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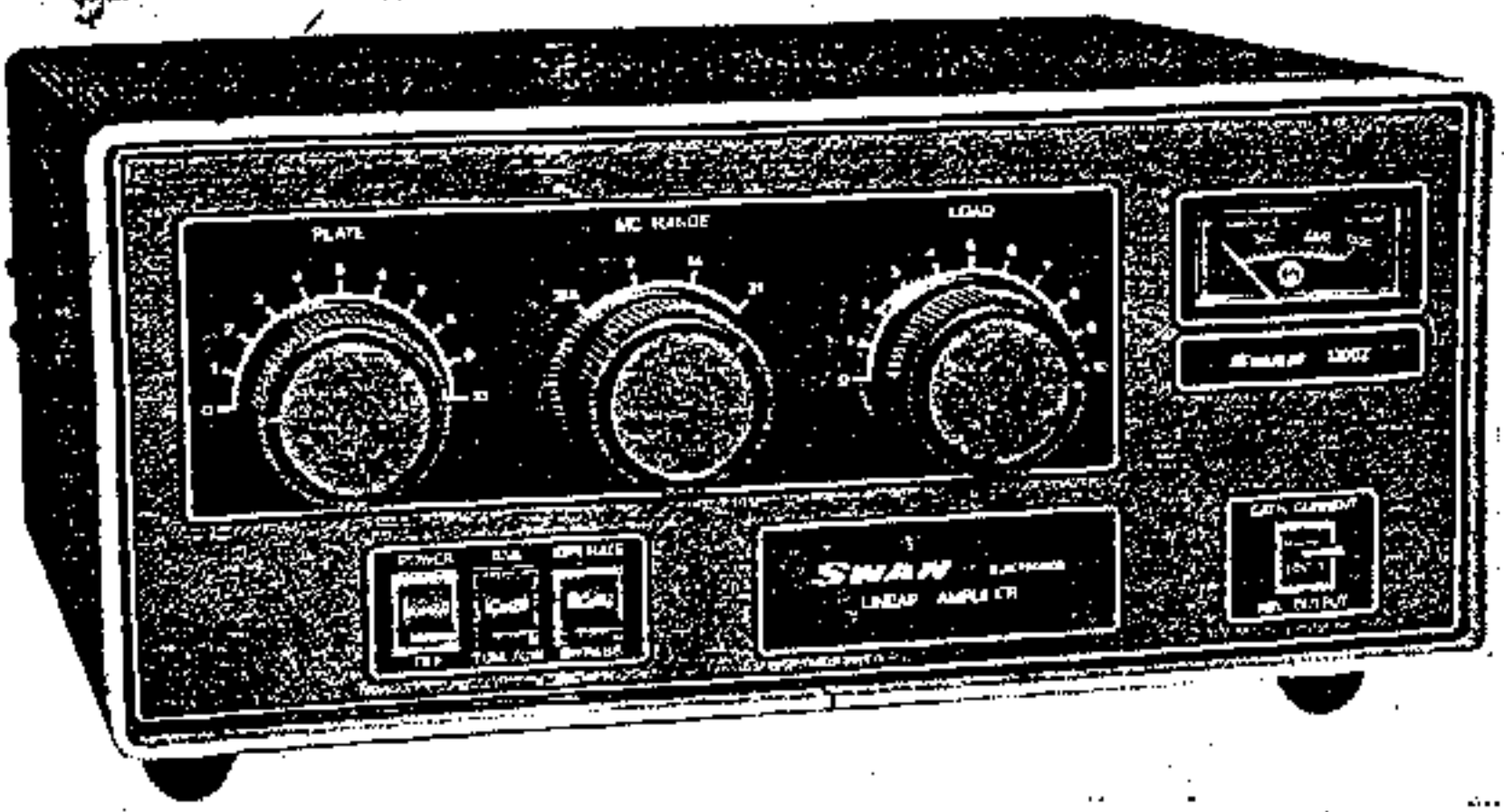
OPERATION AND MAINTENANCE



SWAN MODEL 1200-Z

LINEAR AMPLIFIER

Bob DARRAH

SWAN ELECTRONICS

INTRODUCTION

Swan Model 1200-Z is a linear R.F. power amplifier intended for use in the Amateur Radio Service. ~~When driven by transmitters and transceivers of 100 to 125 watts output, it can develop peak envelope power of 1200 watts in the SSB mode and 900 watts in the CW mode.~~

The 1200-Z is a multiband unit operating on 80, 40, 20 and 15 meters. It has a self contained power supply, cathode current and relative power metering circuits and by-pass provisions to permit the antenna to be driven directly by the associated transmitter (exciter) without the amplification of the 1200-Z or the necessity to disconnect it from the antenna system. Its power transformer has a split primary winding that may be internally connected for 110-120 or 220-240 VAC operation. The unit features four 6MJ6 pentodes in a grounded-grid amplifier and the ability to operate into a wide range of antenna impedances.

INSTALLATION

WARNING

Do not remove the cabinet or the bottom cover when the line cord is connected to a voltage source. Very high voltages, that can cause severe injury or even death on contact, are generated in this unit. Before removing any covers, disconnect the line cord from the power receptacle and wait at least one minute for the power supply capacitors to discharge. When the covers have been removed, use a shorting bar to discharge the power supply capacitors completely before touching any circuit components.

