TECHNICAL MANUAL

BROADCAST TRANSMITTER

TYPE BC-5H

HARRIS CORPORATION

INTRODUCTION

This Technical Manual provides the necessary information for application, installation, operation, adjustment, and maintenance of the Model BC-5H, 5 kW transmitter.

WARNING

EXTREMELY DANGEROUS VOLTAGES EXIST IN THIS TRANSMITTER

Do not make adjustmenst inside the transmitter with the high voltage on. De-energize the transmitter when making repairs. Do not bypass the interlocks. Do not do any servicing alone. Always ground circuits with a shorting stick before touching.

DO NOT TAKE CHANCES WITH LETHAL VOLTAGES!!

888 1287 001
Price: $20.00

SAFETY NOTICE

WARNING: THE CURRENTS AND VOLTAGES IN THIS EQUIPMENT ARE DANGEROUS AND UNDER CERTAIN CONDITIONS, COULD BE FATAL.

This manual is intended as general guidance for trained and qualified installation, operating, maintenance and service personnel who are familiar with and aware of the dangers inherent to handling potentially hazardous electrical and/or electronic circuits. It is not intended to contain a complete statement of all safety precautions which should be observed by personnel in using this or other electronic equipment.

THE INSTALLATION, OPERATION, MAINTENANCE AND SERVICING OF THIS EQUIPMENT INVOLVES RISKS TO BOTH PERSONNEL AND EQUIPMENT, AND MUST BE PERFORMED ONLY BY PROPERLY TRAINED AND EXPERIENCED PERSONNEL EXERCISING DUE CARE. PERSONNEL MUST FAMILIARIZE THEMSELVES WITH SAFETY REQUIREMENTS, SAFE HANDLING AND OPERATING PRACTICE, AND RELATED FIRST-AID PROCEDURES (E.G., FOR ELECTRICAL BURNS AND ELECTRICAL SHOCK).

HARRIS CORPORATION Broadcast Equipment Division shall not be responsible for injury or damage resulting from improper installation, operation, maintenance or servicing, or from the use of improperly trained or inexperienced personnel in the performance of such tasks, or from the failure of persons engaged in such tasks to exercise due care.

As with all electronic equipment, care should be taken to avoid electrical shock in all circuits where substantial currents or voltages may be present, either through design or short circuit. Caution should also be observed in lifting and hoisting equipment, especially regarding large structures, during installation.

LIABILITY LIMITATION

The procedures outlined in this Manual are based on the information available at the time of publication and should permit the specified use with minimum risk. However, the manufacturer cannot assume liability with respect to technical application of the contents and shall, under no circumstances, be responsible for damage or injury (whether to person or property) resulting from its use.

The manufacturer is specifically not liable for any damage or injury arising out of failure to follow the instructions in this Manual or failure to exercise due care and caution during installation, operation, maintenance and service of this equipment.

CAUTIONARY NOTICE

Always disconnect power before opening covers, doors, enclosures, gates, panels or shields. Always use grounding sticks and short out high voltage points before servicing. Never make internal adjustments, perform maintenance or service when alone or when tired.

Never remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits, know your equipment and don't take chances. Proper training of experienced personnel and observing the above guidelines will help assure safe and continued operation of this equipment.

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DRAWINGS

Gates Dwg. No. 827 1997 001, VSWR Trigger
827 1998 001, Directional Wattmeter
827 2046 001, PA Bias, IPA Bias, IPA Scr. Sup.
827 3124 001, Audio Driver Power Supply
827 5174 001, Audio and Bias Change
838 2211 001, Control Circuits
838 6558 001, Audio Driver
842 4924 001, RF Exciter
842 5172 001, Installation
852 6196 001, Overall Schematic, BC-5H

SECTION 1.0 - DESCRIPTION

1.1 General

The BC-5H is an AM transmitter exhibiting outstanding transmission quality and exceptional reliability. Thorough study of this Technical Manual is recommended as new circuitry and advanced design concepts are used throughout the transmitter.

Some of the new features incorporated in the BC-5H are transistorized audio driver to modulator grids, transistorized oscillator and R.F. driver, and built-in VSWR circuitry. The VSWR circuitry maintains continual monitor capabilities of transmission line termination, protection against momentary antenna arc-overs, and affords power output indication.

Additional features are solid state rectifiers throughout, wave shaping in the power amplifier circuits to insure higher conversion efficiency, and modulation of the driving stage of the power amplifier to afford a higher degree of modulation linearity.

1.2 Remote Control

The BC-5H transmitter may be operated by remote control by installing a remote control system, such as the Gates RDC-10AC. Terminations are provided in the BC-5H transmitter for remote control. These remote control terminations are described in detail in Section 4.10 of this Manual.

If the transmitter is to be remotely controlled, it is important to initiate thorough inspection and maintenance procedures at the transmitter location. Also, the installation of equipment to monitor the temperature and humidity at the remote transmitter site would be of value to the overall station operation.

1.3 Technical Specifications, Mechanical

Size:	78 inches high (198.12 cm) 72 inches wide (182.88 cm) 32 inches deep (81.28 cm)
Weight: (Approx.)	1850 lbs. unpacked (819.16 Kg) 2400 lbs. domestic packed (1088.64 Kg) 2600 lbs. export packed (1179.36 Kg)
Finish:	Beige-Gray

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1.4 Technical Specifications, Electrical

Power Output:	(Rated) 5,000 Watts (Capable) 5,600 Watts
RF Frequency Range:	535 kHz to 1620 kHz (Supplied to one frequency as ordered)

Warning, disconnect primary power prior to servicing.

