OPERATING INSTRUCTIONS

~~1840-A~~ 1071-A
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TYPE 1840-A

OUTPUT POWER METER

GENERAL RADIO COMPANY

B

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TYPE 1840-A

OUTPUT POWER METER

Form 1840-0100-B
February, 1963

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS, USA

Figure 1. Panel view of the Type 1840-A Output Power Meter.

SPECIFICATIONS

RANGES OF MEASUREMENT

Power Range: 0.1 milliwatt to 20 watts in five ranges. An auxiliary decibel scale on the meter reads from -15 to +43 decibels, referred to 1 milliwatt.

Impedance Range: 0.6 ohm to 32 kilohms in two ranges; yielding 48 individual impedances spaced approximately $\sqrt[6]{4}$ apart.

ACCURACY

Power: At 1 kc, ±0.3 db; from 50 to 6000 cps, ±0.5 db; from 30 to 10,000 cps, ±1 db; at 20 cps, -1.5 db max, -1 db average; at 20,000 cps, -5 db max, ±1.5 db average.

Impedance: At 1 kc, ±6% max, -0.5% average; from 70 to 5000 cps, ±7% for values below 10,000 ohms (7% from 70 to 2500 cps for 10,000 ohms and above); at 20 cps, -15% max, -8% average; at 20,000 cps, ±50% max, ±12% average.

GENERAL

Waveform Error: A quasi-rms meter is used which will indicate true rms with as much as 20% second and third harmonics present in the input signal.

Cabinet: Convertible bench cabinet, aluminum panel. Cabinet has extension legs to permit instrument to be used in a tilted position. Panel extensions, Type 480-P212 Adaptor Plate Sets, are available for relay-rack mounting.

Dimensions: Panel - width 12, height 3 ½ inches (305 by 90 mm); depth behind panel - 6 ½ inches (170 mm).

Net Weight: 10 ¾ pounds (4.9 kg).

SECTION **1**

INTRODUCTION

1.1 PURPOSE.

The Type 1840-A Output Power Meter (Figure 1) is an adjustable, passive network for the determination of the power output and of the internal impedance of audio-frequency generators, amplifiers, transducers, and other sources of audio-frequency power. The power output is indicated directly, and the internal impedance is indicated by the impedance setting that yields maximum power output.

1.2 DESCRIPTION.

The Type 1840-A comprises an essentially constant load and a multitap transformer that transforms the load to 48 discrete impedance values, logarithmically distributed over the range from 0.6 ohm to 32 kilohms. Successive steps vary approximately as the sixth root of four (≅1.26 to 1), permitting a close approximation to any value within the range. The fixed load incorporates a "T"-network attenuator, calibrated in 10-decibel (10 to 1 power) steps. It is terminated in a quasi root-mean-square detector (meter plus rectifiers) calibrated in both watts and decibels, the latter referred to 1 milliwatt. Compensating resistors are employed to adjust for resistance removed as the secondary of the transformer is tapped down. BECAUSE THE TYPE 1840-A INCORPORATES A TRANSFORMER, CARE MUST BE EXERCISED WHEN TESTING DEVICES, PARTICULARLY TRANSISTORS, THAT MIGHT BE DAMAGED BY EXCESSIVE MAGNETIZING CURRENT AT LOW FREQUENCIES. Figure 2 indicates the power-vs-frequency limitations for the various settings, imposed by this consideration. The curves were determined by the primary volts per turn required to produce approximate saturation of the transformer core.

Figure 3 shows a simplified schematic diagram of the Type 1840-A Output Power Meter.

The convertible bench cabinet that houses the Type 1840-A is equipped with adjustable front feet to tilt the unit for easier reading of the meter. To lock the feet in the fully extended position, rotate them until a click is heard. Further rotation releases the locks for return of the feet to the retracted position.

