

★
UNCLASSIFIED

TECHNICAL MANUAL

for

GENERAL TRANSMITTER

MODEL GPTA-2.5EB/50



THE TECHNICAL MATERIEL CORPORATION
MAMARONECK, N.Y.

OTTAWA, ONTARIO



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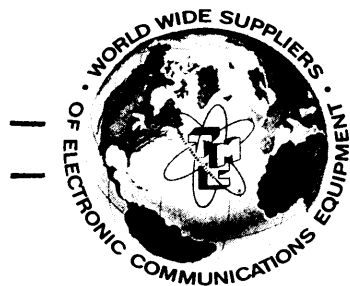
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THE TECHNICAL MATERIEL CORPORATION

C O M M U N I C A T I O N S E N G I N E E R S

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MAMARONECK, N. Y.

W a r r a n t y

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

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

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

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

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

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

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

*Electron tubes also include semi-conductor devices.

LOGISTICS

1. MATERIAL HANDLING.

Whether the equipment is crated or uncrated, various precautions must be observed in material handling.

CAUTION

Crates must never be rolled, crushed, dropped, or struck - they contain delicate electronic apparatus that can be damaged.

General safety precautions should be adhered to when moving the equipment to prevent injury to personnel or damage to equipment. Weight alone is not an important consideration. A light-weight, large, and bulky item cannot easily be handled by one man. When personnel are involved in handling, a good rule-of-thumb to follow is: 50 pounds for one man, or 100 pounds for two men. These weights are considered a safe limit for carrying. When lifting an item, bend the knees, keep back straight and lift with the legs.

2. PACKAGING DATA.

The transmitter is packed in 6 crates (not including running spares). Each crate is assigned a number from one to six and appears on the crate. Physically locate crate 1 closest to the intended point of installation; locate the other crates according to their numerical sequence, such that crate 6 is placed farthest away from crate 1. Arranging crates in this manner makes unpacking and assembling the transmitter easier.

The transmitter is cleaned, preserved, packaged, and marked in accordance with MIL-P-116, PMD-40, and MIL-STD-129.

3. EQUIPMENT INSPECTION AND DAMAGE.

The transmitter has been assembled, calibrated, and tested at the factory before shipment. Inspect all packages for possible transit damage. While

following the procedural installation instructions, carefully unpack each crate as indicated; inspect all packing material for parts that may have been shipped as loose items.

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

4. UNCRATING METHODS.

The following uncrating methods must be adhered to when unpacking the transmitter to prevent equipment damage. Keep in mind the information previously discussed on material handling, packaging data, and equipment inspection.

- a. Remove wire straps or bands from around crates with pair of snips.
- b. Unless otherwise specified, remove nails from three sides of the crates with a nail puller. Do not use claw hammer or pinch bar.
- c. Carefully remove sides of crate, then rip off moisture-proof paper. If a knife is used, care should be exercised not to mar equipment.
- d. If equipment is not packed in cardboard carton, it may be removed from crate as prescribed in installation procedure.
- e. If after removing moisture-proof paper a cardboard carton is encountered, carefully open with case cutter.
- 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. An inventory of the equipment should be made at this time. As parts are unpacked, they should be marked off on the packing list or equipment supplied list.

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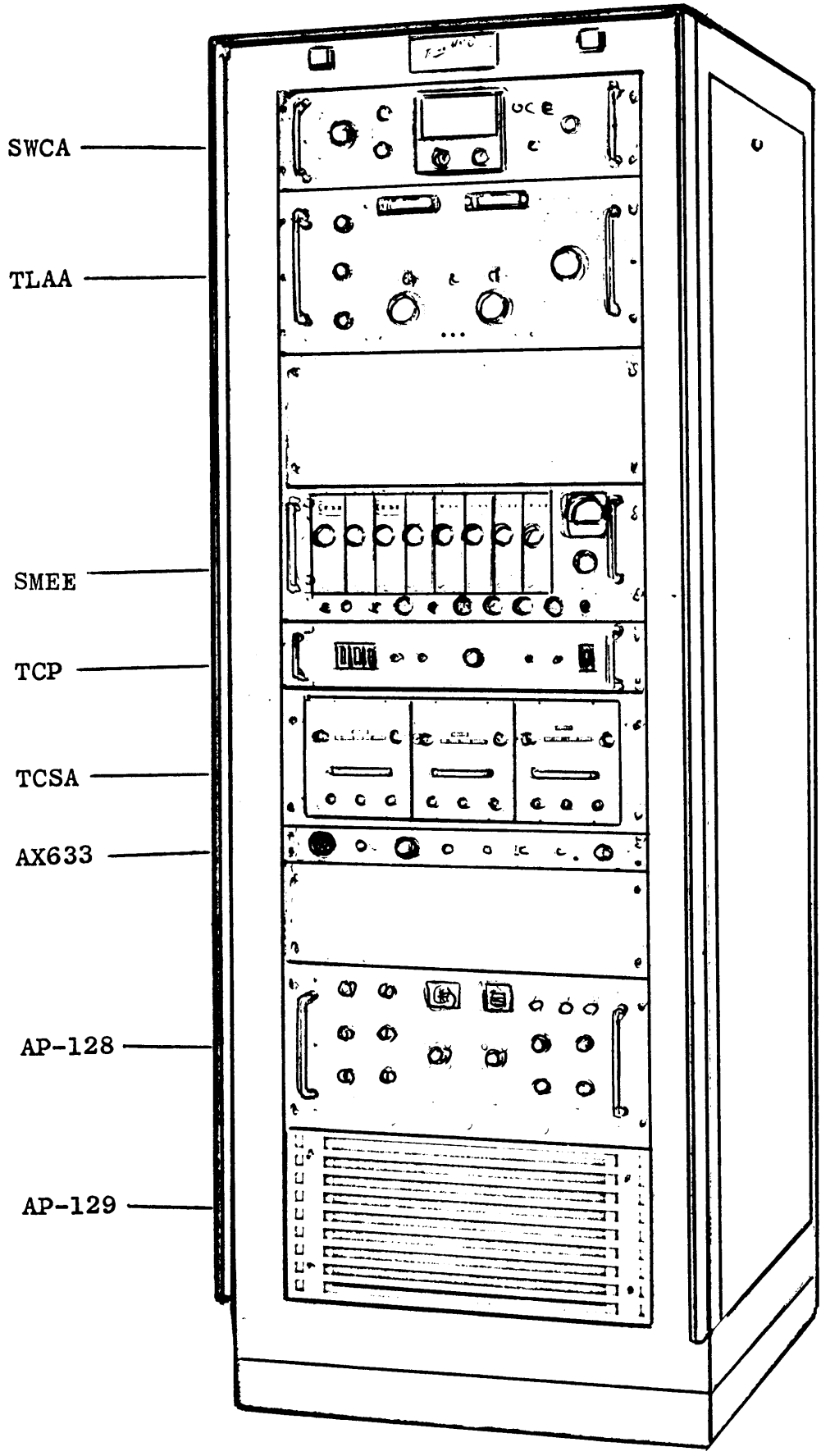
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Figure 1-1. Radio Transmitter, Model GPTA-2.5EB

SECTION 1

GENERAL INFORMATION

1-1. PURPOSE OF EQUIPMENT

Radio Transmitter, Model GPTA-2.5EB/50 (figure 1-1) is a general purpose, self-tunable transmitter system providing 2500 watts peak envelope power (PEP) throughout the 2 to 32 megacycle (MHz) frequency range.

Operating modes include single-sideband (SSB), amplitude modulation equivalent (AME), continuous wave (CW) and modulated continuous wave (MCW). Facsimile (FAX) and frequency-shift keying (FSK) may also be transmitted when used with additional equipment to provide FAX and FSK input signals.

Front-panel meter monitoring of all critical circuits and operational safety features are also provided. Safety features include mechanical/electrical interlocks, overload protective circuits for bias, plate current, screen current and transmission vswr.

1-2. EQUIPMENT MAKE-UP

The transmitter major components are listed in table 1-1. See figure 1-1 for physical component mounting locations and paragraph 1-3 for component descriptions.

1-3. DESCRIPTION OF EQUIPMENT

a. RF CONTROL AND INDICATOR, SWCA-3K. - The SWCA contains the d-c controlled rotary solenoids for bandswitching. The unit also contains a power output meter that is calibrated in kilowatts; this meter also contains a second scale for measuring the transmission line SWR. An SWR switch is associated with the dual purpose output meter. The transmission line SWR is continuously monitored by a sensitive d-c relay that will de-energize the transmitter should the SWR exceed the preset levels.

b. LINEAR AMPLIFIER, TLAA-2.5K. - The linear amplifier serves as a 40 db

power amplifier between the exciter and the antenna. The TLAA contains the tune, loading and bandswitching circuits and all r-f amplifier parts. The final tube (2.5Kw amplifier) of the 3-stage amplifier is convection air-cooled by a self-contained blower in the r-f section.

c. LOW VOLTAGE POWER SUPPLY, AP-128. - The low voltage power supply provides operating voltages to the linear amplifier. This unit also contains the overload protection circuit controls to adjust the overload relay sensitivity settings. The AP-128 provides bias, screen and filament voltages to the linear amplifier plus voltages in the interlock and control circuits. The front panel contains filament and plate time meters and overload indicator lamps. All amplifier overload adjustments and bias controls are also front panel mounted.

d. HIGH VOLTAGE POWER SUPPLY, AP-129. - The 5 kv high voltage power supply, mounted at the bottom of the equipment cabinet, contains the high voltage solid state rectifier stacks, filtering and the delta-wye step-up transformer.

This unit generates 5000 volts d-c for the plate of the 2.5 kw power amplifier tube. An automatic 60-second time delay circuit is integrally mounted inside the unit to delay the application of screen voltages to the linear amplifier to prevent stripping of the PA filaments. This, in effect prevents a sudden heavy conduction of the linear amplifier.

e. SERVO AMPLIFIER ASSEMBLY, TCSA-1. - The TCSA houses three servo amplifier units. These units, when controlled by the sense circuits of the linear amplifier, automatically tune and load the 2nd amplifier and PA portions of the transmitter.

f. MULTI-CHANNEL EXCITER, SMEE-1. - The SMEE is a completely transistorized 8-channel superheterodyne communications exciter that operates on any crystal-controlled frequency in the range of 2 to 32 megacycles. This is accomplished by use of eight fixed-tuned plug-in modules (TTRT) for its r-f section.

The exciter provides up to 250-mv excitation for SSB, AME, FSK, FAX, CW

and MCW modes of operation.

NOTE

Additional equipment is required to provide FSK and FAX input signals.

g. LOCAL CONTROL PANEL, TCP-1. - The TCP controls the application of plate voltages to the 2.5 kw power amplifier section and monitors all interlock circuits contained in the cabinet. The TCP also controls the primary a-c power input to the cabinet. Other front panel controls include a reset push-button associated with the overload and bias relays in the low voltage power supply AP-128.

h. ALARM PANEL, AX633. - The AX633 is an alarm and monitor unit, providing connector receptacles for monitoring the PA output. An audio input jack, front panel mounted, provides for insertion of a two-tone test signal for testing the exciter unit. An audio alarm device, with its associated on/off toggle switch, and a d-c line fuse are also front panel mounted. The alarm is activated when the transmitter's high voltage is removed. This action is controlled by the high voltage power supply circuit breaker.

i. CABINET, ELECTRICAL EQUIPMENT, RAK-110-2AA. - The RAK houses all the components comprising the transmitter, measuring 72-inches high by 25-1/4-inches wide by 30-inches deep. Rear and side access doors permit ease in maintenance and accessibility to hard-to reach components. The r-f output is fed to the directional coupler mounted on the upper rear right-hand portion of the cabinet. Heavy power supply components are bolted at the bottom, where the primary power connections are also made. A harmonic filter AF107 (used to reject all frequencies above the 32-megacycle range) is mounted at the rear right-hand portion of the cabinet.

1-4. TECHNICAL CHARACTERISTICS

Frequency Range:	2 to 32 megacycles (MHz), bandswitched.
Output Power:	2500 watts PEP

1-4. TECHNICAL CHARACTERISTICS (CONT)

Operating Modes: SSB, AME, CW, MCW, FAX*, and FSK*.
*With appropriate external unit such as TMC Model TIS-3.

Tuning: All tuning, loading and bandswitching controls on front panel.

Relative Humidity: Up to 90%.

Ambient Temp. Range: 0° to 50°C.

Metering: Front panel meters monitor operation of all critical circuits.

ALDC: ALDC (automatic load and drive control) circuit provided to improve linearity, limit distortion, and deliver a relatively constant output during high modulation peaks or load changes. Front panel control allows adjustment of ALDC attack point or circuit disabling.

Output Impedance: 50 ohms, unbalanced.

Harmonic Suppression: Second harmonics at least 50 db below full PEP when measured with standard two-tone test; all other harmonics down at least 55 db.

Signal/Distortion Ratio: Distortion products are at least 40 db below either tone of a standard two-tone test at full PEP output.

Hum and Noise Level: Hum at least 50 db below full PEP; all other noise down at least 70 db.

Cooling: Forced air.

Operating Temperature: Designed to operate in a 0° to 50°C ambient with relative humidity of up to 90%.

Power Input: 195/208/220/230/380/440 volts a-c, 50/60 cps, 3-phase.

Heat Dissipation: 5000 watts.

Air Intake: 500 CFM.

Weight: 1000 lbs. (approx).

TABLE 1-1. MAJOR COMPONENTS

TMC DESIGNATION
Cabinet, Electrical Equipment, RAK-110-2AA
Multi Channel Exciter, Model SMEE-1
Linear Amplifier, Model TLAA-2.5K
Servo Amplifier, Model TCSA-1
RF Control and Indicator, Model SWCA-3K
Linear Amplifier Control Panel, Model TCP-1
Low Voltage Power Supply, AP-128/50
High Voltage Power Supply, AP-129/50
Alarm Panel, AX633

SECTION 2

INSTALLATION

2-1. INITIAL INSPECTION

Inspect the transmitter packing cases for possible damage when they arrive at the operating site. With respect to equipment damage for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and the furnishing of replacement parts. Inspect the packing material for parts that may have been shipped as loose items.

2-2. ASSEMBLY

Install the transmitter components into the rack as shown in figure 1-1. Intracomponent cabling is shipped pre-installed in the rack in the form of cable harnesses attached to the rack structure. Connect each free plug-end of the harness to its mating receptacle on the component by matching the "J" number (marked on the cable adjacent to the plug) with the "J" number appearing on the component adjacent to the receptacle. In the same way, connect each free end containing a fanning strip to its mating terminal block by matching "E" numbers. Refer to paragraph 2-4 for installation instructions.

2-3. POWER REQUIREMENTS.

The transmitter requires a 3-phase, 195/205/225/380/410/450 vac, 50/60 cps delta or wye source line. Referring to figure 2-1, make appropriate connections at taps of T8000 transformer at the bottom of the rack for the particular power source available. Then connect source at A5586 Line Filter.

It is recommended that an external 3-phase circuit breaker interface the transmitter with the main 3-phase supply voltage. The external circuit breaker will allow complete isolation of the transmitter voltage input and therefor pro-

vide for safe maintenance and servicing.

The external circuit breaker should be independent from other equipment.

2-4. INSTALLATION PROCEDURES

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

Carefully read the instructions for each step. After reading, consider the complexity involved in performing the step; it may be advisable to simulate a complex step before actually doing it. Make sure each step has been completed before proceeding to the next.

Cables, wires, and other miscellaneous items that are disconnected during linear amplifier 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 frame or section of the frame with a front panel drawer, or piece of exterior trim. If any confusion arises regarding cable or wire connections that must be made, refer to the applicable interconnect wiring diagrams in section 2 of the technical manual.

Temporary removal and replacement of panels, and component mounting assemblies are specifically called-out in the procedure in order to install various items. Do not anticipate instructions; to insure correct installation, perform each step exactly as it is written.

Non-specialized tools are not supplied with the equipment since these items should be contained in an equipped maintenance shop.

Make sure that installation personnel adhere to previously outlined tech-

niques of uncrating and material handling (see Logistics).

STEP 1

- a. Unpack assorted loose items from crate 1.
- b. Check each item contained against equipment supplied list.

STEP 2

- a. Unpack rack from crate 2.
- b. Position rack upright, remove side and rear panels, this can be accomplished by turning the screw type fastener located at the top center of each panel.
- c. Remove all packaging material from rack and position rack in accordance with pre-installation planning.

STEP 3

To secure rack in its permanent position precede as follows:

- a. To gain access to the front mounting holes, loosen mounting hardware that fastens the high voltage power supply assembly to the rack frame.

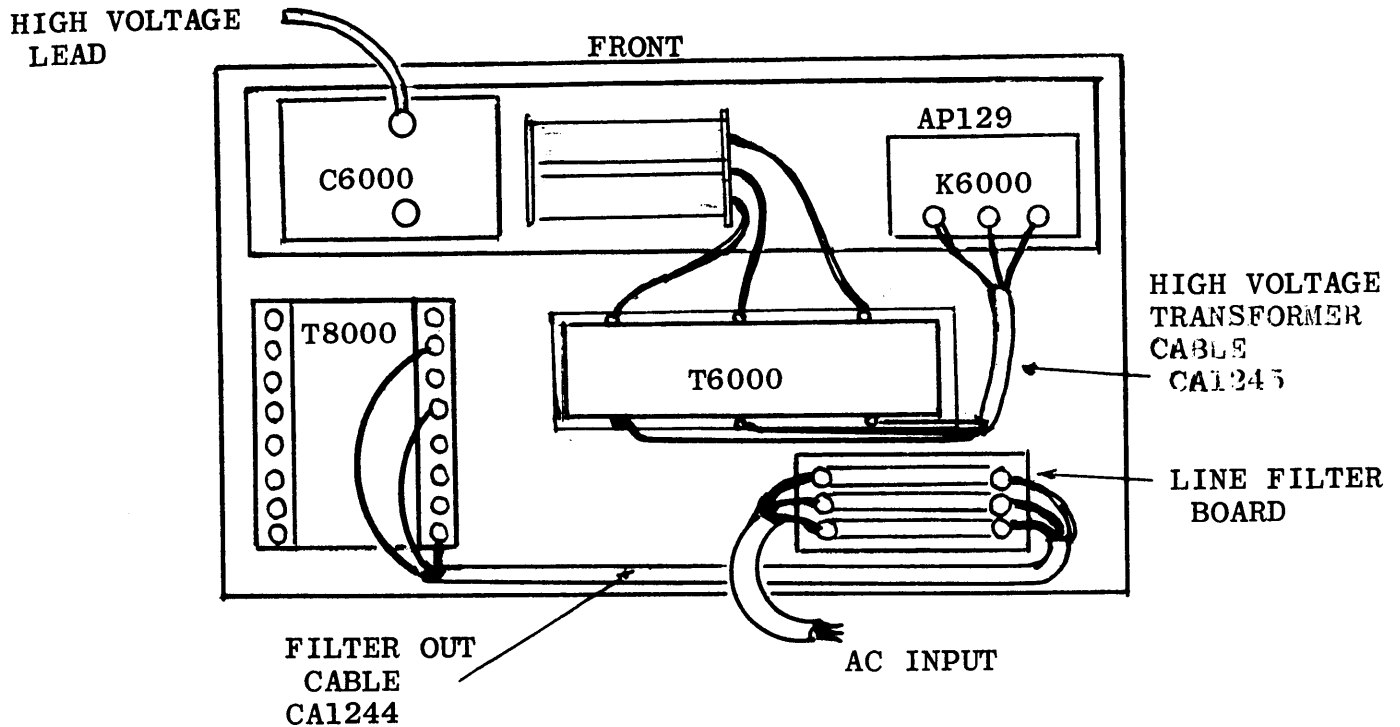
CAUTION

To eliminate any possible damage, remove high voltage lead from C6000 on power supply assembly.

- b. Slide power supply assembly toward rear of rack.
- c. Secure rack in position with four mounting bolts.
- d. Replace high voltage power supply assembly and fasten in place. Be sure to replace the high voltage lead to terminal of C6000.

STEP 4

- a. Unpack crate 3.
- b. Position transformer T8000 on base assembly.
- c. Using hardware from crate 1, tightly bolt transformer to base assembly.
- d. Remove filter out cable, CA1244 from crate 1 and fasten to terminals of transformer. (Refer to figure 2-1).
- e. Using hardware from crate 1, place 4 ceramic standoffs with their associated washers on transformer.



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Figure 2-1. Power Input Component Locations

- f. Using cover and hardware from crate 1, place transformer cover on the ceramic standoffs and secure.

STEP 5

- a. Unpack crate 4.
- b. Position transformer T6000 on base assembly.
- c. Using hardware from crate 1, tightly bolt transformer to base assembly.
- d. Connect high voltage transformer cable CA1245, which is attached to relay K6000 on power supply, to transformer as follows: white lead phase 1 terminal 1; grey lead phase 2 terminal 2; violet lead phase 3 terminal 3.

NOTE

Phase reversal may be required to correct operation of the equipment. Should phasing problems occur, interchange any two of the three phase inputs.

- e. Connect jumper leads between rectifier and transformer as follows:

<u>RECTIFIER</u>	<u>TRANSFORMER</u>
From CR6000, 1	To T6000 terminal 6
From CR6002, 3	To T6000 terminal 5
From CR6004, 5	To T6000 terminal 4

STEP 6

- Remove line filterboard A5586 from crate 1 and remove line filterboard cover.
- Using hardware from crate 1, tightly bolt line-filterboard to the base inside the bottom right-rear of the rack.
- Using loose end of CA1244 from T8000, connect white lead, phase 1 to L8000, grey lead, phase 2 to L8001, violet lead, phase 3, to L8002.
- Route a-c input cable into base assembly through access hole and secure to appropriate terminals on line filterboard.
- Position and secure filterboard cover to filterboard.

STEP 7

Refer to figure 1-1 for location of equipment in the rack.

- Remove TCP from rack and plug-in relays K4000 and K4004 (shipped as loose items) in crate 1.
- Remove SWCA from rack and plug-in relay K7002 (shipped as loose item) in crate 1.
- Unpack AP128 from crate 5 and plug-in relays K5000 through K5050 (shipped as loose items) in crate 1.
- Unpack TLAA from crate 5 and plug-in tube V2002 (PL-8576) (shipped as a loose item) and tighten tube clamp ring.

STEP 8

Now that each drawer assembly is unpacked, install it in its designated position (see figure 1-1) in the rack. To install any drawer assembly, proceed as follows:

NOTE

To insure greater rack stability start with bottom units first and work up.

- a. Untape or unstrap cable assemblies, cable retractors, and all other components secured to the inside of frame for shipment.
- b. Pull out center section of drawer tracks until they lock in an extended position.
- c. Position slide mechanisms in tracks and ease modular unit into track until lock buttons engage holes in tracks.
- d. Where applicable, pull tilt handles on sides of drawer vertically.

NOTE

When making cable or wire connections to drawer, secure cables or wires with cable clamps, where applicable.

- e. Make necessary cable and electrical connections as indicated by interconnect wiring diagrams in section 2.
- f. Pull tilt handles on sides of drawer and re-position drawer horizontally.
- g. Press lock buttons on tracks; slide drawer completely into compartment.
- h. Using hardware from crate 1 secure front panels of drawers to rack frame.

STEP 9

- a. Remove antenna connector from crate 1 and install on transmitter. Connector PL222 is to be fitted to the unbalanced coaxial transmission line and then attached to the transmitter coupler jack.
- b. Using grounding hardware supplied in crate 1 secure grounding strap to rear of unit in the threaded hole in rear center of base.

NOTE

The transmitter requires a good ground connection for efficient operation. Problems that may occur when poor ground connections exist are as follows:

- (1) "Take-off". Unit does not tune correctly. As resonance is achieved, the transmitter output tries to mistakenly reach a peak value and is prevented by overload controls tripping and de-energizing the transmitter.
- (2) "Hot Frame". R-f energy is felt at all parts of the frame and an r-f arc may be drawn from the frame.

NOTE (CONT)

(3) "Instability". The transmitter does not stabilize at the resonant frequency.

Recommendations:

(1) Several copper rods should be driven into the ground outside the station. Depending on soil condition, the rods should be driven down to a depth of 3-feet for moist (good conductive) soil, and deeper for poor conductive soil, i.e., sand, etc.

(2) Copper strapping should be brazed (welded) to the circular rods and fed into the station as the permanent station ground.

It is suggested that 3-inch wide copper straps be used. Copper braid should never be used, due to its high inductive values which may provide r-f ground isolation at certain frequencies.

(3) The length of the ground connection should be studied to prevent wavelengths at the opening frequencies, i.e. a quarter wavelength or multiples thereof of the ground connection may cause r-f ground isolation.

(4) For the HF range (2 to 30 mc), recommended ground connection (to true ground) should be less than 10-meters wherever practicable.

(5) Connection of the station grounding system to the structure or water plumbing of the building should be avoided due to high resistive joints preventing a true ground connection.

(6) The station grounding system should be checked to ensure that the lowest possible resistance is achieved to true ground. A megger type metering device is usually employed for this check.

c. Replace side and rear panels and fasten.

