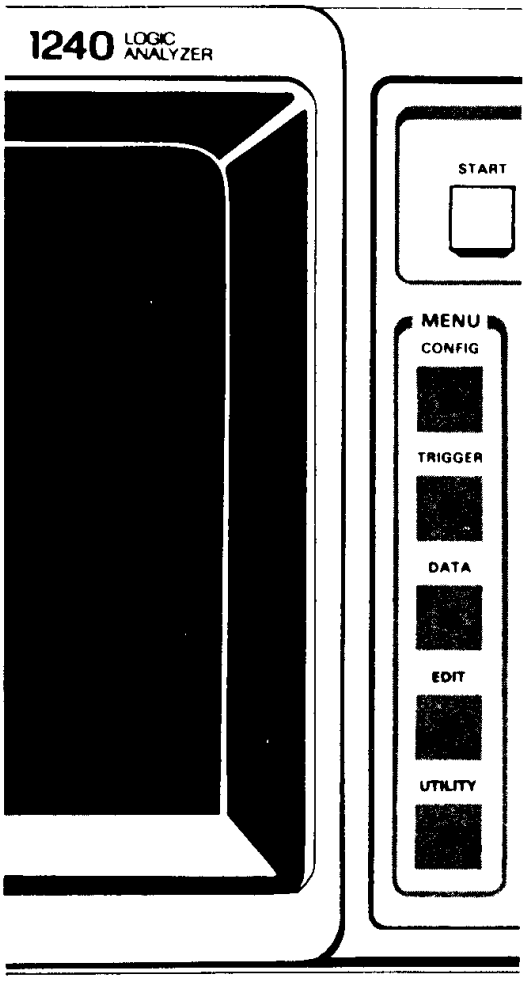
2



DEMONSTRATION

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DEMONSTRATION

This section provides you with a button-pushing tour of 1240 Logic Analyzer features. Follow these "cookbook" procedures if you want to push some buttons without getting lost. If you prefer learning theory before experimenting, skip ahead to Sections 3-7.

SIMPLE EXAMPLE: A QUICK ACQUISITION

The following short procedure causes the 1240 Logic Analyzer to collect data asynchronously at 20 ns intervals on one timebase when a trigger condition of FF is detected.

Required Equipment. This example requires your 1240 Logic Analyzer to be equipped with at least one 9-channel card. No external system is required; input signals are obtained from the internal Test Pattern Generator (TPG). The TPG produces a 63-state repetitive pattern on nine data lines and one clock output.

You will need a 1240 Logic Analyzer with at least:

(1) 1240D1 9-Channel Acquisition Card
(1) P6460 Data Acquisition Probe, with diagnostic lead set [1]

Probe Connection.

1. Connect the data acquisiton probe to the 9-channel card in slot 0.
2. Connect the diagnostic lead set to the probe. (Refer to Figure 2-1.)
3. Connect the other end of the diagnostic lead set to the left (front) TPG connector. The white wire goes down and toward the front of the 1240.

Power—up.

4. Plug in the 1240 and turn on the MAIN POWER SWITCH on the back panel. (Refer to Figure 1-3.)
5. Press the DC POWER pushbutton on the front panel.
6. Refer to Figure 2-2 and verify that the 1240 powers up to the Operation Level menu. After power-up, this menu is accessed using the CONFIG menu key just to right of the screen on the front panel. (If the Main Diagnostic menu appears, the 1240 has failed its power-up diagnostics. Refer to the *1240 Service Manual* or contact your nearest Tektronix Service Center for assistance.)

Setting Input Thresholds.

7. Touch the MEMORY CONFIG soft key at the top of the screen.
8. Turn the SCROLL knob *counter-clockwise* one click until **TPG** appears in the CARD THRESHOLD field.

[1] The 1240 Test Pattern Generator can only be used with the P6460 Data Acquisition Probe.

