Training Guide

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For Safety information, Warranties, and Regulatory information, see the pages behind the index

HP E2433-60010 Training Kit for HP Logic Analyzers

Logic Analysis made easy: a self-paced training guide

This book and its accompanying Logic Analyzer training board will quickly acquaint you with the features of the HP 16500C Logic Analysis System. After you have completed the following short exercises, you will have used most of the major features of the system. You will use the HP 16550A 100-MHz State/500-MHz Timing Analyzer, the HP 16534A Digitizing Oscilloscope, the HP 16517A 4-GSa/s Timing 1-GSa/s Synchronous State Analyzer, and the HP 16522A Pattern Generator modules.

You will also see how easy the HP 16500C Logic Analysis System is to use and, at the same time, learn basic digital measurement concepts.

The exercises in this training guide were selected to fit the most common configuration of the HP 16500C Logic Analysis System. However, if your system does not have all four of these modules, you will still benefit by doing the exercises designed for the modules you have. You may also benefit from reading through the exercises for the modules you do not have by learning what other measurement capabilities exist.

Materials needed

In order to do all of the exercises in this training kit you will need:

- One HP 16500C Logic Analysis System mainframe
- One HP 16550A 100-MHz State/500-MHz Timing Analyzer or HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer
- One HP 16534A Digitizing Oscilloscope
- One HP 16517A 4-GSa/s Timing, 1-GSa/s Synchronous State Analyzer
- One HP 16522A Pattern Generator
- One HP 10444A 10:1 oscilloscope probe (or equivalent)
- One HP 10461A TTL Data Pod
- This training kit (part number HP E2433-60010)

- Probe assembly (part number HP 01650-61608) or termination adapter (part number HP 01650-63203)

The Front-Panel User's Interface

The front-panel user's interface consists of the touch-screen display and the knob. In most of the steps you will touch fields that will bring up a pop-up menu from which you make a selection.

In many cases you will see the selection you want before you do a step. We purposely designed the exercises this way to make sure you would not get lost if, for any reason, the field contained a different selection. You may skip the step if the selection you want is already displayed.

The knob allows you to control the contents of many fields when the color of the field is light blue. It also allows you to move a cursor in some of the pop-up menus.

Configuration Disks

Your training kit includes two disks that contain configuration files for all of the exercises. The configuration files will default the system, then set up the analyzer or oscilloscope as if you had just completed the exercises in the previous chapter. The second disk contains all HP 16555 configuration files.

You do not need to use the configuration files to do any of the exercises if you are working straight through this training guide, chapter-by-chapter.

Getting Unexpected Results

If you get lost or the results of an exercise seem to be different than this guide indicates, the system may have a previously set configuration that prevents the exercise steps from working properly.

To remedy this you can recycle the power and restart the exercise or load the configuration files for the exercises you want to do.

In this book

This book is a fast-track guide to quickly acquaint you with the HP 16500C Logic Analysis System. You will learn how to set up the modules of the HP 16500C and begin making basic measurements right away.

This book was designed with two goals: to let you start at the beginning and progress chapter-by-chapter in a building block approach or to randomly access the exercises you want to do with minimum setup.

Chapters 1 through 9 contain measurement exercises designed to be completed quickly and to give you the knowledge and confidence you need to start making successful measurements in your work environment.

Chapter 10 contains the information you need to set jumpers on the Logic Analyzer Training Board and to load configuration files. However, you will only use chapter 10 occasionally.

Chapter 11 is a reference chapter describing the training board, along with a schematic diagram of its circuitry.

If you need additional details on the operation of your Logic Analysis System, refer to the User's manuals supplied with your system.

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1

Timing Analyzer Exercises

Timing Analyzer Exercises

Timing analysis in its simplest form means acquiring data and storing it at equal time intervals. The time interval is controlled by an internal clock just like a digitizing oscilloscope. However, there are key differences between a timing analyzer and a digitizing oscilloscope. These key differences are the high channel count of the timing analyzer versus the voltage resolution of the digitizing oscilloscope.

These exercises will step you through the process of using the timing analyzer. They are designed to show you how easy the timing analyzer is to use. You should do these exercises in the order given since they will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Change label names
- Modify bit assignments
- Set a trigger pattern
- Use the X-marker to read timing patterns

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use POW_UP1 on the second disk.

Starting the Exercises

1 Load the configuration files, POW_UP0 into System and POW_UP1 into 100/500 MHz LA.

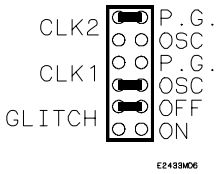
The files will default all system settings and then will set up the analyzer. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

2 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the Logic Analyzer Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

3 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Change a Label Name

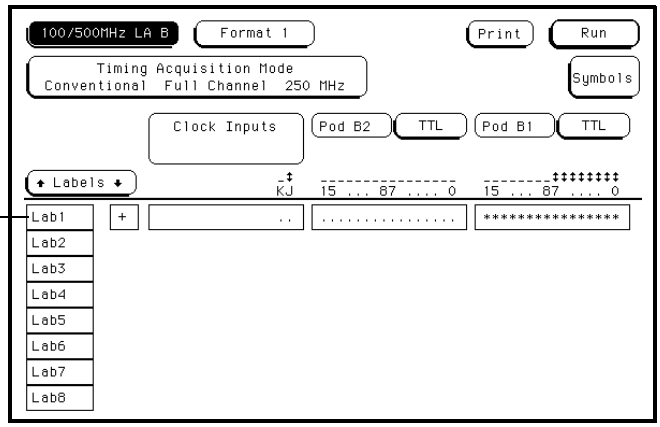
The timing analyzer uses labels to identify groups of channels assigned to it. You can give each label a name that represents a single channel or a group of channels. For example, you could use the label name DATA for all the channels you connect to the data bus of a microprocessor. In this exercise, you will change the default label name, Lab1, to TCOUNT, which represents *timing count*.

1. **Touch the top left field, then touch 100/500 MHz LA.**

   100/500 MHz LA may have already been selected in the top-left field before you did this step. The exercises are designed to make sure you would not get lost if, for any reason, the field contained a different selection. In the future, you may skip steps like these.

2. **Touch the field in the top row, second from the left, then touch Format 1.**
3. **Touch the Lab1 field under Labels, then touch Modify Label.**
4. **Type TCOUNT using the keys in the pop-up menu, then touch Done.**

   You can use the knob to backspace the cursor if you need to correct a typing error.



Changing a Label Name

Modify the Bit Assignments

When you assign bits to a label, you are grouping specific channels to that label. In this exercise you will assign the lower eight bits of Pod 1 to the label TCOUNT. To assign a channel to a label, you place an asterisk in the bit position for that channel in the pop-up.

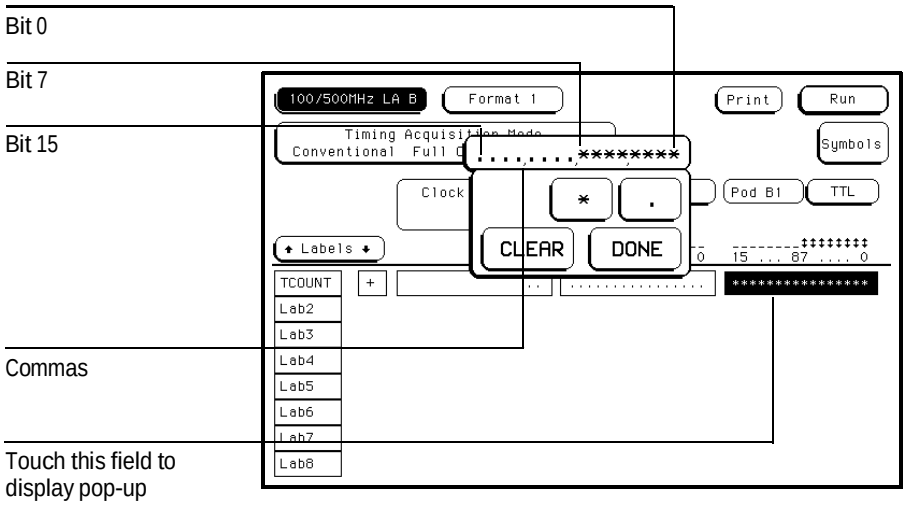
1. **Touch the field showing the 16 bits of Pod 1 (TCOUNT). The pop-up showing the bit assignments appears.**

   In this example, the Pod 1 designator is B1, which means the analyzer is in slot B of the mainframe. Your system configuration may be different, and the B can be any letter between A through J, depending where your analyzer module is located.

2. **Touch clear.**

3. **Using the knob, move the cursor to bit 7 in the pop-up. Then, touch the asterisk field to put asterisks in the lower eight bit positions. Touch Done.**

   Commas are located between each set of four bits to help you locate the bits. Bits are numbered 15 through 0 from left to right.



Modifying Bit Assignments

Set the Pattern for the Trigger

In order for the timing analyzer to store the data you want, you need to tell it when to trigger. In this exercise you will set the trigger in the Trigger menu so that the timing analyzer triggers when the pattern FF is present for more than 16 ns.

1 Touch the Format 1 field, then touch Trigger 1.

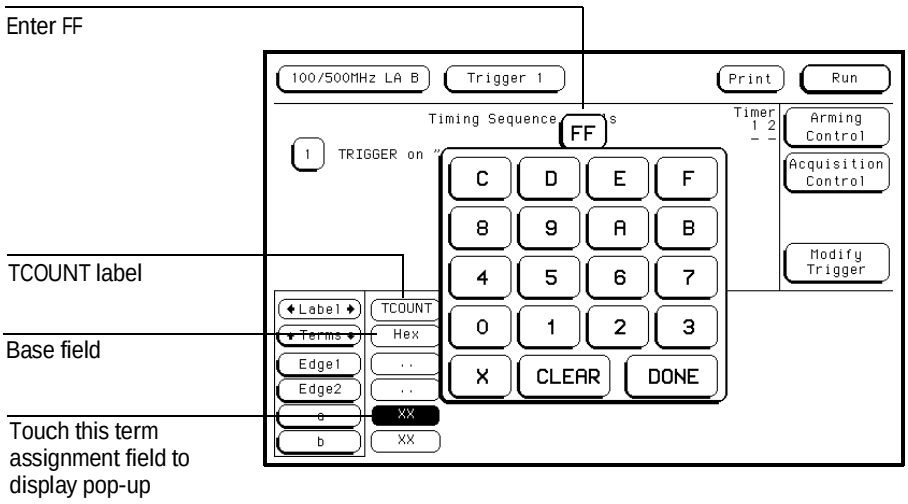
Notice that the TCOUNT label also appears in this menu.

2 Touch the base field to the right of the Terms field, then touch Hex.

3 Touch the term assignment field to the right of the term "a," then enter FF. Touch Done.

If the "a" term is not displayed, turn the knob counterclockwise until it is displayed.

4 Touch the "1" field in the Timing Sequence Levels box. In the pop-up, turn the knob to select 16 ns for the pattern duration. Touch Done.



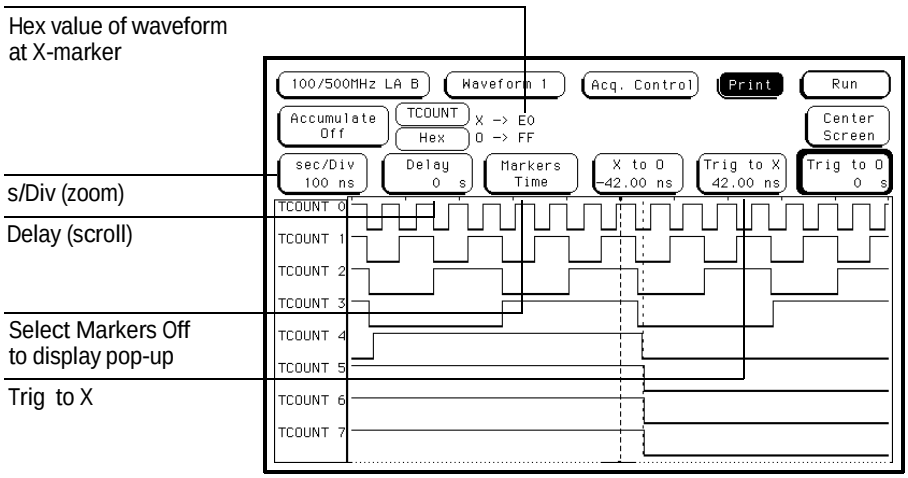
Setting the Pattern for the Trigger

Trigger on the Pattern and Examine the Trace

1. Touch the green Run field.

   The display automatically switches to the Waveform 1 menu and the s/Div field is highlighted in light blue. When a field is highlighted in light blue, you can control its function with the knob.
2. Turn the knob counterclockwise to zoom out and to display more of the data.
3. Touch the Delay field, then turn the knob in either direction to scroll through the data.
4. Touch the Markers Off field, then touch Time.
5. Touch the Trig to X field, then turn the knob.

   Turning the knob moves the X-marker position. As the X-marker position moves past transitions on the waveform, the hex value of TCOUNT changes, reflecting the current X-marker position.
6. Touch the Markers Time field, then touch Off.



Timing Waveform Menu

State Analyzer Exercises

State Analyzer Exercises

State analysis in its simplest form means acquiring data and storing it when it is valid for a system under test. The differences between a state analyzer and a timing analyzer are the source of the sample clock and the way the data is displayed. In order to make sure the data is valid, the clock that controls when the state analyzer samples data is supplied by the system under test. In other words, the state analyzer stores data synchronously. The data stored is merely highs and lows (logic 1s or 0s) on any number of lines from 1 to the maximum number of channels available in the state analyzer. The state analyzer displays the data as a sequential listing of logical states.

What makes the state analyzer more than just a synchronous data acquisition instrument is its capability to acquire and store only the data that you specify. This is called *data qualification*.

Examples of acquired data can be a subroutine in a program, all data being sent to a specified address in the target system, data leading up to a system failure, or certain lines of a microprocessor.

These exercises will step you through the process of using the state analyzer. They are designed to show you how easy the state analyzer is to use. You should do these exercises in the order given because they will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Connect the state analyzer
- Configure the state analyzer
- Change pod assignments
- Select the state clock
- Change a state label name
- Modify the state analyzer bit assignments
- Set the pattern for the state trigger

- Set the state trigger specification
- Run the state analyzer, view and change the state listing
- Assign symbols
- Select and view symbols

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH02 from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed the exercises in chapter 1, go to "Connect the State Analyzer" on the next page.

If you have not just completed the exercises in chapter 1, go to step 2.

2 Load the configuration files, POW_UP0 into System and CH02 into 100/500 MHz LA.

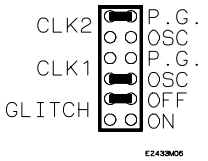
The files will default all system settings and then will set up the analyzer as if you had just completed the exercises in chapter 1. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the training board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Connect the State Analyzer

If you have a termination adapter, connect the adapter between Pod 3 of the logic analyzer and J2 on the training board, then go to the next page.

1 Connect Pod 3 of the logic analyzer to the probe assembly (see the figure below and the figure on the inside back cover).

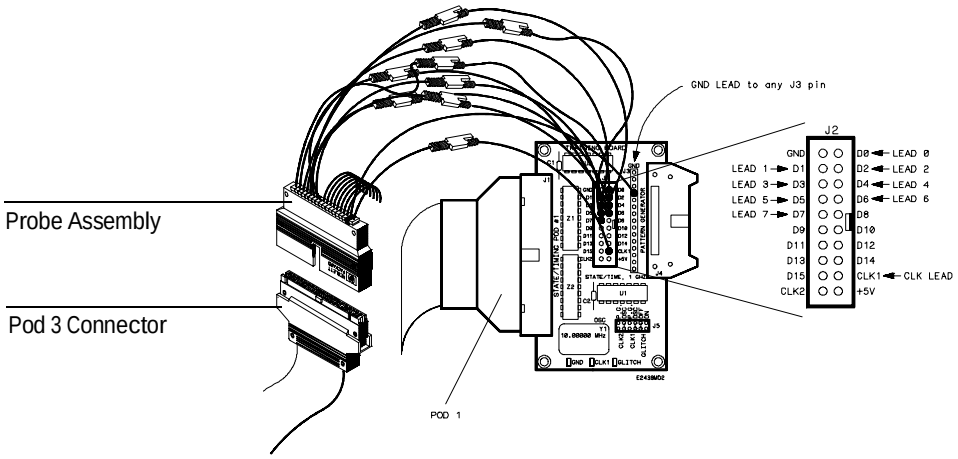
Pod 3 is the upper pod of the center connector when you are facing the rear of the logic analyzer.

Leave Pod 1 connected to J1 of the training board. Pod 1 provides the + 5 V power for the training board.

2 Connect the probe leads 0 through 7 to the pins D0 through D7 of J2.

3 Connect the clock lead of Pod 3 to the CLK1 pin of J2.

4 Connect the probe ground lead to any pin of J3.



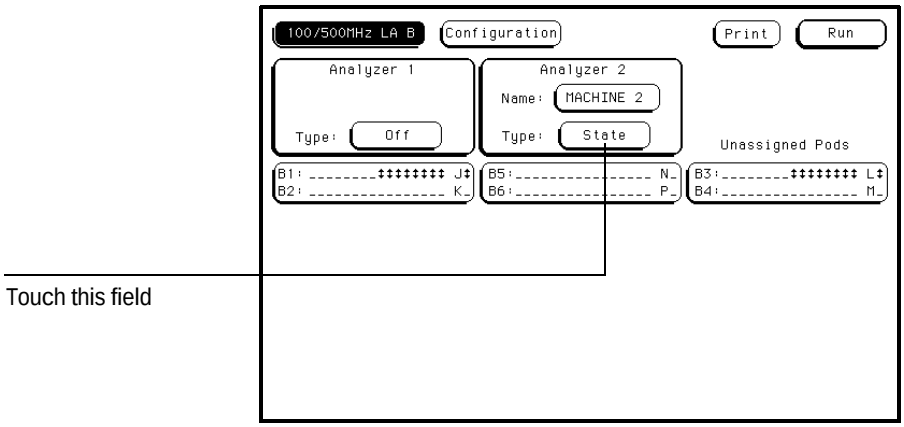
Connecting the Pod 3 Cable to the Probe Assembly

Configure the State Analyzer

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the second from the left field in the top row, then touch Configuration.
3. Touch the field to the right of Type in the Analyzer 2 box, then touch State.
4. Touch the Timing field to the right of Type in the Analyzer 1 box, then touch Off.

   The State/Timing analyzer provides two separate analyzers, named Machine 1 and Machine 2 by default. You can configure the state/timing analyzer as one single analyzer for state or timing, as one analyzer for state and one for timing, or as both analyzers as state analyzers. This configuration gives you the ability to view the system under test using both timing and state analyzers, or using two different state analyzers. One application is analyzing two microprocessors, each with a separate state analyzer.

   In this exercise, you will configure Analyzer 2 as the state analyzer. You will also switch off the timing analyzer to prevent it from interfering with the state analyzer measurement. By switching off the timing analyzer, you preserve the label and bit assignments so you can use them later.



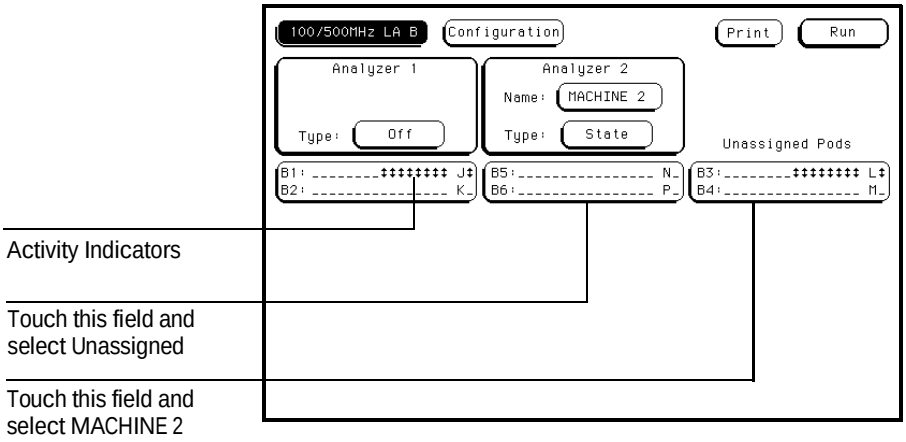
Configuring the State Analyzer

Change Pod Assignments

Pods 5 and 6 are assigned to Analyzer 2 by default; however, you will not be using them in this exercise. Because pod 3 is now connected to the training board, you will unassign pods 5 and 6 and assign pods 3 and 4 to Analyzer 2.