RF Output Impedance:	Supplied for 50 ohms (other as specified)
RF Frequency Stability:	±2 Hz
RF Harmonics:	Meets or exceeds FCC requirements.
Carrier Shift:	Less than 3% @ 100% modulation.
Audio Frequency Response:	±1 dB, 50 to 10,000 Hz ±1.5 dB, 30 to 12,000 Hz
Audio Frequency Distortion:	Less than 2.5% from 50 Hz to 10,000 Hz @ 95% modulation.
Noise:	(Unweighted) 60 dB, or better. Below 100% modulation.
Audio Input:	600/150 ohm @ +10 dBm, ±2 dB.
Primary Power Input:	208/230 Volts, 3 phase, closed delta, 50 or 60 Hz.
Power Consumption:	18.5 kW @ zero modulation. 21.0 kW @ average modulation. 27.5 kW @ 100% modulation.
Tubes Used:	(4) 3CX2500F3. (1) 4-400A.

1.5 Environmental

Operating Temperature Range:	-20°C to +50°C.
Humidity:	95% max.
Operating Altitude Range:	Sea level to 7500 ft. (2286 M), (Higher altitude operation on special order.)

CAUTION

THIS EQUIPMENT IS DESIGNED FOR CONNECTION TO A CLOSED DELTA THREE PHASE POWER SERVICE

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Warning, disconnect primary power prior to servicing.

SECTION 2.0 - INSTALLATION

2.1 General

Before beginning the installation, this Manual should be carefully studied to get a thorough understanding of the principle of operation, circuitry and nomenclature.

Upon receipt of the transmitter and associated equipment, carefully unpack all boxes and cartons, checking the contents against the packing list to be certain all parts of the transmitter are accounted for. Should anything be missing notify the delivering carrier and Gates Division - Harris-Intertype Corporation at once.

2.2 Power Requirements

Three phase, closed delta, 208/230 volts, 50 or 60 Hz is required for the main power supply of the transmitter. This service should be connected with at least No. 6 TW wire and fused at the service disconnect switch for not more than 60 amperes per leg. A second primary supply of 120 volts, 50 or 60 Hz, single phase, and fused for 15 amperes is required for the crystal oven heaters. This supply should be from a source such as the building lighting system, that is not shut off at any time.

2.3 Signal Connections

Two (2) RG59/U cables are connected to the frequency monitor and to the modulation monitor. The audio input is connected by means of one (1) two-conductor shielded cable.

2.4 Initial Installation (Step by Step)

1) Set the transmitter on a smooth, level location, capable of supporting a load of 120 pounds per square foot.

2) Install all components which have been removed for shipment.

NOTE: Each component will have a stenciled identification number, and a similar number will mark the mounting location. All necessary connections to the components will be individually marked to aid in the reassembly.

3) Connect the 230 volt, 3 phase, closed delta, primary power (3-wire) to terminal board TB608. See Fig. 2.1.

CAUTION - Be sure the main primary disconnect switch is in the open position before making these connections.

4) Connect the 115 volt oven power to terminals 1 and 2 on TB603. See Fig. 2.1

CAUTION

THIS EQUIPMENT IS DESIGNED FOR CONNECTION TO A CLOSED DELTA THREE PHASE POWER SERVICE

Warning, disconnect primary power prior to servicing.

NOTE: This voltage source should be on at all times to insure continuous operation of the crystal oven.

5) This step calls for a very IMPORTANT CONNECTION. Connect, as a minimum requirement, a one inch wide copper strap from the RF output network enclosure in the transmitter directly to the main antenna ground system, at the junction of the ground radials, which are terminated at the transmitting tower.

6) Connect the two conductors of the shielded audio line to terminals 1 and 3 on TB601. Connect the shield of the audio line to terminal No. 2 on TB601. Again see Fig. 2.1

NOTE: If a limiting amplifier is used in the audio system, its output would be connected to these terminals.

7) The inner conductor of the RG-59/U coaxial cable (which connects to the signal input of the frequency monitor) will be connected to terminal No. 3 of TB603, the outer shield (ground) to terminal No. 4 of TB603. See Fig. 2.1.

8) The station's modulation monitor will be connected to the transmitter with RG-59/U coaxial cable also. The center conductor (signal input wire to monitor) will be connected to terminal No. 5 of TB603; the shield of this cable will connect to ground terminal No. 6, on TB603. See Fig. 2.1.

9) Connect the antenna system to the transmitter R.F. output terminal (feed-thru bowl located on top of transmitter. See Fig. 2.2.

NOTE: If a coaxial cable is used, connect the outer shield of the cable securely to the metal frame of the transmitter. If an insulated, jacketed, coaxial cable is used, insure that the connection is made directly to the outer metal shield. This ground connection is very important to the overall operation of the transmitter.

10) Mount the 4-400A tube in its socket. Connect the plate lead to the tube. Tighten the set screws on the heat dissipating connector. See Fig. 3.4.

11) Install the modulator and PA tubes. The tube filament leads are directed through the cutouts in the insulated socket plates and thru the grid clamping ring. The tubes are lowered into the shouldered cutout, mounting points.

The filament leads are secured by wing nuts. Position, then tighten the grid ring clamps on the 3CX2500F3 tubes.

NOTE: All large transmitting tubes have a tendency to become gaseous and during this condition the tube could be destroyed if high voltage was applied. To prevent this possibility, the following tube degassing procedure should be initiated.

a) After installing the transmitting tubes, turn on the filaments for a 30 minute period (filaments only, not the high voltage.)

b) After the tuning procedure of paragraph 3.2 has been completed, turn on the high high voltage for 15 minutes, with NO modulation (zero audio input).

12) Insert the plate tune vacuum capacitors into the bottom mounting flange and tighten the locking screws. Attach top flanges at the top end of the capacitors and tighten the set screws.

13) Make a thorough inspection, at this time, of all electrical connections and mechanical junctions. Direct special attention to all grounding straps.

2.5 Control Description

The following controls and indicators are illustrated in Figures 2.3 and 2.4.

2.5.1 Transmitter Start

Pushbutton starts blower, and through the operation of the air switch, turns on the filaments. The pushbutton lights Red.

2.5.2 Power, High and Low

Two pushbuttons select the high or low power. The button lights Amber to indicate high or low power operation. These switches are connected through the door interlocks. All doors must be securely closed for operation.