GENERAL

Figure 1 is a pictorial diagram of the interconnecting cabling between the driver transmitter and the 1200-Z Linear Amplifier. Construct a short piece of coaxial cable (RG-58 or RG-8) with PL-259 connectors at both ends (if the driver transmitter antenna connector is an SO-239 or similar connector) or with a PL-259 connector at the amplifier end and a connector to mate with that of the transmitter on the other end. This cable should be no longer than five feet.

Connect a two-wire cable between the EXT RELAY jack of the Model 1200-Z and the exciter. The 1200-Z end of the cable should be equipped with an RCA jack and the other end should have a connector suitable to the transceiver external relay output.

NOTE

The relay in the 1200-Z requires a ground circuit completion for operation. It will not operate if +12 volts is connected to the center conductor of the jack.

POWER TRANSFORMER CONNECTIONS

The method of connecting the transformer leads for 110-120 VAC and 220-240 VAC operation is shown on the schematic diagram. The terminal strip where these connections are made will be found adjacent to the point where the line cord enters the chassis.

Operating instructions for the Model 1200-Z Linear Amplifier relate primarily to a description of the front panel controls and proper tuning procedures for adjusting the operating frequency to that of the associated transmitter or transceiver which will be referred to in the following paragraphs as the exciter.

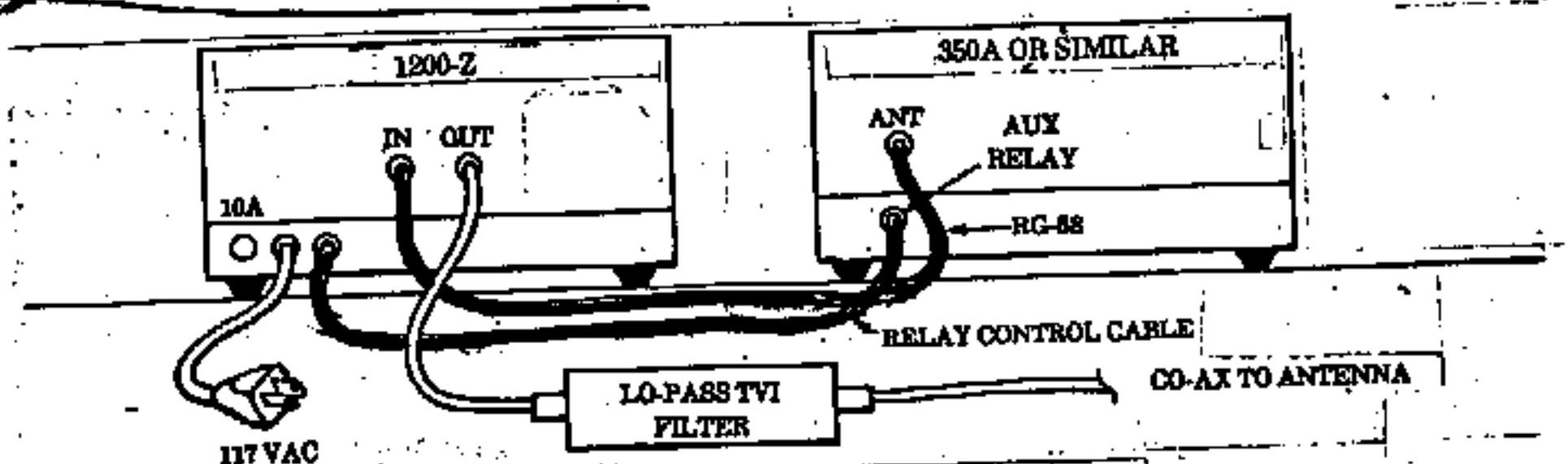


Figure 1. Exciter/1200-Z Linear Amplifier Interconnections.

OPERATION

FRONT PANEL CONTROLS

TUNING CONTROLS

There are three front panel tuning controls:

BANDSWITCH — Sets the operating frequency range to one of the four shown in the table of Page 1. This switch selects the inductance and capacity for the frequency range that will maintain the optimum L/C ratio. This switch also selects the input matching network. The panel legend indicates the lower band edge frequency.

PLATE — By means of a multisection variable capacitor, this control tunes the plate tank circuit to the operating frequency. Calibrations are arbitrary and provide a reference for retuning to a previously used frequency.

LOAD — This control adjusts a second multisection variable capacitor to provide an impedance match between the plate tank circuit and the antenna or dummy load. The output circuit is a Pi section that will match a wide variety of antenna impedances.

POWER SWITCH

A two-position paddle switch controls the primary AC power. When it is in the ON position, the light in the panel meter provides a visual indication that power has been applied.

FUNCTION SWITCHES

There are two function switches on the 1200-Z front panel. One is labeled BYPASS and OPERATE. In the OPERATE position, the 1200-Z will provide linear amplification of the exciter output. In the BYPASS position, the output of the exciter is connected directly to the antenna. The other switch is labeled SSB and TUNE/CW. It should be in the upper (SSB) position when transmitting single sideband and in the lower position (TUNE/CW) when tuning the 1200-Z or when operating CW.

METER AND CONTROLS

The panel meter switch has two positions. When it is in the CATHODE CURRENT position, the meter is reading the total cathode current of the amplifier tubes. It thus serves as a tuning meter to indicate tuning of the amplifier to resonance with a "dip" in the reading. It also indicates the loading of the antenna when the LOAD control is operated. When the switch is in the RELATIVE POWER position, the meter is measuring the voltage on the center conductor of the transmission line and, thus, is an indicator of relative power output.

