Instructions

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12R01 PERFORMANCE ANALYSIS ROM PACK

A 1240 Logic Analyzer with the 12R01 Performance Analysis ROM Pack can be used to perform a variety of tasks in software and hardware analysis. Two alternate methods of analysis are available with the pack: State Overview and Event Measurement.

State Overview counts the occurrences of events within a defined range, and has the advantage of using the 1240's advanced triggering features to acquire the data that is to be processed. Event Measurement allows a variety of measurement techniques, such as counting clock cycles and occurrences, or taking time measurments. The two methods combined in this pack work together to provide a highly flexible software and hardware analysis tool.

Insert this manual at the back of your *1240 Logic Analyzer Operator's Manual*, or in the 1240 Optional Accessories binder.

PLEASE CHECK FOR CHANGE INFORMATION AT THE REAR OF THIS MANUAL

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OVERVIEW AND POWER-UP PROCEDURE

The Performance Analysis ROM Pack provides two separate features that aid in the development and test of software and hardware for microprocessor-based products.

State Overview. State Overview is used to look at the activity levels of various event ranges. The State Overview function lets you define up to 11 pairs of range values, entered as a lower bound, an optional name, and an upper bound. Each range is also associated with a specific channel group defined in the Channel Grouping menu.

Once the ranges have been entered, you begin acquiring data using the standard 1240 triggering. When an acquisition is complete, State Overview software searches the acquired data for matches between the ranges and the channel groups they are associated with. Each time an event falls within a range associated with the event's channel group, a counter for that range is incremented.

In the display, the total number of matches for each range is given. The total number of acquisition cycles that occurred on the given timebase are also counted. The percentage of matches to total acquisition cycles on the given timebase is shown as a histogram for each range.

See *State Overview* in section 2 of this manual for details and instructions.

Event Measurement. Event Measurement lets you take a closer look at event activity. The second feature, Event Measurement, provides an alternate method of analyzing data that does not use the normal 1240 triggering, but acquires data only on defined events. In Event Measurement, a *measurement* contains three elements: the start measurement event, an optional target event, and the stop measurement event.

If no target event is defined, you may choose to count the clock cycles during each measurement or time the duration of each measurement. If the target within the measurement consists of a single event, occurrences of the target event can be counted or timed during each measurement. If the target event consists of two events, the interval between these two events is timed during each measurement.

The statistical totals from all defined events can be compared in one menu. Or, if you desire a more detailed look at one event, the data acquired on an event can be broken into distribution intervals and viewed alone. See *Event Measurement* in Section 2 of this manual for details and instructions.

CAPABILITIES

The Performance Analysis ROM Pack allows the 1240 to perform a variety of hardware and software analysis tasks using entirely non-intrusive analysis methods. Some of the ROM Pack capabilities are:

- analyzing memory use
- determining activity levels of modules and sub-routines
- determining excecution time of program modules
- finding problem areas in the interface between hardware and software

OPTIONAL ACCESSORIES

No optional accessories are available with the 12R01 Performance Analysis ROM Pack.

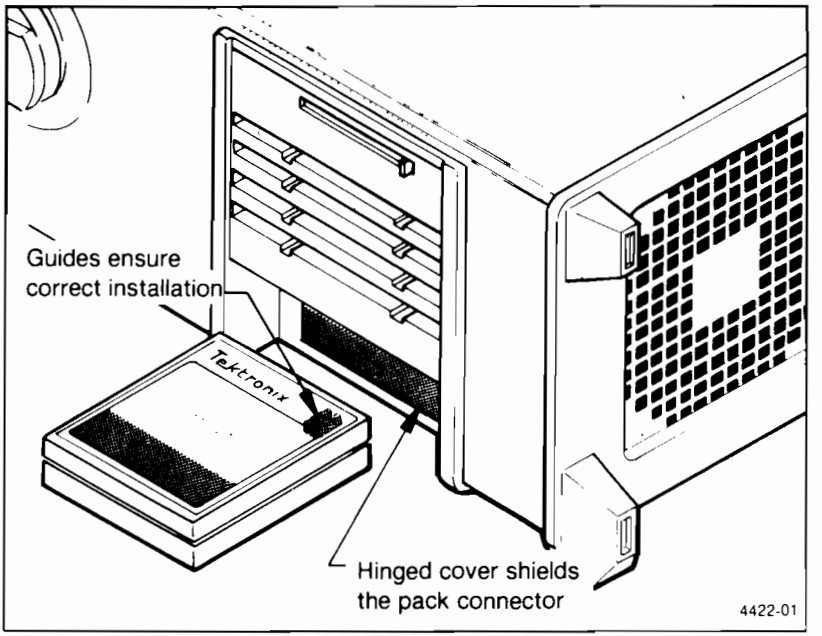


Figure 1-1. Installing a ROM pack.

Loading the ROM Pack Contents. If you install the Performance Analysis ROM Pack while power is off, the contents of the pack will be automatically loaded into the 1240 on powering up. To install the Performance Analysis ROM pack while power is on, you must first enter the Storage Memory Manager menu. Install the ROM pack, then press the LOAD NEW PACK soft key.

Removing the ROM Pack. To unload the ROM pack from the 1240 while power is on, enter the Storage Memory Manager menu, pull the ROM pack straight out of the 1240, then press LOAD NEW PACK. If power is off, simply pull the pack out of the 1240.

