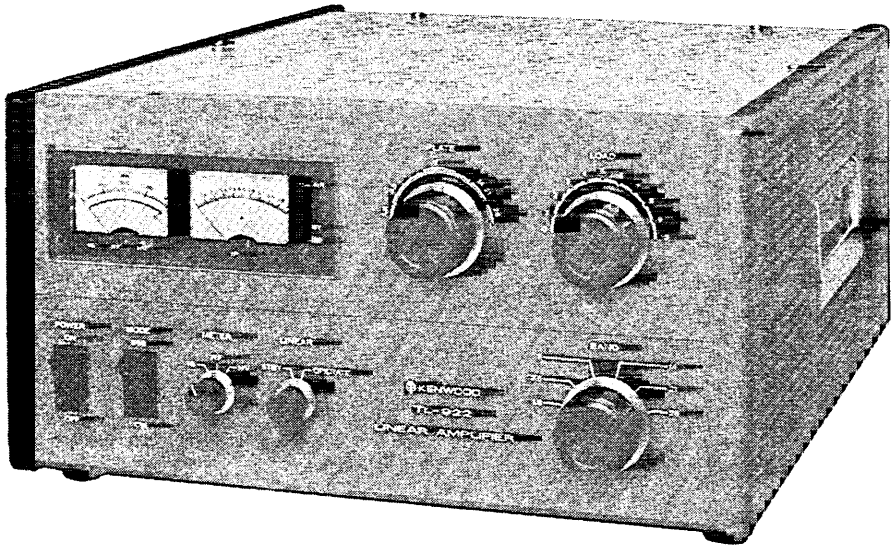
KENWOOD

SERVICE MANUAL

TL-922



LINEAR AMPLIFIER

CONTENTS

SECTION 1. IMPORTANT NOTICE

The following explicit definitions apply in this manual.
Be sure to read these definitions:

NOTE ..... inconvenience only — no damage or personal injury.

CAUTION ..... equipment damage may occur, but not personal injury.

WARNING ..... personal injury may occur — do not disregard.

WARNING

LETHAL VOLTAGES PRESENT
Observe all standard safety procedures regarding high RF, AC and DC potentials.

SECTION 2.1 TECHNICAL SPECIFICATIONS

Transmit Frequency Range	160 m through 10 m amateur bands
Excitation Energy Required	80W nominal, 120W maximum
Mode and Duty Cycle	SSB, continuous for 30 minutes CW and RTTY, key-down continuous for 10 minutes
Rated Plate Input	2 KW P.E.P. SSB 1 KW CW, RTTY
Plate Voltage (at No signal)	3.1 KV DC-SSB, 2.2 KV — CW, RTTY
Circuit Type	Class AB2 grounded grid linear amplifier
3rd Order Intermodulation Distortion	Below −30 dB
Input Impedance	50Ω, unbalanced at better than 1.5 SWR
Output Impedance	50 to 75Ω, unbalanced
Cooling	Forced Air
Interlock Safety Features	Primary high voltage circuit cut-off Secondary high-voltage circuit grounding
Thermal Protector	Locks out transmit relays if power transformers overheat
Fan Motor Delay Stop Time	140 ± 30 seconds (on room temperature)
ALC	Negative going, adjustable threshold −8V DC maximum output (typical)
Power Tubes Used	Eimac 3-500Z, two pieces
Semiconductors	Diodes, 18 peices Zener diode, 1 piece
Power Requirements	120V, 5A; 220/240V, 14A; 50/60 Hz; for maximum SSB input
Cables Supplied	Power cable with 2-pin grounding plug, 2 m long Signal cable (coaxial) with M-type connector, 1.5 m Control cable, 1.5 m
Dimensions	390 mm (15-3/8") x 190 mm (7-1/2") x 407 mm (16") Values in parenthesis include protrusions
Weight	Net 31 kg (68 lbs.) Shipping 38 kg (83 lbs.)

SECTION 2.2 TUBE SPECIFICATIONS

Filament
- Voltage 5.0V
- Current 14.2A

Direct Interelectrode Capacitances (grounded grid)[2]
- Input 8.3pF
- Output 4.7pF
- Feedback 0.07pF

Frequency of Maximum Rating
- CW ..... 110 MHz

Operating Position ..... Vertical, base down or up

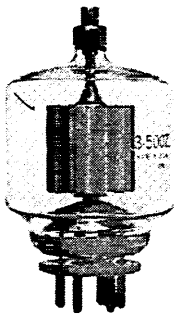
Maximum Operating Temperature
- Plate Seal ..... 225°C
- Base Seals ..... 200°C

Cooling ..... Radiation and forced air

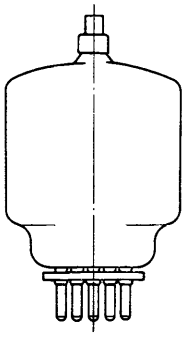
Base ..... 5 Pin Special

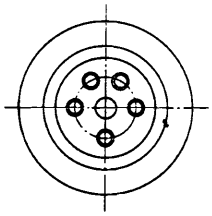
Maximum Ratings

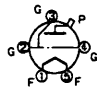
DC Plate Voltage	4000 Volts
DC Plate Current	0.35 Ampere
Plate Dissipation	500 Watts
Grid Dissipation	20 Watts



<3-500Z External View>







(tube basing)

SECTION 3. FEATURES

1. Class AB2, grounded grid linear amplifier using two high-performance Eimac 3-500Z power tubes. Covers all bands 160 m through 10 m for SSB, CW and RTTY modes of operation.
2. Highly reliable, it is designed to provide stable, high RF output power for extended periods of continuous use.
3. Low intermodulation distortion through the use of negative R.F. feedback (unique to Trio-Kenwood linear design).
4. Quick Turn-on. Warv-up is not necessary. The 3-500Z tubes are fast heating.
5. Double safety systems, comprised of interlocking switches. One interrupts the high voltage primary circuit while the second directly grounds the secondary high voltage circuit. Bleeder resistors are provided for discharging the high voltage capacitors and "DANGER" warnings are posted at high voltage positions. Please observe all warnings, they are for your protection.
6. Fan motor delay stop circuit comprised of a thermal delay relay will hold the cooling fan on for 140 seconds (TYP) after power is removed from the unit and will measurably extend tube life.
7. Mode switch for efficient linear operation selects between SSB mode for maximum PEP output with good linearity, and CW Mode for low power consumption and heat generation during extended periods of operation.
8. Linear amplification control switch allows straight-through operation without shutting off the unit.
9. Variable threshold will accommodate exciters 80W to 120W (nominal) by varying the ALC threshold level. This prevents overdriving the final power tubes and limits the amplifier to its linear range, guaranteeing low distortion at maximum power.
10. Two panel meters: one meter always indicates the (Ip) plate current; the second selectively reads (Ig) grid current, (Rf) relative output, or (Hv) high voltage.
11. Rigid mechanical structure: The die-cast side panels effectively support the weight of the amplifier against shocks and jarring during transportation. Recessed side panel handles are provided so the amplifier can be easily carried.
12. Vernier plate tuning dial facilitates easy tuning, particularly for the higher bands.
13. Neat, contemporary appearance. Mechanical arrangement and advanced design match the TS-820 and the TS-520 Series transceivers.
14. Power source selecting: Power source can be selected in two sources (120V ⟷ 240V).

SECTION 4. CIRCUIT DESCRIPTION

1. The TL-922 is a grounded grid class AB_2 amplifier consisting of two Eimac Hi-mu, zero bias triodes, 3-500Z, providing the following features:
   1) Low IMD (intermodulation distortion) through negative RF feedback.
   2) The grounded grid circuit does not require neutralization.
   3) Due to its low input impedance, no cathode-swamping resistors are required.
   4) High stability at any frequency.
   5) Excitation energy is added to the RF output and is not lost.

   Figure 1 shows a circuit diagram of the Linear Power Amplifier.

   The input matching circuit, comprised of L9 through L14, Cin-1, and Cin-2, matches the exciter impedance with the input circuit impedance to efficiently feed exciter energy into the power tubes. The tubes are heated by the center tapped filament transformer T2 requiring current only half the usual, preventing voltage drop due to wire resistance.

   The choke coils L20 and L3 high frequency isolate the filaments from the filament transformer. The bias voltage, which determines the operating point of the tubes is produced across zener diode D2. This diode carries the full current of the tubes excepting filaments. The grids are DC grounded through L7 and L8 and high-frequency grounded by C28 through C33.

   The π network, comprised of VC1, L4, L5 and VC2, matches the plate impedance to the antenna. The tubes are cut off to stand by through a positive voltage of approximately 100V applied to the filament circuit.

2. Power Supply

   The plate high voltage is supplied from avoltage doubling rectifier comprised of a large-capacity, small-sized transformer T1, fourteen high-voltage rectifier diodes rated 800 PIV and eight 200μF electrolytic capacitors rated 550V surge. To improve reliability, the diodes are P.C.B. mounted and the electrolytic capacitors are held by plastic spacers. Filament voltage, relay energizing voltage (in common with the tube cut-off bias voltage), and pilot lamp voltage are supplied from transformer T2. Each primary of the power transformers T1 and T2 has two windings, each of which is fused. Note that fuses are not changed when the input line voltage has been changed.

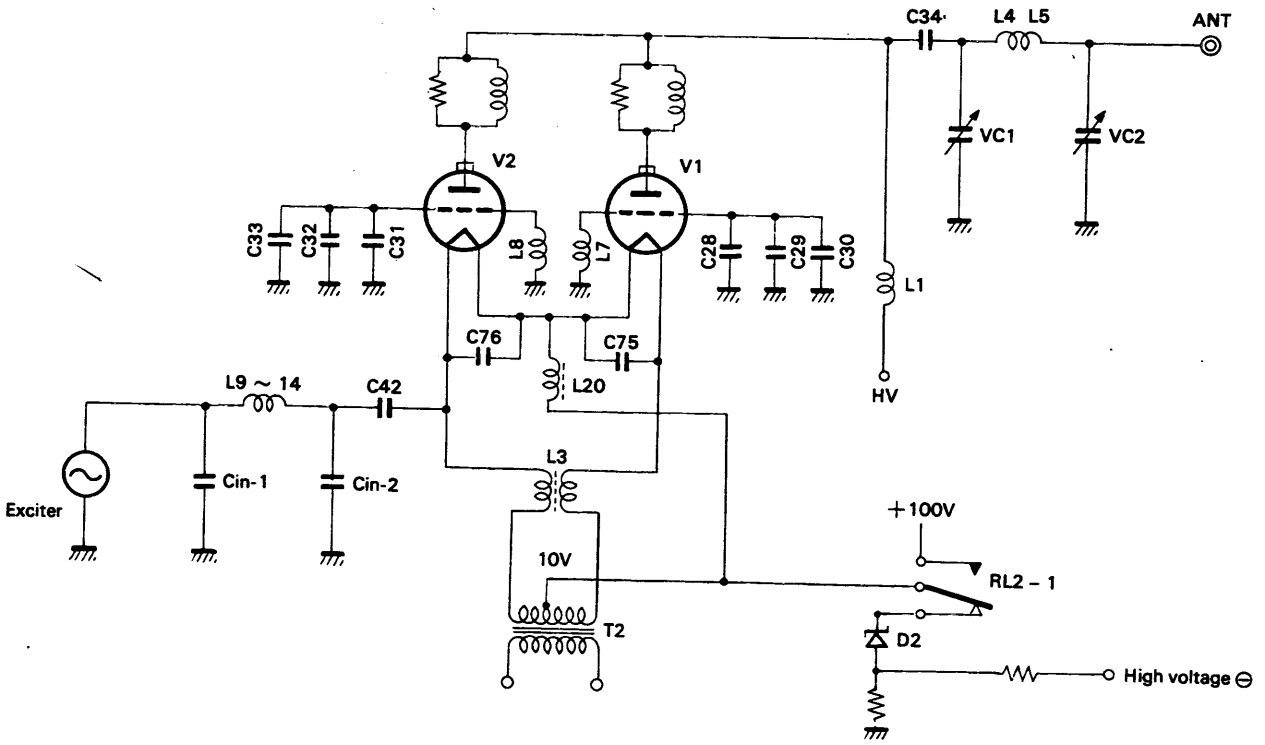


Fig. 1 Linear Power Amplifier and Mode Switching Circuit

SECTION 4. CIRCUIT DESCRIPTION

3. Fan Motor Delay Stop Circuit

The cooling fan is held on for approximately 2 minutes to cool the power tubes after the POWER switch is turned off. This is accomplished by the fan motor delay stop circuit comprised of a bimetal thermal relay.

Figure 2 is a schematic diagram illustrating the circuit. When the POWER switch is at OFF, both the relay RL1 and the thermal relay DL1 are not activated and the fan is off. By turning the POWER switch to ON, RL1 is activated, starting the fan. At the same time, voltage is applied to DL1 generating heat, which makes the contact DL1-1 close in approximately 60 seconds. By turning the POWER switch to OFF, RL1 is deenergized, returning contacts RL1-1 and RL1-2 to their home positions. But, the fan continues operating as the thermal relay contact DL1-1 is still closed. DL1-1 opens after approximately 140 seconds thereby stopping the fan.

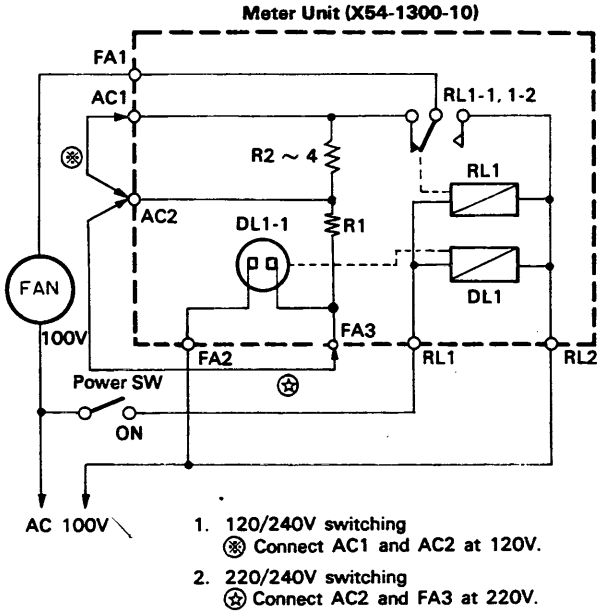


Fig. 2 Fan Motor Delay Stop Circuit

4. Meter Drive Circuit

The power tube Ip (plate current) and Ig (grid current) can be read on individual meters. **Figure 3** is the meter drive circuit. Ip (plate current) is measured through shunt resistor R6 (1Ω), and deflects the Ip meter through R7 (1.5kΩ) which adjusts meter sensitivity. Similarly, Ig (grid current) is measured on the Multimeter. Additional to Ig, the Multimeter can selectively read relative RF output (which is a rectified RF signal), and Hv (plate voltage). Precise plate voltage reading is obtained through three serial voltage dividing resistors of 5% tolerance.

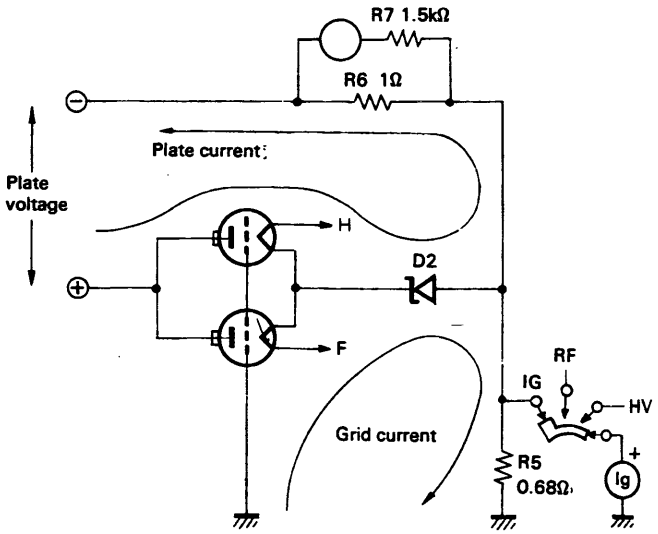


Fig. 3 Meter Drive Circuit

5. Spark Suppressor

The TL-922 contains an oversized relay for conservative operation and its action is slower than smaller relays. The TL-922 is momentarily run leaving the antenna circuit open in such operations as VOX. This leads to high Q at the output circuit which would cause excessive voltage at the plate tuning capacitor. This could arc the capacitor. To prevent this, a discharge gap device is installed at the antenna relay terminals to dissipate any unusually high voltage. During relay changeover, you might sometimes hear arcing from the discharge gap. This is not a failure and should be considered normal.

