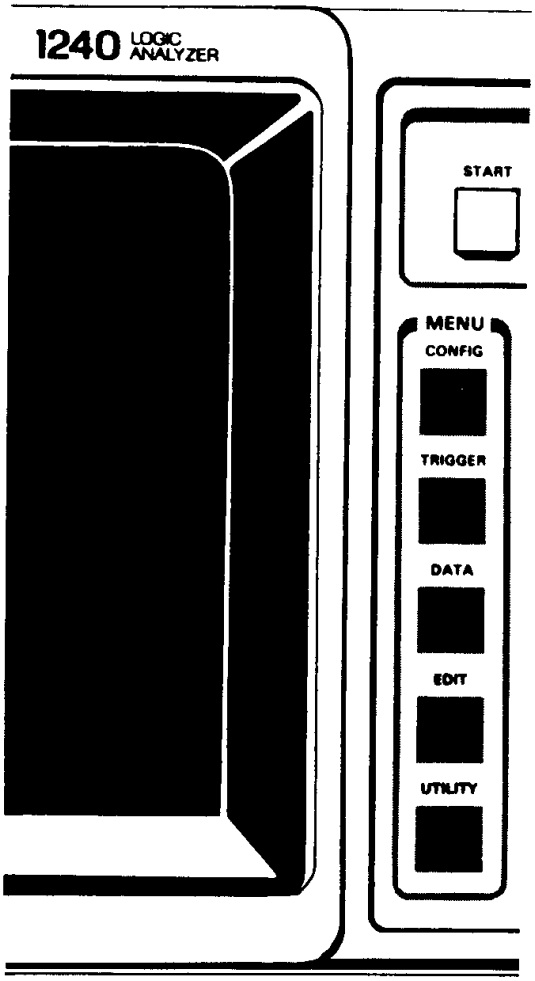
5


1240 LOGIC ANALYZER
START
MENU
CONFIG
TRIGGER
DATA
EDIT
UTILITY

DATA

Press the DATA key on the front panel to access the State Table and Timing Diagram data display formats. Both formats can display acquisition memory or reference memory.

The first time after power-up that the 1240 acquires data and stops, it automatically displays the data in the State Table format. As more acquisitions are taken, the 1240 displays data in either the State Table or Timing Diagram format, depending on which was last used. Change the data display format by touching the appropriate soft key at the top of the screen.

Figures 5-1 and 5-3 show sample State Table displays; Figures 5-5 and 5-6 show sample Timing Diagrams. The other figures in this section illustrate specific data display characteristics.

COMMON DATA DISPLAY FEATURES

Data Scrolling and Cursor Control. Data scrolling is controlled by two data cursors: Cursor 1 and Cursor 2. The cursors are displayed as horizontal lines running through a text line in the State Table and as vertical lines across the timing traces in the Timing Diagram. In both displays, Cursor 1 is a solid line and Cursor 2 is a dotted line. The data cursors are controlled by the SCROLL knob and the CHANGE ACTIVE CURSOR soft key at the bottom of the screen.

One cursor is "active" and the other is inactive; either Cursor 1 or Cursor 2 may be the active cursor. The location of the active cursor determines what data is displayed on the screen. The active cursor never leaves the screen; therefore, only data surrounding the active cursor is displayed. To display a different portion of memory, move the active cursor with the SCROLL knob. The scrolling operation wraps around the end of memory in either direction.

Touch the CHANGE ACTIVE CURSOR soft key at the bottom of the screen to transfer the role of active cursor to the other cursor.

The location of each cursor is displayed at the top of the screen. The label for the active cursor is highlighted. The cursor positions are the number of memory cycles or locations (labeled LOC in the State Table) the cursors are offset from the trigger. Memory locations preceding the trigger are assigned negative values; locations after the trigger are positive. At power-up, both cursors are positioned at the trigger.

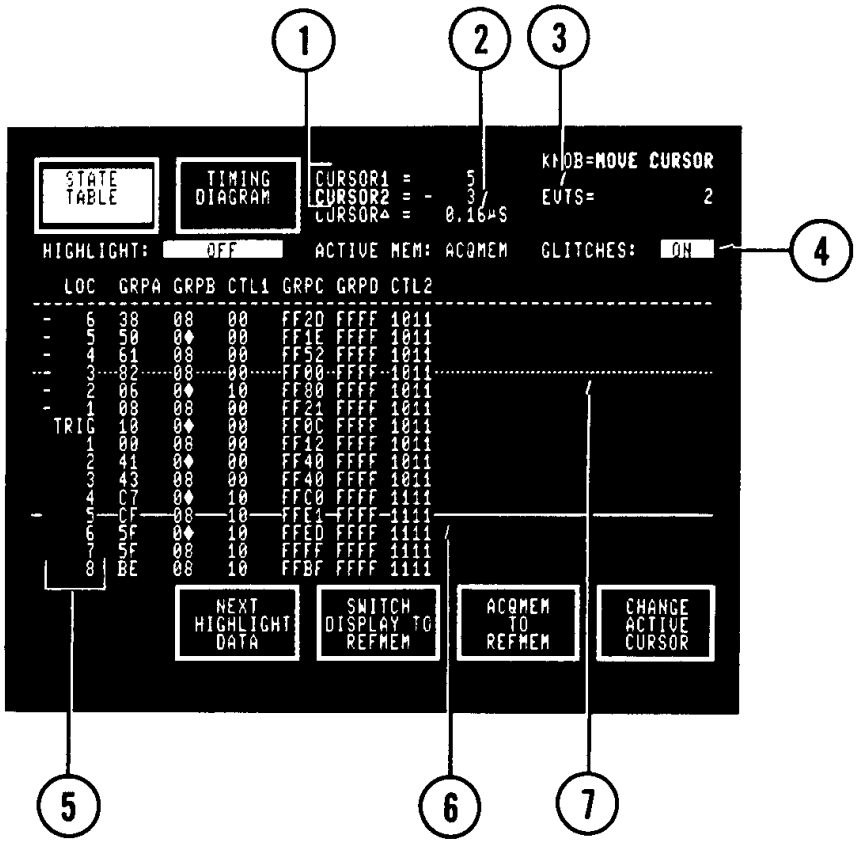
The line below the cursor locations is CURSOR Δ (difference between the cursors). CURSOR Δ is a time value if: T1 is ASYNC with no clock qualification, data qualification (STORE) is not used in the global event recognizer, and Cursors 1 and 2 are both positioned on memory locations within the bounds of the asynchronous data. If these conditions are met, CURSOR Δ is a time value in units of the asynchronous clock period (see callout 2 in Figure 5-1). Use this feature to measure the time between two events.