1. **Touch the Pods 5 and 6 field directly below the Analyzer 2 box, then touch Unassigned.**
2. **Touch the Pods 3 and 4 field under Unassigned Pods on the right, center of the menu, then touch Machine 2.**

   Notice the dashed lines and vertical arrows in the pod fields. These are activity indicators that show you the signal activity on each channel. In this exercise, pod 1 and pod 3 have arrows on the lower eight bits, indicating that transitions are occurring. Also, the L-clock in pod 3 shows activity. When a dash is showing at the bottom of the indicator field, it indicates that the channel is either a logic low, or that it is not connected. If the dash is at the top of the field, it indicates the channel is connected to a logic high.



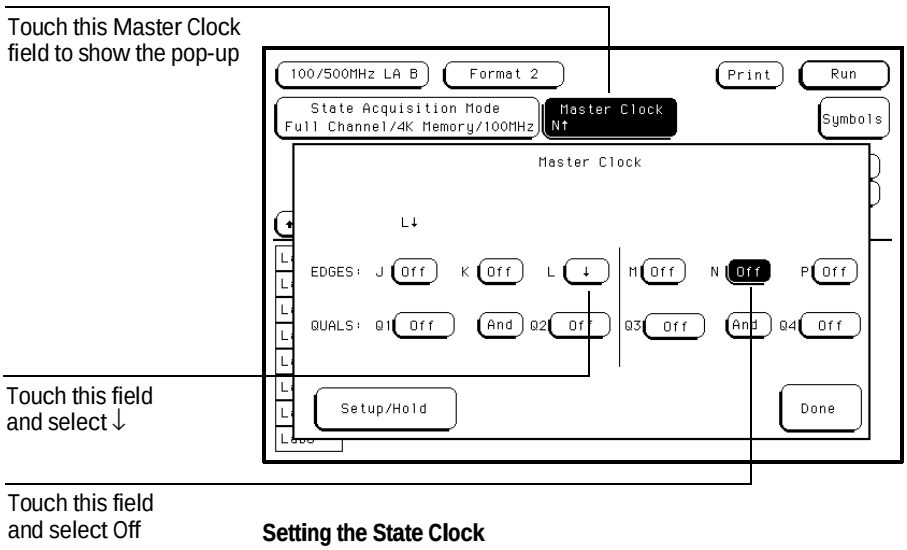
Changing Pod Assignments

Select the State Clock

1. Touch the Configuration field, then touch Format 2.
2. Touch the Master Clock field in the upper center of the display.
3. Touch the L field, then touch ↓ (down arrow).

   For this exercise, the L-clock is needed because Pod 3 is connected to the training board and is assigned to the state analyzer.
4. Turn other Master Clock fields off. For example, touch the N field, then touch Off. Touch Done.

   The state analyzer is clocked by external signals and the pods provide clocks J through P on pods 1 through 6, respectively. The six clocks can be used independently, in various combinations, or turned off. The down arrow represents a negative edge, and this is what clocks the state analyzer in this exercise.



Setting the State Clock

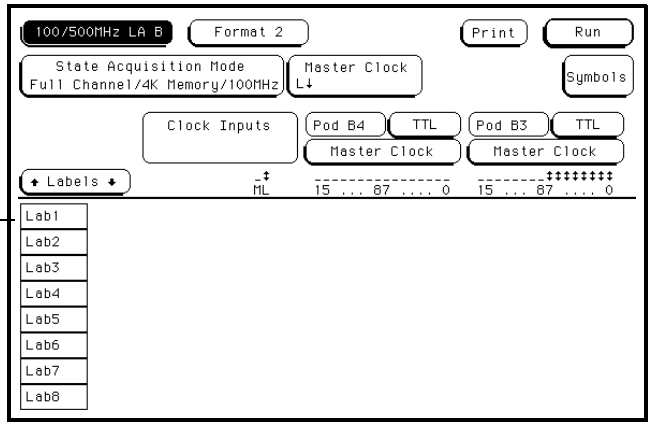
Change a State Label Name

1 Touch the top field below the Labels field, then touch Modify Label.

2 Type SCOUNT using the keys in the pop-up menu, then touch Done.

In order to keep track of the counter output when it is acquired by the state analyzer, you have named a label SCOUNT for the state analyzer exercises.

See Also "Change a Label Name" on page 1–4 for a detailed explanation of label names.



Changing the State Label Name

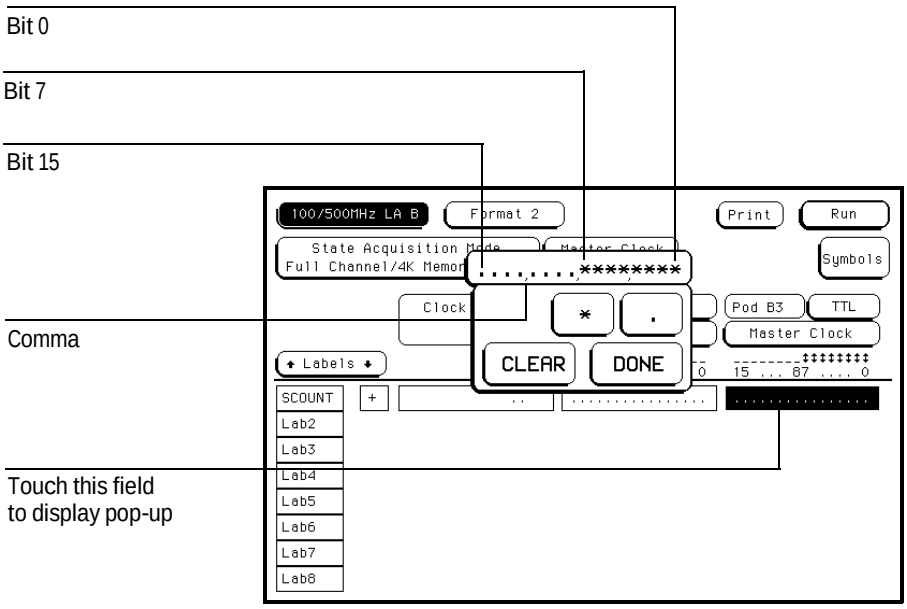
Modify the State Analyzer Bit Assignments

1. Touch the field showing the 16 bits of Pod 3. The pop-up showing the bit assignments appears.
2. Using the knob, move the cursor to bit 7 in the pop-up. Then, use the asterisk field to put asterisks in the lower eight bit positions. Touch Done.

   Commas are located between each set of four bits to help you locate the bits. Bits are numbered 15 through 0 from left to right.

   Because you are using Pod 3 for the state analyzer, you have assigned the lower eight bits of Pod 3 to the label SCOUNT.

See Also "Modify the Bit Assignments" on page 1–5 for a detailed explanation of bit assignments.



Modifying Bit Assignments

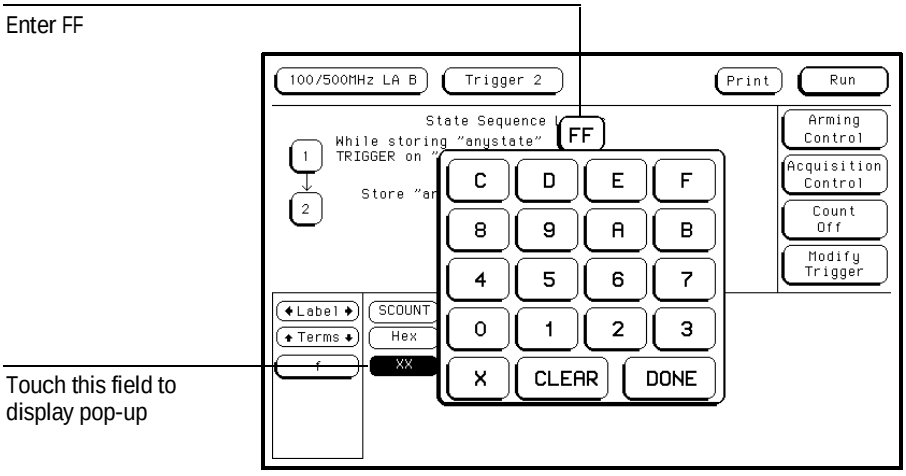
Set the Pattern for the State Trigger

1. Touch the Format 2 field, then touch Trigger 2.
2. Touch Assign, touch "f," then touch Done.

   All the terms are assigned to Analyzer 1 by default. You can assign any of the terms to Analyzer 1 or to Analyzer 2. For this exercise, a term is required for Analyzer 2, so the "f" term is assigned.
3. Touch the Base field under the SCOUNT label, then touch Hex.
4. Touch the field to the right of "f."
5. Enter FF using the pop-up. Touch Done.

   The "f" field is a term to which a pattern can be assigned. In this exercise, the State Trigger Specification will use term "f" as FF to trigger the state analyzer.

   The state analyzer is capable of being triggered in many different ways, including multilevel qualifying, branching, qualified storage, and sequence levels.

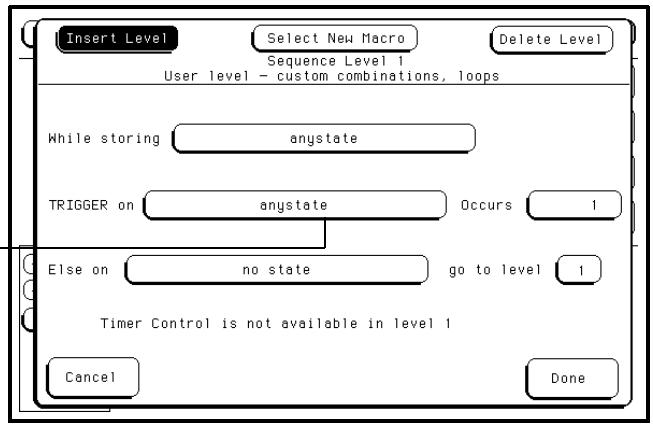


Setting the Pattern for the State Trigger

Set the State Trigger Specification

1. Touch the "1" field in the State Sequence Levels box of the Trigger 2 menu. The Sequence Level 1 pop-up appears.
2. Touch the field to the right of the "Trigger on" field, then touch "f" in the pop-up. Touch Done.
3. Touch the "2" field in the State Sequence Levels box. Touch the field to the right of "Store," then touch "anystate." Touch Done.

   The State Trigger Specification will read "while storing any state, trigger on 'f' (FF) 1 time, then store any state." The state analyzer stores any state, starting when you touch run and until FF is found. The state analyzer will then continue storing any state until the remaining acquisition memory is filled.



Setting the State Trigger Specification

Run the State Analyzer, View and Change the State Listing

1 Touch the green Run field.

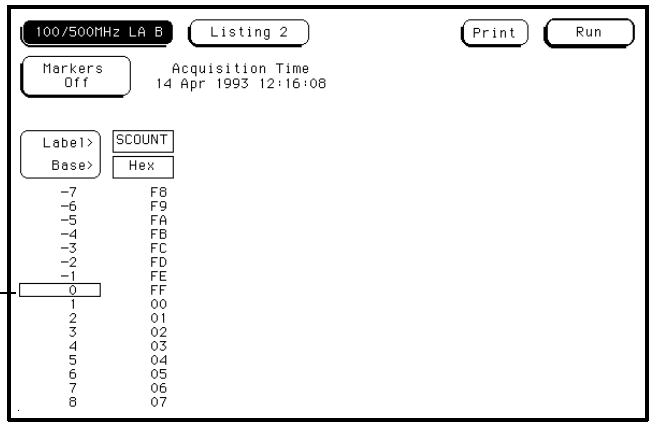
The display automatically changes to the State Listing.

2 Observe the State Listing is now displaying the output of the ripple counter in hexadecimal with FF centered vertically in the listing under the SCOUNT label.

When the listing is in hexadecimal, FF is centered and to the right of a light blue field in which 0 is displayed. The zero line number corresponds to the trigger point specified in the Trigger Specification menu. The negative line numbers indicate the states stored prior to the trigger point.

3 Touch the Hex field directly below the SCOUNT label, then touch Decimal. The state listing is now displayed in decimal.

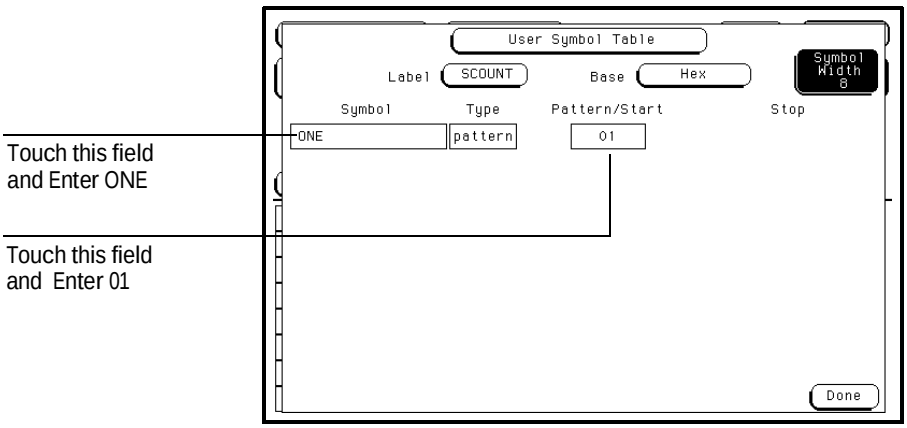
When the listing is in decimal, 255 is displayed instead of FF.



State Listing Menu

Assign Symbols

1. Touch the Listing 2 field, then touch Format 2.
2. Touch the Symbols field below the green Run field.
3. Touch the New Symbol field near the top-left corner of the pop-up. Type ONE using the keys in the pop-up. Touch Done.
4. Touch the field below Pattern/Start. Enter 01 in the pop-up. Touch Done.
5. Touch the "ONE" field below Symbol, then touch Add a Symbol. Type TWO using the keys in the pop-up. Touch Done.
6. Touch the field to the right of the TWO under Pattern/Start. Enter 02 in the pop-up. Touch Done.
7. Touch the "TWO" field. Then, repeat steps 5 and 6 to enter a symbol, THREE, with a value of 03. Touch Done.
8. Touch Done to exit the menu.



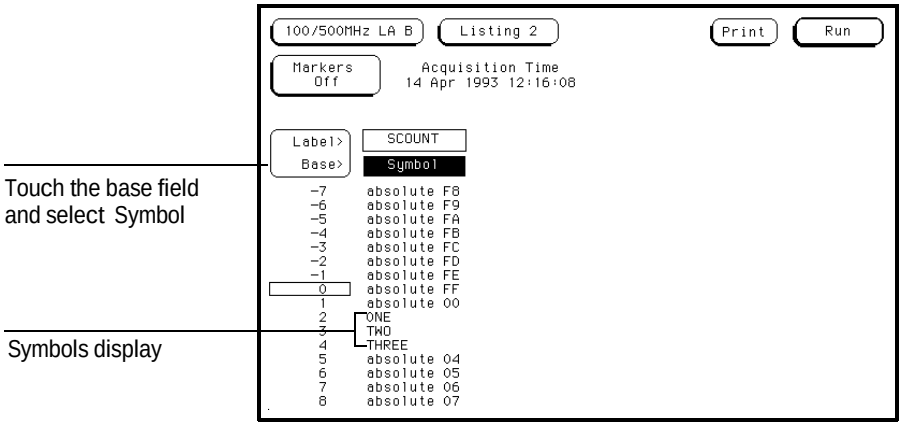
Assigning Symbols

Select and View Symbols

1. Touch Format 2, then touch Listing 2.
2. Touch the base field under the SCOUNT label, then touch Symbol. ONE, TWO, and THREE are displayed in the State Listing in place of the numeric counts 01, 02, and 03, respectively.

   Symbols are helpful when viewing more complex listings. For example, if you are monitoring a microprocessor's status lines with unique patterns for READ and WRITE strobes, you can assign symbols to these patterns. Then as you scroll through the listing, you would see READ and WRITE instead of the numerical patterns.
3. Touch the Symbol field under SCOUNT label, then touch Hex.

   Step 3 changes the base back to hexadecimal for the rest of the exercises.



State Listing with Symbols

State Compare Exercises

State Compare Exercises

State Compare allows you to compare two state listings.

These exercises will step you through the process of using the Compare mode of the state analyzer. They are designed to use many of the same exercises as the State Analyzer Exercises in the previous chapter; therefore, the beginning exercises do not include figures. If you need a visual reminder on any of these common exercises, refer back to the same exercise in chapter 2, "State Analyzer Exercises."

In this chapter you will:

- Connect the state analyzer
- Configure the state analyzer
- Change pod assignments
- Select the state clock
- Change a state label names and assign bits
- Set the pattern for the state trigger
- Set the state trigger specification
- Run the state analyzer, view the state listing
- Copy the state listing to the compare image
- Rerun the state analyzer and find the errors

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH03 from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed the exercises in chapters 1 and 2 and you are using the HP 16550 for this exercise, go to "Set the Pattern for the State Trigger" on page 3–6. On the other hand, if you have just completed the exercises in chapters 1 and 2 and you are using the HP 16555 for this exercise, go to "Configure the State Analyzer" on page 3–5.

If you have not just completed the exercises in chapters 1 and 2, go to step 2.

2 Load the configuration files, POW_UP0 into System and CH03 into 100/500 MHz LA.

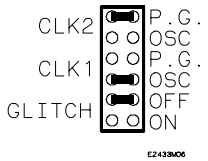
The files will default all system settings and then will set up the analyzer as if you had just completed the exercises in chapters 1 and 2. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the training board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



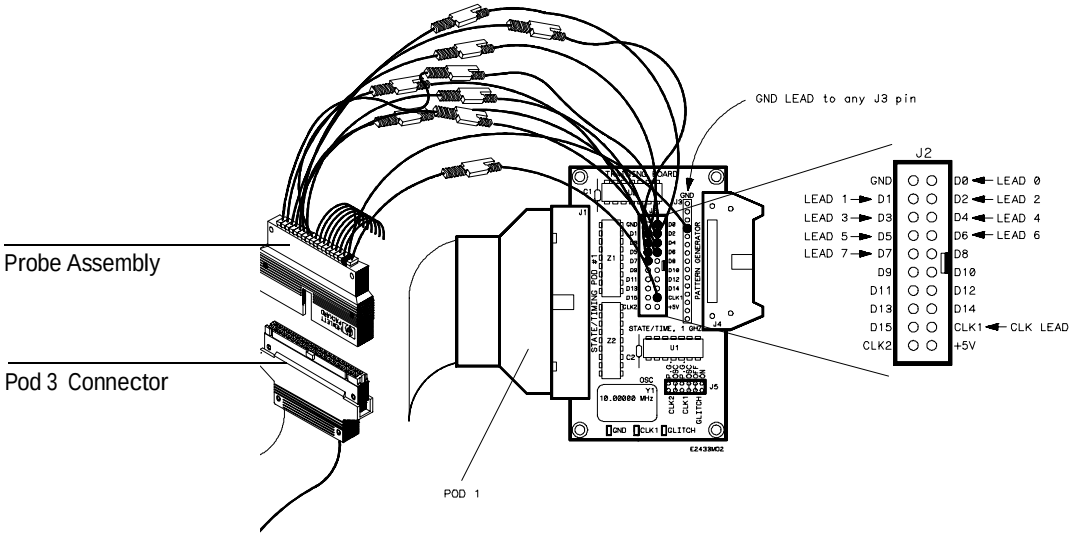
Connect the State Analyzer

If you have a termination adapter, connect the adapter between Pod 3 of the logic analyzer and J2 of the training board, then go to the next page.

1 Connect the Pod 3 connector to the probe assembly (see the figure below and the figure on the inside back cover).

Leave Pod 1 connected to J1 of the training board. Pod 1 provides the + 5 V power for the training board.

2 Connect the probe leads 0 through 7 to the pins D0 through D7 of J2.
3 Connect the probe ground lead to any pin of J3.
4 Connect the clock lead of Pod 3 to the CLK1 pin of J2.



Connecting the Pod 3 Cable to the Probe Assembly

Configure the State Analyzer

Start here if you are using the HP 16555 and have just completed chapter 2.

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from the left, then touch Configuration.
3. If you are using the HP 16555, touch State Compare in the Analyzer 2 box. Otherwise, touch the field to the right of Type in the Analyzer 2 box, then touch State (see the figure on page 2–5).
4. Touch the field to the right of Type in the Analyzer 1 box, then touch Off.

Change Pod Assignments

1. Touch the Pod 5 and 6 field directly below the Analyzer 2 box, then touch Unassigned.
2. Touch the Pod 3 and 4 field under Unassigned Pods, then touch Machine 2 (see the figure on page 2–6).

Because the Pod 3 is now connected to the training board, it must be assigned to the state analyzer, which is now Analyzer 2 (named *Machine 2* by default).

Select the State Clock

1. Touch the Configuration field, then touch Format 2.
2. Touch the Master Clock field directly below the Format 2 field.
3. Touch the L field, then touch ↓ (down arrow).
4. Touch the P field, then touch Off. Touch Done (see the figure on page 2–7).