TUNING INSTRUCTIONS

1. Set the BYPASS/OPERATE switch of the 1200-Z to the BYPASS position and the POWER switch to ON. The meter lamp should light and the tube heaters should be on. The exciter is now connected directly to the antenna through the 1200-Z. Proceed with the tune up of the exciter in accordance with the manufacturer's instructions. If the exciter is not equipped with an output meter, the meter of the 1200-Z may be used as a load indicator as it is always connected in the antenna circuit whether or not the 1200-Z is in operation.

2. Make certain the exciter is not producing power and that its function switch is at the SSB position. Also, be certain that the carrier has been balanced out and that the microphone gain is set to its minimum position. Set the SSB/TUNE/CW switch of the 1200-Z to SSB. Set the meter switch to CATHODE CURRENT position.

CAUTION

Allow at least five minutes after power turn-on for the tubes in the 1200-Z to come up to operating temperature before proceeding.

3. Key the exciter for not more than 10 seconds and note the 1200-Z panel meter reading. It should be 100 ma. 10 ma. If it is not within these limits, turn the exciter off immediately. Turn the 1200-Z on its side and insert an *INSULATED* screwdriver into the hole in the bottom cover. Engage the screwdriver in the slot of the potentiometer that is in line with the hole. Key the exciter and adjust the potentiometer for a reading of 100 ma. This is the "idling current" adjustment.

CAUTION

Unless corrected, excessive idling current can materially shorten tube life. Idling current should be checked prior to each day's operation to insure that it remains within acceptable limits.

4. Place the FUNCTION switch of the 1200-Z in the TUNE/CW position, the BANDSWITCH to a range that includes the frequency of the exciter output, the PLATE control at 5 and the LOAD control at 0. Place the function switch of the exciter in the tune position and key the exciter. *QUICKLY* check the cathode current of the 1200-Z. It should not exceed 250 ma. Do not key the exciter for more than 10 seconds. If the meter reading is in excess of 250 ma., take

steps to reduce the drive from the exciter so that the current does not exceed 250 ma.

CAUTION

Use care that the 1200-Z is not keyed for more than 10 seconds while checking the cathode current as the tubes are operating at full input without a plate load. Extended operation under these circumstances will exceed the power dissipation capability of the tubes and materially shorten their life.

5. Place the 1200-Z meter switch at REL OUTPUT. Key the exciter and *QUICKLY* adjust the PLATE control for maximum indication on the meter. Then readjust the exciter power amplifier tuning for a maximum reading on the 1200-Z panel meter. Next, advance the LOAD control of the 1200-Z for maximum output reading on the panel meter. Alternately, adjust the exciter P.A. tuning, 1200-Z PLATE tuning and LOAD controls for maximum meter indication.

CAUTION

During the tune up procedure, key the system for only the time necessary to accomplish a single tuning adjustment. This will protect the exciter and the 1200-Z tubes which are running at full input while tuning. In practice, keying the exciter, making an adjustment and then unkeying the exciter for a few seconds before making another adjustment will prove to be the best procedure.

With the foregoing adjustments and 100 watts of drive power, the cathode current should be in the order of [illegible] ma. This will produce approximately 400 to 450 watts of power. Higher drive power will, of course, result in higher output power.

6. Having followed the preceeding tuning procedures, set the 1200-Z FUNCTION control to SSB and the meter switch to CATHODE CURRENT. Set the function switch of the exciter to SSB and advance its microphone gain control for a peak reading of 300-400 ma. on the 1200-Z panel meter while speaking into the microphone.

CAUTION

Exercise great care in setting the microphone gain control. It is quite easy to produce higher meter readings but flattopping and distortion will result. Do not switch the exciter to its tune position when The 1200-Z SSB/TUNE/CW switch is in the SSB position. Only voice modulation should be applied in this position.

CAUTION

Care must be exercised that the amplifier is retuned whenever the exciter frequency is removed by more than 25 KHz from the frequency at which the amplifier was previously tuned.

An oscilloscope is recommended for tuning and monitoring an amateur radio station. In addition, it is a very useful item of test equipment for general servicing of other equipment. Its use will permit optimum tuning of both the exciter and the 1200-Z Linear Amplifier. The Heath Model SB-614 is an excellent oscilloscope for this purpose and is offered in kit form by The Heath Company, Benton Harbor, Michigan. The instruction book supplied with this kit explains in detail how to connect and use the instrument, and how to interpret the screen patterns. Other oscilloscopes may also be used. The Radio Amateur's Handbook, published by the American Radio Relay League, and the Radio Handbook by Bill Orr, published by Editors and Engineers, contain detailed information on the use of oscilloscopes for transmitter tuning and operation. These publications are recommended references for this purpose.

7. For AM and CW operation, at approximately [illegible] watts, place the 1200-Z SSB/TUNE/CW switch in the TUNE/CW position.

MAINTENANCE

Little maintenance will be required for the 1200-Z Amplifier. The 6MJ6 tubes, when operated according to the instructions in this manual, will provide thousands of hours of service. Deterioration of a tube will be generally indicated by a change in idling current or inability to draw normal plate current or both. In the grounded-grid circuit used in the 1200-Z, matching of the 6MJ6 tubes is not required.

Other components are also operating conservatively, and well within nominal ratings. The electrolytic filter capacitors in the power supply are computer grade and have a much higher degree of purity and quality control than conventional types. Life expectancy of these filters is approximately 10 years. The silicon diodes in the power supply are hermetically sealed and are not likely to fail or deteriorate with time.

