OPERATING AND MAINTENANCE INSTRUCTIONS

for

TYPE 1932-A DISTORTION AND NOISE METER

GENERAL RADIO COMPANY
275 MASSACHUSETTS AVENUE
CAMBRIDGE 39 MASSACHUSETTS
U.S.A.

SPECIFICATIONS

Distortion Range: Distortion is read directly from a large meter. A multiplier allows full-scale deflections for 0.3%, 1%, 10% or 30% distortion.

Noise Measurement Range: The range for carrier noise measurements extends to 80 db below 100% modulation, when the distortion meter is operated from the Type 1931-A Modulation Monitor, or 80 db below an audio-frequency signal of zero dbm level.

Audio-Frequency Range: 50 to 15,000 cycles (fundamental) for distortion measurements; 30 to 45,000 cycles for noise and hum measurements.

dbm Range: The power-level range is from +20 to —60 dbm. Full scale values of +20, +10, 0, —10, —20, —30, and —40 dbm are provided. The scale is calibrated in terms of a reference level of one milliwatt in 600 ohms.

Input Voltage Range: The input signal level should be between 1.2 and 30 volts for the 100-kilohm input, and between 0.8 and 30 volts for the 600-ohm bridging input.

Accuracy: For distortion measurements, ±5% of full scale of each range ± residual distortion as noted below; for noise and dbm measurements, ±5% of full scale.

Input Impedance: Two input impedances are provided, 100,000 ohms unbalanced, and 600-ohm bridging input (10,000 ohms), balanced or unbalanced.

Residual Distortion Level:

100-Kilohm Input:	0.05%, maximum, below 7500 cycles
	0.10%, maximum, above 7500 cycles
Bridging Input:	0.10%, maximum, between 50 and 70 cycles
	0.05%, maximum, between 70 and 7,500 cycles
	0.10%, maximum, above 7500 cycles

Residual Noise Level: Less than —80 db.

Meter: A large meter with an easily read, illuminated scale is provided. Percentage, decibel and dbm calibrations are included.

Vacuum Tubes:

4—type 6J5	1-type 6H6
1—type 6SN7-GT	1-type 6X5-GT/G
1—type 6K6-GT	2-type 0D3/VR150

Accessories Supplied: Spare fuses and 7-foot connecting cord.

Other Accessories Required: For measuring the distortion in oscillators and other audio-frequency sources, no additional equipment is required. For measurements on amplifiers, lines, and other communication networks, a low-distortion oscillator is required to furnish the test tone. Type 1301-A Low-Distortion Oscillator is recommended. When the modulated output of a radio transmitter is to be measured, a linear rectifier to produce the audio envelope is necessary. The Type 1931-A Modulation Monitor is recommended for this purpose. However, any detector system having an undistorted output of 1.5 volts rms can be used.

Terminals: Input terminals are provided at the rear of the instrument for direct connection to the modulation monitor. A Western Electric jack is provided at the panel also, as an auxiliary input circuit. Plugging into this jack automatically disconnects the rear connectors.

Power Supply: 105 to 125, or 210 to 250, volts, 50 to 60 cycles. The line input power is 60 watts. The power supply is voltage regulated. Line surges will have no appreciable effect.

Mounting: The instrument is relay rack mounted. Walnut end frames are available to adapt the instrument for table mounting.

Other Finishes: Standard General Radio black crackle. Certain standard grays that can be processed in quantity can be furnished at a slight increase in price.

Dimensions: Panel (length) 19 x (height) 7 inches; depth behind panel, 12 inches.

Net Weight: 35½ pounds.

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TYPE 1932-A DISTORTION AND NOISE METER

Form 648-H
January, 1957

GENERAL RADIO COMPANY

275 MASSACHUSETTS AVENUE

CAMBRIDGE 39 MASSACHUSETTS

Broad Avenue at Linden
Ridgefield, New Jersey

8055 13th Street
Silver Spring, Maryland

1150 York Road
Abington, Pennsylvania

920 South Michigan Avenue
Chicago 5, Illinois

1000 North Seward Street
Los Angeles 38, California

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OPERATING INSTRUCTIONS
FOR
TYPE 1932-A DISTORTION AND NOISE METER

The Type 1932-A Distortion and Noise Meter is a device for measuring the total distortion and the level of noise and hum in audio-frequency systems. It will also indicate db level in a 600-ohm line for a reference level of one milliwatt. When the instrument is used in conjunction with a linear detector, such as is provided in the Type 1931-A Amplitude-Modulation Monitor, the distortion and noise characteristics of broadcast and other radio-telephone transmitters can be measured.

A wide range of full-scale distortion values is provided, and levels approaching 0.1% can be measured. The range of noise-level measurement is from 0 to —80 db, and of dbm measurement, from +20 to —60 dbm. Either of two input impedances can be selected by a panel switch: 100,000 ohms, unbalanced; or an impedance for bridging 600 ohms, balanced, or unbalanced.

SECTION 1.0
INSTALLATION

1.1 MOUNTING

The instrument is designed for relay rack mounting. Walnut end frames* to adapt it for table mounting can be purchased separately. When the distortion and noise meter is to be used with the Type 1931-A Modulation Monitor, mount the modulation monitor above the distortion meter and plug in the cable provided to interconnect the two instruments. See also Section 2.4, R-F

1.2 GROUND

If the instrument is to be used in a standard relay rack, make certain that the panel rear surface grounds securely to the relay rack. The panel screws should be set up tight, and it may be necessary to remove a portion of the paint on the relay rack, to insure positive contact.

When the instrument is used with table-mounting end frames, a ground wire should be connected to terminal No. 12 of the rear multipoint connector.

See also Section 4.4, PRECAUTIONS.

*Type ZFRI-412-P1, Price $16.50

1.3 POWER SUPPLY CONNECTIONS

The instrument can be operated from any source of 115/230 volts, 50-60 cycle supply using the connector cord provided. Internal voltage-regulator tubes will stabilize the instrument against the effects of line-voltage variations between the limits of 105-125 volts (210-250 volts). A split-primary winding on the power transformer provides for operating the instrument from a 230-volt line by a simple tap-changing operation. As normally supplied, the instrument is wired for 115-volt operation. To change to 230-volt operation, it is merely necessary to alter the connections to transformer taps so that terminals No. 2 and No. 3 are connected together. (For 115 volts, connect No. 1 to No. 3, and No. 2 to No. 4.)

The line-voltage plate is reversible, for 115 or 230 volts, and should agree with the transformer connections as made. Change fuses as specified in Parts List.

1.4 AUDIO INPUT CONNECTIONS

A standard W. E. panel jack provides a convenient means for making connection to the instrument from the front panel. Plugging into this jack automatically disconnects a rear multipoint connector to which more permanent connections can be made. See wiring diagram.

An INPUT switch is located near the center of the panel and provides a means of selecting an input impedance of either 100,000 ohms or the 600-ohm bridging impedance of approximately 10,000 ohms. The latter can be operated balanced to ground, if desired, or with either side connected to ground.

SECTION 2.0
OPERATION

2.1 DISTORTION MEASUREMENTS

2.11 *Test Tone*

An audio-frequency generator whose output is practically free from distortion, noise, and hum must be used to supply a signal to the device under test. The General Radio Type 1301-A Low-Distortion Oscillator, which has a total distortion of 0.1% or less, is recommended. It supplies 27 fixed frequencies between 20 cps and 15,000 cps. Other oscillators can be used, notably the Type 1304-A Beat-Frequency Oscillator, whose output frequency is continuously variable. When the distortion in the generator is appreciable, however, allowance must be made for it when low values of distortion are being measured.

2.12 *Input Impedance*

Select desired input impedance by depressing corresponding switch on panel.

2.13 *Calibration*

Depress both CAL switches and set meter to CAL point by adjusting CAL control.