Power-Up Diagnostics. If 1240 power-up diagnostics reveal an error, the 1240 remains under diagnostic control. Refer to the *1240 Operator's Manual* for an explanation of power-up conditions. If no error is present, the 1240 automatically exits the diagnostic monitor and displays the Operation Level menu.

OPERATING INSTRUCTIONS

Overview

When the Performance Analysis ROM Pack is installed and loaded, a soft key labeled PERF. ANALYSIS MENU appears at the top of the Storage Memory Manager menu. Touching the PERF. ANALYSIS MENU soft key causes the Performance Analysis menu to appear. Use the Performance Analysis menu to access both the State Overview and Event Measurement menus provided by the 12R01 Performance Analysis ROM Pack.

PERFORMANCE ANALYSIS MENU

The Performance Analysis menu, shown in figure 2-1, is a control menu used only to select from the six other Performance Analysis menus. The first two menus listed, Enter Ranges and View Range Histograms, work together to provide the State Overview function. They have no interaction with the four menus listed under Event Measurement.

State Overview uses the Enter Ranges menu to define ranges, and the View Range Histograms menu to display data. Data acquired on ranges defined in the Enter Ranges menu is available only in the View Range Histograms menu. Event Measurement uses the Enter Events and Enter Display Ranges menus to define events and their displays, and the View One Event and Compare Several Events menus to display the data. Data acquired on events defined in the Enter Events menu will be available only in the View One Event menu or the View All Events menu.

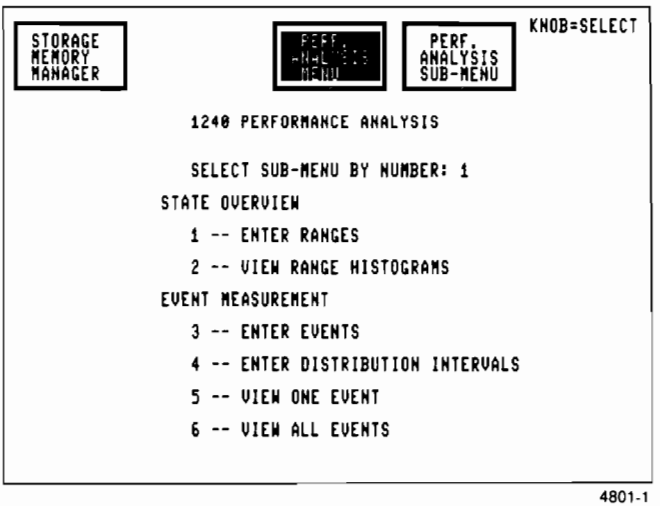


Figure 2-1. Performance Analysis menu. This menu has only one select field. Selections are 1-6. The State Overview selections do not communicate with the Event Measurement selections. When a valid input is received, this menu is exited and the selected menu appears. Using the data entry keys to enter a value causes the selected menu to appear immediately. If you use the SCROLL knob or SELECT keys to select a value, you must touch the PERF. ANALYSIS SUBMENU soft key to call up the chosen menu.

ENTER RANGES MENU

The Enter Ranges menu is used to define a lower and upper bound for up to 11 event ranges. Each range must be associated with a specific group from the Channel Grouping menu.

You may also enter an identifying name of up to eight characters for each range. To enter a name, use the data entry keys, SELECT keys, or SCROLL KNOB to select a character, then move the cursor to the next position. See callout 4 in Figure 2-2.

Ranges may be entirely distinct from each other, or they may overlap. The upper bound of a range is not included in the range. Events falling into more than one range will be counted in all ranges for which they are defined. For example, you might set up range 1 from 0 to 14, range 2 from A to 1E, and range 3 from 14 to 28 (all in hex). In that case, occurrences between 0 and 9 would count in range 1, occurrences between A and 13 would count in ranges 1 and 2, occurrences between 14 and 1D would count in ranges 2 and 3, and occurrences between 1E and 27 would count in range 3. If the lower bound event equals the upper bound event, then that single event forms a range.

The bound values must be entered in the input radix defined for their associated group. Only 11 digits can be entered in a bounds field. If more than 11 digits are necessary for the assigned channel group, the bounds field will automatically be switched to hexadecimal. This means that if you are using a binary radix and have more than 11 channels assigned to the group, you will have to make your bounds entries in hexadecimal.

NOTE

If you define a set of ranges, acquire data on them, then change the ranges, you must use BEGIN SAMPLING to get valid data. If you use CONTINUE SAMPLING to get new data, the data will be invalid.

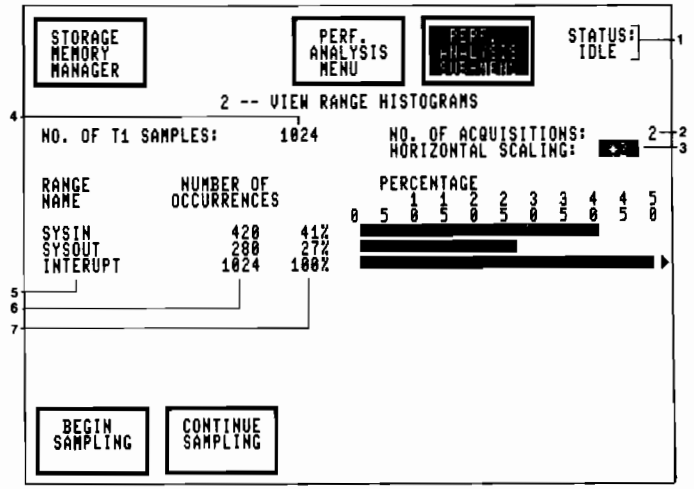
See Figure 2-2 for an example of the Enter Ranges menu with ranges defined.