Change a State Label Name and Assign Bits

1. Touch the top field under Label, then touch Modify Label.
2. Type SCOUNT using the keys in the pop-up menu, then touch Done (see the figure on page 2–8).
3. Touch the field showing the 16 bits of Pod 3 (SCOUNT). The pop-up showing the bit assignments appears.
4. Using the knob, move the cursor to bit 7 in the pop-up. Then, touch the asterisk field to put asterisks in the lower eight bit positions. Touch Done (see the figure on page 2–9).

Set the Pattern for the State Trigger

Start here if you are using the HP 16550 and have just completed chapter 2.

1. Touch the field in the top row, second from the left, then touch Trigger 2.
2. Touch the field to the right of "f" below the SCOUNT label.
3. Enter FF using the pop-up. Touch Done.

Set the State Trigger Specification

1. Touch the "1" field in the State Sequence Levels box. The Sequence Level 1 pop-up appears.
2. Touch the field to the right of the "While storing" field, then touch "no state" from the pop-up.
3. Touch the field to the right of the "Trigger on" field, then touch "f" in the pop-up. Touch Done.
4. Touch the "2" field in the State Sequence Levels box. Touch the field to the right of Store, then touch "anystate." Touch Done.

   Since the number of states stored before the trigger point (prestore) will vary, the State Compare function will always identify some portion of the prestored data as different from the original data. This is eliminated by setting the analyzer to store "no state" before the trigger.

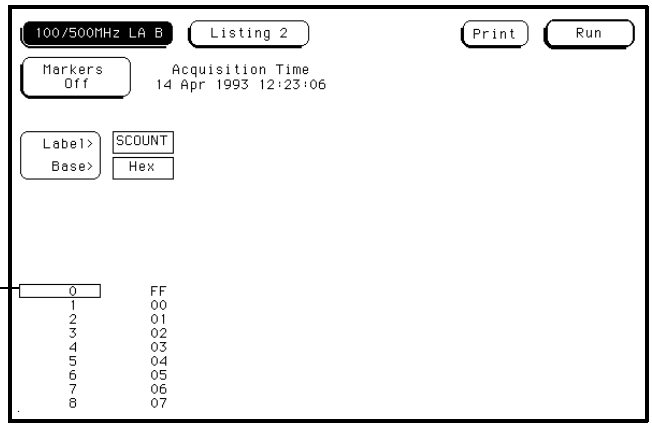
Run the State Analyzer, View the State Listing

1 Touch the green Run field.

The display automatically changes to the State Listing.

2 Observe the State Listing is now displaying the output of the ripple counter in hexadecimal with FF at the top of the listing under the SCOUNT label.

When the listing appears, FF is at the beginning of the listing and to the right of a light blue field in which 0 is displayed. The zero line number displays the trigger point specified in the Trigger Specification menu. There are no negative line numbers preceding the trigger point since the pretrigger specification was set to "While storing no state."



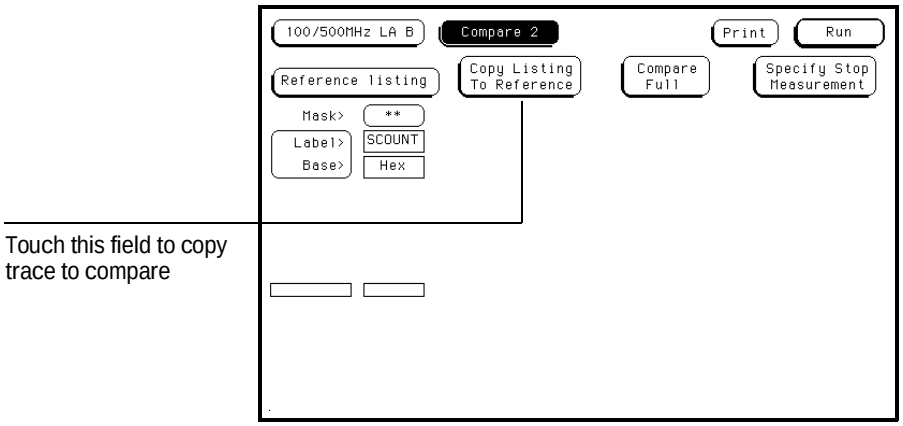
State Listing

Copy the State Listing to the Compare Image

1. Touch the Listing 2 field, then touch Compare 2.
2. Touch the Copy Listing to Reference field, then touch Execute in the pop-up.

   The state listing acquired in the previous exercise is now stored as the reference listing to which the next state listing will be compared.

   This feature can be used in a test environment where you want to check to make sure hardware is passing correct states. You can acquire a state listing from the hardware under test and compare it to a listing that is known to be good. If there are errors, the Difference listing will show you if there are any bad states and where they occur.

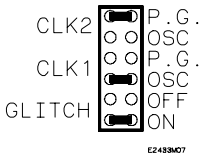


Copying a Trace to Compare

Change the Jumper

Changing the glitch jumper changes bit 7 of the counter so that some of the acquired states will not match the original listing. After you change the jumper, you will acquire the data again in the next exercise, then compare it to the data you stored to the Compare Image.

1. Pull the glitch jumper from the pins labeled Off.
2. Push the jumper onto the glitch pins labeled On.



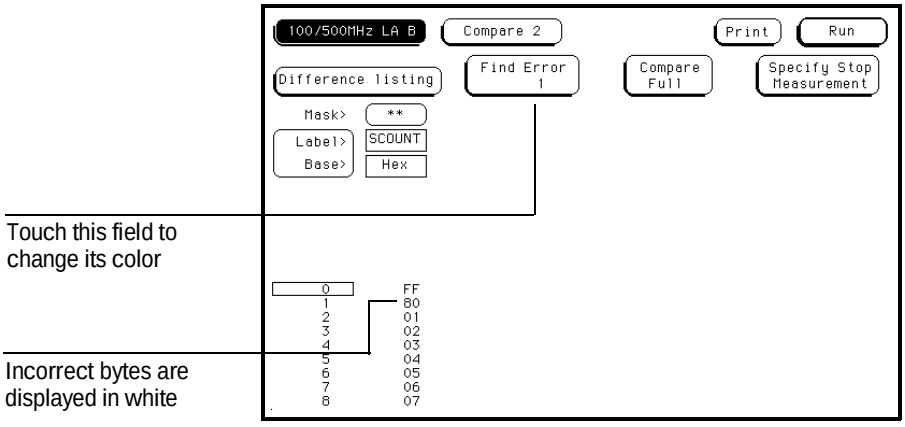
Run the State Analyzer and Find the Errors

1. Touch the green Run field.
2. Touch the Reference Listing field to toggle to the Difference Listing.
3. Observe the states where one of the hex numbers is a different color.

   This indicates states in the new listing that do not match the reference listing.
4. Touch the Find Error field to change its color.
5. Turn the knob clockwise.

   Each error moves to the vertical center of the listing with its state location displayed in the blue box. As each error moves to the center of the listing, the Find Error field is updated to display the corresponding error number.

   As you turn the knob, you will see that large sections of the listing that do not contain errors are skipped. This makes it easier to identify all the sections of the listing that do contain errors.
6. Return the glitch jumper to Off.



Difference Listing

Oscilloscope Exercises

Oscilloscope Exercises

These exercises show you how to use the HP 16534A oscilloscope module. You will start by using the Autoscale feature to set up the oscilloscope. You will also use the Auto-Measure feature to measure the period of the training board clock signal. You should do these exercises in the order given since it will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Get the waveform on the display with Autoscale
- Delete the unused channel from the display
- Expand and scan the clock waveform
- Measure the period of the clock
- Measure the clock period with Auto-Measure
- Read the pulse voltage with the markers

Starting the Exercises

1 Decide what to do next.

If you have just completed the exercises in chapters 1 through 3, go to "Connect the Channel 1 Oscilloscope Probe" on the next page.

If you have not just completed the exercises in chapters 1 through 3, go to step 2.

2 Load the configuration files POW_UP0 into System and POW_UP5 into 2GS 32K Scope.

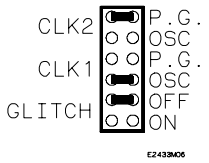
The files will default all system and oscilloscope settings. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the training board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer. Pod 1 must be connected in order to supply the +5 V power for the training board.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."

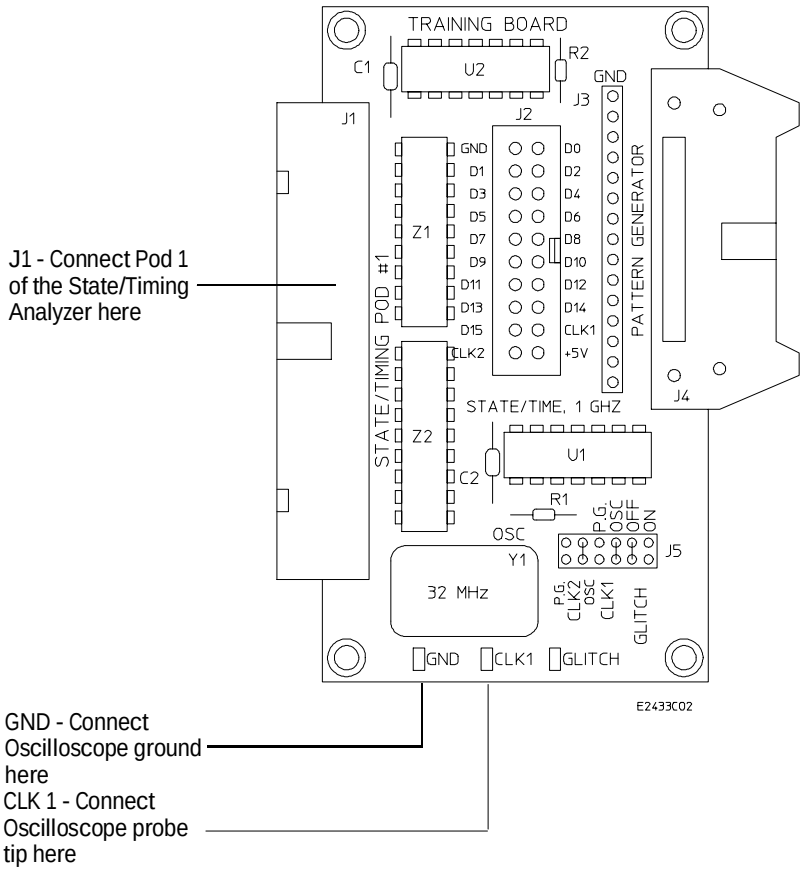


Connect the Channel 1 Oscilloscope Probe

1. Connect the oscilloscope probe to channel 1 on the oscilloscope module.

   The channel 1 input is labeled CHAN 1 on the rear panel.
2. Connect the probe tip to the test point labeled "CLK 1" on the Logic Analyzer Training Board (see the figure below).
3. Connect the probe ground lead to the test point labeled "GND" on the Logic Analyzer Training Board.

> Connect pod 1 of the logic analyzer module to J1 of the training board. Pod 1 must be connected in order to supply the +5 V power for the training board.



Get the Waveform on the Display

1 Touch the top left field, then touch 2 GSa/s 32K Scope. Touch the top field, second from the left, then touch Channel.

> Check to see if the oscilloscope channel designators are displayed in the large blue bar on the left side of the display. If the channel designators are currently displayed, go to step 4.

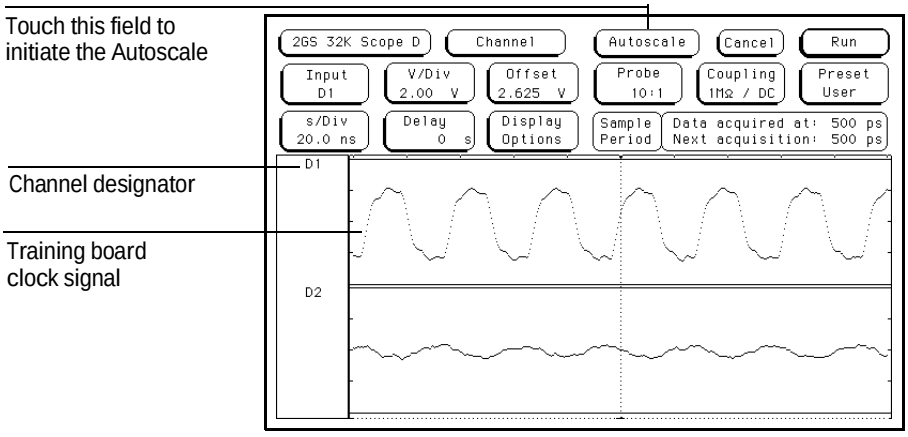
2 Touch the large blue bar on the left side of the display twice.

3 Touch the top channel designator field below Labels, then touch Done.

4 Touch the Autoscale field.

5 Touch Continue in the pop-up menu.

The Autoscale feature automatically scales the vertical sensitivity and the horizontal time base of the oscilloscope to provide a display of the waveform. This simplifies the setup of the oscilloscope, and is very helpful when the amplitude and period of a signal are unknown.



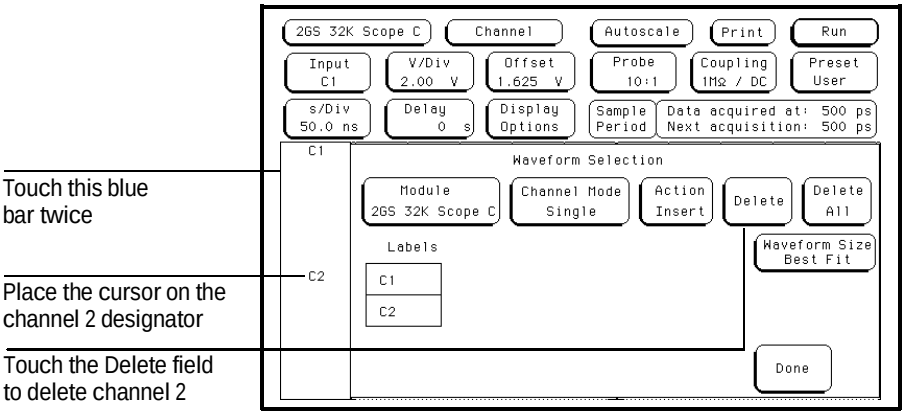
Getting the Waveform on the Display

Delete Channel 2 from the Display

1. Touch the blue bar on the left side of the waveform area twice.
2. Using the knob, place the cursor on the channel 2 designator, then touch Delete.

   In this example, the channel 2 designator is C2, because the oscilloscope is in slot C of the mainframe. Your system configuration may be different, and the designator may be any letter from A to J, depending on where your oscilloscope module is located.
3. Touch Done.

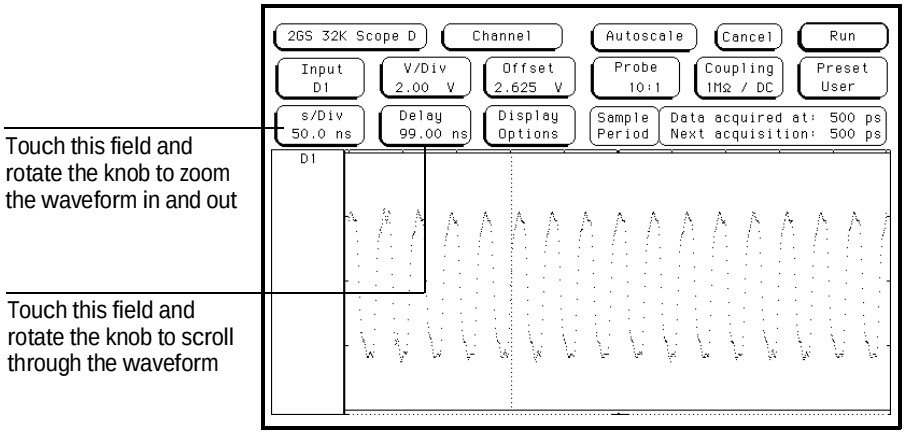
   Deleting the unused channel allows the channel 1 waveform to be displayed over the entire vertical waveform area.



Deleting Channel 2 from the Display

Zoom and Scroll Through the Clock Waveform

1. Touch the s/Div field once to change its color.
2. Rotate the knob clockwise to expand the clock waveform. Rotate the knob counterclockwise to compress the waveform.
3. Touch the Delay field to change its color.
4. Rotate the knob in both directions to scroll the clock waveform.

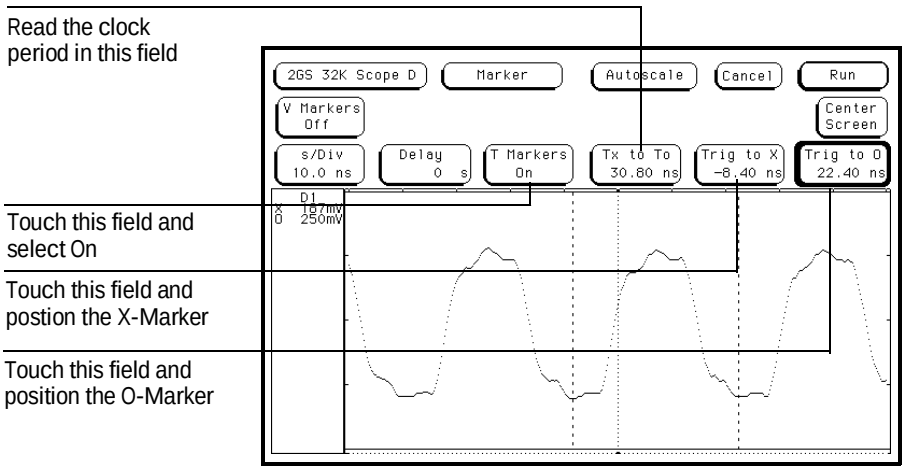


Expanding and Scanning the Clock Waveform

Measure the Period of the Clock

1. Touch the top field, second from the left, then touch Marker in the pop-up.
2. Touch the T Markers Off field, then touch On in the pop-up menu.
3. Touch the Trig to X field. Using the knob, move the Tx-Marker to the lowest point on the negative pulse.

   You may need to expand or compress the waveform, using the s/Div field, in order to see a complete period of the waveform on the display.
4. Touch the Trig to O field. Using the knob, move the To-Marker to the same point on the next negative edge after the Tx-Marker.
5. Read the period of the clock in the Tx to To field.

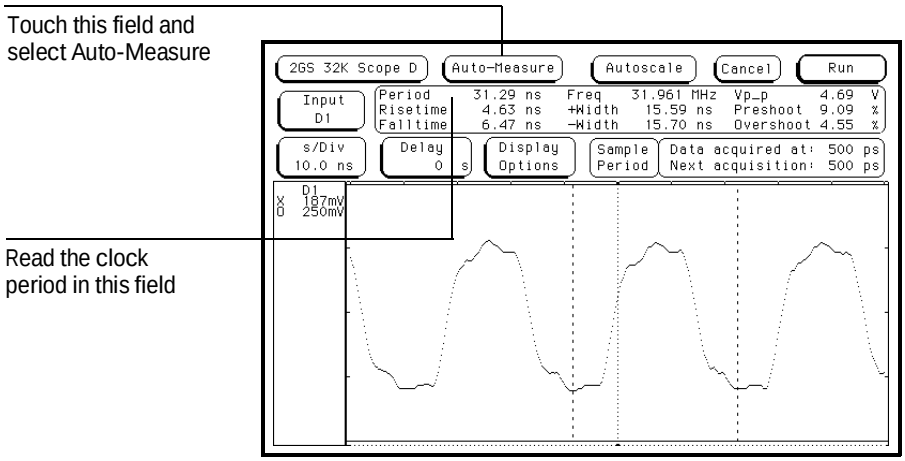


Measuring the Clock Period with the Tx and To-Markers

Measure the Clock Period with Auto-Measure

1. Touch the top field, second from the left, then touch Auto-Measure in the pop-up.
2. Read the clock period in the box below the top row of fields.

   The Auto-measure function allows you to automatically measure many signal parameters.

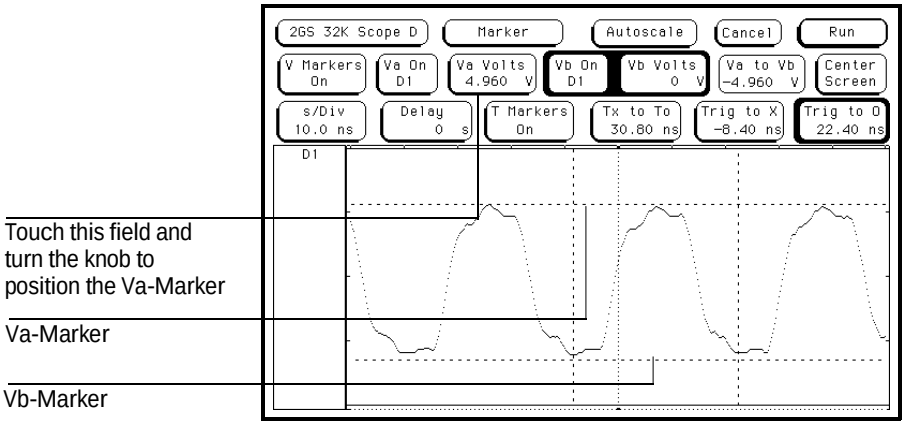


Measuring the Clock Period with Auto-Measure

Read Voltage with the Markers

1. Touch the top field, second from the left, then touch Marker in the pop-up.
2. Touch the V Markers Off field, then touch the Va Volts field.
3. Rotate the knob and watch the Va marker scroll up and down the screen across the displayed waveform.