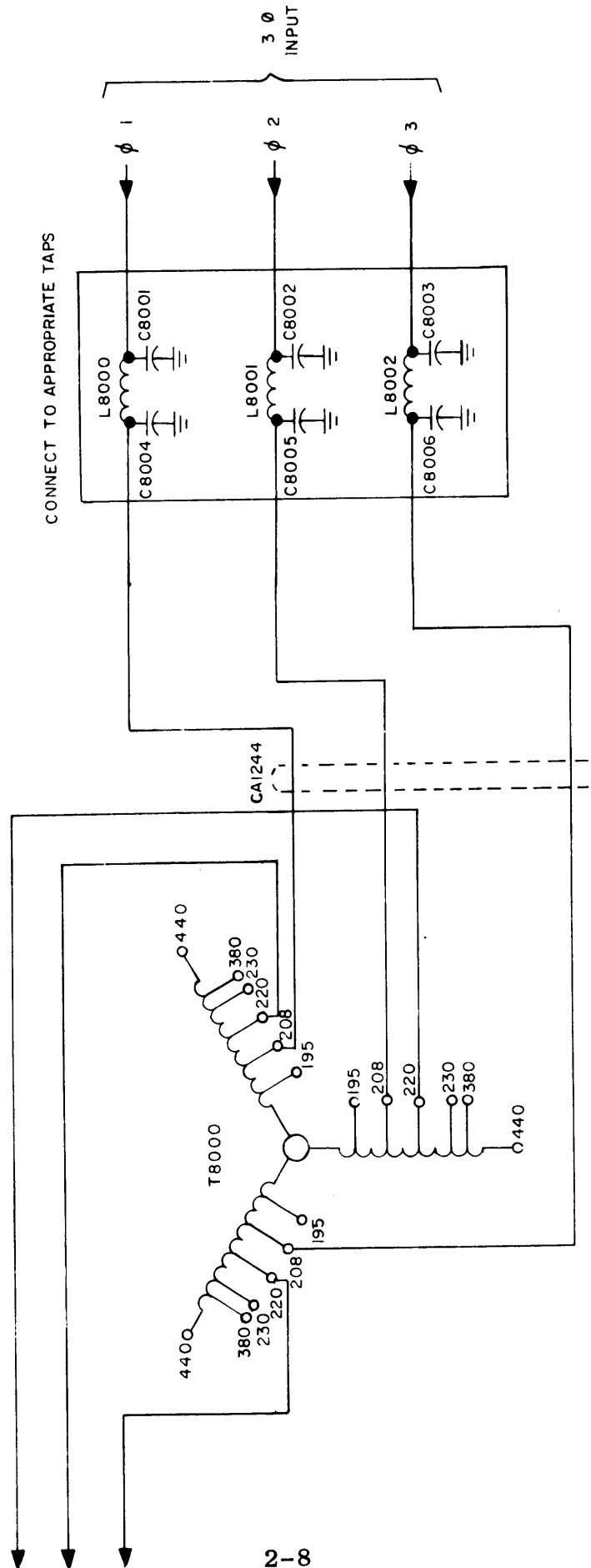
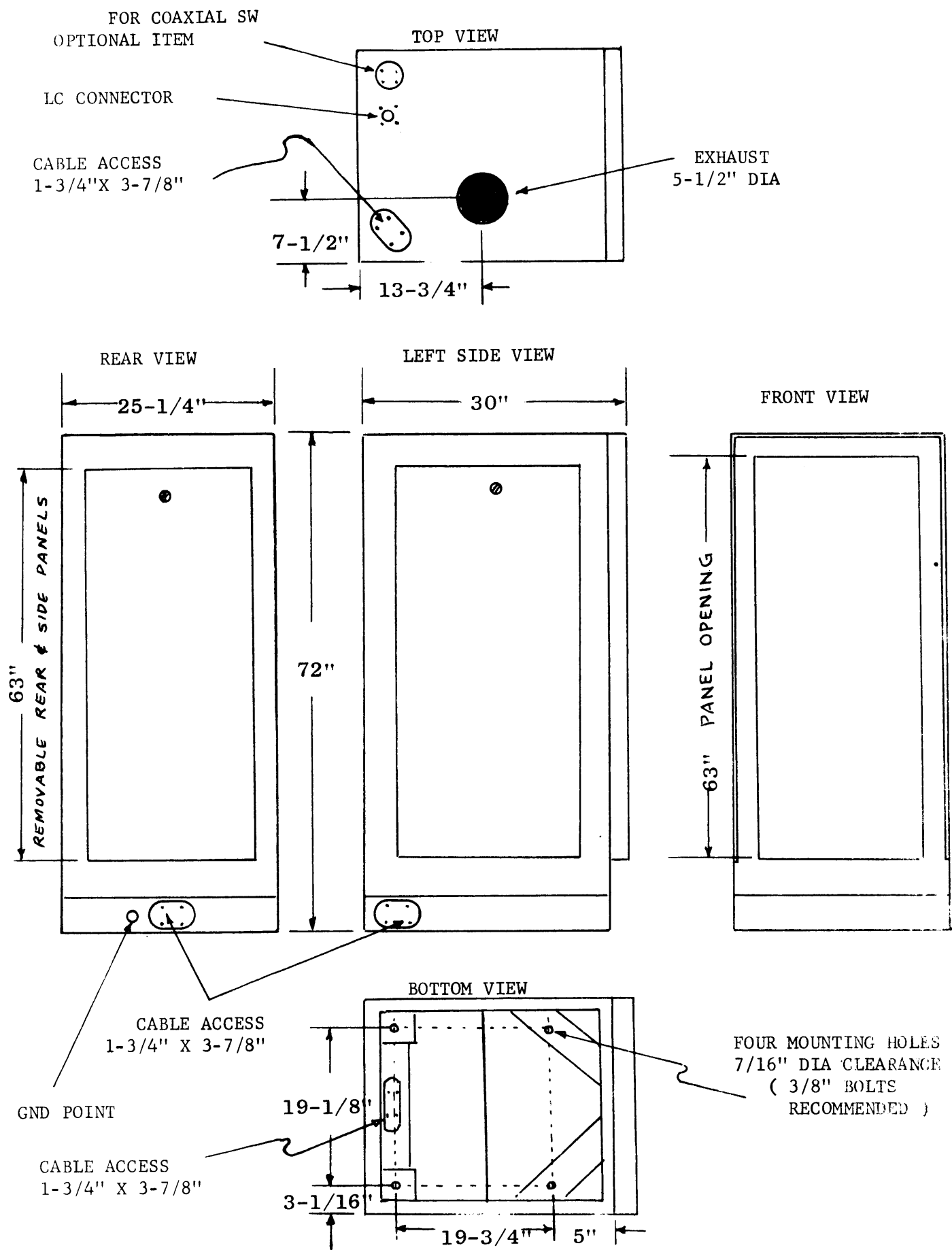


Figure 2-2. Three-Phase Power Input Wiring Diagram



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Figure 2-3. Outline Dimensional Diagram

2-5. PRE-OPERATIONAL CHECKOUT

NOTE

Refer to figure 3-1 for control and indicator designations called out in the following procedures.

a. PRELIMINARY. - With the MAIN POWER circuit breakers (39) set at OFF position, check for short circuits to ground:

- (1) The 3-power input phases should read not less than 1 megohm.
- (2) The positive side of the high voltage circuit should read not less than 100K ohms, with the shorting relays open; with the shorting relays closed, the reading should be zero.

b. LEVEL ADJUSTMENTS.

(1) BIAS LEVEL ADJUSTMENTS:

- (a) Set MAIN POWER circuit breakers (39) at ON position and allow approximately 1 minute for the Time Delay Relay to cycle.
- (b) Set MULTIMETER switch (24) at 1ST AMPL IP position, and adjust 1ST AMPL BIAS ADJ (82) for an indication of 10 on MULTIMETER (20).
- (c) Set MULTIMETER switch (24) at 2ND AMPL IP position and adjust 2ND AMPL BIAS ADJ (81) for an indication of 5 on MULTIMETER (20).
- (d) With XMTR TUNING switch (41) set at MANUAL position, set the HIGH VOLTAGE switch (42) at ON; adjust PA BIAS ADJ (80) for an indication of 350 ma on PA PLATE CURRENT meter (14). Turn off HIGH VOLTAGE switch (42), and set XMTR TUNING switch (41) at AUTO position.

(2) AUTOMATIC TUNING ADJUSTMENTS

(a) 100-Milliwatt Trigger Adjustment:

1. Set the signal generator, or exciter, to a frequency between 20 and 30 MHz.
2. Set SERVO switch (44) at ON position; the HIGH VOLTAGE switch (42) should be at OFF position.

3. Advance the gain of the signal generator, or the exciter, to a 100-millivolt output.

4. Set the SENSE switch (69) at 100 MW position and monitor the output at jack 70 with a VTVM on the +1 volt scale. Adjust the 100 MW potentiometer (located on bottom side of SWCA chassis) so the VTVM reads .5 volts.

(b) Load Sense Adjustments:

1. Tune the transmitter manually to 2.5 kw, then decrease the gain to 500 ma. Set the SENSE switch (69) at the PA LOAD position, then adjust the load sense potentiometer #1 to read zero volts (zero center).

NOTE

Adjustment potentiometers are mounted on bottom underside of SWCA chassis, accessible when SWCA is pulled out of rack. Refer to figure 2-4

2. Set the frequency at 2 MHz and tune the transmitter to full power. Reduce the plate current to read 250 ma.

3. Repeat step 1 above with frequency set at 5 MHz and adjust potentiometer #2, and with frequency set at 19 MHz adjust potentiometer #3.

(c) RF Plate Trigger Adjustment:

1. Detune the transmitter and reduce the drive to 200 ma, then adjust the TUNE and LOAD capacitors (25 and 18, respectively) until a .25 volt indication is obtained on PA LOAD sense position.

2. Set the SENSE switch (69) at PA PLATE position and monitor the output at jack 70 with a VTVM; the VTVM should be set at .5 volts indication on the -1 volt scale.

NOTE

In order to perform load pre-position adjustments that follow, leave the transmitter set up as above.

(d) Load Pre-Position Adjustments:

1. With the adjustments set as in (b) and (c) above, set the frequency at 2 MHz.
2. With the XMTR TUNING switch (41) set at AUTO position and the SERVO switch (44) at OFF, reduce the power output level until the PA PLATE CURRENT indicator reads 250 ma.
3. Unload the transmitter by turning the LOAD capacitor control (18) and re-dip the TUNE capacitor control (25) until the VTVM reads -.25 volts (above zero center).
4. Using the low frequency end of each band, repeat the above procedures on all bands, and record the respective counter readings in related column in table 2-1.
5. Reduce the drive to a minimum; set HIGH VOLTAGE switch (42) at OFF position.
6. Set the frequency of the signal generator or the exciter to the first band (refer to table 2-1). Set the XMTR TUNING switch (41) at AUTO position and the SERVO switch (44) at ON position.
7. Press the TUNE switch (43). The TUNE and LOAD capacitors (25 and 18, respectively) will pre-position to settings (indicated at indications 23 and 17, respectively).
8. Adjust the LOAD PRE-POSITION potentiometer for the selected frequency to the highest counter reading for the respective potentiometer, as indicated in table 2-1. (Refer to figure 2-4).
9. Repeat the potentiometer adjustments for remaining frequencies, as indicated in table 2-1.
10. Set the HIGH VOLTAGE switch (42) at ON position, and press the TUNE switch (43). The transmitter should tune automatically to all frequencies.

c. GENERAL TUNING.

NOTE

Manually set all controls 6, 16, 21,
and 36 to their corresponding positions.

(1) Refer to table 3-2, and set transmitter tuning controls for desired output frequency.

(2) Using a signal generator, set output for a minimum (to prevent PA screen overload from tripping).

(3) With HIGH VOLTAGE switch (42) at OFF position, turn TSTG on, and set the signal generator to 5 MHz.

(4) Set the MULTIMETER switch (24) to the 2ND AMPL EP position, and, with exciter output slightly advanced, adjust 2ND AMPL TUNING control (22) to resonance peak indication on MULTIMETER (20).

(5) Set the signal generator to minimum output, and HIGH VOLTAGE switch (42) at ON position.

(6) Advance the output of the exciter to obtain an increase on the PA PLATE CURRENT indicator (14), then adjust power amplifier TUNE control (25) for a dip in plate current indication.

(7) Adjust the LOAD control (18) for proper power amplifier loading (depending on frequency).

NOTE

After each change of loading, return power amplifier tuning to resonance; proper loading usually will occur at a power output of 2.5 kw, and a plate current of approximately 750 ma, depending on frequency.

d. OVERLOAD ADJUSTMENTS. - Connect a signal generator to the TLAA modular unit, and perform the following adjustments:

(1) PA Plate Overload

(a) Tune the transmitter to full output on any frequency.

(b) Overload the output by increasing the power amplifier output loading (decrease output load capacity).

(c) Retune the power amplifier and increase the output of the signal generator.

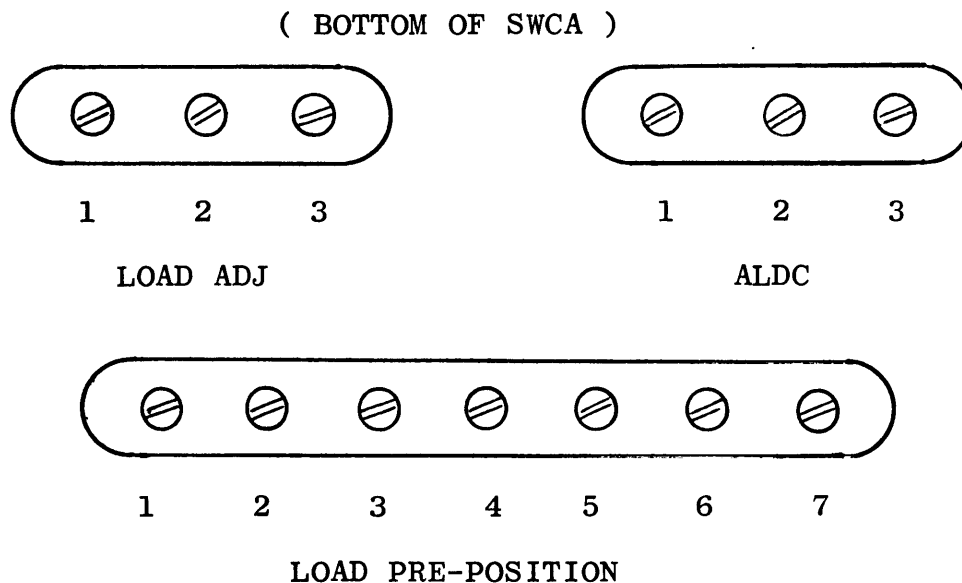
(d) Adjust the PA PLATE OVLD ADJ potentiometer (71) to trip at 1.3 amperes.

(2) PA Screen Overload

(a) With the transmitter tuned to full output on a selected frequency, underload the output by decreasing the power amplifier output loading (increase output load capacity).

(b) Connect a Simpson multimeter (Model 260, or equivalent) in series with the screen overload relay K4003, or terminal 1 or E4001. Retune the power amplifier and increase the output of the signal generator (in order to increase the screen current).

(c) Adjust the PA SCREEN OVLD ADJ potentiometer (72) with the power amplifier screen to trip at 45 ma.



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Figure 2-4. Location of Adjustment Potentiometers, SWCA

TABLE 2-1. LOAD PRE-POSITION ADJUSTMENTS

POTENTIOMETERS	PRE-POSITION BANDS	COUNTER READING
1	2 - 2.5	
2	2.5 - 3	
	3 - 4	
3	4 - 5	
	5 - 6	
4	6 - 7	
	19 - 22	
	22 - 24	
	24 - 26	
5	7 - 9	
	11 - 13	
	15 - 17	
6	9 - 11	
	17 - 19	
	28 - 30	
7	13 - 15	
	26 - 28	

NOTE

For easier handling and reference, this oversized wiring diagram has been placed at the rear portion of this manual.

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SECTION 3

OPERATOR'S SECTION

3-1. GENERAL.

Before operating the transmitter, the operator should familiarize himself with the controls and indicators illustrated in figure 3-1 and described in table 3-1. Refer to Section 1 of this manual for detailed technical information regarding the transmitter modular units. Table 3-2 provides typical tuning information.

3-2. OPERATING PROCEDURE.

The transmitter control settings for (a) manual tuning, and (b) local servo tuning are as follows:

NOTE

All procedures that follow require the POWER switch (26) of the SMEC to be set at ON.

a. MANUAL TUNING

- (1) Select desired channel with CHANNEL switch (36); also set the frequency selector switch (6), the PA BANDSWITCH (16), and the 2ND AMPL BANDSWITCH (21) to the corresponding settings.
- (2) Set the RF GAIN control (11) completely counterclockwise.
- (3) Set MAIN POWER circuit breakers (39) at ON and allow approximately 1 minute for the filament timer to activate.
- (4) Set XMTR TUNING switch (41) at AUTO, and the SERVO switch (44) at ON.
- (5) After the bandswitches have positioned to the desired bands, set the SERVO switch (44) at OFF.
- (6) Set the Power Limit controls (8, 13) for desired power output (controls 8 and 13 are for minimum and maximum power output settings, respectively).

(7) Set the LOAD and TUNE controls (18 and 25 respectively) to obtain capacitor counter readings as given in table 3-2 on indications (17 and 23, respectively).

(8) Set MULTIMETER switch (24) to 2ND AMPL EP.

(9) Set RF GAIN control section (33) fully clockwise.

(10) Advance RF GAIN control (11) and adjust 2ND AMPL TUNING control (22) for a peak indication on MULTIMETER (20); adjust RF GAIN control (11) for MULTIMETER (20) indication not to exceed 20.

(11) Set RF GAIN control (11) counterclockwise to decrease gain.

(12) Set the HIGH VOLTAGE switch (42) at ON.

(13) Advance the RF GAIN control (11) for an increase in PA PLATE CURRENT indicator (14) and adjust TUNE control (25) for a dip in plate current indication. Advance the LOAD control (18) until a desired output is obtained. Proper loading usually will occur at a power output of 2.5 kw and a plate current of approximately 900 ma, depending on frequency.

NOTE

Retune plate resonance after adjusting the LOAD control (18).

(14) Turn RF GAIN control section (33) fully counterclockwise.

(15) The transmitter is now ready for operation. Insert the intelligence, using the AF GAIN/RF GAIN control (33) for desired levels, not to exceed a power amplifier output of 2.5 kw P-P, depending on mode of operation.

b. LOCAL SERVO TUNING

(1) Select desired channel with CHANNEL switch (36).

(2) Set the RF GAIN control (11) completely counterclockwise.

(3) Set MAIN POWER circuit breakers (39) at ON position and allow approximately 1 minute for the filament timer to activate.

- (4) Set XMTR TUNING switch (41) at AUTO and the SERVO switch (44) at ON.

NOTE

If manual tuning is desired (over-riding the SERVO), set the XMTR TUNING switch (41) at MANUAL. If manual setting of the bandswitches is desired, the SERVO switch (44) must be set at OFF.

- (5) Press the TUNE switch (43).
- (6) Set the Power Limit controls (8, 13) for desired power output (controls 8 and 13 are for minimum and maximum power output settings, respectively).
- (7) Turn AF GAIN and RF GAIN controls (33) completely clockwise.
- (8) Set the HIGH VOLTAGE switch (42) at ON.
- (9) Allow several seconds for the tuning to take place; the READY lamp (2) will light, indicating the transmitter is ready for operation.
- (10) Insert the intelligence (not to exceed a power amplifier output of 2.5 kw P-P, or average).

NOTE

To change frequency, set the CHANNEL switch (36) to desired channel, press TUNE switch (43), after which servo tuning should begin. When the READY lamp (2) lights, insert the intelligence.

TABLE 3-1. CONTROLS AND INDICATORS

MODULAR UNIT	ITEM NO. (Fig. 3-1)	DESIGNATION	FUNCTION
RAK	1	TECHNIMATIC lamp	Indicates when primary circuit breaker (39) is set at ON position.
	2	READY lamp	Indicates transmitter is ready for operation.
	3	HIGH VOLTAGE lamp	Indicates when high voltage circuit breaker (42) is set at ON position.
Standing Wave Ratio Indicator SWCA	4	Power Meter (no	Indicates forward and reflected power (KW).
	5	24V DC fuse	Protective fuse for control circuits; lights to indicate fuse has blown.
	6	Frequency Selector switch (no panel designation)	Selects frequencies in the 2- to 30-mc range.
	7	230V AC fuse	Protective fuse for power output meter circuits; lights to indicate fuse has blown.
	8	Power Limit Control (no panel designation)	Used for setting minimum r-f power output of transmitter.
	9	SWR OVLD lamp	Lights when standing wave ratio is excessive.
	10	FAULT lamp	Lights to indicate transmitter failed to tune in specified time.
	11	RF GAIN control	Adjusts excitation level to the TLAA (higher level in INCR arrow direction).
	12	KW/REFL switch	Activates meter (4) for forward or reflected power indication.
	13	Power Limit control (no panel designation).	Used for setting maximum r-f power output of transmitter.

TABLE 3-1. CONTROLS AND INDICATORS

MODULAR UNIT	ITEM NO. (Fig. 3-1)	DESIGNATION	FUNCTION
Linear Amplifier TLAA	14	IPA PLATE CURRENT indicator	Indicates intermediate power amplifier plate current.
	15	ALDC ADJ control	Adjusts level of negative feedback applied to the exciter.
	16	PA BANDSWITCH switch	Selects 2- to 30-mc range in 9 increments.
	17	Indicator (no panel designation)	Veeder indicator for LOAD control (18).
	18	LOAD control	Adjusts the loading of the final PA.
	19	RF trig control (no panel designation)	PA plate trigger adjustment for sensing circuit (factory adjusted).
	20	MULTIMETER indicator	Indicates 1st amplifier plate current, 2nd amplifier plate current, 2nd amplifier r-f plate voltage, and power amplifier r-f plate voltage.
	21	2ND AMPL BAND-SWITCH switch	Selects 2- to 30-mc range in 9 increments.
	22	2ND AMPL TUNING control	Adjusts resonance of the 2nd amplifier.
	23	Indicator (no panel designation)	Veeder indicator for TUNE control (25).
	24	MULTIMETER switch	Selects circuit for MULTIMETER (20).
	25	TUNE control	Adjusts resonance of the final PA.
	Multi Channel Exciter SMEC	26	POWER switch
27		POWER lamp	Lights when primary power is applied to the unit by switch 26.
28		VOX/PTT switch	When set at VOX, enables exciter to be keyed by input audio signal; when set at PTT, enables push-to-talk switch to key exciter.

TABLE 3-1. CONTROLS AND INDICATORS

MODULAR UNIT	ITEM NO. (Fig. 3-1)	DESIGNATION	FUNCTION
Multi Channel Exciter SMEC (CONT)	29	USB/LSB switch	Selects desired sideband.
	30	METER switch	Selects AF or RF output for indication on meter 38.
	31	ANTI VOX control	Adjusts level of audio output signal required to cancel action of VOX circuit.
	32	VOX GAIN control	Adjusts level of audio input signal required to key exciter when VOX/PTT switch 28 is set at VOX.
	33	AF GAIN/RF GAIN control	AF section of control increases AF gain in clockwise direction, RF section increases RF gain in clockwise direction.
	34	CW/SSB/-20DB/AME/MCW switch	Selects mode of operation: CW= keyed tone suppressed carrier SSB= single sideband, suppressed carrier -20 DB= single sideband, reduced carrier AME= single sideband full carrier MCW= keyed tone, full carrier
	35	HANDSET jack	Provides for connection of handset to the exciter.
	36	CHANNEL switch	Selects desired frequency.
	37	Frequency Indicating Card	Indicates Operating frequency of TTRT module.
	38	Meter (no front panel identification)	Indicates AF or RF level of output (selected by METER switch 30).
Linear Amplifier Control Panel TCP	39	MAIN POWER circuit breakers	Controls application of power to all units of the transmitter, excluding SMEC.
	40	OVLD RESET switch	Resets the overload relays.
	41	XMTR TUNING AUTO/MANUAL switch	When set at AUTO, allows automatic operation of transmitter; when set at MANUAL, allows the transmitter to be tuned manually.

TABLE 3-1. CONTROLS AND INDICATORS

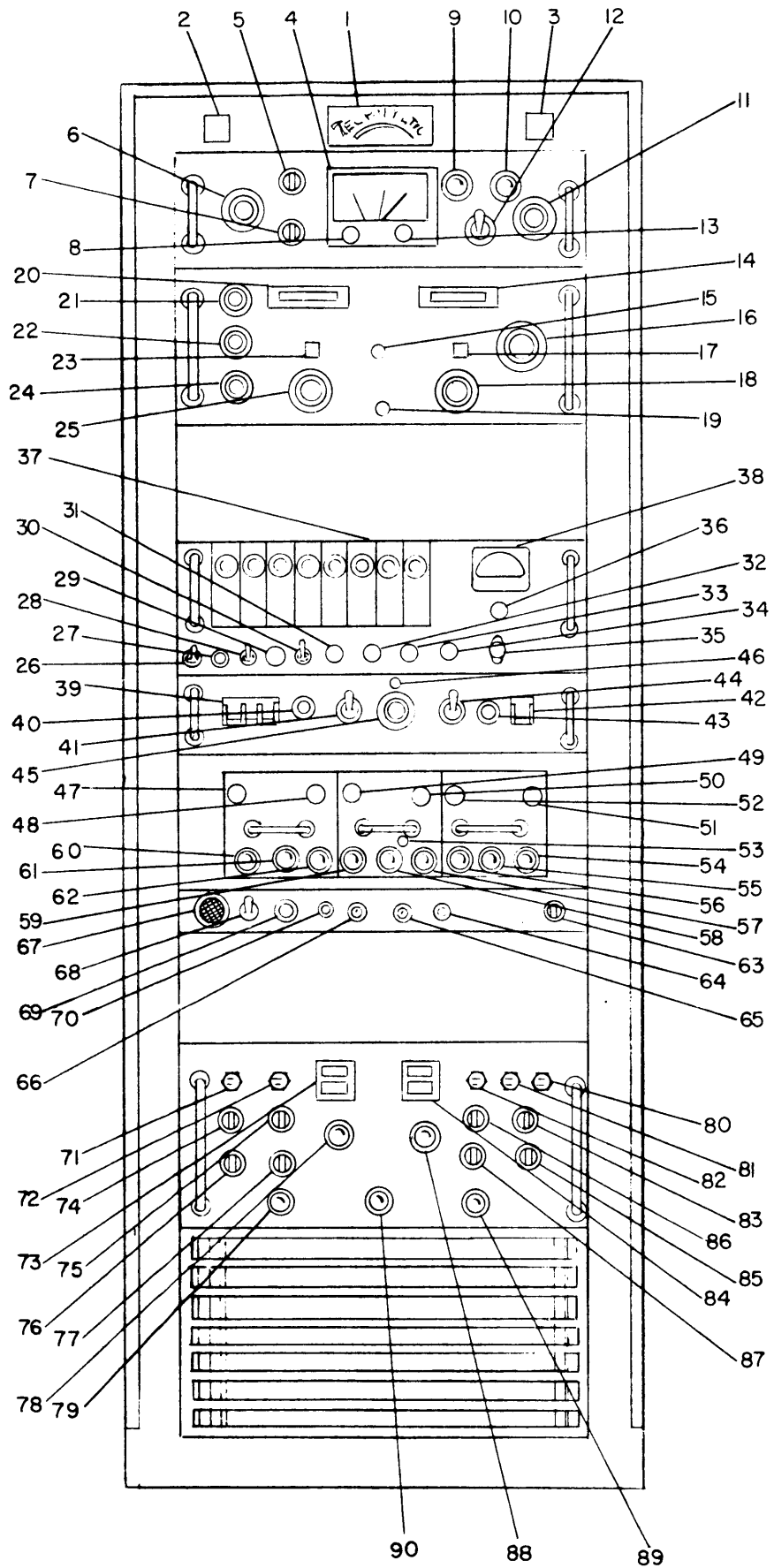
MODULAR UNIT	ITEM NO. (Fig, 3-1)	DESIGNATION	FUNCTION
Linear Amplifier Control Panel TCP (CONT)	42	HIGH VOLTAGE switch	Control application of power to high voltage power supply AP-129.
	43	TUNE switch	When depressed, initiates automatic tuning and loading.
	44	SERVO ON/OFF switch	When set at ON, enables activation of automatic band switching and tuning circuits.
	45	Interlock switch (no panel designation)	Used to locate open interlock switches (indicated by indicator lamp 46).
	46	Interlock Indicator lamp (no panel designation)	When lit, indicates interlock switch is closed.
Servo Amplifier TCSA	47	AC fuse	Protects output circuit of supply.
	48	DC fuse	Protects output circuit of supply.
	49	AC fuse	Same as item 47.
	50	DC fuse	Same as item 48.
	51	DC fuse	Same as item 48.
	52	AC fuse	Same as item 47.
	53	R.F.P.O.	R-F Power On adjustment (factory adjusted).
	54	OPERATE lamp	Lights when PA stage has completed loading.
	55	SEARCH lamp	Lights when PA stage is being loaded.
	56	AC ON lamp	Lights when servo amplifiers are tuning.
	57	OPERATE lamp	Lights when PA has completed tuning.
	58	SEARCH lamp	Lights when final amplifier is tuning.