2.5.3 High Voltage On

This pushbutton turns on the primary voltage to the power supply. The button lights Red to indicate operation.

2.5.4 High Voltage Off

This pushbutton turns off the high voltage. The button does not light.

2.5.5 Transmitter Stop

This pushbutton turns off the filaments and blowers. The button does not light.

NOTE: It is recommended that two or three minutes elapse between operation of the HIGH VOLTAGE OFF button and the TRANSMITTER STOP button. This procedure will tend to increase tube life.

SECTION 3.0 - OPERATION AND ADJUSTMENT

3.1 General

The transmitter is thoroughly factory tested. Variations in primary power, antenna system, and transmission line differences may require slight adjustment.

NOTE: Certain measurements are required by FCC regulations and the following list of test test equipment, or the equivalent, is recommended for making them.

The recommended list is -

1) A source of detected RF output signal from the transmitter, such as a high fidelity audio output from the station's modulation monitor.

2) An audio oscillator with less than 1% distortion, B&W Model 210.

3) A noise and distortion meter, B & W Model 410.

NOTE: Gates Division "Proof of Performance" package, SA-131 is recommended to verify FCC proof of performance requirements.

3.2 Tuning Procedure (Step by Step)

1) Determine that all RF tuning coils have shorting clips and/or rotors in the positions marked during the factory tune-up. (Small black marks on coils.)

2) Insure that the proper load is connected to the output of the transmitter. (Either a dummy load or the operational antenna.)

3) Turn the right and left modulator bias controls on the inner front door, fully counterclockwise. See Fig. 2.3.

4) Open inner front door. Open PA disconnect switch, S609, which is located on the left side wall of the transmitter. See Fig. 2.5. Close inner front door.

5) Rotate the multimeter switch, located on the inner door, to the "4-400 Stage" position. See Fig. 2.4.

NOTE: At this point insure that any degassing necessary has been accomplished. See NOTE of paragraph 2.4, Step No. 11.

6) Energize the 3 phase power to the transmitter.

7) Press the TRANSMITTER START button. Blowers should energize and run. TRANSMITTER START button should light. One of the POWER buttons should light. Press the LOW POWER button (left) in firmly, then release. This button should light.

8) Note the PA plate current meter. The meter pointer should be reading slightly below the zero mark.

NOTE: Do NOT re-zero this meter when the filament and bias voltages are on.

9) Turn multimeter to the "0-9" scale. Turn the filament voltmeter selector switch (See Fig. 2.4) to the left rheostat. Adjust the rheostat for a 7.3 volt reading on the multimeter. Turn the filament voltmeter selector switch to the right rheostat and repeat the procedure.

10) Rotate the multimeter switch to each position, in turn. verify that each reading is on scale. The PA GRID should read about 50.)

11) Turn the multimeter switch to the 4-400 GRID position. Tune the BUFFER TUNE control (See Fig. 2.4) for a maximum reading on the multimeter.

NOTE: Wait until the filaments have been energized for 30 minutes before proceeding.

12) Turn the multimeter to the PA GRID position. Press the HIGH VOLTAGE ON button. The button should light Red.

13) Tune the DRIVER TUNE (See Fig. 2.4) for maximum PA grid current.

14) Adjust the RIGHT and LEFT modulator bias controls (See Fig. 2.3) for a preliminary reading of 0.20 ampere, modulator plate current, per tube. Press the HIGH VOLTAGE OFF button.

15) Open the access door of the RF driver assembly. See Fig. 3.2. Note the two slotted shaft type potentiometers at the bottom of the printed circuit board. Rotate the right hand potentiometer to the full counterclockwise position.

16) Open the left inner door and reconnect the PA disconnect switch opened in Step No. 4, close door.

17) Press the HIGH VOLTAGE ON button. The plate voltage and the indicator light should energize. The PA plate current, as displayed on the meter, should be zero. Slowly rotate the right hand potentiometer, described in Step 15

until a plate current of between 0.5 and 0.6 ampere is noted on the POWER AMPLIFIER meter.

18) Tune the PLATE TUNE control for a minimum plate current indication. After the minimum plate current point is established, turn the PLATE TUNE control one additional turn counter-clockwise.

19) Gradually turn the right hand potentiometer described in paragraph 3.2.15 until 400 milliamperes of grid current is measured on the multimeter. Observe the plate current as the grid current increases. If the plate current exceeds 0.6 ampere, rotate the OUTPUT LOADING control clockwise. If the plate current decreases below 0.5 ampere, rotate the OUTPUT LOADING control counter-clockwise. Adjust the control for approximately 0.5 ampere.

20) Press the HIGH VOLTAGE OFF button, press the right hand POWER button and release. Press the HIGH VOLTAGE ON button. The plate current should now read approximately 1.0 to 1.2 amperes.

21) Set the FORWARD-REFLECTED switch in the F WARD position. Observe the POWER OUTPUT meter. Adjust the 3rd harmonic cathode resonator (slotted shaft marked PA K, see Fig. 2.4) for simultaneous increase of PA plate current and output power.

22) Adjust the 3rd harmonic plate resonator (slotted shaft, reached through an access hole located on the PA panel, see Fig. 2.4) for a simultaneous increase of PA plate current and output power.

23) Steps 21 and 22 should be repeated until the desired power output, with high efficiency, is obtained.

NOTE: Several combinations of settings of the plate tuning control and the output loading control will result in the same power output. Choose the combination that delivers the desired output with a minimum plate current. (Maximum efficiency) The plate tuning control should be counter-clockwise from the point of minimum plate current.

24) The modulator bias controls will probably have to be reset so that each modulator is drawing approximately 0.20 ampere.

3.3 Adjustment for Low Power Operation

The following procedure will reduce the 5 kW output level to 1 kW, or 500 W., as ordered.

1) Turn off the high voltage, press the LOW POWER button and release; turn on the HIGH VOLTAGE, the exact power can be set by means of the OUTPUT LOADING control.