6. Mode Selecting Circuit

Zener diode D2 connected to the filament return circuit biases the cathode positive during transmission (makes the grid negative to the cathode). Thus, the grid is biased without floating it. Bias voltage is low to achieve low distortion. Plate voltage is 2.2kV, idling current 100mA in CW mode and 3.1kV at approximately 200mA in SSB mode. Therefore, plate dissipation power always exceeds 200W.

In SSB mode, the zener diode is shorted by S3 lowering distortion **(See Fig. 1)**.

MODE	At no signal	At transmission
SSB	Approx. 3100V	Approx. 2500V
CW	Approx. 2200V	Approx. 1700V

MODE (SSB ⟷ CW) is switched by switching the second tap of the high voltage transformer.

SECTION 4. CIRCUIT DESCRIPTION

7. High Voltage Transformer Protection.
   If the temperature of T1 rises over 145°C, the transformer protection thermostat locks the transmit relay in STBY. If protection has occured, it has likely been caused by a continuous run exceeding the rated capacity of the amplifier. Leave the POWER switch "ON" to allow forced air cooling. While cooling, the exciter will operate straight through. (**Fig. 4**)

8. High Voltage Primary and Secondary Safety Circuits
   When the top cover is opened, the high voltage transformer primary is switched off by S2. Power supply capacitors will discharge in 20 ~ 30 seconds. When the transmitting tube age is opened, the interlock grounds the B+ supply, discharging the power supply capacitors directly.

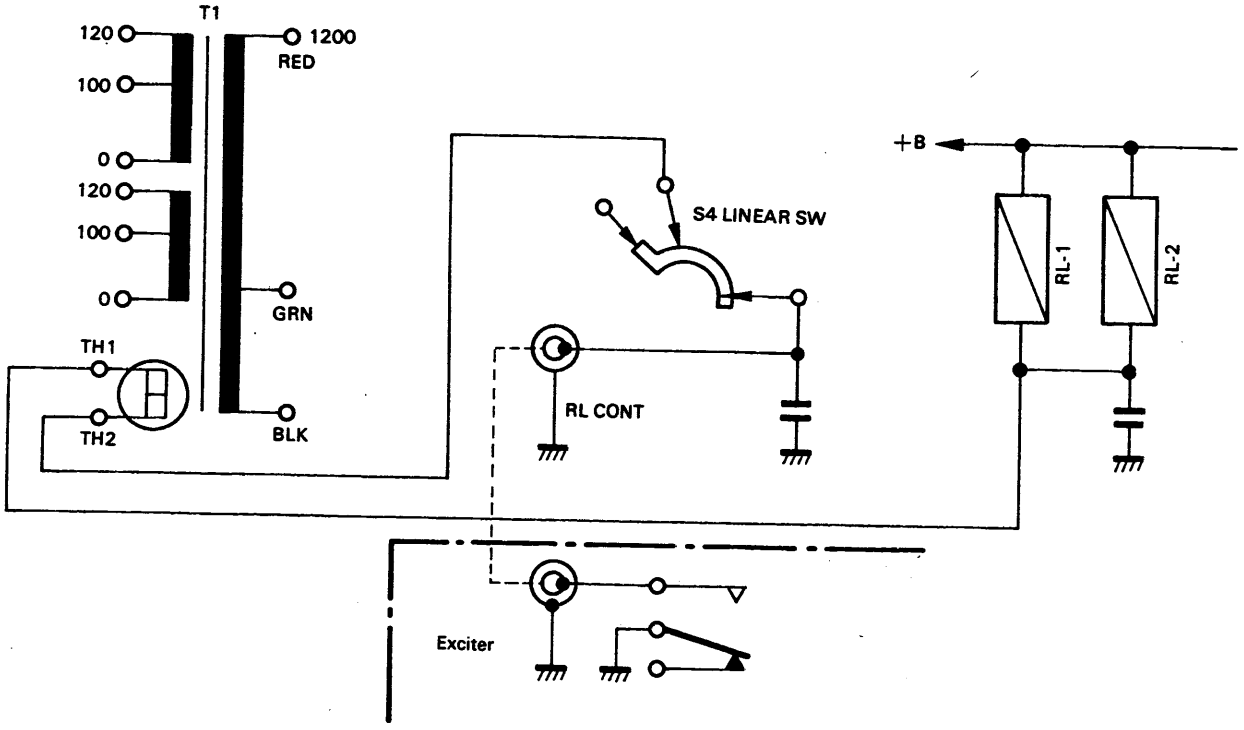
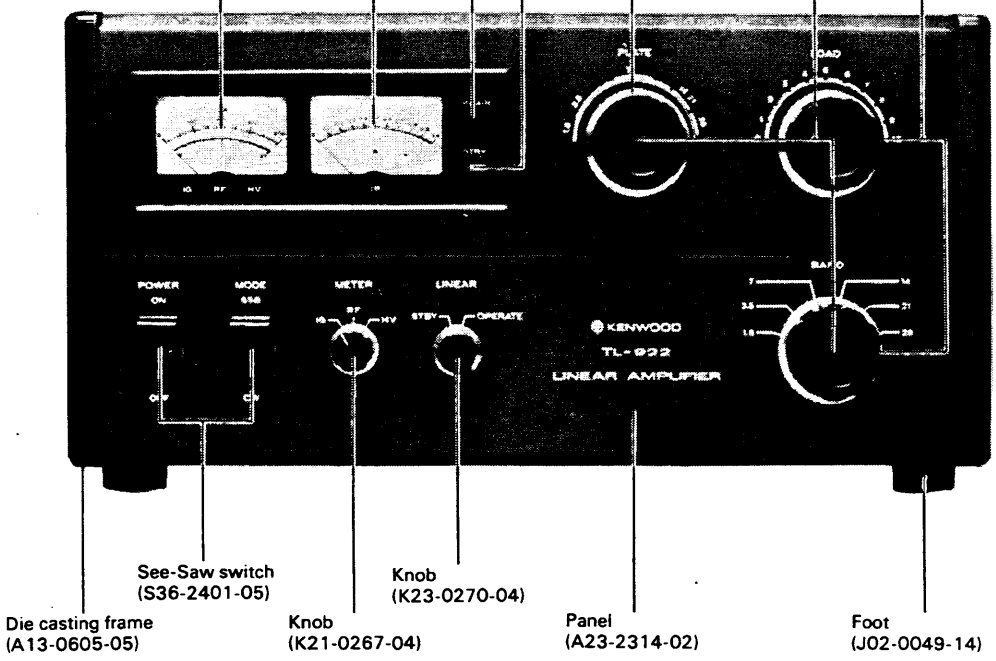
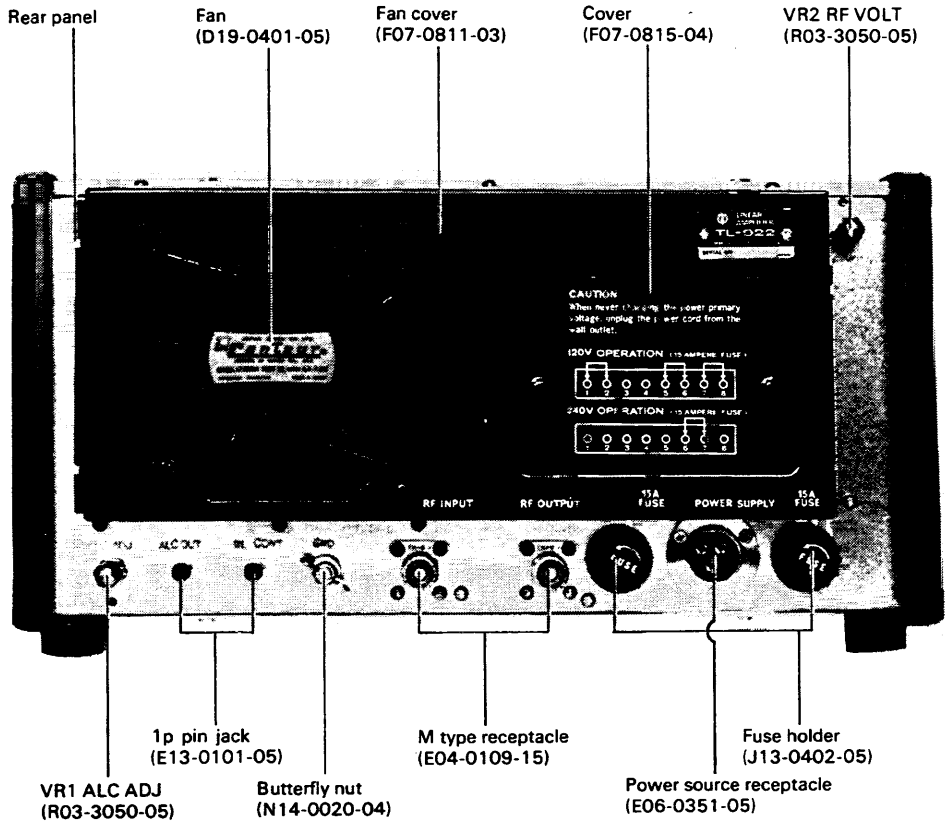


