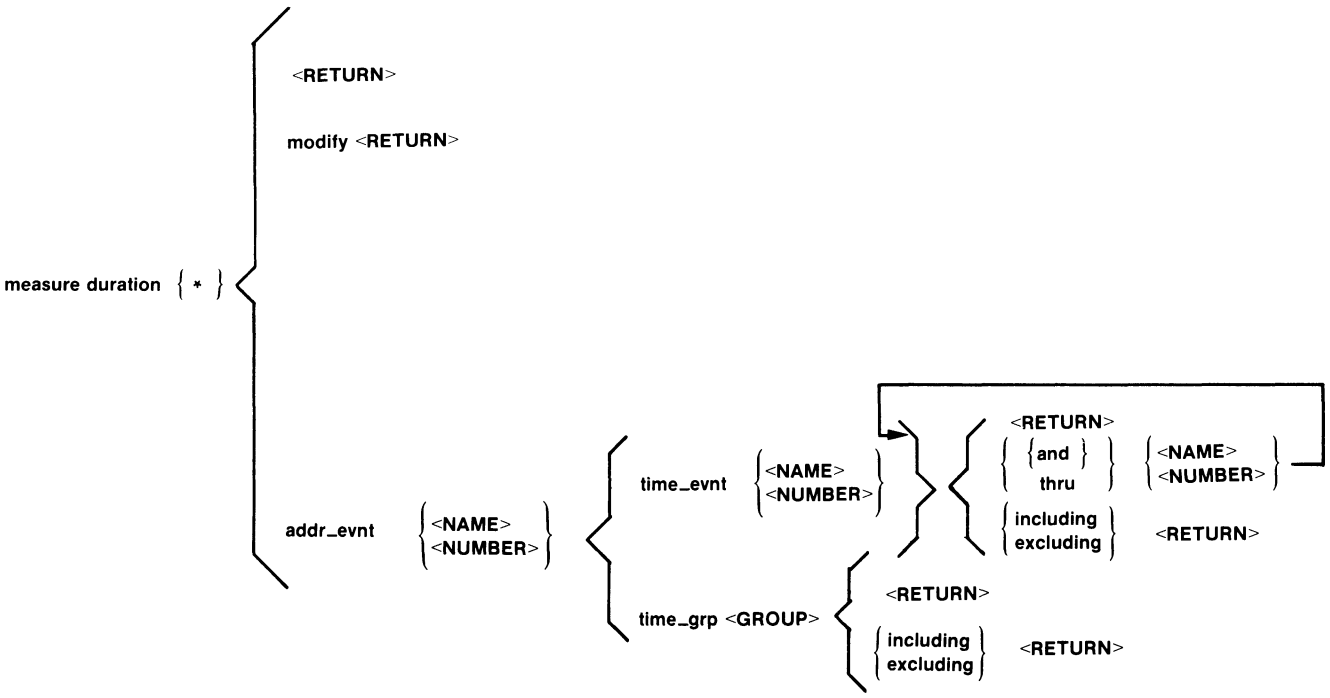
Figure A-8. Measure Program Activity Syntax Diagram



NOTES:
* denotes protection level softkeys. These softkeys are present for some microprocessors. The softkey grammar, when present, is microprocessor dependent.

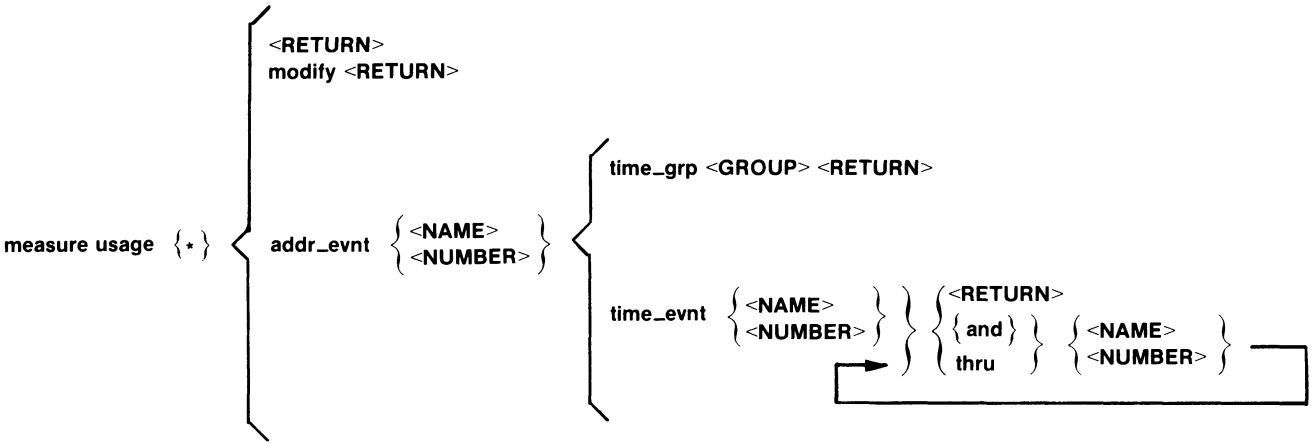
** Status softkey contents are microprocessor dependent.

Figure A-9. Measure Memory Activity Syntax Diagram



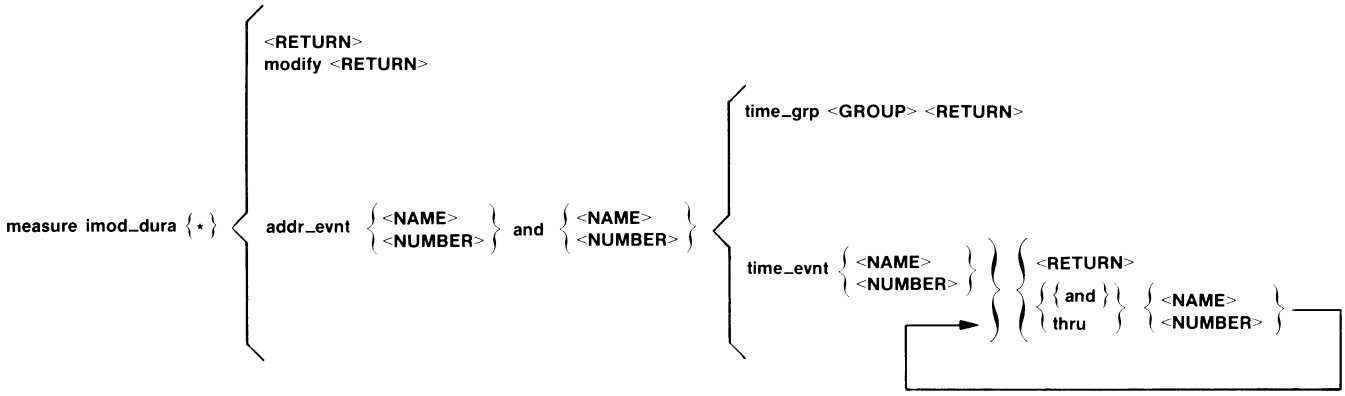
NOTE:
*denotes protection level softkeys. These softkeys are present for some microrpocessors. The softkey grammar, when present, is microprocessor dependent.