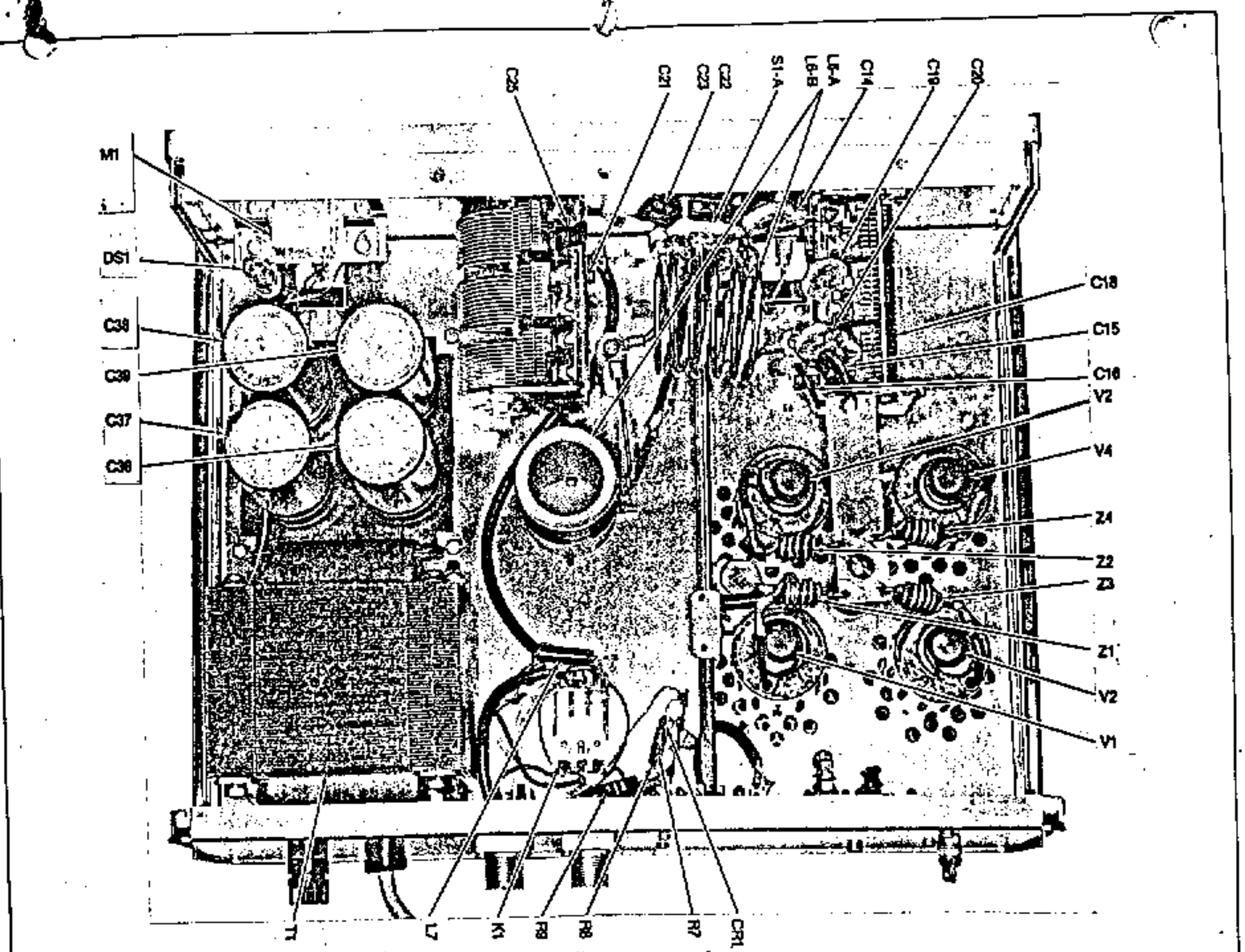


Figure 2. | Top View of 1200-Z Showing Component Locations.

