TECHNICAL MANUAL

FOR

MEDIUM FREQUENCY TRANSMITTER

MODEL MFT-10K/J

PUBLICATION NUMBER

120-021800-002

ISSUE DATE

AUGUST 1979

THE TECHNICAL MATERIEL CORPORATION

CABLE: TEPEI 700 FENIMORE ROAD, MAMARONECK, NY 10543 U.S.A. TLX: 137-358

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NOTICE

RECORD OF REVISIONS

NO.	ISSUED	DESCRIPTION	ENTERED	BY
001	21847	added Part No. CB147 to pg. 6-14, also	10-6-80	RU
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002	22025	PAGES 6-8, 6-14, 6-15 REVISED	5-17-83	RU
004				
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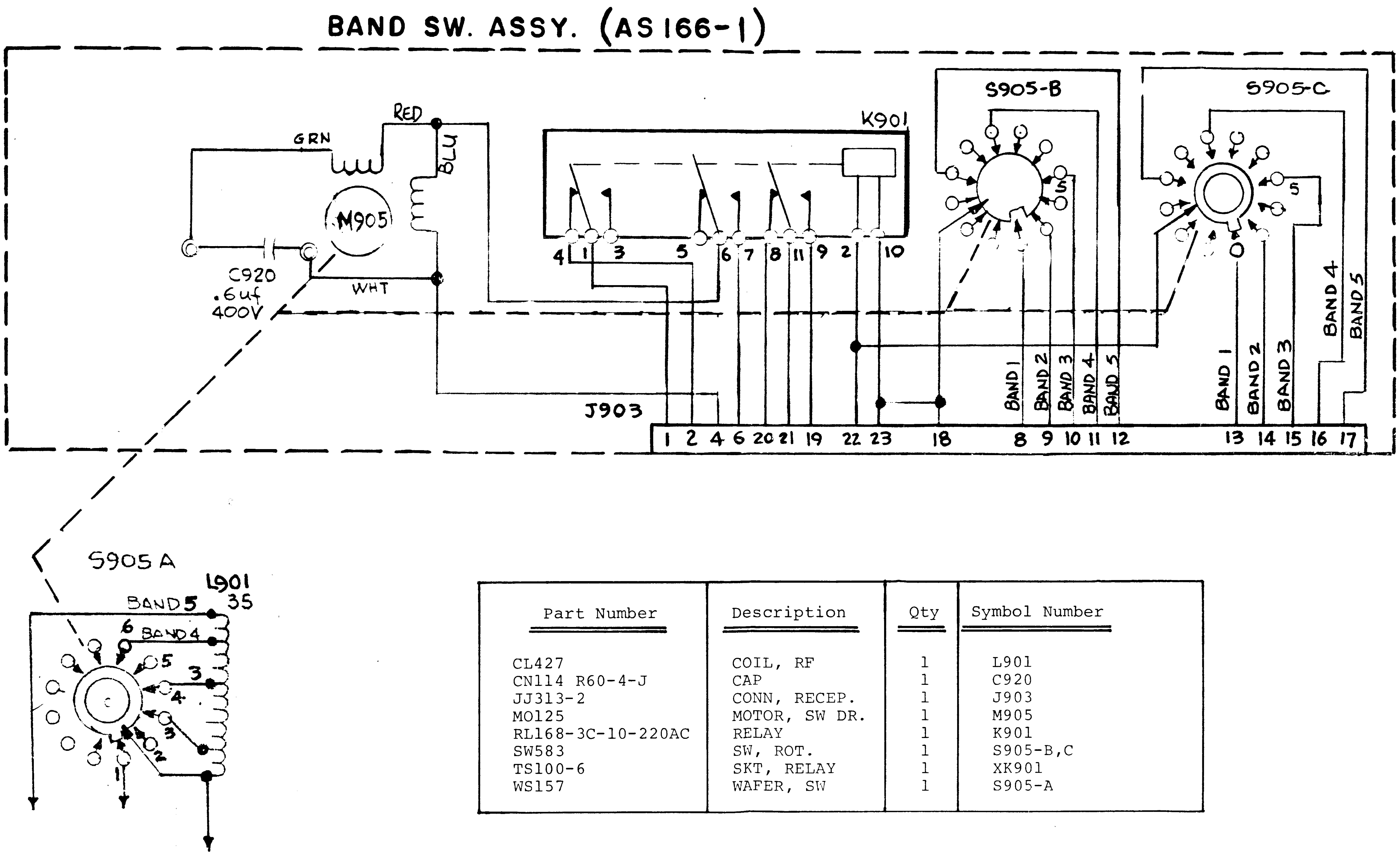
Part Number	Description	Used On	Qty	Symbol Number
A5766	PC ASSY, SENS CKT	AX5240	1	Z902
A5768	PC ASSY, SERVO CONT	AX5240	1	Z901
A4648	NETWORK, ALDC	AX5240	1	Z900
AS166-1	BANDSW ASSY	AX5240	1	S905
AX5241	LOAD ASSY, PA	AX5240	1	T900
BL105	FAN, AXIAL	AX5240	1	B900
CC100-28	CAP, FXD, CER	A4648	3	C1,C2,C3
CL100-5	COIL, RF, FXD	A4648	1	L2
CL177	COIL, RF, FXD	A4648	1	L1
CL426-2	COIL	AX5240	1	L900
CX108-2	CAP, FXD, PLSTG	AX5240	6	C906,C907,C908,C911,12,14
CB147	CAP, VAC	AX5240	1	C909
CX109-5	CAP, FXD, PLSTG	AX5240	2	C901,C902
DC104-2	COUP, DIR	AX5240	1	DC900
DD119-7	RECT, SEC, DEV	AX5240	1	CR901
NS107	INS, FDTHRU	AX5240	1	E804
RC20GF103J	RES, FXD, COMP	A4648	1	R1
RC20GF222J	RES, FXD, COMP	A4648	1	R2
SS107	SW, THERMO	AX5240	1	S904
SW230	SW, PUSH-PULL	AX5240	2	S900,S901
SW260	SW, SENS-SPDT	AX5240	1	S903
TM102-8	TERM, BD-BARR	AX5240	1	TB900
TS102P01	SOC, EL, TUBE	AX5240	1	XZ901
IN303	SCOND DEV, DIO	A4648	1	CR1
4CX3500C	TUBE, EL	AX5240	1	V900

Power Amplifier Components

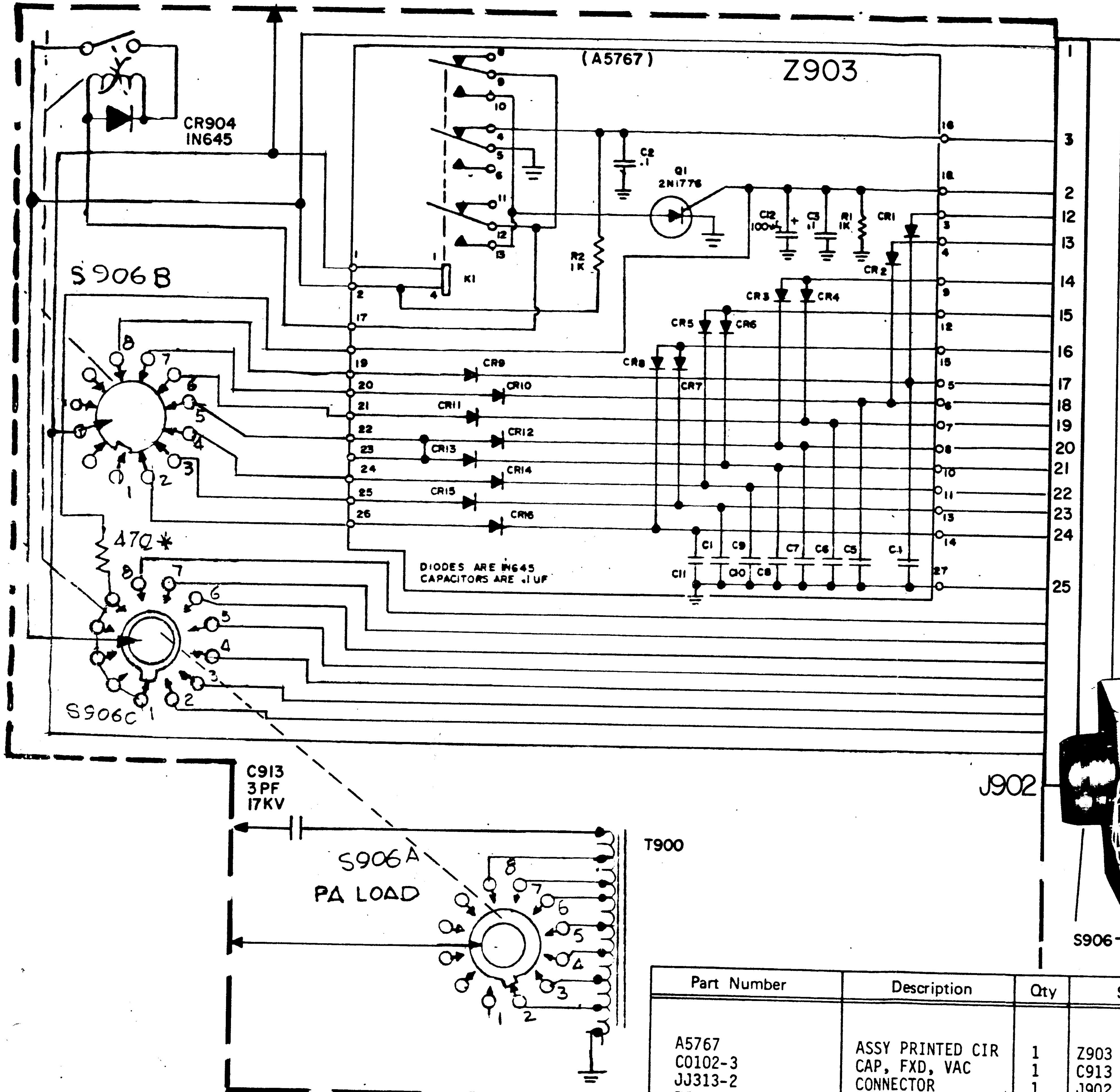
(AX5240)

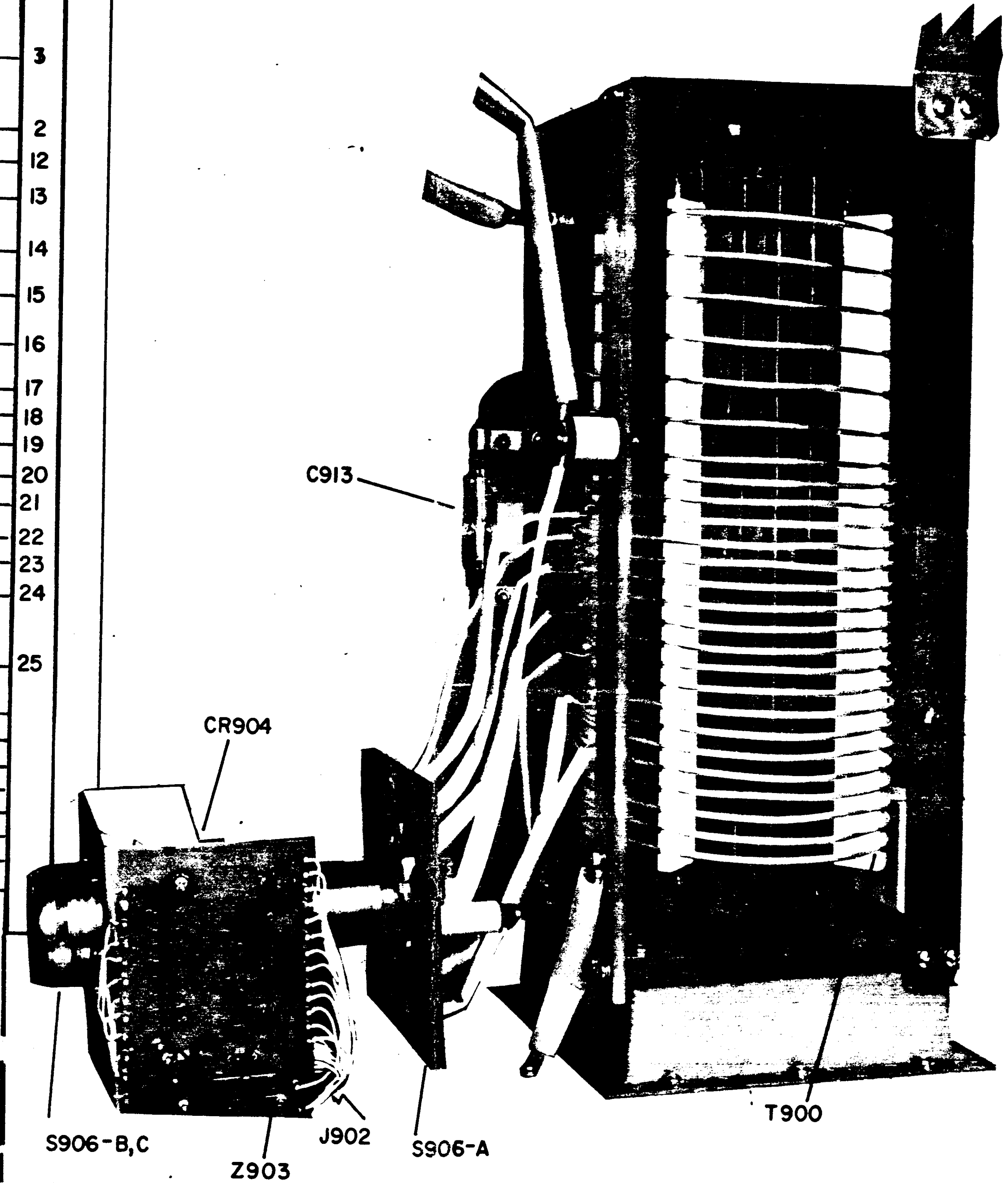


Part Number	Description	Qty	Symbol Number
CL427	COIL, RF	1	L901
CN114 R60-4-J	CAP	1	C920
JJ313-2	CONN, RECEP.	1	J903
MO125	MOTOR, SW DR.	1	M905
RL168-3C-10-220AC	RELAY	1	K901
SW583	SW, ROT.	1	S905-B,C
TS100-6	SKT, RELAY	1	XK901
WS157	WAFER, SW	1	S905-A

Figure 6-8

Bandswitch Assembly (AS166-1





Part Number	Description	Qty	Symbol Number
A5767	ASSY PRINTED CIR	1	Z903
C0102-3	CAP, FXD, VAC	1	C913
JJ313-2	CONNECTOR	1	J902
WS 158	WAFER LOAD, SW	*	PART OF S906-A
SW555	SW, SOLENOID	1	S906-B,C
IN645	DIODE	1	CR904

Figure 6-9

Load Assembly
(AX5241)

WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

TECHNICAL MANUAL

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WORLD WIDE SUPPLIERS OF ELECTRONIC COMMUNICATIONS EQUIPMENT

THE TECHNICAL MATERIEL CORPORATION

COMMUNICATIONS ENGINEERS

700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

TMC will replace or repair any such defective items, F.O.B. factory, which may fail within the stated warranty period, PROVIDED:

1. That any claim of defect under this warranty is made within sixty (60) days after discovery thereof and that inspection by TMC, if required, indicates the validity of such claim to TMC's satisfaction.
2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

Electron tubes* furnished by TMC, but manufactured by others, bear only the warranty given by such other manufacturers. Electron tube warranty claims should be made directly to the manufacturer of such tubes.

TMC's obligation under this warranty is limited to the repair or replacement of defective parts with the exceptions noted above.

At TMC's option any defective part or equipment which fails within the warranty period shall be returned to TMC's factory for inspection, properly packed with shipping charges prepaid. No parts or equipment shall be returned to TMC, unless a return authorization is issued by TMC.

No warranties, express or implied, other than those specifically set forth herein shall be applicable to any equipment manufactured or furnished by TMC and the foregoing warranty shall constitute the Buyers sole right and remedy. In no event does TMC assume any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of TMC Products, or any inability to use them either separately or in combination with other equipment or materials or from any other cause.

*Electron tubes also include semi-conductor devices.

PROCEDURE FOR RETURN OF MATERIAL OR EQUIPMENT

Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

PROCEDURE IN THE EVENT OF DAMAGE INCURRED IN SHIPMENT

TMC's Warranty specifically excludes damage incurred in shipment to or from the factory. In the event equipment is received in damaged condition, the carrier should be notified immediately. Claims for such damage should be filed with the carrier involved and not with TMC.

All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

PREFACE

This technical manual discusses the information you will require to install, operate and maintain the MFT-10K/J Medium Frequency Transmitter. This manual is intended for operators and technicians who will be responsible for the proper functioning of the equipment.

This text is compiled in two parts:

You should read this manual in sequence, section by section, to become totally familiar with the transmitter. After completing this manual, you should be able to install, operate, and depending on your level of technical training, perform maintenance to the component level.

Changes are periodically made to this manual through publications of TECHNICAL NEWSLETTERS that are distributed to users of the equipment. The REGISTRATION CARD located at the front of this manual should be completed and sent to:

THE TECHNICAL MATERIEL CORPORATION
700 Fenimore Road
Mamaroneck, New York 10543 U.S.A.

Attention: Technical Data Group

Your name and address will be entered on permanent TMC records and applicable publications automatically mailed to you. Requests for related publications should be made to your TMC representative, to a TMC field office in your area, or to TMC at the above address.

Forms are provided at the back of this manual for your use. Included are the following: READER'S COMMENTS; REQUEST FOR SPARE PARTS; REQUEST FOR FIELD SERVICE; REQUEST FOR PUBLICATIONS; REQUEST FOR TRAINING; NOTES; and TMC LOCATION MAP.

To facilitate the maintenance of accurate records on the operation of the equipment, a SERVICE LOG and FIELD REPORT are also included.

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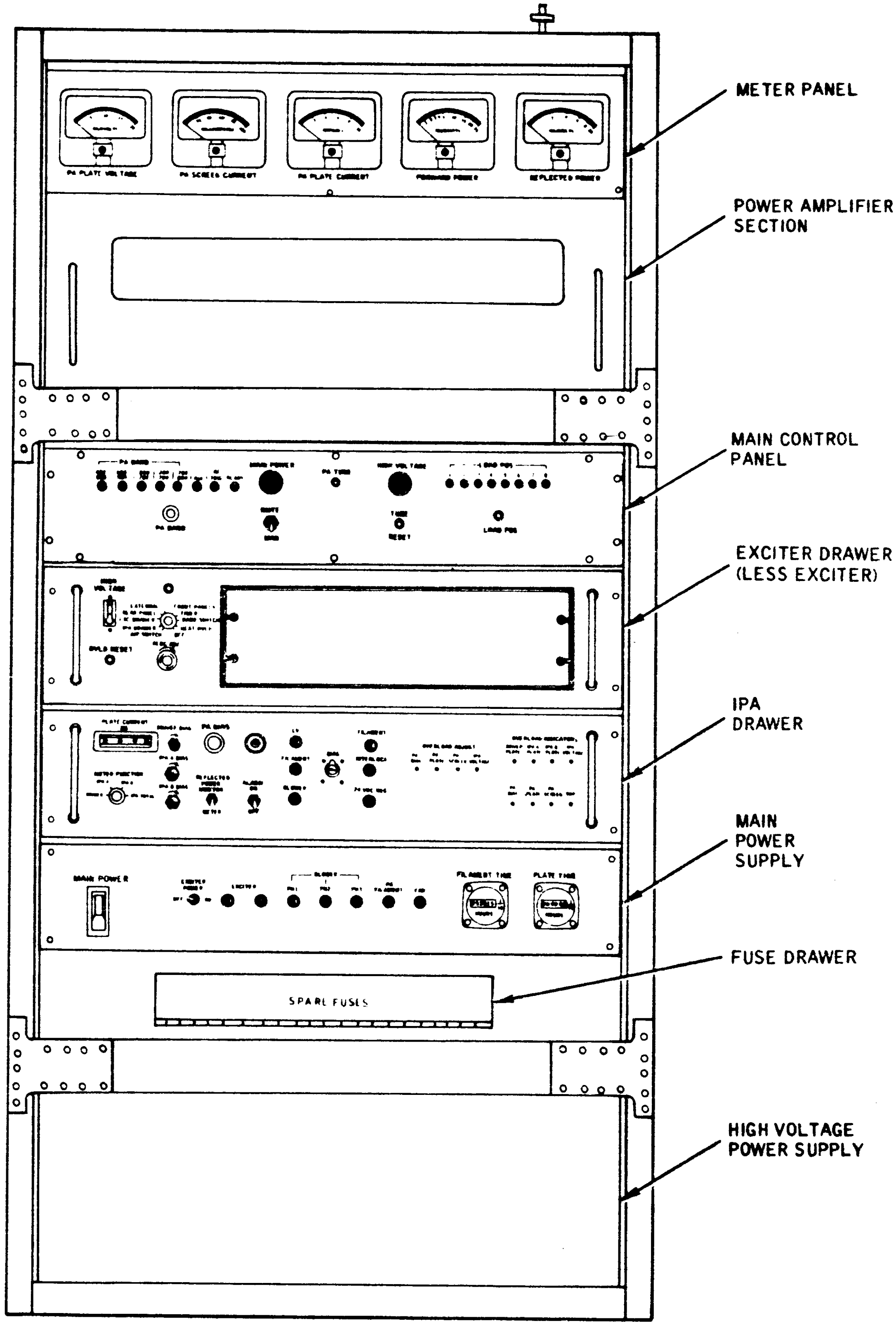


Figure 1-1 Medium Frequency Transmitter Model MFT-10K/J

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION.

The Medium Frequency Transmitter, Model MFT-10K/J (figure 1-1) is a medium frequency unit designed to operate in the broadcast band, providing rapid frequency selection with a minimum of time and effort. The transmitter is capable of 20,000 watts PEP (peak envelope power), or 10,000 watts average power through the frequency range of 450 KHz to 2 MHz.

The operating modes of the transmitter are:

1. AM (amplitude modulation).
2. SSB (single sideband) with suppressed or any degree of carrier.
3. FSK (frequency shift telegraphy).
4. FAX (facsimile).
5. CW (keyed carrier telegraphy).

1-2. PHYSICAL DESCRIPTION.

a. GENERAL. The MFT-10K/J transmitter is a single rack configuration, divided into six individual sections. The rack is 65 inches high, 32 inches wide, and 35 inches deep, and weights approximately 1274 pounds. The individual sections are the power supply with a spare fuse panel located on the front panel, a main power panel assembly, a driver drawer, an exciter drawer, a power amplifier section and a meter assembly panel. Two of the sections are slide out drawers, they are the driver drawer and the exciter drawer. The exciter drawer may contain the exciter unit or it may be mounted externally, using an interface cable. The power supply main power panel assembly, and part of the power amplifier sections internal components are accessible by the removal of the fastening screws holding the front panels to the main chassis.

All operating controls and meters are readily accessible on the front panel. The antenna output is coupled to the flange on top of the transmitter. For maintenance and repair, removal of either side or rear skins will expose internal components.

1) METER PANEL ASSEMBLY

The meter panel located at the top of the transmitter, contains five meters. They monitor PA plate voltage, PA screen current, PA plate current, forward and reflected power. (See figure 1-2)

2) POWER AMPLIFIER

The 10kw PA section contains the 10kw PA tube, and its associated tuned circuits. The front panel contains a plexiglass window, which is located on a separate section of front panel from the PA tuning and loading controls, and main power and high voltage indicators. (See figure 1-3)

3) EXCITER DRAWER

The exciter drawer houses the exciter unit or the exciter unit as stated, may be located externally from the transmitter. The exciter drawer contains a high voltage circuit breaker, the interlock monitoring switch, the overload reset and ALDC adjust control. (Refer to Appendix A for information pertaining to the exciter unit.). (See figure 1-4)

4) DRIVER DRAWER

The driver drawer contains four solid state power supplies, they are the IPA, Filament, Interlock and Bias supplies with two IPA stages, which provide driving power to the final power amplifier. The overload protect circuitry is located in this drawer with the overload adjust resistors and indicators on the front panel. The front panel also contains the IPA plate current meter, the meter function switch, and audible alarm and its on-off switch.

The driver and PA bias adjust resistors can be set from the front panel, with fuses for bias, low voltage, filament, blower, interlock and 24vdc regulated, located close by, (See figure 1-5)

5) MAIN POWER PANEL

The main power panel contains the main power circuit breaker, fuses for main blower unit, PA filament and fan, a filament time and plate time meter.

On the underside of the main power panel is located the audio input jacks, terminal boards and IPA, ALDC and PA monitor jacks. These jacks are accessible when the power supply front panel is removed. (See figure 1-6)

6) POWER SUPPLY

The high Voltage Power Supply Section contains the line filters, a H.V. contactor which controls 3 phase primary power to the High Voltage Power Supply transformer, and the solid state High Voltage Recitifier. In the rear portion of the power supply section is the main PA blower unit providing forced air cooling. (See figure 1-7)

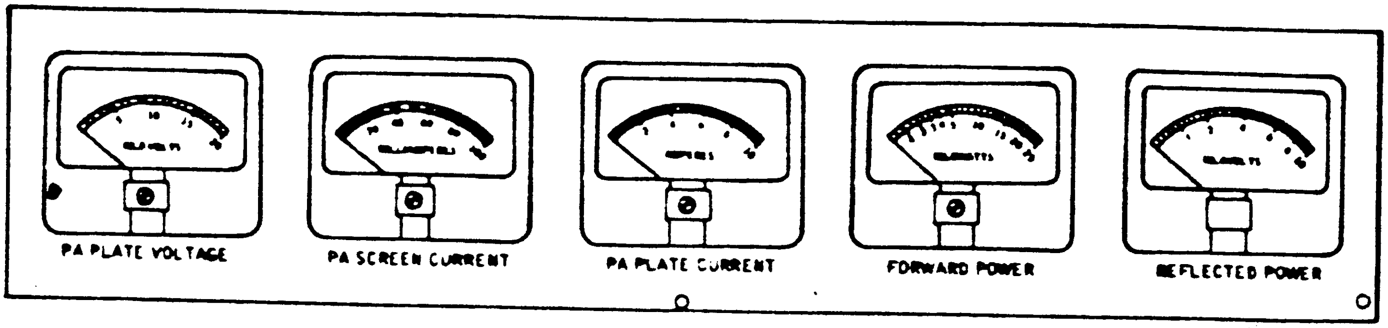


Figure 1-2 Meter Panel Assembly

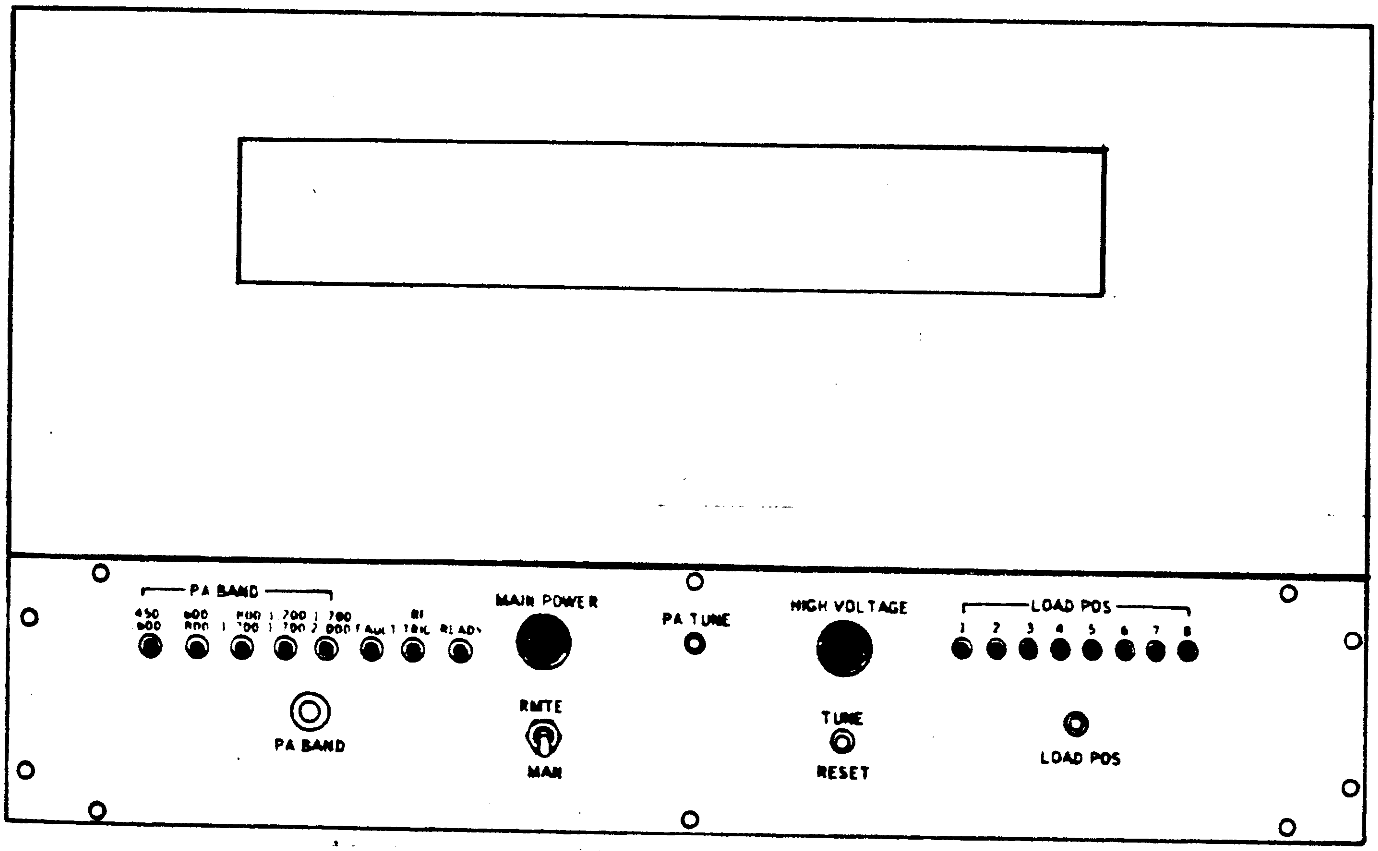


Figure 1-3 Power Amplifier Front Panel Assembly

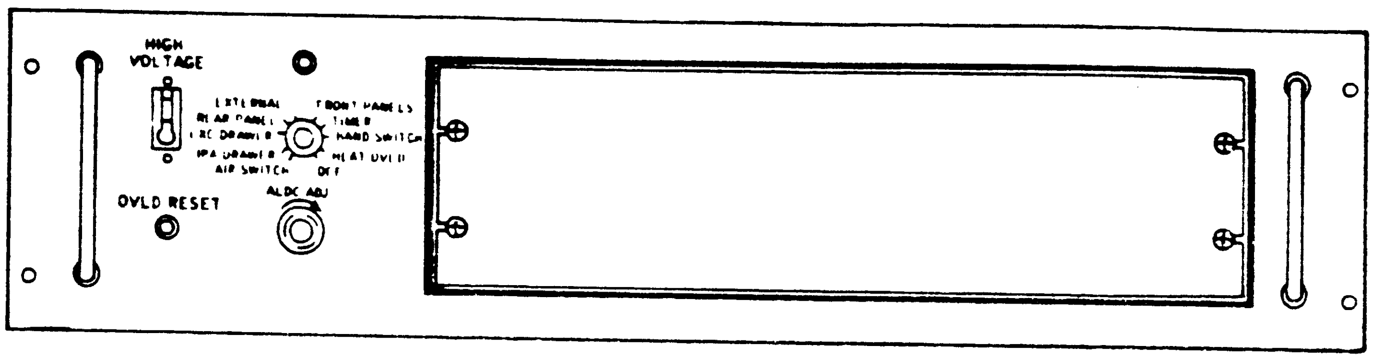


Figure 1-4 Exciter Drawer Front Panel Assembly

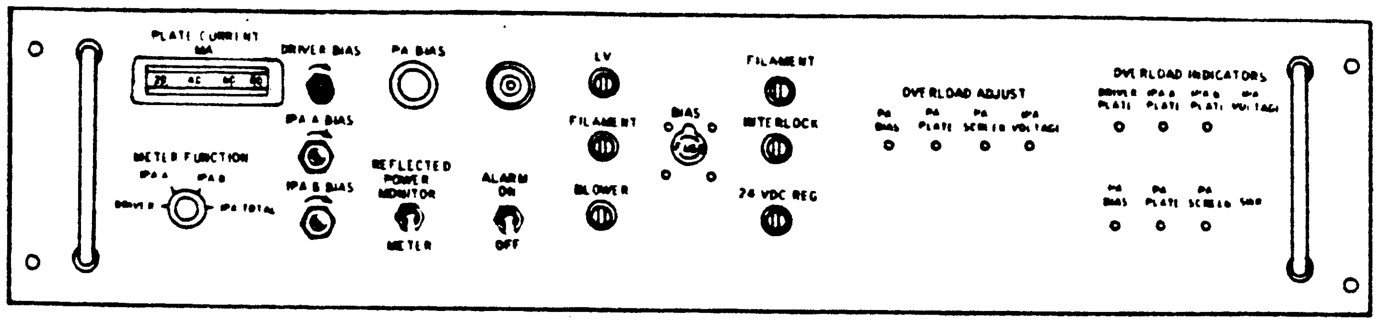


Figure 1-5 Driver Drawer (IPA) Front Panel Assembly

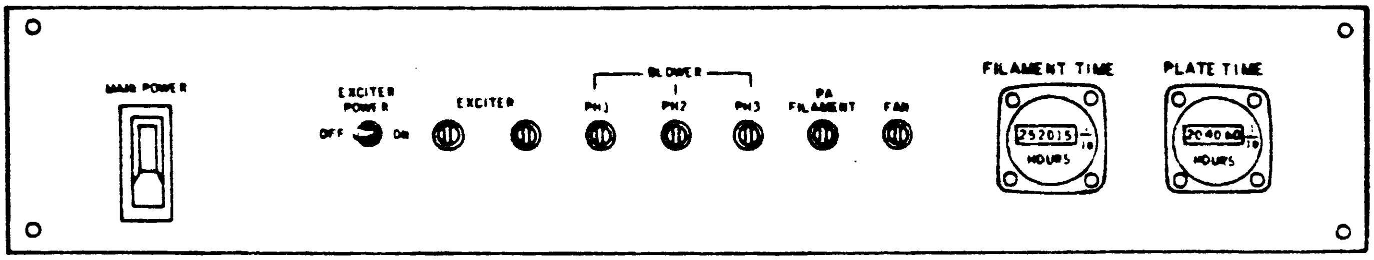


Figure 1-6 Main Power Panel Assembly

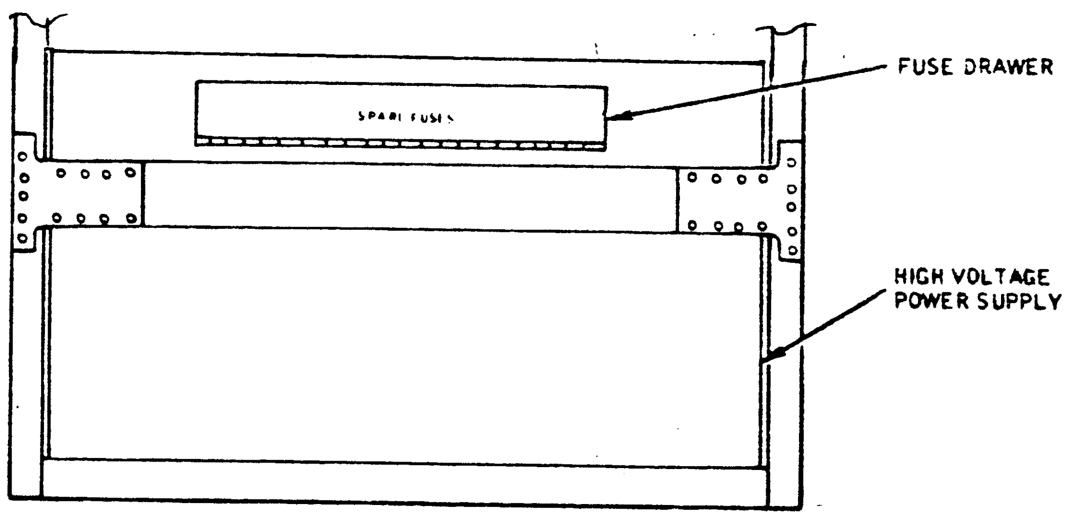


Figure 1-7 Power Supply

1-3. TECHNICAL CHARACTERISTICS.

FREQUENCY RANGE:	450 to 2000 KHz.
MODES OF OPERATION:	CW, AM, AME, SSB, ISB and FSK.
POWER OUTPUT:	10,000 watt kw in 15,000 watt dw PEP
OUTPUT IMPEDANCE:	50 ohms unbalanced. Designed to match any antenna with a VSWR of less than 2:1.
FREQUENCY STABILITY:	Synthesized control with a stability of at least 1 part in 10^8 per day.
TUNING SYSTEM:	Continous tuning across the band with all power tuning and bandswitching controls on the front panel.
VSWR PROTECTION:	Automatic protection against mis-match exceeding 2 to 1 is provided. A higher VSWR can be tolerated with reduced power output.
SIGNAL/DISTORTION RATIO:	In the SSB mode, distortion products are at least 35 db below PEP.
UNWANTED SIDEBAND REJECTION:	A signal at 500 Kz in the wanted sideband is down at least 60 db in the unwanted sideband.
SPURIOUS SIGNALS:	Spurious signals 60 db below PEP.
NOISE LEVEL:	Noise level is at least 60 db down from either tone of a two tone test.
HUM LEVEL:	At least 50 db below full PEP output.
HEAT DISSIPATION:	Approximately 20,000 watts.
ALDC:	Automatic load and drive control circuit maintains a relatively constant output level during high peaks of modulation or load changes. A front panel control allows adjustment of the level at which the ALDC takes effect, or switching off the ALDC as desired.

1-3. TECHNICAL CHARACTERISTICS. (cont.)

METERING:	Front panel meters provide indications of the operation of all critical circuits.
ENVIRONMENTAL CONDITIONS:	Designed to operate in any ambient temperature between 0^{o} C and 55^{o} C, and any value of humidity up to 95%.
STORAGE CONDITIONS:	Equipment will not be materially affected under storage of -30^{o} C to $+75^{o}$ C and humidity of 0 to 95%.
ALTITUDE:	The transmitter is designed to provide full output at an altitude of 10,000 feet.
COOLING:	Air cooled.
SAFETY FEATURES:	Safety interlocks are provided in all high voltage areas. Whenever an interlock is actuated, high voltage is immediately grounded.
INSTALLATION DATA:	Weight: 1,274 pounds. Size: 65 inches High x 32 1/2 inches Wide x 35 inches Deep.
PRIMARY POWER:	208vac three phase, 400 Hz 230vac, 60 Hz
POWER REQUIREMENTS:	Under steady state conditions, with full output, transmitter requires approximately 35 kw.
COMPONENTS & CONSTRUCTION:	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.

SECTION 2

INSTALLATION, PRELIMINARY SETTINGS

2-1. EQUIPMENT INSPECTION.

The MFT-10K/J Transmitter has been assembled calibrated, and tested at the factory before shipment. Inspect all packages for possible damage during transit. Carefully unpack each crate as indicated by the packing list provided with transmitter shipment. Inspect all packing materials for parts that may have been shipped as loose items.

With respect to equipment damage for which the carrier is liable, the Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts.

2-2. EQUIPMENT PACKAGING.

Wherever practical the equipment is shipped in boxes, each box is labeled as to its contents. Normal precautions should be used in removing the strapping and opening the boxes to avoid unjury or damage to the equipment.

2-3. PRIMARY POWER.

The MFT-10K/J requires a three phase source voltage of 208vac at 400Hz and a two phase source voltage of 230vac at 60Hz.

2-4. PRIMARY POWER, AUDIO INPUT AND GROUND CONNECTIONS.

Refer to (figure 2-1 and 6-20)Primary power and external audio signal input cables as well as the station ground cable enter the transmitter through an access hole located in the bottom of the high voltage power supply compartment.

To connect the primary power, the audio signal input cables, and the ground to their respective lugs, and jacks, remove the front panel of the Power Supply compartment.

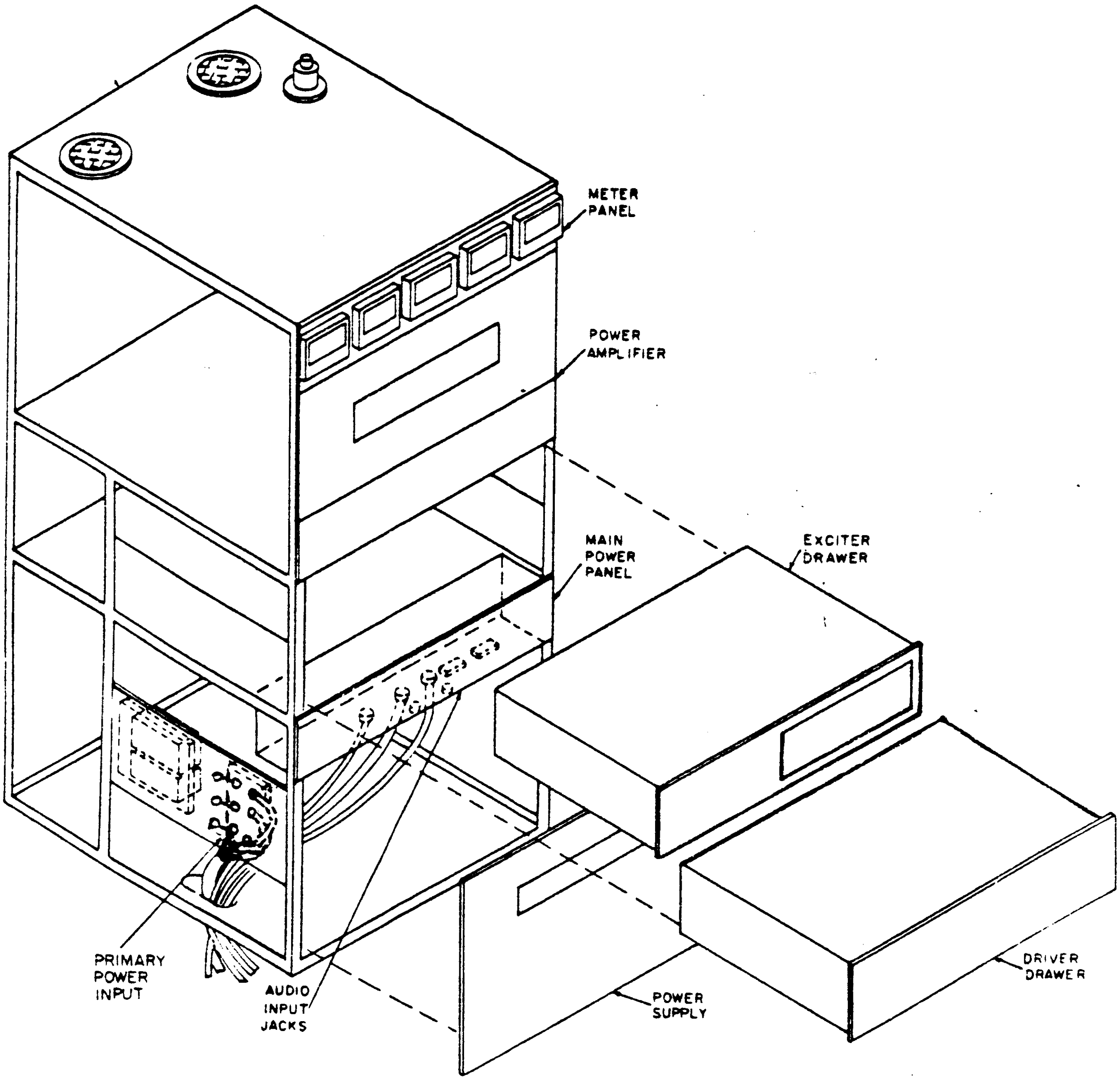


Figure 2-1. Installation Drawing

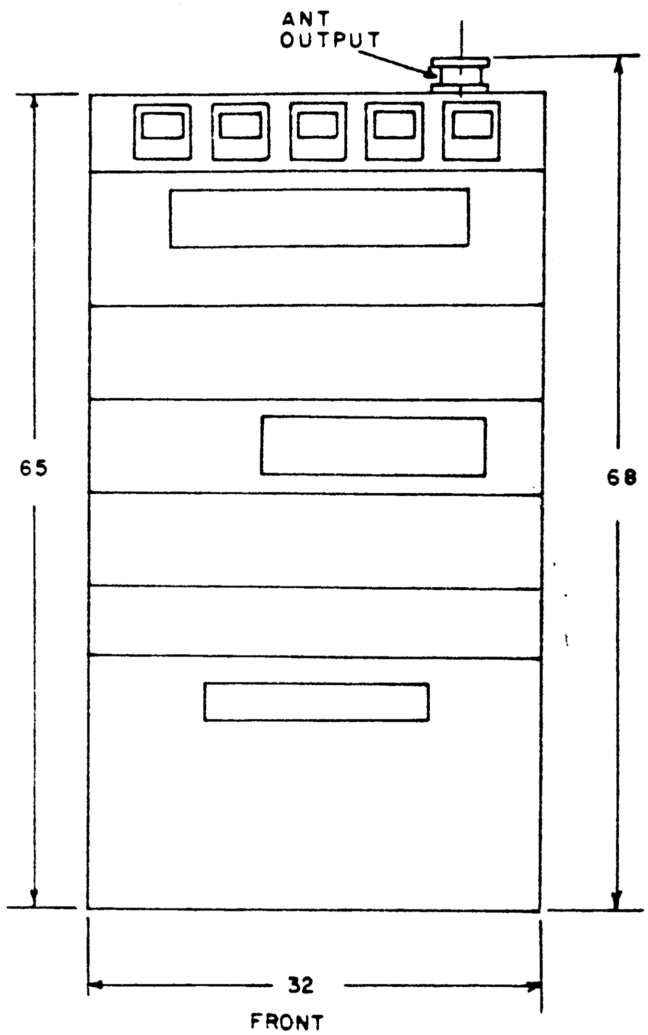


Figure 2-2 Outline Dimensional Drawing

The primary power connectors are mounted on a panel located on the left side of the power supply compartment.

The external audio input jacks are located on the bottom of the Main Power Panel Assembly.

The station ground should be connected to the bolt, below the HV Contactor K800, which fastens the HV Contactor to the frame of the transmitter. After all the connections have been completed replace the power supply front panel.

2-5. DIRECTIONAL COUPLER CHECK.

All power must be OFF in the transmitter when making the following check. The Directional Coupler has two diodes, one for forward power, and the other for reflected power. The 25kw diode is for the forward power, and the arrow must be pointing up. The second diode is for the reflected power and the arrow must be pointing down.

Inspect the diodes to see that they are properly seated in their sockets and making proper electrical contact, also check the two coaxial leads with the fittings to see that they are properly mated to the front and the back coaxial fittings on the Directional Coupler.

2-6. MAIN BLOWER CHECK.

Check for proper direction of air flow. If air is not flowing properly reverse two (2) ac phases at TB900. The Main Blower fan must be rotating in a CCW direction to achieve correct air flow.

2-7. PROCEDURE FOR SETTING BIAS LEVELS IN IPA (refer to figure 3-9).

NOTE: Exciter should be in STAND-BY and the RF gain at minimum (CCW) before setting bias levels.

1. Turn Driver bias, (36), IPA A bias (37) and IPA B bias (38) controls fully CCW.

2-7. PROCEDURE FOR SETTING BIAS LEVELS IN IPA (refer to figure 3-1). (cont.)

2. Set MAIN POWER circuit breaker (62) at ON. Allow 5 minutes time delay.
3. Set HIGH VOLTAGE circuit breaker (11) to ON.
4. Turn METER FUNCTION switch (35) to Driver position.
5. Adjust Driver bias control (36) until a reading of 20 is read on meter.
6. Turn METER FUNCTION switch (35) to IPA A position.
7. Adjust IPA A bias control (37) until a reading of 25 is read on meter.
8. Turn METER FUNCTION switch (35) to IPA B bias.
9. Adjust IPA B bias (38) until a reading of 25 is read on meter.
10. Return METER FUNCTION switch to Driver position and go through meter switch positions again, to make certain second set of readings agree with first.

2-8. PRELIMINARY SETTINGS.

1. High Voltage circuit breaker (11) to OFF.
2. ALDC Adj (15) fully CCW.
3. At the exciter site, place the STANDBY switch in STANDBY (for maximum stability the exciter requires a warm up period.)
   RF OUTPUT control fully CCW.
4. ALARM switch (41) to OFF.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL.

The MFT-20K/J Transmitter is relatively easy to tune since there is a minimum of controls. The operator still should familarize himself thoroughly with the controls and operation of the transmitter before attempting to tune. Tuning instructions and Operating Controls and Indicators in Table 3-1 are provided in this Section to aid in operating the transmitter.

CAUTION

It is highly important to tune up a High power MFT-10K/J on a careful precise step by step basis. Furthermore to avoid damage to the transmitter it is important to operate it within rated loads. Operating the transmitter beyond its rated capacities is not recommended because it is hazardous to the equipment and may cause excessive distortion. It is good operating pracitice to allow the MFT-10K/J at least a ¼ hour warm up period.

3-2. IPA PRELIMINARY CHECK (refer to figure 3-1).

In order for the transmitter to operate manually or automatically the remote control circuitry must be in place. If it is not in use the following connections must be made.

J1001	Pin A connected to Pin B
J1002	Pin K connected to Pin J Pin M connected to Pin N
J1000	Pin K connected to Pin A

3-2. IPA PRELIMINARY CHECK (refer to figure 3-1) (cont.).

NOTE

Before performing below check, exciter unit must be in standby.

1. Before tuning transmitter make sure either a Dummy Load or an antenna is connected to the output. Also insure that any (exciter or RF Generator) input to the transmitter is turned down or off.

2. Check Interlock circuitry by turning interlock monitor switch (14) in the following sequence PA AIR, IPA DRAWER, EXCITER DRAWER, REAR PANELS, EXTERNAL, FRONT PANELS, TIMER, BANDSWITCH HEAT OVERLOAD, and OFF.

When interlock circuit is functioning properly indicator (13) will light. When lamp does not light check for an open or inoperative interlock in the area indicated by switch (14).

3. Place HIGH VOLTAGE circuit breaker (11) at ON.

4. Turn METER FUNCTION switch (35) to each IPA position, and read indication on IPA meter (34). IPA meter should have the following readings:

a) Driver 20 = 80 ma plate current.

b) IPA A 25 = 100 ma plate current.

c) IPA B 25 = 100 ma plate current.

d) IPA TOTAL 25 = 200 ma plate current.

5. Set PA idle current to 1 amp

3-3. PA OPERATION IN THE MANUAL MODE.

1. Set PA BANDSWITCH (5) to desired frequency.

2. Preset LOAD control (10) for correct load condition.

3. Preset tuning caps to maximum capacitence (8).

3-3. PA OPERATION IN THE MANUAL MODE (cont'd.).

4. Set High Voltage Circuit breaker (11) at ON.

5. Increase RF OUTPUT control until PA PLATE CURRENT meter (3) reads 2 amperes. Refer to Appendix A for exciter operation.

6. Turn TUNE control (8) until forward power meter (4) gives resonance indication.

7. If it is necessary to correct LOAD (10) setting, the RF Drive must be turned down or OFF before switching.

8. (Appendix A) Increase RF OUTPUT to a 10 kw reading on forward power meter (4).

NOTE

When tuning transmitter to its rated full power output 10 kw the meter readings should not exceed the following:
PA Plate Current 4.0 amperes
PA Screen Current 80. ma.

9. Transmitter tuning is now completed for the manual mode of operation. (Appendix A) Reset RF OUTPUT control to read 10 kw on FORWARD POWER meter.

10. Check reflected power reading by placing REFLECTED POWER monitor switch (40) (41) in the up position. REFLECTED POWER meter should not exceed a 3:1 VSWR.

11. Set ALARM switch (41) to ON.

12. Keep ALDC control (15) fully CCW, until transmitter is completely tuned. Now increase ALDC control until forward power meter (4) drops slightly. This will varify the functioning of the ALDC.

13. In the event the transmitter shuts down due to an overload, RESET OVLD RESET button (12) and retune the transmitter.

3-4. AUTOMATIC OPERATION.

1. Before proceeding to operate the transmitter automatically, varify the transmitters operation in the manual mode then proceed as follows:

a. Main power breaker (62) switched on (allow for proper warmup).

b. On the Main Control PANEL switch RMTE/MAN switch to RMTE.

c. Insure desired frequency and proper load position.

d. Turn HV ON (11).

e. Tune (17) (the transmitter will now search for resonance).

f. At the exciter (Appendix A) increase the RF Drive until the PA Plate current reachs 2 amps (3).

g. The RF TRIG indication appears.

(NOTE: If an RF TRIG does not appear within approximately 60 seconds a fault light will appear and it is necessary to retune the transmitter.

h. With an RF TRIG indication, a slight period of time will elapse for correction before the transmitter will indicate Ready.

i. Ready: The transmitter is now ready to be driven to a desired output level.

TABLE 3-1. MFT-10K/J OPERATING CONTROLS AND INDICATORS

NUMBER DESIGNATION	PANEL DESIGNATION	FUNCTION
1	PA PLATE VOLTAGE meter	Indicates plate voltage (dc) of 10-kw power amplifier tube.
2	PA SCREEN CURRENT meter	Indicates screen current of 10-kw power amplifier tube.
3	PA PLATE CURRENT meter	Indicates plate current of 10-kw power amplifier tube.
4	FORWARD POWER meter	Indicates power output of transmitter.
5	REFLECTED POWER meter	Indicates REFLECTED POWER.
6	PA BANDSWITCH	Sets frequency range of the PA.
7	MAIN POWER lamp	When lit, indicates that primary power is being applied to transmitter.
8	TUNE CONTROL	PA Tuning.
9	HIGH VOLTAGE lamp	When lit, indicates, that high voltage is on in the transmitter.
10	LOAD CONTROL switch	Varies output impedance of 10-kw PA.
11	HIGH VOLTAGE circuit breaker	Allows application of high voltage to IPA stage.
12	OVLD RESET SWITCH pushbutton	When depressed after an ov rload occurs, resets relay in IPA drawer.
13	INTERLOCK INDICATOR lamp	Lights when a particular interlock circuit being monitored, is functioning properly.

TABLE 3-1. MFT-10K/J OPERATING CONTROLS AND INDICATORS (cont.)

NUMBER DESIGNATION	PANEL DESIGNATION	FUNCTION
14	INTERLOCK MONITOR switch	Monitoring of interlock circuits.
15	ALDC ADJ - switch, control	Connects & sets ALDC Voltage level.
16	RMTE/MAN	Places transmitter in AUTO or MAN mode.
17	TUNE/RESET	Resets transmitter.
18 THROUGH 33	NUMBER DESIGNATIONS	NOT USED
34	IPA PLATE CURRENT meter	Indicates plate current of IPA stages.
35	METER FUNCTION switch	Selects IPA stage, plate current of which is indicated by IPA plate current meter.
36	IPA DRIVER control	Sets bias level of first IPA tube.
37	IPA A BIAS control	Sets bias level of first IPA "A" tube.
38	IPA B BIAS control	Sets bias level of second IPA "B" tube.
39	PA BIAS control	Sets bias level of 10-kw power amplifier.
40	REFLECTED POWER switch	In meter position directs dc couplers to Reflected power meter.
41	ALARM switch	In on position closes circuit to audible alarm.
42	ALARM speaker	Speaker for alarm circuit, which sounds when high voltage fails in transmitter.
43	LV fuse	Protects low voltage power supply
44	FILAMENT fuse	Protects filament power supply
45	BLOWER fuse	Protects blower B301 in IPA.
46	Bias fuse	Protects bias rectifier circuit.
47	FILAMENT fuse	Protects filament rectifier circuit.
48	INTERLOCK fuse	Prot cts Interlock rectifier circuit

TABLE 3-1. MFT-10K/J OPERATING CONTROLS AND INDICATORS (cont.)

NUMBER DESIGNATION	PANEL DESIGNATION	FUNCTION
49	24 VDC	Protects 24 vdc circuit.
50	PA bias control	Sets operating level of PA bias overload.
51	IPA VOLTAGE ADJ control	Sets operating level of IPA voltage overload.
52	PA BIAS OVLD ADJ control	Sets operating point of silicon controlled rectifier in PA bias overload circuit.
53	PA PLATE OVLD AJD control	Sets operating point of silicon controlled rectifier in PA plate overload circuit.
54	DRIVER PLATE OVLD lamp	When lit indicates that an overload has occurred in plate circuit to driver.
55	IPA PLATE OVLD lamp	When lit indicates that an overload has occurred in plate circuit to IPA.
55	IPA PLATE OVLD lamp	When lit, indicates that an overload has occurred in plate circuit of IPA.
57	IPA VOLTAGE OVLD lamp	When lit, indicates that an overload has occurred in PA screen circuit.
58	PA BIAS OVLD lamp	When lit, indicates that an overload has occurred in bias circuit of PA tube.
59	PA PLATE OVLD lamp	When lit, indicates that an overload has occurred in plate circuit of PA tube.
60	PA SCREEN OVLD lamp	When lit, indicates that an overload has occurred in screen circuit of PA tube.
61	SWR OVLD lamp	When lit indicates that an overload has occurred as a result of excessive VSWR.
62	MAIN POWER circuit breaker	In on position applies primary power to transmitter.
63	F800, F801	Protects the 230V 60Hz inputs.
64 & 65 & 66	PH1, PH2, PH3, fuses	Protect PA tube blower B800 in High voltage power supply compartment.

TABLE 3-1. MFT-10K/J OPERATING CONTROLS AND INDICATORS (cont.)

NUMBER DESIGNATION	PANEL DESIGNATION	FUNCTION
67	PA FILAMENT fuse	Protects PA filament circuit transformer.
68	FAN fuse	Protects fan B900 in PA compartment.
69	FILAMENT TIME meter	Indicates total operating time of filament circuit of 10-kw PA.
70	PLATE TIME meter	Indicates operating time of 10-kw plate circuit.

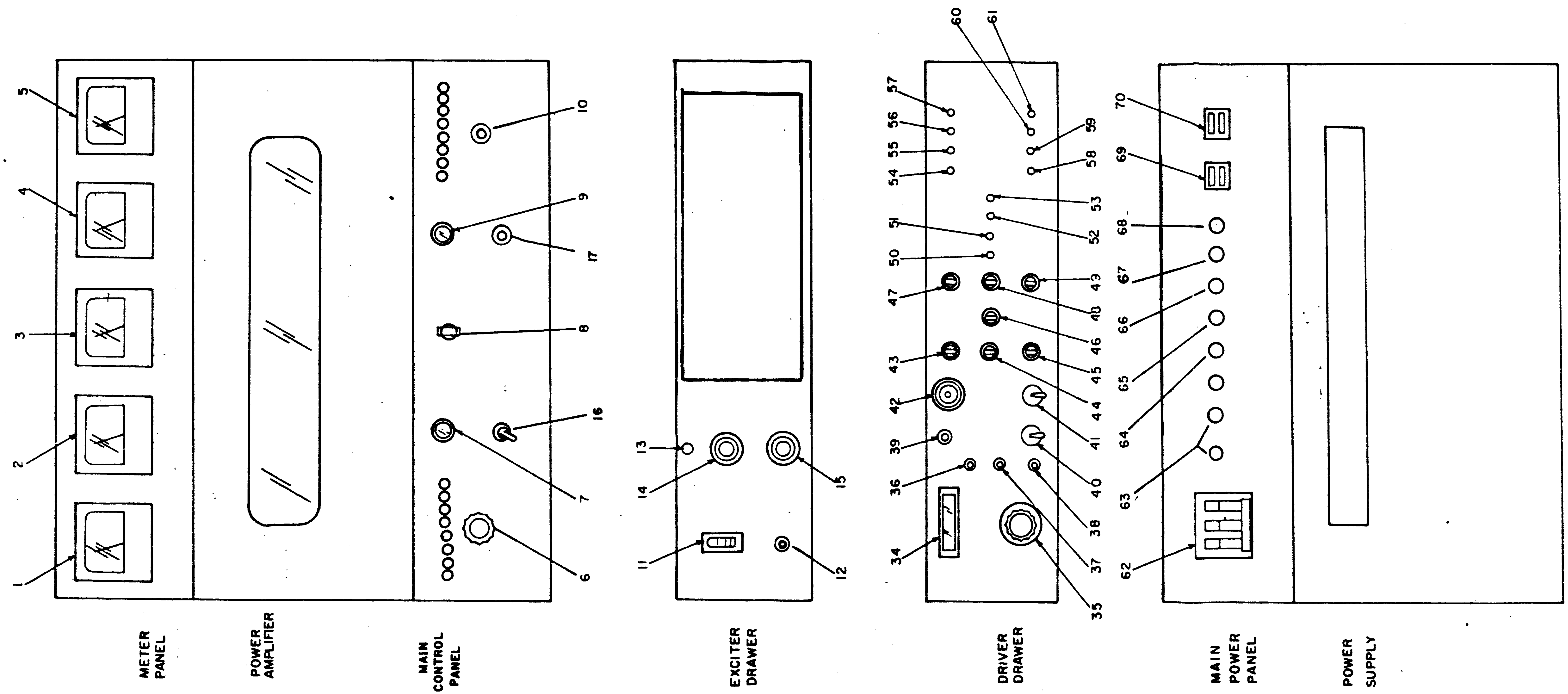


Figure 3-1

Controls and Indicators

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

The MFT-10K/J Transmitter is a single rack configuration, comprised of six individual sections coupled together to form a 10 kw transmitter system.

The exciter unit can be housed in the exciter drawer compartment or be positioned externally away from the transmitter system. All technical data pertaining to the exciter unit is located in Appendix A of this manual.

4-2. AUTOMATIC/MANUAL PA TUNING (refer to figures 6-2, 6-6).

PA Tuning can be accomplished in manual or automatic mode through the AUTO/MAN and PA TUNE switches. 230V, 60Hz phase 1 and 2 ac power, through K802 relay wipers, is applied to AUTO/MAN ganged single pole double throw switch S909. In MAN mode, ac is supplied through S909 poles A and B. 230 volts ac phase is applied to leg C of the tuning cap motor. Phase 2 is applied to either leg A or leg B motor winding, depending on the position of PA TUNE CW/CCW momentary switch S911. Holding S911 in CW allows phase 2 to be applied to leg A through the normally closed contact of S913. In CCW position, phase 2 is applied through S914. When both phase 1 and 2 are present at the windings, the motor starts, driving tuning capacitors C927 (or C928). If during the frequency search the upper or lower limit is reached, switch S913 (S914) circuit opens and the motor stops. In AUTO mode, tuning is controlled through a servo circuit. As in the manual mode Ø1 is applied to leg C of the tuning cap motor. At the same time Ø1 and Ø2 is fed to servo printed circuit board Z901 terminals E and 3. Depressing the TUNE pushbutton resets Z901 , the tune carrier is energized, the servo is prepared to search. A motor drive input signal from Z901-5 causes the servo motor to start searching and, with K900 in the "up frequency" configuration, the DC sence phase detector is disabled. As the tuning capacitors C927 and C928 reach the upper limit, the motor releases to begin a resonance search.

As resonance is approached the phase detector generates a positive voltage. The voltage rises through a peak, passes through zero at resonance, and proceeds towards a negative peak. Servo Z901 senses the positive voltage and triggers transistor Q2 and RF TRIG LED illuminates. When the voltage drops to zero, operational amplifier Z1 output goes to zero, relay K2 is deenergized, Q4 stops. After one second Q11 times out and Q10 is trippered, turning "tune command" signal enabling READY indicator to illuminate. If resonance is not found within 15 seconds after start of sequence, Q8 triggers, the motor stops, and FAULT indicator illuminates.

4-3. PA LOAD AND PA BAND CIRCUITS (refer to figures 6-2, 6-8, 6-9).

The PA load and PA band circuits will operate in either manual or automatic modes. In manual mode the toggle switch S909 is placed to MAN and the Bandswitch S910 is rotated to the selected band. 24 volts from the driver drawer and ground from S909 will energize Z903 relay coil K1. Phase 1 and Ø2 230V, 60Hz is routed to the tuning motor. The motor runs, driving C927 and C928 in search of resonance. Tuning is controlled at the PA TUNE spring-loaded, double pole center-off switch (S911) located on the front panel. Holding the switch to up position will increase capacitance, in down position will decrease capacitance.

In AUTO mode, the selected band frequency is routed to the band switching assembly and to the load assembly printed circuit board Z903. The band frequency is fed through the wafer of S906B and to the grounding side of Z903 relay K1 coil. Positive 24 volts dc is also tapped to the normally open contact of a stepping coil of S906 and to the C deck of S906. If the PA Bandswitch S910 is already in the selected band, nothing will happen. However, if the band must be searched, the stepper coil is energized and transformer T900 interruptor switch causes the coil to be tapped. Between each tap the interruptor switch contactor is forced open, the circuit is broken, the switch resets, and the sequence is repeated until the slotted portion of S906B breaks the circuit, closes the stepper switch, and removes power to K1 relay. The wafer of S906C, tracking S906B, will cause the appropriate PA load indicator to illuminate. The band frequency to deck B of S905 is passed through the wafer to the grounding side of relay K901 coil, completing the circuit, and the relay is actuated. 230V, 60Hz ac is routed through magnetically-latched switching relay K901 to the windings of M905; the motor starts; and S905A begins to step. S905A will progressively short out sections of inductor L901 until the wafer of S905B reaches the selected band or until L901 reaches its upper limits. Reaching the upper limits will cause K901 relay to operate and L901 to drop back and start tracking from its lower limit. Deck C of S905 slaves the B deck and causes the appropriate band indicator to illuminate.

4-4. BLOCK DIAGRAM DESCRIPTION (Refer to figure 4-2).

a. If the exciter unit is housed in the exciter drawer the audio signals enter the transmitter through the audio input jacks located in the main power panel. When the exciter unit is positioned externally away from the transmitter, the audio signals are placed directly at the rear of the exciter unit.

The audio signals mix with the 450 KHz to 2 MHz RF generated in the exciter unit (see Appendix A). The RF output of the exciter unit is then extended to the intermediate power amplifier stage of the transmitter system.

The intermediate power amplifier, consisting of two stages of amplification. When the RF signal from the exciter unit is placed on the grid of the first IPA tube, the signal is then transformer coupled to the grids of the following two tubes which are operated in push pull with a final output of 160 volts.

The output of the IPA is coupled to the grid of the 10 kw linear power amplifier where it is amplified to an RF level of 10K watts average, 20K watts pep. The 10K watts average, 20K watts pep output signal is then fed to a 50 ohm unbalanced antenna. A portion of the high level RF output is rectified and applied to an automatic load and drive control (ALDC) circuit.

When this circuit is switched on, a control voltage is applied to the exciter whenever any preset RF signal level is exceeded. This control circuit limits high drive peaks.

The IPA drawer also houses four separate power supplies: the intermediate power amplifier, the plate supply which provides plate voltage for the three IPA stages; a bias supply which provides a regulated negative bias voltage for the IPA and final PA stages, a filament supply which provides DC voltage for the three tube filaments in the IPA stages, and an interlock supply providing 28 vdc to operate the interlock circuitry, with a regulated 24 vdc tapped off for the overload reset function.

The IPA drawer also contains the transistorized overload circuitry that opens the interlock circuitry cutting off high voltage to the transmitter. The protective circuits sample the bias supply voltages and the IPA and PA plate and screen currents. If current is excessive or if a voltage is deficient, the overload relay operates and removes high voltage.

The High Voltage Power Supply provides the final PA with 10,000 volts DC plate voltage as well as a highly regulated screen voltage.

b. PRIMARY INPUT POWER VOLTAGE CIRCUITS (refer to figures 4-1, 6-2).

The MFT-10K/J Transmitter requires two sources of primary intput power. A 208 vac 400Hz 3 phase input and a 230 vac 60Hz input. Primary power inputs enter the transmitter through the lower left hand side of the power supply compartment. A partial explaination of the routing is explained in the following paragraphs (see figure 4-1).

208VDC 400Hz. The 208 vac 400Hz 3 phase input source is interupted by the main power circuit breaker CB800. When CB800 is closed phase 2 and 3 of the 3 phase source is routed to the exciter drawer at P801 pins A and C. This power source supplies AC for the -28 vdc power supply in the exciter drawer. Phase 1, 2, 3 are carried to K800 contacts (High Voltage Contactor). The contacts of K800 are closed when a 230 vac 60Hz input is placed across K800 coil. K800 when energized will place 208 vac 400Hz 3 phases across T800 High Voltage Transformer. The High Voltage lamp DS901 will now light. One set of contacts of K800 when closed will send a ground signal out to J1002 to be used for remote control High Voltage Indication. Phases 1,2 and 3 are routed to P802 of the driver drawer at pins P, R, and S and to B800 the blower for the PA tube. B800 blower supplies forced air cooling to the base of the PA Tube V900 and also forces the air vane of switch S801 to close. Phase 1 is placed on one side of the filament transformer T801 at pin 2. Phase 2 and 3 will light the Main Power lamp DS900. Fuses for all of the formentioned 3 phase routing are illustrated in figure 4-1 and figure 6-2.

230VAC 60HZ. Phases 1 and 2 of the 230 vac 60Hz source are protected with two 15 amp fuses F800 and F801. Phases 1 and 2 are routed to K802 contacts located at the rear of the Input Chassis (figure 6-20). K802 relay is controlled via -28 vdc generated in the exciter drawer. When K802 is energized phases 1 and 2 are allowed to pass on to the following components: P802 (Driver Drawer connector) at pin k and 0 and routed to B301 blower and K305 relay through air switch S305, B900 (PA compartment blower), at K800 (Phase 2) one side of the HV contactor coil, at M800 (Filament Timer), at S801 air switch (Phase 2) common.

When S801 makes contact Phase 2 continues on to P801 of the Driver Drawer at pin K. Phase 2 also is placed on one side of the plate timer M801. To complete 230 vac 60Hz at K800 and M801 it is necessary for K301 contactor in the driver drawer to be energized. This will route phase 1 to M801 and K800 completing 230 vac 60Hz to these components. Phases 1 and 2 enters the bandswitch assembly at P303 pins 4 and 6, in the servo control printed circuit assembly at P904 pins 3 and E and in the PA TUNE assembly at P905 pins 6, 2 or 4. K801 shorting relay receives phase 1 directly from K802. Phase 2 is placed on K801 by way of P802-0. When K801 is energized a ground is removed from K801 allowing High Voltage to be placed on the PA Plate V900.

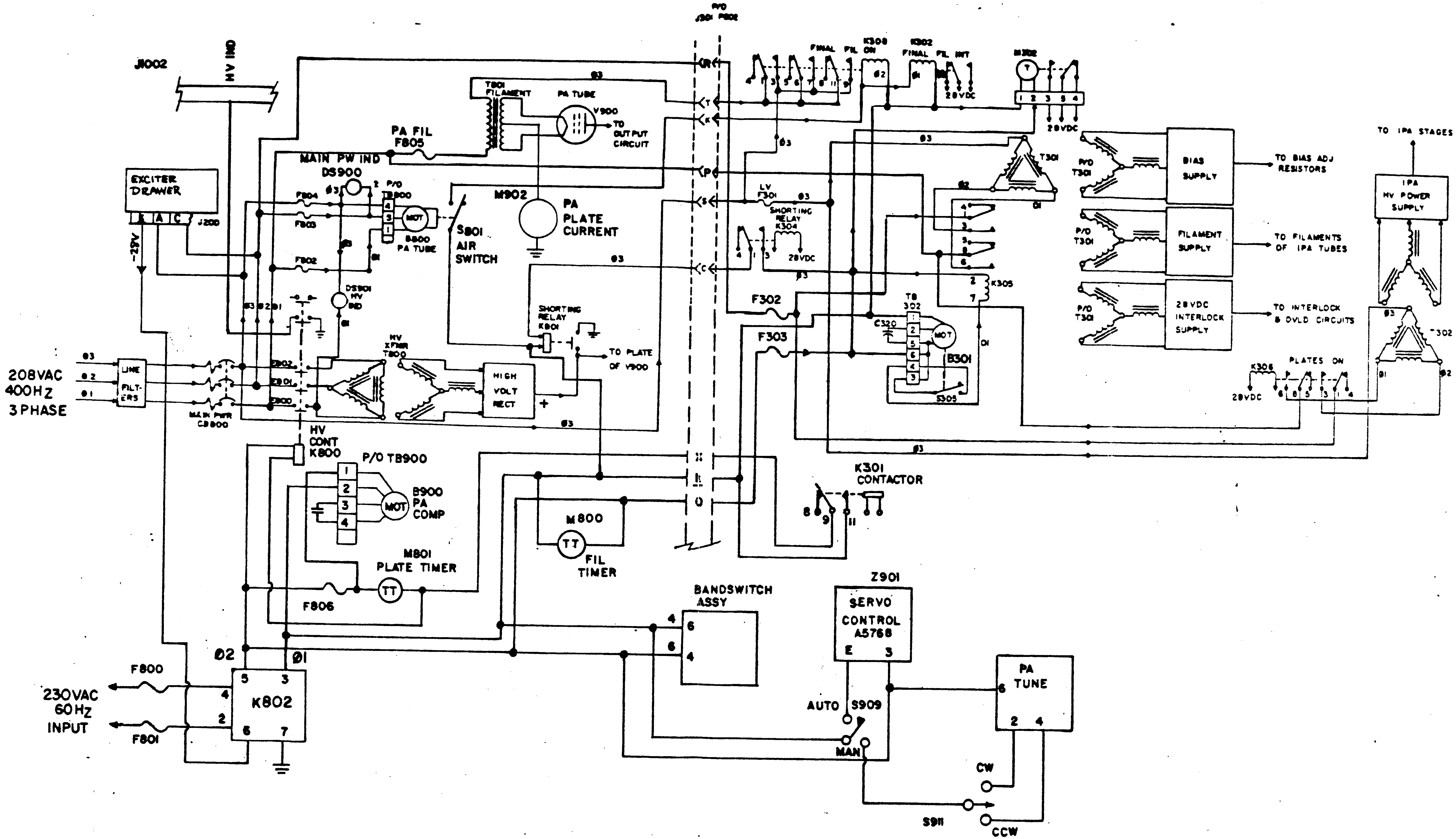


Figure 4-1

Simplified Schematic of A.C. Distribution

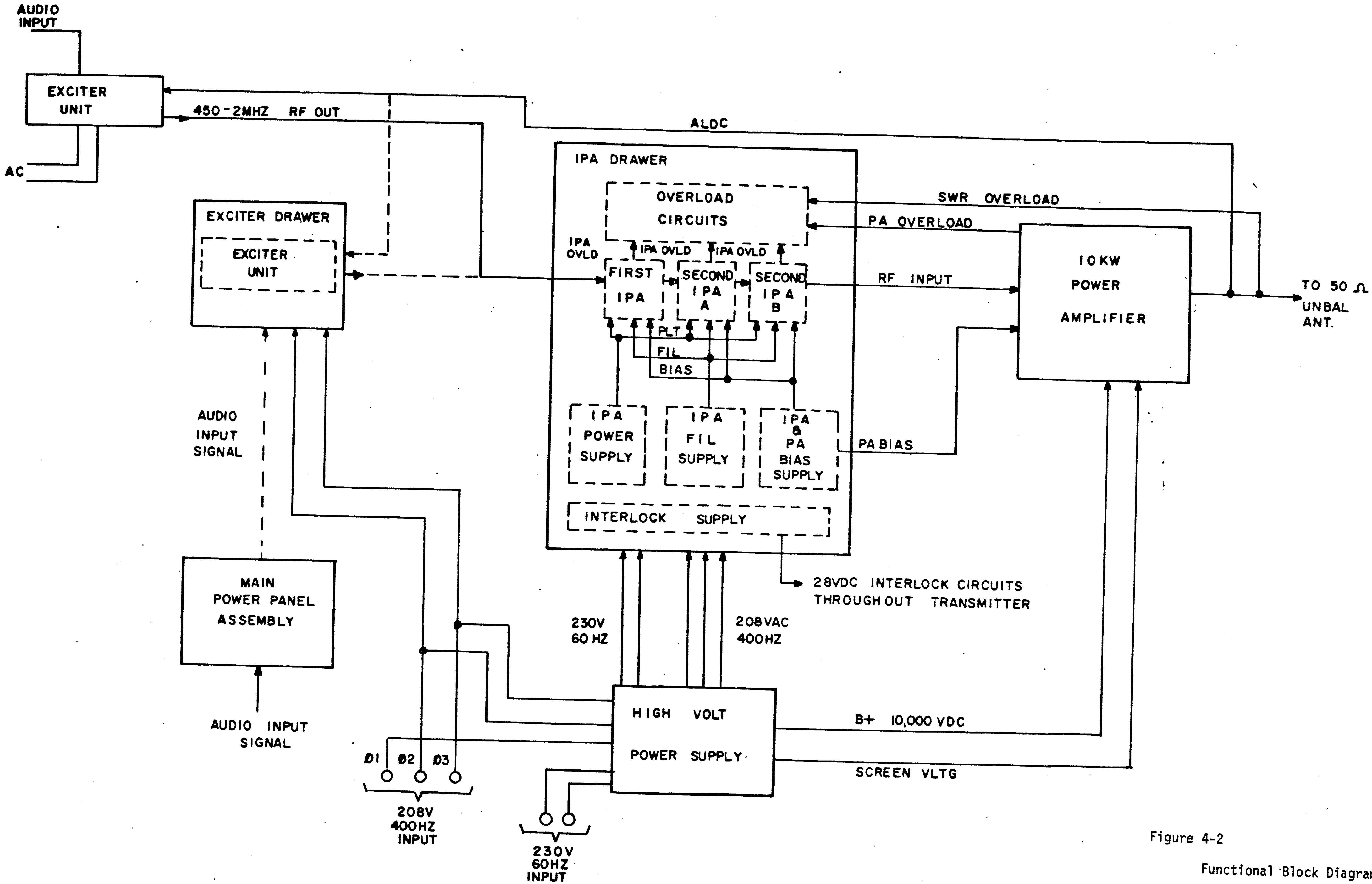


Figure 4-2

Functional Block Diagram

4-5. INTERMEDIATE POWER AMPLIFIER CIRCUIT ANALYSIS (refer to figure 6-15).

The intermediate power amplifier consists of two stages of amplification. The first stage V301 receives approximately 100mw on the grid, from the low frequency exciter unit. The amplified signal is then transformer coupled through T303 to the grids of the second amplifier "A" stage V302, and "B" stage V303 operating in push pull. A 160 volt output through transformer T304 is coupled to the grid of the final Power Amplifier tube V900 by passing through IPA connector J304.

Both stages employ fixed bias type of operation, which is preset by first amplifier bias adjust resistor R320 and second stage "A" and "B" amplifier bias adjust resistors R332 and R335.

The first IPA stage receives 1000 vdc on its plate, and the second stage "A" and "B" amplifiers receive 2000 vdc on each plate.

A front panel switch S303 and its associated meter M301 measure the cathode current of each IPA tube.

