

Pulse Program Generator

By JAKOB H. HOHL
and ROLF F. MÜNGER

For triggering a high-power, short-duration flash equipment, a pulse program generator has been developed. The instrument generates groups of 110 pulses with equal intervals. To form the pulse program, up to 30 pulses of the group may be arbitrarily chosen. The interval between two successive pulses can be varied continuously from 10 μ sec to 1 sec. The generator can be started manually or by an external trigger, upon which the program runs off either once or repetitively. The instrument is fully transistorized.

THERE ARE different methods for observing fast-moving mechanisms. If the events are repeated periodically, the most convenient method is observation under stroboscopic illumination. For nonrepetitive processes there are, for example, the high-speed motion-picture camera and the multiple exposure of a negative with short-duration flashes. For the latter, the lamp is usually triggered with constant repetition rate. The picture series obtained in this manner renders the event with uniformly advancing time. It often happens, however, that the essential information is contained within a small time interval of the whole process and, consequently, most of the pictures are redundant.

To overcome this inconvenience, a pulse program generator has been developed at the IBM Research Laboratory, Zurich, Switzerland, to trigger an electronic flash at arbitrarily chosen instants.

Figure 1 demonstrates how a pulse program is composed. A start signal releases the oscillator which produces clock pulses with equal intervals; 110 consecutive pulses form one program cycle. Up to 30 of the 110 pulses can be selected arbitrarily to form the actual program. When only one program cycle is desired, the 110th clock pulse can be used to stop the clock generator. The interval between two clock pulses, designated by Δ in Fig. 1, is continuously variable from 10 μ sec to 0.025 sec.

The means for selecting the program pulses are shown in Fig. 2. Each of the 110 pulses is available at an individual plug of the 10 by 11 plugboard. The selected pulses are fed to the output busbar by cables. In Fig. 2, pulses Nos. 14, 62 and 99 have been selected.

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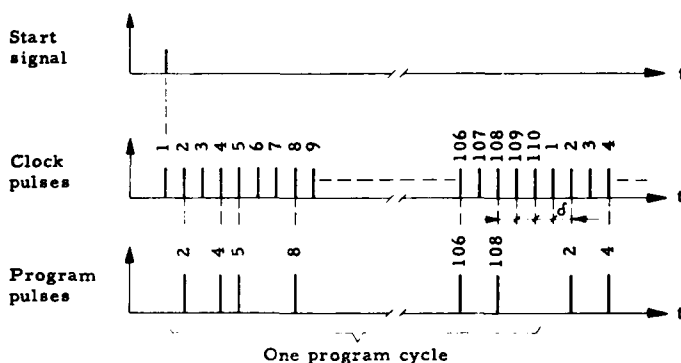


Fig. 1. Composition of pulse program.

An oscillogram of an output pulse is shown in Fig. 3. The pulse has an amplitude of 3 v and a duration of 2.5 μ sec, which is sufficient to trigger ordinary electronic equipment.

In Fig. 4, the front panel with all the controls, inputs and outputs is shown.

Figure 5 shows the block diagram of the electronic circuits of the program generator. The start signal, which may be given manually or by an external trigger source, is applied to a flip-flop circuit. This flip-flop turns on the clock pulse generator. The clock pulses are simultaneously fed to a 10- and an 11-step ring-counter. Both counters have an output at each stage, and these outputs are utilized as drive wires of a magnetic core matrix, which is similar to those used as memories in electronic computers. The matrix consists of 110 ferrite toroid cores suspended in the cross-points of the 10 by 11 drive wires, as shown in the detailed view of Fig. 5.

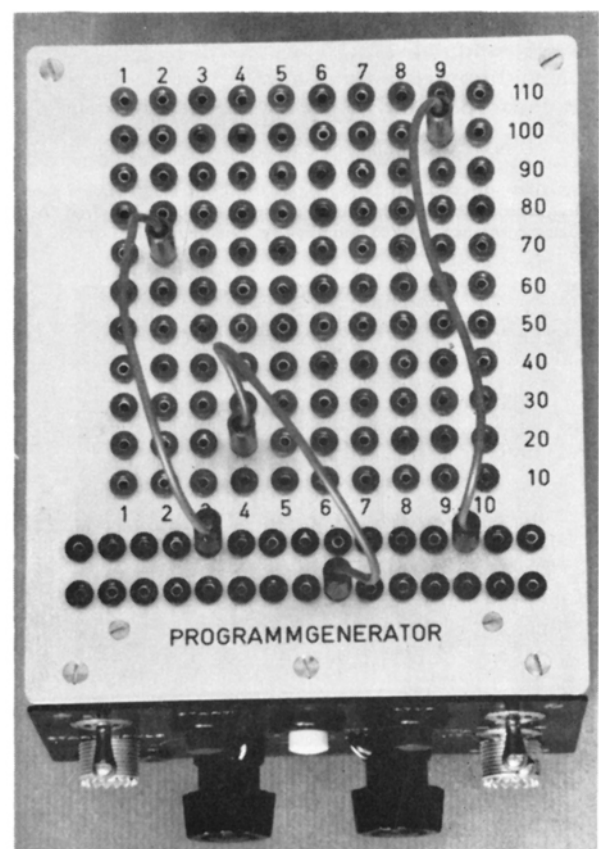


Fig. 2. Program selection board.