TABLE 3-1. CONTROLS AND INDICATORS

MODULAR UNIT	ITEM NO. (Fig. 3-1)	DESIGNATION	FUNCTION
Servo Amplifier TCSA (CONT)	59	AC ON lamp	Same as item 56.
	60	AC ON lamp	Same as item 56.
	61	SEARCH lamp	Lights when 2nd amplifier is tuning.
	62	OPERATE lamp	Lights when 2nd amplifier completes tuning.
Alarm Panel AX633	63	DC fuse	Protective fuse for alarm device circuit.
	64	AUDIO IN jack	Provides for audio test signal to be applied (during maintenance procedures).
	65	PA MON jack	Provides PA monitoring outlet for test purposes.
	66	EXCITER MON jack	Provides exciter monitoring outlet (for test purposes).
	67	Alarm Device (no panel designation)	Alarm sounds if primary power to high voltage power supply is interrupted.
	68	ALARM ON/OFF switch	Activates alarm device circuit when set at ON position.
	69	SENSE switch	Provides for the selection of circuits (as marked) for test purposes.
	70	SENSE jack	Provides monitoring outlet for the sensing positions of SENSE switch 69.
Low Voltage Power Supply AP128	71	PA PLATE OVLD ADJ potentiometer	Used to set plate overload.
	72	PA SCREEN OVLD ADJ potentiometer	Used to set screen overload.
	73	FILAMENT TIME meter	Registers filament operation time.
	74	IPA BANDSWITCH fuse	Protective fuse.

TABLE 3-1. CONTROLS AND INDICATORS

MODULAR UNIT	ITEM NO. (Fig. 3-1)	DESIGNATION	FUNCTION
Low Voltage POWER Supply AP128 (CONT)	75	PA BANDSWITCH fuse	Protective fuse.
	76	INTERLOCK fuse	Protective fuse.
	77	INTERLOCK fuse	Protective fuse.
	78	IPA SCREEN fuse	Protective fuse.
	79	PA BIAS OVLD lamp	Overload indicator light.
	80	PA BIAS ADJ po- tentiometer.	Adjust PA grid bias.
	81	2ND AMPL BIAS ADJ potentiometer	Adjust 2nd amplifier grid bias.
	82	1ST AMPL BIAS ADJ potentiometer	Adjust 1st amplifier grid bias.
	83	FILAMENT fuse	Protective fuse.
	84	PLATE TIM meter	Registers final PA plate opera- tion time.
	85	LOW VOLTAGE fuse	Protective fuse.
	86	BLOWER fuse	Protective fuse.
	87	BIAS fuse	Protective fuse.
	88	PA SCREEN fuse	Protective fuse.
	89	PA SCREEN OVLD lamp	Overload indicator light.
	90	PA PLATE OVLD lamp	Overload indicator light.



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Figure 3-1. Controls and Indicators

TABLE 3-2. SAMPLE TUNING CHART

FREQ. OUT mc	CONTROL SETTINGS				INDICATOR READINGS			
	PA BAND	PA TUNE	PA LOAD	PA IP ma	P out KW PEP	DIST. dB		
2.0	2-2.5	069	113	700	2.5	43		
2.5	2-2.5	098	181	780	2.5	42		
2.5	2.5-3.0	087	110	750	2.5	41		
3.0	2.5-3.0	105	154	840	2.5	43		
3.0	3.0-5.0	098	086	720	2.5	39		
5.0	3.0-5.0	128	157	780	2.5	40		
5.0	5.0-7.0	119	133	750	2.5	45		
7.0	5.0-7.0	133	162	750	2.5	37		
7.0	7.0-11.0	118	130	750	2.5	37		
11.0	7.0-11.0	135	168	660	2.5	37		
11.0	11.0-15.0	123	140	720	2.5	36		
15.0	11.0-15.0	134	164	750	2.5	35		
15.0	15.0-19.0	129	139	750	2.5	35		
19.0	15.0-19.0	137	157	630	2.5	45		
19.0	19.0-24.0	132	142	660	2.5	43		
24.0	19.0-24.0	141	156	660	2.5	46		
24.0	24.0-30.0	134	146	660	2.5	43		
30.0	24.0-30.0	142	161	720	2.5	41		

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL

The transmitter operates in the frequency range of 2 to 32 megacycles (MHz). The 2 to 32 megacycles frequency range is separated into eight selectable channels, each channel being a fixed-tuned, frequency preselected TTRT module. The transmitter circuitry provides automatic pre-positioning of the linear amplifier band switches, electro-mechanical voltage safety features, an audible alarm circuit and a series of critical circuit metering and indicating devices. The final transmitter output is amplified to a 2.5 kilowatt output level which is applied to a directional coupler for antenna connection. Forward and reflected power indications are visually monitored on a front panel meter. See figure 4-1 for a block diagram of the system modular units.

4-2. FUNCTIONAL ANALYSIS

a. General. - The transmitter comprises 8 major sections as follows:

- a. Multi Channel Exciter, SMEE-1.
- b. Servo Amplifier, TCSA-1.
- c. Linear Power Amplifier, TLAA-2.5K.
- d. RF Control and Indicator, SWCA-3K.
- e. Linear Amplifier Control Panel, TCP-1.
- f. Alarm Panel, AX633.
- g. Low Voltage Power Supply, AP-128.
- h. High Voltage Power Supply, AP-129.

b. Block Diagram Analysis. - Transmitter channel selection is accomplished by setting the exciter channel selector switch to any one of the eight channel positions. Each channel position (1 through 8) represents a fixed-tuned, pre-selected r-f frequency module (TTRT).

Setting the exciter channel selector switch to any desired position will initiate a pre-position signal. This pre-position signal is applied to the SWCA where it is processed by a master pre-position stepping switch and routed to the motor-controlled band switch in the linear amplifier. The resulting action causes the linear amplifier bandswitch to position itself to the proper bandswitch setting in relation to the selected frequency channel. Thus, the exciter is now set at the desired frequency range with the linear amplifier at its corresponding setting.

Audio input and push-to-talk control signals are applied to the exciter audio section. The audio is amplified, routed through an i-f section, through an RF GAIN control potentiometer, to the input of the selected fixed-tuned r-f frequency channel module (TTRT). The r-f output is then preamplified and routed to an RF GAIN control in the r-f control and indicator SWCA.

The exciter r-f output is extended, via the RF GAIN control of the SWCA, to the linear power amplifier TLAA where the exciter output level is increased to 2.5 KW. Low level r-f signals applied to the linear amplifier are routed through a broadband amplifier, a tuned second amplifier and a tuned final amplifier to the r-f output jack at the rear of the TLAA. The second and final amplifier band switches are automatically pre-positioned by a switch located on the SWCA. Front panel meters provide the required indications for tuning and loading the amplifier stages. Operating power for the linear amplifier is furnished by power supplies AP-128 and AP-129.

The 2.5kw output of the linear amplifier is coupled to the antenna via a directional coupler which provides the forward and reflected power indication to the SWCA.

The SWCA comprises an RF GAIN control that adjusts the r-f excitation to the linear amplifier, a pre-position switch that sets the linear amplifier bandswitches to the proper band segment, and a front panel meter that provides a for-

ward and reflected transmitter power output indication. The r-f output of the exciter is applied to the SWCA RF GAIN control and routed out to the TLAA. The pre-positioning switch receives it's operating voltage from the power supply AP-128. When the MANUAL/AUTO switch is set at AUTO, contacts of a relay in the AP-128 supply the voltage required to activate the stepping switches attached to the second and final PA bandswitches. The power meter circuit is configured to permit selection of forward or reflected power indications depending upon the setting of the FWD/REFL switch. The reflected power is monitored in a separate circuit that trips the overload relay when the SWR reaches 2:1 or 3:1 depending on the setting of the rear panel switch.

The low voltage power supply AP-128 provides filament voltage and bias for all amplifier stages in the transmitter, plate and screen voltages for the first two amplifier stages, screen voltages for the PA stage, and 24 vac for the interlock circuits. The AP-128 contains overload relays that open interlocks, cutting off all voltages to the 2.5-kw PA stage when preset overload levels are exceeded. The protective circuits sample the PA plate and screen currents and bias supply voltages and activate the overload relay of the SWCA when any of these currents are excessive.

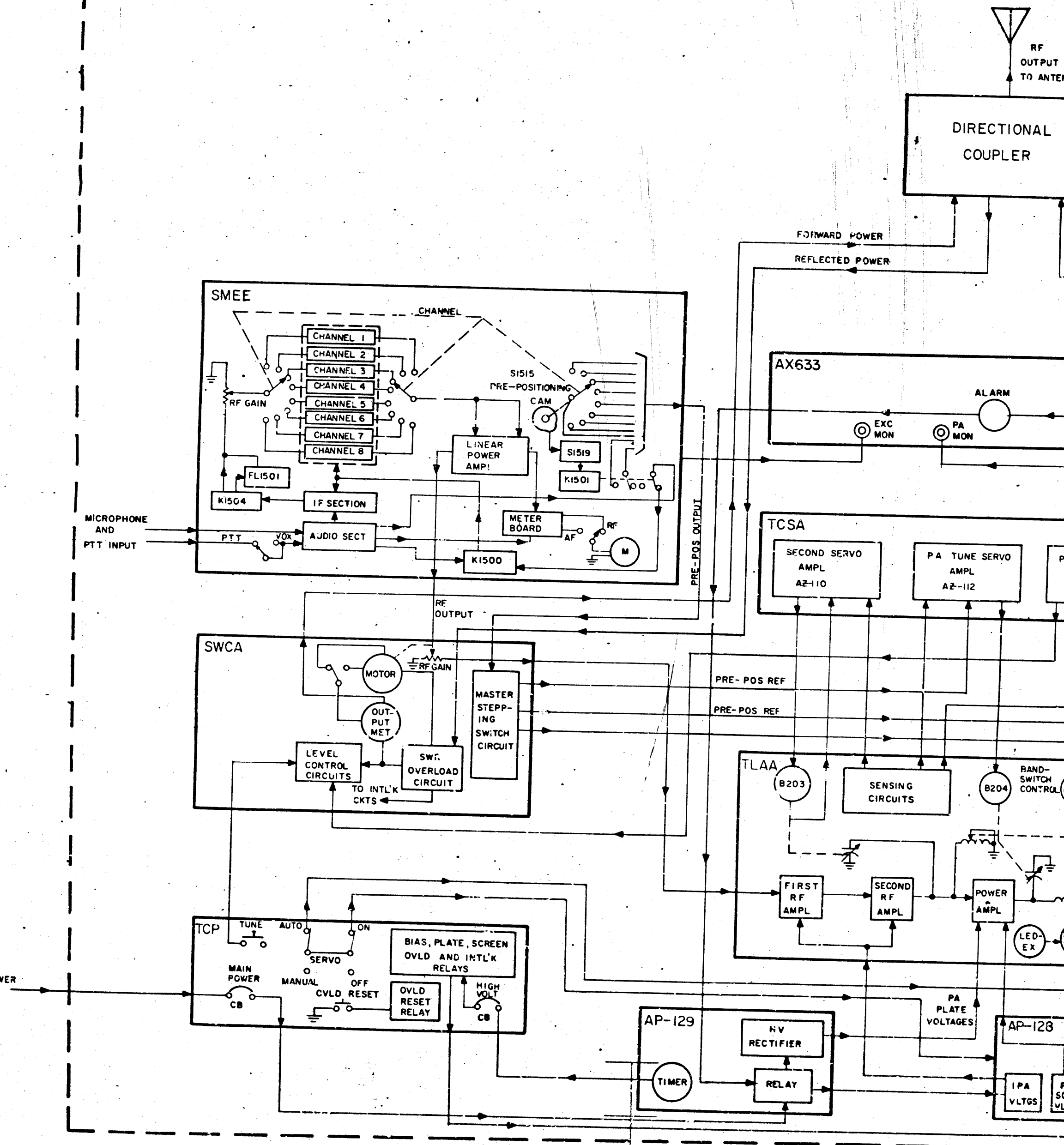
The high voltage power supply AP-129 supplies the 5000 vdc for the operation of the final power amplifier of the TLAA. The AP-129 receives its operating power from a high voltage contactor that is energized by phase-two voltage supplied by the interlock relay, and phase-three voltage that is supplied by the HIGH VOLTAGE switch in the TCP.

Automatic transmitter tuning and loading is accomplished by servo amplifiers driving the tuning and loading controls. This is accomplished by the exciter channel selector switch, when set to its predetermined channel position, driving a pre-position wafer switch. The exciter pre-position wafer switch supplies a pre-position signal to the master pre-position stepping switch in the SWCA. The SWCA

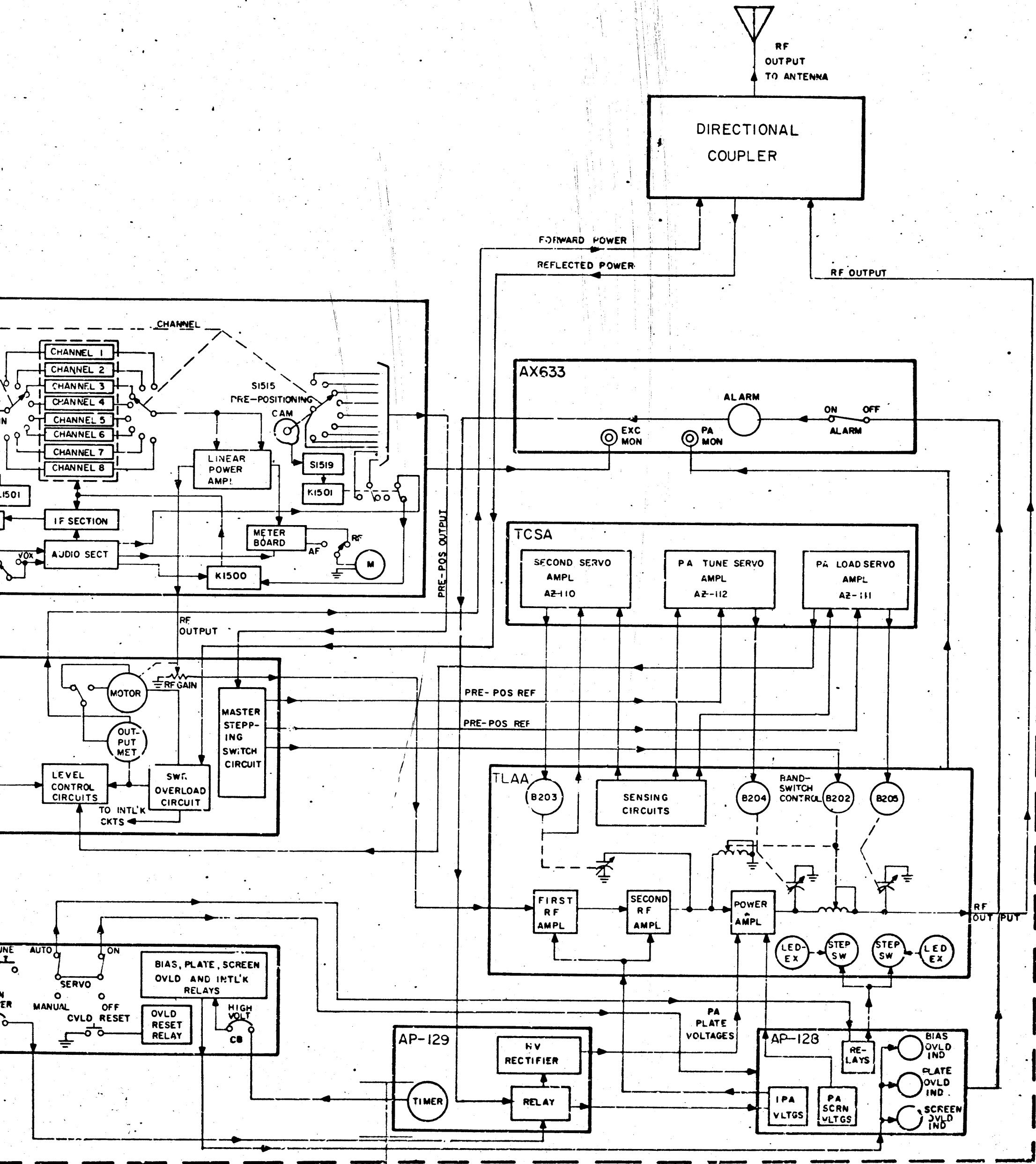
pre-position stepping switch routes the pre-position reference signal to a PA tune servo amplifier AZ112 and a PA load servo amplifier AZ111 in the linear amplifier. The PA tune and PA load servo amplifiers in turn, drive the PA tune and PA load servo controls in the linear amplifier. Both PA tune and PA load servos are also controlled by the linear amplifier sense circuits.

The linear amplifier bandswitch control is directly controlled by the SWCA pre-position stepping switch.

RADIO TRANSMITTER, GPTA-2.5EB/50



RADIO TRANSMITTER, GPTA-2.5E8/50



4-3. TECHNIMATIC CIRCUIT ANALYSIS

Band switches and tuning and loading elements in the transmitter r-f circuits are automatically positioned after application of appropriate control signals from the pre-position switch in the exciter.

The exciter pre-position switch controls the positioning of a master stepping switch located in the SWCA.

The transmitter frequency range (2- to 32-mc) is divided into 10 segments. The master stepping switch is positioned to one of its 10 positions which corresponds to that segment of the 2- to 32-mc frequency range to which the exciter is tuned.

The band switch in the linear amplifier is positioned in accordance with control signals from the master stepping switch assembly. The inductive component of the linear amplifier tuned circuit is therefore adjusted for operation in the selected frequency range.

The three tuning and loading capacitors in the transmitter (2nd AMPL TUNE, PA TUNE, and PA LOAD) are set at pre-position settings when the associated servo amplifiers are initially turned on. The capacitors (all except 2nd AMPL TUNING) are positioned according to reference signals from the master stepping switch assembly. The capacitor settings are therefore dependent on the selected output frequency. Tuning time is thus minimized.

The linear amplifier sensing circuit generates input signals for the 2nd AMPL servo amplifier. The input for the 2nd AMPL servo amplifier is dependent on tube plate current. Since tube plate current increases with excitation, and excitation is dependent on the input circuit resonance, the 2nd AMP tuning capacitor is adjusted until the required tube plate current is reached.

The linear amplifier sensing circuits generate outputs that are dependent on PA tube plate current, pi-input reactance, and pi-input impedance. When excitation is applied to the PA, plate current increases, and a signal from the

sensing circuits trigger the PA TUNE servo amplifier into operation. The PA tuning capacitor is adjusted so as to minimize pi-input impedance to a predetermined value. After tuning and loading of the PA is accomplished, a Drive-up signal is applied to the SWCA level control circuits from the PA LOAD servo amplifier.

Upon reception of the tuning completion signal, the relay circuits in the SWCA level control circuits disable the servo amplifier and band switch control circuits. The level control circuits also disconnects the level control circuits in the stepping switch assembly, and enables its own level control circuit. The linear level control assembly supplies a changing control signal to the exciter so that excitation is increased. The directional coupler generates a signal proportional to transmitter power output; when output power reaches a predetermined point (usually 1.25 kw), the excitation level control signal is stabilized.

a. 2ND AMPL SERVO AMPLIFIER (AZ-110).

(1) GENERAL. - The AZ-110 supplies control voltage to the second r-f amplifier tuning motor. This control voltage is in turn dependent on one of two servo-amplifier input signals: a pre-position feedback signal, or a sense signal. The servo amplifier has three modes of operation: pre-position, search, and operate. Each of these modes are discussed in sequence.

(2) PRE-POSITION. - A pre-position feedback signal enters the AZ-110 at pin 6 of jack P8004, and is routed to pin 1 of plug-in module Z400. Module Z400 also receives a pre-position reference signal (-0.5 vdc) at pin 25. The pre-position feedback signal is a voltage between 0 and +20 vdc. The feedback and reference signals are algebraically added and the resultant is modulated signal is amplified, and routed to contact 3 of relay K400 via pin 11 of J400.

When the pre-position feedback signal is appreciably removed from +0.5 vdc, relay K400 is de-energized, and the a-c modulated signal from pin 11 of Z500 is routed to pin 10 of Z101. This a-c modulated signal is amplified in Z401, and routed to the second amplifier tuning motor via pins 14 and 16 of J402. When the feedback signal approaches a level of +0.5 vdc (the algebraic sum of the feedback and reference signals is small), tuning motor control voltage diminishes, and relay K400 is energized. With K400 energized, the signal path from pin 11 of Z400 to pin 10 of Z401 is broken; also, +28vdc is applied to the coil of relay K402 and to SEARCH lamp DS401.

(3) SEARCH. - A sense signal enters the AZ-110 at pin 1 of jack P8004 this signal is a current between 0 and +200 ua. A voltage divider comprising resistors R412 and R413, and resistor R411 form a -200 ua current source; this is the sense reference signal. The sense input and sense reference signals are algebraically added, and the sum is applied to transformer T401 via resistor R407 and chopper G400. The a-c signal from the secondary of T401 (dependent in amplitude on the sense-input signal) is applied to plug-in module Z401 at pins 1

and 9 of Z401. The signal at pins 1 and 9 of Z401 is amplified, and routed to contact 6 of relay K401 via pin 3 of J401. When K401 is energized (pre-positioning is completed), the signal from pin 3 of J401 is routed via resistor R408 to pin 10 of Z401; this signal is amplified and routed to the tuning motor.

(4) OPERATE. - When the sense-input signal approaches +200 ua (the algebraic sum of the sense-input and sense-reference signals is small), control voltage for the tuning motor diminishes; also, relay K401 is energized. Operation of K401 lights OPERATE lamp DS400, and removes supply voltage from the heater of relay K404. Relay K400, and pin 8 of Z400, however, are returned to the +28 vdc supply via diode CR405 and the external limit switch (connected between pins 30 and 31 of J402). When the sense-input signal reaches +200 us (indicating that the second r-f amplifier is properly tuned), a 28-volt shut-off signal is applied to pin 13 of J402. This shut-off signal energized relay K403. Operation of K403 grounds out the sense-input signal, and removes supply voltage from the tuning motor (normally supplied via pin 15 of J402).

(5) LIMIT SWITCH OPERATION. - If the external limit switch (connected between pins 30 and 31 of J402) opens during the search or operate sequence of operation, relay K400 is de-energized, 28 volts is removed from pin 7 of Z400, and the servo amplifier begins operating in pre-position mode. Note that the signal from pin 11 of Z400 is again routed to pin 10 of Z401. The unit will continue to operate in pre-position mode until the pre-position feedback signal reaches +0.5 vdc, and the search sequence begins.

b. PA TUNE SERVO AMPLIFIERS (AZ-112).

(1) GENERAL. - The AZ-112 supplies a control voltage to the PA tuning motor. This control voltage is, in turn, dependent on various servo-amplifier input signals: pre-position feedback and reference signals, and internally generated search signal, an r-f trigger input, a coarse-tune sense signal, and a fine-tune sense signal. The servo amplifier has three modes of operation: pre-position, search, and operate. Each of these modes is discussed in sequence.

(2) PRE-POSITION. - A pre-position feedback signal enters the AZ-112 at pin 5 of jack P8005 and is routed to pin 12 of plug-in module Z300; a pre-position reference signal enters the AZ-112 at pin 6 of P8005 and is routed to pin 25 of Z300. The pre-position feedback signal is a d-c analogue (between 0 and -20 vdc) of the tuning capacitor setting. The pre-position reference signal is set at a point between 0 and +20 vdc in accordance with the desired tuning capacitor setting. The feedback and reference signals are algebraically added and the resultant is modulated with 60 cps a-c (supplied at pins 21 and 22 of J300). This a-c modulated signal is amplified, and routed via pin 11 of J300, contacts 3 and 4 of relay K301, and pin J301 to module Z301. The a-c modulated signal is further amplified in Z301, and routed to the external tuning motor via pins 14 and 16 of J302.

When the associated tuning capacitor approaches the correct pre-position setting, the algebraic sum of the feedback and reference signals diminishes, and control voltage for the tuning motor diminishes. When the tuning capacitor reaches its correct setting, the algebraic sum of the feedback and reference signals is zero (the feedback and reference signals are equal and opposite in polarity), and control voltage is removed from the tuning motor.

(3) SEARCH. - Application of an RFPO trigger at pin 3 of P8005 causes relay K301 to energize. The RFPO trigger indicates that the previous amplifier stage is tuned. With K301 energized, power is applied to pin 7 of Z300, and to

SEARCH lamp DS301; also the signal path between pin 11 of Z300 to pin 10 of Z301 is broken, and Z301 receives a 60 cps signal from terminal 11 of transformer T300 via contacts 12 and 11 of K303 and resistor R301. This 60 cps signal is amplified in Z301, and then routed to the associated tuning motor.

A coarse-tuning sense signal enters the AZ-112 at pin 21 of P8005; this signal is routed to module Z301 via contacts 8 and 9 of K303, chopper G300, and transformer T302. Chopper G300 and transformer T302 converts the d-c input signal to a-c. This a-c signal is amplified in Z301, and routed to pin 1 of Z300 via contacts 6 and 5 of K303. When the coarse-tuning sense signal approaches 0 vdc (indicating that coarse tuning is completed), relay K303 is energized. With K303 energized, +28 vdc is applied to OPERATE lamp DS300, and to pin 14 of Z300.

(4) OPERATE. - A fine-tuning sense signal enters the AZ-112 at pin 1 of P8005, and is routed to Z301 via contacts 9 and 10 of K303, chopper G300, and transformer T302. This d-c sense signal is converted to a-c in the same manner as the coarse-tuning sense signal was. The resultant a-c signal is amplified, and routed from pin 3 of Z301 through contacts 6 and 7 of K303, contacts 12 and 11 of K302, and resistor R308 to pin 10 of Z301. This a-c signal is further amplified in Z301 and then applied to the associated tuning motor. When the fine-tuning sense signal approaches 0 vdc (indicating that fine tuning is accomplished), control voltage for the tuning motor diminishes, and relay K302 operates. Operation K302 opens the circuit. Servo amplifier gain is therefore cut off, and system oscillation (hunting) prevented.

(5) LIMIT SWITCH OPERATION. - Activation of one of the tuning capacitor limit switches energizes a relay in the load servo amplifier. The relay removes supply voltage from pin 8 of Z300 and relay K301 with relay K301 de-energized, the AZ112 starts operating in pre-position mode. The pre-position, search and operate sequences will then be repeated.

c. PA LOAD SERVO AMPLIFIERS (AZ-111).

(1) GENERAL. - The AZ-111 supplies control voltage to the IPA stage load-capacitor motor. This control voltage is, in turn, dependent on several servo amplifier inputs: pre-position feedback and reference signals, a turn-on signal (supplied by the associated TUNE servo amplifier), and a sense signal. The AZ-111 has three modes of operation: pre-position, search, and operate. Each of these modes are discussed in sequence.

(2) PRE-POSITION. - A pre-position feedback signal enters the AZ-111 at pin 5 of jack P8006 and is routed to pin 12 of plug-in module Z500; a pre-position reference enters at pin 6 of P8006, and is routed to pin 25 of Z500. The pre-position feedback is a d-c analogue (between 0 and -20 vdc) of the associated load capacitor setting. The pre-position reference signal is preset at a level between 0 and +20 vdc corresponding to the desired load capacitor pre-position setting from the master stepping switch in the SWCA. The feedback and reference signals are algebraically added in Z500; the resultant is then modulated with a 60 cps a-c signal (supplied at pins 21 and 22 of Z500). This a-c modulated signal is routed to module Z501 via contacts 5 and 6 of relay K502. The a-c modulated signal is amplified in Z501, and routed to the associated load capacitor motor via pins 14 and 16 of P8006. When the associated load capacitor approaches its correct pre-position setting, the algebraic sum of the feedback and reference signals becomes small, and the motor control voltage diminishes.

