

TECHNICAL MANUAL

for

HIGH FREQUENCY TRANSMITTER

MODEL HFTA-10KJ2

(Rev A)

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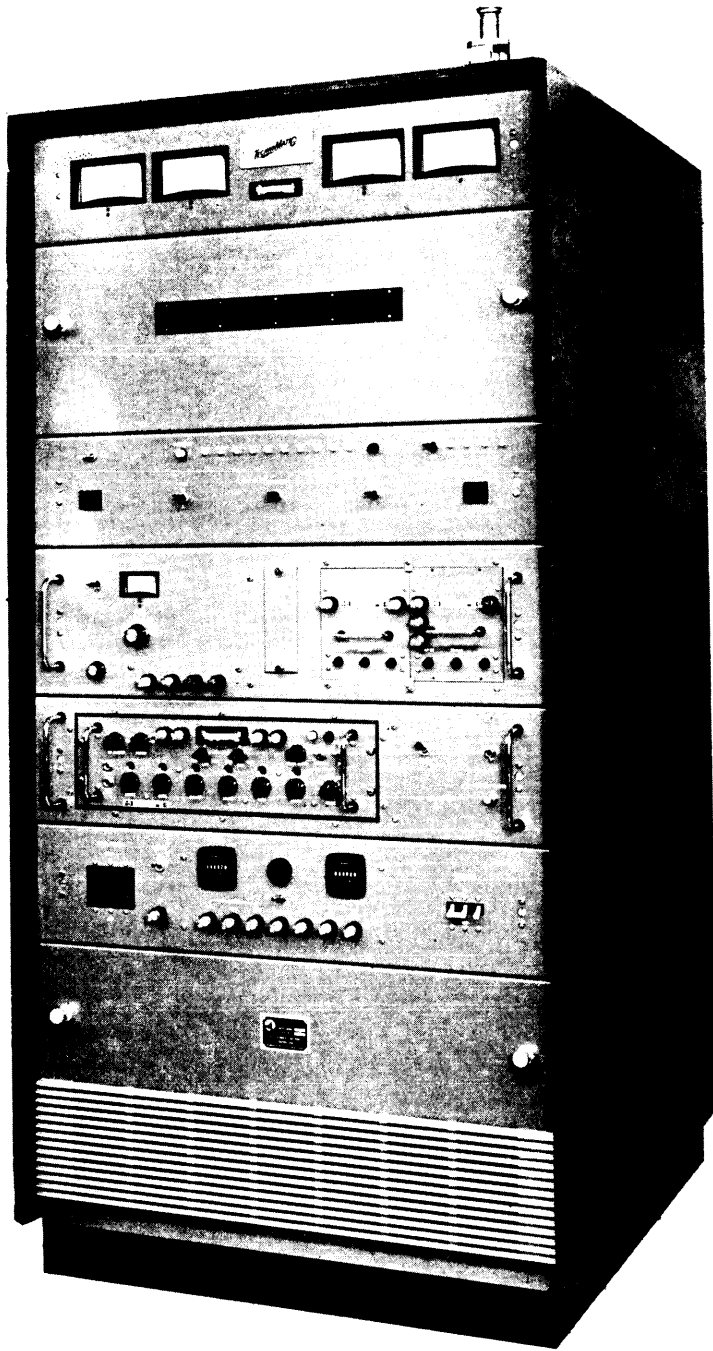


Figure 1-1. High Frequency Transmitter, Model HFTA-10KJ2

## SECTION 1

### GENERAL INFORMATION

#### 1-1. FUNCTIONAL DESCRIPTION

This manual presents operating and maintenance instructions for High Frequency Transmitter HFTA-10KJ2, designed and manufactured by the Technical Materiel Corporation, Mamaroneck, New York. This manual includes a general description of the equipment; installation and operating procedures; principles of operation; maintenance and troubleshooting data; and a parts list.

The High Frequency Transmitter HFTA-10KJ2, hereinafter referred to as the transmitter (figure 1-1), consists of a solid state, multi-mode, exciter MMX(A)-2, used in conjunction with high frequency linear power amplifier HFLA-10K. The exciter is capable of providing CW (continuous wave), AM (amplitude modulation), SSB (single sideband) including AME (amplitude modulated equivalent) full carrier, FSK (frequency shift keyer), FAX (facsimile) and optional ISB (independent sideband) modes of operation. The high frequency linear power amplifier amplifies the exciter output to provide 10 kilowatts (PEP) and average throughout the frequency range of 2 to 30 MHz. The transmitter is readily adaptable for shipboard, aircraft, and land installations. Table 1-1 lists the transmitter components.

TABLE 1-1. COMPONENTS OF TRANSMITTER HFTA-10KJ2

NOMENCLATURE	COMMON NAME
MMX(A)-2	Multi-Mode Exciter
HFLA-10K	High Frequency Linear Power Amplifier

#### 1-2. PHYSICAL DESCRIPTION

The Transmitter consists of a single cabinet, 68-3/4 inches high by 33-1/2 inches wide by 38-3/4 inches deep, which houses all the components which comprise the HFLA-10K power amplifier in addition to the MMX(A)-2 exciter. The HFTA-10KJ2 consists of a main meter panel, a power amplifier, an IPA drawer, an exciter drawer, a main power panel, a main power supply, and an optional harmonic filter. Primary power connections are made through the access hole on the base assembly. External exciter transmitter control connections are made to the exciter remote assembly. Transmitter r-f power is routed through a directional coupler mounted in the opening located on top of the transmitter.

#### 1-3. REFERENCE DATA

Table 1-2 lists the technical specifications of the equipment.

TABLE 1-2. TECHNICAL SPECIFICATIONS

FREQUENCY RANGE:	2 to 30 mHz.
OPERATING MODES:	SSB, ISB, CW, AM, FSK and FAX.
POWER OUTPUT:	10,000 watts 2 tone PEP with signal to distortion 35 db. 10 kw average.
OUTPUT IMPEDANCE:	50 ohms unbalanced with 3:1 vswr EIA flange for 1-5/8 inch coaxial
STABILITY AND FREQUENCY CONTROL:	1 part in $10^8$ per day for ambient change of 15° C within the range of 0-50° C (using exciter internal standard).
TUNING:	Automatic or manual. Automatic has manual override.
REMOTE OPERATION:	Facilities for remote operation including mode, frequency, power level and readback available.
SPURIOUS SIGNALS:	At least 60 db below full PEP output.
HARMONIC SUPPRESSION:	Second harmonic at least 50 db down from PEP output. Third harmonic at least 65 db down from PEP output.
HARMONIC FILTERS:	Available fixed for all frequencies above 30 mHz or bandswitched for lower frequencies. Resultant harmonics conform to latest requirements.
AUDIO INPUT:	<ol style="list-style-type: none"><li>1. For ISB, 2 independent 600-ohm channels balanced or unbalanced, -20 dbm to +5 dbm.</li><li>2. Mike input for low level dynamic mike with front panel selection; -55 db into 47,000 ohms, front panel jack.</li></ol>

TABLE 1-2. TECHNICAL SPECIFICATIONS (cont)

METERING:	Meters with special illuminated overload protection.
NOISE:	Power supply ripple 55 db down from full PEP output. Other 70 db down--special "white noise" protection.
COOLING:	Filtered forced air cooling semi-pressurized cabinet.
ENVIRONMENTAL:	Designed to operate in any ambient temperature between the limits of 0 and 50°C for any value of humidity to 90%.
SPECIAL FEATURES:	Adjustable power output levels with overload and bias protection, and alarm. Controlled and adjustable ALDC. Safety interlocks at all high voltage points.
PRIMARY POWER:	210, 220, 230, 240, 250 volts, 50/60 Hz, 3 phase, Delta or Wye. (other voltages available on special request).
POWER REQUIREMENTS:	Maximum 27,000 watts. All solid state power supply.
SIZE:	33-1/2 inches wide X 38-3/4 inches deep X 68-3/4 inches high standard.
INSTALLED WEIGHT:	Approximately 1300 pounds.
SHIPPING WEIGHT:	Approximately 1660 pounds.
SIZE OF LARGEST SHIPPING CONTAINER:	43 inches wide X 49 inches long X 81 inches high.
COMPONENTS AND CONSTRUCTION:	Manufactured in accordance with JAN/MIL wherever practicable.

## SECTION 2

### INSTALLATION

#### 2-1. INITIAL UNPACKING AND INSPECTION

The HFTA-10KJ2 was assembled, calibrated, and tested at the factory before shipment. Inspect all packages for possible damage during transit. With respect to damage to the equipment for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts. Carefully unpack each crate as indicated by the packing list provided with the transmitter shipment. Inspect all packing materials for parts that may have been shipped as loose items (cabinet hardware, connectors, technical manuals, etc.).

#### 2-2. POWER REQUIREMENTS

The transmitter requires a three phase source voltage of 230 vac, 50/60 Hz. The maximum power requirement is 27,000 watts.

#### 2-3. INSTALLATION

A minimum number of assemblies, subassemblies, components and hardware have been disassembled from the equipment and separately packaged, thus reducing the possibility of equipment damage in transit. The method of disassembly and separate packaging also permits realistic equipment handling.

Cables, wires, and other miscellaneous items that are disconnected during equipment disassembly are tagged and taped to the equipment. The information on a given tag indicates the designated terminal on a component to which the tagged item must be connected. Make sure all cables and wires have been connected as designated on tags and that all packing material, tags, and tape have been removed before sealing-up the cabinet or section of the cabinet with a front panel drawer.

Refer to the technical manual for the HFLA-10K Linear Power Amplifier for detailed procedural steps required to install components in the equipment cabinet. Install the MMX(A)-2 in the equipment cabinet and fasten the front panel to the rack with four screws and four washers (supplied). Connect the MMX(A)-2 to the HFLA-10K using appropriate cables (supplied). With the unit fully assembled, install the cabinet in the desired location, leaving a minimum two-foot clearance on the top and all sides for maintenance and installation purposes.

#### 2-4. PRE-OPERATIONAL CHECK

Although the transmitter has been aligned and thoroughly checked against the manufacturer's specifications prior to shipment, it is necessary to ensure correct installation and proper operation by referring to the applicable technical manual to perform the transformer checks of the HFLA-10K and initial check out of the MMX(A)-2.



## SECTION 3

### OPERATOR'S SECTION

#### 3-1. GENERAL

The controls of the MMX(A)-2 provide rapid transmitter r-f frequency selection of AM, USB, LSB or ISB (optional) intelligence in the 2 to 30 mHz transmission range. Tuning is accomplished manually or automatically.

#### 3-2. OPERATING CONTROLS

For detailed functions of all operating controls and indicators of the HFTA-10KJ2, refer to the applicable HFLA-10K and MMX(A)-2 technical manuals.

#### 3-3. STARTING CONTROLS SETTINGS

Generally, before main power is applied, all operating controls should be set to OFF or maximum counterclockwise position. Set the MMX(A)-2 ON/STANDBY switch to STANDBY. Starting control settings are provided in the operating procedures presented in paragraphs 3-6 and 3-7.

#### 3-4. OPERATING PROCEDURE

a. GENERAL. An extensive interlock and overload system is designed into the transmitter. However, a single incorrect control setting could overload certain components, resulting in equipment malfunctioning.

A definite operating sequence as outlined in this manual should be rigidly followed. Once the operating technique is mastered, it should be consistently followed to ensure continuing proper operation of the equipment and prevent possible malfunctions.

Before applying power to the transmitter, check that antenna or dummy load connections are properly made.

#### b. TUNING CONSIDERATIONS.

1. GENERAL. Before the transmitter is tuned for any specified mode of operation, it should be initially tuned and loaded on a carrier frequency. This procedure should be followed, even if suppressed carrier operation is desired. After the transmitter is tuned to the carrier frequency, either or both sidebands are generated by applying the proper modulating signals required by the particular mode of operation. The carrier level may then be reinserted or bypassed, as desired.

2. CARRIER FREQUENCY VERSUS ASSIGNED FREQUENCY. When operating in certain modes, the carrier frequency may be significantly different than the assigned frequency, and will therefore affect the choice of frequency to be selected in the exciter. Carrier frequency is defined as that position in the r-f spectrum reserved for the carrier, whether or not the carrier is present. The assigned frequency is a reference frequency designed to identify or reserve a given portion of the r-f spectrum.

Most government agencies define the assigned frequency as the center of a frequency band assigned to a station. The assigned frequency and the carrier frequency may or may not be the same. In practice, the assigned frequency is often suffixed by the carrier frequency in parenthesis for clarification.

EXAMPLE 1 - For an upper sideband transmission, with the carrier completely suppressed and with a total r-f bandpass extending from 300 Hz above  $F_c$  (carrier frequency) to 3 kHz, the assigned frequency is 1650 Hz above the non-existent carrier frequency.

EXAMPLE 2 - For an ISB (independent sideband) transmission, with audio intelligence covering 350 - 7500 Hz per sideband, with or without carrier suppression, the assigned frequency and the carrier frequency are one and the same with both occupying the center of the transmitted spectrum.

3. PEAK ENVELOPE POWER VERSUS AVERAGE POWER INDICATION. A common misapprehension continues to exist over the ratio between average and PEP (peak envelope power) in high-power transmitters, particularly when multi-channel (multitone) transmissions are used. The PEP during modulation can be many times that of the average power indicated on the HFTA-10KJ2 PA OUTPUT meter. Thus, the transmitter average power must be reduced sufficiently to avoid a serious peak overload to the transmitter, with consequent flattopping and possible damage.

### 3-5. TRANSMITTER CARRIER TUNING PROCEDURE

The operational procedure presented in paragraph 3-6 contains the manual tuning procedure wherein all operating controls are adjusted by the operator. Paragraph 3-7 contains the automatic tuning procedure that is accomplished once the transmitter has been satisfied with all signal and voltage inputs required for automatic tuning. The numbers in parenthesis following each operating control and indicator locate the controls and indicators in the associated technical manual front panel illustration.

#### CAUTION

In the automatic mode of operation, the HFLA-10K cannot perform the automatic bandswitching function unless properly interfaced with the appropriate exciter, such as the MMX(A)-2. Without an MMX(A)-2, bandswitching must be performed manually prior to starting the automatic tuning cycle (as indicated in the manual tuning procedure).

### 3-6. MANUAL TUNING PROCEDURE

The manual tuning procedure (carrier only) for the HFTA-10KJ2 transmitter is outlined in Table 3-1.

TABLE 3-1. MANUAL TUNING PROCEDURE (CARRIER ONLY)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
1	Set MAIN POWER circuit breaker (30) and EXCITER ON/OFF switch (31) to ON positions.	All transmitter blowers operate. TECHNIMATIC light (3) and PA BAND indicator (12) illuminate. STANDBY indicator on the exciter illuminates.
2	Set SCREENS circuit breaker (33) to ON.	INTERLOCK indicator (8) lights (provided that all safety interlocks are closed and the time delay cycle has been completed)
3	Set MAN/AUTO switch (9) to MAN.	No indications at this time; however, automatic tuning circuitry is disabled.
4	Set ALARM ON/OFF switch (34) to OFF.	If ALARM ON/OFF switch had been in the ON position with high voltage removed, the audible high voltage alarm would be on. This switch disconnects alarm circuitry.
5	Set RF GAIN control (20) fully counterclockwise.	No Indications.

NOTE

The transmitter is equipped with protective overload circuitry incorporated in meters on the transmitter. If an overload occurs in either the PA PLATE current, PA SCREEN current, IPA plate current or at the transmitter output in the form of excessive vswr, the corresponding meter face will light to indicate an overload has occurred in that circuit of the transmitter. Also, each of these meters has an overload indicator that can be adjusted to trip at a value set by the operator.

6 Adjust the OVERLOAD INDICATOR (adjustment screw located directly below each meter face) on each meter for the following:

PA PLATE current	3-1/2 amperes
PA SCREEN current	80 ma
IPA plate current	800 ma
REFLECTED power	as desired

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
7	Select band by holding BAND-SWITCH control (7) first to left until a PA band indicator (12) lights, then holding BAND-SWITCH control to the right until the next PA band indicator lights. Continue this operation until the associated band indicator lights for the desired operating frequency.	PA band indicator (12) lights to indicate PA frequency band selected.

NOTE

The transmitter contains four preset average output power levels which are adjustable and selected at the front of the transmitter. Before applying excitation to the transmitter one of the four preset power levels should be selected. (to calibrate the four levels, refer to the HFLA-10K technical manual). With the power properly calibrated they are automatically adjusted from the internal ALDC circuits. In power level 1, the transmitter will tune to 3 kw, in power level 2 it will tune to 5 kw, in power level 3 it will tune to 8 kw, and in power level 4 the transmitter will tune to 10 kw. When tuning the transmitter manually, the ALDC circuit remains activated and will limit the transmitter power output in accordance with the power level selected, corresponding to the desired power output.

- \*8 Remove bias control cover on IPA drawer to expose bias adjust potentiometers (PA BIAS, IPA BIAS and 2ND AMP BIAS)

\* These steps are not part of the normal operating procedure, and should only be performed periodically in the order indicated.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
9	Press HIGH VOLTAGE switch (10) to light indicator. (It may be necessary to press HIGH VOLTAGE switch twice).	HIGH VOLTAGE switch lights when high voltage is on.
*10	Adjust PA BIAS control for an indication of 0.75 ampere on the PA PLATE CURRENT meter (2).	PA PLATE CURRENT meter indicates quiescent current of 0.75.
<u>NOTE</u>		
The IPA bias adjust is critical, as it will effect the transmitter TUNE LEVEL during automatic tuning.		
*11	Adjust IPA bias control for an indication of 210-230 ma on IPA plate current meter (19).	IPA plate current meter (19) indicates quiescent current of 210-230 ma.
*12	Hold PLATE METER switch (18) up and adjust 2ND AMP BIAS control for an indication of 220-240 ma.	IPA plate current meter (19) indicates IPA quiescent current of 200-240 ma when PLATE METER switch is in 2ND AMP position.
*13	Replace bias control cover, press HIGH VOLTAGE switch (10) to remove high voltage, and extend IPA drawer out on its chassis tracks to expose 1ST AMP BIAS control.	HIGH VOLTAGE indicator goes out and PLATE meters indicate zero.
*14	Pull IPA drawer interlock shaft outward to defeat interlock, and press HIGH VOLTAGE switch (10) to apply high voltage.	HIGH VOLTAGE indicator lights and PLATE meters indicate PA and IPA plate currents.

\*These steps are not part of the normal operating procedure, and should only be performed periodically in the order indicated.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
*15	Set PLATE METER switch (18) to 1ST AMP position and adjust 1ST AMP BIAS control for 60-70 ma (1ST AMP BIAS control located on underside of IPA drawer). After adjustment is completed, remove high voltage, reinsert IPA drawer interlock, and push in and secure IPA drawer.	IPA plate current meter (19) indicates 60-70 ma with PLATE METER switch in 1ST AMP position.
16	Set the TEST KEY switch (35) to the up position.	
17	Set the controls on the MMX(A)-2 exciter as follows; METER switch to RF position, CARR SUPPR switch to FULL position, ON/STANDBY switch to ON position, EXCITER ON/PTT switch to the EXCITER ON position. MODE switch to CW position, frequency selector switches to the desired carrier frequency (refer to paragraph 3-4 b.), RF OUTPUT control for an output of approximately 100 milliwatts.	MONITOR meter on the MMX(A)-2 exciter reads approximately 2 with 100 milliwatt output.

NOTE

During initial manual tuning of transmitter, r-f output power will be increased or decreased with the RF GAIN control (20).

18	Press the HIGH VOLTAGE switch (10) to light indicator, and adjust RF GAIN control (20) clockwise slightly to cause increase in IPA plate current indication on PLATE current meter (19), not to exceed 300 ma.	HIGH VOLTAGE switch indicator (10) illuminates and IPA plate current (19) indicates an increase in meter reading not to exceed 300 ma.
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\* These steps are not part of the normal operating procedure and should only be performed periodically in the order indicated.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
19	Adjust IPA TUNE control (21) for a noticeable increase and peak in PA plate current indication on PA PLATE current meter (2).	The rotation of IPA TUNE control applies IPA output to PA, indicating resonance. At this point PA PLATE current meter (2) indicates an increase in quiescent current.
<u>CAUTION</u>		
During tuning of power amplifier do not exceed a PA PLATE current meter reading of 1.5 amperes. If an overload should occur, the HIGH VOLTAGE indicator will go out. To reset high voltage, decrease r-f drive to minimum and press to light HIGH VOLTAGE indicator. (HIGH VOLTAGE switch must be pressed twice to energize high voltage).		
20	Operate PA TUNE control (11) (press control down or up in small increments), as necessary, to cause a noticeable resonant dip in PA PLATE current meter (2) indication.	PA PLATE current meter indicates resonant dip and PA OUTPUT meter (5) indicates power output.
21	Operate PA LOAD control (17) (press control + or - in small increments), as necessary, to produce a maximum reading on PA OUTPUT meter (5).	PA OUTPUT meter indicates a further increase in power output during loading process.
22	Operate the PA LOAD control (17) (Press control up or down), as necessary, to cause LOAD SENSE meter (6) to indicate at or near zero reading.	PA OUTPUT meter (5) indicates highest value when transmitter is properly loaded into antenna or load.

NOTE

Proper tuning can also be accomplished by observing LOAD SENSE meter (6) for a zero to 100 reading at a level of 1kw.

TABLE 3-1. MANUAL TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
23	Re-adjust IPA TUNE control (21) for further increase in PA OUTPUT meter indication.	PA OUTPUT meter (5), may indicate a slight increase in meter reading.
24	Rotate RF GAIN control (20) clockwise to increase PA output power level to desired preset power level.	PA OUTPUT meter (5) indicates desired output level.
25	Set the TEST KEY switch (35) to its center or neutral position.	PA OUTPUT meter indication goes to zero.

NOTE

Upon completion of manual tuning on carrier, the transmitter is ready for operation in an intelligence mode. Exciter control positions for the various modes of operation are outlined in section 3 of the MMX(A)-2 technical manual. The above outlined procedure has presented a logical sequence for manually tuning the HFTA-10KJ2 on a selected carrier frequency at the desired or rated average power output level. Refer to paragraph 3-8 for power output indications under multitone, multi-channel transmissions, before the reapplication of excitation to the transmitter.

3-7. AUTOMATIC TUNING PROCEDURE

The automatic tuning procedure (carrier only) for the HFTA-10KJ2 transmitter is outlined in table 3-2.

TABLE 3-2. AUTOMATIC TUNING PROCEDURE (CARRIER ONLY)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
1	Set MAIN POWER circuit breaker (30) and EXCITER ON/OFF (31) switch to the ON positions.	All transmitter blowers operate. TECHNIMATIC light (31), PA band indicator (2) and POWER level indicator (14) light. STANDBY indicator on exciter illuminates.



TABLE 3-2. AUTOMATIC TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
2	Set SCREENS circuit breakers (33) to ON.	INTERLOCKS indicator (8) lights (provided that all safety interlocks are closed and the time delay cycle has been completed).
3	Set ALARM ON/OFF switch (34) to OFF position.	If ALARM ON/OFF switch had been in the ON position with high voltage removed, the audible high voltage alarm would be on. This switch disconnects high voltage alarm circuitry.
4	Set the MAN/AUTO switch (9) to the AUTO position.	Automatic tuning circuitry is enabled.
5	Set the controls on the MMX(A)-2 exciter as follows: METER switch to RF position, CARR SUPPR switch to FULL position, ON/STANDBY switch to ON position, EXCITER ON/PTT switch to the EXCITER ON position, MODE switch to the CW position, frequency selector switches to the desired carrier frequency (refer to paragraph 3-4 b), RF OUTPUT control for an output of approximately 100 milliwatts (reading of about 2 on the MONITOR meter).	On the MMX(A)-2 the POWER indicator should illuminate and the MONITOR meter should read approximately 2. The bandswitches in the IPA and PA sections should position automatically; the proper bandswitch indicator (12) for the band including the selected carrier frequency, should illuminate.
6	Select the desired output power level with POWER ADJ switch (15). When POWER ADJ switch is in the up position, one of four preset power levels is selected.	The POWER level indicator (14) illuminates to indicate the power level selected. (the levels are fully adjustable and can be set by the operator; refer to section 5 of the HFLA-10K technical manual for information pertaining to power level adjustments.)
*7	Set the MAN/AUTO switch (9) to the MAN position.	Automatic tuning circuitry is disabled.
* NOTE These steps are not a part of the normal operating procedure and should only be performed periodically in the order indicated.		

TABLE 3-2. AUTOMATIC TUNING PROCEDURE (cont)

<u>STEP</u>	<u>OPERATION</u>	<u>NORMAL INDICATIONS</u>
*8	Ensure that the RF GAIN control (20) is set for minimum (fully counterclockwise), and press the HIGH VOLTAGE switch (10) to light indicator. (It may be necessary to press the HIGH VOLTAGE switch twice.)	HIGH VOLTAGE switch indicator (10) illuminates. The following meter indications should be observed: PA plate current = 0.75 amperes, IPA plate current = 210-230 ma; 2ND AMP plate current = 200-240 ma; 1ST AMP plate current = 60-70 ma. (Plate current for the 1ST and 2ND AMP's will be indicated on PLATE METER (19) with PLATE METER switch (18) in the respective positions.)
<u>NOTE</u>		
If the values for quiescent current in step 8 are not met, refer to steps 8 thru 15 of the manual procedure, Table 3-1, for setting bias controls.		
*9	Press HIGH VOLTAGE switch (10) to remove high voltage, and set the MAN/AUTO switch (9) to the AUTO position.	HIGH VOLTAGE switch indicator (10) will go out. Automatic tuning circuitry will be enabled.
10	Press HIGH VOLTAGE switch (10) to light indicator and press TUNE switch (16).	High voltage is applied to transmitter and automatic tuning takes place. At the completion of the automatic tuning cycle, READY indicator (16) lights indicating transmitter tuning completed at a power output level selected by operator.

NOTE

The transmitter automatic tuning should be completed in approximately 10 seconds; however, incorrect control settings can cause excessive tuning time resulting in a fault indication. If the FAULT indicator (13) lights, check for correct band indication and excitation level before depressing TUNE/READY switch again. If the FAULT indicator lights again, refer to the HFLA-10K technical manual for automatic-tuning adjustment procedures.

\* These steps are not a part of the normal operating procedure, and should only be performed periodically in the order indicated.

#### NOTE

Upon completion of automatic tuning on carrier, the transmitter is ready for operation in an intelligence mode. Exciter control positions for the various modes of operation are outlined in section 3 of the MMX(A)-2 technical manual. This procedure has outlined the logical sequence for automatically tuning the HFTA-10KJ2 on a selected carrier frequency at the desired or rated average power output level. Refer to paragraph 3-8 for power output indications under multitone, multichannel transmissions, before the reapplication of excitation to the transmitter.

#### CAUTION

The aforementioned procedure outlines carrier automatic tuning. However, once the exciter has been adjusted for the desired type of intelligence and emission mode, the reapplication of r-f drive from the exciter must be carefully adjusted to avoid exceeding the PEP rating of the transmitter. Figure 3-1 illustrates the relationship between peak and average power in graphic form under multitone conditions.

#### 3-8. AVERAGE POWER OUTPUT INDICATIONS

When two tones of equal amplitudes are supplied to a single sideband system, the ratio of PEP to average power is 2:1. This relationship is valid for two tones only. Thus, it is apparent that when two tones of equal amplitude are applied to the transmitter, the average power will be 5 Kw when PEP is 10 Kw.

#### NOTE

PA OUTPUT meter indicates average power only. As an option, TMC offers a peak envelope power meter which indicates PEP and average power.

In multichannel, multitone transmission modes where more than two tones are used, a definite relationship exists between the average power as indicated on the PA OUTPUT meter and peak envelope power developed. A chart in graphic form (figure 3-1) indicates the average power meter readings as a function of tones. The graph already contains the correction factor required when measuring multitone envelopes with an average reading meter (5 Kw average reads approximately 4.1 Kw).

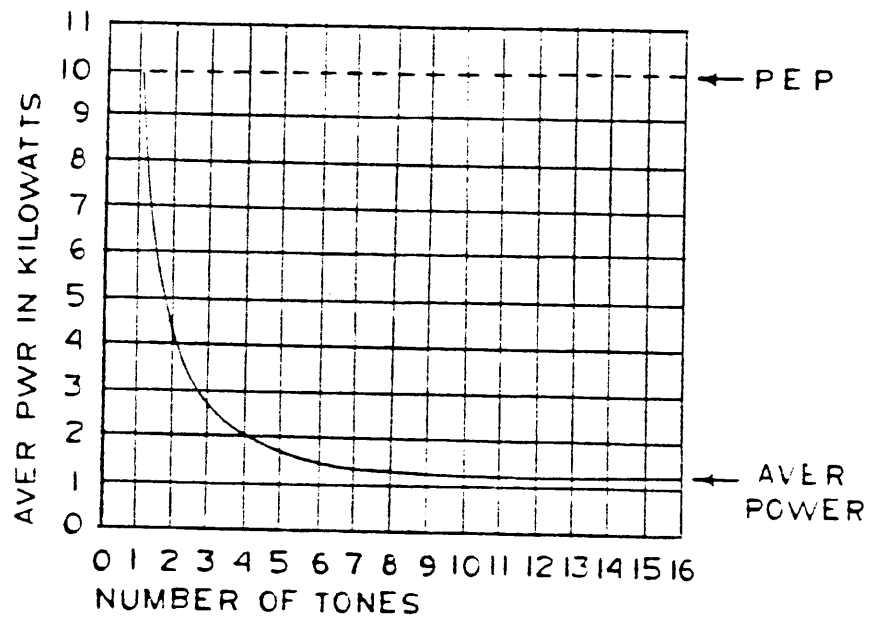


Figure 3-1. Ratio Average Power and PEP as a Function of Tones

## SECTION 4

### PRINCIPLES OF OPERATION

#### 4-1. OVERALL BLOCK DIAGRAM ANALYSIS

Figure 4-1 is an overall block diagram of the HFTA-10KJ2 which consists of an MMX(A)-2 Multi-Mode Exciter driving an HFLA-10K Linear Power Amplifier. The MMX(A)-2 provides at least 100 milliwatts of r-f power to the HFLA-10K within the operating range of 2 to 30 MHz in any one of the following modes: AM, AME (carrier reinserted), SSB, ISB, CW, FSK, or FAX. The HFLA-10K provides linear amplification of the MMX(A)-2 r-f output and provides 10 kilowatt PEP within the operating frequency range of the transmitter. The transmitter r-f is applied to a transmitting antenna which matches the 50 ohm output impedance of the HFTA-10KJ2.

The HFLA-10K provides an ALDC (automatic load and drive control) feedback voltage to the MMX(A)-2 which prevents the r-f output of the transmitter from exceeding a preset level. The ALDC circuit in the MMX(A)-2 automatically compensates for high modulation peaks and load changes, providing a relatively constant output level, in addition to limiting distortion and improving linearity.

Primary power, 230 vac, 50/60 Hz is applied to the HFLA-10K; power for the MMX(A)-2 is obtained via the EXCITER ON/OFF SWITCH located on the HFLA-10K.

#### 4-2. FUNCTIONAL ASSEMBLY SECTIONS

Refer to the associated technical manuals for detailed principles of operation for the MMX(A)-2 Multi-Mode Exciter and the HFLA-10K High Frequency Linear Power Amplifier.

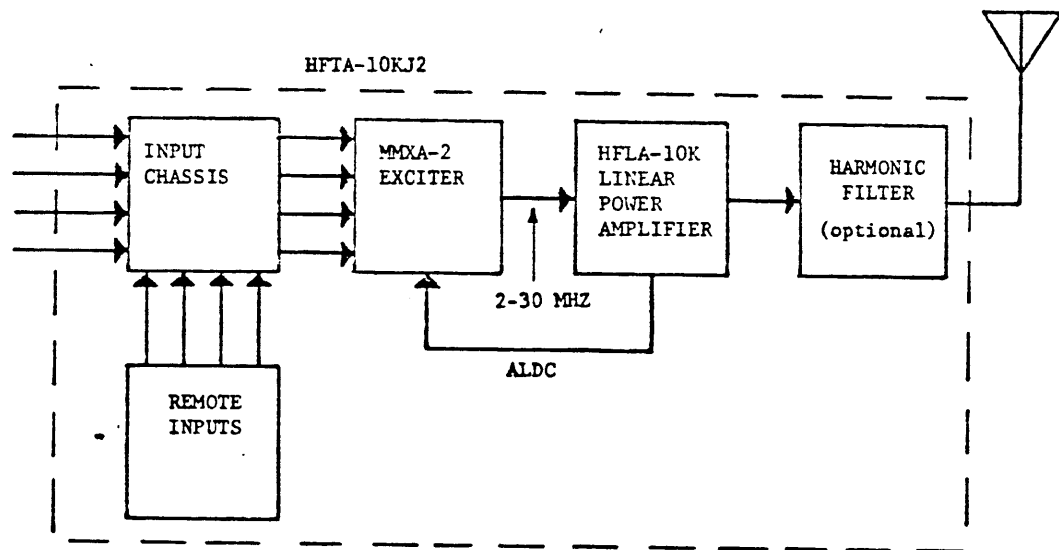


Figure 4-1. Functional Block Diagram

## SECTION 5

### MAINTENANCE AND TROUBLESHOOTING

#### 5-1. INTRODUCTION

The HFTA-10KJ2 has been designed for long term, trouble-free operation. When it becomes necessary to perform alignment and/or adjustments to the equipment, it is recommended that technicians perform the necessary operations outlined in the associated HFLA-10K and MMX(A)-2 technical manuals. The following maintenance aids are provided for troubleshooting and replacement of parts.

- a. Overall block diagram (Section 4, Figure 4-1)
- b. Component location diagram (Figure 5-1)

#### 5-2. TEST EQUIPMENT REQUIRED

Table 5-1 lists the test equipment required for maintaining and troubleshooting the transmitter. Refer to the MMX(A)-2 and HFLA-10K technical manuals for additional equipment required to maintain and troubleshoot these two components.

TABLE 5-1. TEST EQUIPMENT REQUIRED

<u>EQUIPMENT</u>	<u>TYPE</u>
Signal Generator	Hewlett-Packard Model 606A, or equivalent
VIVM	Hewlett-Packard Model 410B, or equivalent
Multimeter	Simpson Model 260, or equivalent
Oscilloscope	Tektronix, Model 541A, or equivalent

#### 5-3. OPERATOR'S MAINTENANCE PROCEDURE

- a. Refer to transmitter operating procedure (paragraphs 3-6 and 3-7)
- b. Refer to troubleshooting (paragraph 5-5).
- c. Refer to maintenance procedures described in the HFLA-10K and MMX(A)-2 technical manuals.

#### 5-4. PREVENTIVE MAINTENANCE

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to. At periodic intervals, the equipment should be pulled out on its slides for internal cleaning and inspection.

The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichloroethylene or methyl chloroform may be used, providing the necessary precautions are observed. For detailed preventive maintenance procedures, refer to the applicable HFLA-10K and MMX(A)-2 technical manuals.

#### WARNING

WHEN USING TOXIC SOLVENTS, MAKE CERTAIN THAT ADEQUATE VENTILATION EXISTS. AVOID PROLONGED OR REPEATED BREATHING OF THE VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. FLAMMABLE SOLVENTS SHALL NOT BE USED ON ENERGIZED EQUIPMENT OR NEAR ANY EQUIPMENT FROM WHICH A SPARK MAY BE RECEIVED. SMOKING, "HOT-WORK", ETC. IS PROHIBITED IN THE IMMEDIATE AREA.

#### CAUTION

When using trichloroethylene, avoid contact with painted surfaces, due to its paint-removing effects.

#### 5-5. TROUBLESHOOTING

Troubleshooting the HFTA-10KJ2 consists of isolating faults to either the MMX(A)-2 Exciter or the HFLA-10K Power Amplifier. Refer to the associated technical manuals for detailed troubleshooting procedures of the MMX(A)-2 and HFLA-10K. Refer to operator's section for normal indications.

a. Disconnect the MMX(A)-2 r-f output from the HFLA-10K and connect the MMX(A)-2 to a 50 ohm, 1 watt, non inductive dummy load. Use an oscilloscope to monitor the exciter output, referring to the MMX(A)-2 technical manual for normal indications.

b. Use an ohmmeter to check for continuity of interconnect cabling between the MMX(A)-2 and HFLA-10K.

c. Disconnect the MMX(A)-2 and connect a signal generator to the HFLA-10K input. Operate the HFLA-10K into a dummy load (if available) and monitor the HFLA-10K meters for proper operation. (Refer to paragraphs 3-6 and 3-7 and the HFLA-10K technical manual for normal indications.)

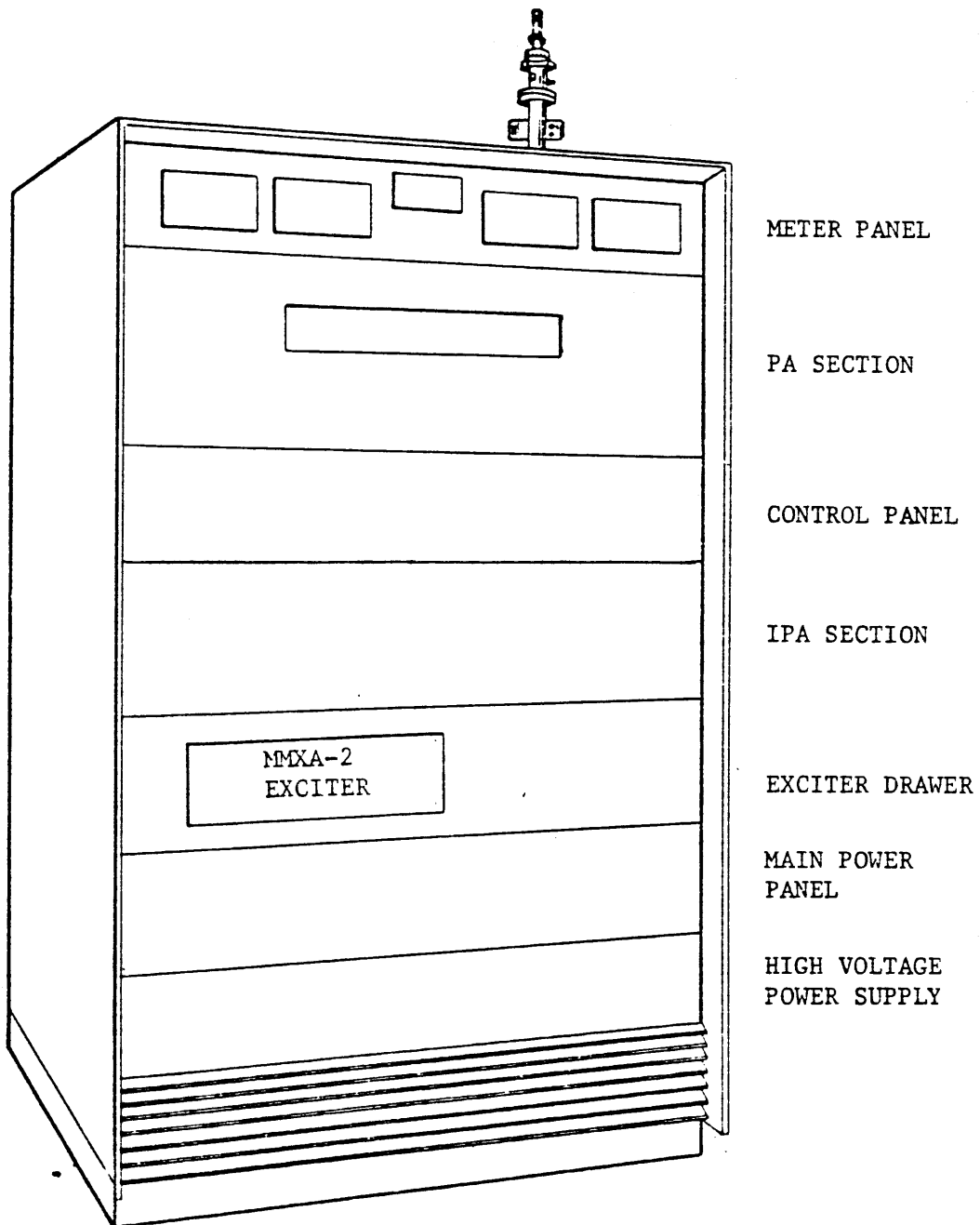


Figure 5-1. Component Location Diagram, HFTA-10KJ2



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CHANGE NO. 3

INSTRUCTION BOOK CHANGE NOTICE

Date January 1975

Manual affected: Linear Power Amplifier, HFLA-10K

1. On page 6-6, add the following to A701 Parts List:

REF. SYMBOL	DESCRIPTION	TMC PART NO.
A701R16	Resistor Variable Composition	RV111U252A

2. On page 6-26, add the following to A1008 Parts List:

REF. SYMBOL	DESCRIPTION	TMC PART NO.
A1008R8	Resistor Variable Composition	RV111U252A

SHOULD ADDITIONAL COPIES OF THIS CHANGE NOTICE BE REQUIRED, PLEASE CONTACT:  
THE TECHNICAL MATERIEL CORP., 700 Fenimore Road, Mamaroneck, New York 10543  
Attn: Director of Eng. Services



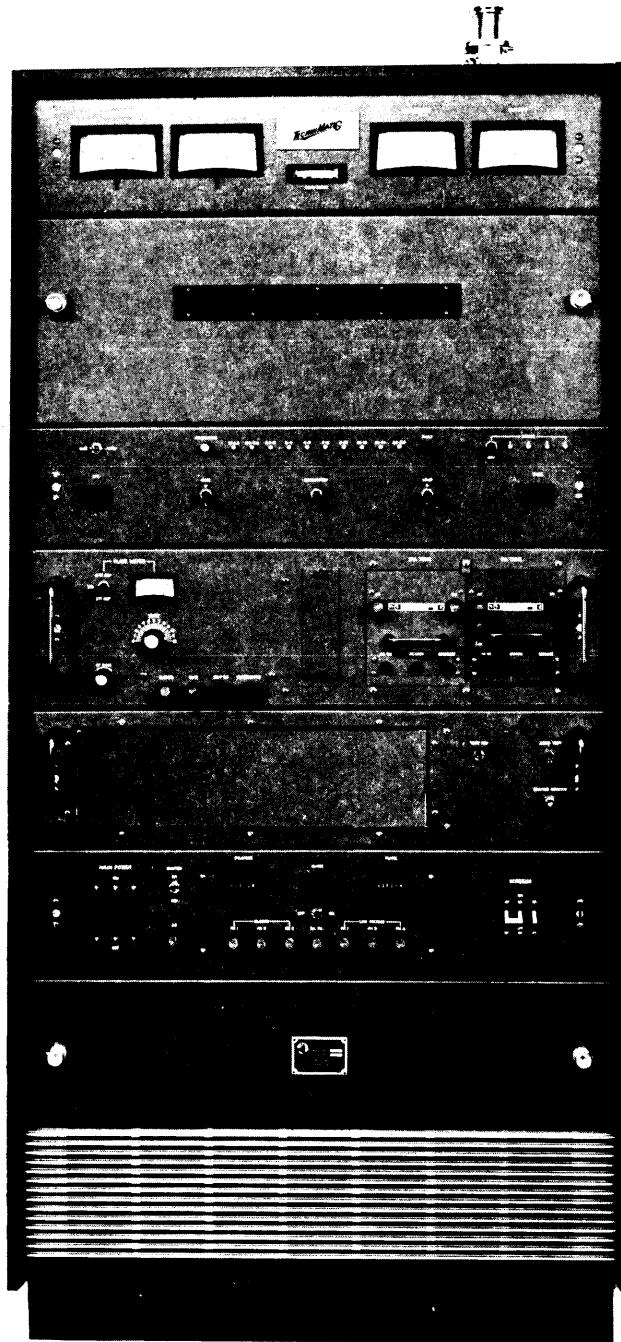


Figure 1-1. Linear Power Amplifier, Model HFLA-10K



## SECTION 1

### GENERAL INFORMATION

#### 1-1. PURPOSE OF EQUIPMENT

The HFLA-10K is a conservatively-rated high-powered automatic linear amplifier which delivers 10 kilowatts PEP (peak envelope power) and average throughout the frequency range of 2 to 30 MHz. The HFLA-10K will accept the output of any exciter providing 100 milliwatts drive. Additionally, the amplifier also contains circuitry that provides rapid tuning, either locally or remotely, as desired.

#### NOTE

The HFLA-10K is basically an amplifier. When combined with an exciter, it is referred to as a transmitter. Although this manual details the HFLA-10K, the unit is referred to as a transmitter, where applicable.

#### 1-2. EQUIPMENT MAKE-UP

Table 1-1 lists the major components of the transmitter.

TABLE 1-1. MAJOR COMPONENTS

TMC DESIGNATION	ASSEMBLY NUMBER
Main Frame Sub-Assembly	AX5164
Meter Panel	AX5165
PA Section	AX5170
IPA Drawer	AX5167
Exciter Drawer	AX5168
Main Power Panel	AX5169
Input Chassis	AX5101
Main Power Supply	AP153
Main Control Panel	AX5166
Harmonic Filter	AF110

#### 1-3. DESCRIPTION OF EQUIPMENT

a. GENERAL. As shown in figure 1-1, the unit consists of a single frame, housing all the components of the transmitter. Primary power connections are made through the access hole on the base assembly. External exciter transmitter control connections are made to the exciter remote assembly. Transmitter r-f power is routed through a directional coupler mounted in the opening located on the top of the transmitter. The transmitter

frame houses an exciter drawer, a two-stage broad band linear amplifier, an intermediate power amplifier, 10-kw power amplifier, and associated power supplies and control circuits. The r-f components are distributed through the upper portion of the frame. Heavy power supply components are bolted to the base channels of the frame.

b. MAIN METER PANEL. The main meter panel contains five meters. The meters monitor PA PLATE current, PA SCREEN current, LOAD SENSE, REFLECTED power, and PA OUTPUT power. The PA OUTPUT meter is calibrated in kilowatts (average power).

c. POWER AMPLIFIER. The power amplifier section is mounted below the main meter panel. It contains the power amplifier tube (4CX10,000J) especially designed for sideband work. The output circuit is a modified parallel L circuit designed to match an unbalanced antenna of 50 ohms with a vswr of 3:1. The automatic tuning and loading components are located in the PA compartment.

d. IPA DRAWER. The IPA drawer is slide mounted directly below the main control panel for the power amplifier and serves as the intermediate power amplifier between an associated exciter and power amplifier. The IPA drawer contains two fully broadbanded r-f amplifiers and a final amplifier which provides approximately 500 watts drive to the PA section. The final IPA and 2ND amp tubes are air-cooled by a self-contained blower within the drawer. Bandswitching is accomplished via the bandswitch control on the main control panel. Transmitter bias supply and 24 volts d-c supply are located in the IPA drawer.

Servo amplifier plug-in units (IPA and PA tune) are also located in the IPA drawer. These units, when controlled by the sense circuits of the IPA and PA, automatically tune and load the IPA and PA sections of the transmitter.

e. EXCITER DRAWER. Normally, the exciter drawer houses an exciter (Model MMX( )-2 or Model SME-6). However, when the transmitter is to be driven from an external source, the exciter drawer is fitted with a blank panel. The exciter drawer also houses control circuitry related to automatic tuning.

f. MAIN POWER PANEL. The main power panel, mounted directly below the exciter drawer, controls the application of primary power, filament and screen voltages to the IPA and PA sections of the transmitter. Other front panel controls include a high voltage aural ALARM with its ON/OFF switch, PLATE and FILAMENT time meters, which monitor the time voltage has been applied to both the plate and filaments of the power amplifier tube, and EXCITER ON/OFF switch, which applies a-c power to the exciter when one is mounted in the exciter drawer.

g. MAIN POWER SUPPLY. The main power supply is mounted on the bottom of the transmitter frame. The power supply contains a high-voltage transformer and associated circuitry to provide plate and screen voltages to the r-f amplifiers within the transmitter.

h. HARMONIC FILTER. (Customer option) The harmonic filter is an automatically switched filter network which decreases the harmonic content of the PA signal. The filter is mounted in the front of the PA section directly behind the PA window. Six filter sections cover the frequency range of the transmitter.

#### 1-4. TECHNICAL SPECIFICATIONS

FREQUENCY RANGE: 2 to 30 mHz standard.

OPERATING MODES: SSB, ISB, CW, AM, FSK and FAX (with the appropriate exciter). Four channel ISB with SBG-4 or TMX adapter.

POWER OUTPUT: 10,000 watts 2 tone PEP with signal to distortion ratio 35 db. 10 kw average.

OUTPUT IMPEDANCE: 50 ohms unbalanced with 3:1 vswr; EIA flange for 1-5/8 inches coaxial.

STABILITY and FREQUENCY CONTROL: Depends on exciter used.

TUNING: Automatic or manual. Automatic has manual override.

RF INPUT: Provides full PEP output with 100 milli-watt r-f input.

REMOTE OPERATION: Facilities for remote operation including mode, frequency, power level and readback available.

SPURIOUS SIGNALS: At least 60 db below full PEP output.

HARMONIC SUPPRESSION: Second harmonic at least 50 db down from PEP output. Third harmonic at least 65 db down from PEP output.

HARMONIC FILTERS: Available fixed for all frequencies above 30 mHz or bandswitched for lower frequencies. Resultant harmonics conform to latest requirements.

AUDIO INPUT: Depends on exciter used.

METERING: Meters with special illuminated overload protection.

NOISE: Power supply ripple 55 db down from full PEP output. Other 70 db down.

1-4. TECHNICAL SPECIFICATIONS (cont)

COOLING: Filtered forced air cooling, semi-presurized cabinet.

ENVIRONMENTAL: Designed to operate in any ambient temperature between the limits of 0 to 50°C for any value of humidity to 90%.

SPECIAL FEATURES: Adjustable power output levels with overload and bias protection, and alarm. Controlled and adjustable ALDC. Safety interlocks at all high voltage points.

PRIMARY POWER: 210, 220, 230, 240, 250 volts, 50/60 Hz, 3 phase, Delta or Wye. (Other voltages available on special request).

POWER REQUIREMENTS: Maximum 27,000 watts. All solid state power supply.

SIZE: 33-1/2 inches wide x 38-3/4 inches deep x 68-3/4 inches high standard.

INSTALLED WEIGHT: Approximately 1300 pounds.

SHIPPING WEIGHT: Approximately 1660 pounds.

SIZE OF LARGEST SHIPPING CONTAINER: 43 inches wide x 49 inches long x 81 inches high.

COMPONENTS AND CONSTRUCTION: Manufactured in accordance with JAN/MIL wherever practicable.

SECTION 2  
INSTALLATION

WARNING

Strictly adhere to the order of presentation of the procedures detailed in this section. Failure to follow the indicated order could result in personnel injury and could cause possible equipment damage.

2-1. EQUIPMENT INSPECTION

The HFLA-10K was assembled, calibrated, and tested at the factory before shipment. Inspect all packages for possible damage during transit. Carefully unpack each crate as indicated by the packing list provided with the shipment. Inspect all packing material for parts that may have been shipped as loose items, (connector, technical manuals, hardware, etc.).

2-2. EQUIPMENT PACKAGING

The equipment is shipped in boxes as shown in figure 2-1 (typical equipment packaging). The box number and contents are stenciled on the outside of each box. Whether an equipment is crated or uncrated, various precautions must be observed in handling to prevent personnel injury and/or damage to the equipment.

2-3. PACKAGING DATA

The transmitter is packed in seven crates (table 2-1), including loose items crate (table 2-2). Each crate is assigned a number which appears on the crate. Table 2-1 also lists the crated weights and dimensions of the transmitter. Figure 2-1 shows typical packaging. Figure 2-2 illustrates the outline dimensions.

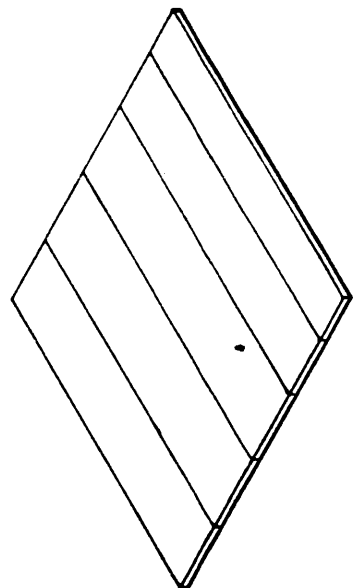
2-4. INSPECTION AND DAMAGE

Inspect the outside of all crates for possible transit damage. While following the procedural installation instructions, carefully unpack each crate as indicated. Inspect all packing material for parts which may have been shipped as loose items.

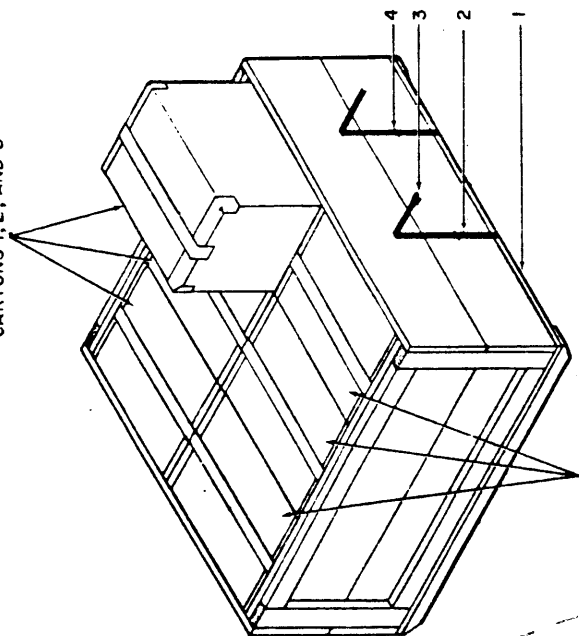
With respect to equipment damage for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

LEGEND

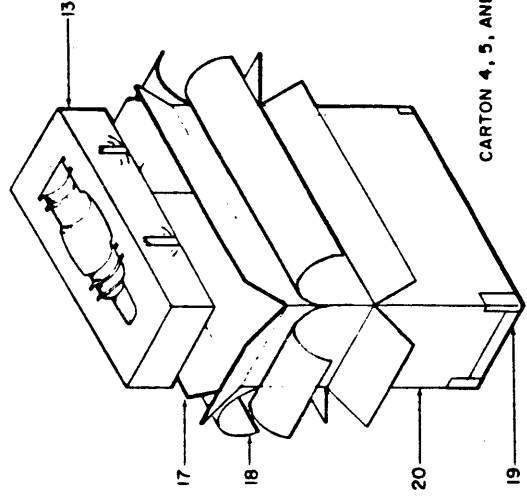
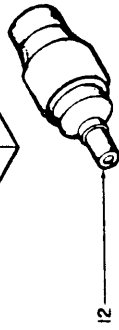
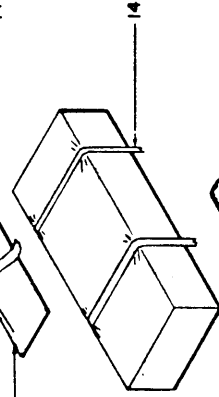
- 1. WOODEN BOX
- 2. STEEL STRAPPING
- 3. STRAPPING SEALS
- 4. STEEL STAPLES
- 5. BARRIER BAG
- 6. FIBERBOARD BOX
- 7. CELLULOSIC WADDING
- 8. FIBERBOARD BOX
- 9. PRESSURE SENSITIVE TAPE
- 10. BARRIER BAG
- 11. FIBERBOARD BOX
- 12. CAPACITOR
- 13. MOULDED CUSHIONING
- 14. MARKING TAPE
- 15. TISSUE PAPER
- 16. BARRIER BAG
- 17. FIBERBOARD BOX
- 18. BARRIER BAG
- 19. PRESSURE SENSITIVE TAPE
- 20. FIBERBOARD BOX
- 21. SHAFT AND GEAR



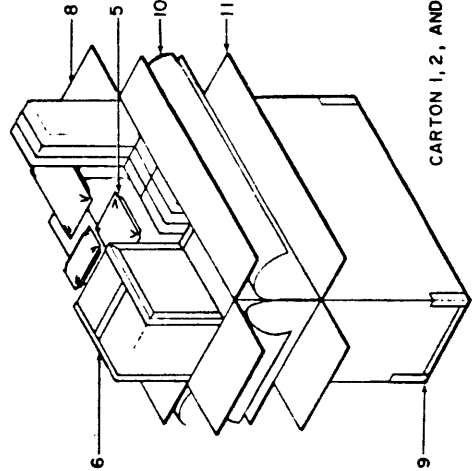
CARTONS 1, 2, AND 3



CARTONS 4, 5, AND 6



CARTON 4, 5, AND 6



CARTON 1, 2, AND 3

DETAIL A

DETAIL B

DETAIL A AND B IN SHIPPING CRATE

Figure 2-1. Typical Equipment Packaging

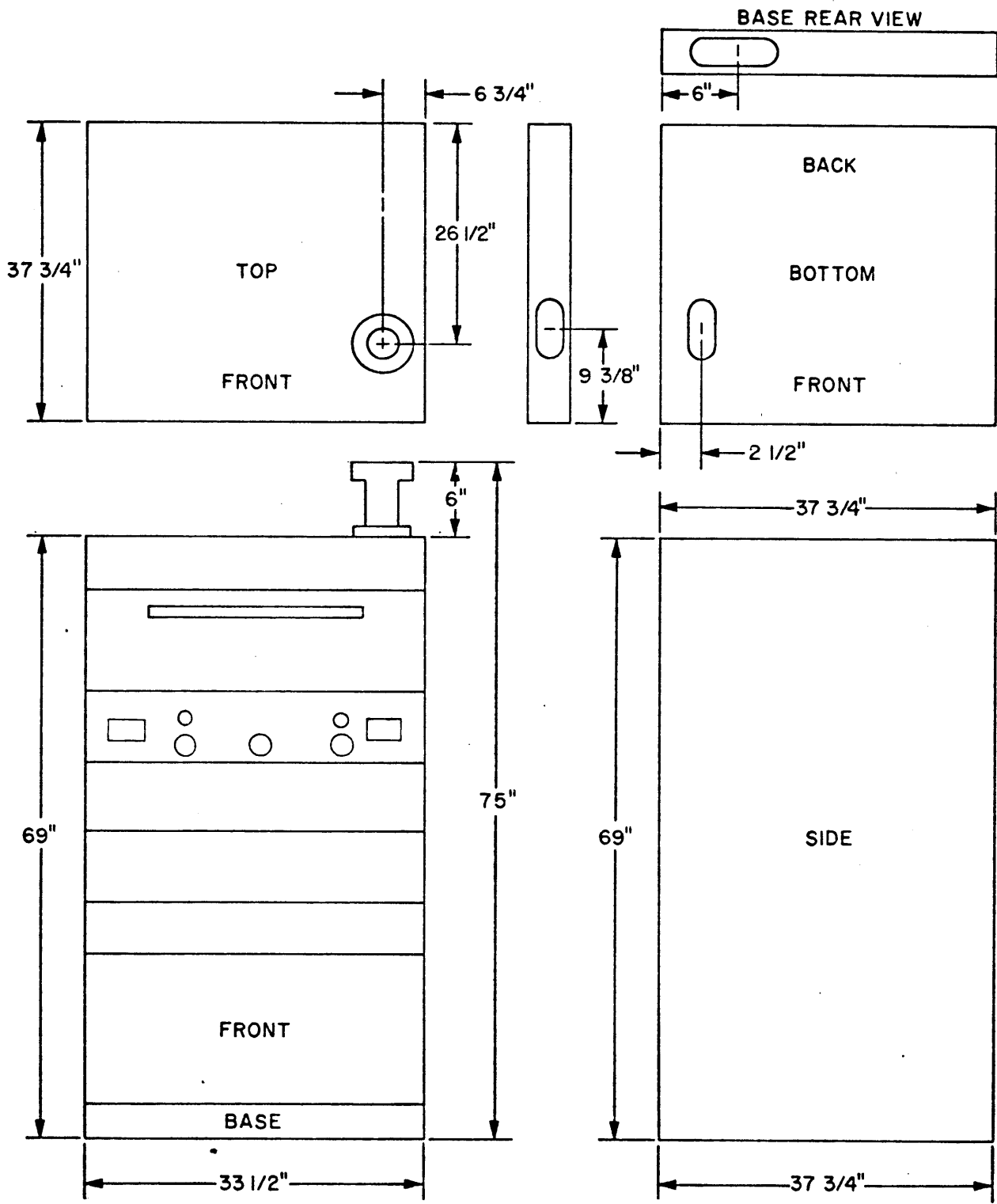


Figure 2-2. Outline Dimensional

TABLE 2-1. CRATED WEIGHTS, DIMENSIONS, AND CONTENTS

Crate No.	Contents	Gr. Wt.	Cu. Ft.	Dimensions (Inches)		
				D	W	H
1	Loose Items	100	8.6	28-3/4	19-3/4	24
2	Frame	947	96.8	48	42-3/8	80-1/4
3	Exterior Covers	280	20.7	73-3/8	45-3/8	14-1/8
4	TF203	536	7.9	28-3/4	19-3/4	24
5	Driver Drawer AX5167	195	14.9	41	31	19-3/8
6	Exciter Drawer AX5168	190	14.9	41	31	19-3/8
7	TF410	275	4.6	24-5/8	17-5/8	17-1/2

TABLE 2-2. LOOSE ITEMS

- |   |  |
|---|--|
| 1. Shorting Stick, 1 each,<br>TMC P/N A1990-6 | 9. BNC Connector, 1 each,<br>TMC P/N UG88/U  |
| 2. Connector, 1 each,<br>TMC P/N MS3106B32-7P | 10. Washer, 4 each,<br>TMC P/N FW10HBN       |
| 3. R-f Connector, 1 each,<br>TMC P/N JJ246-50 | 11. Washer, 20 each,<br>TMC P/N FW25HBN      |
| 4. Cable Clamp, 1 each.<br>TMC P/N MS3057-20  | 12. Washer, 16 each,<br>TMC P/N FW31HBN      |
| 5. Bushing, 1 each,<br>TMC P/N MS3420-16A     | 13. Washer, 4 each,<br>TMC P/N LWE10MRN      |
| 6. Bushing, 1 each,<br>TMC P/N MS3420-20A     | 14. Washer, 20 each,<br>TMC P/N LWS25MRN     |
| 7. Lug, 3 each,<br>TMC P/N TE197-6-25         | 15. Washer, 8 each,<br>TMC P/N LWS31HBN      |
| 8. Lug, 1 each,<br>TMC P/N TE197-6-37         | 16. Screw, 20 each,<br>TMC P/N SCHH2520-SS12 |



TABLE 2-2. LOOSE ITEMS (cont)

- |  |   |
|--|---|
| 17. Screw, 8 each,<br>TMC P/N SCHH3118BN20   | 24. Resistor, 1 each, TMC P/N RW118F310<br>ref./sym. R803 removed from PS section                               |
| 18. Screw, 4 each,<br>TMC P/N SCBP1032BN10   | 25. Relays, 4 each, TMC P/N RL168-3C-10-24DC<br>ref./sym. K2001, K2002, K2004 and K2005<br>removed from exciter |
| 19. NUT, 8 each,<br>TMC P/N NTH3118BN20  | 26. Relay, 1 each, TMC P/N RL168-2C-10-24DC<br>ref./sym. K2003 removed from exciter<br>drawer                   |
| 20. Output Connector, 1 each,<br>TMC P/N DC104 removed from<br>top of frame.         | 27. Tube Electron, 1 each, TMC P/N 8576<br>removed from driver drawer   |
| 21. Tube Electron, 1 each,<br>TMC P/N 4CX10,000J removed<br>from PA section          | 28. Warranty, for TMC P/N 8576 tube Electron  |
| 22. Resistor, 1 each, TMC P/N<br>RW118F502 ref./sym. R802<br>removed from PS section | 29. Test Data, 1 set  |
| 23. Resistor, 1 each, TMC P/N<br>RW118F252 ref./sym. R801<br>removed from PS section | 30. Technical Manuals, 2 each   |

2-5. UNCRATING METHODS

The following information briefly outlines general uncrating methods. They must be adhered to when unpacking the transmitter to prevent damage. Keeping in mind previously discussed information on material handling, packaging data, inspection and damage, proceed as follows:

- a. Remove wire straps or bands from around the crate with a pair of snips.
- b. Unless otherwise specified, remove nails from three sides of the crate with a nail puller. Do not use claw hammer, pinch bar, etc.
- c. When the sides have been removed, rip off the moisture-proof paper. If a knife is used, care should be exercised not to mar equipment.
- d. If equipment is not packed in a cardboard carton, remove it from crate.

e. If after removing moisture-proof paper a cardboard carton is encountered, carefully open with a case cutter or remove tape.

f. Where applicable, remove the following:

1. Creased cardboard blocking pieces.
2. Barrier bags.
3. Tape.
4. Molded cushioning.
5. Cellulose wadding.
6. Tissue paper.

g. Check off items unpacked on the packing list or equipment supplied list.

NOTE

Anticipating the possibility of repacking the transmitter for relocation, it is suggested that all packing crates and materials be saved. Total storage area required can be calculated using dimensions in table 2-1.

2-6. INSTALLATION OF MODULAR UNITS AND LOOSE ITEMS

(Refer to figure 2-3 for installation information regarding cabinet location of all modular units.) The IPA drawer and exciter drawer units are slide mounted. To install any slide mounted unit in its compartment, proceed as described below for each modular unit.

- a. Untape or unstrap cable assemblies and all other components secured to the rack frame for shipment.
- b. Pull center section of associated track out until it locks in an extended position.
- c. Position slide mechanisms of modular unit tracks, and ease modular unit forward into rack until release buttons engage hole in track.
- d. Start at the bottom and proceed up to prevent the rack from tipping.
- e. Make the necessary cable and electrical connections to the modular units.

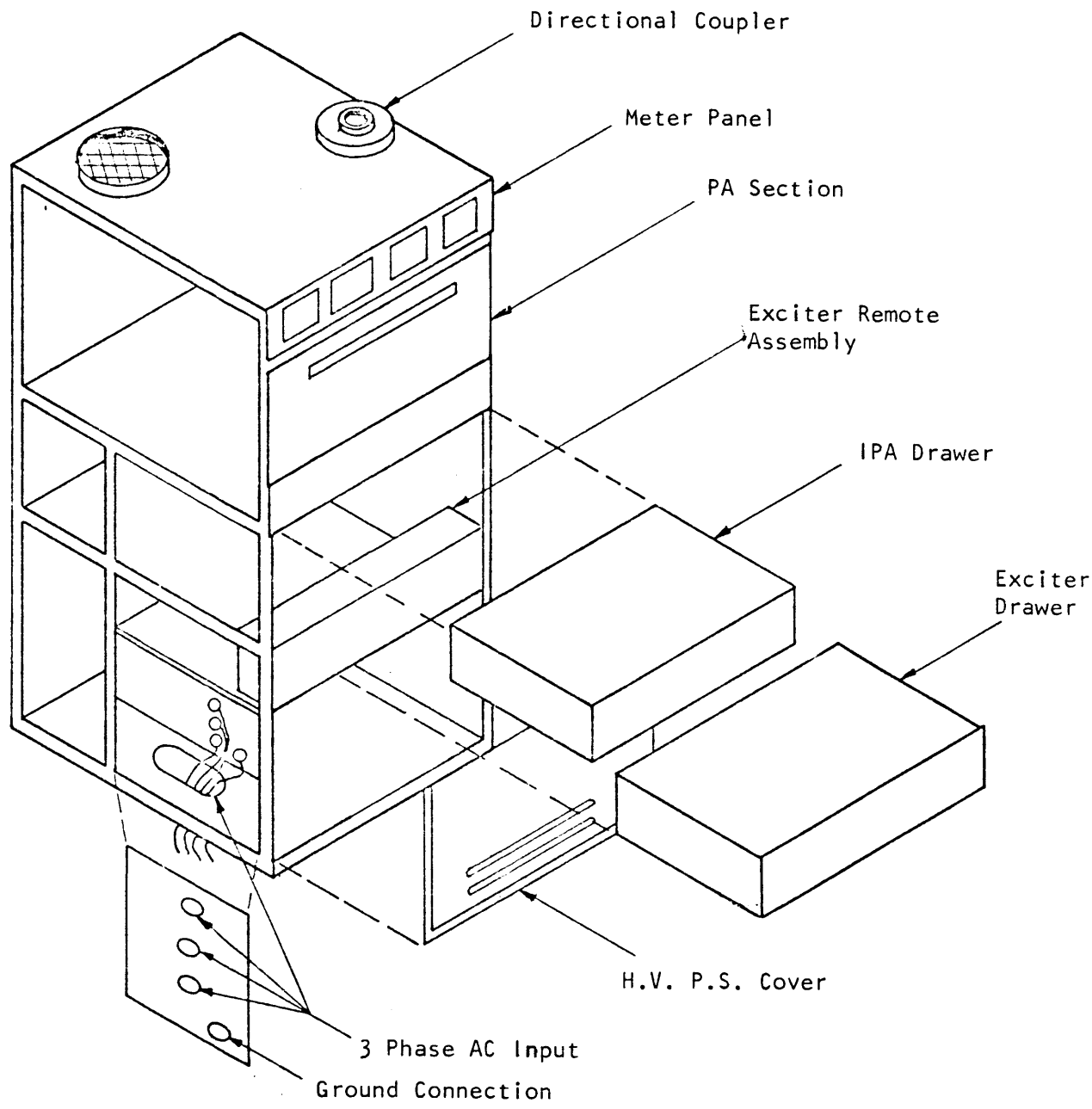


Figure 2-3. Typical Installation

f. Depress release buttons and slide modular unit completely into compartment.

g. Secure front panel of modular unit to the rack with screws.

The loose items must be installed. These consist of the top coupler, resistors in the power supply section, relays and a tube in the exciter drawer. Proceed as follows:

a. Install the coupler on the top of the unit by inserting the coupler into its access hole and securing with four nuts and four washers.

b. Install the three resistors R801, R802 and R803 in the power supply section (figure 5-14) by inserting each resistor into its clip mounting.

c. Insert relays K2001 through K2005 in the exciter drawer, (figure 5-20) by inserting each relay into its socket.

d. Insert tube V1401 in the driver drawer (figure 5-16) by inserting the tube into its socket.

#### 2-7. PRIMARY POWER REQUIREMENTS

The transmitter requires a three-phase source voltage of 210-250 volts ac 50/60 Hz. The maximum power requirement is 27,000 watts. (380 volts ac and 440 volts ac inputs utilizing an externally mounted auto transformer are available on customer request.)

#### 2-8. PRIMARY AC INPUT CONNECTIONS (See figure 2-3)

Primary power cables and station ground cables enter the cabinet through an access hole located in the bottom of the high voltage power supply compartment. To connect the primary power and ground to their respective lugs, proceed as follows:

#### CAUTION

Insure primary three-phase as is off and tagged before making connections to the transmitter.

a. Loosen panel locks on the cover of the high voltage power supply, and temporarily remove cover. (Place cover in safe place to avoid damaging or scratching.)

b. Loosen and remove lockwashers and nuts from terminals E805, E806 and E807 (figure 7-1, sheet 1 and figure 5-15) on primary a-c input board. (Do not discard.)

- c. Connect primary three-phase a-c cables to a-c input board and secure with hardware removed from step b.
- d. Measure the d-c resistance to ground of each a-c input terminal to insure that no short circuits or low resistance to ground have occurred.
- e. Remove test instrument from transmitter and replace high voltage power supply cover.

## 2-9. HIGH VOLTAGE TRANSFORMER INSTALLATION (PRIMARY AC POWER MUST BE OFF)

### CAUTION

The high voltage transformer is extremely heavy. Use fork-lift or some lifting device when attempting installation.

- a. Remove transformer from crate. Position transformer in such a manner that when installed in the bottom of frame, the front of primary terminals of transformer will be facing the front of the transmitter. (Transformer should enter frame from the rear of the power supply section.)

### NOTE

If transformer is to be installed from the front, request information from TMC engineering services for detailed procedures.

### NOTE

All transmitter primary a-c taps should be set up in accordance with station's primary a-c voltage (210 to 250 volts ac).

- b. Move all leads aside that may be in the path of the transformer prior to actual installation.

- c. Refer to figure 5-14 and position transformer in frame accordingly. Connect transformer leads in the following manner. Refer to figure 2-4 and connect CA682-2 to transformer primary terminals. Each of the three primary sections has three heavy insulated leads that must be connected between terminal "0" and the corresponding primary a-c input voltage tap (210, 220, 230, 240, and 250). The length of each heavy lead is such that they will align with the voltage tap sections to which they must be connected.

