NAVELEX 0967-293-0010

TECHNICAL MANUAL

RADIO TRANSMITTING SET
AN/FRT-84(V)

This manual supersedes and replaces
NAVSHIPS 0967-293-0010 dated 26 AUGUST 1969
and Change 1 dated 19 AUGUST 1970

Published by direction of Commander,
Naval Electronic Systems Command

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15 AUGUST 1973

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CRF(A Joint Venture)
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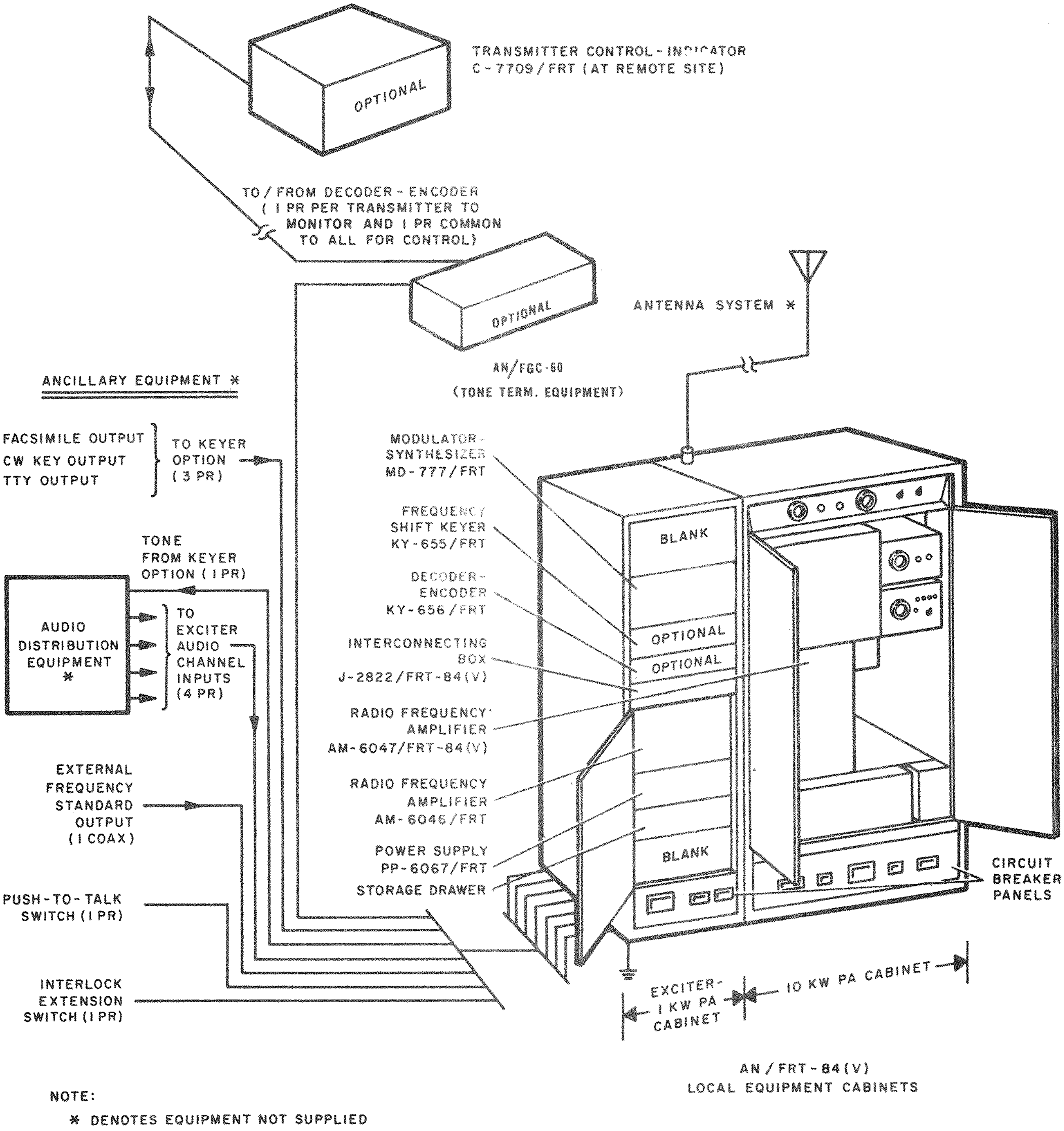


Figure 1-1. Radio Transmitting Set AN/FRT-84(V), Relationship of Units

SECTION I

GENERAL INFORMATION

1-1. SCOPE.

1-2. This technical manual is in effect upon receipt. Extractions from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-3. Radio Transmitting Set AN/FRT-84(V) is designed for use in various configurations, as denoted by the (V) inclusion in its nomenclature.

1-4. Table 1-1 lists the units of the AN/FRT-84(V) Radio Transmitting Set and their common names. Hereinafter, references in this manual will be to the AN/FRT-84(V) and to common names applied to the various units which the AN/FRT-84(V) comprises. For the sake of brevity, full nomenclature will not be used in this manual. Units are identified in figure 1-1, which shows a representative AN/FRT-84(V) with all optional units.

1-5. Standard abbreviations used throughout this manual are in accordance with the requirements of MIL-STD-12. Non standard abbreviations used are identified and defined in table 1-6.

1-6. This technical manual provides overall system information and it also provides detailed technical information for units which are not optional or are not in common with other Transmitting Sets of the AN/

TABLE 1-1. AN/FRT-84(V) UNIT NAMES

COMMON NAME	FULL NOMENCLATURE
10 KW PA	Amplifier, Radio Frequency AM-6047/FRT-84(V)
1 KW PA	Amplifier, Radio Frequency AM-6046/FRT
1 KW Power Supply	Power supply PP-6067/FRT
I. Box	Interconnecting Box J-2822/FRT-84(V)
Exciter	Modulator-Synthesizer MD-777/FRT
Keyer	Keyer, Frequency Shift KY-655/FRT
Remote Control	Transmitter Control-Indicator C-7709/FRT
Decoder-Encoder	Decoder-Encoder KY-656/FRT

FRT-83(V) through AN/FRT-86(V) series. Units so covered are specifically identified in table 1-1.

1-7. Detailed technical coverage of units not provided in this technical manual is provided in separate technical manuals for those individual units. Preventive maintenance information for all units is provided in maintenance standards books. These publications are listed in table 1-2.

1-8. Sections I and II of this technical manual (General Information and Installation) provide system coverage. Operation, Section III, is supplied as a separate Manual Operator's Handbook (NAVELEX 0967-293-0020). Section IV covers Troubleshooting at three levels: it covers the transmitter and associated equipment on a system level and continues by covering the 1 KW PA, 1 KW Power Supply, 10 KW PA, and I. Box units within individual functional section discussions; then it concludes with test data and servicing diagrams for each functional section. Section V (Maintenance) covers the removal and replacement of system units and gives detailed maintenance and repair instructions for the units listed above. Section VI is a Parts List for the units listed above.

1-9. GENERAL DESCRIPTION

Radio Transmitting Set AN/FRT-84(V), herein called AN/FRT-84(V), is a synthesized frequency, independent sideband, automatically tuned, HF Radio Transmitting Set for fixed or transportable use. This equipment transmits with a 10 KW PEP or 5 KW average power level on any one of 280,000 communications channels spaced at 100 CPS intervals in the 2.0 to 29.9999 MC frequency range. Voice, CW, and FSK intelligence is transmitted on the selected HF channel using an upper, lower, or independent sideband mode of operation. With independent sideband operation, two audio subchannels can be transmitted on one HF channel simultaneously.

1-10. The various configurations of the AN/FRT-84(V) all have an Exciter unit, a 1 KW Power Supply unit, a 1 KW PA unit, a 10 KW PA unit with integral power supply, and an I Box unit. Together with their respective cabinets, these units form the basic transmitter as shown in figure 1-1. The transmitter is cooled by forced air. The equipment in the Exciter-1 KW PA cabinet provides the RF power to drive the 10 KW PA in the companion cabinet. Incorporation of optional units extends the capabilities of the basic transmitter as follows: (1) Keyer unit increases variety of input device types which can be used and (2) Remote Control unit and associated Decoder-Encoder unit provides remote control/remote monitoring capability.

1-11. The basic transmitter provides for voice-type independent sideband and compatible AM communications. The equipment is phase-delay compensated to permit high speed data transmission. Incorporation of the Keyer unit allows teletypewriter, facsimile, and CW communications to be transmitted in addition to voice; thus the input devices usable with a particular transmitter are defined by the specific AN/FRT-84(V) configuration.

1-12. Normal control of the AN/FRT-84(V) is accomplished by using operating controls on the Exciter unit. However, control of this transmitting equipment from a remote location is possible by incorporation of an optional Remote Control unit along with is associated (locally-mounted) Decoder-Encoder unit. Control of up to ten AN/FRT-84(V) transmitters is possible; each must have its own Decoder-Encoder unit. The remote operator can select the desired local transmitter to be controlled.

1-13. RADIO FREQUENCY AMPLIFIER AM-6047/FRT-84(V).

1-14. The 10 KW PA is a single-stage linear power amplifier which produces an output of 10 KW PEP or 5 KW average power with a nominal input of about 500 W. Five bands for coarse tuning output matching network components are selected in response to a five-wire code from the Exciter. Automatic fine tuning is then accomplished by internal servo systems. Automatic control circuits operating in conjunction with the 1 KW PA and Exciter units compensate for variations in system gain or loading to protect the unit against transmitter overload. Low and high operating voltages are internally produced from 220 VAC, three-phase, 47-63 CPS power from an autotransformer in the Exciter-1 KW PA cabinet.

1-15. The 10 KW PA has seventeen major subassemblies. Fourteen of these subassemblies make up the power amplifier chassis assembly which is mounted on slides, allowing it to be extended from the cabinet for servicing. The remaining subassemblies are mounted to the interior of the cabinet. Maintenance controls and indicators are located on the front of the power amplifier chassis assembly, except for a small grouping of performance indicators on the top panel of the cabinet. Connections are made internally to the 10 KW PA cabinet, except for the RF output connector which is outside (at top) of the cabinet. The amplifier tube and tuned circuit components of the 10 KW PA are cooled by forced air.

1-16. RADIO FREQUENCY AMPLIFIER AM-6046/FRT.

1-17. The 1 KW PA is a two-stage, 40 DB gain linear power amplifier which is capable of producing an output of 1 KW PEP with a maximum input of 100 MW. (Normally, only about 500 watts is required to drive the 10 KW PA.) Nineteen frequency bands, selected in response to a five-wire code from the 10 KW PA, cover the 2.0 to 29,999 MC operating frequency range. Automatic control circuits, in conjunction with the Exciter and the 10 KW PA, compensate for variations in system gain or loading to optimize performance and protect the unit against overload. Low supply voltages are internally produced. High voltage requirements for the tubes in the amplifier stages are supplied by the 1 KW Power Supply unit.

1-18. The 1 KW PA has eight major subassemblies. These are secured to a chassis and panel assembly which is slide-mounted to allow it to be extended and rotated to a vertical position for servicing. During normal operation, all control is exercised from the Exciter. Maintenance controls and indicators are located on the front panel. Connections are made at the rear of the unit. The four electron tubes in the amplifier stages and the associated interstage transformer assemblies are cooled by forced-air.

1-19. POWER SUPPLY PP-6067/FRT.

1-20. The 1 KW Power Supply produces the high voltages for the 1 KW Amplifier and operates from 220 VAC, three-phase, 47-63 CPS power from an autotransformer in the bottom of the Exciter-1 KW PA cabinet. All components of the 1 KW Power Supply, except power transformers, are mounted on a chassis and panel assembly which is hinge-mounted in a metal case. Loosening five front panel captive screws allows the chassis and panel assembly to be dropped to a horizontal position for servicing and troubleshooting. The power transformers are constructed as an integral part of the case to provide adequate heat dissipation. Two indicating type fuse holders and a POWER ON indicator are located on the front panel; there are no controls. Connections to the 1 KW Power Supply are made at the rear of the case.

1-21. INTERCONNECTING BOX J-2822/FRT-84(V).

1-22. The I. Box contains system control circuitry for sequencing and activation of various system units as required during operation. The primary functions of the I. Box are to provide a central location for interfacing of various transmitter units and to provide coordination of transmitter operations. Thus, the I. Box is considered as the system-logic center.

1-23. The I. Box has four subassemblies. These are mounted to the chassis and panel assembly which is slide-mounted to allow it to be extended and rotated to a vertical position for servicing. Operation is automatic. Maintenance indicators are located on the front panel. All necessary I. Box connections are provided for at the rear of the chassis assembly.

1-24. MODULATOR-SYNTHESIZER MD-777/FRT.

1-25. The Exciter tunes from 2 to 30 MC in 100-cycle increments in response to the setting of six front panel digital tuning controls. It synthesizes the selected frequency and provides the means of modulating this frequency in the following modes; A0, A1, A2, A3a, A3b, A3e, A3j, F1, and F4. (Refer to paragraph 1-45c for mode definitions.) The modulating signals are received by the Exciter through two audio inputs and can be applied to the independent 3 KC wide independent sideband channels as desired. Thus, one or two sideband channels can be used depending on the mode selected and the number of audio channel modules installed. (The Exciter is normally supplied with two 3 KC independent channels). Maximum Exciter output RF power is a total of 250 milliwatts. Individual channel gain controls are provided to adjust the RF power allocated to each of the independent sideband channels.

1-26. Exciter front panel controls and push-button/indicator switches control the operation of the Exciter and associated units. Automatic control circuits provide for the control of peak power (PPC), audio level (ALC), transmitter RF gain (TGC), and voice frequency gate keying (VFG). All RF injection frequencies for Exciter circuit operation are developed from an internal (or external) 1 MC frequency standard.

1-27. Circuit test devices located on the front panel are used to monitor the Exciter DC operating voltages, audio input levels, and RF injection voltages to verify optimum Exciter performance and aid in maintenance evaluation procedures. Panel indicators monitor the status of operation at the Exciter and at the 1 KW PA and 10 KW PA units.

1-28. The Exciter's major circuit modules are designed as plug-in subassemblies for ease of maintenance and are exposed for examination or service by extending the Exciter chassis from its case on its slides. All operating controls and indicators and commonly used maintenance indicators are located on the front panel, and setup/maintenance controls are mounted on a sub-panel within the chassis. All necessary connections to the Exciter are provided at the rear of its case assembly. Monitor connectors are provided on both the front and rear panels.

1-29. FREQUENCY SHIFT KEYER KY-655/FRT.

1-30. The Keyer is an electronic keying device which accepts CW, teletypewriter (FSK), and facsimile (analog) keying at speeds up to 400 bauds. This unit operates in conjunction with the Exciter. Front panel controls and indicators are provided for operation setup and circuit testing.

1-31. The Keyer generates a 1000 CPS tone for CW keying and generates frequency shift tones for teletypewriter and facsimile operations. The frequency shift of tones is adjustable about any of four selectable center frequencies. An automatic control circuit disables the Keyer output and unkeys the transmitter when the input signals are unmodulated for an extended period.

1-32. The Keyer chassis assembly is slide mounted within its case, allowing it to be extended and rotated to a vertical postion for servicing. Set up and maintenance controls and indicators are located on the front panel and all necessary connections to the unit are provided for at the rear of its case. A front panel output monitor connector allows connection of test equipment for troubleshooting.

1-33. TRANSMITTER CONTROL-INDICATOR C-7709/FRT

1-34. This Remote Control unit utilizes digital signals to effect remote control of the transmitter local equipment, and it receives and displays status information from the transmitter. It operates in conjunction with the Decoder-Encoder unit mounted in the Exciter - 1 KW PA local equipment cabinet. A single Remote Control Unit can be used to control and monitor up to ten transmitters. The signalling is selectable either 60 MA, 130V ungrounded, or ± 6V polar.

1-35. Front panel controls on the Remote Control provide selection and remote activation of the desired transmitter local equipment and selection of frequency, class of emission, and sideband channel(s). Readback indicators on the front panel display supervisory status signals which are received from the various transmitters. Thus, the operator can detect at a glance the standby/operate status of the selected transmitter and the class of emission, sideband channel(s), and frequency in use. An alarm system in the Remote Control provides an audible alarm to indicate a fault in any of the associated transmitters, and one of ten station fault indicators lights to indicate which transmitter has a fault condition. Determination of local or remote modes of operation is under the control of the operator at the local equipment.

1-36. The Remote Control is an individually packaged unit with its chassis slide-mounted in a case enclosure. All operating controls and indicators are located on the front panel and the only external connections (interconnecting telephone lines and power input) are located on the rear panel. Primary power is supplied at the remote site as 115 VAC ± 10%, 47-63 CPS, single phase, 90 watts.

1-37. DECODER-ENCODER KY-656/FRT.

1-38. The Decoder-Encoder is the part of the remote control system which is mounted with the other transmitter units in the local equipment cabinet. It operates in conjunction with the Remote Control unit to decode digital commands and to digitally encode transmitter status information and send it to the Remote Control Unit.

1-39. The Decoder-Encoder chassis is mounted in a rack mounting cabinet with chassis slides to allow chassis extension and tilting for maintenance. Monitor indicators are mounted on the front panel, and all connections are made at the rear of the unit.

1-40. AN/FGC-60 REMOTING SET

1-41. The use of the AN/FGC-60 Remoting Set is determined by the individual site requirement, established in part by the distance from the transmitter to the C-7709/FRT Transmitter Control-Indicator. The AN/FGC-60 (NAVSHIP 0967-002-1000) is used for multi-channel transmission and reception of telegraphic, or binary data over nominal voice frequency transmission facilities.

1-42. HIGH-VOLTAGE WARNING LIGHT.

1-43. The use of these lights is to indicate that high-voltage is present at the plates of the 1 KW PA and 10KW PA final output tubes. These lights are optional and are installed on some of the AN/FRT-84 transmitters.

1-44. REFERENCE DATA.

1-45. The following listing contains data on the electrical and physical characteristics of the AN/FRT-84(V).

a. Frequency Range: 2.000 to 29.9999 MC in 0.1 KC increments (280,000 channels).

b. Type of Frequency Control: Frequency synthesizer referenced to a 1 MC internal or external frequency standard.

c. Types of Emission: Unmodulated carrier (A0), CW (A1), modulated CW (A2), compatible AM (A3e), USB/LSB reduced carrier (A3a), two independent sidebands (A3b), USB/LSB suppressed carrier (A3j), FSK (F1), and facsimile (F4).

d. Power Output for Each Type of Emission: A0, A1, F1, and F4 provide 5 KW average; A2 and A3e provide a modulated 2.5 KW carrier; A3a, A3b, A3j, provide 10 KW PEP.

e. Carrier Insertion: Selectable, -10 DB, -20 DB, or -40 DB (A3a, A3b).

f. Full Carrier Suppression: 60 DB below full rated output (A3j).

g. Harmonic Rejection: 80 DB below full rated output.

h. Other Spurious Emissions: 80 DB below full rated output.

i. Intermodulation Distortion: 43 DB below full rated output (white-noise loaded per DCAC-330-175). 35 DB below full rated output (two-tone loaded).

j. Adjacent Channel Interference: Unwanted sidebands 70 DB below the level of those selected for use.

k. Frequency Stability: 1 part in 10^8 per day and 1 part in 10^7 per 100 days.

l. Tuning Procedure and Interval: Tuning automatic with selection of frequency; 15 seconds maximum tuning time.

m. Number of Audio Channels: Two ISB channels (A1, B1 - 250 to 3040 CPS).

n. Envelope Delay Distortion: Less than 500 microseconds.

o. Audio Channel Input Characteristics: 600 ohm balanced input with input signal level for each channel independently adjustable from -25 DBM to +10 DBM.

p. Output Levels: RF power amplification automatically controlled within + 1 DB of full rated outputs (as listed in item d) at all frequencies.

q. Output Impedance: 50 ohms.

r. VSWR Protection: Capable of operation to VSWR of 4:1 and protected from damage above this level.

s. Primary Power: 200, 208, 220, 230, 240, 440, 460, or 480 VAC, 47-63 CPS, 3 phase. (Remote Control unit requires separate 115 ± 11.5 VAC, 47-63 CPS, 1 phase, 90 watts.)

t. Power Consumption: 20,000 watts.

u. Heat Dissipation: 15,000 watts.

v. Ambient Operating Temperature Limits: 0°C to + 54°C.

w. Cooling: Total 870 CFM ambient air. Exciter cabinet 120 CFM 10KW PA cabinet 750 CFM.

x. Acoustic Noise: 60 DB (B weighting, ASA S1.4-1961).

y. Humidity: 0-95% relative humidity.

z. Elevation: Sea level to 10,000 ft.

aa. Radiation Hazard: None.

ab. Remote Control: Frequency and mode selection, carrier reinsertion, and standby/operate. Multiple address for control of up to 10 transmitters from one remote station.

1-46. EQUIPMENT SUPPLIED.

1-47. Equipment which may be supplied as a part of the AN/FRT-84(V) is listed in table 1-2. Note is made in this table of items which may not be supplied, depending on the particular equipment configuration procured.

1-48. EQUIPMENT AND PUBLICATIONS NOT SUPPLIED.

1-49. The equipment and publications required or optional but not supplied as part of the AN/FRT-84(V) are listed in table 1-3.

1-50. FACTORY OR FIELD CHANGES.

1-51. At the time of publication of this manual, there have been 4 field changes to the AN/FRT-84(V). Refer to NAVSHIPS 0967-000-0000, Electronic Installation and Maintenance Book (EIMB), for complete field change identification guide index. Table 1-5 provides space for future records.

1-52. EQUIPMENT SIMILARITIES.

1-53. The AN/FRT-84(V) is one of a family of four radio transmitting sets which are similar in that they utilize the following identical units: (1) MD-777/FRT (Exciter), (2) KY655/FRT (Keyer), (3) KY-656/FRT (Decoder-Encoder) and (4) C-7709/FRT (Remote Control).

1-54. Each type of radio transmitting set of this family is differentiated by its nomenclature, its output power, and by the overall physical and electrical requirements dictated by its power output capability. The reference designation for the various family members and their power output levels are given in table 1-4.

1-55. Installation requirements and procedures are different for each type of transmitter. Consult the applicable technical manual (table 1-4) for installation instructions.

1-56. The AN/FRT-84(V) and the AN/FRT-83(V) have a commonality beyond that shared by all four members of the family as described above. Specifically, the AN/FRT-84(V) and AN/FRT-83(V) utilize identical AM-6046/FRT (1 KW PA) units and PP-6067/FRT (1 KW Power Supply) units.

TABLE 1-2. EQUIPMENT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (IN.)			VOLUME (CU FT)	WEIGHT (LB)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
REF	Radio Transmitting Set consisting of:	AN/FRT-84(V)	78 5/16	54	41	100	2800
1	Radio Frequency Amplifier (10 KW PA) - and -	AM-6047/FRT-84(V)	78 5/16	32 1/4	41	60	1600
1	Cabinet Assembly, Exciter-1 KW PA, which includes 1 each:		78 5/16	21 1/4	41	39	1200
	Radio Freq. Amplifier	AM-6046/FRT					
	Power Supply	PP-6067/FRT					
	Modulator-Synthesizer	MD-777/FRT					
	Frequency Shift Keyer*	KY-655/FRT					
	Decoder-Encoder*	KY-656/FRT					
	Interconnecting Box	J-2822/FRT-84(V)					
*1	Transmitter Control-Indicator	C-7709/FRT	8 3/4	19	20	1.42	65
2	Technical Manual, Radio Transmitting Set AN/FRT-84(V)	NAVELEX 0967-293-0010					
2	Technical Manual, Modulator-Synthesizer MD-777/FRT	NAVELEX 0967-292-9030					
*2	Technical Manual, Frequency Shift Keyer KY-655/FRT	NAVELEX 0967-292-9020					
*2	Technical Manual, Decoder-Encoder KY-656/FRT	NAVELEX 0967-292-9050					
*2	Technical Manual, Transmitter Control-Indicator C-7709/FRT	NAVELEX 0967-292-9040					
2	Operator's Handbook, AN/FRT-84(V)	NAVELEX 0967-293-0020					
1	Local Operator Instruction Chart, AN/FRT-84(V)	NAVSHIPS 0967-293-0030					
*1	Remote Operator Instruction Chart, AN/FRT-84(V)	NAVSHIPS 0967-293-5010					
1	Performance Standards Sheet, AN/FRT-84(V)	NAVSHIPS 0967-293-0040					
1	Maintenance Standards Book, AN/FRT-84(V)	NAVSHIPS 0967-293-0050					
1	Maintenance Standards Book, MD-777/FRT	NAVSHIPS 0967-293-3010					
*1	Maintenance Standards Book, KY-655/FRT	NAVSHIPS 0967-293-4010					
*1	Maintenance Standards Book, KY-656/FRT	NAVSHIPS 0967-293-6010					
*1	Maintenance Standards Book, C-7709/FRT	NAVSHIPS 0967-293-5020					
1	Maintenance Kit consisting of 1 each:	Part No./FMC**					
	Detachable Test Lead, 10 KW PA	6049-6225/14304					
	PCB Extender, 1 KW PA	6049-3015/14304					

TABLE 1-2. EQUIPMENT SUPPLIED (Cont)

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (IN.)			VOLUME (CU FT)	WEIGHT (LB)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
	Maintenance Kit (cont)	Part No./FMC**					
	PCB Extender, 1 KW PA	6049-3020/14304					
	PCB Extender, I. Box	6049-2760/14304					
	PCB Extender, 10 KW PA	6049/6223/14304					
	PCB Extender, Exciter	D45184G1/42498					
	PCB Extender, Exciter	E45170G1/42498					
	PCB Extender, Exciter	D46442G1/42498					
	PCB Extender, Exciter	D46442G2/42498					
	PCB Extender, Remote Control*	D44183G4/42498					
	PCB Extender, Remote Control*	D44183G6/42498					
	PCB Extender, Remote Control*	D44183G1/42498					
	PCB Extender, Remote Control*	D44183G3/42498					
	PCB Extender, Decoder-Encoder*	D44183G2/42498					
	PCB Extender, Decoder-Encoder*	D44183G1/42498					
	PCB Extender, Decoder-Encoder*	D44183G3/42498					
	Module Extender, Exciter	C45138G1/42498					
	Module Extender, Exciter	C45148G1/42498					
	Module Extender, Exciter	C45149G1/42498					
	Module Extender, Exciter	C45149G2/42498					
	Module Extender, Keyer*	C45629G1/42498					
	Module Extender, Keyer*	C45630G1/42498					
	Module Puller Handle, Exciter	B43412G1/42498					
	Module Puller Handle, Exciter	B45837G1/42498					
1	Connector, Exciter	MS3116F14-19S					
*1	Connector, Keyer	MS3116F14-15SW					
*1	Connector, Decoder-Encoder	MS3116F12-10S					
*1	Connector, Remote Control	MS3116E20-39S					
*1	Connector, Remote Control	MS3108R14S-7S					

*Optional equipment items, not supplied with all configurations.

**FMC 14304 - RF Communications, Inc.; FMC 42498 - National Radio Co., Inc.

TABLE 1-3. EQUIPMENT AND PUBLICATIONS NOT SUPPLIED*

QTY PER EQUIP	NOMENCLATURE		REQUIRED USE	REQUIRED EQUIPMENT CHARACTERISTICS
	NAME	DESIGNATION		
1	Antenna System	--------------	Radiation of signal	Frequency Range: 2-30 MCS Characteristic Impedance: 50 ohms Maximum VSWR: 4/1 Power Handling Capability: 10 KW PEP, 5 KW Avg. CCS
1	Primary Power Feeder Line	--------------	Supply power to transmitter	200-240 VAC or 440-480 VAC ±5%, 50-60 CPS±5%, 3-phase, with proper overload protection for 22.5KVA (20KW required at full output, power factor = 0.90)
1	Air Duct Systems	--------------	Supply and remove cooling air	870 CFM to 2 cabinets, custom-build for individual installation using guidelines in Section II.
1**	Audio Distribution Equipment	--------------	Optional station accessory to allow patching various audio sources into the transmitter audio input lines	600 ohm balanced pair line compatibility
1**	Frequency Standard	--------------	Optional station accessory to provide standby frequency standard signal and to allow checking of internal frequency standard.	1 MC, 1.0 VRMS, 50 ohm output, frequency accuracy equal to or better than 1 part in 10^8 per day and 1 part in 10^7 per 100 days.
1**	Push-to-talk Switch	--------------	Optional accessory to allow silencing transmitter when not required to be on the air.	Dry contact closure to key transmitter to "on the air" condition.
1**	Interlock Extension Switch	--------------	Optional accessory to allow power shutdown from a short distance away from the transmitter.	Isolated dry contact closure to maintain operation; open to prevent operation.
1	Overhaul and Repair Manual, AN/FRT-84(V)	NAVSHIPS 0967-293-0060	General transmitter overhaul excepting units below.	
1	Overhaul and Repair Manual, MD-777/FRT	NAVSHIPS 0967-293-3020	Exciter overhaul	
1	Overhaul and Repair Manual, KY-655/FRT	NAVSHIPS 0967-293-4020	Keyer overhaul	
1	Overhaul and Repair Manual, KY-656/FRT	NAVSHIPS 0967-293-6020	Decoder-Encoder overhaul	
1	Overhaul and Repair Manual, C-7709/FRT	NAVSHIPS 0967-293-5030	Remote Control unit overhaul	

*Test equipment and special adapters required for servicing are listed in table 4-4. See also, test equipment list in Overhaul and Repair Manual, NAVSHIPS 0967-293-0060.

**Refer to figure 1-1 to determine relationship of optional items to transmitter.

(An additional 10 KW PA unit is also used with the AN/FRT-84(V) only.)

1-57. PREPARATION FOR RESHIPMENT.

1-58. The AN/FRT-84(V), exclusive of (Remote Control) C-7709/FRT, is shipped complete in two shipping containers. To prepare the AN/FRT-84(V) for reshipment, remove all external interconnecting cables and accessories connected to the units. Remove the power amplifier tube and the Bias and Servo Supply PC board 9A2A1. Pack small parts in the storage drawer at the front of the Exciter-1 KW PA local equipment cabinet, and tape them in place. Tape front of drawer to prevent it from opening, and block the main 10 KW PA chassis and slides to prevent damage.

Wood blocks should be installed between the top of the chassis sides and the upper left and right hand side rails to prevent lateral movement of the chassis assembly, and blocks should be installed between the front of the chassis slides and the inside of the left and right hand cabinet channels. Pack instruction manuals, larger parts, and cable connectors separately. Crate the equipment in accordance with applicable specifications.

TABLE 1-4. RADIO TRANSMITTING SET FAMILY

RADIO TRANSMITTING SET REF DESIGNATION	OUTPUT POWER	TECHNICAL MANUAL
AN/FRT-83(V)	1 KW	NAVELEX 0967-292-9010
AN/FRT-84(V)	10 KW	NAVELEX 0967-293-0010
AN/FRT-85(V)	40 KW	NAVSHIPS 0967-293-1010
AN/FRT-86(V)	200 KW	NAVSHIPS 0967-293-2010

TABLE 1-5. FIELD CHANGE RECORD

FIELD CHANGE NUMBER	FIELD CHANGE TITLE AND PURPOSE	SERIAL NO. AFFECTED	INDICATION OF ACCOMPLISH-MENT
1.	Side carrier generator simulator A20 for MD-777/FRT (EIB-806)	ALL	VISUAL INSPECTION
2.	Modification of Frequency Shift Keyer KY-655/FRT (EIB 818)	ALL	VISUAL INSPECTION
3.	Addition of Circuit Breaker 8A1CB3	ALL	VISUAL INSPECTION
4.	Internal, External Frequency Standard MD-777/FRT	ALL	VISUAL INSPECTION

TABLE 1-6. FACTORY CHANGE RECORD

FACTORY CHANGE NUMBER	FACTORY CHANGE TITLE AND PURPOSE	SERIAL NO. AFFECTED	INDICATION OF ACCOMPLISH-MENT
1.	Modification of Driver Tube Assembly 1A1A1 in Radio Frequency Amplifier AM-6046/FRT	ALL	VISUAL INSPECTION
2.	Modification of PP-6067/FRT Power Supply	ALL	VISUAL INSPECTION
3.	Addition of Step-Start Circuit to Plate Transformer 9T1	ALL	VISUAL INSPECTION

Table 1-6. Non-standard Abbreviations.

ABBREVIATION	DEFINITION
DTA	Driver Transformer Assembly
FTA	Final Transformer Assembly
PPC	Peak Power Control
TGC	Transmitter Gain Control
TOP	Tune Overload Protection

SECTION II

INSTALLATION

2-1. GENERAL INFORMATION.

2-2. This section consists of procedures for installation and initial set up of the AN/FRT-84(V). The major equipment is shipped in two crates containing the 10 KW PA cabinet and the Exciter -1 KW PA cabinet. When the delivered equipment includes an optional Remote Control unit, that unit is created separately and includes its individual technical manual, NAVELEX 0967-292-9040, which describes installation of that unit.

2-3. The following instructions apply to the installation of the uncrated local equipment cabinets containing optional units (Keyer and Decoder-Encoder). If the delivered AN/FRT-84(V) omits either of these options, disregard instructions herein which apply to the omitted option. Also disregard installation instructions in the Exciter and Keyer technical manuals except as referenced herein.

2-4. Unpacking requires the normal care accorded electronic equipment. Avoid rough handling and use care to protect front panel controls and connectors and the RF output connector on the top of the 10 KW PA cabinet. The Exciter -1 KW PA cabinet weighs 1200 pounds and the 10 KW PA cabinet weighs 1600 pounds. Suitable moving equipment must be available for placing the cabinets at the mounting locations. Block should be removed from 10 KW PA chassis assembly after the unit is in place.

2-5. Table 2-1 is supplied as a guide to items required for installation.

2-6. INSTALLATION REQUIREMENTS.

2-7. POWER REQUIREMENTS. The AN/FRT-84(V) local equipment operates from a power source of 200, 208, 220, 230, 240, 440, 460, or 480 VAC, 50-60 CPS ± 5%, 3-phase. Power consumption of the local equipment is 20 KW (maximum loading), of which 5 KW is useful average output and 15 KW is dissipated heat. Power factor is 0.9. Direct power connections are made from the building power distribution panel to circuit breaker screw terminals in the Exciter -1 KW PA cabinet.

2-8. Power distribution within the local equipment cabinets is illustrated in figure 2-3, showing connections required for various line voltages. The Exciter and its blower and the optional Keyer and Decoder-Encoder units are supplied with 115 VAC, 50-60 CPS, single-phase power from outlet strip 8A3 in the Exciter -1KW PA local equipment cabinet. The installing activity has the option of supplying 115 VAC power to outlet grip 8A3 from the 115 VAC output of the autotransformer in the cabinet as shipped or reconnecting outlet strip 8A3 to a separate source of 115 VAC power via circuit breaker 8A1CB3. Power connections are described in paragraph 2-29.

2-9. EQUIPMENT LOCATION.

2-10. Figure 2-1 shows dimensions of importance in installing the cabinets.

TABLE 2-1. INSTALLATION TOOLS AND MATERIAL REQUIRED

QUANTITY	ITEM	NOTES
1	Fork lift, 2000 lb.	Placement of cabinets
1 set	Socket wrenches, 1/4 in. to 5/8 in.	Bolting cabinets
1 set	Electrician tools	Wiring connections
1 set	Sheet metal tools and carpenter tools	Installing air ducts
1	1/2 in. Electric drill	Drilling mounting holes and holes for installing air ducts
1 set	Twist drills 1/8 in. to 1/2 in.	Drilling mounting holes and holes for installing air ducts
1 set	RF output cable and connector	Determine from paragraph 2.3.3.4 and site plans
1 lot	Power cables	Determine from paragraph 2.3.3.3 and site plans
1 lot	Signal cables	Determine from paragraph 2.3.3.2 and site plans
1	Sheet metal cutter	See paragraph 2.3.2
1 set	Caulking gun and compound	See paragraph 2.3.2
1 set	Air ducts	Fabricate per paragraph 2.3.4 and site plans
22 sets	6-32 binding head machine screws and lock washers	Air duct mounting
8 sets	1/2 in. diameter lag screws or bolts	As required for mounting cabinets on floor or platform
1	AN/PSM-4B Multimeter	Line voltage checks
1	Manometer (differential pressure gauge)	See paragraph 2.3.4
REF	Test Equipment	Refer to paragraph 2.4.2 to determine additional test equipment requirements.

The local equipment cabinets are designed for floor mounting over a cable duct or mounting on a supporting platform. The equipment should be level to allow proper operation of the cabinet doors and chassis slides. The exact location selected should make allowances for clearance on various sides as shown. Minimum clearances at the top and rear should be determined from air ducts and antenna cable. It is recommended that at least 12 inches be allowed at the top and 24 inches be allowed at the rear.

2-11. Provisions have been made for cables to be routed to and between cabinets through entry ports in the bases of the cabinets. The only exception is the RF output cable which is connected at a coaxial connector on the top of the 10 KW PA cabinet. A typical installation will route primary power, audio input signal, and control wiring through cable duct in the floor to the Exciter -1 KW PA cabinet. Internal power, signal, and control cables between that cabinet and the 10 KW PA cabinet are also routed through a cable duct in the floor. Cable ducts under mounting platforms can be used in lieu of floor ducts. Optional cable ports can be cut in the cabinets to allow for top or side cable routing.

2-12. Access, cable ducting, and air ducting will necessarily be factors in selecting the mounting location for the cabinets. The exact installation location must also take into consideration the possibility of interaction between the AN/FRT-84(V) and other electronic equipment in the immediate vicinity.

2-13. INSTALLATION PROCEDURES.

2-14. CABINET MOUNTING.

2-15. Prepare the floor area or platform upon which the Exciter-1 KW PA cabinet and the 10 KW PA cabinet are to be set by providing eight holes (per figure 2-1) for 0.5 inch O.D. lag bolts (not supplied) used to secure the cabinets. Ensure that base openings for cable routing will match the holes provided in the floor or platform. Set the cabinet in place and bolt it down. The cabinets may be bolted together, if desired, as follows. Place the two units together and block them to the desired relative positions. Match drill 0.531 inch diameter holes in the frames at 8 locations (figure 2-1). Take care to catch chips. Bolt the cabinets together with 1/2 inch hardware.

NOTE

> Care should be taken to assure that any cabinets which are to be bolted together have mating faces parallel within 1/8 inch before installing the bolts. Adjustments in vertical alignment should be made by shimming the mounting base.

2-16. Side panels may be removed, if necessary for access during installation, by removing two screws at the top from inside the cabinet and lifting the panel off.

2-17. PREPARATION OF WIRING ENTRY PORTS.

2-18. Wiring entry ports in the bases of the local equipment cabinets are covered with solid cover plates. Unscrew and remove these cover plates if base routing will be used. All external and interconnecting cables except the 10 KW PA RF output cable should be routed through these openings. Be careful to avoid damaging cables on sharp metal edges.

NOTE

Optionally, ports may be cut in the sides or tops of the cabinets (as shown in figure 2-1) for primary power and intercabinet cables.

2-19. Before proceeding with wiring connections, locate and unbundle the intercabinet cable, which is preconnected in the Exciter-1 KW PA cabinet. Route the free end of this cable through the bottom cable port and over to the 10 KW PA cabinet. If an alternate route has been chosen, longer cables may have to be fabricated.

2-20. After cable installation, determine the cover plate openings required to snugly fit around all cables. Cut out necessary size opening in one corner of each plate and reinstall plates around external and inter-cabinet cables. The excess space should be caulked around cables to prevent undesirable air intake from these openings during operation.

2-21. SIGNAL AND CONTROL WIRING INSTALLATION PROCEDURES.

2-22. Table 2-2 describes the audio and control wiring provisions required between external equipment and the AN/FRT-84(V). These connections to external equipment are made in the Exciter-1 KW PA cabinet, with the exception of the 10 KW PA output monitor connection which is made in the 10 KW PA.

2-23. Required connectors, as listed in table 2-2, are supplied. All signal wiring near the transmitter, the antenna, or other sources of RF energy should be done with shielded cable, the shield of which should be securely connected to the shell of the plug. Allow 8 feet of cable inside the Exciter-1 KW PA cabinet to provide for routing to the required connection points, except that the ground wire and the interlock extension wires require only about two feet if brought in through the bottom entry port. The signal and control wiring to the various units in the upper part of the cabinet should be routed and clamped as necessary within the cabinet so that it will not interfere with the movement of slide out drawers or their cable retractors.

2-24. After routing and securing the cables and pairs as required, individual connections should be made by cutting wires to final length and attaching the required connectors. The ground cable is connected to the cabinet, using the 1/4-20 x 1/2 inch bolt (8E2, figure 2-2) provided in the staked-in nut at the lower left-rear corner of the Exciter-1 KW PA cabinet base plate.

2-25. The AN/FRT-84(V), as shipped, provides a jumper between the interlock extension terminals on 8TB1 (see figure 2-2). If an external interlock switch is to be used to provide external shutdown of power to the various units of the AN/FRT-84(V), the jumper between terminals 1 and 2 must be removed and the pair of incoming wires from the external (normally-closed) interlock extension switch must be connected to these terminals.

2-26. Although some of the optional cable connections listed in table 2-2 may not be required for present operations, it is recommended that a study of future uses of these options be made. If thought desirable, these cables should be provided for future use (labelled and tied out of the way in the cabinet), since future installation of these cables may be difficult.

2-27. INTERCABINET POWER, CONTROL, AND SIGNAL WIRING.

2-28. Intercabinet power, control, and signal interconnecting wiring is described

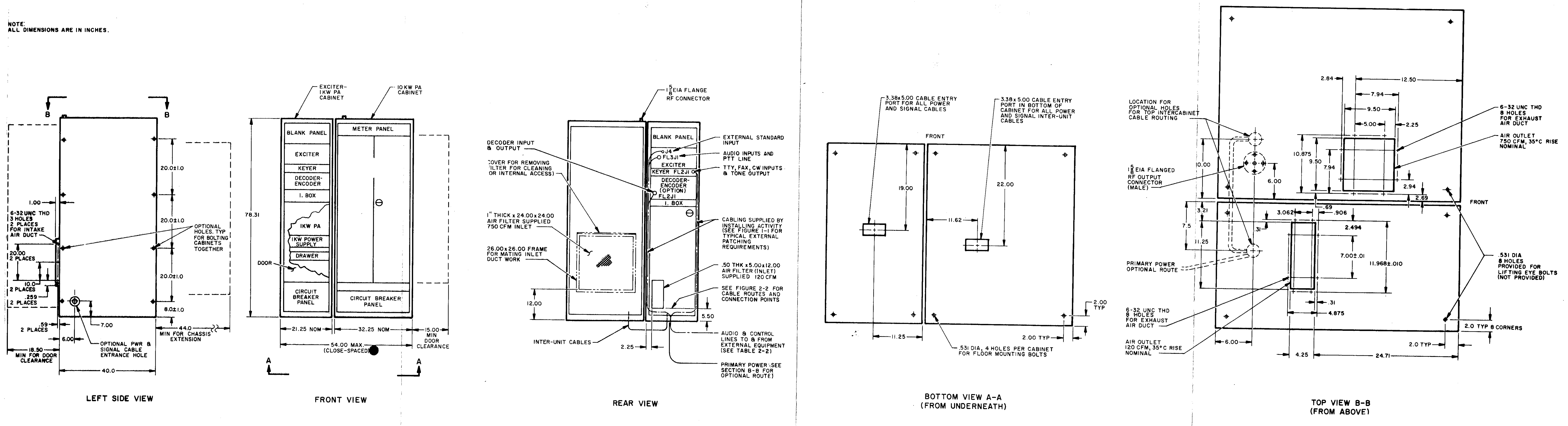


Figure 2-1. Radio Transmitting Set AN/FRT-84(V), Local Equipment Cabinets, Outline Drawing

TABLE 2-2. INPUT SIGNAL AND CONTROL WIRING PROVISIONS OF AN/FRT-84(V) LOCAL EQUIPMENT

LOCAL UNIT TERMINALS	MATING CON-NECTOR TYPE	WIRE TYPE**	CONNECTS TO	SIGNAL/CONTROL FUNCTION
Keyer*:				
4FL2J1-E(+),D(-)	MS-3116F14-15SW	1 pair	GFM Facsimile Mach.*	Facsimile Signal
4FL2J1-A(+),B(-)		1 pair	GFM Teletypewriter*	Teletypewriter Signal
4FL2J1-G,H		1 pair	GFM CW Key*	CW Key Signal
4FL2J1-K,R		1 twisted pair	GFM Audio Distribution Equipment *	Keyer Audio Tone Output
4FJ2J1-M,N		1 pair	GFM Key Switch***	Transition Relay Key
Exciter:				
3FL3J1-E,F	MS-3116F14-19S	1 twisted pair	GFM Audio Distribution Equipment	Audio Input, Channel A1
3FL3J1-C,D		1 twisted pair		Audio Input, Channel B1
3FL3J1-G,H		1 twisted pair		Audio Input, Channel A2*
3FL3J1-A,B		1 twisted pair		Audio Input, Channel B2*
3FL3J1-J,K		1 pair	GFM Push-to-talk switch*	Push-to-talk Keyline
3FL3J1-L		1 conductor	GFM Status Indicators ****	Common
3FL3J1-M		1 conductor		A2,B2 Readback
3FL3J1-N		1 conductor		B1 Readback
3FL3J1-P		1 conductor		A1 Readback
3FL3J1-R		1 conductor		B+ on (operate) readback
3FL3J1-S		1 conductor		RF on (keyed) readback
3J4	UG-88C/U (BNC)	RG-58/U	GFM External Frequency Standard*	External 1 MC Frequency Standard Input
3J5	UG-88C/U (BNC)	RG-58/U	GFM External Test Jack*	External Test Point for Exciter Internal Frequency Standard
1 KW PA:				
1A2J10	UG-88C/U (BNC)	RG-58/U	GFM External Test Jack*	External Test Point for 1 KW PA RF Input (Exciter output)
10 KW PA:				
9J3	UG-88C/U (BNC)	RG-58/U	GFM External Test Jack*	External Test Point for 10 KW PA RF Output Monitor
Decoder-Encoder*:				
5FL2J1-F(+),D(-)	MS-3116F12-10S	1 twisted pair	Remote Control*	Control
5FL2J1-B(+),H(-)		1 twisted pair	Remote Control*	Readback
Exciter-1 KW PA Cabinet:				
8TB1 - 1 & 2	Spade Lugs	1 pair	GFM External Interlock Switch*	Power Interlock Extension (normally closed)
8E2				
1/2 in. dia. ground bolt on cabinet base	Spade Lug	#8 or larger wire	Good earth ground	RF and Safety Ground

*Indicates optional equipment.

**Use shielded cables near source of RF energy.

***Transition relay in Keyer automatically unkeys transmitter and disables Keyer audio output when input signal is sustained without keying. Refer to Keyer technical manual for internal jumper connections required to allow manual transition relay operation.

****Connections for optional remote status indicators. Contact closure to common to indicate condition. Current capacity of contacts is 0.5 AMP.

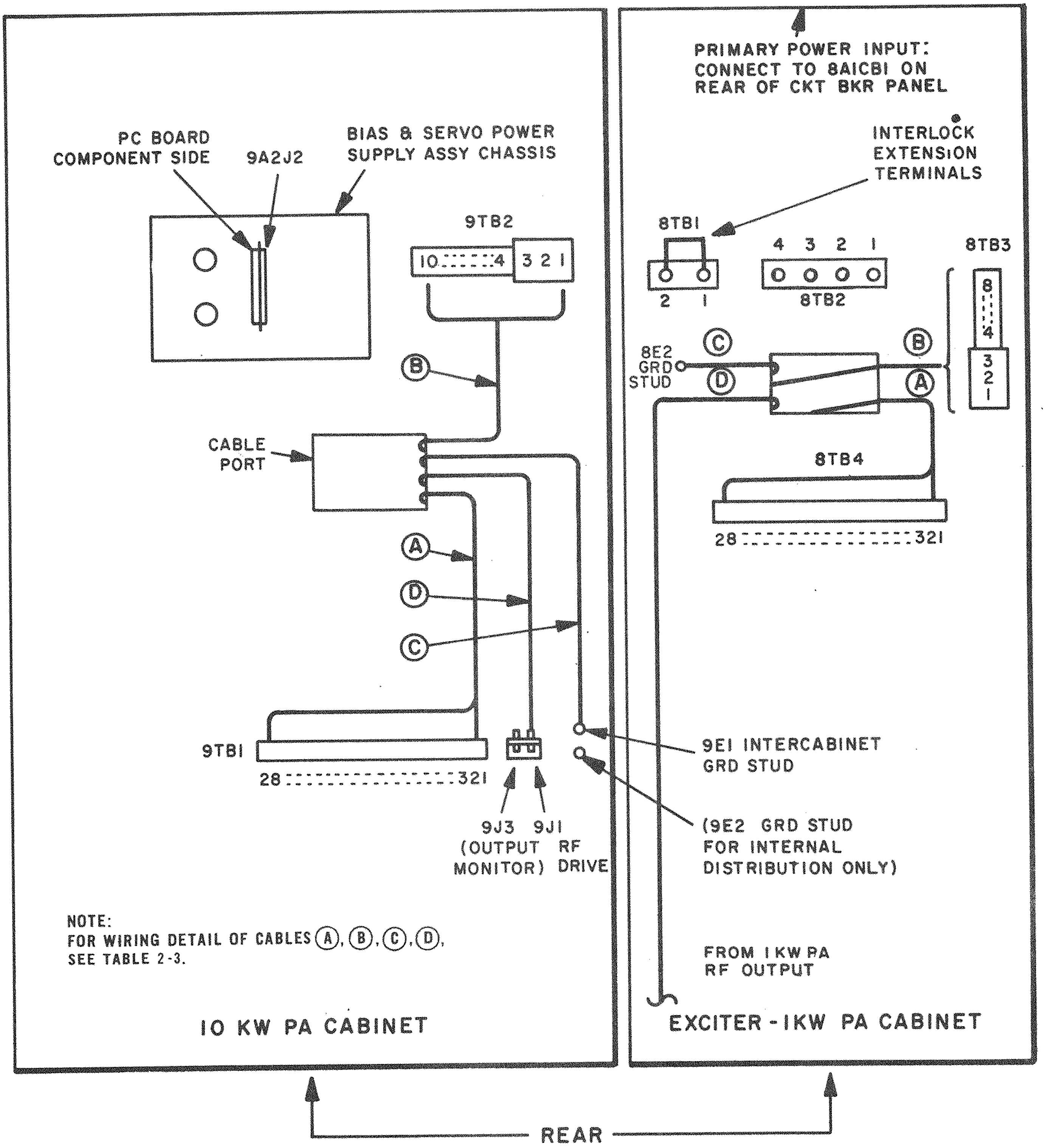


FIGURE 2-2. Exciter-1 KW PA Cabinet to 10 KW PA Cabinet, Interconnecting Cable Termination Points

TABLE 2-3. EXCITER-1 KW PA TO 10 KW PA CABINET INTERCONNECTIONS

WIRE TYPE	FROM EXCITER - 1 KW PA CABINET	TO 10 KW PA CABINET	FUNCTION	
#22 AWG-Brn	8TB4-1	9TB1-1	10 KW PA to	5
#22 AWG-Red	2	2	1 KW PA Fre-	4
#22 AWG-Orn	3	3	quency Code	3
#22 AWG-Yel	4	4	Lines	2
#22 AWG-Grn	5	5		1
#22 AWG-Blu	6	6	Exciter to	5
#22 AWG-Vio	7	7	10 KW PA Fre-	4
#22 AWG-Gry	8	8	quency Code	3
#22 AWG-Wht	9	9	Lines	2
#22 AWG-Wht/Blk	10	10		1
#22 AWG Blk from 2 shields	11	11	Shield Grd	
#22 AWG Shielded	12	12	Refl Pwr	
#22 AWG Shielded	13	13	Fwd Pwr	
#22 AWG-Wht/Red	14 CABLE Ⓐ	14 CABLE Ⓐ	Tune Pwr Request	
#22 AWG-Wht/Orn	15	15	Stdby Info Common	
#22 AWG-Wht/Yel	16	16	Stdby Command	
#22 AWG-Wht/Grn	17	17	10 KW PA Inhibit	
#22 AWG-Wht/Blu	18	18	Operate Command	
#22 AWG-Wht/Vio	19	19	RF Mute	
#22 AWG-Wht/Gry	20	20	Stdby Info N.C.	
#22 AWG-Wht/Blk/Brn	21	21	Fault	
#22 AWG-Wht/Blk/Red	22	22	10 KW PA Man. Grd	
#22 AWG-Wht/Blk/Orn	23	23	Operate Info N.O.	
#22 AWG-Wht/Blk/Yel	24	24	Operate Info N.C.	
#22 AWG-Wht/Blk/Grn	25	25	10 KW PA Keyline	
#22 AWG-Wht/Blk/Blu	26	26	+28 V	
#22 AWG Shielded	27	27	T.O.P.	
#22 AWG-Blk from shield	8TB4-28	9TB1-28	Shield Grd	
#6 AWG, #1	8TB3-1	9TB2-1		
#6 AWG, #2	2	2	220 VAC, 3 ø	
#6 AWG, #3	3	3		
#18 AWG-Wht/Orn	7 CABLE Ⓑ	7	115 VAC, 1 ø	
#18 AWG-Wht/Yel	8	8 CABLE Ⓑ		
#18 AWG-Wht/Blk	4	4		
#18 AWG-Wht/Brn	5	5	20.6 VAC, 3 ø	
#18 AWG-Wht/Red	8TB3-6	9TB2-6		
#6 AWG	8E2 (ground stud) CABLE Ⓒ	9E1 (ground stud) CABLE Ⓒ	Cabinet Ground	
RG-58/U	1A2J3(rear of 1 KW PA) CABLE Ⓓ	9J1 (BNC connector) CABLE Ⓓ	1 KW PA RF Output	

CAUTION

Do not interchange connections at 9J1 and 9J3 (figure 2-2) as damage will result.

in table 2-3 and shown in figure 2-2. An interconnecting cable has been supplied preconnected at the Exciter-1 KW PA cabinet, with sufficient length for bottom or side cable routing. Mating connectors are already installed on the cables. Refer to figure 2-1, and fabricate a similar cable if top routing of interconnecting cable is desired.

CAUTION

Be careful to avoid interchanging RF drive and RF monitor cables at 9J1 and 9J3, as damage will result.

2-29. PRIMARY POWER CONNECTIONS.

WARNING

Shut off and secure building power circuit breaker before connecting primary power.

2-30. Primary power connections should be made from circuit breaker 8A1CB1 (figure 2-2) behind the circuit breaker panel of the Exciter-1 KW PA cabinet directly to the building power distribution panel circuit breaker (figure 2-3). Primary power requirements are 22.5 KVA (20K 200, 208, 220, 230, 240, 440, 460, or 480 VAC line-to-line, 50-60 CPS ±5%, 3-phase. Select the building power panel circuit breaker value to protect properly against overloads; do not depend upon the circuit breaker value to protect properly against overloads; do not depend upon the circuit breaker on the bottom of the Exciter-1 KW PA cabinet for exclusive protection. The circuit breaker on the bottom panel of the Exciter-1 KW PA cabinet is intended primarily as a readily available emergency shutoff. A neutral power cable wire (if used) can be connected to ground stud 8E2 (in addition to a good RF earth ground). Connections should be made with #4 AWG or larger wire, depending upon wire length.

NOTE

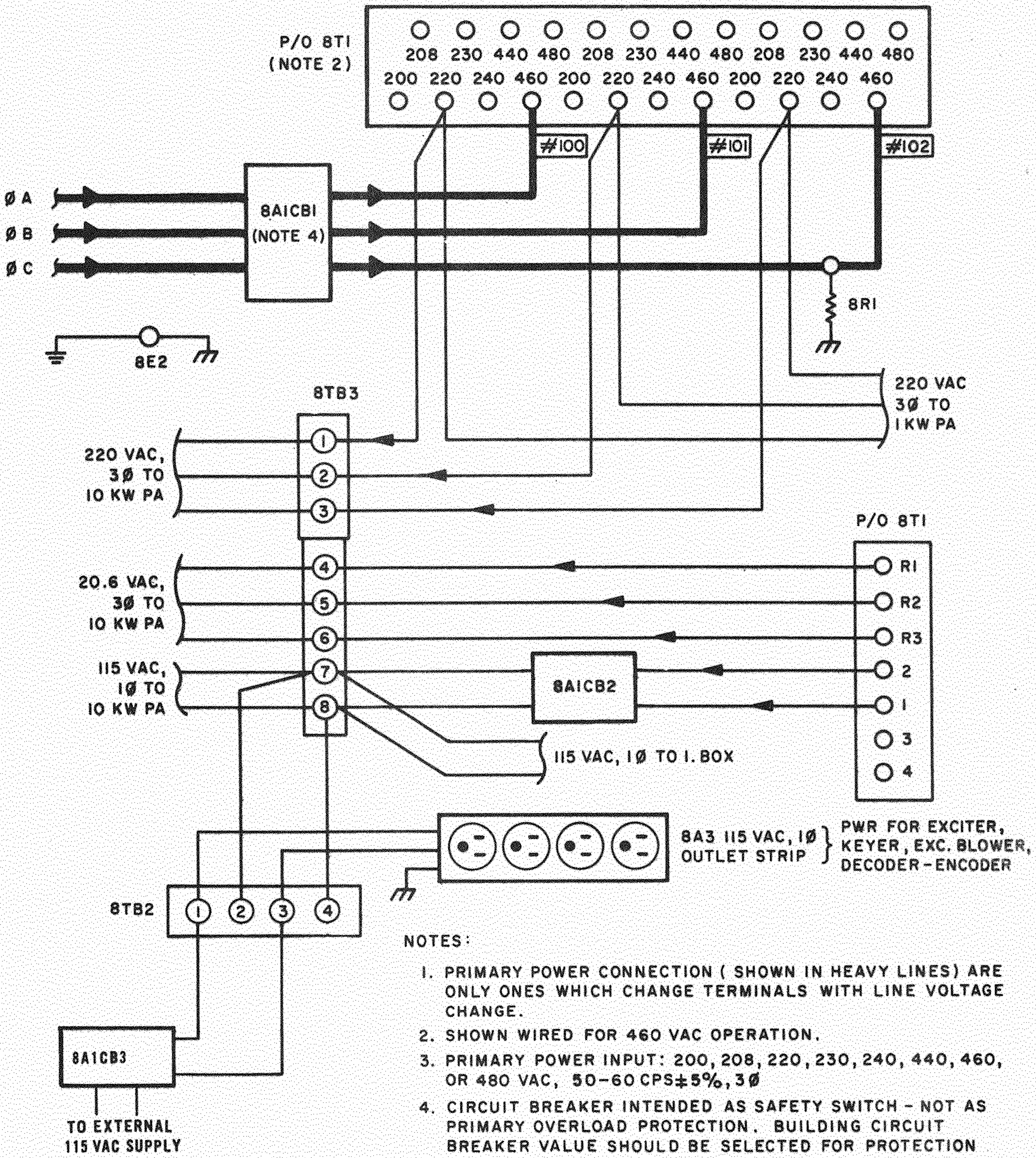
It is necessary to temporarily unmount circuit breaker 8A1CB1 to make connections. Before remounting, check all screw terminals for tightness.

2-31. The heavy lines in figure 2-3 represent wiring from the output terminals of circuit breaker 8A1CB1 to individual taps on the rear of autotransformer 8T1. These three wires (and no others) should be reconnected at the autotransformer as necessary to adjacent taps which correspond closest to the actual measured line to line voltage. Good equipment performance requires that the line voltage be maintained within 5 percent of the nominal voltage for which the selected taps are intended. Phasing of the lines should be as noted in figure 2-3; however, the phasing will be checked when installation is completed.

NOTE

The lines which are reconnected for line voltage change are identified with wire markers numbered "100, 101, and 102".

2-32. As shown in figure 2-3, 115VAC single phase power is normally supplied from a secondary winding on the autotransformer to terminals 2 and 4 of terminal board 8TB2 (bottom of Exciter-1KW cabinet). An external source of 115VAC 60CPS power is brought in through 8A1CB3 and connected to terminals 1 and 3 of 8TB2 for application to outlet strip 8A3 which is a source of operating power for the Exciter and the Exciter's blower and, if installed, for the Keyer and Decoder-Encoder units.



NOTES:

1. PRIMARY POWER CONNECTION (SHOWN IN HEAVY LINES) ARE ONLY ONES WHICH CHANGE TERMINALS WITH LINE VOLTAGE CHANGE.
2. SHOWN WIRED FOR 460 VAC OPERATION.
3. PRIMARY POWER INPUT: 200, 208, 220, 230, 240, 440, 460, OR 480 VAC, 50-60 CPS±5%, 3Ø
4. CIRCUIT BREAKER INTENDED AS SAFETY SWITCH - NOT AS PRIMARY OVERLOAD PROTECTION. BUILDING CIRCUIT BREAKER VALUE SHOULD BE SELECTED FOR PROTECTION (22.5 KVA (20 KW) AT INPUT VOLTAGE).

Figure 2-3. Primary Power Distribution

2-33. RF OUTPUT CONNECTION.

2-34. A standard 1-5/8 inch EIA (male) flange fitting is provided at the top of the 10 KW PA cabinet (figure 2-1) for connection of the RF output to a 50 ohm unbalanced antenna system. A suitable connector should be obtained to mate with this connector and be compatible with the cable to be used.

2-35. AIR DUCTS.

2-36. Input and exhaust air ducts for the 10 KW PA cabinet may be required, depending on the particular installation. Ducts must be terminated at the cabinet with flanges to mate with air ports shown in figure 2-1. Mounting screws should be selected to be compatible with the mounting holes shown.

2-37. The air intake at the rear of the cabinet should be connected in a manner which will not interfere with changing the air filter mounted at the intake port. The intake duct should be of sufficient size (24 x 24 inches minimum) to supply 750 CFM air flow.

2-38. The exhaust port is located at the top of the 10 KW PA cabinet. The exhaust duct should be of sufficient size (10 x 10 inches minimum) to provide 750 CFM air flow. Duct lengths for intake and exhaust may be up to a length equivalent to 50 feet each of the minimum size specified, using only the blower in the cabinet. Estimated nominal temperature rise above ambient for the 10 KW PA cooling system is 35°C.

2-39. The Exciter-1 KW PA cabinet requires no air ducts; however, an exhaust duct system may be specially fabricated for attachment to the exhaust port on the top of the Exciter-1 KW PA cabinet, if desired. Air flow of 120 CFM is required for this cabinet.

2-40. The design conditions for the external ducting assumes the CFM air flow specified. The maximum allowable static air pressure difference at the equipment between the supply and exhaust ducts must be less than .05 ± .05 inches water gauge for the Exciter-1 KW PA cabinet and less than ± 0.5 inches water gauge for the 10 KW PA cabinet. If external booster fans are used, the maximum static air pressure at the supply ducts shall be less than +2 inches water gauge. If a negative supply pressure up to -1 inch is present, the installer must take care to block air leaks around wiring parts so that the air supplied to the cabinet passes through the air filter.

2-41. For minimum noise level, both intake and exhaust ducts should be lined with acoustic insulation to the entrance and exit of transmitter room. Selection of acoustic insulation must be done to be compatible with air flow requirements outlined. Ducts and insulation should be selected together to provide desired results.

2-42. REMOTE CONTROL CONNECTIONS.

2-43. Control and readback lines between the Decoder-Encoder and the associated Remote Control unit should be connected as described in the Technical Manual for the Remote Control unit, NAVSHIPS 0967-292-9040. That manual should also be consulted for other remote control system installation instructions.

2-44. INSTALLATION OF ITEMS PACKED SEPARATELY.

2-45. The Bias and Servo Power Supply PC Board and the power amplifier tube are removed from the 10 KW PA unit for shipping. Following are procedures for installing these items after unpacking.

2-46. PC BOARD INSTALLATION. To install the PC boards, perform the following steps:

a. Remove two 10-32 screws from the left hand side of the bottom compartment access door, and swing the door open.

b. Locate PC card edge connector 9A2J2 on Bias and Servo Power Supply Assembly 9A2 (figure 2-2).

c. Orient Bias and Servo Power Supply PC Board Assembly 9A2A1 over the card edge connector, with the component side of the assembly toward the right hand side of the cabinet.

d. Plug the PC Board into the connector and seat it carefully.

e. Close the bottom compartment access door and secure with the two 10-32 screws.

2-47. PA TUBE INSTALLATION. To install the PA tube, perform the following steps:

a. Remove top and side screws from plate compartment front cover. Loosen bottom screws, and remove cover plate.

WARNING

Use shorting stick to check plate clamp for possible high voltage charge before working in the plate compartment. Make sure all power is secured.

b. Remove two 6-32 screws from top flange of front top-chimmey bracket, and remove bracket.

c. Loosen but do not remove similar screws on left and right hand side top-chimney brackets.

d. Slide RFI filter out the front, and remove from compartment.

e. Raise top chimney, rotate 45 degrees, and remove from top-chimney brackets.

f. Loosen screw used to tighten plate clamp band if necessary.

g. Orient tube over bottom chimney with handles toward sides of compartment. Set the tube in the chimney and socket, being careful to avoid bending contact fingers. Rock the tube back and forth slightly to overcome friction while seating tube firmly in the socket. Leave handles oriented toward compartment sides.

CAUTION

Do not attempt to seat tube without rocking it, as the socket can be damaged.

h. Tighten the plate clamp band screw.

i. Set the top chimney over the tube. Raise it, and seat it with its flange slots over the screws protruding from the left and right hand side chimney clamps.

j. Slide the RFI filter in place over the top-chimney flanges.

k. Tighten screws on the two top-chimney clamps at the left and right hand sides of the chimney, and reinstall the front clamp with two 6-32 screws.

l. Inspect the components in the plate compartment, and reinstall the compartment cover.

m. Place the shorting stick on its hook, and secure the handle in the clamp provided.

2-48. INSPECTION AND ADJUSTMENT

2-49. INSPECTION.

2-50. After the equipment has been installed, and before energizing it for the first time, make a thorough inspection to ensure that the AN/FRT-84(V) is electrically and mechanically ready to be operated. The following checklist covers the items to be inspected. Replacement or repairs should be made if necessary.

a. Inspect mounting hardware throughout the equipment for correct installation and tightness.

b. Inspect installation wiring and all cable connections to ensure that connections are made to the proper connectors/ terminals and that all connections are complete, properly seated, and tightened.

c. Inspect for proper grounding.

d. Inspect all front panel controls and indicators for mechanical damage, looseness, and proper mechanical action.

e. For each unit with slide-out chassis mounting; loosen the front panel screws (or retaining latch), slide unit forward, and inspect for signs of damage. Check interlock switches when reclosing units.

f. Check primary power connections and line voltage tap connections in Exciter-1 KW PA cabinet bottom (figure 2-3) for proper connections and tightness.

2-51. PERFORMANCE CHECKS

2-52. When the AN/FRT-84(V) is energized for the first time, or if the primary power wiring has been disconnected and reinstalled, it must be established that the proper phase relationship exists between the AN/FRT-84(V) and the primary power source.

2-53. Before energizing the equipment, open open 10 KW PA cabinet doors, and slide chassis out of cabinet. Refer to paragraph 3-4 of the Operator's Handbook (NAVELEX 0967-293-0020) to activate the transmitter to standby only. Energize the equipment, and determine that blower 9A1B1 is rotating in the proper direction (counterclockwise as viewed from left side of unit) and at full speed. If the primary power connections have been made in incorrect order, reversing any two, but only two, of the connections to primary power circuit breaker (figures 2-2 and 2-3) will ensure that the proper relationship is attained.

2-54. After checking primary power phasing, perform checks listed in paragraph 3-4 of the Operator's Handbook.

2-55. Before operating the transmitter at full power, refer to paragraph 5-20, and perform all Monitor/Control Assembly (10 KW PA) adjustments to ensure proper filament operation and proper fault detector protection. Then check the TGC and PPC adjustments in paragraphs 5-28 and 5-33. Also, if a Keyer or remote control equipment is to be used, refer to Section II of the appropriate technical manuals for the individual units for required adjustment procedures.

2-56. Then operate the transmitter in all modes according to information in the Operator's Handbook. Make any other necessary adjustments and repairs before releasing the set to the operator. Also perform initial performance checks listed in Maintenance Standards Book NAVSHIPS 0967-293-0050, and record required data.

2-57. INTERFERENCE REDUCTION.

2-58. To reduce the possibility of RF interference, the system should be operated with all units bolted securely in their cases. Cable shielding and ground connections in all fabricated cables should be carefully inspected to ensure proper terminations. The complete bonding system should also receive careful attention during installation. In addition, to assure a good ground reference for the antenna, the system must be installed close to an effective, permanent ground termination. Ground connections should be clean and tight to ensure good bonding.

2-59. PRELIMINARY CONTROL SETTINGS.

2-60. Table 2-4 lists the normal operating positions of maintenance controls for the various local units to allow automatic operation. Set controls as specified before proceeding with operation.

2-61. INITIAL CHECKS AND ADJUSTMENTS.

2-62. Perform the following initial checks and adjustments before operating after installation or maintenance or whenever you may be uncertain of control setting. Refer any discrepancies to maintenance personnel.

WARNING

High DC voltages are applied in various units when the set is placed in the operate condition; and high AC voltages are present in many units, even in standby or amplifier off conditions. Do not reach into units or cabinets with primary power applied. Do not touch or reach near any high voltage circuits until a shorting stick has been used to ensure circuits are discharged.

TABLE 2-4. PRELIMINARY CONTROL SETTINGS, LOCAL EQUIPMENT

UNIT	CONTROL	SETTING
All units	Circuit breakers	RESET or NORMAL
Exciter	REMOTE/LOCAL selector	LOCAL*
	INPUT LEVEL selector	OFF
	CHANNEL GAIN RATIO selectors	0 (fully CCW)
	CLASS OF EMISSION selector	SSB (∞)
	SIDEBAND SELECTOR	(4)ISB
1 KW PA	PWR control	Fully CW
	FREQUENCY MEGACYCLES selector	AUTOMATIC
	Key switch	NORMAL
10 KW PA	MAN/AUTO selector (inside, behind righthand door)	AUTO
	TUNE PWR REQUEST selector	Down
Keyer	FUNCTION TEST selector	OPERATE

*Note: Do not use REMOTE position at any time unless the set has a Decoder-Encoder unit, and then only when operating by remote control.

a. Set controls as listed in table 2-4. Those not listed may be in any position or are of the spring return type.

b. Turn on building power to transmitter cabinet. Turn on all circuit breakers on bottom panels of both cabinets. Momentarily depress the Exciter STANDBY pushbutton. The following indicators should immediately illuminate: the Exciter FREQUENCY KC indicators, TUNE indicator, and STD OVEN indicator; the Keyer STANDBY indicator; the I. Box POWER indicator; and the 1 KW Power Supply POWER ON indicator. The Exciter STANDBY pushbutton will illuminate after a three minute time delay has elapsed, and other indicators may illuminate, depending on the status of the equipment.

CAUTION

> Excessive plate current (above 330 MA) with no RF signal will damage the 1 KW PA final amplifier tubes. Do not place the set in OPERATE for long periods until step h is properly completed. If necessary, placethe set in STANDBY between steps.

c. When the Exciter STANDBY pushbutton illuminates, place the set in the operate condition by momentarily depressing the Exciter OPERATE pushbutton. The STANDBY pushbutton will extinguish, and the OPERATE pushbutton will illuminate.

d. Set 1 KW PA Multipurpose Meter switch at PA DRIVER SCRNS VOLTS. Multipurpose Meter should indicate 287 ± 15 VDC.

e. Set Multipurpose Meter switch at DRIVER PLATE VOLTS. Multipurpose Meter should indicate 600 ± 60 VDC.

f. Set Multipurpose Meter switch at PA PLATE VOLTS. Multipurpose Meter should indicate 2400 ± 240 VDC.

g. Set Multipurpose Meter switch at PA PLATE 1 AMPERES and then at PA PLATE 2 AMPERES. Note Multipurpose Meter indication at both settings.

h. If the indications obtained in step g were within 220 to 280 MA, with not more than 40 MA difference between tubes, proceed with step i. If not, refer to paragraph 5-14 in the AN/FRT-84(V) Technical Manual, NAVSHIPS 0967-293-0010, for corrective procedure.

i. Set 1 KW PA Multipurpose Meter switch to DRIVER 1 AMPERES and then DRIVER 2 AMPERES. If the indications are within 260 to 400 MA, proceed with operation. If not, refer to paragraph 5.2.1.1 in the AN/FRT-84(V) Technical Manual for corrective procedure.

j. Open right hand 10 KW PA cabinet door.

k. Set FAULT DETECTOR meter selector at LINE. FAULT DETECTOR meter should indicate in the NORMAL area.

l. Set FAULT DETECTOR meter selector at 28V. FAULT DETECTOR meter should indicate in the NORMAL area.

m. Set FAULT DETECTOR meter switch at FIL. FAULT DETECTOR meter should indicate in the NORMAL area.

n. Set FAULT DETECTOR meter switch at +15V. FAULT DETECTOR meter should indicate in the NORMAL area.

o. Set FAULT DETECTOR meter switch at -15V. FAULT DETECTOR meter should indicate in the NORMAL area.

p. Set FAULT DETECTOR meter switch at BIAS. FAULT DETECTOR meter should indicate in the KEYED BIAS area (center of area corresponds to 1.1 AMP plate current).

q. Set FAULT DETECTOR meter switch at + 1 KV. FAULT DETECTOR meter should indicate in the NORMAL area.

r. Set FAULT DETECTOR meter switch at +8 KV. FAULT DETECTOR meter should indicate in the NORMAL region.

s. Use CIRCUIT TEST meters and selectors on the Exciter and Keyer units to check power supplies. Meter should indicate in green area.

t. Momentarily depress the Exciter's STANDBY pushbutton.

u. Apply normal level audio signals to the two (or four) active audio input channels. Slide the Exciter out of the case.

v. Set the INPUT LEVEL selector to A1, and the CIRCUIT TEST selector to A1-ALC. Advance internal input level control A1 from a starting position at the counterclockwise end until ALC action is indicated by a slight occasional deflection of the CIRCUIT TEST meter. Then reduce the setting slightly until no ALC action is apparent. Check the INPUT LEVEL meter to ensure that input to Exciter audio channel is no greater than 0 VU.

NOTE

The nominal level for proper operation is 0 VU for a single-tone, sine-wave signal. For a complex waveform input signal, the VU meter indication will be lower, depending on the peak to RMS voltage ratio of the input signal. The ALC indication is based on the peak of the input signal. The peak of the signal is the significant factor, since distortion and overload in the transmitter depends on the signal peaks.

w. Set the INPUT LEVEL selector to B1 and the CIRCUIT TEST selector to B1-ALC and adjust input level control B1 as in step v.

x. Slide Exciter chassis back into its case and secure.

2-63. OPERATING PROCEDURES:

2-64. Normal operation for voice transmission is accomplished completely from the Exciter front panel. Tuning is automatic. For teletypewriter, facsimile, and CW transmission, the Keyer also requires operation. Remote control operation requires setup of the Exciter unit for remote control; otherwise operation is accomplished at the remotely located Remote Control Unit.

2-65. This paragraph contains descriptions and identification of normal operating controls (Exciter and Keyer), starting and shutdown procedures, local voice and data operating procedures, and a procedure for set up for remote operation.

NOTE

Operation with 10 KW PA cabinet doors open should be limited to avoid dust accumulation in the set. With doors open, intake air bypasses the air filter.

2-66. OPERATING CONTROLS. Normal automatic operation requires only the use of Exciter front panel controls and indicators and, for TTY, FAX, or CW, the Keyer front panel devices. All other controls are for setup only, or are for maintenance or emergency manual operation.

2-67. GENERAL INFORMATION FOR STARTING.

2-68. Starting and shutdown of the local equipment is accomplished with the Exciter's STANDBY, OPERATE, and AMPLIFIER OFF pushbuttons. The status is indicated by illumination of these pushbuttons. To start the equipment proceed as follows:

NOTE

Do not use the equipment circuit breakers as off/on switches, since the Exciter frequency standard oven should remain on at all times and circuit breaker life is reduced by repeated use. Circuit breakers should be used only for overload protection, safety during maintenance, or emergency shutdown.

a. Momentarily depress Exciter's STANDBY pushbutton. After a three-minute time delay, the STANDBY pushbutton will illuminate. Other indicators may also illuminate. The time delay allows 1 KW PA and 10 KW PA tubes to warm up.

b. After the STANDBY pushbutton is illuminated, the OPERATE pushbutton can be depressed to put the transmitter on the air.

NOTE

Except when the SIDEBAND SELECTOR is in the USB-VFG or USB-PTT positions, the TUNE pushbutton is illuminated, or the FAULT indicator is illuminated, the transmitter is keyed and it will go on the air when the OPERATE pushbutton is momentarily depressed. If the TUNE pushbutton is illuminated, the transmitter must go through a tune cycle before it is on the air.

SECTION III

OPERATIONS

Note

This section is bound as a separate volume. Refer to Operator's Handbook, NAVELEX 0967-293-0020, for operation of this equipment.

SECTION IV
TROUBLE SHOOTING

4-1. INTROUDCTION.

4-2. This section of the technical manual contains information to enable the electronics technician to locate efficiently the cause of equipment malfunction and abnormal performance. Effective trouble shooting of electronic equipment consists of recognizing the fault sysmptom, identifying the circuit responsible, and isolating the defective component or module in order to repair the equipment and return it to normal operation. To perform these steps quickly and efficiently, the technician should clearly understand the purpose and operation of each functional circuit in the equipment, and follow a systematic, logical trouble shooting procedure. Refer to NAVSHIPS 0967-000-0000 for descriptions of conventional electronic circuits.

4-3. LOGICAL TROUBLE SHOOTING.

4-4. The following paragraphs present trouble shooting techniques based on six logical steps that will provide the technician with the basis for localizing and locating trouble areas in the transmitter. The transmitter should first be considered as a complete system and secondly, by units. Certain units are covered by separate technical manuals. Table 1-2 Section 1 of this manual lists units and their Technical Manual numbers.

4-5. SYMPTOM RECOGNITION.
This is the first step in a logical trouble shooting procedure and is based on a complete knowledge and understanding of equipment operating characteristics. Some equipment troubles are not the direct result of component failure. This type of trouble is not always easy to recognize since all condition of less than peak performance are not always apparent. This type of trouble is usually discovered during performance of preventive maintenance. It is important that an unfamiliar trouble, as well as a familiar and apparent trouble, be recognized.

4-6. SYMPTOM INVESTIGATION.
When a trouble symptom has been recognized. all the available aids designed into the equipment should be used to further elaborate on the original trouble symptom. Use of front panel controls and other built-in indicating and testing aids will provide better identification of the original trouble symptom. Also, checking or otherwise manipulating the operating controls may eliminate the trouble.

4-7. PROBABLE FAULTY SECTION.
The next step in logical trouble shooting procedure is to make a number of logical choices as to the cause and location of the trouble. The logical choices are mental decisions based on knowledge of the equipment operation, a full identification of the trouble symptom, and information contained in this manual. The overall functional description and service block diagrams in this section should be referred to when selecting a possible faulty section.

4-8. LOCALIZING THE FAULTY SECTION.
For the greatest efficiency in localizing trouble, the functional sections which have been selected by the logical choice method should be tested in an order that will require the least time. This requires a mental selection to determine which section to test first. The selection should be based on the validity of the logical choice and the difficulties in making the necessary tests. If the tests do not prove that a particular section is at fault, the next selection should be tested, and so on until the faulty section is located. As aids in this process the manual contains

a functional description for each functional section based on the Servicing Block Diagram.

4-9. ISOLATING THE FAULTY SECTION. After the faulty section has been identified, the trouble should be pinpointed to the particular circuit, part, or module. The servicing block diagram, schematic diagram, and parts-location illustrations for the faulty section should be used for this purpose. The Functional description provides the signal flow and test information needed to isolate the faulty circuit.

4-10. FAILURE ANALYSIS. After the trouble has been located, as being a faulty component, misalignment, or other problem, but prior to performing corrective action, the above procedures should be reviewed to determine exactly why the fault affected the equipment in the manner it did. This review is usually necessary to make certain that the fault discovered is actually the cause of the malfunction, and not just the result of the malfunction.

4-11. Troubleshooting information is provided in various forms in this section. Paragraph 4-13 consists of a general functional description of the system with emphasis on the interrelation of the various units. Following the general information are major paragraphs (paragraphs 4-21-4-278), each covering a particular functional section of the 1 KW PA, 10 KW PA 1 KW Power Supply, and I. Box units. RF signal path, tuning circuits, keying circuits, protection and power control circuits, metering, and power supplies, are discussed individually in these paragraphs. Refer to table 1-2 for a list of related publications containing detailed information for the Exciter, Keyer, Encoder-Decoder, and Remote Control units, which are described in separate manuals.

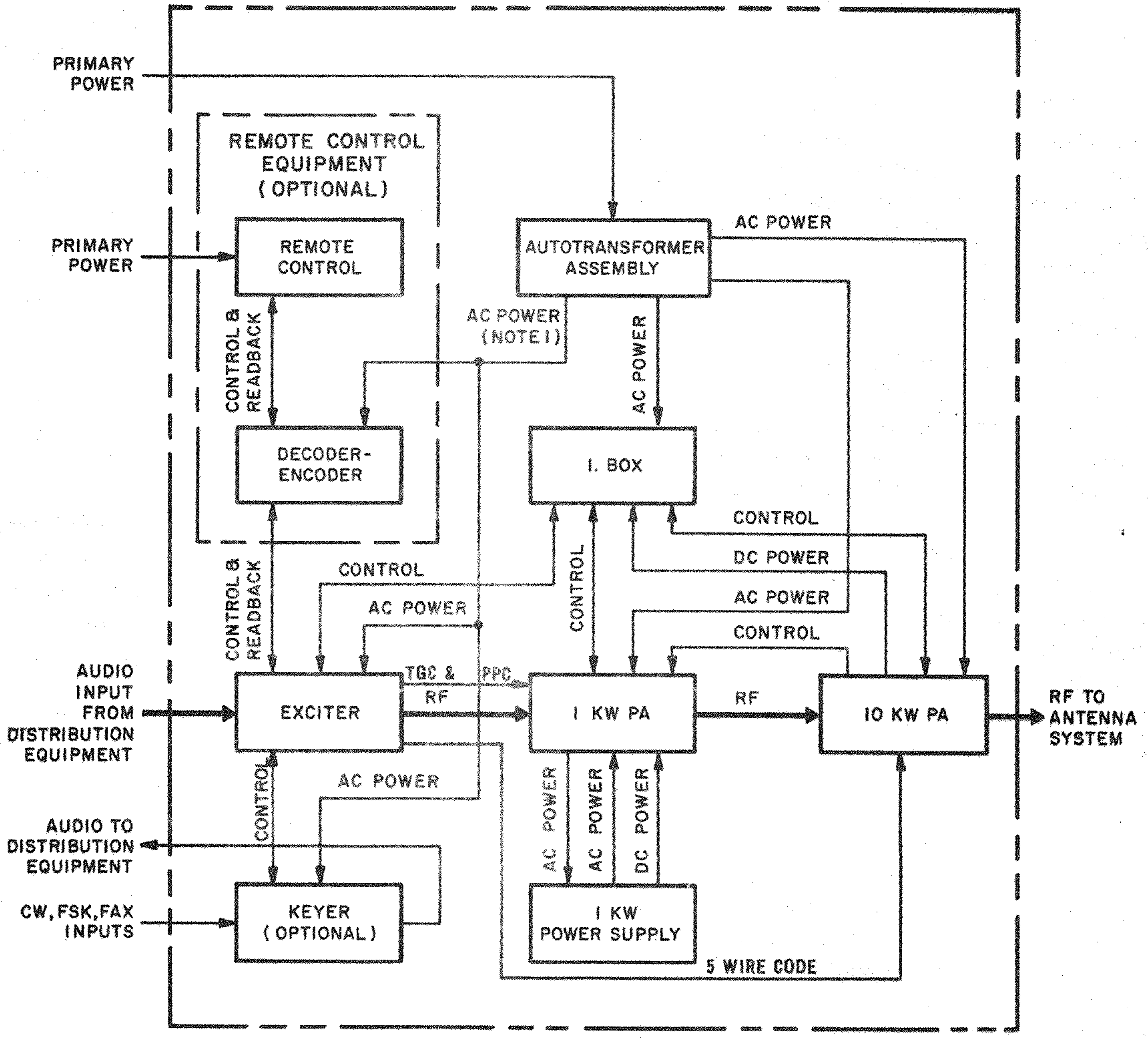
4-12. Following the text protion of this section are test data and servicing diagrams for units covered in detail in previous paragraphs, located together in one area for convenient reference. Servicing diagrams are intended to be used in localizing the fault of a particular circuit; and therefore, details of interassembly and intercircuit connections are shown in detail in these illustrations. The simplified schematic diagrams, which are included with the text to support circuit discussions, are not intended for signal tracing between circuit groups; so connector pin connections and most terminal connections are represented therein only by breaks for the sake of clarity and simplicity.

WARNING

Dangerous high voltages are found in many places in the units while operating, and appropriate precautions should be taken in servicing. The 1 KW Power Supply and the 1 KW PA contain DC voltages up to 2400 volts, and the 10 KW PA contains voltages of up to 8000 volts. High RF voltages are also found in the 1 KW PA and 10 KW PA units. Also, depending upon the type of primary power used, AC voltages of 220 or 460 volts can be found in the 1 KW Power Supply, the Autotransformer assembly. Even after power is removed, high voltage DC circuits may still have voltage applied from filter capacitors, so they should be shorted to ground before touching them. High voltage shorting sticks are provided inside the 1 KW PA and 10 KW PA units for this purpose.

4-13. FUNCTIONAL DESCRIPTION, RADIO TRANSMITTING SET AN/FRT-84(V).

4-14. Figure 4-1 illustrates the functional interrelation of units in a typical AN/



NOTES:

1. PROVISION IS MADE FOR OPTIONAL SUPPLY OF AC POWER FROM EXTERNAL SOURCE TO UNITS SERVED BY THIS AUTOTRANSFORMER ASSEMBLY OUTPUT.
2. REFER TO TABLE I-I FOR FULL NOMENCLATURE OF UNITS.

Figure 4-1. Radio Transmitting Set AN/FRT-84(V), Overall Functional Block Diagram

FRT-84(V) configuration. The Exciter allows the operator to select the transmission frequency, type of sideband and mode (USB-PTT, USB-VFG, USB, LSB, (2) ISB and class of emission (AO, A1-F1-F4, A2-A3e, and SSB with various levels of carrier). When the operator selects one of the 280,000 frequencies available in the 2.0 to 29.999 MC range, the Exciter supplies a five-wire code to the 10 KW PA unit; and the 10 KW PA, in turn, supplies a five-wire code to the 1 KW PA. The 10 KW PA and 1 KW PA units use the five-wire code information to automatically tune to the correct operating band. The Exciter and the 1 KW PA units then generate a low power CW tune signal, and servo tuning circuits in the 10 KW PA fine tune to the correct operating frequency and adjust the output loading circuit. All units are then tuned and ready for full power transmission.

4-15. Voice inputs may be supplied to the Exciter either directly or through an external distribution equipment such as a ptach panel. Facsimile, FSK, and CW inputs enter the AN/FRT-84(V) at the Keyer. The Keyer processes these signals and applies its audio output signal to the Exciter input.

4-16. Once the set is keyed and an input signal is applied, the Exciter produces a low level RF output signal for driving the 1 KW PA unit. The 1 KW PA provides linear amplification to a power level sufficient to drive the 10 KW PA. Further linear amplification in the 10 KW PA unit produces an RF output signal of 10 KW PEP or 5 KW average power for application to the antenna system. During operation, fault circuits continually monitor the equipment for abnormalities. If a fault is detected, the equpment is unkeyed and held inoperative until the condition is corrected and the fault circuit is reset. Fault indicators on the individual units aid in determining fault location.

4-17. The 10 KW PA develops and applies DC control signals to the 1 KW PA which in turn supplies DC control signals to the Exciter to maintain the level of transmitted power at a constant predetermined value, thus compensating for overall gain variations and preventing the RF power output from decreasing below rated levels or from exceeding safe limits. The majority of other control functions are routed through the I. Box. This unit acts upon the control information supplied to it from various other units to provide sequencing for interrelated functions and to assure that operational steps and controls are handled in a predetermined and orderly manner. Additional control functions, such as some between the Exciter and 1 KW PA or between the 1 KW PA and 10 KW PA, are not routed through the I. Box.

4-18. For those AN/FRT-84(V) configurations which include Remote Control equipment, the additional units supplied are the Decoder-Encoder (mounts in Exciter-1 KW PA local equipment cabinet) and the Remote Control unit, which is located away from the local equipment. The installation site of the Remote Control unit is dependent only upon the availability of a suitable primary power source and a two-wire circuit such as a telephone line to connect it to the local equipment(s) it controls. With suitable circuit connections, a single Remote Control unit can control and monitor up to ten local AN/FRT-84(V) sets equipped with individual Decoder-Encoder units.

4-19. Control and readback between the Remote Control unit and the Decoder-Encoder and between the Decoder-Encoder and the Exciter allows the remote operator to signal the selected local transmitter to change its mode of operation, frequency, and standby/operate status. Display functions on the front panel of the Remote Control unit advise the remote operator of the identity of the local transmitter being monitored and its frequency, mode of operation, transmitter ready status, and standby/operate status. Additionally, fault displays show when there is a fault at the transmitter or within the Remote Control unit.

4-20. Primary power for all AN/FRT-84(V) units (except the Remote Control unit) is applied at the Autotransformer assembly in the equipment rack, which converts 220 or 460 VAC three phase primary power to 220 VAC three-phase for the 10 KW PA and to single phase 115 VAC power for the Keyer, Exciter, and Decoder-Encoder. Provisions are made to allow 115 VAC single phase power to be supplied to the Keyer, Exciter, and Decoder-Encoder externally. 220 VAC three-phase power is also supplied from the Autotransformer assembly through the 1 KW PA to the 1 KW Power Supply. Transformed AC power and high voltage DC power from the 1 KW Power Supply is delivered back to the 1 KW PA. A 28 VDC Power Supply circuit in the 10 KW PA provides 28 VDC power to the I Box unit in addition to the 10 KW PA control circuits.

4-21. RF CIRCUITS

4-22. FUNCTIONAL DESCRIPTION.

4-23. Refer to figure 4-2. The Exciter generates an RF signal with a maximum level during normal operation of 50 milliwatts PEP. This signal is applied to the input of the 1 KW PA unit, in which it is successively amplified by two linear amplifier stages: a driver amplifier stage and a final amplifier stage. The driver and final amplifier stages each consist of a pair of parallel-connected electron tubes. The output of each stage is automatically turned to one of nineteen operating bands by automatically selected, pretuned transformer assemblies.

4-24. The output of the 1 KW PA unit, at a level of approximately 500 watts PEP, is applied through the 1 KW PA VSWR bridge to the input circuit of the 10 KW PA unit. The 10 KW PA unit contains one stage of linear amplification which employs a broadband input and a tuned output. The output tuned circuits incorporate several variable elements which are tuned to accommodate changes in loading and to attenuate harmonics. Basically, inductance values are automatically switched in steps according to frequency bands, and variable capacitors are servo tuned according to circuit parameter monitoring devices. Additional fixed-tuned filters are provided to attenuate high frequency harmonics and parasitics. The output of the 10 KW PA is applied to the antenna system through a directional coupler, which detects forward and reflected power and drives DC amplifiers which distribute these signals to various monitor and

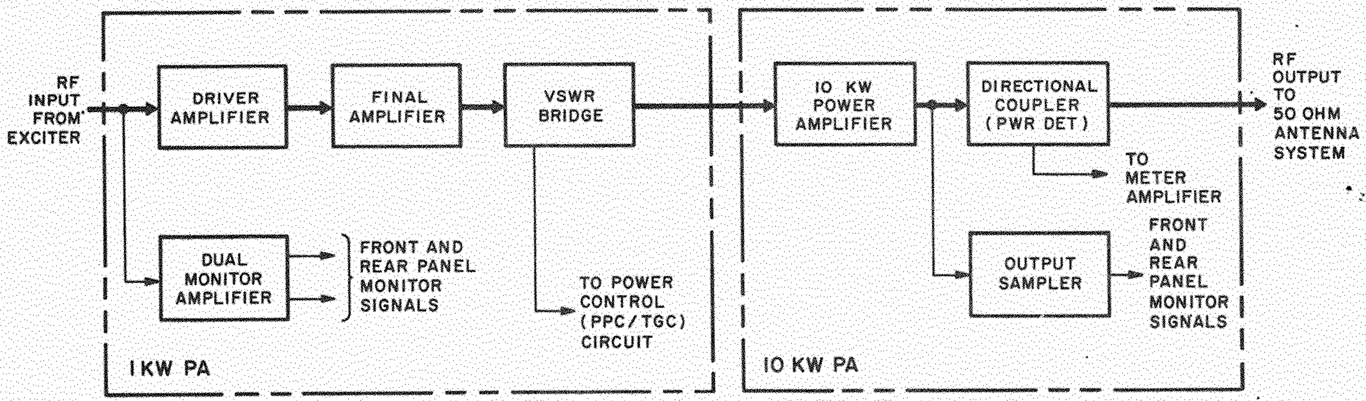


Figure 4-2. RF Circuits, Functional Block Diagram

control circuits.

4-25. RF monitor signals are provided by a dual monitor amplifier at the input of the 1KW PA and a sampler at the output of the 10 KW PA for checking the RF signal with external test equipment.

4-26. Turning circuits, which control the tuning of all amplifier stages, are described separately in paragraph 4-56.

4-27. 1 KW PA DRIVER AMPLIFIER CIRCUIT DESCRIPTION.

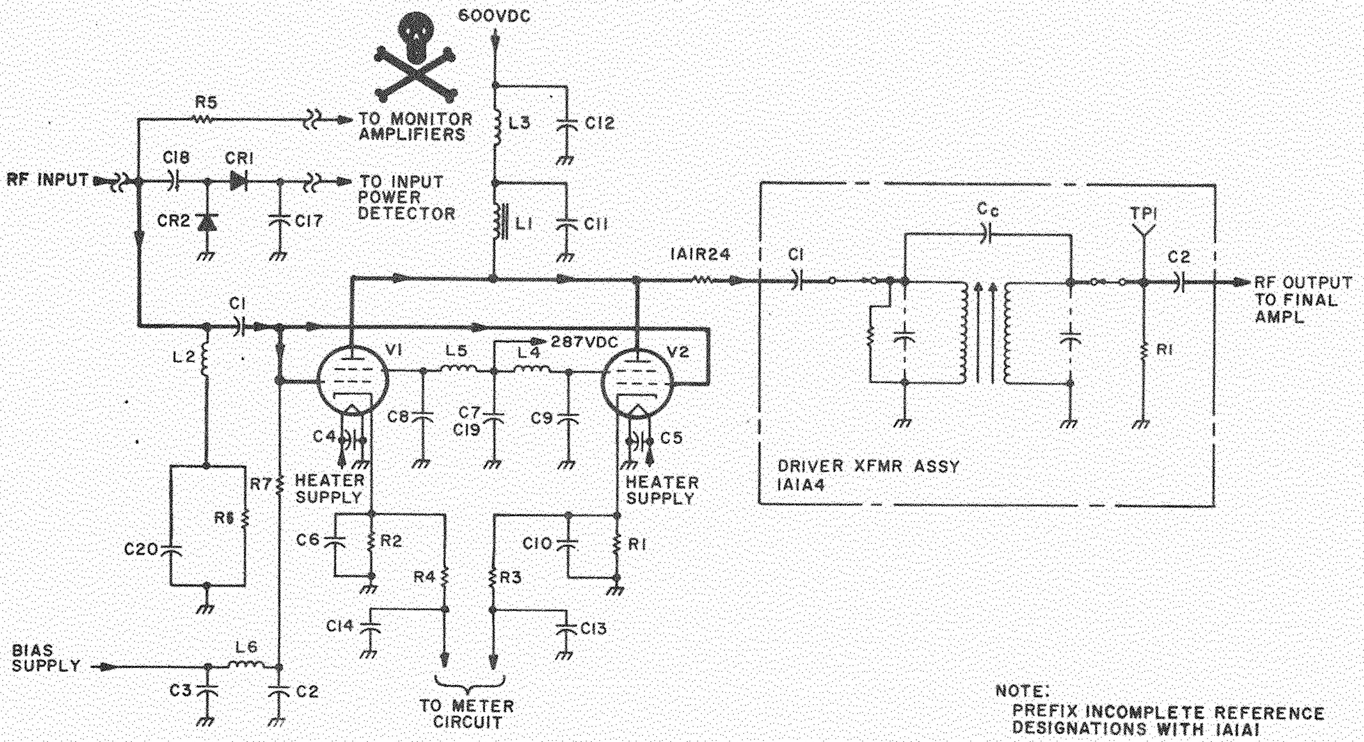
WARNING

> This circuit contains high voltage up to 600 VDC. Use appropriate precautions when servicing.

4-28. The driver amplifier (figure 4-3) consists of two electron tubes, an interstage transformer assembly, and various other components. The function of this circuit is to amplify the input from the Exciter in a linear manner to a level sufficient to drive the final amplifier.

4-29. The RF input from the Exciter is applied to a nominal 50 ohm load network, consisting of C20, L2, and R6, which compensates for the input capacitance of the two electron tubes and provides a VSWR of 1.3:1 or less over the entire operating frequency range. The RF input is also coupled through R5 to a broadband amplifier circuit for monitor outputs and a voltage doubler-detector circuit formed by C17, C18, CR1, and CR2 to the metering circuit.

4-30. From the input load, the RF input signal is applied through coupling capacitor C1 to the control grids of the two driver electron tubes. The two parallel connected electron tubes are operated as a class A linear amplifier stage which provides a nominal power gain of 20 DB. One of nineteen broadband tuned circuits is used to provide selectivity and to couple the RF output from the driver amplifier to the



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 1A1A1

Figure 4-3. 1 KW PA Driver Amplifier 1A1A1, Simplified input of the final amplifier.

4-31. The nineteen tuned circuits are mounted on a motor-driven bandswitch assembly which selects the proper one automatically according to the operating frequency. Each one above 8 MC consists of a double-tuned circuit transformer which uses capacitive top coupling. This type of circuit provides a wide, flat-response passband with very sharp skirts, i.e., broadband tuning. Below 8 MC, conventional single-tuned circuits are employed.

4-32. The voltages developed across cathode resistors R1 and R2 due to screen and plate current drawn through the resistors and the cathodes are applied to the metering circuit for monitoring and measurement.

4-33. Each of the power supply input lines (bias, screen, and plate) is filtered to provide RF decoupling. Capacitors C2 through C12 and C19 are local bypasses. Resistor 1A1R24 is used for parasitic suppression.

4-34. The applicable servicing diagrams for this circuit is figure 4-38. Bias adjustment is described in paragraph 5-12 and transformer assembly alignment is described in paragraph 5-19. Complete circuit details are shown in schematic diagram figures 5-44 and 5-46.

4-35. 1 KW PA FINAL AMPLIFIER CIRCUIT DESCRIPTION.

WARNING

This circuit contains high voltages up to 2400 VDC. Use appropriate precautions when servicing.

4-36. The final amplifier (figure 4-4) consists of two electron tubes, an output transformer assembly, and various other components. is to amplify the output from the driver amplifier in a linear manner to a level sufficient to drive the 10 KW PA.

4-37. The RF output from the driver amplifier is applied through parasitic suppressors R16 and R17 to the grid of electron tube V1 and through parasitic suppressors R18 and R19 to the grid of electron tube V2. The two parallel-connected electron tubes are operated class AB_1. One of nineteen broadband output transformers is used to provide selectivity and couple the RF output from the final amplifier through the 1 KW PA and a 50 ohm coaxial line to the 10 KW PA. The voltage at the input to the final transformer assembly is also applied to the overload circuit for monitoring.

4-38. The nineteen transformers are mounted on a motor-driven bandswitch assembly which is switched according to the operating frequency to automatically connect the proper transformer into the signal path. Each transformer consists of a double tuned circuit which uses capacitive bottom coupling. In addition, the secondary winding is tapped such that the top of the secondary winding and the secondary tuning capacitor form a series resonant circuit to trap second harmonic frequencies.

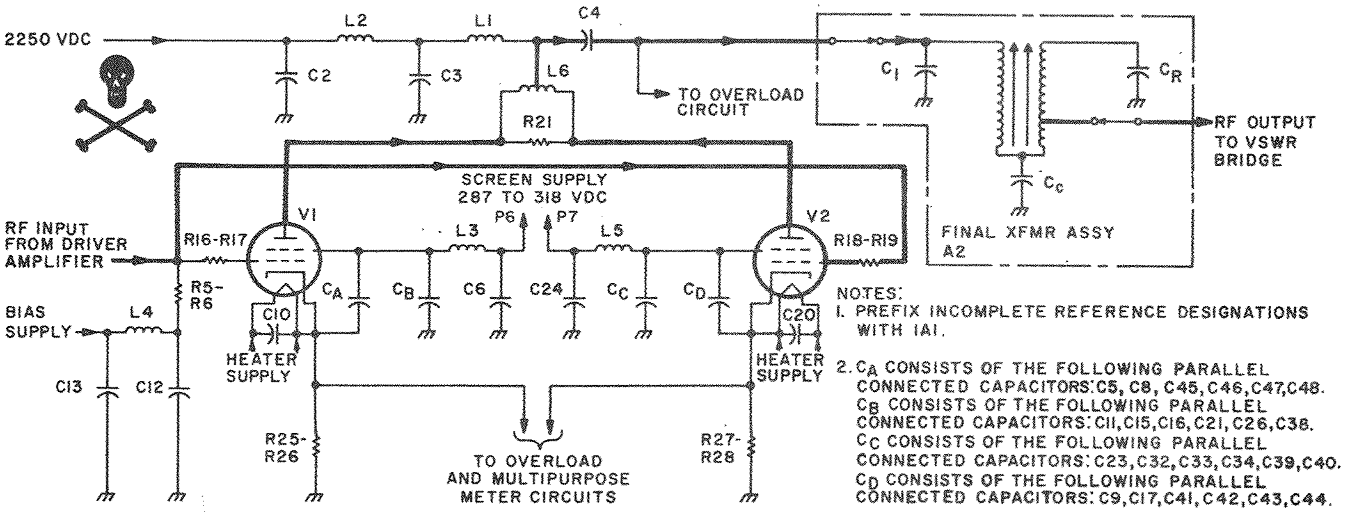
4-39. The voltage drops developed across cathode resistors R25-R26 and R27-R28 by the screen and plate current drawn through the cathode circuits are applied to the metering circuit for monitoring and measurement and to the overload circuit for monitoring. Each of the power supply input lines (bias, screen, and plate) is filtered to provide RF decoupling. The cathode resistors are bypassed by capacitors C_A-C_B and C_D-C_C. Parallel connected resistors R5 and R6 provide grid loading to swamp the non-linear input impedance of the electron tubes, thus preventing distortion. Inductor L6 and resistor R21 serve as a parasitic suppressor. L6 presents a high impedance to VHF parasitics and R21 swamps L6 to prevent its resonance from causing oscillations. Capacitors C10 and C20 are RF bypasses for the tube heaters. Plugs P6 and P7 allow the screen voltages to be selected independently at the screen regulator to balance the idling currents of the two tubes.

4-40. The applicable servicing diagram for this circuit is figure 4-38. Screen supply voltage adjustment for balancing is described in paragraph 5-14, and transformer assembly alignment is described in paragraph 5-19. Bias supply adjustment is a front panel control (described in Operator's Handbook, NAVSHIPS 0967-293-0020). Complete circuit details are shown in schematic diagram figure 5-44 and 5-45 and adjustment is described in paragraph 5-14.

4-41. 1 KW PA VSWR BRIDGE GENERAL DESCRIPTION.

4-42 The 1 KW PA VSWR bridge circuit consists of a toroidal transformer and barious voltage divider, detector, and filter networks. The function of the 1 KW PA VSWR bridge is to provide outputs proportional to the forward and reflected power on the output transmission line to the TGC-PPC circuits which protect against overdrive and damage from high VSWR conditions. Refer to figure 4-5.

4-43. The center conductor of the output transmission line passes through the center of toroidal transformer T1 and consititutes its single turn primary; the walls of the assembly serve as the shield for the transmission line. The short shield around the center conductor, grounded at only one end, does not serve as a part of the transmission line, but acts as a Faraday shield to prevent undesired capacitive coupling between the center conductor and the secondary winding on the toroid. Current through the transmission line induces equal voltages in two parts of the center tapped secondary



NOTES:
1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 1A1.
2. C_A CONSISTS OF THE FOLLOWING PARALLEL CONNECTED CAPACITORS: C5, C8, C45, C46, C47, C48.
C_B CONSISTS OF THE FOLLOWING PARALLEL CONNECTED CAPACITORS: C11, C15, C16, C21, C26, C38.
C_C CONSISTS OF THE FOLLOWING PARALLEL CONNECTED CAPACITORS: C23, C32, C33, C34, C39, C40.
C_D CONSISTS OF THE FOLLOWING PARALLEL CONNECTED CAPACITORS: C9, C17, C41, C42, C43, C44.

Figure 4-4. 1 KW PA Final Amplifier, Simplified Schematic Diagram winding, one voltage being in phase with the line current and the other 180 degrees out of phase with the line current. Voltage divider C6-L2-C1 provides a compensated reference voltage at the center tap of toroidal transformer T1 that is in phase with the line voltage. When the load on the transmission line is 50 ohms resistive so that there is no reflected power, the line voltage and current are in phase. Trimmer C6 is adjusted so that the reference voltage is equal in magnitude to the induced voltage when the load on the transmission line is 50 ohms resistive. In this case, the vector sum of the voltage between terminal 3 of transformer T1 (reflected power side of the bridge) and ground is zero, since the induced voltage is equal in magnitude and 180 degrees out of phase with the reference voltage. At the same time, the vector sum of voltages between terminal 1 of T1 (forward power side of the bridge) and ground is at a maximum, since the induced voltage is in phase with the reference voltage at that side of the bridge.

4-44. As the load changes to something other than 50 ohms resistive, causing reflected power on the line, the two voltages are no longer exactly equal. Since the voltages at the reflected side of the bridge no longer cancel, an output is produced at terminal 3 of T1. The output at the forward side also changes accordingly.

4-45. The signals at terminals 1 and 3 are peak detected and filtered by CR2-C3 and CR3-C4, respectively, to provide output signals for application through isolating resistors R5 and R6 to the TGC-PPC circuit. These signals are essentially rectified envelopes of the RF signal. Inductor L1 provides a DC path to ground from the center tap of toroidal transformer T1. Resistor R9 prevents the coupling capacitor in final tansformer assembly 1A1A2 from holding a DC charge.

4-46. The applicable servicing diagram for the 1KW PA VSWR bridge is figure 4-38. adjustment of balance capacitor C6 is described in paragraph 5-16. Complete circuit details are shown in schematic diagram figure 5-44.

4-47. DUAL MONITOR AMPLIFIER CIRCUIT

4-48. The dual monitor amplifier circuit (figure 4-38) consists of two RF amplifier modules 1A8A1Z1-Z2. The function of this circuit is to provide isolated monitor signals to front and rear panel monitor jacks to allow easy testing of the RF input signal from the Exciter.

4-49. Each amplifier module provides a gain of about 23 DB. The nominal output level of the amplifier modules is 1 volt (with 100 MW RF input to the 1 KW PA). The amplifier modules are considered to be replaceable parts, since repair is impractical.

4-50. The dual monitor amplifier circuit requires no adjustments. Complete circuit connections are shown in schematic diagram figure 5-44.

4-51. 10 KW PA POWER AMPLIFIER.

WARNING

This circuit contains high DC voltages up to 8000 VDC and high RF voltages. Use appropriate precautions when servicing.

4-52. The power amplifier stage used in the 10 KW PA (figure 4-6) consists of a single tube connected in a grounded-grid configuration that has a broadband input and a tuned output. The function of this circuit is to linearly amplify the 1 KW PA output to a level of 10 KW PEP or 5 KW average power (depending on mode) for application to an antenna system. Since only a relatively small amount of gain (13 DB) is required, the grounded grid configuration is used due to its characteristically good linearity, good stability, and high efficiency.

4-53. The RF output from the 1 KW PA is applied to the filament (cathode) of amplifier tube V1 through a broadband impedance matching network which matches the input impedance of the power amplifier tube to the 50 ohm output from the 1 KW PA. The power amplifier stage is biased for class AB_1 operation, with the unit being keyed by changing the bias voltage from cutoff (-600 VDC) to operate (-210 VDC). The RF output from the power amplifier is applied through a matching network (L3, L5, L7, C4, C6, C8) to the antenna. Each of the variable components in the matching network is automatically positioned (paragraph 4-56) according to the system operating frequency in order to match the antenna impedance to the plate impedance of the power amplifier tube. The matching network is required to ensure optimum transfer of power and to minimize the amount of harmonic energy applied to the antenna.

4-54. An in-line directional coupler (directional power detector) is used between the output from the matching network and the antenna to develop two DC voltages: one proportional to forward power and one proportional to reflected power. These DC voltages are applied to the A5A3 Meter Amplifier Assembly for amplification and routing to the 1 KW PA for developing the required system gain control voltages (PPC and TGC) and to the 10 KW PA peak/average meter circuit. In addition, the one proportional to reflected power is monitored by the VSWR fault detector circuit to shut down the equipment if excessive reflected power develops.

4-55. Table 4-1 provides a listing of each component of the power amplifier circuit and its function. The applicable servicing

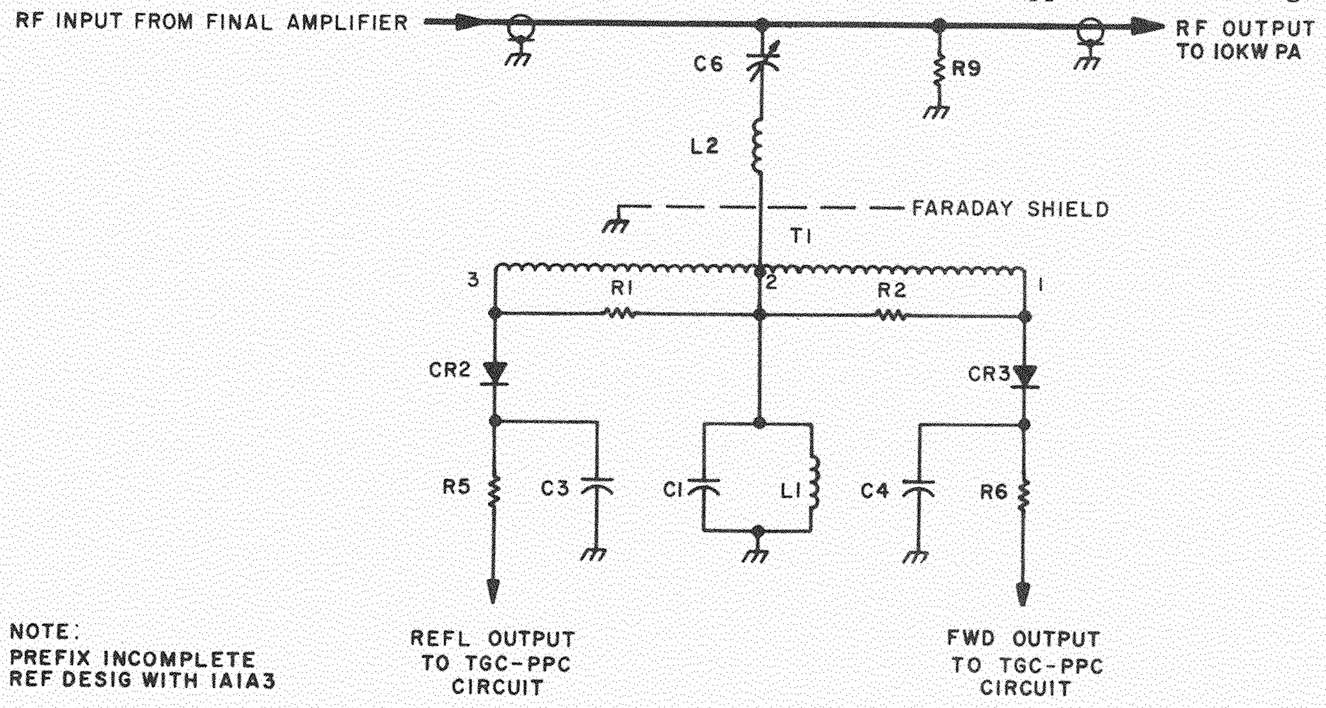


Figure 4-5. 1 KW PA VSWR Bridge, Simplified Schematic Diagram

diagram for this circuit is figure 4-38. Bias adjustment is described in paragraph 5-31a. Complete circuit details are shown in schematic diagram figure 5-50.

