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.

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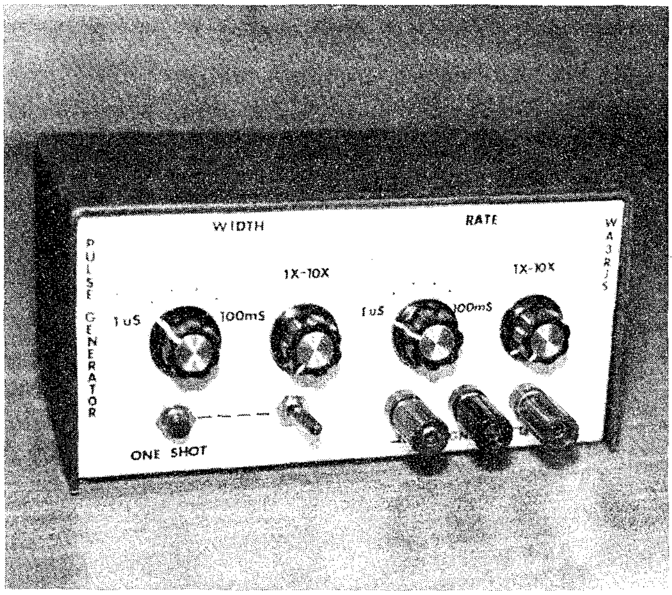
This handy pulse generator is built around two commonly available under-a-dollar ICs. Both pulse width and repetition rate are continuously variable over six decade ranges from one microsecond to one second. Normal and inverted pulse train outputs are available, and a one-shot feature allows the user 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.

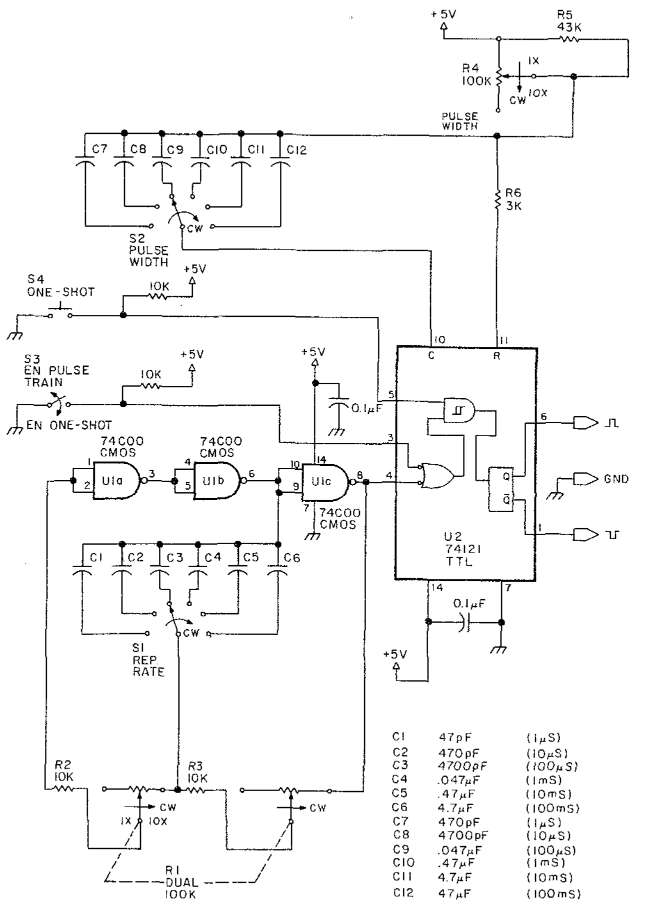


Fig. 1.

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 enclosure 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 simple 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. ■

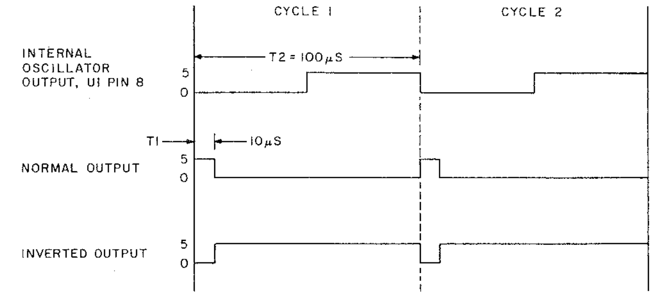


Fig. 2. Pulse generator timing diagram. This shows a pulse train which has a 10-µs pulse width and a 100-µs repetition rate. The duty cycle is equal to 10 µs divided by 100 µs times one hundred percent, which equals 10 percent.

SATELLITES

Late September brought amateur satellite enthusiasts something to cheer about for a change. On the 20th, the University of Surrey amateur scientific satellite (UoSAT) was rescued from oblivion when ground controllers managed to turn its telemetry beacons off for the first time since April. By the time you read this, UoSAT may already be back in full operation.