2.14 *Measurement Procedure*

Depress the DIST switch, and set the main dial and range switch to agree with the fundamental frequency of the test signal. Tune the R and C balance controls simultaneously for minimum deflection on the meter. The meter scale switch should be changed as necessary to keep the deflection at a readable point on the scale.

The initial adjustments can be made quite rapidly. If the signal under test is low in distortion, and the 0.3% full-scale range of the meter is used, reasonable care will be required to balance accurately the R and C controls for an absolute minimum. The resulting indication is the average distortion in per cent as read from the meter scale.

When operating on the 0.3% full-scale range, the meter may tend to show erratic variations, if the source of signal frequency is unstable, or affected by line voltage surges. Use of a line-voltage regulator on the system under test is recommended for such conditions. For normal conditions, it should not be necessary to provide an external line-voltage regulator for the Type 1932-A Distortion and Noise Meter.

Several distortion measurements, at various frequencies, may be made without the need for the calibration step being repeated each time, provided the input signal is kept at constant amplitude.

2.2 NOISE LEVEL MEASUREMENTS

The initial calibration procedure is the same as for distortion measurements (see paragraph 2.12). After calibration, turn off the signal at its source, depress the NOISE switch, and increase the meter sensitivity by depressing the panel switches until an indication is obtained on the meter. The arithmetic sum of the meter reading in db and the switch position in db is the average value of the noise referred to the original signal level.

2.3 dbm LEVEL MEASUREMENTS

To measure the volume level in a 600-ohm line, the METER READS switch is set to the dbm position, which simultaneously depresses the 600-ohm Bridging Input switch. The circuit is internally calibrated to read the volume level directly in dbm, and is independent of all other panel controls. Thus it is possible to measure quickly the dbm level at any time by merely depressing the dbm switch and observing the meter reading in db, plus the reading of the meter scale switch. The absolute dbm level is the arithmetic sum of the meter reading and the calibration, in db, on the meter scale switch.

2.4 MEASUREMENTS OF THE MODULATION CHARACTERISTICS OF RADIO-TELEPHONE TRANSMITTERS

When the Type 1932-A Distortion and Noise Meter is used in conjunction with the Type 1301-A Low-Distortion

Oscillator and the Type 1931-A Modulation Monitor, the complete audio-modulation characteristics of a transmitter may be measured. The oscillator is used to apply a modulation of extremely low initial distortion to the transmitter. The modulation monitor provides a means of measuring percentage modulation, and also has an internal linear-diode detector which may be used to supply an undistorted signal to operate the Type 1932-A Distortion and Noise Meter. Cables are provided for all necessary interconnections at the rear of the instruments, and may be left permanently connected. Convenient panel jacks permit individual use of each instrument, by electrical disconnection of the rear plugs when the panel plug is inserted. See also "Operating Instructions for Type 1931-A Modulation Monitor", paragraphs 2.22-2.24.

2.41 *Input Impedance*

The 100-kΩ INPUT position should be used, when checking distortion or noise-level of a transmitter, using the Type 1931-A AMPLITUDE MODULATION MONITOR, and Type 1932-A DISTORTION AND NOISE METER. The removable push-button is engraved with the word MONITOR, which further identifies the correct setting of the INPUT switch. This position only should be used when the two instruments are used as a complete transmission-monitoring assembly. When the Type 1932-A DISTORTION AND NOISE METER is used alone, a blank button is provided.

SECTION 3.0
PRINCIPLES OF OPERATION AND OPERATING CHARACTERISTICS

3.1 DISTORTION MEASUREMENTS

The Type 1932-A Distortion and Noise Meter consists essentially of a continuously variable null network, followed by a calibrated vacuum-tube voltmeter. Figure 1 shows the circuit in elementary form. The fundamental frequency of the signal being measured is balanced out by means of two panel controls; all other components remain and are passed on directly, and without attenuation, to the voltmeter. Thus, if the voltmeter is first set to 100% with the entire signal voltage present, an arbitrary reference level is established. Upon switching in the null network, to remove the fundamental frequency only, a second reading may be obtained on the voltmeter scale. This second reading is composed of all distortion products present, plus extraneous noise and power-supply hum frequencies. Since the ratio between the two readings may be observed by means of the voltmeter attenuator, this becomes a measure of the distortion, and/or noise products, present in the signal, expressed as a percentage of the total signal.

3.11 *Range and Accuracy*

Distortion is indicated directly on the meter, which is provided with two scales calibrated in per cent. Full-scale ranges of 100%, 30%, 10%, 3%, 1%, and 0.3% can be selected by push-button switches. Readings are accurate to ±5% of full scale ± the residual distortions noted below.

3.12 *Residual Distortion Level:*

100-kΩ Input 0.05% maximum, below 7500 cps
0.10% maximum, above 7500 cps

Bridging Input 0.10% maximum, between 50 and 100 cps
0.05% maximum, between 100 and 7500 cps
0.10% maximum, above 7500 cps

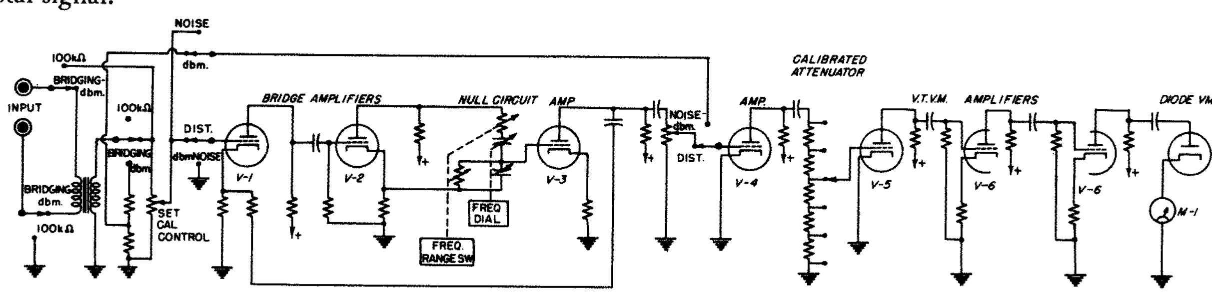


Figure 1. Elementary schematic diagram of the Type 1932-A Distortion and Noise Meter.

3.13 *Frequency*
The frequency is continuously variable between 50 and 15,000 cps. The scale of the main frequency dial is accurate to $\pm 2\%$. The response is flat, within ± 1 db, from the second harmonic of the fundamental frequency up to 45,000 cps, and from $\frac{1}{2}$ the fundamental frequency down to 30 cycles, for the 100-kΩ input. With the 600-ohm bridging input, the upper limit for ± 1 db tolerance is 30,000 cps.

3.14 *Input Level*
The input signal level should be between 1.2 and 30 volts for the 100-kΩ input and between 0.8 and 30 volts for the bridging input. For higher signal levels, an external attenuator should be used.

3.15 *Meter Characteristics*
The indicating meter circuit employs an average response type, diode vacuum-tube voltmeter.

3.2 NOISE MEASUREMENTS

The instrument is used in this position as a calibrated, sensitive, vacuum-tube voltmeter. To determine the noise level in a system, the sensitivity is set to give 100%, or full-scale reading on the meter. If the audio signal is then turned off, and the voltmeter sensitivity increased until a reading is again obtained on the meter scale, the ratio between the two attenuator settings becomes a measure of the signal-to-noise ratio, or noise level.

3.21 *Range and Accuracy*
Noise levels between 0 and —80 db can be measured satisfactorily. With the 100-kΩ input, the response is flat, within 1 db, between 30 and 45,000 cps; with the bridging input, between 30 and 30,000 cps.

3.22 *Input Level*
See paragraph 3.14, above.