Additionally, there are small insulated leads that must be connected to the primary sections. (See figure 2-4.) Connect:

Violet lead to 230-volt terminal of first primary winding.  
White lead to 230-volt terminal of second primary winding.  
Gray lead to 230-volt terminal of third primary winding.

## 2-10. TRANSFORMER SECONDARY CONNECTIONS

The secondary terminals of transformer T801 are located at the rear of the transmitter. Connect secondary leads in the following manner. (See figure 5-14.)

### NOTE

Left, middle, and right terminals when viewed from the rear of the transmitter.

<u>CONNECT FROM</u>	<u>CONNECT TO</u>
Top rectifier (CR802)	left 3400-volt terminal on T801
Middle rectifier (CR802)	middle 3400-volt terminal on T801
Bottom rectifier (CR802)	right 3400-volt terminal on T801
Choke (L802)	neutral terminal on T801

### WARNING

Insure that all personnel are clear from transmitter before proceeding.

## 2-11. PRIMARY PHASE ROTATION CHECK

Apply primary a-c voltage to the transmitter and set MAIN POWER circuit breaker to ON. The main blower should operate. Operate BANDSWITCH control and observe that band indicators light from left to right as the BANDSWITCH control is operated. Also, check that the main blower (figure 5-14) is rotating in the direction of the arrow indicated on the hub of the blower.

### NOTE

If blower rotation or band indicator lighting sequence is incorrect, set MAIN POWER circuit breaker to OFF, insure primary a-c power is off, and reverse any two a-c input phase leads. Blower rotation and bandswitch indicator lighting sequence should be correct.

## 2-12. POWER AMPLIFIER TUBE (V701) INSTALLATION

### CAUTION

Insure primary a-c power and MAIN POWER breakers are OFF and tagged before installing PA tube.

CAUTION

Do not bend the finger contacts located inside the mounting socket. Check contacts carefully before attempting to install the tube in the socket.

- a. Remove the four screws from the air duct at the top of the cabinet.
- b. Pull out thermostat S701.
- c. Loosen clamp, slide up bottom section, and remove flue.
- d. Carefully lift tube V701 up into air duct in PA section of frame until base of tube clears socket.
- e. Carefully lower tube straight down into socket until slight resistance is encountered. Make sure tube is centered in socket.
- f. In one motion while firmly grasping tube, rotate tube approximately a quarter turn and push tube firmly down into socket. A slight amount of effort may be required to seat tube. Be careful not to damage the finger contacts in the socket when seating tube. Check tube seating; it must be all the way down and centered in tube socket.
- g. Secure with retaining strap to post.
- h. Slide the two flue sections together and slide flue over the tube.
- i. Extend the flue and secure with the clamp.
- j. Secure air duct to top of cabinet with four screws and insert thermostat S701.

CAUTION

Before proceeding with installation procedures, remove bias control cover on front of IPA drawer to expose the bias adjustment controls and adjust PA BIAS, IPA BIAS, and 2ND AMP BIAS. Pull out the IPA drawer and adjust 1ST AMP BIAS control for maximum bias (maximum clockwise).

2-13. PA FILAMENT VOLTAGE CHECK (See figure 5-14 and 7-1)

CAUTION

Insure primary a-c power and MAIN POWER breakers are OFF and tagged before connecting meter.

Once the power amplifier tube has been installed in the tube socket, perform the following filament voltage checks:

- a. Remove rear cover to expose bottom of V701.
- b. Connect a-c voltmeter between the center pin of V701 and the right pin at the junction of C713 and L703.
- c. Place meter in such a manner that it can be easily seen at a safe distance from the transmitter.
- d. Insure that personnel are clear and set primary power circuit breaker and MAIN POWER circuit breaker to ON. HIGH VOLTAGE and SCREENS circuit breakers must be OFF.
- e. Wait approximately 3 minutes for proper warmup and measure the filament voltage. It should be between 7.3 to 7.5 volts ac.
- f. If measured voltage is not within the specified limits, set MAIN POWER and primary power circuit breakers to OFF.
- g. Relocate the connection on terminal No. 2 of T804 to a terminal (3, 4, 5, 6, or 7) that will provide a secondary output of 7.3 to 7.5 volts ac. Repeat steps d, e, and f as necessary to obtain the proper filament voltage requirement.

NOTE

For longer tube life, it is suggested that the filament be operated closer to its lower limit of 7.3 volts ac.

- h. After the correct value has been obtained, set MAIN POWER circuit breaker and primary power circuit breaker to OFF and remove the test meter and leads.

2-14. LOW VOLTAGE TRANSFORMER T803 CONNECTIONS (See figure 5-14)

The low voltage transformer T803 is a three-phase transformer with multi-tapped primary windings. Once the primary a-c voltage value has been measured, the measured value should coincide with the appropriate tap on low voltage transformer T803. For example, for a primary a-c voltage value of 230 volts ac, the connections should then be on the 230v taps on T803. Do not remove the connection marked "0". To change T803 primary taps, proceed as follows:

- a. Set MAIN POWER circuit breaker and primary power circuit breaker to OFF.
- b. On each of the primary windings of T803, relocate the connection to coincide with the measured primary a-c voltage value. Do not change the connection on the terminal marked "0".



- c. Secure hardware on transformer terminal.

## 2-15. INPUT CHASSIS (See figure 2-5)

External input connections are made at the input chassis assembly located in the rear portion of the transmitter directly below the exciter drawer. Audio intelligence, CW, FSK, and FAX input connections are made at jack J3001 on the input chassis assembly. The mating plug for J3001 is supplied as a loose item. Make the external signal input connections to mating plug MS3106B32-7P prior to connecting to J3001.

### NOTE

The HFLA-10K leaves the factory wired for local control operation. Mating plugs that connect to input chassis jacks J3002 and J3003 are supplied as loose items, and are prewired with connections between pins on each plug for local transmitter operation. These mating plugs supplied as loose items must be connected to J3002 and J3003 on the input chassis.

## 2-16. HIGH VOLTAGE CHECK AND BIAS ADJUSTMENT

### WARNING

Prior to applying high voltage, close all drawers and fasten with panel locks and replace all covers and fasten with mounting hardware.

After the transmitter has been installed and the checks and adjustments performed as indicated in the previous paragraphs, the high voltage should be checked and the bias adjustments performed. These checks and adjustments are performed from the front of the unit. Connect a proper antenna to the top of the transmitter coupler or dissipate transmitter power into a dummy load. Proceed as follows:

- a. Set primary power, MAIN POWER and SCREENS circuit breakers to ON.
- b. Set MAN/AUTO switch to MAN.
- c. Set ALARM ON/OFF switch to OFF.
- d. Set r-f drive from associated exciter to minimum.
- e. Adjust the OVERLOAD INDICATOR (adjustment screw located directly below each meter face) on each meter for the following values:

PA PLATE current	3-1/2 amperes
PA SCREEN current	80 ma
IPA plate current	800 ma
REFLECTED power	as desired

f. Press HIGH VOLTAGE switch. After a short time delay, the HIGH VOLTAGE indicator should light. (It may be necessary to press the HIGH VOLTAGE switch twice.)

g. Adjust PA BIAS control for an indication of 0.75 ampere on the PA PLATE current meter.

NOTE

The IPA BIAS adjust is critical because it will effect the transmitter TUNE LEVEL during automatic tuning.

h. Adjust IPA BIAS control for an indication of 210-230 ma on IPA plate current meter.

i. Hold PLATE METER switch up and adjust 2ND AMP BIAS control for an indication of 220-240 ma on IPA plate current meter.

j. Replace bias control cover, press HIGH VOLTAGE switch to remove high voltage, and extend IPA drawer out on its chassis tracks to expose 1ST AMP BIAS control. The HIGH VOLTAGE indicator will extinguish and the PLATE meters will indicate zero.

k. Pull interlock shaft outward to defeat IPA drawer interlock, and press HIGH VOLTAGE switch to apply high voltage. The HIGH VOLTAGE indicator will light and the PLATE meters will indicate PA and IPA plate currents.

l. Set PLATE METER switch to 1ST AMP position and adjust 1ST AMP BIAS control for 60-70 ma. The 1ST AMP BIAS control is located on the underside of the IPA drawer.

m. Press HIGH VOLTAGE switch, set MAIN POWER and SCREEN circuit breakers to OFF, reinsert IPA drawer interlock, and push in and secure the IPA drawer.

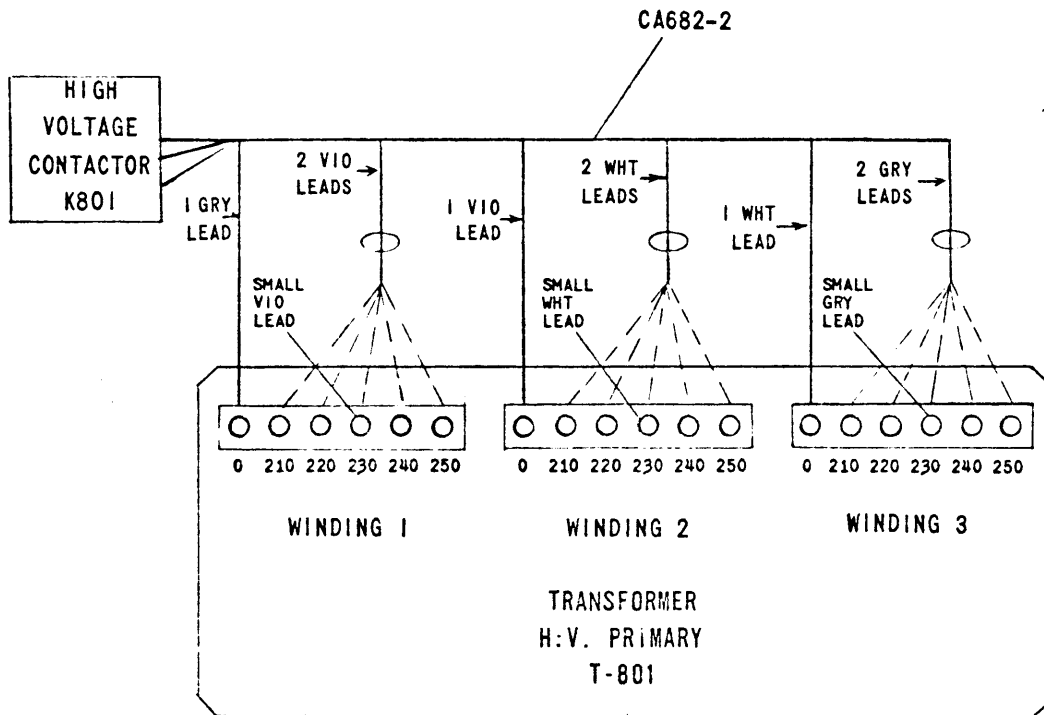


Figure 2-4. Transformer HV Primary Connections

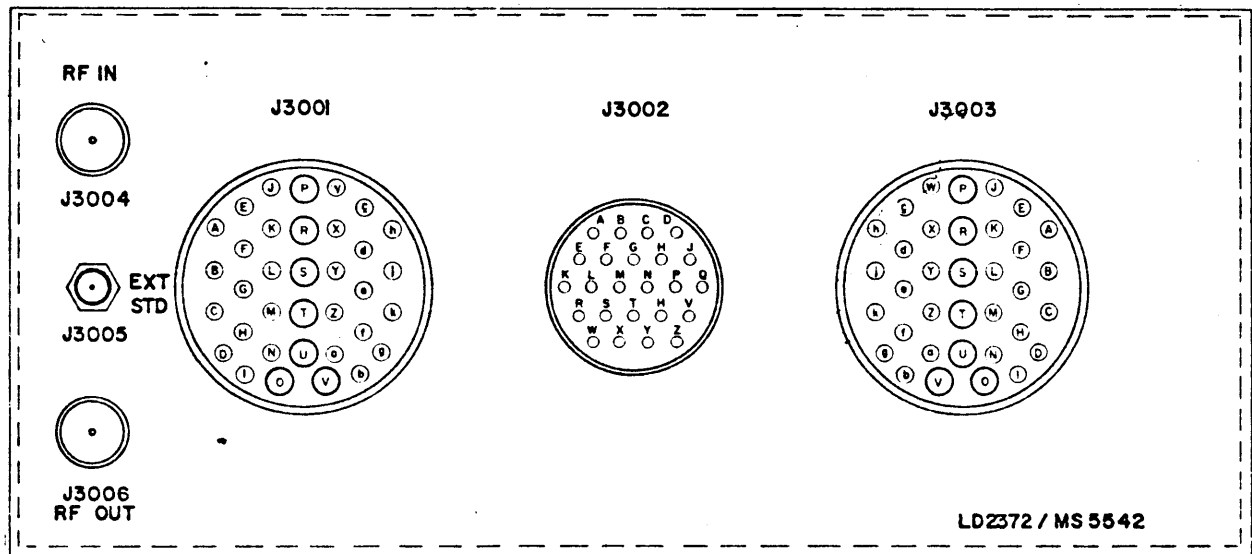


Figure 2-5. Input Chassis (As viewed from rear of transmitter)

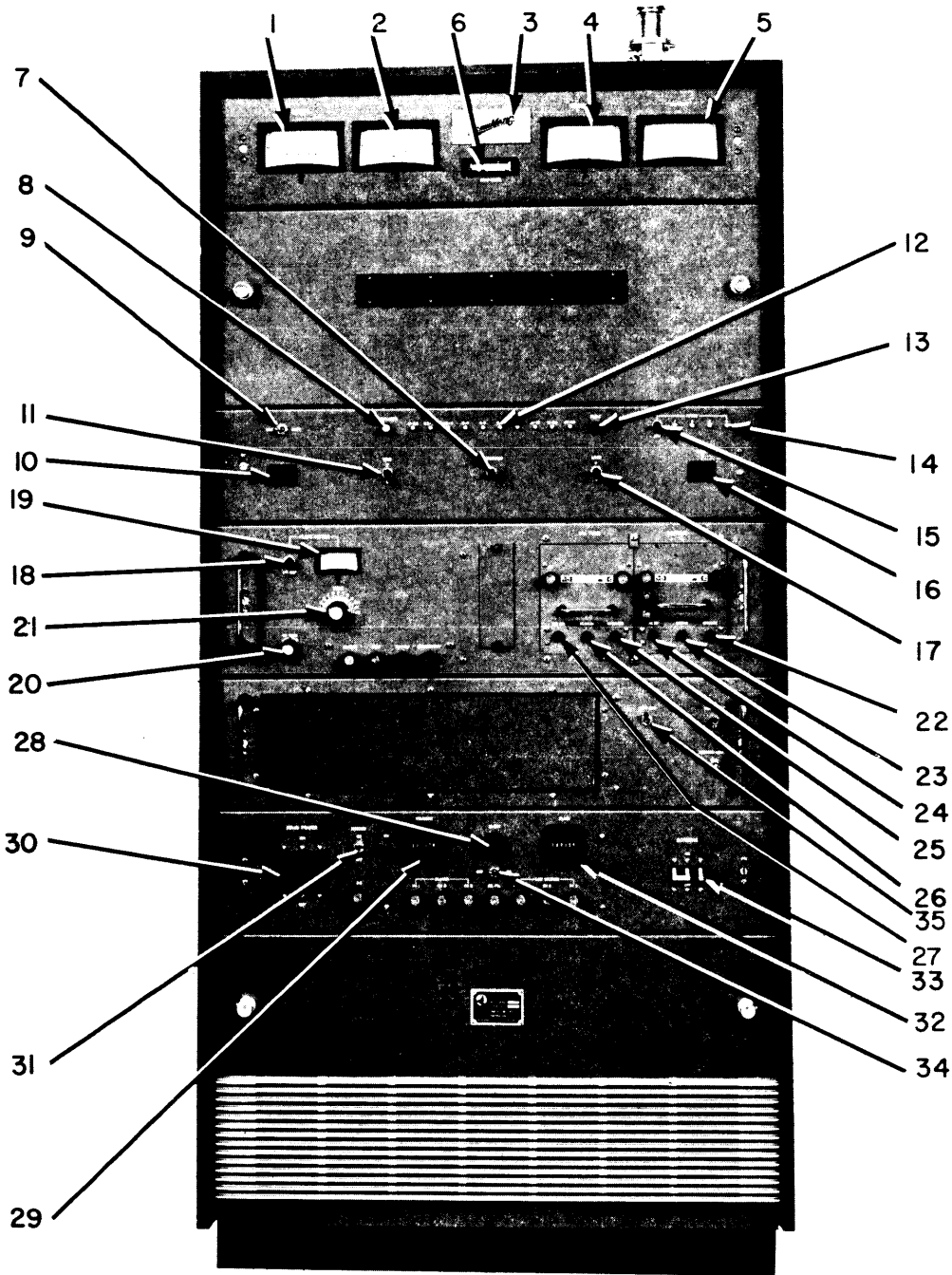


Figure 3-1. Controls and Indicators

SECTION 3  
OPERATORS SECTION

3-1. GENERAL

The HFLA-10K is basically an amplifier. When combined with an exciter, it is referred to as a transmitter. This section details the functions of the HFLA-10K front panel controls and indicators. For full operating instructions for the HFLA-10K when combined with an exciter, refer to the transmitter system operating procedures, of which this is a part.

3-2. CONTROLS AND INDICATORS

Table 3-1 details the functions of the HFLA-10K operating controls and indicators. Figure 3-1 locates the controls and indicators.

TABLE 3-1. CONTROLS AND INDICATORS

ITEM NO. (Fig. 3-1)	PANEL DESIGNATION	FUNCTION
1	PA SCREEN current meter	Indicates PA screen current of 10-kw amplifier and PA screen overload. Meter lights to indicate overload.
2	PA PLATE current meter	Indicates PA plate current of 10-kw amplifier and PA plate overload. Meter lights to indicate overload.
3	TECHNIMATIC light	Lights to indicate MAIN POWER circuit breaker is set to ON and primary power is applied to transmitter.
4	REFLECTED power meter	Indicates reflected power on upper meter scale and SWR on lower meter scale.
5	PA OUTPUT meter	Indicates average PA output power.
6	LOAD SENSE meter	Monitors samples of PA plate current and PA plate r-f voltage. (At 1-kw output level, when PA plate current and PA plate rf are equal, the load sense meter indicates at or near zero center scale reading.)

TABLE 3-1. CONTROLS AND INDICATORS (cont)

ITEM NO. (FIG. 3-1)	PANEL DESIGNATION	FUNCTION
7	BANDSWITCH control	Operates PA bandswitch in manual operation only. Lateral movement of control to the left or right rotates the PA bandswitch to next position.
8	INTERLOCKS indicator	Lights to indicate all interlocks are closed and interlock circuit is complete.
9	MAN/AUTO switch	Determines transmitter mode of operation; manual or automatic. In AUTO (with the appropriate exciter), bandswitching, tuning, and loading are accomplished automatically. In MANUAL, bandswitching, tuning, and loading must be performed manually.
10	HIGH VOLTAGE on/off switch indicator	When pressed to on position, high voltage is applied to PA and IPA plate circuits and switch indicator lights. When pressed to off position, high voltage is removed and switch indicator goes out.
11	PA TUNE control	Operates PA tune capacitor when MAN/AUTO switch is in MAN position only.
12	PA Band indicators	One lamp for each position. Lights to indicate PA bandswitch control positions: 2-2.3, 2.3-2.6, 2.6-3, 3-4, 4-5, 5-8, 8-12, 12-16, 16-24, and 24-30.
13	FAULT indicator	Lights to indicate transmitter automatic tuning not completed within 30 seconds.
14	POWER level indicators	Light to indicate one of the four preset power levels selected by the operator.
15	POWER ADJ switch	Dual functioning switch, when pressed down, preset output level can be calibrated prior to actual r-f output of transmitter. When placed in the up position, one of the four preset power levels is selected. Each time switch is placed in up position, one power level is selected.

TABLE 3-1. CONTROLS AND INDICATORS (cont)

ITEM NO. (FIG 3-1)	PANEL DESIGNATION	FUNCTION
16	TUNE/READY switch indicator	When pressed, starts the automatic tuning cycle, providing the MAN/AUTO switch is in AUTO position. When automatic tuning is completed, and preset power output level is reached, READY indicator lights.
17	PA LOAD control	Operates PA loading capacitor when MAN/AUTO switch is in MAN position.
18	PLATE METER switch	When activated (up position), IPA PLATE METER indicates 2ND AMP plate current, or 1ST AMP plate current when switch is pressed down. In neutral position, PLATE METER indicates IPA plate current.
19	IPA PLATE METER	Indicates 1ST AMP, 2ND AMP, and IPA plate currents. (Meter illuminates to indicate overload).
20	RF GAIN control	Adjusts transmitter power output. In manual mode, control must be adjusted manually. In automatic mode, control is adjusted automatically.
21	IPA TUNE control	Tunes IPA to resonance during manual and auto operation. In manual mode, control must be adjusted manually. In automatic mode, control is adjusted automatically.
22	PA TUNE servo OPERATE indicator	Lights to indicate completion of automatic tuning of PA.
23	PA TUNE servo SEARCH indicator	Lights to indicate voltage applied to PA tuning section to initiate automatic tuning of PA.
24	PA TUNE servo AC ON indicator	Lights to indicate a-c power applied to PA servo amplifier.
25	IPA TUNE servo OPERATE indicator	Lights to indicate completion of automatic tuning of IPA.
26	IPA TUNE servo SEARCH indicator	Lights to indicate voltage applied to IPA tuning section to initiate automatic tuning of IPA.

TABLE 3-1. CONTROLS AND INDICATORS (cont)

ITEM NO. (FIG 3-1)	PANEL DESIGNATION	FUNCTION
27	IPA TUNE servo AC indicator	Lights to indicate a-c power applied to servo-amplifier chassis. After completion of servo tuning, a-c power is automatically removed and all indicators on servo amplifiers extinguish.
28	ALARM indicator	Audible alarm to indicate high voltage failure.
29	FILAMENT time meter	Registers total time (in hours and minutes) voltage has been applied to the PA filaments.
30	MAIN POWER circuit breaker	In ON position, applies primary power to transmitter.
31	EXCITER ON/OFF switch	In ON position, applies a-c power to exciter. (Used only when exciter is installed in exciter drawer.)
32	PLATE time meter	Registers total time (in hours and minutes) d-c plate voltage has been applied to PA plate circuit.
33	SCREENS circuit breaker	In ON position, applies screen voltage to PA tube.
34	ALARM ON/OFF switch	In ON position, activates high voltage ALARM indicator.
35	TEST KEY switch	In up position, switch locks and provides keyline closure in the CW mode for test purposes or for manual tuning in the CW mode. In neutral position, keyline is open.



## SECTION 4

### PRINCIPLES OF OPERATION

#### 4-1. GENERAL

With an r-f input of at least 100 mw, the HFLA-10K provides fully automatic, or manual continuous tuning over the frequency range of 2 to 30 mHz.

The IPA drawer contains three r-f linear amplifier stages. The first two stages of amplification in the IPA section are broad-band tuned, and the IPA stage is a tuned parallel L circuit. The PA is an air cooled stage with a tuned parallel L circuit, providing an output impedance of 50 ohms.

Servo tuning of the transmitter is accomplished at approximately 1kw, with final output determined by one of four adjustable power level controls. The output is maintained at the adjusted power level by ALDC feedback to the exciter. Front panel meters provide required overload settings as well as meter indications.

#### 4-2. BLOCK DIAGRAM ANALYSIS (See figure 4-1)

Figure 4-1 shows the path of r-f input from the exciter, through the amplifier stages, the output meter circuits, and finally to the transmitting antenna. Basic servo-tuning control signals are also shown to illustrate the servo functions during tune-up. The Tuning Sequence is as follows:

An r-f input of 100 mw from the exciter is applied to the motor driven RF GAIN control R1301 and the 100-mw rectifying circuit. The application of high voltage causes a cathode voltage input to the drive-up comparator assembly A1005, via servo-tuning complete relay A2001K4 contacts, and 28 vdc from the PA tune servo A1004 to the IPA servo A1003, via contacts on high voltage relay K2004.

The application of 100 mw and 28 vdc from the PA tune servo causes the IPA servo amplifier to go into the search mode. The IPA servo supplies control voltage to the IPA servo motor A1001B1, which is coupled to the IPA tuning capacitor A1001C1, causing it to start turning. Simultaneously, the drive-up comparator assembly has been comparing the IPA cathode input to an adjustable tune-level voltage. The adjustment of the TUNE-level control A1007R11 determines the level of r-f drive to which the transmitter will servo tune.

R-f drive, at the desired tune level, is applied to broad-band linear amplifier V1301, an 8233 tube. V1301, a class A amplifier, provides amplification of approximately 5 before application to the second broad-band linear amplifier V1302, a 4CX350A tube. V1302 operates as a class A amplifier providing amplification of approximately 8. The amplified signal is then applied to V1401. V1401 is an 8576 tube operating as a class AB1 intermediate-power amplifier, providing approximately 500 watts of drive power to the input of the PA amplifier V701.

With the application of amplified r-f input on the grid of V1401, the rotating IPA tuning capacitor develops rf at the plate when approaching resonance. A rectified sample of the plate rf, called the IPA plate trigger, is routed to the IPA servo through the IPA plate trigger potentiometer A1007R12. The IPA plate trigger potentiometer determines the required level of plate rf necessary to stop the IPA tuning capacitor from searching. The application of the plate trigger to the IPA servo completes the search mode and initiates the servo mode.

The IPA servo amplifier remains in the servo mode until a d-c correction voltage from the IPA phase detector A1008 approaches zero. The IPA phase detector compares the phase relationship between the grid and plate of V1401 to determine when the plate circuit is properly tuned to resonance. When the correction voltage approaches zero, the OPERATE indicator on the IPA servo amplifier lights, indicating that the IPA servo amplifier is in the operate mode.

The d-c voltage that lights the OPERATE indicator, is also applied to the PA tune servo A1004 to place it into a search mode. The search mode provides the necessary motor control voltage to A702B1, which is coupled to the PA tuning capacitor A702C1, to start the capacitor searching for resonance. The amplified signal from V1401 has been routed to the grid of the PA tube V701, a class AB1 amplifier providing 10 kw output.

As the PA tuning capacitor approaches resonance, the PA plate r-f sample developed is routed through the PA plate trigger-adjust A1007R13 to the PA tune servo. The plate trigger places the PA tune servo into the servo mode. When the d-c correction voltage from the PA phase detector A701 approaches zero, the servo mode ends and the OPERATE indicator lights.

The OPERATE indicator on the PA tune servo routes a load search-on signal to relay A703A1K2, closing its normally open contacts. Thusfar, in the servo tuning sequence, the load comparator assembly A703A2 has received only a PA cathode input, which has kept the load capacitor at a minimum capacity. This has kept the transmitter unloaded during PA search to assure that sufficient r-f plate trigger is always present.

The closure of A703A1K2 contacts provides a path for a sample of the PA plate rf to the load comparator assembly, through the load sense potentiometer A705A1R7. The load sense potentiometer is adjusted so that the LOAD SENSE meter M4003 reads zero (+100) when loading is correct at approximately 1 kw. When the LOAD SENSE meter reads zero (+100), motor control diminishes, stopping the load capacitor A703C1.

When the load comparator is nulled, the load comparator develops a 28 vdc tuning complete signal which energizes tuning complete relay A2001K4, placing it in the operate condition. A set of contacts on A2001K4 removes the IPA cathode input to the drive-up comparator assembly. The unbalanced drive-up comparator causes the r-f gain motor to start driving the RF GAIN control. As the r-f drive is increased, the output sense circuit A4004 compares one of the selected power level voltages from A705 to the input from the PA OUTPUT meter M4005. When the two inputs to the output sense circuit are equal, a ground energizes the ready 1 relay A2001K5, latching it in the output condition.

The output condition of A2001K5 removes the operating voltage from the drive-up comparator assembly and switches the voltage to the READY indicator. When the READY indicator lights, the transmitter is ready to accept an intelligence input from the exciter.

If the transmitter fails to tune within approximately 30 seconds, the adjustable fault circuit provides an energizing ground to the servo-off relays which disables the servos and biases the transmitter near cutoff.

#### 4-3. AC POWER DISTRIBUTION (See figures 4-2 and 7-1)

a. GENERAL. Three-phase power is supplied to three input terminals E805, E806, and E807 located at the bottom left side of the transmitter. Safety and protective interlocks are employed throughout the transmitter to prevent application of high voltage until specific requirements are met, to prevent injury to personnel and damage to the transmitter.

b. BLOCK DIAGRAM ANALYSIS. Phases 1 and 2 at the input terminals are routed through the EXCITER ON/OFF switch S3002 to supply a-c input to the exciter. A-c input to the exciter is therefore present at all times, independent of the position of the MAIN POWER circuit breaker CB3001.

Closure of the MAIN POWER circuit breaker CB3001, provides 3-phase power to the PA blower B801, the optional tuneable filter through its control relay, the PA bandswitch motor A704B1 through its control relay A704A1K1, and the high voltage contactor K801. The MAIN POWER breaker also provides phases 1 and 2 to the top fan B701 and phases 1 and 3 to the drive-up motor B1301, through the drive-up assembly A1005, and to the IPA blower B1401. The IPA drawer bottom cover interlock-switch S1201, is normally open when the cover is removed. The air switches S801 and S1401 for the PA and IPA blowers are normally open when the blowers are not operating. When the blowers commence operating, their respective air switches close, energizing filament-on relay K802 when the bottom cover is in place. If one of the blowers fails to operate, the open air switch prevents energizing the filament relay, inhibiting a-c power from the primaries of the filament transformers.

With the blowers operating properly, a-c input power is applied to the PA filament transformer T804 and low voltage filament transformer T803. The FILAMENT time meter M3001 records filament time of the PA tube. The contacts of the filament timer M801 prevent a closure of the series interlock chain until the delay of the timer (0-5 minutes) has expired. The PA filament transformer develops 7.5 vac nominal for the PA filament. The low voltage filament transformer supplies 3-phase a-c power to the IPA filament rectifier, CR805, and the +24 vdc rectifier, CR1103. The transformer also supplies 15 vac to the control windings of the tune motor A702B1. The output of the filament rectifier provides 6.2 vdc for the filaments of the IPA tubes.

The series interlock chain routes 24 vdc to the filament timer interlock M801. After the time delay, with all interlocks closed, the +24 vdc energizes the bias on relay K2005. Phase 1 is routed through K2005 to the high voltage deadman assembly A801. Energizing the deadman removes the ground from the high

voltage circuits. With the high voltage control circuits closed, the high voltage contactor K801 is energized, applying 3-phase a-c power to the primary of the high voltage transformer T801, and through the SCREEN circuit breaker to the primary of the screen transformer T802. The high voltage transformer supplies the a-c power to the high voltage rectifier CR802. The screen transformer supplies a-c power to the screen rectifiers CR803 and CR804. Energizing the bias-on relay also applies a-c power to the bias transformer T1101, which supplies 3-phase a-c to the bias rectifier CR1106.

The a-c input voltage to the tune assembly A702 and the load assembly A703 consists of a constant phase 3 and a switched phase 2. In the automatic mode phase 2 is routed through the servo-off relay K2001 and the manual relays K2002 and K2003 to the tune and load assemblies. The 115 vac is tapped off A703T1 in the load assembly for power to the IPA tune motor A1001B1. In the manual mode, phase 2 is routed through the manual TUNE and LOAD switches S5003 and S5005 respectively, through the manual relays K2002 and K2003 to the tune and load assemblies. The 115 vac control voltage for the tune motor A702B1 is routed from the low voltage transformer through the manual tune switch S5003 to the motor.

A-c input voltage for the PA TUNE servo amplifier A1004 consists of a constant phase 3 and phases 1 and 2, controlled by the servo-off relay K2001 and the manual relay K2002.

#### 4-4. DC POWER DISTRIBUTION (See figures 4-3 and 7-1)

a. PLATE VOLTAGE. Application of 3-phase power input to high voltage transformer T801 provides plate voltage for the IPA and PA tubes, V1401 and V701. The PA plate voltage of 7500 vdc is derived from a full-wave bridge rectifier circuit CR802A through CR802F, and filtered by L801 and C801. Resistors R804 through R807 are bleeders for the power supply. One half of the value of the PA plate voltage (3750 vdc), available at the neutral tap of T801 secondary, is the plate voltage for the IPA tube. It is filtered by L802 and C802 before application to the IPA plate. The plate time meter M3002 records the time high voltage is applied to the plate of the PA tube.

Full-wave bridge rectifier circuit CR804 provides 1600 vdc plate voltage, filtered by L803 and C804, for the second IPA tube V1302. The d-c return for the power supply is through the SCREEN circuit breaker contacts C and D, which open in the event of excessive current drain.

The voltage divider R809, R810 and CR807 provides 400 vdc plate voltage for the first IPA tube V1301, which is derived from the neutral of screen transformer T802.

b. SCREEN VOLTAGE. Closure of SCREENS circuit breaker CB3002 provides 2 of the 3-phase inputs to screen transformer, T802. The output of the full-wave bridge rectifier CR803 is 2000 vdc and regulated by 200-volt zener diodes, CR801A through CR801H. The top of the zener stack provides 1600 vdc which is dropped to 1400 vdc and applied to the PA screen. At the junction of CR801D and CR801E is 800 vdc for IPA screen, and 400 vdc is at the junction of CR801F and CR801G for the screen of V1302. Screen voltage of 200 vdc for the first IPA V1301 is derived from zener diode CR807B.

c. BIAS VOLTAGE. (See figures 7-2 and 7-3) When bias-on relay K2005 energizes, two phases of the 3-phase input are applied to the bias transformer T1101, in the IPA drawer. The secondary output of the transformer is applied to full-wave bridge rectifier CR1106. The -400 vdc nominal output of CR1106 is filtered by L1101 and C1104 before application to the zener diode regulators CR1107, CR1108 and CR1109. The d-c return for the bias supply is through F1002 to protect the circuit against overloads.

Regulated bias voltages are tapped from the zener diode regulators CR1107, CR1108 and CR1109 for application to three voltage-divider networks on A1007. The ground necessary for voltage drop across the dividers is supplied by contacts 1 and 3 of the PTT (push-to-talk) relay K1101. The bandswitch interlock circuit prevents 24 vdc from reaching PTT relay during band changes which keeps the amplifier stages at maximum bias and near cutoff.

The top of the zener diode stack provides -360 vdc to the PA bias voltage divider before application to the grid of the PA tube V701. The PA bias potentiometer A1007R4 is adjusted to provide approximately 500 to 600 ma of quiescent current as indicated on the PA PLATE current meter M4002. The junction of CR1107 and CR1108 provides -240 volts to the driver bias-voltage divider. The bias adjust potentiometer A1007R5 is adjusted to provide approximately 200 ma of quiescent current on the IPA plate current meter M1001, when PLATE METER switch S1001 is in the center IPA position. The junction of CR1108 and CR1109 provides -120 volts to the 2nd amp voltage divider before application to the grid of second IPA amplifier. The 2nd amp bias potentiometer A1007R6 is adjusted to provide approximately 200 ma of the quiescent current as observed on the IPA plate current meter when the PLATE METER switch is in the 2ND AMP position. The voltage derived from zener diode CR1109 is applied to the control grid of the IPA first amplifier V1301, via first amplifier-bias potentiometer R1303. The first amplifier-bias potentiometer is adjusted to provide approximately 60 to 70 ma of quiescent current as observed on the IPA plate current meter when the PLATE METER switch is in the 1ST AMP position.

d. LOW VOLTAGE SUPPLY. The secondary of the low voltage transformer T803, provides three-phase a-c input to the full-wave bridge rectifier CR1103. The unregulated output of approximately 30 vdc is used to drive the IPA bandswitch solenoid A1002S2. The output of the rectifier is filtered by C1101, C1102 and R1101 and applied to CR1104, a 24 volt zener diode. The regulated +24 vdc is used as the control voltage for the transmitter. The 24 vdc is dropped through R1102 and the 12 volt zener diode CR1105 to provide a regulated +12 vdc. The return of the low voltage supply is through the 24 vdc fuse F1103, to protect against overloads.

#### 4-5. PROTECTIVE OVERLOADS AND INTERLOCKS (See figure 4-4)

a. GENERAL. The transmitter interlock and overload circuitry protects the equipment and operating personnel. An open interlock or overload condition deenergizes high voltage on/off relay K2004.

b. SIMPLIFIED CIRCUIT ANALYSIS INTERLOCK CIRCUITS. The regulated 24 vdc is routed through the mechanically closed interlock switches to the time delay M801. When the filament warm-up time delay period has expired, the 24 vdc energizes the bias-on relay K2005, which in turn energizes the high voltage shorting assembly relay A801. Auxiliary contacts on A801 route the 24 vdc through the heat overload S701 and the external interlock pins of J3003, to the coil of the high voltage on/off relay K2004 and illuminates the interlock indicator DS5002. The high voltage relay is energized when a ground is applied to the coil, via the high voltage on/off switch S5001, the main overload relay A4003K1 and the remote high voltage-on pins of J3003. The high voltage on/off relay applies phase 2 to the coil of the high voltage contactor K801, through the SCREENS circuit breaker CB3002C. Energizing the high voltage contactor applies 3-phase power to the high voltage transformer T801. Auxiliary contacts on the contactor provide a ground for the local and remote high voltage-on indicators. A ground is removed from the ALARM ON/OFF switch S3001 and high voltage-off ALARM, DS3001 disabling the circuit. If the high voltage is removed for any reason, the ground is applied to the alarm circuit activating the audible signal.

If for any reason any of the switches are opened the high voltage on/off relay will deenergize removing the high voltage. If one of the mechanical interlock switches in the circuit preceding the bias-on relay are open, the bias-on relay will deenergize and cause the high voltage shorting assembly to deenergize placing a short on the high voltage and screen voltage supplies. This will result in a loud discharge, due to the filtering capacitors' not having sufficient time to bleed off. To prevent unnecessary arcing and pitting of the shorting assembly contacts, the mechanical interlocks should not be opened until a few seconds after the high voltage has been shut off to allow for the potential to bleed off.

c. SIMPLIFIED CIRCUIT ANALYSIS OVERLOAD CIRCUITS. Any condition of the transmitter that causes the IPA plate current meter M1001, the PA screen current meter M4001, the PA plate current meter M4002, or the reflected power meter M4003 pointers to come into contact with the adjustable red overload pointer, will cause closure of a set of contacts in the meter. This closure will apply 24 vdc across a voltage divider network causing the meter solenoid to hold the contacts closed. A trigger voltage is derived from the divider and applied to the gate of an SCR firing the SCR. This applies 24 vdc to the overload indicator lamps, illuminating the meter, and to the trip coil of the latching-type overload relay A4003K1. Tripping this coil opens the ground leg of the high voltage on/off relay K2004, removing the high voltage from the transmitter. To restore the high voltage to the transmitter, the HIGH VOLTAGE switch S5001 is depressed to the off position removing the 24 vdc from the meter solenoids and the SCR'S. This releases the meter switch contacts, removes the trigger voltage from the voltage divider, re-sets the SCR'S, extinguishes the indicator lamps and deenergizes the trip coil of the overload relay. The 24 vdc on the HIGH VOLTAGE switch is applied to the reset coil of the overload relay restoring the ground leg to the high voltage on/off relay. Depressing the HIGH VOLTAGE switch to the on position closes the high voltage relay ground leg, energizes the relay and re-applies the 24 vdc to the meter switch contacts. This overload reset function is available at J3003 for remote operation. The 24 vdc from the on position of the HIGH VOLTAGE switch is routed through the SCREENS breaker auxiliary contact, tripping the overload relay, when the HIGH VOLTAGE switch is turned on with the SCREENS circuit breaker off.

Excessive current of the 2nd amp in the driver will develop a trigger voltage which is applied to the gate of the SCR, Q1 of the IPA overload board A1006. This will fire the SCR forcing the transmitter into the overload condition and illuminating the IPA meter. If the IPA plate meter pointer is not held to the red overload pointer, this indicates that the overload was caused by the 2nd amp and not the IPA plate current.

Except for the high voltage shorting assembly A801 (deadman) and the heat overload S701, the opening of any interlock, with the HIGH VOLTAGE switch on, will not only deenergize the high voltage on/off relay but also trip the overload relay A4003K1. Thus, when the interlock switch is closed, the high voltage is prevented from coming on immediately, preventing a dangerous situation. Resetting the overload circuit will restore the transmitter to its normal operating condition.

#### 4-6. AUTOMATED TUNING SEQUENCE (See figure 4-1)

The automated tuning cycle of the transmitter is accomplished in less than 10 seconds after pressing the TUNE button. The exciter carrier level of 100 mw initiates the IPA servo amplifier A1003 into the search mode, whereupon the presence of IPA plate r-f stops the servo controlled IPA tuning capacitor A1002C1 and places the IPA servo amplifier into the servo mode. The servo amplifier remains in the servo mode until the d-c correction voltage being fed back to the servo amplifier approaches zero. At zero it initiates the operate mode, lighting the OPERATE indicator. The OPERATE indicator voltage on the IPA servo amplifier signals the PA tune servo amplifier to commence searching. R-f voltage appearing at the plate of the PA tube V701 stops the search mode and places the PA tune servo amplifier into the servo mode, and then operate mode, when the d-c correction voltage approaches zero. When the PA tune capacitor A702C1 has completed tuning, the load assembly A703 latches the servo tuning-complete relay A2001K4 into the operate position. The servo tuning-complete relay disables the servo amplifiers and transfers output control to one of the selected power level controls, connected to the PA OUTPUT meter. The r-f gain control motor B1301 drives up until the selected output is attained. At the selected output, a ground supplied by the sensing circuit on the OUTPUT meter A4004 places ready 1 A2001K5 and ready 2 A2001K3 relays into the output position. Ready 1 and 2 relays light the READY indicator, unground the ALDC and PTT circuits, and remove the exciter input. The exciter then automatically switches its output to the intelligence selected. A fault circuit is incorporated in the transmitter that automatically biases the transmitter near cutoff and shuts off the servo amplifiers if tuning is not completed within 30 seconds.

#### 4-7. SCHEMATIC ANALYSIS, AUTOMATED TUNING SEQUENCE (See figures 4-1, 7-1, 7-2, 7-3 and 7-4)

a. INITIAL REQUIREMENTS FOR AUTO TUNING. The initial requirements to commence the automated tuning sequence are: the MAN/AUTO switch S5002 placed in the AUTO position, 100-mw r-f carrier input from the exciter, and the application of high voltage with the HIGH VOLTAGE ON/OFF switch S5001. Pressing the TUNE switch S5007 momentarily starts the sequence by providing a ground at pin M of the tuning control assembly A2001. The ground at pin M places the following relays in the

tune position: servo tuning complete relay A1002K4, ready 1 relay A1002K5, ready 2 relay A1002K3 (through ready 1 relay). The ground at pin M also energizes servo recycle relay A1002K1 for 1/2 second.

The application of high voltage provides approximately 150 ma of quiescent current in IPA tube V1401. The resultant voltage derived from the IPA cathode at E1205 is routed through closed contacts 14 and 15 of the servo tuning-complete relay A1002K4 to pin 1 of the drive-up comparator assembly A1005A1.

b. 100-MW TRIGGER. (See figures 4-10, 7-1, 7-2, and 7-3) The 100-mw r-f input at J3004 from the exciter drawer J2003 is applied to the RF GAIN control R1301 and the 100-mw rectifier circuit CR1203. The positive voltage output from the rectifier circuit is applied to pin 12 of A1007, through the 100-mw trigger potentiometer R10 and out pin 11. The 100-mw trigger potentiometer adjusts the rectified 100 mw for approximately .4 vdc before it is applied to pin 6 of the IPA servo amplifier A1003. Application of the 100-mw trigger at pin 6 of IPA servo amplifier energizes search relay A1003A1K1. With K1 energized, contacts 9 and 10 close and apply the closure at pins 23 and 25 of J1 on the IPA servo amplifier.

c. TUNE LEVEL. (See figures 7-1 and 7-2) Zener diode CR1105 in the IPA drawer provides a regulated 12 volts through pin 14 of A1007 to the tune level control A1007R11. The tune level control adjusts the tune level voltage to approximately 5 vdc and then routes it out pin 13 of A1007, through the closure provided by A1003A1K1 at pins 23 and 25 of the IPA servo to pin 2 of the drive-up comparator assembly A1005.

Two inputs are applied to drive-up assembly A1005: a sample of the IPA cathode voltage at pin 1 and a tune level voltage at pin 2. If the cathode voltage at pin 1 is less than the tune level or command signal voltage at pin 2, A1005A1Q1 is forward biased energizing drive-up relay A1005A1K1. If the voltage at pin 1 is greater than the voltage at pin 2, drive-down relay A1005A1K2 is energized.

Assume that the tune level voltage is higher than the cathode voltage: this energizes A1005A1K1. Phase 3, present at pin N of J1001, is routed through R1106, the closed set of relay contacts 15 and 16, the upper limit switch S1301 to the yellow lead (drive-up) of B1301, the drive-up motor. Phase 1, present at pin Q of J1001, is routed through F1001, the closed set of relay contacts 13 and 12, to the red (fixed phase) lead of B1301. The motor drives up the RF GAIN potentiometer R1301 until the cathode voltage equals the tune level voltage, de-energizing A1005A1K1, or the upper limit switch opens removing voltage from the motor. If the high voltage is applied to the transmitter causing the cathode voltage to appear at A1005, but the 100-mw r-f input is not present, there will be no closure at pins 23 and 25 of IPA servo amplifier A1003, thereby preventing the tune level voltage from appearing at pin 2 of A1005. This causes A1005A1K2 to energize, routing phase 3 through the lower limit switch S1302 to the green (drive-down) lead of B1301. The motor drives down the RF GAIN R1301 until the lower limit switch opens. With high voltage on. this provides automatic drive-down with no drive to the transmitter present.



d. IPA SEARCH. (See figures 4-2, 7-1, 7-2, 7-3 and 7-4) Placing the MAN/AUTO switch S5002 in the AUTO position removes 24 volts from pin e of J2001, deenergizing manual relay A2001K6 on the tuning control assembly and the manual relays K2002 and K2003 in the exciter drawer.

A-c power is applied to the automatic tuning components in the following manner: Phases 1 and 2 (210 vac), available at the primary of the low voltage transformer T803, is routed through the servo-off relay K2001, the manual relay K2002 (both deenergized), to pins 32 and 35 of the PA servo amplifier A1004. Phase 3 (210 vac) is routed from T803 to pin 30 of the PA servo amplifier. Phase 3 (210 vac) is applied to the power transformer A1004T1. The power transformer then supplies 52 vac for the IPA servo amplifier A1003 at pins 18 and 19. Phase 3 (230 vac), available at the primary of the low voltage transformer, is routed to pin 8 of the PA tune assembly A702 and to pin 1 of the PA load assembly A703. Phase 3 is then applied to one side of the PA tune motor A702B1, to one side of the PA load motor A703B1, and to one side of the transformer A703T1. Phase 2 (230 vac) is routed from the primary of the low voltage transformer, through the servo-off relay K2001, the manual relays K2002 and K2003, to pin 1 of the PA tune assembly A702, pin B of the PA load assembly A703 and pin F of the IPA tune assembly. Phase 2 is then applied to the other side of the PA tune motor A702B1, PA load motor A703B1 and the transformer A703T1. The 115 vac from the center tap of the transformer is routed from pin A of the PA load assembly to pin J of the IPA tune assembly. This applies the 115 vac to the IPA tune assembly motor A1001B1. With a-c power applied to the PA servo amplifier A1004, 28 vdc is available at pin 29 of the amplifier. The 28 vdc is routed through the high voltage on/off relay K2004 to pin 29 of the IPA servo amplifier. This voltage is used to energize the search relay A1003K4, with application of the 100-mw input at pin 6 of the IPA servo amplifier, and applies approximately 20 vac control voltage to pins 14, 15 and 16. The control voltage is then routed to pins H, K, and L of the IPA tune assembly A1001 and then to the control windings of the motor A1001B1. The application of the control voltage to the motor disturbs the phase relationship between the fixed phase winding and the control phase winding, starting the motor. The IPA tune capacitor A1001C1, coupled to the motor, starts to search for resonance. The generator winding produces a feedback voltage which is routed through pin 5 of the tune assembly to pin 12 of the IPA servo amplifier. The 52 vac is tapped at the servo amplifier and fed through pins 36 and 37 of A1003J1 to pins D and E of the IPA tune assembly to provide excitation of the generator, producing a feedback voltage.

e. IPA OPERATE. (See figures 4-5 and 7-2) As resonance is approached, a sample of the r-f voltage at the plate of the IPA tube V1401 is rectified to a positive d-c voltage by the IPA sense assembly diode A1008CR3 and fed to the driver r-f trigger potentiometer A1007R12. The potentiometer is adjusted to provide approximately 0.5 vdc to pin 3 of the IPA servo amplifier A1003, which stops the amplifier from searching and places it into the servo mode.

Since the IPA tune capacitor A1001C1 provides continuous tuning, it is possible that resonance may occur at two settings of the capacitor. To insure that the capacitor tunes on only one half of its rotation (thereby assuring proper sensing voltage polarity) the microswitch A1001S2 is set to provide a closure between pins 1 and 4 of the IPA tune capacitor assembly A1001 as the

capacitor rotates from minimum to maximum capacitance. The 24 vdc on pin 4 is then routed through A1001S2 to pin 9 of the IPA servo amplifier and used to latch the r-f trigger cutoff relay A1003K1 into the position that shorts the r-f trigger voltage appearing on pin 3. When the tune capacitor rotates 180° and is then turning maximum to minimum capacitance, the switch A1001S1 provides a closure between pins 4 and 2 of the assembly. The 24 vdc is then routed to pin 8 of the IPA servo amplifier and latches the r-f trigger cutoff relay in the other direction ungrounding the r-f trigger voltage. Therefore, the function of A1001S1 and A1001S2 is to disable the automatic tuning sequence during the improper half of the IPA tune capacitor rotation.

The correct value of the IPA plate trigger voltage causes the IPA servo amplifier A1003 to stop searching and places it into the servo mode, switching motor control from a fixed voltage within the servo amplifier to d-c correction voltage from the IPA phase detector A1008. The IPA servo amplifier remains in the servo mode until the d-c correction voltage from the IPA phase detector diminishes to zero, at which time the OPERATE indicator lights. The phase detector compares the phase relationship between the r-f voltage at the plate and the induced voltage from the toroid at the input to the tube. When the phase relationship is other than 90 degrees apart, a negative or positive correction voltage is developed and applied to pin 1 of the IPA servo amplifier to correct the control voltage to the IPA tune motor A1001B1, bringing it to rest at resonance. For frequency bands 4 through 9, a portion of the d-c correction voltage is shunted to ground through A1002S2C to decrease sensitivity of the phase detector at the high frequencies. When the correction voltage is zero, the IPA tuning motor stops, indicating that the IPA stage is tuned properly.

f. PA TUNE SEARCH. (See figures 4-10, 4-11, 7-1, 7-2, 7-3, 7-4, 7-6, 7-7, and 7-8) With the AUTO/MAN switch S5002 in the AUTO position a-c power is applied to the transformer A703T1. The secondary voltage is rectified and applied to the load comparator assembly A703A2 through the manual relay A703A1K1 and the drive-down drive-up relays A703A2K1 and A703A2K2. With the high voltage on, the PA tube V701 draws quiescent current developing a cathode voltage, available at E813 and routed through pin 9 of the PA load assembly A703 to pin 2 of the load comparator, A703A2. With no voltage applied to the other input at pin 1 of the load comparator, due to the open relay A703A1K2, the drive-down relay A703A2K1 is energized. This applies the control phase voltage from A703T1 to the load motor A703B1, through the lower limit switch A703S1A. The motor is coupled to the load capacitor A703C1 and positions the capacitor to minimum capacity. When the capacitor reaches minimum position, the lower limit switch S703S1A opens, removing the control phase voltage from the motor. The load capacitor is therefore kept at minimum capacity during the PA tuning sequence to ensure the presence of sufficient r-f trigger voltage at all times.

The IPA servo amplifier OPERATE indicator also provides 28 vdc at pin 17 of the amplifier. This voltage is applied to the PA tune servo amplifier A1004 at pin 3. This voltage energizes the search relay A1004K2, which latches on, and is also fed out of pin 31 to pin 13 of the IPA servo amplifier, energizing the disable relay A1003A1K4. This prevents the disturbing of the IPA circuit tuning. The search relay places the PA tune servo amplifier into the search mode.

The PA tune motor A702B1 fixed-phase winding has phases 2 and 3 applied through pins 1 and 8 of the tune assembly A702. The control phase winding then has a control voltage applied from the PA tune servo amplifier pins 14, 15 and 16 through pins 12, 13 and M of the PA tune assembly. The PA tune motor starts to rotate, causing the PA tune capacitor A702C1 to start searching for resonance. The direction of rotation is controlled by the servo amplifier. The 52 vac output of the PA tune servo amplifier at pins 24 and 25 is routed to the tune servo rotation relay A2001K2. The common terminal routes one side to pin 28 of the PA tune servo amplifier. The phase difference causes the servo amplifier to control the direction of the PA tune motor. If resonance is not achieved as the motor rotates, either the upper limit switch A702S2A or the lower limit switch A702S1A will be activated. The upper limit switch routes 24 vdc to the counterclockwise coil of the servo rotation relay A2001K2 reversing the motor rotation from clockwise to counterclockwise. The lower limit switch activates the clockwise coil of the servo rotation relay causing the motor to change rotation to clockwise. The generator produces a feedback voltage which is routed through pin 6 of the PA tune assembly to pin 12 of the servo amplifier. Excitation of the generator is provided by the voltage available at pins 36 and 37 of the servo amplifier, and routed to pins F and K of the tune assembly.

As resonance is approached, a rectified sample of the PA plate rf is developed at pin D of the PA sense assembly A1001. The rectified sample is applied to the PA r-f trigger potentiometer A1007R13. A portion of the voltage is tapped off and applied to pin 21 of the PA tune servo amplifier, placing the servo amplifier in the servo mode. Relay A1004K1 energizes and changes the motor control from a fixed voltage to the d-c correction voltage from the PA phase detector. The d-c correction voltage is developed at pin L of the PA sense assembly A702 and applied to pin 1 of the PA tune servo amplifier. The voltage is shunted by different valued resistors at A704AIS1E to compensate for different values of voltage in the different transmitter bands. When the d-c correction voltage is 0 vdc, the servo amplifier switches to the operate mode, the OPERATE indicator lights and the transmitter is tuned to resonance.

g. LOAD CAPACITOR OPERATION. (See figures 4-11, 7-1, 7-2, 7-6) With the PA tune servo amplifier A1004 in the operate mode, the OPERATE indicator lights and relay A1004K4 energizes. The 28 vdc is routed through a closed set of contacts on A1004K4 and latches A1004K3 in the closed position. A 28 vdc load servo-on voltage is then applied to pin 9 of the servo amplifier through a set of closed contacts on A1004K3. This voltage appears at pin 3 of the PA load assembly A703 and is used to energize the load servo-on relay A703A1K2. A rectified PA plate r-f voltage is available at pin E of the PA sense assembly A701. This voltage is routed to pin J of the remote power assembly and applied to the load sense potentiometer A705A1R7. The voltage at the wiper of the potentiometer is then applied through pin H of the remote power assembly to pin E of the PA load assembly. The load sense voltage is applied to pin 1 of the load sense comparator assembly A703A2 through the now closed contacts of the load servo-on relay A703A1K2. The comparator assembly now has one input applied from the cathode of the PA tube V701, and one input from the PA plate circuit. Comparing the two signals causes the PA load motor to increase or decrease the loading, as necessary. The load sense potentiometer A705A1R7 is adjusted so the loading of the transmitter is correct at approximately 1-kw output power. The PA load motor stops when both inputs are equal. The load

sense meter M4003, connected across the two inputs of the comparator assembly, then reads zero center when the correct load is achieved. When the load sense meter reads to the left of zero center, the load capacitor A703C1 travels upward increasing the loading capacitance; when the load sense meter reads to the right of zero center, the load capacitor travels downward decreasing the loading capacitance.

h. TUNING COMPLETE AND OUTPUT LEVEL. (See figures 4-6, 4-10, 7-1, 7-2, 7-3, 7-4, and 7-6) When the load capacitor A703C1 completes tuning the 28 vdc load servo on voltage appearing at pin 3 of the PA load assembly A703, is routed through closed sets of contacts on the now deenergized motor control relays A703A2K1 and A703A2K2, and appears at pin L of the load assembly. The voltage is then routed to pin 7 of the tuning control assembly A2001 and applied through a one-half second time delay A2001CR3 to latch the servo tuning complete relay A2001K4 in the operate mode. Contacts 14 and 15 of the servo tuning complete relay open, removing the IPA cathode input to pin 1 of the drive-up comparator assembly A1005A1. Contacts 8 and 9 open, removing a ground that was applied to E1106, and is now a source of +3 vdc. Contacts 12 and 13 close, providing a ground to energize the servo off relay K2001. The servo off relay then removes phases 1 and 2 from the servo amplifiers. This causes the IPA servo amplifier search relay A1002A1K1 to deenergize, removing the closure between pins 23 and 25 of the servo amplifier and closing pins 23 and 24. This disconnects the tune level voltage at pin 25 and connects the 3 vdc (from ungrounded E1106) to pins 24 and 23 of the servo amplifier which is then applied to pin 2 of the drive-up comparator assembly. With no input at pin 1, the drive-up comparator causes the drive-up motor B1301 to increase the drive applied to the transmitter, thereby increasing the r-f output. The 6 vdc is available at terminals of TB703 and pin 14 of the output power assembly A4004 and is routed to pin 13 of the remote power assembly A705. This voltage is then applied to one of four POWER ADJUST potentiometers A705A1R1 through R4 whichever is activated by a ground applied by the switch A705S1F. An adjustable value of this voltage is then applied to pin N of the remote power assembly and applied to terminal 4 of TB703 and pin 16 of the output power assembly as the fixed input to the comparator circuit. The r-f output of the transmitter continues to rise until the output level input at the comparator equals the fixed input level. Transistor A4004Q3 is forward biased and a ground appears at pin 4 of the output power assembly and terminal 7 of TB703. The ground is routed to pin F of the tuning control assembly A2001, through the now closed contacts 6 and 7 of the servo tuning complete relay A2001K4 and latches the ready 1 relay A2001K5 in the operate position. Contacts 6 and 5 open, removing the ground applied to pin T of the exciter connector J119 which originally activated the 100-mw level excitation. The 24 vdc at contact 15, applied from pin W of the tuning control assembly, is removed from contact 14 and the fault circuit and applied to contact 16 and is then routed to TB905 terminal 2 and the READY indicator DS5004. Contacts 11 and 12 open, removing 24 vdc from the coil of ready 2 relay A2001K3. With the ready 2 relay deenergized, contacts 6 and 7 open and remove the ground applied at pin 2 of the ALDC assembly A707. This prevented the ALDC voltage from limiting the output of the transmitter during the tuning sequence. Contacts 9 and 10 also open, thereby removing the ground provided by the MAN/AUTO switch S5002 to the push-to-talk circuit through the fault relay A2001K7 to pin 2 of the push-to-talk relay K1101. With the PTT relay deenergized, the transmitter is in the biased-off condition. With the ALDC

circuit in the normal condition and the exciter carrier-on signal removed, the transmitter is ready to accept the incoming intelligence.

i. FAULT. (See figure 7-4) The 24 vdc available at pin W of the tuning control assembly A2001 is routed through contacts 15 and 14 of the manual relay A2001K6 to contact 15 of the ready 1 relay A2001K5. The open contact 14 is routed through normally closed contacts 5 and 6 of the servo recycle relay A2001K1, through the normally closed contacts 12 and 11 of the fault relay A2001K7, and is applied to the time delay adjust potentiometer A2001R4. When the tune button S5007 is depressed, the ready 1 relay is latched in the tune position and energizes the servo recycle relay for one-half second. The 24 vdc at contact 15 of the ready 1 relay is applied through contact 14 to the servo recycle relay. After the one-half second delay the servo recycle relay deenergizes, and the 24 vdc is applied through the fault relay to the time delay r-c constant of A2001R4 and A2001C2. When the capacitor is fully charged, A4001 is triggered energizing the fault relay. The relay is then self-latched through holding contacts 12 and 13. Contacts 6 and 7 apply a ground to the servo off relay K2001 which removes the power from the servo amplifiers, stopping the tuning sequence. Contacts 14 and 15 open the PTT relay circuit. Contact 16 then applies a ground to the FAULT indicator DS5003. Contacts 8 and 9 provide a remote indication of the fault condition. The time delay is normally set for a 30-second delay before fault condition. To recycle the transmitter, the TUNE switch is depressed energizing the servo recycle relay. Contacts 5 and 6 open, removing the 24 vdc from the fault circuit, thereby recycling the fault relay.

#### 4-8. ALDC (See figures 7-1, 7-7, and 7-10)

The ALDC circuit provides a feedback voltage to the exciter to prevent excessive r-f output from the transmitter. A sample of the transmitter r-f output appears at terminal A706E2 of the harmonic filter A706. The voltage passes through capacitor divider network C740 and C741, and is rectified by the ALDC rectifier assembly A708. The positive voltage is then applied to the input of the ALDC amplifier assembly A707 at pin 7. The ALDC amplifier consists of two series connected integrated circuit amplifiers. The amplifier output at pin 2 is applied to the exciter to control the exciter power output, thereby controlling the transmitter power output.

A negative voltage at pin 1 of the remote power assembly A705 is applied to the four ALDC potentiometers, A705A1R8, A705A1R9, A705A1R10 or A705A1R11. Selection of power levels 1, 2, 3, or 4 by closing POWER switch S5006 on the control panel selects one of the four potentiometers and routes the voltage to pin M of the assembly. The voltage is then applied to terminal 2 of the ALDC rectifier assembly A708 and controls the level of the rectified r-f output sample. Selection of a power level also connects one of four POWER LIMIT potentiometers, A705A1R12, A705A1R13, A705A1R14 or A705A1R15 to pins 3 and 4 of the remote power assembly. The leads are routed to terminals 1 and 2 of TB702 and then to pins 4 and 6 of the ALDC amplifier assembly A707. The potentiometer controls the gain of the amplifier. These potentiometers are adjusted to provide and maintain the proper output level for each selected power level positions.

#### 4-9. AUTOMATIC POWER LEVEL (See figures 4-6,7-1,7-3,7-4 and 7-7)

The transmitter is capable of selecting any one of four preset power levels as determined by the power output requirements of the using station. The output power assembly A4004 compares the forward power level input from the PA OUTPUT POWER meter M4005 with a preset voltage from the selected power level potentiometer in the remote power assembly A705. When the two voltages are equal, the sensing circuit assembly applies a ground to the ready 1 relay A2001K5 to latch it in the output position.

The forward power output level sample voltage is derived by the forward power diode CR701 at the directional coupler DC701, and routed to pin 20 of the remote power assembly A705. The signal is then routed through the remote meter relay A705A1K2 and the power calibrate relay A705A1K1 to pin C of the remote power assembly. The signal is then routed to terminal 10 of the output power assembly A4004 via terminal 1 of TB703. The voltage is applied as one input to the comparator circuit and also to the OUTPUT POWER meter M4005. A potential of 6.6 vdc is available at terminal 14 of the output power assembly and applied to pin 13 of the remote power assembly through terminal 5 of TB703. The 6.6 vdc is then applied to the four power adjust potentiometers A705A1R1, A705A1R2, A705A1R3 and A705A1R4. The 24 vdc available at pin L of the remote control connector J3003 is jumpered to pin K. The voltage is then routed to the interruptor contacts of the remote power level switch A705S1A, and to an open set of contacts on the POWER switch S5006 through terminal 11 of TB904. When the POWER switch is momentarily pushed to the up position, the 24 vdc is routed to pin 7 and a ground is routed to pin 2 of the remote power assembly. The voltage and the ground are applied to the solenoid of the remote power level switch A705S1 advancing it one position. The switch must be released and pushed again to advance the switch. When the desired position is reached, the appropriate power adjust potentiometer is then set for the desired output level. The voltage at the wiper of the potentiometer is routed through the meter calibrate potentiometer A705A1R6, through pin N of the remote power assembly to terminal 16 of the output power assembly A4004 via terminal 4 of TB703. The voltage is applied as the fixed input to the comparator circuit. When the two inputs are equal, a ground appears at terminal 4 of the output power assembly which energizes ready 1 relay A2001K4. This stops the transmitter tuning sequence at the desired power level. (Refer to paragraph 4-7 h.) To select the power level position remotely, the 24 vdc available at pin L of the remote control connector J3003 is jumpered to pin K, the 24 to 30 vdc input. The coil return line at pin J is jumpered to the notch homing common line at pin E. A ground is then applied to one of the position lines appearing at pins A, B, C or D.

Calibration of the power level circuit is performed by substituting a calibrated voltage for the forward power output level sample voltage as the variable input for the comparator circuit. Depressing the POWER switch S5006 to the ADJ (down) position, places a ground on the coil of the power calibrate relay A705A1K1, energizing the relay. Contact 15 (connected to terminal 10 of the output power assembly A4004 which is the input for the comparator and OUTPUT POWER meter M4005) is switched from contact 14, the forward power sample, to contact 16. The voltage appearing at the wiper of the selected power adjust potentiometer is applied through a series resistor A705A1R5 to contact 16, and then to terminal 10 of the output power assembly. The voltage is the fixed input to the comparator circuit.

With no r-f power out of the transmitter, and the POWER switch S5006 in the neutral position, no voltage is applied to terminal 10 of the output power assembly A4004. Therefore, there is no reading on the OUTPUT POWER meter M4005 and no input to the variable input of the comparator circuit. The fixed input line from the power adjust potentiometers is removed from terminal 5 of TB703. The output power assembly level potentiometer A4004R3 is adjusted to trip the comparator circuit and place the transmitter in the ready condition. This calibrates the lower power level limit at 0-kw. The fixed input line is reconnected to terminal 5 of TB703 and the POWER switch is depressed to the ADJ (down) position. The activated power adjust potentiometer now provides both the fixed and variable inputs to the comparator circuits. The power adjust potentiometer is adjusted for a full scale reading on the OUTPUT POWER meter. The meter calibrate potentiometer A705A1R6 is then adjusted to trip the comparator circuit. This calibrates the upper power level limit at 10 kw. With the circuit now calibrated at the end points, the four potentiometers may be set to the desired power level by depressing the POWER switch and adjusting the power adjust potentiometers to obtain the desired power level reading on the POWER OUTPUT meter. Releasing the switch then returns the transmitter to normal with the forward power sample voltage applied to the meter and comparator circuit.

Observation of the set power level value may be made by depressing the POWER switch S5006, selecting the position, and reading directly the indication on the OUTPUT POWER meter M4005.

#### 4-10. BANDSWITCH CONTROL (See figures 4-7,7-1,7-2,7-3,7-4, and 7-8)

a. GENERAL. Bandswitching within the transmitter may be performed locally with the BANDSWITCH control switch S5004, automatically by the frequency selection on the exciter, or remotely. Bandswitching is accomplished by providing a ground to the bandswitch manual control wafer A704A1S1A front and rear, or to the bandswitch servo control notching type wafer A704A1S1B rear. The ground energizes the PA bandswitch relay A704A1K1 which supplies the a-c voltage to the PA bandswitch motor A704B1.

b. MANUAL CONTROL. Placing the MAN/AUTO switch S5002 into the MAN position provides 24 vdc to energize the manual relay A2001K6. Contacts 7 and 6 close providing a ground at pin X of the tuning control assembly which is then routed to the common terminal of the BANDSWITCH S5004. The two normally open terminals of the switch are connected through pins i and j of A704A1J1 to alternate terminals of the front and rear of the bandswitch manual control wafer A704A1S1A. When the BANDSWITCH is set to the right, a ground appears at the rear half of the manual control wafer. If the wiper is in contact with one of the terminals on the rear of the wafer, the ground is fed to one side of the coil of the bandswitch relay A704A1K1. The other side of the coil is connected to 24 vdc, energizing the relay and applying phases 1 and 2 to the bandswitch motor causing it to rotate. The bandswitch control switch A704A1S1 is mechanically connected to the bandswitch motor and also turns. As the switch is rotated 30°, the wiper loses contact with the grounded terminal on the rear portion of the wafer deenergizing the relay and stopping the motor. The wiper now makes contact with a terminal on the front portion of the bandswitch manual control wafer. When the BANDSWITCH is set to the left, the ground appears on the front terminals

causing the motor to rotate another 30°. Setting the BANDSWITCH switch alternately right and left causes the bandswitch to rotate in 30° steps. The 24 vdc is applied through pin N of A704A1J1 to the wiper of the bandswitch indicator control wafer A704A1S1B front. With the bandswitch in the 2-2.3 MHz band position, the voltage is applied to terminal 1, through pin M of A704A1J1 to terminal 10 of the band indicator by-pass assembly A5001, and illuminates the 2-2.3 MHz indicator DS5005.

A ground provided at pin B of A704A1J1 is routed through the IPA bandswitch control wafer A704A1S1C to the notch homing type control wafer of the IPA bandswitch A1002S2A front. The ground is applied to the IPA bandswitch relay. This energizes and provides 24 vdc for the solenoid of the bandswitch. The switch rotates until the notch reaches the terminal with the ground applied stopping the switch. The IPA bandswitch A1002 is thereby placed in a compatible band with the PA bandswitch A704.

A ground provided at pin T of A704A1J2 is routed through the filter bandswitch control wafer A704A1S1D front to the notch homing type control wafer of the filter A706S1A and energizes the filter bandswitch relay A706K1. The a-c power is applied to the bandswitch motor A706B1 causing it to rotate until the notch reaches the grounded terminal. The relay deenergizes, stopping the motor in the proper band. The filter is thereby placed in a compatible band with the PA bandswitch A704.

While any of the motors are energized or if the PA bandswitch A704, the IPA bandswitch A1002 or the filter A706 are not in the correct band the voltage source applied to the push-to-talk relay K1101 is withheld to prevent the relay from being energized. The transmitter is thus in the biased off condition preventing damage to the switch contacts that could be caused by opening a hot contact. The circuit tracing for the 2-2.3 MHz band will be used as a typical bandswitching interlock circuit.

The unregulated 24 vdc available at the low voltage rectifier CR1103 is applied through pin 22 of the IPA bandswitch assembly A1002 to contact 8 of the bandswitch relay A1002K1. When the motor comes to rest with the switch in the proper band, the relay is deenergized and the voltage goes through the normally closed contact 5 to pin 20 of the bandswitch assembly. The 24 vdc is then routed to contact 11 of the PA bandswitch relay A704A1K1. With the motor stopped, the relay is deenergized and the voltage applied at the normally closed contact 8 is then routed to pin 6 of the IPA bandswitch A1002. The voltage is then applied through the wiper of wafer B of S1002S2, solenoid driven switch, through terminal 2 which makes contact in the IPA 2-2.6 MHz band, to pin 5 of the bandswitch assembly. The voltage then arrives at terminal 1 of the IPA bandswitch interlock wafer A705A1S1C rear in the PA bandswitch control assembly. With the PA bandswitch in the 2-2.3 MHz band, terminal 1 makes contact with the wiper and the voltage continues through to pin Q of the filter plug P903. If the filter assembly A706 is the fixed filter, pin Q is jumpered to pin G. If the filter is the switchable filter, the voltage is applied to terminal 1 of the A706S1 rear wafer. With the filter in the 2-3 MHz band, the wiper makes contact with terminal 1 and the voltage is fed to contact 1 of the filter relay A706K1. With the motor at rest, the relay is deenergized and the voltage is fed through the normally closed contact 4 to pin G of the filter connector A706J2. Pin G of the filter



plug P903 is connected to terminal 1 at the filter bandswitch interlock wafer of the PA bandswitch control A704A1S1D rear. The voltage continues through the wiper to the voltage dropping resistor R1107 and is then applied to the coil of the push-to-talk relay K1101. The ground return of the relay then follows the normal PTT circuit control for operation of the transmitter.

c. AUTO CONTROL. Placing the MAN/AUTO switch S5002 in the AUTO position removes the voltage applied to energize the manual relay A2001K6. Contacts 6 and 7 open, removing the ground for the BANDSWITCH switch S5004 disabling the manual control of the PA bandswitch A704. The manual relay contacts 5 and 6 are now closed providing a ground at pin Y of the tuning control assembly A2001. The ground is then connected to terminal E2002. If the transmitter has an exciter as part of the exciter drawer, the ground is applied at the common pin M of the exciter connector J119. The band or channel switching in the exciter, in conjunction with the proper programming of the channel-band select assembly A2002, causes the ground to appear at pin N of the channel-band select assembly for the 2-2.3 MHz band. The ground is routed to pin A of the remote control connector J3001. If the exciter is located at a remote position, the ground is routed from E2002 to the common pin K of the remote control connector J3001. The ground is then returned at the 2-2.3 MHz pin A of the remote control connector J3001. The ground from pin A is then routed to terminal 1 of the bandswitch servo control wafer A704A1S1B rear in the PA bandswitch control assembly. If the bandswitch is in any position except with the notch at terminal 1, the ground is passed through to the bandswitch relay A705A1K1 causing it to energize which activates the motor A704B1. The bandswitch then rotates until the notch hits terminal 1 at wafer B removing the ground and deenergizing the relay. The interlock circuitry is identical to the manual control detailed in the previous paragraph.