VIEW RANGE HISTOGRAMS MENU

The View Range Histograms menu is used only as a data display: it has no select fields. Bars in the histogram are ordered by name in the same sequence as the Range Entry menu. If you enter ranges in the Enter Ranges menu and then start acquisition, this menu will appear immediately. If you start or continue acquisition in this menu, the menu begins displaying data as it is acquired. As with auto-run setups, using State Overview causes the 1240 to continue making acquisitions and updating the display screen until you press the STOP key, any of the Menu keys, or any of the Menu soft keys at the top of a screen.

In case of an overlap in ranges, data falling into more than one range will be counted and displayed in all applicable ranges. See the previous section on the Enter Ranges menu for an example.

The percentage for each range reflects the number of matches out of the total number of cycles acquired on its associated timebase. The presence of other ranges has no effect on that percentage.



1 Current State Overview status. Possible states are ACQUIRING, PROCESSING, and IDLE.

2 Number of samples that occurred on each timebase. If the 1240 is set up for one timebase, only that timebase will appear.

3 Triangular arrow indicates data extends off screen. Increase HORIZONTAL SCALING to see all data.

4 Total number of acquisitions made.

5 This is the range name you entered in the Enter Ranges menu. Ranges defined on T2 will have their names highlighted.

6 Total number of matches between the range and its group.

7 Percentage of matches out of the total number of events acquired on associated channel group. Histogram also represents this percentage.

4801-3

Figure 2-3. View Range Histograms. Example data has been acquired.

Soft Keys. On the bottom of all menus used in Event Measurement you will find soft keys labeled BEGIN SAMPLING and CONTINUE SAMPLING. The BEGIN SAMPLING soft key starts acquisition after setting all data or accumulated totals to zero. If you touch the BEGIN SAMPLING soft key in the View One Event menu, only the event you are viewing will have its values reset to zero. Any events not displayed will retain old data. The CONTINUE SAMPLING soft key also begins data acquisition, but adds the new data to the old rather than resetting the totals to zero. The DEFAULT EVENT SPEC. soft key in the Enter Event menu resets all event recognizer fields for the displayed event to X (don't care). The LOAD FROM ACTIVE CURSOR soft key loads the event from the active data cursor in the state table into the event recognizer field in which the cursor is located. Any glitches will also be loaded, even if the glitch display is OFF.

Data Display. Data acquired on events defined in the Enter Events menu is available in one of two menus. If you choose to display in the View All Events menu, all events are sampled. In that case, the summed times or counts of all samples (Start Measurement/Stop Measurement cycles) of each event can be displayed as the average of all samples, the largest single sample, or the smallest single sample. See *View All Events* later in this section for a detailed explanation.

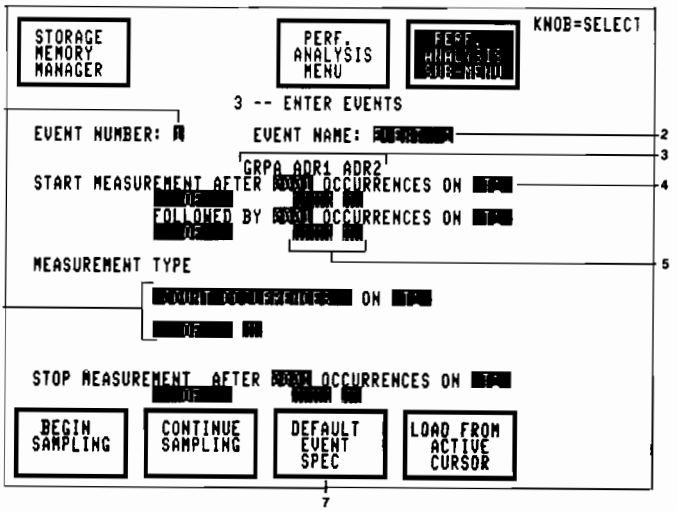
Defined events can also be sampled alone, with results displayed in the View One Event menu. These individual results are first divided into distribution intervals using the Enter Distribution Intervals menu. If you begin sampling using distribution intervals, each time the count (or time) from an event sample falls into a user-defined interval, the counter for that interval is incremented by one. See *Enter Distribution Intervals* later in this section for a detailed explanation.

ENTER EVENTS MENU

This menu is used to control data acquisition for Event Measurement functions. As previously described, the three main items to be specified in this menu are the Start and Stop measurement events, the target event, and the type of measurement to be used. Up to four separate events can be defined.

The five optional methods of collecting data during each sample are described below. These options are selected under MEASUREMENT TYPE, and are only selectable when you are in event 1 (indicated in the EVENT ENTERED field). When you change the MEASUREMENT TYPE in event 1, it is automatically changed for all events. This is necessary since the View All Events menu must have a common basis to compare the events by. The choice you make under MEASUREMENT TYPE affects the entire area marked by callout 6 in Figure 2-4.