4-6. IPA HIGH VOLTAGE POWER SUPPLY (refer to figure 6-15).

With reference to the interlock circuit analysis it can be seen that the IPA High Voltage Power Supply will not operate until High Voltage Contactor K301 is activated. When K301 is activated a ground is placed on the coil of PLATES ON relay K306 energizing it and allowing phase 1 and 2 to pass through to the terminals of High Voltage Power Supply Transformer T302. The delta wye input transformer receives 208 vac on each leg and builds it up to 2000 volts output on the secondary wye section, before applying it to the solid state rectifier CR307. The IPA employs a full wave bridge rectifier consisting of a total of six rectifier cells. In this type of arrangement two half wave rectifiers are connected in series across each leg of the transformer.

4-6. IPA HIGH VOLTAGE POWER SUPPLY (cont'd.).

The rectified output of the power supply, passes through several filtering components before being applied to the plates of V302 and V303.

Transformer T302 also supplies 1000 vdc plate voltage for the first IPA stage and a regulated screen voltage for both stages of the IPA, by tapping the common point of all three legs of the secondary wye section T302.

The screen voltage is developed by voltage divider network R339, R340, R341, R343, and R342, and voltage regulated by two OA2 tubes V307 and V308, and an OB2 tube V309 before being applied to the screen of each tube.

4-7. BIAS SUPPLY, FILAMENT SUPPLY 28VDC SUPPLY (refer to figure 6-15).

The Bias supply, the IPA filament supply and the 28vdc interlock and overload circuit supply are all delta wye input transformer configurations. The 208 VAC delta portion of the input transformer T301 receives three phase primary power and transfers it to the bias, filament and interlock supply wye sections producing 500 volts, 12vdc, and 28vdc, respectively. The rectifier portion of the three supplies are all full wave bridge circuits, using a total of six rectifier cells in each circuit. In this type of arrangement two half wave rectifiers are connected in series across each leg of the transformer.

The rectified output of the bias supply passes through choke input filter L304 dropping resistor R337 capacitor C318 and resistor R338 smoothing output ac ripple before it can reach the amplifier circuits. After filtering the rectified output the voltage is regulated by three gas filled OA2 voltage regulator tubes before being applied to the voltage divider networks and bias adjust resistors in the IPA and PA tube circuits.

When PTT relay K303 is de-activated the PA tube V900 is cut-off. When relay K303 is energized a ground is applied to the bias circuit of V900 and it is able to operate.

4-7. BIAS SUPPLY, FILAMENT SUPPLY 28VDC SUPPLY (refer to figure 6-15) (cont'd.).

The filament supply provides 12 vdc to each IPA tube. The circuit is protected by a 4 amp fuse.

The 28 vdc interlock and overload supply circuits provides 28 vdc to interlock switches and relays.

The 28 vdc internal supply circuit is protected by 2 amp fuse F309 the 24 vdc has an additional 1½ amp fuse F304 for protection.

4-8. 10KW PA and ANTENNA TUNING UNIT (refer to figure 6-15).

The 10 kw Power Amplifier tube V900 a 4CX35000 tetrode amplifies the output of the two stage intermediate power amplifier. The output of V900 is 10,000 watts average power. The antenna tuning unit in the output circuit is designed for unbalanced operation.

The RF output of the third IPA is 160 volts applied to the grid of PA tube V900. Filament power at 10 volts, 300 amperes is supplied to the directly heated cathode of V900 from filament transformer T801. The center tap from T801 goes to PA PLATE CURRENT meter M902. By passing the RF signal to ground through capacitors C809, C811, C810, and C808, places the cathode of V900 at RF ground potential.

The -320 volt level of grid bias is controlled by final bias adjust potentiometer R311. The resistor can be adjusted from the front panel of the IPA Drawer.

The PA screen voltage is tapped off of High Voltage Power Supply Transformer T800 and is highly regulated by a series of six zener diodes and seven resistors. PA SCREEN mèter M901 placed in the screen circuit monitors the PA SCREEN current.

4-8. 10KW PA and ANTENNA TUNING UNIT (refer to figure 6-15) (cont'd.).

The amplified signal from the plate of V900 passes through the output tuning network consisting of tuning capacitors C909 and C910 with PA bandswitch S905 progressively shorting out sections of inductor L901. Load switch S906 progressively shorts out sections of output transformer T900. This network is designed to match the impedance of a 50 OHM UNBALANCED load to the impedance of the PA tube plate for maximum transfer of power.

The AUTOMATIC LOAD AND DRIVE CONTROL (ALDC) circuit Z900 samples the RF voltage at the plate of V900, the RF voltage is further reduced by capacitive voltage divider C913, C824, C825, C827, before being applied to the cathode of diode CR1. The ALDC ADJUST potentiometer R201 is coupled to front panel control ALDC ON-OFF switch S203. One side of R201 is returned to a positive voltage, the wiper of this control varies the bias on ALDC diode CR1. When the peak value of the RF signal exceeds the bias on CR1, the diode conducts, developing a negative voltage, which is filtered and applied to ALDC switch S302. When ALDC is utilized this negative voltage is returned to the exciter drawer to control the signal amplitude.

The DIRECTIONAL COUPLER DC900 directs the RF output signal to the antenna as well as directing the reflected power to the SWR overload circuitry, and the forward power to forward power meter M903. DC900 provides the means of measuring the output power on the Forward Power Meter of the transmitter, and the SWR of the transmission line on the reflected Power Meter, M904. Forward Power from DC900 is rectified by diode CR900 and applied to M903. Reflected power from DC900 is rectified by diode CR901 and applied to SWR protective circuit or rectified power meter M904 depending on the position of switch S301. When switch S301 is in the meter position, input to the protective circuit is opened and meter M904 reads the SWR.

4-9. HIGH VOLTAGE POWER SUPPLY (refer to figure 6-2, p.6-36).

The High Voltage Power Supply provides the required plate voltage for the 10 kw power amplifier. The three phase primary ac input is connected to delta wye transformer T800. The transformer builds up the 208 vac input to 4500 volts on each leg before it is applied to the full wave bridge circuit using a total of six rectifier cells. In this arrangement, two half wave rectifiers are connected in series across each leg of the high voltage transformer, and has an extremely small percentage of ripple and a very low ratio of peak to average voltage.

The 10,000 vdc output of the three phase full wave bridge rectifier is applied to a choke input type filter consisting of inductor L800 and capacitor C800, before being applied to the plate of power amplifier tube V900 it again passes through a series of filter components.

The high voltage level is measured by PA PLATE VOLTAGE meter M900.

4-10. OVERLOAD CIRCUITS (refer to figures 6-16, 6-17a-b).

The MFT-10K/J Transmitter is protected by eight solid state overload circuits. They are the power amplifier plate, bias, and screen, the IPA driver, IPA "A", and "B" and IPA voltage overload, and SWR overload circuits. The circuits are designed to shut off the Power Amplifier and Intermediate Power Amplifier High Voltage Power supplies should an overload condition exist in any of the prenamed areas.

All overload control circuits ultimately trigger overload relay 2K301. They are isloated by Diodes 2CR301, 2CR302, 2CR303, 2CR304, 2CR305, 2CR306, 2CR307, and 2CR308 which prevent the signal from an activated overload circuit from interacting with the other integrated overload circuits.

4-10. OVERLOAD CIRCUITS (refer to figure 6-16, 6-17a-b) (cont'd.).

With the contacts of relay 2K301 in the energized state, the 28 vdc supply circuit to High Voltage contactor K301, is cut off deactivating it, this in turn de-energizes Plates On relay K306 that controls the IPA High Voltage Power Supply transformer T301. The 28 vdc supply voltage to shorting relay K304 is also cut off, when overload relay 2K301 is energized. One leg of the 230 vac 60 Hz input is cut-off from the shorting relay K801. K801 is deenergized and shorts out the High Voltage Power Supply.

a. PA BIAS OVERLOAD - The PA Bias Overload adjust resistor 2R302 is connected to the PA Bias supply circuit of PA tube V900. The PA Bias voltage is from -320 to -500 vdc. Under normal conditions the value of resistor 2R304 is set by PA Bias overload resistor 2R302 for a -0 negative voltage. The 24 volt supply passes through 2R302, 2R303, and 2R304 to ground.

When an overload occurs by a positive going voltage a .5 to .7 volts is developed across the divider circuit causing SCRQ1, to trigger, With Q1 conducting front panel overload lamp 2DS301 lights and transistor SQ312 goes into conduction, activating overload relay 2K301.

b. PA PLATE OVERLOAD - The PA plate overload adjust resistor 2R308 set at a pre-determined level is connected to the cathode circuit of the PA tube to measure the plate current. If an excessive plate current should exist, the level of the plate overload adjust potentiometer is affected and produces a positive voltage high enough to exceed the forward breaker voltage of 2Q302. When 2Q302 conducts, a plate overload condition is indicated by the front panel indicator lamp 2DS302, and transistor 2Q312 conducts, activating overload relay 2K301, which opens the 28 vdc supply line causing the High Voltage to be removed from the transmitter.

4-10. OVERLOAD CIRCUITS (refer to figure 6-16, 6-17a-b) (cont'd.).

c. SCREEN VOERLOAD - The PA Screen overload adjust 2R312 is connected to the screen circuit of PA tube V900. During normal operation transistor 2Q304 conducts, creating a small voltage drop from collector to emitter. When the screen current rises excessively the voltage drop across overload adjust potentiometer 2R312, decreases. The base of 2Q304 sees this as a negative change and conducts less. At this point the collector to emitter voltage increases sufficiently to trigger 2Q303. Front panel indicator lamp for screen overload 2DS303 will light, and transistor 2Q312 is activated causing overload relay 2K301 to energize and remove High Voltage from transmitter.

d. DRIVER, IPA "A", IPA "B" OVERLOAD CIRCUITS - Since all three overload circuits operate the same they will be discussed together. The Driver, IPA "A", and IPA "B" overload adjust resistors 2R315, 2R318, 2R321, set at a pre-determined level are connected to the cathode circuit of the first IPA amplifier stage, the 2nd IPA "A" and 2nd IPA "B" stages to measure the plate current. If an excessive plate current should exist the level of the associated overload adjust potentiometer is affected and produces a positive voltage high enough to exceed the forward breaker voltage of the SCR in the effected circuit, either 2Q305, 2Q306 or 2Q307. When any one of the SCR's go into conduction, an over-load condition is indicated by the front panel lamp either 2DS304, 2DS305, or 2DS306, depending upon which stage of the IPA caused the overload. When the related SCR is conducting, transistor 2Q312 conducts energizing overload relay 2K301 which opens the 28 vdc supply line, removing the high voltage from the transmitter.

4-10. OVERLOAD CIRCUITS (refer to figure 6-16, 6-17a-b) (cont'd.).

e. IPA VOLTAGE OVERLOAD CIRCUIT - The IPA voltage overload adjust resistor 2R324 is connected to the voltage divider network which develops screen voltage for the IPA stages. During normal operation transistor 2Q309 conducts creating a small voltage drop from collector to emitter. When the screen current rises excessively the voltage drop across overload adjust potentiometer 2R324 decreases. The base of 2Q309 sees this as a negative change and conducts less. At this point the collector to emitter voltage increases sufficiently to trigger 2Q308. The front panel IPA overload indicator 2DS307 will light and transistor 2Q312 is activated, causing the overload relay 2K301 to energize and remove High Voltage from the transmitter.

f. SWR OVERLOAD - Transistor 2Q311 is connected in the SWR circuit to SWR trip assembly A5705. When the transmitter is operating normally 2Q311 is non-conducting. When an SWR greater than 3:1 is felt, SWR trip assembly energizes and a positive voltage is applied to the base of transistor 2Q311 causing it to conduct and trigger 2Q310, which lights front panel overload indicator 2DS308 and also energize transistor 2Q312 which energizes overload relay 2K301 removing High Voltage from the transmitter.

4-11. OVERLOAD RESET AND ALARM CIRCUIT (refer to figure 6-13).

In the event of an overload High Voltage contactor K301 de-energizes and removes high voltage from the transmitter. If desired an audible alarm will go off by having the alarm switch S302 in the closed position and allowing the 24 vdc to complete the alarm circuit to ground through the contacts of the de-energized High Voltage Contactor.

4-11. OVERLOAD RESET AND ALARM CIRCUIT (refer to figure 6-13) (cont'd.).

The regulated 24 vdc also flows through the overload reset switch S201 located on the front panel of the exciter drawer, through the associated circuitry to the contacts of overload Delay relay K309. As described in the interlock circuit description relay K309 delays the 24 vdc from reaching the overload circuits for just an instant until after the high voltage is applied to the transmitter. Relay K309 then energizes and the overload circuits receive the regulated 24 vdc supply voltage.

When an overload occurs overload relay 2K301 will energize. To reset overload relay, depress overload reset button, this opens the 24 vdc line to the coil of the overload relay and returns it to its normal deenergized position.

4-12. 28 VDC AND INTERLOCK CIRCUITRY.

The MFT-10K/J Transmitter has a network of interlock switches and protective devices throughout the unit to protect the operating and maintenance personnel as well as the equipment. The circuit is comprised of switches, relays and a timer designed to disable high voltage in the event an interlock is open. There is a total of 12 interlock switches. In order to locate an open or faulty interlock, switch S202 is provided on the front panel of the exciter drawer. Turning the switch through each of nine positions and observing when indicator lamp DS200 lights will indicate the interlock circuit is functioning properly. In the event indicator lamp DS200 does not light, the position that switch S202 is in will be the area of an open or faulty interlock.

The 28 vdc interlock and overload circuitry is actuated by the application of 3 phase power to PA Tube Blower B800. Blower B800 applies air pressure to close the air vane on switch S801. Filament ON relay K308 and Final Filament Interlock relay K302 in series with switch S801 are then energized with the 230 vac 60Hz power.

4-12. 28 VDC AND INTERLOCK CIRCUITRY (cont'd.).

The delta wye configured 28 vdc interlock supply transformer T301 is also energized by 3 phase primary power and the 28 vdc interlock supply is able to function.

a. SERIES INTERLOCK CIRCUIT (refer to figure 6-13) - When all interlock switches are closed the 28 vdc supply voltage will take the following path. It will first pass through the closed contacts of Final Filament Interlock Relay K302. It then takes two paths, one path to contact 1 of switch S202, and another path through switch S304, to contact 2 of switch S202 and also through switch S200 to contact 3 of interlock switch S202. The 28 vdc Interlock Voltage then goes out terminal b of jack J200 passing through the PA rear and PS rear interlock switches, through the External interlocks which are parallel and passing to the Fuse and Window panel interlocks to the closed contacts of Timer M302. The 28 vdc then takes two paths: one path will energize the coil of shorting relay K304. The second path is through terminal h of Jack 301 to remote high voltage on-off switches which are in parallel, and then passes through the PA Band switch relay K901. It then continues through terminal 6 of TB900, going through Heat Voerload switch S904. The 28 vdc then flows out terminal 8 of TB900 to pin j of jack J301. It again takes two paths; one path goes to the coil of Overload Delay Relay K309, and the other to delay circuit capacitor C315 and Resistor R318. (After a momentary Delay K309 enables the 24 vdc supply voltage to flow to overload circuit board). The other path goes through pin 18 of jack J302 and the closed contacts of Overload control circuit board Z301 Relay 2K301, passing out terminal y of jack J302 to the coil of High Voltage Contactor K301. When High Voltage circuit breaker CB200 is placed in the ON position a ground is applied to the coil of the HV Contactor energizing it.

a. SERIES INTERLOCK CIRCUIT (refer to figure 6-13) (cont'd.) - When HV Contactor K301 is energized a ground is applied to the coil of Plates on Relay K306 energizing it.

Diode CR301 and CR302 prevent the series interlock circuit from feeding back to the shorting relay K304, when the HV Circuit Breaker CB200 is in an open position.

b. INTERLOCK INDICATOR - When the 28 vdc is supplied to the interlock circuitry the interlock circuits can be monitored by switch S202. Indicator light on the exciter drawer front panel provide the capability to monitor each interlock circuit and the rotary switch (S202) provides the following selections:

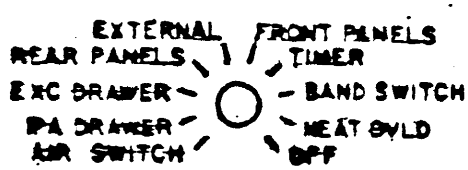


Figure 4-3

INTERLOCK SWITCH LOCATIONS

1. AIR SWITCH

By placing switch S202 in PA air switch position, switch S801 can be monitored. Since filament of relay is in series with PA switch S801 the activation of filament of relay indicates that S801 is closed. When final filament interlock relay K320 is energized it allows 28 vdc to flow through switch S202 to indicator lamp DS200.

2. IPA DRAWER

By placing switch S202 in the IPA drawer position the interlock switch S304 can be monitored. If interlock switch S304 is in the normally open position it allows 28 vdc to light the indicator lamp DS200. If the interlock switch S304 is in the normally closed position the HV Circuit Breaker CB200 will open and shut off the High Voltage.

3. EXCITER DRAWER

By placing switch S202, to the exciter drawer position, switch S200 can be monitored. Indicator DS200 will light if S200 is in the normally open position. If the switch is in the normally closed position the interlock supply voltage will flow through HV circuit breaker CB200 opening up the switch and shutting off high voltage.

4. REAR PANELS

By placing switch S202 in rear panels position PA rear switches can be monitored. If the switches are in the normally open position they allow 28 vdc to flow to indicator lamp DS200. In the normally closed position the switches will allow the 28 vdc to open HV Circuit Breaker, CB200, and shut off the high voltage.

5. EXTERNAL

By placing switch S202 in the external position the external interlocks can be monitored.

6. FRONT PANELS

By placing switch S202 in front panel position the fuse and window panel switches can be monitored. If the switches are in the normally open position indicator lamp DS200 will light. If the switches are in the normally closed position, the High Voltage Circuit Breaker CB200 will open and shut off the high voltage.

WARNING

To monitor the following positions, Bandswitch, Heat Overload, and Timer the following sequence must be adhered to or switch S202 will give a misleading indicaiton and could cause needless maintenance.

7. TIMER

In the Timer position, the interlock supply voltage passes through the Timer contacts on to the indicator lamp DS200.

8. BANDSWITCH

In the Bandswitch position the interlock supply voltage passes through the Timer contacts on to the indicator lamp DS200.

9. HEAT OVLD

In the Heat Ovld position the indicator lamp DS200 will light as long as the Heat Ovld switch is in the normally closed position, and the interlock supply voltage is allowed to pass through the bandswitch assembly K901, and M302 contacts. If the switch is tripped to the normally open position by excessive, the High Voltage circuit CB200 will open and shut off the high voltage.

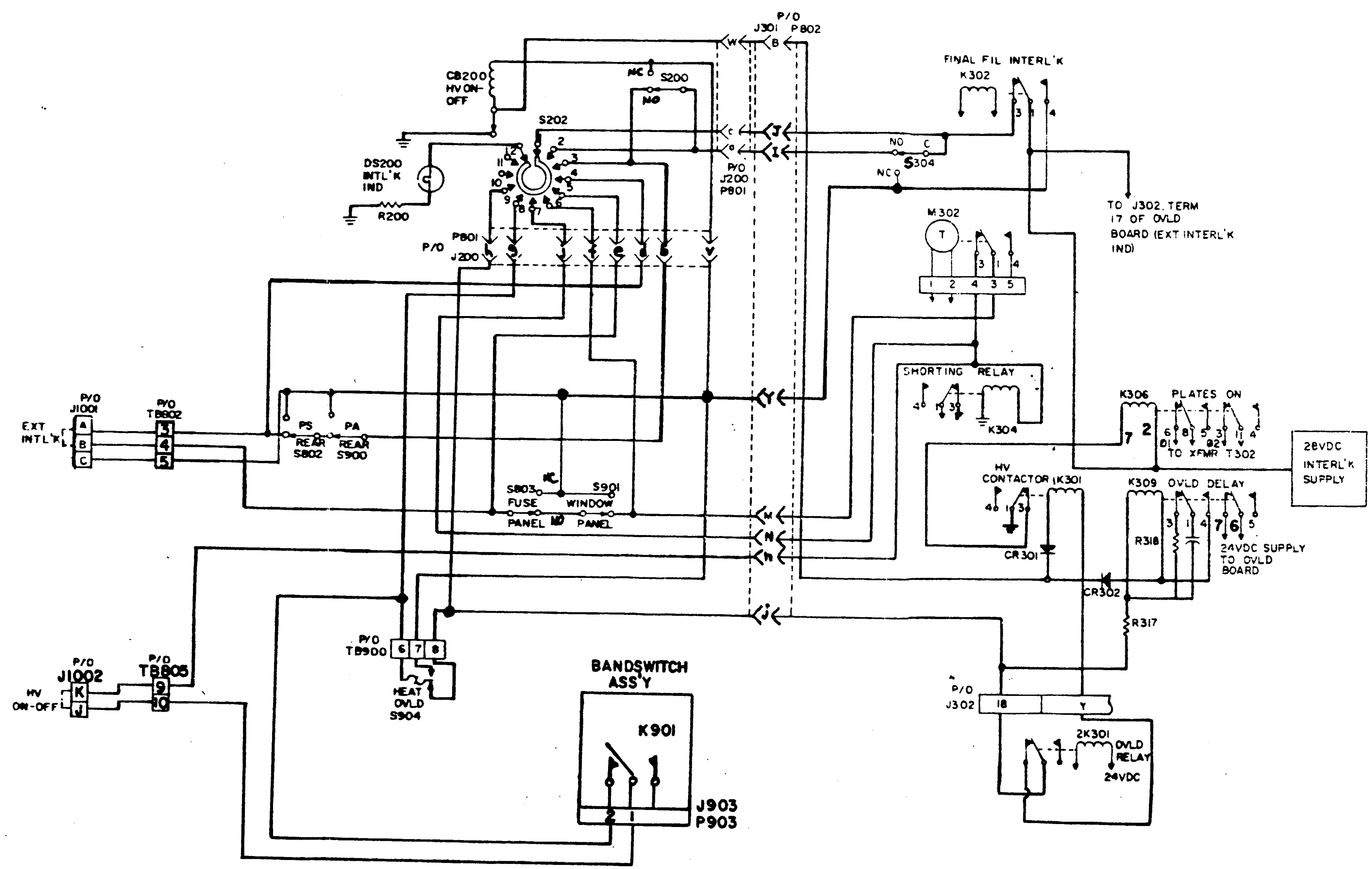


Figure 4-4

Simplified Schematic of Interlock Circuits

SECTION 5

MAINTENANCE

5-1. GENERAL.

Maintenance is divided into three categories: operator's maintenance, preventive maintenance, and corrective maintenance. Tne operator's maintenance, performed by the operator as he works with the equipment, is confined to visual inspection, cleaning, and fuse replacement.

This section also contains detailed troubleshooting techniques and reference data that should be used to quickly locate malfunctions in the transmitter. A preliminary inspection procedure, table 5-1 is included as a visual aid to determine obvious conditions which may have caused equipment breakdown. This is followed by an equipment performance check, table 5-2, and a system troubleshooting chart, table 5-3. The combined data of tables will permit sectionalization of troubles to specific drawers in the transmitter and in many instances, to specific stages and parts.

NOTE

It is assumed in this section that the trouble symptoms listed are produced by malfunctions rather than by improper operating procedures. Thus, if an overload lamp lights, it is assumed that the operator cannot clear the trouble by normal operating procedures such as reducing the drive, retuning, and reloading. Also, the results of defective front-panel indicator lamps and meters, and the remedial measures concerned are obvious and are not covered in this section.

5-2. PREVENTIVE MAINTENANCE.

Preventive maintenance is maintenance that detects and corrects trouble-producing conditions before they become serious enough to affect equipment operation. Common causes of trouble are dirt and grime, contact erosion, improper contact pressure, lack of proper lubrication, improper relay adjustment, dirty air filters, overheating unstable power supplies, vacuum tubes with poor emission, and loose parts (due to vibration). Recommended schedules for preventive maintenance are presented below.

a. ONCE EACH SHIFT DURING AN "ON THE AIR" PERIOD. - Check the operator's performance record for irregularities and possible sources of future trouble. Make minor adjustments of tuning controls to verify proper tuning. Observe all electrical quantities measurable with built-in meters and compare observations with established standards. Observe indicator lights for abnormal color and signs of internal flashing.

b. DAILY DURING AN "OFF THE AIR" PERIOD. - Visually and manually inspect all parts in the transmitter for overheating and damage. Inspect all sliding of moving coil contacts. Feel blower and fan motors for overheating and observe rotating parts for wear. Note deposits of dust and dirt. Inspect condition of relay contacts. Check operation of all door interlocks.

c. MONTHLY DURING "OFF THE AIR" PERIOD. - Recondition rotary and switch contacts as necessary. Use crocus cloth and trichlorethylene or ethylene-dichloride for cleaning. Inspect and clean the transmitter. Check the condition of air filters. Replace or clean dirty filters. Inspect the equipment for loose solder connections or screws, especially in those areas in which appreciable vibration occurs. Gear trains showing signs of becoming dry should be lubricated with a drop or two of any high quality, light machine lubricant. Check the condition of all tubes.

WHAT TO INSPECT	DEFECTS TO LOOK FOR	REMEDY
All electrical connections at rear of main and auxiliary frames.	Open connections, dirt, frayed cables.	Tighten, replace or clean as necessary.
Antenna connections at side of main frame.	Loose connections, dirt, frayed cables.	Tighten, replace or clean as necessary.
Knobs, screws, connectors.	Loose or missing hardware.	Tighten or replace.
Wiring	Loose or frayed wires.	Resolder or rewire.
Resistors	Cracks, chipping blistering, discoloration, and other signs of overheating.	Replace as necessary.
Capacitors	Leaks, bulges, discoloration.	Replace as necessary.
Tubes	Poor seating.	Secure firmly in place.
Meters	Bent needle, cracked case, broken glass.	Replace as necessary.

Table 5-1. Preliminary Inspection Procedure

5-3. EQUIPMENT PERFORMANCE CHECK.

Table 5-2 is a procedure that systematically checks equipment performance in terms of operating procedures. Perform each step in the order given.

STEP	OPERATION	NORMAL INDICATION	PROBABLE CAUSE OF ABNORMAL INDICATION
1	Connect antenna or dummy load to transmitter, and check that all doors, covers and components are secured.		
2	Set all tuning controls on transmitter to positions specified in transmitter tuning chart.		
3	Set the following controls to there preliminary setting.		
	1. H.V. circuit (11) to OFF. 2. EXCITER switch to ON. 3. ALDC adj (15) fully CCW. 4. RF OUTPUT control (at exciter) to min. 5. ALARM switch (41) to OFF.	STANDBY lamp on (exciter unit) should light.	Open line fuse

Table 5-2. Equipment Performance Check

STEP	OPERATION	NORMAL INDICATION	PROBABLE CAUSE OF ABNORMAL INDICATION
4	Set MAIN POWER circuit breaker (62) to ON.	MAIN POWER lamp (7) lights. PA Tube blower B800 operates. PA compartment B900 operates. FILAMENT TIME meter (69) operates. IPA BLOWER operates	Open line fuses to BLOWERS and main power lamp. Blower motors defective Filament on relay K302 or Air switch S801 defective.
5	Set all tuning controls on transmitter to positions specified in transmitter tuning chart TUNE up EXCITER UNIT accordingly to operators instructions in Appendix A of this manual.		Refer to Appendix A for maintenance if exciter fails to operate.
	NOTE Turn RF OUTPUT control fully counter clockwise before performing next steps of operation.		
6	Turn Interlock monitor switch (14) through each position.	Interlock Indicator lamp (13) lights.	Open Interlock switch.

Table 5-2. Equipment Performance Check (Cont'd.)

STEP	OPERATION	NORMAL INDICATION	REMEDY
7	Set High Voltage Circuit Breaker (11) ON.	High Voltage lamp (9) lights. PA PLATE TIME meter (79) operates. PA H.V. Power Supply is energized. IPA H.V. Power Supply is energized. PA PLATE volt meter should read 9000 vdc.	Overload condition occurrs. Defective shorting relay K304. Defective H.V. contactor K800. Defective shorting relay K801. Defective Plates On relay K306.
8	Increase RF OUTPUT control until 2 amperes is indicated on PLATE Current Meter (3).	PA PLATE current meter (3) should have 2 amperes indication.	Defective PA PLATE current. Low PA plate voltage PA bias not functioning properly. Excessive screen current.
9	Turn TUNE control (8) until forward power meter indicates resonance	Resonance Indication by forward power meter.	Defect in power amplifier V900.
10	Increase RF OUTPUT to a 15 kw reading on forward power meter (4). Then reset RF OUTPUT control to read 10 kw on forward power meter.	Forward Power meter (4) should read 15kw.	Improper tuning or loading; or defect in P.A. circuit. Defective Direct-Coupler DC900.
11	Throw REFLECTED power switch (40) to REFLECTED power position.	REFLECTED POWER meter should not exceed a 3:1 VSWR.	Improper tuning or loading. Defective Directional Coupler DC900.
12	Increase ALDC control (15).	FORWARD POWER meter (4) drops slightly.	ALDC ADJ R201 Defective. ALDC circuit failure (Z900).

Table 5-2. Equipment Performance Check (Cont'd.)

5-4. PROCEDURE FOR REPLACEMENT OF PA TUBE.

WARNING

Extremely high voltages are present in the transmitter. Before replacing PA TUBE make sure the HIGH VOLTAGE and MAIN POWER circuit breakers are set at OFF. Use the shorting rod provided to discharge all capacitors to ground.

1) Remove rear skin of transmitter.

2) Remove one half of PA TUBE AIR DUCT by unfastening dzus fasteners and screws.

3) Remove metal band around PA tube by unfastening take up screw, and sliding off band from tube.

4) Turn WING nut in a clockwise direction to raise tube in its holder.

5) The PA tube weighs approximately 60 pounds, lift tube from its holder being careful not to injure personnel or other components on removal.

6) Carefully replace new tube in holder.

7) Slowly turn knorled head on bottom of tube holder until tube seats correctly.

8) Turn WING nut in a counter clockwise direction and lower tube into socket.

9) Replace other parts in the reverse order from when they were removed.

5-5. REPLACING BEARING ON MAIN BLOWER MOTOR B800 (See figure 5-1).

1) Remove six screws (91-18-18) and six washers (92-8), then remove inlet ring (67-729-IN-2).

2) Loosen two setscrews (91-91-1) on blower wheel (68-3-45) and slide off shaft.

5-5. REPLACING BEARING ON MAIN BLOWER MOTOR B800 (see figure 5-1) (cont'd.).

3) Remove four screws (91-82-2) and four washers (92-26) holding blower housing (67-729-1CC-1) to motor with air retainer (64-30-7).

4) Remove air retainer (64-30-7) from front end cap and remove four nuts (94-1), four washers (92-3), and four screws (69-60-1).

5) Remove frount end cap (3645B7-1).

6) Remove rotor assembly (414B5-1) from motor.

NOTE

If any shim washers should adhere to rear bearing, be sure to put them back into rear bearing bore of the end cap. All shim washers and loading springs (83-48) must be positioned in their original order when reassembling motor.

7) Press off old bearings from shaft (one at a time), by supporting bearings and applying pressure to centers in shaft end. Take care not to damage shaft. Discard old bearings.

8) Press new bearing (47-41-1) on shaft by applying pressure to inner race only, keeping bearing square with shaft. DO NOT APPLY PRESSURE TO OUTER RACE OF BEARINGS.

9) Replace rotor assembly (4145B6-1) in motor housing. Replace front end cap (3645B7-1) and secure in place with four washers (92-3), four nuts (94-1), and four screws (69-60-1).

10) Replace air retainer (64-30-7) to front end cap and attach motor to blower housing (67-729-1CC-1) with four screws (91-83-2) and four washers (92-26).

5-5. REPLACING BEARING ON MAIN BLOWER MOTOR B800 (see figure 5-1) (cont'd.).

11) Slide blower wheel (68-3-45) on shaft. The two setscrews (91-91-1) should line up with flats on shaft to prevent raising burr on shaft which would interfere with future disambly. Tighten setscrews.

12) Attach inlet fing (67-720-IN-2) to blower usning four screws (91-18-18) and six washers (92-8).

5-6. IDLE PLATE CURRENT ADJUSTMENT.

1) Turn transmitter ON, and apply High Voltage. (Don not apply any drive from the Exciter).

2) Set the PA idle plate current with Bias Adjust Control for 1 amperes.

3) Turn meter switch on IPA drawer to Driver. Turn Driver Bias control clockwise to obtain an indication of 20 on the meter.

4) Turn meter switch to IPA "A". Adjust IPA bias until meter indicates 25.

NOTE

Meter positions Driver to IPA "B" times 4 are actual PLATE CURRENT (i.e. 20x4=80 ma.) IPA total times 8 are total Plate Current of IPA "A" and "B" (i.e. 25x8=200 ma.). The PA Plate idle current adjustment must be rechecked after 15 minutes. As PA tube heats up further, the quiescent current increases. The above are the correct idling currents for normal operation.

5-7. IPA, DRIVER, PA, SWR, and PA SCREEN OVERLOAD ADJUSTMENTS.

The IPA Voltage, PA Screen, PA Plate and PA Bias overload adjustments may all be made through the front panel of the driver drawer.

The IPA Plate "A" and "B" and Driver Plate adjustments must be made inside the Driver drawer.

5-7. IPA, DRIVER, PA, SWR, and PA SCREEN OVERLOAD ADJUSTMENTS (cont'd.).

The SWR overload circuit (Z302) is controlled by a sensitive tripping circuit within the driver drawer. When the SWR exceeds 3:1 the circuit is designed to shut off the High Voltage. R1 (5K) must be adjusted for proper operation of the SWR overload circuit.

To make the following adjustments a small screw driver, an alignment tool, and an extender card will be required.

It should be remembered that the MTT-10K/J is capable of peak power output many times that of the front panel meter indications. Therefore, the adjustments which appear to be much higher than normal indications are protecting the transmitters rated capability. After each adjustment has been completed, return plate current to normal IDLING conditions.

a) IPA VOLTAGE OVERLOAD ADJUSTMENT

1. Turn the transmitter ON and apply High Voltage. (Do not apply any drive from the Exciter).
2. Turn IPA Voltage SLOWLY until overloads trigger, back off slightly (CW) from this adjustment.
3. High Voltage must go OFF when IPA voltage overload trips.
4. IPA Voltage overload indicator must light.
5. Reset IPA Voltage Adjust back to normal.

b) PA PLATE OVERLOAD

1. Set PA Bias Adj for a reading of 6 amperes on the PA Plate Current meter.
2. Adjust the PA Plate overload to trip at this point.
3. PA Plate overload indicator must light when overload trips.
4. High Voltage must go OFF when the PA Plate overload trips.

5. Depress Reset button and overload must reset.

6. Return PA Plate Current back to normal. (Do not keep plate current at 6 amperes for more than 30 seconds).

c) PA BIAS OVERLOAD THRESHOLD ADJUSTMENT

1. Adjust Bias Overload to point where transmitter trips.

2. Retard setting slightly to obtain threshold adjustment.

3. Reset overload and check setting.

4. Return Bias to normal if proper setting is obtained.

d) PA SCREEN OVERLOAD

1. Tune transmitter at a frequency of 1.9 MHz.

2. Unload transmitter as much as possible and retune PA until maximum screen current is obtainable.

3. Adjust PA screen overload to trip at this point. It should trip at approximately 60 ma.

4. High Voltage must go-off when overload trips.

5. PA screen overload indicator must light when overload trips.

6. Reduce exciter output to minimum, depress reset button and High Voltage must come on.

e) Before adjusting the internal overloads circuits, make the following preparations.

1. Turn Transmitter OFF completely.

2. Extend driver drawer out on its slides.

3. Remove top cover.

4. Remove Overload Board.

5. Close interlock switch by pulling outward on shaft.

6. Insert Overload Board into extender card.

7. Insert extender with overload board into chassis.

NOTE

Adjust overload circuits. Use insulated alignment tool.

WARNING

The following procedures should be performed by qualified maintenance technicians. High voltage dangerous to life do exist within the driver drawer and care should be taken while making adjustments.

f) IPA PLATE "A" OVERLOAD

1. Turn trnasmitter ON, and apply High Voltage. (Do not apply RF drive from the exciter).

2. Set IPA Plate "A" current to read 55 on IPA meter.

3. Adjust IPA "A" overload 2R318 to trip at this point.

4. IPA Plate "A" overload indicator must light.

5. High Voltage must go OFF when High Voltage trips.

6. Depress Reset Button and overload must reset.

7. Restore IPA Plate Current back to normal.

g) IPA PLATE "B" OVERLOAD

1. Refer to IPA PLATE "A" overload adjustment and follow steps 1-7. The only exception will be the IPA PLATE "B" adjustment will be variable resistor 2R321.

h) DRIVER PLATE OVERLOAD

1. Set driver bias adjust until Driver Plate Current reads 40 on meter.

2. Adjust driver overload 2R315 to trip at this point.
3. High Voltage must go OFF when overload trips.
4. Driver plate overload must light, when driver overload trips.
5. Return Driver bias back to normal, Depress reset Button and High Voltage must come ON.

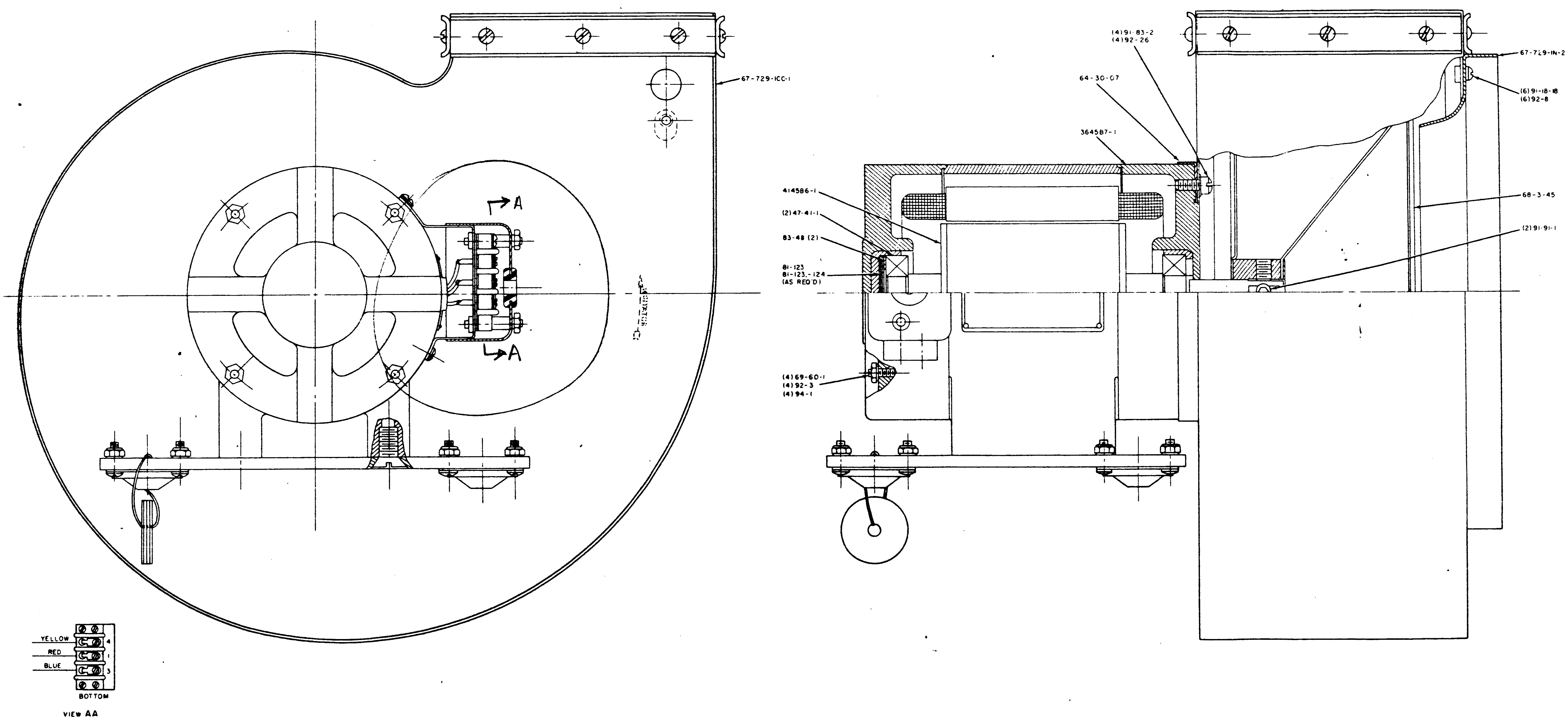


Figure 5-1

Power Supply Blower (B800)

SECTION 6

PARTS LIST AND SCHEMATIC DIAGRAMS

6-1. INTRODUCTION

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Reference symbol.

b. Description as indicated in parts list.

c. TMC part number.

d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

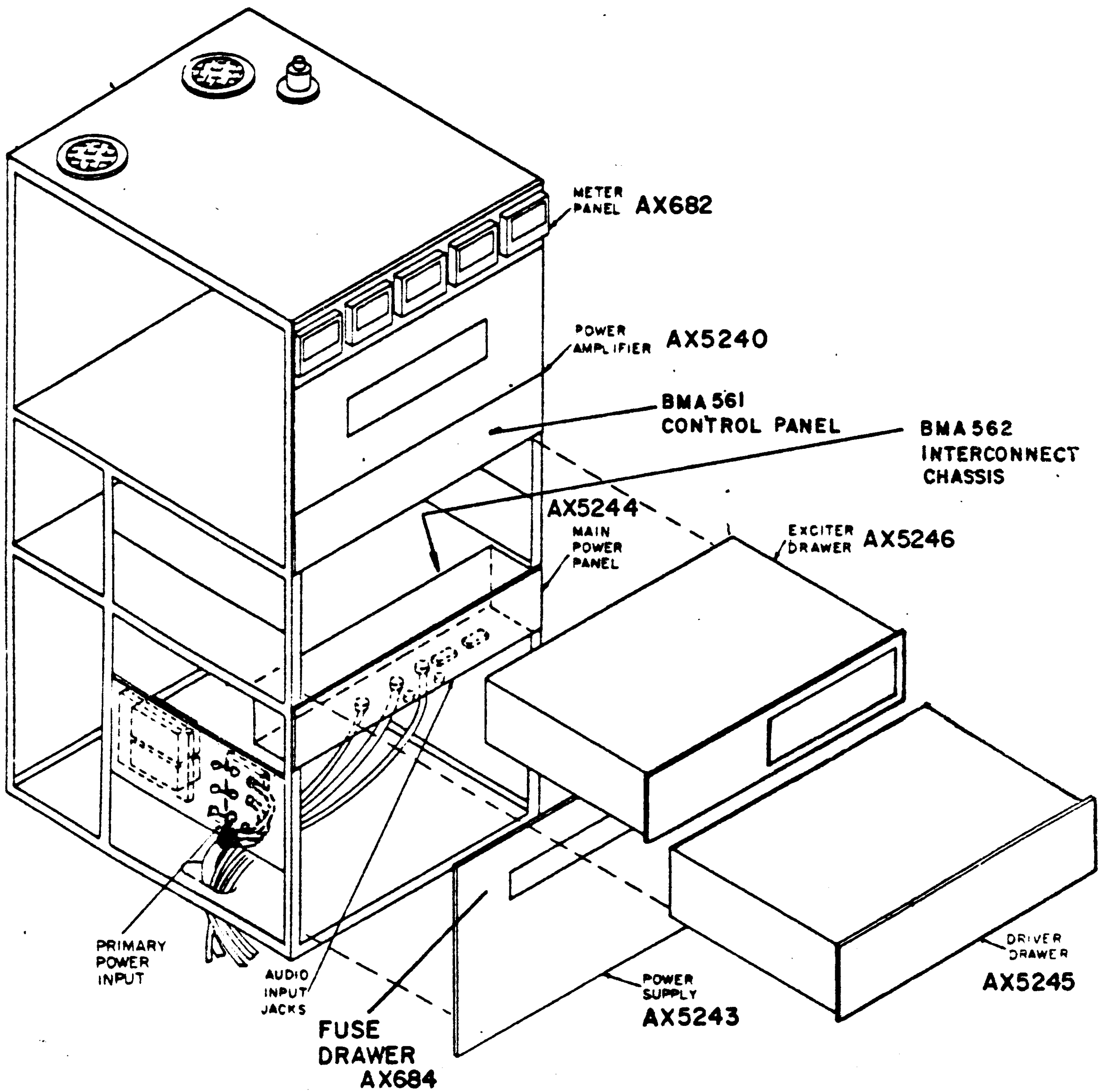


Figure 6-1
Modular Identification and Location

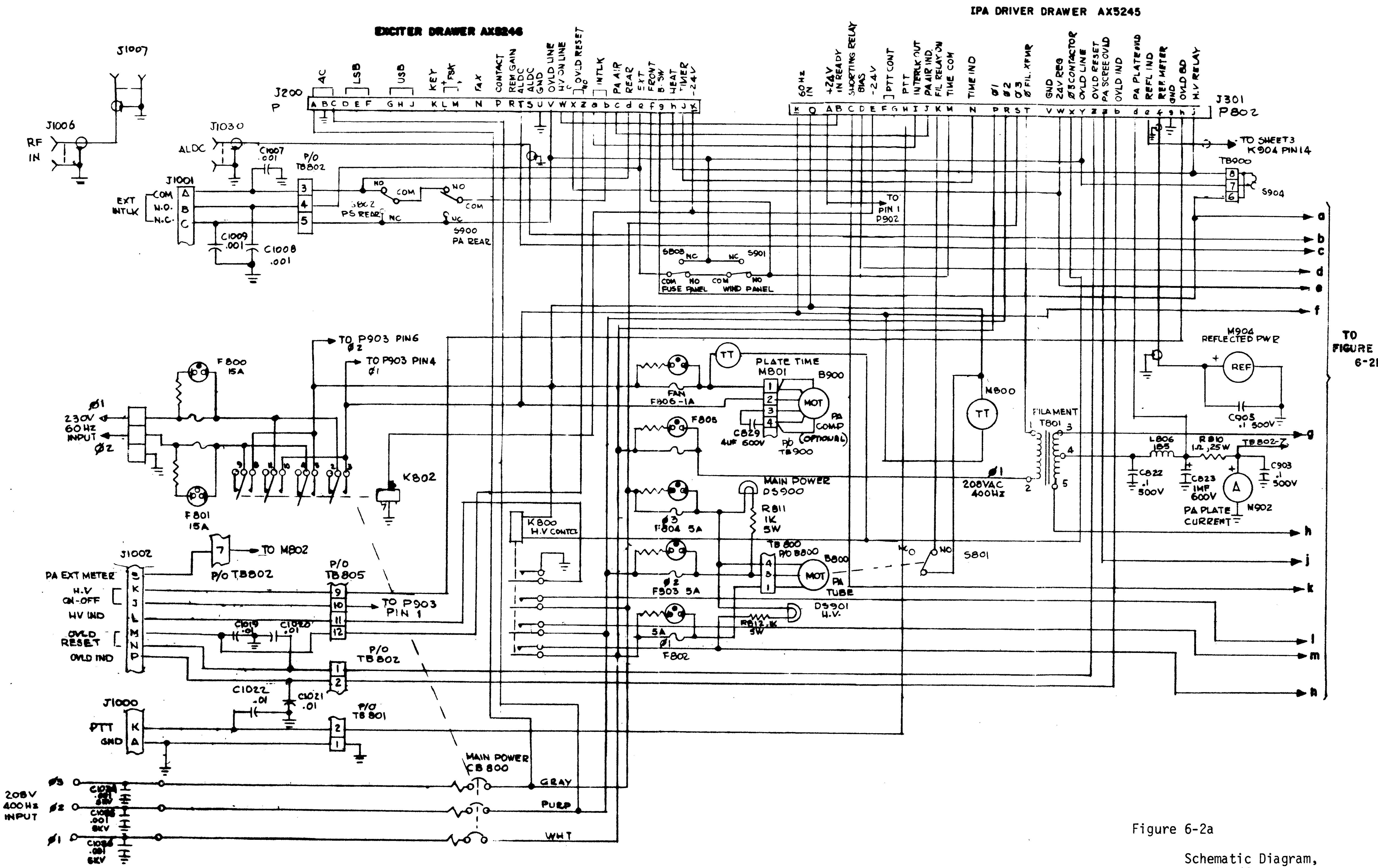


Figure 6-2a

Schematic Diagram, MFT-10K/J

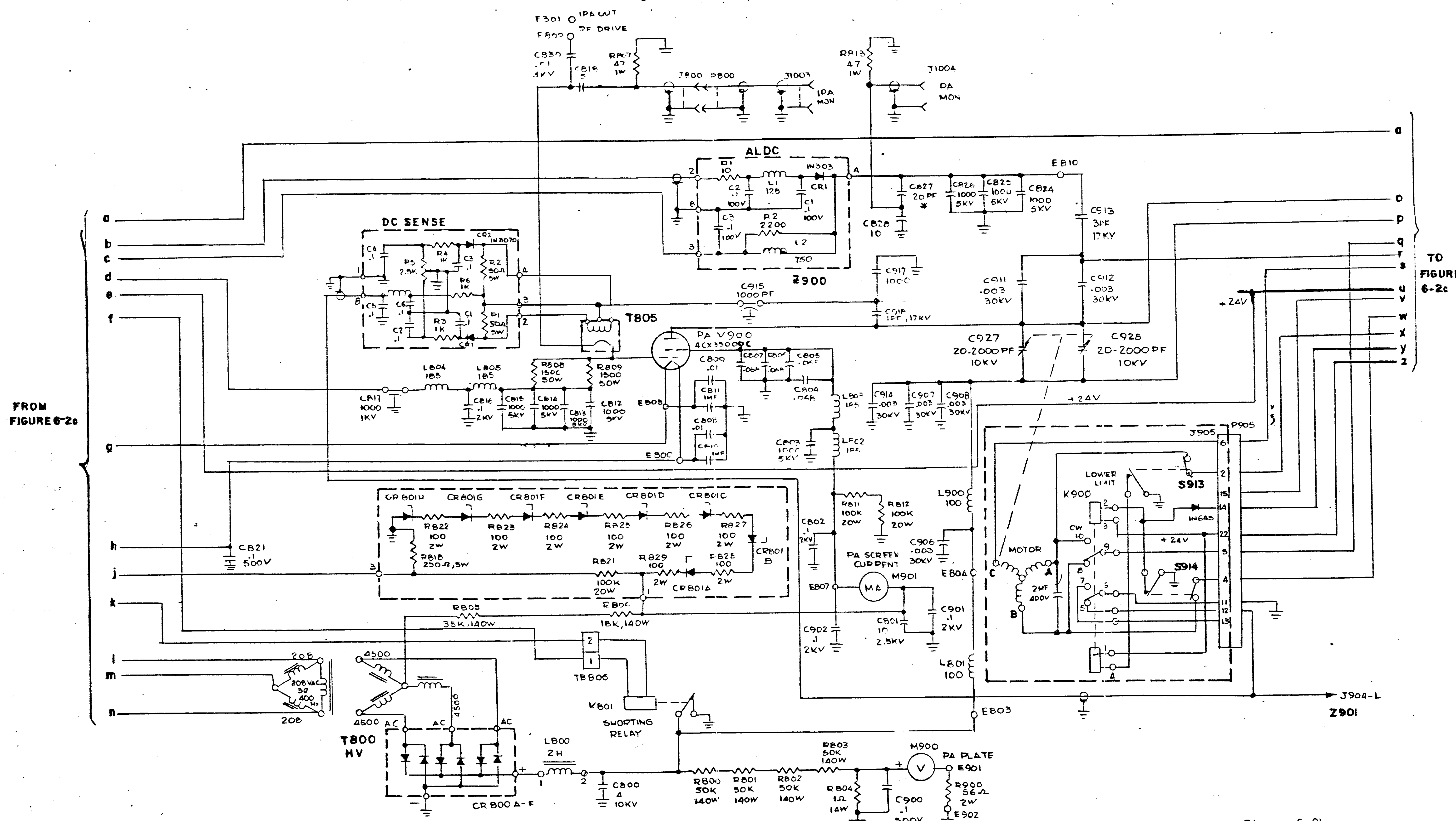


Figure 6-2b

Schematic Diagram, MFT-10K/J

120-021800-001

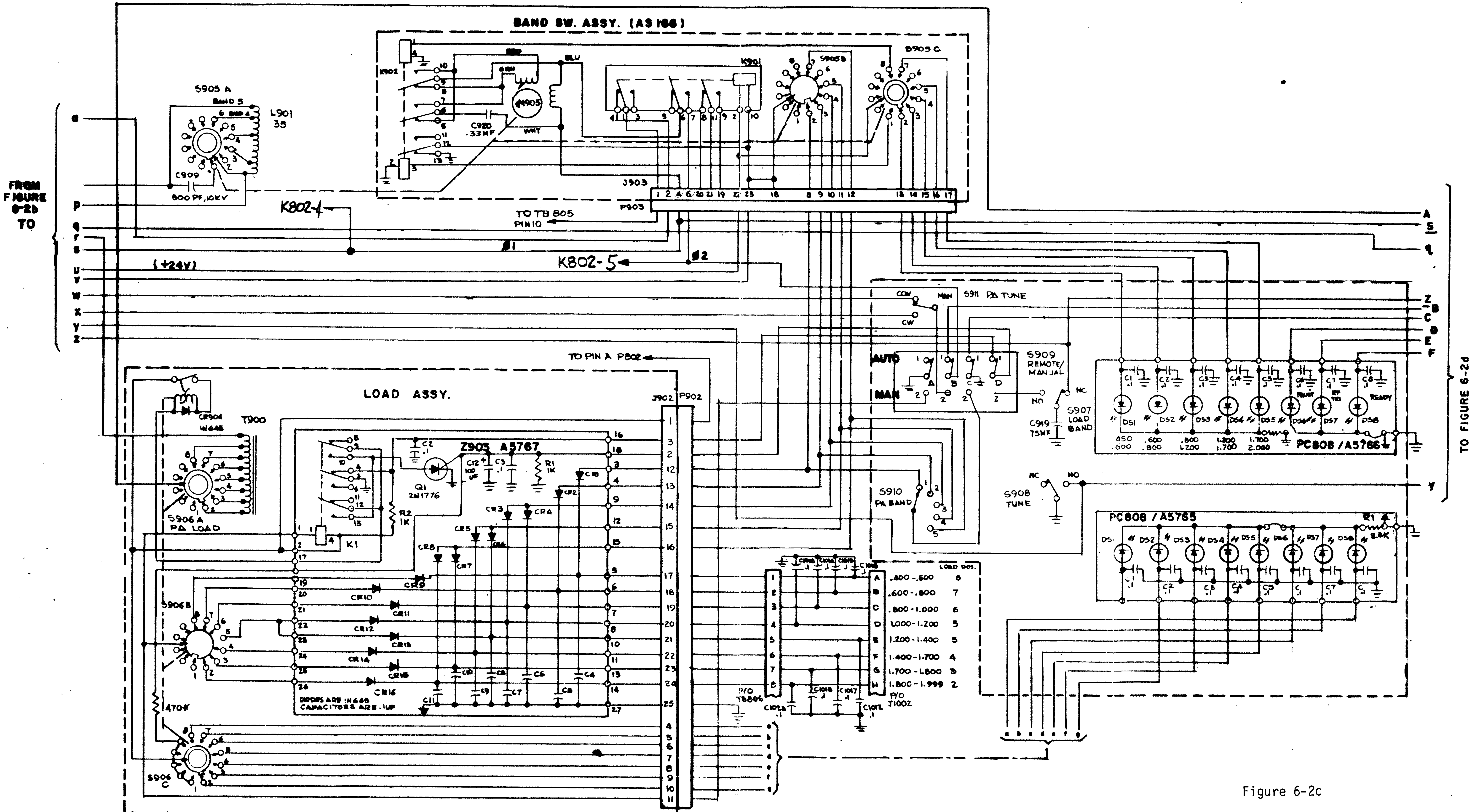
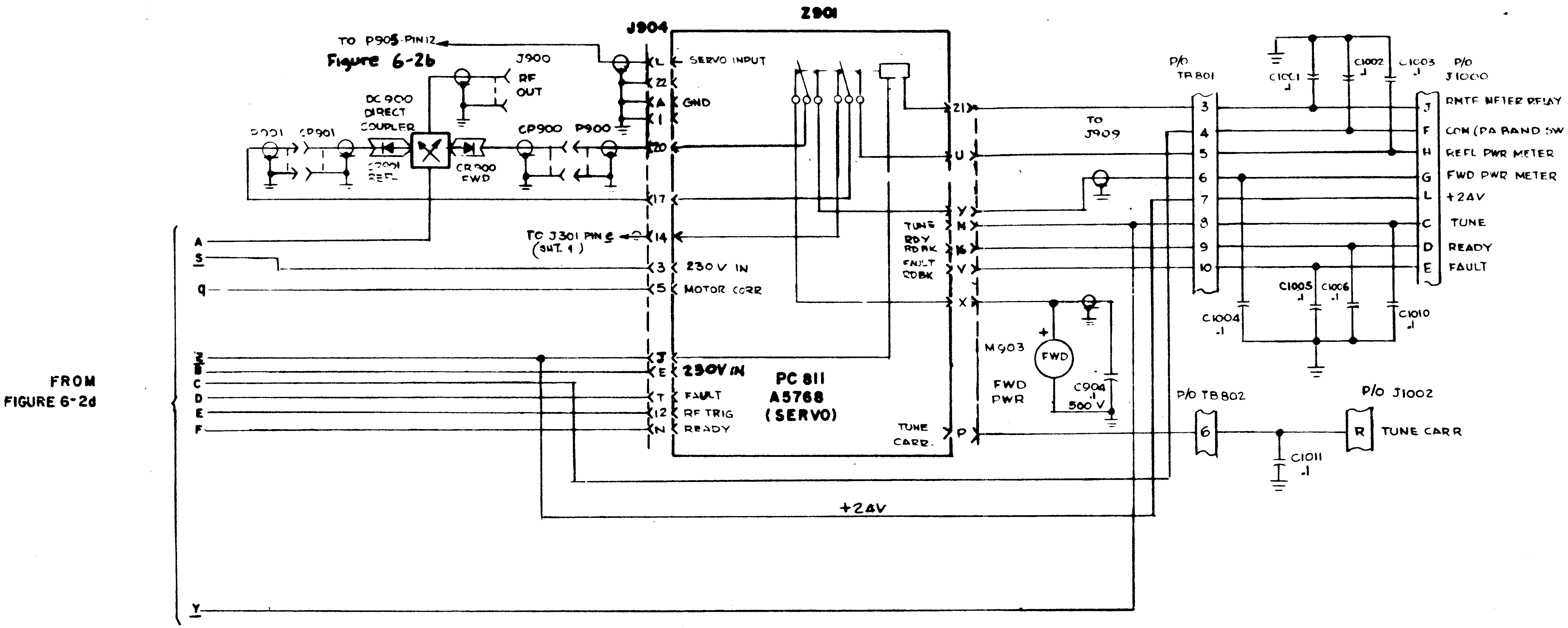


Figure 6-2c

Schematic Diagram, MFT-10K/J



LAST SYMB	MISSING SYMBOLS
B900 C928 CP901 CR903 DC900 DS901 J903 L901 M905 P905 R900 S911 T900 TB900 V900 Z900	910, 921 THRU 926 C916

800 SERIES

B800 C830 CB800 CR801 E810 F806 J800 K802 L806 M801 P802 R829 S803 T805 TB806	C819 E805, 806, 802, 801 R816, 817, 820, 819 TB05, T804

1000 SERIES

C1026 J1006 TB1001	L1000, 1001, 1002

200 SERIES

LAST SYMBOL	MISSING SYMBOLS
J201	

300 SERIES

E301 J303	E300 J300, 302

UNLESS OTHERWISE SPECIFIED

ALL RESISTANCE VALUES ARE IN OHMS.
ALL DECIMAL NUMBER CAPACITOR VALUES ARE IN MICROFARADS.
ALL WHOLE NUMBERS CAPACITOR VALUES IN PICOFARADS.
ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
FUSES

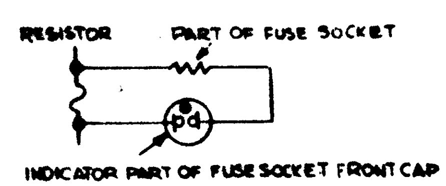
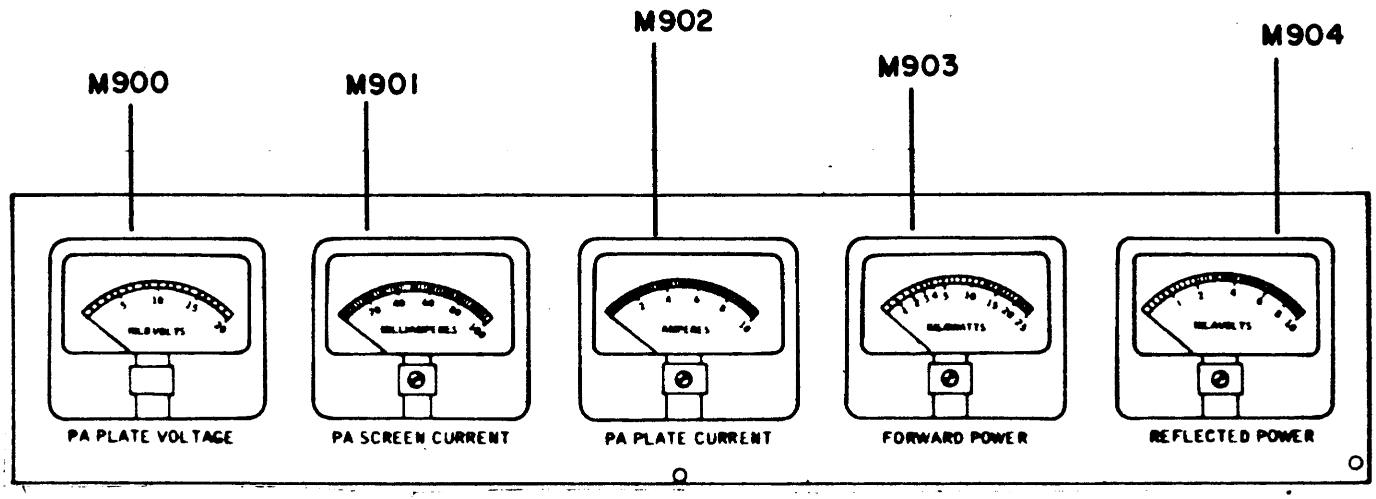


Figure 6-2d

Schematic Diagram, MFT-10K/J



Part Number	Description	Used On	Qty	Symbol Number
CC100-32	CAP, RXD, CER	AX682	4	C900,C903,C904,C905
MR116	MTR	AX682	1	M901
MR129	MTR	AX682	1	M902
MR133	MTR	AX682	1	M900
MR199	MTR	AX682	1	M903
MR200	MTR	AX682	1	M904
RC42GF560J	MTR	AX682	1	R900

Figure 6-3
Metering Panel

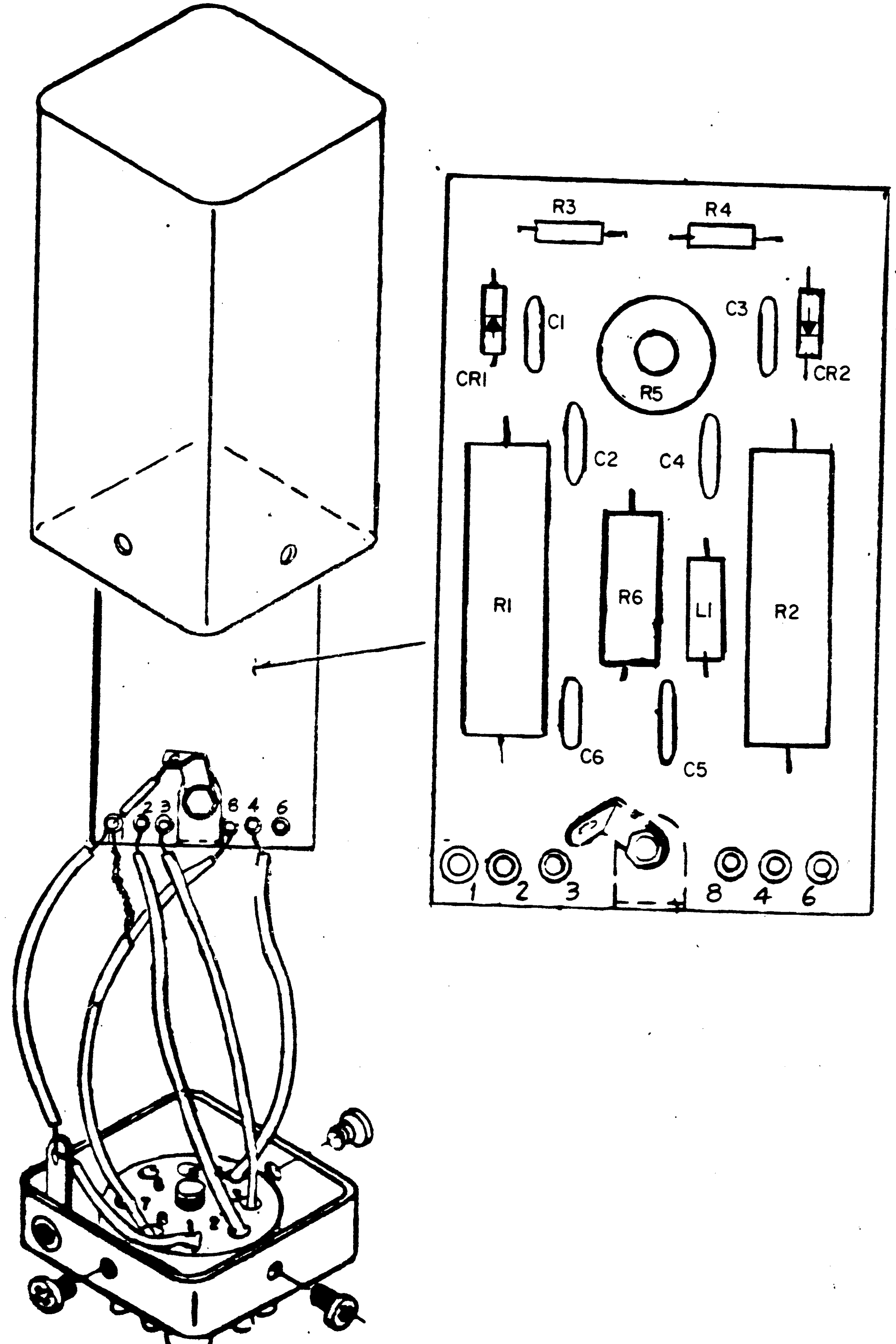
Part Number	Description	Used On	Qty	Symbol Number
CC108-4P1000M	CAP, FXD, CER	BMA212	1	C817
CC109-3	CAP, FXD, CER	BMA212	1	C818
CC109-38	CAP, FXD, CER	BMA212	6	C803,C812,C813,C814, C815,C819
CC115-2-6800	CAP, FXD, CER	BMA211	4	C804,C805,C806,C807
CL178	COIL, RF, FXD	BMA212	4	L802,L803,L804,L805
CM35F103F03	CAP, FXD, MICA	BMA212	2	C808,C809
CP116	CAP, FXD	BMA212	2	C810,C811
CP117-2	CAP, FXD, CER	BMA212	2	C802,C816
CX102J103M	CAP, FXD, PLSTC	BMA212	1	C830
NS112-2	INS FD THRU	BMA212	1	E807
RC32GF470J	RES, FXD, COMP	BMA212	1	R807
RR134-152	RES, FXD, FILM	BMA212	2	R808,R809
RW110-43	RES, FXD, WW	BMA212	2	R811,R812
TS188	SOC, EL TUBE	BMA211	1	XV900
UG625*/U	CONN, RECP-BNC	BMA212	1	J800

Part Number	Description	Used On	Qty	Symbol Number
CB155	CAP, VAR, VAC	BMA560	2	C927,C928
MO129	MOT, CAP DR	BMA560	1	M906
RL156-15	RELAY	BMA560	1	K900
SW353-3	SW, SENS	BMA560	2	S913,S914
TS171-15	SKT, RELAY	BMA560	1	XK900

Part Number	Description	Used On	Qty	Symbol Number
A5766	PC ASSY, SENS CKT	AX5240	1	Z902
A5768	PC ASSY, SERVO CONT	AX5240	1	Z901
A4648	NETWORK, ALDC	AX5240	1	Z900
AS166	BANDSW ASSY	AX5240	1	S905
AX5241	LOAD ASSY, PA	AX5240	1	T900
BL105	FAN, AXIAL	AX5240	1	B900
CC100-28	CAP, FXD, CER	A4648	3	C1,C2,C3
CL100-5	COIL, RF, FXD	A4648	1	L2
CL177	COIL, RF, FXD	A4648	1	L1
CL426-2	COIL	AX5240	1	L900
CX108-2	CAP, FXD, PLSTG	AX5240	6	C906,C907,C908,C911 C912,C914
CX109-5	CAP, FXD, PLSTG	AX5240	2	C901,C902
DC104-2	COUP, DIR	AX5240	1	DC900
DD119-7	RECT, SEC, DEV	AX5240	1	CR901
NS107	INS, FDTHRU	AX5240	1	E804
RC20GF103J	RES, FXD, COMP	A4648	1	R1
RC20GF222J	RES, FXD, COMP	A4648	1	R2
SS107	SW, THERMO	AX5240	1	S904
SW230	SW, PUSH-PULL	AX5240	2	S900,S901
SW260	SW, SENS-SPDT	AX5240	1	S903
TM102-8	TERM, BD-BARR	AX5240	1	TB900
TS102P01	SOC, EL, TUBE	AX5240	1	XZ901
IN303	SCOND DEV, DIO	A4648	1	CR1
4CX35000C	TUBE, EL	AX5240	1	V900

Power Amplifier Components

(AX5240)



Part Number	Description	Used On	Qty	Symbol Number
CC131-39	CAP, FXD, C	A5766	6	C1,C2,C3,C4,C5,C6
CL275-103	COIL, RF (1MH)	A5766	1	L1
RC20GF102J	RES, FXD, C	A5766	2	R3,R4
RC32GF102J	RES, FXD, C	A5766	1	R6
RR114-50W	RES, FXD, WW	A5766	2	R1,R2
RV111U252A	RES, VAR	A5766	1	R5
IN3070	SCOND, DEV, DIO	A5766	2	CR1,CR2

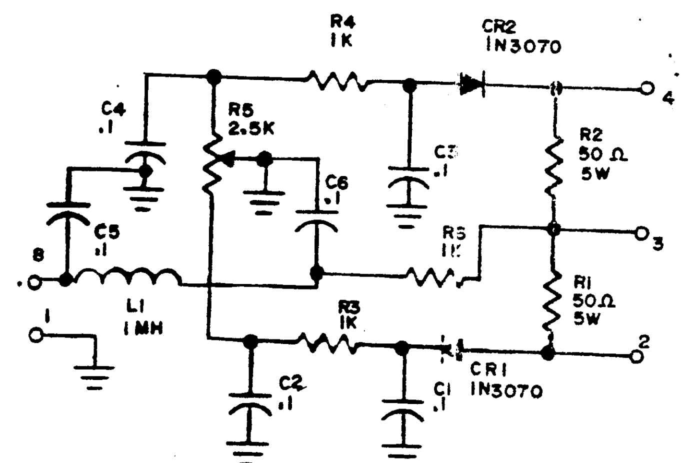


Figure 6-4

Sensing Circuit Assembly
(Z902)

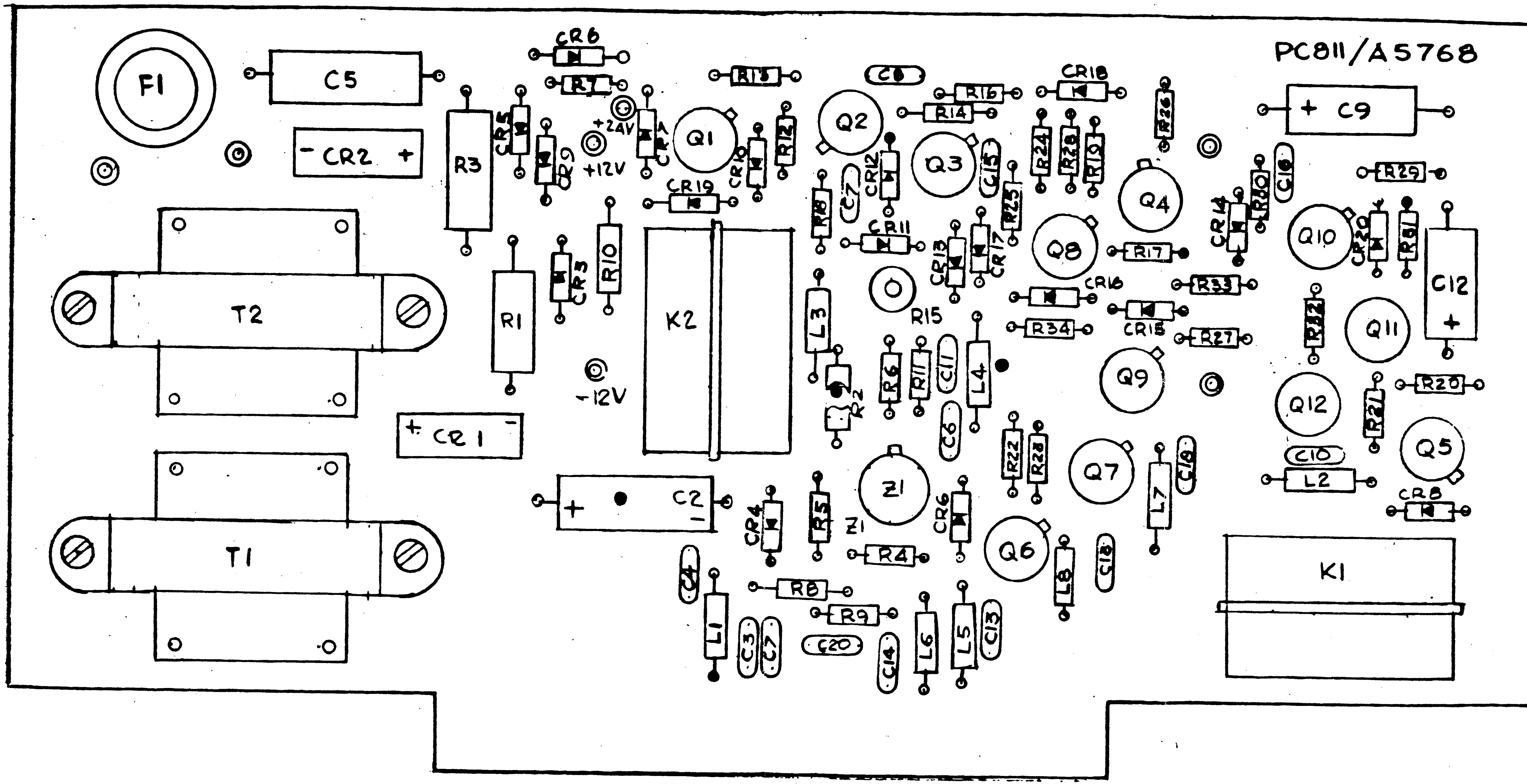
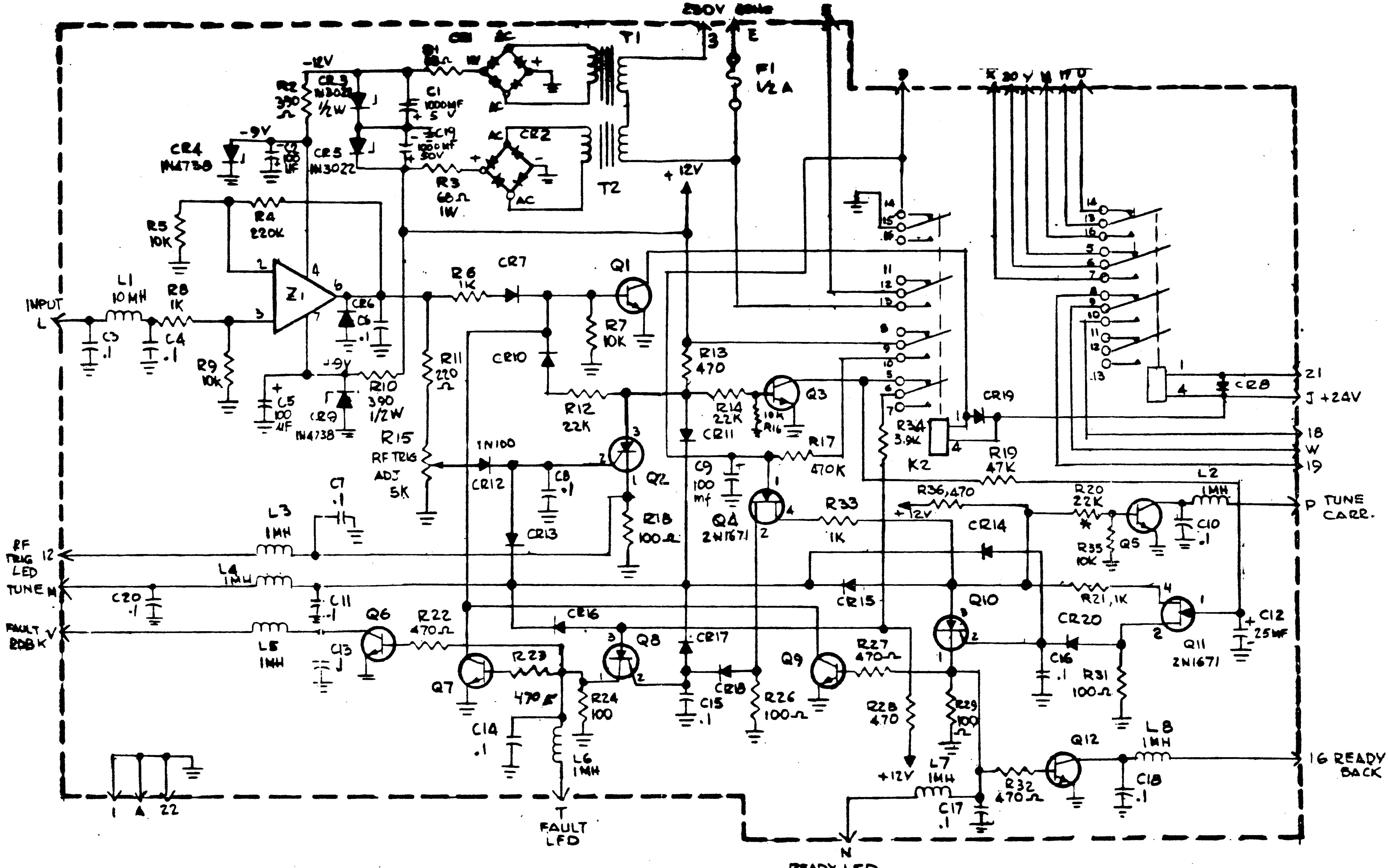


Figure 6-5

Servo Control Assembly
(Z901)