#### 4-11. HARMONIC FILTER (See figures 4-8 and 7-9)

The output from the PA tuning circuit is applied to a harmonic filter A706. The fixed filter provides additional attenuation for frequencies above 34 MHz. The optional switchable filter provides transmitter harmonic suppression of 80 db throughout the frequency range of 2 to 30 MHz. The harmonic filter is a low pass filter supplying the necessary harmonic suppression (with a minimum insertion loss) in six automatically switched bands. The switched filter bands cover the frequency of the transmitter, rejecting all frequencies beyond the upper limit of each band. Refer to paragraph 4-10 for the operation of the switching circuit.

#### 4-12. IPA SERVO AMPLIFIER A1003 (See figures 4-9 and 4-10)

a. GENERAL. The IPA servo amplifier A1003 supplies control voltage to the IPA capacitor motor A1001B1. The IPA servo amplifier has three modes of operation: search, servo and operate. Each of these modes is discussed in sequence.

b. SEARCH MODE. The 52 vac is routed to the IPA servo amplifier at pins 18 and 19 from the PA servo amplifier. Also from the PA servo amplifier, a 28 vdc voltage is routed through the HV ON/OFF relay K2004, with HV on, to pin 29 of the IPA servo amplifier. Application of a 100 mw r-f input to the transmitter causes a 100 mw trigger voltage to appear at pin 6 of the servo amplifier which

is routed to pin 1 of A1003J3 . This causes a ground to appear at pin 4 of A1003J3 which energizes search relay A1003A1K1. Holding contacts 12 and 13 close, applying a ground to the coil, latching the relay energized. Contacts 9 and 10 close providing a path for the tune level voltage through pins 23 and 25 of the servo amplifier to start the drive-up motor. Contacts 15 and 16 close removing a ground and applying parts of the 24 vdc from the voltage divider A1003R1 and A1003R2 to pin 1 of A1003J2 through contacts 14 and 15 of A1003A1K2. This causes a voltage to appear at pins 8 and 15 of A1003J2 which is routed to pins 14 and 16 of the servo amplifier. A fixed voltage is applied to pin 15 of the servo amplifier through contacts 14 and 15 of A1003A1K4. The voltage at pins 14, 15 and 16 is the control voltage for the IPA tune capacitor motor A1001B1 and causes it to rotate. Contacts 6 and 7 of the search relay A1003A1K1 also close applying 28 vdc to the SEARCH indicator, illuminating it, and also applies the voltage to pin 8 of A1003J3. This enables the relay driven circuit for the servo relay A1003A1K2.

c. SERVO MODE. When the IPA circuit approaches resonance, an r-f trigger voltage is generated and applied to pin 3 of the servo amplifier. This voltage is applied to pin 10 of A1003J3 which causes a ground to appear at pin 7 of A1003J3 energizing the servo relay A1003A1K2. If the IPA tuning capacitor A1001C1 is in the incorrect position of its rotation, the r-f trigger cut-off relay A1003K1 is latched to provide a ground from contacts 6 and 7 and applied to the r-f trigger voltage at pin 10 of A1003J3 disabling the relay driver circuit. When the tuning capacitor rotates 180°, the r-f trigger cut-off relay latches in the other direction removing the ground and enabling the relay driver circuit to function. With the servo relay A1003A1K2 energized, contacts 12 and 13 close providing a ground to latch the relay energized. Contacts 15 and 16 close removing a fixed voltage from the IPA sense assembly A1008 appearing at pin 1 of the servo amplifier, to pin 1 of A1003J2. This voltage now controls the motor control voltage appearing at pins 8 and 15 of A1003J2 and routed to pins 14 and 16 of the servo amplifier. When the d-c correction voltage becomes 0 volts, the motor control voltage also becomes 0 volts and the motor stops rotating. This causes the generator portion of the IPA tune motor A1001B1 to stop generating the tach signal appearing at pin 12 of the servo amplifier. The voltage now removed from pin 15 of A1003J3 causes a ground to be removed from pin 16 of A1003J3 deenergizing the operate relay A1003A1K3. Contacts 11 and 12 close routing 28 vdc through contacts 6 and 7 of A1003A1K2 to illuminate the OPERATE light, and to pin 17 of the servo amplifier.

d. OPERATE MODE. The voltage from pin 17 is routed to PA servo amplifier A1004 and energizes the search relay A1004K2. The relay then routes a voltage back to pin 13 of the IPA tune servo amplifier which energizes the servo disable relay A1003A1K4. Contacts 12 and 13 close, applying a ground to pin 1 of A1003J2 which controls the motor control voltage. Contacts 15 and 16 open, removing the 28 vdc from pin 15 of the servo amplifier which is also the motor control voltage. This assures that the IPA tune motor is disabled during the remaining tuning sequence.

#### 4-13. PA TUNE SERVO A1004 (See figures 4-9 and 4-11)

a. GENERAL. The PA tune servo amplifier A1004 supplies control voltage to the PA tuning capacitor motor A702B1. The IPA tune servo amplifier has three

modes of operation; search, servo, and operate. Each of these modes is discussed in sequence.

b. SEARCH MODE. The 28 vdc voltage at pin 17 of the IPA servo amplifier A1003 in the operate mode is routed to pin 3 of the PA tune servo amplifier A1004. The voltage energizes the search relay A1004K2, illuminates the SEARCH indicator, and also is applied to pin 31 of the servo amplifier. Pin 31 is routed to the IPA servo amplifier disable circuit. Contacts 9 and 10 of the search relay close, latching the relay energized. Both ends of the 52 vac winding of the transformer A1004T1 are routed to pins 24 and 25 of the servo amplifier, and then to the tune servo rotation relay A2001K2. The common terminal of the relay then routes one side to pin 28 of the servo amplifier where the voltage is applied to a voltage divider A1004R3 and A1004R4. A portion of this voltage is routed through contacts 12 and 11 of A1004K1 to contact 7 of the search relay A1004K2. Contacts 7 and 6 are now closed routing this fixed voltage to pin 10 of A1004J3. This causes a voltage to appear at pins 8 and 15 of A1004J3 which is routed to pins 14 and 16 of the servo amplifier. A fixed phase is applied to pin 15. These are then applied to the PA tune capacitor motor A702B1 which starts rotating in a direction determined by the tune servo rotation relay A2001K2.

c. SERVO MODE. As resonance is approached, a rectified sample of the PA plate r-f voltage is fed as the plate power trigger voltage to the servo amplifier on pin 21. This voltage is routed through contacts 8 and 9 of the servo relay A1004K1 and applied to pin 1 of A1004J3. The signal is amplified in the module A1004Z2, appears at pin 3 of A1004J3, is routed through contacts 6 and 5 of A1004K1, and applied to pin 1 of A1004J2. This energizes the servo relay A1004K1. Contacts 8 and 9 open and 9 and 10 close removing the plate power trigger voltage from pin 1 of A1004J3 and applying the d-c correction voltage from the PA sense assembly A701. Contacts 11 and 12 open, removing the fixed control voltage from contact 7 of the search relay A1004K2. The amplified d-c correction voltage appearing at pin 3 of A1004J3 is routed through the now closed contacts 6 and 7 of the servo relay A1004K1 through the gain resistor R2 to pin 10 of A1004J3. This voltage at pin 10 now controls the motor control phase voltages appearing at pins 8 and 15 of A1004J3 and is routed to pins 14 and 16 of the servo amplifier. When the d-c correction voltage becomes 0 volts (at resonance) no voltage is applied to pin 1 of A1004J3. Therefore, no amplified signal appears at pin 3 and pin 10 of A1004J3 has no input. The motor control phase voltage at pins 8 and 15 then stops the PA tune capacitor assembly motor A702B1. With the motor stopped, the generator ceases to generate the tach voltage which was routed to pin 12 of the servo amplifier. When this voltage no longer appears at pin 11 of A1004J3 and pin 6 of A1004J2, the module A1004Z1 causes the operate relay A1004K4 to close and illuminates the OPERATE indicator.

d. OPERATE MODE. When the operate relay A1004K4 energizes, contacts 6 and 7 close latching relay A1004K3 in the operate position. This closes contact 6 and 7 of A1004K7 which routes 28 vdc to pin 9 of the servo amplifier as the load servo on signal. This voltage energizes the load servo relay A103A1K2 and applies the second input to the comparator circuit and activates the loading circuit. The tuning sequence now continues until the servo off relay K2001 is energized. The relay removes the a-c power from both servo amplifiers, disabling them.

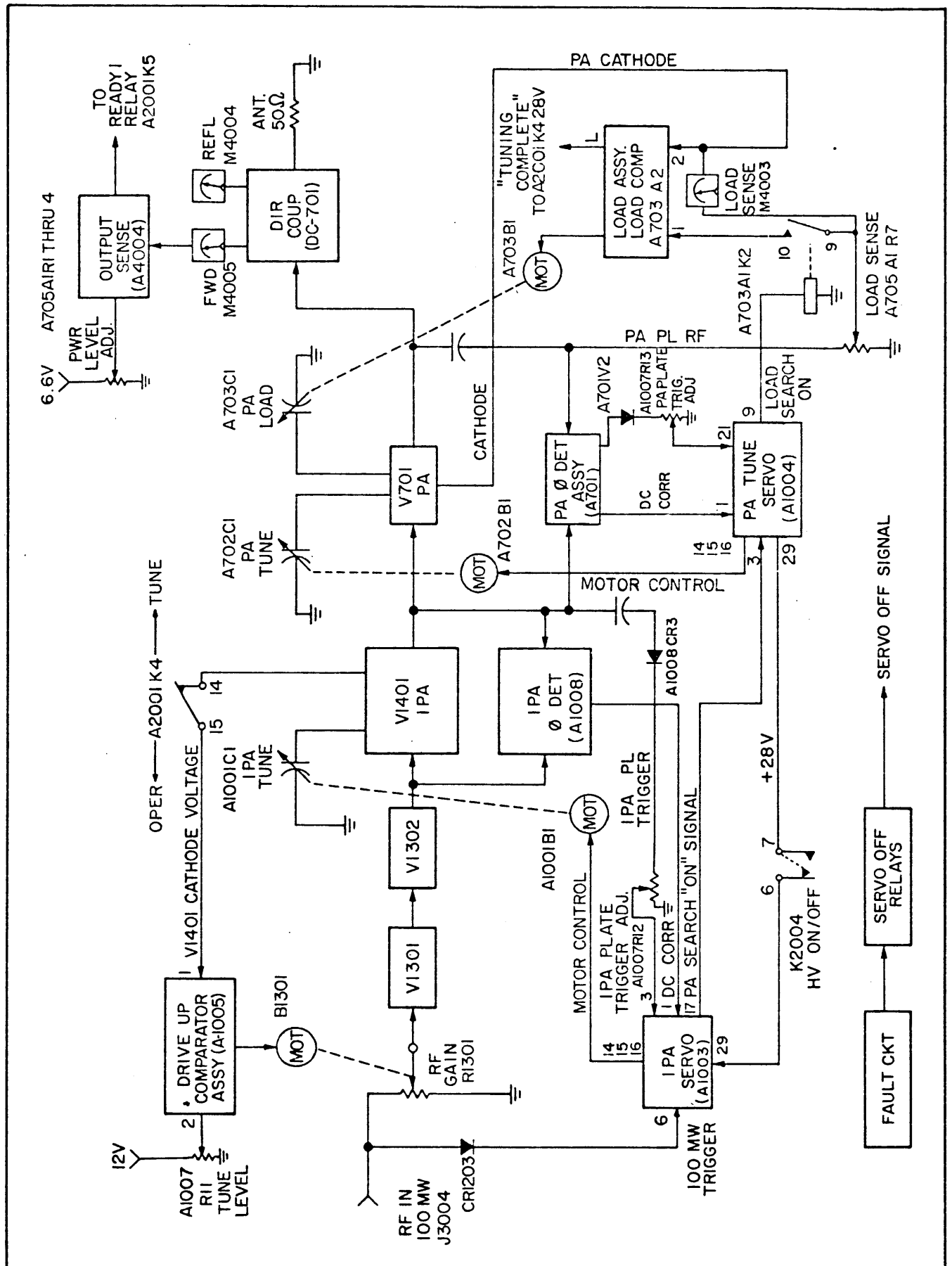


Figure 4-1. Block Diagram, HFLA-10K

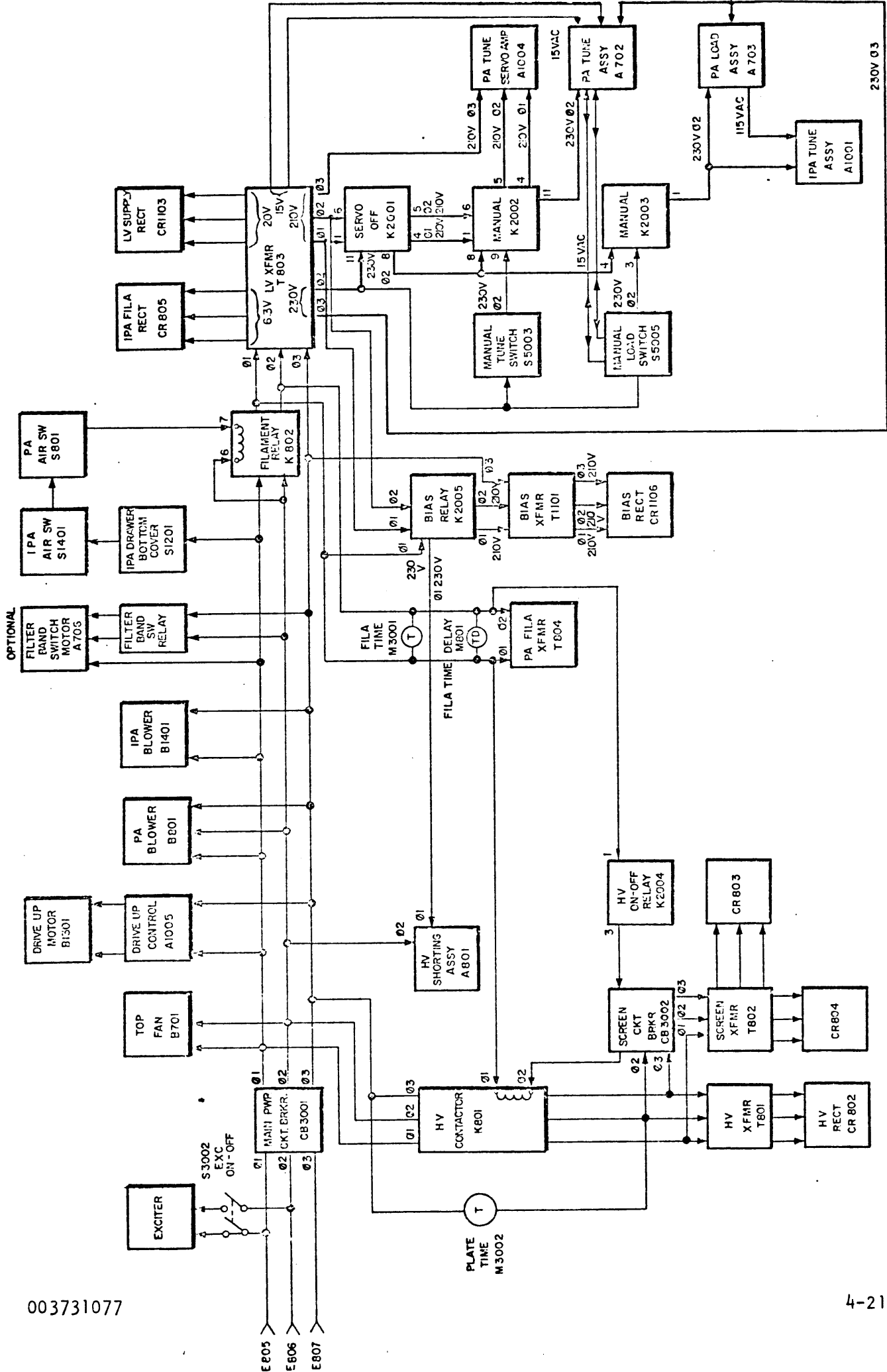


Figure 4-2. Simplified Diagram AC Power Distribution

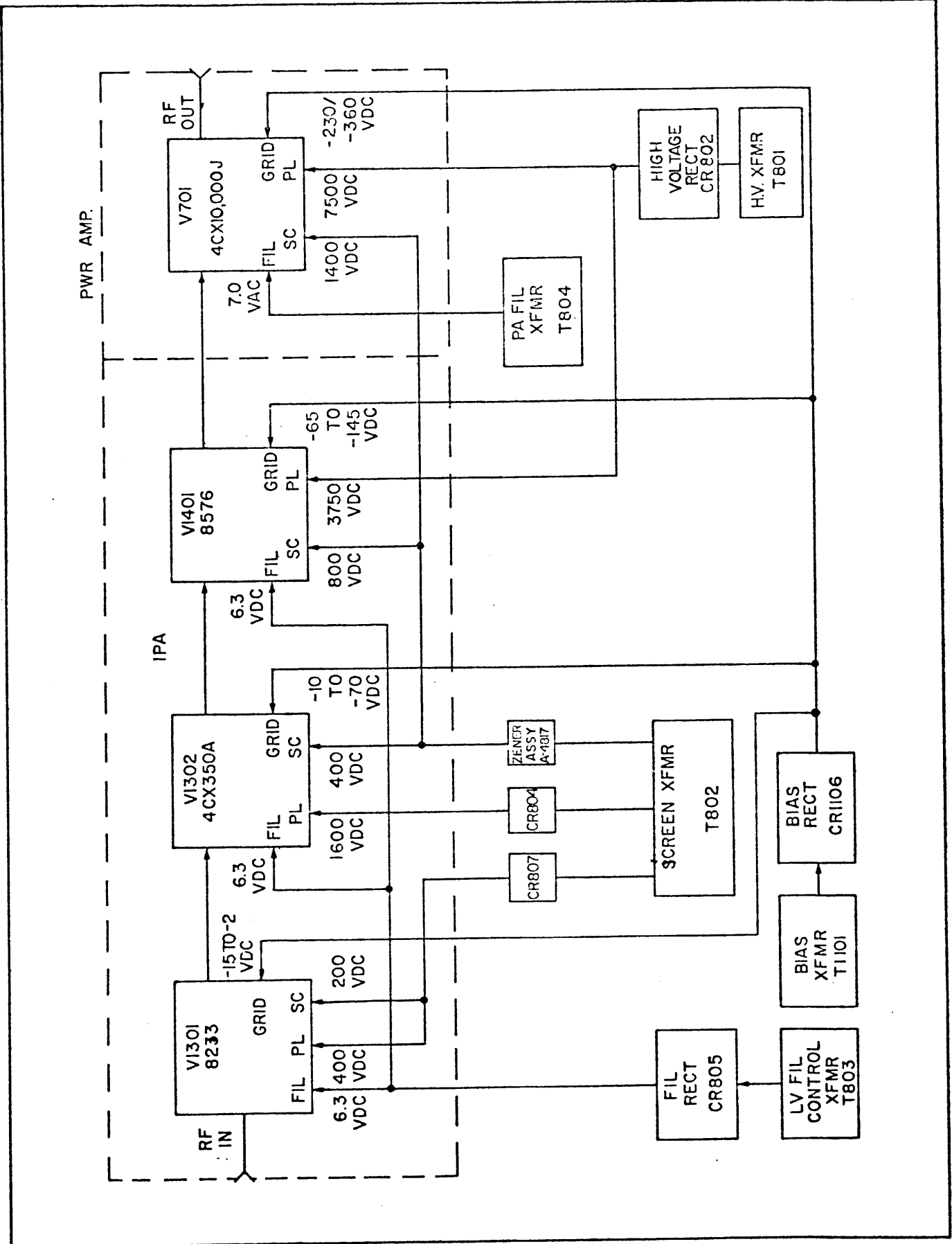


Figure 4-3. IFLA-10K Operating Potentials

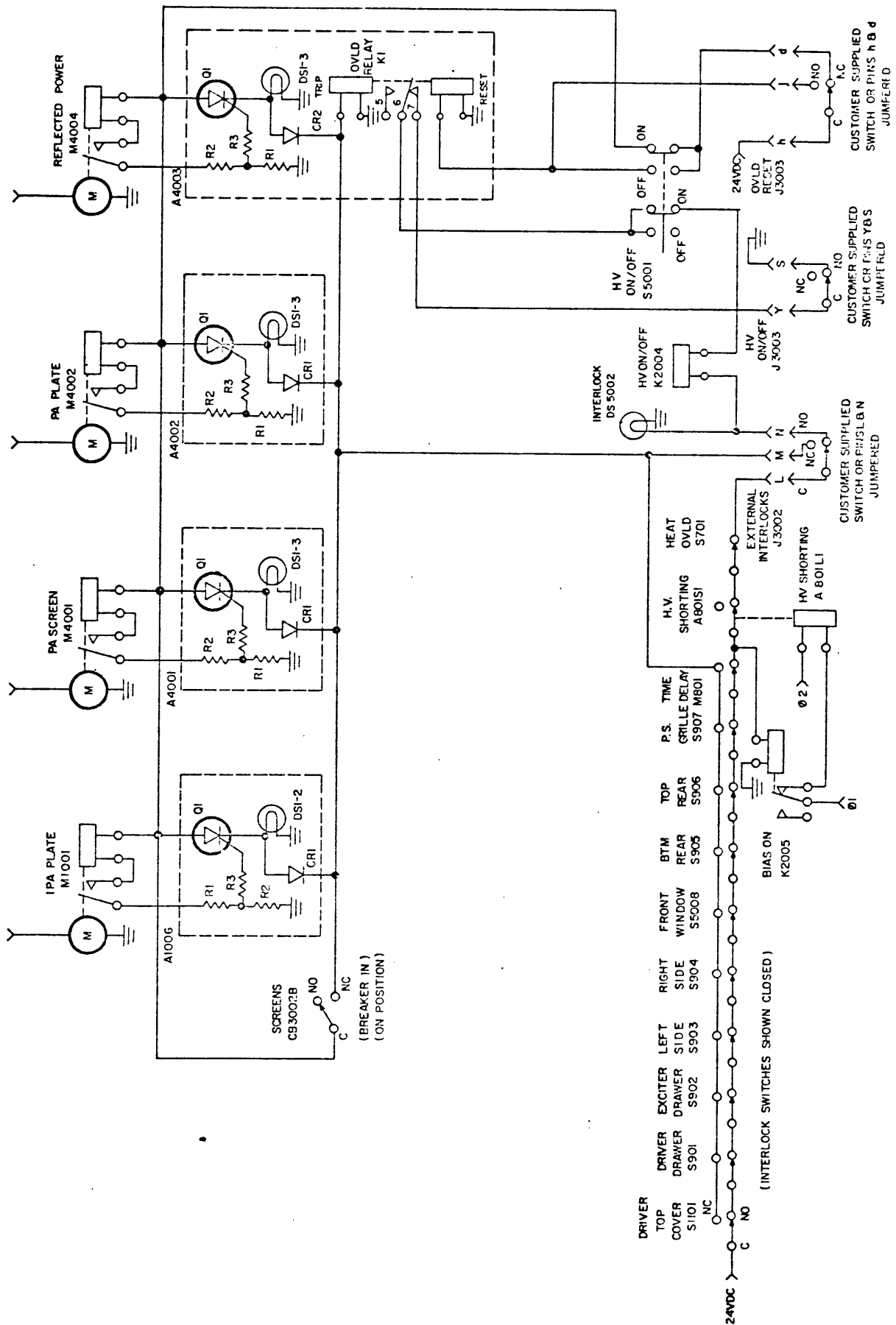


Figure 4-4. Simplified Interlock and HV Overload Circuits

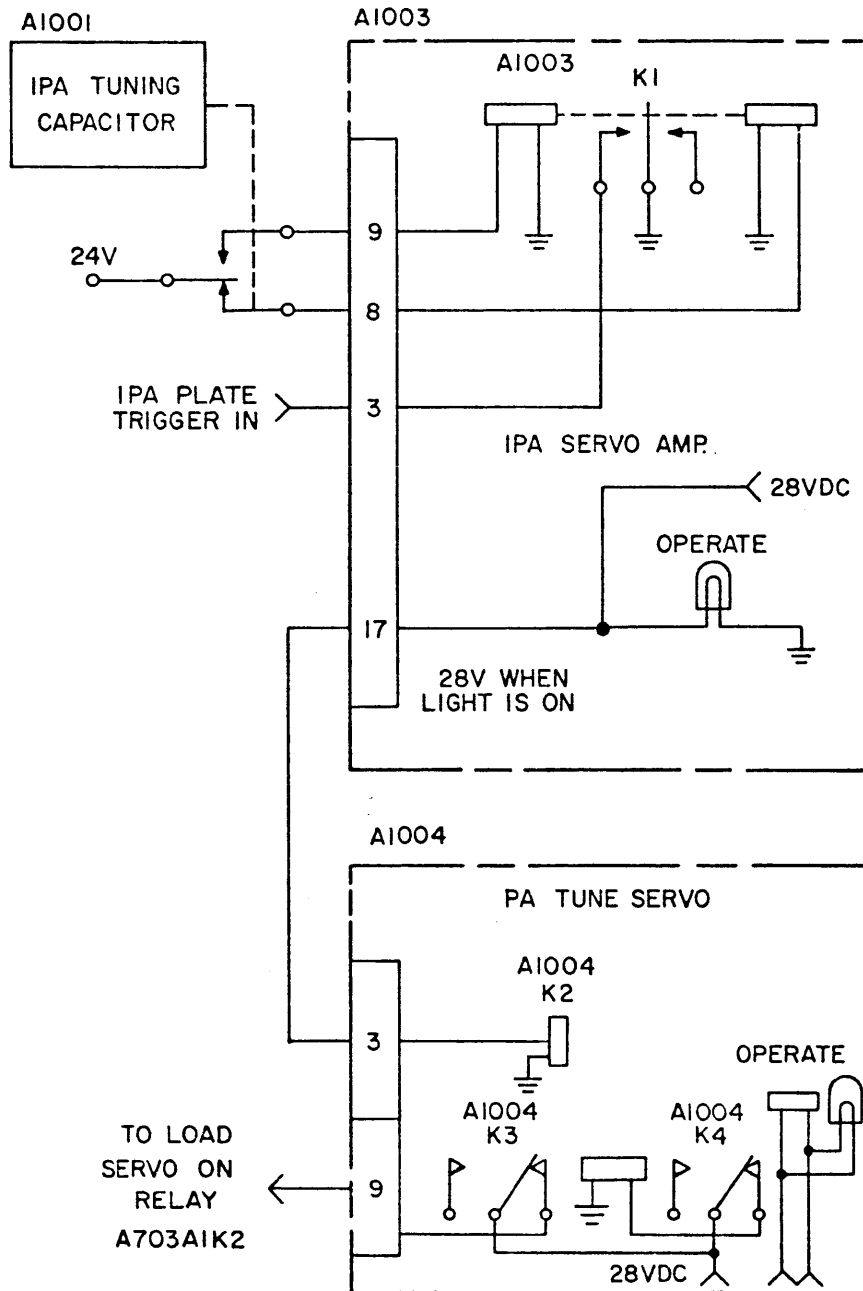


Figure 4-5. IPA Plate Trigger Shorting and Input to PA Tune Servo



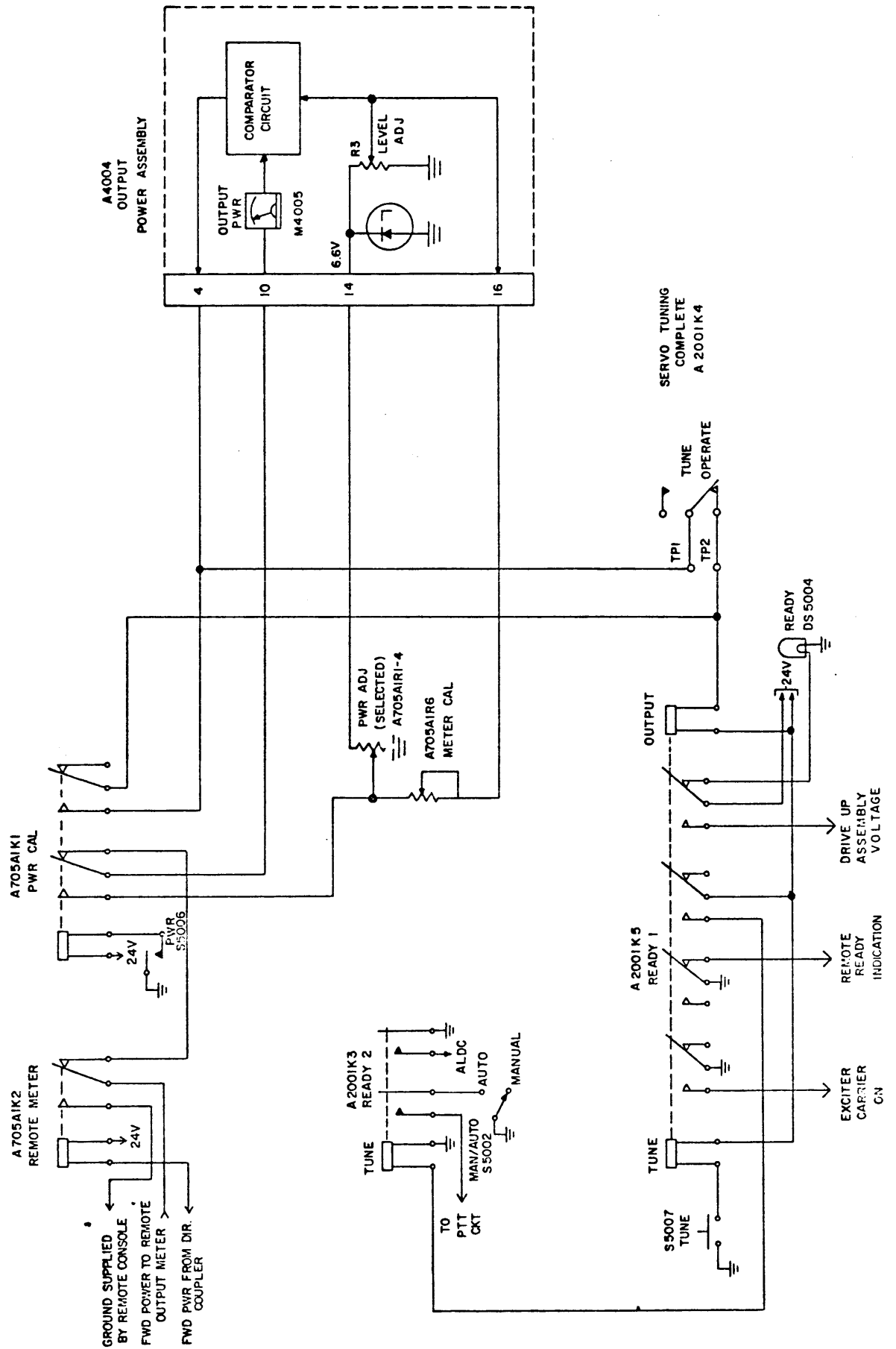


Figure 4-6. Functional Diagram, Power Level and Output Control

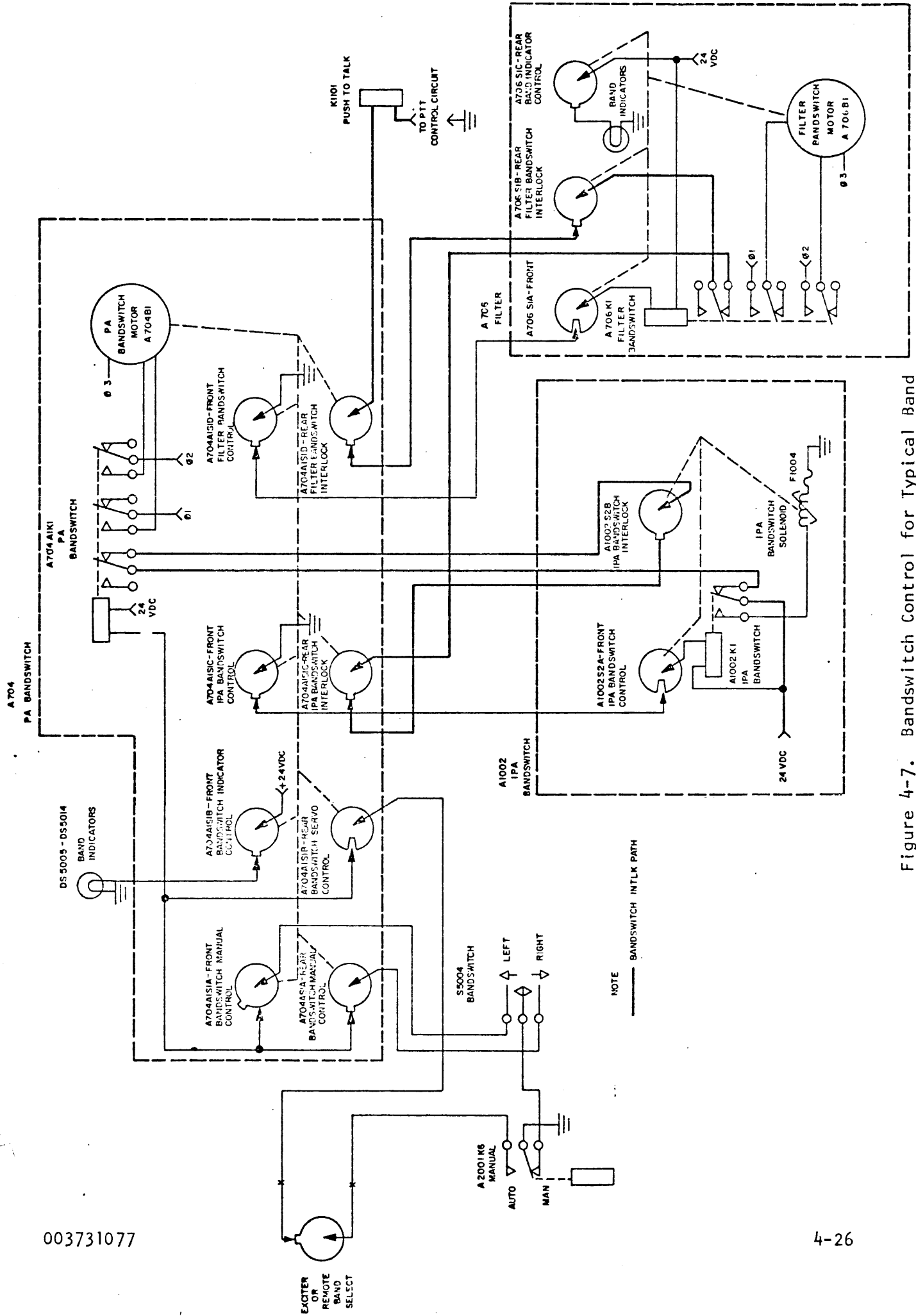


Figure 4-7. Bandswitch Control for Typical Band

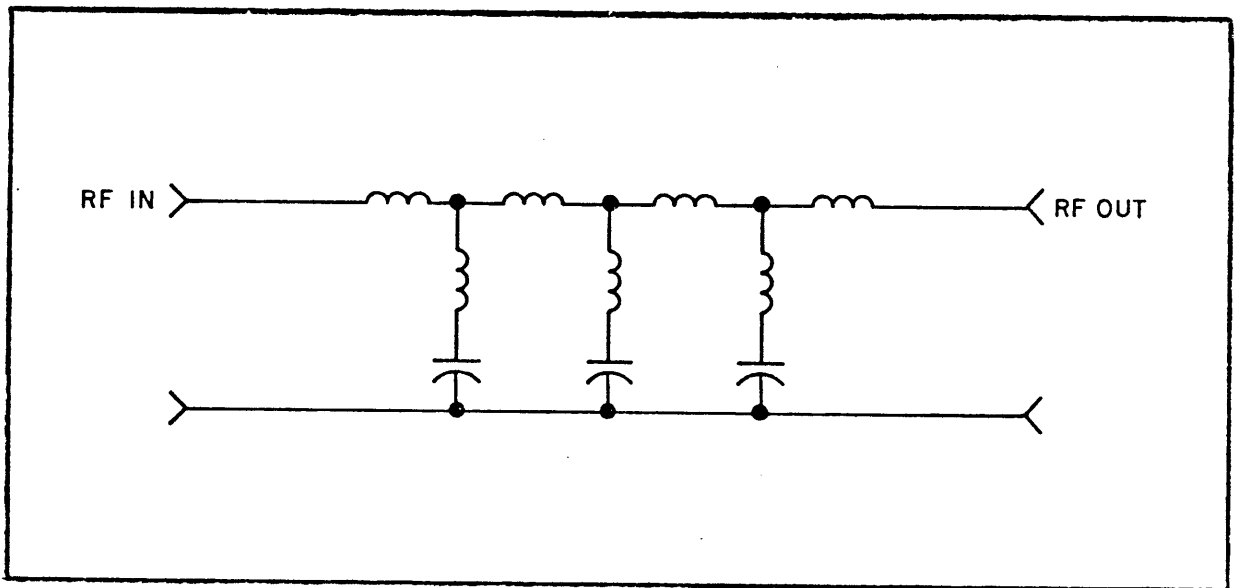


Figure 4-8. Equivalent Circuit of Harmonic Filter, AF110

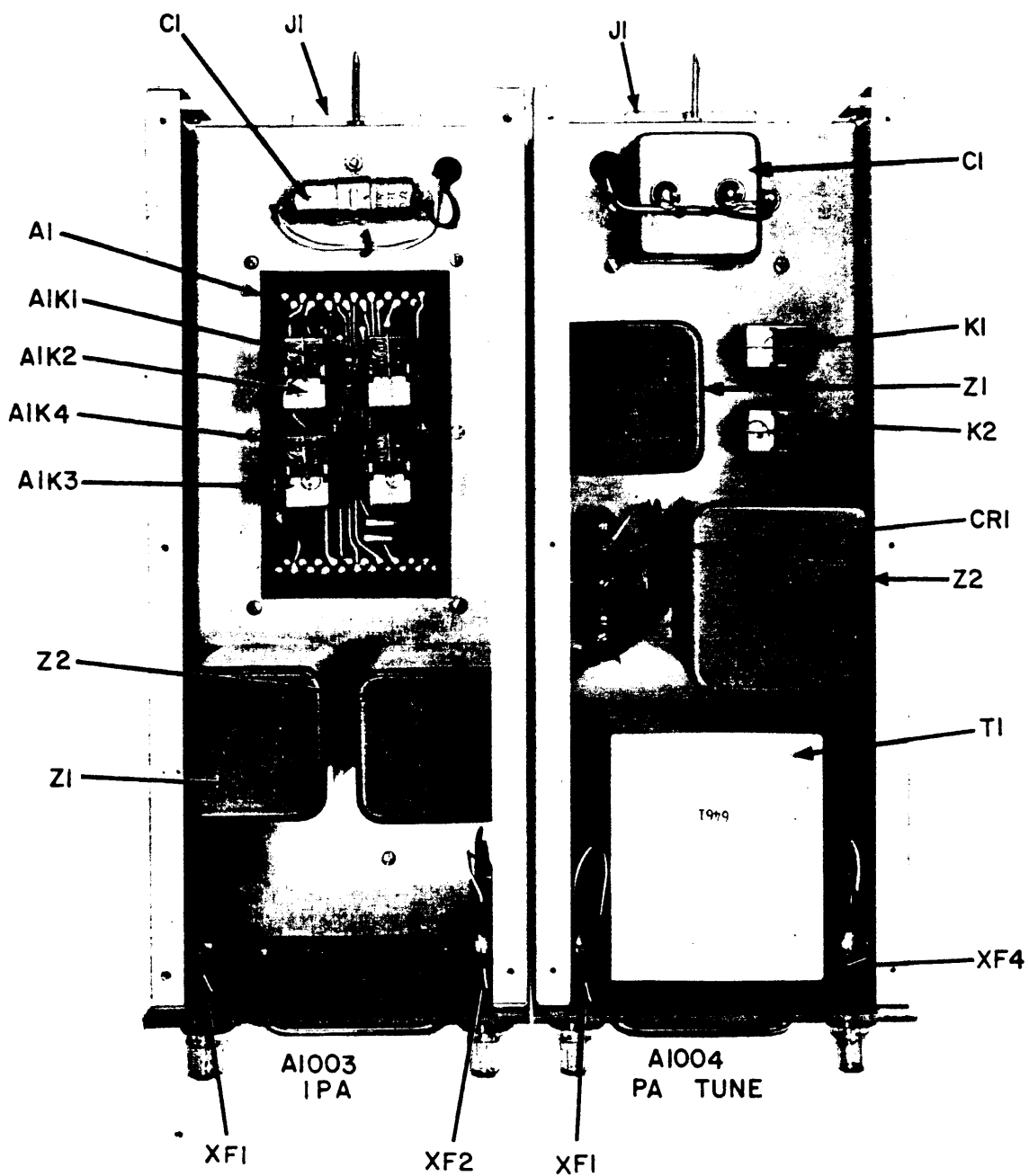
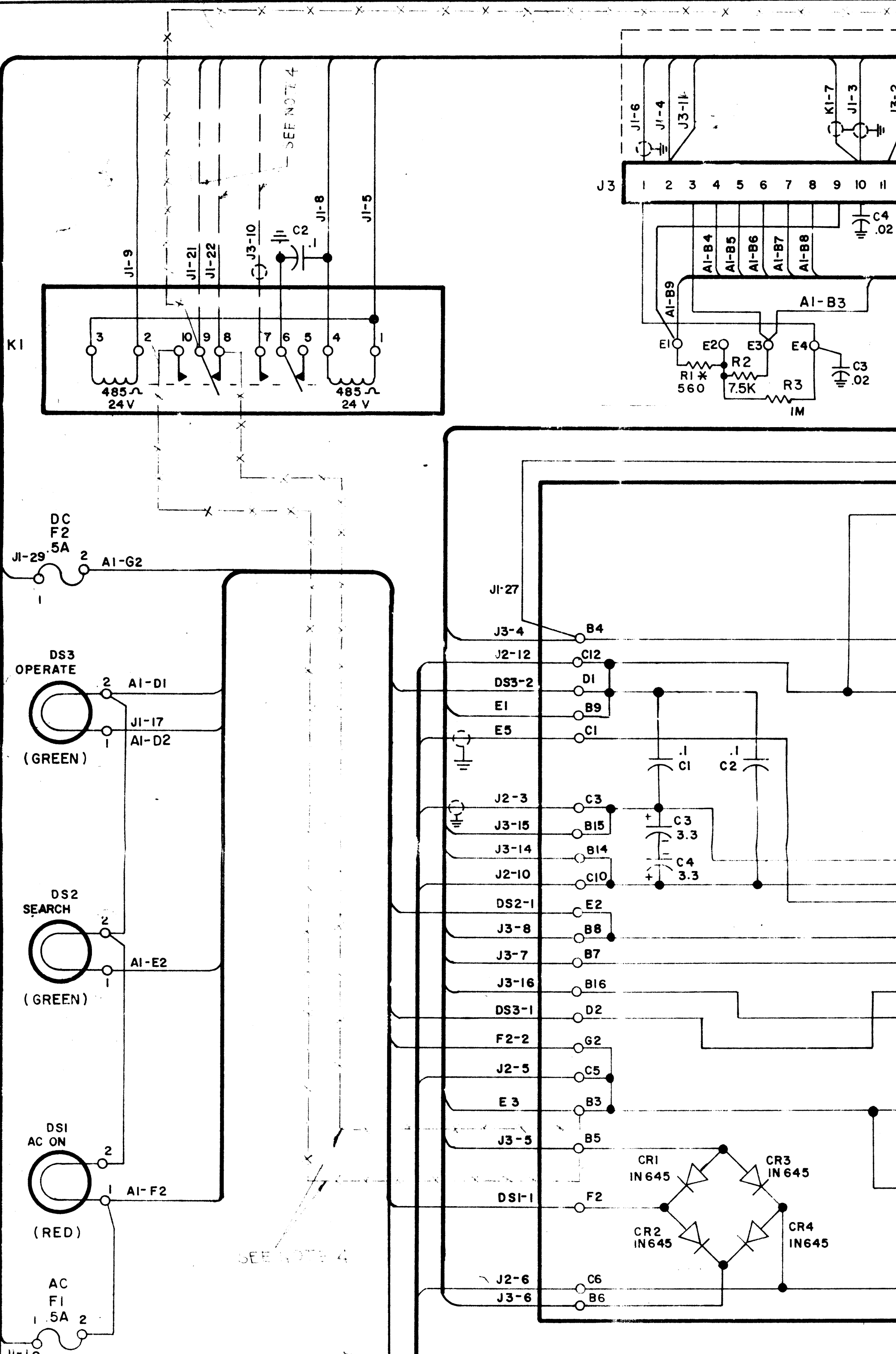
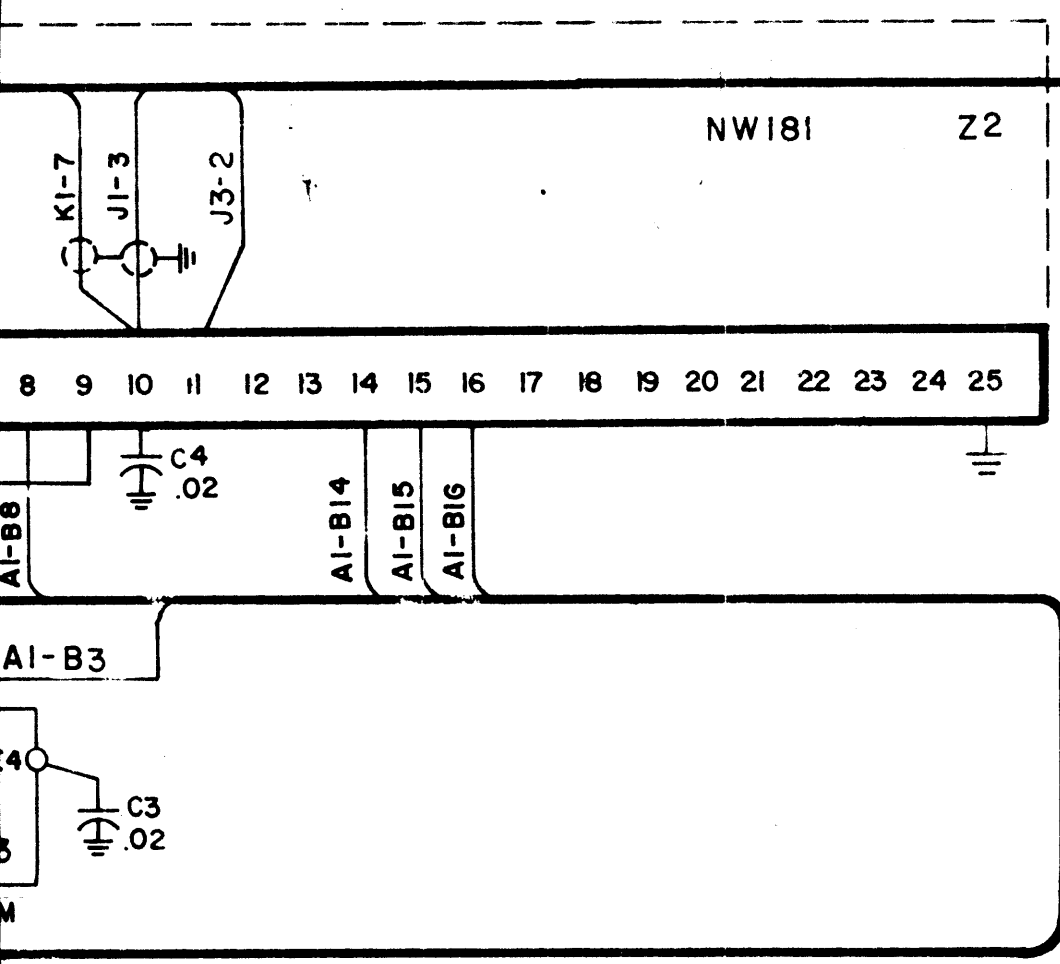


Figure 4-9. Top View, PA Tune Servo Amplifier and IPA Servo Amplifier

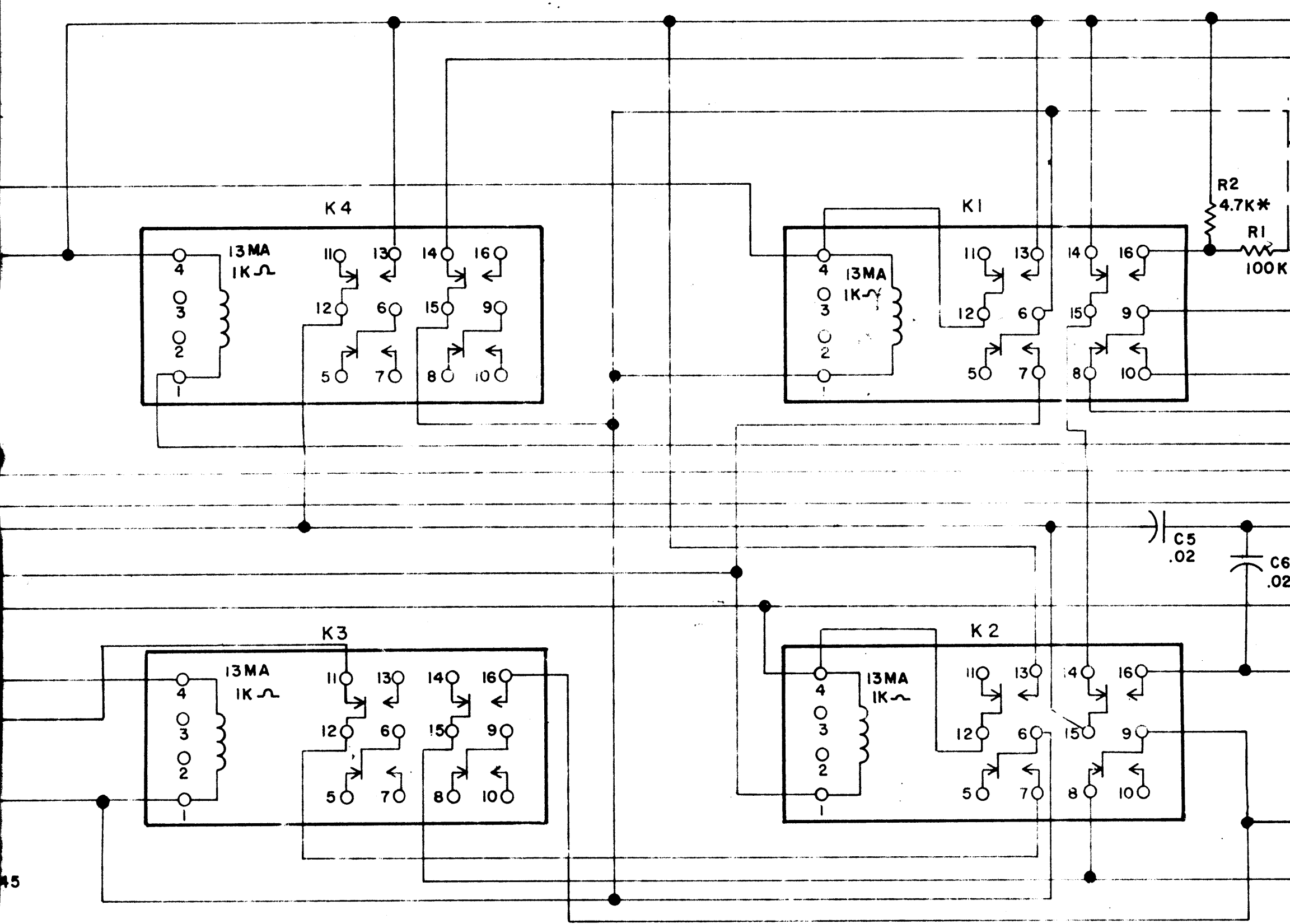
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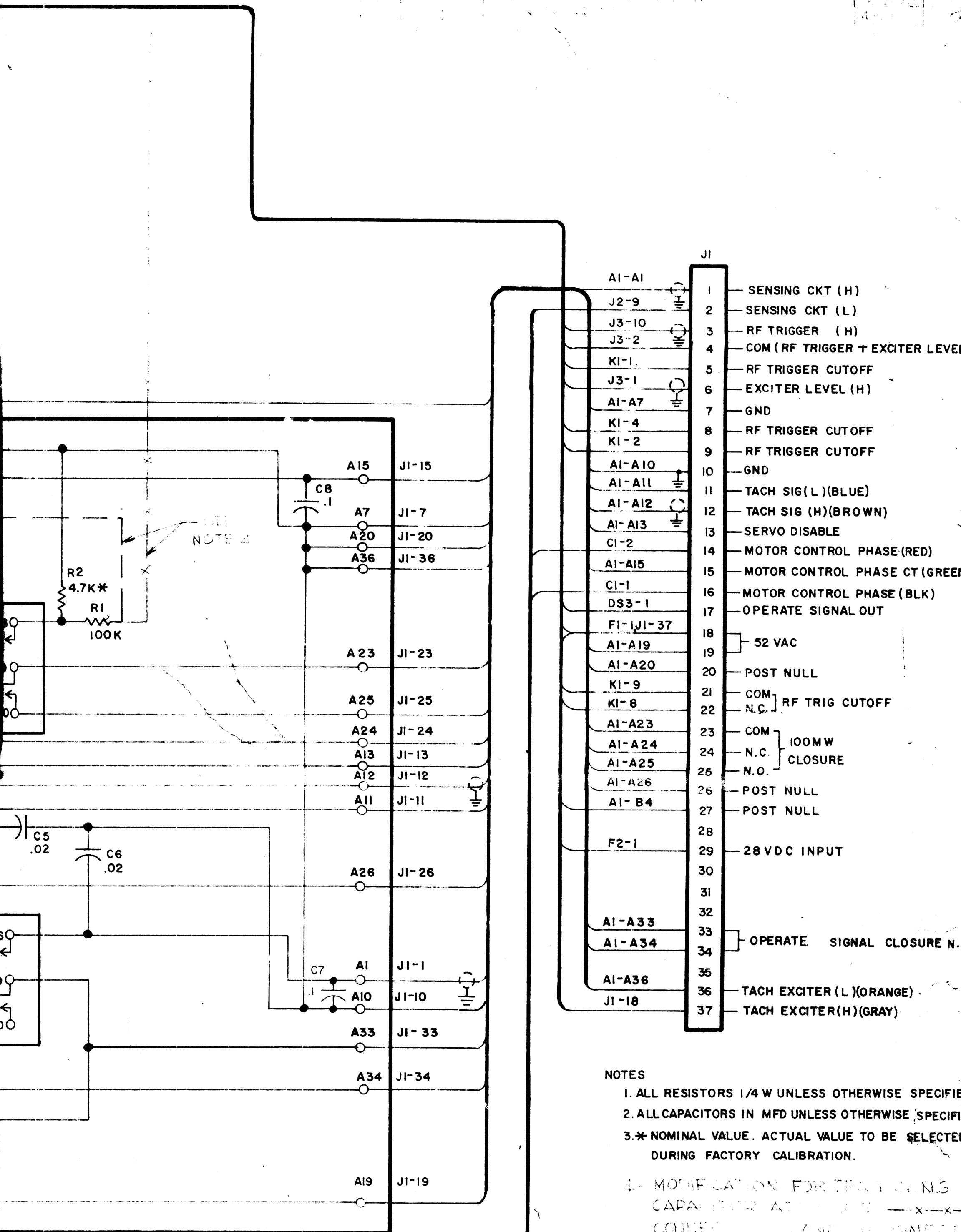


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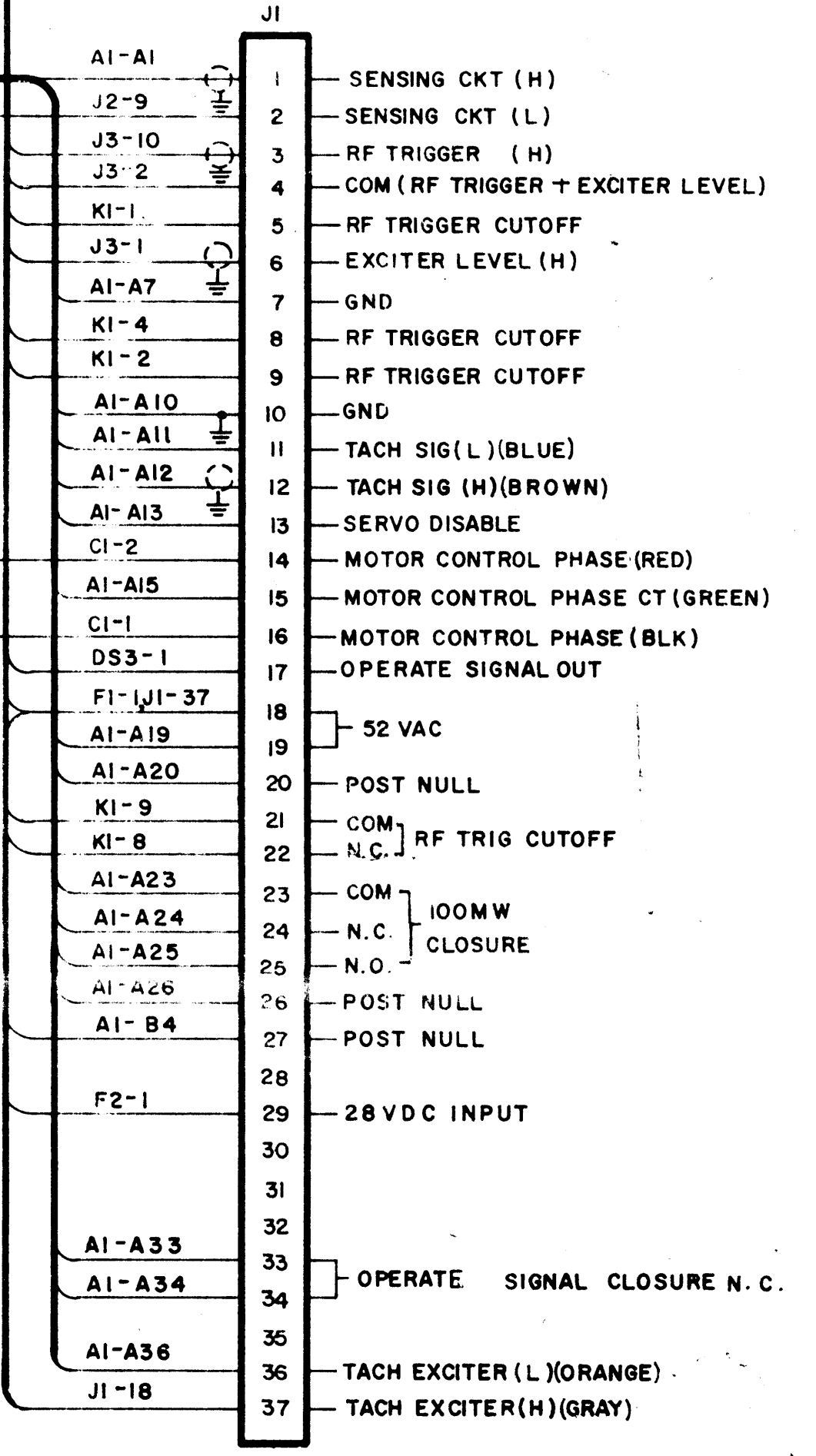
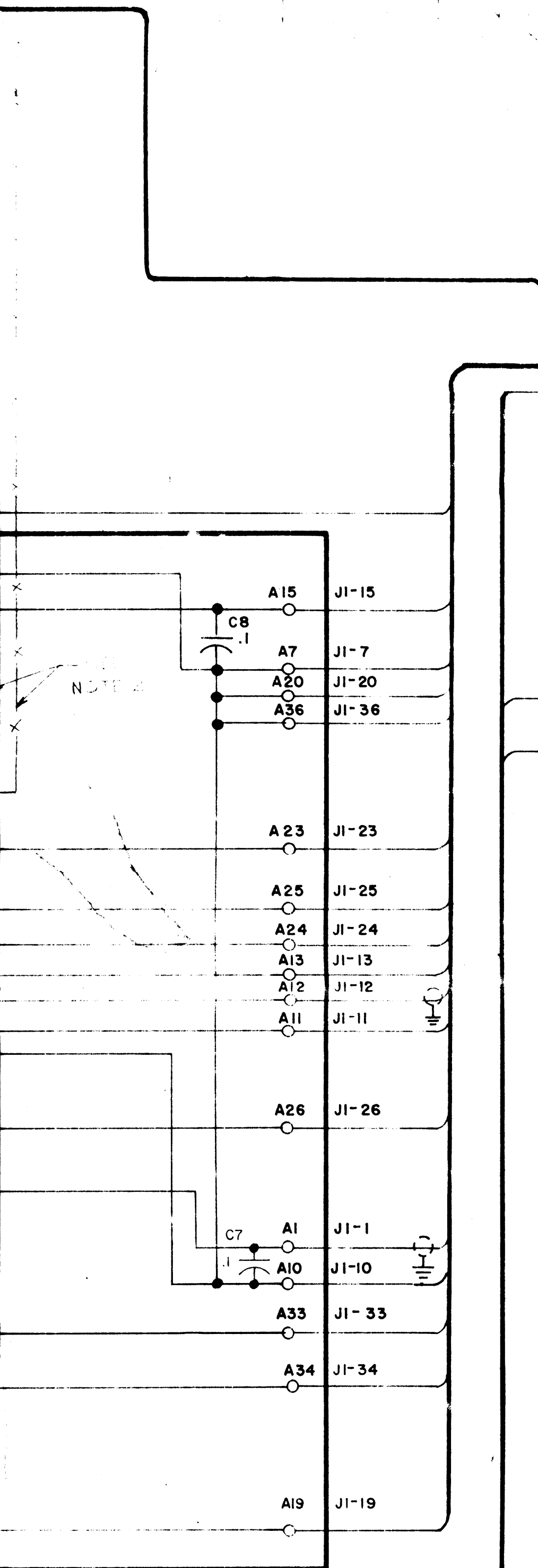


NOTES

1. ALL RESISTORS 1/4 W UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS IN MFD UNLESS OTHERWISE SPECIFIED
3. \* NOMINAL VALUE. ACTUAL VALUE TO BE SELECTED DURING FACTORY CALIBRATION.

4- MODIFICATION FOR TESTING CAPACITORS AT J1 - X-X- CONDUCTORS AND DISCONNECT

REVISIONS					DATE	APPROVED
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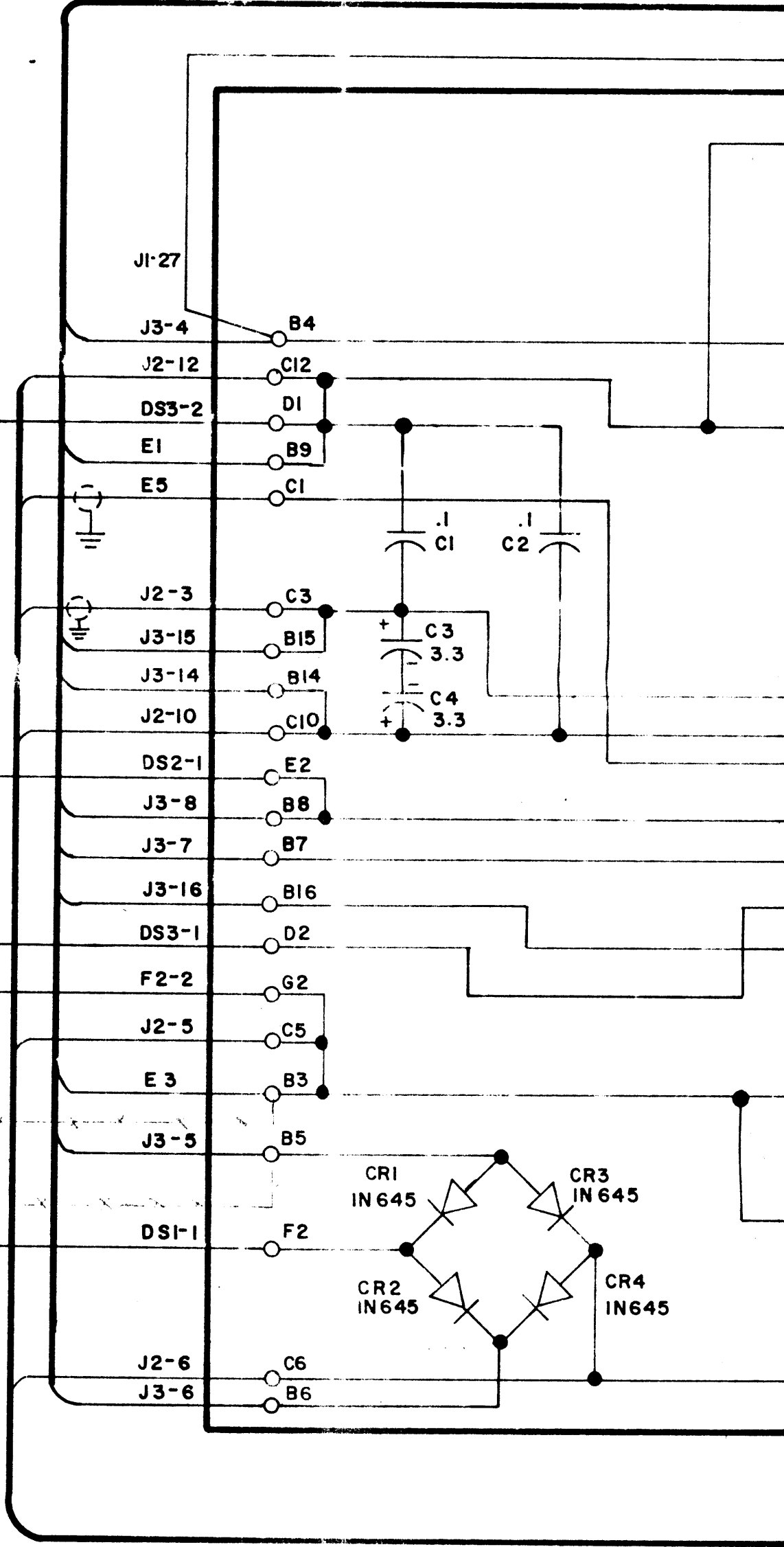
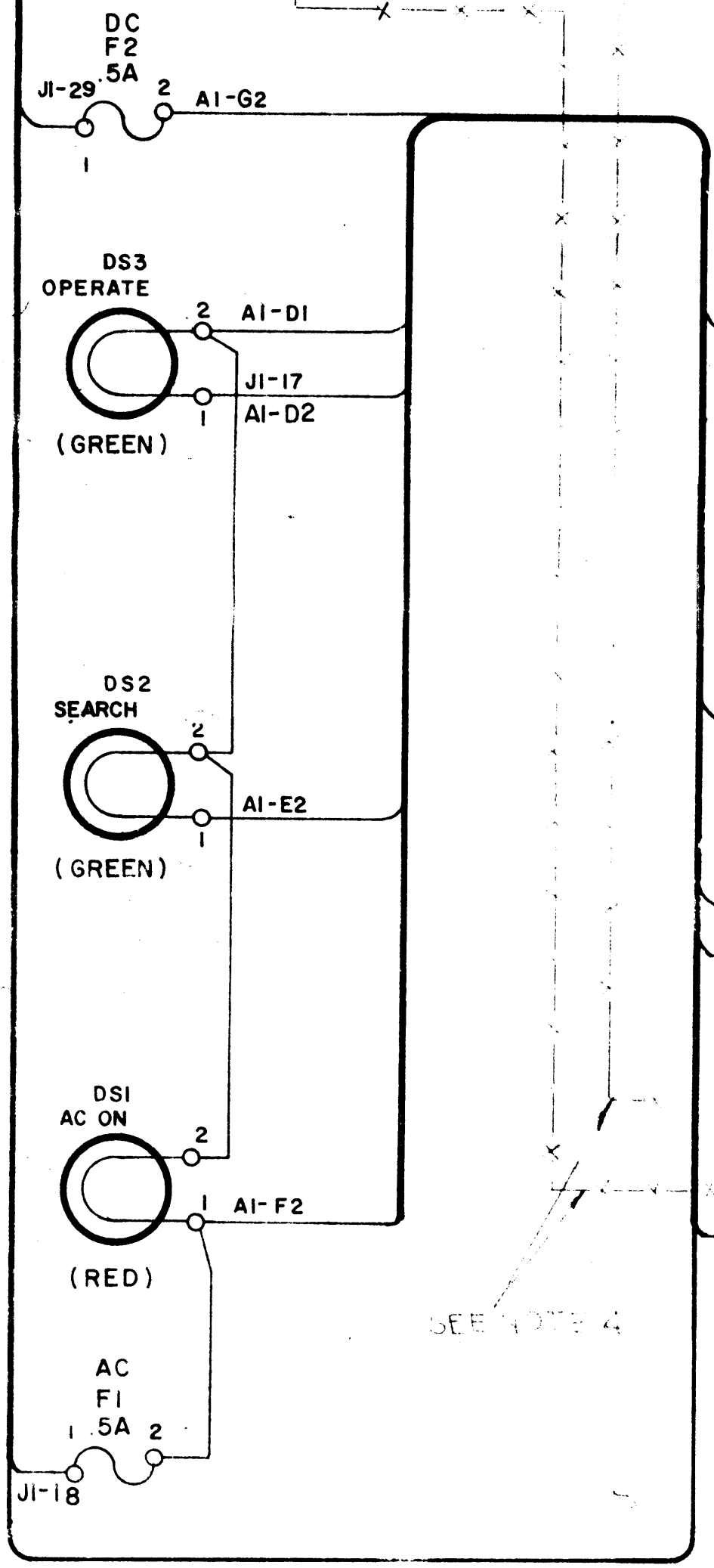


NOTES

1. ALL RESISTORS 1/4 W UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS IN MFD UNLESS OTHERWISE SPECIFIED
3. \* NOMINAL VALUE. ACTUAL VALUE TO BE SELECTED DURING FACTORY CALIBRATION.

