

OPERATING INSTRUCTIONS



TYPE **783-A**

OUTPUT-POWER METER

GENERAL RADIO COMPANY

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OUTPUT-POWER METER

Form 0783-0100-F
August, 1961

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

SPECIFICATIONS

- Power Range:** 0.2 mw to 100 w in five ranges. Auxiliary db scale on the meter reads from -10 to +10 db above 1 mw. With multiplier, total range is -10 to +50 db above 1 mw.
- Impedance Range:** 2.5 to 20,000 ohms. Forty discrete impedances, distributed approximately logarithmically, are obtained by a 10-step selector and 4-step multiplier.
- Impedance Accuracy:** $\pm 2\%$ except for high impedances at high audio frequencies (refer to Section 3).
- Power Accuracy:** ± 0.25 db at full-scale reading. At lowest impedance multiplier setting (2.5 to 20 ohms) an additional error of 0.2 db may appear due to switch contact resistance with power multiplier set at 10 (10 to 100 watt range).
- Waveform Error:** Over-all frequency characteristic of power indication is flat within ± 0.5 db from 20 to 10,000 cps; within ± 0.75 db to 15,000 cps.
- Temperature and Humidity Effects:** Nonsinusoidal voltages may cause error, since meter is not a true rms indicator. With waveforms normally encountered in communications, error is not serious (refer to Section 3).
- Mounting:** Instrument calibrated at 77 F, and if ambient temperature varies widely from this value, additional errors will result. At high temperatures (95 F), this error may approach the nominal calibration error, especially at higher audio frequencies. The heat dissipated by the instrument has a negligible effect on accuracy. Humidity conditions have negligible effect on accuracy.
- Dimensions:** Walnut cabinet, with aluminum panel.
- Weight:** Width 8, length 18, depth 7 inches (250 by 460 by 180 mm), over-all. 17 lb (8 kg).