(3) SEARCH. - A sense signal enters the AZ-111 at pin 1 of P8006, and is routed to Z501 via chopper G500 and transformer T501. The chopper and transformer convert the d-c sense signal to a-c. This a-c signal is amplified in Z500, and then routed to contact 7 of relay K502. When coarse tuning of the stage is completed, 28 vdc is applied to relay K502 via pin 32 of P8006 via contacts 15 and 14 of K501 and contacts 11 and 12 of K500. Operation of K502 completes the signal path between pins 3 and 10 of Z501. The associated load

capacitor now receives control voltage that is derived from the sense input signal. Relay K501 is energized when an appreciable amount of control voltage is being applied to the load capacitor motor.

(4) OPERATE. - When the sense input signal approaches 0 vdc, motor control voltage diminishes, and relay K502 energizes. With K502 energized, 28 vdc is applied to OPERAT lamp DS500, and to relay K504. Operation of K504 removes the ground from the fine-tune sense signal path for the associated tune servo amplifier (this path includes pins 23 and 24 of J502, and resistor R508).

(5) LIMIT SWITCH OPERATION. - The limit switches for the stage tune and load capacitors are connected between pins 30 and 31 of J502. If one of these switches closes, relay K500 is energized. Operation of relay K500 removes supply voltage from K502 and relay K301 in the associated tune servo amplifier. De-energizing these two relays (K502 and K301) places the respective servo amplifiers in pre-position mode.

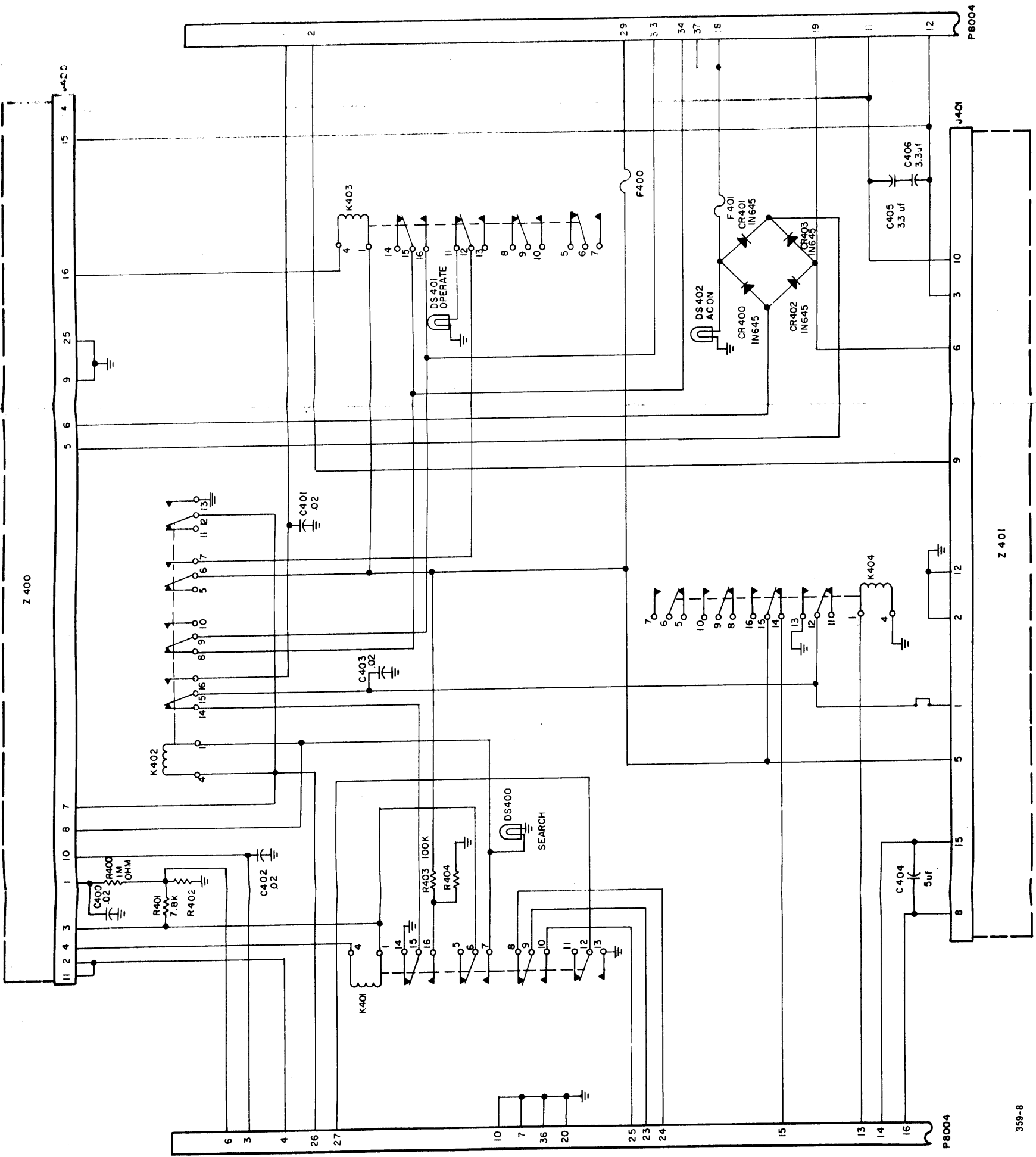


Figure 4-2. Second Servo Amplifier
AZ110, Circuit Diagram

4-15/4-16

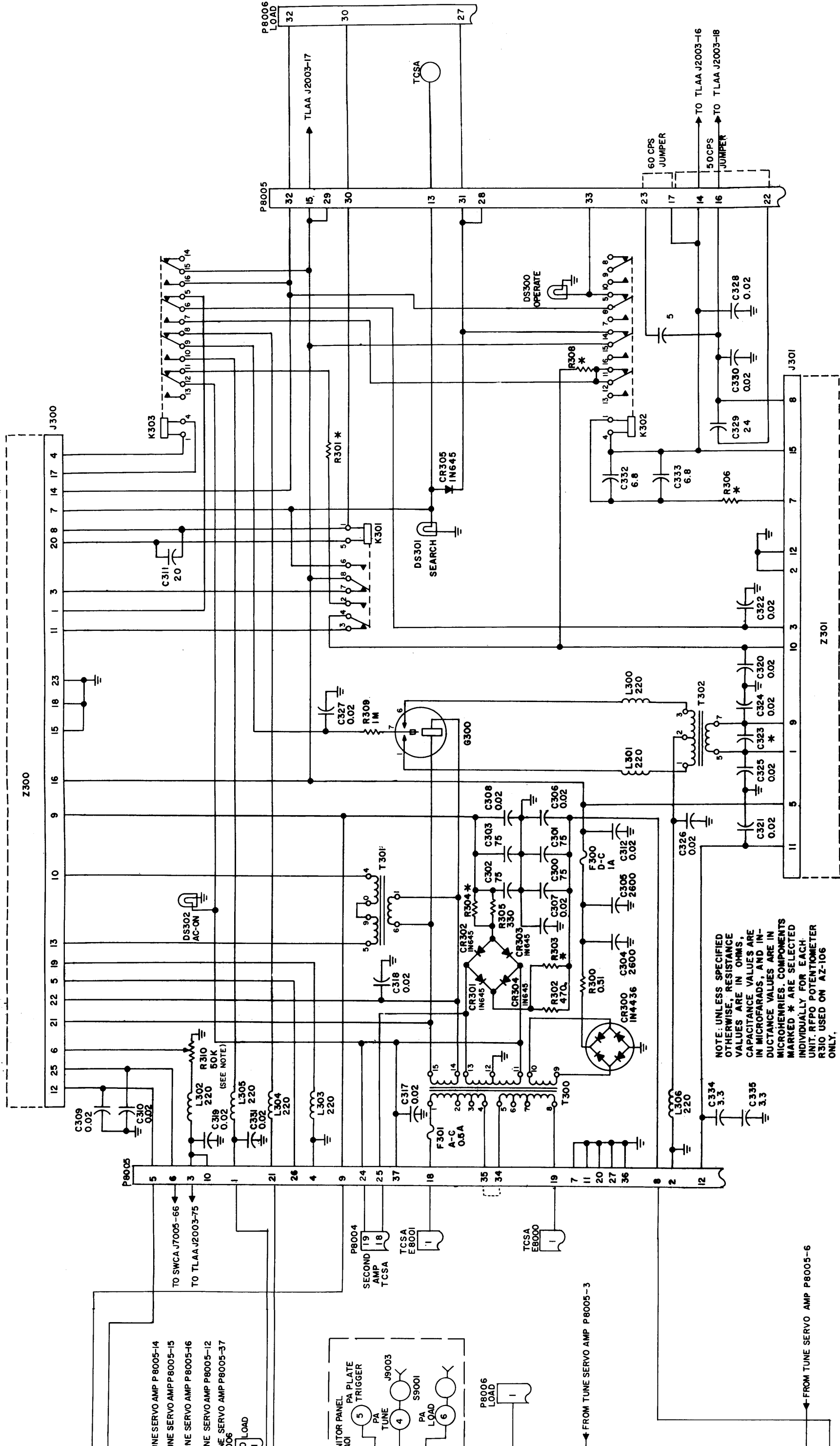
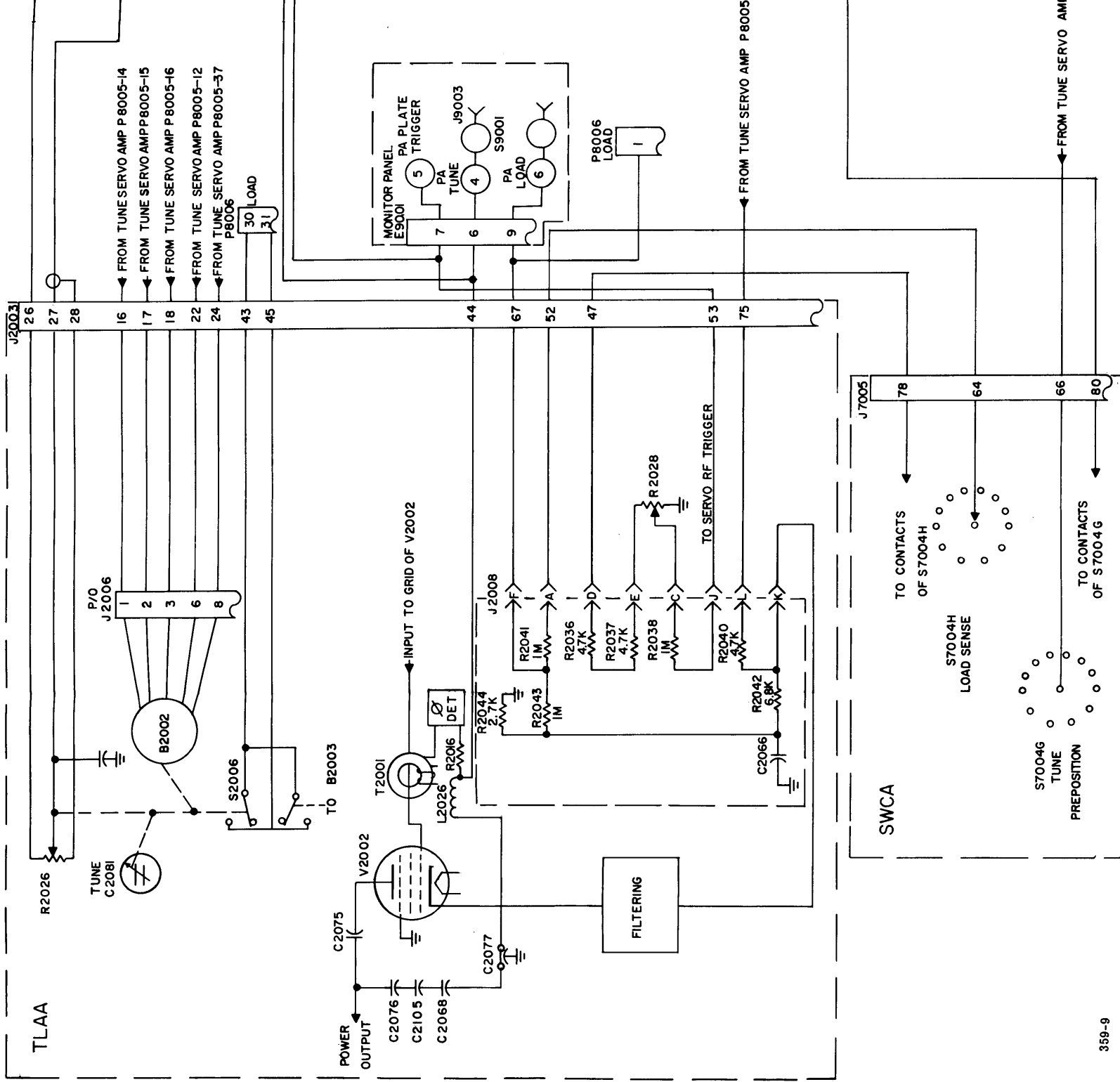
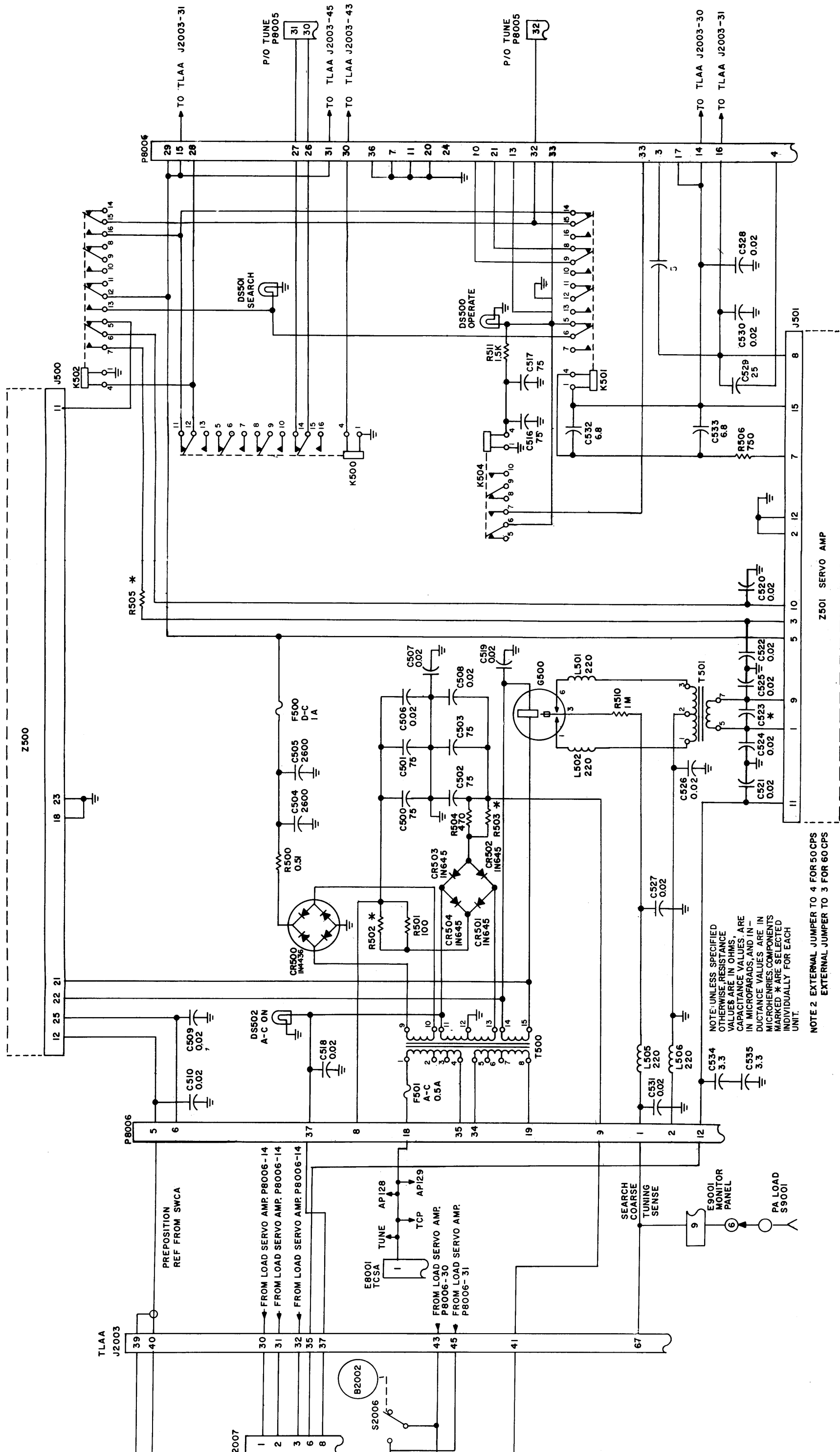


Figure 4-3. PA Tune Servo Amplifier AZ112, Circuit Diagram





NOTE: UNLESS SPECIFIED OTHERWISE RESISTANCE VALUES ARE IN OHMS, CAPACITANCE VALUES ARE IN MICROFARADS, AND INDUCTANCE VALUES ARE IN MICROHENRIES. COMPONENTS MARKED * ARE SELECTED INDIVIDUALLY FOR EACH UNIT.

NOTE 2: EXTERNAL JUMPER TO 4 FOR 50CPS
EXTERNAL JUMPER TO 3 FOR 60CPS

Figure 4-4. PA Load Servo Amplifier AZ111, Circuit Diagram

SECTION 5

MAINTENANCE

5-1. 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 removed from its mounting for 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. Trichlorethylene 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 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 trichlorethylene, avoid contact with painted surfaces, due to its paint removing effects.

5-2. TROUBLESHOOTING

When a piece of equipment has been operating satisfactorily and suddenly fails, the cause of failure may be due to symptoms of past failures or due to component aging.

The first step in troubleshooting is to ascertain that proper equipment voltages are present, interconnecting cables are secure, and that all fuses are in functional condition. Refer to table 5-1, used in conjunction with figure 5-1, for system fuse locations and functions.

NOTE

Never replace a fuse with one of a higher rating unless brief continued operation is more important than probable equipment damage. If a fuse burns out immediately after replacement, do not replace it a second time until the cause has been located and corrected.

If the above mentioned checks fail to locate the fault, perform the pre-operational checkout procedure shown in paragraph 2-5. Use of this procedure will help localize the particular fault at hand.

Visual troubleshooting of the modular unit chassis components and tube conditions may also help localize the fault.

The following troubleshooting aids are provided:

- a. Pre-operational checkout procedures (Paragraph 2-5).
- b. System block diagram (Figure 4-1).
- c. Fuse functions (Table 5-1 and figure 5-1).
- d. System protective circuit checks (paragraph 5-2, sub-paragraphs a. through g.

TABLE 5-1. Fuse Functions

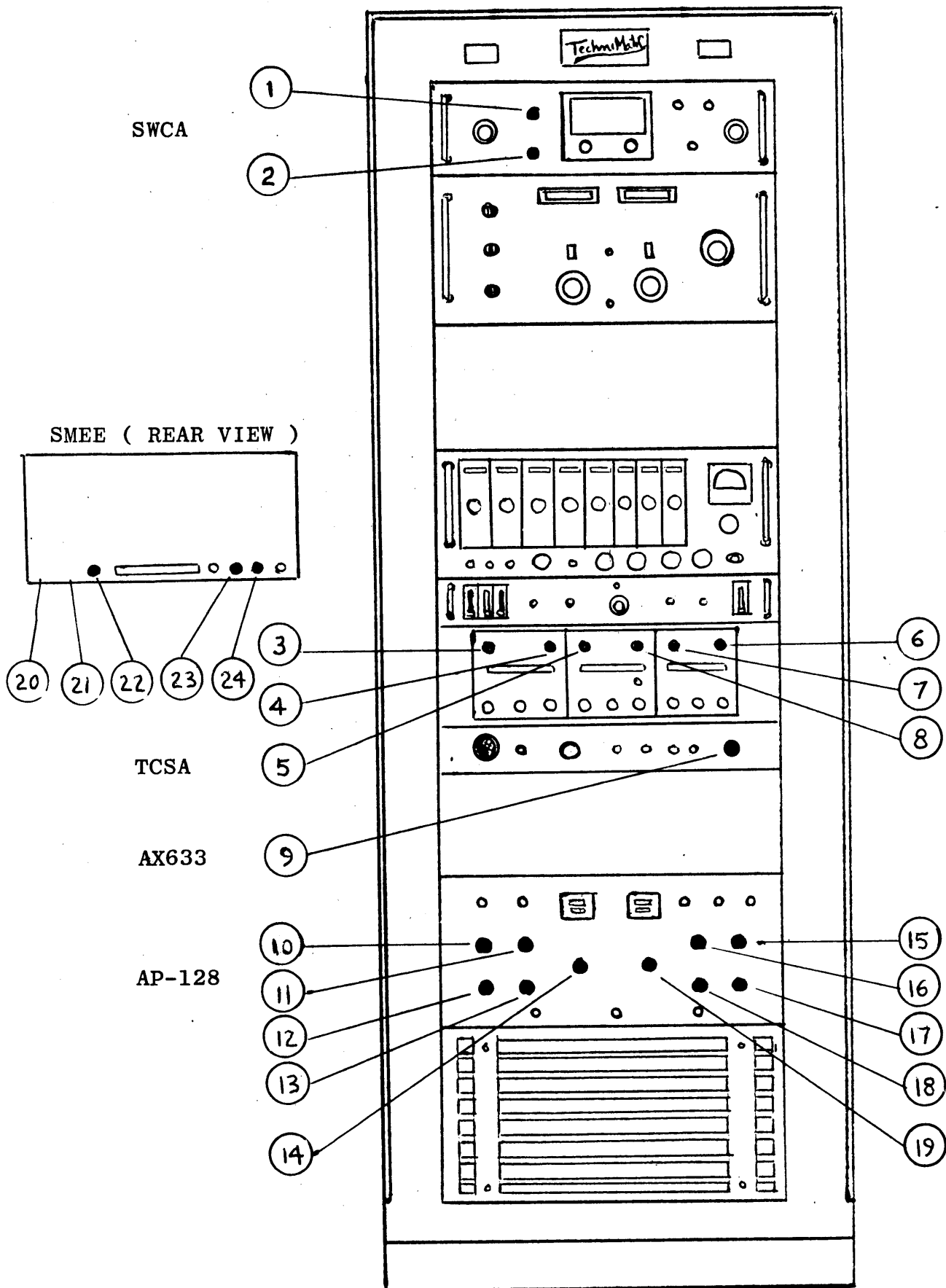
ITEM NO. (Fig. 5-1)	REF. SYMBOL NO.	UNIT	FUSE RATING	FUNCTION
1	F7002	SWCA-3K	3A/24 VDC SLOW-BLOW	Protective fuse for control circuit; lights to indicate fuse is defective.
2	F7000	SWCA-3K	1A/230VAC SLOW-BLOW	Protective fuse for power output meter circuits; lights to indicate fuse is defective.
3	F401	TCSA-1 AS110	0.5A, AC	Protective fuse for AZ110 power supply input.
4	F400	TCSA-1 AZ110	1.0A, DC	Protective fuse for AZ110 power supply output.
5	F301	TCSA-1 AS112	0.5A, AC	Protective fuse for AZ112 power supply input.
6	F500	TCSA-1 AZ111	1.0A, DC	Protective fuse for AZ111 power supply output.
7	F501	TCSA-1 AZ111	0.5A, AC	Protective fuse for AZ111 power supply input.
8	F300	TCSA-1 AZ112	1.0A, DC	Protective fuse for AZ112 power supply output.
9	F9000	AX633	0.1A/DC quick- acting	Protective fuse for alarm ckt.
10	F5006	AP128	0.75A slow- blow	Protective fuse for IPA bandswitch ckt.
11	F5007	AP128	2.5A slow- blow	Protective fuse for PA bandswitch ckt.
12	F5008	AP128	3.0A slow- blow	Protective fuse for interlock ckt.
13	F5009	AP128	10.0A slow-blow	Protective fuse for interlock ckt.
14	F5005	AP128	0.5A high- voltage	Protective fuse for IPA screen ckt.
15	F5000	AP128	5.0A slow-blow	Protective fuse for filament ckt.
16	F5002	AP128	3.0A slow-blow	Protective fuse for blower ckt.

TABLE 5-1. Fuse Functions (CONT)

ITEM NO. (Fig. 5-1)	REF. SYMBOL NO.	UNIT	FUSE RATING	FUNCTION
17	F5001	AP128	2.0A slow-blow	Protective fuse for low-voltage ckt.
18	F5003	AP128	0.25A slow-blow	Protective fuse for bias ckt.
19	F5004	AP128	0.5A high-voltage	Protective fuse for PA screen ckt.
20	F911	SMEE (rear)	.125A	Negative 36-volts d-c power supply.
21	F910	SMEE (rear)	.125A	Positive 12-volts d-c power supply.
22	F909	SMEE (rear)	.125A	Negative 12-volts d-c power supply.
23	F907	SMEE (rear)	.125A/115V	Power supply a-c input circuit.
24	F908	SMEE	SEE NOTE	Crystal oven input.

NOTE

Fuse value for F908 in the SMEE is dependent upon the type of crystal oven used.



400B-8

Figure 5-1. Fuse Locations

a. PRELIMINARY ELECTRICAL INSPECTION

(1) With main power switch set at OFF, check for short circuits to ground.

(a) The 3 power input phases should measure not less than 1-megohm.

(b) The positive side of the high voltage circuit should measure not less than 100 K ohms with the shorting relay contacts open. With the shorting relay contacts closed, this reading should measure zero.

(2) Check all system modular units for proper cable terminations.

(3) Check all system modular unit fuses for proper values.

(4) Check PA output circuitry for proper connections.

(5) Set main power switches at ON and observe for the following:

(a) TechniMatic indicator should light.

(b) The PA blower and top fan must activate.

b. CIRCUIT FUSING CHECKS

(1) Make sure that at least one interlock is open.

(2) With the main power switch set at OFF, remove the blower fuse.

The main blower and top fan must not operate when the main power switch is set at ON. Reset main power switch at OFF and replace the blower fuse. Set main power switch at ON and continue fusing checks listed below.

(3) Remove the filament fuse; the PA Bias indicator lamp should go out (extinguish).

(4) Remove the LV fuse; the PA Bias indicator lamp should go out (internal relay may chatter).

(5) Set bandswitch control on TCP at AUTO.

(6) Remove IPA bandswitch fuse and turn SWCA band knob. The IPA and PA bandswitches should not turn. Replace fuse and bandswitches should turn. Check all positions of IPA and PA bandswitch positions in relation to the SWCA bandswitch settings.

(7) Remove PA bandswitch fuse and turn SWCA band knob. The IPA bandswitch should turn but the PA bandswitch should not turn. Replace fuse and PA bandswitch should turn.