TABLE 4-1. 10 KW PA POWER AMPLIFIER COMPONENT FUNCTIONS

COMPONENT	FUNCTION
C32-L15-C31-C33	Low pass filter with 35 MC cutoff for harmonic suppression.
R6	Series resistor to convert 35 ohm tube input resistance to 50 ohms required as a load by 1 KW PA.
L11-C27-C28-L14-C3-C16-C15-C18-A4L1-A4L2 & tube input capacitance	Constant k, pi-section, bandpass filter, 2-30 MC, 35 ohm input and output impedance matches tube input impedance. (Physically L14 is a length of wire.)
C3-C15-C16-C18	Blocking capacitors.
T1	Filament transformer with adjustable taps.
C29-C30	Preserves balance in filament circuit while sampling RF input voltage to be applied to Detector Assembly A3.
C17-C1	Voltage Divider to sample RF voltage at filament for application to Detector Assembly A3.
C5-C7, C19-C2	Voltage dividers used to sample RF voltage at the plate of the tube for application to Detector Assembly A3.
R4	Static discharge for the power amplifier tube RF output voltage-sampling divider.
A9C1-A9L1-R10	Harmonic trap (series-resonant) for 50-60 MC range.
R3-L9	Parasitic suppressor. (Physically L9 is a connection strap.)
C9	DC blocking capacitor.
C8	Provides tuning (phasing) control. It is automatically positioned according to the operating frequency as explained in paragraph 4-96.
L8	Optimizes performance at the high operating frequencies. (Physically this part is the connection strap between C9 and L7.)

TABLE 4-1. 10 KW PA POWER AMPLIFIER COMPONENT FUNCTIONS (Cont)

COMPONENT	FUNCTION
L7	Provides the required amount of series inductance to enable the tuning of the plate circuit to be accomplished within the capacitance range of C8. The amount of inductance used is automatically selected during prepositioning according to the operating frequency as explained in paragraph 4-60.
C4-C6	Provide loading control. They are automatically positioned according to the operating frequency as explained in paragraph 4-96.
L3-L5	Provide the Required amount of series inductance to enable the loading of the transmission line to be accomplished within the capacitance range of C4 and C6. The amount of inductance used is automatically selected during prepositioning according to the operating frequency as explained in paragraph 4-60.
L4	Provides static drain for the transmission line to prevent DC voltages from building up on the antenna due to static. In addition, if capacitor C9 fails, L4 shorts the B+, causing the high voltage circuit breaker to trip for shock hazard protection.
C23-C24-C25-L13	M-derived low pass filter with 32 MC cutoff to attenuate harmonics.
C26-L12	High frequency harmonic trap.
C22-A14C1	Capacitive voltage divider for sampling RF output to the antenna for monitoring purposes.
A14R1	Loading resistor to prevent a connection to either of the monitor jacks from affecting the level of the other.
A14R2-A14R4, A14R3-A14R5	Voltage dividers which provide a sample of RF output at monitor test jacks.
All other components	RF decoupling/filtering.

4-56. TUNING CIRCUITS FUNCTIONAL DESCRIPTION.

4-57. Refer to figure 4-7. The 1 KW PA uses pretuned transformer assemblies in the driver and final amplifier stages. These transformers are selected by the 1 KW PA tuning circuit in response to a band code generated at the Exciter and repeated by the band repeater assembly in the 10 KW PA.

4-58. The 10 KW PA output matching network employs tune and load inductors which have taps that are selected by the 10 KW PA bandswitch circuits in response to a band code from the band repeater assembly, and it employs continuously variable tune and load capacitors which are tuned at the direction of the tune and load servo amplifiers. Tune and load servo amplifiers operate in three modes. When the operating frequency is first changed, preposition signals from the band repeater are applied to the servo amplifiers to coarse tune the variable capacitors acaccording to band information. Then RF power is applied, and the servo amplifiers fine tune according to information from the detector assembly which indicates RF power amplifier stage parameters. The tune variable capacitor is tuned to resonance, which the detector assembly senses by detecting the phase shift between the cathode and plate of the amplifier tube. The load variable capacitor is adjusted to provide a 1200 ohm load impedance at the plate, which the detector senses by comparing cathode and plate voltages. Finally, after tuning is completed, automatic surveillance is maintained by the detector and servo amplifiers to keep the output circuit tuned and loaded properly.

4-59. Control of the sequence of operation in the 10 KW PA bandswitch circuits and the servo amplifiers is accomplished in the tune-up logic circuits. These circuits initiate the tuning cycle when an inhibit signal is received from the Exciter, and sequence the transition from bandswitching and servo prepositioning, to fine tuning, and finally to full power transmission. The tune-up logic also functions to provide RF mute, tune power request, and manual ground signals to the I. Box as required during tuning and prevents continued operation if the tuning process is not completed in the maximum time allowed (15 seconds).

4-60. 10 KW PA TUNE-UP LOGIC CIRCUIT DESCRIPTION. The tune-up logic circuits function to control the sequence of events in the automatic positioning (tuning) of the matching network elements for the selected operating frequency (MAN/AUTO switch set at AUTO). Two steps are used in tuning: first the elements are prepositioned or rough tuned without RF, then fine tuned using a low level RF tune power signal. The general sequence of events is as follows. (Circuit details will be considered later.)

4-61. Selection of a new operating frequency causes the Exciter to produce a 5 wire, 19 position code which is applied to the band repeater assembly. In addition, the Exciter produces an inhibit signal which prevents an RF output from that unit and is applied through the I. Box to the 10 KW PA tune-up logic for initiating a tuning cycle. If the selected frequency is in a band different from that for which the system has previously been tuned, the band repeater will reposition and generate new codes for the 1 KW PA and 10 KW PA bandswitch circuits.

4-62. While the band repeater repositions, a decoder-on ground signal is supplied to prevent the tune-up logic from changing state. As soon as the band repeater stops, the decoder-on ground signal is removed and the inhibit signal activates the necessary circuits in the tune-up logic for a preposition mode. This enables the bandswitch and servo motors to energize, if required, and reposition according to the codes generated above. When all motors stop, the tune-up logic supplies a tune power request signal to the I. Box for application to the Exciter, and places the servo amplifiers in a high gain mode. The cycle will hold at this point and the Exciter will continue to produce the inhibit signal until the Exciter's TUNE pushbutton is depressed (or the cycle will continue if the TUNE pushbutton was already depressed).

4-63. Depressing the Exciter's TUNE pushbutton (indirectly) removes the inhibit signal, switching the tune-up logic out of the preposition mode. Since a tune power request signal is being supplied to the I. Box, a low-level tune-power RF output is applied to the 10 KW PA power amplifier stage which increases in level until sensed at the plate of the power amplifier tube. The RF sensor enables the servo amplifiers, allowing the output matching network variable capacitors to be positioned according to the output from the detector assembly. The tune and load servo amplifiers are interlocked when, tuning with RF power so that only one is activated at a time.

4-64. Once the variable capacitors have been tuned, the tune power request signal is removed, the servo amplifiers are disabled and switched out of the high gain mode, and all tune-up logic circuits are reset as required for the start of a new cycle.

4-65. Thereafter during operation, whenever there is an RF voltage at the plate of the power amplifier corresponding to greater than 500 watts output, the servo amplifiers are enabled but at a preset sensitivity to maintain the system in a tuned condition during operation (automatic surveillance feature). However, the tune-up logic circuits do not otherwise change state.

4-66. Refer to figure 4-39 during the following detailed circuit discussion. A frequency change at the Exciter produces an inhibit signal which prevents the Exciter from producing an RF output. The inhibit signal (ground) is applied through the I. Box system logic circuit to activate AND A6A1Q1.

4-67. However, if the frequency change requires the band repeater to reposition, a decoder-on ground signal is applied, while it is repositioning, to the base of A6A1Q1 to prevent conduction until the band repeater stops. The decoder-on ground signal is also applied through OR gate A6A2CR5 to the I. Box system logic circuit to mute any RF output during prepositioning and through the motor-run line to the tune-up logic to prevent it from changing state.

4-68. When the band repeater stops, AND gate A6A1Q1 turns on and applies a ground signal to the base of bandswitch enable transistor A6Q1 and applies a preposition signal to the two servo amplifier assemblies, enabling the servo amplifier assemblies and placing them in a preposition mode. The servo amplifiers will then energize and preposition the tune and load capacitors in the matching network according to the analog preposition voltage outputs from the band repeater assembly. (The servo amplifiers preposition the tune and load capacitors every time an inhibit signal is produced, even though the band repeater might not reposition.

4-69. The ground applied to the base circuit of bandswitch enable transistor A6Q1 turns

NOTES:

1. Prefix incomplete reference designations with 9A1.
2. Letters outside transistor blocks indicate elements, numbers at relays indicate terminals.
3. ☐ indicates equipment front panel marking.
4. Refer to table 4-2 for five-wire, 19 position code used in switch sections 9A1A13S1-1-F&R, 9A1A13S1-4-F&R, 1A1S7-1, and 1A1A4S1-C.
5. 1A1S7-2, 3, and 4 shown functionally and in AUTOMATIC position. Alternate switch position shown represents all other positions (2-30 MC).
6. +28V removed by fault relay 9A3A2K5 (not shown) when fault occurs.
7. The following table correlates tune and load bandswitch operation with 9A1A13 Band Repeater assembly and 1 KW PA tuning circuit band positions.

FREQ RANGE (MC)	BAND REPEATER 9A1A13 BAND	1 KW PA TUNING CKT BAND	A11		A12	
			BAND	PIN	BAND	PIN
2.0-2.5	1	1	1	F	1	F
2.5-3.0	2	2	1	F	1	F
3.0-3.5	3	3	1	F	1	F
3.5-4.0	4	4	1	F	1	F
4-5	5	5	2	G	2	G
5-6	6	6	2	G	2	G
6-7	7	7	2	G	2	G
7-8	8	8	2	G	2	G
8-10	9	9	3	H	3	H
10-12	10	10	3	H	3	H
12-14	11	11	3	H	3	H
14-16	12	12	3	H	3	H
16-18	13	13	4	M	4	M
18-20	14	14	4	M	4	M
20-22	15	15	4	M	4	M
22-24	16	16	4	M	4	M
24-26	17	17	5	R	5	N
26-28	18	18	5	R	5	N
28-30	19	19	5	R	5	N

8. Following is a correlation of 9A1A11 and 9A1A12 bandswitch sequence with bands listed in columns A11 and A12 above:

   A11 Sequence: 1-2-3-4-0-5-0-0-0-0.
   A12 Sequence: 1-2-3-4-5-0-0-0-0-0.

   (0 indicates switch does not stop at this position.)
9. Make measurements between indicated points.
10. P/O intercabinet cable.

TEST POINT	CONDITION	READING
10	A11A1B1 energized (A11S2 tuning) A11A1B1 de-energized MOTOR WINDING RESISTANCE	115 VAC 0 VAC 75 ohms
11	A12A1B1 energized (A12S2 tuning) A12A1B1 de-energized MOTOR WINDING RESISTANCE	115 VAC 0 VAC 75 ohms
12	1A1B2 energized (Bandswitches tuning) 1A1B2 de-energized MOTOR WINDING RESISTANCE	115 VAC 0 VAC 180 ohms
K	5-wire code — see table 4-2	GRD or OPEN
L	STBY NORMAL While decoder solenoid is operating	+26 V +26 V GRD
M	STBY NORMAL While decoder solenoid is operating	+26 V +26 V +2 V pulses
N	5-wire code — see table 4-2	GRD or OPEN
O	5-wire code — see table 4-2	GRD or OPEN
P	5-wire code — see table 4-2	GRD or OPEN
Q	Motor 1A1B2 Running	GRD

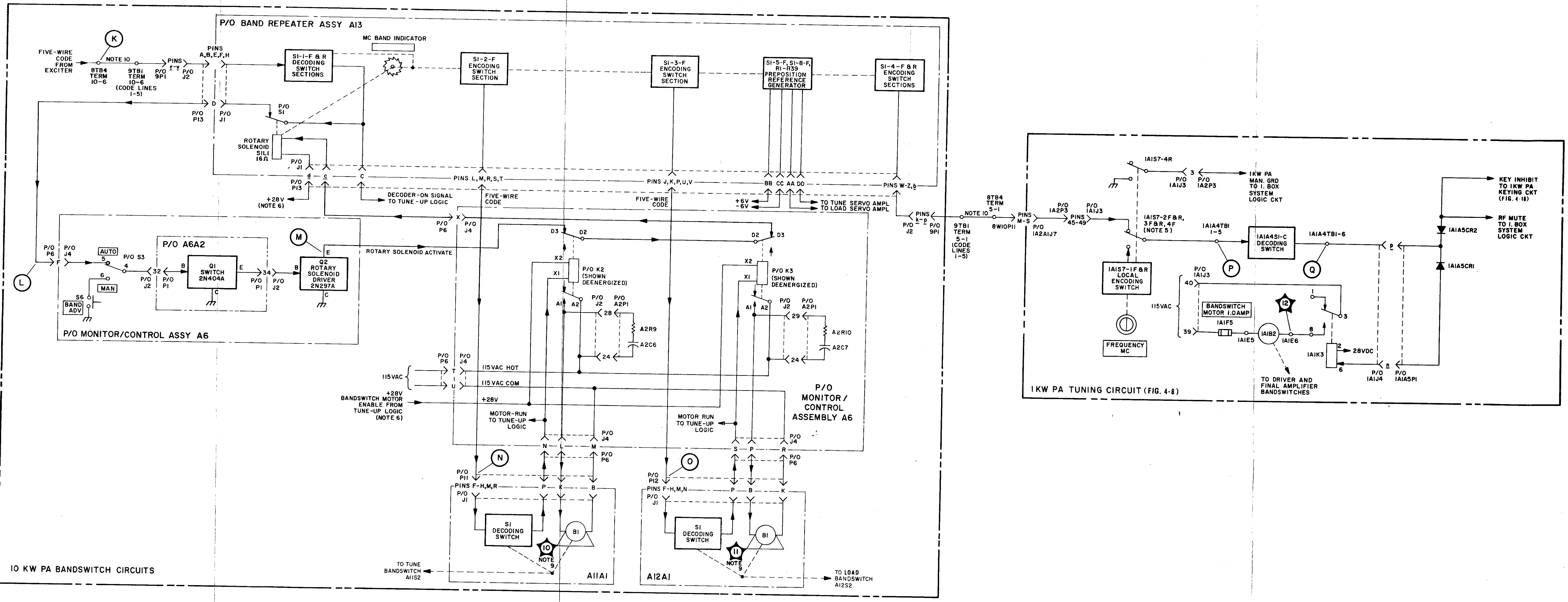


Figure 4-41. Bandswitch Circuits, 9A1, Servicing Diagram

NOTES:

1. Prefix incomplete reference designations with 9A1.
2. Letters outside transistor blocks indicate elements.
3. ⊘ indicates slotted shaft for screwdriver adjustment.
4. Signal levels are indicated by arrow types. All arrow symbols point in direction of signal flow, (signal level indicators are for understanding only and do not indicate exact signal level since signals are analog):

   HI = ◣ , LO = ◺ .

5. +28V to servo amplifiers is removed by fault relay 9A3A2K5 (not shown) when fault occurs.
6. Measure voltage between indicated points.

TEST POINT	CONDITION	MEASUREMENT
13	A7B1 energized (tune servo tuning) A7B1 de-energized Motor winding resistance	+18 to 22 VDC +0 to 10 VDC 12 Ω Min.
14	A8B1 energized (load serve tuning) A8B1 de-energized Motor winding resistance	+18 to 22 VDC 0 to 10 VDC 12 Ω Min.
R	STBY NORMAL	0 V • 1.8 to 2.2 V RF
S	STBY NORMAL	0 1.8 to 2.2 V RF
T	STBY NORMAL	-3 VDC -3 VDC
U	STBY NORMAL	+6 to 8 VDC +6 to 8 VDC
V	STBY NORMAL	+6 to 8 VDC +6 to 8 VDC
W	STBY NORMAL	-3 VDC -3 VDC
X	STBY NORMAL	+4 to 5 VDC +4 to 5 VDC
Y	STBY NORMAL	+6 to 8 VDC +6 to 8 VDC

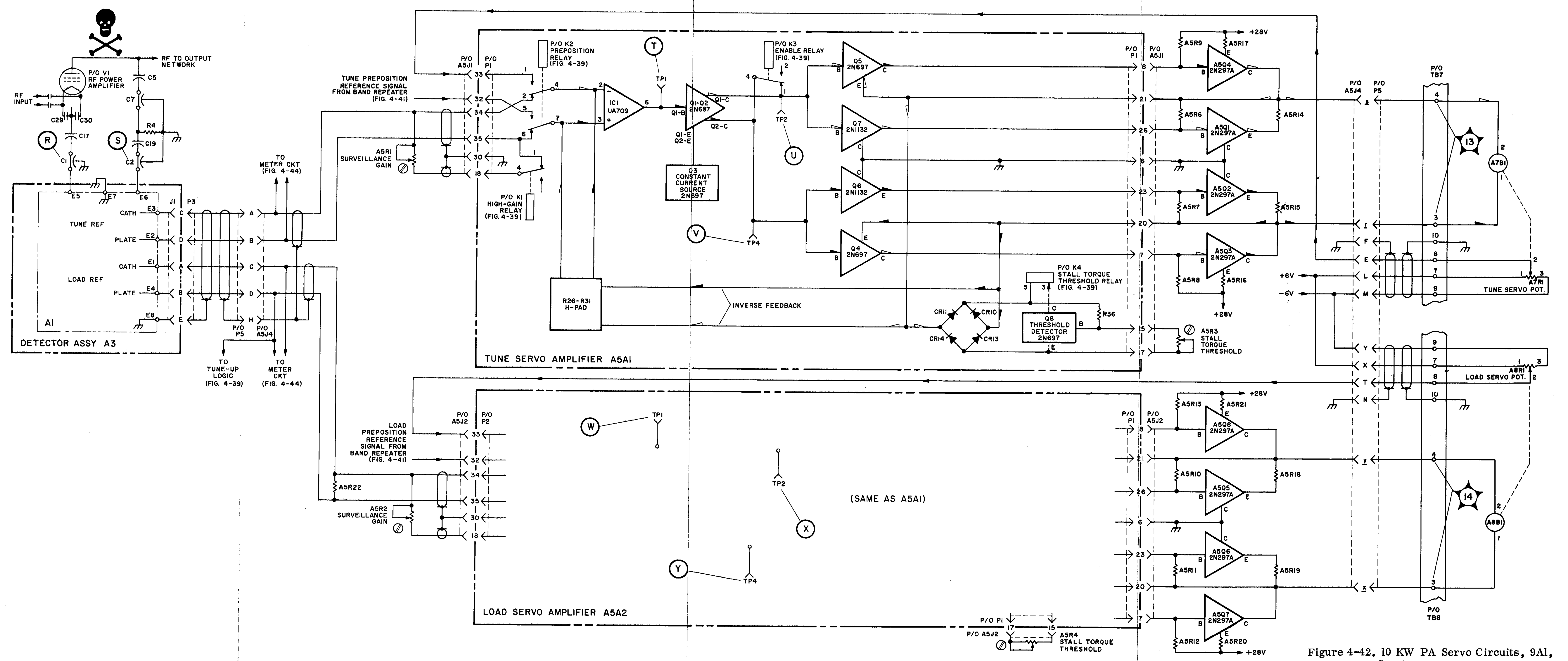


Figure 4-42. 10 KW PA Servo Circuits, 9A1, Servicing Diagram

NOTES FOR FIGURE 4 - 43:

1. Letters outside transistor and diode blocks indicate elements; numbers outside relay blocks indicate terminals.
2. Signal levels are indicated by arrow types. All arrows indicate direction of signal flow.

   HI = ▶ = close to positive supply voltage

   LO = ▷ = less than +2V (nominally grd)
3. ⊘ indicates slotted shaft for screwdriver adjustments.
4. ▭ indicates front panel markings.
5. Signal at this point is inverted functionally; i.e., Grd = normal condition.
6. Measurements taken with AN/PSM-4B.
7. Measurements made between indicated points.
8. P/O Exciter-1 KW PA Cabinet cable harness.
9. P/O Intercabinet Harness.
10. Most I. Box test points can conveniently be checked at indicated feedthru capacitors on rear of I. Box.
11. D.C. test point voltages were measured with the following equipment conditions:

STBY:	System in standby, at least 3 min. after Exciter STANDBY pushbutton depressed, and TUNE pushbutton illuminated.
OPERATE:	Exciter OPERATE pushbutton has been depressed, and TUNE pushbutton is illuminated.
NORMAL:	Exciter keyed in Compatible AM, with 2.5 KW Carrier only. (USB, A2,3e mode with no audio input.)
MANUAL:	Same as STBY except Monitor/Control assembly AUTO/MAN switch A6S3 set at MAN. and with tune power request.
PA FAULT:	System condition when a fault has been generated in the 1 KW PA or 10 KW PA.

12. Ground in automatic operation.
13. Ground during RF mute.

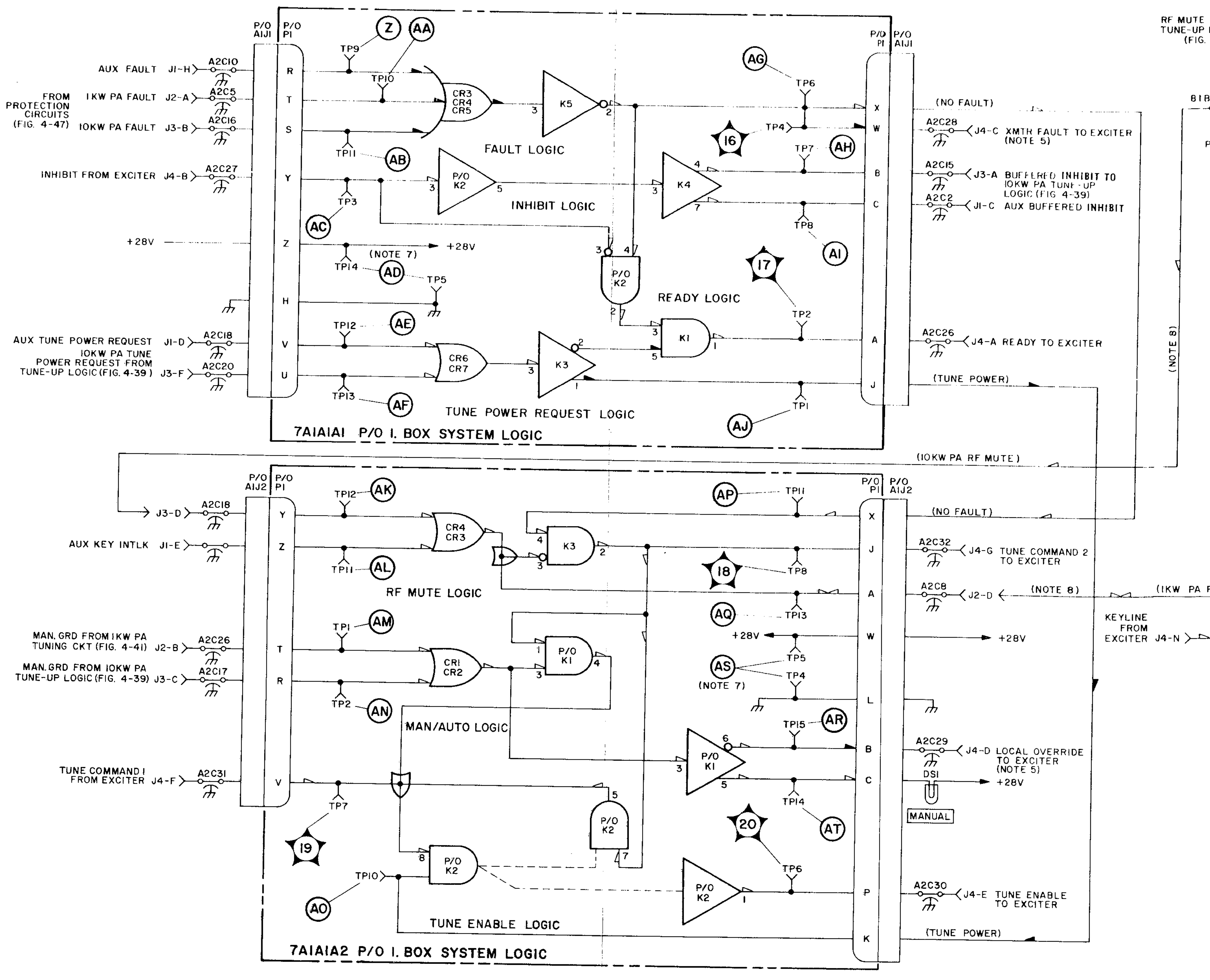
TEST POINTS (7A1A1___)		I. BOX ALTERNATE TEST POINTS (NOTE 10)	CONDITIONS (NOTE 11)				
			STBY	OPERATE	NORMAL	MANUAL	P.A. FAULT
16	(A1TP4)	A2C28	0	0	0	0	1.7 V
17	(A1TP2)	A2C26	18 V	18 V	18 V	0	18 V
18	(A2TP2)	A2C32	0	0	0	0.75 V	2.4 V
19	(A2TP7)	A2C31	25 V	25 V	0	0.75 V	2.4 V
20	(A2TP6)	A2C30	18 V	18 V	18 V	0	0
Z	(A1TP9)	A2C10	0	0	0	0	25 V (AUX)
AA	(A1TP10)	A2C5	0	0	0	0	25 V (1 KW)
AB	(A1TP11)	A2C16	0	0	0	0	25 V (10 KW)
AC	(A1TP3)	A2C27	0	0	25 V	0	0

TEST POINTS (7A1A1___)		I. BOX ALTERNATE TEST POINTS (NOTE 10)	CONDITIONS (NOTE 11)				
			STBY	OPERATE	NORMAL	MANUAL	P.A. FAULT
AD	(A1TP14/ TP15	----------	27 V	27 V	27 V	27 V	27 V
AE	(A1TP12)	A2C3	1.7 V	1.7 V	25 V	1.7 V	1.75 V
AF	(A1TP13)	A2C20	1.4 V	1.4 V	25 V	1.4 V	1.4 V
AG	(A1TP6)	-----------	.30 V	.30 V	0	.30 V	0
AH	(A1TP7)	A2C15	0	0	18 V	0	0
AI	(A1TP8)	A2C2	GRD	0	0	GRD	0
AJ	(A1TP1)	-----------	27 V	27 V	0	27 V	0
AK	(A2TP12) Note 13	A2C18	25 V	25 V	25 V	25 V	25 V
AL	(A2TP11)	A2C24	0	0	0	0	0
AM	(A2TP1)	A2C6	25 V	25 V	25 V	0.35 V	25 V
AN	(A2TP2)	A2C17	25 V	25 V	25 V	0	25 V
AO	(A2TP10)	-----------	27 V	26 V	0	27 V	0
AP	(A2TP11)	-----------	0.3 V	0.3 V	0	0.3 V	0
AQ	(A2TP13) Note 13	A2C8	25 V	25 V	25 V	25 V	25 V
AR	(A2TP15) Note 12	A2C29	0	0	0	0	0
AS	(A2TP5/TP4)	-----------	27 V	27 V	27 V	27 V	27 V
AT	(A2TP14)	(MANUAL indicator)	27 V	26 V	27 V	0 V	27 V

TEST POINT		STBY	OPERATE	NORMAL	MANUAL	P.A. FAULT
㉑	(1A1A6TP2)	-140 V	-16 V	-16	-140	-160 V
㉒	(1A1A1TB1-8)	-100 V	-10 to 15 V	-10 to 15 V	-100 V	-100 V
AU	(9TB1-19) Note 13	0	25	25	--	--
AW	(1A1A5TP3) Note 13	+27 V	+27 V	+27 V	+27 V	+27 V
AX	(1A1A5TP5)	+0.25 V	+0.2 V	+0.2 V	+0.25 V	+0.25 V
AY	(1A1A5TP6)	+0.3 V	+8.2 V	+8.2 V	+0.3 V	+0.3 V
AZ	(1A1A6TP3)	-170 V	-75 V	-75 V	-170 V	-170 V
BA	(1A1A6TP1)	-100 V	-0.3V	-0.3 V	-100 V	-100 V

TRUTH TABLE FOR I. BOX SYSTEM LOGIC CIRCUITS

INPUTS → 1 = Present 0 = Not Present - = May or May Not be Present 2 = One of Indicated Inputs Present OUTPUTS (Present only when required conditions are present) ↓	Aux Tune Power Request	10 KW PA Tune Power Request	Inhibit from Exciter	Aux Fault	1 KW PA Fault	10 KW PA Fault	Aux Key Interlock	10 KW PA RF Mute	Tune Command 1 from Exciter	1 KW PA Man. GRD	10 KW PA Man. GRD	Keyline from Exciter	NOTES
READY to EXCITER	0	0	0	0	0	0	-	-	-	-	-	-	
10 KW PA INHIBIT	-	-	1	-	-	-	-	-	-	-	-	-	
AUX. INHIBIT	-	-	1	-	-	-	-	-	-	-	-	-	
XMTR FAULT to EXCITER	-	-	-	2	2	2	-	-	-	-	-	-	NOTE 5
TUNE COMMAND 2 to EXCITER	-	-	-	0	0	0	0	0	-	-	-	-	
RF MUTE to 1 KW PA 1) (Either of Two Conditions) 2)	- -	- -	- -	- -	- -	- -	- 1	1 -	- -	- -	- -	- -	
TUNE ENABLE to EXCITER 1) (Any of Six Conditions) 2)	1 -	- 1	- -	0 0	0 0	0 0	0 0	0 0	2 2	2 2	2 2	- -	
LOCAL OVERRIDE to EXCITER	-	-	-	-	-	-	-	-	-	2	2	-	NOTE 5
KEYLINES to 10 KW PA, 1 KW PA, & AUX EQUIP.	-	-	-	-	-	-	-	-	-	-	-	1	



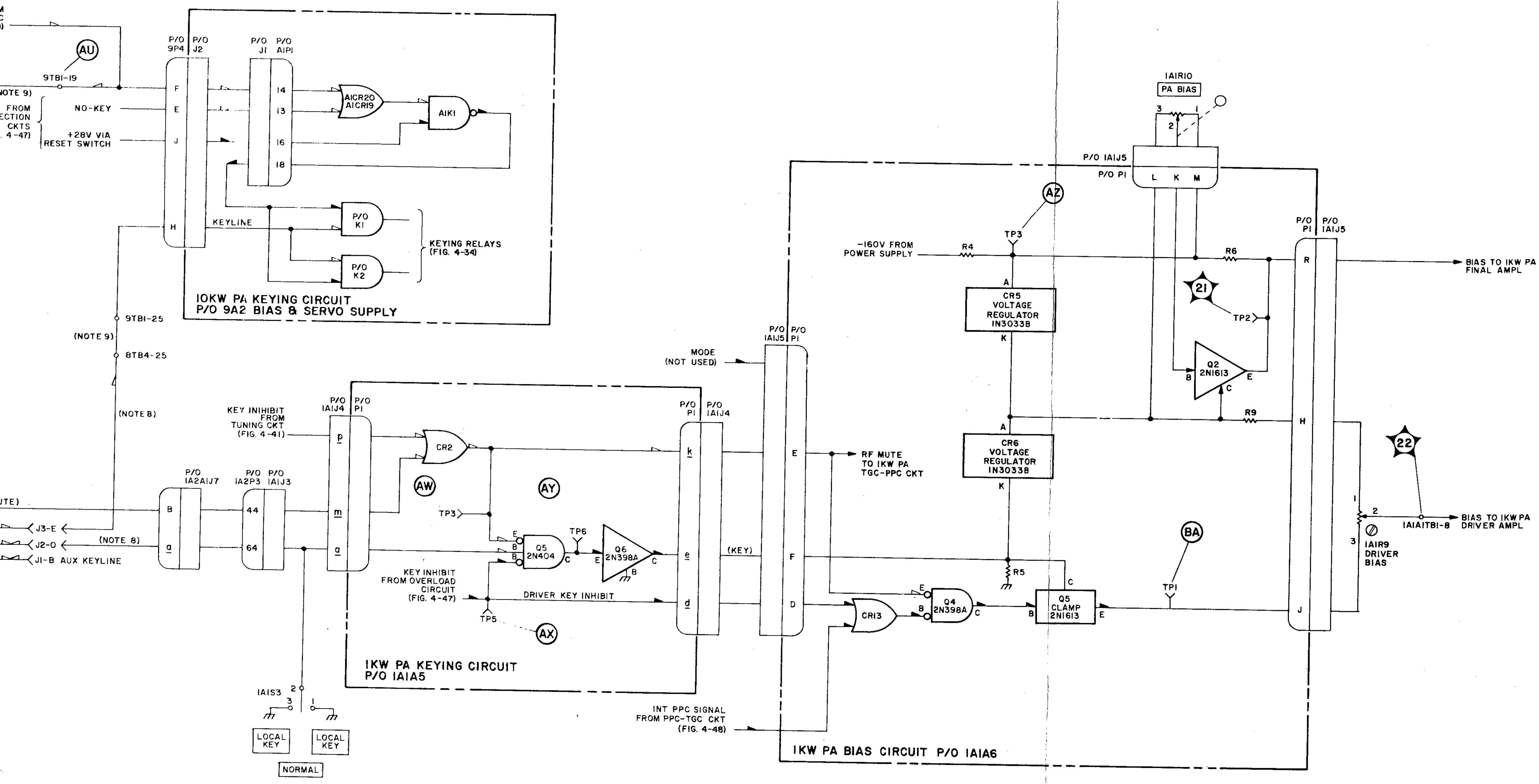


Figure 4-43. Keying Circuits, Servicing Diagram

ORIGINAL

NOTES:

1. Prefix incomplete reference designations with 9A1A5A4.
2. Numbers inside integrated circuit blocks indicate terminals.
3. Multimeter switch S1-1 connections are shown functionally, except 1, 2 and 3, which have a negative output from IC1 (switch wafer S1-4 (not shown) is used for tie points only).
4. Troubleshoot by applying external DC input on test probe to ensure IC1 etc. is working.

SWITCH TERMINAL	SWITCH POSITION AND FUNCTION
1	V_k - Cathode Voltage
2	V_p - Plate Voltage
3	I_s - Screen Current
4	P_F - Forward Power
5	P_R - Reverse Power
6	Tune Set
7	Tune Position
8	Tune Detector
9	Load Detector
10	Load Position
11	Load Set
12	6 } Test Probe
13	60 } Test Probe
14	600 } Test Probe
15	Zero (No Input)

TEST POINT	CONDITIONS	VOLTAGE
㉓	Full scale on Multimeter 9A1A5M1	0.6 V difference between pin 2 (-) and 3 (+).

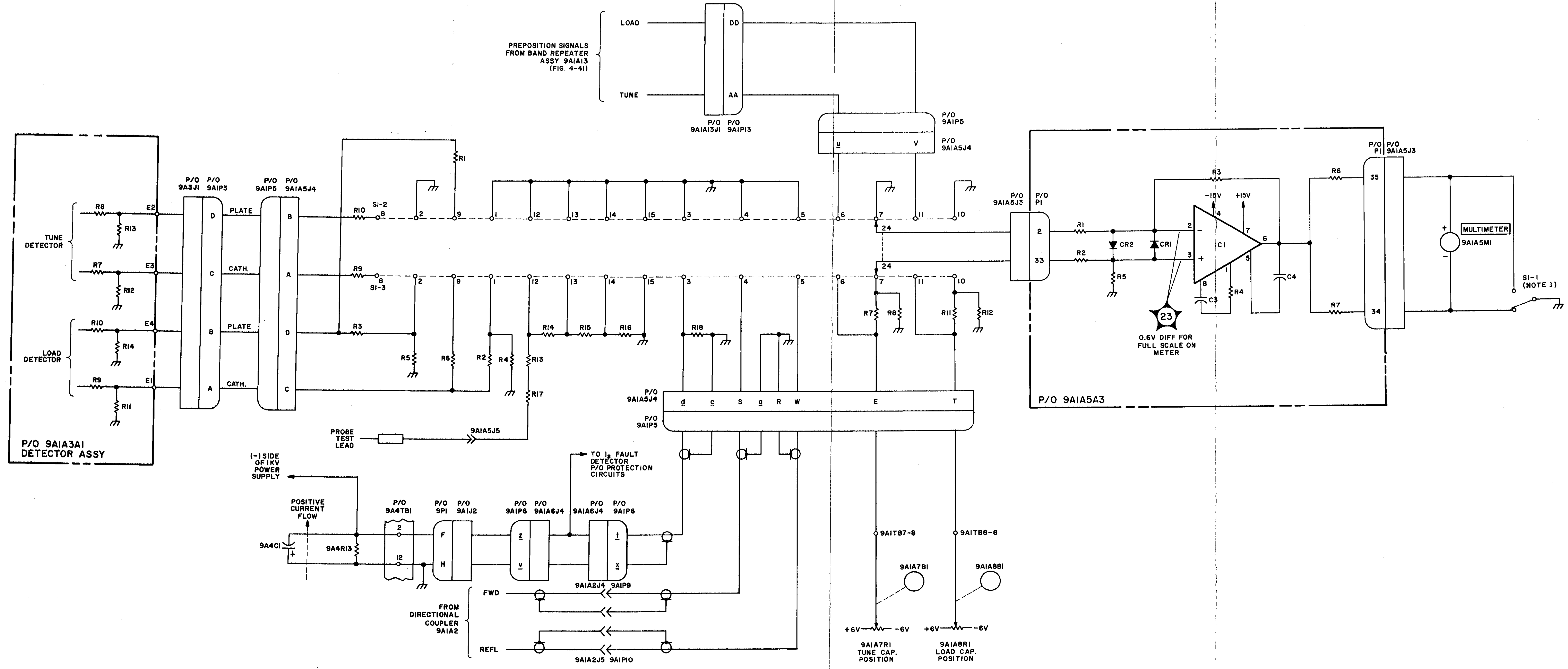


Figure 4-44. 10 KW PA Multimeter Circuit, 9A1A5A4, Servicing Diagram

NOTES:

1. Prefix incomplete reference designations with 9A1A6.
2. Multimeter switch wafer 9A1A5A4S1 - section 9 (not shown) used for tie point only. For switch functions see table .
3. Measurements taken with AN/PSM-4B.
4. Measurements made between indicated points.

TEST POINT	CONDITIONS	VOLTAGE
(BB) Note 4	STANDBY	+10 V
(BC)	STANDBY	+30 V
(BD)	STANDBY OPERATE	-10 V -3.5 V
(BE) Note 4	OPERATE	+1.2 V
(BF) Note 4	OPERATE	+11 V
(BG)	NORMAL FAULT	+28 V 0

FAULT DETECTOR SWITCH A4S1

SWITCH TERMINAL	SWITCH POSITION AND FUNCTION
	SUPPLIES
1	*LINE - 115 V Line Voltage input from autotransformer
2	*28 V - Voltage of 28 VDC power supply for control circuits.
3	*FIL - Voltage to PA tube filament.
4	*+15 - Voltage of regulated +15 VDC supply to meter and servo amplifiers.
5	*-15 - Voltage of -15 VDC supply to meter and servo amplifiers.
6	BIAS - Bias voltage to PA tube control grid (unkeyed, over 0.5; keyed, KEYED BIAS shaded area).
7	**1 KV - Voltage of screen supply to PA tube.
8	**8 KV - Voltage of plate supply to PA tube.
	OVERLOAD
9	***I_S - Excessive PA tube screen current (over 100 MA).
10	***I_P - Excessive PA tube plate current (over 3.4 amp).
11	SWR - Excessive reflected power (over 3 KW).
	***TUNE
12	TIME - Excessive time required for tuning (over 15 sec).
13	LIMIT - Variable capacitor run to far end stop.
	***INTERLOCKS
14	STICK - High Voltage shorting stick not in place.
15	SLIDE - PA chassis not secured in cabinet.
16	CB - Cabinet bottom access door not secured.
17	PL - Cover not on PA tube plate compartment.
18	IN - Cover not on input circuit compartment.

*Proper indication in NORMAL area

**Proper indication in NORMAL area, drops to zero when fault occurs, since high voltage power supply is de-activated by any fault.

***FAULT area when specific fault occurs.

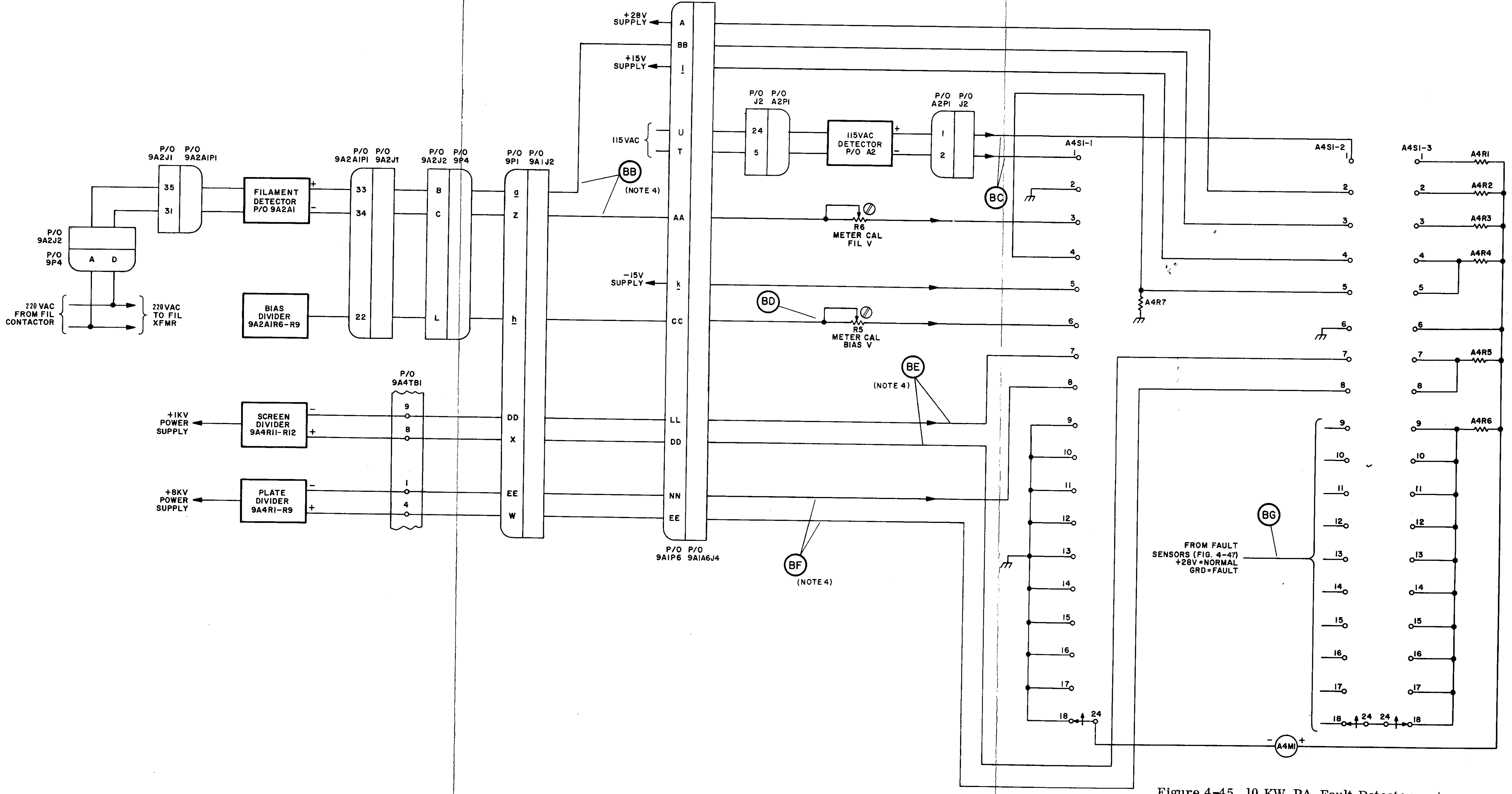


Figure 4-45. 10 KW PA Fault Detector meter Circuit, 9A1A6, Servicing Diagram

NOTES:

1. Prefix incomplete reference designations with 9A1A1.
2. Letter outside semiconductor blocks indicate elements; numbers inside integrated circuit blocks indicate terminals.
3. ⊘ indicates slotted shaft for screwdriver adjustments.
4. ▭ indicates front panel markings.
5. All voltage measurements made with AN/PSM-4B.
6. Graphic representations show shaping network response and signal processing for understanding only, using a rectified envelope input. Wafeforms not critical — do not require checking.

TEST POINT	CONDITION	VOLTAGE
BH	NORMAL	+1.1 V
BI	NORMAL	-0.1 V
BJ	NORMAL	+3.5 V
24	NORMAL	+0.1 V

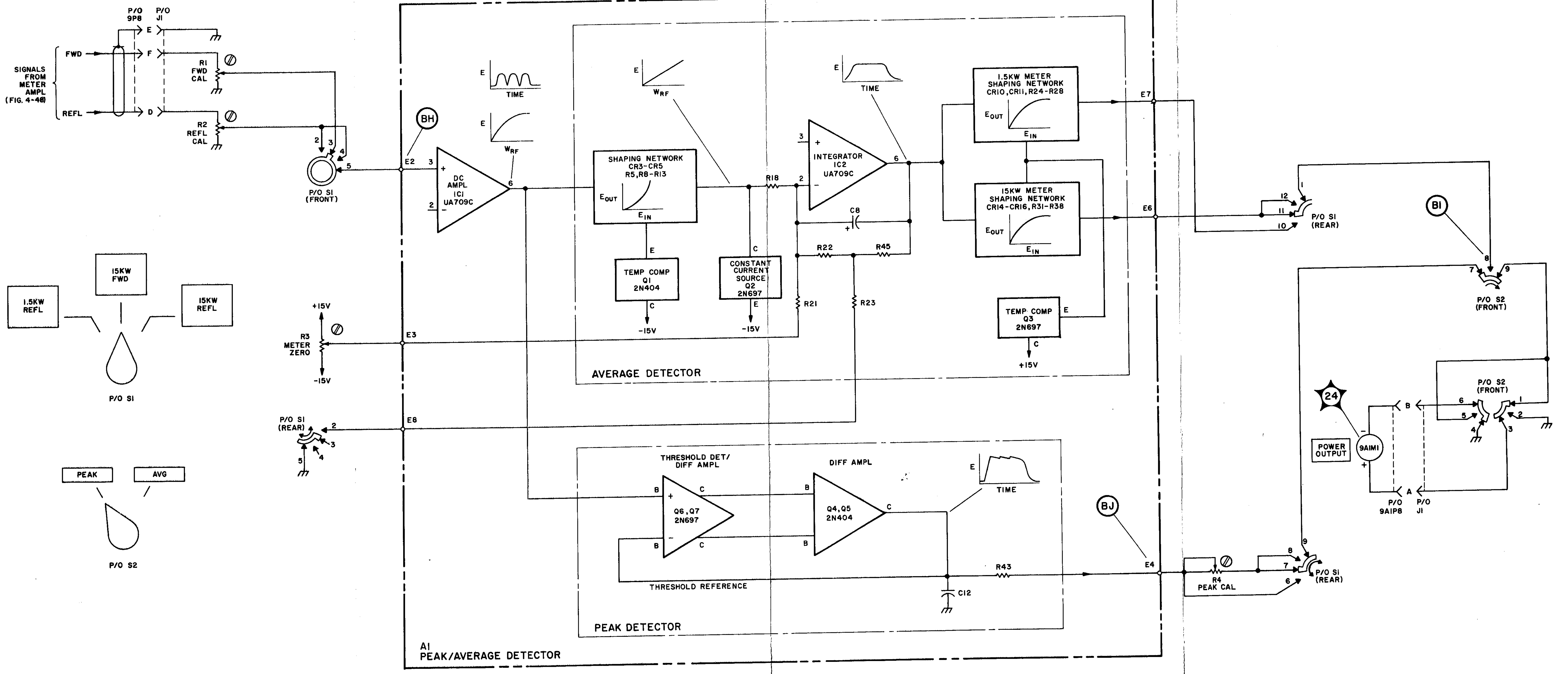


Figure 4-46. 10 KW PA Peak/Average meter Circuit, 9A1A1, Servicing Diagram

NOTES:

1. Letters outside transistor blocks indicate elements.
2. ⊘ indicates slotted shaft for screwdriver adjustments.
3. ▭ indicates front panel markings.
4. Measurements taken with AN/PSM-4B.
5. Unkeyed, 3 VDC;
   Keyed with no signal, 1 ± 0.5 VDC;
   Keyed with signal, 1 to 4 VDC;
   Overload condition, +10 ± 1.0 VDC.
6. Fault detector meter (and switch) in 10 KW PA should be used check fault detector outputs.
7. Other part of 9A3A2K5 breaks operate command path when faulted. See figure 4-51, 10 KW PA Power Supply.
8. Transistors 9A1A6Q1-Q5 are SCR latching fault detectors.
9. Use test point or indicator for check.
10. Timer off, 0.4V; timer running, 0.4V.

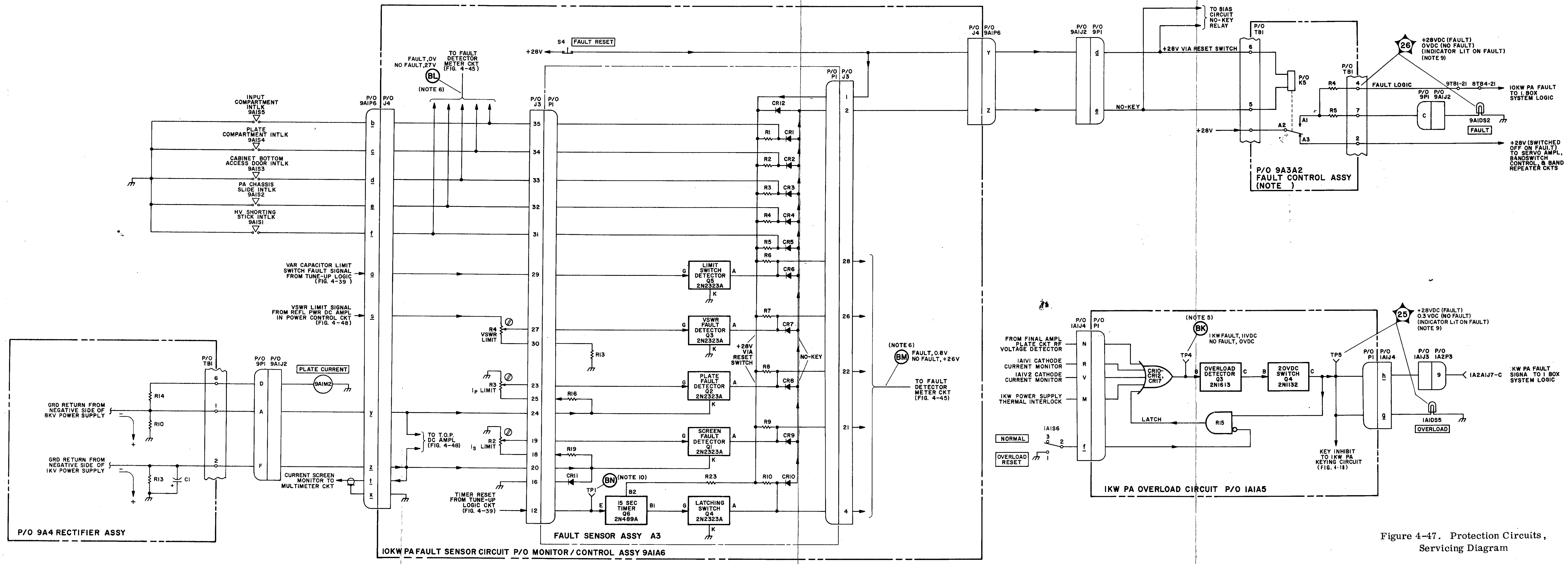


Figure 4-47. Protection Circuits, Servicing Diagram

NOTES:

1. Heavy lines indicate main signal paths.
2. Letters outside transistor blocks indicate elements. Numbers outside integrated circuit blocks indicate terminals.
3. ⊘ indicates slotted shaft for screwdriver adjustments.
4. ▭ indicates front panel markings.
5. All measurements taken with AN/PSM-4B.
6. Unkeyed condition is USB-PTT mode with Push-to-talk line open.
7. P/O Intercabinet cable.
8. P/O Exciter-1 KW PA Cabinet Cable Harness.

TEST POINT	CONDITION	VOLTAGE
27	NORMAL STBY	0V 0V
28	NORMAL STBY	+4.4V 0V
29	NORMAL STBY	0.5 V 0.5 V
30	NORMAL STBY	4.2 V 0 V
BO	NORMAL STBY	0 V 0 V
BP	NORMAL STBY	+3 V 0 V
BQ	NORMAL STBY	+5 V 0 V
BR	NORMAL STBY	+1.0 V 0 V
BS	NORMAL STBY	+1.2 V 0 V

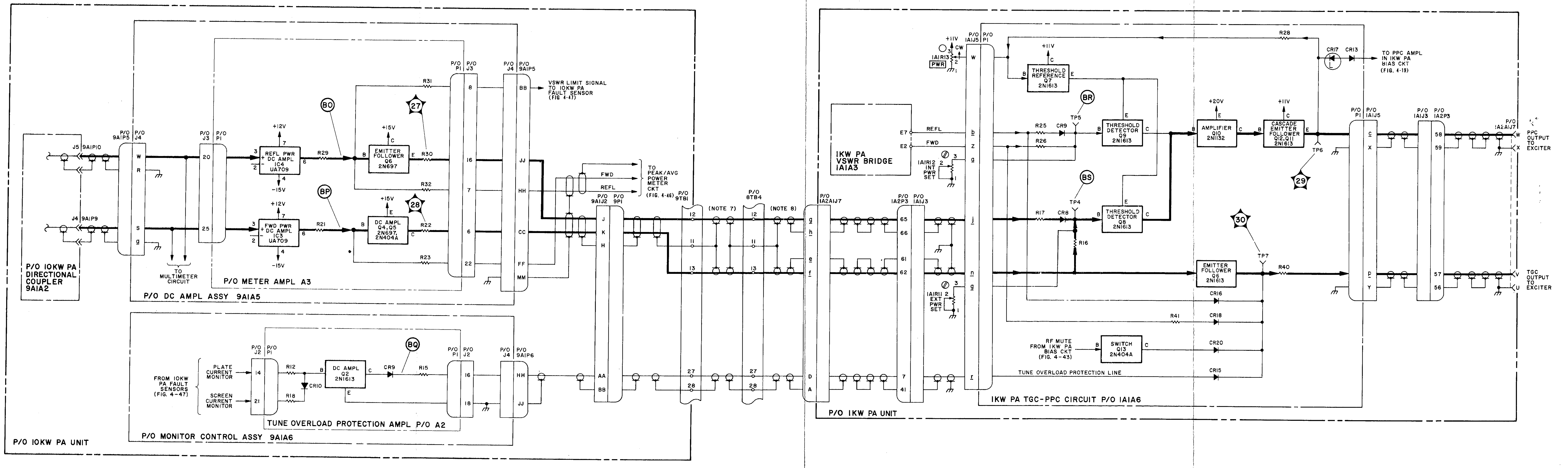


Figure 4-48. Power Control Circuits, Servicing Diagram

ORIGINAL

NOTES:

1. Letters outside transistor blocks indicate elements: numbers outside rectifiers and filter blocks indicate terminals.
2. ▭ Indicates front panel markings.
3. Measurements taken with transmitter in operate.
4. Measurements taken between indicated points.
5. Unless otherwise indicated all measurements taken with AN/PSM-4B.
6. Measurement taken with bandswitch motor energized.
7. Refer to figure 5-47 for jumpering details.
8. Measurements taken with AN/USM-117.
9. Use 1 KW PA Multipurpose meter to make these measurements.
10. P/O Exciter-1 KW PA Cabinet Cable Harness.
11. P/O Intercabinet Cable.
12. Refer to figure 5-44 for jumpering details.
13. Refer to figure 5-42 for jumpering details.

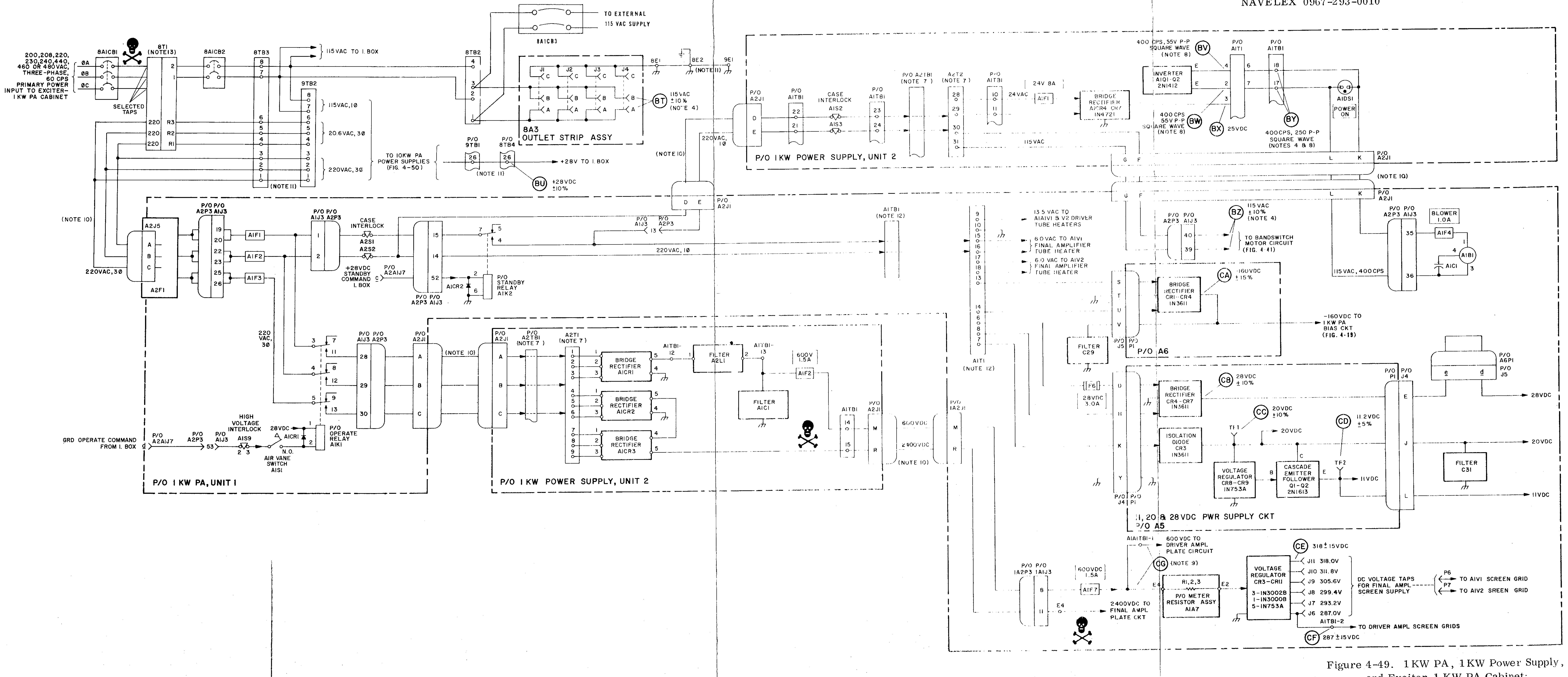


Figure 4-49. 1 KW PA, 1 KW Power Supply, and Exciter-1 KW PA Cabinet; Power Supplies; Servicing Diagram

ORIGINAL

NOTES:

1. Prefix incomplete reference designations with 9.
2. Letters outside transistor blocks indicate elements; numbers outside rectifier and filter blocks indicate terminals.
3. ▭ indicates front panel markings.
4. If one diode in a rectifier block is bad replace all six diodes in that block.
5. Voltage measurements are to be made with the FAULT DETECTOR meter. Refer to table, figure 4-45 apron, for proper meter indications.

TEST POINT	VOLTAGE TO BE MEASURED	SET METER SWITCH TO
(CM)	Plate Supply (8 KV)	8 KV
(CN)	Screen Supply (1 KV)	1 KV
(CJ)	Regulated +15 V	+15 V
(CK)	Regulated -15 V	-15 V
(CH)	28 VDC Supply	28 V
(CL)	Filament Supply	FIL
(CI)	Bias Supply	BIAS

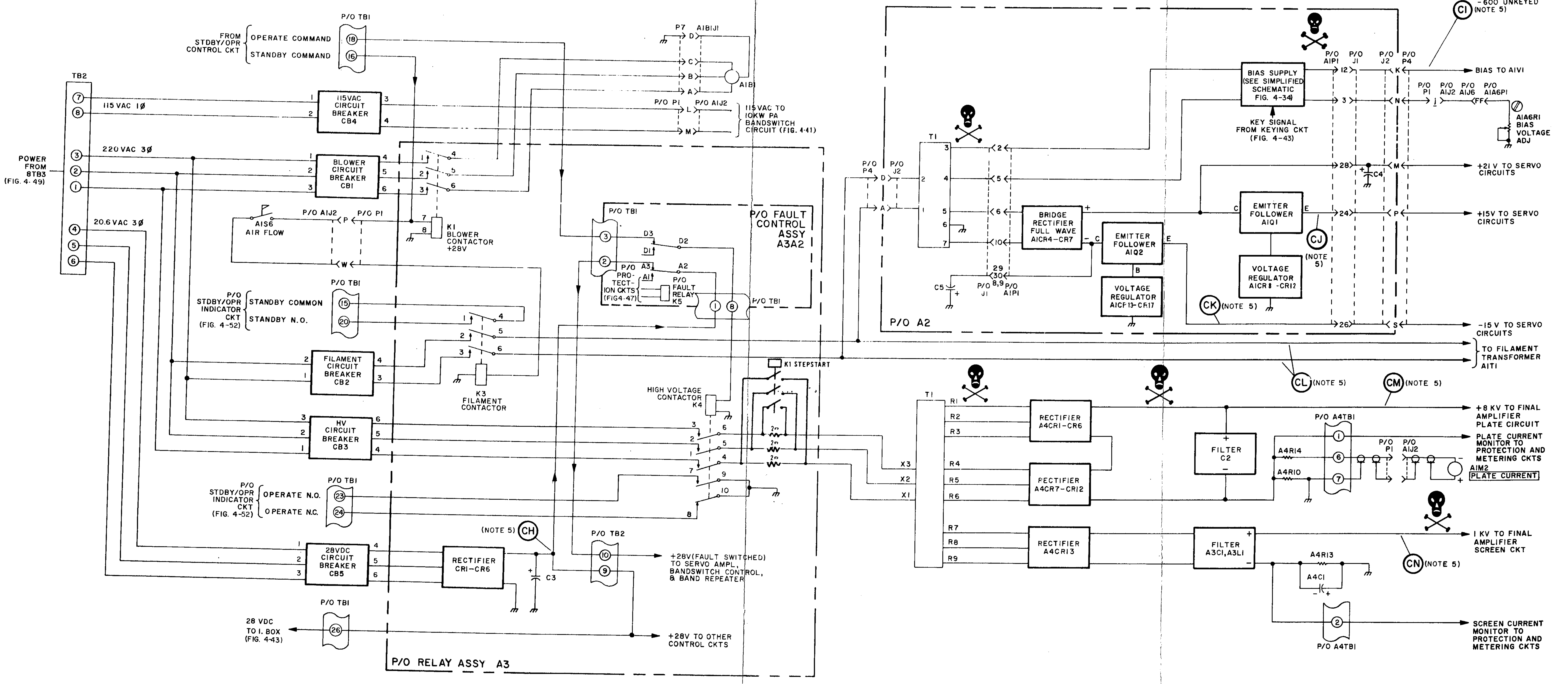


Figure 4-50. 10 KW PA, Power Supplies, Servicing Diagram

NOTES:

1. Numbers outside relay or terminal blocks indicate terminals.
2. Heavy lines indicate main signal path.
3. ▭ indicates equipment front panel marking.
4. Measurements made with AN/PSM-4B.
5. P/O Exciter-1 KW PA Cabinet Cable Harness.
6. P/O Intercabinet Cable.

Figure 4-51. Standby and Operate Control Circuit, Servicing Diagram

NOTES:

1. Heavy lines indicate main signal flow.
2. Letters and numbers at connections indicate relay or terminal block terminal.
3. P/O Exciter-1 KW PA Cabinet Cable Harness.
4. P/O Intercabinet Cable.
5. All relays shown de-energized.
6. Energized upon standby command from Exciter.
7. Relay energized 3 minutes after Standby Command.
8. Energized upon operate command.

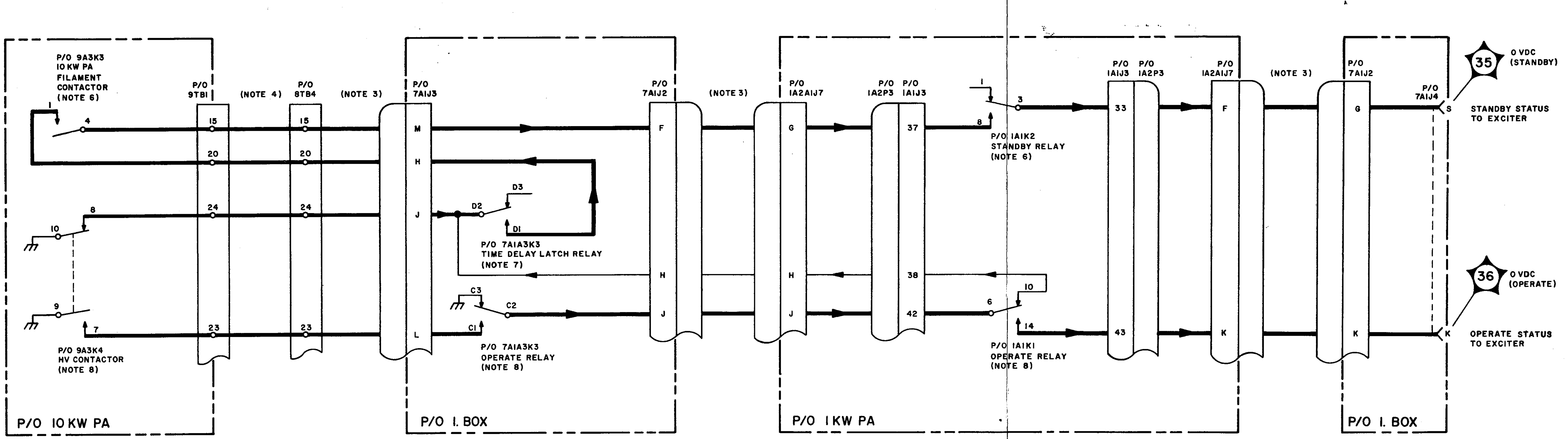
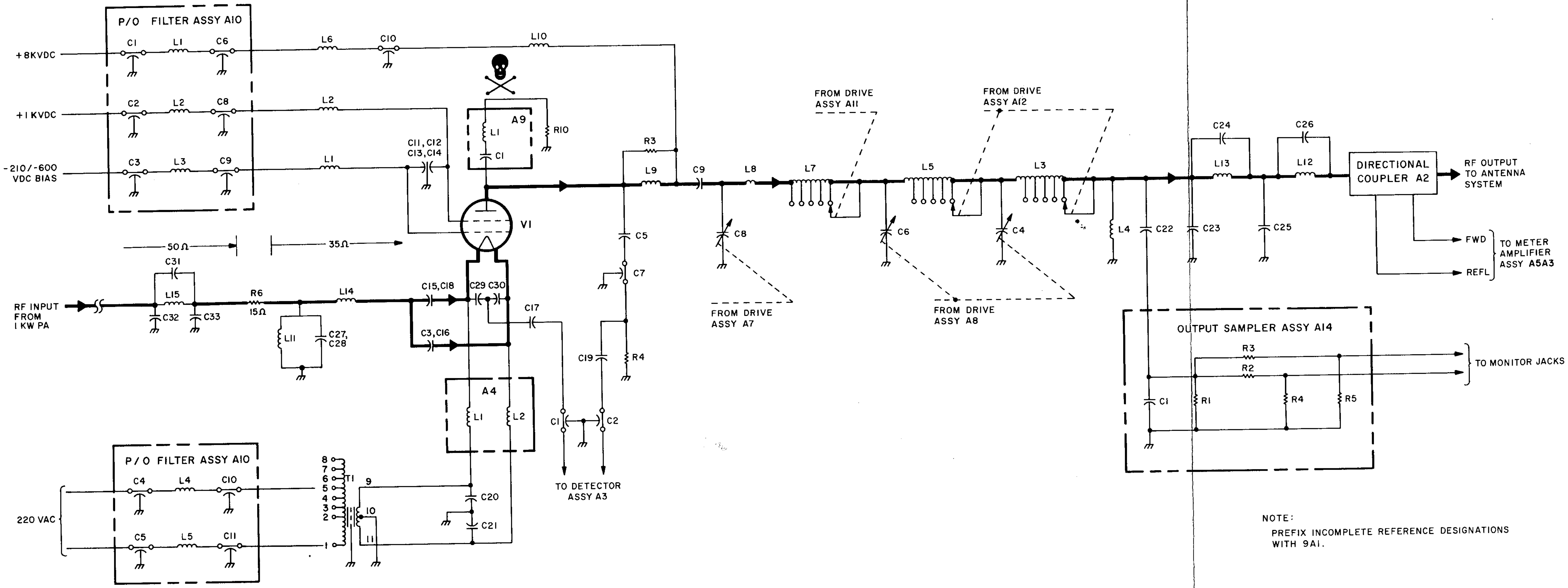


Figure 4-52. Standby and Operate Indicator Circuit, Servicing Diagram



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS
WITH 9A1.

Figure 4-6. 10 KW PA Power Amplifier Circuit, Simplified Schematic Diagram

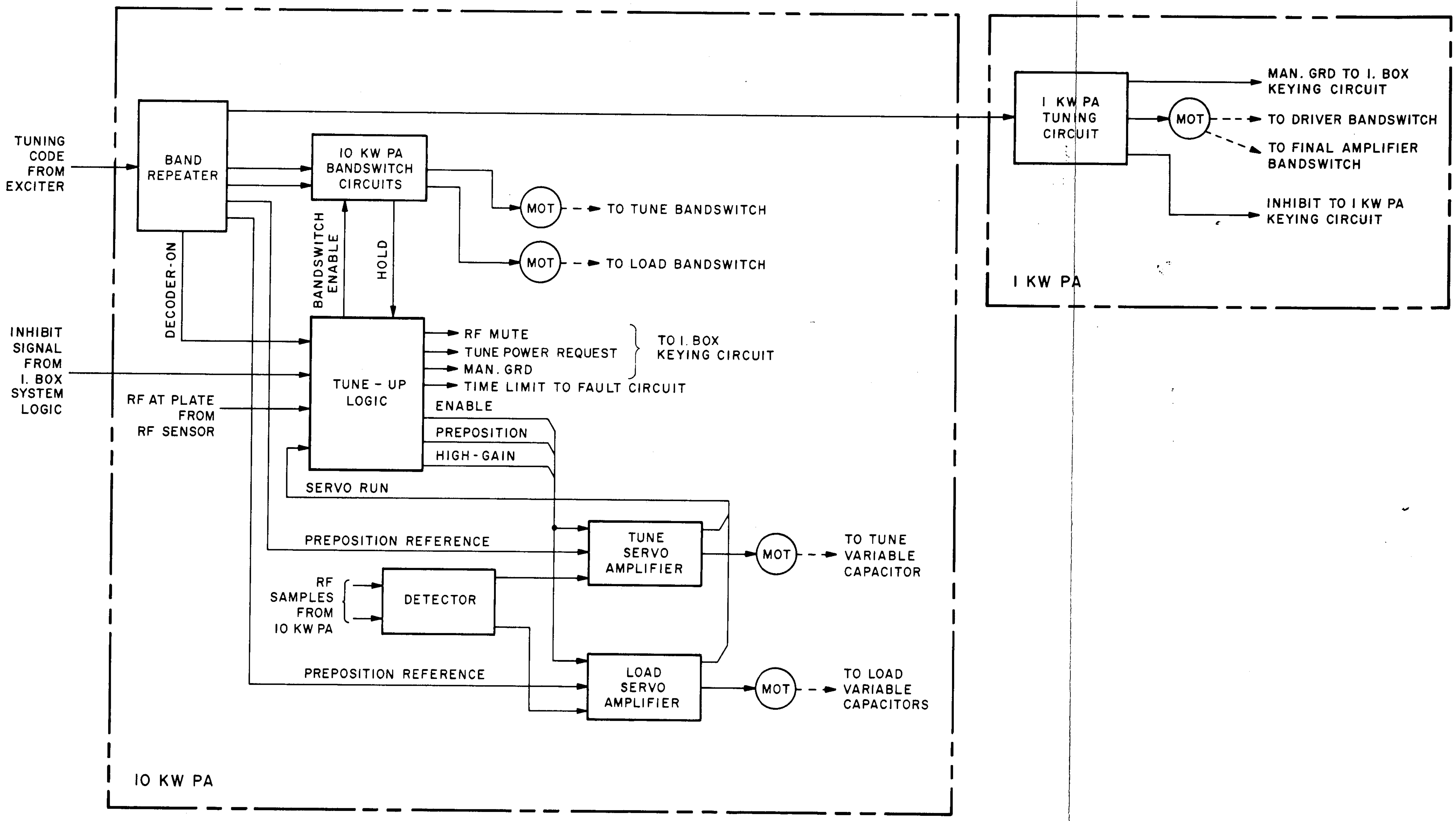


Figure 4-7. Tuning Circuits, Functional Block Diagram.

that stage on, switching +28 VDC to the two bandswitch relays A6K2-K3 and to PREPOS indicator A6DS1.

4-70. If the selected frequency requires the bandswitches to reposition, a ground is applied through the decoding wafer on the bandswitch to the associated relay. This energizes the relay, which in turn energizes the associated bandswitch motor to rotate the bandswitch until the ground path is broken. As long as either bandswitch motor is running or the band repeater motor is running, an RF mute signal is supplied through OR gate A6A2CR2-CR3-CR5 to the I. Box. In addition, whenever a bandswitch or servo motor is running, a ground is applied through motor on OR gate A6A1CR8 to the NOT input of the AND gate at the input of time delay network A6A1C4-R7 to prevent a tune power request from being generated until all motors have stopped, indicating that bandswitching and prepositioning have been completed.

4-71. Flip-flop A6A1Q2-Q5 controls the second step in the tune cycle, i.e., it enables the transmitter to produce a tune power RF signal and conditions the servo amplifiers to operate at high gain. The flip-flop is normally off; a HI signal is produced at its "1" output when on and a LO signal is produced when off. Initially the flip-flop is off, and it is triggered on by a HI signal at its SET input applied through time delay A6A1R7-C4. The trigger signal originates from bandswitch enable stage A6Q1 at the beginning of the tune cycle, but is not applied to time delay A6A1R7-C4 until all motors have stopped and the motor-on ground is removed from the AND gate at the time delay network input. The time delay at the SET input of the flip-flop prevents false triggering before all motors are completely stopped.

4-72. When the output of the flip-flop is HI, tune power request switch A6A1Q7-Q6 provides a LO output to the tune power request line to the I. Box system logic. In addition this signal is applied to TUNE PWR indicator A6DS2 and through OR gate A6A1CR12 to the servo amplifier high gain relays. All circuits then remain in these states until the TUNE pushbutton on the Exciter is depressed.

4-73. With the tune power request applied to the I. Box system logic, the I. Box applies a tune enable signal to the Exciter as soon as the Exciter's TUNE pushbutton is depressed. The Exciter then removes the inhibit signal, therefore A6A1Q1, A6Q1, and A6A1Q2 are deactivated, and the PREPOS indicator is extinguished, indicating that the prepositioning portion of the tune cycle has been completed. The flip-flop remains in the on state, even through the set input has been removed. The Exciter supplies a tune power RF signal to the 1 KW PA, and the drive signal increases in level until sufficient RF voltage is developed at the plate of the 100 KW PA (or the plate or screen current limit is reached).

4-74. When sufficient RF is sensed at the plate (equivalent to about 500 watts of power), RF sensor switch A5A3Q1 turns on relay driver A5A3Q2-Q3 which energizes the enable relays in the servo amplifiers. The load servo amplifier enable relay is interlocked to the tune servo amplifier stall torque threshold relay contacts such that the load servo amplifier is enabled only when the tune servo is not operating the tune motor. Thus, the tune servo always takes precedence over the load servo when tuning with RF power. The ground from the relay driver is also used to energize RF AT PL indicator A6DS3 to provide a front panel indication whenever there is an RF output of more than 500 watts.

4-75. The RF sensor relay driver also drives inverter A6A1Q8 which, in turn, applies a positive signal through time delay network A6A1R24-C5 to the CLEAR input of the flip-flop. However, until the servo motors stop running, a ground servo run signal is applied to prevent the collector of inverter A6A1Q8 from going positive. Time delay network A6A1R24-C5 prevents false triggering while servos are reversing and alternately turning on and off.

4-76. When the tuning elements reach their final tuning position, the servo run ground is removed; and after a slight time delay (charge time of capacitor A6A1C5), the collector of inverter A6A1Q8 will go positive. Therefore, a CLEAR input signal is applied to flip-flop transistor A6A1Q5; and the flip-flop output returns to its off state (LO output). Switch A6A1Q7-Q6 is thereby turned off, extinguishing the TUNE PWR indicator and removing the tune power request signal from the I. Box system logic. The latter causes removal of the tune enable from the Exciter and allows the system logic to revert to the ready status. Removing the tune enable causes the Exciter to remove tune power. Therefore, relay driver A5A3Q2-Q3 turns off, extinguishing the RF AT PL indicator and allowing inverter A6A1Q8 to revert to a LO output. Therefore, all circuits have been returned to the rest (logical "0") state to wait for new tune cycle.

4-77. When the transmitter comes back on the air for normal transmission after tuning, RF sensor relay driver A5A3Q2-Q3 is again turned on. This enables the servo amplifiers so that they may run if required to maintain a tuned condition (automatic surveillance). In addition, the RF AT PL indicator comes on to provide an indication that there is an RF output at the plate of the power amplifier. Note that inverter A6A1Q8 is turned off, thus providing a CLEAR input to A6A1Q5 in an attempt to turn off the flip-flop. However, this has no effect since it is already deactivated.

4-78. Fifteen second timer A6A3Q6 is part of the fault sensor circuit. A ground signal is required at the input to hold the timer off. When the ground is removed for longer than 15 seconds, the timer triggers the tune time fault detector to shut the transmitter down (paragraph 4-180). The ground input to hold the timer off is applied by inverter-driver A6A1Q10. When A6A1Q10 receives a ground through OR gate A6A1CR17, the timer begins to run; and when the ground is removed from the OR gate, the timer is reset. Normal timer operation occurs as follows:

a. When the frequency is first changed at the start of a tune cycle, the band repeater decoder-on ground is applied through OR gates A6A1CR5 and A6A1CR8 to A6A1CR17.

b. While the bandswitches are actibated, ground is applied through OR gates A6A1CR2-CR3 and A6A1CR8 to hold the ground at A6A1CR17.

c. While prepositioning, the servo run ground is applied through OR gate A6A1CR8 to A6A1CR17.

d. If a servo motor runs at any time, regardless of the status of the tune cycle, a motor-on ground is applied to A6A1CR17 through OR gate A6A1CR8.

4-79. From d. above, it can be seen that if a servo motor runs for longer than 15 seconds at any time or is energized and does not run for any reason, the tune timer will trip the fault sensor circuit. Thus complete protection is afforded against odd malfunctions such as stalled motors or creeping servos.

4-80. The discussion to this point has been for automatic operation. The system can also be tuned manually. The first step is to set the MAN/AUTO switch at MAN. This action supplies a 10 KW PA manual ground to the I. Box system logic, and provides a ground to energize the high gain relays in the servo amplifiers, defeats the timer by applying a ground to AND gate A6A1CR16, disconnects +28 VDC from the A6A1 tune up control and the A5A1 and A5A2 servo amplifier assemblies, connects +28 VDC to one side of the bandswitch relays, and enables the BAND ADV pushbutton switch and the TUNE PWR REQUEST switch.

4-81. The second step is repositioning the band repeater with the BAND ADV button until the desired operating band is displayed in the MC band indicator window on the band repeater assembly. Since +28 VDC is applied to one side of the Bandswitch relays by the MAN/AUTO switch being in the MAN position, the bandswitch relays will energize as required by the Exciter frequency selection and will position the bandswitches as during an automatic tune cycle. The operator then manually prepositions the tune and load variable capacitors for a null on the multimeter (TUNE and LOAD SET positions).

4-82. The final step requires setting the 10 KW PA TUNE PWR REQUEST switch to the up (ON) position. This supplies a tune power request signal manually to the I. Box system logic. Then depressing the Exciter TUNE pushbutton causes the I. Box to apply a tune enable signal to the Exciter to activate a tune power signal. The tuning elements can then be manually positioned for a null on the multimeter (TUNE and LOAD DET positions).

4-83. The applicable servicing diagram for the tune-up logic circuits is figure 4-39. Complete circuit details are shown in schematic diagram figures 5-50, 5-52, and 5-53. Refer to figure 4-40 for a tuning sequence timing diagram.

4-84. 1 KW PA TUNING CIRCUIT DESCRIPTION.

4-85. The 1 KW PA tuning circuit (figure 4-8) consists of a decoder, an encoder, two bandswitches, a motor, a motor relay, and a gating circuit. The function of this circuit is to automatically position the bandswitches in the final and driver transformer assemblies according to the selected operating frequency.

4-86. An open-seeking circuit that employs a five-wire, 19 position coding scheme is used to automatically position the bandswitch assemblies in the driver and final transformer assemblies according to the selected operating frequency. Nineteen bands are used to cover the 2.0 to 29.999 MC frequency range, and thus nineteen different five-wire codes are required for tuning (table 4-2). The code is generated either externally (FREQUENCY MC switch S7 set at AUTOMATIC) by an encoder switch wafer in the 10 KW PA band repeater assembly or internally by an encoder switch wafer in switch S7 (FREQUENCY MC switch S7 set at one of nineteen MC positions). In either case, a series of opens and grounds is applied to the five code lines, through which the code is connected to decoder switch deck A4S1C. This establishes a ground path through contact 3 of A4S1C-front, terminal 6 of A4TB1, and diode gate A5CR1 to pin 6 of motor drive relay K3. Thus, relay K3 energizes, completing the 115 VAC circuit through motor B2. The motor rotates the decoder switch and the two bandswitches until the decoder code is the complement of the code generated by the encoder. At this time, the ground path to relay K3 is broken, de-energizing motor B2.

4-87. Both the encoder and the decoder

consist of a "master" section and an "image" section which is the mirror image of the master. The image sections are required to complete the ground path in certain combinations of encoder-decoder positions.

4-88. Figure 4-8A shows the circuit tuned for an operating frequency in the 2.0 to 2.5 MC band. This can be seen by noting that decoder master A4S1C pattern (1,1,1,1,0) is the complement of encoder master S7A pattern (0,0,0,0,1). Suppose, however, that the 1 KW PA had previously been tuned to the 2.5 to 3.0 MC band (one position clockwise), and that FREQUENCY MC switch S7 has just been set at the 2.0 to 2.5 MC band (figure 4-8B). In this situation, contacts 3 and 708-9 of the decoder master are connected; but this does not complete the ground path to relay K3, since code lines 1 through 3 are not grounded by encoder S7 master. Instead, the ground path is provided through the image decks: from S7A-20 front to S7A-1 front to A4S1C-5 rear to A4S1C-6 rear to S7A-2 rear to S7A-3 rear to A4S1C-7 front to A4S1C-3 front to terminal 6 of the relay. Thus the relay energizes and motor B2 turns the decoder and bandswitches. The masters and images ensure that there will always be a ground path for any combination of encoder and decoder positions until the decoder reaches the unique position corresponding to that of the encoder. The same process occurs when FREQUENCY MC switch S7 is set to AUTOMATIC, except that an encoder switch wafer in the 10 KW PA performs the function of S7A front and rear.

4-89 When FREQUENCY MC switch S7 is not set to AUTOMATIC, section D rear sends a ground signal to the I. Box system logic via the manual ground line. The I. Box in turn activates an indicator lamp in the I Box and sends a local override to the Exciter when the manual ground line is grounded.

4-90. The applicable servicing diagram for this circuit is figure 4-41. Figure 4-40 illustrates the timing sequence during a typical automatic tune cycle. Complete circuit details are shown in schematic diagram figure 5-45.

TABLE 4-2. TUNING CODE CHART, EXCITER TO 10 KW PA AND 10 KW PA TO 1 KW PA FREQUENCY CONTROL

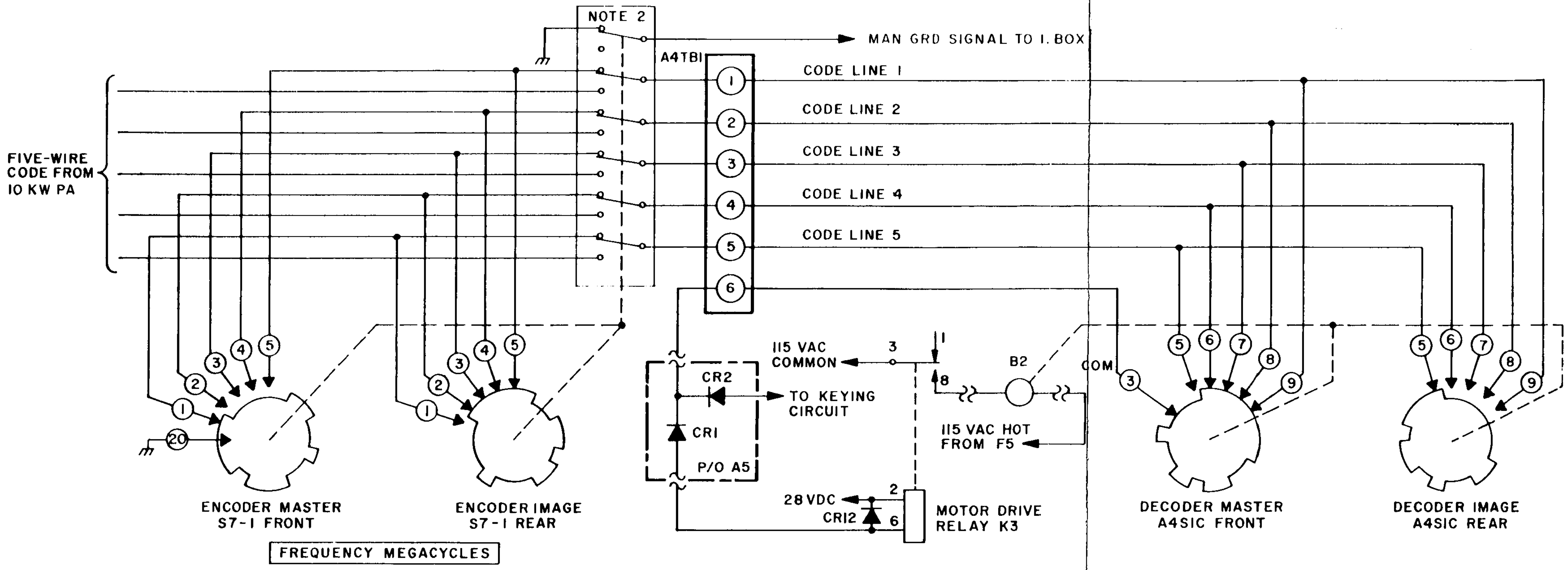
BAND	CODE LINES				
	1	2	3	4	5
2.0 to 2.5	0	0	0	0	1
2.5 to 3.0	0	0	0	1	1
3.0 to 3.5	0	0	1	1	1
3.5 to 4.0	0	1	1	1	1
4.0 to 5.0	1	1	1	1	0
5.0 to 6.0	1	1	1	0	1
6.0 to 7.0	1	1	0	1	1
7.0 to 8.0	1	0	1	1	1
8.0 to 10.0	0	1	1	1	0
10.0 to 12.0	1	1	1	0	0
12.0 to 14.0	1	1	0	0	1
14.0 to 16.0	1	0	0	1	0
16.0 to 18.0	0	0	1	0	0
18.0 to 20.0	0	1	0	0	1
20.0 to 22.0	1	0	0	1	1
22.0 to 24.0	0	0	1	1	0
24.0 to 26.0	0	1	1	0	0
26.0 to 28.0	1	1	0	0	0
28.0 to 30.0	1	0	0	0	0

Note

"0" is open;
"1" is ground.

4-91. 10 KW PA BANDSWITCH CIRCUITS DESCRIPTION

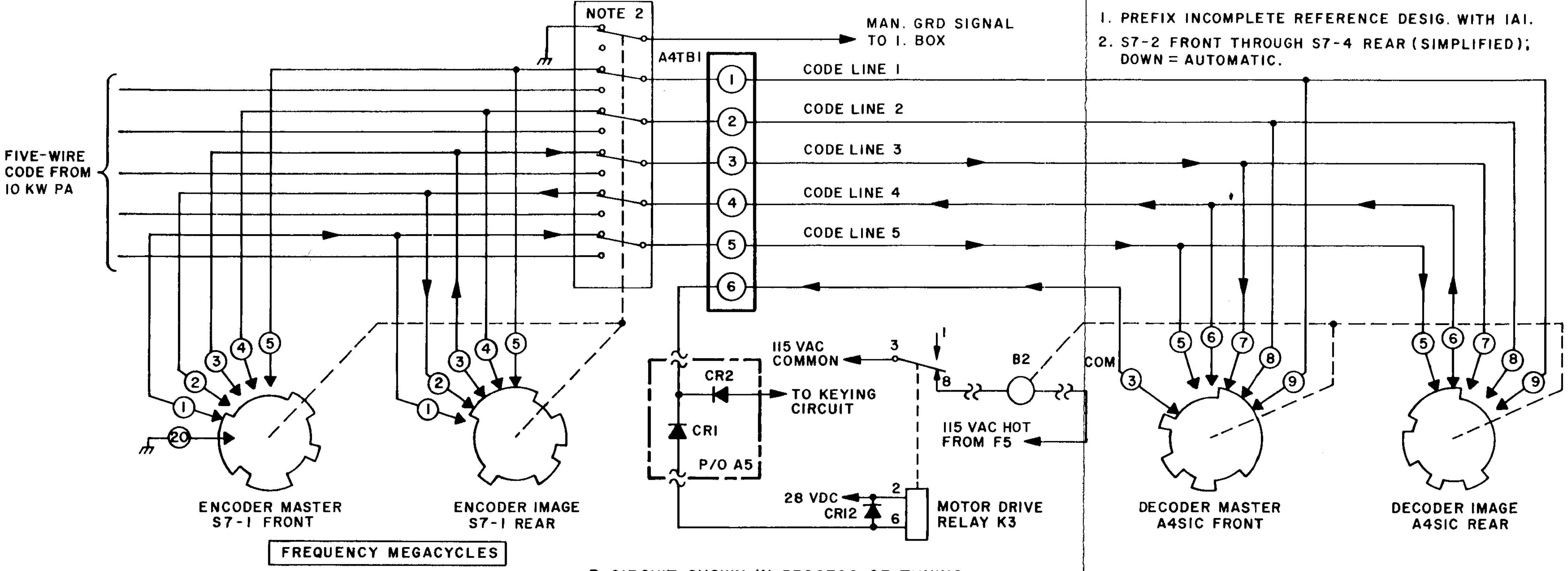
4-92. The 10 KW PA bandswitch circuits (figure 4-41) consist of decoding and encoding switches, switching transistors, a rotary solenoid, motors, and relays. The



A. CIRCUIT SHOWN POSITIONED TO THE 2.0 TO 2.5 MC BAND

NOTES:

1. PREFIX INCOMPLETE REFERENCE DESIG. WITH 1A1.
2. S7-2 FRONT THROUGH S7-4 REAR (SIMPLIFIED); DOWN = AUTOMATIC.



B. CIRCUIT SHOWN IN PROCESS OF TUNING

Figure 4-8. 1 KW PA Tuning Circuit, 1A1, Simplified Schematic Diagram functions of the circuits are to convert a five wire, 19 position frequency band information code from the Exciter to other signals and to use these signals as follows:

a. A five wire, 19 position code is provided by encoding switch section S1-4-F&R in Band Repeater Assembly A13, to operate the tuning (bandswitch) circuit in the 1 KW PA (paragraph 4-84).

b. Two analog voltages are developed by R1-R39, S1-5-F, and S1-8-F in Band Repeater Assembly A13 and applied to the tune and load servo amplifiers to preposition the tune and load variable capacitors (paragraph 4-109).

c. A five wire, five position code is generated by encoding switch section S1-2 F in Band Repeater Assembly A13 and is used to operate tune inductor bandswitch motor A11A1B1.

d. Another identical five wire, five position code is generated by encoding switch section S1-3-F in Band Repeater Assembly A13 and is used to operate load inductor bandswitch motor A12A1B1.

4-93. The Exciter five wire, 19 position code (table 4-2) is decoded by switch sections A13S1-1 F&R to supply ground until band repeater switch A13S1 reaches the indicated position. (Refer to paragraph 4-84 for detailed discussion of the decoding process.) This ground signal is applied through interrupter contacts (P/O A13S1) to switch A6A2Q1 when AUTO-MAN switch A6S3 is in the AUTO position. (In MAN position, a ground signal is generated by manually depressing BAND ADV pushbutton switch A6S6). The ground signal energizes switch A6A2Q1 and rotary solenoid driver A6Q2 to supply an operating ground to rotary solenoid A13S1L1. The rotary solenoid rotates the switch wafers one postion while opening the interrupter contacts, which interrupt the ground signal used to turn on A6A2Q1. Each time the ground to A13S1L1 is switched off in this manner, the armature springs back and engages the next tooth in its ratchet. The rotary solenoid continues advancing in this manner until decoding switch sections A13S1-1-F&R reach the position indicated by the input code, at which time ground is removed. The rotary solenoid activate line from A6Q2 to the solenoid is interlocked through bandswitch relays A6K2-A6K3 to prevent accidental misalignment of bandswitches under certain conditions.

4-94. The bandswitch motors in A11A1 and A12A1 operate identically. For discussion, consider the operation of the portions of these circuits associated with A11A1. Encoding switch section A13-S1-2-F applies ground to one of five wires as required to position tune bandswitch A11S2 for the operating frequency set at the Exciter. Decoding switch A11A1 is an open seeking switch, i.e., it passes the ground signal through relay A6K2 until motor A11A1B1 rotates it to the position in which the notch in the rotor is aligned with the one input line which is grounded. Then the motor stops. In addition to the relay, decoding switch A11A1S1 also applies its ground as a motor-run signal to the tune-up logic circuit to indicate that a bandswitch motor is running. The normally-open contacts of relay A6K2 switch 115 VAC to motor A11A1B1 to operate it when the decoding switch applies ground to the relay coil. The resistor and capacitor across the relay contacts are for contact arc suppression.

4-95. The applicable servicing diagram for this circuit is figure 4-41. Complete circuit details are shown in schematic diagram figures 5-50, 5-53, and 5-54.

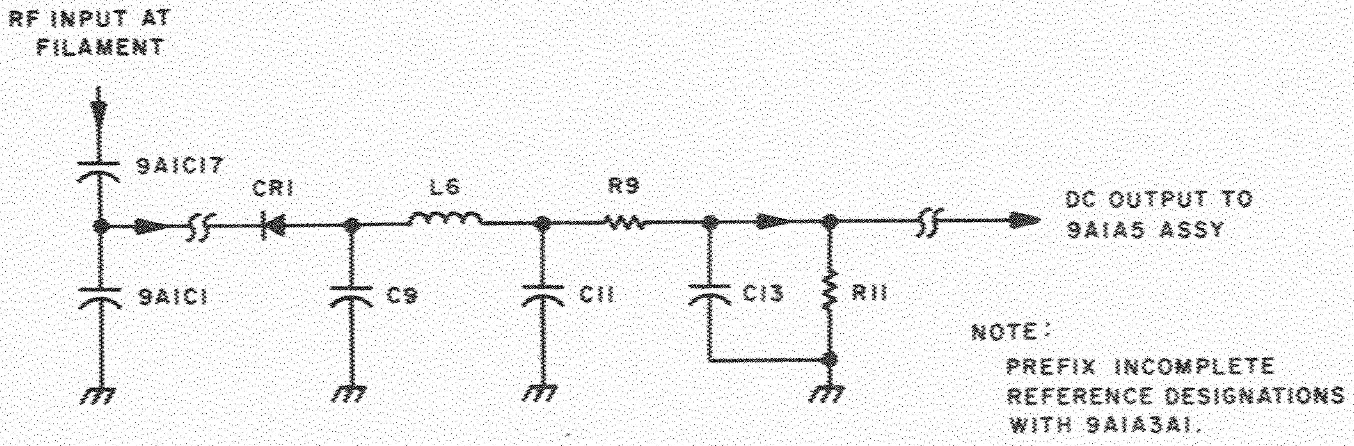
4-96. DETECTOR ASSEMBLY CIRCUIT DESCRIPTION.

4-97. The functions of the Detector Assembly are: (1) to sample the RF input (drive) voltage to the filament of the power amplifier tube, (2) to sample the RF output voltage at the plate of the power amplifier tube, and (3) to compare the phase relationship between the two sampled RF voltages. The assembly consists of three passive networks as illustrated in figure 5-50. The following discussion breaks each network out separately and subdivides and supplements as required for understanding.

4-98. The function of the RF input voltage sampling network (figure 4-9) is to produce a DC output proportional to the RF drive voltage at the filament of the power amplifier tube. The RF drive is sampled through a capacitive divider. The output from the divider is peak detected by diode CR1 and capacitor C9, filtered by L6-C11, divided by resistors R9 and R11, producing a DC output. This DC signal is applied as one side of the differential input to the load servo amplifier and is also supplied to the 9A1A5 assembly for metering when the Multimeter switch is set at V_k.

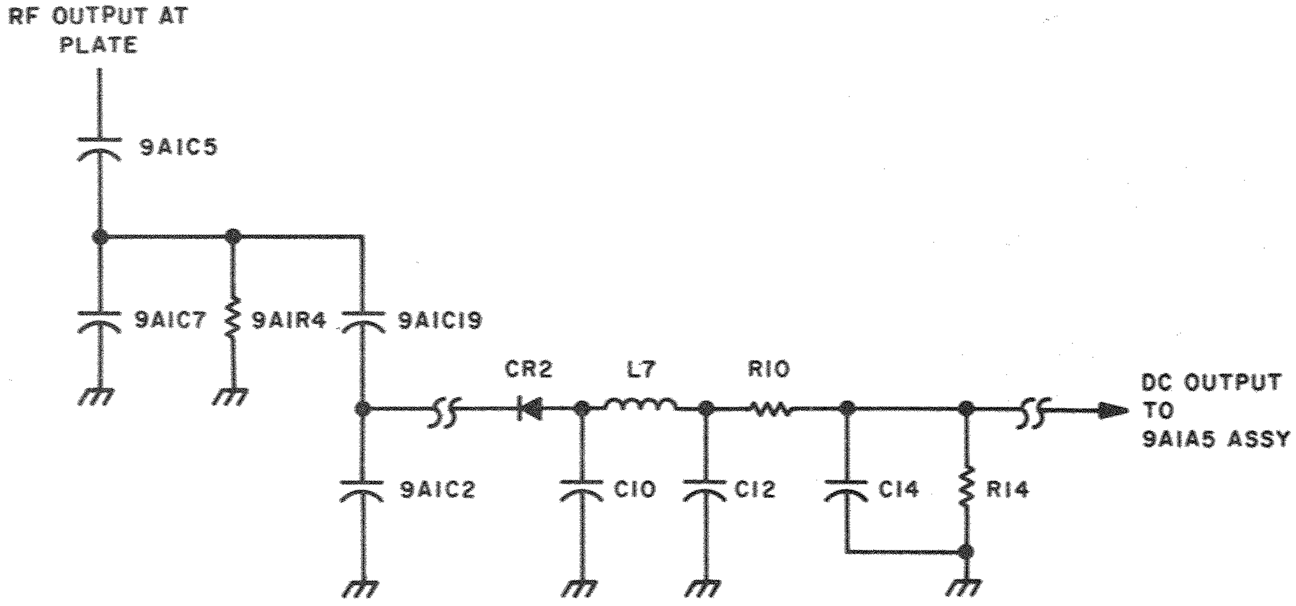
4-99. The function of the RF output voltage sampling network (figure 4-10) is to produce a DC output proportional to the RF voltage at the plate of the power amplifier tube. The network is identical to that used to sample the input drive, except two capacitive voltage dividers are used to sample the RF voltage. The DC output from the network is applied to the 9A1A5 assembly to (1) drive one side of the differential input to the load servo amplifier, (2) enable metering when the multimeter switch is set at V_p, (3) drive the RF sensor DC amplifier in the tune-up logic circuit.

4-100. As previously stated, the outputs from the two sampling networks above are applied to the differential input of the load servo amplifier. When the output of the power amplifier is correctly loaded, these two DC voltages will be equal (assuming that the tune servo amplifier has already tuned correctly); incorrect loading results in a differential level which energizes the load servo amplifier to reposition capacitors 9A1C4 and 9A1C6 in the output matching network until the loading is correct. The parts used in the two capacitive voltage dividers (one for each sampling network) are chosen such that approximately four (peak envelope) volts of RF is applied to each peak detector when the power amplifier is correctly loaded (approximately 1200 ohms), and the unit is producing a 10 KW PEP output. The tune servo amplifier takes precedence over the load servo



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 9AIA3AI.

Figure 4-9. RF Input Voltage Sampling Network, 9A1A3A1, Simplified Schematic Diagram



NOTE:
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Figure 4-10. RF Output Voltage Sampling Network, 9A1A3A1, Simplified Schematic Diagram

amplifier so that the plate circuit remains in resonance as the load servo amplifier approaches the correct loading point. If the tune capacitor was not held close to resonance, the servo amplifier would run the load capacitors to maximum capacitance in an attempt to raise the plate load impendance to the correct value.

4-101. The remaining portion of the tune detector assembly constitutes a phase detector. The function of this network is to produce two DC outputs which are applied to the tune servo amplifier. These levels will be equal when tuning capacitor 9A1C8 in the matching network is correctly positioned, i.e. when the power amplifier is working into an essentially resistive load. Efficiency and low distortion in the power amplifier requires tuning accuracy with no more than five degrees of phase difference between the voltages at the plate and cathode of the amplifier tube.

4-102. The basic building block of the phase detector is an all-pass network. Figure 4-11 illustrates such a network and, for convenience, shows which of the parts in the phase detector make up the basic network. An important characterisitc of such a network is 6MC. (The resonant point is not critical.) Phase reversing transformer T1 is a special bifilar wound 1:1 transformer which has minimum phase shift over the 2 to 30 MC operating frequency range. At resonance

$$X_{C2} = A_{L1} = R3 = R4 = Z_{IN}.$$

If one analyzes the network, it will be found that $Z_{IN} = R4$ across the entire frequency range.

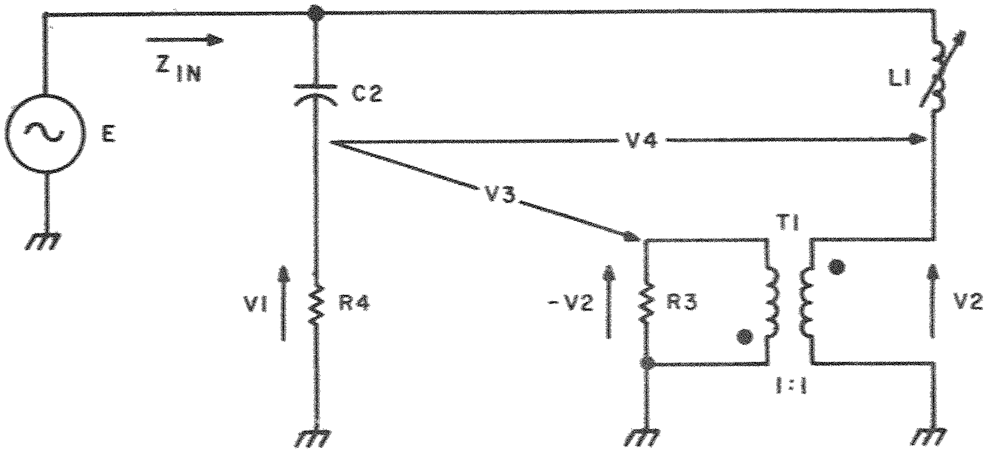
4-103. If diodes CR3 and CR4 were added to the above circuit as shown on figure 5-49, the resulting circuit would be similar in appearance and function to a conventional phase detector. (The detected levels are those designated V3 and V4 in figure 4-11). Voltage V4 is equal to the vector sum of V2-V1, V3 is equal to - V2-V1. If a vector analysis is done as shown in figure 4-12, the following conclusions are drawn.

a. Voltages V1 and V2 are always 90 degrees apart.

b. Voltage V4 is of constant amplitude and is always in phase with E, even though V1 amd V2 vary in amplitude and phase as the frequency is varied.

c. Voltages V4 and V3 always will be equal in amplitude, since V1 and V2 are always 90 degrees apart and T1 is a perfect transformer.

4-104. If the all-pass network of figure 4-11



NOTE:
PREFIX ALL REFERENCE DESIGNATIONS WITH 9A1A3A1

Figure 4-11. All-Pass Network, 9A1A3A1, Simplified Schematic Diagram

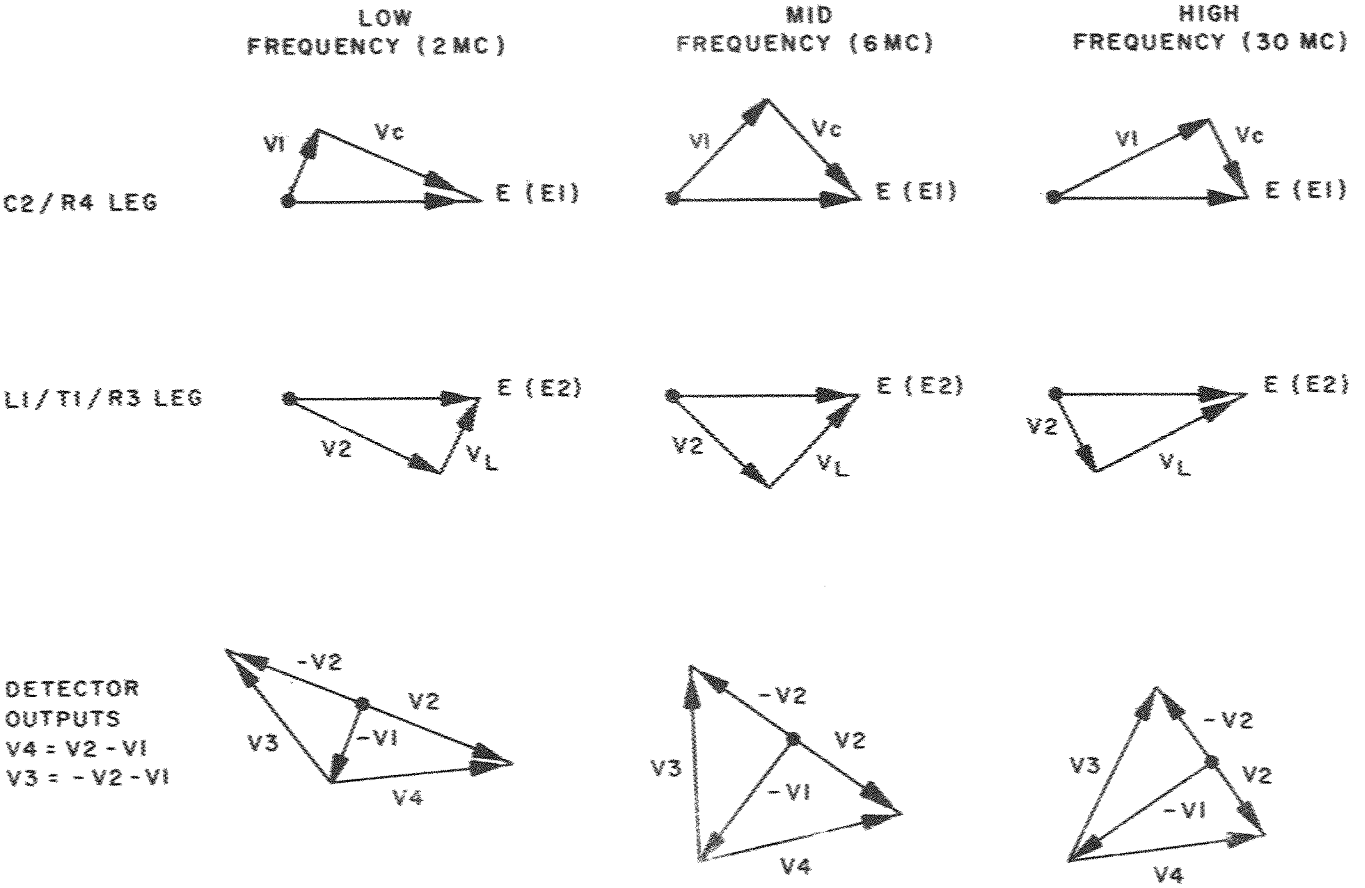


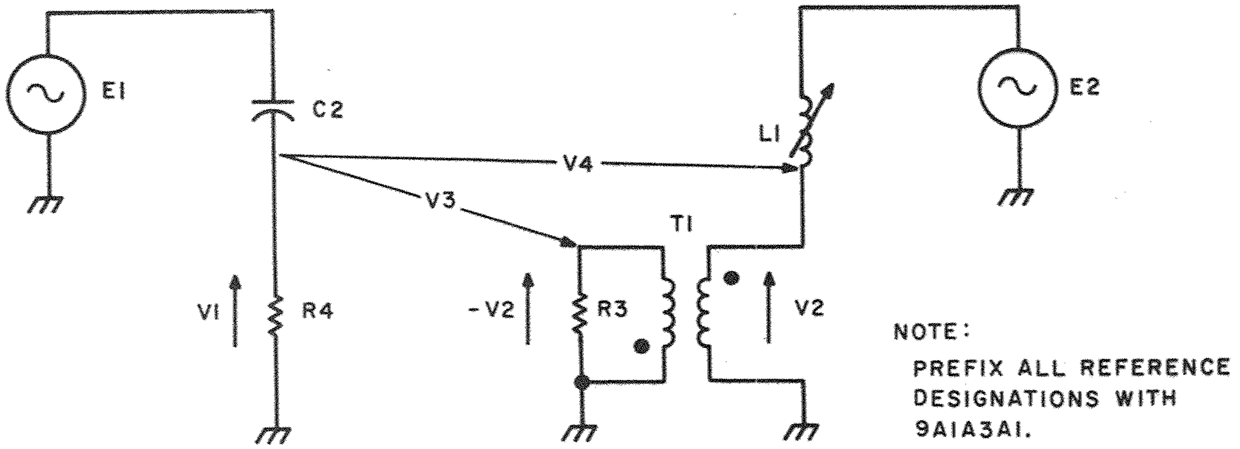
Figure 4-12. Conventional Phase Detector Vector Diagram

is divided in two, each leg is driven by a separate generator, the result is the phase detector shown in figure 4-13. The generators represent the two capacitive voltage dividers shown in the detector discussions above. Generator E1 is the input to the 10 KW PA and is constant. Generator E2 is the output from the 10 KW PA, and its phase is variable depending on the tuning. In the previous vector analysis it was shown that V4 and V3 were equal in amplitude across the entire frequency range. This was the result of V1 and V2 being always 90 degrees apart, since a single generator was used to drive the network. However, with the two generators, V1 and V2 will only be 90 degrees apart when the generators are in phase, or when the output is correctly tuned. Otherwise, V2 and -V2 rotate degree for degree with generator E2. Therefore, as shown in figure 4-14, the only time V4 and V3 are equal in amplitude is when the system is tuned. Otherwise, the phase difference between V2 and V1 will change, causing a proportional difference in magnitude between V4 and V3. This differential voltage is used to energize the tune servo amplifier to correct the position of tuning capacitor 9A1C8 until V4 and V3 are of equal magnitude.

4-105. The vector relationships shown in figure 4-14 are at a mid-frequency. It should be noted that the amplitude of V4 and V3 will vary somewhat across the frequency range; but the differential polarity caused by a tuning error will be the same.

4-106. Figure 5-50 shows the complete phase detector. To this point only the basic circuit has been discussed in its simplest form to clearly show how a phase difference (tuning error) can be detected by this type of circuit. Inductor L8 and L13 and resistor R2 are used to compensate the input impedance of capacitor C2 and resistor R4 by completing another all-pass circuit. Similarly, capacitor C1 and resistor R1 form an all-pass circuit with inductor L1, transformer T1, and resistor R3. This is necessary so that the amplitude and phase difference betwen the input and output voltage samples can be maintained accurately as they pass through voltage dividers to the input of the detector.

4-107. L2 is used to compensate for the phase delay through transformer T1. In addition, inductor L2 is used as a high frequency adjustment to vary the phase of the voltage developed across resistor R4 (V1)



NOTE:
PREFIX ALL REFERENCE DESIGNATIONS WITH 9A1A3A1.

Figure 4-13. Basic Phase Detector, 9A1A3A1, Simplified Schematic Diagram slightly for zero balance purposes. Inductor L3 is the low frequency balance control for the phase detector. Inductor L3 is the low frequency balance control for the input voltage sampling network and has a slight effect on the phase at low frequencies. L1 has its greatest affect at 6 MC due to the resonance of the all-pass network. Resistors R5 and R6 compensate the diode detectors, making the detectors less sensitive to diode characteristics or RF waveform variations.

NOTE

L8 and 9A1C17 are selected to compensate for variations in chassis and detector assembly reactances respectively. If replacement is necessary, simply replace with a part of the same value as selected at the factory.

4-108. The applicable servicing diagram is figure 4-42. Adjustments are described in Overhaul and Repair Manual, NAVSHIPS 0967-293-0060. Complete circuit details are shown in schematic diagram figure 5-49.