None of the five measurement methods are cumulative. Each sample total is distinct, and it is never added to other sample totals. If you compare the events, the results can be shown as an average, maximum, or minimum value for each sample of an event. If you look at a measurement using distribution intervals, each sample is represented as a single increment in an interval group total.



1 Selections are 1-4. Up to four events may be defined, to be viewed alone, or together for comparison.

2 Use this field to name the event. The maximum number of characters in this field is 8. Select from letters A-Z, numbers 0-9, special characters / , . : ^ $ and a blank space.

3 Group names. Names associated with T2 are highlighted.

4 Selections are T1 and T2 if the 1240 is set up for dual-timebase operation. An event recognizer field can be associated with only one timebase. Your selection in this field determines which groups are displayed in the event value fields. In this figure, the Start Measurement event contains only groups associated with T1, and the target event contains only groups associated with T2.

5 Event recognizer fields, one field per channel group. The number of digits available in a field is determined by the input radix selected for that group in the Channel Grouping menu. You can select OF, or OF NOT to precede each event.

6 Selections are COUNT OCCURRENCES, COUNT CYCLES, MEASURE TOTAL TIME, TIME OCCURRENCES, and ACCUMULATE TIME. The configuration of this area is determined by your selection. COUNT OCCURRENCES has been selected in this figure. The MEASUREMENT TYPE can only be selected when you are in event number 1 (see callout 1). See Figure 2-5 for the effects of other selections on this area.

7 Resets the event recognizer fields to X (don't care), the iteration counts to 1, and OF NOT to OF. No change is made until you confirm the action by pressing the X (don't care) key.

4801-4

Figure 2-4. Enter Events menu. The Enter Events menu with COUNT OCCURRENCES selected.

The diagrams below give three examples of time measurements. All three diagrams begin sampling with:

START MEASUREMENT AFTER 1 OCCURRENCES ON T1 OF A
FOLLOWED BY 1 OCCURRENCES ON T1 OF B. The sample ends with: STOP MEASUREMENT AFTER 1 OCCURRENCES ON T1 OF C.

A Z represents any event that does not need to be specified.

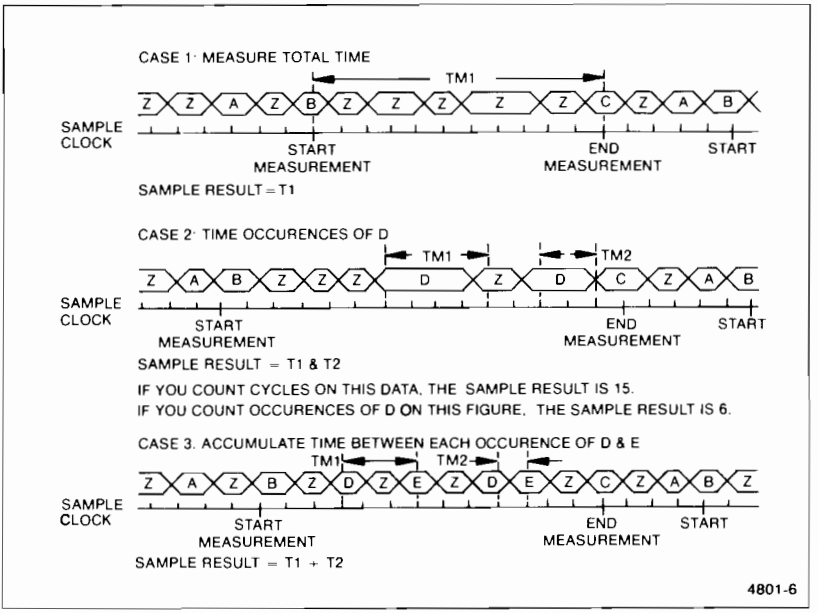


Figure 2-6. Diagrammed examples of Event Measurement.

ENTER DISTRIBUTION INTERVALS MENU

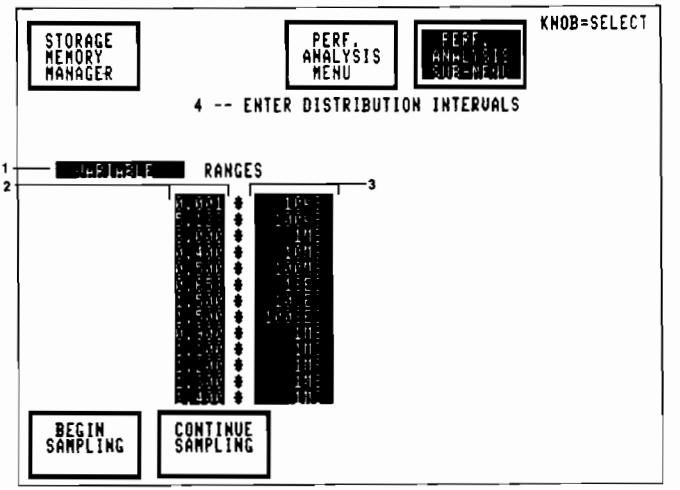
If you desire a more detailed look at one event using the Event Measurement function, you can divide sampled data for the event into distribution intervals. A distribution interval is a range of occurrences formed by a low-bound value and a high-bound value.