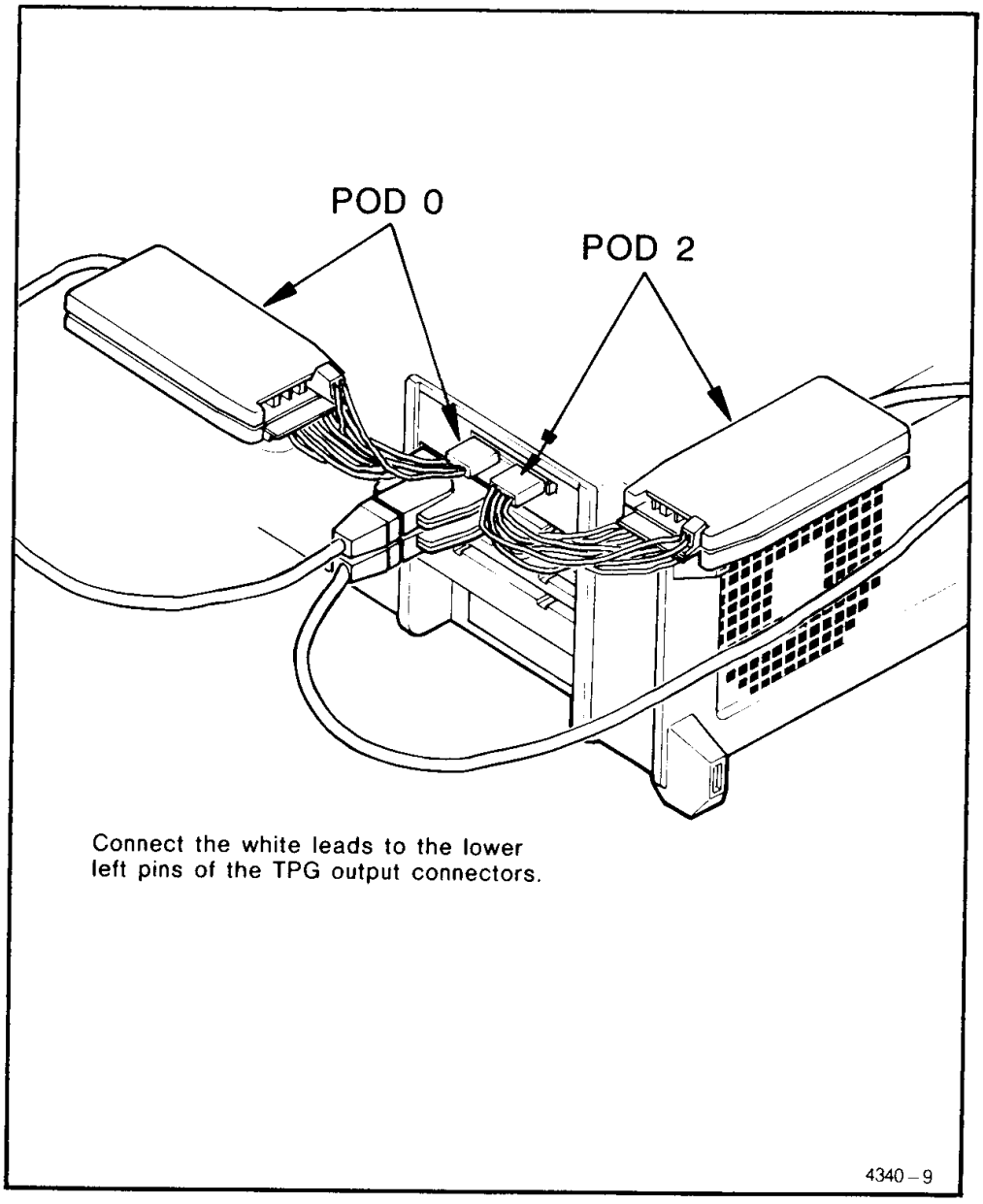

Figure 2-1. Map of the TPG outputs and how diagnostic lead sets connect to them.

Defining the Trigger Condition. This example relies on default values in the other CONFIG menus, Timebase and Channel Grouping, so you do not have to change anything in those menus. But if you would like to look at those default settings, push the TIMEBASE and CHANNEL GROUPING soft keys and take a look before proceeding to the next step.

