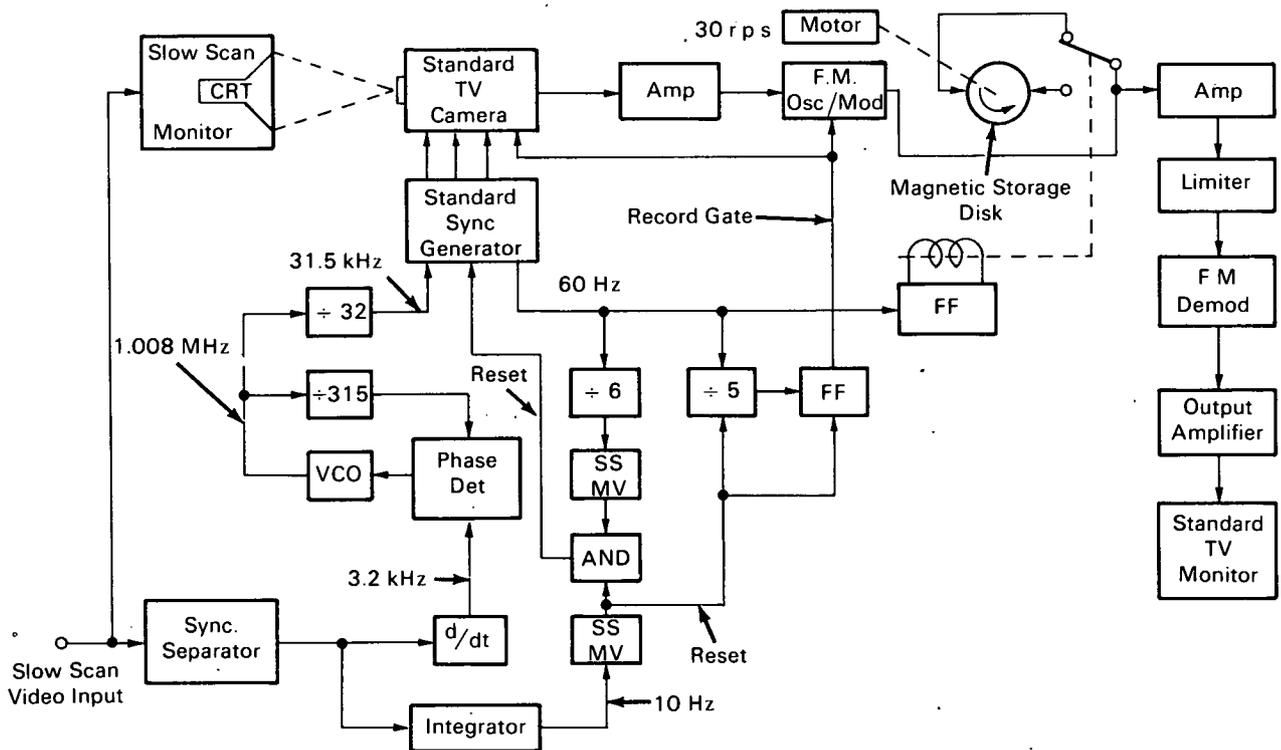


NASA TECH BRIEF



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System Converts Slow-Scan to Standard Fast-Scan TV Signals



The system shown in the block diagram has been developed to convert slow-scan video signals (transmitted from a special TV camera) into standard fast-scan television signals that are required for reproduction of television pictures on American TV sets. This system is specially designed to convert slow-scan video signals transmitted from the Apollo television equipment into the required fast-scan TV format. Each TV image or frame from the Apollo equip-

ment is composed of 320 horizontal lines, and the frames are formed at a rate of 10 per second in a non-interlaced manner. In the standard TV broadcast system used in this country, each complete picture frame is composed of 525 horizontal lines, and 30 complete frames are generated per second using a 2:1 interlacing technique. Although specifically developed for the Apollo application, the new system can be readily modified to accept different slow-scan TV

(continued overleaf)

formats, including European slow-scan rates, for conversion to the standard U.S. TV broadcast format. The new system, modified with adjustable circuit elements, will eliminate many of the difficulties associated with other systems used for converting TV pictures produced in accordance with the standards of one country into TV signals conforming to the standards of another country.