4-109. PREPOSITION CIRCUITS DESCRIPTION.

4-110. The preposition circuits operate in conjunction with the servo amplifier circuits to provide a means of setting the tune and load capacitors as closely as possible to their final tuning points before RF power is applied. A large number of parts is involved, in various locations in the 10 KW PA; but the function is actually very simple, as shown in figure 4-15.

4-111. Thirty-nine resistors in Band Repeater Assembly 9A1A13 are connected in series between a + 6V source and a -6V source. Taps at resistor junctions are connected in a predetermined manner to provide step voltages to contacts on switch wafer S1-5-F and S1-6-F. When Band Repeater switch S1 is rotated to a position corresponding to one of nineteen bands, predetermined reference voltages are provided at the common contacts of the two switch wafers. These two voltages — a tune preposition reference voltage and a load preposition reference voltage — are applied to the tune and load servo amplifiers along with respective signals from the tune and load servo motor position potentiometers. The servo amplifiers subsequently direct the rotation of the two servo motors until the servo motor position potentiometer voltages equal the respective preposition reference voltages from the band repeater assembly.

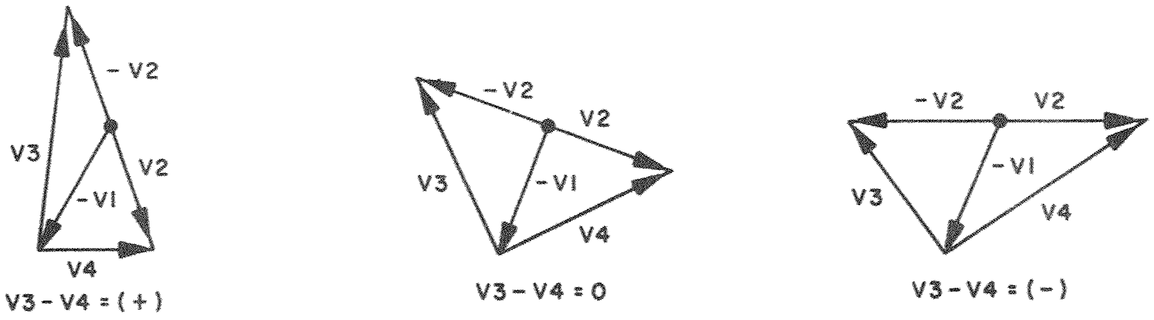


Figure 4-14. Phase Detector Vector Diagram

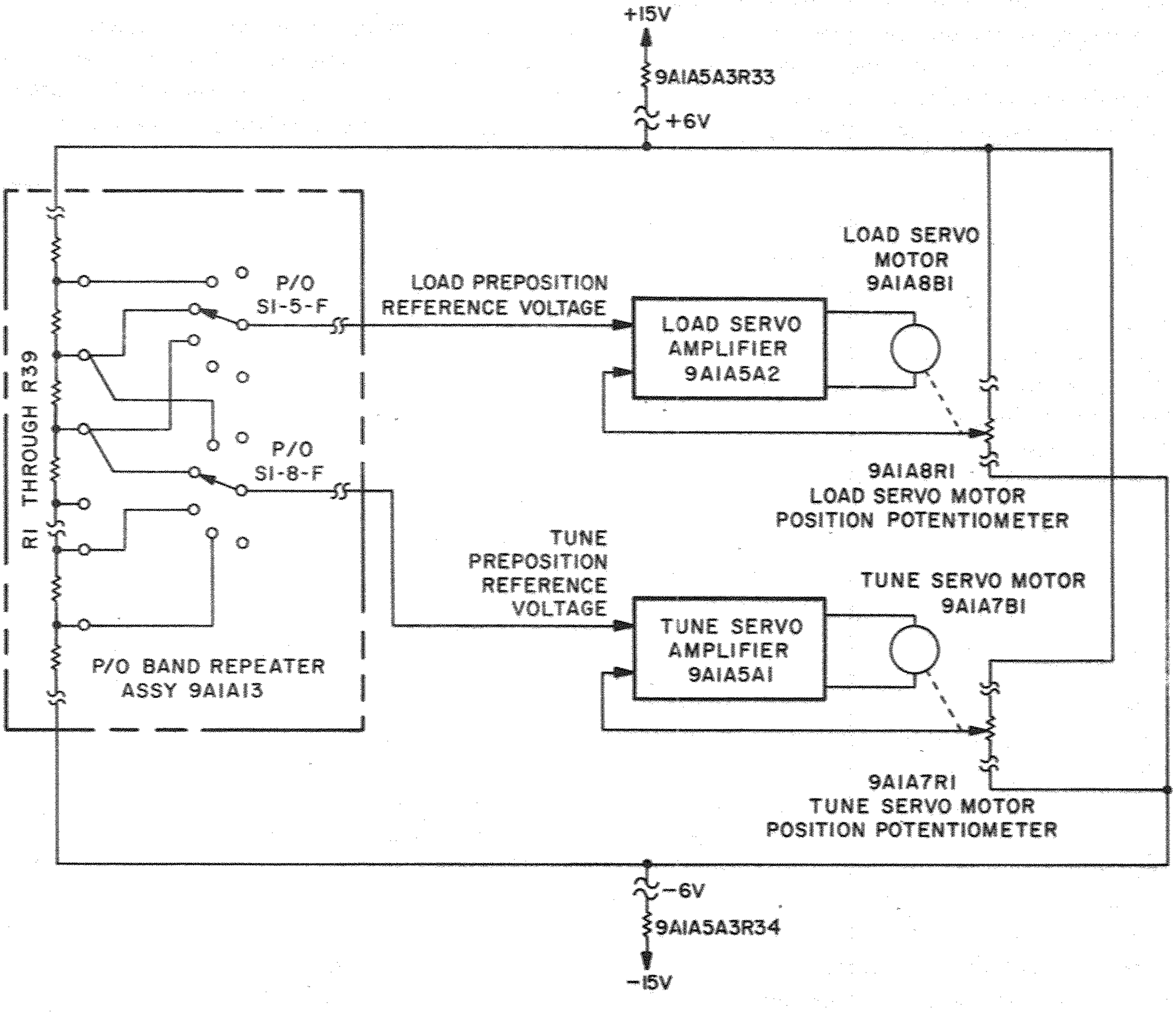


Figure 4-15. Preposition Circuits, Simplified Schematic Diagram

4-112. The applicable servicing diagrams for this circuit are figures 4-41 and 4-42. Complete circuit details and a preposition voltage chart are given in schematic diagram figures 5-50, 5-52 and 5-54.

4-113. SERVO AMPLIFIERS CIRCUIT DESCRIPTION.

4-114. Two essentially identical servo amplifier circuits are used in the 10 KW PA to operate the tune and load capacitor motor drives. Each consists of an integrated circuit operational amplifier, a differential amplifier with a constant current source, four driver transistors, and a stall-torque threshold detector, all mounted on a printed circuit board (9A1A5A1, tune and 9A1A5A2, load), and four motor-driver (power) transistors mounted directly on the DC Amplifier Assembly 9A1A5 chassis.

4-115. The tune servo amplifier is shown in figure 4-16 and is discussed herein. With the exception of reference designators of non-circuit board mounted parts, the two circuits are identical. (The two PC boards may be interchanged if desired for trouble-shooting purposes.)

4-116. The servo amplifiers direct tuning in three steps. First a preposition reference signal is compared with the signal obtained from the servo motor's position indicating potentiometer to coarsely preposition the tuning capacitors before applying RF power. Then RF power is applied, and the servo amplifier fine tunes the tuning capacitors according to output signals from Detector Assembly 9A1A3. At this point, the 10 KW PA is ready to transmit. During transmission, the servo amplifiers monitor th outputs of the detector assembly and operate in a lower-gain mode (because of higher RF power level) to readjust the tuning capacitors, to accomodate changes in antenna loading or the output network (automatic surveillance feature). In all cases, the servo amplifier compares two input signals and operates the servo motor in the proper direction until no difference between the two input signals is sensed.

4-117. Refer to figure 4-16. The input signals are applied to operational amplifier IC1 through preposition relay K2. During the initial (preposition) tuning step, the tune-up logic circuit applies an energizing signal to the coil of K2 to select the pair of input lines required for prepositioning. Thus, the tune preposition reference voltage from Band Repeater Assembly 9A1A13 is applied to one side of the input of operational amplifier IC1 and the voltage from the wiper of servo motor position potentiometer 9A1A7R1 is applied to the other side of IC1.

4-118. During fine tuning, preposition relay K2 is de-energized; and the input signals are applied to IC1 from Detector Assembly 9A1A3. During the initial low-power tuning step, high-gain relay K1 is energized by the tune-up logic circuit to remove surveillance gain potentiometer 9A1A5R1 from across the input lines. During full power operation after initial tuning, high-gain relay K1 is de-energized to connect the surveillance gain potentiometer across the input lines from the detector assembly to reduce servo amplifier sensitivity during normal transmissions.

4-119. The operation of IC1 and the remainder of the servo circuits is always the same. Operational amplifier IC1 compares the two input signals. It provides an output signal of amplitude and polarity proportional to the algebraic difference between the two input signals. If no difference exists between the two input signals in amplitude or polarity, the output signal of IC1 will be zero. The output from IC1 is applied to the base of differential amplifier transistor Q1 through current limiting resistor R6 and diode CR3. Diode CR3 prevents base to emitter breakdown of Q1 when the output of IC1 is at a high negative level.

4-120. Differential amplifier transistors Q1 and Q2 are biased for class A operation, with both initially conducting equally. They draw their emitter current from constant-current source transistor Q3. Q3 is biased at its base with a fixed voltage, and therefore its emitter current (and thus its collector current) is fixed (emitter current equals base voltage minus base-emitter voltage drop divided by resistance of R12). Because the total current through Q1 and Q2 is thus held constant, Q2 will draw less current if the signal at the base of Q1 becomes more positive, and Q2 will draw more current if the Q1 base signal becomes less positive or more negative. It can therefore be seen that the output of Q2 will always go in the opposite direction of the Q1 output in response to an imput signal at the base of Q1.

4-121. If an unbalance at the input of operational amplifier IC1 causes a positive signal to be applied to the base of Q1, the collector of Q1 will become less positive than at its quiescent operating point and the collector of Q2 will become more positive. If the output of IC1 is negative, just the opposite response of Q1 and Q2 will occur.

4-122. With no output from IC1, Q1 and Q2 apply equal signals to complementary driver stages Q5-Q7 and Q4-Q6. Note that the contacts of enable relay K3 are opened whenever the servo should be tuning. The driver transistors are direct coupled to motor-driver transistors 9A1A5Q4-Q1 and 9A1A5Q3-Q2. The driver and motor-driver transistors all conduct in equal degrees to their symmetrical counterparts in the opposite side of the circuit. Thus the output leads to the motor will have equal voltages applied, and the motor does not operate.

4-123. Considering the top set of driver and motor-driver transistors in figure 4-16 for the moment, it can be seen that if the signal at the bases of Q5 and Q7 becomes more positive, the base of 9A1A5Q4 will be driven to a less positive value, and thus 9A1A5Q4 will conduct harder and more positive current will flow through the top motor lead. (At the same time, the base 9A1A5Q1 is driven more positive, and thus 9A1A5Q1 conducts less to ground from the top motor lead.) The bottom set of driver and motor driver transistors is driven in the opposite direction by the differential amplifier, so the bottom output lead is less positive and motor ground current flows through 9A1A5Q2. The two sets of driver and motor-driver transistors operate in a push-pull manner. If the outputs of the differential amplifier were of the opposite sense, the motor-driver stages would apply signals of opposite relative polarity to the motor to drive it in the opposite direction. The level at which the motor-driver stages are driven determines the torque of the motor and thus the speed. (The speed also depends on the frictional load of the variable capacitors.) When top speed is necessary, the motor-driver transistors are saturated to apply a maximum potential difference to the motor leads of about 22 volts.

4-124. Negative (inverse) feedback from the outputs of the motor-driver stages is applied back through voltage-dropping resistors R26 through R31 to the inputs of IC1 to stabilize the gain of the servo amplifier. The overall gain is thus reduced, but the stability and linearity of the servo network in its transition area (between motor off and full speed) is improved. The gain of the servo network is such that with a large difference in input levels at IC1, the motor runs at top speed. As the correct tuning point is approached, the difference in input signal levels is reduced, and the motor is alowed down proportionately. Finally, when the correct tuning point is reached, the remaining difference in the two input signals is very small, and the motor is stopped. (Because of friction, the motor stalls just before an exact null is reached.)

4-125. Enable relay K3 prevents servo operation, except when its coil is energized, by shorting the outputs of Q1 and Q2 together, thus preventing a difference in output levels. With no difference in output levels, no motor current is drawn since both outputs of the motor-driver stages are at equal levels. Enable relay K3 is energized by the tune-up logic circuit only when more than about 500 watts of RF is sensed at the plate of the amplifier tube or when prepositioning.

4-126. Diodes CR10-CR-11 and CR-13CR14 from a bridge gate circuit to couple output signals of correct polarity to threshold detector Q8, regardless of the direction in which the motor is driven. The positive output signal is applied to the base of Q8 through a voltage divider consisting of R36 and stall-torque threshold potentionmeter 9A1A5R3. When the level at the base is greater than the total voltage of the drop across the base to emitter junction of Q8 plus the voltage drop across zener diode VR1, Q8 is driven into conduction to energize motor-run relay K4. Potentiometer 9A1A5R3 is adjusted to allow K4 to energize when sufficient drive is applied to the servo motor to cause it to run. During that part of the tuning cycle when RF is applied, the contacts of K4 are used in conjunction with the tune-up logic circuit to allow only one of the two servo networks to be active at a time. The tune servo amplifier always takes precedence over the load servo amplifier when the tune error signal is large enough, so that the plate circuit is kept in resonance. (Otherwise, with the plate circuit far from resonance, the load servo amplifier input signals would always attempt to drive the load variable capacitors to maximum to raise the plate load impedance, and correct runing would not be accomplished.)

Resistors R1 through R4 and capacitors C1 through C4 and C6-C7 at the input of 1C1 provide RF filtering. Diodes CR1 and CR2 limit the levels of the input signals for overload protection. Resistor R5 and capacitors C9 and C8 prevent oscillation of IC1. Capacitors C10 and C13 provide RF filtering of the ±15V lines. Diode CR4 allows the collector of Q1 to conduct as much as possible to ground at saturation. Resistor R9 provides a voltage drop to prevent the output of Q2 from going negative at saturation (base of Q2 is biased alightly negative). Diode CR5 aids in temperature compensation for transistor Q3.

4-127. The applicable servicing diagram for this circuit is figure 4-42. Adjustments are described in paragraph 5-21. Complete circuit details are shown in schematic diagram figure 5-50 and 5-52. Refer to figure 4-40 for tuning sequence timing diagram.

NOTE

If any motor drive transistor fails, also check other transistor of the pair, driver transistors, and assocated resistors for possible damage before replacing transistor because these components are known to fail when the motor transistors are defective.

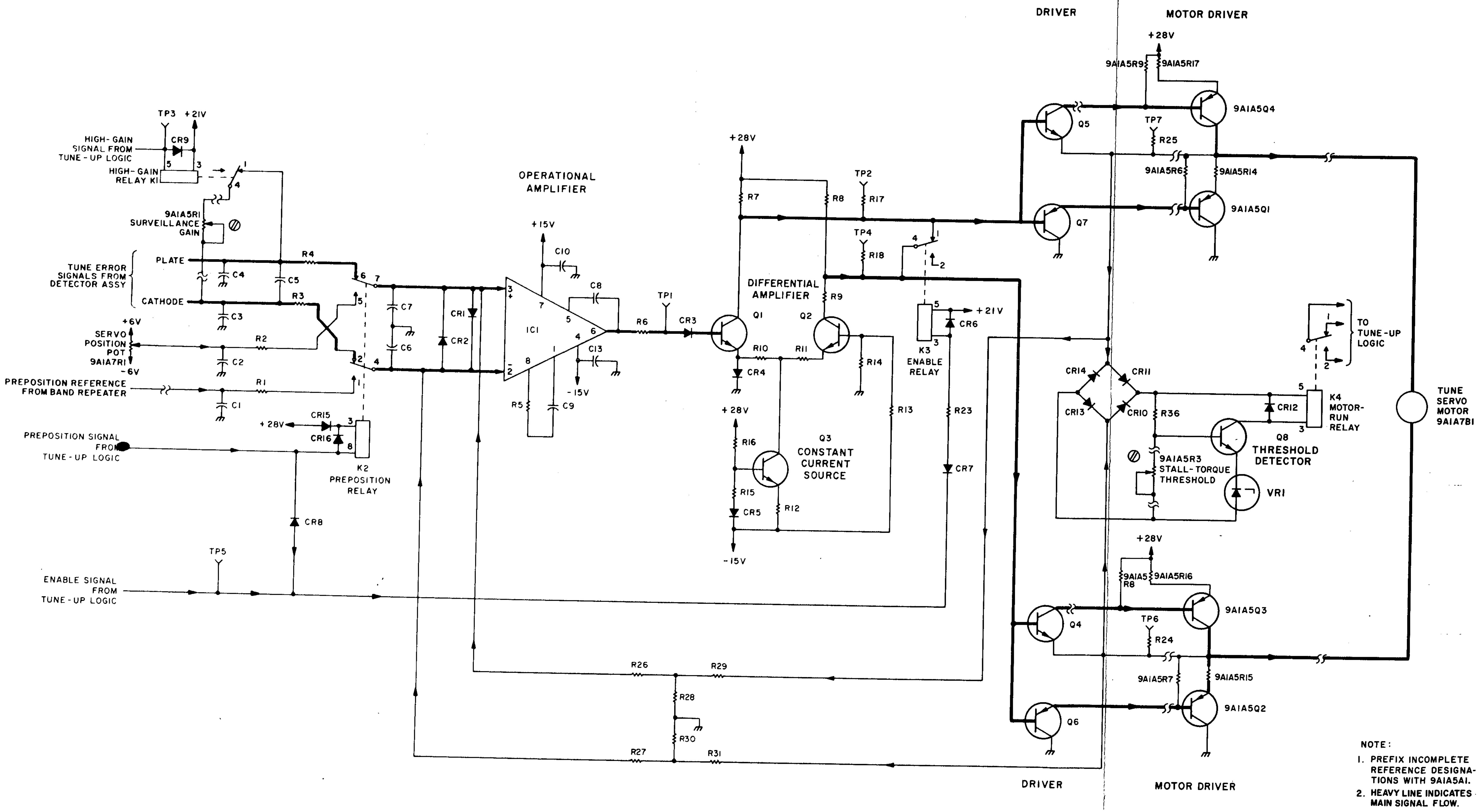


Figure 4-16. Tune Servo Amplifier, 9A1A5A1, Simplified Schematic Diagram

ORIGINAL

4-129. KEYING CIRCUITS.

4-129. FUNCTIONAL DESCRIPTION

4-130. The keying section comprises the I. Box system logic, the 10 KW PA keying circuit, the 1 KW PA bias circuit, and the 10 KW PA bias supply.

4-131. Refer to figure 4-17. The I. Box system logic circuit performs system keying, RF mute, keyline interlock, and fault logic functions during regular operation, and it provides tuning activation logic function during the tune-up cycle. Outputs from the I. Box system logic circuit provide status indications to the Exciter and activate it for tuning. Other outputs key the 1 KW PA keying circuit and the 10 KW PA bias supply and mute (interlock) the 1 KW PA keying circuit. The 1 KW PA keying circuit can also be muted by a key inhibit signal from the 1 KW PA over load circuit.

4-132. The 1 KW PA bias circuit applies appropriate bias voltages to the driver and final amplifier stages in response to a key signal from the 1 KW PA keying circuit. Key inhibit and driver key inhibit signals from the 1 KW PA keying circuit prevent the KW PA bias circuit from applying full power operation bias voltages to the amplifier tubes during fault conditions.

4-133. The 10 KW PA bias supply incorporates relays to change the 10 KW power amplifier grid bias level for keying; therefore, the relay portion of the circuit is considered as a keying function. The relays change the bias level from cutoff to the operating level when a key signal is applied from the I. Box system logic circuit, and prevent keying when either a fault signal is received from the 10 KW PA fault sensor circuit or an RF mute

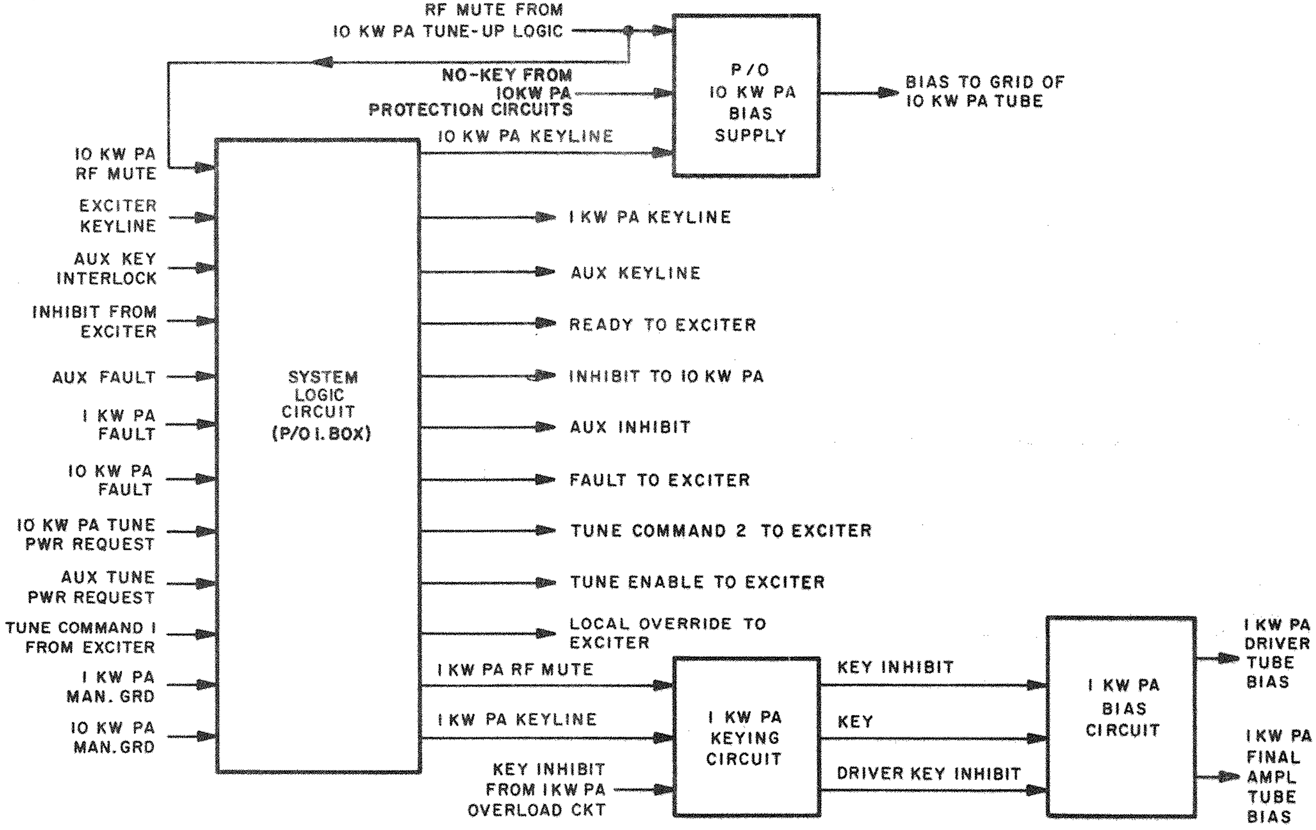


Figure 4-17. Keying Circuits, Functional Block Diagram

signal is received from the 10 KW PA tune-up logic.

4-134. 1 KW PA KEYING CIRCUIT DESCRIPTION.

4-135. The 1 KW PA keying circuit (figure 4-18) consists of a key driver, a keying stage, and various key inhibit interlocks. The function of this circuit is to activate the 1 KW PA amplifier stage on command by causing the 1 KW PA bias circuit to remove cutoff bias whenever the keyline is grounded unless a 1 KW PA overload exists, the 1 KW PA tuning circuit is energized, or an RF mute signal is applied by the I. Box system logic circuit.

4-136. Key driver Q5 is normally biased off by the positive voltage applied through R18; therefore, key stage Q6 is turned off. When the system keyline is grounded, current is drawn through R23 and R24, and the base voltage at key driver Q5 is pulled down (less positive) to make Q5 conduct. The Q5 collector current drawn through the emitter of key stage Q6 causes Q6 to conduct, and the resultant current flow in the collector circuit of Q6 pulls the bias circuit voltage down to the operating value required for operation of the RF driver and final amplifier stages (paragraph 4-142).

4-137. The output of 20 VDC switch Q4 in the overload circuit is connected through R17 and CR16 to the base of key driver Q5. When an overload occurs, a key inhibit voltage from Q4 in the overload circuit biases Q5 off to unkey the bias circuit until the overload is cured and the overload circuit is reset.

4-138. An external RF mute line input is provided to allow the I. Box system logic circuit to unkey the 1 KW PA bias circuit. The RF mute line is connected through CR13

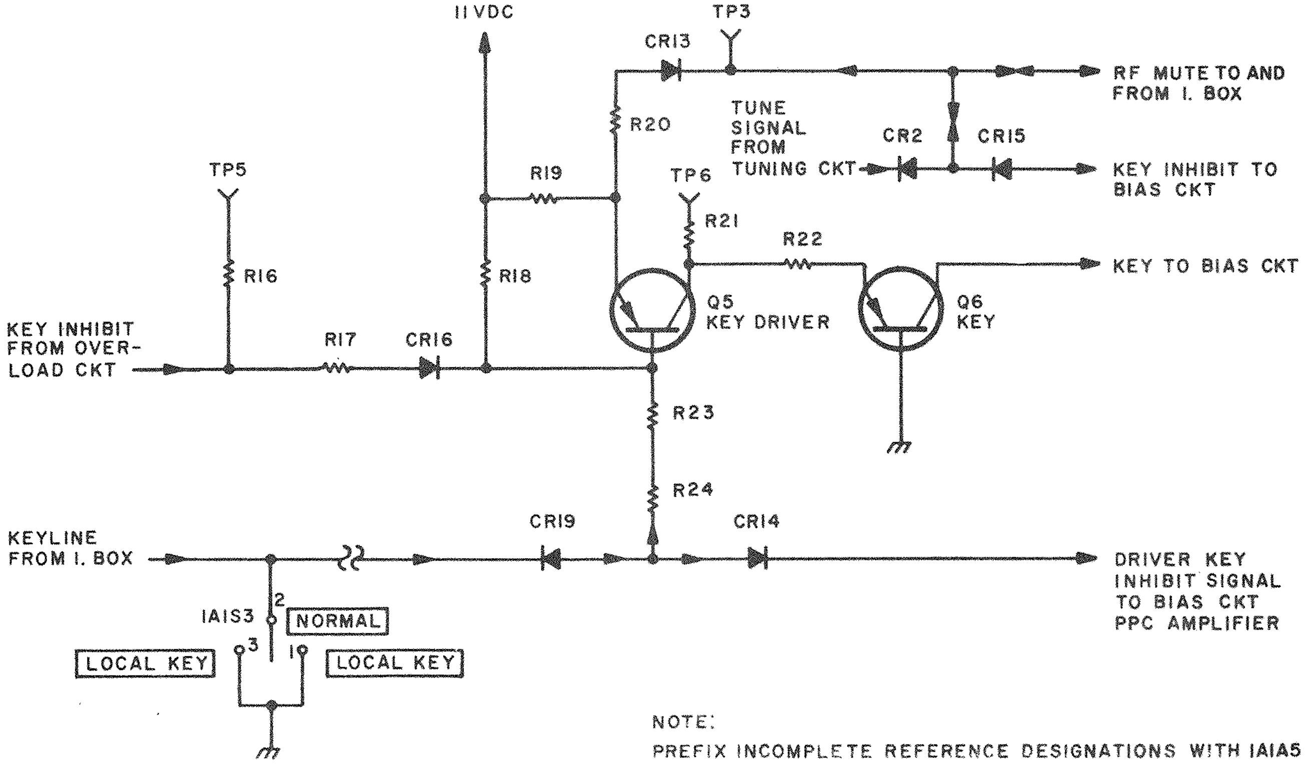


Figure 4-18. 1 KW PA Keying Circuit, 1A1A5, Simplified Schematic Diagram

and R20 to the emitter of key driver Q5. Then a ground is applied to the RF mute line, the voltage at the emitter of Q5 is pulled down to the extent that grounding the system keyline will not make Q5 conduct. The RF mute line is also interlocked through CR15 directly to the emitter of PPC amplifier 1A1A6Q4 in the bias circuit. Thus, in case of key circuit failure, the RF driver stage is still biased off.

4-139. A ground is also applied to the RF mute line through CR2 from the 1 KW PA tuning circuit to prevent keying when the bandswitch motor is energized. In addtion to preventing operation of key driver Q5, the 1 KW PA tuning circuit ground signal is also applied directly to the key inhibit output to the 1 KW PA bias circuit.

4-140. A driver key inhibit line is provided from the bottom of R24 through isolation diode CR14 to the base of PPC amplifier 1A1A6Q4 in the bias circuit. When the system keyline is ungrounded, +11 volts is applied through CR14 to the PPC amplifier to ensure that it is fully biased off.

4-141. The applicable servicing diagram for this circuit is figure 4-43. Complete circuit details are shown in schematic diagram figure 5-55

4-142. 1 KW PA BIAS CIRCUIT DESCRIPTION.

4-143. The 1 KW PA bias circuit (figure 4-19) consists of a full-wave bridge rectifier and filter, a voltage regulator and divider, and various switching circuits whose function is to provide the required control-grid bias voltages for operation of the electron tubes. Until the system is keyed, the outputs from the bias power supply are at a high negative level to bias the electron tubes beyond cutoff. When the transmitter is keyed, the bias voltages are reduced to the values required to establish proper plate currents in the electron tubes.

4-144. The final amplifier bias is changed to the value required for class AB_1 operation of the tubes when keyed. The value of driver bias is such that the tubes operate classA when the transmitter is keyed. However, the driver bias can be controlled by the PPC circuit according to the 1 KW PA and 10 KW PA power output requirements (auxiliary internal PPC for protection if the Exciter PPC circuits fail).

4-145. The output from secondary winding 14-14 of transformer 1A1T1 is full-wave rectified by diodes CR1 through CR4, filtered by capacitor 1A1C29, and applied to a voltage regulator and divider circuit consisting of current limiting resistor R4, zener diodes CR5 and CR6, and resistor R5. When the system is unkeyed, the voltage drop across the relatively high resistance of R5 allows the bias levels to be negative enough to bias both 1 KW PA RF amplifier stages to cutoff. When the system is keyed, key stage transistor 1A1A5Q6 conducts, effectively placing a short circuit across R5 and grounding the voltage regulator circuit positive return. Thus, the bias voltages are reduced to their normal operating levels.

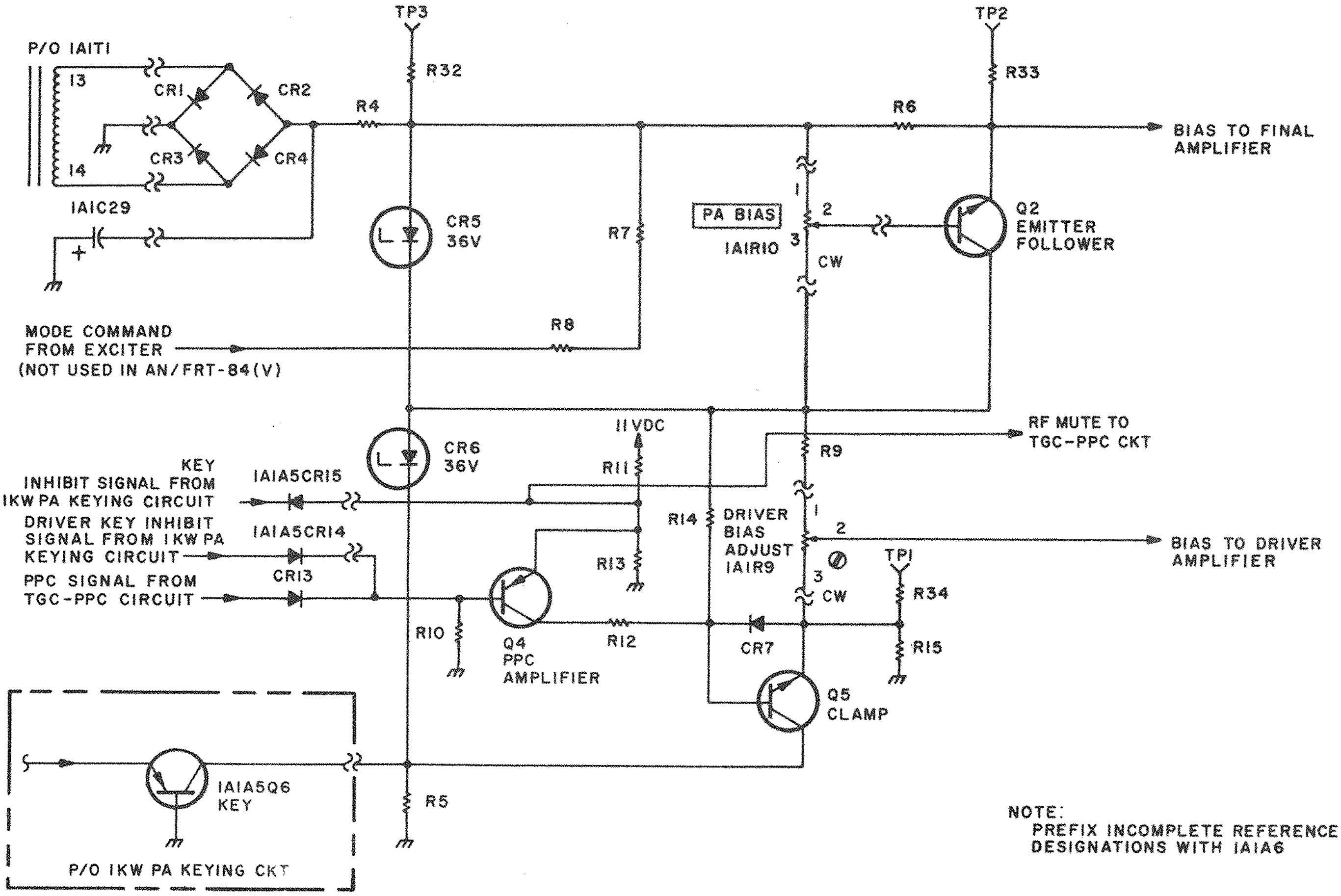
4-146. PA BIAS potentiometer 1A1R10 is adjusted for normal class AB_1 operation of the final amplifier stage. The level established by the PA BIAS potentiometer controls the bias voltage which is applied to the final amplifier by emitter follower action of Q2.

4-147. During normal operation, PPC amplifier Q4 is conducting sufficiently to bias clamp Q5 into saturation. Therefore, the one end of Driver Bias Adj potentiometer 1A1R9 is clamped to ground through Q5 and and 1A1R9 is clamped to ground through Q5 and 1A1A5Q6. In this condition, the potentiometer can be adjusted over the normal range of class A operating bias for the driver amplifier electron tubes (0 to -24 VDC).

4-148. Normally, the PPC circuit in the Exciter performs the function of limiting the output level of the 1 KW PA and 10 KW PA. However, should the Exciter PPC circuit fail, the PPC output voltage in the 1 KW PA will rise higher than normal in an attempt to reduce the output power. The increasing level is applied through isolation diode CR13 to gradually cut off PPC amplifier Q4. As the voltage at the collector of Q4 becomes more negative, so does the base voltage of clamp Q5. By emitter follower action, the voltage at the bottom of driver bias adj potentiometer 1A1R9 also becomes more negative, thus reducing the gain of the driver stage electron tubes until the proper output is obtained. Diode CR7 keeps any reverse base-to-emitter voltage at clamp Q5 from exceeding safe limits.

4-149. When the 1 KW PA tuning circuit is energized or when the RF mute line to the 1 KW PA keying circuit is grounded at the I. Box system logic circuit, a ground is applied through diode 1A1A5CR15 to the emitter of PPC Amplifier Q4 to turn Q4 off. With Q4 off, clamp Q5 is non-conducting, and the driver stage is biased to cutoff, thus preventing operation until tuning is completed or the RF mute signal from the I. Box system logic circuit is removed.

4-150. A driver key inhibit line is provided from the keyline input in the 1 KW PA keying circuit through isolation diode 1A1A5CR14 to the base of PPC amplifier Q4. With the keyline ungrounded, +11 volts is applied from the keying circuit through the diode



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH IAIA6

Figure 4-19. 1 KW PA Bias Circuit, 1A1A6, Simplified Schematic Diagram to the base of Q4. This ensures that Q4 is turned off, thereby keeping clamp Q5 turned off so that maximum bias is applied to the driver tubes to keep them biased off.

4-151. The applicable servicing diagram for this circuit is figure 4-43. Driver bias adjustment is described in paragraph 5-12. PA BIAS adjustment is a front panel operator accessible control and, as such, is described in Operator's Handbook, NAVELEX 0967-293-0020. Complete circuit details are shown in schematic diagram figure 5-55.

4-152. 10 KW PA KEYING CIRCUIT DESCRIPTION.

4-153. The 10 KW PA keying circuit (figure 4-43) consists of relays 9A2A1K1, 9A2K1, and 9A2K2 and related miscellaneous components.

4-154. Operating voltage for keying relays 9A2K1 and 9A2K2 is applied through normally colsed contacts of no-key relay 9A2A1K1. The other coil leads of the keying relays are actuated (to key the bias supply) by a ground signal on the keyline from the I. Box system logic circuit. The normally closed contacts of no-key relay 9A2A1K1 are opened to prevent activation of the keying relays when either of three ground signals is applied to the relay coil through OR-gate diodes 9A2A1CR19-CR20; RF mute from the 1 KW PA tune-up logic, RF mute from the 1 KW PA, or fault from the 10 KW PA fault sensor circuit.

4-155. I. BOX SYSTEM LOGIC CIRCUIT DESCRIPTION

4-156. The I. Box system logic circuit consists of two printed circuit subassemblies in the I. Box unit. The primary function of this circuit is system coordination in keying, mute, fault, and tune-up activation.

4-157. Refer to figure 4-20. The operation of the circuits is straight-forward, and the logic diagram illustrates the input conditions necessary to achieve the various outputs. The following discussion will help to visualize the sequence of operation, starting from tune-up, and the relationships between various functions. The Exciter section is an oversimplified logic representation of the interfacing functions of the Exciter. It is intended for understanding of the I. Box system logic only, and it is not intended for use in Exciter troubleshooting.

4-158. With the system in the operate condition, changing settings of the Exciter (or Remote Control) FREQUENCY KCS controls, occurrance of a fault in the system, or changing the CLASS OF EMISSION control setting from a single-tone to a multi-tone class of emission or vice-versa applies an inhibit signal from the Exciter. The I. Box system logic, in turn, removes the ready status signal from the ready line to the Exciter and provides inhibit (ground) signals to the 10 KW PA tune-up logic and to auxiliary inhibit output line. The inhibit signal at the 10 KW PA initiates the tune cycle.

4-159. During the first part of the tune cycle (bandswitch and preposition operation), the 10 KW PA applies an RF mute signal to the I. Box, which responds by applying an RF mute signal to the 1 KW PA to prevent keying and by temporarily disabling the tune command 2 line to the Exciter. After the 10 KW PA bandswitches are positioned and the variable capacitors are prepositioned, the RF mute is removed. When the Exciter generates the inhibit signal which is applied to the I. Box to initiate the tune cycle, it simultaneously illuminates the Exciter TUNE pushbutton to indicate that tuning must be accomplished before returning to normal operation and conditions the Exciter RF circuits for a tune cycle.

4-160. During the second part of the tune cycle, the 10 KW PA requires an RF signal to tune by. The 10 KW PA tune up logic supplies a tune power request signal to the I. Box system logic. Simultaneously, lack of RF mute and fault signals provide a tune command 2 signal to the Exciter. When The exciter's TUNE pushbutton is depressed, the tune command 2 signal is returned to the I. Box via the tune command 1 line. The tune command 1 signal, together with the tune power request signal, generates a tune enable signal which is applied to the Exciter to activate a tune power RF signal for tuning. Once the tune enable signal is activated by the process described, it is latched on providing that no fault, key interlock, or RF mute signal is received. While the tune enable signal is on, the 1 KW PA, 10 KW PA, and auxiliary keylines are grounded by the Exciter to key those units.

4-161. When the tuning cycle in the 10 KW PA is completed, the 10 KW PA tune power request signal is removed from the I. Box system logic circuit. Therefore, the tune enable signal is deactivated: and providing that no fault, key interlock, or RF mute signal is received, the ready signal to the Exciter is reactivated to indicate that normal operation can resume. Thereafter, during normal operation, the 1 KW PA, 10 KW PA, and auxiliary keylines are keyed only on command from the Exciter, depending on the mode of operation.

4-162. During manual operation of either the 1 KW PA or the 10 KW PA, a manual ground signal is applied to the I. Box system logic. This signal activates the manual indicator on the I. Box and a local override signal is applied to the Exciter. During manual operation of the 10 KW PA, the 10 KW PA tune power request signal is generated manually by activating the TUNE PWR REQUEST switch in the 10 KW PA.

4-163. During any mode of operation, if a fault occurs in the 10 KW PA, the 1 KW PA, or in an auxiliary equipment connected to the auxiliary fault line, a fault signal is applied to the I. Box system logic circuit, which in turn applies a fault signal to the Exciter to prevent further operation until the fault is cured and the appropriate unit's fault circuit is reset. In addition, a fault will disable the tune enable signal to the Exciter if in a tune cycle.

4-164. The applicable servicing diagram for this circuit, figure 4-43, shows the logic circuits stage-by-stage with relative signal levels indicated. Since all of the signals are either grounds or at positive supply voltage levels, troubleshooting is straight forward. Using the truth table accompanying the servicing diagram, outputs can be checked relative to the required inputs for the functions in question. An additional troubleshooting aid, figure 4-40, shows the timing sequence of the tuning cycle. Complete circuit details are shown in schematic diagram figure 5-49.

4-165. PROTECTION AND POWER CONTROL CIRCUITS.

4-166. FUNCTIONAL DESCRIPTION.

4-167. The functions of the protection and power control sections are to protect the 1 KW PA and 10 KW PA units from overload and to ensure that personnel and the equipment are not accidentally harmed if all necessary compartment covers and the high voltage shorting stick are not secured. Basically, the protection section consists of fault detectors, and the power control

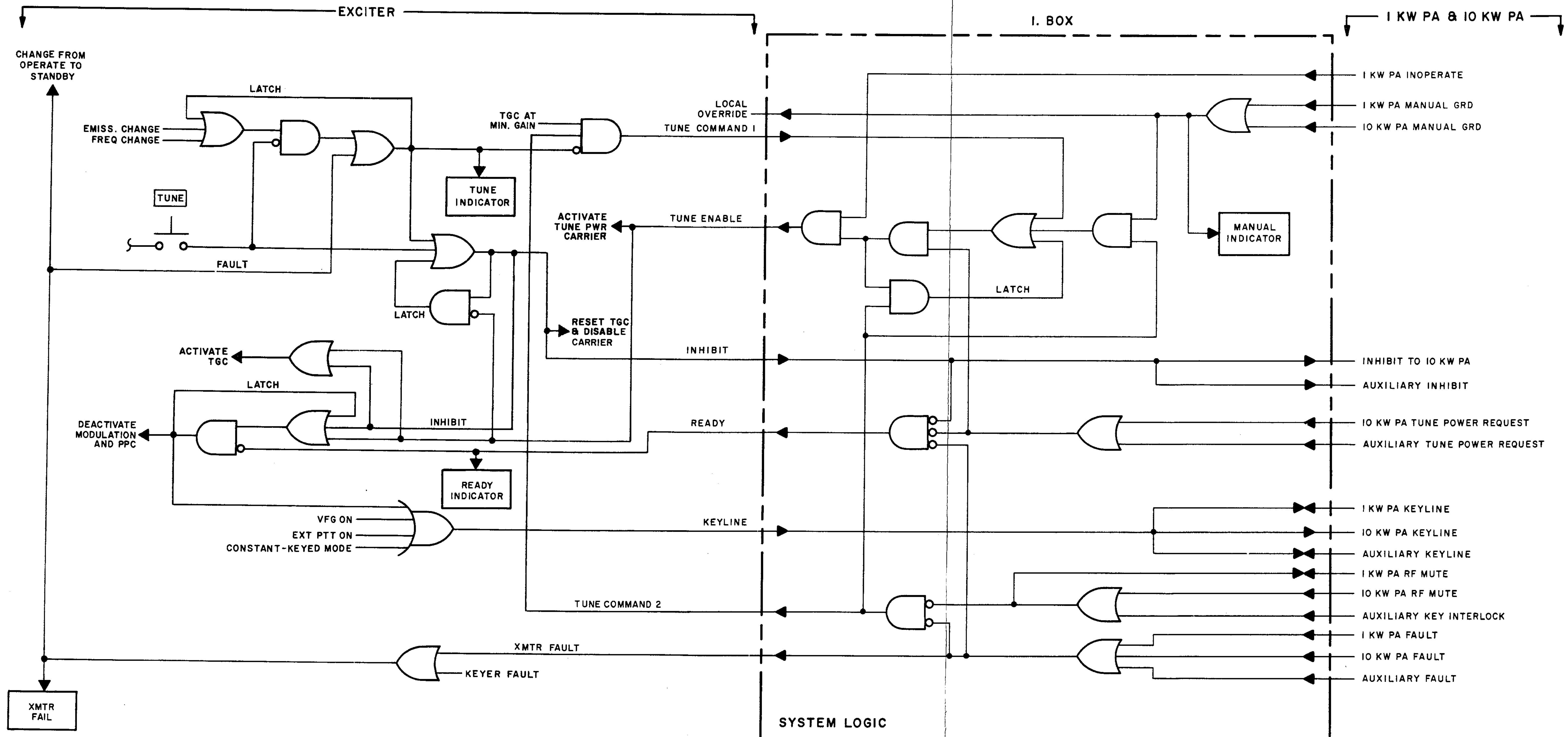


Figure 4-20. I. Box System Logic, Functional Block Diagram

section consists of circuitry for Peak Power Control (PPC) and Transmitter Gain Control (TGC) which limit the maximum RF signal level. The two sections perform related functions, and some interchange of signals takes place between them. The differentiating factors in the operation of the two sections are that the power control section directly and variably controls the level of the transmitted RF signal (TGC during tune up and PPC during normal transmission) and the protection section monitors circuit parameters and compartment interlocks for dangerous or circuit-overload conditions to shut down the transmitter in the event that any abnormal condition occurs.

4-168. POWER CONTROL SECTION DESCRIPTION.

4-169. Refer to the power control section of figure 4-21. The RF signal from the output of the 1 KW PA final amplifier is applied to the 10 KW PA through the VSWR bridge, which senses the forward and reflected power levels and supplies corresponding control signals to the 1 KW PA TGC-PPC circuit. The RF signal from the 10 KW PA is applied to the antenna system through a directional coupler, which supplies forward and reflected power indicating signals to the 10 KW PA meter amplifier circuit. The meter amplifier, in turn, supplies forward and reflected power indicating signals to the 10 KW PA peak/average power meter circuit, a VSWR limit (reflected) signal to the 10 KW PA fault sensor circuit, and forward and reflected power indicating signals to the 1 KW PA TGC-PPC circuit. The TGC-PPC circuit uses the forward power signal from the 10 KW PA meter amplifier as a primary input and the reflected power signal from the 10 KW PA meter amplifier and the forward and reflected signals from the 1 KW PA VSWR bridge as secondary inputs to produce two level control signals for application to the Exciter unit.

4-170. During normal operation, the PPC signal is used to limit the peak power level which the Exciter can apply to the 1 KW PA. During tune-up, the TGC signal is used to limit the Exciter's output to a safe tune power level while tuning and to adjust the final Exciter RF gain level after the 10 KW PA is tuned and just before the transmitter returns to normal operation. TGC thus sets the gain level of the Exciter at the end of the tune-up cycle to compensate for transmitter gain variations over the 2-30 MC frequency range. During tune-up, the TGC signal is normally developed from the forward power signal from the 10 KW PA meter amplifier circuit; but before the 10 KW PA output network is tuned somewhere near resonance, insufficient RF power is available at the directional coupler to properly limit the drive level. During this period in the tune-up cycle, the tune overload protection amplifier monitors plate and screen current and applies a T.O.P. signal to the 1 KW PA TGC-PPC circuit to take precedence in controlling the TGC signal to the Exciter.

4-171. PROTECTION SECTION DESCRIPTION

4-172. Refer to the protection section of figure 4-21. The 1 KW PA overload circuit monitors the RF voltage at the plates of the final amplifier stage, the cathode current of each final amplifier tube, and the internal temperature of the 1 KW Power Supply. If an abnormal indication is detected at any of these inputs, the 1 KW PA overload circuit trips to provide a key inhibit signal to the 1 KW PA keying circuit, and a fault signal to the I. Box system logic circuit. It also applies illuminating voltage to the 1 KW PA OVERLOAD indicator. After the fault is corrected, momentary operation of the front panel fault reset

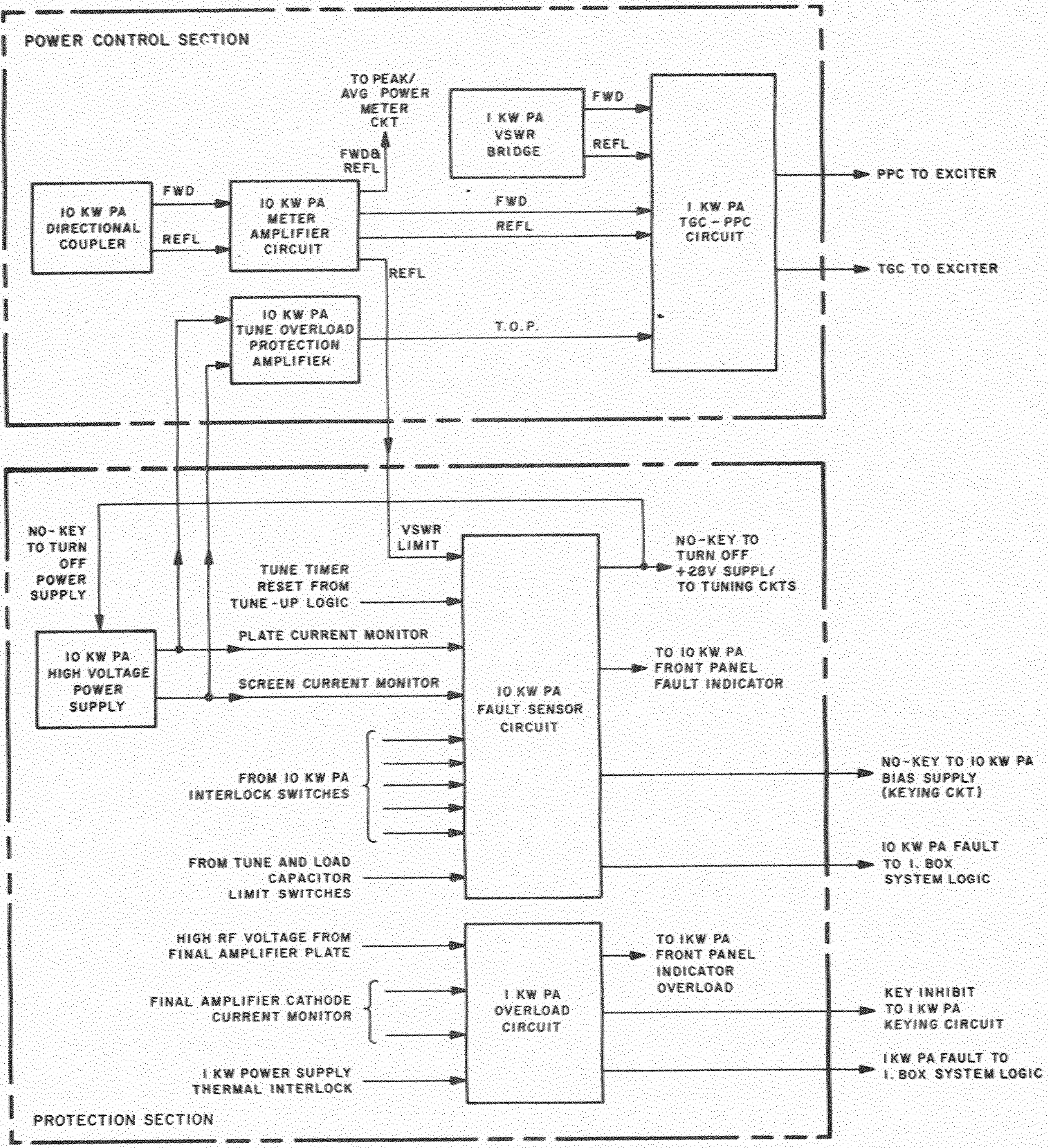


Figure 4-21. Protection and Power Control Sections, Functional Block Diagram

switch will restore normal operation.

4-173. The 10 KW PA fault sensor circuit monitors the following inputs and responds as indicated:

a. VSWR limit signal from the 10 KW PA meter amplifier trips a fault detector if the reflected power level exceeds 1.6 KW average power.

b. A tune-timer reset signal from the tune-up logic starts a tune-up cycle timer. If tune-up takes longer than 15 seconds or if a servo or bandswitch motor runs longer than 15 seconds at any time, a fault detector is tripped.

c. Plate and screen currents trip corresponding fault detectors if they exceed 3.4 AMP or 100 MA, respectively.

d. Input, plate, and power supply compartment covers, the PA chassis slide, and the high voltage shorting stick hanger are all interlocked to trip the fault sensor if required conditions are not met.

e. Tune and load variable capacitors are protected by limit switches on their drive mechanisms, which trip a fault detector if either of the variable capacitor drive assemblies is driven to the limit of its travel.

4-174. If any of the listed faults occur, the 10 KW PA fault sensor circuit applies a no-key signal to the 10 KW PA bias supply, a fault signal to the I. Box system logic circuit, and an illuminating voltage to the 10 KW PA front panel FAULT indicator. It also supplies a no-key signal to the 10 KW PA high voltage power supply to remove plate and screen voltages and a no-key signal to remove +28 volts from tuning circuits. The interlock switch faults are self-correcting. If one of the other faults occurs, a FAULT RESET pushbutton on the 10 KW PA Monitor/Control Assembly panel must be depressed to reset the fault sensor circuit after fault is corrected.

4-175. 1 KW PA OVERLOAD CIRCUIT DESCRIPTION.

The 1 KW PA overload circuit (figure 4-22) consists of an overload detector a 20 VDC switch, an overload indicator, an overload switch, and various gates. The function of this circuit is to monitor the cathode current of the two final amplifier electron tubes, the RF output voltage from the final amplifier, and the temperature of the 1 KW Power Supply. If any of these is abnormal, the overload circuit trips, unkeying the 1 KW PA, energizing an overload indicator in the 1 KW PA, and energizing a relay in the I. Box which in turn lights the XMTR FAIL indicator in the Exciter and prevents continued operation. The overload circuit can be reset with a front panel OVERLAOD switch.

4-176. Four inputs to the circuit are used to sense overload conditions as follows:

a. The RF output voltage from the plates of the final amplifier electron tubes is sampled by capacitive voltage divider 1A1C35-C36 and detected by diode 1A1CR13; and a DC voltage proportional to the RF output voltage is developed across base resistor R9. Resistor 1A1R20 completes the DC path for diode 1A1CR13, and 1A1C37 is an RF bypass capacitor.

b. The DC voltage developed across the cathode resistor for final amplifier tube 1A1V1 as a function of the current drawn by the Screen and plate is applied to base resistor R9 through decoupling network 1Z1R7-1A1C27-R6-C2 and gate CR11.

c. The DC voltage developed across the

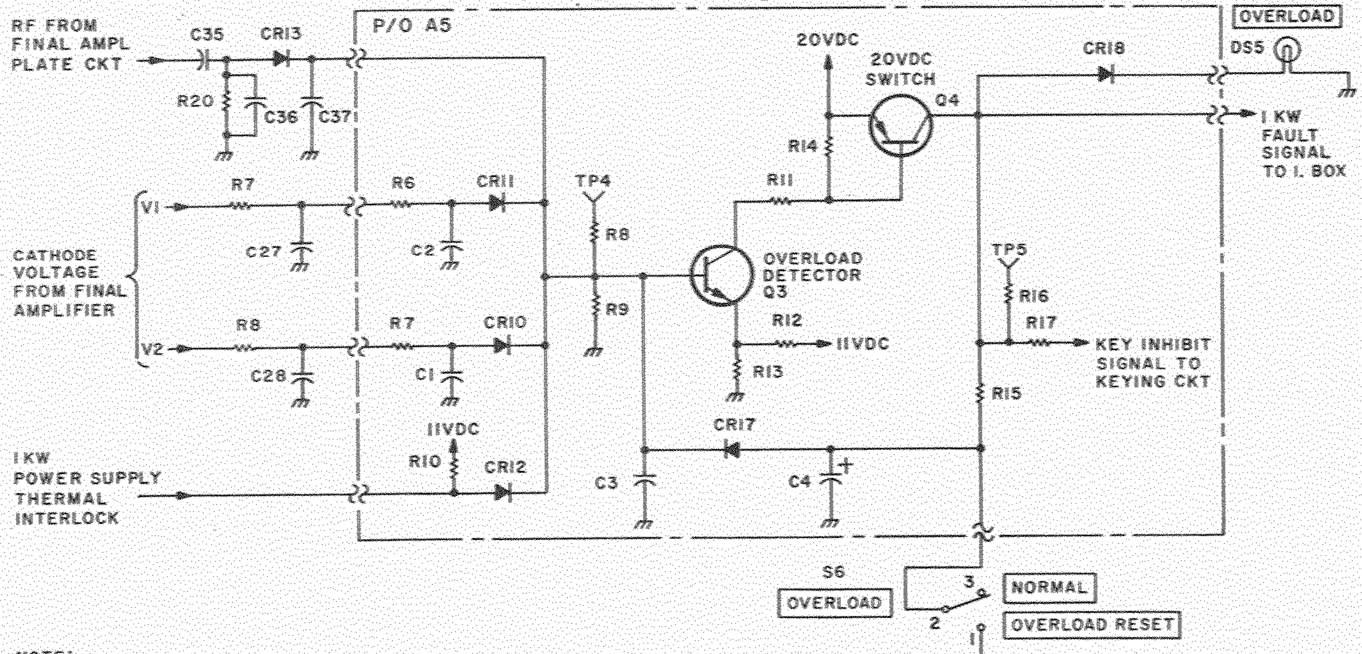
cathode resistor for final amplifier tube 1A1V1 as a function of the current drawn by the screen and plate is applied to base resistor R9 through decoupling network 1A1R8-1A1C28-R7-C1 and gate CR10.

d. When the temperature of the 1 KW Power Supply is within safe limits, ground is applied to the power supply interlock line by the thermal switch in the 1 KW Power Supply. Therefore the full 11 VDC applied to resistor R10 is dropped across the resistor. If the thermal switch in the 10 KW Power Supply opens (temperature too high), the ground is removed by the thermal switch, and part of the 11 VDC applied through R10 is connected across base resistor R9 through gate CR12.

4-177. When the voltage on any one of these input lines exceeds the threshold voltage established by resistors R12 and R13, overload detector Q3 is forward biased, thereby turning on 20 VDC switch Q4. With Q4 energized initially, overload detector Q3 is latched on by the voltage at the collector of Q4 which is fed back through R15 and isolation diode CR17 to the base of Q3. The time constant of R15-C4 provides a one millisecond delay in latching to allow extremely short overloads to occur without latching the circuit.

4-178. With Q4 turned on, 20 VDC is applied through the 1 KW fault line to the I. Box system logic circuit to energize a relay, through isolation diode CR18 to OVERLOAD indicator light 1A1DS5, and through R17 to key driver Q5 in the keying circuit to unkey the bias circuit for deactivation of the RF amplifier stages. Once energized, the overload circuit will remain latched on until the overload is discontinued and overload switch 1A1S6 is momentarily placed in the reset position or the primary power is removed. Due to the isolation of diode CR17, grounding the feedback loop with the overload switch will not short out the overload input signal which turns on the overload detector initially; and as long as the overload circuit is turned on, it will latch again when the overload switch is released.

4-179. The applicable servicing diagram for this circuit is figure 4-47. Complete circuit details are shown in schematic diagram figure 5-45.



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 1A1

Figure 4-22. 1 KW PA Overload Circuit, 1A1, Simplified Schematic Diagram

4-180. 10 KW PA FAULT SENSOR CIRCUIT DESCRIPTION.

4-181. The 10 KW PA fault sensor circuit consists of a ten branch diode OR-gate, five interlock switch circuits, and five silicon-controlled rectifier (SCR) latching fault detectors, one of which has a unijunction transistor driver. Associated with the circuit is a panel mounted FAULT RESET switch and also two relays which are parts of other circuits but are activated by the fault sensor circuit.

4-182. Refer to figure 4-47. Diodes CR1 through CR10 form an OR gate output from the ten branches of the fault sensor circuit to the no-key output line which operates two relays. Normally, the cathodes of the OR gate diodes are not grounded by their associated fault detectors; and positive bias is applied through resistors R1-R10 to provide an operating voltage for the outputs to the fault detector meter circuit. Thus, the fault detector meter indicates that no fault has occurred in a selected branch by deflecting; and the meter indicates a fault by not deflecting when the monitored fault detecgor line has been grounded.

4-183. The no-key output from the OR-gate is applied to two relays; a fault relay in the Fault Control Assembly, which shuts off the high voltage power supply and the +28V supply to the automatic tuning circuits and provides a fault signal to the I. Box system logic circuit; and a no-key relay in the bias supply, which prevents keying when a fault has occurred. The two relays and the ten bias resistors (R1-R10) get their +28 VDC operating voltage through normally-closed FAULT RESET switch S4 and their ground through any of the fault sensor branches and the associated or-gage diode.

4-184. Five branches of the fault sensor are individually actuated when the corresponding interlock switch is closed to apply a ground to the OR gate diode in the output circuit. The other five branches are grounded by SCR1s, which fire when corresponding faults occur. The five branches with interlock switches are self-resetting, i.e., the ground at the no-key output line is removed when the interlock switch is reopened. The five SCR fault detecotors latch once a fault has occurred, and current continues to flow through the relays connected to the no-key output and through the SCR which has fired, until the current path is interrupted by momentarily depressing FAULT RESET switch S4 (or by turning the transmitter completely off).

4-185. The five SCR fault detectors operate basically in the same manner. No current flows through the SCR until a signal is applied to the gate which is about 1 volt more positive than the cathode. Then the SCR fires, and positive current flows from the fault and no-key relays through the anode of the SCR to the cathode and then to ground. Limit switch detector Q5 is fired by +28 VDC from either of two limit switches (9A1A7S1 or 9A1A8S1) if the tune or load variable capacitors run to their end stops (an abnormal condition). VSWR fault detector Q3 is fired by a positive voltage from the reflected-power DC amplifier in the power control circuit if the reflected power level becomes excessive. The input to Q3 is normally adjusted by VSWR limit adjustment potentiometer 9A1A6R4 to fire the SCR at a 1.6 KW average reflected power level.

4-186. The plate and screen fault detectors operate from voltages developed across resistors 9A4R10 and 9A4R13 in the ground return paths from the negative sides of the 8 KW and 1 KV power supplies. The two are similar with the exception that the screen fault detector requires the use of

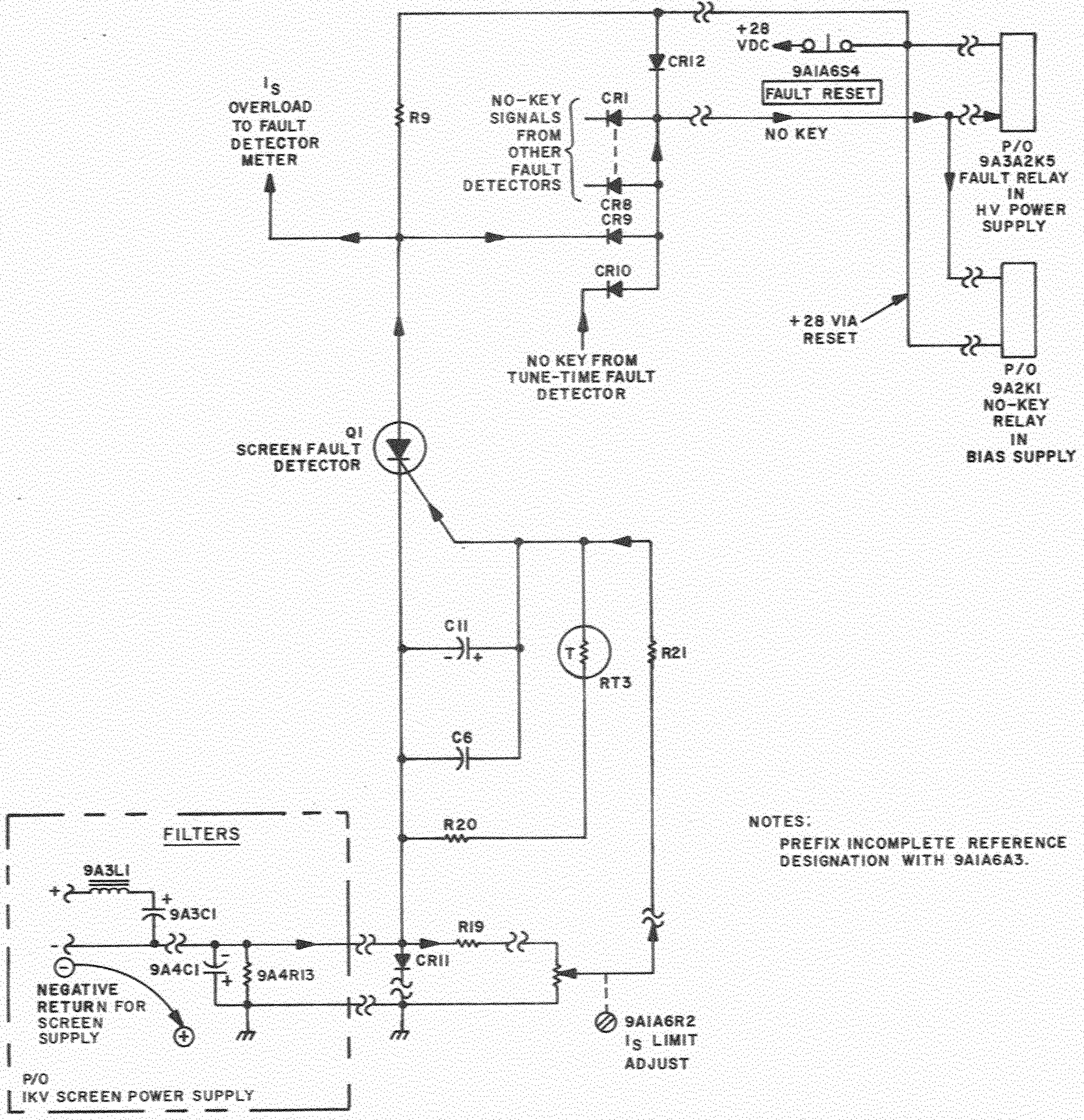


Figure 4-23. Screen Fault Detector, 9A1A6A3, Simplified Schematic Diagram

diode CR11 in the ground return path from the cathode of SCR Q1. When the plate or screen current becomes excessive, the voltage dropped across the corresponding power supply ground return resistor reaches a high enough level to fire Q2 or Q1. Refer to figure 4-23 during the following detailed description of the screen and plate fault detectors.

4-187. The voltage drop across 9A4R13 due to screen current flow results in a screen current monitor voltage which is negative with respect to ground. This voltage is applied to the cathode of Q1 and through R19 to I_S limit adjustment potentiometer 9A1A6R2. The resultant polarity across the potentiometer results in application of a signal to the gate of the SCR which is more positive (less negative) than the cathode voltage, as shown in the diagram. Before Q1 fires, current flow in the fault detector circuit returns to ground through the power supply ground return resistor, 9A4R13. In the plate fault detector circuit, the resistance of the plate supply ground return resistor is low enough to allow proper operation of the fault detector with SCR current flowing through the resistor after the SCR fires. In the screen fault detector circuit, however, the screen supply resistor is of too great a value to permit the SCR anode current to be drawn through it and still maintain the negative screen current monitor signal long enough to permit proper latching of the SCR. Since the fault detector current through 9A4R13 is of opposite polarity to that of the power supply, the negative voltage would be reduced at the instant the SCR fires. Therefore, diode CR11 is used to bypass the positive current from the fired SCR around the resistor. The higher current level and lower resistance of the ground return resistor in the plate power supply makes it unnecessary to bypass SCR anode current around the power supply ground return resistor in the plate fault detector dircuit. The function of capacitor C11 is to maintain the gate voltage long enough to fire the SCR when a momentary overload occurs. C6 is an RF bypass. Thermistor RT3 and resistor R20 provide temperature compensation.

4-188. Refer to figure 4-24 during the following discussion of the tune-time fault detector. The tune-time fault detector is controlled by the tune-up logic circuit, which supplies a ground signal except when tuning or requesting tune power. During the tune cycle, the ground is removed while the bandswitches rotate, the servo motors are tuning or when ever a tune enable is sent to the Exciter. Ground is re-applied when tuning is completed and the tune power request is removed from the I. Box. While ground is applied, R24 holds C9 in a discharged state. When the input ground signal is removed, C9 charges slowly through R25. If the ground is not re-applied to discharge C9 before 15 seconds has elapsed, C9 charges to a high enough positive value to bias the emitter to base 1 junction of unijunction transistor Q6 to conduction. The unijunction timer transistor is thus turned on to trigger SCR latching switch Q4. The SCR remains latched to provide a constant no-key output until reset as previously discussed for the other fault detectors. Unijunction transistor Q6 will return to its off state once the tune power request is removed and the timer reset ground is re-applied.

4-189. The applicable servicing diagram for the fault detector circuits is figure 4-47. Adjustments are described in paragraphs 5-31b and 5-31c. Complete circuit details are shown in schematic diagram, figure 5-53.

4-190. 1 KW PA TGC-PPC CIRCUIT DESCRIPTION.

4-191. The 1 KW PA TGC-PPC circuit (figure 4-25) consists of seven transistor stages. The function of this circuit is to generate control voltages which are used internally and in the Exciter to prevent overdrive and to compensate for system gain variations over the 2-30 MC frequency range. The control voltages are derived from the outputs of VSWR bridge 1A1A3 in the 1 KW PA and the meter amplifier in the 10 KW PA which are, in essence, the envelopes of the forward and reflected RF signals at the output of 1 KW PA and the 10 KW PA units. An auxiliary input is received from the 10 KW PA tune overload protection amplifier.

4-192. The forward output of VSWR Bridge Assembly 1A1A3 is applied to the input of the PPC circuit at a voltage divider consisting of R26 and Internal Power Set potentiometer 1A1R12. This potentiometer is adjusted for sufficient sensitivity at the input of threshold detector Q9 so that the output of the 1 KW PA cannot exceed a safe level (approximately 1 KW) with front panel PWR control potentiometer 1A1R13 set for full output. The reflected output of VSWR bridge 1A1A3 is applied across the voltage divider formed by R25 and R19. The output from this divider, when at a level greater than that at the voltage divider for the forward input, is applied to the base of threshold detector Q9 through diode gate CR9. Thus, whichever voltage divider output is greater will control the system power. The reflected input voltage divider attenuates the signal less than the forward input is attenuated so that less reflected power is required to exert control than forward power. Whenever the VSWR exceeds 3:1, the reflected input exerts control.

4-193. In a like manner, the external forward and reflected signals from the 10 KW PA meter amplifier are applied to the base

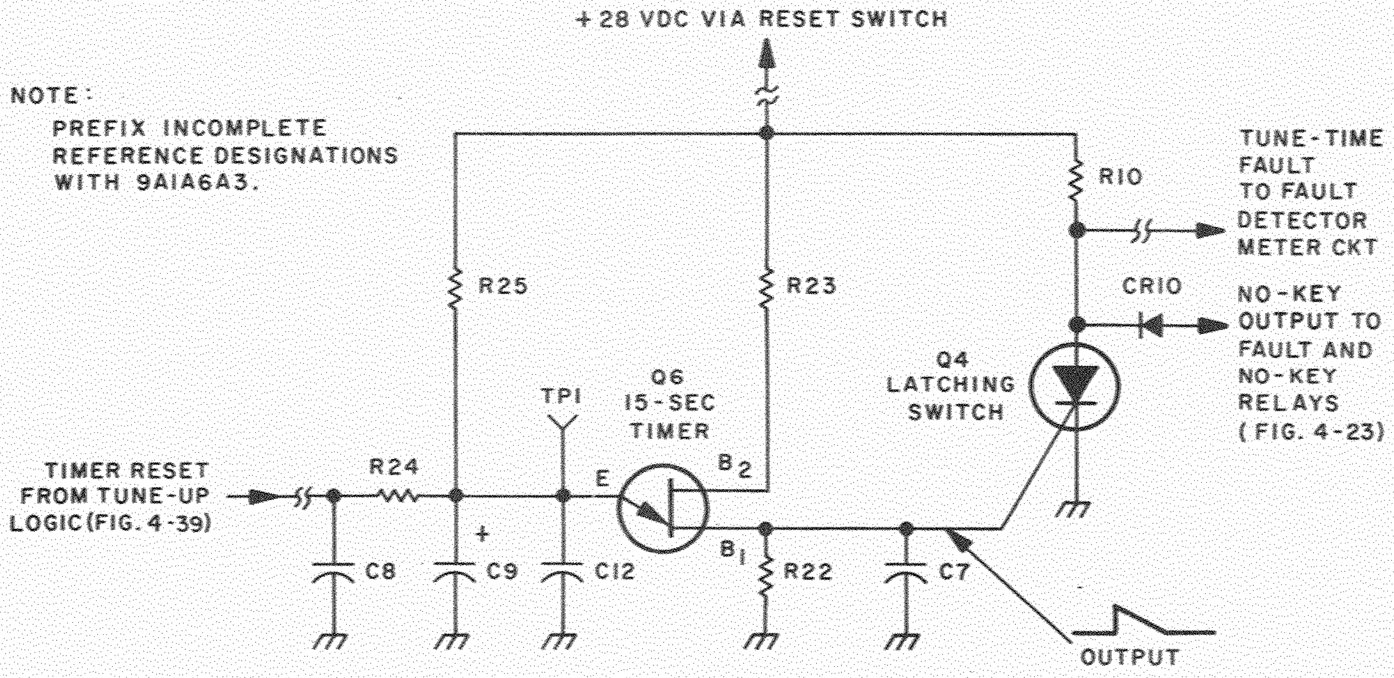


Figure 4-24. Tune-time Fault Detector, 9A1A6A3, Simplified Schematic Diagram

of threshold detector Q8 through the forward signal voltage divider, consisting of R16 and External Power Set potentiomerter 1A1R11, and the reflected signal voltage divider and diode gate, consisting of R17, R18 and CR8. The two threshold detectors, Q8 and Q9, are connected in parallel so that any of the four input signals can control the PPC signal, depending on which has the higher voltage. The external forward and reflected inputs from the 10 KW PA are normally the controlling elements in the PPC circuit. The internal inputs take over control only during a failure of the external inputs and, as such, are just added protection. The threshold level is determined by threshold reference state Q7, which develops a reference voltage across emitter resistor R21. The threshold voltage is set initially by a voltage from PWR control potentiometer 1A1R13, which is applied through diode gate CR14 to Q7 base voltage divider R23-R24. Reducing the setting of PWR control potentiometer 1A1R13 reduces the output of the system by lowering the threshold and thus the level of the input signal required to generate a PPC output signal.

4-194. When the output of any of the input voltage dividers reaches a level greater than the preset threshold reference voltage at the emitter plus the transistor base to emitter voltage drop, the corresponding threshold detector conducts and draws current through the base of amplifier Q10. The amplified signal from the collector of Q10 drives cascade emitter follower stage Q12-Q11, which provides a low impedance source to drive the PPC line to the Exciter. The output from Q11 charges output capacitor C5 quickly through low value resistor R39; but C5 discharges slowly through high value shunt resistor R31. The result is a fast attack, slow release time constant, which is required for proper control of SSB voice and similar signals which have recurring peaks. Capacitor C6 is used to prevent oscillations in amplifier stage Q10.

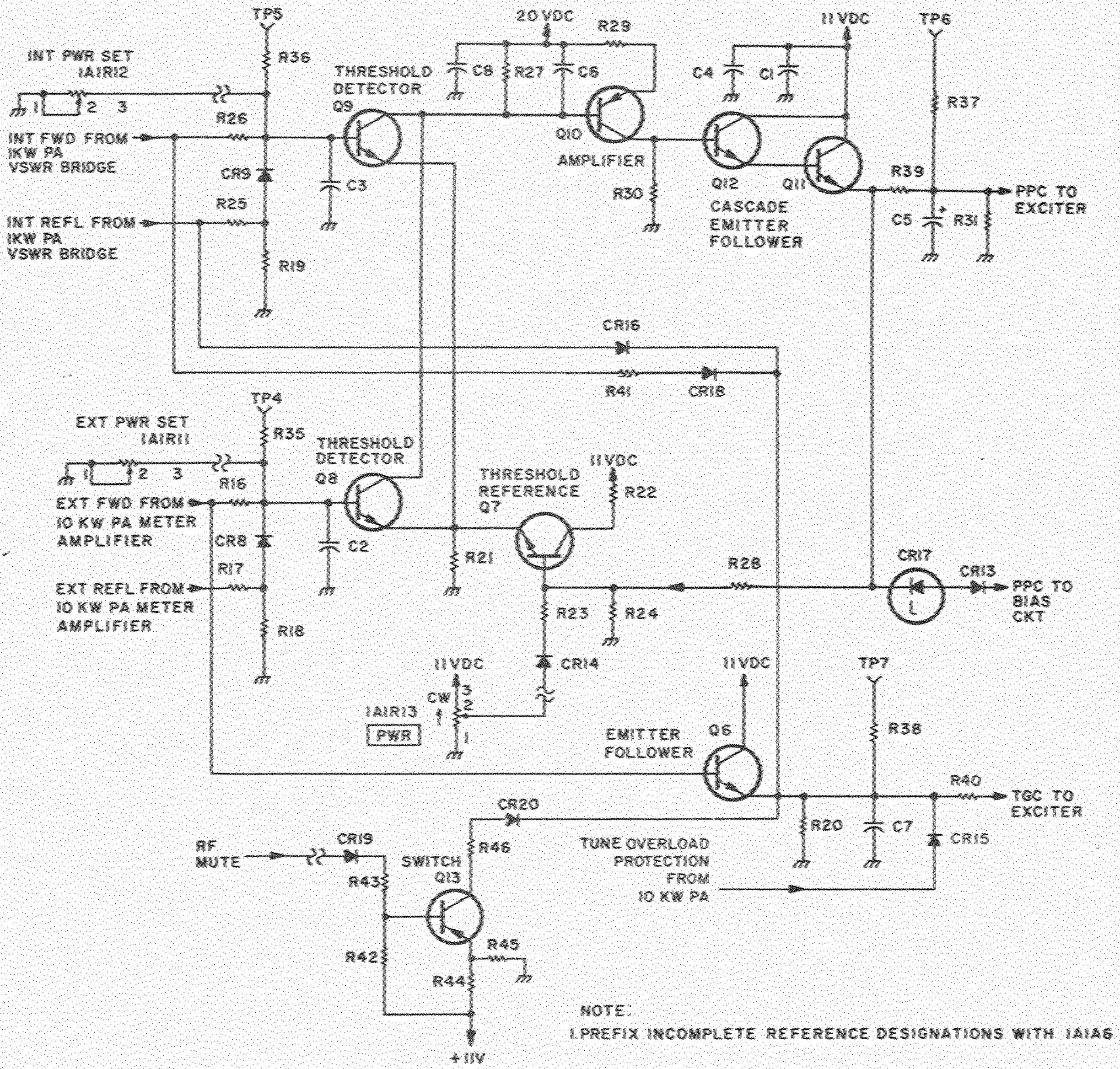
4-195. Some of the output at the emitter of Q11 is applied through R28 to the base of threshold reference stage Q7 to provide negative feedback for stabilizing the amplifier circuits. The output at the emitter of Q11 is also applied through zener diode C17 and diode gate CR13 to PPC amplifier Q4 in the bias circuit. If the PPC circuit in the Exciter fails, the PPC voltage will rise higher than normal, and Q4 will be biased partially off to increase the bias to the driver stage and consequently reduce the power of the 1 KW PA and 10 KW PA units to a safe level. Therefore, the 1 KW PA and 10 KW PA units are always protected against excessive drive to the final amplifier tubes.

4-196. The external forward input from the 10 KW PA meter amplifier circuit is also fed directly to the base of emitter follower Q6. The low impedance output from the emitter of Q6 is essentially a duplicate of the envelope input signal. This signal is applied to the TGC circuit in the Exciter and is used during the transmitter tune cycle to limit the tune power level and to adjust the drive level to compensate for variations in transmitter gain which occur over the 2-30 MC operating frequency range.

4-197. Diode gate CR15 provides an auxiliary TGC circuit input for the Tune Overload Protection (T.O.P.) line from the 10 KW PA. The 10 KW PA tune overload protection amplifier provides a T.O.P. control voltage proportional to the screen and plate current of the 10 KW PA tube. When the 10 KW PA is in a tune cycle, but the output network is not tuned close enough to resonance to produce sufficient RF forward power to safely limit the drive level, the T.O.P. signals will exert control by producing the required TGC voltage to limit the plate current to about 2.5 amperes. As the output network approaches the correct tuning point, the plate current is reduced and the RF forward power level increases to assume control of the TGC signal.

4-198. Diode gates CR16 and CR18 are used in the AN/FRT-83 transmitter for backup protection against TGC failure. Switch Q13 is used in conjunction with diode gate CR20 to provide a dummy TGC signal during an RF mute pulse, also necessary only in the AN/FRT-83 transmitter. Neither of these features are required for the AN/FRT-84 transmitter, nor do they affect normal operation. Due to commonality of the 1 KW PA unit in both the AN/FRT-83 and AN/FRT-84 transmitters, these circuits are provided in all 1 KW PA units.

4-199. The applicable servicing diagrams for this circuit is figure 4-48. Internal and external power set adjustments are described in paragraph 5-41. Repair of emitter-follower Q6 may necessitate TGC adjustment in the Exciter (paragraph 5-36). Complete circuit details are provided in schematic diagram figure 5-45.



NOTE:
1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 1A1A6

Figure 4-25. 1 KW PA TGC - PPC Circuit, 1A1A6, Simplified Schematic Diagram

4-200. METERING CIRCUITS FUNCTIONAL DESCRIPTION

4-201. Six metering circuits in the 1 KW PA and 10 KW PA units provide a method of monitoring significant parameters and troubleshooting common faults. Refer to figure 4-26.

4-202. The 1 KW PA multipurpose meter circuit receives signals from the driver and final amplifier stages to indicate RF input power and cathode currents for individual electron tubes in the amplifier stages. It also receives signals from the high voltage power supply circuit to indicate plate and screen voltages.

4-203. The 10 KW PA multimeter circuit receives signals from the detector which allow it to indicate tune and load error signals and the RF voltages at the cathode and plate of the power amplifier stage. It also receives and indicates levels of tune and load set and position signals from the servo circuits; forward and reflected power signals from the directional coupler, and a screen current signal from the high voltage power supply. Three other positions of the meter switch facilitate general troubleshooting DC voltage measurements to ground, using a detachable test lead, in ranges of 6, 60, and 600 VDC.

4-204. The 10 KW PA fault detector meter circuit indicates AC line voltage and +28 VDC power supply voltage; filament, +15V, -15V, and bias voltages from the bias and servo power supply; +1 KV and +8 KV from the high voltage power supply; and the outputs of the various overload and interlock fault detectors in the fault sensor circuit.

4-205. The 10 KW PA plate current meter provides a continuous indication of power amplifier tube plate current. The meter operates from a voltage developed across the gound return resistor in the high voltage power supply.

4-206. The 10 KW PA peak/average power meter circuit indicates forward power in one range and reflected power in two ranges, reading either peak or average power, from signals applied to the circuit from the directional coupler through DC amplifiers in the meter amplifier circuit (not to be confused with peak/average power meter circuit which is separate).

4-207. 1 KW PA MULTIPURPOSE METER CIRCUIT DESCRIPTION.

4-208. The 1 KW PA multipurpose meter circuit (figure 4-38) consists of meter M1, meter switch S5, a peak detector circuit, and meter resistor assembly A7. The function of the circuit is to allow significant parameters of the driver and final amplifier stages and their associated power supplies to be checked.

4-209. When the multimeter selector is set at DRIVER 2, DRIVER 1, PA PLATE 2, or PA PLATE 1 (AMPERES), cathode current of the respective amplifier tube produces a proportional voltage drop across its cathode resistor. The voltages thus developed are applied selectively through calibrating resistors (in the RF amplifier circuits) to the meter.

4-210. A sample of the RF input at the control grids of the driver tubes is peak detected by input power detector A1CR1-CR2 to provide a proportional DC voltage. The DC signal operates the meter through current amplifier A6Q1 when the multimeter selector is set to INPUT POWER 0-150 MW.

4-211. High voltages of 2400 VDC, 600 VDC, and 287 VDC (PA PLATE, DRIVER PLATE, and PA-DRIVER SCREEN VOLTS multimeter selector positions, respectively) are indicated on the meter by current from these power supplies flowing through calibrating resistors in meter resistor assembly A7.

4-212. The applicable servicing diagram for this circuit is figure 4-38. Complete circuit details are shown in schematic diagram figure 5-45.

4-213. 10 KW PA MULTIMETER CIRCUIT DESCRIPTION.

4-214. The 10 KW PA multimeter circuit. (figure 4-44) consists of a meter, a switch, a detector circuit, a meter amplifier, and numerous voltage dividing and calibrating resistors. The function of this circuit is to allow the following significant parameters of the 10 KW PA to be monitored:

a. When multimeter selector S1 is positioned at V_K, (position 1) a voltage from the detector, which is proportional to the 10 KW PA cathode RF voltage, is applied through calibrating resistors R2 and R4 to meter amplifier IC1.

b. When multimeter selector Sl is positioned at V_P, (position 2) a voltage from the detector assembly, which is proportional to the 10 KW PA plate RF voltage, is applied through calibrating resistors R3 and R5 to meter amplifier IC1.

c. When multimeter selector S1 is positioned at I_s, (position 3) 10 KW PA final amplifier screen current develops a proportional voltage drop across resistor 9A4R13 which is integrated by capacitor 9A4C1 and applied through meter calibrating resistors R19 and R18 to meter amplifier IC1.

d. When multimeter selector S1 is positioned at P_F, (position 4) a voltage from the directional coupler proportional to the forward RF power output is applied to meter amplifier IC1.

e. When multimeter selector S1 is positioned at P_R, (position 5) a voltage from the directional coupler proportional to the reflected RF output power is applied to meter amplifier IC1.

f. When multimeter selector S1 is positioned at TUNE SET (position 6), a preposition reference voltage from band repeater assembly 9A1A13 is applied to one of the inputs of meter amplifier IC1, and the actual position reference voltage from 9A1A7R1 is applied to the other input of IC1. Equal voltages will produce a null on multimeter M1 when the correct preposition setting is reached.

g. When multimeter selector S1 is positioned at TUNE POS, (position 7) a position reference voltage from potentiometer 9A1A7R1 is applied through calibrating resistors R7 and R8 to meter amplifier IC1.

h. When multimeter selector S1 is positioned at TUNE DET (position 8), a voltage proportional to the phase error between the cathode and plate RF voltages is applied through calibrating resistors R9 and R10 to meter amplifier IC1. A null indicates the correct setting of the tune variable capacitor in the matching network.

i. When multimeter selector S1 is positioned at LOAD DET (position 9), a voltage proportional to the amplitude difference between the plate and cathode load detector voltages is applied through calibrating resistors R1 and R6 to meter amplifier IC1. A null (occurring at the same time a null is obtained on TUNE DET) indicates the correct setting of the load variable capacitors in the matching network.

j. When multimeter selector S1 is positioned at LOAD POS (position 10), a position voltage from potentiometer 9A1A8R1 is applied through calibrating resistors R11 and R12 to meter amplifier IC1.

k. When multimeter selector S1 is positioned at LOAD SET (position 11), a preposition reference voltage from Band Repeater Assembly 9A1A13 is applied to one of the inputs of meter amplifier IC1, and the actual position information voltage from potentiometer 9A8A7R1 is applied to the other meter amplifier input. Equal voltages will produce a null when the correct preposition setting is reached.

l. When multimeter selector S1 is positioned at 6, 60, or 600 (position 12, 13,

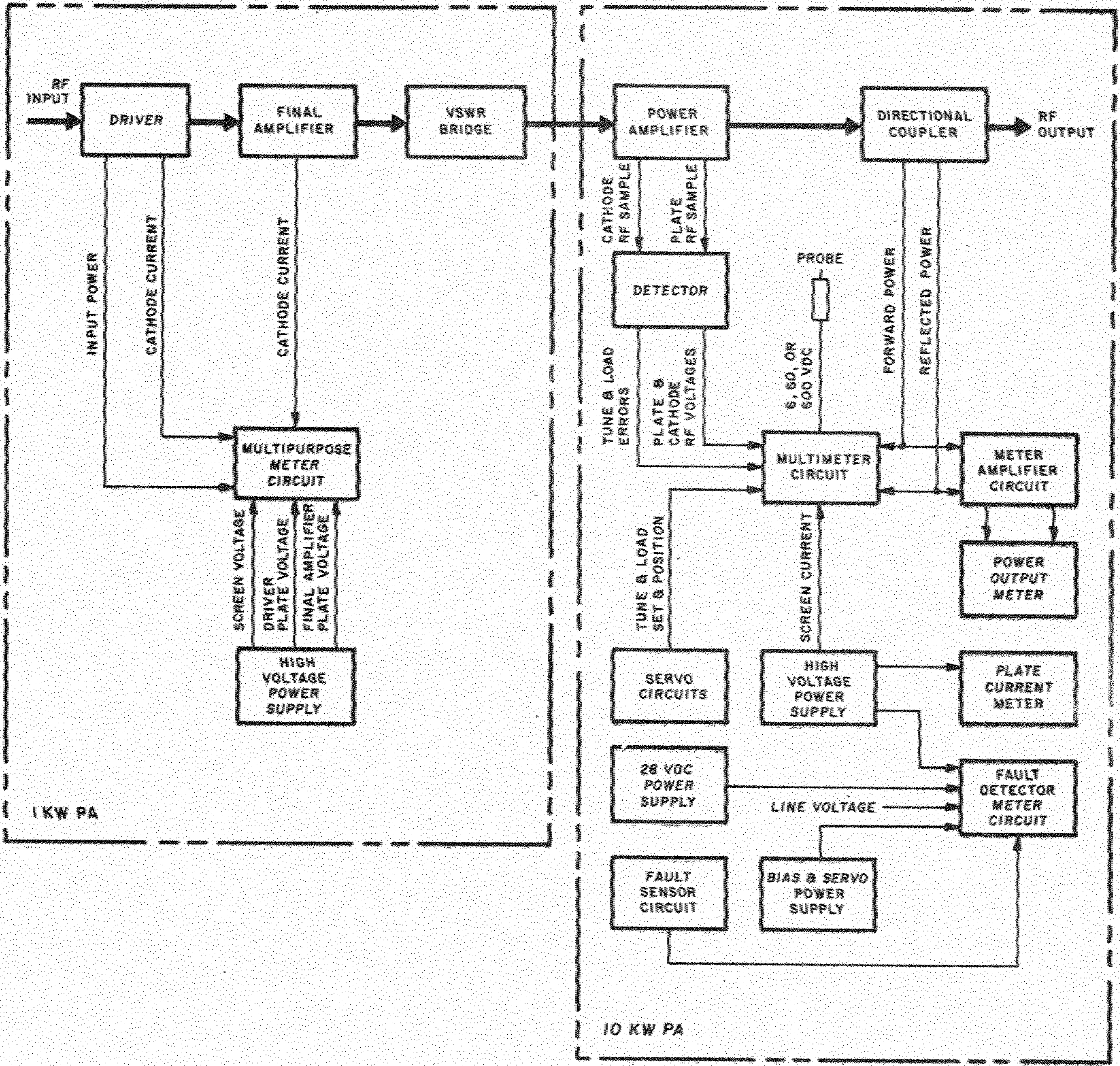


Figure 4-26. Metering Circuits, Functional Block Diagram

or 14), any voltage applied to PROBE connector 9A1A5J5 is applied through calibrating resistors R13-R17, as appropriate, to meter amplifier IC1.

m. When multimeter selector S1 is positioned at ZERO (position 15), both inputs to meter amplifier IC1 are grounded, providing a null check of the meter and meter amplifier circuits.

4-215. The applicable servicing diagram for this circuit is figure 4-44. Complete circuit details are shown in schematic ciagram figure 5-51.

4-216. 10 KW PA FAULT DETECTOR METER CIRCUIT

4-217. The fault detector meter circuit (figure 4-45) consists of a meter, a meter switch, and various calibrating resistors. The function of this circuit is to provide indications of some of the operating voltages in the equipment, and to provide a means of determining fault locations.

4-218. When fault detector meter selector A4S1 is positioned at LINE, 28V, FIL, +15V, BIAS, +1 KV, or +8 KV (positions 1-8), suitable calibrating resistors are inserted by fault detector meter switch A4S1, and the outputs of the power supplies are monitored by fault detector meter A4M1.

4-219. When fault detector meter selector A4S1 is positioned at I_S, I_P, SWR, TUNE TIME, TUNE LIMIT, STICK, SLIDE, CB, PL, or IN (positions 9-18), +28 VDC from the fault sensor is normally applied through a series resistor in the fault sensor and calibrating resistor A4R6 to fault detector meter A4M1. If a fault is present, the +28 VDC signal is shorted to ground at the fault sensor series resistor, resulting in no meter deflection.

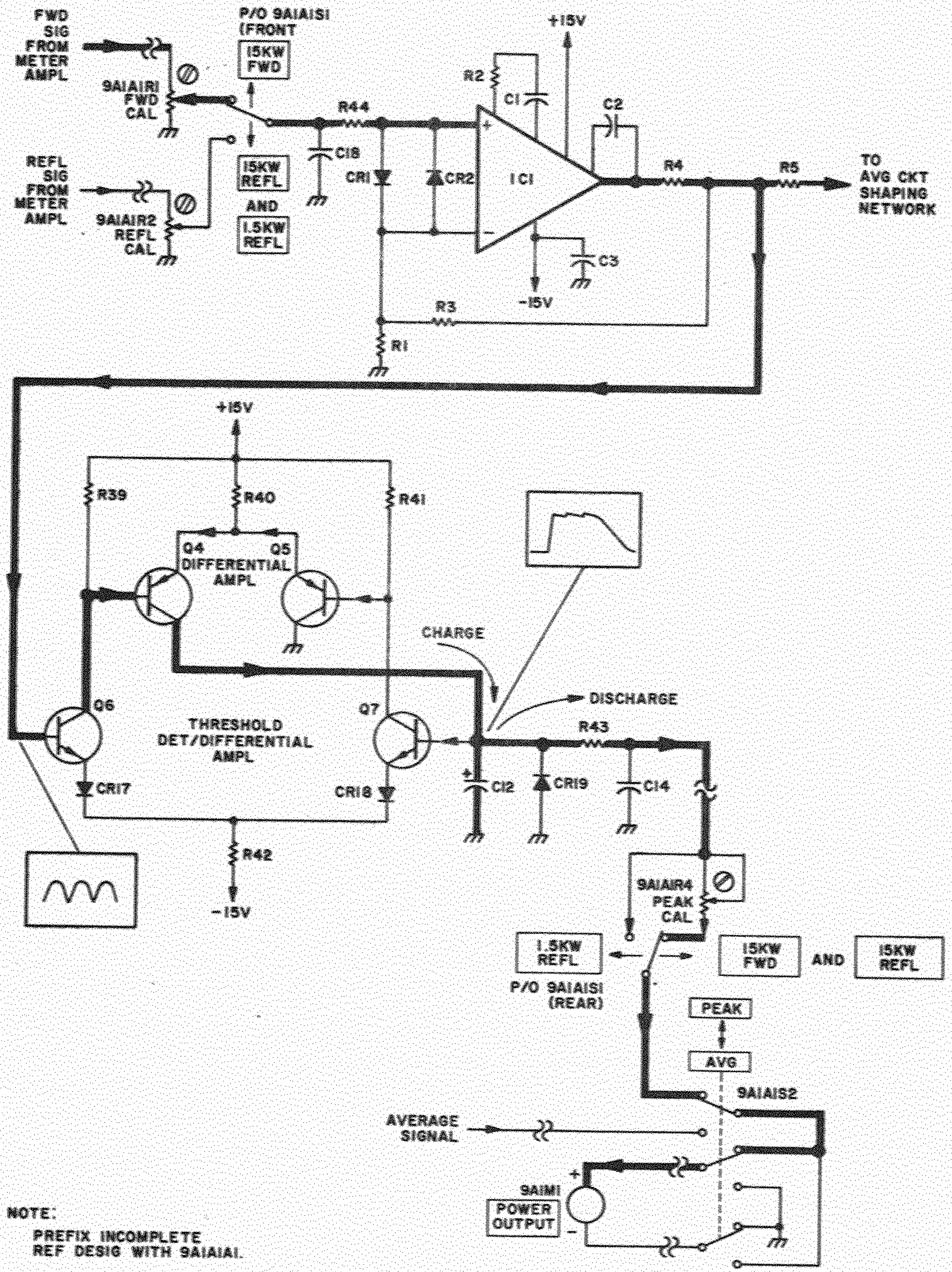
4-220. The applicable servicing diagram for this circuit is figure 4-45. The bias voltage meter calibration adjustment (9A1A6R5) is described in paragraph 5-28e. The filament voltage meter calibration adjustment (9A1A6R6) is described in paragraph 5-28d. Complete circuit details are shown in schematic diagram figure 5-53.

4-221. 10 KW PA PEAK/AVERAGE METER CIRCUIT DESCRIPTION.

4-222. The peak/average meter circuit (figure 4-46) consists essentially of six stages of signal processing, employing amplifiers, detectors, and shaping network. The function of the circuit is to convert envelope signals from the meter amplifiers to true peak and average DC signals with a relatively low source impedance to drive the power meter on the front door of the 10 KW PA cabinet.

4-223. Refer to figure 4-27. The forward and reflected input signals from the meter amplifier stages (on DC Amplifier Assembly 9A1A5) are adjusted by forward and reflected calibrate potentiometers 9A1A1R1 and 9A1A1R2. The two signals are selectively applied to input amplifier IC1 through range selector 9A1A1S1. IC1 has a voltage gain of 2, as determined by the ratio of feedback resistors (R3/R1), and ahigh current gain. R4 is a current limiter. Diodes CR1 and CR2 limit the input voltage. The components associated with this stage which have not been mentioned are employed for stablization and RF bypassing. The output of IC1 is applied simultaneously to the peak and average signal processing circuits. The outputs of the peak and average processing circuits are connected selectively through PEAK/AVG switch 9S1A1S2 to the power meter. The switch also reverses the meter connections to accommodate the positive output voltage of the peak circuit and the negative output of the average circuit.

4-224. The peak detector circuit consists of two cascade differential amplifiers, with the single output of the second stage connected is such a manner that it can reapidly charge C12 to a positive level, but not discharge it One input to the first differential amplifier (Q4-Q7) is supplied from the output of input amplifier IC1, which is essentially an envelope of the transmitted signal waveform. The input to the other side of the differential amplifier is connected to C12, a capacitor which supplies the signal to the



NOTE:
PREFIX INCOMPLETE
REF DESIG WITH 9A1A1A1.

Figure 4-27. Peak/Average Meter Circuit; Input Amplifier, Peak Detector, and Meter; 9A1A1A1, Simplified Schematic Diagram meter. Because of the common mode element (R42) in the emitter circuits of both Q6 and Q7, the two emitters are always at close to the same potential. One of the transistors will usually be turned on at any time, depending on which base has a voltage sufficiently higher than the common emitter voltage.

4-225. Q6 can conduct only when the voltage at its base is greater than the voltage on C12, since by emitter-follower action C12 and Q7 regulate the emitter voltage of Q6, and thus the cut-off voltage for the base of Q6. Q4 conducts to charge C12 whenever Q6 conducts.

4-226. Because of the common mode emitter action at R40, whenever the voltage at the base of Q6 drops below that at the base of Q7, Q7 and Q5 conduct to cut off Q4 and prevent discharge of C12. A fast-attack, slow-release time constant results from the extremely fast charging of C12 through the high gain amplifier circuit and the slow discharge through the relatively light loading of R43 and the power meter in parallel with the Q7 base circuit.

4-227. Diode CR19 protects C12 against the possibility of reverse voltage application from the emitter circuit of Q7. Diodes CR17 and CR18 protect against reverse voltage breakdown from emitter to base in transistors Q6 and Q7. Potentiometer 9A1A1R4 in series with the meter signal line is adjusted for proper full scale reading on the 15 KW range when using the 1.5 KW REFL range, switch 9A1A1S1 bypasses the potentiometer to lower the voltage required for full scale meter deflection.

4-228. Refer to figure 4-28. The average power section consists of integrator IC2 and its associated input and output shaping networks. The integrator stage requires an input signal which has a voltage directly proportional to the RF power level at the output of the transmitter. However, the output of the directional coupler and the meter amplifiers (and thus the output of the input amplifier) is approximately proportional to the square root of the output power. Therefore, a shaping network (to be discussed later) is used before the integrator to compensate for the compressed response of the directional coupler. Since the original response is of the type desirable to operate the meter (providing a compression at high power levels), additional shaping networks are used at the output of the integrator. Separate ones are used due to the use of different scales on the meter for the 1.5 KW and 15 KW ranges.

4-229. Integrator IC2 is an operational amplifier, which is employed in a fashion which allows it to respond to the average value of the input signal. The device has a very high input impedance, a low output impedance, high current gain, and an inverted output (positive signal applied to inverting input port). The voltage gain of the stage is determined by the feedback and input networks. The voltage gain is normally 2; and it is increased to 20 for the 1.5 KW REFL range.

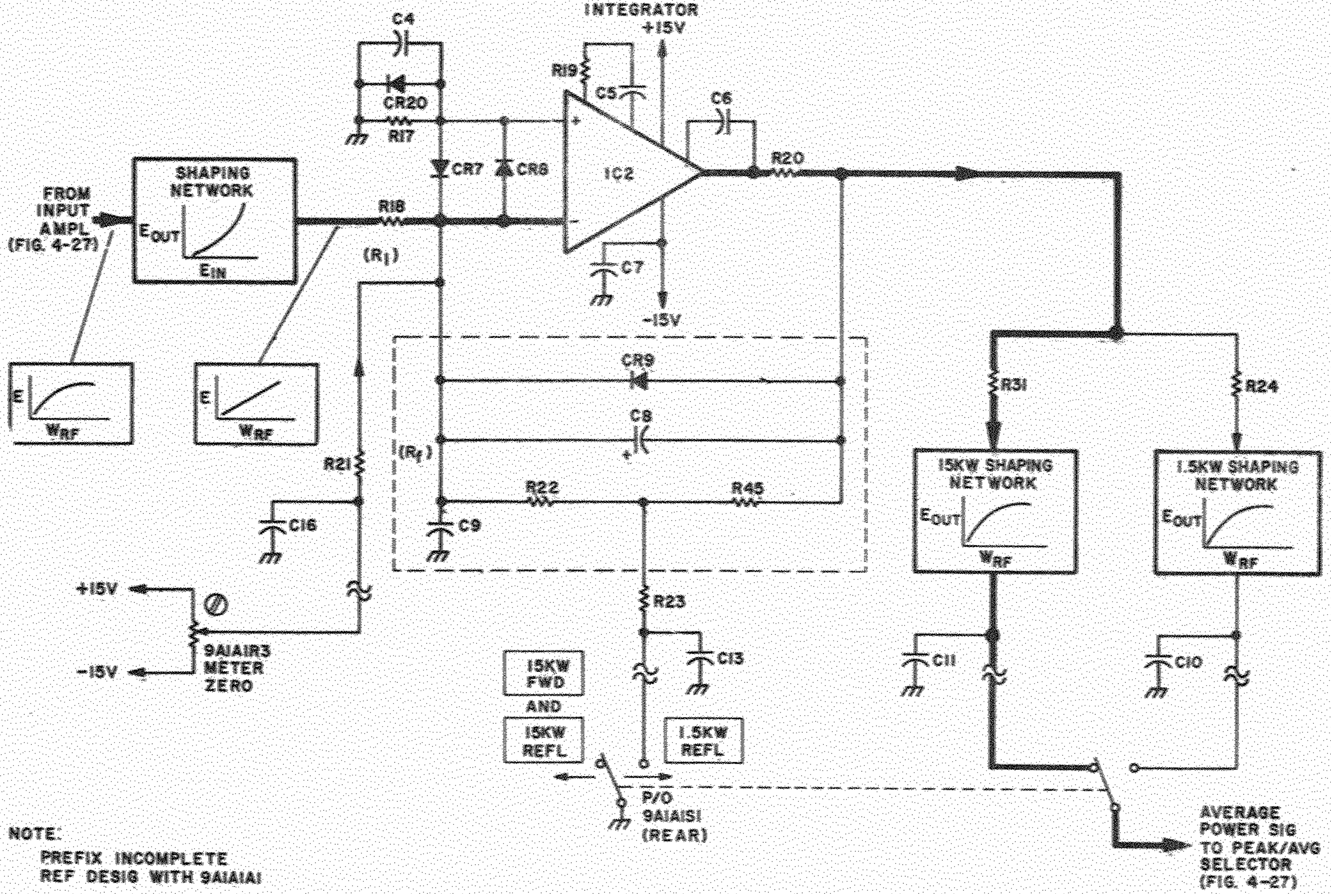
4-230. The normal voltage gain is determined by the impedance of the feedback network (R_f) divided by the impedance of the input resistance (R_i). Considering the parts of R_f, it is evident that the DC voltage gain is established by the ratio of R45 and R22 (in series) to R18. R45 + R22 = 2 x R18, so the gain is normally 2. For AC signals, C8 provides a very low impedance compared to R18, so there is essentially no voltage developed due to the AC component of the input envelope signal. The output of the integrator, therefore, only responds to the DC component of the envelope signal.

The output is a slowly varying DC voltage which follows the average power, regardless of the waveform characteristics of the RF signal. Diode CR9 protects C8 against reverse polarity. Resistor R23 is grounded when 9A1A1S1 is set to the 1.5 KW REFL range, to increase the gain of the integrator state. R22, R23, and R45 then act as a "T" pad attenuator to reduce the feedback and thus increase the DC gain.

4-231. A bias voltage, set by meter zero potentiometer 9A1A1R3, is applied through R21 to the input port of IC2 to balance the idling output of the stage to zero. Diodes CR7 and CR8 protect theamplifier by limiting the input. Diode CR20 prevents latch up if the positive supply is applied momentarily sooner at turn-on than the negative supply. The capacitors which have not been discussed as yet are for RF bypassing and protection against oscillation. R20 is current limiter.

4-232. Refer to figure 4-29 during the following discussion of the input shaping network. The network consists of three diode-resistor voltage dividers, a constant current source, and a temperature compensating transistor stage. The compressed signal from the input emitter follower amplifier is applied to the network through R5, which is considered as half of a voltage divider. The three diode-resistor networks are the other half.

The example voltages marked at the junctions of the biasing networks for the diodes and the response curves illustrate how the biased diodes turn off at progressively increasing



NOTE:
PREFIX INCOMPLETE REF DESIG WITH 9A1A1A1

Figure 4-28. Peak/Average Power Meter Circuit, Average Detector, Simplified Schematic Diagram voltages at the input of R5 to lighten the loading at the "bottom" part of the voltage divider. Starting at 0 volts applied to R5, all diodes are conducting, and thus load the output side of R5. As the voltage at the cathode of each diode approaches the bias voltage applied at the anode, the diode begins to gradually turn off. The degree to which each diode circuit loads the output of R5, when the diode is fully conducting, is dependent upon the values of the resistors in the respective bias voltage divider (R8-R9, R10-R11, or R12-R13). As the diode begins to cut off, its resistance increases and adds to that of the biasing resistors to increase the load resistance. At cut-off , the diode no longer loads the output of R5, therefore the voltage at the output of the shaping network can increase faster with respect to the increase in R5 input voltage. Values of resistance and bias are selected to provide the results shown at the bottom curve, to compensate for the compression of the signal applied to the input of R5.

4-233. The bottom of each biasing network is tied to ground through Q1, which compensates for changes in diode conduction with temperature. The transistor base-emitter junction is connected in a manner such that its change with temperature offsets that in the diodes. Constant current source transistor Q2 is provided to absorb the idling current which flows from the diode circuits into the shaping network output lines. This operates in conjunction with the meter zero potentiometer in the integrator stage to set the input to the integrator to zero with no input signal at R5. Diode CR6 in the constant-current-source stage temperature compensates Q2.

The two output shaping networks each have slightly different characteristics due to the separate meter scales for the high and low ranges, and they operate in a

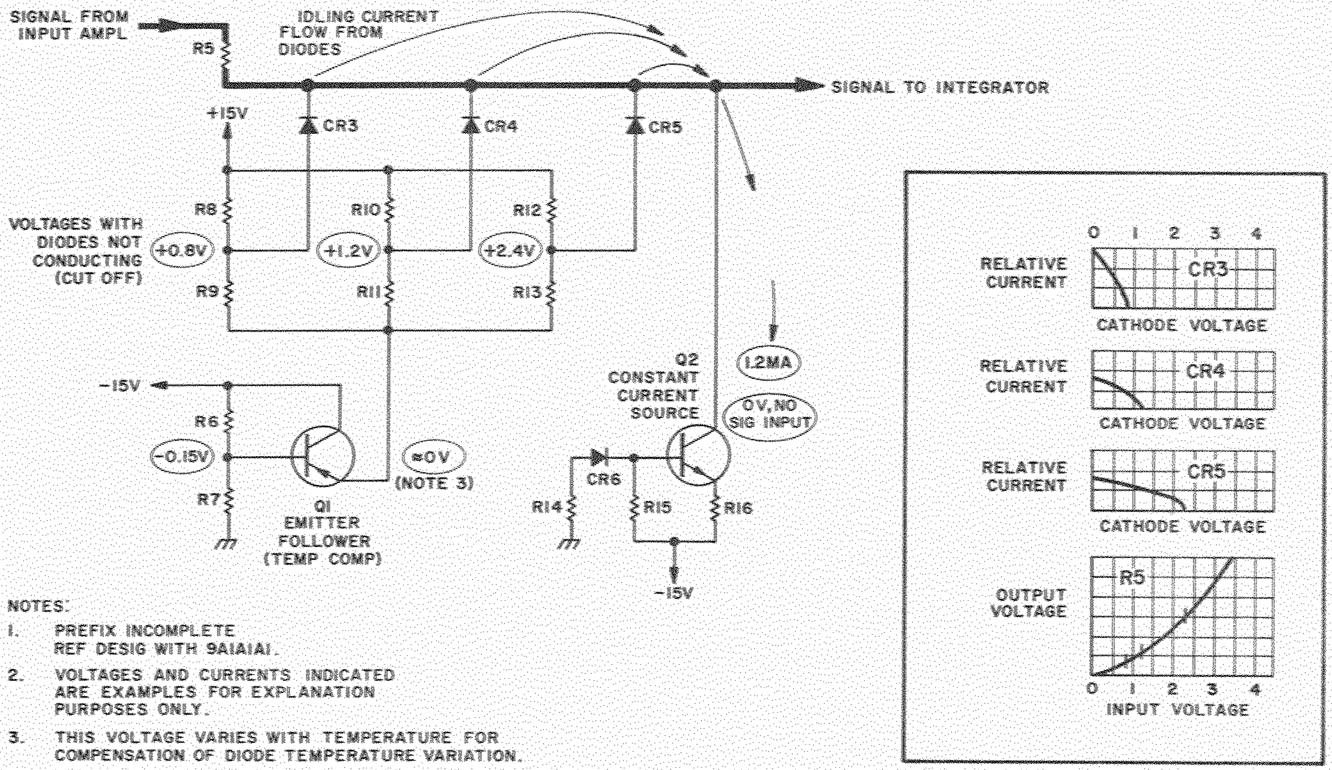


Figure 4-29. Input Shaping Network, 9A1A1A1, Simplified Schematic Diagram

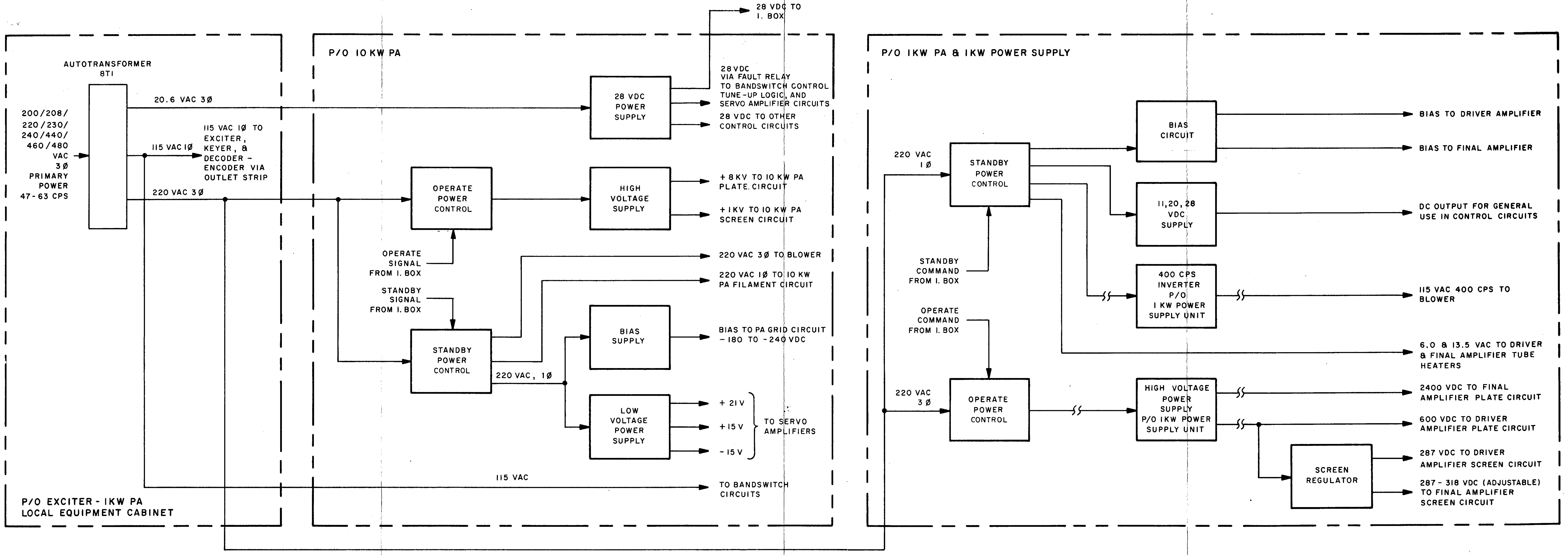


Figure 4-30. Power Supply Circuits,
Functional Block Diagram

similar but reverse manner from the input shaping network. The diodes are connected and biased to turn on in progression, rather than turn off, to provide the opposite response and thus convert back to a non-linear voltage to RF power relationship. A temperature compensating transistor is provided, as in the input shaping network. However, because the diodes are used in opposite manner, the emitter-base junction temperature effect of the compensating transistor adds to the temperature problem, in this case, instead of compensating. Therefore, two series diodes are used in the compensating transistor base-biasing circuit: one to cancel the base-emitter effect and one to provide the desired compensation.

