RESISTOR-CAPACITOR TIMED RELAY INTERRUPTER TESTS

1. GENERAL

1.01 This section covers methods of checking the output of resistor-capacitor timed relay interrupter circuits in the form of pulses-per-second and percent break or in the form of milliseconds. It also lists and covers typical values that may be expected during these tests.

1.02 This section is reissued to:

(a) Change the title

(b) Include the use of the 4A signaling test set, J94743A (SD-1C244-01)

(c) Make changes in some of the figures

(d) Make minor changes as necessary.

This reissue affects the Equipment Test List.

1.03 The procedures covered are:

1.04 The circuit requirement tables on all circuits issued or reissued after June 1, 1935 and employing resistor-capacitor timed relay interrupters specify ***pulse speed*** and ***percent break*** or make and break time interval requirements for these interrupters, except where the interrupters form a complete circuit in themselves.

1.05 Reference should be made to the circuit requirement tables of the individual interrupter circuits for additional information not covered in this section.

2. APPARATUS

2.01 The apparatus required for each test is shown in Table A. The details of each item are covered in the paragraph indicated by the number in parentheses.

2.02 35-type test set.

2.03 KS-3008 stopwatch, or watch with a second hand.

2.04 KS-7361 percent break meter.

2.05 KS-7608 impulse counter or CENCO No. F789 impulse counter.

2.06 Pulse checking test set, J94725 (SD-96362-01).

2.07 4A signaling test set, J94743A (SD-1C244-01), equipped with the E&M interface unit, J94743AD. See Section 100-267-101.

2.08 Patching cord, P2P cord, 10 feet long, equipped with a 309 plug and a 310 plug (2P10A cord assembly).

2.09 Patching cord, P3F cord, 6 feet long, equipped with a 309 plug and a 310 plug (3P12G cord assembly).

2.10 Patching cord, P3K cord, 6 feet long, equipped with two 310 plugs (3P15A cord assembly).

2.11 Testing cord, 893 cord, 6 feet long, equipped with two 360A tools (1W13B cord assembly).

2.12 Testing cord, W2W cord, 6 feet long, equipped with a 310 plug, a 360B tool and a 360C tool (2W17A cord assembly).

TABLE A

APPARATUS	PROCEDURE		
	A	B	C
35 Type Test Set (2.02)	1		
Stopwatch (2.03)	1		
Percent Break Meter (2.04)	1		
Impulse Counter (2.05)	1		
Pulse Checking Test Set (2.06)		1	
4A Signaling Test Set (2.07)			1
Patching Cord, 2P10A (2.08)	1		
Patching Cord, 3P12G (2.09)	1		
Patching Cord, 3P15A (2.10)		1-2	1
Testing Cord, 1W13B (2.11)	1		
Testing Cord, 2W17A (2.12)	2-3	1	
Testing Cord, 3W4A (2.13)	1	1	
Testing Cord, 2W17A (2.14)			1
Tools, 364	√	√	√
Tools, 365	√	√	√
Tools, 624	√	√	√
Tools, 419A	√	√	√
Tools, KS-6278	√	√	√
Tools, Blocking and Insulating	√	√	√

√ As required

2.13 Testing cord, W3M cord, 6 feet long, equipped with a 310 plug and one each 360A, 360B, and 360C tools (3W4A cord assembly).

2.14 ◗Testing cord, W2W cord, 10 feet long, equipped with a 310 plug, a 360B tool, a 360C tool, and KS-6278 clips or 419A clips for connecting to leads or contact springs, as required, (2W17C cord assembly).◖

3. METHOD

STEP	ACTION	VERIFICATION
A.	**Using KS-7361 Percent Break Meter, KS-7608 Impulse Counter, and 35-Type Test Set**	
1	At 35 test set— Set all switches and keys to their normal	