10. Press the TRIGGER key. This takes you to the Trigger Spec menu so you can define an event.

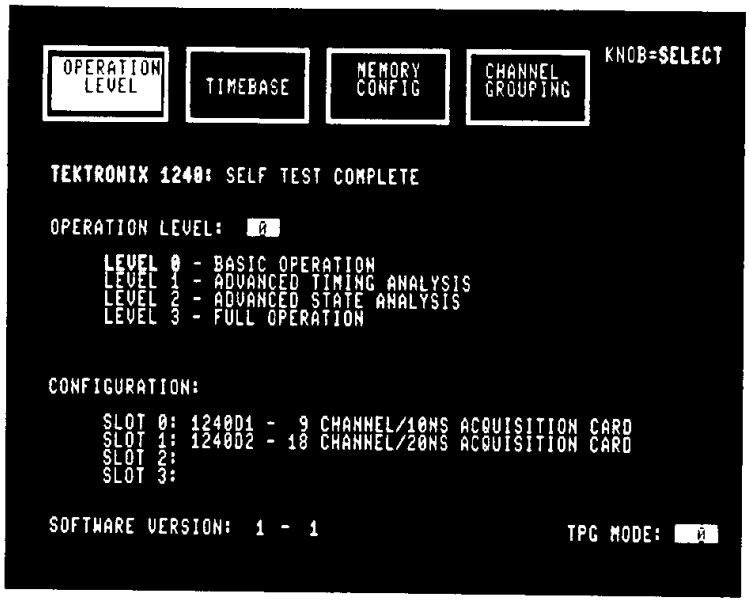

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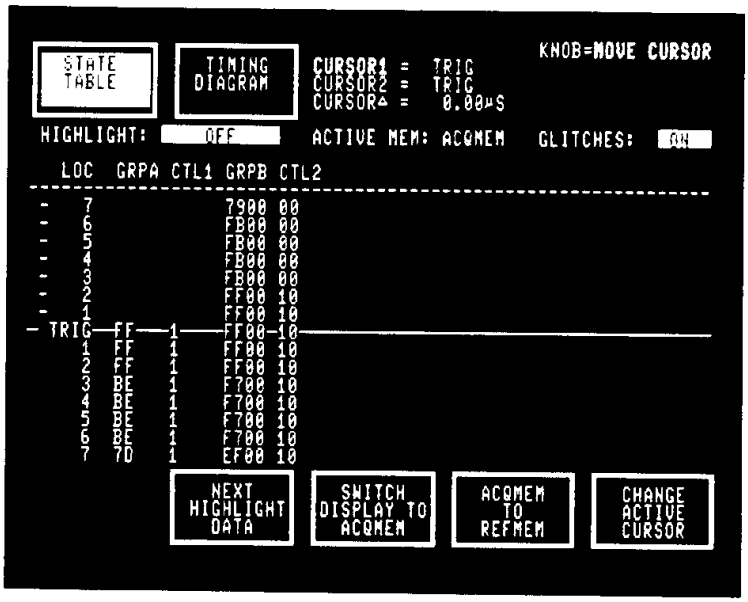
Figure 2-2. 1240 power-up display with one 9-channel and one 18-channel acquisition card installed.



4340—11

Figure 2-3. Data acquired at 20 ns ASYNC after triggering on FF in the TPG pattern.

11. Press **F** twice. This enters **FF** as the event which will cause the 1240 to trigger. The 1240 contains two independent event recognizers, the GLOBAL and the SEQUENTIAL. You are leaving the GLOBAL EVENT recognizer **OFF**, and using only one level of the 14-level SEQUENTIAL EVENT recognizer for this simple acquisition.

Acquiring Data.

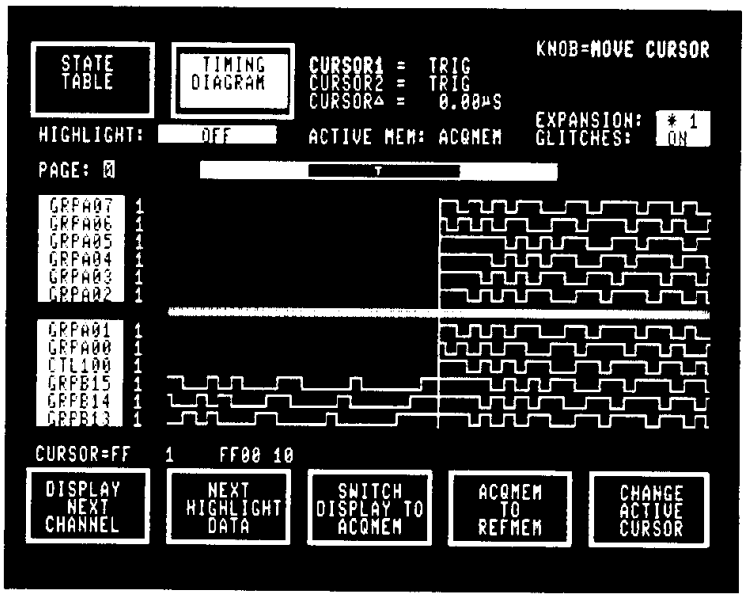
12. Press the START key and observe a data acquisition. The data display when the acquisition is complete will look like Figure 2-3.

NOTE

The examples in this section were generated using an instrument equipped with one 9-channel card and one 18-channel card. If your instrument has a different number of acquisition cards, you will have a different number of data display columns and fields than are shown in these examples.

Timing Diagram Display.

13. Press the TIMING DIAGRAM soft key. The display changes to a timing diagram that looks like Figure 2-4.



4340–12

Figure 2-4. Timing diagram display of data acquired at 20 ns ASYNC after triggering on FF in the TPG pattern.

A MORE COMPLICATED EXAMPLE: TWO TIMEBASES AND DEMULTIPLEXING

The previous example showed a simple method for acquiring meaningful timing data, but it relied heavily on power-up default parameters. The following example is longer and will allow you to set more of the instrument parameters yourself. It also demonstrates several of the 1240's more advanced features, such as dual timebase operation and demultiplexing. In this example, you acquire date asynchronously at 50 ns intervals on one timebase, while you use the other timebase synchronously to demultiplex different data.

Required Equipment. This example requires your 1240 Logic Analyzer to be equipped with at least one 9-channel and one 18-channel acquisition card. No external system is required; input signals are obtained from the internal Test Pattern Generator (TPG). The TPG produces two 63-state repetitive patterns, each of which is available on nine data lines and one clock output.

You will need a 1240 Logic Analyzer with at least:

(1) 1240D1 9-Channel Acquisition Card
(1) 1240D2 18-Channel Acquisition Card
(2) P6460 Data Acquisition Probes, with diagnostic lead sets

Probe Connection.