   You can use the time and voltage markers to make time and voltage measurements at specific points on the waveform.



Reading the Voltage at the Markers

5

Pattern Generator Exercises

Pattern Generator Exercises

The pattern generator provides programmable digital output that can be used to stimulate and control a system under test. These exercises will show you how to program the pattern generator so that it provides a pattern of "walking ones." Since the pattern generator is an output module, the timing analyzer will be used to view the pattern generator's output.

These exercises also show you a simple process that represents basic stimulus/response testing. For example, if you are applying the "walking ones" pattern from the pattern generator to a memory, you can use the timing analyzer to see if the walking ones are being written to and read from memory properly.

In this chapter you will learn how to:

- Create a timing label for the pattern generator output
- Add a pattern generator label to the timing waveform display
- Set up the Pattern Generator Format Menu
- Program the pattern generator for a "walking ones" output
- View the pattern generator output with the timing analyzer
- Stop the pattern generator

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH05 from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed all of the exercises in chapters 1 through 4, go to "Connect the Pattern Generator" on the next page.

If you have not just completed all of the exercises in chapters 1 through 4, go to step 2.

2 Load the configuration files POW_UP0 into System, POW_UP3 into 200M Patt Gen and CH05 into 100/500 MHz LA.

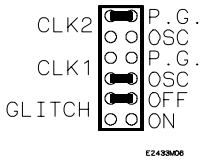
The files will default all system settings, then set up the system as if you had just completed all of the exercises in chapters 1 through 4. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Connect the Pattern Generator

1. Using the TTL Data Pod, connect the pattern generator output Pod 2 (data bits 0 through 7) to J4 on the training board, which is labeled PATTERN GENERATOR.

   Pod 2 is the second pod from the right as you are facing the back of the pattern generator.

2. Connect Pod 1 of the logic analyzer module to J1 of the training board, if it is not already connected.

   You can leave the state analyzer signal leads connected to J2 on the training board.

> Pod 1 of the logic analyzer module is used to acquire the pattern generator's output pattern, and it provides the +5 V power for the training board.

Set Up the Logic Analyzer Configuration

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from left, then touch Configuration.
3. Touch the field to the right of Type in the Analyzer 2 box, then touch Off.
4. Touch the field to the right of Type in the Analyzer 1 box, then touch Timing.

Configure Timing Labels

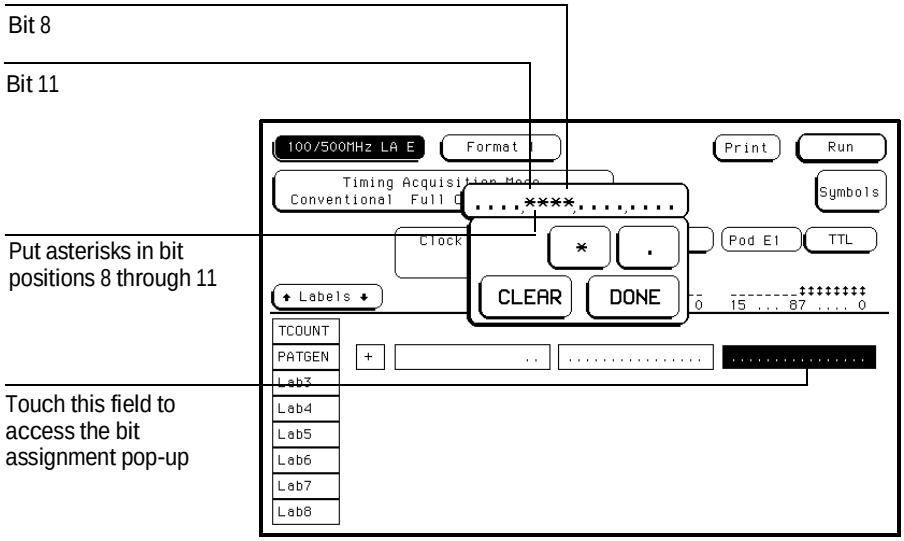
1. Touch the top field, second from the left, then touch Format 1.
2. Touch the second field from the top under Labels, then touch Modify Label.
3. Type PATGEN using the keys in the pop-up menu, then touch Done.
4. If the PATGEN label you just entered is the only active label on the display, and all of the other labels are turned off, go to "Assigning the Timing Analyzer Bits" on the next page.
5. If the TCOUNT label is still active, touch TCOUNT. Then touch Turn Label Off.

   Other labels may be on, depending on what exercises you have previously done. Turn off all labels except PATGEN. Turning a label off, rather than modifying it, saves the label name and its bit assignments for later use.

Assign the Timing Analyzer Bits

1. Touch the field showing the 16 bits of Pod 1 (PATGEN). The pop-up showing the bit assignments appears.
2. If there are any bits assigned, touch clear.
3. Using the knob, move the cursor to bit 11 in the pop-up. Then, touch the asterisk field to put four asterisks in bit positions 11 through 8. Touch Done.

   Bits are numbered 15 through 0 from left to right.

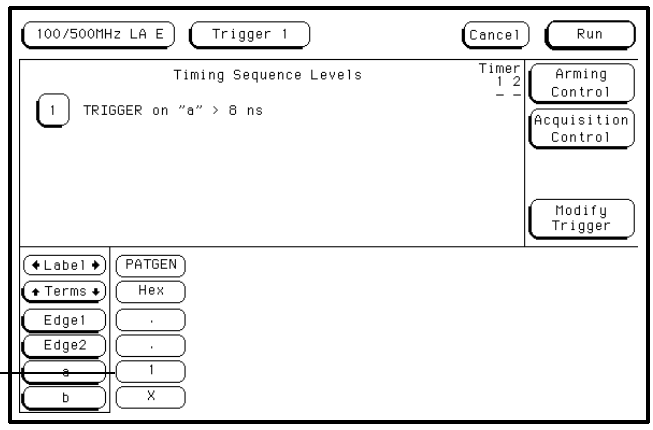


Assigning the Timing Analyzer Bits

Set Up the Timing Analyzer Trigger

1. Touch the Format 1 field, then touch Trigger 1.
2. Touch the field to the right of "a," below the PATGEN Label. Enter a 1 using the pop-up. Touch Done.

   If the "a" term is not displayed, turn the knob counterclockwise until it is displayed.

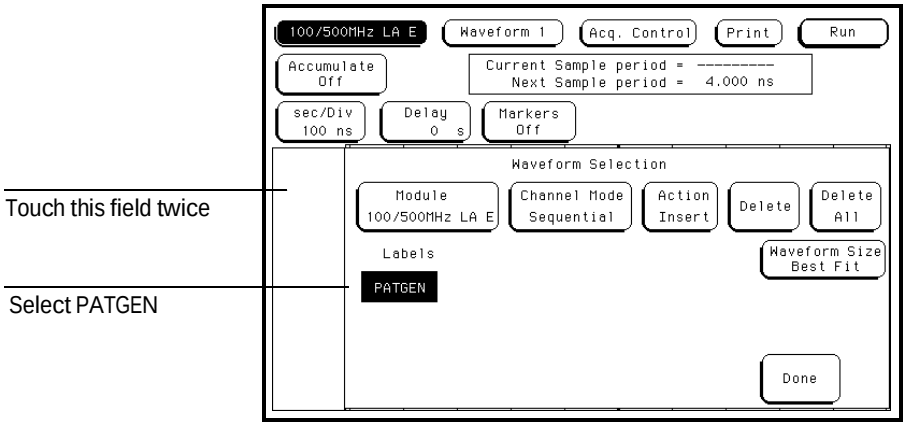


Setting the Timing Analyzer Trigger

Add a Pattern Generator Label to the Timing Waveform Display

1. Touch the Trigger 1 field, then touch Waveform 1.
2. Touch the blue bar on the left side of the waveform area twice. Touch PATGEN in the pop-up. Touch Done.

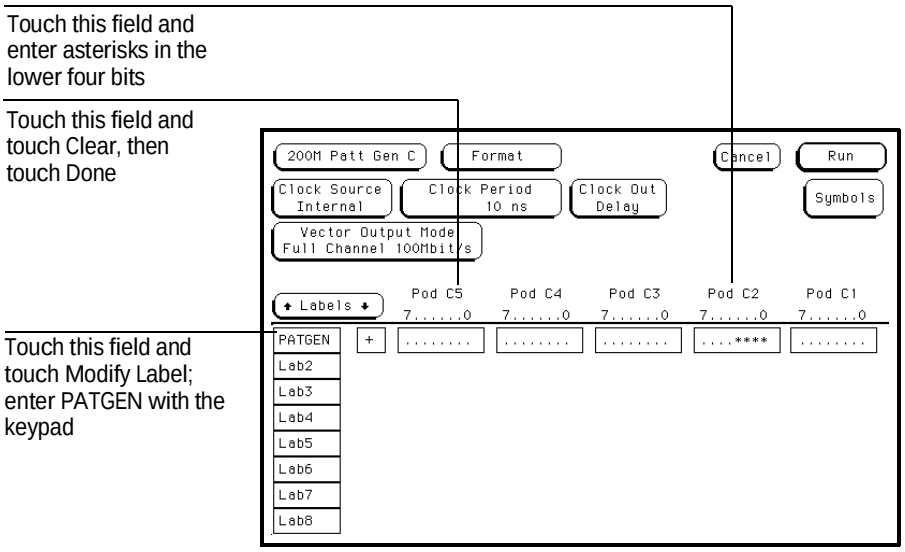
   In the previous exercises, labels had been automatically added to the display. In this exercise, we created a new label which must be added to the display in order to see it.



Adding a Pattern Generator Label to the Timing Waveform Display

Configure the Pattern Generator Format Menu

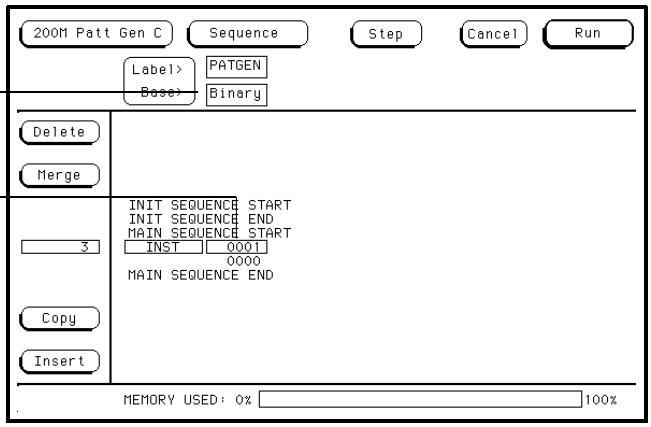
1. Touch the 100/500 MHz LA field, then touch 200M Patt Gen.
2. Touch the top field, second from the left, then touch Format.
3. Touch the Lab1 field under Label, then touch Modify Label.
4. Type PATGEN using the keys in the pop-up menu. Touch Done.
5. Touch the field showing the seven bits of Pod 5, to the right of the PATGEN label, then touch Clear. Touch Done. Do the same for Pods 3 and 1.
6. Touch the field showing the eight bits of Pod 2, to the right of the PATGEN label. Place asterisks in the lower four bits of Pod 2. Touch Done.



Configuring the Pattern Generator Format Menu

Program the Pattern Generator Output

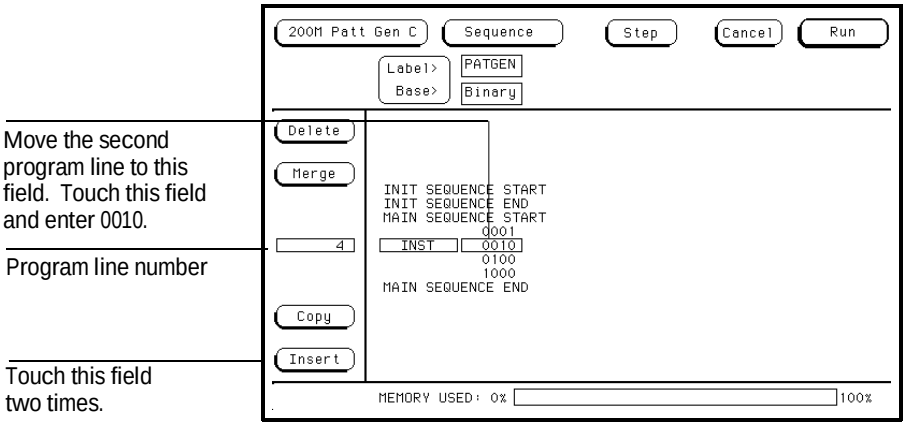
1. Touch the Format field, then touch Sequence.
2. Touch the Base field, below the PATGEN label, then touch Binary.
3. Using the knob, move the cursor to program line 3.
4. Touch the field in the second column, center row of the listing. Enter 0001 in the pop-up. Touch Done.



Programming the Pattern Generator Output

Add Program Lines

1. Touch the Insert field, bottom left, two times to add two additional program lines to the listing.
2. Using the knob, move the second program line (line number 4) to the center of the listing.
3. Touch the field in the second column of the listing, center row, then enter 0010 in the pop-up. Touch Done.
4. Repeat steps 2 and 3 for program lines 5 and 6 entering 0100, then 1000, respectively.



Adding Program Lines

Start the Pattern Generator and View the Walking Ones Pattern

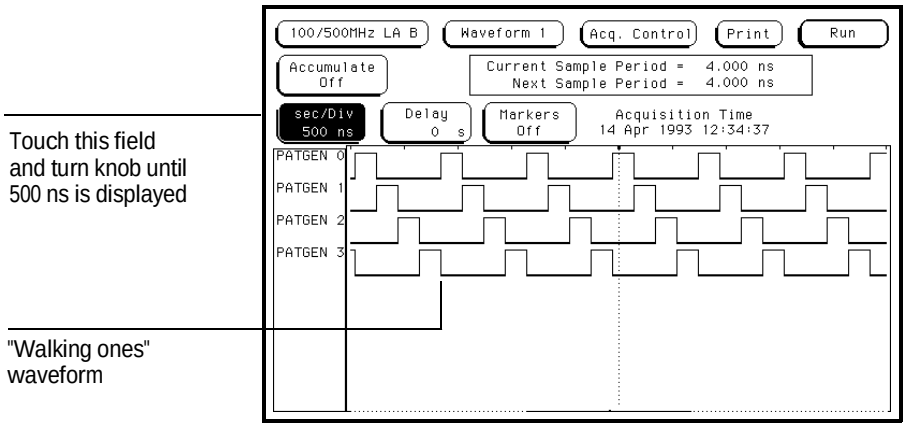
1. **Without lifting your finger, touch the green Run field and drag it to Repetitive in the pop-up. Then lift your finger.**

   The green Run field becomes a red Stop field, indicating that the pattern generator is now running in the repetitive mode. Its output is repeating the "walking ones" pattern; however, you will not see it until you run the timing analyzer in step 3. The pattern generator will run independently until you stop it in the last exercise in this chapter

2. **Touch the 200M Patt Gen field, in the top left corner of the display, then touch 100/500 MHz LA.**
3. **Touch the green Run field, but do not drag your finger to Repetitive in this step.**

   The Timing analyzer runs a single trace and automatically displays the Waveform 1 menu in which you see the "walking ones" pattern.

4. **Touch the s/Div field to change its color to light blue.**
5. **Turn the knob until the s/Div field displays 500 ns.**



Walking Ones Waveform

Stop the Pattern Generator

1. Touch the 100/500 MHz LA field, then touch 200M Patt Gen.
2. Touch the red Stop field.

   The field changes back to the green Run field.

> The pattern generator requires CPU time when it is running independently in the repetitive mode. Stopping the pattern generator now will prevent other exercises that do not use it from running slower than normal.

6

Mixed Mode Exercises

Mixed Mode Exercises

Mixed mode allows you to analyze a target system in both state and timing modes, simultaneously. A common example is using the state analyzer to capture a problem that occurs infrequently and then analyzing the problem in detail with the timing analyzer. The Mixed Mode exercises will show you how to use the mixed mode capabilities of the timing and state analyzers. These exercises are built on the timing and state exercises in chapters 1 and 2.

In this chapter you will learn how to:

- Arm the timing analyzer with the state analyzer
- Enable time correlation between the timing and state analyzers
- Select the Mixed Mode display
- Run the analyzers and view time-correlated marker placement

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH06 from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed all of the exercises in chapters 1 through 5, go to "Turn on Timing Analyzer Label" on the next page.

If you have not just completed all of the exercises in chapters 1 through 5, go to step 2.

2 Load the configuration files POW_UP0 into System and CH06 into 100/500 MHz LA.

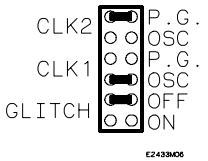
The files will default all system settings, then set up the analyzer as if you had just completed all of the exercises in chapters 1 through 5. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the Logic Analyzer Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Turn on Timing Analyzer Label

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from the left, then touch Format 1.
3. Turn the knob counterclockwise until the label names on the left no longer scroll down.

   When the label names stop scrolling down, the label name at the top of the list is the first label.
4. Touch the top field under Labels, then touch Turn Label On.

   The TCOUNT label that you previously turned off now appears. Note that the lower eight bits of Pod 1 are still assigned to TCOUNT.

> If the TCOUNT label name does not appear, the TCOUNT label has been deleted or modified. In this case, complete the "Change a Label Name" and "Modify the Bit Assignments" exercises, on pages 1–4 and 1–5, then continue at step 5 of this exercise.

5. Touch the second from the top field below Labels, then touch Turn Label Off.

Turn on TCOUNT Label in Waveform 1

1. Touch the top field, second from the left, then touch Waveform 1.
2. Touch the blue bar on the left side of the waveform area twice, then touch TCOUNT in the pop-up. Touch Done.

Configure the State Analyzer

1. If the state analyzer signal leads are not already connected, perform the steps in chapter 2, "Connect the State Analyzer," on page 2–4.
2. Touch the top field, second from the left, then touch Configuration.
3. Touch the field to the right of Type in the Analyzer 2 box, then touch State.

Turn on the SCOUNT Label

1. Touch the top field, second from the left, then touch Format 2.
2. Touch the top field below "Labels."
3. Touch Turn Label On in the pop-up.

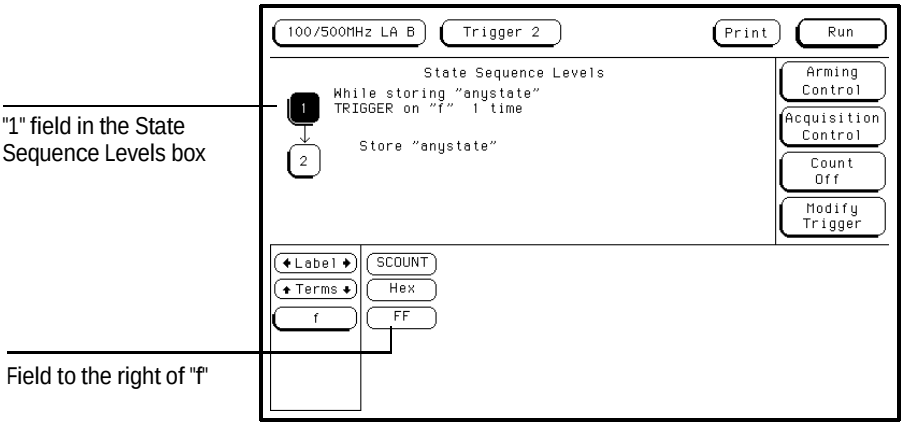
   The top label should now be the SCOUNT label, with the lower eight bits of Pod 3 assigned to it. If this is not the case, perform the steps in chapter 2, "Change a State Label Name," and "Modify the State Analyzer Bit Assignments," on pages 2–8 and 2–9.

Configure the State Trigger Specification

1. Touch the top field, second from the left, then touch Trigger 2.
2. If the "f" term is displayed in the bottom left corner of the screen, go to step 4.
3. If the "f" term is not displayed, touch the Assign field. Touch the "f" field in the Resource Term Assignment pop-up. Touch Done.

   Resource term "f" is now available for use by the state analyzer.
4. Touch the field to the right of "f," below the SCOUNT label.
5. Enter FF using the keypad. Touch Done.
6. Touch the "1" field in the State Sequence Levels box.

   The Sequence Level 1 pop-up appears.
7. Touch the field to the right of "While storing," then touch "anystate."
8. Touch the field to the right of "TRIGGER on," then touch "f." Touch Done to close the Sequence Level 1 pop-up.