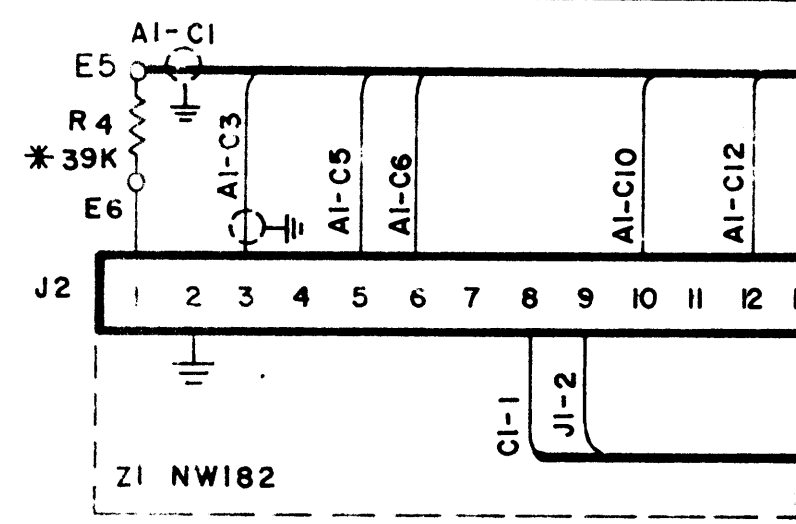
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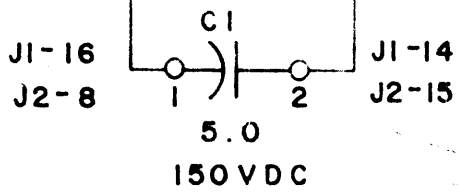
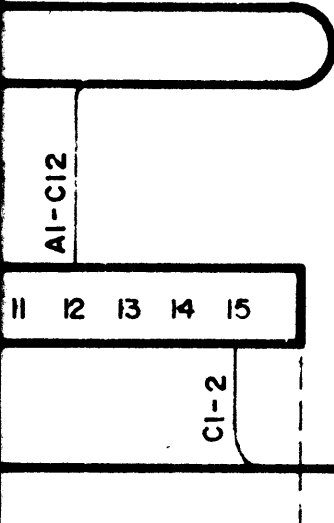
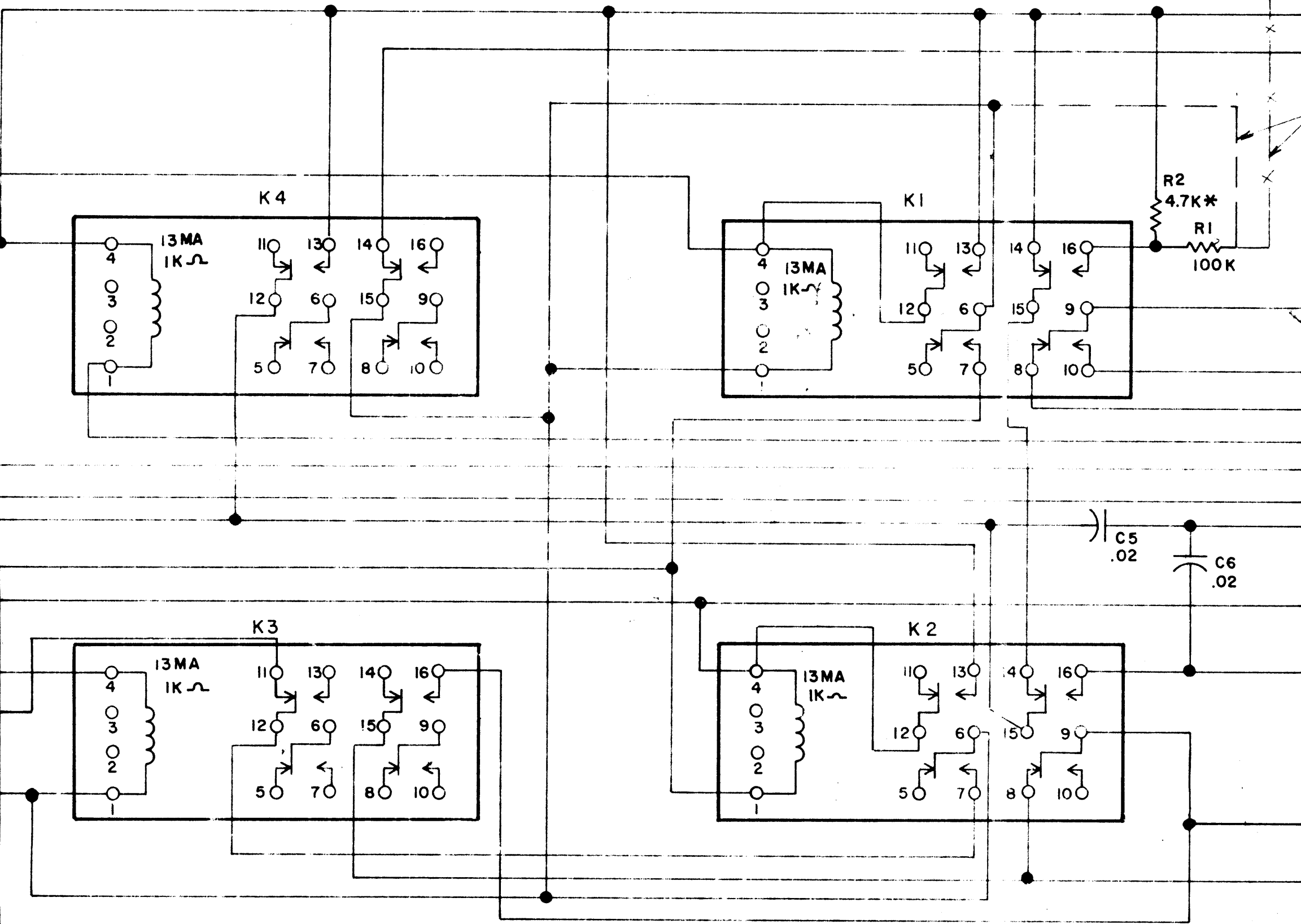


LAST SYMBOLS AI SERIES	
AI	
C8	
CR4	
K4	
R2	

LAST SYMBOLS UNIT SERIES	
AI	Z2
C4	
DS3	
E6	
F2	
J3	
K1	
R4	



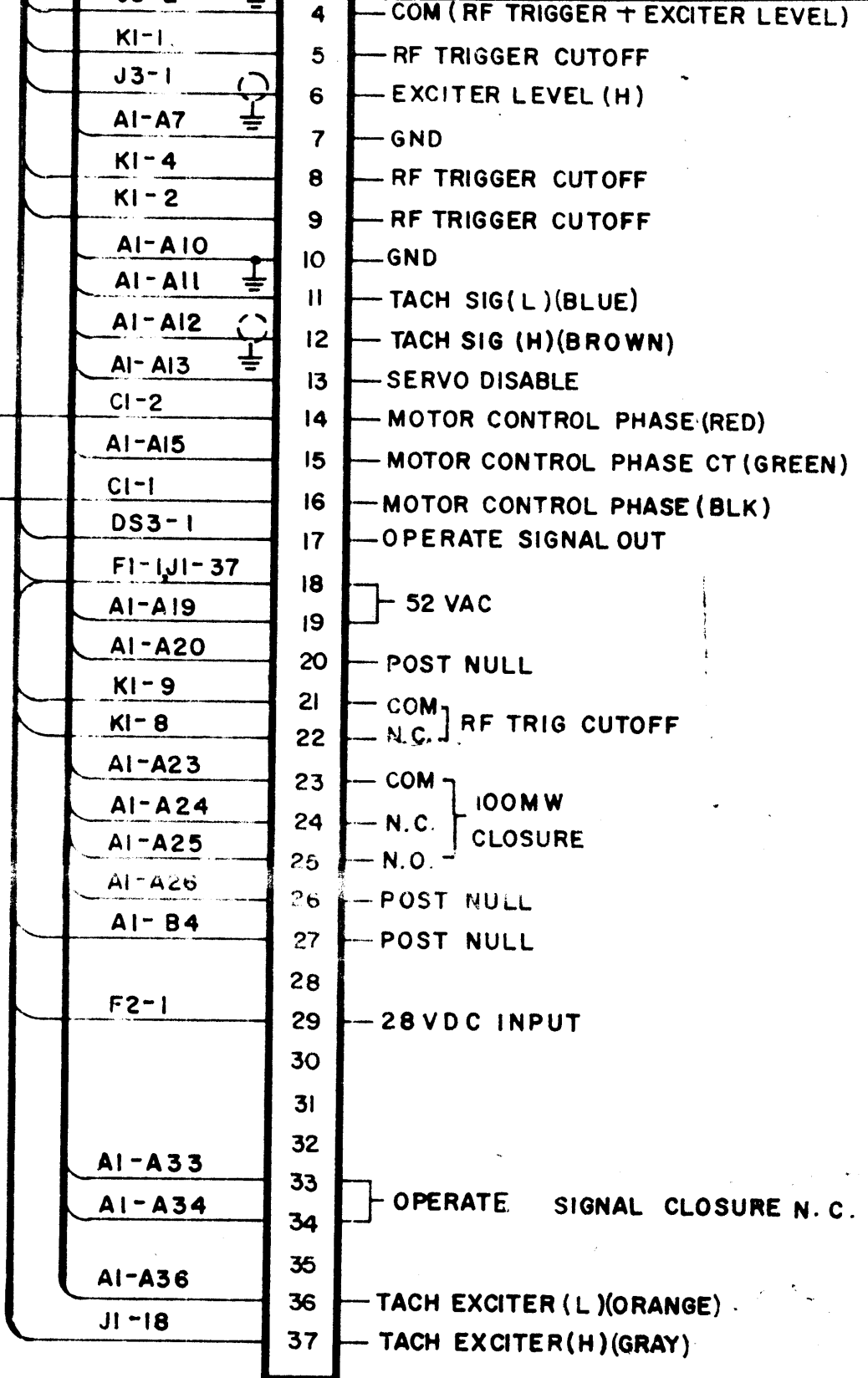
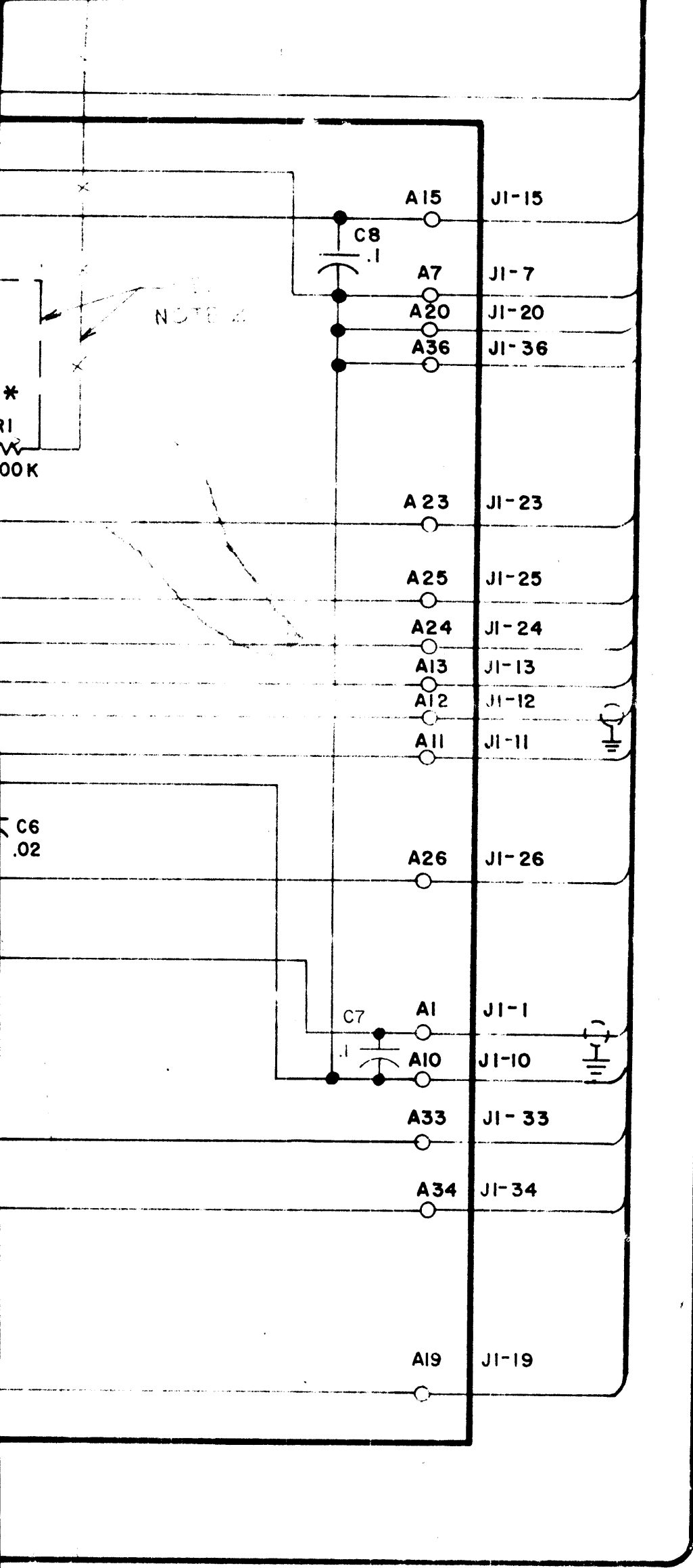
C  
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QTY / UNIT	MODEL USED ON	ASS'Y NO.
APPLICATION		
COLL.		

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**NOTES**

1. ALL RESISTORS 1/4 W UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS IN MFD UNLESS OTHERWISE SPECIFIED
3. \* NOMINAL VALUE. ACTUAL VALUE TO BE SELECTED DURING FACTORY CALIBRATION.

4. MODIFICATION FOR IPAC LINE CAPACITORS AT 100MW CLOSURE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND INCLUDE CHEMICALLY APPLIED OR PLATED FINISHES

TOLERANCES ON	
DECIMALS	FRACTIONS
.X ± .05	1/64
.XX ± .01	ANGLES
.XXX ± .005	± 0° -30'

MATERIAL  
FINISH  
CK1681-A

Figure 4-10. A1003  
IPA Servo Amplifier AZ119

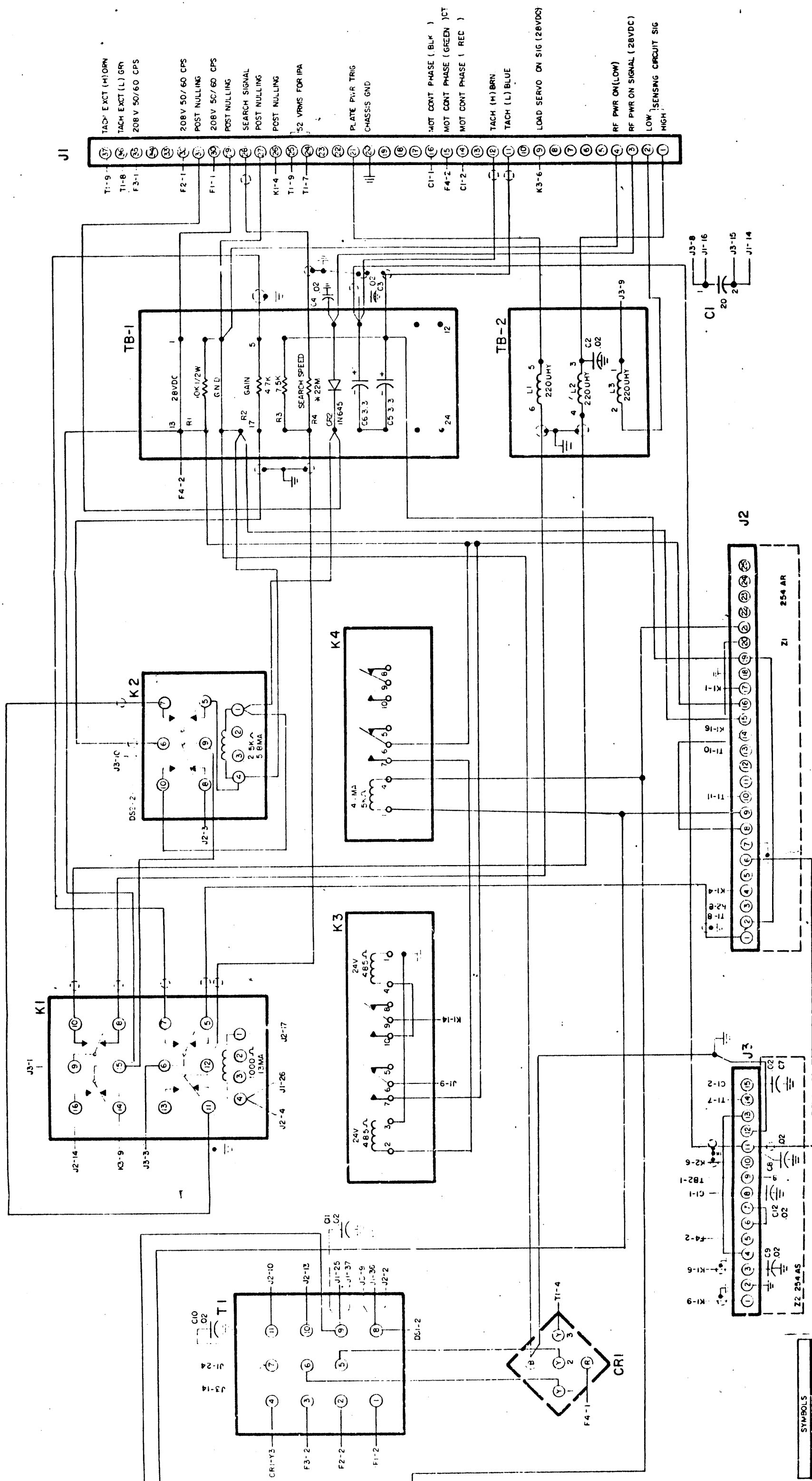
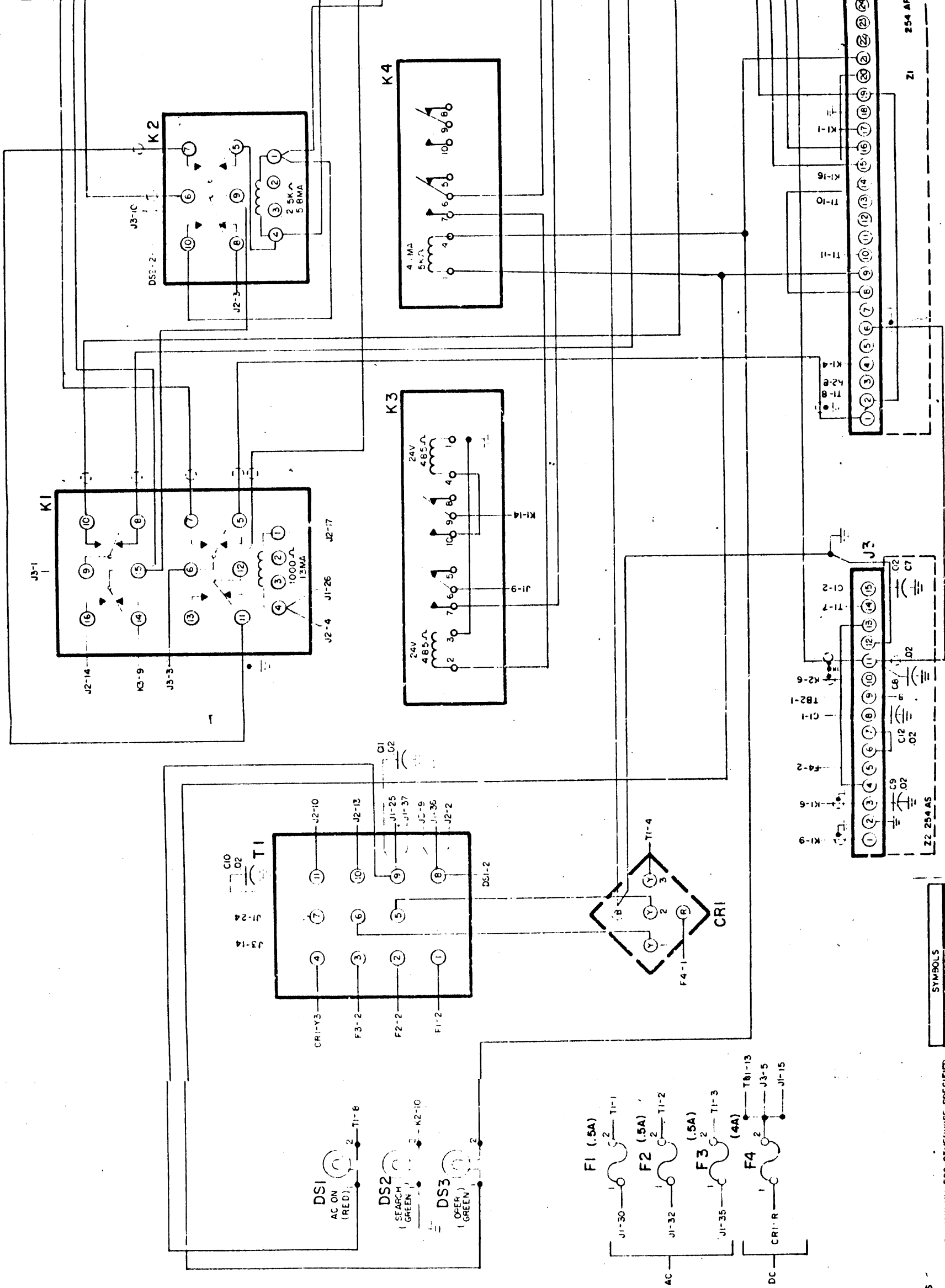


FIGURE 4-11. PA TUNE SERVO AMPLIFIER. AZ120  
4-31/4-32

SYMBOLS	MISSING
LAST	
C12	
CR2	
DS3	
F4	
J3	
K4	
R4	
T1	
TR2	
Z2	

FED  
ED



- NOTES**
- 1 ALL RESISTORS 1/4W UNLESS OTHERWISE SPECIFIED
  - 2 ALL CAPACITORS ARE MFD UNLESS OTHERWISE SPECIFIED
  - 3 \* NOMINAL VALUE ACTUAL VALUE TO BE SELECTED DURING FACTORY CALIBRATION

SYMBOLS	
LAST	MISSING
C12	
CR2	
DS3	
F4	
J3	
K4	
R4	
T1	
TR2	
Z2	

SECTION 5  
MAINTENANCE

5-1. INTRODUCTION

The HFLA-10K has been designed for long term trouble free operation. When it becomes necessary to perform alignment and/or adjustments to the equipment, it is recommended that technicians perform the necessary operations outlined under FIELD MAINTENANCE.

The following maintenance aids are provided for troubleshooting, alignment and replacement of parts.

- a. Fuse Location Diagram (figure 5-8)
- b. Fuse Functions (table 5-3)
- c. System Overload and Bias Setting Procedure
- d. Alignment Procedure
- e. Maintenance Programs (for troubleshooting)

5-2. LIST OF TEST EQUIPMENT REQUIRED

Signal Generator	Hewlett-Packard Model 606A, or equivalent
VTVM	Hewlett-Packard Model 410B, or equivalent
Multimeter	Simpson Model 260, or equivalent

5-3. OPERATORS MAINTENANCE PROCEDURE

- a. Refer to operational checkout procedures for manual or automatic depending on desired mode of operation (Operators Manual).
- b. Operators troubleshooting chart (table 5-1 and figure 5-8, Fuse Locations).

5-4. PREVENTIVE MAINTENANCE

In order to prevent equipment failure due to dust, dirt or other destructive elements, it is suggested that a schedule of preventive maintenance be set up and adhered to.

At periodic intervals, the equipment should be pulled out on its slides for internal cleaning and inspection. The wiring and all components should be inspected for dirt, dust, corrosion, grease or other harmful conditions. Remove

dust with a soft brush or vacuum cleaner. Remove dirt or grease with any suitable cleaning solvent. Use of carbon tetrachloride should be avoided due to its highly toxic effects. Trichloroethylene or methyl chloroform may be used, providing the necessary precautions are observed.

#### WARNING

When using toxic solvents, make certain that adequate ventilation exists. Avoid prolonged or repeated breathing of the vapor. Avoid prolonged contact with skin. Flammable solvents shall not be used on energized equipment or near any equipment from which a spark may be received. Smoking "hot-work", etc. is prohibited in the immediate area.

#### CAUTION

When using trichloroethylene, avoid contact with painted surfaces, due to its paint removing effects.

### 5-5. TROUBLESHOOTING

The first step in troubleshooting the automated system is as follows.

- a. OBSERVATIONS. Observe the operation of the transmitter and determine whether the indications are normal or abnormal. (Refer to operators manual for both manual and automatic tuning).
- b. FUSE CHECKS. If a malfunction occurs a visual check of fuses on the system must be performed. (See figure 5-8 for fuse location)
- c. VOLTAGE CHECKS. At this time voltage checks are not necessary until localization of the malfunction has taken place.
- d. LOCALIZATION OF MALFUNCTION. Perform the operational check-out procedure outlined in Operators Manual. Use of this procedure will help localize the particular fault at hand.

Troubleshooting charts have been specially prepared to assist in localizing a malfunction. The table presents a logical sequential order for localizing malfunctions.

- e. FIELD MAINTENANCE. Procedures presented on the following pages give instructions for qualified personnel to maintain, align, and/or troubleshoot the HFLA-10K.

WARNING

When it becomes necessary to measure transmitter voltages, use extreme caution. Hazardous voltage potentials are present although the MAIN POWER circuit breaker may be OFF. It is recommended that the following precautions be strictly adhered to !!

1. CHECK TO ASCERTAIN MAIN PRIMARY POWER IS OFF OR REMOVED FROM TRANSMITTER.
2. SHORT OUT ALL HIGH-VOLTAGE POINTS WITH SHORTING STICK PROVIDED.
3. ATTACH TEST METER TO POINT OF TEST DESIRED AND REAPPLY VOLTAGE TO TRANSMITTER.
4. WHEN MEASURING HIGH VOLTAGE POTENTIALS, DO NOT TOUCH TEST METER OR LEADS ONCE VOLTAGE HAS BEEN APPLIED.
5. ESTABLISH TEST CONDITIONS AND OBSERVE READING ON TEST METER.
6. REMOVE PRIMARY POWER AND SHORT OUT ALL HIGH VOLTAGE POINTS; REMOVE TEST METER.

TABLE 5-1. OPERATORS TROUBLESHOOTING CHART

NO.	MALFUNCTION	PROBABLE CAUSE OF MALFUNCTION
1	IPA blower B1401 does not operate.	REPLACE IPA BLOWER FUSE F2001 (2 AMPS)
2	INTERLOCK indicator DS5002 does not light.	
3	RF GAIN control R1301 does not drive up with required input present.	REPLACE BIAS FUSE F1002 (1/10 AMP)
4	PA PLATE CURRENT excessive, IPA PLATE CURRENT excessive, overloads continue to trip.	
5	PA TUNE control does not operate manually.	REPLACE 24VDC FUSE F1003 (8 AMPS)
6	PA LOAD control does not operate manually.	



TABLE 5-1. OPERATORS TROUBLESHOOTING CHART (cont)

NO.	MALFUNCTION	PROBABLE CAUSE OF MALFUNCTION
7	BANDSWITCH control does not operate.	REPLACE 24VDC FUSE F1003 (8 AMPS)
8	RF GAIN control R1301 does not operate automatically.	
9	IPA BANDSWITCH A1002 does not change frequency bands.	REPLACE IPA BANDSWITCH FUSE F1004 (5 AMPS)
10	AC lamp on IPA servo amplifier A1003 does not light when MAN/AUTO switch S5002 is in AUTO position.	REPLACE AC FUSE A1003F1 ON IPA SERVO AMPLIFIER. (0.5 AMP)
11	SEARCH lamp on IPA servo amplifier does not light in the AUTO mode of operation.	REPLACE DC FUSE A1003F2 ON IPA SERVO AMPLIFIER. (0.5 AMP)
12	AC lamp on PA tune servo amplifier does not light when switch is in AUTO position.	REPLACE AC FUSE A1004F1 THROUGH A1004F3 ON PA TUNE SERVO AMPLIFIER. (0.5 AMP)
13	SEARCH lamp on PA tune servo amplifier does not light when MAN/AUTO switch is in AUTO position.	REPLACE DC FUSE A1004F4 ON PA TUNE SERVO AMPLIFIER. (4 AMPS)
14	MAIN blower B801 does not operate.	REPLACE
15	INTERLOCK lamp DS5002 does not light.	Ø1 BLOWER FUSE F3001 OR (3 AMPS)
16	HIGH VOLTAGE indicator DS5001 does not light when switch is pressed.	Ø2 BLOWER FUSE F3002 OR (3 AMPS) Ø3 BLOWER FUSE F3003 OR (3 AMPS)
17	PA SCREEN meter M4001 indicates no reading with high voltage on.	REPLACE
18	PA M4002 AND IPA M4001 plate meters indicate no reading on high voltage on.	Ø1 LOW VOLTAGE FUSE F3005 OR (5 AMPS) Ø2 LOW VOLTAGE FUSE F3006 OR (10 AMPS)
19	Transmitter output power suddenly drops to zero.	Ø3 LOW VOLTAGE FUSE F3007 OR (5 AMPS)

TABLE 5-1. OPERATORS TROUBLESHOOTING CHART (cont)

NO.	MALFUNCTION	PROBABLE CAUSE OF MALFUNCTION
20	PA TUNE control inoperative.	
21	PA LOAD control inoperative.	
22	Filament time meter M3001 inoperative.	REPLACE PA FIL FUSE F3004 (5 AMPS).
23	HIGH VOLTAGE indicator does not light when HIGH VOLTAGE switch is pressed.	
24	INTERLOCK lamp does not light.	

5-6. ALDC ADJUSTMENT PROCEDURE (See figure 5-5 for control location)

The ALDC adjustments maintain a constant reference during modulating emission modes. The transmitter provides a negative d-c voltage which is adjustable and proportional to the transmitter output. This voltage is available at the exciter drawer ALDC plug P2003 and at pin e of the remote connector J3001.

a. Slide the technimatic light cover up to expose the ALDC and POWER LIMIT adjustment potentiometers mounted on the power level assembly A705.

b. Set the MAN/AUTO switch S5002 to MAN, operate the POWER switch S5006 to select position 1. (Press the POWER switch up to select position.)

c. Pre-set the four ALDC potentiometers A705A1R8 through A705A1R11 fully counterclockwise; then pre-set the four POWER LIMIT potentiometers A705A1R12 through A705A1R15 fully clockwise.

d. Tune and load the transmitter to any carrier frequency between 2 and 30 MHz. For best results it is recommended to use the station operating frequency.

e. Adjust the RF GAIN control R1301 for a PA OUTPUT indication of 15% higher than the desired output level.

f. Adjust the ALDC 1 potentiometer A705A1R8 until the PA OUTPUT indication commences to decrease.

g. Adjust the POWER LIMIT 1 potentiometer A705A1R12 for the desired PA OUTPUT indication.

h. Check for ALDC capture by increasing the RF gain. The PA OUTPUT indication should remain constant.

i. Reduce the RF gain to minimum and operate the POWER switch to select position 2 if the transmitter is to be used with more than one frequency or power level.

- j. If more than one frequency is to be used, retune and load the transmitter to the second carrier frequency. (Although it is not necessary to change the power level positions when changing frequencies without changing the output level, it is recommended for optimum results.) If only the power level is to be changed delete this step.
- k. Increase the RF gain until the PA OUTPUT indication is 15% higher than the desired output level.
- l. Adjust the ALDC 2 potentiometer A705A1R9 until the PA OUTPUT indication commences to decrease.
- m. Adjust the POWER LIMIT 2 potentiometer A705A1R13 for the desired PA OUTPUT indication.
- n. Check for ALDC capture for increasing the RF gain. The PA OUTPUT indication should remain constant.
- o. Reduce the RF gain to minimum and operate the POWER switch to select position 3.
- p. Increase the RF gain until the PA OUTPUT indication 15% higher than the desired output level.
- q. Adjust the ALDC 3 potentiometer A705A1R10 until the PA OUTPUT indication commences to decrease.
- r. Adjust the POWER LIMIT 3 potentiometer A705A1R14 for the desired PA OUTPUT indication.
- s. Check for ALDC capture by increasing the RF gain. The PA OUTPUT indication should remain constant.
- t. Reduce the RF gain to minimum and operate the POWER switch to select position 4.
- u. Increase the RF gain until the PA OUTPUT indication is 15% higher than the desired output level.
- v. Adjust the ALDC 4 potentiometer A705A1R11 until the PA OUTPUT indication commences to decrease.
- w. Adjust the POWER LIMIT 4 potentiometer A705A1R15 for the desired PA OUTPUT indication.
- x. Check for ALDC capture by increasing the RF gain. The PA OUTPUT indication should remain constant.
- y. Reduce the RF gain and replace the technimatic lamp cover. This completes the ALDC adjustment procedure.

### NOTE

Should the ALDC capture voltage be insufficient, resulting in an increase in the PA output when the RF gain is increased, further adjustment of the ALDC potentiometer is necessary to hold the PA output constant.

#### 5-7. PRE-SET AVERAGE POWER LEVEL ADJUSTMENT PROCEDURE (See figure 5-5)

The transmitter has four selectable pre-set average power levels which are adjustable from the front of the transmitter. Once calibrated, these power levels can be selected locally or remotely, depending upon system requirements.

##### a. INITIAL LOWER LIMIT REFERENCE ADJUSTMENTS.

1. Energize the transmitter. Set MAIN POWER circuit breaker CB3001 to ON. Set HV switch S5001 to OFF.
2. Loosen the exciter drawer panel locks and extend the drawer out on its slides. Remove the top cover and defeat the exciter drawer interlock switch S902 (#7 figure 5-7). (To defeat the interlock switch pull the shaft in the out position.)
3. Remove the Tuning Control Assembly A2001 (figure 5-20), insert the extender card into the socket XA2001 and insert the Tuning Control Assembly into the extender card.
4. Place a jumper between A2001TP1 and A2001TP2 on the rear side of the assembly.
5. Remove the front window panel assembly, loosen the meter panel locks and carefully lower the meter panel on its hinges to expose the rear side.
6. Set the MAN/AUTO switch S5002 to AUTO. Remove the lead from terminal 16 of the Output Power Assembly A1004.
7. Adjust the LEVEL potentiometer A1004R3 located on the Output Power Assembly, until the READY indicator DS5004 lights. Press the TUNE switch S5007 and readjust the LEVEL potentiometer in the opposite direction (back off) slightly until the READY indicator extinguishes.
8. Remove the jumper between A2001TP1 and A2001TP2, remove the extender card and replace the Tuning Control Assembly into its socket. Replace the exciter drawer top cover and close and lock the drawer into the frame.
9. Replace the lead to terminal 16 of the Output Power Assembly, close and lock the meter panel in place. Replace the front window panel assembly. This completes the lower limit reference adjustment.

b. UPPER LIMIT REFERENCE ADJUSTMENT (See figure 5-5).

1. Operate the POWER switch S5006 to select position 1. (Press the POWER switch up to select position.)
2. Slide the technimatic light cover up to expose the power level assembly A705.
3. With the high voltage OFF, hold the POWER switch in the ADJUST position (down) and adjust the POWER ADJUST 1 potentiometer A705A1R1 for a full scale indication on the OUTPUT POWER meter M4005.
4. With the POWER switch in the adjust position, adjust the METER CALIBRATE potentiometer A705A1R6 until the READY indicator illuminates. Back off on the adjustment slightly.
5. Press the TUNE switch S5007 and observe that the READY indicator illuminates when the OUTPUT POWER meter indicates full scale.

NOTE

If the READY indicator does not illuminate when the TUNE switch is pressed repeat step 4.

6. This completes the upper limit reference adjustment.

c. POWER SELECT ADJUSTMENTS (See figure 5-5). Once the upper and lower limit references have been calibrated, any output power level from approximately 1.5 KW to the rated output may be pre-set. Hold the POWER switch S5006 in the ADJUST position (down) and adjust the following potentiometers for the desired output level read directly on the OUTPUT POWER meter M4005.

Power Level Position 1 adjust A705A1R1  
Power Level Position 2 adjust A705A1R2  
Power Level Position 3 adjust A705A1R3  
Power Level Position 4 adjust A705A1R4

NOTE

When adjusting power levels, set them approximately 20% higher than the desired output level. This will insure that the level will be within the ALDC capture range.

5-8. POWER LIMITING ADJUSTMENT

After completion of the procedure outlined in paragraph 5-7a. through 5-7c., a final power limiting adjustment is performed in the following manner.

- a. Select a power level as per paragraph 5-7c.

b. Remove the ALDC connection to the exciter either at the remote connector J3001 or P2003 in the exciter drawer. Servo tune the transmitter to any carrier frequency between 2 and 30 MHz. (It is recommended to use the station operating frequency.)

c. Observe the PA output indication on the OUTPUT POWER meter M4005. Depress the POWER switch S5006 down into the adjust position and observe the reading on the OUTPUT POWER meter.

d. Release the POWER switch. Compare the two readings (actual vs. calibrated power).

e. Replace the ALDC connection to the exciter.

f. Servo tune the transmitter to the carrier frequency again and power output should now be as the desired level.

#### 5-9. TRANSMITTER BIAS ADJUSTMENT PROCEDURE

The bias adjustments outlined below are to obtain the proper quiescent plate current values. Before the bias adjustments can be made the bias control cover must be removed from the front panel of the IPA drawer to expose the bias potentiometers. Loosen the front panel locks on the IPA drawer and extend the drawer on its slides. The 1ST AMP BIAS potentiometer R1303 is available through a hole provided in the bottom cover of the drawer. See figure 5-1 for the location of the remaining controls.

#### NOTE

Quiescent plate current values indicated in the procedure are normal operating values. However, if an abnormal condition exists refer to figure 5-2, Simplified Bias Control Diagram.

a. Set the PA BIAS A1007R4, IPA BIAS A1007R5 and the 2ND ANP BIAS A1007R6 potentiometers to the maximum clockwise position. (Bias voltage will be at the maximum value.)

b. Defeat the IPA drawer interlock switch S901. (Pull the plunger out until it locks.)

c. Set the MAIN POWER circuit breaker CB3001 to ON. Set the SCREENS circuit breaker CB3002 to ON. Set the MAN/AUTO switch S5002 to MAN.

#### CAUTION

Insure that a dummy load or antenna is connected to the transmitter output J703 and that the RF drive control R1301 is at the maximum counter-clockwise position. (Minimum drive)

d. Press the HV switch S5001 to apply the high voltage. Check the PA PLATE CURRENT meter M4002 to see that the PA tube is biased at or near cutoff. Check the IPA drawer PLATE meter M1001 to see that the IPA tube is biased at or near cutoff. Press the IPA drawer meter switch S1001 to the 2ND AMP position (up) and check the PLATE meter to see that the 2ND AMP tube is biased at or near cutoff.

e. Press the PLATE METER switch to the 1ST AMP position (down) and adjust the 1ST AMP BIAS potentiometer R1303 for a reading of 60-70 ma on the meter. R1303 is located on the underside of the IPA drawer and is accessible through a hole in the bottom cover.

f. Release the meter switch and press the HV switch to turn the high voltage OFF. Slide the drawer back into the unit and re-lock the front panel.

g. Press the HV switch to turn the high voltage on.

h. Observe the PA PLATE CURRENT meter M4002 and adjust the PA BIAS potentiometer A1007R4 to obtain a reading of 0.5 to 0.65 amperes on the meter.

i. Observe the IPA drawer PLATE meter M1001 and adjust the IPA BIAS potentiometer A1007R5 to obtain a reading of 210-230 ma on the meter.

j. Press the IPA drawer meter switch to the 2ND AMP position and observing the meter, adjust the 2ND AMP BIAS potentiometer to obtain a reading of 220-240 ma.

k. Press the HV switch to turn the high voltage OFF and replace the bias control cover on the IPA drawer.

#### 5-10. AUTO TUNING ADJUSTING PROCEDURE (IPA SECTION)

The following paragraphs detail the procedures for adjusting controls that enable transmitter automatic tuning. The controls mentioned throughout have been set at the factory and therefore need only to be adjusted if abnormalities or parts replacement have taken place.

The transmitter automatic tuning is sequential, rapid and inter-dependent on proceeding functions that supply control voltages to enable the automatic tuning. The requirements for automatic tuning are 100 milli-watt input, MAN/AUTO switch S5002 in AUTO position, HIGH VOLTAGE switch S5001 in ON position and the TUNE switch S5007 pressed.

NOTE

All adjustments in the following procedure(s) enable the transmitter's automatic tuning circuitry to function normally. Before making any adjustments observe the transmitter indicators (meters, lamps, control knobs, circuit breakers and fuses) and refer to the associated technical manual for normal transmitter indications. If a transmitter control or indicator does not appear to function normally check all switches and breakers and determine if the switches and breakers are in the correct positions for AUTO-TUNING. Refer to list of adjustments and determine which control(s) require adjustments.

LIST OF ADJUSTMENTS

ABNORMAL OBSERVATION	ADJUSTMENT
IPA servo amplifier SEARCH indicator does not light.	Check 100 milli-watt trigger adjustment (paragraph 5-10a.)
IPA servo amplifier OPERATE indicator does not light.	Check driver r-f trigger adjustment (paragraph 5-10c.)
PA plate current increases from quiescent value to a value outside of 1.1-1.2 amps.	Check driver r-f trigger adjustment (paragraph 5-10b.)
PA servo amplifier OPERATE indicator does not light.	Check PA r-f trigger adjustment (paragraph 5-11a.)
LOAD SENSE meter does not indicate at or near zero (after PA OPERATE indicator lights).	Check load sense adjustment (paragraph 5-11b.)

a. 100 MILLI-WATT TRIGGER ADJUSTMENT. The 100 milli-watt trigger adjustment determines the amount of voltage required to energize the search relay A1003-A1K1 within the IPA servo amplifier A1003, thus placing the servo amplifier into the SEARCH mode.

1. Insure that the transmitter is properly terminated into a 50 ohm dummy load or antenna.

2. Set the MAIN POWER circuit breaker CB3001 and the SCREENS circuit breaker CB3002 to ON. Set the MAN/AUTO switch S5002 to MAN and operate the BAND-SWITCH control S5004 to select a frequency band the coincides with the assigned operating frequency.



3. Set the MAN/AUTO switch to AUTO. Insure that the RF input is unmodulated and at a 100 milli-watt level. Press the HIGH VOLTAGE switch S5001 to apply the high voltage and press the TUNE switch S5007.

4. The AC ON indicators on both servo amplifiers A1003 and A1004, and the SEARCH indicator on the IPA servo amplifier A1003 illuminate indicating that the IPA servo amplifier is in the SEARCH mode with the 100 milli-watt input present.

5. If the SEARCH indicator does not light, remove the bias control on the IPA drawer and adjust the 100 milli-watt trigger potentiometer A1007R10 until the SEARCH indicator lights. Refer to figure 5-4 for control location. When the SEARCH indicator lights the IPA TUNING control must rotate automatically tuning the IPA to resonance. When adjusting the 100 milli-watt trigger potentiometer, be sure that it is adjusted to a point that will make the SEARCH indicator illuminate and no further. If the indicator does not light refer to Table 5-5 for troubleshooting information.

b. TUNE LEVEL ADJUSTMENT The TUNE LEVEL control determines the transmitter output level during initial automatic tuning cycle. When the tune level control is adjusted, the voltage present on the control is routed to the drive-up comparator board A1005 providing one input, the second input to the comparator is a sample of the IPA cathode voltage. The drive-up comparator compares the levels of the two input voltages, and when either the IPA cathode or tune level voltage is unequal the comparator will control the r-f drive motor B1301 which is mechanically coupled to the RF GAIN control R1301 to increase or decrease the r-f drive as necessary to equalize the input voltage level, therefore the amount of tune level voltage will determine the tune up level or inhibit auto-tuning if incorrectly adjusted.

When IPA cathode voltage less than tune level voltage, transmitter drives-up.

When IPA cathode voltage greater than tune level voltage, transmitter drives-down.

When tune level voltage incorrectly adjusted too high, transmitter tuning level high.

When tune level voltage incorrectly adjusted too low, transmitter drives-down.

When IPA cathode voltage missing, transmitter drive-up to limit switch.

When tune level voltage missing, transmitter drives-down.

When 100 milli-watt trigger voltage missing, transmitter drives-down.

1. Insure that the transmitter is properly terminated into a 50 ohm dummy load or antenna.
2. Set MAIN POWER circuit breaker CB3001 and SCREENS circuit breaker CB3002 to ON.
3. Set MAN/AUTO switch S5002 to MAN (r-f drive must be at minimum).
4. Press HIGH VOLTAGE switch S5001 to apply high voltage.
5. Check quiescent current values as indicated on the PA plate meter M4002 and IPA plate meter M1001, if necessary adjust for the following values:

PA PLATE CURRENT	0.50 - 0.65 AMP
IPA PLATE CURRENT	210 - 230 ma
2ND AMP PLATE CURRENT	220 - 240 ma
1ST AMP PLATE CURRENT	60 - 70 ma

6. Set MAN/AUTO switch to AUTO and adjust exciter for 100 milli-watt output.
7. Press TUNE switch S5007.
8. Observe the following transmitter actions and/or indicators.
  - (a) AC ON indicators on IPA and PA servo amplifiers A1003 and A1004 light.
  - (b) SEARCH indicator on IPA servo amplifier A1003 lights.
  - (c) IPA plate current increases from quiescent value.
  - (d) PA plate current increases from quiescent value to 1.1 amps depending on frequency.
  - (e) OPERATE indicator on IPA servo amplifier lights.
  - (f) SEARCH indicator on PA tune servo amplifier A1004 lights.
  - (g) OPERATE indicator on PA tune servo amplifier lights, transmitter output power increases to preset power level and READY indicator DS5004 lights.
9. The TUNE LEVEL potentiometer A1007R11 must be adjusted only if after the IPA servo amplifier OPERATE indicator lights, and PA PLATE current meter indicates less than 1.1 amps or more than 1.2 amps.
10. To adjust TUNE LEVEL potentiometer, observe PA plate current indication, if more or less than 1.1 to 1.2 amps, press TUNE switch to recycle transmitter and adjust TUNE LEVEL potentiometer counterclockwise to increase PA plate current or clockwise to decrease PA plate current to obtain a PA PLATE current value of 1.1 amps after the IPA servo amplifier OPERATE indicator lights.

### NOTE

After each adjustment of the TUNE LEVEL potentiometer, the TUNE switch must be pressed to initiate a retune cycle. The adjustment should be repeated as often as necessary to obtain the proper PA plate current level of 1.1-1.2 amps after the OPERATE indicator lights.

c. DRIVER RF TRIGGER ADJUSTMENT. The driver (IPA) r-f trigger potentiometer, when adjusted determines the amount of voltage required to stop the IPA tuning capacitor A1001C1 from searching thereby ending the search mode and beginning the servo and operate modes. Initially, as the IPA tuning capacitor approaches resonance and/or zero drive tune sense voltage, the IPA servo amplifier OPERATE indicator lights indicating IPA resonance and search and servo mode completed. During the auto tuned cycle of the transmitter, if the IPA tuning capacitor continues to rotate (search mode) or the IPA servo amplifiers OPERATE indicator fails to light, the IPA r-f trigger voltage may be insufficient to stop the IPA tuning capacitor. To adjust the driver r-f trigger potentiometer, proceed as follows:

1. Set MAN/AUTO switch S5002 to the MAN position.
2. Place a test vtvm in the DRIVER TUNE test point A1007TP3. Connect and set meter as per figure 5-3.
3. Manually adjust RF GAIN control R1301 clockwise slightly to apply drive to transmitter and adjust IPA tune control observing PA PLATE current meter M4002 and test vtvm. Plate current must be between 1.1-1.2 amps and test vtvm should indicate zero at IPA resonance.
4. Once zero indication has been observed, place test meter in DRIVER R-F TRIGGER test point A1007TP1. The driver r-f trigger voltage should be 0.5 volt dc.

### NOTE

If driver trigger voltage is not at 0.5 vdc, adjust DRIVER R-F TRIGGER potentiometer until test meter indicates 0.5 volt dc.

5. Set MAN/AUTO switch to AUTO. Press TUNE switch and observe the following:

IPA SEARCH indicator lights.  
PA TUNING control rotates seeking resonance and stops.  
IPA servo amplifier OPERATE indicator lights indicating end of search mode and start of servo and operate modes.

## 5-11. AUTO TUNING ADJUSTMENT PROCEDURE (PA SECTION)

a. PA PLATE R-F TRIGGER ADJUSTMENT. The PA plate trigger potentiometer, when adjusted, determines the level of voltage necessary to stop the PA tune capacitor A702C1 from searching. When PA tune capacitor completes the search mode, the OPERATE indicator of the PA servo amplifier lights indicating completion of the servo mode and the start of the operate mode. Therefore, the PA plate trigger control should be adjusted to stop the PA tune capacitor at the point of resonance. Before adjusting the PA plate trigger potentiometer, set transmitter controls for auto operation, energize transmitter, and press TUNE switch to initiate the auto tune cycle.

The IPA servo amplifier A1003 SEARCH and OPERATE indicators should light and, sequentially, PA tune servo amplifier A1004 SEARCH and OPERATE indicators should light.

However, if the PA tune servo amplifier OPERATE indicator fails to light, it indicates that PA resonance has not been reached and/or the PA trigger voltage is insufficient to stop the tune capacitor at a point of resonance.

To adjust the PA r-f trigger potentiometer proceed as follows:

1. Set MAN/AUTO switch S5002 to MAN.
2. Press PA LOAD switch S5005 down to set PA loading capacitor at minimum.
3. Energize transmitter (HIGH VOLTAGE switch S5001 and SCREEN circuit breaker CB3002 to ON.)
4. Operate IPA TUNE AND PA TUNE controls to resonate PA to desired operating frequency (refer to associated technical manual for manual tuning procedure).
5. Adjust PA output to a level of 1 kw as indicated on the PA output meter M4005.
6. Connect vtm, (meter control must be set as per figure 5-3) to PA TUNE test point A1007TP4 and monitor PA TUNE sense voltage. When the PA is at resonance the PA TUNE sense voltage should be approximately zero.

### NOTE

If the PA TUNE sense voltage is not at zero, readjust the PA TUNE control S5002 to obtain a zero voltage indication on the test vtm.

7. Place test vtm in PA R-F TRIGGER test point A1007TP2 and adjust PA R-F TRIGGER potentiometer until the test vtm indicates -0.5 volt dc.

b. LOAD SENSE ADJUSTMENT. The load sense potentiometer is used to adjust the LOAD SENSE meter M4003 to indicate a zero reading when loading is correct at 1 kilowatt output level. When the transmitter is in the auto mode of operation,

the PA load capacitor A703C1 immediately rotates to minimum capacitance when high voltage is on and PA plate current is present. This condition is normal and is indicated by the LOAD SENSE meter reading to the right of center scale. During transmitter loading, the load capacitor travels toward maximum capacitance and the LOAD SENSE meter indicator follows and indicates at or near zero when loading is correct at 1 kilowatt.

A condition of improper loading is noted by the following:

1. LOAD SENSE meter M4003 reads to left of center scale after PA servo amplifier A1004 OPERATE indicator lights.
2. LOAD SENSE meter reads to right of center after PA servo amplifier OPERATE indicator lights.
3. READY lamp DS5004 does not light due to no loading (insufficient PA output).
4. Excessive PA plate current and insufficient PA output.
5. Servo amplifier indicators do not extinguish and FAULT indicator DS5003 lights after 30 seconds.

Should it become necessary to adjust the load sense potentiometer, proceed as follows:

1. Energize transmitter (MAIN POWER AND SCREEN circuit breakers CB3001 and CB3002 set to ON, and HV switch S5001 set to ON.)
2. Set MAN/AUTO switch S5002 to MAN.
3. Operate PA TUNE S5003 and PA LOAD S5005 controls to produce the maximum PA output with the least amount of PA plate current.
4. Increase r-f drive until PA output meter M4005 indicates rated output. (Readjust TUNE and LOAD controls if PA screen current is excessive at rated output.)
5. Reduce PA output to a level of 1kw as indicated on PA output meter.
6. Slide technimatic cover up to expose LOAD sense adjustment potentiometer A705A1R7. (See figure 5-5 for control location). Adjust LOAD SENSE potentiometer until LOAD SENSE meter M4003 indicates zero (center scale).
7. Set MAN/AUTO switch to AUTO and press TUNE switch S5007.
8. Transmitter indicators and meters should indicate in the following sequence:
  - (a) IPA and PA servo amplifiers A1003 and A1004 AC ON lamps light.

(b) IPA quiescent current 210-230 ma as read on the IPA plate current meter M1001.

(c) PA quiescent current 0.50-0.65 amp as read on PA plate current meter M4002.

(d) IPA servo amplifier SEARCH lamp followed by IPA servo amplifier OPERATE lamp light.

(e) PA PLATE current meter increase to between 1.1 and 1.2 amperes.

(f) Simultaneously, the PA servo amplifier SEARCH lamp followed by the PA servo amplifier OPERATE lamp light.

(g) LOAD SENSE meter swings toward center as loading takes place.

(h) All servo amplifier indicators (AC, SEARCH, OPERATE) extinguish.

(i) Transmitter PA OUTPUT meter reads approximately 1 kw to rated output and READY indicator lights.

#### 5-12. FAULT INDICATION ADJUSTMENT PROCEDURE

The transmitter is designed to servo tune to rated or desired output in less than ten seconds. The fault circuit featured in the transmitter, senses the transmitter tuning time and removes voltages to the servo amplifiers, r-f drive motor and biases the transmitter at or near cutoff if the transmitter has not completed the tuning cycle within the duration of time affixed by the following adjustment.

a. Extend exciter drawer out on its slides, remove top cover and defeat exciter drawer interlock S902. (Pull interlock shaft out slightly until interlock switch closes.)

b. Remove tuning control assembly A2001 (located in exciter drawer) and insert extender card in tuning control board jack. Reinsert tuning control board into extender card.

c. Remove the r-f input from J3004 (or insure that r-f drive minimum). Set MAN/AUTO switch S5002 to AUTO.

d. Set MAIN POWER CB3001 and SCREEN CB3002 circuit breakers to ON.

e. Press HIGH VOLTAGE switch S5001 to light indicator.

f. Press TUNE switch S5007. After approximately 30 seconds, the FAULT indicator DS5003 should light and all servo amplifier indicators should extinguish.

g. If the FAULT indicator does not light within 30 seconds, adjust A2001R4 on tuning control board until FAULT indicator lights 30 seconds after TUNE button pressed. (Repeat the adjustment as often as necessary to obtain optimum results).

h. Press HIGH VOLTAGE switch to OFF. HIGH VOLTAGE indicator extinguishes, remove extender card, and replace tuning control assembly into its respective jack.

i. Affix top cover to exciter drawer and slide drawer back to its original position. This completes the FAULT indicator adjustment procedure.

#### 5-13. OVERLOAD CIRCUIT TEST (See figure 5-6 for control location)

The overload circuitry protects the transmitter against excessive currents and VSWR. The simplicity of overload adjustments and indications of overloaded conditions affords ease of overload recognition. To set the overloads, proceed as follows:

a. Energize transmitter, (set MAIN POWER CB3001 and SCREENS CB3002 circuit breakers to ON.)

b. Set MAN/AUTO switch S5002 to MAN and press HIGH VOLTAGE switch S5001 to apply the high voltage.

c. Apply r-f source (11 MHz) to r-f input of transmitter J3004 or P2004.

d. Manually tune transmitter for rated output.

e. Reduce r-f drive to minimum.

#### NOTE

To reset an overload, the HIGH VOLTAGE switch S5001 must be pressed twice (press to reset overload, press to apply high voltage). If a malfunction occurs and overload circuitry does not function normally, refer to paragraph 5-18 for troubleshooting information.

#### 5-14. PA PLATE OVERLOAD ADJUSTMENT

a. Adjust overload indicator (adjustment screw located directly below meter-face) for 2 amperes as indicated on the PA PLATE current meter M4002.

b. Increase drive until the PA PLATE current meter indicates 2 amperes. Observe the following:

1. When meter indication reaches the value of the overload indicator setting, the high voltage trips off.

2. PA PLATE current meter illuminates indicating overload in the PA PLATE current.

3. Meter indicator remains at the overload value to indicate value which caused overloaded condition.

c. Reduce r-f drive to minimum and press HIGH VOLTAGE button to reset high voltage. (HIGH VOLTAGE switch may have to be pressed twice.)

d. To further check operation of plate overload, increase r-f drive again noting that high voltage is tripped as in step 2. Set overload indicator for an indication of 3-1/2 amps as read on the PA PLATE current meter.

#### 5-15. PA SCREEN OVERLOAD ADJUSTMENT

a. Repeat paragraph 5-13a thru d and proceed to step b.

b. Reduce r-f drive and set PA SCREEN overload indicator to 30 milli-amps as indicated on the PA SCREEN current meter M4001.

c. Increase r-f drive and operate PA TUNE and PA LOAD controls S5003 and S5005 to draw screen current, (under-load transmitter).

d. Further increase the r-f drive until meter indicator reaches value set on overload indicator.

e. Observe the following:

1. High voltage trips OFF (indicated by HIGH VOLTAGE indicator extinguishing).

2. PA SCREEN meter face illuminates and meter indicator remains at the overloaded value.

3. PA PLATE current and IPA plate current meters indicate zero.

f. To further check operation of PA screen overload, reduce r-d drive, press HIGH VOLTAGE button to reapply high voltage and increase drive until overload trips at overload indicator value.

g. Reset overload indicator to 80 ma.

#### 5-16. SWR OVERLOAD ADJUSTMENT

a. Repeat paragraphs 5-13a thru d and proceed to step b.

b. Press HIGH VOLTAGE switch S5001 to remove high voltage. (HIGH VOLTAGE indicator DS5001 extinguishes).

c. Rotate 5 kw reflected power diode element CR702 (located in directional coupler DC701) 180 degrees. (Arrow on diode element should be in direction of r-f output from transmitter to antenna after it has been rotated 180 degrees).

d. Press HIGH VOLTAGE button to apply high voltage. Set reflected power overload indicator to 2.0:1 as indicated on the bottom scale on REFLECTED power meter M4004.



e. Increase r-f drive until REFLECTED power indicator reaches overload indicator value and observe the following:

1. High voltage trips OFF. (HIGH VOLTAGE indicator extinguishes).
2. REFLECTED power meter illuminates.
3. REFLECTED power indicator remains at the overload value to further indicate overload.
4. PA and IPA plate current meters will indicate zero.
5. To further check operation of SWR overload, reduce r-f drive, press HIGH VOLTAGE button, to re-apply high voltage and increase r-f drive again until overload trips high voltage off.
6. Restore 5 kw (reflected power) diode element to original position (arrow on diode element facing direct opposite of 20 kw forward diode).
7. Set SWR overload indicator to desired value.

#### 5-17. IPA PLATE CURRENT OVERLOAD ADJUSTMENT

- a. Insure r-f drive is at minimum setting.
- b. Energize transmitter, (MAIN POWER and SCREENS circuit breakers CB3001 and CB3002 set to ON, HIGH VOLTAGE switch S5001 pressed to ON, and MAN/AUTO switch S5002 in MAN position).
- c. Set IPA PLATE overload indicator to 300 ma as read on IPA plate current meter M1001.
- d. Remove bias control cover and adjust IPA BIAS potentiometer A1007R5 counterclockwise noting PLATE meter indication. When IPA plate current meter indicates 300 ma (value of IPA plate current overload setting), observe the following indications:
  1. High voltage trips OFF. (HIGH VOLTAGE indicator extinguishes).
  2. IPA plate meter illuminates.
  3. IPA plate meter indicator remains at overloaded value.
  4. PA plate current meter indicates zero.
  5. Adjust IPA BIAS potentiometer maximum clockwise and press HIGH VOLTAGE switch twice to apply high voltage.
  6. Readjust IPA BIAS control counterclockwise to restore original state plate current value of 210-230 ma as read on the IPA plate current meter.

7. Reset overload indicator to indicate 800 ma as read on the IPA plate current meter.

5-18. TROUBLESHOOTING TRANSMITTER OVERLOAD CIRCUITRY

The overload is designed to remove high voltage in the event of excessive current conditions. Paragraph 5-13 through 5-17 provides information for checking and setting overloads. However, if the overload circuitry does not function in accordance with paragraphs 5-13 through 5-17, troubleshoot the circuitry in the following manner:

- a. Temporarily remove PA window. Loosen meter panel locks and lower meter panel on its hinges to expose rear side.
- b. Extend IPA drawer on its slides and remove top cover. Defeat the IPA drawer interlock switch S901.
- c. Set MAIN POWER and SCREENS circuit breakers (dual section) to ON, single section of SCREENS circuit breaker must be in OFF position.
- d. Adjust overload pointer counterclockwise to make contact with meter pointer. The overload lamps should light.

NOTE

If overload lamp on associated meter board does not light, temporarily place a jumper across switch contacts on meter board, (Refer to assembly drawing on associated schematic diagram for parts location.) IF overload lamps do not light with jumper, check Q1, and/or the presence of 24 volts on the associated board inputs. The voltage that lights the overload lamp also energizes the overload relay.

- e. Observe overload relay A4003K1, when the overload lamps light on any meter board. A4003K1 should energize to an overload condition. If A4003K1 does not energize check A4003E8 for the presence of 24 volts. (Refer to assembly drawing for parts location.)

NOTE

When an overload condition exists, the associated meter overload lamp should light. However, should more than one set of overload lamps light, check isolation diode CRI on each overload board.

- f. When an overload relay A4003K1 is latched in the overload condition, it must be reset to enable a high voltage on condition. Remove temporary jumper or adjust overload pointer clockwise and press HIGH VOLTAGE switch.

g. Observe overload relay A4003K1. It should latch into the reset position and associated overload lamps should extinguish. If overload relay A4003K1 does not reset, check for the presence of 24 volts on A4003E11.

TITLE	REFERENCE SYMBOL	SCHEMATIC DIAGRAM (Figure)
PA PLATE OVERLOAD BOARD	A4002	Figure 7-1 (Sheet 5)
PA SCREEN OVERLOAD BOARD	A4001	Figure 7-1 (Sheet 5)
MAIN OVERLOAD BOARD	A4003	Figure 7-1 (Sheet 5)
IPA PLATE OVERLOAD BOARD	A1006	Figure 7-2 (Sheet 2)

TABLE 5-2. INTERLOCK LOCATION

FIGURE 5-7 REFERENCE NUMBER	TITLE	SYMBOL NUMBER	FUNCTION
1	IPA DRAWER BOTTOM COVER	S1201	With IPA drawer bottom cover removed, the switch is opened deenergizing the Filament Relay K801.
2	IPA DRAWER	S1101	With IPA drawer top cover removed, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
3	IPA DRAWER	S901	With the IPA drawer extended, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
4	EXCITER DRAWER	S902	With the EXCITER drawer extended, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
5	LEFT SIDE	S903	With the left side skin removed, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
6	RIGHT SIDE	S904	With the right side skin removed, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
7	FRONT WINDOW	S5008	With the window panel removed, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.

TABLE 5-2. INTERLOCK LOCATION (cont)

FIGURE 5-7 REFERENCE NUMBER	TITLE	SYMBOL NUMBER	FUNCTION
8	REAR BOTTOM	S905	With the rear bottom skin removed, the switch is opened de-energizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
9	REAR TOP	S906	With the rear top skin removed, the switch is opened de-energizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
10	POWER SUPPLY GRILLE	S907	With the front grille panel removed, the switch is opened deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
11	TIME DELAY	M801	If the time delay has not elapsed, the switch is opened de-energizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVE LOAD relay A4003K1.
12	HV SHORTING ASSEMBLY	A801S1	If the HV Shorting Assembly does not energize, the switch is opened deenergizing the HV ON-OFF relay K2004 and the INTERLOCKS indicator DS5002.
13	HEAT OVERLOAD		If the PA tube compartment becomes overheated, the switch opens deenergizing the HV ON-OFF relay K2004, BIAS ON relay K2005, INTERLOCKS indicator DS5002, HV SHORTING ASSEMBLY A801 and tripping the OVERLOAD relay A4003K1.
14	EXTERNAL	PINS L,M AND N J3001	If pins L and N are not connected the HV relay K2004 and the INTERLOCKS indicator DS5002 are not energized. If pins L and M are connected the OVERLOAD relay A4003K1 is tripped.

TABLE 5-3. FUSE LOCATIONS

FIGURE 5-5 REFERENCE NUMBER	PANEL DESIGNATION	SYMBOL NUMBER	VALUE (AMPS)	PROTECT FUNCTION
1	BLOWER	F1001	2	B1401 IPA BLOWER K802 Filament relay B1301 Drive-up motor
2	BIAS	F1002	1/10	Bias voltage circuits A707 ALDC assembly negative voltage circuits.
3	24 VDC	F1003	8	Unregulated and regulated +24 VDC circuits Regulated +12V circuits
4	BANDSWITCH	F1004	5	A1002S2 IPA bandswitch solenoid
5	BLOWER Ø1	F3001	3	B801 Main blower B701 Top fan A706 Harmonic filter AC input A704B1 PA bandswitch motor
6	BLOWER Ø2	F3002	3	B801 Main blower B701 Top fan A706 Harmonic filter AC input A704B1 PA bandswitch motor
7	BLOWER Ø3	F3003	3	B801 Main blower A706 Harmonic filter AC Input A704B1 PA bandswitch motor M3002 PA plate elapsed time meter
8	PA FILAMENT	F3004	5	T804 PA filament transformer M801 Time delay M3001 Filament elapsed time meter A801L1 HV shorting assembly

TABLE 5-3. FUSE FUNCTIONS (cont)

FIGURE 5-8 REFERENCE NUMBERS	PANEL DESIGNATION	SYMBOL NUMBER	VALUE (AMPS)	PROTECT FUNCTION
13	BLOWER Ø3	F3003	3	B801 Main blower A706 Harmonic filter AC input A704B1 PA bandswitch motor M3002 PA plate elapsed time meter
14	PA FILAMENT	F3004	5	T804 PA filament transformer M801 Time delay M3001 Filament elapsed time meter A801L1 HV shorting assembly
15	LOW VOLTAGE Ø1	F3005	5	T803 Low voltage transformer K801 HV contactor T1101 Bias transformer
16	LOW VOLTAGE Ø2	F3006	10	T803 Low voltage transformer M3001 Filament elapsed time meter T804 PA filament transformer A702 PA tune capacitor assembly A703 PA load capacitor assembly A1004 PA servo amplifier K801 HV contactor T1101 Bias transformer
17	LOW VOLTAGE Ø3	F3007	5	T803 Low voltage transformer A702 PA tune capacitor assembly A703 PA load capacitor assembly A1004 PA servo amplifier
18	EXCITER AC	F3008	1	B2001 Exciter drawer fan Exciter AC

TABLE 5-3. FUSE FUNCTIONS (cont)

FIGURE REFERENCE NUMBERS	PANEL DESIGNATION	SYMBOL NUMBER	VALUE (AMPS)	PROTECT FUNCTION
19		A705F1	2	A705S1 Remote power assembly switch solenoid
20	AC	A703F1	2/10	A703B1 PA load capacitor motor A703T1 PA load capacitor assembly transformer
21	DC	A703F2	1/16	A703A1CR1 PA load capacitor rectifier
22	TOP FAN	F701	1/2	B701 Top fan

TABLE 5-4. HV CONTROL VOLTAGE CHART

TEST POINT	MEASURED VALUE	REFERENCE SYMBOL
A to ground	+24VDC	K2004 Pin 2
B to ground	0 ohms	K2004 Pin 10
C to ground	0 ohms	S5001
D to ground	0 ohms	S5001
E to ground	0 ohms	A4003 Pin 6
F to ground	0 ohms	A3002 Term 76



REF SYM	TUBE TYPE	TUBE FUNCTION	STATIC PLATE CURRENT ADJ TO	MAX AVAILABLE BIAS VOLTAGE
V1301	8233	1ST AMP	60-70MA	-15VDC
V1302	4CX350	2ND IPA	220-240MA	-70 VDC
V1401	8576	IPA	210-230MA	-145 VDC
V701	4CX10,000J	PA	.50-.650A	-360 VDC

NOTE:

1. MAX BIAS VOLTAGE WILL BE PRESENT IF :
  - A. BANDSWITCH NOT IN PROPER POSITION.
  - B. PTT RELAY NOT ENERGIZED.
  - C. BIAS CONTROLS ARE AT MAX CLOCKWISE.
  
2. WHEN MAX BIAS VOLTAGE IS PRESENT AT V1301, V1302, V1401, V701 THE STATIC PLATE CURRENT IS REDUCED TO ZERO WHICH PLACES THE AMPLIFIERS AT OR NEAR CUTOFF.