If any of the conditions listed above are not met, CURSOR Δ is expressed as the number of memory locations between the cursors.

Trigger Display. The trigger location in the State Table is marked by the letters TRIG in the LOC (memory location) column. In the Timing Diagram, the trigger is marked by a broken vertical line across the timing traces.

If you press the STOP key before a trigger has occurred, the last (most recently acquired) location in acquisition memory is the "stop trigger." This location is labeled STOP in the State Table. All other memory locations are negative in relation to a stop trigger.

If a cursor is positioned at the trigger, the cursor location display at the top of the screen is TRIG (or STOP).



1 Location of Cursors 1 and 2. Active cursor is highlighted.

2 Distance between cursors. See *Data Scrolling and Cursor Control* in this section for details.

3 Event counter value. Expressed as a number of events. Displayed when INCR CNTR is the action for the global event recognizer.

4 Glitch display. This field is displayed only if glitch storage was enabled in the Memory Config menu when the data was acquired. If you select **ON**, the 1240 displays ♦ for each digit of the display radix that contains a bit of glitch. If you select **OFF**, the data at the sample point is displayed.

5 Memory location number. Events preceding the trigger (TRIG) are assigned negative locations; events following TRIG have positive locations.

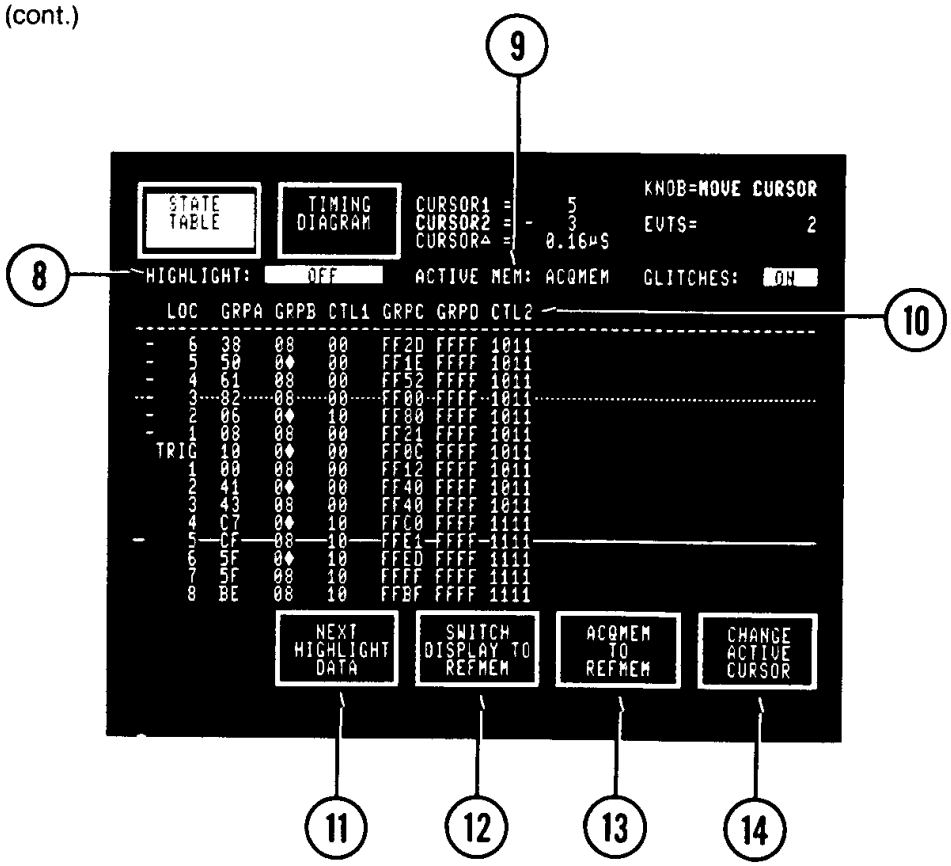
6 Cursor 1.

7 Cursor 2.

(cont.)

Figure 5-1. One-timebase State Table display with glitches. A ♦ symbol indicates that glitch information was stored for at least one bit of the digit. The location of the active cursor determines which data is displayed. Move the active cursor with the SCROLL knob. The label of the active cursor is highlighted at the top of the screen. Touch the CHANGE ACTIVE CURSOR soft key to assign the active role to the other data cursor. Data is displayed in the radices selected in the Channel Grouping menu.

(cont.)



8 Determines the type of data to be displayed with highlighted video. Selections are **OFF**, **MEM DIFFS**, **PATTERNS**, **GLITCHES**, **T1 VALID**, and **T2 VALID**. See *Highlighting* in this section for details.