1. Connect one probe to the 9-channel card in slot 0.
2. Connect another probe to the even-numbered (front) connector of the first 18-channel card.
3. Connect diagnostic lead sets to both probes.
4. Connect the lead set from the 9-channel card to the left (front) TPG connector. Refer to Figure 2-1. Make sure the white wire goes down and to the front of the 1240.
5. Connect the lead set from the 18-channel card to the right (rear) TPG connector. Refer to Figure 2-1.

Power—up.

6. Plug in the 1240 and turn on the MAIN POWER SWITCH on the back panel. (Refer to Figure 1-3.)
7. Press the DC POWER pushbutton on the front panel.
8. Refer to Figure 2-2 and verify that the 1240 powers up to the Operation Level menu. After power-up, this menu is accessed using the CONFIG key just to right of the screen on the front panel. (If the Main Diagnostic menu appears, the 1240 has failed its power-up diagnostics. Refer to the *1240 Service Manual* or contact your nearest Tektronix Service Center for assistance.)

Operation Level and TPG Mode.

9. Turn the SCROLL knob until a **3** appears in the OPERATION LEVEL select field. Note that the highlighting below moves from **LEVEL 0** down to **LEVEL 3**. We now have the full feature set of the instrument available.
10. Using the CURSOR keys, move the blinking field cursor to the TPG MODE select field.

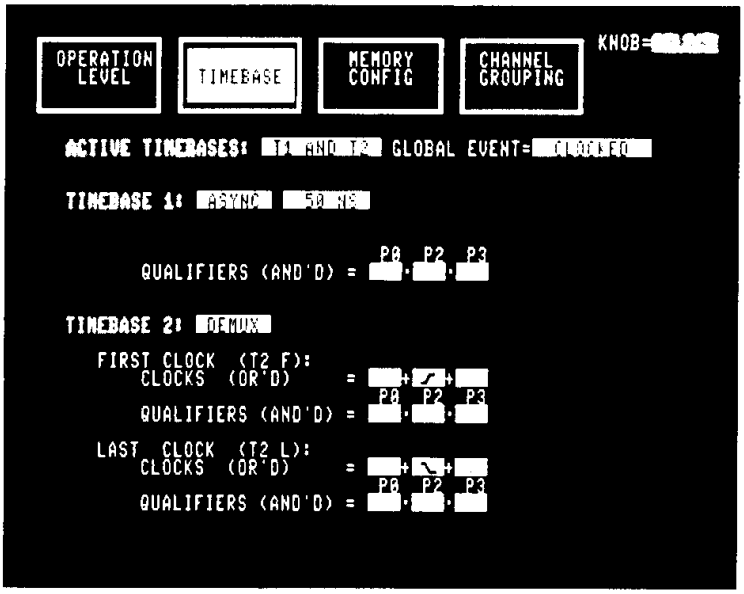
11. Turn the SCROLL knob until a **1** appears. This selects a Test Pattern Generator output which is clocked internally at 6 MHz and which contains glitches in the output.

Setting Up the Timebases.

12. Press the TIMEBASE soft key at the top of the display. Use the SCROLL knob to select **T1 AND T2** as the active timebases.
13. Move the cursor down once and change the period of the asynchronous TIMEBASE 1 from **20 NS** to **50 NS**. This selection gives you several locations of asynchronous data for each synchronous one.
14. Move the cursor down to the first TIMEBASE 2 select field. This field will contain the word **SYNC**, its power-up default value. Select **DEMUX** using the knob or SELECT keys. With this timebase you will acquire data from a single set of lines. But, by using different clock edges, you will demultiplex this data into two different areas of acquisition memory and display it with different labels. (The TPG output data is not really multiplexed, but pretend that it is for the purpose of this exercise.)
15. Move the cursor down once to the first select field for CLOCKS (OR'D) in the FIRST CLOCK (T2 F) row. Turn the SCROLL knob until the select field for the clock edge polarity of pod P0 is blank. The default for all timebases is the rising edge of pod 0. Since your first 9-channel card (pod 0) is being used asynchronously, the pod 0 clock will not be used. For the 18-channel card that you will use for demultiplexing, select edges of the clock associated with the even numbered pod of that card.
16. Move the cursor to the right until it is in the select field of the pod that corresponds to the location of the first 18-channel card. Turn the SCROLL knob to select the rising edge of that clock. With this choice we are selecting the rising edge of the TPG clock as the storage strobe for collecting the data we will later label ADDR.
17. Move the cursor down until it is in the corresponding CLOCKS (OR'D) field of the LAST CLOCK (T2 L) row.
18. Turn the SCROLL knob to select the falling edge of this clock. You are selecting the falling edge of the TPG clock, obtained through the even-numbered pod of the 18-channel card, as the timebase for collecting the data you will later label DATA.
19. Move the cursor to the left until it is in the select field for P0 (**T2 L**).
20. Turn the SCROLL knob until a blank appears (neither edge is selected).
21. Compare the screen with Figure 2-5 to verify what you have done so far.