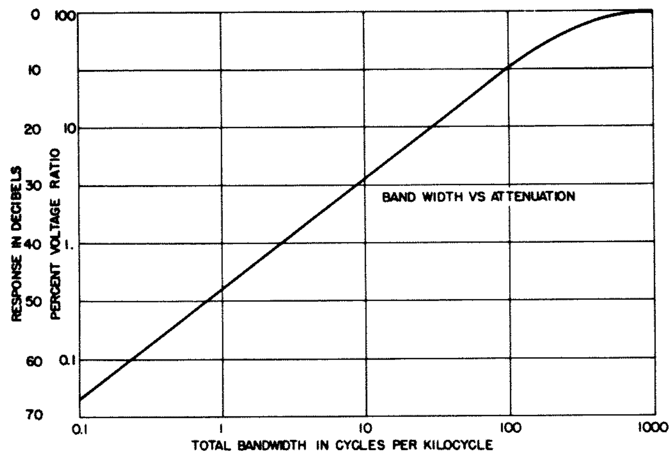


Figure 2. Band width vs. attenuation for the fundamental elimination circuit.

3.3 dbm MEASUREMENTS

When the METER READS switch is set to the dbm position, the meter indicates directly in dbm for a 600-ohm line. The 600 bridging input position must be used, but the line can be balanced or unbalanced.

3.31 *Range*
The calibration covers the range from +20 to —60 dbm referred to a zero level of 1.0 milliwatt in 600 ohms. The db scale is used for dbm measurements.

3.32 *Meter Characteristic*
The ballistic characteristics of the meter movement are the standard characteristics for volume-level indicators, i.e., the reading will reach 99% of steady-state value in 0.3 second.

3.33 *Frequency Characteristic*
Frequency response for dbm measurements is flat within ± 2.5 db between 30 and 45,000 cycles, and within ± 1 db between 50 and 15,000 cycles.

SECTION 4.0
ADJUSTMENTS AND MAINTENANCE

4.1 DISTORTION CALIBRATION

The potentiometer R-36 is provided to permit the calibration of the distortion measuring circuit. Its function is to compensate for the insertion loss of the null network, at frequencies in the pass band. Its setting is accomplished merely by making the readings of the meter equal, for the NOISE and DIST positions of the METER READS switch, when the main frequency dial is set at a point *removed* from the applied frequency by an amount equal to, or greater than, the second harmonic of this frequency. (*Example:* Let the signal frequency be 1000 cycles, then the dial may be set anywhere in the range above 2000 cycles. Depress the NOISE switch and note the meter reading. Now depress the DIST switch and adjust R-36 until the same meter reading is obtained.)

This adjustment is made initially at the factory and should not normally require correction.

4.2 CALIBRATION OF dbm LEVEL

The potentiometer R-37 is provided for this purpose. Its function is to set the gain of the amplifier so as to provide a reading of 0 dbm, when a voltage of 0.775 volt (1.0 milliwatt in 600 ohms) is applied to the 600-ohm Bridging Input terminals. This may be checked at any time by using an accurately calibrated voltmeter or volume-level indicator, as a reference standard.

This adjustment has been pre-set at the factory and should not normally require correction.

4.3 TUBE REPLACEMENTS

The instrument is substantially free from variations in tube characteristics. All normal tubes will work satisfactorily. Should it prove necessary to replace V-1, V-2, or V-3, it may be desirable to check the adjustment outlined in paragraph 4.1. Replacement of V-4, V-5, V-6, or V-7 may make it desirable to check the dbm calibration, as outlined in 4.2. Certain tubes used in the V-2 position may introduce a residual distortion of the order of 0.1%.

4.4 PRECAUTIONS

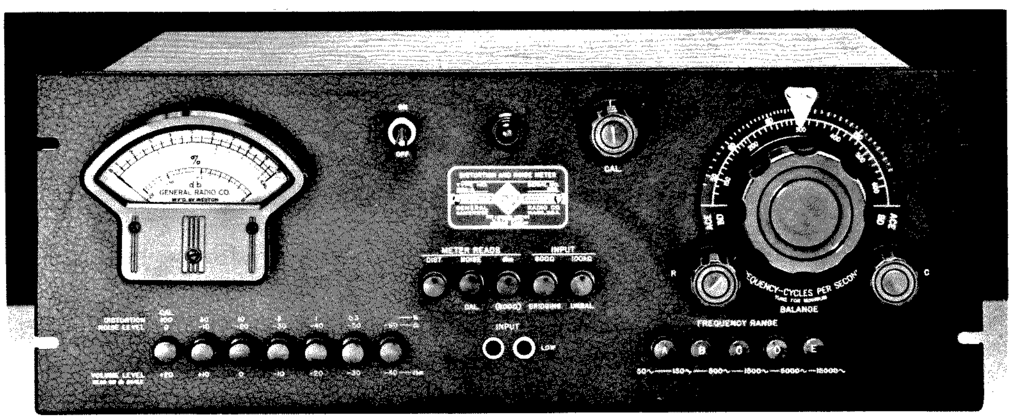
Due to the inherently high gain of the internal amplifiers, difficulties due to a-c hum pickup, stray fields, etc., may be encountered unless certain rules are followed. The instrument should not be operated in the vicinity of strong electromagnetic fields, such as may be found near equipment containing saturating core regulating transformers, etc. The 600-ohm input will be most sensitive to this type of interference. Grounding the panel securely is highly desirable, and in some locations where an unbalanced a-c supply line is found, it may help to reverse the a-c input-power cord. When the instrument is operating properly, the hum should not be visible as a deflection above −20 db on the meter scale when the meter switch is set at the −60 db position, with no connections to the input when the 100-kΩ position is used. The BRIDGING input may be similarly checked, except that a dummy 600-ohm load must be connected to the input terminals. If, when an external lead is connected to the input terminals, the reading increases, it is an indication of pickup on the connecting leads. Use of shielding on all connecting leads is desirable.

R-68 located at the rear of the instrument should be adjusted for a minimum deflection of the meter; with the FREQUENCY RANGE dial set to the power-line frequency, all INPUT connections removed, and the meter scale switch set to the 0.3% DISTORTION position.

Since noise and hum components are present in the distortion voltage reading, abnormally high values of either will of course, lead to an incorrect distortion indication if the total harmonic distortion is very low. This can be checked, since the noise level measurement will also be high.

In some cases it may be desirable to investigate the character of the noise and hum components, and for this purpose a standard telephone jack marked CRO is provided at the rear, to which a cathode-ray oscilloscope can be connected for observing the waveform. The internal impedance of this circuit is approximately 18,000 ohms.

When it is desired to evaluate individual components of distortion, noise, and hum, a Type 736-A Wave Analyzer can be connected directly to the device under test, or, for r-f systems, to the output of the Type 1931-A Modulation Monitor.



SERVICE AND MAINTENANCE NOTES FOR THE TYPE 1932-A DISTORTION AND NOISE METER

1.0 FOREWORD

1.1 This Service Information together with the information given in the Operating Instructions should enable the user to locate and correct ordinary difficulties resulting from normal usage.

1.2 Major service problems should be referred to the Service Department which will cooperate as far as possible by furnishing information and instructions, as well as by shipping replacement parts which may be required. If the instrument is more than one year old, a reasonable charge may be expected for replacement parts or for complete reconditioning and recalibration of the distortion and noise meter if returned.

1.3 Detailed facts giving type and serial numbers of the instrument and parts, as well as operating conditions, should always be included in your report to the Service Department.

2.0 GENERAL

If the Distortion and Noise Meter becomes inoperative, a few simple tests should be made before removing the dust cover.