NOTES: At the 1 kW power level, the adjustment of the OUTPUT LOADING for 1 kW output can be minimized by adjusting the slider of resistor R652. See Fig. 2.5

If the modulator static currents for low power and high power operation are not similar, see paragraph 5.9 (Modulator idling currents)

3.4 Adjustment of the modulation monitor pickup; the steps listed below should be followed:

1) Remove the upper left shield cover. See Fig. 2.2

2) Adjust the transmitter to operate in the LOW POWER configuration.

3) Adjust the sliding wheel on the modulation pickup coil, L615 (Fig. 2.2) for the desired R.F. drive to the modulation monitor.

4) Switch the transmitter to HIGH POWER operation.

5) Adjust the resistor, R628 (Fig. 2.2) to provide the same R.F. drive as in Step 3, above.

3.5 Adjustment Bias-Set Potentiometer

On the audio input level assembly, mounted on the left hand side wall of the transmitter and accessible through the left hand inner door, are mounted two locking type potentiometers, marked LEFT MOD. and RIGHT MOD. The purpose of these potentiometers is to keep the modulator plate currents approximately the same when operating on low power as they are when operating on high power. The following steps should be followed if these potentiometers need adjusting.

1) Operate transmitter at HIGH POWER, setting modulator static plate currents to desired level with potentiometers on outside of left hand inner door.

2) Shut down transmitter, switch to LOW POWER, turn plate voltage on, and read modulator static currents without adjusting potentiometers mentioned in Step No. 1.

3) Turn transmitter off, open door, adjust potentiometer(s) on audio input level assembly in small increments, repeating Steps 2 and 3 until desired balance is reached.

NOTE: Do not try to adjust these potentiometers by disabling interlocks and making adjustments with plate voltage on!

3.6 Adjustment of Harmonic Trap

L619 and C619 form a series resonant 2nd harmonic trap. These components are located beneath the main plate tank coil L608, in a separate shielded compartment; an adjusting rod extends through the front of this compartment and is accessible by opening the right hand inner door, which is interlocked. (See Fig. 2.2)

This trap has been preset at the factory and there should be little necessity for adjustment. If adjustment is necessary the following steps should be followed:

1) Terminate the transmitter into a 1 or 2 watt carbon resistor of the same value as nominal output impedance (normally around 51 ohms).

2) Secure a well shielded stable oscillator. Tune exactly to the frequency of the harmonic trap to be adjusted. Connect to power amplifier tube plate.

3) Be sure back covers are in place and securely fastened over the power amplifier tubes and over the output network (top left and right rear covers).

4) Secure a communications type receiver with an S meter. Connect to the output terminating resistor, using a pad if necessary for isolation and level control into receiver.

5) Adjust the appropriate trap for a minimum reading on the S meter.

NOTE: Do not try to adjust these traps by disabling interlocks and making adjustments with plate voltage on!!

3.7 Adjustment of the Directional Power Meter (equipment required) An accurately known load for the transmitter. The load must have a VSWR of less than 1.05 to 1 at the operating frequency and around the load impedance for which the directional coupler has been adjusted at the factory. (i.e., 50 ohms).

A means of accurately determining the power output of the transmitter into the above load. If load impedance is known, an R.F. ammeter is sufficient, if accuracy is known.

A VOM capable of measuring the 0-10 volts DC and equipped with a 610 0412 Switchcraft No. 3501 phone plug.

CAUTION: This adjustment has been made at the factory and should not be repeated unless it has been necessary to replace a component or affect a repair. If it is necessary, proceed as follows:

1) Adjust the transmitter to approximately 1 kW power output.

2) Plug the VOM into the REFLECTED POWER jack on the coupler and adjust meter so that a reading is obtained well up on the scale.

3) Adjust C4 for minimum indication on the meter. See Fig. 2.2.

4) Increase the power output of the transmitter and continue adjustment of C4 until it is assured that minimum indication is obtainable at full power output.

5) Reverse the power flow through the coupler by physically changing the R.F. line connections to it.

6) Repeat Steps 2 thru 4 with the VOM plugged into the FORWARD jack and adjusting C5.

This completes the adjustment of the directional coupler. Failure to achieve a sharp, deep null with either C4 or C5 means either or both of the following conditions exist. They should be investigated in the order given.

The load into which the transmitter is connected at the point where the directional coupler is connected has a VSWR of greater than 1.05 to 1.

There is a defective component within the coupler. Probably one of the capacitors in the capacitive divider associated with the troublesome adjustment.

3.8 Adjustment of Power Meter

1) Adjust the transmitter to full power output, into a known load, having a VSWR of less than 1.05 to 1.

2) Compute exact power being dissipated into load.

3) Adjust FWD. CAL. control R4 until power meter reads exactly the same power as computed in Step 2, above. See Fig. 2.5.

CAUTION: Be sure that lead connecting to the FWD jack of the directional coupler is connected in the COUPLER FWD. jack (J2) on the VSWR trigger. See Fig. 2.5. Also determine that the meter FWD-REF switch is in the FWD position.

4) Reduce the transmitter output to a lower known value of power output.

5) Disable the VSWR trigger by removing the 12AU7 tube (V1) from its socket. See Fig. 2.5.

6) Connect the lead from the FWD. output of the directional coupler to the COUPLER REF. jack (J1) of the trigger and adjust REF-CAL (R3) until meter reads the known power output when the FWD-REF switch is in the REF. position. See Fig. 2.5.

7) Restore all connections to the VSWR trigger into their respective jacks and re-insert the 12AU7 tube in its socket.

3.9 Adjustment of VSWR Trigger

The VSWR trigger may be set for any value of reflected power desired. It is adjusted at the factory to operate on a reflected power indication that approximates a VSWR of 2 to 1. It should be adjusted so that it will operate when a serious fault or arc-over occurs on the antenna or transmission line but not because of modulation, minor changes in line impedance or changes in weather, etc. Experience may prove to be the best criteria for proper adjustment of the trigger point.

3.10 Adjustment of High Efficiency Circuits

The adjustment of the PA cathode resonator is not a critical adjustment and is easily accomplished as described in Section 3.2, Step 21. However, the proper adjustment of the plate circuit resonator is quite important and requires extreme care.