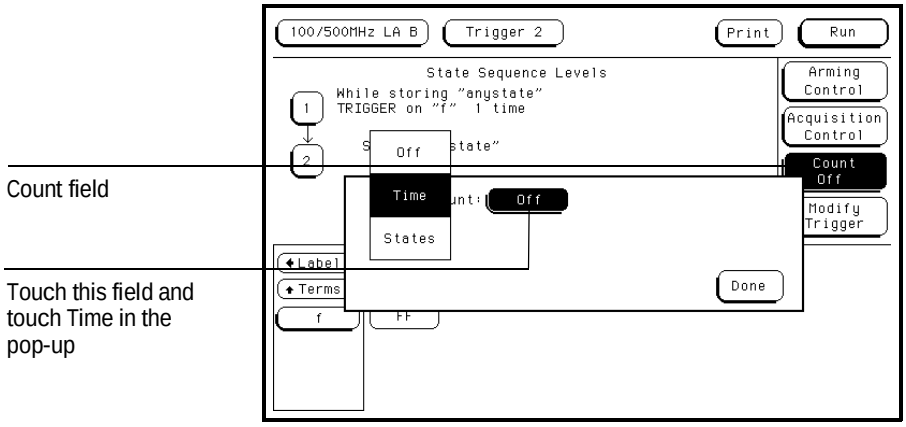


Configuring the State Trigger Sequence

Enable Time Correlation between the Timing and State Analyzers

1 Touch the Count field.
2 In the pop-up menu, touch the field to the right of "Count."
3 Touch Time in the pop-up. Touch Done.

Setting the Count to Time causes the state analyzer to store a time stamp for each data point that is stored in memory. When the mixed display is selected, the time stamp information is used to display the data in both the timing and state displays with the proper time relationship (correlation).



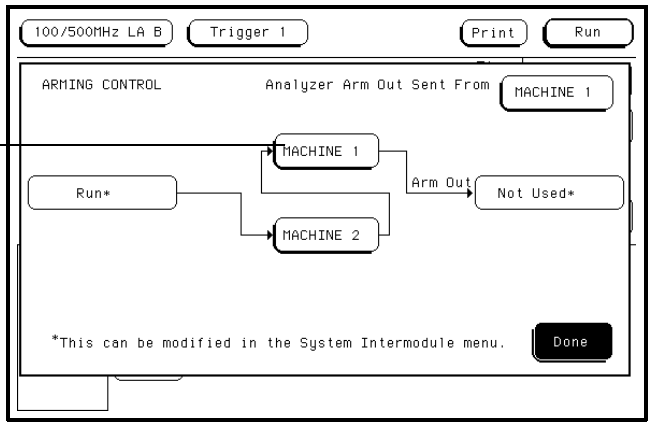
Enabling Time Correlation

Arm the Timing Analyzer

1. Touch the top field, second from the left, then touch Trigger 1.
2. Touch the "Modify Trigger" field on the right side of the screen. Touch Clear Trigger in the pop-up, then touch All.

   In this exercise, the timing analyzer must trigger as soon as it is armed by the state analyzer; therefore, the timing trigger specification must be set to a "don't care" state. Clearing the trigger specification resets the trigger to its default setting, which is a "don't care" state.
3. Touch the Arming Control field, below the green Run field.
4. Touch Machine 1.
5. Touch the field next to "Run from."
6. Touch MACHINE 2 in the pop-up. Touch Done. Touch Done to exit the Arming Control menu.

   When Machine 1, the timing analyzer, is armed by Machine 2, the state analyzer, the timing analyzer waits for the state trigger condition to be met before it begins to look for its own trigger condition. In this way, the data stored by both analyzers can be time-correlated.



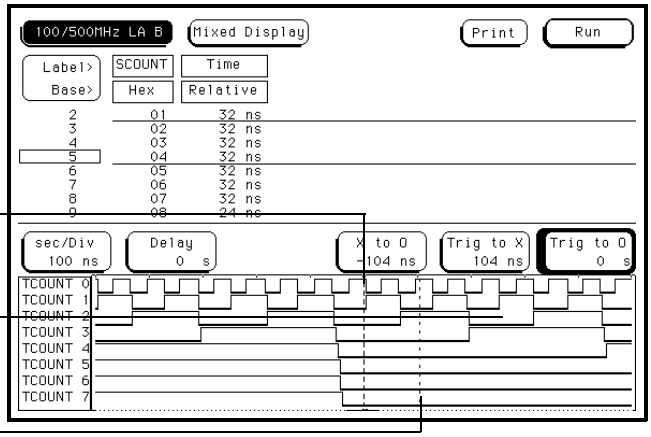
Touch this field. Touch the Run from field and select MACHINE 2

Arming the Timing Analyzer

Run the Analyzers and View Time-Correlated Marker Placement

1. Touch the green Run field.
2. Touch the top field, second from the left, then touch Mixed Display.

   Note that both the timing analyzer and the state analyzer trigger points are on the same data. In the State Listing display the trigger is FF. In the Timing Waveform display the trigger is located on the waveform where all eight lines are high, corresponding to a hexadecimal value of FF.
3. Touch the Trig to X field once to change its color.
4. Rotate the knob and observe that the X markers (green lines) move in both displays.



Mixed Mode Display

High-Speed Timing Exercises

High-Speed Timing Analyzer Exercises

These exercises will step you through the process of using the 4-GSa/s timing analyzer. You should do these exercises in the order given since it will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Change label names
- Modify bit assignments
- Set a trigger pattern
- Take a timing trace
- Oversample a state trace

Starting the Exercises

1 Decide what to do next.

If you have just completed all of the exercises in chapters 1 through 6, go to "Connect the 4-GSa/s Timing Analyzer" on the next page.

If you have not just completed all of the exercises in chapters 1 through 6, go to step 2.

2 Load the configuration files POW_UP0 into System and POW_UP2 into 4 GHz Timing.

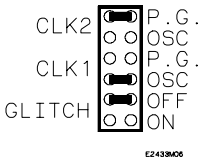
The files will default all system and analyzer settings. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

3 Connect Pod 1.

Connect Pod 1 of the HP 16550A or HP 16555A to J1 on the Logic Analyzer Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer. Pod 1 provides power for the Training Board.

4 Set the jumpers as shown below.

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



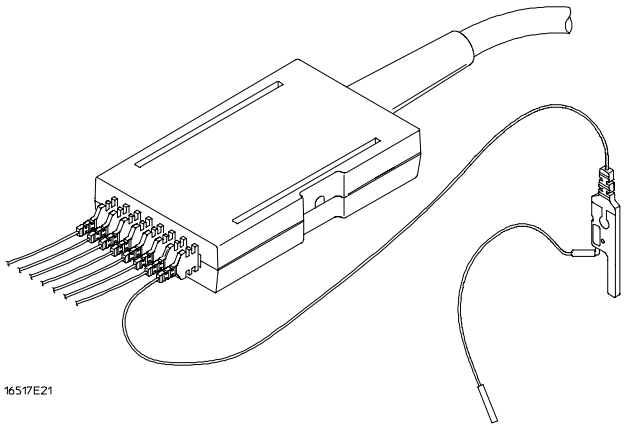
Connect the 4-GSa/s Timing Analyzer

1. Disconnect the state analyzer probe leads from J2 of the training board if they are connected.
2. Touch the top left field, then touch 4GHz/1GHz LA.

   An advisory message might appear on the screen telling you that the machine is using default skew values. The exercises in this guide can use the default skew values.
3. Press the Pod ID button on each of the 4-GSa/s pods and read the advisory message until you locate Pod 1.
4. Connect the black ground leads in the accessory kit to probe leads 0 through 7 of Pod 1 of the 4-GSa/s Timing Analyzer.

   Ground leads are not necessary for every pod lead. You can bend the ground lead pins so that the probe leads fit into J2 in the next step.
5. Connect the signal probes 0 through 7 and Clk to the pins D0 through D7 and CLK1 of J2 on the training board.
6. Connect some of the probe ground leads to the ground pins of J3.

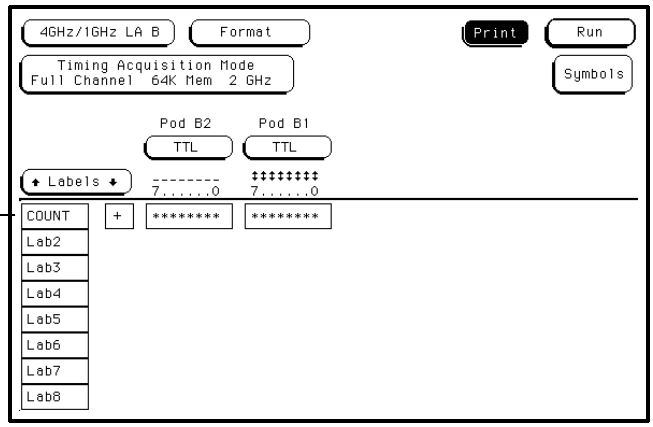
Leave Pod 1 of the HP 16550A or HP 16555A module connected to J1 to provide the needed +5 V for the training board. If Pod 1 is not connected, connect it now.



4-GSa/s Timing Analyzer Probe Assembly

Change a Label Name

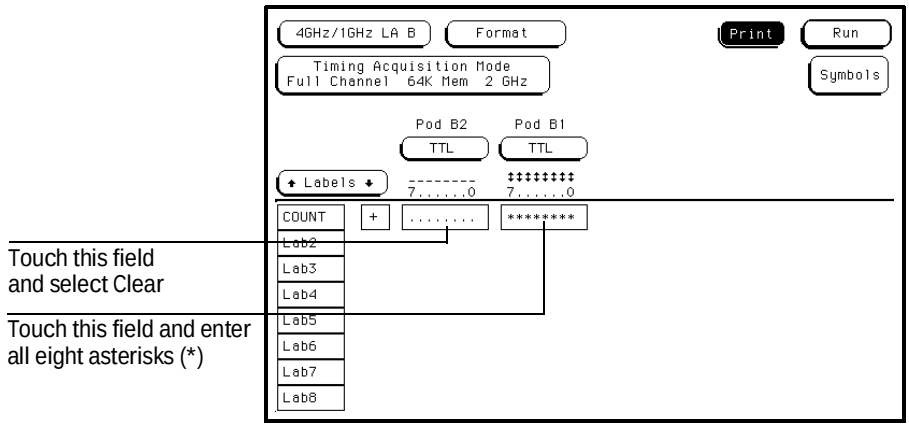
1 Touch the top field, second from the left, then touch Format.
2 Touch the top field under Label, then touch Modify Label.
3 Type COUNT using the keys in the pop-up menu. Touch Done.



Changing a Label Name

Modify the Bit Assignments

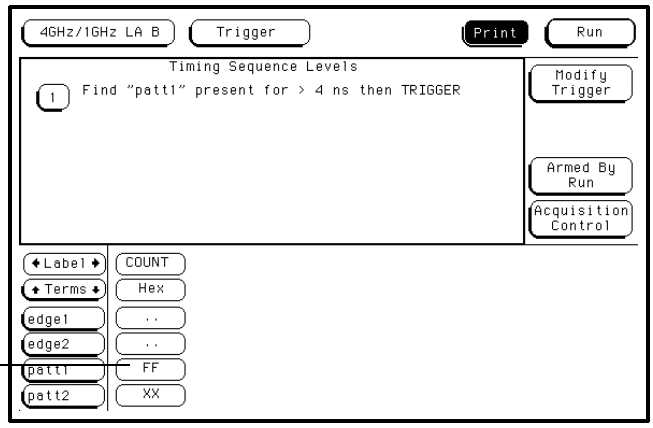
1. Touch the field showing the eight bits of Pod 1 (COUNT). The pop-up showing the bit assignments appears. If all eight bits of Pod 1 have asterisks, touch Done, then go to step 3.
2. Using the knob, move the cursor to bit 7 in the Pod 1 pop-up. Then, touch the asterisk field to put asterisks in all eight of the bit positions. Touch Done.
3. Touch the field showing the eight bits of Pod 2. The pop-up showing the bit assignments appears.
4. Touch Clear to remove the asterisks, then touch Done.



Modifying the Bit Assignments

Set the Pattern for the Trigger

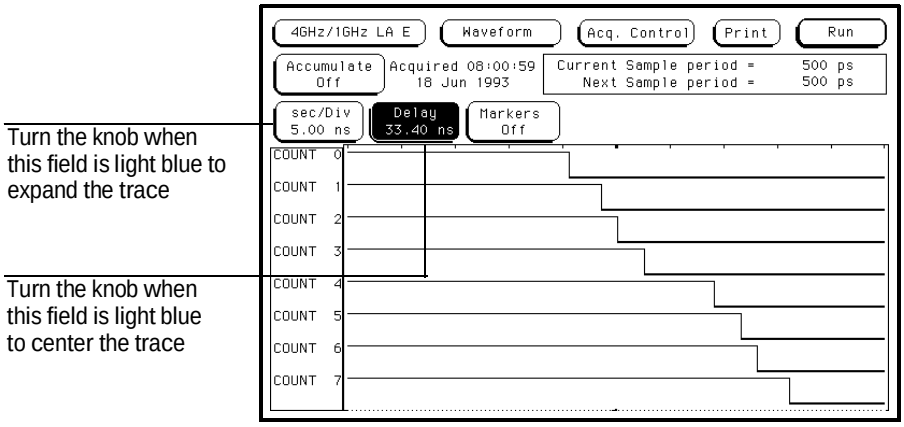
1. Touch the Format field, then touch Trigger.
2. If the Base field is currently set to Hex, go to step 3. Touch the Base field, then touch Hex.
3. Touch the field to the right of the patt1 field. Enter FF using the pop-up. Touch Done.



Setting the Pattern for the Trigger

Trigger on the Pattern and Display the Timing Trace

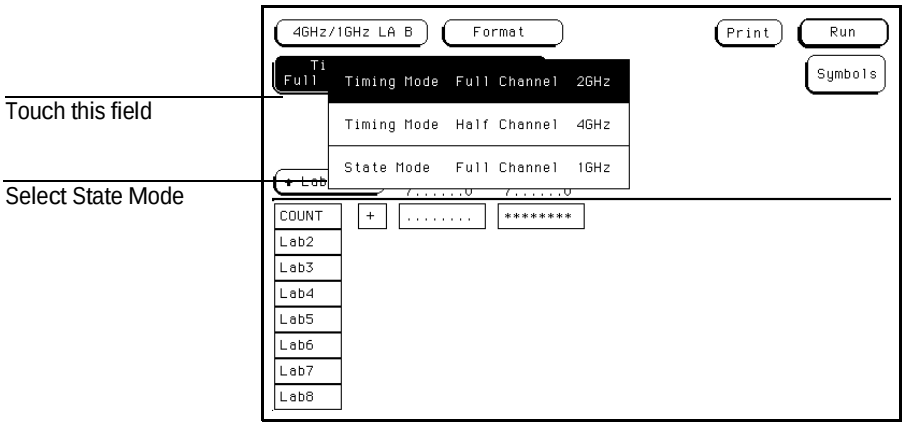
1. Touch the green Run field.
   The display automatically switches to the Waveform menu.
2. Turn the knob to display one falling edge on each of the waveforms.
3. If the falling edges are centered in the display, as in the figure below, go to the exercise on the next page. Otherwise, go to the step 4.
4. Touch the Delay field, then turn the knob in either direction to move the falling edges into the display.
5. Repeat step 4 if there is still more than one edge on any of the waveforms.



Trigger on the Pattern and Display the Trace

Change the Acquisition Mode to State

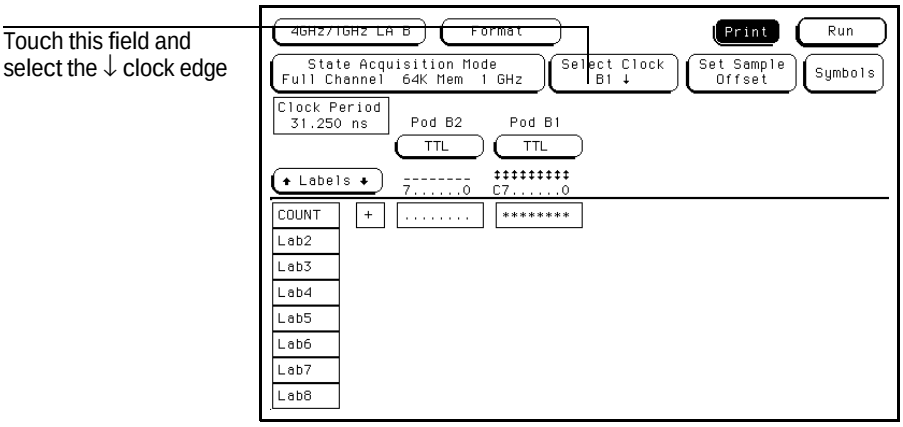
1 Touch the top field, second from the left, then touch Format.
2 Touch Timing Acquisition Mode, then touch State Mode in the pop-up menu.



Changing the Acquisition Mode

Change the Clock Edge

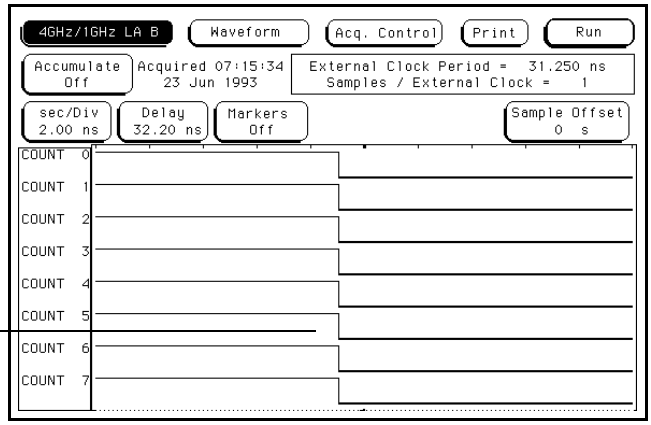
1 Touch Select Clock.
2 In the pop-up menu, touch the box showing the falling clock edge.



Changing the Clock Edge

Trigger on the Pattern and Display the State Listing

1. Touch the green run field.
   The display automatically changes to the listing menu.
2. Touch the top field, second from the left, then touch Waveform.
   The screen displays a waveform display of the state listing.



Waveform display of the state listing

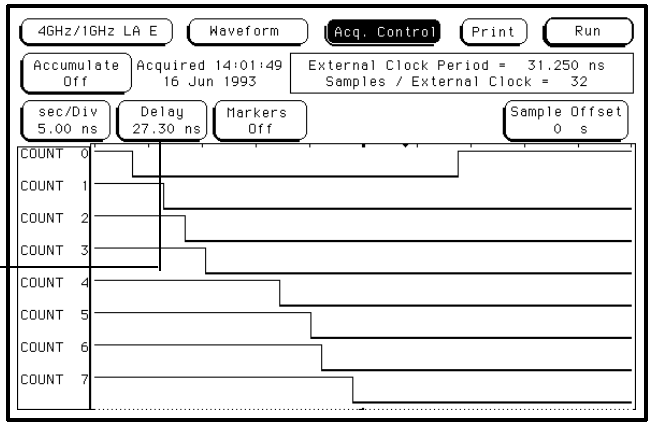
Triggering on the Pattern and Displaying the State Listing

Oversample a State Trace

1. Touch Acquisition Control, then touch Samples/Clock.
2. Touch 32, then touch Done.

   You have just increased the number of samples that will be taken per clock edge from 1 to 32. Normally, state analyzers can only take one sample per clock edge. The ability to take more adds significantly to the flexibility of the state mode, as you will see when you press the run field.
3. Touch Run. Adjust the Delay to center the falling edges on the screen.

   Taking 32 samples per clock edge allows you to see details of what is happening between states. In this case, you are able to see the ripple of the counter.



Turn the knob when this field is light blue to center the trace

Oversampling the Ripple Counter

8

Intermodule Bus Exercises

Triggering the Oscilloscope with the Timing Analyzer

The Intermodule Bus (IMB) allows you to use all of the modules in the HP 16500 system together, so that the data and trigger points of all the modules can be time-correlated. These exercises will show you how to use the IMB to make the timing analyzer trigger the oscilloscope and find a glitch on the Training Board. You should do these exercises in the order given since it will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Run the oscilloscope with Autoscale
- Run the oscilloscope in the repetitive mode
- Configure the oscilloscope to use the Intermodule Bus
- Configure the Intermodule Bus
- Configure the timing analyzer
- Capture a glitch on the oscilloscope

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH08A from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed all of the exercises in chapters 1 through 7, go to the "Set the Jumpers" exercise, on the next page.

If you have not just completed all of the exercises in chapters 1 through 7, go to step 2.