4-234. The applicable servicing diagram for this circuit is figure 4-46. Adjustments are described in paragraph 5-32. Complete circuit details are shown in schematic diagram figure 5-51.

4-235. POWER SUPPLY CIRCUITS FUNCTIONAL DESCRIPTION.

4-236. The power supply circuits (figure 4-30) provide all voltages necessary to operate the AN/FRT-84(V) from either a 220 or a 460 VAC, 3 phase source. Taps on the input of autotransformer 8T1 allow for small deviations from the nominal voltage.

4-237. The 220 VAC, 3 phase output of the autotransformer is applied to the standby and operate power control circuits in the 1 and 19 KW PA units. In the 10 KW PA, this power is applied to the blower, the filament circuit, the bias supply, and the low voltage power supply when the equipment is in the standby condition, and additionally to the high voltage power supply in the operate condition. In the 1 KW PA, one phase of this power is applied through the standby power distribution circuit to the bias circuit, the 11, 20, and 28 VDC supply, the 400 CPS inverter, and the tube filament circuit. In the operate condition, 220 VAC, 3 phase power is applied to the high voltage power supply which furnishes 600 VDC and 2400 VDC for amplifier tube plates and 600 VDC to the screen regulator for the amplifier screen circuits. (The 400 CPS inverter and the high voltage power supply are located in the 1 KW Power Supply.) The 20.6 VAC, 3 phase power from the autotransformer is supplied to the 28 VDC power supply in the 10 KW PA cabinet. This furnishes 28 VDC for operation of various control circuits in the 10 KW PA and in the I. Box unit. The 28 VDC for the automatic tuning circuits is disabled by a fault relay whenever a 10 KW PA fault occurs. One branch of 115 VAC, 1 phase power is applied through an outlet strip to the Exciter and to the optional Keyer and Decoder-Encoder units. A second 115 VAC 1 phase tap on the autotransformer powers the bandswitch circuits in the 10 KW PA.

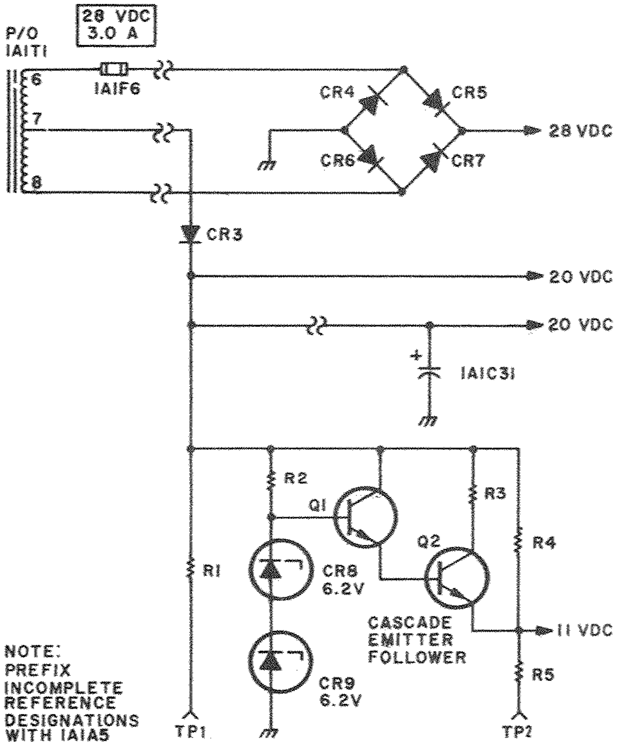
4-238. 1 KW PA 11, 20, AND 28 VDC POWER SUPPLY CIRCUIT DESCRIPTION.

4-239. The 11, 20, and 28 VDC power supply in the 1 KW PA (figure 4-31) consists of a bridge rectifier, a filter, and a voltage regulator. The function of this circuit is to provide the low DC voltages required for the operation of the 1 KW PA control circuits.

4-240. The output of secondary winding 6-8 of transformer 1A1T1 (activated when standby relay 1A1K2 is energized) is full-wave bridge rectified by diodes CR4 through CR7, producing an unfiltered DC output with an average value of 28 VDC.

4-241. Because one side of the secondary winding of transformer 1A1T1 is always grounded through CR4 or CR6 during any particular half-cycle of AC output from the winding, and the other side is always positive with respect to the grounded side, a positive voltage equal to one-half the voltage across the full secondary is present at the center tap. Diodes CR5 and CR7 are not a part of this circuit, since only CR4 and CR6 in the ground return path are required for full-wave rectification. The positive full-wave rectified output from the center tap of the secondary winding is routed through isolation diode CR3 to charge capacitor 1A1C31. The isolation diode allows the capacitor to charge to the peak value of the voltage from the center tap, which is about 20 volts.

4-242. In addition to being applied to some of the control circuitry, the 20 VDC is also applied to the 11 VDC regulator. Voltage divider R2-CR8-CR9 provides a stable reference voltage at the base of the first emitter follower Q1. By emitter follower action, the voltage at the emitters of Q1 and Q2 must remain fixed with relation to the voltage at the base of Q1, regardless of changing load conditions. Q1 and Q2 provide current gain to allow a relatively large current to be controlled by the low current zener diode regulator at the base of Q1. The output of the 11 VDC supply is taken through two current paths, consisting of R3-Q2 and R4 in parallel. The excess of the 20 volt input voltage is dropped across R4 and the combination of R3 and the collector-base junction of Q2. The dynamic resistance in Q2 changes with load current and input voltage variations to maintain regulation of the output voltage. R3 is connected in series with Q2 so that the entire voltage drop of about 9 volts does not take place in Q2, thereby reducing the power dissipation in the transistor. Resistor R4 is used so that with minimum load current, very little current is drawn through Q2; thus providing a further reduction in transistor power dissipation.



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH IAIA5

Figure 4-31. 1 KW PA 11, 20, and 28 VDC Power Supply, 1A1A5, Simplified Schematic Diagram

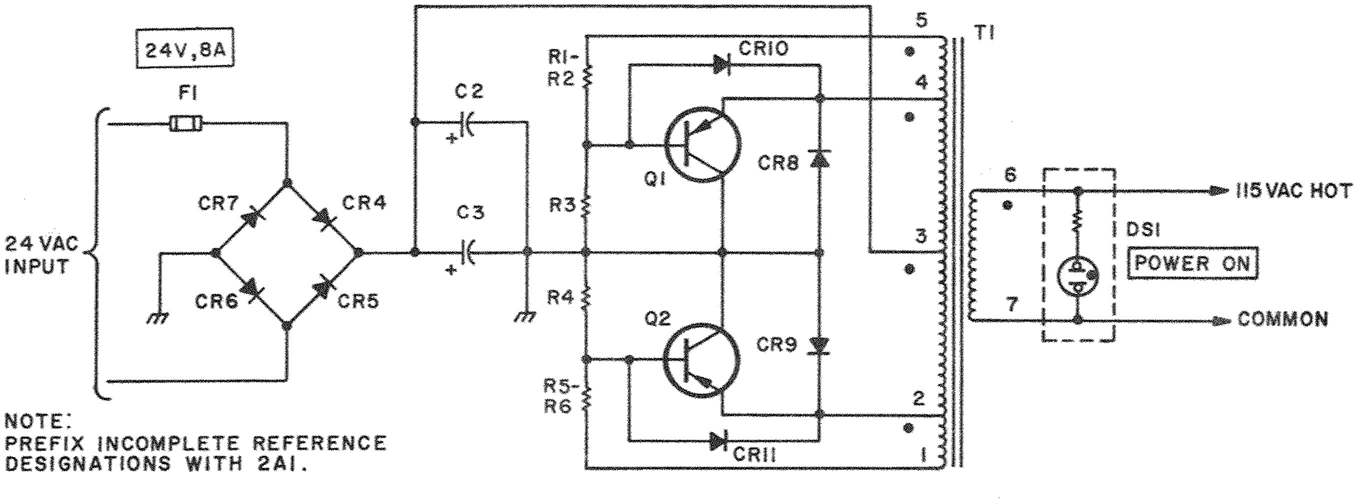
4-243. The applicable servicing diagram for this circuit is figure 4-49. Complete circuit details are shown in schematic diagram figure 5-44.

4-244. 1 KW POWER SUPPLY 400 CPS INVERTER CIRCUIT DESCRIPTION

2-245. The 400 CPS inverter in the 1 KW Power Supply unit (figure 4-32) is a saturable core oscillator. The function of this circuit is to produce a 115 VAC, 400 CPS, single phase output to power the blower in the 1 KW PA and the POWER ON indicator lamp in the 1 KW Power Supply.

4-246. The 400 CPS inverter utilizes a saturablecore transformer oscillator circuit to develop a 115 VAC, 400 CPS output from the 24 VAC, 60 CPS input supplied by the secondary of transformer 2A2T2. When standby relay 1A1K2 is energized, ϕ A and ϕ B primary power inputs are applied to the primary of 2A2T2. The 24 VAC output of 2A2T2 is full-wave rectified by a diode bridge consisting of CR4 through CR7. This bridge delivers its DC output to the center tap on the primary winding of transformer T1. Capacitors C2 and C3 provide filtering of the bridge rectifier output.

4-247. Resistors R3 and R4 pull the bases of transistors Q1 and Q2 toward ground, tending to turn both transistors on. Because the two sides of the circuit are never precisely balanced, one transistor will conduct more strongly than the other. Assume that transistor Q1 conducts more strongly, inducing a voltage in winding 3-4 with a polarity that makes terminal 3 more positive than terminal 4. By transformer action, terminal 4 will be more positive than terminal 5, terminal 2 more positive than terminal 3, and terminal 2 more positive than terminal 2. Therefore, transistor Q2 becomes reverse biased and transistor Q1 becomes more strongly forward biased. Due to the positive feedback loop between base and emitter through feedback winding 4-5, the collector-to-emitter current flow will regeneratively increase rapidly until the transistor is driven into saturation. When this occurs, the primary voltage can no longer increase and a condition of quasi-stable equilibrium is maintained. During this equilibrium period, the voltage drop across the transistor is small, and essentially the full 24 VDC is dropped across winding 3-4 of transformer T1. With a constant voltage across the winding, both the current and the magnetic flux increase until the core reaches saturation, a process requiring about 8.3 mSEC. At this time, the exciting current required by the transformer exceeds that which is supplied by the transistor, so the current can rise no more. Therefore, transistor Q1 is regeneratively turned off, ending the first half cycle. As the flux in the transformer collapses, the polarity of the voltages induced in the transformer is opposite to that originally induced. Therefore, transistor Q2 becomes turned on and is regeneratively driven into saturation. Transistor Q2 then continues to conduct until the transformer core is driven into negative saturation. The flux will then again collapse, regeneratively turning transistor Q2 off and transistor Q1 back on, completing a full cycle. This switching action continues at a 400 CPS rate, as determined by the magnetic, electrical, and dimensional characteristics of transformer T1, and the value of the supply



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 2A1.

Figure 4-32. 400 CPS Inverter, 2A1, Simplified Schematic Diagram voltage. The peak voltage from the emitter of either transistor to ground is approximately twice the supply voltage.

4-248. As the transistors turn on and off, spikes are produced in the circuit. Diodes CR8 and CR9 preclude possible transistor damage by preventing these spikes from pulling the emitters of the transistors below ground. Similarly, diodes CR10 and CR11 provide protection against excessive base-to-emitter voltage. Resistors R1-R2 and R5-R6 limit the base current in transistors Q1 and Q2 to the correct value.

4-249. The AC voltage induced in the primary of transformer T1 is coupled by transformer action to secondary winding 6-7. The 115 VAC, 400 CPS developed in the secondary is applied to POWER ON indicator DS1 and to blower 1A1B1 in the 1 KW PA.

4-250. The applicable servicing diagram for this circuit is figure 4-49. Complete circuit details are shown in schematic diagram figure 5-48.

4-251. 1 KW POWER SUPPLY HIGH VOLTAGE POWER SUPPLY CIRCUIT DESCRIPTION

WARNING

> The 1 KW PA high voltage power supply contains voltages up to 2400 VDC. Use appropriate precautions when servicing.

4-252. The high voltage power supply in the 1 KW Power Supply (figure 4-33) consists of a three-phase transformer, 3 three-phase diode blocks, and various other parts. The function of this circuit is to produce the 2400 and 600 VDC required by the four electron tubes in the driver and final amplifiers.

4-253. When operate relay 1A1K1 is energized,

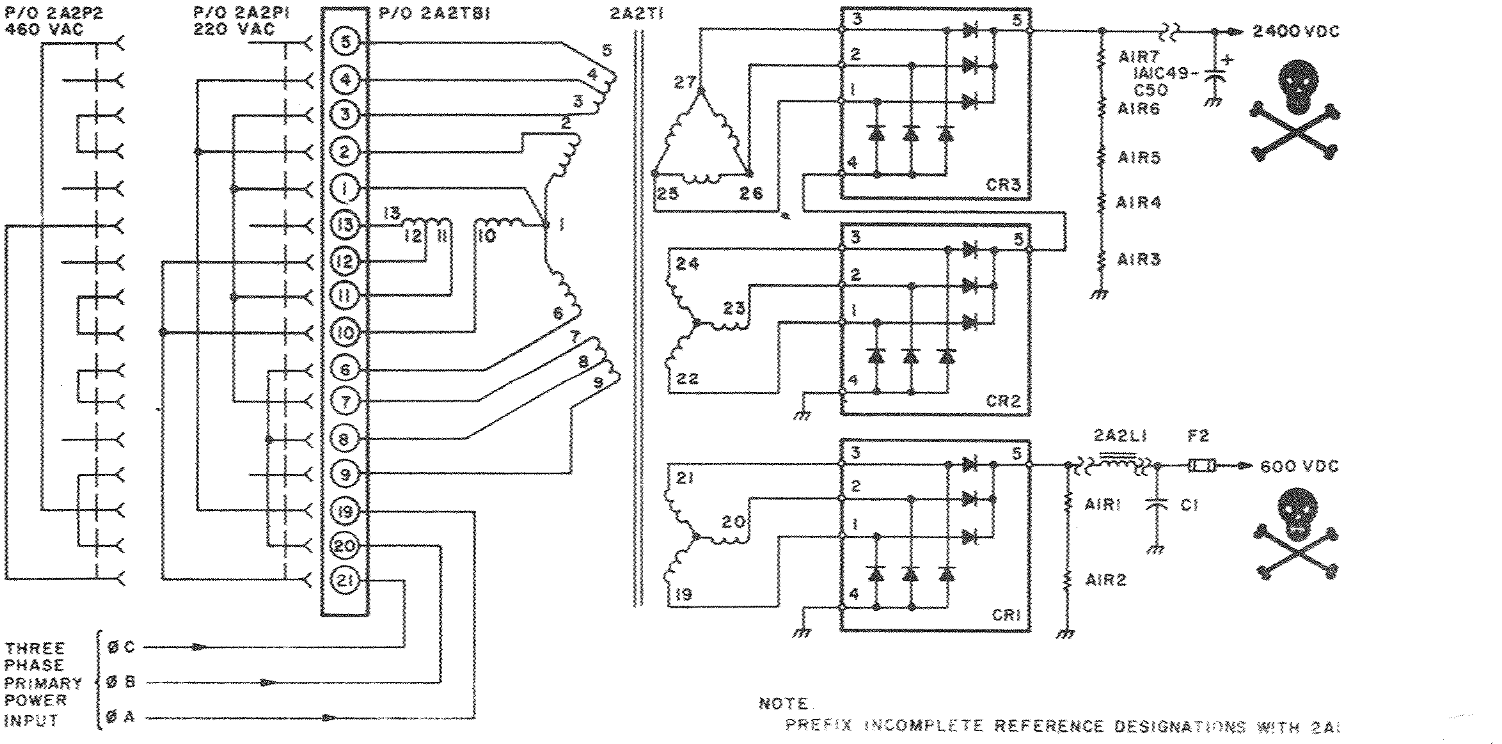


Figure 4-33. 1 KW Power Supply High Voltage Power Supply, 2A1, Simplified Schematic Diagram

the three phase primary power is applied through one of two jumpering schemes to the primary windings of transformer 2A2T1. The primary is a wye type in which each leg consists of two windings. The windings are jumpered together according to the voltage of the three phase input. The output from transformer 2A2T1 consists of three secondary windings: two wye type and one delta type.

4-254. The output from wye winding 19-20-21 is full-wave rectified by three-phase diode stack CR1 to produce 600 VDC. This 600 VDC is filtered by inductor 2A2L1 and capacitor C1, and applied through fuse F1 to the 1 KW PA. The 600 VDC is used as plate voltage for the two electron tubes in the driver amplifier and as input to the screen regulator to provide screen voltage for all four final and driver amplifier electron tubes.

4-255. The output from wye winding 22-23-24 is full-wave rectified by three-phase diode stack CR2 to produce 1200 VDC. This 1200 VDC is used as the return for three phase diode stack CR3. The output from delta winding 25-26-27 is full-wave rectified by three-phase diode stack CR3, producing 1200 VDC that is added to the 1200 VDC output from three phase diode stack CR2. This results in the required 2400 VDC. This 2400 VDC is filtered slightly by capacitor 1A1C49 in the 1 KW PA (not shown) and is used as plate voltage for the two electron tubes in the final amplifier. One wye and one delta winding are used to produce the 2400 VDC rather than a single winding, since the phase relationships inherent in this combination produce one-quarter the ripple amplitude and twice the ripple frequency as compared with a single winding, thus requiring less filtering.

4-256. The applicable servicing diagram for this circuit is figure 4-49. Complete circuit details are shown in schematic diagram figure 5-50.

4-257. 10 KW PA BIAS SUPPLY CIRCUIT DESCRIPTION.

WARNING

This circuit contains voltages as great as -600 VDC. Use appropriate precautions when servicing.

4-258. The 10 KW PA bias supply (figure 4-34) consists of a voltage doubler and filter, voltage dividers, and switching circuits. The function of this circuit is to provide the required grid bias voltages for operation of the 10 KW PA final amplifier tube. Until the system is keyed, the output from the bias supply is at the correct level to bias the tube beyond cut-off. When the system is keyed, the bias voltage changes to the value required to establish the proper plate current in the tube.

4-259. 220 VAC operating voltage for the bias supply is obtained from the autotransformer and is applied to primary winding 1-2 of transformer 9A2T1 whenever the filament contactor is energized. The output of winding 3-4 of transformer 9A2T1 is applied to diodes 9A2CR1-CR2, and capacitors 9A1C1-C2, which form a voltage doubler circuit and provide -600 VDC to the voltage divider composed of 9A2A1R1-R2-R15 and BIAS ADJUST potentiometer 9A1A6R1. The potentiometer allows the operating bias to be varied from -180 VDC to -240 VDC.

4-260. Relays 9A2K1 and 9A2K2 switch the bias, providing cut-off bias (approximately -600 VDC) when unkeyed. Relay 9A2A1K1 prevents bias switching if either an RF mute or a no key signal (ground) is recieved through 9A2A1CR19 or 9A2A1CR20. (Refer to 10 KW PA keying circuit, paragraph

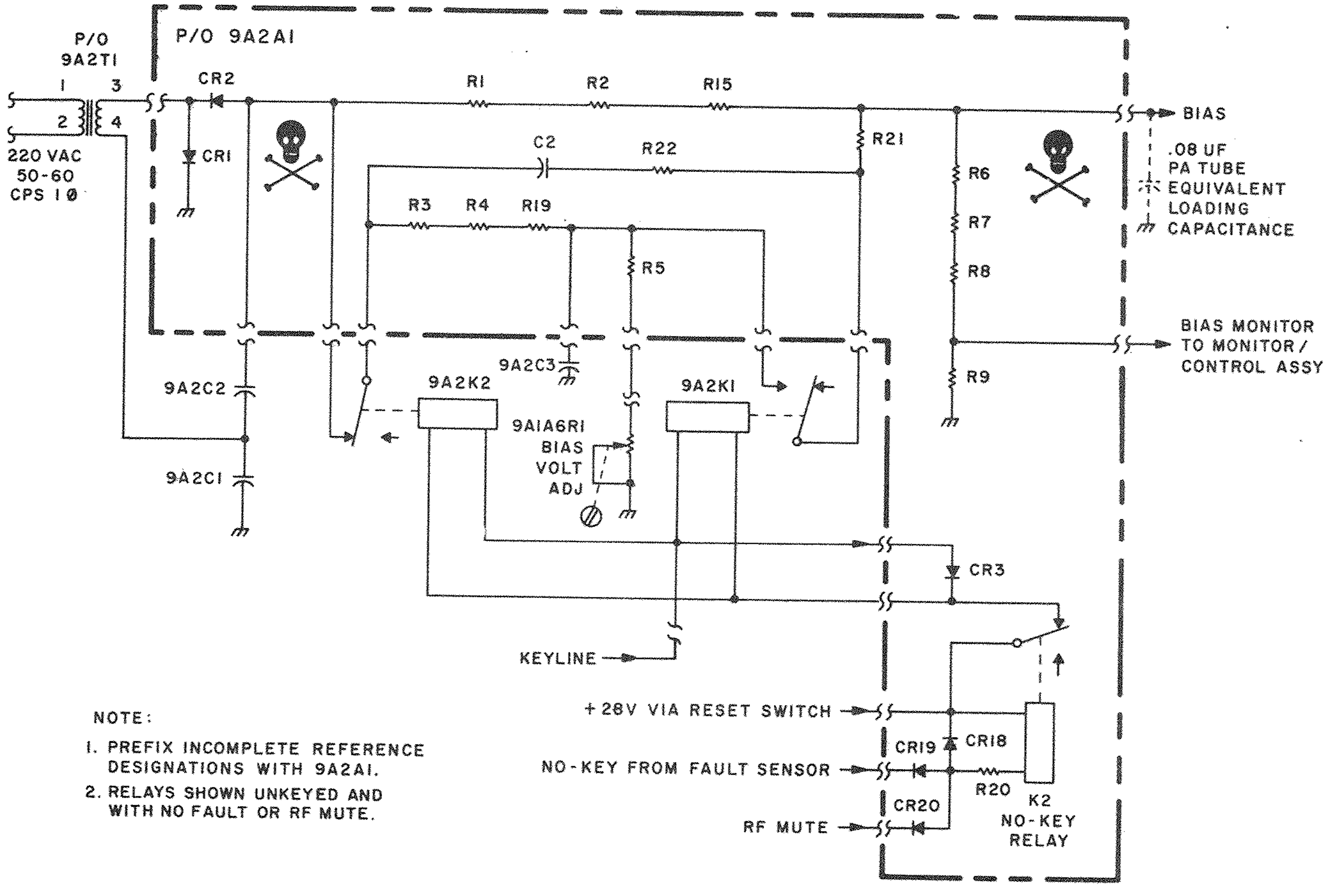
4-152, for keying details.)

4-261. Resistors 9A2A1R21 and 9A2A1R22 are current limiting resistors which provide protection for the contacts of relays 9A2K1 and 9A2K2. Capacitor 9A2A1C2 speeds up the voltage transition from cutoff to the operating level when the supply is keyed. While unkeyed, a charge is built up across the .08 uf equivalent capacitance of the grid circuit of the final amplifier tube. This capacitance is largely composed of decoupling and bypass capacitors. While the tube is biased to cutoff, 9A2C3 ishld charged to slightly below the correct operating bias by voltage divider 9A2A1R3-R4-R19-R5 and 1A1A6R1. This ensures that, when the supply is keyed, the bias value is reduced to the operating level quickly as the .08 uf capacitance is discharged through 9A2A1R21 into 9A2C3 to bring 9A2C3 up to the correct value. 9A2C3 also provides additional filtering to eliminate any 120 cycle ripple voltage from the grid while operating voltage is being supplied.

4-262. The applicable servicing diagram for this circuit is figure 4-50. Adjustment of bias adjust control 9A1A6R1 is described in paragraph 5-28e. Complete circuit details are shown in schematic diagram figure 5-50.

4-263. 10 KW PA LOW VOLTAGE POWER SUPPLY (±15 VDC) CIRCUIT DESCRIPTION

4-264. The 10 KW PA Servo Supply (figure 4-35) consists of a full wave bridge rectifier, two filters, and two regulators. The function of this circuit is to produce the voltages



NOTE:
1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 9A2A1.
2. RELAYS SHOWN UNKEYED AND WITH NO FAULT OR RF MUTE.

Figure 4-34. 10 KW PA Bias Supply, 9A2A1, Simplified Schematic Diagram required for the operation of the meter amplifier, the servo amplifiers and some control relays.

4-265. The operating voltage for the 10 KW PA servo supply is obtained from the autotransformer and is applied to the primary winding of transformer 9A2T1 whenever the filament contactor is energized.

4-266. The output from secondary winding 5-7 of transformer 9A2T1 is full-wave bridge rectified by CR4-CR7 and filtered by 9A2C4 and 9A2C5, providing ±21 VDC whichis supplied to two series voltage regulators, Q1 and Q2. Diodes CR8-CR12 and CR13-CR17 in conjunction with resistors R11 and R17 respectively, provide reference voltages for the bases of Q1 and Q2. Resistor R10 provides some of the voltage drop for the +15 VDC regulator and therefore reduces the dissipation of Q1 under heavy load. The same is not required for the -15 VDC regulator, since its pass transistor has a higher dissipation rating.

4-267. The applicable servicing diagram for this circuit is figure 4-50. Complete circuit details are shown in schematic diagram figure 5-50.

4-268. 10 KW PA HIGH VOLTAGE POWER SUPPLY CIRCUIT DESCRIPTION

WARNING

The circuit contains voltages up to 8 KVDC. Use appropriate precautions when servicing.

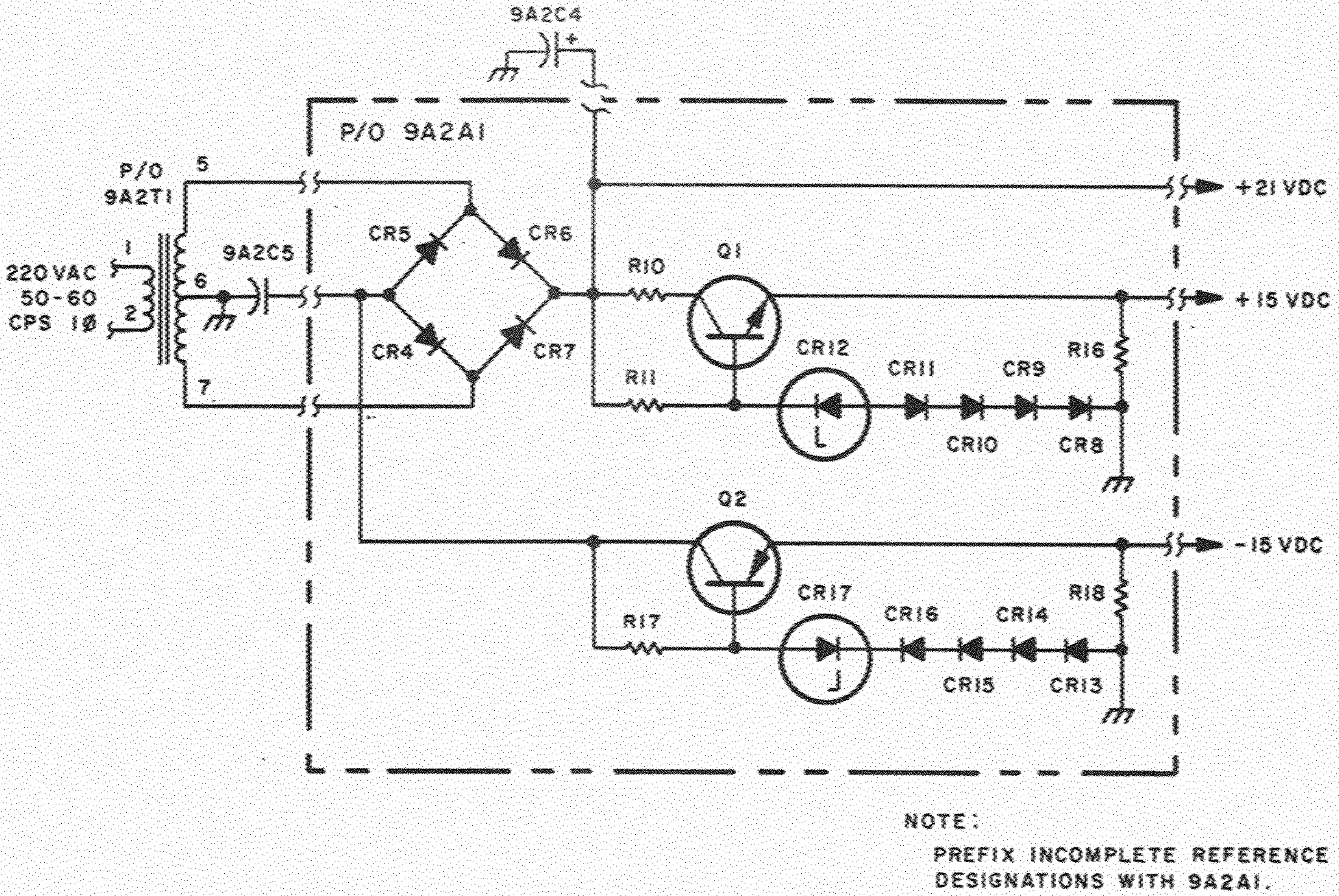
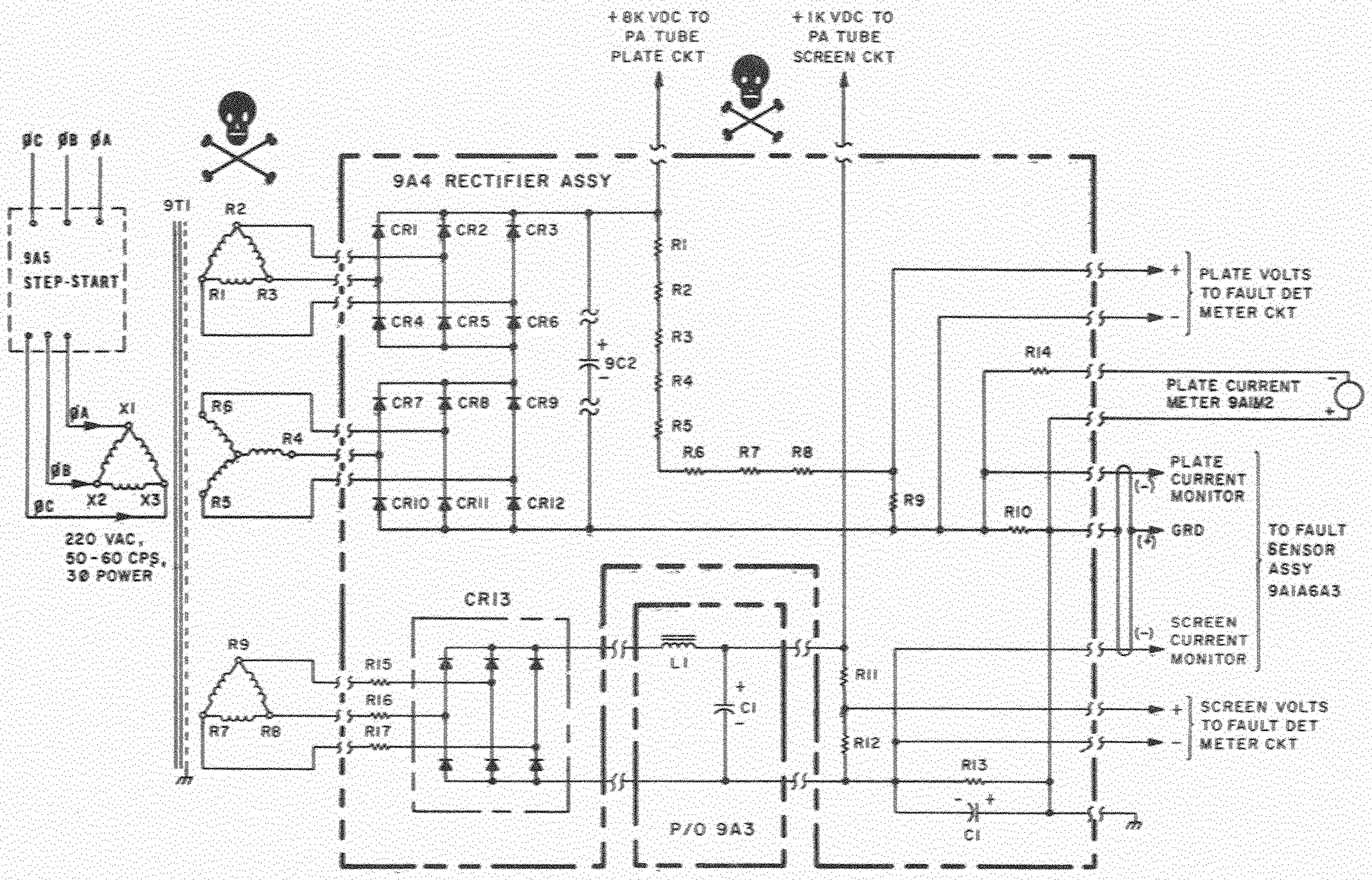


Figure 4-35. 10 KW PA Low Voltage Power Supply, 9A2A1, Simplified Schematic Diagram

4-269. The high voltage power supply (figure 4-36) consists of a three-phase transformer, 3 three-phase bridge rectifiers, and various other related parts. The primary function of this circuit is to produce the 8 KV plate supply and the 1 KV screen supply for amplifier tube 9A1V1.

4-270. When plate supply contactor 9A3K4 is energized, 220 VAC three-phase power from the autotransformer in the Exciter-1 KW PA cabinet is connected through the step-start to 10 KW PA power transformer 9T1 at primary windings X1-X2-X3. The output from delta-connected secondary windings R7,R8,R9 is full-wave rectified by three-phase diode bridge CR13 and filtered by choke 9A3L1 and capacitor 9A3C1 to produce +1 KVDC for the screen grid of the amplifier tube. The output of wye-connected secondary windings R4-R5 -R6 is full-wave rectified by diode stacks CR7-CR12 and added to the output of delta-connected windings R1-R2-R3, which is full-wave rectified by diode stacks CR1-CR6, to produce +8 KVDC for the plate supply. Combining a delta-connected secondary with a wye-connected secondary in this manner results in one-quarter the ripple amplitude and twice the ripple frequency compared with using a single 8000 volt secondary of either type. The filtering requirements are thereby minimized. The +8 KVDC output is filtered by capacitor 9C2.



NOTE:
PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 9A4.

Figure 4-36. 10 KW PA High Voltage Power Supply, 9A4, Simplified Schematic Diagram

4-271. Bleeder resistors are provided for the 8 KVDC, and 1 KVDC power supply outputs. Taps are provided between some of the series-connected bleeder resistors to supply appropriate supply voltage monitor signals to Monitor/Control Assembly 9A1A6 for the fault detector meter circuit. Plate current is sampled across current sensing resistor R10, and the resultant monitor signal is applied through calibration resistor R14 to PLATE CURRENT meter 9A1M2. Automatic fault sensing with respect to plate current and screen current is provided by analog current monitor signals from the power supply ground return resistors which are applied to Fault Sensor Assembly 9A1A6A3. The plate and screen current monitor signals are also applied to TGC DC amplifier 9A1A6A2Q2 to control the TGC signal during the initial portion of a tune-up cycle. The screen current monitor signal also feeds into one position of the MULTIMETER selector in Multimeter Assembly 9A1A5A4. Capacitor C1 reduces transients on the screen current monitor line. Resistors R15, R16, and R17 serve as current limiters (fuses) for the screen supply.

4-272. The applicable servicing diagram for this circuit is figure 4-50. Complete circuit details are shown in schematic diagram figure 5-50.

4-273. TRANSMITTER STANDBY AND OPERATE CONTROL CIRCUIT DESCRIPTIONS

4-274. The standby and operate control circuit consists of various relays and switches. This circuit controls the standby and operate functions of the 1 KW PA and 10 KW PA units and provides standby and operate status signals to the Exciter.

4-275. Refer to figure 4-51. System power control is accomplished from the Exciter. 28 VDC from the I. Box is supplied through interlock extension terminals 8TB1-1 & 2 to the Exciter as a standby/operate common signal. To give a standby command, the Exciter returns this signal to standby relay 7A1A3K1 in the I. Box, which in turn supplies 28 VDC signals to the 1 KW PA and 10 KW PA standby control relays (to 1A1K2 in the 1 KW PA and via air flow interlock 9A1S6 to filament contactor 9A3K3 in the 10 KW PA). Standby relay 7A1A3K1 also applies 115 VAC to FILAMENT elapsed time meter 7A1M1. At the same time, 28 VDC from standby relay 7A1A3K1 in the I. Box is applied through time delay latch relay 7A1A3K2 to time delay relay 7A1A3K4, which latches after the three-minute warmup period expires. then the time delay latch relay is energized, and it latches to release heater current from the time delay relay and close an operate command circuit path to allow an operate command to be given.

4-276. When the operate command is given by the Exciter, 28 VDC passes through time delay latch relay 7A1A3K2 contacts to energize operate relay 7A1A3K3. This relay then applies a ground operate signal to the 1 KW PA and a 28 VDC operate signal to the 10 KW PA. It also applies 115 VAC to operate PLATE elapsed time meter 7A1M2. The 28 VDC to high voltage contactor 9A3K4 in the 10 KW PA is interrupted by fault relay 9A3A3K5 if a 10 KW PA fault occurs. The ground signal to 1 KW PA operate relay 1A1K1 is interrupted by air vane interlock 1A1S9 if 1 KW PA air flow is reduced below the acceptable rate.

4-277. The relays already discussed also provide standby and operate status signals (ground) to the Exciter. Refer to figure 4-52. Functions are obvious from the illustration. Note that indicator signals are provided to the Exciter only if both the 1

KW and 10 KW PA units carry out the required commands.

4-278. Complete circuit details for these circuits are shown in schematic diagram figures 5-43, 5-45, 5-49, and 5-50.

4-279. TROUBLESHOOTING CHARTS

4-280. Table 4-3 provides a listing of likely symptoms and possible corresponding faults which would cause the symptoms. It is not intended to be a complete troubleshooting chart, but rather a compilation of those items which might not be found directly through a logical troubleshooting procedure. This quick reference information might help in isolating a problem area without the requirement of a detailed analysis.

4-281. Figure 4-37 provides a guide to the recommended sequence of tests for complete system troubleshooting checkout. To use this diagram as a troubleshooting aid, start on sheet 1 with the transmitter in AMPLIFIER OFF condition. Activate and checkout the transmitter step-by-step, following along the heavy line and checking the first item of each series of blocks under the primary step. Proceed with further tests as necessary if a trouble indication is obtained at one of the first item blocks. Proceed with primary steps along heavy line until all steps are checked out. Use all available troubleshooting and checkout aids during tests. Front panel indicators, servicing diagrams and adjustment procedures should be used to the fullest possible extent to supplement information in the troubleshooting sequence diagram.

4-282. TEST DATA.

4-283. TEST EQUIPMENT AND SPECIAL ADAPTERS.

4-284. Test equipment and special adapters required to perform troubleshooting of transmitter units other than Exciter, Keyer, Decoder-Encoder, and Remote Control are listed in table 4-4. Equivalent substitutes may be used if determination of equipment characteristics shows that the substitute will effectively perform required functions. Refer to individual equipment manuals for units excluded above.

4-285. VOLTAGE AND RESISTANCE MEASUREMENTS.

Tables 4-5 and 4-6 give expected voltage and resistance measurements for the 1 KW PA driver amplifier tubes. Table 4-7 gives resistance measurements for the 1 KW PA final amplifier tubes. Table 4-8 gives resistance measurements for the 10 KW PA tube. The multipurpose meter on the front of the 1 KW PA can be useed to check 1 KW PA final amplifier screen and plate voltages. Voltage measurements for the 10 KW PA tube can be made using the FAULT DETECTOR meter. No attempt should normally be made to measure these voltages directly. Tables 4-9 through 4-11 give voltage measurements for transistor stages in the 1 KW PA, 1 KW Power Supply, and 10 KW PA units, respectively. Table 4-12 gives voltage measurements for integrated circuits in the 10 KW PA.

WARNING

Use extreme care when working on high voltage circuits. Before checking resistances of tube circuits, use shorting stick to discharge high voltage points.

TABLE 4-3. TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE FAULT
EXC FAIL indicator illuminates.	a. One of four injection signals low or dead. b. One of five power supply outputs low or dead.
XMTR FAIL indicator illuminates, transmitter held inoperative.	a. 1 KW PA excessive RF at plate. b. 1 KW PA excessive final amplifier cathode current. c. 1 KW Power Supply interlock open. d. 10 KW PA excessive VSWR. e. 10 KW PA taking over 15 seconds to tune. f. 10 KW PA plate or screen current excessive. g. One of five 10 KW PA compartment interlock switches open. h. 10 KW PA tune or load variable capacitor at far end stop.
Exciter STANDBY pushbutton illuminated but 1 KW PA standby power not present.	a. 1 KW PA case interlock opens. b. 1 KW Power Supply case interlock open.
Exciter STANDBY and OPERATE pushbuttons will not activate 1 KW PA or 10 KW PA, other Exciter indications normal.	Lack of 28 VDC power from 10 KW PA to I. Box; check 28 V circuit breaker on bottom panel.
Transmitter will not go into operate.	a. Lack of 1 KW PA or 10 KW PA air flow or sticky air flow interlock. b. 1 KW PA plate compartment interlock open. c. I. Box time delay or operate relay defective.
Exciter READY indicator will not illuminate, TUNE pushbutton not illuminated, 10 KW PA not tuning, possibly some RF output.	a. XMTR FAIL type fault (see above). b. Exciter not removing inhibit from I. Box after tuning. c. 10 KW PA not completing tune cycle or 10 KW PA tune-up logic circuits faulty. d. 10 KW PA MANUAL TUNE POWER REQUEST switch left in ON position.
Transmitter will go to standby and operate but appropriate Exciter pushbuttons will not illuminate.	Dirty or damaged auxiliary contacts on 1 KW PA or 10 KW PA standby/operate relays/contactors.
Automatic tune cycle will not take place when depressing Exciter's TUNE pushbutton.	a. XMTR FAIL type fault (see above). b. Faulty 10 KW PA tune-up logic. c. RF mute from 10 KW PA to I. Box. d. RF mute from 1 KW PA to I. Box. e. Transmitter not in operate.
I. Box MANUAL TUNE indicator illuminated.	a. 10 KW PA not set for automatic. b. 1 KW PA not set for automatic.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
High reflected power.	a. Mistuned or damaged antenna system. b. Open or shorted transmission line.
Excessive 1 KW PA final plate current.	a. Mistuned transformer assembly in Final Transformer Assembly 1A1A2. b. Final Transformer Assembly switch not connecting tuning capacitors correctly. c. Open final amplifier bypass capacitor. d. Open coupling capacitor in Final Transformer Assembly 1A1A2. e. Faulty grid bias.
Excessive 10 KW PA plate current.	a. Mistuned output matching network or misadjusted Detector Assembly 9A1A3. b. Defective voltage divider capacitors at input of Detector. c. Open coupling capacitor 9A1C9. d. Faulty grid bias. e. Open power amplifier bypass capacitor.
Excessive 10 KW PA plate current, worse at high frequencies.	Harmonic trap coil 9A1A9L1 open or arcing; can also cause damage to 9A1C5, 9A1C17, and Detector Assembly 9A1A3.
Low RF power output.	a. Exciter output at wrong frequency. b. Mistuned transformer assembly in Driver Transformer Assembly 1A1A4 or Final Transformer Assembly 1A1A2. c. Faulty or misadjusted TGC-PPC circuits. d. High VSWR at 1 KW PA or 10 KW PA output. e. Misadjusted 10 KW PA Detector or Servo Amplifier.
No RF output; 1 KW PA final plate current increases with increased RF input.	Short to ground or an open circuit in Final Transformer Assembly 1A1A2.
Essentially no RF output; no increase in 1 KW PA final plate current with increase in RF input.	a. Driver Assembly 1A1A1 not properly seated, or fault in assembly. b. Driver Transformer Assembly 1A1A4 not properly seated or fault in assembly.
No RF output; 10 KW PA plate current increases with increased RF input.	Short to ground or open circuit in output matching network.
DC short across high voltage supply at 1 KW PA final amplifier plates or 10 KW PA plate.	Shorted blocking capacitor in plate circuit or bypass capacitor in DC plate feed circuit.

TABLE 4-3. TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE FAULT
EXC FAIL indicator illuminates.	a. One of four injection signals low or dead. b. One of five power supply outputs low or dead.
XMTR FAIL indicator illuminates, transmitter held inoperative.	a. 1 KW PA excessive RF at plate. b. 1 KW PA excessive final amplifier cathode current. c. 1 KW Power Supply interlock open. d. 10 KW PA excessive VSWR. e. 10 KW PA taking over 15 seconds to tune. f. 10 KW PA plate or screen current excessive. g. One of five 10 KW PA compartment interlock switches open. h. 10 KW PA tune or load variable capacitor at far end stop.
Exciter STANDBY pushbutton illuminated but 1 KW PA standby power not present.	a. 1 KW PA case interlock opens. b. 1 KW Power Supply case interlock open.
Exciter STANDBY and OPERATE pushbuttons will not activate 1 KW PA or 10 KW PA, other Exciter indications normal.	Lack of 28 VDC power from 10 KW PA to I. Box; check 28 V circuit breaker on bottom panel.
Transmitter will not go into operate.	a. Lack of 1 KW PA or 10 KW PA air flow or sticky air flow interlock. b. 1 KW PA plate compartment interlock open. c. I. Box time delay or operate relay defective.
Exciter READY indicator will not illuminate, TUNE pushbutton not illuminated, 10 KW PA not tuning, possibly some RF output.	a. XMTR FAIL type fault (see above). b. Exciter not removing inhibit from I. Box after tuning. c. 10 KW PA not completing tune cycle or 10 KW PA tune-up logic circuits faulty. d. 10 KW PA MANUAL TUNE POWER REQUEST switch left in ON position.
Transmitter will go to standby and operate but appropriate Exciter pushbuttons will not illuminate.	Dirty or damaged auxiliary contacts on 1 KW PA or 10 KW PA standby/operate relays/contactors.
Automatic tune cycle will not take place when depressing Exciter's TUNE pushbutton.	a. XMTR FAIL type fault (see above). b. Faulty 10 KW PA tune-up logic. c. RF mute from 10 KW PA to I. Box. d. RF mute from 1 KW PA to I. Box. e. Transmitter not in operate.
I. Box MANUAL TUNE indicator illuminated.	a. 10 KW PA not set for automatic. b. 1 KW PA not set for automatic.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
High reflected power.	a. Mistuned or damaged antenna system. b. Open or shorted transmission line.
Excessive 1 KW PA final plate current.	a. Mistuned transformer assembly in Final Transformer Assembly 1A1A2. b. Final Transformer Assembly switch not connecting tuning capacitors correctly. c. Open final amplifier bypass capacitor. d. Open coupling capacitor in Final Transformer Assembly 1A1A2. e. Faulty grid bias.
Excessive 10 KW PA plate current.	a. Mistuned output matching network or misadjusted Detector Assembly 9A1A3. b. Defective voltage divider capacitors at input of Detector. c. Open coupling capacitor 9A1C9. d. Faulty grid bias. e. Open power amplifier bypass capacitor.
Excessive 10 KW PA plate current, worse at high frequencies.	Harmonic trap coil 9A1A9L1 open or arcing; can also cause damage to 9A1C5, 9A1C17, and Detector Assembly 9A1A3.
Low RF power output.	a. Exciter output at wrong frequency. b. Mistuned transformer assembly in Driver Transformer Assembly 1A1A4 or Final Transformer Assembly 1A1A2. c. Faulty or misadjusted TGC-PPC circuits. d. High VSWR at 1 KW PA or 10 KW PA output. e. Misadjusted 10 KW PA Detector or Servo Amplifier.
No RF output; 1 KW PA final plate current increases with increased RF input.	Short to ground or an open circuit in Final Transformer Assembly 1A1A2.
Essentially no RF output; no increase in 1 KW PA final plate current with increase in RF input.	a. Driver Assembly 1A1A1 not properly seated, or fault in assembly. b. Driver Transformer Assembly 1A1A4 not properly seated or fault in assembly.
No RF output; 10 KW PA plate current increases with increased RF input.	Short to ground or open circuit in output matching network.
DC short across high voltage supply at 1 KW PA final amplifier plates or 10 KW PA plate.	Shorted blocking capacitor in plate circuit or bypass capacitor in DC plate feed circuit.

TABLE 4-3. TROUBLESHOOTING CHART

SYMPTOM	POSSIBLE FAULT
EXC FAIL indicator illuminates.	a. One of four injection signals low or dead. b. One of five power supply outputs low or dead.
XMTR FAIL indicator illuminates, transmitter held inoperative.	a. 1 KW PA excessive RF at plate. b. 1 KW PA excessive final amplifier cathode current. c. 1 KW Power Supply interlock open. d. 10 KW PA excessive VSWR. e. 10 KW PA taking over 15 seconds to tune. f. 10 KW PA plate or screen current excessive. g. One of five 10 KW PA compartment interlock switches open. h. 10 KW PA tune or load variable capacitor at far end stop.
Exciter STANDBY pushbutton illuminated but 1 KW PA standby power not present.	a. 1 KW PA case interlock opens. b. 1 KW Power Supply case interlock open.
Exciter STANDBY and OPERATE pushbuttons will not activate 1 KW PA or 10 KW PA, other Exciter indications normal.	Lack of 28 VDC power from 10 KW PA to I. Box; check 28 V circuit breaker on bottom panel.
Transmitter will not go into operate.	a. Lack of 1 KW PA or 10 KW PA air flow or sticky air flow interlock. b. 1 KW PA plate compartment interlock open. c. I. Box time delay or operate relay defective.
Exciter READY indicator will not illuminate, TUNE pushbutton not illuminated, 10 KW PA not tuning, possibly some RF output.	a. XMTR FAIL type fault (see above). b. Exciter not removing inhibit from I. Box after tuning. c. 10 KW PA not completing tune cycle or 10 KW PA tune-up logic circuits faulty. d. 10 KW PA MANUAL TUNE POWER REQUEST switch left in ON position.
Transmitter will go to standby and operate but appropriate Exciter pushbuttons will not illuminate.	Dirty or damaged auxiliary contacts on 1 KW PA or 10 KW PA standby/operate relays/contactors.
Automatic tune cycle will not take place when depressing Exciter's TUNE pushbutton.	a. XMTR FAIL type fault (see above). b. Faulty 10 KW PA tune-up logic. c. RF mute from 10 KW PA to I. Box. d. RF mute from 1 KW PA to I. Box. e. Transmitter not in operate.
I. Box MANUAL TUNE indicator illuminated.	a. 10 KW PA not set for automatic. b. 1 KW PA not set for automatic.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
High reflected power.	a. Mistuned or damaged antenna system. b. Open or shorted transmission line.
Excessive 1 KW PA final plate current.	a. Mistuned transformer assembly in Final Transformer Assembly 1A1A2. b. Final Transformer Assembly switch not connecting tuning capacitors correctly. c. Open final amplifier bypass capacitor. d. Open coupling capacitor in Final Transformer Assembly 1A1A2. e. Faulty grid bias.
Excessive 10 KW PA plate current.	a. Mistuned output matching network or misadjusted Detector Assembly 9A1A3. b. Defective voltage divider capacitors at input of Detector. c. Open coupling capacitor 9A1C9. d. Faulty grid bias. e. Open power amplifier bypass capacitor.
Excessive 10 KW PA plate current, worse at high frequencies.	Harmonic trap coil 9A1A9L1 open or arcing; can also cause damage to 9A1C5, 9A1C17, and Detector Assembly 9A1A3.
Low RF power output.	a. Exciter output at wrong frequency. b. Mistuned transformer assembly in Driver Transformer Assembly 1A1A4 or Final Transformer Assembly 1A1A2. c. Faulty or misadjusted TGC-PPC circuits. d. High VSWR at 1 KW PA or 10 KW PA output. e. Misadjusted 10 KW PA Detector or Servo Amplifier.
No RF output; 1 KW PA final plate current increases with increased RF input.	Short to ground or an open circuit in Final Transformer Assembly 1A1A2.
Essentially no RF output; no increase in 1 KW PA final plate current with increase in RF input.	a. Driver Assembly 1A1A1 not properly seated, or fault in assembly. b. Driver Transformer Assembly 1A1A4 not properly seated or fault in assembly.
No RF output; 10 KW PA plate current increases with increased RF input.	Short to ground or open circuit in output matching network.
DC short across high voltage supply at 1 KW PA final amplifier plates or 10 KW PA plate.	Shorted blocking capacitor in plate circuit or bypass capacitor in DC plate feed circuit.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
Impossible to reach full output; 1 KW PA driver current decreases with increased RF input.	Defective or misadjusted TGC-PPC circuit in 1 KW PA or Exciter.
Excessive RF output.	a. Defective TGC-PPC circuit (1 KW PA or Exciter) or misadjustment. b. Defective 1 KW PA VSWR Bridge and 10 KW PA directional coupler. c. TGC or PPC cable not connected to Exciter or cables faulty or reversed. d. Oscillating 1 KW PA driver or final amplifier stage or 10 KW PA power amplifier stage.
1 KW PA final amplifier plate currents equal at idle but spread at 1 KW out.	a. Unmatched or defective 1 KW PA final amplifier tube. b. Defective or shorted cathode resistors.
1 KW PA final amplifier plate currents not equal or near equal at idle.	a. 1A1P6-P7 not plugged into proper sockets. b. Shorted tube element.
1 KW PA FREQUENCY MEGACYCLES dial does not index at correct position.	a. If the switch in Final Transformer Assembly 1A1A2 also stops out of position, the coupling on Driver Transformer Assembly 1A1A4 has slipped. b. If the switch in Final Transformer Assembly 1A1A2 does stop in correct position, the set screws in FREQUENCY MEGACYCLES dial are loose. c. Open or mis-wired frequency code line between Exciter and 10 KW PA or 10 KW PA and 1 KW PA. d. Defective Band Repeater Assembly 9A1A13 in 10 KW PA.
Motor 1A1B2 does not de-energize.	a. Shorted or miswired code line between Band Repeater Assembly 9A1A13 and switch S1 in Driver Transformer Assembly 1A1A4. b. Coupling on Driver Transformer Assembly 1A1A4 does not pick up the mating coupling.
Motor 9A1A13 does not de-energize.	Shorted or miswired code line between Exciter and Band Repeater Assembly 9A1A13.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
Motor 1A1B2 does not energize.	a. Blown BANDSWITCH MOTOR fuse. b. Code lines not connected. c. Band Repeater Assembly 9A1A13 not energized when required.
1 KW Power Supply 115 VAC, 400 CPS line shorted to ground.	Blower 1A2B1 rotated in its mounting so that its terminal strip touches chassis.
1 KW PA driver and final amplifier screen voltages fall when keyed.	a. Shorted screen in any of four tubes. b. Zener diodes 1A1CR3-CR11 open or shorted. c. Open phase in primary of 1 KW Power Supply 600 VDC supply. d. Open rectifier in 600 VDC supply.
1 KW Power Supply 2400 VDC supply circuit falls to about 2000 volts when keyed.	Open phase of 1 KW Power Supply power transformer 2A2T1 or open rectifier.
A tune condition can not be achieved at 10 KW PA.	a. Defective or unbalanced 10 KW PA servo amplifier. b Defective or mistuned Detector Assembly 9A1A3 or associated input capacitors. c. No high gain signal from tune-up logic or servo amplifier high gain relay. d. Adequate tune power not maintained throughout tune cycle. e. Exciter output at incorrect or multiple frequencies.
Incorrect or lack of prepositioning in 10 KW PA during tune up.	a. Defective Band Repeater Assembly 9A1A13. b. Defective tune-up logic. c. Defective servo amplifier preposition relay.
After prepositioning, 10 KW PA TUNING indicator does not illuminate.	a. Inadequate RF power for tuning. b. Faulty or mistuned detector assembly 9A1A3. c. Faulty or unbalanced servo amplifiers. d. Faulty motor drive transistors. e. Lack of tune power request to Exciter. f. Defective tune-up logic in 10 KW PA.
10 KW PA screen voltage falls greatly when keyed.	Open phase in 1 KV power supply or open rectifier.
10 KW PA plate voltage falls greatly when keyed.	Open phase in 8 KV power supply or open rectifier.
I_s or I_p fault with proper screen or plate current.	I_s or I_p limit adjustment incorrect.

TABLE 4-3. TROUBLESHOOTING CHART (Cont)

SYMPTOM	POSSIBLE FAULT
Output power varies with frequency.	Exciter power output controls improperly set.
10 KW PA does not operate properly after an 8 KV short to ground; voltages ok.	High negative pulse produced when high voltage shorted may damage semiconductor in control circuitry in assemblies 9A1A5 and 9A1A6
10 KW PA POWER OUTPUT meter reads incorrectly when Meter Amplifier Assembly 9A1A5A3 is extended.	Normal sometimes; meter amplifier oscillates with extended board connections.
Grid bias drifts causing shift of idling plate current in 10 KW PA.	a. Resistors 9A2A1R1, R2, and R15 in bias supply overheating. b. Leaky filter or bypass capacitors associated with bias supply.
PLATE AND SCREEN circuit breaker trips when going to operate, no apparent shorts on supply lines.	Dust or dirt on 10 KW PA tube socket bypass capacitors.
10 KW PA Tune or Load capacitor runs to limit and trips fault sensor.	a. Stall torque threshold misadjusted. b. Arcing in output network. c. Faulty Detector Assembly 9A1A3. d. Faulty voltage divider capacitors at input to Detector Assembly.
10 KW PA servo motors have below normal torque.	a. Motor drive transistors at output of servo amplifier overheated or defective. b. Q4, Q5, Q6, or Q7 in servo amplifier defective. c. Defective resistors associated with stages in a. and b. above.
10 KW PA TUNING indicator remains illuminated after tune up cycle is otherwise successfully completed.	a. Servo motor or drive assembly sticky. b. Stall torque threshold misadjusted. c. Faulty tune-up logic.
10 KW PA tune time fault.	a. Servo amplifier oscillating. b. Servo motor not turning. c. Drive mechanism jammed or excessive friction. d. Stall torque threshold potentiometers 9A1A5R3-R4 misadjusted.
I_p or I_s fault in 10 KW PA during tune up.	a. Tune overload protector DC amplifier 9A1A6A2Q2 not limiting drive level properly through TGC system. b. Improper prepositioning.

TABLE 4-4. TEST EQUIPMENT AND SPECIAL ADAPTERS

EQUIPMENT	TYPE	REQUIRED CHARACTERISTICS	USE
Multimeter	AN/PSM-4B	AC volts 2.5 to 1000V full scale (FS), DC volts 2.5 to 5000 FS, resistance 30 ohms to 30 MEGOHM	General voltage and resistance measurements in troubleshooting.
Electronic Multimeter	AN/USM-116	AC volts 1 to 500 volts FS, 2 to 30 MCS.	Checking RF levels.
RF Cable Adapter	UG-1447/ USM-117	Type N coaxial feedthrough with "Tee" tap for AC probe of USM-116.	Connecting USM-116 AC probe in coaxial line at output of 1 KW PA.
Oscilloscope	AN/USM-117 Tektronix 535A	Square wave AC voltage measurements to 300 V P-P at 400 CPS.	Checking 400 CPS square wave AC voltage.
Calorimeter (10 KW, 50 ohm dummy load with calibrated power meter.)	Electro-Impulse Corp. model CPM-10K or equivalent	10 KW, 50 ohm, RF dummy load with calibrated power meter.	Terminating transmitter when antenna not used or checking output power.
PC Board and Module Extenders and Module Puller Handles	See table 1-2.	Supplied with AN/FRT-84(V)	Testing assemblies extended from chassis.
RF Dummy Load	DA-242/V	10KW 50	Terminate Transmitter When a antenna not used.
RF signal Generator	SG-582	0-30MC output	Checking tuning dircuits
AF signal generator	SG-376/V	AF output 0-25KC	Input level testing
Sweep generator	Texscan model VS-30	1-35MC 0.5 VRF output 0-5MC sweep	Checking tuning circuits
DC power supply	Power design TW5005	0-25VDC	Bias control testing
Detector Test fixture	See figure 5-2		Driver and final transformer alignment

TABLE 4-5. 1 KW PA DRIVER AMPLIFIER ASSEMBLY (1A1A1) VOLTAGE MEASUREMENTS

Note

The voltage measurements for the driver amplifier are made at the terminals of terminal board 1A1A1TB1. If the Driver Amplifier Assembly was removed to gain access directly to the tube sockets, cooling air to both the driver and final amplifier tubes would be lost.

1A1A1TB1 TERMINAL NO.	1	2	6	7	8	9	10	11	12	13
CONDITIONS										
OPERATE, UNKEYED	+630	+287	13.5 VAC	0	-83	0	0	+0.85	0	0
OPERATE, KEYED, NO SIGNAL	+610	+287	13.5 VAC	0	-2.7	+3.4*	+3.4*	0	0	0

*Multipurpose meter switch must not be set in DRIVER 1 AMPERES or DRIVER 2 AMPERES position during this measurement.

TABLE 4-6. 1 KW PA DRIVER AMPLIFIER TUBES (1A1A1V1/V2) RESISTANCE MEASUREMENTS

Note

Resistance measurements made directly at the tube sockets, with the assembly wired into the set. To remove the 1A1A1 assembly without disconnecting the leads to 1A1A1TB1, first detach the small cable clamps holding the main cable against the rear lip of the chassis near 1A1A4.

TUBE SOCKET PIN NO.	1	2	3	4	5	6	7	8	9	10	11
CONDITIONS											
METER POSITIVE POLARITY	10.0	220K	23K	10.0	0	0.2	220K	23K	10.0	220K	23K
METER NEGATIVE POLARITY	10.0	40K	22K	10.0	0	0.2	40K	22K	10.0	40K	22K

TABLE 4-7. 1 KW PA FINAL AMPLIFIER TUBES (1A1V1/V2) RESISTANCE MEASUREMENTS

Note

See paragraph 5-56 to obtain access to final amplifier tube sockets. These measurements are made with assemblies 1A1A1 and 1A1A4 disconnected and removed from the set. Figure 5-10 illustrates the final amplifier tube socket.

PIN / COND	HEATERS	GRID	SCREEN	PLATE	CATHODE
METER POSITIVE POLARITY	5.4	5.5K	175K	800K	5
METER NEGATIVE POLARITY	5.4	16K	70K	125K	5

TABLE 4-8. 10 KW PA POWER AMPLIFIER TUBE (9A1V1) RESISTANCE MEASUREMENTS

Note

Figure 5-31 illustrates the final amplifier tube socket.

WARNING

Use shorting stick before connecting meter.

PIN / COND	GRID	SCREEN	PLATE	EACH FILAMENT LEAD TO GROUND
METER POSITIVE POLARITY	110K	23K	700K	approx. 0 ohms
METER NEGATIVE POLARITY	130K	23K	700K	approx. 0 ohms

TABLE 4-9. 1 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A5Q1	Standby	10.5	11.0	21.0
A5Q2	Standby	10.0	11.0	18.0
A5Q3	Normal	3.8	0	21.0
	Overload	9.6	10.2	9.6
A5Q4	Normal	19.0	19.0	0.15
	Overload	21.0	20.0	21.0
A5Q5	Normal-Keyed	7.4	7.0	7.2
	Normal-Unkeyed	5.8	9.7	-0.1
	RF mute line grounded or bandswitch motor running	5.2	6.8	-0.1
A5Q6	Normal	-0.1	0	-62.0
	Keyed	0.3	0	0.35
A6Q1	(Note 3)	12.0	4.6	11.0
A6Q2	Standby	-125	-125	-93.0
	Normal - Keyed	-47.0	-46.0	-34.0
	(Note 3)	-68.0	-68.0	-34.0
A6Q3	Not Used			
A6Q4	Normal - Unkeyed	1.5	9.4	-87
	Normal - Keyed	5.0	4.8	4.9
A6Q5	Normal - Unkeyed	-86.0	-87.0	-61.0
	Normal - Keyed	-0.6	-.05	0.2
A6Q6	Normal - Unkeyed	4.4	0	11.0
	(Note 3)	8.0	8.0	11.0
A6Q7	Normal	1.55	1.85	7.7
A6Q8	Normal - Unkeyed	1.0	0	20.0
	(Note 3)	2.35	2.45	18.0
A6Q9	Normal - Unkeyed	1.0	0	20.0
	(Note 3)	2.35	2.5	18.0
A6Q10	Normal - Unkeyed	26.0	19.5	0
	(Note 3)	17.0	16.0	3.5
A6Q11	Normal - Unkeyed	0.3	0	11.0
	(Note 3)	4.1	3.0	11.0

TABLE 4-9. 1 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS (Cont)

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A6Q12	Normal - Unkeyed	0	0	11.0
	(Note 3)	13.0	3.0	11.0
A6Q13	Standby	10.5	11.0	0 to .05

NOTES:

1. Prefix reference designations with 1A1.
2. Measurements taken in OPERATE, SSB( ), USB-PTT mode, unkeyed, no modulation unless otherwise specified (normal).
3. AO mode, 5 KW AVG output.
4. Exact value depends on setting of PA BIAS control 1A1R10.

TABLE 4-10. 1 KW POWER SUPPLY TRANSISTOR DC VOLTAGE MEASUREMENTS

TRANSISTOR STAGE	CONDITION	DC VOLTAGE TO GROUND		
		E	B	C
2A1Q1	USB-PTT Unkeyed - Standby	22.0	22.0	0
2A1Q2	USB-PTT Unkeyed - Standby	22.0	22.0	0

TABLE 4-11. 10 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A1A1Q1	Normal or Standby	0	-0.15	-15
A1A1Q2	Normal	-2.0	-1.4	+0.85
	Standby	-2.0	-1.4	0
A1A1Q3	Normal or Standby	0	+0.6	+15
A1A1Q4	Normal	+15	+15	+3.8
	Standby	+15	+15	-.02
A1A1Q5	Normal or Standby	+15	+15	0
A1A1Q6	Normal	+3.2	+3.8	+15
	Standby	-0.6	-.02	+15
A1A1Q7	Normal	+3.2	+3.4	+15
	Standby	-0.6	-.02	+15

TABLE 4-11. 10 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS (Cont)

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A5Q1	Normal	+7.5	+7.5	0
	Standby	+7.4	+7.3	0
A5Q2	Normal	+7.1	+7.0	0
	Standby	+7.8	+7.8	0
A5Q3	Normal	+28	+25	+7.1
	Standby	+28	+26	+7.8
A5Q4	Normal	+28	+25	+7.5
	Standby	+28	+26	+7.4
A5Q5	Normal	+5.0	+5	0
	Standby	+5.3	+5.8	0
A5Q6	Normal	+6.0	+6.0	0
	Standby	+6.9	+6.9	0
A5Q7	Normal	+28	+26	+6
	Standby	+28	+25	+6.9
A5Q8	Normal	+28	+26	+5.0
	Standby	+28	+25	+5.3
A5A1Q1	Normal	-4.2	-3.8	+8.2
	Standby	-3.8	-3.1	+6.8
A5A1Q2	Normal	-4.0	-3.6	+4.9
	Standby	-4.0	-3.4	+7.1
A5Q1Q3	Normal	-11	-10	-6.0
	Standby	-11	-10	-5.9
A5A1Q4	Normal	+7.1	+6.3	+25
	Standby	+7.8	+8.4	+26
A5A1Q5	Normal	+7.5	+8.1	+25
	Standby	+7.4	+6.6	+26
A5A1Q6	Normal	+7.0	+6.4	0
	Standby	+7.8	+8.4	0
A5A1Q7	Normal	+7.5	+8.0	0
	Standby	+7.3	+6.8	0
A5A1Q8	Normal	+6.6	+7.0	+7.0
	Standby	+6.9	+7.4	+7.4

TABLE 4-11. 10 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS (Cont)

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A5A2Q1	Normal	-3.8	-3.1	+4.9
	Standby	-3.6	-2.9	+4.4
A5A2Q2	Normal	-4.1	-3.5	+5.6
	Standby	-3.9	-3.3	+6.2
A5A2Q3	Normal	-11	-11	-6.0
	Standby	-11	-10	-5.8
A5A2Q4	Normal	+6.0	+7.0	+26
	Standby	+6.9	+7.5	+25
A5A2Q5	Normal	+5.0	+5.0	+26
	Standby	+5.3	+4.4	+25
A5A2Q6	Normal	+6.0	+7.0	0
	Standby	+6.9	+7.5	0
A5A2Q7	Normal	+5.0	+5.0	0
	Standby	+5.8	+5.0	0
A5A2Q8	Normal	+6.0	+6.0	+6.0
	Standby	+5.9	+6.4	+6.4
A5A3Q1	Normal	-3.5	-11	+1.4
	Standby	-2.6	-2.0	-2.6
A5A3Q2	Normal	+0.6	+1.4	+0.6
	Standby	0	-2.6	+26
A5A3Q3	Normal	0	+0.6	+0.6
	Standby	0	0	+26
A5A3Q4	Normal	+2.5	+3.0	+14
	Standby	0	0	+14
A5A3Q5	Normal	+14	+4.4	+14
	Standby	+14	0	+14
A5A3Q6	Normal	0	0	+14
	Standby	0	0	+14
A6Q1	Normal	+25	+25	0
	Standby	+25	+25	+25
A6Q2	Normal	+26	+26	0
	Standby	+26	+26	0

TABLE 4-11. 10 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS (Cont)

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A6A1Q1	Normal	+18	+18	+26
	Standby, untuned	+0.8	+1.7	+1.0
	Manual, standby, untuned	0	-2.4	+16
A6A1Q2	Normal	-0.6	-4	+11
	Standby, untuned	-0.7	0	-0.6
	Manual, standby, untuned	-0.7	-4.2	-2.1
A6A1Q3	Normal	-0.6	-2.4	+11
	Standby, untuned	-0.7	0	-0.6
	Manual, standby, untuned	-0.7	-3.6	-2.1
A6A1Q4	Normal	0	+0.6	0
	Standby, untuned	0	-2.2	+14
	Manual, standby, untuned	0	-3.5	-1.6
A6A1Q5	Normal	0	-0.6	0
	Standby, untuned	0	-4.0	+14
	Manual, standby, untuned	0	-9.0	-1.6
A6A1Q6	Normal	0	0	+26
	Standby, untuned	0	+0.7	+0.7
	Manual, standby, untuned	0	0	+26
A6A1Q7	Normal	0	-1.5	+26
	Standby, untuned	+0.7	+1.4	+0.7
	Manual, standby, untuned	0	-3.0	+26
A6A1Q8	Normal	0	-3.1	+8.0
	Standby, untuned	0	+0.6	0
	Manual, standby, untuned	0	-8.0	-6.0
A6A1Q9	Normal	0	-2.4	+12
	Standby, untuned	0	-2.4	+12
	Manual, standby, untuned	0	-9	-3.2
A6A1Q10	Normal	0	+0.6	0
	Standby, untuned	0	+0.6	0
	Manual, standby, untuned	0	-7.0	0
A6A2Q1	Normal	+26	+26	0
	Standby, untuned	+26	+26	0
A6A2Q2	Normal	0	+0.5	+5.0
	Standby, untuned	0	+0.6	0
A6A3Q1	Normal	+26(A)	-0.8(K)	-0.8(G)
A6A3Q2	Normal	+26(A)	-1.0(K)	-0.8(G)

TABLE 4-11. 10 KW PA TRANSISTOR DC VOLTAGE MEASUREMENTS (Cont)

TRANSISTOR STAGE	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND		
		E	B	C
A6A3Q3	Normal After VSWR fault	+26(A) +0.8	0 (K) 0	0 (G) +0.8
A6A3Q4	Normal After 15 SEC timer fault	+26(A) +0.8	0 (K) 0	+0.1(G) +0.8
A6A3Q5	Normal After limit switch fault	+26(A) +0.8	0 (K) 0	0 (G) +0.8
A6A3Q6	Normal After running 15 SEC	+0.4(E) +0.4	+0.1(B_1) +0.6	+10 (B_2) +10
9A2A1Q1	Normal or standby	+15	+15.4	+20
9A2A1Q2	Normal or standby	-15	-15.4	-20

NOTES:

1. Prefix incomplete reference designations with 9A1.
2. Standby mode is the condition of the system three minutes after the STANDBY push-button on the Exciter is pushed and the TUNE light on the Exciter is illuminated (inhibit supplied). Normal is a condition defined as 2.5 KW output AM carrier at 2.500 MC (USB, A3e, no audio applied). Manual indicates that the Monitor/Control Assembly AUTO/MAN selector is set to MAN; otherwise set to AUTO.
3. Readings taken with AN/USM-116.
4. Readings for 9A1A1A1 taken with 9A1A1S1 set to 15 KW FWD and 9A1A1S2 set to PEAK.

TABLE 4-12. 10 KW PA INTEGRATED CIRCUIT DC VOLTAGE MEASUREMENTS

INTEGRATED CIRCUIT	CONDITION (NOTE 2)	DC VOLTAGE TO GROUND							
		1	2	3	4	5	6	7	8
A1A1IC1	Normal	+10	+1.2	+1.2	-15	-15	-3.8	+15	+11
	Standby	+10	0	0	-15	-15	-.02	+15	+11
A1A1IC2	Normal	+10	0	0	-15	-15	-1.7	+15	+11
	Standby	+10	0	0	-15	-15	0	+15	+11
A5A1IC1	Normal or standby	+10	-	-	-16	-16	-3.0	+15	+11
A5A2IC1	Normal or standby	+10	-	-	-16	-16	-3.0	+15	+10
A5A3IC1	Normal or standby	+8	-	-	-16	-16	0	+12	+8.0
A5A3IC2	Normal	+7	-	-	16	-16	-11	+11	+8.0
	Standby	+7	-	-	-16	-16	0	+11	+8.0
A5A3IC3	Normal	+7	-	-	-16	-16	+2.8	+11	+9.0
	Standby	+7	-	-	-16	-16	0	+11	+8.0
A5A4IC4	Normal or standby	+7	-	-	-16	-16	0	+11	+8

NOTES:

1. Prefix reference designations with 9A1.
2. IC voltage measurements must be made with a meter with greater than 1 MEGO input impedance. Use VTVM or multimeter in 10 KW PA. DO NOT TOUCH PINS 2 or 3. DAMAGE TO THE I. C. MAY RESULT. Do not use 10 KW PA multimeter to check A5A3IC1.
3. Readings for 9A1A1A1 taken with 9A1A1S1 set to 15 KW FWD and 9A1A1S2 set to peak.

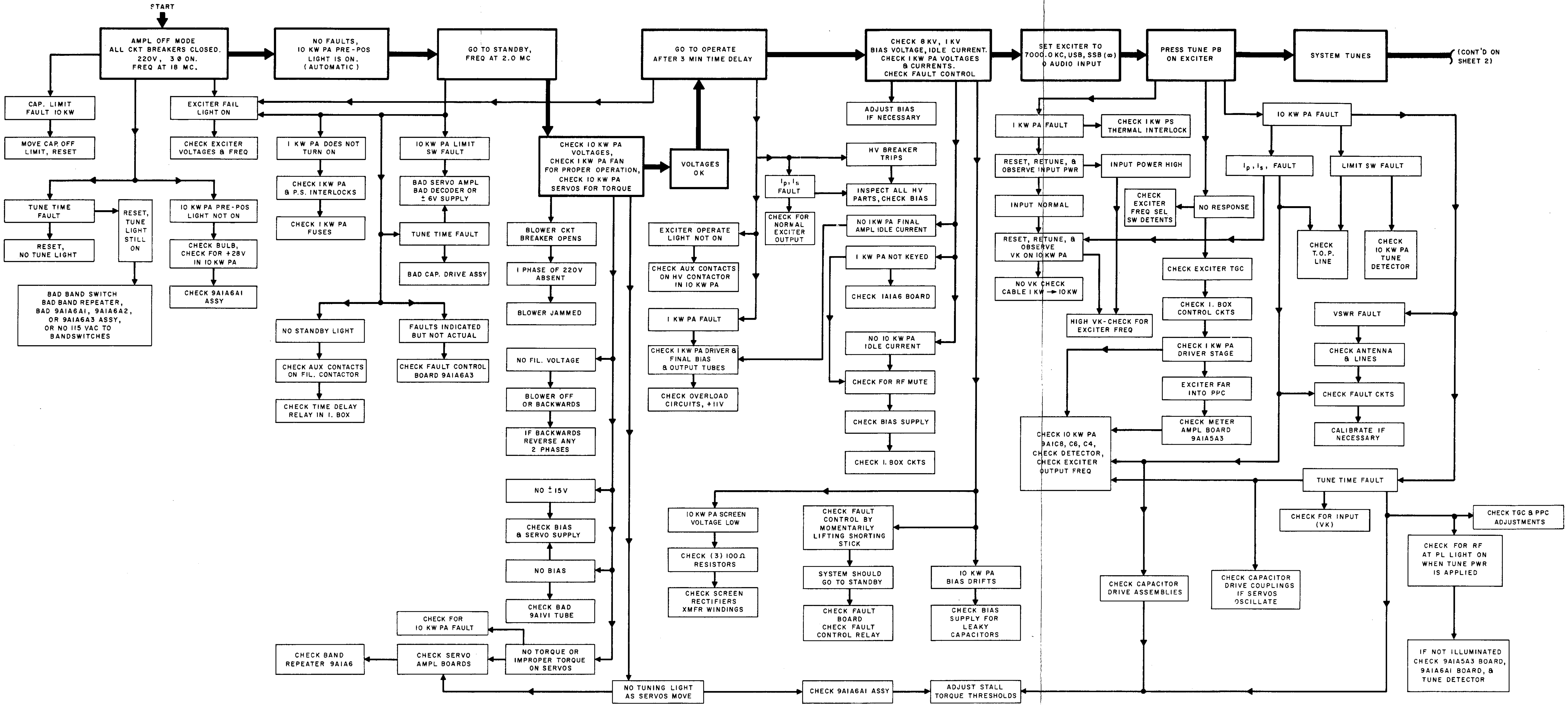


Figure 4-37. Troubleshooting Sequence Diagram (Sheet 1 of 2)

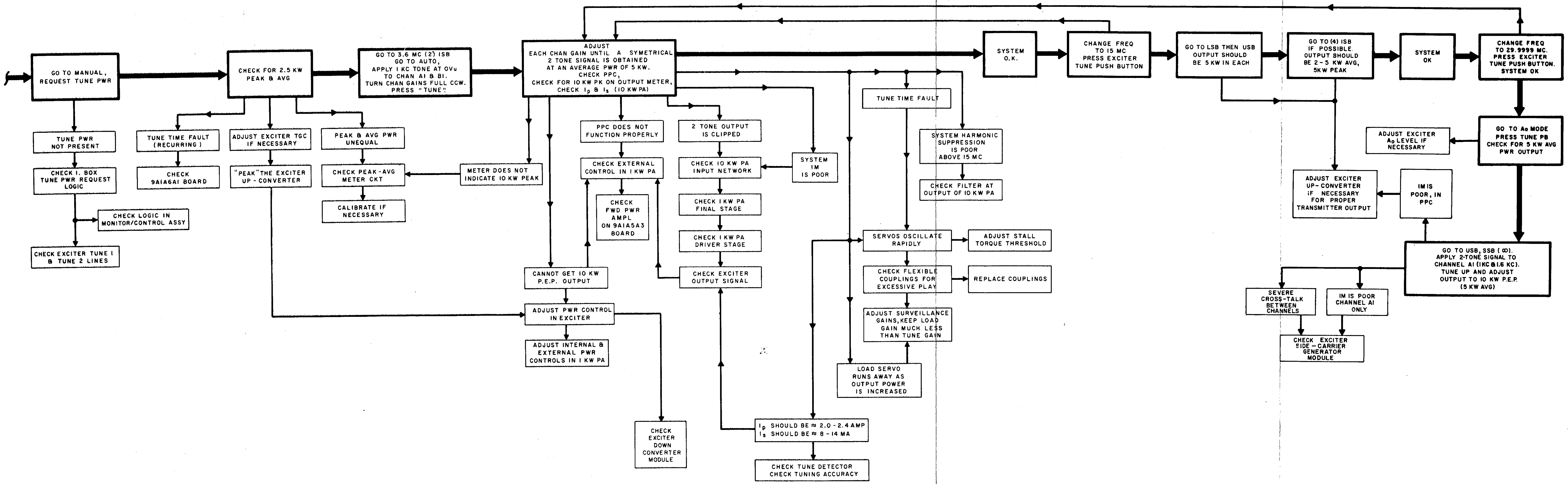


Figure 4-37. Troubleshooting Sequence Diagram (Sheet 2 of 2)

NOTES:

1. Heavy lines indicate main signal paths.
2. Letters outside transistor and tube blocks indicate elements.
3. ▭ indicates equipment front panel markings.
4. P/O Intercabinet cable.
5. Test point voltages were measured with the following system conditions:

TEST POINT	CONDITION (NOTE 5)	VOLTAGE
1	5 KW output, 1 tone	20-80 mw
2	Read on V_k range of Multimeter (9A1A5M1). 5 KW output, 1 tone	200-300 Vrms
3	5 KW output, 1 tone, into 50 ohm load	500 Vrms
Ⓐ	5 KW output, 1 tone	1-2 Vrms
Ⓑ	5 KW output, 1 tone	20-10 Vrms
Ⓒ	5 KW output, 1 tone	120-160 Vrms
Ⓓ	5 KW output, 1 tone	120-160 Vrms
Ⓔ	Read on V_p range of Multimeter (9A1A5M1) 5 KW output, 1 tone	2000-3000 Vrms

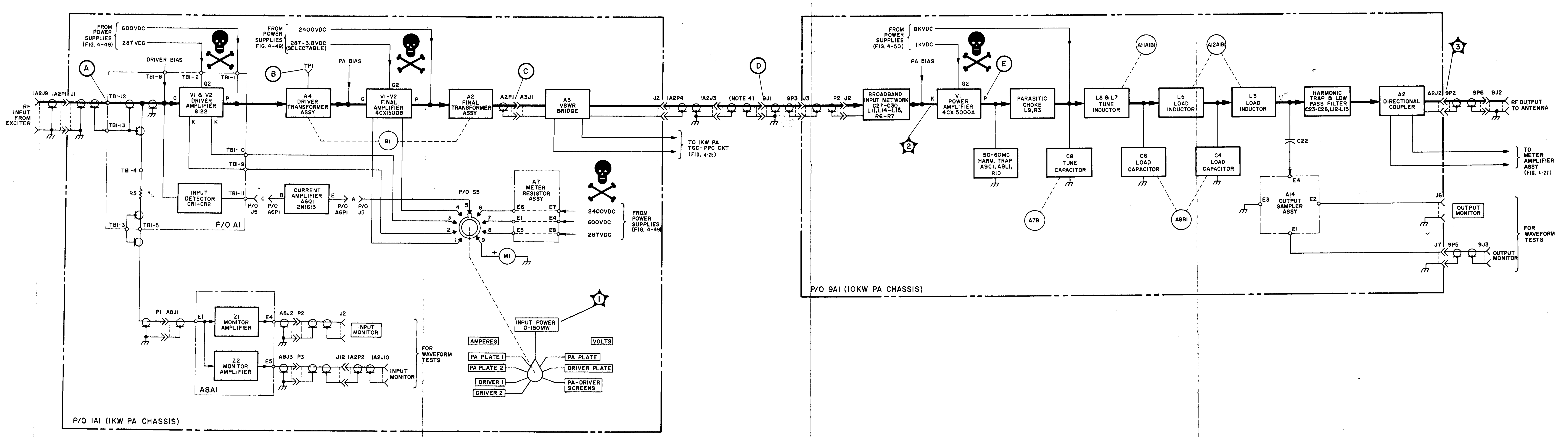


Figure 4-38. 1 KW PA, 1A1, and 10 KW PA, 9A1, RF Circuits, Servicing Diagram

NOTES:

1. Prefix incomplete reference designations with 9A1.
2. Heavy lines indicate main signal paths.
3. Letters outside transistor blocks indicate elements; numbers at relays indicate terminals.
4. ☐ indicates equipment front panel markings.
5. Signal levels are indicated by arrow types (all arrow symbols point in direction of signal flow); check low level signals to +28V reference; check high level signals to ground reference. Level indicators are as follows:

   HI = ▶ = Positive level (close to positive supply voltage)

   LO = ▷ = Ground level (less than +2V).
6. +28V removed by fault relay 9A3A2K5 (not shown) when fault occurs.
7. Measurements taken with AN/PSM-4B, all voltages referenced to ground.
8. Test point voltages were measured with the following equipment conditions:

   NORMAL: Exciter keyed in Compatible AM, with 2.5 KW Carrier only (USB; A2,A3e mode; with no audio input).

   STBY: System in standby, at least 3 min. after Exciter STBY pushbutton depressed, and TUNE pushbutton illuminated (inhibit).

   MANUAL-STBY: Same as standby, except Monitor/Control assembly AUTO/MAN switch A6S3 set at MAN. and with tune power request.

10KW PA TUNE UP LOGIC

TEST POINT	SYSTEM MODE (NOTE 8)	VOLTAGE TO GRD
4 (A6A1TP1)	NORMAL STBY MANUAL-STBY	+26.0 V + 1.0 V +16.0 V
5 (A6DS2 TUNE PWR indicator or A6A1TP3)	MANUAL-STBY STBY	+26V (indicator illuminated) +0.7V (indicator extinguished)
6 (A5A1TP5)	NORMAL, or STBY Transmitter tuned, no RF output	0 V +21 V
7 (A5A1TP3)	NORMAL STBY	+21 V 0 V
8 (A5A2TP3)	NORMAL STBY	+21 V 0 V
9 (A5A2TP5)	NORMAL, or STBY Transmitter tuned, no RF output	0 V +21 V
F (A6A1TP2)	NORMAL STBY, or MANUAL-STBY	+18 V 0 V
G (A6DS1 PREPOS indicator)	NORMAL STBY, or MANUAL-STBY	+4 V +24 V
H (A6DS3 RF AT PL indicator)	NORMAL	+3 V +27 V
I (A6DS4 TUNING indicator)	STBY, while tuning STBY, tuning completed	+3 V +27 V
J (A6A2P1-25)	NORMAL STBY	+25 V 0 V

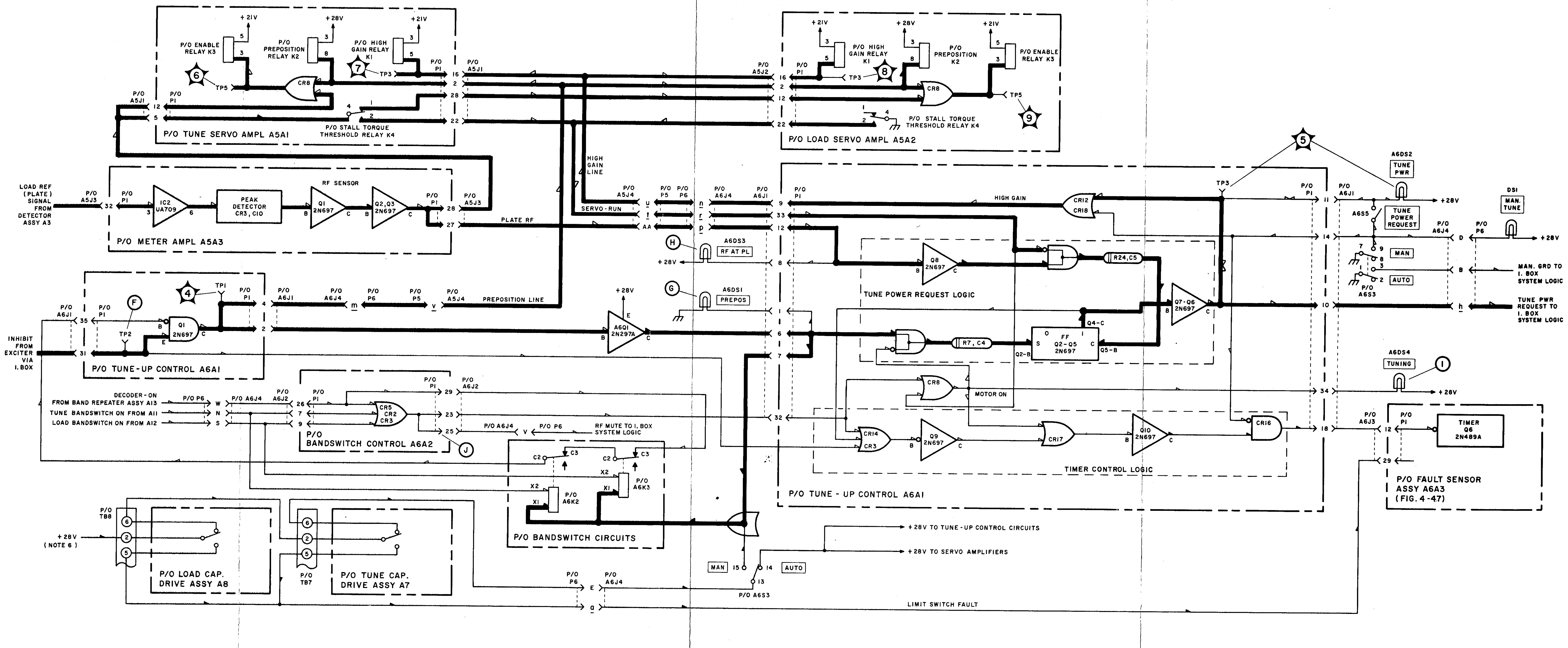


Figure 4-39. 10 KW PA, Tune UP Logic, 9A1, Servicing Diagram

ORIGINAL

NOTES:

1. High = on, Low = off; except analog signals, which indicate relate level.
2. Band repeater and band switches will run in AMPL OFF, STBY, or OPERATE; servos will preposition in STBY or OPERATE. Other actions require OPERATE.

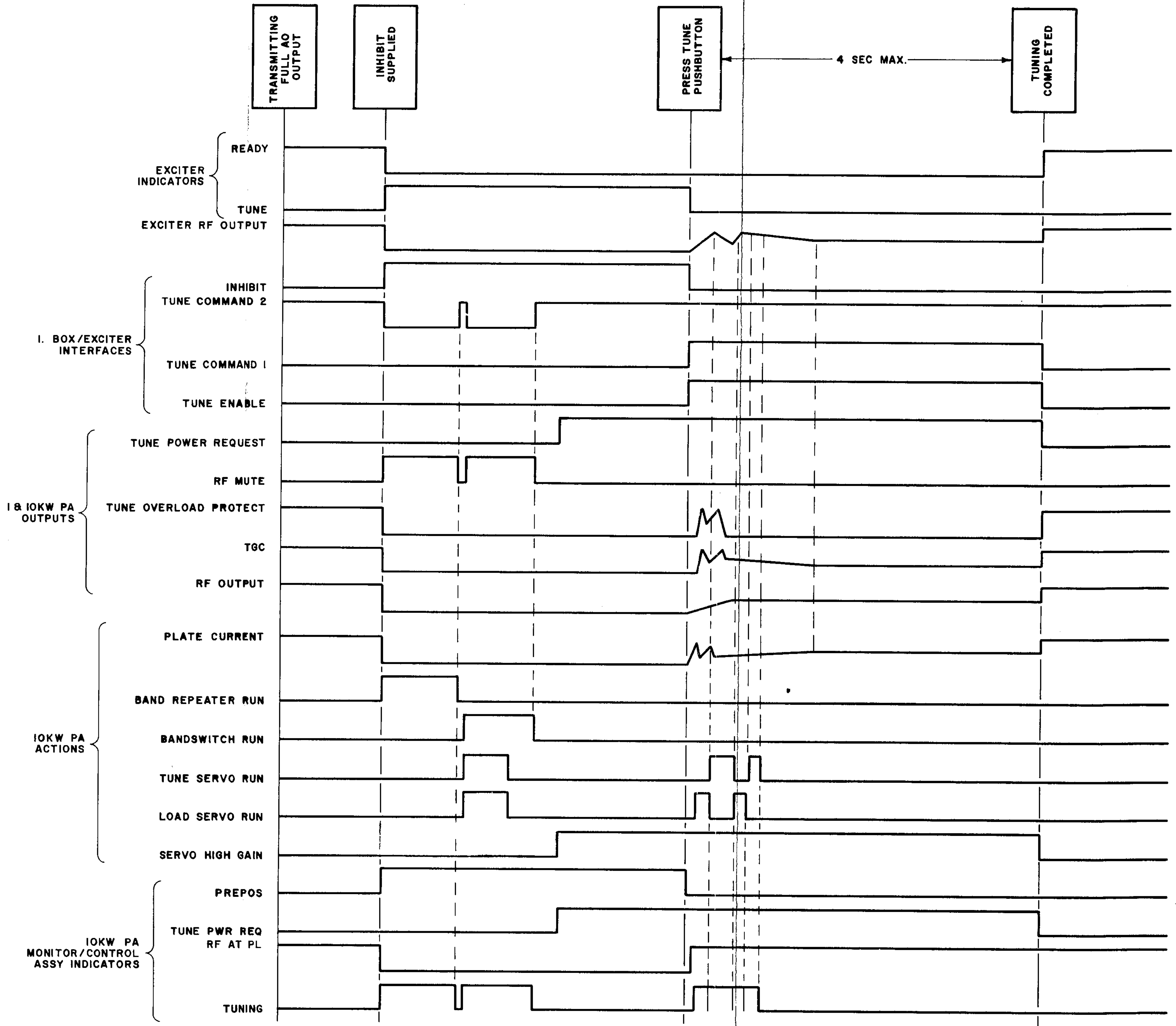


Figure 4-40. Tune Cycle, Timing Diagram

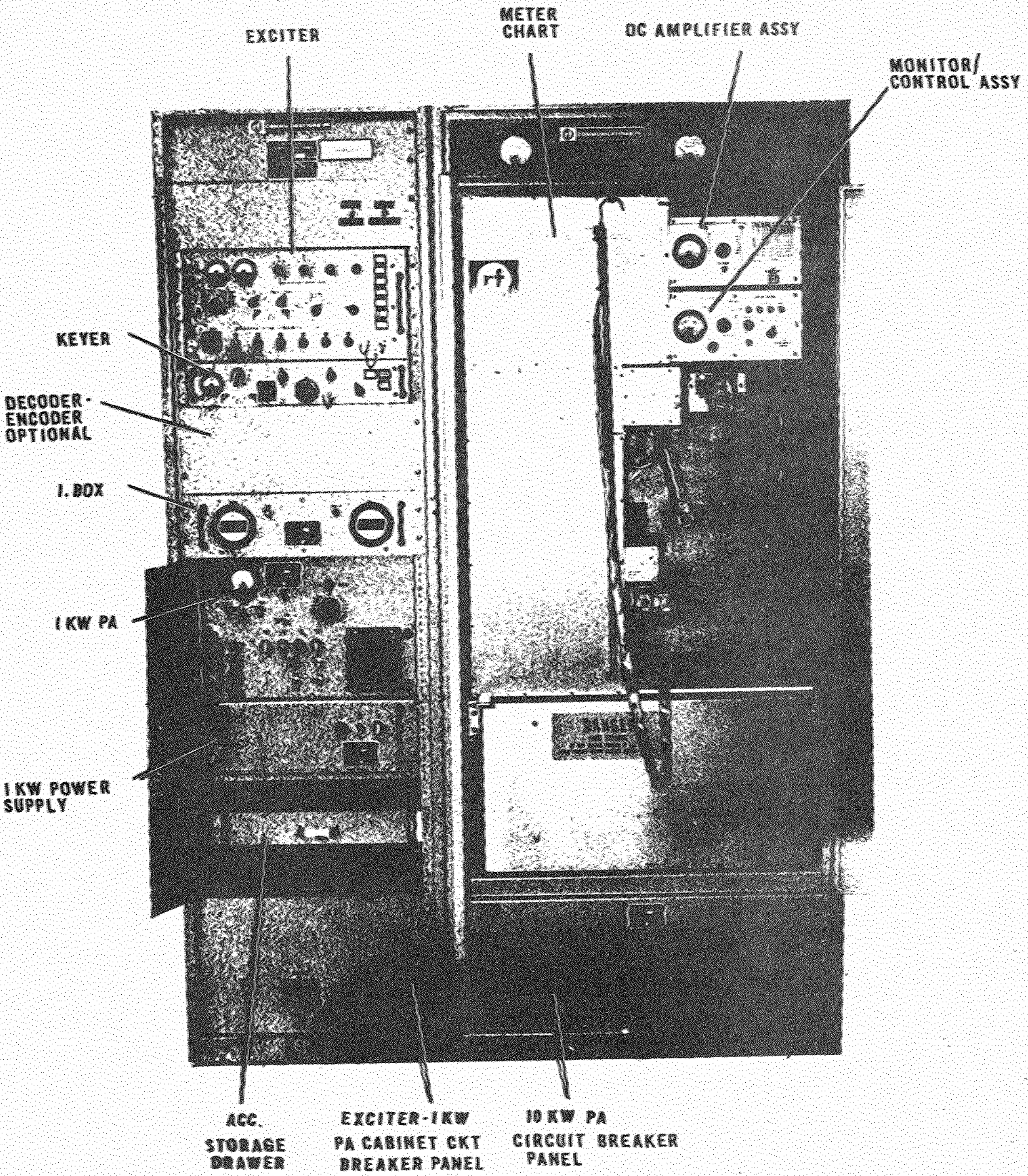


Figure 5-1. AN/FRT-84(V) Transmitting Set, Front View

SECTION V

MAINTENANCE

5-1. GENERAL INFORMATION.

5-2. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS

5-3. The Navy no longer requires the submission of failure reports for all electronic equipment. Failure reports and performance and operational reports are to be accomplished for designated equipment (refer to electronic installation and maintenance book, Navships 0967-000-000.) Only to the extent required by existing directives. All 3-M reports shall be on current OPNAV 4790 series forms in accordance with OPNAV Manual 43P2.

5-4. MAINTENANCE SCOPE.

5-5. This section covers the maintenance of the 1 KW PA, 1 KW Power Supply, I. Box, 10 KW PA, and adjustment of the AN/FRT-84(V) power control loops. The Exciter, keyer, Decoder-Encoder, and Remote Control equipments are covered by publications listed in table 5-1.

Within this scope, this section contains, and parts replacements procedures which use test equipment and procedures which use test equipment and tools generally available at shore installations. Special devices and test fixtures required are limited to those which are provided by the Maintenance Kit supplied as part of the AN/FRT-84(V) (table 1-2) or those which can readily be constructed with moderate maintenance-shop facilities. A list of recomended test equipment appears in table 4-4. Maintenance procedures which require special test equipment, or more elaborate devices and test fixtures, are

TABLE 5-1. MAINTENANCE COVERAGE FOR UNITS NOT COVERED IN THIS MANUAL

DESIGNATION & COMMON NAME	TECHNICAL MANUAL	MAINTENANCE STANDARDS BOOK	OVERHAUL AND REPAIR MANUAL
MD-777/FRT, Exciter	0967-292-9030	0967-293-3010	0967-293-3020
KY-655/FRT, Keyer	0967-292-9020	0967-293-4010	0967-293-4020
C-7709/FRT, Remote Control	0967-292-9040	0967-293-5020	0967-293-5030
KY-656/FRT, Decoder-Encoder	0967-292-9050	0967-293-6010	0967-293-6020

included in the Overhaul and Repair Manual, NAVSHIPS 0967-293-0060.

5-6. Following is a summary of items covered by the Overhaul and Repair Manual.

a. 1 KW PA driver and final transformer assembly and transmission assembly repair and mechanical alignment.

b. 1 KW PA driver and final transformer assembly switch and coil replacement.

c. 1 KW PA bandswitch motor replacement.

d. 10 KW PA chassis assembly removal.

e. 10 KW PA bandswitch repair and alignment.

f. 10 KW PA variable capacitor, drive assembly, and related parts removal, replacement, and alignment.

g. 10 KW PA detector assembly alignment.

h. Transmitter measurements to check intermodulation distortion, unwanted sideband suppression, carrier suppression, harmonic output, and no-signal noise.

Preventive maintenance coverage for the AN/FRT-84(V) is presented in the AN/FRT-84(V) Maintenance Standards Book, NAVSHIPS 0967-293-0050 and the Maintenance Standards Books listed in table 5-1.

5-7. TUNING AND ADJUSTMENT.

CAUTION

Whenever the antenna system is removed, the transmitter must be terminated into a 50 OHM dummy load. Otherwise dammage will result if the transmitter is activated.

5-8. No adjustment procedures are required for the 1 KW Power Supply or I. Box. Adjustments for the 1 KW PA and 10 KW PA, plus AN/FRT-84(V) power control adjustments, are described under the subheadings which follow. Electrical adjustments are given first, followed by mechanical adjustment procedures where applicable.

5-9. 1 KW PA SWITCH ADJUSTMENT PROCEEDURE

5-10. It is essential that whenever a Final Transformer Assembly (FTA) (1A1A2) or a Driver Transformer Assembly (DTA) (1A1A4) is replaced, that the positioning of the switch wipers be checked, and adjusted as necessary. Failure to properly adjust the switching contacts will cause arcing and burned contacts or switches in the Final Transformer Assembly (FTA).

5-11. The switches in both the FTA and DTA are mechanically indexed to the bandswitch motor. However, there are no mechanical adjustments within the drive train for the switches. Adjustments for the switching contacts result from movement of the code plate on S1 of the DTA. (Figure 5-14). Refer to the following steps for correct alignment.

CAUTION

Do not key system at any time during this alignment check or dammage to the FTA and the DTA will occur.

a. After replacement of the Final Transformer Assembly (FTA) and/or Driver Transformer Assembly (DTA) install the 1 KW PA in the system and secure in the ready-to-operate condition.

b. Turn the transmitter system power ON and place the MD-777/FRT (Exciter) in STANDBY.

c. To assure that the switches are properly indexed to the bandswitch motor drive, place the Exciter FREQUENCY KC switch in the 3.0 MCS position, then place the switch in the 2.0 to 2.5 MCS band.

CAUTION

The switch must only be rotated in the direction indicated by the decal on the front of the switch assembly otherwise damage to the FTA and DTA will occur.

d. Turn power OFF.

e. Remove the FTA and DTA assemblies and check that the switch wipers are properly centered at position 1. The FTA wiper must be properly centered on the contact button. The DTA wiper may be slightly off center, but must be fully engaged with the contacts.

f. If the FTA wiper contacts are not properly centered, remove the plug buttons on the top plate of the D.TA and loosen the exposed nuts sufficiently to permit rotation of the code plate. Rotate the code plate C W to retard the wipers or CCW to advance the wipers. (Remember, the FTA wipers turn clockwise as viewed from the top.) Normally the code plate requires a very small movement to adjust the wipers.

g. Tighten the code plate securing nuts, replace the plug buttons, and reinstall the FTA and DTA in the Power Amplifier.

h. Repeat steps a thru g until inspection determines that the wipers are making proper contact.

NOTE

In some instances, it will be impossible to obtain an adjustment which will be satisfactory for both the FTA and DTA. In such instances it is necessary to replace one of the assemblies and adjust the code plate to obtain a satisfactory mating of the new pair of assemblies. This condition does not result from improperly assembled units, but reflects a pile-up of manufacturing tolerances. It is highly probable that the removed unit will mate satisfactorily with some other assembly.

5-12. 1 KW PA DRIVER TUBES BIAS

5-13. When the plate current of either driver tube, 1A1A1V1 or 1A1A1V2, is greater than 400 milliamperes or less than 260 milliamperes while the 1 KW PA is keyed, the driver tube bias should be adjusted as follows. (All control, indicator, and connector reference apply to the 1 KW PA unless otherwise specified.)

a. Depress Exciter AMPLIFIER OFF pushbutton.

b. Turn off PLATE AND SCREEN circuit breaker on bottom of 10 KW PA cabinet.

c. Loosen 1 KW PA front panel captive screws and slide out chassis.

d. Defeat two interlock switches on 1 KW PA (figure 5-19) by pulling plungers straight out.

c. Loosen lock nut on DRIVER BIAS ADJ 1A1R9 (figure 5-7) and set maximum counterclockwise.

f. Apply external primary power to equipment and depress Exciter OPERATE pushbutton after three minute standby time delay

g. Change Exciter frequency to lock transmitter into tune cycle condition, but do not depress TUNE pushbutton for the balance of this procedure. With the TUNE pushbutton illuminated and the

READY indicator extinguished, there will be no driving signal at the 1 KW PA.

h. After Exciter STANDBY indicator illuminates, depress OPERATE pushbutton.

i. Set Multipurpose Meter switch at DRIVER PLATE VOLTS and observe indication of 600± 60 VDC at nominal line voltage.

j. Set Multipurpose Meter switch at PA DRIVER SCRNS VOLTS and observe indication of 287± 15 VDC.

k. Set Multipurpose Meter switch alternately at DRIVER 1 AMPERES and DRIVER 2 AMPERES and observe Multipurpose Meter while slowly rotating DRIVER BIAS ADJ clockwise.

l. Set DRIVER BIAS ADJ for an indication of 320 milliamperes for tube which indicates lowest plate current. Plate current of other tube should now indicate between 320 and 400 milliamperes; if it does not, one of the tubes is defective and should be replaced or there is a defect in the circuit. Tighten lock nut on DRIVER BIAS ADJ, and recheck indications.

m. Depress Exciter AMPLIFIER OFF pushbutton.

n. Slide 1 KW PA chassis into cabinet and secure.

o. Turn on PLATE AND SCREEN circuit breaker on bottom panel of 10 KW PA.

5-14. 1 KW PA FINAL AMPLIFIER TUBES SCREEN VOLTAGE.

5-15. The difference in plate current between 1 KW PA final amplifier tubes 1A1V1 and 1A1V2 should not exceed 40 milliamperes. In case the difference does exceed 40 milliamperes, compensating adjustments in screen voltages should be made to reduce the difference, in order to maintain equal load sharing between the two tubes. (In the adjustment procedure which follows, all control, indicator, and connector references apply to the 1 KW PA unless otherwise specified.)

WARNING

Lethal voltages exist within the 1 KW PA during operation. Screen voltage (300 VDC) is present at jacks J6 through J11. Refer to NAVSHIPS 0967-000-0000 Electronics Book, High-Voltage Adjustment Procedures before proceeding.

a. Turn off 10 KW PA PLATE AND SCREEN circuit breaker.

b. Depress Exciter STANDBY pushbutton; and after three-minute time delay, depress OPERATE pushbutton.

c. Change Exciter frequency to lock transmitter in a tune cycle condition, but do not depress TUNE pushbutton for this procedure. With the TUNE pushbutton illuminated and the READY indicator extingushed, no drive will be applied to the 1 KW PA.

d. Set Multipurpose Meter switch at PA PLATE VOLTS. Multipurpose Meter should indicate 2400± 240 VDC at nominal ling voltage.

f Rotate PA BIAS control full counterclockwise.

CAUTION

Excessive plate current will damage final amplifier tubes 1A1V1 and 1A1V2.

g. Set Multipurpose Meter switch alternately at PA PLATE 1 AMPERES and PA PLATE 2 AMPERES and observe Multipurpose Meter while slowly rotating PA BIAS control clockwise.

h. Set PA BIAS control for an indication of 240 milliamperes for the tube which indicates the highest plate current. Take note of which tube is set for 240 milliamperes, and also note the difference between this and the (lower) current of the other tube. If the lower-current tube is conducting at 220 to 240 milliampere rate, no further adjustment is required; if conduction is below 220 milliamperes, continue with procedure below.

i. Depress Exciter STANDBY pushbutton.

j. Loosen 1 KW PA front panel captive screws and slide out chassis.

k. Defeat two interlock switches on 1 KW PA (figure 5-19) by pulling plungers straight out.

l. Locate screen voltage adjustment jacks J6 through J11 on left side of 1 KW PA chassis (figure 5-7).

m. Observe position of two plugs coded P6 (brown) and P7 (red); screen voltage taps for tubes 1A1V1 and 1A1V2 respectively.

NOTE

Increasing the screen voltage will increase the plate current. Jacks J6 through J11 provide connections to a voltage divider network. Moving a screen voltage plug (P6 or P7) to a higher-number jack will increase the plate current of that tube.

n. Determine which plug should be moved to adjust conduction of lower-current tube toward desired rate of at least 220 milliamperes, but not more than 240 milliamperes. Change that plug to a new trial position.

o. Depress Exciter OPERATE pushbutton.

p. Recheck plate current indication for tube which was adjusted. If current is not yet within the stated range (approaching 240 milliamperes), depress Exciter STANDBY pushbutton and adjust appropriate plug as required to attain accepatable plate current. Depress Exciter OPERATE pushbutton, and check results. Repeat this step until acceptable results are obtained.

CAUTION

Damage to the tubes may result if screen plugs are left disconnected during operation.

q. Depress Exciter AMPLIFIER OFF pushbutton.

r. Slide 1 KW PA chassis into cabinet and secure.

s. Turn on PLATE AND SCREEN circuit breaker on 10 KW PA bottom panel.

5-16. 1 KW PA VSWR BRIDGE BALANCE ALIGNMENT.

a. The following TEST EQUIPMENT is required.

RF Dummy Load DA-242/U.

Electronic Multimeter An/USM-116.

Multimeter AN/PSM-4B.

RF Signal Generator SG-582.

RF Cable Adapter UG-1447/USM-117.

Non-inductive alignment tool, JFD #5284.

b. To check out the 1KW PA VSWR Bridge, proceed as follows:

NOTE

All control, indicator, and connector references apply to the 1 KW PA unless otherwise specified.

1. Depress Exciter AMPLIFIER OFF pushbutton.

2. Open rear door of Exciter-1KW PA cabinet, and disconnect RF cable from XMTR OUT connector 1A2J3 on the 1 KW PA.

3. Disconnect RF cable from RF input connector 1A2J9 on the 1 KW PA and connect a 47 ohm, 2W resistor or similar type of dummy load to the end of the cable to terminate the Exciter.

4. Connect RF signal Generator SG-582 to 1 KW PA RF input connector 1A2J9. Set SG-582 for minimum output at 21 MCS with no modulation (CW).

5. Connect DA-242/U RF Dummy Load through RF Cable Adapter UG-1447/USM-117 to 1 KW PA XMTR OUT connector 1A2J3.

6. Connect Electronic Multimeter AN/USM-116, set to measure 225 VAC, to RF cable adapter UG-1447/USM-117.

7. Turn off PLATE AND SCREEN circuit breaker 9CB3 on 10 KW PA bottom panel.

8. Loosen 1 KW PA front panel captive screws, and slide out chassis.

WARNING

Lethal voltages are present in the 1 KW PA. Refer to high voltage adjustment procedures in Electronics Installation and Maintenance Book, NAVSHIPS 0967-000-0000 before proceeding.

9. Remove protective shield from over left side of 1 KW PA chassis.

10. Carefully connect AN/PSM-4B multimeter positive lead to VSWR bridge terminal 1A1A3E7 (figure 5-14 and negative lead to chassis ground. Set to 10V DC voltage range.