CK2213-X3

NOTES

1- ALL TRANSISTORS ARE TYPE 2N1711

2- ALL SCRS ARE TYPE 2N1598

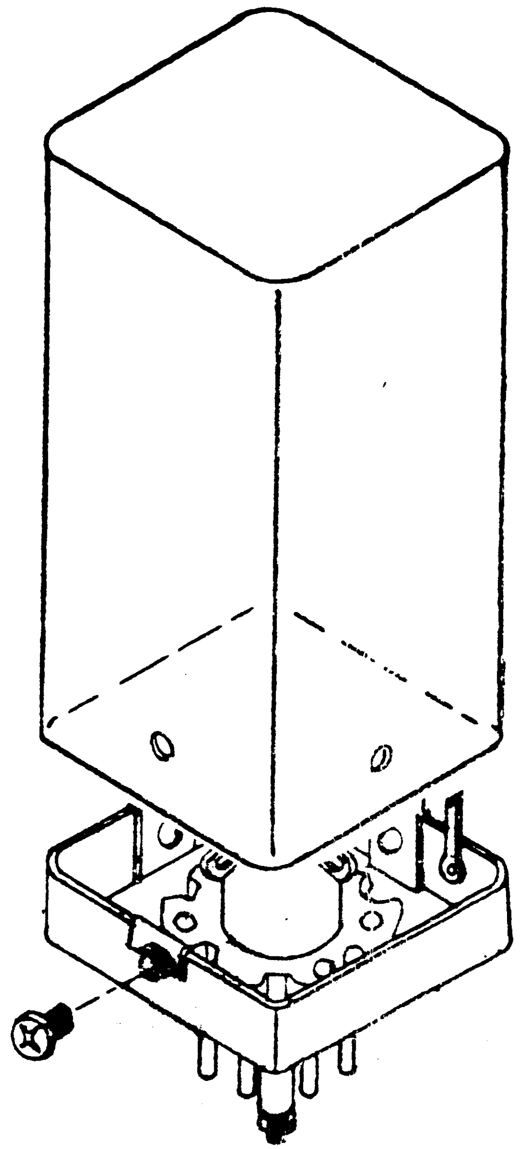
3- ALL DIODES ARE TYPE 1N645

Figure 6-6

Servo Control Schematic (Z901)

Part Number	Description	Used On	Qty	Symbol Number	S1200
CC131-39	CAP, FXD, CER	A5768	14	C3,C4,C6,C7,C8,C10, C11,C13,C14,C15,C16, C17,C18,C20	
CE105-100-16	CAP, FXD, ELEC	A5768	3	C2,C5,C9	
CE105-25-16	CAP, FXD, ELEC	A5768	1	C12	
CE116-8VN	CAP, FXD, ELEC	A5768	2	C1,C19	
CL274-103	COIL, RF	A5768	1	L1	
CL275-102	COIL, RF	A5768	7	L2,L3,L4,L5,L6,L7,L8	
DD130-200-1.5	RECT, SCOND DEV	A5768	2	CR1,CR2	
FU102.500	FUSE	A5768	1	F1	
RC07GF101J	RES, FXD, COMP	A5768	5	R24,R29,R18,R26,R31	
RC07GF102J	RES, FXD, COMP	A5768	6	R6,R8,R21,R25,R30,R33	
RC07GF103J	RES, FXD, COMP	A5768	5	R5,R7,R9,R16,R35	
RC07GF221J	RES, FXD, COMP	A5768	1	R11	
RC07GF222J	RES, FXD, COMP	A5768	1	R20	
RC07GF223J	RES, FXD, COMP	A5768	2	R12,R14	
RC07GF224J	RES, FXD, COMP	A5768	1	R4	
RC07GF471J	RES, FXD, COMP	A5768	7	R13,R22,R23,R27,R28, R32,R36	
RC07GF474J	RES, FXD, COMP	A5768	2	R17,R19	
RC07GF392J	RES, FXD, COMP	A5768	1	R34	
RC20GF391J	RES, FXD, COMP	A5768	2	R2,R10	
RC32GF680J	RES, FXD, COMP	A5768	2	R1,R3	
RL156-8	RELAY	A5768	2	K1,K2	
RV124-3-502	RES, VAR	A5768	1	R15	
TF444	XFMR	A5768	2	T1,T2	
TS171-4	SKT, RELAY	A5768	2	XK1,XK2	
UA741	INT CKT	A5768	1	Z1	
IN645	SCOND DEV, DIO	A5768	13	CR6,CR7,CR8,CR10, CR11,CR13,CR14,CR15, CR16,CR17,CR18,CR19, CR20	
IN3022	SCOND DEV DIO	A5768	2	CR3,CR5	
IN4738	SCOND DEV, DIO	A5768	2	CR4,CR9	
2N1595	TRANSISTOR	A5768	3	Q2,Q8,Q10	
2N1671	TRANSISTOR	A5768	2	Q11,Q4	
2N1711	TRANSISTOR	A5768	7	Q1,Q3,Q5,Q6,Q7,Q9,Q12	

Servo Control
Component Parts



Part Number	Description	Used On	Qty	Symbol Number
CC100-28	CAP, FXD, CER	A4648	3	C1,C2,C3
CL100-5	COIL, RF, FXD	A4648	1	L2
CL177	COIL, RF, FXD	A4648	1	L1
IN303	SCOND DEV, DIO	A4648	1	CR1
RC20GF103J	RES, FXD, COMP	A4648	1	R1
RC20GF222J	RES, FXD, COMP	A4648	1	R2

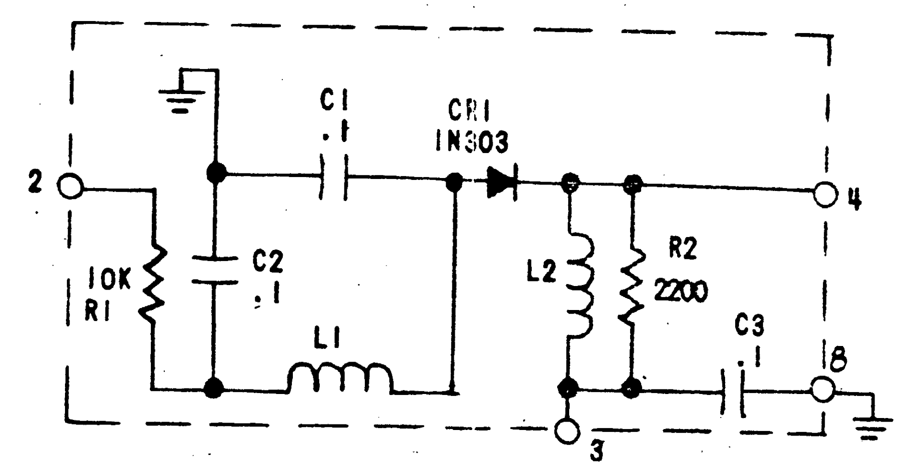
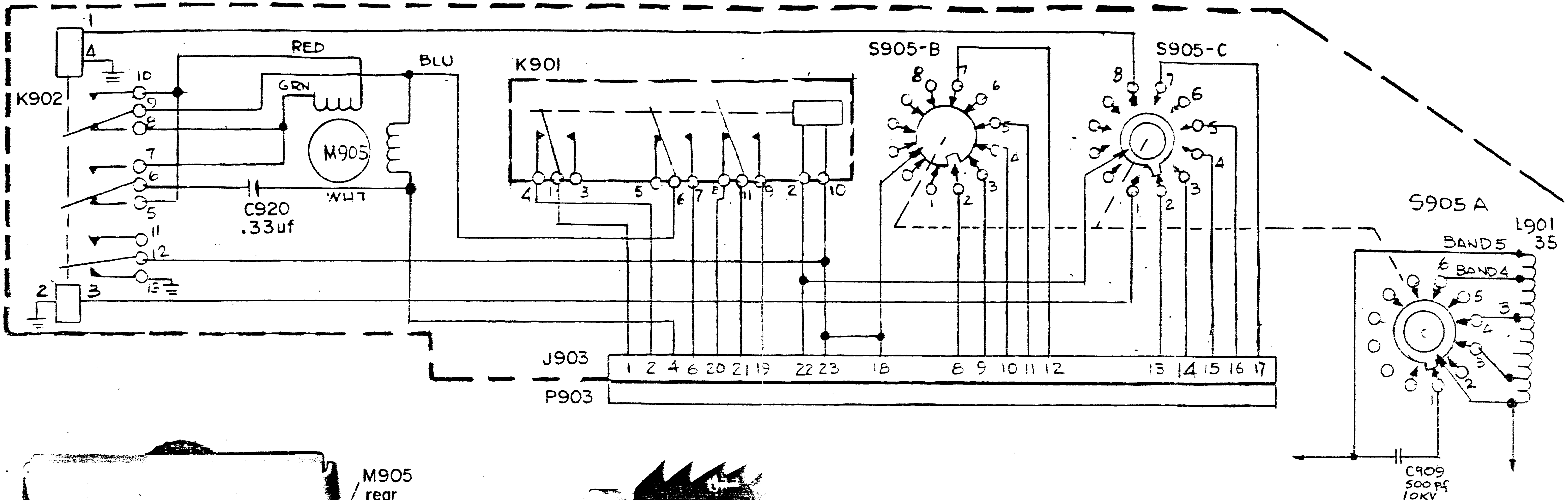
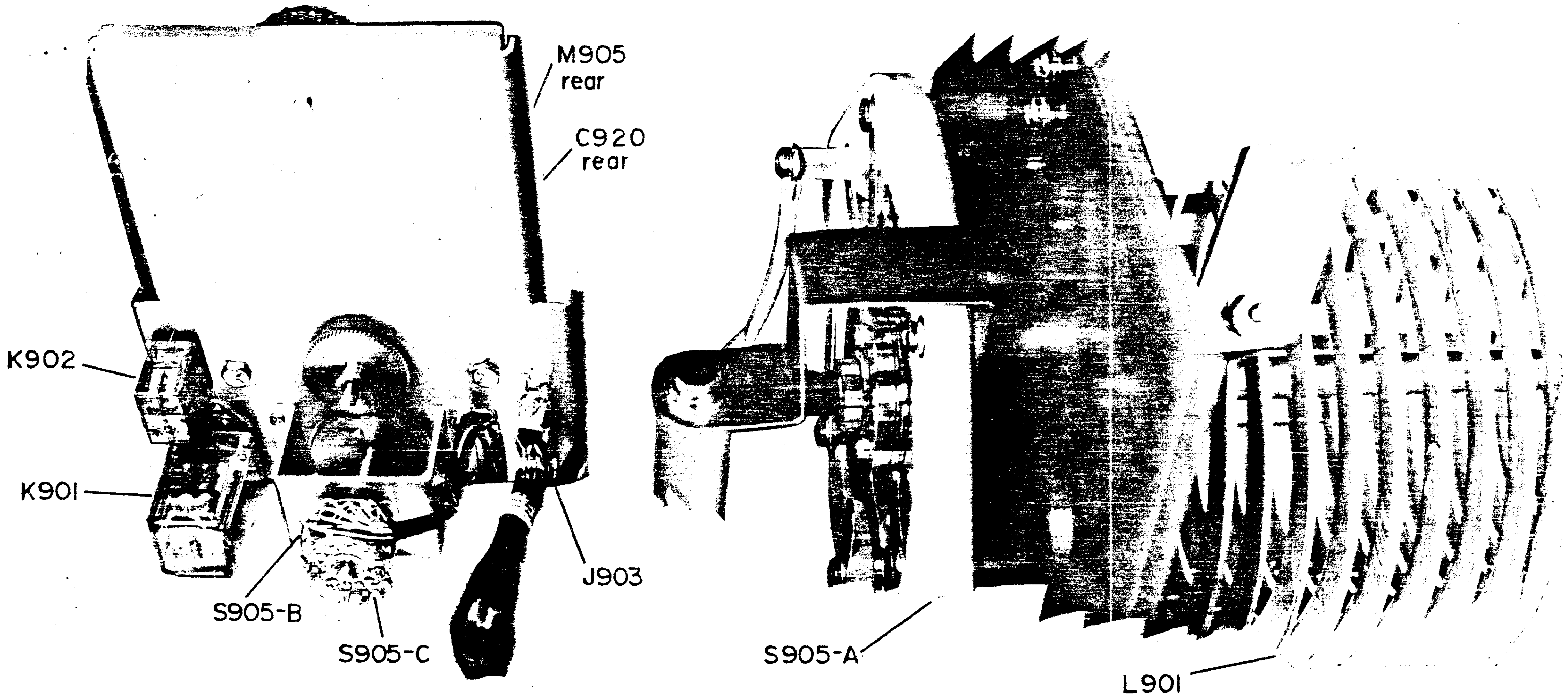


Figure 6-7

ALDC Assembly
(Z900)

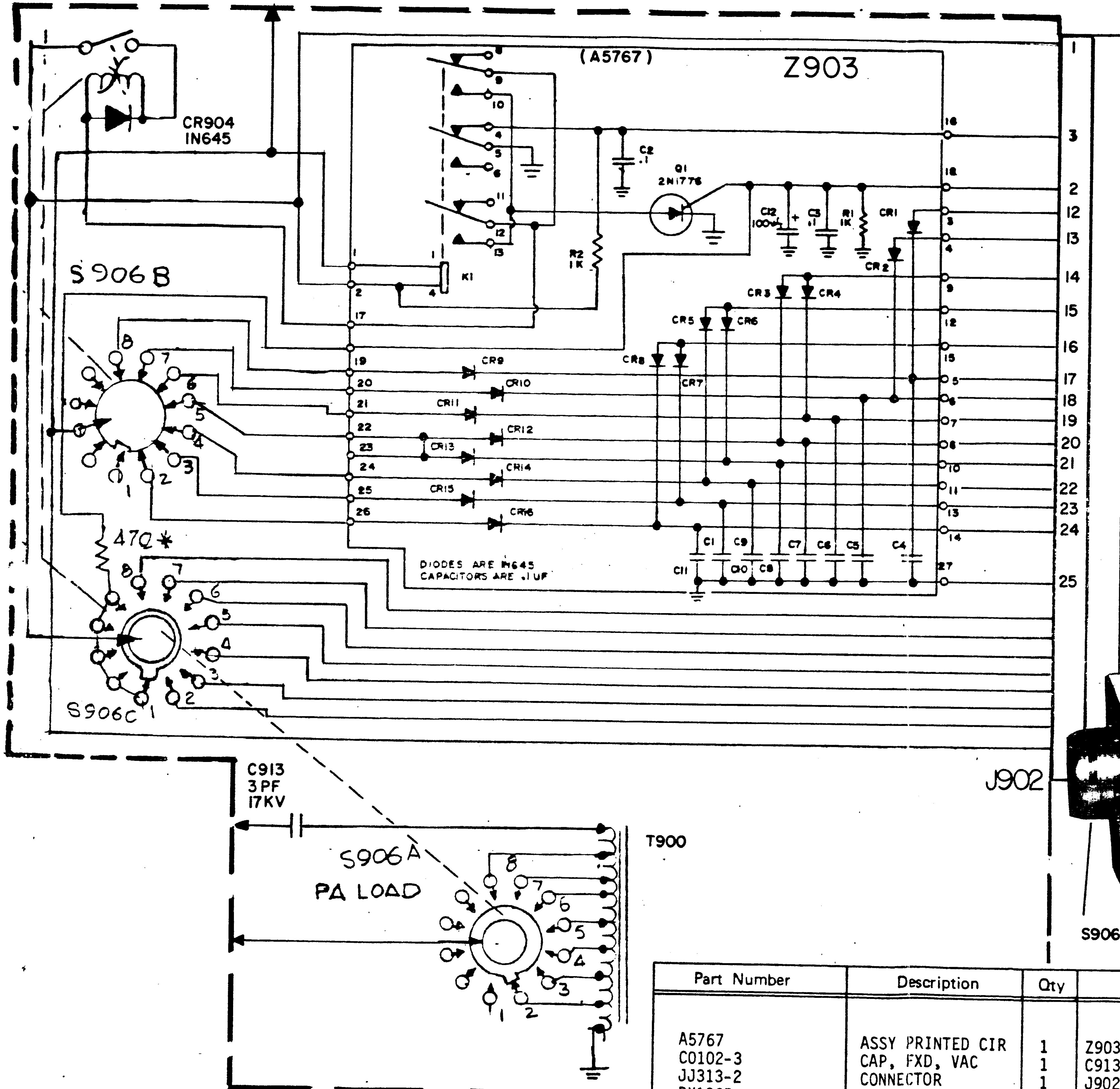


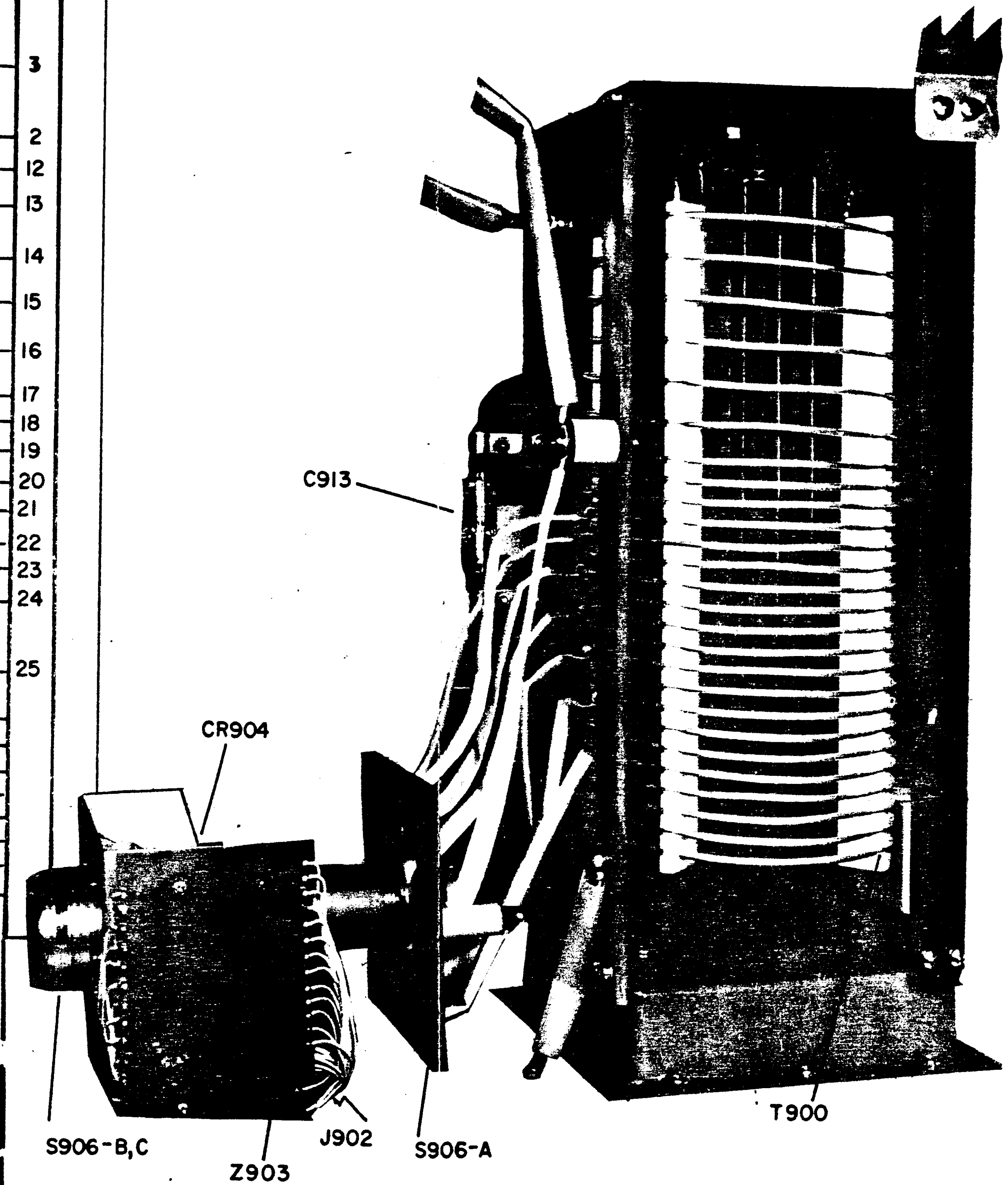


Part Number	Description	Qty	Symbol Number
CB147	CAP. VAC	1	C909
CL427	COIL, RF	1	L901
CN114-R33-2-J	CAP	1	C920
JJ313-2	CONN, RECEP,	1	J903
MO125	MOTOR, SW DR	1	M905
~~RL156-10~~	RELAY, LATCH	1	K902
RL168-3C-10-220AC	RELAY	1	K901
SW 583	SW, ROT	1	S905-B,C
TS100-6	SKT, RELAY	1	XK901
~~TS171-3~~	SKT, RELAY	1	XK902
~~WS143~~ WS157	WAFER, SW	1	S905-A

Figure 6-8

Bandswitch Assembly
(AS166)



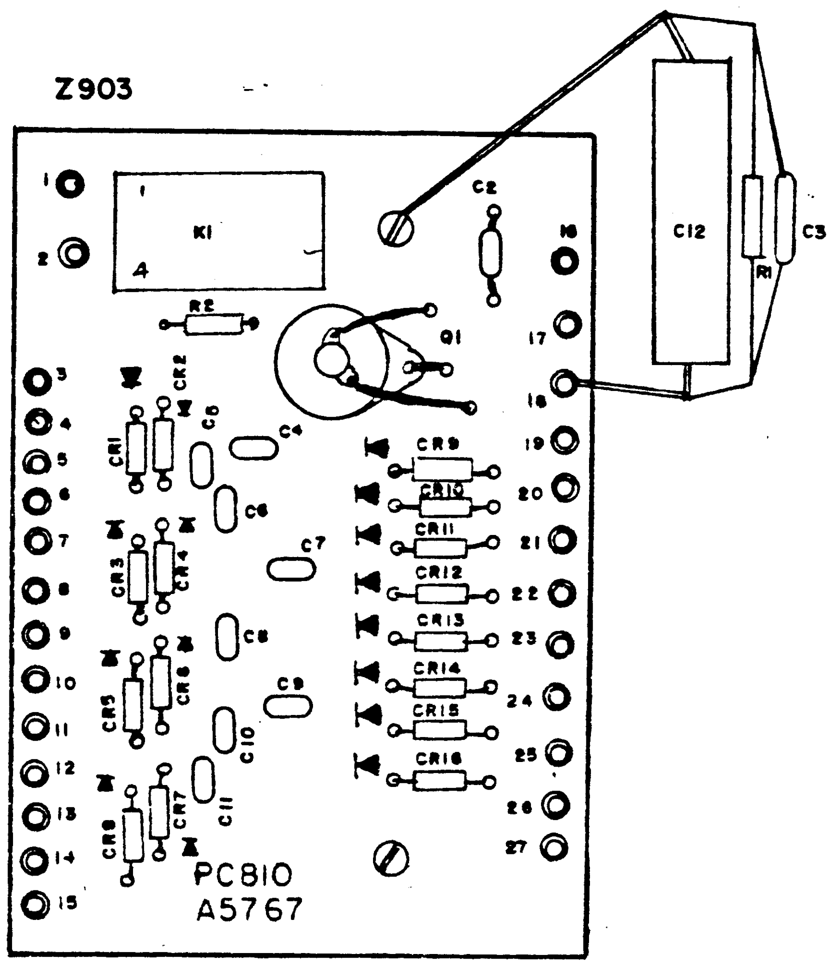


Part Number	Description	Qty	Symbol Number
A5767	ASSY PRINTED CIR	1	Z903
C0102-3	CAP, FXD, VAC	1	C913
JJ313-2	CONNECTOR	1	J902
PX1265	WAFER LOAD, SW	*	PART OF S906-A
SW555	SW, SOLENOID	1	S906-B,C
IN645	DIODE	1	CR904

Figure 6-9

Load Assembly
(AX5241)

Z903



Part Number	Description	Used On	Qty	Symbol Number
CC131-39	CAP, FXD, CER	A5767	11	C1,C2,C3,C4,C5,C6,C7,C8,C9,C10,C11
CE105-100-25	CAP, FXD, CER	A5767	1	C12
RC07GF102J	RES, FXD, CER	A5767	2	R1,R2
RL156-8	RELAY	A5767	1	K1
TS171-4	SOCKET	A5767	1	XK1
IN645	SCOND DEV, DIO	A5767	16	CR1,CR2,CR3,CR4,CR5,CR6,CR7,CR8,CR9,CR10,CR11,CR12,CR13,CR14,CR15,CR16
2N1776	TRANSISTOR	A5767	1	Q1

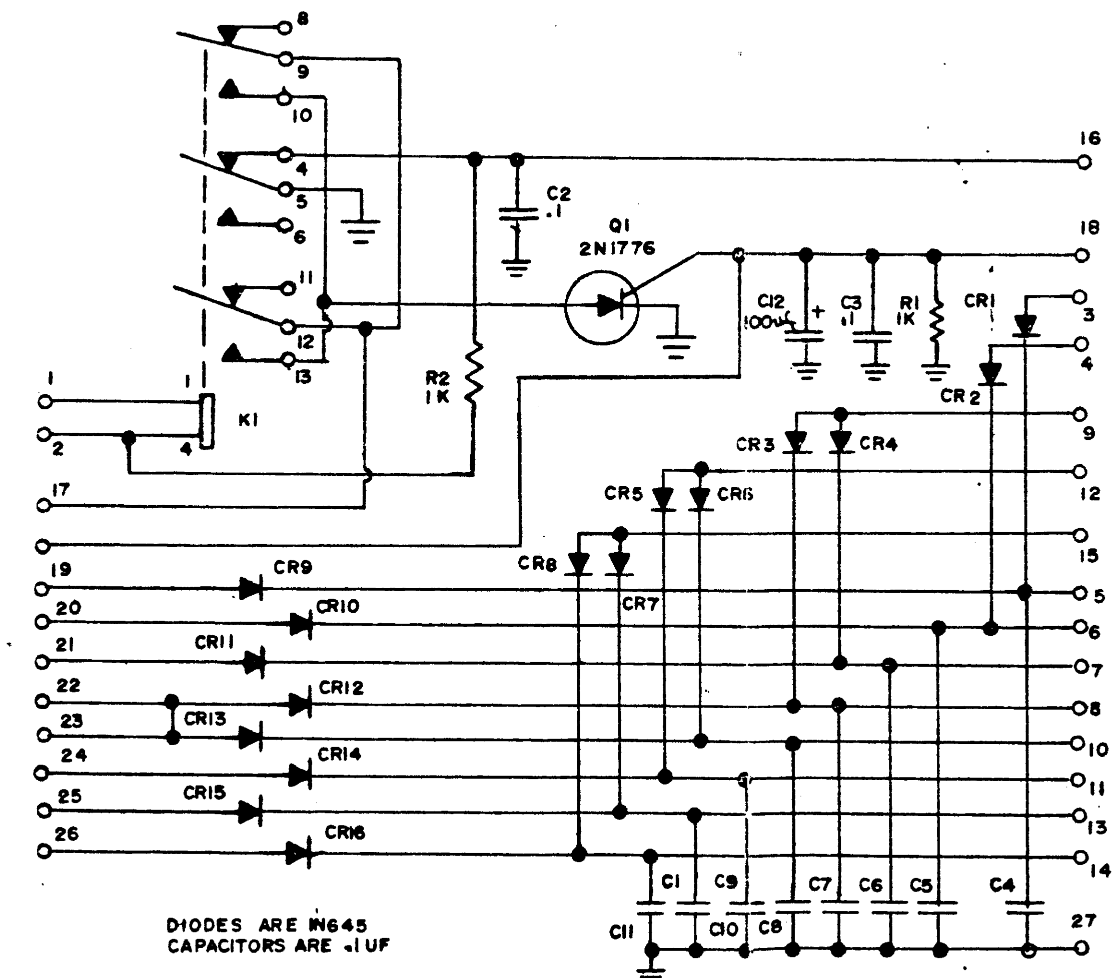


Figure 6-10

Load Assembly,
Printed Circuit

Part Number	Description	Used On	Qty	Symbol Number
A5765-1	IND ASSY, PA BND	BMA561	1	Z904
A5765-2	IND ASSY, LOAD POS	BMA561	1	Z905
BI105-1	LAMP, INCAN	BMA561	2	DS900,DS901
CE105-100-25	CAP, ELEC	BMA561	1	C919
ST109B	SW, TOG	BMA561	1	S909
SW296-1	SW, PB, RED	BMA561	1	S908
SW296-2	SW, PB, BLK	BMA561	1	S907
SW523-1	SW, LEVER	BMA561	1	S911
SW	SWITCH,	BMA561	1	S910
TS136-1FS	LIGHT, IND	BMA561	1	XDS900
TS136-4FS	LIGHT, IND	BMA561	1	XDS901

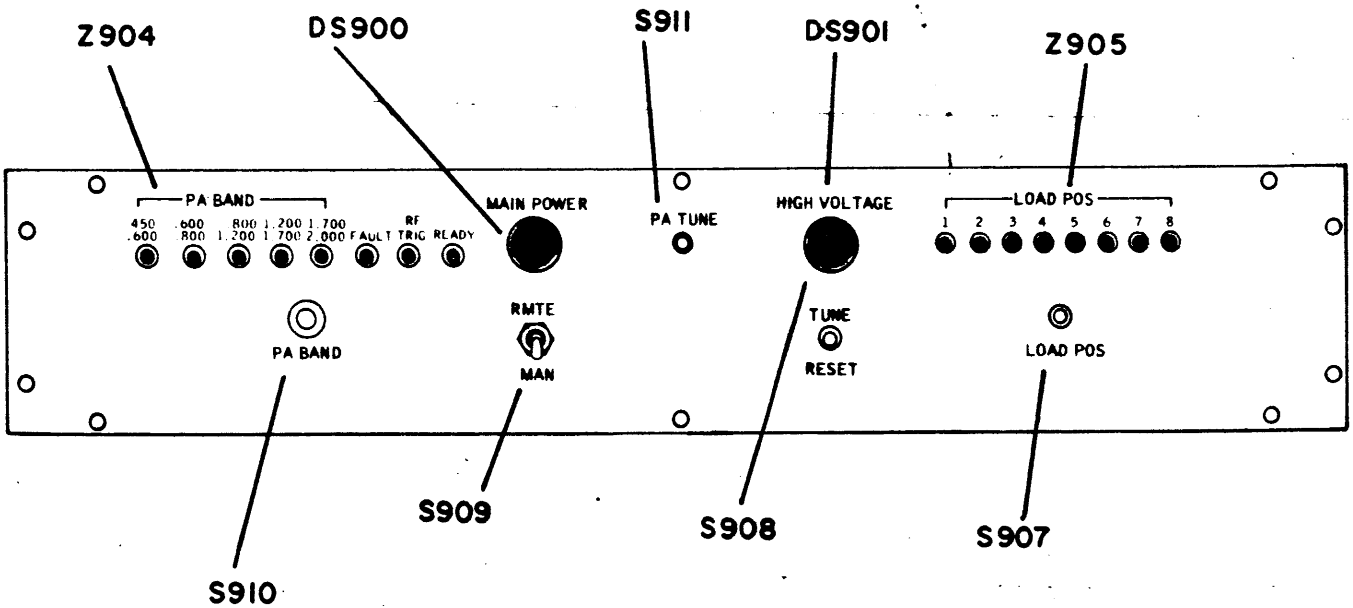
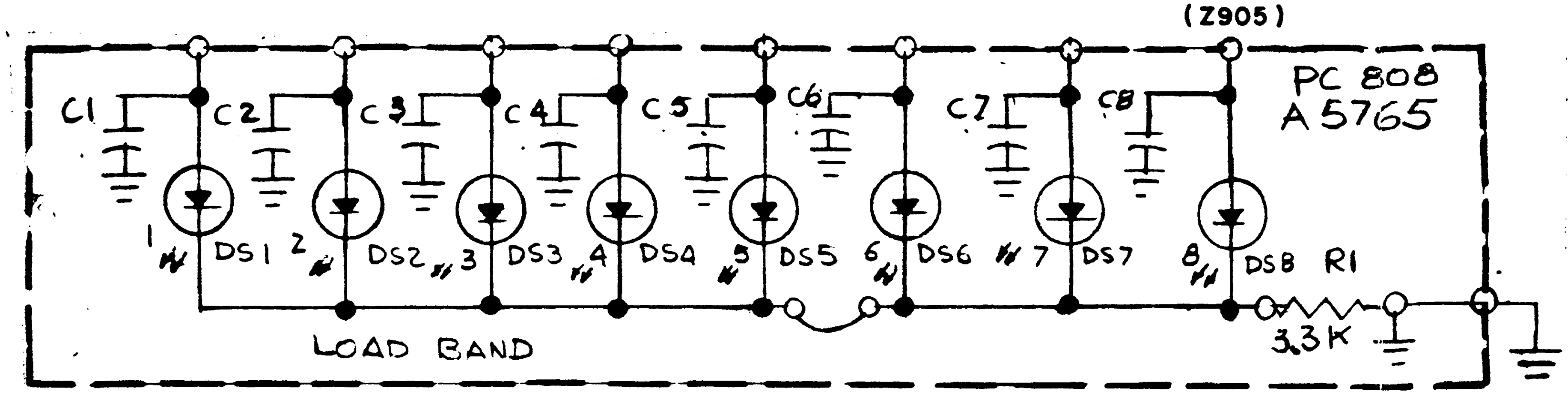
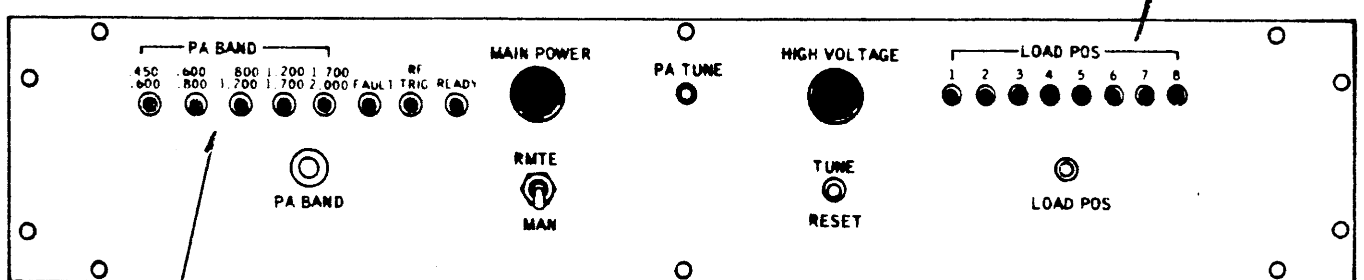
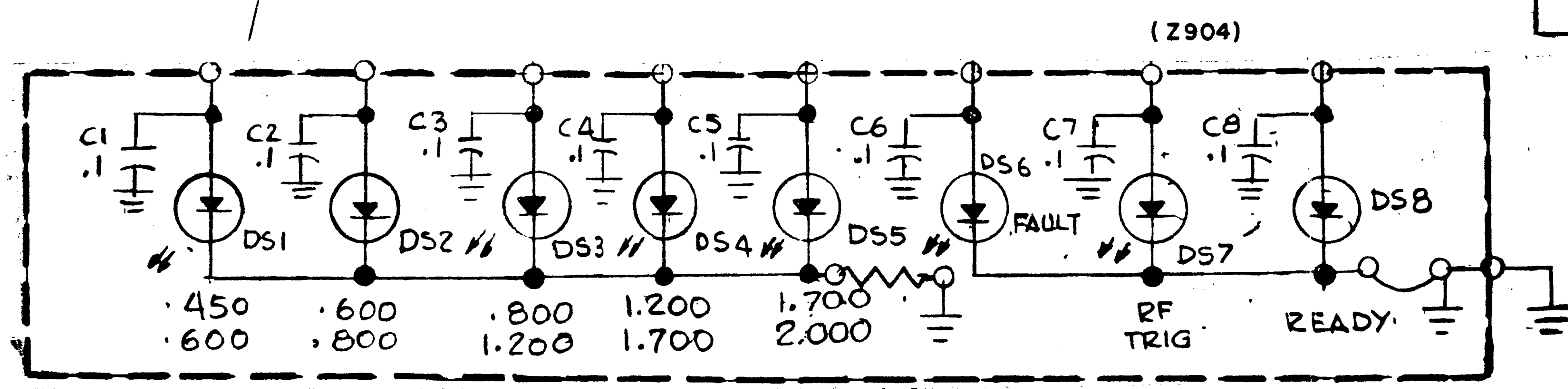


Figure 6-11

Control Panel
(BMA561)







Part Number	Description	Used On	Qty	Symbol Number
BI132	LED	A5765	8	DS1,DS2,DS3,DS4,DS5, DS6,DS7,DS8
CC131-39	CAP, FXD, C	A5765	8	C1,C2,C3,C4,C5,C6,C7, C8
RC07GF332J	RES, FXD, C	A5765	1	R1

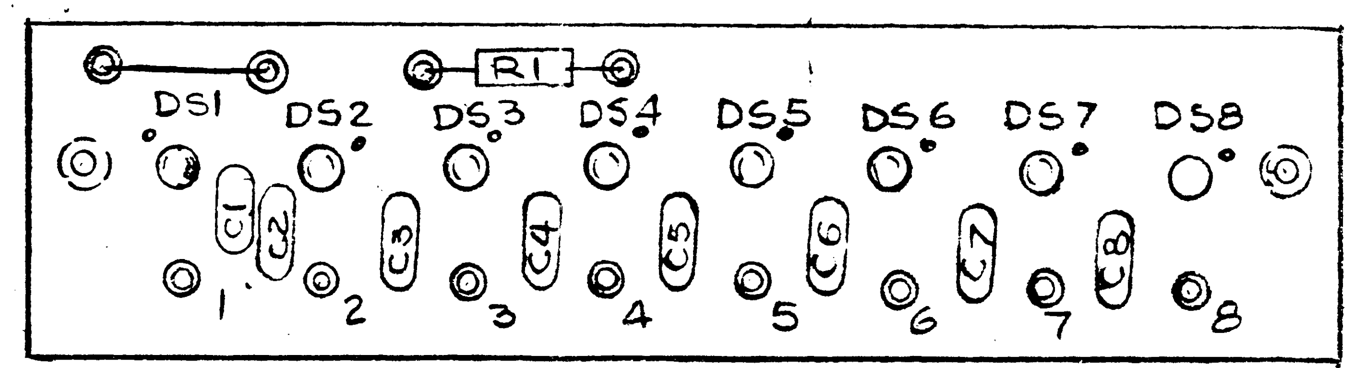
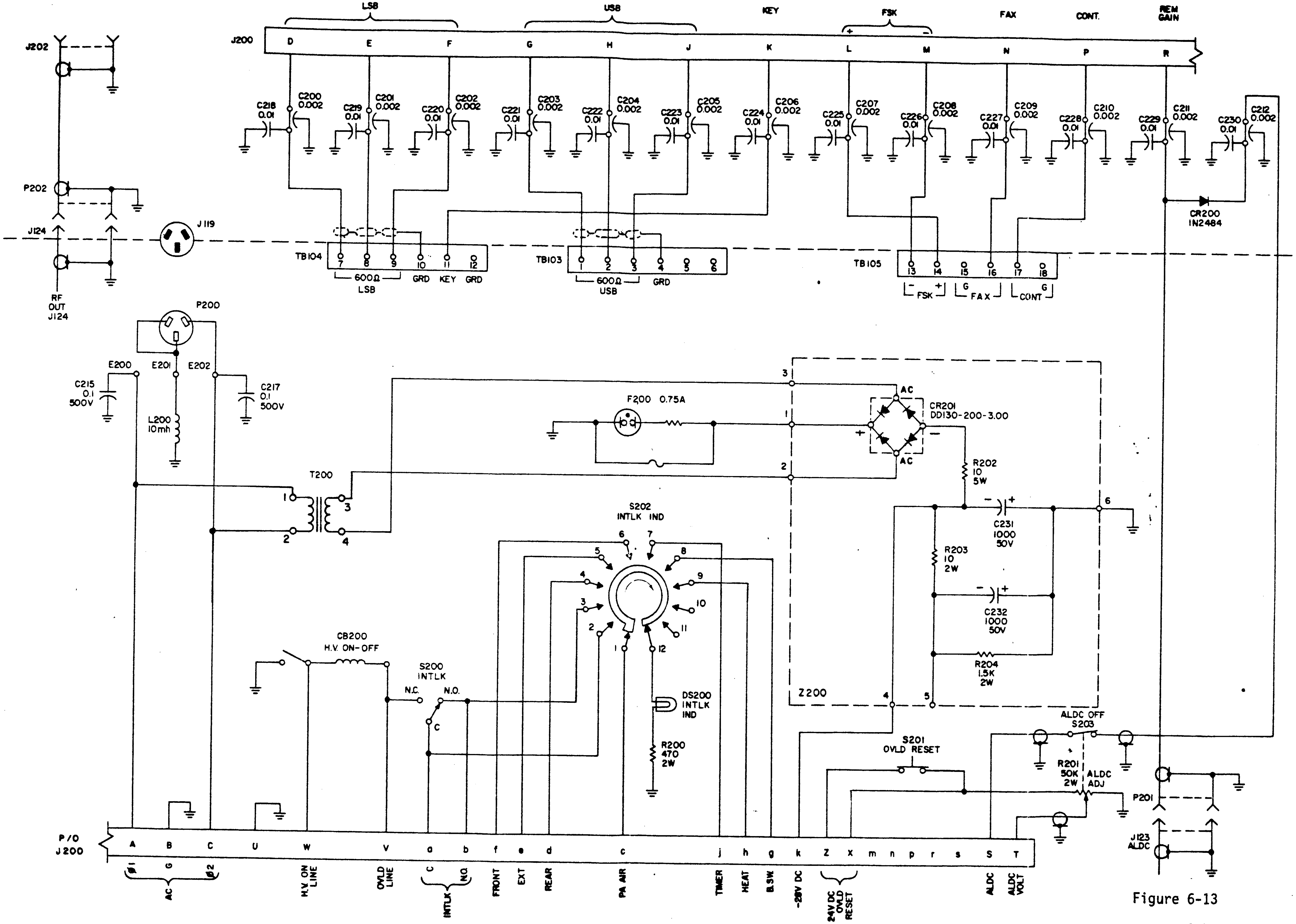


Figure 6-12

Control Panel,
Printed Circuits

Part Number	Description	Used On	Qty	Symbol Number
BI116-1-5	LAMP, INCAND	AX5246	1	DS200
CC100-32	CAP, FXD, CER	AX5246	2 3	C215,~~C216~~,C217
CE116-8VN	CAP, FXD, ELECT	A4649	2	C231,C232
CK70AW202M	CAP, FXD, CER	AX5246	14	C200,C201,C202,C203, C204,C205,C206,C207, C208,C209,C210,C211, C212,C213
CM35F103F03	CAP, FXD, MICA	AX5246	13	C218,C219,C220,C221, C222,C223,C224,C225, C226,C227,C228,C229, C230
DD130-200-3.00	RECT, SCOND DEV	A4649	1	CR201
FH104-11	FUSEHOLDER	AX5246	1	XF200
FU102-.750	FUSE, CTG	AX5246	1	F200
MS3102A28-21P	CONN, RECP, ML	CA1398	1	J200
PL176	CONN, RECP, UHF	CA1385	1	P200
PL244-1	CONN, PL, BNC	CA0480-15-2400	2	P202,P201
RC20GF271J	RES, FXD, COMP	AX5246	1	R210
RC20GF562J	RES, FXD, COMP	AX5246	1	R209
RC42GF100J	RES, FXD, COMP	A4649	1	R203
RC42GF152J	RES, FXD, COMP	A4649	1	R204
RC42GF471J	RES, FXD, COMP	AX5246	1	R200
RL167-1	REL, ARM-SPDT	AX5246	1	K204
RR114-10W	RES, FXD, WW-5W	A4649	1	R202
RV4NCYSD503AYY	RES, VAR-COMP	AX5246	1	R201
SW230	SW, PUSH-PULL	AX5246	1	S200
SW250	SW, ROTARY	AX5246	1	S202
SW296-1	SW,PUSH-RED	AX5246	1	S201
SW418-1	SWITCH	AX5246	1	CB200
TE0114-2	TERM, FDTHR, INS	AX5246	3	E200,E201,E202
TF380	XFMR, PWR, SD	AX5246	1	T200
IN2484	TRANSISTOR	AX5246	2	CR200 CR200
CL101-4	CHOKE RF	AX5246	1	L200 [illegible] 3-27-8?

Exciter Drawer
Component Parts



CK1411

Figure 6-13

Schematic Diagram
Exciter Drawer

Part Number	Description	Used On	Qty	Symbol Number
A4651	BD, ASSY, PC	AX5245	1	Z301
A4705-4	BD, ASSY, RES	AX5245	1	TB301
A5705	BD, ASSY, PC	AX5245	1	Z302
BL126	FAN ANT	AX5245	1	B301
BZ101-2	ALARM	AX5245	1	DS301
CC100-28	CAP, FXD, CER	AX5245	1	C301
CC100-32	CAP, FXD, CER	AX5245	18	C302,C305,C307,C308, C309,C311,C313,C331, C332,C333,C334,C336, C337,C338,C339,C340, C341,C342
CE105-200-15	CAP, FXD, ELECT	AX5245	3	C310,C312,C304
CE112-6	CAP, FXD, ELECT	AX5245	2	C315,C321
CE51C800R	CAP, FXD, ELECT	AX5245	2	C318,C319
CK80AW202M	CAP, FXD, CER	AX5245	9	C322,C323,C324,C325, C326,C327,C328,C329, C330
CL226-5	COIL, RF, FXD	AX5245	5	L305,L306,L307,L308, L309
CL275-102	COIL, RF, FXD	AX5245	1	L301
CM50B103J03	CAP, FXD, MICA	AX5245	1	C306
CP105	CAP, FXD, P	AX5245	1	C316
CP113-1	CAP, FXD, P	AX5245	1	C320
CP70B1FG106K	CAP, FXD, P	AX5245	1	C317
CX102J103M	CAP, FXD, PLSTC	AX5245	1	C314
DD124	RECT, SCOND, DEV	AX5245	1	CR303
DD129	RECT, SCOND, DEV	AX5245	1	CR307
FH104-3	FUSEHOLDER, IND	AX5245	3	XF301,XF302,XF303
FH104-11	FUSEHOLDER, IND	AX5245	3	XF304,XF306,XF307
FH106	FUSEHOLDER, IND	AX5245	1	XF305
FU102-1.5	FUSE, CTG	AX5245	1	F304
FU102-2	FUSE, CTG	AX5245	1	F307
FU102-4	FUSE, CTG	AX5245	4	F301,F302,F303,F306
FU104R25	FUSE, CTG	AX5245	1	F305
JJ319-22DTE	CONN, RECP, FML	AX5245	1	J302
MR191-3	MTR	AX5245	1	M301

(IPA) Driver Drawer

Component Parts

Part Number	Description	Used On	Qty	Symbol Number
RA30NASD253A	RES, VAR, COMP	AX5245	1	R326
RC20GF101J	RES, FXD, COMP	AX5245	1	R348
RC20GF103J	RES, FXD, COMP	AX5245	1	R311
RC20GF330J	RES, FXD, COMP	AX5245	1	R301
RC20GF393J	RES, FXD, COMP	AX5245	5	R319,R320,R321,R346, R347
RC20GF470J	RES, FXD, COMP	AX5245	1	R310
RC32GF100J	RES, FXD, COMP	AX5245	1	R312
RC32GF202J	RES, FXD, COMP	AX5245	2	R313,R316
RC42GF100J	RES, FXD, COMP	AX5245	2	R314,R315
RC42GF101J	RES, FXD, COMP	AX5245	1	R350
RC42GF104J	RES, FXD, COMP	AX5245	1	R343
RC42GF151J	RES, FXD, COMP	AX5245	1	R317
RC42GF331J	RES, FXD, COMP	A-4705-4	8	R302,R303,R304,R305, R306,R307,R308,R309
RC42GF333J	RES, FXD, COMP	A-4705-4	3	R330,R331,R336
RC42GF392J	RES, FXD, COMP	AX5245	3	R328,R333,R334
RC42GF470J	RES, FXD, COMP	AX5245	2	R318,R349
RC42GF474J	RES, FXD, COMP	AX5245	1	R338
RC42GF823J	RES, FXD, COMP	AX5245	1	R344
RL168-2C10-220AC	REL, ARM, DPDT	AX5245	2	K302,K305
RL168-2C10-24DC	REL, ARM, DPDT	AX5245	4	K303,K304,K306,K309
RL168-3C10-220AC	REL, ARM, 3 PDT	AX5245	1	K308
RL168-3C10-24DC	REL, ARM, 3 PDT	AX5245	2	K301,K309
RV4LAYSA253A	RES, VAR, COMP	AX5245	3	R329,R332,R335
RW105-29	RES, FXD, WW	AX5245	1	R339
RW105-48	RES, FXD, WW 50W	AX5245	2	R322,R323
RW107-16	RES, FXD, WW 5W	AX5245	1	R345
RW109-15	RES, FXD, WW 10W	AX5245	1	R342
RW109-24	RES, FXD, WW 10W	AX5245	1	R337
RW109-29	RES, FXD, WW 10W	AX5245	1	R327
RW109-36	RES, FXD, WW 10WW	AX5245	1	R324
RW110-30	RES, FXD, WW 20W	AX5245	1	R341
RW110-39	RES, FXD, WW 20W	AX5245	1	R340
ST103-5-62	SW, TOGGLE-SPST	AX5245	1	S302
ST103-11-62	SW, TOGGLE SPDT	AX5245	1	S301
SW230	SW, PUSH-PULL	AX5245	1	S304
SW252	SW, AIR FLOW	AX5245	1	S305
SW464	SW, ROTARY	AX5245	1	S303
TE101-3	INS. FDTHRU	BMA226	1	E311
TE102-2	TERM, STUD-INS	AX5245	11	E301,E302,E303,E304, E305,E306,E307,E308, E309,E310,E313

(IPA) Driver Drawer
Component Parts (cont.)

Part Number	Description	Used On	Qty	Symbol Number
TF366	XFMR, PWR-DS-SU	AX5245	1	T301
TF412	XFMR, PWR-SU	AX5245	1	T302
TF5013	REACTOR-7H	AX5245	1	L303
TF5028	REACTOR	AX5245	1	L304
TI105	TIMER, INTERVAL	AX5245	1	M302
TM102-6	TERM, BD-BARR	AX5245	1	TB302
TR190	XFMR, OUTPUT	AX5245	1	T304
TR190-2	XFMR, OUTPUT	AX5245	1	T304
TR191	XFMR	AX5245	1	T303
TS100-6	SOC, EL TUBE	AX5245	3	XK301,XK308,XK309
TS100-7	SOC, EL TUBE	AX5245	1	XK307
TS101P01	SOC, EL TUBE	AX5245	8	XC318,XC319,XK302, XK303,XK304,XK305, XK306,XK309
TS102P01	SOC, EL TUBE	AX5245	6	XV304,XV305,XV306, XV307,XV308,XV309
TS132	SOC, EL TUBE	AX5245	1	XV302
TS132-2	SOC, EL TUBE	AX5245	1	XV303
UG560/U	CONN, RECP-HN	AX5245	1	XV301
OA2	TUBE, EL	AX5245	5	V304,V305,V306,V307, V308
OB2	TUBE, EL	AX5245	1	V309
IN2484	SCOND, DEV, DIO	AX5245	2	CR301,CR302
IN2986B	SCOND, DEV, DIO	AX5245	1	CR306
4CX350A	TUBE, ELEC	AX5245	2	V302,V303
8121	TUBE, ELEC	AX5245	1	V301

(IPA) Driver Drawer
Component Parts (cont.)

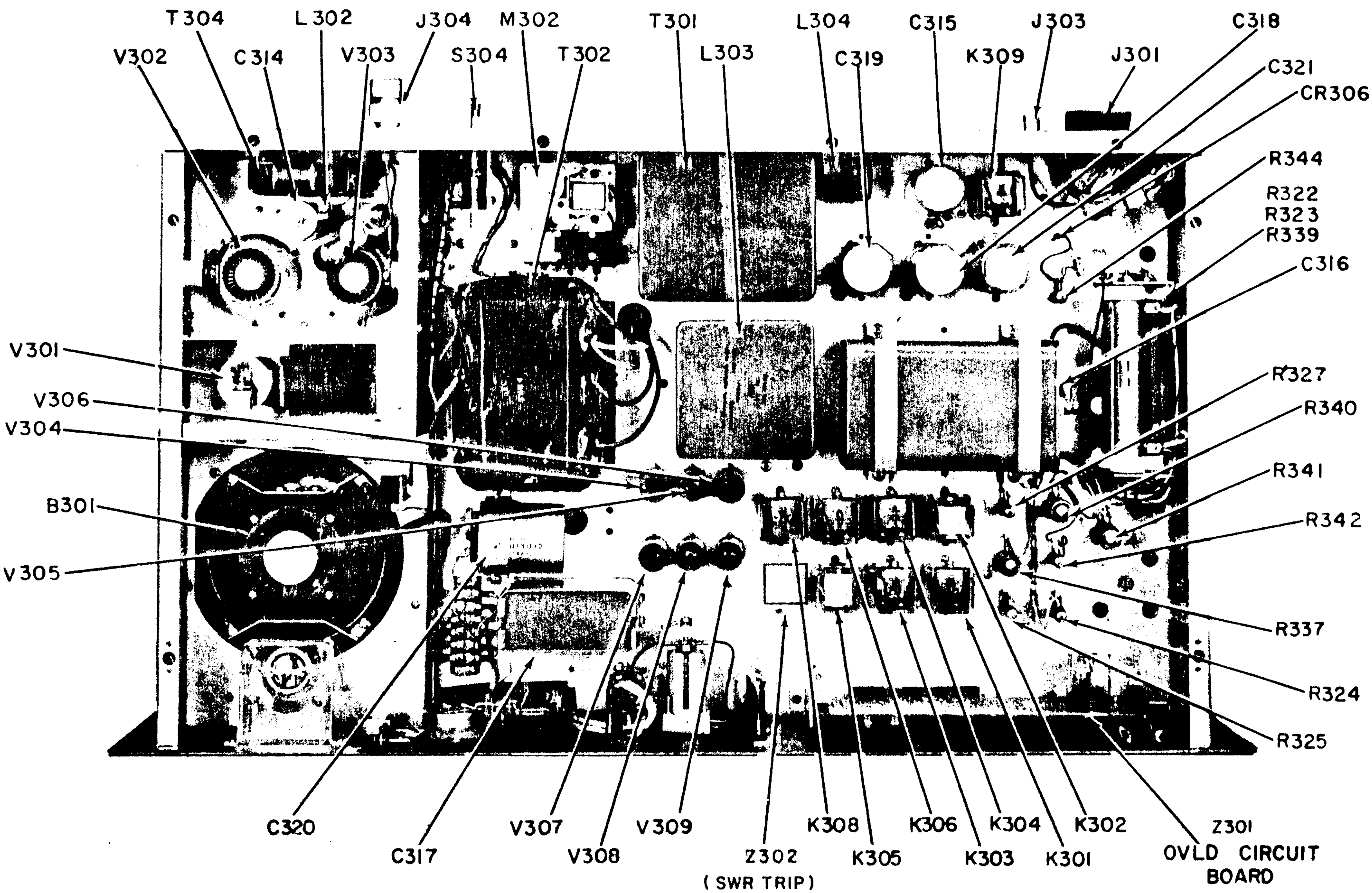
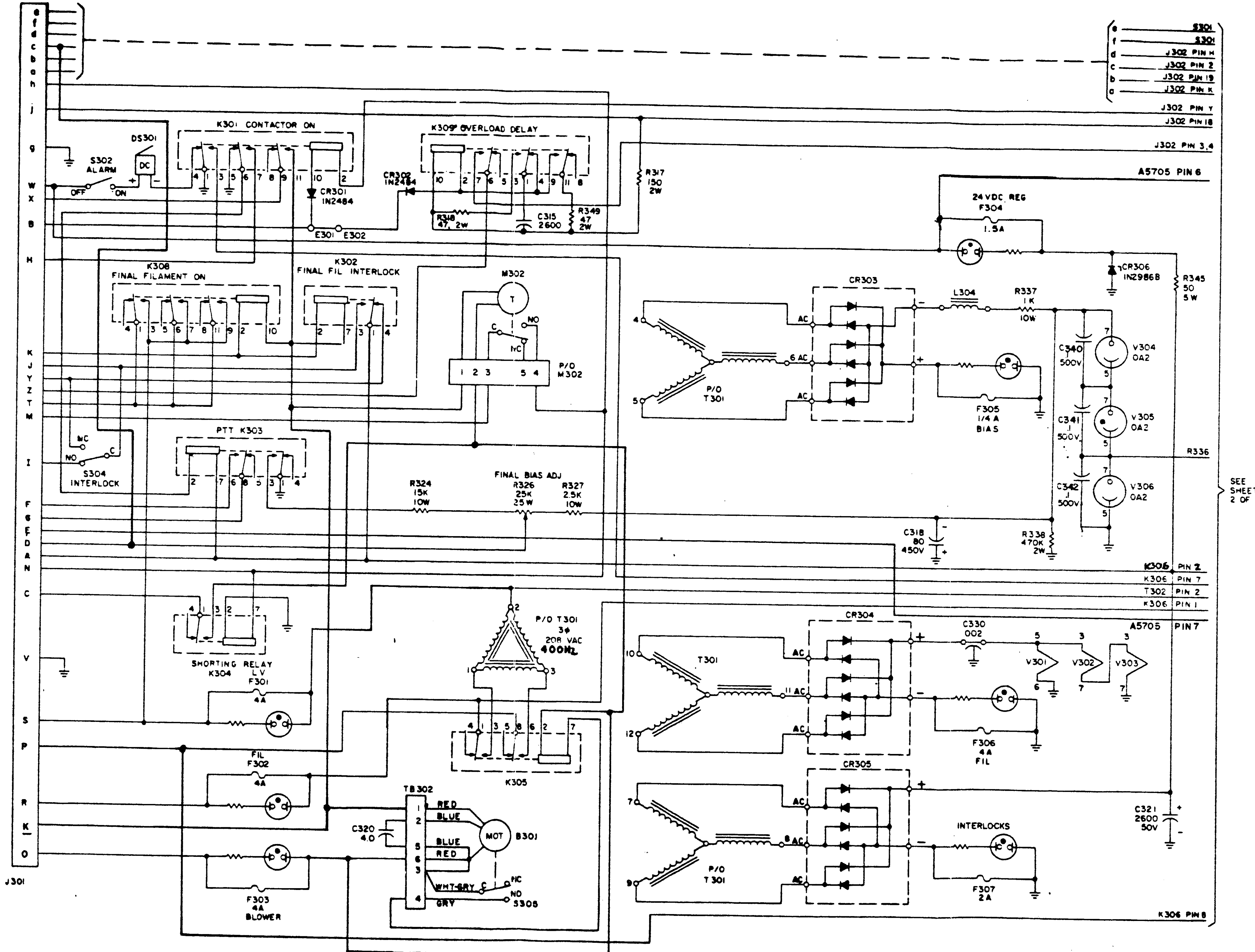


Figure 6-14

Top View (IPA) Driver Drawer



CK2217-Ø

Figure 6-15a

Schematic Diagram
(IPA) Driver Drawer

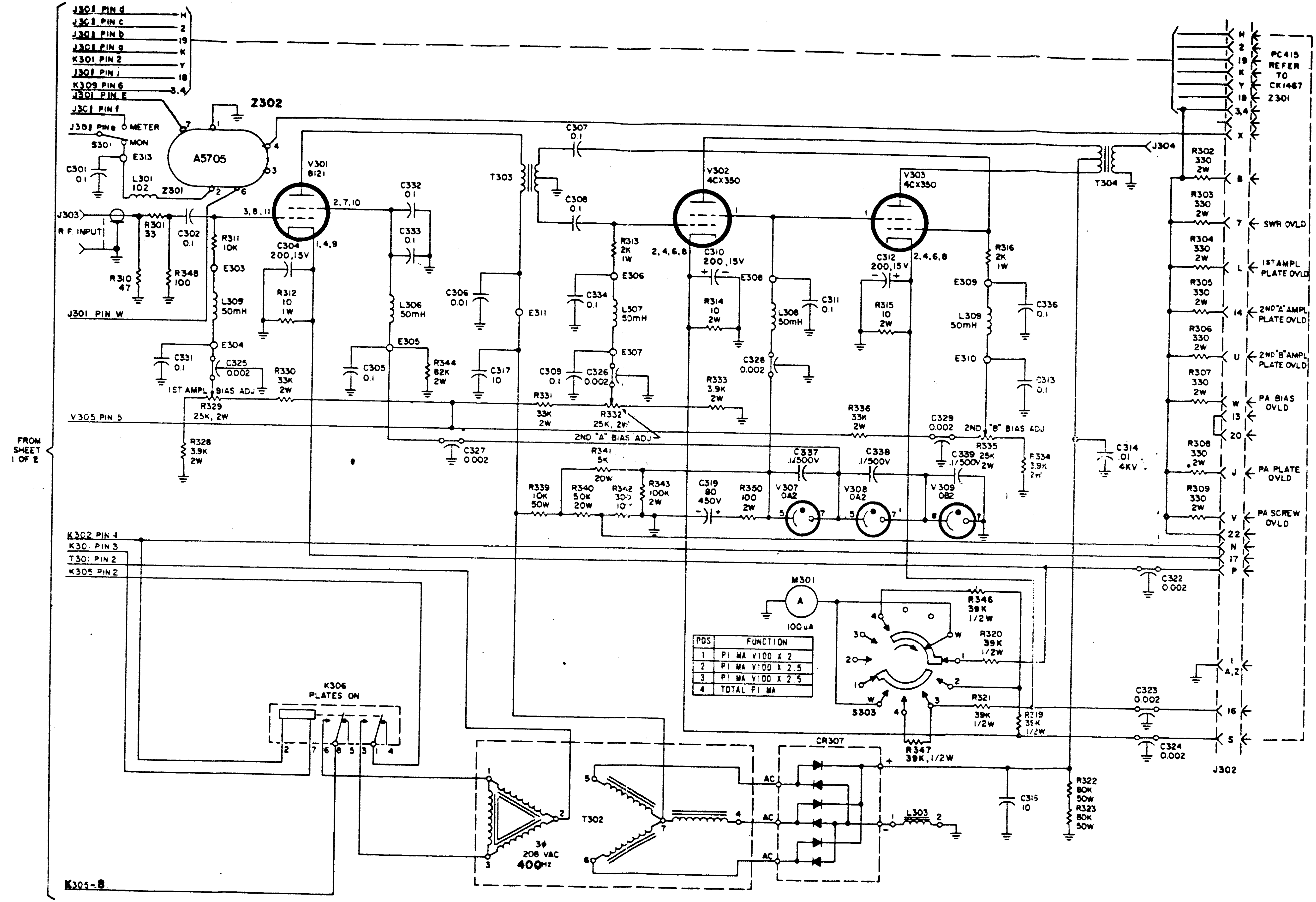


Figure 6-15b

Schematic Diagram (IPA) Driver Drawer

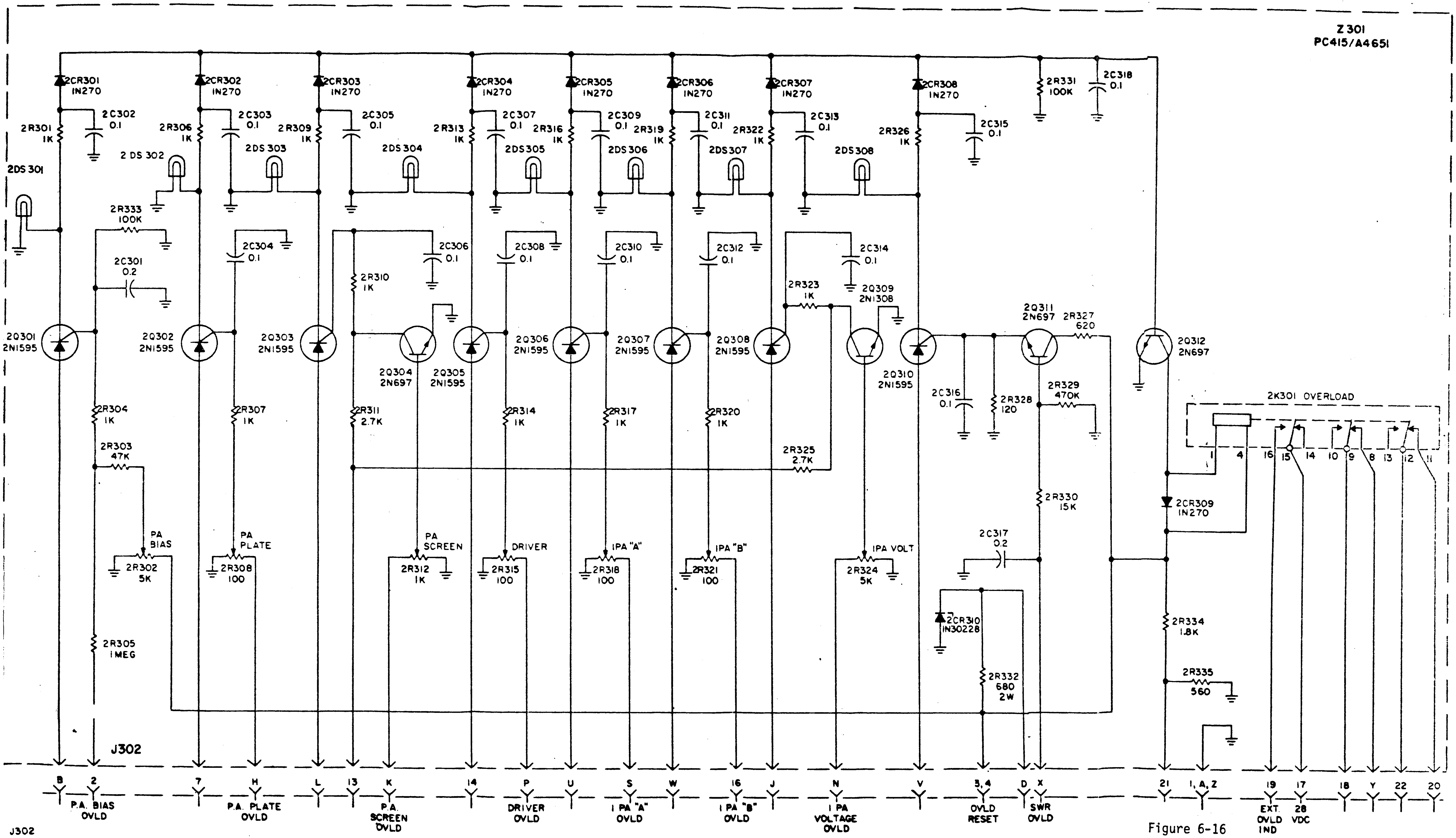


Figure 6-16

Schematic Diagram
Overload Control Circuitry

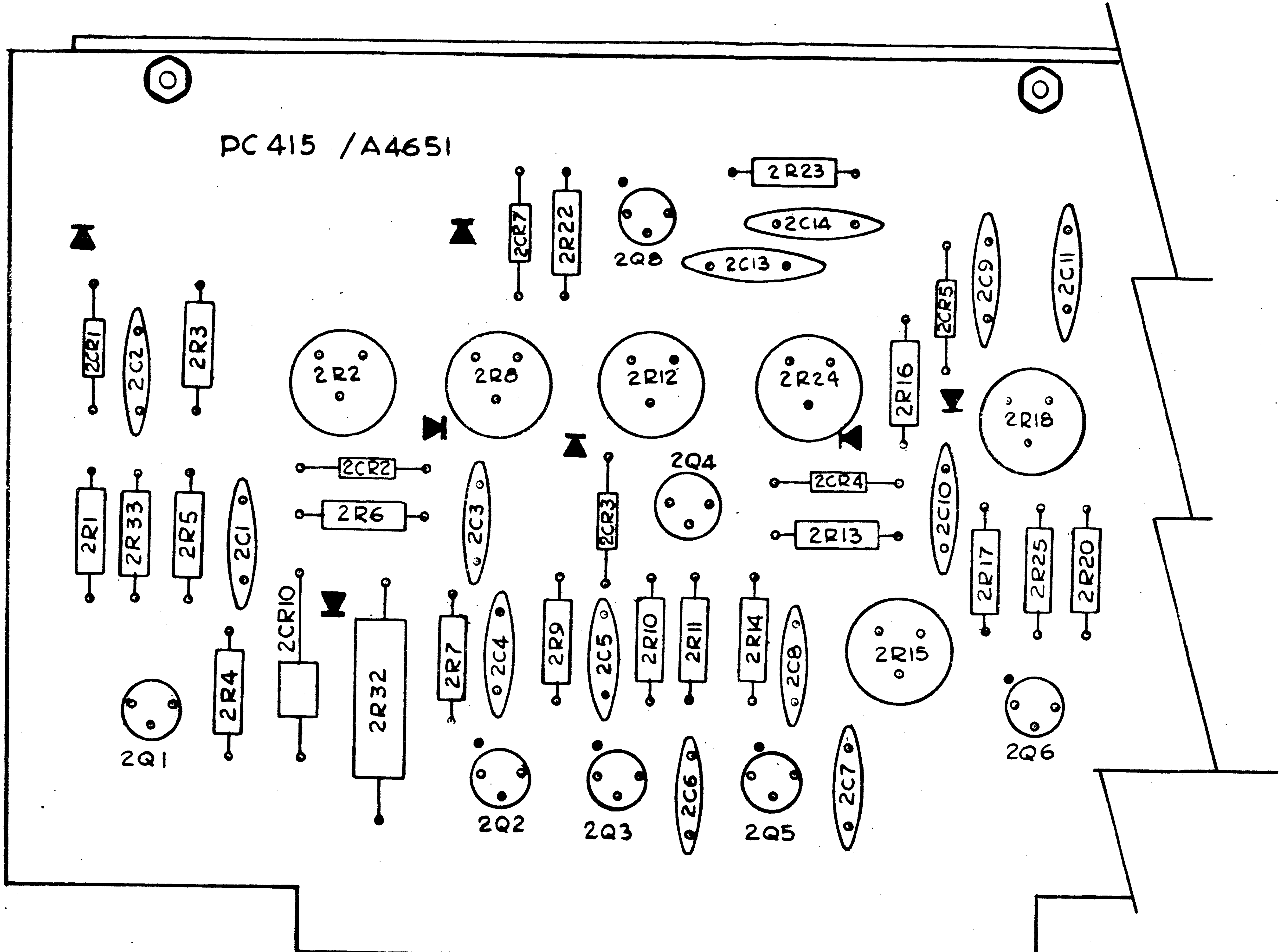


Figure 6-17a

Assembly Diagram
Overload Control Circuit

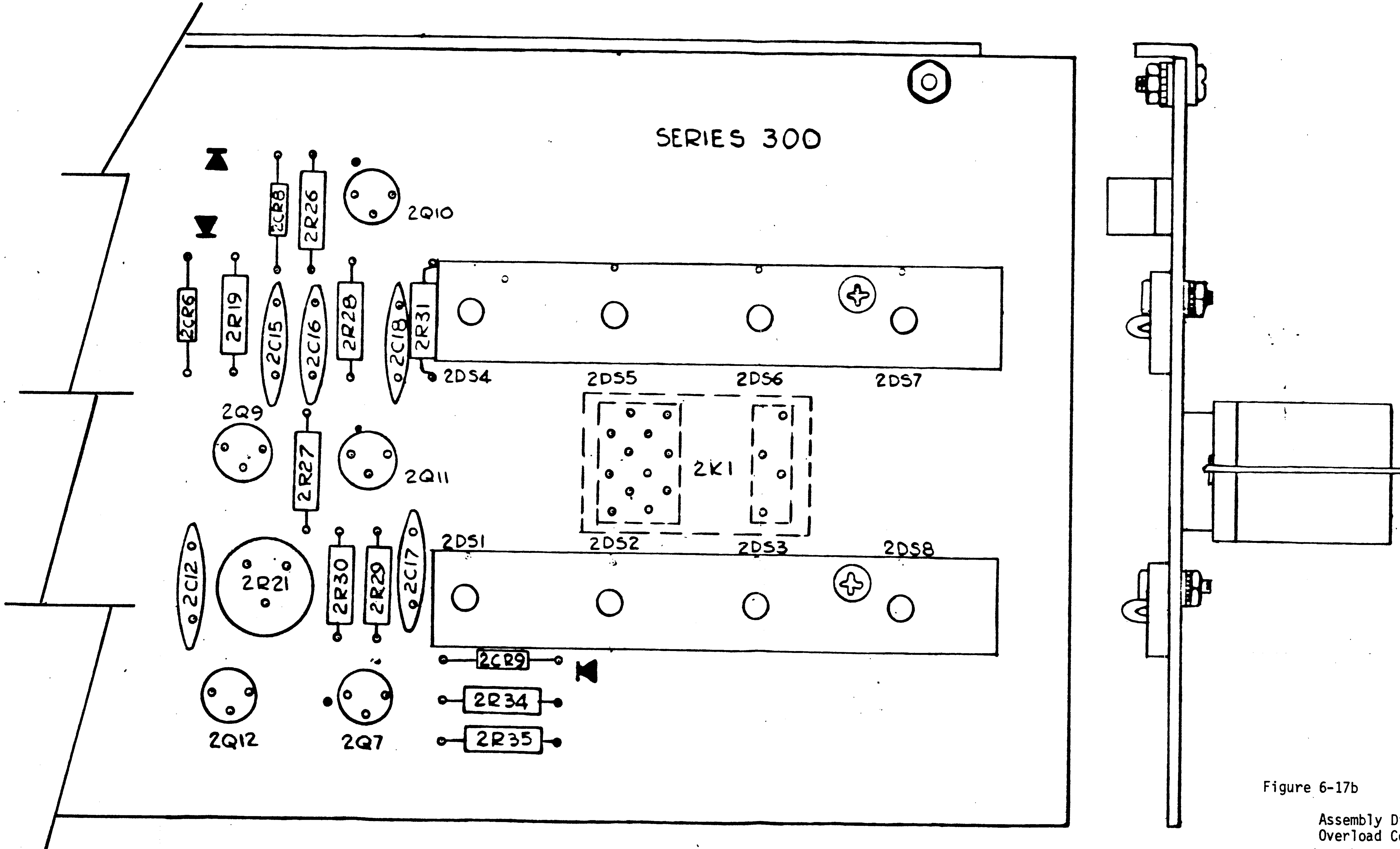


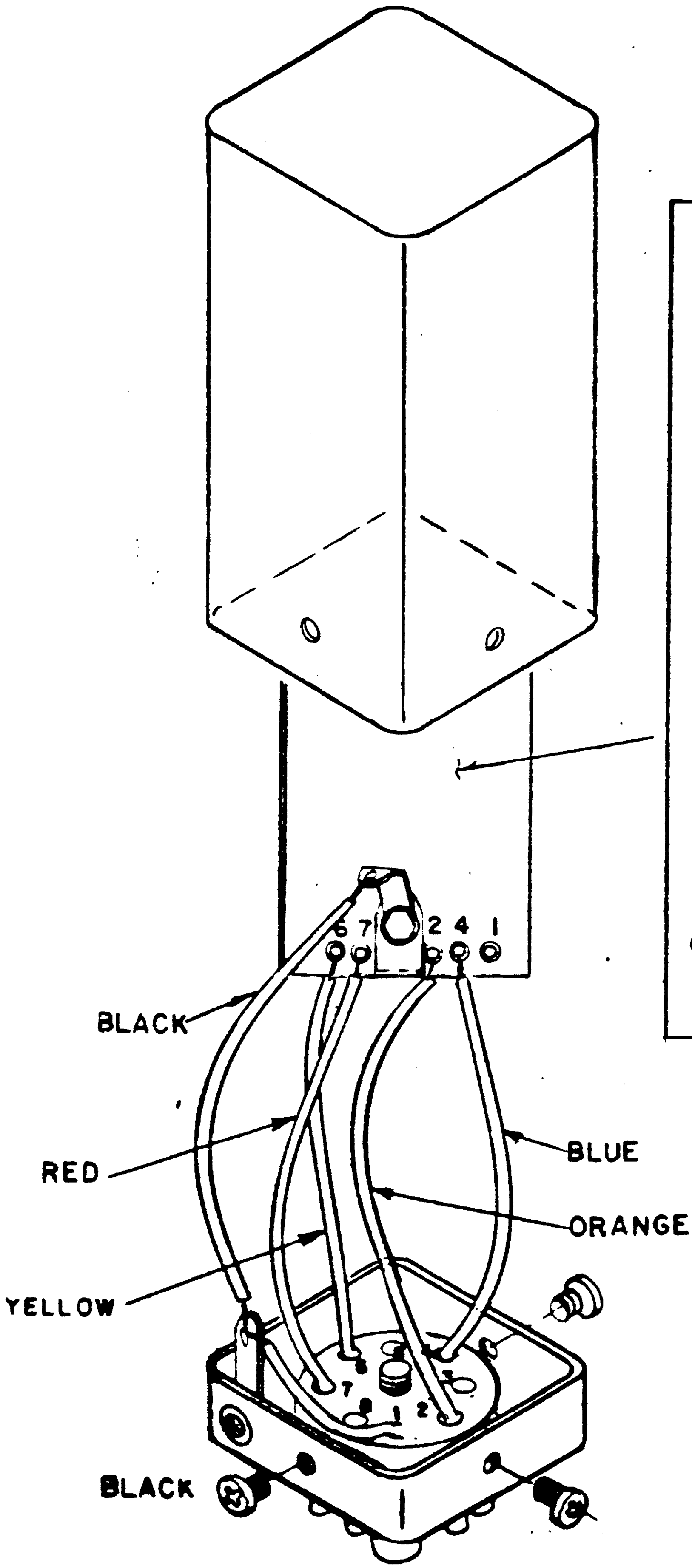
Figure 6-17b

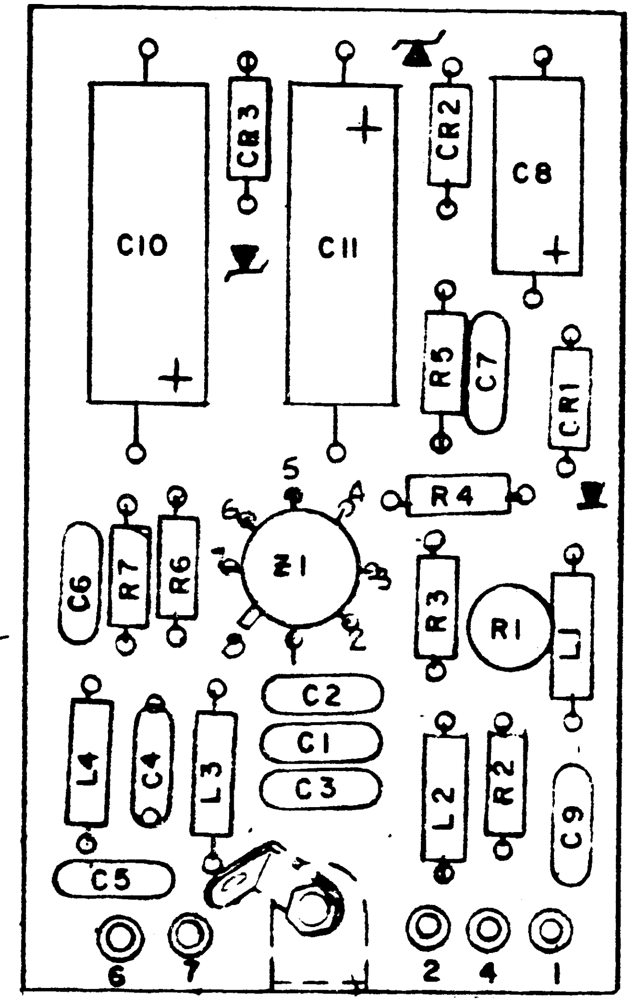
Assembly Diagram
Overload Control Circuit
(Z301)