(8) Remove first one and then the other interlock fuse; interlock lamp and TCP should go out.

c. PROTECTIVE INTERLOCK SYSTEM

(1) Before checking the interlock system, insure that a jumper is connected from COM to NO terminals 1 and 2 on terminal board E8006 on the rear junction box. The interlock indicator lamp and switch are connected so that the indicator lamp will be ON (lit) if all interlocks are closed. To find an open interlock, always turn the interlock switch to extreme counter-clockwise direction to the position where the indicator lamp goes out. This is an open interlock.

In cases where there are more than one interlocks open, the preceding procedure must be repeated until all interlocks are closed and all individual interlock indicator lamps are out (extinguished).

NOTE

For this check, the PS covers, PA covers, the Airswitch and Timer will not trip the HV circuit breaker.

(2) With the Main Power switch closed (ON), each interlock should be opened and closed with the interlock indicator switch in the appropriate position to show that the interlock is operating properly. Each time an interlock is opened, the High Voltage switch should be placed at the ON position. This switch should trip, preventing high voltage from coming on.

d. PROTECTIVE RELAY CHECKS

WARNING

Line voltage is constantly present on leads connected to top of Main Power switch located on TCP-1.

(1) Unlatch the PA plate overload relay; the corresponding overload indicator lamp should light.

(2) Unlatch the PA Screen overload relay; the corresponding overload indicator lamp should light.

By depressing the Overload Reset switch on the main control panel, the overload indicator lamps must go out (extinguish) and stay out and the overload relays must reset.

(3) The Filament Elapse Time meter must indicate that the filaments are on.

(4) With the HV at ON and the PA bias adjusted for minimum plate current, the Plate Elapse Time Meter must indicate that HV is on.

Check the Time Delay relay for proper operate and time interval, maximum time of 80 seconds after which the IPA Bias OVLD indicator lamp should go out and the shorting relay should energize (if all interlocks are closed).

(5) Adjust PA bias adjust control on the power supply for 350 milliamperes as indicated on the TLAA Plate Current meter with AUTO/MANUAL switch set at MANUAL. With the ALARM switch set at ON, the alarm must sound (activate).

e. HIGH VOLTAGE REMOVAL, PROTECTIVE CIRCUIT CHECK

(1) With the system energized as in the preceding paragraph d., and with the ALARM switch set at ON, mechanically trip the PA Plate Overload and PA Screen Overload protective devices in sequence. Each time a protective device is mechanically tripped, the device must reset electrically, and the high voltage must be turned on again before testing the next protective device.

(2) Set High Voltage at OFF and remove the PA Bias fuse. Setting the High Voltage switch at ON should not energize the high voltage.

(3) Mechanically tripping each of the aforementioned protective devices on at a time, the high voltage must go off and the alarm must sound; the Plate Elapse Time meter must stop running.

- (4) Set High Voltage at OFF.

f. PARASITIC CHECK

- (1) Set the 2nd AMP and PA bandswitches at the 24-30 band position.
- (2) Set the PA loading capacitor to minimum capacity.
- (3) With no r-f drive, set High Voltage switch at ON.
- (4) Rotate the PA tune capacitor from minimum to maximum capacity;

there must be no indication on the PA Plate RF meter.

- (5) Set High Voltage at OFF.

g. OVERLOAD ADJUSTMENTS

(1) Connect signal generator (Hewlett-Packard, Model 606A or equivalent) to the TLAA.

(2) PA Plate Overload:

- (a) Tune system to full output on any frequency within the assigned frequency range.
- (b) Overload the system output by increasing the PA output loading (decreasing Output Load capacity).
- (c) Retune the PA and increase the signal generator output.
- (d) Adjust the PA Plate overload adjust control to trip at 1.3 amperes.

(3) PA Screen Overload:

- (a) With the system tuned in as the preceding sub-paragraph (2) (a), underload the system output by decreasing the PA output loading (increasing Output Load capacity).
- (b) Connect a multimeter (Simpson Model 260 or equivalent) in series with the screen overload relay K4003 or terminal 1 on E4001.
- (c) Retune the PA and increase the signal generator output to increase the screen current.
- (d) Adjust the PA Screen overload with the PA Screen; adjust to trip at 45 milliamperes.

5-3. REPAIR AND REPLACEMENT.

Maintenance will consist mainly of component replacement. It should be noted that when replacing components have many wires connected, such as switches,

relays, etc., the wires should be tagged and marked for accurate identification when replacing.

When replacing components, the technician should observe for exact or equivalent replacements by referring to the parts list in section 6 of this manual.

Polarity and positioning of certain components should be observed before removing so that the replacement component will fit and operate correctly.

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

<u>Assembly or Subassembly</u>	<u>Page</u>
CABINET, ELECTRICAL EQUIPMENT, RAK-110-2AA	6-2
RF AMPLIFIER, MODEL TLAA-2.5K	6-5
TRANSMITTER CONTROL PANEL, MODEL TCP-1	6-19
LOW VOLTAGE POWER SUPPLY, MODEL AP128 & AP128/50	6-21
HIGH VOLTAGE POWER SUPPLY, MODEL AP129 & AP129/50	6-28
RF CONTROL/INDICATOR, MODEL SWCA-3K	6-29
TUNING CONTROL SYSTEM, MODEL TCSA-1	6-37
ALARM PANEL, MODEL AX633	6-38

PARTS LIST

for

RACK, ELECTRICAL EQUIPMENT, RAK110-2AA

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B8000	FAN, VANEAXIAL: AC motor, 230 V, $\pm 10\%$; single phase, 50/60 cps (Hz); one 4uf capacitor, 400 VAC; 2800/3300 RPM; current rating 0.85/0.6 amps.	BL117
C8000	CAPACITOR, FIXED, PAPER DIELECTRIC: 4 uuf, $\pm 10\%$; 600 WVDC.	CP41BIEF405K
C8001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, $\pm 20\%$; 5,000 WVDC.	CC109-38
C8002 thru C8006	Same as C8001.	
DS8000	LAMP, INCANDESCENT: 28 VAC/DC; 0.04 amps; single contact, T-1-3/4 bulb.	BI110-7
DS8001	LAMP, INCANDESCENT: 230 V, 10 watts; S-6 type bulb; screw type base.	BI105-1
DS8002	Same as DS8001.	
DS8003	Same as DS8000.	
E8000	Part of Tuning Control System, Model TCSA-1.	
E8001	Part of Tuning Control System, Model TCSA-1.	
E8002	NOT USED	
E8003	TERMINAL BOARD, BARRIER: two 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM102-2
E8004	TERMINAL BOARD, BARRIER: three 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM102-3
E8005	TERMINAL BOARD, BARRIER: twenty-two 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM100-22
E8006	Same as E8005.	
E8007	TERMINAL BOARD, BARRIER: ten 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM102-10
E8008	TERMINAL BOARD, BARRIER: fourteen 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM102-14

PARTS LIST
for
RACK, ELECTRICAL EQUIPMENT, RAK110-2AA

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J8000	CONNECTOR, RECEPTACLE, ELECTRICAL: 4 female contacts.	MS3102A14S2S
L8000	COIL, RADIO FREQUENCY: fixed; 15 uh; operating frequency 10 Kcs.	CL410
L8001	Same as L8000.	
L8002	Same as L8000.	
R8000	RESISTOR, FIXED, COMPOSITION: 68 ohms, <u>+5%</u> ; 2 watts.	RC42GF680J
S8000	SWITCH, ROLLER LEVER: SPDT; current rating 15 amps at 125 VAC.	SW260
S8001	SWITCH, INTERLOCK: push-pull; current rating 15 amps at 120/250 VAC or 0.2 amps resistive at 250 VAC.	SW230
S8002 thru S8006	Same as S8001.	
S8007	SWITCH, MICRO: low torque; SPDT; current rating 5 amps at 125/250 VAC; CCW rotation.	SW252
S8008	SWITCH, THERMOSTATIC	SS104-2
T8000	TRANSFORMER	TF342
XDS8000	LAMPHOLDER: used with indicator lens, TMC Part No. LI114G2.	TS184
XDS8001	LAMPHOLDER: accommodates candelabra screw type base lamps.	TS186
XDS8002	Same as XDS8001.	
XDS8003	Same as XDS8000. Used with indicator lens, TMC Part No. LI114R1.	

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PARTS LIST
for
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B2000	FAN, CENTRIFUGAL: 230 V, 50/60 cps (Hz); single phase; rotation 2,800/3,200 RPM; consists of one 4 uf, 220 VAC capacitor.	BL126
B2001	MOTOR, TUBEAXIAL FAN: motor voltage fixed phase 115 volts, control phase 40 volts; current rating fixed phase 0.063 amps, control phase 0.182 amps; power input fixed phase 6.0 watts, control phase 6.4 watts; 50/60 cps; black oxide case.	MO127
B2002	MOTOR, TUBEAXIAL FAN: motor voltage fixed phase 220 volts, +10%, control phase 36 volts; current rating fixed phase 0.067 amps, control phase 0.330 amps; power output 3 watts; 50/60 cps; steel case.	MO126
B2003	Same as B2002.	
C2000	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, +2%; 500 WVDC.	CM20F102G03
C2001	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uuf, GMV; 500 WVDC.	CC100-16
C2002	Same as C2001.	
C2003	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uuf, +10%; 300 WVDC.	CB21QB102K
C2004	Same as C2001.	
C2005	Same as C2001.	
C2006	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 300 WVDC.	CC100-37
C2007	Same as C2006.	
C2008	Same as C2003.	
C2009	Same as C2003.	
C2010	Same as C2006.	
C2011	Same as C2006.	
C2012	Same as C2001.	
C2013	Same as C2001.	

PARTS LIST (CONT)

RF AMPLIFIER, MODEL TLA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C2014	CAPACITOR, FIXED, MICA DIELECTRIC: 10,000 uuf, $\pm 2\%$; 300 WVDC.	CM35F103G03
C2015	Same as C2003.	
C2016	Same as C2003.	
C2017	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, $\pm 20\%$; 500 WVDC.	CK70AW102M
C2018	Same as C2003.	
C2019	Same as C2003.	
C2020	CAPACITOR, FIXED, MICA DIELECTRIC: 1,500 uuf, $\pm 2\%$; 500 WVDC.	CM100-10
C2021	Same as C2006.	
C2022	Same as C2003.	
C2023	Same as C2003.	
C2024	CAPACITOR, FIXED, MICA DIELECTRIC: 24 uuf, $\pm 5\%$; 500 WVDC.	CM15C240J03
C2025	NOT USED	
C2026	NOT USED	
C2027	Same as C2003.	
C2028	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 2 x 4,000 uuf, GMV; 1,000 WVDC.	CC100-22
C2029	NOT USED	
C2030	Same as C2003.	
C2031	NOT USED	
C2032	CAPACITOR, FIXED, MYLAR DIELECTRIC: 1.0 uf, $\pm 5\%$; 400 WVDC.	CN114-1R0-4J
C2033	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 500 uuf, $\pm 20\%$; 5,000 WVDC.	CC109-36

PARTS LIST (CONT)
RF AMPLIFIER, MODEL T1AA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C2034	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, <u>+20%</u> ; 500 WVDC.	CC108-1P1000M
C2035	Same as C2028.	
C2036	CAPACITOR, FIXED, CERAMIC DIELECTRIC	CC115-2-6800
C2037	Same as C2028.	
C2038	CAPACITOR, VARIABLE, AIR: 10.0 to 200 uuf, 1,500 V RMS; 60 cps; nominal air gap 0.0245".	CB118SRX200
C2039	Same as C2001.	
C2040	CAPACITOR, FIXED, MICA DIELECTRIC: 15 uuf, <u>+5%</u> ; 500 WVDC.	CM15D150J03YY
C2041	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 2 x 2,000 uuf, GMV; 1,000 WVDC.	CC100-19
C2042	CAPACITOR, FIXED, MICA DIELECTRIC: 150 uuf, <u>+2%</u> ; 500 WVDC.	CM15F151G03
C2043	NOT USED	
C2044	NOT USED	
C2045	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3 uuf, <u>+10%</u> ; 5,000 WVDC.	CC109-1
C2046	Same as C2040.	
C2047 thru C2051	Same as C2001.	
C2052	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 3 uuf, <u>+10%</u> ; 5,000 WVDC.	CC109-2
C2053	Same as C2003.	
C2054	Same as C2003.	
C2055	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 1,000 uuf, <u>+20%</u> ; 5,000 WVDC.	CC109-38

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C2056	Same as C2055.	
C2057	Same as C2017.	
C2058 thru C2060	Same as C2014.	
C2061	CAPACITOR, FIXED, CERAMIC DIELECTRIC:	CC115-1-500
C2062	Same as C2014.	
C2063	Same as C2014.	
C2064	Same as C2055.	
C2065	Same as C2034.	
C2066	Same as C2001.	
C2067	Same as C2061.	
C2068	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10uuf, $\pm 10\%$; 5,000 WVDC.	CC109-6
C2069	Same as C2061.	
C2070	NOT USED	
C2071	Same as C2036.	
C2072	NOT USED	
C2073	Same as C2001.	
C2074	NOT USED	
C2075	Same as C2061.	
C2076	Same as C2068.	
C2077	CAPACITOR, FIXED, MICA DIELECTRIC: 1,200 uuf, $\pm 2\%$; 500 WVDC.	CM100-12
C2078	Same as C2052.	
C2079	Same as C2052.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL T1AA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C2080	Same as C2033.	
C2081	CAPACITOR, VARIABLE, VACUUM: 10 to 1500 uuf; peak test voltage 5 Kv.	CB172-5
C2082	CAPACITOR, FIXED, PAPER DIELECTRIC: 0.68 uf, $\pm 10\%$; 1,000 WVDC.	CP106C684-10K
C2083	Same as C2082.	
C2084	NOT USED	
C2085	Same as C2001.	
C2086	NOT USED	
C2087	NOT USED	
C2088	Same as C2061.	
C2089	CAPACITOR, VARIABLE, VACUUM: 20 to 2000 uuf; peak test voltage 5 Kv.	CB172-6
C2090	Same as C2061.	
C2091	NOT USED	
C2092	Same as C2001.	
C2093	CAPACITOR, FIXED, MICA DIELECTRIC: 100 uuf, $\pm 5\%$; 500 WVDC.	CM15F101J03
C2094	Same as C2006.	
C2095	Same as C2006.	
C2096	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 20,000 uuf, $+80\%$ -20% ; 500 WVDC.	CC100-24
C2097 thru C2102	Same as C2001.	
C2103	Same as C2000.	
C2104	NOT USED	
C2105	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10 uuf, $\pm 10\%$; 5,000 WVDC.	CC109-5

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C2106	NOT USED	
C2107	Same as C2006.	
C2108	Same as C2006.	
C2109	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100,000 uuf, +80% -20%; 500 WVDC.	CC100-32
C2110	NOT USED	
C2111	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uuf, $\pm 5\%$; 500 WVDC.	CM15C100J03YY
C2112	CAPACITOR, FIXED, MICA DIELECTRIC: 18 uuf, $\pm 5\%$; 500 WVDC.	CM15C180J03YY
C2113 thru C2115	Same as C2014.	
C2116	Same as C2052.	
C2117	Same as C2052.	
C2118	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 100 uuf, $\pm 10\%$; 5,000 WVDC.	CC109-28
C2119	Same as C2020.	
C2120	Same as C2001.	
CR2000	ABSORBER, OVERVOLTAGE: operating voltage range 28 to 33 V; max. reverse voltage 10 VDC; current rating 750 ma; 200 PIV diode; 6.8 V, 1 watt Zener diode.	DD111-1
CR2001	SEMICONDUCTOR DEVICE, DIODE	1N3070
CR2002	Same as CR2001.	
CR2003	Same as CR2000.	
CR2004	Same as CR2001.	
CR2005 thru CR2009	Same as CR2001.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
DS2000	LAMP, INCANDESCENT: 5 to 6 volts; 0.063 amps; bulb size T-1.	BI114-2
DS2001 thru DS2008	Same as DS2000.	
E2000 thru E2011	TERMINAL	TE *
J2000	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact, straight type; series BNC to BNC.	JJ172
J2001	CONNECTOR, RECEPTACLE, ELECTRICAL: female	MS3102A28-21S
J2002	CONNECTOR, RECEPTACLE, ELECTRICAL: 14 male contacts, brass gold over silver plated.	JJ242-5P
J2003	CONNECTOR, RECEPTACLE, ELECTRICAL	*
J2004	CONNECTOR, RECEPTACLE, ELECTRICAL: 9 female contacts, removeable crimp pin style; current rating 5 amps at 500 V RMS; polarized.	JJ310-4
J2005	CONNECTOR, RECEPTACLE, ELECTRICAL	*
J2006	Same as J2004.	
J2007	Same as J2004.	
J2008	CONNECTOR, RECEPTACLE, ELECTRICAL: 20 female contacts rated for 5 amps at 1,800 V RMS.	JJ319-10DFE
J2009	CONNECTOR, RECEPTACLE, ELECTRICAL: female; teflon insulation.	UG560*/U
J2010	CONNECTOR, RECEPTACLE, ELECTRICAL: RF: 1 round female contact; 52 ohms; series BNC to BNC.	UG625*/U
J2011	Same as J2000.	
J2012	CONNECTOR, RECEPTACLE, ELECTRICAL	MS
J2013	Same as J2004.	
J2014	Same as J2004.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J2015	CONNECTOR, RECEPTACLE, ELECTRICAL: 30 female contacts, straight type; current rating 5 amps at 1,800 V RMS; printed circuit board type.	JJ319A15DPE
L2000	COIL, RADIO FREQUENCY: fixed; 220 uh, $\pm 5\%$; current rating 230 ma; molded case.	CL275-221
L2001	Same as L2000.	
L2002	COIL, RADIO FREQUENCY: fixed; 120 uh, $\pm 5\%$; current rating 311 ma; molded case.	CL275-121
L2003	NOT USED	
L2004	Same as L2002.	
L2005	COIL	*
L2006	COIL, RADIO FREQUENCY: fixed; 3 PI; 1 mh inductance; 23 ohms, $\pm 10\%$ resistive; current rating 75 to 100 ma.	CL101-2
L2007	COIL, RADIO FREQUENCY: fixed; 128 uhy; test frequency 790 Kc.	CL177
L2008	NOT USED	
L2009	COIL	
L2010	Same as L2000.	
L2011		TZ210
L2012	Same as L2007.	
L2013	Same as L2007.	
L2014	COIL, RADIO FREQUENCY: fixed; 113 uh, $\pm 5\%$.	CL361
L2015	Same as L2006.	
L2016	COIL	CL406
L2017	Non-replaceable item. Part of CL407.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
L2018	Non-replaceable item. Part of CL407.	
L2019	Non-replaceable item. Part of CL409.	
L2020	Non-replaceable item. Part of CL409.	
L2021	Non-replaceable item. Part of CL408.	
L2022	Non-replaceable item. Part of CL408.	
L2023	Non-replaceable item. Part of CL409.	
L2024	Non-replaceable item. Part of CL408.	
L2025	COIL, RADIO FREQUENCY: fixed; 2.50 mh, $\pm 5\%$; current rating 200 ma; 3 PI.	CL226-1
L2026	COIL, RADIO FREQUENCY: fixed; 2.5 uh, $\pm 10\%$; current rating 100 ma; molded case.	CL140-1
L2027	COIL, RADIO FREQUENCY	CL100-5
L2028	Same as L2026.	
L2029	NOT USED	
L2030	COIL, RADIO FREQUENCY: 185 uh, ± 15 uh; operating frequency 790 Kc; 3/8" dia. x 2" long o/a.	CL178
L2031	COIL, RADIO FREQUENCY: fixed; 0.150 uh, $\pm 10\%$; current rating 400 ma; molded case.	CL140-2
L2032	Same as L2031.	
L2033	COIL, RADIO FREQUENCY	CL413
L2034	NOT USED	
L2035	COIL, RADIO FREQUENCY: fixed; 33 uh, $\pm 10\%$; rated for 2.5 mc.	CL366
L2036	COIL, RADIO FREQUENCY: 0.270 uh, $\pm 10\%$; current rating 300 ma; molded case.	CL140-3
L2037	Same as L2036.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLA-2.5K

REF SYMBOL	DESCRIPTION	IMC PART NUMBER
L2038	COIL, RADIO FREQUENCY: fixed; 0.680 uh, $\pm 10\%$; current rating 200 ma; molded case.	CL140-9
L2039	COIL	CL398
L2040	COIL	CL399
L2041	Same as L2030.	
L2042	NOT USED	
L2043	COIL, RADIO FREQUENCY: fixed; 3.3 uh, $\pm 10\%$; current rating 1,030 ma; molded case.	CL275-3R3
L2044	NOT USED	
L2045	COIL, RADIO FREQUENCY: fixed; 150 uh, $\pm 5\%$; current rating 315 ma; molded case.	CL275-151
L2046	COIL, RADIO FREQUENCY: fixed; 68 uh, $\pm 10\%$; current rating 750 ma; molded case.	CL275-68
L2047	Same as L2045.	
L2048	COIL	CL402
L2049	COIL	CL405
M2000	METER: full scale deflection 0 to 100 ua; 11,000 ohms, $\pm 15\%$; dust proof molded lucite case.	MR191-3
M2001	METER	MR191-7
P2000	CONNECTOR, PLUG, ELECTRICAL: 14 female contacts rated for 7.5 amps; spring temper phosphor bronze, gold plated; 1,900 V RMS at sea level.	PL225-5S
P2001	CONNECTOR, PLUG, ELECTRICAL: w/hood; 9 male contacts crimp pin removeable style; current rating 5 amps at 500 V RMS; polarized.	JJ313-4H

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
P2002	NOT USED	
P2003	Same as P2001.	
P2004	Same as P2001.	
P2005	CONNECTOR, PLUG, ELECTRICAL: 9 male contacts, removeable crimp pin style; current rating 5 amps at 500 V RMS; polarized.	JJ313-4
P2006	Same as P2005.	
R2000	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, $\pm 5\%$; 1/2 watt.	RC20GF272J
R2001	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF103J
R2002	RESISTOR, PRECISION, WIREWOUND: 120 ohms, $\pm 1\%$; 0.66 watt.	RB101R66R1200 F
R2003	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, $\pm 5\%$; 2 watts.	RC42GF472J
R2004	NOT USED	
R2005	Same as R2001.	
R2006	RESISTOR, FIXED, GLASS: 1,000 ohms, 15 watts.	*
R2007	RESISTOR, FIXED, COMPOSITION: 47 ohms, $\pm 5\%$; 1/2 watt.	RC20GF470J
R2008	Same as R2002.	
R2009	NOT USED	
R2010	RESISTOR, FIXED, COMPOSITION: 47 ohms, $\pm 5\%$; 1 watt.	RC32GF470J
R2011	Same as R2010.	
R2012	RESISTOR, FIXED, COMPOSITION: 1,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF102J
R2013	Same as R2012.	
R2014	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF104J

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLAA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R2015	Same as R2012.	
R2016	Same as R2012.	
R2017	RESISTOR, FIXED, COMPOSITION: 120 ohms, $\pm 5\%$; 1 watt.	RC32GF121J
R2018	Same as R2010.	
R2019	Same as R2010.	
R2020	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, $\pm 5\%$; 1/2 watt.	RC20GF222J
R2021	RESISTOR, FIXED, COMPOSITION: 220,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF224J
R2022	RESISTOR, FIXED, COMPOSITION: 470,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF474J
R2023 thru R2025	NOT USED	
R2026	RESISTOR, VARIABLE, PRECISION: 1,000 ohms, $\pm 3\%$; 0 watt at 125°C or 2.5 watts at 70°C.	RV118-1-102
R2027	Same as R2026.	
R2028	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms, $\pm 10\%$; 1/2 watt.	RV106UX10C104 A
R2029	RESISTOR, VARIABLE, COMPOSITION: 500,000 ohms, $\pm 10\%$; 1/2 watt.	RV106UX10B504 A
R2030	RESISTOR, FIXED, COMPOSITION: 10 ohms, $\pm 5\%$; 1/2 watt.	RC20GF100J
R2031	RESISTOR, FIXED, COMPOSITION: 1,200 ohms, $\pm 5\%$; 1/2 watt.	RC20GF122J
R2032	RESISTOR, FIXED, COMPOSITION: 4,700 ohms, $\pm 5\%$; 1/2 watt.	RC20GF472J
R2033	Same as R2007.	
R2034	Same as R2020.	
R2035	Same as R2031.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL T1AA-2.5K

RFF SYMBOL	DESCRIPTION	FMC PART NUMBER
R2036	Same as R2032.	
R2037	RESISTOR, FIXED, COMPOSITION: 47,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF473J
R2038	RESISTOR, FIXED, COMPOSITION: 1 megohm, $\pm 5\%$; 1/2 watt.	RC20GF105J
R2039	RESISTOR, FIXED, COMPOSITION: 47 ohms, $\pm 5\%$; 2 watts.	RC42GF470J
R2040	Same as R2032.	
R2041	Same as R2038.	
R2042	RESISTOR, FIXED, COMPOSITION: 6,800 ohms, $\pm 5\%$; 1/2 watt.	RC20GF682J
R2043	Same as R2038.	
R2044	Same as R2000.	
S2000	SWITCH, INTERLOCK: SPDT; operating voltage 250 VAC; current rating 5 amps.	SW219
S2001	Same as S2000.	
S2002	SWITCH, ROTARY: 1 section, 2 positions; 60° angle of throw; non-shorting type contacts, silver plated brass; mycalex insulation.	SW252
S2003	SWITCH, ROTARY: 1 section, 4 positions; 30° angle of throw; non-shorting type contacts; mycalex insulation.	SW105
S2004	SWITCH	SW430
S2005	SWITCH	SW429
S2006	SWITCH, SENSITIVE: SPDT; current rating 5 amps at 125 VAC or 250 VAC; 7 amps resistive, 4 amps inductive at 28 VDC; plastic body.	SW353-2
S2007	Same as S2006.	