STEP	ACTION	VERIFICATION
	position, set resistance slides to extreme right position, open keys 1 through 4.	
2	Using P2P or W3M cord, connect TEST BATT & GRD jack or binding posts to −48 volt battery supply, with white (tip) lead of W3M cord, if used, to BATT terminal of 35 test set and red (sleeve) lead to GRD terminal. (See Fig. 1.) ***Note:*** Connect cord to 35 test set first, then to battery. When disconnecting, remove cord from battery supply first.	
3	Using W2W cord, connect the percent break meter to the 3R jack of the 35 test set, with white (tip) lead to positive (+) terminal of percent break meter and black (ring) lead to negative (−) terminal. ***Note:*** To insure proper accuracy of the percent break meter, it should be located approximately level and should not be closer than 12 inches to magnetic material.	
4	Using W2W cord, connect the impulse counter to the 4W jack of the 35 test set, with white lead to left terminal of counter and black lead to right terminal.	
5	Using P3F or W2W cord (see Fig. 1), connect the TEST T & R jack or binding posts of the 35 test set to the pulsing contacts of the interrupter circuit. Refer to the circuit requirements table of the interrupter under test for connection points.	
6	At interrupter circuit— Block or insulate apparatus per circuit requirements table, as necessary, to obtain continuity through the pulsing contacts.	
7	At 35 test set— Close key 3.	
8	Adjust slides 3 until percent break meter indicates 0.	35 test set indicates approximately .012 ampere. ***Caution: Exercise extreme care to see that the current is not allowed to exceed this value while adjusting the resistance sliders.***
9	Open key 3.	

STEP	ACTION	VERIFICATION
10	At impulse counter— Operate the key.	
11	At 35 test set— Close key 4.	
12	Adjust slides 4 until 35 test set indicates .150 ampere (for KS-7608 counter or CENCO counter with serial number 401 and above) or .500 ampere (for CENCO counter with serial number 1 through 400).	
13	Remove any blocking or insulating tools that may have been used in preparation.	
14	Start the interrupter pulsing per circuit requirements table and circuit notes of circuit under test.	
15	At 35 test set— Close key 3.	Percent break meter indicates the percent break of the interrupter contacts.
16	Open key 3.	
17	Prepare stopwatch for timing.	
18	Close key 4 and begin timing for one minute.	Impulse counter begins registering.
19	After precisely timing for one minute, restore key on impulse counter.	Impulse counter indicates number of pulses received from interrupter in one minute.
20	Open key 4.	
21	Calculate the pulses-per-second by dividing the results obtained in the verification of Step 19 by 60, then refer to Part 4 of this section.	

B. Using Pulse Checking Test Set J-94723

1	Place pulse checking (PC) test set in an approximately level position.	
2	Set CAL potentiometer fully counterclockwise.	Pointer indicates 100 on percent break scale. See Step 3a.
3a	If pointer does not indicate 100— Adjust pointer adjust screw for 100 indication.	
4	Using a P3K or W3M cord, connect BAT G jack or binding posts to −48 battery supply, with white (tip) lead of W3M cord, if used,	

