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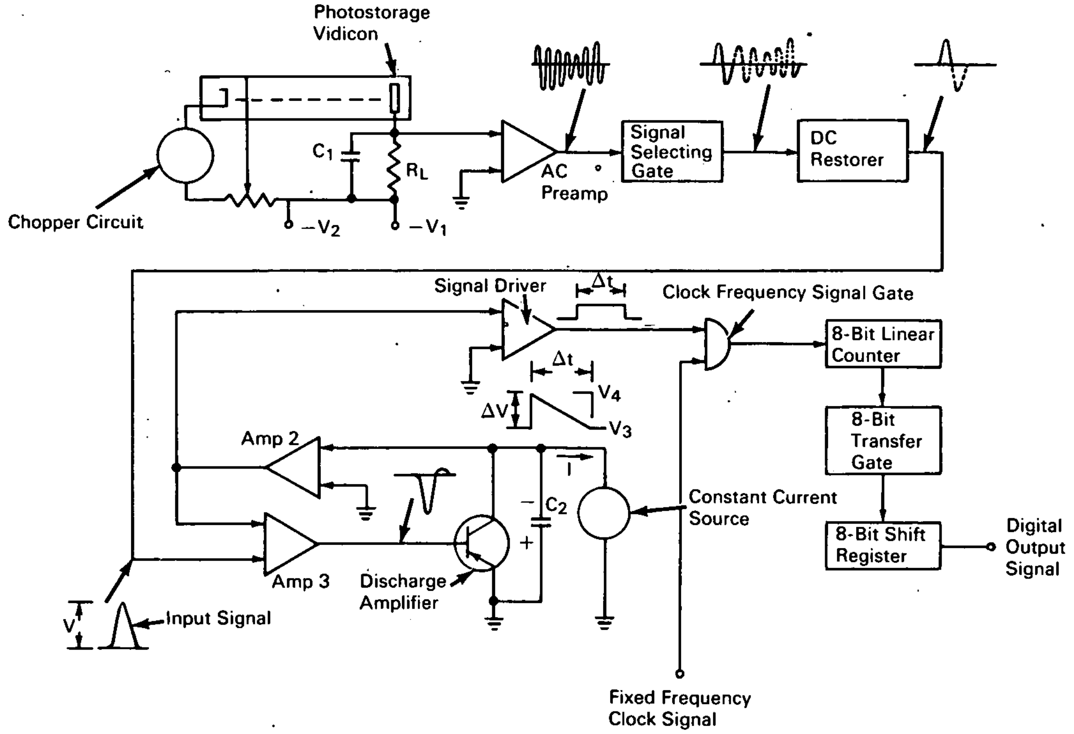
Improved Television Signal Processing System



An improved digital system has been developed for processing spacecraft television pictures. In this system, the image sensed on a photostorage vidicon is digitized, ac-amplified, data-compressed, dc-restored, and then converted to pulses of width accurately proportional to signal amplitude. These pulses are used for gating a frequency-standard clock to a binary counter, which yields a count that is more accurately representative of camera signal levels. The counts are shifted serially, by transfer gate and register, into a magnetic tape recorder from which they are subsequently transmitted by telemetry at slow scan rates.

An illuminated pattern of the optical image of the subject is stored on the photostorage surface of the vidicon. The vidicon represents a constant current source that generates a video signal across a load impedance R_L. Capacitance C_1 represents the sum of the photostorage and other stray capacities. The video signal is obtained by scanning the photostorage surface with an electron scanning beam. V_1 is the voltage source supplying a current to generate the video

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signal, and V_2 is the voltage source for generating the electron scanning beam. To obtain a signal of higher signal-to-noise ratio, the electron beam is chopped by the chopper circuit in the beam cathode return lead to turn the beam on and off at the rate of f_c times per second. Thus, the signal developed across the load resistor is an amplitude-modulated signal with a carrier frequency of f_c cycles per second. The light intensity of the illuminated image, therefore, contains in the envelope peaks of the carrier signal. The modulated signal is then amplified by the capacitor-coupled preamplifier, and the dc component of the signal is removed.

Because of the limited data storage capacity of the digital tape recorder that will store the video data, only the necessary minimal number of video signal cycles are processed and digitized so that an accurate reconstruction of the television pictures can be made. The signal selecting gate is used to select the desired signal cycle at a regular interval (for example, every 7th signal cycle). Each of the selected signal cycles is then dc-restored to its original photometric amplitude by the dc restorer.

The dc restored signal is converted to a time signal by the peak amplitude-to-time signal converter. The converter consists of amplifiers 2 and 3, a discharge amplifier, timing capacitor C_2, and a constant current source. The converter processes the input signal so that the timing capacitor C_2 is discharged by the discharge amplifier as the input signal reaches its peak. The net voltage $\Delta V = V_3 - V_4$, across C_2, as a result of the discharge, is equal to the peak of the input signal V, or $\Delta V = V$. As the input signal reaches its peak and begins to drop, C_2 begins to be recharged to its initial voltage level of V_3 by a constant current I from the constant current source. Therefore, the time, $\Delta t = (C_2/I)\Delta V$, for the timing capacitor to be fully recharged is proportional to the peak of the input signal. The signal driver is used to generate a gate signal whose pulse width is equal to the charging time Δt of capacitor C_2. The gate signal is then used to control the clock frequency signal gate so that the 8-bit linear counter can be used to count the number of clock frequency cycles during each gating. The resulting 8-bit linear word from the counter is used to provide 256 distinctive video photometric levels.

When each counting is completed, the content of the counter is transferred in parallel by the 8-bit transfer gate to the 8-bit shift register. The transferred content in the shift register is then shifted out to the digital recorder bit by bit in series for recording. While the content is being shifted out of the register, a new input signal can be digitized by the digitizing circuitry.

Notes:

1. This system may be applicable to the taking of pictures for processing by digital computer to enhance contrast and correct distortions in the pictures. An example of such application, in the processing of medical X-ray photographs, is described in NASA Tech Brief 67-10005. This system may also be useful in electron microscopy.
2. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California
   Reference: B67-10246

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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