Since several measurement types are available in the Enter Events menu, the bound values can be by time or by count. After defining events in the Enter Events menu and entering distribution intervals, you begin taking samples. If a sample result falls into a defined distribution interval, the counter for that interval is incremented by one. For example, if you defined a distribution interval ranging from 20 ns to 50 ns, and took a sample that returned a value of 30 ns, the counter for the 20 to 50 ns interval would be incremented by one.

To gather data on the distribution intervals, you must begin sampling in the Enter Events menu, the Enter Distribution Intervals menu, or the View One Event menu. If you begin sampling in the View All Events menu, the distribution intervals are ignored.

10 ns, and two fields must be used to enter an interval value. The lefthand field is the multiplicand for the righthand field, which is a select field with entries ranging from 10 μs to 100 seconds. To enter time intervals smaller than 10 μs you must enter a decimal value in the left column. For example, to enter a bound value of 20 ns for a distribution interval, you must enter 0.002 in the left column and 10 μs in the right. Whether by count or by time, the upper bound of an interval is not included in the interval. When by count, the upper bound is one less than the stated value. When by time, the upper bound is 10 ns less than the stated value.

Another way of stating this is: low-bound $\leq X <$ high-bound. If the lower bound value equals the upper bound value, no interval is defined.



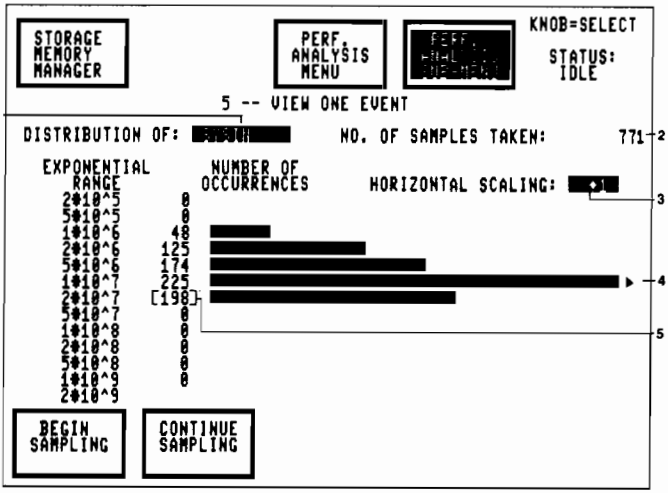
1 Selections are EXPONENTIAL, LINEAR, and VARIABLE.

2 If measurement is by time, this field takes inputs from 0 to 9.999. The number you enter here is used as a multplicand with the time select field (callout 3) to determine the value of the interval bound. If measurement is by count, you can enter numbers ranging from 0 to 11 digits, and the time field is not displayed.

3 Selections are 10 and 100 in microseconds (μs), and 1, 10, or 100 in milliseconds (ms) and seconds (s). This field is multiplied by the value in the previous field to determine the value of the interval bound. For example, the first interval determined in this figure is for values greater than or equal to 10 ns and less than 512.3 μs. The second interval is for values greater than or equal to 512.3 μs and less than 8 ms. This field is only displayed if measurement is by time.

4801-7

Figure 2-7. Enter Distribution Intervals menu with VARIABLE selected. Figure 2-8 shows the variations of the Enter Distribution Intervals menu with EXPONENTIAL and LINEAR selected.



1 Select the name of the event you want to see. Any event you defined in the Enter Events menu is available as a selection here.

2 Indicates the total number of samples taken for each event. If the defined events cover all possibilities, this field will be equal to the sum of the number of occurrences in each interval.

3 Selections are *1, *2, *5, *10, and *20. This field determines the relative size of the bar graph on the screen. A larger number gives a shorter graph.

4 Indicates the histogram extends off the screen. To see all data, increase the value in HORIZONTAL SCALING.

5 Indicates the number of times that the event occurred within the interval. In this callout the interval is $2*10\uparrow7 \leq X < 5*10\uparrow7$, and the event samples fell into that range 198 times. Histogram bars always represent the interval between the value listed on the same line and the value listed on the following line.

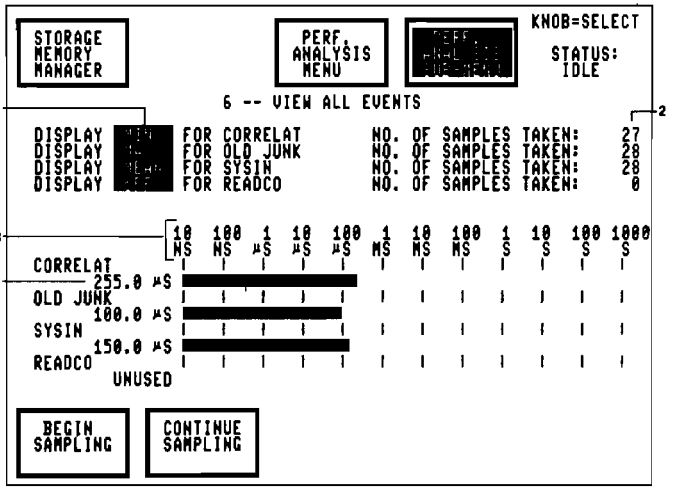
6 Resets data to zero and starts sampling for the event being viewed. Other events are unaffected.

4801-9

Figure 2-9. View One Event. Data has been sampled for EXPONENTIAL intervals.