2.1 Measure the voltage of the power line.

2.2 Test the power line cord for open circuits or poor contacts in the power outlet.

2.3 Check the fuses mounted on the rear of the instrument.

3.0 INSTRUMENT INOPERATIVE

3.1 See that all tube filaments are lighted, that voltage regulator tubes glow, and that metal tubes are warm. Also check the power line filter components, C-37 and C-38, mounted at the power input receptacle.

3.2 Pilot and Meter lamps do not light, refer to Section 4.0.

3.3 Meter cannot be set to full scale with switches set to CAL and input switch at either position, refer to Section 5.0.

3.4 Meter erratic on CAL switch positions, refer to Section 6.0.

3.5 Meter inoperative when making distortion measurement, refer to Section 7.0.

3.6 Meter remains at full scale on distortion measurement with BALANCE dial set to fundamental frequency, refer to Section 8.0.

3.7 Meter cannot be set to full scale with switches set for noise measurement, refer to Section 9.0.

3.8 Meter inoperative or reads incorrectly with switches set at dbm position, refer to Section 10.0.

3.9 Power supply inoperative or has low output, refer to Section 11.0.

3.10 No output at CRO jack J-3, refer to Section 12.0.

3.11 Vacuum-tube data, refer to Section 13.0.

4.0 PILOT AND METER LAMPS DO NOT LIGHT

4.1 Test lamps P-1 and P-2 for open circuit.

4.2 Measure resistance of R-28 and R-69.

4.3 Check connections on transformer T-2 terminals.

4.4 Test operation of ON-OFF switch S-5 with ohmmeter.

5.0 METER CANNOT BE SET TO FULL SCALE WITH SWITCHES SET AT *CAL* AND *INPUT* SWITCH AT EITHER POSITION

5.1 Be sure that the input signal is at least 1.5 volts at the input to the Type 1932-A.

5.2 Check amplifier.

5.21 Test tube V-4 and measure operating voltages.

5.22 Test cathode, grid and plate resistors and capacitors.

5.23 Check CAL dbm potentiometer R-37.

5.3 Check vacuum-tube voltmeter amplifiers.

5.31 Test tubes V-5 and V-6 and measure operating voltages.

5.32 Check cathode, grid and plate resistors and capacitors.

5.4 Test tube V-7 and measure operating voltages.

5.5 Check meter. This should read full scale with 250 microamperes D. C.

5.51 If the meter is defective, a replacement should be ordered from the Service Department. The General Radio Company cannot assume responsibility for any local repairs to the meter, although such repairs might be necessary in an emergency.

5.6 Check connections to input plug PL-2 and/or INPUT jacks J-1 and J-2.

5.7 If using the 600-Ω INPUT, check connection to, and continuity of, transformer T-1.

5.8 Test resistor R-5 for short circuit.

5.9 Check operation and continuity of circuits through switches S-1 (INPUT) and S-2 (METER READS).

5.10 Check operation and continuity of circuits through switch S-4 (meter scale switch).

5.11 Test capacitor C-1 for short and open circuit.

5.12 Test resistors R-6 and R-7 for continuity and correct resistance.

5.13 Check capacitors C-22, C-23, and resistor R-75.

5.14 Check resistors R-40 through R-46.

5.15 Check capacitors C-33, C-35, and resistor R-58.

6.0 METER ERRATIC ON *CAL* SWITCH POSITIONS

6.1 Try replacing tubes V-4, V-5, V-6, and V-7. Refer to Section 4.3, Operating Instructions.

6.2 Check operation of switches S-1, S-2, and S-4 for faulty contacts.

6.3 Test for low power-line voltage and intermittent operation of voltage regulator tubes V-9 and V-10.

7.0 METER INOPERATIVE ON DIST. POSITION

7.1 Check bridge amplifiers.

7.11 Test tubes V-1 and V-2 and measure operating voltages.

7.12 Test cathode, grid and plate resistors and capacitors.

7.121 Test resistors R-15, R-17, R-24, and R-25. Also check R BALANCE potentiometer R-16.

7.2 Check amplifier.

7.21 Test tube V-3 and measure operating voltages.

7.22 Test cathode, grid and plate resistors and capacitors.

7.3 Refer to Sections 5.6, 5.7, 5.8, 5.9, 5.11, and 5.12.

7.4 Check null circuit.

7.41 Check operation and continuity of circuits through FREQUENCY RANGE switch S-3.

7.5 Test CAL DIST potentiometer R-36 for continuity. Refer to Section 4.1, Operating Instructions.

7.6 Refer to Sections 5.2, 5.3, 5.4, 5.10, 5.13, 5.14, and 5.15.

8.0 METER REMAINS AT FULL SCALE ON DISTORTION MEASUREMENT WITH *BALANCE* DIAL SET TO FUNDAMENTAL FREQUENCY

8.1 Refer to Section 7.4.

8.2 Test capacitors C-10 and C-11 for dirty contacts and short circuits.

8.3 Test capacitors C-12, C-13, and C-14 for open or short circuits. Do NOT disturb settings of these condensers as they control the frequency calibration.

8.4 Test capacitors C-15, C-16, and C-17.

8.5 See that all shaft setscrews are tight so that condensor rotors turn with rotation of the panel controls. If main BALANCE dial has slipped on its shaft, calibration can be restored by applying an accurately known audio frequency and tuning for minimum meter reading. Dial can then be set to read correct frequency.

8.6 Check continuity of resistors R-15, R-16, and R-17. Check R-25 for the "A" FREQUENCY RANGE, R-24 for all other ranges.

8.7 Refer to Section 7.1.

9.0 METER CANNOT BE SET TO FULL SCALE WITH SWITCHES SET FOR NOISE MEASUREMENT

9.1 Refer to Section 5.0.

10.0 METER INOPERATIVE OR READS INCORRECTLY WITH SWITCHES SET AT dbm POSITION

10.1 Refer to Section 5.0.

10.2 dbm calibration can be checked by applying an audio signal of 1000 cycles of 0.775 volts, rms. With the VOLUME LEVEL switch set at 0 dbm position, adjust potentiometer R-37 (CAL dbm) until the meter reads full scale (0 db). Refer to Section 4.2, Operating Instructions.

11.0 POWER SUPPLY INOPERATIVE OR HAS LOW OUTPUT

11.1 Test tube V-8 and measure operating voltages.

11.2 Test tubes V-9 and V-10 and measure operating voltages.

11.3 Test capacitors C-40, C-41, and C-42.

11.4 Test resistors R-61 through R-71.

11.5 Check connections to and continuity of transformer T-2.

12.0 NO OUTPUT AT *CRO* JACK

12.1 Check continuity of resistor R-27.

12.2 Test jack J-3 for ground at terminal No. 1 and approximately 18,000 ohms between terminal 1 and 2.

12.3 Refer to Section 5.

13.0 VACUUM-TUBE DATA

Table of tube socket voltages measured from socket pin to ground, unless otherwise noted, using a 20,000 ohm-per-volt meter (Weston 772 Analyzer). D-C voltages may vary ±20%.

SYMBOL	TYPE	SOCKET PIN NUMBER							FUNCTION
		2	3	4	5	6	7	8	
V-1	6J5	2 and 7 6.3v AC	230					11.0	Bridge Amplifier
V-2	6K6-GT	2 and 7 6.3v AC	203	203				26.0	Bridge Amplifier
V-3	6J5	2 and 7 6.3v AC	95					1.6	Amplifier
V-4	6J5	2 and 7 6.3v AC	170					6.8	Amplifier
V-5	6J5	2 and 7 6.3v AC	105					2.15	VTVM Amplifier
V-6	6SN7-GT	95	1.0		65	0.6	7 and 8 6.3v AC		VTVM Amplifier
V-7	6H6	2 and 7 6.3v AC	-0.15					0.15	Diode VM
V-8	6X5-GT/G	2 and 7 6.3v AC	360(AC)		360(AC)			370	Rectifier
V-9	0D3/VR150	150			300				Voltage Regulator
V-10	0D3/VR150				150				Voltage Regulator

CONDITIONS: Line voltage 115 v, 50-60 cycle.
Switches set at CAL.
No INPUT signal.