2 Load the configuration files POW_UP0 into System, CH08A into 100/500 MHz LA and CH08B into 2GS 32K Scope.

The files will default all system settings, and then set up the analyzer and oscilloscope as if you had just completed all of the exercises in chapters 1 through 7. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

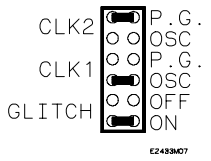
3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the Logic Analyzer Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

Set the Jumpers

1. Set the jumpers as shown below.

   Setting the jumpers in this way turns on the glitch on bit 7 of the counter on the training board. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Connect the Oscilloscope Probe

1. Connect the oscilloscope probe to channel 1 of the oscilloscope.

   The channel 1 input of the oscilloscope is labeled Chan 1 on the rear panel.

2. Connect the probe tip to the test point labeled "Glitch" on the Logic Analyzer Training Board.

   Note that this is a different test point than the "CLK 1" test point that was used in chapter 4.

3. Connect the probe ground lead to the test point labeled "Ground" on the training board.

> Leave Pod 1 of the logic analyzer connected to J1. This provides +5 V for the training board. If Pod 1 is not connected to J1, connect it now.

Turn Off the State Analyzer

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from the left, then touch Configuration.
3. Touch the field to the right of Type in the Analyzer 2 box, then touch Off.

Run the Oscilloscope with Autoscale

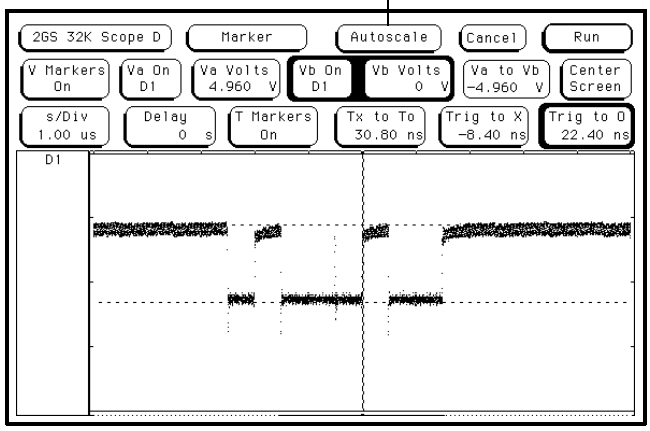
1 Touch the top left field, then touch 2 GSa/s 32K Scope.

2 Touch the Autoscale field, then touch Continue.

The oscilloscope may or may not capture the glitch with autoscale. The purpose of this exercise and the next two exercises is to show that glitches, being random, cannot always be captured with the oscilloscope alone.

In the next exercise, you will run the oscilloscope in the Repetitive mode to see that the glitch will not always be captured.

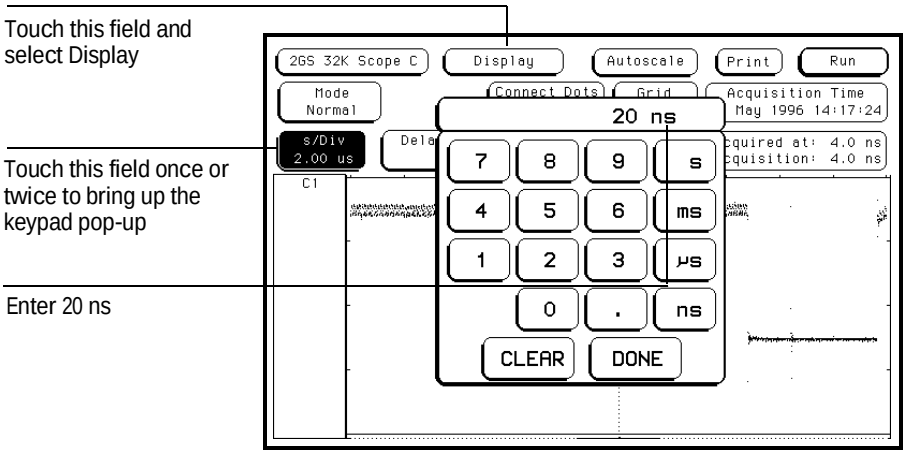
Touch this field and select Continue



Running the Oscilloscope with Autoscale

Change the Seconds per Division (s/Div)

1. Touch the top field, second from the left, then touch Display.
2. Touch the s/Div field to display the keypad pop-up.
3. Enter 20 ns, then touch Done.



Changing the Seconds per Division (s/Div)

Run the Oscilloscope in the Repetitive Mode

1 Touch the green Run field. Without lifting your finger, drag it to Repetitive in the pop-up, then lift your finger.

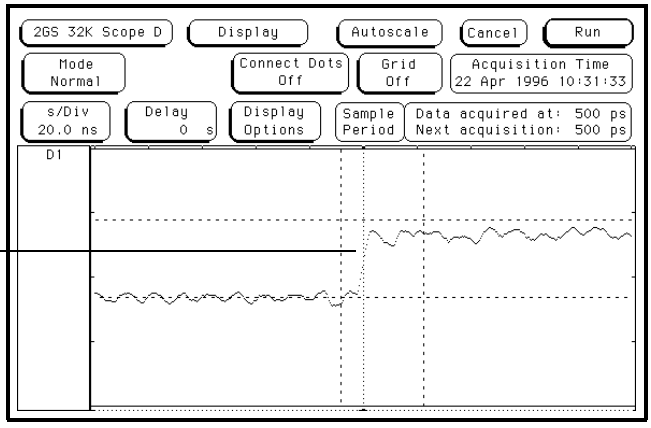
You will see the display change each time the oscilloscope runs, but the glitch might not appear in each display. You will use the glitch trigger of the timing analyzer and the IMB in the following exercises to enable the oscilloscope to trigger reliably on the glitch.

2 Touch the red Stop field.

3 Touch the green Run field, then, without lifting your finger, drag it to Single in the pop-up, then lift your finger.

Step 2 stops the oscilloscope and resets the run mode to Single for the rest of the exercises in this chapter.

The glitch generated by the training board occurs more regularly than it would in a malfunctioning system. Therefore, you will see the glitch on consecutive traces.

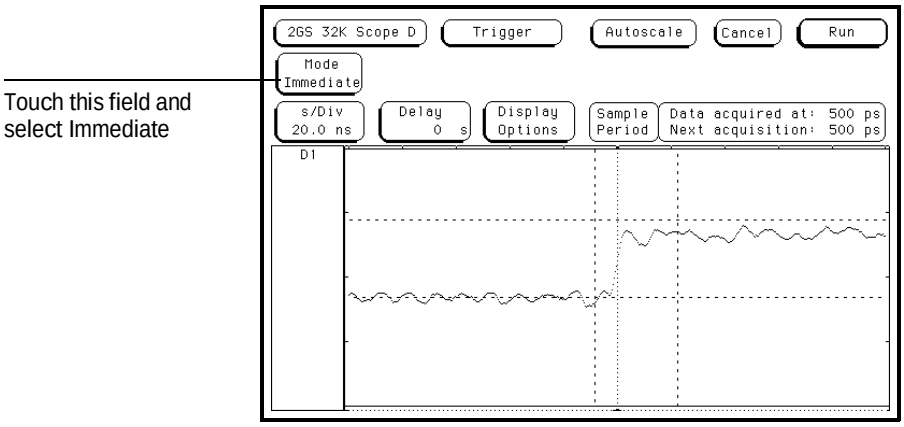


Running the Oscilloscope in the Repetitive Mode

Change the Oscilloscope Trigger

1. Touch the top field, second from the left, then touch Trigger.
2. Touch the Mode field at the left side of the display, then touch Immediate.

   The Immediate trigger mode allows the oscilloscope to trigger immediately when it receives the intermodule bus arming signal from the timing analyzer.



Changing the Oscilloscope Trigger

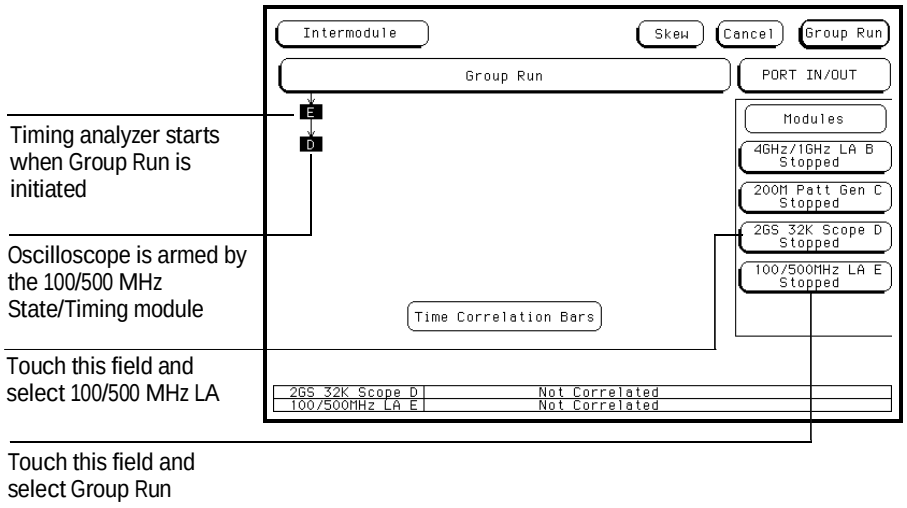
Configure the Intermodule Bus

In this exercise, you will configure the Intermodule Bus so that the timing analyzer arms the oscilloscope. You have seen in the "Run the Oscilloscope in the Repetitive Mode" exercise that the oscilloscope will not reliably trigger on the glitch.

When you complete this and the following exercises, the timing analyzer and the oscilloscope will be configured so that the timing analyzer's glitch triggering capability will capture the glitch. The timing analyzer will then use the Intermodule Bus to arm the oscilloscope so that it, too, captures the glitch.

1. Touch the top left field, then touch Intermodule.
2. Touch the 100/500 MHz LA field under Modules, on the right side of the display. Touch Group Run in the pop-up menu.
3. Touch 2 GSa/s 32K Scope, then touch 100/500 MHz LA in the pop-up menu.

   In this exercise the oscilloscope module is in slot D and the HP 16550A module is in slot E. The letters under the group run field will be different on your system if your modules are installed in different slots.

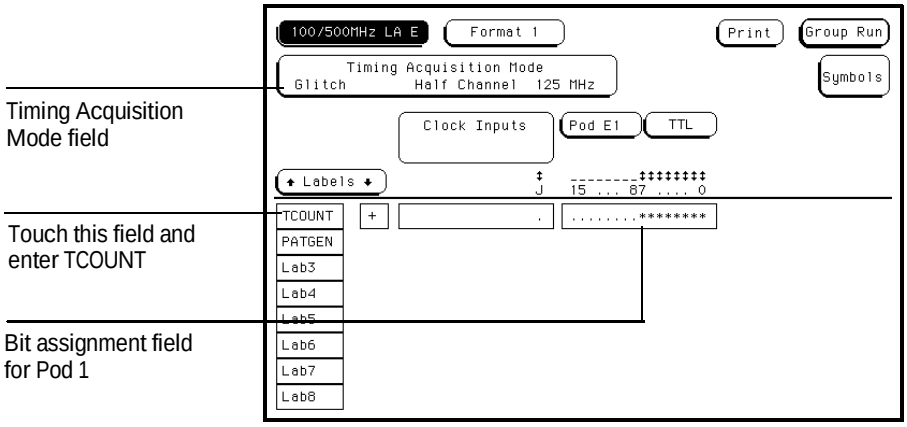


Configuring the Intermodule Bus

Configure the Timing Format Menu

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from the left, then touch Format 1.

   If the TCOUNT label is already being displayed and the lower eight bits of Pod 1 are assigned to it, go to step 7. The PATGEN label may still be displayed, but you will not use it during these exercises.
3. Touch the top field below Labels, then touch Modify Label.
4. Enter TCOUNT using the keypad.
5. Touch the bit assignment field for Pod 1, to the right of TCOUNT, then touch Clear.
6. Move the cursor with the knob to bit 7, then enter an asterisk in each of the lower eight bits. Touch Done.
7. Touch the Timing Acquisition Mode field. Touch "Glitch, Half Channel, 125 MHz," in the pop-up. For the HP 16555, touch "2M Sample Half Channel 500 MHz."



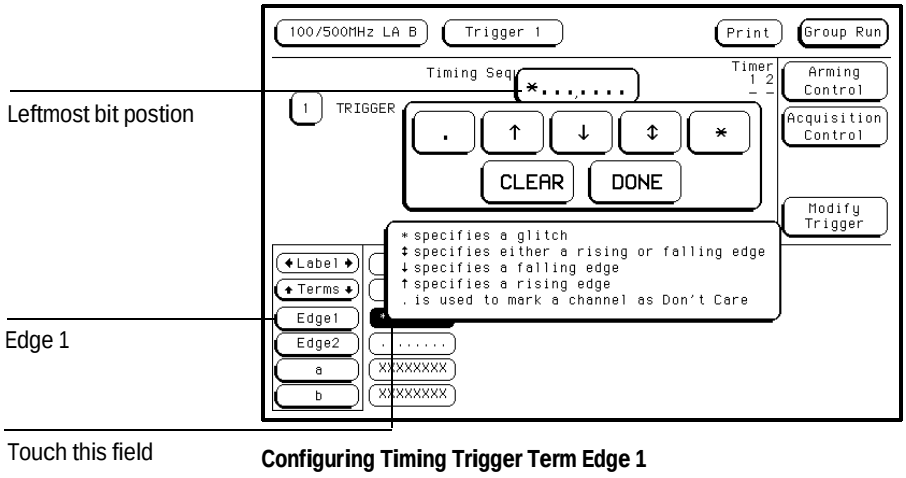
Configuring the Timing Format Menu

Configure Timing Trigger Term "Edge 1"

1. Touch the top field, second from the left, then touch Trigger 1.
2. Touch the Base field to the right of "Terms," below the TCOUNT label. Touch Binary in the pop-up menu.
3. Touch the field to the right of Edge 1.

   If Edge 1 is not on the screen, touch the field under Terms, then touch Cancel. Use the knob to scroll up to Edge 1.
4. Place an asterisk (*) in the leftmost bit position. Touch Done.

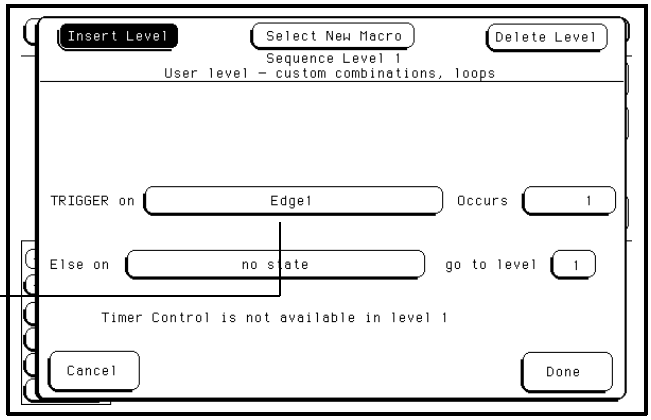
   The asterisk tells the logic analyzer to look for a glitch on bit 7 of the counter.



Configuring Timing Trigger Term Edge 1

Configure the Timing Trigger Sequence Levels

1. Touch the 1 field in the Timing Sequence Levels box.
2. Touch the field next to "TRIGGER on," then touch Edge 1 in the pop-up. Touch Done.

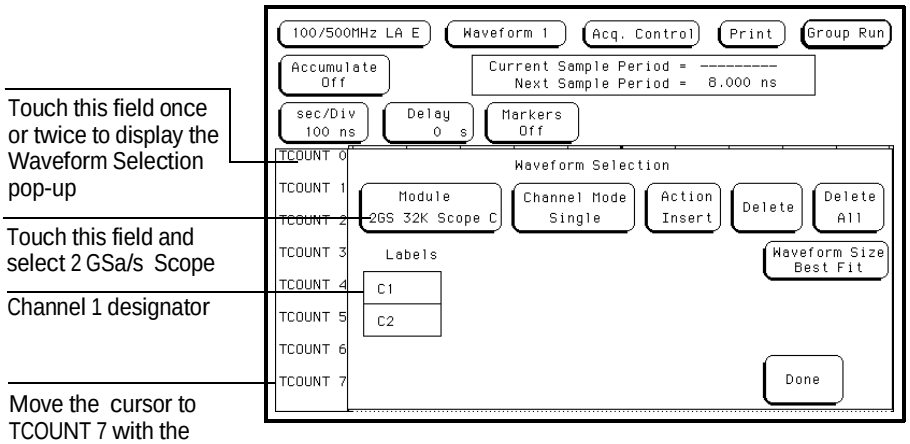


Trigger on Edge 1

Configuring the Trigger Sequence Level

Add Oscilloscope Waveform to the Timing Waveforms

1. Touch the top field, second from the left, then touch Waveform 1.
2. Touch the large blue field at the left side of the display, either once or twice, until the Waveform Selection pop-up appears.
3. Touch the 100/500 MHz LA field, then touch 2 GSa/s 32K Scope.
4. Turn the knob to position the cursor on the TCOUNT 7 label.
5. Touch the channel 1 designator label, then touch Done.



Adding Oscilloscope Waveform to the Timing Waveforms

Capture the Glitch with the Timing Analyzer and Oscilloscope

1. **Touch the Group Run field then, without lifting your finger, drag it to Single in the pop-up and lift your finger.**

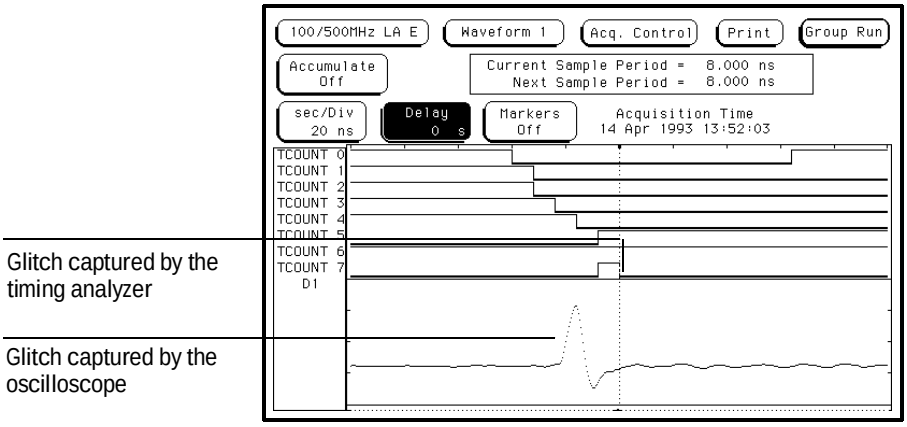
   The timing analyzer will run, and once it triggers, it will arm the oscilloscope via the Intermodule Bus. Since the oscilloscope will not always trigger on the glitch, the glitch trigger of the timing analyzer and the Intermodule Bus will ensure the glitch is captured by the oscilloscope.

2. **Touch the s/Div field to change its color to light blue.**

3. **Rotate the knob to change the s/Div to 20 ns.**

   You will now see the glitch on both the oscilloscope waveform, and TCOUNT7 in the timing analyzer section of the display.

   If the oscilloscope module was not calibrated in its present slot, then you might not see the glitch unless you change the Delay setting.

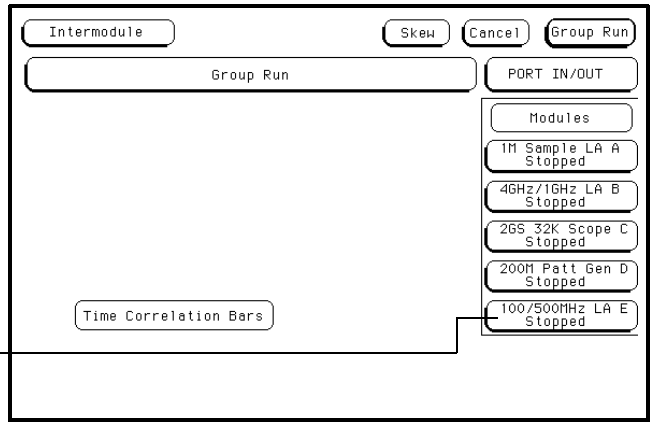


Capturing the Glitch on the Oscilloscope

Turn Off the Intermodule Bus

1. Touch the top left field, then touch Intermodule.
2. Touch the 100/500 MHz LA field on the right side of the display, then touch Independent.

   This exercise turns the Intermodule Bus off so that the logic analysis system is ready for the other exercises in this guide. This is good practice whenever you want to use one of the logic analysis system modules by itself. Depending on the configuration of the system, the Intermodule Bus could interfere with the module you are using independently.



Turning Off the Intermodule Bus

Multilevel State Triggering

Multilevel State Triggering Exercises

The power of the state analyzer lies in its wide range of trigger capabilities. These exercises will step you through the process of using the multilevel triggering capabilities of the state analyzer, giving you a strong foundation for using its additional capabilities. You should do these exercises in the order given since they will be similar to the logical order many of your day-to-day tasks will be performed.