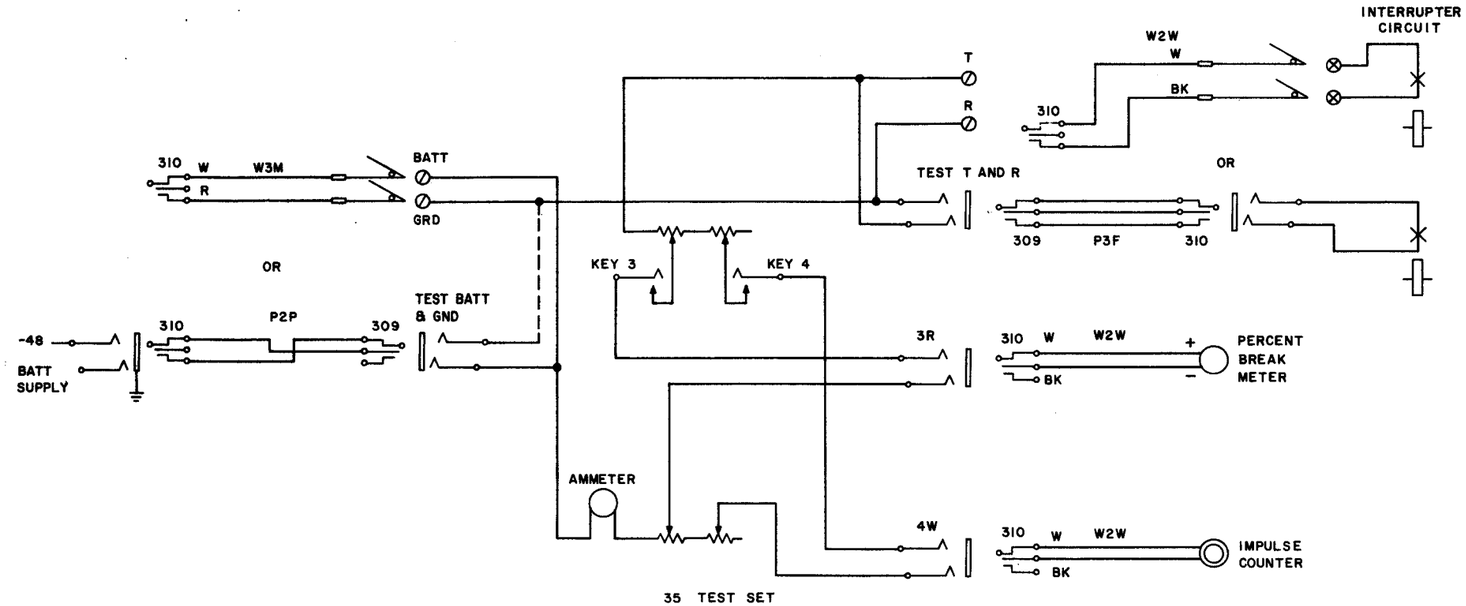

Fig. 1—Typical Connections—Using 35 Test Set, Percent Break Meter, and Impulse Counter

STEP	ACTION	VERIFICATION

to BAT terminal of PC test set and red (sleeve) lead to G terminal. (Fig. 2.)

Note: Connect cord to PC test set first, then to battery supply. When disconnecting, remove cord from battery supply first.

5 Using P3K or W2W cord, (Fig. 2), connect P jack of PC test set to the pulsing contacts of the interrupter circuit. Refer to the circuit requirements table of the interrupter under test for connection points.