NOTE

If you define distribution intervals, sample data, then change the intervals, you must use BEGIN SAMPLING to get valid data. If you use CONTINUE SAMPLING to get new data, the new data will be invalid.



1 Selections are MIN, MAX, MEAN, and OFF. If you select OFF, the field name will appear in the histogram, but no samples will be taken for that event and UNUSED will be displayed in place of the count or time. If you select MEAN, the average number of occurrences, cycles, or time for all samples of an event will be displayed. If you select MIN or MAX, the largest or smallest sample of an event will be displayed. Since this field can be changed while sampling, events may or may not be sampled the same number of times.

2 Tells the number of times that each defined event has been sampled. Since you can turn an event OFF or ON while samples are being taken, these numbers may vary greatly even though the events are sampled in sequence.

3 This example makes comparisons by time, with values ranging from 10 ns to 1000 seconds. If the comparison is by count, this field will be replaced by fields ranging from 1 to 10↑11.

4 This number is the cumulative mean, maximum, or minimum sample for the event. The histogram bar represents the same value. UNUSED indicates that OFF has been selected and the event was not sampled.

4801-10

Figure 2-10. View All Events menu. Example data has been sampled for three events.

APPLICATION EXAMPLES

The examples in this section are intended to show some of the capabilities of the Performance Analysis features. They will help familiarize you with the operation and interaction of the menus provided for State Overview and Event Measurement. All examples use entirely imaginary code and subroutine names. They are not intended as hands on experiments that you can set up and repeat.

These examples assume that you are familiar with the 1240 in general, and know how to make the necessary connections between the 1240 and a system under test.

Example One

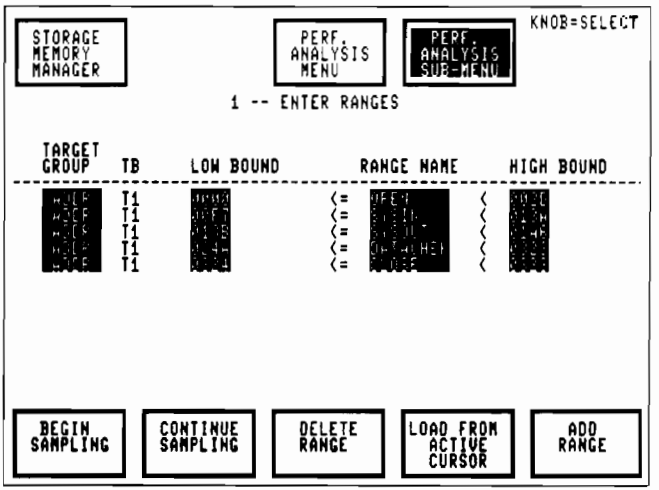
PART ONE

This example shows how to use State Overview to help improve the efficiency of a small program. We want to look at several of the subroutines in our code that we suspect might be taking a large piece of the execution time. Our example program will be 1000 bytes of code.

We must first set up the Timebase, Memory Config, and Channel Grouping menus to correctly acquire data from the microprocessor. Since we are using a short piece of code, we want to capture all of the data. To do this we will go into the Trigger Spec menu and set it up to acquire data on the first occurrence of any word (don't care) using the synchronous timebase. We will trigger after memory full with the trigger position in the center of memory.

The next step is to determine the exact addresses of the subroutines we are interested in. In this example the addresses will be in hexadecimal. We wish to look at five subroutines: Open, Sysin, Sysout, Datachek, and Close. Open starts at 0000 and ends at address 002D, Sysin starts at address 00F7 and ends at address 013A, Sysout starts at address 013B and ends at address 01A6, Datachek starts at address 024A and ends at address 0323, and Close starts at address 0324 and ends at address 03E7.

Figure 3-1 shows the Enter Ranges menu with these subroutines defined as ranges.



4801-11

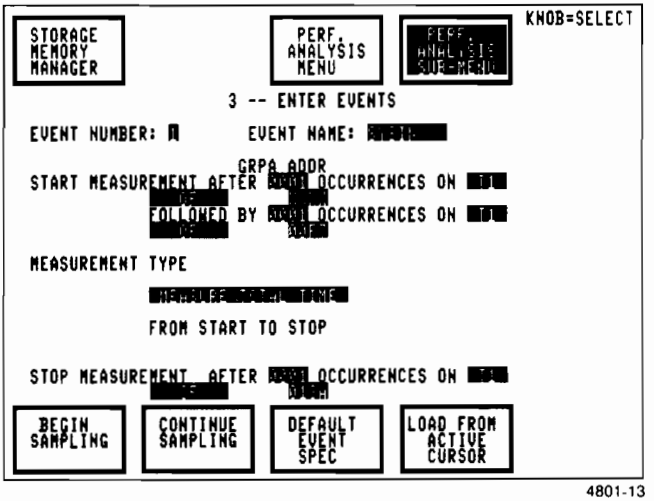
Figure 3-1. Example 1: Setup for Enter Ranges menu.

PART TWO

In this example we will use Event Measurement to look more closely at the Sysin and Open subroutines that we defined in part 1. Since State Overview only counts occurrences of state values falling in defined ranges, we need to use Event Measurement to see how much time is really being spent in those areas.

