A Simple Way of Obtaining a Composite Video Output Signal from the GAMMA-11 Computing System

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Many departments of nuclear medicine are currently using the GAMMA-11 computer to process clinical images. Often practitioners would like to display the output pictures on conventional cathode-ray monitors that they already have. Some may want to record the images on a video tape recorder. Both of these devices require a composite video signal, which the computer does not provide. Such a signal can be obtained, however, by combining two signals that the system does produce. A number of relatively complicated systems for doing this have been suggested. The desired result can be obtained, however, by using two ten-cent resistors in the simple circuit described in this paper.

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Many departments of nuclear medicine are currently using the GAMMA 11 computer system* to process their clinical images. Often practitioners would like to display the output pictures of the conventional cathode-ray monitors that they have available. Some may want to record the images on a video tape recorder. This usually presents a problem, since the computer does not deliver a composite video output signal. Instead, the picture video waveform and the sweep synchronization pulses are provided as separate output signals.

A number of relatively complicated schemes for combining the synchronization and video signals have been developed. It turns out, however, that a standard composite video signal can be obtained with a pair of ordinary ten-cent resistors. The figure shows this configuration for cases where one or two 75-ohm loads are attached. These loads represent monitors or tape recorders. The circuits shown in the figure have several advantages over other configurations that have been suggested. First, they are simple, inexpensive, and will be essentially failure-proof. Circuits containing transistors, integrated circuits, or capacitors do not enjoy these characteristics. Also, no dc power supply is required, and because the components have low resistance values, no problem with system frequency response will occur. Note, however, that if transmission lines longer than 100 ft are to be used for connection to a peripheral device, some form of line driver may be needed.

The composite video signal obtained from the GAMMA 11 computer departs somewhat from the standards used by the broadcast industry. The computer provides a 256-line noninterlaced picture. Each vertical field contains 273 horizontal lines, of which 256 are active and 17 occur during the vertical retrace period. The cathode-ray tube is blanked during the retrace. A complete picture is produced during each vertical field, which recurs 60 times per second.

In commercial television the vertical-field rate is also 60 per second but each field contains 262.5 horizontal lines. It takes two successive vertical fields to display all of the picture information in an interlaced manner. In this case, a complete picture is generated 30 times per second.

The horizontal line rate for the GAMMA 11 output is therefore 16,380 lines/second compared with 15,734 lines/second for commercial systems. In the GAMMA 11 display, each horizontal line is 61.05 μsec long, whereas the commercial television line period is 63.56 μsec. Most monitors can be made to operate on this slightly different horizontal-line rate by merely adjusting the horizontal hold and/or the horizontal frequency controls.

In nearly all monitors, an internal blanking waveform is generated and applied to the display tube during the vertical and horizontal retrace periods. For commercial systems, vertical blanking lasts for about 1.25 msec and horizontal blanking for 10.5 μsec. For the computer output data the vertical retrace period is 1.04 msec and the horizontal

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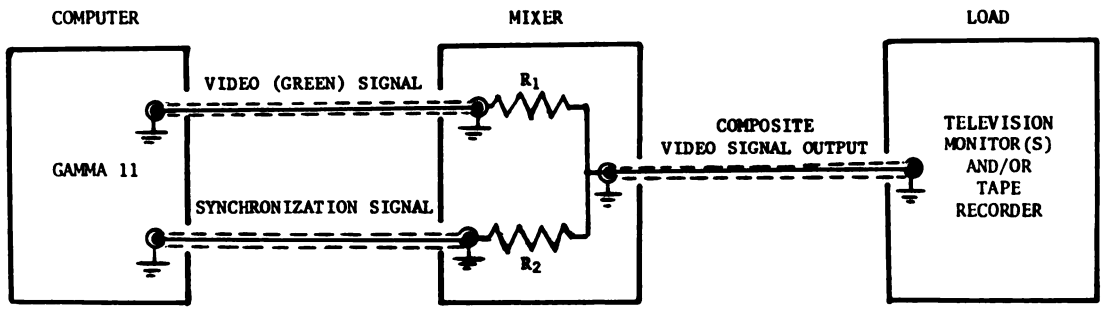

OUTPUT LOADING	R_1 (OHMS)	R_2 (OHMS)
ONE 75-OHM LOAD	39	470
TWO 75-OHM LOADS IN PARALLEL	15	160

FIG. 1. Block diagram of mixing system for composite video signal, showing resistor sizes for two different output loading situations.

blanking 9.5 μsec. The effect of the longer commercial vertical blanking period on the display of the computer output is to blank out the first few lines along the top of the picture. The effect of the longer horizontal blanking is to chop off a small slice on each side of the display area. Since alpha-numeric data sometimes appear in these regions, such losses of display area cannot be tolerated. These effects, when they occur, can be eliminated by shortening the internally generated blanking waveforms. This usually requires the changing of one or two inexpensive components in the monitor's blanking circuitry. We find that the easiest way to determine which component(s) should be changed is to talk to an engineer in the manufacturer's plant.

FOOTNOTE

* Digital Equipment Corp., Maynard, Mass.