6 Adjust CAL potentiometer until percent break meter indicates 0.

7 Start the interrupter pulsing per circuit requirements table and circuit notes of circuit under test.

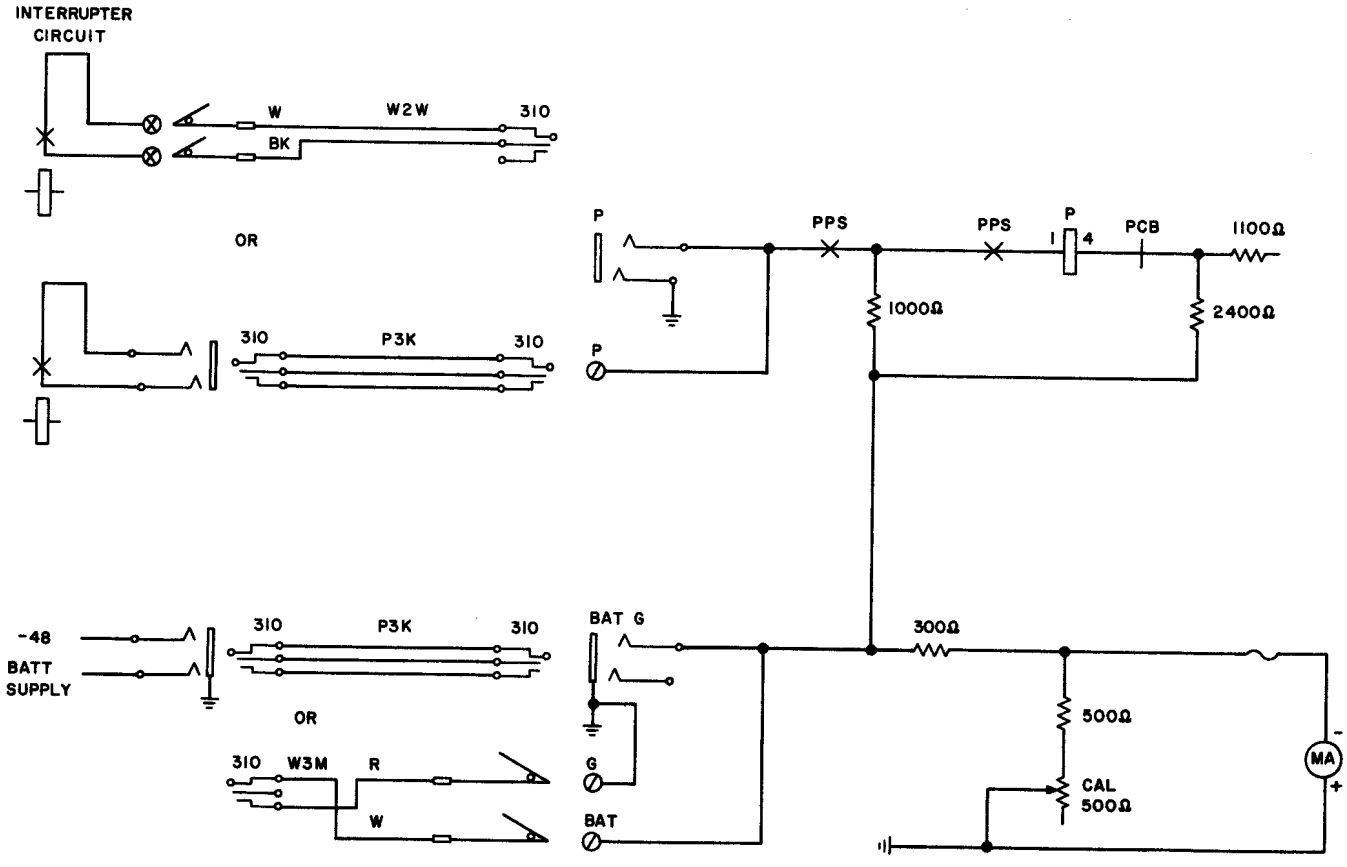

Fig. 2—Typical Connections—Using Pulse Checking Test Set

STEP	ACTION	VERIFICATION
8	At Pulse Checking Test Set— Operate PCB key.	Pulse checking test set indicates percent break of interrupter contacts.
9	Operate PPS key.	
10	Set SCALE switch to 20 or 40 position, as necessary, to obtain proper indication.	Pulse checking test set indicates the interrupter rate of pulsing in pulses-per-second.
11	Restore PPS key to normal.	
12	Refer to Part 4 of this section for application of results obtained in this procedure.	

C. Using 4A Test Set J-94743A

1 Connect 4A test set to 110 volts ac, operate POWER switch to ON.

2 Equip 4A test set with E&M interface unit.

3 Using P3K or W2W cord, connect the pulsing contacts of the interrupter's pulsing relay to the tip and ring of the LINE/R jack on the E&M unit per Fig. 3.