11. Defeat two interlock switches on 1 KW PA by pulling plungers straight out.

12. Depress Exciter STANDBY pushbutton, and allow for three-minute time delay; then depress OPERATE pushbutton.

13. Set 1 KW PA FREQUENCY MEGACYCLES selector to the "20 to 22" MC band. Observe that FREQUENCY MEGACYCLES dial rotates to "20 to 22" MC band.

14. Turn the output level of the SG-582 up to obtain a 220 VAC indication on the AN/USM-116 Multimeter.

15. Insert JFD #5284 tuning tool through access hole in VSWR bridge assembly (figure 5-14) and carefully adjust 1A1A3C6 (BAL TRIMMER) for minimum indication on multimeter (must be less than 0.65V at null).

16. Remove tuning tool from VSWR bridge.

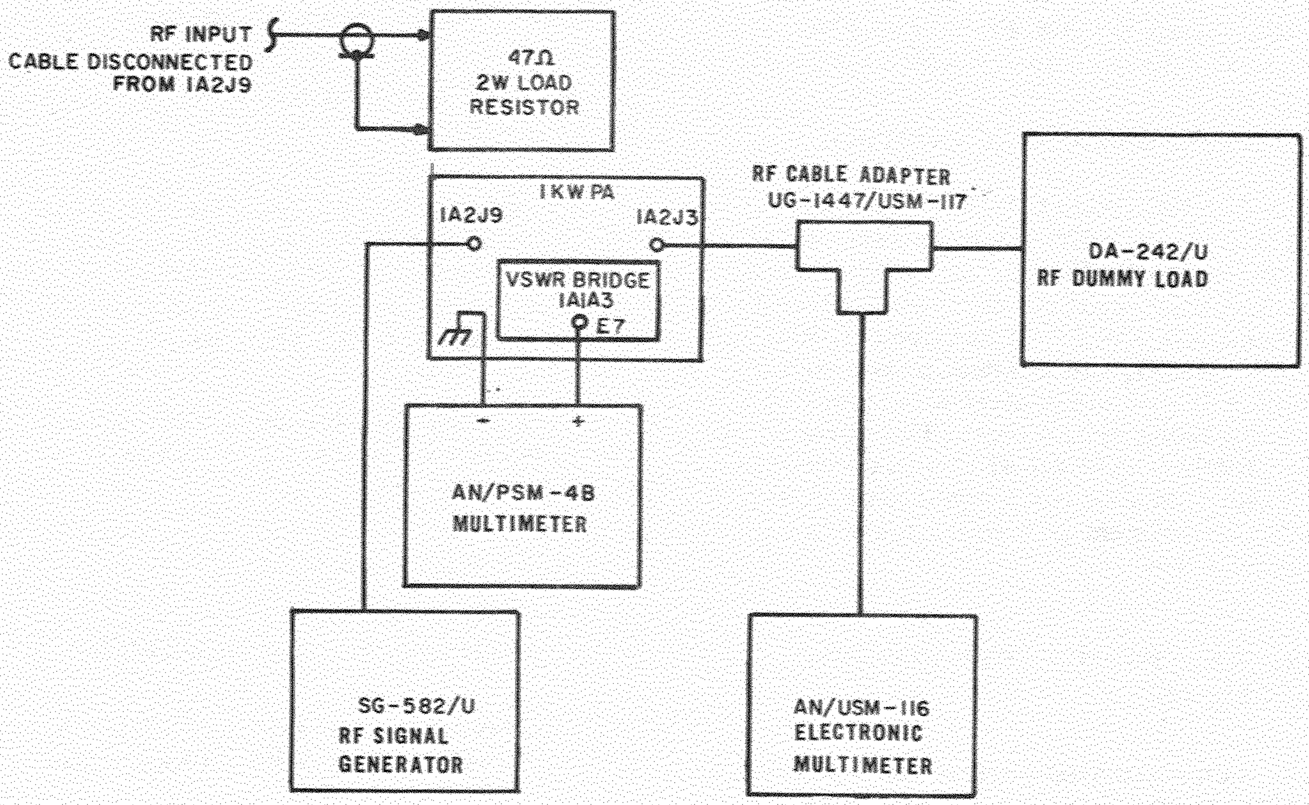


Figure 5-2. 1 KW PA VSWR Bridge Alignment Setup

17. Depress Exciter AMPLIFIER OFF pushbutton.

18. Turn on PLATE AND SCREEN circuit breaker 9CB3 on 10 KW PA bottom panel.

19. Break down test setup, and reassemble equipment and cables, following reverse order of steps 2 through 10 and referring to figure 5-2 as a guide.

20. Return 1 KW PA FREQUENCY MEGACYCLES selector to AUTOMATIC.

5-17. INTERNAL POWER CONTROL.

5-18. The INTERNAL POWER SET adjustment within the 1 KW PA is an extra protection for the 1 KW PA. In the event of a fault in the external power control circuit, or when the 1 KW PA is removed from the AN/FRT-84(V), the internal power control circuit will provide protection against the 1 KW PA being overdriven. The adjustment of INTERNAL POWER SET is accomplished in conjunction with the overall peak power control adjustment procedure found in paragraph 5-41.

5-19. 1 KW PA RF TUNED CIRCUITS ALIGNMENT.

5-20. Complete alignment of the 1 KW PA consists of tuning the driver and final transformer assemblies. These procedures must be performed whenever sufficient power output cannot be obtained from the 1 KW PA to drive the 10 KW PA or excessive plate current (not due to aging tubes or component failure) is noted on one or more frequency bands or whenever a transformer assembly is replaced.

5-21. The critical parameters are used to determine proper final amplifier tube and final transformer assembly operation are as follows. The maximum plate current for either amplifier tube with 1 KW output is 710 MA. The maximum allowable difference between one band edge and the other is 30 MA. If the balance between band edges is greater than 30 MA after alignment to obtain proper scope pattern, a final adjustment should be made to provide this degree of balance.

5-22. The driver stage, operating as a class A amplifier, does not provide a simple indicator of performance. However, after both driver and final transformer assembly alignment, no more than 100 MW (2.24 VAC) of drive should be required to obtain full 1 KW rated output at any frequency.

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED.

Sweep Generator, Texscan Model VS-30 or equivalent, with remote flattening, 0-5 MC sweep bandwidth, 1 to 35 MC, 0.5V RF output, multiple markers at 0.5, 1.0, and 5.0 MC intervals.

Dual trace oscilloscope, Tektronix model 535A with type CA dual trace plug in or equivalent.

Signal Generator SG-582/U.

Electrical dummy load DA-242/U.

Electronic multimeter AN/USM-116 with UG-1447/USM-117 RF cable adapter.

Detector test fixture (fabricate per figure 5-3).

Alignment tool, 0.100 inch hex each end, non-conductive, one end with undercut shank.

Nut driver, 1/4 inch, for alignment of the nineteen tuning coils in the driver and final transformer assemblies.

b. PRELIMINARY PROCEDURES TO ALIGN TUNED CIRCUIT ASSEMBLIES.

WARNING

Lethal voltages exist within the 1 KW PA during operation. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance Book High-Voltage Adjustment Procedures before proceeding.

1. Depress Exciter AMPLIFIER OFF pushbutton.

2. Loosen 1 KW PA front panel captive screws and slide out chassis (figure 5-7).

3. Disconnect 1A2P1 (RF from Exciter) from 1A1J1 on rear of 1 KW PA chassis.

4. Connect 47 ohm, 2W resistor (other suitable dummy load) to 1A2P1 to terminate Exciter.

5. Disconnect 1A2P4 (RF from VSWR bridge) from 1A1A3J2 on rear of 1 KW PA chassis (figure 5-7).

6. Turn off PLATE AND SCREEN circuit breaker 9C B3 on bottom 10 KW PA panel.

c. DRIVER TRANSFORMER ALIGNMENT PROCEDURES. The driver transformer assemblies for the 19 frequency bands are arranged on 16 coil forms. Figure 5-47 illustrates the schematic representation of the coils, while table 5-3 lists the frequencies covered by each band. To align the coils of any one band proceed as follows. (All control, indicator, and connector references apply to the 1 KW PA unless otherwise specified.)

1. Perform preliminary procedures is directed by paragraph 5-15b.

2. Tilt chassis to expose underside; lock.

3. Connect test equipment with 1 KW PA to provide test setup illustrated by figure 5-3. Note that Detector Test Fixture is placed at driver transformer 1A1A4 so that very short (1/4") leads are utilized. Shielded RF cables connect between sweep generator and 1 KW PA and between sweep generator and Detector Test Fixture.

4. Make sure set is in AMPLIFIER OFF condition. Then record positions of screen balance plugs P6 and P7 in jacks J6-J11 at left-rear of chassis, and unplug and ground plugs P6 and P7 to disable final amplifier stage (figure 5-7).

5. Activate test equipment. Temporarily set the output level of the sweep generator to zero. Allow 15 minutes for warmup.

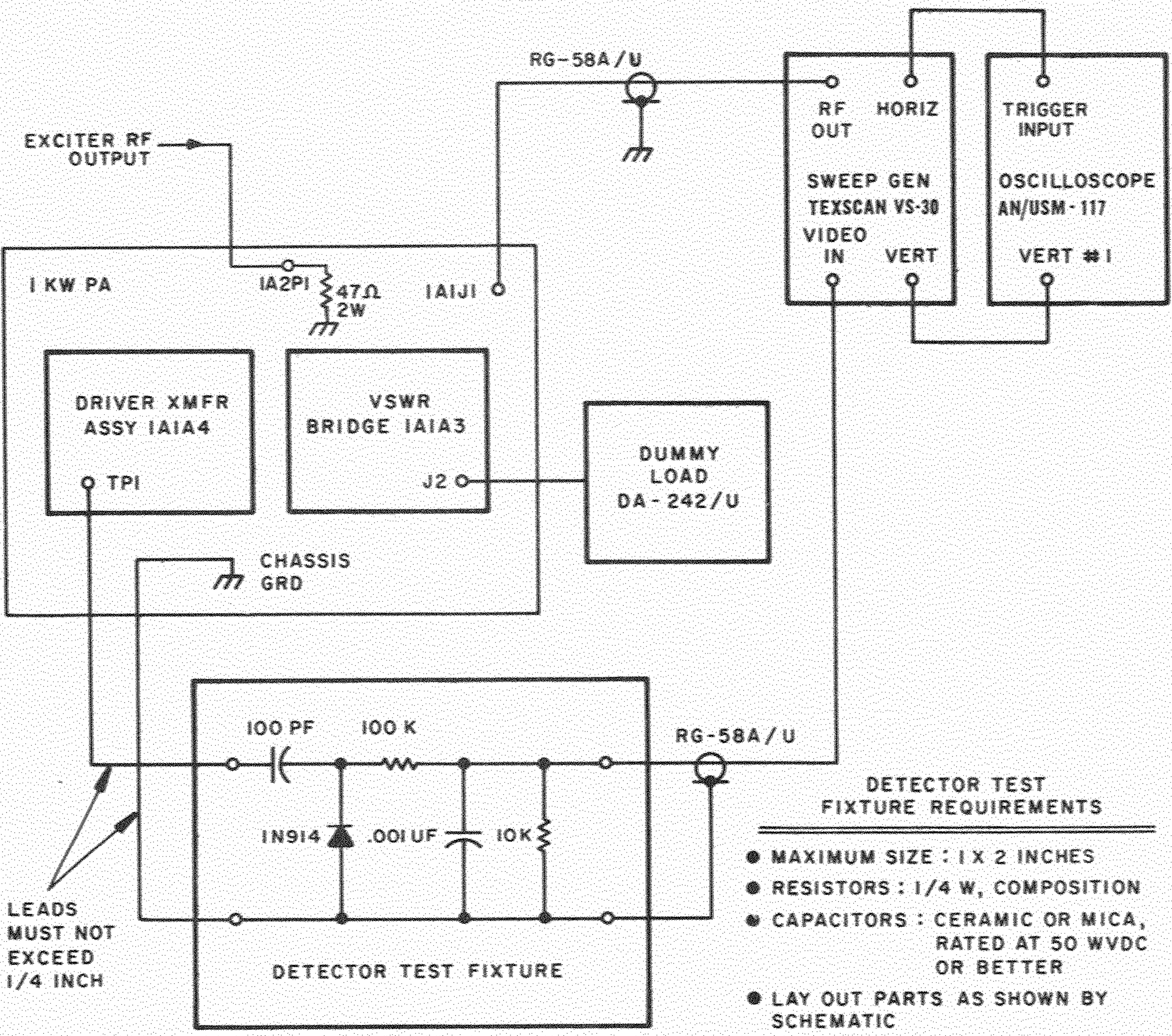
6. Defeat two interlock switches on 1 KW PA by pulling plungers straight out.

7. Depress Exciter STANDBY pushbutton and allow 15 minutes for equipment warmup.

8. Depress Exciter OPERATE pushbutton. Change frequency at Exciter to place transmitter in a tune condition, but do not depress TUNE pushbutton.

9. Set Multipurpose Meter switch 1A1S5 at DRIVER 1 AMPERES and then at DRIVER 2 AMPERES. If necessary, adjust driver bias control 1A1R9 to obtain 320 MA for the lowest of the two DRIVER AMPERES positions. The higher DRIVER AMPERES current should then not exceed 400 MA.

10. Set 1 KW PA FREQUENCY MEGACYCLES selector at frequency range corresponding to frequency of band being aligned.



DETECTOR TEST FIXTURE REQUIREMENTS

- MAXIMUM SIZE : 1 X 2 INCHES
- RESISTORS : 1/4 W, COMPOSITION
- CAPACITORS : CERAMIC OR MICA, RATED AT 50 WVDC OR BETTER
- LAY OUT PARTS AS SHOWN BY SCHEMATIC

Figure 5-3. Driver Transformer Alignment Test Setup

11. Set generator to sweep band being aligned (approximately 0.5 volts RF output) and insert markers for center, upper, and lower limits of this band (table 5-2).

12. For bands 1 through 8, adjust the appropriate slug as stated in table 5-2, which shows a single tuned response curve typical of bands 1 through 8 when properly aligned. Repeat steps 10 through 12 for each successive band alignment.

13. For bands 9 through 19, alternately adjust two slugs per band (top slug first), as stated in table 5-2, until the double tuned response curve, which is typical of band 9 through 19 when properly aligned, is obtained. Repeat steps 10, 11, and 13, for each successive band alignment.

14. Depress Exciter AMPLIFIER OFF pushbutton.

15. Disconnect Detector Test Fixture and all other test equipment.

16. Reconnect P6 and P7 disconnected in step 4.

17. Reconnect 1A2P1, 1A2P4, by reversing steps 3 through 5 of Preliminary Procedures, paragraph 5-22b.

NOTE

Omit steps 17 and 18 if final transformer assembly must also be aligned.

18. The return equipment to operation, slide 1 KW PA into cabinet and secure. Turn on PLATE AND SCREEN circuit breaker on 10 KW PA bottom panel. Reset 1 KW PA FREQUENCY MEGACYCLES selector to AUTOMATIC.

d. FINAL TRANSFORMER ALIGNMENT. The final transformer assemblies for the 19 frequency bands are arranged on 19 coil forms (figure 5-45). Frequency bands 1 and 2 both use coil forms 1 and 2 connected in series, and frequency bands 3 and 4 both use coil forms 3 and 4 connected in series. The coils for the remaining 15 bands are arranged on 15 separate forms, with 2 coils on each form providing a double-tuned circuit for each band. The slug-tuned coils are aligned from the top of the form. The adjustment slug for the coil on the top of each form (coil L1) is marked black while the slug for the bottom coil is unmarked. To align final transformer assemblies, proceed as follows. (All control, indicator, and connector references apply to the 1 KW PA unless otherwise specified.)

a. Perform preliminary procedures as directed in paragraph 5-22b.

b. Connect test equipment with 1 KW PA to provide test setup illustrated by figure 5-4.

c. Activate test equipment, and set sweep generator output level to minimum.

d. Set PWR control 1A1R13 (front panel) to maximum clockwise and set Internal Power Set control 1A1R12 (figure 5-7) to maximum counterclockwise.

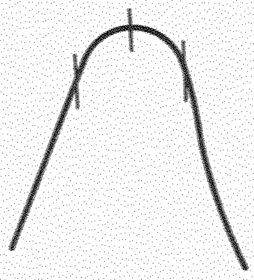
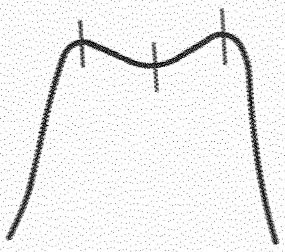
e. Defeat two interlock switches on 1 KW PA by pulling plungers straight out.

f. Turn off PLATE AND SCREEN circuit breaker on 10 KW PA bottom panel.

g. Depress Exciter STANDBY pushbutton and allow 15 minutes for equipment warmup.

h. Depress Exciter OPERATE pushbutton. Change Exciter frequency to lock transmitter in tune condition, but do not

TABLE 5-2. DRIVER TRANSFORMER ALIGNMENT

BAND NO.	BAND LIMITS (MC)	TUNING SLUG(s)	WAVEFORM
1	2 - 2.5	A1	 Single Tuned Requirements · Good symmetry over top of curve · High and low markers same amplitude
2	2.5 - 3	A2	
3	3 - 3.5	A3 bottom	
4	3.5 -4	A3 top	
5	4 - 5	A4 top	
6	5 - 6	A4 bottom	
7	6 - 7	A5 top	
8	7 - 8	A5 bottom	
9	8 - 10	A6 top & bottom	 Double Tuned Requirements · Top symmetry · High and low markers each near peak of hump
10	10 - 12	A7 top & bottom	
11	12 - 14	A8 top & bottom	
12	14 - 16	A9 top & bottom	
13	16 - 18	A10 top & bottom	
14	18 - 20	A11 top & bottom	
15	20 - 22	A12 top & bottom	
16	22 - 24	A13 top & bottom	
17	24 - 26	A14 top & bottom	
18	26 - 28	A15 top & bottom	
19	28 - 30	A16 top & bottom	

Note

Detuning the top slug (primary of a double-tuned circuit will move the entire waveform with respect to the markers. Detuning the bottom slug (secondary) will skew the waveform so that one peak is more pronounced.

depress TUNE pushbutton. This will key the set.

i. Set 1 KW PA FREQUENCY MEGACYCLES selector at frequency range corresponding to frequency band being aligned.

j. Set generator to sweep band being aligned (approximately 0.5 volts RF output) and insert markers for upper and lower limits of this band.

NOTE

The second trace on the oscilloscope will display the remote flattening (external monitor) input to the sweep generator. The flat portion of the display must always be wider than the edges of the band being aligned to ensure that the remote flattening is maintaining constant driver stage output.

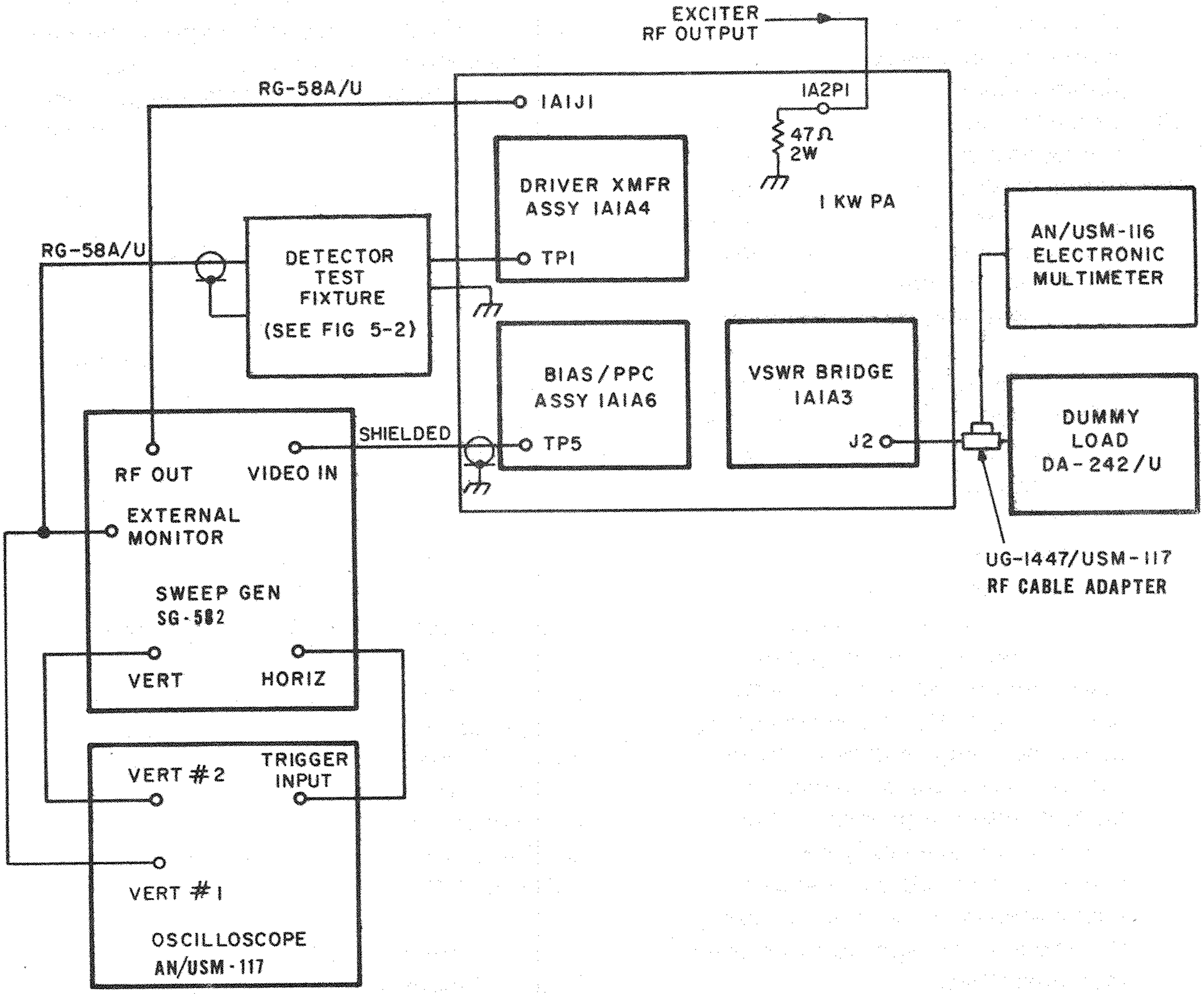


Figure 5-4. Final Transformer Alignment Test Setup.

k. Perform alignment as stated in table 5-3 to obtain a waveform with maximum amplitude and resembling the example shown as closely as possible.

NOTE

1. Each final transformer assembly is aligned individually, except for bands 2 and 4. Band 2 alignment must be followed by band 1 alignment and band 4 alignment must be followed by band 3 alignment. When aligning bands 1-2 or 3-4, it will be necessary to repeat alignment of the two interacting bands a few times to obtain the best compromise on amplitude and waveshape between the two bands.
2. Coils for bands 5-19 have primary tuning adjustments color-coded black, with no color marker on the secondary. Generally, once tuned close to the correct area, the primary adjustment can be expected to change the position of the entire waveform with respect to the frequency markers, and the secondary will affect the relative amplitudes of the two peaks and the shape of the response waveform.
3. For bands 16-19, after alignment for desired waveform is completed, it may be necessary to readjust slightly for equal plate circuits at band edges to obtain best I.M. characteristics, using the setup in step 1. This can be done after all bands are aligned with the present setup. Other bands need only be checked as specified in step 1; readjustment is necessary only if plate current spread is greater than specified.

l. To change bands, set 1 KW PA FREQUENCY MEGACYCLES selector and sweep generator to new band and repeat adjustments for the new band.

m. When alignment is completed, check alignment according to parameters listed in paragraph 5-19 using the following setup to generate a single-frequency signal. Repeat alignment on any band which fails to meet the basic requirements listed. Depress Exciter STANDBY pushbutton. Disconnect sweep generator and oscilloscope from 1 KW PA. Connect RF output from SG-582/U Signal Generator to 1 KW PA RF input connector 1A1J1. Set Internal and External Power Set controls to maximum clockwise. Use CW output from signal generator to drive 1 KW PA. Set Exciter CLASS OF EMISSION selector to SSB (∞). Depress OPERATE pushbutton.

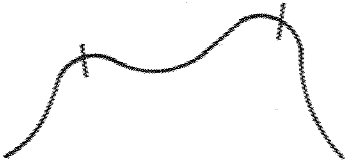
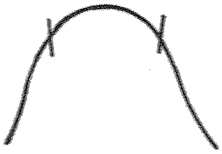
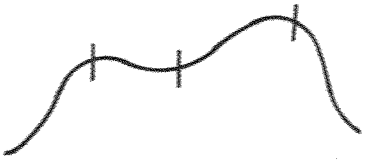
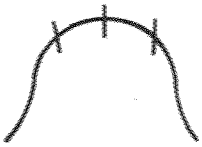
CAUTION

With Internal and External Power Set controls set to maximum clockwise, there is no overdrive protection for the 1 KW PA. Therefore, care must be exercised when setting signal generator output to prevent exceeding 1 KW (224 VAC on AN/USM-116 Electronic Multimeter).

n. After all alignment and tests are completed, depress STANDBY pushbutton, and allow one minute for cooling; then depress AMPLIFIER OFF pushbutton. Disconnect all test equipment, and reconnect original cables and close up unit, following step 2 through 6 of preliminary procedure (paragraph 5-22b) in reverse order. Reset 1 KW PA FREQUENCY MEGACYCLES selector to AUTOMATIC.

o. Turn on 10 KW PA PLATE AND SCREEN circuit breaker. Perform

TABLE 5-3. FINAL TRANSFORMER ALIGNMENT

BAND NO.	BAND LIMITS (MC)	TUNING SLUG(s)	NOTES	WAVEFORMS
1	2 - 2.5	A1 black		
2	2.5 - 3	A2 black A1 unmarked	Must realign band 1 after band 2 alignment	
3	3 - 3.5	A3 black		
4	3.5 - 4	A4 black A3 unmarked	Must realign band 3 after band 4 alignment	
5 6 7 8	4 - 5 5 - 6 6 - 7 7 - 8	A5 both A6 both A7 both A8 both		
9 10	8 - 10 10 - 12	A9 both A10 both		
11 12 13 14 15	12 - 14 14 - 16 16 - 18 18 - 20 20 - 22	A11 both A12 both A13 both A14 both A15 both		
16 17 18 19	22 - 24 24 - 26 26 - 28 28 - 30	A16 both A17 both A18 both A19 both		

Transmitter Peak Power Control Adjustment, paragraph 5-41, prior to releasing equipment to operating personnel.

5-23. DRIVE CHAIN ADJUSTMENT.

5-24. To tighten the 1 KW PA drive chain proceed as follows:

a. Turn off PRIMARY POWER circuit breaker on Exciter-1 KW PA cabinet bottom panel.

b. Loosen 1 KW PA front panel captive screws, and slide out chassis.

c. Tilt chassis to expose underside; lock.

d. Locate two Phillips-head screws which secure drive chain bracket assembly to main chassis, directly behind front panel (figure 5-9).

e. Loosen two screws.

f. Push bracket toward front panel to increase tension on chain.

CAUTION

> The chain should be tight enough to eliminate all backlash. However, too much tension on the drive chain will cause excessive wear to the drive mechanism.

g. While maintaining light tension on drive chain bracket assembly, tighten two screws securing assembly to main chassis.

h. Return chassis to horizontal position, slide into cabinet, and secure.

i. Turn on PRIMARY POWER circuit breaker.

5-25 10 KW PA ADJUSTMENTS.

5-26. The adjustments provided on the 10 KW PA consist of operating level and calibration potentiometers on the DC Amplifiers and Monitor/Control assemblies.

5-27. MONITOR/CONTROL ASSEMBLY ADJUSTMENTS.

5-28. The Monitor/Control Assembly 9A1A6 has six potentiometer adjustments which are made accessible by extending the 10 KW PA chassis on its slides. Adjustment potentiometers are located on the rear of the Monitor/Control assembly (figure 5-29).

NOTE

> Adjustments should be checked whenever the PA tube, the bias and servo power supply board, or the 9A1A6 boards are changed; when operation or maintenance procedures indicate readjustment is necessary; or after repairs to associated circuits have been made. Proper adjustment is essential to protect the 10 KW PA, and adjustments should be performed in the order in which they are presented in the following procedures.

Following is a list of Monitor/Control Assembly adjustments.

9A1A6R1	Keyed Bias Adjust
9A1A6R2	Screen Current Limit
9A1A6R3	Plate Current Limit
9A1A6R4	VSWR Limit
9A1A6R5	Bias Voltage Meter Calibrate
9A1A6R6	Filament Voltage Meter Calibrate

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED.

Variable Voltage DC Power Supply

0-15 VDC, 3.5 AMP minimum.

Multimeter AN/PSM-4B.

RF Dummy Load, 50 ohms, 10 KW.

b. SCREEN CURRENT LIMIT ADJUSTMENT PROCEDURE. This adjustment determines the screen current limit which, if exceeded, will cause a 10 KW PA fault indication. In the following procedure the screem current limit is nominally adjusted to indicate a fault for 100 milliamperes screen current.

WARNING

Turn off external primary power to equipment and use the high voltage shorting stick to ground exposed high voltage terminals before making test connections. Lethal AC and DC voltages are present at 9A4TB1 terminals and other nearby component terminals in the 10 KW PA.

1. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on Exciter-1 KW PA cabinet bottom panel and PLATE AND SCREEN circuit breaker on 10 KW PA cabinet bottom panel.

2. Open hinged power supply access door by removing two screws on the left hand side.

3. Locate filter capacitor 9A3C1 (figure 5-25), and use shorting stick to ground all capacitor terminals and all nearby terminals. Short 9A3C1 capacitor terminals together for the following adjustment.

4. Set up variable DC power supply with the negative lead connected through AN/PSM-4B to either terminal of capacitor 9A3C1. Set AN/PSM-4B to 500 MA DC range connect positive lead to ground.

5. Close power supply access door, and secure with one screw.

6. Slide out chassis assembly 9A1, being careful of test leads.

7. Defeat the interlock switch on the air exhaust plenum by pulling plunger straight out.

8. Locate Screen Current Limit Adjust potentiometer 9A1A6R2 (figure 5-29), loosen locknut, and set to maximum counterclockwise.

9. Turn on PRIMARY POWER circuit breaker. Exciter STANDBY indicator should illuminate after three minute time delay.

CAUTION

Do not depress OPERATE pushbutton. Test equipment may be damaged.

10. Turn on variable DC power supply, and adjust to provide 100 MA indication on AN/PSM-4B, Multimeter.

11. Turn Screen Current Limit Adjust 9A1A6R2 slowly clockwise until 10 KW PA FAULT indicator illuminates.

12. Tighten locknut. Reduce variable DC power supply output, reset fault circuit, and slowly increase variable DC power supply output until FAULT indicator again illuminates. Note the current at which the fault trips. If necessary, readjust 9A1A6R2 slightly, and recheck trip current. Repeat as necessary until fault detector trips at exactly 100 MA.

13. Turn off PRIMARY POWER circuit breaker.

14. Remove test connections and short across capacitor 9A3C1.

15. Proceed with subsequent adjustment procedure, or secure equipment. After final adjustment, turn on PLATE AND SCREEN circuit breaker on bottom 10 KW PA panel and PRIMARY POWER circuit breaker on bottom Exciter-1 KW PA cabinet panel.

c. PLATE CURRENT LIMIT ADJUSTMENT PROCEDURE. This adjustment determines the plate current limit which, if exceeded, will cause a 10 KW PA fault indication. In the following procedure, the plate current limit is nominally adjusted to indicate a fault for 3.4 amperes plate current.

WARNING

Turn off external primary power to equipment and use high voltage shorting stick to ground exposed high voltage terminals before making test connections. Lethal AC and DC voltages are present at Rectifier Assembly 9A4 and other nearby component terminals in the 10 KW PA.

1. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on Exciter-1 KW PA cabinet bottom panel and PLATE AND SCREEN circuit breaker on 10 KW PA bottom panel.

2. Open hinged power supply access door by removing two screws on left hand side.

3. Locate resistor 9A4R10 on the Rectifier Assembly (figure 5-27), and use shorting stick to ground all terminals in the area.

4. Connect variable DC power supply with positive lead to chassis ground and negative lead through AN/PSM-4B Multimeter to the ungrounded terminal of resistor 9A4R10. Set AN/PSM-4B to 10 AMP DC range.

5. Close power supply access door, and secure with one screw.

6. Slide out chassis assembly 9A1, being careful of test leads.

7. Defeat the interlock switch on the air exhaust plenum by pulling plunger straight out.

8. Locate Plate Current Limit Adjust potentiometer 9A1A6R3 (figure 5-29), loosen lock nut, and set to maximum counterclockwise.

9. Turn on PRIMARY POWER circuit bresker, and allow for three-minute standby time delay.

CAUTION

Do not depress OPERATE pushbutton. Test equipment may be damaged.

10. Turn on variable DC power supply, and adjust to provide a 3.4 AMP indication on AN/PSM-4B Multimeter.

11. Turn Plate Current Limit Adjust 9A1A6R3 slowly clockwise until 10 KW PA FAULT indicator illuminates.

12. Tighten locknut. Reduce variable DC power supply output, reset fault circuit, and slowly increase variable DC power supply output until FAULT indicator again illuminates. Note the plate current incication at which the fault detector trips. If necessary, readjust 9A1A6R3 slightly, and recheck trip current. Repeat as necessary until fault detector trips at exactly 3.4 AMP.

13. Turn off PRIMARY POWER circuit breaker.

14. Remove test connections.

15. Proceed with subsequent adjustment procedures, or secure equipment.

16. Turn on PLATE AND SCREEN circuit breaker on bottom 10 KW PA panel and PRIMARY POWER circuit breaker on bottom Exciter-1 KW PA cabinet panel.

d. FILAMENT VOLTAGE, METER CALIBRATION PROCEDURE. This adjustment calibrates the FAULT DETECTOR meter with respect to the 220 VAC filament supply for PA tube 9A1V1. Before the calibration can be made, however, voltages to the 10 KW PA unit input and the PA tube filament must be proven to be within tolerance or adjusted if necessary. The filament voltage meter circuit indicates as a function of voltage on the lines to the primary of the filament transformer in order to minimize the number of leads entering the input compartment. Thus, due to the indirect metering method, the meter reading must be correlated with actual voltage at the filament. The following procedure also provides for changing taps on the filament transformer if the filament voltage is found to be incorrect.

1. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom panel of Exciter-1 KW PA cabinet.

2. Open rear door of Exciter-1 KW PA cabinet. Remove protective cover from rear of autotransformer 8T1, and familiarize yourself with terminal identification. Refer to figure 5-6.

WARNING

High voltages are present at autotransformer terminals when power is turned on. Refer to high voltage measurement precautions in NAVSHIPS 0967-000-0000, Electronics Installation and Maintenance Book, before proceeding.

3. Turn on PRIMARY POWER circuit breaker.

4. Connect Multimeter AN/PSM-4B, set to 250 VAC range, alternately between two of the three taps marked 220V to check the line to line voltage of the three phase power output to the 10 KW PA. Ensure that the voltage is within 5 percent of the proper voltage (220V L-L) for the 10 KW PA. If not, refer to paragraph 2-29 for tap reconnection procedure.

5. After proper line voltage is established, turn off PRIMARY POWER circuit breaker, and reinstall protective cover over back of autotransformer. Close rear door.

6. Open 10 KW PA cabinet front door, and remove input compartment cover (figure 5-29). Use shorting stick to discharge input compartment circuits. Check filament leads at tube socket to ensure tight connections.

NOTE

Filament operates with low voltage and very high current. Any resistance in connections will cause substantial voltage drop and heating.

7. Connect Multimeter AN/PSM-4B, set to measure 6.4 VAC, to the filament terminals 9A1XV1 at the bottom of the tube socket (figure 5-32). Replace input compartment cover, using several screws to hold it in place and being careful of test leads.

8. Turn on PRIMARY POWER circuit breaker. Check to see that filament voltage is between 5.8 and 6.3 VAC. If necessary, the tap connections on the primary of filament transformer (figure 5-50) should be reconnected (after turning off power) to provide desired filament voltage.

9. Turn off PRIMARY POWER circuit breaker.

10. Disconnect test leads, and securely reinstall input compartment cover with all screws.

11. Slide out chassis assembly 9A1.

12. Set FAULT DETECTOR meter selector to FIL.

13. Turn on PRIMARY POWER circuit breaker.

14. With Exciter in STANDBY, loosen locknut and adjust Filament Voltage Meter Calibrate potentiometer 9A1A6R6 to make FAULT DETECTOR meter indicate in the center of the NORMAL shaded area. Tighten locknut.

15. Depress Exciter AMPLIFIER OFF pushbutton.

16. Slide chassis assembly into cabinet and secure.

e. BIAS ADJUSTMENT AND BIAS VOLTAGE METER ADJUSTMENT PROCEDURE. The bias adjustment may be performed at any time when it seems necessary; however, idling current may change somewhat after long periods of continuous operation at full power, due to heating. Therefore, the bias should be checked and readjusted if necessary after a warm-up period of transmission at about 5 KW average power for a period of at least 30 minutes. This is recommended, since reduced idling current when running cool (as low as 0.7 AMP) will still provide acceptable results, but increased idling current (considerably greater than 1.1 AMP) should be avoided.

NOTE

All references in the following procedure refer to the 10 KW PA unless otherwise specified.

1. Depress Exciter AMPLIFIER OFF pushbutton.

2. Slide out chassis assembly 9A1, and defeat interlock switch on air exhaust plenum (figure 5-31).

3. Depress Exciter STANDBY pushbutton, and allow for three-minute time delay; then depress OPERATE pushbutton.

4. Change Exciter frequency to lock transmitter in tune cycle condition, but do not depress TUNE pushbutton. With TUNE pushbutton illuminated and READY indicator extinguished, the transmitter will be keyed, but no drive will be applied.

5. Adjust Bias potentiometer 9A1A6R1 (figure 5-28) for 1.1 AMP keyed idling

current indication on PLATE CURRENT meter.

6. Set FAULT DETECTOR meter switch to BIAS. Adjust Bias Voltage Meter Adjust potentiometer 9A1A6R5 to position resulting in FAULT DETECTOR meter indication in the center of the KEYED BIAS shaded area while front door PLATE CURRENT meter reads 1.1 AMP.

7. Depress Exciter AMPLIFIER OFF pushbutton, and return CHANNEL GAIN RATIO control A1 to 100.

8. Slide chassis assembly 9A1 back into cabinet, and secure.

f. VSWR LIMIT ADJUSTMENT PROCEDURE. This adjustment determines the reflected RF power limit which, if exceeded, will cause a 10 KW PA fault indication. In the following procedure, the VSWR limit is nominally adjusted to trip the VSWR fault detector at 1.6 KW average reflected power, which allows operation at full power into a 4:1 VSWR without tripping. If desired, the adjustment optionally may be set to trip at any lower reflected power level, although unnecessary for transmitter protection

NOTE

If uncertain of OUTPUT PWR meter accuracy, check calibration in paragraph 5-32 before proceeding.

1. Connect a 50 ohm, 10 KW RF dummy load to 10 KW PA output connector.

2. Connect a 1000 CPS audio source at 0 DBM output level to Exciter audio input channel A1. The CW key-down audio output of the Keyer unit may be used for this purpose, or a separate signal generator may be used. Output level does not have to be set precisely at the source; it is only necessary to be able to have sufficient drive level so the transmitter can be adjusted for a specific output level in the range from 0 to 5 KW.

3. Depress Exciter STANDBY pushbutton, and allow for three-minute time delay; then depress OPERATE pushbutton.

4. Set Exciter FREQUENCY KC selectors to 03600.0 KCS, and set CLASS OF EMISSION selector to A1, F1, F4. Set SIDEBAND SELECTOR to USB, and set CHANNEL GAIN RATIO control A1 to 0. Set PEAK/AVG selector on top panel of 10 KW PA to AVG.

5. Depress TUNE pushbutton, and wait for completion of tune cycle.

6. Turn up CHANNEL GAIN RATIO control A1 (and signal source if necessary) to obtain 5 KW average power reading on OUTPUT PWR meter to ensure that transmitter operation is normal.

7. Set 10 KW PA MAN/AUTO selector on Monitor/Control assembly to MAN:

8. Reduce CHANNEL GAIN RATIO control A1 setting to 1 KW output level.

9. Depress Exciter STANDBY pushbutton, allow one minute for tube cooling, and depress AMPLIFIER OFF pushbutton.

10. Slide out chassis assembly 9A1, and lock.

WARNING

Check to make sure set is in AMPLIFIER OFF condition, and use high voltage shorting stick on any exposed terminals under chassis assembly before reaching under chassis for the following step. Note the presence of the 8 KV feedthru capacitor under the front of the chassis, and avoid contact during the following procedure.

11. Locate Directional Coupler assembly 9A1A2 under 10 KW PA chassis (figure 5-27), and rotate reflected power element 180 degrees, so that directional arrow points down.

NOTE

Element of Directional Coupler which is viewed from rear of 10 KW PA chassis (with up-pointing arrow) is element which normally samples reflected power. For the following procedures, the reflected power element is reversed in direction to sense forward power, so that a low forward power signal can be used with a matched load; thus making higher power operation into a special high VSWR load unnecessary for calibration.

12. Defeat interlock switch on air exhaust plenum (figure 5-30) by pulling plunger straigh out.

13. Depress Exciter STANDBY pushbutton, and allow for three-minute time delay; then depress OPERATE pushbutton. Do not depress TUNE pushbutton. Ensure that there is no fault condition. Then depress STANDBY pushbutton.

14. Remove cover from 9A1A6 Monitor/Control Assembly, and disable fault sensors by pulling out Fault PC Board 9A1A6A3 (rear-most of three) about an inch. This will prevent VSWR fault tripping during tune up.

15. Depress OPERATE and TUNE pushbuttons. Set the 10 KW PA TUNE PWR REQUEST switch to the up position, and wait for TGC stabilization of the tune power level (approximately 2.5 KW). Turn off TUNE PWR REQUEST.

16. After removing tune power request, the 1 KW output level indication (same as step 8) should be obtained using the 15 KW REFL range.

17. Without returning to STANDBY, push Fault PC Board 9A1A6A3 back into position to allow fault sensor operation for following steps.

18. Slowly increase the setting of CHANNEL GAIN RATIO control A1 while watching 10 KW PA OUTPUT PWR meter and FAULT indicator and holding output power meter range selector in the 15 KW REFL position. Determine power level at which VSWR fault sensor trips. FAULT indicator should illuminate when power level reaches 1.6 KW (or optional lower level).

19. If necessary to reset trip level, proceed as follows; Depress 10 KW PA FAULT RESET pushbutton. Loosen locknut on VSWR fault adjust control 9A1A6R4 (rear of assembly), adjust setting (clockwise to trip at lower power), and tighten locknut. Reduce CHANNEL GAIN RATIO control A1 setting to zero. Then recheck trip level by repeating steps 14 and 15, and 17 through 19.

20. Replace cover on 9A1A6 Monitor/Control Assembly.

21. Depress AMPLIFIER OFF pushbutton, turn off PRIMARY POWER circuit breaker, and use shorting stick under chassis.

22. Return reflected power element of Directional Coupler assembly to its original position by rotating 180 degrees, so that

directional arrow points upward, as it originally did.

23. Disconnect test equipment, and restore transmitter to original operating condition. Reset 10 KW PA MAN/AUTO selector to AUTO.

5-29. DC AMPLIFIERS ASSEMBLY ADJUSTMENTS.

5-30. The DC Amplifiers Assembly 9A1A5 has four adjustments which are made accessible by extending the 10 KW PA chassis on its slides. Adjustment potentiometers are located on the rear of the DC Amplifiers Assembly (figure 5-29).

5-31. Adjustments should be made only if repairs to associated circuits have been made or if operational performance indicates adjustment is necessary. The four adjustments in this assembly are:

9A1A5R1	Tune Surveillance Gain
9A1A5R2	Load Surveillance Gain
9A1A5R3	Tune Stall Torque Threshold
9A1A5R4	Load Stall Torque Threshold

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED. Multimeter AN/PSM-4B.

b. TUNE/LOAD SURVEILLANCE GAIN ADJUSTMENT PROCEDURE. The automatic surveillance feature keeps the output network tuned during operation to compensate for changing load conditions or component drift due to heating. Tune and Load Surveillance Gain potentiometers 9A1A5R1 and 9A1A5R2 are normally left in the fully counter clockwise position. Resetting of these potentiometers from full counter clockwise is not a normal adjustment, but is may be done, if necessary, to reduce the surveillance gain in the event of servo "creeping" (small-increment retuning of drive mechanisms during operation). Turning potentiometers to the extreme clockwise position will completely disable the automatic tune and load surveillance feature.

1. In the event that creeping is noticed during operation, both Surveillance Gain potentiometers (9A1A5R1, Tune and 9A1A5R2, Lodd) should be reset slightly clockwise as necessary to reduce the gain until creeping stops.

2. Occasional servo operation to compensate for changing load conditions is normal and should not be confused with creeping, which is a more constant retuning unrelated to the former. The load surveillance gain must never be greater than the tune surveillance gain or the load servo may "run away" toward maximum capacity. The tune servo should always be the dominant factor in automatic tuning of the output network, since if the tune servo does not hold the output network in resonance, the load will attempt hopelessly to raise the plate impedance to the proper value. Therefore, if the tune surveillance gain is reduced, the load surveillance gain must be reduced by at least the same amount.

c. TUNE/LOAD STALL TORQUE THRESHOLD ADJUSTMENT PROCEDURE. Tune Stall Torque Threshold potentiometer 9A1A5R3 and Load Stall Torque Threshold potentiometer 9A1A5R4 set the sensitivity of the servo amplifier threshold detector circuits which sense when the servo motors are or should be running. Proper adjustment is essential to sequencing of alternate tune and load servo operation and indicating to the tune-up logic circuit when the servos are or are not tuning. Adjustments should be checked after repair or replacement of the threshold detector on the servo amplifier assembly or if malfunction is evident.

If TUNING indicator remains illuminated after tune up is completed, either tune or load adjustment may be set too low. If the load servo "runs away", the tune adjustment may be set too high, thus tune servo operation is not sensed. If premature tune up completion is indicated by TUNING indicator extinguishing before servo has completed tuning, the load adjustment may be set too high.

1. Turn off PRIMARY POWER circuit breaker on bottom panel of Exciter-1 KW PA cabinet.

2. Extend 10 KW PA chassis out on chassis slides and lock. Defeat interlock switch on air exhaust pelnum (figure 5-31).

3. Connect AN/PSM-4B Multimeter, set to 50 VDC range, across load servo motor leads at 9A1TB8 terminals 3 and 4 (figure 5-29).

CAUTION

Do not attempt to connect meter while power is on and be careful of leads when power is on during tests, since a short from either motor lead to ground or a short across the motor will damage the output transistors and the driver transistors in the servo amplifier circuit.

4. Turn on PRIMARY POWER circuit breaker.

5. Turn the variable load control 9A6R1 (figure 5-28) manually to generate a driving voltage of 14 volts between the motor terminals.

6. Adjust Load Stall Torque Threshold 9A1A5R4 so that TUNING indicator on front of assembly just turns on.

7. Check both directions of rotation, reversing the polarity of the AN/PSM-4B. The TUNING indicator should illuminate at an indication of 14 ± 0.5V Readjust if necessary.

8. Turn off 28V circuit breaker on bottom panel of 10 KW PA.

9. Reconnect AN/PSM-4B test leads to 9A1TB7 terminals 3 and 4 (tune motor leads).

10. Turn on 28V circuit breaker.

11. Turn the variable tune control 9A1A7R1 (figure 5-29) manually to generate a driving voltage across the motor terminals of 11 volts.

12. Adjust Tune Stall Torque The 9A1A5R3 so that TUNING indicator just turns on.

13. Check both directions of rotation as in step 7, except using a 11 ± 0.5V indication.

14. Turn off 28V circuit breaker, and depress Exciter AMPLIFIER OFF pushbutton.

15. Disconnect test leads, and place chassis back in cabinet.

16. Turn on 28V circuit breaker, and depress Exciter STANDBY pushbutton. After three-minute time delay, depress OPERATE pushbutton.

17. Check for proper automatic tuning by operational checkout of tune cycle at 2 MCS, 16 MCS, and 29.9999 MCS. Correct operation is indicated by completion of tune cycle as noted by having the TUNING indicator on the 10 KW PA extinguish.

NOTE

Adjustments are set according to voltages across motors which are determined empirically at the factory to be the voltages at which motors will no longer rotate with the frictional load of the capacitors and drive mechanisms. After adjusting by this method, it may be necessary to make slight readjustments to compensate for a difference in friction in your unit.* However, if motor stalling occurs at higher than 17 volts, the drive assembly should be checked for damage or lubrication to determine the cause of the added friction.

If high friction is suspected, the torque required to turn the motors, drives, and capacitors may be checked. The motor, drive, and tune capacitor 9A1C8 should require no more than 20 oz. in. The motor, drive, and both load capacitors 9A1C4 and 9A1C6 should require no more than 25 oz. in. total. (The motor should supply 35 oz. in. with full 28V drive applied.)

*To check the actual motor stalling voltage, proceed as follows:

18. Depress Exciter STANDBY pushbutton, and change Exciter frequency to put transmitter into preposition mode.

19. Connect multimeter across the respective motor leads (9A1TB7 or TB8-terminals 3 and 4).

20. Turn the manual tuning knob until restoring torque is felt. Then slowly ease back, allowing the motor to return to null position. Note the voltage across the motor after your hand is removed.

21. To find the worst case stall voltage, the above steps must be repeated several times and at various frequencies (2, 16, and 29.999 MC).

22. The stall torque threshold can then be set to a voltage about 0.5V higher than the maximum stall voltage found empirically above.

5-32. PEAK/AVERAGE DETECTOR ASSEMBLY ADJUSTMENTS.

5-33. The peak/average detector assembly has four adjustments, which are accessible from under the front of the assembly (figure 5-31) without extending the chassis out on its slides.

5-34. Adjustments should be made only if repairs to associated circuits have been made or if meter calibration is found to be in error when compared to a known standard. The four adjustments in the assembly are:

9A1A1R1	Forward Calibrate
9A1A1R2	Reflected Calibrate
9A1A1R3	Meter Zero
9A1A1R4	Peak Calibrate

5-35. The forward and reflected calibrations affect both peak and average power readings. The meter zero adjustment affects only the average readings, and the peak calibration affects only peak readings. Whenever adjustments are made, it is good practice to perform all four adjustments; thus, a single procedure is provided.

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED.

1. Calorimeter (10 KW, 50 ohm dummy load with calibrated power meter) Electro-Impulse Corp, model CPM-10K or equivlent.

NOTE

If a calorimetric power meter is not available, a VTVM (HP410B) with a 100:1 capacity divider probe (HP10040A) may be connected to the RF output of the 10KW PA along with a 50 dummy load by use of a T-connector. The power output is read in voltage from the following relationship:

386 VRMS	3.0 KW
275 VRMS	1.5 KW

2. AF Signal Generator, SG-376/U (Keyer unit may be used as a substitute).

b. TO ADJUST THE PEAK/AVERAGE DETECTOR, PROCEED AS FOLLOWS

1. Depress AMPLIFIER OFF pushbutton.

2. Connect calorimeter (or substitute) to 10 KW PA RF output connector.

3. Connect a 1000 CPS audio source, at 0 DBM output level, to Exciter audio input channel A1. The CW key down audio output of the Keyer unit may be used for this purpose, or a separate signal generator may be used. Output level does not have to be set precisely; it is only necessary to provide sufficient drive level to allow transmitter output to be set to any level up to its rated output.

4. Check OUTPUT PWR meter for mechanical zero, and adjust meter zero screw if necessary.

5. Momentarily depress Exciter STANDBY pushbutton.

6. Loosen locknuts on the four peak/average detector controls.

7. Set PEAK/AVG selector (figure 5-30) to AVG. Hold output power meter selector in the 1.5 KW REFL position; and check OUTPUT PWR meter indication.

8. Adjust meter zero control 9A1A1R3 for exact zero indication if necessary. Then tighten locknut, and check indication.

9. Set Exciter FREQUENCY KC selectors to 03600.0 KCS; set CLASS OF EMISSION selector to A1, F1, F4; and set sideband selector to USB. Set CHANNEL GAIN RATIO control A1 to 0.

10. Momentarily depress Exciter OPERATE pushbutton and then the TUNE pushbutton.

11. Slowly increase CHANNEL GAIN RATIO control A1 setting to obtain 3.0 KW (386 volts RMS output reading on calorimeter (or other RMS power standard). Allow sufficient time for calorimeter to stabilize to avoid application of excessive drive.

12. With output power meter selector in 15 KW FWD position loosen locknut and adjust forward calibrate control 9A1A1R1 for exact 3.0 KW indication on the 10 KW PA OUTPUT PWR meter. Then tighten locknut, and recheck indication.

13. Set PEAK/AVG selector to PEAK loosen locknut and adjust peak calibrate control 9A1A1R4 for 3.0 KW indication on OUTPUT PWR meter. Then tighten locknut, and recheck indication.

14. Depress Exciter STANDBY pushbutton, and allow one minute for cooling; then depress AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom of Exciter-1 KW PA cabinet.

15. Extend 10 KW PA chassis 9A1 on its slides.

WARNING

Check to make sure primary power is off, and use high voltage shorting stick on any exposed terminals under chassis before reaching under chassis for the following step. Note the presence of the 8 KV feed-thru capacitor under the chassis (figure 5-28).

16. Locate Directional Coupler Assembly 9A1A2 under 10 KW PA chassis (figure 5-28), and rotate reflected power element 180 degrees, so that arrow points down.

NOTE

1. Element of Directional Coupler which is viewed from rear of 10 KW PA chassis (with up-pointing arrow) is element which normally samples reflected power. For the following steps, the reflected power element is reversed in direction to sense forward power so that a low power forward signal can be used with a matched load to simulate reflected power, rather than using high power with a special high VSWR load.
2. The calibration procedure requires power levels which would trip the VSWR fault detector when the directional coupler element is turned around. Refer to VSWR limit adjustment procedure (paragraph 5-28 f. and set the VSWR limit adjustment fully counterclockwise. After completing meter adjustment, reset VSWR limit adjust control to the required trip level.

17. Slide 10 KW PA chassis back into cabinet.

18. Set Exciter CHANNEL GAIN RATIO control A1 to 0.

19. Turn on PRIMARY POWER circuit breaker on the bottom of the Exciter-1 KW PA cabinet. Allow for three-minute time delay; then depress OPERATE and TUNE pushbuttons.

20. Slowly increase CHANNEL GAIN RATIO control A1 setting until a 1.5 KW (275 volts RMS) indication is obtained on calorimeter (or other RMS power standard). Allow sufficient time for calorimeter stabilization as power is increased.

21. Hold output power meter selector in 1.5 KW REFL position loosen locknut and adjust reflected calibration control 9A1A1R2 for a 1.5 KW indication on the 10 KW PA OUTPUT PWR meter. Then tighten locknut, and recheck indication.

22. Depress Exciter STANDBY pushbutton. Allow one minute for cooling, and depress AMPLIFIER OFF pushbutton. Then turn off PRIMARY POWER circuit breaker on bottom of Exciter-1 KW PA cabinet.

23. Extend 10 KW PA chassis on its slides.

WARNING

Check to make sure primary power is off, and use high voltage shorting stick on all exposed terminals before reaching under chassis in the following step.

24. Locate Directional Coupler Assembly reflected element (rear element), and rotate element 180 degrees -- back to its original direction (arrow pointing upward).

25. Disconnect test equipment, and restore transmitter to original operating condition.

NOTE

If it is desired to check forward power calibration at full power, leave calorimeter connected. Bridge 1000 CPS audio signal into both Exciter audio channels A1 and B1. Set the Exciter for (2) ISB, SSB (∞) operation, and use CHANNEL GAIN RATIO controls and signal generator SG-376/U output control to slowly increase levels to exactly 5000 W indication on calorimeter and a proper two-tone envelope pattern on an oscilloscope connected to 10 KW PA OUTPUT MONITOR connector. Be sure to allow sufficient time for calorimeter stabilization as power is increased to avoid overdriving the transmitter before power meter on the 10 KW PA should read 5 KW ± 500 W on AVG and 10 KW ± 1 KW on PEAK.

5-36. TRANSMITTER GAIN CONTROL ADJUSTMENT.

5-37. The TGC system automatically sets the gain in the Exciter to provide proper drive to the 1 KW PA and 10 KW PA units. The two controls which are adjusted in the following procedure are the TGC control and the PWR control. Both are located in the Exciter unit. The TGC control sets the TGC circuit null point with respect to the TGC signal received from the 1 KW PA TGC-PPC circuit during tune-up (approximately 4V). The PWR control sets the maximum drive available with the TGC system at full gain.

5-38. Circumstances which might require adjustments to be made include changing Exciter unit, repairing the Exciter TGC circuit or RF circuits in the RF path after the TGC gain control, repairing or replacing TGC-PPC circuit in the 1 KW PA, or repairing or changing 10 KW PA directional coupler assembly or meter amplifier assembly.

5-39. In addition to affecting the power level during tune-up, the TGC control adjustment also affects the level of the final transmitted signal with respect to the point at which PPC should take affect. Thus, if set too low, the peak envelope power of the transmitter signal after tune up will always be lower than the PPC level (10 KW). If set too high, PPC will be constantly working to reduce the signal - - not just on peaks, and even less than full input audio signals will drive the transmitter to the PPC level. The desired setting results in a safe tune power level (2500 watts) and desired PPC action during transmission.

5-40. The PWR control is adjusted, after the TGC control, so that the power level available with TGC motor run up to its maximum gain position is just over the level required for the frequency with the lowest gain in the overall transmitter. This is normally 15 MCS; so that frequency is used for adjustment of the PWR control. The procedure forces the TGC circuit to remain at full gain, while the PWR control is being set to a level just over that required for normal tune-up. After the adjustment is made, the TGC circuit operates near the full gain end of its range on subsequent tune cycles. Thus, if a malfunction of the TGC system or the output of the transmitter ever occurs and the TGC circuit in the Exciter doesn't receive the TGC voltage it expects, the drive to the 1 KW PA and 10 KW PA is not much higher than necessary for normal operation. With the PWR control left wide open, the TGC circuit would otherwise raise the drive level considerably under such conditions.

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED. Non-inductive alignment tool, JFD #5284.

b. TO ADJUST THE TRANSMITTER GAIN CONTROL, PROCEED AS FOLLOWS:

1. Depress Exciter AMPLIFIER OFF pushbutton.

2. Loosen Exciter front panel captive screws, and pull Exciter chassis out on slides.

3. Set Exciter PWR control on inside top sub-panel to maximum clockwise. Set all CHANNEL GAIN RATIO controls on front panel to 0.

4. Check 1 KW PA front panel control to ensure that it is at maximum clockwise.

5. Depress Exciter STANDBY pushbutton, and allow for three-minute time delay; then depress OPERATE pushbutton.

6. Set Exciter FREQUENCY KC selectors for 04,000.0 KC operation. Set class of emission selector to A2, A3e.

7. Depress Exciter TUNE pushbutton. After tuning, tilt Exciter chassis up to expose underside.

8. Set 10 KW PA MAN/AUTO selector to MAN, and set TUNE POWER request selector to the up (on) position.

9. Locate the TGC module in the right hand rear corner of the underside of the Exciter. Remove its cover, and find the TGC adjustment potentiometer in the lower right corner Insert a JFD #5284 alignment tool in the slot of the potentiometer. Adjust the potentiometer for a 2500W indication on the 10 KW PA OUTPUT PWR meter.

10. Turn off the 10 KW PA TUNE POWER REQUEST selector, and set MAN/AUTO selector to AUTO.

11. Reinstall the cover on the TGC Module in the Exciter.

12. Rotate Exciter to expose top controls at a 45 degree angle.

13. Set Exciter FREQUENCY KC selectors to 15,000.0 KCS.

14. Depress Exciter TUNE pushbutton. After tuning, the transmitter output power should be approximately 2.5 KW.

15. Set PWR control at top sub-panel of Exciter to full counterclockwise. The transmitter output should be greatly reduced.

16. Set 10 KW PA MAN/AUTO selector to MAN, and turn on TUNE POWER REQUEST switch.

17. Depress Exciter TUNE pushbutton. The TGC motor should run to its maximum gain limit in a futile effort to provide full tune power drive.

18. Turn PWR control on Exciter subpanel slowly clockwise until the 10 KW PA OUTPUT METER indication reaches approximately 2.0 KW. Do not exceed 2.5 KW so that the TGC motor stays at its maximum gain position.

19. Reset 10 KW PA MAN/AUTO selector to AUTO, and turn off TUNE POWER

REQUEST selector. The Exciter READY indicator should be illuminated. The 10 KW PA output should be about 2 KW.

CAUTION

> An 8 KW single-tone signal exceeds the continuous 5 KW average rating power of the transmitter. The adjustment should be made quickly and the TUNE pushbutton should be depressed as soon as possible to reduce the power level. High average power operation should not be sustained for longer than two minutes.

20. Turn Exciter PWR control clockwise until 10 KW PA output power reaches 8 KW. Then immediately depress Exciter TUNE pushbutton.

NOTE

> After retuning, the transmitter should return to the air with a power level of about 2.5 KW. Turning the PWR control up without retuning, as was done, allows the TGC system to compensate only after a new tune cycle.

21. Depress Exciter STANDBY pushbutton.

5-41. The following procedure provides proper limiting levels for the peak power control function of the transmitter so the RF output is maintained at the proper level and the equipment is protected from being overdriven.

a. THE FOLLOWING TEST EQUIPMENT IS REQUIRED.

RF Dummy Load DA-242/U.

Electronic Multimeter AN/USM-116.

RF Cable Adapter UG-1447/USM-117.

AF Signal Generator SG-376/U.

b. TO ADJUST THE PEAK POWER CONTROL, PROCEED AS FOLLOWS:

1. Connect dummy load to output of 10 KW PA (RF output connector).

2. Set Internal Power Set control (1A1R12) to its fully CW position.

3. Set External Power Set control (1A1R11) to its fully CW position.

4. Connect SG-376/U through audio distribution panel to channel A1 input of Exciter. Set SG-376/U for mimimum output at frequencies of 1000 and 1625 cps.

WARNING

> Lethal voltages as high as 1200 VRF, 2400 VDC, and 460 VAC are present within the 1 KW PA when the system is operating. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance Book High-Voltage Adjustment Procedures before proceeding.

5. Loosen 1KW PA front panel captive screws, and slide out chassis.

6. Defeat two interlock switches by pulling plunger straight out. Check 1 KW PA front PWR control to ensure that it is at maximum clockwise.

7. Depress Exciter STANDBY pushbutton, and allow three minutes for

warmup; then depress OPERATE pushbutton.

8. Depress Exciter TUNE pushbutton, and allow for tune up.

9. Carefully increase output levels of two tones at the SG-376/U in equal amounts until the 10 KW PA OUTPUT PWR meter indicates just over 10 KW output.

10. Slowly turn 1KW PA External Power Set control (1A1R11) counterclockwise until OUTPUT PWR indication drops to 10 KW. Tighten locknut.

11. Check transmitter at various frequencies throughout the 2-30MC range to ensure that power limiting occurs at 10KW as drive is gradually increased from a low level as in step (9).

12. Depress Exciter AMPLIFIER OFF pushbutton.

13. Slide 1 KW PA chassis into case, and secure.

14. Disconnect SG-376/U.

5-43. REPAIRS.

5-44. The following paragraphs give the removal and replacement instructions necessary for maintenance of the 1 KW PA, 1 KW Power Supply, 10 KW PA, and I. Box. Note that any procedures which require test equipment usually available only at a depot or depot level maintenance personnel are given in Overhaul and Repair Manual NAVSHIPS 0967-293-0060.

5-45. CIRCUIT BOARD EXTRACTORS.

5-46. There are three printed circuit boards enclosed within assembly 7A1A1 of I. Box. To extract any of these circuit boards, loosen two captive screws on left and right hand flanges, and swing assembly 7A1A1 up on its hinge to gain access to internal circuit boards. Use extractor levers provided on each circuit board to remove the board from its mounting.

5-47. When using extractor levers to remove I. Box, 1 KW PA, or 10 KW PA circuit boards, use levers simultaneously and apply equal extracting force on both levers to prevent binding of circuit boards due to tilting. Binding may damage board or socket connections. Similar precaution should be given to reinstallation. Be careful not to damage connector or break keys.

5-48. CIRCUIT BOARD PARTS REPLACEMENT.

5-49. When working with printed circuit boards, special handling and repair procedures described in Electronics Installation and Maintenance Book, NAVSHIPS 0967-000-0160, should be used to avoid damage and facilitate parts replacement.

5-50. PRIMARY INPUT AUTOTRANSFORMER REPLACEMENT.

5-51. The input autotransformer which receives the primary power input to the AN/FRT-84(V) is bottom mounted in the Exciter-1 KW PA cabinet. It is removeable through the rear door of the cabinet as follows.

NOTE

This autotransformer is a 250-pound part, and will require two men and mechanical lifting assistance to remove it from the cabinet.

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off external primary power to the equipment.

CAUTION

> Turn off primary power at facility power panel and red tag so nobody will inadvertently turn power on until work is completed.

b. Open front door; remove circuit breaker panel and lay carefully forward without disconnecting wiring.

c. Tag and remove the wires leaving the front of autotransformer.

d. Remove the two mounting bolts, accessible from the front, that attach the autotransformer to cabinet base.

e. Open rear door; remove cover protecting rear autotransformer.

f. Tag and remove wires leaving terminal strip on rear of autotransformer.

g. Remove the two remaining mounting bolts attaching autotransformer to cabinet base.

h. Carefully guide and lift out autotransformer through rear of cabinet with suitable lifting equipment.

i. Replace autotransformer in reverse order.

j. Check tap connections as per paragraph 2-29.

5-52. 1 KW POWER SUPPLY TRANSFORMERS.

5-53. If either 1 KW Power Supply transformer, 2A2T1 or 2A2T2 requires replacement, the complete transformer/case assembly must be replaced. Remove components from the old transformer/case assembly and install them on the new assembly.

5-54. 1 KW PA PANEL-MOUNTED PARTS.

5-55. Electrolytic capacitors 1A1C29, 1A1C30, and 1A1C21, along with drive chain and 1 KW PA front panel parts, are more easily accessible if the front panel is loosened. This panel is secured by three screws on each side and one center screw. To allow some movement of the panel, remove the top two screws on each side plus the center screws. Loosen, but do not remove bottom screw on each side; panel can now be tipped forward slightly to improve access to parts.

CAUTION

> If all six panel screws are removed, panel will hang by interconnecting wires and chain; damage to these items may result.

5-56. 1 KW PA FINAL TUBE SOCKET ACCESS.

5-57. The brief procedure outlined here will aid in gaining access to tube socket assemblies of 1 KW PA final amplifier tubes 1A1V1 and 1A1V2.

a. For repairs affecting tube sockets, remove tube 1A1V1/1A1V2 (paragraph 5-58).

b. Remove driver tube assembly 1A1A1 (steps a through f of paragraph 5-60).

c. Remove driver transformer assembly 1A1A4 (paragraph 5-64).

d. Remove chassis bottom plate (9 screws).

c. Remove driver transformer assembly 1A1A4 (paragraph 5-64).

d. Remove chassis bottom plate (9 screws).

e. Swing bottom plate out of way (wires need not be unsoldered).

f. Capacitors 1A1C59 and 1A1C60 may be removed if required to gain desired parts access.

5-58. 1 KW PA FINAL AMPLIFIER TUBE REPLACEMENT.

5-59. To replace either final amplifier tube in the 1 KW PA, proceed as follows:

WARNING

Lethal RF and DC voltages exist at the various tube terminations and connection points. Before proceeding, check to ensure that the equipment is completed de-energized and secured at the source; then short all accessible terminals to chassis ground with the shorting stick. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance book, High-Voltage Adjustment Procedures before continuing

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off external primary power to the equipment.

CAUTION

Turn off primary power at facility power panel and red tag so nobody will inadvertently turn power on until work is completed.

b. Loosen front panel captive screws and slide out chassis.

c. Remove protective cover from over top of tubes at rear of chassis (10 screws).

d. Use shorting stick to short top terminal of tubes to ground.

e. Carefully release tube clamp and lift clamp off tube.

f. Without lifting, carefully rotate tube counterclockwise for approximately sixty degrees, until tube is free in socket. (Further tube rotation will be prevented by a hidden pin on bottom of socket.)

CAUTION

When lifiting the tube out of the socket, proceed slowly. If the tube catches, "rock" the tube gently to free it. Excessive force can damage the tube and the socket contacts.

g. Lift tube straight up from socket and set it aside.

NOTE

Before replacing tube 1A1V1 or 1A1V2, carefully inspect tube contacts on the tube and in the tube socket for signs of damage, or for signs of arcing which could indicate loose or improperly meshing contacts.

h. To start tube installation, observe guide pin in hole in base of tube and orient tube so that guide pin mates with one of the slots in center guide post in tube socket.

i. Gently lower tube over guide post and into socket until tube touches bottom.

j. Carefully totate tube clockwise. Tube should rotate approximately sixty degrees, with moderate mechanical resistance as contacts mesh, until a hidden pin prevents further rotation.

k. Place tube clamp over tube end, and lock. Check connection braid at both ends for tightness.

l. Replace protective cover over tubes 1A1V1 and 1A1V2, and secure.

m. Move plugs 1A1P6 and 1A1P7 (screen voltage connectors for tubes 1A1V1 and 1A1V2), to jacks 1A1J8 and 1A1J9 (figure 5-7).

n. If tubes are being replaced after 1000 hours of operation, as indicated by PLATE elapsed time meter on I. Box, note time to determine when next replacement is due.

o. Refer to paragraph 5-14 and perform the complete screen voltage and control grid bias adjustment for tubes 1A1V1 and 1A1V2.

5-60. 1 KW PA DRIVER AMPLIFIER TUBE REPLACEMENT.

5-61. To replace either driver amplifier tube of the 1 KW PA, proceed as follows:

WARNING

Lethal RF and DC voltages exist at the various tube terminations and connection points. Before proceeding, check to ensure that the equipment is completed de-energized and secured at the source; then short all accessible terminals to chassis ground with the shorting stick. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance book, High-Voltage Adjustment Procedures before continuing

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom panel of Exciter-1 KW PA cabinet.

CAUTION

Turn off primary power at facility power panel and red tag so nobody will inadvertently turn power on until work is completed.

b. Loosen front panel captive screws and slide out chassis.

c. Tilt chassis to expose underside lock.

d. Remove shield from over terminal board 1A1A1TB1 on bottom of driver tube assembly (figure 5-8).

e. Remove wires from terminal board 1A1A1TB1.

CAUTION

When removing the driver tube assembly, avoid using excessive force to prevent damage to the spring contacts located between driver tube assembly 1A1A1 and driver transformer assembly 1A1A4.

f. Loosen two captive screws and carefully lift driver tube assembly out from chassis.

g. Release tube clamp on tube to be removed.

CAUTION

Be careful to avoid damage to nearby capacitors.

h. Place a blunt tool against base of tube through underside of socket and push tube out. Prepare to catch tube when it suddenly pops out, as these tubes fit very tightly in their sockets.

i. To start tube installation, orient tube to properly align pins, and plug into socket.

j. Engage tube clamp and lock.

CAUTION

While installing the driver tube assembly, observe that the spring contacts located between driver tube assembly 1A1A1 and driver transformer assembly 1A1A4 mate properly to avoid damage.

k. Carefully guide driver tube assembly into position on bottom of main chassis and secure. Ensure that edges of driver tube assembly mate properly with their slots in main chassis.

l. Reconnect wires to terminal board 1A1A1TB1 and replace its shield.

m. Perform driver tube bias adjustment, paragraph 5-12).

5-62. 1 KW PA FINAL TRANSFORMER ASSEMBLY REMOVAL AND REPLACEMENT.

5-63. The following procedure allows removal and replacement of Final Transformer Assembly 1A1A2 for inspection, minor repairs, or replacement. Major repairs, such as switch or coil repair or replacement or switch coupling alignment, require special procedures which are done at depot level maintenance facilities, using Overhaul and Repair Manual, NAVSHIPS 0967-293-0060. After repair or when installing a replacement assembly, realignment must be performed with the assembly in the unit (paragraph 5-19).

WARNING

Lethal DC voltages may remain due to charged filter capacitors. Before proceeding, check to be sure that equipment is completely de-energized. With final tube cover removed, short all accessible terminals to ground with the shorting stick. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance Book, High-Voltage Adjustment Procedures, before continuing.

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom panel of Exciter-1 KW PA Cabinet.

b. Loosen front panel screws, and slide out chassis.

c. Remove protective cover from over top of final tubes at rear of chassis (10 screws, figure 5-8).

d. Use shorting stick to ground top terminal of tubes.

e. Disconnect 1A1A2P1 at VSWR bridge (figure 5-7), and unscrew and free cable clamp at bottom of left side plate adjacent to VSWR bridge.

f. Disconnect lead from final tube compartment at terminal on contact block at the front of the compartment.

g. Insert long screwdriver through each of four clearance holes; and after carefully engaging screwdriver in slot of captive screw (not caught on adjacent components), loosen each screw.

h. Loosen pan head screws (2) holding left and right hand "L" brackets.

i. Bend stiff wire to fabricate a pulling tool with hooks to insert into two opposite screwdriver clearance holes. Lift assembly straight out while freeing coaxial cable grommet on left side partition.

j. To reinstall assembly, orient as shown in figure 5-7, carefully lower into compartment, and engage locating pins.

k. Reverse steps c through i to secure and reconnect assembly. The two "L" brackets on each side (step h) should be positioned with one inside and one outside the partition as shown in figure 5-7. Tighten screws with brackets snug against partition.

l. Refer to paragraph 5-19 if realignment is necessary. Otherwise slide chassis into case and secure.

m. Activate the set to standby, and rotate the 1 KW PA FREQUENCY MEGACYCLES selector several times. Then reset it to AUTOMATIC.

NOTE

Coupling pin on Transformer Assembly will engage coupling on Transmission Assembly during first full rotation of bandswitch motor.

5-64. 1 KW PA DRIVER TRANSFORMER ASSEMBLY REMOVAL AND REPLACEMENT.

5-65. The following procedure allows removal and replacement of Driver Transformer Assembly 1A1A4 for inspection, minor repairs, or replacement. Major repairs, such as switch or coil replacement or switch coupling alignment, require special procedures which are done at depot level maintenance facilities, using Overhaul and Repair Manual NAVSHIPS 0967-293-0060. After repair or when installing a replacement assembly, realignment must be performed with the assembly in the unit (paragraph 5-19).

WARNING

Lethal DC voltages may remain due to charged filter capacitors. Before proceeding, check to be sure that equipment is completely de-energized. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance Book, High Voltage Adjustment Procedures before continuing.

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom panel.

b. Loosen front panel screws, and slide out chassis. Tilt chassis up 90 degrees to expose underside.

c. Disconnect six wires from terminal board 1A1A4TB1 on the bottom of the assembly (Figures 5-8 and 5-14). Tag wires corresponding to the number of the terminal from which the wire was removed.

d. Loosen two captive screws and carefully remove assembly.

CAUTION

Avoid using excessive force to prevent damaging contact fingers on the side of the assembly.

e. To reinstall assembly, orient it with the terminal board toward the rear of the chassis, and carefully set it in the chassis. As it slides into position engage two locating pins on the transmission assembly. Avoid excessive force to protect contact fingers.

f. Secure assembly with the two captive screws.

g. Reconnect wires to terminal board 1A1A4TB1 according to tags previously attached in step c.

h. Refer to paragraph 5-19 if realignment is necessary. Otherwise tilt chassis back to horizontal, slide in case, and secure.

i. Activate the set to standby, and rotate the 1 KW PA FREQUENCY MEGACYCLES selector several times. Then reset it to AUTOMATIC.

NOTE

Coupling pin on Transformer Assembly will engage coupling on Transmission Assembly during first full rotation of bandswitch motor.

5-66. 1 KW PA DRIVE CHAIN REPLACEMENT.

5-67. To replace the drive chain of the 1 KW PA frequency-select mechanism, proceed as follows. (all control, indicator, and connector references apply to 1 KW PA unless otherwise specified.)

WARNING

Lethal RF and DC voltages exist at the various tube terminations and connection points. Before proceeding, check to ensure that the equipment is completely de-energized and secured at the source; then short all accessible terminals to chassis ground. Refer to NAVSHIPS 0967-000-0000 Electronics Installation and Maintenance Book, High-Voltage Adjustment Procedures before proceeding.

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on bottom panel.

b. Loosen front panel captive screws and slide out chassis.

c. Tilt chassis to expose underside lock.

d. Loosen (but do not remove) two Phillips-head screws which secure drive chain bracket to chassis (figure 5-8).

e. Return chassis to horizontal position; lock.

f. Loosen front panel assembly by removing center screw and two screws on each side at top. Bottom screws on each side should be loosened but not removed. Front panel can now be tipped forward slightly to aid in chain removal/replacement.

g. Remove damaged chain.

h. Loosen two Allen-head set screws on FREQUENCY MEGACYCLES dial sprocket directly behind front panel (figure 5-7) so that sprocket rotates freely on shaft.

CAUTION

When tilting chassis up or down during chain installation, move the chassis slowly and with care to avoid damaging the loosely secured front panel.

i. Thread new chain around motor drive sprocket on motor 1A1B2, over sprockets on drive chain bracket, and around chain sprocket on FREQUENCY MEGACYCLES dial. Arrange chain so that ends meet for connection just behind drive chain bracket, underneath chassis (tilt and lock chassis as necessary).

CAUTION

Excessive pressure when connecting the chain ends will crush the chain.

j. Connect two ends of chain by inserting connecting link into split sphere and gently closing sphere around line with a small pair of pliers.

k. Tip front panel back into position and secure with screws loosened and removed in step f.

l. Ensure that drive chain is properly engaged in all sprockets, then use a screwdriver to push drive chain bracket toward front panel to take up slack in chain. Apply light tension to hold bracket in place while tightening two Phillips-head screws which secure bracket.

m. Check chain tension. Chain should have just enough tension to eliminate slack.

CAUTION

Excessive tension on the drive chain will cause excessive wear.

n. Lock chassis in horizontal position.

o. Manually rotate dial behind FREQUENCY MEGACYCLES window until one set screw is accessible.

p. Defeat two interlock switches on 1 KW PA by pulling plungers straight out.

q. Turn on PRIMARY POWER circuit breaker on bottom panel.

r. Depress Exciter STANDBY pushbutton.

s. Set 1 KW PA FREQUENCY MEGACYCLES selector to frequency band indicated in center FREQUENCY MEGACYCLES window. The 1 KW PA will automatically tune.

t. Depress Exciter AMPLIFIER OFF pushbutton.

u. Carefully rotate dial behind FREQUENCY MEGACYCLES window, until numbers corresponding to setting of FREQUENCY MEGACYCLES selector are located in center of window.

v. Tighten allen-head set screw which is accessible on dial behind FREQUENCY MEGACYCLES window.

w. Depress Exciter STANDBY pushbutton.

x. Set FREQUENCY MEGACYCLES selector in each position except AUTOMATIC. For each position, observe that numbers corresponding to selector setting are centered in window. Note amount of adjustment in dial setting required to center them perfectly.

y. Reset FREQUENCY MEGACYCLES selector to position which makes the dial set screw accessible.

z. Depress Exciter AMPLIFIER OFF pushbutton.

aa. Loosen dial set screw, make necessary compensating adjustment in dial position, and retighten set screw.

ab. Repeat steps w through aa until dial position is satisfactory.

ac. Depress Exciter STANDBY pushbutton.

ad. Observe set screws on rear of dial and set FREQUENCY MEGACYCLES selector to different positions until second set screw is accessible.

ae. Depress Exciter AMPLIFIER OFF pushbutton.

af. Tighten remaining set screw on dial behind FREQUENCY MEGACYCLES window.

ag. Set FREQUENCY MEGACYCLES selector to AUTOMATIC.

ah. Slide 1 KW PA chassis into cabinet and secure.

5-68. 10 KW PA TUBE REPLACEMENT.

5-69. Following is a procedure for removing and replacing power amplifier tube 9A1V1 in the 10 KW PA. After replacement, refer to paragraph 5-28e and set the bias for the new tube.

a. Depress Exciter AMPLIFIER OFF pushbutton. Turn off PRIMARY POWER circuit breaker on Exciter-1 KW PA cabinet bottom panel.

b. Remove top and side screws from plate compartment front cover plate.

WARNING

Use shorting stick to check plate clamp and plate for possible high voltage before touching. Make sure power is secured.

c. Remove two 6-32 screws from top flange of front top-chimney bracket, and remove bracket.

d. Loosen, but do not remove, similar screws on left and right hand top-chimney brackets.

e. Slide RFI filter out the front, and remove from compartment.

f. Raise top chimney, rotate 45 degrees, and remove from brackets.

g. Loosen screw used to tighten plate clamp band.

h. Lift tube straight out while rotating it back and forth slightly to overcome friction.

i. Install new tube by orienting it over the bottom chimney, with the handles toward the sides. Rock tube back and forth gently while firmly seating it in the socket. Leave handles towards sides of compartments.

CAUTION

Do not attempt to seat tube without rocking as the socket can be damaged. It may also be damaged by too much rotation.

5-70. 10 KW PA PLATE TRANSFORMER REPLACEMENT.

5-71. The plate transformer is removeable through the rear of the 10 KW PA cabinet as follows after removing the air filter.

NOTE

This plate transformer is a 300-pound part and will require two men and mechanical lifting assistance to remove it from the cabinet.

a. Turn off external primary power to the equipment.

b. Remove rear panel of 10 KW PA cabinet.

c. Open front doors of 10 KW PA and slide PA chassis out from cabinet.

d. Remove connecting wires on plate transformer and tag as necessary.

e. Remove four mounting bolts attaching plate transformer to cabinet base.

f. Carefully remove plate transformer through rear of cabinet.

g. Replace plate transformer in reverse order.

5-72. 10 KW PA MONITOR/CONTROL AND DC AMPLIFIER ASSEMBILES ACCESS.

5-73. Monitor/Control Assembly 9A1A6 and DC Amplifier Assembly 9A1A5 are readily accessible. By extending the 10 KW PA chassis on its slides, the end cover (figure 5-29) of either assembly can be removed and the internal printed circuit boards extracted or made externally operable by the use of the printed circuit board extender. Complete removal of either assembly is accomplished by disconnecting the appropriate input/output plug and removing two forward mounting screws after loosening the two rear mounting screws. Access to internally mounted parts can be accomplished by removing front panel screws and swinging the front panel aside.

5-74. 10 KW PA 28 VDC SUPPLY, FAULT CONTROL, AND BIAS SUPPLY ACCESS.

5-75. These assemblies (9A3A1, 9A3A2, 9A2A1 respectively) are accessible from the front of the 10 KW PA cabinet for servicing checks as follows.

a. Turn off external primary power to the equipment.

CAUTION

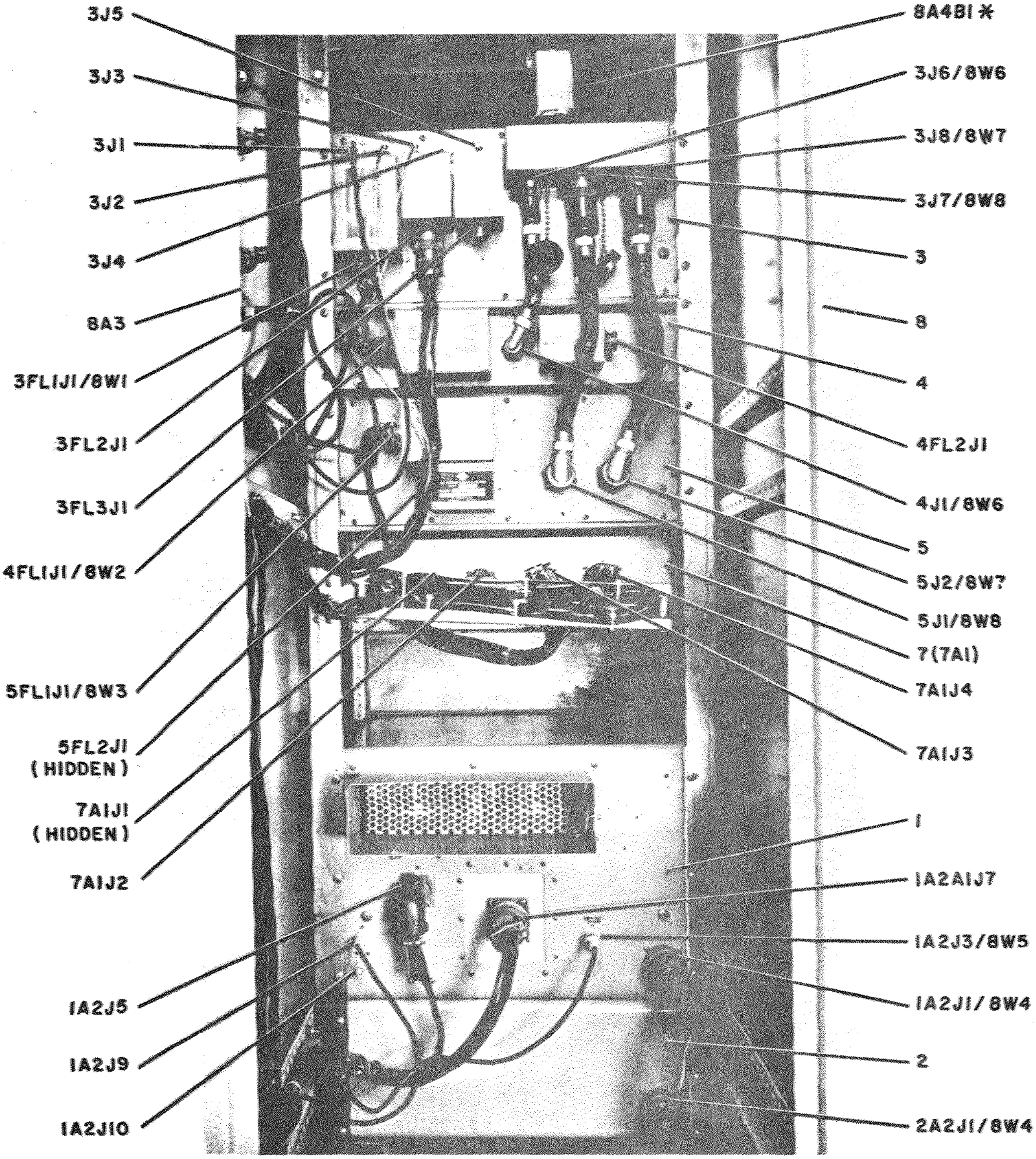
Turn off primary power at facility power panel and red tag so nobody will inadvertently turn power on until work is completed.

b. Open front cabinet door, and remove two screws on left hand side of bottom access door.

c. Use shorting stick through front of cabinet to ensure that any exposed terminals in the work area are discharged. Special attention should be given to the larger filter capacitors and the primary input terminals.

NOTE

To improve access to internal assemblies and parts, circuit breaker panel mounting screws can be removed and the panel carefully laid forward.



*** ALSO 8A4C1, 8A4C2, 8A4F1, 8A4P1, 8A4XF1 (NOT SHOWN)**

Figure 5-5. Exciter- 1 KW PA Cabinet, Rear View, Component Locations

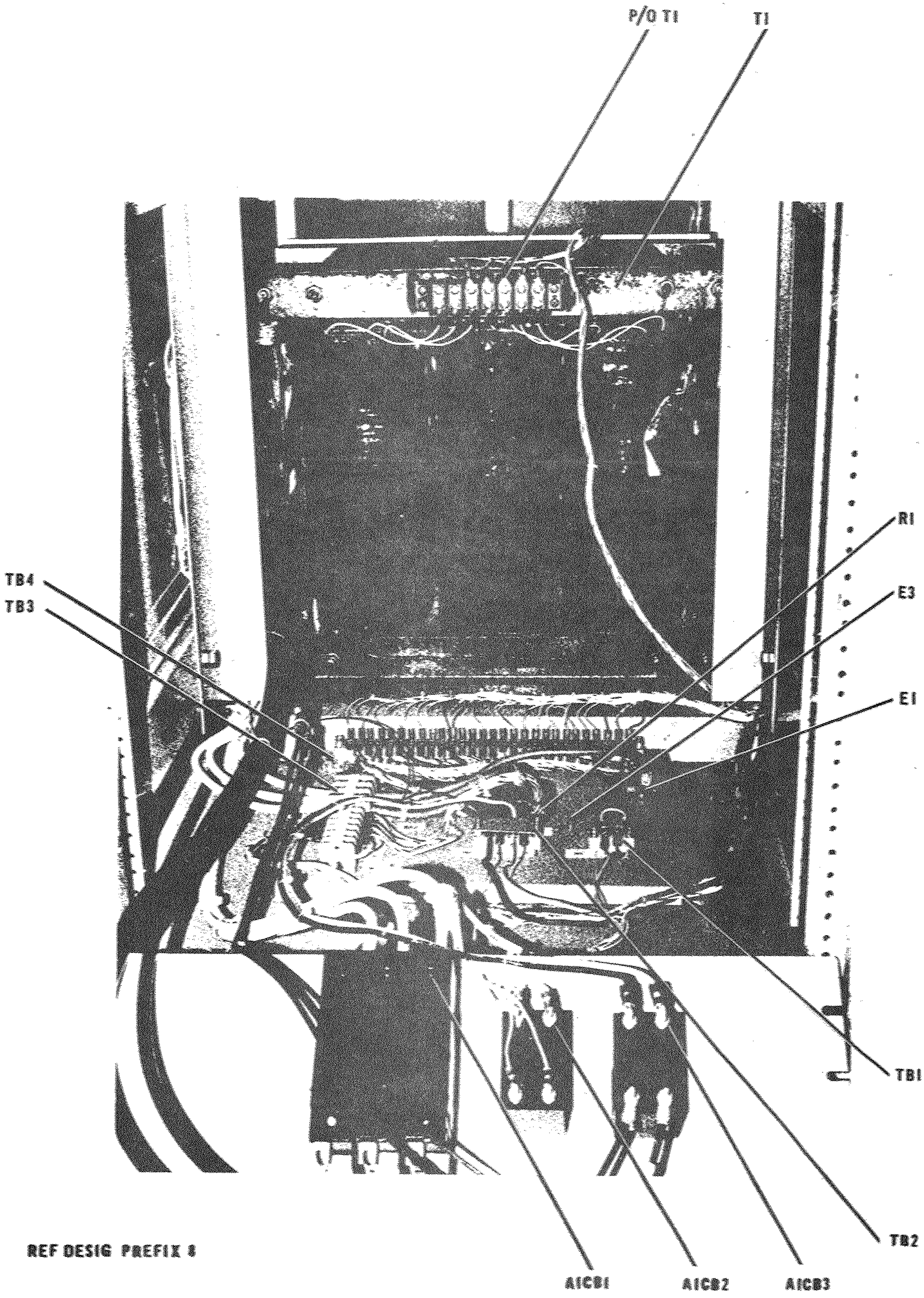
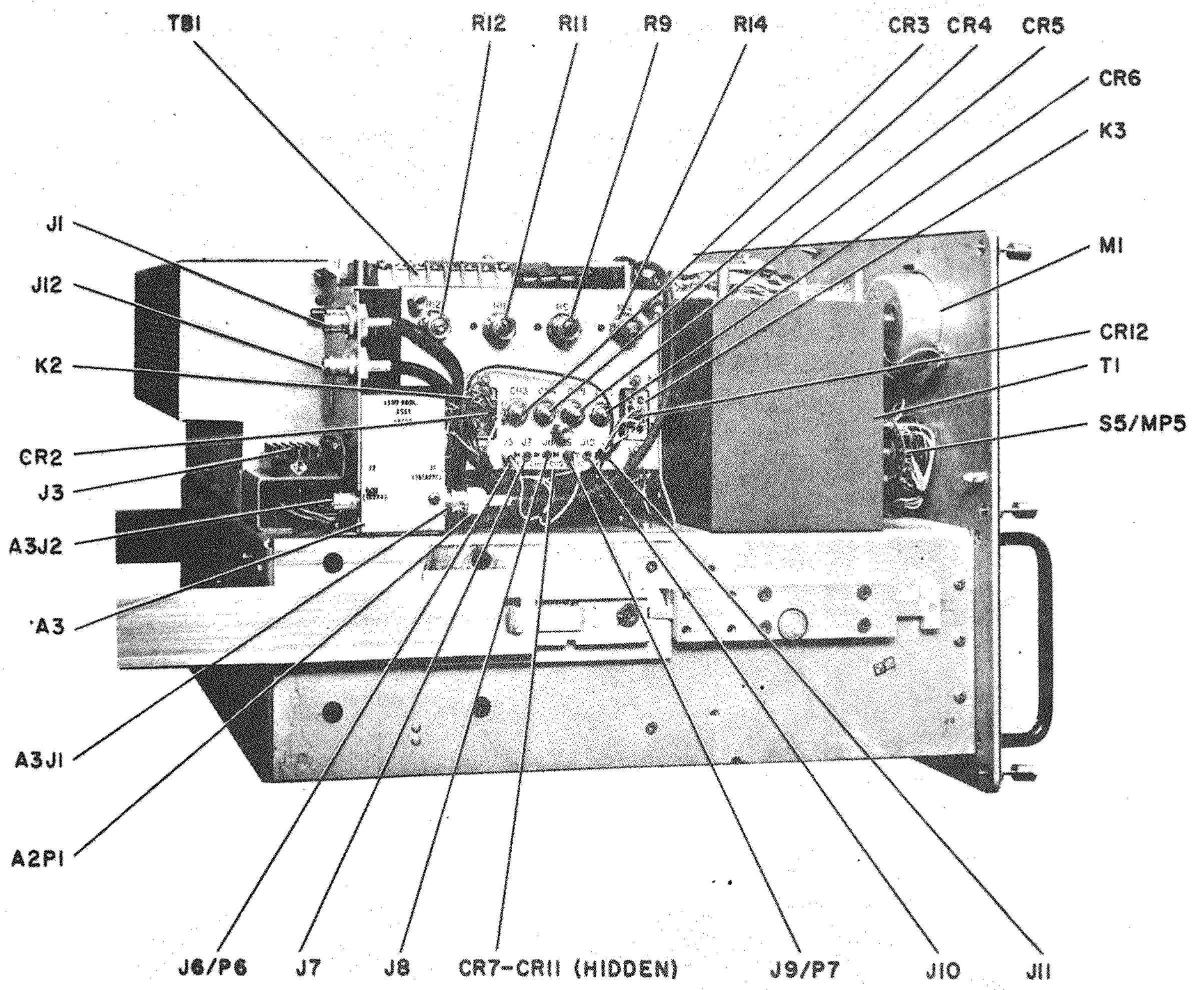
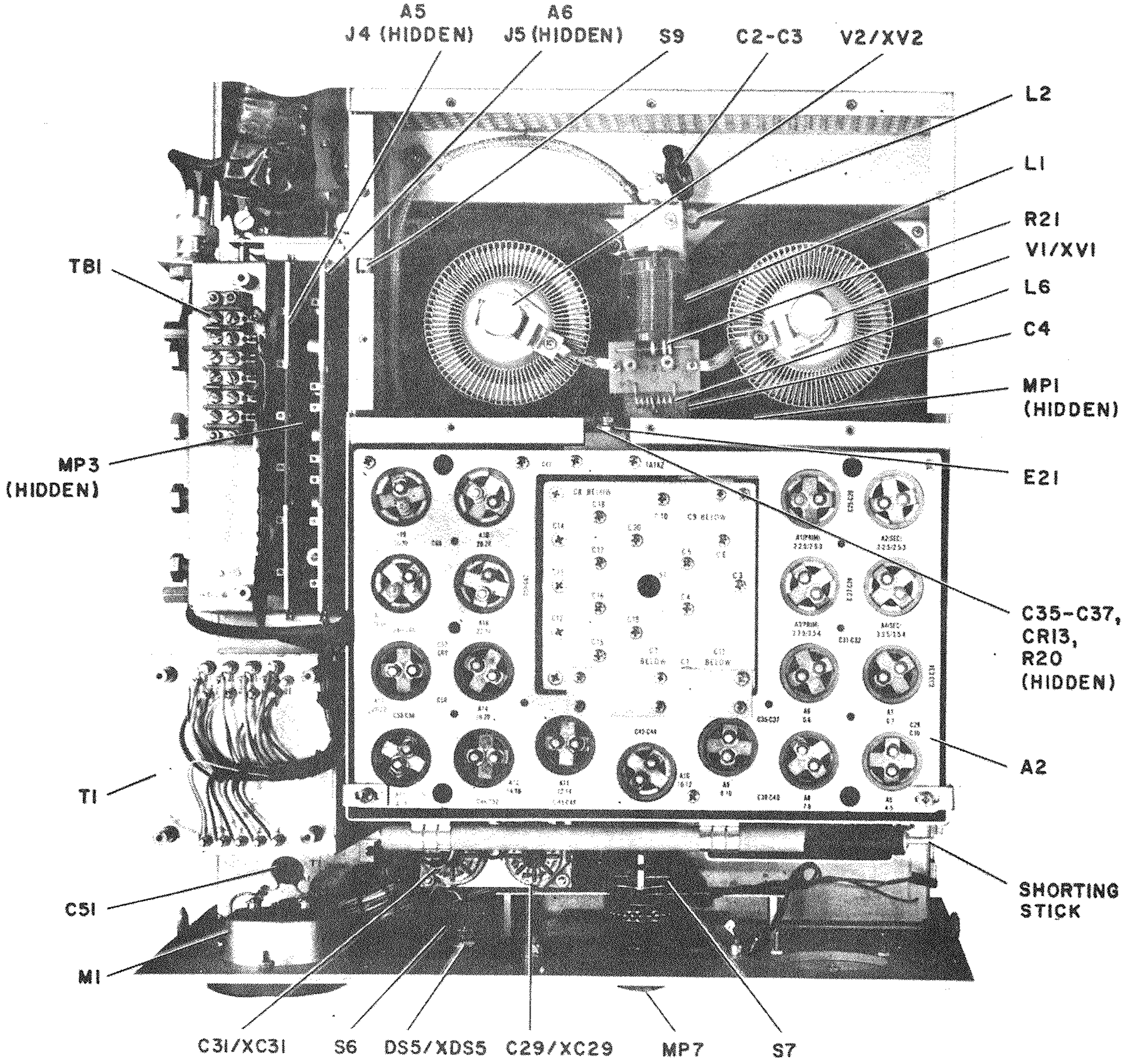


Figure 5-6. Exciter-1 KW PA Cabinet, 1, Lower Front View, Component Location



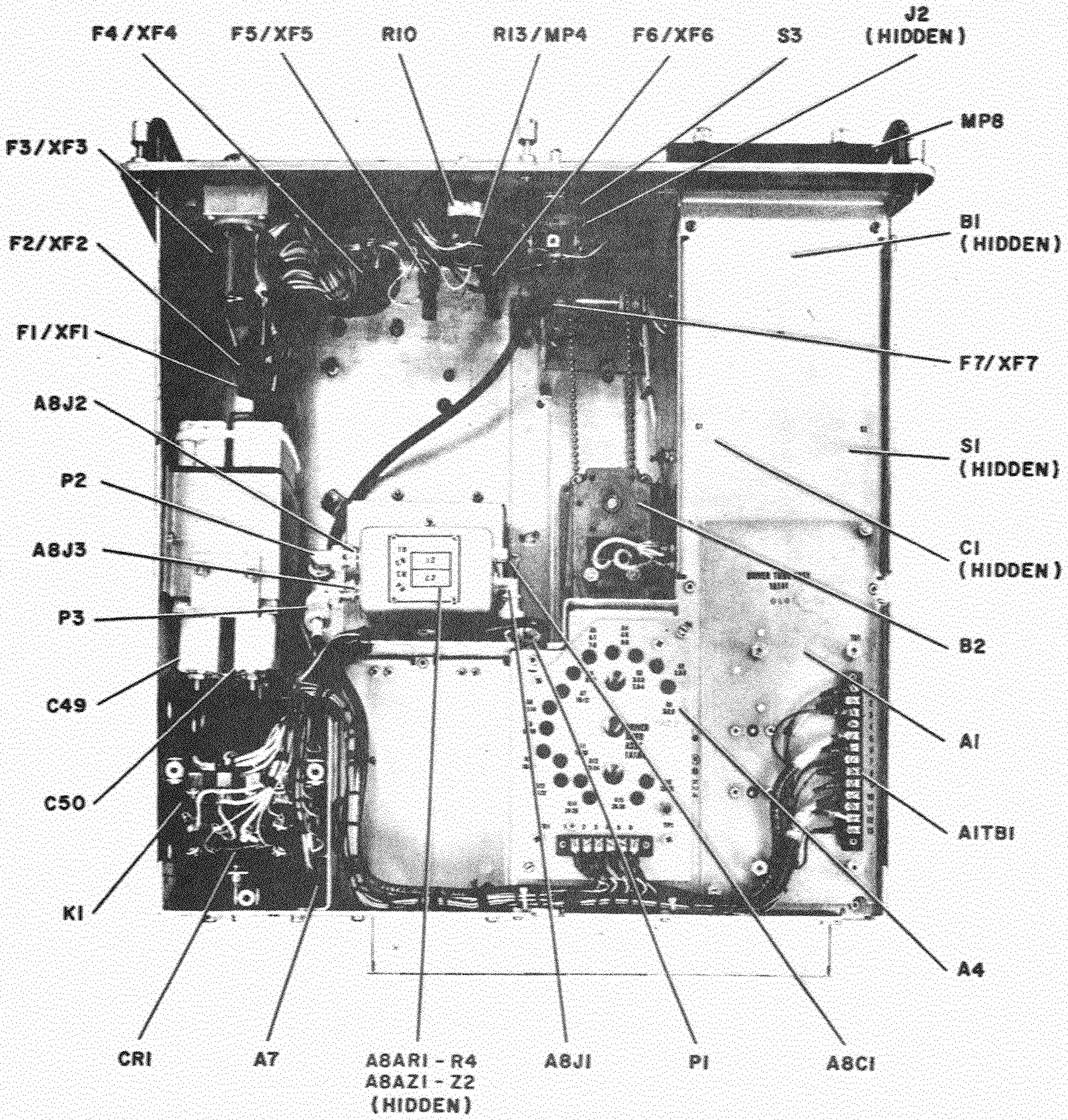
REF DESIG PREFIX 1A1

Figure 5-7. 1 KW PA, 1A1, Left Side, Component Locations



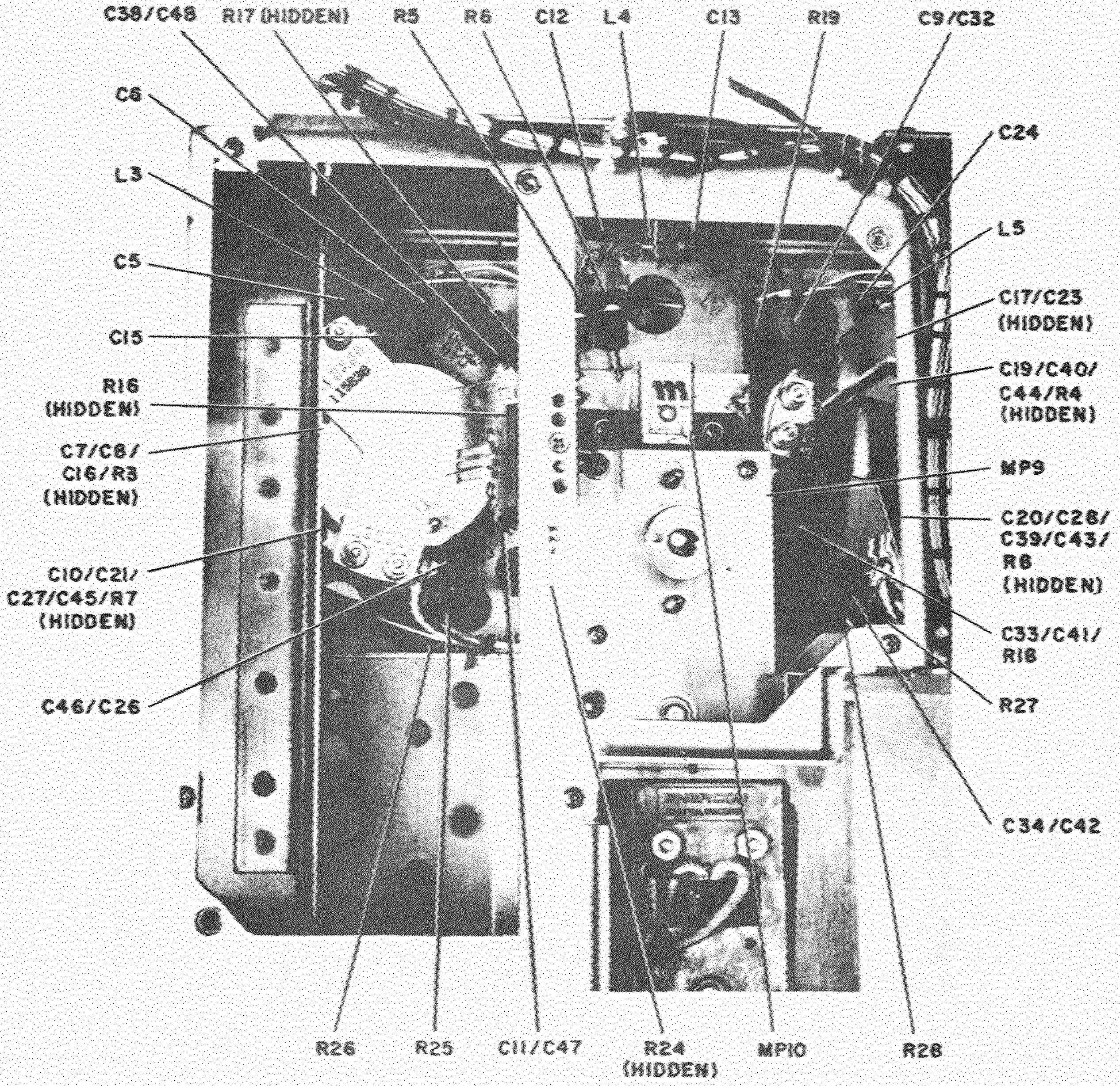
REF DESIG PREFIX 1A1 (PROTECTIVE COVERS REMOVED)

Figure 5-8. 1 KW PA, 1A1, Top View, Component Locations



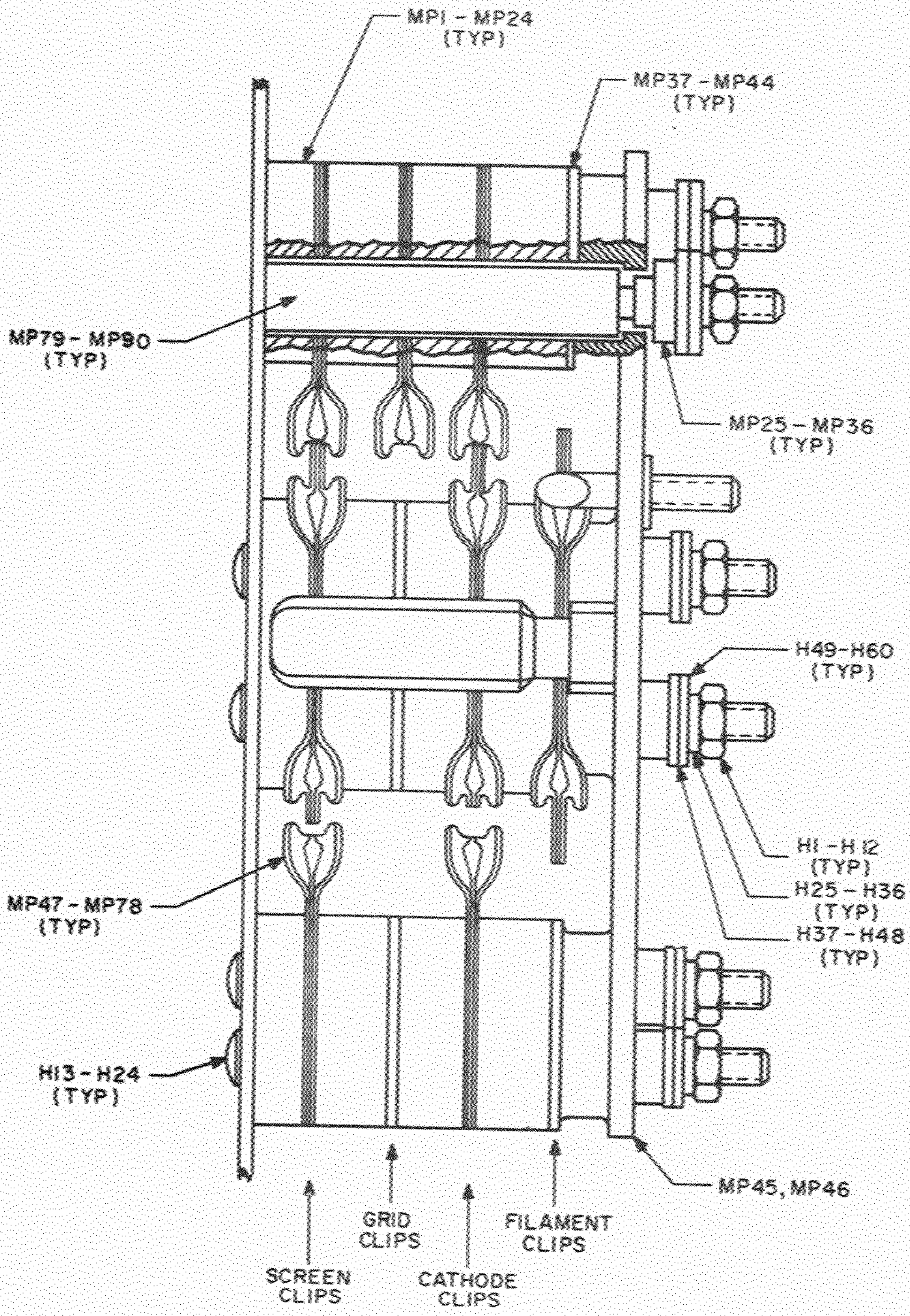
REF DESIG PREFIX 1A1

Figure 5-9. 1 KW PA, 1A1, Bottom View, Component Locations



REF DESIG PREFIX 1A1

Figure 5-10. 1 KW PA, 1A1, Bottom View with 1A1A1 DriverTube Assembly and 1A1A4 Driver Transformer Assembly Removed. Component Locations

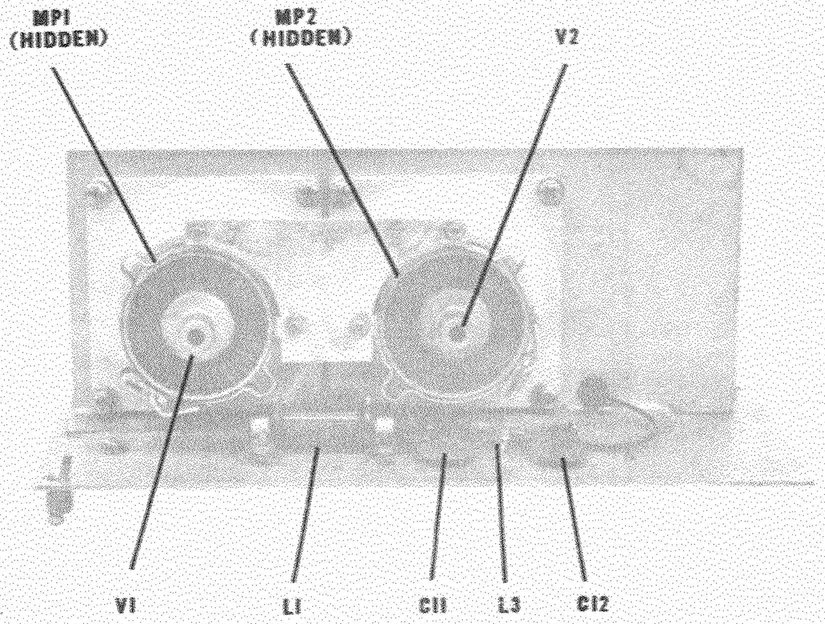


NOTE:

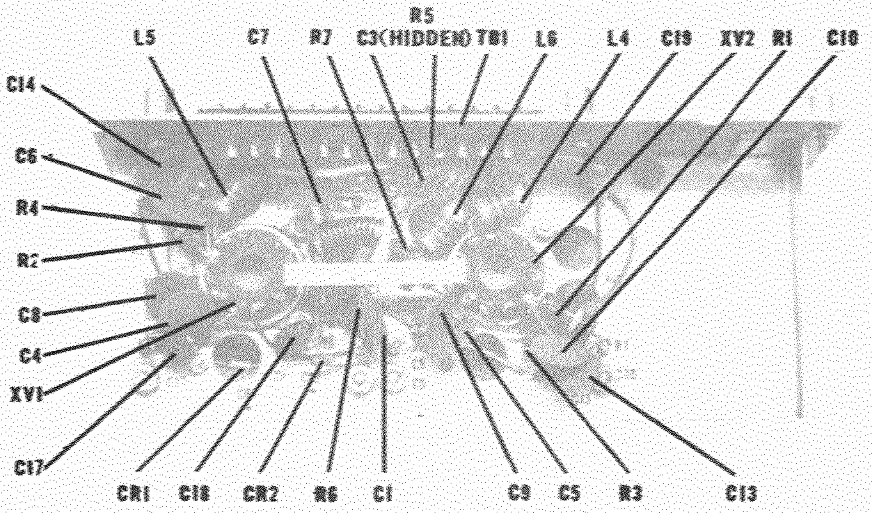
AS SHOWN ABOVE, THE VIEW IS FROM THE REAR, AS IF LOOKING THRU THE REAR WALL OF THE CHASSIS.