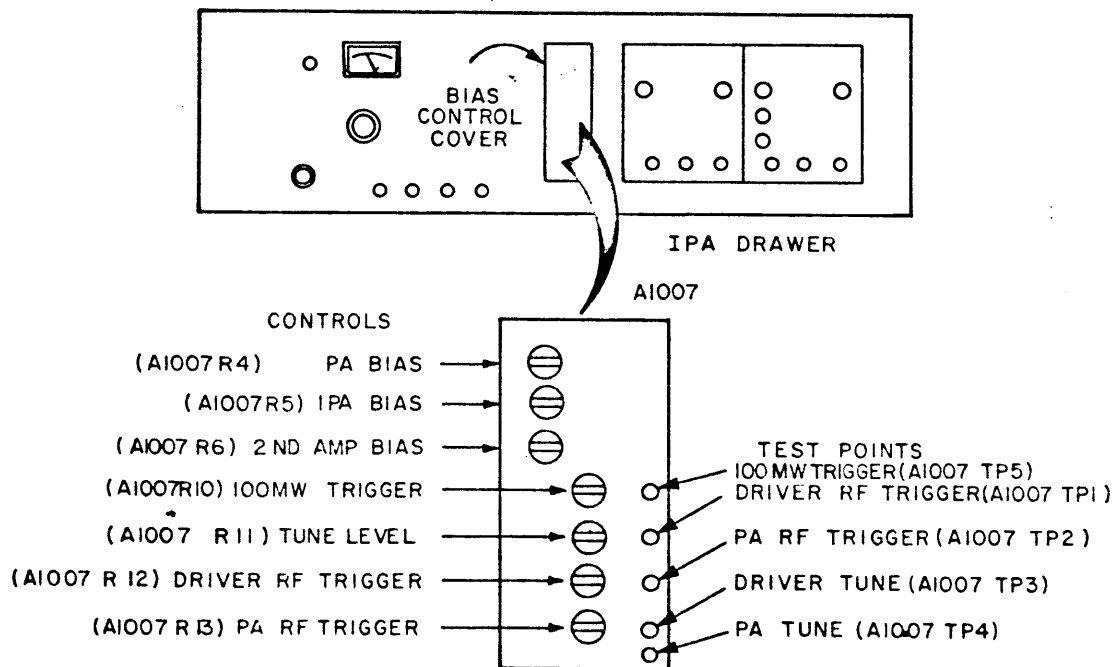
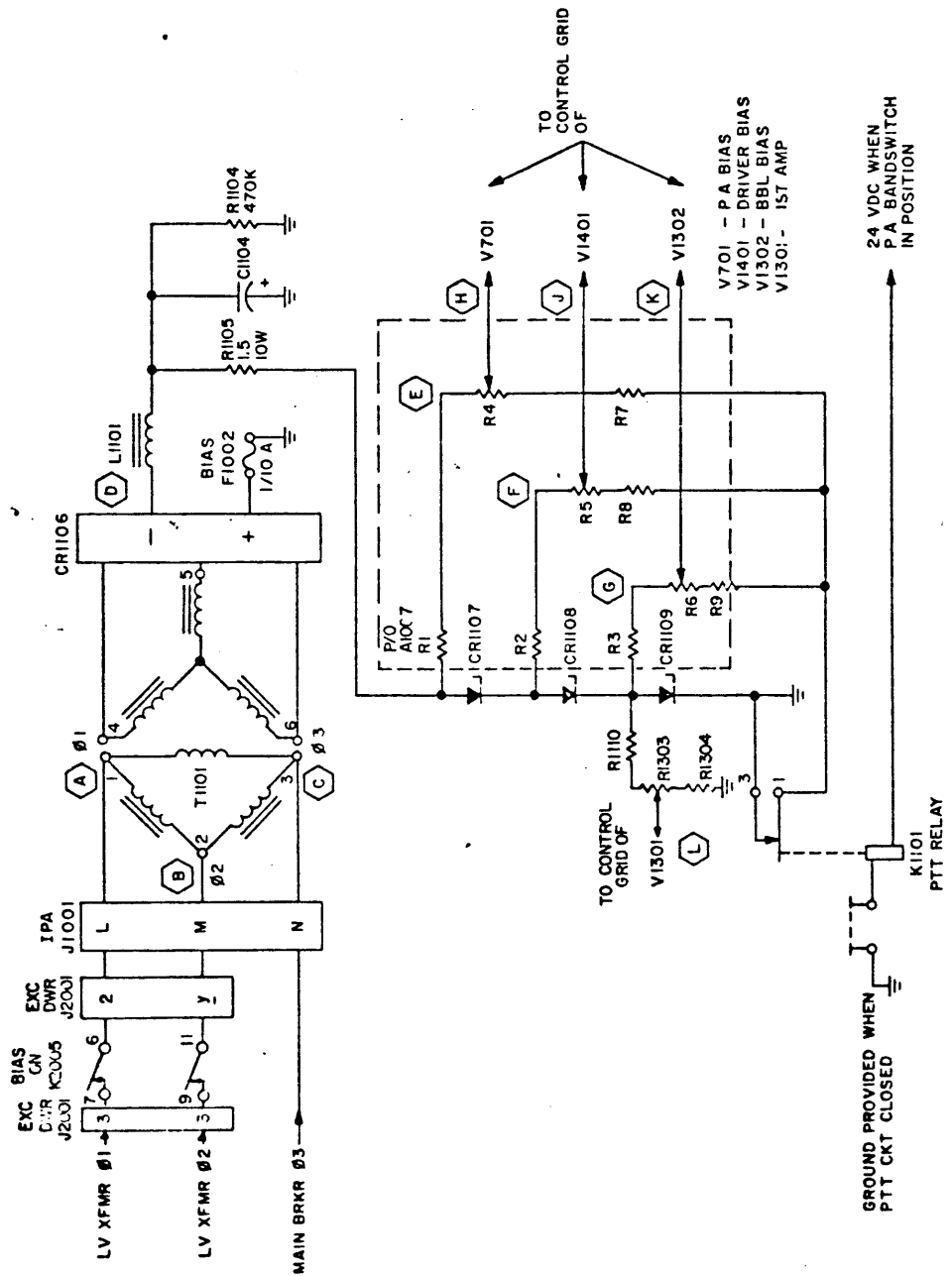


Figure 5-1. Bias Controls



BIAS SUPPLY VOLTAGE (PTT RELAY CLOSED)					
POINT OF TEST	VOLTAGE	REFERENCE DESIGNATION	POINT OF TEST	VOLTAGE	REFERENCE DESIGNATION
A	230 VAC Ø1	T1101	G	-70 VDC	R6
B	230 VAC Ø2	T1101	H	-350 TO -230 V.D.C	V701
C	230 VAC Ø3	T1101	J	-145 TO -05 VDC	V1401
D	-420 VDC	L1101	K	-70 TO -10 V.D.C	V1302
E	-360 VDC	R4	L		V1301
F	-145 VDC	R5		-15 TO -2 VDC	

BIAS SUPPLY VOLTAGE (PTT RELAY OPEN)					
POINT OF TEST	VOLTAGE	REFERENCE DESIGNATION	POINT OF TEST	VOLTAGE	REFERENCE DESIGNATION
A	230 VAC Ø1	T1101	G	-120 VDC	R6
B	230 VAC Ø2	T1101	H	-360 VDC	V701
C	230 VAC Ø3	T1101	J	-240 VDC	V1401
D	-420 VDC	L1101	K	-120 VDC	V1302
E	-360 VDC	R4	L	-15 TO -2 VDC	V1301
F	-240 VDC	R5			

Figure 5-2. Simplified Bias Control Circuit

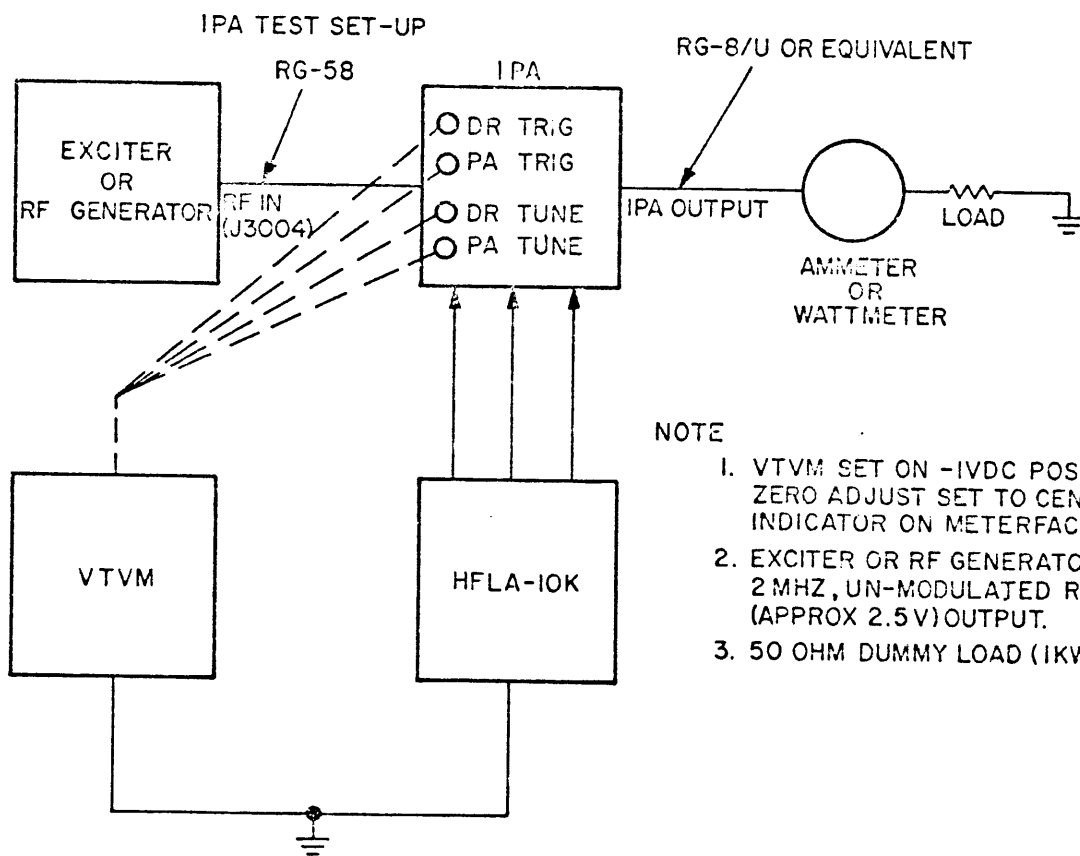


Figure 5-3. IPA Alignment Test Set-Up

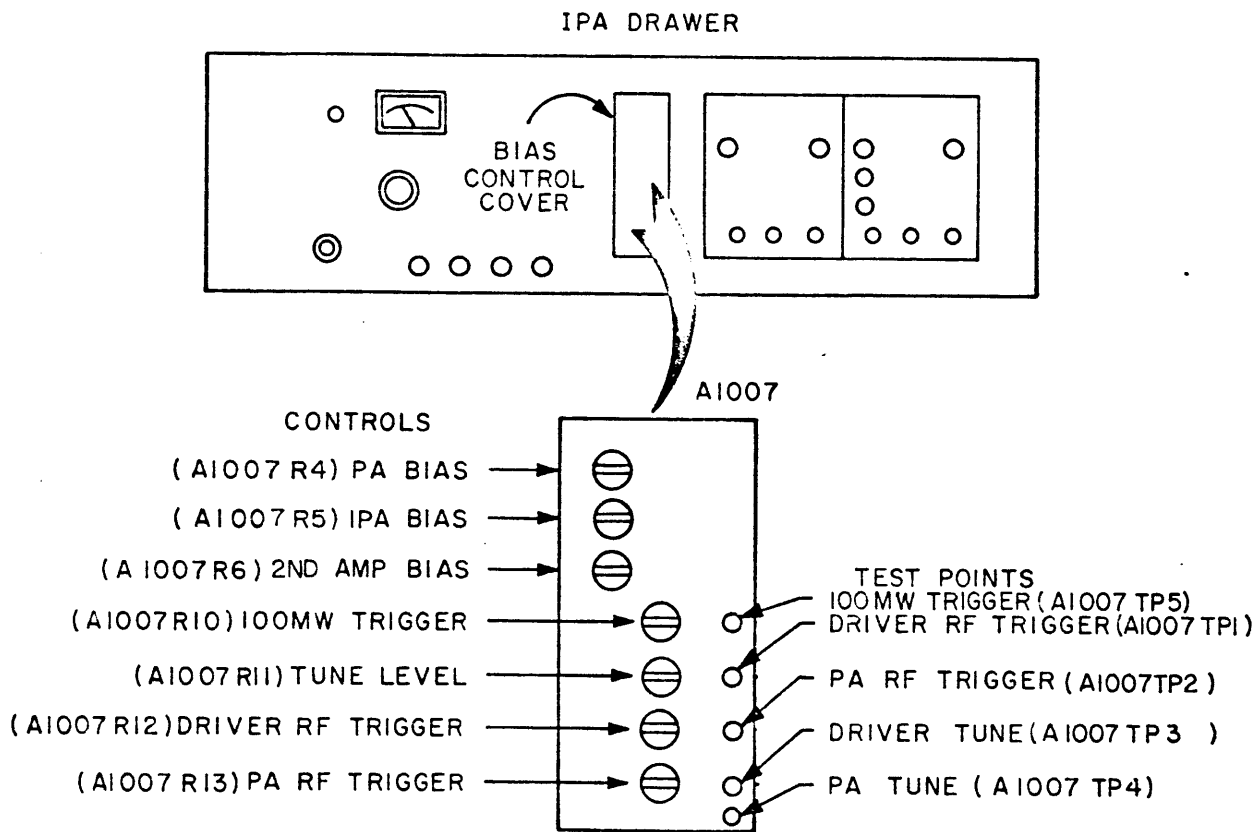
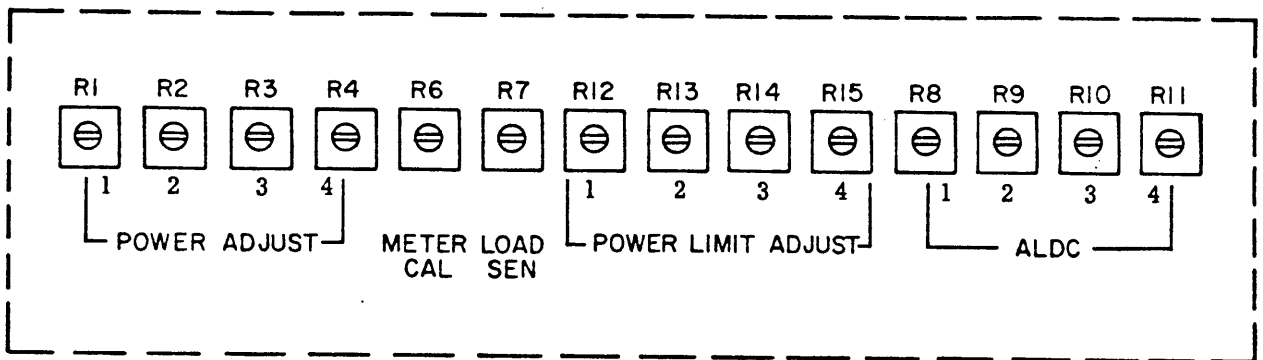


Figure 5-4. Automatic Tuning Adjustment Controls



NOTE: CONTROL POTENTIOMETER LOCATED BEHIND TECHNIMATIC COVER

Figure 5-5. Transmitter Output Control Board, PC533

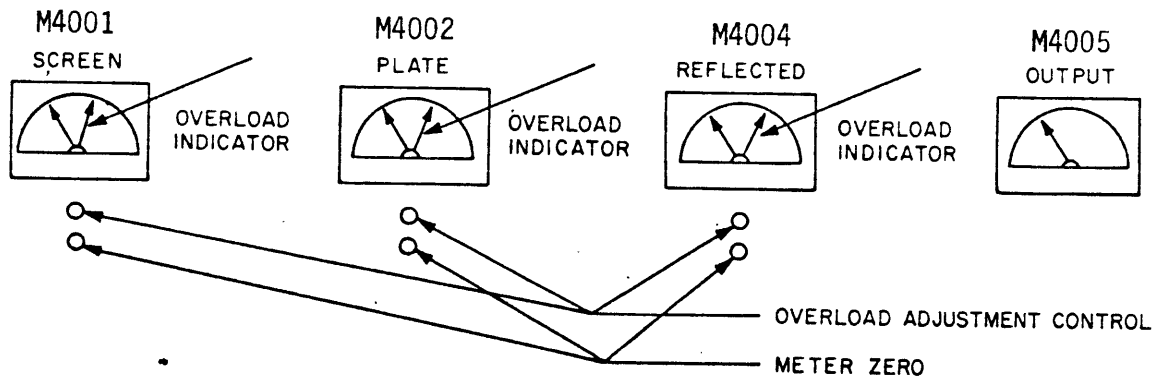


Figure 5-6. Overload Adjustment Controls

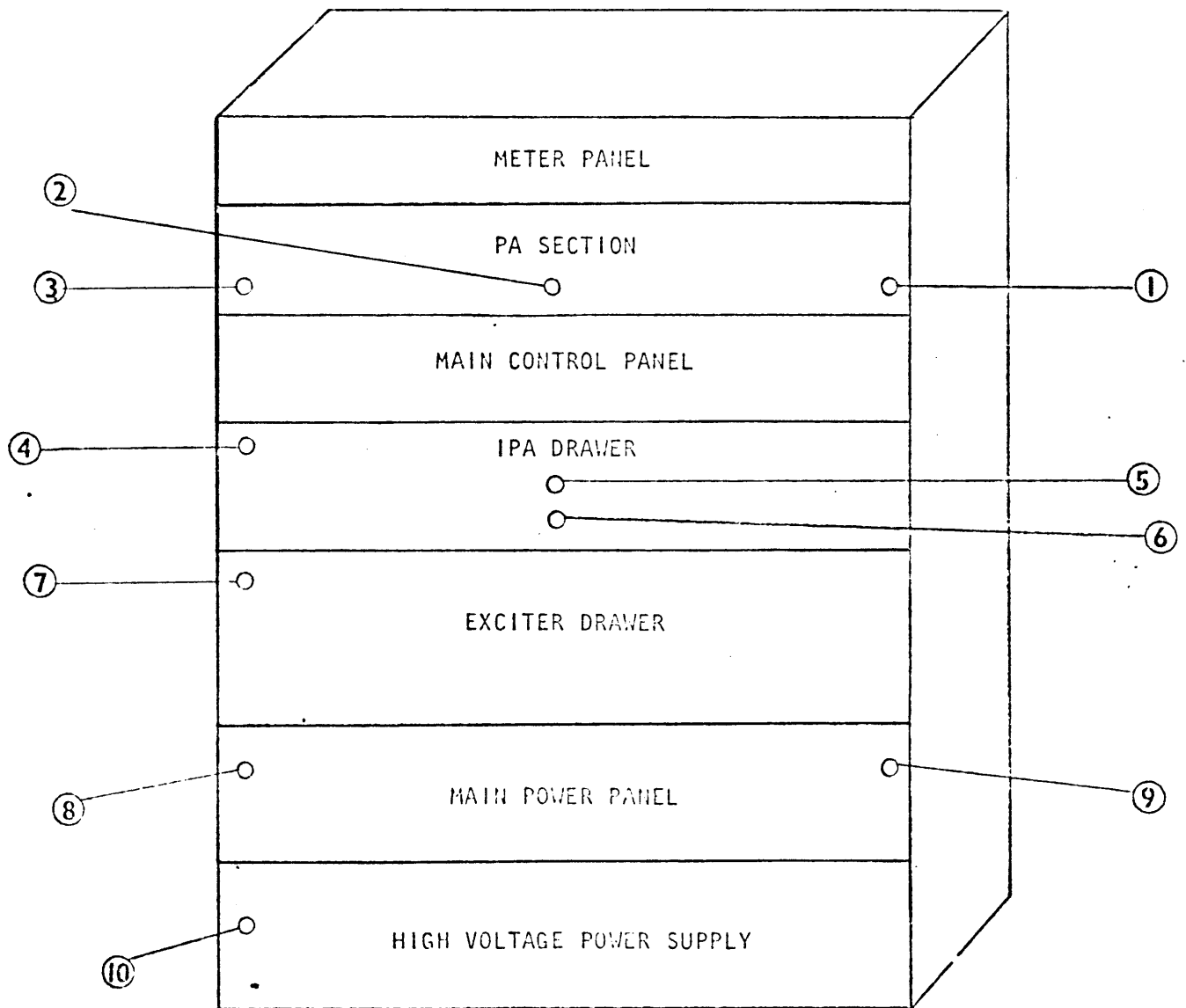
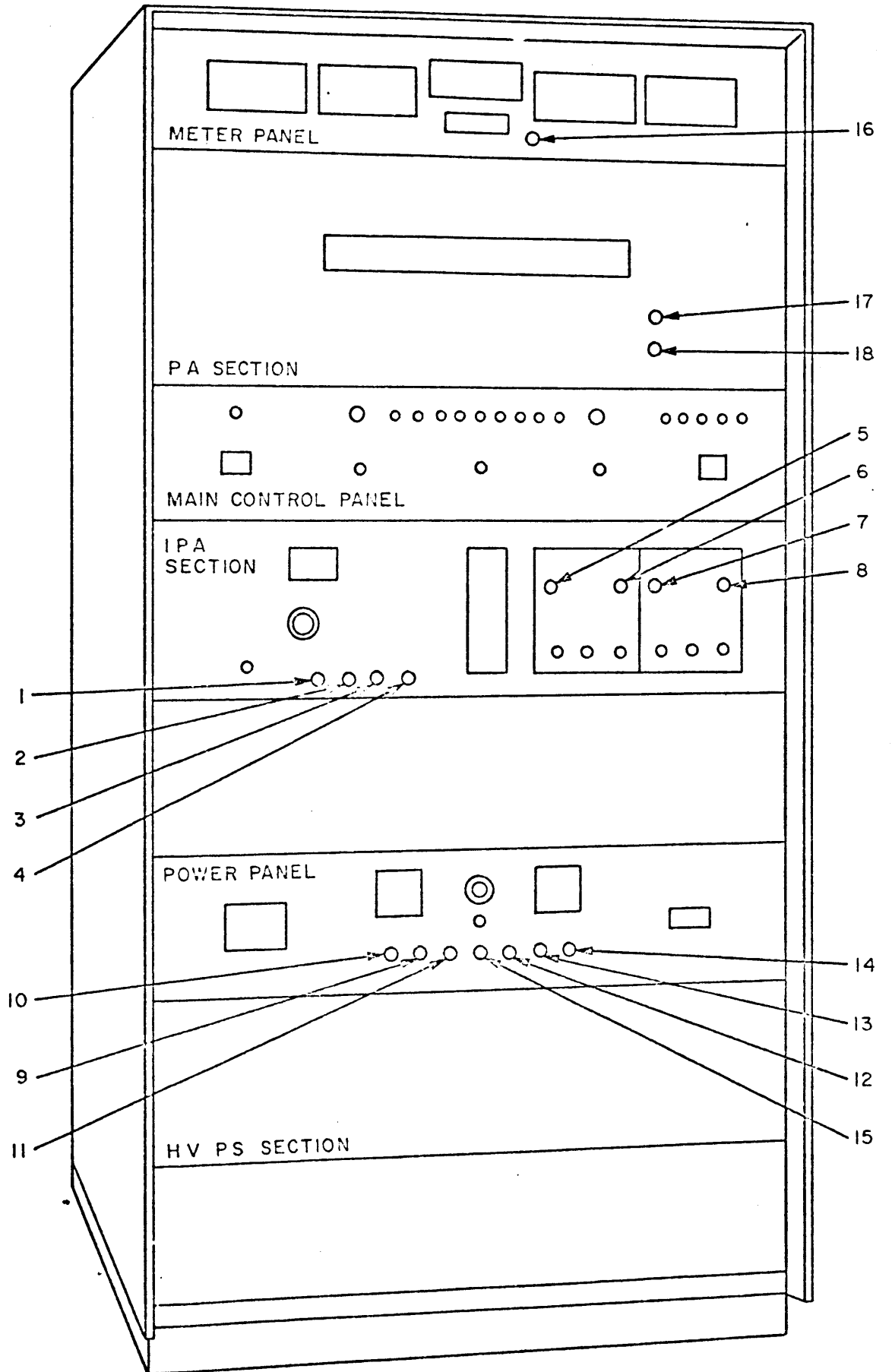


Figure 5-7. Interlock Locations



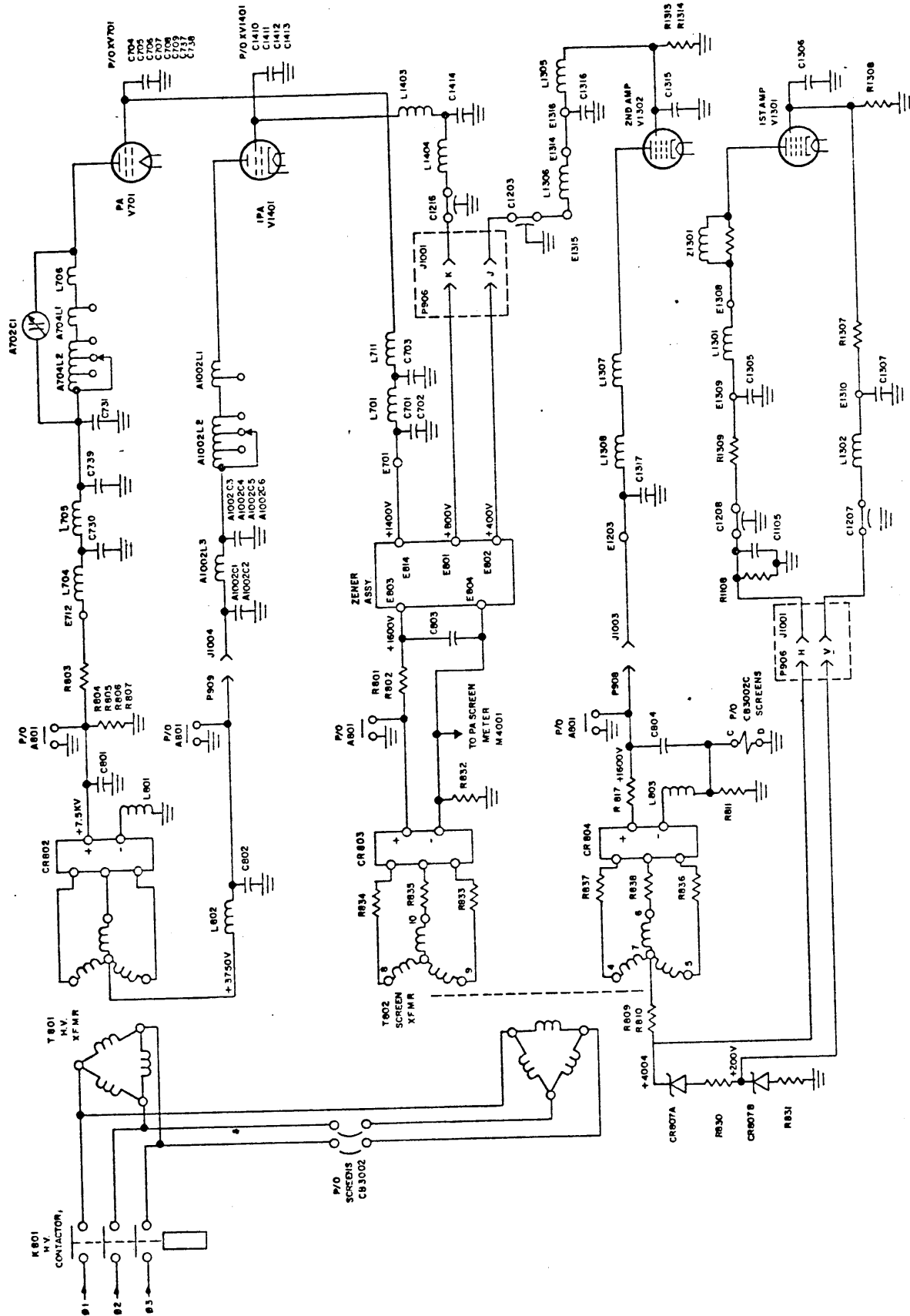
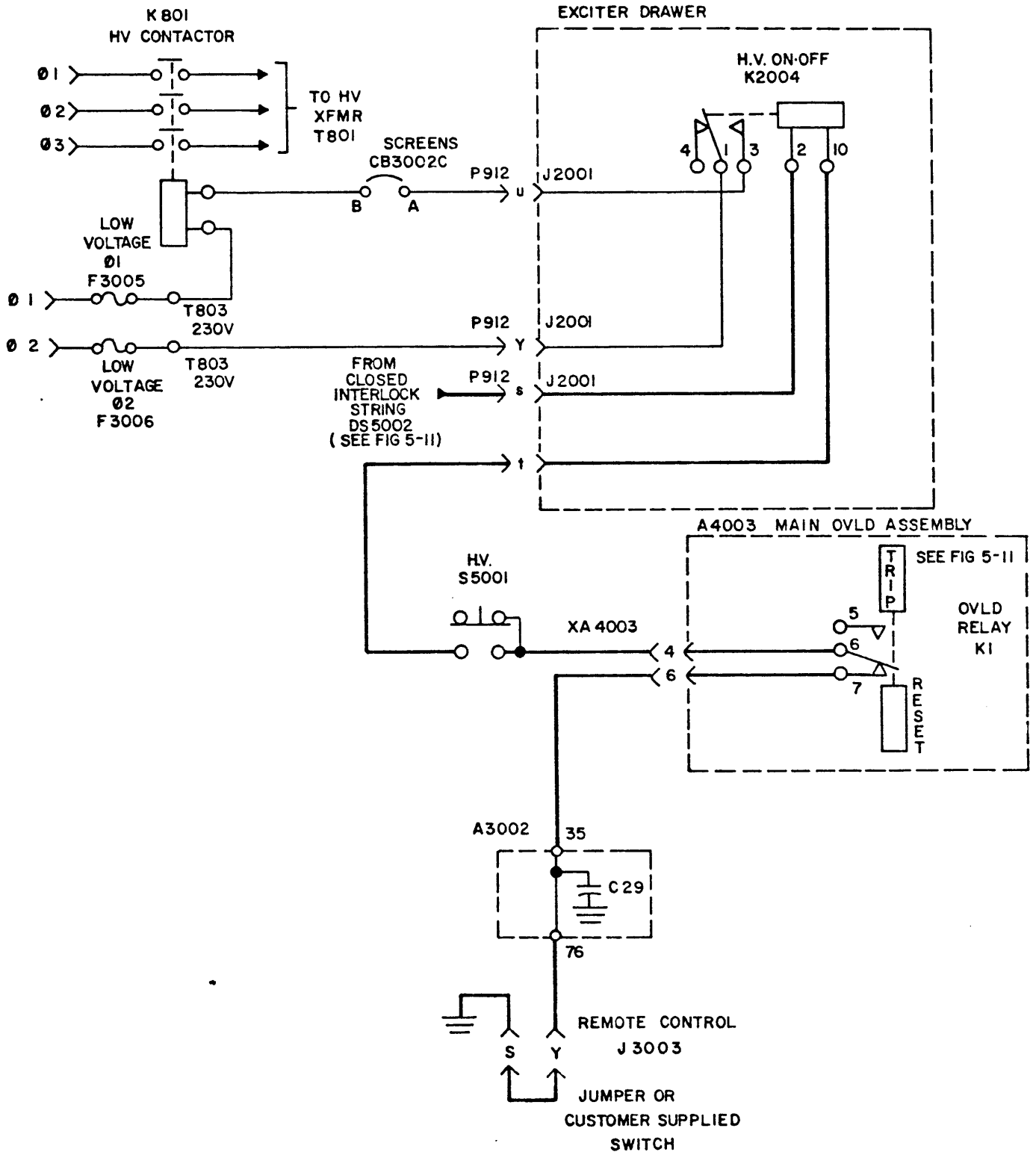


Figure 5-9. Simplified Diagram Plate and Screen Circuits V1301, V1302, V1401 and V701





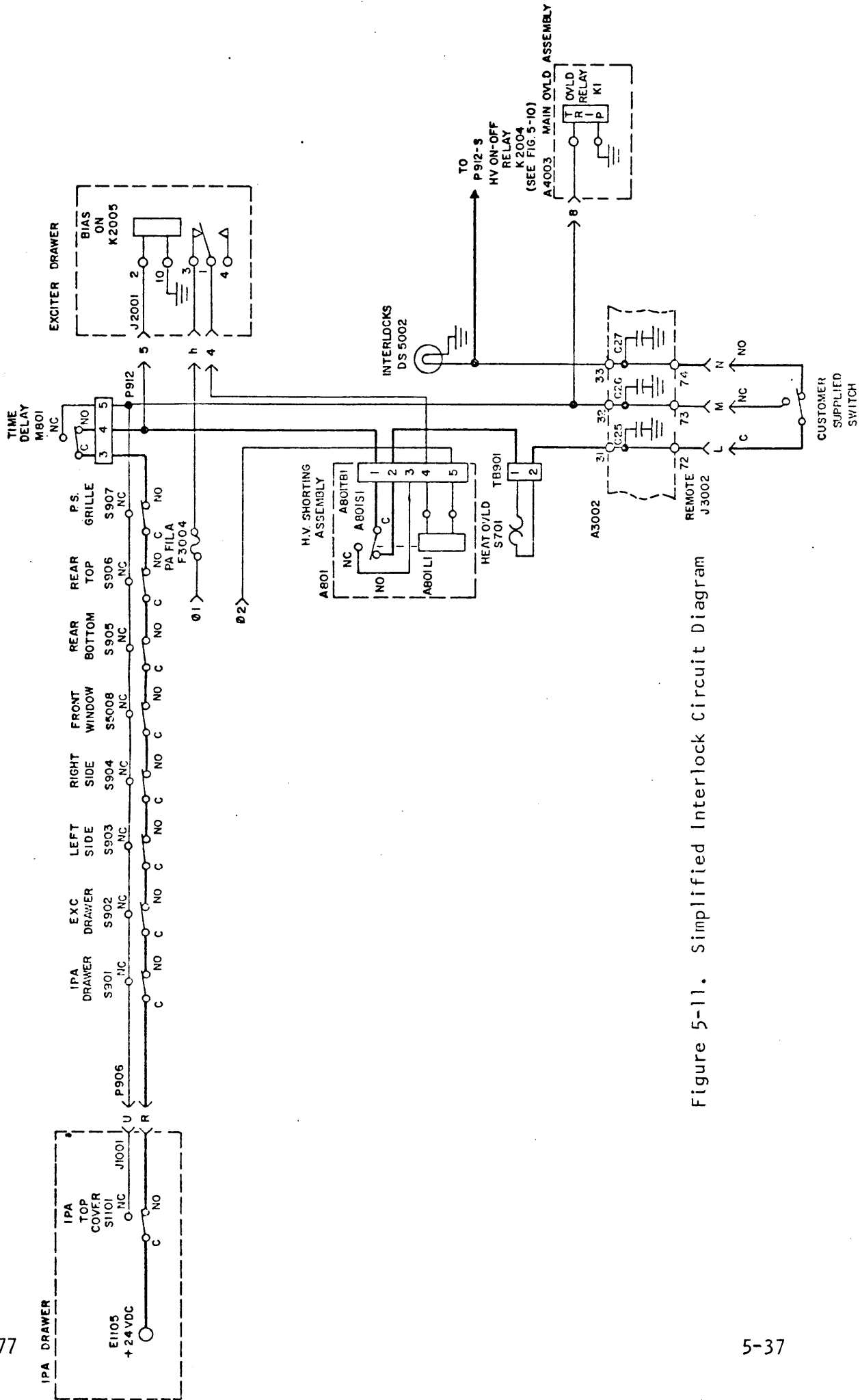


Figure 5-11. Simplified Interlock Circuit Diagram

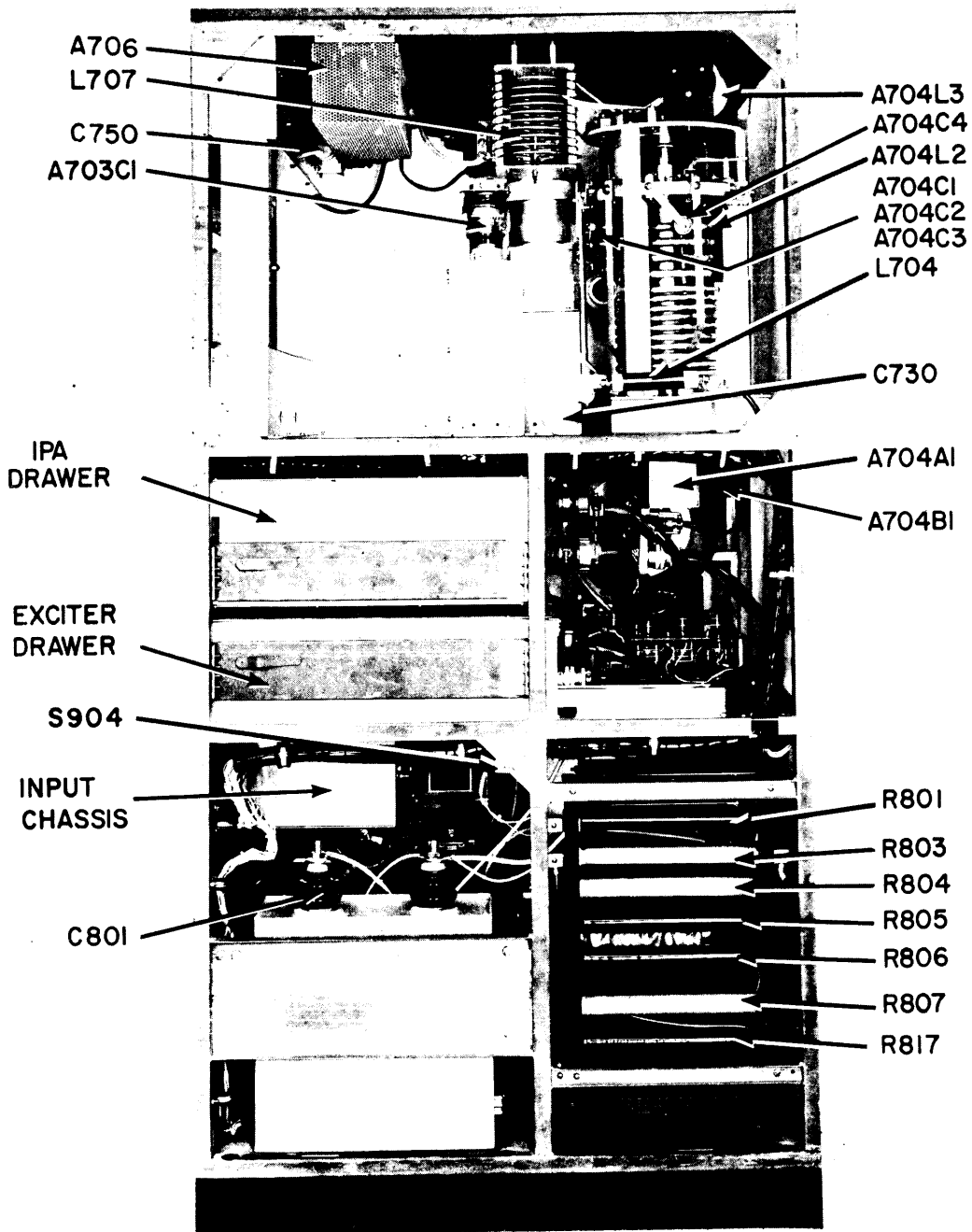


Figure 5-12. Overall Transmitter Rightside View

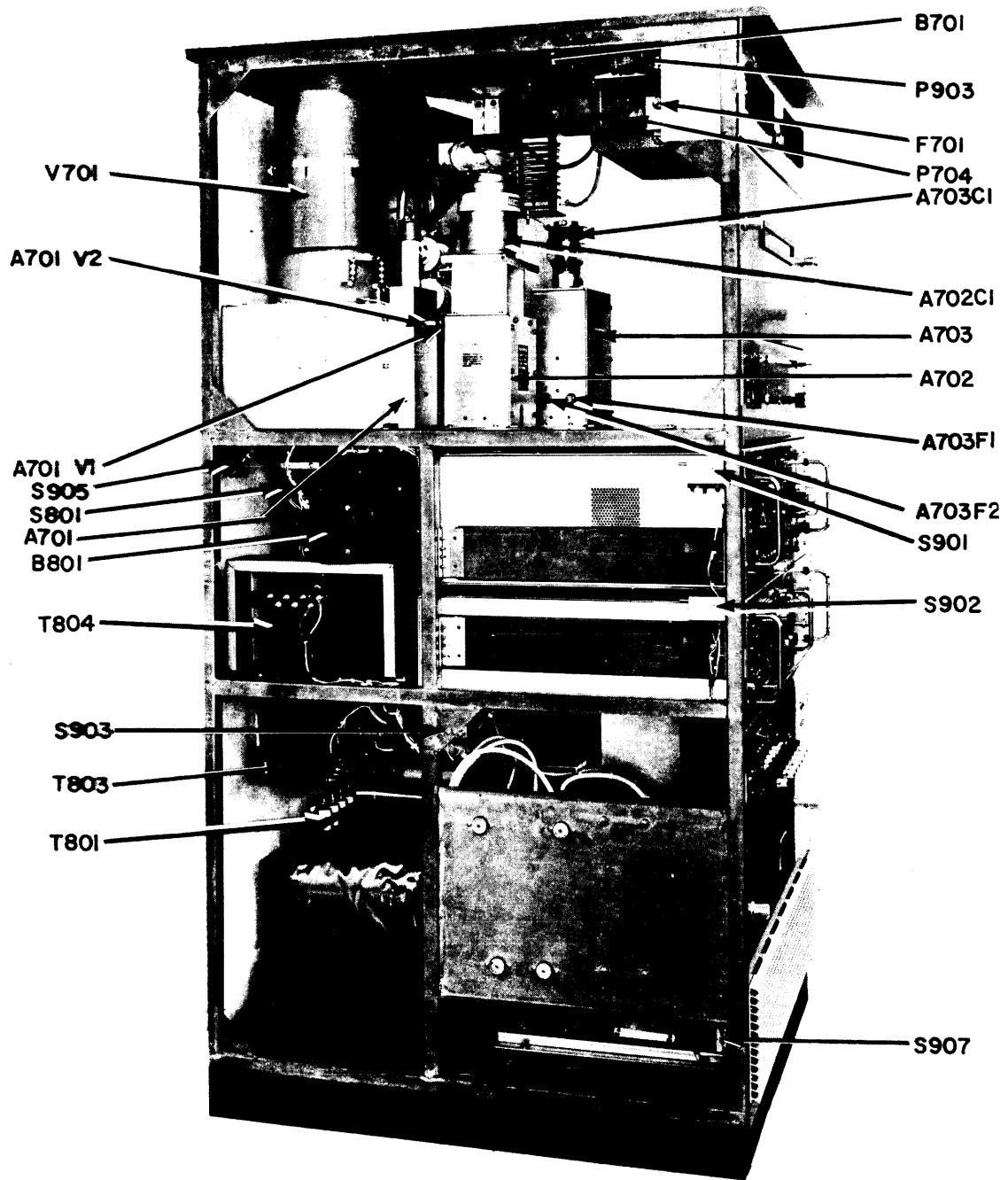


Figure 5-13. Transmitter Overall Leftside View

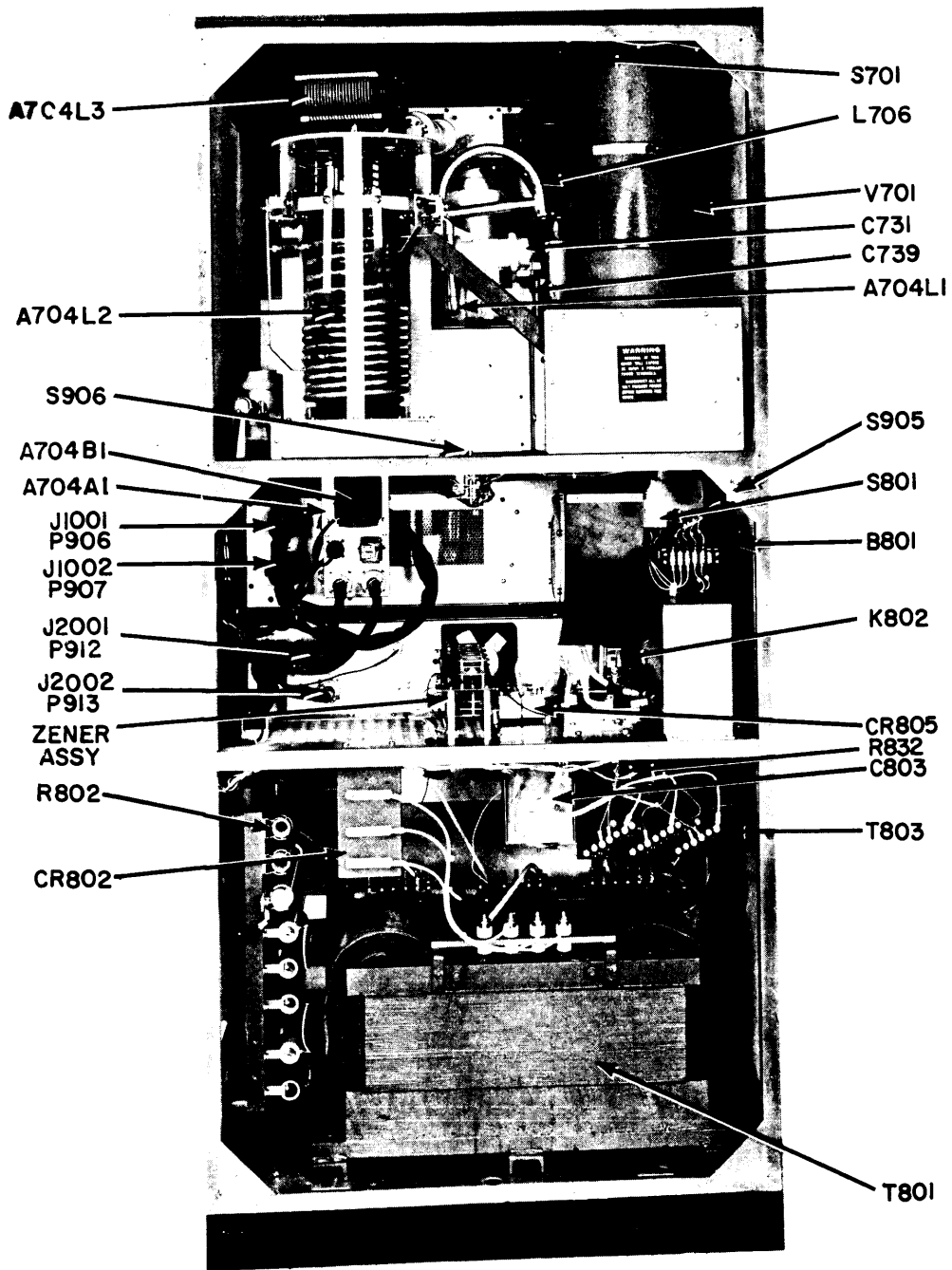


Figure 5-14. Transmitter Overall Rear View

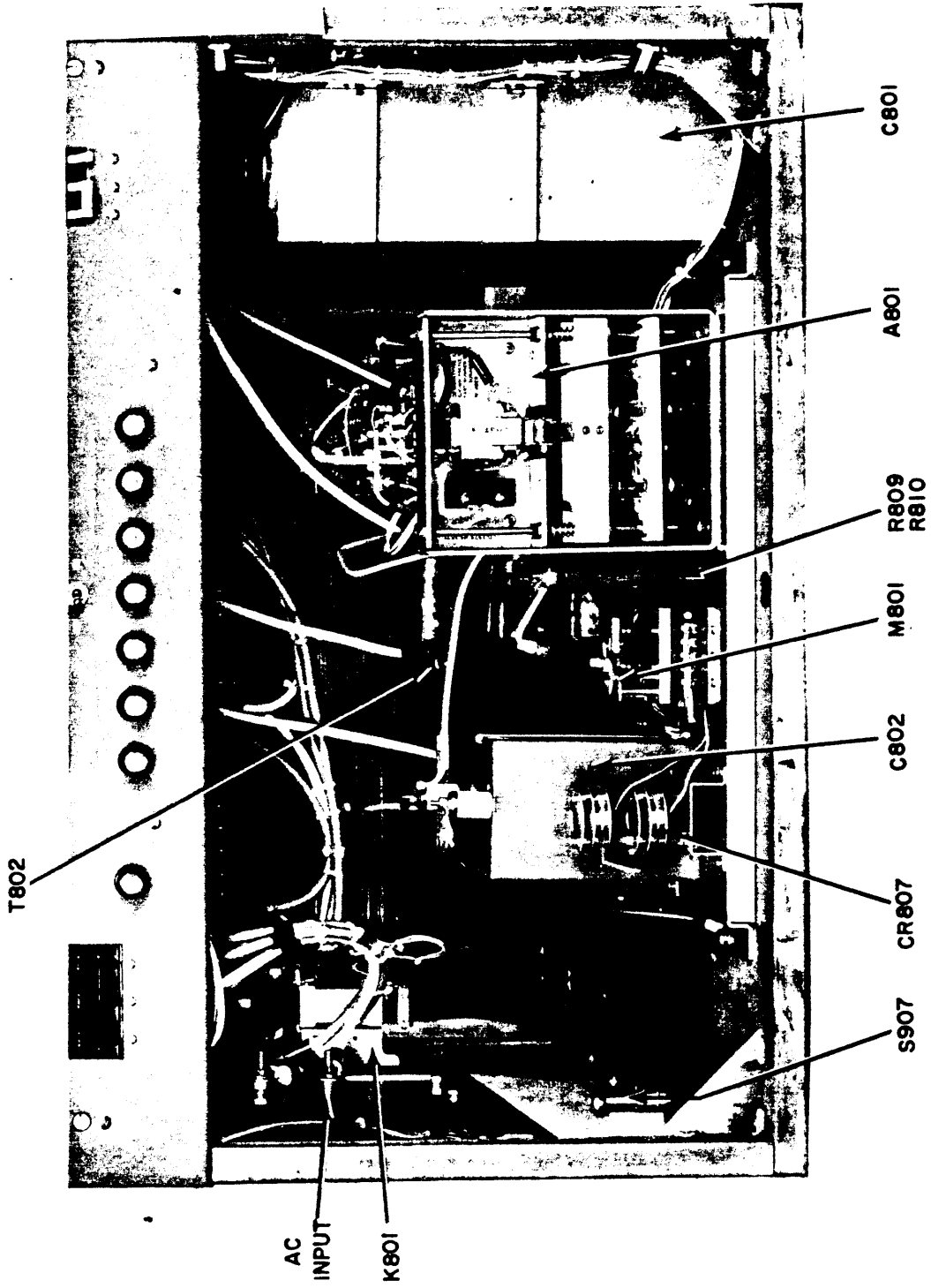


Figure 5-15. High Voltage Power Supply Section

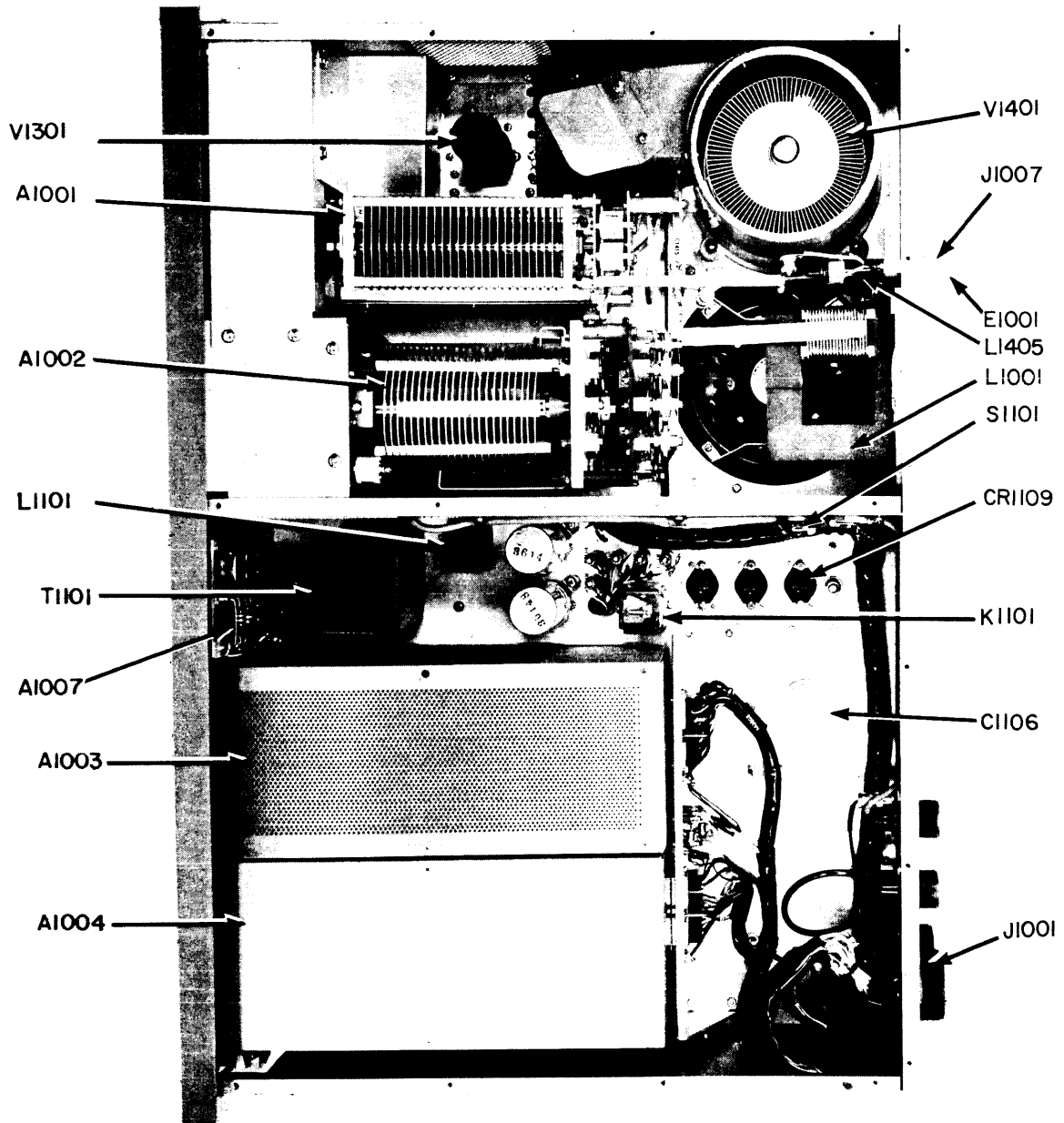


Figure 5-16. IPA Drawer Top View

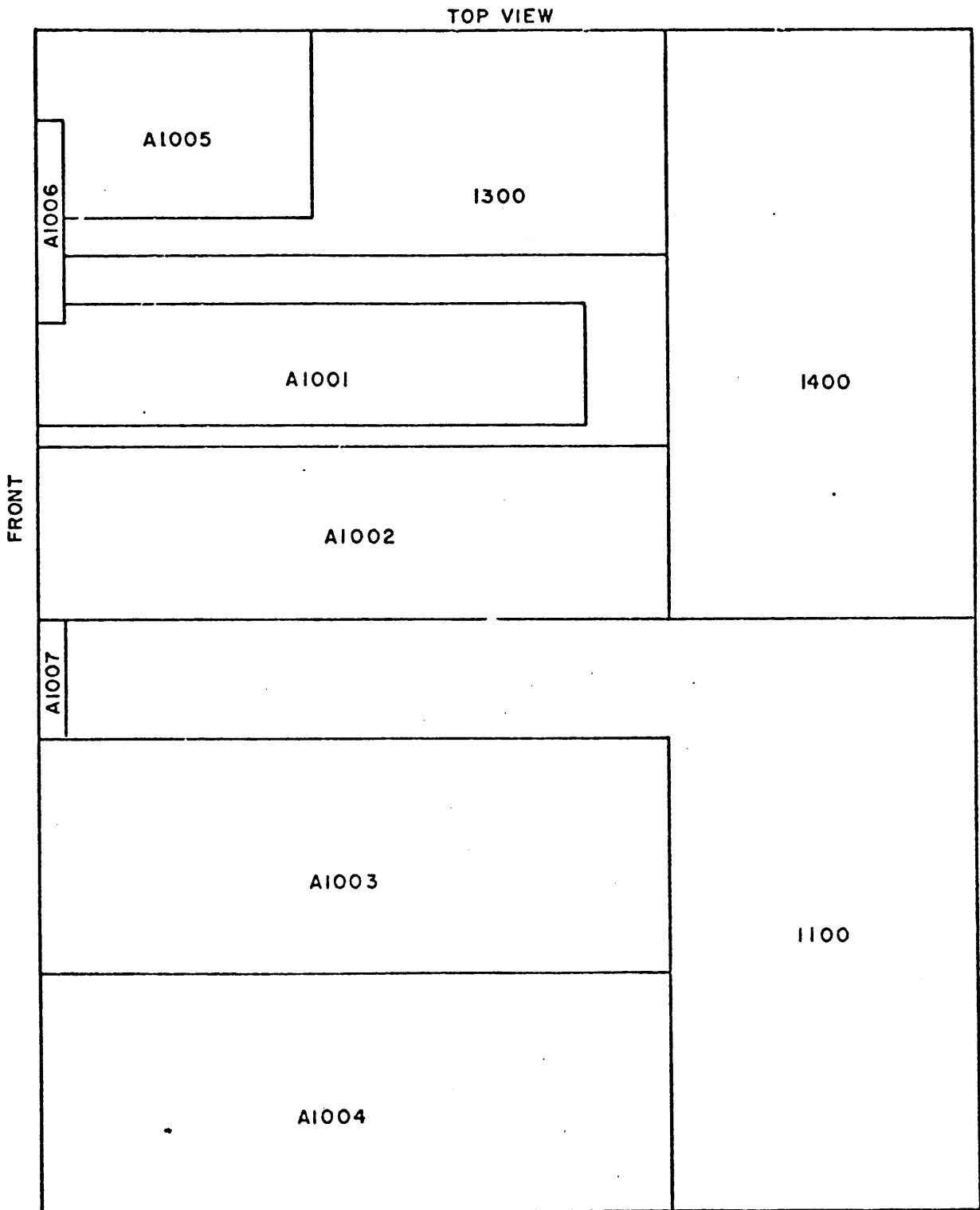


Figure 5-17. IPA Drawer AX-5167 Symbol Series Location Top View



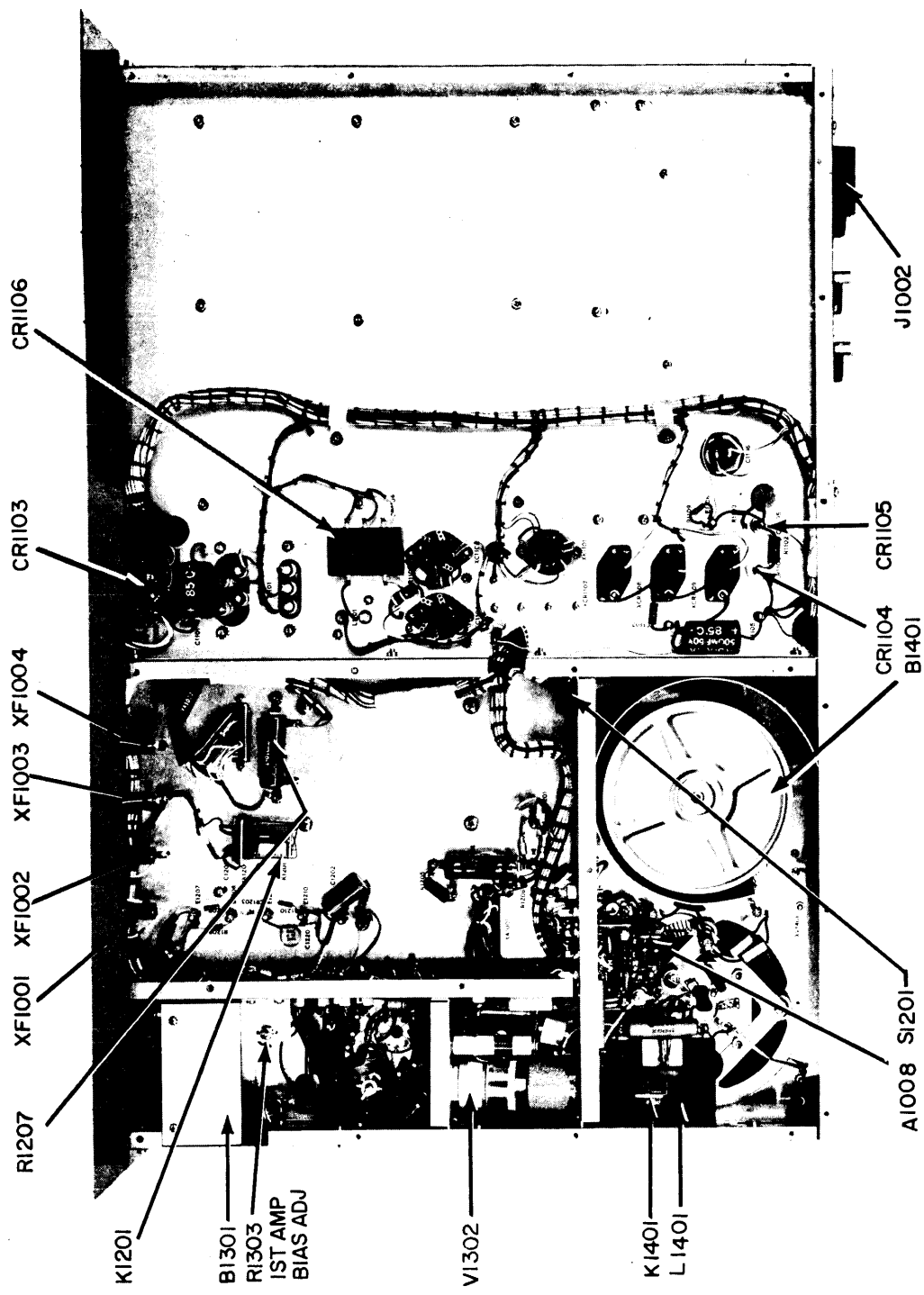


Figure 5-18. IPA Drawer Bottom View

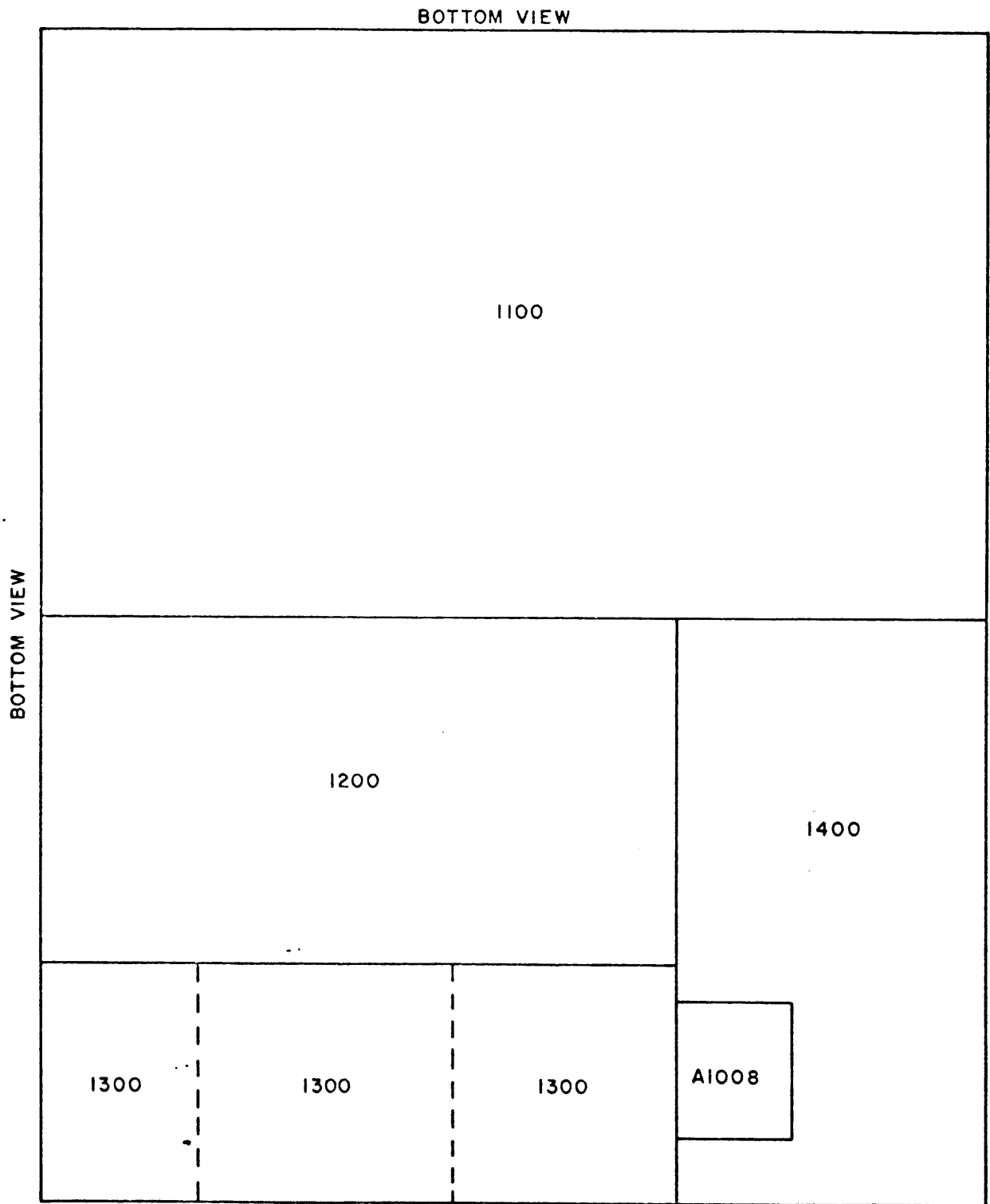


Figure 5-19. IPA Drawer AX-5167 Symbol Series Location Bottom View

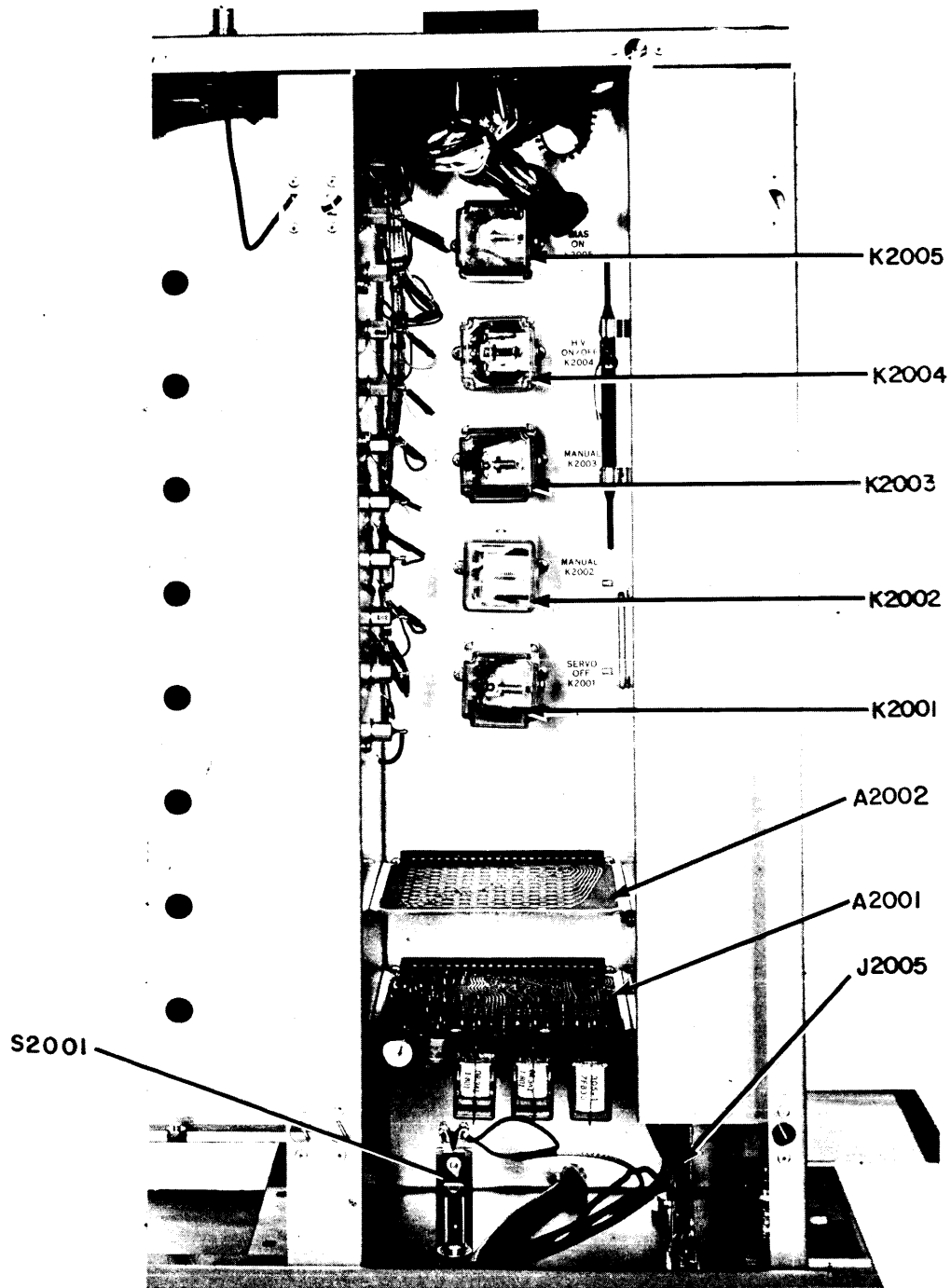


Figure 5-20. Exciter Drawer Top View

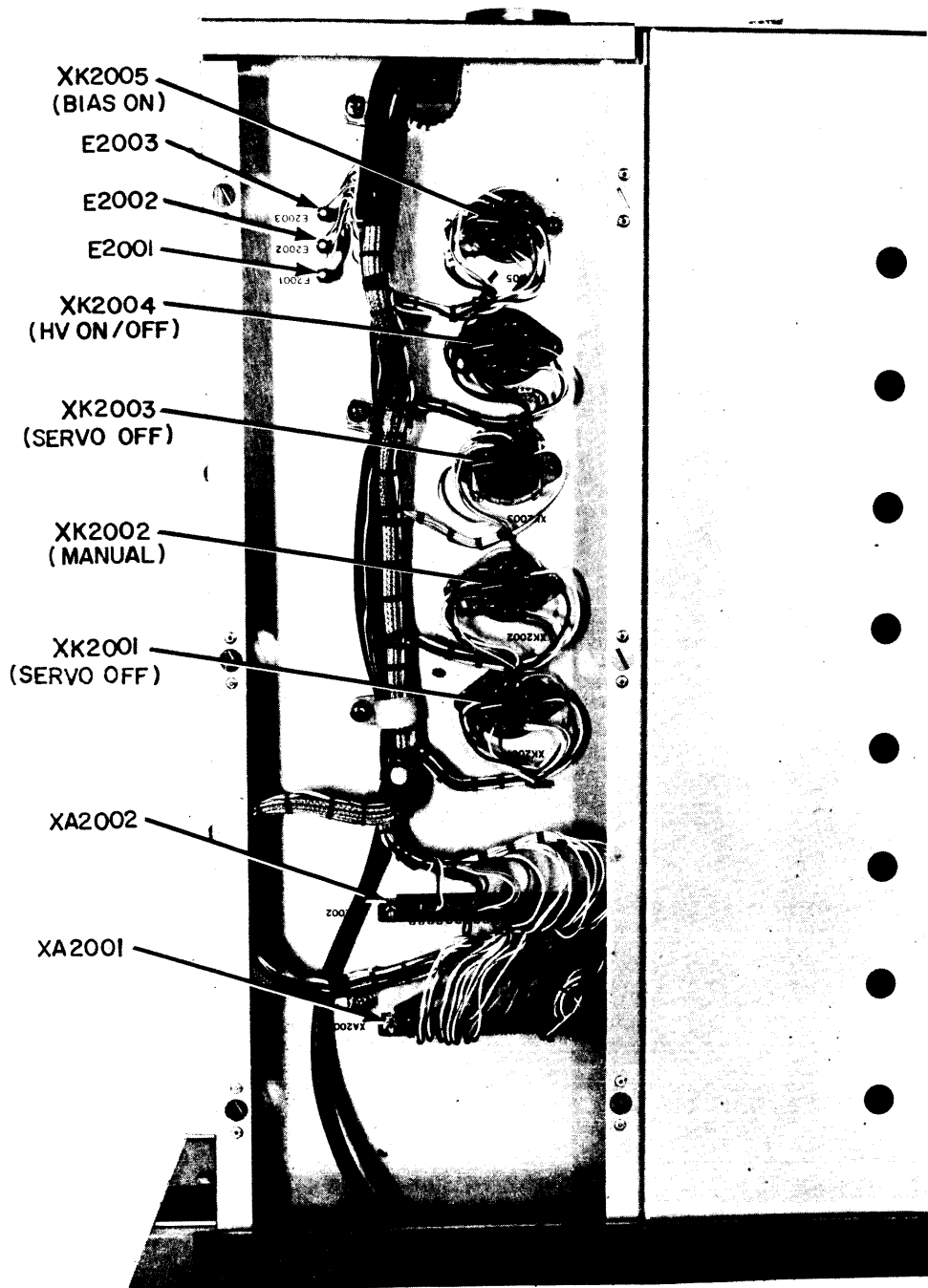
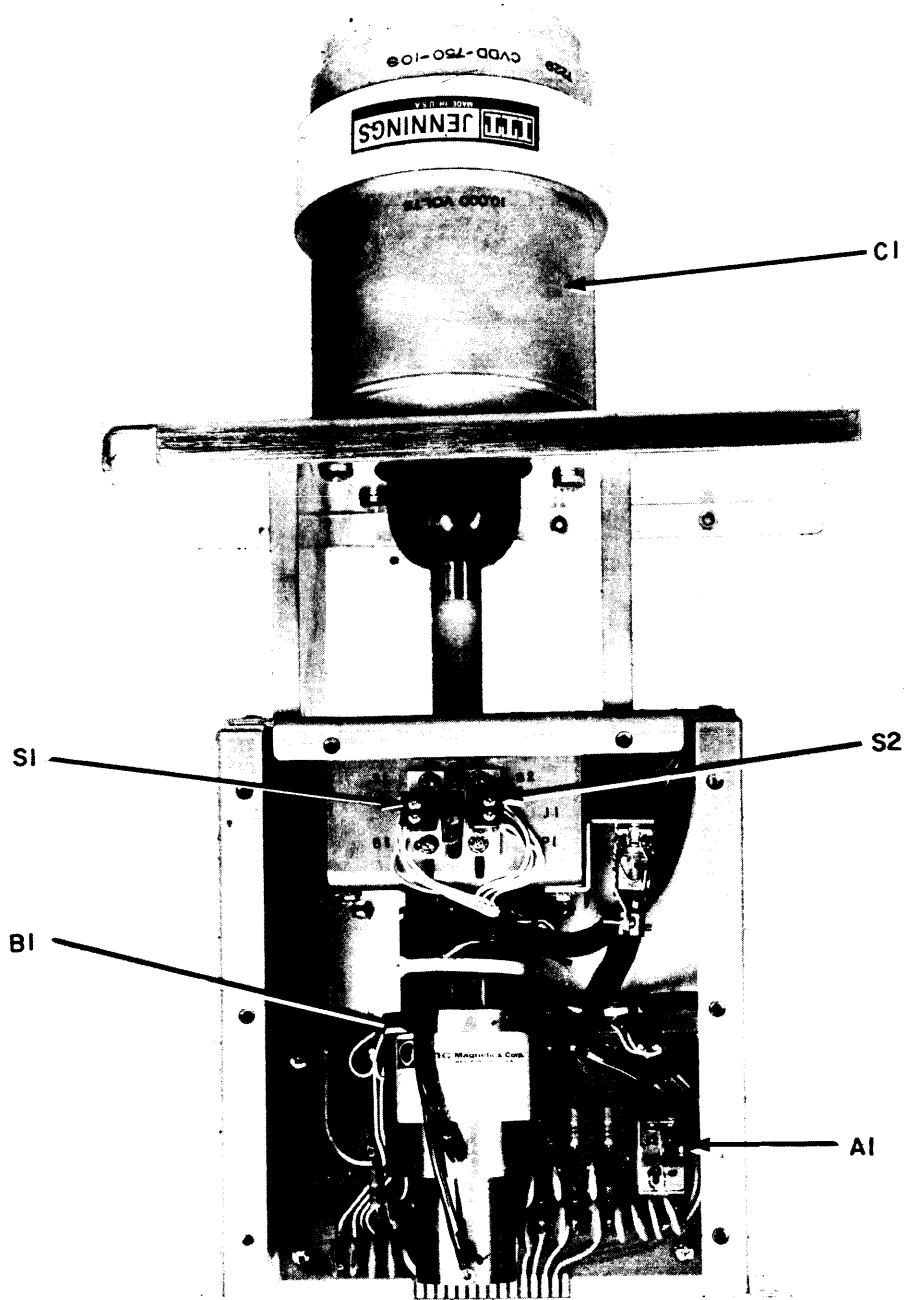


Figure 5-21. P/O Exciter Drawer Bottom View



A702

Figure 5-22. PA Tuning Assembly

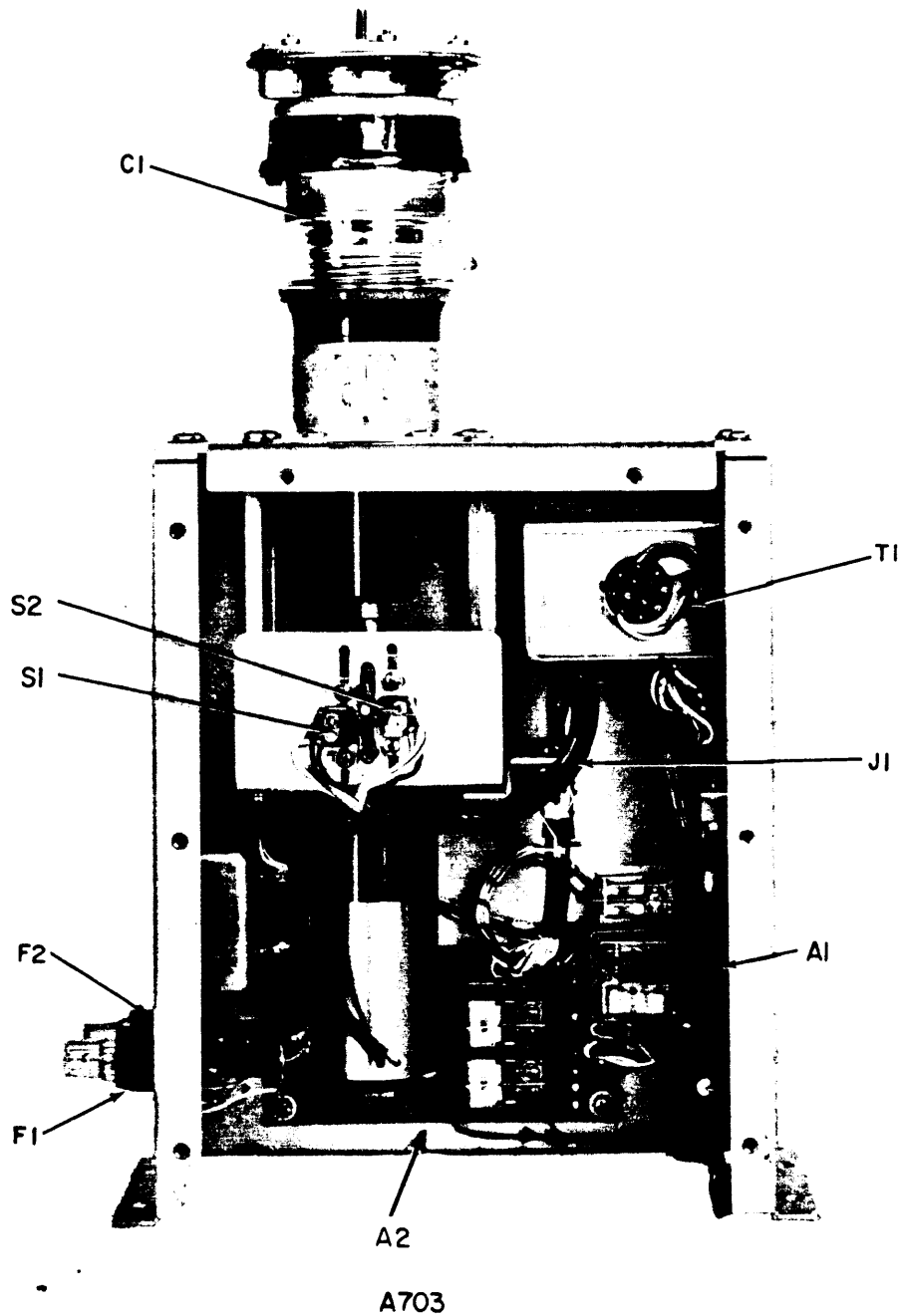
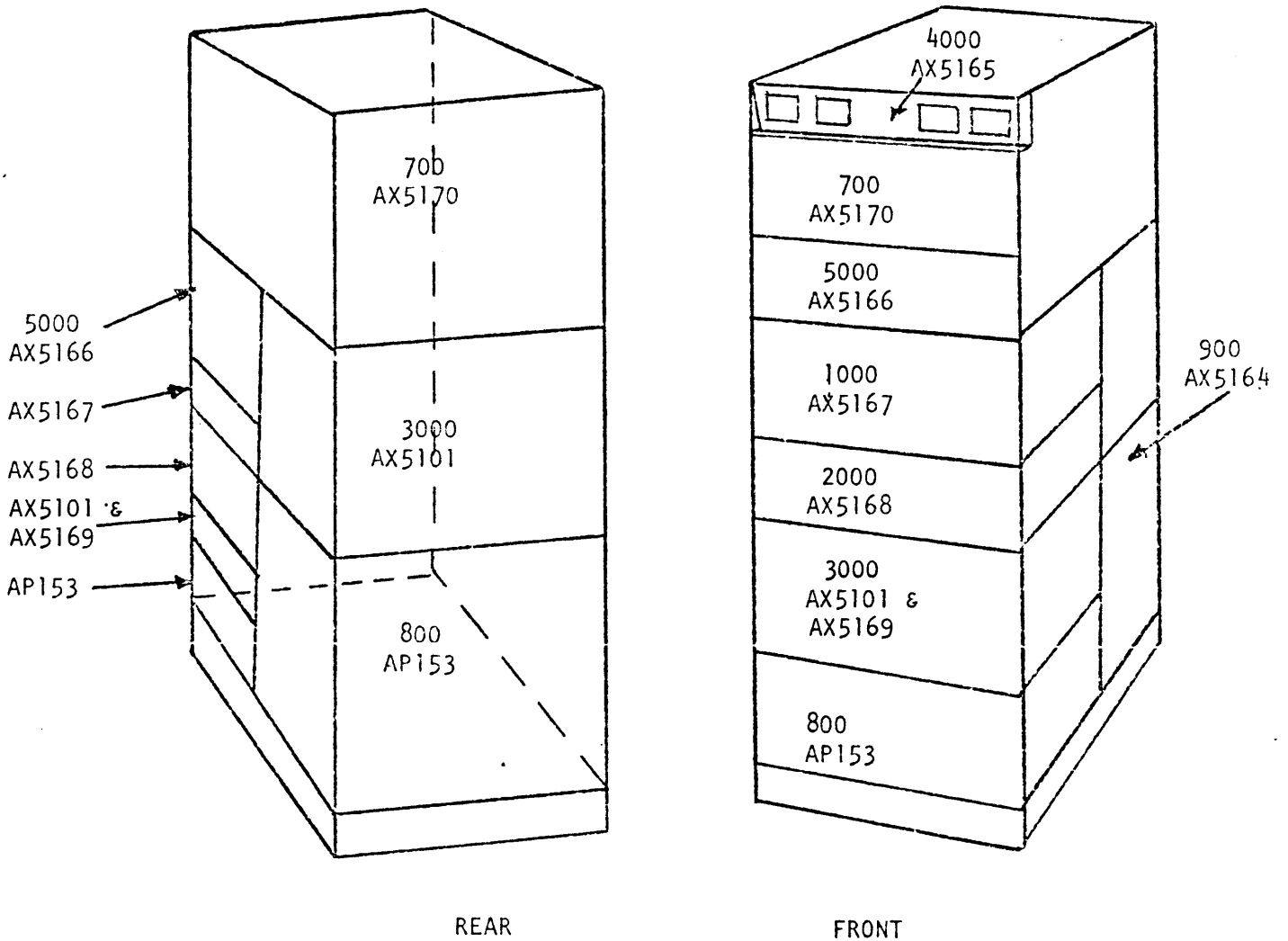


Figure 5-23. PA Load Assembly

VOLUME 2

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ASSEMBLY NO.	NAME	SYMBOL SERIES
AX5170	PA SECTION	700
AP153	POWER SUPPLY	800
AX5164	MAIN FRAME SUB ASSY	900
AX5167	IPA DRAWER	1000
AX5168	EXCITER DRAWER	2000
AX5101	INPUT CHASSIS	3000
AX5169	MAIN POWER PANEL ASSY	3000
AX5165	METER PANEL	4000
AX5166	MAIN CONTROL PANEL	5000

Figure 6-1. Assembly location Drawing HFL( )-10K



SECTION 6  
PARTS LIST

6-1. INTRODUCTION

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

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

- a. Reference symbol.
- b. Description as indicated in parts list.
- c. TMC part number.
- d. Model and serial numbers of the equipment containing the part being replaced; this can be obtained from the equipment nameplate.