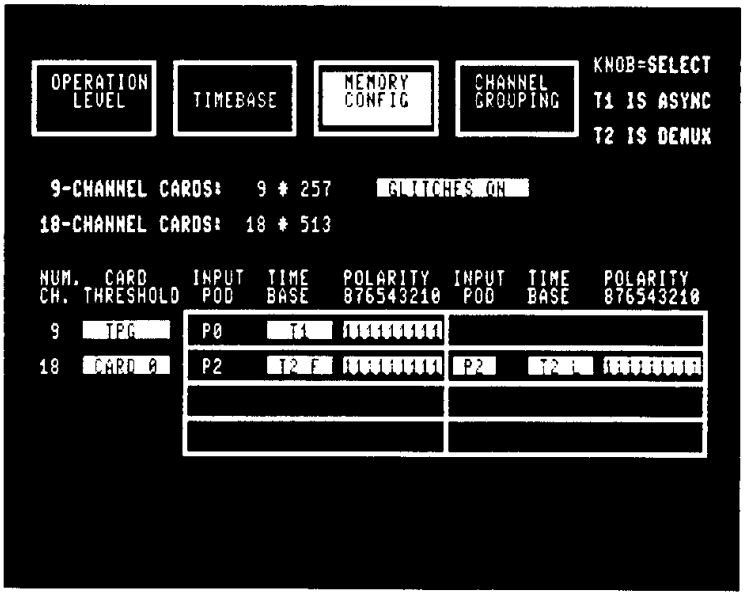
Setting Input Threshholds.

22. Press the MEMORY CONFIG soft key at the top of the display. The blinking cursor is in the CARD THRESHOLD select field for the first 9-channel card.
23. Turn the SCROLL knob *counter-clockwise* one click until **TPG** appears. This sets the input threshold value to +3.70 Volts, to correspond to the Test Pattern Generator output levels. It is not necessary to change the value of any of the other cards because the default value of **CARD 0** means "the same as card 0."



4340—13

Figure 2-5. Setup of the Timebase menu for the second example.



4340—14

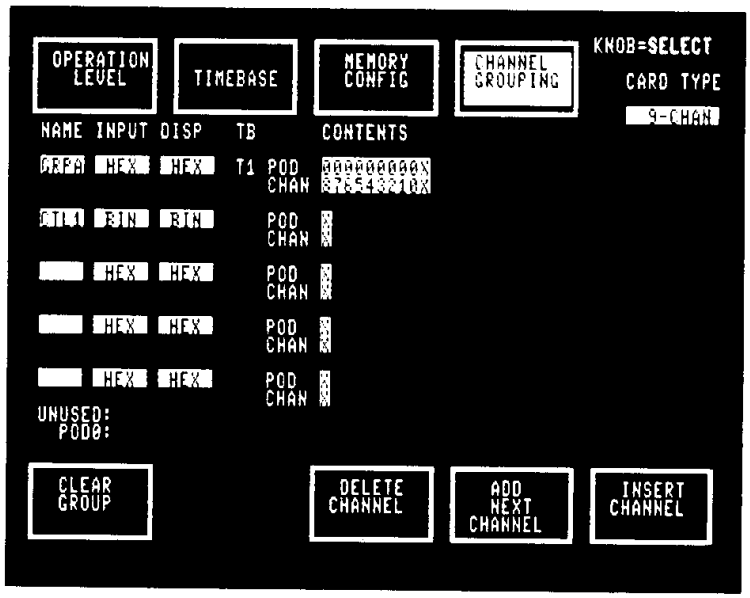
Figure 2-6. Setup of the Memory Config menu for the second example.

Memory Configuration.

24. Move the cursor down to reach the leftmost TIMEBASE column of the first 18-channel card.
25. Turn the SCROLL knob to select **T2 F**, timebase two — *first*. This is the timebase that you defined in the Timebase menu as the rising edge of the TPG clock.
26. Move the cursor right to the INPUT POD select field (reverse video) on the right side of the screen.
27. Turn the SCROLL knob to select the *even* choice of pod. This is the same INPUT POD number shown in a non-select field on the left side of the same card. There are only two choices in this field: the odd, default value supports maximum channel width; the other value, the even choice you just selected, supports demultiplexing of 9 channels into 18.
28. Move the cursor to the right, to the second TIMEBASE column of the first 18-channel card.
29. Turn the SCROLL knob to select **T2 L**, timebase two - *last*. This is the timebase that you defined in the Timebase menu as the falling edge of the TPG clock.
30. Compare the screen with Figure 2-6 to verify what you have done so far.

Channel Grouping. Each TPG output connector contains a clock line and nine lines of data. The power-up default channel grouping for 9-channel cards is eight lines of data in one group with the control lines collected in a separate group. Because the TPG output is nine lines wide (plus a clock), you must move one line from the control group to the first data group. Likewise, the default arrangement of the 18-channel cards is 16 channels of data and 2 control lines. Because you will be doing demultiplexing, you will want to rearrange these lines into two 9-wide groups.