Figure A-10. Measure Module Duration Syntax Diagram



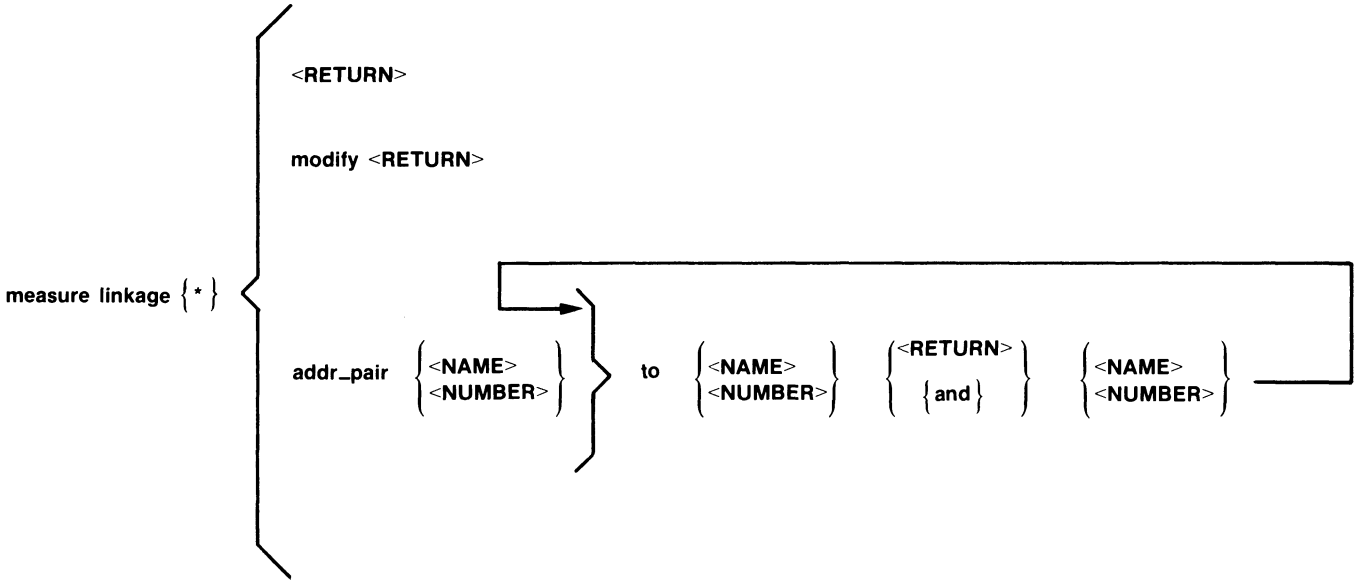
NOTE:
*** denotes protection level softkeys. These softkeys are present for some microprocessors. The softkey grammar, when present, microprocessor dependent.**

Figure A-11. Measure Module Usage Syntax Diagram



NOTE:
*denotes protection level softkeys. These softkeys are present for some microprocessors. The softkey grammar, when present, is microprocessor dependent.

Figure A-12. Measure Intermodule Duration Syntax Diagram



NOTE:
* denotes protection level softkeys. These softkeys are present for some microprocessors. The softkey grammar, when present, is microprocessor dependent.

Figure A-13. Measure Intermodule Linkage Syntax Diagram

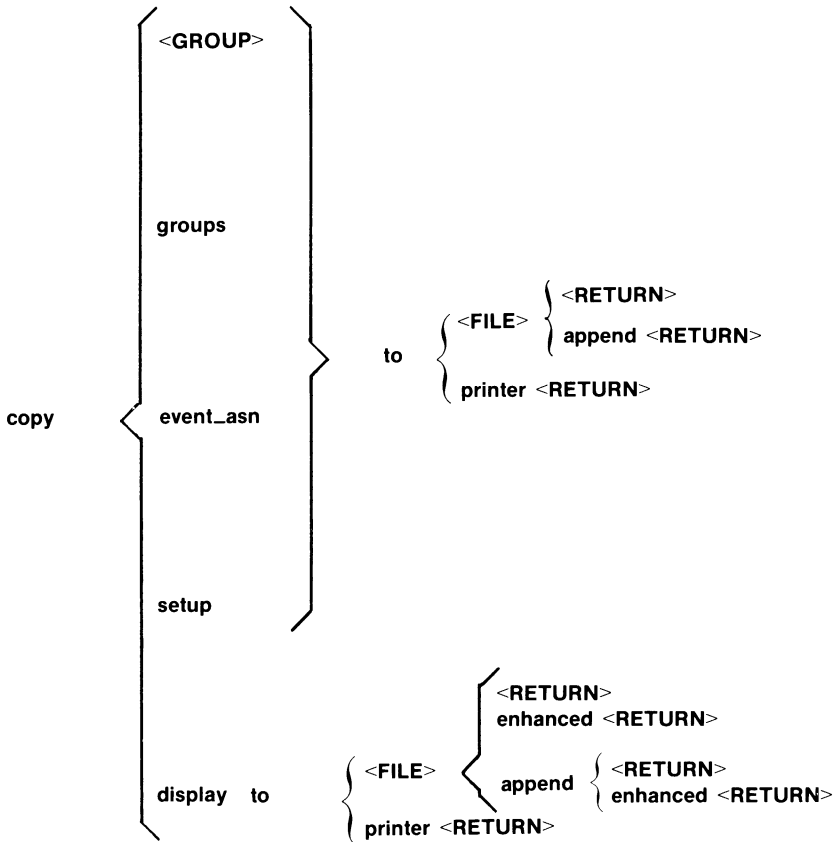


Figure A-14. Copy Syntax Diagram (Available Prior to a Measurement)