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

The Technical Materiel Corporation  
Attention: Sales Department  
700 Fenimore Road  
Mamaroneck, New York 10543

NOTE

The parts list in this section applies to all HFL( )-10K/REV A series linear amplifiers. When using the parts list, particular attention should be paid to "Reference Notes". These notes are used to identify parts which are peculiar to a particular linear amplifier, i.e. HFLA-10K (automated linear amplifier), HFLM-10K (manual linear amplifier). The reference notes are listed as follows:

Reference Note	Description
1	All items referenced to this note are supported by a parts breakdown provided on a separate list.
2	All items referenced to this note are used <u>only</u> on automated equipment, i.e. HFLA-10K linear amplifier.
3	All items referenced to this note are used <u>only</u> on manual equipment, i.e. HFLM-10K linear amplifier.
4	All items referenced to this note are customer options.
5	All items referenced to this note are nominal values.

AX5170

POWER AMPLIFIER SECTION

SYMBOL SERIES 700

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A701	PA Sense Board Assembly (Ref Notes 1, 2)	A-4835
A702	Tune Capacitor Assembly (Ref Note 1)	AX5171
A703	Load Capacitor Assembly (Ref Note 1)	AX5172
A704	Bandswitch Assembly (Ref Note 1)	AS163
A705	Remote Power Assembly (Ref Note 1)	AX5173
A706	Harmonic Filter Assembly (Ref Notes 1, 4)	AF110
A707	ALDC Assembly (Ref Note 1)	A-4856
A708	ALDC Printed Circuit Board Assembly (Ref Note 1)	A-4850-3
B701	Fan, Axial	BL105
C701 thru C703	Capacitor, Fixed, Ceramic	CC109-38
C704 thru C709	Capacitor, Fixed, Ceramic	CC109-36
C710	Capacitor, Fixed, Ceramic	CC100-32
C711	Capacitor, Fixed, Ceramic	CK70AW102M
C712	Same as C711	
C713 thru C715	Capacitor, Fixed, Ceramic	CC115-2-6800
C716 thru C719	Capacitor, Fixed, Ceramic	CC109-19
C720	Capacitor, Fixed, Ceramic	CC109-28
C721	Same as C720	
C722 thru C727	Capacitor, Fixed, Ceramic (Ref Note 2)	CC109-6
C728	Same as C720	
C729	Same as C720	
C730 thru C732	Capacitor, Fixed, Ceramic	CC120-202-A25
C733 thru C736	Capacitor, Fixed, Ceramic	CC100-28
C737	Same as C704	
C738	Same as C704	
C739	Same as C730	
C740	Capacitor, Fixed, Mica	CM15C050J03YY
C741	Capacitor, Fixed, Mica	CM15C180J03YY
C742 thru C747	Same as C733	

## AX5170

## POWER AMPLIFIER SECTION (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C748	Not Used	
C749	Not Used	
C750	Capacitor, Fixed, Electrolytic	CP41B1EF405K
CR701	Detector Element	DD119-10
CR702	Detector Element	DD119-9
DC701	Directional Coupler	DC104-3
E701	Insulated Bowl	NS112-2
E702	Insulated Standoff	NS3W0108
E703	Contact Feed-thru	AX707
E704	Same as E703	
E705	Not Used	
E706	Not Used	
E707	Terminal Turret	TE102-2
E708	Insulated Feed-thru (Ref Note 2)	TE169-4
thru		
E710		
E711	Insulated Feed-thru	TE101-3
E712	Insulated Standoff	NS3W0320
E713	Not Used	
E714	Same as E707	
thru		
E717		
F701	Fuse, Cartridge	FU102-.5
J701	Connector, Receptacle, RF	UG560/U
J702	P/O DC701	
J703	P/O DC701	
J704	Connector, Receptacle, Male 24/C	MS3102A24-28P
J705	Not Used	
J706	Connector, Receptacle, Female 4/C	MS3102A14S-2S
L701	Coil, RF, Fixed	CL178
L702	Coil, RF, Fixed	CL100-5
L703	Coil, Filament	CL444
L704	Coil, RF, Fixed	CL166
L705	Same as L704	
L706	Coil, RF, Fixed	CL442
L707	Coil, Output Assembly	CL443
L708	Coil, RF, Fixed	CL240-120
L709	Same as L708	
L710	Not Used	
L711	Same as L701	

## AX5170

## POWER AMPLIFIER SECTION (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P701 P702 P703 P704	Connector, Plug, RF Same as P701 Plug, Tip Connector, Plug, Male 4/C	PL254  PL163-2 MS3106A14S-2P
R701 R702 R703	Resistor, Fixed, Composition Resistor, Fixed, Composition (Ref Note 2) Resistor, Fixed, Composition (Ref Note 2)	RC42GF471J RC32GF221J RC32GF471J
S701	Thermo Switch	SS104-2
T701	Transformer, RF (Ref Note 2)	TZ229
TB701 TB702 TB703	Terminal Strip Barrier Terminal Strip Barrier Terminal Strip Barrier	TM102-2 TM102-4 TM102-8
V701	Tube Electron	4CX10,000J
XA701 XA702 XA703 XA704 XA705 XA706 XA707	Connector, Receptacle, Female, PC Connector, Receptacle, Electrical PC Same as XA701 Not Used Connector, Receptacle, Electrical PC Not Used Socket, EI Tube	JJ287-20 JJ293-15DFE  JJ319-22DFE  TS101-P01
XF701	Fuse Holder, Indicator	FH104-3
XV701 XV701	Tube Socket Assembly (Ref Note 2) Tube Socket Assembly (Ref Note 3)	AX743-1 AX743-2

## A701

## PA SENSE BOARD (A-4835)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A701C1	Capacitor, Fixed, Mica	CM111C100J5S
A701C2	Capacitor, Fixed, Mica	CM111C180J5S
A701C3 thru A701C15	Capacitor, Fixed, Ceramic	CC100-28
A701CR1	Semiconductor, Device, Diode	1N3022B
A701E1 thru A701E4	Terminal, Stud	TE127-2
A701L1	Coil, RF, Fixed	CL240-120
A701L2	Choke, RF	CL105-2
A701L3	Same as A701L1	
A701R1	Resistor, Fixed, WW	RR114-50W
A701R2	Same as A701R1	
A701R3	Resistor, Fixed, Composition	RC42GF222J
A701R4	Resistor, Fixed, Composition	RC20GF123J
A701R5	Resistor, Fixed, Composition	RC20GF103J
A701R6	Resistor, Fixed, Composition	RC20GF223J
A701R7	Resistor, Fixed, Composition	RC20GF474J
A701R8	Same as A701R5	
A701R9	Resistor, Fixed, Precision	RN65D4751F
A701R10	Same as R701R9	
A701R11	Resistor, Fixed, Composition	RC42GF223J
A701R12	Same as A701R7	
A701R13	Resistor, Fixed, Composition	RC20GF471J
A701R14	Same as A701R5	
A701R15	Resistor, Fixed, Composition (Ref Note 5)	RC20GF473J
A701V1	Tube, Elec	5726
A701V2	Same as A701V1	
A701XV1	Socket, E1 Tube	TS160-1
A701XV2	Same as A701XV1	

## A702

## TUNE CAPACITOR ASSEMBLY (AX5171)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A702A1	Tune, Capacitor Control Board (Ref Notes 1, 2)	A-4830
A702B1	Motor (Ref Note 2)	M0140
A702C1	Capacitor, Variable, Vacuum	CB176
A702J1	Connector, Receptacle, Female (Ref Note 2)	JJ310-2
A702P1	Connector, Plug, Male (Ref Note 2)	JJ313-2H
A702S1 A702S2	Switch, Sensing (Ref Note 2) Same as A702S1	SW353-3

## A702A1

## TUNE CAPACITOR CONTROL BOARD (A-4830)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A702A1C1 thru A702A1C20	Capacitor, Fixed, Ceramic	CC100-16
A702A1E1 thru A702A1E17	Terminal, Stud	TE127-3
A702A1K1	Relay, Armature 4 PDT	RL156-8
A702A1L1 thru A702A1L13	Coil, RF, Fixed	CL240-120
A702A1XK1	Socket, Relay with retainer	TS171-4

## A703

## LOAD CAPACITOR ASSEMBLY (AX5172)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A703A1	Load Motor Assembly (Ref Notes 1, 2)	A-4831
A703A2	Network, Discriminator (Ref Note 2)	AZ117
A703B1	Motor (Ref Note 2)	M0139
A703C1	Capacitor, Variable, Vacuum	CB147
A703C2	Capacitor, Fixed, Metalized (Ref Note 2)	CP121-25M150T
A703C3	Capacitor, Fixed, Ceramic (Ref Note 2)	CC100-28
A703C4	Same as A703C3	
A703C5	Same as A703C3	
A703F1	Fuse, Cartridge (Ref Note 2)	FU102-.2
A703F2	Fuse, Cartridge (Ref Note 2)	FU102-.062
A703J1	Connector, Receptacle, Male (Ref Note 2)	JJ313-1
A703P1	Connector, Plug, Female (Ref Note 2)	JJ310-1H
A703S1	Switch, Sensing (Ref Note 2)	SW353-3
A703S2	Same as A703S1	
A703T1	Transformer, Power Step-Down (Ref Note 2)	TF245
A703XA1	Connector, Receptacle, Female (Ref Note 2)	JJ293-15DFE
A703XF1	Fuseholder, Ind (Ref Note 2)	FH104-3
A703XF2	Fuseholder, Ind (Ref Note 2)	FH104-11



## A703A1

## LOAD MOTOR ASSEMBLY (A-4831)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A703A1C1 thru A703A1C3	Capacitor, Fixed, Ceramic	CC100-16
* A703A1C4 A703A1C5 A703A1C6 thru A703A1C18 A703A1C19	Capacitor, Fixed, Metalized Capacitor, Fixed, Electrolytic Same as A703A1C1  Same as A703A1C5	CN114-1R0-4J CE105-75-50
A703A1CR1 A703A1CR2 A703A1CR3	Semiconductor, Device, Diode Rectifier, Semiconductor, Device Semiconductor, Device, Diode	1N3029 DD130-100-1.5 1N3070
A703A1K1 A703A1K2	Relay, Armature 4 PDT Relay, Armature DPDT	RL156-8 RL156-1
A703A1L1 thru A703A1L4	Coil, RF, Fixed	CL240-120
A703A1R1	Resistor, Fixed, Composition	RC32GF181J
A703A1XK1 A703A1XK2	Socket, Relay with retainer Socket, Relay with retainer	TS171-4 TS171-5
* Additional capacitor may be required according to manufactures specification.		

## A704

## BANDSWITCH ASSEMBLY (AS163)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A704A1	Switch Assembly Control (Ref Note 1)	AX5103
A704B1	Motor	M0129
A704C1 A704C1 thru A704C4	Capacitor, Fixed, Ceramic (Ref Note 3) Capacitor, Fixed, Ceramic (Ref Note 2)	CC109-31 CC109-31
A704E1 thru A704E8	Contact Assembly	A-1701
A704E9	Contact Assembly	AX573
A704E10	Same as A704E9	
A704E11	Contact Wiper	PM1176
A704E12	Contact Assembly	A-1700-2
A704E13	Contact Shorting	MS5613
A704E14A	Contact Switch	MS1601-4
A704E14B	Contact Switch	MS1601-5
A704E15	Contact Rotor	PM1430
A704E16A	Same as A704E14A	
A704E16B	Same as A704E14B	
A704E17 thru A704E21 A704E22 A704E23	Contact Assembly  Same as A704E12 Same as A704E17	A1701-2
A704L1	Coil, RF, HF	CL441
A704L2	Coil, Main Tank	CL445
A704L3	Coil Assembly	CL440
A704P1	Connector, Plug, Male	MS3106A14S-7P

## A704A1

## CONTACT SWITCH ASSEMBLY (AX5103)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A704A1C1	Capacitor, Fixed, Ceramic	CX119-104M
A704A1CR1 A704A1CR2	Semiconductor, Device, Diode Same as A704A1CR1	1N645
A704A1J1 A704A1J2 A704A1J3	Connector, Receptacle, Female Connector, Receptacle, Male Connector, Receptacle, Female 3/C	JJ200-9 JJ200-10 MS3102A14S-7S
A704A1K1	Relay, Armature	RL168-3C10-24DC
A704A1R1 A704A1R2 A704A1R3 A704A1R4	Resistor, Fixed, Composition (Ref Note 5) Same as A704A1R1 Resistor, Fixed, Composition (Ref Note 5) Same as A704A1R3	RC20GF102J RC20GF152J
A704A1S1	Switch, Rotary	SW526
A704A1W1	Wiring Harness Branched	CA1494
A704A1XK1	Socket, Relay	TS100-6

## A705

## REMOTE POWER ASSEMBLY (AX5173)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A705A1 A705A1	Power Output Control (Ref Notes 1, 2) Power Output Control (Ref Notes 1, 3)	A-4805 A-4805-2
A705F1	Fuse, Cartridge (Ref Note 2)	FU102-2
A705S1	Switch, Rotary Ledex (Ref Note 2)	SW530
A705XF1	Fuse Holder, Indicator (Ref Note 2)	FH104-11

## A705A1

## POWER OUTPUT CONTROL (A-4805)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A705A1CR1 thru A705A1CR4	Semiconductor, Device, Diode	1N914
A705A1CR5 A705A1CR6 thru A705A1CR8	Semiconductor, Device, Diode Same as A705A1CR1	1N538
A705A1DS1 A705A1DS2	Lamp, Incandescent Same as A705A1DS1	B1101-1820
A705A1E1 thru A705A1E34 A705A1E35 A705A1E36 thru A705A1E38	Terminal, Stud  Not Used Same as A705A1E1	TE127-8
A705A1K1 A705A1K2	Relay, Armature, 4PDT Relay, Armature, 6PDT	RL156-8 RL156-5
A705A1R1 thru A705A1R4 A705A1R5 A705A1R6 A705A1R7 thru A705A1R15 A705A1R16	Resistor, Variable, Wirewound  Resistor, Fixed, Composition Resistor, Variable, Wirewound Same as A705A1R1	RV119-1-502C  RC20GF563J RV119-1-503C
A705A1R15 A705A1R16	Resistor, Fixed, Composition	RC20GF102J
A705A1XDS1 A705A1XDS2	Lampholder Same as A705A1XDS1	TS107-2
A705A1XK1 A705A1XK2	Socket, Relay with retainer Socket, Relay with retainer	TS171-4 TS171-6

## A705A1

## POWER OUTPUT CONTROL (A-4805-2)

(Ref Note 3)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A705A1DS1 A705A1DS2	Lamp, Incandescent Same as A705A1DS1	B1101-1820
A705A1E1 thru A705A1E34 A705A1E35 A705A1E36 thru A705A1E38	Terminal, Stud  Not Used Same as A705A1E1	TE127-8
A705A1K1 A705A1K2	Not Used Relay, Armature	RL156-5
A705AIR1 thru A705AIR7 A705AIR8	Not Used  Resistor, Variable, Wirewound	RV119-1-502C
A705A1XDS1 A705A1XDS2	Lampholder Same as A705A1XDS1	TS107-2
A705A1XK1 A705A1XK2	Not Used Socket, Relay with retainer	TS171-6

## A706

## HARMONIC FILTER ASSEMBLY (AF110)

(Ref Note 4)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A706C1	Capacitor, Fixed, Ceramic	CC109-28
A706C2	Capacitor, Fixed, Ceramic	CC109-13
A706C3	Same as A706C1	
A706C4	Same as A706C2	
A706C5	Same as A706C1	
thru		
A706C8		
A706C9	Same as A706C2	
A706C10	Same as A706C1	
thru		
A706C13		
A706C14	Same as A706C2	
A706C15	Same as A706C2	
A706C16	Same as A706C1	
A706C17	Capacitor, Fixed, Ceramic	CC109-5
A706C18	Capacitor, Fixed, Ceramic	CC109-19
A706C19	Same as A706C1	
A706J1	Jack, Tip	JJ114-2
A706L1	Coil, RF	CL449-3
A706L2	Coil, RF	CL449-1
A706L3	Coil, RF	CL449-2
A706L4	Same as A706L3	
A706L5	Same as A706L2	
A706L6	Same as A706L1	

## A707

## ALDC ASSEMBLY (A-4856)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A707A1	ALDC Can Assembly (Ref Note 1)	A-4855
A707R1	Resistor, Fixed, Composition	RC20GF221J
A707R2	Resistor, Fixed, Composition	RC07GF474J
A707R3	Resistor, Fixed, Composition	RC07GF101J
A707R4	Resistor, Fixed, Composition	RC07GF682J
A707R5	Same as A707R1	
A707R6	Resistor, Fixed, Composition	RC07GF471J
A707R7	Refer to A707A1 List	
thru		
A707R29		
A707R30	Resistor, Fixed, Composition	RC07GF682J

## A707A1

## ALDC CAN ASSEMBLY (A-4855)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A707A1C1	Capacitor, Fixed, Electrolytic	CE121-100-20
A707A1C2	Not Used	
A707A1C3	Capacitor, Fixed, Ceramic	CC10026-14
A707A1C4	Not Used	
A707A1C5	Same as A707A1C1	
A707A1C6	Not Used	
thru		
A707A1C8		
A707A1C9	Capacitor, Fixed, Ceramic	CC100-9
A707A1C10	Capacitor, Fixed, Mica	CM110C030J1S
A707A1C11	Not Used	
A707A1C12	Same as A707A1C9	
A707A1C13	Same as A707A1C10	
A707A1C14	Capacitor, Fixed, Ceramic	CC10026-19
A707A1CR1	Semiconductor, Device, Diode	1N100
A707A1CR2	Semiconductor, Device, Diode	1N756
A707A1CR3	Same as A707A1CR2	
A707AIR1	Refer to A707 list	
thru		
A707AIR6		
A707AIR7	Not Used	
A707AIR8	Resistor, Fixed, Composition	RC07GF471J
A707AIR9	Resistor, Fixed, Composition	RC07GF153J
A707AIR10	Resistor, Fixed, Composition	RC07GF221J
A707AIR11	Resistor, Fixed, Composition	RC07GF224J
A707AIR12	Same as A707AIR8	
A707AIR13	Resistor, Fixed, Composition	RC07GF104J
A707AIR14	Resistor, Fixed, Composition	RC07GF102J
A707AIR15	Resistor, Fixed, Composition	RC07GF273J
A707AIR16	Resistor, Fixed, Composition	RC07GF152J
A707AIR17	Resistor, Fixed, Composition	RC07GF333J
A707AIR18	Resistor, Variable	RV119-9-502
A707AIR19	Same as A707AIR9	
A707AIR20	Resistor, Fixed, Composition	RC07GF562J
A707AIR21	Resistor, Fixed, Composition	RC07GF103J
A707AIR22	Same as A707AIR14	
A707AIR23	Same as A707AIR9	
A707AIR24	Same as A707AIR18	
A707AIR25	Same as A707AIR17	
A707AIR26	Same as A707AIR16	
A707AIR27	Resistor, Fixed, Composition	RC07GF183J
A707AIR28	Resistor, Fixed, Composition	RC07GF472J
A707AIR29	Same as A707AIR14	
A707AIZ1	Operational Amplifier	NW156
A707AIZ2	Same as A707AIZ1	

## A708

## ALDC PRINTED CIRCUIT BOARD ASSEMBLY (A-4850-3)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A708C1 A708C2 A708C3	Capacitor, Fixed, Ceramic Same as A708C1	CX119-104M
A708C3	Capacitor, Fixed, Electrolytic	CE105-4-50
A708CR1	Semiconductor, Device, Diode	1N100
A708E1 thru A708E3	Terminal, Stud	TE127-2
A708R1 A708R2	Resistor, Fixed, Composition Resistor, Fixed, Composition	RC20GF472J RC20GF102J



AP153

POWER SUPPLY

SYMBOL SEREIS 800

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A801	Shorting Relay Assembly (Ref Note 1)	AX5096
B801	Fan, Centrifugal, 3 Phase	BL145
C801	Capacitor, Fixed, Paper	CP103
C802	Capacitor, Fixed, Plastic	CX113-2
C803	Capacitor, Fixed, Paper	CP105
C804	Same as C803	
C805	Capacitor, Fixed, Ceramic	CC109-38
thru		
C807		
CR801A	Semiconductor, Device, Diode	1N2846A
thru		
CR801H		
CR802A	Rectifier, Semiconductor, Device	DD128-3
thru		
CR802F		
CR803	Rectifier, Semiconductor, Device	DD129
CR804	Same as CR803	
CR805	Rectifier, Semiconductor, Device	DD147
CR806	Semiconductor, Device, Diode	1N3022B
CR807A	Semiconductor, Device, Diode	1N2846A
CR807B	Same as CR807A	
E801	Screw, Machine	SCBP0832BN10
thru		
E804		
E805	Screw, Machine, H.H.	SCHH3118BN24
thru		
E807		
E808	Screw, Machine, H.H.	SCHH2520BN24
E809	Contact Kit, Single	PO183
thru		
E811		
E812	Terminal Turret	TE102-2
E813	Same as E812	
E814	Same as E801	
E815	Not Used	
E816	Contact, RF	A-1654-2
E817	Same as E816	
K801	Relay Solenoid 3 Phase	RL130-3
K802	Relay Armature	RL184-1
L801	Reactor, .8h	TF5035
L802	Reactor, 5h	TF5034

API53

POWER SUPPLY (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L803 L804	Reactor, 7h Coil, Fixed, RF	TF5013 CL178
M801	Timer Interval	TI105-1
P801	Connector, Plug, HN	PL253-1
R801 R802 R803 R804	Resistor, Fixed, Wirewound Resistor, Fixed, Wirewound Resistor, Fixed, Wirewound Resistor, Fixed, Wirewound	RW118F252 RW118F502 RW118F310 RW116-603B
thru R807		
R808	Resistor, Fixed, Wirewound	RW109-42
R809	Resistor, Fixed, Wirewound	RW105-29
R810	Same as R809	
R811	Resistor, Fixed, Wirewound	RW110-7
R812	Same as R811	
R813	Resistor, Fixed, Wirewound	RW110-3
R814	Resistor, Fixed, Composition	RC42GF331J
R815	Resistor, Fixed, Composition	RC42GF102J
R816	Same as R814	
R817	Resistor, Fixed, Wirewound	RW116-202B
R818	Resistor, Fixed, Wirewound	RW110-43
R819	Resistor, Fixed, Composition	RC42GF101J
R820	Same as R819	
R821	Same as R818	
R822	Same as R819	
thru R831		
R832	Same as R811	
R833 thru R838	Resistor, Fixed, Wirewound	RW109-7
S801	Micro-switch, Low torque	SW252
T801	Transformer, Power, Step-Up	TF203
T802	Transformer, Power, Step-Up	TF386
T803	Transformer, Power, Step-Up	TF384
T804	Transformer, Power, Step-Down	TF421
XK801	Not Used	
XK802	Socket, Relay	TS196-1

## A801

## Shorting Relay Assembly (AX5096)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A801E1 thru A801E4	Nut, Cap	NTC2520BN6
A801E5 thru A801E8	Nut, Round	NT159
A801L1	Solenoid, Elec	SZ100-60
A801S1	Switch, Sensing, SPDT	SW260
A801TB1	Terminal, Board Barrier	TM102-5
A801W1 A801W2 thru A801W5	Cable, Shorting Assembly Cable, Jumper Assembly	CA1504 CA409-45-2.37
A801W6 A801W7	Cable, Jumper Assembly Same as A801W6	CA409-69-4.00

AX5164

MAIN FRAME SUB ASSEMBLY

SYMBOL SERIES 900

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
E901 E902	Terminal, Strip Finger Same as E901	TM105-5AR
P901	Not Used	
P902	Not Used	
P903	Connector, Plug, Female, 24/C	MS3106B24-28S
P904	Connector, Plug, Female, 27/C	PL212-10
P905	Connector, Plug, Male, 37/C	PL212-9
P906	Connector, Plug, Female, 52/C	MS3106B32-414S
P907	Connector, Plug, Male, 52/C	MS3106B32-414P
P908	Connector, Plug, Male, 1/C	MS3106B18-16P
P909	Connector, Plug, Female, 1/C	MS3106B18-16S
P910	Connector, Plug, BNC	PL244-1
P911	Same as P910	
P912	Connector, Plug, Female, 52/C	MS3108B32-414S
P913	Same as P904	
P914	Same as P910	
S901	Switch, Interlock	SW230
thru		
S906		
S907	Switch, Roller	SW260
TB901	Terminal, Strip Barrier	TM102-4
TB902	Terminal, Strip Barrier	TM102-8
TB903	Same as TB902	
TB904	Terminal, Strip Barrier	TM102-14
TB905	Terminal, Strip Barrier	TM102-7

## A1000

IPA DRAWER (AX5167)

SYMBOL SERIES 1000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1001	Tune Capacitor Assembly (Ref Notes 1, 2)	BMA433
A1001	Tune Capacitor Assembly (Ref Notes 1, 3)	BMA433-2
A1002	Bandswitch Assembly (Ref Note 1)	AS146
A1003	IPA Servo Amplifier (Ref Note 2)	AZ119
A1004	PA Servo Amplifier (Ref Note 2)	AZ120
A1005	Drive-Up Assembly (Ref Notes 1, 2)	BMA503
A1006	Plate Meter Assembly (Ref Note 1)	A-4801
A1007	Bias Control Assembly (Ref Notes 1, 2)	A-4833
A1007	Bias Control Assembly (Ref Notes 1, 3)	A-4833-2
A1008	IPA Sense Assembly (Ref Notes 1, 2)	A-4807
C1001	Capacitor, Fixed, Ceramic	CC109-6
E1001	Button Contact	PM1332
F1001	Fuse, Cartridge	FU102-2
F1002	Fuse, Cartridge	FU102-.1
F1003	Fuse, Cartridge	FU102-8
F1004	Fuse, Cartridge	FU102-5
J1001	Connector, Receptacle, Male 52/C	MS3102A32-414P
J1002	Connector, Receptacle, Female 52/C	MS3102A32-414S
J1003	Connector, Receptacle, Female 1/C	MS3102A18-16S
J1004	Connector, Receptacle, Male	MS3102A18-16P
J1005	Adapter, Connector, RF	UG492/U
J1006	Same as J1005	
J1007	Connector, Receptacle, RF	UG560/U
L1001	Transformer, Output Matching	TR192
M1001	Meter	MR216-1
P1001	Connector, Plug, BNC	PL244-1
S1001	Switch Lever	SW523-3
XA1001	Connector, Receptacle, Female	JJ287-20
XA1002	Connector, Receptacle, Female 25/C	JJ310-2F
XA1003	Connector, Receptacle, Female 37/C	JJ310-5F
XA1004	Same as XA1003	
XA1005	Connector, Receptacle, Female 15/C	JJ310-1
XF1001	Fuseholder, Indicator	FH104-3
XF1002	Same as XF1001	
XF1003	Fuseholder, Indicator	FH104-11
XF1004	Same as XF1003	

## A1001

## TUNE CAPACITOR ASSEMBLY (BMA433-2)

(Ref Note 3)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1001C1 A1001C2 thru A1001C5	Capacitor, Variable, Air Capacitor, Fixed, Ceramic	CB175 CC109-38

## A1001

## TUNE CAPACITOR ASSEMBLY (BMA433)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1001A1	Printed Circuit Board Assembly (Ref Note 1)	A-4832
A1001B1	Motor	M0127
A1001C1 A1001C2 thru A1001C5	Capacitor, Variable, Air Capacitor, Fixed, Ceramic	CB175-2 CC109-38
A1001S1 A1001S2	Switch Same as A1001S1	SW353-2
A1001W1	Cable, Tune Capacitor	CA1521

## A1001A1

## PRINTED CIRCUIT BOARD ASSEMBLY (A-4832)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1001A1C1 thru A1001A1C12	Capacitor, Fixed, Ceramic	CC100-16
A1001A1E1 thru A1001A1E12	Terminal, Stud	TE127-3

## A1002

## BANDSWITCH ASSEMBLY (AS146)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1002C1 thru A1002C6	Capacitor, Fixed, Ceramic	CC109-38
A1002C7	Capacitor, Fixed, Ceramic	CC109-19
A1002C8	Capacitor, Fixed, Ceramic	CC116-9
A1002C9	Same as A1002C8	
A1002C10	Capacitor, Fixed, Ceramic	CC116-8
A1002C11	Same as A1002C10	
A1002CR1	Semiconductor, Device, Diode	1N547
A1002E1	Terminal, Stud, Insulated	TE102-2
A1002E2	Same as A1002E1	
A1002E3	Contact, Leaf, Spring	PM1210-4
thru A1002E5		
A1002E6	Contact Wiper	PM1415
A1002E7	Same as A1002E3	
thru A1002E20		
A1002E21	Contact, Leaf, Spring	PM1210-5
A1002E22	Same as A1002E3	
A1002E23	Same as A1002E3	
A1002J1	Connector, Receptacle, Male	JJ313-2F
A1002K1	Relay, Armature DPDT	RL168-2C10-24DC
A1002L1	Coil, RF	CL447
A1002L2	Coil, Main Tank	CL446
A1002L3	Coil	CL292
A1002R1	Resistor, Fixed, Composition (Ref Note 2)	RC20GF472J
A1002R2	Resistor, Fixed, Composition (Ref Note 2)	RC20GF103J
A1002R3	Resistor, Fixed, Composition (Ref Note 2)	RC20GF392J
A1002S1A	Wafer, IPA	PX1083
A1002S1B	Wafer, Output	PX1082
A1002S2	Switch, Ledex	SW429
A1002W1	Cable, Ledex Assembly	CA1522
A1002XK1	Socket, Relay	TS100-3

## A1005

## DRIVE-UP ASSEMBLY (BMA503)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1005A1	Drive-Up Control	AZ117
A1005C1 thru A1005C3 A1005C4	Capacitor, Fixed, Ceramic	CC100-28
A1005C4	Capacitor, Fixed, Electrolytic	CE105-200-25
A1005CR1	Semiconductor, Device, Diode	1N645

## A1006

## PLATE METER ASSEMBLY (A-4801)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1006C1 A1006C2 thru A1006C4	Capacitor, Fixed, Electrolytic Capacitor, Fixed, Ceramic	CE105-50-15 CC100-28
A1006CR1	Semiconductor, Device, Diode	1N2484
A1006DS1 A1006DS2	Lamp, Incandescent Same as A1006DS1	B1101-1820
A1006Q1	Transistor	2N1595
A1006R1 A1006R2 A1006R3 A1006R4	Resistor, Fixed, Composition Resistor, Fixed, Composition Resistor, Fixed, Composition Resistor, Fixed, Composition	RC20GF122J RC20GF121J RC20GF821J RC20GF332J
A1006XDS1 A1006XDS2	Lampholder Same as A1006XDS1	TS107-4



## A1007

## BIAS CONTROL ASSEMBLY (A-4833)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1007C1 thru A1007C4	Capacitor, Fixed, Mica	CX119-104M
A1007R1	Not Used	
A1007R2	Resistor, Fixed, Composition	RC42GF123J
A1007R3	Resistor, Fixed, Composition	RC42GF822J
A1007R4	Resistor, Variable, Composition	RV4NAYSA103AY
thru A1007R6		
A1007R7	Resistor, Fixed, Composition	RC42GF183J
A1007R8	Same as A1007R3	
A1007R9	Resistor, Fixed, Composition	RC42GF182J
A1007R10	Resistor, Variable, Composition	RV119-1-104B
A1007R11	Resistor, Variable, Composition	RV119-1-102C
A1007R12	Same as A1007R10	
A1007R13	Resistor, Variable, Composition	RV119-1-503B
A1007R14	Resistor, Fixed, Composition	RC20GF563J
thru A1007R16		
A1007TP1 thru A1007TP5	Terminal, Stud	TE127-10

## A1007

## BIAS CONTROL ASSEMBLY (A-4833-2)

(Ref Note 3)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1007R1	Not Used	
A1007R2	Resistor, Fixed, Composition	RC20GF123J
A1007R3	Resistor, Fixed, Composition	RC42GF822J
A1007R4	Resistor, Variable, Composition	RV4NAYSA103AY
thru A1007R6		
A1007R7	Resistor, Fixed, Composition	RC42GF183J
A1007R8	Same as A1007R3	
A1007R9	Resistor, Fixed, Composition	RC42GF182J

## A1007 (cont)

## BIAS CONTROL ASSEMBLY (A-4833-2)

(Ref Note 3)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1007R14 thru A1007R16	Resistor, Fixed, Composition	RC20GF563J
A1007TP1 thru A1007TP5	Terminal, Stud	TE127-10

## A1008

## IPA SENSE ASSEMBLY (A-4807)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A1008C1 thru A1008C5	Capacitor, Fixed, Ceramic	CC100-16
A1008CR1 thru A1008CR3 A1008CR4	Semiconductor, Device, Diode	1N3070
A1008L1	Transformer, Fixed	1N3022B
A1008R1	Resistor, Fixed, Composition	TR194
A1008R2	Resistor, Fixed, Composition	RC20GF103J
A1008R3	Same as A1008R2	RC42GF470J
A1008R4	Resistor, Fixed, Composition	RC20GF102J
A1008R5	Same as A1008R4	RC20GF222J
A1008R6	Resistor, Fixed, Composition	
A1008R7	Same as A1008R1	

## IPA DRAWER (AX5167)

## SYMBOL SERIES 1100

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1101	Capacitor, Fixed, Electrolytic	CE116-10VN
C1102	Same as C1101	
C1103	Capacitor, Fixed, Ceramic	CC100-28
C1104	Capacitor, Fixed, Electrolytic	CE51C800R
C1105	Same as C1104	
C1106	Capacitor, Fixed, Paper	CP41B1EF405K
C1107	Capacitor, Fixed, Ceramic	CC100-37
thru		
C1112		
C1113	Capacitor, Fixed, Ceramic (Ref Note 2)	CC100-28
thru		
C1117		
CR1101	Semiconductor, Device, Diode (Ref Note 2)	1N547
CR1102	Same as CR1101	
CR1103	Rectifier, Semiconductor, Device	DD146-2
CR1104	Semiconductor, Device, Diode	1N3321B
CR1105	Semiconductor, Device, Diode	1N2976B
CR1106	Rectifier, Semiconductor, Device	DD124
CR1107	Semiconductor, Device, Diode	1N2841R
thru		
CR1109		
E1101	Turret Terminal	TE102-2
thru		
E1107		
K1101	Relay, Armature 3PDT	RL168-3C10-24DC
L1101	Coil, Choke	TF5028
R1101	Resistor, Fixed, Wirewound 10W	RW109-2
R1102	Resistor, Fixed, Composition	RC42GF181J
R1103	Resistor, Fixed, Composition	RC20GF272J
R1104	Resistor, Fixed, Composition	RC42GF474J
R1105	Resistor, Fixed, Wirewound 10W	RW109-20
R1106	Resistor, Fixed, Wirewound 10W	RW109-14
R1107	Resistor, Fixed, Wirewound 10W	RW109-9
R1108	Same as R1104	
R1109	Resistor, Fixed, Composition	RC20GF102J
R1110	Resistor, Fixed, Composition	RC32GF223J
R1111	Resistor, Fixed, Wirewound 10W	RW109-30
S1101	Switch, Interlock	SW219
T1101	Transformer, Power	TF375

IPA DRAWER (AX5167)

SYMBOL SERIES 1100 (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
TB1101 TB1102	Not Used Terminal Board Barrier	TM102-6
XC1101 thru XC1103 XC1104 XC1105	Not Used  Socket, Capacitor Same as XC1104	TS100-3
XCR1101 thru XCR1106 XCR1107 thru XCR1109	Not Used  Socket, Semiconductor, Device	TS166-1
XK1101	Socket, Relay	TS100-6

IPA DRAWER (AX5167)

SYMBOL SERIES 1200

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1201 C1202 C1203 C1204 C1205 thru C1212 C1213 C1214 C1215 C1216 C1217 C1218 C1219 C1220 C1221	Not Used Capacitor, Fixed (Ref Note 2) Capacitor, Fixed, Ceramic Capacitor, Fixed, Ceramic Same as C1203  Capacitor, Fixed, Ceramic Same as C1203 Same as C1203 Same as C1213 Same as C1203 Capacitor, Fixed, Electrolytic Capacitor, Fixed, Ceramic (Ref Note 2) Same as C1219 Capacitor, Fixed, Ceramic (Ref Note 2)	CN114-1R0-4J CK70AW202M CK70AW102M  CC108-4P1000M  CE105-25-25 CC100-16 CC100-37

IPA DRAWER (AX5167)

SYMBOL SERIES 1200 (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR1201	Semiconductor, Device, Diode (Ref Note 2)	1N547
CR1202	Semiconductor, Device, Diode (Ref Note 2)	1N3022B
CR1203	Semiconductor, Device, Diode (Ref Note 2)	1N34A
E1201	Turret Terminal	TE102-2
E1202	Same as E1201	
E1203	Bushing, Slot Head	TE101-3
E1204	Same as E1203	
E1205	Same as E1201	
E1206	Turret Terminal (Ref Note 2)	TE102-2
E1207	Same as E1201	
E1208	Same as E1206	
E1209	Same as E1206	
E1210	Same as E1201	
K1201	Relay, Armature (Ref Note 2)	RL156-1
R1201	Resistor, Fixed, Wirewound 5W (Ref Note 2)	RW107-28
R1202	Resistor, Fixed, Composition	RR114-5W
R1203	Same as R1202	
R1204	Resistor, Fixed, Wirewound 25W	RW111-5
R1205	Resistor, Fixed, Composition	RC42GF100J
R1206	Resistor, Fixed, Composition (Ref Note 2)	RC42GF391J
R1207	Resistor, Fixed, Wirewound 20W	RW110-1
R1208	Resistor, Fixed, Composition (Ref Note 2)	RC20GF471J
R1209	Resistor, Fixed, Composition (Ref Note 2)	RC20GF223J
R1210	Resistor, Fixed, Composition (Ref Note 2)	RC20GF103J
R1211	Same as R1202	
S1201	Switch, Interlock	SW219
XK1201	Socket, Relay	TS171-1

IPA DRAWER (AX5167)

SYMBOL SERIES 1300

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B1301	Motor, RF Gain (Ref Note 2)	M0136-5-UH-F
C1301	Capacitor, Fixed, Ceramic	CC100-35
C1302	Capacitor, Fixed, Ceramic	CC100-44
C1303	Capacitor, Fixed, Ceramic	CC100-43
C1304	Same as C1302	
C1305	Capacitor, Fixed, Ceramic	CC100-32
thru		
C1307		
C1308	Capacitor, Fixed, Ceramic	CC100-31
C1309	Capacitor, Fixed, Mica	CM111E220J5S
C1310	Capacitor, Fixed, Mica	CM112F222F3S
C1311	Capacitor, Fixed, Ceramic	CC100-37
thru		
C1313		
C1314	Same as C1302-	
I315	Capacitor, Fixed, Ceramic	CC100-23
C1316	Same as C1315	
C1317	Capacitor, Fixed, Mica	CM50B222G03
C1318	Capacitor, Fixed, Ceramic	CC100-38
E1301	Terminal, Teflon	TE169-1
thru		
E1304		
E1305	Turret Terminal	TE102-2
thru		
E1317		
L1301	Coil, RF	CL101-2
L1302	Coil, RF	CL140-2
L1303	Coil, RF	CL460
L1304	Same as L1302	
thru		
L1306		
L1307	Inductor, Fixed	CL459
L1308	Coil, RF	CL178
R1301	Resistor, Variable, Composition	RV4NAYSK500A
R1302	Resistor, Fixed, Composition	RC20GF102J
R1303	Resistor, Variable, Composition	RV106UX8B252A
R1304	Resistor, Fixed, Composition	RC20GF271J
R1305	Resistor, Fixed, Composition	RC32GF100J
R1306	Resistor, Fixed, Composition	RC42GF120J
R1307	Resistor, Fixed, Composition	RC42GF222J
R1308	Resistor, Fixed, Composition	RC42GF183J
R1309	Resistor, Fixed, Wirewound 10W	RW109-28

IPA DRAWER (AX5167)

SYMBOL SERIES 1300 (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R1310	Resistor, Fixed, Composition	RC20GF333J
R1311	Resistor, Fixed, Composition	RC42GF331J
R1312	Resistor, Fixed, Composition	RC42GF472J
R1313	Resistor, Fixed, Composition	RC42GF154J
R1314	Same as R1313	
S1301	Switch Limit (Ref Note 2)	SW353-2
S1302	Same as S1301	
V1301	Tube, Electron	8233
V1302	Tube, Electron	4CX350A
XV1301	Socket, Tube Electron	TS198
XV1302	Socket, Tube Electron	TS197
Z1301	Parasitic Suppressor	A-1546-2
Z1302	Parasitic Suppressor	A-1546-4

IPA DRAWER (AX5167)

SYMBOL SERIES 1400

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B1401	Blower, Centrifugal	BL126
C1401	Not Used	
C1402	Capacitor, Fixed, Ceramic	CC100-37
C1403	Same as C1402	
C1404	Capacitor, Fixed, Mica	CM112F562J5S
C1405	Capacitor, Fixed, Mica	CM35F103F03
C1406	Same as C1405	
C1407	Capacitor, Fixed, Ceramic	CC100-32
C1408	Not Used	
C1409	Same as C1407	
C1410	Capacitor, Fixed, Ceramic	CC109-36
C1411		
C1412		
C1413		
C1414	Capacitor, Fixed, Ceramic	CC109-38
C1415	Capacitor, Fixed, Ceramic (Ref Note 2)	CC108-4P1000M
C1416	Capacitor, Fixed, Ceramic (Ref Note 2)	CC109-6
C1417		
C1418		
C1419	Same as C1415	

## IPA DRAWER (AX5167)

## SYMBOL SERIES 1400 (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C1420 C1421	Same as C1416 Same as C1416	
E1401 E1402	Insulator, Standoff Insulator, Standoff (Ref Note 3)	NS3W0108 NS3W0204
K1401	Relay, Armature	RL185-1
L1401	Transformer, Interstage	TR193
L1402	Not Used	
L1403	Coil, RF	CL140-6
L1404	Same as L1403	
L1405	Coil, RF	CL138
R1401	Resistor, Fixed, Composition	RR116-1400W
R1402	Not Used	
R1403	Same as R1401	
R1404	Resistor, Fixed, Composition	RR116-20W
R1405	Resistor, Fixed, Composition	RR114-5W
S1401	Switch, Air	SW252
V1401	Tube, Electron	8576/PL264J
XV1401	Socket, Tube, Electron	TS182



EXCITER DRAWER (AX5168)

SYMBOL SERIES 2000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A2001 A2002	Tuning Control Board (Ref Notes 1, 2) Channel Band Select (Ref Note 2)	A-4834 PC532
B2001	Fan, Vent	BL106-2
C2001 thru C2011	Capacitor, Fixed, Ceramic	CK70AW202M
C2012 C2103	Capacitor, Fixed, Ceramic (Ref Note 2) Same as C2012	CC100-28
E2001 thru E2003	Turret Terminal	TE102-2
E2004 thru E2006	Terminal Board Finger	TM105-6AL
E2007 E2008	Not Used Same as E2001	
J2001 J2002	Connector, Receptacle, Male 52/C Connector, Receptacle, Male 37/C	MS3102A32-414P JJ200-10-
J2003 J2004	Connector, BNC Same as J2003	JJ172
J2005	Jack Telephone	JJ116-10
K2001 K2002	Relay, Armature 3PDT (Ref Note 2) Same as K2001	RL168-3C10-24DC
K2003 K2004	Relay, Armature DPDT (Ref Note 2) Relay, Armature 3PDT	RL168-2C10-24DC RL168-3C10-24DC
K2005	Same as K2004	
L2001	Coil, RF	CL101-3
P2001 P2002	Connector, Plug, Female 24/C Connector, Plug, Female 3/C	MS3106B24-28S MS3106B16S-5S
P2003 thru P2005	Connector, Plug, BNC	PL244-1
R2001 R2002	Resistor, Fixed, Wirewound Same as R2001	RW110-21
S2001	Switch, Lever	SW186-3
TB2001	Terminal, Strip Barrier	TM102-4
XA2001	Connector, Receptacle, PC Board	JJ319-22DFE

EXCITER DRAWER (AX5168)

SYMBOL SERIES 2000 (cont)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XA2002	Same as XA2001	
XK2001	Socket, Relay	TS100-6
XK2002	Same as XK2001	
XK2003 thru XK2005	Socket, Relay	TS101-P01

A2001

TUNING CONTROL BOARD (A-4834)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A2001C1	Capacitor, Fixed, Electrolytic	CE105-150-75
A2001C2	Capacitor, Fixed, Electrolytic	CE105-100-25
A2001C3	Capacitor, Fixed, Electrolytic	CE116-10VN
A2001CR1	Semiconductor, Device, Diode	1N2484
A2001CR2	Same as A2001CR1	
A2001CR3	Network	NW179
A2001CR4	Same as A2001CR1	
A2001K1	Relay, Armature DPDT	RL156-1
A2001K2	Relay, Armature DPDT	RL156-9
A2001K3	Same as A2001K1	
A2001K4	Relay, Armature 4PDT	RL156-10
A2001K5	Same as A2001K4	
A2001K6	Relay, Armature 4PDT	RL156-8
A2001K7	Relay, Armature 4PDT	RL156-15
A2001Q1	Transistor	2N492A
A2001R1	Resistor, Fixed, Composition	RC20GF221J
A2001R2	Resistor, Fixed, Composition	RC32GF221J
A2001R3	Same as A2001R2	
A2001R4	Resistor, Variable, Composition	RV111U254A
A2001R5	Same as A2001R1	
A2001TP1	Terminal, Stud	TE127-2
A2001TP2	Same as A2001TP1	
A2001XK1 thru A2001XK3	Socket, Relay with retainer	TS171-5
A2001XK4 thru A2001XK7	Socket, Relay with retainer	TS171-4

MAIN POWER PANEL ASSEMBLY (AX5169)  
and  
INPUT CHASSIS ASSEMBLY (AX5101)

SYMBOL SERIES 3000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A3001 A3002	Exciter Input Assembly (Ref Note 1) Transmitter Input Assembly (Ref Note 1)	A-4809 A-4810
CB3001 CB3002A,B CB3002C	Circuit Breaker, 3PST Circuit Breaker, DPST Circuit, Breaker, SPST	SW448 SW527 SW525
DS3001	Generator, Audio Signal	BZ101-2
F3001 thru F3003 F3004 F3005 F3006 F3007 F3008	Fuse, Cartridge  Fuse, Cartridge Same as F3004 Fuse, Cartridge Same as F3004 Fuse, Cartridge	FU102-3  FU102-5 FU102-10 FU102-1
J3001 J3002 J3003 J3004	Connector, Receptacle, Female Connector, Receptacle, Male Connector, Receptacle, Male Connector, Receptacle, BNC	MS3102A32-7S MS3102A24-28S MS3102A32-7P JJ172
M3001 M3001 M3002 M3002	Indicator, Elapsed Time (50 cycle oper) Indicator, Elapsed Time (60 cycle oper) Indicator, Elapsed Time (50 cycle oper) Indicator, Elapse Time (60 cycle oper)	MR198-2 MR198-1 MR198-2 MR198-1
S3001 S3002	Switch, Toggle SPST Switch, Toggle DPST	ST103-5-62 ST103-24-62
XF3001 thru XF3008	Fuseholder, Indicator	FH104-3
W3001	Wiring Harness, Branched	CA1520

## A3001

## EXCITER INPUT ASSEMBLY (A-4809)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A3001C1 thru A3001C30	Capacitor, Fixed, Ceramic	CC100-42
A3001E1 thru A3001E80	Terminal, Stud	TE127-2
A3001L1 thru A3001L10	Coil, RF, Fixed	CL240-120

## A3002

## TRANSMITTER INPUT ASSEMBLY (A-4810)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A3002C1 thru A3002C17 A3002C18 A3002C19 thru A3002C34	Capacitor, Fixed, Ceramic  Not Used Same as A3002C1	CC100-42
A3002CR1 A3002CR2	Semiconductor, Device, Diode Same as A3002CR1	1N914
A3002E1 thru A3002E58 A3002E59 A3002E60 thru A3002E81	Terminal, Stud  Not Used Same as A3002E1  •	TE127-2
A3002L1 A3002L2 A3002L3	Coil, RF, Fixed Not Used Same as A3002L1	CL240-120

METER PANEL ASSEMBLY (AX5165)

SYMBOL SERIES 4000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A4001	Overload Board (Ref Note 1)	A-4800
A4002	Same as A4001	
A4003	VSWR Board (Ref Note 1)	A-4802
A4004	Network (Ref Note 2)	NW161
C4001	Capacitor, Fixed, Ceramic	CC100-28
C4002 thru C4005	Capacitor, Fixed, Ceramic (Ref Note 2)	CC100-28
E4001	Terminal Board, Lug (Ref Note 2)	TM117-1
M4001	Ammeter, Screen	MR215-2
M4002	Ammeter, Plate	MR215-1
M4003	Ammeter, Load Sense (Ref Note 2)	MR191-15
M4004	Ammeter, Reflected Power	MR214
M4005	Ammeter, Output Power	MR213
R4001	Resistor, Fixed, Composition (Ref Note 2)	RC20GF682J

A4001

OVERLOAD BOARD ASSEMBLY (A-4800)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A4001C1	Capacitor, Fixed, Electrolytic	CE105-50-15
A4001C2	Capacitor, Fixed, Ceramic	CC100-28
A4001C3	Same as A4001C2	
A4001CR1	Semiconductor, Device, Diode	1N2484
A4001DS1 thru A4001DS3	Lamp, Incandescent	BI101-1820
A4001E1 thru A4001E5	Terminal, Stud	TE127-3
A4001Q1	Transistor	2N1595
A4001R1	Resistor, Fixed, Composition	RC20GF121J
A4001R2	Resistor, Fixed, Composition	RC20GF122J
A4001R3	Resistor, Fixed, Composition	RC20GF102J
A4001XDS1 thru A4001XDS3	Lampholder	TS107-4

## A4003

## VSWR BOARD (A-4802)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A4003C1 A4003C2 thru A4003C12	Capacitor, Fixed, Electrolytic Capacitor, Fixed, Ceramic	CE105-50-15 CC100-28
A4003CR1 A4003CR2 A4003CR3 A4003CR4	Semiconductor, Device, Diode Same as A4003CR1 Semiconductor, Device, Diode Same as A4003CR3	1N2484 1N270
A4003DS1 thru A4003DS3	Lamp, Incandescent	B1101-1820
A4003E1 thru A4003E13	Terminal, Stud	TE127-3
A4003K1	Relay, Armature DPDT	RL156-9
A4003Q1	Transistor	2N1595
A4003R1 A4003R2 A4003R3	Resistor, Fixed, Composition Resistor, Fixed, Composition Resistor, Fixed, Composition	RC20GF121J RC20GF122J RC20GF102J
A4003XDS1 thru A4003XDS3	Lampholder	TS107-4
A4003XK1	Socket, Relay with retainer	TS171-5

MAIN CONTROL PANEL (AX5166)

SYMBOL SERIES 5000

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A5001 A5002	Band Indicator Assembly (Ref Note 1) Power Level Indicator Assembly (Ref Notes 1, 2)	A-4791 A-4806
C5001 thru C5006 C5007	Capacitor, Fixed, Ceramic  Capacitor, Fixed, Ceramic (Ref Note 2)	CC100-28  CC100-28
DS5001 thru DS5003 DS5004 DS5005 thru DS5014 DS5015 thru DS5018	Lamp, Incandescent  Lamp, Incandescent (Ref Note 2) Lamp, Incandescent  Lamp, Incandescent (Ref Note 2)	B1110-7  B1110-7 B1116-1-5  B1116-1-5
R5001 R5002	Resistor, Variable, Composition (Ref Note 3) Resistor, Fixed, Composition (Ref Note 3)	RV4NAYSA102A RC20GF102J
S5001 S5002 S5003 S5004 S5005 S5006 S5007 S5008	Switch, Push Switch, Toggle DPDT (Ref Note 2) Switch, Lever (Ref Note 2) Switch, Lever Same as S5003 Switch, Lever (Ref Note 2) Switch, Push (Ref Note 2) Switch, Interlock	SW522-1 ST103-24-62 SW523-3 SW523-1  SW523-2 SW522-2 SW230
XDS5001 XDS5002 XDS5003 XDS5004	Part of S5001 Light, Indicator Light, Indicator Part of S5007	TS153-13 TS153-8

## A5001

## BAND INDICATOR BOARD (A-4791)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A5001C1 thru A5001C10	Capacitor, Fixed, Ceramic	CC100-28
A5001E1 thru A5001E10	Terminal, Stud	TE127-2
A5001R1	Resistor, Fixed, Composition	RC42GF311J

## A5002

## POWER LEVEL INDICATOR ASSEMBLY (A-4806)

(Ref Note 2)

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
A5002C1 thru A5002C4	Capacitor, Fixed, Ceramic	CC100-28
A5002E1 thru A5002E5	Terminal, Stud	TE127-2
A5001R1	Resistor, Fixed, Composition	RC42GF331J



SECTION 7  
DRAWINGS

7-1. INTRODUCTION

This section contains the schematic diagrams for the main unit and all drawers of the HFLA-10K linear amplifier. In addition, this section contains component location drawings for all printed circuit board assemblies.

Table 7-1 lists the manufacturer's engineering drawing numbers for all figures. Each drawing number is followed by a revision letter under which this equipment was manufactured.

TABLE 7-1. TMC ENGINEERING DRAWINGS

Figure Number	TMC Drawing Number
7-1	CK1946B
7-2	CK1954D
7-3	CK1955Ø
7-4	CK1756B
7-5	CK1757A
7-6	CK1636B
7-7	CK1645C
7-8	CK1646E
7-9	CK1771A
7-10	CK1850D
7-11	A4835A
7-12	A4830A
7-13	A4831A
7-14	A4805B
7-15	A4855D
7-16	A4850-3B
7-17	A4832A
7-18	A4801A

TABLE 7-1. TMC ENGINEERING DRAWINGS (cont)

Figure Number	TMC Drawing Number
7-19	A4833D
7-20	A4807D
7-21	A4834B
7-22	A4809A
7-23	A4810A
7-24	A4800A
7-25	A4802A
7-26	A4791A
7-27	A4806A

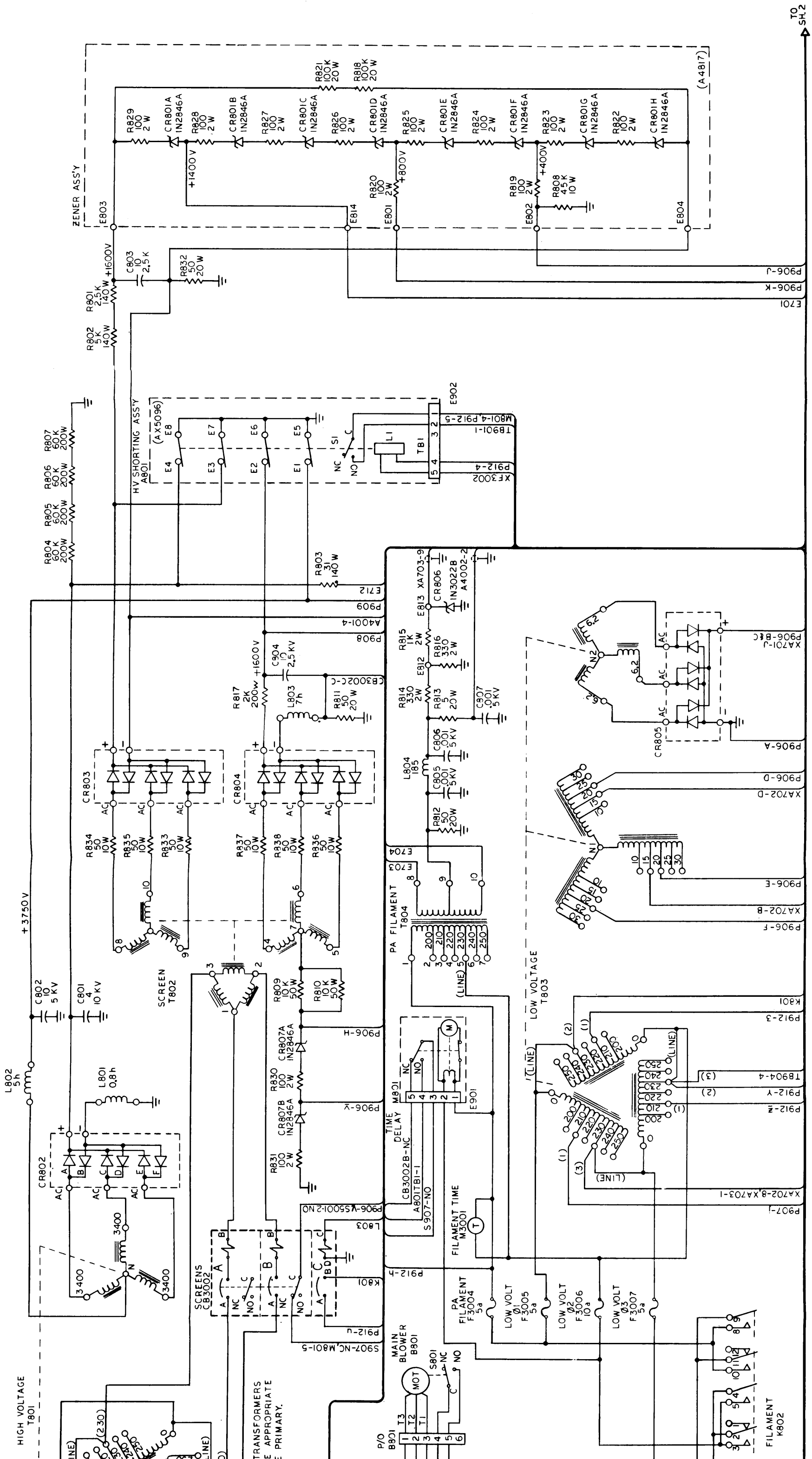
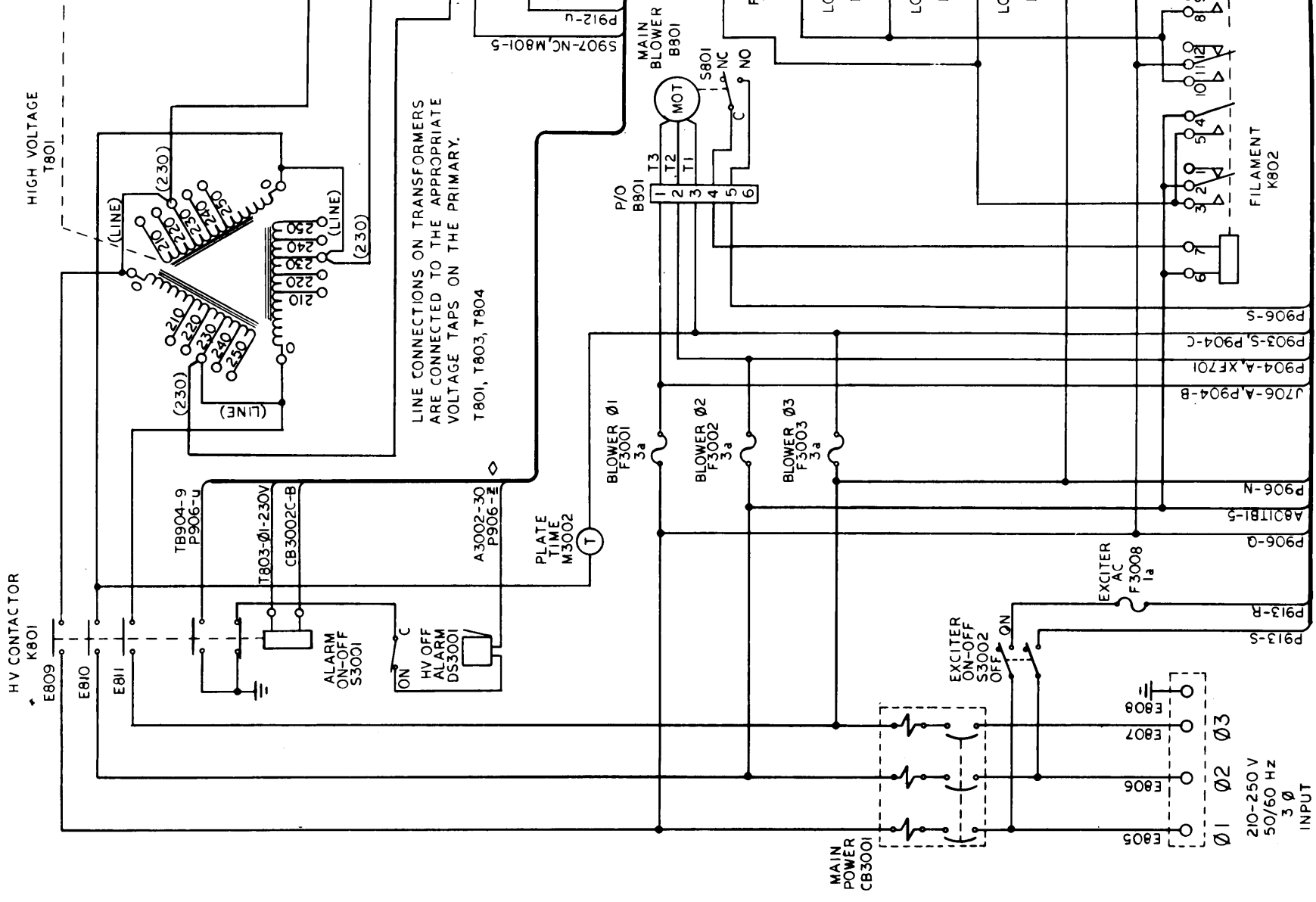
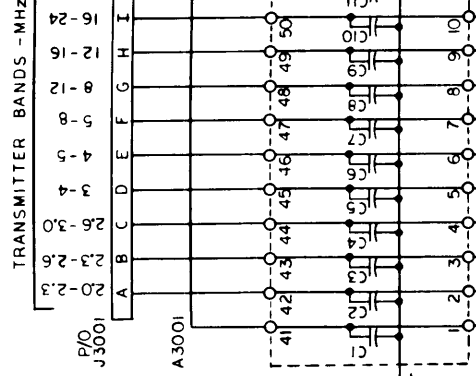


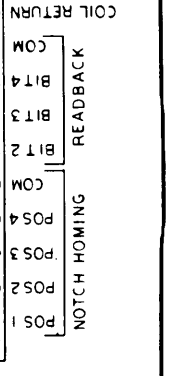
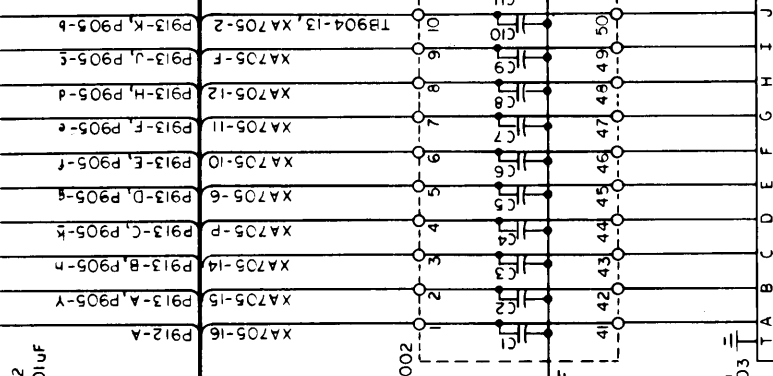
Figure 7-1. Schematic Diagram, HFL( )-1 0K  
(Sheet 1 of 5)