31. Press the CHANNEL GROUPING soft key at the top of the display.
32. Press the NEXT key three times to move the cursor to the CONTENTS column of the display.
33. Press the INSERT CHANNEL soft key at the bottom of the screen. Notice that $\begin{matrix}X\\X\end{matrix}$ appears to the left of the CONTENTS field.
34. Press the **0** data entry key. Note that the top X changes to a 0, and that the cursor is now over the bottom X.
35. Press the **8** data entry key. You have now defined **GRPA** as including all nine data channels of pod 0.
36. Observe the CONTENTS column of the group labeled **CTL1**. Note that $\begin{matrix}X\\X\end{matrix}$ has replaced the $\begin{matrix}0\\8\end{matrix}$ that used to be on the left. When you inserted channel 8 of pod 0 into **GRPA**, the 1240 automatically removed it from its previous group.
37. If your 1240 has more than one 9-channel card, move the cursor down to the groups associated with these other cards and press the CLEAR GROUP soft key. Each time, press the X key on the front panel to confirm that you really want to do this.
38. Move the cursor down to the **CTL1** group. Press the CLEAR GROUP soft key. Press X to confirm that action. Compare the screen to Figure 2-7 to check what you have done.



4340—15

Figure 2-7. Setup of the 9-channel portion of the Channel Grouping menu for the second example.

39. Move the cursor up to the CARD TYPE select field (which currently contains **9-CHAN**). Turn the SCROLL knob until it reads **18-CHAN**. The screen now contains grouping assignments for the lines from 18-channel cards.

40. Press the NEXT key once. The cursor will move to the first select field in the NAME column. (This will be **GRPB** if there is only one 9-channel card installed, **GRPC** if there are two 9-channel cards installed, and **GRPD** if there are three 9-channel cards installed.)

41. Press the CLEAR GROUP soft key and X to confirm that action.

42. Turn the SCROLL knob *counter-clockwise* until an **A** appears in the first character location. Move the cursor to the right once. Turn the SCROLL knob until the character **D** appears. Move the cursor to the right once again. Turn the SCROLL knob until the character **D** appears here too. Move the cursor to the right again and turn the SCROLL knob to obtain an **R**. You have defined a group name as **ADDR**.

43. Press the NEXT cursor key three times to move out to the CONTENTS column.

44. Press the numeric key which corresponds to the even-numbered pod of the first 18-channel card in your instrument. (For instruments with only one 9-channel card, this is **2**. For instruments with two 9-channel cards, this is **4**. For instruments with three 9-channel cards, this is **6**.) Then press the **8** key.

45. Press the ADD NEXT CHANNEL soft key *eight* times. You have now defined a group of nine channels as **ADDR**. These should be the nine channels associated with the even-numbered pod of the first 18-channel card.

46. Press the NEXT key twice to move to the second field in the NAME column. Using the SCROLL knob and the cursor, change this name to read **DATA**. (As in step 42.)

47. Press the CLEAR GROUP soft key and X to confirm that action.

48. Move the cursor to the right, to the INPUT radix column of the **DATA** group. Turn the knob until this field contains **HEX** (if it does not already). Move the cursor to the right, to the DISP (display radix) column of the **DATA** group. Turn the knob until this field contains **HEX** (if it does not already).
49. Move the cursor to the right, to the CONTENTS column of the **DATA** group.
50. Press the numeric key which corresponds to the odd-numbered pod of the first 18-channel card in your instrument. (For instruments with only one 9-channel card, this is **3**. For instruments with two 9-channel cards, this is **5**. For instruments with three 9-channel cards, this is **7**.) Then press the **8** key.
51. Press the ADD NEXT CHANNEL soft key *eight* times. You have now defined a group of nine channels as **DATA**. This group will receive demultiplexed data from the odd-numbered pod of the first 18-channel card.
52. Use the CLEAR GROUP soft key to clear all of the groups below **DATA**. Each time, press the X key on the front panel to confirm that you really want to do this.
53. Compare the screen with Figure 2-8 to verify what you have done so far.