4 Set RECEIVE switch to EM.

5 Set MS RANGE switch to 99.9.

6 Set FUNCTION switch on main unit to SPEED.

7 Operate TWD LINE key of E&M unit to ON HK.

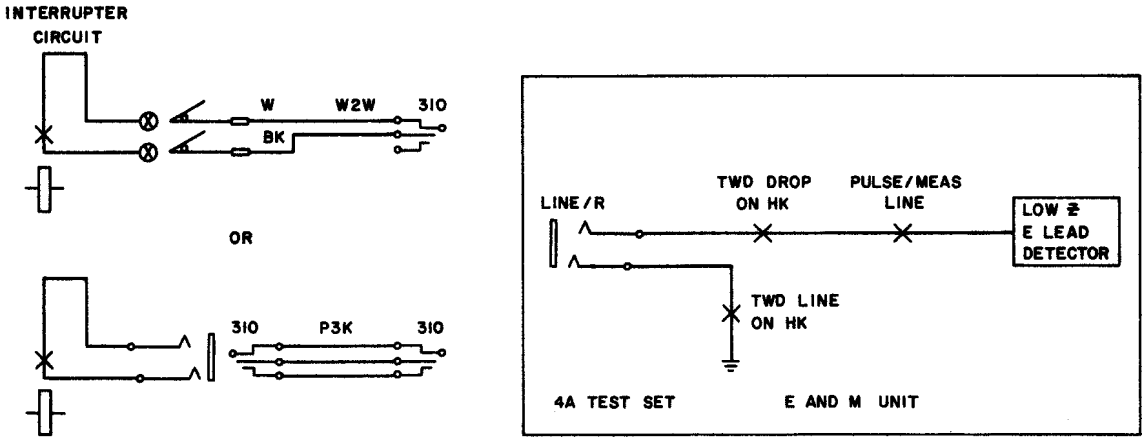

Fig. 3—Typical Connections—Using 4A Test Set

STEP	ACTION	VERIFICATION
8	Operate TWD DROP key to ON HK.	
9	Operate PULSE/MEAS key to LINE.	
10	Set E&M/CX—S/R switch to E&M/CX.	
11	At circuit under test— Start interrupter pulsing. (Refer to SD and CD of circuit to be tested for relay to block etc.)	
12	At 4A test set— Operate START-STOP key. *Note:* The OPERATE-CLEAR and START-STOP keys are operated when the lamps behind the keys are lighted and released when the lamps are extinguished.	4A display indication of pulses-per-second.
13	Release START-STOP key.	
14	Set FUNCTION switch on main unit to % BK.	
15	Operate START-STOP key.	4A display indication of percent break.
16a	If measurements are to be made in the form of milliseconds— Set SELECTOR switch to NORM.	
17a	Set FUNCTION switch to MSEC PER to measure pulses or to MSEC BK to measure milliseconds break.	
18a	Set MS RANGE switch to 999.	
19a	Set READ switch to MSEC UPDATE.	4A display indication in milliseconds. See Part 4.
20	Remove all test connections, restore all circuits to normal.◀	

4. GRAPHS AND CHARTS

4.01 The percent break and pulse-per-second requirements for a particular circuit are shown in the circuit requirements table for that circuit. ▶If the requirements in the circuit requirements table are expressed in milliseconds, they can be measured directly in milliseconds by the 4A test set, if used. However, if test sets other than the 4A are used, as set forth in this section, the break or make interval in milliseconds may be obtained by use of the conversion charts shown in Fig. 8 and 9. For example, a value of 8 pulses-per-second at 60 percent break to be converted to milliseconds break would be obtained by placing a straightedge from 8 on the PPS scale to 60 on the % BRK OR MAKE scale. The straightedge would cross the TIME IN MILLISECONDS scale at 75 (75 milliseconds break).◀

4.02 The interrupter output measurements can be plotted on the circuit requirements table

graphs similar to those shown in Fig. 4 through 7 to determine if they are within limits. When the percent break and pulses-per-second values are plotted on the graph and the point of intersection falls outside the solid lines, adjustments must be made. In some circuits the pulsing relay characteristics may be changed by changing resistance and capacitance values built into the circuit network. The solid lines are extended as dashed lines on the graphs in Fig. 4, 5, and 6 and information is placed in these areas pertaining to adjustments of resistors and capacitors. A plus (+) sign indicates an increase in value should be made and a minus (−) sign indicates a decrease in value should be made for the relay to meet requirements. The electrical and mechanical requirements of the relay should be met before making adjustments on resistors and capacitors.

4.03 Fig. 5 illustrates an arrangement in which there are two pulsing relays, PLS (master) and CTG (slave), where the adjustment for both relays is controlled by the same set of resistors. Unless otherwise specified, first check the relay for which the pulsing requirements are expressed by the inside solid lines designated PLS. If this relay meets its requirements, the relay having requirements expressed by the outside solid lines should automatically meet its requirements.

4.04 Fig. 6 illustrates a pulsing arrangement using two or more relays but where the output (slave) relay OPA only is checked. Pulsing limits for the pulse generator (master) relay PG are not specified. Therefore the solid lines representing the PG relay are not shown on the graph. If the OPA requirements are met, the other relays are satisfactory.

4.05 Fig. 7 illustrates an arrangement for a pulsing relay where there are no adjustable resistors or capacitors. In this case, only the electrical and mechanical requirements of the relay itself are applicable.

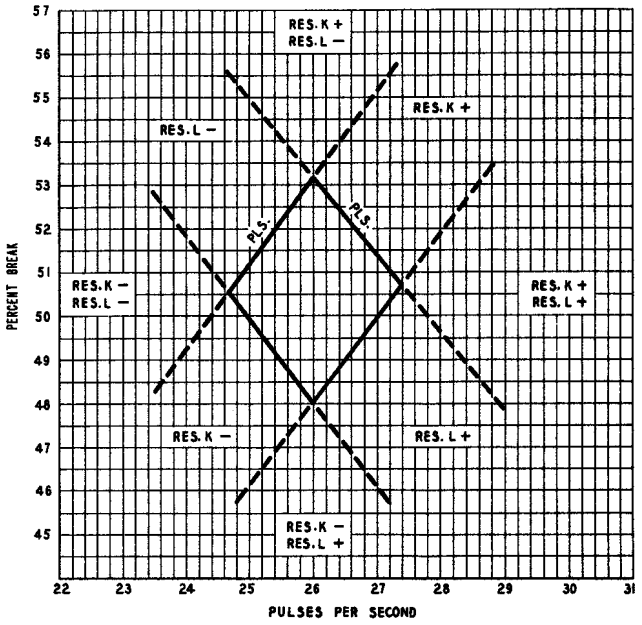

Fig. 4—Chart Illustrating Pulse Speed and Percent Break Requirements—Variable Resistors Provided for Readjustment