Part Number	Description	Used On	Qty	Symbol Number
BI114-2	LAMP INCAND	A4651	8	2DS301,2DS302,2DS303, 2DS304,2DS305,2DS306, 2DS307,2DS308
CC100-28	CAP, FXD, CER	A4651	16	2C304,2C306,2C308, 2C309,2C307,2C305, 2C303,2C302,2C311, 2C313,2C315,2C318, 2C316,2C310,2C312, 2C314
CC100-33	CAP, FXD, CER	A4651	2	2C301,2C317
RC20GF102J	RES, FXD, COMP	A4651	15	2R301,2R306,2R304, 2R309,2R310,2R313, 2R316,2R323,2R322, 2R317,2R320,2R319, 2R326,2R314,2R307
RC20GF104J	RES, FXD, COMP	A4651	2	2R333,2R331
RC20GF105J	RES, FXD, COMP	A4651	1	2R305
RC20GF121J	RES, FXD, COMP	A4651	1	2R328
RC20GF153J	RES, FXD, COMP	A4651	1	2R330
RC20GF182J	RES, FXD, COMP	A4651	1	2R334
RC20GF272J	RES, FXD, COMP	A4651	2	2R311,2R325
RC20GF473J	RES, FXD, COMP	A4651	1	2R303
RC20GF474J	RES, FXD, COMP	A4651	1	2R329
RC20GF621J	RES, FXD, COMP	A4651	1	2R327
RC20GF561J	RES, FXD, COMP	A4651	1	2R335
RC42GF681J	RES, FXD, COMP	A4651	1	2R332
RL156-8	REL, ARM-4DPT	A4651	1	2K301
RV111U101A	RES, VAR, COMP	A4651	4	2R308,2R315,2R318, 2R321
RV111U102A	RES, VAR, COMP	A4651	1	2R312
RV111U502A	RES, VAR, COMP	A4651	2	2R302,2R324
TS171-4	SOC, REL-W/RET	A4651	1	XK301
IN270	SCOND, DEV, DIO	A4651	9	2CR301,2CR302,2CR303, 2CR304,2CR305,2CR306, 2CR307,2CR308,2CR309
IN3022B	SCOND, DEV, DIO	A4651	1	2CR310
2N1308	TRANSISTOR	A4651	1	2Q309
2N1595	TRANSISTOR	A4651	8	2Q301,2Q302,2Q303, 2Q305,2Q306,2Q307, 2Q308,2Q310
2N697	TRANSISTOR	A4651	3	2Q304,2Q311,2Q312

Overload Control Circuit
Component Parts

Part Number	Description	Used On	Qty	Symbol Number
CC100-37	CAP, FXD, CER	A5705	8	C1,C2,C3,C4,C5,C6,C7,C9
CE105-15-25	CAP, FXD, ELECT	A5705	1	C8
CE105-50-25	CAP, FXD, ELECT	A5705	2	C10,C11
CL275-221	COIL, RF	A5705	4	L1,L2,L3,L4
RC07GF102J	RES, FXD, COMP	A5705	3	R4,R6,R7
RC07GF122J	RES, FXD, COMP	A5705	2	R2,R5
RC07GF472J	RES, FXD, COMP	A5705	1	R3
RV124-5K	HELITRIM	A5705	1	R1
UG741	OP AMP	A5705	1	Z1
IN756	DIODE	A5705	2	CR2,CR3
IN5061	DIODE	A5705	1	CR1





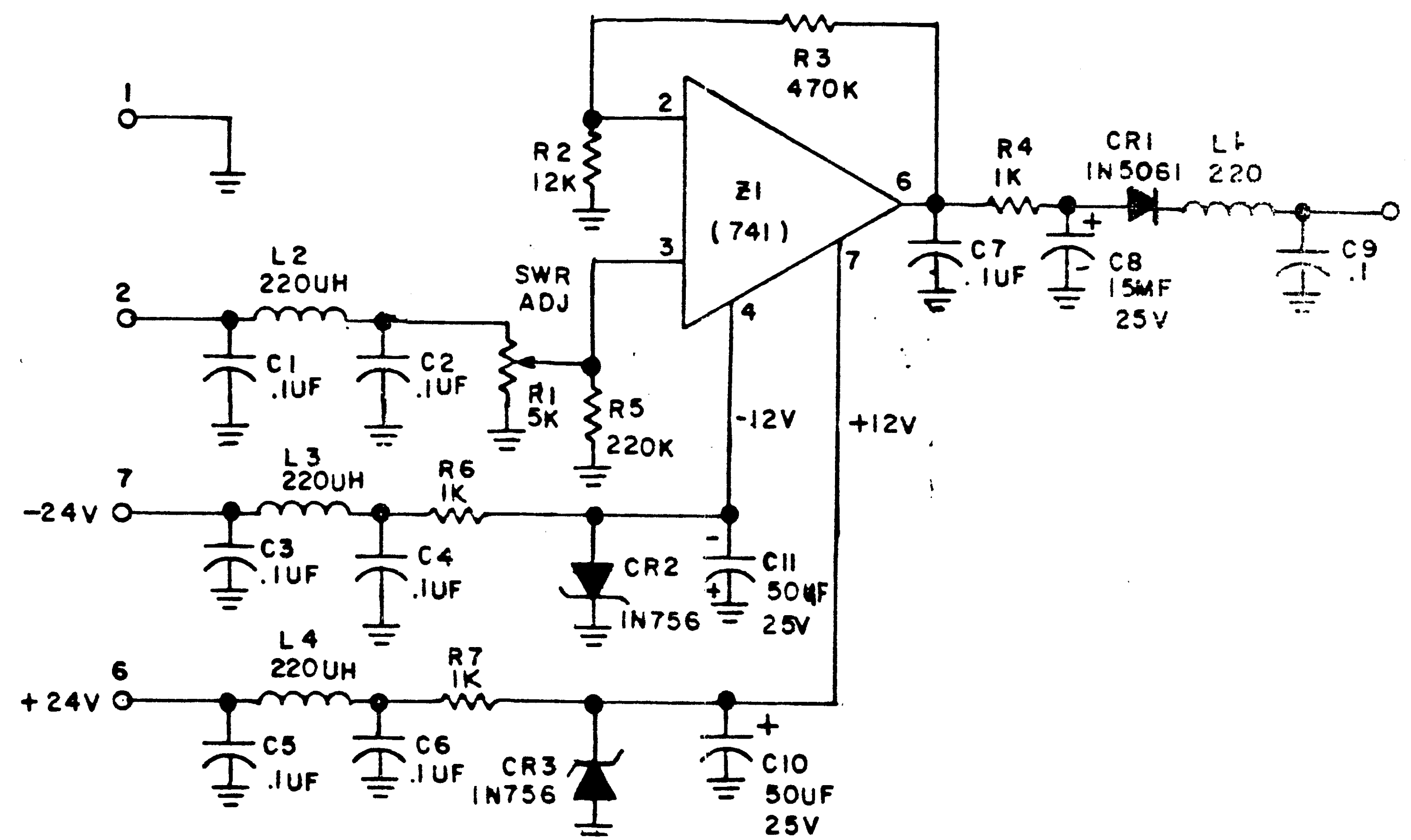
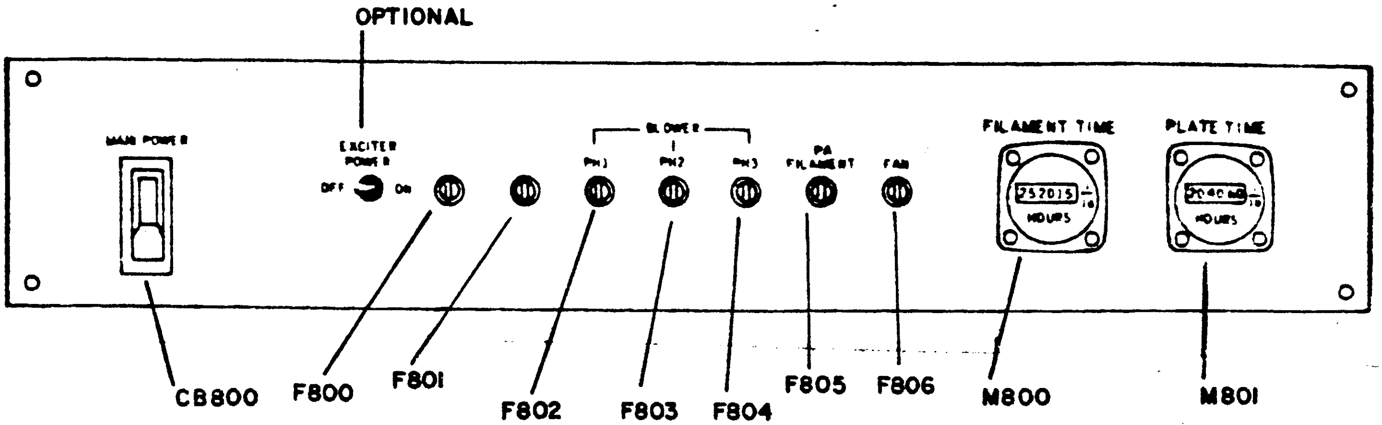


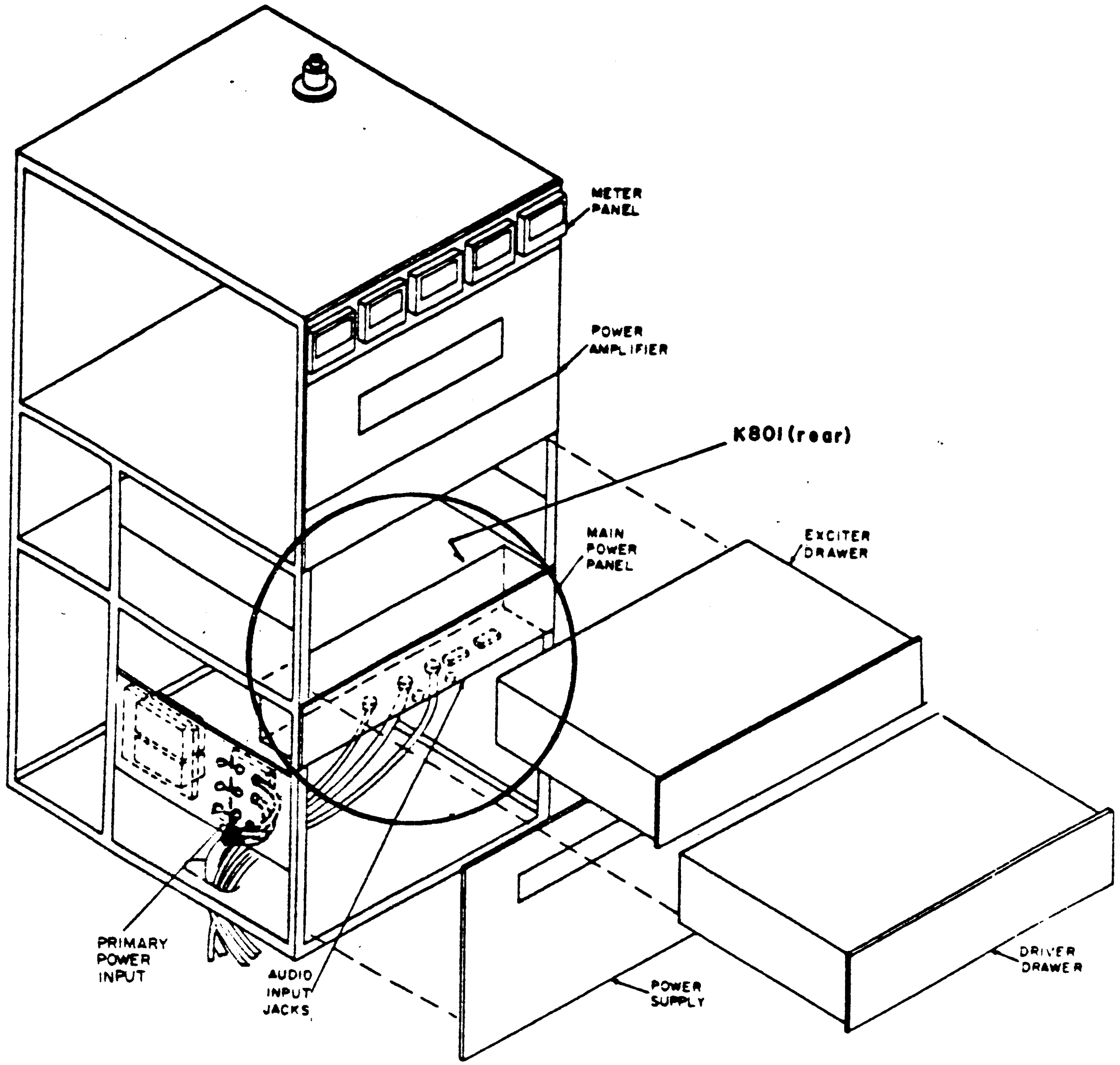
Figure 6-18

SWR Trip Circuit A5705
(Z302)



Part Number	Description	Used On	Qty	Symbol Number
FH104-3	FUSEHOLDER, IND	AX5244	7	XF800,XF801,XF802, XF803,XF804,XF805, XF806
FU102-1	FUSE, CTG	AX5244	1	F806
FU102-15	FUSE, CTG	AX5244	3	F805,F800,F801
FU102-5	FUSE, CTG	AX5244	3	F802,F803,F804
MR198-1	TIMER, STOP	AX5244	2	M800,M801
RW107-34	RES, FXD, WW	AX5244	2	R811,R812
SW462	CKT BKR-3PST	AX5244	1	CB800

Figure 6-19
Main Power Panel



Part Number	Description	Used On	Qty	Symbol Number
CC100-29	CAP, FXD, CER	BMA562	3	C1007,C1008,C1009
CC100-43	CAP, FXD, CER	BMA562	2	C1020,C1021
CC100-28	CAP, FXD, CER	BMA562	17	C1001,C1002,C1003, C1004,C1005,C1006, C1010,C1011,C1012, C1014,C1015,C1016, C1017,C1018,C1019, C1013,C1022
JJ172	CONN, RECP, BNC	BAM562	3	J1003,J1004,J1030
MS3102A165-1S	CONN, RECP	CA1374	1	J1001
MS3102A20-27S	CONN, RECP, FML	CA1375	1	J1000
MS3102A20-29S	CONN, RECP, FML	CA1376	1	J1002
SW230	SW, PUSH-PULL	BMA562	1	S803
TM100-10	TERM, BD, BARR	BMA562	1	TB801
TM100-12	TERM, BD, BARR	BMA562	1	TB805
TM100-5	TERM, BD, BARR	BMA562	2	TB1000,TB1001
TM100-7	TERM, BD, BARR	BMA562	1	TB802
TM100-4	TERM, BD, BARR	BMA562	2	TB803,TB804

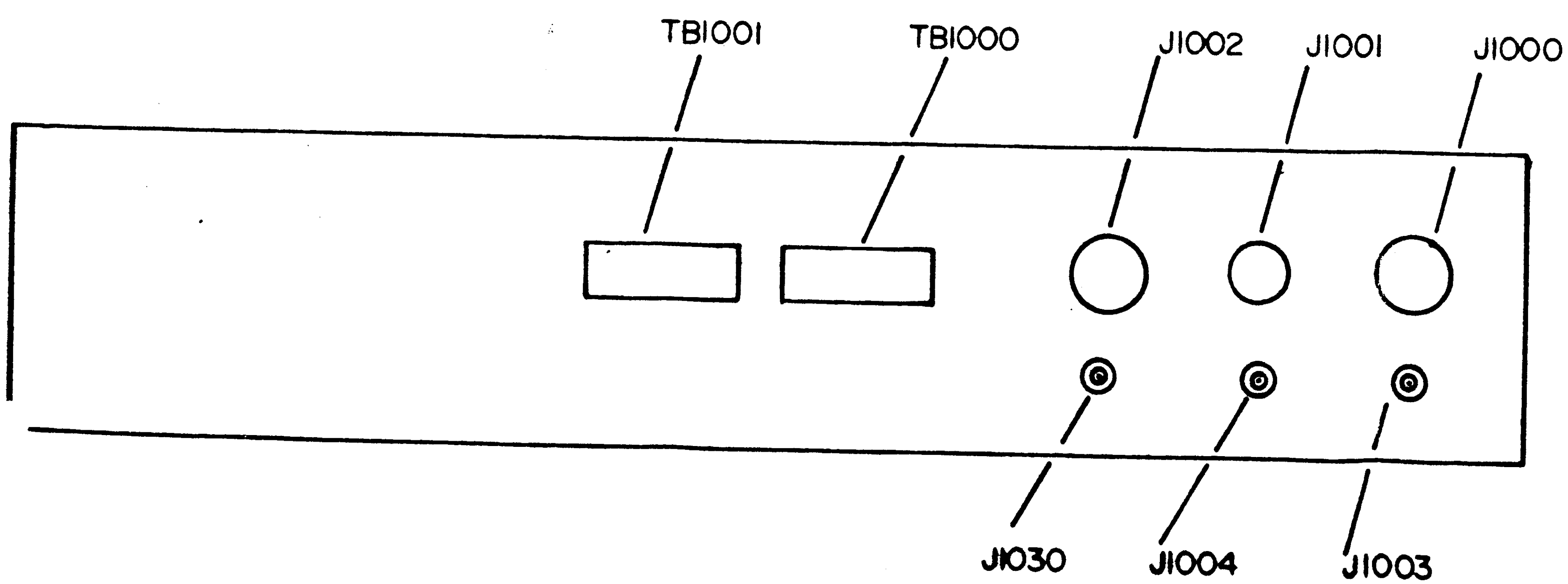


Figure 6-20

Interconnect Chassis BMA562
(Rear of Main Power Panel)

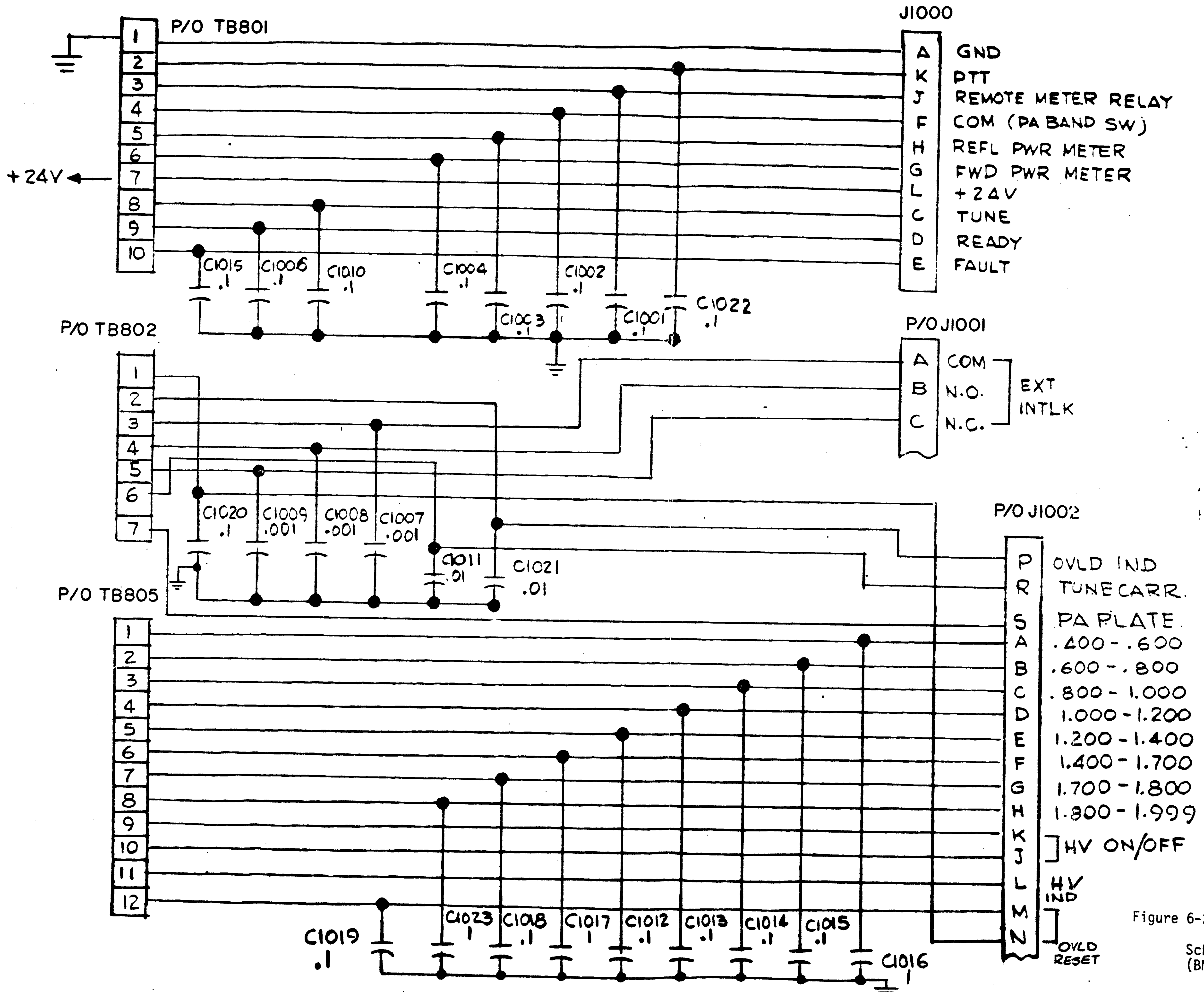


Figure 6-21

Schematic, Interconnect Chassis (BMA562)

Part Number	Description	Used On	Qty	Symbol Number
FU102-1	FUSE, CTG	AX684	3	SPARES
FU102-1.5	FUSE, CTG	AX684	1	SPARES
FU102-15	FUSE, CTG	AX684	1	SPARES
FU102-2	FUSE, CTG	AX684	1	SPARES
FU102-4	FUSE, CTG	AX684	5	SPARES
FU102-5	FUSE, CTG	AX684	3	SPARES
FU104-R25	FUSE, CTG	AX684	2	SPARES

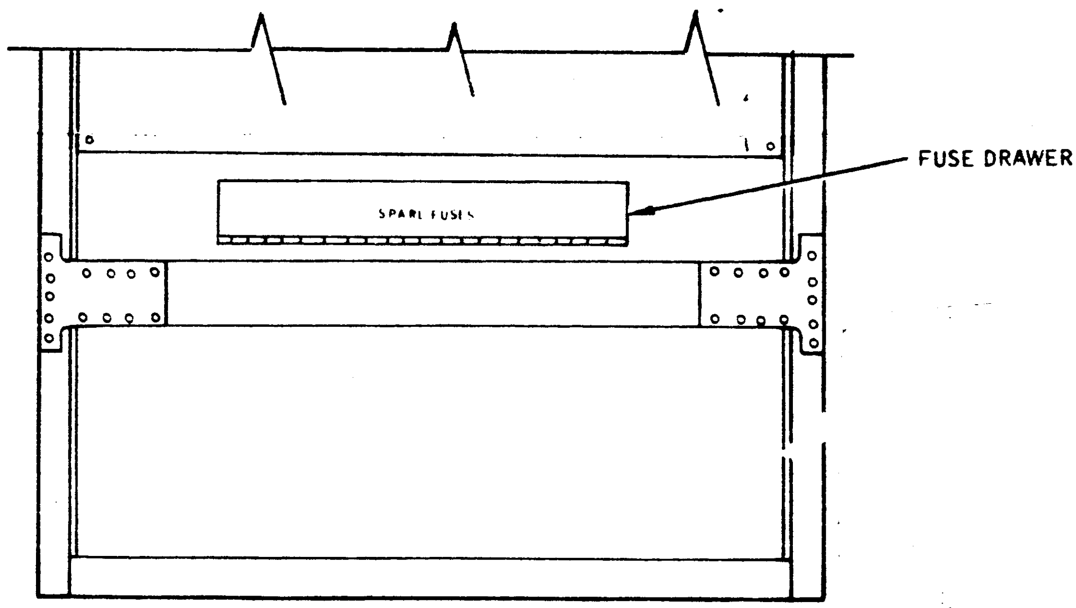


Figure 6-22

Spare Fuse Drawer

Part Number	Description	Used On	Qty	Symbol Number
AX5096	REL ASSY, SHORT	AX5243	1	K801 **(rear of BMA562)**
BL149-400	FAN, CENT, 3PH	AX5243	1	B800
CC100-32	CAP, FXD, CER	AX5243	3	C820,C821,C822
CC109-38	CAP, FXD, CER	AX5243	6	C824,C825,C826, C1031,C1033,C1035
CE63C500G	CAP, FXD	AX5243	1	C823
CL178	COIL, RF, FXD	AX5243	1	L806
CL426-1	COIL	AX5243	1	L801
CM15B050M03	CAP, FXD, MICA	AX5243	1	C827
CM30B202G03	CAP, FXD, MICA	AX5243	1	C828
CM35B103J03	CAP, FXD, MICA	AX5243	1	C808
CP103	CAP, FXD, P	AX5243	1	C800
CP105	CAP, FXD, P	AX5243	1	C801
CP116	CAP, FXD, P	AX5243	2	C810,C811
CP41B1FF405K	CAP, FXD, P	AX5243	1	C829
DD128-3	RET, SCOND, DEV	AX5243	6	CR800A,CR800B,CR800C, CR800D,CR800E,CR800F
NS107	INS, FDTHRU	AX5243	1	E803
RC32GF470J	RES, FXD, COMP	AX5243	1	R813
RC42GF101J	RES, FXD, COMP	A4704	7	R822,R823,R824,R825, R826,R827,R828
RC42GF221J	RES, FXD, COMP	A4704	1	R829
RL138	REL, SOL-3P	AX5243	1	K800
RW107-23	RES, FXD, WW	A4704	1	R818
RW110-43	RES, FXD, WW	A4704	1	R821
RW111-1	RES, FXD, WW	AX5243	1	R810
RW118F183	RES, FXD, WW	AX5243	1	R806
RW118R353	RES, FXD, WW	AX5243	1	R805
RW118F503	RES, FXD, WW	AX5243	4	R800,R801,R802,R803
RW119G1R0	RES, FXD, WW	AX5243	1	R804
SW243-1	SW, AIR FLOW	AX5243	1	S801
TF280	XFMR, PWR, SD	AX5243	1	L800
TF440	XFMR, PWR, SD	AX5243	1	T800
TF365	XFMR, PWR, SD	AX5243	1	T801
VR100S/8-1600-5	SCOND, DEV, SET	A4704	8	CR801A,CR801B,CR801C, CR801D,CR801E,CR801F, CR801G,CR801H

Power Supply

Component Parts

APPENDIX A

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont)

LIST OF ILLUSTRATIONS

LIST OF TABLES

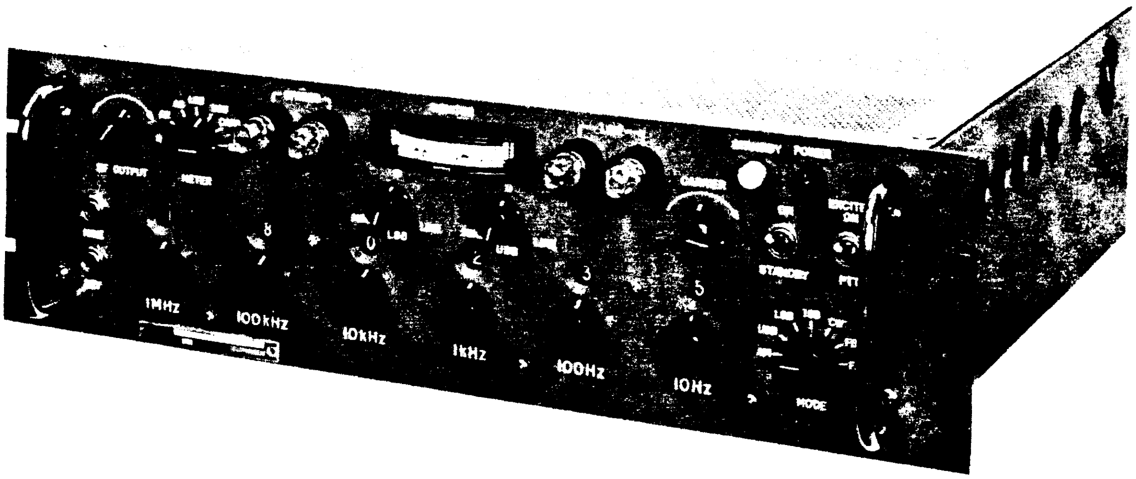


Figure 1-1. Low Frequency Exciter, LFE

SECTION 1

GENERAL INFORMATION

1-1. FUNCTIONAL DESCRIPTION

This manual presents operating and maintenance instructions for Low Frequency Exciter, LFE , designed and manufactured by The Technical Materiel Corporation, Mamaroneck, New York. The manual includes a general description of the equipment, installation and operating instructions, principles of operation, maintenance data and a parts list.

Low Frequency Exciter, LFE (figure 1-1) referred to as the Exciter, or the LFE , is a solid-state sideband exicter that provides an rf output containing amplitude-modulated (AM) intelligence; upper or lower sideband (USB/LSB) intelligence; independent sideband (ISB) intelligence; continuous wave (CW) keyed; frequency shift keyer (FSK); or facsimile (FAX) information. The rf output appears in the 30 kHz to 1.99999 MHz frequency range and is selectable in discrete 10 Hz increments by means of six front panel frequency selector switches with direct-reading digital dials; output frequency range has a built-in stability of 1 part in 10^8/day. The desired mode of operation is controlled by the seven-position (AM, USB, LSB, ISB, CW, FSK, FAX) MODE selector switch. A MONITOR meter, in conjunction with the METER selector switch, presents a display of rf output amplifier (Q1/Q2) collector currents, upper and lower sideband (USB/LSB) relative audio level, and relative carrier (CARR) and overall rf output (RF) signal levels. In addition, a CARRIER control is provided to vary degree of carrier insertion as displayed on the MONITOR meter, while independent LSB and USB MIKE-LINE controls permit variations in the degree of LSB and/or USB audio intelligence. Two front panel jacks permit a 55 dbm low-level microphone (MIKE) an dry-contact keyer (KEY) input to be coupled to the Exciter.

Optional capabilities of the Exciter include a choice of internal frequency standards to provide stabilities of 1 part in 10^7 or 10^9/day, and direct, remote control of the LFE and associated transmitter. Standard BNC connectors are provided on the rear panel of the Exciter to interface the standard 1 MHz output frequency, 1 MHz monitor (MON), automatic load and drive control (ALDC) circuit, rf output (RF OUT) and rf monitor (RF MON) with the external equipment. The remaining interface connections with the external equipment are made at three panel-mounted terminal boards; these connections are detailed in Section 2, Installation.

NOTE

The terms MHz, kHz and Hz are used herein, represent megacycles (Mc), kilocycles (kc) and cycles (CPS), respectively.

1-2. PHYSICAL DESCRIPTION

The majority of electronic components which constitute the Exciter are mounted on 14 printed circuit boards which plug into chassis-mounted connectors. In addition, a standard extender board and power supply extender board are included, and mate with the respective printed circuit boards and chassis connectors, thereby facilitating maintenance alignment and troubleshooting procedures. The chassis is designed for installation in a standard 19-inch wide electrical equipment cabinet; removable top and bottom protective covers are provided on the chassis.

1-3. TECHNICAL SPECIFICATIONS

Table 1-1 presents a listing of the technical specifications for the Exciter.

TABLE 1-1. TECHNICAL SPECIFICATIONS

FREQUENCY RANGE	30 kHz to 1.99999 MHz, in 10 Hz increments.
FREQUENCY READOUT	Direct-reading digital dials.
MODES OF OPERATION	AM, USB, LSB, ISB, CW, FSK and FAX.
OUTPUT POWER	Continuously adjustable from 0 to 250 mw all modes.
OUTPUT IMPEDANCE	50 ohms, nominal.

TABLE 1-1. TECHNICAL SPECIFICATIONS (Cont)

FREQUENCY STABILITY	1 part in 10^8/day.
FREQUENCY STANDARD	All frequency-determining elements referenced to built-in 1 MHz source.
METERING	Built-in multimeter allows monitoring of critical circuits and rf output.
SIGNAL/DISTORTION RATIO	Distortion products are at least 40 db below either tone of a two-tone test at 100 mw, which exceeds FCC requirements.
UNWANTED SIDEBAND REJECTION	A signal of 500 Hz is at least 60 db down from PEP in the unwanted sideband.
SPURIOUS SIGNALS	Spurious signals greater than 120 Hz removed from the carrier are at least 55 db below full PEP output.
HUM AND NOISE LEVEL	Noise level is at least 60 db down from either tone of a two-tone test.
CARRIER INSERTION	-55 db to full output, continuously variable.
AUDIO RESPONSE	Flat within ±1.5 db, 350-3500 Hz, either upper or lower sideband.
AUDIO INPUT	A filter providing ±1.5 db, 250-3040 Hz and another ±1.5 db, 250-6080 Hz are available on special order.
MICROPHONE INPUT	-55 db into 47K-ohms.
AUDIO CONTROL	USB and LSB MIKE-LINE controls for controlling level of mike or line audio level to sideband generator and AM amplifier.
ALDC	Will accept 0 to approximately -11 vdc from ALDC circuit of an associated linear amplifier to improve linearity, limit distortion and deliver a relatively constant output level during high modulation peaks or load changes.
ENVIRONMENTAL CONDITIONS	Designed to operate in any ambient temperature between 0°C and +50°C, and in any value of humidity up to 95%.
CW KEYING INFORMATION	KEY jack on front panel, or rear panel connection, for up to 300 wpm carrier keying in CW mode, dry contact.
FSK CAPABILITY:	
KEYING INPUT	60 ma, 20 ma, 50V or 100V, either positive or negative with respect to ground.
KEYING SPEED	Up to 75 baud.
SHIFT	±42.5, ±85, ±170 or ±425 Hz selectable
FACSIMILE INPUT	+1 to +10 volts provides a linear shift of ±400 Hz about center frequency.

TABLE 1-1. TECHNICAL SPECIFICATIONS (Cont)

INSTALLATION DATA	Size: 5-1/4" H x 19" W x 18" D
PRIMARY POWER	115/230 volts, ±10%, 50/60 Hz, single phase, 60 watts.
LOOSE ITEMS	Mating coaxial fittings (BNC) and two instruction manuals.
COMPONENTS AND CONSTRUCTION	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.

SECTION 2

INSTALLATION

2-1. GENERAL

The Exciter is calibrated and tested at the factory prior to shipment. When the Exciter is received at the operating site, inspect the packing case and contents for possible damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packaging material for parts that have been shipped as loose items. With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

2-2. POWER REQUIREMENTS

CAUTION

When ON/STANDBY switch (9, figure 3-1) is set to STANDBY and the line cord is connected to appropriate power source, the power supply is energized.

The Exciter is designed for 115/230 vac, 50/60 Hz, single phase power operation. Unless specifically ordered otherwise, the unit is shipped wired for 115 vac operation. For 230 vac operation, wiring changes must be made, as shown in figure 7-17. For 230 vac operation, replace line protective fuses having 1/2 the 115 vac fuse rating.

2-3. MECHANICAL INSTALLATION

The Exciter is equipped with a standard 19-inch wide front panel. To install the unit in an equipment rack, fasten the front panel to the rack with four screws and four washers (supplied).

When the Exciter is equipped with a tilt-lock slide mechanism, installation is as follows: (See figure 2-1.)

a. Pull out center sections of tracks, located in equipment rack, until they lock in extended position.

b. Position slide mechanisms of unit in tracks, and ease unit into rack until release fingers engage holes in tracks.

c. Press release fingers and slide unit completely into rack. Secure front panel of unit to rack with screws and washers.

d. Make necessary electrical connections, as described in paragraph 2-4.

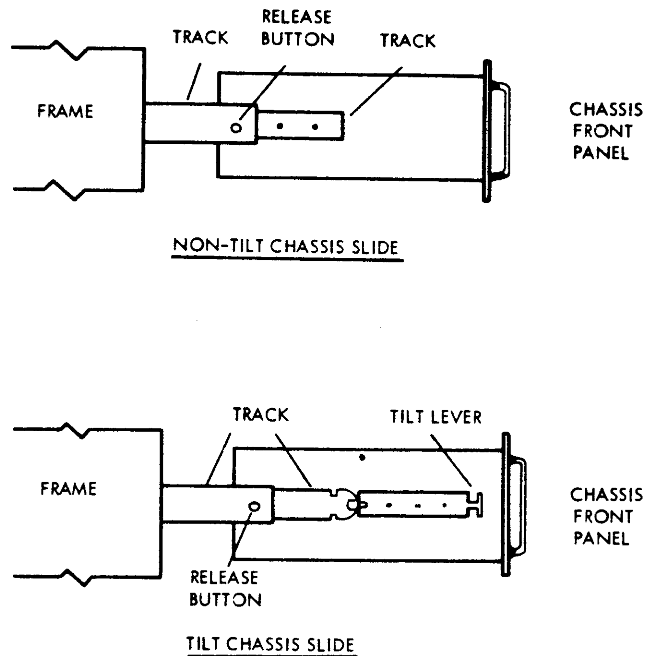


Figure 2-1. Tilt-Lock Slide Mechanism

2-4. ELECTRICAL INSTALLATION

All electrical connections between the Exciter and associated equipment are made at the rear of the unit. Figure 2-2 illustrates all rear panel connections, while table 2-1 lists the panel designation and function of each connection.

TABLE 2-1. REAR PANEL CONNECTIONS

Panel Designation	Function
J116 (POWER)	Power input for 115 vac or 230 vac line power.
J119 (Remote Input)	Optional input connector for remote control operation.
J120 (1 MHz OUT)	1 MHz standard output jack.
J121 (1 MHz MON)	1 MHz standard monitor jack.

TABLE 2-1. REAR PANEL CONNECTIONS (Cont)

Panel Designation	Function
J122 (STD)	Input for connection of external 1 MHz standard
J123 (ALDC)	Input for connection of external ALDC control voltage
J124 (RF OUT)	RF output jack
J125 (RF MON)	RF output monitor jack
TB103	
-1, -2, -3	USB 600-ohm balanced audio input line
-4	Ground terminal
-5	Terminals for connecting PTT ground to external equipment
-6	Not used

TABLE 2-1. REAR PANEL CONNECTIONS (Cont)

Panel Designation	Function
TB104 (LSB)	
-7, -8, -9	LSB 600-ohm balanced audio input line
-10	Ground terminal
-11	Keyer input terminal for CW keying
-12	Ground terminal for CW keying
TB105	
-13, -14	FSK inputs for FSK transmission (TTY) battery loop
-15, -16	FAX input
-17, -18	Dry contact input for FSK mode of operation

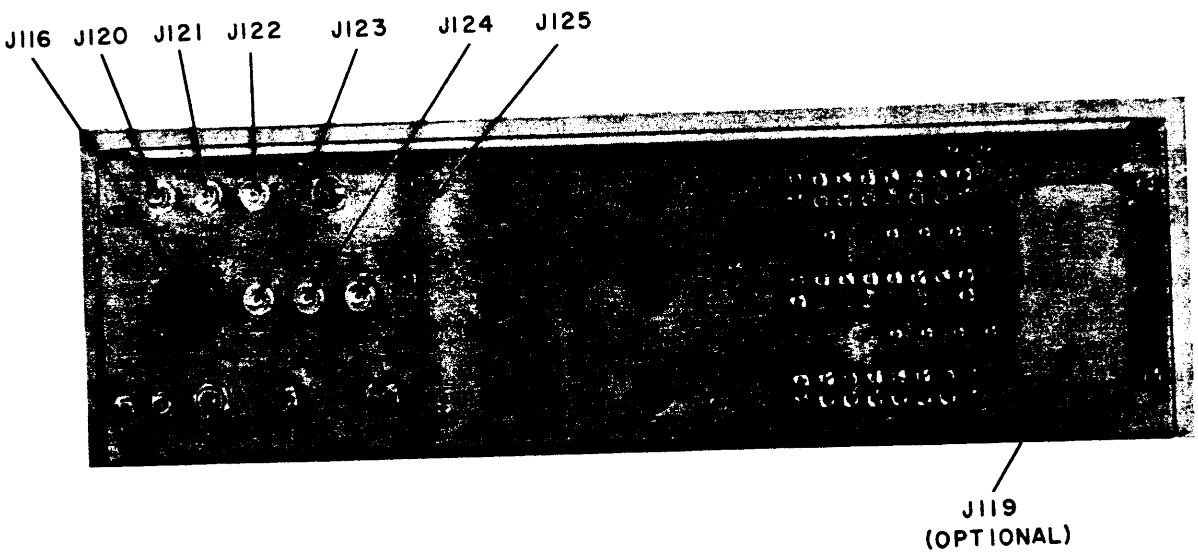


Figure 2-2. Rear Panel Connections

2-5. INITIAL CHECKOUT PROCEDURE (See figures 2-2 and 2-3.)

Although the Exciter has been aligned and thoroughly checked against the manufacturer's specifications prior to shipment, it is necessary to ensure correct installation and proper Exciter operating conditions by performing the following checkout procedures. Refer to Section 3 for location and functions of all operating controls and indicators.

NOTE

Unless otherwise indicated, item numbers (numbers in parentheses) are callouts referred to figure 3-1.

a. Set ON/STANDBY switch (9) to STANDBY position.

b. Connect source of 115 vac line power to connector J116 (figure 2-2). STANDBY indicator (8) shall illuminate amber.

c. Using an audio Two Tone Generator (TMC Model TTG, or equivalent) connect a 600-ohm, 1 millivolt single tone signal to TB103 terminals 1, 2 and 3 (figure 2-2).

d. Set RF OUTPUT control (1) fully counterclockwise.

e. Using frequency selector switches (14), set output frequency to 1.99999 MHz.

f. Set CARRIER control (13) fully counterclockwise.

g. Set LSB MIKE-LINE (4) and USB MIKE-LINE (6) controls to zero (0).

h. Postion MODE switch (12) to ISB.

i. Set ON/STANDBY switch (9) to ON. Standby indicator (8) shall extinguish and POWER indicator (10) shall illuminate red.

j. Set EXCITER switch (11) to ON.

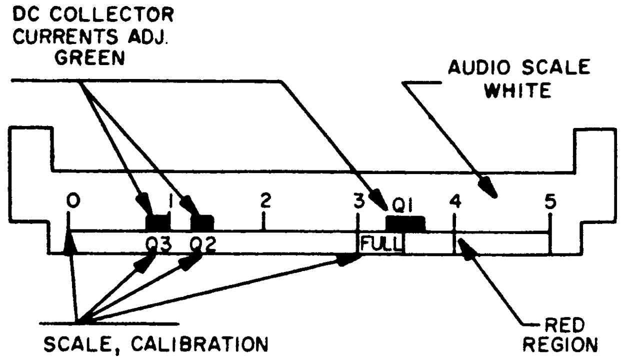


Figure 2-3. Front Panel Monitor Indicators

k. Set METER switch (2) to Q1 position. MONITOR meter (5) shall indicate in the green region marked Q1. (See figure 2-3.)

l. Set METER switch (2) to Q2 position. MONITOR meter (5) shall indicate in the green region marked Q2. (See figure 2-3.)

m. Set METER switch (2) to RF position. MONITOR meter (5) shall indicate zero with RF OUTPUT control (1) fully counterclockwise.

n. Connect a VTVM (Hewlett-Packard Model 410B, or equivalent) to RF OUT jack J124 (figure 2-2) across a 50-ohm load resistor. Adjust RF OUTPUT control (1) until VTVM indicates 7.0 volts.

o. When using a 600-ohm line input, set EXCITER switch (11) to ON.

p. Set METER switch (2) and MODE switch (12) to USB position. Adjust USB MIKE-LINE control (4) to appropriate level as indicated on MONITOR meter (5) (approximately 4/5 full scale).

q. Set METER switch (2) to CARR position and adjust carrier to desired level using CARRIER control (13).

r. Disconnect all test equipment.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL

The information contained herein describes operation of the LFE and includes the functions of controls, indicators and connectors and normal operating considerations for the various Exciter modes of operation.

3-2. CONTROLS AND INDICATORS (See figure 3-1)

All operator controls, indicators and connectors are located on the front and rear panels of the Exciter. Figure 3-1 illustrates the locations of all operator controls, indicators and connectors, while table 3-1 lists the controls, indicators and connectors and provides the panel designation and function of each.

TABLE 3-1. FUNCTIONS OF CONTROLS, INDICATORS AND CONNECTORS

Item Number (Figure 3-1)	Panel Designation	Function
1	RF OUTPUT control	Adjusts rf output level
2	METER switch (six position):	
	Q1	Displays rf output transistor Q1 collector current (350 ma) on MONITOR meter
	Q2	Displays rf output transistor Q2 collector current (130 ma) on MONITOR meter
	LSB	Displays LSB output level on MONITOR meter
	USB	Displays USB output level on MONITOR meter
	CARR	Displays carrier level on MONITOR meter
	RF	Displays RF output level on MONITOR meter
3	SPARES (2) fuses	Spare 1 ampere line voltage fuses
4	LSB MIKE-LINE control	Adjusts gain of microphone or LSB line audio input
5	MONITOR meter	Monitors circuit selected by METER switch
6	USB MIKE-LINE control	Adjusts gain of microphone or USB line audio input
7	LINE (2) fuses	1 ampere line voltage fuses
8	STANDBY indicator	Illuminates amber when ON/STANDBY switch is positioned to STANDBY

TABLE 3-1. FUNCTIONS OF CONTROLS, INDICATORS AND CONNECTORS (Cont)

Item Number (Figure 3-1)	Panel Designation	Function
9	ON/STANDBY switch	When positioned to ON, applies 12 and 24 vdc to modules. When positioned to STANDBY, removes dc voltages from modules and illuminates STANDBY indicator
10	POWER indicator	Illuminates when ON/STANDBY switch is positioned to ON
11	EXCITER ON/PTT switch	Set to ON for all modes of operation using inputs other than MIKE. Set to PTT when using MIKE input, with a PTT-equipped microphone
12	MODE switch (seven position)	Establishes one of seven operating modes: AM, USB, LSB, ISB, CW, FSK or FAX
13	CARRIER control	Permits continuously variable carrier suppression from 0 db to at least -55 db below PEP
14	Frequency selector switches	Six rotary switches for selection of desired output frequency from 30 kHz to 1.99999 MHz in 10 Hz increments
15	MIKE jack	Accepts a -55 dbm low impedance microphone input
16	KEY jack	Accepts dry contact keyer input used for CW mode of operation
17	STD INT-EXT switch	Selects internal or external 1 MHz standard frequency for frequency translator circuits
18	USB (TB103)	External connection of USB 600-ohm line audio input and PTT ground enable
19	LSB (TB104)	External connection of LSB 600-ohm line audio input and dry contact keyer for CW mode
20	FSK/FAX (TB105)	External connection of FSK (TTY or dry contact) or facsimile (FAX) inputs
21	FSK LOOP input switch (five positions)	Selects proper FSK loop input: 100V, 50V, 20MA, 60MA, or CONT (contact keyer)
22	SHIFT switch (four positions)	Determines the "mark" and "space" frequency shift above and below the carrier frequency: ±42.5, ±85, ±170 or ±425 Hz
23	SENSE switch (two position)	Establishes FSK polarity (MARK/SPACE inversion)

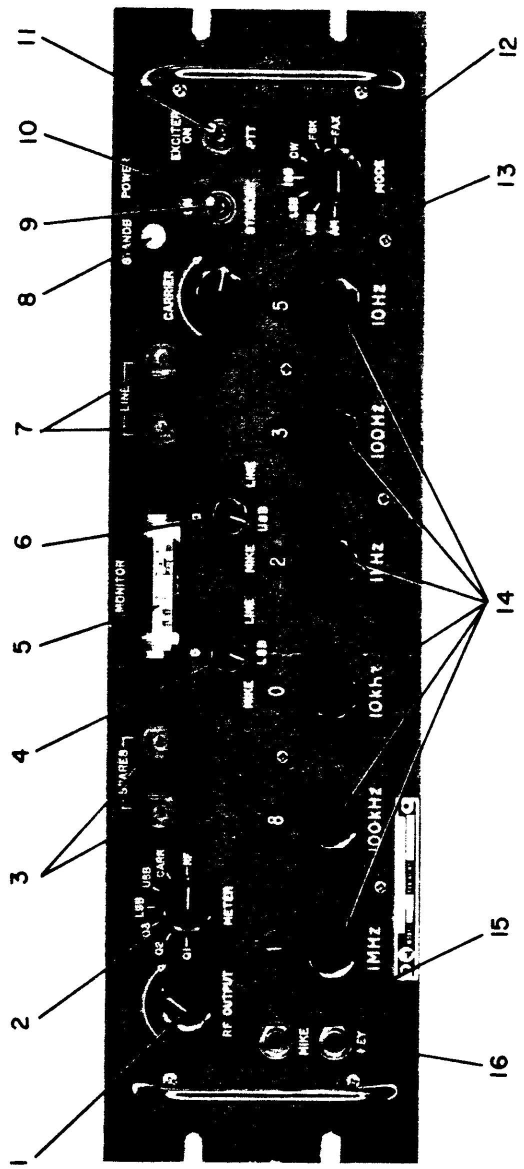


Figure 3-1. Operating Controls, Indicators, and Connectors

3-3. OPERATING PROCEDURES

Before initially placing the Exciter in operation, perform the initial checkout procedure outlined in Section 2, Installation. To place the Exciter in operation, proceed as follows:

NOTE

Verify that ON/STANDBY switch (9, figure 3-1) is set to STANDBY.

a. Connect a source of 115 vac, single-phase power to connector J116 (figure 2-2). Observe that STANDBY indicator (8) illuminates amber.

b. Make necessary interface connections on rear panel jacks (figure 2-2).

3-4. SINGLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION

a. Set ON/STANDBY switch (9) to ON.

b. Set EXCITER switch (11) to ON position when using either USB or LSB 600-ohm line inputs. Set EXCITER switch to PTT position when using MIKE input (15).

c. Select desired sideband with MODE switch (12).

d. Select desired operating frequency with frequency selection switches (14).

e. Turn METER switch (2) at desired sideband.

f. Connect a mike to the front panel MIKE jack (15) if used.

g. Adjust the MIKE-LINE control of sideband used to 4/5 full-scale level as indicated on MONITOR (5).

NOTE

DO NOT ENTER RED REGION.

h. Turn METER switch (2) to CARR position. Set CARRIER control (13) to desired level as indicated on MONITOR meter (5).

NOTE

Turn RF OUTPUT control (1) fully ccw before selecting different modes of operation.

i. Turn METER switch (2) to RF position. Adjust RF OUTPUT control (1) for desired level of RF output as indicated on MONITOR meter (5).

3-5. INDEPENDENT SIDEBAND WITH ANY DEGREE OF CARRIER

a. Set ON/STANDBY switch (9) to ON position.

b. Set EXCITER switch (11) to ON position when using either USB or LSB 600-ohm line inputs. Set EXCITER switch (11) to PTT position when using MIKE input (15) with a PTT-equipped microphone.

c. Select ISB position on MODE switch (12).

d. Select desired operating frequency with frequency selection switches (14).

e. Turn METER switch (2) to LSB position. Adjust LSB MIKE-LINE control (4) for a MONITOR meter (5) indication of up to but not exceeding the red region.

f. Turn METER switch (2) to USB position. Adjust USB MIKE-LINE control (6) for a MONITOR meter (5) indication of up to but not exceeding the red region.

g. Turn METER switch (2) to CARR position. Set CARRIER control (13) to full or the desired level as indicated on MONITOR meter (5).

h. Turn METER switch (2) to RF position and adjust RF OUTPUT control (1) for level of RF output indicated on MONITOR meter (5).

3-6. CONVENTIONAL AM OPERATION

a. Set ON/STANDBY switch (9) to ON position.

b. Set EXCITER (11) to ON position when using either USB or LSB 600-ohm line input. Set EXCITER switch to PTT position when using MIKE input (15).

c. Set MODE switch (12) to AM position.

d. Select desired operating frequency with frequency selection switches (14).

NOTE

DO NOT ENTER RED REGION. When mike input is used, adjust level so as not to exceed red region with highest input from microphone.

e. Connect a mike to front panel MIKE jack (15) if used.

f. Adjust MIKE-LINE control (4 or 6) of sideband used to appropriate level as indicated on MONITOR meter (5).

g. Turn METER switch (2) to RF position and adjust RF OUTPUT control (1) for desired level of RF output as indicated on MONITOR meter (5).

3-7. FREQUENCY SHIFT TELEGRAPH OPERATION

a. Set ON/STANDBY switch (9) to ON position.

b. Set EXCITER switch (11) to ON position.

c. Turn MODE switch (12) to FSK position.

d. Set frequency selector switches (14) to desired position.

e. Select appropriate FSK operation by setting switches S110 (22) and S111 (21).

f. Place SENSE switch S109 (23) to desired sense (+) or (-).

g. Place METER switch (2) to RF position. Adjust RF OUTPUT for desired MONITOR (5) reading.

3-8. FACSIMILE (FAX) OPERATION

a. Set ON/STANDBY switch (9) to ON position.

b. Set EXCITER switch (11) to ON position.

c. Turn MODE switch (12) to FAX position.

d. Set frequency selector switches (14) to desired frequency.

e. Place METER switch (2) to RF position. Adjust RF OUTPUT control for desired MONITOR (5) reading.

3-9. CW TELEGRAPH OPERATION

a. Set ON/STANDBY switch (9) to ON position.

b. Set MODE switch (12) to CW position.

c. Connect key to KEY input (16 or 19).

d. Adjust RF OUTPUT control for desired MONITOR (5) reading.

SECTION 4

PRINCIPLES OF OPERATION

4-1. INTRODUCTION

The principles of operation for the LFE is presented in two parts. The first part discusses LFE operation with reference to an overall functional block diagram, while the second part presents a detailed description of the individual LFE circuits and is referenced to applicable simplified diagrams, and to the interconnection and schematic diagrams contained in Section 7.

4-2. FUNCTIONAL BLOCK DIAGRAM DESCRIPTION (See figure 4-1.)

The LFE is a low frequency rf exciter capable of providing amplitude-modulated (AM) operation; conventional single sideband suppressed carrier (SSSC) or single sideband (SSB) operation; independent sideband (ISB) operation; continuous wave (CW) keyed operation; frequency shift keyer (FSK) operation; and facsimile (FAX) operation. The rf output appears in the 30 kHz to 1.99999 MHz frequency range, and is selectable in discrete 10 Hz increments by means of six frequency selector switches. The Exciter includes a spectrum generator; two comb filters, a frequency select switching network; two dual mixer-dividers; a final mixer; a double-sideband generator; a carrier generator and AM amplifier; a frequency shift generator and converter; an rf translator and ALDC circuit; an rf output amplifier; two rf output filters; a mode-switching network, and a power supply assembly. **RF output filters (Z113) and Z114 may be supplied as optional** equipment. The following paragraphs present brief descriptions of each of these sections.

a. SPECTRUM GENERATOR Z101. The spectrum generator develops four fundamental output frequencies which are derived from a stable 1 MHz standard in the power supply assembly. Firstly, the 1 MHz input is amplified and sent both to the mixer-divider circuits, for formulation of five discrete decimal integers to enable frequency selection to 10 Hz steps, and to the carrier generator to produce a basic 250 kHz subcarrier and a 2.75 MHz carrier frequency for translation to a selected rf output frequency band. Secondly, the 1 MHz input is clipped, divided by a factor of 10 and applied to a 100 kHz spectrum generator; this output, containing the 100 kHz fundamental, plus harmonics, is applied to the comb filter circuits. Finally, the 1 MHz input is squared to produce a 1 MHz spectrum containing the required harmonics for generation of three additional output frequencies of 8, 12 and 13 MHz. The 8 MHz output is applied to the mixer-divider section as the fundamental input frequency, and the 12 and 13 MHz outputs are sent to the translator circuit for derivation of the basic rf output frequency range.

b. COMB FILTERS Z102 and Z103. The 100 kHz spectrum output from the spectrum generator is applied to the comb filter sections. These circuits produce 10 discrete output frequencies from 1.0 to 1.9 MHz in 100 kHz steps and apply them to the frequency select switch network. These frequencies are generated by exciting corresponding crystal-controlled filters at the appropriate harmonic of the 100 kHz spectrum input. The 1.0 to 1.9 output range is applied to the 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz select switches, which control the mixer-divider sections.

c. FREQUENCY SELECT SWITCHING NETWORKS, AND MIXER-DIVIDERS Z104, Z105 AND Z107. The mixer-divider sections consist of five frequency channels that can be considered as a cascaded frequency counter; each channel is controlled by a frequency select switch to determine the appropriate 10's, 100's, 1000's, 10,000's and 100,000's integers of the desired output frequency. The 8 MHz input from the spectrum generator is applied to each of the five channels; in the 10 Hz channel, this signal is modulated by the 1 MHz input to yield a basic frequency of 9 MHz. This frequency is then mixed with the 1.0 to 1.9 MHz input from the 10 Hz selector switch to produce a sum frequency of 10 to 10.9 MHz, which is divided by 10 to yield a 1.0 to 1.09 MHz input to the next mixer-divider channel. By modulating the 8 MHz input to each successive channel with the net input from the previous channel and the desired frequency from the next higher frequency selector switch, a final output of 10.0 to 10.99999 MHz results, with the last five digits representing the last significant five decimal places in the selected output frequency. The 10.0 to 10.99999 MHz output is applied to the frequency translator section.

d. CARRIER GENERATOR Z112 The carrier generator develops a basic subcarrier frequency of 250 kHz, and a 2.75 MHz carrier frequency used for conversion and subsequent translation to an rf output frequency band; it also contains a meter amplifier circuit for upper and lower sideband audio translation to an equivalent dc level for display on the MONITOR meter, when USB or LSB audio is selected by the METER switch. In addition, an AM amplifier circuit is included, and provides an audio amplitude-modulated 250 kHz output when the AM mode of operation is selected.

The carrier generator receives a 1 MHz standard frequency input from the power supply assembly, which is supplied to both the 250 kHz and 2.75 MHz frequency generation circuits. In the 2 0 kHz channel, the 1 MHz input is divided by 4 to derive the basic 250 kHz subcarrier frequency; a switched ground enable is applied from the mode switching network in the AM, USB, LSB, ISB, and FSK modes to enable a 250 kHz subcarrier output signal; in the CW mode, the ground enable is interrupted at the key rate, thereby producing a 250 kHz CW output. The 250 kHz output is applied to the mode switching network for distribution to the various sections of the Exciter in accordance with the MODE switch setting, and to the CARRIER control network for carrier reinsertion, when desired. In the FAX mode, the 250 kHz channel is disabled.

The 2.75 MHz channel produces an rf output by multiplying the resultant 250 kHz (1 MHz divided by 4) by 11 to derive the 2.75 MHz rf translation frequency. Switched +12 vdc to this channel and to the AM amplifier section is controlled by the MODE switch and is present in the AM, USB, LSB, ISB and CW positions. The 2.75 MHz output is supplied to the converter section of the frequency shift generator for translation to a resultant 3 MHz rf carrier.

The AM amplifier section develops an amplitude-modulated 250 kHz signal in the AM mode of operation, and consists of an audio amplifier and mixer circuit. In the AM mode, USB and/or LSB audio is routed to the audio amplifier stage and then to the mixer; the 250 kHz subcarrier is applied directly to the mixer. The resultant amplitude-modulated 250 kHz signal is then routed through the AM position of the MODE switch to the converter section of the frequency shift generator, Z111.

e. SIDEBAND GENERATOR Z109. The sideband generator includes upper and lower sideband circuits which are similar in configuration and operation; the exception is the tuned frequency of the USB and LSB amplifier circuits. The sideband generator also contains a microphone audio preamplifier and an audio impedance-matching transformer for translation of externally applied 600-ohm USB/LSB line audio to a 500-ohm audio output.

When a microphone input is used, the front panel EXCITER switch is set to the press-to-talk (PTT) position to furnish a PTT ground enable to the carrier generator via the mode switching network; in all other modes, the EXCITER switch is set to the ON position, which supplies a permanent ground to the same point, except in the case of CW. Microphone audio from 300 Hz to 7.5 kHz is applied to the sideband generator audio preamplifier circuit, and then to the mode switching network for re-distribution to either, or both, of the sideband generator modulator circuits. Similarly, 600-ohm line audio from 300 Hz to 3.3 kHz is translated to a 500-ohm line output and applied to the mode switching network. In the USB, LSB and ISB modes, the audio is routed to the modulation input of the respective, or each sideband generator; in the AM mode, the respective audio signal is applied to the AM amplifier in carrier generator Z112. USB and LSB audio amplitude is controlled by a respective front panel MIKE-LINE gain control.

The SSB modulation section of the sideband generator accepts both a 250 kHz subcarrier input and the USB/LSB audio signal via the MODE switch. These two signals are applied to a balanced modulator to derive the upper and/or lower sideband intelligence; the 250 kHz subcarrier is suppressed. The resulting USB and/or LSB signals are supplied to the mode switching network and are then routed to the converter section of frequency shift generator Z111.

f. FREQUENCY SHIFT GENERATOR Z111. The frequency shift generator consists of two sections; namely the frequency shift generator section and the converter section. The frequency shift generator section operates in the frequency shift keyer (FSK) and facsimile (FAX) modes; it contains a 3 MHz amplifier, a keyer-modulator and dc amplifier section, and the FAX circuit. FSK operation is controlled by the SHIFT and FS LOOP switches. The converter section operates in all other modes except FSK and FAX, and functions to produce an amplitude-modulated (AM) or single sideband (SSB) rf carrier of 3 MHz for use in frequency translator Z108.

In the FSK mode, the 250 kHz subcarrier is applied to the keyer modulator, which also receives an external teletype input via the FS LOOP switch. Therefore, the subcarrier is effectively modulated by a current input representing teletype marks and spaces; the FS loop switch network is set to the appropriate voltage rating, and when a dry-contact keyer is used, the switch is set to the contact (CONT) position. The keyer-modulator thus produces a shift in frequency above and below the 250 kHz center frequency. This shift is rectified and translated to a dc level, which is then amplified and applied to the 3 MHz variable crystal-controlled oscillator (VXCO) in the power supply assembly via the shift switch network.

When the FSK or FAX operation is selected, +12 vdc is supplied to both the frequency shift generator and to the VXCO in the power supply assembly. As a result, the VXCO operates at the center frequency of 3 MHz. Upon application of the variable dc level (E MOD) from the SHIFT switch, the frequency of the VXCO is shifted above and below center frequency, corresponding to respective marks and spaces, by an amount determined by SHIFT switch setting ±42.5±85±170, ±425). The frequency-shifted VXCO signal of 3 MHZ is re-applied to the 3 MHz VXCO amplifier section of the frequency shift generator and then to the 3 MHz amplifier circuit of the converter section.

In FAX operation, an externally applied FAX signal produces a variable dc level through a dc regulator circuit; this level is applied to the VXCO to produce the required frequency shift.

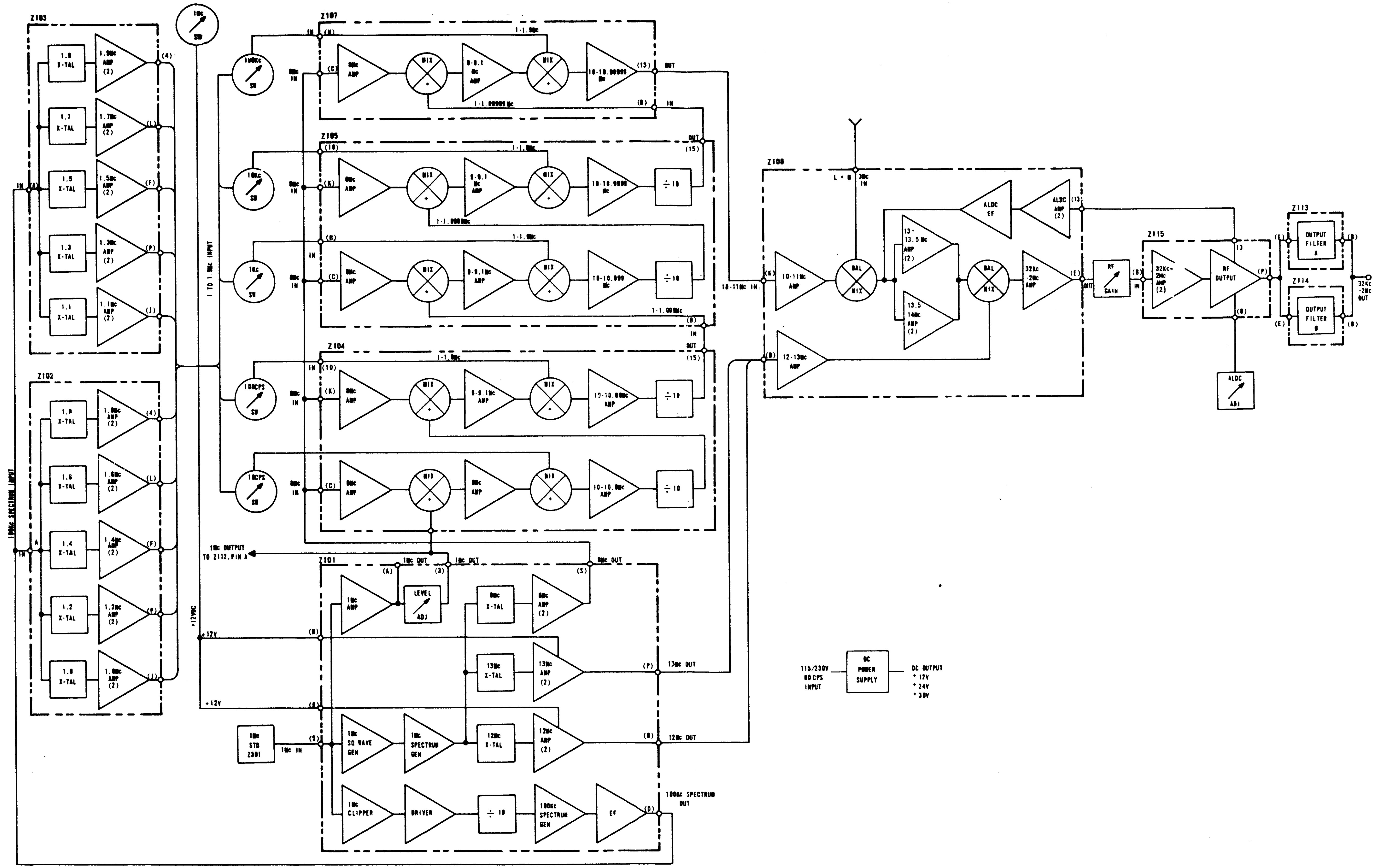


Figure 4-1. LFE Functional Block Diagram (Sheet 1 of 2)

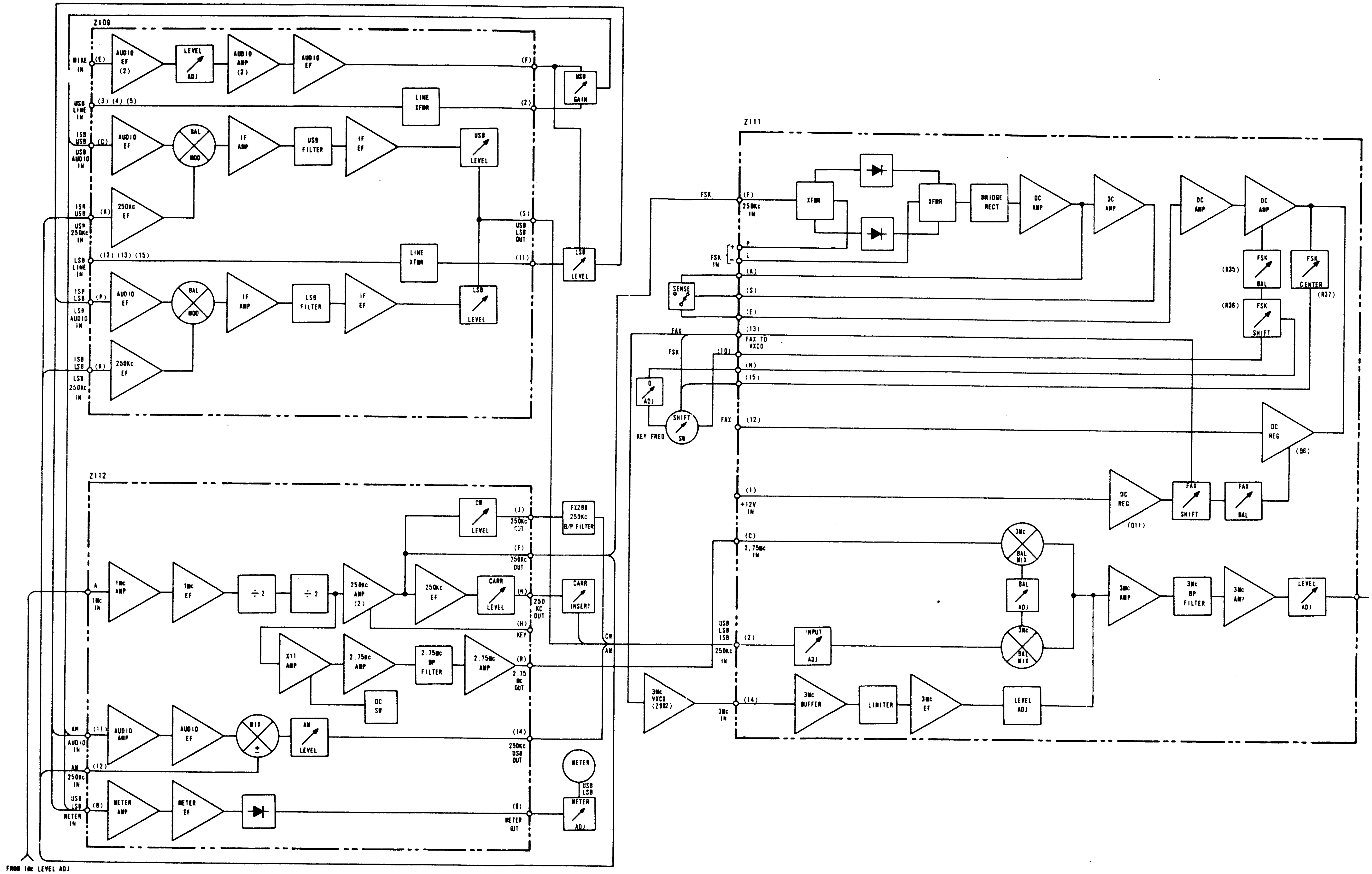


Figure 4-1. LFE : Functional Block Diagram (Sheet 2 of 2)

The converter section of Z103 accepts the 2.75 MHz carrier from carrier generator Z112; the 250 kHz AM, USB, LSB, ISB or CW input from the mode switching network; or the 3 MHz VXCO input from the 3 MHz VXCO amplifier in the frequency shift generator section.

In the AM mode, the 2.75 MHz carrier and the amplitude-modulated 250 kHz signal are mixed in a balanced modulator to produce a sum amplitude-modulated carrier of 3 MHz, which is amplified and applied to translator Z108. In the USB, LSB and ISB modes, the input signals consist of the 2.75 MHz carrier and USB and/or LSB audio with, or without, the 250 kHz signal, depending upon the amount of carrier suppression introduced by the CARRIER control network. This control permits continuously variable carrier reinsertion from zero (0) to full by attenuating the 250 kHz input from the mode switching network. The attenuated 250 kHz subcarrier from the CARRIER control is applied to the mode switching network, where it is reinserted with the USB and/or LSB audio as a pilot carrier prior to being sent to the converter section of Z111. Therefore, the 250 kHz USB, LSB or ISB signal is mixed with the 2.75 MHz carrier to again produce a single sideband or independent sideband output with a 3 MHz center frequency.

In the CW mode, the 250 kHz output is interrupted at the keyer rate and thus results in a 3 MHz CW output. In the FSK and FAX modes, the 250 kHz and 2.75 MHz inputs are not present; the only input is the 3 MHz VXCO signal from the frequency shift generator 3 MHz amplifier section, which is further amplified in the converter section and then applied to translator Z108.

g. TRANSLATOR Z108. The translator performs the function of producing a 30 kHz to 1.99999 MHz rf output signal by modulating the 10.0 to 10.99999 MHz output signal from final mixer Z107 with the 3 MHz AM, SSB or FSK output from the 3 MHz amplifier of the converter section in frequency shift generator Z111, and the 12 or 13 MHz output from spectrum generator Z101. The 10.0 to 10.99999 MHz input is amplified and modulated by the 3 MHz input signal to yield a resultant frequency range of 13.0 to 13.99999 MHz; this frequency then modulates the amplified 12 or 13 MHz input from the spectrum generator to yield a difference rf output frequency range from zero (0) to 1.99999 MHz. The resultant frequency range is coupled through an rf filter network that introduces an abrupt frequency rolloff below 30 kHz, thereby forming the 30 kHz to 1.99999 MHz rf output range. This signal is amplified and applied through the RF OUTPUT control to rf output section Z115. The 12 or 13 MHz inputs from the spectrum generator are enabled when the selected frequency is, respectively, above or below 1 MHz. The translator also includes an automatic load and drive control (ALDC) amplifier circuit to limit the rf output level to rf output section Z115.

h. RF OUTPUT Z115, OUTPUT FILTERS Z113 AND Z114, AND METERING CIRCUIT. The 30 kHz to 1.99999 MHz output signal from the RF OUTPUT control is amplified in rf output section Z115 and applied to rf filters Z113 **and Z114 (optional)** rf output circuit also accepts an ALDC signal from the external transmitter, which is amplified in translator Z108 and used to limit the translator rf output level to rf output section Z115. Output filters Z113 and Z114 each consist of five independent relay-controlled bandpass output filters; the appropriate filter is inserted in series with the output signal according to the desired frequency set on the frequency selector switches. RF filter Z113 passes the five high-frequency ranges of 200-300 kHz, 300-400 kHz, 400-700 kHz, 0.7-1.2 kHz and 1.2-1.99999 MHz, while rf filter Z114 passes the five lower frequency ranges of 30-45 kHz, 45-65 kHz, 65-100 kHz, 100-150 kHz and 150-200 kHz.

A metering circuit is included to monitor the collector currents of the two amplifiers on rf output section Z115 and the rf output level of the selected frequency; these parameters are controlled by the METER switch and displayed on the front panel MONITOR meter.

i. POWER SUPPLY ASSEMBLY. The LFE power supply operates from either 115 or 230 vac when the power transformer is appropriately wired. The power supply outputs are regulated dc voltages of +30, +24 and ±12 volts for operation of the Exciter circuits. The +24 and +12 vdc outputs are applied to the STANDBY position of the ON-STANDBY switch and are distributed throughout the Exciter when set to the ON position. The 1 MHz and 3 MHz frequency standards are produced by crystal-controlled oscillators; the 1 MHz signal is applied to the carrier generator and spectrum generator, while the 3 MHz signal, enabled in the FSK and FAX modes, is applied to the frequency shift generator.

4-3. DETAILED CIRCUIT ANALYSIS

The following paragraphs present a detailed description of the circuits used to provide rf frequency generation, selection and translation in the LFE . The circuit descriptions are referenced to applicable schematic and interconnection diagrams in Section 7.

a. SPECTRUM GENERATOR Z101. (See figure 7-2.) The spectrum generator performs the function of generating both broad-band and discrete frequencies for use in the frequency translation sections, and consists of the 1 MHz output circuit; the 1 MHz spectrum generator; the 100 kHz spectrum generator; and three discrete frequency generators.

(1) In the 1 MHz output circuit, the 1 MHz frequency standard from Z301 in the power supply subassembly is coupled through capacitor C5 to 1 MHz output amplifier Q1, whose collector is tuned

by the combination of the primary winding of transformer T1 and capacitor C2. The 1 MHz low-impedance output signal from the T1 secondary is supplied to 1 MHz OUT jack J120, and through isolation resistor R128 to 1 MHz MON jack J121. (See figure 7-1.) In addition, the 1 MHz output is applied through Level Adjust potentiometer R60 and J101, pin 3 (figure 7-2) to mixer-divider Z104 and to carrier generator Z112.

(2) In the 1 MHz spectrum generator circuit, the 1 MHz standard is coupled through capacitor C8 to the input of 1 MHz squarewave generator Q2. This stage essentially reacts as an overdriven amplifier with inverse feedback introduced by resistor R6. The output squarewave is coupled through C9 and is amplified by 1 MHz spectrum output amplifier Q3. This output signal consists of the 1 MHz fundamental frequency, plus harmonics, and is applied to the discrete frequency generator circuits.

(3) The 100 kHz spectrum generator consists of 1 MHz clipper Q14, driver amplifier Q17, decade divider Z1, 100 kHz spectrum generator Q15 and emitter follower Q16. The 1 MHz frequency standard is coupled to the input of 1 MHz clipper Q14, an overdriven amplifier similar to squarewave generator Q2; the collector output signal is amplified by driver Q17 and applied to divider decade Z1, a type NW135 integrated circuit (1C). Zener diode CR1 regulates Z1 operating voltage at 12 volts dc. The resultant 100 kHz squarewave output from Z1 is coupled through capacitor C69 to 100 kHz spectrum generator Q15, which amplifies the 100 kHz signal and sends it to output emitter follower Q16. This last stage provides the required low output impedance for comb filter sections A (Z102) and B (Z103) and effectively isolates the spectrum generator from undesirable load changes.

(4) The discrete frequency generator section consists of three similar frequency determining circuits; these circuits produce discrete frequencies of 8 MHz, 12 MHz and 13 MHz. Since the principle of operation for each circuit is the same, only the 8 MHz circuit is discussed.

The output signal from the 1 MHz spectrum generator circuit is applied across the 8 MHz series resonant circuit formed by 8 MHz crystal Y3, trimmer capacitors C64 and C73, capacitor C72, resistor R64 and the base-emitter junction of harmonic select amplifier Q12. Since the 8th harmonic is present in the 1 MHz spectrum, crystal Y3 oscillates at 8 MHz; this input signal is amplified and applied to the tuned collector circuit consisting of transformer T10 and capacitor C75. Being a parallel tuned circuit, this combination is highly selective and rejects all other frequencies; resistor R53 provides the required regenerative feedback to reinforce or sustain oscillations at 8 MHz. The 8 MHz output signal from transformer T10 is coupled through C78 to 8 MHz output amplifier Q13. The tuned collector output is transferred, via the secondary winding of T11 and J101, pin S, to the inputs of dual mixer-dividers Z104 and Z105, and final mixer Z107. Discrete frequencies of 12 MHz and 13 MHz formulated in a similar manner; the 12 MHz and 13 MHz outputs are applied to translator Z108 through J101, pins 8 and P, respectively. It should be noted that +12 vdc is applied to the 12 and 13 MHz generators only when the selected frequency is respectively above or below 1 MHz. (See figure 7-1.)

b. COMB FILTERS A (Z102) AND B (Z103). (See figures 7-3 and 7-4.) Each of the comb filter boards contains five independent discrete frequency filters; comb filter A (Z102) provides generation of frequencies from 1.0 to 1.8 MHz in 0.2 MHz steps, while comb filter B (Z103) provides generation of frequencies from 1.1 MHz to 1.9 MHz in 0.2 MHz steps. As a result, 10 discrete frequencies are provided, at 100 kHz intervals, from 1.0 MHz to 1.9 MHz.