ON A3001 & A3002  
ALL CAPS ARE .01uF  
ALL INDUCTORS  
ARE 120 uH

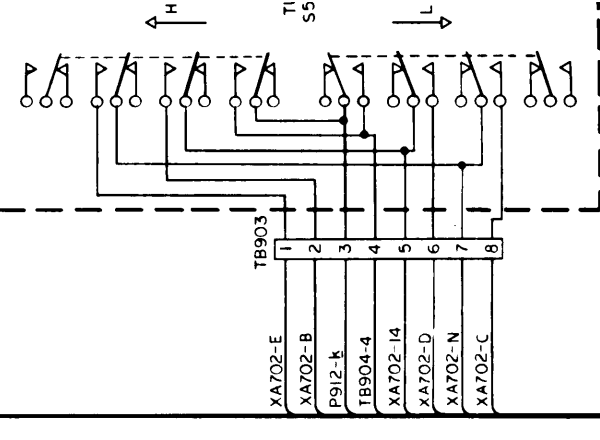
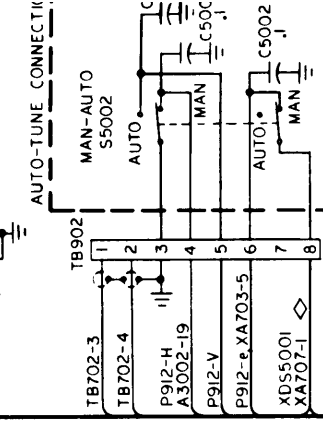
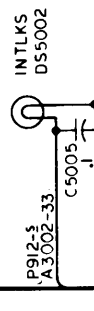
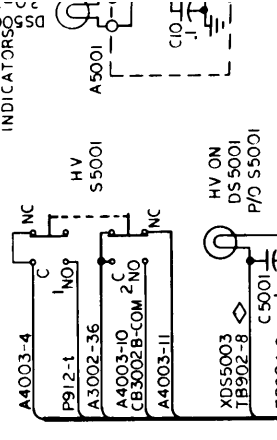


700		A701	
LAST SYMBOLS	MISS SYM	LAST SYM	MISS
A708	C748,49	C15	
B701	E705,6,13	CR1	
C750	J705	L3	
CR702	L710	R15	
DC701	V701	V2	
E717	XA707	XV2	
F701	XF701		
J706	XV701		
L711	XA704,6		

TO SH-1



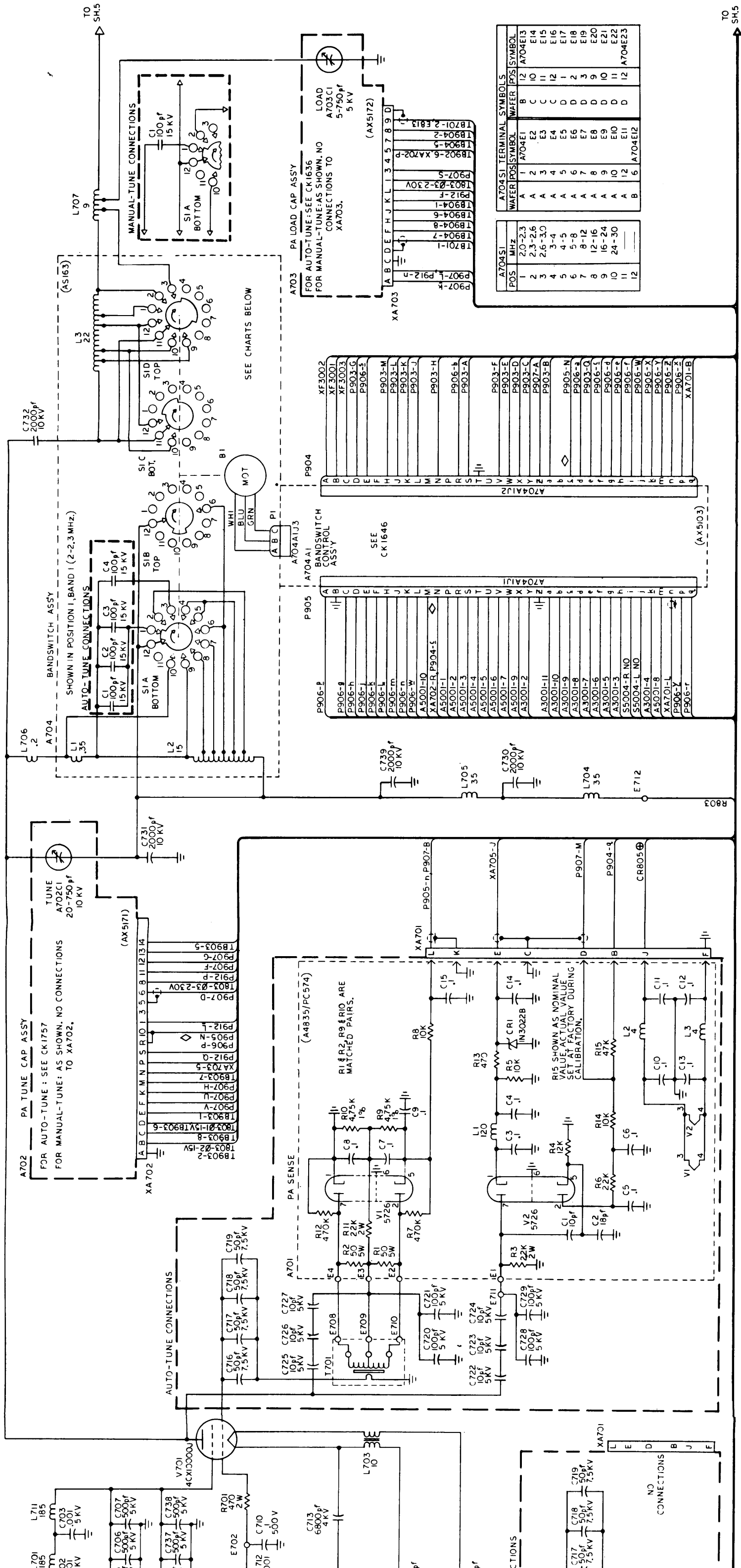
BAND INDICATOR



TO SH.2

800		A801	
LAST SYMBOLS	MISS SYM	LAST SYM	MISS SYM
A801	S301	FB	
B801	T804	LI	
C807	XK802	SI	
CR807		T81	
E817	E815		
K802			
L804			
M801			
P801			
R838			
	XK801		

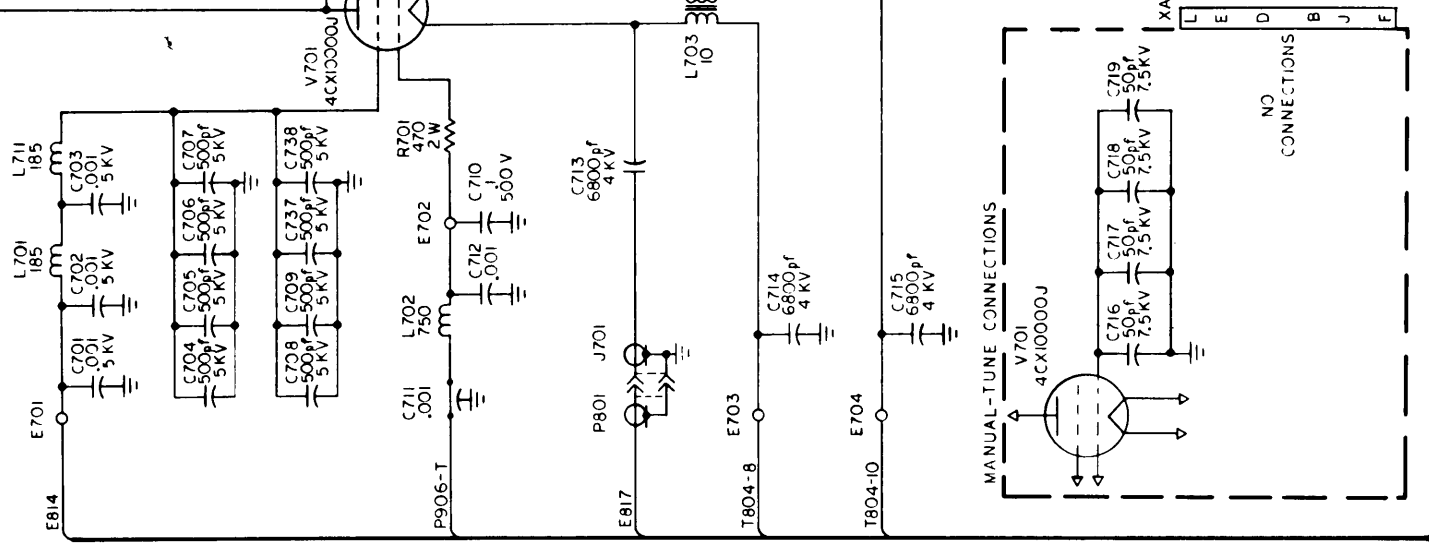




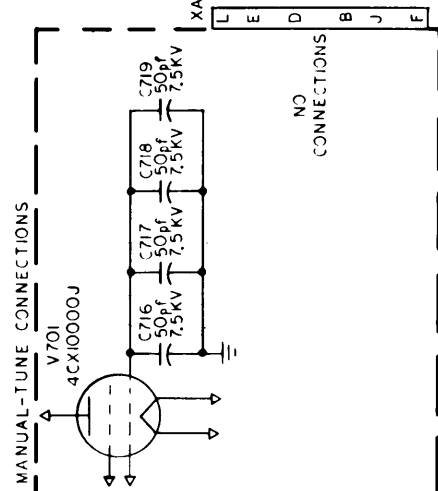
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1	2.0-2.3	A	A	A	A
2	2.3-2.6	A	A	E	E
3	2.6-3.0	A	A	E	E
4	3-4	A	A	E	E
5	4-5	A	A	E	E
6	5-8	A	A	E	E
7	8-12	A	A	E	E
8	12-16	A	A	E	E
9	16-24	A	A	E	E
10	24-30	A	A	E	E
11		A	A	E	E
12		A	A	E	E

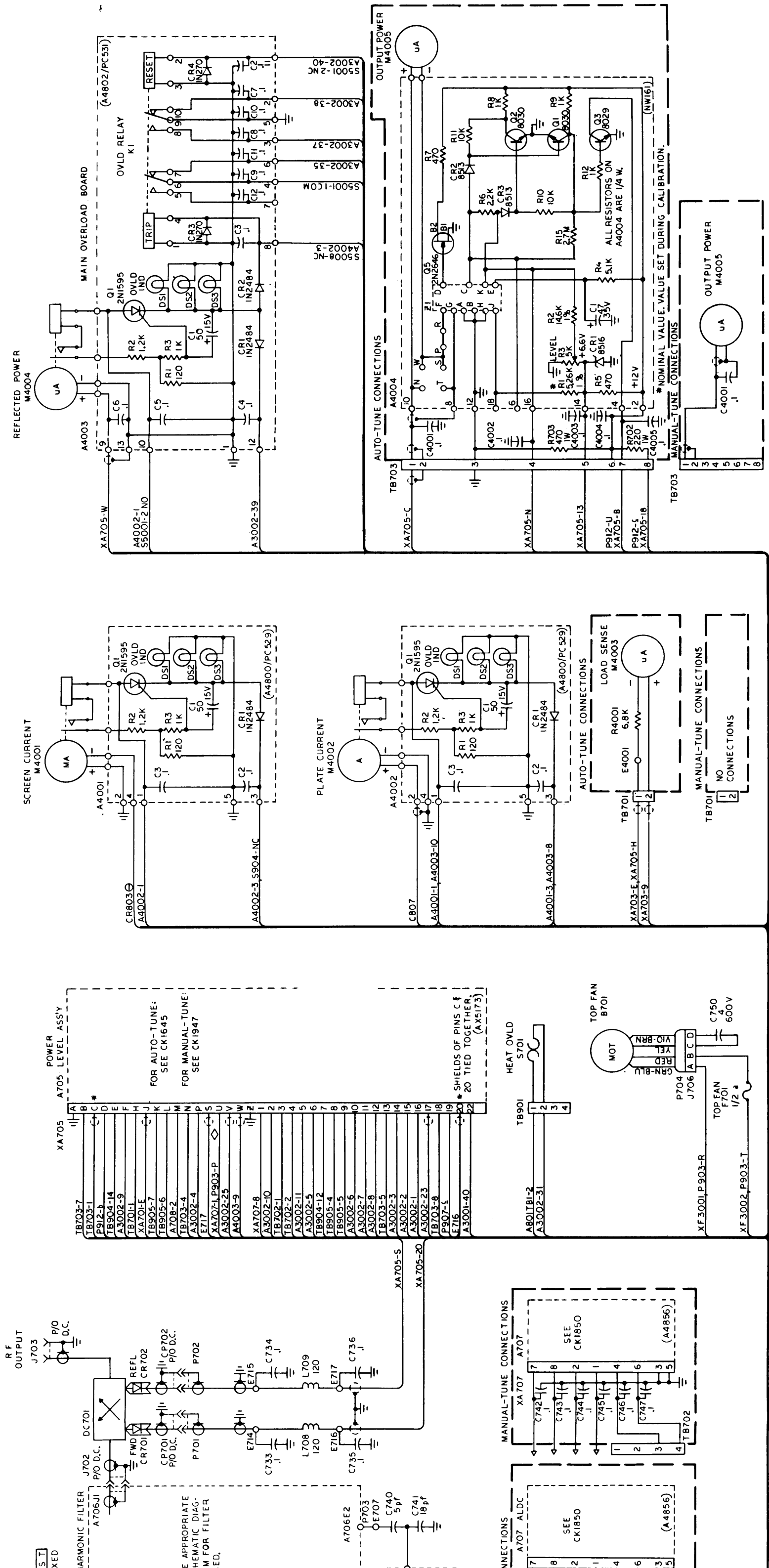
A704S1		A704S1	
POS	MHZ	WAFER	POS SYMBOL
A	2.0-2.3	A	A
B	2.3-2.6	A	E
C	2.6-3.0	A	E
D	3-4	A	E
E	4-5	A	E
F	5-8	A	E
G	8-12	A	E
H	12-16	A	E
I	16-24	A	E
J	24-30	A	E
K		A	E
L		A	E
M		A	E
N		A	E
O		A	E
P		A	E
Q		A	E
R		A	E
S		A	E
T		A	E
U		A	E
V		A	E
W		A	E
X		A	E
Y		A	E
Z		A	E
a		A	E
b		A	E
c		A	E
d		A	E
e		A	E
f		A	E
g		A	E
h		A	E
i		A	E
j		A	E
k		A	E
l		A	E
m		A	E
n		A	E
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q		A	E
r		A	E
s		A	E
t		A	E
u		A	E
v		A	E
w		A	E
x		A	E
y		A	E
z		A	E
aa		A	E
ab		A	E
ac		A	E
ad		A	E
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aj		A	E
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am		A	E
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ao		A	E
ap		A	E
aq		A	E
ar		A	E
as		A	E
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az		A	E
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bd		A	E
be		A	E
bf		A	E
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bj		A	E
bk		A	E
bl		A	E
bm		A	E
bn		A	E
bo		A	E
bp		A	E
bq		A	E
br		A	E
bs		A	E
bt		A	E
bu		A	E
bv		A	E
bw		A	E
bx		A	E
by		A	E
bz		A	E
ca		A	E
cb		A	E
cc		A	E
cd		A	E
ce		A	E
cf		A	E
cg		A	E
ch		A	E
ci		A	E
cj		A	E
ck		A	E
cl		A	E
cm		A	E
cn		A	E
co		A	E
cp		A	E
cq		A	E
cr		A	E
cs		A	E
ct		A	E
cu		A	E
cv		A	E
cw		A	E
cx		A	E
cy		A	E
cz		A	E
da		A	E
db		A	E
dc		A	E
dd		A	E
de		A	E
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do		A	E
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en		A	E
eo		A	E
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fe		A	E
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fj		A	E
fk		A	E
fl		A	E
fm		A	E
fn		A	E
fo		A	E
fp		A	E
fq		A	E
fr		A	E
fs		A	E
ft		A	E
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fv		A	E
fw		A	E
fx		A	E
fy		A	E
fz		A	E
ga		A	E
gb		A	E
gc		A	E
gd		A	E
ge		A	E
gf		A	E
gg		A	E
gh		A	E
gi		A	E
gj		A	E
gk		A	E
gl		A	E
gm		A	E
gn		A	E
go		A	E
gp		A	E
gq		A	E
gr		A	E
gs		A	E
gt		A	E
gu		A	E
gv		A	E
gw		A	E
gx		A	E
gy		A	E
gz		A	E
ha		A	E
hb		A	E
hc		A	E
hd		A	E
he		A	E
hf		A	E
hg		A	E
hh		A	E
hi		A	E
hj		A	E
hk		A	E
hl		A	E
hm		A	E
hn		A	E
ho		A	E
hp		A	E
hq		A	E
hr		A	E
hs		A	E
ht		A	E
hu		A	E
hv		A	E
hw		A	E
hx		A	E
hy		A	E
hz		A	E
ia		A	E
ib		A	E
ic		A	E
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ij		A	E
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il		A	E
im		A	E
in		A	E
io		A	E
ip		A	E
iq		A	E
ir		A	E
is		A	E
it		A	E
iu		A	E
iv		A	E
iw		A	E
ix		A	E
iy		A	E
iz		A	E
ja		A	E
jb		A	E
jc		A	E
jd		A	E
je		A	E
jf		A	E
jj		A	E
jh		A	E
ji		A	E
jj		A	E
jk		A	E
jl		A	E
jm		A	E
jn		A	E
jo		A	E
jp		A	E
jq		A	E
jr		A	E
js		A	E
jt		A	E
ju		A	E
ju		A	E
jv		A	E
iw		A	E
ix		A	E
iy		A	E
iz		A	E
ka		A	E
kb		A	E
kc		A	E
kd		A	E
ke		A	E
kf		A	E
kg		A	E
kh		A	E
ki		A	E
kj		A	E
kk		A	E
kl		A	E
km		A	E
kn		A	E
ko		A	E
kp		A	E
kq		A	E
kr		A	E
ks		A	E
kt		A	E
ku		A	E
kv		A	E
kw		A	E
kx		A	E
ky		A	E
kz		A	E
la		A	E
lb		A	E
lc		A	E
ld		A	E
le		A	E
lf		A	E
lg		A	E
lh		A	E
li		A	E
lj		A	E
lk		A	E
ll		A	E
lm		A	E
ln		A	E
lo		A	E
lp		A	E
lq		A	E
lr		A	E
ls		A	E
lt		A	E
lu		A	E
lv		A	E
lw		A	E
lx		A	E
ly		A	E
lz		A	E
ma		A	E
mb		A	E
mc		A	E
md		A	E
me		A	E
mf		A	E
mg		A	E
mh		A	E
mi		A	E
mj		A	E
mk		A	E
ml		A	E
mm		A	E
mn		A	E
mo		A	E
mp		A	E
mq		A	E
mr		A	E
ms		A	E
mt		A	E
mu		A	E
mv		A	E
mw		A	E
mx		A	E
my		A	E
mz		A	E
na		A	E
nb		A	E
nc		A	E
nd		A	E
ne		A	E
nf		A	E
ng		A	E
nh		A	E
ni		A	E
nj		A	E
nk		A	E
nl		A	E
nm		A	E
nn		A	E
no		A	E
np		A	E
nq		A	E
nr		A	E
ns		A	E
nt		A	E
nu		A	E
nv		A	E
nw		A	E
nx		A	E
ny		A	E
nz		A	E
oa		A	E
ob		A	E
oc		A	E
od		A	E
oe		A	E
of		A	E
og		A	E
oh		A	E
oi		A	E
oj		A	E
ok		A	E
ol		A	E
om		A	E
on		A	E
oo		A	E
op		A	E
oq		A	E
or		A	E
os		A	E
ot		A	E
ou		A	E
ov		A	E
ow		A	E
ox		A	E
oy		A	E
oz		A	E
pa		A	E
pb		A	E
pc		A	E
pd		A	E
pe		A	E
pf		A	E

TO SH.3



4000	LAST SYM/MISS SYM	A4003	LAST SYM/MISS SYM
A4004	C12	A4001-4002	LAST SYM/MISS SYM
C4005	CR1	C3	CR4
F4001	DS3	CR4	DS3
M4005	E5	DS3	E13
R4001	Q1	Q1	K1
	R3	R3	Q1
	XDS3	XDS3	R3
		XKI	XKI



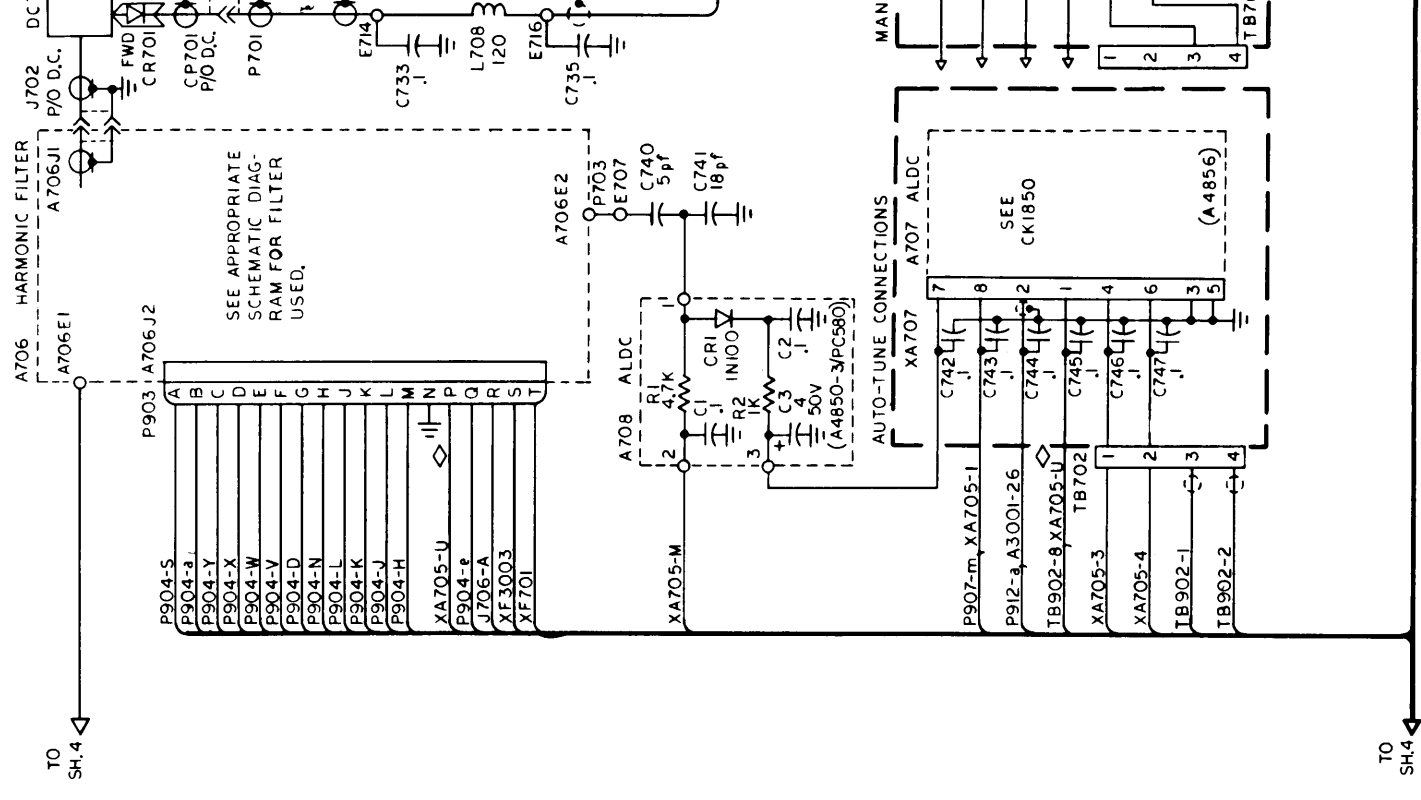


RESISTORS ARE SHOWN FOR THE PART DESIGNATION. FOR THE +24V

RESISTORS ARE 1/2 WATT MICROFARADS. CAPACITORS ARE MICROFARADS.

Figure 7-1. Schematic Diagram, HFL( )-10K (Sheet 5 of 5)

J704 [A B C D E F G H J K L M N P Q R S T]  
 P903 CONNECTS TO J704 WHEN FIXED  
 FILTER OR NO FILTER IS USED.



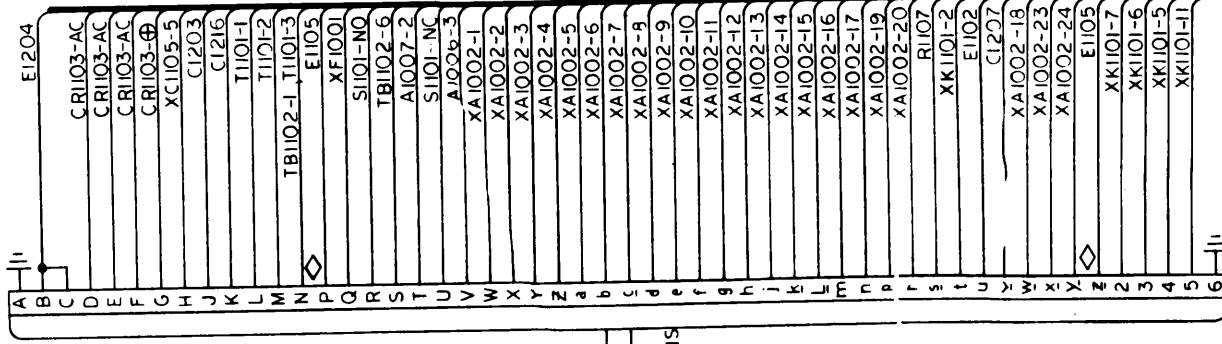
Note 1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION PREFIX THE PART DESIGNATION WITH THE SUB-ASSEMBLY DESIGNATION.

Note 2. ◊ IS A REFERENCE INDICATOR FOR THE +24V REGULATED DC SUPPLY.

Note 3. UNLESS OTHERWISE SPECIFIED:  
 ALL RESISTANCE VALUES IN OHMS, 1/2 WATT.  
 ALL CAPACITANCE VALUES IN MICROFARADS.  
 ALL INDUCTANCE VALUES IN MICROHENRIES.

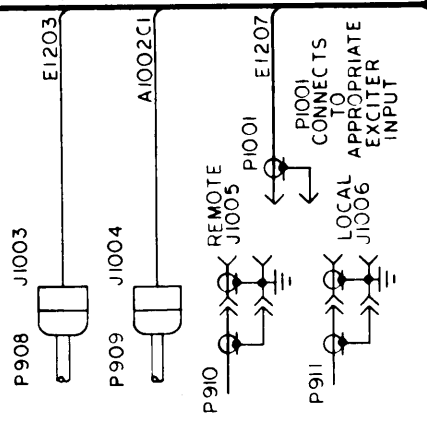
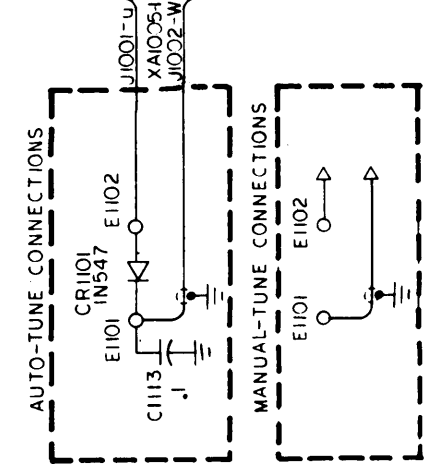
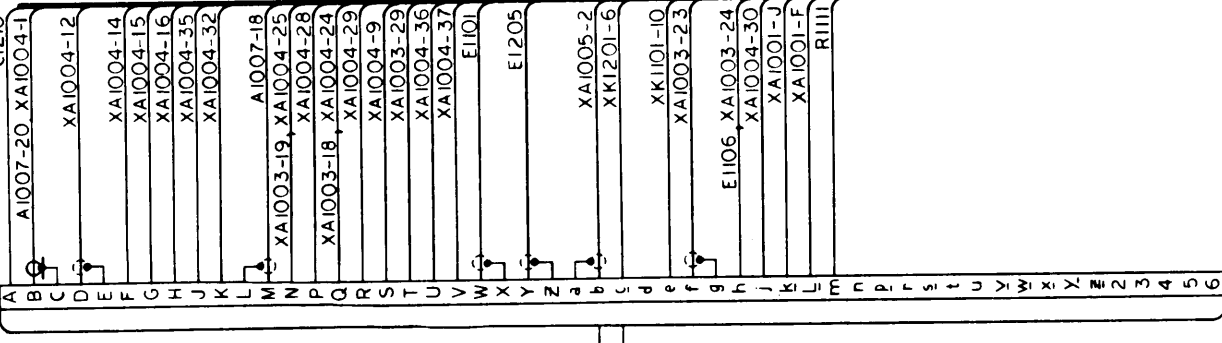


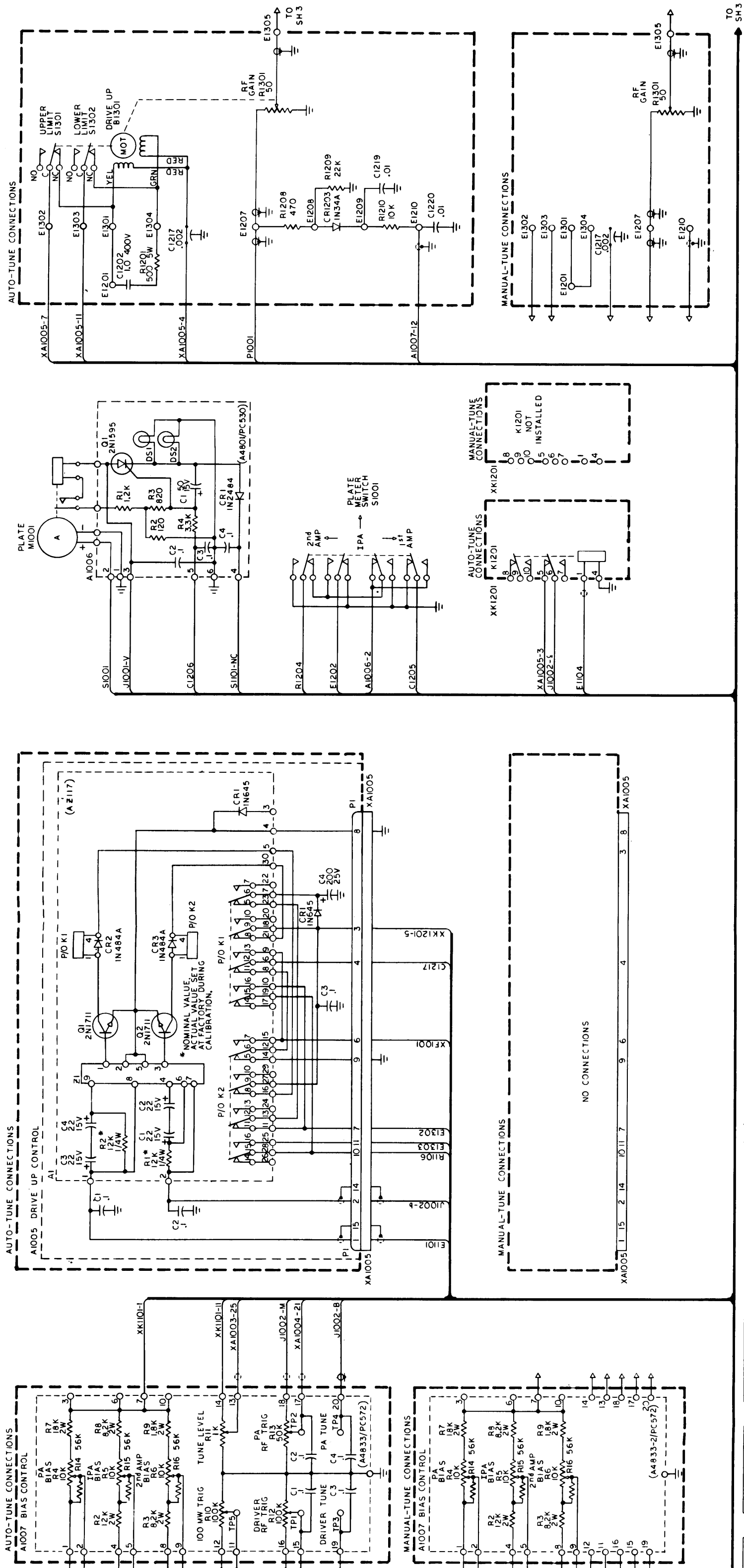
P906 J1001



SEE CK1946 FOR CONNECTIONS

P907 J1002



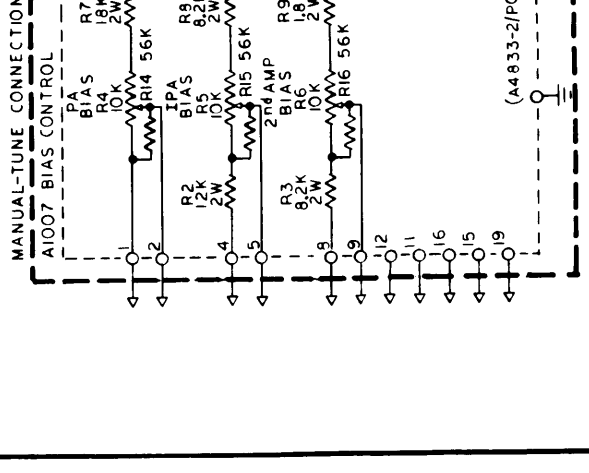
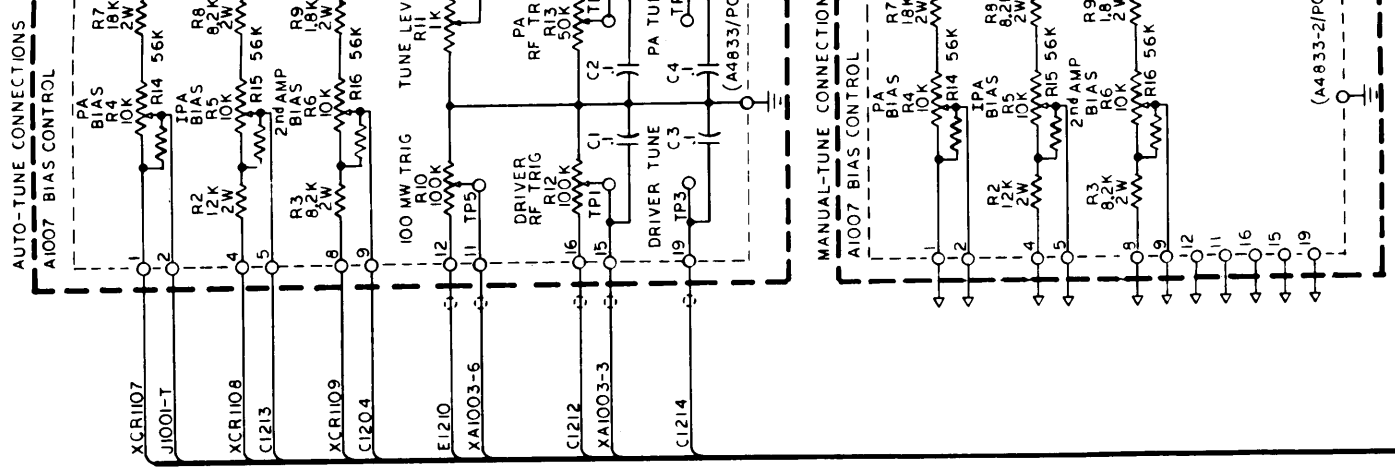


FOR A1003 & A1004 SYMBOL CHARTS - SEE APPROPRIATE SCHEMATICS.

IS SYM	A1001	A1002	A1003
LAST SYM	A1	C11	C12
MISS SYM	B1	CR1	E12
	C5	E23	
	S2	J1	
		K1	
		L3	
		R3	
		S2	
		XK1	

CK1954-E

Figure 7-2. Schematic Diagram, HFL( )-10K IPA Drawer (Sheet 2 of 4)



TO SH 1

1000		MISS SYM	
LAST SYMBOLS	A1008	MISS SYM	A1001
	XA1005		LAST SYM
	F1004		A1
	J1007		B1
	L1001		C5
	M1001		S2
	P1001		
	S1001		



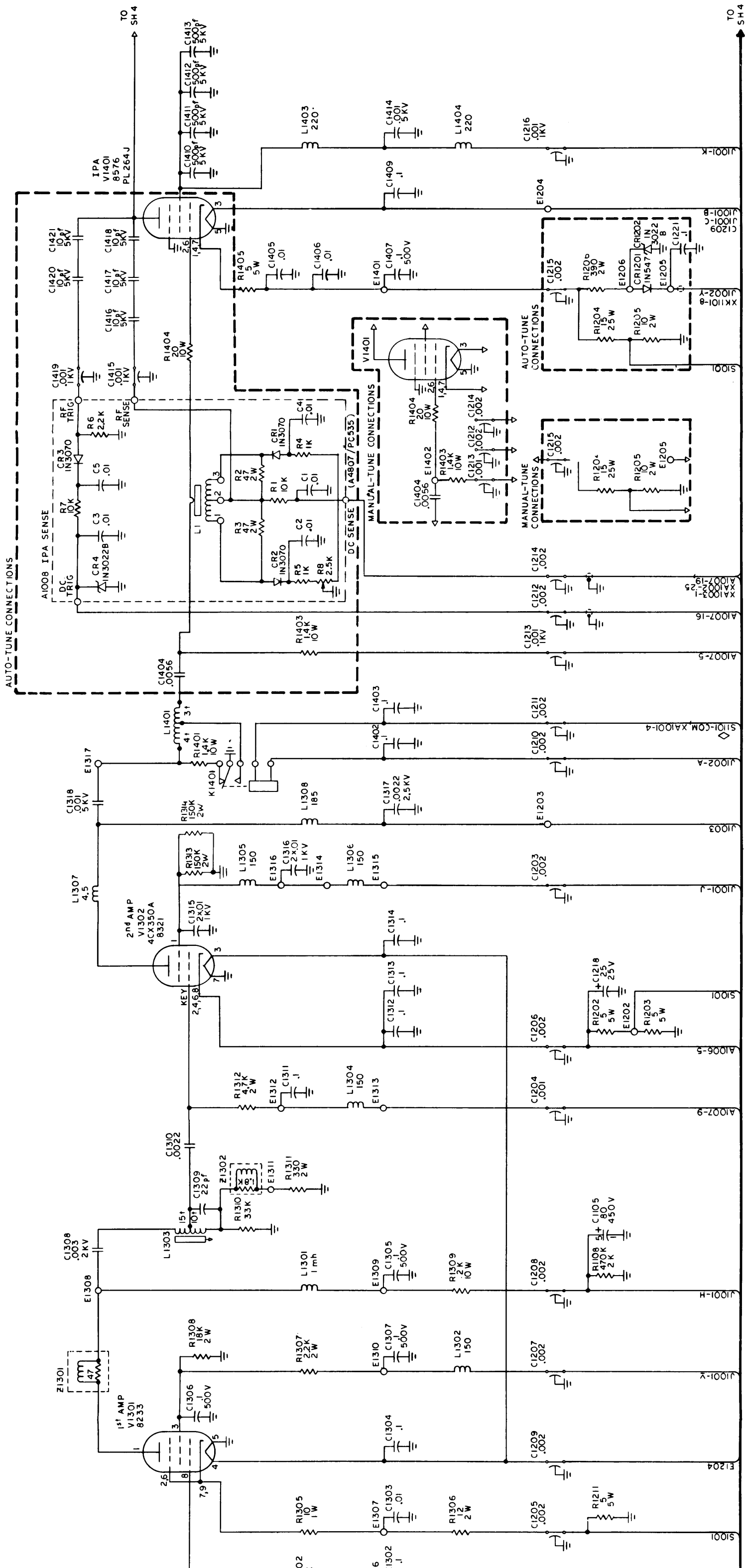
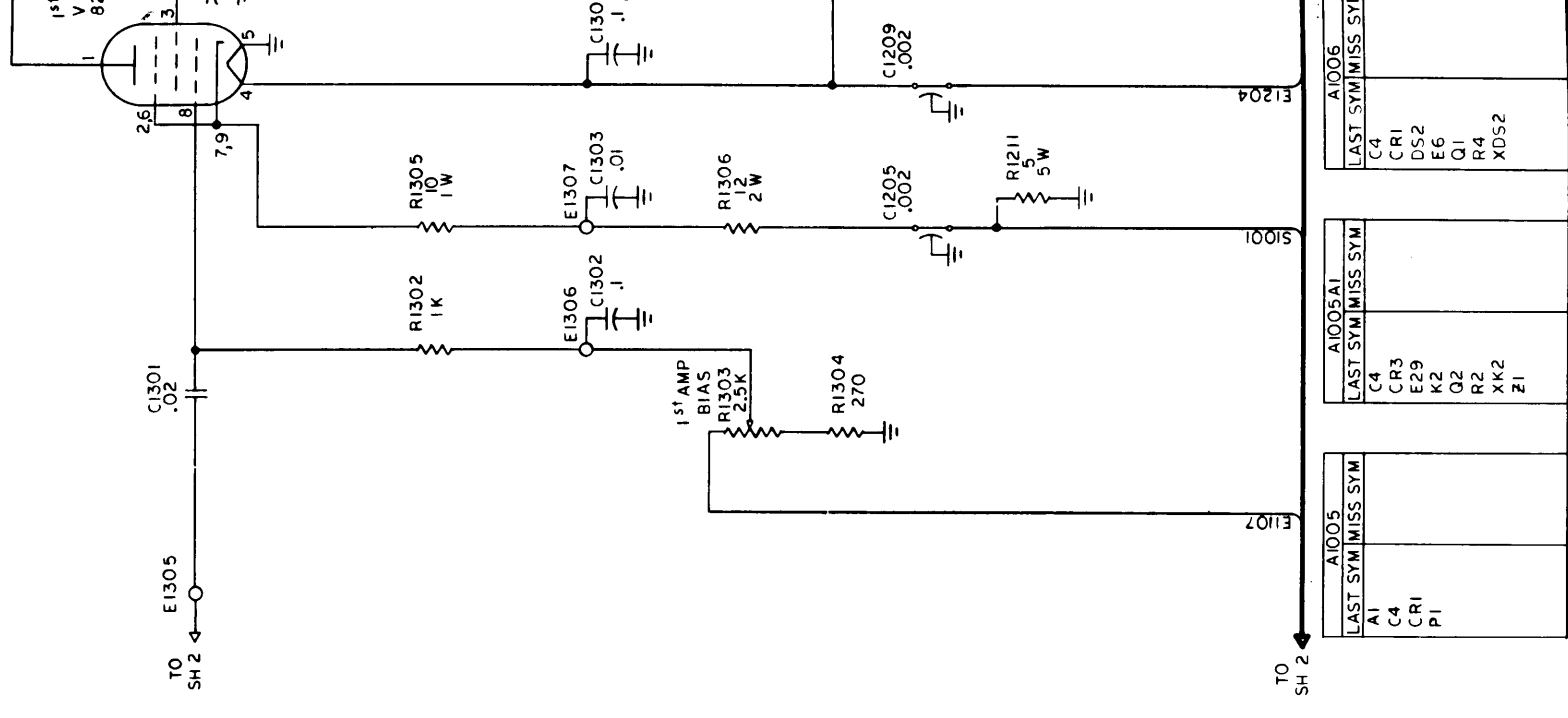


Figure 7-2. Schematic Diagram, HFL( )-10K IPA Drawer (Sheet 3 of 4)

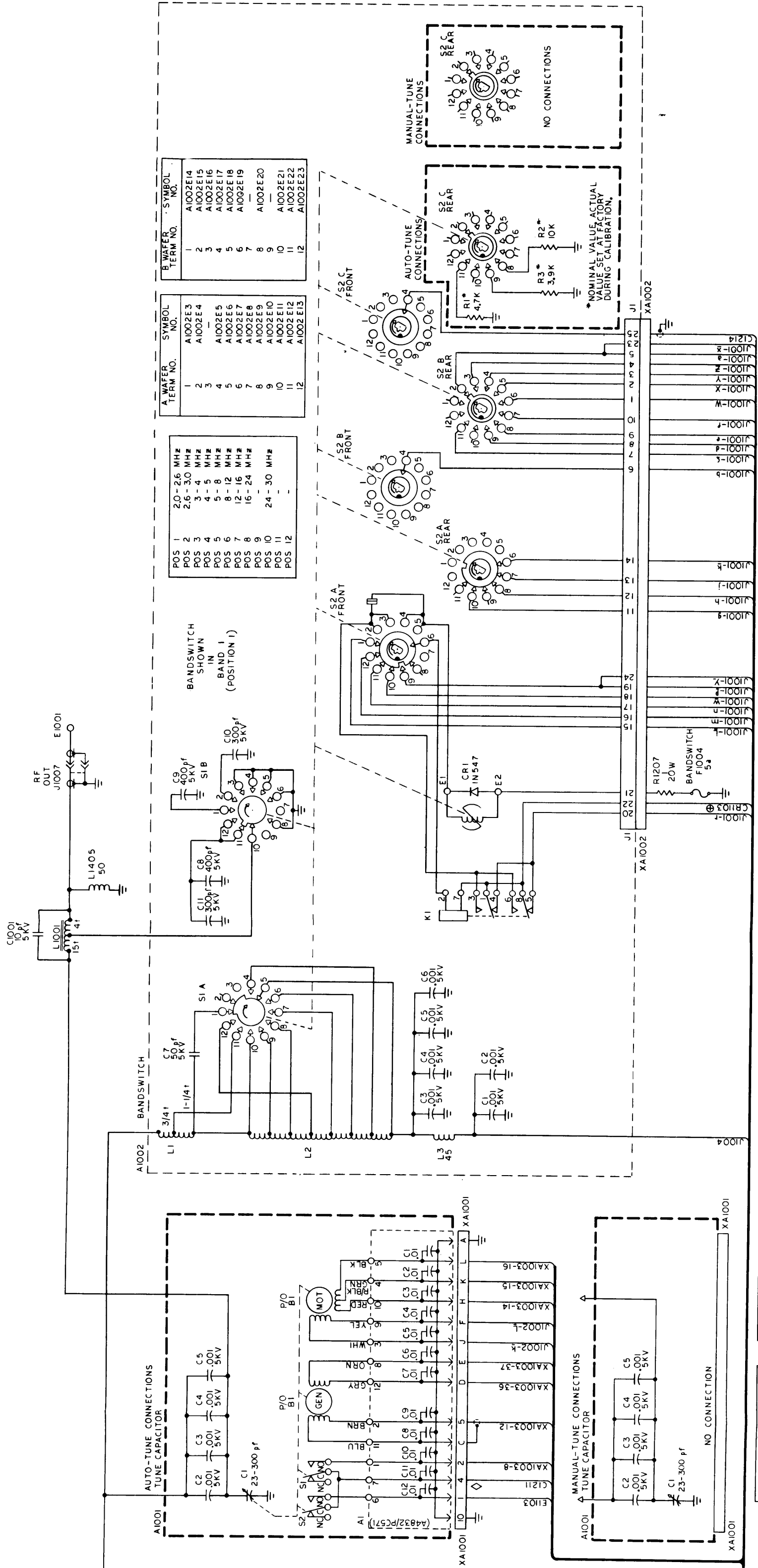
7-17/7-18

AI	MISS SYM	A1006	LAST SYM/MISS SYM	A1007	LAST SYM/MISS SYM	A1008	LAST SYM/MISS SYM
		C4	CR1 DS2 E6 Q1 R4 XD52	C4 E20 R16 TP5	R1	C5 CR4 L1 R8	

CK1954-E



A1005	A1005A1	A1006
LAST SYM/MISS SYM	LAST SYM/MISS SYM	LAST SYM/MISS SYM
A1	C4	C4
C4	CR3	CR1
CR1	E29	DS2
PI	K2	EG
	Q2	Q1
	R2	R4
	XK2	XDS2
	Z1	



A WAFER TERM NO.	SYMBOL NO.	B WAFER TERM NO.	SYMBOL NO.
1	A1002E3	1	A1002E14
2	A1002E4	2	A1002E15
3	A1002E5	3	A1002E16
4	A1002E6	4	A1002E17
5	A1002E7	5	A1002E18
6	A1002E8	6	A1002E19
7	A1002E9	7	A1002E20
8	A1002E10	8	A1002E21
9	A1002E11	9	A1002E22
10	A1002E12	10	A1002E23
11	A1002E13	11	
12		12	

POS	FREQ RANGE
1	2.0 - 2.6 MHz
2	2.6 - 3.0 MHz
3	3 - 4 MHz
4	4 - 5 MHz
5	5 - 8 MHz
6	8 - 12 MHz
7	12 - 16 MHz
8	16 - 24 MHz
9	24 - 30 MHz
10	
11	
12	

Note 1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN FOR COMPLETE DESIGNATION. PREFIX AND PART DESIGNATION WITH THE SUB-ASSEMBLY DESIGNATION.

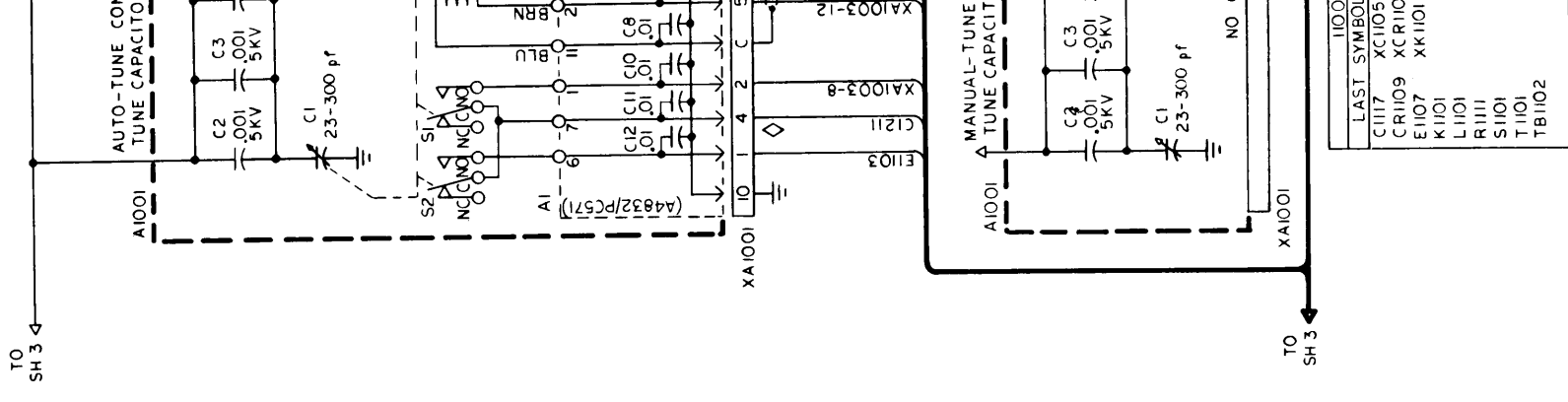
Note 2.  $\diamond$  IS REFERENCE INDICATOR FOR THE +24V REGULATED DC SUPPLY.

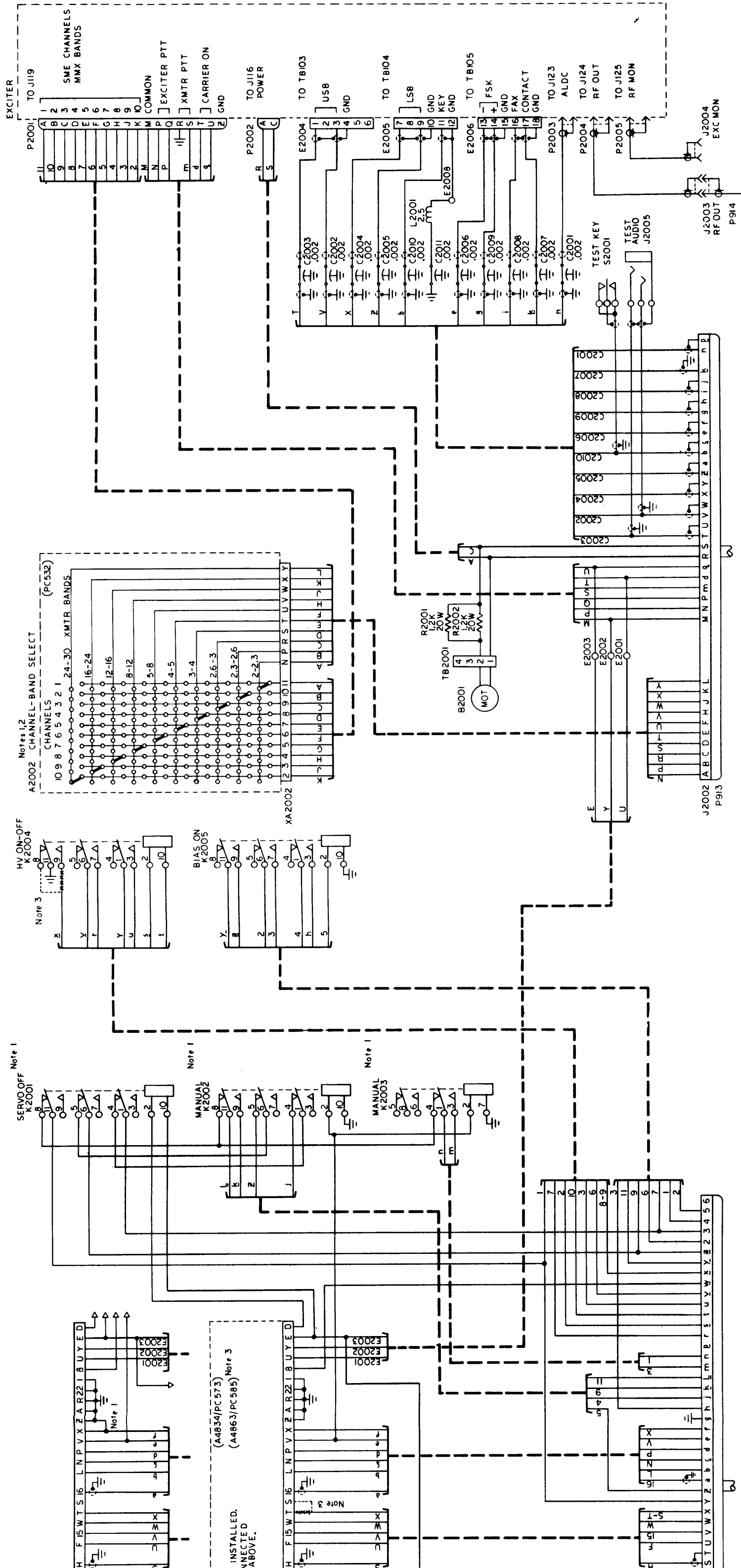
Note 3. UNLESS OTHERWISE SPECIFIED:  
 ALL RESISTANCE VALUES IN OHMS, 1/2 WATT.  
 ALL CAPACITANCE VALUES IN MICROFARADS.  
 ALL INDUCTANCE VALUES IN MICROHENRIES.

1100	1200	1300	1400
LAST SYMBOLS	MISS SYM	LAST SYM	MISS SYM
C117	C1221	B1301	B1401
XCR109	E1210	C1318	C1421
E107	K1201	E1402	E1402
K1101	R1201	L1308	K1401
L1101	S1201	R1314	L1405
R1111	XK1201	S1302	L1402
S1101		V1302	R1402
T1101		XV1302	S1401
TB1102		Z1302	V1401
			XV1401

Figure 7-2. Schematic Diagram, HFL( )-10K IPA Drawer (Sheet 4 of 4)

CK1954-E



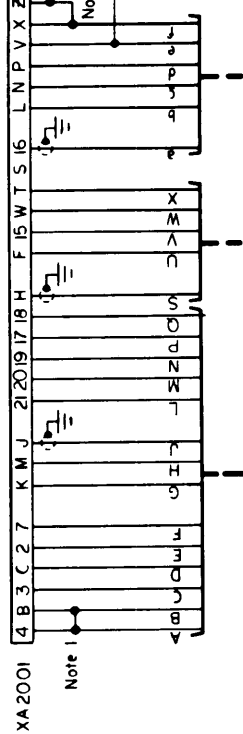


SEE CK1946 FOR CONNECTIONS

- Note 1. FOR MANUAL XMITR A2001, A2002, C2012, C2013, K2001, K2002, K2003 ARE NOT INSTALLED. XA2001 JUMPERS INSTALLED AS SHOWN.
- Note 2. A2002 SHOWN JUMPED FOR MMX INSTALLATION. FOR SMC INSTALLATION JUMP APPROPRIATE CAPACITORS TO A PROPER BAND. BAND CAPACITORS FOR EXCITER INSTALLATION, A2002, NOT SUPPLIED.
- Note 3. WHEN XMITR IS CONTROLLED BY A LRCA-2 REMOTE UNIT, A4863/PC585 REPLACES A4834/PC573 AS A2001. REMOVE CONNECTIONS MARKED \*\*\* AND MAKE CONNECTIONS MARKED ----.
- Note 4. UNLESS OTHERWISE SPECIFIED: ALL RESISTANCE VALUES IN OHMS. ALL CAPACITANCE VALUES IN MICROFARADS. ALL INDUCTANCE VALUES IN MILLIHENRIES.

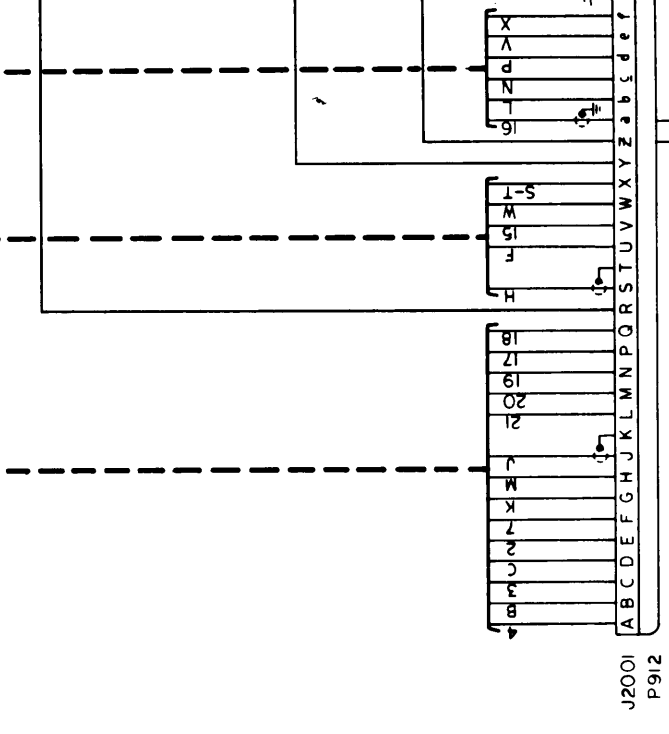
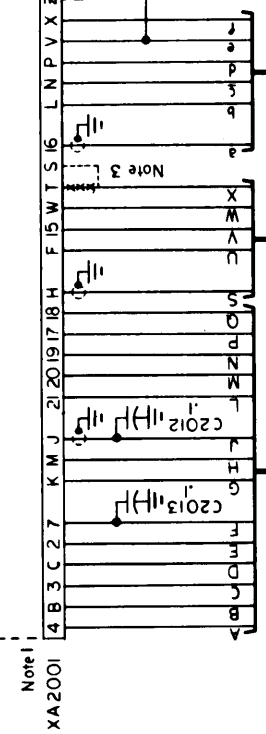
CK1955-0

Figure 7-3. Schematic Diagram, HFL( )-10K Exciter Drawer



A2001 Note 1

(A483)  
FOR AUTO-TUNE: SEE CK1756.  
(A486)  
FOR MANUAL-TUNE: A2001 NOT INSTALLED.  
XA2001 CONNECTED AS SHOWN ABOVE.

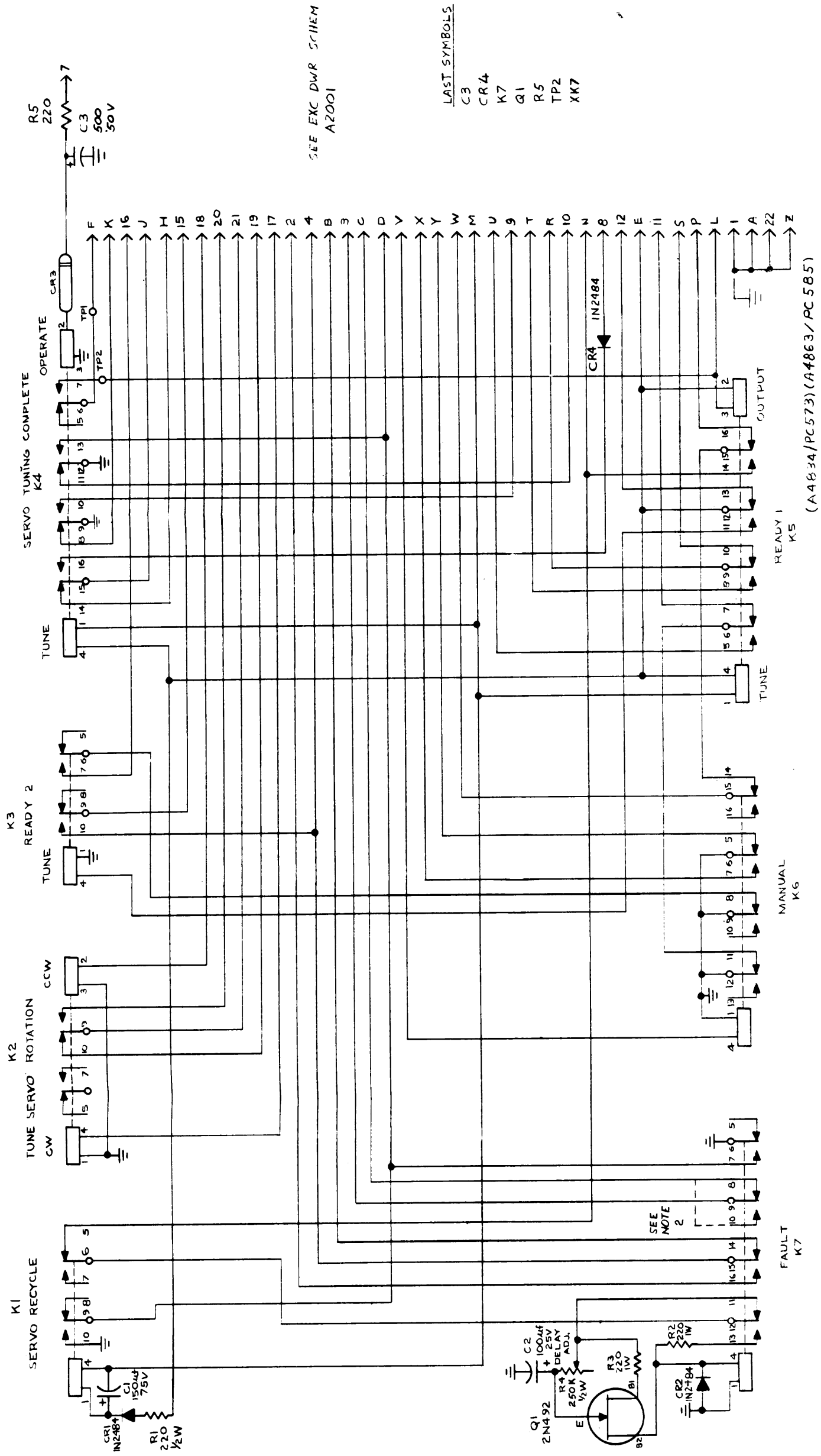


LAST SYMBOLS	MISSING SYMBOLS
A2002	S2001
B2001	TB2001
C2013	XA2002
E2008	XK2005
J2005	
K2005	
L2001	
P2005	
R2002	
	E2007

Note 1. FOR MANUAL X  
FOR ON K2002 K  
XA2001 JUMPER

Note 2. A2002 SHOWN  
FOR SMC INSTA  
CHANNEL TO  
FOR EXTERNAL  
NOT SUPPLIED

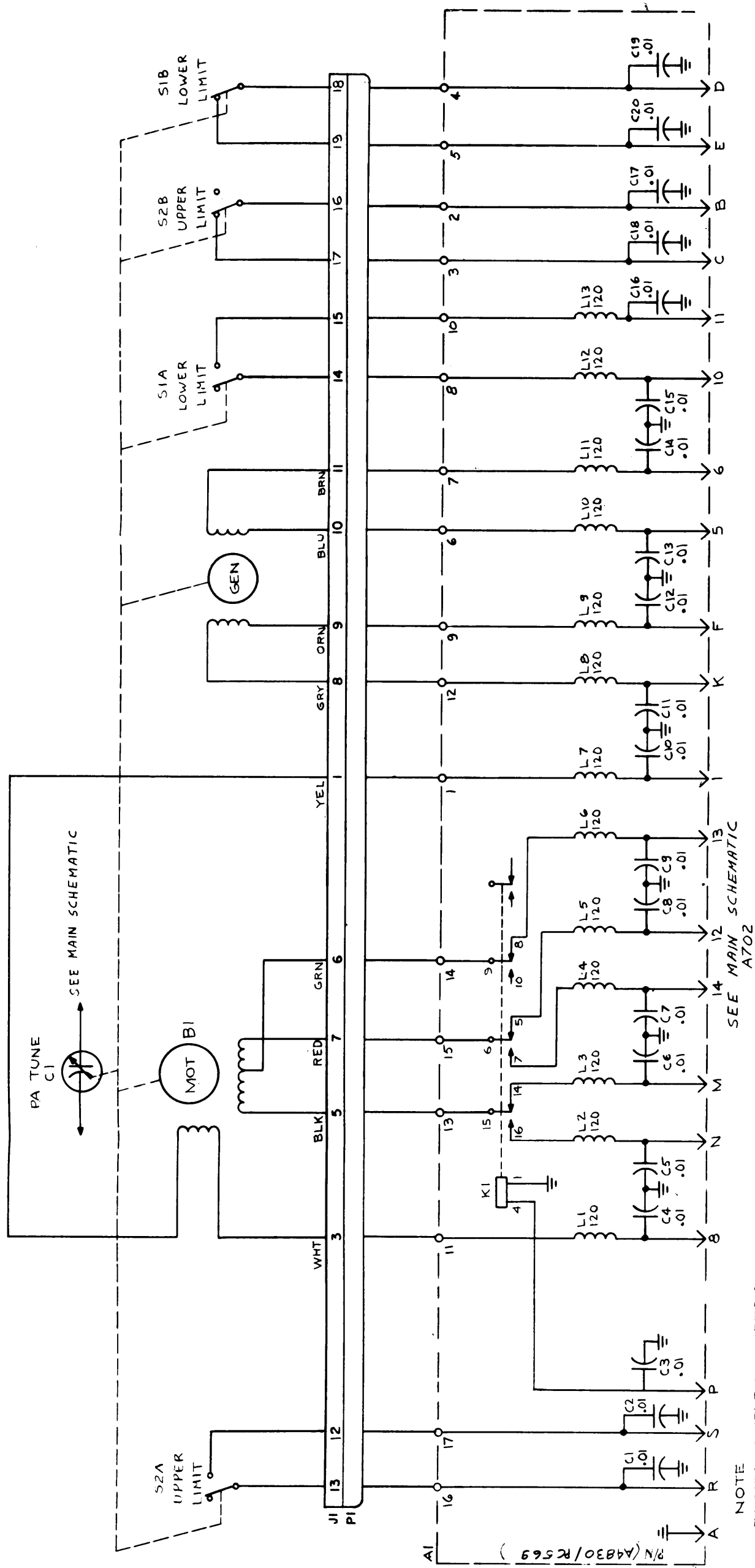
Note 3. WHEN XMTR IS  
REMOVED FROM  
MAKE CONNEC



NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX THE PART DESIGNATION WITH THE SUB-ASSEMBLY DESIGNATION.
2. DOTTED LINE SHOWS ONLY WIRING DIFFERENCE BETWEEN A4834 & A4863. A4863 BEING CONFIGURED AS SHOWN WITH THE DOTTED LINE.

Figure 7-4. Schematic Diagram, HFL( )-10K  
Tuning Control Board

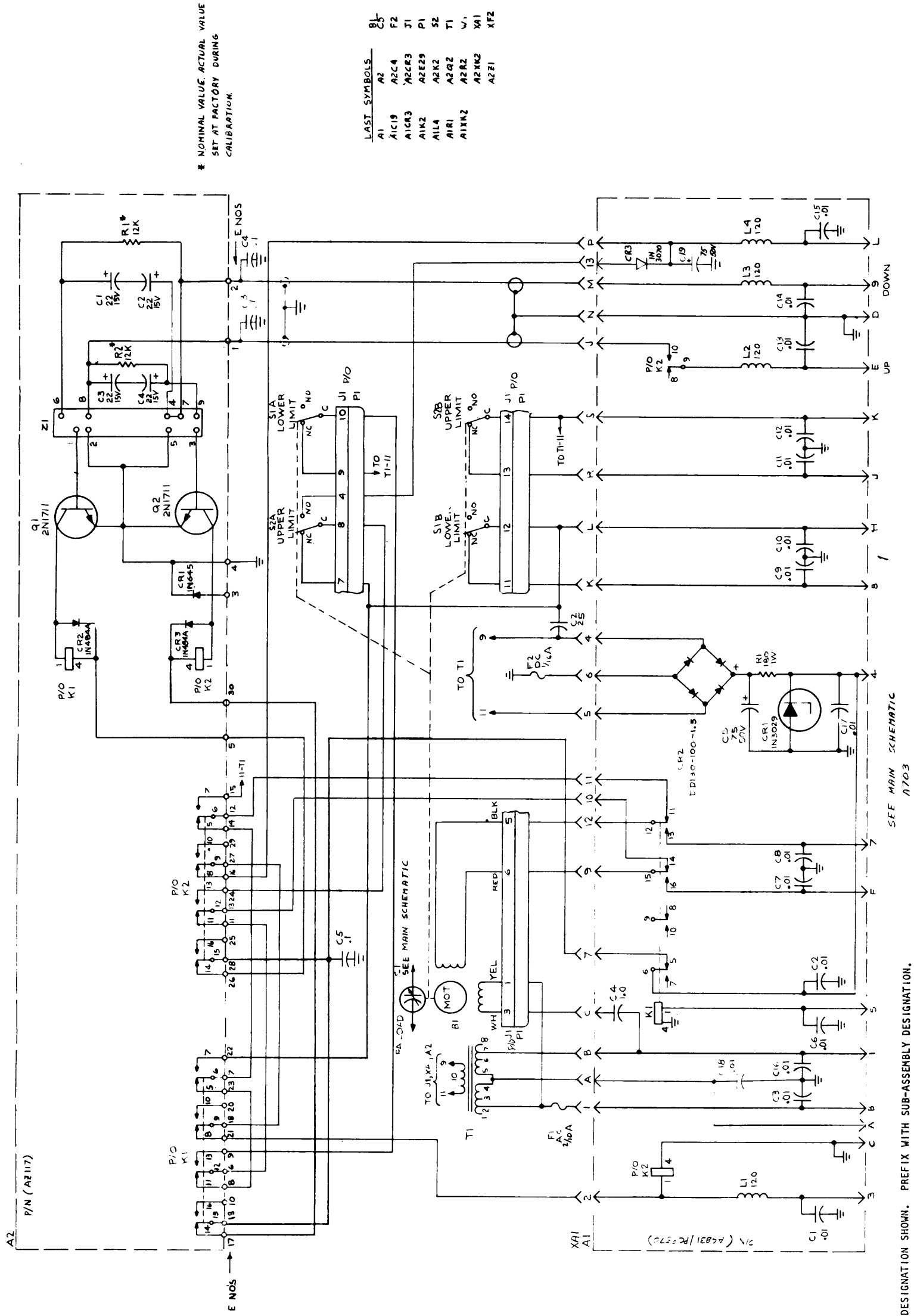


NOTE:  
 PARTIAL REFERENCE DESIGNATIONS SHOWN,  
 FOR COMPLETE DESIGNATION PREFIX WITH  
 SUBASSEMBLY DESIGNATION.  
 ALL CAPACITORS ARE IN  $\mu$ F.  
 ALL INDUCTORS ARE IN  $\mu$ H.

- LAST SYMBOLS
- A1
  - A1C20
  - A1E17
  - A1K1
  - A1L13
  - A1XK1
  - B1
  - C1
  - J1
  - P1
  - S2
  - W1

Figure 7-5. Schematic Diagram, HFL( )-10K Tune Capacitor Assembly







\* NOMINAL VALUE. ACTUAL VALUE SET AT FACTORY DURING CALIBRATION.