Unlike State Overview, Event Measurement does not use the standard 1240 triggering. This means that we must define measurement events to locate the data we wish to sample. We first go to the Enter Events menu, enter the name Sysin for event number one, and select MEASURE TOTAL TIME under MEASUREMENT TYPE. The first-level event recognizer in the Start Measurement event is set to X (don't care). For the second level of the Start Measurement event we use the same address that we previously used as the lower bound for Sysin in the Enter Ranges menu. We use the upper bound of the Sysin range as the Stop Measurement event.

This process is repeated in event number two for the area we have named Open. We do not make a selection under MEASUREMENT TYPE for Open, since that area is configured to match event number 1. Figure 3-3 shows the Enter Events menu setup Sysin.



4801-13

Figure 3-3. Example 1: Setup for Enter Events menu. Sysin is defined. The MEASUREMENT TYPE field is selectable only for Sysin, which is event number 1. The measurement type for event number 2, named Open, is automatically configured to match event number 1.By selecting MEASURE TOTAL TIME we will determine the actual time spent in each area.

Once these events have been defined, we must go to the Performance Analysis menu to access the View All Events menu. We then select MEAN in the VIEW EVENT field for both Sysin and Open.

We touch the BEGIN SAMPLING soft key, which causes the Event Measurement software to begin taking successive time measurements from each event. As samples are taken, the data is displayed in the View All Events menu. Regardless of the sample rate, the display is updated approximately once a second. Once a significant number of samples have been taken for each event we press the STOP key.

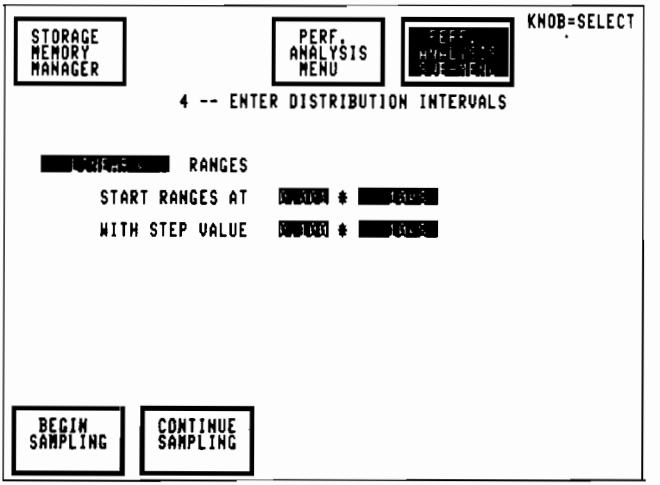


Figure 3-5. Example 1: Setup for Enter Distribution Intervals.

We then go to the View One Event menu, select Sysin as the EVENT BEING VIEWED, and touch the BEGIN SAMPLING soft key. As data from the Sysin event is acquired, the View One Event display will be updated. When we feel there is a significant amount of data displayed on the screen we press the STOP key. Figure 3-6 shows the View One Event display after acquiring data on the subroutine Sysin.

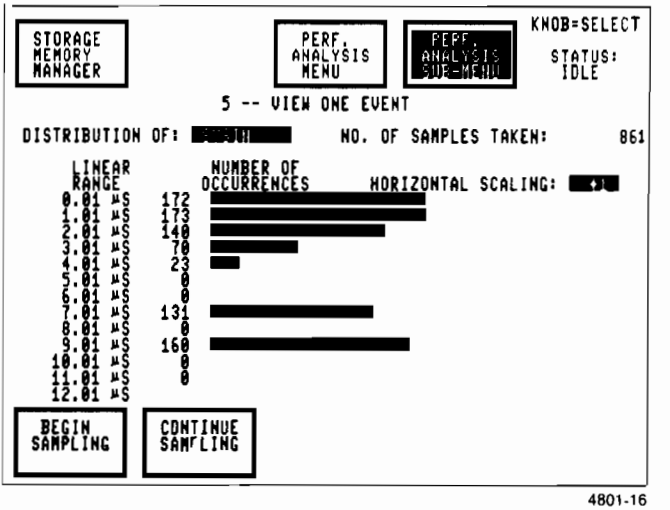


Figure 3-6. Example 1: View One Event display. Data is acquired for Sysin. This display shows that most samples tend toward the average, but that a number of them are disproportionately large.

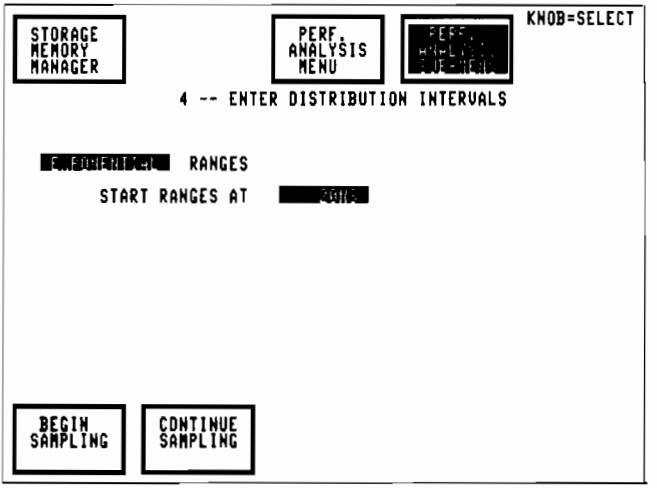


Figure 3-7. Example 2: Setup for Enter Distribution Intervals. As a first guess we have selected a base value of 50 NS. Defined ranges are shown in Figure 3-8.