XV1 IS SHOWN, XV2 IS IDENTICAL, EXCEPT IT IS A MIRROR IMAGE

Figure 5-11. 1 KW PA, Final Amplifier Tube Socket Assembly, Component Locations



REF DESIG PREFIX 1A1A1



REF DESIG PREFIX 1A1A1

Figure 5-12. 1 KW PA Driver Tube Assembly, 1A1A1, Component Locations

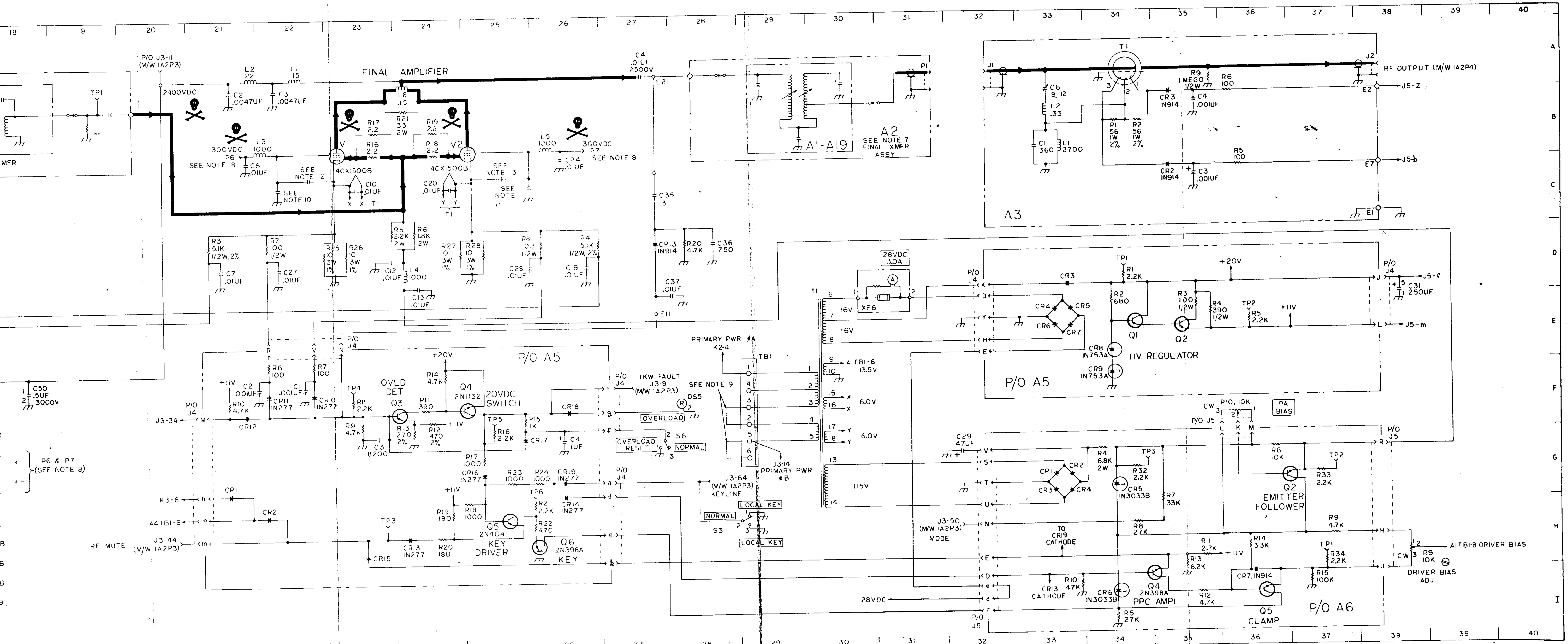
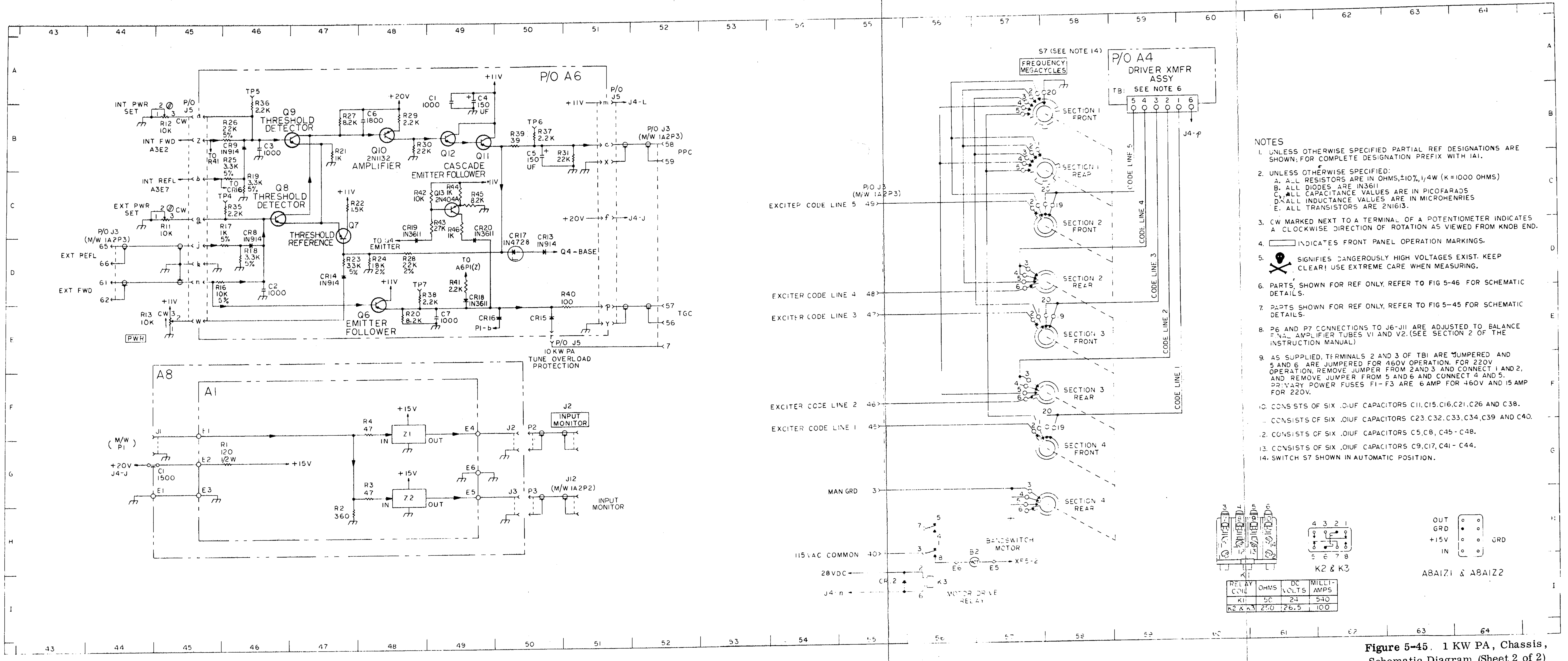


Figure 5-45. 1 KW PA, Chassis, Schematic Diagram (Sheet 1 of 2)



NOTES

1. UNLESS OTHERWISE SPECIFIED PARTIAL REF DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH 1A1.
2. UNLESS OTHERWISE SPECIFIED:
   - A. ALL RESISTORS ARE IN OHMS,±10%,1/4W (K=1000 OHMS)
   - B. ALL DIODES ARE IN3611
   - C. ALL CAPACITANCE VALUES ARE IN PICOFARADS
   - D. ALL INDUCTANCE VALUES ARE IN MICROHENRIES
   - E. ALL TRANSISTORS ARE 2N1613.
3. CW MARKED NEXT TO A TERMINAL OF A POTENTIOMETER INDICATES A CLOCKWISE DIRECTION OF ROTATION AS VIEWED FROM KNOB END.
4. ▭ INDICATES FRONT PANEL OPERATION MARKINGS.
5. ☠ SIGNIFIES DANGEROUSLY HIGH VOLTAGES EXIST. KEEP CLEAR! USE EXTREME CARE WHEN MEASURING.
6. PARTS SHOWN FOR REF ONLY, REFER TO FIG 5-46 FOR SCHEMATIC DETAILS.
7. PARTS SHOWN FOR REF ONLY, REFER TO FIG 5-45 FOR SCHEMATIC DETAILS.
8. P6 AND P7 CONNECTIONS TO J6-J11 ARE ADJUSTED TO BALANCE FINAL AMPLIFIER TUBES V1 AND V2. (SEE SECTION 2 OF THE INSTRUCTION MANUAL)
9. AS SUPPLIED, TERMINALS 2 AND 3 OF TB1 ARE JUMPERED AND 5 AND 6 ARE JUMPERED FOR 460V OPERATION. FOR 220V OPERATION, REMOVE JUMPER FROM 2 AND 3 AND CONNECT 1 AND 2, AND REMOVE JUMPER FROM 5 AND 6 AND CONNECT 4 AND 5. PRIMARY POWER FUSES F1-F3 ARE 6 AMP FOR 460V AND 15 AMP FOR 220V.
10. CONSISTS OF SIX .01UF CAPACITORS C11, C15, C16, C21, C26 AND C38.
11. CONSISTS OF SIX .01UF CAPACITORS C23, C32, C33, C34, C39 AND C40.
12. CONSISTS OF SIX .01UF CAPACITORS C5, C8, C45-C48.
13. CONSISTS OF SIX .01UF CAPACITORS C9, C17, C41-C44.
14. SWITCH S7 SHOWN IN AUTOMATIC POSITION.

RELAY COIL	OHMS	DC VOLTS	MILLI-AMPS
K1	50	24	540
K2 & K3	250	26.5	100

Figure 5-45. 1 KW PA, Chassis, Schematic Diagram (Sheet 2 of 2)

ORIGINAL

NOTES:
1 UNLESS OTHERWISE INDICATED ALL CAPACITORS ARE IN PICOFARADS AND RESISTORS ARE IN OHMS
2 SWITCH IS SHOWN IN 2.0-2.5MC POSITION
3 ⬇ INDICATES BLUE COLOR CODED TUNING SCREW
⬇ INDICATES UNCODED SCREW
ARROWS INDICATE DIRECTION OF SLUG TRAVEL WITH CLOCKWISE ROTATION OF SCREW
4 PREFIX PARTIAL REFERENCE DESIGNATIONS WITH 1A1A2
5 * CONSISTS OF R1 THROUGH R4 IN PARALLEL, EACH 27K, 2W
** CONSISTS OF R5 THROUGH R8 IN PARALLEL, EACH 27K, 2W

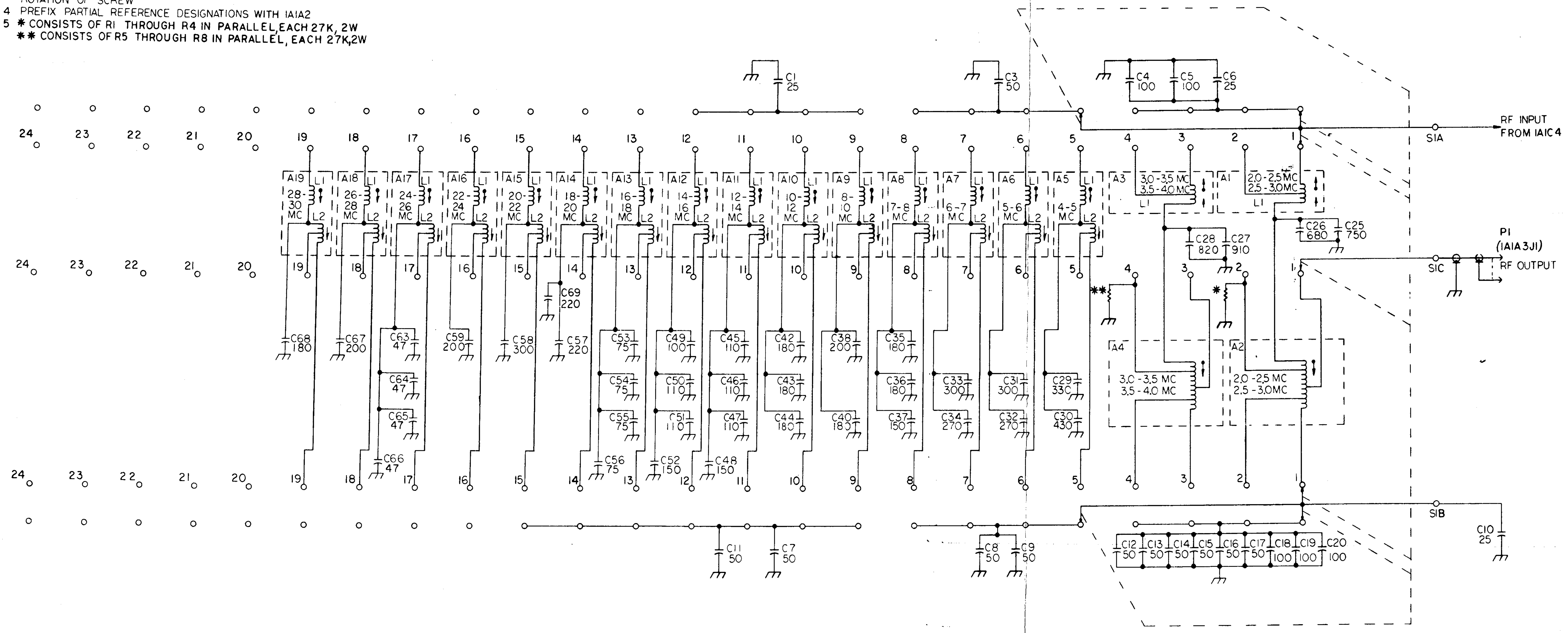
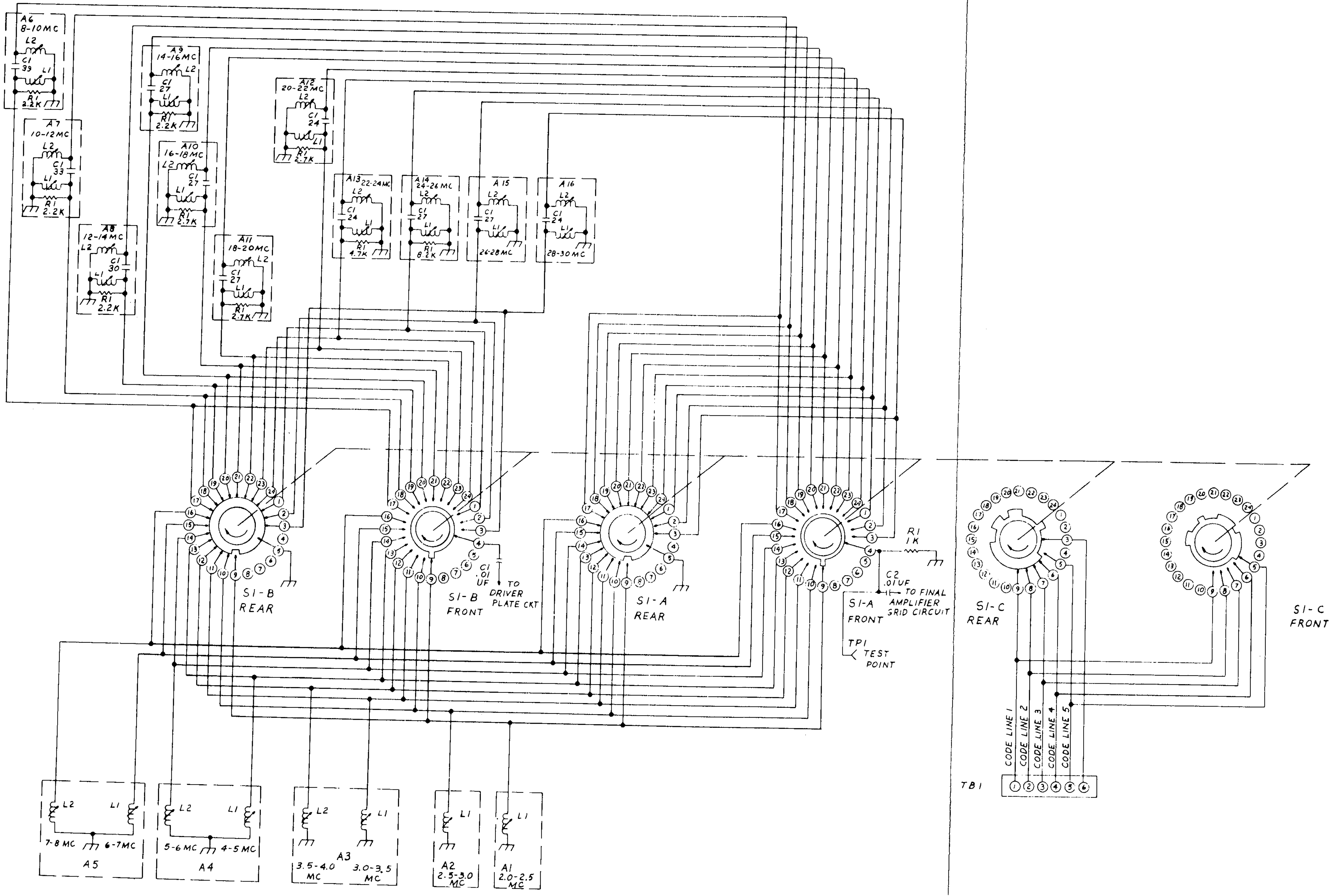


Figure 5-46. 1 KW PA, Final Transformer Assembly 1A1A2, Schematic Diagram



NOTES:
1. UNLESS OTHERWISE INDICATED
A. ALL CAPACITORS ARE IN PICOFARADS
B. ALL RESISTORS ARE IN OHMS, 2W, 10% CARBON

Figure 5-47. 1 KW PA, Driver Transformer Assembly 1A1A4, Schematic Diagram

NOTES:

1. UNLESS OTHERWISE INDICATED:
   A ALL RESISTORS ARE IN OHMS, 1/2 W, 10%.
2. PREFIX ALL INCOMPLETE REFERECE DESIGNATIONS WITH 2A1.
3. ▭ INDICATES FRONT PANEL MARKING.

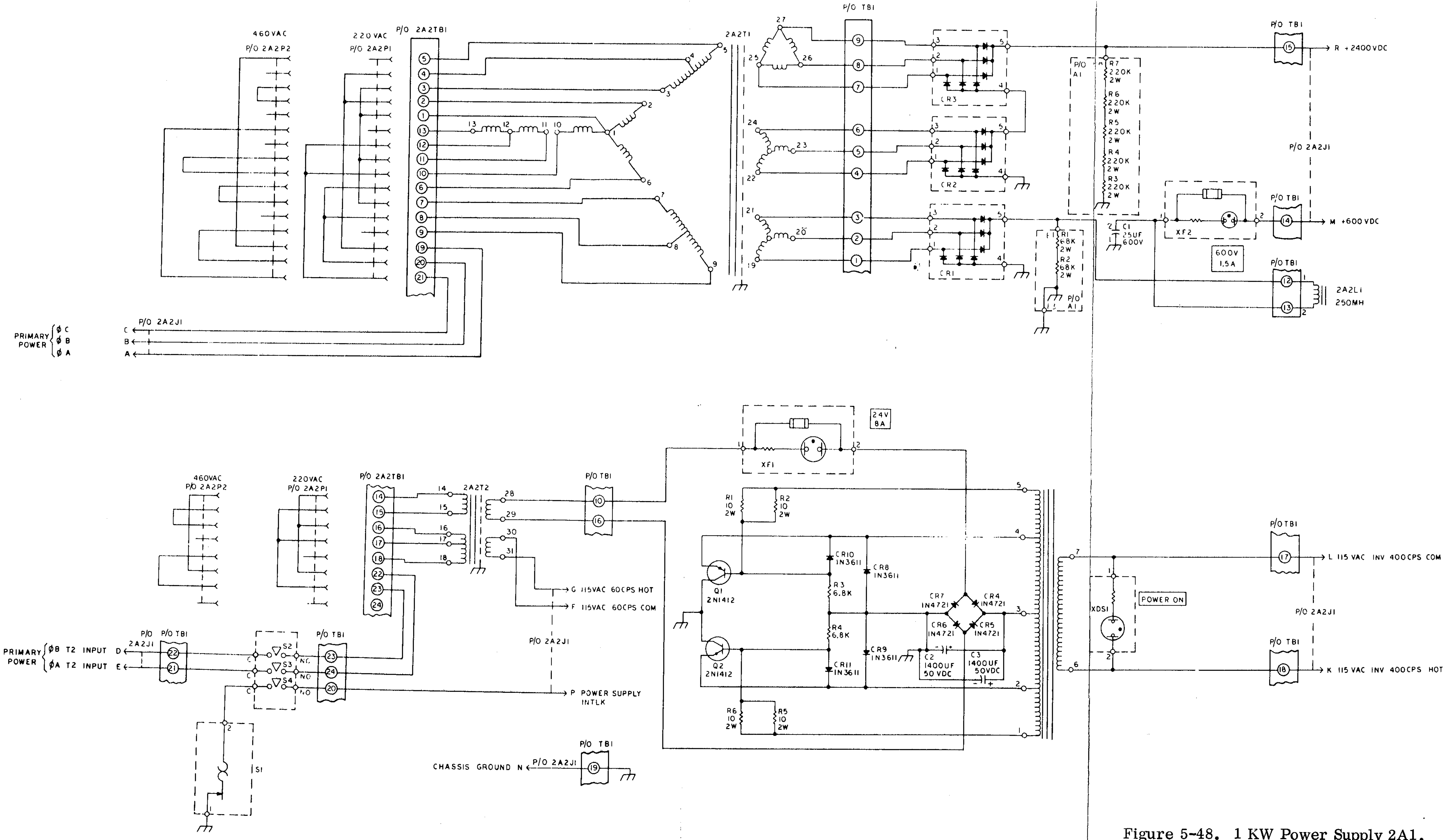
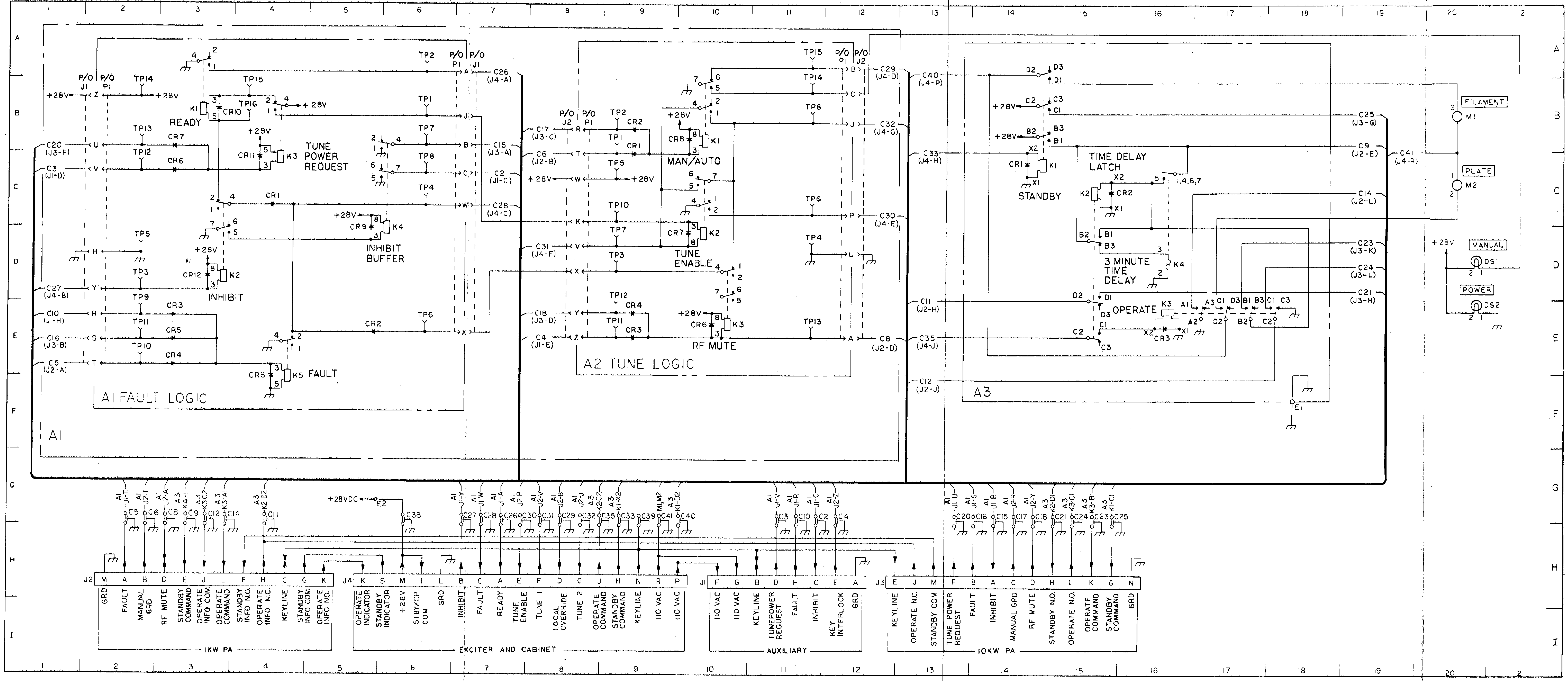


Figure 5-48. 1 KW Power Supply 2A1, Schematic Diagram



NOTES:

1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 7A1.
2. PREFIX ALL FEED-THROUGH CAPACITORS WITH 7A1A2.
3. UNLESS OTHERWISE SPECIFIED
   a. ALL DIODES ARE 1N3611
   b. ALL FEED-THROUGH ARE 1500PF.
4. ▭ INDICATES FRONT PANEL MARKING.
5. FEED-THROUGH CAPACITORS, C1-C50, ARE PART OF A2. PREFIX DESIGNATIONS WITH 7A1A2.

Figure 5-49. I. Box 7A1, Schematic Diagram

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C2	17A	A1L1	39B	A1A3A1CR2	45E	A1A14R1	60C	A2A1R14	16G
CB1	6B	A1L2	39A	A1A3A1CR2	45E	A1A14R2	60C	A2A1R15	18G
CB2	6F	A1L3	57A	A1A3A1CR3	44F	A1A14R3	60C	A2A1R16	21H
CB3	6C	A1L4	59B	A1A3A1CR4	44G	A1A14R4	50C	A2A1R17	22H
CB4	4A	A1L5	56A	A1A3A1L1	44F	A1A14R5	61C	A2A1R18	23H
CB5	6H	A1L6	38A	A1A3A1L2	42F	A2C1	17G	A2A1R19	20F
J1	35D	A1L7	50A	A1A3A1L3	43E	A2C2	17G	A2A1R20	23G
J2	67A	A1L8	49A	A1A3A1L4	44G	A2C3	23F	A2A1R21	19G
J3	59E	A1L9	45A	A1A3A1L5	44G	A2C4	17K	A2A1R22	19G
P1	27B	A1L10	43A	A1A3A1L6	42F	A2C5	17H	A3C1	19D
P2	66A	A1L11	39D	A1A3A1L7	45F	A2J1	15F,15I,	A3C3	10H
P3	36D	A1L12	62A	A1A3A1R1	44E		24G	A3CR1	9G
P4	15E,15I,	A1L13	61A	A1A3A1R2	43E	A2J2	16G,16I,	A3CR2	9E
	24G	A1L14	42D	A1A3A1R3	44C		17F,19F,	A3CR3	9C
P5	60E	A1L15	38D	A1A3A1R4	42G		24F,24I	A3CR4	9E
P6	66A	A1M1	36H	A1A3A1R5	44F	A2K1	21F	A3K1	8G
P7	12A	A1M2	34F	A1A3A1R6	44G	A2K2	19F	A3K3	8G
T1	15B	A1P2	37D	A1A3A1R7	43G	A2T1	16F	A3K4	8E
TB1	3C	A1P3	41I	A1A3A1R8	44G	A2A1C1	16H	A3L1	19D
TB2	3A,6G	A1P5	47F,49E	A1A3A1R9	42F	A2A1C2	19F	A3A1CR1	8H
A1B1	13A		53F	A1A3A1R10	45C	A2A1CR1	18G	A3A1CR2	9H
A1B1J1	13A	A1P6	54F,56E	A1A3A1R12	42H	A1A8R1	18F	A3A1CR3	9H
A1C1	22D		61F	A1A3A1R13	45F	A2A1CR3	22G	A3A1CR4	8G
A1C2	42D	A1P8	39H	A1A3A1R14	45H	A2A1CR4	18H	A3A1CR5	9G
A1C3	41D	A1P9	65B	A1A3A1T1	44G	A2A1CR5	18H	A3A1CR6	9G
A1C4	57B	A1P10	64C	A1A4L1	41C	A2A1CR6	18H	A3A1CR7	Not us
A1C5	45C	A1P11	52P	A1A4L2	41C	A2A1CR7	18H	A3A1R1	10H
A1C6	53B	A1P12	58D	A1A5	49I	A2A1CR7	18H	A3A2K5	11F
A1C7	44L	A1P13	63F,67F	A1A6	57I	A2A1CR8	21H	A3A2R4	11G
A1C8	47B	A1R3	45B	A1A7B1	47E	A2A1CR9	20H	A3A2R5	12G
A1C9	46A	A1R4	45C	A1A7R1	49C	A2A1CR10	20H	A3A2TB1	11H
A1C10	40A	A1R5	43C	A1A7S1	48C	A2A1CR11	20H	A4C1	20E
A1C11	40B	A1R6	38D	A1A8B1	53C	A2A1CR12	20H	A4CR1	16B
A1C12	40B	A1S1	63C	A1A8R1	55C	A2A1CR13	23H	A4CR2	17B
A1C13	41B	A1S2	62B	A1A8S1	53C	A2A1CR14	23H	A4CR3	17B
A1C14	42B	A1S3	62C	A1A9C1	44B	A2A1CR15	23H	A4CR4	16B
A1C15	42D	A1S4	62D	A1A9L1	44B	A2A1CR16	23H	A4CR5	16C
A1C16	42D	A1S5	62D	A1A10C1	36A	A2A1CR17	22H	A4CR6	17C
A1C17	42D	A1S6	35E	A1A10C2	36A	A2A1CR18	23G	A4CR7	16C
A1C18	41D	A1T1	40C	A1A10C3	36B	A2A1CR19	23G	A4CR8	16C
A1C19	44D	A1TB7	46D	A1A10C4	36C	A2A1CR20	23G	A4CR9	16C
A1C20	41C	A1TB8	52D	A1A10C5	36C	A2A1CR21	16H	A4CR10	16D
A1C21	41C	A1TB10	62B	A1A10C6	37A	A2A1CR22	22G	A4CR11	16D
A1C22	60B	A1V1	42B	A1A10C8	37A	A2A1K1	22G	A4CR12	17D
A1C23	61B	A1A1	38G	A1A10C9	37B	A2A1P1	16G,16H,	A4CR13	17D
A1C24	61A	A1A2	64A	A1A10C10	37C		18H,19F,	A4R1	18B
A1C25	62B	A1A3J1	41H	A1A20C11	37C		24G,24H	A4R2	18B
A1C26	62A	A1A3A1C1	44E	A1A10L1	36A	A2A1Q1	20H	A4R3	19B
A1C27	40D	A1A3A1C2	42F	A1A10L2	36A	A2A1Q2	22G	A4R4	19B
A1C28	40D	A1A3A1C3	43F	A1A10L3	36B	A2A1R1	18F	A4R5	19B
A1C29	42D	A1A3A1C4	43G	A1A10L4	36C	A2A1R2	18F	A4R6	20B
A1C30	42D	A1A3A1C5	43H	A1A10L5	36C	A2A1R3	20F	A4R7	20B
A1C31	38D	A1A3A1C6	44H	A1A11S2	50B	A2A1R4	20F	A4R8	21B
A1C32	38D	A1A3A1C7	42H	A1A11A1B1	51C	A2A1R5	21F	A4R9	21C
A1C33	38D	A1A3A1C8	44H	A1A11A1J1	52D	A2A1R6	19G	A4R10	19D
A1DS1	34I	A1A3A1C9	41E	A1A11A1S1	50C	A2A1R7	19G	A4R11	20D
A1DS2	34H	A1A3A1C10	45E	A1A12S2	56B,58B	A2A1R8	20G	A4R12	20E
A1J2	37D	A1A3A1C11	41F	A1A12A1B1	57V	A2A1R9	21F	A4R13	20E
A1J3	36D	A1A3A1C12	45F	A1A12A1J1	58D	A2A1R10	19G	A4R14	19C
A1J6	61D	A1A3A1C13	41F	A1A12A1S1	56E	A2A1R11	19H	A4R15	16D
A1J7	60D	A1A3A1C14	45F	A1A13	65I	A2A1R12	15G	A4R16	16D
A1J12	28B	A1A3A1CR1	42E	A1A14C1	60B	A2A1R13	16G	[illegible]	16E

Figure 5-50. 10 KW PA, Main Frame, Schematic Diagram (Sheet 1 of 2)

ORIGINAL

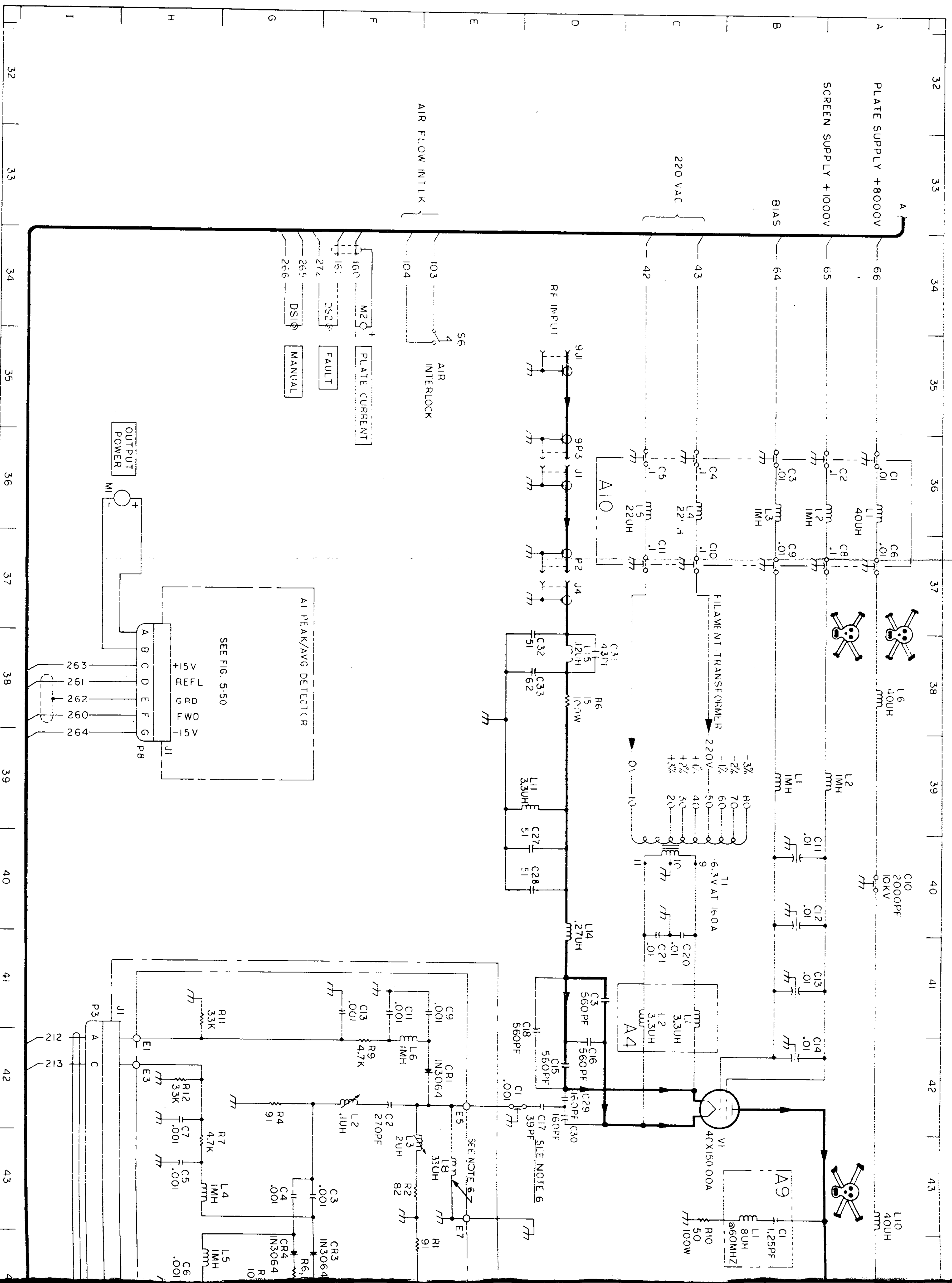


PLATE SUPPLY +8000V
SCREEN SUPPLY +1000V
BIAS
220 VAC
AIR FLOW INTLK
RF INPUT
S6
AIR INTERLOCK
M2
PLATE CURRENT
DS2
FAULT
DS1
MANUAL
OUTPUT POWER
M1
A1 PEAK/AVG DETECTOR
SEE FIG 5-50
+15V
REFL
GRD
FWD
-15V
P8
J1
A10
A4
A9
FILAMENT TRANSFORMER
T1
6.3V AT 160A
C10
2000PF
10KV
L6
40UH
L10
40UH
V1
4CX15000A
R10
50
100W
L14
.27UH
L11
3.3UH
R6
15
10W
C3
560PF
C16
560PF
C15
560PF
C18
560PF
C17
39PF
SEE NOTE 6
CR1
IN3064
CR3
IN3064
CR4
IN3064
L2
.1UH
C2
270PF
L3
2UH
L8
33UH
R4
91
R9
4.7K
R11
33K
R12
33K
L4
1MH
L5
1MH
P3
212
213
263
261
262
260
264
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42
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104
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9J1
9P3
J1
P2
J4

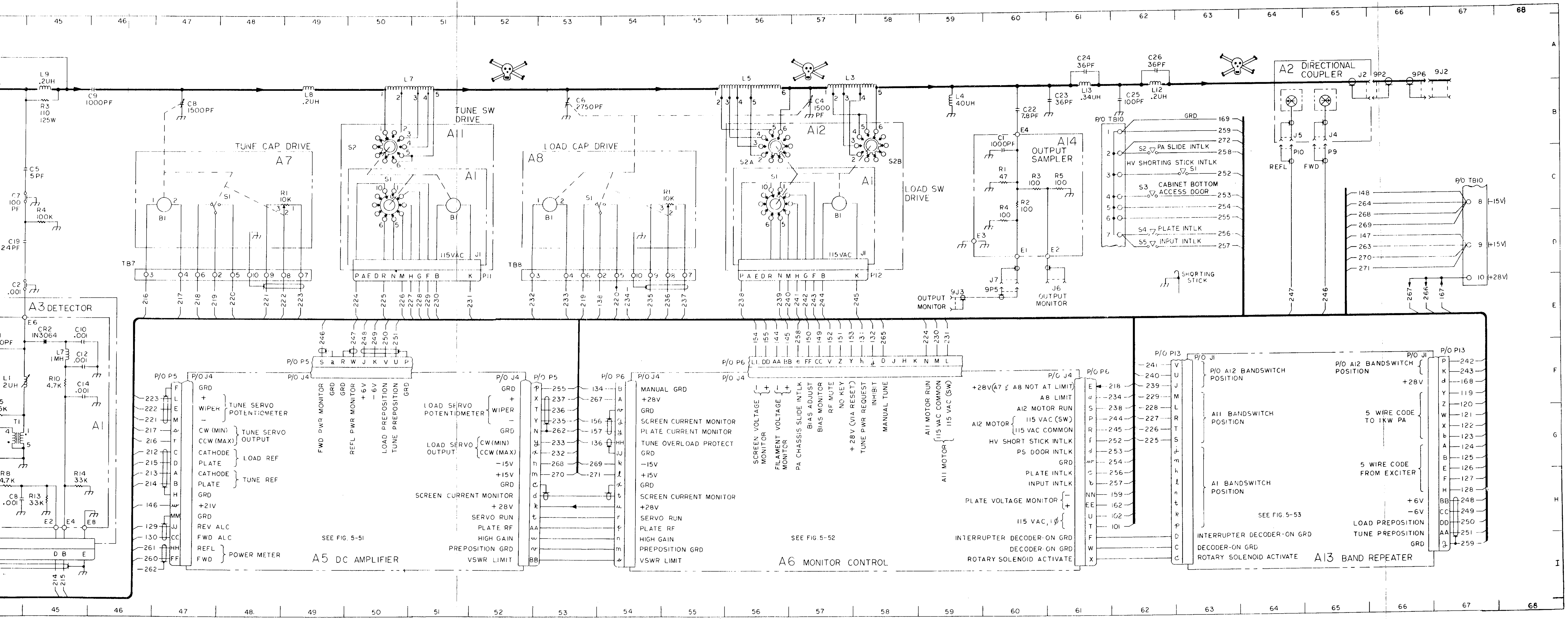


Figure 5-50. 10 KW PA, Main Frame, Schematic Diagram (Sheet 2 of 2)

NOTES:

1. PREFIX ALL INCOMPLETE REF DESIGNATIONS ON SHEET 1 WITH 9 & PREFIX ALL INCOMPLETE REF DESIGNATIONS ON SHEET 2 WITH 9A1.

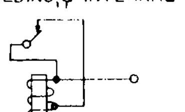
2. UNLESS OTHERWISE SPECIFIED:
   a. ALL RESISTORS ARE IN OHMS, 1/2W, 5%, EXCEPT 9A1A3 ARE 1/4W.
   b. ALL CAPACITORS ARE IN MICROFARADS.
   c. ALL DIODES ARE IN3611, EXCEPT ON 9A4 WHICH ARE DIODE STACKS.

3. ▭ INDICATES FRONT PANEL MARKINGS.

4. FOR REF WIRE NUMBERS USED ON THE WIRING HARNESS REFER TO THE CHART BELOW:

WIRE NUMBER	CONNECTS
0 TO 99	DIRECTLY FROM THE CABINET ASSY TO THE CHASSIS ASSY 9A1, VIA 9P1.
100 TO 199	WIRES ON THE CHASSIS ASSY 9A1. (ADD 100 TO THE CAB. WIRE NUMBER AT 9A1J2).
200 TO 299	WIRES WITH BOTH ENDS ON THE CHASSIS ASSY 9A1.
300 TO 499	WIRES BETWEEN 9A1 AND 9A1A5 OR 9A1A6 (ADD 200 TO THE 100 TO 299 SERIES WIRES).
500 TO 599	WIRES WITH BOTH ENDS ON 9A1A5.
600 TO 699	WIRES WITH BOTH ENDS ON 9A1A6 OR ONLY TO 9A1A5.

5. 9A3K1, 9A3K3 & 9A3K4 HAVE DUAL WINDINGS, ONE FOR PULL-IN & ONE FOR HOLDING, & INTERNAL SEPARATE PULL-IN CONTACTS.



6. THE VALUE OF 9A1C17 AND 9A1A3L8 IS SELECTED IN FINAL TEST. A TYPICAL VALUE IS SHOWN

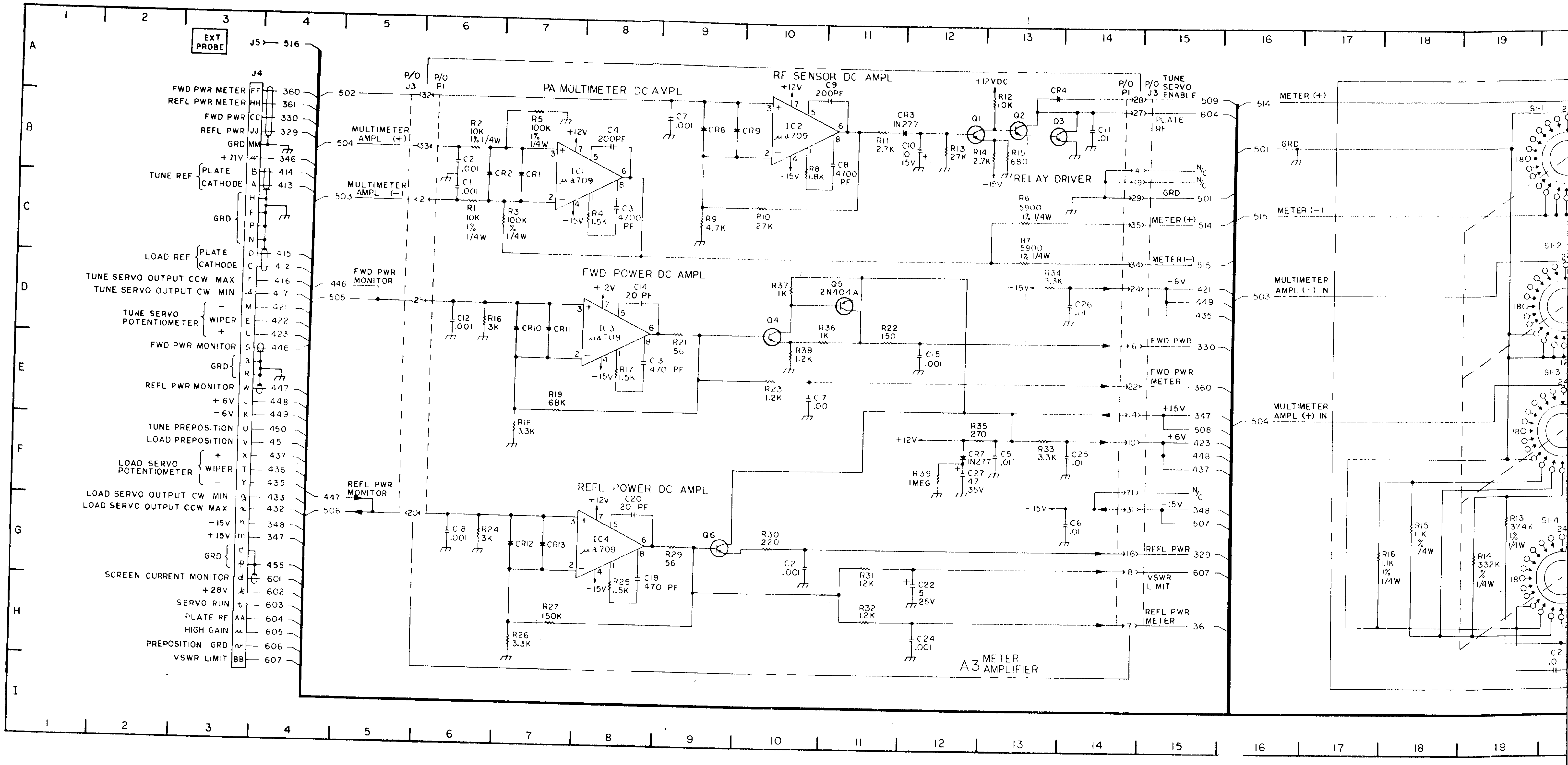
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
  a) ALL RESISTOR ARE IN OHMS, 1/2W.
  b) ALL CAPACITORS ARE IN UF.
  c) ALL DIODES ARE 1N914.

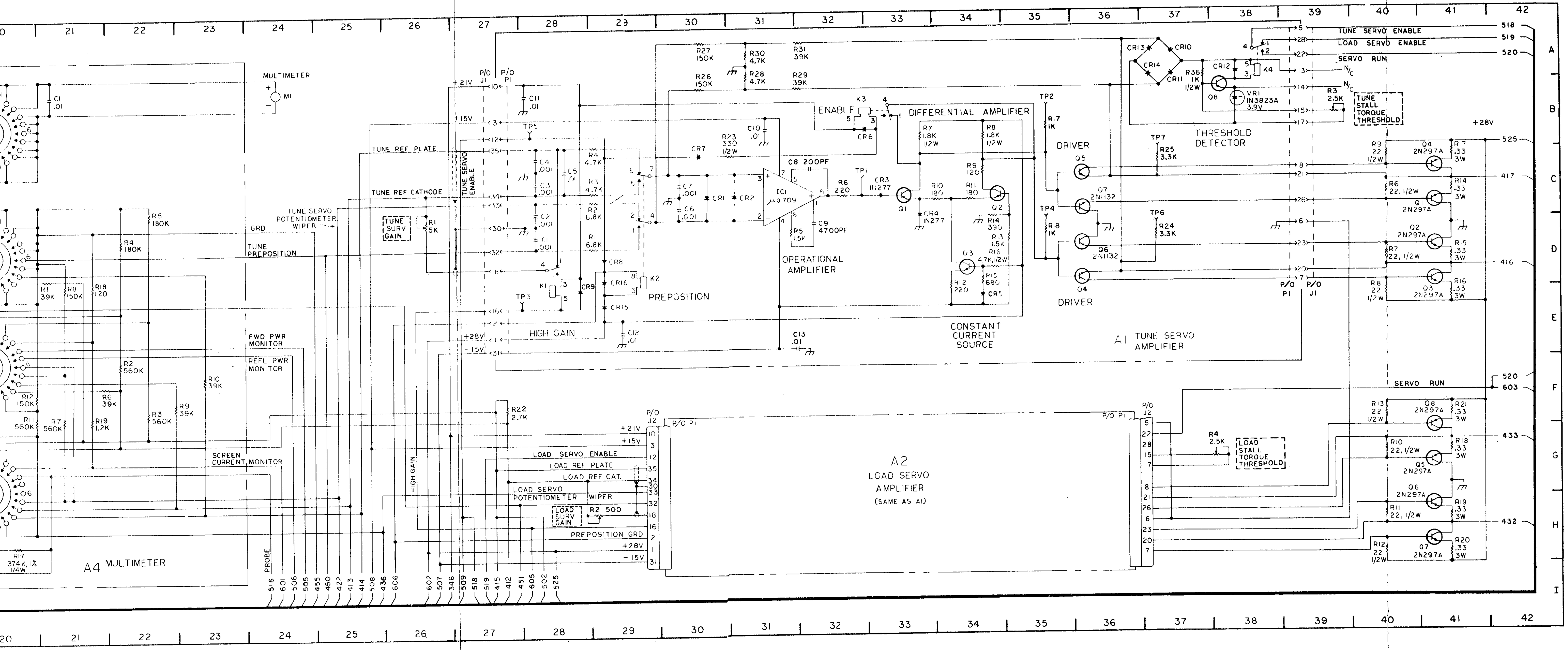
Figure 5-51. 10 KW PA, Peak/Average Detector Assembly 9A1A1, Schematic Diagram

ORIGINAL

PARTS LOCATION INDEX FOR FIGURE 5-52

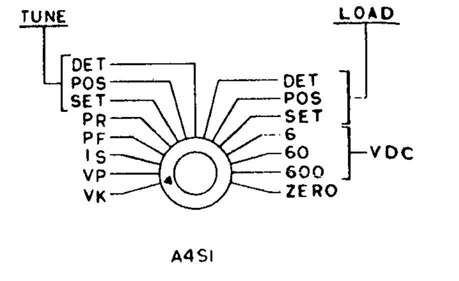
REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
J1	27A,39E	A1CR9	28D	A1TP7	37B	A3R6	13C
J2	29F,37F	A1CR10	37A	A1VR1	38C	A3R7	13C
J3	5A,15A	A1CR11	37A	A2	33G	A3R8	10B
J4	3A	A1CR12	38A	A3C1	6C	A3R9	9C
J5	3A	A1CR13	37A	A3C2	6B	A3R10	10C
M1	24A	A1CR14	37A	A3C3	8C	A3R11	11B
Q1	41C	A1CR15	29E	A3C4	8B	A3R12	13A
Q2	41D	A1CR16	29D	A3C5	13F	A3R13	12B
Q3	41E	A1IC1	31C	A3C6	14G	A3R14	13B
Q4	41C	A1K1	28D	A3C7	9B	A3R15	13B
Q5	41G	A1K2	29D	A3C8	11B	A3R16	6D
Q6	41H	A1K3	32B	A3C9	11B	A3R17	8E
Q7	41H	A1K4	38A	A3C10	12B	A3R18	7E
Q8	41F	A1P1	27A,39E	A3C11	10B	A3R19	7E
R1	26D	A1Q1	33C	A3C12	6D	A3R21	9D
R2	29G	A1Q2	34C	A3C13	8E	A3R22	11D
R3	39B	A1Q3	34D	A3C14	8D	A3R23	10E
R4	38G	A1Q4	36D	A3C15	12E	A3R24	6G
R6	40C	A1Q5	36C	A3C17	10E	A3R25	8G
R7	40D	A1Q6	36D	A3C18	6G	A3R26	7H
R8	40E	A1Q7	36C	A3C19	8G	A3R27	7H
R9	40C	A1Q8	38B	A3C20	8F	A3R29	9G
R10	40G	A1R1	29D	A3C21	10G	A3R30	10G
R11	40H	A1R2	29C	A3C22	12G	A3R31	11G
R12	40H	A1R3	29C	A3C24	12H	A3R32	11G
R13	40F	A1R4	29B	A3C25	14F	A3R33	13F
R14	41C	A1R5	32D	A3C26	14D	A3R34	13D
R15	41D	A1R6	32C	A3C27	12F	A3R35	12E
R16	41D	A1R7	33B	A3CR1	7C	A3R36	10D
R17	41C	A1R8	34B	A3CR2	6B	A3R37	10D
R18	41G	A1R9	34C	A3CR3	11B	A3R38	10E
R19	41H	A1R10	34C	A3CR4	13B	A3R39	12F
R20	41H	A1R11	34D	A3CR5-6	Not used	A4C1	21B
R21	41F	A1R12	34D	A3CR7	12F	A4C2	20H
R22	27F	A1R13	34D	A3CR8	9B	A4R1	21F
A1C1	28D	A1R14	34C	A3CR9	10B	A4R2	22F
A1C2	28C	A1R15	34D	A3CR10	7D	A4R3	22E
A1C3	28C	A1R16	34D	A3CR11	7D	A4R4	22C
A1C4	28B	A1R17	35B	A3CR12	7G	A4R5	22D
A1C5	28B	A1R18	35D	A3CR13	7G	A4R6	21C
A1C6	30C	A1R23	31B	A3IC1	7B	A4R7	21F
A1C7	30C	A1R24	34D	A3IC2	10B	A4R8	21C
A1C8	32C	A1R25	34B	A3IC3	8D	A4R9	23F
A1C9	32C	A1R26	30A	A3IC4	8G	A4R10	23F
A1C10	31B	A1R27	30A	A2P1	6A,14A	A4R11	20F
A1C11	28B	A1R28	31A	A3Q1	12B	A4R12	20F
A1C12	29E	A1R29	32A	A3Q2	13B	A4R13	19G
A1C13	32E	A1R30	31A	A2Q3	13B	A4R14	19G
A1CR1	30C	A1R31	32A	A3Q4	10D	A4R15	18G
A1CR2	31C	A1R36	37A	A3Q5	11D	A4R16	18G
A1CR3	33C	A1TP1	32C	A3Q6	9G	A4R17	20H
A1CR4	33C	A1TP2	35B	A3R1	6C	A4R18	21C
A1CR5	34D	A1TP3	28D	A3R2	6B	A4R19	21F
A1CR6	32C	A1TP4	35C	A3R3	7C	A4S1	20B,20D
A1CR7	30B	A1TP5	28B	A3R4	8C		20E,20G
A1CR8	29D	A1TP6	37C	A3R5	7B		


EXT PROBE
J5 516
J4
FWD PWR METER FF 360
REFL PWR METER HH 361
FWD PWR CC 330
REFL PWR JJ 329
GRD MM
+21V 346
TUNE REF PLATE B 414
CATHODE A 413
GRD
LOAD REF PLATE D 415
CATHODE C 412
TUNE SERVO OUTPUT CCW MAX 416
TUNE SERVO OUTPUT CW MIN 417
TUNE SERVO POTENTIOMETER WIPER 421 422 423
FWD PWR MONITOR S 446
REFL PWR MONITOR W 447
+6V 448
-6V 449
TUNE PREPOSITION 450
LOAD PREPOSITION 451
LOAD SERVO POTENTIOMETER WIPER 437 436 435
LOAD SERVO OUTPUT CW MIN 433
LOAD SERVO OUTPUT CCW MAX 432
-15V 348
+15V 347
455
SCREEN CURRENT MONITOR 601
+28V 602
SERVO RUN 603
PLATE RF AA 604
HIGH GAIN 605
PREPOSITION GRD 606
VSWR LIMIT BB 607
P/O J3
P/O P1
PA MULTIMETER DC AMPL
MULTIMETER AMPL (+)
MULTIMETER AMPL (-)
R2 10K 1% 1/4W
R5 100K 1% 1/4W
C4 200PF
C2 .001
C1 .001
R1 10K 1% 1/4W
R3 100K 1% 1/4W
CR2
CR1
IC1 μa709
R4 1.5K
C3 4700 PF
C7 .001
RF SENSOR DC AMPL
C9 200PF
CR8
CR9
IC2 μa709
R8 1.8K
C8 4700 PF
R9 4.7K
R10 27K
R11 2.7K
CR3 1N277
C10 10 15V
R13 27K
R14 2.7K
+12VDC
R12 10K
Q1
Q2
Q3
R15 680
CR4
C11 .01
RELAY DRIVER
R6 5900 1% 1/4W
R7 5900 1% 1/4W
TUNE SERVO ENABLE 509
PLATE RF 604
GRD 501
METER(+) 514
METER(-) 515
FWD PWR MONITOR
FWD POWER DC AMPL
C14 20 PF
C12 .001
R16 3K
CR10
CR11
IC3 μa709
R17 1.5K
C13 470 PF
R21 56
R19 68K
R18 3.3K
Q4
R37 1K
Q5 2N404A
R36 1K
R38 1.2K
R22 150
C15 .001
R23 1.2K
C17 .001
R34 3.3K
C26 .01
-6V 421 449 435
FWD PWR 330
FWD PWR METER 360
+15V 347 508
+6V 423 448 437
R35 270
CR7 1N277
C5 .01
R33 3.3K
C25 .01
R39 1MEG
C27 47 35V
REFL PWR MONITOR
REFL POWER DC AMPL
C20 20 PF
C8 .001
R24 3K
CR12
CR13
IC4 μa709
R25 1.5K
C19 470 PF
R29 56
R27 150K
R26 3.3K
Q6
R30 220
C21 .001
R31 12K
R32 12K
C22 5 25V
C24 .001
-15V 348 507
C6 .01
REFL PWR 329
VSWR LIMIT 607
REFL PWR METER 361
A3 METER AMPLIFIER
METER (+)
GRD
METER (-)
MULTIMETER AMPL (-) IN
MULTIMETER AMPL (+) IN
R16 1.1K 1% 1/4W
R15 1.1K 1% 1/4W
R14 332K 1% 1/4W
R13 374K 1% 1/4W
S1-1
S1-2
S1-3
S1-4
C2 .01



NOTES:

1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 9A1A5.
2. UNLESS OTHERWISE SPECIFIED:
   a. ALL RESISTORS ON 9A1A5A1 & 9A1A5A2 ARE 1/
   ALL OTHERS ARE 1/2W.
   ALL RESISTORS ARE IN OHMS, 5%.
   b ALL CAPACITORS ARE IN UF.
   c ALL DIODES ARE IN3611.
   d. ALL TRANSISTORS ARE 2N697.
3. ▭ INDICATES FRONT PANEL MARKING.



A4S1

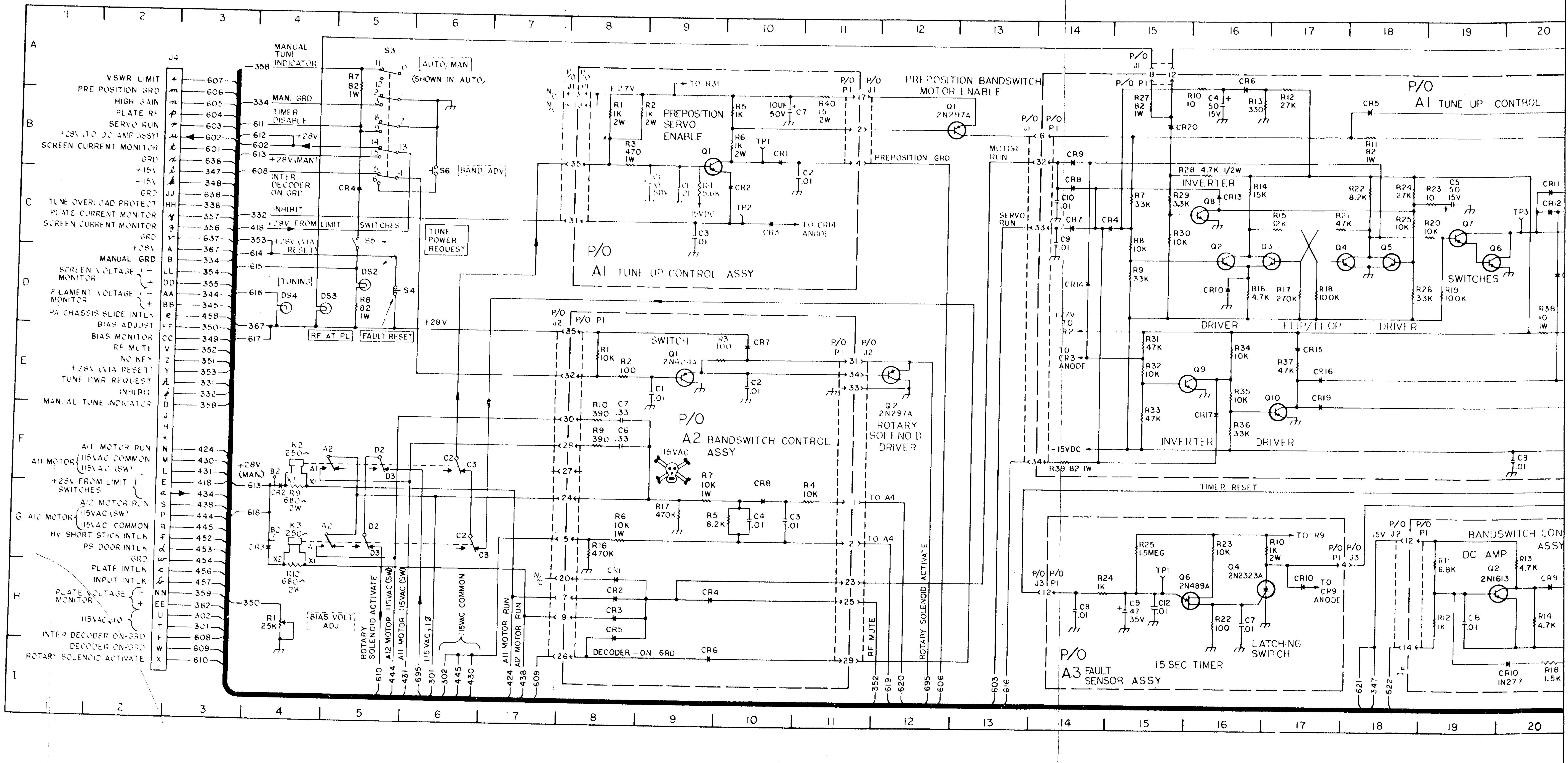
FRONT PANEL MARKING

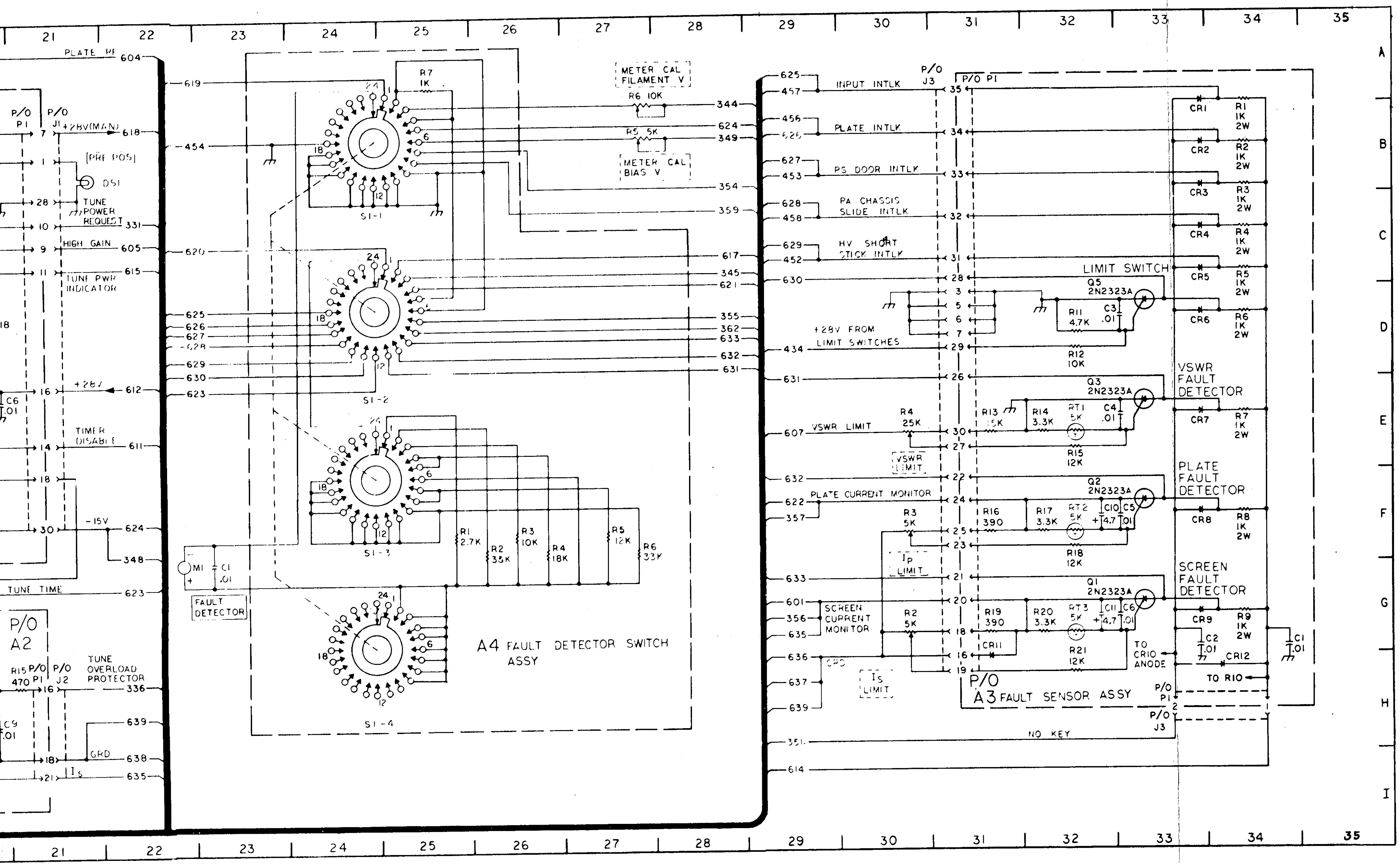
Figure 5-52. 10 KW PA, DC Amplifier Assembly 9A1A5, Schematic Diagram

PARTS LOCATION INDEX FOR FIGURE 5-53

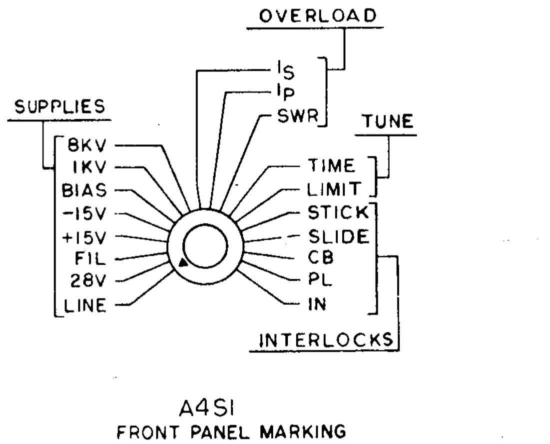
REF DESIG	LOC
C1	23F
CR2	4G
CR3	4G
CR4	5C
DS1	22B
DS2	5D
DS3	4D
DS4	4D
J1	7B,11A, 13B,15A, 21B
J2	7D,11E, 18G,21H
J3	14H,18G, 31E
J4	2A
K2	4F
K3	4G
M1	22F
Q1	13B
Q2	12E
R1	4H
R2	30G
R3	30F
R4	30E
R5	27B
R6	27A
R7	5A
R8	5D
R9	4G
R10	4H
S3	5A
S4	5D
S5	5C
S6	3B
A1C1	9C
A1C2	11C
A1C3	9C
A1C4	16B
A1C5	19C
A1C6	20E
A1C7	10B
A1C8	20F
A1C9	14C
A1C10	14C
A1C11	9C
A1CR1	10B
A1CR2	10C
A1CR3	10C
A1CR4	14C
A1CR5	18B
A1CR6	16A
A1CR7	14C
A1CR8	14C
A1CR9	14B
A1CR10	16D
A1CR11	20C
A1CR12	20C
A1CR13	16C
A1CR14	14D
A1CR15	17E
A1CR16	17E
A1CR17	16F
A1CR18	20D
A1CR20	15B
A1P1	8B,11A, 14B,15B, 21B
A1Q1	9B
A1Q2	16C
A1Q3	17C
A1Q4	17C
A1Q5	18C
A1Q6	19C
A1Q7	19B
A1Q8	16C
A1Q9	16E
A1Q10	17E
A1R1	8B
A1R2	8B
A1R3	8B
A1R4	9C
A1R5	10B
A1R6	10B
A1R7	15C
A1R8	15C
A1R9	15D
A1R10	16B
A1R11	18B
A1R12	17B
A1R13	16B
A1R14	17C
A1R16	16D
A1R17	17D
A1R18	17D
A1R19	19D
A1R20	19C
A1R21	17C
A1R22	18C
A1R23	19C
A1R24	18C
A1R25	18C
A1R26	18D
A1R27	15B
A1R28	15B
A1R29	15C
A1R30	15C
A1R31	15E
A1R32	15E
A1R33	15F
A1R34	16E
A1R35	16E
A1R36	16F
A1R37	17E
A1R38	20D
A1R39	14F
A1R40	10B
A1TP1	10B
A1TP2	10C
A1TP3	20C
A2C1	9E
A2C2	10E
A2C3	10G
A2C4	10G
A2C5	Not used
A2C6	8F
A2C7	8E
A2C8	19H
A2C9	20H
A2CR1	8H
A2CR2	8H
A2CR3	8H
A2CR4	9H
A2CR5	8H
A2CR6	9I
A2CR7	10E
A2CR8	10F
A2CR9	20H
A2CR10	20I
A2P1	8D,11E, 19G,21H
A2Q1	9E
A2Q2	19H
A2R1	8E
A2R2	8E
A2R3	10E
A2R4	11G
A2R5	10G
A2R6	8G
A2R7	9F
A2R9	8F
A2R10	8E
A2R11	19G
A2R12	19H
A2R13	20G
A2R14	20H
A2R15	20H
A2R16	8G
A2R17	9G
A2R18	20I
A3C1	34G
A3C2	33G
A3C3	33D
A3C4	33E
A3C5	33F
A3C6	33G
A3C7	16H
A3C8	14H
A3C9	15H
A3C10	33F
A3C11	33G
A3C12	15H
A3CR1	33A
A3CR2	33B
A3CR3	33B
A3CR4	33C
A3CR5	33C
A3CR6	33D
A3CR7	33E
A3CR8	33F
A3CR9	33G
A3CR10	17H
A3CR11	31G
A3CR12	34H
A3P1	14H,17G, 31A
A3Q1	32G
A3Q2	32F
A3Q3	32E
A3Q4	16G
A3Q5	32C
A3Q6	16H
A3R1	34A
A3R2	34B
A3R3	34B
A3R4	34C
A3R5	34C
A3R6	34D
A3R7	34E
A3R8	34F
A3R9	34G
A3R10	17G
A3R11	32D
A3R12	32D
A3R13	31E
A3R14	32E
A3R15	32E
A3R16	31F
A3R17	32F
A3R18	32F
A3R19	31G
A3R20	32G
A2R21	32H
A3R22	16H
A3R23	16G
A3R24	14H
A3R25	15G
A3RT1	32E
A3RT2	32F
A3RT3	32G
A3TP1	15A
A4R1	25F
A4R2	26F
A4R3	26F
A4R4	26F
A4R5	27F
A4R6	27F
A4R7	25A
A4S1	24B,D,F,G

BLANK


J4
VSWR LIMIT
PRE POSITION GRD
HIGH GAIN
PLATE RF
SERVO RUN
+28V (TO DC AMP ASSY)
SCREEN CURRENT MONITOR
TUNE OVERLOAD PROTECT
PLATE CURRENT MONITOR
SCREEN CURRENT MONITOR
MANUAL GRD
SCREEN VOLTAGE MONITOR
FILAMENT VOLTAGE MONITOR
PA CHASSIS SLIDE INTLK
BIAS ADJUST
BIAS MONITOR
RF MUTE
NO KEY
+28V (VIA RESET)
TUNE PWR REQUEST
INHIBIT
MANUAL TUNE INDICATOR
A11 MOTOR RUN
A11 MOTOR 115VAC COMMON
115VAC (SW)
+28V FROM LIMIT SWITCHES
A12 MOTOR RUN
A12 MOTOR 115VAC (SW)
115VAC COMMON
HV SHORT STICK INTLK
PS DOOR INTLK
PLATE INTLK
INPUT INTLK
PLATE VOLTAGE MONITOR
115VAC, 1Ø
INTER DECODER ON-GRD
DECODER ON-GRD
ROTARY SOLENOID ACTIVATE
MANUAL TUNE INDICATOR
S3
AUTO/MAN
(SHOWN IN AUTO)
MAN. GRD
TIMER DISABLE
+28V(MAN)
INTER DECODER ON GRD
INHIBIT
+28V FROM LIMIT SWITCHES
+28V (VIA RESET)
S5
S6 BAND ADV
TUNE POWER REQUEST
TUNING
DS2
DS3
DS4
S4
RF AT PL
FAULT RESET
+28V
P/O A1 TUNE UP CONTROL ASSY
PREPOSITION SERVO ENABLE
PREPOSITION GRD
PREPOSITION BANDSWITCH MOTOR ENABLE
Q1 2N297A
P/O A2 BANDSWITCH CONTROL ASSY
SWITCH
Q1 2N404A
Q2 2N297A ROTARY SOLENOID DRIVER
115VAC
K2 250~
K3 250~
BIAS VOLT ADJ
R1 25K
DECODER-ON GRD
TO A4
RF MUTE
ROTARY SOLENOID ACTIVATE
A11 MOTOR 115VAC (SW)
A12 MOTOR 115VAC (SW)
115VAC COMMON
A11 MOTOR RUN
A12 MOTOR RUN
MOTOR RUN
SERVO RUN
INVERTER
DRIVER
FLIP/FLOP
SWITCHES
-15VDC
R39 82 1W
TIMER RESET
P/O A1 TUNE UP CONTROL
P/O A3 FAULT SENSOR ASSY
15 SEC TIMER
LATCHING SWITCH
Q6 2N489A
Q4 2N2323A
BANDSWITCH CON ASSY
DC AMP
Q2 2N1613
CR10 IN277

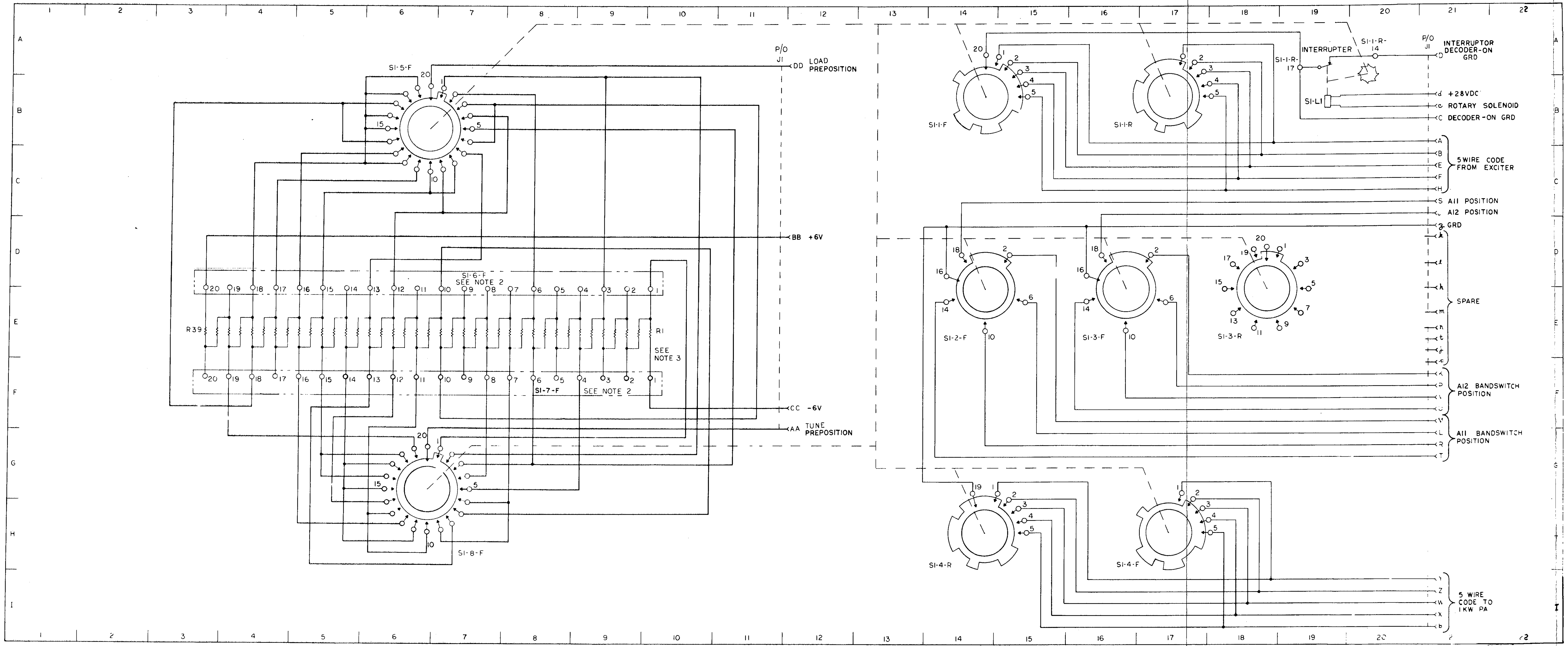


NOTES:
1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 9A1A6.
2. UNLESS OTHERWISE SPECIFIED:
   a. ALL RESISTORS ON 9A1A6A1 ARE 1/4W ALL OTHER RESISTORS ARE IN OHMS, 1/2W, 5%.
   b. ALL CAPACITORS ARE IN UF.
   c. ALL DIODES ARE IN3611.
   d. ALL TRANSISTORS ARE 2N697.
3. ▭ INDICATES FRONT PANEL MARKINGS.
4. WIRE NUMBERS ARE ASSIGNED AS FOLLOWS: 300-399 & 400-499 SERIES NUMBERS = MAIN FRAME SCHEMATIC. MATING CONNECTION NUMBERS PLUS 200. 600 SERIES NUMBERS ARE FOR WIRE INTERNAL TO THIS ASSEMBLY (A6) OR WIRES CONNECTING TO ASSY A5 (NO NUMBER ASSIGNED ON MAIN FRAME SCHEMATIC.)



A4S1
FRONT PANEL MARKING

Figure 5-53. 10 KW PA, Monitor/Control Assembly 9A1A6, Schematic Diagram



NOTES:

1. PREFIX INCOMPLETE REF DESIGNATIONS WITH 9A1A13.
2. S1 WAFERS 6 & 7 ARE USED AS CONNECTION TERMINALS ONLY.
3. RESISTORS R1-R39 ARE WIRED CONSECUTIVELY AROUND S1 WAFERS 6 & 7 ACCORDING TO FOLLOWING CHART. ALL ARE 1/4W, 5%.

REF DES	VALUE (OHMS)	JUNCTION PT S1-	TEST VOLTAGE
		7-F-1	-6.0V
R1	3.3K	6-F-1	-2.7V
R2	300	7-F-2	-2.4V
R3	100	6-F-2	-2.3V
R4	2K	7-F-3	-0.3V
R5	300	6-F-3	0V
R6	1K	7-F-4	1.0V
R7	200	6-F-4	1.2V
R8	300	7-F-5	1.5V
R9	100	6-F-5	1.6V
R10	100	7-F-6	1.7V
R11	300	6-F-6	2.0V
R12	300	7-F-7	2.3V
R13	300	6-F-7	2.6V
R14	100	7-F-8	2.7V
R15	100	6-F-8	2.8V
R16	100	7-F-9	2.9V
R17	100	6-F-9	3.0V
R18	100	7-F-10	3.1V
R19	300	6-F-10	3.4V
R20	100	7-F-11	3.5V
R21	100	6-F-11	3.6V
R22	200	7-F-12	3.8V
R23	100	6-F-12	3.9V
R24	100	7-F-13	4.0V
R25	100	6-F-13	4.1V
R26	100	7-F-14	4.2V
R27	100	6-F-14	4.3V
R28	200	7-F-15	4.5V
R29	100	6-F-15	4.6V
R30	100	7-F-16	4.7V
R31	100	6-F-16	4.8V
R32	100	7-F-17	4.9V
R33	100	6-F-17	5.0V
R34	100	7-F-18	5.1V
R35	100	6-F-18	5.2V
R36	100	7-F-19	5.3V
R37	100	6-F-19	5.4V
R38	300	7-F-20	5.7V
R39	300	6-F-20	6.0V

Figure 5-54. 10 KW PA, Band Repeater Assembly 9A1A13, Schematic Diagram

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX THE PART DESIGNATION WITH 1A1A2
2. DRESS OF ALL COIL CONNECTIONS IS CRITICAL. IF LEADS MUST BE MOVED, REPLACE IN PRECISELY THE SAME LOCATION.
3. COUPLING SETUP-AFTER PINNING, COUPLING DRIVE PIN SHALL BE ORIENTED AS SHOWN & ROTORS ON SWITCH DECKS SHALL CENTER ON THEIR CONTACTS WITHIN ± 1° HEIGHT OF COUPLING TO BE AS SHOWN.
4. SHIM AS REQUIRED TO COMPENSATE FOR HEIGHT DIFFERENCE.
5. NO. 10 TEFLON TUBING SHALL COVER ALL BARE NO. 12 GAGE WIRE.
6. NUMBER SHOWN ADJACENT TO COIL TERMINAL IS THE HOLE ON COIL FORM IN WHICH THAT TERMINAL IS LOCATED.
7. ALL CONNECTIONS TO TRANSFORMER ASSYS (A1-A19) SHALL BE MADE WITH HIGH TEMPERATURE SOLDER, COMPOSITION Ag 1.5 PER QQ-S-571.
8. HARDWARE ON CAPACITOR HEATSINKS MUST BE TIGHT TO ENSURE ADEQUATE COOLING.

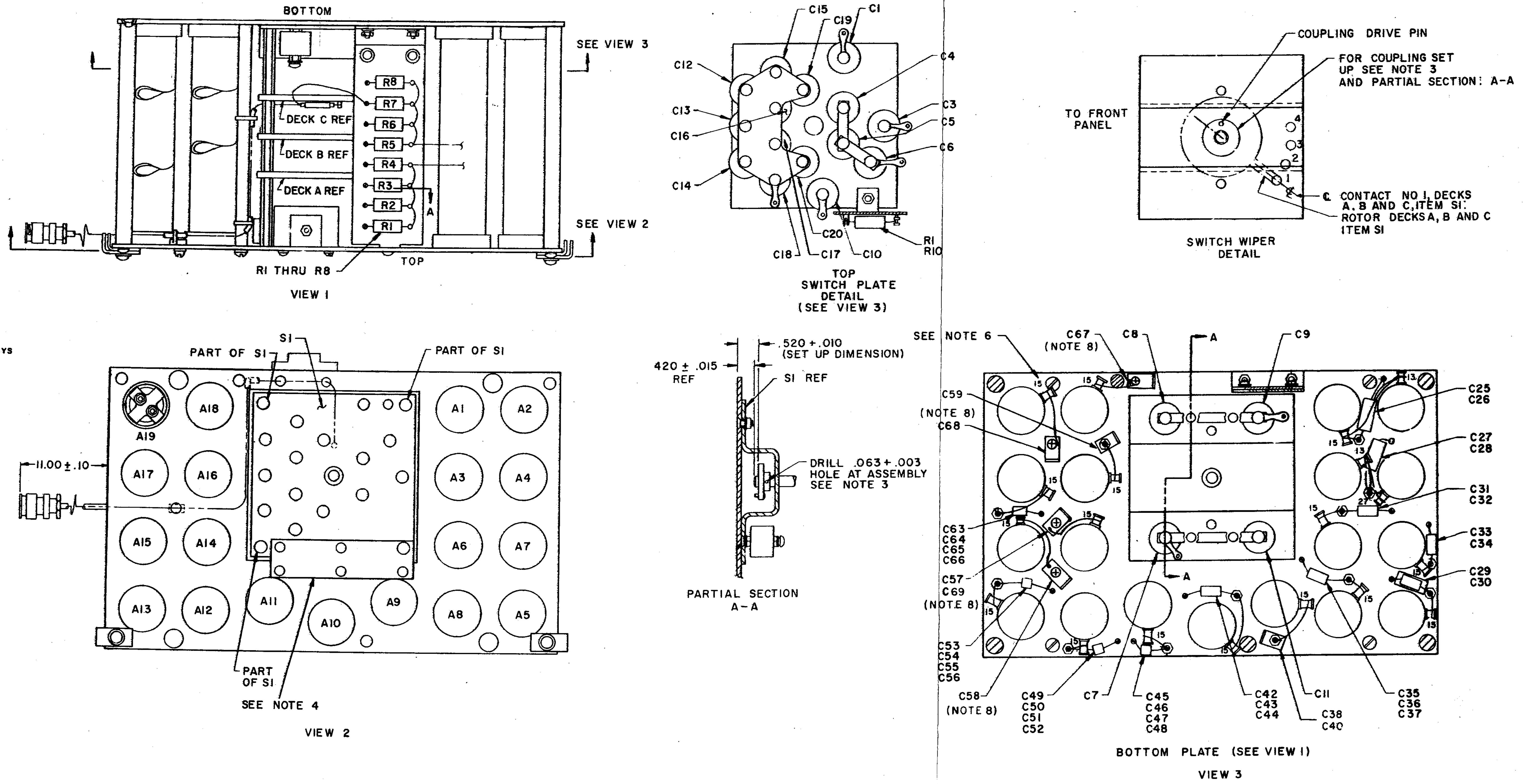
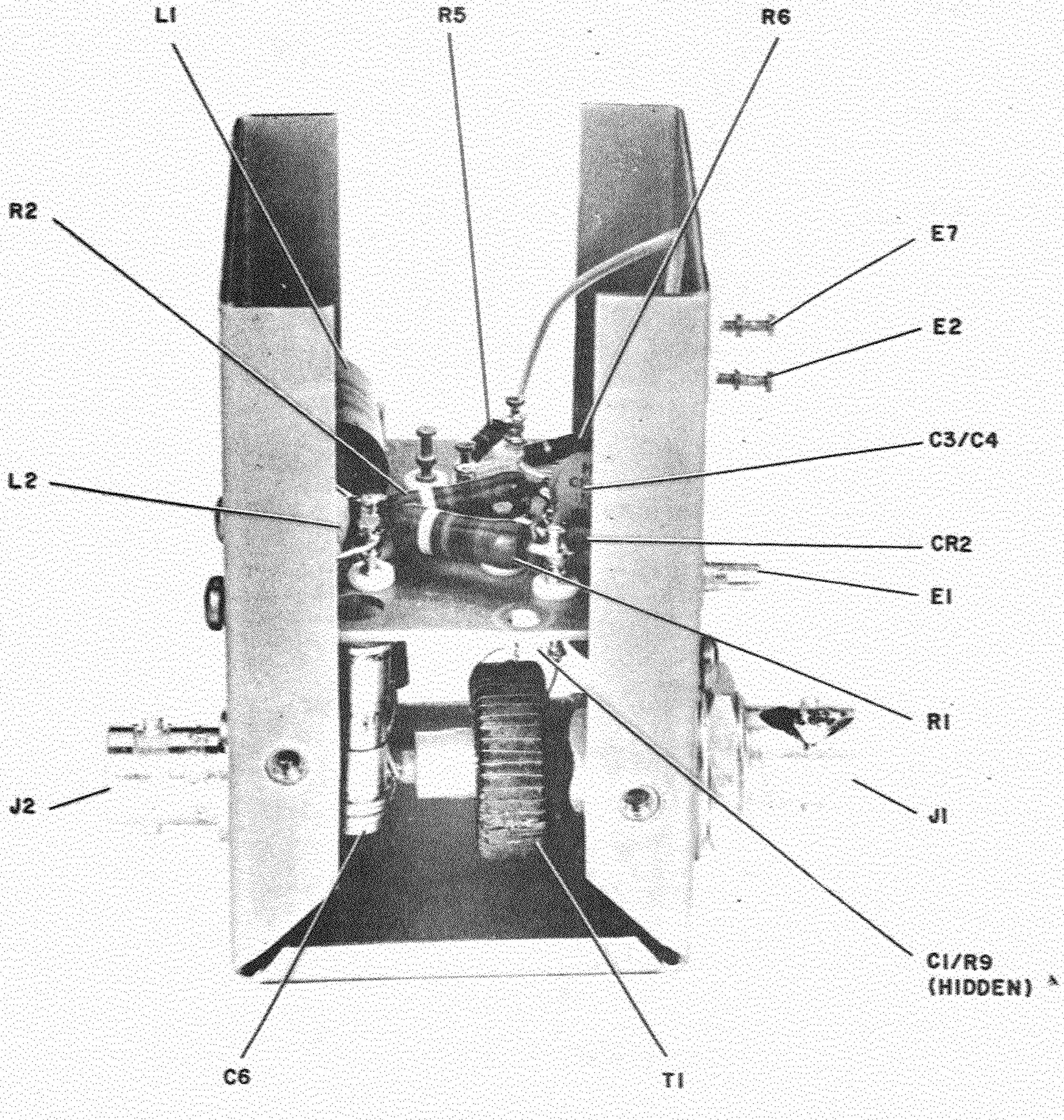
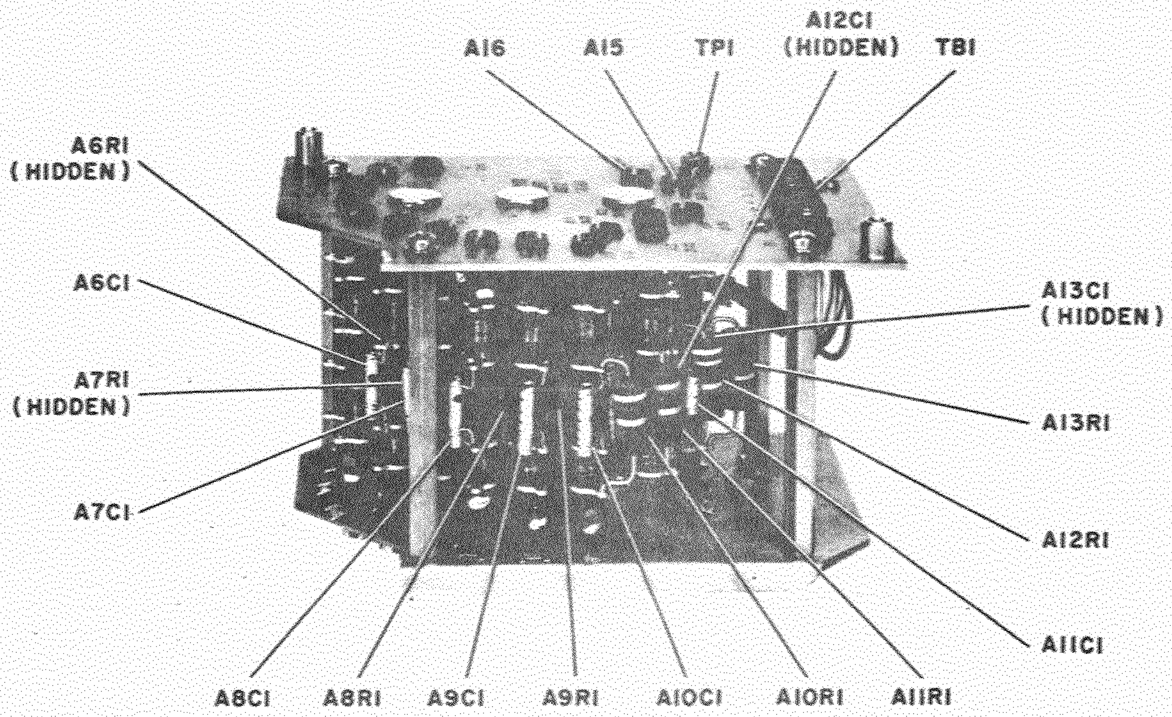


Figure 5-13. 1 KW PA, Final Transformer Assembly, 1A1A2, Component Locations

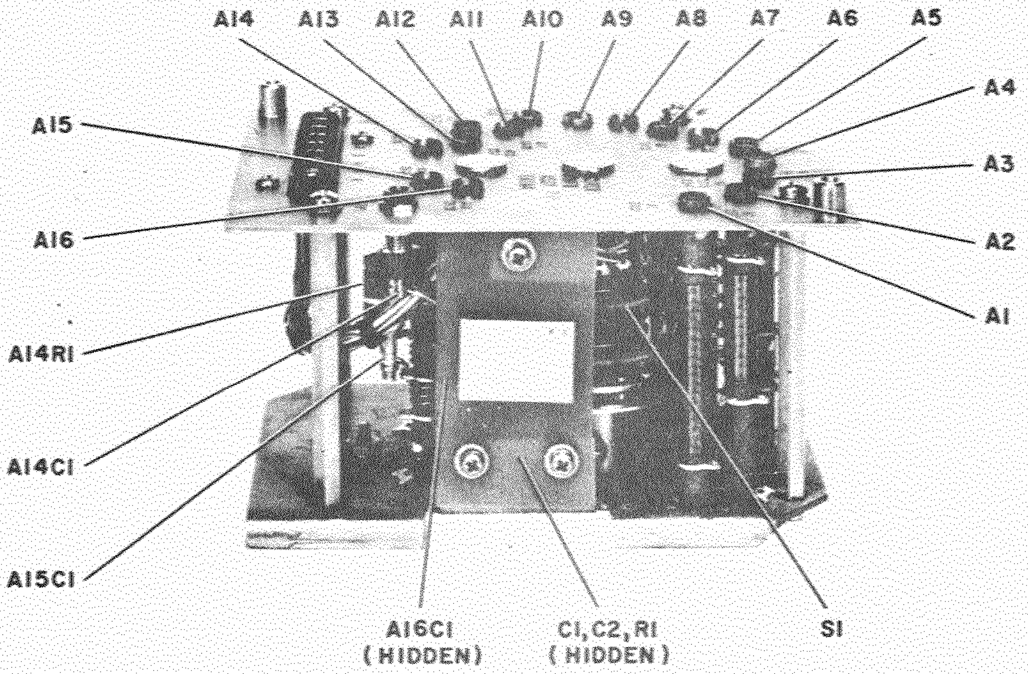


REF DESIG PREFIX 1A1A3

Figure 5-14. 1 KW PA, VSWR Bridge Assembly 1A1A3, Component Locations



REF DESIG PREFIX 1A1A4



REF DESIG PREFIX 1A1A4

Figure 5-15. 1 KW PA, Driver Transformer Assembly, 1A1A4, Component Locations

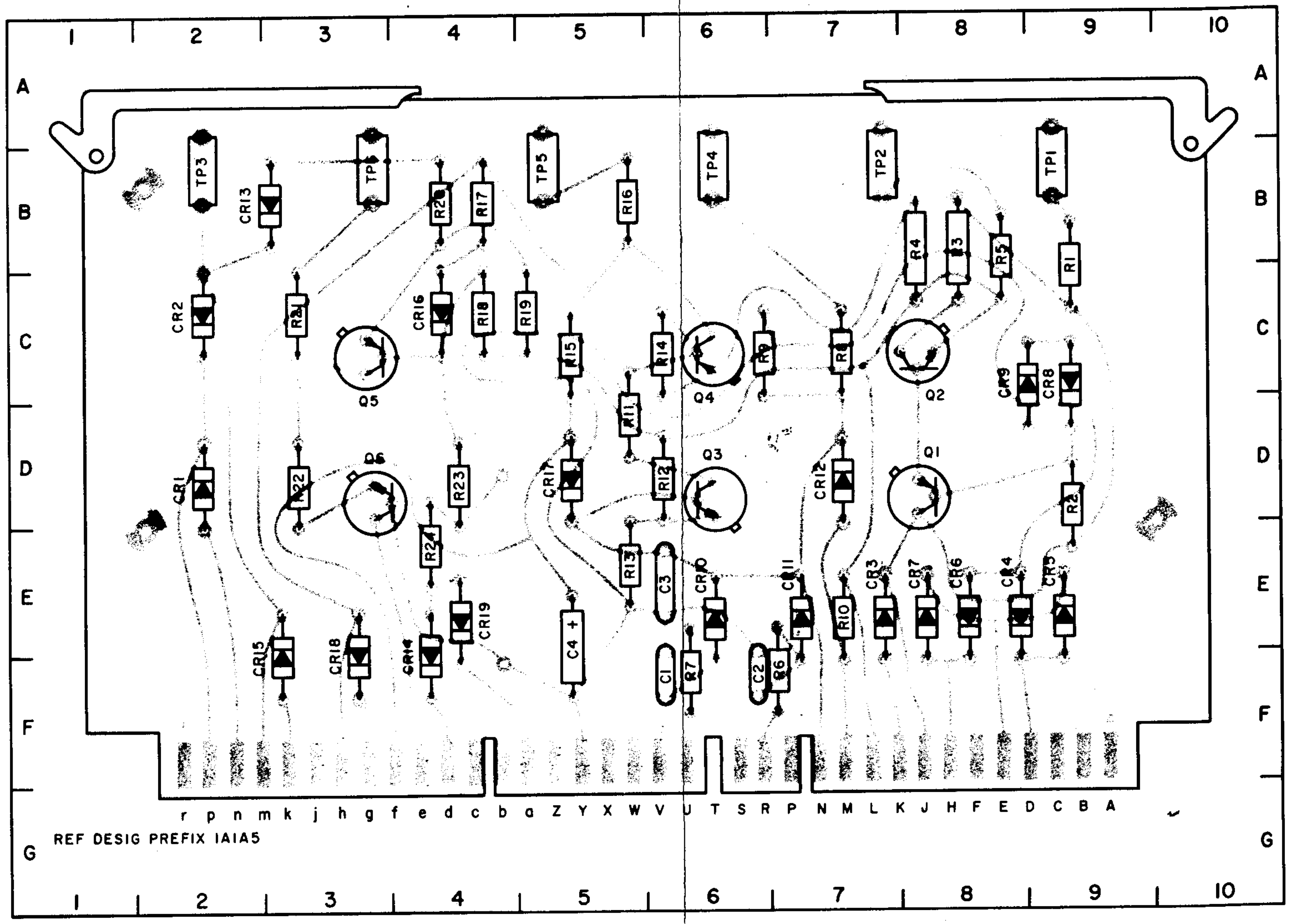
PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC
C1	6F	R2	9D
C2	6F	R3	8B
C3	6E	R4	8B
C4	5E	R5	8B
CR1	2D	R6	7F
CR2	2C	R7	6F
CR3	7E	R8	7C
CR4	8E	R9	6C
CR5	9E	R10	7E
CR6	8E	R11	5D
CR7	8E	R12	6D
CR8	9C	R13	5E
CR9	9C	R14	6C
CR10	6E	R15	5C
CR11	7E	R16	5B
CR12	7D	R17	4B
CR13	3B	R18	4C
CR14	4F	R19	5C
CR15	3F	R20	4B
CR16	4C	R21	3C
CR17	5D	R22	3D
CR18	3F	R23	4D
CR19	4E	R24	4E
Q1	8D	TP1	9B
Q2	8C	TP2	7B
Q3	6D	TP3	2B
Q4	6C	TP4	6B
Q5	3C	TP5	5B
Q6	3D	TP6	3B
R1	9B		

PIN FUNCTIONS

A - (not used)
B - (not used)
C - (not used)
D - 16 VAC input
E - +28 VDC output
F - (not used)
H - 16 VAC input
J - +20 VDC output
K - +20 VDC input

L - +11 VDC reg. output
M - Power Supply Overload Input
N - Plate RF Overload Input
P - (not used)
R - 1A1V1 Cathode Overload Input
S - (not used)
T - (keyway)
U - (not used)
V - 1A1V2 Cathode Overload Input



W - (not used)
X - (not used)
Y - Ground
Z - (not used)
a - Keyline
b - (not used
c - (not used)
d - Driver Key Inhibit
e - Key to Bias Ckt
f - Overload Reset
g - Overload Light
h - 1 KW PA Fault to I. Box.
j - (not used)
k - Key Inhibit to Bias Ckt
m - RF Mute Input
n - To Motor Relay Coil
p - From Decoding Switch
r - (not used)

Figure 5-16. 1 KW PA, DC Power Control PCB Assembly, 1A1A5 Component Locations from Foil Side

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	2D	CR20	5D	R10	7C	R32	6C
C2	2C	Q1	9C	R11	8B	R33	7C
C3	5D	Q2	7C	R12	8C	R34	8D
C4	2B	Q3	7D	R13	8C	R35	3B
C5	4E	Q4	8B	R14	7D	R36	5B
C6	3D	Q5	9E	R15	8D	R37	4C
C7	2D	Q6	2E	R16	2F	R38	2C
CR1	6E	Q7	4B	R17	3E	R39	4E
CR2	6D	Q8	3C	R18	2E	R40	2E
CR3	6E	Q9	5C	R19	5E	R41	5E
CR4	6D	Q10	4D	R20	2D	R42	6B
CR5	7E	Q11	3E	R21	3C	R43	6B
CR6	8E	Q12	4D	R22	4B	R44	6B
CR7	8D	Q13	6C	R23	5C	R45	5C
CR8	3E	R1	9D	R24	5B	R46	6C
CR9	4E	R2	9C	R25	4E	TP1	9B
CR13	7B	R3	9D	R26	5E	TP2	7B
CR14	5D	R4	6F	R27	3D	TP3	6B
CR15	2E	R5	9D	R28	4C	TP4	3B
CR16	4E	R6	7C	R29	3D	TP5	5B
CR17	2C	R7	6E	R30	5D	TP6	4B
CR18	5D	R8	7E	R31	4F	TP7	2B
CR19	6B	R9	8E				

PIN FUNCTIONS

A - To Meter Switch
B - Ground
C - From RF Input Detector
D - Driver Key Inhibit
E - Key Inhibit
F - Key
H - Top of Driver Bias Pot.
J - Bottom of Driver Bias Pot.
K - Wiper of PA Bias Pot.
L - Bottom PA Bias Pot.
M - Top of PA Bias Pot.
N - Mode from Exciter
P - (not used)
R - PA Bias Output
S - 115 VAC Input
T - Ground
U - 115 VAC Input
V - 1A1C29

W - PWR Pot Wiper
X - Shield Ground
Y - Shield Ground
Z - Int. Forward from VSWR Bridge
a - Top of Int. Pwr Set Pot.
b - Int. Reflected from VSWR Bridge
c - PPC Output
d - +28 VDC Interlock Output
e - +28 VDC Interlock Input
f - +28 VDC Input
g - Top of Ext. Pwr Set Pot.
h - (keyway)
j - Ext. Reflected Input
k - Shield Ground
m - Reg. +11 VDC Input
n - Ext. Forward Input
p - TGC Output
r - 10 KW PA T.O.P. Input

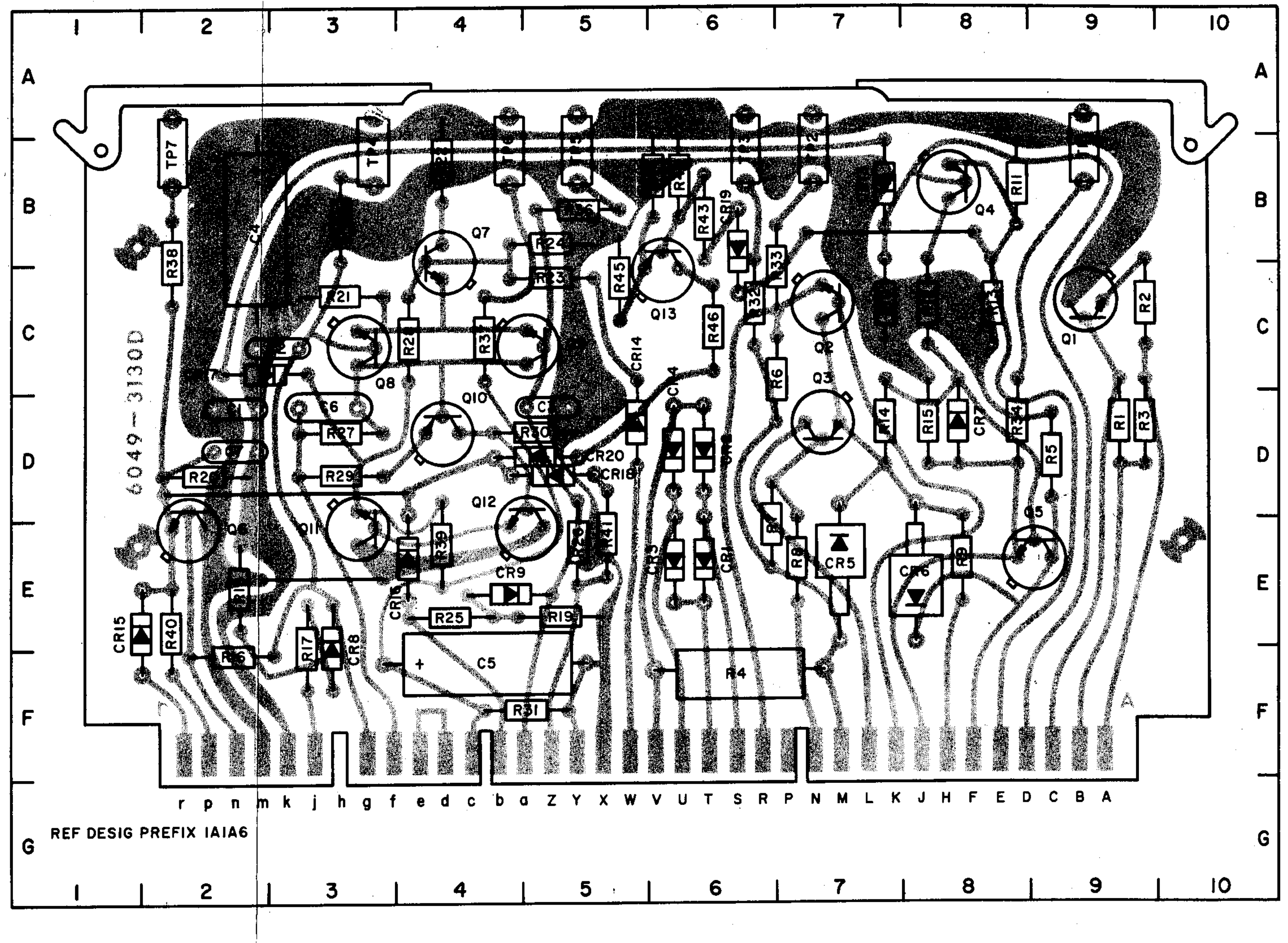


Figure 5-17. 1 KW PA, TGC-PPC PCB Assembly, 1A1A6, Component Locations From Foil Side

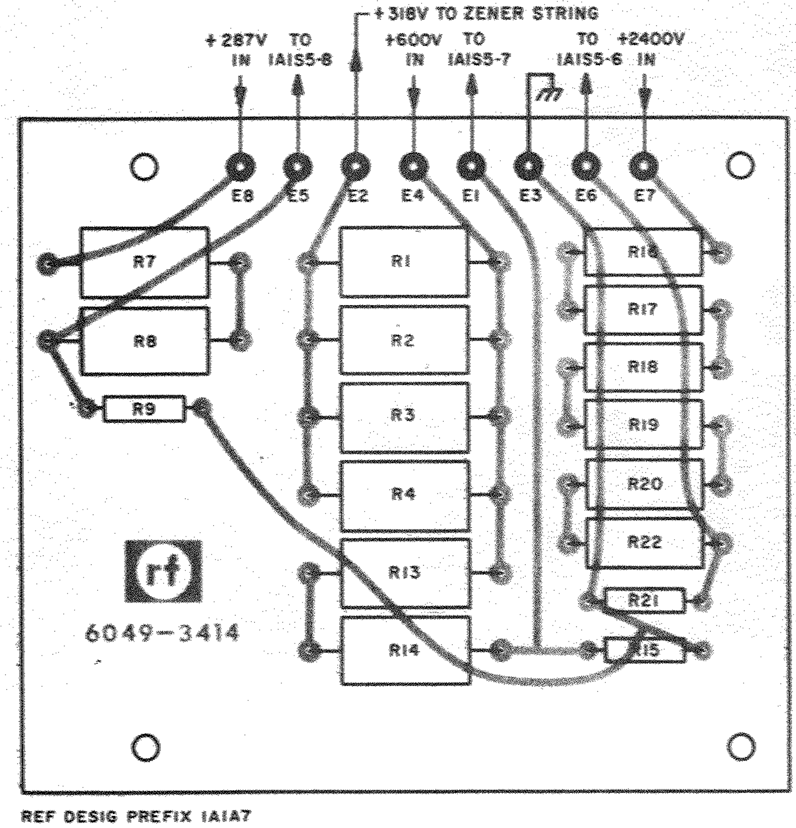
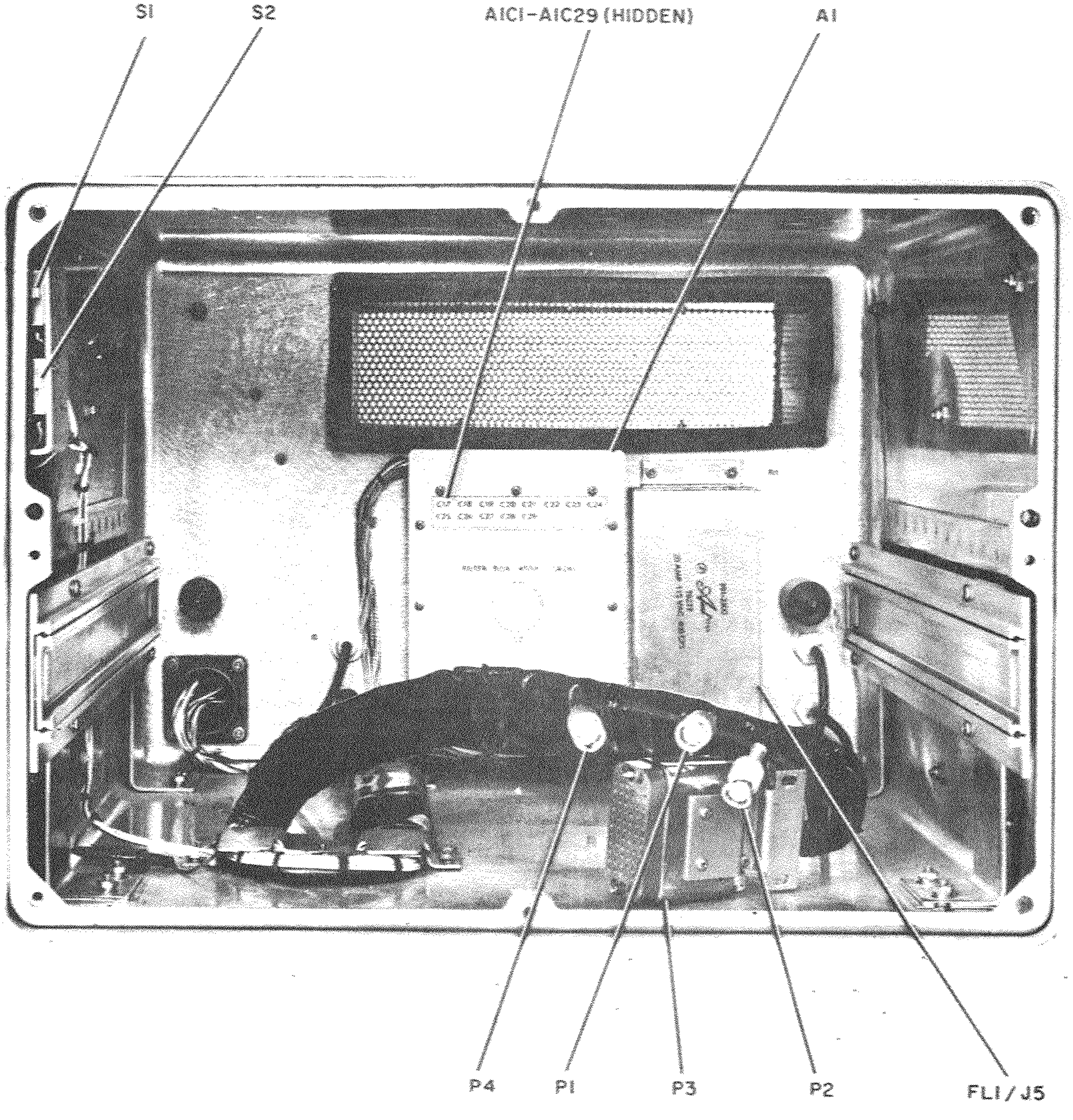
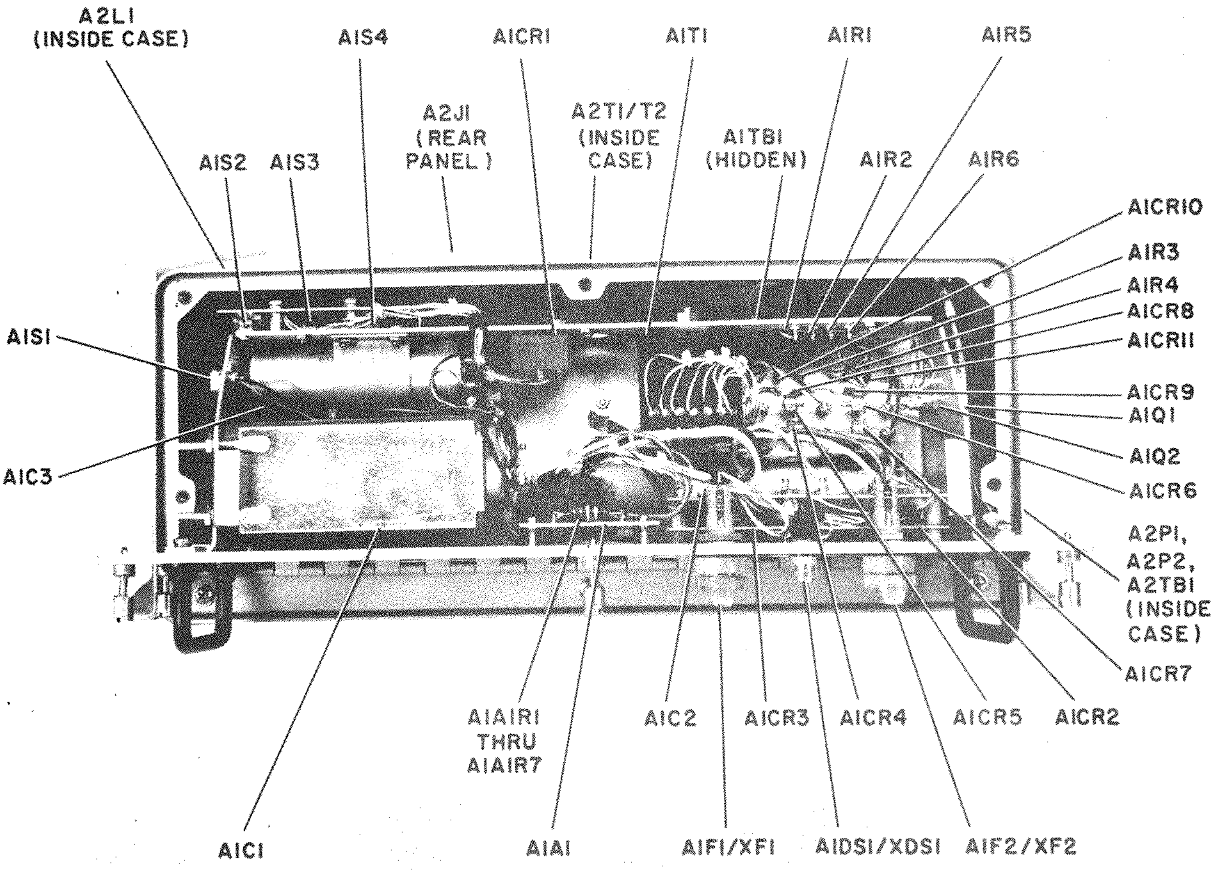


Figure 5-18. 1 KW PA, Meter Resistor Assembly 1A1A7, Component Locations from Foil Side



REF DESIG PREFIX 1A2

Figure 5-19. 1 KW PA, Case 1A2, Component Locations



REF DESIG PREFIX 2

Figure 5-20. 1 KW Power Supply, 2, Component Locations

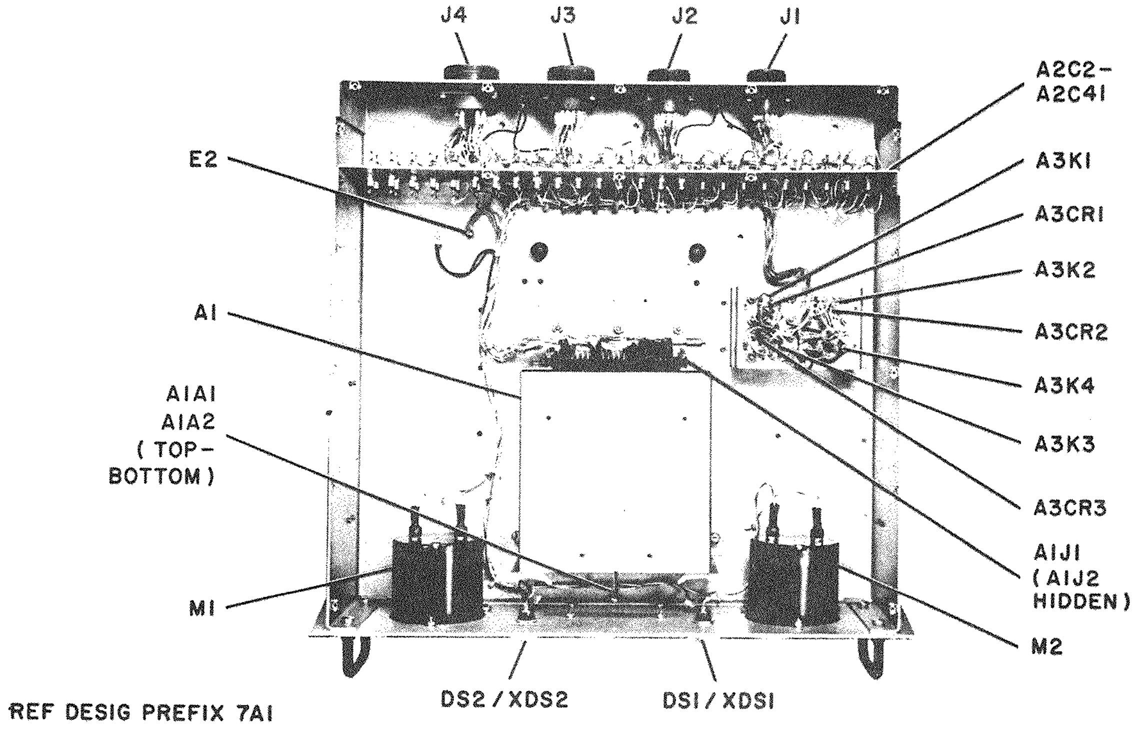
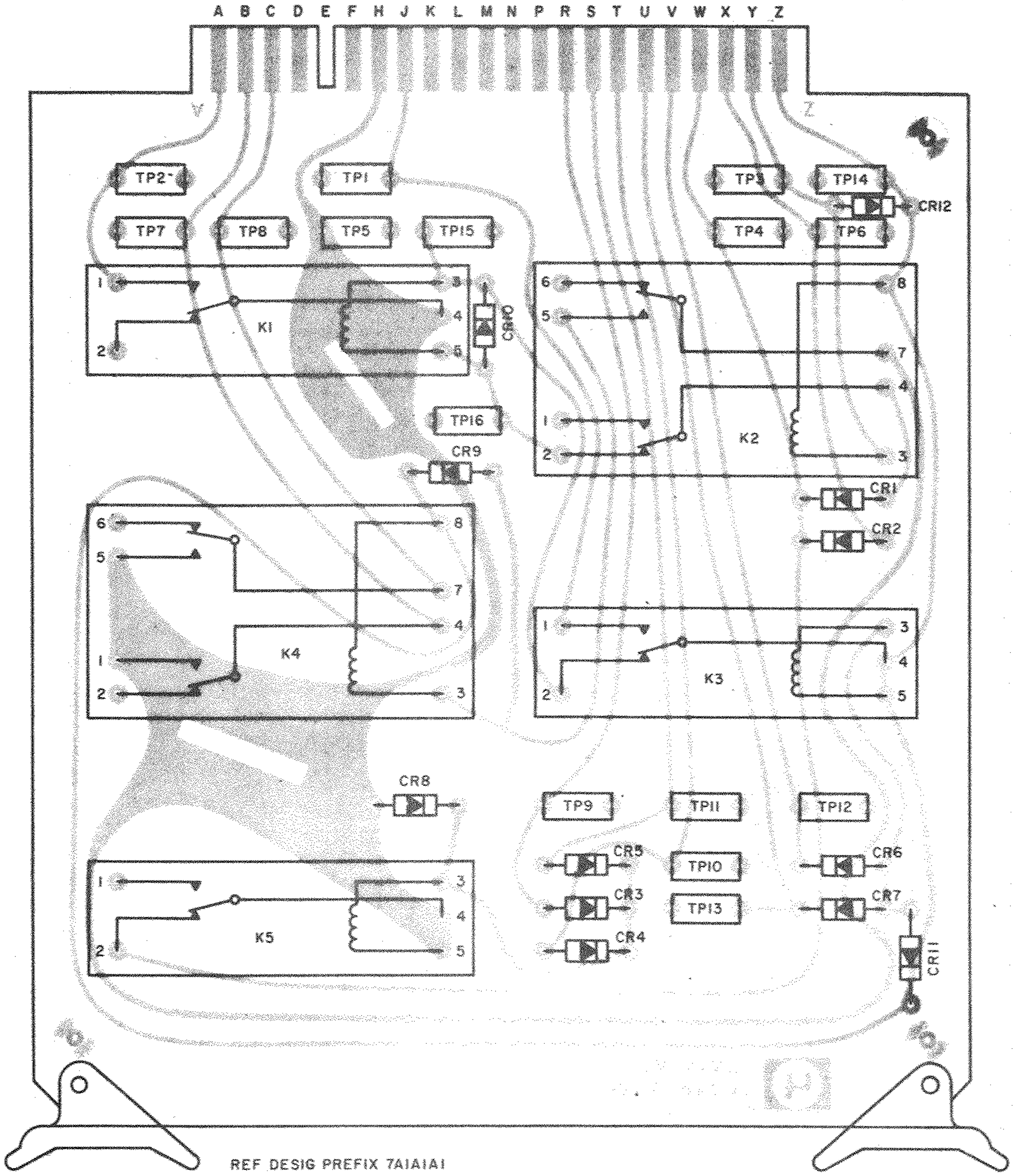


Figure 5-21. I. Box, Top View 7A1, Component Locations



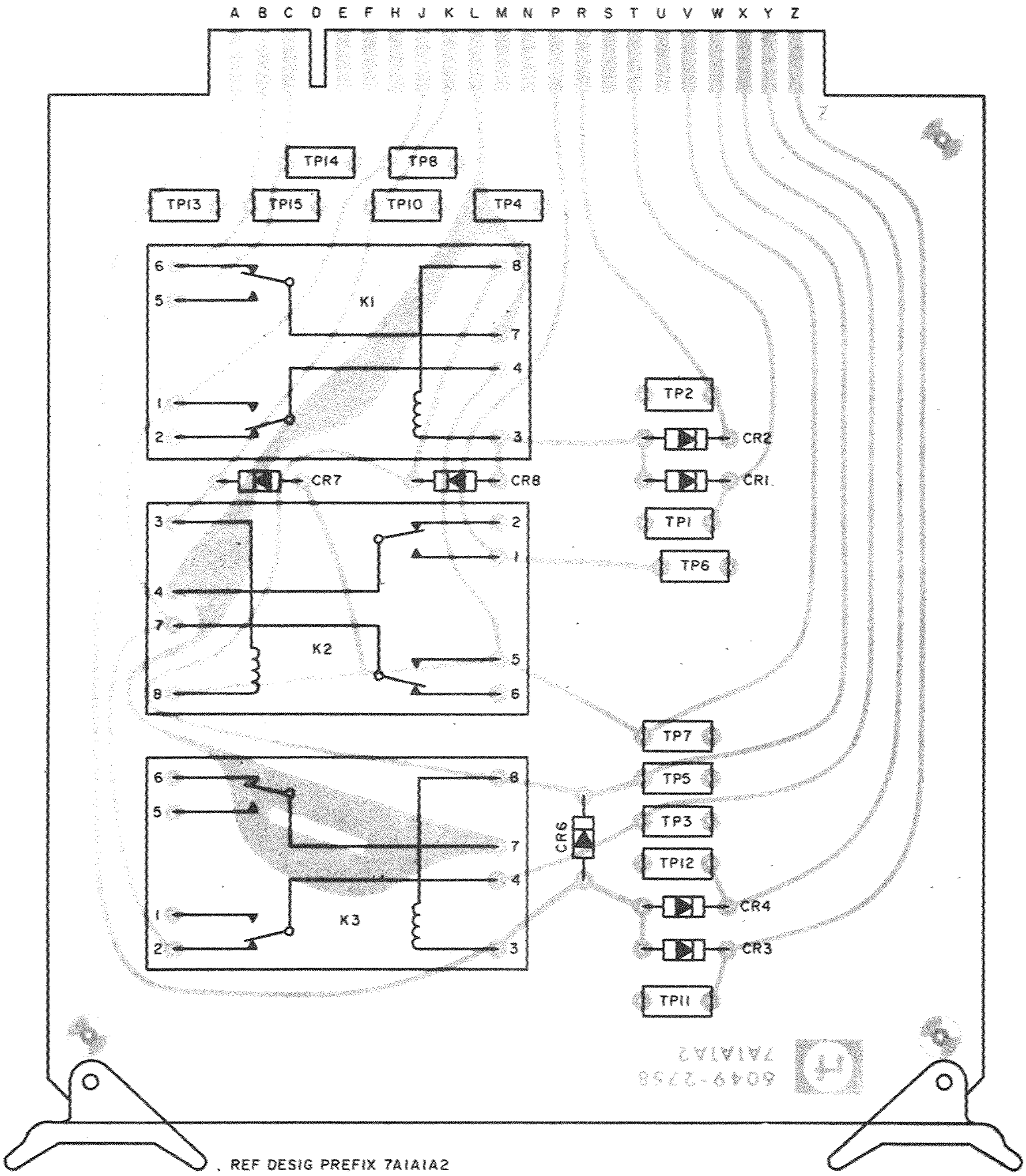
PIN FUNCTIONS

A - Ready to Exciter
B - 10 KW PA Inhibit
C - Aux. Inhibit
D - (not used)
E - (keyway)
F - (not used)
H - Ground
J - Tune Pwr. Req. Out.