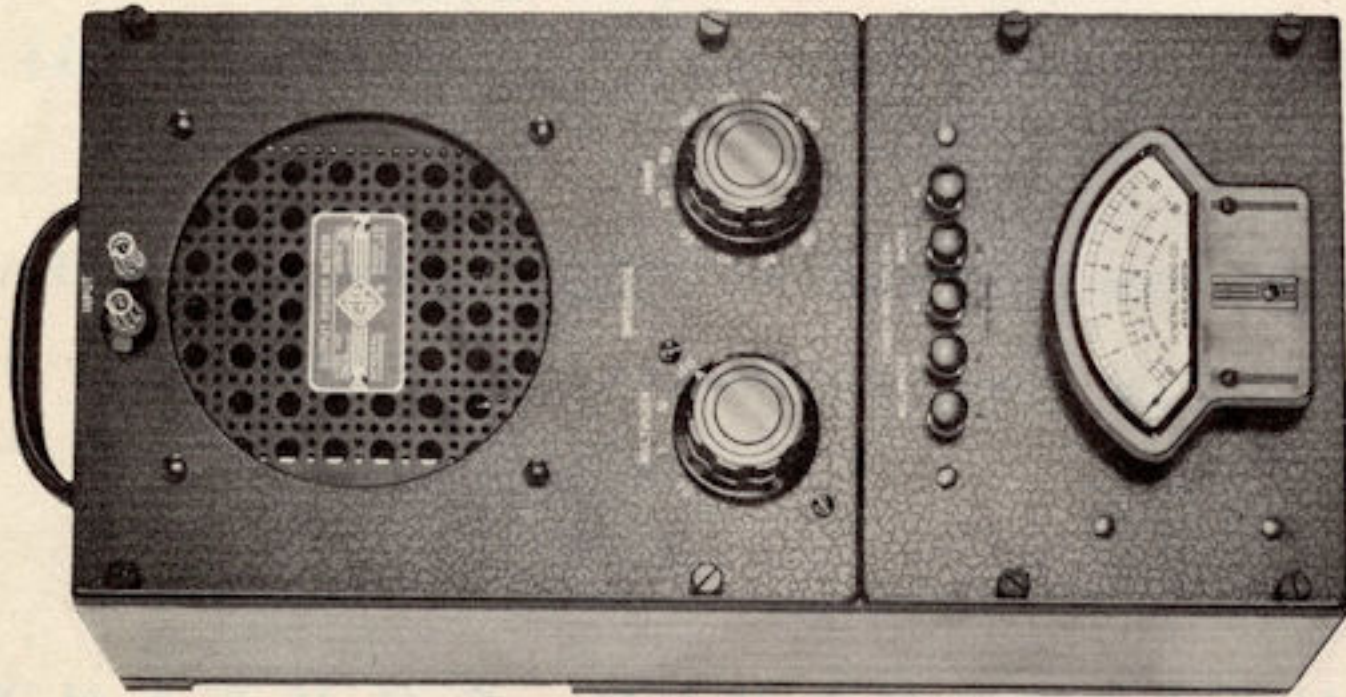


Figure 1.
Type 783-A Output-Power Meter

TYPE 783-A OUTPUT-POWER METER

1 INTRODUCTION

1.1 PURPOSE. The Type 783-A Output-Power Meter (Figure 1) gives a direct indication of the power output of audio-frequency circuits, and can be used to test amplifiers, transformers, oscillators, filters, and similar networks. Often used to simulate loud-speaker or other load impedances in high-power audio systems, the Output-Power Meter will handle power outputs up to 100 watts, yet is sensitive enough to measure directly the power output of a phonograph pickup.

1.2 DESCRIPTION.

1.2.1 GENERAL. (See Figure 2.) The Output-Power Meter is functionally an adjustable load impedance, with a voltmeter calibrated directly in watts dissipated in the load.

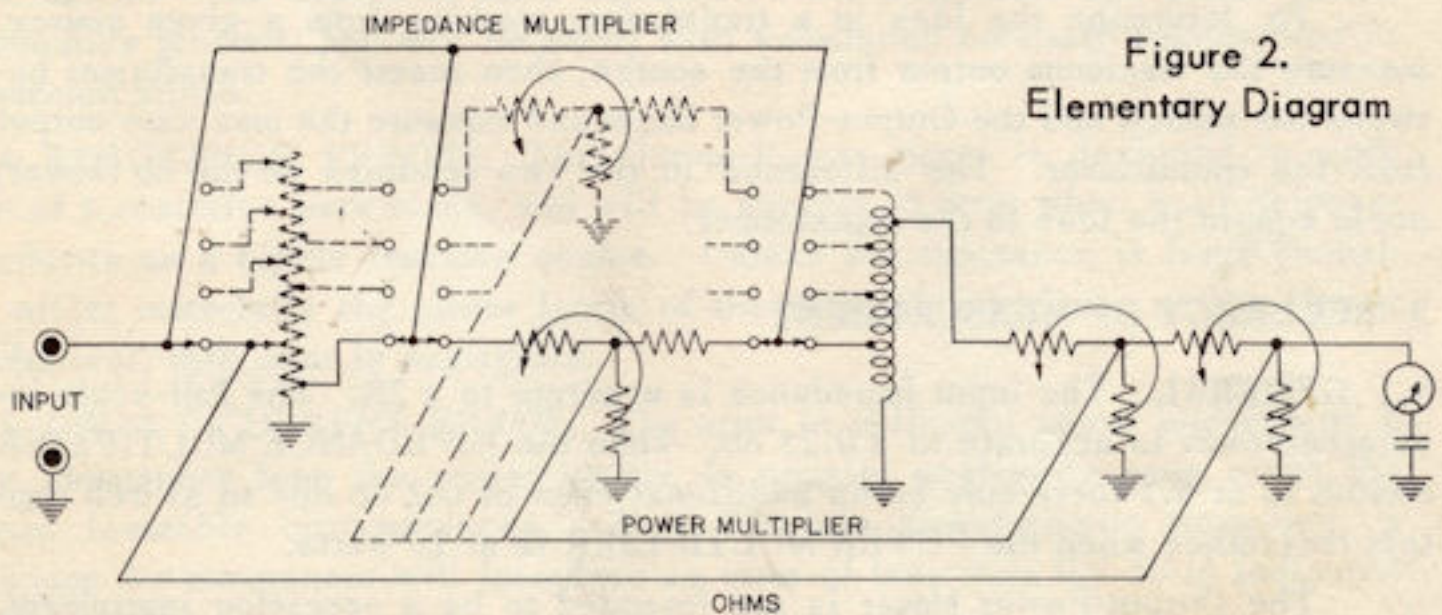


Figure 2.
Elementary Diagram

1.2.2 CONTROLS AND CONNECTIONS. The following controls and connections are on the front panel of the instrument:

<u>Name</u>	<u>Type</u>	<u>Function</u>
INPUT	Jack-top binding posts (2)	Output from circuit under test should be connected here. Right-hand post is ground.