The adjustment is made at the factory and should not require additional adjustment if the procedures followed, Section 3.2, Step 22 produce the desired results. Stray capacities and inductances may under some conditions result in false indications causing the PA 3rd harmonic resonator to be mistuned, resulting in; extremely low plate circuit efficiency; excessive heating of the components in this circuit; and/or, inability to get full power output. If either of these conditions exist, proceed as follows:

1) Secure an R.F. signal generator and adjust it to produce the EXACT 3rd harmonic of the transmitter frequency by beating it with the transmitter oscillator.

2) With the transmitter turned off, connect the R.F. signal generator to the plate of the PA tubes through a 1000 ohm resistor.

3) Ground the end of the 3rd harmonic resonator coil connected to the plate blocking capacitor.

4) Connect an R.F. voltmeter or an oscilloscope across this coil and tune this resonator coil for a maximum voltage across it.

5) Now remove all test equipment and ground connection. Restart transmitter and repeat adjustment of Section 3.2, Steps 21 and 22 without allowing the plate resonator coil to move very far from the correct position found.

6) When the correct adjustment of this circuit is found in this manner, both the coil and the capacitor will not show signs of heating at maximum power output. In fact, the current in the coil and capacitor will tend to reduce as the power output is increased and maximum efficiency is achieved.

3.11 Final Adjustment R.F. Driver

Observe the color of the plate of the 4-400 stage by looking through the door at the hinge side. If there is sufficient drive to the PA and the color of the 4-400 plate is a dull orange, this stage is in proper adjustment and should not be changed.

If the above conditions are not obtained, move the PA grid tap on L605 closer to the center tap of the coil. Note the PA grid current and the 4-400 plate current after the 4-400 plate is re-resonated as indicated by maximum PA grid current.

Now move the PA grid tap, one turn at a time away from the center tap, tuning each time for maximum grid current. Continue this process until the PA grid current no longer increases in the same proportion as does the 4-400 plate current. The setting at which this condition just occurs is the optimum setting for the 4-400 plate circuit.

With the 4-400 plate circuit properly tuned, using a small screw driver, reduce the setting of R6 in the R.F. exciter until the PA grid current just begins to fall off. The proper setting of this control occurs about 1/8 turn clockwise beyond the point that the PA grid current ceases to rise with an increase in this control. This is also the proper drive setting for the 4-400 stage.

3.11.1 Capacitor heating check, R.F. driver insert a 0-15 ampere RF meter in series with lead between L605 and capacitor C608 and observe current. It should read less than 80% of capacitor rating. If current is too high, increase PA grid coil turns (by means of the coil tap) one turn at a time until the RF current is within limits. If no RF ammeter is available, check heating of capacitors by feel after 10 minutes operation. Capacitors should normally operate only slightly warm to the touch.

SECTION 4.0 - THEORY OF OPERATION

4.1 Control Circuits

An auto-transformer is used to provide 230 VAC to operate all contactors and relays. The 230 VAC will be maintained when the primary voltage is either 208 or 230 VAC.

4.1.1 Transmitter Turn-On

The transmitter is energized by pushing the TRANSMITTER START button. This initiates the operation of the blowers. When sufficient air pressure has built up in the plenum chambers, air pressure switches close. If all interlocks are closed, the filaments are energized, and power is applied to the bias and screen supply, the R.F. exciter, and the audio driver power supply. At this point the power change switch light should illuminate and indicate which position the power change relays are in.

The high voltage may now be applied by pushing the HIGH VOLTAGE ON button. This closes the high voltage auxiliary relay and applies power through the overload relays to the high voltage start contactor. This contactor applies primary power to the high voltage plate transformer through series resistors. This is to restrict the initial current to the transformer.

As soon as the high voltage start contactor closure is complete, power is applied to the high voltage run contactor and the step-start resistors are shorted, connecting the high voltage transformer directly to the primary power.

4.1.2 Power Change

When the power change pushbuttons are actuated, the position of a high voltage latching relay is changed. The power change pushbuttons also switch an audio level change pad, a modulator change relay and at the same time the modulation monitor output is changed. This automatically assures correct operating conditions for different power output levels.

4.1.3 Overload Relays

The overload relays are D.C. relays connected across small resistors. The resistors are adjusted to provide a sufficient voltage drop to operate the relays when the currents through the resistors exceed a prescribed value. The overload relay resistors are in series with the high voltage supply, the PA plate current, each modulator plate current and the 4-400 cathode return.

4.1.4 Recycling

When an overload condition actuates any of the overload relays, a D.C. change is applied to the capacitor in the recycling circuit. If the overload occurs repeatedly,

sufficient charge is built up in the capacitor to operate the recycle relay, this will open the circuit to the high voltage auxiliary relay and de-energize the high voltage. The number of D.C. charges required to charge the capacitor sufficiently to operate the recycling relay is dependent upon the adjustment of the resistance in series with the capacitor.

4.2 Power Supplies

4.2.1 High Voltage

The high voltage power supply is a 3 phase, closed delta, bridge, silicon rectifier power supply. A half voltage, half wave supply is provided for the plate of the R.F. driver supply from the center tap of the transformer secondary windings. These windings are connected in a "Y" configuration.

4.2.2 Bias and Screen Supply

The bias and screen supply provide holding bias voltages for the PA stage, the 4-400 stage, and screen voltage for the 4-400 tube.

The screen supply voltage is provided by a single phase, full wave, silicon rectified supply with a two stage filter. The full voltage of 540 volts is applied across a voltage divider and the required voltage for each power level is provided by relay switching.

The two half wave rectified voltages are taken from different secondary windings of the same power transformer. The PA bias voltage and the IPA bias voltage are approximately 400 and 80 volts respectively.

4.2.3 Audio Driver Power Supply

The audio driver power supply is a combination of two well filtered, full wave power supplies. One supply provides -535 volts, and the other supply provides a +130 volts.

