TECHNICAL NOTE

AN INTEGRATED CIRCUIT SWITCH FOR AUDITORY RESEARCH*

INTRODUCTION

AUDITORY research and clinical evaluation of hearing require controlled switching of audio signals. Acoustic stimuli must be presented with minimum switching artifact and distortion. In addition, stimulus repetition rate, delay before onset, duration, and rate of rise and fall must be accurately determined. Various methods including vacuum tubes, transistors, and Hall multipliers (OLSON and LUDWIG, 1965; KLIG et al., 1970) have been used to meet these requirements. This paper describes an instrument using commercial integrated circuits, I.C., for the switching, timing, and synchronizing elements resulting in a smaller, simpler, less expensive device. Its performance is generally better than previously achieved.

DESCRIPTION

A block diagram with waveforms at key points is shown in Fig. 1. The multiplier, by combining the input signal with the trapezoidal gate modulates the signal to produce a tone burst with linear rise and fall. To eliminate residual signal from the multiplier the fast switch is turned on at the start of the rise and turned off at the end of the fall. The repetition rate, delay and duration timers are designed with I.C. one shots (nonadjustable multivibrators). Minor modifications of the circuit enable operation as either as table or monostable multivibrators. An I.C. comparator is used in a synchronizing circuit to gate the switch on at any point of the sine wave. The trapezoidal generator incorporates circuits for determining the linear rise and fall as well as a rectangular gate for the fast switch.

Figure 2 illustrates the multiplier, (RENSCHLER) the circuit which modulates the audio signal and gates it on and off. The input signal level of one volt is amplified by I.C. 1, an operational amplifier set for a gain of three, the optimum level for the X input of the multiplier, I.C. 2, a Motorola MC1595L. The trapezoidal gating signal is fed to the Y input. The output of the multiplier which is proportional to the product of the X and Y inputs is off when the X input is 0 V and full on when the Y input is 5 V. Because the multiplier is not perfectly balanced a switching signal at the Y input with no X input results in a residual artifact in the output. This may be reduced to –60 db relative to the full signal output with the artifact balance adjustment. There is a similar feed-through of signal from the X input when the Y input is zero. The signal balance adjustment reduces this to

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FIG. 2. Multiplier.

FIG. 3. Trapezoid generator.