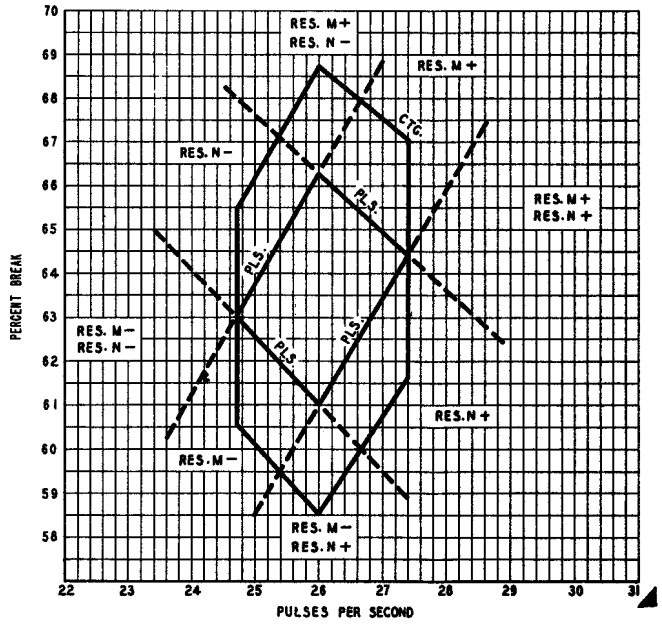

Fig. 5—Chart Illustrating Pulse Speed and Percent Break Requirements—Variable Resistors Provided for Readjustment of Output of Two Relays

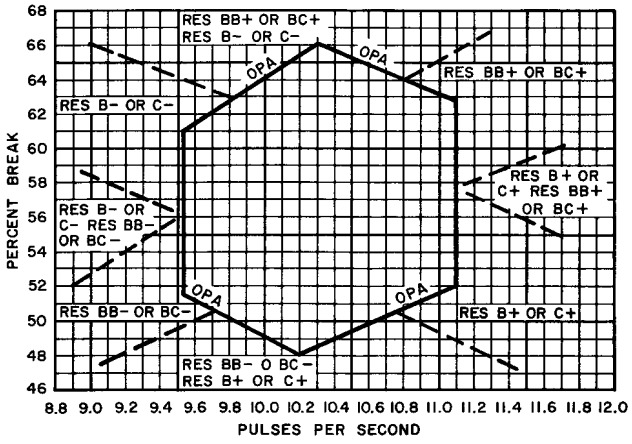

Fig. 6—Chart Illustrating Pulse Speed and Percent Break Requirements—Variable Resistors Provided for Readjustment of Relays but Where Facilities are Only Provided for Checking Output of Slave Relay