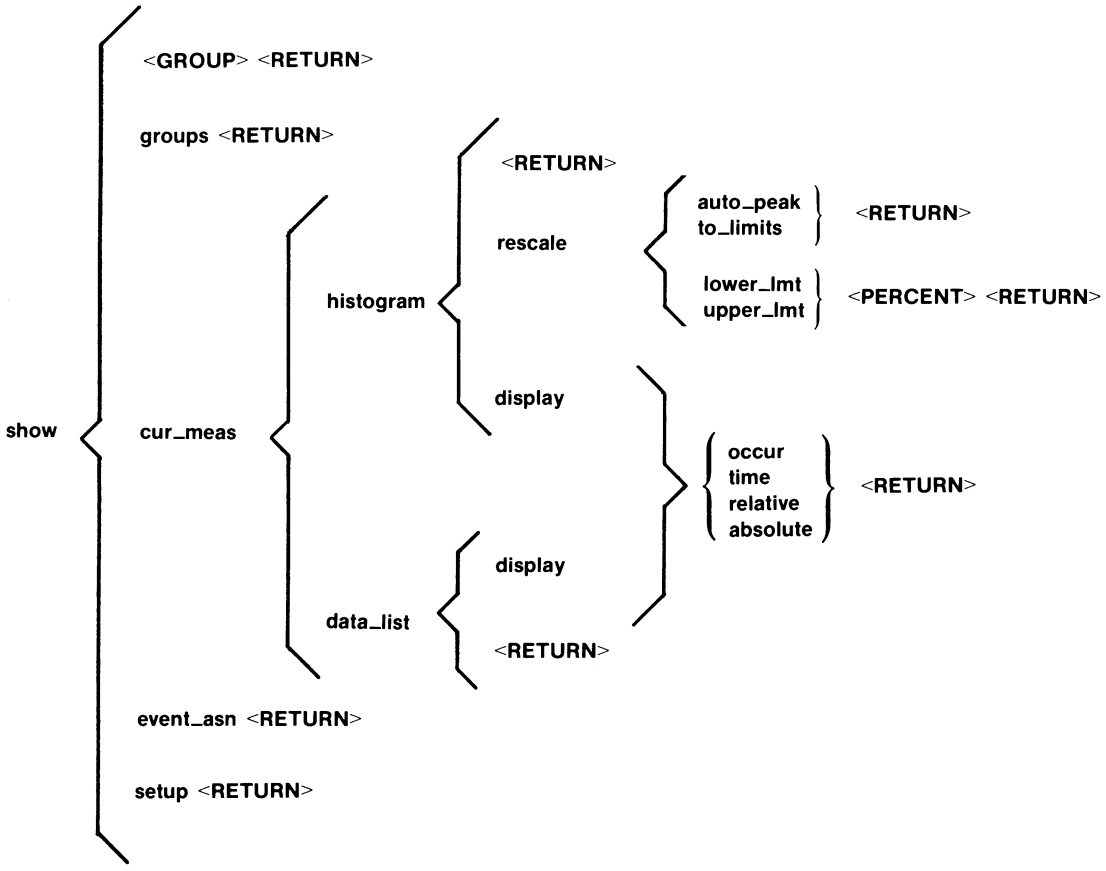


Figure A-15. Show Syntax Diagram

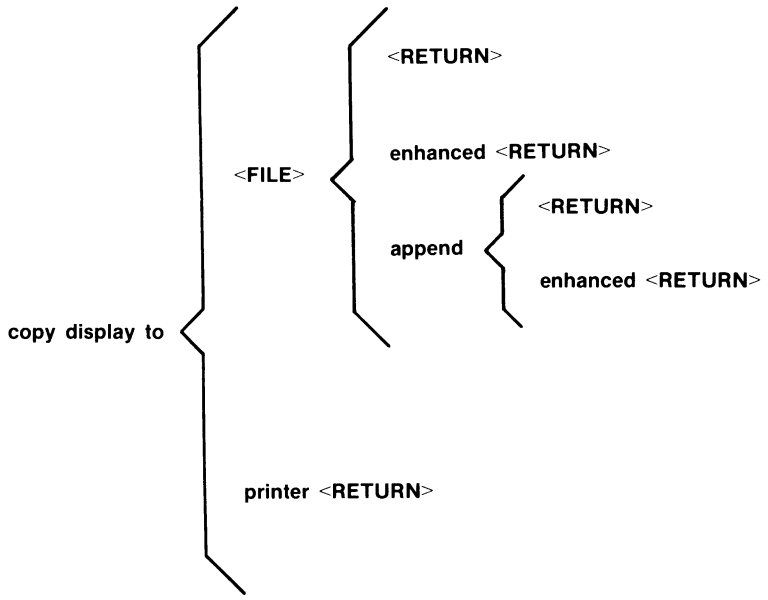


Figure A-16. Copy Syntax Diagram (Available During a Measurement)

Appendix B

STATUS, ERROR AND SOFTKEY PROMPT MESSAGES

INTRODUCTION

This appendix contains a list of the status and error messages, and the softkey prompts and their corresponding messages. All these messages are displayed on the CRT as a result of the software performance analyzer software. An explanation for each message is also given. Table B-1 provides a list of status messages, table B-2 provides a list of error messages, and table B-3 provides a list of the softkey prompts. Status messages are displayed on screen to provide an indication of operating status. Error messages are displayed on screen to indicate an improper operating condition or invalid entry on the command line. The softkey prompts are provided on the softkey label line to prompt the operator to input the required information.

Table B-1. Status Messages

Status Messages	Meaning
Awaiting command userid XXXXXX	Displayed when the software performance analyzer is in a quiesent state, ready to accept a new command in its input command line.
Disable condition found - measurement complete	Displayed when a measurement is completed after the user defined disable condition is found.
Display update suspended - measurement running	Displayed after the user causes the measurement to be suspended by using the suspend display command.
Download Complete	Displayed when the software performance analyzer completes its download of the execution code to the hardware.
Execution repeating	Displayed when the user has specified an execute repetitively command and the measurement execution is repeating.
Hardware error	Displayed when the software performance analyzer detects an internal hardware error.

Table B-1. Status Messages (Continued)

Status Messages	Meaning
Hardware error, execution aborted - Module not involved	Displayed when the software performance analyzer detects an error caused by a module other than the software performance analyzer.
Loading Analyzer	Displayed when the software performance analyzer is in the process of loading the code required for execution.
Measurement Halted	Displayed when the user halts execution.
Measurement running: Scan count = XXXX	Displayed when the software performance analyzer is running normally, performing a measurement.
Multiple module execution completed - disable condition found	Displayed when the software performance analyzer has detected the user specified disable condition and the intermodule measurement has completed.
Multiple module execution completed - Module not involved	Displayed when the software performance analyzer has detected the completion of an intermodule measurement of which it was not a part.
Multiple module execution completed - termination cond. found	Displayed when the software performance analyzer has detected a user specified or default termination condition and the intermodule measurement has completed.
Multiple module execution halted	Displayed when the software performance analyzer has detected the halt of an intermodule measurement.
Multiple module execution halted - Module not involved	Displayed when the software performance analyzer has detected a halt in an intermodule measurement of which it was not a part.
Multiple module execution in process - disable condition found	Displayed when the software performance analyzer has detected a user specified disable condition and an intermodule measurement is still in process.
Multiple module execution in process - Module not involved	Displayed when the software performance analyzer has detected an intermodule measurement in process of which it is not a part.