PARTS LIST

RESISTORS

R-3 =	90 Kilohms	±1%	REPR-16	
R-4 =	10 Kilohms	±1%	REPR-16	
R-5 =	82 Kilohms	±5%	REC-20BF	
R-6 =	100 Kilohms		POSC-12	
R-7 =	1 Kilohm	±10%	REC-20BF	
R-8 =	47 Kilohms	±10%	REC-20BF	
R-9 =	8.2 Kilohms	±10%	REC-20BF	
R-10 =	33 Kilohms	±5%	REC-20BF	
R-11 =	30 Kilohms	±1%	REPR-16	
R-12 =	4 Kilohms	±1%	REPR-16	
R-13 =	1 Megohm	±10%	REC-20BF	
R-14 =	3.77 Kilohms	±1%	REPR-16	
R-15 =	1 Kilohm	±10%	REC-20BF	
R-16 =	400 Ohms		410-411	
R-17 =	10 Kilohms	±1%	REPR-16	
R-18 =	1 Meghom	±10%	REC-20BF	
R-19 =	1.60 Megohms	±.5%	REF-1-2	} *
R-20 =	560 Kilohms	±0.25%	REPR-17	} *
R-21 =	160 Kilohms	±0.25%	REPR-17	} *
R-22 =	56 Kilohms	±0.25%	REPR-16	} *
R-23 =	24 Kilohms	±0.25%	REPR-16	} *
R-24 =	0-390 Ohms		REW-3C	} *1
R-25 =	0-270 Ohms		REW-3C	} *1
R-26 =	100 Ohms	±10%	REW-3C	
R-27 =	15 Kilohms	±10%	REC-20BF	
R-28 =	15 Ohms	±10%	REW-3C □	
R-29 =	1.60 Megohms	±.5%	REF-1-2	} *
R-30 =	560 Kilohms	±0.25%	REPR-17	} *
R-31 =	160 Kilohms	±0.25%	REPR-17	} *
R-32 =	56 Kilohms	±0.25%	REPR-16	} *
R-33 =	24 Kilohms	±0.25%	REPR-16	} *
R-34 =	270 Ohms	±10%	REW-3C	
R-35 =	33 Kilohms	±10%	REC-41BF	
R-36 =	100 Kilohms		POSC-11	
R-37 =	2.5 Kilohms		POSW-3	
R-38 =	18 Kilohms	±10%	REC-20BF	
R-39 =	27 Kilohms	±10%	REC-20BF	
R-40 =	158.1 Kilohms	±1%	REPR-16	
R-41 =	50 Kilohms	±1%	REPR-16	
R-42 =	15.81 Kilohms	±1%	REPR-16	
R-43 =	5 Kilohms	±1%	REPR-16	
R-44 =	1.581 Kilohms	±1%	REPR-16	
R-45 =	500 Ohms	±1%	REPR-16	
R-46 =	231.2 Ohms	±1%	REPR-16	
R-47 =	390 Ohms	±10%	REW-3C	
R-48 =	27 Kilohms	±10%	REC-30BF	
R-49 =	10 Kilohms	±10%	REC-30BF	
R-50 =	1 Megohm	±10%	REC-20BF	
R-51 =	22 Kilohms	±10%	REC-30BF	
R-52 =	27 Kilohms	±10%	REC-30BF	
R-53 =	390 Ohms	±5%	REW-3C	
R-54 =	100 Ohms	±10%	REW-3C	
R-55 =	1 Megohm	±10%	REC-20BF	
R-56 =	5.1 Kilohms	±5%	REC-30BF	
R-57 =	15 Kilohms	±10%	REC-41BF	
R-58 =	3 Kilohms	±1%	REPR-16	
R-59 =	3 Kilohms	±1%	REPR-16	
R-60 =	6.2 Kilohms	±5%	REC-20BF	
R-61 =	300 Ohms	±10%	} REPO-25	
R-62 =	300 Ohms	±10%	} REPO-25	
R-63 =	300 Ohms	±10%	} REPO-25	
R-64 =	300 Ohms	±10%	} REPO-25	
R-65 =	150 Kilohms	±10%	REC-20BF	
R-66 =	100 Kilohms	±10%	REC-20BF	
R-67 =	100 Kilohms	±10%	REC-20BF	
R-68 =	100 Ohms	±10%	POSW-3	
R-69 =	4.1 Ohms	±10%	2 x 8.2Ω REW-3C in //Δ	
R-70 =	1 Megohm	±10%	REC-20BF	
R-71 =	100 Ohms	±10%	REC-30BF	
R-72 =	100 Ohms	±10%	REW-3C	
R-73 =	100 Ohms	±10%	REW-3C	
R-74 =	100 Ohms	±10%	REW-3C	
R-75 =	100 Ohms	±10%	REW-3C	
R-76 =	100 Ohms	±10%	REW-3C	
R-77 =	100 Ohms	±10%	REW-3C	
R-78 =	470 Kilohms	±10%	REC-20BF	
R-79 =	68 Kilohms	±10%	REC-20BF	
R-80 =	10 Kilohms	±10%	POSC-11**	
R-81 =	22 Kilohms	±10%	REC-20BF	
R-82 =	1 Megohm	±10%	REC-20BF	
R-83 =	1 Megohm	±10%	REC-20BF	

CONDENSERS

C-1 =	0.1 μf	±10%	COL-71	
C-2 =	20 μf ⌓	+50%-10%	COEB-25	Part of C-9
C-3 =	0.05 μf	±10%	COM-50B	
C-4 =	100 μμf	±10%	COM-20B	
C-5 =	200 μμf	±10%	COM-20B	
C-6 =	1.0 μf	±10%	COL-45	
C-7 =	1.0 μf	±10%	COL-5	
C-8 =	1.0 μf	±10%	COL-5	
C-9 =	60.0 μf ⌛	+50%-10%	COEB-20	Part of C-2
C-10 =	1206 μμf (2 Sections 603μμf in //)		COA-23	
C-11 =	1206 μμf (2 Sections 603μμf in //)		COA-23	
C-12 =	4-50 μμf		COA-2	
C-13 =	4-50 μμf		COA-2	
C-14 =	6-100 μμf		COA-4	
⊙C-15 =	280 μμf	±5%	COM-20C	
⊙C-16 =	280 μμf	±5%	COM-20C	
⊙C-17 =	450 μμf	±5%	COM-20C	*1
C-18 =	100 μf	+50%-10%	COE-15	
C-19 =	0.1 μf	±10%	COL-2	
C-20 =	0-0.003 μf		COM-30B	*1
C-21 =	100 μf	+50%-10%	COE-15	
C-22 =	0.1 μf (2 x 0.05)	±10%	COM-50B (in //)	
C-23 =	35 μμf	±5%	COM-20B	
C-24 =	160 μμf	±10%	COM-20B	
C-25 =	250 μμf	±10%	COM-20B	
C-26 =	0.001 μf	±10%	COM-30B	
C-27 =	40 μf	+50%-10%	COEB-25	Part of C-29
C-28 =	0.04 μf	±10%	COM-50B	
C-29 =	40 μf	+50%-10%	COEB-25	Part of C-27
C-30 =	50 μμf	±10%	COM-20B	
C-31 =	40 μf	+50%-10%	COEB-25	Part of C-34
C-32 =	0.04 μf	±10%	COM-50B	
C-33 =	4.0 μf	±10%	COL-8	
C-34 =	40 μf	+50%-10%	COEB-25	Part of C-31
C-35 =	0.002 μf	+10%	COM-30B	
C-36 =	0-25 μμf		COM-20B	*2
C-37 =	0.01 μf	±10%	COM-41B	
C-38 =	0.01 μf	±10%	COM-41B	
C-39 =				
C-40 =	60 μf ≙□	+50%-10%	} 2 x COEB-25	
C-41 =	60 μf ≙⌓	+50%-10%	} 2 x COEB-25	
C-42 =	40 μf ≙	+50%-10%	} 2 x COEB-25	
C-43 =	0.05 μf	±10%	COM-50B	
C-44 =	60 μμf	±10%	COM-20B	
C-45 =	16 μf 150 WVDC		COE-4	

TRANSFORMERS

T-1 = 641-4

T-2 = 365-4

FUSES

For 115v. operation

F-1 = 1.0 amp. Slo-Blo 3

F-2 = 1.0 amp. Slo-Blo 3

For 230v. operation

F-1 = 0.5 amp. Slo-Blo 3

F-2 = 0.5 amp. Slo-Blo 3

METER

M-1 = 250 μ amp.