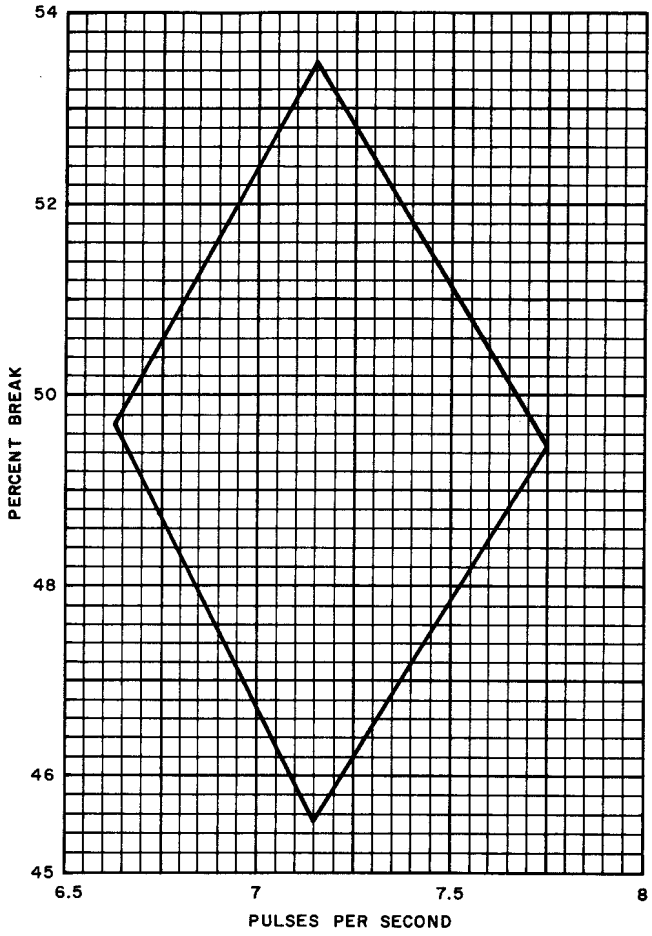

Fig. 7—Chart Illustrating Pulse Speed and Percent Break Requirements—No Variable Resistors or Capacitors Provided for Readjustment