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1.2.2 CONTROLS AND CONNECTIONS. (Continued)

<u>Name</u>	<u>Type</u>	<u>Function</u>
IMPEDANCE-OHMS	10-position selector switch	Product of these settings equals load impedance. Forty steps, from 2.5 to 20,000 ohms, are available.
MULTIPLIER	4-position selector switch	
POWER MULTIPLIER	Pushbuttons (5)	Product of POWER MULTIPLIER setting and meter reading (upper scale) equals measured output power. Range is from 0.2 milliwatt to 100 watts.

2 OPERATION. To measure the power that a circuit can deliver into a given impedance, simply connect the circuit output terminals to the Output-Power Meter INPUT terminals, set the load impedance to the desired value, and determine the power output from the meter indication and the POWER MULTIPLIER setting.

The Output-Power Meter can also measure the internal impedance of the circuit under test, since that impedance equals the impedance into which maximum power is delivered.

To determine the loss in a transformer working from a given source, measure the maximum output from the source, then insert the transformer between the source and the Output-Power Meter and measure the maximum output from the transformer. The difference in the two readings on the db (lower) scale equals the loss in the transformer.

3 ACCURACY OF MEASUREMENT

3.1 GENERAL. The input impedance is accurate to $\pm 2\%$. The full-scale indicated power is accurate to ± 0.25 db. When the IMPEDANCE MULTIPLIER switch is at 0.1 there may be an additional error of 0.2 db due to switch contact resistance when the POWER MULTIPLIER is at 10 watts.

The Output-Power Meter is not intended to be a precision instrument, and the uses for which it is designed usually do not justify precision methods. It combines convenience and wide range with a reasonable degree of accuracy, and permits high accuracy over a somewhat smaller range.

3.2 FREQUENCY ERRORS. At high impedances and high frequency, there is an input-impedance error, which at 15,000 cycles is about 5 percent for impedances from 10,000 to 20,000 ohms.

Power indication is essentially independent of frequency (± 0.5 db to 10,000 cycles; ± 0.75 db to 15,000 cycles).

TYPE 783-A OUTPUT-POWER METER

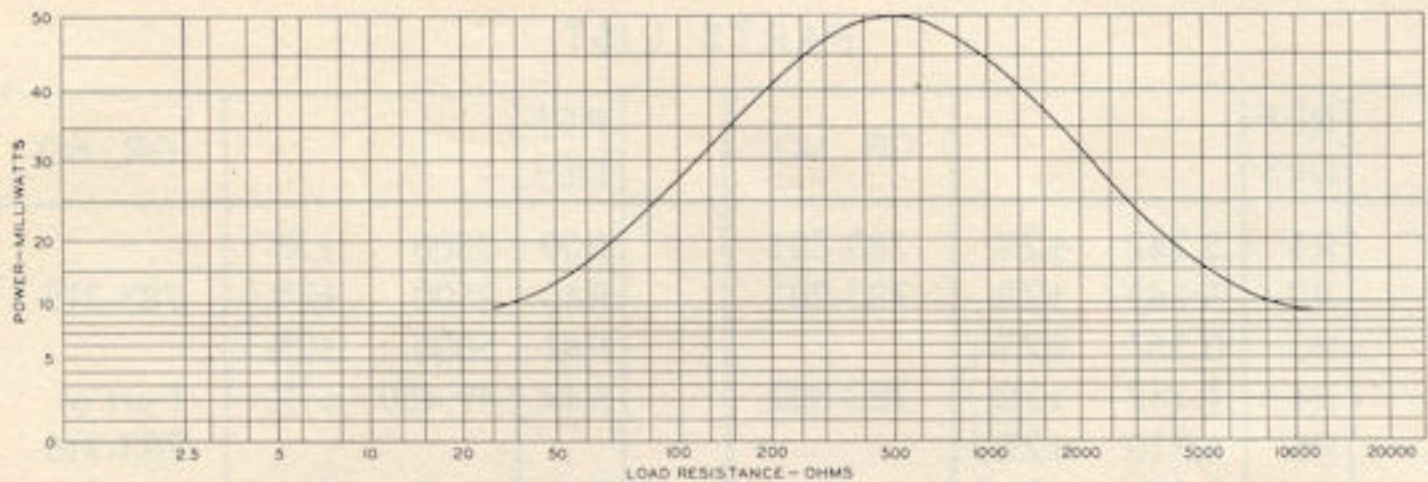


Figure 3. Power Output vs Load Resistance for a Generator with 500-ohm Internal Impedance.

Figure 3 shows power output plotted against load resistance for a generator with an internal impedance of 500 ohms. An analysis of the accuracy figures with reference to this curve shows that errors are negligible over most of the frequency range.