Fig. 4 Transformer Thermal Protection Circuit

SECTION 5. VIEWS

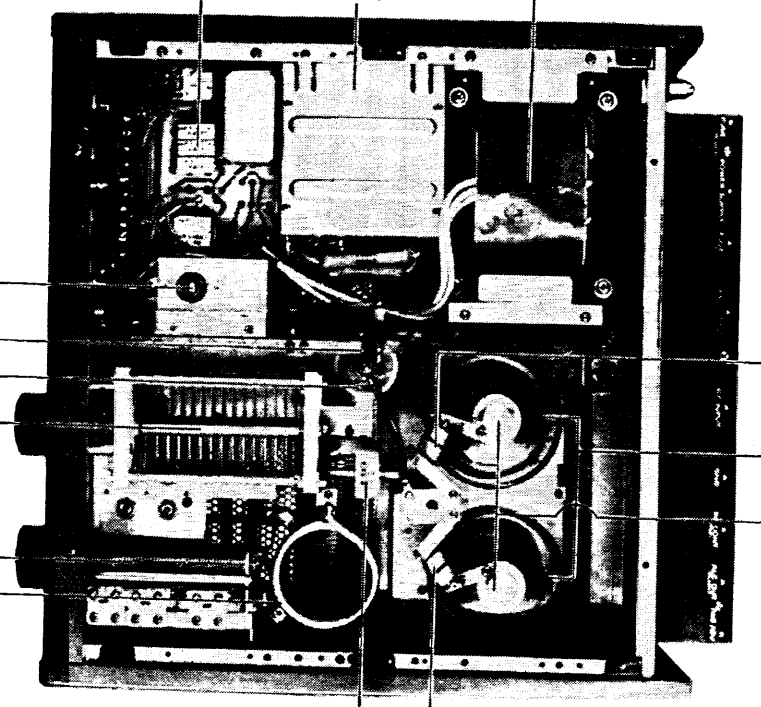
▼ EXTERNAL VIEW

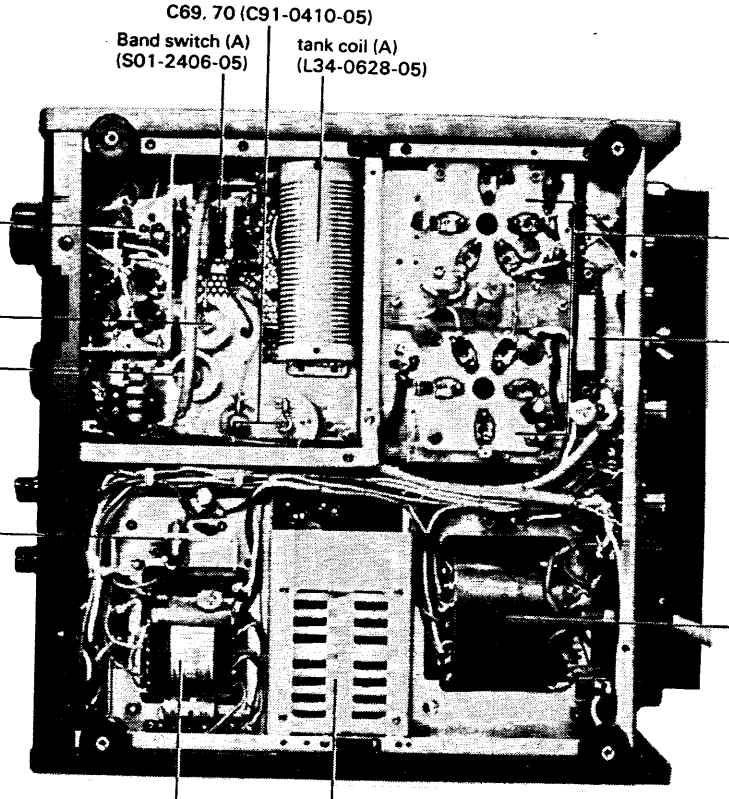




SECTION 5. VIEWS

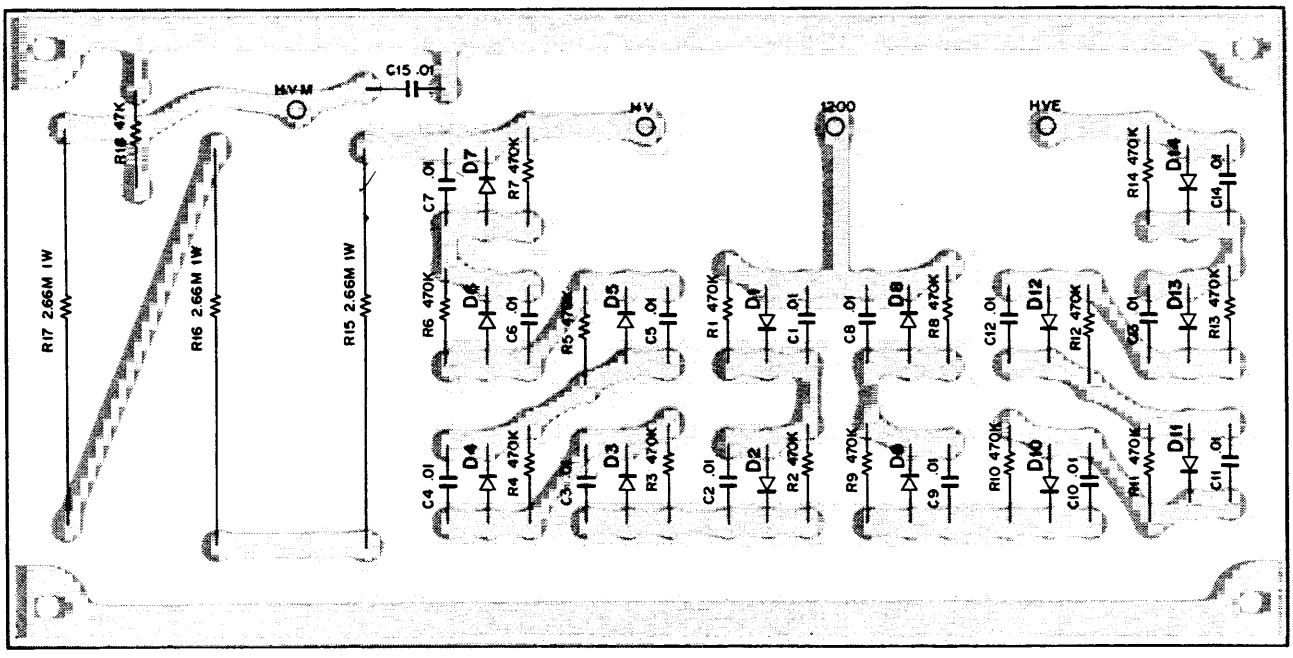
▼ INTERNAL VIEW



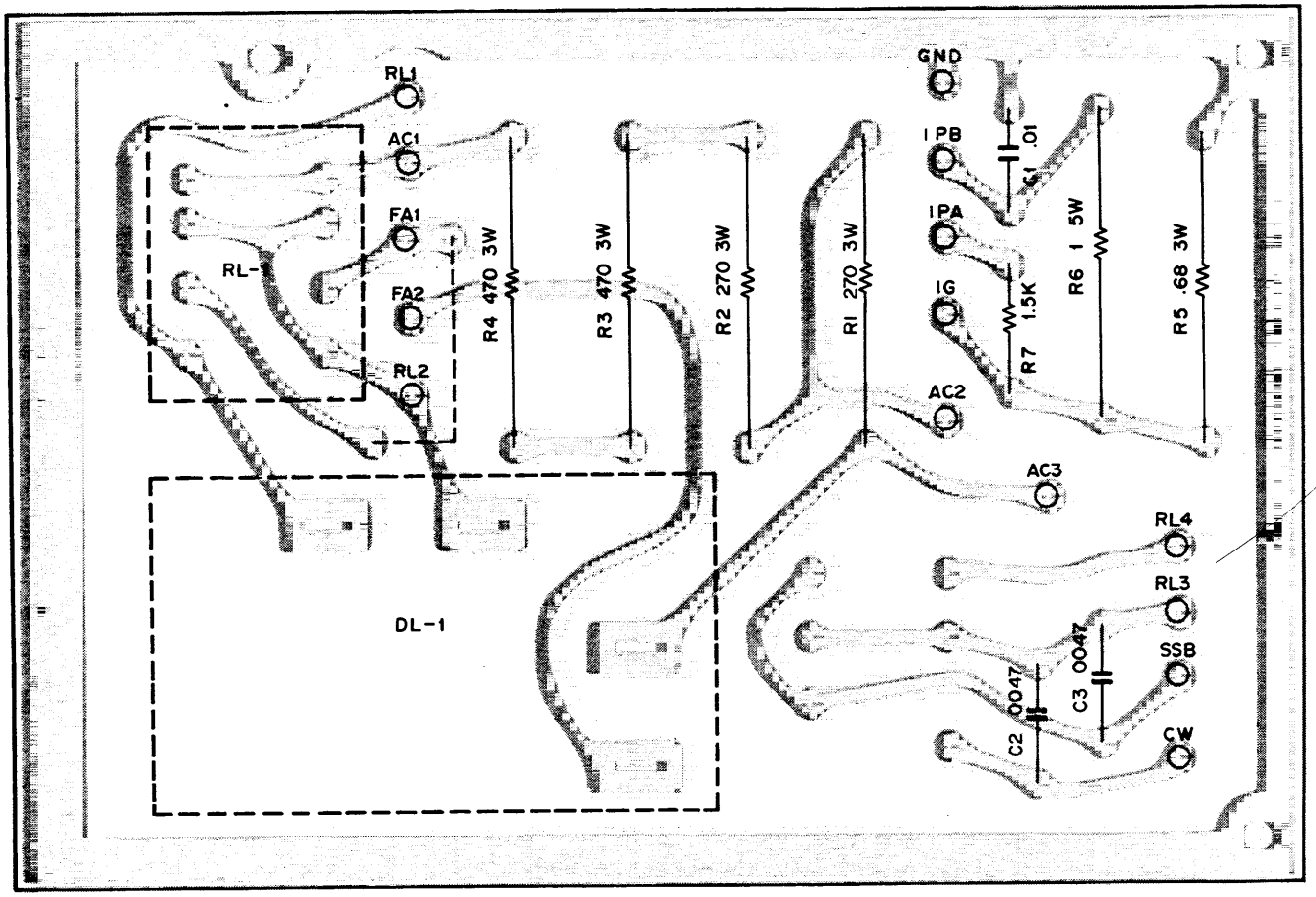


SECTION 6. PRINTED CIRCUIT BOARDS

▼ Rectifier Unit (X43-1280-10)



▼ Meter Unit (X54-1300-10)



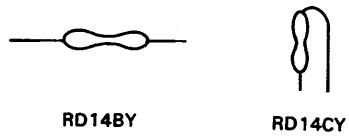
SECTION 7. PARTS LIST

NOTE:

Resistors except the special type (example: cement, metal film, etc.) are not detailed in PARTS LIST. With regard to the value, refer to the schematic diagram or the PC board illustration. Resistors not detailed are carbon type (1/4 or 1/8W). You should give an order for the carbon resistors according to the ways described as follows:

A carbon resistor's part number is; example RD14BY 2E 222J.

1. Kinds of the carbon resistor



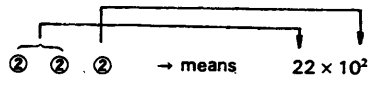
RD14BY RD14CY

2. Wattage

   1/4W → 2E

   1/8W → 2B

3. Resistance value



Significant figure Multiplier

Ecample:

221 → 220Ω

222 → 2.2kΩ

223 → 22kΩ

224 → 220kΩ

225 → 2.2MΩ

4. Torelance

   J = ±5% (Gold color)

   K = ±10% (Silver color)

GENERAL

☆: New parts [K]: USA, [W]: Europe

Ref. No.	Parts No.	Description			Remarks
CAPACITOR					
C1,2	C90-0300-05	Ceramic	470pF	AC150V	
C3	CE02W2C330	Electrolytic	33μF	160WV	
C4	CK45D2H472M	Ceramic	4700pF	±20%	
C5,6	CK45D1H223M	Ceramic	0.011μF	±20%	
C7～14	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C15～22	C90-0803-05	Electrolytic	200μF	500WV	☆
C23,24	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C25	C90-0409-05	HV Capacitor	2000pF	15kV	
C26	CE04W1C101	Electrolytic	100μF	16WV	
C27	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C28～33	CM93D2H221J	Mica	220pF	±5%	
C34	C91-0408-05	HV Capacitor	2000pF	15kV	☆
C35	CC45SL1H100D	Ceramic	10pF	±0.5pF	
C36～39	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C40	CC45SL2H150J	Ceramic	15pF	±5%	
C41	CC45SL2H470J	Ceramic	47pF	±5%	
C42	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C43	C91-0406-05	HV Capacitor	100pF	7.5kV	☆
C44	C91-0407-05	HV Capacitor	200pF	7.5kV	☆
C45	C91-0413-05	HV Capacitor	47pF	3.15kV	
C46	Missing Number				
C47	CM93D2H561J	Mica	560pF	±5%	
C48,49	CM93D2H102J	Mica	1000pF	±5%	
C50	CM93D2H561J	Mica	560pF	±5%	
C51～53	CM93D2H331J	Mica	330pF	±5%	
C54	CM93D2H471J	Mica	470pF	±5%	
C55	CM93D2H101J	Mica	100pF	±5%	
C56,57	CM93D2H221J	Mica	220pF	±5%	
C58	CM93D2H121J	Mica	120pF	±5%	
C59	CM93D2H221J	Mica	220pF	±5%	
C60	CM93D2H121J	Mica	120pF	±5%	
C61～65	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C66	C91-0412-05	Ceramic	4700pF	AC500V	☆
C67,68	Missing Number				
C69,70	C91-0410-05	HV Capacitor	500pF	3kV	☆
C71～74	Missing Number				
C75,76	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
C77	CC45SL2H220J	Ceramic	22pF	±5%	
C78	CK45E2H103P	Ceramic	0.01μF	+100%,−0%	
RESISTOR					
R1～21	RC05GF2HOOOJ	Carbon	OOOΩ*	±5% 1/2W	
		*Refer to schematic diagram.			
R11	RS14AB3A683J	Metal film	68kΩ	±5% 1W	
R13～20	RS14AB3Y473J	Metal film	47kΩ	±5% 7W	
SEMICONDUCTOR					
D1	V11-0285-05	Diode V06E			
D2	V11-3161-76	Zener diode 1S265			☆
D3	V11-0370-05	Diode 1S1587			
D4	V11-0051-05	Diode 1N60			
D7	V11-0270-05	Diode U05B			
POTENTIOMETER/VC					
VR1,2	R03-3050-05	10kΩ (B) Potentiometer			
VC1	C02-0007-05	Variable capacitor (plate) 154pF AC 4kV a minute			☆
VC2	C02-0008-05	Variable capacitor (load) 1920pF (1150pF+770pF) DC 1kV a minute			☆
SWITCH/RELAY					
S1	S36-2401-05	See-saw switch			☆
S2	S50-2401-05	Micro switch			☆
S3	S36-2401-05	See-saw switch			☆
S4	S01-1042-05	Rotary switch STBY			
S5	S01-1017-05	Rotary switch meter			
S6	S01-2407-05	Band switch B			☆
S7	S01-2406-05	Band switch A			☆
RL1	S51-2403-05	Relay			☆
RL2	S51-2402-05	Relay			☆
COIL/TRANSFORMER					
L1	L33-0610-05	Choke coil 160μH PLATE			☆
L2	L33-0609-05	Choke coil 12μH			☆
L3	L33-0612-05	Choke coil 22μH Filament			☆
L4	L34-0629-05	Tank coil B 14～28 MHz			☆
L5	L34-0628-05	Tank coil A 1.9～7 MHz			☆
L7,8	L33-0259-05	Choke coil 470μH (Safety)			
L9	L34-0630-05	Input tuning coil A 1.9 MHz			☆
L10	L34-0631-05	Input tuning coil B 3.5 MHz			☆
L11	L34-0632-05	Input tuning coil C 7MHz			☆
L12	L34-0633-05	Input tuning coil D 14 MHz			☆
L13	L34-0634-05	Input tuning coil E 21 MHz			☆
L14	L34-0635-05	Input tuning coil F 28 MHz			☆
L15～17	L34-0637-05	Beads (Ferrite)			☆
L18	L33-0611-05	Choke coil 1 mH			☆
L19	L34-0637-05	Beads (Ferrite)			☆
L20	L33-0613-05	Choke coil 80μH			☆
T1	L01-8026-05	Power transformer			☆
T2	L01-8036-05	Filament transformer			☆

SECTION 7. PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
PC1	L39-0401-05	Parastic suppressor (clockwise winding)	☆
PC2	L39-0402-05	Parastic suppressor (counterclockwise winding)	☆
		MISCELLANEOUS	
V3		Surge absorber DSA-301LS	☆
—	A01-0715-05	Case	☆
—	A01-0717-03	Control case	☆
—	A20-2314-02	Panel	☆
—	A20-2316-02	Panel assembly	☆
—	B08-2302-04	Indicating window A (red)	☆
—	B08-9302-04	Indicating window B (white)	☆
—	B09-0003-05	Coupling × 2	
—	B10-0609-03	Front glass	☆
—	B20-0807-04	Dial plate A 8ϕ	☆
—	B20-0808-04	Dial plate B × 2 6ϕ	☆
—	B30-0048-05	Lamp × 6 8V 50 mA	
—	B31-0607-05	Meter A HV, IG, RF	☆
—	B31-0608-05	Meter B Ip	☆
—	B40-2423-04	Model name plate	☆
—	B46-0058-00	Warranty card [K]	
—	B50-2552-00	Operating manual	☆
—	D19-0401-05	Fan	☆
—	D40-0602-05	Vernier mechanism assembly	☆
—	E01-0001-05	Tube socket 5P × 2	☆
—	E04-0109-15	M type receptacle × 2	
—	E06-0351-05	Power source receptacle 3p	☆
J1,2	E13-0101-05	Pin jack 1P × 2	
—	E20-0314-05	Terminal strip 3P	
—	E20-0512-05	Terminal strip 5P × 3	
—	E20-0881-05	Terminal strip 8P [K: 1] [W: 2]	☆
—	E20-1003-05	Terminal strip 10P	
—	E22-0207-05	Lug	
—	E23-0014-04	Acme terminal × 2	
—	E23-0402-05	Straight through time terminal	☆
—	E23-0403-05	Joint terminal	☆
—	E23-0404-05	Press-fit terminal × 23	☆
—	E23-0406-04	Lugs × 4	☆
—	E29-0402-04	Shorted terminal	☆
—	F02-0407-04	Plate cap × 2	☆
—	F02-0408-04	Heat radiator	☆
—	F05-1533-05	Fuse 15A × 4	☆
—	F15-1610-03	Shading plate	☆
—	F15-0614-04	Switch mask	☆
—	F20-0507-02	Separating plate	☆
—	F20-0508-04	Insulating plate	☆
—	F29-0014-05	Insulating washer × 4	
—	G02-0503-04	Breaking spring	☆
—	G09-0401-04	Back spring × 2	☆
—	G13-0612-04	Cushion × 2	☆
—	H01-2554-04	Carton case (inside) [K]	☆
—	H01-2555-04	Carton case (inside) [W]	☆
—	H03-1655-04	Carton case (outside) [K]	☆
—	H03-1656-04	Carton case (outside) [W]	☆
—	H12-0418-04	Cushion (Set)	☆
—	H12-0429-04	Cushion	☆
—	H12-0435-03	Cushion (Bottom)	☆
—	H12-0436-04	Cushion (Middle)	☆
—	H20-1403-03	Protection cover	☆
—	H25-0106-04	Polyetylene bag	
—	H25-0117-04	Polyetylene bag	
—	H39-0101-05	Joint (plastics) × 4	
—	J02-0049-14	Foot × 6	
—	J13-0402-05	Fuse holder × 2	☆
—	J21-2537-04	PC board A × 2	☆
—	J21-2538-03	PC board B	☆
—	J29-0401-04	GND hard-ware	☆
—	J30-0061-04	Spacer (rubber) × 2	
—	J30-0503-04	Spacer (for foot) × 8	☆
—	J32-0710-04	Stud A (high voltage)	☆
—	J32-0711-04	Stud B (power source)	☆
—	J32-0712-04	Round boss × 2	☆
—	J42-0038-04	Bushing × 2	
—	J59-0001-05	Grommet (carrying handle) × 2	
—	J59-0002-05	Plunger × 2	
—	J61-0019-05	Vinyl tie × 3	
—	K01-0401-05	Carring handle × 2	☆
—	K21-0267-04	Knob (small) METER	
—	K21-0715-04	Knob (large) × 3	☆
—	K23-0270-04	Knob LINEAR	
—	N09-0256-05	GND screw × 27	
—	N10-2030-46	Nut	
—	N10-2040-46	Nut (soket) × 8	
—	N10-3060-11	Nut (M6) (for GND)	
—	N14-0020-04	Butterfly nut (M6) (for GND)	
—	N14-0069-14	Cap nut	
—	N15-1030-46	Washer × 8	
—	N15-1040-46	Washer × 8	
—	N16-0038-46	Spring washer	
—	N16-0040-46	Spring washer × 20	
—	N16-0060-14	Spring washer (for GND)	
—	N19-0089-00	Washer (for GND)	
—	N19-0603-04	Nylon washer × 8 (for socket)	☆
—	N30-4012-46	Pan head screw × 4 (for auxiliary foot)	
—	N35-4006-11	Binding screw × 12 (case, handle)	
—	N87-3010-46	Tapping screw × 4 (Terminal stand)	
—	N87-4012-46	Tapping screw × 2 (Foot)	
—	X42-1090-10	Power cord assembly with plug	☆
—	X42-1110-10	Control cable ass'y	☆
—	X42-1120-10	Coaxial cable ass'y	☆
—	X43-1280-10	Rectifier unit	☆
—	X54-1300-10	Meter unit	☆