In this chapter you will learn how to:

- Define individual trigger terms
- Define range terms
- Select the State Trigger Specification
- Run the state analyzer and view the state listing
- Assign symbols
- Select and view symbols in the state listing

If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA" and use CH09 from the second disk.

Starting the Exercises

1 Decide what to do next.

If you have just completed all of the exercises in chapters 1 through 8, go to "Set the Jumpers" below.

If you have not just completed all of the exercises in chapters 1 through 8, go to step 2.

2 Load the configuration files POW_UP0 into System and CH09 into 100/500 MHz LA.

The files will default all system settings, and then set up the analyzer as if you had just completed all of the exercises in chapters 1 through 8. If you need instructions to load the configuration files, refer to chapter 10, "To Load a Configuration."

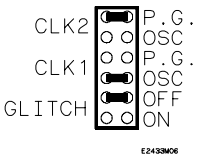
3 Connect Pod 1.

Connect Pod 1 of the logic analyzer to J1 on the Logic Analyzer Training Board. Pod 1 is the top cable in the right-most position when you are facing the rear of the logic analyzer.

Set the Jumpers

- **Set the jumpers as shown below.**

The jumper settings of J5 on the training board for this chapter are the same as the default settings. For more information about setting the jumpers, refer to chapter 10, "To Set the Jumpers."



Turn on the State and Timing Analyzers

1. Touch the top left field, then touch 100/500 MHz LA.
2. Touch the top field, second from the left, then touch Configuration.
3. Touch the field to the right of Type in the Analyzer 2 box, then touch State.
4. Touch the field to the right of Type in the Analyzer 1 box, then touch Off.

Configure the State Analyzer

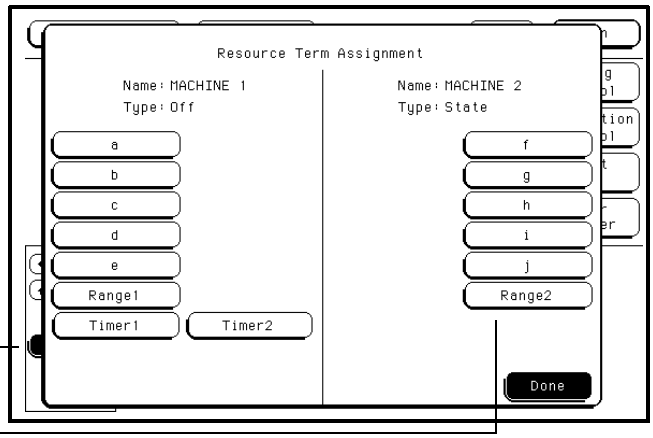
1. Touch the top field, second from the left, and touch Format 2.
2. Touch the top field below Labels, then touch Turn Label On in the pop-up.

   The label SCOUNT should now be active, with the lower eight bits of Pod 3 assigned to it. If this is not the case, perform the steps in chapter 2, "Change a State Label Name," and "Modify the State Analyzer Bit Assignments", on pages 2–8 and 2–9.
3. If the state analyzer signal leads are not already connected, perform the steps in chapter 2, "Connect the State Analyzer," on page 2–4.

Assign State Trigger Terms to Analyzer 2

1. Touch the top field, second from the left, then touch Trigger 2.
2. Touch the "Assign" field, in the bottom left corner of the display, or, if the "Assign" field is not available, touch the "f" field, then touch Assign in the pop-up.
3. Touch "g," "h," "i," "j," and "Range2" in the Resource Term Assignment menu, to assign these terms to analyzer 2. If the "f" term is still assigned to analyzer 1, touch the "f" field to re-assign it to analyzer 2.

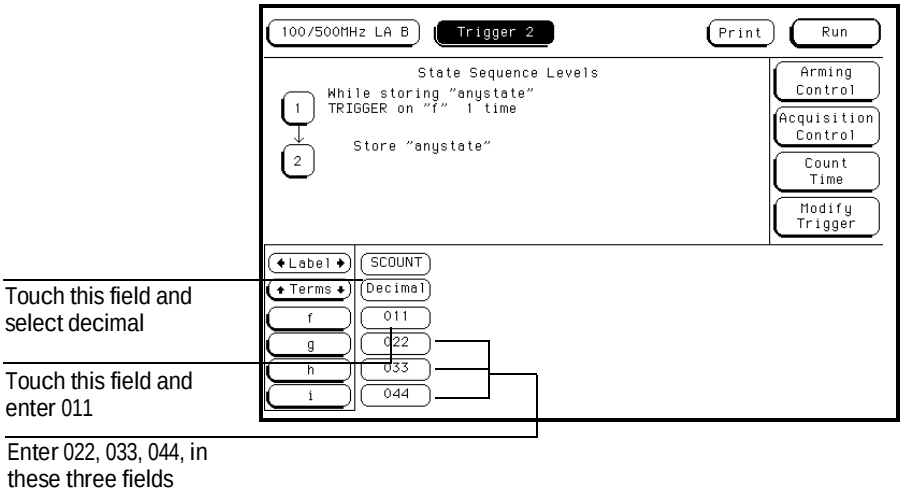
   Each field moves to the other side of the display, beneath the Name: MACHINE 2, Type: State heading. This indicates that the terms are now assigned to analyzer 2, and they can now be used as a trigger terms for the state analyzer.
4. Touch Done to close the Resource Term Assignment pop-up menu.



Assigning State Trigger Terms to Analyzer 2

Define State Trigger Terms "f" through "i"

1. **Touch the field to the right of "Terms," below the SCOUNT label, then touch Decimal.**
   You may notice dollar signs ($) in the fields below the SCOUNT label when you select decimal. The dollar signs appear when the resolution, or width, of the field does not match the base you have selected. When you touch the field, the pop-up menu appears in the base you have selected. Once you enter the data and close the pop-up, the field will display the correct data.
2. **Touch the field to the right of "f" below the SCOUNT label.**
3. **Enter 011 using the pop-up. Touch Done.**
4. **Repeat steps 3 and 4 to enter 022, 033, and 044 in terms "g," "h," and "i," respectively.**
   Terms "f" through "i" are now defined as decimal 11, 22, 33, and 44, respectively. The state analyzer searches for the values defined for each of the terms in the trigger specification.

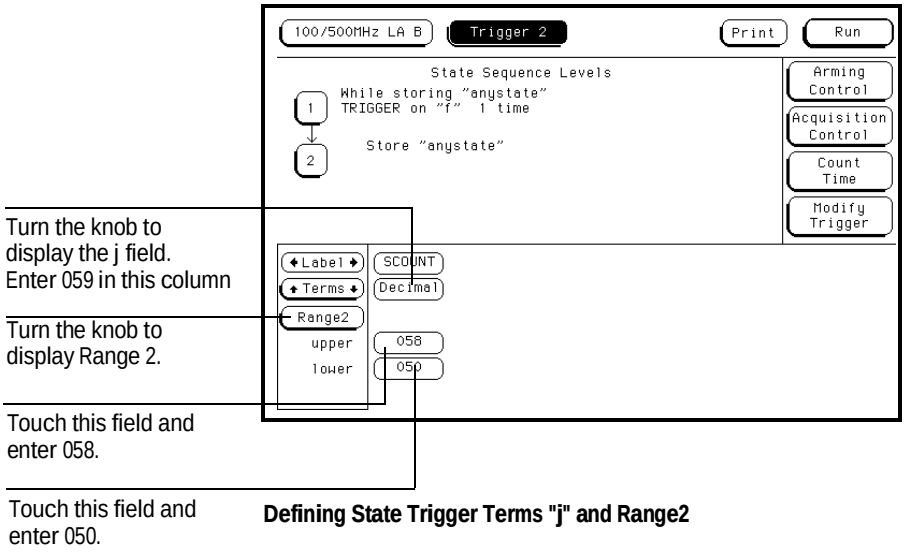


Defining State Trigger Terms "f" through "i"

Define State Trigger Term "j" and Range2

1. Turn the knob clockwise to display the "j" term in the bottom left corner of the display. Touch the field to the right of "j," below the SCOUNT label. Enter 059 using the pop-up. Touch Done.
2. Turn the knob until the Range2 term is displayed. Touch the field to the right of "upper," below SCOUNT. Enter 058 using the pop-up. Touch Done.
3. Touch the field to the right of "lower," below SCOUNT. Enter 050, using the pop-up. Touch Done.

In addition to terms "f" through "j," the logic analyzer provides another five terms, "a" through "e," for a total of ten single value terms. The state analyzer also provides two range terms, in which you define lower and upper limits, and two timer terms, which you can use to define durations. The terms "a" through "e," Range1, and Timer1 are assigned to Analyzer 1 by default.



Defining State Trigger Terms "j" and Range2

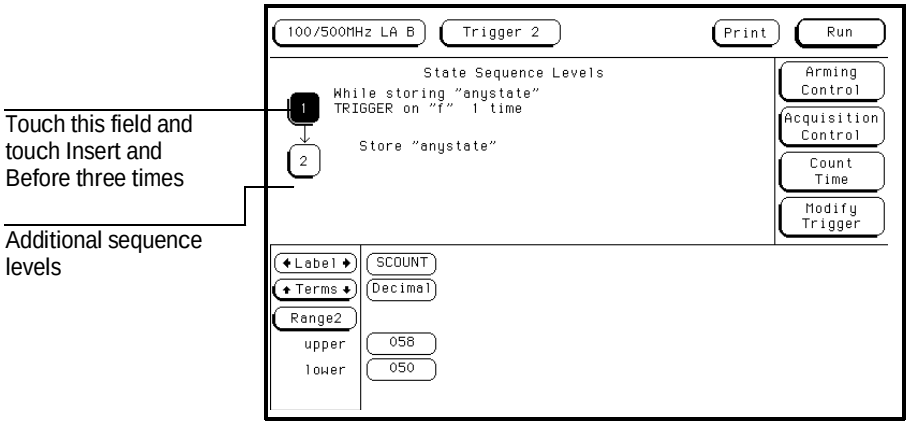
Add State Sequence Levels

1. Touch the "1" in the State Sequence Levels box. The Sequence Level 1 pop-up appears.
2. Touch the Insert Level field, then touch Before in the pop-up.
3. In the Trigger Macro Library, use the knob to highlight "1. User level - custom combinations, loops," then touch Done.

   This exercise shows how to set up custom triggering by selecting the user level. In the Trigger Macro Library, trigger macros are also available for common trigger applications.
4. Repeat steps 2 and 3 two more times. After inserting these two levels, touch Done in the pop-up menu.

   You will now see Sequence Levels 1 through 3. Notice that the text in the second line of each level changes from "Trigger on" to "Find" or "Then find."

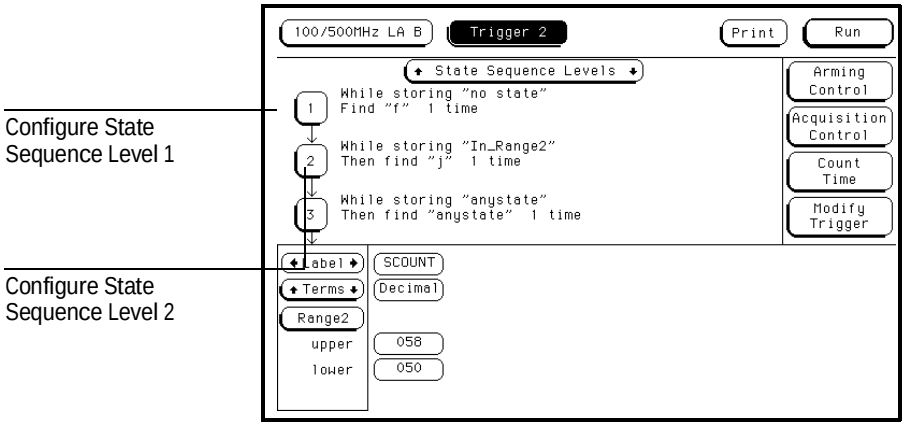
   You can also add sequence levels by touching Modify Trigger, then touching Add Sequence Level in the Trigger menu.



Adding Sequence Levels

Configure State Sequence Levels 1 and 2

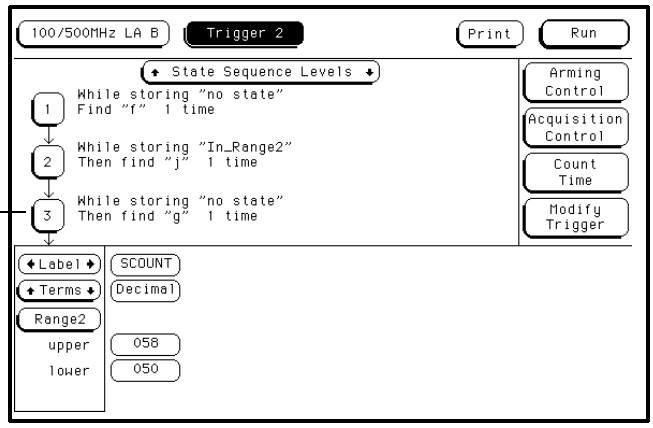
1. Touch the 1 field. In the pop-up, touch the field to the right of "While storing," then touch "no state."
2. Touch the field to the right of "Find," then touch "f." Touch Done.
3. Touch the 2 field. In the pop-up, touch the field to the right of "While storing," then touch "In range2."
4. Touch the field to the right of "Then find," then touch "j." Touch Done.



Configuring Sequence Level 1

Configure State Sequence Level 3

1. Touch the 3 field in the State Sequence Levels box. Touch the field to the right of "While storing," then touch "no state."
2. Touch the field to the right of "Then find," then touch "g." Touch Done.



Configure State Sequence Level 3

Configuring State Sequence Level 3

Configure State Sequence Level 4

1. Turn the knob clockwise to display sequence levels 3, 4, and 5.
2. Touch the 4 field. Touch the field to the right of "While storing," then touch "Combination."

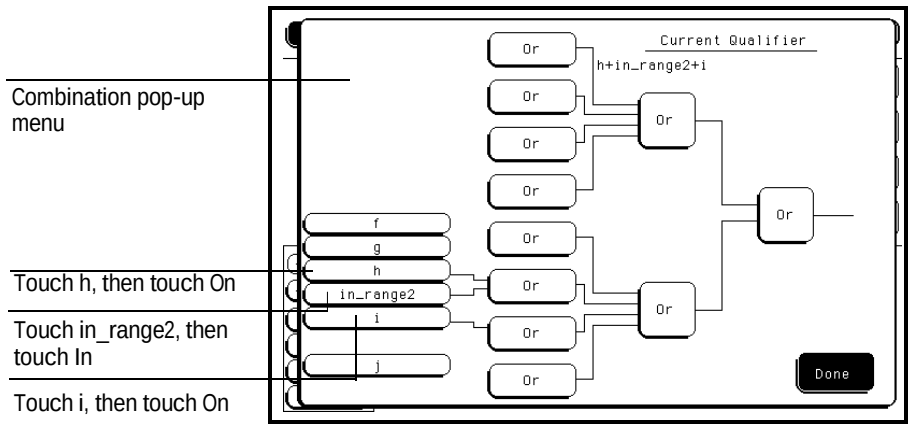
   Another pop-up appears, showing you a graphical menu in which you can define Boolean combinations of your trigger terms. You will define a combination of (h OR range2 OR i) in this exercise.
3. In the combination pop-up menu, touch "h", then touch ON.

   The h term is now turned on and the display shows a connection from h to one of the Or fields. The Or field represents the Boolean Or function.
4. Touch "in_range2". Touch "In" in the pop-up.

   When "In" is selected, the logic analyzer looks for values that are within the limits you defined for the term Range2, in the "Defining State Trigger Term j and Range2" exercise.
5. Touch the i field and touch ON in the pop-up.

   Note the Current Qualifier display in the top right corner of the screen. Your qualifier should now be "h + in_range2 + i".
6. Touch Done to close the combination pop-up menu.

   The "While storing" term in Sequence Level 4 is replaced by the Boolean expression, "h + in_range2 + i".



Configuring State Sequence Level 4

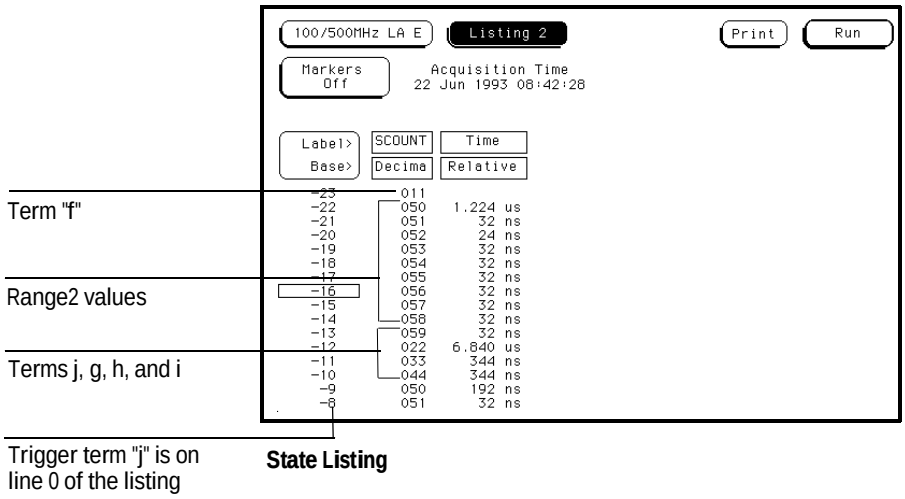
Define the Trigger Term

1. If the Sequence Level 4 pop-up is currently displayed, go to step 2. If the Sequence Level 4 pop-up is not currently displayed, touch the 4 field.
2. Touch the field to the right of the "TRIGGER on" field, then touch "j." Touch Done.
3. Using the knob, scroll through the sequence levels to confirm the following Trigger Specification:
   - Level 1 — While storing "no state"; Find "f" one time
   - Level 2 — While storing "in_range2"; Then find "j" one time
   - Level 3 — While storing "no state"; Then find "g" one time
   - Level 4 — While storing "h + in_range2 + i" ; TRIGGER on "j" one time
   - Level 5 — Store "any state"

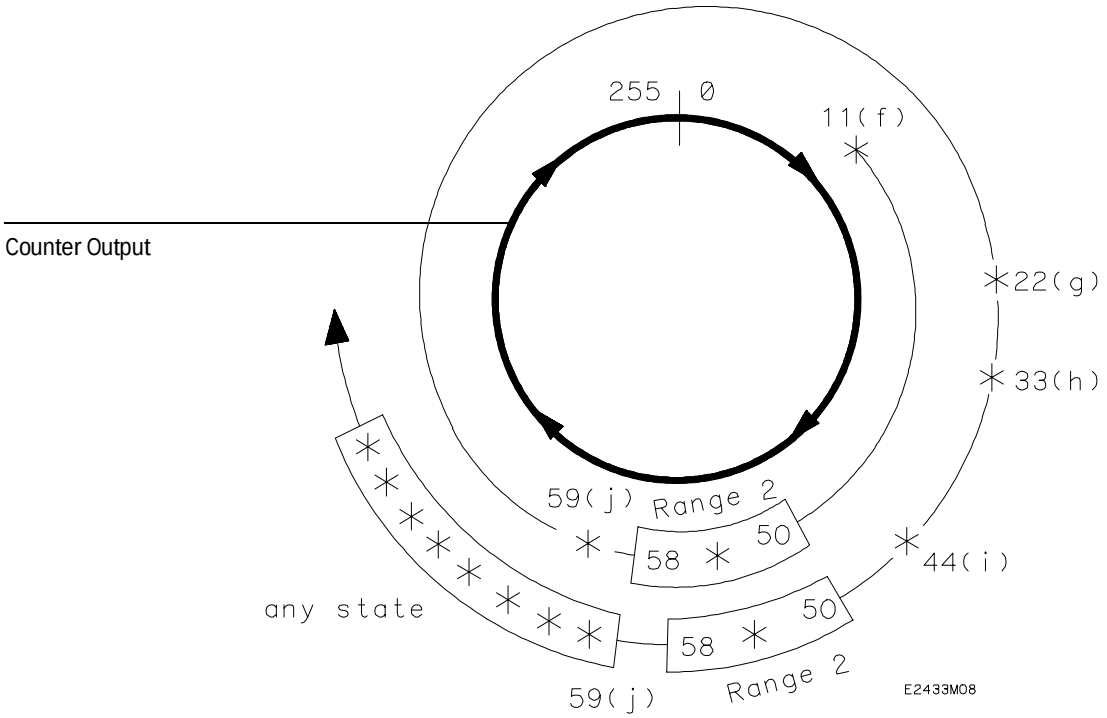
Run the State Analyzer and View the Trace

1. Touch the green Run field.
2. Touch the base field below the SCOUNT label. Touch Decimal in the pop-up.
3. Scroll the listing to the beginning by turning the knob counter-clockwise.
4. Compare your listing to the data under the SCOUNT label in the listing in the figure below.