The circuit configuration and operation of all filter sections of Z102 and Z103 are identical; therefore, a discussion of one of these sections should suffice as a model: for example, the 1.0 MHz circuit (figure 7-3) consists of 1.0 MHz crystal Y5, 0.8 MHz amplifier Q9 and 0.8 MHz output amplifier Q10. Upon receipt of the 100 kHz spectrum signal from spectrum generator Z101, the circuit oscillates at the tenth harmonic and thus produces 1.0 MHz in the same manner as discussed for the 8 MHz discrete frequency generator. (Refer to paragraph 4-3a. (4).) Level Adjust potentiometer R35 varies the gain of 1.0 MHz output amplifier Q10, and thus the overall amplitude of the 1.0 MHz output signal at pin J of J102.

c. FREQUENCY SELECT SWITCHING (See figure 7-1.) Frequency select switching in the LFE is accomplished by six rotary switches S101 through S106, with direct-reading dials, corresponding to frequencies of 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz and 1 MHz, respectively. (See figure 4-2.) The five discrete frequencies, generated on each of the comb filter boards, Z102 and Z103, are applied through 100-ohm series isolation resistors on respective terminal boards TB101 and TB102, prior to being sent to the selector switch networks. (See figure 7-1.)

Each of the first five selector switches (S101 through S105) receives the 10 discrete frequencies (1.0 MHz to 1.9 MHz) from terminal boards TB101 and TB102, and distributes them to dual mixer-dividers Z104 and Z105, and to final mixer Z107,

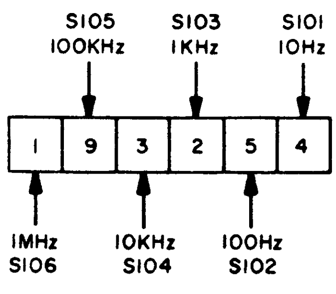


Figure 4-2. Frequency Selector Switch Readouts

for frequency shift modulation. The remaining decks of switches S103 (1 kHz), S104 (10 kHz) and S105 (100 kHz) provide distribution of switched +12 vdc and ground enables to the frequency translator circuits and rf output filters, respectively, such that proper operating voltages and injection frequencies are provided to produce the selected output frequency.

d. DUAL MIXER-DIVIDERS Z104 AND Z105, AND FINAL MIXER Z107. (See figures 7-5 and 7-6.) The mixer-dividers and final mixer shift a basic 8 MHz input signal such that a frequency component, as chosen by the frequency selector switches, is generated having five decimal places and representing tens (10 Hz) through one-hundred thousands (100 kHz). The circuits accomplish the task of shifting the fundamental 8 MHz signal through the use of tuned, balanced-modulator and amplifier circuits. Because the circuit configuration and principle of operation for each dual mixer-divider and the final mixer is similar, only dual mixer-divider Z104 is discussed. (See figure 7-5.)

The 8 MHz output from spectrum generator Z101 is supplied to the inputs of each dual mixer-divider and to the input of the final mixer. In dual mixer-divider Z104, the 8 MHz input is applied to 8 MHz collector-tuned amplifier Q1; the 8 MHz signal developed across the T1 primary/C6 tank circuit is transferred to a balanced modulator consisting of the T1 secondary. Balance potentiometer R9 and modulator CR1, a matched pair of diodes. The balanced modulator receives the standard 1.0 MHz output from spectrum generator Z101 and produces sum and difference frequencies while attenuating the two original frequencies; since the tuned primary of coupling transformer T2 is selective at 9 MHz, the sum of the two frequencies is transferred by coupling transformer T3 to the input of the first of two tuned 9.05 amplifiers, Q2 and Q3. The tuned collector output developed across coupling transformer T6 is applied to the second balanced modulator consisting of the T6 secondary, Balance potentiometer R23 and CR2.

The second balanced modulator receives a 1 MHz to 1.9 MHz input signal from 10 Hz selector switch S101, depending upon switch position (0 through 9). As a result, the 9 MHz signal is modulated as explained previously for 8 MHz, thereby resulting in a 10 MHz to 10.9 MHz signal. This output is tuned by transformers T7 through T11 and amplified by transistors Q4 and Q5. The 10 MHz to 10.9 MHz output signal from T11 is applied to Q6, the first of two direct-coupled clipper/driver stages. The output signal from Q6 is applied to divide-by-ten decade Z1, producing the resultant frequency of 1.0 to 1.09 MHz.

Operation of the remaining half of the dual mixer-divider is similar to the preceding, where the 1.0 to 1.09 MHz signal is added to 8 MHz in the third balanced modulator (T12, R54 and CR3) to yield a resultant of 9.0 to 9.09 MHz. After being amplified, this signal is added in the fourth balanced modulator to a 1.0 to 1.9 MHz signal from 100 Hz selector switch S102, depending upon desired frequency; this results in a frequency of 10.0 to 10.99 MHz, thus satisfying the 100 Hz selection. The 10.0 to 10.99 MHz is divided by 10 to produce a 1.0 to 1.099 MHz output signal to the first balanced modulator in dual mixer-divider Z105.

Dual mixer-divider Z105 is identical to Z104 and functions to produce a resultant output signal between 1.0 and 1.09999 MHz, thereby satisfying selector switches S103 (1 kHz) and S104 (10 kHz). Final mixer Z107 (figure 7-6) satisfies selector switch S105 (100 kHz) by modulating the 8 MHz signal with the 1.0 to 1.09999 MHz signal from Z105 to produce 9.0 to 9.09999 MHz; this signal is then modulated by the 1.0 to 1.9 MHz output from the 100 kHz selector switch S105 to yield a 10.0 to 10.99999 Mhz output to translator Z108. In the 0 to 4 positions of 100 kHz selector switch S105 (figure 7-1), +12 vdc is applied to final mixer Z107 through the tuned output network consisting of capacitors C36 and C48, and diodes CR5 and CR6; this network forms a high pass filter which effectively prevents the higher range of frequencies, 10.5 through 10.99999 MHz (positions 5 through 9 of switch S105), from appearing at the output. In positions 5 through 9 of switch S105, +12 vdc is applied to the circuit through an alternate pin (14), thereby making the tuned output filter inoperative.

e. CARRIER GENERATOR Z112. (See figure 7-7.) The carrier generator performs the function of producing a 250 kHz subcarrier frequency and a 2.75 MHz carrier frequency for translation to an AM, SSB, or ISB rf carrier signal of 3 MHz. The 250 kHz subcarrier and 2.75 MHz carrier is derived from the 1 MHz standard oscillator in the power supply assembly. The carrier generator includes a metering amplifier circuit for conversion of the USB and/or LSB audio signals to a proportional dc level for display on the front panel MONITOR meter. In addition, an AM amplifier circuit is included for formulation of an amplitude-modulated 250 kHz subcarrier when the MODE switch is in the AM position.

(1) In the 250 kHz channel of Z112, the 1 MHz standard input signal is supplied to amplifier Q13; the 1 MHz collector signal is applied to emitter-follower Q2 whose output is supplied to the first of two cascade-connected divide-by-2 integrated circuits (IC's), Z1 and Z2. The resultant 250 kHz squarewave output is both amplified by 250 kHz amplifier Q2, a transformer-coupled amplifier and is also applied to X11 multiplier Q7 in the 2.75 MHz carrier channel. The signal developed across the secondary of transformer T1 is coupled through capacitor C8 to a second 250 kHz transformer-coupled amplifier, Q3; the 250 kHz output from the T2 secondary is coupled through capacitor C14 to emitter-follower Q4 and through C45 to the MODE switching network for distribution. The 250 kHz signal is also developed across the series combination of CW Level Adjust potentiometer R20 and resistor R21; the 250 kHz output from

the junction of R20 and R21 is coupled through capacitor C44 to MODE switch S114B (rear) as the subcarrier frequency for CW operation. The 250 kHz output developed across Carrier Level Adjust potentiometer R27 in the emitter of Q4 is coupled through capacitor C16 to CARRIER control R102 for formulation of the 250 kHz pilot carrier reinsert signal. A switched ground input is supplied to the 250 kHz subcarrier generator section at the junction of resistors R22 and R23 from the ON position of the EXCITER switch, or from the PTT position of the EXCITER switch when the MIKE input is used. The switched ground is applied via the AM, USB, LSB and CW positions of the MODE switch and enables 250 kHz amplifiers Q2 and Q3. (Refer to paragraph 4-3g. for a discussion of MODE switching.)

(2) In the 2.75 MHz channel of Z112, the 250 kHz output from Z2 is applied to X11 multiplier Q7; the resultant 2.75 MHz signal developed across the collector circuit consisting of transformer T3 and capacitor C22 is coupled to 2.75 MHz amplifier Q8 whose collector output is then supplied through 2.75 MHz bandpass filter FL1 to 2.75 MHz amplifier Q9. The 2.75 MHz output signal from the T4 secondary is applied through J112, pin R, to the converter section of frequency shift generator Z111 for translation to the assigned rf fundamental frequency of 3 MHz.

(3) The metering amplifier circuit of Z112 consists of meter amplifier Q5, emitter follower Q6 and the half-wave rectifier and filter output consisting of diode CR2 and capacitors C19 and C20. This circuit receives either microphone or 500-ohm line audio from the USB/LSB MIKE/LINE controls via the USB or LSB positions of METER switch S115A (rear), and provides conversion to a dc level proportional to signal amplitude for display on MONITOR meter M101. (See figure 7-1.)

(4) The AM amplifier section of Z112 performs the function of amplitude-modulating the 250 kHz subcarrier signal with audio intelligence in the 300 to 7500 Hz range, and supplies it to the converter section of frequency shift generator Z111, when the MODE switch is positioned at AM.

With the MODE switch in the AM position, the 250 kHz subcarrier is applied to the AM amplifier from S114A (rear); USB and/or LSB audio is supplied from the AM position of S114A (front) to the AM amplifier. The audio input is coupled through C32 to a conventional audio amplifier, Q10, whose collector output is fed to emitter follower Q11; this latter stage provides isolation between the modulator stage Q12 and the input audio amplifier. The audio output from Q11 is coupled through capacitor C38 to the emitter of modulator Q12. The 250 kHz subcarrier frequency is coupled to the base of modulator Q12 through capacitor C34, resistor R62 and capacitor C37. Since the emitter of Q12 is modulated with the audio signal, the resultant collector signal across the T5 primary and C39 consists of a 250 kHz subcarrier whose amplitude fluctuates at the audio signal rate. The 250 kHz amplitude-modulated signal at the T5 secondary is developed across AM Level Adjust potentiometer R69, and coupled through C43 to the AM position of MODE switch S114C (rear). With S114 in the AM position, the 250 kHz AM signal is then routed to the 250 kHz input of the converter section of frequency shift generator Z111.

f. SIDEBAND GENERATOR Z109. (See figures 7-8 and 7-1.) The sideband generator contains upper and lower sideband circuits which are identical in configuration and operation. In addition, as shown in figure 7-8, the sideband generator also includes an audio preamplifier circuit. A 600-ohm to 500-ohm impedance matching circuit is also included for conversion of an external 600-ohm audio line input to a 500-ohm output when the mike input is not being used for AM, USB, LSB or ISB operation.

(1) The audio preamplifier circuit consists of a Darlington-connected microphone input pair, followed by two cascaded class A audio amplifier stages and an output emitter follower. Input audio range of 300 Hz to 7.5 kHz is coupled to the input pair, Q1 and Q2, which present a high input impedance of 47K-ohms to the external microphone. Capacitor C5 introduces degenerative feedback to audio input signals above 7.5 kHz. The audio signal developed across Level Adjust potentiometer R9 is R-C coupled to the first of two cascaded class A amplifiers Q3 and Q4. Bypassed emitter resistors in these stages introduce a small amount of degenerative feedback, thereby limiting distortion and improving the overall audio frequency response of the preamplifier section. The audio signal from output emitter follower Q5 is coupled through C13 to the MIKE half of USB and LSB MIKE/LINE controls R104 and R105, respectively; the audio signal is then routed to MODE switch S114A (front) for distribution to either the upper or lower sideband generators in USB or LSB operation, to both of the sideband generators when independent sideband (ISB) operation is desired, or to the AM amplifier circuit when AM operation is desired. (See figure 7-1.)

(2) The SSB modulation circuit receives the audio input signal from the MODE switch; when the MODE switch is set to the USB or LSB positions, audio is channeled to the respective sideband generator audio input and is used to modulate the 250 kHz subcarrier input from carrier generator Z112. In the ISB position of the MODE switch, audio signals are channeled simultaneously to both of the sideband generators to institute independent sideband (ISB) operation. In the USB circuit of Z109, input audio signals from MODE switch S114A (front) in the USB or ISB positions, is coupled through capacitor C14 to audio emitter follower Q6; output signals at the emitter are R-C coupled to the balanced modulator consisting of diodes CR1 through CR4, and Balance Adjust potentiometer R28, to modulate the 250 kHz subcarrier output signal from 250 kHz emitter follower Q9. The balanced modulator produces sum and difference frequency outputs, while the subcarrier and audio frequencies are attenuated. The sum and difference frequency output from the modulator are transformer-coupled via T1 to IF amplifier Q7. The sideband output at

the collector of Q9 is coupled through C24 and USB filter FL1 to IF emitter follower Q8. In the upper sideband generator FL1 is tuned to the upper sideband frequency range from 250,300 Hz to 253,000 Hz (microphone input) or 250,300 Hz to 257,500 Hz (AM operation). Conversely, in the lower sideband generator circuit LSB filter FL2 is tuned to the lower sideband frequency range of 247,000 Hz to 249,700 Hz (microphone input) or 242,500 Hz to 249,700 Hz (AM operation). The filter consisting of the T1 primary, capacitors C20 and C50, and trimmer capacitor C52, presents a decided notch at 250 kHz, thereby fully suppressing the 250 kHz subcarrier center frequency. The sideband output from emitter follower Q7 is coupled through capacitor C28 and isolation resistor R72 to MODE switch S114C (rear) for carrier reinsertion (paragraph 4-3g.).

g. MODE SWITCHING. (See figures 4-3, 4-4 and 7-1.) Mode switching for the LFE-1 is accomplished by MODE switch S114, which selects the desired mode of operation (AM, USB, LSB, ISB, CW, FSK and FAX) by routing audio, subcarrier and certain enables to the proper circuits of the Exciter. Mode switching can be divided into areas of audio, present in the AM, USB, LSB and ISB modes, and the remaining modes of CW, FSK and FAX operation.

(1) In the audio modes (figure 4-3), microphone or 500-ohm line audio inputs from the upper and/or lower sideband generators are developed across half of the respective MIKE/LINE control and sent ot MODE switch S114A (front). Consider upper sideband (USB) audio. Microphone audio from the audio preamplifier circuit is developed across the MIKE half of USB MIKE/LINE control R104 and is applied to contact 2 of S114A; when the 600-ohm audio input line is used, the USB generator (figure 7-8) supplies a 500-ohm line audio output which is developed across the LINE half of control R104. In either case, USB MIKE/LINE control R104 sets the amplitude of the USB audio signal. With the MODE switch in the AM position, the USB audio is coupled through contact 3 of S114C and R112 to the AM amplifier in carrier generator Z112; in the USB position, the audio is coupled through contact 4 of S114C to the upper sideband generator audio input; in the LSB position, LSB audio from LSB MIKE/LINE control R105 is coupled through contacts 8/11 of S114C to the lower sideband generator audio input; and in the ISB position of S114C, both USB and LSB audio is sent simultaneously to the respective sideband generator audio input (if audio intelligence is desired on both).

(2) The remaining decks of MODE switch S114 (C rear, B front and rear, and A rear) perform independent functions such as 250 kHz subcarrier and AM distribution and reinsertion, and CW, FSK and FAX selection. (See figure 4-4.) The 250 kHz subcarrier output from carrier generator Z112 is applied to S114A (rear) at contacts 9 and 5. With the MODE switch in the AM position, the subcarrier is channeled to the AM amplifier in Z112; in the USB, LSB and ISB positions, the 250 kHz subcarrier is applied to either the respective sideband generator circuit in Z109, or to both sideband generator circuits simultaneously. Deck S114B (front) of the MODE switch distributes +12 vdc operating potential to the 2.75 MHz carrier generator and AM amplifier circuits in Z112 in the AM, USB, LSB, ISB and CW positions. (See figure 7-1.) In the FSK and FAX positions, +12 vdc is routed through the ON position

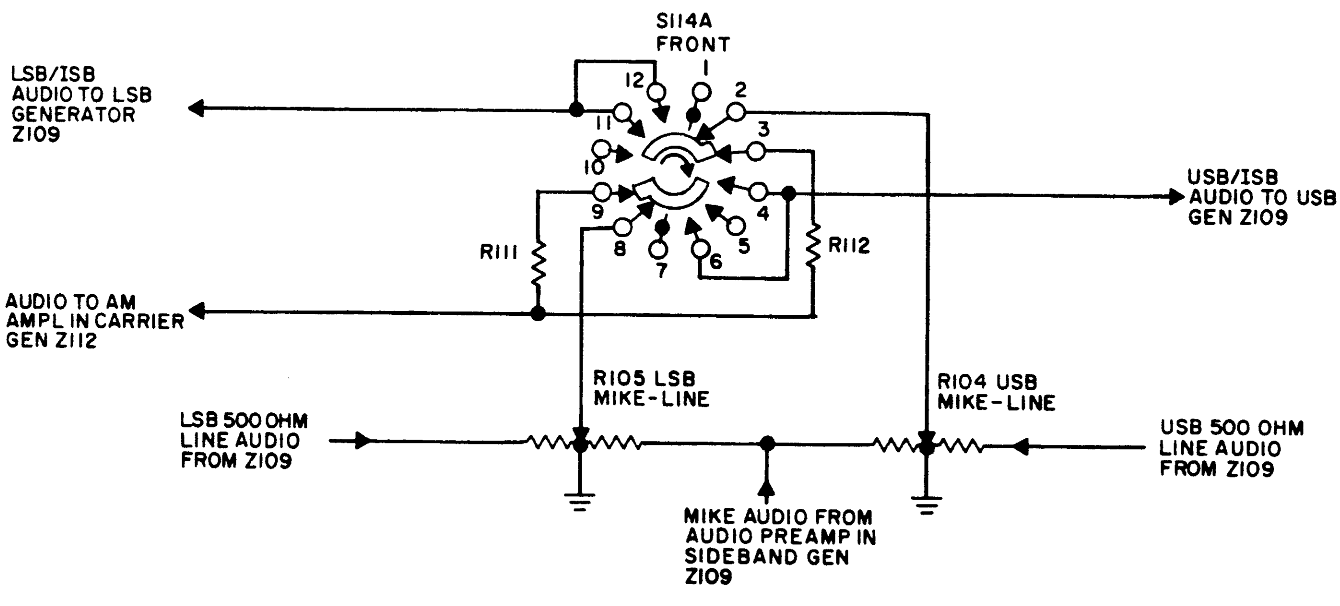


Figure 4-3. Audio Mode Switching, Simplified Schematic Diagram

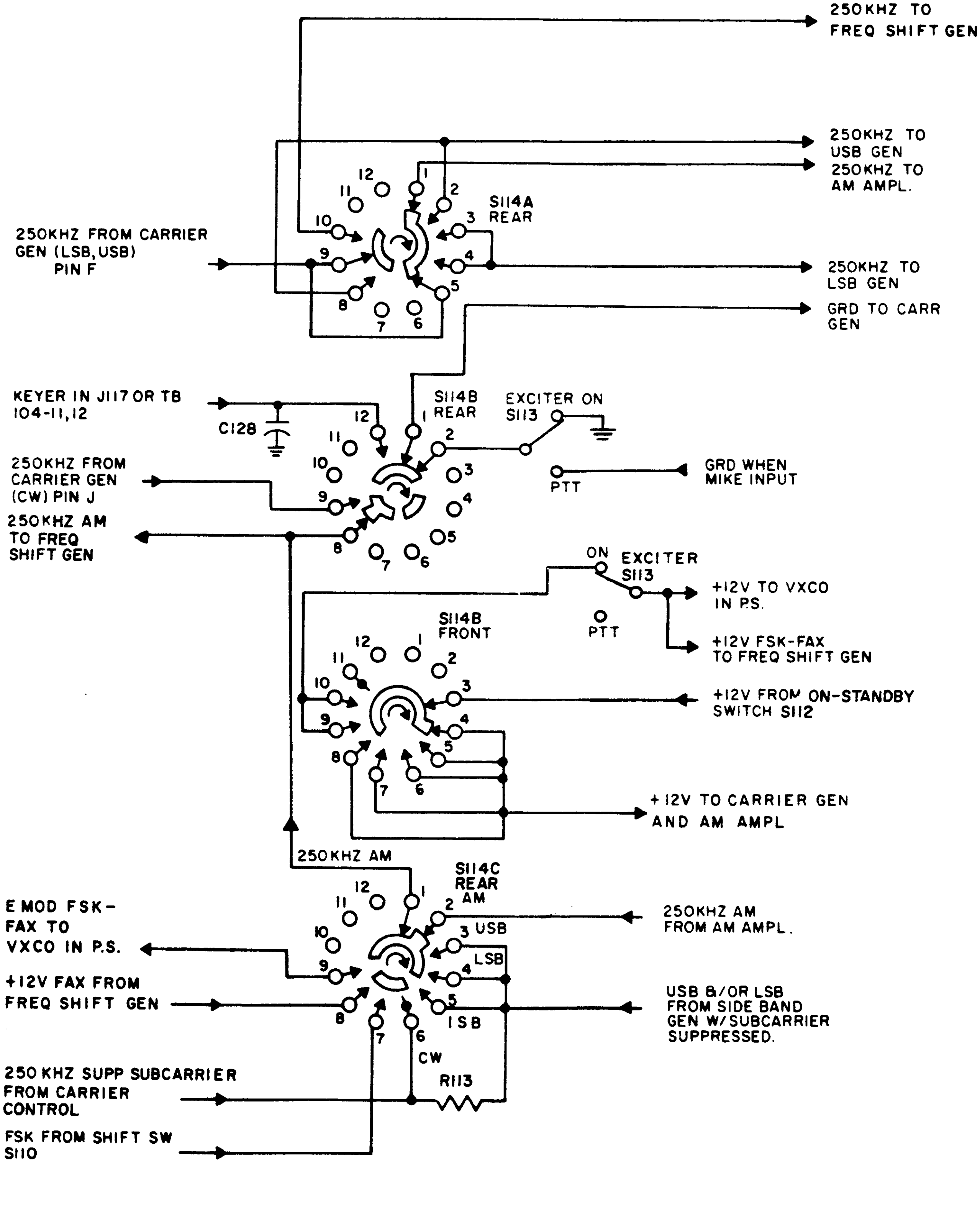


Figure 4-4. CW, FSK, and FAX Mode Switching, Simplified Schematic Diagram

of EXCITER switch S113 to frequency shift generator Z111 and the 3 MHz variable crystal controlled oscillator (VXCO) in the power supply assembly. The amplitude-modulated 250 kHz output from the AM amplifier circuit in Z112 is supplied to the AM position of S114C (rear) and is supplied to the converter section of frequency shift generator Z111. In the USB, LSB and ISB positions of S114C, sideband audio intelligence, with a suppressed 250 kHz subcarrier, is supplied from either or both sideband generator circuits to contacts 3, 4 and 5. This SSSC input is added to the 250 kHz subcarrier signal from CARRIER control R102A through isolation resistor R113. The amount of subcarrier injection depends on the position of R102 and consists of continuously variable injection from zero (0) to full. When subcarrier injection is desired, the resultant USB and/or LSB audio intelligence is accompanied by a 250 kHz pilot carrier and is supplied to the converter section of Z111.

Frequency shift keyer (FSK) and facsimile (FAX) operation is controlled by S114C (rear). For FSK operation, a variable dc current, proportional either to the keyed 250 kHz subcarrier frequency, or to an external teletype input, is applied to contact 7 of S114C from SHIFT switch S110. This signal is routed to the variable crystal controlled oscillator (VXCO) in the power supply assembly, thereby causing a shift in frequency, above and below center frequency, which represents the marks and spaces in the FSK operation. In FAX operation, a variable dc current from frequency shift generator Z111 is supplied to S114C at contact 8 and is routed to the VXCO. CW operation is controlled by S114B (rear), where a 250 kHz subcarrier frequency from the carrier generator is routed through contacts 9/8 to the converter section of Z111.

h. FREQUENCY SHIFT GENERATOR Z111. (See figures 4-5 and 7-9.) The frequency shift keyer consists of four distinct sections; namely, the 3 MHz converter and VXCO buffer-amplifier, the FSK keyer and modulator, and the FAX circuit.

(1) The 3 MHz converter and VXCO buffer-amplifier circuit performs the function of translating a 250 kHz input signal to an rf output carrier at 3 MHz. The 250 kHz input can be an AM signal; USB and/or LSB intelligence with, or without, the 250 kHz subcarrier suppressed; or an interrupted 250 kHz input at an external keyed rate in the CW mode. In addition, in the FSK and FAX modes, a variable crystal controlled frequency of 3 MHz is supplied to the 3 MHz converter buffer-amplifier circuit for translation, while the 2.75 MHz carrier and 250 kHz inputs are not used. As discussed previously, when the MODE switch is in the AM, USB, LSB, ISB or CW positions, the 2.75 MHz channel in the carrier generator is enabled and supplies the 2.75 MHz carrier frequency to the converter channel of Z111. This input signal is amplified by 2.75 MHz input stage Q1 and fed to 2.75 MHz emitter follower Q2. The emitter output from Q2 is applied to balanced modulator Z1. In the AM position of MODE switch S114, the 250 kHz input consists simply of a 250 kHz subcarrier, amplitude-modulated by audio intelligence in the 300 Hz to 7500 Hz range. When the AM signal is mixed with the 2.75 MHz input, the balanced modulator produces the sum and difference frequencies while attenuating the two original frequencies; the combination of tuned transformer T1 and capacitor C6 traps the 2.75 MHz signal. As a result, an amplitude-modulated sum frequency of 3 MHz results and is amplified by Q3. The collector output of Q3 is coupled through 3 MHz bandpass filter FL1 and is amplified by tuned-collector stage Q4. The 3 MHz AM tuned collector output of Q4 is developed across Level Adjust Potentiometer R58 and is applied to translator Z108.

In the USB, LSB and ISB positions of MODE switch S114, the 250 kHz input to the converter section consists of upper and/or lower sideband audio intelligence in the 300 to 3300 Hz range with the 250 kHz carrier suppressed or unsuppressed, according to the position of CARRIER control R102. These signals are obtained from S114C (rear). Since the 2.75 MHz rf carrier input is also present in these modes, the balanced modulator produces upper and/or lower sideband signals with a center frequency of 3 MHz. If the 250 kHz subcarrier is suppressed, so also is the 3 MHz rf carrier (sum frequency of 2.75 MHz and 250 kHz). The upper and/or lower sideband signals are amplified in the same manner as the AM signal, and are coupled through J111, pin 7, and sent to translator Z108.

In the CW position of MODE switch S114, the 250 kHz input is not modulated by audio intelligence, but is interrupted at a rate determined by a keyer input at KEY jack J117 or at terminals 11 and 12 of TB103 on the rear panel of the Exciter. This results in a keyed difference frequency of 3 MHz in the balanced modulator. The CW rf is then amplified as before and sent to the translator.

In the FSK and FAX modes of operation, the 3 MHz variable crystal controlled oscillator (VXCO) is enabled in the power supply assembly, and its frequency is varied by the dc current produced in the FSK and FAX circuit of the frequency shift generator. Since both the 250 kHz (AM, USB/LSB or CW) and 2.75 MHz inputs are inhibited in these modes, the 3 MHz FSK-FAX input is coupled directly to the input of 3 MHz amplifier Q12 in the VXCO buffer-amplifier, thus bypassing the 2.75 MHz amplifier and balanced modulator circuit.

(2) Both FSK and FAX operation is initiated when MODE switch S114B (front) is set to either the FSK or FAX position as previously indicated in the discussion of MODE switching. In either of these positions, S114B supplies a +12 vdc enable to both the 3 MHz crystal controlled oscillator Z302 in the power supply assembly, and to the 3 MHz buffer-amplifier circuit in frequency-shift generator Z111. With MODE switch S114 in the FSK position, S114A (rear) routes the 250 kHz subcarrier frequency from carrier generator Z112 to the frequency shift generator keyer circuit consisting of coupling transformers T3/T4 and keyer diodes

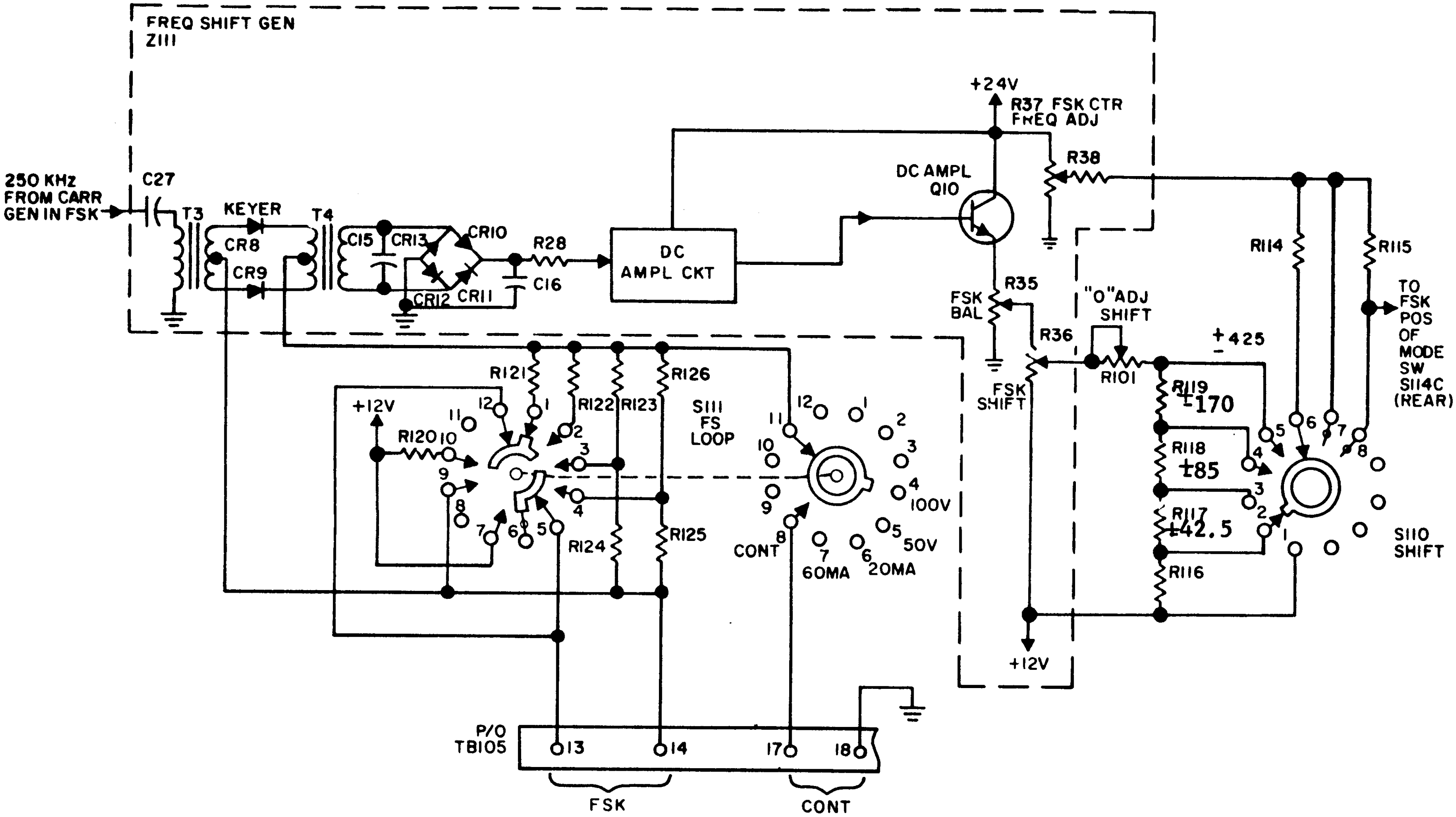


Figure 4-5. Frequency Shift Keyer Circuit, Simplified Schematic Diagram

CR8/CR9. The keyer circuit is, in effect, a modulator, in that the 250 kHz input is interrupted by a dc current representing marks and spaces from an externally connected dry-contact keyer or teletype at terminals 13 and 14 of TB105. (See figure 4-5.) The keyer input is connected to the modulator through FS LOOP switch S111 which is set to the 100V or 50V positions when dry contact keying is used, and to the 20 mA or 60 mA positions to match the dc battery loop when a teletype keyed input is used. The external keying rate is 200 WPM and 75 bauds. By keying the 250 kHz subcarrier, a frequency shift above and below center frequency is obtained, corresponding to the marks and spaces of the teletype input. This signal is coupled through T4 to the full-wave bridge rectifier consisting of diodes CR10 through CR13; the resultant varying dc signal is then applied to a series of three dc amplifiers, Q7 through Q9, and an output emitter follower, Q10. (See figure 7-9.) Amplifier Q8 is inserted in the circuit when dc SENSE switch S109 is in the + position; otherwise, in the - position, Q8 is bypassed. This produces a respective positive or negative FSK output to establish FSK polarity (mark/space inversion). The variable output is developed across FSK balance potentiometer R35 and applied to FSK Shift potentiometer R36; the dc output is coupled to SHIFT switch S110. FSK Center frequency Adjust potentiometer R37 sets the average level about which the dc signal varies, and thus the center frequency of the VXCO in the power supply assembly. DC regulator Q5 provides a regulated 24 vdc to the dc amplifier circuit from the +24 vdc supply input line; regulator Q11 supplies a regulated +12 vdc to SHIFT switch S110 and R36 from the +12 vdc MODE switch input. SHIFT switch S110 effectively sets the amplitude of the dc signal varying about the average dc level as set by R37. By changing the maximum amplitude, the shift in VXCO output frequency is correspondingly changed to provide the desired shift above and below center frequency. The varying dc output from the SHIFT switch is coupled through the FSK position of MODE switch S114C and sent to 3 MHz VXCO Z302 in the power supply assembly.

With +12 vdc applied to 3 MHz oscillator Z302, and with the variable dc input present, representing keyer frequency shift, the frequency of Z302 varies about the 3 MHz center frequency by an amount dictated by SHIFT switch S110. This shifted frequency is applied to the buffer-amplifier section of frequency shift generator Z111. The input signal is amplified in buffer Q12, and applied to limiter Z1 which maintains amplitude within acceptable inputs without destroying the frequency shift characteristics. The limiter output is applied to emitter follower Q13 and then through 3 MHz Level Adjust potentiometer R56 to the 3 MHz converter section.

In FAX operation, an externally applied facsimile input at terminals 15 and 16 is applied to DC regulator Q6. The facsimile input is a variable dc voltage and causes a shift in output voltage across FAX Balance potentiometer R25. This varying voltage is developed across FAX shift potentiometer R27 and is sent to the FAX position of MODE switch S114C (rear). When FAX is selected, this dc signal then modulates the VXCO in the power supply assembly in the same manner as FSK operation.

i. TRANSLATOR Z108. (See figure 7-10.) Translator Z108 receives the 3 MHz AM, SSB, ISB, CW or FSK/FAX carrier from frequency shift generator Z111; the 10 to 10.99999 MHz signal from final mixer Z107; and either the 12 or 13 MHz signal from spectrum generator Z101. These signals are effectively shifted or translated to produce an output frequency range from 30 kHz to 1.99999 MHz, depending upon the selected rf output carrier frequency.

The 10 to 10.99999 MHz selectable frequency range input is applied to amplifier Q3, developed across the tuned collector tank circuit, T3/C27, and coupled to the balanced modulator consisting of the T3 secondary, Balance Adjust potentiometer R19 and matched diodes CR3 and CR4. With the 3 MHz input coupled to the balanced modulator via transformer T4 and C28, diode CR4 of the modulator outputs the sum frequency to tuned coupling transformer T5 in the 13 to 13.5 MHz circuit, and to tuned coupling transformer T10 in the 13.5 to 14 MHz circuit. With T5 and T6 tuned to the lower half of the sum frequency, a 13.0 to 13.5 MHz signal is applied to a series of two amplifiers, Q4 and Q5, tuned by transformers T7 through T9. Similarly, with transformers T10 and T11 tuned to the upper half of the sum frequency, a 13.5 to 13.99999 MHz signal is applied to amplifiers Q9 and Q10, and tuned by transformers T12 through T14. The upper half of the frequency range is then applied to the secondary of transformer T9, combined with the lower half of the frequency range developed across the primary, and applied to the output of balanced modulator diodes CR1/CR2 in the 12 or 13 MHz amplifier section. The Automatic Load and Drive Control (ALDC) circuit consisting of Q6, Q7 and Q8 receives a negative bias level from rf output Z115 when an external ALDC input is present. The ALDC circuit supplies each half of the 13 to 13.9999 MHz circuits with a control voltage to maintain a relatively constant net output signal at the secondary of T9.

The 12 or 13 MHz input from spectrum generator Z101 is applied to a tuned amplifier Q1; the tuned collector output is then coupled to the balanced modulator consisting of the T1 secondary, Balance Adjust potentiometer R5 and matched diodes CR1 and CR2. As a result, the 12 or 13 MHz signal is modulated by the 13 to 13.9999 MHz signal from the secondary of transformer T9, resulting in sum and difference frequencies. The difference frequency range from zero (0) to 1.99999 MHz is applied to a three-section L-type inductive filter consisting of inductors L3, L4 and L5, and capacitors C6, C7 and C8, which provides sharp rolloff below 30 kHz; thus, a 30 kHz to 1.99999 MHz frequency range results and is coupled through C9 to output amplifier, Q2. The collector output developed across autotransformer T2 is coupled through C12 to RF OUTPUT control R102 (figure 7-1).

Switched +12 vdc inputs are applied to the translator circuits, depending upon the selected range value of rf output frequency. In addition, application of either the 12 or 13 MHz input is also dictated by frequency selection, where the 12 MHz input is present when the selected frequency is above 1.0 MHz, and the 13 MHz input is present below 1.0 MHz. (Refer to paragraph 4-3a.)

j. RF OUTPUT Z115 AND METERING CIRCUIT. (See figures 7-1 and 7-11.) RF output Z115 consists of two cascade-connected rf stages, Q1 and Q2. The 30 kHz to 1.99999 MHz input frequency range from the RF OUTPUT control is applied to rf amplifier Q2 through capacitor C1 and resistor R9. Potentiometer R3 establishes the operating bias of the input stage, while RF OUTPUT control R103 sets the desired input signal amplitude. The tuned collector output of Q2 across autotransformer T1 is coupled through C6 to rf amplifier Q1. The 30 kHz to 1.99999 MHz signal output from Q1 is coupled through C11 and applied to filter networks Z113 and Z114, and to the rf metering and ALDC circuits. The signal to the metering circuit is coupled through capacitor C12, isolation resistor R13 and capacitor C14 to diode CR2 which rectifies the positive half-cycle; the positive half-cycle is then filtered to produce a dc level proportional to the rf output. This level is supplied to MONITOR meter M101 when METER switch S115 is in the RF position. In the ALDC circuit, a positive ALDC threshold adjustment level is obtained from ALDC Adjust potentiometer R107; this level is filtered and applied to diode CR1, thereby setting the reverse-bias threshold level. The externally applied ALDC signal is a negative level from the transmitting circuits, and occurs whenever the transmitted envelope crest exceeds a preset threshold. This level is coupled through diode CR3; is filtered; and is applied through J115, pin 13, to the ALDC amplifier in translator Z108.

In the metering circuit (figure 7-1), +30 vdc and +24 vdc from the power supply assembly is coupled to METER switch S115B and through dropping resistors R108 and R109 to S115A and to rf output circuit Z115. Therefore, meter M101 is effectively placed in series with the collectors of each rf amplifier and the B+ supply voltage, thereby monitoring respective collector current of each amplifier when METER switch S115 is set to the Q1 (350 ma) or Q2 (130 ma) position. Potentiometer R106 provides a means of calibrating meter M101. In the RF position of switch S115, one side of meter M101 is returned to ground through S115A, while S115B, connects the other side of the meter to the RF output. In this position, the MONITOR displays relative amplitude of the output signal.

k. OUTPUT FILTERS Z113 AND Z114. (See figures 7-12 and 7-13.) Output filters Z113 (optional) and Z114 each contain five relay-controlled bandpass filters, with each relay returned to the appropriate postions on the 1 kHz (S103), 10 kHz (S104), 100 kHz (S105) and 1 MHz (S106) switches relative to the selected rf output frequency. As a result, the switch-selected frequency is filtered by an appropriate L-C network prior to appearing at RF OUT jack J124 and MON jack J125. (See figure 7-1.) Table 4-1 presents a listing of the bandpass filter control relays in Z113 and Z114 and the corresponding frequency range they control.

A4653 is supplied when A4623 & A4624 is not ordered.

TABLE 4-1. OUTPUT FILTER PASSBANDS AND CONTROL RELAYS

Control Relay	Filter Bandpass Frequency	
	Z113	Z114
K1	200 kHz - 300 kHz	30 kHz - 45 kHz
K2	300 kHz - 400 kHz	45 kHz - 65 kHz
K3	400 kHz - 700 kHz	65 kHz - 100 kHz
K4	0.7 MHz - 1.2 MHz	100 kHz - 150 kHz
K5	1.2 MHz - 1.99999 MHz	150 kHz - 200 kHz

l. POWER SUPPLY ASSEMBLY. (See figures 7-14 through 7-16.) Three subassemblies are incorporated into the power supply; namely, rectifier and filter capacitor board (A) Z304, regulator Z303, and heat sink Z305. (See figure 7-14.) Also included is power transformer T301, 1 MHz standard oscillator Z301, and the 3 MHz ovenized oscillator Z302 (FSK and FAX operation). Input power of either 115 or 230 vac is applied to power transformer T301 via POWER INPUT jack J116 and line fuses F101 and F102. For 115-volt operation, the primaries of T301 are connected in parallel and line fuses of 1.0-ampere value are used; for 230-volt operation, the primaries of T301 are connected in series and fuse value is 0.5 ampere. The secondary output voltage, approximately 60 vac, is applied to the full-wave bridge rectifier on Z304 (figure 7-15). The rectified output voltage of 40 vdc is filtered by C4 and applied to regulator Z303. The centertap voltage from T301, approximately 30 vac, is filtered by capacitor C3 and also applied as +20 volts to regulator Z303.

The +40 volt input to regulator Z303 (figures 7-16) is developed across the combination of voltage reference diode CR5 and 24V Current Adjust potentiometer R12, thus providing a stable positive reference input to over-current amplifier Q6. As a result, Q6 conducts by an amount proportional to the setting of R12, and causes regulator drivers Q2 and Q3 to conduct, which, in turn, cause respective series regulators Q302 and Q303 to conduct on heat sink Z305. The supply collector current drawn by regulator Q302 is sensed by the R15, R19 and CR2 network in the emitter circuit of over-current amplifier Q6, thereby establishing a current reference in conjunction with the bias applied to the base via R12. Series regulator Q302 furnishes a +30 vdc output at pin E of jack J301 while regulator Q303 supplies +24 vdc at pin P of jack J301.

Fluctuations in the +24 vdc output of Q303 are applied to a resistive divider consisting of R6, +24V Adjust potentiometer R18 and R16; R18 applies this positive voltage to dc amplifier Q7. Since the emitter of Q7 is maintained at a constant +15 vdc potential by zener diode CR7, variations in the output voltage, when compared with this stable reference, cause Q7 to provide more or less drive current to regulator drivers Q2 and Q3. As a result, the +24 vdc and +30 vdc outputs are maintained at relatively nominal values. The +12 vdc regulator, consisting of Q1, Q4, Q5 and Q301, is similar in operation to the +24 vdc/+30 vdc regulators. (This regulated +12 vdc is an output at pin H of jack J301.)

The +30 vdc output from the power supply assembly (figure 7-14) is applied to output filter Z114 and to METER switch S115; the +24 vdc and +12 vdc outputs are applied to ON-STANDBY switch S112. (See figure 7-1.)

SECTION 5

MAINTENANCE

5-1. PREVENTIVE MAINTENANCE

The following paragraphs describe procedures to inspect, check and clean the components of the LFE . In general, preventive maintenance provides a basis for recognizing future probable causes of equipment malfunction in the early stages of deterioration. Many such causes are apparent to the senses of sight, touch and smell. Therefore, by adhering to a stringent program of preventive maintenance, involving periodic inspection and checks, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules. Table 5-3 presents a listing of test equipment required for LFE maintenance.

a. INSPECTION AND TEST. The following paragraphs describe equipment inspection and power supply checks to be performed on a weekly basis.

(1) General Inspection. A most important and least expensive tool in the preventive maintenance program is the sense of sight; a thorough visual inspection of an assembly or component for tell-tale signs of deterioration prior to failure can save hours of test and troubleshooting time after a complete breakdown. Table 5-1 presents a weekly inspection checklist for the LFE .

TABLE 5-1. WEEKLY INSPECTION ROUTINE

Assembly or Subassembly	Check
Line Power Cord	Check three-wire line power cord for cracks, nicks or fraying.
Main Chassis Assemblies	1. Check underside of chassis for dirt and dust.
	2. Check all inter-connecting wiring for nicks, cracks or fraying.
	3. Check all printed circuit boards for cracks; check components for looseness and evidence of deterioration from possible overheating.
	4. Check printed circuit board jacks for tightness against chassis.

TABLE 5-1. WEEKLY INSPECTION ROUTINE (Cont)

Assembly or Subassembly	Check
Main Chassis Assemblies (Cont)	5. Check ground connections for security.
Front and Rear Panels	1. Check panel for general cleanliness.
	2. Check all control knobs for smooth action from limit-to-limit. Check all switches for positive action.
	3. Check MONITOR meter face for cracks, scratches, etc.
	4. Check indicator faces for cracks.
	5. Remove line fuses and check for proper 1-ampere or 0.5-ampere value and condition (0.5-ampere with 230 vac line).
	6. Check all input/output jacks for security against panel.

(2) Power Supply Checks. Perform the power supply checks on a weekly basis as follows:

(a) Disconnect line power cord from 115 or 230 vac source.

(b) Unplug power supply regulator board Z303 from its receptacle at the rear center of the chassis; insert the small extender board in the vacated receptacle and mount the regulator board on the extender board.

(c) Check that POWER switch on front panel is in STANDBY position and connect line power cord to 115 or 230 vac source as applicable.

(d) Using an HP410B VTVM, or equivalent, check dc voltage at pin F of Z303; voltage should be +12 vdc ±1%.

(e) Check voltage at pin 4 of Z303; voltage should be +24 vdc ±1%.

(f) Check voltage at pin 3 of Z303; voltage should be +30 vdc ±1%.

(g) Remove line cord from power source, and replace regulator board into mating jack J303 after removing extender board.

(3) Functional Test. Perform the checkout procedure for the LFE as outlined in Section 2, paragraph 2-5, on a weekly basis, after a check has been made of the power supplies.

b. CLEANING INSTRUCTIONS. In general, the LFE should be cleaned once a week, using a soft camel's hair brush, forced air pressure of not more than 20 psi and a suitable cleaning agent such as trichlorethylene or methylchloroform.

WARNING

When using toxic solvents, make certain that adequate ventilation is provided; prolonged or repeated breathing of the vapor shall be avoided. Avoid prolonged or repeated contact with the skin. Flammable solvents shall not be used on energized equipment or near other equipment from which a spark may be received.

CAUTION

Trichlorethylene contains a paint removing solvent; avoid contact with painted surfaces.

Remove dirt or grease from wiring and chassis surfaces using cleaning solvent; dry with compressed air. Remove dust from printed circuit boards using a soft camel's hair brush. Blow out accumulated dust from inaccessible areas of chassis using forced air.

5-2. TROUBLESHOOTING

The circuits of the LFE are contained on 15 PC boards accessible from the top of the chassis. The card Zxxx numbers are the circuit reference designation prefix. Numbers prefixed with an "A" are the PC assembly part numbers by which they are identified and ordered. The "Z" prefix number is silkscreened both on the card and on the chassis adjacent to the PC board receptacle. Some PC boards in the LFE and in other TMC equipment, although they are assigned different "Z" designations, have the same assembly "A" prefix and are thus identical and interchangeable. These PC boards have similar keying at their plug ends and mating receptacles. The power supply assembly heat sink is mounted against the rear wall of the chassis; the smaller power supply boards are mounted forward of the heat sink and are removable.

In general, a malfunction in the LFE will usually manifest itself by lack of, or improper readings on the MONITOR meter, and can be quickly localized to a particular printed circuit board by the logical process of elimination. If a second LFE is obtainable, or a set of spare PC boards is available, troubleshooting can be facilitated by the board substitution method. In some instances, a particular board may require alignment or adjustment as outlined in paragraph 5-3. Table 5-2 presents a troubleshooting chart for the LFE ; figures 5-1 and 5-2 show respective top and bottom views of the equipment.

TABLE 5-2. TROUBLESHOOTING CHART

Step	Trouble	Probable Cause	Remedy
1	No rf output at any selected frequency.	Check that POWER indicator is illuminated with POWER switch ON.	If lamp is not illuminated, check power supply voltages as outlined in paragraph 5-1a. (2). If lamp is illuminated, proceed to step 2.
2		Check that STD switch is set to INT.	Set switch at INT. If switch is at INT, proceed to step 3.
3		Check for normal display on MONITOR with METER switch in Q1 and Q2 position.	If all readings are normal, proceed to step 4. If any reading is abnormal, check Q1 or Q2 and associated circuitry on rf output Z115 as indicated by meter reading.
4		Check for 1 MHz output at 1 MHz MON jack on rear of chassis.	If 1 MHz is present, proceed to step 5. If 1 MHz is not present, check for 1 MHz output at J302 on the power supply assembly. If not present, replace 1 MHz standard Z301.

TABLE 5-2. TROUBLESHOOTING CHART (Cont)

Step	Trouble	Probable Cause	Remedy
5		Check for 1 MHz spectrum from 1 MHz spectrum generator on Z101.	If present, proceed to step 6. Troubleshoot 1 MHz spectrum generator and 1 MHz square-wave generator on Z101.
6		Check for 100 kHz spectrum output at pin D of Z101.	If present, proceed to step 7. Troubleshoot 100 kHz spectrum generator channel on Z101.
7		Check for 3 MHz input to translator Z108.	If not present, proceed to step 8. If present, proceed to step 10.
8		Switch to FAX operation.	If 3 MHz input to translator appears in FAX, troubleshoot 2.75 MHz amplifiers Q1 and Q2. Check balanced modulator Z2. If 3 MHz does not appear, proceed to step 9.
9		Check for 2.75 MHz input to Z111.	If not present, troubleshoot carrier generator Z112. If present, check for 250 kHz input to Z111 and troubleshoot carrier generator Z112.
10		Check for 10.0 to 10.99999 MHz, and 12 or 13 MHz inputs to translator Z108.	If 10 to 10.99999 MHz input is missing, check mixer-divider circuits Z104, Z105 and Z107. If 12 or 13 MHz input is missing, check 12 or 13 MHz circuit on Z101. If all inputs to Z108 are present, check translator Z108; check output amplifier Q2.
11	No FSK operation.	3 MHz oscillator Z302 or frequency shift generator Z111.	Check for +12 vdc at pin K of J301 on power supply assembly. If present, check for varying 3 MHz output at J305. If 3 MHz output is present without frequency shift, proceed to step 12. If 3 MHz is not present, replace oscillator Z302.
12		Check for varying 3 MHz output at pin 7 of Z111.	If not present, check for varying 3 MHz at pin 14 of Z111. If not present, proceed to step 13. If present, troubleshoot 3 MHz amplifier on Z111.
13		Check for varying dc level at pin L of J301.	If present, replace Z302 in power supply assembly. If not present, check modulator, rectifier and dc amplifier circuits in Z111.
14	No FAX operation.	Same as for FSK operation, except check for varying dc output at pin 13 of Z111 and troubleshoot DC regulator circuit if not present.	

TABLE 5-2. TROUBLESHOOTING CHART (Cont)

Step	Trouble	Probable Cause	Remedy
15	No audio in AM mode only.	Carrier generator Z112	Troubleshoot AM amplifier consisting of Q10, Q11 and Q12.
16	No SSB operation.	If normal operation is evident in either USB or LSB modes, trouble is in sideband generator.	Troubleshoot defective sideband generator on Z109.

5.3 ALIGNMENT

TABLE 5-3. TEST EQUIPMENT REQUIRED

Equipment	Manufacturer
Signal Generator	H. P. Model 606B or equivalent
Oscilloscope	Tektronix Model 541A or equivalent
Spectrum Analyzer	Lavoie Model LA-40 or equivalent
Audio Oscillator	H. P. Model 200CD or equivalent
DC Power Supply	0-10 Volts
Step Attenuator	Telonic D950 or equivalent
VTVM	Millivac Model 28B or equivalent
VTVM	H. P. Model 410B or equivalent
VTVM	Ballantine Model 314 or equivalent
VOM	Simpson Model 260 or equivalent
Two Tone Audio Gen	TMC Model TTG or equivalent

NOTE

1) Remove RF output card Z115. Do not insert until directed.

2) Turn POWER to ON and wait at least 30 minutes to allow oven warmup.

3) Use appropriate extender cards where applicable.

(a) Power Supply "A": Z304

1) Using VOM, measure the DC voltage at J304-A. It should be about +40 volts.

2) Measure the DC voltage at J304-E. It should be about +20 volts.

(b) Power Supply "B": Z303

1) With VOM, measure the DC voltage at J303-E. It should be about +20 volts.

2) Measure the DC voltage at J303-A. It should be about +40 volts. Then turn R3 and R12 fully clockwise.

3) Measure the DC voltage at J303-F; adjust R-8 for exactly +12.0 volts with all cards except Z115 inserted. Then adjust R-3 until the voltage level just commences to drop. Then back off R-3 to +12.0 volts.

4) Measure the DC voltage at J303-4. Adjust R-18 for exactly +24.0 volts. Then adjust R-12 until the voltage level just commences to drop. Then back off R-12 to 24 volts.

5) Measure the DC voltage at J301-E. It should be 30 volts ±1 volt.

6) Turn POWER switch to STANDBY. Place METER switch to Q-1. Connect the arrangement shown in the following sketch:

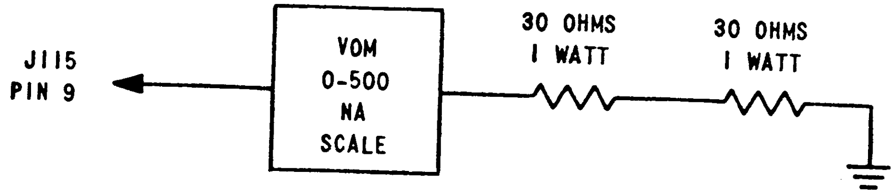


Figure 5-1. Power Supply Test Setup

7) Record the current reading on the VOM. Let the 0-5 dial divisions on the LFE meter represent 0-500 milliampers. Adjust R-106 meter adjust control for the same reading recorded on the VOM.

c) Spectrum Generator Card: Z 101:

1) Set the INT-EXT standard switch on the rear panel of the LFE to INT. Connect oscilliscope to J101-A. Adjust T-1 for maximum 1 MC output.

2) Connect the oscilliscope to pin 3 of J101. Adjust R-60 for 0.6 volts P-P at 1 MC.

3) Connect the scope to the collector of Q3, and observe a 1 MC spectrum signal at 1.5 volts P-P.

4) Connect the scope to J101-D, and observe a 100KC spectrum signal at 1.0 volt P-P.

5) Connect the scope to TP-3. Adjust T-2 and C-12 for maximum 12 MC signal with the 1 MC front panel selector to "1", and all other selectors to "0".

6) Connect the scope to J101-8. Adjust T3 for maximum 12 MC signal. (about 0.4 volt P-P.)

7) Connect scope to TP-6. Adjust C-50 and T-8 for maximum 13.0 MC signal with all front panel frequency selectors set to "0".

8) Connect scope to J101-P. Adjust T- 9 for maximum 13 MC signal. (about 0.4 volt P-P)

9) Connect scope to TP-9. Adjust C-73 and T-10 for maximum 8 MC signal

10) Connect scope to J101-S. Adjust T-11 for maximum 8 MC signal. (about 1.5 volts P-P)

d) Comb Filter A: Z 102:

1) Set 100KC, 10KC, 1KC, 100 cycle frequency selectors to BLANK positions. Remove Comb Filter B (Z-103).

2) Connect the scope to TP-9. Adjust C43, T9, for maximum 1.0 MC signal.

3) Connect the scope to TP-10. Adjust T-10 for maximum 1.0 MC signal. Then adjust R-35 for a level of 0.7 volts P-P.

4) Connect scope to TP-7. Adjust C32 and T-7 for maximum 1.2 MC signal.

5) Connect scope to TP-8. Adjust T-8 for maximum 1.2 MC signal. Then adjust R28 for o.7 volts P-P.

6) Connect scope to TP-5. Adjust T-5 and C22 for maximum 1.4 MC signal.

7) Connect scope to TP-6. Adjust T-6 for maximum 1.4 MC signal. Then adjust R-21 for o.7 volts P-P.

8) Connect scope to TP-4. Adjst T3 and C-11 for maximum 1.6 MC signal.

9) Connect scope to TP-3. Adjust T-4 for maximum 1.6 MC signal. Then adjust R-14 for 0.7 volts P-P.

10) Connect scope to TP-1. Adjust C-10 and T-2 for maximum 1.8 MC signal.

11) Connect scope to TP-2. Adjust T-1 for maximum 1.8 MC signal. Then adjust R-3 for 0.7 volts P-P.

e) Comb Filter B: Z 103:

1) Remove Comb Filter Z-102 from the unit. Set the 100KC, 10KC, 1KC and 100 cycle selectors to BLANK positions.

2) Connect scope to TP-9. Adjust C43 and T-9 for maximum 1.1 MC signal.

3) Connect scope to TP-10. Adjust T-10 for maximum 1.1 MC signal. Then adjust R35 for 0.7 volts P-P.

4) Connect scope to TP-7. Adjust C-32 and T-7 for maximum 1.3 MC signal.

5) Connect scope to TP-8. Adjust T-8 for maximum 1.3 MC signal. Then adjust R-28 for 0.7 volts P-P.

6) Connect scope to TP-5. Adjust T-5 and C-22 for maximum 1.5 MC signal.

7) Connect scope to TP-6. Adjust T-6 for maximum 1.5 MC signal. Then adjust R-21 for 0.7 volts P-P.

8) Connect scope to TP-4. Adjust T-3 and C-11 for maximum 1.7 MC signal.

9) Connect scope to TP-3. Adjust T-4 for maximum 1.7 MC signal. Then adjust R-14 for 0.7 volts P-P.

10) Connect scope to TP-1. Adjust C-10 and T-2 for maximum 1.9 MC signal.

11) Connect scope to TP-2. Adjust T-1 for maximum 1.9 MC signal. Then adjust R-3 for 0.7 volts P-P.

f) Dual Mixer-Dividers Z 104 and Z 105.

1) Set all frequency selectors to a blank position (not "0").

2) Place scope probe from cathode side of CR1 to ground. Ground PIN "B" of J-104. Adjust transformer T1 for maximum output. Place scope on TP1. Adjust potentiometer R9 for minimum output. Output at cathode of CR1 should be 0.5 volt peak-to-peak minimum.

3) Remove ground from Pin B of J-104.

4) Place scope probe on cathode side of CR3 and ground lead to ground.

Adjust transformers T2 through T6 for maximum output 9 MHz. Place probe on TP5 and adjust potentiometer R23 for minimum output. Output at cathode of CR3 should be 0.5 volt peak-to-peak minimum.

5) Place signal generator (terminated with 47 ohms) through a 220-ohm resistor to TP5. Adjust generator output for 10.4 MHz and terminate generator line with a 47-ohm resistor.

6) Place scope probe at TP5, ground lead to ground. Short TP6 to ground and adjust transformer T7 for maximum output. Remove short from TP6 and adjust transformer T8 for minimum output.

7) Place scope probe at TP7 with ground lead grounded near this point. Short TP8 to ground. Adjust transformer T9 for maximum output. Remove short from TP8 and adjust transformer T10 for minimum output.

8) Place scope probe between TP9 and ground. Adjust Adjust transformer T11 for maximum indication. With a generator input of 10 mv rms, the output should be 0.2 volts peak-to-peak minimum for the range of 10 MHz to 11 MHz.

9) Disconnect generator. Place scope probe at junction of L4 and R46. Rotate 10 Hz switch from position 0 to position 9. The output should be 0.6 volt peak-to-peak (1.00 thru 1.09 MHz). Return to a blank position.

10) Place scope probe between cathode end of CR6 and ground. Adjust transformer T12 for maximum output (8 MHz). Place scope probe at TP10. Adjust potentiometer R54 for minimum output. Output at cathode CR6 should be 0.5 volt peak-to-peak minimum.

11) Place scope probe between cathode side of CR8 and ground. Rotate 10 Hz switch to position 5. Adjust transformers T13 through T17 for maximum output (9.04 MHz). With 10 Hz switch in position 4, place scope probe between TP14 and ground. Adjust potentiometer R69 for minimum indication. Output at cathode of CR8 should be 0.5 volt peak-to-peak minimum with 10 Hz switch in positions 0 through 9.

12) Connect signal generator through 220-ohm resistor to TP14 and connect ground lead to ground. Make sure signal generator lead is terminated with 47 ohms.

13) Place scope probe between TP14 and ground. Adjust

signal generator for 10.4 MHz. Short TP-15 to ground. Adjust transformer T18 for maximum output. Remove short from TP15 and adjust transformer T19 for minimum output.

14) Place scope probe between TP16 and ground. Short TP17 to ground. Adjust transformer T20 for maximum output. Remove short from TP17. Adjust transformer T21 for minimum output.

15) Place scope probe between TP18 and ground. Adjust transformer T22 for maximum output. With a generator input of 10 mv rms, the output should be 0.2 volts peak-to-peak minimum for the range of 10 MHz to 11 MHz.

16) Disconnect generator and rotate 10 Hz switch to position 5. Place scope probe at pin 15 and ground lead pin to R. Rotate 100 Hz switch from position 0 through position 9. Output should be 0.6 volts peak-to-peak over a frequency variation from 1.005 to 1.095 MHz. NOTE: Repeat the above procedure for Z-105 using the correct frequencies and switch positions of the 1 KHz and 10 KHz selectors.

g) Final Mixer Z-107.

1) Place scope probe from cathode end of CR2 to ground. Rotate 10 kHz switch to blank position. Rotate 100 kHz switch to blank position. Adjust transformer T1 for maximum output. Place scope probe at TP1 and adjust potentiometer R7 for minimum output. Place short between pin H and pin E. Output at cathode of CR2 should be 0.5 volts peak-to-peak minimum.

2) Rotate 10 kHz, 100 Hz and 10 Hz switches to position 5. Place scope probe between cathode od CR3 and ground. Tune T2, T3, T4, T5, T6 and T13 for maximum. Connect scope to C-60. Adjust potentiometer R18 for minimum output. Output at cathode of CR3 should be 0.5 volts peak-to-peak minimum.

3) Rotate 10 kHz switch to blank position. Connect generator (terminated by 47 ohms) through 220-ohm resistor to TP5. Connect ground lead to ground. Adjust signal generator for 10.4 MHz. Rotate 100 kHz switch to position 4.

4) Connect scope probe to TP5. Short TP7 to ground. Adjust transformer T7 for maximum output. Remove

short from TP7 and adjust transformer T8 for minimum output.

5) Place scope probe between TP8 and ground. Short TP9 to ground. Adjust transformer T9 for maximum output. Remove short from TP9 and adjust transformer T10 for minimum output.

6) Remove translator Z108 from unit. Place 47-ohm resistor between pins 12 and 13 of J107. Place scope probe on TP10. Place short across secondary of transformer T12. Rotate 100 kHz switch to position 5. Adjust generator for frequency of 10.75 MHz. Adjust transformer T11 for maximum output. Remove short from transformer T12 and adjust T12 for minimum output.

7) Rotate 100 kHz switch to position 4. Adjust generator frequency for 10.1 MHz. Short secondary of transformer T12. Adjust capacitor C36 for maximum output. Remove short from transformer T12 and adjust capacitor C48 for minimum output.

8) Place scope across 47-ohm resistor (step (b)). Set generator for 10.5 MHz at 100 mv rms out. With the 100 kHz switch in position 4, output should be at least 0.2 volt peak-to-peak with frequency input of 10.5 MHz to 11 MHz.

9) Remove generator input and set 10 kHz switch to position 5. Remove short from pins H and E. Rotate 100 kHz switch from position 0 to position 9. Output should be a minimum of 0.2 volt peak-to-peak. Remove 47-ohm resistor from pins 12 and 13. Replace translator Z108.

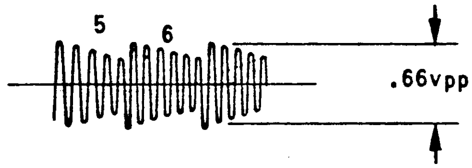
h) Carrier Generator Z 112.

1) Adjust potentiometer R27 fully ccw; set EXCITER switch ON and MODE switch to AM. Place scope at TP1. Voltage should be 10.0 volts peak-to peak.

2) Place scope at TP3 and adjust transformer T1 for maximum level (approximately 900 mv peak-to-peak).

3) Place scope at TP4 and adjust transformer T2 for maximum level (Approximately 1.4 volts peak-to-peak).

4) Adjust potentiometer R-47 fully cw. Place scope at TP6 and adjust transformer T3 for maximum level as shown in the waveform below:



6 AND 5 CYCLES/ENVELOPE PATTERN ALTERNATELY

Figure 5-2. Carrier Generator Alignment Waveform

5) Place scope at TP7, adjust transformer T4 for maximum level, and adjust potentiometer R-47 for 70 mv peak-to-peak.

6) Place MODE switch in AM position and remove sideband generator Z109. Place scope at TP8 and adjust transforer T5 for maximum level (approximately 1.0 volt peak-to-peak). Replace sideband generator Z109.

i) Sideband Generator Z109.

NOTE

Carrier generator Z112 must be aligned and inserted into unit; frequency shift generator Z111 removed and potentiometers R34 and R60 fully clockwise.

1) Connect audio generator with one side grounded to USB terminals on rear of unit.

2) Set audio generator for 1kHz with output level set to 78 mv (-20dbm).

3) Set MODE switch and METER switch on front panel to USB positions.

4) Set USB MIKE-LINE control for 2/5 of full scale reading on front panel meter (reading of 2).

5) Place Ballantine 314 meter at TP4. Level should be approximately.013 volt rms.

6) Place scope at TP5 and adjust transformer T1 for maximum level. Adjust USB MIKE-LINE control for full-scale reading on meter.

7) Adjust potentiometer R28 and capacitor C52 until waveform as shown below is symmetrical and crossover is sharp and clear as viewed on scope. If necessary, change value of C50 and repeat until sharp crossover can be obtained.

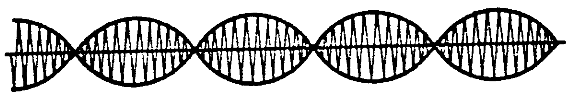


Figure 5-3. Sideband Generator Alignment Waveform

8) Return USB MIKE-LINE control to 2/5 full-scale reading on meter and adjust potentiometer R34 for 200 mv peak-topeak at collector of Q7. Check output of sideband filter for approximately 75 mv peak-to-peak (TP-10).

9) Repeat steps (a) through (h) for LSB using:
   (a) TP1 for step (e).
   (b) TP8 and transformer T2 for step (f).
   (c) Potentiometer R54 and capacitors C53 and C51 for step (g)

   (d) Potentiometer R60, Q12 and TP-9 for step (h).

10) Remove audio generator input to unit and connect to MIKE input on front panel or to pin E of J109 and ground.

11) Set audio generator for 1 kHz with output level of 1.0 mv as measured with Ballantine 314, and short capacitor C49 with short jumper.

12) Connect Ballantine 314 to TP3 and adjust potentiometer R9 for level of 40 mv rms.

j) Frequency Shift Generator Z111.

1) Remove Z111 from unit. Place MODE switch to ISB position and adjust potentiometer R58 fully ccw. Turn CARRIER control on front panel fully clockwise.

2) Set EXCITER switch to ON position and measure 2.75 MHz input at J111 pin C (approximately 70 mv peak-to-peak). Measure 250 kHz input at J111 pin 2 (approximately 70 mv peak-to-peak). Insert Z111 on extender card in its socket.

3) Place scope at TP-5 and tune transformers T1 and T2 for maximum level (approximately 0.4 volts peak-to-peak).

NOTE

Do not attempt FSK and/or FAX adjustments without a one hour warm-up period for the 3 MHz oven. (The oven is on as long as the LFE line cord is plugged in.)

4) Connect frequency counter to vertical output terminals of scope. Place MODE switch in FSK position. On rear panel, set potentiometer R101 to mid-range; frequency SHIFT switch to ±425 (maximum) shift position; and SENSE switch to + (up) position.

5) Adjust potentiometer R56 for maximum level indication on scope (Pin 7). Note location of adjustments as shown in the sketch below: (These are 25 turn potentiometers.)

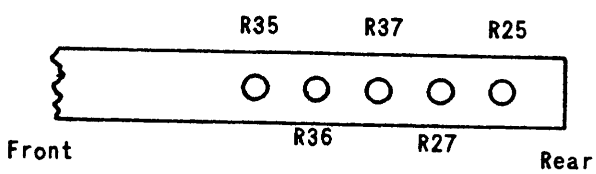


Figure 5-4. Frequency Shift Generator Adjustment Locations

6) Insert Z111 into unit (not on extender). Set potentiometers R36 and R35 fully ccw.

7) Adjust potentiometer R37 for 3,000,000 Hz reading on frequency counter.

8) Adjust potentiometer R36 for 2, 999, 575 Hz reading on frequency counter.

9) Set SENSE switch to - (down) position, and adjust potentiometer R35 for 3,000, 425 Hz reading on frequency counter.

10) Repeat steps (i) and (j) until frequencies are within 5 Hz.

11) Set frequency SHIFT switch to ± 170 (rear panel) and set SENSE switch to + (up) position. Counter should read 2,999, 830 ± 15 Hz.

12) Set SENSE switch to - (down) position; counter should read 3,000, 170 ± 15 Hz.

13) Repeat steps (l) and (m) for ± 85 position. Specification is ± 10 Hz.

14) Repeat steps (l) and (m) for ±42.5position. Specification if ± 7 Hz.

15) Place MODE switch in FAX position and set potentiometer R25 fully cw.

16) Connect 0-10-volt power supply to FAX terminals on rear panel and set for +1.0-volt input.

17) Adjust potentiometer R27 for 2,999,600 ±5 Hz reading on counter.

18) Reset input to +10.0 volts and adjust. potentiometer R25 for 3,000,400 ±5 HZ reading on counter.

19) Repeat steps (q) through (s).

20) Check for linearity by varying input from +1.0 to +10.0 volts. Counter should change 89 ± 5 Hz for every 1.0-volt change from 1.0 volt to 10.0 volts as shown in Table 5-4, FAX Voltage vs Frequency Linearity check.

Table 5-4. FAX Voltage vs Frequency Linearity

VOLTAGE	FREQUENCY
1	600 Hz ± 5 Hz
2	689 Hz ± 5 Hz
3	778 Hz ± 5 Hz
4	867 Hz ± 5 Hz
5	956 Hz ± 5 Hz
6	1045 Hz ± 5 Hz
7	1134 Hz ± 5 Hz
8	1223 Hz ± 5 Hz
9	1312 Hz ± 5 Hz
10	1400 Hz ± 5 Hz

k) Translator Z 108. Align the translator as follows:

1) Remove rf output Z115 from unit. Set all frequency select switches on front panel to blank positions.

2) Connect signal generator between junction of R21 and R23 and ground through the the attenuator as shown in the sketch below:

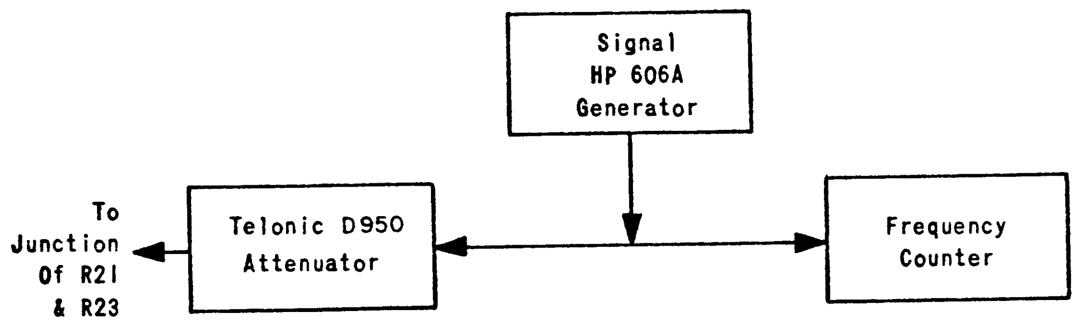


Figure 5-5. Translator, Test Setup

3) With full attenuation on toggle switch attenuator, adjust generator for 1 volt output at frequency of 13.3000 MHz. Set 100 kHz switch on front panel to position 3.

4) Connect short jumper across secondary of transformer T6 and connect Millivac MV-28B across R22 observing proper ground. Set meter to .01-volt range.

5) Remove attenuation from Telonic attenuator until mid-scale reading is observed on meter. (Maintain reading on .01 scale of meter using attenuator, for the following steps.)

6) Adjust transformer T5 for peak indication on meter.

7) Remove jumper from transformer T6 and adjust for dip on meter.

8) Connect short jumper across secondary of transformer T8 and connect Millivac Meter to TP-2 and ground.

9) Change attenuation of Telonic attenuator for mid-scale reading on meter and adjust transformer T7 for peak reading on meter.

10) Remove jumper from transformer T8 and adjust for dip on meter.

11) Connect meter to TP3 and adjust transformer T9 for maximum indication on meter.

12) Repeat steps (c) through (k) using positions 8 and 13.8000 MC for step (c); transformers T11 and R59, respectively, for step (d); transformer T10 for step (f); transformer T11 for step (g); transformers T13 and TP-4 respectively for step (h); transformer T12 for step (i); transformer T13 for step (j); and TP5 and T14 for step (k).

13) Remove generator and turn MODE switch to ISB Full Carrier (no audio) position. Set frequency select switches on front panel for 1.50000 MHz and turn EXCITER switch to ON position.

14) Using scope, check for 10.5 MHz signal at level of .2 volt peak-to-peak minimum at J108 pin K and for 3 MHz signal of approximately 90 mv peak-to-peak at J108 pin M (depending on setting of potentiometer R58 on Z111).

15) Adjust potentiometer R19 to mid-position, short across pin L and M and tune transformer T3 for maximum indication on meter connected to cathode of CR-3.

16) Connect Millivac meter to junction of resistors R21 and R23, observing proper ground.

17) Adjust potentiometer R19 for minimum indication on meter, and return all frequency selected switches on front panel to zero position.

18) Connect scope to J108 pin B and ground; for 12 MHz (position 1 of 1 MHz switch on front panel) and 13 MHz (position 0 of 1 MHz switch on front panel), level should be approximately .4 volt peak-to-peak.

19) Position potentiometer R5 to mid-range and connect scope to cathode of CR1. Adjust transformer T1 for equal indications on scope in positions 0 and 1 of the 1 MHz switch on front panel. Connect scope to TP-3 and adjust R5 for minimum 13 Mc. Remove jumper across pins L and M.

20) Connect scope to J108 pin E and turn EXCITER switch to ON position. Set frequency dials on front panel to 1.99999 MHz and remove rf output Z115 from unit. The scope should indicate a 125 mv peak-to-peak signal.

21) Connect 0 to 10 volt power supply between J108 pin 13 (+) and ground(-). Increase the voltage from 0 to 10 volts. The output level indication on scope should drop to zero as voltage increases from 6.5 to 8.5 volts.

l) RF Output Card Z 115:

<u>NOTE</u>

Do not attempt an alignment of Z-115 until steps 3.4 (f) and (g) have been checked.

1) Before inserting card into unit, adjust potentiometers R3 and R8 for maximum resistance. Turn RF OUTPUT control on front panel fully ccw. Set MODE switch to ISB and turn EXCITER switch ON. Turn CARRIER control fully cw. Insert RF output card into unit on extender card. Re-check power supply voltages and readjust as outlined in paragraphs 3.3 and 3.4.

2) Turn METER switch to Q1 position. On RF out-

put card, adjust potentiometer R8 until meter on front panel r ads in the green region marked Q1.

3) Turn METER switch on front panel to Q2 and adjust potentiometer R3 until meter on front panel reads in the green region marked Q2.

4) Turn METER switch on front panel to OFF position.

5) Connect 50-ohm load to RF OUT jack J124 on rear panel of unit and a Hewlett-Packard Model 410B VTVM across the load. Turn ALDC control on rear panel fully ccw and set frequency of unit to 1.99999 MHz. Place short jumper from pin P of J115 to pin B J114.

6) Connect Ballantine Model 314 meter to pin B of J115 and set to 1-10 mv scale. Turn RF OUTPUT control on front panel until Ballantine Meter reads 10 mv rms. Hewlett-Packard meter should read 3 volts, approximately. Remove jumper and insert Z114 into J114. Output should not change more than 0.2 volt.

7) Using Simpson Model 260 meter, measure the dc voltage on pin 8 of J115. It should vary from 0-12 vdc with ALDC adjust control on rear panel of unit. Return ALDC control fully ccw.

m) Overall Alignment. This allignment should be completed after all PC cards have been adjusted.

n) Preliminary Steps:

1) Make the following preliminary checks and adjustments.

(a) Check power supply voltages and re-adjust, if necessary.
(b) All cards aligned and inserted.
(c) RF OUTPUT control fully ccw.
(d) Output frequency set to 1.99999 MHz.
(e) CARRIER control fully ccw.
(f) MODE switch to ISB position.
(g) EXCITER switch to ON position.
(h) Two-tone generator connected to both sideband inputs on rear panel.

(i) MIKE-LINE controls to zero.
(j) METER switch to Q1 position.
(k) ALDC control on rear panel fully ccw.

