TECHNICAL NOTE

A TRANSIENT-FREE OPERANDUM FOR USE WITH ELECTROPHYSIOLOGICAL RECORDING¹

Electrophysiological recordings, such as the electroencephalogram or electrocardiogram, taken from subjects performing operant tasks are frequently contaminated by artifacts emanating from the response lever. Typically, the subject is required to press a lever that operates 12- or 28-v equipment. The arcing caused by contact closure may produce radio-frequency emission that is picked up as an artifact by the sensitive electrophysiological recording equipment. While conventional methods of arc suppression by diodes and capacitors may protect the contact surfaces, they may not be completely eliminate the recording artifact. The recording artifact becomes particularly important when signal averaging techniques are being used, since over a large number of trials a relatively insignificant time-locked transient can sum to a troublesome size.

To solve these problems, we designed a lever that provides transient-free operation by utilizing a photocell as an on-off switch. Pressing the lever exposes a photocell to a light beam, resulting in a large fall in the photocell resistance. The type of photocell and the light intensity depend on the precision required in measuring the response. For example, one application involves the measurement of reaction time. To avoid introducing an appreciable latency through the photocell operation, a Clairex CL 703L was used. This has a conductivity-time constant of 1 msec for an illumination change from dark to 100 foot-candles. The final resistance change for this illumination change is from over 30 megohms to approximately 200 ohms. Lower light intensities, e.g., 2 foot-candles, yield a higher light resistance of about 1500 ohms and a longer conductivity rise-time constant of about 10 msec. If this order of time factor is permissible, longer bulb life may be obtained by passing less current through the bulb.

The leads from the photocell are connected directly to the normally open input of a BRS CX-3 solid-state unit. Alternatively, a simple common-emitter circuit (Fig. 1A) can be used to drive solid-state equipment. The optimal value of *R* in this circuit depends on the light intensity level, and can be determined empirically: the transistor collector voltages should be -12 and 0 v under dark and light conditions respectively.

In another application, the photocell is used to operate a relay by connecting it directly in series with the relay coil and a 28 v dc power supply as in Fig. 1B. A sensitive, high coil resistance relay, such as the

Fig. 1A. Common-emitter circuit for driving solid-state equipment. B. Circuit for driving relay.

Sigma 11 F with a 9000-ohm, 2.4-ma dc coil, must be used so that the current passing through the photocell does not dissipate more power than the 125-mw rating of the cell.

A light-tight aluminum box houses a simple telegraph key and the photocell. A #1819 28 v dc bulb is located outside the box directly in line with a 1-mm hole in the side of the box and the face of the photocell. An aluminum strip attached to the lever inside the box normally covers the hole in the box. When the lever is depressed, a 1-mm hole in this strip lines up with the hole in the box, permitting light from the constantly illuminated bulb to fall on the face of the photocell.

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