Table B-1. Status Messages (Continued)

Status Messages	Meaning
Multiple module execution in process - termination cond. found	Displayed when the software performance analyzer has detected a user specified or default termination condition, and an intermodule measurement is still in process.
Multiple module execution repeating - disable condition found	Displayed when the software performance analyzer has detected a user specified disable condition, and an intermodule measurement is executing repetitively.
Multiple module execution repeating - Module not involved	Displayed when the software performance analyzer has detected that an intermodule measurement is executing repetitively, but the analyzer is not part of the measurement.
Multiple module execution repeating - termination cond. found	Displayed when the software performance analyzer has detected a user specified or default termination condition , and that an intermodule measurement is executing repetitively.
Reloading configuration	Displayed when the software performance analyzer is in the process of reloading a configuration file.
Single module execution completed - Module not involved	Displayed when the software performance analyzer has detected the completion of an execution by some other module.
Single module execution halted - Module not involved	Displayed when the software performance analyzer has detected the halt of an execution by some other module.
Single module execution in process - Module not involved	Displayed when the software performance analyzer has detected the execution of some other module.
Single module execution repeating - Module not involved	Displayed when the software performance analyzer has detected a repetitive execution of some other module.
Termination condition found - measurement complete	Displayed when the software performance analyzer measurement becomes complete after detecting a termination condition.

Table B-1. Status Messages (Continued)

Status Messages	Meaning
Waiting for Enable	Displayed when the software performance analyzer is looking for a user specified enable condition (either internal or external (IMB).

Table B-2. Error Messages

Error Messages	Meaning
Absolute file must be set up	Displayed when the user attempts to use the symbolic interface before having set up the absolute file.
Address must be within processor address space	Displayed when a address is found to be outside of the legal range of the processor involved.
Auto increment of event # is not possible	Displayed when a condition is detected where the time and address event boundaries overlap, or if 99 events have been defined.
Config file inconsistent with hardware	Displayed when you attempt to load a configuration file that was saved using a different type of emulator than the one currently being used.
Decimal point not allowed when entering usec	Displayed when you try to enter a time value in usec which contains a decimal point (i.e.; 1.02 usec)
Emulator unsupported by Performance Analyzer	Displayed when the software performance analyzer detects that the emulator installed cannot be supported.
Event group not defined	Displayed when you try to specify an event group in a measurement when that group has not been previously defined.
Event label must be defined	Displayed when you try to specify an event label in a measurement, or when defining a group, and that event has not been defined.

Table B-2. Error Messages (Continued)

Error Messages	Meaning
Event of this name already exists	Displayed when you attempt to define an event of the same name as an existing event.
Event type must be compatible with measurement	Displayed when you attempt to specify a measurement with a time event when an address event is required or vice versa.
Event(s) not defined	Displayed when attempting to use an event which has not been previously defined.
File exists, wrong module type	Displayed when you try to load a configuration into the software performance analyzer from a file that is not a software performance analyzer configuration file (i.e.; a state/software performance analyzer configuration file).
File is write protected	Displayed when you try to save a configuration under a file name that already contains a write-protected configuration.
File not found	Displayed when the specified source file is not an entry in the global symbol table.
Global module not found	Displayed when you attempt to specify a global module which does not appear in the "global symbol" file.
Global symbol not found	Displayed when you attempt to specify a global symbol which does not appear in the "global symbol" file.
Group definitions limited to 16	Displayed when you attempt to define more than 16 groups.
Group type must be compatible with measurement	Displayed when you attempt to use a time group where an address group is required or vice versa.
Invalid display request for this measurement	Displayed when you attempt to use the time display mode when making a duration measurement.
Invalid slot selection	Displayed when you enter a slot that does not contain an emulator control card, when polled to do so.

Table B-2. Error Messages (Continued)

Error Messages	Meaning
Label not found	Displayed when the symbolic interface cannot locate the specified label (symbol) in either the global or local symbol tables.
Line number must be an executable statement	Displayed when the symbolic interface recognizes that the specified line number is not an executable statement.
Lower bound must be less than upper bound	Displayed when you attempt to enter a scale factor which makes the lower bound greater than the upper bound.
Measurement enable must be specified	Displayed when you attempt to use the command "setup measurement_enable_on" when an enable condition has not been specified.
Measurement disable must be specified	Displayed when you attempt to use the command "setup measurement_disable_on" when a disable condition has not been specified.
Measurement must be requested first	Displayed when you attempt to issue an execute command prior to requesting a measurement.
Measurement must be specified first	Displayed when you attempt to use commands like "measure memory_activity" prior to specifying that type of measurement.
Measurement window must be specified	Displayed when you attempt to use the command "setup window" when a window has not been specified.
Measurements limited to 12 events	Displayed when more than 12 events are specified, for those measurements which have a limit of 12 events.
Measurements limited to 6 event pairs	Displayed when more than 6 event pairs are specified for the intermodule linkage measurement, which is limited to 6 pairs.
Module not found	Displayed when the symbolic interface cannot locate the specified module in either the global or local symbol tables.

Table B-2. Error Messages (Continued)

Error Messages	Meaning
Multiple drivers on trigger enable	Displayed when you attempt to drive the IMB trigger enable line when another module has already requested to do so.
No current data available	Displayed when you attempt to display the current measurement histogram or event data list when there is no current data available.
Occurrence values limited to 65535	Displayed when you attempt to specify an occurrence count within the measurement specification which is greater than 65535.
Occurrences for event period must be no less than 4	Displayed when you attempt to specify fewer than 4 occurrences for an event period.
Syntax Error	Displayed when you try to enter an invalid command and press the RETURN key.
The second value must be greater than the first value	Displayed when a range of time or address values are specified where the second value is found to be less than the first.
Time must be 1 usec or greater	Displayed when you attempt to specify a time value of less than 1 usec.
Time values for event period must be no less than 40 usec	Displayed when you attempt to specify less than 40 usec for an event period.
Time values limited to 4 digits	Displayed when you attempt to specify a time value containing more than 4 digits (like 23.003 msec).
Time values limited to 671 seconds	Displayed when you attempt to specify a time value greater than a maximum value of 671.0 seconds.

Table B-3. Softkey Prompt Messages

Softkey Prompt	Message and Meaning
<ADDR>	"Absolute address" - Any absolute address within within the limits of the processor address space.
<FILE>	"Absolute file name (requires link_sym file of same name)" - This file is required whenever the symbolic interface is used.
<FILE>	"Listing file from compiled source [:userid] [:disc#]" - The symbolic interface requires the user to specify the name of the "listing" file when entering line numbers. This file name is used to locate the appropriate line number in the associated symbol table.
<FILE>	"Source file containing label [:userid][:disc#]" - The symbolic interface requires the source file to be specifies so that the associated symbol table can be accessed to find the specified local symbol.
<FILE>	"Source file containing module (procedure) [:userid] [:disc#]" - The symbolic interface requires the source file to be specified for accessing the associated symbol table to find the specified local module.
<FILE>	"Valid file name" - Files will either be of the type "trace" (for configuration files) or "listing" (for copying a file).
<GROUP>	"Event group name" - Each event group has a name with up to eight characters associated with it.
<INTEGER>	"Integer value (0 to 4294967295)" - Integers are positive values over the specified range.
<INVALID>	"Command syntax is invalid" - The portion of the command between the beginning of the command line and the cursor contains an error in syntax. Refer to the softkeys at each point in the command to verify the syntax.
<LABEL>	"Label from the source file [:filename]" - The symbolic interface allows the entry of labels having up to fifteen characters.
<LINE>	"Line number from compiled source listing" - The symbolic interface allows the entry of line numbers as found in the compiled listing file.