PARTS LIST (CONT)
RF AMPLIFIER, MODEL TLA-2.5K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S2008	SWITCH	AS128
S2009	Same as S2006.	
T2000		CL415-1
T2001		CL415-2
TB2000	TERMINAL BOARD,	TB*
V2000	TUBE, ELECTRON: tetrode; 11 pin contact.	8121
V2001	Same as V2000.	
V2002	TUBE, ELECTRON	PL264
XV2000	SOCKET, ELECTRON TUBE: 11 pin contact.	TS170-1
XV2001	Same as XV2000.	
XV2002	SOCKET, ELECTRON TUBE	TS182
PS2000		AX*
PS2001	NOT USED	
PS2002		AX*
PS2003		AX*

PARTS LIST
for
TRANSMITTER CONTROL PANEL, MODEL TCF-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C4000	CAPACITOR, FIXED, ELECTROLYTIC: 75 μ F, -10% +150% at 120 cps (Hz) at 25°C; 50 WVDC; polarized.	CE105-75-50
CB4000	CIRCUIT BREAKER	SW417-1
CB4001	CIRCUIT BREAKER	SW418-1
CR4000	SEMICONDUCTOR DEVICE, DIODE	1N2484
DS4000	LAMP, INDICATOR: w/white lens; 5.0 V at 0.06 amps for 60,000 hrs or 6.3 V at 0.07 amps for 6,000 hrs.	BI116-1-5
E4000	TERMINAL BOARD, BARRIER: sixteen 6-32 std. x 1/4" long binder head machine screws; phenolic body.	TM102-16
E4001	TERMINAL BOARD, BARRIER: twelve 6-32 std. x 1/4" long binder head machine screws; phenolic body.	TM102-12
J4000	CONNECTOR, RECEPTACLE, ELECTRICAL: 7 male contacts.	MS3102A24-10P
J4001	CONNECTOR, RECEPTACLE, ELECTRICAL: 52 male contacts.	MS3102A32-414 P
K4000	RELAY, ARMATURE: DPDT; 24 VDC, 400 ohms; contacts rated for 10 amps resistive at 115 VAC or 5 amps inductive at 26 VDC; nominal coil power 1 to 2 watts.	RL168-2C10-24 DC
K4001	RELAY, ARMATURE	RL126
K4002	RELAY, ARMATURE	RL123
K4003	RELAY, ARMATURE: 4PDT; contacts rated for 25 amps non-inductive load at 125 VAC.	RL127
K4004	Same as K4000.	
R4000	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, \pm 5%; 2 watts.	RC42GF391J
R4001	RESISTOR, FIXED, COMPOSITION: 390 ohms, \pm 5%; 2 watts.	RC42GF391J
S4000	SWITCH, PUSHBUTTON: w/red lens; AC; current rating 250 ma non-inductive; 30 watts.	SW230-1
S4001	SWITCH, TOGGLE: DPDT, nominal current rating 1 amp; at 250 VAC/DC, 1 amp at 125 VAC/DC.	ST103-16-02

PARTS LIST (CONT)

TRANSMITTER CONTROL PANEL, MODEL TCP-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S4002	SWITCH, ROTARY: 1 section, 12 positions; 30° angle of throw; non-shorting type contacts.	SW250
S4003	Same as S4000.	
S4004	Same as S4001.	
XDS4000	Non-replaceable item. Part of DS4000.	
XK4000	SOCKET, RELAY: 8 contacts	TS101P01
XK4001 thru XK4003	NOT USED	
XK4004	Same as XK4000.	

PARTS LIST
for
LOW VOLTAGE POWER SUPPLY, AP128 & AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C5000	CAPACITOR, FIXED, PAPER DIELECTRIC: 10 uf, $\pm 10\%$; 2,000 WVDC; polarized.	CP70IEG106K
C5001	CAPACITOR, FIXED, ELECTROLYTIC: 80 uf, 450 WVDC.	CE51C800R
C5002	Same as C5001.	
C5003	NOT USED	
C5004	CAPACITOR, FIXED, PAPER DIELECTRIC: 4 uuf, $\pm 10\%$; 600 WVDC.	CP41IFF405K
C5005 thru C5008	Same as C5004.	
CR5000	RECTIFIER, SEMICONDUCTOR DEVICE: 3 phase; average current 1.5 amps at 75°C; non-recurrent surge 20 amps at 75°C; peak reverse voltage 4 Kv.	DD129
CR5001	Same as CR5000.	
CR5002	RECTIFIER, SEMICONDUCTOR DEVICE: forward current 22 amps at 40°C; peak reverse voltage 200 V; output voltage 128 V.	DD132-1
DS5000	Non-replaceable item. Part of XF5003.	
DS5001	Non-replaceable item. Part of XF5004.	
DS5002	Non-replaceable item. Part of XF5002.	
DS5003	Non-replaceable item. Part of XF5001.	
DS5004	Non-replaceable item. Part of XF5000.	
DS5005	LAMP, INCANDESCENT: 28.0 VAC/DC, 0.04 amps; single contact, T-1-3/4 bulb.	BI110-7
DS5006	Same as DS5005.	
DS5007	Same as DS5005.	
DS5008	Non-replaceable item. Part of XF5005.	
DS5009	Non-replaceable item. Part of XF5006.	
DS5010	Non-replaceable item. Part of XF5008.	

PARTS LIST (CONT)

LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
DS5011	Non-replaceable item. Part of XF5007.	
DS5012	Non-replaceable item. Part of XF5009.	
F5000	FUSE, CARTRIDGE: 5 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-5
F5001	FUSE, CARTRIDGE: 2 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-2
F5002	FUSE, CARTRIDGE: 3 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-3
F5003	FUSE, CARTRIDGE: 1/4 amp; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-.250
F5004	FUSE, CARTRIDGE: 1/2 amp; 600 VAC/DC; 1-1/2" long x 13/32" dia.; high voltage.	FU104-R5
F5005	Same as F5004.	
F5006	FUSE, CARTRIDGE: 3/4 amp; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-.750
F5007	FUSE, CARTRIDGE: 2-1/2 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-2.5
F5008	Same as F5002.	
F5009	FUSE, CARTRIDGE: 10 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-10
J5000	CONNECTOR, RECEPTACLE, ELECTRICAL: male	MS3102A32P
J5001	CONNECTOR, RECEPTACLE, ELECTRICAL: female	MS3102A32S
K5000	RELAY, ARMATURE: DPDT; 220 VDC, 5,000 ohms; contacts rated for 10 amps resistive at 115 VAC or 5 amps inductive at 26 VDC; nominal coil power 2 to 3 volt - amps. (Model AP128)	RL168-2C10-220AC
* K5000	RELAY, ARMATURE: DPDT; 220 VDC, 5,000 ohms; contacts rated for 10 amps resistive at 115 VAC or 5 amps inductive at 26 VDC; nominal coil power 2 to 3 volt - amps. (Model AP128/50)	RL168-2C10-220AC/50

*NOTE add -50 to Part number of K5000 for 50 cycle version.
TMC Model AP128/50.

PARTS LIST (CONT)
 LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
K5001	RELAY, ARMATURE: DPDT; 24 VDC, 400 ohms; contacts rated for 10 amps resistive at 115 VAC or 5 amps inductive at 26 VDC; nominal coil power 1 to 2 watts.	RL168-2C10-24DC
K5002 thru K5005	Same as K5001.	
L5000	REACTOR: 5 hy at 25 MADC; DC resistance 375 ohms; hermetically sealed rectangular steel case.	TF5028
L5001	REACTOR: 5 hy; current rating 250 MADC; nominal DC resistance 90 ohms; 120 cps (Hz) at 450 VAC, 400 cps at 30 VAC. stud mounted.	TF5025
L5002	Same as L5001.	
M5000	METER, TIME ELAPSED: 115 V, 60 cps; 2.5 watts. (Model AP128)	MR193-1
* M5000	METER, TIME ELAPSED: 115 V, 60 cps; 2.5 watts. (Model AP128/50)	MR193-1-50
M5001	Same as M5000. (Model AP128)	
* M5001	Same as M5000. (Model AP128/50)	
R5000	RESISTOR, FIXED, COMPOSITION: 12,000 ohms, $\pm 5\%$; 2 watts.	RC42GF123J
R5001	RESISTOR, VARIABLE, COMPOSITION: 25,000 ohms, $\pm 10\%$; 2 watts.	RV4LAYS253A
R5002	RESISTOR, FIXED, COMPOSITION: 18,000 ohms, $\pm 5\%$; 2 watts.	RC42GF183J
R5003	RESISTOR, FIXED, COMPOSITION: 33,000 ohms, $\pm 5\%$; 2 watts.	RC42GF333J
R5004	Same as R5001.	
R5005	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, $\pm 5\%$; 2 watts.	RC42GF392J
R5006	Same as R5003.	
R5007	Same as R5001.	

*NOTE add -50 to Part number of M5000 & M5001 for 50 cycle version.
 TMC Model AP128/50 only.

PARTS LIST (CONT)
 LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R5008	Same as R5005.	
R5009	RESISTOR, FIXED, WIREWOUND: 50 ohms, 10 watts.	RW109-7
R5010	Same as R5009.	
R5011	Same as R5009.	
R5012	Same as R5003.	
R5013	Non-replaceable item. Part of XF5003.	
R5014	RESISTOR, FIXED, COMPOSITION: 470,000 ohms, $\pm 5\%$; 2 watts.	RC435F4700
R5015	RESISTOR, FIXED, WIREWOUND: 1,500 ohms, 10 watts.	RW109-26
R5016	Same as R5014.	
R5017	Non-replaceable item. Part of XF5004.	
R5018	RESISTOR, VARIABLE, WIREWOUND: 6 ohms, $\pm 10\%$; 25 watts; linear taper.	RA75AXC6ROAK-25
R5019	RESISTOR, FIXED, WIREWOUND: 5 ohms; current rating 1,000 ma; 5 watts.	RW107-6
R5020	Same as R5014.	
R5021	RESISTOR, FIXED, WIREWOUND: 5,000 ohms, $\pm 5\%$; 5 watts non-inductive.	RR114-5000W
R5022	Same as R5021.	
R5023	Non-replaceable item. Part of XF5002.	
R5024	Non-replaceable item. Part of XF5001.	
R5025	Non-replaceable item. Part of XF5000.	
R5026	RESISTOR, FIXED, WIREWOUND: 500 ohms; current rating 100 ma; 5 watts.	RW107-28
R5027	RESISTOR, VARIABLE, WIREWOUND: 2,500 ohms, $\pm 10\%$; 25 watts; linear taper.	RA75AXC252AK-25
R5028	RESISTOR, FIXED, WIREWOUND: 1,000 ohms, 10 watts.	RW109-24

PARTS LIST (CONT)

LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R5029	RESISTOR, FIXED, COMPOSITION: 56,000 ohms, $\pm 5\%$; 2 watts.	RC42GF563J
R5030	Non-replaceable item. Part of XF5006.	
R5031	RESISTOR, FIXED, COMPOSITION: 82,000 ohms, $\pm 5\%$; 2 watts.	RC42GF823J
R5032	Non-replaceable item. Part of XF5007.	
R5033	Non-replaceable item. Part of XF5009.	
R5034	Non-replaceable item. Part of XF5008.	
R5035	Non-replaceable item. Part of XF5005.	
R5036	RESISTOR, FIXED, WIREWOUND: 25 ohms, 10 watts.	RW109-6
R5037	Same as R5036.	
R5038	Same as R5036.	
S5000	SWITCH, INTERLOCK: SPDT; current rating 5 amps inductive at 30 VDC or 4 amps resistive at 30 VDC at sea level.	SW219
S5001	Same as S5000.	
T5000	TRANSFORMER, FILIAMENT	TF341
T5001	TRANSFORMER, POWER, STEP-UP: primary 220/440 VAC; triple phase, 50/60 cps (Hz); secondary 634 VAC at 200 MADC; neutral 365 VAC at 250 MADC; secondary 346 VAC at 50 MADC.	TF313
V5000	TUBE, ELECTRON: voltage regulator; 7 pin miniature.	0A2
V5001	TUBE, ELECTRON: voltage regulator; 7 pin miniature.	0B2
V5002	Same as V5001.	
V5003	Same as V5000.	
V5004	Same as V5000.	
V5005	Same as V5001.	
XC5000	NOT USED	

PARTS LIST (CONT)
LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TM PART NUMBER
XC5001	SOCKET, ELECTRON TUBE; 8 pin contact; saddle type; C5001 mounting.	5410190
XC5002	Same as XC5001. for mounting a C5002.	
XDS5000 thru XDS5004	NOT USED	
XDS5005	LIGHT, INDICATOR; with white lens; sub-miniature type.	TS153-5
XDS5006	Same as XDS5005.	
XDS5007	Same as XDS5005.	
XF5000	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 300 V, 20 amps; incan lamp type with a 220K ohm lamp resistor; transparent clear flat sided knob; black body; consists of DS5004, R5025.	FH104-3
XF5001	Same as XF5000. Consists of DS5003, R5024.	
XF5002	Same as XF5000. Consists of DS5002, R5023.	
XF5003	Same as XF5000. Consists of DS5000, R5013.	
XF5004	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 500 V, 30 amps; incan lamp type with a 220K ohm lamp resistor; clear octagon knob; Consists of DS5001, R5017.	FH100
XF5005	Same as XF5004. Consists of DS5008, R5035.	
XF5006	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 22 to 33 V, 50 amps; incandescent lamp type with a 330 ohm lamp resistor; transparent amber flat sided knob; brown body. Consists of DS5009, R5030.	FH104-1
XF5007	Same as XF5006. Consists of DS5011, R5031.	
XF5008	Same as XF5006. Consists of DS5010, R5034.	
XF5009	Same as XF5006. Consists of DS5012, R5033.	

PARTS LIST (CONT)
 LOW VOLTAGE POWER SUPPLY, AP128/AP128/50

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XV5000 thru XV5005	Same as XV5001.	
XV5000	SOCKET, ELECTRON TUBE: 7 pin contact.	TS102101
XV5001 thru XV5005	Same as XV5000.	

PARTS LIST
for
HIGH VOLTAGE POWER SUPPLY, AP129 & AP129/50

REF SYMBOL	DESCRIPTION	TM PART NUMBER
C6000	CAPACITOR, FIXED, PLASTIC DIELECTRIC: 10 μ f, \pm 10%, 50 VDC.	CX113-2
CR6000	RECTIFIER, SEMICONDUCTOR DEVICE: average rectified current 2.6 amps; max. forward voltage drop 9.6 V; max. peak reverse voltage 6,400 V.	D9123-1
CR6001 thru CR6005	Same as CR6000.	
E6000	TERMINAL BOARD, BARRIER: eight 6-32 thd. x 1/4" long binding head machine screws; plastic body.	TM102-8
RE6000	RELAY, ARMATURE: 4 pole; contact current rating 30 amps at 600 VAC; coil voltage 208 VAC at 60 cps (Hz).	RL171-8
L6000	REACTOR; 2 hy	TF5029
M6000	TIMER, INTERVAL: adjustable; range setting 30 sec. minimum, 5 min. maximum; switch contact arrangement SPDT; current rating 10 amps at 125 VAC or 5 amps at 250 VAC resistive load.	T1105
R6000	RESISTOR, FIXED, WIREWOUND: 71,000 ohms, \pm 5%; 50 watts.	RW12587134
R6001	Same as R6000.	
R6002	Same as R6000.	
S6000	Non-replaceable item. Part of M6000.	
T6000	TRANSFORMER, POWER	T1114

PARTS LIST
for
RF CONTROL/INDICATOR, MODEL 5WCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
B7000	MOTOR	M0130-2
C7000	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 10,000 uf, 500 WVDC.	CC100-16
C7001	Same as C7000.	
C7002	Same as C7000.	
C7003	CAPACITOR, FIXED, ELECTROLYTIC: 500 uf, 50 WVDC; polarized.	CE116-10VN
C7004	CAPACITOR, FIXED, CERAMIC DIELECTRIC: 200,000 uf, +80% -20%; 25 WVDC.	CC100-33
C7005	Same as C7004.	
C7006 thru C7010	Same as C7000.	
C7011	CAPACITOR, FIXED, ELECTROLYTIC: 2,000 uf, 25 WVDC; polarized.	CE116-5VN
C7012	Same as C7000.	
C7013	CAPACITOR, FIXED, MICA DIELECTRIC: 1,000 uf, $\pm 2\%$; 500 WVDC.	CM20F102G03
C7014	Same as C7013.	
C7015	CAPACITOR, FIXED, MICA DIELECTRIC: 10 uf, $\pm 2\%$; 500 WVDC.	CM15C100G03- YY
C7016	CAPACITOR, FIXED, MICA DIELECTRIC: 47 uf, $\pm 2\%$; 500 WVDC.	CM15F470G03- YY
C7017	Same as C7003.	
C7018	CAPACITOR, FIXED, ELECTROLYTIC: 100 uf, -10% +150% at 120 cps (Hz) at 25°C; 25 WVDC; polarized.	CE105-100-25
CR7000	SEMICONDUCTOR DEVICE, DIODE	1N3027B
CR7001	SEMICONDUCTOR DEVICE, DIODE	1N34A
CR7002	Same as CR7001.	

PARTS LIST (CONT)

RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
CR7003	ABSORBER, OVERVOLTAGE: operating voltage range 28 to 33 V; max. reverse voltage 10 VDC; current rating 750 ma; 200 PIV diode; 6.8 V, 1 watt Zener diode.	DD111-1
CR7004	SEMICONDUCTOR DEVICE, DIODE	1N2484
CR7005	SEMICONDUCTOR DEVICE, DIODE	1N270
CR7006	Same as CR7004.	
CR7007	Same as CR7004.	
DS7000	LAMP, INCANDESCENT: 28.0 VAC/DC; 0.04 amps; single contact, T-1-3/4 bulb.	BI110-7
DS7001	Non-replaceable item. Part of XF7000.	
DS7002	Same as DS7000.	
DS7003	Non-replaceable item. Part of XF7002.	
F7000	FUSE, CARTRIDGE: 1 amp; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-1
F7001	FUSE, CARTRIDGE: 3 amps; time lag; 1-1/4" long x 1/4" dia.; slo-blo.	FU102-3
F7002	Same as F7000.	
J7000	CONNECTOR, RECEPTACLE, ELECTRICAL: 44 female contacts, rated for 5 amps at 1,800 V RMS; for double sided printed circuit board.	JJ319-22DFE
J7001	CONNECTOR, RECEPTACLE, ELECTRICAL	*
J7002	Same as J7000.	
J7003	CONNECTOR, RECEPTACLE, ELECTRICAL: RF; 1 round female contact, straight type; 52 ohms; BNC to BNC.	UG625*/U
J7004	Same as J7003.	
J7005	CONNECTOR, RECEPTACLE, ELECTRICAL	*
J7006	Same as J7000.	

* NOTE Part number to be supplied at a later date.

PARTS LIST (CONT)
RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
J7007	CONNECTOR, RECEPTACLE, ELECTRICAL: RF; 1 round male contact, straight type; series BNC to BNC.	JJ211
J7008	Same as J7007.	
J7009	CONNECTOR, RECEPTACLE, ELECTRICAL: male	JJ313-1
K7000	RELAY, ARMATURE: DPDT; 700 ohms, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 35 ma; power rating 700 mw at 25°C; 8 contacts rated for 3 amps at 115 VAC or 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-1
K7001	RELAY, ARMATURE: 4PDT; 485 ohms each coil, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 49 ma each coil; power rating 1,200 mw at 25°C; 16 contacts rated for 0.5 amps at 115 VAC or 1 amp at 29 VDC; clear high impact styrene dust cover case.	RL156-10
K7002	RELAY, ARMATURE: DPDT; 485 ohms each coil, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 49 ma each coil; power rating 1,200 mw at 25°C; 10 contacts rated for 3 amps at 115 VAC or 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-9
K7003	Same as K7002.	
K7004	Same as K7002.	
K7005	Same as K7000.	
K7006	RELAY, ARMATURE: 4PDT; 700 ohms, $\pm 10\%$ DC resistance; operating voltage 24 VDC; current rating 35 ma; power rating 700 mw at 25°C; 14 contacts rated for 3 amps at 115 VAC or 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-8
K7007	RELAY, HI-SEN: insulated for 400 VDC or 300 VAC; calibrated at 77°F; 9 male contacts, open 51 ua, closed 50 ua; 2,700 ohms; corrosion resistant aluminium case.	RL158
K7008	Same as K7002.	
K7009	Same as K7002.	
K7010	Same as K7000.	

PARTS LIST (CONT)

RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
K7011	Same as K7001.	
K7012	Same as K7001.	
K7013	RELAY, ARMATURE: DPDT; 185 ohms, $\pm 10\%$ DC resistance; operating voltage 12 VDC; current rating 65 ma; power rating 700 mw at 25°C; 8 contacts rated for 3 amps at 115 VAC or 5 amps at 29 VDC; clear high impact styrene dust cover case.	RL156-13
K7014	RELAY, ARMATURE: SPST; contacts rated for 2 amps at 115 VAC normally open; 5 seconds time delay; operating voltage 26 V; aluminum case.	RL166-26N05
L7000	COIL, RADIO FREQUENCY: fixed; 0.150 uh, $\pm 10\%$; current rating 400 ma.	CL140-2
L7001	Same as L7000.	
L7002	Same as L7000.	
M7000	METER, CONTACTLESS: KW/SWR	MR195
P7000	CONNECTOR, PLUG, ELECTRICAL	*
P7001	CONNECTOR, PLUG, ELECTRICAL: RF; 1 round female contact, straight type; miniature bayonet lock series.	PL204
P7002	Same as P7001.	
P7003	CONNECTOR, PLUG, ELECTRICAL: 15 female contacts rated for 5 amps at 500 V RMS; polarized.	JJ310-1H
Q7000	TRANSISTOR	2N697
Q7001	TRANSISTOR	2N492
R7000	RESISTOR, FIXED, COMPOSITION: 2,200 ohms, $\pm 5\%$; 1/2 watt.	RC20GF222J
R7001	RESISTOR, FIXED, COMPOSITION: 15,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF153J
R7002	RESISTOR, FIXED, COMPOSITION: 22,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF223J
R7003	Same as R7000.	

* Part number to be supplied at a later date.

PARTS LIST (CONT)

RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R7004	RESISTOR, FIXED, COMPOSITION: 470,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF474J
R7005	Same as R7000.	
R7006	Non-replaceable item. Part of XF7002.	
R7007	NOT USED	
R7008	Same as R7000.	
R7009	RESISTOR, FIXED, COMPOSITION: 220 ohms, $\pm 5\%$; 1/2 watt.	RC20GF221J
R7010	RESISTOR, FIXED, COMPOSITION: 220 ohms, $\pm 5\%$; 1 watt.	RC32GF221J
R7011	NOT USED	
R7012	NOT USED	
R7013	RESISTOR, FIXED, COMPOSITION: 10,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF103J
R7014	RESISTOR, VARIABLE, COMPOSITION: 100,000 ohms, $\pm 10\%$; 0.25 watts.	RV111U104A
R7015	NOT USED	
R7016	RESISTOR, VARIABLE, COMPOSITION: 50 ohms, $\pm 10\%$; 2 watts.	RV4NAYSK500A
R7017	Non-replaceable item. Part of XF7000.	
R7018	Same as R7010.	
R7019	RESISTOR, VARIABLE, COMPOSITION: 500,000 ohms, $\pm 10\%$; 0.25 watts.	RV111U504A
R7020	RESISTOR, VARIABLE, WIREWOUND: 5,000 ohms, $\pm 5\%$; 1 watt at 50°C.	RV119-1-502
R7021 thru R7026	Same as R7020.	
R7027	RESISTOR, FIXED, COMPOSITION: 2,700 ohms, $\pm 5\%$; 1/2 watt.	RC20GF272J

PARTS LIST (CONT)
RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
R7028	RESISTOR, FIXED, COMPOSITION: 3,900 ohms, $\pm 5\%$; 1/2 watt.	RC20GF392J
R7029	Same as R7027.	
R7030	Same as R7027.	
R7031	RESISTOR, FIXED, COMPOSITION: 3,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF302J
R7032	Same as R7000.	
R7033	RESISTOR, FIXED, COMPOSITION: 3,300 ohms, $\pm 5\%$; 1/2 watt.	RC20GF332J
R7034	RESISTOR, VARIABLE, WIREWOUND: 50,000 ohms, $\pm 5\%$; 1 watt at 50°C.	RV119-1-503
R7035	Same as R7034.	
R7036	Same as R7034.	
R7037	RESISTOR, FIXED, COMPOSITION: 100,000 ohms, $\pm 5\%$; 1/2 watt.	RC20GF104J
R7038	RESISTOR, VARIABLE, WIREWOUND: 100,000 ohms, $\pm 5\%$; 1 watt at 50°C.	RV119-1-104
R7039	Same as R7038.	
R7040	Same as R7038.	
R7041	RESISTOR, FIXED, COMPOSITION: 470 ohms, $\pm 5\%$; 2 watts.	RC42GF471J
S7000	SWITCH, TOGGLE: DPDT; 6 contacts rated for 5.0 amp at 250 VAC or 6 amps at 125 VAC; bat type handle.	ST105
S7001	SWITCH, TOGGLE: SPDT; 28° angle of throw; bat type handle.	ST12D
S7002A,B	SWITCH, SENSITIVE: DPDT; current rating 5.0 amps at 125 VAC, 250 VAC; 7 amps resistive, 4 amps inductive at 28 VDC; plastic body.	SW353-3
S7003	SWITCH, SENSITIVE: SPDT; current rating 5.0 amps at 125 VAC, 250 VAC; 7 amps resistive, 4 amps inductive at 28 VDC; plastic body.	SW353-2

PARTS LIST (CONT)
RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S7004A,B C,D,E,F, G,H,I,J, K	SWITCH, ROTARY: solenoid; 10 sections, 18 positions; current rating 10 to 15 amps resistive, break at 24 VDC, 5 amps resistive, break at 115 VDC; bakelite wafer insulation.	SW428
XDS7000	LIGHT, INDICATOR: w/red lens, sub-miniature type.	TS153-1
XDS7001	NOT USED	
XDS7002	Same as XDS7000.	
XF7000	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 300 V, 20 amps; neon lamp type with a 220K ohm lamp resistor; transparent clear flat sided knob; black body. Consists of DS7001, R7017.	FH104-3
XF7001	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 22 to 33 V, 20 amps; incandescent lamp type with a 330 ohm lamp resistor; transparent amber flat sided knob; brown body. Consists of DS7003, R7006.	FH104-11
XK7000	SOCKET, RELAY: w/retainer; 6 male beryllium copper gold plated contacts; black phenolic body.	TS171-5
XK7001	SOCKET, RELAY: w/retainer; 12 male beryllium copper gold plated contacts; black phenolic body.	TS171-4
XK7002 thru XK7005	Same as XK7000.	
XK7006	Same as XK7001.	
XK7007	SOCKET, RELAY: 9 pin contact; 3 amps at 1,250 V RMS at sea level; phenolic body.	TS100-7
XK7008 thru XK7010	Same as XK7000.	
XK7011	Same as XK7001.	
XK7012	Same as XK7001.	
XK7013	Same as XK7000.	