(1) Connect jumper across input terminals on rear panel (terminal 11 and 12).

o) Z101 Spectrum Generator Procedure

1) Place Z101 on extender card and correct Lavoie Model LA-40 spectrum analyzer to J101 pin 8 and ground to lead pin J. Adjust analyzer for 12 MHz display. Adjust capacitor C56 so that 11 MHz and 13 MHz are at least -80 db from 12 MHz level.

2) Set frequency on front panel to 0.99999 MHz and connect analyzer to J101 pin P and ground lead to pin R. Display 13 MHz. Adjust capacitor C80 so that 12 MHz and 14 MHz are at least -80 db from 12 MHz level.

3) Connect analyzer to J101 pin S and ground lead to pin 15. Display 8 MHz. Adjust capacitor C64 so that 7 MHz and 9 MHz are at least -80 db from 8 MHz level.

4) Remove Z101 from extender card and place it in its socket.

p) Z102 and Z103 Comb Filter Procedure

1) Place Z101 into unit and place Z102 on extender card. Remove Z103 from unit. Connect analyzer to J102 pin J and ground to pin 8. Display 1 MHz. Adjust capacitor C54 so that 100 kHz spurs above and below 1 MHz are at least -80 db from 1 MHz level.

2) Repeat step (a) using 1.2 MHz, pin P and ground to lead pin 13, and capacitor C55.

3) Repeat step (a) using 1.4 MHz, pin F and ground lead to pin 5, and capacitor C56.

4) Repeat step (a) using 1.6 MHz, pin L and ground lead to pin 10, and capacitor C57.

5) Repeat step (a) using 1.8 MHz, pin 4 and ground to lead pin D, and capacitor C58.

6) Place Z103 on extender card and remove Z102 from unit. Connect analyzer to J103 pin J and ground to lead pin 8. Display 1.1 MHz. Adjust capacitor C54 so that 100 kHz spurs above and below 1.1 MHz are at least -80 db from 1.1 MHz.

7) Repeat step (f) using 1.3 MHz, pin P and ground lead to pin 13, capacitor C55.

8) Repeat step (f) using 1.5 MHz, pin F and ground lead to pin 5 and capacitor C56.

9) Repeat step (f) using 1.7 MHz, pin L and ground lead to pin 10, and capacitor C57.

10) Repeat step (f) using 1.9 MHz, pin 4 and ground lead to pin D, and capacitor C58.

q) Front Panel Meter Check

1) Turn METER switch to Q1 position. Front panel meter should read in green region marked Q1.

2) Turn METER switch to Q2 position. Front panel meter should read in green region marked Q2.

3) Turn METER switch to OFF position. Front panel should read zero.

4) Using Ballantine 314 meter, adjust audio input to rear panel to 78 mv (-20 dbm) single tone.

5) Connect scope to TP1 of sideband generator Z109 and set LSB MIKE-LINE control for 44m volt peak-to-peak.

6) Set METER switch on front panel to LSB position. The front panel meter should read 2/5 of full-scale. Return LSB MIKE-LINE control to zero.

7) Connect scope to TP4 of sideband generator and set USB MIKE-LINE control for 44m volt peak-to peak.

8) Set METER switch on front panel to USB position. The front panel meter should read 2/5 for full-scale. Return USB MIKE-LINE control to zero.

r) Mode Level Adjustments

1) Connect the spectrum analyzer to the RF MONITOR jack on the rear of the LFE.

2) Connect a 50 ohm resistor to the RF OUTPUT jack on the rear of the unit. Connect the H.P. 410B VTVM across the 50 ohm load.

3) Put Z112 on extender card.

4) Turn mode switch to ISB.

5) Connect scope to Pin N and adjust R27 for 70.0m Volts peak-to-peak. Remove scope.

6) Set the Front Panel carrier control fully CW and adjust the RF OUTPUT control on the front panel

for 3.5 volts on the VTVM.

7) Connect an oscilloscope at the RF OUTPUT. Use the front panel selectors to choose frequencies at random, keeping RF output below 7.0vrms on VTVM. Examine the resultant sine waves by moving the TIME/CM oscilloscope controls through a wide range. There should be no trace of modulation. Remove the oscilloscope.

8) Set the LFE frequency to 00.25000mc. With front panel carrier control fully CW, adjust RF OUTPUT control for 2.5V on the VTVM. Set LFE frequency to 01.75000mc, and adjust R-58 on Z-108 for the same output level. (Some models only) Use T-14 if R-58 is not adjustable.

9) Move the frequency selectors from 0.01000 to 1.99999mc, and find the frequency with the lowest output amplitude. Then adjust R-45 on Z-108 for maximum signal at that frequency.

10) Turn mode switch to CW.

11) Select 1.99999 MC on front panel.

12) Turn RF output control max CW, adjust R58 on Z111 for 7.0 VRMS on the VTVM connected to dummy load J-124.

13) Turn mode switch to ISB and front panel carrier control maximum clockwise.

14) Set front panel frequency selectors to 1.0000MC.

15) Adjust RF output control for 3.5VRMS on VTVM. (Do not touch RF output control for the rest of these adjustments unless told to do so.) One signal should be present on the spectrum analyzer. Adjust display so that this signal is at a ODB reference.

16) Turn mode switch to CW mode.

17) With Z112 on the extender card, adjust R-20 for 3.5VRMS on the VTVM connected to J-124. (one signal at 0 db on analyzer)

18) When switching from ISB (full carrier, no audio) to CW, there should not be any change in RF output voltage.

19) Turn mode switch to AM (no modulation).

20) Adjust R-69 for 1.75VRMS on VTVM connected to J-124. NOTE: The signal level on the analyzer

should be at a -6.0DB level. There should be 6.0DB less than when the mode switch is in the CW, USB or LSB Full Carrier, ISB Full Carrier (one tone on analyzer).

21) Remove Z112 from the extender card and replace it in its socket.

22) Put Z111 on the extender card.

23) Turn mode switch to FSK.

24) Adjust R-56 for 3.5VRMS on the VTVM connected to J-124, with the RF gain control adjusted as for previous adjustments (0 DB on analyzer).

25) Remove Z111 from extender card and replace it in its socket.

26) With front panel carrier control at maximum clockwise, the following voltages should be observed on the VTVM connected to the RF output and one signal on analyzer at the DB level indicated when the mode switch is changed.

Mode		VTVM	ANALYZER
AM	-	1.76 VRMS	-6.0 DB
USB	-	3.5 VRMS	0.0 DB
LSB	-	3.5 VRMS	0.0 DB
ISB	-	3.5 VRMS	0.0 DB
CW	-	3.5 VRMS	0.0 DB
FSK	-	3.5 VRMS	0.0 DB
FAX	-	3.5 VRMS	0.0 DB

s) Modulation Level Adjustments and Check. 1.00000MC front panel frequency.

1) Turn mode switch to ISB and Carrier Control Max. CW.

2) Insure that USB and LSB MIKE/LINE Gain Controls are at "0".

3) Adjust RF output control for 3.5 VRMS across 50 ohm load connected to J-124. NOTE: <u>DO NOT</u> change position for following adjustments.

4) Adjust spectrum analyzer to indicate 0 DB connected to J-125. NOTE: A single tone (Carrier) should be displayed.

5) Turn carrier control maximum counter-clockwise and signal on analyzer should drop to -55DB or lower.

6) Turn meter switch to USB and adjust USB MIKE/LINE for 4/5 full scale. VTVM on dummy load (J-124) should indicate 3.5 VRMS. If it does not, adjust R-34 on Z109 until it does.

7) Turn USB MIKE/LINE gain control maximum CCW (0 on meter).

8) Turn meter switch to LSB and adjust LSB/MIKE gain control to indicate 4/5 full scale. VTVM across dummy load (J-124) should indicate 3.5 VRMS. If it does not, adjust R-60 on Z109.

9) Turn LSB MIKE/LINE gain control maximum CCW (0 on meter) and RF output maximum CCW.

10) Remove the audio generator from the sideband inputs and connect a two-tone generator (TTG) to both sideband inputs.

11) Turn meter switch to USB and adjust USB MIKE/LINE gain for 4/5 on meter.

12) Adjust RF output control for 3.5 VRMS out on VTVM connected across dummy load at J-124.

13) Two tones should be displayed on spectrum analyzer. Adjust, alternately, R5 and R19 on Z108 for minimum distortion products. Distortion should be down -40 DB from the two tones.

14) Turn USB MIKE/LINE gain control to "0".

15) Turn meter switch to LSB and LSB MIKE/GAIN control to indicate 4/5 on meter.

16) Distortion products should be down -40 DB from the two tones displayed on the analyzer.

17) Turn LSB MIKE/LINE gain control to "0".

18) Adjust TTG for <u>one</u> tone out at 78m VRMS.

19) Turn LSB MIKE/LINE gain control to indicate 4/5 on meter.

20) Turn mode switch to AM.

21) VTVM across output should indicate 3.5 VRMS.

22) The distortion products on the analyzer should be down -25 DB or lower from the carrier and the upper and lower sideband tone approximately -7 DB as per following sketch.

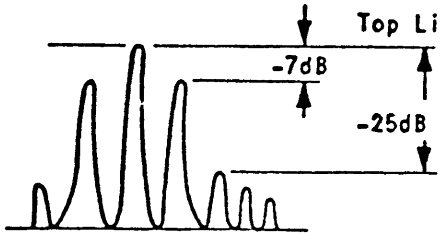


Figure 5-6. Carrier Double-Sideband Modulation Waveform

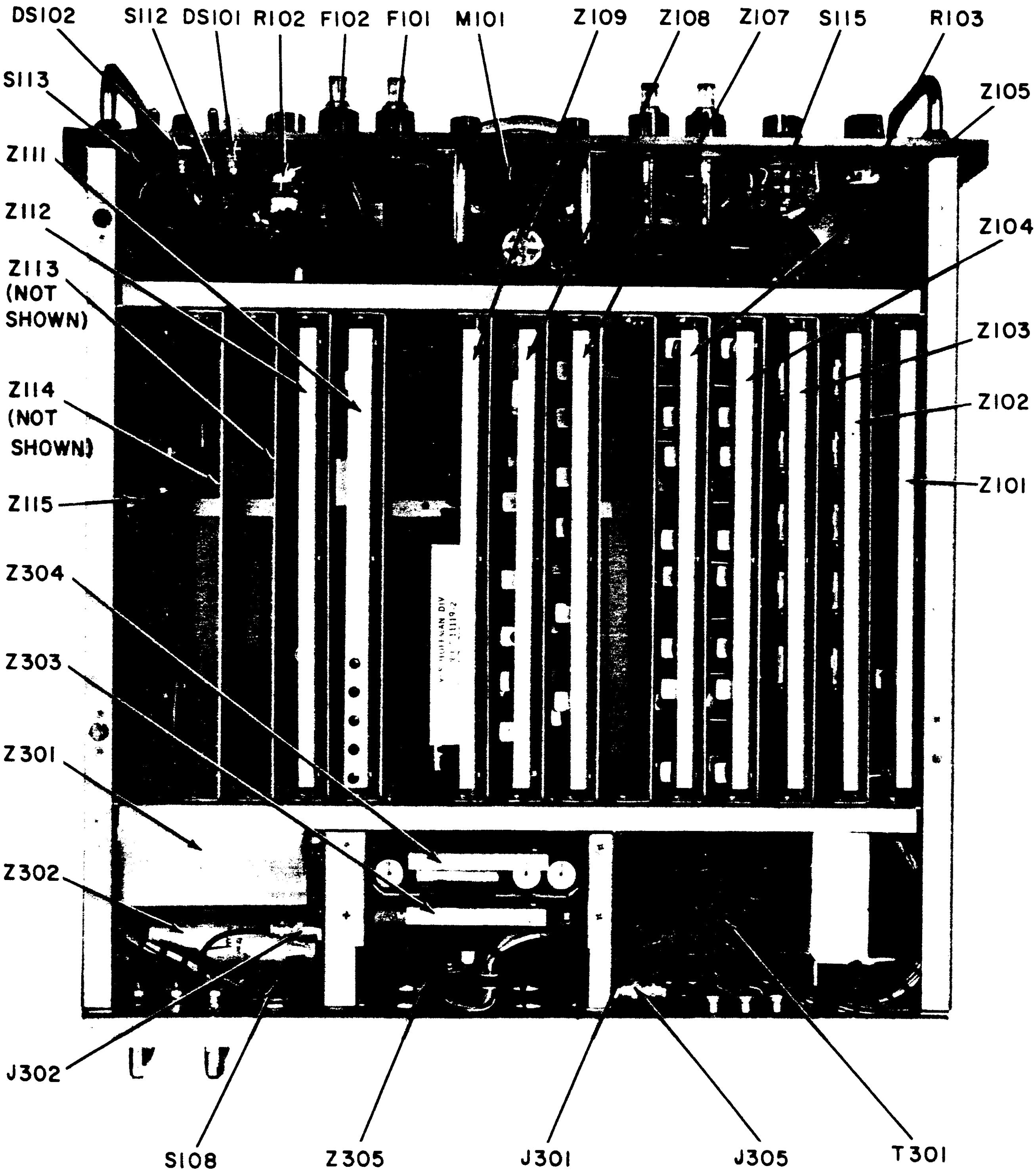


Figure 5-7. LFE Top View, Location of Major Components

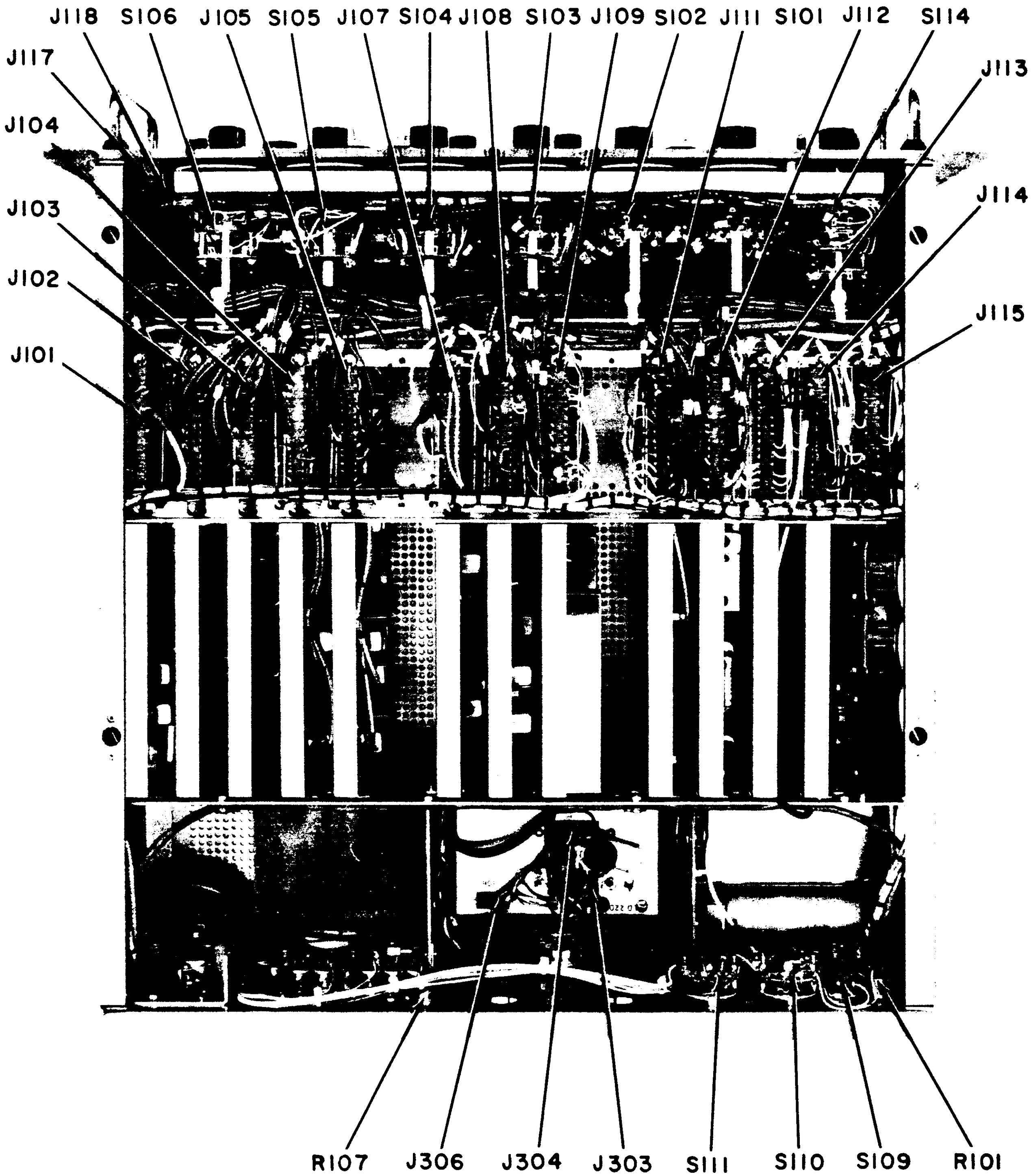


Figure 5-8. LFE Bottom View, Location of Major Components

5-4. REPAIR OF PRINTED CIRCUITRY

a. INTRODUCTION. Repair of the chassis-mounted power supply circuitry follows standard laboratory procedures. Repair of printed circuit cards and card receptacle wiring, however, require the special tools and techniques as outlined here. Section 6, Parts List, lists all replaceable parts and their circuit symbol numbers. These symbol numbers are shown on the schematics contained in Section 7 and located on figures 5-10 through 5-23.

NOTE

> Replacement of parts on the printed circuit boards requires the special tools and techniques described in table 5-3.

b. REPLACEMENT OF PARTS. When replacing a part on a board, it is necessary to remove the old part from the board by melting the solder on all the component pins. Soldering the new part to the board is done pin-by-pin with conventional methods.

c. CHECKING PRINTED CIRCUIT CONDUCTORS. Breaks in the conducting strip (foil) on a printed circuit board can cause permanent or intermittent trouble. In many instances, these breaks will be so small that they cannot be detected by the naked eye. These invisible cracks (breaks) can be located only with the aid of a powerful magnifying glass.

To check out and locate trouble in the conducting strips of a printed circuit board, set up a multimeter (one which does not use a current in excess of 1 ma) for making point-to-point resistance tests, using needle probes. Insert one point into the conducting strip, close to the end of terminal, and place the other probe on the terminal or opposite end of the conducting strip. The multimeter should indicate continuity. If the multimeter indicates an open circuit, drag the probe along the strip (or if the conducting strip is coated, puncture the coating at intervals) until the multimeter indicates continuity. Mark this area; then use a magnifying glass to locate the fault in the conductor.

CAUTION

> Before using an ohmmeter for testing a circuit containing transistors or other voltage-sensitive semiconductors, check the current it passes under test on all ranges. DO NOT use a range that passes more than 1 ma.

d. REPAIR OF PRINTED CONDUCTORS. If the break in the conductor strip is small, lightly scrape away any coating covering the area of the conducting strip to be repaired. Clean the area with a firm-bristly brush and approved solvent. Then repair the cracked or broken area of the conducting strip by flowing solder over the break. Considerable care must be exercised to keep the solder from flowing onto an adjacent strip.

If a strip is burned out or fused, cut and remove the damaged strip. Connect a length of insulated wire across the breach or from solder-point to solder-point.

After the repairs are completed, clean the repaired area with a stiff brush and solvent. Allow the board to dry thoroughly, and then coat the repaired area with an epoxy resin or similar compound. This coating not only will protect the repaired area, but will help to strengthen it.

CAUTION

> After repairs, check the board for solder drippings; they may cause shorts.

Frequently, a low resistance leakage path will be created by moisture and/or dirt that has carbonized onto the phenolic board. This leakage can be detected by measuring the suspected circuit with a multimeter. To overcome this condition, thoroughly clean the carbonized area with solvent and a stiff brush. If this does not remove it, use a scraping tool (spade end of a solder-air tool or its equivalent) to remove the carbon or drill a hole through the leakage path to break the continuity of the leakage. When the drilling method is used, be careful not to drill into a part mounted on the other side.

SECTION 6
PARTS LIST

6-1. INTRODUCTION.

The parts list presented in this section is a cross-reference list of parts identified by a reference designation and TMC part number. In most cases, parts appearing on schematic diagrams are assigned reference designations in accordance with MIL-STD-16. Wherever practicable, the reference designation is marked on the equipment, close to the part it identifies. In most cases, mechanical and electro-mechanical parts have TMC part numbers stamped on them.

To expedite delivery when ordering any part, specify the following:

a. Assembly number and Reference symbol - ex. A-4475 - C1

b. Description as indicated in parts list.

c. TMC part number.

d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

For replacement parts not covered by warranty (refer to warranty sheet in front of manual), address all purchase orders to:

The Technical Materiel Corporation
Attention: Sales Department
700 Fenimore Road
Mamaroneck, New York

Main Chassis

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C101 thru C103	Capacitor,Fixed,Mica	CB21QB102K
C104 thru C106	Capacitor,Fixed,Ceramic	CC100-28
C107	Same as C101	
C108	Same as C101	
C109	Same as C101	
C110	Capacitor,Fixed,Ceramic	CC100-41
C111	Same as C101	
C112	Same as C110	
C113	Same as C101	
C114	Same as C101	
C115	Same as C104	
C116	Same as C101	
C117	Same as C101	
C118	Capacitor,Fixed,Ceramic	CC100-29
C119	Same as C118	
C120	Same as C104	
C121	Not used	
C122 thru C124	Same as C104	
C125	Capacitor,Fixed,Ceramic	CC100-33
C126	Same as C101	

MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C127	Same as C118	
C128	Not used	
C129	Same as C118	
C130	Same as C118	
C131	Capacitor,Fixed,Electrolytic	CE105-10-50
C157	Same as C118	
CR1	Semiconductor,Device,Diode	1N39A
DS101	Lamp,Incandescent	BI110-7
DS102	Same as DS101	
F101	Fuse,Cartridge	FU102-1.00
F102	Same as F101	
F103	Fuse,Cartridge	FU102-.500
F104	Same as F103	
J101 thru J105	Connector,Receptacle,Female	JJ319A15DFE
J106	Not used	
J107 thru J115	Same as J101	
J116	Connector,Receptacle,Male	MS3102A16S5P
J117	Jack,Telephone	JJ034
J118	Jack,Telephone	JJ033
J119	Not used	

MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J120 thru J125	Connector,Receptacle,Rf	UG625/U
L101 thru L103	Coil,Rf,Fixed	CL240-120
L104 thru L106	Coil,Rf,Fixed	CL275-121
L107 thru L109	Same as L101	
L110	Not used	
L111	Same as L101	
L112	Same as L104	
L113	Same as L101	
L114	Same as L101	
L115	Not used	
L116	Same as L101	
L117	Same as L101	
L118	Not used	
L119	Same as L104	
L124	Coil,Rf,Fixed	CL349-1
M101	Meter	MR191-10
P305	Connector,Plug,Miniature	PL204
P306	Connector,Receptacle,Male	PL225-8P
Q301	Transistor,Silicon,NPN	2N1488
Q302	Same as Q301	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q303	Same as Q301	
R101	Resistor,Variable,Composition	RV106UX88102A
R102	Resistor,Variable,Composition	RV108-2
R103	Resistor,Variable,Composition	RV4NAYSD501A
R104	Resistor,Variable,Composition	RV110-1
R105	Same as R104	
R106	Resistor,Variable,Composition	RV106UX8B-103A
R107	Same as R106	
R108	Resistor,Fixed,Wirewound	RW126-41RO
R109	Same as R108	
R110	Resistor,Fixed,Composition	RC07GF304J
R111	Not used	
R112	Not used	
R113	Not used	
R114	Resistor,Fixed,Composition	RC07GF473J
R115	Same as R114	
R116	Resistor,Fixed,Composition	RF07GF102J
R117	Same as R116	
R118	Resistor,Fixed,Composition	RC07GF222J
R119	Resistor,Fixed,Composition	RC07GF392J
R120	Same as R119	
R121	Resistor,Fixed,Composition	RC07GF104J

MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R122	Resistor,Fixed,Composition	RC07GF473J
R123	Resistor,Fixed,Composition	RC07GF272J
R124	Resistor,Fixed,Composition	RC07GF151J
R125	Same as R124	
R126	Resistor,Fixed,Composition	RC07GF822J
R127	Resistor,Fixed,Composition	RC20GF222J
R128	Resistor,Fixed,Composition	RC20GF102J
R129	Not used	
R130	Resistor,Fixed,Composition	RC07GF820J
R131	Resistor,Fixed,Composition	RC07GF680J
R161	Resistor,Fixed,Composition	RC07GF563J
R193	Resistor,Fixed,Composition	RC07GF103J
S101	Switch,Rotary	SW443
S102	Same as S101	
S103 thru S105	Switch,Rotary	SW441
S106	Switch,Rotary	SW442
S107	Not used	
S108	Switch,Toggle,SPT	ST103-11-62
S109	Same as S108	
S110	Switch,Rotary	SW447
S111	Switch,Rotary	SW446
S112	Switch,Toggle,DPDT	ST22N

MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S113	Same as S112	
S114	Not used	
S115	Switch,Rotary	SW445
TB103 thru TB105	Terminal,Board,Barrier	TM100-6
XDS101	Light,Indicator,Red	TS153-2
XDS102	Light,Indicator,White	TS153-5
XF101	Fuse,Holder	FH104-3
XF102	Same as XF101	
Z101	Spectrum,Generator	A-4619
Z102	Comb,Filter A	A-4522
Z103	Comb,Filter B	A-4523
Z104	Mixer,Divider,Dual	A-4475
Z105	Same as Z104	
Z106	Not used	
Z107	Mixer,Final	A-4479
Z108	Translator	A-4621
Z109	Sideband,Generator	A-4524
Z110	Not used	
Z111	F.S. Generator	A-4525
Z112	Carrier,Generator	A-4526
Z113	Not used	
Z114	Output,Filter	A-4653

MAIN CHASSIS

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Z115	R.F. Output	A-4620
Z305	Heat,Sink,Assembly	BMA173

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic, 1000 uuf, GMV, 500 WVDC	CC100-29
C2 thru C5	Same as C1	
C6	Capacitor, Fixed, Mica 220 uuf, ±2%, 500 WVDC	CM111F221G5S
C7	Same as C1	
C8	Capacitor, Fixed, Mica, 1200 uuf, ±½%, 500 WVDC	CM11SF122D5S
C9	Not Used	
C10	Not Used	
C11	Same as C6	
C12	Same as C6	
C13	Capacitor, Fixed, Mica, 5 uuf, ±10%, 500 WVDC	CM111C050K5S
C14 thru C17	Same as C1	
C18	Same as C6	
C19	Same as C13	
C20	Same as C1	
C21	Same as C6	
C22 thru C25	Same as C1	
C26	Capacitor, Fixed, Mica, 180 uuf, ±2%, 500 WVDC	CM111F181G5S
C27	Not Used	
C28	Same as C1	
C29	Capacitor, Fixed, Mica, 1500 uuf, ±½%, 500 WVDC	CM112F152D5S
C30	Same as C29	
C31	Capacitor, Fixed, Mica, 130 uuf, ±2%, 500 WVDC	CM111F131J5S

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C32	Capacitor, Fixed, Mica, 12 uuf, ±5%, 500 WVDC	CM111C120J5S
C33	Same as C31	
C34 thru C36	Same as C1	
C37	Same as C31	
C38	Same as C1	
C39	Same as C31	
C40	Same as C32	
C41 thru C44	Same as C1	
C45	Same as C31	
C46 thru C49	Same as C1	
C50	Capacitor, Fixed, Mica, .01 uf, ±20%, 500 WVDC	CC100-41
C51	Same as C50	
C52	Same as C50	
C53	Same as C8	
C54 thru C62	Not Used	
C63	Same as C8	
C64 thru C69	Same as C1	
C70	Same as C6	
C71	Same as C1	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C72	Same as C6	
C73	Same as C13	
C74	Same as C6	
C75 thru C78	Same as C1	
C79	Same as C6	
C80	Same as C13	
C81	Same as C1	
C82	Same as C6	
C83 thru C86	Same as C1	
C87	Same as C26	
C88	Same as C1	
C89	Not Used	
C90	Same as C29	
C91	Same as C29	
C92	Same as C31	
C93	Same as C32	
C94	Same as C31	
C95 thru C97	Same as C1	
C98	Same as C31	
C99	Same as C1	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C100	Same as C31	
C101	Same as C32	
C102 thru C105	Same as C1	
C106	Same as C31	
C107 thru C111	Same as C1	
C112 thru C114	Same as C50	
C115	Same as C8	
CR1,CR2	Semiconductor Device Diode - Matched Pair	DD139
CR3,CR4	Same as CR1, CR2	
CR5	Semiconductor, Device Diode	1N752
CR10	Same as CR5	
L1	Coil, Radio Frequency, Fixed, 8.2 uh, ±10%, molded case	CL275-8R2
L2	Coil, Radio Frequency, Fixed, 120 uh, ±10%, molded case	CL275-121
L3	Coil, Radio Frequency, Fixed, 220 uh, ±10%, molded case	CL275-221
L4	Coil, Radio Frequency, Fixed, 15 uh, ±10%, molded case	CL275-150
L5	Same as L2	
L6	Same as L1	
L7	Same as L2	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L8	Same as L3	
L9	Same as L4	
Q1	Transistor	2N3646
Q2 thru Q14	Same as Q1	
R1	Resistor, Fixed, Composition, 390 ohms, ±5%, ¼ watt	RC07GF391J
R2	Resistor, Fixed, Composition, 56 ohms, ±5%, ¼ watt	RC07GF560J
R3	Resistor, Fixed, Composition, 1500 ohms, ±5%, ¼watt	RC07GF152J
R4	Resistor, Fixed, Composition, 8200 ohms, ±5%, ¼watt	RC07GF822J
R5	Resistor, Fixed, Composition, 680 ohms, ±5%, ¼ watt	RC07GF681J
R6	Resistor, Fixed, Composition, 330 ohms, ±5%, ¼ watt	RC07GF331J
R7	Resistor, Fixed, Composition, 15 ohms, ±5%, ¼ watt	RC07GF150J
R8	Resistor, Fixed, Composition, 120 ohms, ±5%, ¼ watt	RC07GF121J
R9	Resistor, Variable, Composition, 500 ohms, ±30%, 0.5 watts	RV124-1-501
R10	Resistor, Fixed, Composition, 1000 ohms, ±5%, ¼watt	RC07GF102J
R11	Same as R1	
R12	Resistor, Fixed, Composition, 27000 ohms, ±5%, ¼ watt	RC07GF273J
R13	Resistor, Fixed, Composition, 3300 ohms, ±5%, ¼watt	RC07GF332J
R14	Resistor, Fixed, Composition, 470 ohms, ±5%, ¼ watt	RC07GF471J
R15	Same as R7	
R16	Same as R6	
R17	Same as R5	
R18	Resistor, Fixed, Composition, 4700 ohms, ±5%, ¼watt	RC07GF472J

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R19	Resistor, Fixed, Composition, 10000 ohms, ±5%, ¼ watt	RC07GF103J
R20	Same as R5	
R21	Same as R6	
R22	Resistor, Fixed, Composition, 47 ohms, ±5%, ¼watt	RC07GF470J
R23	Same as R9	
R24	Resistor, Fixed, Composition, 6800 ohms, ±5%, ¼ watt	RC07GF682J
R25	Same as R13	
R26	Same as R12	
R27	Same as R10	
R28	Same as R7	
R29	Resistor, Fixed, Composition, 560 ohms, ±5%, ¼watt	RC07GF561J
R30	Same as R24	
R31	Resistor, Fixed, Composition, 270 ohms, ±5%, ¼watt	RC07GF271J
R32	Same as R13	
R33	Resistor, Fixed, Composition, 18000 ohms, ±5%, ¼ watt	RC07GF183J
R34	Same as R10	
R35	Same as R7	
R36	Same as R29	
R37	Resistor, Fixed, Composition, 220 ohms, ±5%, ¼watt	RC07GF221J
R38	Resistor, Fixed, Composition, 100000 ohms, ±5%, ¼ watt	RC07GF104J
R39	Same as R38	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R40	Resistor, Fixed, Composition, 2200 ohms, ±5%, ¼ watt	RC07GF222J
R41	Same as R19	
R42	Resistor, Fixed, Composition, 3900 ohms, ±5%, ¼ watt	RC07GF392J
R43	Resistor, Fixed, Composition, 100 ohms, ±5%, ½ watt	RC20GF101J
R44	Same as R40	
R45	Same as R5	
R46	Same as R8	
R47	Same as R1	
R48	Same as R2	
R49	Same as R3	
R50	Same as R4	
R51	Same as R5	
R52	Same as R7	
R53	Same as R6	
R54	Same as R9	
R55	Same as R10	
R56	Same as R1	
R57	Same as R13	
R58	Same as R12	
R59	Same as R10	
R60	Same as R7	
R61	Same as R14	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R62	Same as R6	
R63	Same as R5	
R64	Same as R18	
R65	Same as R19	
R66	Same as R5	
R67	Same as R6	
R68	Same as R22	
R69	Same as R9	
R70	Same as R24	
R71	Same as R13	
R72	Same as R12	
R73	Same as R10	
R74	Same as R7	
R75	Same as R29	
R76	Same as R24	
R77	Same as R31	
R78	Same as R13	
R79	Same as R33	
R80	Same as R10	
R81	Same as R7	
R82	Same as R29	
R83	Resistor, Fixed, Composition, 220 ohms, ±5%, ½watt	RC20GF221J
R84	Same as R38	
R85	Same as R38	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R86	Same as R40	
R87	Same as R19	
R88	Same as R42	
R89	Same as R43	
R90	Same as R40	
R91	Same as R5	
R92 thru R94	Same as R10	
R95	Resistor, Fixed, Composition, 18 ohms, ±5%, ¼watt	RC07GF180J
R96	Same as R29	
R97	Same as R29	
R98	Same as R10	
R99	Same as R10	
R100	Same as R29	
R101	Same as R29	
R102	Same as R29	
T1	Transformer, Radio Frequency, tuned	TT285-4
T2	Transformer, Radio Frequency, tuned	TT285-2
T3 thru T5	Same as T2	
T6	Transformer, Radio Frequency, tuned	TT285-17
T7	Transformer, Radio Frequency, tuned	TT285-3
T8	Same as T1	
T9	Same as T7	

MIXER DIVIDER
A-4475

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T10 thru T12	Same as T1	
T13 thru T16	Same as T2	
T17	Same as T6	
T18	Sameaas T7	
T19	Same as T1	
T20	Same as T7	
T21	Same as T1	
T22	Same as T1	
Z1	Network, Decade Counter	NW134
Z2	Same as Z1	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic, 1,000 uuf, GMV, 500 WVDC	CC100-29
C2	Same as C1	
C3	Capacitor, Fixed, Mica, 220 uuf, ±2%, 500 WVDC	CM111F221G5S
C4 thru C7	Same as C1	
C8	Capacitor, Fixed, Mica, 1,200 uuf, ±5%, 500 WVDC	CM112F122J5S
C9	Not used	
C10	Same as C3	
C11	Capacitor, Fixed, Mica, 5 uuf, ±10%, 500 WVDC	CM111C050K5S
C12	Same as C3	
C13	Same as C1	
C14	Same as C1	
C15	Capacitor, Fixed, Mica, 270 uuf, ±1%, 500 WVDC	CM111F271F5S
C16	Same as C11	
C17	Same as C3	
C18	Same as C1	
C19	Same as C1	
C20	Same as C3	
C21	Same as C1	
C22	Capacitor, Fixed, Mica, 1,500 uuf, ±½%, 500 WVDC	CM112F152DS
C23	Same as C22	
C24	Capacitor, Fixed, Mica, 130 uuf, ±2%, 500 WVDC	CM111F131G5S
C25	Capacitor, Fixed, Mica, 12 uuf, ±5%, 500 WVDC	CM111C120J5S
C26	Same as C24	
C27	Same as C1	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C28	Same as C24	
C29	Same as C1	
C30	Same as C24	
C31	Same as C25	
C32	Same as C1	
C33	Same as C1	
C34	Not used	
C35	Same as C1	
C36	Capacitor, Variable, Ceramic, 9 to 35 uuf, 100 WVDC	CV112-2
C37	Capacitor, Fixed, Ceramic, 20000 uuf, +80-20%, 25 WVDC	CC100-40
C38 thru C44	Same as C37	
C45	Capacitor, Fixed, Mica, 200 uuf, ±5%, 500 WVDC	CM111F201J5S
C46	Same as C1	
C47	Same as C1	
C48	Same as C36	
C49 thru C51	Same as C1	
C52	Same as C45	
C53	Same as C25	
C54	Same as C1	
C55	Same as C1	
C56	Same as C11	
C57	Same as C3	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C58 thru C64	Same as C1	
CR1	Semiconductor, Device, Diode	DD139
CR2 thru CR4	Same as CR1	
CR5	Semiconductor Device, Diode	1N4864
CR6	Same as CR5	
CR8	Semiconductor Device, Diode	1N914
CR7	Same as CR5	
CR9	Semiconductor Device, Diode	1N751
L1	Not used	
L2	Coil, Radio Frequency, fixed, 8.2 uh, ±10%, molded case	CL275-8.2
L3	Coil, Radio Frequency, fixed, 120 uh, ±10%, molded case	CL275-121
L4 thru L12	Same as L3	
Q1	Transistor	2N3646
Q2 thru Q8	Same as Q1	
R1	Resistor, Fixed, Composition, 390 ohms, ±5%, ¼ watt	RC07GF391J
R2	Resistor, Fixed, Composition, 56 ohms, ±5%, ¼ watt	RC07GF560J
R3	Resistor, Fixed, Composition, 8200 ohms, ±5%, ¼watt	RC07GF822J
R4	Resistor, Fixed, Composition, 2200 ohms, ±5%, ¼watt	RC07GF222J
R5	Same as R1	
R6	Resistor, Fixed, Composition, 220 ohms, ±5%, ¼ watt	RC07GF221J
R7	Resistor, Variable, Composition, 500 ohms, ±30%, 0.5 watts	RV124-1-501
R8	Same as R6	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R9	Resistor, Fixed, Composition, 120 ohms, ±5%, ¼ watt	RC07GF121J
R10	Resistor, Fixed, Composition, 1,800 ohms, ±5%, ¼watt	RC07GF182J
R11	Resistor, Fixed, Composition, 10000 ohms, ±5%, ¼watt	RC07GF103J
R12	Resistor, Fixed, Composition, 15 ohms, ±5%, ¼ watt	RC07GF150J
R13	Resistor, Fixed, Composition, 1000 ohms, ±5%, ¼ watt	RC07GF102J
R14	Resistor, Fixed, Composition, 4700 ohms, ±5%, ¼ watt	RC07GF472J
R15	Same as R11	
R16	Same as R1	
R17	Resistor, Fixed, Composition, 8.2 ohms, ±5%, ¼ watt	RC07GF8R2J
R18	Same as R7	
R19	Resistor, Fixed, Composition, 330 ohms, ±5%, ¼ watt	RC07GF331J
R20	Resistor, Fixed, Composition, 470 ohms, ±5%, ¼ watt	RC07GF471J
R21	Resistor, Fixed, Composition, 47 ohms, ±5%, ¼ watt	RC07GF470J
R22	Resistor, Fixed, Composition, 6800 ohms, ±5%, ¼watt	RC07GF682J
R23	Resistor, Fixed, Composition, 3300 ohms, ±5%, ¼ watt	RC07GF332J
R24	Resistor, Fixed, Composition, 12000 ohms, ±5%, ¼watt	RC07GF123J
R25	Resistor, Fixed, Composition, 560 ohms, ±5%, ¼ watt	RC07GF561J
R26	Same as R22	
R27	Resistor, Fixed, Composition, 270 ohms, ±5%, ¼ watt	RC07GF271J
R28	Same as R22	
R29	Resistor, Fixed, Composition, 33 ohms, ±5%, ¼ watt	RC07GF330J
R30	Same as R19	
R31	Resistor, Fixed, Composition, 1 meg ohm, ±5%, ¼ watt	RC07GF105J
R32	Resistor, Fixed, Composition, 47000 ohms, ±5%, ¼ watt	RC07GF473J
R33	Same as R6	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R34	Same as R31	
R35	Resistor, Fixed, Composition: 680 ohms, ±5%, ¼watt	RC07GF681J
R36	Same as R13	
R37	Same as R14	
R38	Same as R19	
R39	Same as R12	
R40	Resistor, Fixed, Composition, 22 ohms, ±5%, ¼ watt	RC07GF220J
R41	Resistor, Fixed, Composition	RC07GF100J
R42 thru R44	Same as R6	
R45	Same as R27	
R46	Same as R24	
R47	Same as R24	
R48	Resistor, Fixed, Composition, 1200 ohms, ±5%, ¼watt	RC07GF122J
R49	Resistor, Fixed, Composition, 180 ohms, ±5%, ¼ watt	RC07GF181J
T1	Transformer, Radio Frequency, tuned	TT285-4
T2	Transformer, Radio Frequency, tuned	TT285-2
T3	Same as T2	
T4	Same as T2	
T5	Transformer, Radio Frequency, tuned	TT285-6
T6	Same as T2	
T7	Transformer, Radio Frequency, tuned	TT285-3
T8	Same as T1	
T9	Same as T7	
T10	Same as T1	

MIXER FINAL A-4479

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T11	Transformer, Radio Frequency, tuned	TT285-7
T12	Transformer, Radio Frequency, tuned	TT285-18
T13	Same as T1	
Z1	NTWK, Nandgate	NW176
R56	Same as R13	
R52	Same as R9	
R54	Same as R48	
R53	Resistor, Fixed, Composition	RC07GF152J
R50	Resistor, Fixed, Composition	RC07GF223J
R51	Resistor, Fixed, Composition	RC07GF242J
R55	Same as R20	
R57	Same as R25	

PC BD A POWER SUPPLY A-4512

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Electrolytic, 200 mfd, 50 WVDC	CE105-200-50
C2	Same as C1	
C3	Capacitor, Fixed, Electrolytic, 150 mfd, 75 WVDC	CE105-150-75
C4	Same as C3	
CR1	Rectifier, Semiconductor, Device	DD130-200-40

PC BD B POWER SUPPLY A-4513

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed Electrolytic, 25 mfd, +50-15%, 50 WVDC	CE107-6
C2	Same as C1	
C3	Same as C1	
C4	Same as C1	
C5	Same as C1	
CR1	Semiconductor, Device Diode	1N100
CR2	Same as CR1	
CR3	Semiconductor, Device, Diode	1N4619
CR4	Semiconductor, Device, Diode	1N753A
CR5	Same as CR3	
CR6	Semiconductor, Device, Diode	1N972B
CR7	Same as CR4	
Q1	Transistor	2N1481
Q2	Same as Q1	
Q3	Same as Q1	
Q4	Transistor	2N3638
Q5	Same as Q1	
Q6	Same as Q4	
Q7	Same as Q1	
R1	Resistor, Fixed, Composition, 470 ohms, ±5%, ¼ watt	RC07GF471J
R2	Resistor, Fixed, Composition, 1000 ohms, ±5%, ¼watt	RC07GF102J
R3	Resistor, Variable, Composition, 1000 ohms, ±30%, ½ watt	RV124-1-102
R4	Same as R2	

PC BD B POWER SUPPLY A-4513

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R6	Resistor, Fixed, Composition, 10000 ohms, ±5%, ¼watt	RC07GF103J
R7	Same as R2	
R8	Same as R3	
R9	Resistor, Fixed, Composition, 4700 ohms, ±5%, ¼watt	RC07GF472J
R10	Resistor, Fixed, Composition, 1500 ohms, ±5%, ¼watt	RC07GF152J
R11	Resistor, Fixed, Wirewound, 10 ohms, ±2%, 5 watt	RR114-10W2
R12	Same as R3	
R13	Resistor, Fixed, Composition, 6800 ohms, ±5%, ¼watt	RC07GF682J
R14	Same as R2	
R16	Resistor, Fixed, Composition, 4700 ohms, ±5%, ¼watt	RC07GF472J
R17	Resistor, Fixed, Composition, 150 ohms, ±5%, ¼watt	RC07GF151J
R18	Resistor, Variable, Composition	RV124-1-103
R19	Same as R17	

A 4522

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C501	Capacitor, Variable, Ceramic, 20,000 uufd, +60%-40%, 150 WVDC.	CC100-35
C502	Capacitor, Fixed, Mica, 1800 uufd, ±2%, 500 WVDC.	CM112F182G5S
C503	Capacitor, Fixed, Ceramic, 1000 uufd, GMV,500 WVDC.	CC100-29
C504	Capacitor, Variable, Ceramic, 10000 uufd, GMV, 500 WVDC.	CC100-16
C505 thru C509	Same as C501.	
C510	Capacitor, Variable, Ceramic, 5.5-18 uufd, 100 WVDC.	CV112-7
C511	Same as C510.	
C512	Same as C501.	
C513	Same as C501.	
C514	Same as C502.	
C515	Same as C501.	
C516	Same as C501.	
C517	Same as C502.	
C518	Same as C501.	
C519	Same as C504.	
C520	Same as C503.	
C521	Same as C504.	
C522	Same as C510.	
C523	Same as C501.	
C524	Same as C501.	
C525	Capacitor, Fixed, Mica, 2400 uufd, ±2%, 500 WVDC.	CM112F242G5S

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C526	Same as C501.	
C527	Same as C525.	
C528	Same as C501.	
C529	Same as C503.	
C530	Same as C504.	
C531	Same as C504.	
C532	Same as C510.	
C533	Same as C501.	
C534	Same as C501.	
C535	Capacitor, Fixed, Mica, 2700 uufd, ±1%, 500 WVDC.	CM-112F272F5S
C536	Same as C501.	
C537	Same as C501.	
C538	Same as C501.	
C539	Same as C503.	
C540	Same as C535.	
C541	Same as C504.	
C542	Same as C504.	
C543	Same as C510.	
C544	Same as C501.	
C545	Same as C501.	
C546	Same as C535.	
C547	Same as C501.	
C548	Same as C501.	
C549	Same as C535.	

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C567 thru C571		CM111C100J5S
C550	Same as C501.	
C551	Same as C503.	
C552	Same as C504.	
C553	Same as C504.	
C554 thru C558	Same as C510	
C565	Same as C504.	
C566	Same as C501.	
L501	Coil, RF, Fixed, 120 uhy, ±10%, Molded.	CL275-121
L502 thru L510	Same as L501.	
Q501	Transistor, Silicon.	2N3646
Q502 thru Q505	Same as Q501.	
Q506 thru Q510	Same as Q501.	
R501	Resistor, Fixed, Composition, 15000 ohms, ±5%, 1/4 watt.	RC07GF153J
R502	Resistor, Fixed, Composition, 3300 ohms, ±5%, 1/4 watt.	RC07GF332J
R503	Resistor, Fixed, Composition, 500 ohms, ±30%, 1/4 watt.	RV124-1-501
R504	Resistor, Fixed, Composition, 1000 ohms, ±5%, 1/4 watt.	RC07GF102J
R505	Resistor, Fixed, Composition, 8200 ohms, ±5%, 1/4 watt.	RC07GF822J
R506	Resistor, Fixed, Composition, 470,000 ohms, ±5%, 1/4 watt.	RC07GF474J

A 4522

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R507	Resistor, Fixed, Composition, 560 ohms, ±5%, 1/4	RC07GF561J
R508	Same as R507.	
R509	Same as R506.	
R510	Same as R505.	
R511	Same as R504.	
R512	Same as R501.	
R513	Same as R502.	
R514	Same as R503.	
R515	Same as R507.	
R516	Same as R506.	
R517	Same as R505.	
R518	Same as R504.	
R519	Same as R501.	
R520	Same as R502.	
R521	Same as R503.	
R522	Same as R507.	
R523	Same as R506.	
R524	Same as R505.	
R525	Same as R504.	
R526	Same as R501.	
R527	Same as R502.	
R528	Same as R503.	
R529	Same as R507.	

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R530	Same as R506.	
R532	Same as R504.	
R533	Same as R501.	
R534	Same as R502.	
R535	Same as R503.	
R536	Resistor, Fixed, Composition, 100 ohms, ±5%, 1/4 watt.	RC07GF101J
R537 thru R540	Same as R536.	
R541 thru R545	Same as R507	
R551	Same as R505.	
T501	Transformer, RF, Adj.	TT286-2
T502	Transformer, RF, Adj.	TT-286-1
T503	Same as T501.	
T504	Same as T502.	
T505	Transformer, RF, Adj.	TT-286-4
T506	Transformer, RF, Adj.	TT-286-3
T507	Transformer, RF, Adj.	TT286-6
T508	Transformer, RF, Adj.	TT286-5
T509	Same as T507.	
T510	Same as T508.	
TP501	Terminal Stud.	TE0127-2
TP502 thru TP510	Same as TP501.	
XY501	Socket, Crystal.	TS167-1
XY502 thru XY505	Same as XY501.	

A 4522

COMB. FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Y501	Crystal, Unit, Quartz, 1.8 MHz.	CR109-100
Y502	Crystal, Unit, Quartz, 1.0 MHz.	CR109-98
Y503	Crystal, Unit, Quartz, 1.2 MHz.	CR109-96
Y504	Crystal, Unit, Quartz, 1.4 MHz.	CR109-94
Y505	Crystal, Unit, Quartz, 1.6 MHz.	CR109-92

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C601	Capacitor, Fixed, Ceramic, 20000 uufd, +60%/-20%, 150 wvdc.	CC100-35
C602	Capacitor, Fixed, Mica, 1600 uufd, ±2%, 500 WVDC.	CM112F162G5S
C603	Capacitor, Fixed, Ceramic, 1000 uufd, GMV, 500 WVDC.	CC100-29
C604	Capacitor, Fixed, Ceramic, 10000 uufd, GVM, 500 WVDC.	CC100-16
C605	Same as C601.	
C606	Same as C601.	
C607	Same as C601.	
C608	Same as C602.	
C609	Same as C601.	
C610	Capacitor, Variable, Ceramic, 5.5-18uufd, 100 WVDC.	CV112-7
C611	Same as C610.	
C612	Same as C601.	
C613	Same as C601.	
C614	Capacitor, Fixed, Mica, 2000 uufd, ±2%, 500 WVDC.	CM112F202G5S
C615	Same as C601.	
C616	Same as C601.	
C617	Same as C614.	
C618	Same as C601.	
C619	Same as C604.	
C620	Same as C603.	
C621	Same as C604.	
C622	Same as C610.	
C623	Same as C601.	
C624	Same as C601.	

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C625	Capacitor, Fixed, Mica, 2200 uufd, ±1%, 500 WVDC.	CM112F222F5S
C626	Same as C601.	
C627	Same as C625.	
C628	Same as C601.	
C629	Same as C603.	
C630	Same as C604.	
C631	Same as C604.	
C632	Same as C610.	
C633	Same as C601.	
C634	Same as C601.	
C635	Same as C625.	
C636	Same as C601.	
C637	Same as C601.	
C638	Same as C601.	
C639	Same as C603.	
C640	Same as C625.	
C641	Same as C604.	
C642	Same as C604.	
C643	Same as C610.	
C644	Same as C601.	
C645	Same as C601.	
C646	Capacitor, Fixed, Mica, 3300 uufd, ±2%, 500 WVDC.	CM112F332G05S
C647	Same as C601.	
C648	Same as C601.	

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C649	Same as C646.	
C650	Same as C601.	
C651	Same as C603.	
C652	Same as C604.	
C653	Same as C604.	
C654 thru C658	Same as C610.	
C665	Same as C604.	
C666	Same as C601.	
C667 thru C671		CM111C100J5S
L601	Coil, R.F., ADJ., 120 uhy, ±10%, Molded Case.	CL275-121
L602 thru L610	Same as L601.	
Q601	Transistor, Silicon.	2N3646
Q602 thru Q610	Same as Q601.	
R601	Resistor, Fixed, Composition, 15000 ohm, ±5%, 1/4 watt.	RC07GF153J
R602	Resistor, Fixed, Composition, 3300 ohms, ±5%, 1/4 watt.	RC07GF332J
R603	Resistor, Fixed, Composition, 500 ohms, ±30%, 1/2 watt.	RV124-1-501
R604	Resistor, Fixed, Composition, 1000 ohms, 5%, 1/4 watt.	RC07GF102J
R605	Resistor, Fixed, Composition, 8200 ohms, ±5%, 1/4 watt.	RC07Gf822J
R606	Resistor, Fixed, Composition, 470000 ohms, ±5%, 1/4 watt.	RC07GF474J

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R607	Resistor, Fixed, Composition, 560 ohms, ±5%, 1/4 watt.	RC07GF561J
R608	Same as R607.	
R609	Same as R606.	
R610	Same as R605.	
R611	Same as R604.	
R612	Same as R601.	
R613	Same as R602.	
R614	Same as R603.	
R615	Same as R607.	
R616	Same as R606.	
R617	Same as R605.	
R618	Same as R604.	
R619	Same as R601.	
R620	Same as R602.	
R621	Same as R603.	
R622	Same as R607.	
R623	Same as R606.	
R624	Same as R605.	
R625	Same as R604.	
R626	Same as R601.	
R627	Same as R602.	
R628	Same as R603.	

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R629	Same as R607.	
R630	Same as R606.	
R631	Same as R605.	
R632	Same as R604.	
R633	Same as R601.	
R634	Same as R602.	
R635	Same as R603.	
R636	Resistor, Fixed, Composition, 100 ohms, ±5%, 1/4 watt.	RC07GF101J
R637 thru R640.	Same as R636.	
R641 thru R645	Same as R607	
T601	Transformer, Radio Frequency, Tuned.	TT286-8
T602 thru T604	Same as T601.	
T605	Transformer, Radio Frequency, Tuned.	TT286-6
T606	Same as T605.	
T607	Transformer, Radio Frequency, Tuned.	TT286-4
T608	Same as T607.	
T609	Same as T607.	
T610	Same as T605.	
TP601 thru TP610	Terminal Stud.	TE0127-2
XY601 thru XY605.	Socket XTAL.	TS167-1

A 4523

COMB FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Y601	Crystal, Unit, Quartz, Frequency 1.9 MHz.	CR109-101
Y602	Crystal, Unit, Quartz, Frequency 1.7 MHz.	CR109-99
Y603	Crystal, Unit, Quartz, Frequency 1.5 MHz.	CR109-97
Y604	Crystal, Unit, Quartz, Frequency 1.3 MHz.	CR109-95
Y605	Crystal, Unit, Quartz, Frequency 1.1 MHz.	CR109-93

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, Ceramic, 100,000 uufd, +80%-20%, 100 WVDC	CC100-28
C2	Capacitor, Fixed, Electrolytic, 75 mfd, 15 WVDC	CE105-75-15
C3	Same as C1	
C5	Capacitor, Fixed, Electrolytic, 10 mfd, 25 WVDC	CE105-10-25
C4	Capacitor, Fixed, Mica, 22 uufd, ±5%, 500 WVDC	CM111C220J5S
C6	Same as C5	
C7	Capacitor, Fixed, Ceramic, 10,000 uufd, 25 WVDC	CC100-41
C8	Capacitor, Fixed, Electrolytic, 2 mfd, 50 WVDC	CE105-2-50
C9	Same as C5	
C10	Same as C7	
C11	Capacitor, Fixed, Electrolytic, 2 uufd, 50 WVDC	CE105-2-50
C12 thru C15	Same as C5	
C16	Same as C1	
C17	Same as C5	
C18	Same as C7	
C19	Same as C1	
C20	Same as C7	
C21	Capacitor, Fixed, Electrolytic, 3900 uufd, ±1%, 30 WVDC	CM112F392F5S
C22 thru C32	Same as C1	
C33	Same as C5	
C34	Same as C5	
C35	Same as C1	

SIDEBAND GENERATOR A-4524

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C36	Same as C5	
C37	Same as C7	
C38	Same as C1	
C39	Same as C7	
C40	Same as C21	
C41 thru C48	Same as C1	
C49	Capacitor, Fixed, Electrolytic, 50 mf, 50 WVDC	CE105-50-50
C50	Capacitor, Fixed, Mica, 150 uufd, ±1%, 500 WVDC	CM111F151F5S
C51	Same as C50	
C52	Capacitor, Variable, Ceramic, 15-60 uufd, 100 WVDC	CV112-5
C53	Same as C52	
C54, C55	Same as C7	
CR1	Semiconductor, Device Diode	IN541
CR2 thru CR8	Same as CR1	
L1	Coil, Fixed, R.F., 1000 ohms, ±20%, 135 ma	CL275-102
L2	Coil, Fixed, R.F., 220 ohms, ±20%, 250 ma	CL275-221
L3	Coil, Fixed, R.F. 3300 ohms, ±20%, 80 ma	CL275-332
L4	Same as L3	
Q1	Transistor, Silicon	2N3646
Q2	Transistor, Same as Q1	
Q3	Transistor, Same as Q1	
Q4	Transistor, Same as Q1	
Q5	Transistor, Same as Q1	
Q6	Transistor, Same as Q1	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
Q7 thru Q13	Transistor, Same as Q1	
R1	Resistor, Fixed, Composition, 220 ohms, ±5%, ¼ watt	RC07GF221J
R2	Resistor, Fixed, Composition, 4700 ohms, ±5%,	RC07GF221J
R3	Resistor, Fixed, Composition, 10,000 ohms, ±5%, ¼ watt	RC07GF103J
R4	Resistor, Fixed, Composition, 56,000 ohms, ±5% ¼ watt	RC07GF563J
R5	Resistor, Fixed, Composition, 100,000 ohms, ±5%, ¼ watt	RC07GF104J
R6	Same as R4	
R7	Resistor, Fixed, Composition 470,000 ohms, ±5%, ¼ watt	RC07GF474J
R8	Same as R3	
R9	Resistor, Variable, Composition, 10,000 ohms, ±30%, ½ watt	RV124-1-103
R10	Resistor, Fixed, Composition, 22,000 ohms, ±5%, ¼ watt	RC07GF223J
R11	Same as R3	
R12	Resistor, Fixed, Composition 1500 ohms, ±5%, ¼ watt	RC07GF152J
R13	Resistor, Fixed, Composition 100 ohms, ±5%, ¼ watt	RC07GF101J
R14	Resistor, Fixed, Composition, 470 ohms, ±5%, ¼ watt	RC07GF471J
R15	Same as R10	
R16	Same as R3	
R17	Same as R12	
R18	Same as R13	
R19	Same as R14	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R20	Same as R2	
R21	Resistor, Fixed, Composition, 15,000 ohms, ±5%, ¼ watt	RC07GF153J
R22	Resistor, Fixed, Composition, 1000 ohms, ±5%, ¼ watt	RC07GF102J
R23	Resistor, Fixed, Composition, 33,000 ohms, ±5%, ¼ watt	RC07GF333J
R24	Same as R21	
R25	Same as R22	
R26	Same as R22	
R27	Same as R14	
R28	Resistor, Variable, Composition, 100 ohms, ±30%, ¼ watt	RV124-1-101
R29	Same as R14	
R30	Same as R22	
R31	Same as R23	
R32	Same as R3	
R33	Same as R22	
R34	Same as R28	
R35	Same as R14	
R36	Same as R22	
R37	Same as R14	
R38	Same as R3	
R39	Resistor, Fixed, Composition, 1200 ohms, ±5%, ¼ watt	RC07GF122J
R40	Same as R3	
R41	Same as R22	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R42	Same as R3	
R43	Resistor, Fixed, Composition, 27000 ohms, ±5%, ¼ watt	RC07GF273J
R44	Same as R22	
R45	Same as R22	
R46	Same as R43	
R47	Same as R3	
R48	Same as R22	
R49	Same as R23	
R50	Same as R21	
R51	Same as R22	
R52	Same as R22	
R53	Same as R14	
R54	Same as R28	
R55	Same as R14	
R56	Same as R22	
R57	Same as R23	
R58	Same as R3	
R59	Same as R22	
R60	Same as R28	
R61	Same as R14	
R62	Same as R22	
R63	Same as R39	
R64	Same as R14	
R65	Same as R3	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R66	Same as R3	
R67	Same as R22	
R68	Same as R39	
R69	Same as R39	
R70	Same as R22	
R71	Same as R13	
R72	Same as R13	
T1	Transformer, R.F. Tuned	TT285-11
T2	Same as T1	
T3	Transformer, Audio Frequency	TF0359
T4	Same as T3	
TP1	Term, Stud	TEO-127-2
TP2	Same as TP1	
TP3	Same as TP1	
TP4	Same as TP1	
TP5	Same as TP1	
TP6	Same as TP1	
TP7 thru TP10	Term, Stud, Same as TP1	TE127-2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1001	Capacitor, Fixed, Ceramic, 100000 uufd, ±80-20%, 100 WVDC	CC100-28
C1002	Capacitor, Fixed, Ceramic, 100000 uufd, ±80-20%, 25 WVDC	CC100-41
C1003	Same as C1002	
C1004	Same as C1001	
C1005	Same as C1002	
C1006	**Same as C1012**	
C1008	Same as C1002	
C1009	Same as C1002	
C1010	Same as C1002	
C1011	Same as C1002	
C1012	Capacitor, Fixed, Ceramic, 360 uufd, ±2%, 500 WVDC	CM111F361G5S
C1013	Same as C1002	
C1014	Capacitor, Fixed, Ceramic, 1000 uufd, GMV, 500WVDC	CC100-29
C1015	Capacitor, Fixed, Ceramic, 330 uufd, ±2%, 500 WVDC	CM111F331G5S
C1016	Same as C1014	
C1017	Same as C1014	
C1018	Same as C1001	
C1019	Same as C1002	
C1020	Same as C1002	
C1021	Same as C1002	
C1022	Capacitor, Fixed, Ceramic, 20000 uufd, +80-20%, 25 WVDC	CC100-40
C1023	Same as C1002	
C1024	Sam as C1002	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1025	Same as C1002	
C1026	Same as C1002	
C1027	Capacitor, Fixed, Ceramic, 200,000 uufd, +80-20%, 25 WVDC	CC100-33
C1028	Same as C1022	
C1029	Capacitor, Fixed, Ceramic, 5 uufd, ±10%, 500 WVDC	CM111C050K55
C1030	Same as C1028	
C1031	Same as C1002	
C1032	Same as C1001	
C1033	Same as C1002	
CR1001	Semiconductor, Device, Diode	IN755A
CR1002	Same as CR1001	
CR1003	Semiconductor, Device, Diode	IN627
CR1004	Same as CR1003	
CR1005	Same as CR1003	
CR1006	Same as CR1003	
CR1007	Same as CR1003	
CR1008	Semiconductor, Device, Diode	IN914
CR1009	Same as CR1008	
CR1010	Semiconductor, Device, Diode	IN34A
CR1011	Same as CR1010	
CR1012	Same as CR1010	
CR1013	Same as CR1010	
CR1014	Subconductor, Device, Diode	IN754A
FL1001	Filter, Bandpass	FX268

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L1001	Coil, R.F., Fixed 1000 uhy, ±10%, 135 ma	CL275-102
L1002	Same as L1001	
L1003	Coil, R.F., Fixed, 220 uhy, ±10%, 250 ma	CL275-221
L1004	Coil, R.F., Fixed, 100 uhy, ±10%, 432 ma	CL275-101
L1005	Same as L1004	
Q1001	Transistor, Silicon	2N3646
Q1002	Same as Q1001	
Q1003	Same as Q1001	
Q1004	Same as Q1001	
Q1005	Transistor	2N696
Q1006	Transistor, Silicon	2N1711
Q1007	Same as Q1006	
Q1008	Same as Q1005	
Q1009	Same as Q1005	
Q1010	Same as Q1005	
Q1012	Same as Q1001	
Q1013	Same as Q1001	
R1001	Resistor, Fixed, Composition, 22000 ohms, ±5%, ¼watt	RC07GF223J
R1002	Resistor, Fixed, Composition, 33000 ohms, ±5%, ¼watt	RC07GF333J
R1003	Resistor, Fixed, Composition, 33 ohms, ±5%, ¼ watt	RC07GF330J
R1004	Resistor, Fixed, Composition, 560 ohms, ±5%, ¼ watt	RC07GF561J
R1005	Resistor, Fixed, Composition, 330 ohms, ±5%, ¼ watt	RC07GF331J
R1011	Resistor, Fixed, Composition, 15000 ohms, ±5%, ¼watt	RC07GF153J
R1012	**Resistor, Fixed Composition, 1800 ohms**	**RC07GF182J**
R1013	Resistor, Fixed, Composition, 470 ohms, ±5%, ¼ watt	RC07GF471J

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1014	**Same as R1020**	
R1016	Resistor, Fixed, Composition, 1500 ohms, ±5%, ¼ watt	RC07GF152J
R1017	Same as R1011	
R1018	Same as R1001	
R1019	Same as R1013	
R1020	Resistor, Fixed, Composition, 100 ohms, ±5%, ¼ watt	RC07GF101J
R1021	Same as R1015	
R1022	Resistor, Fixed, Composition, 220 ohms, ±5%, ¼ watt	RC07GF221J
R1023	Resistor, Fixed, Composition, 100000 ohms, ±5%, ¼ watt	RC07GF104J
R1024	Resistor, Fixed, Composition, 10000 ohms, ±5%, ¼watt	RC07GF103J
R1025	Resistor, Variable, WW, 1000 ohms, ±30%, ½ watt	RV119-3-102
R1026	Same as R1024	
R1027	Resistor, Variable, WW, 10000 ohms, ±30%, ½ watt	RV119-3-103
R1028	Same as R1024	
R1029	Resistor, Fixed, Composition, 47000 ohms, ±5%, ¼watt	RC07GF473J
R1030	Same as R1029	
R1031	Same as R1029	
R1032	Same as R1029	
R1034	Resistor, Fixed, Composition, 6800 ohms, ±5%, ¼watt	RC07GF682J
R1035	Same as R1025	
R1036	Same as R1027	
R1037	Same as R1027	
R1038	Same as R1029	
R1039	Same as R1005	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1040	Same as R1015	
R1041	Resistor, Fixed, Composition, 2200 ohms, ±5%, ¼watt	RC07GF222J
R1042	Same as R1041	
R1043	Same as R1015	
R1044	Same as R1016	
R1045	Same as R1013	
R1046	Same as R1041	
R1047	Same as R1024	
R1048	Resistor, Fixed, Composition, 4700 ohms, ±5%, ¼ watt	RC07GF472J
R1049	Same as R1015	
R1050	Same as R1001	
R1051	Same as R1024	
R1052	Same as R1001	
R1053	Same as R1001	
R1054	Same as R1013	
R1055	Same as R1048	
R1056	Resistor, Variable, Composition, 10000 ohms,±30%, ½ watt	RV124-1-103
R1057	Resistor, Fixed, Composition, 3300 ohms, ±5%, ¼ watt	RC07GF332J
R1058	Resistor, Variable, Composition, 100 ohms, ±30%, ½ watt	RV124-1-101
R1060	Same as R1015	
Z1001	Network Frequency, Divider	NW137
Z1002	NW BAL MIXER	NW163
T1001	XFormer, R.F., ADj	TT285-6
T1002	Same as T1001	

FREQUENCY SHIFT GENERATOR A4525

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
T1003	XFormer, IF	TZ216
T1004	XFormer, Toriod	TZ218
TP1001	Term, Stud.	TE0127-2
TP1002 thru TP1008	Same as TP1001	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1101	Capacitor, Fixed, Ceramic 10,000 uuf, +80%-20%	CC100-41
C1102	Capacitor, Fixed, Ceramic 100,000 uuf, +80%-20% 100 WVDC	CC100-28
C1103	Same as C1101	
C1104	Same as C1101	
C1105	Capacitor, Fixed, Mica 3900 uuf, ±1%, 500 WVDC	CM112F392F5S
C1106	Same as C1102	
C1107	Same as C1102	
C1108	Same as C1102	
C1109	Same as C1105	
C1110	Same as C1102	
C1111	Same as C1102	
C1112	Same as C1102	
C1113	Capacitor, Fixed, Electrolytic 10 uf, 25 WVDC	CE105-10-25
C1114	Same as C1101	
C1115	Same as C1102	
C1116	Same as C1102	
C1117	Same as C1113	
C1118	Same as C1113	
C1119	Capacitor, Fixed, Electrolytic, 2 uf, 50 WVDC	CE105-2-50
C1120	Same as C1119	
C1121	Same as C1101	
C1122	Capacitor, Fixed, Mica 360 uuf, ±1%, 500 WVDC	CM111F360F5S
C1123	Same as C1101	
C1125	Same as C1101	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1126	Same as C1101	
C1127	Capacitor, Fixed, Ceramic: 1000 uuf, 500 WVDC	CC100-29
C1129	Same as C1122	
C1130	Same as C1101	
C1132	Capacitor, Fixed, Electrolytic, 125 uuf, 15 WVDC	CE105-125-15
C1133	Same as C1132	
C1134	Same as C1101	
C1135	Same as C1102	
C1136	Same as C1113	
C1137	Capacitor, Fixed, Electrolytic, 40 uuf, 15 WVDC	CE105-40-15
C1138	Capacitor, Fixed, Electrolytic, 100 uuf, 15 WVDC	CE105-100-15
C1139	Same as C1105	
C1140	Same as C1102	
C1141	Same as C1102	
C1142	Same as C1127	
C1143	Capacitor, Fixed, Ceramic 200,00 uuf, 25 WVDC	CC100-33
C1144	Same as C1143	
C1145	Same as C1143	
C1146	Capacitor, Fixed, Ceramic 20,000 uuf, 25 WVDC	CC100-40
C1147	Same as C1146	
C1148	Same as C1102	
C1149	Same as C1102	
C1150	Capacitor, Fixed, Electrolytic, 25 uuf, 25 WVDC	CE105-25-25
C1151	Capacitor, Fixed, Electrolytic, 175 uuf, 15 WVDC	CE105-175-15
C1152	Same as C1101	

CARRIER GENERATOR A-4526

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1153	Same as C1102	
C1154	Same as C1102	
CR1101	Semiconductor, Device, Diode Silicon	1N746A
CR1102	Semiconductor, Device, Diode, Silicon	1N34A
F11101	Filter Bandpass, 2.75 MHz Symmetrical	FX267
L1101	Coil, Radio Frequency, Fixed: 1000 uh, ±20%, 135 MA	CL275-102
L1102	Coil, Radio Frequency, Fixed: 220 uh, ±20%, 250 MA	CL275-221
L1103	Same as L1101	
L1104	Same as L1102	
L1105	Same as L1101	
L1106	Coil, Radio Frequency, Fixed: 330 uh, ±20%, 505 MA	CL275-331
Q1101	Transistor	2N3646
Q1102 thru Q113	Same as Q1101	
R1101	Resistor, Fixed, Composition: 10,000 ohms, ±5%, ¼ watt	RC07GF103J
R1102	Resistor, Fixed, Composition: 27,000 Ohms, ±5%, ¼ watt	RC07GF273J
R1103	Resistor, Fixed, Composition: 1000 ohms, ±5%, ¼ watt	RC07GF102J
R1104	Same as R1103	
R1105	Resistor, Fixed, Composition: 180 ohms, ±5%, ½ watt	RC20GF181J
R1106	Resistor, Fixed, Composition: 470 ohms, ±5%, ¼ watt	RC07GF471J
R1107	Same as R1106	
R1108	Resistor, Fixed, Composition: 33,000 ohms, ±5%, ¼ watt	RC07GF333J

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1109	Same as R1101	
R1110	Same as R1103	
R1111	Resistor, Fixed, Composition: 100 ohms, ±5%, ¼ watt	RC07GF101
R1112	Same as R1103	
R1113	Same as R1111	
R1114	Same as R1108	
R1115	Same as R1101	
R1116	Same as R1103	
R1117	Same as R1111	
R1118	Same as R1103	
R1119	Resistor, Fixed, Composition: 1500 ohms, ±5%, ¼watt	RC07GF152J
R1120	Resistor, Variable, Composition: 100 ohms, ±30%, ½ watt	RV124-1-101
R1121	Same as R1106	
R1122	Same as R1103	
R1123	Same as R1103	
R1124	Same as R1102	
R1125	Same as R1101	
R1126	Same as R1103	
R1127	Resistor, Variable, Composition: 1000 ohms, ±30% ½ watt	RV124-1-102
R1128	Resistor, Fixed, Composition: 22,000 ohms, ±5%, ¼ watt	RC07GF223J
R1129	Resistor, Fixed, Composition: 6800 ohms, ±5%, ¼ watt	RC07GF682J
R1130	Resistor, Fixed, Composition: 3300 ohms, ±5%, ¼ watt	RC07GF332J

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1131	Same as R1111	
R1132	Resistor, Fixed, Composition: 1200 ohms, ±5%, ¼ watt	RC07GF122J
R1133	Resistor, Fixed, Composition: 4700 ohms, ±5%, ¼ watt	RC07GF472J
R1134	Same as R1101	
R1135	Same as R1101	
R1136	Same as R1111	
R1137	Same as R1103	
R1138	Same as R1108	
R1139	Same as R1133	
R1141	Resister, Fixed, Composition: 560 ohms, 5%, ¼ watt.	RC07GF561J
R1142	Same as R1128	
R1143	Same as R1101	
R1144	Same as R1103	
R1145	Same as R1103	
R1146	Same as R1141	
R1147	Resistor, Variable, Composition: 5,000 ohms, ±30% ½ watt	RV124-1-502
R1148	Same as R1108	
R1149	Same as R1132	
R1150	Same as R1133	
R1152	Same as R1103	
R1154	Resistor, Fixed, Composition: 560 ohms, ±5%, ¼ watt	RC07GF561J
R1155	Same as R1101	
R1156	Same as R1130	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1157	Same as R1119	
R1158	Resistor, Fixed, Composition: 120 ohms, ±5%, ¼ watt	RC07GF121J
R1159	Same as R1106	
R1160	Resistor, Fixed, Composition: 270 ohms, ±5%, ¼ watt	RC07GF271J
R1162	Same as R1103	
R1163	Resistor, Fixed, Composition: 47000 ohms, ±5%, ¼ watt	RC07GF473J
R1164	Same as R1101	
R1165	Same as R1106	
R1166	Same as R1111	
R1167	Same as R1106	
R1168	Resistor, Fixed, Composition: 47 ohms, ±5%, ¼ watt	RC07GF470J
R1169	Same as R1120	
R1170	Resistor, Fixed, Composition: 8200 ohms, ±5%, ¼watt	RC07GF822J
R1171	Same as R119	
R1172	Same as R1103	
R1173	Resistor, Fixed, Composition: 330 ohms, ±5%, ¼watt	RC07GF331J
R1174	Same as R1106	
T1101	Transformer, Radio Frequency: Operating Frequency. 79 MHZ; "L" 100.0 Nom uh; "Q" 40 Min.	TT285-12
T1102	Transformer Radio Frequency: Operating Frequency. 79 MHZ; "L" 100.0 Nom uh; "Q" 30 Min	TT285-11
T1103	Transformer, Radio, Frequency: Operating Frequency 2.5 MHZ; "L" 33.00 Nom uh: "Q" 60 Min.	TT285-13
T1104	Transformer, Radio Frequency: Operating Frequency 2.5 MHZ; "L" 33.00 Nom uh: "Q" 35 Min.	TT285-14
T1105	Transformer, Radio Frequency: Operating Frequency MHZ. "L" 100.0 Nom uh, "Q" 35 Min.	TT285-15

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REF SYMBOL	DESCRIPTION	TMC PART NUMBER
TP1101	Terminal Stud	TE127-2
TP1103 thru TP1108	Same as TP1101	

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C401	Capacitor, Fixed, Ceramic, 20000 uufd, +60%/-40%, 150 WVDC.	CC100-35
C402	Capacitor, Fixed, Mica, 2700 uufd, ±1/2%, 500 WVDC.	CM112F272D55
C403	Same as C401.	
C404	Same as C401.	
C405	Capacitor, Fixed, Mica, 100 uufd, ±1%, 500 WVDC.	CM111F101F5S
C406 thru C408	Capacitor, Fixed, Ceramic, 10000 uufd, GMV, 500 WVDC.	CC100-16
C409	Capacitor, Fixed, Mica, 200 uufd, ±2%, 500 WVDC.	CM111C200J5S
C410	Same as C406.	
C411	Same as C406.	
C412	Capacitor, Variable, Ceramic, 9-35 uufd, 100 WVDC.	CV112-2
C413	Capacitor, Fixed Ceramic, 1000 uufd, GMV, 500 WVDC.	CC100-29
C414	Same as C406.	
C415	Capacitor, Fixed, Mica, 320 uufd, ±2%, 500 WVDC.	CM111F321G5S
C416 thru C418	Same as C406.	
C419	Capacitor, Fixed, Mica, 320 uufd, ±1/2%, 500 WVDC.	CM111F321D5S
C420	Same as C406.	
C421	Same as C413.	
C422	Same as C406.	
C445 thru C448	Same as C406.	
C449	Same as C413.	
C450	Same as C412.	

A 4619 (Cont'd)

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C451	Same as C406.	
C452	Same as C406.	
C453	Capacitor, Fixed,Mica, 270 uufd, ±2%, 500 WVDC.	CM111F271G5S
C454	Same as C413.	
C455	Same as C406.	
C456	Same as C412.	
C457	Same as C453.	
C458 thru C462	Same as C406.	
C464	Same as C412.	
C465	Same as C406.	
C466 thru C468	Capacitor, Fixed, Ceramic, 200,000 uufd, +80%/-20%, 25 WVDC.	CC100-33
C469	Capacitor, Fixed, Mica, 180 uufd, ±2%, 500 WVDC.	CM111F181G5S
C470 thru C472	Same as C406.	
C473	Same as C412.	
C474	Same as C406.	
C475	Capacitor, Fixed, Mica, 430 uufd, ±2%, 500 WVDC.	CM111F431G5S
C476	Same as C406.	
C477	Same as C406.	
C478	Same as C413.	
C480	Same as C412.	
C481	Same as C475.	

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C482	Same as C413.	
L401 thru L403	Coil, Reference, Fixed.	CL275-121
L408 thru L414	Same as L401.	
L417	Same as L401.	
L419	Same as L401.	
Q401 thru Q405	Transistor.	2N3646
Q410 thru Q417	Same as Q401	
R401	Resistor, Fixed, Composition, 330 ohms, ±5%, 1/4 watt.	RC07GF331J
R402	Resistor, Fixed, Composition, 8200 ohms, ±5%, 1/4 watt.	RC07GF822J
R403	Resistor, Fixed, Composition, 1000 ohms, ±5%, 1/4 watt.	RC07GF102J
R404	Resistor, Fixed, Composition, 47 ohms, ±5%, 1/4 watt.	RC07GF470J
R405	Same as R403.	
R406	Resistor, Fixed, Composition, 33000 ohms ±5%, 1/4 watt.	RC07GF333J
R407	Same as R403.	
R408	Resistor, Fixed, Composition, 10000 ohms, ±5%, 1/4 watt.	RC07GF103J
R409	Same as R404.	
R410	Same as R408.	