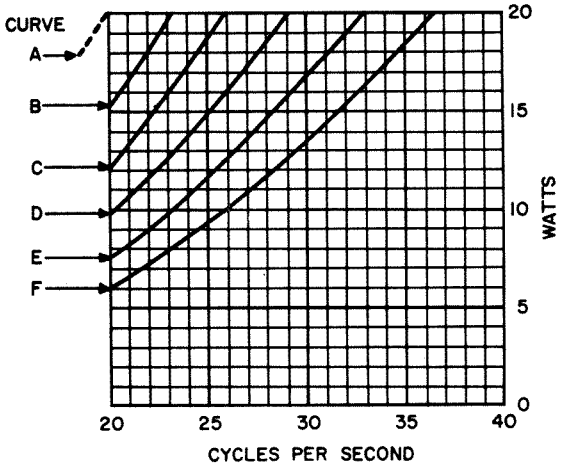


Figure 2. Power limitations vs frequency and impedance setting (see Table 1).

TABLE 1
IMPEDANCE SETTING

Figure 2 Curves		A	B	C	D	E	F	Direct Current For 0.5 DB Error
Ω		0.6	0.8	1	1.25	1.6	2	2 amp
		2.5	3.12	4	5	6.4	8	1 amp
		10	12.5	16	20	25	32	0.5 amp
		40	50	64	80	100	128	250 ma
KΩ		0.15	0.2	0.25	0.312	0.4	0.5	125 ma
		0.6	0.8	1	1.25	1.6	2	63 ma
		2.5	3.12	4	5	6.4	8	32 ma
		10	12.5	16	20	25	32	16 ma

1.3 CONTROLS AND CONNECTORS.

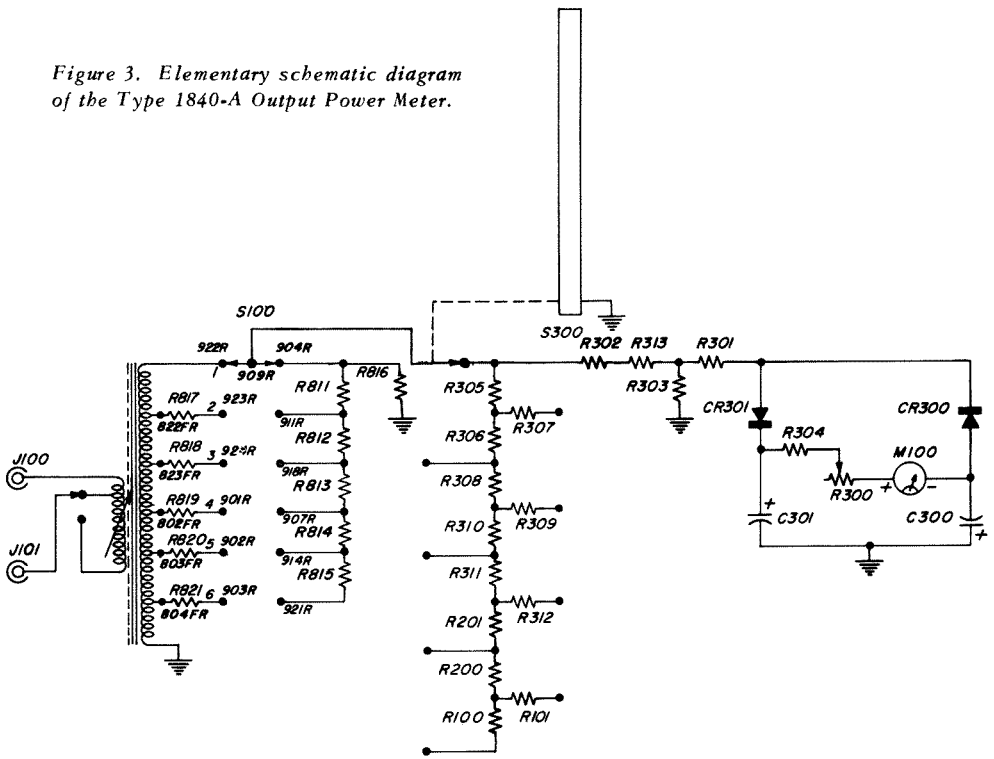
The following table lists the controls and connectors on the panel of the Type 1840-A Output Power Meter:

NAME	TYPE	FUNCTION
LOAD	2-position (Ω-KΩ) switch and 24-position rotary switch.	These two switches select the load. When the Ω-KΩ switch is in the Ω position, any value between 0.6 and 128 ohms can be selected on the inner (white) scale of the rotary switch. When the Ω-KΩ switch is in the KΩ position, any value between 0.15 and 32 kilohms can be selected on the outer (red) scale of the rotary switch.
FULL-SCALE POWER and ADD DB	5-position rotary switch.	This switch selects the power and decibel levels. The lower figures (white) give the full-scale power reading of the meter. The upper figures (red) indicate the decibels that must be added algebraically to the meter reading.