POWER CORD ASS'Y (X42-1100-00)

Ref. No.	Parts No.	Description	Re-marks
—	E07-0351-05	Plug 3P	
—	E19-0251-05	AC plug 2P	
—	J61-0014-05	Free-up belt	☆

CONTROL CABLE ASS'Y (X42-1110-10)

Ref. No.	Parts No.	Description	Re-marks
—	E12-0010-05	RCA type pin plug 1P	
—	E14-0801-05	US plug	
—	J42-0402-05	Cord bushing	☆

SECTION 7. PARTS LIST

COAXIAL CABLE ASS'Y (X42-1120-10)

Ref. No.	Parts No.	Description	Re-marks
—	E05-0117-05	M type plug × 2	

RECTIFIER UNIT (X43-1280-10)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1～15	CK45E2H103P	Ceramic 0.01μF +100%,−0%	
		RESISTOR	
R1～14	RC05GF2H474J	Carbon 470kΩ ±5% 1/2W	
R15～17	R92-0608-05	Cement 2.66MΩ 1W	☆
R18	RC05GF2H473J	Carbon 47kΩ ±5% 1/2W	
		SEMICONDUCTOR	
D1～14	V11-0282-09	Diode V08J	
		MISCELLANEOUS	
—	E23-0047-04	Lapping terminal × 4	

METER UNIT (X54-1300-10)

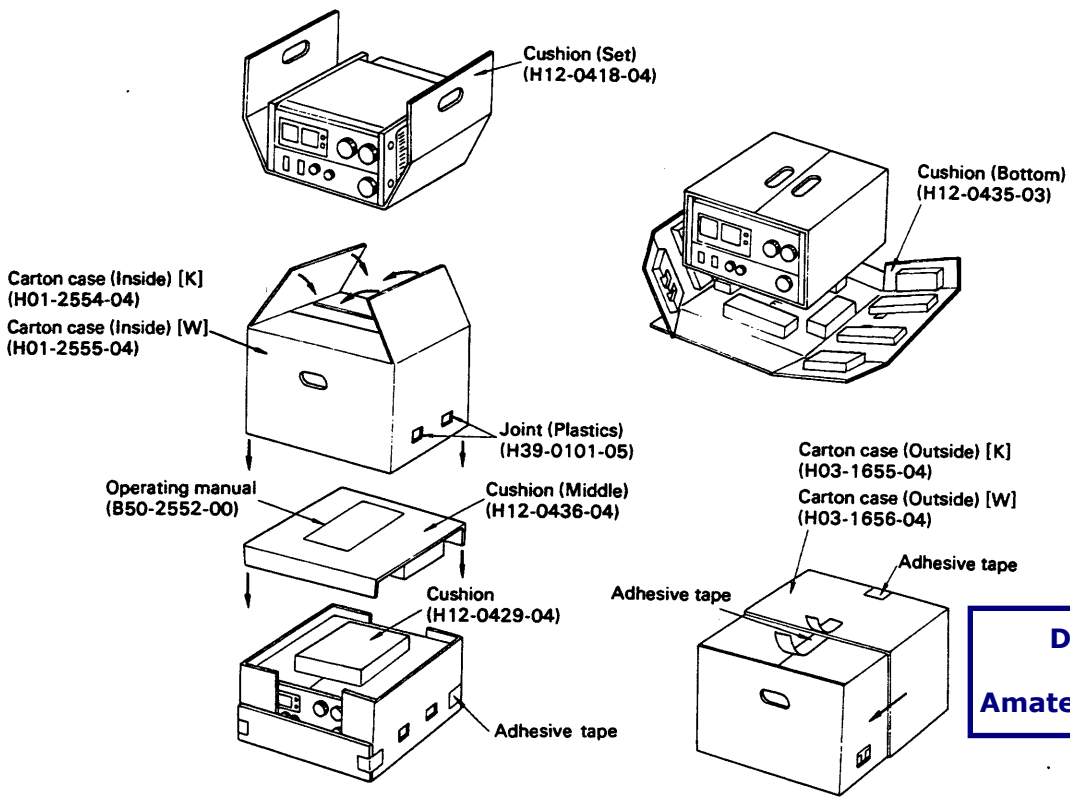
Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CK45E2H103P	Ceramic 0.01μF +100%,−0%	
C2,3	C91-0412-05	Ceramic 0.0047μF AC 500V	

Ref. No.	Parts No.	Description	Re-marks
		RESISTOR	
R1	R92-0610-05	Cement 270Ω ±5% 3W	☆
R2～4	R92-0614-05	Cement 470Ω ±5% 3W	☆
R5	R92-0606-05	Cement 0.68Ω ±5% 3W	☆
R6	R92-0607-05	Cement 1Ω ±5% 5W	☆
R7	RC05GF2H152J	Carbon 1.5kΩ ±5% 1/2W	
		MISCELLANEOUS	
RL1	S51-2404-05	Relay	☆
DL1	S59-1402-05	Timer relay (100V 140 sec.)	☆
—	E23-0047-04	Lapping terminal	

ACCESSORIES (Supplied)

1. Operating manual (B50-2552-00) ..... 1 copy
2. AC power cord (X42-1090-10) ..... 1 piece
3. Coaxial cable, 1.5 m, with M-typ connectors (X42-1100-00) ..... 1 piece
4. Control cable (X42-1110-10) ..... 1 piece
5. Spare fuse, 15A (F05-1533-05) ..... 2 pieces
6. Foot (J02-0049-14) ..... 2 pieces
7. Screws, 4 × 12 mm long (N30-4012-46) ..... 2 pieces
8. Plate cap (F02-0407-04) ..... 2 pieces
9. Parasitic suppressor coil, right hand (L39-0401-05) ..... 1 piece
10. Parasitic suppressor coil, left hand (L39-0402-05) ..... 1 piece
11. Screw, 3 × 6 mm long (N30-3006-46) ..... 4 pieces
12. Plain washer (N15-1030-46) ..... 4 pieces
13. Spring washer (N16-0030-46) ..... 4 pieces

SECTION 8. PACKING



SECTION 9. DISASSEMBLY AND ADJUSTMENT NOTES

These are high voltage and large current handling circuits. Exercise the greatest care when working inside the unit. Carelessness could endanger your life.

WARNING

1) Disconnect the AC line cord before removing the covers. When the top cover is removed, the primary protection switch will disconnect AC input to the high voltage transformer. However, the low voltage transformer remains connected to the AC line. When the transmitting tube compartment cover is removed, the high voltage secondary supply will be grounded, but the electrolytic capacitors may remain charged. Use an insulated screw driver to verify they are fully discharged.
2) Adjustments are made with both safety interlocks bypassed, and lethal voltages are present at both sides of the cha-sis. Observe all standard safety procedures regarding high RF, AC and DC potentials.

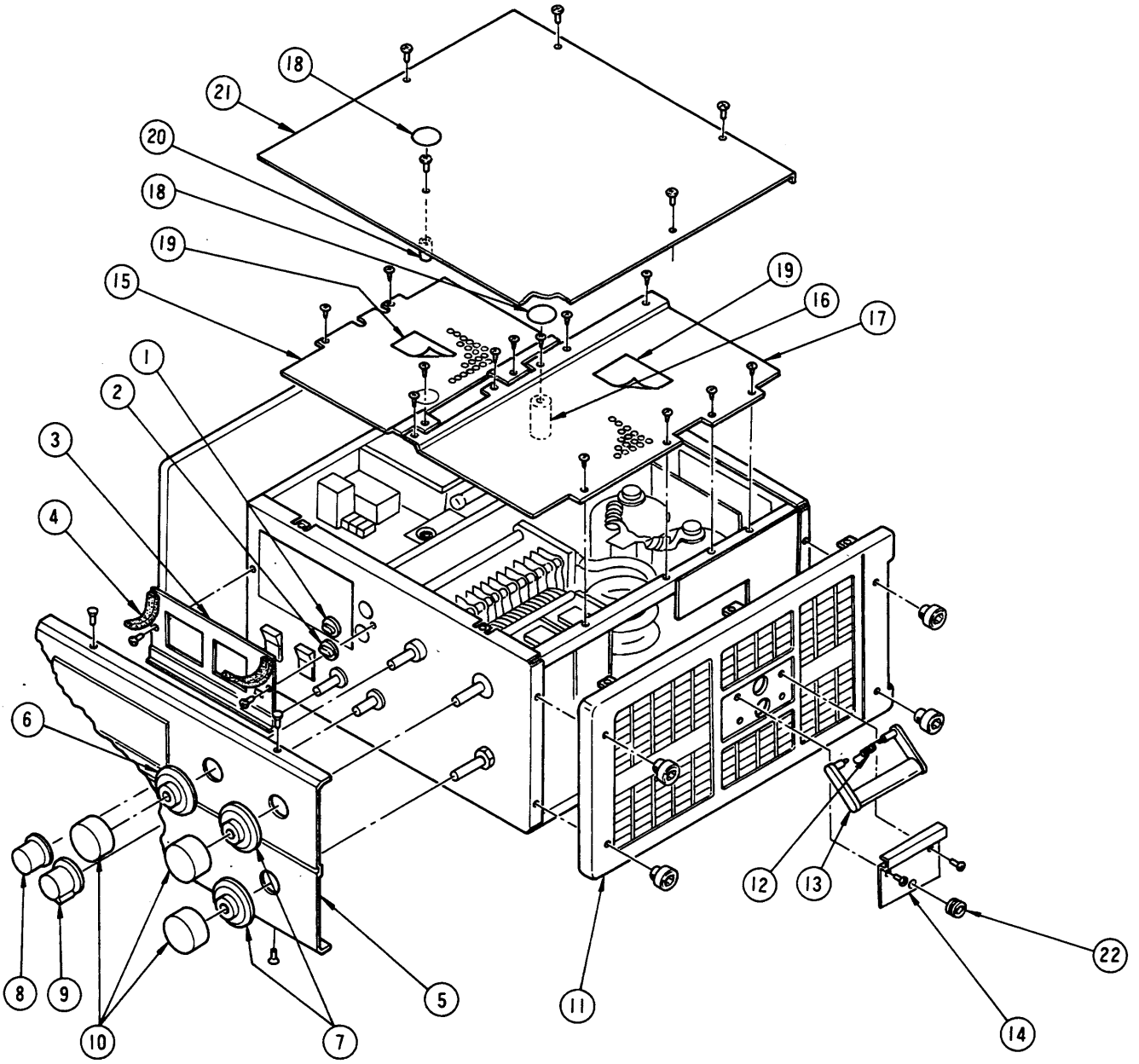
TUBE REPLACEMENT

In addition to the preceeding warnings, please observe the following:

CAUTION

At no time should excessive force be applied to glass envelopes or ceramic sockets. Excessive strain on the pins may fracture the envelope. Check pin indexing before you attempt to insert tubes. Always handle the tube by its envelope, not by the plate cap.

SECTION 10. DISASSEMBLY



No.	Description	Parts No.	Remarks	No.	Description	Parts No.	Remarks
1	Indicating window A	B08-2302-04	ON AIR	12	Back spring	G09-0401-04	
2	Indicating window B	B08-9302-04	STBY	13	Carrying handle	K01-0401-05	
3	Blinding plate	F15-0610-03		14	Handle cover		
4	Cushion	G13-0612-04		15	Control case	A01-0717-03	
5	Panel ass'y	A20-2317-02		16	Short stud A	J32-0710-04	for High voltage
6	Dial plate A	B20-0807-04	PLATE	17	Shield plate		
7	Dial plate B	B20-0808-04	LOAD, BAND	18	Coution sticker		
8	Knob	K21-0267-04	METER	19	Caution sticker (High voltage)		
9	Knob	K23-0270-04	LINEAR	20	Short stud B	J32-0711-04	for Power source
10	Knob	K21-0715-04	PLATE, LOAD, BAND	21	Case	A01-0715-02	
11	Die-casting frame			22	Bushing	J42-0038-04	