A 4619 (Cont'd)

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R411	Resistor, Fixed, Composition, 180 ohms, ±5%, 1/4 watt.	RC07GF181J
R412	Same as R403.	
R413	Resistor, Fixed, Composition, 560 ohms, ±5%, 1/4 watt.	RC07GF561J
R414	Resistor, Fixed, Composition, 470,000 ohms, ±5%, 1/4 watt.	RC07GF474J
R415	Same as R402.	
R416	Same as R403.	
R417	Resistor, Fixed, Composition, 15,000 ohms, ±5%, 1/4 watt.	RC07GF153J
R418	Resistor, Fixed, Composition, 3300 ohms, ±5%, 1/4 watt.	RC07GF332J
R419	Resistor, Fixed, Composition 270 ohms, ±5%, 1/2 watt.	RC07GF271J
R434		
R435	Same as R403.	
R436	Same as R402.	
R437	Same as R413.	
R438	Same as R417.	
R439	Same as R418.	
R440	Same as R419.	
R441	Resistor, Fixed, Composition, 4700 ohms, ±5%, 1/4 watt.	RC07GF472J
R442	Resistor, Fixed, Composition, 100,000 ohms, ±5%, 1/4 watt.	RC07GF104J
R443	Same as R442.	
R444	Same as R408.	

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R445	Resistor, Fixed, Composition, 2200 ohms, ±5%, 1/4 watt.	RC07GF222J
R446	Resistor, Fixed, Composition, 3900 ohms, ±5%, 1/4 watt.	RC07GF392J
R447	Same as R445.	
R448	Resistor, Fixed, Composition, 180 ohms, ±5%, 1/4 watt.	RC07GF181J
R449	Same as R408.	
R450	Same as R446.	
R451	Same as R403.	
R452	Same as R403.	
R453	Same as R414.	
R454	Same as R413.	
R455	Same as R403.	
R456	Same as R402.	
R457	Same as R417.	
R458	Same as R418.	
R459	Resistor, Fixed, Composition, 390 ohms, ±5%, 1/4 watt.	RC07GF391J
R460	Resistor, Variable, Composition, 5000 ohms, ±30%, 5 watts.	RV124-1-502
R461	Same as R411.	
R462	Resistor, Fixed, Composition, 100 ohms, ±5%, 1/4 watt.	RC07GF101J
R464	Same as R462.	
R466	Same as R462.	
R467	Resistor, Fixed, Composition, 27 ohms, ±5%, 1/4 watt.	RC07GF270J

A 4619 (Cont'd)

SPECTRUM GENERATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R468	Same as R462.	
R473	Resistor, Fixed, Composition, 120 ohms, ±5%, 1/4 watt.	RC07GF121J
R475	Same as R473.	
T401	Transformer, R.F., Adj.	TT286-2
T402	Transformer, R.F., Adj.	TT286-16
T403	Transformer, R.F., Adj.	TT286-15
T408	Same as T402.	
T409	Same as T403.	
T410	Transformer, R.F., Adj.	TT286-14
T411	Transformer, R.F., Adj.	TT286-13
TP401 thru TP403	Terminal Stud.	TE0127-2
TP406 thru TP409	Same as TP401.	
Z401	Decade Counter.	NW135
Y401	Crystal, Unit Quartz, Frequency 12MHz.	CR109-124
Y403	Crystal, Unit Quartz, Frequency, 8MHz.	CR109-104
Y405	Crystal, Unit Quartz, Frequency, 13MHz.	CR109-134.

RF OUTPUT

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1501	Capacitor, Fixed MTLZ, 1.0 mfd, ±5%, 50 WVDC	CN114-1RO-5J
C1502 thru C1511	Same as C1501	
C1512	Capacitor, Fixed, Ceramic, .1 ufd, +80%-20%, 100 WVDC	CC100-28
C1513	Capacitor, Fixed, Ceramic, 10,000 uufd, GMV, 500 WVDC.	CC100-16
C1514 thru C1518	Same as C1512.	
C1519	Capacitor, Fixed, Ceramic, 15 mfd, 50 WVDC.	CE105-15-50
L1501	Coil, R.F., Fixed, 2500 uhy, ±10%, 110 ma.	CL140-1
L1502	Same as L1501.	
L1503	Coil, R.F., Fixed, 39 uhy, ±10%, 390 ma.	CL270-39
L1504	Choke, R.F., Adjust, 14 mhy, ±6 mhy.	CL420
L1505 thru L1507	Same as L1501.	
L1508	Coil, R.F., Fixed, 120 uhy, ±10%, 315 ma.	CL240-120
L1509	Same as L1508.	
L1510	Same as L1501.	
L1511	Same as L1504	
Q1501	Transistor, Silicon.	2N5070
Q1502	Transistor, Silicon.	2N3296
R1501	Resistor, Fixed, Composition, 47 ohms, ±5%, 1/2 watt.	RC20GF470J
R1502	Resistor, Fixed, Composition, 22 ohms, ±5%, 1 watt.	RC32GF220J
R1503	Resistor, Variable, Composition, 5000 ohms, ±30%, 1/2 watt.	RV124-1-502

A 4620 (Cont'd)

RF OUTPUT

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1504	Resistor, Fixed, Composition, 3900 ohms, ±5%, 1/2 watt.	RC20GF392J
R1505	Resistor, Fixed, Composition, 1000 ohms, ±5%, 1/2 watt.	RC20GF102J
R1506	Resistor, Fixed, Composition, 3.3 ohms, ±5%, 1/2 watt.	RC20GF3R3J
R1507	Resistor, Fixed, Composition, 100 ohms, ±5%, 1/2 watt.	RC20GF101J
R1508	Resistor, Variable, Composition, 2000 ohms, ±30%, 1/2 watt.	RV124-1-202
R1509	Resistor, Fixed, Composition, 15 ohms, ±5%, 1/2 watt.	RC20GF150J
R1510	Resistor, Fixed, Composition, 1500 ohms, ±5%, 1/2 watt.	RC32GF152J
R1511	Resistor, Fixed, Composition, 2200 ohms, ±5%, 1/2 watt.	RC20GF222J
R1513	Same as R1505.	
R1514	Resistor, Fixed, Composition, 47000 ohms, ±5%, 1/2 watt.	RC20GF473J
R1515	Resistor, Fixed, Composition, 220 ohms, ±5%, 1/2 watt.	RC20GF221J
R1516	Resistor, Fixed, Composition, 43000 ohms, ±5%, 1/2 watt.	RC20GF433J
T1501	Transformer, R.F., Adj.	TT288
T1502	Same as T1501.	
CR1501	Semiconductor Device, Diode	IN4864
CR1502	Same as CR1501.	
CR1503	Semiconductor Device, Diode.	IN100

TRANSLATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C701	Capacitor, Fixed, Ceramic 10,000 uufd, +80%-20%	CC100-41
C702	Capacitor, Fixed, Ceramic, 1000 uufd, +80%-20%	CC100-29
C703	Capacitor, Fixed, MTLZ, 1.0 mfd, ±5%, 50 WVDC	CN114-1RO-5J
C704	Capacitor, Fixed, Mica, 91 uufd, ±5%, 500 WVDC.	CM111F910J5S
C705	Same as C702	
C706	Capacitor, Fixed, Mica, 1,200 uufd, ±2%, 500 WVDC.	CM111F122G5S
C707	Same as C706	
C708	Capacitor, Fixed, Mica, 680 uufd, ±2%, 500 WVDC.	CM111F681G5S
C710	Cap, Fix, Elec	CE105-10-15
C709	Same as C703.	
C711	Same as C703	
C712	Same as C703	
C713	Capacitor, Fixed, Electrolytic, 50 mfd, 15 volts.	CE105-50-15
C714	Same as C702.	
C715	Same as C702.	
C716	Capacitor, Fixed, Mica, 510 uufd, ±2%, 500 WVDC.	CM111F511G5S
C717	Capacitor, Fixed, Mica, 120 uufd, ±2%, 500 WVDC.	CM111F101G5S
C718	Capacitor, Fixed, Mica, 560 uufd, ±2%, 500 WVDC.	CM111F561G5S
C719	Capacitor, Fixed, Mica, 430 uufd, ±2%, 500 WVDC.	CM111F361G5S
C720	Capacitor, Fixed, Ceramic, 100,000 uufd, +80%-20%, 100 WVDC.	CC100-28
C721	Same as C720	
C722	Capacitor, Fixed, Mica, 360 uufd, ±2%, 500 WVDC	CM111F361G5S
C723	Same as C720	
C724	Same as C702	
C725	Same as C702	
C726	Capacitor, Fixed, Ceramic, 20,000 uufd, +80%-20%, 25 VDC.	CC100-40

A 4621

TRANSLATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C727	Capacitor, Fixed, Mica, 130 uufd, ±2%, 500 WVDC.	CM111F131G5S
C728	Same as C702.	
C729	Capacitor, Fixed, Mica, 390 uufd, +2%, 500 WVDC.	CM111F391G5S
C730	Same as C726.	
C731	Capacitor, Fixed, Mica, 750 uufd, ±2%, 500 WVDC.	CM111F751G5S
C732	Same as C729.	
C733	Capacitor, Fixed, Mica, 110 uufd, ±5%, 500 WVDC.	CM111F111J5S
C734	Capacitor, Fixed, Mica, 5 uufd, ±10%, 500 WVDC.	CM111C050K5S
C735	Same as C733.	
C736	Same as C702.	
C737	Same as C702.	
C738	Same as C733.	
C739	Same as C734.	
C740	Same as C733.	
C741	Same as C702.	
C742	Same as C702.	
C743	Same as C733.	
C744	Same as C733.	
C745	Same as C734.	
C746	Same as C733.	
C747 thru C752	Same as C702.	
C753	Same as C733.	
C754	Same as C734.	
C755	Same as C733.	

A 4621

TRANSLATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C756 thru C758	Same as C702.	
C759	Same as C733.	
C760	Same as C702.	
C761	Cap, Fix, Elec	CE105-50-25
CR701	Semiconductor, Device, Diode,	DD138
CR702 thru CR704	Same as CR701	
CR705	Semiconductor, Device, Diode	IN914
CR706	Same as CR705	
CR707	Same as CR705	
L701	Coil, R.F. Fixed, 2.5 uhy, 10%.	CL140-1
L702	Coil, R.F., Fixed, 47 uhy, ±10%.	CL275-470
L703	Coil, R.F. Fixed 6.8 uhy, +10%.	CL240-6.8
L704	Same as L703	
L705	Same as L704	
L706	Same as L701	
L707	Same as L701	
L708	Coil, R.F. Fixed, 120 uhy, ±10%.	CL275-121
L709	Coil, R.F. Fixed, .63 uhy ±4%.	CL412-24
L710	Coil, R.F. Fixed, .36 uhy, ±4%.	CL412-25
L711	Same as L708	
L712	Same as L708	
L713	Same as L708	
L714	Coil, R.F. Fixed, 8.2 uhy, ±10%.	CL275-8R2

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L715	Same as L714	
L716	Coil, R.F. Fixed, 22 uhy, ±10%	CL275-220
L717	Same as L716	
L718 thru L721	Same as L708	
L722	Coil, RF Fixed, 56 uh	CL275
Q701	Transistor, Silicon	2N3646
Q702 thru Q710	Same as Q701	
R701	Resistor, Fixed, Composition, 47 ohms, ±5%, 1/4 watts.	RC07GF470J
R702	Resistor, Fixed, Composition, 100,000 ohms, ±5%, 1/4 watts.	RC07GF104J
R703	Resistor, Fixed, Composition, 47,000 ohms, ±5%, 1/4 watts.	RC07GF473J
R704	Same as R701.	
R705	Resistor Variable, Composition, 500 ohms, ±30%, 1/2 watts.	RV124-1-501
R706	Resistor, Fixed, Composition, 120 ohms, ±5%, 1/4 watts.	RC07GF121J
R707	Same as R706	
R708	Resistor, Fixed, Composition, 100 ohms, ±5%, 1/4 watts.	RC07GF101J
R709	Resistor, Fixed, Composition, 8,200 ohms, ±5%, 1/4 watts.	RC07GF822J
R710	Resistor, Fixed, Composition, 3,300 ohms, ±5%, 1/4 watts.	RC07GF272J
R711	Resistor, Fixed, Composition, 150 ohms, ±5%, 1/4 watts.	RC07GF151J
R712	Resistor, Fixed, Composition, 220 ohms, ±5%, 1/4 watts.	RC07GF101J
R713	Same as R701	
R714	Same as R703	

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R715	Same as R702	
R716	Resistor, Fixed, Composition, 1,000 ohms, ±5%, 1/4 watts.	RC07GF102J
R717	Same as R706	
R718	Resistor, Fixed, Composition, 1,500 ohms, ±5%, 1/4 watts.	RC07GF152J
R719	Same as R705	
R720	Same as R706	
R721	Same as R712	
R722	Resistor, Fixed, Composition, 470 ohms, ±5%, 1/4 watts.	RC07GF471J
R723	Same as R712	
R724	Resistor, Var watts.	RV124-3202
R725	Same as T716	
R726	Same as R725	
R727	Same as R702	
R728	Resistor, Fixed, Composition, 27,000 ohms, ±5%, 1/4 watts.	RC07GF273J
R729	Resistor, Fixed, Composition, 22 ohms, ±5%, 1/4 watts.	RC07GF220J
R730	Same as R701	
R731	Same as R724	
R732	Same as R722	
R733	Resistor, Fixed, Composition, 56,000 ohms, ±5%, 1/4 watts.	RC07GF563J
R734	Resistor, Fixed, Composition, 10,000 ohms, ±5%, 1/4 watts.	RC07GF103J
R735	Same as R703	

TRANSLATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R736	Resistor, Fixed, Composition, 820 ohms, ±5%, 1/4 watts.	RC07GF821J
R737	Resistor, Fixed, Composition, 68,000 ohms, ±5%, 1/4 watts.	RC07GF683J
R738	Same as R701	
R739	Resistor, Fixed, Composition, 820,000 ohms, ±5%, 1/4 watts.	RC07GF824J
R740	Resistor, Fixed, Composition, 330,000 ohms, ±5%, 1/4 watts.	RC07GF334J
R741	Resistor, Fixed, Composition, 220,000 ohms, ±5%, 1/4 watts.	RC07GF224J
R742	Same as R734	
R743	Resistor, Fixed, Composition, 4700 ohms, ±5%, 1/4 watts.	RC07GF472J
R744	Same as R724	
R745	Same as R722	
R746	Same as R702	
R747	Same as R729	
R748	Same as R728	
R749	Same as R701	
R750	Resistor, Fixed, Composition, 1,000 ohms, ±5%, 1/4 watts.	RC07GF102J
R751	Same as R722	
R752	Same as R724	
R753	Same as R736	
R754	Same as R733	
R755	Same as R734	
R756	Same as R703	
R757	Same as R737	

TRANSLATOR

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R758	Same as R712	
R759	Same as R722	
R760	Same as R712	
T701	Transformer, R.F., Adjust.	TT285-4
T702	Transformer, R.F. fixed.	TT295
T703	Same as T701.	
T704	Transformer, RF, Fixed	TF0228U13
T705	Transformer, RF, Adjust	TT285-2
T706 thru T714	Same as T705	
TP701	Term, Stud	TE0127-2
TP702 thru TP705	Same as TP701	

A 4623

OUTPUT FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, MTLZ, .82 mfd, ±5%, 50 WVDC	CN114R82-5J
C2	Capacitor, Fixed, MTLZ, .015 mfd, 50 WVDC	CN116AR015
C3	Capacitor, Fixed, Mica, 2700 uufd, ±1/2%, 500 WVDC.	CM112F272D5S
C4	Capacitor, Fixed, MTLZ, .018 ufd, 50 WVDC.	CN116AR018
C5	Capacitor, Fixed, Mica, 8200 uufd, ±1/2%, 500 WVDC.	CM112F822D5S
C6	Capacitor, Fixed, MTLZ, .012 ufd, 50 WVDC.	CN116AR012
C7	Same as C1	
C8	Same as C6	
C9	Capacitor, Fixed, Mica, 1300 uufd, ±1%, 500 WVDC.	CM112F132F5S
C10	Same as C2	
C11	Capacitor, Fixed, Mica, 3600 uufd, ±1%, 500 WVDC.	CM112F362F5S
C12	Capacitor, Fixed, MTLZ, .01 ufd, 50 WVDC.	CN116AR01
C13 thru C14	Same as C1	
C15	Capacitor, Fixed, Mica, 5100 uufd, ±1/2%, 500 WVDC.	CM112F512D5S
C16	Capacitor, Fixed, Mica, 1100 uufd, ±1/2%, 500 WVDC.	CM112F112D5S
C17	Capacitor, Fixed, Mica, 6200 uufd, ±2%, 500 WVDC.	CM112F622G5S
C18	Same as C17	
C19	Same as C15	
C20	Capacitor, Fixed, Mica, 4300 uufd, ±2%, 500 WVDC.	CM112F432G5S
C21	Capacitor, Fixed, Mica, 3300 uufd, ±2%, 500 WVDC.	CM112F332G5S
C22	Same as C1	
C23	Same as C1	
C24	Capacitor, Fix d, Mica, 2900 uufd, ±1%, 500 WVDC.	CM112F292F5S

A 4623 (Cont'd)

OUTPUT FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C25	Capacitor, Fixed, Mica, 680 uufd, ±2%, 500 WVDC.	CM112F681G5S
C26	Same as C11	
C28	Same as C24	
C29	Capacitor, Fixed, Mica, 2400 uufd, ±1%, 500 WVDC.	CM112F242F5S
C30	Capacitor, Fixed, Mica, 1800 uufd, ±2%, 500 WVDC.	CM112F182G5S
C31	Capacitor, Fixed, Mica, 100 uufd, ±1%, 500 WVDC.	CM111F101F5S
C32	Same as C1	
C33	Same as C30	
C34	Capacitor, Fixed, Mica, 360 uufd, ±2%, 500 WVDC.	CM111F361G5S
C35	Capacitor, Fixed, Mica, 2000 uufd, ±1/2%, 500 WVDC.	CM112F202D5S
C36	Same as C35	
C37	Same as C30	
C38	Capacitor, Fixed, Mica, 1500 uufd, ±1/2%, 500 WVDC.	CM112F152D5S
C39	Same as C16	
CR1	Semiconductor Device, Diode	IN914A
CR2 thru CR6	Same as CR1	
K1	Relay, Armature, Min, DC Resistance, 9100 ohms.	RL143-4
K2 thru K5	Same as K1	
L1	Coil, R.F., Fixed	CL275-3R3
L2	Coil, R.F., Adjust, 73 uhy, ±4%.	AC220-2
L3	Coil, R.F., Adjust, 17.5 uhy, ±4%.	AC220-10
L4	Same as L1.	

A4623 (Cont'd)

OUTPUT FILTER A

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L5	Coil, R.F., Adjust, 21.0 uhy, ±4%.	AC220-9
L6	Coil, R.F., Adjust, 16.7 uhy, ±4%.	AC220-11
L7	Same as L1	
L8	Same as L1	
L9	Coil, R.F., Fixed, 12.8 uhy, ±4%.	CL412-27
L10	Coil, R.F., Fixed, 5.5 uhy, ±4%.	CL412-30
L11	Coil, R.F., Fixed. 7.5 uhy, ±4%.	CL412-28
L12	Same as L1	
L13	Same as L1	
L14	Coil, R.F., Fixed, 6.7 uhy, ±4%.	CL412-29
L15	Coil, R.F., Fixed, 4.0 uhy, ±4%.	CL412-33
L16	Coil, R.F., Fixed, 4.5 uhy, ±4%.	CL412-31
L17	Same as L1	
L18	Coil, R.F., Fixed, 4.3 uhy, ±4%.	CL412-32
L19	Coil, R.F., Fixed, 2.3 uhy, ±4%.	CL412-35
L20	Coil, R.F., Fixed, 2.5 uhy, ±4%.	CL412-34

OUTPUT FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, MTLZ, .82 mfd, ±5%, 50 WVDC.	CN114R82-5J
C2	Capacitor, Fixed, Ceramic, 100,000 uufd, +80%/-20%, 100 WVDC.	CC100-28
C3	Capacitor, Fixed, Mylar, .056 ufd, 50 WVDC.	CN116A-R056
C4	Same as C2.	
C5	Same as C1.	
C6	Capacitor, Fixed, Mica, 6800 uufd, ±2%, 500 WVDC.	CM112F682G5S
C7	Capacitor, Fixed, Mylar, .068 ufd, 50 WVDC.	CN116A-R068
C8	Capacitor, Fixed, Mylar, .039 ufd, 50 WVDC.	CN116A-R039
C9	Same as C6.	
C10	Same as C7.	
C11	Same as C1.	
C12	Capacitor, Fixed, Mylar, .047 ufd, 50 WVDC.	CN116A-R047
C13	Capacitor, Fixed, Mylar, .022 ufd, 50 WVDC.	CN116A-R022
C14	Same as C12	
C15	Same as C1.	
C16	Capacitor, Fixed, Mica, 3000 uufd, ±2%, 500 WVDC.	CM112F302G5S
C17	Capacitor, Fixed, Mylar, .027 ufd, 50 WVDC.	CN116A-R027
C18	Capacitor, Fixed, Mica, 5600 uufd, ±2%, 500 WVDC.	CM112F562G5S
C19	Same as C8.	
C20	Capacitor, Fixed, Mylar, .015 ufd, 50 WVDC.	CN116A-R015
C21	Same as C13.	
C22	Same as C1.	
C23	Same as C1.	
C24	Capacitor, Fix d, Mica, 3300 uufd, ±2%, 500 WVDC.	CM112F332G5S

A 4624 (Cont'd)

OUTPUT FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C25	Same as C13.	
C26	Same as C24.	
C27	Capacitor, Fixed, Mylar, .033 ufd. 50 WVDC.	CN116A-R033
C28	Capacitor, Fixed, Mylar, .01 ufd, 50 WVDC.	CN116A-R01
K1	Relay, Armature, Min, DC Resistance, 2450 ohms.	RL143-4
K2 thru K5	Same as K1.	
L1	Coil, Radio, Frequency, Fixed, 3.3 uhy, ±10%.	CL275-3R3
L2	Coil, R.F., Adjust, 100 uhy, ±4%.	AC220-1
L3	Same as L1.	
L4	Coil, R.F., Adjust, 73 uhy, ±4%.	AC220-2
L5	Same as L1.	
L6	Coil, R.F., Adjust, 46 uhy, ±4%.	AC220-4
L7	Same as L1.	
L8	Coil, R.F., Adjust, 51 uhy, ±4%.	AC220-3
L9	Coil, R.F., Adjust, 39 uhy, ±4%.	AC220-6
L10	Same as L1.	
L11	Same as L1.	
L12	Coil, R.F., Adjust, 41 uhy, ±4%.	AC220-5
L13	Coil, R.F., Adjust, 30.5 uhy, ±4%.	AC220-7

A 4624

OUTPUT FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1	Capacitor, Fixed, MTLZ, .82 mfd, ±5%, 50 WVDC.	CN114R82-5J
C2	Capacitor, Fixed, Ceramic, 100,000 uufd, +80%/-20%, 100 WVDC.	CC100-28
C3	Capacitor, Fixed, Mylar, .056 ufd, 50 WVDC.	CN116A-R056
C4	Same as C2.	
C5	Same as C1.	
C6	Capacitor, Fixed, Mica, 6800 uufd, ±2%, 500 WVDC.	CM112F682G5S
C7	Capacitor, Fixed, Mylar, .068 ufd, 50 WVDC.	CN116A-R068
C8	Capacitor, Fixed, Mylar, .039 ufd, 50 WVDC.	CN116A-R039
C9	Same as C6.	
C10	Same as C7.	
C11	Same as C1.	
C12	Capacitor, Fixed, Mylar, .047 ufd, 50 WVDC.	CN116A-R047
C13	Capacitor, Fixed, Mylar, .022 ufd, 50 WVDC.	CN116A-R022
C14	Same as C12	
C15	Same as C1.	
C16	Capacitor, Fixed, Mica, 3000 uufd, ±2%, 500 WVDC.	CM112F302G5S
C17	Capacitor, Fixed, Mylar, .027 ufd, 50 WVDC.	CN116A-R027
C18	Capacitor, Fixed, Mica, 5600 uufd, ±2%, 500 WVDC.	CM112F562G5S
C19	Same as C8.	
C20	Capacitor, Fixed, Mylar, .015 ufd, 50 WVDC.	CN116A-R015
C21	Same as C13.	
C22	Same as C1.	
C23	Same as C1.	
C24	Capacitor, Fixed, Mica, 3300 uufd, ±2%, 500 WVDC.	CM112F332G5S

A 4624 (Cont'd)

OUTPUT FILTER B

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C25	Same as C13.	
C26	Same as C24.	
C27	Capacitor, Fixed, Mylar, .033 ufd. 50 WVDC.	CN116A-R033
C28	Capacitor, Fixed, Mylar, .01 ufd, 50 WVDC.	CN116A-R01
K1	Relay, Armature, Min, DC Resistance, 2450 ohms.	RL143-4
K2 thru K5	Same as K1.	
L1	Coil, Radio, Frequency, Fixed, 3.3 uhy, ±10%.	CL275-3R3
L2	Coil, R.F., Adjust, 100 uhy, ±4%.	AC220-1
L3	Same as L1.	
L4	Coil, R.F., Adjust, 73 uhy, ±4%.	AC220-2
L5	Same as L1.	
L6	Coil, R.F., Adjust, 46 uhy, ±4%.	AC220-4
L7	Same as L1.	
L8	Coil, R.F., Adjust, 51 uhy, ±4%.	AC220-3
L9	Coil, R.F., Adjust, 39 uhy, ±4%.	AC220-6
L10	Same as L1.	
L11	Same as L1.	
L12	Coil, R.F., Adjust, 41 uhy, ±4%.	AC220-5
L13	Coil, R.F., Adjust, 30.5 uhy, ±4%.	AC220-7

POWER SUPPLY AX652

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C301	Capacitor, Fixed, Ceramic, 100000 uufd, +80-20%, 300 WVDC	CC100-37
C302	Capacitor, Fixed, Mtlz, 1.00 mfd, ±20%, 200 WVDC	CN112A-105-M2
C303	Capacitor, Fixed, Electrolytic, 150 mfd, ±10%, 75 WVDC	CE105-150-75
C304	Capacitor, Fixed, Electrolytic, .47 mfd, ±5%,	CN114R47-5
C305 thru C309	Same as C301	
CR301	Semiconductor Device Diode	1N2484
CR302	Same as CR301	
J301	Connector, Receptacle, Male	JJ242-5P
J302	Connector, Receptacle, RF	JJ211
J303	Connector, Receptacle, Female	JJ319-6DPE
J304	Same as J303	
J305	Same as J302	
J306	Connector, Receptacle, Female	JJ242-5S
L301		CL275-121
P301		PL225-8S
R301	Resistor Fixed Composition, 47 ohms, ±5%, ½ watt	RC20GF470J
R302	Resistor Wire Wound Fixed, 5 Watt.	RW107-10
T301	Transformer	
XZ301	Socket, Electronic Tube	TS100-3
XZ302	Same as XZ301	

Parts List for A4653

REF SYMBOL	DESCRIPTION		TMC PART NUMBER
C1401	Cap.,Fxd,Mica	1800 pf	CM112F182J5S
C1402	Cap.,Fxd,Mica	360 pf	CM111F361J5S
C1403	Cap.,Fxd,Mica	2000 pf	CM112F202G5S
C1404	Same as C1403		
C1405	Same as C1401		
C1406	Cap.,Fxd,Mica	1500 pf	CM112F152F5S
C1407	Cap.,Fxd,Mica	1100 pf	CM112F112G5S
L1401	Coil,Fxd,RF	4.3 microhenrys	CL412-32
L1402	Coil,Fxd,RF	2.3 microhenrys	CL412-35
L1403	Coil,Fxd,RF	2.5 microhenrys	CL412-34

SECTION 7

DIAGRAMS

7-1. INTRODUCTION

This section contains the interconnection and schematic diagrams for the LFE Table 7-1 presents a list of the figures contained herein and the corresponding TMC drawing numbers.

TABLE 7-1. LIST OF DIAGRAMS

Figure No.	Title	TMC Dwg No.
7-1	LFE , Interconnection Diagram	CK1409
7-2	Spectrum Generator Z101, Schematic and Component Location Diagram	CK1395
7-3	Comb Filter Z102, Schematic and Component Location Diagram	CK1315
7-4	Comb Filter Z103, Schematic and Component Location Diagram	CK1316
7-5	Dual Mixer-Dividers Z104 and Z105, Schematic and Component Location Diagram	CK1393
7-6	Final Mixer Z107, Schematic and Component Location Diagram	CK1319
7-7	Carrier Generator Z112, Schematic and Component Location Diagram	CK1311
7-8	Sideband Generator Z109, Schematic and Component Location Diagram	CK1309
7-9	Frequency Shift Generator Z111, Schematic and Component Location Diagram	CK1310
7-10	Translator Z108, Schematic and Component Location Diagram	CK1400
7-11	RF Output Z115, Schematic and Component Location Diagram	CK1399
7-12	RF Filter Z113, Schematic and Component Location Diagram	CK13970
7-13	RF Filter Z114, Schematic and Component Location Diagram	CK13980
7-14	Power Supply Assembly, Wiring Diagram	CK1330
7-15	Rectifier-Filter Z304, Schematic and Component Location Diagram	CK1328
7-16	Regulator Z303, Schematic and Component Location Diagram	CK1291

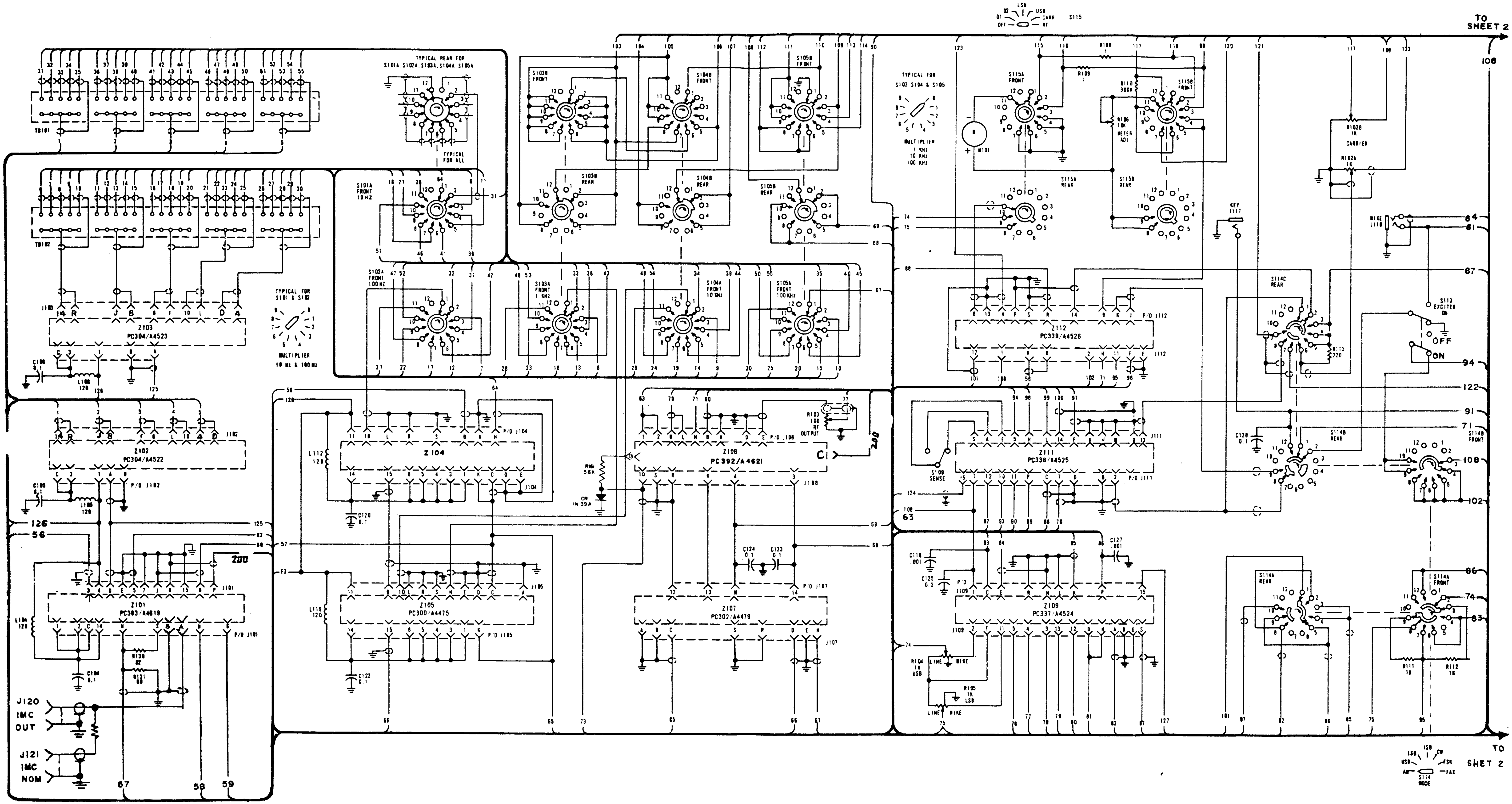


Figure 7-1. LFE-1, Interconnection Diagram (Sheet 1 of 2)

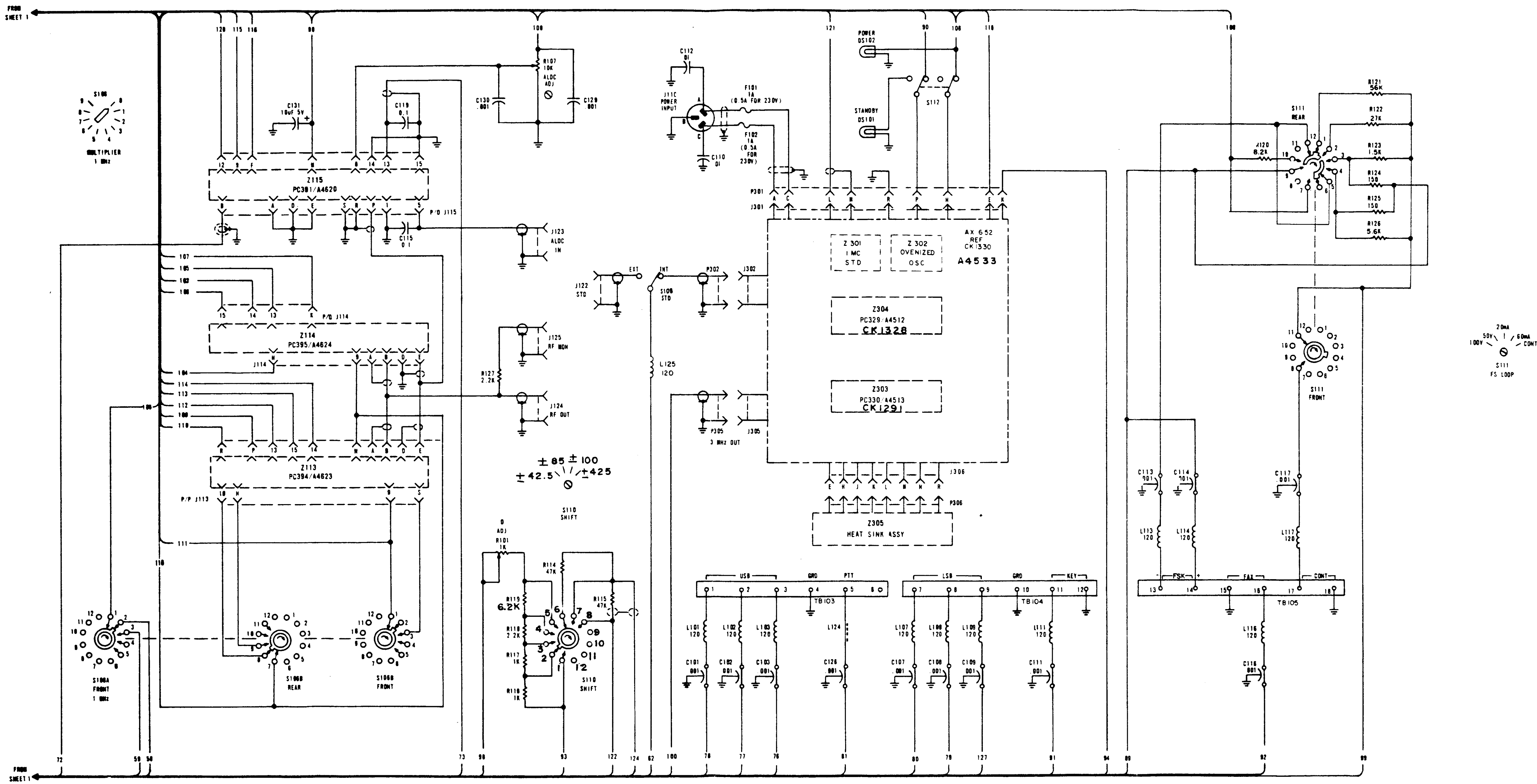
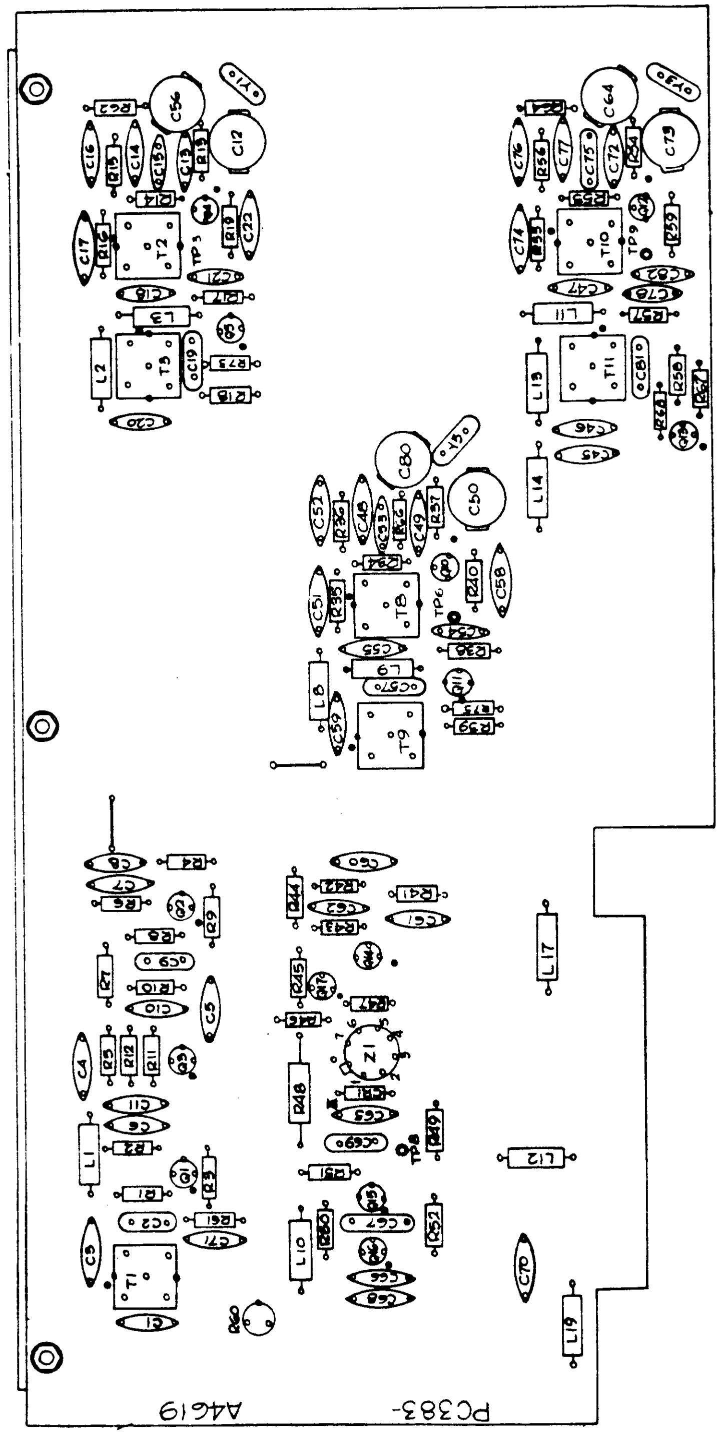
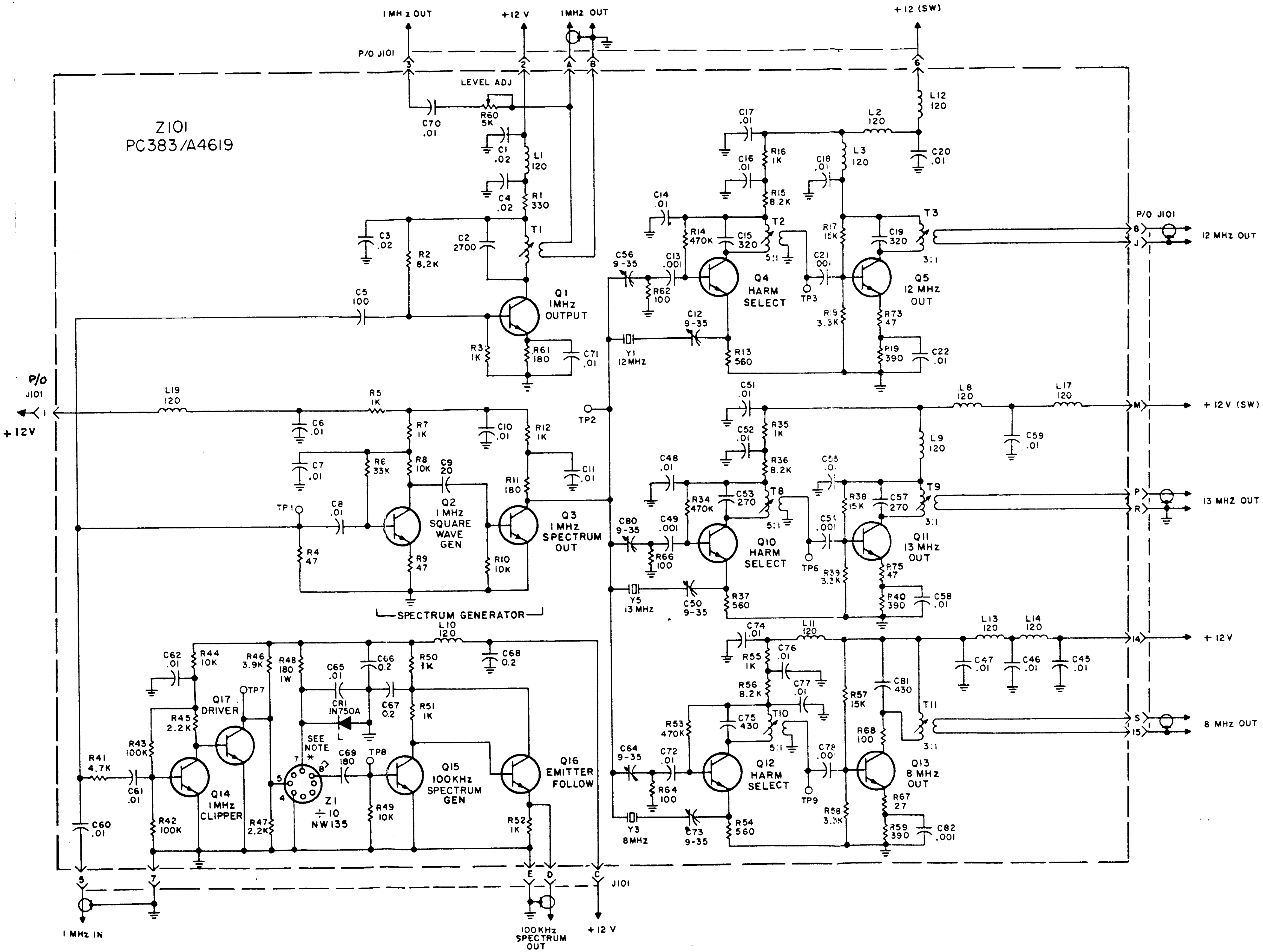


FIGURE 7-1. LFE-1, INTERCONNECTION DIAGRAM
(SHEET 2 OF 2)





*NOTE
"⊓" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK

Figure 7-2. Spectrum Generator Z101, Schematic and Component Location Diagram

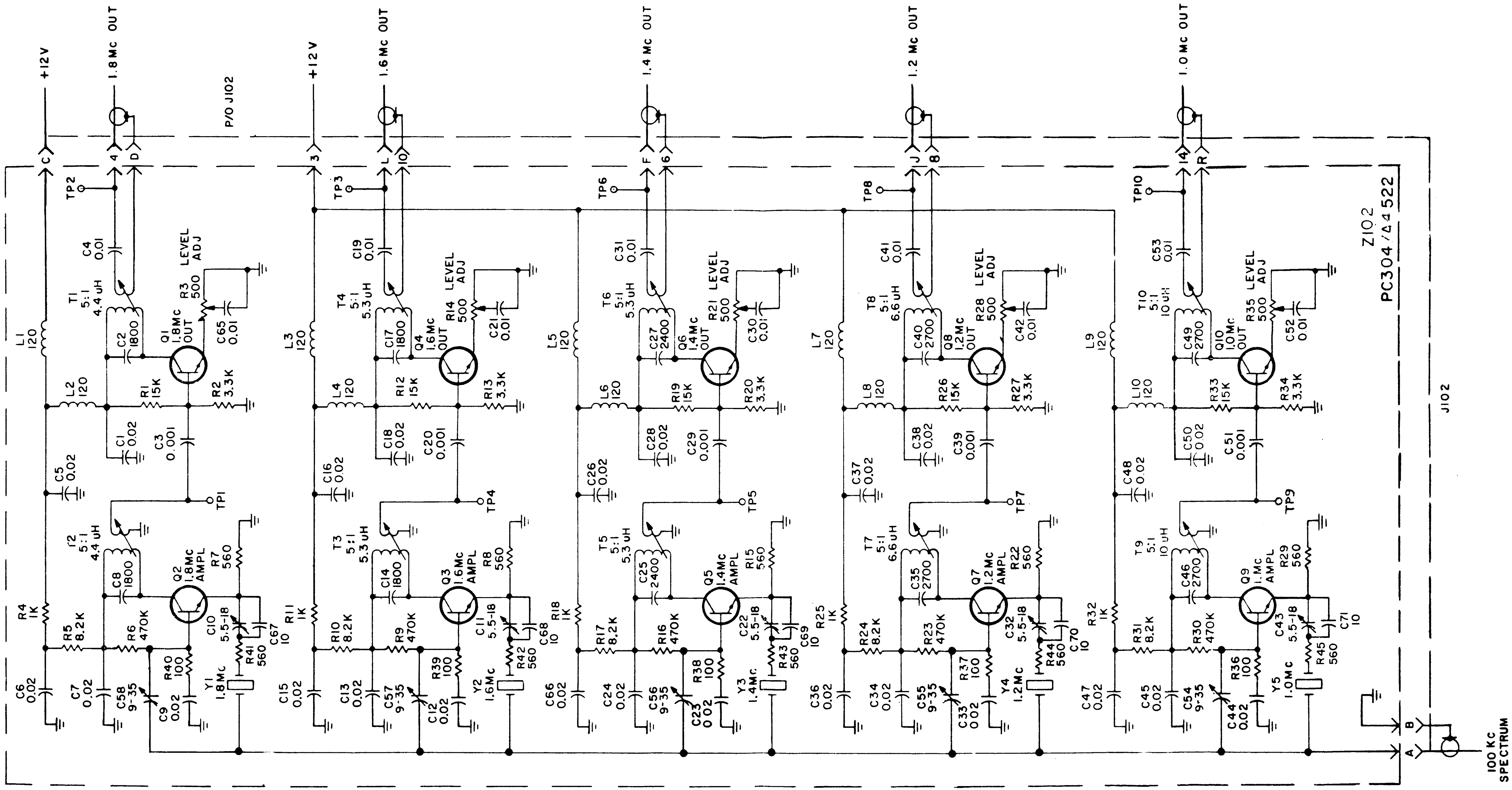
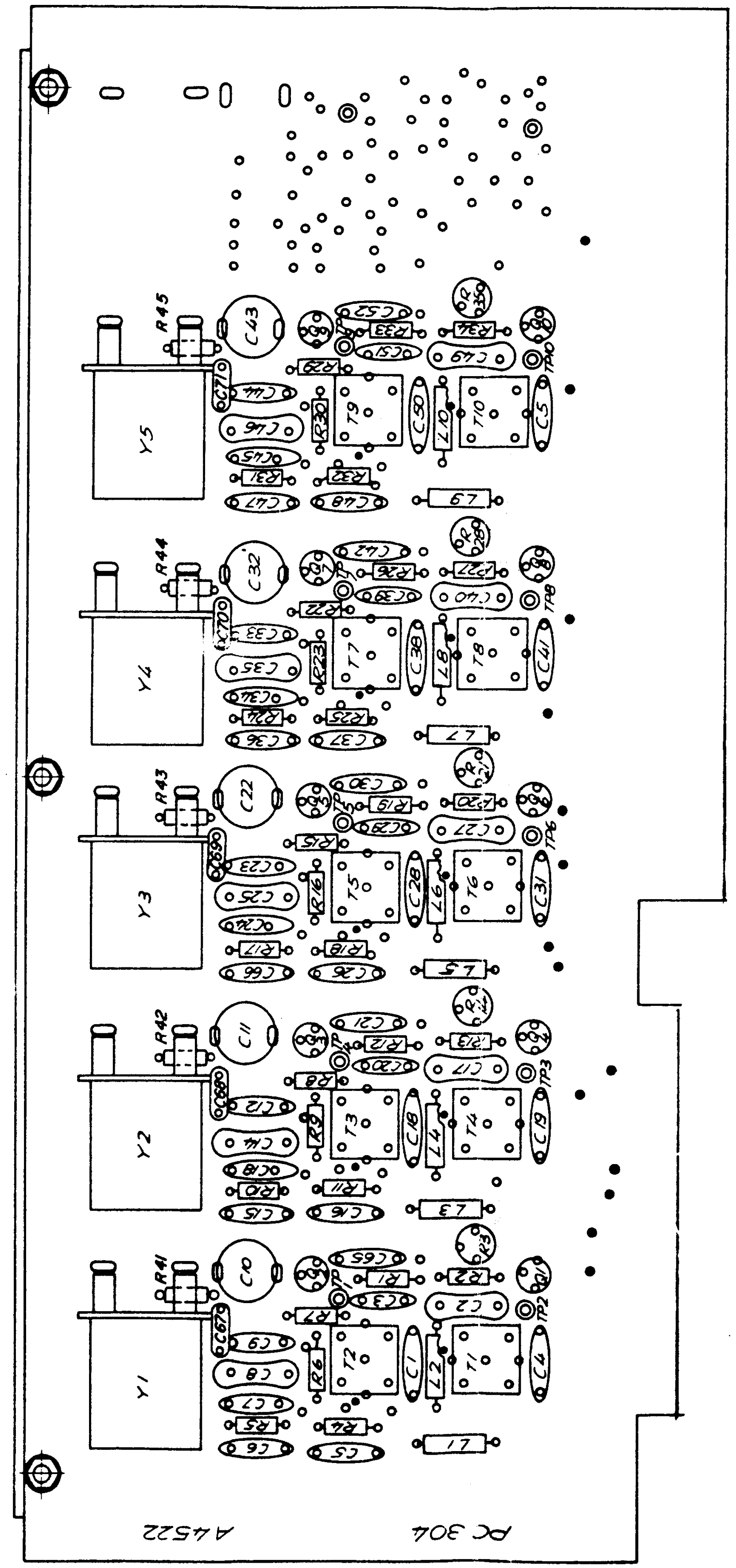


Figure 7-3. Comb Filter Z102, Schematic and Component Location Diagram


PC 304
A4522

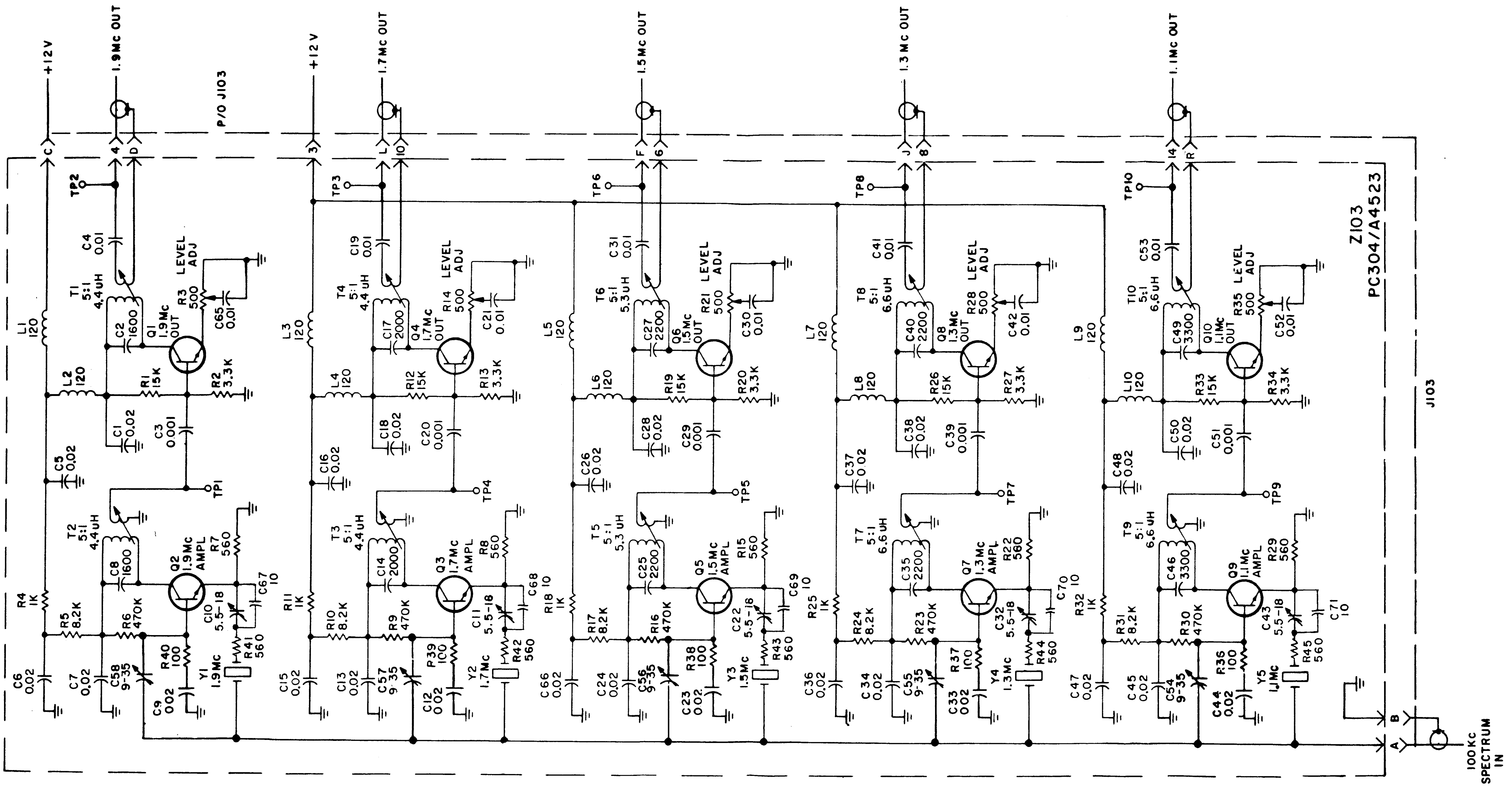
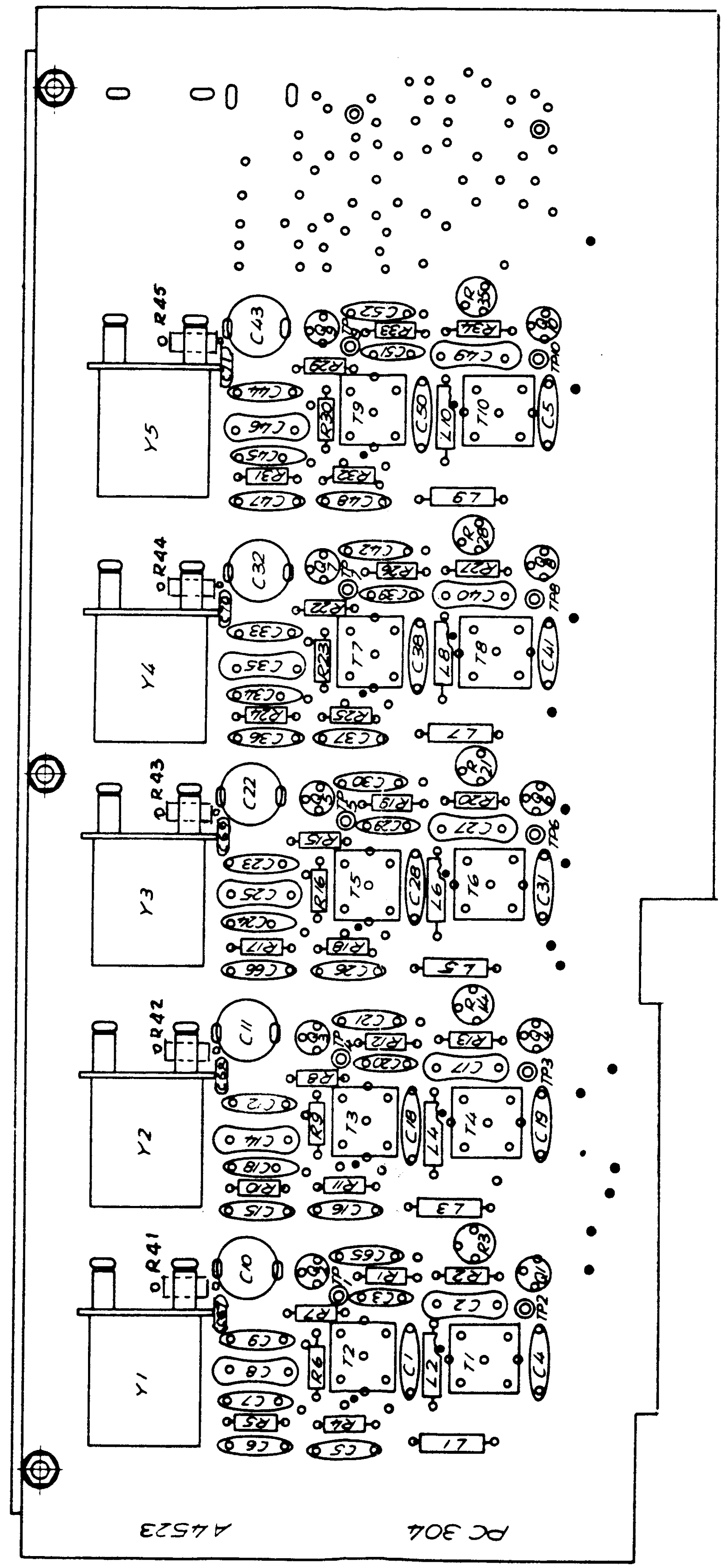
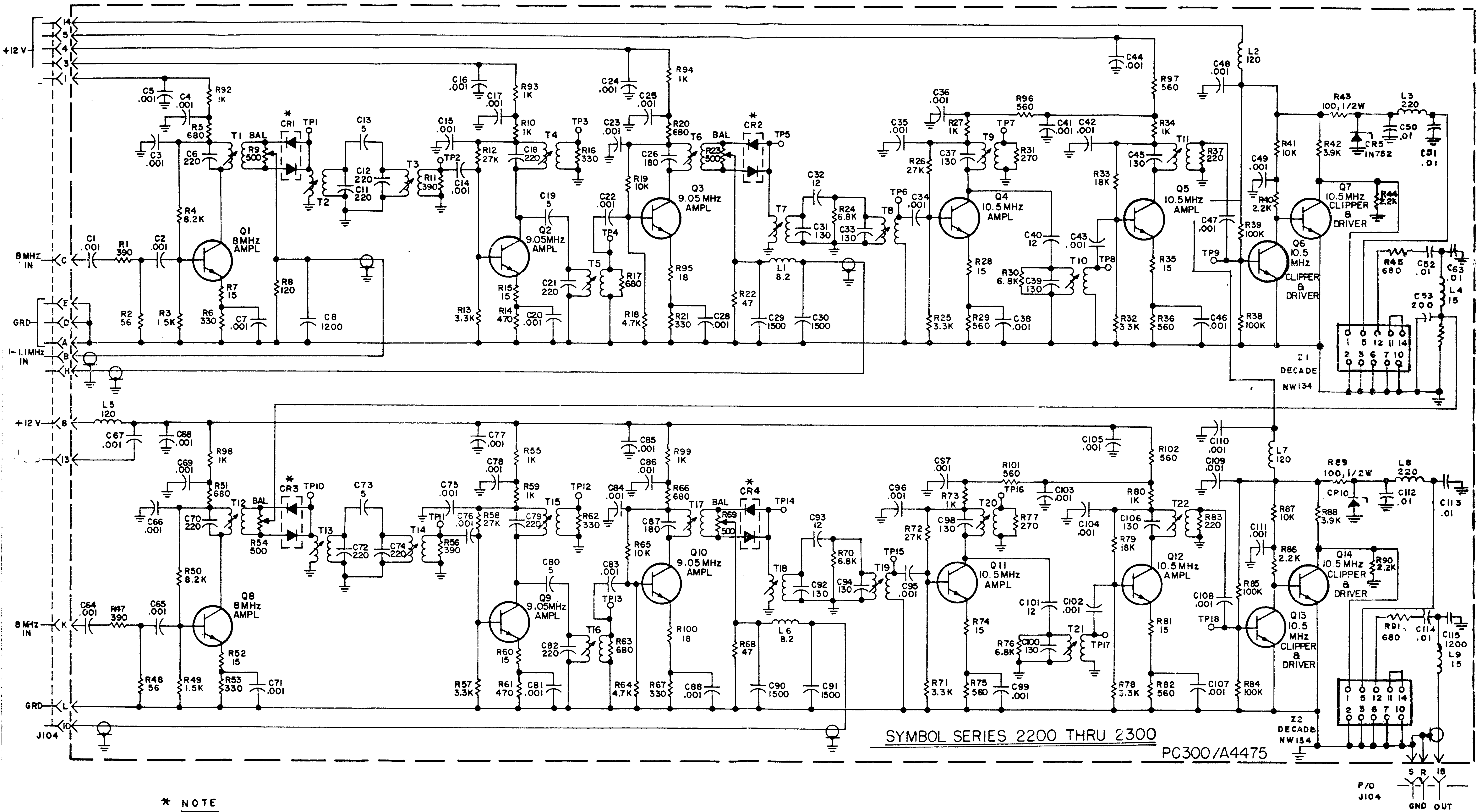


Figure 7-4. Comb Filter Z103, Schematic and Component Location Diagram

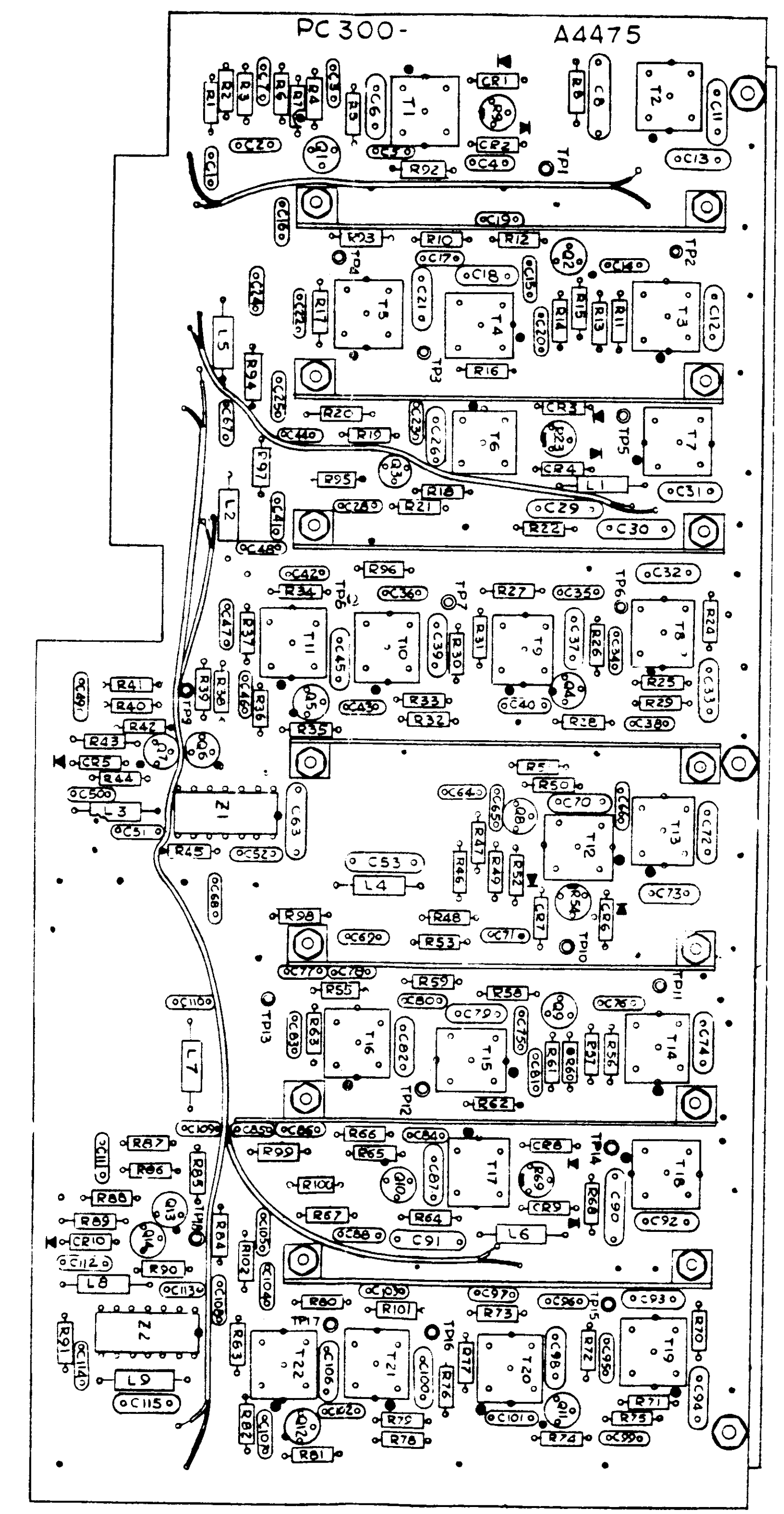

PC 304
A4523

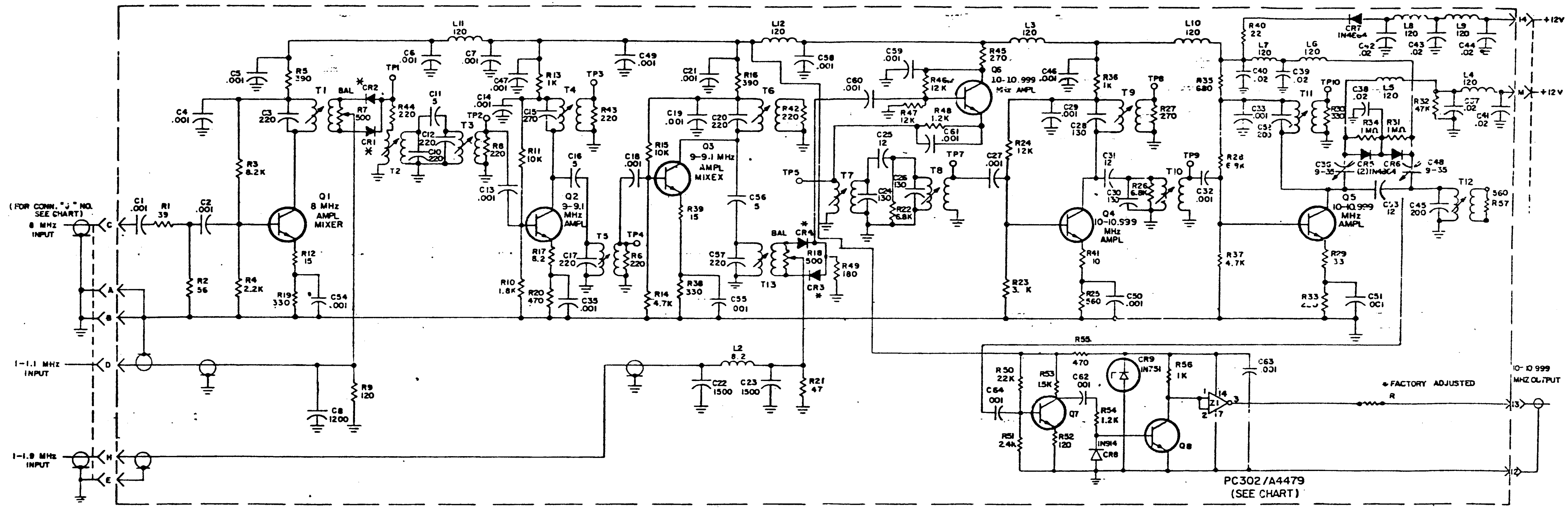


* NOTE

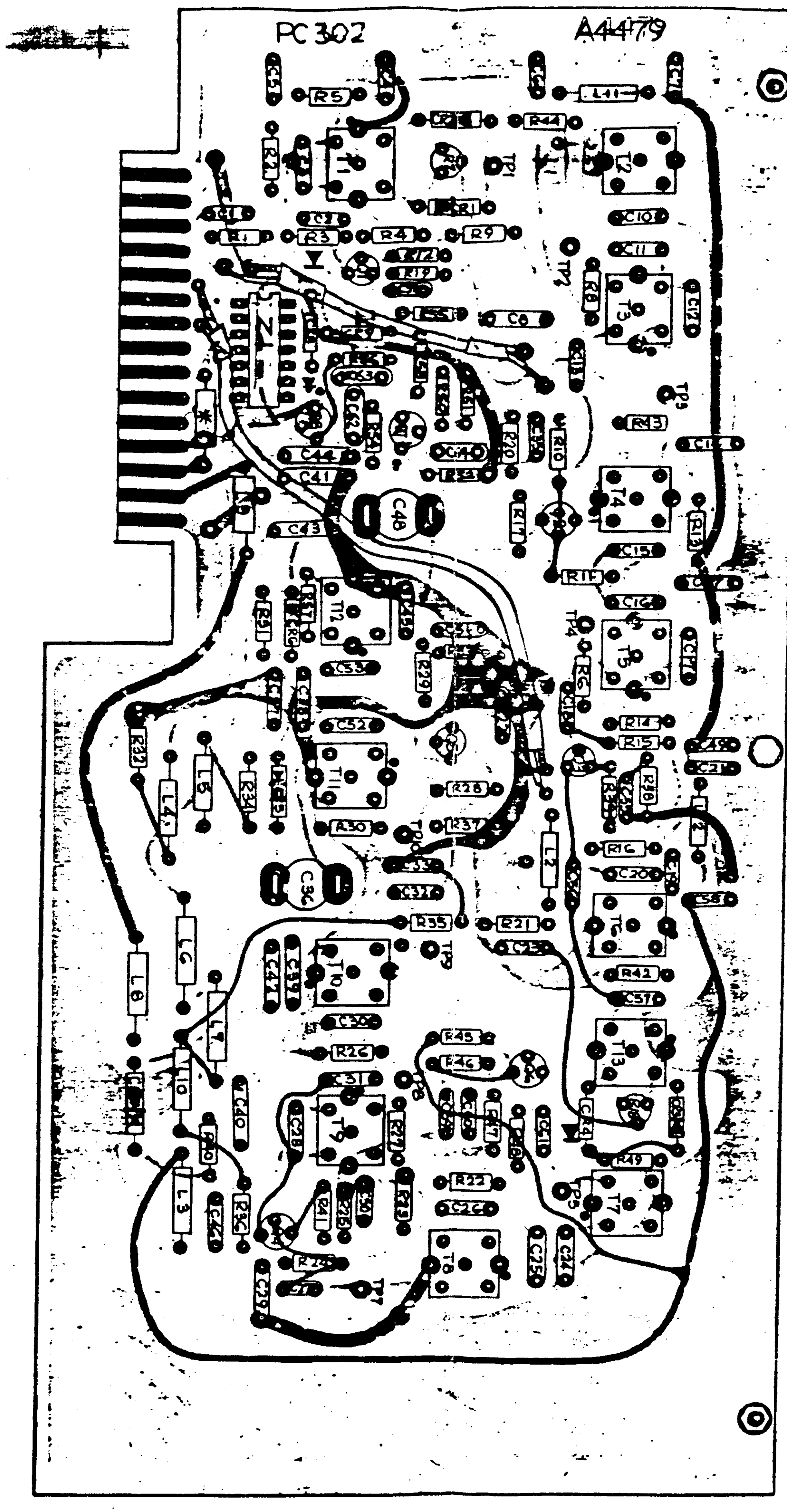
CR1 & CR2, CR3 & CR4, CONSIST OF MACHED PAIRS OF IN995 DIODES

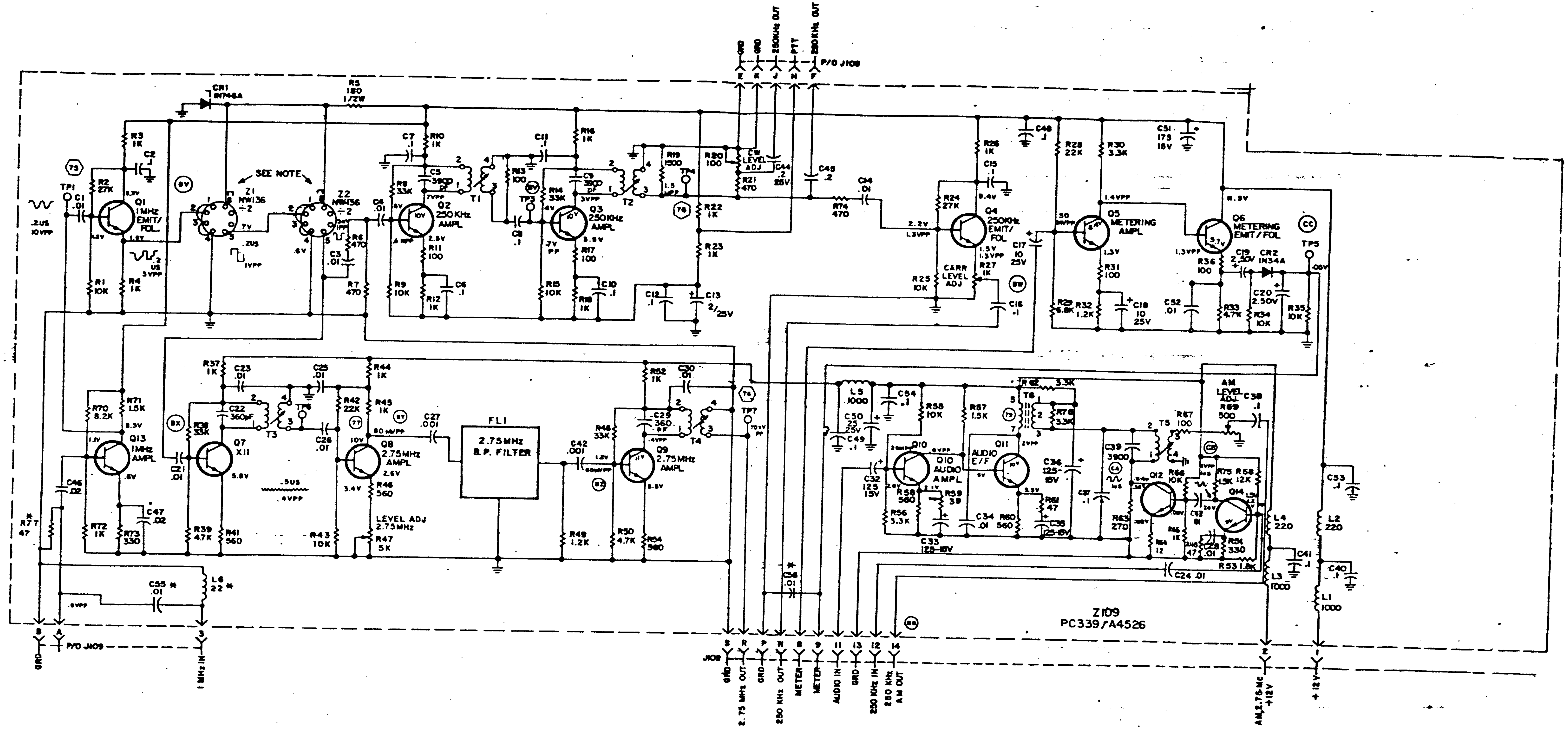
FIGURE 7-5. DUAL MIXER-DIVIDERS Z104 AND Z105, SCHEMATIC AND COMPONENT LOCATION DIAGRAM


PC 300-
A4475



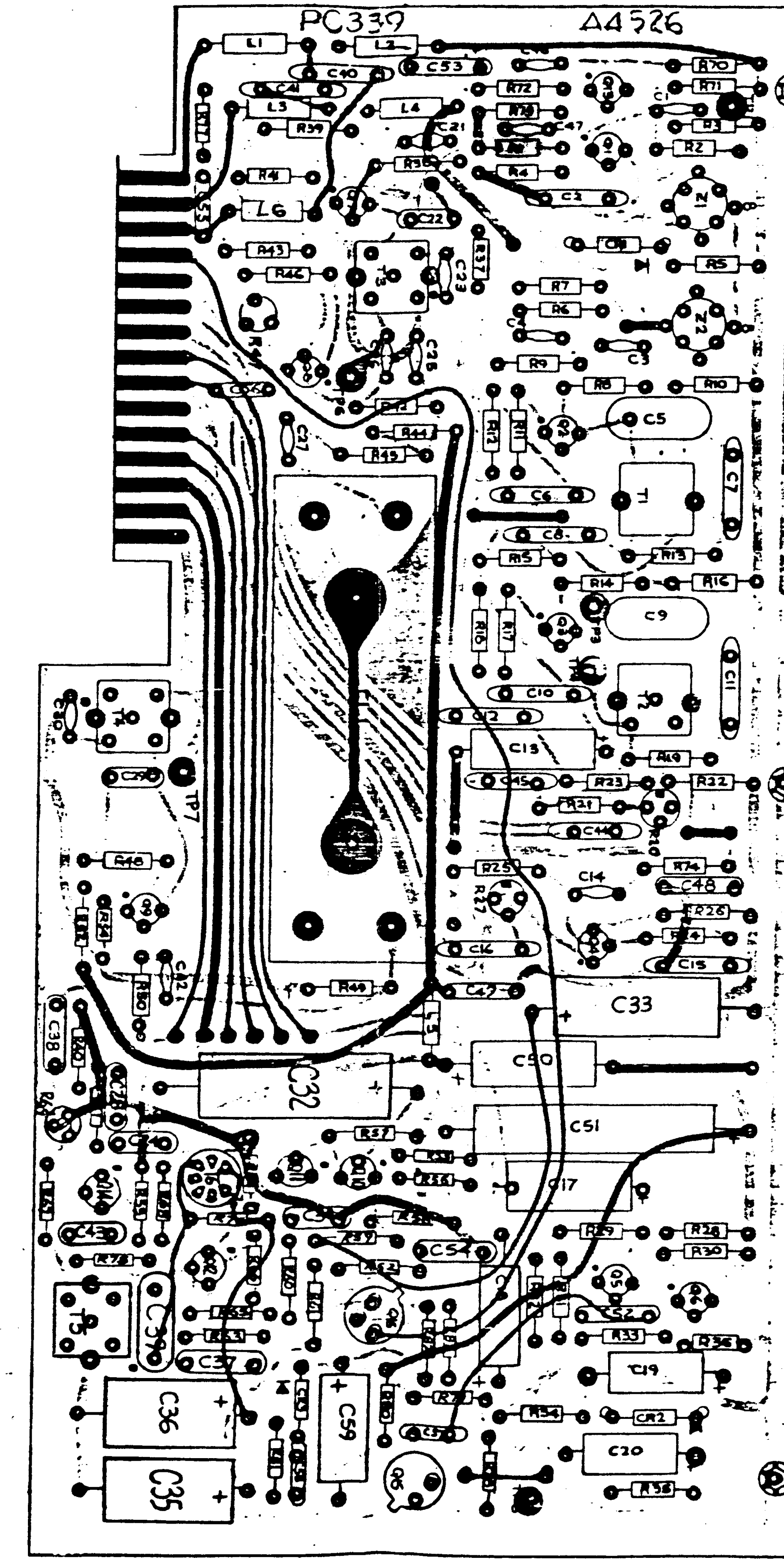
Z107 Final Mixer (A4479)

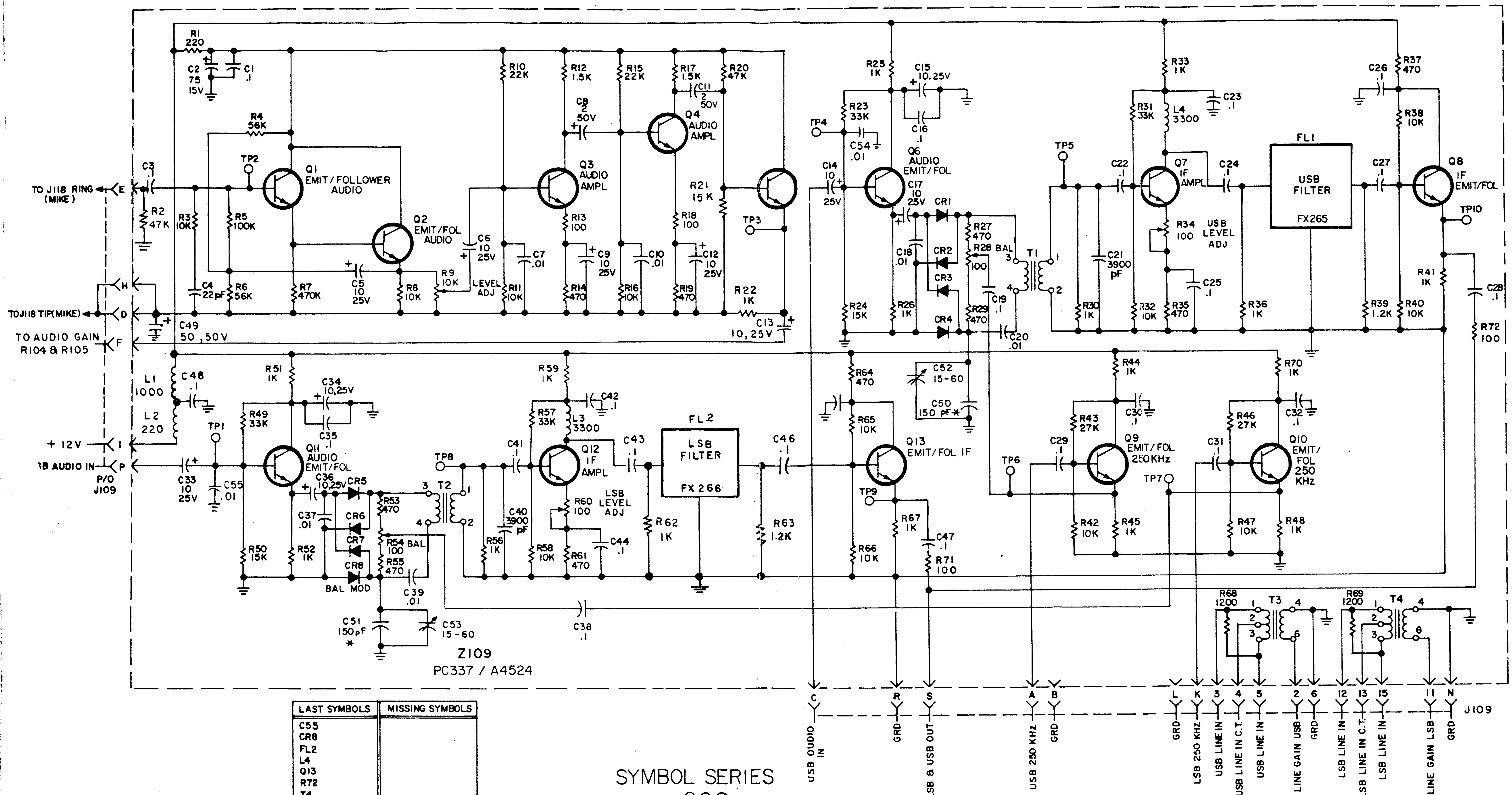

PC 302
A4479



* R77, C55, L6, C56 WILL NOT APPEAR FOR AN (MMX-2/A SERIES) LFE-2 COMPONENTS EXIST ON CONNECTOR SIDE (J109)

Z112 Carrier Generator (A4526)


PC339
A4526

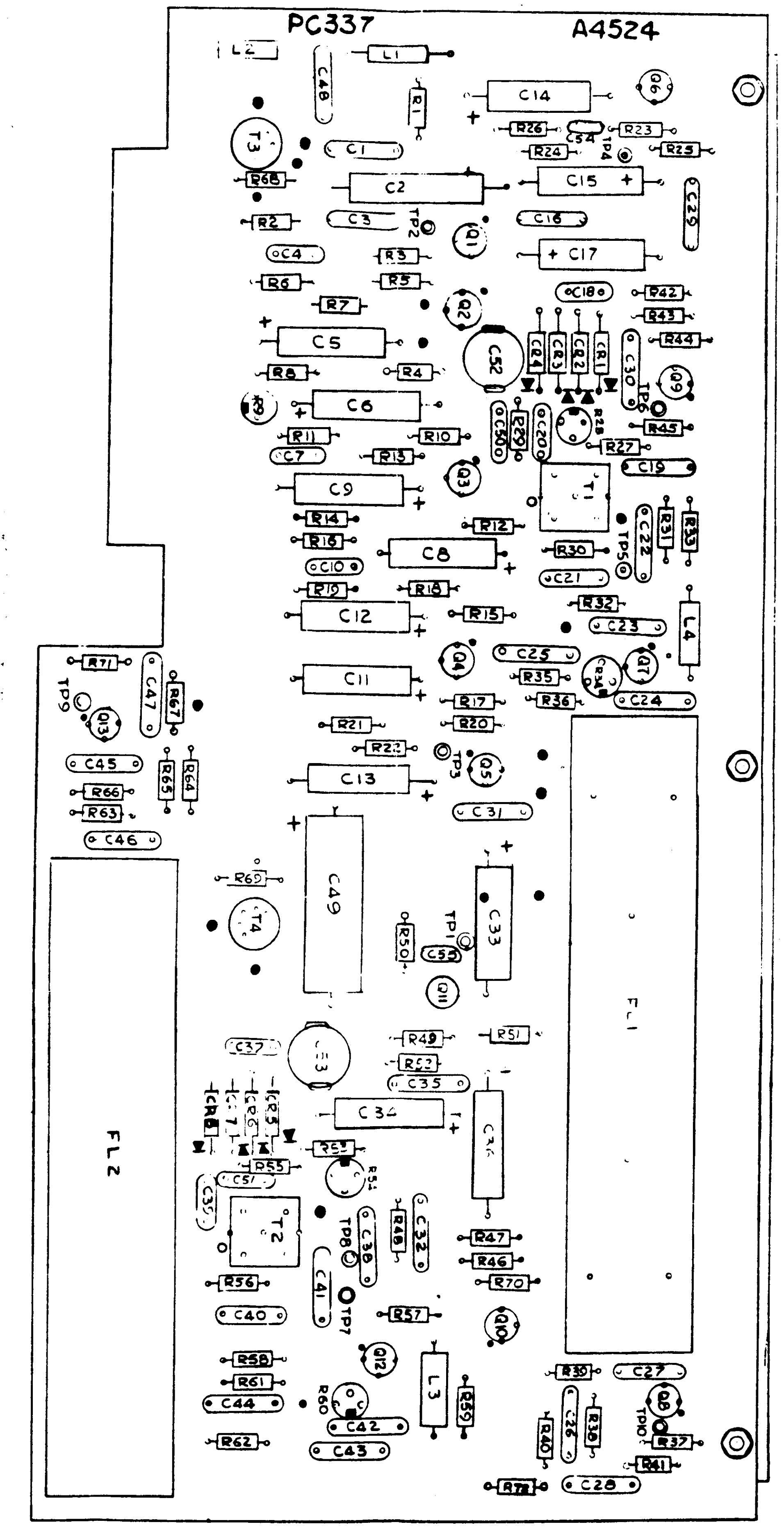


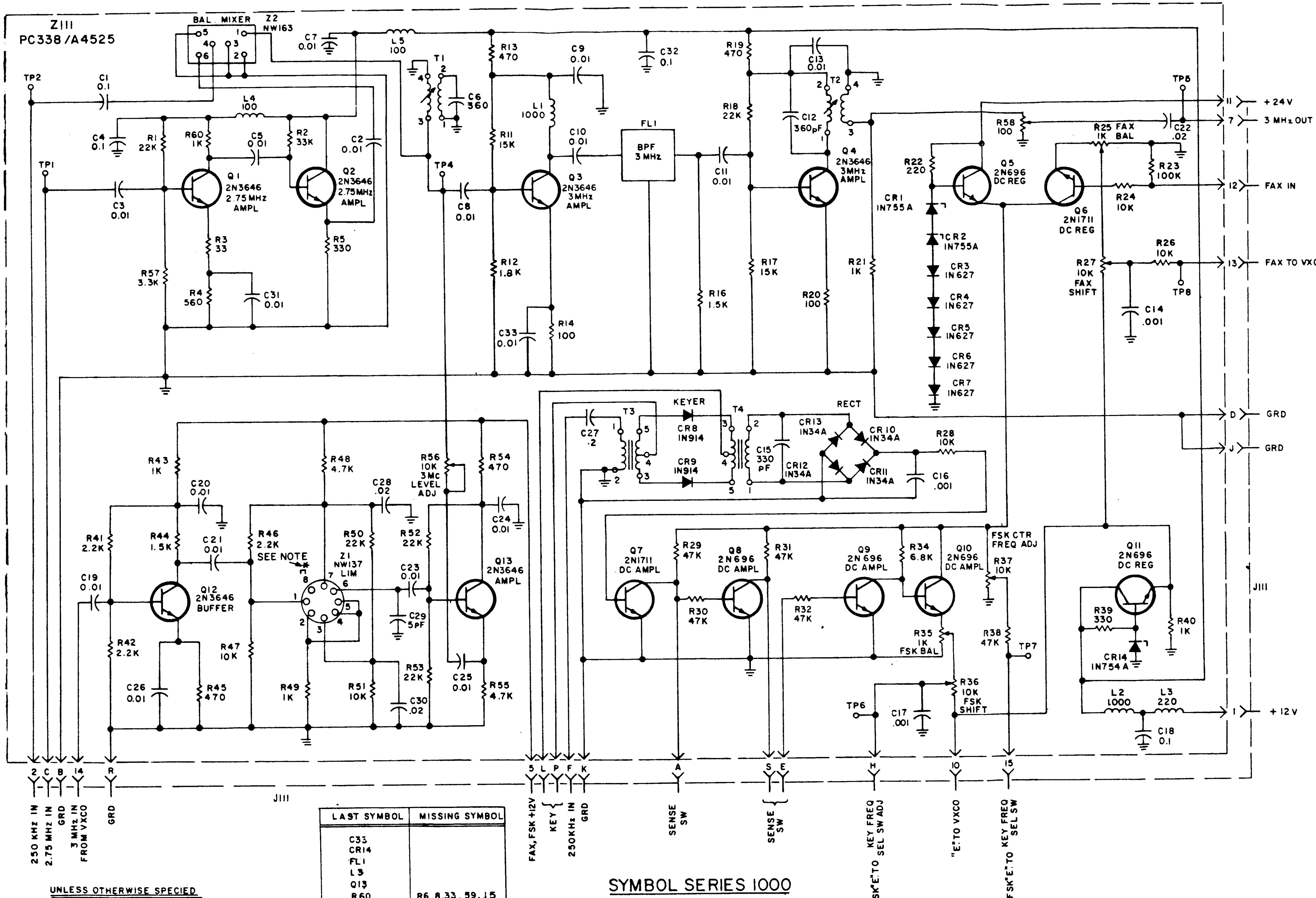
LAST SYMBOLS	MISSING SYMBOLS
C55	
CR8	
FL2	
L4	
Q13	
R72	
T4	
TP10	

SYMBOL SERIES
900

NOTE
* EXACT VALUE TO BE DETERMINATE BY TEST DEPARTMENT.

Figure 7-8. Sideband Generator Z109, Schematic and Component Location Diagram


PC337
A4524

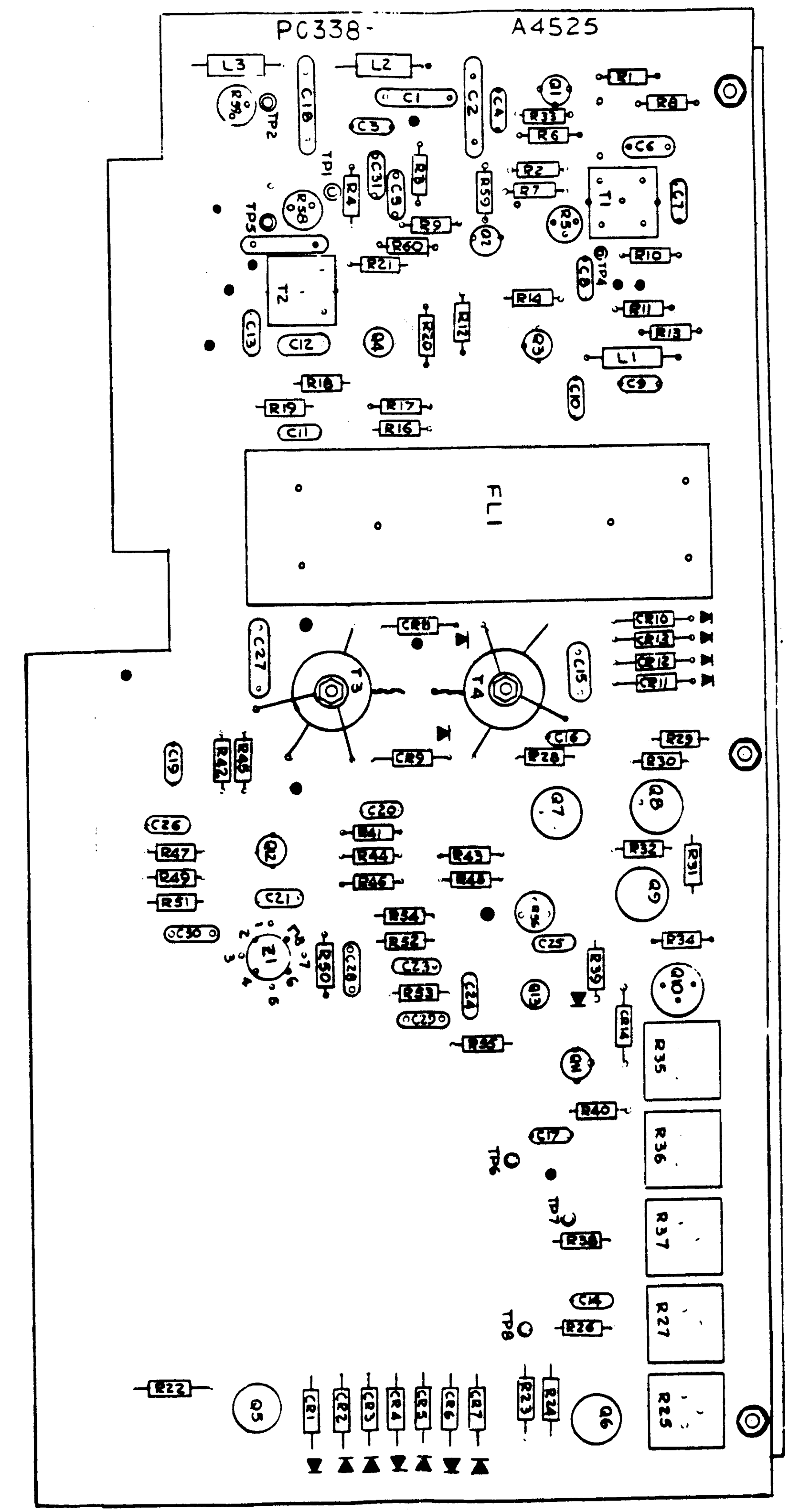


LAST SYMBOL	MISSING SYMBOL
C33	
CR14	
FL1	
L3	
Q13	
R60	R6,8,33,59,15
T4	
TP8	TP3
Z2	

UNLESS OTHERWISE SPECIED

1- ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
2- ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
* "⊓" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK

Figure 7-9. Frequency Shift Generator Z111, Schematic and Component Location Diagram



PC338- A4525
FL1
T1
T2
T3
T4

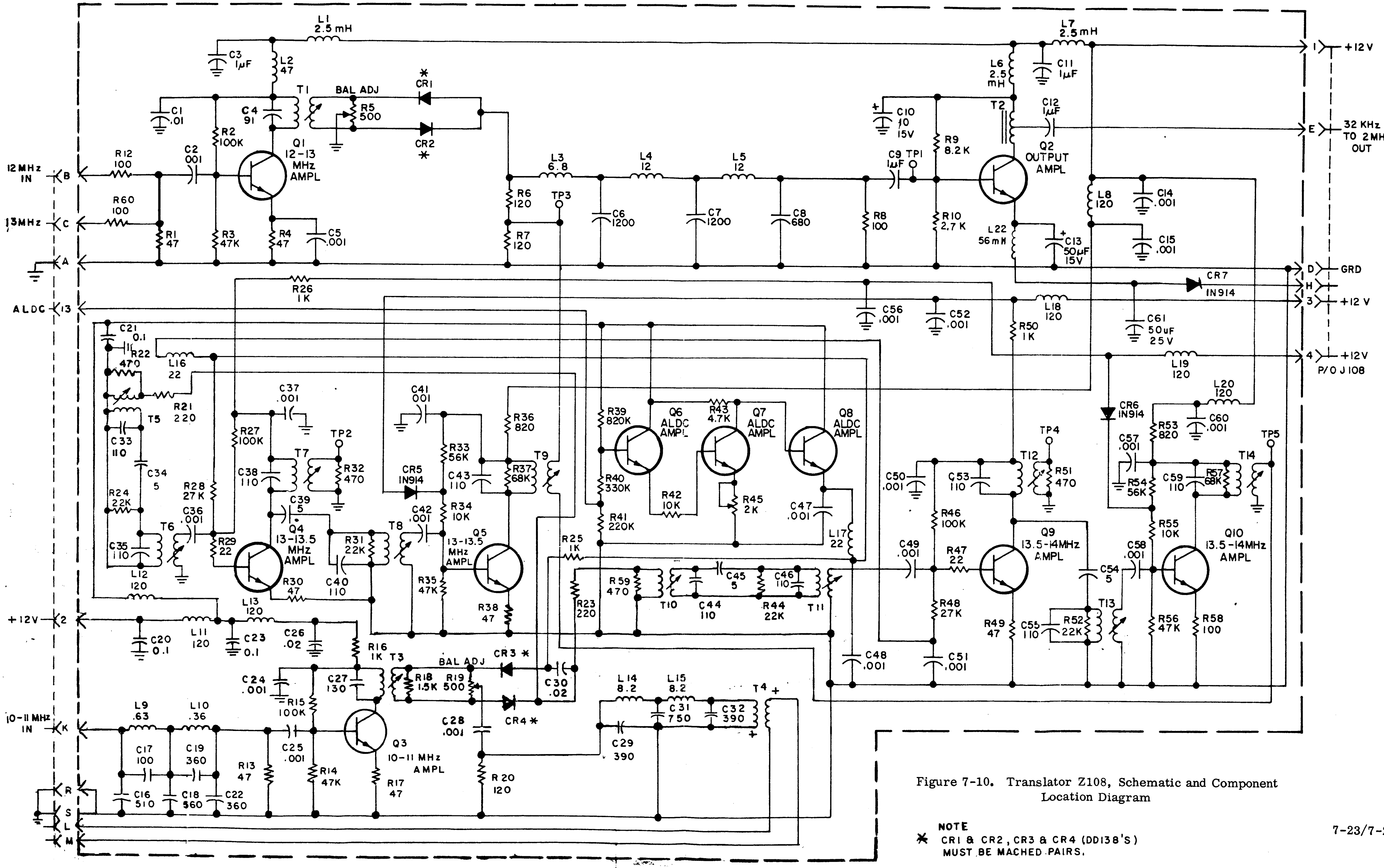
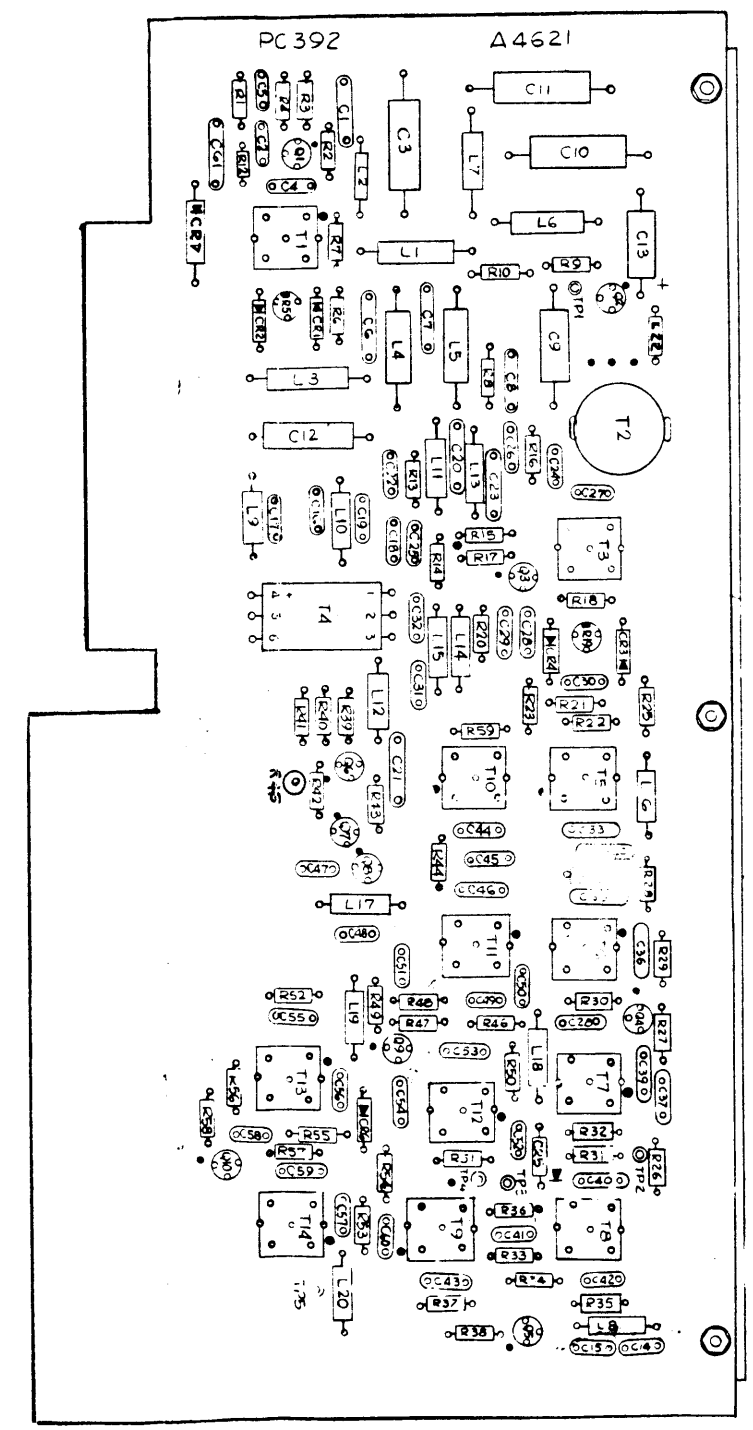
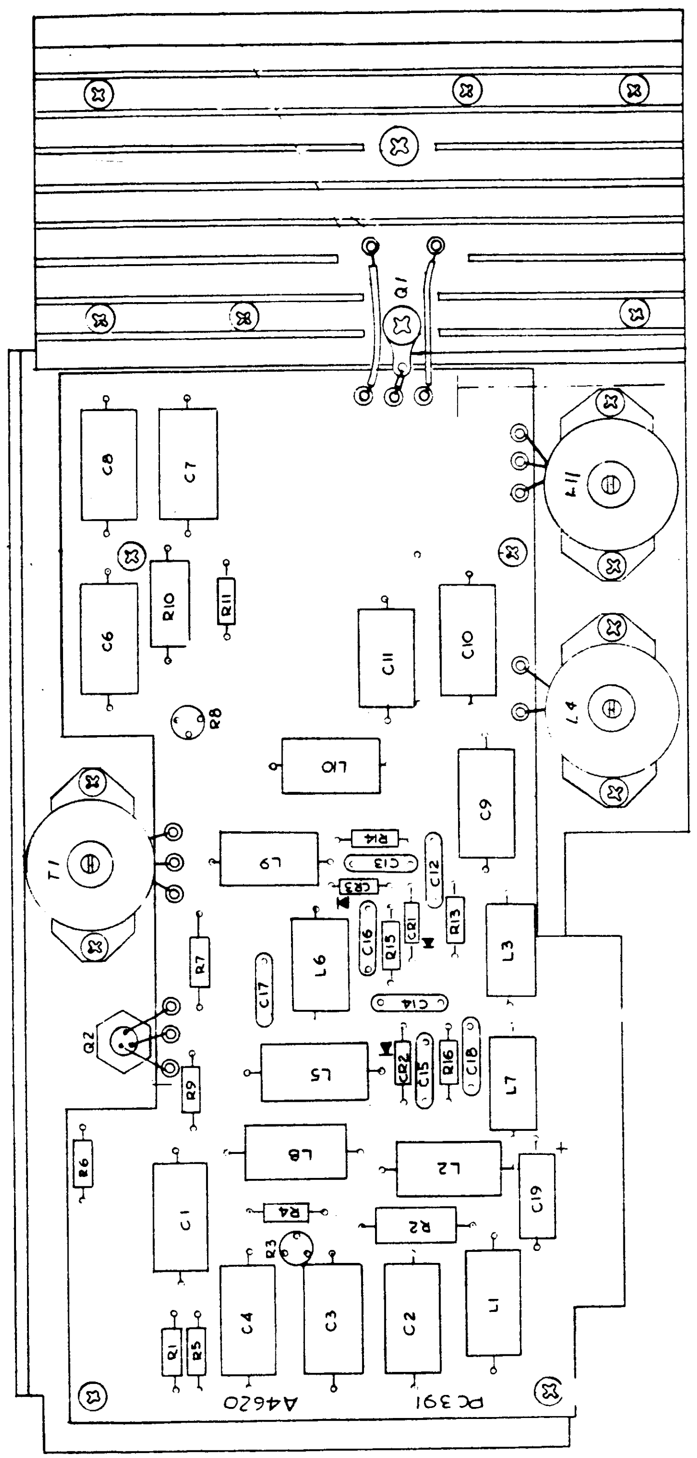


Figure 7-10. Translator Z108, Schematic and Component Location Diagram

NOTE

* CR1 & CR2, CR3 & CR4 (DD138'S) MUST BE MACHED PAIRS.


PC392
A4621



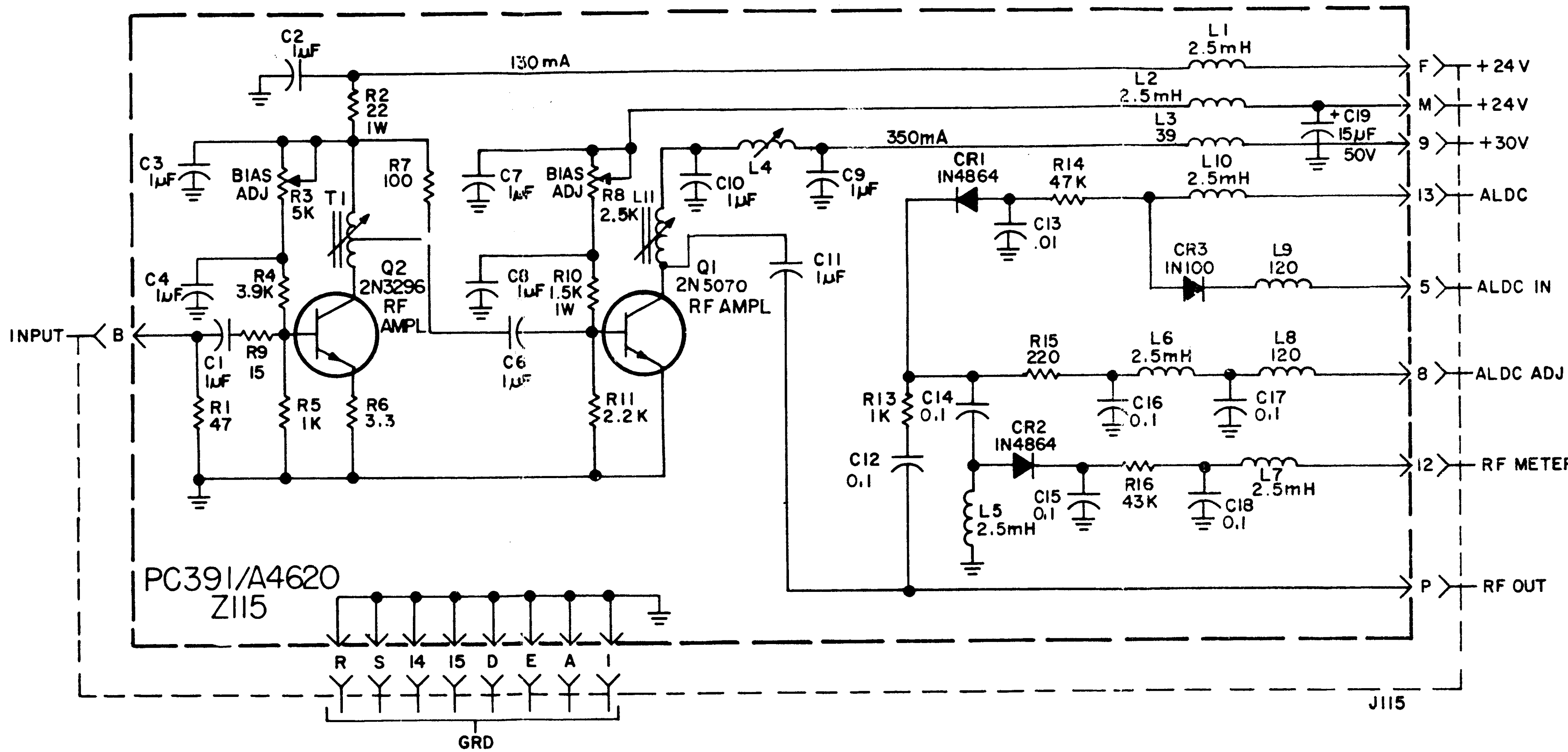


Figure 7-11. RF Output Z115, Schematic and Component Location Diagram

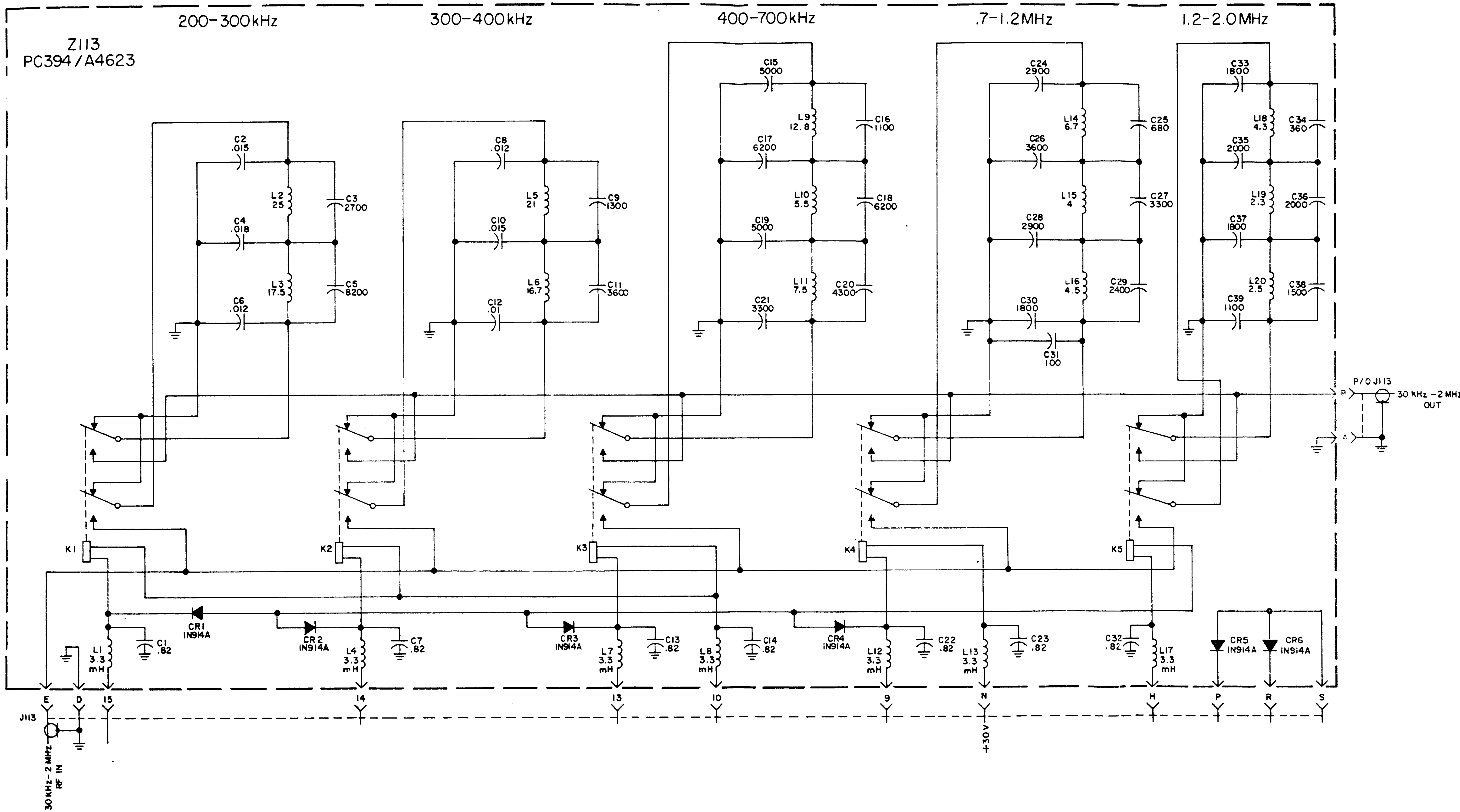
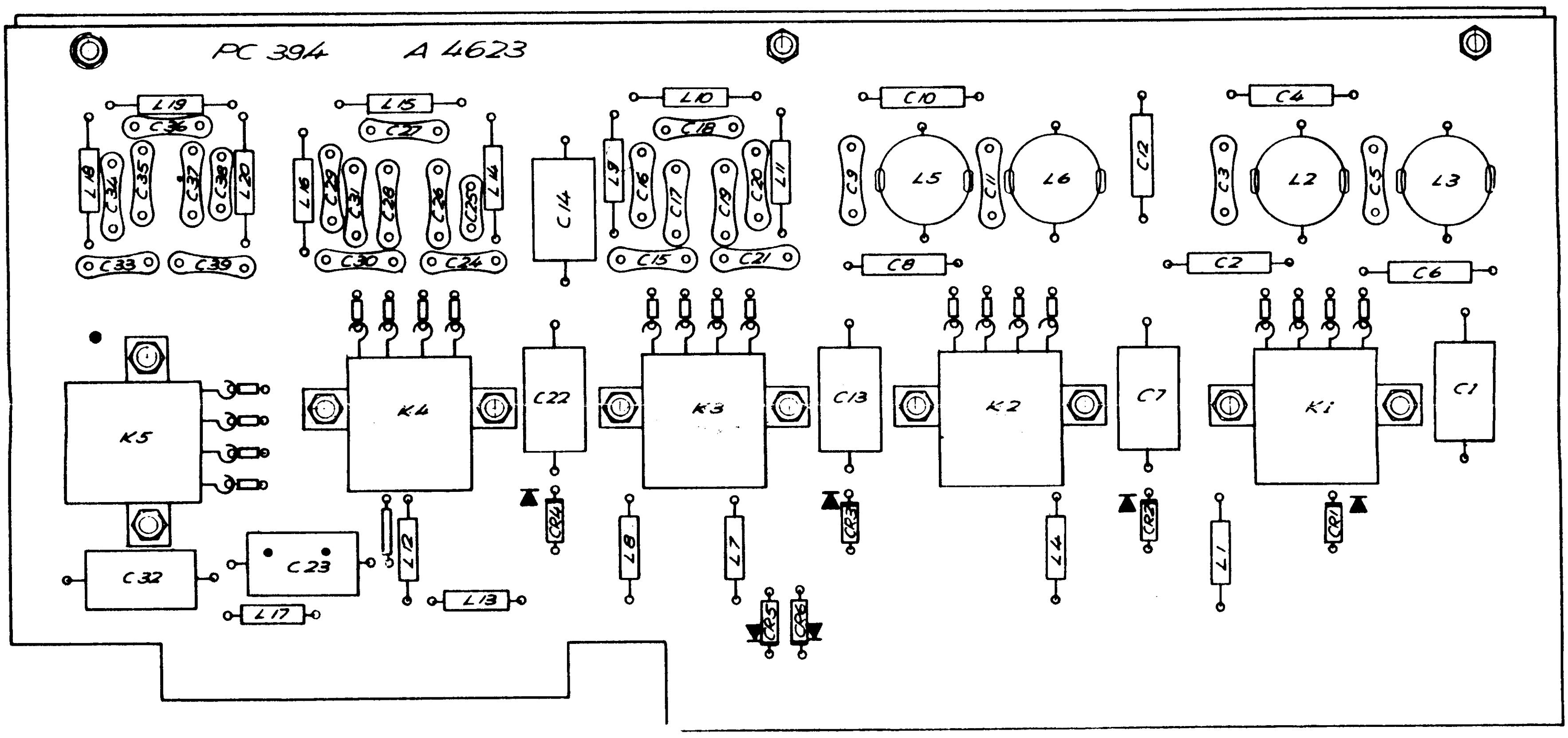
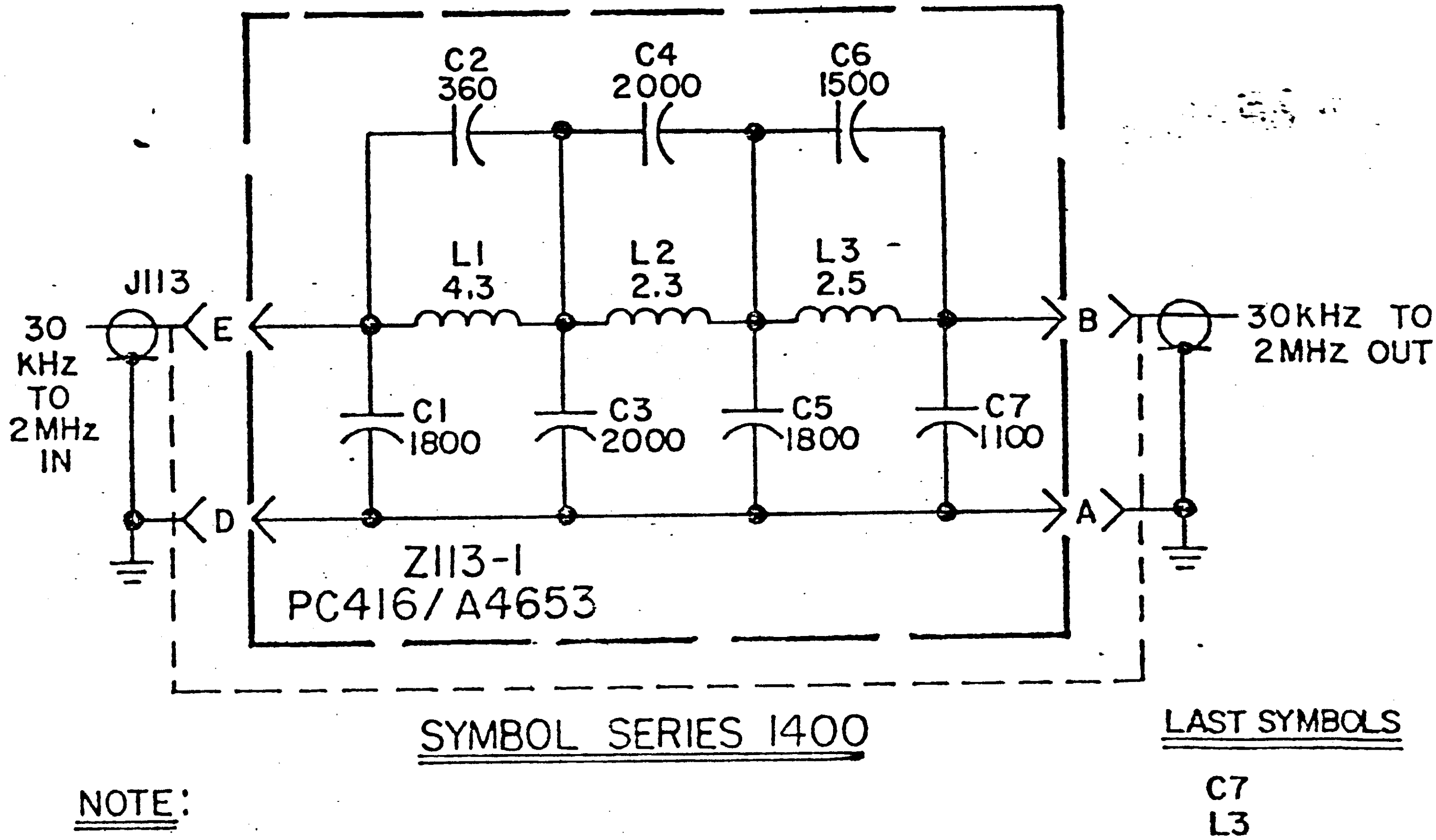


Figure 7-12. RF Filter Z113, Schematic and Component Location Diagram

006692042


PC 394
A 4623
K1
K2
K3
K4
K5
C1
C7
C13
C22
C14
C23
C32
L1
L2
L3
L5
L6



NOTE:

ALL CAPACITANCE VALUES ARE IN PICOFARADS.

ALL INDUCTANCE VALUES ARE IN MICROHENRIES.

Figure 7-17. Diagram, Schematic Output Filter

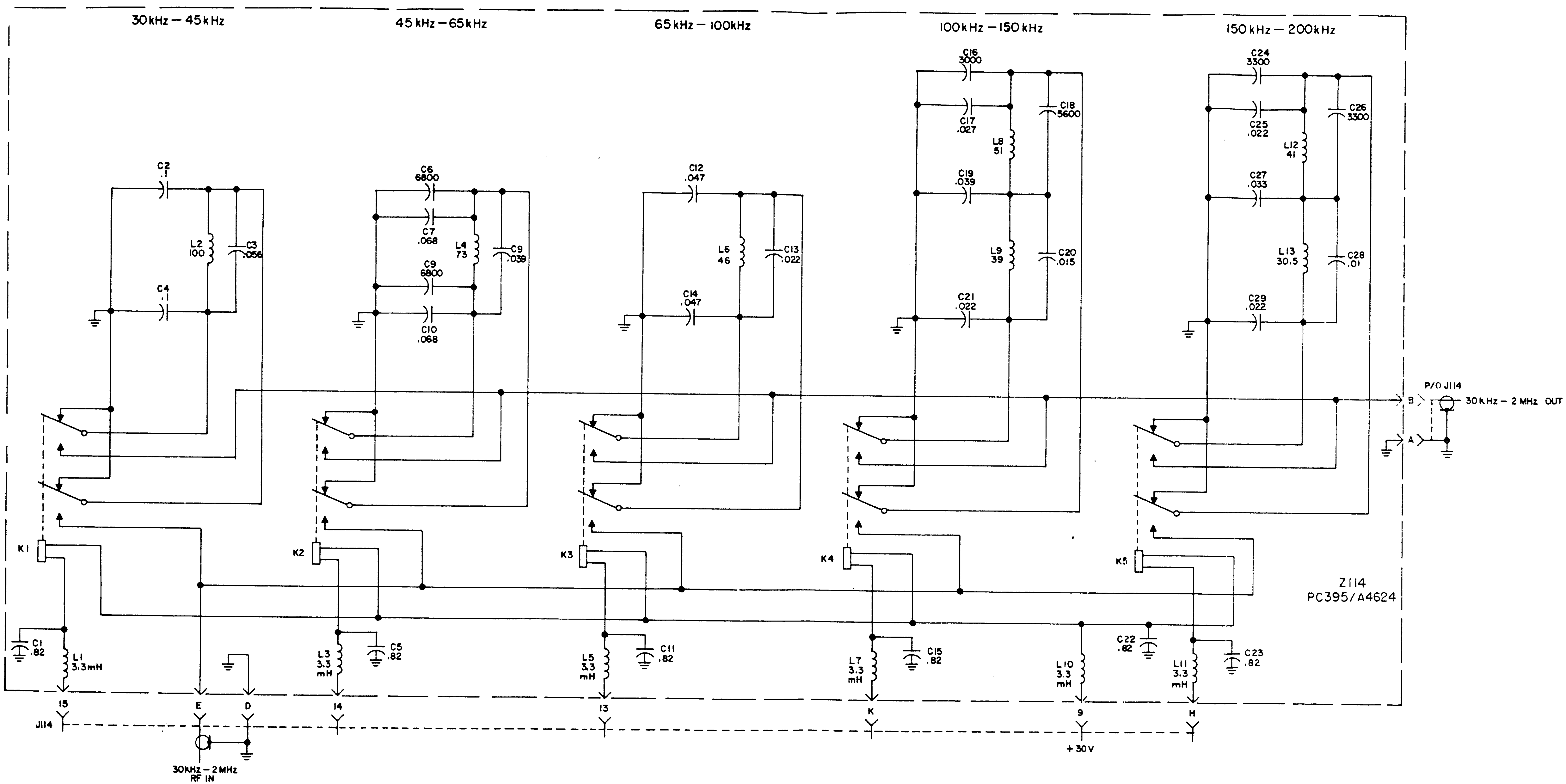
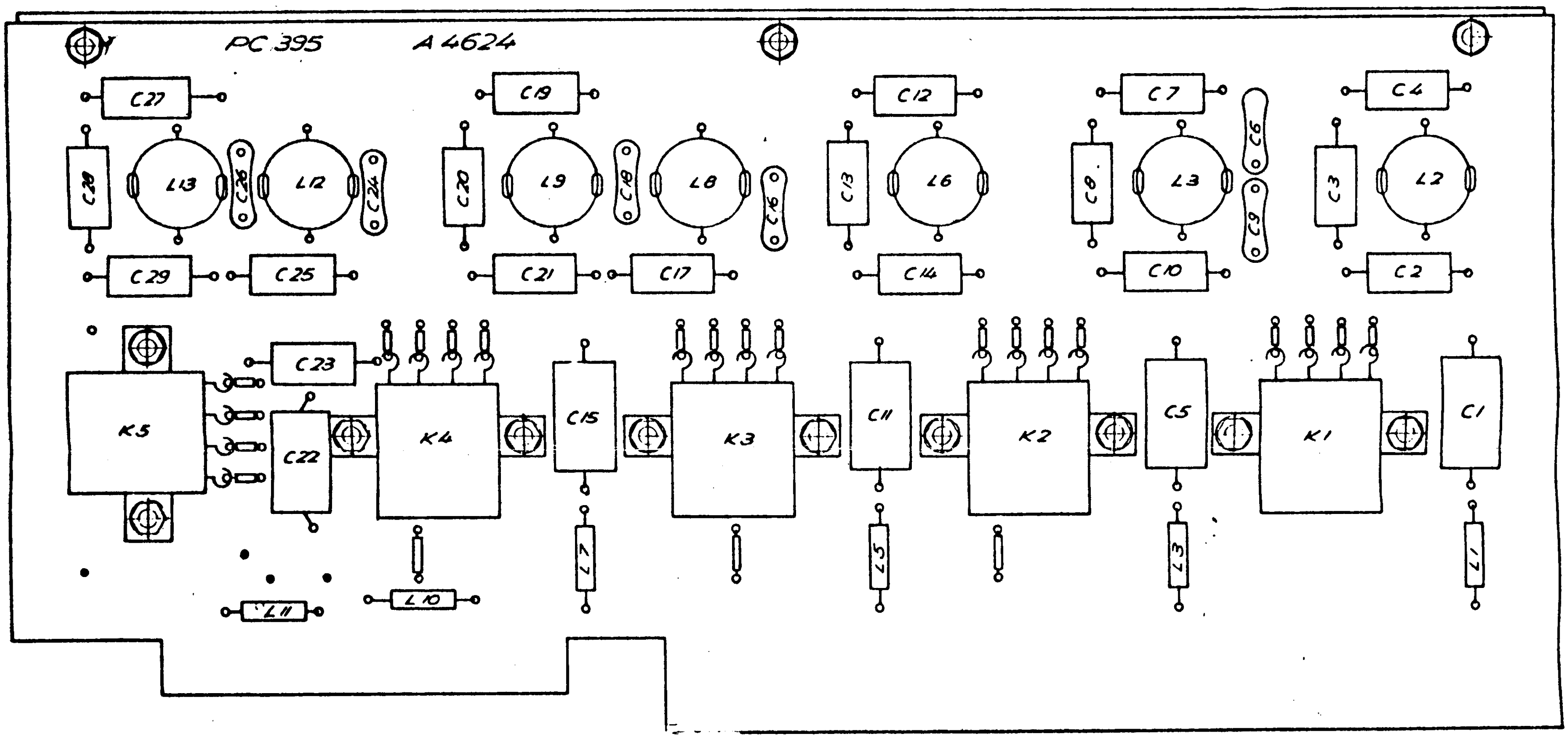
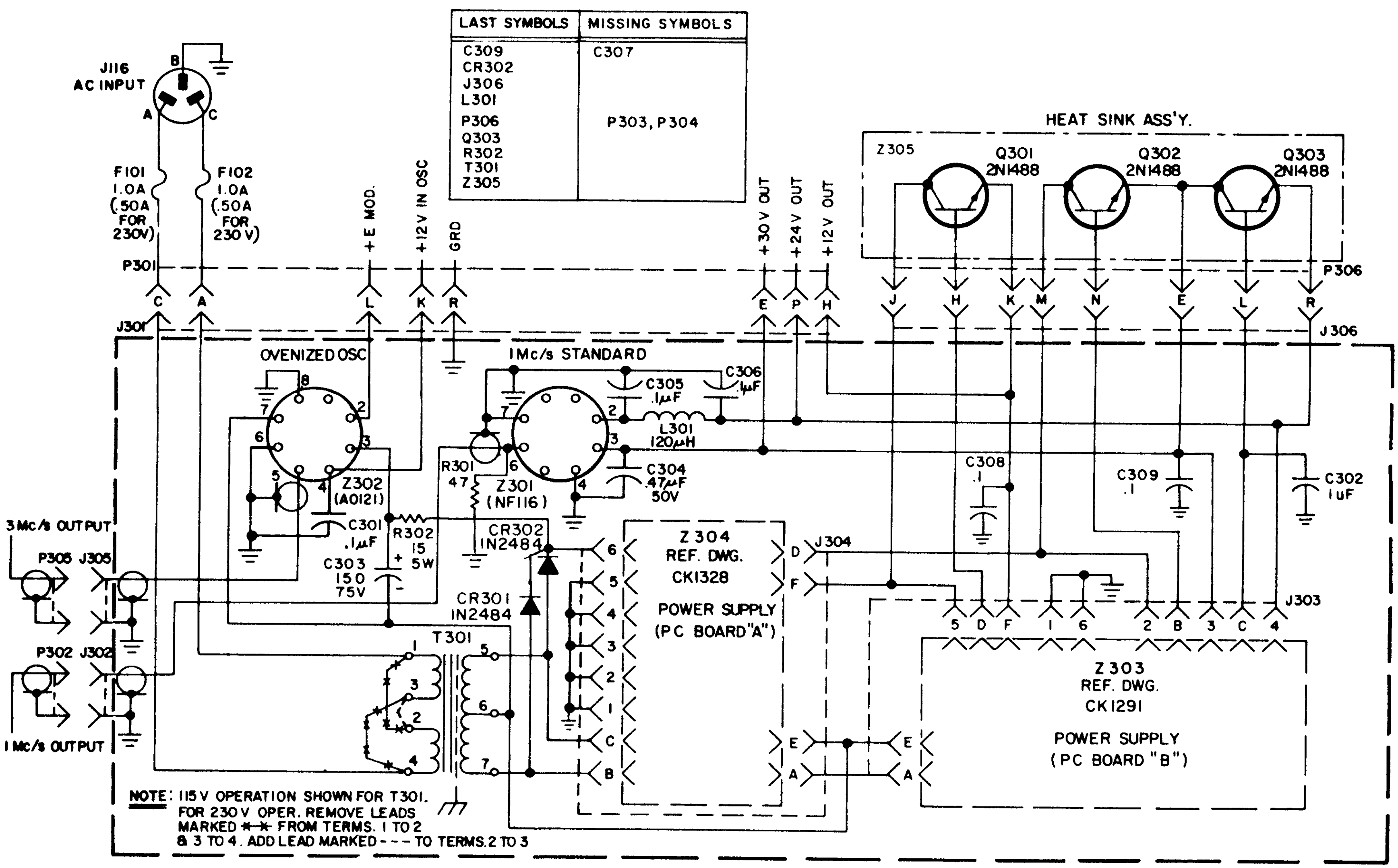


Figure 7-13. RF Filter Z114, Schematic and Component Location Diagram

006692042


PC 395
A 4624
C27
C19
C12
C7
C4
C28
L13
C26
L12
C24
C20
L9
C18
L8
C16
C13
L6
C8
L3
C6
C9
C3
L2
C29
C25
C21
C17
C14
C10
C2
C23
K5
C22
K4
C15
K3
C11
K2
C5
K1
C1
L7
L5
L3
L1
L11
L10



LAST SYMBOLS	MISSING SYMBOLS
C309 CR302 J306 L301 P306 Q303 R302 T301 Z305	C307 P303, P304

Figure 7-14. Power Supply Assembly, Wiring Diagram

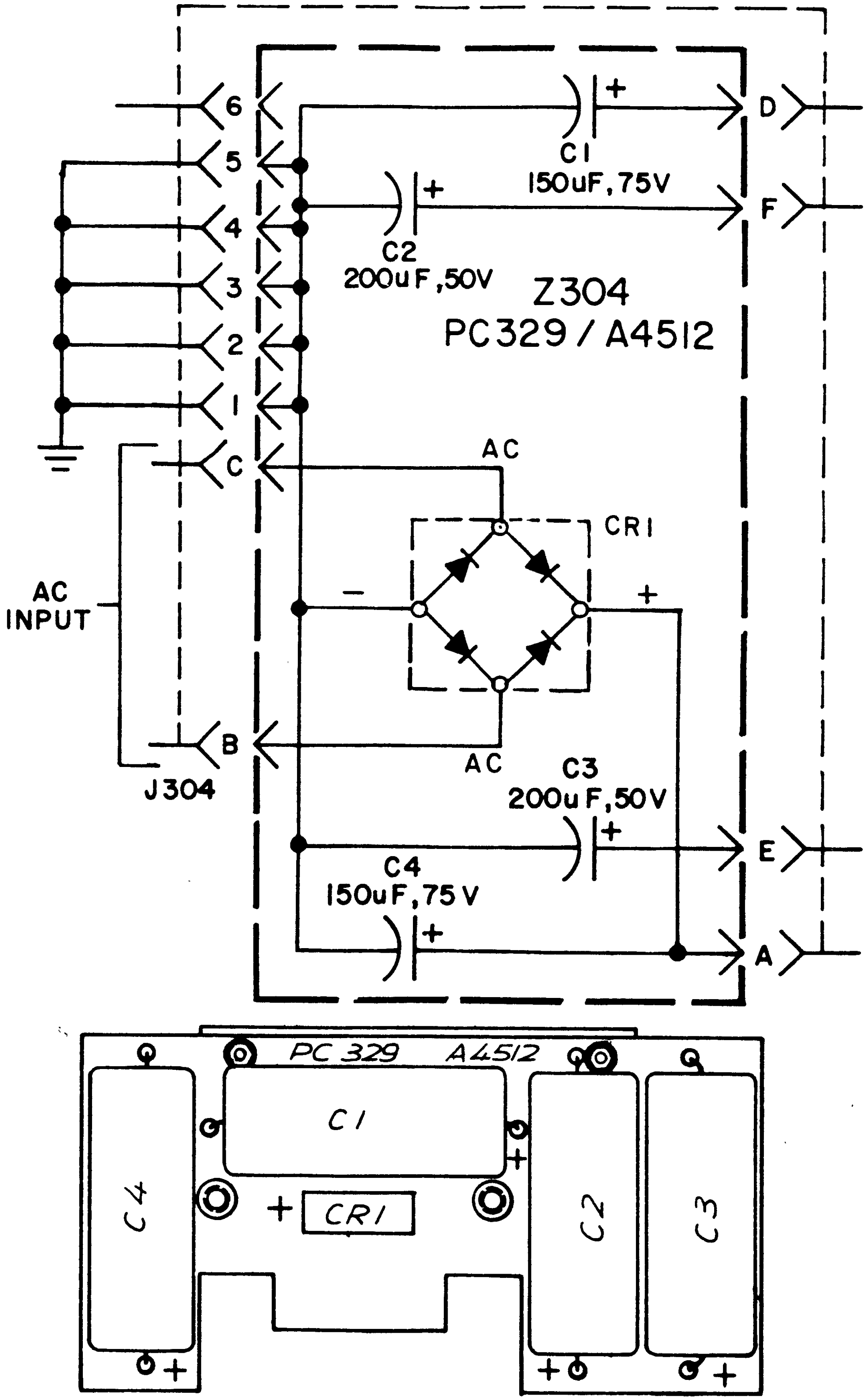
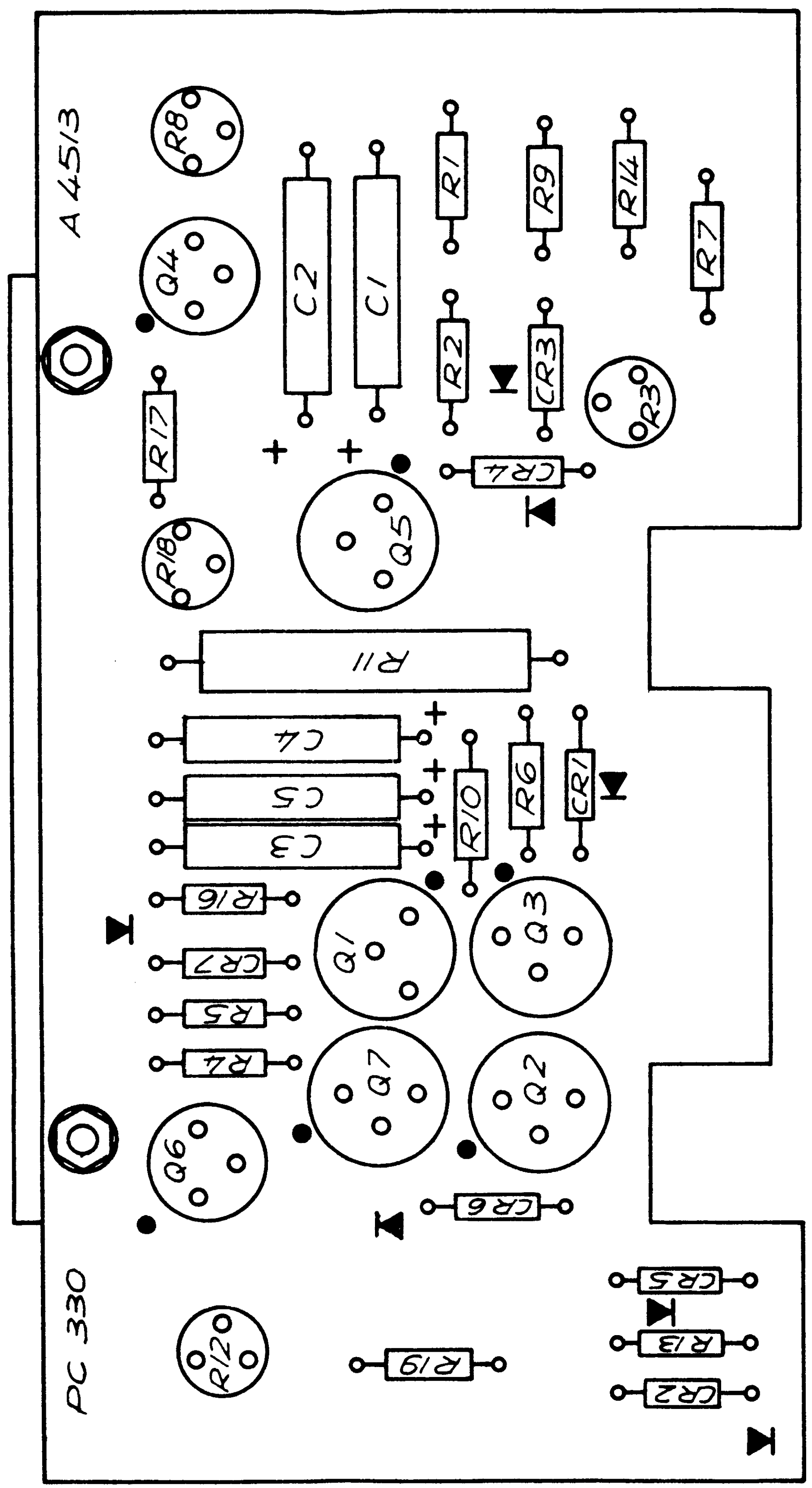


Figure 7-15. Rectifier-Filter Z304, Schematic and Component Location Diagram



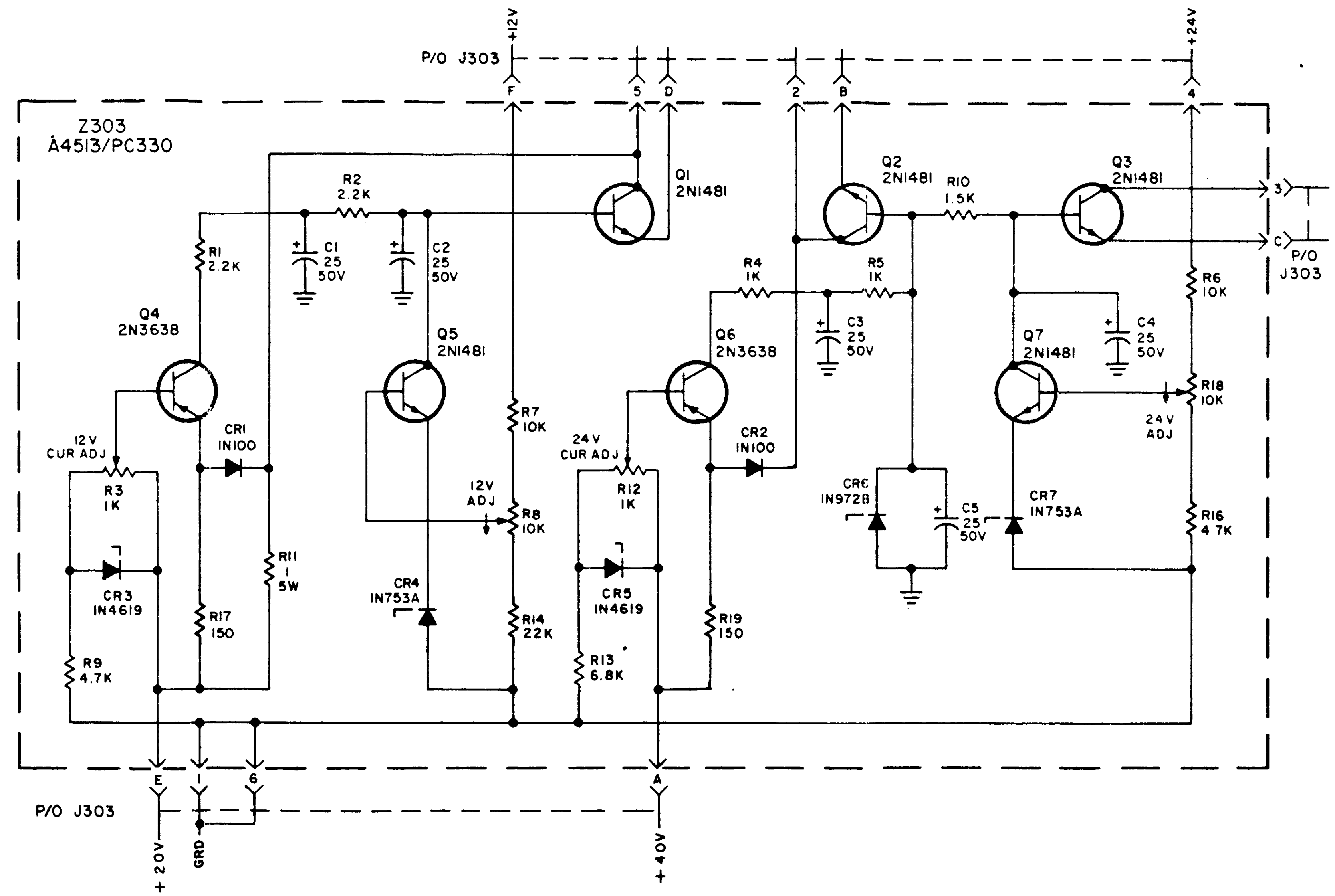


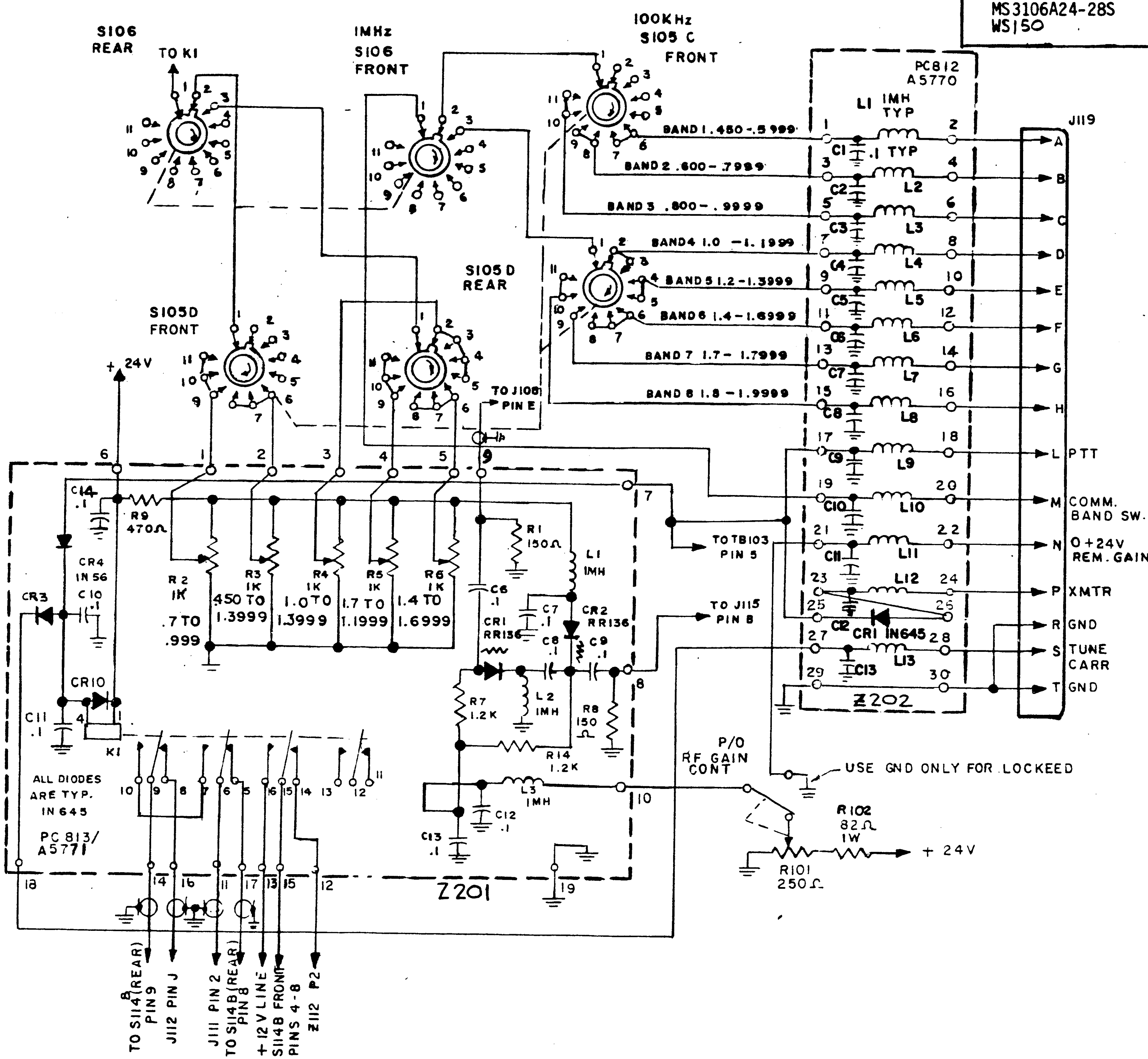
Figure 7-16. Regulator Z303, Schematic and Component Location Diagram

7-1a. INTRODUCTION - AX5248

The following pages contain information concerning the interfacing for bandswitching and RF Gain control internal to the LFE-2A when used with the MFT-10K/J transmitter.

FIGURE NO.	TITLE	TMC DWG. NO.
7-18	SCHEMATIC INTERFACING	CK2214
7-19	ASSY PC BD (BANDSWITCHING)	A5771
7-20	ASSY PC BD (FILTER)	A5770

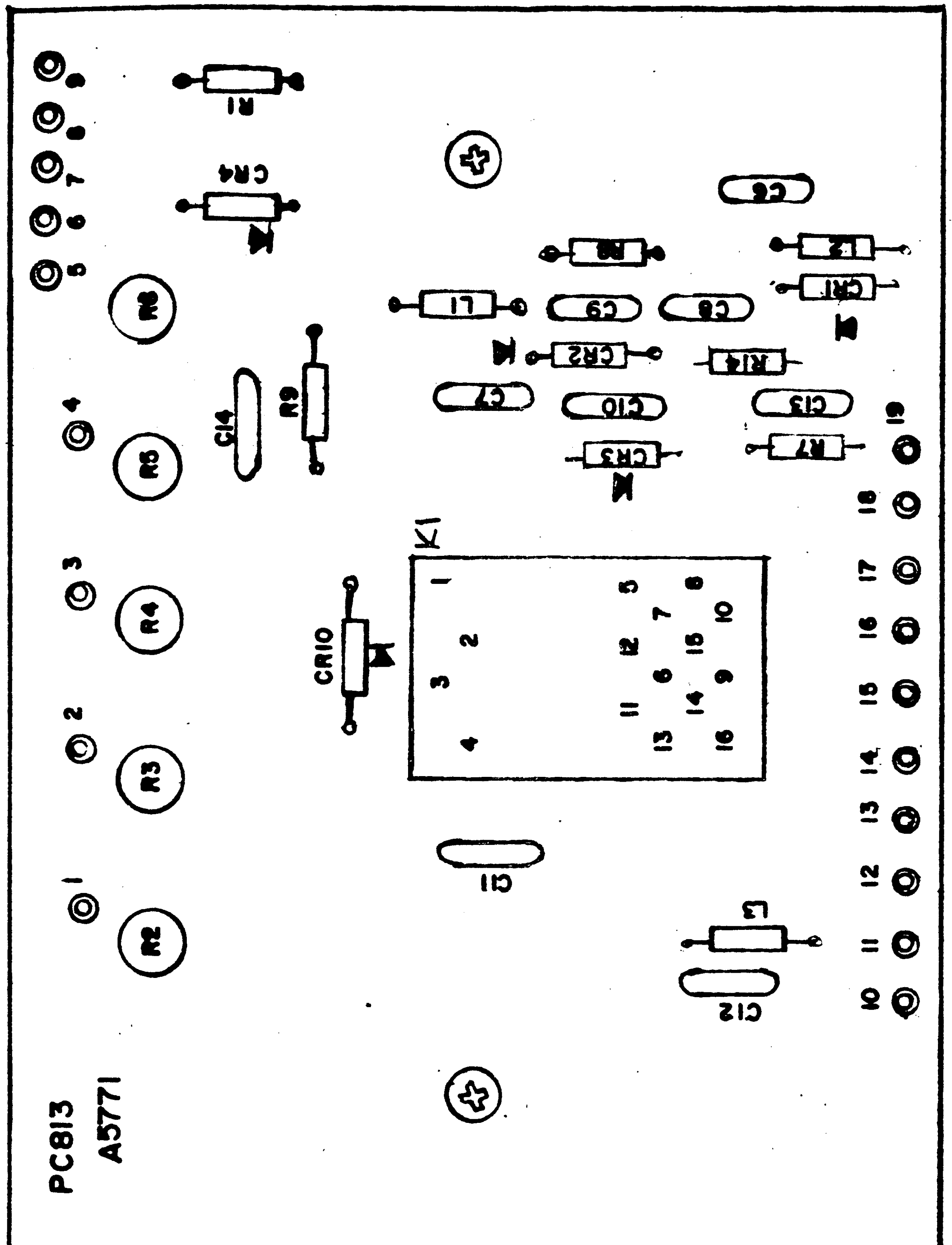
Part Number	Description	Used On	Qty	Symbol Number
A5770	ASSY, PC BD	LFE-2A	1	Z202
A5771	ASSY, PC BD	LFE-2A	1	Z201
MS3106A24-28S	CONNECTOR	LFE-2A	1	J119
WS150	WAFER	LFE-2A	3	S105-C,S105-D,S106



CK2214-0

Figure 7-18

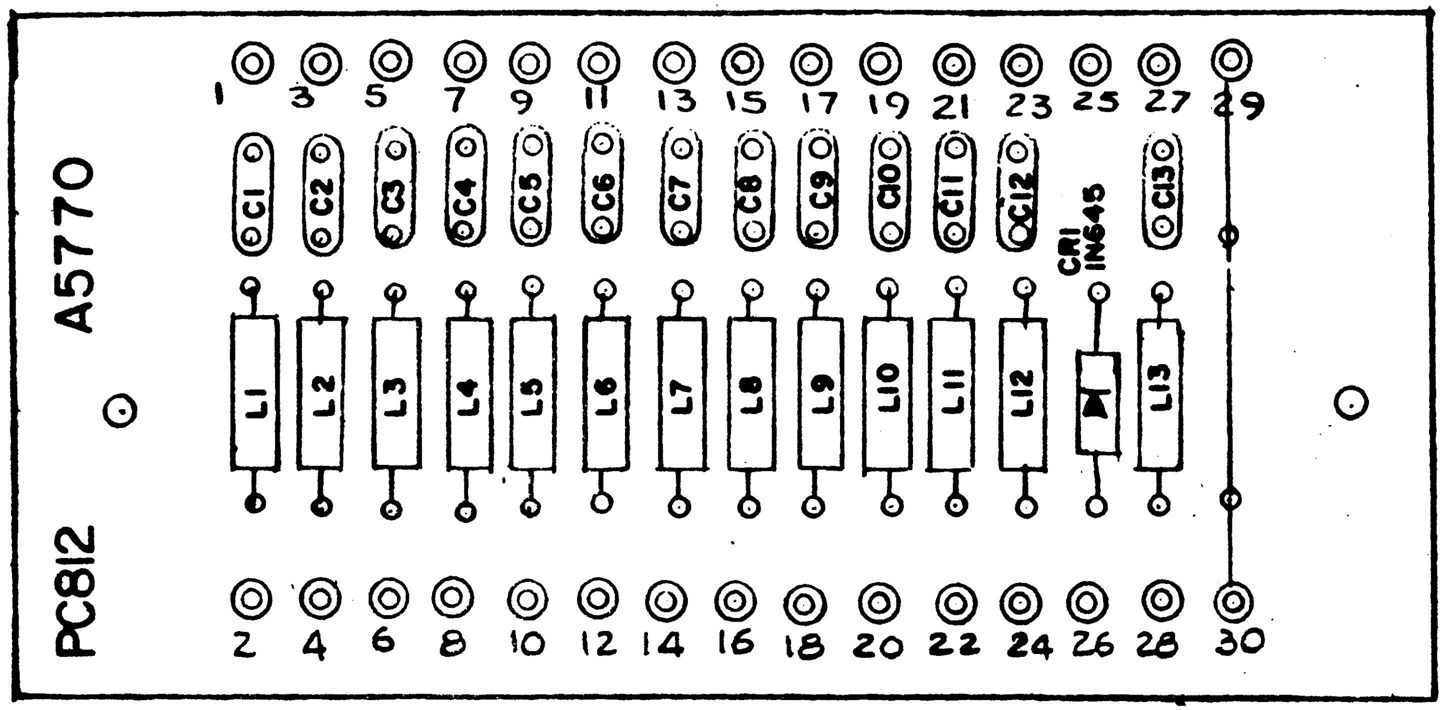
AX5248 Bandswitching and RF Gain Interfacing for LFE-2A



Part Number	Description	Used On	Qty	Symbol Number
CC100-28	CAP, FXD	A5771	9	C6,C7,C8,C9,C10,C11,C12,C13,C14
CL275-103	COIL, RF	A5771	3	L1,L2,L3
RC07GF122J	RES, FXD	A5771	2	R7,R14
RC07GF151J	RES, FXD	A5771	2	R1,R8
RC07GF471J	RES, FXD	A5771	1	R9
RL156-8	RELAY	A5771	1	K1
RR136	DIODE	A5771	2	CR1,CR2
RV121-3-102	RES, VAR	A5771	5	R2,R3,R4,R5,R6
TS171-3	SOCKET, RELAY	A5771	1	XK1
1N56	DIODE	A5771	1	CR4
1N645	DIODE	A5771	2	CR3,CR10

Figure 7-19

A5771 Bandswitching Printed Circuit Board (Z101)



Part Number	Description	Used On	Qty	Symbol Number
CC100-37	CAP, FXD	A5770	13	C1,C2,C3,C4,C5,C6,C7, C8,C9,C10,C11,C12,C13
CL275-103	COIL	A5770	13	L1,L2,L3,L4,L5,L6,L7, L8,L9,L10,L11,L12,L13
1N645	DIODE	A5770	1	CR1

Figure 7-20

A5770 Decoupling Printed Circuit Board (Z202)