LAST SYMBOLS	VALUES
A1	B1
A2	C1
A1C19	A2C4
A1C4	A2C3
A1K2	A2E29
A1L4	A2K2
A1R1	A2Q2
A1XK2	A2R2
	A2XK2
	A2Z1
	F2
	J1
	P1
	S2
	T1
	V1
	XA1
	XF2

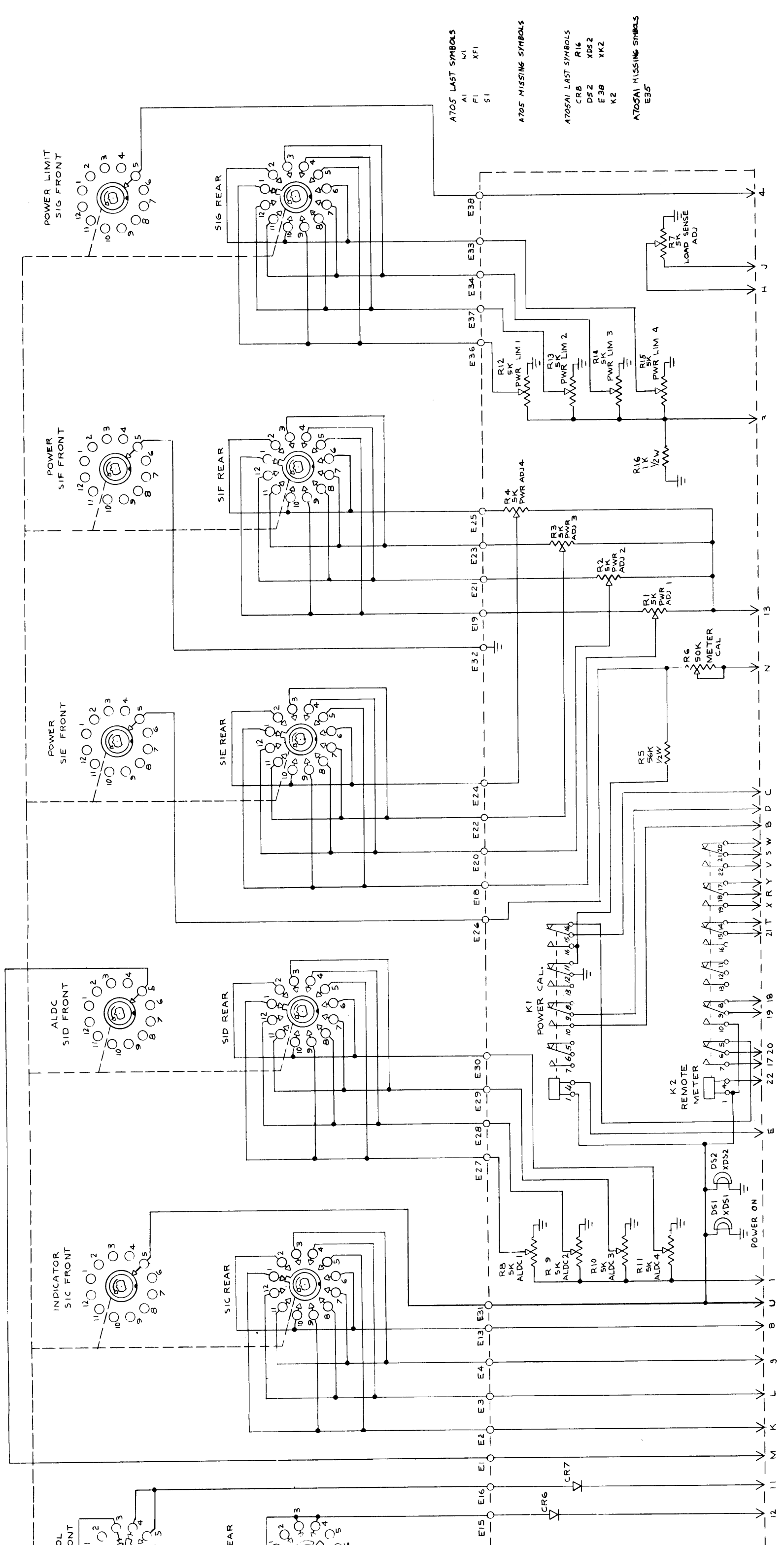
NOTE: PARTIAL DESIGNATION SHOWN. PREFIX WITH SUB-ASSEMBLY DESIGNATION. UNLESS OTHERWISE SPECIFIED:

1. RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
2. CAPACITORS ARE IN MICROFARADS.
3. INDUCTORS ARE IN MICROHENRIES.

FUSE ASSEMBLY IS AS SHOWN  
 Part of socket  
 Part of cap.

CK1636-B

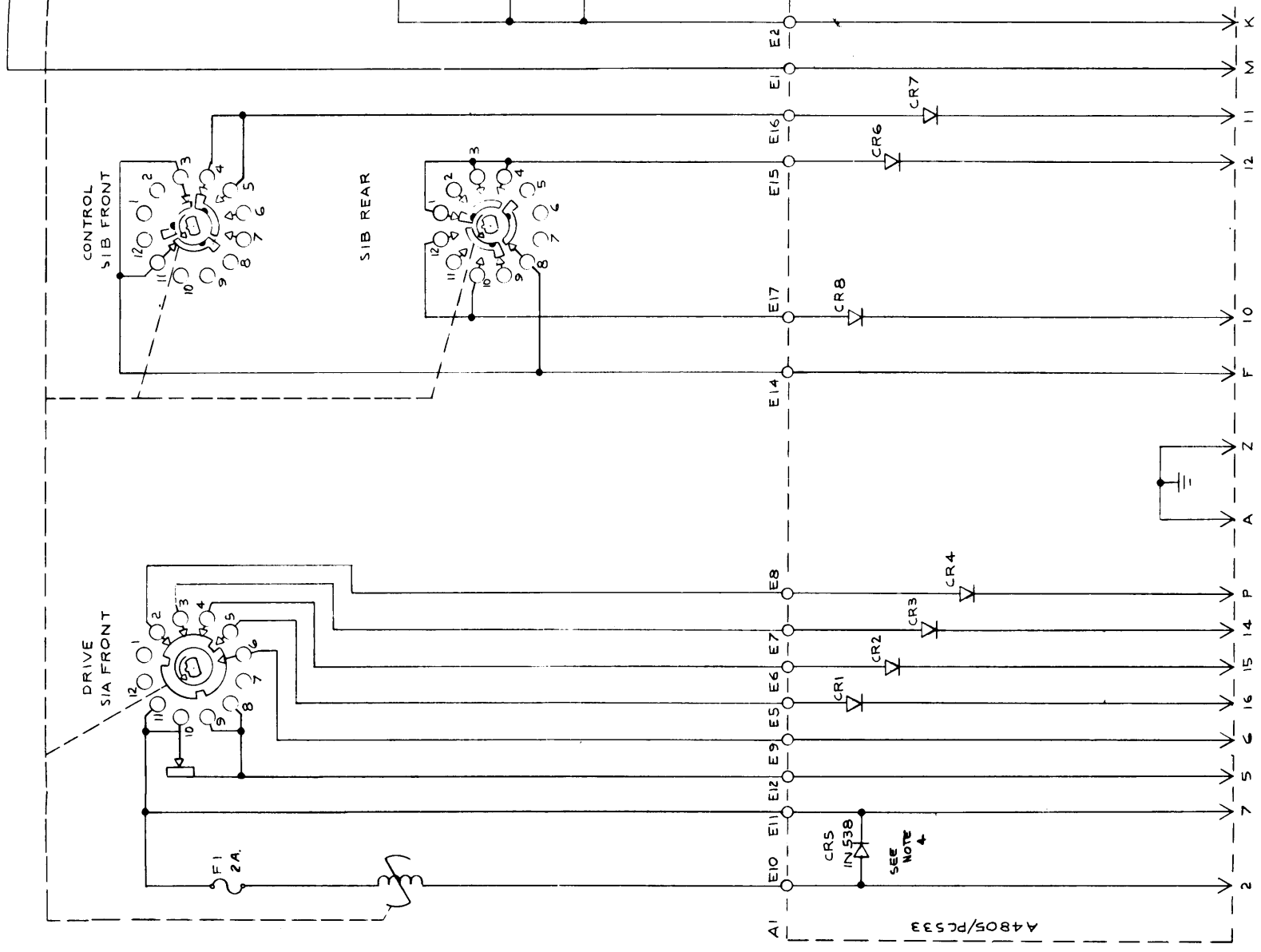
Figure 7-6. Schematic Diagram, HFL( )-10K Load Capacitor Assembly



- A705 LAST SYMBOLS**  
 AI W1  
 FI XFI  
 SI
- A705 MISSING SYMBOLS**
- A705AI LAST SYMBOLS**  
 CRB R16  
 DS2 XDS2  
 E3B XK2  
 K2
- A705AI MISSING SYMBOLS**  
 E35

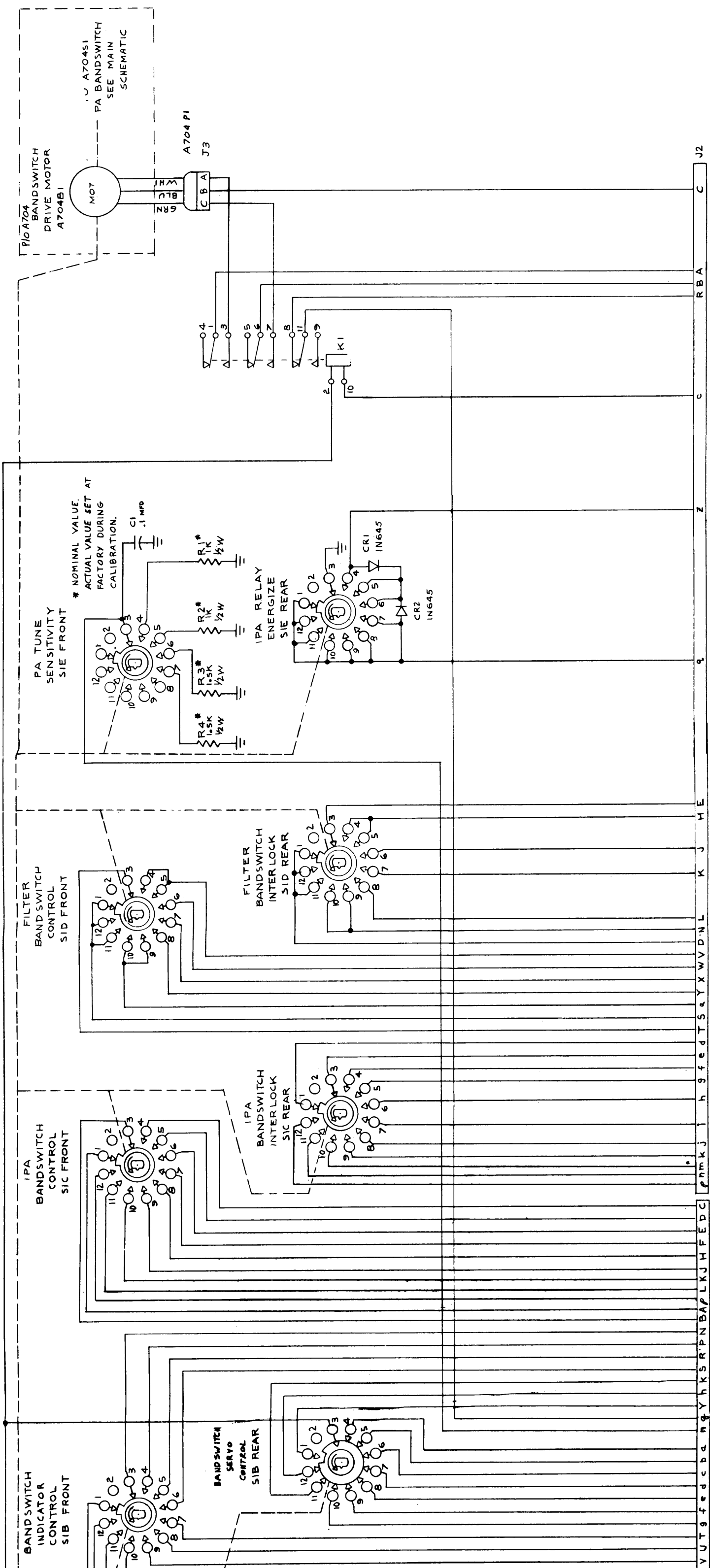
SEE MAIN SCHEMATIC

Figure 7-7. Schematic Diagram, HFL( )-10K Remote Power Assembly



NOTE

1. CR1 THRU CR4 & CR6 THRU CR8 ARE IN 914
2. SWITCH SHOWN FROM MOTOR END, PWR POS1.
3. PARTIAL REFERENCE DESIGNATION SHOWN, PREFIX WITH SUBASSEMBLY DESIGNATION.
4. CR5 SHOWN FOR POSITIVE VOLTAGE OPERATION, REVERSE FOR NEGATIVE VOLTAGE.



SEE MAIN SCHEMATIC

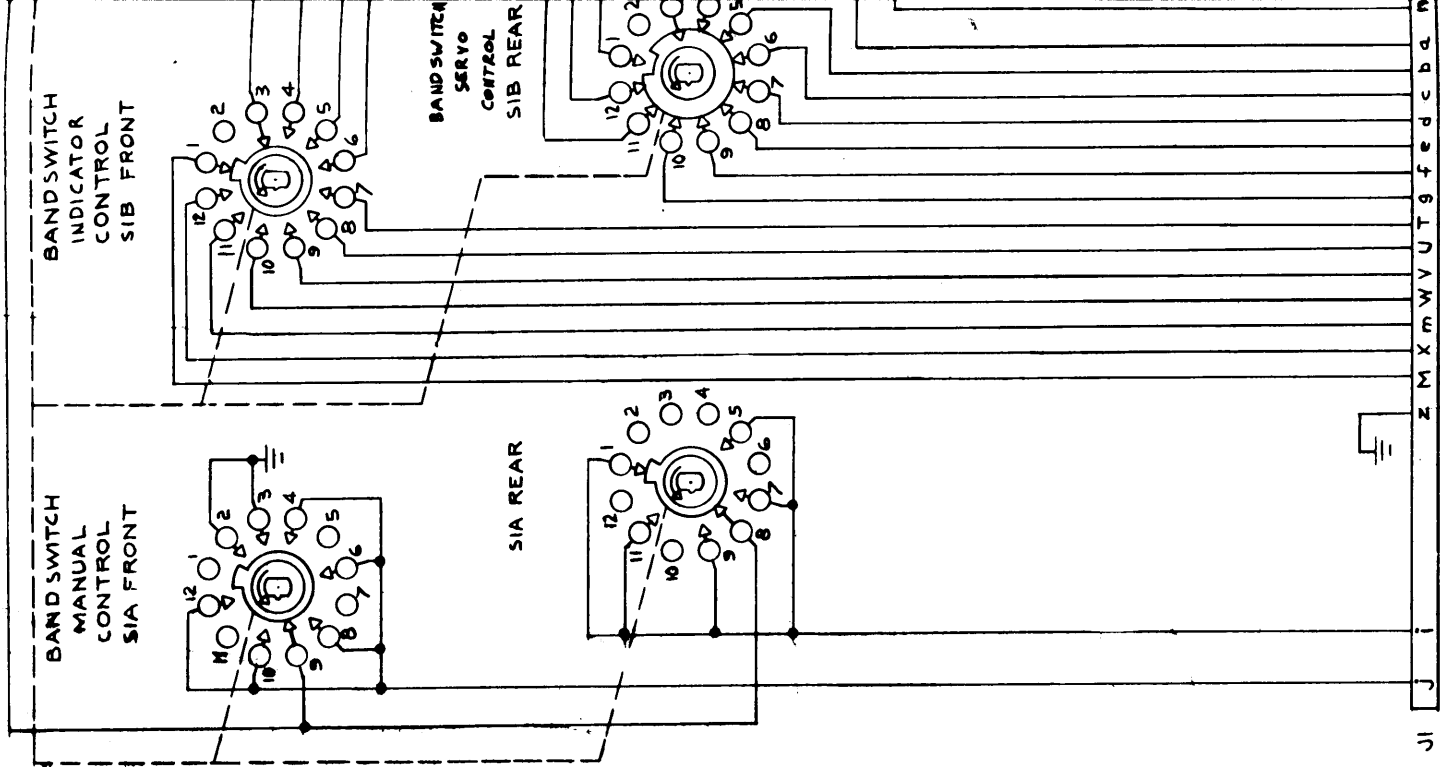
PARTIAL REFERENCE DESIGNATIONS ARE SHOWN  
 PREFIX PART DESIGNATIONS WITH SUBASSEMBLY  
 DESIGNATION. A704A1

LAST SYMBOLS MISSING SYMBOLS

- CR2 C1
- J3
- K1
- R4
- S1
- W1
- XK1

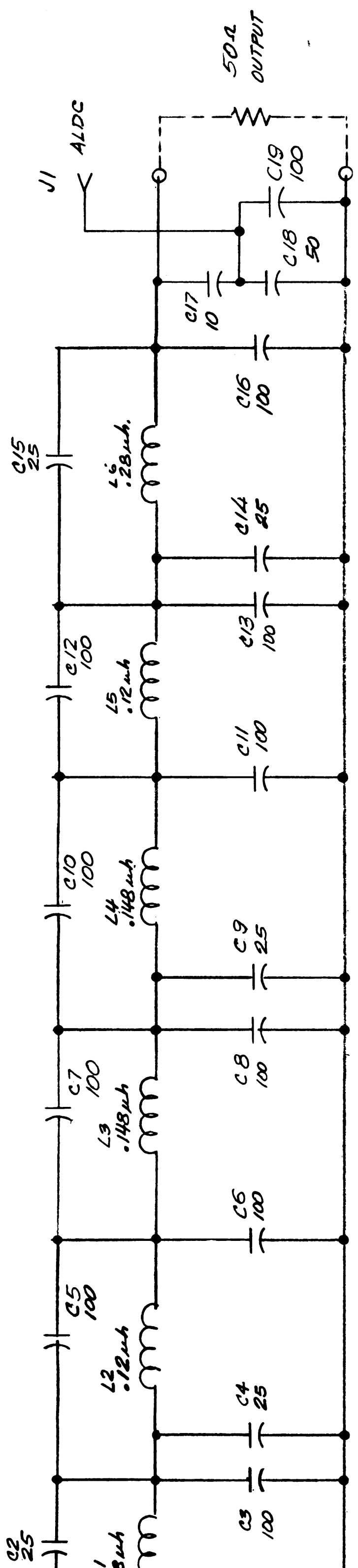
Figure 7-8. Schematic Diagram, HFL( )-10K  
 PA Bandswitch Control

CK1646-E



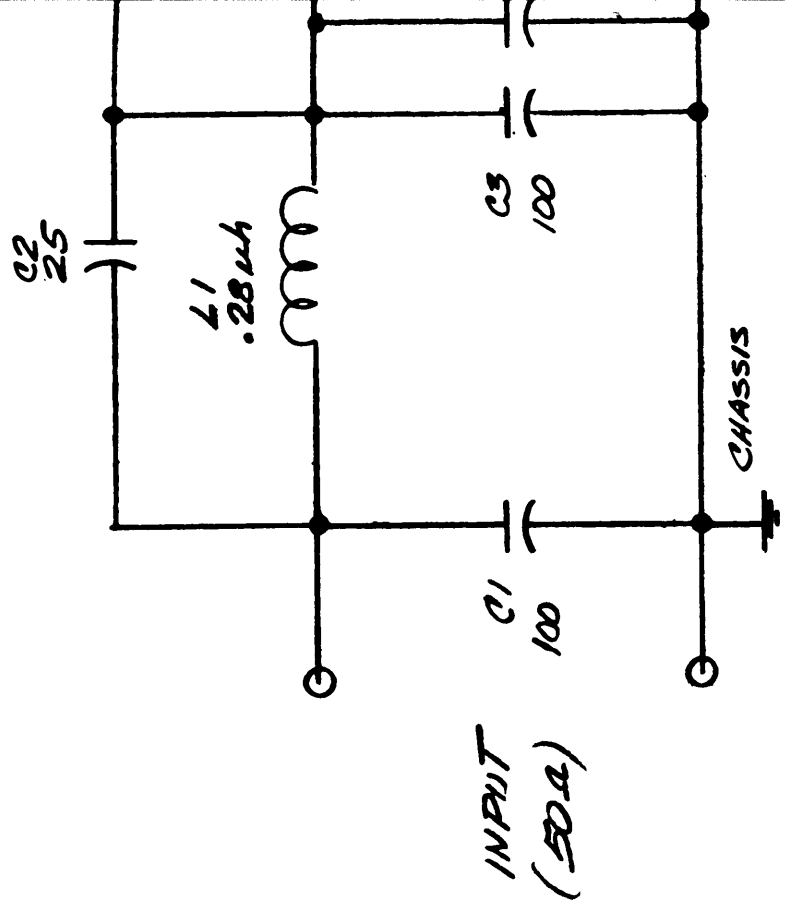
A704S1	
POS	BAND - MHz
1	2 — 2.3
12	2.3 — 2.6
11	2.6 — 3
10	3 — 4
9	4 — 5
8	5 — 8
7	8 — 12
6	12 — 16
5	16 — 24
4	24 — 30

SWITCH SHOWN  
IN POSITION 1



NOTE  
CAPACITOR VALUES IN PICOFARAD

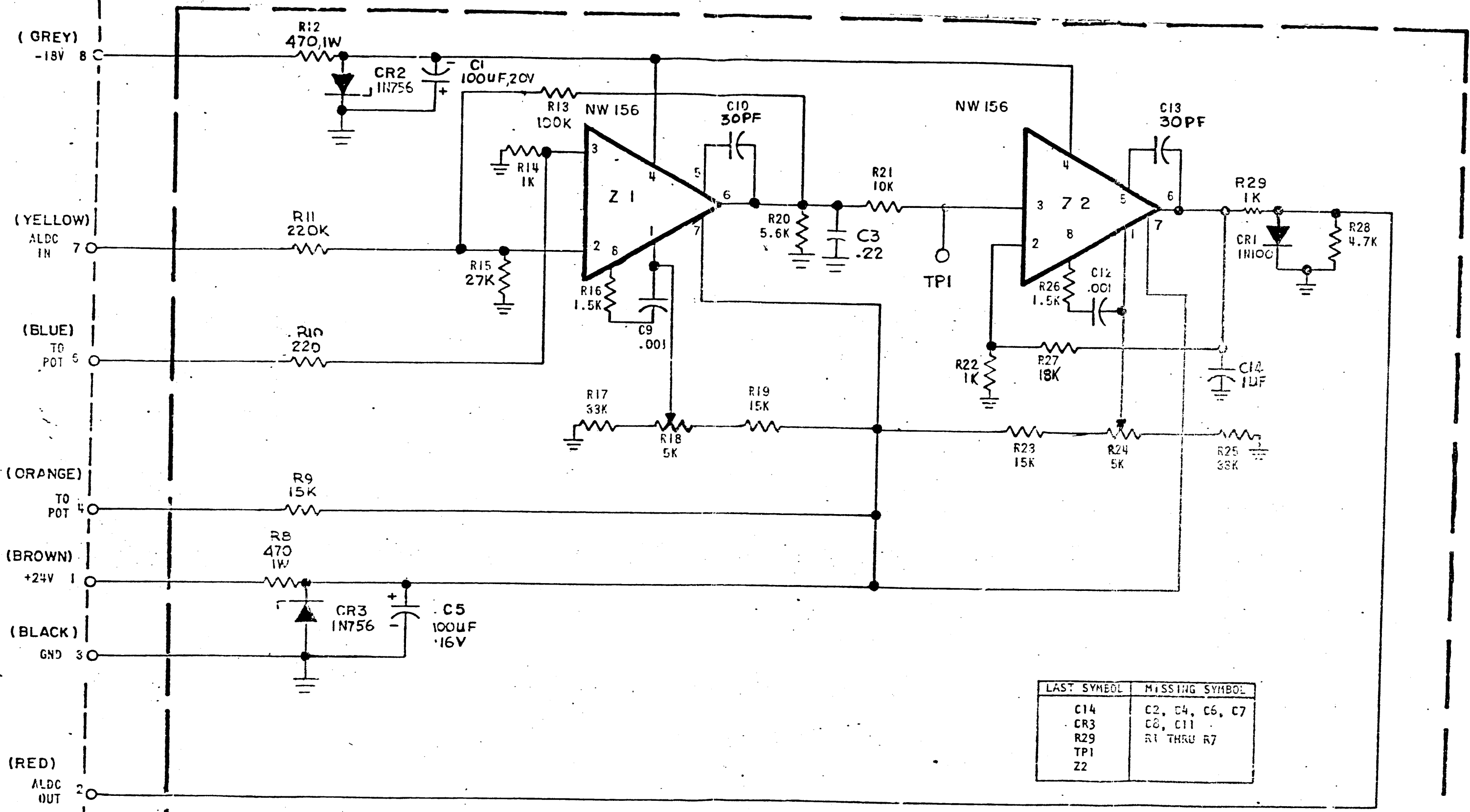
Figure 7-9. Schematic Diagram, HFL( )-10K Harmonic Filter



INPUT  
(50Ω)

NOTE  
CAPAC

A 4856



LAST SYMBOL	MISSING SYMBOL
C14	C2, C4, C6, C7
CR3	C8, C11
R29	R1 THRU R7
TPI	
Z2	

A4855/PC583

Figure 7-10 Schematic Diagram, HFL( )-10K  
ALDC Assembly (A707)



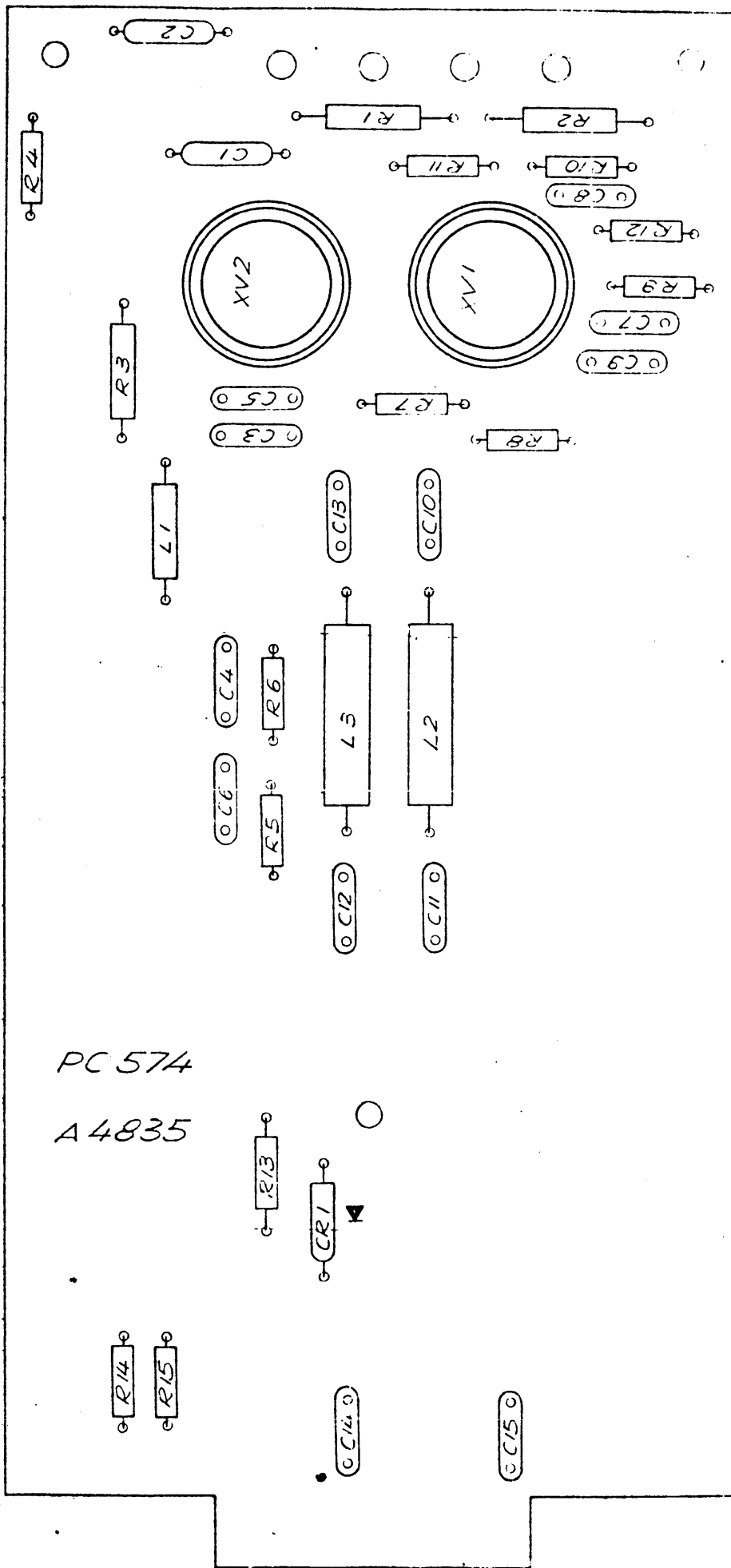


Figure 7-11. Component Location, A701 (A4835)

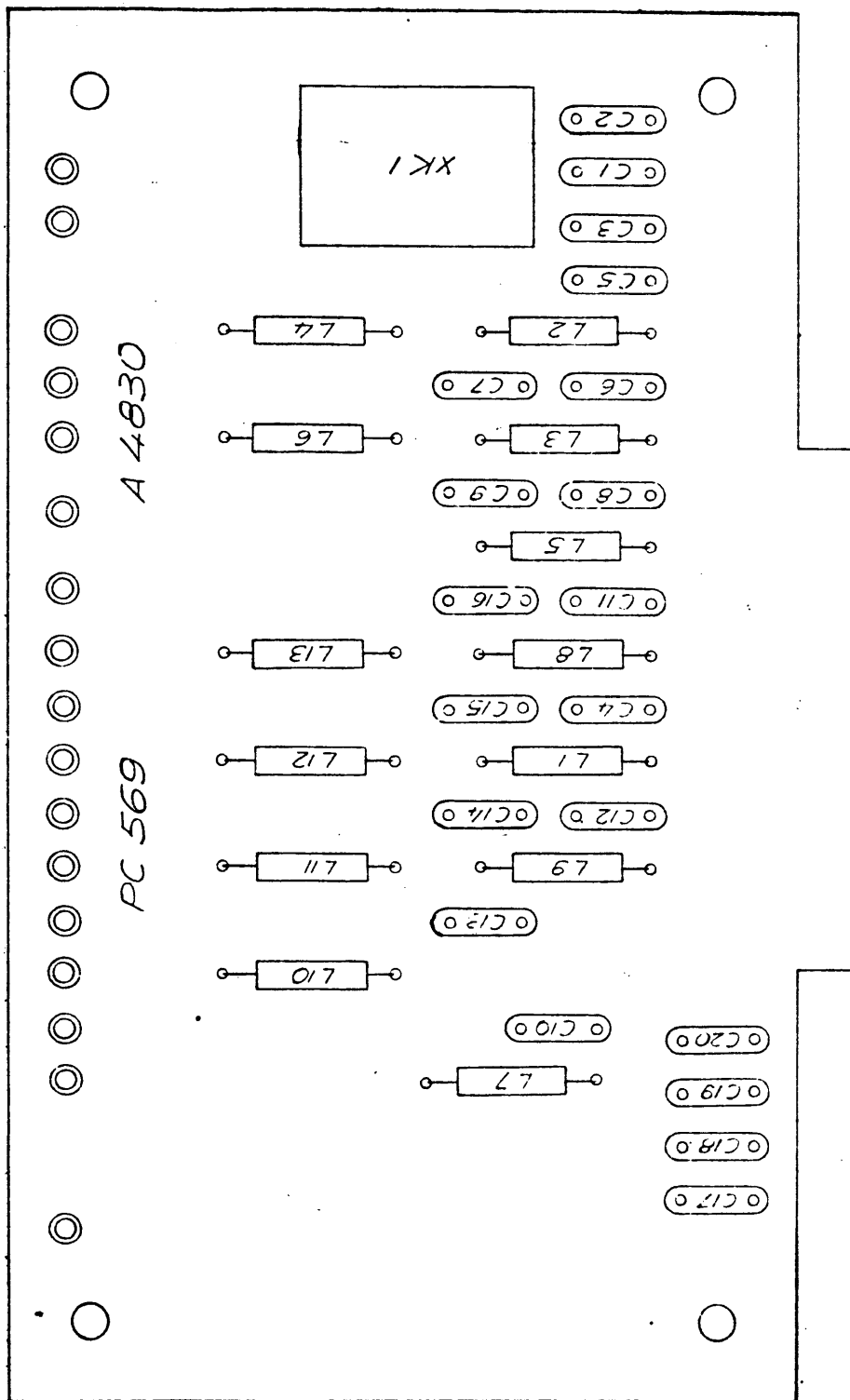


Figure 7-12. Component Location,  
A702A1 (A4830)

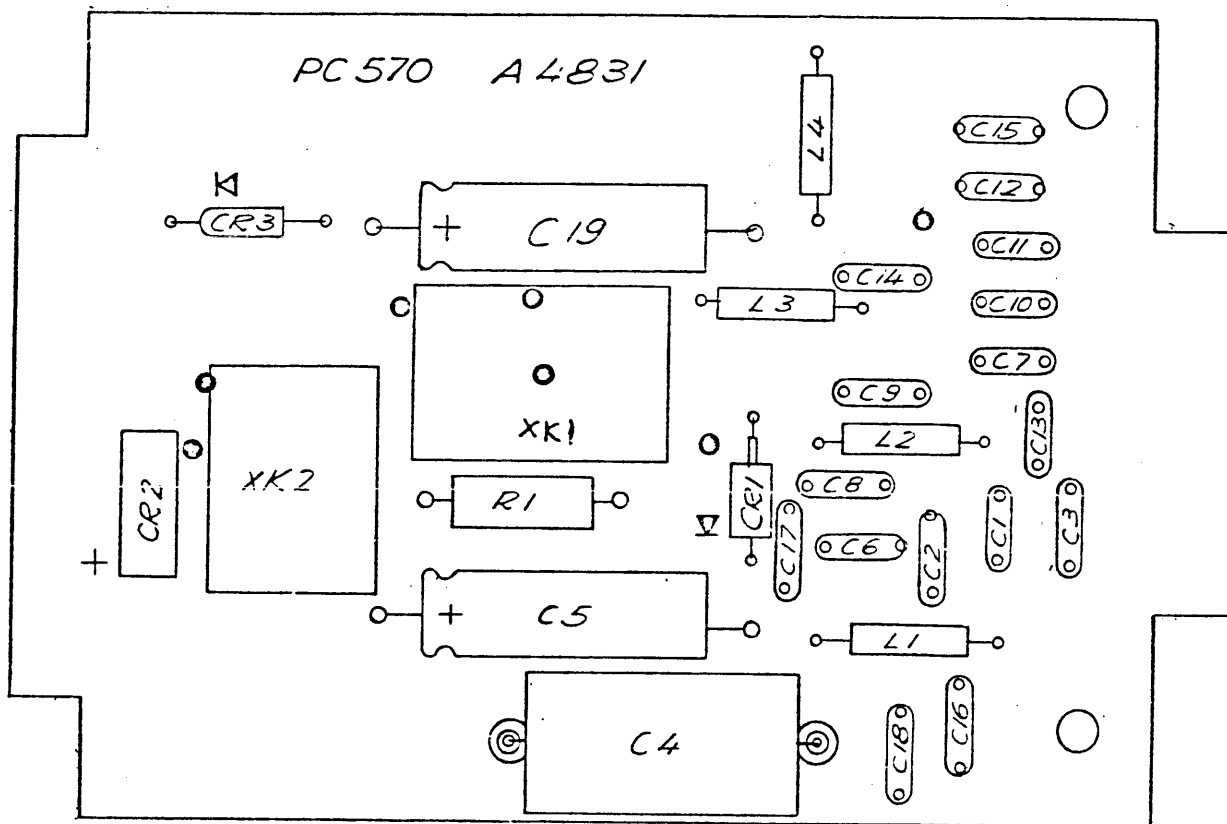


Figure 7-13. Component Location,  
A703A1 (A4831)

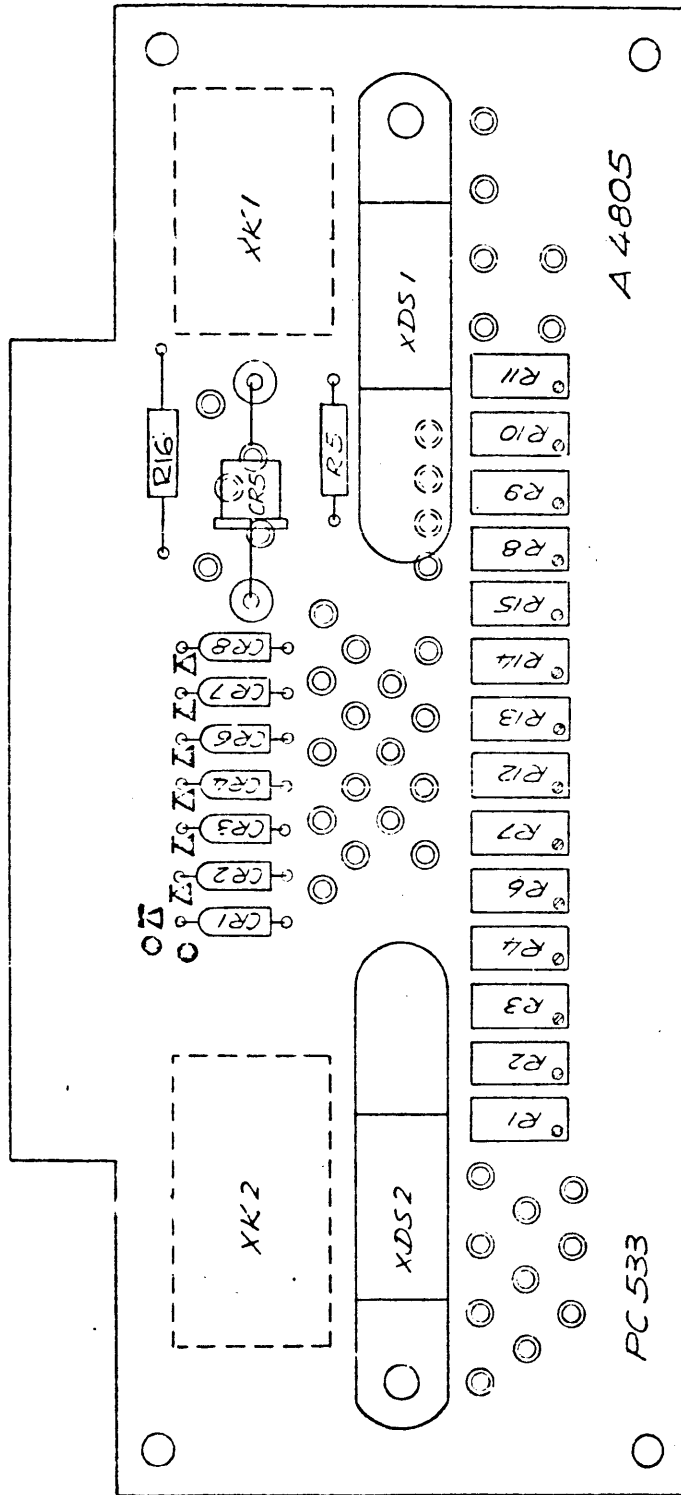


Figure 7-14. Component Location,  
A705A1 (A4805)

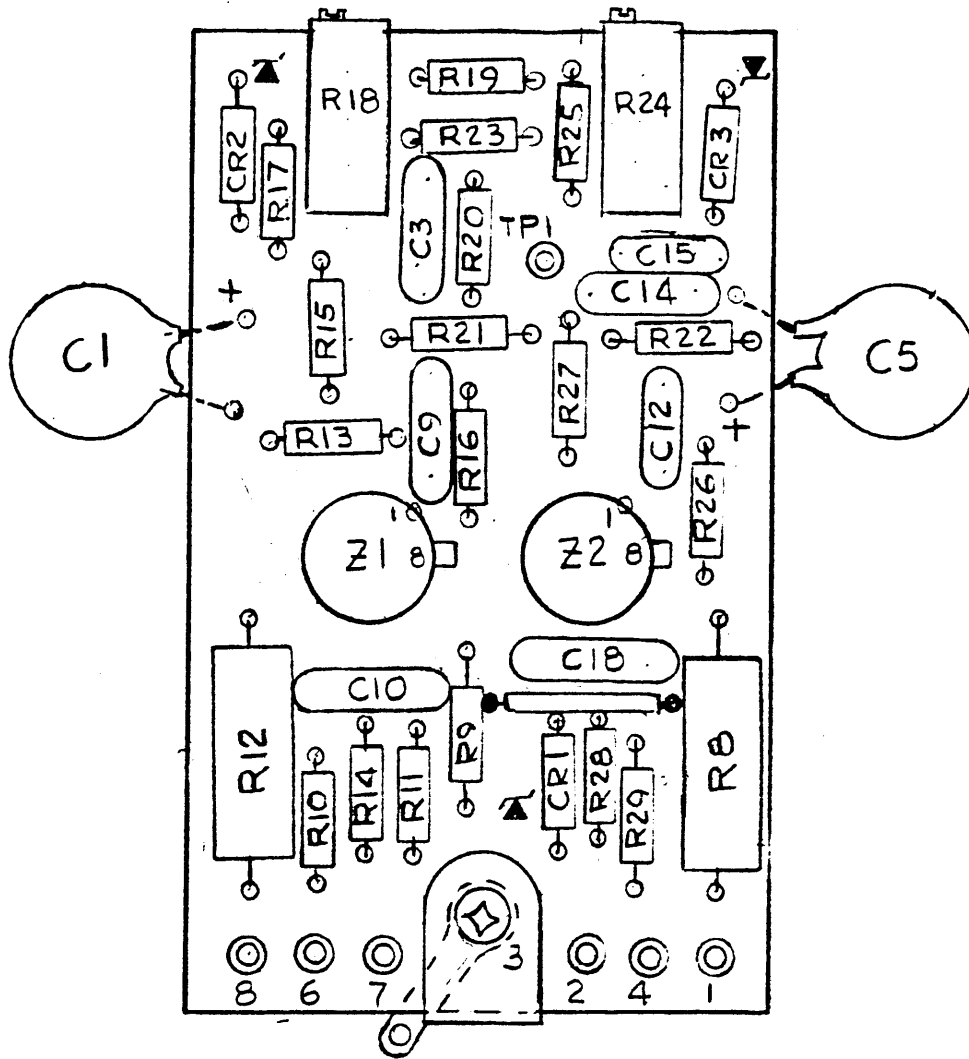


Figure 7-15. Component Location,  
A707A1 (A4855)

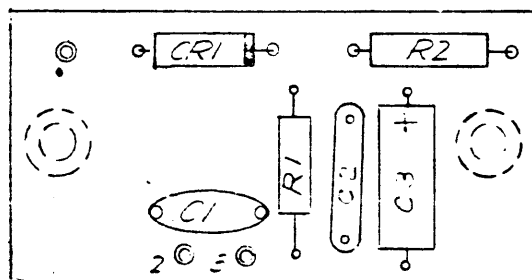


Figure 7-16. Component Location,  
A708 (A4850-3)

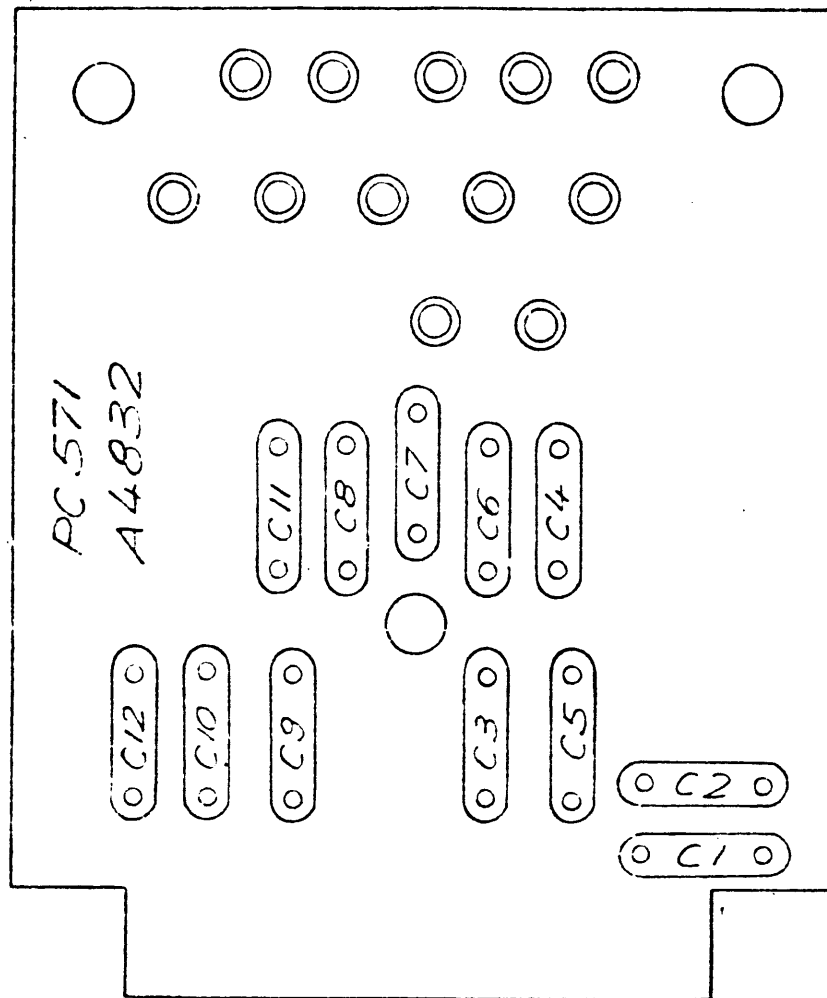


Figure 7-17. Component Location,  
A1001A1 (A4832)

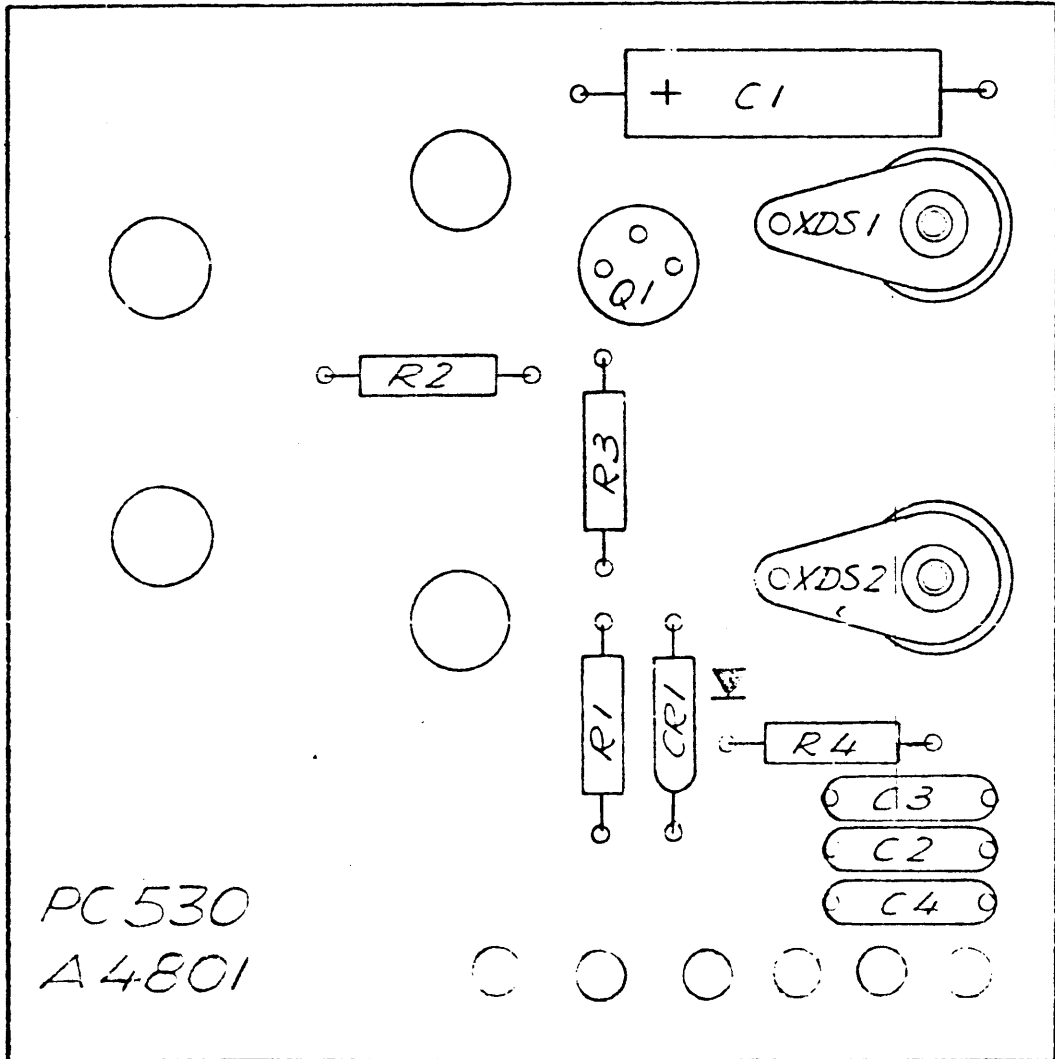


Figure 7-18. Component Location,  
A1006 (A4801)

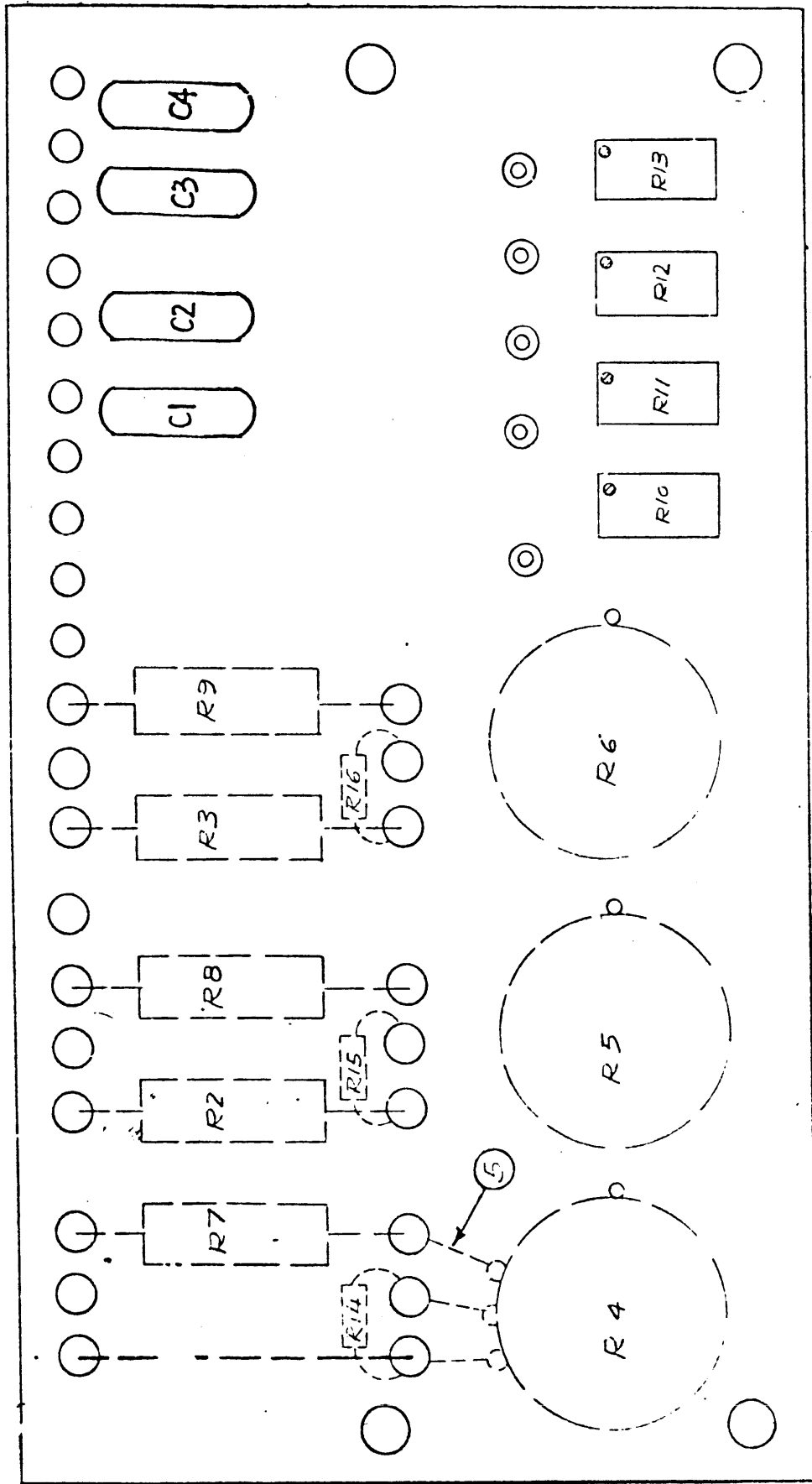


Figure 7-19. Component Location, AT1007 (A4833)



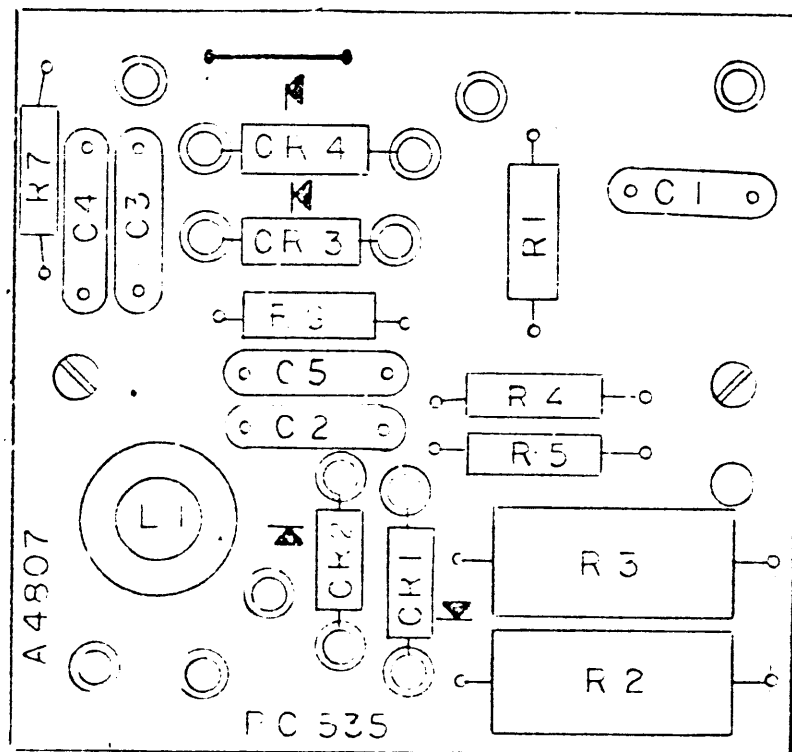


Figure 7-20. Component Location,  
A1008 (A4807)

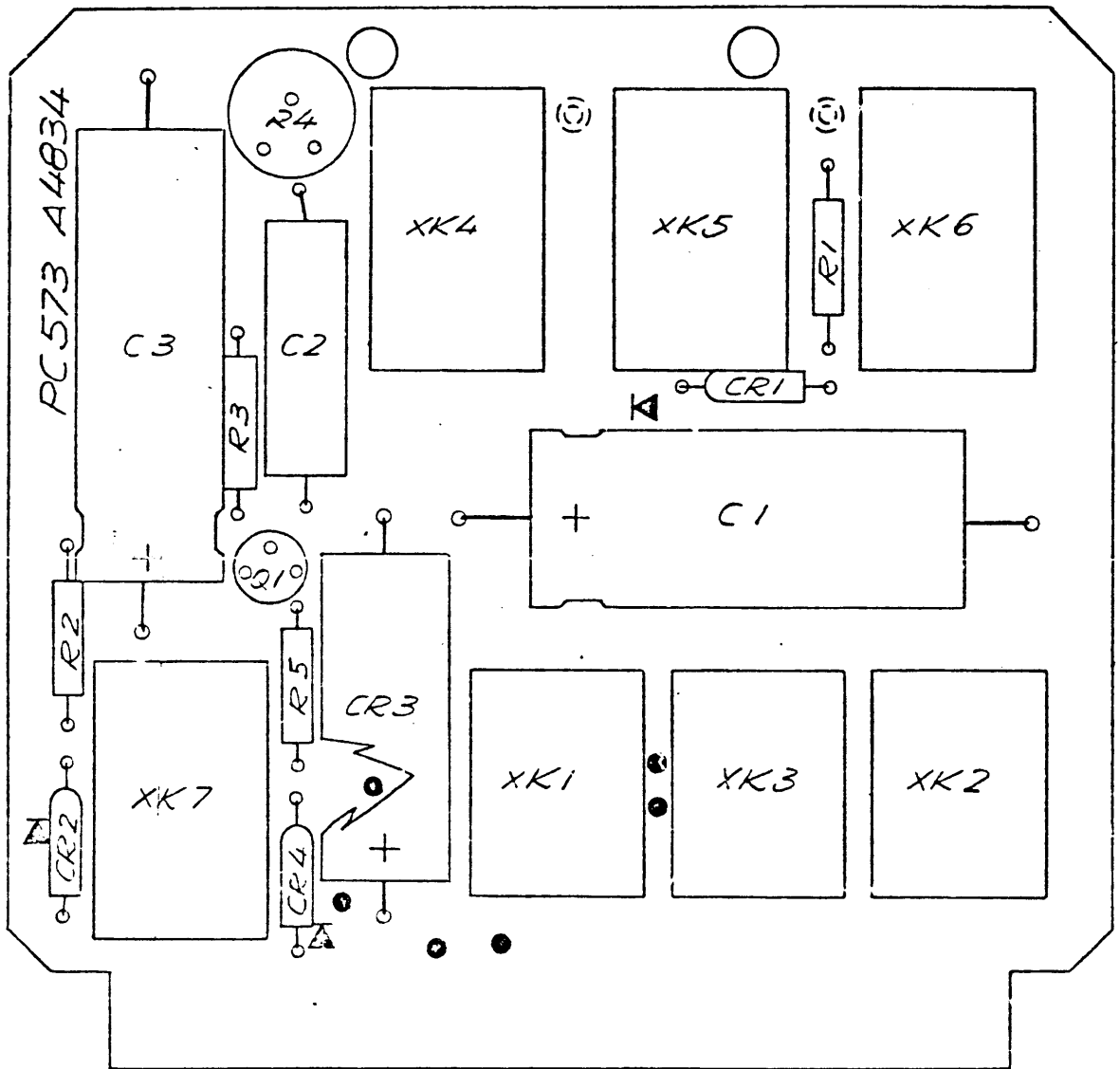


Figure 7-21. Component Location,  
A2001 (A4834)

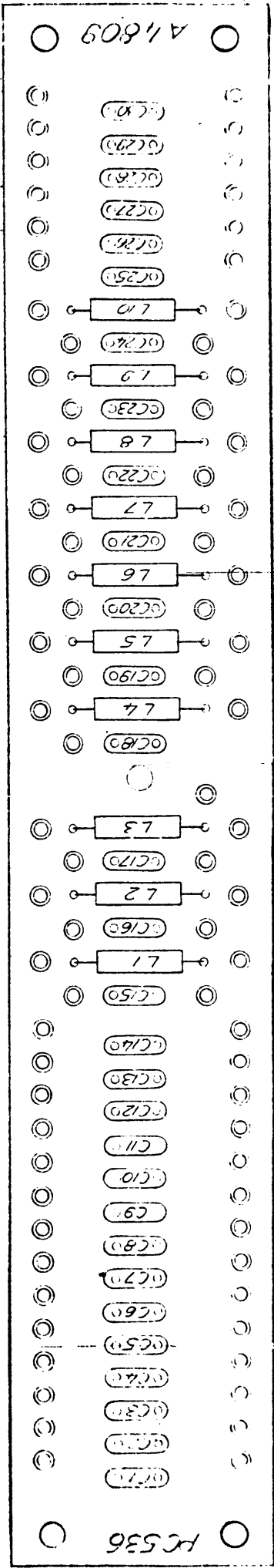


Figure 7-22. Component Location, A3001 (A4809)

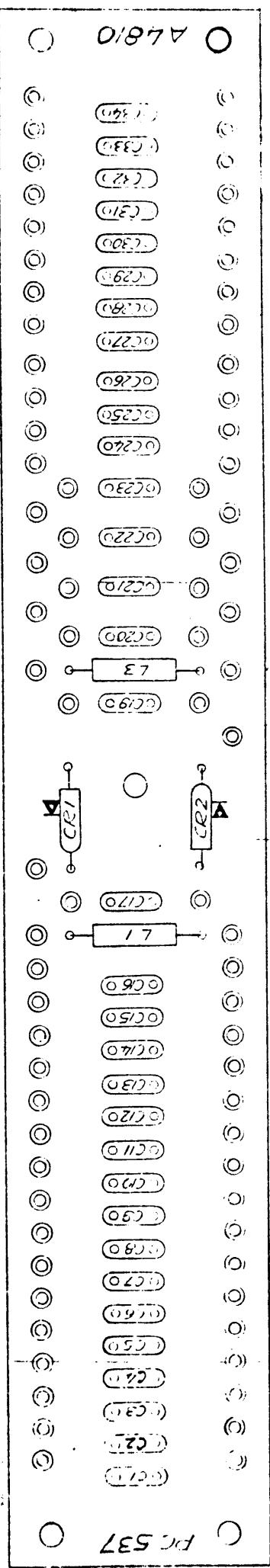


Figure 7-23. Component Location, A3002 (A4810)

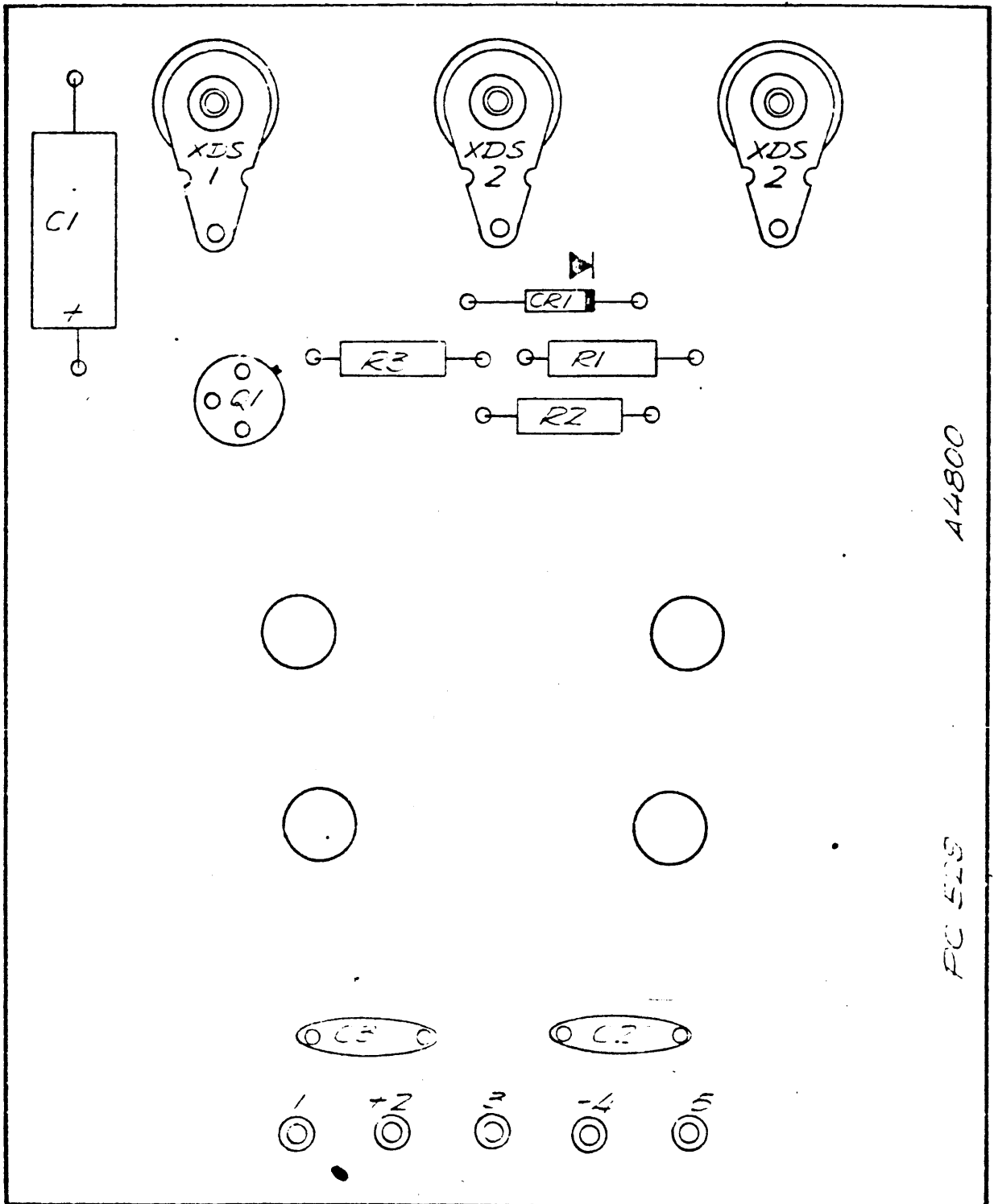


Figure 7-24. Component Location,  
A4001 (A4800)

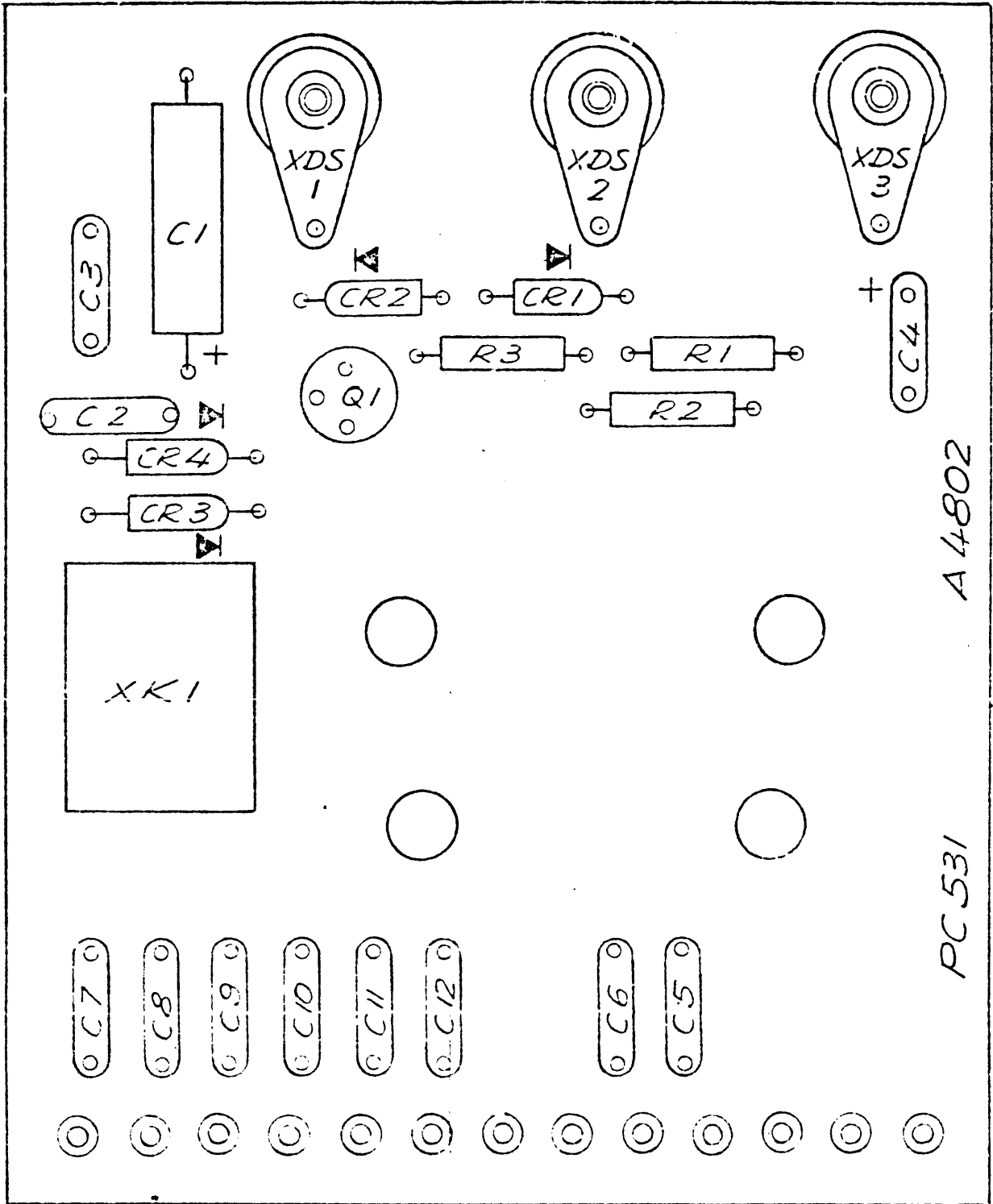


Figure 7-25. Component Location, A4003 (A4802)

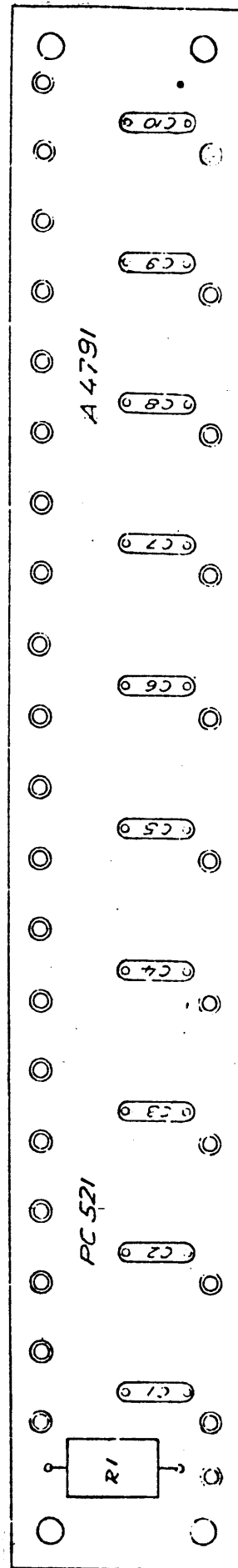


Figure 7-26. Component Location,  
A5001 (A4791)

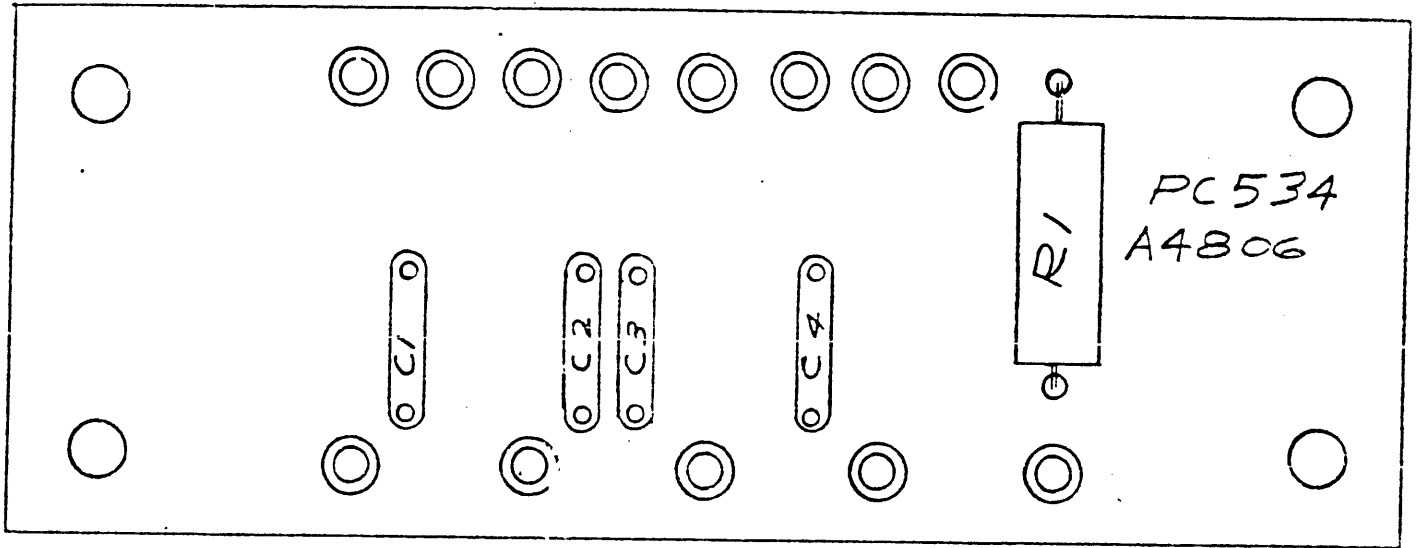


Figure 7-27. Component Location,  
A5002 (A4806)