PARTS LIST (CONT)

RF CONTROL/INDICATOR, MODEL SWCA-3K

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
XK7014	SOCKET, RELAY: 7 pin contact.	TS130MPW
Z7000	NETWORK, RELAY METER.	NW132
Z7001	NETWORK, RELAY METER: power supply	NW131

PARTS LIST
for
TUNING CONTROL SYSTEM, MODEL TCSA-1

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
E8000	TERMINAL BOARD, BARRIER: four 6-32 thd. x 1/4" long binding head machine screws; phenolic body.	TM102-4
E8001	Same as E8000.	
J8000	Part of Rack, Electrical Equipment, RAK111-2	
J8001 thru J8003	NOT USED	
J8004	CONNECTOR, RECEPTACLE, ELECTRICAL: 37 female contacts, removeable crimp pin style; current rating 5 amps, 500 V RMS; polarized.	JJ310-3
J8005	Same as J8004.	
J8006	Same as J8004.	
Z8000	SECOND AMPLIFIER SERVO	AZ110
Z8001	PA LOAD SERVO AMPLIFIER	AZ111
Z8002	PA TUNE SERVO AMPLIFIER	AZ112

PARTS LIST
for
ALARM PANEL, MODEL AX633

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
C9000	CAPACITOR, FIXED, ELECTROLYTIC: 25 uf, -10% +150% at 120 cps (Hz) at 25°C; 50 WVDC; polarized.	CE105-25-50
CP9000	ADAPTER, CONNECTOR, ELECTRICAL: series BNC	UG492D/U
CP9001	Same as CP9000.	
CR9000	SEMICONDUCTOR DEVICE, DIODE	1N2484
DS9000	Non-replaceable item. Part of XF9000.	
DS9001	BUZZER: audible signal; operating voltage 6 to 28 VDC; current rating 3 to 14 ma; 1-5/8" long x 1-11/16" dia. o/a.	BZ101-1
E9000	TERMINAL BOARD, BARRIER: fourteen 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM100-14
E9001	TERMINAL BOARD, BARRIER: ten 6-32 thd. x 1/4" long binding head machine screws; black phenolic body.	TM100-10
F9000	FUSE, CARTRIDGE: 1 amp; 1-1/4" long x 1/4" dia.; quick acting.	FU100-1
J9000	JACK, TELEPHONE: silver alloy contacts.	JJ116-10
J9001	CONNECTOR, RECEPTACLE, ELECTRICAL: 1 round female contact, straight type; series BNC to BNC.	JJ172
J9002	Same as J9001.	
J9003	CONNECTOR, RECEPTACLE, ELECTRICAL: series BNC	UG1094A/U
P9000	CONNECTOR, PLUG, ELECTRICAL: 1 male contact; voltage rating 500 V peak; polarized.	PL244-1
P9001	Same as P9000.	
R9000	Non-replaceable item. Part of XF9000.	
R9001	RESISTOR, FIXED, COMPOSITION: 330 ohms, $\pm 5\%$; 1 watt.	RC32GF331J
S9000	SWITCH, TOGGLE: SPST; nominal current rating 3 amps at 250 VAC/DC or 6 amps at 125 VAC/DC.	ST103-1-62

PARTS LIST (CONT)

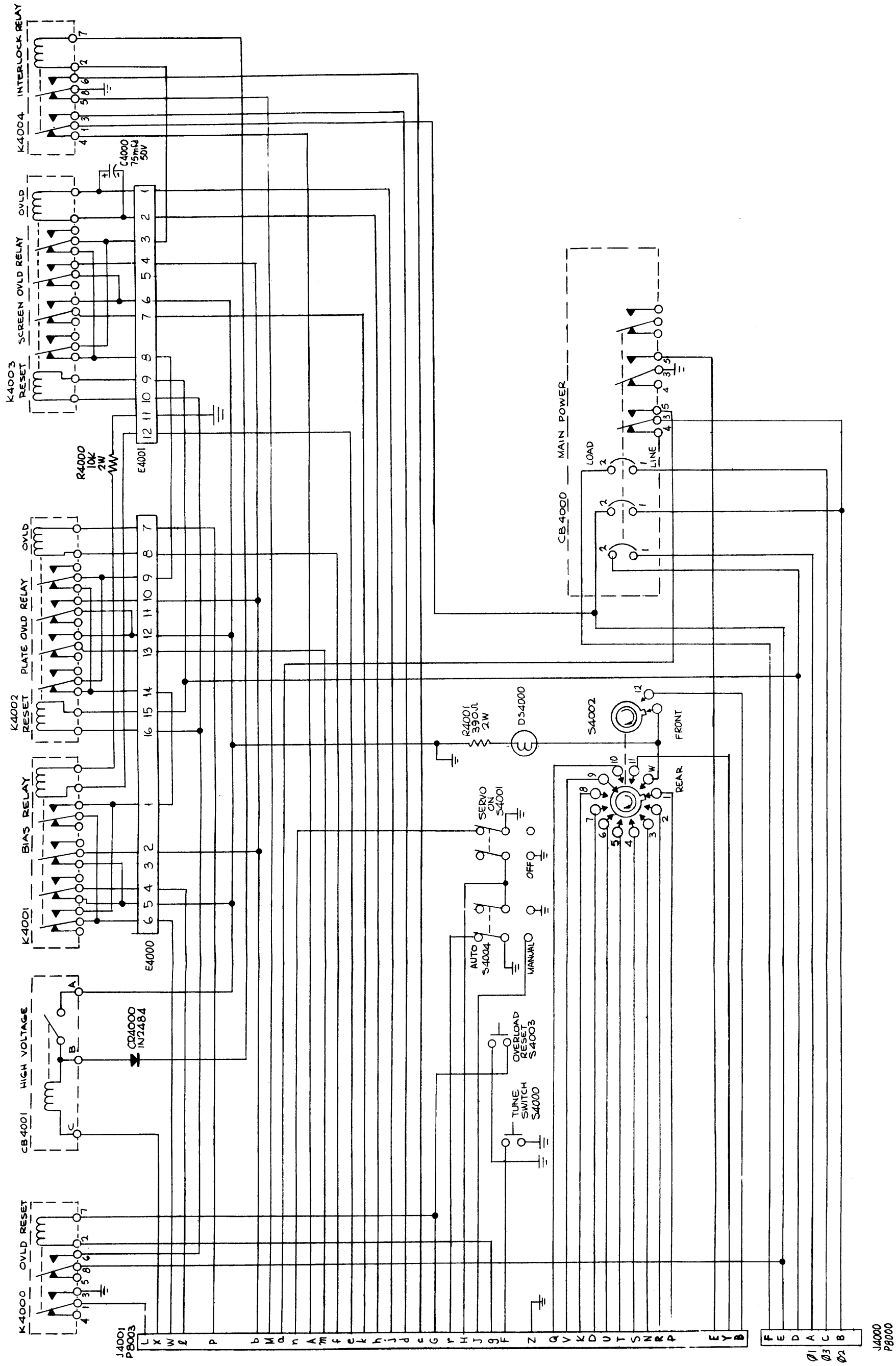
ALARM PANEL, MODEL AX633

REF SYMBOL	DESCRIPTION	TMC PART NUMBER
S9001	SWITCH, ROTARY	SW147
XF9000	FUSEHOLDER: lamp indicating; accomodates cartridge fuse 1-1/4" long x 1/4" dia.; 22 to 33 V, 20 amps; incandescent lamp type with a 330 ohm lamp resistor; transparent amber flat sided knob; brown body; consists of DS9000, R9000.	FH104-11

SECTION 7
SCHEMATIC DIAGRAMS

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Figure 7-1.

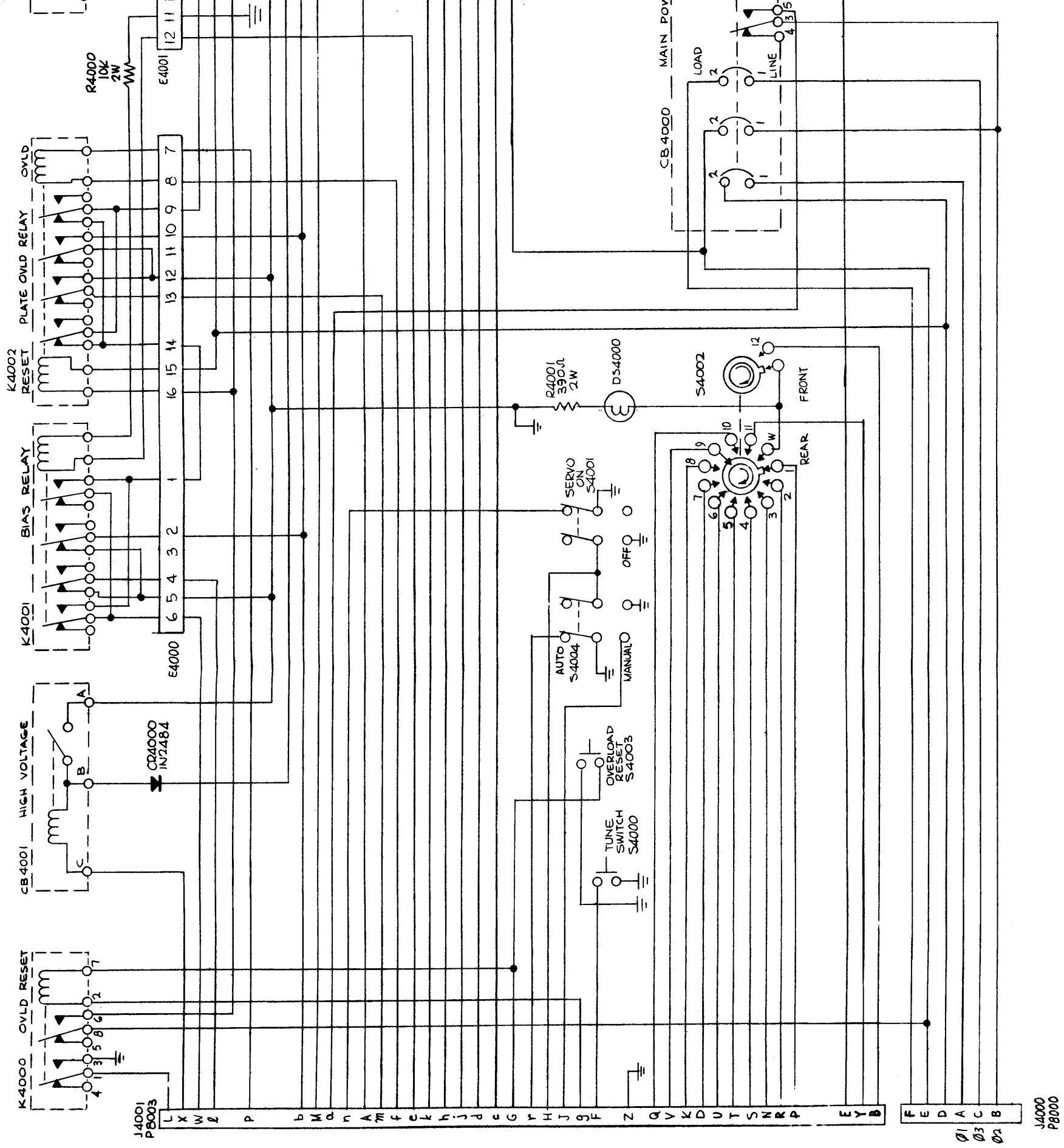


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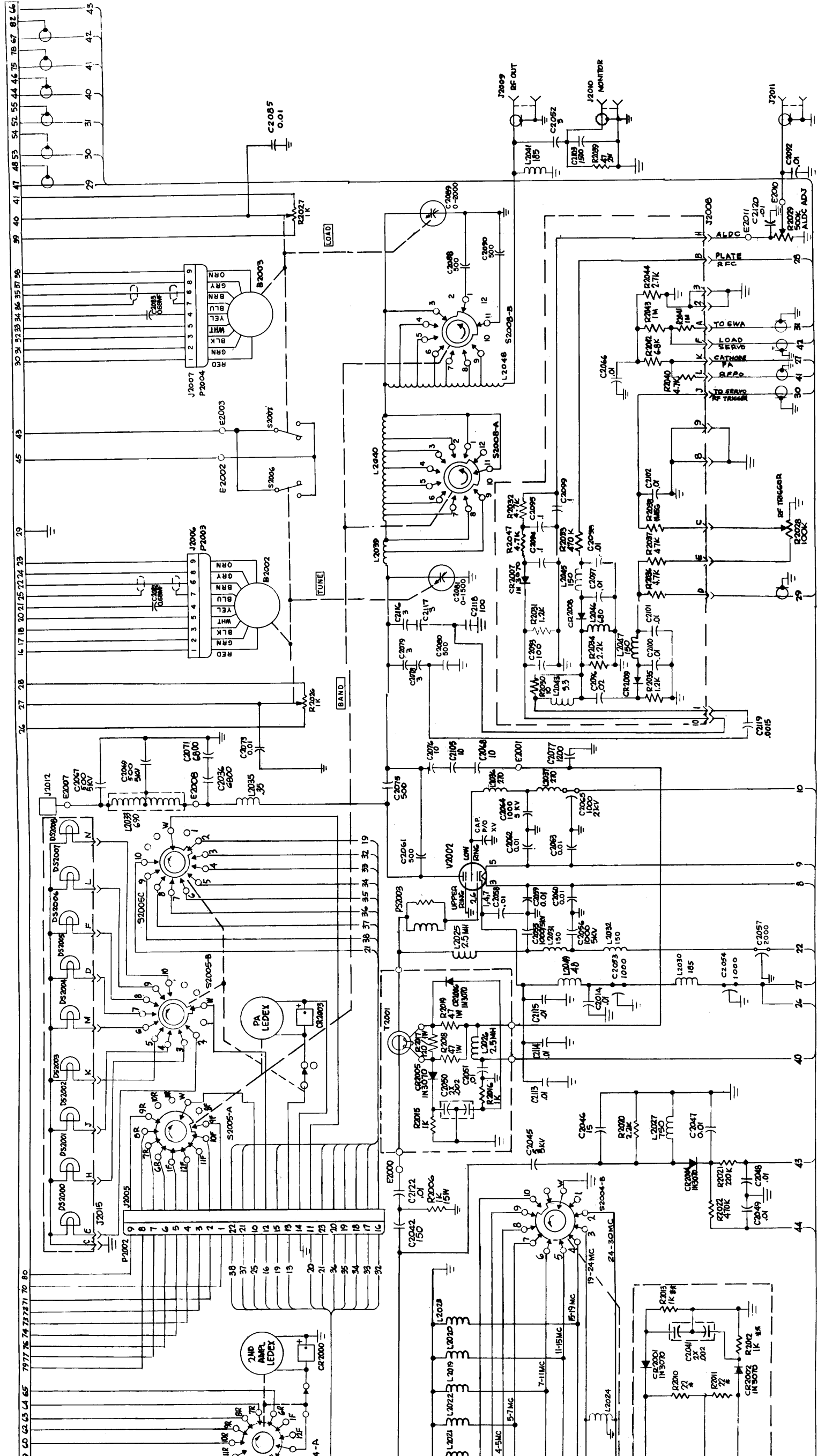
Figure 7-2. Schematic Diagram, TCP-1

S4002 INTERLOCK SWITCH	
POSITION	FUNCTION
1	PS COVERS
2	PA COVERS
3	AIR SWITCH
4	EXTERNAL
5	PS GRILLE
6	PS DRAWER
7	FILTER DRAWER
8	PA DRAWER
9	REAR PANEL
10	LEFT PANEL
11	RIGHT PANEL
12	TIMER

LAST SYMBOLS	MISSING SYMBOLS
C4000	
CB4001	
CR4000	
DS4000	
E4001	
J4001	
K4004	
R4001	
S4004	



CK11370



BREAKOUT	LAST NO. MISSING NO.
	45

LAST SYM	MISSING SYMBOLS
B 2003	31 45, 44, 70, 72, 74, B4, B6
C 2122	B1, 91, 204, 211, 6, 210, 212
CR 2009	
DS 2008	
E 2011	
J 2015	2008, 16, 29, 34, 3
L 2049	
N 2001	
PS 2003	PS 2001
R 2044	R 2009, 25, 55
S 2009	
T 2001	03, 04, 23, 24
V 2002	

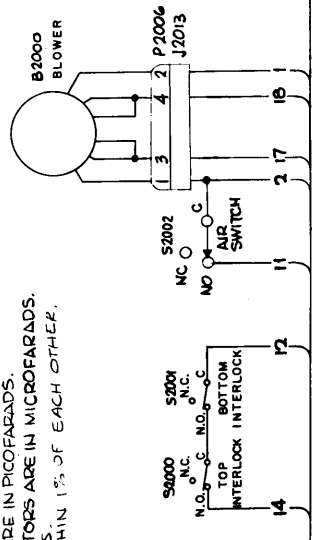
CK11180

Figure 7-3. Schematic Diagram, TLAA-2.5K

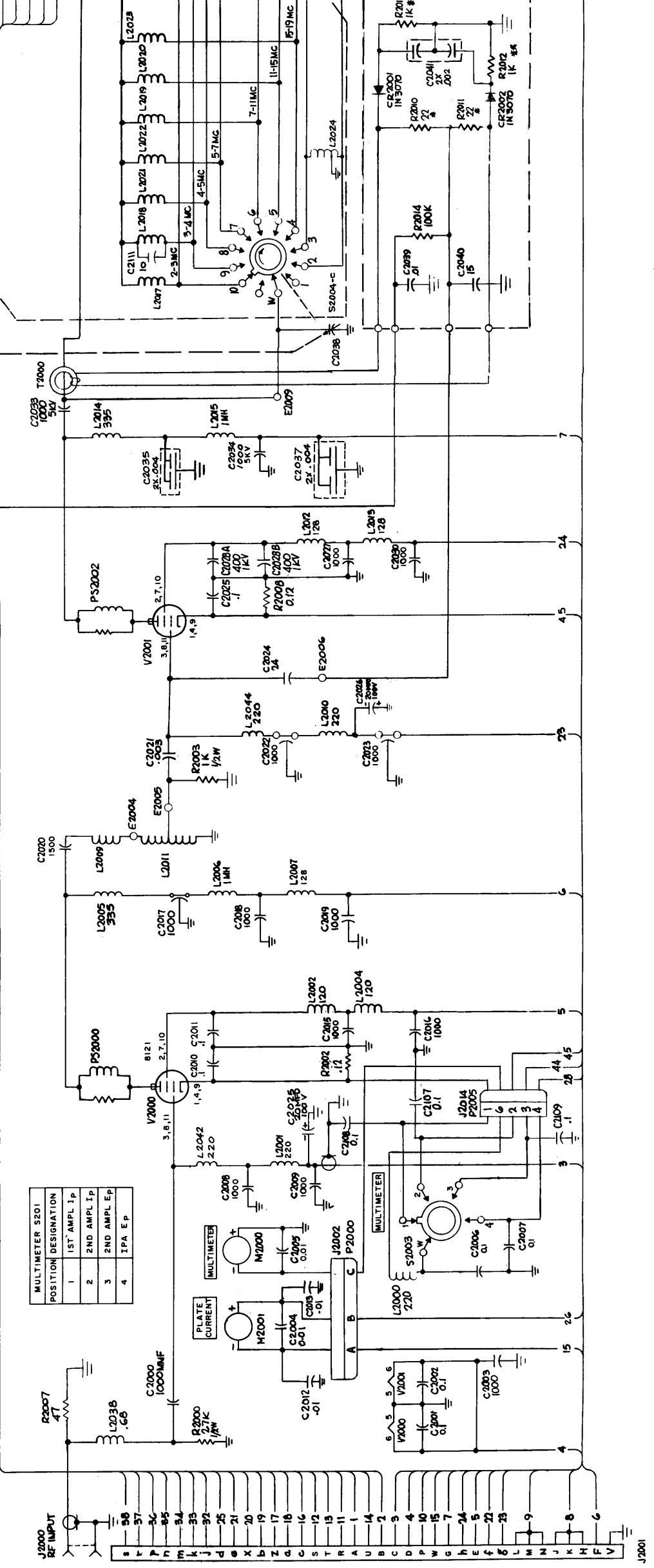
J2005 12 13 49 2 1 3 5 4 11 7 10 8 51 57 59 60 62 63 64 65 79 77 76 74 73 72 71 7

CONTROL WAFER	
POSITION	
1	2-3
2	20-25
3	25-30
4	3-5
5	4-5
6	5-7
7	11-15
8	15-19
9	19-24
10	24-30

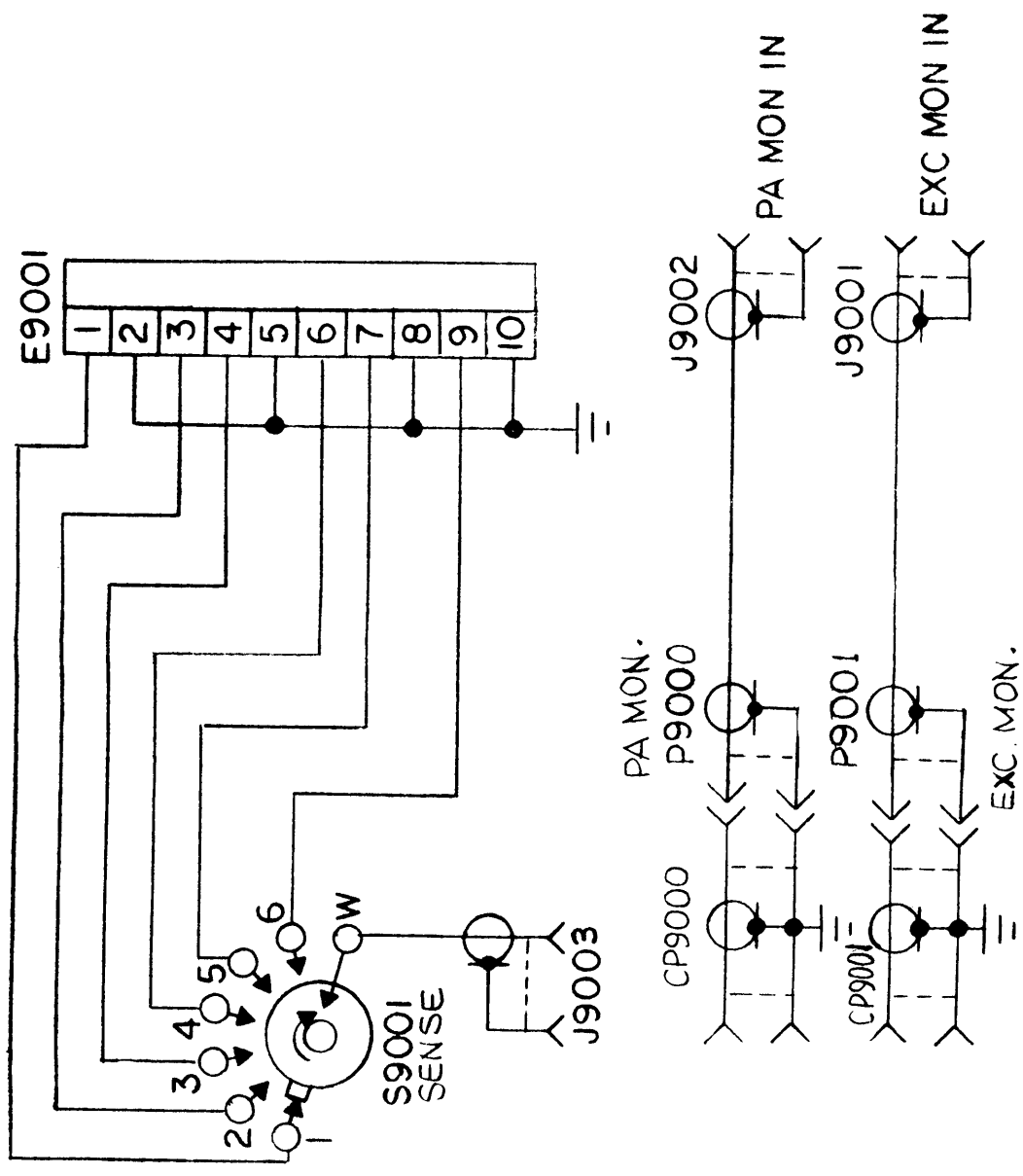
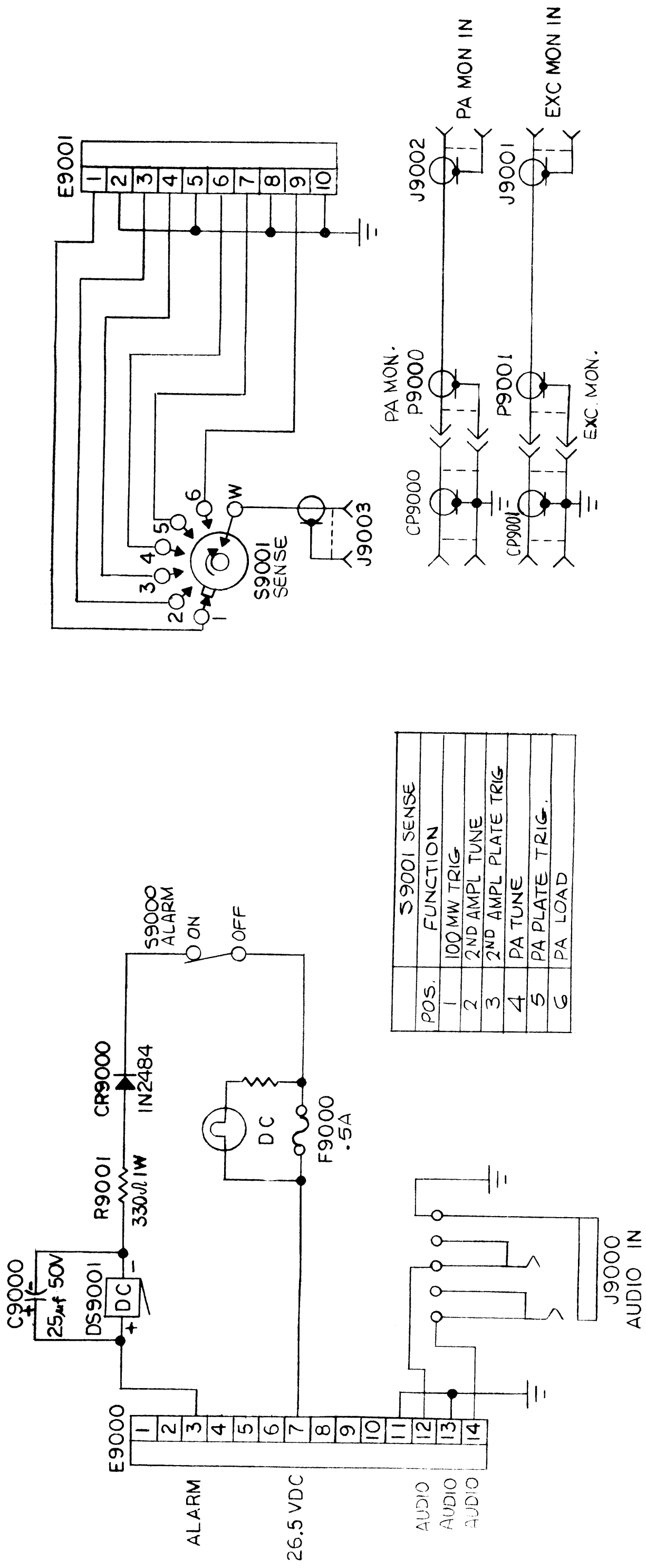
UNLESS OTHERWISE SPECIFIED
 ALL RESISTORS ARE IN OHMS.
 ALL COILS ARE IN MICROHENRIES.
 ALL WHOLE CAPACITORS ARE IN MICROFARADS.
 ALL DECIMAL CAPACITORS ARE IN MICROFARADS.
 *MATCHED RESISTORS.
 **MATCHING TO BE WITHIN 1% OF EACH OTHER.