   You will see that the first state is decimal 011 which is term "f." You will then see the range2 values (050 - 058), followed by terms "j," "g," "h," and "i." As you scroll the listing, you will see Range2 again, then the term "j," and then anystate. The figure on the next page shows you the output of the counter (the circle) and the sequence of qualification and storage that the state analyzer performs.



State Listing



Ripple Counter Output and Stored States

With multilevel state triggering, you specify the data to be stored by the state analyzer. If you are de-bugging software, you can store or exclude certain program lines or entire blocks of code, such as subroutines.

The asterisks in the figure above indicate when the state analyzer found and stored valid terms in this example. All states were initially excluded, using the "no state" term. Next, states that were within the specified range2 term (50 - 58) were stored, while the analyzer searched for an occurrence of term "j." Once the remaining terms and range were found in the specified sequence, the state analyzer stored everything (anystate) until its acquisition memory was filled.

10

Setting the Jumpers and Loading the Configurations

Setting the Jumpers and Loading the Configurations

Before you start each chapter, you should check the jumpers on J5 of the training board to make sure they are properly set. The "To Set the Jumpers" exercise, on the next page, gives you the information you need to change the jumpers. Table 1 shows you the jumper settings for each chapter at a glance.

If you are not performing the exercises in order, you may also need to load configuration files to set up your system. The "To Load a Configuration File" exercise, on the second page following, gives you the information you need to load configuration files. The flexible disk you received in this training kit contains the configuration files which allow you to quickly configure your system for the exercises. The POW_UPx (power-up) files put the HP 16500C system or modules in a default mode. The CH0x files are configurations that set up the HP 16550A or HP 16555A module so that you can complete the exercises.

If you are doing the exercises for the first time, we recommend you follow the steps in each consecutive exercise, from chapter 1 through chapter 9, without loading the configuration files. If you do not want to do the exercises in order, you can load the files listed in the "Starting the Exercises" section of a chapter, then do the exercises in that chapter.

There are also several sample application files on the flexible disk. These files allow you to view sample configurations and data acquired by the HP 16500C Logic Analysis System. These application files give you examples of what you can do with the logic analysis system.

> If you are using the HP 16555A 1.0M Sample 110-MHz State/500-MHz Timing Analyzer instead of the HP 16550A 100-MHz State/500-MHz Timing Analyzer, simply replace all references to "100/500MHz LA" with "1M Sample LA."

To Set the Jumpers

1 Pull the appropriate jumper off of the pins of J5, then push the jumper onto the correct pins of J5 (see the figure inside the rear cover). You only need to change jumpers that differ from the settings in table 1.

Set the jumpers at their default settings for all chapters except chapter 8, "Intermodule Bus Exercises." Table 1 shows you the default settings and the settings for each chapter. Chapter 3, "State Compare Exercises," requires you to change the setting of the glitch jumper part way through the exercises.

Table 1 **Jumper Settings**

		Jumper	
	Glitch	**CLK1**	**CLK2**
Default	OFF	OSC	P.G. (pattern generator)
Chapter 8	ON	OSC	P.G.
All other chapters	OFF	OSC	P.G.

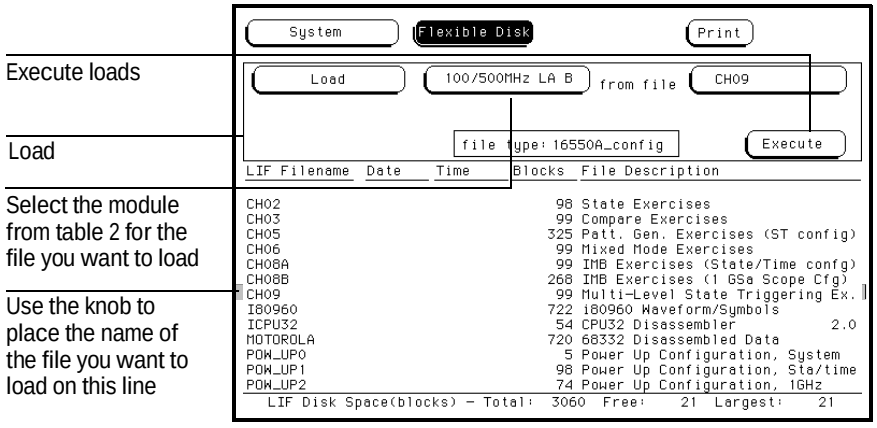
To Load a Configuration File

Each chapter has configuration files that you might need load before starting the exercises. The introduction of each chapter tells you when you should load the configuration files.

1. Place the flexible disk labeled "LOGIC ANALYZER TRAINING KIT CONFIGURATIONS" in the flexible disk drive.
2. Touch the top left field, then touch System.
3. Touch the top field, second from the left, then touch Flexible Disk.

   If the file directory has not been previously read by the logic analyzer, you will see "reading directory . . ." before the directory is displayed.
4. Touch the field below the System field, on the left side of the screen. Touch Load.
5. Using the knob, place the file name you want to load on the light blue center line of the display.
6. Touch the field to the right of Load. Refer to table 2 on the following page; touch the module that matches the file that you want to load.
7. Touch the Execute field.

   Repeat steps 5 through 7 for any additional files that you want to load.
8. Once the files are loaded, touch the System field, in the top left corner of the screen, then touch the module you are going to use.



Loading a Configuration File

Table 2

Configuration Files

To Load file...	Select Module...	File type*	File description
CH02	100/500 MHz LA	16550A_config	State Exercises
CH03	100/500 MHz LA	16550A_config	Compare Exercises
CH05	100/500 MHz LA	16550A_config	Patt. Gen. Exercises (ST config)
CH06	100/500 MHz LA	16550A_config	Mixed Mode Exercises
CH08A	100/500 MHz LA	16550A_config	IMB Exercises (State/Time config)
CH08B	2 GS 32K Scope	16534A_config	IMB Exercises (2 GSa Scope Cfg)
CH09	100/500 MHz LA	16550A_config	Multi-level State Triggering Ex.
POW_UP0	System	16500C_config	Power Up Configuration, System
POW_UP1	100/500 MHz LA	16550A_config	Power Up Configuration, Sta/time
POW_UP2	4 GHz Timing	16517A_config	Power Up Configuration, 4 GHz
POW_UP3	200M Patt Gen	16522A_config	Power Up Configuration, Pat Gen
POW_UP5	2 GS 32K Scope	16534A_config	Power Up Configuration, 2GSa Osc

If a configuration file will not load, you may see an error message on the screen. Make sure you have selected the correct module from table 2. The "All" option will not work for the configuration files provided with the Training Kit.

* If you are using the HP 16555A, be sure that you obtain the configuration files from the second disk.

All About the Logic Analyzer Training Board

All About the Logic Analyzer Training Board

The training board demonstrates the basics of HP Logic Analyzers. The following reference information is provided for those of you who want to know more about how the training board works.

Power Source

The training board is powered by the +5 V supplied by the logic analyzer pods. Therefore, a logic analyzer pod must be connected to either J1 or J2 of the training board in order for the training board to work. If ONLY J2 is connected, it must be connected to the logic analyzer through a termination adaptor (HP part number 01650-63203). If J1 is connected, the termination adaptor is not required because J1 is terminated on the board by Z1 and Z2.

CAUTION

If the termination adaptor part number is HP 01650-63201 (old style), the CLK2 jumper must be set to P.G. to avoid connecting the output of the oscillator to +5 V and eventually damaging the oscillator.

Circuit Description

The training board uses an 8-bit ripple counter running at 32 MHz to produce transitions on the lower 8 bits of a logic analyzer pod. The upper eight bits can be connected to the pattern generator through connector J4.

For state analysis, you can clock the state analyzer via the oscillator on the training board (Y1) or via the pattern generator. The sources for clocks 1 and 2 are selected by the positions of jumpers CLK1 and CLK2, respectively. When the CLK1 and CLK2 jumpers are set to OSC (oscillator) the clock source for the state analyzer is the oscillator on the training board (Y1). When the CLK1 and CLK2 jumpers are set to P.G. (pattern generator) the clock source for the state analyzer is bit D7 or strobe 2 of the pattern generator, depending on which pattern generator pod is connected to J4.

The glitch is generated using the delay between the falling edge of D4 and rising edge of D5 of the ripple counter, and the delay using R2 with the input capatiance of the 74F02N . The ripple counter is a 74FC393. A 74F02 is used to generate the pulse (glitch) and combine it with D7 of the ripple counter. Since the 74F02 is a fast CMOS gate, it boosts the amplitude of the glitch it receives from the 74FC393 counter. This combination of logic families produces a positive glitch that is about 6 ns wide and has an amplitude of about 4 volts. The glitch is available on channel D7 of J1 and J2 when the GLITCH jumper is set to ON.

Jumpers

The jumpers are used to turn the glitch on and off and to select the sources for state clocks 1 (CLK1) and 2 (CLK2).

Glitch

When the GLITCH jumper is set to OFF, the waveform on D7 of J1 and J2 is the most significant bit of the counter. When this jumper is set to ON, a glitch will appear on D7 and the waveform no longer represents the most significant bit of the counter. The glitch always appears on the test point labeled GLITCH, regardless of the position of this jumper.

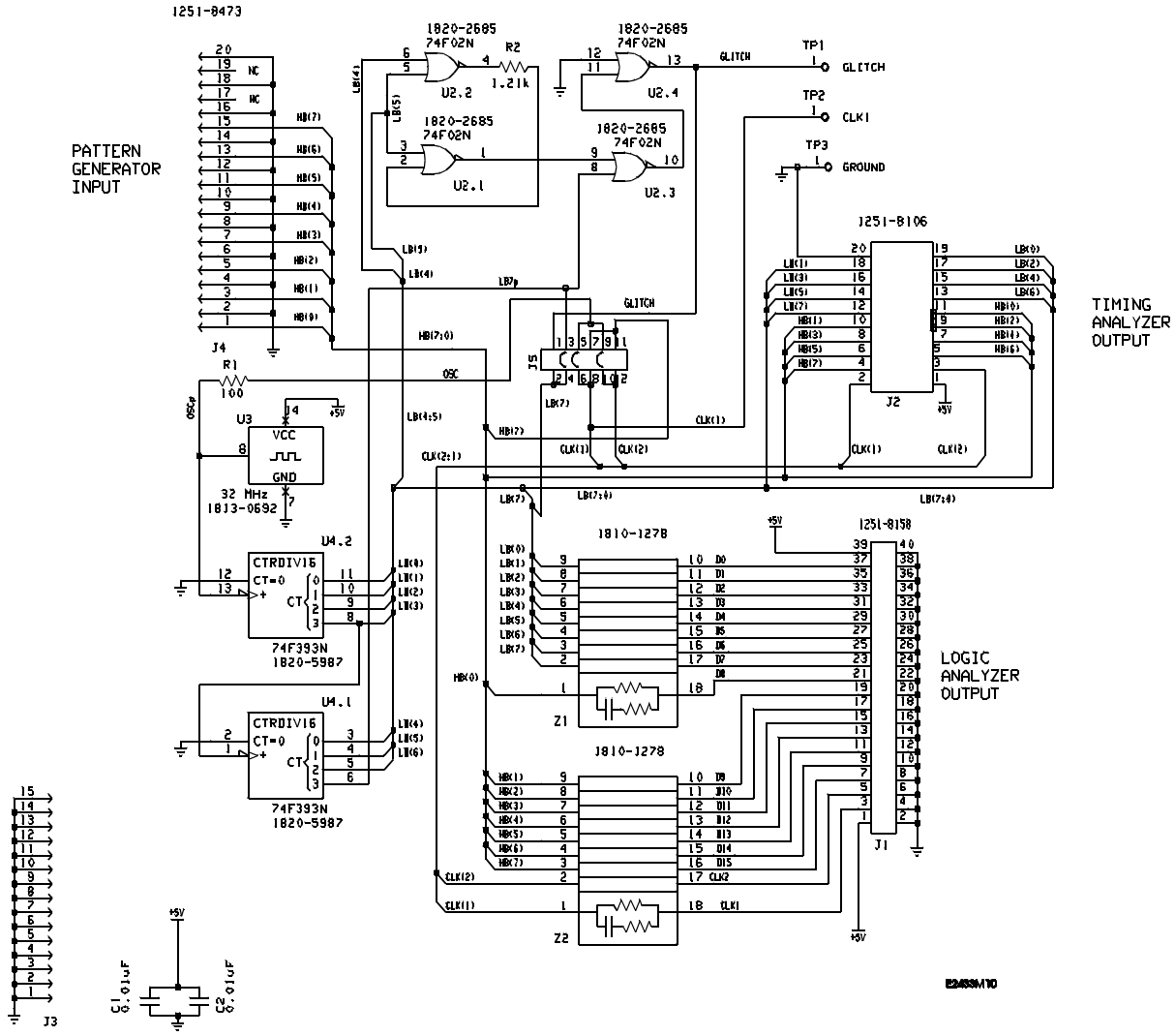
CLK1

The CLK1 jumper selects the source of state clock 1. If you choose OSC (the default), the source of the clock will be the oscillator on the training board. If you choose P.G., the source of the clock will be Strobe 2 or D7 of the pattern generator, depending on which pattern generator pod you have connected to the training board.

CLK2

The CLK2 jumper selects the source of state clock two (used for the HP 16540A). If you choose OSC, the source of the clock will be the oscillator on the training board. If you choose P.G. (the default), the source of the clock will be Strobe 2 or D7 of the pattern generator, depending on which pattern generator pod you have connected to the training board.

Schematic



Logic Analyzer Training Board Schematic

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Document Warranty

The information contained in this document is subject to change without notice.

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability or fitness for a particular purpose.

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Safety

This apparatus has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Measuring Apparatus, and has been supplied in a safe condition. This is a Safety Class I instrument (provided with terminal for protective earthing). Before applying power, verify that the correct safety precautions are taken (see the following warnings). In addition, note the external markings on the instrument that are described under "Safety Symbols."

Warning

- Before turning on the instrument, you must connect the protective earth terminal of the instrument to the protective conductor of the (mains) power cord. The mains plug shall only be inserted in a socket outlet provided with a protective earth contact. You must not negate the protective action by using an extension cord (power cable) without a protective conductor (grounding). Grounding one conductor of a two-conductor outlet is not sufficient protection.
- Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuseholders. To do so could cause a shock of fire hazard.
- Service instructions are for trained service personnel. To avoid dangerous electric shock, do not perform any service unless qualified to do so. Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.
- If you energize this instrument by an auto transformer (for voltage reduction), make sure the common terminal is connected to the earth terminal of the power source.
- Whenever it is likely that the ground protection is impaired, you must make the instrument inoperative and secure it against any unintended operation.
- Do not operate the instrument in the presence of flammable gasses or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.
- Do not install substitute parts or perform any unauthorized modification to the instrument.
- Capacitors inside the instrument may retain a charge even if the instrument is disconnected from its source of supply.
- Use caution when exposing or handling the CRT. Handling or replacing the CRT shall be done only by qualified maintenance personnel.

Safety Symbols

Instruction manual symbol: the product is marked with this symbol when it is necessary for you to refer to the instruction manual in order to protect against damage to the product.

Hazardous voltage symbol.

Earth terminal symbol: Used to indicate a circuit common connected to grounded chassis.

WARNING

The Warning sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a Warning sign until the indicated conditions are fully understood and met.

CAUTION

The Caution sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a Caution symbol until the indicated conditions are fully understood or met.

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Colorado Springs, CO 80901

Product Warranty

This Hewlett-Packard product has a warranty against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by Hewlett-Packard.

For products returned to Hewlett-Packard for warranty service, the Buyer shall prepay shipping charges to Hewlett-Packard and Hewlett-Packard shall pay shipping charges to return the product to the Buyer. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Hewlett-Packard from another country.

Hewlett-Packard warrants that its software and firmware designated by Hewlett-Packard for use with an instrument will execute its programming instructions when properly installed on that instrument. Hewlett-Packard does not warrant that the operation of the instrument software, or firmware will be uninterrupted or error free.

Limitation of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

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The remedies provided herein are the buyer's sole and exclusive remedies. Hewlett-Packard shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

Assistance

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

For any assistance, contact your nearest Hewlett-Packard Sales Office.

Certification

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by the Institute's calibration facility, and to the calibration facilities of other International Standards Organization members.

About this edition

This is the first edition of the *HP E2433-60010 Training Kit for HP Logic Analyzers Training Guide.*

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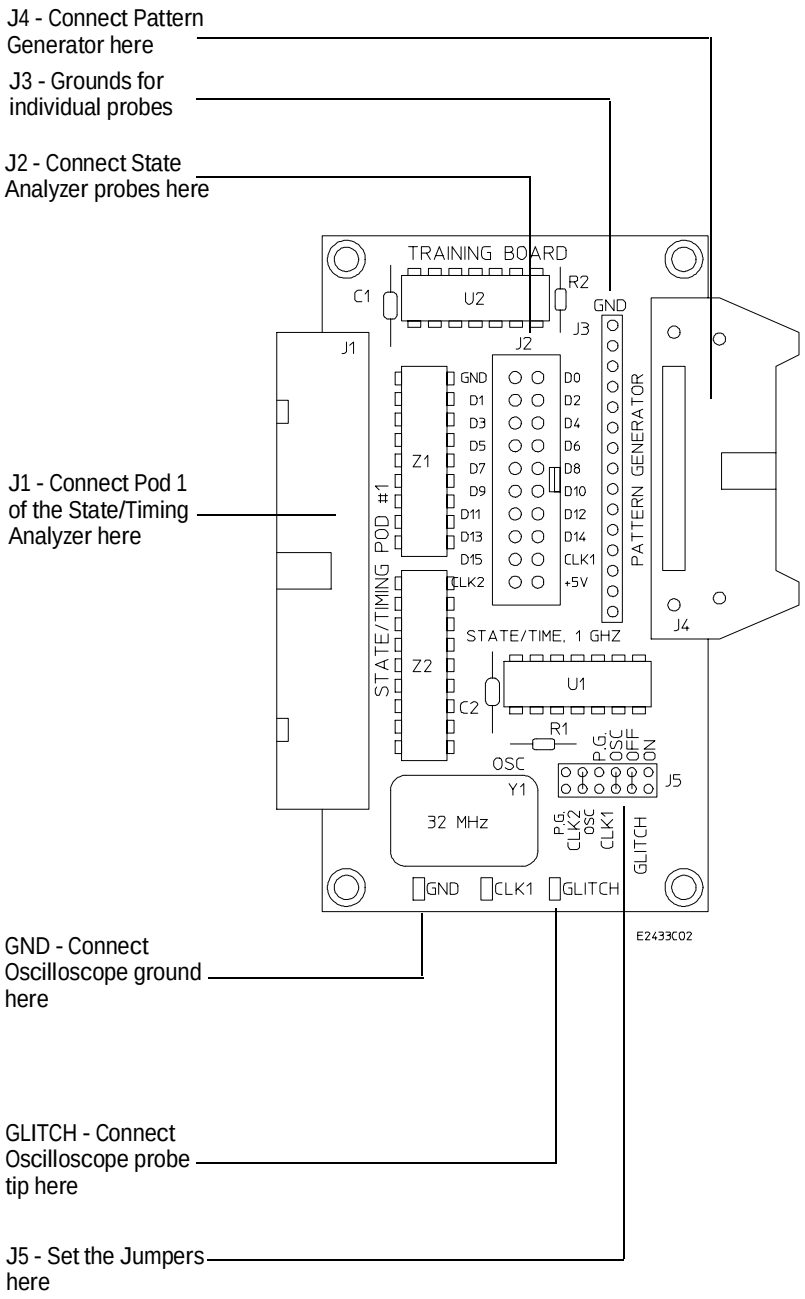
New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by you. The dates on the title page change only when a new edition is published.

A software or firmware code may be printed before the date. This code indicates the version level of the software or firmware of this product at the time the manual or update was issued. Many product updates do not require manual changes; and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

The following list of pages gives the date of the current edition and of any changed pages to that edition.

All pages original edition


J4 - Connect Pattern Generator here
J3 - Grounds for individual probes
J2 - Connect State Analyzer probes here
J1 - Connect Pod 1 of the State/Timing Analyzer here
GND - Connect Oscilloscope ground here
GLITCH - Connect Oscilloscope probe tip here
J5 - Set the Jumpers here
TRAINING BOARD
C1
U2
R2
GND
J3
J2
J1
Z1
GND
D1
D3
D5
D7
D9
D11
D13
D15
CLK2
D0
D2
D4
D6
D8
D10
D12
D14
CLK1
+5V
PATTERN GENERATOR
J4
STATE/TIMING POD #1
Z2
STATE/TIME, 1 GHZ
U1
C2
R1
P.G. OSC OFF ON
J5
OSC
Y1
32 MHz
P.G. CLK2 OSC CLK1
GLITCH
GND
CLK1
GLITCH
E2433C02