3.3 WAVEFORM ERRORS. The copper-oxide rectifier-type meter used in the instrument is calibrated in rms values for sinusoidal applied voltages, and nonsinusoidal voltages may cause errors, since the meter is not a true rms instrument. The degree of error depends on the magnitude and phase of the harmonics present, and will be small with waveforms normally encountered in communications.

3.4 REACTANCE ERRORS. The Output-Power Meter is designed to work out of a resistive impedance, and will be subject to error when used in measurements on a highly reactive source. Unless the reactance is large enough to affect materially the power factor of the internal impedance of the circuit under test, this error is negligible.

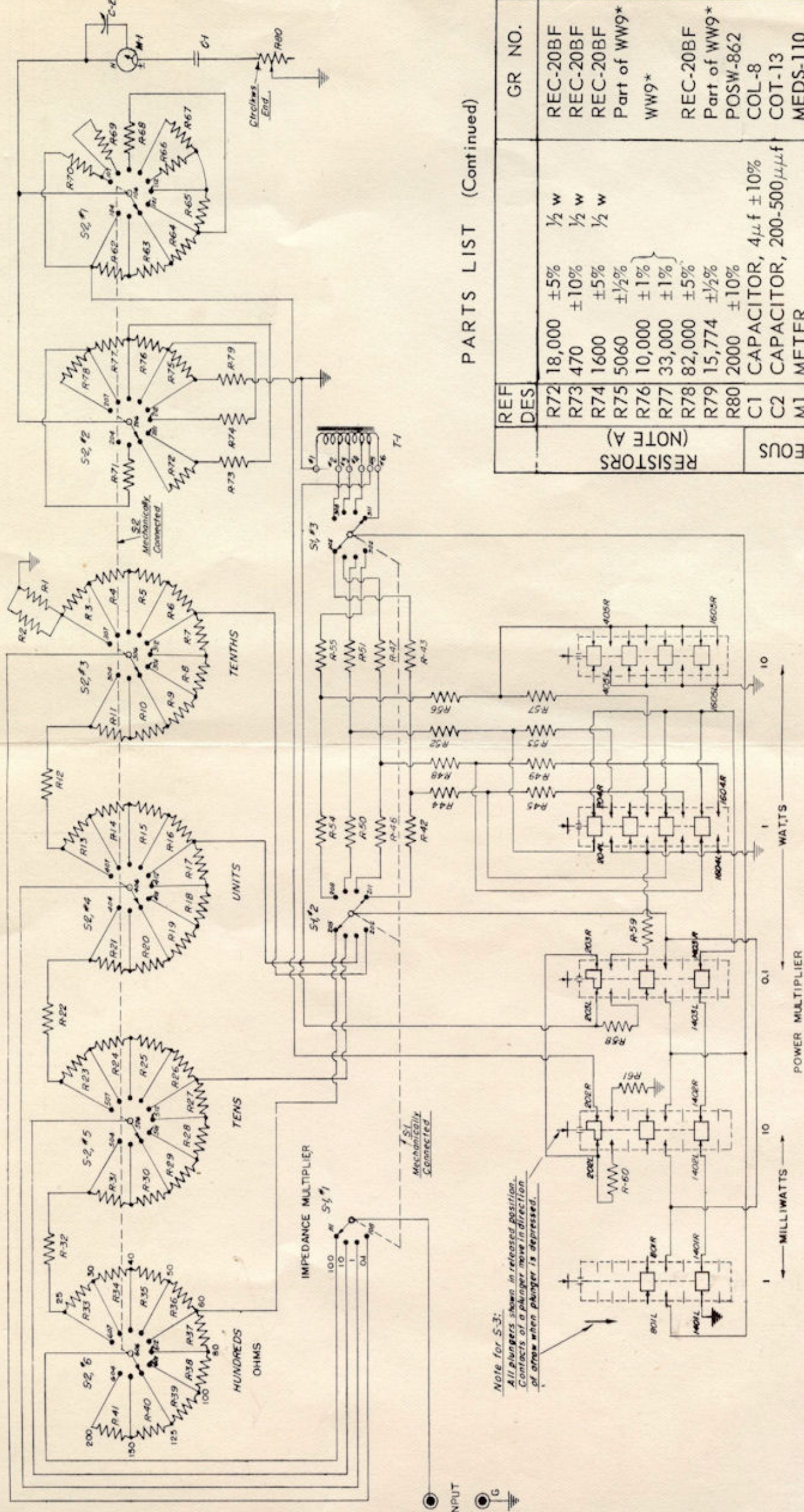
3.5 DIRECT-CURRENT ERROR. The error in indicated power because of a d-c component from the power source is usually negligible even under the least favorable circumstances. At a 60-cycle power-source frequency, a 0.5-amp d-c component will introduce an error of less than 0.2 db in indicated power reading.

3.6 TEMPERATURE AND HUMIDITY EFFECTS: The Output-Power Meter was calibrated at a temperature of 77 degrees Fahrenheit, and errors in indication will result if the ambient temperature departs widely from this value. At high temperatures (about 95 degrees F) this additional error may approach the nominal calibration error, especially at the higher audio frequencies. The instrument is so designed that the heat dissipated inside the instrument itself has a negligible effect on accuracy. Humidity conditions also have a negligible effect on the accuracy of the instrument.

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PARTS LIST

	REF DES			GR NO.		REF DES		GR NO.
RESISTORS (NOTE A)	R1	5.242	±2%	783-301	RESISTORS (NOTE A)	R39	2500 ±2%	783-315
	R2	5.242	±2%	783-301		R40	2500 ±2%	
	R3	0.557	±2%	783-302		R41	5000 ±2%	
	R4	1.152	±2%			R42	49,450 ±1%	Part of 783-316
	R5	1.210	±2%			783-303	R43	5446 ±¼%
	R6	1.278	±2%				R44	560 ±¼%
	R7	2.000	±2%	R45			1292 ±½%	
	R8	2.000	±2%	783-304		R46	4945 ±1%	Part of 783-316
	R9	2.500	±2%			R47	544.6 ±¼%	
	R10	2.500	±2%	783-305		R48	56.0 ±¼%	783-321
	R11	5.000	±2%			R49	129.2 ±¼%	
	R12	5.392	±2%			R50	494.5 ±1%	Part of 783-317
	R13	5.570	±2%	783-306		R51	54.46 ±¼%	
	R14	11.52	±2%			R52	5.60 ±½%	783-322
	R15	12.10	±2%	783-307		R53	12.92 ±½%	
	R16	12.78	±2%			R54	49.45 ±1%	Part of 783-317
	R17	20.00	±2%			R55	5.44 ±½%	
	R18	20.00	±2%	783-308		R56	0.558 ±½%	Part of 783-326
	R19	25.00	±2%			R57	1.284 ±½%	
	R20	25.00	±2%	783-309		R58	11,700 ±½%	REPR-16
	R21	50.00	±2%			R59	1444.4 ±¼%	Part of 783-326
	R22	53.92	±2%			R60	8889 ±½%	REPR-16
	R23	57.70	±2%	783-311		R61	6012 ±½%	REPR-16
	R24	115.2	±2%			R62	1741 ±¼%	
	R25	121.0	±2%	783-312		R63	982.5 ±¼%	Part of 783-318
	R26	127.8	±2%			R64	1083.5 ±¼%	
	R27	200.0	±2%			R65	971 ±¼%	
	R28	200.0	±2%	783-313		R66	1101 ±¼%	783-319
	R29	250.0	±2%			R67	221 ±¼%	
	R30	250.0	±2%	783-314		R68	46.0 ±1%	
	R31	500.0	±2%			R69	1155 ±¼%	Part of 783-318
	R32	539.2	±2%			R70	1042 ±¼%	
	R33	557.0	±2%	783-314		R71	20,000 ±5%	REC-20BF
	R34	1152	±2%					
	R35	1210	±2%					
	R36	1278	±2%					
	R37	2000	±2%					
	R38	2000	±2%					



PARTS LIST (Continued)

REF	DES	GR NO.
	R72	REC-20BF
	R73	REC-20BF
	R74	REC-20BF
	R75	Part of WW9*
	R76	WW9*
	R77	REC-20BF
	R78	Part of WW9*
	R79	POSW-862
	R80	COL-8
	C1	CAPACITOR, 4 μ f \pm 10%
	C2	CAPACITOR, 200-500 μ f
	M1	METER
	S1	SWITCH
	S2	SWITCH
	S3	SWITCH
	T1	TRANSFORMER
		MISCELLANEOUS
		RESISTORS (NOTE A)
		18,000 \pm 5%
		470 \pm 10%
		1600 \pm 5%
		5060 \pm 1/2%
		10,000 \pm 1%
		33,000 \pm 1%
		82,000 \pm 5%
		15,774 \pm 1/2%
		2000 \pm 10%
		1/2 w
		1/2 w
		1/2 w

NOTES: (A) All resistances are in ohms.
* IRC Part No.

Figure 4. Schematic Diagram