Fig. 5 Chassis and Front Panel

SECTION 10. DISASSEMBLY

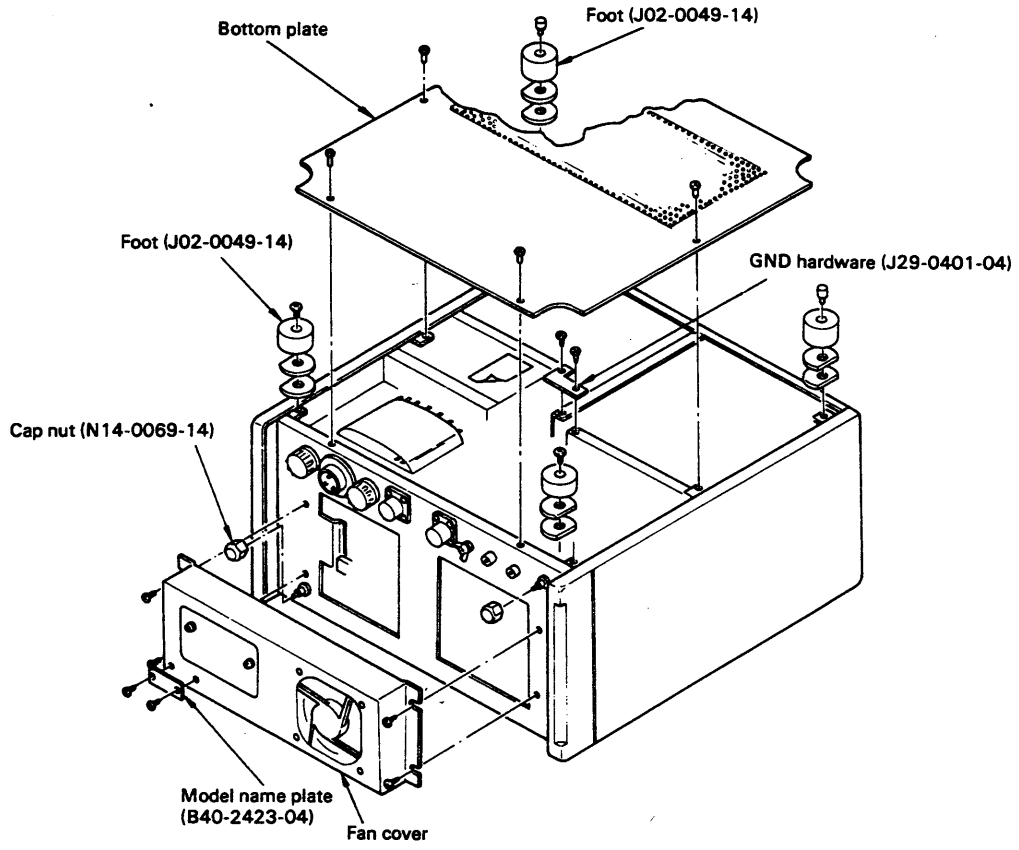


Fig. 6 Subpanel

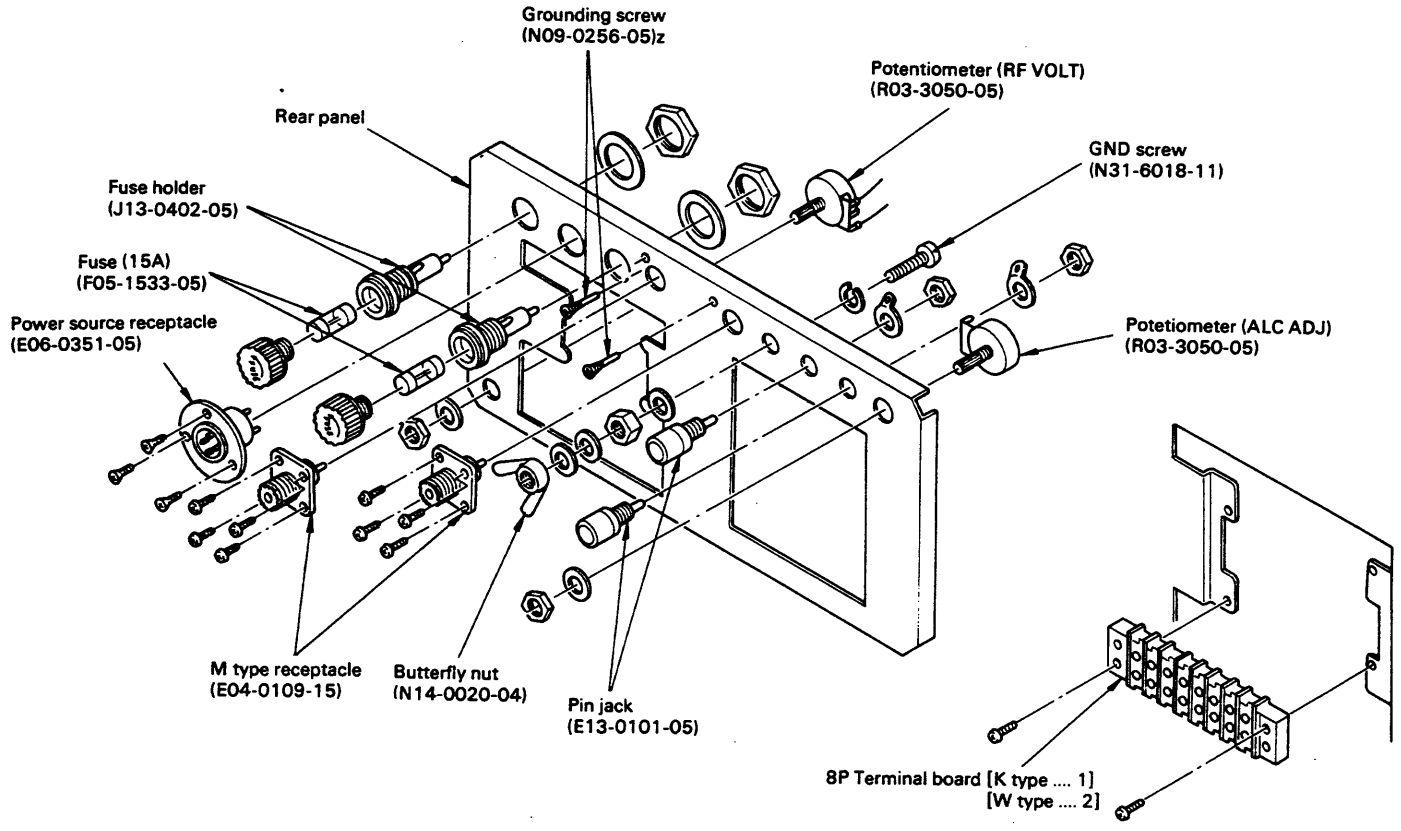


Fig. 7 Rear Panel

SECTION 10. DISASSEMBLY

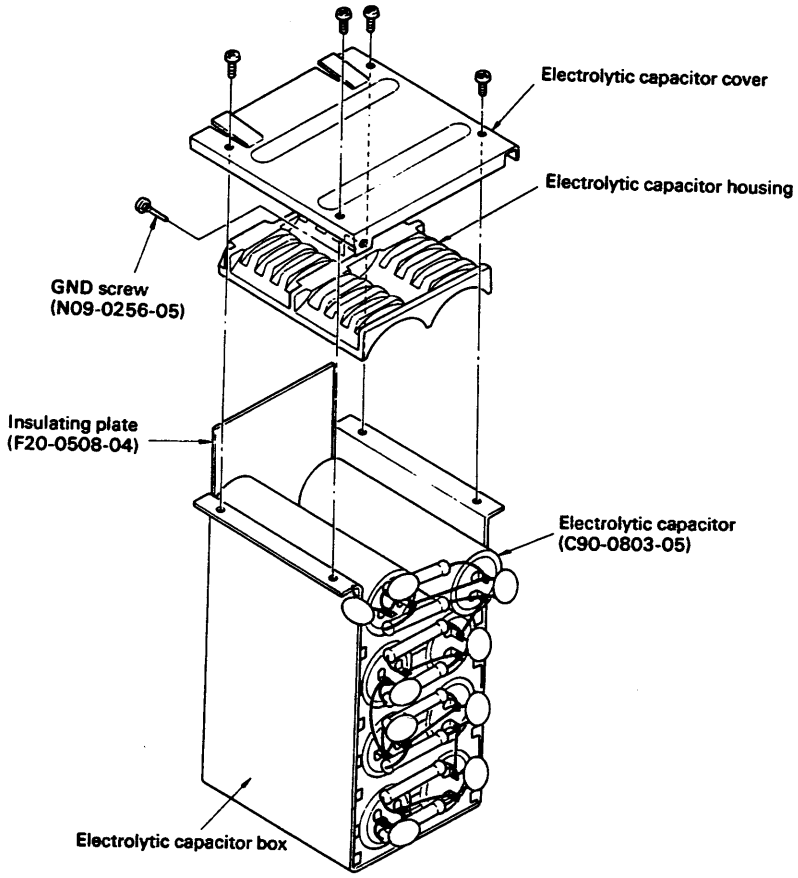


Fig. 8 Electrolytic Assembly

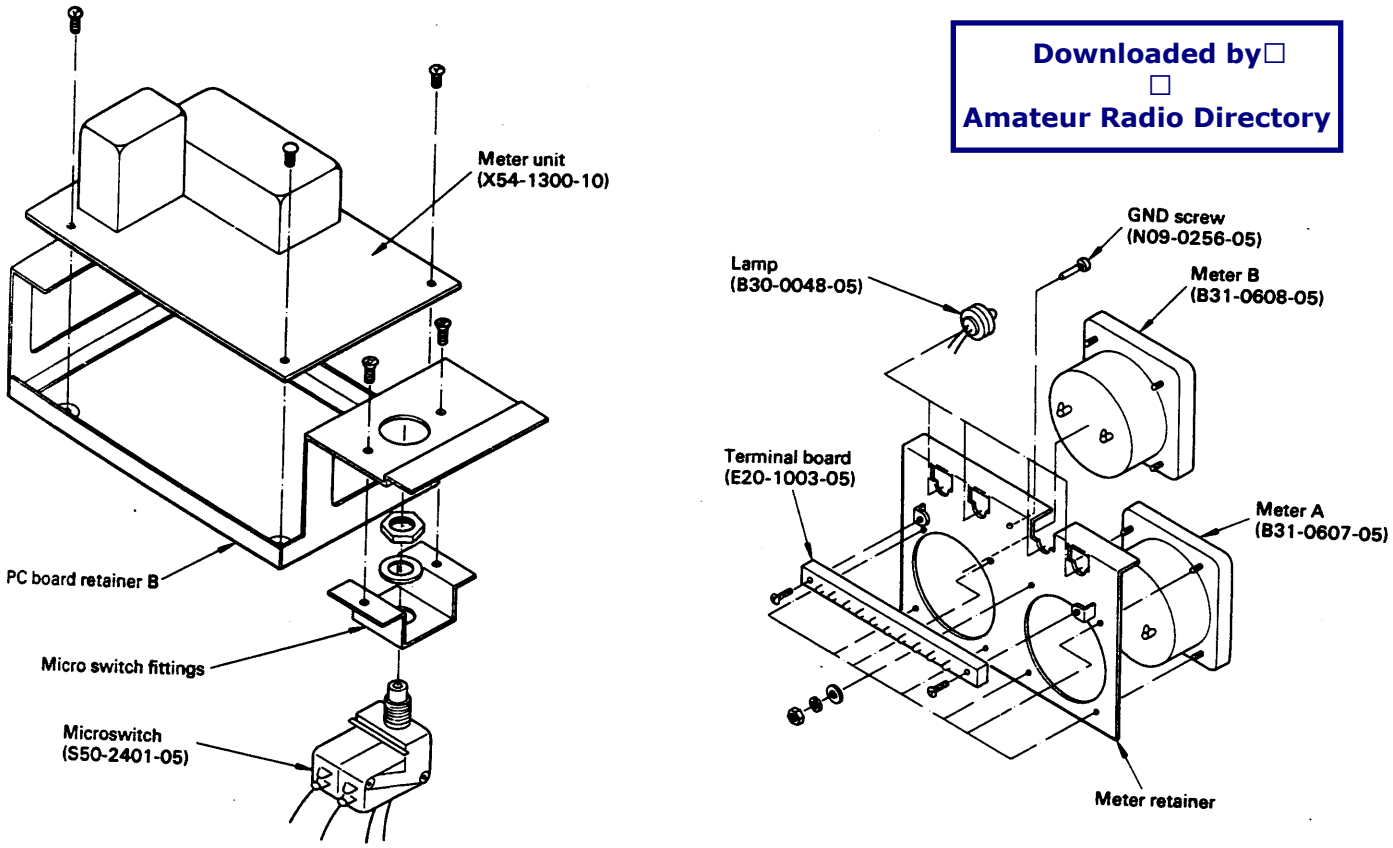


Fig. 9 Relay and Meter Mountings

SECTION 10. DISASSEMBLY

Power Transformer: (Fig. 10)

1) Remove the upper and lower cases.
2) Remove the upper shielding plate.
3) Loosen 2 upper screws of the electrolytic capacitor assembly.
4) Remove leads from the transformer.
5) Remove 8 screws marked ★.

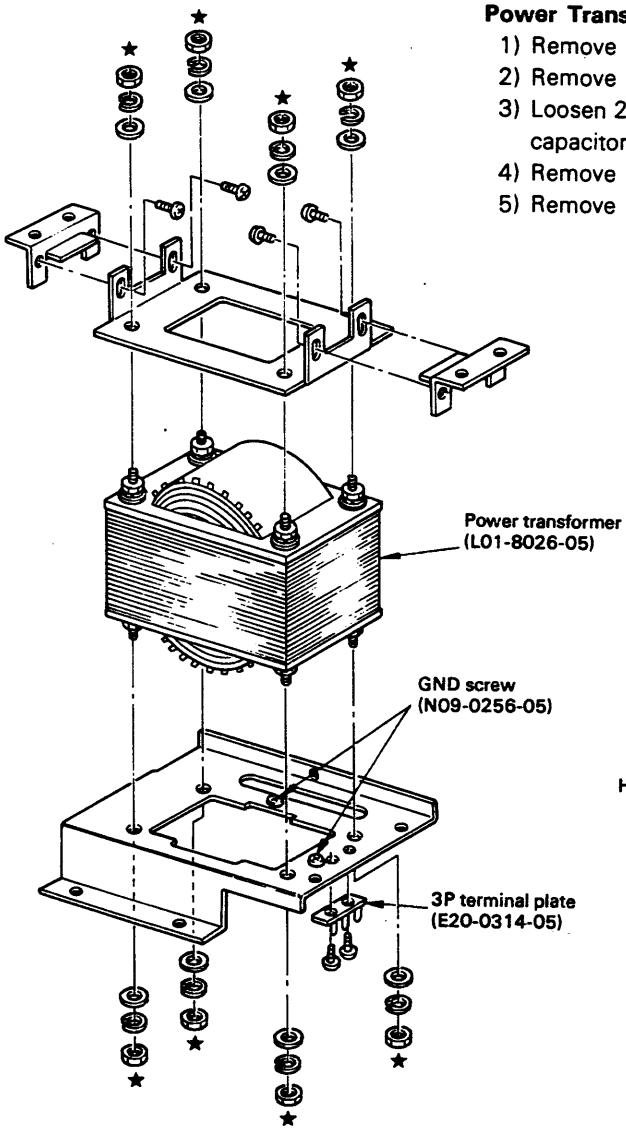


Fig. 10 Disassembly Power Transformer

Filament Transformer: (Fig. 11)

1) Remove the upper and lower cases.
2) Remove the upper shielding plate.
3) Remove the meter unit mounting and disconnect leads CW, SSB and RL3.
4) Remove heater transformer leads.
5) Remove 4 screws marked ★.

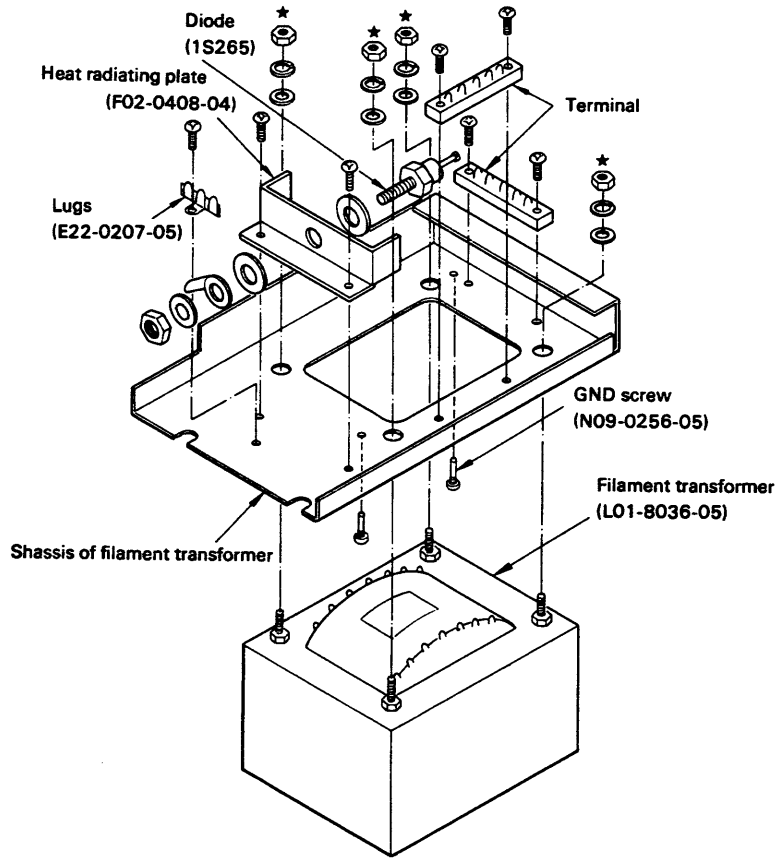


Fig. 11 Disassembly Filament Transformer

SECTION 10. DISASSEMBLY

Plate Variable Capacitor: (Fig. 12a)

1) Remove the top cover and the cage cover.
2) Remove screws marked ★ and the HV capacitor C34.

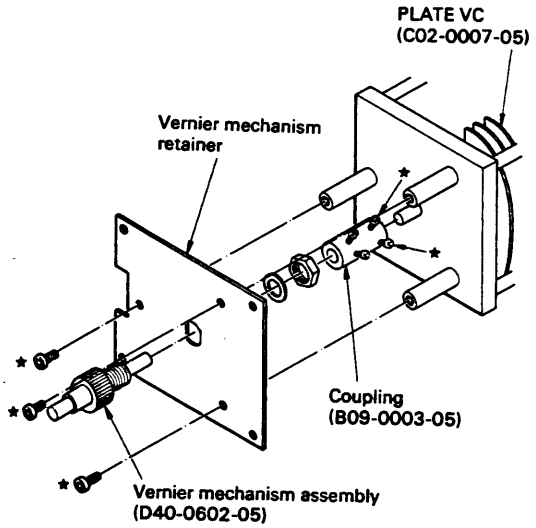


Fig. 12a Disassembly Plate Variable Capacitor

Coupling Capacitor:

1) Remove the top cover and the cage cover.
2) Remove screws according to **Fig. 12b**.

NOTE:
Treat the coupling capacitor carefully.