The trouble with UoSAT (also known as UoSAT-OSCAR 9 or, more simply, UO-9) began when both the 2-meter and 70-cm beacons were accidentally commanded on at the same time. The effect was to desense both receivers aboard the bird, making it impossible for UoSAT to "hear" instructions from the ground. Even the massive 26-dB-gain 2-meter EME array of K1WHS proved insufficient to break through.

After an enormous expenditure of time and effort, the spell was finally broken on 70 cm when the UoSAT salvage team obtained the services of a little-used 150-foot dish antenna at SRI International in California. With a gain at 70 cm of 46 dB and an erp approaching 12 megawatts, the big dish did the trick, though not without practically being rebuilt by the UoSAT gang in the process.

Fortunately, UoSAT seems none the worse for the experience. The satellite, which does not carry communications transponders, continues to send a steady stream of scientific data earthward. In addition to telemetry beacons at 145.825 and 435 MHz, look for HF beacons at 7.05, 14.002, 21.002, and 28.510 MHz. An on-board TV camera may be activated as well.

Ever since the failure of the European Space Agency (ESA) Ariane rocket during its fifth flight (September 9), the date for the launch of AMSAT's Phase IIIB satellite has been anyone's guess. The best bet is now sometime in mid-April, assuming no further problems arise.

Thanks to AMSAT *Satellite Report*.—Jeff DeTray WB8BTH, *73* Staff.

Amateur Satellite Reference Orbits

	OSCAR 8		RS-5		RS-6		RS-7		RS-8		
Date	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	UTC	EQX	Date
Jan 1	0113	97	0041	38	0008	33	0108	46	0041	36	1
2	0118	98	0036	38	0152	61	0059	45	0038	37	2
3	0122	99	0030	38	0136	59	0049	44	0035	38	3
4	0127	101	0025	39	0121	56	0039	43	0032	39	4
5	0131	102	0020	39	0105	54	0030	42	0030	39	5
6	0135	103	0014	39	0050	52	0020	41	0027	40	6
7	0140	104	0009	39	0035	49	0010	40	0024	41	7
8	0001	79	0004	39	0019	47	0001	39	0021	42	8
9	0006	80	0158	69	0004	45	0150	68	0018	43	9
10	0010	82	0153	70	0147	72	0141	67	0016	44	10
11	0014	83	0147	70	0132	70	0131	67	0013	44	11
12	0019	84	0142	70	0116	67	0121	66	0010	45	12
13	0023	85	0137	70	0101	65	0112	65	0007	46	13
14	0028	86	0131	70	0046	63	0102	64	0004	47	14
15	0032	87	0126	71	0030	60	0053	63	0001	48	15
16	0036	88	0121	71	0015	58	0043	62	0158	79	16
17	0041	90	0115	71	0158	86	0033	61	0156	79	17
18	0045	91	0110	71	0143	83	0024	60	0153	80	18
19	0050	92	0105	71	0127	81	0014	59	0150	81	19
20	0054	93	0059	72	0112	79	0004	59	0147	82	20
21	0059	94	0054	72	0056	76	0154	88	0144	83	21
22	0103	95	0049	72	0041	74	0144	87	0142	84	22
23	0107	96	0043	72	0026	72	0135	86	0139	84	23
24	0112	98	0038	72	0010	69	0125	85	0136	85	24
25	0116	99	0033	72	0154	97	0115	84	0133	86	25
26	0121	100	0027	73	0138	94	0106	83	0130	87	26
27	0125	101	0022	73	0123	92	0056	82	0127	88	27
28	0129	102	0017	73	0107	90	0046	81	0125	88	28
29	0134	103	0011	73	0052	87	0037	81	0122	89	29
30	0138	104	0006	73	0037	85	0027	80	0119	90	30
31	0143	105	0001	74	0021	83	0017	79	0116	91	31
Feb 1	0004	81	0155	104	0006	80	0008	78	0113	92	1
2	0008	82	0149	104	0149	108	0157	107	0111	93	2
3	0013	83	0144	104	0134	106	0148	106	0108	93	3
4	0017	84	0139	104	0118	103	0138	105	0105	94	4
5	0022	85	0133	105	0103	101	0128	104	0102	95	5
6	0026	86	0128	105	0048	99	0119	103	0059	96	6
7	0030	88	0123	105	0032	96	0109	102	0056	97	7
8	0035	89	0117	105	0017	94	0059	102	0054	98	8
9	0039	90	0112	105	0001	92	0050	101	0051	98	9
10	0044	91	0107	106	0145	119	0040	100	0048	99	10
11	0048	92	0101	106	0129	117	0030	99	0045	100	11
12	0052	93	0056	106	0114	114	0021	98	0042	101	12
13	0057	94	0051	106	0059	112	0011	97	0040	102	13
14	0101	96	0045	106	0043	110	0002	96	0037	102	14