Table B-3. Softkey Prompt Messages (Continued)

Softkey Prompt	Message and Meaning
<NAME>	"Event label" - Each event can have a name with up to fifteen characters associated with it.
<NAME>	"Module (procedure) name [:filename]" - The symbolic interface allows the entry of module names of up to fifteen characters.
<NUMBER>	"Event number" - Each event has a number associated with it.
<PARMS>	"Command file parameters" - The parameters passed to a command file.
<PERCENT>	"Percentage (0 - 100)" - An entry of a percentage between 0 and 100 is valid.
<PERCENT>	"Percentage (1 - 99)" - An entry of a percentage between 1 and 99 is valid.
<PERCENT>	"Percentage (51 - 99)" - An entry of a percentage between 51 and 99 is valid.
<RETURN>	"Command syntax is valid to cursor" - The portion of the command between the beginning of the command line and the cursor contains no errors in syntax and could be entered if no further options are desired.
<TIME>	"Time value (1us to 999us, 0.001ms to 671.0s)" - Time values are valid from 1 usec to 671 seconds. Time values entered in usec are not allowed to contain a decimal point, and those entered in msec and seconds are allowed only four decimal places; three if no decimal point is used.
<TIME>	"Time value (40us to 999us, 0.040ms to 671.0s)" - Time values are valid from 40 usec to 671 seconds. Time values entered in usec are not allowed to contain a decimal point, and those entered in msec and seconds are allowed only four decimal places; three if no decimal point is used.
<#TIMES>	"# times state described must occur (1 to 65535)" - The software performance analyzer allows the user to specify the number of times a condition within the measurement enable must occur.

Table B-3. Softkey Prompt Messages (Continued)

Softkey Prompt	Message and Meaning
<#TIMES>	"# times state described must occur (4 to 4294967295)" - The software performance analyzer allows the user to specify the event period in terms of occurrences where the definition of occurrence changes with the type of measurement selected.
None	"Slot # of Emulator connected to Analyzer" - The software performance analyzer requires that, if more than one emulator is present in the card cage, the user must specify the slot number of the one which is in use. This prompt message is present upon first entry to the software performance analyzer when multiple emulators are present.

Appendix C

GLOSSARY OF SOFTKEY LABELS

INTRODUCTION

This appendix contains a list of, and definitions for, the softkey labels provided in the software performance analyzer software. The corresponding command line message is given for each softkey label and an explanation of the softkey label follows. An example is also given which shows the message as it would appear on the command line.

Softkey Label	Command Line Message
absolute	*data_absolute*

Used with the display command to specify that the information to be displayed for an event is compared with all activity in the entire program rather than just the events involved in the measurement.

```
"display data_absolute"
```

abs_file	*absolute_file*

Used with the setup command to provide the file name of the symbol file the analyzer uses to establish the physical address of symbols entered by the user.

```
"setup absolute_file FILENAME:USERID:0"
```

address	*address*

Used with measurement enable, disable, and window to indicate that the information which follows is either a physical address constant (specified in decimal, binary, hex, or octal) or a label whose address is to be "looked up" in the symbol table(s).

```
"setup measurement_enable_on address 33H"
"setup measurement_disable_on address ADDRESS"
"setup window enable_after address ADDRESS:FILENAME:USERID:0
   disable_after address ADDRESS file FILENAME:USERID:1"
```

address	*address_event*

Used with the define command to indicate that the information which follows defines an address event (by number and/or name). The address event may consist of an address, a module, or a line range from a compiled source listing.

```
"define address_event 1 named EVENT_1 as_address 1"
"define address_event 1 named MOD_1 as_module MODULE_1"
"define address_event 1 named EVENT_1 as_line_range 1 thru
   58 in_file FILE"
```

Softkey Label **Command Line Message**

address *as_address*

Used with the define command to indicate that the information which follows is either a physical address constant or a label whose physical address must be obtained from the associated symbol file(s).

"define address_event as_address 4000H"
"define address_event as_address ADDRESS"

address *as_address_events*

Used when defining a group to indicate that it is a group of address events being defined. The definition can be by event number or label, or a combination of each.

"define event_group GROUP as_address_events 1 thru 10 ,
LABEL_A thru LABEL_Z"

address *between_address_events*

When measuring intermodule duration, you must specify the events between which the duration is to be measured. This command indicates that the events to follow are for that measurement.

"measure intermodule_duration between_address_events X and
Y using_time_events_group TIME"

addr_evnt *of_address_event*

Used with the "measure module_duration" and "measure_module_usage" commands to indicate the event upon which the measurement is to be made.

"measure module_duration of_address_event PROC_1
using_time_events 1, 2, 4 thru 10"

addr_evnt *using_address_events*

Used with the "measure program_activity" and "measure memory_activity" commands to indicate that address events are to be used in the measurement.

"measure memory_activity using_address_events 1, 3, 5 thru
7, MATH_LIB"

addr_grp *using_address_events_group*

Used with the "measure program_activity" and "measure memory_activity" commands to indicate that a previously defined group of address events is to be used in the measurement.

"measure program_activity using_address_events_group
PROG_ACT"

Softkey Label **Command Line Message**

addr_pair *using_address_event_pairs*

Used with the "measure intermodule_linkage" command to indicate that pairs of address events are to be used in the measurement.

"measure intermodule_linkage using_address_event_pairs
CALCULATE to MATH_LIB"

always *always*

Used with the setup trigger_enable command to specify that the IMB trigger enable signal will always be true.

"setup trigger_enable always"

and *and*

Used in the intermodule duration measurement to specify the two event groups to be measured. It is also used in the setup specification to enter both the level of confidence percentage and the error percentage as parameters to terminate the measurement.

"measure intermodule_duration between_address_events 1 and
2 using_time_events_group TIME"
"setup measurement_termination percent_confidence_level 90
and percent_error 5"

append *append*

Used with the copy command when information is to be copied to a file. Indicates that the information is to be added on to the end of the file. The absence of the append command causes the information to be copied to overwrite the existing file, causing the existing information in that file to be lost.

"copy display to FILE append"
"copy measurement_setup to FILE append"

as_range *as_range*

Used when defining a time event to indicate that a time range follows.