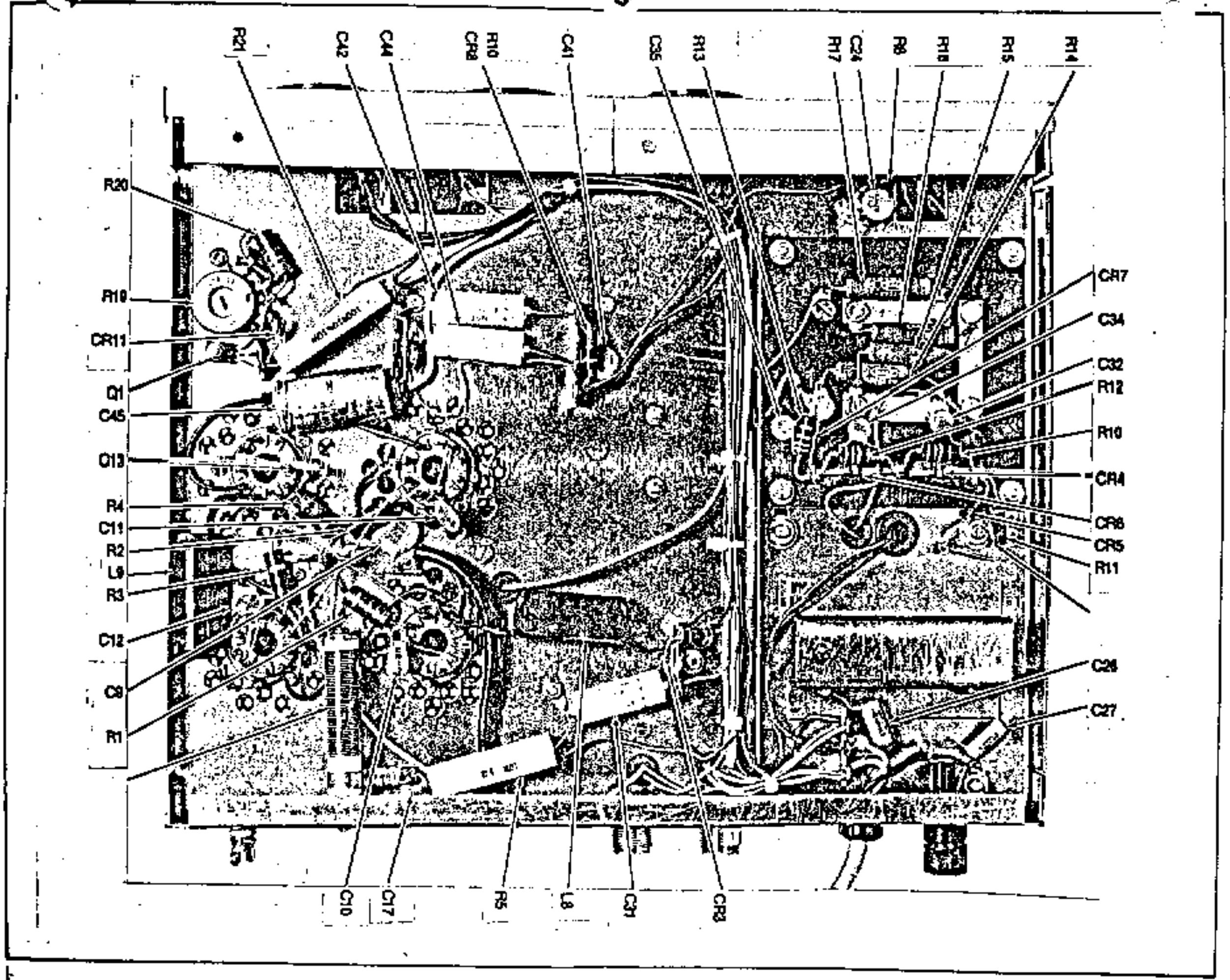
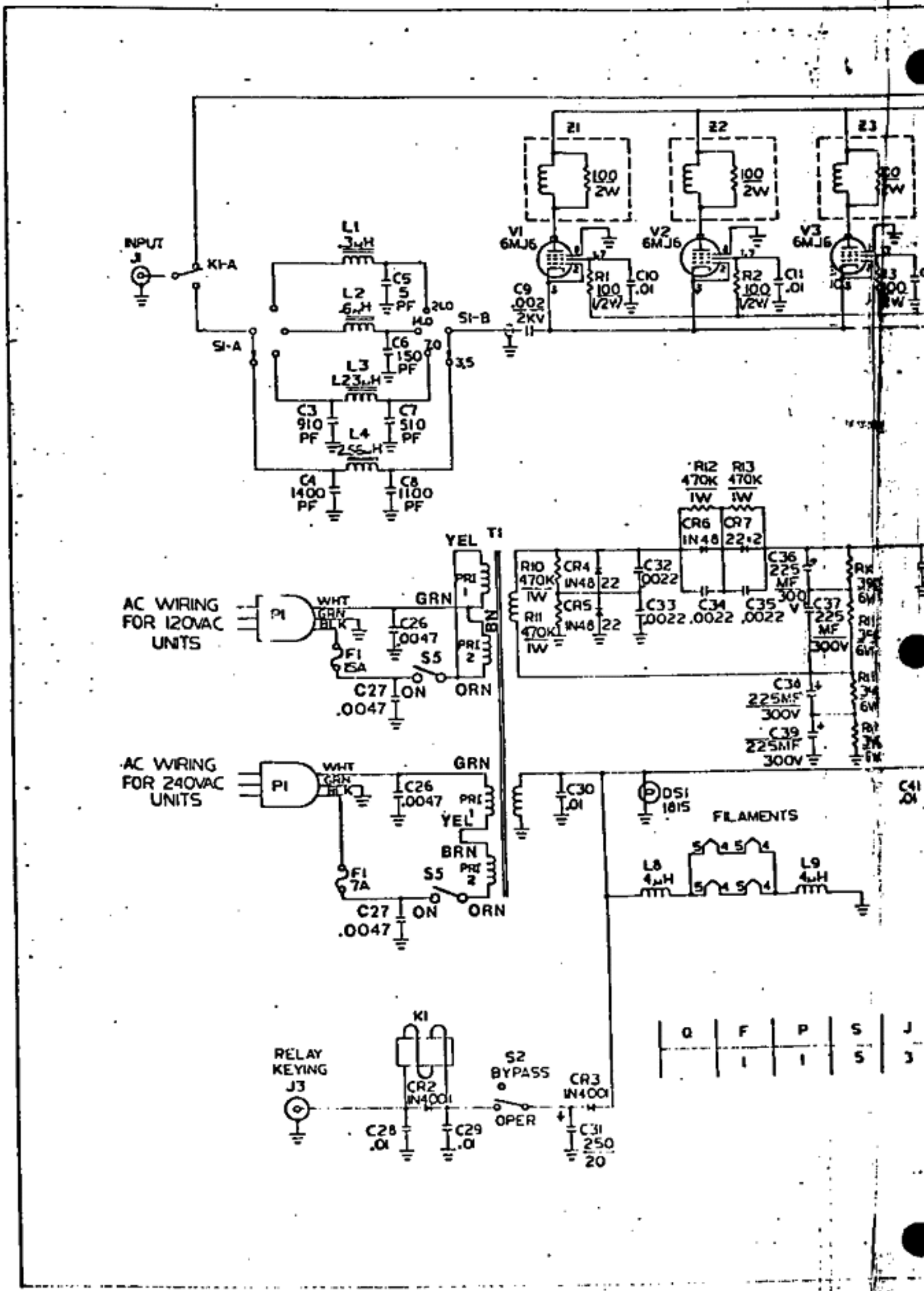