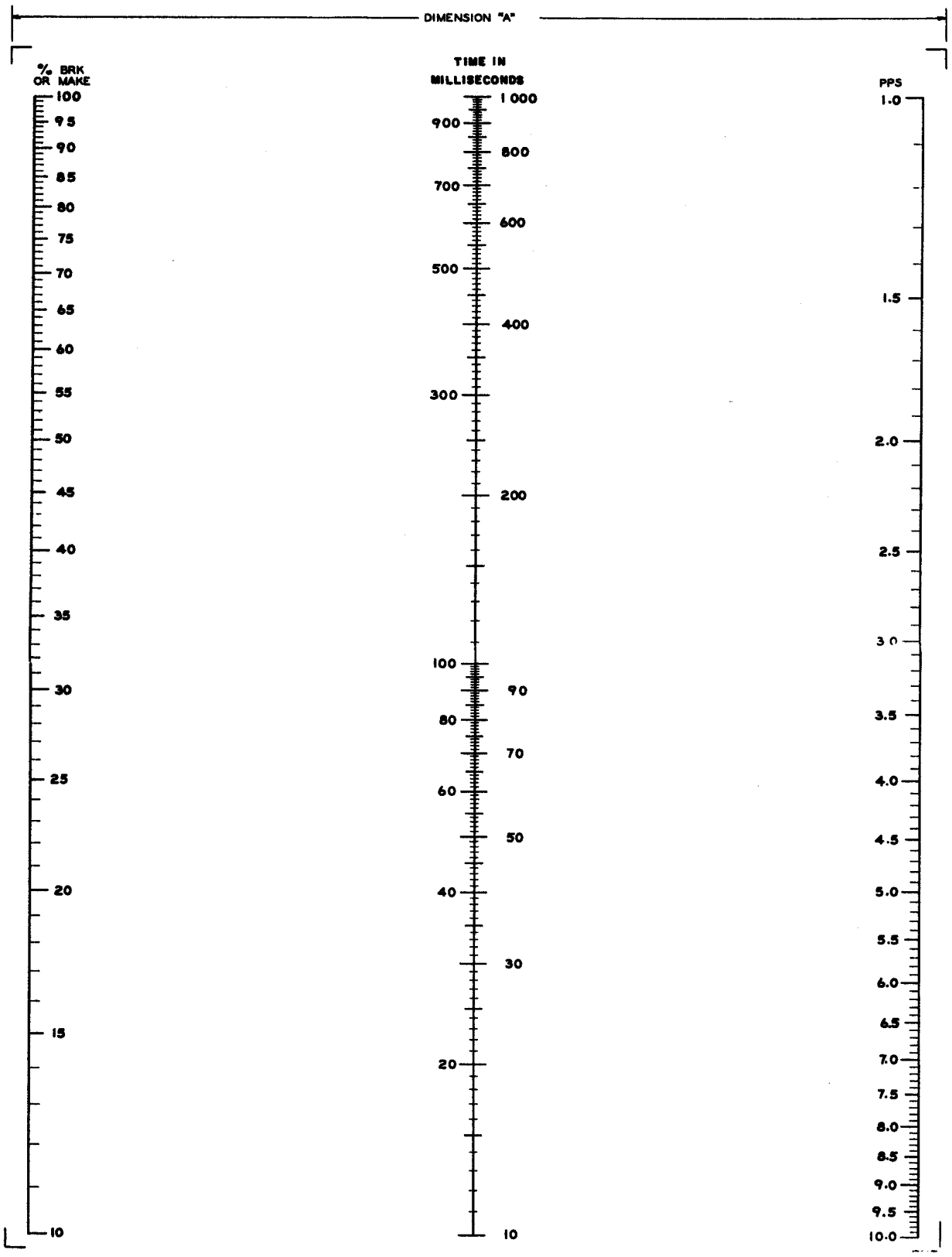

Fig. 8—Pulse Conversion Chart

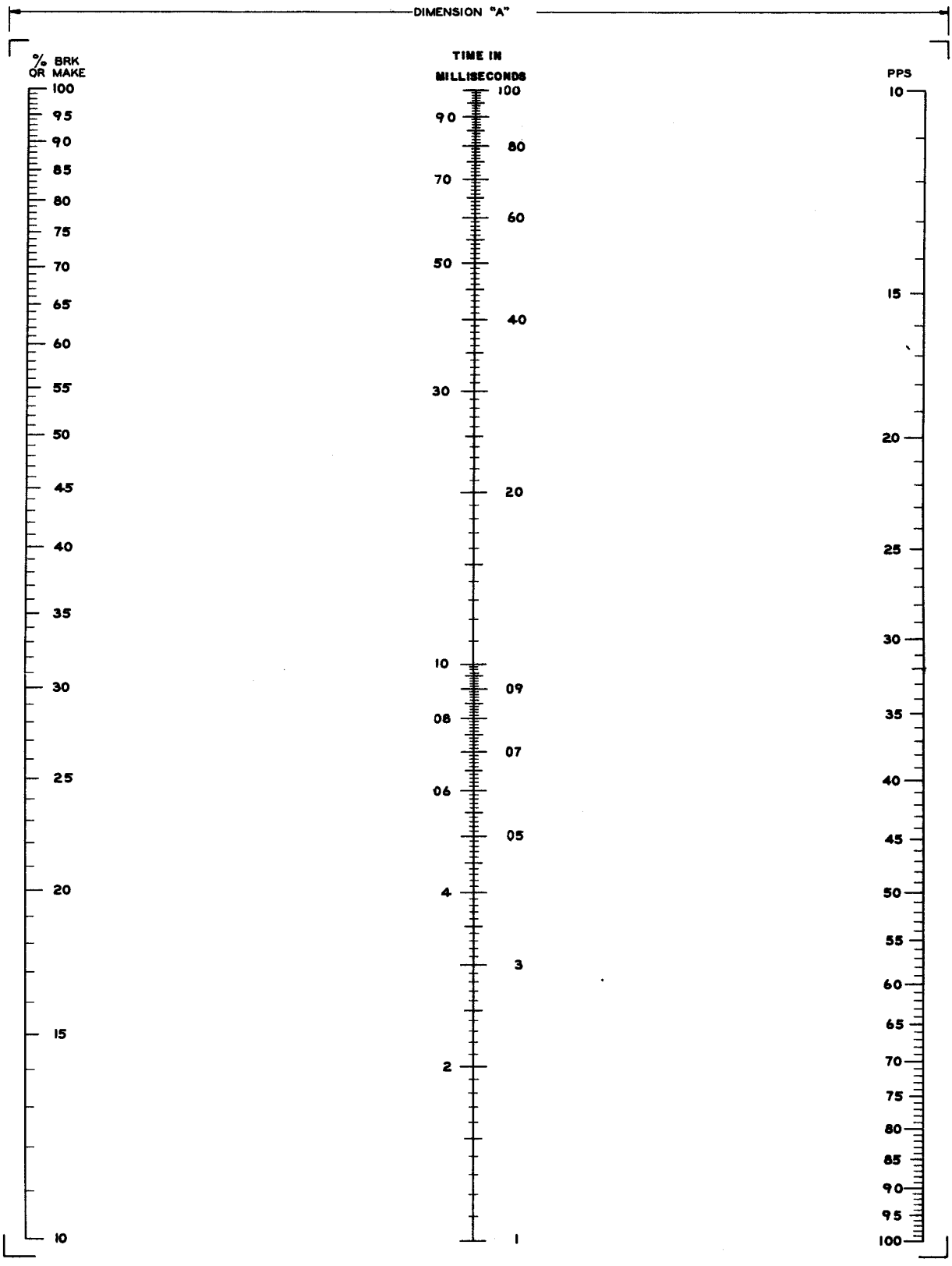

Fig. 9—Pulse Conversion Chart