MULTIMETER S201	
POSITION	DESIGNATION
1	1ST AMPL IP
2	2ND AMPL IP
3	2ND AMPL EP
4	1PA EP

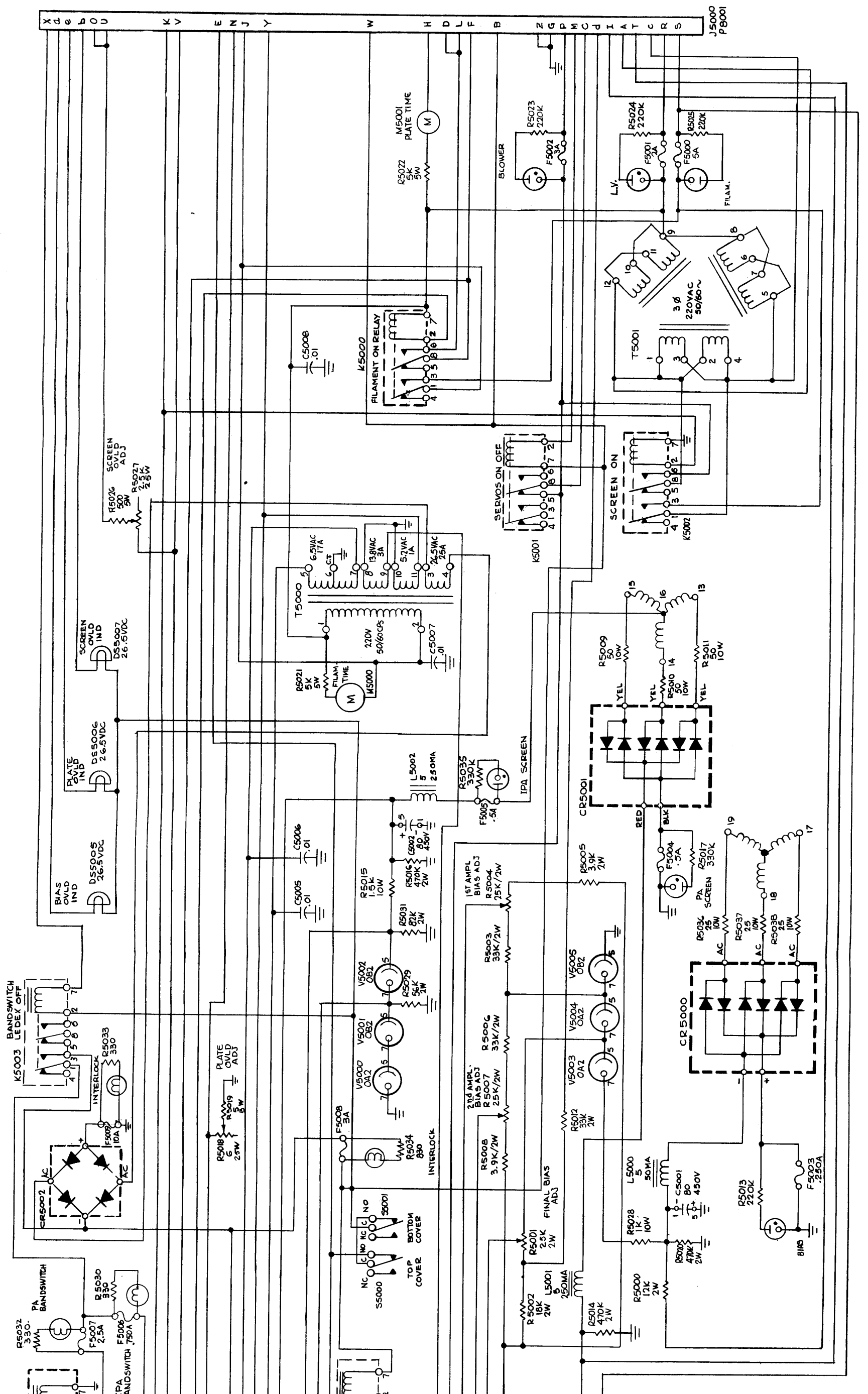


J2001



CK12070

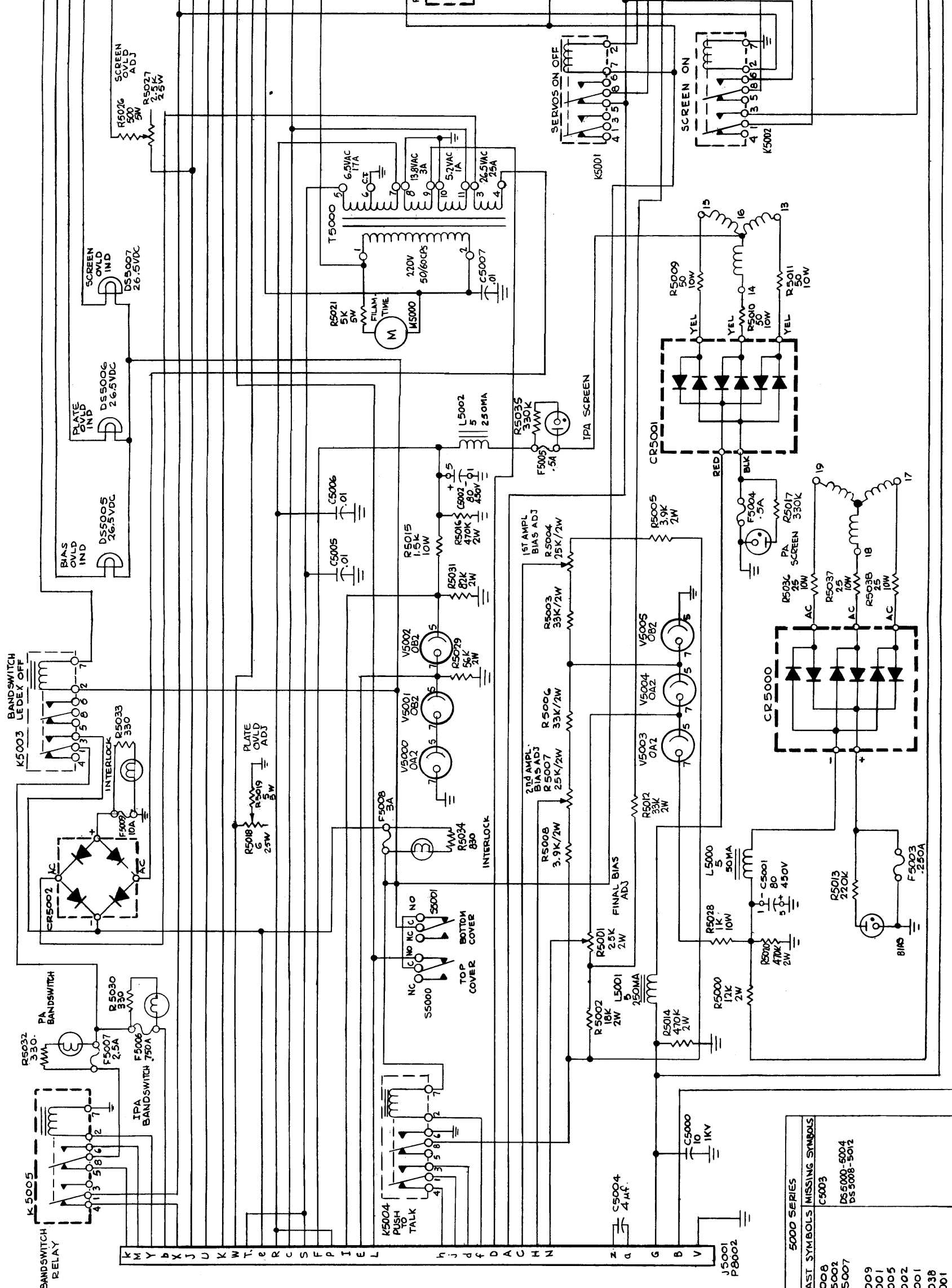
Figure 7-4. Schematic Diagram, AX633



UNLESS OTHERWISE SPECIFIED -
 ALL RESISTOR VALUES ARE IN OHMS ± 10% 1/2 WATT
 ALL CAPACITOR VALUES ARE IN MFD
 ALL CLOKES VALUES ARE IN HY

CK10450

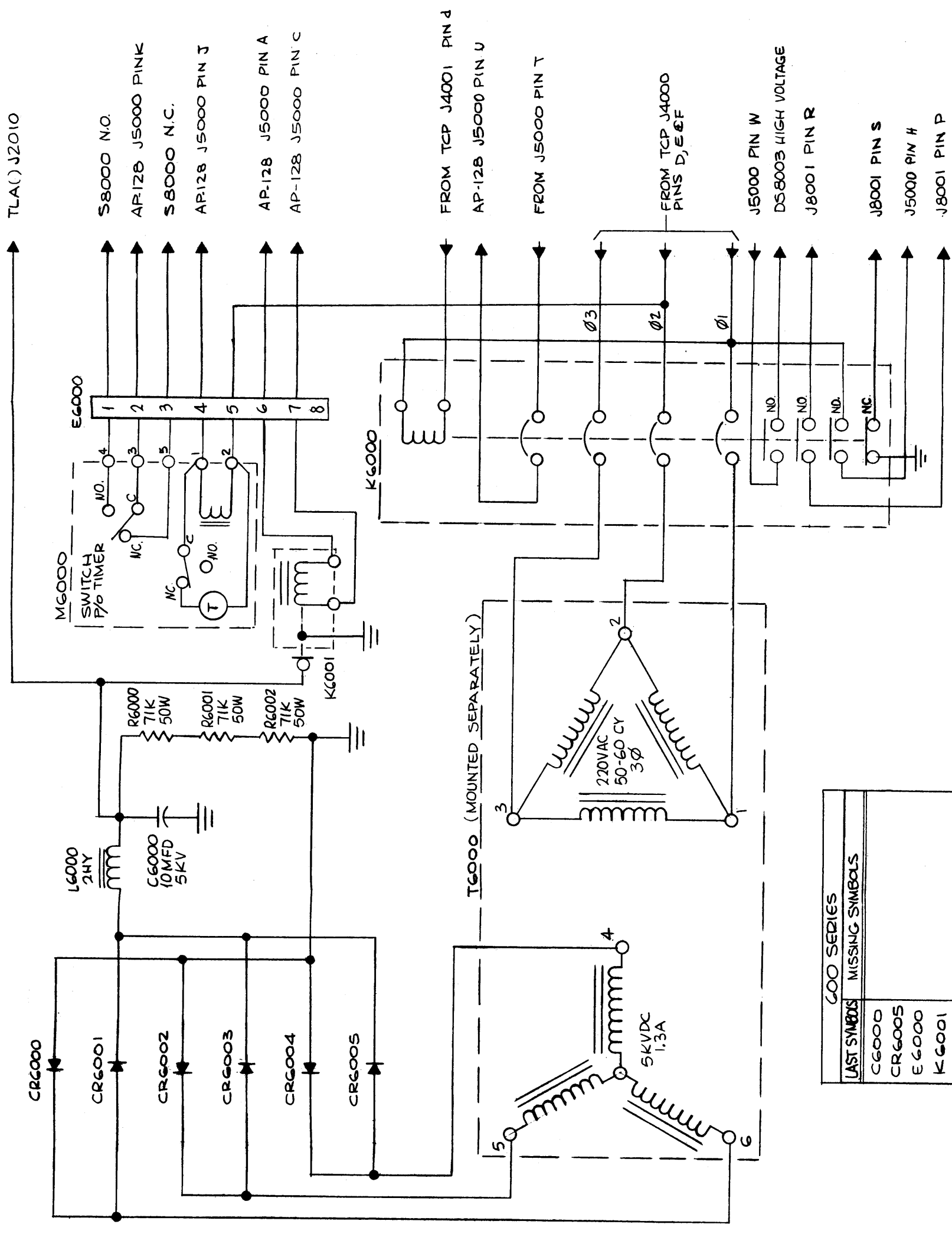
Figure 7-5. Schematic Diagram, AP128



5000 SERIES	
LAST SYMBOLS MISSING SYMBOLS	
C5008	C5003
CR5002	DS5000-5004
DS5007	DS5008-5012
F5009	
T5001	
K5005	
L5002	
M5001	
R5038	
SS001	
T5001	
V5006	

UNLESS OTHERWISE SPECIFIED -
 ALL RESISTOR VALUES ARE IN OHMS ± 10% 1/2 WATT
 ALL CAPACITOR VALUES ARE IN MFD
 ALL CLOCK VALUES ARE IN HY

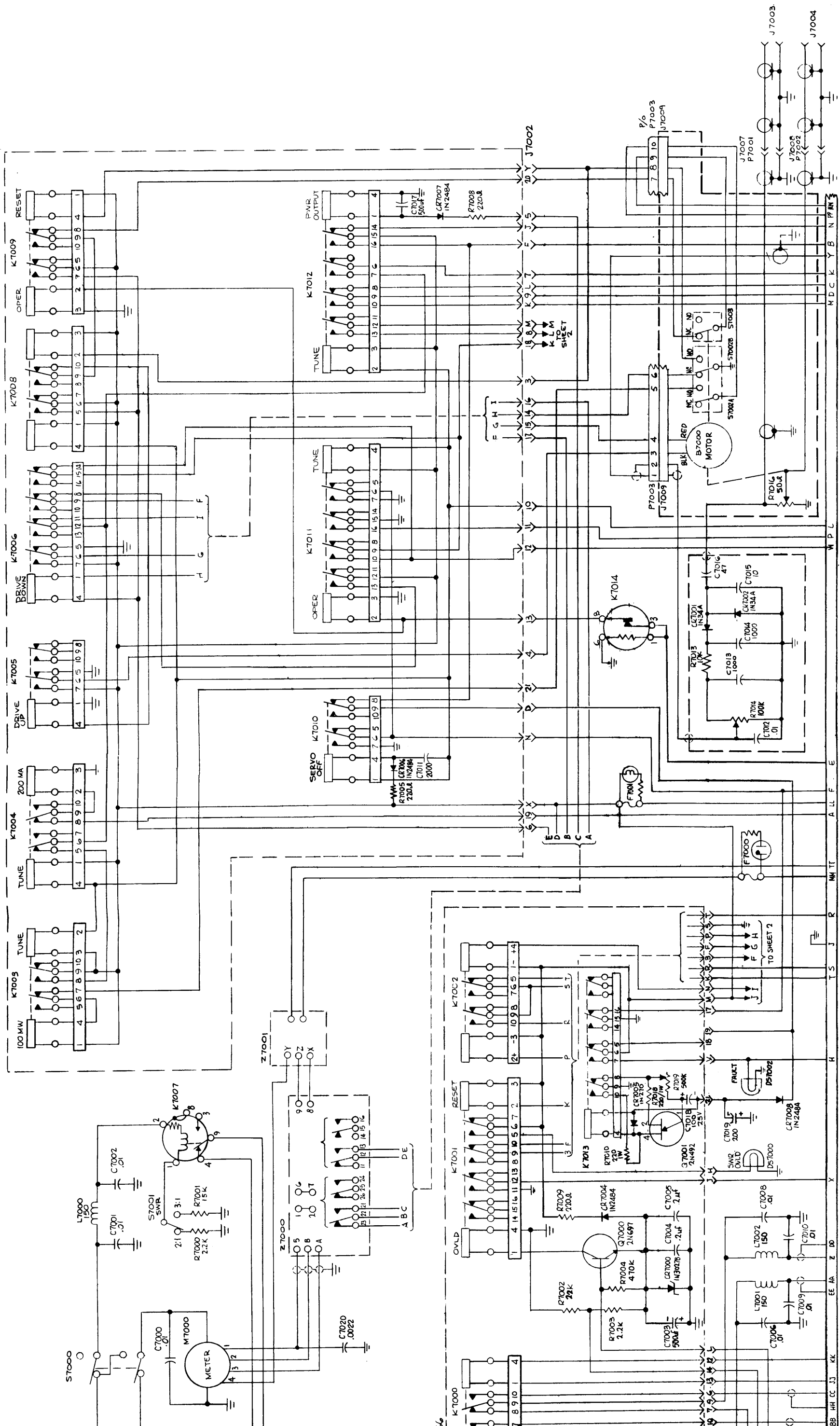
CK10450



C00 SERIES	
LAST SYMBOLS	MISSING SYMBOLS
CG000	
CR6005	
E6000	
K6001	
L6000	
M6000	
R6002	
T6000	

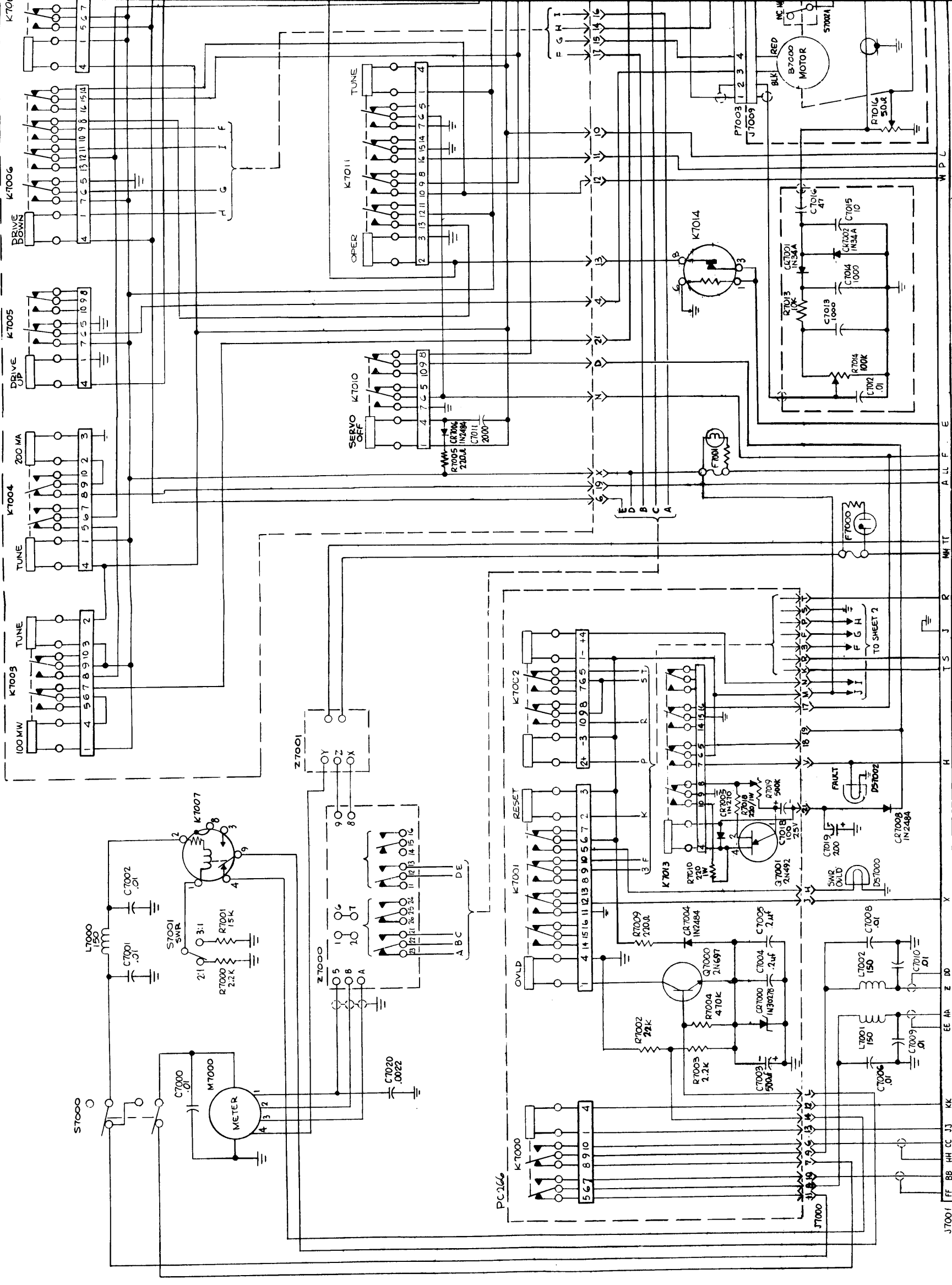
CK10460

Figure 7-6. Schematic Diagram, AP129

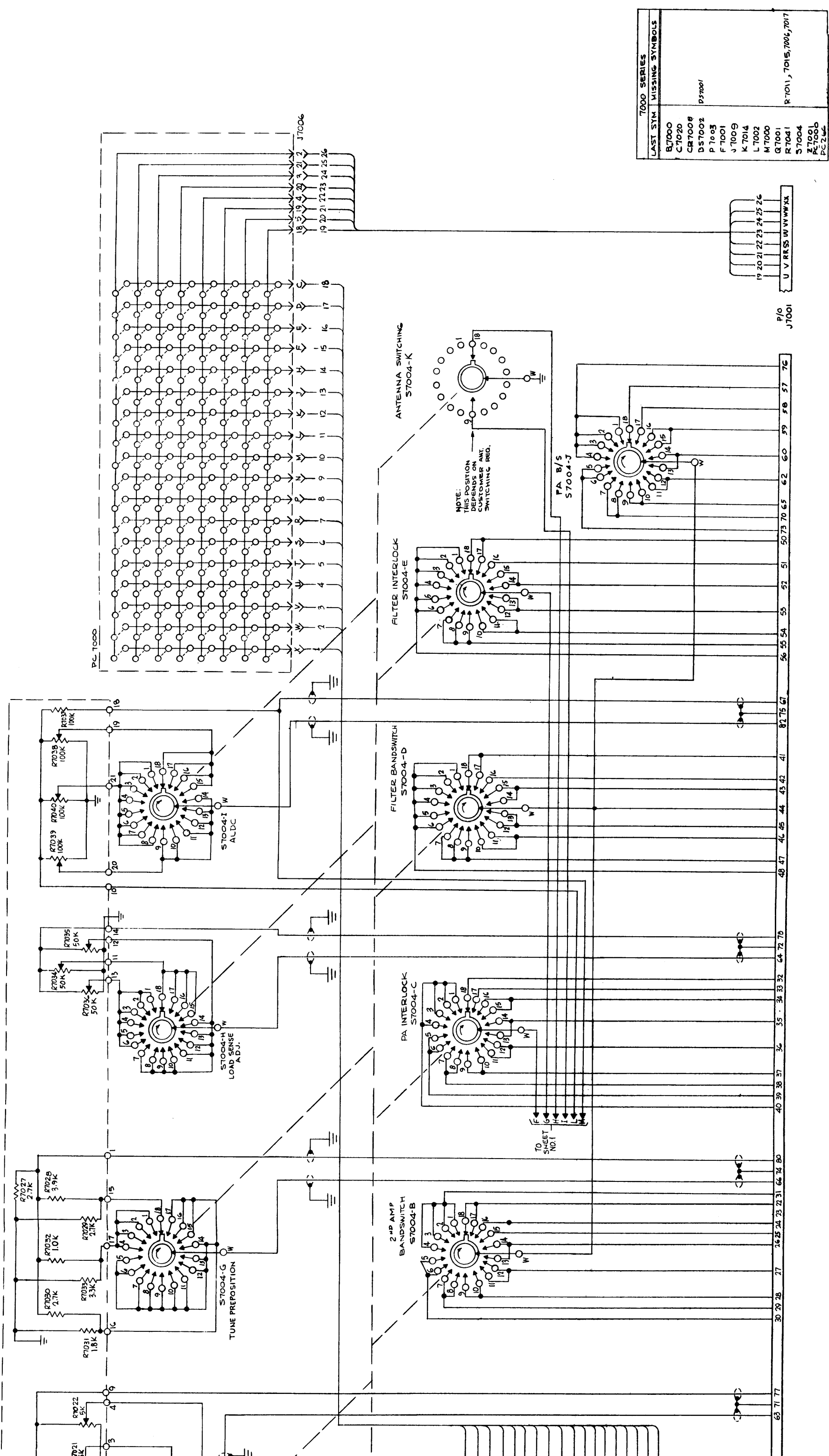


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Figure 7-7. Schematic Diagram, SWCA-3K (sheet 1 of 2)

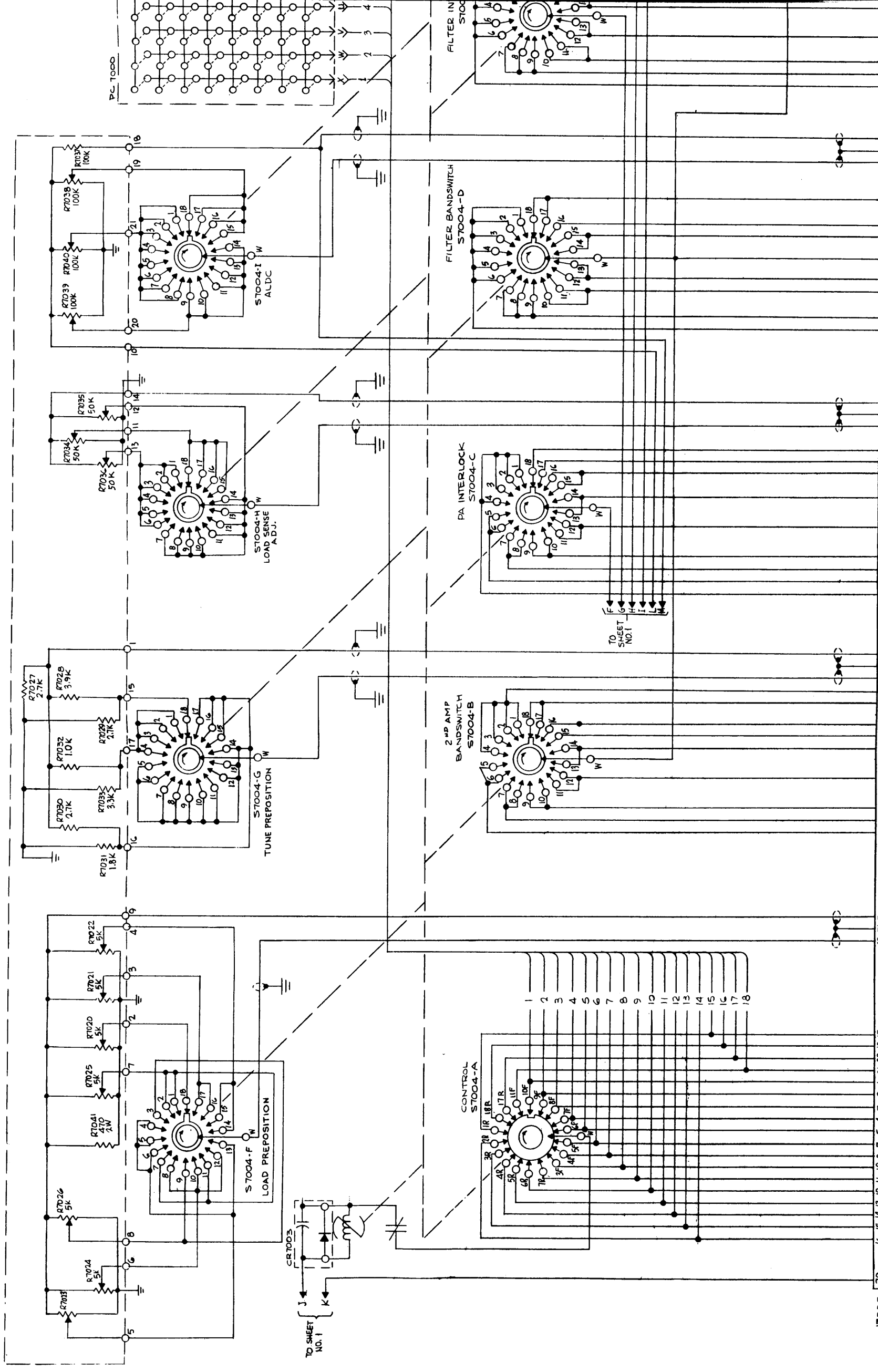


CK10480



CK1048Ø

Figure 7-7. Schematic Diagram, SWCA-3K (sheet 2 of 2)



J7005 79 16 15 14 13 12 11 10 8 7 5 4 3 2 21 20 18 17 30 29 28 27 16 25 24 23 22 21 64 74 80 40 39 38 37 36 35 34 33 32 64 72 78 48 47 46 45 44 43 42 41 82 75 67 56 55 54 53