(Continued)

NAME	TYPE	FUNCTION
None	Jack-top binding posts (three).	The unknown is connected at the red (high) and black (low) binding posts. The case binding post (metal top) can be connected to the low post by means of the captive strap; it can be left floating, or it can be independently grounded, as desired. For best accuracy at high frequencies, disconnect the grounding strap from the low input terminal.

Figure 3. Elementary schematic diagram of the Type 1840-A Output Power Meter.



NOTE S100

POSITIONS 1-4 AND 23 & 24 8 PRI WINDINGS IN PARALLEL
POSITIONS 5-10 2 PRI WINDINGS IN SERIES 4 IN PARALLEL
POSITIONS 1-16 4 PRI WINDINGS IN SERIES 2 IN PARALLEL
POSITIONS 17-22 8 PRI WINDINGS IN SERIES NOMINAL PRIMARY RESISTANCE 303 OHMS
SECONDARY IN POSITION 1 WHEN S100 IS IN POSITIONS 23-5-11-17 NOMINAL SECONDARY RESISTANCE 89 OHMS
SECONDARY IN POSITION 2 WHEN S100 IS IN POSITIONS 24-6-12-18
SECONDARY IN POSITION 3 WHEN S100 IS IN POSITIONS 1-7-13-19
SECONDARY IN POSITION 4 WHEN S100 IS IN POSITIONS 2-8-14-20
SECONDARY IN POSITION 5 WHEN S100 IS IN POSITIONS 3-9-15-21
SECONDARY IN POSITION 6 WHEN S100 IS IN POSITIONS 4-10-16-22

Section 2

OPERATING PROCEDURE

2.1 DETERMINATION OF UNKNOWN IMPEDANCE.

To find the value of an unknown source impedance, set the LOAD switches to their highest readings and reduce these readings, step-by-step, until the maximum power reading of the meter is obtained. The source impedance is the value indicated by the LOAD switches that gives this maximum meter reading. ALWAYS START WITH THE FULL SCALE POWER SWITCH SET TO 20 WATTS, to avoid damage to the meter.

2.2 HIGHER-POWER SOURCES.

To use the Type 1840-A with sources of higher power (up to 200 watts), a "T"-network attenuator (Figure 4) should be used. To find the proper impedance (Z), operate the source below 20 watts. The resistance can then be calculated and the proper values can be inserted in the circuit.

Connect the "T" attenuator (Figure 4) between the source and the Type 1840-A. The attenuator adds 10 db to the meter-switch indication, and the meter now reads 200 watts full-scale.

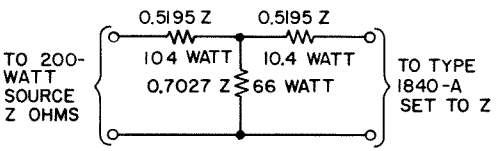


Figure 4. "T"-Network attenuator.

2.3 INSERTION LOSSES.

The insertion loss of an audio device can be determined from the output of a system before and after the insertion of the device in question. The difference between the two maximized decibel readings is the insertion loss in decibels.

Similarly, the insertion loss of a transformer can be measured. Note the decibel readings before and after insertion of the transformer into the circuit. The difference between these two readings is the insertion loss.

2.4 ACCURACY OF MEASUREMENTS.

2.4.1 METER INDICATION ACCURACY. The error in the full-scale power reading is less than 0.5 db between 50 and 10,000 cps. It is less than 1.5 db at 20 and 20,000 cps if the power limitations of Figure 2 are observed.

2.4.2 ACCURACY OF IMPEDANCE INDICATION. The impedance error is within ±(5% + 0.02 ohm) from 20 cps to 2 kc at power levels above 2 milliwatts and from 250 cps to 1.5 kc on the 2-milliwatt scale. At 20 kc, maximum error is not more than 50% if the limitations of Figure 2 are observed.