9 Memory currently displayed (ACQMEM or REFMEM).

10 Group names. Names of groups associated with T1 are displayed in normal video. Names associated with T2 are highlighted.

11 Moves the active cursor to the first location of the next occurrence of highlighted data.

12 Displays the other memory (ACQMEM or REFMEM). When REFMEM is displayed, the label for this soft key changes to SWITCH DISPLAY TO ACQMEM. The cursor positions do not change.

13 Copies the contents of acquisition memory into reference memory, overwriting the previous REFMEM contents. No action is taken unless you confirm the operation by pressing the X key.

14 Transfers the role of active cursor to the other cursor. If the other cursor is not onscreen, the display changes to show the data around it.

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Figure 5-1. One-timebase State Table display with glitches (cont.).

Glitch Display. The GLITCHES **ON/OFF** field is displayed only if glitch storage was enabled in the Memory Config menu when the displayed data was acquired. See callout 4 in Figure 5-1 and callout 13 in Figure 5-5.

If you select GLITCHES **ON** in the State Table, the 1240 displays the special diamond-shaped glitch character (♦) for each digit of the display radix for which glitch information was stored. It is not necessary for all bits of the digit to be glitch; the glitch character is displayed for the digit if any bit is glitch information.

If you select GLITCHES **ON** in the Timing Diagram, a glitch is displayed as a wide, intensified rising edge (see Figure 5-5).

If you select GLITCHES **OFF**, the data at the sample point is displayed instead of the glitch symbol. (GLITCHES **OFF** disables glitch highlighting; see *Highlighting* in this section.)

NOTE

ACQMEM to REFMEM comparisons in Auto-Run and highlighting for patterns and memory differences are based on the actual contents of memory and not on what may be displayed if glitch display is off.

Data Correlation. The 1240 displays data in the order it occurred at the probe tip. The data correlation feature preserves the time relationship between events, including events occurring on different timebases.

Figure 5-2 illustrates the data correlation feature. The State Table and Timing Diagram displays in the figure are based on the sample waveforms. Each waveform represents one channel of data. In this example, one channel is clocked by T1 ASYNC and the other by T2 SYNC.

To interpret the order in which events occurred from a two-timebase State Table or Timing Diagram display, remember this convention:

If a T2 event occurs after a T1 event and before any other event, the 1240 displays both events at the same memory location. In all other cases, there is one event per location.

A sample two-timebase State Table display is shown in Figure 5-3.

To cover gaps in timing diagram traces, the 1240 displays information extrapolated from the last valid data. In Figure 5-2, extrapolated data is shown by lighter-weight lines. In an actual Timing Diagram, you can differentiate extrapolated data from valid data by using the **T1 VALID** or **T2 VALID** highlighting selections (see *Highlighting*, next, for more information). See Figure 5-6 for a sample two-timebase Timing Diagram display.

Highlighting. Highlightling accents data on a location-by-location basis to make analysis of acquired data easier. In the State Table display, data that meets the highlight requirements is marked by highlighted LOC numbers. In the Timing Diagram, vertical bars of highlighting across all displayed traces mark locations that meet the highlighting requirements (see Figure 5-6 for an example). The selections available in the HIGHLIGHT field are:

- **OFF** — no highlighting.
- **MEM DIFFS** — highlight differences between acquisition and reference memory.
- **GLITCHES** — highlight glitches. Glitch display must be on (GLITCHES **ON** selected). In the Timing Diagram, a location is highlighted only if a glitch is present in a currently displayed trace.

- **PATTERNS** — highlight the first location of all occurrences of the search pattern. The search pattern is specified in the Search Pattern Entry menu. See *Searching for a Data Pattern*, next, for more information.
- **T1 VALID** — highlight a location if it has valid T1 data.
- **T2 VALID** — highlight a location if it has valid T2 data.

Touch the NEXT HIGHLIGHT DATA soft key at the bottom of the screen to move the active cursor to the first location of the next highlighted data. The active cursor does not move if there is no more data in memory that meets the highlight requirements. This function wraps around the end of memory if necessary.

NOTE

*The **T1 VALID** and **T2 VALID** highlighting selections are useful in the Timing Diagram when data for two timebases is displayed (see Figure 5-6).*

*Highlighting for patterns and memory differences is based on the actual contents of memory and not on what may be displayed if glitch display is off. For example: if you select GLITCHES **OFF** and HIGHLIGHT: **MEM DIFFS**, areas that appear to be the same in both memories can be highlighted if the actual memories (containing glitch information) are different.*

Searching for a Data Pattern. The Search Pattern Entry menu in the EDIT menu group (see Section 6) allows you to specify a pattern of 1 - 8 consecutive memory locations. If you select **PATTERNS** in the highlighting field of the State Table or Timing Diagram, the 1240 highlights the first location of each pattern occurrence on the screen. In the State Table, LOC numbers are highlighted. In the Timing Diagram, a location is highlighted by a vertical bar across all displayed traces.

The default search pattern is one line of all don't cares (X). This pattern matches all values, including no data.

NOTE

*The pattern function operates only if PATTERN SEARCH **ENABLED** is selected in the Search Pattern Entry Menu.*

Acquisition Memory (ACQMEM) and Reference Memory (REFMEM). Acquisition and reference memory can both be displayed in State Table and Timing Diagram formats. When the 1240 displays acquisition memory, a soft key at the bottom of the screen is labeled SWITCH DISPLAY TO REFMEM. Touch this soft key to display reference memory. When reference memory is displayed, this soft key is labeled SWITCH DISPLAY TO ACQMEM. The ACTIVE MEMORY field is displayed below the cursor readout (see callout 9 in Figure 5-1 and callout 12 in Figure 5-5). This field serves as a reminder of which memory (ACQMEM or REFMEM) is currently displayed. ACTIVE MEMORY is an informational field; it cannot be accessed by the field cursor.