"define time_event as_range 1 usec thru 4 seconds"

auto_peak *automatically_to_peak*

Used when rescaling the histogram display to call up the automatic rescale to peak mode. This mode zooms in on the displayed information by adjusting the boundaries of the display so that the longest bar fills the screen.

"rescale automatically_to_peak"

Softkey Label	Command Line Message
complete	*on_measurement_complete*

Used with "setup trigger_enable driven_only" command to indicate that the IMB trigger enable signal is to be driven by the software performance analyzer on measurement completion.
"setup trigger_enable driven_only on_measurement_complete"

confidenc	*percent_confidence_level*

Used with "setup measurement_termination" to specify the desired confidence level for the measurement. Valid entries are integer values from 51 through 99.
"setup measurement_termination percent_confidence_level 99"

configure	*configuration*

Used to "load_from" or "save_in" a file. The file is type "trace" and contains the entire configuration of the analyzer.
"configuration load_from SETUP:USER"

copy	*copy*

Used to copy the "event_assignments", "measurement_setup", "group_definitions", individual groups, or the display to a listing file or to the printer. The exception to this is that when a measurement is in progress, only the display can be copied to a listing file or to the printer.
"copy display to printer"

cur_meas	*current_measurement*

Used with the "show" command to select, for display, the latest measurement information, if available.
"show current_measurement histogram display data_absolute"

data_list	*event_data_list*

Used with the "display" and "show current_measurement" commands to specify that the raw statistical data is being displayed.
"display event_data_list"

default	*default*

Used with the "measurement_enable_on", "measurement_disable_on", "window", "event_period", and "measurement_termination" commands to default those conditions to (respectively) any_term, never, inactive, and 25 occurrences for duration measurements and 800 usec for activity and linkage measurements.
"setup window default"

Softkey Label **Command Line Message**

define *define*

Used to define events and groups for use in specifying measurements.
"define time_event 99 named TIME_99 as_range 1 usec thru 671 seconds"

disable *disable_after*

Used with the "window" command to establish the disable condition. If specified before the enable condition, the window starts in an enabled condition (see the definition for enable_after).
"setup window disable_after address 33H enable_after address 44H"

disable *measurement_disable_on*

Used with the "setup" command to specify the disable condition for the measurement.
"setup measurement_disable_on address range 33H thru 44H"

display *display*

Used in two ways as follows:

1. to alter the presentation of information acquired by the measurement, i.e.; display occurrences, time, data_relative, data_absolute, histogram, or event_data_list.
"display event_data_list"

2. to request that the display be copied to a file or to the printer.
"copy display to printer"

dont_care *dont_care*

Used with the "status" command and the protection level commands to indicate that no qualification of the data based on the status or level of protection is required.
"setup measurement_enable_on address 23H status dont_care"

drv_only *driven_only*

Used with "setup trigger_enable" to indicate that the IMB trigger enable signal is to be driven by the software performance analyzer on either measurement start or measurement completion.
"setup trigger_enable driven_only on_measurement_complete"

duration *module_duration*

Used with the "measure" command to specify a module duration measurement.
"measure module_duration of_address_event 1 using_time_events_group TM_MOD_ON"

Softkey Label	Command Line Message

enable *enable_after*

Used with the "window" command to establish the enable condition. If specified before the disable condition, the window starts in a disabled condition (see the disable_after specification).

"setup window enable_after address 33H disable_after address 44H"

enable *measurement_enable_on*

Used with the "setup" command to specify the enable condition for the measurement.

"setup measurement_enable_on address 33H"

end *end*

Used to end a software performance analysis session. The current configuration is saved in a file and the software returns to the next higher level (i.e.; the measurement_system). The configuration file is named SpaIJ:HP:trace; where I = the card slot of the control board (0 to 8), and J = the cluster address of the station (0 to 7 or 8 if stand alone).

"end"

enhanced *enhanced*

Used with the "copy display" command to indicate that each character in an enhanced video field on the display should be underscored in the output file.

"copy display to FILE enhanced"

error *percent_error*

Used with "setup measurement_termination" to specify the desired error tolerance for the measurement. Valid entries are integer values from 1 through 99.

"setup measurement_termination percent_error 1 and percent_confidence_level 99"

event_asn *event_assignments*

Used with the "copy" and "show" commands to indicate that the previously defined events are to be copied to either a file or a printer, or displayed on the screen.

"copy event_assignments to printer"

Softkey Label	Command Line Message

excluding *excluding_calls*

Used in a module duration measurement specification to indicate that calls outside the range of the event are not to be considered part of the event.

```
"measure module_duration of_address_event 1
  using_time_events_group TIME excluding_calls"
```

execute *execute*

Begins the execution of a measurement. If interaction on the IMB is involved, all analyzers are started simultaneously.

```
"execute"
```

file *file*

Used after entries for modules and labels to indicate that the file name of the originating source of the symbol follows. Also establishes a default file.

NOTE: A colon (:) may be used in place of pressing the *file* softkey.

```
"define address_event as_module PROC_1 file FILENAME:USERID"
```

followed *followed_eventually_by*

Used when specifying a measurement enable condition to establish a 2-deep sequence.

```
"setup measurement_enable_on address 33H followed_eventually_by
  address 44H"
```

group *event_group*

Used with the "define" command to either default, modify, or specify an event group.

```
"define event_group X"
"define event_group X modify"
"define event_group X as_address_events 1 thru 7"
```

groups *group_definitions*

Used with the "copy" and "show" commands to indicate that the previously defined groups are to be copied to a file or printer or to be shown on the display.

```
"show group_definitions"
"copy group_definitions to printer"
```

halt *halt*

Stops the measurement in progress. If IMB interaction is involved, all analysis modules are halted.

```
"halt"
```

Softkey Label **Command Line Message**

histogram *histogram*

Used with the "display" and "show current_measurement" commands to specify that the accumulated data from the measurement is to be displayed in histogram form.
"display histogram"

imod__dura *intermodule__duration*

Used with the "measure" command to specify an intermodule duration measurement.
"measure intermodule_duration between_address_events X and Y using_time_events_group TIME"

in__file *in__file*

Used after entering line numbers to indicate that the file name of the originating file (a compiled Pascal or C listing file) of the line numbers follows.
"define address_event as_line_range 10 thru 100 in_file FILENAME:USERID"

including *including__calls*

Used in a module duration measurement specification to indicate that calls outside the range of the event are to be considered part of the event.
"measure module_duration of_address_event 1 using_time_events_group TIME including_calls"

lin__range *as__line__range*

Used with the "define" command to indicate that the information to follow is a line range (specified from a compiled Pascal or C listing) whose physical addresses must be obtained from the associated symbol file(s).
"define address_event as_line_range 1 thru 10 in_file X"

line *line*

Used to specify either a line or line range from a compiled Pascal or C listing when setting up a window or a measurement enable or disable condition.
"setup measurement_disable_on line range 1 thru 10 in_file FILENAME:USERID"

linkage *intermodule__linkage*

Used with the "measure" command to specify an intermodule linkage measurement.
"measure intermodule_linkage using_address_event_pairs 1 to 2, X to Y"

Softkey Label	Command Line Message
load_from	*load_from*

Used with the "configuration" command to configure the entire software performance analyzer as specified in the file being loaded. The file being loaded is type "trace".