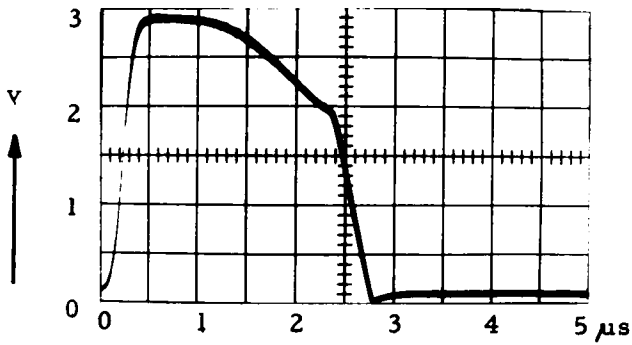


Fig. 3. Output pulse.



Fig. 4. Front panel of generator showing all controls.

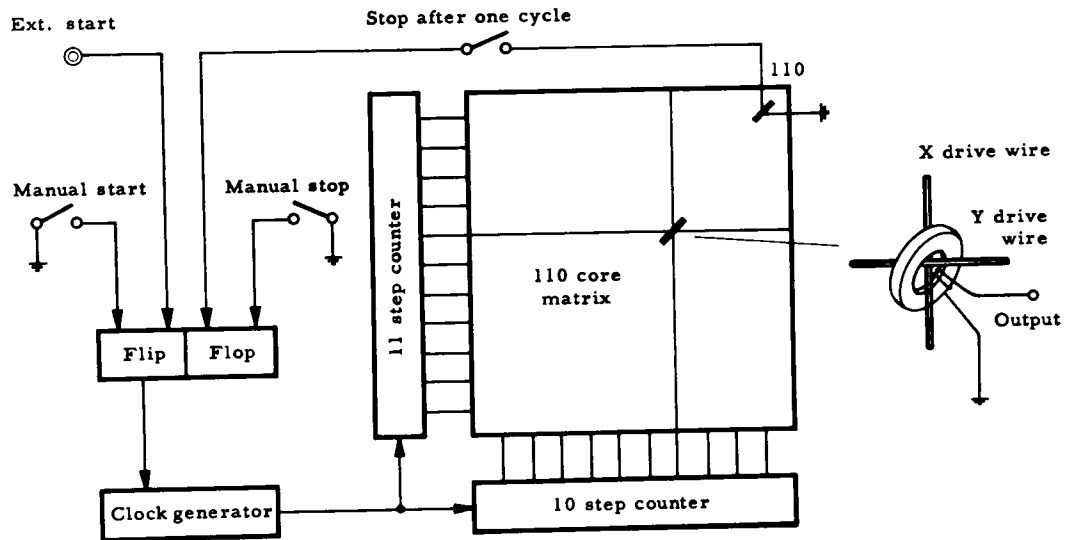


Fig. 5. Block diagram of electric circuits of program generator.

Whenever both drive wires linking a core are simultaneously energized, this core produces an output signal on a separate signal winding. The signal windings of the cores are individually connected to the 10 by 11 plug-board shown in Fig. 2. As the numbers of stages of the two ring-counters are coprime, the cores are consecutively scanned and, on each output, only one pulse occurs during a cycle.

If the signal of the 110th core is connected to the flip-flop, by closing the appropriate switch, the program will stop after the first cycle.

Figure 6 is an overall view of the pulse program generator. As it is fully transistorized, it is of small size and weight and requires little power.

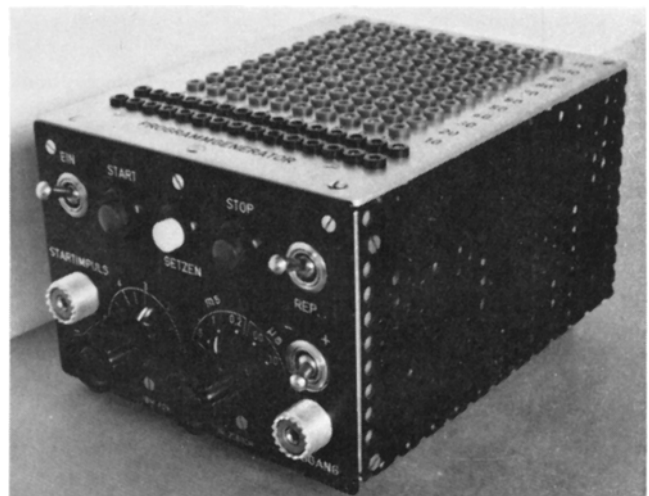


Fig. 6. General view of pulse program generator.