In describing the system with reference to the block diagram, the term "frame" refers to the picture image or video signal produced during one vertical scanning interval regardless of whether an interlaced or a non-interlaced technique is used. The slow-scan monitor, which receives the incoming slow-scan video signals, reproduces on its CRT display screen the TV pictures corresponding to these signals. For the slow-scan, non-interlaced signal of 320 lines per frame and 10 frames per second, the electron beam in the CRT of the slow-scan monitor traces out the horizontal lines of the picture at a rate of 3200 lines per second. An electron image of the slow-scan monitor picture is produced on the target structure within the standard broadcast TV camera which is focused on the display screen of the slow-scan monitor. This target structure is scanned line-by-line by the electron beam contained in the camera to generate a video output signal corresponding to the monitor picture being viewed by the camera. The standard broadcast-type of sync generator controls the scanning process in the camera. This scanning is performed (in this case) in accordance with the U.S. standard of 525 horizontal lines per complete picture and 30 complete pictures per second with 2:1 interlacing. Because of the 2:1 interlacing, the electron beam in the standard TV camera moves from the top to the bottom of the image at a rate of 60 times per second, and during each such scan traces out a series of 262.5 lines. Thus the sync generator supplies to the camera 12 vertical scanning signals at a frequency of 60 Hz and horizontal scanning signals at a frequency of 15.75 kHz. The generator also supplies to the camera the usual synchronizing and blanking pulses. The slow-scan monitor, running at a vertical-scanning frequency of 10 Hz, takes 0.1 second to build up a complete picture; on the other hand, the camera, running at a vertical-scanning frequency of 60 Hz, can completely scan a complete image in 1/60 second. Thus the camera scans at 6 times the speed of the slow-scan monitor.

If the camera were allowed to generate a continuous output signal in its normal manner and if such signal were applied to a TV set or monitor, the successive images reproduced on the TV screen would be composed of varying proportions of earlier and later slow-

scan frames. In order to prevent this from occurring, the vertical scanning action of the camera is locked in step with the vertical scanning action of the slow-scan monitor, so that one of every six vertical scans in the camera constitutes a scanning of a single complete frame or picture on the display screen of the slow-scan monitor. Therefore every sixth camera scan is used to provide the desired fast-scan TV signal. This, however, leaves a time gap of 5/60 second (5 camera vertical-scan intervals) between the successive usable fast scans of the camera. To fill in these gaps, each usable fast-scan signal portion is stored on the disk of a magnetic recorder. This recorder then plays back the usable fast-scan signal five times, and these repeated signals are used to fill in the time delay between the original fast-scan signal and the next usable fast-scan signal. The fast-scan TV signal thus obtained will produce continuous TV pictures on conventional TV sets or standard TV monitors. The resulting pictures will have a pleasing and entirely normal appearance, except for scenes having fast-moving objects. In the latter case, the movement will appear to occur in short, quick jumps instead of in a smooth, continuous manner. This movement, however, has only a relatively slight effect on the appearance of the scene to the viewer.

The continuous, interlaced standard TV broadcast signal from the output amplifier can be supplied to standard TV sets or monitors at various remote locations by means of an appropriate signal distribution system. It can also be supplied to a TV transmitting station for further broadcasting.

Notes:

1. Magnetic tape recording and playback equipment for the scan-rate conversion of TV signals is described in Tech Brief 67-10676.
2. Requests for further information may be directed to:

Technology Utilization Officer
Manned Spacecraft Center
Houston, Texas 77058
Reference: TSP69-10748

Patent status:

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