2.4.3 WAVEFORM ACCURACY. The quasi-rms meter circuit assures reasonable freedom from error introduced by the harmonic content of normally encountered waveforms (20% second and third harmonics).

2.4.4 REACTANCE ACCURACY. Highly reactive sources are improperly terminated by the Type 1840-A and yield erroneous readings. The reactance present in most audio devices will have a negligible effect on the accuracy.

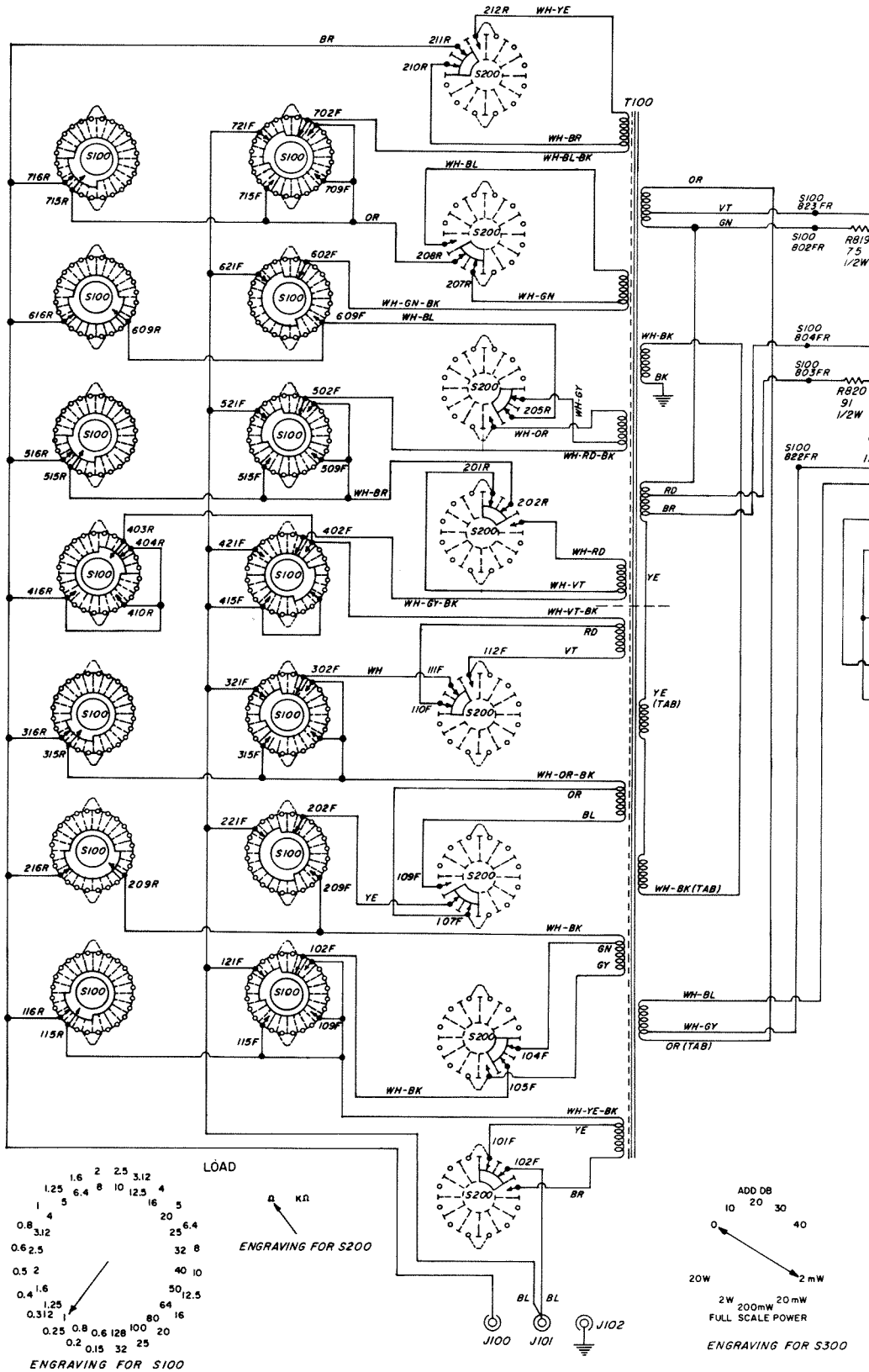
2.4.5 DIRECT-CURRENT ACCURACY. Table 1 gives the values of direct current that can traverse the Type 1840-A for each impedance setting, without exceeding a maximum error of 0.5 db.