The ACQMEM TO REFMEM soft key at the bottom of the screen allows you to copy acquisition memory to reference memory. After you touch this key, PRESS "X" TO CONFIRM OPERATION (ANY OTHER HARD KEY CANCELS IT) is displayed at the top of the screen. When you press X, reference memory is overwritten by a copy of acquisition memory; the previous contents of REFMEM cannot be retrieved.

The power-up default acquisition memory contains all zeros; default reference memory contains a fixed random pattern.

NOTE

The positions of the data cursors do not change when you change memories or perform a new acquisition.

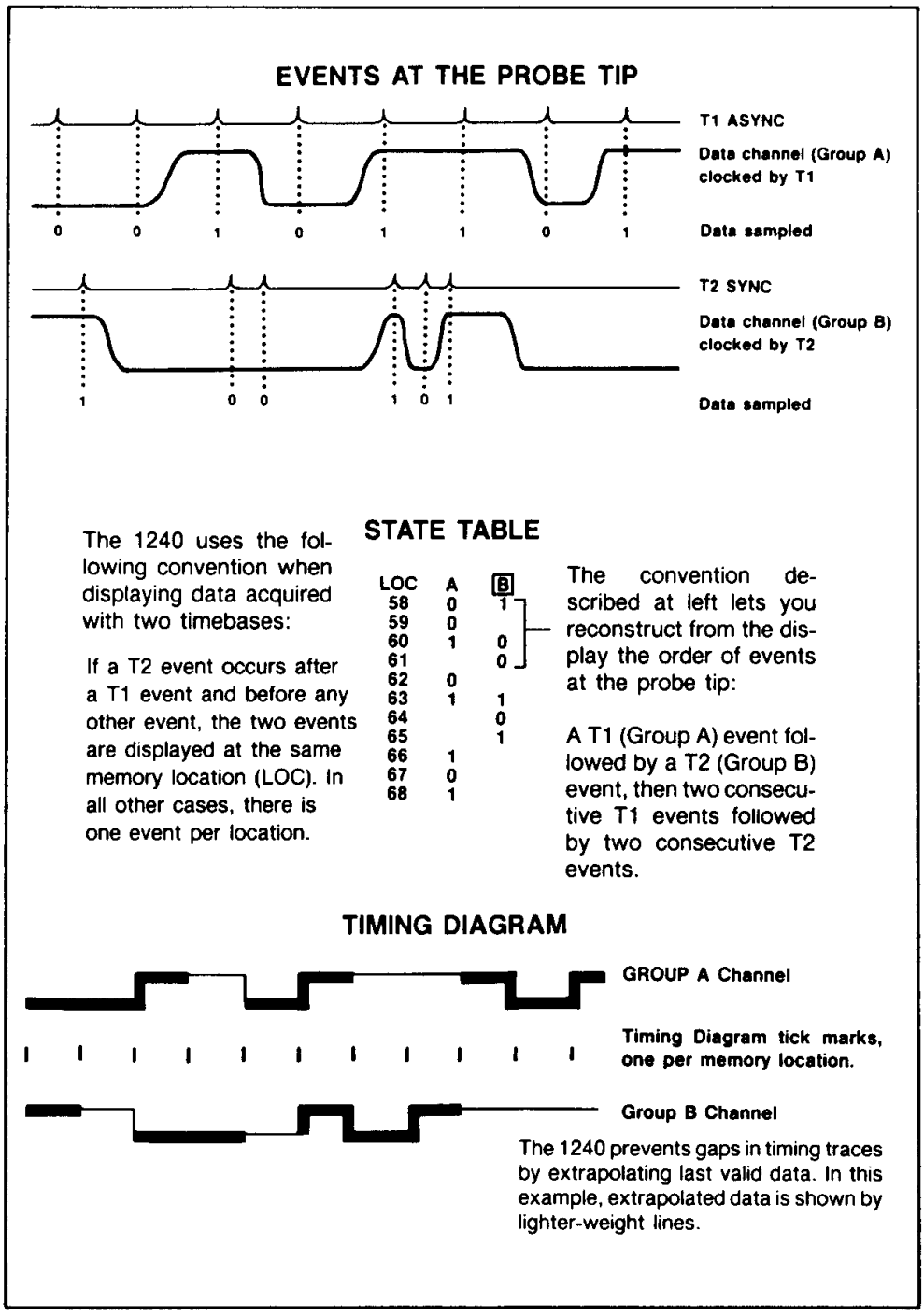

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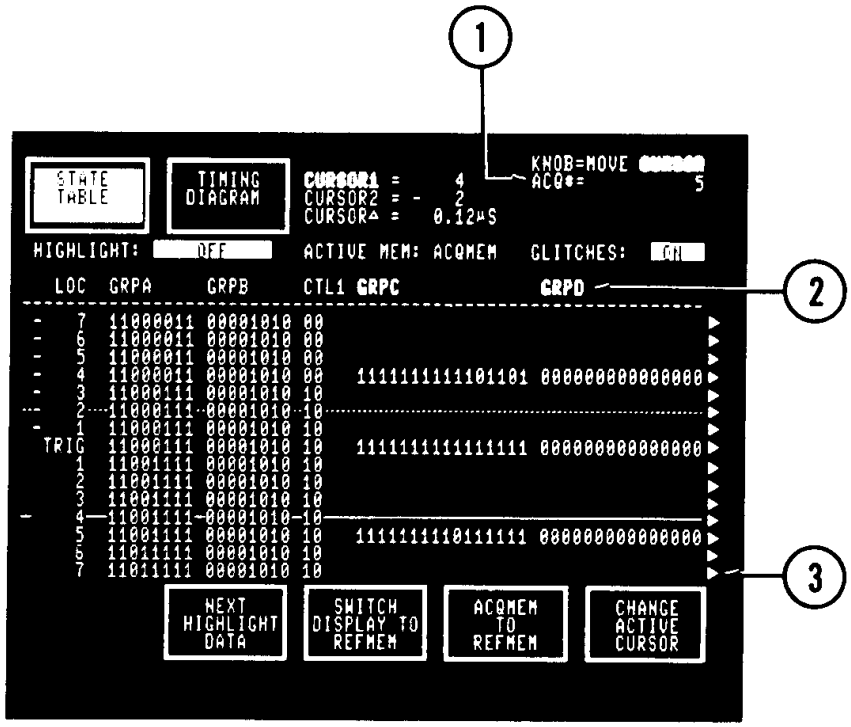
Figure 5-2. Explanation of the 1240 data correlation feature. If a T2 event occurs after a T1 event and before any other event, the 1240 displays both events at the same memory location.



1 Number of acquisitions. Displayed when the data was acquired using the **COMPARE ACQMEM TO REFMEM** Auto-Run condition. See *COMPARE ACQMEM TO REFMEM* in Section 4 for details.

2 Group names. Names of groups associated with T1 are displayed in normal video. Names of groups associated with T2 are highlighted.

3 Symbol for truncated data. The 1240 cannot display all the data for this memory location on the screen. To see the truncated data, change the display radix of the affected group or of other groups. Display radix is specified in the Channel Grouping menu.

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Figure 5-3. Two-timebase State Table display with truncated data. If a T1 and a T2 event are displayed on the same line, you know the T1 event occurred before (or at the same time as) the T2 event. See *Data Correlation* for details.

Memory Configuration Requirements. Two setup parameters from the Memory Config menu are stored with each acquisition and reference memory: memory width vs. depth, and pod-timebase assignments. An acquisition or reference memory that differs from the current setup in one or both of these parameters cannot be displayed. An error message is displayed that describes the first incompatibility found. (Refer to Section 8 for a description of all error messages.) For example: if REFMEM was stored with a 9-channel memory width vs. depth of 9*257 samples, it can be displayed only if the current 9-channel memory width vs. depth selection is also 9*257. If the current width vs. depth selection is not 9*257, the error message displayed is CONFIG ERROR: REFMEM 9 CHANNEL CARDS ARE 9 BY 257.

