TECHNICAL NOTE

A BIFUNCTIONAL PULSE FORMER

In electromechanical programming, pulse formers are used as interface between response operands and control apparatus. The function of the pulse former is to emit a constant-duration pulse when triggered by an input that may vary in duration from only a few milliseconds to infinity. There are basically two types of pulse formers, those operated by normally open switches, and those operated by normally closed switches. Normally open pulse formers emit a pulse on an input or the leading edge of a negative signal. Normally closed pulse formers emit a pulse on a current interruption or the effect of a negative signal. The pulse former diagrammed in Figure 1 employs a switch that allows it to function in either of the two modes, thus increasing its versatility as a standard programming module. In addition, since connections are made to only one side of each relay coil, the pulse former can be wired with snap leads directly on the face of any standard relay panel.

The pulse former operates as follows. With the switch (TS) in the up position as shown ("normally open"), capacitor C1 charges. When the relay Ry1 is operated by an input, C1 discharges through relay Ry2, causing it to operate. Operation of Ry2 allows capacitor C2 to discharge through Ry2, providing the constant-duration output through a set of Ry2 contacts.

With the switch in the down position ("normally closed"), Ry1 is connected to negative via the input, allowing C1 to charge. Interruption of the current to

Ry1 then allows C1 to discharge through Ry2 operating the timing circuit and output contacts. Operation of Ry1 with an input pulse with the switch in this position will provide an output at the termination of the input (output delayer function).

The minimum operating time of the pulse former in both modes is a function of the operating characteristics of Ry1, since the output pulse does not begin until after the operation of this relay. The duration of the output in both modes is a function of the capacitance of C1 and C2 and the resistance of Ry2. A Sigma 62R4 relay (700 ohm coil) and a 40 mfd capacitor for C1 and a 10 mfd capacitor for C2 with 47 ohm resistors (R1 and R2) in series yields a 55-msec output at 26 V and a 70-msec output at 31 V. The Sigma relay had a pull-in time of 15 msec and a drop-out time of 8 msec, thus delaying the output 8 or 15 msec depending on the operational mode. All diodes are 1N4003s.

A prototype constructed with Sigma relays was capable of tracking a regular pulse stream of six inputs per second (the fastest we could generate—not the fastest the pulse former could track). Pulse formers of this design have been in use in our laboratory for several months and have operated reliably for hundreds of thousands of inputs with only rare failures due to the fusing of output contacts.

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Fig. 1. A schematic drawing of the bifunctional pulse former.