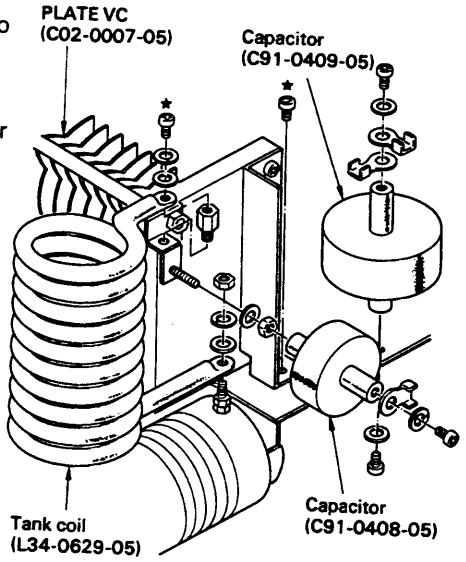


Fig. 12b Output Coupling Capacitor

Rectifying Unit: (Fig. 13)

1) Remove the upper and lower cases.
2) Remove the cage cover.
3) Remove the meter mounting.
4) Remove the HV lead.
5) Remove 3 screws marked ★.
6) Rotate the assembly clockwise and withdraw

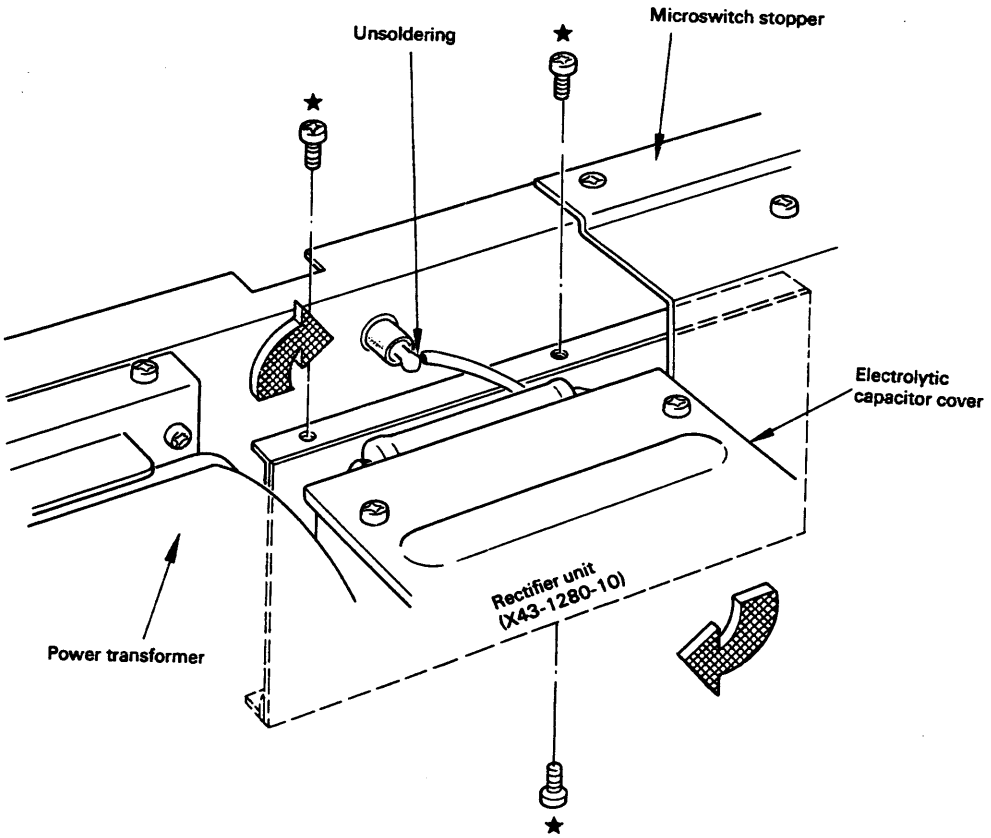


Fig. 13 Rectifying Unit

SECTION 11. LINE VOLTAGE CHANGE

WARNING

DISCONNECT THE AC INPUT POWER CABLE FROM THE TL-922 BEFORE PROCEEDING.

There are two versions of the TL-922; A 240/120V line model and a 220/240V line model. The input voltage in either version can be changed either up or down as required, by changing the power transformer input links located in the duct on the rear panel.

NOTE:

The 240/120V version was set in the 120V position and the 220/240V version in the 220V position.

To change link positions, remove the access cover by the two black snap fasteners. Loosen the screws holding the shorting bars, a few turns only. (Do not loosen excessively as they could drop into the amp.) Draw each shorting bar upward for removal, and replace the bars for the operating voltage desired (**Fig. 14**). Be sure to tighten the screws from which the shorting bars were removed, besides securing the bars in their new positions.

CAUTION: BE SURE TO TIGHTEN ALL LOOSENED SCREWS.

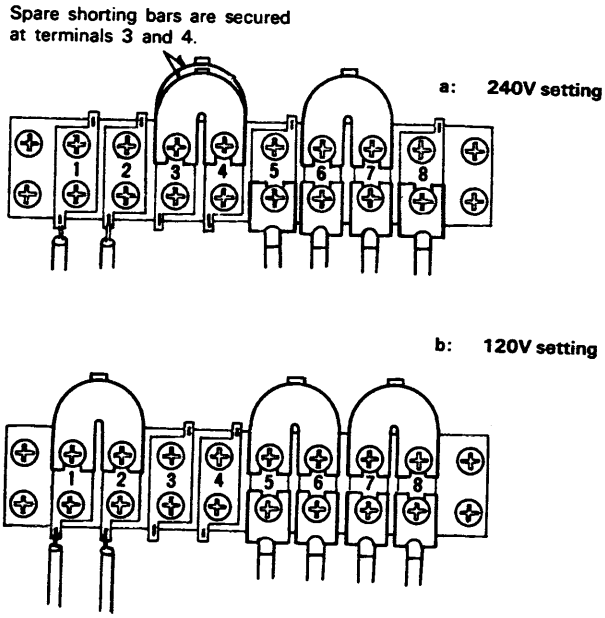


Fig. 14a 240/120V Version [K type] Input Voltage Terminal Boards

NOTE:

Fuses need not be changed in current rating when the input voltage is changed.

1) 240/120V Version
   This version has one input voltage terminal board, which was set to 120V at the factory. For 240V line, replace the short bars as illustrated. Spare shorting bars are secured at Terminals 3 and 4.
2) 220/240V Version
   This version has two input voltage terminal boards, which were set to 220V at the factory. For 240V line, replace the shorting bars as illustrated.

CAUTION: BE SURE TO TIGHTEN ALL LOOSENED SCREWS.

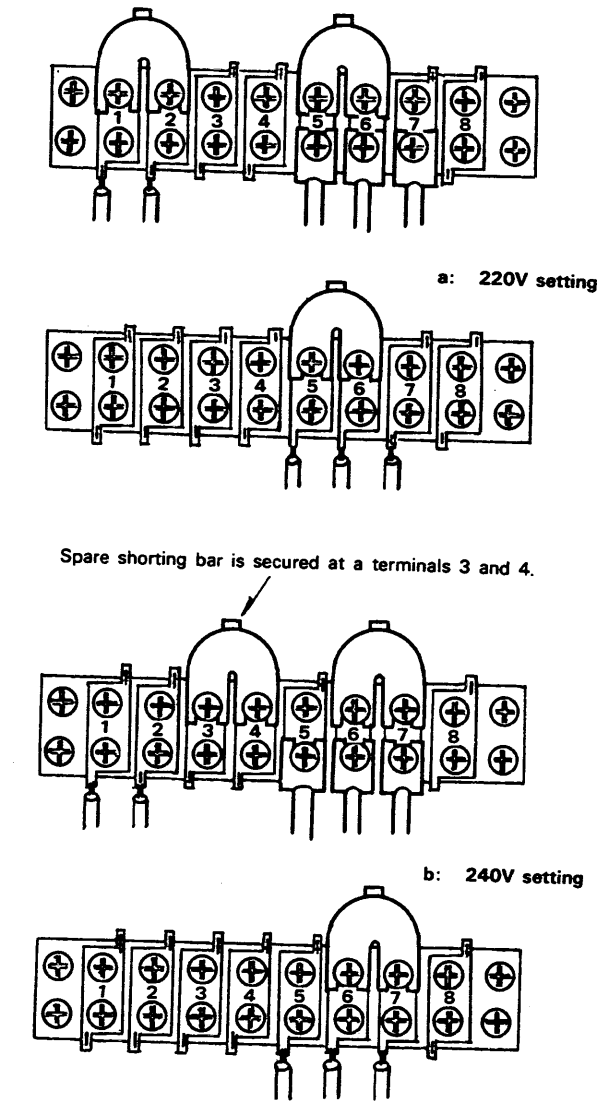
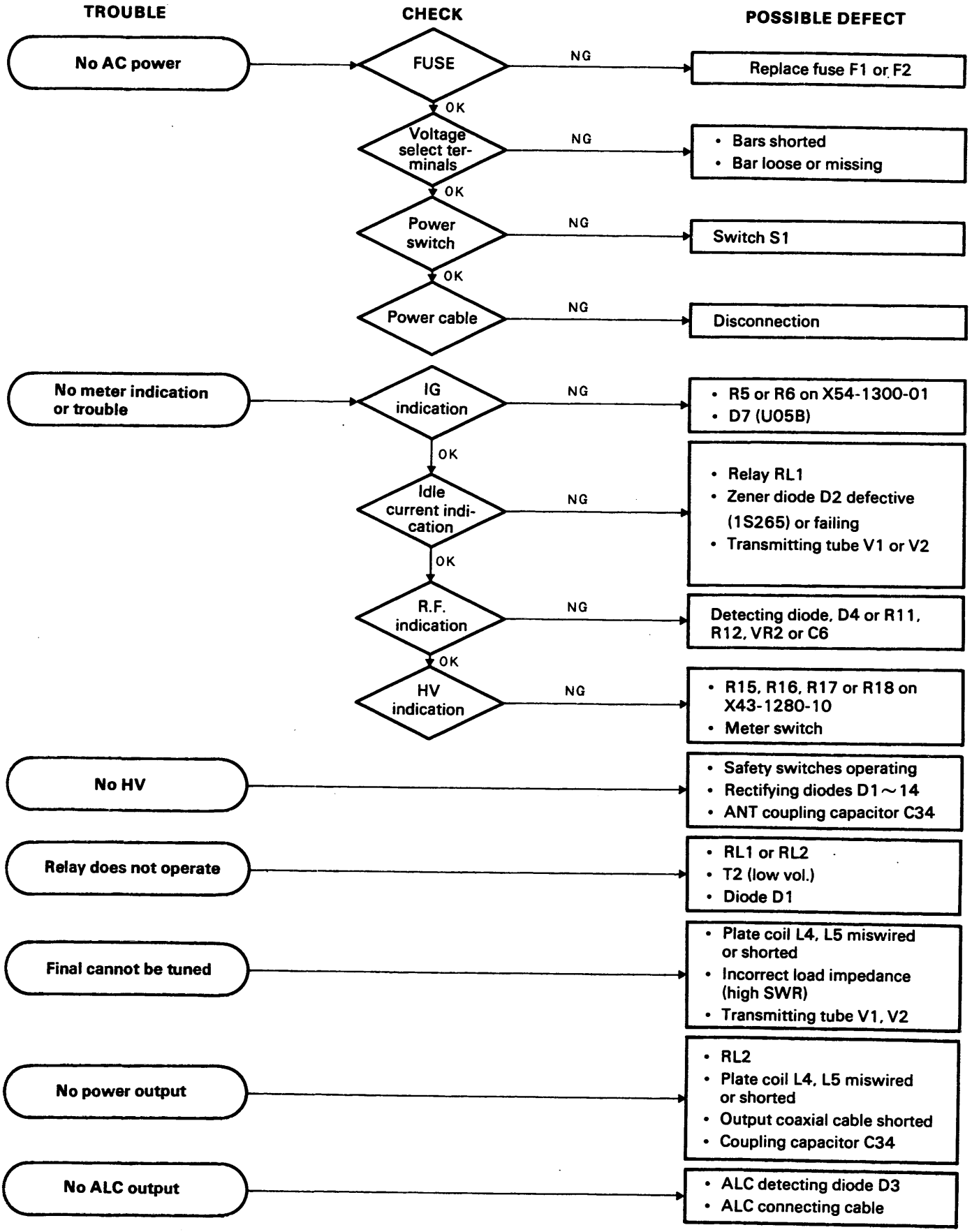


Fig. 14b 220/240V Version [W type] Input Voltage Terminal Boards

SECTION 12. TROUBLESHOOTING



SECTION 13. ADJUSTMENTS

Measuring Instruments

1. Voltmeter
   - Input impedance..... more than 1MΩ
   - Range ..... F.S. = 1.5 ~ 3500V AC, DC
2. RF Dummy Load
   - Impedance..... 50 ~ 75Ω
   - 1000W or greater disapation
3. Exciter
   - 100 ~ 120W output
     (Example: TS-820D, S; TS-520D, S)
4. Ohmmeter
   - Range ..... 1kΩ ~ 500kΩ
5. In-line watt meter, 100W or greater and 1500W or greater element.

■ Preparation

WARNING:
Lethal Voltages Present!

1. Disconnect the power cable.
2. Check for two 15A fuses.
3. Check for correct AC input voltage setting. (**Fig. 14**)
4. Remove the top and bottom covers (**Fig. 5** and **6**).
5. Defeat the HV interlock with a suitable insulator.

■ Continuity Test

1. Measuring Instrument
   Ohmmeter
2. Measuring Point
   a. Between V1, V2 plates and chassis: more than 300kΩ.
   b. Between TH1 and TH2 of the high voltage transformer: 0Ω (switch closed).

■ Voltage Check

1. Measuring Instrument
   Voltmeter
2. Measuring Point

WARNING:
Lethal Voltages Present!

   a. Remove the top cover which will open the primary safety switch disconnecting T1.
   b. Connect AC power.

WARNING:
Avoid High Voltage Contacts!

   c. Turn the POWER SW on and check the following voltages.

	Check Point	Value to be Measured
Heater voltages	Pin No. 1 of V1 Pin No. 1 of V2	10V AC ±0.5V 5V AC ±0.25V
Voltage between relay terminals	Pins of RL1 and RL2	Approximately 120V DC

   d. Turn the POWER SW off and bypass the primary microswitch. Connect the meter leads and then turn the POWER SW on. Check the plate voltage.
   CW mode: Approx. 2.2kV
   SSB mode: Approx. 3.1kV

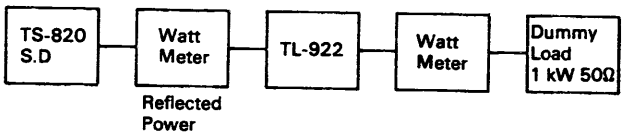


Fig. 15 Equipment Connection

■ BIAS Current Check

1. Meauring Instrument
   a. Exciter (Ex.: TS-820S)
   b. RF Dummy Load
2. Method
   a. Connect the exciter to the linear amplifier according to **Fig. 15**.
   b. Connect AC power and turn the POWER SW on. Check that the linear amplifier is controlled by the stand-by switch of the exciter.
   c. Check the Ip readings for:

CW mode	100mA	CW
SSB mode	200mA	SSB (nominal)

   d. Place the LINEAR SW in the OPERATE position. Adjust plate and loading, checking Ip for any indication of self-oscillation.