These two Memory Config parameters also affect the search pattern set up in the Search Pattern Entry menu. When you leave Memory Config after changing any of these parameters, the 1240 restructures the search pattern to match the new configuration. Refer to Table 8-3 for a description of the changes.

Blank Areas in the Data Display. Blank areas in the State Table can be caused by one or more of the following conditions:

- A difference in the 9-channel and 18-channel acquisition memory depths. The sample State Table display in Figure 5-4 shows the active cursor positioned on the last data sample in 9-channel acquisition memory. Beyond this sample, the screen is blank for 9-channel groups but data continues to be displayed for 18-channel groups.
- Certain trigger conditions combined with the LOOK FOR TRIGGER **IMMEDIATELY** selection in the Trigger Spec menu. See *Trigger Position* in Section 4 for details.
- Active cursor positioned out of the bounds of stored data.[1] Any movement of the SCROLL knob will move the active cursor to the closest location with valid data.
- Correlation of a two-timebase acquisition. For example: in Figure 5-3, the blanks between occurrences of timebase T2 data indicate intervals where there was activity on timebase T1 but none on T2.

Blank areas in the Timing Diagram can be caused by the first three conditions described above, plus:

- A PAGE setting with channels that have no data for the locations displayed. The sample Timing Diagram display in Figure 5-4 illustrates this condition. In this display, channels GRPA07 - GRPA00 have no data for the locations displayed. Refer to *PAGE Field* later in this section for more information.

[1] ACQMEM and REFMEM can be different lengths; the length of ACQMEM can vary between acquisitions. If you display a memory with fewer locations than the previously displayed memory, the active cursor may be positioned on a blank location. Any movement of the SCROLL knob causes the 1240 to move the active cursor to the closest location with valid data.