CAUTION

THIS EQUIPMENT IS DESIGNED FOR CONNECTION TO A CLOSED DELTA THREE PHASE POWER SERVICE

Warning, disconnect primary power prior to servicing.

4.2.4 R.F. Exciter Power Supply

The R.F. exciter power supply is series regulated and provides a fixed 50 V DC potential. From the 50 V DC a zener diode regulated 15 volts is provided for the oscillators and the binary divider.

4.3 R.F. Oscillators

The transmitter oscillators are crystal, transistorized, environmental controlled oscillators. Each oscillator with the appropriate crystal is mounted on a printed circuit board. The oscillator crystal sub-assembly is mounted within the plug-in oven assembly.

The output of the crystal oscillator is directed to a binary divider if the operating frequency is less than 1 MHz. The binary divider provides a one pulse output for each two cycles input. This will exactly divide the crystal frequency by two.

For frequencies greater than 1 MHz, the output of the crystal oscillator is connected to a series of untuned, transistor R.F. amplifiers.

NOTE: For operating frequencies below 1 MHz; order the crystal for twice the operating value.

Two controls are provided at the emitter of the first R.F. amplifier to control the drive to the following stages. This provides greater control over the adjustment of the drive to the 4-400 stage. The output of the penultimate transistor state is the only tuned circuit in the exciter and with the coupling transformer provides adequate drive to the output stage. The output of the exciter contains a "Pi" network which provides tunable coupling to the 4-400 grid. A second output jack connected through a coupling capacitor is provided to feed a frequency monitor.

4.4 R.F. Driver

The R.F. driver for the PA stage uses a tetrode, 4-400 tube. The plate voltage for this stage is obtained from the center tap of the high voltage supply through the auxiliary winding on the modulation reactor. The plate of this stage is modulated 15 to 20% in this manner to improve the carrier shift of the transmitter.

The tuned grid of the 4-400 improves the coupling between the 4-400 and the R.F. exciter.

The plate of the 4-400 is fine tuned by means of a moving vane within the plate tank coil. The tank capacitors are fixed.

The drive to the final is adjusted by a tap on the tank coil feeding the grid of the Power Amplifier.

The bias to the PA is directed to the center of this coil which becomes R.F. ground.

The PA plate-to-grid neutralizing adjustment and coupling is provided by a third tap below the R.F. ground.

4.5 Power Amplifier

The Power Amplifier is a high efficiency Class "C" amplifier using one type 3CX2500F3 tube. There are parasitic suppressors in both grid and plate circuits, to aid in preventing self-oscillation.

The filament to the PA tube is fed through a bi-filar wound coil. This coil is tuned to the 3rd harmonic by a variable capacitor. The tube plate is directed to the output circuit through a parallel tuned circuit. This parallel tuned circuit is tuned to the 3rd harmonic.

NOTE: The effect of tuning these two circuits to the 3rd harmonic produces a plate current pulse resembling a square wave with more rapid rise and decay times. More of the plate current pulse occurs during a lower value of the plate voltage wave, reducing the required input power to the plate of the stage for a given output level.

Careful adjustment of these circuits can produce plate conversion efficiencies greater than 90%, although in practice 85 to 90% conversion efficiency is considered nominal for every day operation.

A holding bias of 400 volts is applied to the grid of the PA stage with the additional operating bias being developed by excitation in the grid resistors.

4.6 VSWR Directional Coupler

The VSWR directional coupler provides two D.C. signals. Each signal is a combination of a current and voltage sample obtained from the transmission line. Because of the polarity of the diode rectifiers and the point where the sampling occurs, one output is proportional to the power toward the load and the other output proportional to the reflected power from the load.

4.6.1 VSWR Trigger

A portion of the reflected power is directed to a 12AU7 tube, used as a two stage, direct coupled amplifier. This circuit drives a relay when the reflected power exceeds a predetermined level. The relay is in series with the collector of the oscillator excitation. This circuit shuts down the transmitter in

the event of an arc in the antenna or transmission line, or any change in the load that substantially changes the power reflected back to the transmitter.

4.7 Modulators

The modulators are two 3CX2500F3 tubes operating in the class AB2 region. The grids will be driven positive and draw grid current during the peak of the positive modulation cycle.

NOTE: Measurements confirm that the modulators and the audio driver are capable of modulating the power amplifier stage 140% on the positive peaks.

The modulation transformer is Askarel filled to inhibit the development of corona within the windings at high modulation peaks.

NOTE: Build out reactances, in the form of R.F. chokes, are sometimes added to improve frequency response and distortion characteristics during factory tests. These additions are necessary due to variations in the transformers that result during manufacturing processes or from one manufacturer to another.

A modulation reactor carries the plate current of the PA stages. The combination of modulation reactor inductance, blocking capacitor, and modulation transformer impedance ratio is a critical design area. Careful design consideration insures excellent frequency response and distortion characteristics.

4.8 Audio Driver

The audio driver basically is made up of four stages (five transistors) per side. Transistors Q1 and Q2 operate as voltage amplifiers, Q3 and Q4 as feedback amplifiers, Q5 and Q6 as high voltage amplifiers and Q7, Q9 and Q8, Q10 as Darlington current amplifiers.

The first three stages are referenced to the -520 volt supply, rather than ground. Input transformer, T1, provides matching, plus the DC isolation needed to operate Q1 and Q2 at this 520 volt reference.

The supply voltage for Q1, 2, 3 and 4 is 30 volts and is obtained from resistor R38 and CR1. It must be remembered that this regulated 30 volt supply is referenced to the unregulated -520 volt supply.

Transistors Q1 and Q2 operate as voltage amplifiers, using emitter feedback. R1 provides a dynamic balance adjustment for the entire modulator. This stage is capacity coupled to Q3 and Q4.

A D.C. voltage from the modulator bias potentiometers, and feedback from the plates of the modulator tubes is applied to the base of Q3 and Q4; all following stages are DC coupled so that both D.C. and A.C. feedback may be used to stabilize the bias and reduce distortion.