■ Input Tuning Coil Adjustment

1. Measuring Instruments
   a. Exciter
   b. Wattmeter, 100W element
   c. RF dummy load
2. Adjusting Method
   a. Connect equipment according to **Fig. 15**.
   b. Place the LINEAR SW in STBY. Set the exciter output to 80W at 1.9 MHz.
   c. Set the linear amplifier in 1.9 MHz BAND and place the LINEAR SW in OPERATE.
   d. While transmitting, adjust the core of input tuning coil so that V.SWR is minimum at 1.900 MHz. Repeat the procedure for the remaining frequencies:

BAND	FREQUENCY	ADJUST
1.9 MHz	1.900 MHz	L9 A
3.5 MHz	3.750 MHz	L10 B
7.0 MHz	7.150 MHz	L11 C
14.0 MHz	14.175 MHz	L12 D
21.0 MHz	21.225 MHz	L13 E
28.0 MHz	28.800 MHz	L14 F

SECTION 13. ADJUSTMENTS

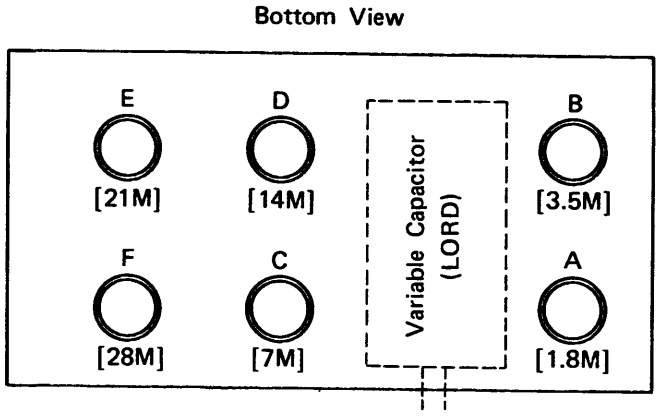


Fig. 16 Coil Locations

■ RF Meter Adjustment

1. Measuring Instruments
   Same as Section 5.
2. Method
   a. Interconnect according to **Fig. 15.**
   b. Set the exciter and the linear amplifier to 14 MHz BAND and adjust for maximum output power.
   c. Place the METER SWITCH in the RF position and set the RF VOLT pot on the rear panel to indicate "7". Check this value at every band.

   NOTE:
   This value will be obtained when the RF dummy load is 50Ω impedance. When the impedance is 75Ω, the indicated value will be slightly higher but should be less than "10".

■ ALC Voltage Adjustment

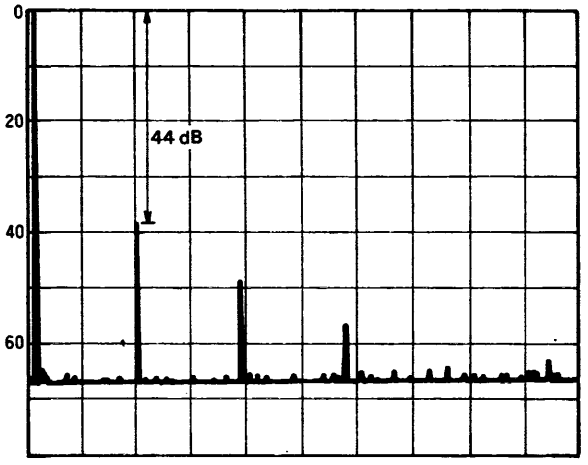
1. Measuring Instruments
   Same as Section 5.
2. Method
   a. Interconnect according to **Fig. 15.**
   b. Set the exciter and the linear amplifier to 14 MHz BAND and adjust for maximum output power.
   c. With 80W excitation, check for −10V or less at the ALC output terminal with the ALC pot on the rear panel at MAX.
   d. Set the exciter output to maximum and adjust the ALC pot for 500W output.

■ Fan Motor Delay Stop Circuit Check

1. Measuring Instruments
   No instrument is needed.
2. Checking Method
   After two minutes of power on at STBY, switch power off and verify a 2 minute delay for fan shut-off, ±30 seconds. (At the room temperature of 25°C). In the case of the room temperature of −10°C ~ +40°C, the delay time lies in 90 sec ~ 190 sec.

SECTION 14. REFERENCE DATA (EXAMPLE)

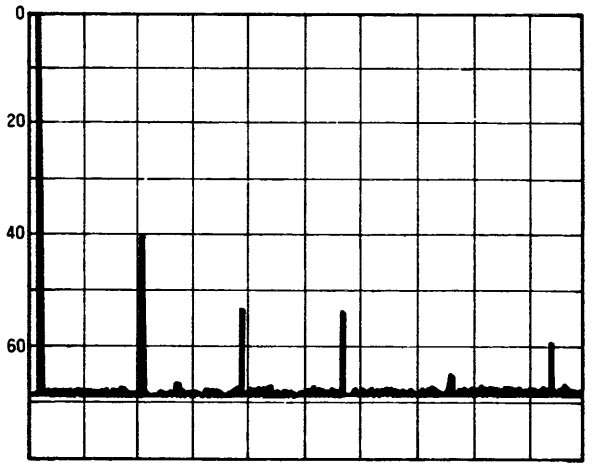
Sprious Radiation (Harmonies)



1.9 MHz
B.W 10 kHz

3.75 MHz
S.T. 0.1 sec/div
S.W 1 MHz/div
6 dB/Oct
(EXAMPLE)
Second harmonics
Nominal value: 38 dB
Correcting value: 6 dB
Therefore
Real value: 44 dB
Third harmonics
Real value: 47 dB
Force harmonics
Real value: 50 dB

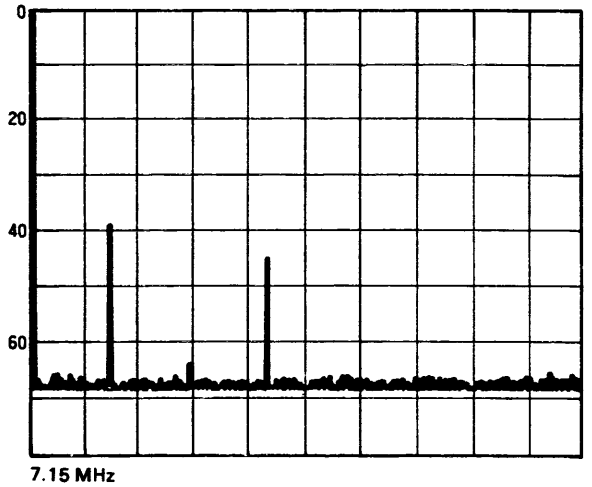
Sprious Radiation (Harmonies)



3.75MHz
B.W 10 kHz

S.T. 0.1 sec/div
S.W 5 MHz/div
6 dB/Oct

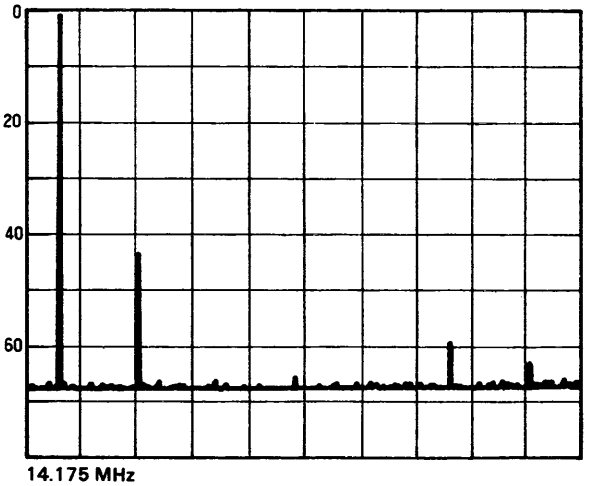
Sprious Radiation (Harmonies)



7.15 MHz
B.W 10 kHz

S.T. 0.1 sec/div
S.W 5 MHz/div
6 dB/Oct

Sprious Radiation (Harmonies)

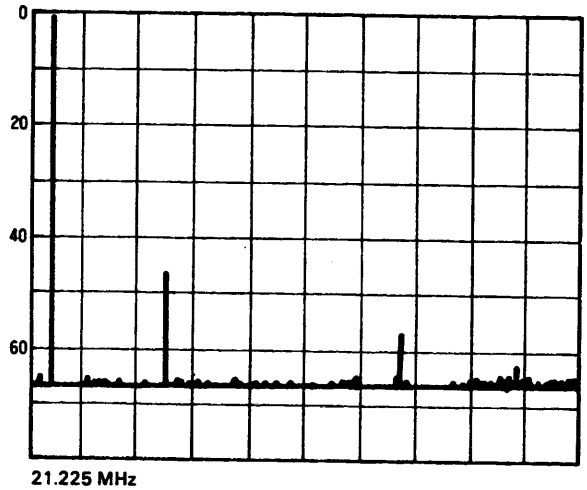


14.175 MHz
B.W 10 kHz

S.T. 0.1 sec/div
S.W 5 MHz/div
6 dB/Oct

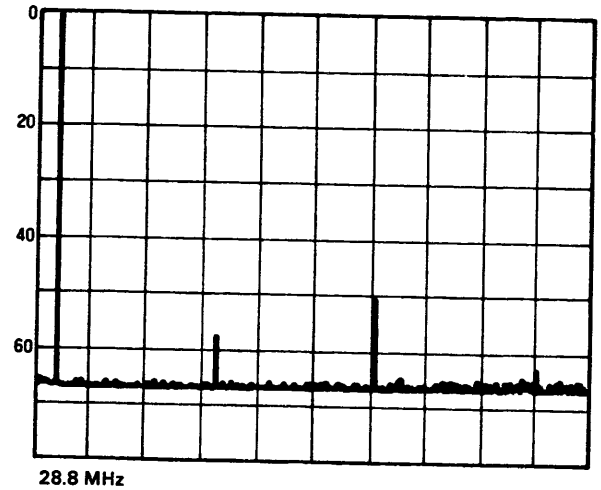
SECTION 14. REFERENCE DATA (EXAMPLE)

Sprious Radiation (Harmonies)



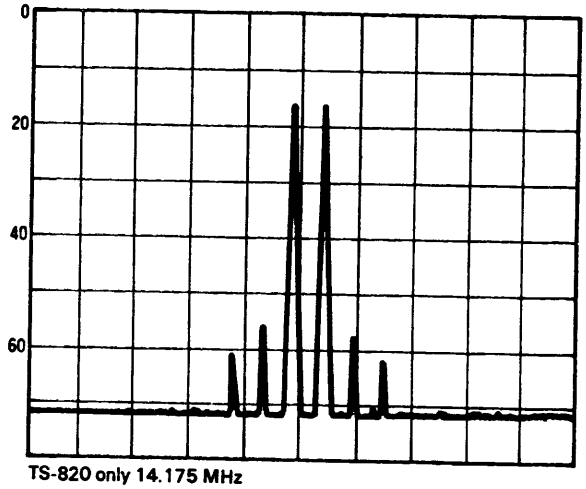
21.225 MHz
S.T 0.1 sec/div
S.W 10 MHz/div
B.W 10 kHz
6 dB/Oct

Sprious Radiation (Harmonies)



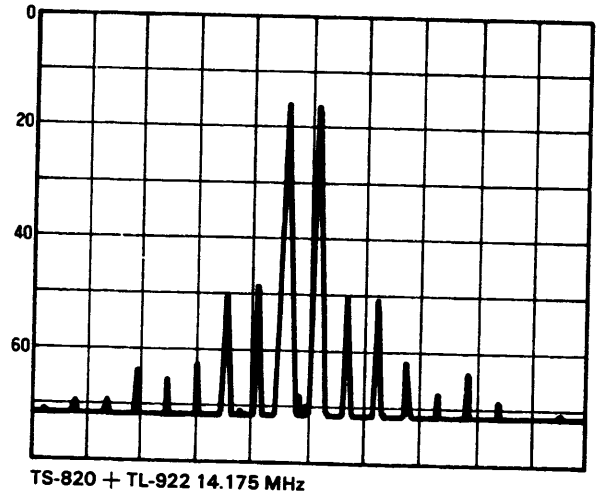
28.8 MHz
S.T 0.1 sec/div
S.W 10 MHz/div
B.W 10 kHz
6 dB/Oct

IMD Products



TS-820 only 14.175 MHz
2 tone Output 5.0W
B.W 0.03 kHz
S.T 2 sec/div
S.W 1 kHz/div

IMD Products



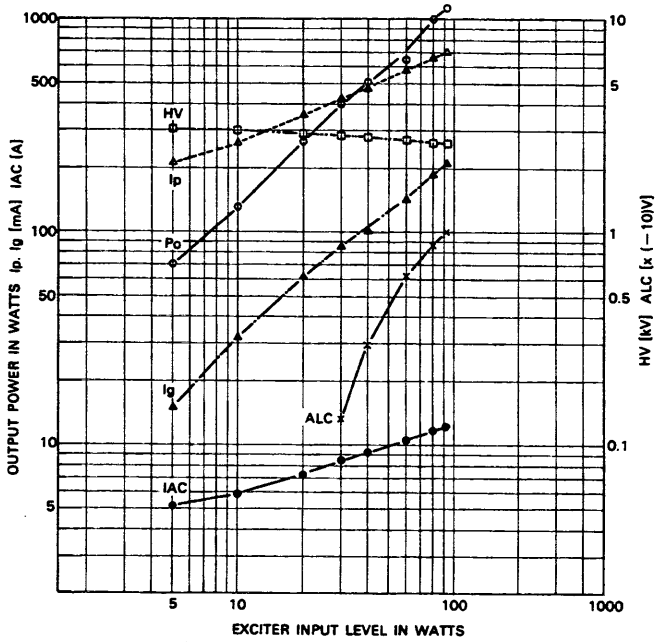
TS-820 + TL-922 14.175 MHz
2 tone Output 320W
B.W 0.03 kHz
S.T 2 sec/div
S.W 1 kHz/div

SECTION 14. REFERENCE DATA (EXAMPLE)

OUTPUT VS INPUT

ALC: OFF (After setting to 600W at 14.175 MHz)
LINE: AC 240V
MODE: SSB
EXCITER: TS-820

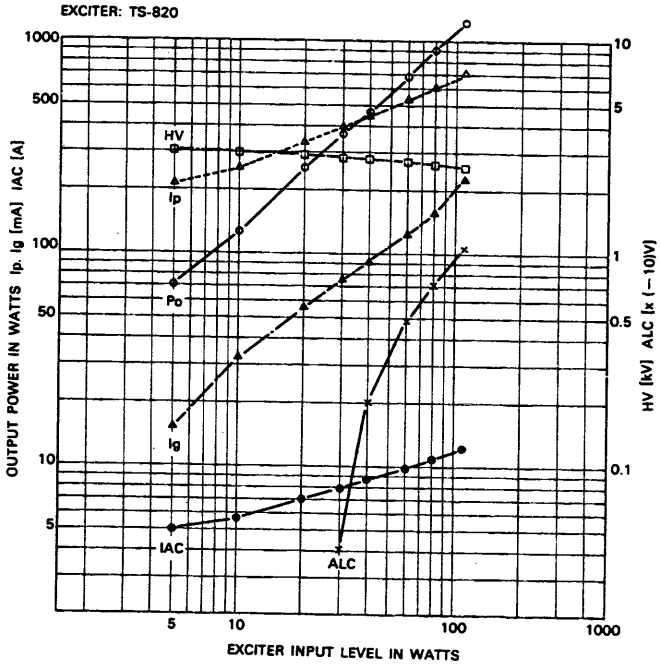
SIGNAL FREQ.: 1.9 MHz
DUMMY LOAD IMP.: 50Ω



OUTPUT VS INPUT

ALC: OFF (After setting to 600W at 14.175 MHz)
LINE: AC 240V
MODE: SSB
EXCITER: TS-820

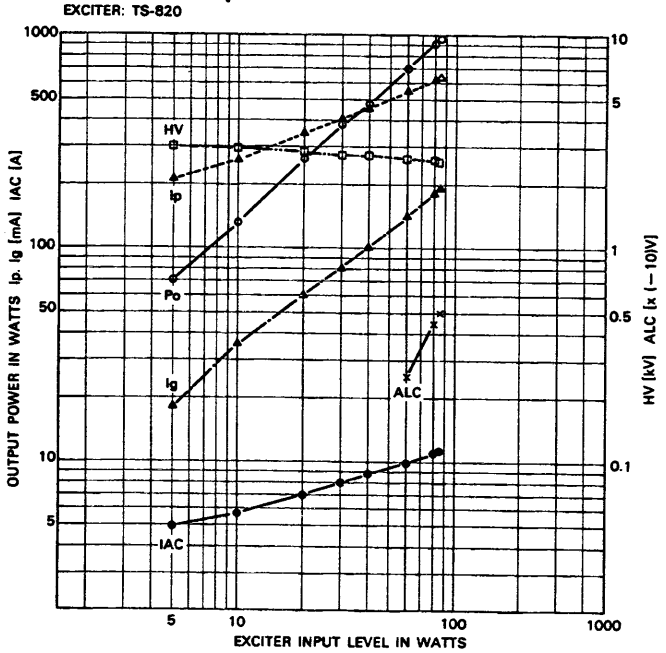
SIGNAL FREQ.: 14.175 MHz
DUMMY LOAD IMP.: 50Ω