Once this menu is set up we can touch the BEGIN SAMPLING soft key. The 1240 will go immediately to the View One Event menu, then begin acquiring samples and updating the display. Once a significant amount of data is displayed we press the STOP key to halt sampling. Figure 3-8 shows the View One Event menu with several hundred samples acquired.

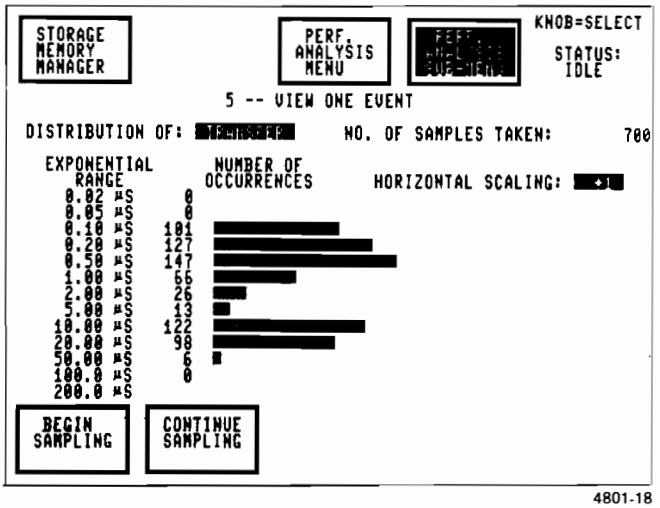


Figure 3-8. Example 2: View One Event display. This display shows some data for the subroutine Transfer.

APPENDIX A

STORING AND LOADING ROM PACK SETUPS

The 1240 provides a special feature that allows the user to store Performance Analysis ROM Pack-related setups in a 12RS01 RAM pack. This information can later be retrieved to configure the Performance Analysis menus, without repeating the time-consuming setup steps initially required.

STORING PERFORMANCE ANALYSIS SETUPS

To store the setups you have created while using your 12R01 Performance Analysis ROM Pack, you must take the following steps.

1. Enter the Storage Memory Manager menu, then remove the Performance Analysis ROM Pack.
2. Install a RAM pack in the slot vacated by the ROM pack.
3. Touch the LOAD NEW PACK soft key.
4. Select PA_SET in the FILETYPE field.
5. Select PACK in the STORE IN field on the new file line.
6. Touch the STORE NEW FILE soft key.

All user-supplied data relevant to the 12R01 Performance Analysis ROM Pack will be saved in the RAM pack.

LOADING SETUPS FROM RAM PACKS

To retrieve the Performance Analysis setups you have stored in a RAM pack, you must take the following steps in the Storage Memory Manager menu.

1. Install and load the Performance Analysis ROM Pack into the 1240.
2. Remove the ROM pack and replace it with the desired RAM pack.
3. Touch the LOAD NEW PACK soft key.
4. Select the PA_SET file in the FILETYPE field, then touch the LOAD FILE soft key.
5. Remove the RAM pack and install the Performance Analysis ROM Pack, then touch the LOAD NEW PACK soft key.

The Performance Analysis ROM Pack menus will be configured as they were when the PA_SET file was stored in the RAM pack.

REPLACEABLE PARTS LIST
PERFORMANCE ANALYSIS ROM PACK — 12R01

NUMBER	TEK. P/N	DESCRIPTION
ELECTRICAL (REFER TO SCHEMATIC IN 1240 SERVICE MANUAL)		
A43	670-8172-00	CRT. BOARD ASSY: 32/64K MEMORY ROM PACK (U200, U300 EPROMs ARE NOT PART OF A43)
A43C100	281-0775-00	CAP, FIXED, CER, DI: 0.1 uF, 20%, 50V
A43C400	281-0775-00	CAP, FIXED, CER, DI: 0.1 uF, 20%, 50V
		CHASSIS PARTS
U200	160-2458-00	MICROCKT, DGTL: 16384 x 8 EPROM, PRGM
U300	160-2457-00	MICROCKT, DGTL: 16384 x 8 EPROM, PRGM
MECHANICAL (REFER TO EXPLODED VIEW DRAWING)		
1	334-5228-00	1 MARKER, IDENT: MKD 12R01
2	200-2503-01	1 COVER, ROM PACK: TOP
		(ATTACHING PARTS)
3	211-0012-00	4 SCREW, MACHINE: 4.40 x 0.375, PHD, STL
		— — * — —
4	- - - - - -	CKT BOARD ASSY: 32/64K MEMORY ROM PACK (SEE A43 REPL)
5	131-0993-00	2 • BUS CONDUCTOR: 2 WIRE, BLACK
6	131-0608-00	6 • TERMINAL, PIN: 0.365 L x 0.025 PH BRZ GOLD
7	136-0755-00	2 • SKT, PL-IN ELEC: MICROCIRCUIT, 28 DIP
8	337-3122-00	1 SHIELD, ELEC: STATIC
9	200-2504-01	1 COVER, ROM PACK: BOTTOM
10	334-4727-00	1 MARKER, IDENT: MKD PROM PROGRAM IDENT
		STANDARD ACCESSORIES
	070-4801-00	1 MANUAL, TECH: INSTRUCTION

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* When an index entry has more than one page reference, the one in bold type is the primary reference.