PARTS LIST

EXPLANATION OF CONTACT NUMBERING ON ROTARY SWITCHES

Rotary switch sections are shown as viewed from the panel end of the shaft. The first digit of the contact number refers to the section. The section nearest the panel is 1, the next section back is 2, etc. The next two digits refer to the contact. Contact 01 is the first position clockwise from a strut screw (usually the screw above the locating key), and the other contacts are numbered sequentially (02, 03, 04, etc.), proceeding clockwise around the section. A suffix F or R indicates that the contact is on the front or rear of the section, respectively.

REF NO.	DESCRIPTION	PART NO.
R100	RESISTOR 1.21 kΩ ±1% 10 w	Part of
R101	RESISTOR 1.87 kΩ ±1% 7 w	1840-0410
R200	RESISTOR 1.54 kΩ ±1% 2 w	Part of
R201	RESISTOR 1.21 kΩ ±1% 1 w	1840-0420
R300	POTENTIOMETER, Wire-wound 10 kΩ ±10%	6050-1800
R301	RESISTOR, Film 2.61 kΩ ±1% 1/4 w	6350-1261
R302	RESISTOR, Film 1.35 kΩ ±1% 1/4 w	6350-1135
R303	RESISTOR, Film 1.1 kΩ ±1% 1/4 w	6350-1110
R304	RESISTOR, Composition 10 kΩ ±5% 1/2 w	6100-3105
R305	RESISTOR, Film 1.54 kΩ ±1% 1/4 w	6350-1154
R306	RESISTOR, Film 1.21 kΩ ±1% 1/4 w	6350-1121
R307	RESISTOR, Film 1.87 kΩ ±1% 1/4 w	6350-1187
R308	RESISTOR, Film 1.54 kΩ ±1% 1/4 w	6350-1154
R309	RESISTOR, Film 1.87 kΩ ±1% 1/4 w	6350-1187
R310	RESISTOR, Film 1.21 kΩ ±1% 1/4 w	6350-1121
R311	RESISTOR, Film 1.54 kΩ ±1% 1/4 w	6350-1154
R312	RESISTOR, Film 1.87 kΩ ±1% 1 w	6550-1187
R313	RESISTOR, Composition 130 Ω ±5% 1/2 w	6100-1135
R314	RESISTOR, Composition 43 kΩ ±5% 1 w	6110-3435
R811	RESISTOR, Composition 33 Ω ±5% 1/2 w	6100-0335
R812	RESISTOR, Composition 22 Ω ±5% 1/2 w	6100-0225
R813	RESISTOR, Composition 51 Ω ±5% 1/2 w	6100-0515
R814	RESISTOR, Composition 33 Ω ±5% 1/2 w	6100-0335
R815	RESISTOR, Composition 68 Ω ±5% 1/2 w	6100-0685
C300	CAPACITOR, Electrolytic 10 μf 50 dcwv	4450-3100
C301	CAPACITOR, Electrolytic 10 μf 50 dcwv	4450-3100
CR300	DIODE, Type 1N34AS	6082-1003
CR301	DIODE, Type 1N34AS	6082-1003
J100	BINDING POST	4060-0400
J101	BINDING POST	4060-0410
J102	BINDING POST	4060-1800
M100	METER, 50 μa, 1500 Ω	5730-1280
S100	SWITCH, Rotary Wafer	7890-2440
S200	SWITCH, Rotary Wafer	7890-2420
S300	SWITCH, Rotary Wafer	7890-2430
T100	TRANSFORMER	0365-4001



NOTES:

RESISTORS 1/4 WATT UNLESS OTHERWISE SPECIFIED
RESISTANCE IN OHMS UNLESS OTHERWISE SPECIFIED
K=1000 OHMS M=1 MEGOHM
CAPACITANCE VALUES ONE AND OVER IN PICOFARADS, LESS THAN ONE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED

⊘ SCREWDRIVER CONTROL

ANCHOR TERMINALS USED: A.T. 1, 2, 5, 7, 8, 9, 12

Figure 5. Schematic diagram of the Type 1840-A Outp

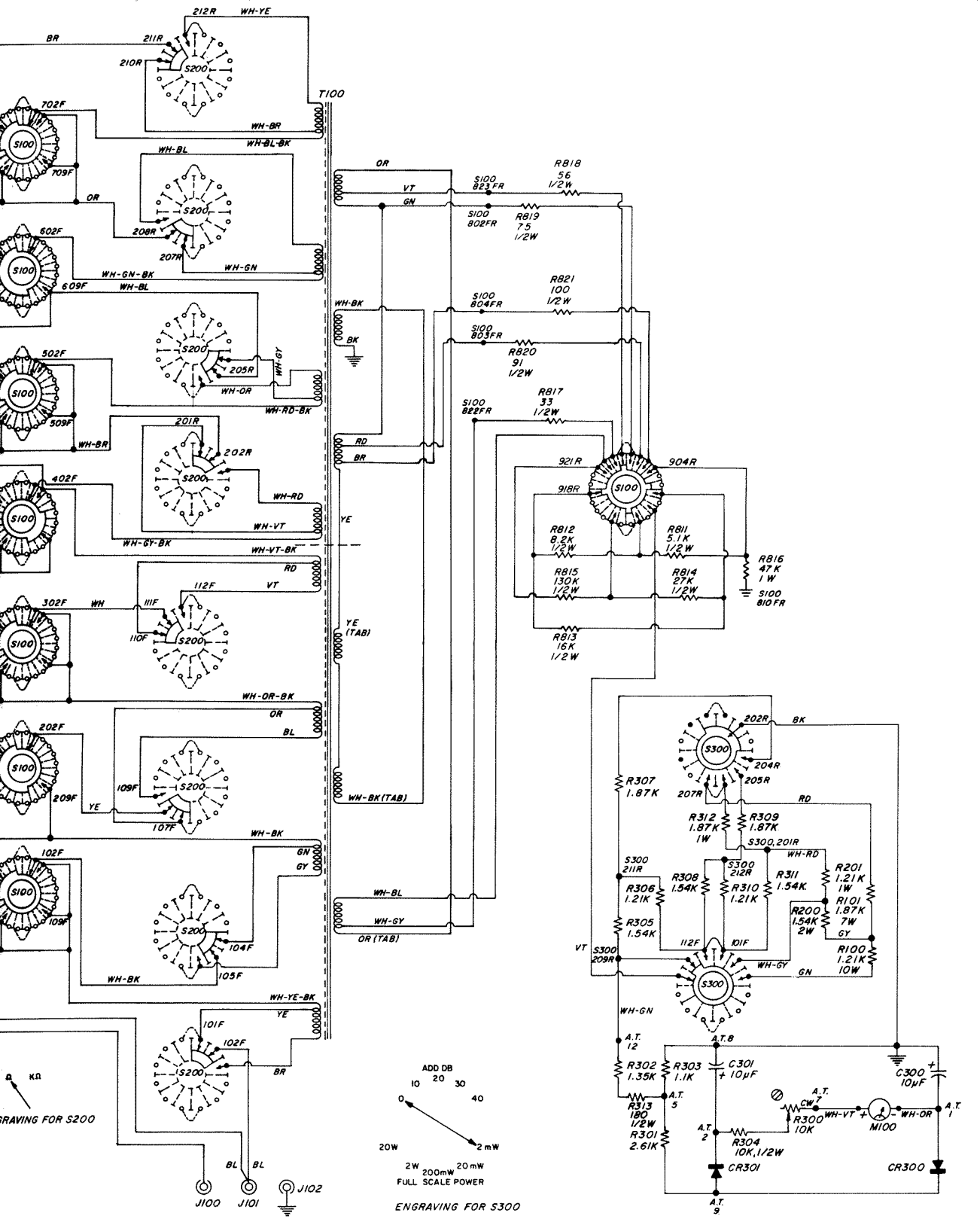


Figure 5. Schematic diagram of the Type 1840-A Output Power Meter.

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