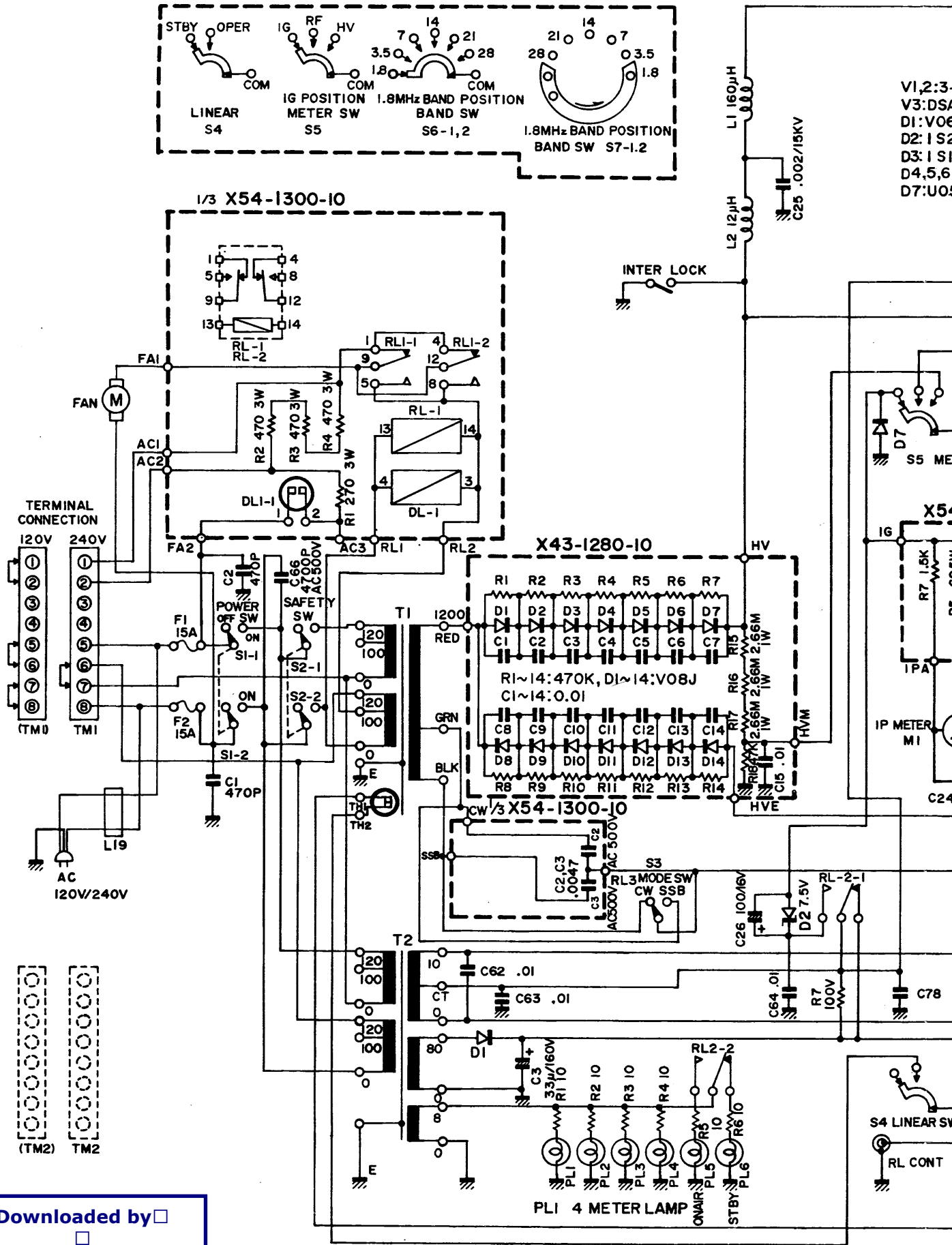


OUTPUT VS INPUT

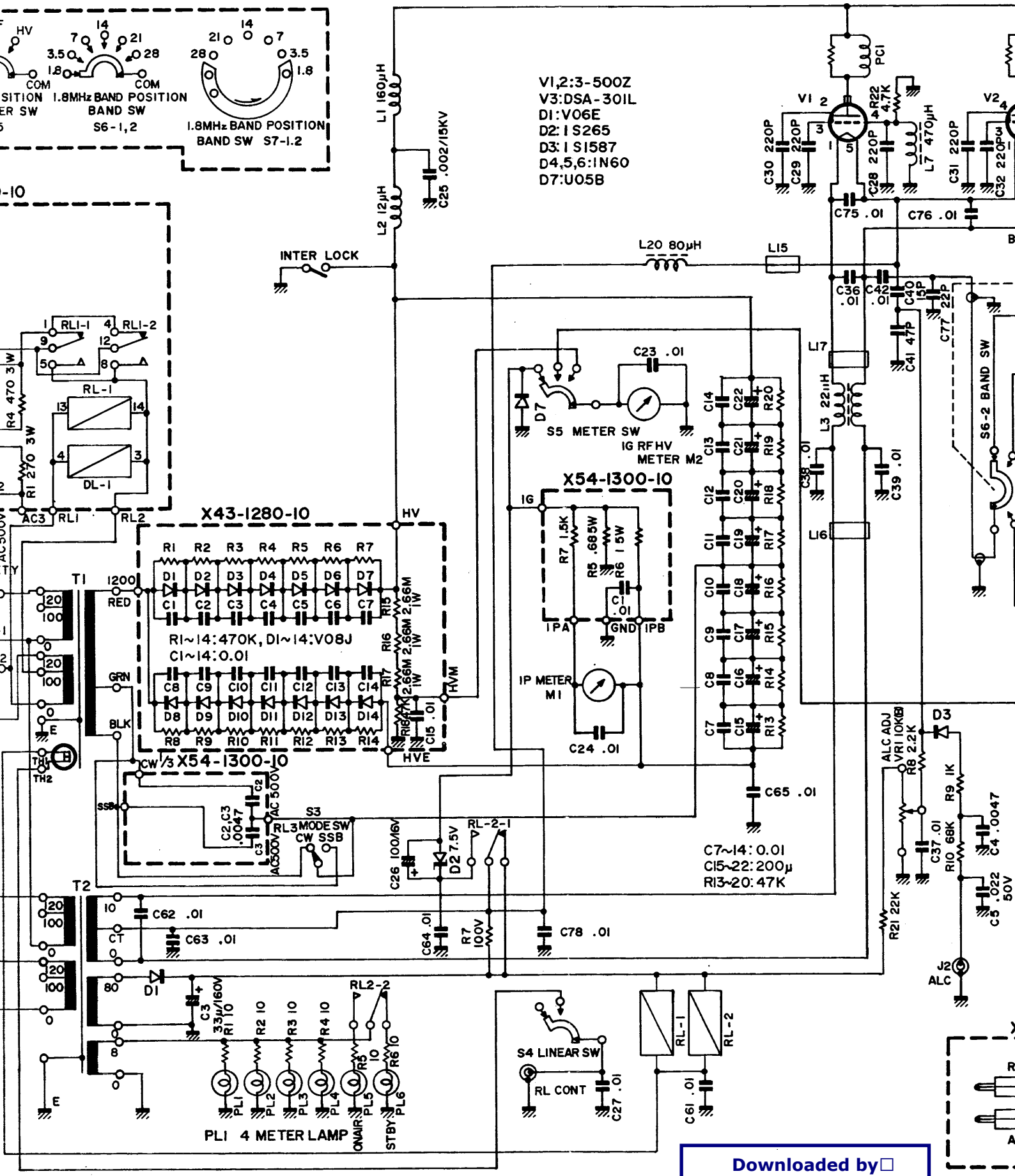
ALC: OFF (After setting to 600W at 14.175 MHz)
LINE: AC 240V
MODE: SSB
EXCITER: TS-820

SIGNAL FREQ.: 28.8 MHz
DUMMY LOAD IMP.: 50Ω



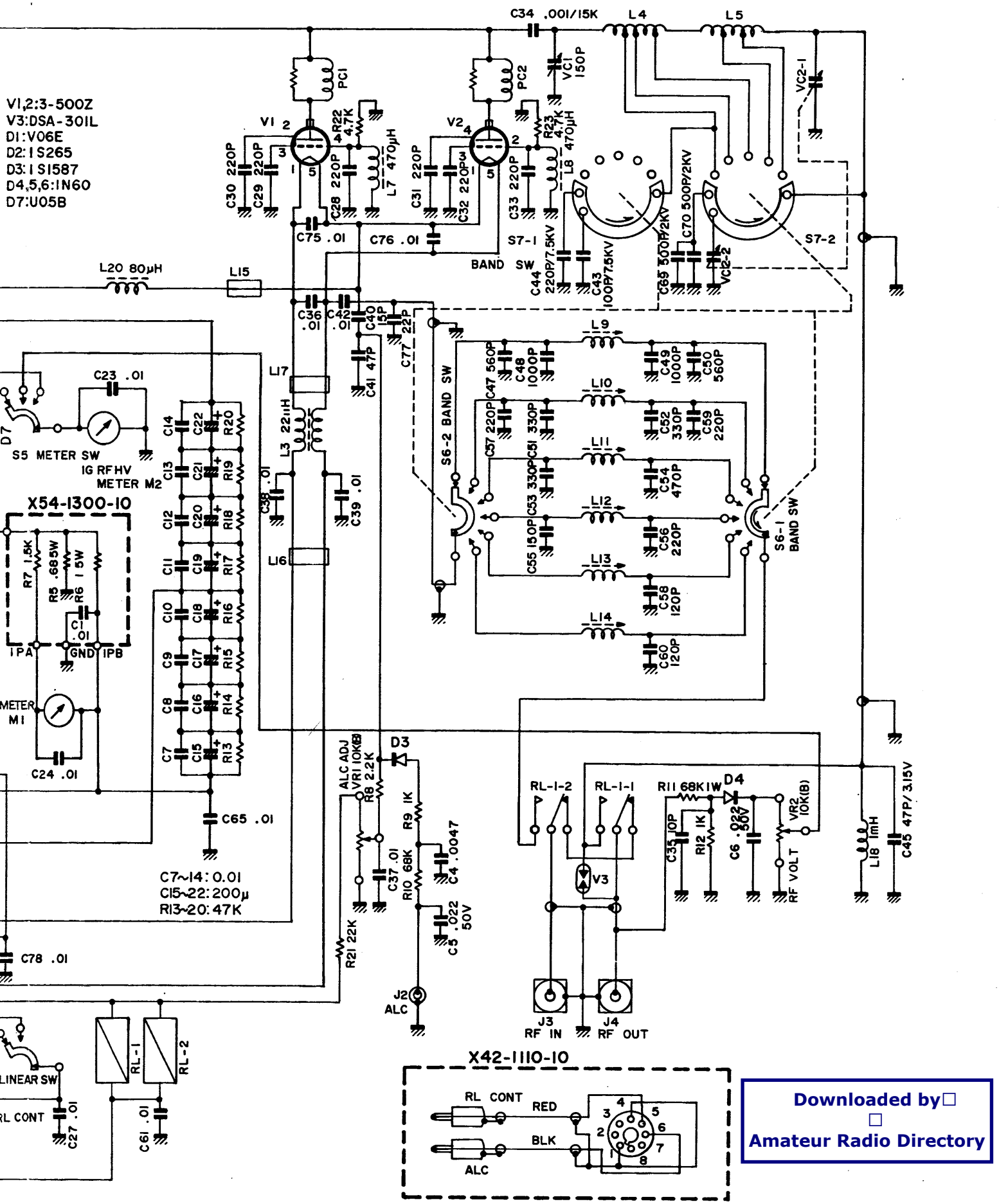


SCHEMATIC DIAGRAM



ATIC DIAGRAM

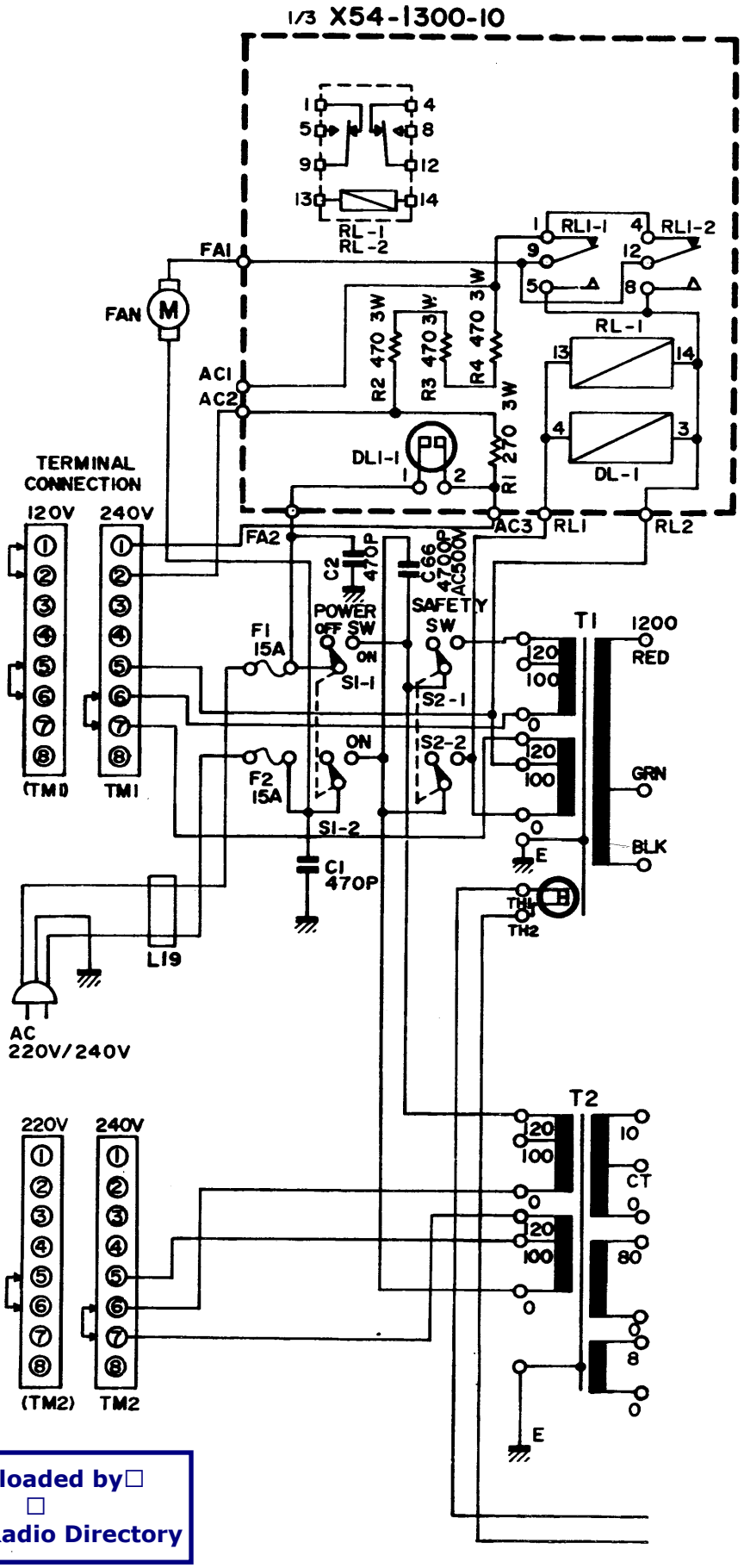
Circuits and specifications are subject to change for improvement.



TL-922(K)

SECTION 15. SCHEMATIC DIAGRAM

Modification for W Type



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