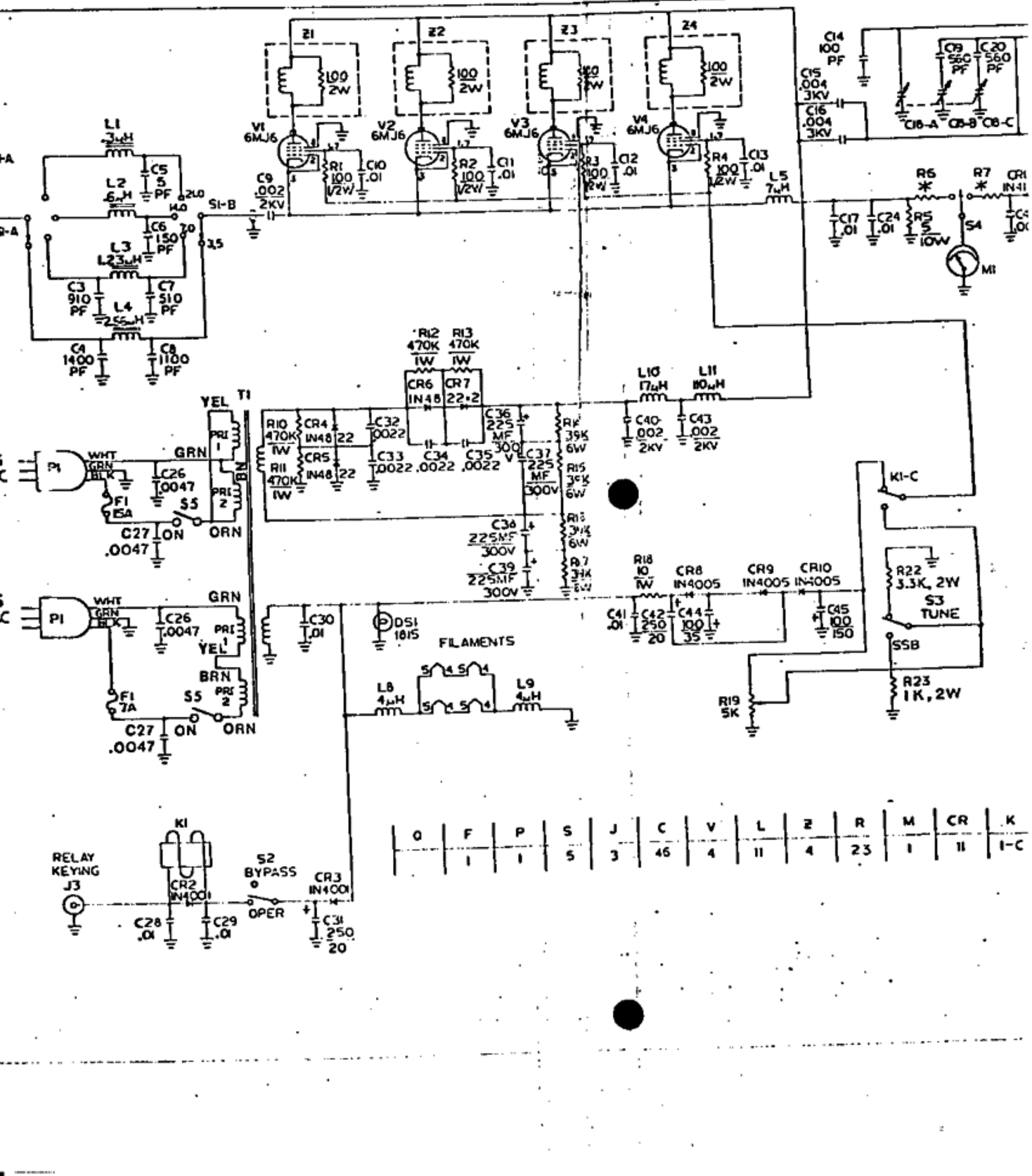
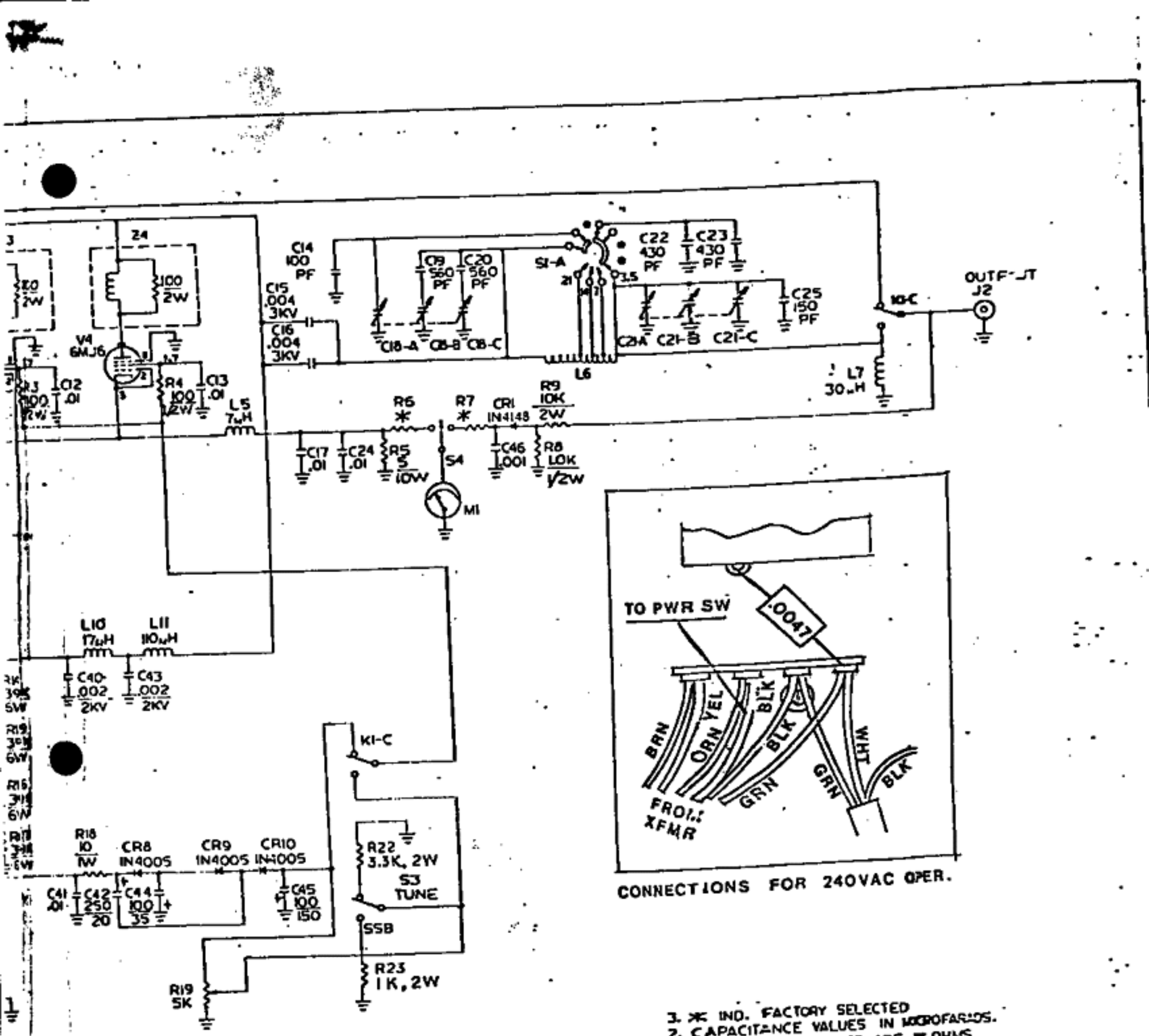


