King of the Pulse Generators

*One-shot or a train, TTL or CMOS, this
generator will fit the bill. It's just what
your test bench always wanted.*

*Ronald A. Miara WA3RJS
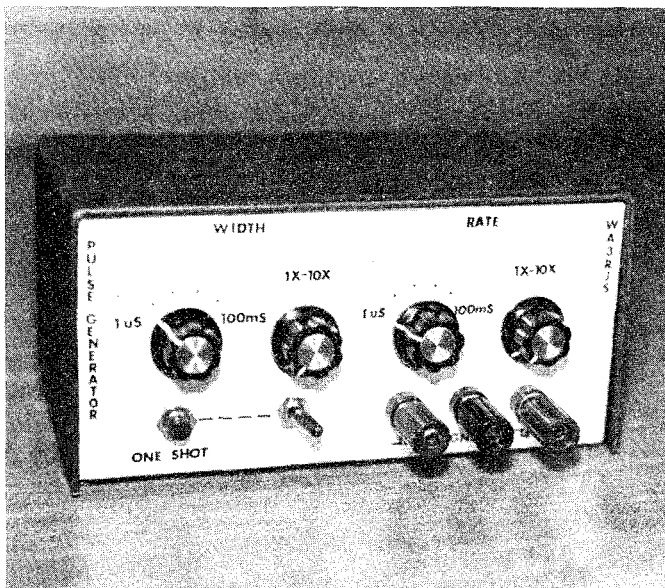8803 Enfield Court, #22
Laurel MD 20708*

This handy pulse generator is built around two commonly available under-a-dollar ICs. Both pulse width and repetition rate are continuously variable over six decade ranges from one microsecond to one second. Normal and inverted pulse train outputs are available, and a one-shot feature allows the user to output a single pulse by depressing a front-panel push-button switch. The outputs are TTL and 5-V-dc CMOS compatible.

To operate the generator, the desired repetition rate range is selected with switch S1. (Repetition rate is the time between the occurrence of each pulse and is equal to the reciprocal of the frequency of the pulse train.) The ranges that may be selected by S1 are: 1 μs, 10 μs, 100 μs, 1 ms, 10 ms, and 100 ms. Variable resistor R1 is then used to tune the repetition rate between one and ten times the range value selected by S1. For example, if S1 is set to 10 μs and R1 is set to 1X (fully
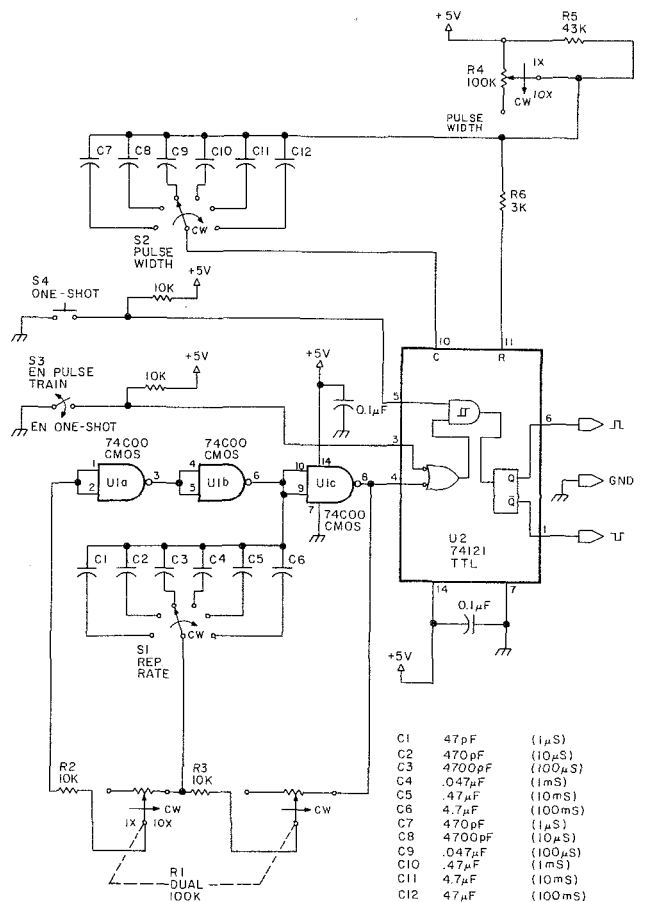

Pulse generator.