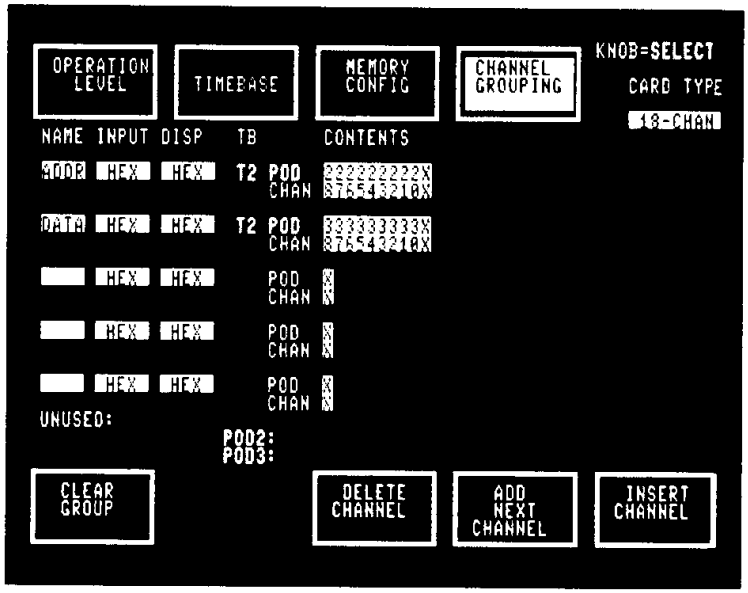


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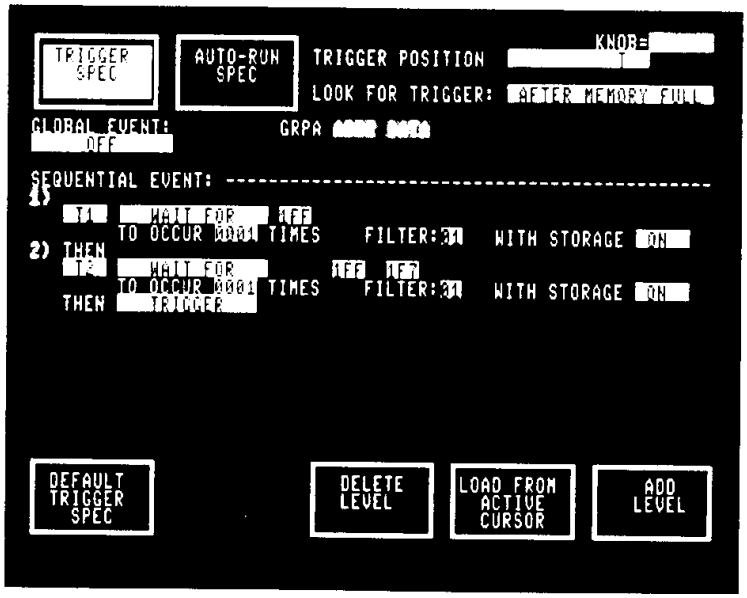
Figure 2-8. Setup of the 18-channel portion of the Channel Grouping menu for the second example.

Specifying the Trigger Condition.

54. Press the TRIGGER key. Then press the CURSOR *up* key three times to move the blinking cursor to the TRIGGER POSITION select field. Use the knob to move the **T** to the right end of the bar graph. This positions the trigger near the end of memory.
55. Move the cursor down *three* times and to the right *once*, to the **XXX**'s in the sequential event recognizer. Enter **1FF** in this field.



4340—17

Figure 2-9. Setup of the Trigger Spec menu for the second example.

56. Press the ADD LEVEL soft key. Move the cursor to the left and change **T1** to **T2**. This level will look for an occurrence of data on timebase 2 after a 1FF occurs on timebase 1.

57. Move the cursor to the right twice and enter **1FF 1F7**. This is the value that will now cause the instrument to trigger.

58. Compare the screen with Figure 2-9 to verify what you have done.

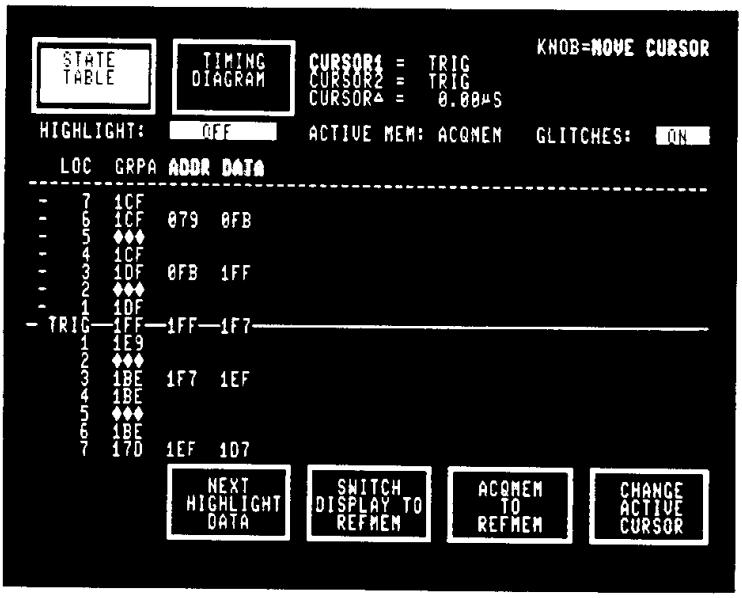


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Figure 2-10. Data display of TPG output triggered on a sequential event recognizer value of 1FF on timebase 1, followed by a 1FF, 1F7 on timebase 2.

Acquiring Data.

59. Press the START key in the EXECUTE area of the front panel. Within a few seconds, the screen should display data around the TRIG location and the lamp in the DATA key should light. The displayed data should look like that in Figure 2-10. Refer to Section 8 for more information about the TPG.

Scrolling and Cursors. Until now you have used the SCROLL knob to make selections in the select fields. In the data display frames, however, the SCROLL knob has a different function. Now it moves the active cursor between data locations and the data itself onto and off of the screen. This is indicated in the upper right corner of the screen. Field selections can now only be made using the SELECT keys.