Figure 3. Bottom View of 1200-Z Showing Component Locations.


INPUT
J1
K1-A
L1
.3μH
L2
.6μH
L3
L2 3μH
L4
.25μH
C1
5
PF
C2
150
PF
C3
910
PF
C4
1400
PF
C5
5
PF
C6
150
PF
C7
510
PF
C8
1100
PF
S1-A
S1-B
1.0
2.0
3.0
3.5
Z1
Z2
Z3
100
2W
V1
6MJ6
V2
6MJ6
V3
6MJ6
R1
100
(2W)
C10
.01
R2
100
(2W)
C11
.01
C9
.002
2KV
R12
470K
1W
R13
470K
1W
CR6
IN48
CR7
22.2
R10
470K
1W
CR4
IN48
22
CR5
IN48
22
R11
470K
1W
C32
.0022
C33
.0022
C34
.0022
C35
.0022
C36
225
MF
300
V
C37
225
MF
300V
C38
225MF
300V
C39
225MF
300V
T1
YEL
PRI
1
PRI
2
BN
GRN
ORN
AC WIRING
FOR 120VAC
UNITS
P1
WHT
GRN
BLK
C26
.0047
F1
15A
S5
ON
C27
.0047
AC WIRING
FOR 240VAC
UNITS
P1
WHT
GRN
BLK
C26
.0047
GRN
PRI
1
YEL
BRN
PRI
2
F1
7A
S5
ON
ORN
C27
.0047
C30
.01
DS1
1815
FILAMENTS
L8
4μH
L9
4μH
C41
.01
K1
RELAY
KEYING
J3
CR2
IN4001
C28
.01
C29
.01
S2
BYPASS
OPER
CR3
IN4001
C31
250
20
Q
F
P
S
J
1
1
5
3



O	F	P	S	J	C	V	L	Z	R	M	CR	K
	1	1	5	3	46	4	11	4	23	1	11	1-C



CONNECTIONS FOR 240VAC OPER.

NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE VALUES ARE IN OHMS.
2. CAPACITANCE VALUES IN MICROFARADS.
3. * IND. FACTORY SELECTED

J	C	V	L	Z	R	M	CR	K	D
3	46	4	11	4	23	1	11	1-C	1

Figure 1. Schematic Diagram, Model 1[illegible]

PARTS LIST

CAPACITORS

C1	180, DM-15, Silver Mica
C2	330, DM-15, Silver Mica
C3	820, DM-15, Silver Mica
C4	1400, DM-19, Silver Mica
C5	470 DM-15, Silver Mica
C6	560, DM-15, Silver Mica
C7	820, DM-15, Silver Mica
C8	100, DM-15, Silver Mica
C9	0.002 ufd., 2KV, Ceramic Disc
C10	0.01 ufd., 500V, Ceramic Disc
C11	0.01 ufd., 500V, Ceramic Disc
C12	0.01 ufd., 500V, Ceramic Disc
C13	0.01 ufd., 500V, Ceramic Disc
C14	100, DM-19, Silver Mica
C15	0.004 ufd., 3KV, Mica
C16	0.004 ufd., 3KV, Mica
C17	0.02 ufd., 500V, Ceramic Disc
C18	3-Section, Air Variable, 180 pfd. per section
C19	560 pfd., 6KV, Ceramic Disc
C20	560 pfd., 6KV, Ceramic Disc
C21	3-Section, Air Variable, 518 pfd. per section
C22	430, DM-19, Silver Mica
C23	430, DM-19, Silver Mica
C24	0.01 ufd., 500V, Ceramic Disc
C25	150, DM-15, Silver Mica
C26	0.0047 ufd., 1000V, Molded Paper
C27	0.0047 ufd., 1000V, Molded Paper
C28	0.01 ufd., 500V, Ceramic Disc
C29	0.01 ufd., 500V, Ceramic Disc
C30	0.01 ufd., 500V, Ceramic Disc
C31	250 ufd., 20V, Electrolytic
C32	0.0022 ufd., 500V, Ceramic Disc
C33	0.0022 ufd., 500V, Ceramic Disc
C34	0.0022 ufd., 500V, Ceramic Disc
C35	0.0022 ufd., 500V, Ceramic Disc
C36	225 ufd., 300V, Electrolytic
C37	225 ufd., 300V, Electrolytic
C38	225 ufd., 300V, Electrolytic
C39	225 ufd., 300V, Electrolytic
C40	0.002 ufd., 2KV, Ceramic Disc
C41	0.01 ufd., 500V, Ceramic Disc
C42	250 ufd., 20V, Electrolytic
C43	0.002 ufd., 2KV, Ceramic Disc
C44	100 ufd., 35V, Electrolytic
C45	100 ufd., 150V, Electrolytic
C46	0.001 ufd., 500V Ceramic Disc

DIODES/TRANSISTORS

CR1	1N4148
CR2	1N4001
CR3	1N4001
CR4	1N4822
CR5	1N4822
CR6	1N4822
CR7	1N4822
CR8	1N4005
CR9	1N4005
CR10	1N4005
CR11	1N4005
Q1	MJE521

RESISTORS

R1	100 Ohms, 2W, 10%
R2	100 Ohms, 2W, 10%
R3	10 Ohms, 2W, 10%
R4	10 Ohms, 2W, 10%
R5	5 Ohms, 10W, 10%, WW
R6	Factory Selected
R7	Factory Selected
R8	1.0K Ohms, 1/2W, 10%
R9	10K Ohms, 2W, 10%
R10	470K Ohms, 1W, 10%
R11	470K Ohms, 1W, 10%
R12	470K Ohms, 1W, 10%
R13	470K Ohms, 1W, 10%
R14	39K Ohms, 6W, 10%, WW
R15	39K Ohms, 6W, 10%, WW
R16	39K Ohms, 6W, 10%, WW
R17	39K Ohms, 6W, 10%, WW
R18	10 Ohms, 1W, 10%
R19	5K Ohms, 2W, Potentiometer
R20	[illegible]
R21	[illegible]
R22	3.5K 2W 10%
R23	1K 2W 10%

INDUCTORS

L1	0.8 uhy., Toroid
L2	0.6 uhy., Toroid
L3	2.5 uhy., Toroid 4 H
L4	2.5 uhy., Toroid
L5	7 uhy., RFC
L6	Pi-Network Coil
L7	30 uhy., RFC
L8	4 uhy., RFC
L9	4 uhy., RFC
L10	17 uhy., RFC
L11	110 uhy., RFC

FUSES

F1	15A, 125V (117VAC Operation) 7A, 250V (230VAC Operation)

PLUGS/JACKS

P1	P/O AC Line Cord
J1	SO-239
J2	SO-239
J3	RCA Phone Jack

SWITCHES

S1	2-Section, 5 Pos., Wafer
S2	SPDT, Toggle
S3	SPDT, Toggle
S4	SPDT, Toggle
S5	SPDT, Toggle

TUBES

V1	6MJ6
V2	6MJ6
V3	6MJ6
V4	6MJ6

NETWORKS

Z1	Parasitic Suppressor
Z2	Parasitic Suppressor
Z3	Parasitic Suppressor
Z4	Parasitic Suppressor

METER

M1	1 MA. Full Scale

RELAY

K1	3PDT, 12V DC

LAMP

DS1	#1815

W4CCQ

1200Z Manual Addendum

PAGE	PARAGRAPH	CHANGE
1	1	Delete second sentence. Add following sentence; "The SWAN 1200Z is capable of PEP voice input power of 1KW or 600 watts CW, when driven by transmitters or transceivers producing a minimum output power of 100 watts.
3	5	Line 19 should read; power, cathode current should be in the order of 600 ma.
3	7	first line should read; For AM and CW operation, at approximately 400 watts,
7	PARTS LIST	C3 to 910, C5 to 5, C6 to 150, C7 to 510, C8 to 1100, R1 to 100 ohms 1/2W, R2 to 100 ohms 1/2W, R3 to 100 ohms 1/2W, R4 to 100 ohms 1/2W, Delete R20 and R21, Add R22 3.3K, 2W, 10%, R23 1K, 2W, 10%, Change L3 to 1.23uh, L4 to 2.56uh.