Fig. 1.

C1	47 pF	(1 μS)
C2	470 pF	(10 μS)
C3	4700 pF	(100 μS)
C4	.047 μF	(1 mS)
C5	.47 μF	(10 mS)
C6	4.7 μF	(100 mS)
C7	470 pF	(1 μS)
C8	4700 pF	(10 μS)
C9	.047 μF	(100 μS)
C10	.47 μF	(1 mS)
C11	4.7 μF	(10 mS)
C12	47 μF	(100 mS)

counterclockwise), a pulse will occur every 10 μs. R1 may then be tuned up to ten times this value (10X, fully clockwise), in which case a pulse will be output every 100 μs.

Pulse width is similarly set with S2 and R4. S2 selects the same range values as S1, and R4 is used to tune the pulse width from one to ten times the value selected by S1. Pulse widths with duty cycles up to 90% may be set up. (Duty cycle is defined as the ratio of time the pulse is on to the time of a complete cycle, times one hundred. An ordinary square wave would then have a 50% duty cycle since it is on half the time of a complete cycle.)

To use the pulse generator as a one-shot, switch S3 is closed, disabling the output pulse train. Push-button switch S4 is then depressed and released to output a single pulse from U2.

Refer to the schematic (Fig. 1) to understand how the pulse generator works. Three NAND gates in U1 are configured with capacitors C1 through C6, variable resistor R1, and resistors R2 and R3 to form a square-wave oscillator. The frequency of this oscillator determines the repetition rate of the generator. The resistors were chosen to produce repetition rates in convenient decade ranges. The oscillator drives one-shot generator U2. Capacitors C7 through C12, variable resistor R4, and resistors R5 and R6 determine the width of the pulses output from U2. The values of these resistors and capacitors were also chosen to produce pulse widths in decade ranges. Since the oscillator driving U2 causes pulses to be output at a periodic rate, the output of U2 becomes the output of the pulse generator.

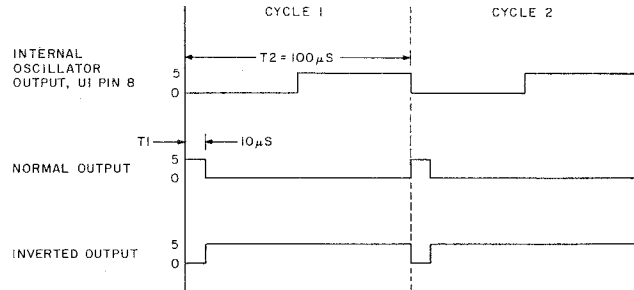Construction of this unit is not critical. Short lead lengths and an all-metal en-

Fig. 2. Pulse generator timing diagram. This shows a pulse train which has a 10-μs pulse width and a 100-μs repetition rate. The duty cycle is equal to 10 μs divided by 100 μs times one hundred percent, which equals 10 percent.

closure should be used to ensure a clean and stable pulse-train output. U1 (74C00) should be CMOS, not TTL, to ensure that the oscillator will work. The accuracy of the pulse width and repetition rate depends on the tolerance of the resistors and capacitors used and how carefully the front-panel multiplier controls are labeled (from 1X to 10X). Since I normally use an oscilloscope to set up my pulse generator, I used sim-

ple front-panel labeling and rely on the scope for calibration of the pulse train. Simple front-panel labeling also keeps the cabinet size small since less space is required on the front panel. My unit is powered by four penlight batteries which drive a miniature three-terminal +5-V-dc regulator IC (LM309H).

The small size and low cost of this handy pulse generator should make it a nice addition to any ham's workbench. ∎