The output of Q3 and Q4 provide the necessary voltage to drive the modulator tubes from -500 to +180 volts. The Darlington outputs Q7, Q9 and Q8, Q10 provide the necessary current gain to supply over an ampere of peak grid current at +180 volts.

A.C. and D.C. feedback is applied to the emitter of Q3 and Q4 from the outputs, through CR4, C8 and R13 and CR11, C19 and R42 respectively. CR4 and CR11 provide a 200 volt offset for maximum D.C. feedback. C8 and C19 provide an A.C. bypass of CR4 and CR11. R13 and R42 provide the step-down required for proper feedback.

CR3, 6, 7 and CR12 14, and 15 protect their respective transistors by conducting, if the base of the transistor tries to go negative with respect to the emitters. CR8 and CR16 protect the output stages from going higher than 180 volt supply, should the modulator tube arc from plate to grid.

Diode CR5 and CR3 decouple Q5 and Q6 from the output stages, should the tube arc, or one of the output stages short.

L1 and L2 provide a constant current source for Q5 and Q6 so the output transistors can be driven to the 180 volt level.

C10 and R23 provide phase shift and some offset feedback at high frequencies when this audio driver unit is used in the Gates BC-5H transmitter.

4.9 Output Circuit

The output circuitry consists of a "Pi" network tank circuit followed by an impedance adjusting and harmonic attenuating "T" network. Plate tuning is accomplished by varying a tuning vane located in the center of the tank coil. Plate loading is adjusted by a variable coil in series with the output of the transmitter. In the output circuit is one series resonant circuit across the output of the "Pi" network. This resonant circuit aids in 2nd harmonic reduction.

NOTE: This circuit provides additional control of harmonic output when, because of pecularities of the transmitter load, the harmonics are not sufficiently attenuated otherwise.

The first consideration of the output circuitry is to direct the output power of the power amplifier stage to the load in the most efficient manner possible. The overall phase shift through the system is important also. An adjustment that will result in a phase lag through the network of either 135° or 225° will make the output coil act as a loading control and the tank adjustment performing as a plate tuning control. At other phase shift adjustments both loading and tank coil adjustments will provide plate tuning but there will be slight control over loading.

A coil is connected from the transmitter output to ground. This coil provides a voltage for feeding a modulation monitor. The coil acts as a static drain choke to prevent high static charges from entering the transmitter. A relay and resistor are added in conjunction with this coil so that the correct modulation monitor voltage is supplied when the transmitter is switched to low or high power.

4.10 Transmitter Terminations for Remote Control

The following transmitter functions can be remotely controlled -

1) FILAMENT ON:
Remove jumper from Terminals 1 and 2 on TB602.
Connect remote filament relay to Terminals 2 and 3 of TB602.

2) PLATE OFF:
Remove jumper between Terminals 7 and 8 of TB602 and connect to these terminals. Remote control unit must provide normally closed contacts which are opened momentarily for this function.

3) PLATE ON:
Connect to Terminals 5 and 7 of TB602. Remote control unit must provide normally open contacts which are momentarily closed for this function.

4) HIGH POWER:
Connect to Terminals 5 and 6 of TB602.
Remote control unit must provide normally open contacts which are momentarily closed for this function. Plate voltage must be turned off before power change switching function can be done.

5) LOW POWER:
Connect to Terminals 4 and 5 of TB602.
Remote control unit must provide normally open contacts which are momentarily closed for this function.

6) PLATE CURRENT METERING:
Connect to the meter terminals of Gates M-4720A Plate Current Metering Kit, mounted on right hand side wall of transmitter. Circuit provides 3 to 5 volts to operate remote meter. See Fig. 4.1.

7) PLATE VOLTAGE METERING:
Connect to the meter terminals of Gates M-4719A Plate Voltage Metering Kit, installed on right hand side wall of transmitter. Circuit provides 3 to 5 volts to operate remote meter. See Fig. 4.1.

8) POWER RAISE/LOWER:
Tuning motor, pushbuttons, and relay assembly to provide remote control of POWER RAISE/LOWER are available as a kit. Cabled wiring, terminal boards, and holes for pushbuttons (which afford LOCAL control of POWER RAISE/LOWER function) are already in the transmitter

9) REMOTE OPERATION OF MONITORS:
As this is not part of the transmitter installation instructions, it is suggested that the technical manuals on monitor remoting equipment be referred to.

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SECTION 5.0 - MAINTENANCE

5.1 General

It is recommended that a regular documented cleaning and inspection schedule be initiated. This is of paramount importance in remote installations.

5.2 Relay Care

A regular and systematic check of all relay contacts should be included in the maintenance program. Use a contact burnishing tool to clean dust and dirt from the relay contacts to assure minimum contact arcing and positive relay operation.

5.3 Care of Printed Circuit Boards

Use a very soft bristled brush to remove dust and dirt from these boards periodically. Do not use a stiff brush or a dust cloth. They are apt to remove the silicon varnish that protects the printed wiring from corrosion.

5.4 DC Voltage Check

DC voltages should be measured and recorded at appropriate points throughout the overall schematic. The same voltmeter to be used for troubleshooting should be utilized.

5.5 Care of 3CX2500F3 Tubes

Life of these tubes is dependent upon two very important operating conditions:

1) Operation of its filament at the correct voltage.

2) The free flow of air over its anode.

(Filament Voltage) - With new tubes, the voltage is adjusted as low as full power output, with acceptable carrier shift and acceptable distortion performance, can be obtained from the transmitter. One manufacturer of the 3CX2500F3 tube suggest a nominal filament voltage of 7.2 volts for extended life in broadcast service.

(Anode Air Cooling) - At the weekly or periodic maintenance period, clean anode fins. This assures free flow of air and longer tube life. Be sure and follow degassing procedure prior to use of spare tubes for the first time.

5.6 Air Filters and Blowers

Air filters, mounted in rear of transmitter, should be cleaned as often as needed to avoid having excessive air pressure drop, with resulting decrease in air flow. Filters may be cleaned by washing. Spraying a light coating of light weight machine oil on filter after washing will aid in dust filtering.