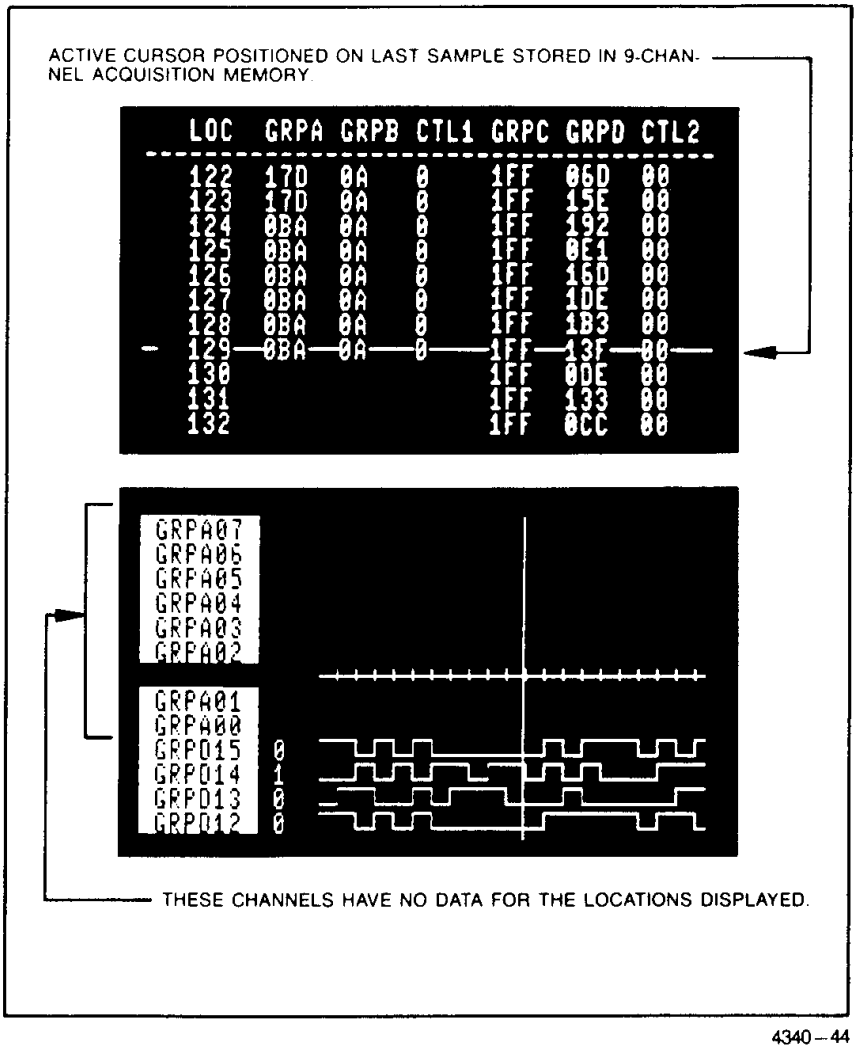


Figure 5-4. Some causes of blank areas in the data displays. The blank area in the State Table display in this example is caused by a difference in 9- and 18-channel acquisition memory depths. The blank area in the Timing Diagram is caused by channels with no data for the locations displayed. See *Blank Areas in the Data Display* for a description of other causes of blank areas.

FEATURES SPECIFIC TO THE STATE TABLE

Data Display Truncation. In some combinations of instrument configuration and display radix, the 1240 cannot display all the data for a memory location on the screen. In these cases, the data is truncated at the right edge of the screen and the truncation symbol (►) is displayed as the rightmost character (see callout 3 in Figure 5-3).

To see the truncated data, you must change the display radix of one or more groups in the Channel Grouping menu. You can take a group out of the display by changing its display radix to OFF, or you can decrease the number of digits displayed by selecting a higher display radix.

FEATURES SPECIFIC TO THE TIMING DIAGRAM

EXPANSION Field. You can change the horizontal magnification of the Timing Diagram by changing the value in the EXPANSION field. The available selections are ***1**, ***2**, ***5**, ***10**, and ***20**. When ***1** is selected, each trace shows 204 data samples. Each trace shows 11 data samples when ***20** is selected.

Memory Window. Above the timing traces is a memory window showing which part of acquisition or reference memory is displayed. (see callout 11 in Figure 5-5). The window shifts if data is scrolled (active cursor moved to a different area of memory). Window size decreases as the expansion factor increases. A "T" is displayed in the field to show the location of the trigger event. If you press the STOP key before the trigger is found, the T is displayed at the far right of the memory window.

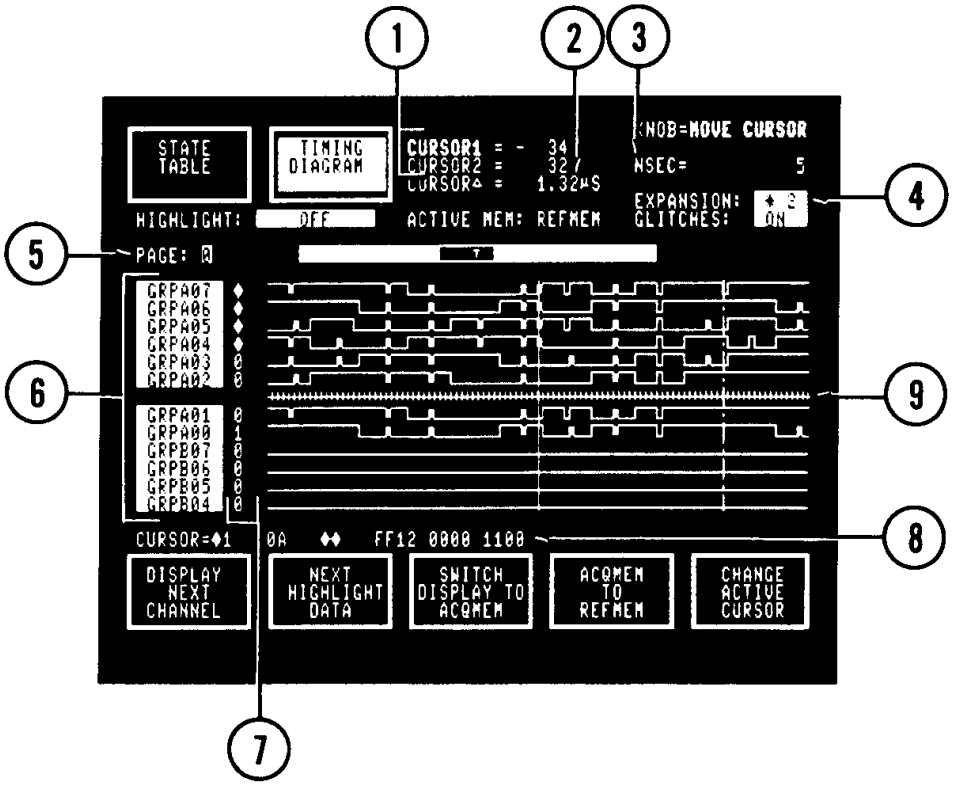
PAGE Field. The 1240 can display traces for 12 channels at a time, but the total number of channels may be much larger. The PAGE field allows you to group channels for display and provides a method for quickly recalling a specific group of channels to the screen.