PILOT LAMP

P-1 = 6.3 v. 2LAP-

P-2 = in M-1

PLUGS

PL-1 = CDPP-562

PL-2 = CDMP-9-6

JACKS

J-1 = CDSJ-818

J-2 = CDSJ-818

J-3 = CDSJ-820

SWITCHES

S-1 = } SWPM-6

S-2 = } SWPM-6

S-3 = SWPM-7

S-4 = SWPM-8

S-5 = SWT-323

Δ Mounted on P-2 Terminal

⊙ Silver Mica

□ Part of P-1 Socket.

*1 Subject to laboratory selection for final value.

**Lab. Adjustment

*2 Subject to laboratory selection for final value, and may be connected across C-12, or C-13, with S-3 on E Range settings.

*Resistors with same value matched in pairs before assembling to ±0.1%

TRANSFORMERS

1 = 641-401
2 = 365-444

ation
. Slo-Blo 3AG GR FUF-1
. Slo-Blo 3AG GR FUF-1

ation
. Slo-Blo 3AG GR FUF-1
. Slo-Blo 3AG GR FUF-1

METER

250 μ amp. D.C. 588-319A

PILOT LAMP

6.3 v. 2LAP-939 (MAZDA #44) in M-1

PLUGS

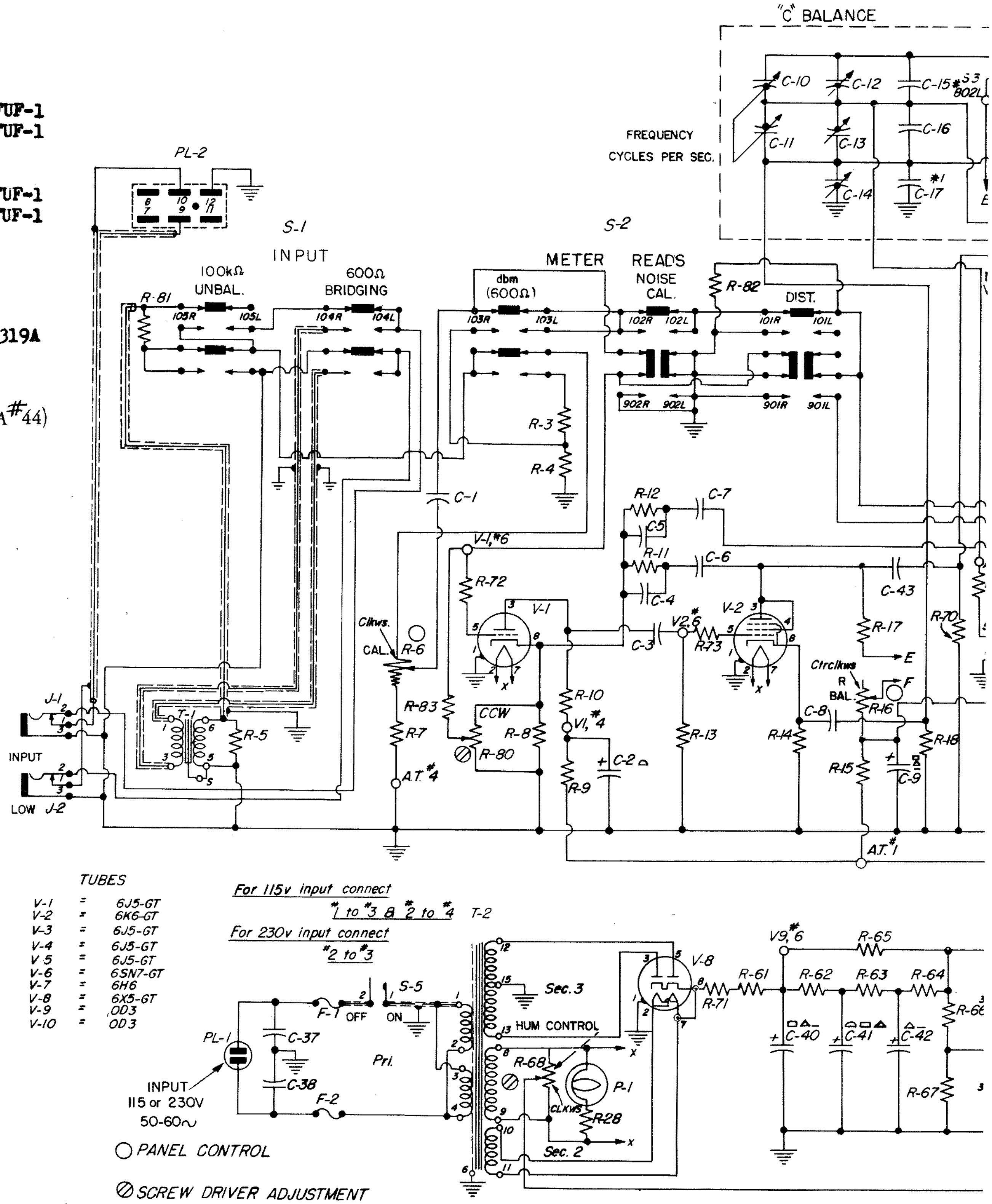
= CDPP-562
= CDMP-9-6

JACKS

CDSJ-818
CDSJ-818
CDSJ-820

SWITCHES

} SWPM-6
SWPM-7
SWPM-8
SWT-323



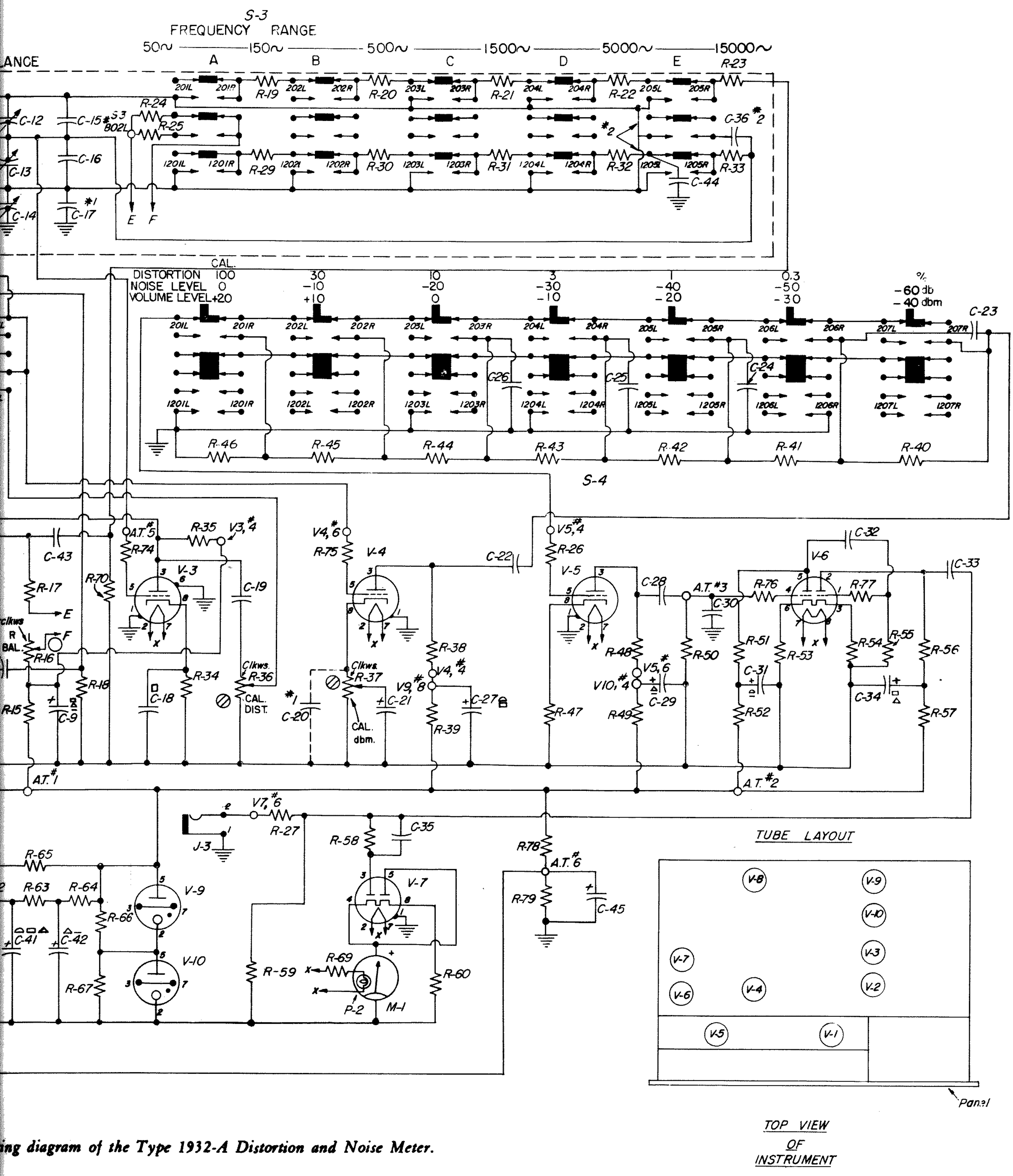
n P-2 Terminal.

ca

-1 Socket.

Figure 3. Complete wiring diagram of the

d in pairs



…ing diagram of the Type 1932-A Distortion and Noise Meter.

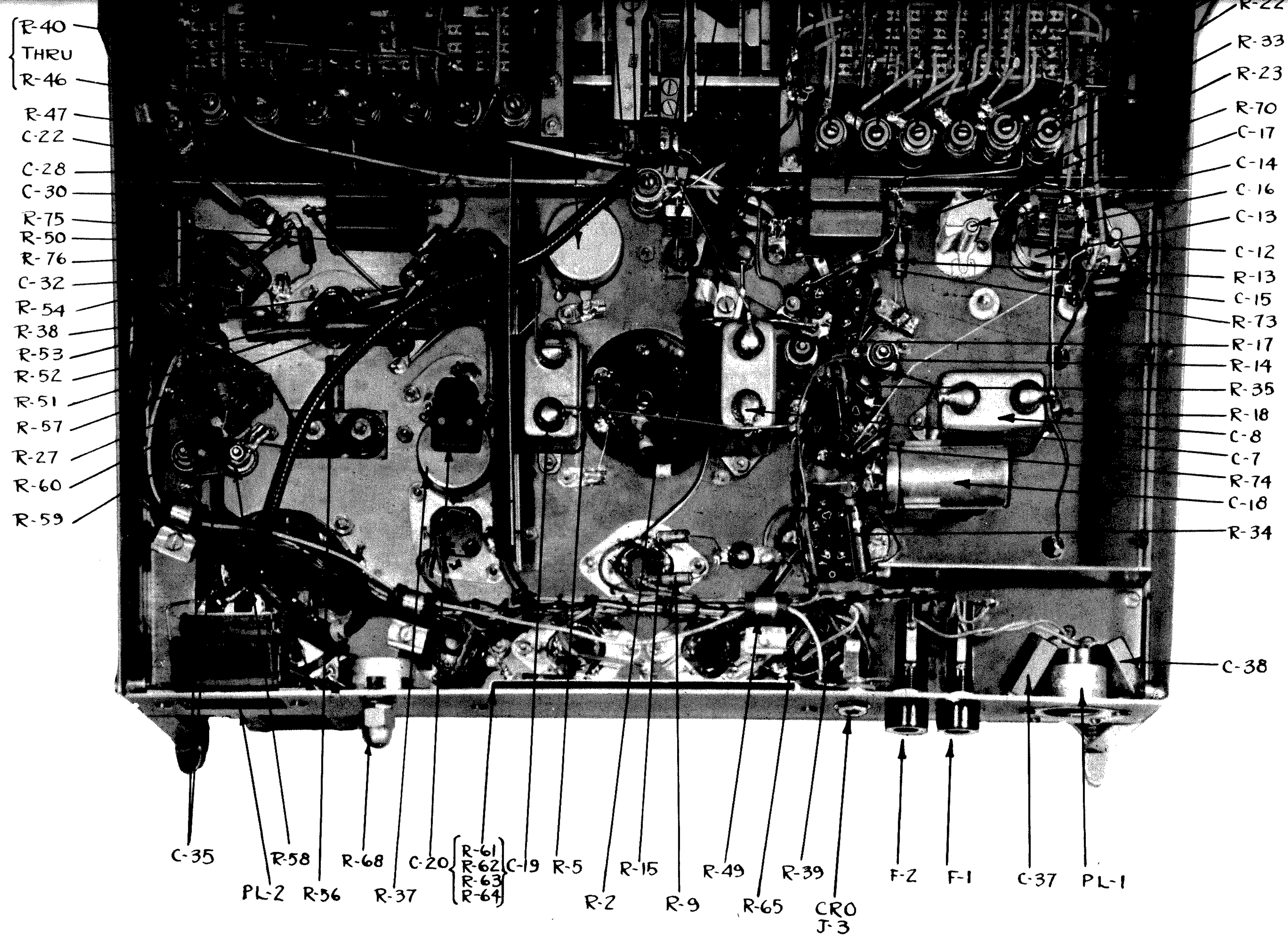


Figure 5. View of under side of chassis with cover plate removed.

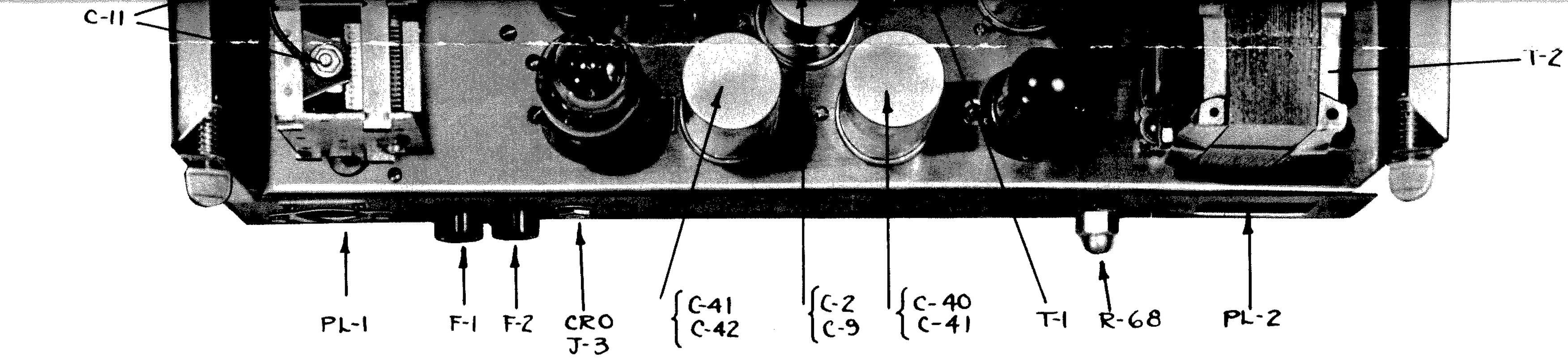
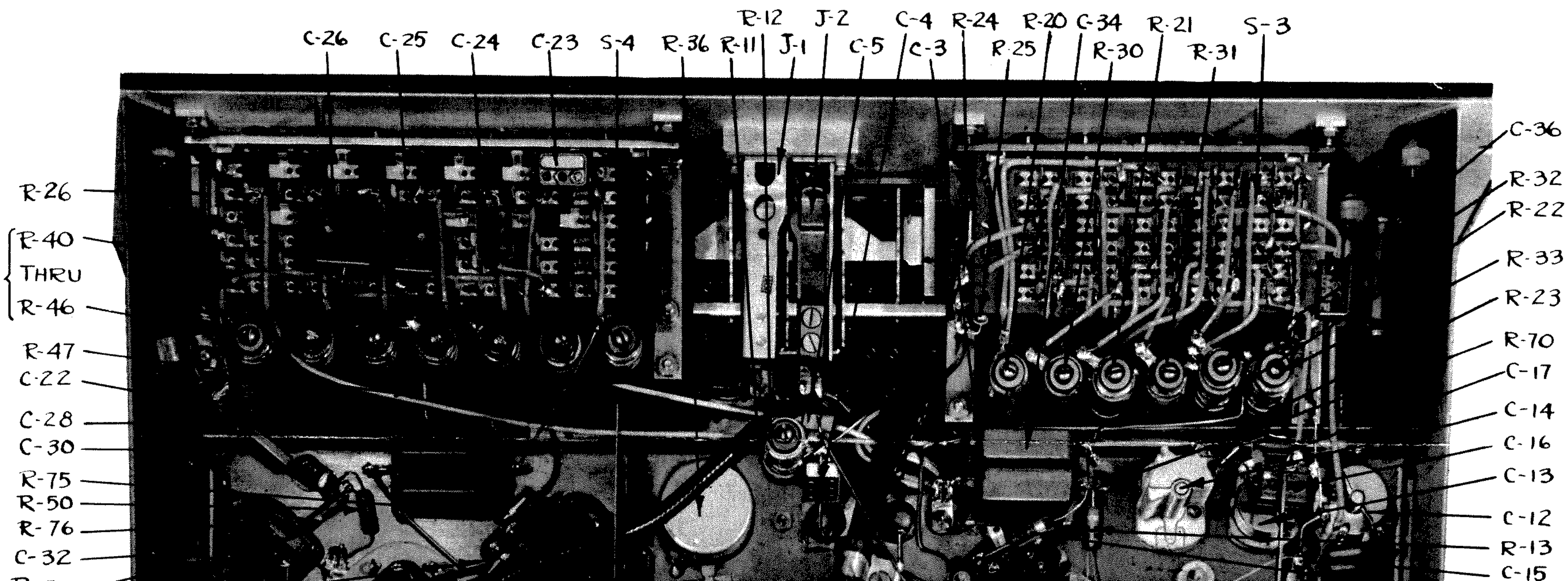
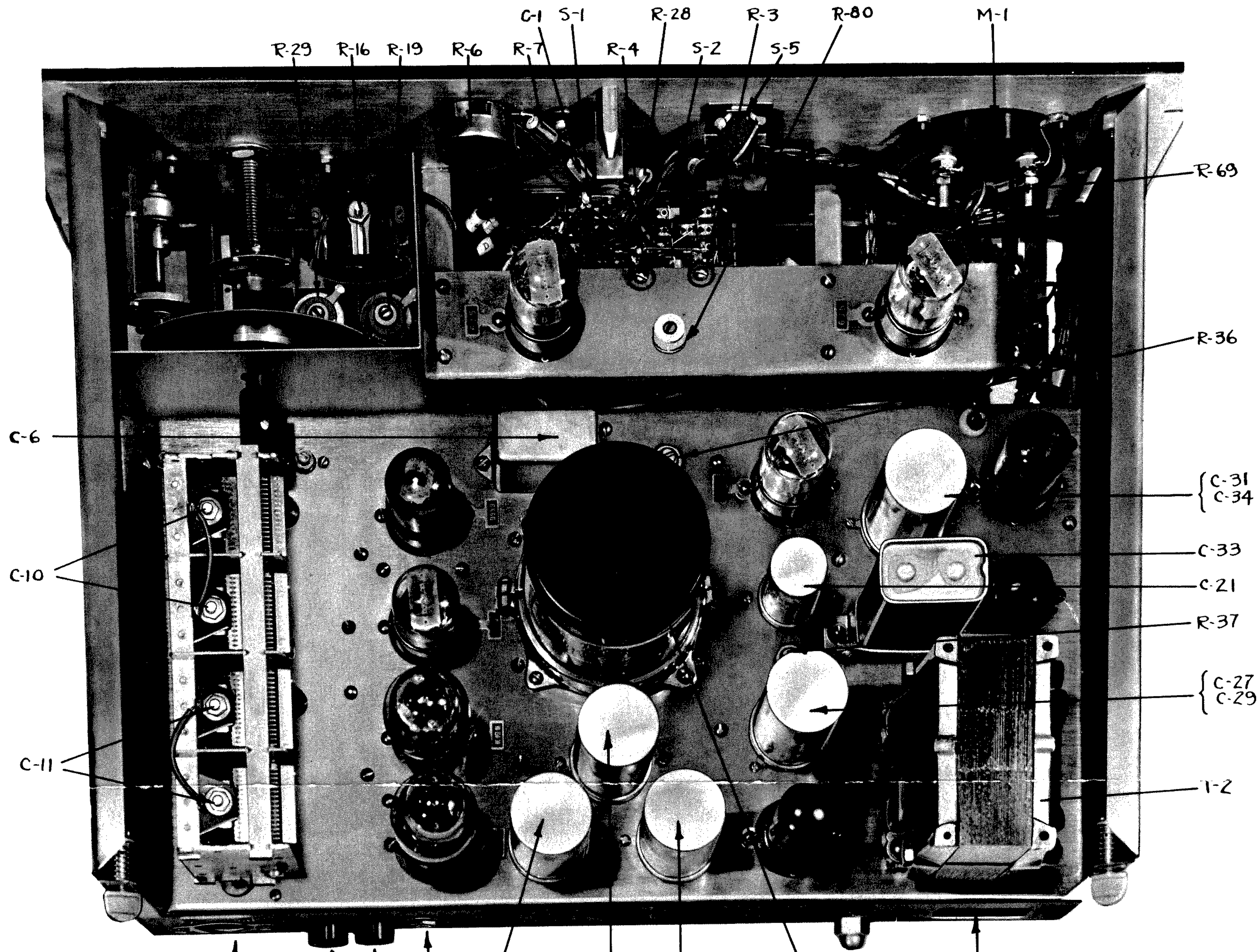


Figure 4. Top view of chassis with dust cover removed.





C-1
S-1
R-28
R-3
R-80
M-1
R-29
R-16
R-19
R-6
R-7
R-4
S-2
S-5
R-69
R-36
C-6
C-31
C-34
C-33
C-10
C-21
R-37
C-27
C-29
C-11
T-2