K - (not used)
L - (not used)
M - (not used)
N - (not used)
P - (not used)
R - Aux. Fault
S - 10 KW PA Fault

T - 1 KW PA Fault
U - 10 KW PA Tune Pwr Req.
V - Aux. Tune Pwr Req.
W - Fault to Exciter
X - No Fault
Y - Inhibit from Exciter
Z - +28 VDC

Figure 5-22. I. Box, Fault Logic PCB Assembly, 7A1A1A1, Component Locations from Foil Side.



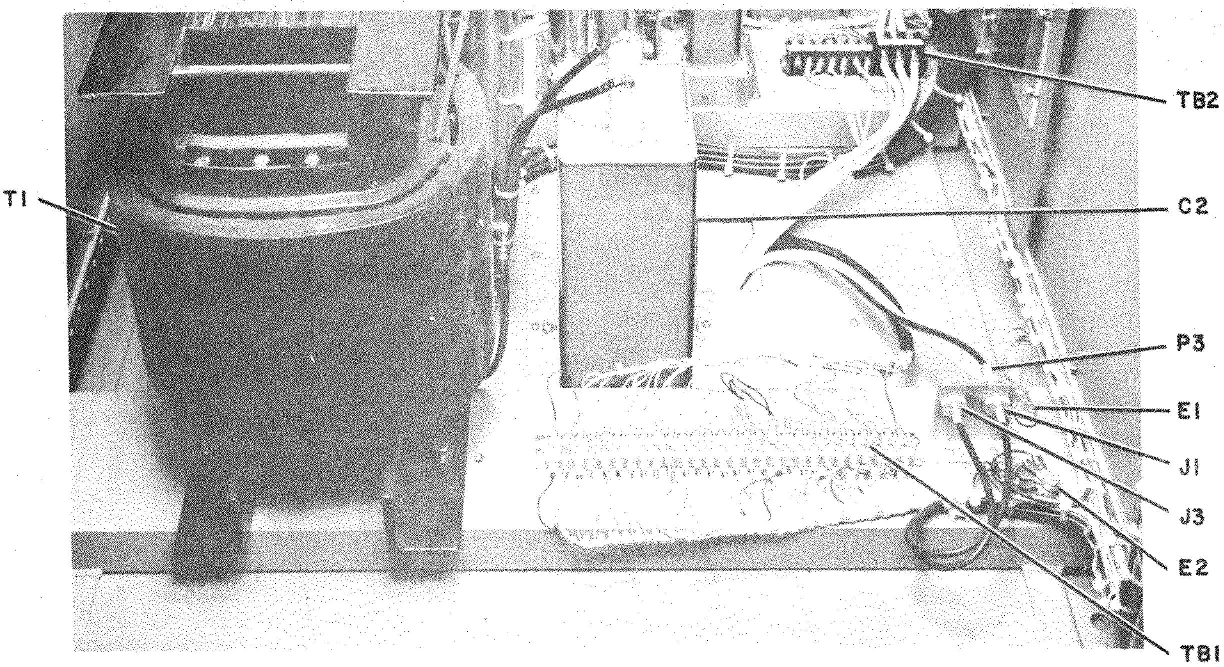
. REF DESIG PREFIX 7A1A1A2

PIN FUNCTIONS

A - RF Mute
B - Local Override to Exciter
C - MANUAL Indicator
D - (keyway)
J - Tune Command 2 to Exciter
K - Tune Power Request Input
L - Ground
P - Tune Enable to Exciter

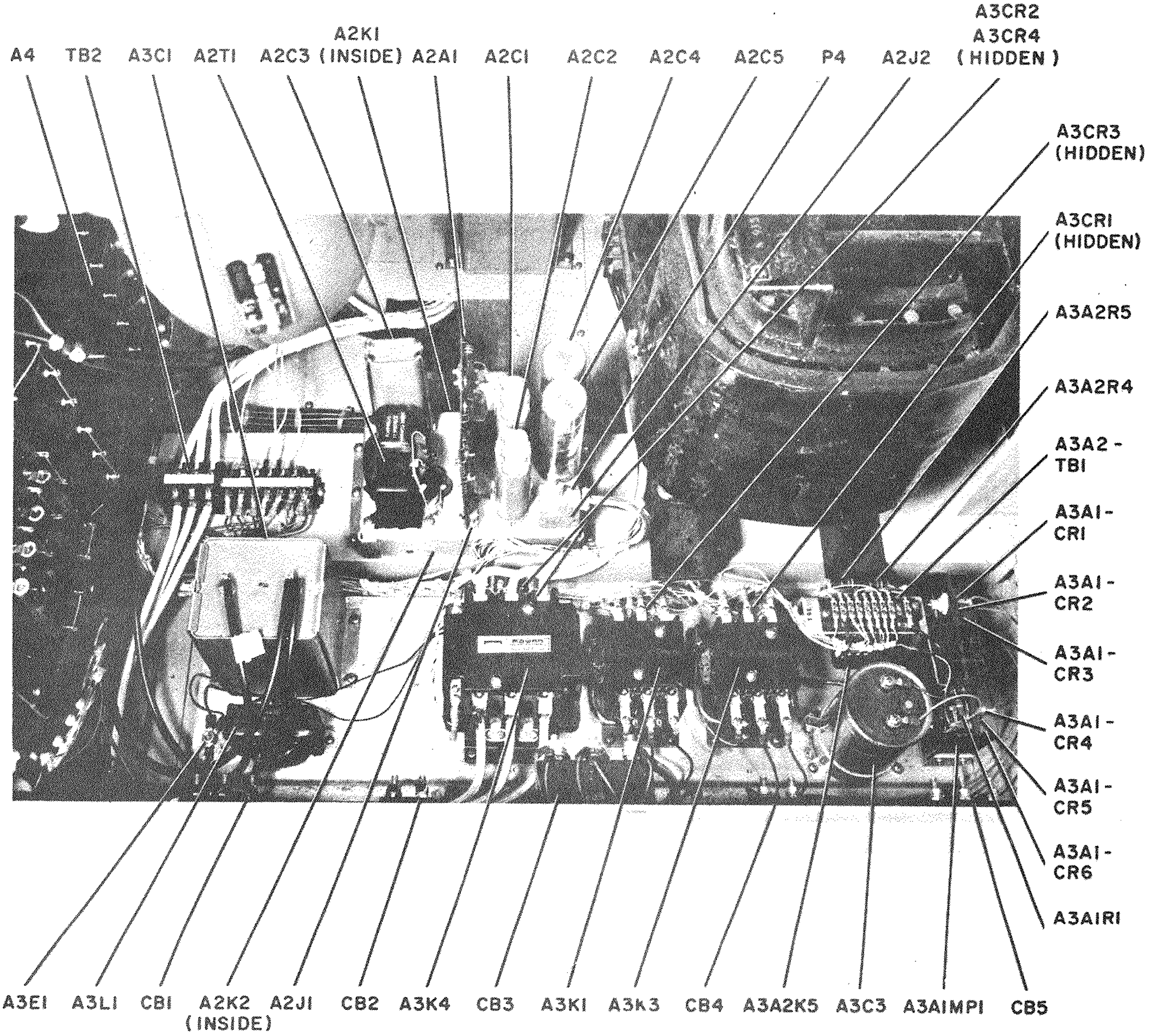
R - 10 KW PA Manual Ground
T - 1 KW PA Manual Ground
V - Tune Command 1 from Exciter
W - +28 VDC
X - No Fault Input
Y - RF Mute
Z - Aux Keyline Interlock
E, F, H, M, N, S, U, not used

Figure 5-23. I. Box, Tune Logic PCB Assembly, 7A1A1A2, Component Location from Foil Side.



REF DESIG PREFIX 9

Figure 5-24. 10 KW PA Cabinet, Lower Rear View 9, Component Locations

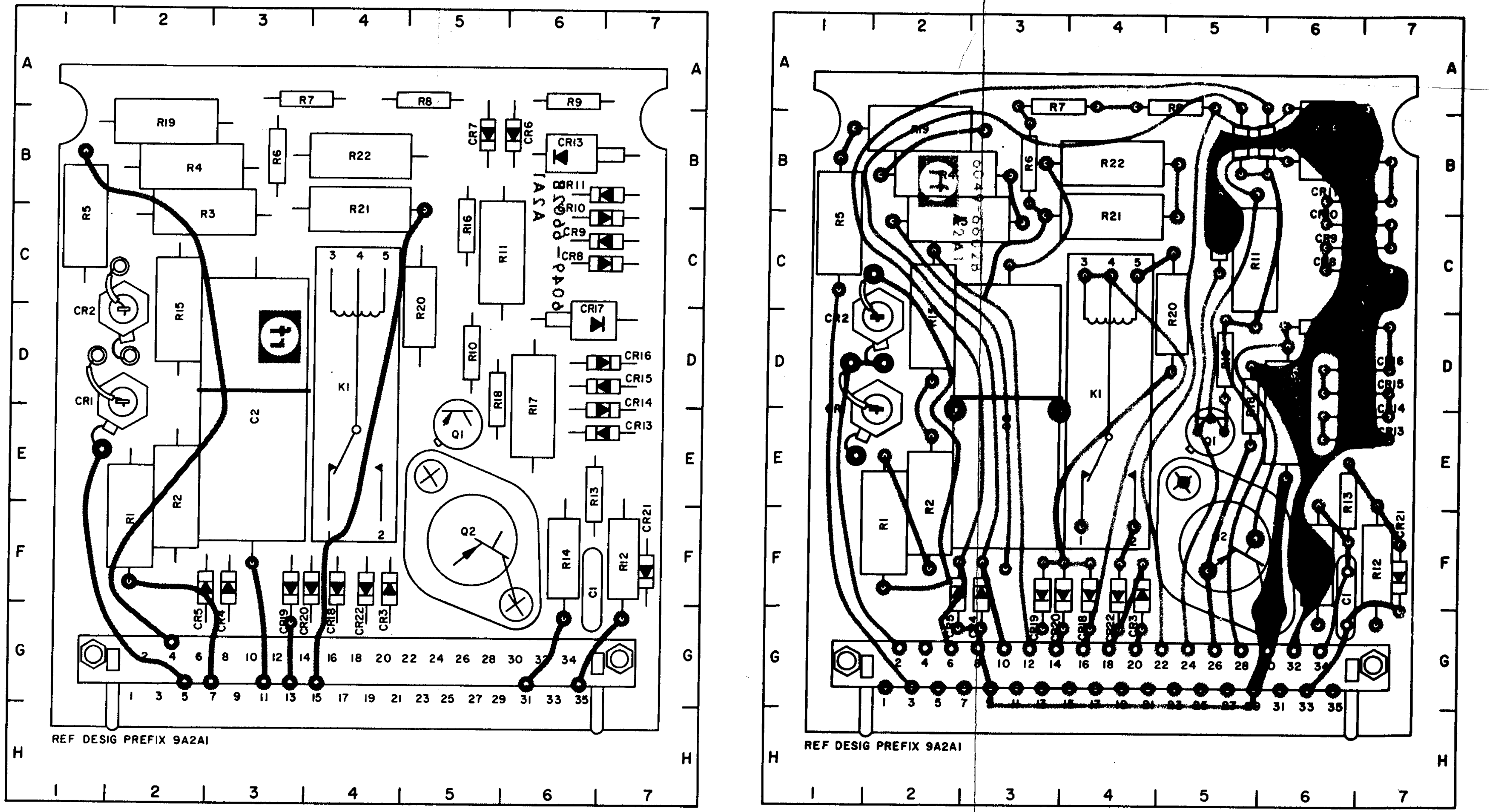


REF DESIG PREFIX 9

Figure 5-25. 10 KW PA Cabinet 9, Lower Front View Component Locations

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC
C1	6F	P1	4G
C2	3E	Q1	5E
CR1	1D	Q2	5F
CR2	1D	R1	2F
CR3	4F	R2	2E
CR4	3F	R3	2C
CR5	2F	R4	2B
CR6	5B	R5	1C
CR7	5B	R6	3B
CR8	6C	R7	3A
CR9	6C	R8	5A
CR10	6C	R9	6A
CR11	6B	R10	5D
CR12	6B	R11	5C
CR13	6E	R12	7F
CR14	6D	R13	6E
CR15	6D	R14	6F
CR16	6D	R15	2D
CR17	6D	R16	5C
CR18	4F	R17	6D
CR19	3F	R18	5D
CR20	4F	R19	2B
CR21	7F	R20	5D
CR22	4F	R21	4C
K1	4D	R22	4B



COMPONENT SIDE TRACK

OPPOSITE (FOIL) SIDE TRACK

Figure 5-26. 10 KW PA, Bias and Servo Power Supply PCB Assembly 9A2A1, Component Locations from Foil Side

PIN FUNCTIONS

1	(not used)
2	600 VAC input
3	Bias Adjust
4	To 9A2K1-A
5	Ground
6	15 VAC input
7	To 9A2C2
8	To 9A2C5
9	To 9A2C5
10	15 VAC Input
11	To 9A2K2-B
12	Bias Output
13	No Key
14	RF Mute
15	To 9A2K1-B
16	+28 VDC via Reset
17	(not used)
18	To 9A2K1 (+)
19	(not used)
20	Keyline
21	(not used)
22	Bias Monitor
23	(not used)
24	+15 VDC Output
25	(not used)
26	-15 VDC Output
27	(not used)
28	+21 VDC Output
29	To 9A2C5
30	To 9A2C5
31	220 VAC
32	Ground
33	Fil. V. Monitor (+)
34	Fil. V. Monitor (-)
35	220 VAC

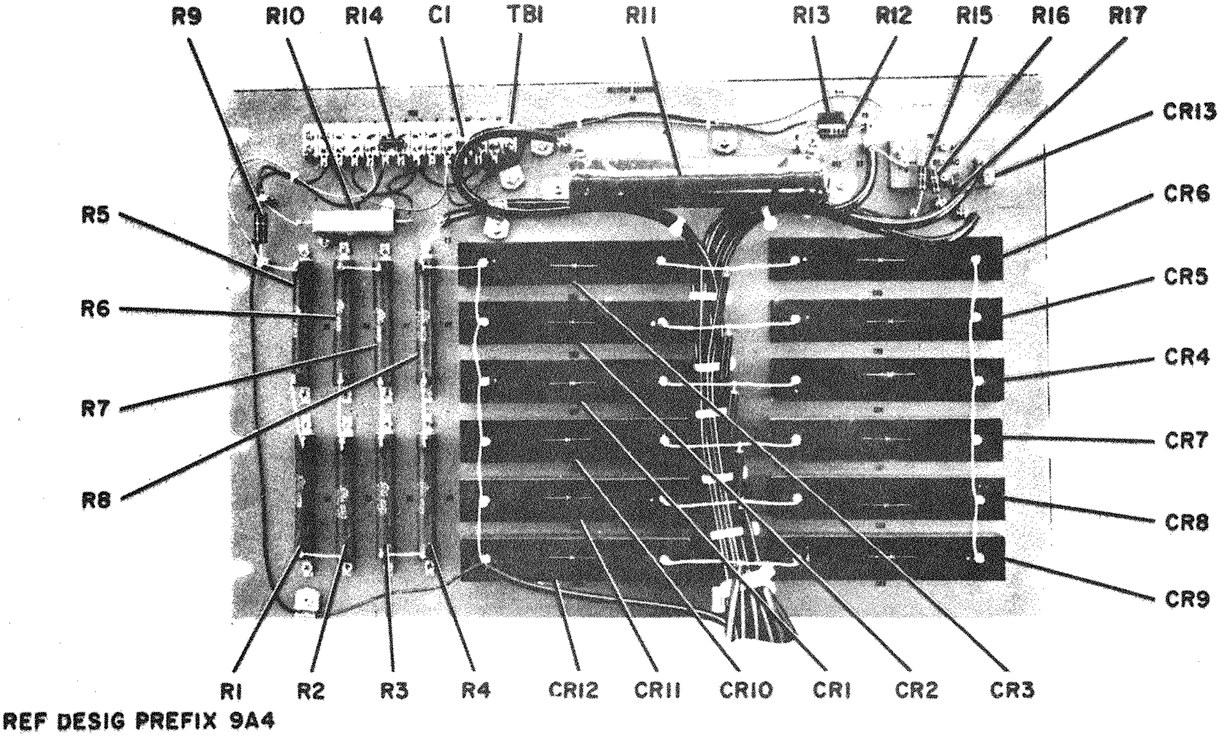


Figure 5-27. 10 KW PA, Rectifier Assembly 9A4, Component Locations

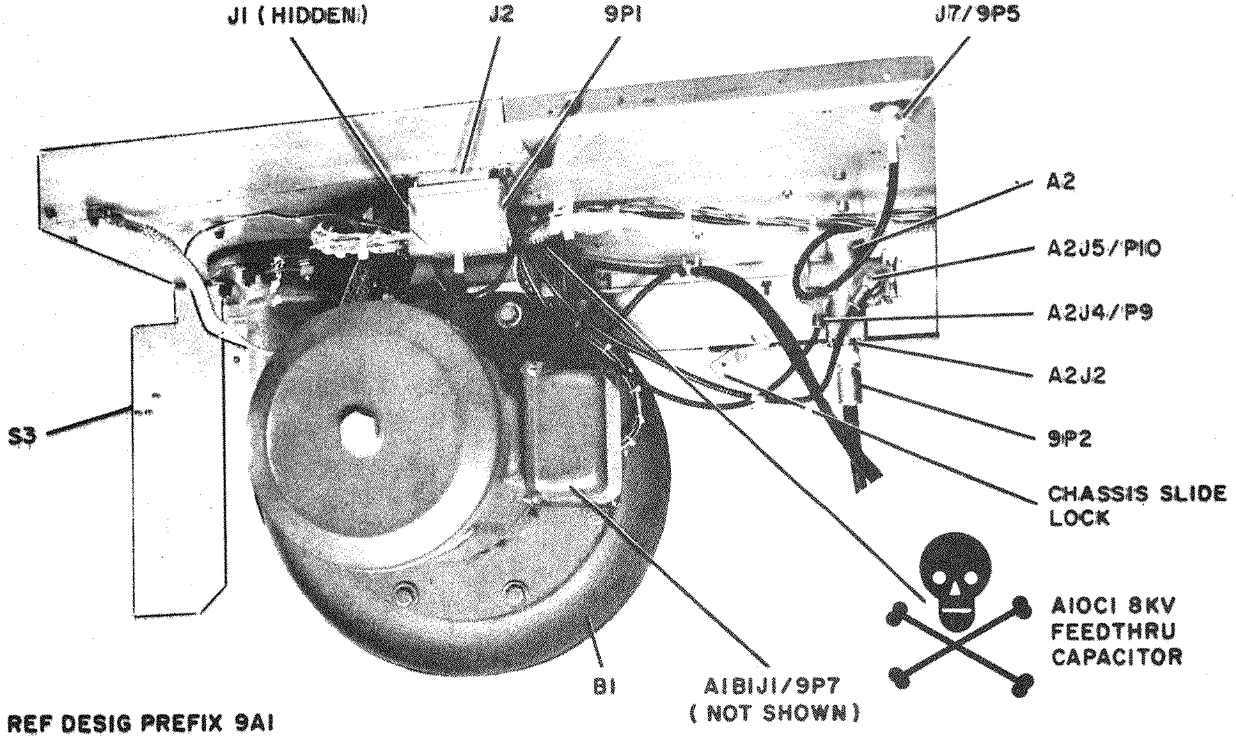
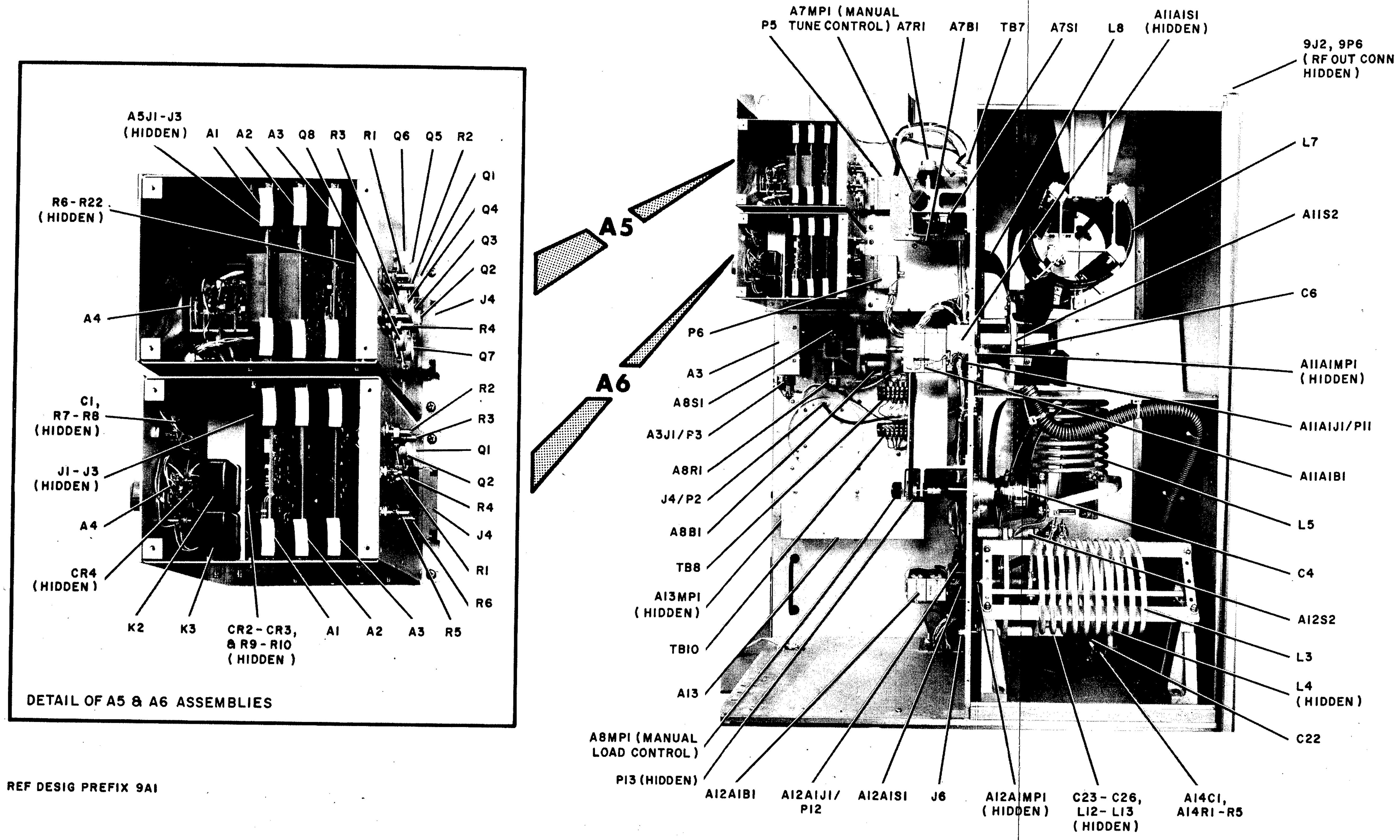


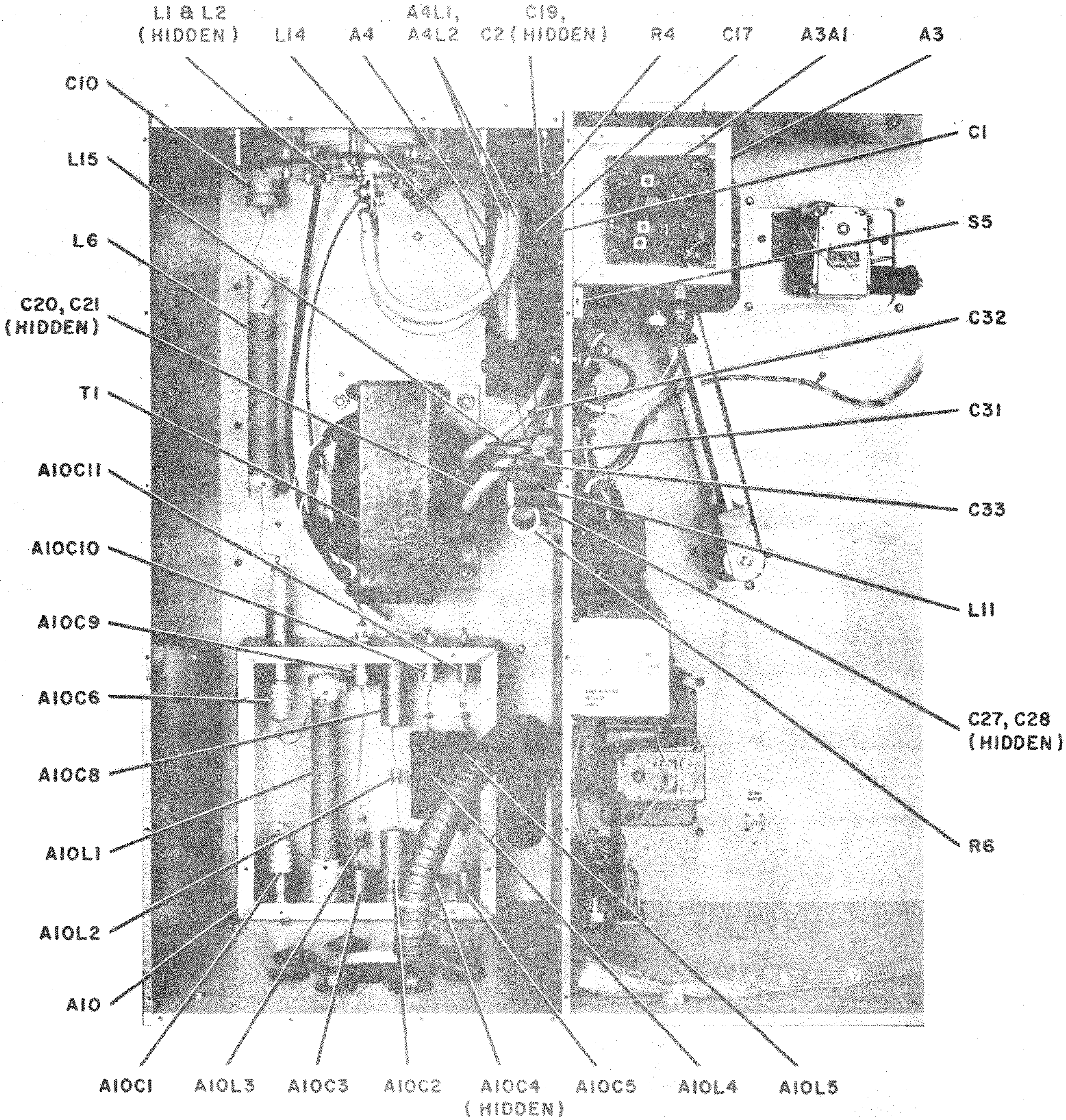
Figure 5-28. 10 KW PA, Chassis Assembly 9A1, Bottom Right Side View, Component Locations

BLANK



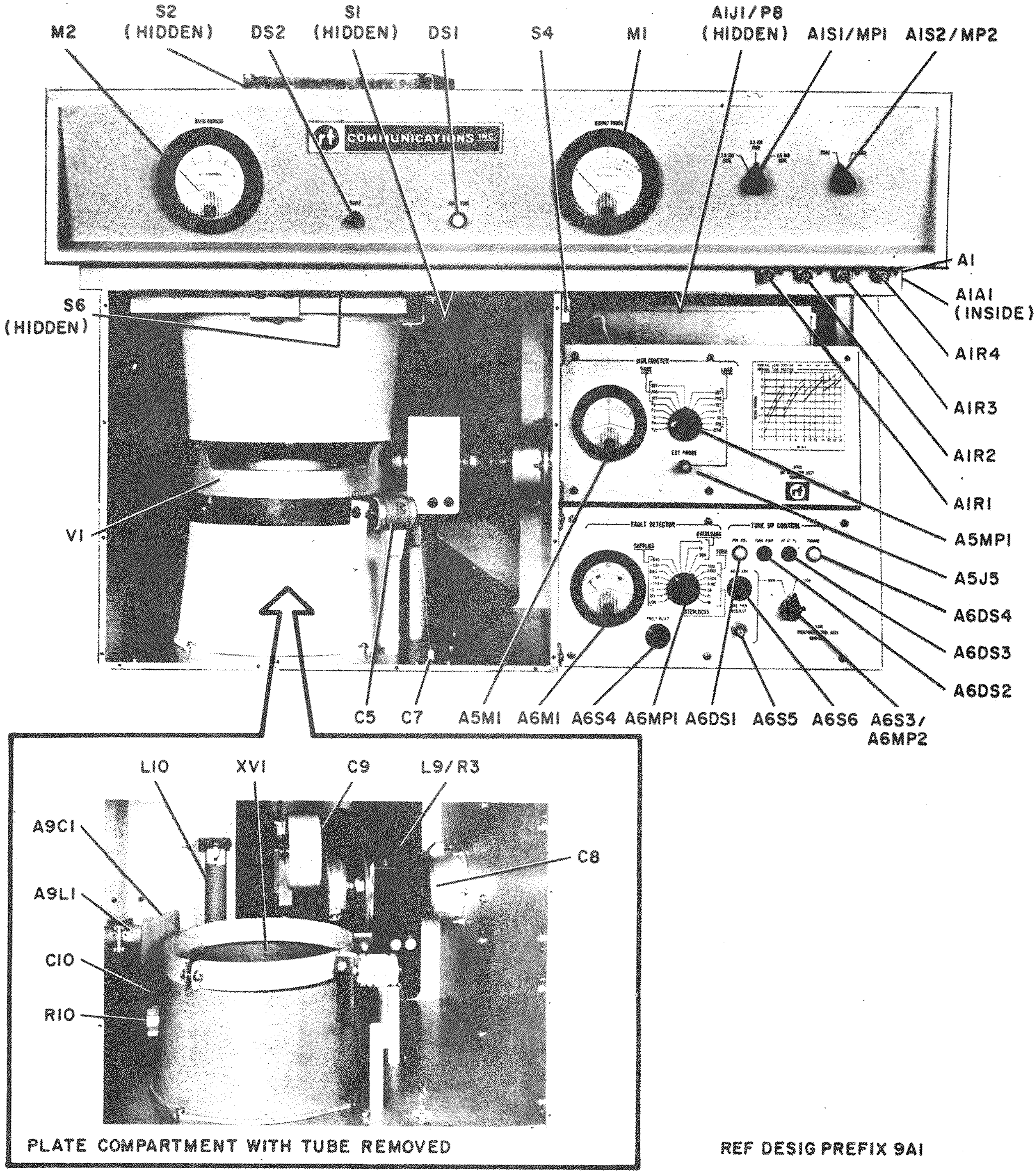
REF DESIG PREFIX 9A1

Figure 5-29. 10 KW PA, Chassis Assembly 9A1, Right Side View, Component Locations



REF DESIG PREFIX 9A1

Figure 5-30. 10 KW PA, Chassis Assembly 9A1, Front Center View, Component Locations



REF DESIG PREFIX 9A1

Figure 5-31. 10 KW PA, Chassis Assembly 9A1, Front Top View, Component Locations

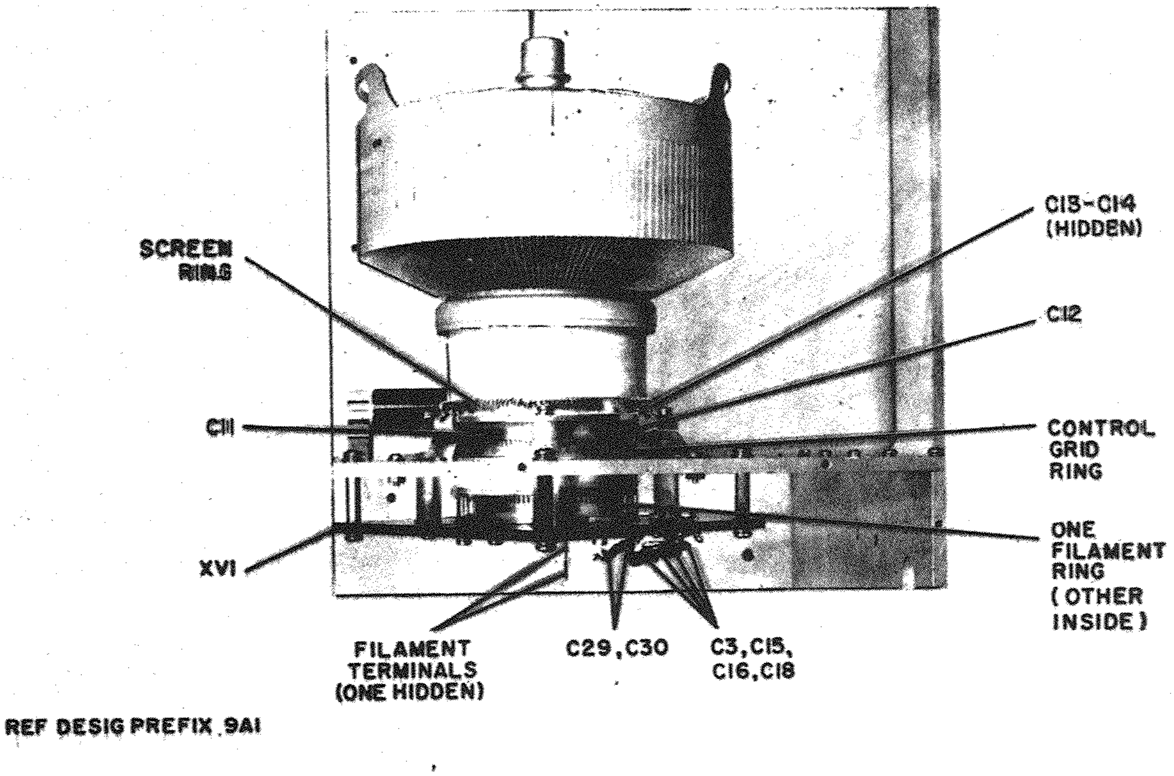


Figure 5-32. 10 KW PA, Tube Socket Detail 9A1, Component and Terminal Locations

BLANK

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	2G	CR6	4D	Q7	6E	R23	8E
C2	3G	CR7	5G	R1	1F	R24	8D
C3	4G	CR8	5G	R2	2G	R25	9D
C4	4G	CR9	5F	R3	2G	R26	9D
C5	6G	CR10	8D	R4	3G	R27	9C
C6	6G	CR11	8C	R5	4B	R28	9C
C7	6G	CR12	7E	R6	4D	R29	6F
C8	6F	CR13	7D	R7	4E	R30	8C
C9	4G	CR14	8G	R8	2C	R31	8G
C10	8C	CR15	8F	R9	2C	R32	8F
C11	7C	CR16	8E	R10	2D	R33	9F
C12	6D	CR17	7C	R11	2D	R34	9G
C13	8C	CR18	7D	R12	2E	R35	9F
C14	5C	CR19	6D	R13	2E	R36	9F
C15	2B	CR20	4G	R14	3E	R37	9E
C16	3C	IC1	2F	R15	4D	R38	9E
C17	9B	IC2	5G	R16	4E	R39	6C
C18	2B	Q1	4C	R17	4G	R40	5E
CR1	2F	Q2	4C	R18	4D	R41	6D
CR1	2F	Q3	7F	R19	5G	R42	7E
CR3	3C	Q4	5C	R20	6G	R43	6C
CR4	3D	Q5	5E	R21	3E	R44	3C
CR5	3D	Q6	6C	R22	5F	R45	7G

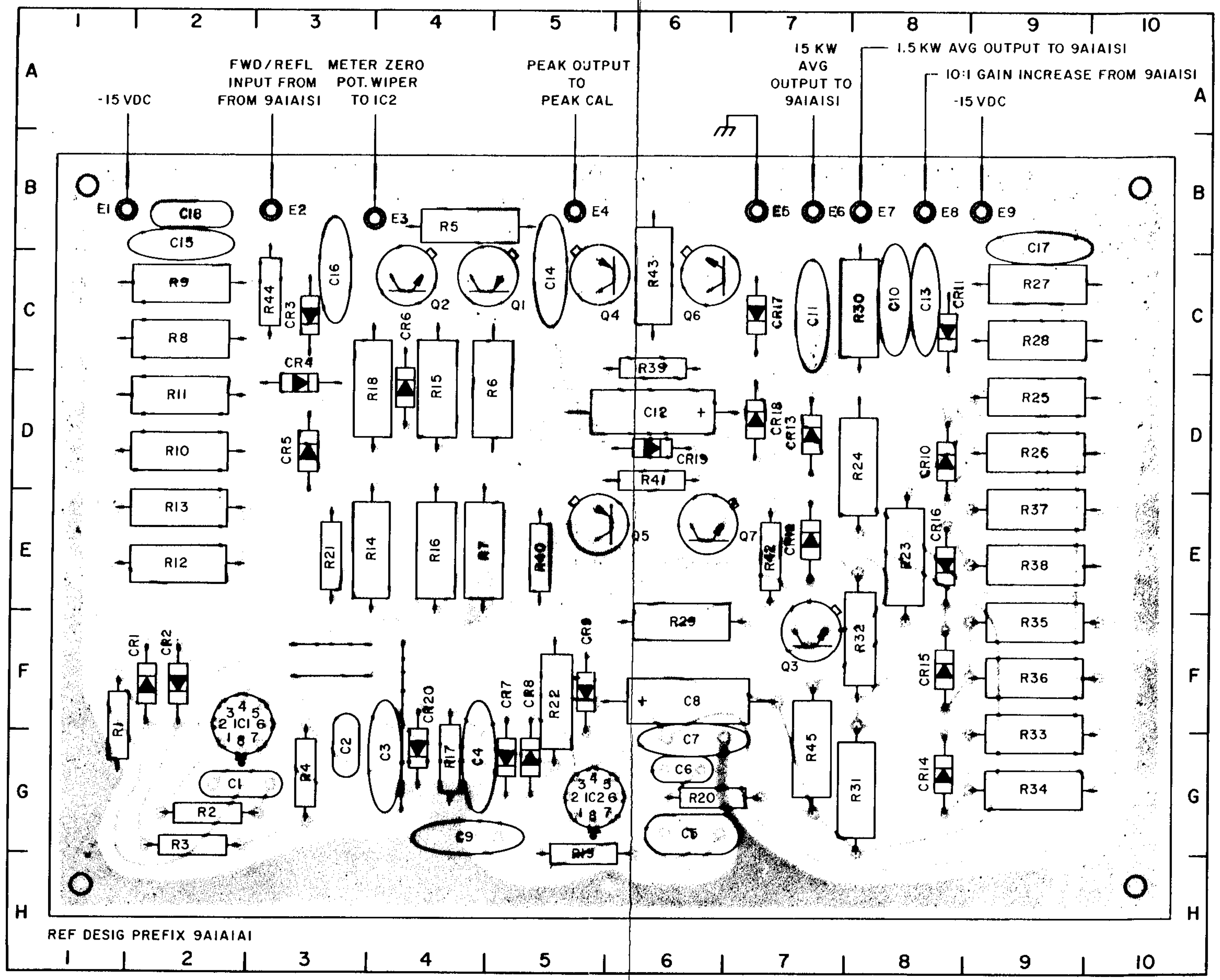
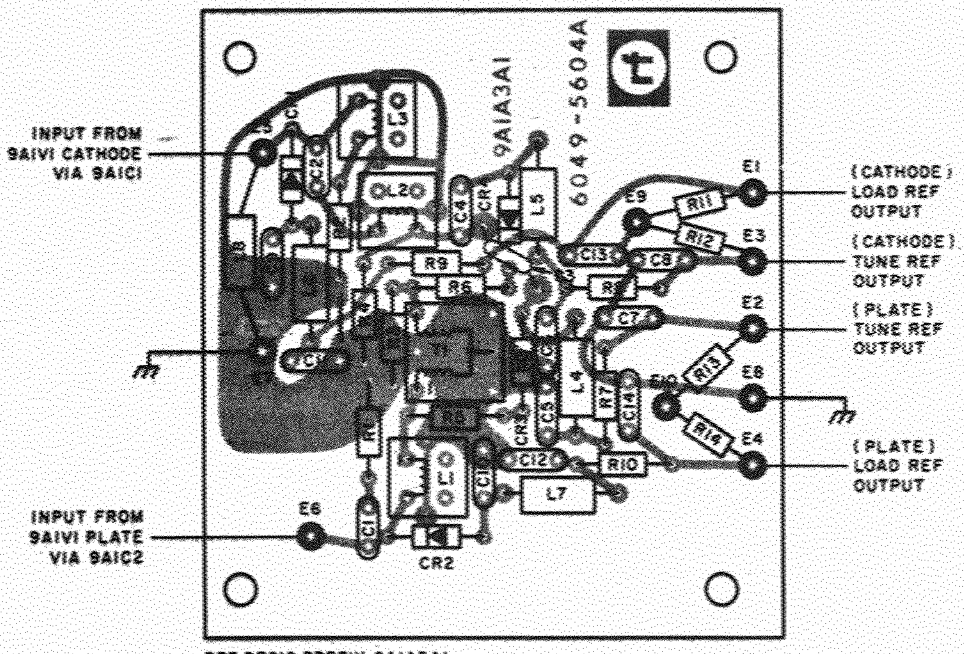


Figure 5-33. 10 KW PA, Peak/Average Detector PCB Assembly, 9A1A1A1, Component Locations from Foil Side

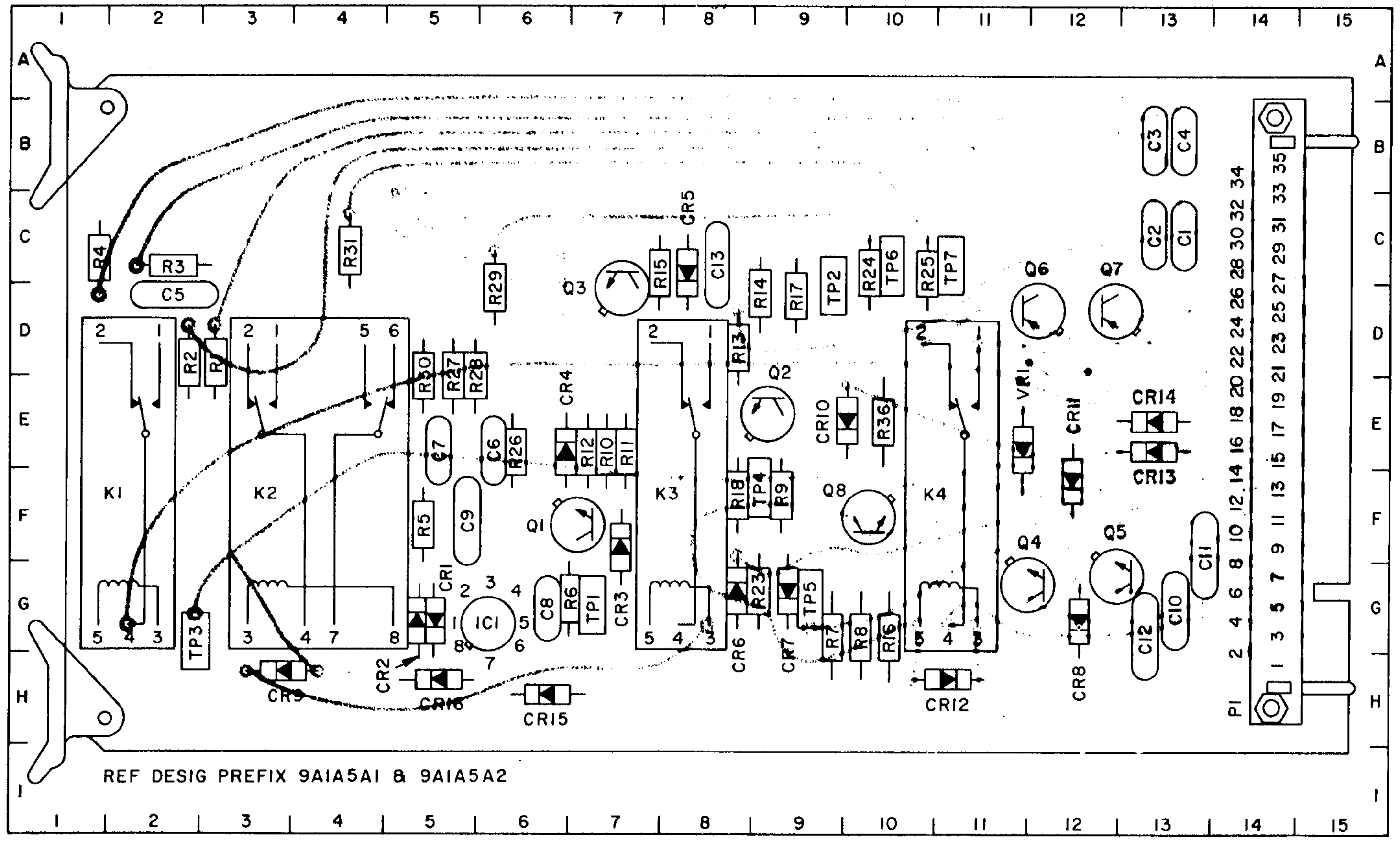
ORIGINAL



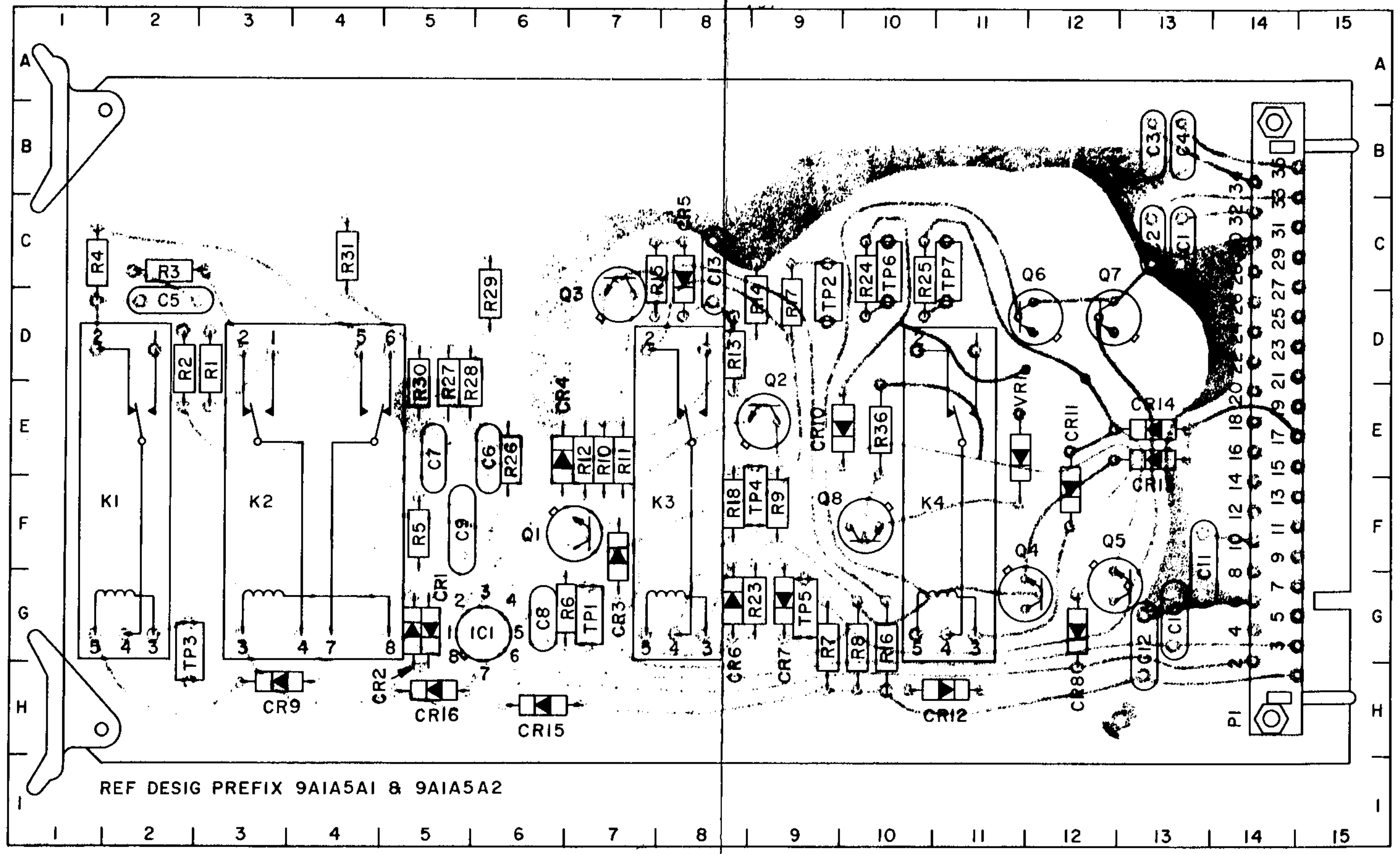
REF DESIG PREFIX 9AIA3AI

Figure 5-34. 10 KW PA, Detector PCB Assembly 9A1A3A1, Component Locations

BLANK



COMPONENT SIDE TRACK



OPPOSITE (FOIL) SIDE TRACK

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	13C	CR4	6E	K3	8F	R6	7G	R26	6E
C2	13C	CR5	8C	K4	11F	R7	9G	R27	5E
C3	13B	CR6	8G	P1	14H	R8	10G	R28	5E
C4	13B	CR7	9G	Q1	7F	R9	9F	R29	6D
C5	2D	CR8	12G	Q2	9E	R10	7E	R30	5E
C6	6E	CR9	3H	Q3	7C	R11	7E	R31	4C
C7	5E	CR10	10E	Q4	12G	R12	7E	R36	10E
C8	6G	CR11	12F	Q5	13G	R13	8D	TP1	7G
C9	5F	CR12	11H	Q6	12D	R14	9D	TP2	9D
C10	13G	CR13	13E	Q7	12D	R15	7C	TP3	2G
C11	13F	CR14	13E	Q8	10F	R16	10G	TP4	9F
C12	13G	CR15	6H	R1	3D	R17	9D	TP5	9G
C13	8C	CR16	5H	R2	2D	R18	8F	TP6	10C
CR1	5G	IC1	6G	R3	2C	R23	9G	TP7	11C
CR2	5G	K1	2F	R4	1C	R24	10C	VR1	11E
CR3	7F	K2	3F	R5	5F	R25	10C		

PIN FUNCTIONS

1	+28 VDC
2	Preposition Ground
3	+15 VDC
4	(not used)
5	Threshold Relay Wiper
6	Ground
7	To 9A1A5Q3-B or Q7-B
8	To 9A1A5Q4-B or Q8-B
9	(not used)
10	+21 VDC
11	(not used)
12	Servo Enable
13	(not connected)
14	(not connected)
15	To Threshold Pot.
16	High Gain Input
17	To Threshold Pot.
18	To Surveillance Gain Pot.
19	(not used)
20	To 9A1A5Q3-C or Q7-C
21	To 9A1A5Q4-C or Q8-C
22	Servo Run
23	To 9A1A5Q2-B or Q6-B
24	(not used)
25	(not used)
26	To 9A1A5Q1-B or Q5-B
27	(not used)
28	Threshold Relay N.C.
29	(not used)
30	Shield Ground
31	-15 VDC
32	Preposition Voltage
33	Position Pot. Wiper
34	Cathode Sig. from Detector
35	Plate Sig. from Detector

Figure 5-35. 10 KW PA, Tune and Load Servo Amplifier PCB Assemblies, Component Locations from Foil Side

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	11G	C24	10F	Q2	5E	R17	5F
C2	12C	C25	9F	Q3	6E	R18	7C
C3	2F	C26	10C	Q4	7E	R19	7D
C4	3F	C27	10E	Q5	7E	R21	7F
C5	11F	CR1	2E	Q6	9D	R22	8F
C6	10D	CR2	2E	R1	2F	R23	7D
C7	10C	CR3	5E	R2	2D	R24	9C
C8	4F	CR4	5C	R3	2F	R25	8F
C9	4F	CR7	11E	R4	2F	R26	8C
C10	5D	CR8	4E	R5	2D	R27	9D
C11	6D	CR9	4E	R6	3D	R29	9E
C12	11C	CR10	6D	R7	3D	R30	9E
C13	6F	CR11	6D	R8	4F	R31	10F
C14	6F	CR12	8D	R9	3E	R32	10F
C15	11F	CR13	8D	R10	3F	R33	9F
C17	12D	IC1	3E	R11	5F	R34	10C
C18	11D	IC2	4E	R12	5F	R35	11E
C19	8F	IC3	6E	R13	4D	R36	7E
C20	9F	IC4	8E	R14	5C	R37	7F
C21	9F	P1	12G	R15	5C	R38	7F
C22	12E	Q1	5D	R16	7C	R39	11D

PIN FUNCTIONS

1	(not used)
2	Multimeter Ampl (-) Input
3	(not used)
4	Ground
5	(not used)
6	Fwd Power Monitor Output
7	Reflected Power Meter Output
8	VSWR Limit Monitor Output
9	(not used)
10	+6 VDC
11	(not used)
12	(not used
13	(not used)
14	+15 VDC
15	(not used)
16	Reflected Power Monitor Output
17	-15 VDC
18	(not used)
19	Ground
20	Reflected Power Monitor Input
21	(not used)
22	Forward Power Meter Output
23	(not used)
24	-6 VDC
25	Forward Power Monitor Input
26	(not used)
27	Plate RF Status Output
28	Tune Servo Enable
29	Ground
30	(not used)
31	-15 VDC
32	Load Ref. Plate from Detector
33	Multimeter Ampl (+) Input
34	Meter (-)
35	Meter (+)

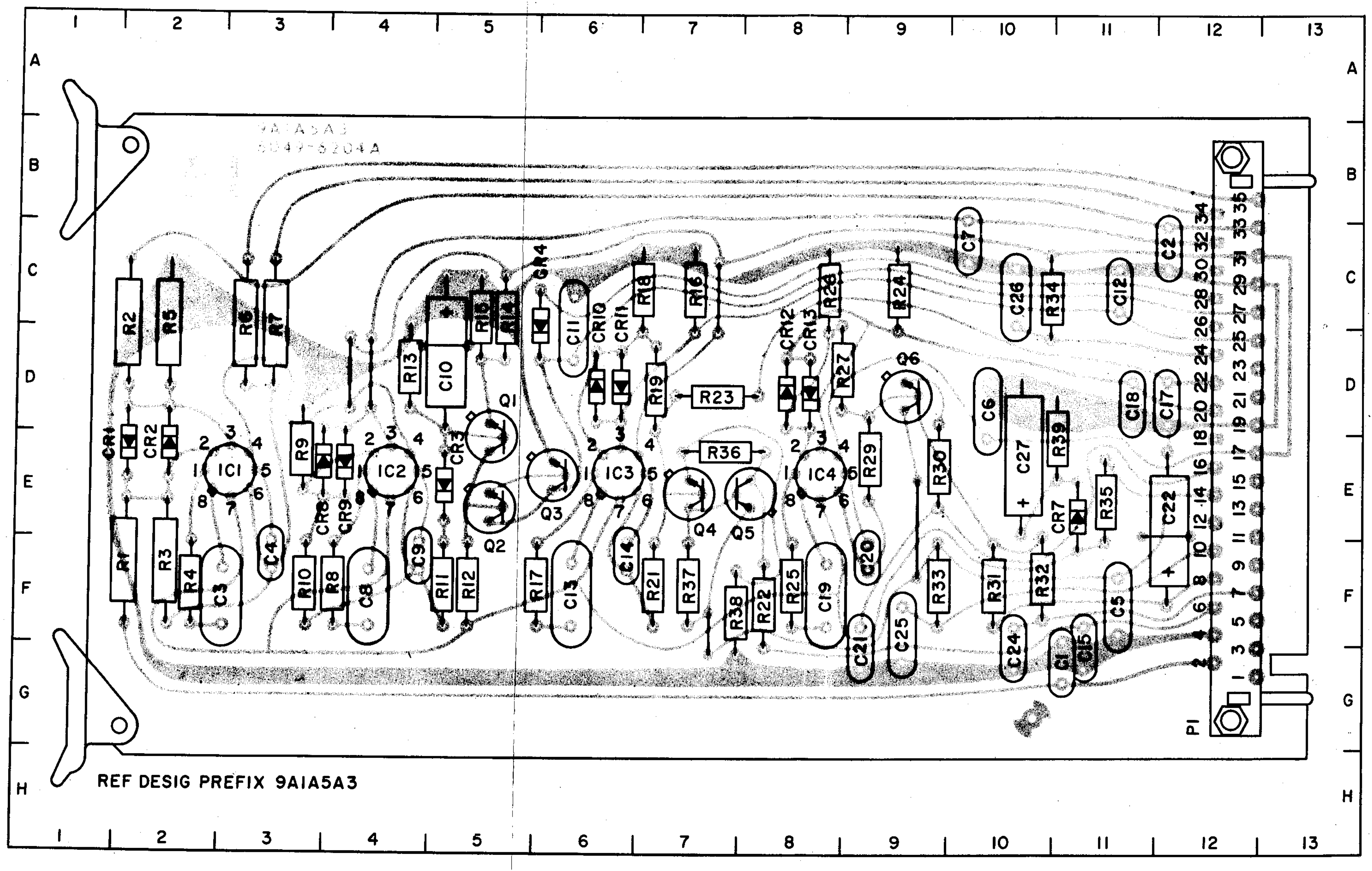


Figure 5-36 10 KW PA, Meter Amplifier PCB Assembly 9A1A5A3, Component Locations from Foil Side

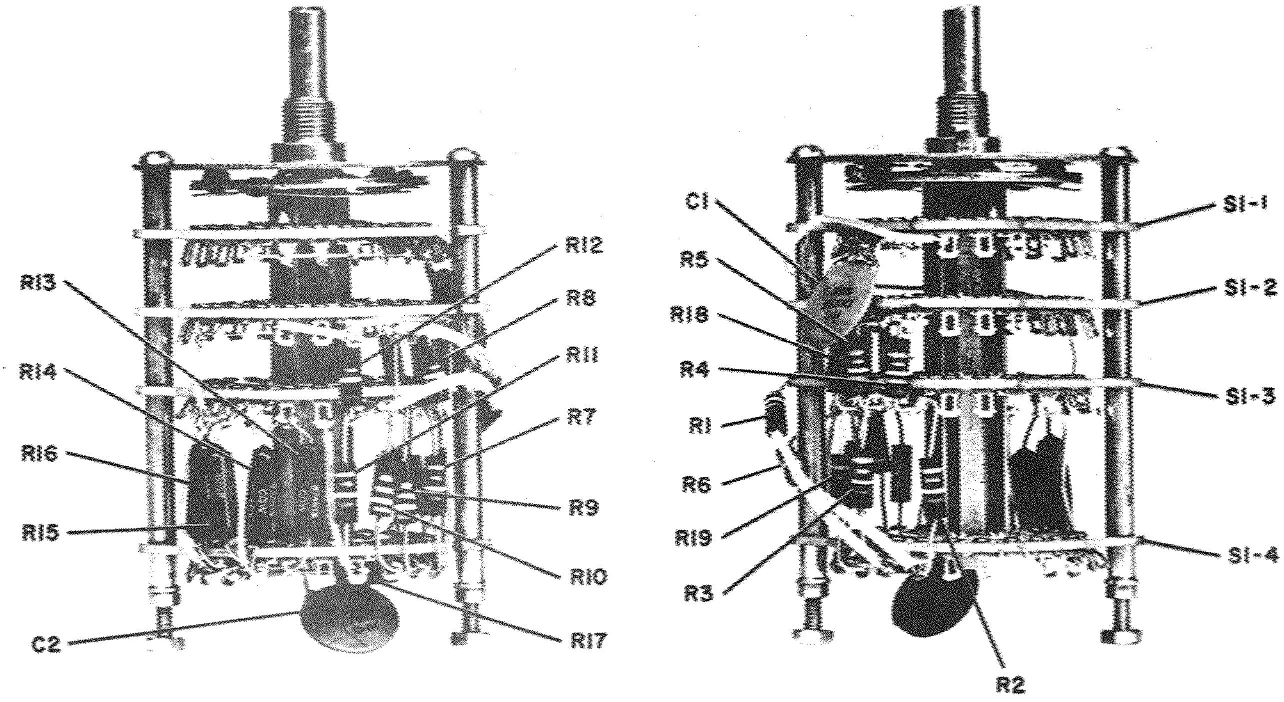


Figure 5-37. 10 KW PA, Multimeter Switch Assembly 9A1A5A4, Component Locations

BLANK

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	9C	CR12	6F	R3	2E	R25	7E
C2	3C	CR13	7D	R4	2C	R26	7D
C3	10C	CR14	6E	R5	3F	R27	9F
C4	4E	CR15	10E	R6	2F	R28	10E
C5	8E	CR16	10E	R7	3E	R29	8E
C6	10D	CR17	8C	R8	3D	R30	8C
C7	11D	CR18	10F	R9	3C	R31	9E
C8	10C	CR19	10E	R10	3E	R32	8D
C9	10C	CR20	9F	R11	3G	R33	8C
C10	10C	P1	12G	R12	4G	R34	9E
C11	6C	Q1	3D	R13	4E	R35	9D
CR1	2E	Q2	4D	R14	5G	R36	9C
CR2	2C	Q3	5D	R15	5E	R37	10E
CR3	8C	Q4	5D	R16	4C	R38	9E
CR4	3D	Q5	6D	R17	5C	R39	9C
CR5	4E	Q6	6E	R18	5C	R40	12E
CR6	4F	Q7	7E	R19	7D	TP1	3E
CR7	4C	Q8	8D	R20	5E	TP2	2C
CR8	4C	Q9	9D	R21	5E	TP3	6F
CR9	6C	Q10	9D	R22	5G		
CR10	4C	R1	2F	R23	7E		
CR11	6F	R2	2F	R24	7F		

PIN FUNCTIONS

1	To PREPOS Indicator
2	To 9A1A6Q1-B
3	(not connected)
4	Preposition Ground
5	(not used)
6	To 9A1A6Q1-C
7	+28 VDC in Manual
8	To RF AT PL Indicator
9	High Gain
10	Tune Power Request Output
11	To TUNE POWER REQUEST Indicator
12	Plate RF
13	(not connected)
14	Timer Disable
15	(not used)
16	+28 VDC
17	To 9A1A6Q1-E
18	Timer Reset
19	(not used)
20	(not used)
21	(not used)
22	(not used)
23	(not used)
24	(not used)
25	(not used)
26	(not used)
27	(not used)
28	Ground
29	(not used)
30	-15 VDC
31	Inhibit from I. Box
32	Motor Run
33	Servo Run
34	To TUNING Indicator
35	Decoder-on Ground

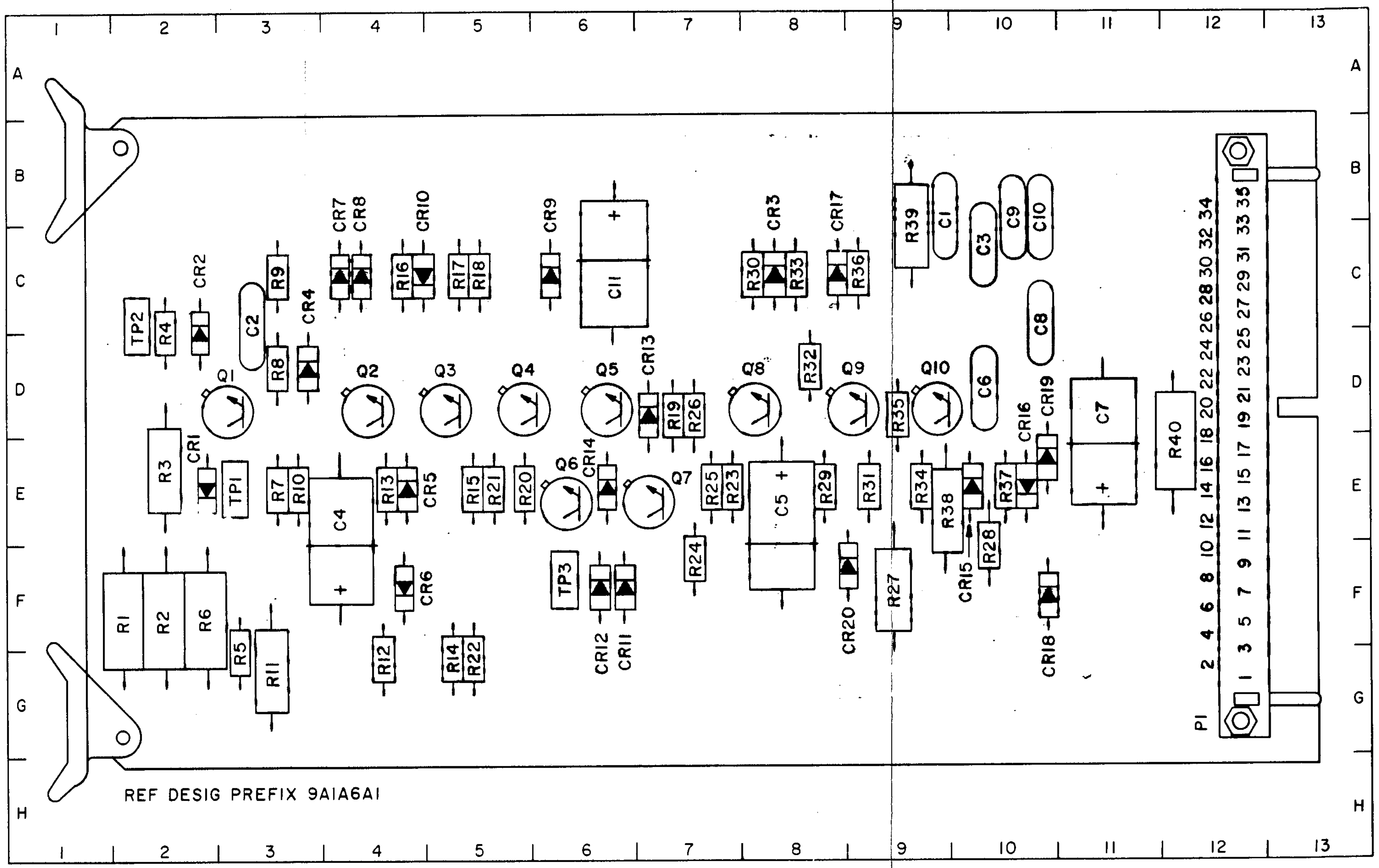
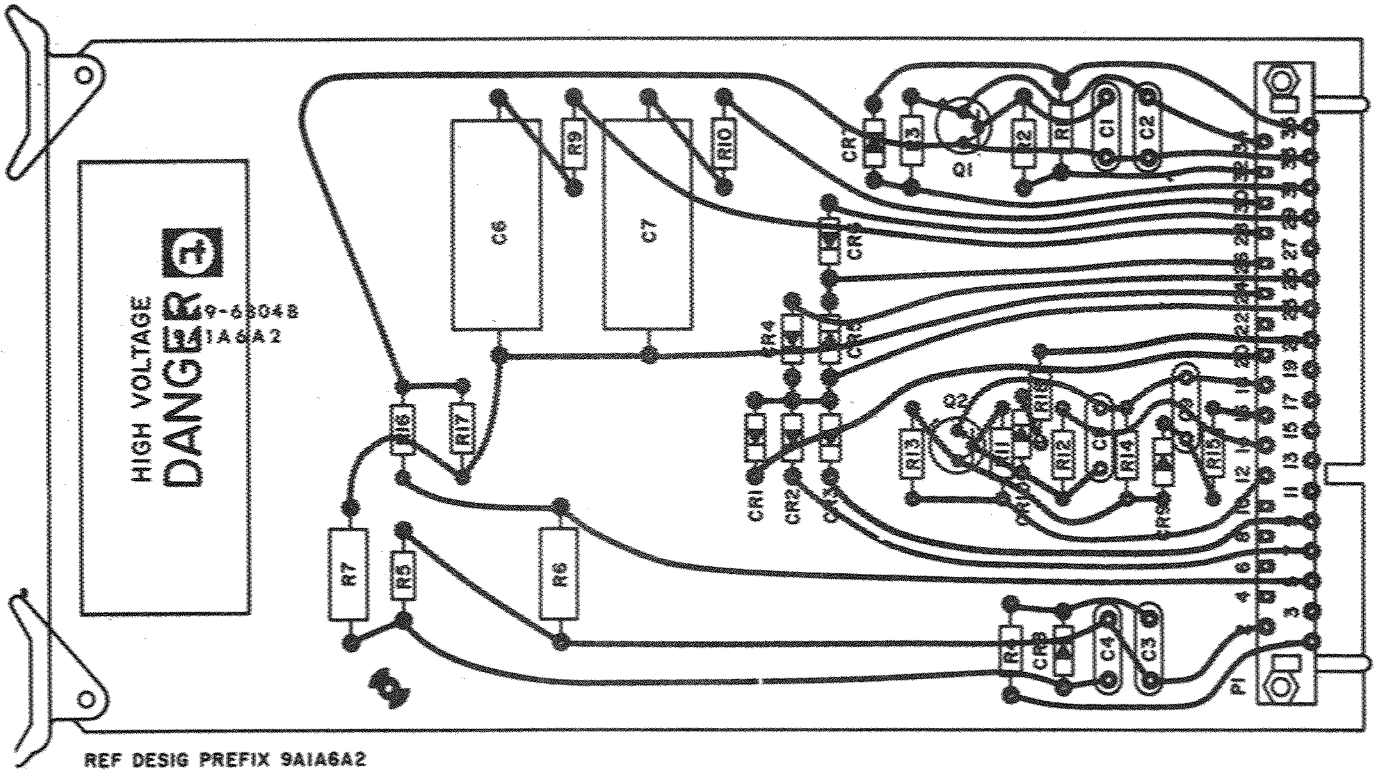


Figure 5-38. 10 KW PA, Tune-up Control PCB Assembly 9A1A6A1, Component Locations from Foil Side



PIN FUNCTIONS

1	Line Voltage Det. (+)
2	Line Voltage Det. (-)
3	(not used)
4	(not used)
5	115 VAC Common
6	(not used)
7	A11 Motor Run
8	(not used)
9	A12 Motor Run
10	(not used)
11	(not used)
12	+15 VDC
13	(not used)
14	Plate Current Monitor Input
15	(not used)
16	Tune Overload Protect Output
17	(not used)
18	Ground
19	(not used)
20	(not connected)
21	Screen Current Monitor Input
22	(not used)
23	Motor Run
24	115 VAC
25	RF Mute
26	Decoder-on Grd Input
27	(not used)
28	Relay Contact Arc Protect
29	Decoder-on Grd Output
30	Relay Contact Arc Protect
31	To 9A1A6Q2-E
32	Band Advance
33	Ground
34	To 9A1A6Q2-B
35	+28 VDC

Figure 5-39. 10 KW PA, Bandswitch Control PCB Assembly 9A1A6A2, Component Locations from Foil Side

PARTS LOCATIONS

REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C1	12G	CR9	8F	R10	8G
C2	11G	CR10	9F	R11	5D
C3	5D	CR11	10E	R12	5D
C4	6D	CR12	9G	R13	5C
C5	8D	P1	13D	R14	6D
C6	9E	Q1	8E	R15	6D
C7	9E	Q2	7E	R16	7D
C8	12F	Q3	6E	R17	7D
C9	11F	Q4	9E	R18	8D
C10	7C	Q5	5E	R19	10D
C11	8D	Q6	10E	R20	9D
C12	9F	R1	3C	R21	9D
CR1	3C	R2	3C	R22	10E
CR2	3D	R3	3D	R23	10G
CR3	3D	R4	3E	R24	11F
CR4	3E	R5	3E	R25	10G
CR5	3F	R6	4G	RT1	6D
CR6	5F	R7	5G	RT2	7D
CR7	6F	R8	6G	RT3	9D
CR8	7F	R9	7G	TP1	11F

PIN FUNCTIONS

1 +28 VDC via Reset Switch
2 No Key Output
3 Ground
4 Tune Time Fault Meter
5 Ground
6 Ground
7 Ground
8 (not used)
9 (not used)
10 (not used)
11 (not used)
12 Timer Reset
13 (not used)
14 (not used
15 (not used)
16 Ground
17 (not used)
18 Bottom of I_s Limit Pot.
19 I_s Limit Pot. Wiper
20 Screen Monitor Reference
21 Screen Fault Meter
22 Plate Fault Meter
23 Wiper of I_p Limit Pot.
24 Plate Monitor Reference
25 I_p Limit Pot. Bottom
26 VSWR Fault Meter
27 VSWR Limit Pot. Wiper
28 Limit Switch Fault Meter
29 +28 VDC from Limit Switches
30 Bottom of VSWR Limit Pot.
31 Shorting Stick Interlock
32 Chassis Slide Interlock
33 PS Access Door Interlock
34 Plate Interlock
35 Input Interlock

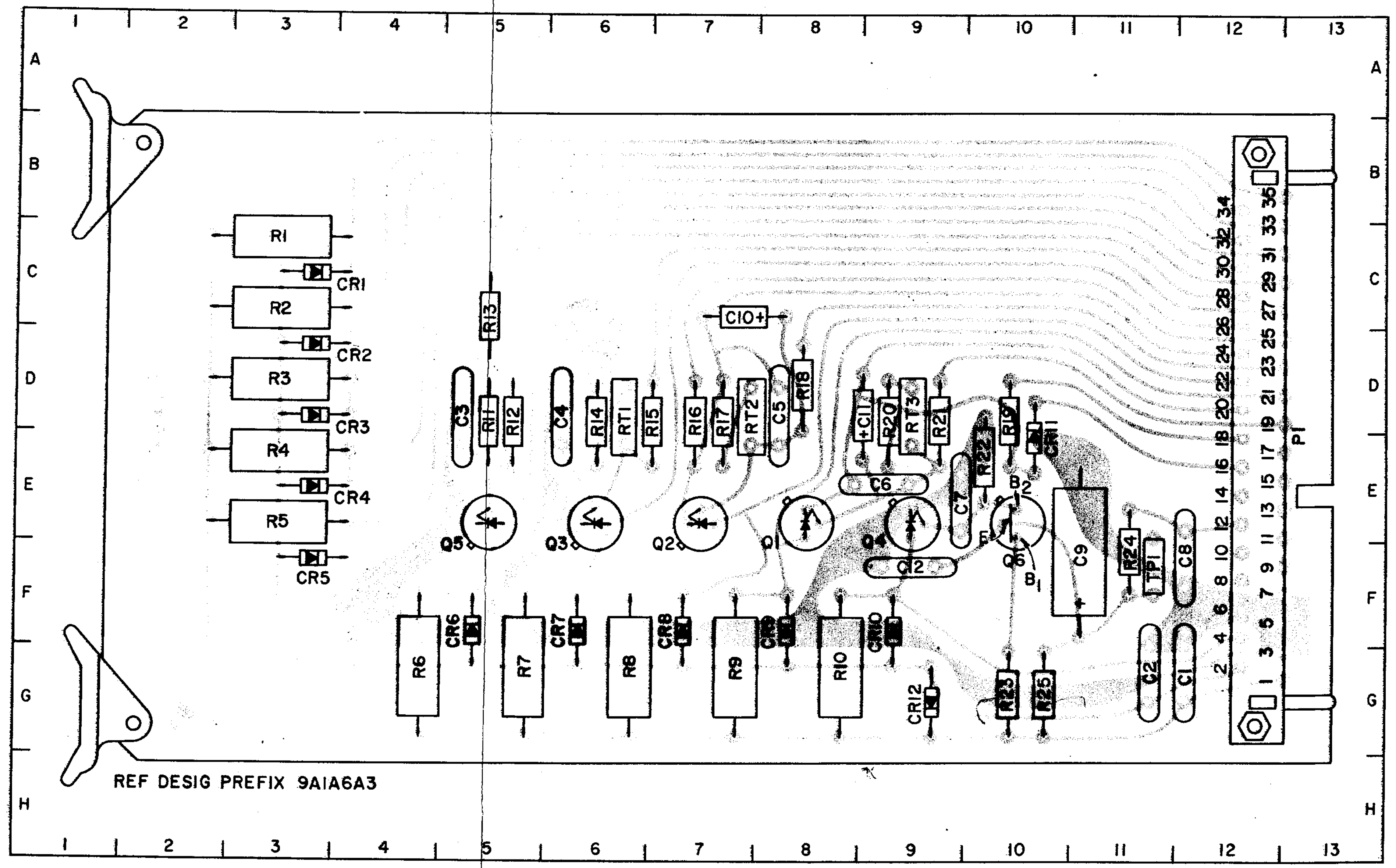
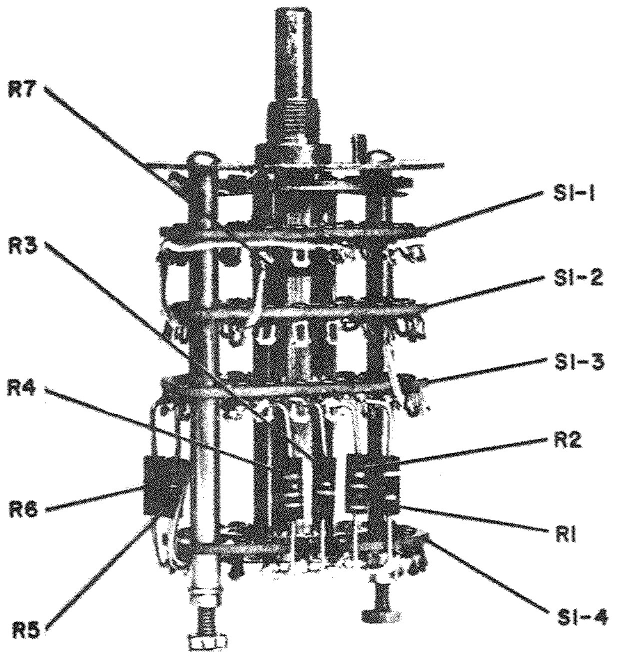
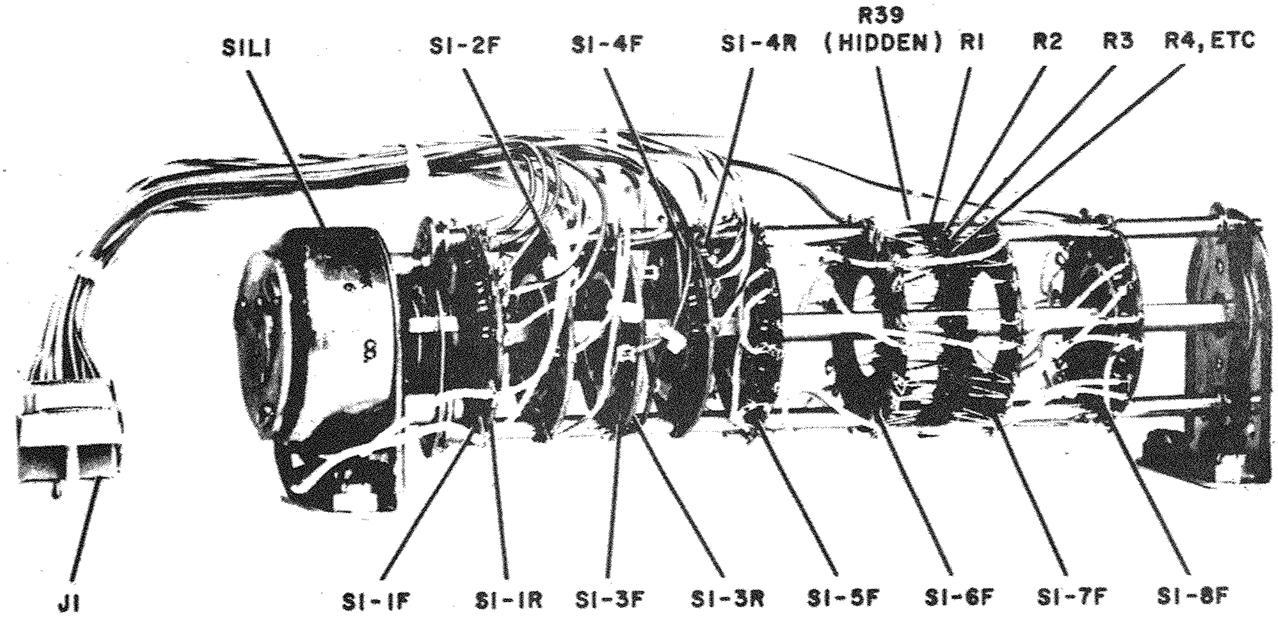


Figure 5-40. 10 KW PA, Fault Sensors PCB Assembly 9A1A6A3, Component Locations from Foil Side



REF DESIG PREFIX 9A1A6A4

Figure 5-41. 10 KW PA, Fault Detector Switch Assembly, Component Locations



REF DESIG PREFIX 9A1A13A1

Figure 5-42. 10 KW PA, Band Repeater Switch Assembly 9A1A13A1, Component Locations

BLANK

UNIT NO.	UNIT	CABLE	FROM	TO
1	1 K		P 10 - A	8T1 220VAC
			B	
			C	
			P 11 - A	Shield Grd.
			B	P7-D (7)
			C	P7-A (7)
			D	8TB4-27
			E	Spare
			F	P7-G (7)
			G	F (7)
			H	H (7)
			J	J (7)
			K	K (7)
			L	B (7)
			M	8TB4-5
			N	4
			P	3
			R	2
			S	1
			T	Spare
			U	Shield Grd.
			V	P2 (3)
			W	P3 (3)
			X	Shield Grd.
			Z	8E1
			a	P7-C (7)
			b	Spare
			c	P7-E (7)
			d	P7-L (7)
			e	8TB4-13
			f	Shield
			g	8TB4-12
			h	Shield
			j,k,m	
			n,p,r.	Spares
			s	
3	Exciter	W1	W1P1 -A	W1P2-A (8A3)
			B	C (8A3)
			C	B (8A3)
			P15 - A	Spare
			B	8TB4-6 *
			C	8TB4-7 *
			D	8TB4-8 *
			E	8TB4-9 *
			F	8TB4-10 *
			R	8E1
			G	P9-S (7)
			H	K (7)
			J	A (7)
			K	E (7)
			L	C (7)
			M	B (7)
			N	F (7)
			P	G (7)
			W	P9 J (7)
			R	8TB1-1
			S	P9-H (7)
			T	Spare
			U	P9-N (7)
			V	P9-D (7)
			X,Y,Z	
			a,b,c	
			d,e,f	Spares
			g,h,i	
			j,k,m	
			P15- n,p,q	
3	Exciter		P1	P12 (1)
			P2	P11-V (1)
			P3	P11-W (1)
		W6	W6P1 - A	W6P2 - A (4)
			B	B (4)
			C	C (4)
			D	D (4)
			E	E (4)
			F	F (4)
			G	G (4)
			H	H (4)
			J	J (4)
			K	K (4)
		W8	W8P1 - A	W8P2 - A (5)
			B	B (5)
			D	D (5)
			E	E (5)
			F	F (5)
			G	G (5)
			H	H (5)
			J	J (5)
			K	K (5)
			L	L (5)
			M	M (5)
			N	N (5)
			P	P (5)
			R	R (5)
			S	S (5)
			T	T (5)
			U	U (5)
			V	V (5)
			W	W (5)
			X	X (5)
			Z	Z (5)
			a	a (5)
			b	b (5)
			c	c (5)
			d	d (5)
			e	e (5)
			f	f (5)
			g	g (5)
			h	h (5)
			i	i (5)
			j	j (5)
			k	k (5)
			m	m (5)
			n	n (5)
			p	p (5)
			r	r (5)
		W7	W7P1 - A	W7P2 - A (5)
			B	B (5)
			C	C (5)
			D	D (5)
			E	E (5)
			F	F (5)
			G	G (5)
			H	H (5)
			J	J (5)
			K	K (5)
			L	L (5)
			M	M (5)
			N	N (5)
			P	P (5)
			R	R (5)
			S	S (5)
			T	T (5)
			U	U (5)
3	Exciter	W7	W7P1- V	W7P2 - V (5)
			W	W (5)
			X	X (5)
			Y	Y (5)
			Z	Z (5)
			a	a (5)
			b	b (5)
			c	c (5)
			d	d (5)
			e	e (5)
			f	f (5)
			g	g (5)
			h	h (5)
			j	j (5)
			k	k (5)
			m	m (5)
			n	n (5)
			p	p (5)
			q	q (5)
			r	r (5)
4	Keyer	WZ	WZP1 - A	W2P2 - A (8A3)
			B	C (8A3)
			C	B (8A3)
		W6	W6PZ - A	W6P1 - A (3)
			B	B (3)
			C	C (3)
			D	D (3)
			E	E (3)
			F	F (3)
			G	G (3)
			H	H (3)
			J	J (3)
			K	K (3)
5	Decoder	W3	W3P1 - A	W3P2 - A
			B	C
			C	B
5	Decoder Encoder	W8	W8P2 - A	W8P1 - A (3)
			B	B (3)
			C	C (3)
			D	D (3)
			E	E (3)
			F	F (3)
			G	G (3)
			H	H (3)
			J	J (3)
			K	K (3)
			L	L (3)
			M	M (3)
			N	N (3)
			P	P (3)
			R	R (3)
			S	S (3)
			T	T (3)
			U	U (3)
			V	V (3)
			W	W (3)
			X	X (3)
			Z	Z (3)
			a	a (3)
			b	b (3)
			c	c (3)
			d	d (3)
			e	e (3)
			f	f (3)
			g	g (3)
5	Decoder Encoder	W8	W8P2 - h	W8P1 - h (3)
			i	i (3)
			j	j (3)
			k	k (3)
			m	m (3)
			n	n (3)
			p	p (3)
			r	r (3)
5	Decoder Encoder	W7	W7P2 - A	W7P1 - A (3)
			B	B (3)
			C	C (3)
			D	D (3)
			E	E (3)
			F	F (3)
			G	G (3)
			H	H (3)
			J	J (3)
			K	K (3)
			L	L (3)
			M	M (3)
			N	N (3)
			P	P (3)
			R	R (3)
			S	S (3)
			T	T (3)
			U	U (3)
			V	V (3)
			W	W (3)
			X	X (3)
			Y	Y (3)
			Z	Z (3)
			a	a (3)
			b	b (3)
			c	c (3)
			d	d (3)
			e	e (3)
			f	f (3)
			g	g (3)
			h	h (3)
			j	j (3)
			k	k (3)
			m	m (3)
			n	n (3)
			p	p (3)
			q	q (3)
			r	r (3)
7	I Box 10 KW		J1	Optional Auxiliary
			P7 - A	P11 - C (1)
			B	L (1)
			C	a (1)
			D	B (1)
			E	c (1)
			F	G (1)
			G	F (1)
			H	H (1)
			J	J (1)
			K	K (1)
			L	d (1)
			M	8E1
			N,P,R, S,T,U, V	Spares
			P8 - A	8TB4 - 17
			B	21

Figure 5-43. AN FRT-84(V) Exciter-1 KW PA Cabinet and Unit Interconnection Wiring, Schematic Diagram (Sheet 1 of 2)

UNIT NO.	UNIT	CABLE	FROM	TO
			P8 - C	8TB4 - 22
			D	19
			E	25
			F	14
			G	16
			H	20
			J	24
			K	18
			L	23
			M	15
			N,P,Q,R, S,T,U,V, W,X,Y,Z	Spares
7	I Box 10 KW		P9 - A	P15 - J (3)
			B	M (3)
			C	L (3)
			D	V (3)
			E	K (3)
			F	N (3)
			G	P (3)
			H	S (3)
			I	8TB1 - 2
			J	P15 - W (3)
			K	H (3)
			L	Spare
			M	8TB4 - 26
			N	P15 - U (3)
			P	8TB3 - 7
			R	8TB3 - 8
			S	P15 - G (3)
			T,U,V, W,X	Spares
	Ckt. Bkr. 8A1CB3		8A1CB3	8TB2 - 1
			8A1CB3	8TB2 - 3
	Term. Board 8TB2		8TB2 - 1	8A1CB3
				8A3J1 - A
				J2 - A
				J3 - A
				J4 - A
			2	8TB3 - 7
			3	8A1CB3
				8A3J1 - C
				J2 - C
				J3 - C
				J4 - C
			4	8TB3 - 8
	8A3 115 VAC Power Strip	W9	W9P1 - A	8A4P1 - A
			B	Spare
			C	8A4P1 - B
		W1	W1P2 - A	W1P1 - A (3)
			B	C (3)
			C	B (3)
		W2	W2P2 - A	W2P1 - A (4)
			B	C (4)
			C	B (4)
		W3	W3P2 - A	W3P1 - A (5)
			B	C (5)
			C	B (5)
			J1 A	8TB2 - 1
				8A3J2- A
				J3 - A
				J4 - A

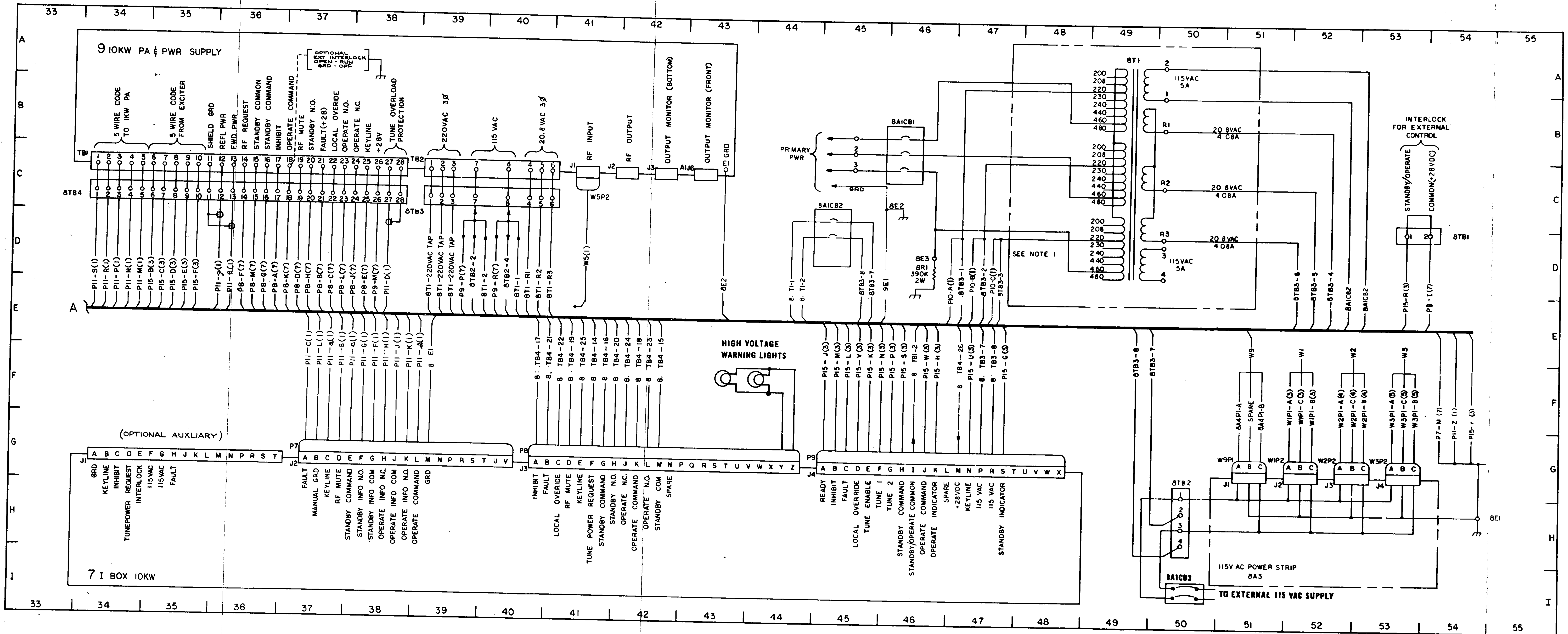
UNIT NO.	UNIT	CABLE	FROM	TO
			J1 - B	8A3J2 - B
				J3 - B
				J4 - B
				8E1
			C	8TB2 - 3
				8A3J2- C
				J3 - C
				J4- C
			J2 - A	8TB2 - 1
				J1 - A
				J3 - A
				J4 - A
			B	J1 - B
				J3 - B
				J4 - B
				8E1
	8A3 115 VAC Power, Strip		J2 - C	8TB2 - 3
				8A3J1 - C
				J3 - C
				J4 - C
			J3 - A	8TB2 - 1
				J1 - A
				J2 - A
				J4 - A
			B	J1 - B
				J2 - B
				J4 - B
				8E1
			C	8TB2 - 3
				J1 - C
				J2 - C
				J4 - C
			J4 - A	8TB2 - 1
				J1 - A
				J2 - A
				J3 - A
			B	J1 - B
				J2 - B
				J3 - B
				8E1
			C	8TB2 - 3
				J1 - C
				J2 - C
	Ground Terminal 8E1		8E1	P7 - M (7)
				P11 - Z (1)
				P15 - r (3)
				8A3J1 - B
				J2 - B
				J3 -B
				J4 -B
	Blower Assy. 8A4		8A4 - A	W9P1 -A
			8A4 - B	W9P1 -C
	Terminal Board 8TB4		8TB4 - 1	P11 -S (1)
			2	-R (1)
			3	-P (1)
			4	-N (1)
			5	-M (1)
			6	P15 -B (3)
			7	C (3)
			8	D (3)
			9	E (3)
			10	F (3)
			11	Shield Grd.

UNIT NO.	UNIT	CABLE	FROM	TO
			8TB4 - 12	P11 - g (1)
			- 13	P11 - e (1)
			- 14	P8 - F (7)
			- 15	- M (7)
			- 16	- G (7)
			- 17	- A (7)
			- 18	- K (7)
			- 19	- D (7)
			- 20	- H (7)
			- 21	- B (7)
			- 22	- C (7)
			- 23	- L (7)
			- 24	- J (7)
			- 25	- E (7)
			- 26	P9 - M (7)
			- 27	P11 - D (1)
			- 28	Shield Grd.
	Terminal Board 8TB3		8TB3 - 1	8T1-220 VAC TAP
			- 2	8T1-220 VAC TAP
			- 3	8T1-220 VAC TAP
			- 7	P9 - P (7)
				8TB2 - 2
				8T1 - 2
			- 8	P9 - R (7)
				8TB2 - 4
				8T1 - 1
			- 4	- R1
			- 5	- R2
			- 6	- R3
	Circuit Breaker 8A1CB2		8A1CB2	8T1 - 1
				8T1 - 2
				8TB3 - 8
				8TB3 - 7
	Ground Terminal 8E2		8E2	9E1 Ground
	Circuit Breaker 8A1CB1		8A1CB1	Primary Power
				8E3
				8T1 (Note 1)
	Terminal 8E3		8E3	8R1(390K RES)
				8T1 (Note 1)
				8A1CB1
	8T1		8T1 (Note 1)	8A1CB1
			(Note 1 TAP 3)	8E3
			220 V TAP 1	8TB3 - 1
			220 V TAP 2	P10 - (1)
				8TB3 - 2
			220 V TAP 3	P10 - (1)
				8TB3 - 3
			- 1	8A1CB2
			- 2	8A1CB2
			- 3	115 VAC
			- 4	115 VAC
			R1	8TB3 - 4
			R2	8TB3 - 5
			R3	8TB3 - 6
	Interlock 8TB1		8TB1 - 1	P15 - R (3)
			2	P9 - I (7)

NOTE 1: T1 Primary Taps used (3 Taps) depend on facility primary power.

UNIT NO.	UNIT	CABLE	FROM	TO
9	10 KW PA & Power Supply		TB1 - 1	8TB4 - 1
			2	2
			3	3
			4	4
			5	5
			6	6
			7	7
			8	8
			9	9
			10	10
			11	11
			12	12
			13	13
			14	14
			15	15
			16	16
			17	17
			18	18
			19	19
			20	20
			21	21
			22	22
			23	23
			24	24
			25	25
			26	26
			27	27
			28	28
			TB2 - 1	8TB3 - 1
			2	2
			3	3
			7	7
			8	8
			4	4
			5	5
			6	6
		W5	W5P2	W5P1 (1)
			E1	8E2
1	1 KWPA	W5	W5P1	W5P2 (9)
			P12	P1 (3)
		W4	W4P1 - A	W4P2 - A (2)
			B	B (2)
			C	C (2)
			D	D (2)
			E	E (2)
			F	F (2)
			G	G (2)
			H	Spare
			J	Spare
			K	W4P2 K (2)
			L	L (2)
			M	M (2)
			N	N (2)
			P	P (2)
			W4P1 - R	W4P2 R (2)

UNIT NO.	UNIT	CABLE	FROM	TO
2	1 KW Power Supply	W4	W4P2 - A	W4P1 - A (1)
			B	B (1)
			C	C (1)
			D	D (1)
			E	E (1)
			F	F (1)
			G	G (1)
			H	Spare
			J	Spare
			K	W4P1 K (1)
			L	L (1)
			M	M (1)
			N	N (1)
			P	P (1)



NOTES:
1. T1 SHOWN WIRED FOR 460V AC INPUT, FOR 220V AC INPUT MOVE THE WIRES FROM 8A1CB1 TO T1 PRIMARY FROM 460V AC TAPS TO 220V AC TAPS.