There are six PAGE displays, numbered 0-5. Each PAGE consists of 12 traces. PAGE 0 is displayed the first time you access the Timing Diagram; use the data entry keys to enter a different PAGE number. When the number is changed, the traces associated with the new PAGE are displayed.

A reverse video select field to the left of each trace contains the trace's group name and the position of that trace (channel) within the group. You can select any channel assigned to a group in the Channel Grouping menu or **OFF** (no trace). This feature allows you to alter any PAGE to suit your needs. When you select a new channel, the trace corresponding to that channel is displayed, and the current PAGE is redefined to include the new channel. The number displayed next to the group name identifies a specific channel by its position in the group as seen in the Channel Grouping menu. For example: an eight-channel group named DATA is defined in the Channel Grouping menu as $\overset{00002222X}{32103210X}$. Trace DATA07 refers to the most significant (leftmost) channel: channel 3 of pod 0. Trace DATA00 refers to the least significant (rightmost) channel: channel 0 of pod 2. Trace DATA04 refers to channel 0 of pod 0.

The DISPLAY NEXT CHANNEL soft key at the bottom of the screen allows you to quickly build a set of descending channel numbers. Each time you touch the soft key, the trace for the next lower channel in that group is displayed, and the blinking field cursor moves down to the next field. For example: To change the last six channels of the PAGE shown in Figure 5-5 to channels GRPB07 - GRPB02, move the blinking field cursor to trace GRPA01, then use the SELECT keys to choose GRPB07. Now touch DISPLAY NEXT CHANNEL five times.

The 1240 creates six default PAGE trace sets from the power-up default grouping arrangement in the Channel Grouping menu. The first channel in PAGE 0 is the most significant channel in GRPA. The remaining channels in GRPA are displayed sequentially and are followed by the channels in GRPB (most significant channel first) until PAGE 0 is full. The next GRPB channel is the first channel in PAGE 1. This pattern continues through subsequent PAGEs until all channels are assigned. The pattern repeats as necessary until all six PAGEs are defined. The default PAGE 0 for a 1240 equipped with two 9-channel cards is displayed in Figures 5-5 and 5-6.



1 Location of Cursors 1 and 2. Active cursor is highlighted. Move the active cursor with the SCROLL knob.

2 Distance between cursors. See *Data Scrolling and Cursor Control* in this section for details.

3 Timer value. Displayed when START TIMER or TIME WHILE is the action for the global event recognizer. Expressed in appropriate time units.

4 Horizontal trace expansion. Selections are ***1**, ***2**, ***5**, ***10**, and ***20**.

5 Specifies which PAGE of 12 channels is displayed. Selections are **0** - **5**. When the number is changed, the channels assigned to the new PAGE are displayed.

6 Trace names. Each name consists of a trace's group name and channel number. For each trace, you can select any channel defined in the Channel Grouping menu or **OFF** (no trace displayed). When you change a trace name, the current PAGE is redefined to include the new channel.

7 Binary value of the displayed channels at the position of the active cursor. In two-timebase displays, a value shown in this readout may have been extrapolated from previously sampled data.

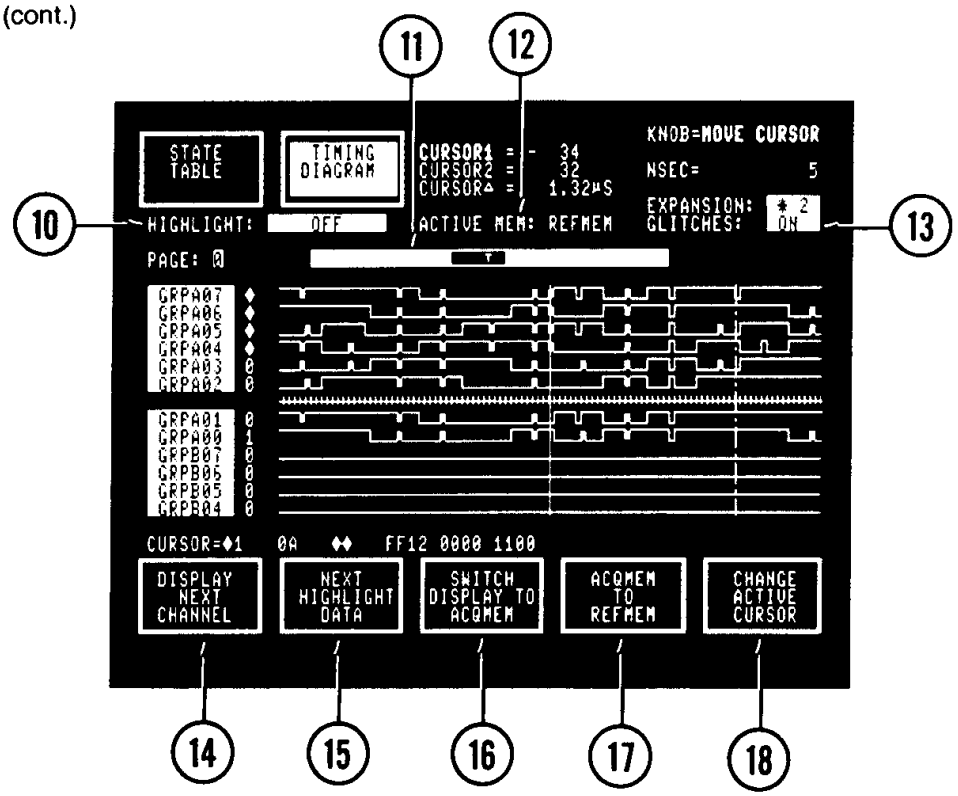
8 Active cursor value. Value, in State Table format, of all channels at the position of the active cursor. The values of all channels are displayed regardless of which traces are displayed on the screen.