Lubrication of blower and fan motors is unnecessary, units being lubricated for life.

5.7 Care and Maintenance of Vacuum Capacitors

Vacuum capacitors are components that will withstand very high voltages and currents. However, they are expensive and may be easily damaged.

Maintenance of vacuum capacitors consists primarily of keeping them clean and free of dust and dirt. An accumulation of dirt on the outside of the capacitor reduces its ability to withstand high voltages. If arcing should occur on the outside of the capacitor there is danger that the arc will burn a hole through the glass or ceramic envelope thus, destroying the component.

Vacuum capacitors should be protected against shock and mechanical strain when mounted in their holders. Glass to metal seals or metal to ceramic seals are the most vulnerable points of their construction. When working in the equipment around these vacuum capacitors, cover or protect them against accidental dropping of tools.

5.8 Modulator Idling Currents

It will be found that the modulator idling current (currents drawn by the two modulator tubes when no audio input is applied) have an effect on measured performance of distortion. As the modulator static currents rise, distortion will decrease, more heat will be developed at the modulator plates, and the transmitter will draw more current from the power line. For a reasonable balance of these factors an idling current of .15 to .20 ampere per tube is recommended; satisfactory performance may be obtained in some cases with as little as .05 ampere per tube, and there is no point in increasing the idling current past .25 ampere per tube to improve performance.

5.9 Power Meter

This meter on right hand end of the meter panel is an output power meter, driven by a VSWR coupler, and gives an indication of output power. FORWARD/REFLECTED switch on the upper right hand panel switches the meter to read FORWARD or REFLECTED power. See Fig. 2.3.

NOTE: The R.F. ammeter, at either the antenna tower, or at the common feed point of the phasor, is the FCC recognized power measuring instrument; the power meter on the front panel is not.

The power meter will read inaccurately if the transmission line has a standing wave - e.g., if the line is not correctly terminated.

The meter will read power in the reverse direction, and the output from the transmitter is equal to the reading in the forward direction minus the reading in the reverse direction.

Reading the power in the reverse direction gives an indication of the amount of mismatch, or VSWR of the load.

The following indicates the VSWR for the REFLECTED/FORWARD power reading:

VSWR	REFLECTED/FORWARD Power
1.0	0
1.1	.002
1.2	.008
1.3	.017
1.4	.028
1.5	.040
1.75	.065
2.0	.111
2.5	.183
3.0	.25
4.0	.36

Power in the reverse direction drives the trigger tube. This operates the relay to take voltage from the crystal oscillator, thus removing the excitation. The trigger is factory set to remove excitation at 1 kW reflected power. The trigger will remove excitation in event of arc-overs in the antenna system, preventing damage from follow-up arcing. Excitation is restored immediately after removal, faster than the ear can detect. Defective components in the antenna system, causing reflected power of 1 kW or more will result in continuous operation of the trigger, removing and restoring excitation.

5.10 Recycling

Overload relays, with the exception of the main DC overload, operate to remove voltage from the main high voltage supply momentarily for the duration of overload, high voltage is restored automatically. In the event, of several closely spaced overloads, the "Memory" relay on the relay panel in the front of the transmitter will remove plate voltage, and the transmitter will have to be turned back on manually. Operation of the main DC overload will turn the high voltage off, and it will not be restored automatically.

5.11 Ordering Replacement Parts

Please list the Gates stock number and parts description as tabulated in the Parts List when replacements are ordered from Gates Division - Harris-Intertype Corporation.

SECTION 6.0 - TROUBLESHOOTING

6.1 Excessive Carrier Shift

Excessive carrier shift may be caused by poor line voltage regulation. Monitor the line voltage before and during tone modulation. If the line voltage drop is greater than 1%, insist that the power company improve the regulation. Marginal cases may be improved by running higher modulator static currents.

6.1.1 Other Possible Causes of Excessive Carrier Shift Are:

1) Weak or old tubes.

2) Low filament voltage.

3) RF drive to power amplifier too low.

4) Mis-tuned power amplifier.

5) Poor neutralization of power amplifier.

6) Incorrect measurement of power output, resulting in excessive power output demand from transmitter.

6.2 High Distortion at High Audio Frequencies

Excessive distortion at high audio frequencies when distortion is near normal at mid-frequencies is usually caused by the selectivity of the antenna system or the radio frequency load into which the transmitter is working. If the load presented to the transmitter becomes substantially reactive at any point within the bandwidth of the transmitter, high distortion will result. When this condition exists, no amount of tuning in the transmitter will correct the problem - the load itself must be corrected.

6.3 Excessive Noise or Hum

Excessive noise or hum may be caused by a serious unbalance in the 3-phase line voltages supplying the transmitter. Another cause of excessive noise is substantial unbalance of the modulator idling plate currents.

6.4 Modulator Overloads, Transmitter Will Not Stay On

The problem is most likely due to a bad modulator tube, or to loss of modulator grid bias. To check modulator bias, put the negative voltmeter lead on one of the audio drive output terminals, positive lead on ground. With the transmitter filaments ON, close door interlocks. Bias should be approximately 240 volts. After checking on one audio driver output terminal, check the other output terminal. If trouble is from loss of bias, check voltages from audio driver power supply to localize problem.

6.5 Part Replacement, Audio Driver P.C. Board

The maintenance technician must act with greater skill and care in removing parts from a printed circuit board, than was required in installing the part originally. Too much heat applied for too long a time can permanently damage the circuitry, as well as other electrical parts on the board.

6.5.1 Soldering Techniques (Etched Wiring Boards)

Use a 30-40 watt soldering pencil type soldering iron. The tip should be clean and well tinned for best heat transfer to the soldered joint. Too much heat may cause the etched copper wiring to separate from the base material. The following method should be used to remove a defective component from an etched wiring board, and then replacing same with a new part.

1) Grip the lead near the component body with long-nosed pliers. