NOTE

A programmable circuit for varying light intensity

TYLER S. LORIG, ANTHONY J. GOLDEN,
and WALTER ISAAC
University of Georgia, Athens, Georgia 30602

An inexpensive circuit is described for the control of light intensity. The control is obtained by a method that produces no color changes and may be programmed by any system that can express itself in four-digit binary numbers.

The circuit (Figure 1) consists of two functional systems: intensity select and intensity control. The intensity selection system takes the binary coded output from an external programming device (e.g., the BRS TRS-4 tape reader) and optically couples (FCD 820B) it to a binary-to-decimal converter (74145). This optic coupling allows flexibility so that a variety of programming voltages may be used. The 74145 chip provides ground to 1 of 10 resistors to suit individual needs. The resistor chosen is in series with a 100-ohm resistor connected to the ground side of the light-emitting diode of another FCD 820B. Five volts is provided continuously to the positive side of the light-emitting diode contained in the 820B. Arranged in this fashion, the transistor portion of the 820B acts as a variable resistor that is dependent upon the particular resistor chosen in the intensity select portion of the circuit. Thus, the FCD 820B is the interface between the intensity select and the intensity control systems.

The intensity of the light source is controlled by varying the duration of on-time of a light source, a bank of light-emitting diodes, flashing at a fixed rate. This fixed rate is controlled by the oscillation of a timer chip (555). The wide range of intensities available are determined by the frequency of oscillation of the 555 chip, which, in turn, is controlled by the resistor-capacitor network connected to the chip. The lower limit of oscillation frequency should depend upon the upper limits of the subject's flicker-frequency perceptual capabilities. The oscillation frequency must be higher than the critical flicker-frequency threshold. At the transition from low to high in each oscillation, a one-shot (74121) is triggered to produce an output pulse.

A. J. Golden's present address is Department of Psychology, Austin Peay State University, Clarksville, Tennessee 37040.

Figure 1. Schematic diagram of the programmable intensity control circuit.

Table 1

R1	100 ohms	R13	4.7 kohms
R2	2.2 kohms	R14	2.2 kohms*
R3	100 ohms	R15	12.0 kohms
R4	330 ohms*	C1	1.0 microfarads*
R5	470 ohms*	C2	.01 microfarads
R6	560 ohms*	C3	.00011 microfarads*
R7	760 ohms*	U1	74145
R8	820 ohms*	U2	555
R9	1.6 kohms*	U3	74121
R10	2.2 kohms*	Q1	RS 2018
R11	6.8 kohms*	Z1	FCD 820B
R12	∞^*	Z2	FLV 340*

**Substitutions may be made for specific applications.*

The pulse width is determined by the resistor chosen in the intensity select portion of the circuit, but it may be further modified by altering the capacitor fixed to the 74121. The output pulse controls a transistor (RS 1818) that drives the bank of light-emitting diodes and produces the visual stimulus. Pulse widths show a linear change over the resistance values specified in Table 1.

In summary, a means of varying light intensity that provides a wide range of brightness levels with no changes in stimulus color has been described. The range of brightness that may be produced is determined by the frequency at which a light source is triggered and the duration of the pulse delivered to the light-emitting diode array. The brightness may be varied within this range by selecting different resistors to alter the duration of the light pulses. Such a system may be controlled by any programming system that can express itself in four-digit binary numbers.

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