9 Tick marks, one per memory location. Distance between marks increases with the value of the expansion field.

(cont.)

Figure 5-5. Timing Diagram display with glitches. In the Timing Diagram, glitches are displayed as a wide, intensified rising edge. The trigger is marked by a broken vertical line across the traces. Cursor 1 is a solid vertical line; cursor 2 is a dotted vertical line.

(cont.)



10 Determines the type of data to be displayed with highlighted video. Selections are **OFF**, **MEM DIFFS**, **PATTERNS**, **GLITCHES**, **T1 VALID**, and **T2 VALID**. See *Highlighting* in this section for details.

11 Memory window; shows area of memory displayed. T marks trigger.

12 Memory currently displayed (ACQMEM or REFMEM).

13 Glitch display. This field is displayed only if the data was acquired with glitch storage enabled in the Memory Config menu. If you select **ON**, each glitch is displayed as a wide, intensified rising edge. If you select **OFF**, the data value at the sample point is displayed.

14 Valid only when the blinking field cursor is in a trace name field (callout 6). Displays the next-lower channel name below the field cursor.

15 Moves the active cursor to the first location of the next occurrence of highlighted data.

16 Displays the other memory (ACQMEM or REFMEM). When ACQMEM is displayed, the label for this soft key changes to SWITCH DISPLAY TO REFMEM. The cursor positions do not change.

17 Copies the contents of acquisition memory into reference memory, overwriting the previous REFMEM contents. No action is taken unless you confirm the operation by pressing the X key.

18 Transfers the role of active cursor to the other cursor. If the other cursor is not onscreen, the display changes to show the data around it.

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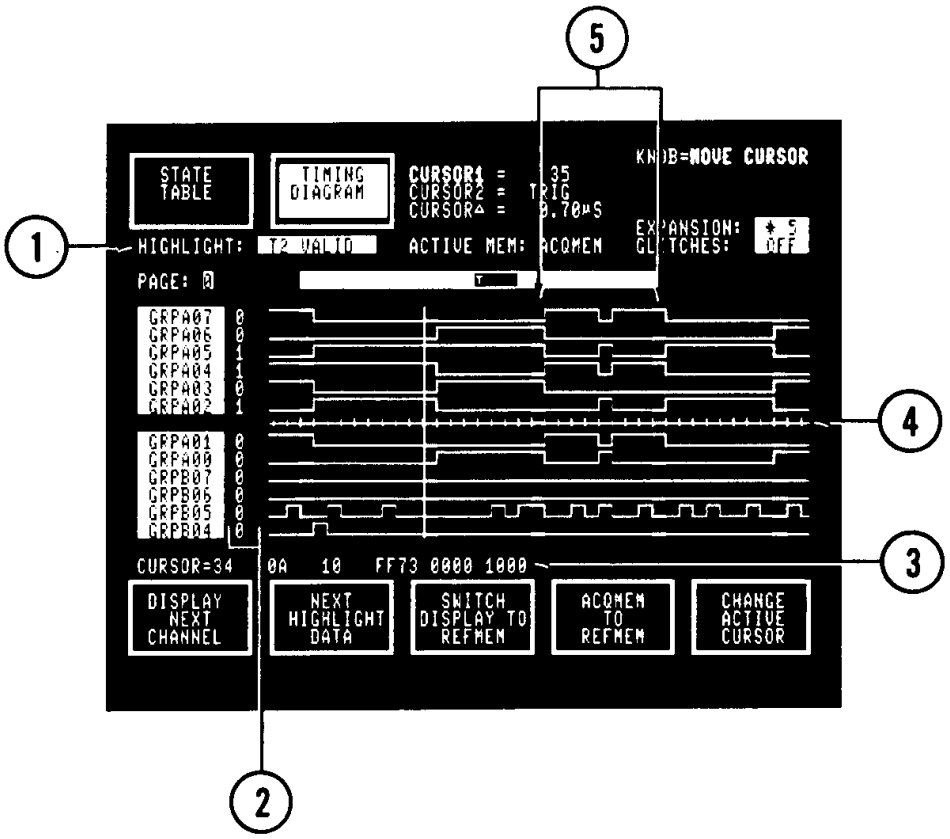
Figure 5-5. Timing Diagram display with glitches (cont.).



1 Highlights memory locations that have valid data for T2. In a two-timebase Timing Diagram display, the **T1 VALID** and **T2 VALID** highlighting selections distinguish valid data from extrapolated data. NOTE: **T2 VALID** highlights all displayed channels (T1 as well as T2 channels) for any location (tick mark) associated with valid T2 data. **T1 VALID** works similarly for T1 data.

2 Binary readout of displayed channels at the position of the active cursor. May show extrapolated values in two-timebase displays.

3 Value of all channels at the position of the active cursor; displayed in State Table format.

4 Tick marks, one per memory location.

5 Highlighting marks memory locations with valid T2 data. Unhighlighted memory locations may show data extrapolated from the previous valid sample.

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Figure 5-6. Timing Diagram display of data acquired with two timebases. To prevent gaps in the timing traces, the 1240 displays values extrapolated from the last valid data. The binary values displayed to the left of the traces show the value of each channel at the position of the active cursor, including any extrapolated values. Use the **T1 VALID** or **T2 VALID** highlighting selections to distinguish between valid and extrapolated data in two-timebase displays.