"configuration load_from SETUP:USER"

lower_lmt	*lower_limit_to*

Used with the "rescale" command to alter the lower limit of the histogram display to a user-specified percentage of 0 to 100 percent.

"rescale lower_limit_to 50"

measure	*measure*

Used to specify the type of measurement to be made.

"measure memory_activity using_address_events_group ADD_EVENTS"

memory	*memory_activity*

Used with the "measure" command to specify a memory_activity measurement.

"measure memory_activity using_address_events_group MEM_ACT"

modify	*modify*

Used when redefining groups or respecifying a measurement. Will cause the command line for the group or measurement to be recreated so that the command line can then be restructured.

"measure memory_activity modify"

module	*module*

Used with the "setup" command to indicate that a program module or module range will follow and the software performance analyzer symbolic interface will be required to obtain the physical address range from the associated symbol file(s).

"setup measurement_disable_on module PROC_1"

module	*as_module*

Used with the "define" command to indicate that the information to follow is a range whose physical addresses must be obtained from the associated symbol file(s).

"define address_event as_module PROCEDURE_X file X"

Softkey Label **Command Line Message**

msec *msec*

Used to indicate that the unit for a time_event or an event_period time duration is millisecond(s).
"setup event_period time_duration 100 msec"

named *named*

Used with the "define" command to name events (up to 15 characters) to simplify recognition of certain events in the user program. Used also when using the software performance analyzer symbolic interface to rename an event whose first 15 characters match a previously defined event.
"define time_event named MIN as_range 1 usec thru 10 usec"

occur *occurrence_count*

Used wih the "setup event_period" command to specify an event_period from 4 to 4294967295 occurrences.
"setup event_period occurrence_count 42"

occur *occurrences*

Used with the "display" command to specify that the information to be displayed is to come from the occurrence counters (not the time counters).
"display occurrences"

occurs *occurs*

Used with the "setup measurement_enable_on" command to specify that the particular condition of the enable sequence must occur N (when N = 1 to 65535) times before the condition is satisfied.
"setup measurement_enable_on address 33H occurs 100
followed_eventually_by address 44H occurs 200"

or *or*

Used as a logical combinatoric for inclusive ORing status terms or measurement termination conditions together.
"setup measurement_termination scan_count 500 or
total_event_count 600"

"setup measurement_disable_on address 88H status opcode
or write_mem"

period *event_period*

Used with the "setup" command to specify an event period other than the default condition, or to default an existing event period.
"setup event_period occurrence_count 75"

Softkey Label **Command Line Message**

printer *printer*

Used with the "copy" command to indicate that the requested information is to be listed on the system printer. This is available only if the analyzer mainframe is connected to a cluster system with a printer.

"copy display to printer"

program *program_activity*

Used with the "measure" command to specify a progran_activity measurement.

"measure program_activity using_address_events_group PROG _ACT"

protect *write_protect*

Used with the "configuration save_in <FILE>" command to prevent the accidental modification of the file with a later "configuration save_in" command. The file is protected against writes only within the software performance analyzer software. It can still be purged, renamed, or copied into from the system monitor level software.

"configuration save_in SETUP:USER write_protect"

range *range*

Used to indicate that a range of values is required rather than a single value.

"define address_event as_address range 33H thru 99H"

real_time *real_time*

Used in specifying program_activity and memory_activity measurements, on a maximum of two events, as being a real-time measurement (i.e.; the specified events are not sampled, they are continuously monitored).

"measure program_activity real_time using_address_events
1, 2"

received *received*

Used with the "setup trigger_enable"command to indicate that the software performance analyzer is to use the IMB trigger enable signal to enable its measurement.

"setup trigger_enable received"

relative *data_relative*

Used with the "display" command to specify that the information to be displayed for an event is compared with only the events involved in the measurement. All other system activity is ignored.

"display data_relative"

Softkey Label **Command Line Message**

repeat *repetitively*

Used with the "execute" command to cause the analyzer to begin another measurement as soon as the current measurement is completed. Measurements will repeat until the "halt" command is issued.
"execute repetitively"

rescale *rescale*

Used to alter the scaling of the histogram display. Includes the auto_peak, lower_lmt, upper_lmt, and to_limits options.
"rescale to_limits"

restart *restart_measurement*

Used during a measurement execution to reinitialize all counts to zero and start the measurement over.
"restart measurement"

resume *resume_display*

Available only after the display has been suspended using the "suspend" command. Used to cause the display to resume its updating functions. No data is lost during this transaction.
"resume_display"

save_in *save_in*

Used with the "configuration" command to save the entire software performance analyzer configuration in a file. This file is of the type "trace".
"configuration save_in SETUP:USER"

scan_cnt *scan_count*

Used with the "setup measurement_termination" command to specify a desired number of scans to be performed after which the measurement becomes complete. Count is valid from 0 to 4294967295.
"setup measurement_termination scan_count 4294967295"

seconds *seconds*

Used to indicate that the unit for a time event or an event period time duration is second(s).
"define time_event as_range 1 seconds thru 671 seconds"

Softkey Label	Command Line Message
setup	*measurement_setup*

Used with the "show" and "copy" commands to display, or copy to a file or printer, the parameters that have been set up that affect the measurement. These parameters consist of the following: termination conditions, event_period, window, measurement enable and disable, IMB trigger enable, and the absolute file.

"show measurement_setup"

setup	*setup*

Used to specify the following parameters (which may be required during a measurement session): termination conditions, event period, window, measurement enable and disable, IMB trigger enable, and the absolute file.

"setup absolute_file FILENAME:USERID"

show	*show*

Used to display any available information from the software performance analyzer data base. This data base consists of the following information: current measurement event data list and histogram, event assignments, group definitions and event information within the individual groups, and the measurement setup.

"show TIME_GROUP"

start	*on_measurement_start*

Used with the "setup trigger_enable driven_only" command to indicate that the IMB trigger enable signal is to be driven by the software performance analyzer on measurement start.

"setup trigger_enable driven_only on_measurement_start"

stats_off	*statistics_off*

Used to suspend the statistical calculations; resulting in a more frequent updating of the display during a measurement. When these calculations are suspended, the software performance analyzer is unable to terminate a measurement based on the percent error and/or the percent confidence level.

"statistics_off"

stats_on	*statistics_on*

Used to cause resumption of the statistical calculations after they have been suspended by the "statistics_off" command.

