Fig. 3. *Models 1600A and 1607A Logic State Analyzers work together to monitor and display 32-bit words, or work with independent clocks to examine the interaction between two digital machines. The combination of the two instruments is known as the Model 1600S. Model 1607A has most of the capabilities of Model 1600A and can work by itself using an oscilloscope or CRT monitor for the display.*

The two qualifier inputs may also be used with the trigger word, in effect giving an 18-bit trigger word.

Data may be clocked in at rates up to 20 MHz. This speed allows tests to be conducted at the full operating rate of most digital systems, thereby uncovering faults caused by circuit response—faults that do not occur when a system is tested by single-stepping it at a slow rate.

Positioning of the trigger word on the display has been made more flexible in the new instrument. As before, in the START DISPLAY mode, the trigger word appears at the top of the displayed table and the next fifteen words follow below. In the END DISPLAY mode, the trigger word appears at the bottom with the previous fifteen words above. In either case, the trigger word is brightened to show its position. Now the digital delay may be used with the END DISPLAY as well as the START DELAY mode, making it possible to display events both prior to and immediately following the trigger word. The word at the top of the display is the word that occurs fifteen clock periods before the trigger word minus the selected delay. If the delay is less than fifteen, the trigger word appears brightened part way down the display.

Another added display mode is known as partial display. This occurs automatically whenever the rate of the clocks qualified by the DISPLAY qualifiers is below 60 Hz. If the instrument is in the START DISPLAY mode, the display shows the trigger word as soon as it occurs (or the first word following the selected delay) and fills in each successive word as it is clocked in. Previously the user had to wait for sixteen words to accumulate before the display would show what had occurred.

In the case of partial display in the END DISPLAY mode, each word is entered at the bottom of the display, pushing the others up. When the display is full, each new word entering at the bottom pushes the top word off the display. This continues until trigger conditions are met.

An "arm" mode is now provided for the trigger. In this mode, the instrument does not respond to the trigger word unless armed by a pulse at its ARM input. This prevents the data acquisition cycle from being initiated until some other event occurs.

Dual Data

Model 1600A has an auxiliary memory for storage of data. A front-panel pushbutton (STORE A → B) transfers the data stored in the main memory (A) to the auxiliary memory (B). The contents of each memory may be displayed separately or both may be displayed side by side for comparisons.

To make it easier to compare stored data with new data, a comparison mode [A & (A⊕B)] may be selected. The contents of the A memory are then displayed on the left half of the display while the right half shows how the contents of B differ from A—bit positions where the two memories are identical are displayed as 0's, and bit positions where they differ are displayed as 1's (Fig. 4). In addition, the 1's are brightened to make them easier to identify.

To help find elusive errors, the instrument may be operated in a HALT A≠B mode in which the A memory acquires the data in repeating data acquisition cycles until there is a difference between the contents of memories A and B. The instrument then reverts to the single-cycle mode and stops acquiring data when the current cycle is completed.

Map Display

A more comprehensive view of the operation of digital machines is provided by a new capability in Model 1600A. This is the MAP mode.

When operating in the MAP mode, the new logic state analyzer presents a digital word simply as a dot on the CRT display. The position of the dot is determined by the word, one half of the word giving the x-axis position and the other half giving the y-axis po-