60. Turn the SCROLL knob *counter-clockwise*. This is the direction of negative location numbers (those that were acquired before the trigger). Note the minus signs at the far left of the display. Continue moving the cursor until it is over location − 10. Note that the trigger location is now near the bottom of the screen.

61. Press the CHANGE ACTIVE CURSOR soft key at the bottom of the screen. Notice that the data moved to put the new active cursor, cursor 2, in the middle of the screen.

62. Move cursor 2, the dotted cursor, down to (positive) location 10. Note that the location of each cursor is shown at the top of the screen. Notice too that the time difference between these two locations is also shown. In this case it is 100 μs.

Glitch Display ON and OFF (State Table).

63. Move the blinking field cursor to the GLITCHES select field with the NEXT key.

64. Press either SELECT key. Note that the selection in the GLITCHES field alternates between **ON** and **OFF**. Continue pressing either SELECT key while watching the data. Notice that rows of glitch symbols (♦) appear and disappear as GLITCHES are selected and de-selected. Leave the GLITCHES **OFF**.

Timing Diagram Display. When you first acquired data, the 1240 presented it in *state table* form. The 1240 can also display data in *timing diagram* form.

65. Press the TIMING DIAGRAM soft key. Note the reverse video area to the left of the traces. These are the group and line number identifications of the displayed traces.

66. Note the three vertical lines in the middle of the screen. The one in the center, composed of dots and dashes, is the trigger position. The one on the left is cursor 1, the one you moved to location −10. The one on the right is cursor 2, the one you moved to location +10.

67. Look at the cursor data in the top center of the screen. Notice that CURSOR 2 is highlighted, indicating that this is the active cursor.

68. Turn the SCROLL knob back and forth. Notice that the active cursor moves and several different things happen on the screen. At the top of the screen the location number is changing. On the left side of the data display, ones, zeroes, and glitch symbols reflect the status of the data on the displayed lines at the location of the active cursor. On the lower left of the screen, just above the soft keys, is a hexadecimal readout of all of the *valid* data at this location. Note that this readout includes traces which are not displayed, as well as those on the screen. Move the cursor back and forth over a large distance. Notice that the synchronous, 18-channel data is only displayed there part of the time, since it is only valid on the less frequent T2 clocks.

Expanding the Timing Diagram.

69. The blinking field cursor is in the EXPANSION field. Press the SELECT *up* key several times and note the effect on the display. Leave the EXPANSION factor at *** 2**.

Glitch Display ON and OFF (Timing Diagram).

70. Move the blinking cursor down once to the GLITCHES field.

71. Press either SELECT key several times and notice the effect on the display. Those bars that appear and disappear are glitch indicators. Remember that you chose a TPG output that included glitches. Leave the GLITCHES field **ON**.

Measuring Time Using the Cursors.

72. Move the active cursor to a location containing glitches. Note that glitch symbols appear in the binary data at the left of the display and in the hexadecimal data at the lower left of the display.

73. Press the CHANGE ACTIVE CURSOR soft key. Cursor 1 is now the active cursor again.

74. Move cursor 1 over a column containing glitches ten columns away from the column where you left cursor 2. Observe that the CURSOR Δ = 1.65 μs or 1.70 μs. Because this is ten times the interval between sets of glitches, and glitches occur at the frequency of the TPG clock, this interval is what you should expect from a TPG which has a period of 168 ns ($\pm$ 1%) in the 6-MHz-with-glitches mode.

Search Pattern Entry.

75. Press the EDIT key.

76. Move the cursor up once, to the ENTER DATA FOR field, and replace **T1 ONLY** with **T1 AND T2** by pressing the SELECT *down* key once.

77. Move the cursor down and to the right, to the ADDR field, and enter **1FF**.

78. Press the DATA key. Because you were looking at a timing diagram when you left this menu, that timing diagram is still present when you return. Press the STATE TABLE soft key to return to a state table display.

79. Move the blinking field cursor to the HIGHLIGHT field and press the SELECT key to highlight **PATTERNS**.

80. Press the NEXT HIGHLIGHT DATA soft key. Notice that the active cursor moves to the next occurrence of the pattern **1FF** in the ADDR column.

Storing a Setup.

81. Press the UTILITY key.

82. Use the SCROLL knob and the CURSOR keys to enter your initials in the FILENAME field.

83. Move the blinking cursor to the right to the STORED IN field. Turn the SCROLL knob. There is only room for one setup in nonvolatile memory (**NVM**). (Three setups can be stored in internal **RAM**, but that is volatile.)

84. Press the STORE NEW FILE soft key.

85. Turn off the 1240 and turn it on again. Press the UTILITY key. Notice that there are two files, the one with your initials and INIT. Both contain your setup. That is because the 1240 automatically stores the current setup when power is turned off or fails. When someone else uses your 1240 and turns it off, their setup will be in INIT and, if they didn't replace it, your setup will still be in the file with your initials.

86. To recover the file with your initials, turn the knob *counter-clockwise* until a **1** appears in the SELECTED field. Press the LOAD FILE soft key, then the X key to confirm. You can now look back through the other menus and verify that the 1240 remembered how you set it up.