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## Contourograph Display System for Monitoring Electrocardiograms

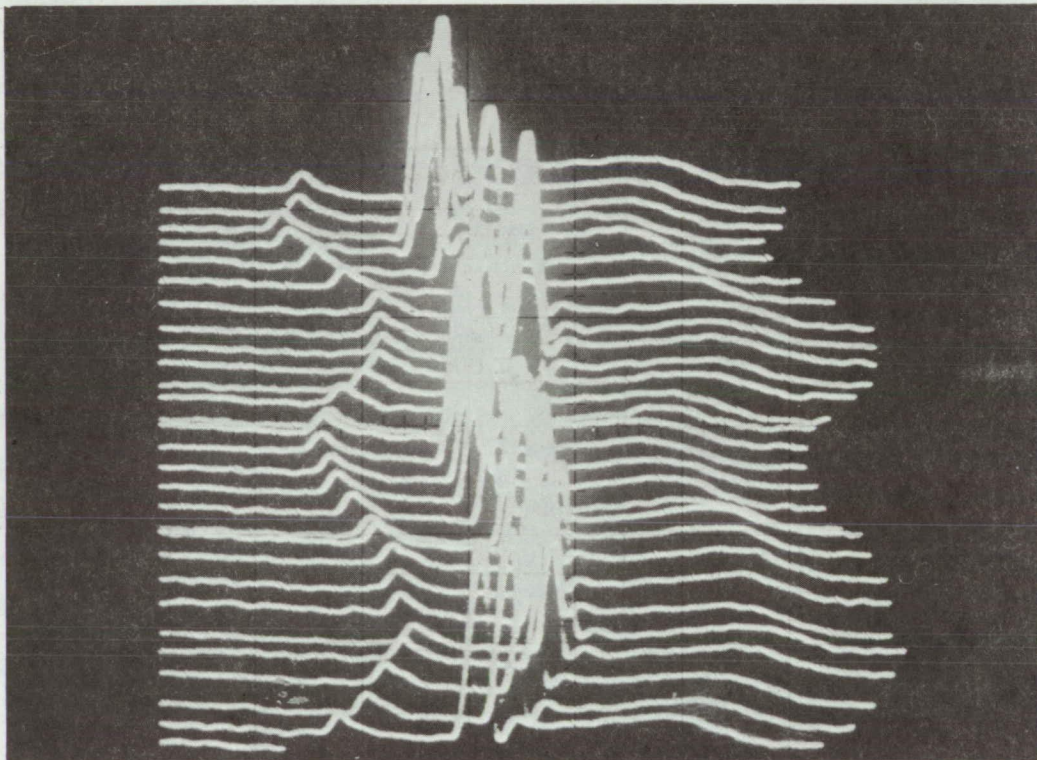


Figure 1. ECG Contourogram

A visual display system has been devised for the real-time presentation of an electrocardiogram (ECG) in a highly informative manner. The ECG is displayed as a contourogram on the cathode ray tube (CRT) of a variable-persistence oscilloscope. Each individual cycle of the ECG is stacked below its predecessors as shown in Figure 1. Minor cycle-to-cycle variations in the ECG contribute to the three-dimensional contour effect; a major change in the signal is immediately apparent as a change in the contourogram pattern.

The three-dimensional effect is accentuated by dynamically modulating the intensity of the trace so that the peaks of the ECG are brighter than the baseline.

The contourograph system converts a single scalar ECG signal into three orthogonal voltages for the horizontal, vertical, and z-axis inputs of the variable-persistence oscilloscope. A block diagram of the real-time contourograph is shown in Figure 2. The amplifier-filter allows the signal amplitude to be adjusted and the high frequencies to be attenuated at 30, 50, or

(continued overleaf)

100 Hz. The ECG from the amplifier is summed with the vertical-sweep sawtooth wave, and the resultant waveform is fed to the vertical input of the oscilloscope. The Schmitt trigger, monostable multivibrator, and horizontal sweep circuit synchronize the contourogram so that only one ECG cycle appears on each line and corresponding waveforms of succeeding cycles are properly aligned. Besides the three horizontal sweep speeds for contourography, a fourth speed for standard clinical display is also available. The z-axis circuitry modulates the intensity of the trace to give the contourogram its three-dimensional quality. Since each trace displays only one ECG cycle, the end point of the trace implies a value of instantaneous heartrate. A sliding scale is affixed to the oscilloscope CRT so that heartrates from 30 to 180 beats per minute can be determined.

In a monitoring scheme the real-time contourogram would present information about the patient's cardiac condition in an easily assimilated form. Dramatic changes in the display would alert the observer to abnormal patient conditions.

**Note:**

Requests for further information may be directed to:  
 Technology Utilization Officer  
 Manned Spacecraft Center, Code BM7  
 Houston, Texas 77058  
 Reference: TSP70-10030

**Patent status:**

No patent action is contemplated by NASA.  
 Source: D. P. Golden, Jr., D. G. Maudlin, and  
 R. A. Wolthuis of  
 Technology Incorporated  
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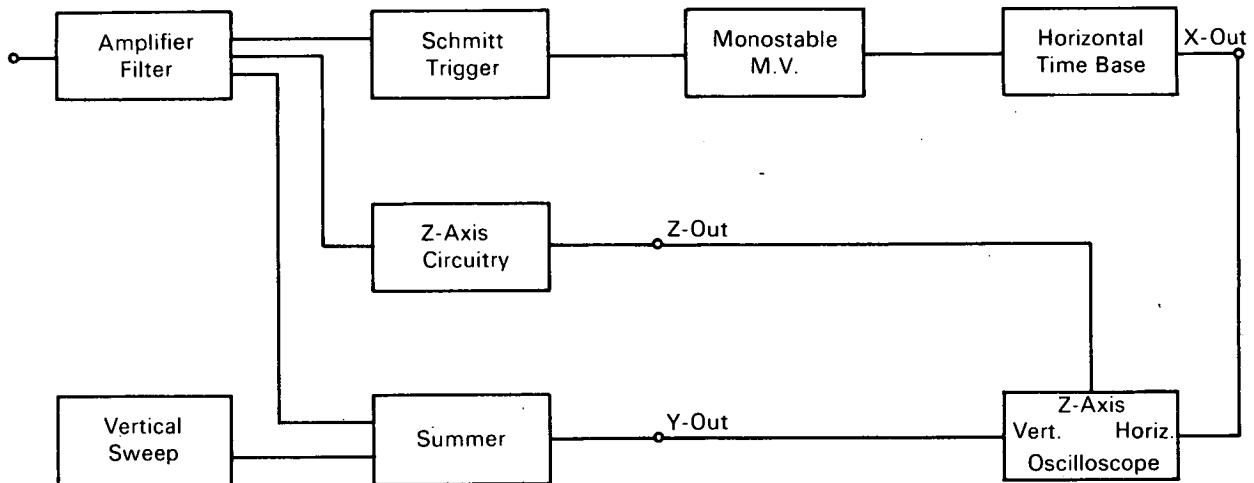


Figure 2. Block Diagram of Contourograph