"statistics_on"

Softkey Label **Command Line Message**

status *status*

Used in the "measure memory_activity" mode and with the "setup measurement_enable_on" command. The status is set up to indicate a qualification based on a desired status condition. This status depends on the type of emulator that the software performance analyzer is connected to. The softkeys which appear on the softkey label line on the screen will be tailored to that particular emulator.

"measure memory_activity using_address_events_group MEM_ACT
status opcode or read_mem"

suspend *suspend_display*

Used to suspend the process of updating the display during a measurement. The process is resumed by using the "resume" command.

"suspend_display"

terminate *measurement_termination*

Used with the "setup" command to establish the termination conditions for a measurement.

"setup measurement_termination scan_count 100"

thru *thru*

Used with ranges to separate the minimum and maximum values of the range. Also used when specifying groups and measurements to delimit a range of events.

"define event_group TIME_GROUP as_time_events 1 thru 5"

time *as_time_events*

Used to assign specific time events to a specific event group.

"define event_group TIME as_time_events 4 thru 7"

time *time*

Used with the "display" command to indicate that the information desired to be measured and displayed is relative to time, not event occurrences.

"display time"

time *time_duration*

Used with the "setup event_period" command to indicate an event period based on time (as opposed to occurrences) is desired for the measurement.

"setup event_period time_duration 15 msec"

Softkey Label	Command Line Message
time	*time_event*

Used with the "define" command to indicate that the type of event being defined is a time event.

"define time_event as_range 1 usec thru 671 seconds"

Softkey Label	Command Line Message
time	*total_event_time*

Used with the "setup measurement_termination" command to indicate that the total event time is to be a factor in determining when the measurement is complete. The total event time entry is valid over the range of 1 usec to 671 seconds.

"setup measurement_termination total_event_time 45.02 msec"

Softkey Label	Command Line Message
time_evnt	*using_time_events*

Used with the "measure module_duration", "measure module_usage", and "measure intermodule_duration" commands to indicate that time events are to be used in the measurement.

"measure module_duration of_address_event MATH_LIB
using_time_events 1, 2, 4 thru 9, OVER_TIME"

Softkey Label	Command Line Message
time_grp	*using_time_events_group*

Used with the "measure module_duration", "measure module_usage", and "measure intermodule_duration" commands to indicate that a previously defined group of time events are to be used in the measurement.

"measure module_usage of_address_event MATH_LIB
using_time_events_group TIMES"

Softkey Label	Command Line Message
to	*to*

Used in an intermodule linkage measurement to indicate the direction of transfer is from one event "to" the other. Also used with the "copy" command to indicate where to copy the data to.

"measure intermodule_linkage using_address_event_pairs
CALCULATE to MATH_LIB"
"copy display to printer"

Softkey Label	Command Line Message
to_limits	*to_limits*

Used with the "rescale" command to indicate that the scaling on the histogram is to be based on the data taken at the time the command was executed using the minimum and maximum values of the data to establish the scale. This effectively "zooms" in on the data.

"rescale to_limits"

Softkey Label	Command Line Message

total_cnt *total_event_count*

Used with the "setup measurement_termination" command to indicate that the total event count is to be a factor in determining when the measurement is complete. The total_event_count entry is valid over the range of 0 to 4294967295.

"setup measurement_termination total_event_count 65536"

trig_en *trigger_enable*

Used with the "setup" command to indicate that the IMB trigger enable signal will be involved in the measurement.

"setup trigger_enable received"

upper_lmt *upper_limit_to*

Used with the "rescale" command to alter the upper limit of the histogram display to the user-specified percentage point (0 to 100).

"rescale upper_limit_to 75"

usage *module_usage*

Used with the "measure" command to specify a module usage measurement.

"measure module_usage of_address_event 1
using_time_events_group T_MOD_US"

usec *usec*

Used to indicate that the unit for a time event or an event period time duration is microseconds.

"setup event_period time_duration 500 usec"

window *window*

Used with the "setup" command to establish a measurement window for selectively qualifying measurement data based on the enable and disable conditions specified. The order in which they were specified will determine whether the window is initially open or closed.

"setup window enable_after address OPEN disable_after
address CLOSE"

Appendix D

SPECIFICATIONS

INTRODUCTION

This appendix provides the specifications for the software performance analyzer. The specifications are given in table D-1.

Table D-1. Software Performance Analyzer Specifications

Acquisition Rate: 5 MHz

Acquisition Width: 24 Address Bits, 8 Status Bits

Measured Events:
- 12 maximum, activity and duration measurements
- 6 maximum, linkage measurement
- 2 maximum, real-time activity measurements

Maximum Event Count: $2^{32} - 1$

Event Definitions: 99 maximum

Group Definitions: 16 maximum

Time Event Definitions: 1 usec to 671 seconds

IMB Functions: Trigger Enable (drive, receive)
Master Enable (receive)

Symbolic Interface: Automatically from 64000 symbol files

Termination Conditions:
- Time Duration - 1 usec to 671 seconds
- Occurrence Count - $2^{32} - 1$ maximum
- Scan Count - $2^{32} - 1$ maximum
- Confidence Level - 51 to 99 percent
- Error Tolerance - 1 to 99 percent

Measurement Qualification:
- Window
- Enable - 2 eventually followed by sequence terms
- Disable
- IMB Trigger Enable - driven on measurement start, complete
- IMB Master Enable - received always

Table D-1. Software Performance Analyzer Specifications (Continued)

Language Support:	C, Pascal, Assembly
Processor Support:	All 8 & 16 bit processors supported by HP 64000 emulators.

Index

INTRODUCTION

This index lists important terms and concepts contained in this manual and shows the location where they can be found. The keys for using this index are described below.

* Chapters - references to chapters appear as "Chapter X", where "X" represents the chapter number.

* Appendices - references to appendices appear as "Appendix Y", where "Y" represents the letter designator for the appendix.

* Figures - references to figures are represented by the capital letter "F" followed by the chapter (or appendix) figure number.

* Other Entries in the Index - references to other entries in this index are preceded by the word "See", followed by the reference entry.

a

b

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SALES & SUPPORT OFFICES
Arranged alphabetically by country

Product Line Sales/Support Key

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CM Components
C Computer Systems Sales only
CH Computer Systems Hardware Sales and Services
CS Computer Systems Software Sales and Services
E Electronic Instruments & Measurement Systems
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***RIO DE JANEIRO,** RJ*
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Jorge Calcagni y Cia. Ltda.
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Monjitas 454 of. 206
SANTIAGO
Tel: 395752, 398296
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International Engineering Associates
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67060
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CH,CM,CS,E,P

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Telex: 22481 AREEG KT
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E,M,A

Photo & Cine Equipment
P.O. Box 270
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W.J. Towell Computer Services
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P

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