Figure 5-43. AN/FRT-84(V) Exciter-1 KW PA Cabinet and Unit Interconnection Wiring, Schematic Diagram (Sheet 2 of 2)

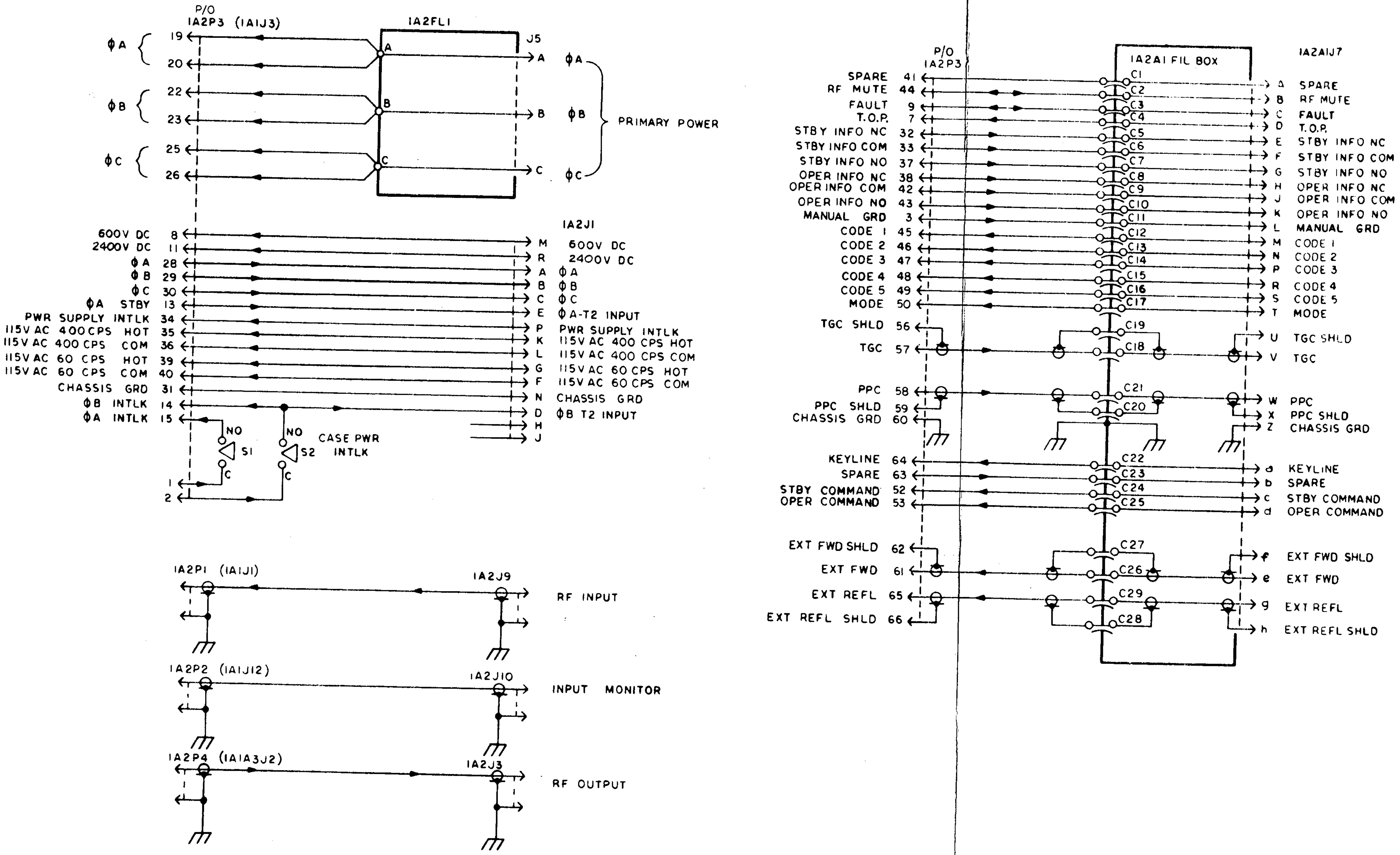


Figure 5-44. 1 KW PA, Case, Schematic Diagram.

ORIGINAL

Figure 5-44
Parts Locations

REF DESIG	LOC
B1	5C
B2	57I
C1	5C
C2	21A
C3	22A
C4	27A
C5	22B
C6	22B
C7	21D
C8	22B
C9	25B
C10	23C
C11	22C
C12	23D
C13	24D
C15	22C
C16	22C
C17	25B
C19	26D
C20	24C
C21	22C
C23	25C
C24	26B
C25	Not used
C26	22C
C27	22D
C28	25D
C29	32G
C31	38D
C32	25C
C33	25C
C34	25C
C35	27C
C36	28D
C37	27D
C38	22C
C39	25C
C40	28C
C41	25B
C42	25B
C43	25B
C44	25B
C45	22B
C46	22B
C47	22B
C48	22B
C49	17F
C50	18F
C51	12G
CR1	6G
CR2	5I
CR3	17H
CR4	17H
CR5	17H
CR6	17I
CR7	17G
CR8	17G
CR9	17G
CR10	17G
CR11	17E
CR12	55I
CR13	27D
DS5	28F
F1	4E
F2	4F
F3	4F
F4	4C
F5	4C
F6	31D
F7	4H
J1	3A
J2	51F
J3	3B,6E, 20A,27F, 28G,20H, 32H,44D, 52B,55C
J4	21F,27F, 27G,23E, 38D,32D
J5	9E,9G, 10F,35F, 38G,45B, 51A,50E
J6	18H
J7	18G
J8	18G
J9	18G
J10	18F
J11	18F
J12	51G
K1	5G
K2	5I
K3	56I
L1	22A
L2	21A
L3	21B
L4	24D
L5	26B
L6	24B
M1	13G
M2	Not used
P1	7C,14G
P2	50G
P3	50G
P6	21B
P7	26B
R3	21D
R4	26D
R5	24C
R6	24C
R7	22D
R8	26D
R9	38H
R10	36F
R11	45C
R12	45B
R13	45E
R14	Not used
R16	23B
R17	23B
R18	24B
R19	24B
R20	28D
R21	24B
R24	16F
R25	23D
R26	23D
R27	24D
R28	25D
S1	5G
S3	28H
S5	13F
S6	28G
S7	58A
S8	Not used
S9	9G
T1	30D
TB1	29E
V1	23B
V2	25B
A1C1	10B
A1C2	11C
A1C3	11D
A1C4	8D
A1C5	8D
A1C6	12B
A1C7	14B
A1C8	13A
A1C9	13C
A1C10	12C
A1C11	14A
A1C12	15A
A1C13	12D
A1C14	12B
A1C17	10D
A1C18	9B
A1C19	15B
A1C20	9B
A1CR1	9B
A1CR2	10D
A1L1	14A
A1L2	10B
A1L3	15A
A1L4	13B
A1L5	13B
A1L6	11C
A1R1	13C
A1R2	12B
A1R3	12C
A1R4	12B
A1R5	8C
A1R6	10B
A1R7	11B
A1TB1	8B,9D, 15A,15B
A1V1	9C,12A
A1V2	9D,13C
A2	31B
A3C1	33B
A3C3	35C
A3C4	35B
A3C5	Not used
A3C6	33A
A3CR1	Not used
A3CR2	35C
A3CR3	35B
A3CR4	Not used
A3J1	32A
A3J2	38A
A3L1	33B
A3L2	33B
A3R1	34B
A3R2	34B
A3R3	Not used
A3R4	Not used
A3R5	36B
A3R6	36A
A3R7	Not used
A3R8	Not used
A3R9	35B
A3T1	34A
A4	17B,69A
A5C1	22F
A5C2	21F
A5C3	23G
A5C4	26G
A5CR1	21G
A5CR2	22H
A5CR3	33D
A5CR4	33E
A5CR5	33E
A5CR6	33E
A5CR7	33E
A5CR8	34E
A5CR9	34F
A5CR10	23F
A5CR11	22F
A5CR12	21F
A5CR13	24H
A5CR14	26G
A5CR15	23H
A5CR16	25G
A5CR17	25G
A5CR18	26F
A5CR19	26G
A5P1	21H,23F, 26F,32F, 38D
A5Q1	34E
A5Q2	35E
A5Q3	23F
A5Q4	25F
A5Q5	25H
A5Q6	26H
A5R1	34D
A5R2	34E
A5R3	35E
A5R4	35E
A5R5	36E
A5R6	22E
A5R7	23E
A5R8	23F
A5R9	23F
A5R10	21F
A5R11	24F
A5R12	24F
A5R13	24F
A5R14	24F
A5R15	25F
A5R16	25F
A5R17	25G
A5R18	25H
A5R19	24H
A5R29	24H
A5R21	26G
A5R22	26G
A5R23	25G
A5R24	26G
A5TP1	34D
A5TP2	36E
A5TP3	23H
A5TP4	23F
A5TP5	25F
A5TP6	25H
A6C1	49A
A6C2	46D
A6C3	46B
A6C4	49A
A6C5	50B
A6C6	48B
A6C7	49E
A6CR1	33G
A6CR2	33G
A6CR3	33G
A6CR4	33G
A6CR5	34G
A6CR6	34I
A6CR7	36I
A6CR8	46C
A6CR9	46B
A6CR13	50D
A6CR14	47D
A6CR15	50E
A6CR16	50E
A6CR17	50D
A6CR18	49D
A6CR19	98C
A6CR20	49C
A6P1	9E,9F, 10F,32G, 35F,38G, 45A,51B
A6Q1	10E
A6Q2	37G
A6Q3	36H
A6Q4	35I
A6Q5	36I
A6Q6	48E
A6Q7	47C
A6Q8	46C
A6Q9	46B
A6Q10	48B
A6Q11	49B
A6Q12	49B
A6Q13	49C
A6R1	9F
A6R2	10F
A6R3	10F
A6R4	34G
A6R5	34I
A6R6	36G
A6R7	35G
A6R8	34H
A6R9	37H
A6R10	33I
A6R11	35H
A6R12	35I
A6R13	35H
A6R14	36H
A6R15	37I
A6R16	46D
A6R17	46D
A6R18	46D
A6R19	46C
A6R20	48E
A6R21	47B
A6R22	47C
A6R23	47D
A6R24	48D
A6R25	46B
A6R26	46B
A6R27	47B
A6R28	48D
A6R29	48B
A6R30	48B
A6R31	51B
A6R32	34G
A6R33	37G
A6R34	37H
A6R35	46C
A6R36	46A
A6R37	50B
A6R38	48D
A6R39	50B
A6R40	51D
A6R41	49D
A6R42	49C
A6R43	49C
A6R44	49C
A6R45	49C
A6R46	49C
A6TP1	37H
A6TP2	37G
A6TP3	39G
A6TP4	46C
A6TP5	46A
A6TP6	50B
A6TP7	98B
A7R1	16F
A7R2	16F
A7R3	16G
A7R4	16G
A7R7	15G
A7R8	15G
A7R9	14G
A7R13	15F
A7R14	15F
A7R15	14F
A7R16	16E
A7R17	16F
A7R18	15E
A7R19	15F
A7R20	15E
A7R21	14E
A7R22	14F
A8C1	45G
A8J1	45F
A8J2	50F
A8J3	50G
A9A1R1	46G
A8A1R2	47H
A8A1R3	48G
A8A1R4	48F
A8A1Z1	48F
A8A1Z2	48H

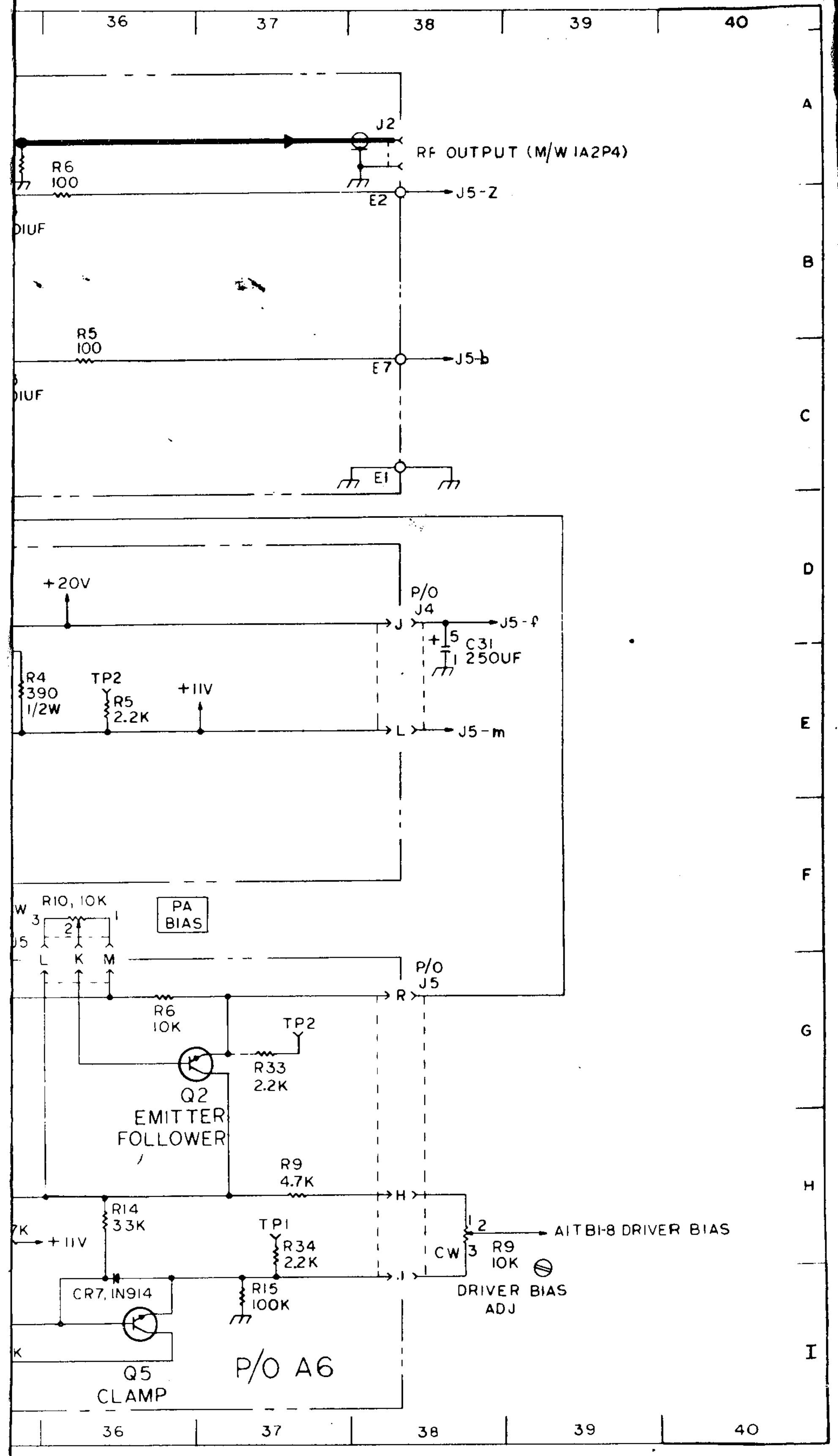


Figure 5-45. 1 KW PA, Chassis, Schematic Diagram (Sheet 1 of 2)

Figure 5-44
Parts Locations

REF DESIG	LOC
B1	5C
B2	57I
C1	5C
C2	21A
C3	22A
C4	27A
C5	22B
C6	22B
C7	21D
C8	22B
C9	25B
C10	23C
C11	22C
C12	23D
C13	24D
C15	22C
C16	22C
C17	25B
C19	26D
C20	24C
C21	22C
C23	25C
C24	26B
C25	Not used
C26	22C
C27	22D
C28	25D
C29	32G
C31	38D
C32	25C
C33	25C
C34	25C
C35	27C
C36	28D
C37	27D
C38	22C
C39	25C
C40	28C
C41	25B
C42	25B
C43	25B
C44	25B
C45	22B
C46	22B
C47	22B
C48	22B
C49	17F
C50	18F
C51	12G
CR1	6G
CR2	5I
CR3	17H
CR4	17H
CR5	17H
CR6	17I
CR7	17G
CR8	17G
CR9	17G
CR10	17G
CR11	17E
CR12	55I
CR13	27D

REF DESIG	LOC
DS5	28F
F1	4E
F2	4F
F3	4F
F4	4C
F5	4C
F6	31D
F7	4H
J1	3A
J2	51F
J3	3B,6E, 20A,27F, 28G,20H, 32H,44D, 52B,55C
J4	21F,27F, 27G,23E, 38D,32D
J5	9E,9G, 10F,35F, 38G,45B, 51A,50E
J6	18H
J7	18G
J8	18G
J9	18G
J10	18F
J11	18F
J12	51G
K1	5G
K2	5I
K3	56I
L1	22A
L2	21A
L3	21B
L4	24D
L5	26B
L6	24B
M1	13G
M2	Not used
P1	7C,14G
P2	50G
P3	50G
P6	21B
P7	26B
R3	21D
R4	26D
R5	24C
R6	24C
R7	22D
R8	26D
R9	38H
R10	36F
R11	45C
R12	45B
R13	45E
R14	Not used
R16	23B
R17	23B
R18	24B
R19	24B
R20	28D

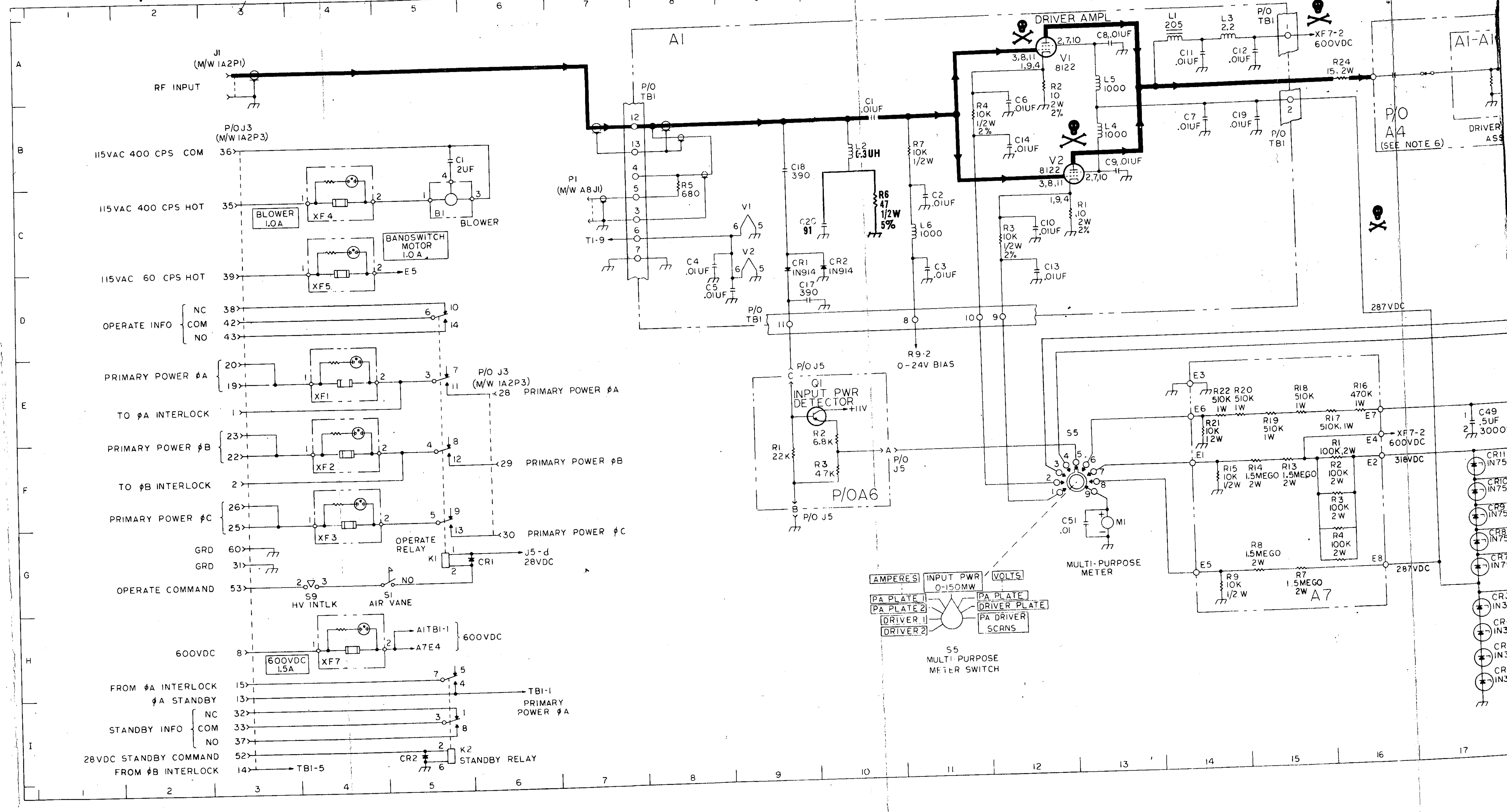
REF DESIG	LOC
R21	24B
R24	16F
R25	23D
R26	23D
R27	24D
R28	25D
S1	5G
S3	28H
S5	13F
S6	28G
S7	58A
S8	Not used
S9	9G
T1	30D
TB1	29E
V1	23B
V2	25B
A1C1	10B
A1C2	11C
A1C3	11D
A1C4	8D
A1C5	8D
A1C6	12B
A1C7	14B
A1C8	13A
A1C9	13C
A1C10	12C
A1C11	14A
A1C12	15A
A1C13	12D
A1C14	12B
A1C17	10D
A1C18	9B
A1C19	15B
A1C20	9B
A1CR1	9B
A1CR2	10D
A1L1	14A
A1L2	10B
A1L3	15A
A1L4	13B
A1L5	13B
A1L6	11C
A1R1	13C
A1R2	12B
A1R3	12C
A1R4	12B
A1R5	8C
A1R6	10B
A1R7	11B
A1TB1	8B,9D, 15A,15B
A1V1	9C,12A
A1V2	9D,13C
A2	31B
A3C1	33B
A3C3	35C
A3C4	35B
A3C5	Not used

REF DESIG	LOC
A3C6	33A
A3CR1	Not used
A3CR2	35C
A3CR3	35B
A3CR4	Not used
A3J1	32A
A3J2	38A
A3L1	33B
A3L2	33B
A3R1	34B
A3R2	34B
A3R3	Not used
A3R4	Not used
A3R5	36B
A3R6	36A
A3R7	Not used
A3R8	Not used
A3R9	35B
A3T1	34A
A4	17B,69A
A5C1	22F
A5C2	21F
A5C3	23G
A5C4	26G
A5CR1	21G
A5CR2	22H
A5CR3	33D
A5CR4	33E
A5CR5	33E
A5CR6	33E
A5CR7	33E
A5CR8	34E
A5CR9	34F
A5CR10	23F
A5CR11	22F
A5CR12	21F
A5CR13	24H
A5CR14	26G
A5CR15	23H
A5CR16	25G
A5CR17	25G
A5CR18	26F
A5CR19	26G
A5P1	21H,23F, 26F,32F, 38D
A5Q1	34E
A5Q2	35E
A5Q3	23F
A5Q4	25F
A5Q5	25H
A5Q6	26H
A5R1	34D
A5R2	34E
A5R3	35E
A5R4	35E
A5R5	36E
A5R6	22E
A5R7	23E
A5R8	23F
A5R9	23F
A5R10	21F

REF DESIG	LOC
A5R11	24F
A5R12	24F
A5R13	24F
A5R14	24F
A5R15	25F
A5R16	25F
A5R17	25G
A5R18	25H
A5R19	24H
A5R29	24H
A5R21	26G
A5R22	26G
A5R23	25G
A5R24	26G
A5TP1	34D
A5TP2	36E
A5TP3	23H
A5TP4	23F
A5TP5	25F
A5TP6	25H
A6C1	49A
A6C2	46D
A6C3	46B
A6C4	49A
A6C5	50B
A6C6	48B
A6C7	49E
A6CR1	33G
A6CR2	33G
A6CR3	33G
A6CR4	33G
A6CR5	34G
A6CR6	34I
A6CR7	36I
A6CR8	46C
A6CR9	46B
A6CR13	50D
A6CR14	47D
A6CR15	50E
A6CR16	50E
A6CR17	50D
A6CR18	49D
A6CR19	98C
A6CR20	49C
A6P1	9E,9F, 10F,32G, 35F,38G, 45A,51B
A6Q1	10E
A6Q2	37G
A6Q3	36H
A6Q4	35I
A6Q5	36I
A6Q6	48E
A6Q7	47C
A6Q8	46C
A6Q9	46B
A6Q10	48B
A6Q11	49B
A6Q12	49B
A6Q13	49C
A6R1	9F

REF DESIG	LOC
A6R2	10F
A6R3	10F
A6R4	34G
A6R5	34I
A6R6	36G
A6R7	35G
A6R8	34H
A6R9	37H
A6R10	33I
A6R11	35H
A6R12	35I
A6R13	35H
A6R14	36H
A6R15	37I
A6R16	46D
A6R17	46D
A6R18	46D
A6R19	46C
A6R20	48E
A6R21	47B
A6R22	47C
A6R23	47D
A6R24	48D
A6R25	46B
A6R26	46B
A6R27	47B
A6R28	48D
A6R29	48B
A6R30	48B
A6R31	51B
A6R32	34G
A6R33	37G
A6R34	37H
A6R35	46C
A6R36	46A
A6R37	50B
A6R38	48D
A6R39	50B
A6R40	51D
A6R41	49D
A6R42	49C
A6R43	49C
A6R44	49C
A6R45	49C
A6R46	49C
A6TP1	37H
A6TP2	37G
A6TP3	39G
A6TP4	46C
A6TP5	46A
A6TP6	50B
A6TP7	98B
A7R1	16F
A7R2	16F
A7R3	16G
A7R4	16G
A7R7	15G
A7R8	15G
A7R9	14G
A7R13	15F
A7R14	15F
A7R15	14F

REF DESIG	LOC
A7R16	16E
A7R17	16F
A7R18	15E
A7R19	15F
A7R20	15E
A7R21	14E
A7R22	14F
A8C1	45G
A8J1	45F
A8J2	50F
A8J3	50G
A9A1R1	46G
A8A1R2	47H
A8A1R3	48G
A8A1R4	48F
A8A1Z1	48F
A8A1Z2	48H


RF INPUT
J1 (M/W 1A2P1)
P/O J3 (M/W 1A2P3)
115VAC 400 CPS COM
115VAC 400 CPS HOT
115VAC 60 CPS HOT
OPERATE INFO
NC
COM
NO
PRIMARY POWER ϕA
TO ϕA INTERLOCK
PRIMARY POWER ϕB
TO ϕB INTERLOCK
PRIMARY POWER ϕC
GRD
OPERATE COMMAND
600VDC
FROM ϕA INTERLOCK
ϕA STANDBY
STANDBY INFO
28VDC STANDBY COMMAND
FROM ϕB INTERLOCK
BLOWER 1.0A
XF4
XF5
XF1
XF2
XF3
XF7
600VDC 1.5A
BANDSWITCH MOTOR 1.0 A
B1
BLOWER
C1 2UF
E5
OPERATE RELAY
K1
CR1
J5-d 28VDC
S9 HV INTLK
S1 AIR VANE
NO
A1TB1-1
A7E4
600VDC
TB1-1 PRIMARY POWER ϕA
TB1-5
CR2
K2 STANDBY RELAY
P/O J3 (M/W 1A2P3)
PRIMARY POWER ϕA
PRIMARY POWER ϕB
PRIMARY POWER ϕC
A1
P/O TB1
P1 (M/W A8J1)
T1-9
R5 680
V1
V2
C4 .01UF
C5 .01UF
C18 390
CR1 1N914
CR2 1N914
C17 390
C20 91
L2 .3UH
R6 47 1/2W 5%
C1 .01UF
R7 10K 1/2W
C2 .01UF
L6 1000
C3 .01UF
R9-2 0-24V BIAS
P/O J5
Q1 INPUT PWR DETECTOR
+11V
R1 22K
R2 6.8K
R3 4.7K
P/OA6
DRIVER AMPL
V1 8122
V2 8122
3,8,11
1,9,4
2,7,10
C8 .01UF
C9 .01UF
L5 1000
L4 1000
R2 10 2W 2%
R1 10 2W 2%
R4 10K 1/2W 2%
R3 10K 1/2W 2%
C6 .01UF
C14 .01UF
C10 .01UF
C13 .01UF
L1 205
L3 2.2
C11 .01UF
C12 .01UF
C7 .01UF
C19 .01UF
XF7-2 600VDC
R24 15, 2W
P/O A4 (SEE NOTE 6)
A1-A1
DRIVER ASS
287VDC
S5
C51 .01
M1
MULTI-PURPOSE METER
AMPERES
INPUT PWR 0-150MW
VOLTS
PA PLATE 1
PA PLATE 2
DRIVER 1
DRIVER 2
PA PLATE
DRIVER PLATE
PA DRIVER SCRNS
S5 MULTI-PURPOSE METER SWITCH
E3
R22 510K 1W
R20 510K 1W
R18 510K 1W
R16 470K 1W
E6
E7
R21 10K 12W
R19 510K 1W
R17 510K, 1W
E4
XF7-2 600VDC
R1 100K,2W
E1
E2
318VDC
R15 10K 1/2W
R14 1.5MEGO 2W
R13 1.5MEGO 2W
R2 100K 2W
R3 100K 2W
R4 100K 2W
R8 1.5MEGO 2W
E5
E8
R9 10K 1/2 W
R7 1.5MEGO 2W
A7
287VDC
C49 .5UF 3000
CR11 1N75
CR10 1N75
CR9 1N75
CR8 1N75
CR7 1N7
A
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SECTION 6

PARTS LIST

6-1. REFERENCE DESIGNATIONS

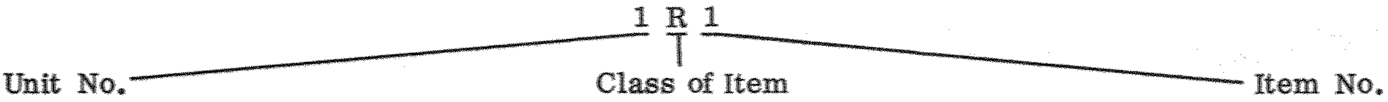
6-2. The unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies, and parts. This method has been expanded as much as necessary to adequately cover the various degrees of subdivision of the equipment. The assembly prefix for each part within any assembly is not repeated for each item listing. However, where the item listing within an assembly runs over to a new page , the prefix is repeated as a heading on each subsequent page. Examples of this unit numbering method and typical expansions of the same are illustrated by the examples below.

6-3. REFERENCE DESIGNATION PREFIX

6-4. Partial reference designations are used on the equipment and illustrations. The partial reference designations consists of the class letter(s) and the identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on illustrations following the notation:

"REF DESIG PREFIX"

Example 1:

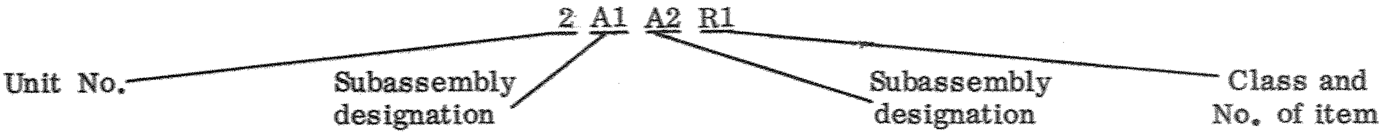


Read as: First (1) resistor of the first unit (1).

Example 2:

Read as: First (1) resistor (R) of first (1) subassembly (A) of the first (1) unit.

Example 3;



Read as: First (1) resistor of second (2) subassembly (A) of first (1) subassembly (A) of second (2) unit.

6-5. LIST OF UNITS

6-6. Table 6-1 is a listing of the units comprising the equipment. As indicated, parts lists for units not covered in detail in this manual are given in technical manuals for individual units. The units are listed by unit numbers in numerical order. Thus when the complete reference designation of a part is known, this Table will furnish the identification of the unit in which the part is located, since the first number of a complete reference designation identifies the unit. Table 6-1 also provides the following informating for each unit listed: (1) quantity per equipment, (2) official name, (3) designation, (4) colloquial name, and (5) location of the first page of its parts listing in Table 6-2.

6-7. MAINTENANCE PARTS LIST

6-8. Table 6-2 lists units covered in detail in this manual and their maintenance parts. The units are listed in numerical sequence. Maintenance parts are listed alphabetically-numerically by class of part following the unit designation for each unit. Thus the parts for each unit are grouped together. Table 6-2 provides the following information: (1) the complete reference designation of each unit, assembly or subassembly, (2) reference to explanatory notes in paragraph 6-9, (3) noun name and brief description, and (4) identification of the illustration which locates the part.

6-9. LIST OF MANUFACTURERS

6-10. Table 6-3 lists the manufacturers of parts used in the equipment. The table includes the manufacturer's code used in Table 6-2 to identify the manufacturers.

6-11. NOTES

6-12. The following notes provide information as referenced in Table 6-2.

NOTE 1: The AN/FRT-84(V) always supplies 220 VAC to the 1 KW PA; therefore, 15 amp fuses are always used for 1A1F1 to 1A1F3.

NOTE 2: The AN/FRT-84(V) always supplies 220 VAC to the 1 KW Power Supply; therefore 2A2P2 is not required. (Used in AN/FRT-83(V) only.)

NOTE 3: The values of 9A1C17 and 9A1A3A1L8 are selected during alignment. Refer to paragraph 0.4 of Overhaul and Repair Manual NAVSHIPS 0967-293-0060 for procedure.

NOTE 4: 9A1P9 and 9A1P10 are supplied with replacement 9A1A2 Directional Coupler Assemblies.

NOTE 5: Extender boards tested in Table 1-2 are included as a part of Accessory Kit 6049-0034.

TABLE 6-1. LIST OF UNITS

UNIT NO.	QTY	NOTE	NAME OF UNIT	DESIGNATION	COLLOQUIAL NAME	PAGE
1	1		Radio Frequency Amplifier	AM-6046/FRT	1 KW PA	6-4
2	1		Power Supply	PP-6067/FRT	1 KW Power Supply	6-11
3	1		Modulator-Synthesizer	MD-777/FRT	Exciter	*
4	1		Frequency Shift Keyer	KY-655/FRT	Keyer	*
5	1		Decoder-Encoder	KY-656/FRT	Decoder-Encoder	*
6	1		Transmitter Control-Indicator	C-7709/FRT	Remote Control	*
7	1		Interconnecting Box	J-2822/FRT-84(V)	I. Box	6-12
8	1				Exciter-1 KW PA Cabinet	6-14
9	1		Radio Frequency Amplifier	AM-6047/FRT-84(V)	10 KW PA	6-15

* Parts lists for these units provided in individual technical manuals. See Table 5-1.

TABLE 6-2. MAINTENANCE PARTS LIST

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1		AMPLIFIER, RADIO FREQUENCY AM-6046/FRT: MFR 14304, PN 6049-3000	5-5
1A1		AMPLIFIER ASSEMBLY, RADIO FREQUENCY: MFR 14304, PN 6049-3100	
B1		FAN: 115V, 400CPS, 1Ø, MFR 14304, PN B22-0001-000	5-9
B2		MOTOR, SYNCHRONOUS: 115V, 60CPS, 1Ø, 6RPM, MFR 14304, PN B11-0004-000	
C1		CAPACITOR, FIXED PAPER: Mil type CP53B1EF205K1	
C2, C3		CAPACITOR, FIXED CERAMIC: Mil type CK65AW472M	5-8
C4		CAPACITOR, FIXED MICA: Mil type CM60B103K03	
C5 to C13		CAPACITOR, FIXED CERAMIC: Mil type CK63AY103X	5-10
C14		Not Used	
C15 to C17		Same as 1A1C5	
C18		Not Used	
C19 to C21		Same as 1A1C5	
C22		Not Used	
C23, C24		Same as 1A1C5	
C25		Not Used	
C26 to C28		Same as 1A1C5	
C29		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE51C470K	5-8
C30		Not Used	
C31		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE51C251F	
C32 to C34		Same as 1A1C5	5-10
C35		CAPACITOR, FIXED CERAMIC: 3PF NPO ±5%, 5000WVDC, MFR 14304, PN C15-0002-001	5-8
C36		CAPACITOR, FIXED MICA: Mil type CM06D751J03	
C37 to C48		Same as 1A1C5	5-10
C49, C50		CAPACITOR, FIXED PAPER: Mil type CP70E1FL504K1	5-9
C51		Same as 1A1C5	5-8
CR1, CR2		DIODE: Mil type 1N3611	5-7 5-9
CR3		DIODE: Mil type 1N3000B	5-7
CR4 to CR6		DIODE: Mil type 1N3002B	
CR7 to CR11		DIODE: Mil type 1N753A	
CR12		Same as 1A1CR1	
CR13		DIODE: Mil type 1N914	5-8
DS1 to DS4		Not Used	
DS5		LAMP, INCANDESCENT: Mil Type MS25237-327	
F1 to F3	1	FUSE, CARTRIDGE: Mil Type F60-6A or F60-15A	5-9
F4, F5		FUSE, CARTRIDGE: Mil type F02A250V1A	
F6		FUSE, CARTRIDGE: Mil type F02A250V3A	
F7		FUSE, CARTRIDGE: Mil type F02A250V1.5A	
J1		CONNECTOR, RECEPTACLE: Mil type UG-909A/U	5-7
J2		CONNECTOR, RECEPTACLE: Mil type UG-909B/U	5-9
J3		CONNECTOR, RECEPTACLE: 66 pin, Rectangular, MFR 14304, PN J10-0001-000	5-7
J4, J5		CONNECTOR, RECEPTACLE: 36 pin, MFR 14304, PN J10-0007-008	5-8
J6 to J11		CONNECTOR, RECEPTACLE: 1 pin, MFR 14304, PN J60-0002-213	5-7
J12		Same as 1A1J1	
K1		RELAY, SOLENOID: 24VDC, 4PDT, MFR 14304, PN K30-0001-003	5-9
K2		RELAY, SOLENOID: MFR 14304, PN K32-0002-001	5-7
K3		RELAY, SOLENOID: Mil type M5757-23-001	
L1		COIL, FIXED RF: MFR 14304, PN 8948-3307	5-8

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1 (Cont)			
L2		CHOKE, RF: Mil type MS16221-15	5-8
L3		CHOKE, RF: Mil type LT4K068	5-10
L4, L5		Same as 1A1L3	
L6		COIL, FIXED RF: MFR 14304, PN 391-3311	5-8
M1		METER, PANEL: MFR 14304, PN 391-3677	
MP1		PLUG, BUTTON: MFR 14304, PN Z24-0001-001	
MP2		Not Used	
MP3		POLARIZING KEY: MFR 14304, PN J10-0007-501	
MP4		KNOB: Mil type MS91528-1D2B	5-9
MP5		KNOB: Mil type MS91528-1P2B	5-7
MP6		Not Used	
MP7		KNOB: Mil type MS91528-3F2B	5-8
MP8		FILTER, AIR: MFR 14304, PN Z16-0001-000	5-9
MP9		TRANSMISSION ASSEMBLY: MFR 14304, PN 391-3250	5-10
MP10		CONTACT ASSEMBLY: MFR 14304, PN 391-3605	
P1 to P3		CONNECTOR, PLUG: Mil type UG-88E/U	5-9
P4, P5		Not Used	
P6		CONNECTOR, PLUG: MFR 14304, PN J20-0002-101	5-7
P7		CONNECTOR, PLUG: MFR 14304, PN J20-0002-201	
R1, R2		Not Used	
R3, R4		RESISTOR, FIXED FILM: Mil type RL20S512G	5-10
R5		RESISTOR, FIXED COMPOSITION: Mil type RC42GF222K	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC42GF182K	
R7, R8		RESISTOR, FIXED COMPOSITION: Mil type RC20GF101J	
R9		RESISTOR, VARIABLE: Mil type RA20LASB103A	5-7
R10		RESISTOR, VARIABLE: Mil type RA20NASD103A	5-9
R11, R12		Same as 1A1R9	5-7
R13		Same as 1A1R10	5-9
R14, R15		Not Used	
R16 to R19		RESISTOR, FIXED COMPOSITION: 2.2 ohms, ±5%, 1/2 watt, MFR 14304, PN R11-0001-001	5-10
R20		RESISTOR, FIXED COMPOSITION: Mil type RC20GF472J	5-8
R21		RESISTOR, FIXED COMPOSITION: Mil type RC42GF330K	
R22, R23		Not Used	
R24		RESISTOR, FIXED COMPOSITION: Mil type RC42GF150K	5-10
R25 to R28		RESISTOR, FIXED WIREWOUND: Mil type RWP20F10R0F	
S1		SWITCH, SENSITIVE: MFR 14304, S95-0001-000	5-9
S2		Not Used	
S3		SWITCH, TOGGLE: Mil type MS35059-31	
S4		Not Used	
S5		SWITCH, ROTARY: MFR 14304, PN 391-3673	5-7
S6		Same as 1A1S3	5-8
S7		SWITCH, ROTARY: MFR 14304, PN 391-3660	
S8		Not Used	
S9		SWITCH, INTERLOCK: Mil type MS16106-4	
T1		TRANSFORMER: MFR 14304, PN 6049-3010	
TB1		TERMINAL BOARD: Mil type 37TB6	
V1, V2		ELECTRON TUBE: MFR 14304, PN V12-0002-000	
XC1 to XC28		Not Used	
XC29		SOCKET, OCTAL: Mil type TS101P02	
XC30		Not Used	
XC31		Same as 1A1XC29	
XDS1 to XDS4		Not Used	
XDS5		LAMPHOLDER: Mil type LH73LC12RT	
XF1 to XF3		FUSEHOLDER: Mil type FHL12U	5-9

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1 (Cont)			
XF4		FUSEHOLDER: Mil type FHL17G	5-9
XF5		Same as 1A1XF1	
XF6		FUSEHOLDER: Mil type FHL18G2	
XF7		Same as 1A1XF1	
1A1A1		DRIVER TUBE ASSEMBLY: MFR 14304, PN 6049-3180	5-12
C1 to C14		Same as 1A1C5	
C15, C16		Not Used	
C17, C18		CAPACITOR, FIXED MICA: Mil type CM05D391J03	
C19		Same as 1A1C5	
C20		CAPACITOR, FIXED MICA: Mil type FD910J03	
CR1, CR2		Same as 1A1CR13	
L1		COIL, FIXED RF: MFR 14304, PN 391-3860	
L2		COIL, FIXED RF: MFR 14304, PN 6049-3149	
L3		COIL, FIXED RF: Mil type LT4K005	
L4 to L6		Same as 1A1L3	
MP1, MP2		TUBE CHIMNEY: MFR 14304, PN 391-3869	
R1, R2		RESISTOR, FIXED FILM: Mil type RL42S100G	
R3, R4		RESISTOR, FIXED FILM: Mil type RL20S103G	
R5		RESISTOR, FIXED COMPOSITION: Mil type RC07GF681K	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC20GF0470J	
R7		RESISTOR, FIXED COMPOSITION: Mil type RC20GF103K	
R8	NOT USED		
R9	NOT USED		
R10	NOT USED		
TB1		TERMINAL BOARD: 13 terminal, MFR 14304, PN E31-0004-013	
V1, V2		ELECTRON TUBE: MFR 14304, PN V12-0001-000	5-12
XV1, XV2		SOCKET, ELECTRON TUBE: MFR 14304, PN J30-0001-000	
1A1A2		FINAL TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3700	5-8 5-13
C1		CAPACITOR, FIXED CERAMIC: 25PF ±10%, 7500WVDC, MFR 14304, PN C15-0001-001	
C2		Not Used	
C3		CAPACITOR, FIXED CERAMIC: 50 PF ±10%, 7500WVDC, MFR 14304, PN C15-0001-002	
C4, C5		CAPACITOR, FIXED CERAMIC: 100PF ±10%, 5000WVDC, MFR 14304, PN C15-0001-003	
C6		Same as 1A1A2C1	
C7 to C9		Same as 1A1A2C3	
C10		Same as 1A1A2C1	
C11 to C17		Same as 1A1A2C3	
C18 to C20		Same as 1A1A2C4	
C21 to C24		Not Used	
C25		CAPACITOR, FIXED PORCELAIN: 750PF ±5%, 500WVDC, MFR 14304, PN C50-0001-046	
C26		CAPACITOR, FIXED PORCELAIN: 680PF ±5%, 500WVDC, MFR 14304, PN C50-0001-045	
C27		CAPACITOR, FIXED PORCELAIN: 910PF ±5%, 500WVDC, MFR 14304, PN C50-0001-048	
C28		CAPACITOR, FIXED PORCELAIN: 820PF ±5%, 500WVDC, MFR 14304, PN C50-0001-047	
C29		CAPACITOR, FIXED PORCELAIN: 330 PF ±5%, 500WVDC, MFR 14304, PN C50-0001-037	
C30		CAPACITOR, FIXED PORCELAIN: 430PF ±5%, 500WVDC, MFR 14304, PN C50-0001-040	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A1 (Cont			
C31		CAPACITOR, FIXED PORCELAIN: 300PF ±5%, 500WVDC MFR 14304, PN C50-0001-036	5-13
C32		CAPACITOR, FIXED PORCELAIN: 270PF ±5%, 500WVDC, MFR 14304, PN C50-0001-035	
C33		Same as 1A1A2C31	
C34		Same as 1A1A2C32	
C35, C36		CAPACITOR, FIXED PORCELAIN: 180PF ±5%, 500WVDC, MFR 14304, PN C50-0001-031	
C37		CAPACITOR, FIXED PORCELAIN: 150PF ±5%, 500WVDC, MFR 14304, PN C50-0001-029	
C38		CAPACITOR, FIXED CERAMIC: 200PF ±5%, 2500WVDC, MFR 14304, PN C11-0004-028	
C39		Not Used	
C40		CAPACITOR, FIXED CERAMIC: 180PF ±5%, 2500WVDC, MFR 14304, PN, C11-0004-029	
C41		Not Used	
C42 to C44		Same as 1A1A2C35	
C45 to C47		CAPACITOR, FIXED PORCELAIN: 110PF ±5%, 500WVDC, MFR 14304, PN C50-0001-026	
C48		Same as 1A1A2C37	
C49		CAPACITOR, FIXED PORCELAIN: 100PF ±5%, 500WVDC, MFR 14304, PN C50-0001-025	
C50, C51		Same as 1A1A2C45	
C52		Same as 1A1A2C37	
C53 to C56		CAPACITOR, FIXED PORCELAIN: 75PF ±5%, 500WVDC, MFR 14304, PN C50-0001-022	
C57		CAPACITOR, FIXED CERAMIC: 220PF ±5%, 2500WVDC, MFR 14304, PN C11-0004-009	
C58		CAPACITOR, FIXED CERAMIC: 300PF ±5%, 2500WVDC, MFR 14304, PN C11-0004-018	
C59		Same as 1A1A2C38	
C60 to C62		Not Used	
C63 to C66		CAPACITOR, FIXED PORCELAIN: 47PF ±5%, 500WVDC, MFR 14304, PN C50-0001-017	5-13
C67		Same as 1A1A2C38	
C68		Same as 1A1A2C40	
C69		Same as 1A1A2C57	
P1		Same as 1A1P1	
R1 to R8		RESISTOR, FIXED COMPOSITION: Mil type RC42GF273K	
S1		SWITCH ASSEMBLY: MFR 14304, PN 391-3732	
1A1A2A1		2-3 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3711	
1A1A2A2		2-3 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3712	
1A1A2A3		3-4 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3713	
1A1A2A4		3-4 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3714	
1A1A2A5		4-5 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3715	
1A1A2A6		5-6 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3716	
1A1A2A7		6-7 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3717	
1A1A2A8		7-8 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3718	
1A1A2A9		8-10 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3719	
1A1A2A10		10-12 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3720	
1A1A2A11		12-14 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3721	
1A1A2A12		14-16 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3722	
1A1A2A13		16-18 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3723	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A2A14		18-29 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3724	5-13
1A1A2A15		20-22 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3725	
1A1A2A16		22-24 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3726	
1A1A2A17		24-26 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3727	
1A1A2A18		26-28 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3728	
1A1A2A19		28-30 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3729	
1A1A3		VSWR BRIDGE ASSEMBLY: MFR 14304, PN 6049-3150	5-7 5-14
C1		CAPACITOR, FIXED MICA: Mil type CM05F361J03	
C2		Not Used	
C3, C4		CAPACITOR, FIXED CERAMIC: Mil type CK60AW102M	
C5		Not Used	
C6		CAPACITOR, VARIABLE GLASS: Mil type PC51H160	
CR1		Not Used	
CR2, CR3		Same as 1A1CR13	
J1		Same as 1A1J1	
J2		CONNECTOR, RECEPTACLE: Mil type UG-625B/U	
L1		COIL, FIXED RF: Mil type LT4K071	
L2		COIL, FIXED RF: Mil type LT4K029	
R1, R2		RESISTOR, FIXED FILM: Mil type RL32S560G	
R3, R4		Not Used	
R5, R6		RESISTOR, FIXED COMPOSITION: Mil type RC07GF101J	
R7, R8		Not Used	
R9		RESISTOR, FIXED COMPOSITION: Mil type RC20GF105J	
T1		TRANSFORMER, TOROID: MFR 14304, PN 391-3426	5-14
1A1A4		DRIVER TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3800	5-9 5-15
C1, C2		Same as 1A1C5	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC42GF102K	
S1		SWITCH ASSEMBLY: MFR 14304, PN 391-3830	
TB1		TERMINAL BOARD: 6 terminal, MFR 14304, PN E31-0004-006	
TP1		JACK, TEST: Mil type MS16108-2A	
1A1A4A1		2-2.5 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3807	
1A1A4A2		2.5-3 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3808	
1A1A4A3		3-4 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3809	
1A1A4A4		4-6 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3810	
1A1A4A5		6-8 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3811	
1A1A4A6		8-10 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3812	
1A1A4A7		10-12 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3813	
1A1A4A8		12-14 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3814	
1A1A4A9		14-16 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3815	
1A1A4A10		16-18 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3816	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A4A11		18-20 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3817	5-15
1A1A4A12		20-22 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3818	
1A1A4A13		22-24 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3819	
1A1A4A14		24-26 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3820	
1A1A4A15		26-28 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3821	
1A1A4A16		28-30 MC TRANSFORMER ASSEMBLY: MFR 14304, PN 391-3822	
1A1A5		KEYER OVERLOAD PCB ASSEMBLY: MFR 14304, PN 6049-3140	5-8 5-16
C1, C2		Same as 1A1A3C3	
C3		CAPACITOR, FIXED CERAMIC: Mil type CK62AW822M	
C4		CAPACITOR, FIXED TANTALUM: Mil type CS13BF105M	
CR1 to CR7		Same as 1A1CR1	
CR8, CR9		Same as 1A1CR7	
CR10, CR11		DIODE: Mil type 1N277	
CR12		Same as 1A1CR1	
CR13 to CR16		Same as 1A1A5CR10	
CR17, CR18		Same as 1A1CR1	
CR19		Same as 1A1A5CR10	
MP1		PC BOARD: MFR 14304, PN 6049-3141	
MP2, MP3		EXTRACTOR, PC BOARD: MFR 14304, PN Z13-0002-001	
Q1 to Q3		TRANSISTOR: Mil type 2N1613	
Q4		TRANSISTOR: Mil type 2N1132	
Q5		TRANSISTOR: Mil type 2N404	
Q6		TRANSISTOR: Mil type 2N398A	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC07GF222K	5-16
R2		Same as 1A1A1R5	
R3		RESISTOR, FIXED COMPOSITION: Mil type RC20GF101K	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC20GF391K	
R5		Same as 1A1A5R1	
R6, R7		RESISTOR, FIXED COMPOSITION: Mil type RC07GF101K	
R8		Same as 1A1A5R1	
R9, R10		RESISTOR, FIXED COMPOSITION: Mil type RC07GF472K	
R11		RESISTOR, FIXED COMPOSITION: Mil type RC07GF391K	
R12		RESISTOR, FIXED FILM: Mil type RL07S471J	
R13		RESISTOR, FIXED FILM: Mil type RL07S271J	
R14		Same as 1A1A5R9	
R15		RESISTOR, FIXED COMPOSITION: Mil type RC07GF102K	
R16		Same as 1A1A5R1	
R17, R18		Same as 1A1A5R15	
R19, R20		RESISTOR, FIXED COMPOSITION: Mil type RC07GF181K	
R21		Same as 1A1A5R1	
R22		RESISTOR, FIXED COMPOSITION: Mil type RC07GF471K	
R23, R24		Same as 1A1A5R15	
TP1		JACK, TEST: MFR 14304, PN J60-0001-008	
TP2		JACK, TEST: MFR 14304, PN J60-0001-002	
TP3		JACK, TEST: MFR 14304, PN J60-0001-006	
TP4		JACK, TEST: MFR 14304, PN J60-0001-007	
TP5		JACK, TEST: MFR 14304, PN J60-0001-004	
TP6		JACK, TEST: MFR 14304, PN J60-0001-010	
1A1A6		PPC-TGC- BIAS PCB ASSEMBLY: MFR 14304, PN 6049-3130	5-8 5-17

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A6 (Cont)			
C1 to C3		Same as 1A1A3C3	5-17
C4, C5		CAPACITOR, FIXED TANTALUM: Mil type CS13BD157K	
C6		CAPACITOR, FIXED MICA: Mil type CM06DC182J	
C7		Same as 1A1A3C3	
CR1 to CR4		Same as 1A1CR1	
CR5, CR6		DIODE: Mil type 1N3033B	
CR7 to CR9		Same as 1A1CR13	
CR10 to CR12		Not Used	
CR13, CR14		Same as 1A1CR13	
CR15, CR16		Same as 1A1CR1	
CR17		DIODE: Mil type 1N4728	
CR18 to CR20		Same as 1A1CR1	
MP1		PC BOARD: MFR 14304, PN 6049-3131	
MP2, MP3		Same as 1A1A5MP2	
Q1, Q2		Same as 1A1A5Q1	
Q4		Same as 1A1A5Q6	
Q5 to Q9		Same as 1A1A5Q1	
Q10		Same as 1A1A5Q4	
Q11, Q12		Same as 1A1A5Q1	
Q13		TRANSISTOR: Mil type 2N404A	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC07GF223K	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC07GF682K	
R3		RESISTOR, FIXED COMPOSITION: Mil type RC07GF473K	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC42GF682K	
R5		RESISTOR, FIXED COMPOSITION: Mil type RC07GF273K	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC07GF103K	
R7		RESISTOR, FIXED COMPOSITION: Mil type RC07GF333K	
R8		Same as 1A1A6R5	5-17
R9		Same as 1A1A5R9	
R10		Same as 1A1A6R3	
R11		RESISTOR, FIXED COMPOSITION: Mil type RC07GF272K	
R12		Same as 1A1A5R9	
R13		RESISTOR, FIXED COMPOSITION: Mil type RC07GF822K	
R14		Same as 1A1A6R7	
R15		RESISTOR, FIXED COMPOSITION: Mil type RC07GF104K	
R16		RESISTOR, FIXED FILM: Mil type RL07S103J	
R17		RESISTOR, FIXED FILM: Mil type RL07S102J	
R18, R19		RESISTOR, FIXED FILM: Mil type RL07S332J	
R20		Same as 1A1A6R13	
R21		Same as 1A1A5R15	
R22		RESISTOR, FIXED COMPOSITION: Mil type RC07GF152K	
R23		RESISTOR, FIXED FILM: Mil type RL07S333J	
R24		RESISTOR, FIXED FILM: Mil type RL07S183G	
R25		Same as 1A1A6R18	
R26		RESISTOR, FIXED FILM: Mil type RL07S223J	
R27		Same as 1A1A6R13	
R28		RESISTOR, FIXED FILM: Mil type RL07S223G	
R29		Same as 1A1A5R1	
R30, R31		Same as 1A1A6R1	
R32 to R38		Same as 1A1A5R1	
R39		RESISTOR, FIXED COMPOSITION: Mil type RC07GF390K	
R40		Same as 1A1A5R6	
R41		Same as 1A1A5R1	
R42		Same as 1A1A6R6	
R43		Same as 1A1A6R5	
R44		Same as 1A1A5R15	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A1A6(Cont)			
R45		RESISTOR, FIXED COMPOSITION: Mil type RC07GF822K	5-17
R46		Same as 1A1A5R15	
TP1		Same as 1A1A5TP1	
TP2		Same as 1A1A5TP2	
TP3		Same as 1A1A5TP3	
TP4		Same as 1A1A5TP4	
TP5		Same as 1A1A5TP5	
TP6		Same as 1A1A5TP6	
TP7		JACK, TEST: MFR 14304, PN J60-0001-012	
1A1A7		METER RESISTOR PCB ASSEMBLY: MFR 14304, PN 6049-3414	5-9 5-18
MP1		PC BOARD: MFR 14304, PN 6049-3415	
R1 to R4		RESISTOR, FIXED COMPOSITION: Mil type RC42GF104K	
R5, R6		Not Used	
R7, R8		RESISTOR, FIXED FILM: Mil type RL42S155G	
R9		Same as 1A1A1R7	
R10 to R12		Not Used	
R13, R14		Same as 1A1A7R7	
R15		Same as 1A1A1R7	
R16		RESISTOR, FIXED FILM: Mil type RL32S474G	
R17 to R20		RESISTOR, FIXED FILM: Mil type RL32S514G	
R21		Same as 1A1A1R7	
R22		Same as 1A1A7R17	
1A1A8		DUAL AMPLIFIER ASSEMBLY: MFR 14304, PN 6049-3190	5-9
C1		CAPACITOR, FIXED CERAMIC: Mil type CK70AW152M	
J1		CONNECTOR, RECEPTACLE: Mil type UG-1098/U	
J2, J3		Same as 1A13J2	
1A1A8A1		DUAL AMPLIFIER PCB ASSEMBLY: MFR 14304, PN 6049-3196	
MP1		PC BOARD: MFR 14304, PN 6049-3197	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC20GF121K	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC07GF361J	5-9
R3, R4		RESISTOR, FIXED COMPOSITION: Mil type RC07GF470J	
Z1, Z2		WIDE BAND AMPLIFIER: MFR 14304, PN 6049-3189	
1A1XV1/XV2		TUBE SOCKET ASSEMBLY: PN None	5-11
H1 to H12		NUT, HEX, LARGE PATTERN: No. 4-40 UNC-2B, MFR 14304, PN J30-0002-003	
H13 to H24		SCREW, MACHINE, BINDING HEAD, CROSS RECESSED: No. 4-40 UNC-2A, 1.75 In. long, MFR 14304, PN J30-0002-006	
H25 to H36		LOCKWASHER, SPLIT, LIGHT SERIES: No. 4, MFR 14304, PN J30-0002-007	
H37 to H48		WASHER, FLAT, FIBER: .03 thick x .31 OD x .12ID, MFR 14304, PN J30-0002-009	
H49 to H60		WASHER, PLAIN, NICKEL PLATED BRASS: .03 thick x .31OD x .12ID, MFR 14304, PN J30-0002-010	
MP1 to MP24		SPACER, CERAMIC: MFR 14304, PN J30-0002-001	
MP25 to MP36		BUSHING, CERAMIC: MFR 14304, PN J30-0002-002	
MP37 to MP44		SPACER, SILVER PLATE: MFR 14304, PN J30-0002-004	
MP45, MP46		BASE: MFR 14304, PN J30-0002-005	
MP47 to MP78		CONTACT FINGER: MFR 14304, PN J30-0002-008	
MP79 to MP90		SPACER: MFR 14304, PN 391-3488	
1A2		CASE ASSEMBLY: MFR 14304, PN 6049-3400	5-19
FL1/J5		FILTER, INPUT: MFR 14304, PN 391-2300	5-5 5-19

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
1A2(Cont)			
J1		CONNECTOR, RECEPTACLE: Mil type MS3102R28-17S	5-5
J2		Not Used	
J3		CONNECTOR, RECEPTACLE: Mil type UG-556B/U	
J4 to J8		Not Used	
J9, J10		Same as 1A1J1	
P1, P2		Same as 1A1P1	5-19
P3		CONNECTOR, PLUG: MFR 14304, PN 391-2405	
P4		Same as 1A1P1	
S1, S2		Same as 1A1S9	
1A2A1		FILTER BOX ASSEMBLY: MFR 14304, PN 6049-3420	
C1 to C29		Same as 1A1A8C1	
J1 to J6		Not Used	
J7		CONNECTOR, RECEPTACLE: Mil type MS3102R28-21S	5-5
2		POWER SUPPLY PP-6067/FRT: MFR 14304, PN 6049-3500	5-20
2A1		CHASSIS-PANEL ASSEMBLY: MFR 14304, PN 6049-3700	
C1		CAPACITOR, FIXED PAPER: 25UF ±10%, 600WVDC, MFR 14304, PN C30-0001-000	
C2, C3		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE71C142G	
CR1		RECTIFIER BRIDGE: MFR 14304, PN D22-5001-000	
CR2, CR3		RECTIFIER BRIDGE: MFR 14304, PN 8948-4015	
CR4 to CR7		DIODE: MFR 14304, PN D22-0004-001	
CR8 to CR11		DIODE: Mil type 1N3611	
DS1		LAMP, NEON: Mil type MS25252NE2D	
F1		FUSE, CARTRIDGE: Mil type F03A250V8AS	
F2		FUSE, CARTRIDGE: Mil type F02A250V1.5A	
Q1, Q2		TRANSISTOR: Mil type 2N1412	
R1, R2		RESISTOR, FIXED COMPOSITION: Mil type RC42GF100K	
R3, R4		RESISTOR, FIXED COMPOSITION: Mil type RC20GF682K	5-20
R5, R6		Same as 2A1R1	
S1		SWITCH, THERMAL: MFR 14304, PN S70-0002-000	
S2 to S4		SWITCH, INTERLOCK: Mil type MS16106-4	
T1		TRANSFORMER, TOROID: MFR 14304, PN 391-8405	
TB1		TERMINAL BOARD: Mil type 37TB24	
XDS1		LAMPHOLDER: Mil type LH74LC13CN	
XF1		FUSEHOLDER: MFR 14304, PN J50-0004-002	
XF2		FUSEHOLDER: MFR 14304, PN J50-0004-001	
2A1A1		BLEEDER RESISTOR ASSEMBLY: MFR 14304, PN 391-8111	
MP1		TERMINAL BOARD: MFR 14304, PN 391-8110	
R1, R2		RESISTOR, FIXED COMPOSITION: Mil type RC42GF683K	
R3 to R7		RESISTOR, FIXED COMPOSITION: Mil type RC42GF224K	
2A2		CASE ASSEMBLY: MFR 14304, PN 6049-3600	
J1		CONNECTOR, RECEPTACLE: Mil type MS3102R28-17P	
L1		CHOKE-FILTER: MFR 14304, PN 6049-3105	
P1	2	PLUG, 220V JUMPER: MFR 14304, PN 6049-3610	
P2	2	PLUG, 460V JUMPER: MFR 14304, PN 391-8300	
T1/T2		CASE AND TRANSFORMER ASSEMBLY: MFR 14304, PN 6049-3507	
TB1		Same as 2A1TB1	
7		BOX, INTERCONNECTING J-2822/FRT-84(V): MFR 14304, PN 6049-2700	5-5

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
7A1		CHASSIS ASSEMBLY: MFR 14304, PN 6049-2710	5-5 5-21
DS1, DS2		LAMP INCANDESCENT: Mil type MS25237-327	
J1		CONNECTOR, RECEPTACLE: Mil type MS3102R20-29S	
J2		CONNECTOR, RECEPTACLE: Mil type MS3102R22-14S	
J3		CONNECTOR, RECEPTACLE: Mil type MS3102R24-28S	
J4		CONNECTOR, RECEPTACLE: Mil type MS3102R28-11S	
M1, M2		METER: MFR 14304, PN 6049-2530	
XDS1		LAMPHOLDER: Mil type LH73LC12WT	
XDS2		LAMPHOLDER: Mil type LH73LC12RT	
7A1A1		RETAINER ASSEMBLY, CIRCUIT BOARD: MFR 14304, PN 6049-2750	
J1, J2		CONNECTOR, RECEPTACLE: Mil type M21097/6-48	
7A1A1A1		FAULT LOGIC PC BOARD ASSEMBLY: MFR 14304, PN 6049-2756	5-22
CR1 to CR12		DIODE: Mil type 1N3611	
K1		RELAY, REED: MFR 14304, PN 6049-6210-1	
K2		RELAY, REED: MFR 14304, PN 6049-6210-2	
K3		Same as 7A1A1A1K1	
K4		Same as 7A1A1A1K2	
K5		Same as 7A1A1A1K1	
MP1		PC BOARD: MFR 14304, PN 6049-2557	
MP2, MP3		EXTRACTOR, PC BOARD: MFR 14304, PN Z03-0003-001	
TP1		JACK, TEST: MFR 14304, PN J60-0001-004	
TP2		JACK, TEST: MFR 14304, PN J60-0001-005	
TP3		JACK, TEST: MFR 14304, PN J60-0001-001	
TP4		JACK, TEST: MFR 14304, PN J60-0001-007	
TP5		JACK, TEST: MFR 14304, PN J60-0001-003	
TP6		JACK, TEST: MFR 14304, PN J60-0001-006	5-22
TP7		JACK, TEST: MFR 14304, PN J60-0001-008	
TP8		JACK, TEST: MFR 14304, PN J60-0001-012	
TP9		JACK, TEST: MFR 14304, PN J60-0001-010	
TP10		Same as 7A1A1A1TP6	
TP11		Same as 7A1A1A1TP4	
TP12		Same as 7A1A1A1TP8	
TP13		Same as 7A1A1A1TP7	
TP14		JACK, TEST: MFR 14304, PN J60-0001-002	
TP15		JACK, TEST: MFR 14304, PN J60-0001-013	
TP16		Same as 7A1A1A1TP3	
7A1A1A2		TUNE LOGIC PC BOARD ASSEMBLY: MFR 14304, PN 6049-2758	5-21 5-23
CR1 to CR4		Same as 7A1A1A1CR1	
CR5		Not Used	
CR6 to CR8		Same as 7A1A1A1CR1	
K1 to K3		Same as 7A1A1A1K2	
MP1		PC BOARD: MFR 14304, PN 6049-2759	
MP2, MP3		Same as 7A1A1A1MP2	
TP1		Same as 7A1A1A1TP8	
TP2		Same as 7A1A1A1TP3	
TP3		Same as 7A1A1A1TP2	
TP4		Same as 7A1A1A1TP5	
TP5		Same as 7A1A1A1TP14	
TP6		Same as 7A1A1A1TP4	
TP7		Same as 7A1A1A1TP1	
TP8		Same as 7A1A1A1TP15	
TP9		Not Used	
TP10		Same as 7A1A1A1TP2	
TP11		Same as 7A1A1A1TP3	
TP12		Same as 7A1A1A1TP15	
TP13		JACK, TEST: MFR 14304, PN J60-0001-009	
TP14		Same as 7A1A1A1TP4	
TP15		Same as 7A1A1A1TP6	
7A1A2		FILTER BRACKET ASSEMBLY: MFR 14304, PN 6049-2714	5-21
C1		Not Used	
C2 to C6		CAPACITOR, FIXED CERAMIC: Mil type CK70AW152M	
C7		Not Used	
C8 to C12		Same as 7A1A1C2	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
7A1A2(Cont)			
C13		Not Used	
C14 to C18		Same as 7A1A2C2	5-21
C19		Not Used	
C20, C21		Same as 7A1A2C2	
C22		Not Used	
C23 to C33		Same as 7A1A2C2	
C34		Not Used	
C35		Same as 7A1A2C2	
C36 to C37		Not Used	
C38 to C41		Same as 7A1A2C2	
7A1A3		RELAY BRACKET ASSEMBLY: MFR 14304, PN 6049-2520	
K1 to K3		RELAY, SOLENOID: Mil type M5757-15-001	
K4		RELAY, THERMAL: Mil type M19648-1-021	
8		ENCLOSURE ASSEMBLY: MFR 14304, PN 6049-2100	5-5
P1		CONNECTOR, PLUG: Mil type UG-536B/U	
P2, P3		CONNECTOR, PLUG: Mil type UG-88E/U	
P5, P6		Not Used	
P7		CONNECTOR, PLUG: Mil type MS3106A22-14P	
P8		CONNECTOR, PLUG: Mil type MS3106A24-28P	
P9		CONNECTOR, PLUG: Mil type MS3106A28-11P	
P10		CONNECTOR, PLUG: Mil type MS3108B20-19S	
P11		CONNECTOR, PLUG: Mil type MS3106A28-21P	
P12		CONNECTOR, PLUG: Mil type MS23329/3-03	
P13, P14		Not Used	
P15		CONNECTOR, PLUG: Mil type MS3116E20-39SX	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC42GF394J	5-6
TF*		AUTOTRANSFORMER: MFR 14304, PN 6049-5101	
TB1		TERMINAL BOARD: Mil type 37TB2	
TB2		TERMINAL BOARD: Mil type 37TB4	
TB3A to TB3G		TERMINAL BOARD: MFR 14304, PN E31-0008-001	

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
TB3H		TERMINAL BOARD: MFR 14304, PN E31-0008-004	5-6
TB3I		Not Used	
TB3J, TB3K		Same as 8TB3H	
TB4		TERMINAL BOARD: Mil type 37TB28	
8A1		CIRCUIT BREAKER FRONT PANEL ASSEMBLY: MFR 14304, PN 6049-1210	
CB1		CIRCUIT BREAKER: MFR 14304, PN6049-1043	
CB2		CIRCUIT BREAKER: MFR 14304, PN 6049-5705	
CB3*			
8A2		Not Used	
8A3		OUTLET STRIP: MFR 14304, PN 6049-2031	5-5
8A4		BLOWER ASSEMBLY: MFR 14304, PN 6049-1054	
B1		BLOWER: Mil type FC1S6CA10-0A	
C1, C2		CAPACITOR, FIXED PAPER: Mil type CP53B1EF205K1	
F1		FUSE, CARTRIDGE: Mil type M23419/1-015	
P1		CONNECTOR, PLUG: Mil type MS3116F8-4S	
XF1		FUSEHOLDER: Mil type M19207/26-0001	
8W1		CABLE ASSEMBLY: MFR 14304, PN 6049-1019	
P1		CONNECTOR, PLUG: MFR 14304, PN W80-0001-000	
P2		CONNECTOR, PLUG: Mil type MS3108B14S7S	
8W2, 8W3		Same as 8W1	
8W4		CABLE ASSEMBLY: MFR 14304, PN 399-0027	
P1		CONNECTOR, PLUG: Mil type 10-109628-17P	
P2		CONNECTOR PLUG: Mil type 10-109628-17S	
8W5		CABLE ASSEMBLY: MFR 14304, PN 6049-0030	
P1		Same as 8P1	
P2		Same as 8P12	
8W6		CABLE ASSEMBLY: MFR 42498, PN D45336G1	

* SEE PAGE 6-27

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
8W7		CABLE ASSEMBLY: MFR 42498, PN D45336G3	5-5
8W8		CABLE ASSEMBLY: MFR 42498, PN D45336G2	
9		AMPLIFIER, RADIO FREQUENCY AM-6047/FRT-84(V): MFR 14304, PN 6049-6000	
C1		Not Used	
C2		CAPACITOR, FIXED CERAMIC: Mil type 6049-6116	5-24
CB1		CIRCUIT BREAKER: MFR 14304, PN 6049-5706-1	5-25
CB2		CIRCUIT BREAKER: MFR 14304, PN 6049-5705	
CB3		CIRCUIT BREAKER: MFR 14304, PN 6049-5707	
CB4		Same as 9CB2	
CB5		CIRCUIT BREAKER: MFR 14304, PN 6049-5706-2	
J1		CONNECTOR, RECEPTACLE: Mil type UG-909A/U	5-24
J2		CONNECTOR, INPUT, RF: MFR 14304, PN 6049-5214	5-29
J3		Same as 9J1	5-24
P1		CONNECTOR, PLUG: MFR 14304, PN J20-0003-206	5-28
P2		CONNECTOR, PLUG: MFR 14304, PN 6049-5215	
P3		CONNECTOR, PLUG: Mil type M23329/3-02	5-24
P4		CONNECTOR, PLUG: MFR 14304, PN J20-0003-202	5-25
P5		CONNECTOR, PLUG: Mil type M23329/3-03	5-28
P6		Same as 9P2	5-29
P7		CONNECTOR, PLUG: Mil type MS3116F14-5S	5-28
T1		TRANSFORMER, PLATE: MFR 14304, PN 6049-5100	5-24
TB1		TERMINAL BOARD: Mil type 37TB28	
TB2A		TERMINAL BOARD: MFR 14304, PN E31-0005-101	
TB2B		TERMINAL BOARD: MFR 14304, PN E31-0005-004	5-24
TB2C		TERMINAL BOARD: MFR 14304, PN E31-0008-001	
9A1		POWER AMPLIFIER ASSEMBLY: MFR 14304, PN 6049-7100-1	
B1		BLOWER: MFR 14304, PN 6049-5500	5-28
C1		CAPACITOR, FIXED MICA: Mil type CB50RD102G	5-30
C2		Same as 9A1C1	
C3		CAPACITOR, FIXED MICA: Mil type CM06DD561JP3	5-32
C4		CAPACITOR, VARIABLE: 15 to 1500PF, 5KV, MFR 14304, PN 6049-6113	5-29
C5		CAPACITOR, FIXED CERAMIC: 5PF, ±10%, MFR 14304, PN 6049-6115	5-31
C6		CAPACITOR, VARIABLE: 50 to 2600PF, 5KV, MFR 14304, PN 6049-6112	5-29
C7		CAPACITOR, FIXED CERAMIC: 100PF, MFR 14304, PN 6049-6107	5-31
C8		CAPACITOR, VARIABLE: 20 to 1500PF, 10KV, MFR 14304, PN 6049-6111	
C9		CAPACITOR, FIXED CERAMIC: 1000PF, ±20%, MFR 14304, PN 6049-6104	
C10		CAPACITOR, FIXED CERAMIC: 2000PF, ±20%, MFR 14304, PN 6049-6106	
C11		CAPACITOR, FIXED CERAMIC: .01UF, +60% -20%, MFR 14304, PN 6049-6105	5-32
C12 to C14		Same as 9A1C11	
C15, C16		Same as 9A1C3	
C17	3	CAPACITOR, FIXED MICA: Mil type CM05DD___JP3	5-30
C18		Same as 9A1C3	5-32

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1 (Cont)			
C19		CAPACITOR, FIXED MICA: Mil type CM05DD240JP3	5-30
C20		CAPACITOR, FIXED CERAMIC: Mil type CK63AW103M	
C21		Same as 9A1C20	
C22		CAPACITOR, COAX: MFR 14304, PN 6049-6108	5-29
C23		CAPACITOR, FIXED CERAMIC: 36PF, ±10%, MFR 14304, PN 6049-6114	
C24		Same as 9A1C23	
C25		CAPACITOR, FIXED CERAMIC: 100PF, ±10%, MFR 14304, PN 6049-6117	
C26		Same as 9A1C23	
C27		CAPACITOR, FIXED MICA: Mil type CM05DD510JP3	5-30
C28		Same as 9A1C27	
C29		CAPACITOR, FIXED MICA: Mil type CM06DD161JP3	5-32
C30		Same as 9A1C29	
C31		CAPACITOR, FIXED MICA: Mil type CM05DD430JP3	5-30
C32		Same as 9A1C27	
C33		CAPACITOR, FIXED MICA: Mil type CM05DD620JP3	
DS1		LAMP, INCANDESCENT: Mil type MS25237-327	5-31
DS2		Same as 9A1DS1	
J1		Same as 9J1	
J2		CONNECTOR, RECEPTACLE: MFR 14304, PN J20-0003-005	
J3		Not Used	
J4		CONNECTOR, RECEPTACLE: Mil type UG-625B/U	5-29
J5		Not Used	
J6		CONNECTOR, RECEPTACLE: Mil type UG-290A/U	
J7		Same as 9A1J2	5-28
L1		COIL: Mil type MS75054-5	
L2		Same as 9A1L1	
L3		COIL: 64UH, MFR 14304, PN 6049-6034	5-29
L4		CHOKE ASSEMBLY: MFR 14304, PN 6049-5365	5-29
L5		COIL: 17UH, MFR 14304, PN 6049-6035	
L6		Same as 9A1L4	5-30
L7		COIL: 12UH, MFR 14304, PN 6049-6036	5-29
L8		COIL: MFR 14304, PN 6049-6012	
L9		COIL: MFR 14304, PN 6049-6014	5-31
L10		Same as 9A1L4	
L11		COIL: MFR 14304, PN 6049-6516-1	5-30
L12		COIL: MFR 14304, PN 6049-6093	5-29
L13		COIL SERIES: MFR 14304, PN 6049-6508-7	
L14		COIL: MFR 14304, PN W80-0001-014	5-30
L15		Same as 9A1L12	
M1		METER: MFR 14304, PN 6049-5216	5-31
M2		METER: MFR 14304, PN 6049-5217	
MP1		KNOB: Mil type MS91528-2N2BC	
MP2		Same as 9A1MP1	
P1		Not Used	
P2		CONNECTOR, PLUG: Mil type UG-88E/U	5-29
P3		CONNECTOR PLUG: Mil type MS3116F12-10S	
P4		Not Used	
P5, P6		Same as 9P1	
P7		Not Used	
P8		Same as 9A1P3	5-31
P9	4	CONNECTOR, PLUG: MFR 70998, PN 7500-076	5-28
P10	4	Same as 9A1P9	
P11		CONNECTOR, PLUG: Mil type MS3116F14-15S	5-29
P12		Same as 9A1P11	
P13		CONNECTOR, PLUG: MFR 14304, PN J20-0003-106	
R1, R2		Not Used	
R3		RESISTOR: 100OHMS, ±10%, MFR 14304, PN R90-0003-015	5-31
R4		RESISTOR, FIXED COMPOSITION: Mil type RC32GF104J	5-30
R5		Not Used	

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1 (Cont)			
R6		RESISTOR: 15 OHMS, ±10%, MFR 14304, PN R90-0003-028	5-30
R7 to R9		Not Used	
R10		RESISTOR: 50OHMS, ±10%, MFR 14304, PN R90-0003-011	5-31
S1		SWITCH, INTERLOCK: Mil type MS16106-4	5-31
S2 to S5		Same as 9A1S1	5-28 5-30 5-31
S6		SWITCH, AIRFLOW: MFR 14304, PN 6049-5220	5-31
T1		TRANSFORMER: MFR 14304, PN 6049-5102	5-30
TB1 to TB6		Not Used	
TB7		TERMINAL BOARD: Mil type 37TB10	5-29
TB8		Same as 9A1TB7	
TB9		Not Used	
TB10		Same as 9A1TB7	5-29
V1		ELECTRON TUBE: MFR 14304, PN V12-0003-001	5-31
XDS1		LAMPHOLDER: Mil type LH73LC12YT	
XDS2		LAMPHOLDER: Mil type LH73LC12RT	5-31
XV1		SOCKET, TUBE: MFR 14304, PN J30-0004-001	5-32
9A1A1		PEAK AVERAGE DETECTOR ASSEMBLY: MFR 14304, PN 6049-5060	5-31
J1		CONNECTOR, RECEPTACLE: Mil type MS3112E12-10P	
R1		RESISTOR, VARIABLE: Mil type RV4LAYSD502A	
R2		Same as 9A1A1R1	
R3		RESISTOR, VARIABLE: Mil type RV4LAYSD253A	
R4		RESISTOR, VARIABLE: Mil type RV4LAYSD104A	
S1		SWITCH, ROTARY: 1 section, 4P3T, MFR 14304, PN 6049-4544	
S2		SWITCH, ROTARY: MFR 14304, PN 392-6118	
9A1A1A1		PEAK AVERAGE WATT-METER PC BOARD ASSEMBLY: MFR 14304, PN 6049-5054	5-31 5-33

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
C1		CAPACITOR, FIXED MICA: Mil type CM06DC471JM3	5-33
C2		CAPACITOR, FIXED MICA: Mil type CM05DC200JP3	
C3, C4		Same as 9C1	
C5		CAPACITOR, FIXED MICA: Mil type CM06DC472JM3	
C6		CAPACITOR, FIXED MICA: Mil type CM05DC201JP3	
C7		Same as 9C1	
C8		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE11C050F	
C9 to C11		Same as 9C1	
C12		Same as 9A1A1A1C8	
C13 to C17		Same as 9C1	
C18		CAPACITOR, FIXED MICA: Mil type CM06DC102JP3	
CR1		DIODE: Mil type 1N914	
CR2 to CR11		Same as 9A1A1A1CR1	
CR12		DIODE: Mil type 1N277	
CR13		Same as 9A1A1A1CR12	
CR14 to CR16		Same as 9A1A1A1CR1	
CR17, CR18		Same as 9A1A1A1CR12	
CR19, CR20		Same as 9A1A1A1CR1	
IC1		INTEGRATED CIRCUIT: MFR 14304, PN 6049-6205	
IC2		Same as 9A1A1A1IC1	
MP1		PC BOARD: MFR 14304, PN 6049-5055	
Q1		TRANSISTOR: Mil type 2N404	
Q2		TRANSISTOR: Mil type 2N697	
Q3		Same as 9A1A1A1Q2	
Q4, Q5		Same as 9A1A1A1Q1	
Q6, Q7		Same as 9A1A1A1Q2	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC20GF472J	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC20GF152J	5-33

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A1A1 (Cont)			
R3		RESISTOR, FIXED COMPOSITION: Mil type RC20GF103J	5-33
R4		RESISTOR, FIXED COMPOSITION: Mil type RC20GF560J	
R5		RESISTOR, FIXED FILM: MIL type RN65D2741F	
R6		RESISTOR, FIXED FILM: Mil type RN65D1002F	
R7		RESISTOR, FIXED FILM: Mil type RN65D90R9F	
R8		RESISTOR, FIXED FILM: Mil type RN65D1272F	
R9		RESISTOR, FIXED FILM: Mil type RN65D7320F	
R10		RESISTOR, FIXED FILM: Mil type RN65D2742F	
R11		RESISTOR, FIXED FILM: Mil type RN65D2431F	
R12		RESISTOR, FIXED FILM: Mil type RN65D1912F	
R13		RESISTOR, FIXED FILM: Mil type RN65D3651F	
R14		RESISTOR, FIXED FILM: Mil type RN65D5110F	
R15		Same as 9A1A1A1R6	
R16		RESISTOR, FIXED FILM: Mil type RN65D1022F	
R17		RESISTOR, FIXED COMPOSITION: Mil type RC20GF392J	
R18		RESISTOR, FIXED FILM: Mil type RN65D7681F	
R19		Same as 9A1A1A1R2	
R20		Same as 9A1A1A1R4	
R21		RESISTOR, FIXED COMPOSITION: Mil type RC20GF105J	
R22		RESISTOR, FIXED FILM: Mil type RN65D7871F	5-33
R23		RESISTOR, FIXED FILM: Mil type RN65D4220F	5-33
R24		Same as 9A1A1A1R6	
R25		RESISTOR, FIXED FILM: Mil type RN65D1913F	
R26		RESISTOR, FIXED FILM: Mil type RN65D1102F	
R27		RESISTOR, FIXED FILM: Mil type RN65D5232F	
R28		Same as 9A1A1A1R26	
R29		RESISTOR, FIXED FILM: Mil type RN65D5231F	
R30		RESISTOR, FIXED FILM: Mil type RN65D4422F	
R31		RESISTOR, FIXED FILM: Mil type RN65D2211F	
R32		RESISTOR, FIXED FILM: Mil type RN65D2942F	
R33		RESISTOR, FIXED FILM: Mil type RN65D9532F	
R34		RESISTOR, FIXED FILM: Mil type RN65D1651F	
R35		RESISTOR, FIXED FILM: Mil type RN65D1742F	
R36		RESISTOR, FIXED FILM: Mil type RN65D1331F	
R37		RESISTOR, FIXED FILM: Mil type RN65D8251F	
R38		RESISTOR, FIXED FILM: Mil type RN65D1151F	
R39		Same as 9A1A1A1R17	
R40		RESISTOR, FIXED COMPOSITION: Mil type RC20GF681J	
R41		Same as 9A1A1A1R17	
R42		RESISTOR, FIXED COMPOSITION: Mil type RC20GF273J	
R43		RESISTOR, FIXED FILM: Mil type RN65D2492F	5-33

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A1A1 (Cont)			
R44		RESISTOR, FIXED COMPOSITION: Mil type RC20GF182J	5-33
R45		Same as 9A1A1A1R18	5-33
9A1A2		DIRECTIONAL COUPLER ASSEMBLY: MFR 14304, PN 6049-6800	5-28
9A1A3		TUNE DETECTOR ASSEMBLY: MFR 14304, PN 6049-5600	5-29 5-30
J1		CONNECTOR, RECEPTACLE: Mil type MS3112E12-10P	5-29
9A1A3A1		TUNE DETECTOR PC BOARD ASSEMBLY: MFR 14304, PN 6049-5604	5-30 5-34
C1		CAPACITOR, FIXED MICA: Mil type CM05DD271JP3	
C2		Same as 9A1A3A1C1	
C3		CAPACITOR, FIXED CERAMIC: Mil type CK60AW102M	
C4 to C14		Same as 9A1A3A1C3	
CR1		DIODE: Mil type 1N3064	
CR2 to CR4		Same as 9A1A3A1CR1	
L1		COIL, VARIABLE: 1.98 to 2.42UH, MFR 14304, PN L11-0004-017	
L2		COIL, VARIABLE: .090 to .110UH, MFR 14304, PN L11-0004-001	
L3		Same as 9A1A3A1L1	
L4		CHOKE, RF: Mil type LT4K290	
L5 to L7		Same as 9A1A3A1L4	
L8	3	CHOKE, RF: Value selected from: LT4K099 LT4K097 LT4K212	
MP1		PC BOARD: MFR 14304, PN 6049-5605	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC07GF910J	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC07GF820J	
R3		RESISTOR, FIXED COMPOSITION: RC07GF101J	
R4		Same as 9A1A3A1R1	
R5		RESISTOR, FIXED COMPOSITION: Mil type RC07GF182J	5-34

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
R6		RESISTOR, FIXED COMPOSITION: Mil type RC07GF152J	5-34
R7		RESISTOR, FIXED COMPOSITION: Mil type RC07GF472J	
R8 to R10		Same as 9A1A3A1R7	
R11		RESISTOR, FIXED COMPOSITION: Mil type RC07GF333J	
R12 to R14		Same as 9A1A3A1R11	
T1		TRANSFORMER: MFR 14304, PN 6049-5609	5-34
9A1A4		FILAMENT CHOKE ASSEMBLY: MFR 14304, PN 6049-5150	5-30
9A1A5		DC AMPLIFIER ASSEMBLY: MFR 14304, PN 6049-6200	5-29
J1		CONNECTOR, RECEPTACLE: Mil type M21097/4-25	
J2, J3		Same as 9A1A5J1	
J4		Same as 9A1J4	5-29
J5		JACK, TIP: Mil type MS16108-2A	5-31
M1		METER: MFR 14304, PN 6049-6216	
MP1		KNOB: Mil type MS91528-1F2B	5-31
Q1		TRANSISTOR: Mil type 2N297A	5-29
Q2 to Q8		Same as 9A1A5Q1	
R1		RESISTOR, VARIABLE: Mil type RV4LAYSD502B	
R2		RESISTOR, VARIABLE: Mil type RV4LAYSD501B	
R3		RESISTOR, VARIABLE: Mil type RV4LAYSD252B	
R4		Same as 9A1A5R3	
R5		Not Used	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC20GF220J	
R7 to R13		Same as 9A1A5R6	
R14		RESISTOR, FIXED WIREWOUND: Mil type RW69VR33	
R15 to R21		Same as 9A1A5R14	
R22		RESISTOR, FIXED COMPOSITION: Mil type RC20GF272J	
9A1A5A1		SERVO AMPLIFIER PC BOARD ASSEMBLY: MFR 14304, PN 6049-6203	5-29 5-35
C1 to C4		Same as 9A1A3A1C3	5-35

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A5A1 (Cont)			
C5		Same as 9C1	5-35
C6, C7		Same as 9A1A3A1C3	
C8		Same as 9A1A1A1C6	
C9		CAPACITOR, FIXED MICA: Mil type CM06DD472JP3	
C10 to C13		Same as 9C1	
CR1		DIODE: Mil type 1N3611	
CR2		Same as 9A1A5A1CR1	
CR3, CR4		Same as 9A1A1A1CR12	
CR5 to CR16		Same as 9A1A5A1CR1	
IC1		Same as 9A1A1A1IC1	
K1		RELAY, REED: MFR 14304, PN 6049-6210-1	
K2		RELAY, REED: MFR 14304, PN 6049-6210-2	
K3		RELAY, REED: MFR 14304, PN 6049-6210-3	
K4		RELAY, REED: MFR 14304, PN 6049-6210-4	
MP1		PC BOARD: MFR 14304, PN 6049-6213	
MP2		EXTRACTOR, PC BOARD: MFR 14304, PN Z03-0003-001	
MP3		Same as 9A1A5A1MP2	
P1		CONNECTOR, PLUG: Mil type M21097/5-07	
Q1 to Q5		Same as 9A1A1A1Q2	
Q6		TRANSISTOR: Mil type 2N1132	
Q7		Same as 9A1A5A1Q6	
Q8		Same as 9A1A1A1Q2	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC07GF682J	
R2		Same as 9A1A5A1R1	
R3, R4		Same as 9A1A3A1R7	
R5		Same as 9A1A3A1R6	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC07GF221J	
R7, R8		Same as 9A1A1A1R44	
R9		RESISTOR, FIXED COMPOSITION: Mil type RC07GF121J	
R10		RESISTOR, FIXED COMPOSITION: Mil type RC07GF181J	
R11		Same as 9A1A5A1R10	
R12		Same as 9A1A5A1R6	
R13		Same as 9A1A3A1R6	
R14		RESISTOR, FIXED COMPOSITION: Mil type RC07GF391J	5-35
R15		RESISTOR, FIXED COMPOSITION: Mil type RC07GF681J	5-35
R16		Same as 9A1A1A1R1	
R17		RESISTOR, FIXED COMPOSITION: Mil type RC07GF102J	
R18		Same as 9A1A5A1R17	
R19 to R22		Not Used	
R23		RESISTOR, FIXED COMPOSITION: Mil type RC20GF331J	
R24		RESISTOR, FIXED COMPOSITION: Mil type RC07GF332J	
R25		Same as 9A1A5A1R24	
R26		RESISTOR, FIXED COMPOSITION: Mil type RC07GF154J	
R27		Same as 9A1A5A1R26	
R28		Same as 9A1A3A1R7	
R29		RESISTOR, FIXED COMPOSITION: Mil type RC07GF393J	
R30		Same as 9A1A3A1R7	
R31		Same as 9A1A5A1R29	
R32 to R35		Not Used	
R36		RESISTOR, FIXED COMPOSITION: Mil type RC20GF102J	
TP1		JACK, TEST: MFR 14304, PN J60-0001-007	
TP2 to TP7		Same as 9A1A5A1TP1	
VR1		DIODE: Mil type 1N3823A	5-35
9A1A5A2		Same as 9A1A5A1	5-29 5-35
9A1A5A3		METER AMPLIFIER PC BOARD ASSEMBLY: MFR 14304, PN 6049-6204	5-29 5-36
C1, C2		Same as 9A1A3A1C3	
C3		Same as 9A1A5A1C9	
C4		Same as 9A1A1A1C6	
C5		Same as 9C1	
C6		Same as 9A1C20	
C7		Same as 9A1A3A1C3	
C8		Same as 9A1A5A1C9	
C9		Same as 9A1A1A1C6	
C10		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE11C100G	
C11		Same as 9A1C20	
C12		Same as 9A1A3A1C3	5-36

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A5A3 (Cont)			
C13		CAPACITOR, FIXED MICA: Mil type CM06DD471JP3	5-36
C14		CAPACITOR, FIXED MICA: Mil type CM05DD200JP3	
C15		Same as 9A1A3A1C3	
C16		Not Used	
C17, C18		Same as 9A1A3A1C3	
C19		Same as 9A1A5A3C13	
C20		Same as 9A1A5A3C14	
C21		Same as 9A1A3A1C3	
C22		Same as 9A1A1A1C8	
C23		Not Used	
C24		Same as 9A1A3A1C3	
C25, C26		Same as 9A1C20	
C27		CAPACITOR, FIXED TANTALUM: Mil type CS13BF476M	
CR1, CR2		Same as 9A1A5A1CR1	
CR3		Same as 9A1A1A1CR12	
CR4		Same as 9A1A5A1CR1	
CR5, CR6		Not Used	
CR7		Same as 9A1A1A1CR12	
CR8 to CR13		Same as 9A1A5A1CR1	
IC1 to IC4		Same as 9A1A1A1IC1	
MP1		PC BOARD: MFR 14304, PN 6049-6214	
MP2, MP3		Same as 9A1A5A1MP2	
P1		Same as 9A1A5A1P1	
Q1 to Q4		Same as 9A1A1A1Q2	
Q5		TRANSISTOR: Mil type 2N404A	
Q6		Same as 9A1A1A1Q2	
R1, R2		Same as 9A1A1A1R6	
R3		RESISTOR, FIXED FILM: Mil type RN65D1003F	
R4		Same as 9A1A1A1R2	
R5		Same as 9A1A5A3R3	
R6		RESISTOR, FIXED FILM: Mil type RN65D5901F	
R7		Same as 9A1A5A3R6	
R8		Same as 9A1A1A1R44	
R9		Same as 9A1A1A1R1	
R10		Same as 9A1A1A1R42	
R11		Same as 9A1A5R22	
R12		Same as 9A1A1A1R3	
R13		Same as 9A1A1A1R42	
R14		Same as 9A1A5R22	
R15		Same as 9A1A1A1R40	5-36
R16		RESISTOR, FIXED COMPOSITION: Mil type RC20GF302J	5-36
R17		Same as 9A1A1A1R2	
R18		RESISTOR, FIXED COMPOSITION: Mil type RC20GF332J	
R19		RESISTOR, FIXED COMPOSITION: Mil type RC20GF683J	
R20		Not Used	
R21		Same as 9A1A1A1R4	
R22		RESISTOR, FIXED COMPOSITION: Mil type RC20GF151J	
R23		RESISTOR, FIXED COMPOSITION: Mil type RC20GF122J	
R24		Same as 9A1A5A3R16	
R25		Same as 9A1A1A1R2	
R26		Same as 9A1A5A3R18	
R27		RESISTOR, FIXED COMPOSITION: Mil type RC20GF154J	
R28		Not Used	
R29		Same as 9A1A1A1R4	
R30		RESISTOR, FIXED COMPOSITION: Mil type RC20GF221J	
R31		RESISTOR, FIXED COMPOSITION: Mil type RC20GF123J	
R32		Same as 9A1A5A3R23	
R33, R34		Same as 9A1A5A3R18	
R35		RESISTOR, FIXED COMPOSITION: Mil type RC20GF271J	
R36, R37		Same as 9A1A5A1R36	
R38		Same as 9A1A5A3R23	
R39		Same as 9A1A1A1R21	5-36
9A1A5A4		MULTIMETER SWITCH ASSEMBLY: MFR 14304, PN 6049-6206	5-29 5-37
C1, C2		Same as 9C1	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC20GF393J	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC20GF564J	
R3		Same as 9A1A5A4R2	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC20GF184J	
R5		Same as 9A1A5A4R4	5-37

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A5A4 (Cont)			
R6		Same as 9A1A5A4R1	5-37
R7		Same as 9A1A5A4R2	
R8		Same as 9A1A5A3R27	
R9, R10		Same as 9A1A5A3R1	
R11		Same as 9A1A5A4R2	
R12		Same as 9A1A5A3R27	
R13		RESISTOR, FIXED FILM: Mil type RN65G3743F	
R14		RESISTOR, FIXED FILM: Mil type RN65G3323F	
R15		RESISTOR, FIXED FILM: Mil type RN65G1102F	
R16		RESISTOR, FIXED FILM: Mil type RN65G1101F	
R17		Same as 9A1A5A4R13	
R18		RESISTOR, FIXED COMPOSITION: Mil type RC20GF121J	
R19		Same as 9A1A5A3R23	
S1		SWITCH, ROTARY: 4 Section, 24 position, MFR 14304, PN 6049-6207	5-37
9A1A6		MONITOR CONTROL ASSEMBLY: MFR 14304, PN 6049-6300	5-29
C1		Same as 9C1	
CR1		Not Used	
CR2 to CR4		Same as 9A1A5A1CR1	5-29
DS1 to DS4		Same as 9A1DS1	5-31
J1		CONNECTOR, RECEPTACLE: Mil type M21097/4-25	5-29
J2, J3		Same as 9A1A6J1	
J4		Same as 9A1J4	
K1		Not Used	
K2		RELAY, SOLENOID: Mil type M5757/15-001	
K3		Same as 9A1A6K2	5-29
M1		METER: MFR 14304, PN 6049-6316	5-31
MP1		Same as 9A1A5MP1	
MP2		KNOB: Mil type MS91528-1K2B	5-31
Q1, Q2		Same as 9A1A5Q1	5-29
R1		RESISTOR, VARIABLE: Mil type RV4LAYSD253B	
R2 to R5		Same as 9A1A6R1	
R6		RESISTOR, VARIABLE: Mil type RV4LAYSD103B	5-29
R7		RESISTOR, FIXED COMPOSITION: Mil type RC32GF820J	5-29
R8		Same as 9A1A6R7	
R9		RESISTOR, FIXED COMPOSITION: Mil type RC42GF681J	
R10		Same as 9A1A6R9	5-29
S1, S2		Not Used	
S3		Same as 9A1A1S2	5-31
S4		SWITCH: Mil type MS25089-3C	
S5		SWITCH, TOGGLE: Mil type MS25100-22	
S6		Same as 9A1A6S4	
XDS1		Same as 9A1XDS1	
XDS2		LAMPHOLDER: Mil type LH73LC12BT	
XDS3		LAMPHOLDER: Mil type LH73LC12GT	
XDS4		LAMPHOLDER: Mil type LH73LC12WT	5-31
9A1A6A1		TUNE UP CONTROL PC BOARD ASSEMBLY: MFR 14304, PN 6049-6303	5-29 5-38
C1 to C3		Same as 9C1	
C4		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE11C500E	
C5		Same as 9A1A6A1C4	
C6		Same as 9C1	
C7		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE11C100G	
C8 to C10		Same as 9C1	
C11		Same as 9A1A6A1C7	
CR1 to CR20		Same as 9A1A5A1CR1	
MP1		PC BOARD: MFR 14304, PN 6049-6313	
MP2, MP3		Same as 9A1A5A1MP2	
P1		Same as 9A1A5A1P1	
Q1 to Q10		Same as 9A1A1A1Q2	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC42GF102J	
R2		Same as 9A1A6A1R1	
R3		RESISTOR, FIXED COMPOSITION: Mil type RC32GF471J	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC07GF562J	
R5		Same as 9A1A5A1R17	5-38

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A6A1 (Cont)			
R6		Same as 9A1A6A1R1	5-38
R7		Same as 9A1A3A1R11	
R8		RESISTOR, FIXED COMPOSITION: Mil type RC07GF103J	
R9		Same as 9A1A3A1R11	
R10		RESISTOR, FIXED COMPOSITION: Mil type RC07GF100J	
R11		Same as 9A1A6R7	
R12		RESISTOR, FIXED COMPOSITION: Mil type RC07GF273J	
R13		RESISTOR, FIXED COMPOSITION: Mil type RC07GF331J	
R14		RESISTOR, FIXED COMPOSITION: Mil type RC07GF153J	
R15		RESISTOR, FIXED COMPOSITION: Mil type RC07GF123J	
R16		Same as 9A1A3A1R7	
R17		RESISTOR, FIXED COMPOSITION: Mil type RC07GF274J	
R18		RESISTOR, FIXED COMPOSITION: Mil type RC07GF104J	
R19		Same as 9A1A6A1R18	
R20		Same as 9A1A6A1R8	
R21		RESISTOR, FIXED COMPOSITION: Mil type RC07GF473J	
R22		RESISTOR, FIXED COMPOSITION: Mil type RC07GF822J	
R23		Same as 9A1A6A1R10	
R24		Same as 9A1A6A1R12	
R25		Same as 9A1A6A1R8	
R26		Same as 9A1A3A1R11	
R27		Same as 9A1A6R7	
R28		Same as 9A1A1A1R1	
R29		Same as 9A1A5A1R24	
R30		Same as 9A1A6A1R8	
R31		Same as 9A1A6A1R21	
R32		Same as 9A1A6A1R8	
R33		Same as 9A1A6A1R21	
R34, R35		Same as 9A1A6A1R8	
R36		Same as 9A1A3A1R11	
R37		Same as 9A1A6A1R21	
R38		RESISTOR, FIXED COMPOSITION: Mil type RC32GF100J	
R39		Same as 9A1A6R7	5-38

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
R40		RESISTOR, FIXED COMPOSITION: Mil type RC42GF150J	5-38
TP1 to TP3		Same as 9A1A5A1TP1	5-38
9A1A6A2		BANDSWITCH CONTROL PC BOARD ASSEMBLY: MFR 14304, PN 6049-6304	5-29 5-39
C1 to C4		Same as 9C1	
C5		Not Used	
C6		CAPACITOR, FIXED PAPER: Mil type CP09A1EB334K3	
C7		Same as 9A1A6A2C6	
C8, C9		Same as 9C1	
CR1 to CR9		Same as 9A1A5A1CR1	
CR10		Same as 9A1A1A1CR12	
MP1		PC BOARD: MFR 14304, PN 6049-6314	
MP2, MP3		Same as 9A1A5A1MP2	
P1		Same as 9A1A5A1P1	
Q1		Same as 9A1A5A3Q5	
Q2		TRANSISTOR: Mil type 2N1613	
R1		Same as 9A1A1A1R3	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC20GF101J	
R3		Same as 9A1A6A2R2	
R4		Same as 9A1A1A1R3	
R5		RESISTOR, FIXED COMPOSITION: Mil type RC20GF822J	
R6		RESISTOR, FIXED COMPOSITION: Mil type RC32GF103J	
R7		Same as 9A1A6A2R6	
R8		Not Used	
R9		RESISTOR, FIXED COMPOSITION: Mil type RC20GF391J	
R10		Same as 9A1A6A2R9	
R11		RESISTOR, FIXED COMPOSITION: Mil type RC20GF682J	
R12		Same as 9A1A5A1R36	
R13, R14		Same as 9A1A1A1R1	
R15		RESISTOR, FIXED COMPOSITION: Mil type RC20GF471J	
R16		RESISTOR, FIXED COMPOSITION: Mil type RC20GF474J	5-39

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A6A2 (Cont)			
R17		Same as 9A1A6A2R16	5-39
R18		Same as 9A1A1A1R2	
9A1A6A3		FAULT SENSOR PC BOARD ASSEMBLY: MFR 14304, PN 6049-6305	5-29/ 5-40
C1 to C8		Same as 9C1	
C9		CAPACITOR, FIXED TANTALUM: Mil type CS13BF476K	
C10		CAPACITOR, FIXED TANTALUM: Mil type CS13BC475K	
C11		Same as 9A1A6A3C10	
C12		Same as 9C1	
CR1 to CR12		Same as 9A1A5A1CR1	
MP1		PC BOARD: MFR 14304, PN 6049-6315	
MP2, MP3		Same as 9A1A5A1MP2	
P1		Same as 9A1A5A1P1	
Q1		TRANSISTOR: Mil type 2N2323A	
Q2 to Q5		Same as 9A1A6A3Q1	
Q6		TRANSISTOR: Mil type 2N489A	
R1 to R10		Same as 9A1A6A1R1	
R11		Same as 9A1A1A1R1	
R12		Same as 9A1A1A1R3	
R13		RESISTOR, FIXED COMPOSITION: Mil type RC20GF153J	
R14		Same as 9A1A5A3R18	
R15		Same as 9A1A5A3R31	
R16		Same as 9A1A6A2R9	
R17		Same as 9A1A5A3R18	
R18		Same as 9A1A5A3R31	
R19		Same as 9A1A6A2R9	
R20		Same as 9A1A5A3R18	
R21		Same as 9A1A5A3R31	
R22		Same as 9A1A6A2R2	
R23		Same as 9A1A1A1R3	
R24		Same as 9A1A5A1R36	
R25		RESISTOR, FIXED COMPOSITION: Mil type RC20GF155J	
RT1		THERMISTOR: 5000OHMS, ±10%, MFR 14304, PN 6049-6311	
RT2, RT3		Same as 9A1A6A3RT1	
TP1		Same as 9A1A5A1TP1	5-40
9A1A6A4		FAULT DETECTOR SWITCH ASSEMBLY: MFR 14304, PN 6049-6306	5-29 5-41
R1		Same as 9A1A5R22	5-41
R2		RESISTOR, FIXED COMPOSITION: Mil type RC20GF333J	
R3		Same as 9A1A1A1R3	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC20GF183J	
R5		Same as 9A1A5A3R31	
R6		Same as 9A1A6A4R2	
R7		Same as 9A1A5A1R36	
S1		Same as 9A1A5A4S1	5-41
9A1A7		CAPACITOR DRIVE ASSEMBLY: MFR 14304, PN 6049-6020	5-29
B1		TORQUE MOTOR: MFR 14304, PN 6049-6025	
MP1		KNOB: Mil type MS91528-3N2B	
R1		RESISTOR, VARIABLE: Mil type RV4NAYSD103A	
S1		SWITCH: Mil type MS25253-4	
9A1A8		Same as 9A1A7	5-29
9A1A9		HARMONIC TRAP ASSEMBLY: MFR 14304, PN 6049-6070	5-31
9A1A10		FILTER ASSEMBLY: MFR 14304, PN 6049-5300	5-30
C1		CAPACITOR: .01UF, +30% -20%, 10KVDC @ 65°C, MFR 14304, PN 6049-6102	
C2		CAPACITOR: .1UF, ±20%, 2500VDC, MFR 14304, PN 6049-6101	
C3		CAPACITOR: .01UF, 2500VDC @ 85°C, MFR 14304, PN 6049-6103	
C4		CAPACITOR: Mil type CZ24BEF104	
C5		Same as 9A1A10C4	
C6		Same as 9A1A10	
C7		Not Used	
C8		Same as 9A1A10C2	
C9		Same as 9A1A10C3	
C10, C11		Same as 9A1A10C4	
L1		Same as 9A1L4	
L2, L3		Same as 9A1L1	
L4		COIL: MFR 14304, PN 6049-5308	
L5		Same as 9A1A10L4	5-30

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A1A11		INPUT BAND SWITCH ASSEMBLY: MFR 14304, PN 6049-6540	5-29
S1		Not Used	
S2		SWITCH: MFR 14304, PN 6049-6546	
9A1A11A1		DRIVE ASSEMBLY: MFR 14304, PN 6049-6525	
B1		MOTOR: MFR 14304, PN 6049-6502	
J1		CONNECTOR, RECEPTACLE: Mil type MS3112E14-15P	
MP1		COUPLING: MFR 14304, PN Z06-0008-001	
S1		SWITCH: MFR 14304, PN 6049-6526	
9A1A12		SWITCH ASSEMBLY: MFR 14304, PN 6049-6530	
S1		Not Used	
S2		SWITCH, ROTARY: MFR 14304, PN 6049-6531	
9A1A12A1		Same as 9A1A11A1	
9A1A13		BAND REPEATER ASSEMBLY: MFR 14304, PN 6049-6700	
MP1		DIAL ASSEMBLY: MFR 14304, PN 6049-6707	5-29
9A1A13A1		BAND REPEATER SWITCH ASSEMBLY: MFR 14304, PN 6049-6710	5-42
J1		Same as 9A1J4	
R1		Same as 9A1A5A1R24	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC07GF301J	
R3		Same as 9A1A3A1R3	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC07GF202J	
R5		Same as 9A1A13A1R2	
R6		Same as 9A1A5A1R17	
R7		RESISTOR, FIXED COMPOSITION: Mil type RC07GF201J	
R8		Same as 9A1A13A1R2	
R9, R10		Same as 9A1A3A1R3	
R11 to R13		Same as 9A1A13A1R2	
R14 to R18		Same as 9A1A3A1R3	
R19		Same as 9A1A13A1R2	5-42
R20,R21		Same as 9A1A3A1R3	5-42
R22		Same as 9A1A13A1R7	
R23 to R27		Same as 9A1A3A1R3	
R28		Same as 9A1A13A1R7	
R29 to R37		Same as 9A1A3A1R3	
R38,R39		Same as 9A1A13A1R2	
S1		SWITCH, ROTARY: 8 section, 20 position, MFR 14304, PN 6049-6704	5-42
9A1A14		OUTPUT SAMPLER PC BOARD ASSEMBLY: MFR 14304, PN 6049-6080	5-29
C1		CAPACITOR, FIXED MICA: Mil type CM06DD102JP3	
MP1		PC BOARD: MFR 14304, PN 6049-6081	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC20GF470K	
R2		RESISTOR, FIXED COMPOSITION: Mil type RC20GF101K	
R3 to R5		Same as 9A1A14R2	5-29
9A2		POWER SUPPLY ASSEMBLY, BIAS AND SERVO: MFR 14304, PN 6049-6600	5-25
C1		CAPACITOR, FIXED PAPER: Mil type CP72B1EF205K1	
C2		Same as 9A2C1	
C3		CAPACITOR, FIXED PAPER: Mil type CB72B1EG205K1	
C4		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE71C142G	
C5		Same as 9A2C4	
J1		CONNECTOR, RECEPTACLE: Mil type M21097/4-25	
J2		CONNECTOR, RECEPTACLE: MFR 14304, PN J20-0003-001	
K1		RELAY: 24VDC, MFR 14304, PN 6049-6606-1	
K2		RELAY: 12VDC, MFR 14304, PN 6049-6606-2	
T1		TRANSFORMER: MFR 14304, PN 6049-5105	5-25

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A2A1		POWER SUPPLY BIAS AND SERVO PC BOARD: MFR 14304, PN 6049-6602	5-24/ 5-26
C1		Same as 9C1	5-26
C2		CAPACITOR, FIXED PAPER: Mil type CP09A1EG104K1	
CR1		DIODE: Mil type 1N1130	
CR2		Same as 9A2A1CR1	
CR3 to CR11		Same as 9A1A5A1CR1	
CR12		DIODE: Mil type 1N3023B	
CR13 to CR16		Same as 9A1A5A1CR1	
CR17		Same as 9A2A1CR12	
CR18 to CR22		Same as 9A1A5A1CR1	
K1		Same as 9A1A5A1K3	
MP1		PC BOARD: MFR 14304, PN 6049-6603	
P1		Same as 9A1A5A1A1	
Q1		TRANSISTOR: Mil type 2N697A	
Q2		Same as 9A1A5Q1	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC42GF223J	
R2 to R4		Same as 9A2A1R1	
R5		RESISTOR, FIXED COMPOSITION: Mil type RC42GF183J	
R6		Same as 9A1A5A4R4	
R7		RESISTOR, FIXED COMPOSITION: Mil type RC20GF224J	
R8		Same as 9A2A1R7	
R9		Same as 9A1A1A1R3	
R10		RESISTOR, FIXED COMPOSITION: Mil type RC20GF180J	
R11		RESISTOR, FIXED COMPOSITION: Mil type RC42GF151J	
R12		RESISTOR, FIXED COMPOSITION: Mil type RC32GF223J	
R13		Same as 9A1A6A2R5	
R14		Same as 9A2A1R12	
R15		Same as 9A2A1R1	
R16		Same as 9A1A1A1R1	
R17		Same as 9A2A1R11	
R18		Same as 9A1A1A1R1	
R19		RESISTOR, FIXED COMPOSITION: Mil type RC42GF273J	5-26
R20		Same as 9A1A6A1R3	5-26
R21		RESISTOR, FIXED COMPOSITION: Mil type RC42GF101J	
R22		Same as 9A2A1R21	5-26
9A3		RELAY ASSEMBLY: MFR 14304, PN 6049-6400	5-25
C1		CAPACITOR, FIXED PAPER: Mil type CP70B1EH106K1	
C2		Not Used	
C3		CAPACITOR, FIXED ELECTROLYTIC: Mil type CE71C562G	
CR1 to CR3		Same as 9A1A5A1CR1	
CR4		DIODE: Mil type 1N4764	
K1		CONTACTOR: 10AMP, MFR 14304, PN 6049-6413	
K2		Not Used	
K3		Same as 9A3K1	
K4		CONTACTOR: 60AMP, MFR 14304, PN 6049-6414	
L1		CHOKE: 5H, MFR 14304, PN 6049-5103	
9A3A1		POWER SUPPLY ASSEMBLY: MFR 14304, PN 6049-6405	
CR1		DIODE: Mil type 1N1614	
CR2 to CR6		Same as 9A3A1CR1	
MP1		HEAT SINK: MFR 14304, PN 6049-6406	
R1		RESISTOR, FIXED COMPOSITION: Mil type RC32GF272J	
9A3A2		FAULT CONTROL ASSEMBLY: MFR 14304 PN 6049-6410	
K1 to K4		Not Used	
K5		Same as 9A1A6K2	
R1 to R3		Not Used	
R4		RESISTOR, FIXED COMPOSITION: Mil type RC42GF820J	
R5		Same as 9A3A2R4	
TB1		TERMINAL BOARD: MFR 14304, PN E31-0009-010	
9A4		RECTIFIER ASSEMBLY: MFR 14304, PN 6049-5400	5-25/ 5-27

TABLE 6-2. MAINTENANCE PARTS LIST (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
9A4 (Cont)			
C1		CAPACITOR, FIXED TANTALUM: Mil type CS13BE336K	5-27
CR1		DIODE STOCK: MFR 14304, PN 6049-5104	
CR2 to CR12		Same as 9A4CR1	
CR13		RECTIFIER BRIDGE: MFR 14304, PN D22-5002-000	
MP1		PC BOARD: MFR 14304, PN 6049-5404	
R1		RESISTOR, FIXED WIREWOUND: 100K OHMS, ±5%, MFR 14304, PN 6049-6120	
R2 to R8		Same as 9A4R1	
R9		Same as 9A1A6A1R1	5-27
R10		RESISTOR, FIXED WIREWOUND: Mil type RE75GR500	5-27
R11		RESISTOR, FIXED WIREWOUND: Mil type RW37V223	
R12		RESISTOR, FIXED COMPOSITION: Mil type RC42GF221J	
R13		RESISTOR, FIXED WIREWOUND: Mil type RE60G1210	
R14		RESISTOR, FIXED FILM: Mil type RN65D1911F	
R15		RESISTOR, FIXED COMPOSITION: Mil type RC32GF101J	
R16, R17		Same as 9A4R15	
TB1		TERMINAL BOARD: Mil type 37TB12	5-27
9A5		**STEP START ASSEMBLY PN 6049-9325**	**5-50**
8A1CB3		**CIRCUIT BREAKER: MFR 74193 TYPE AM33MG6-3-250-4-60**	

TABLE 6-3. LIST OF MANUFACTURERS

MFR CODE	NAME	ADDRESS
14304	RF COMMUNICATIONS, INC.	ROCHESTER, N.Y.
42498	NATIONAL RADIO CO., INC.	MELROSE, MASS.
70998	BIRD ELECTRONIC CORP.	CLEVELAND, OHIO

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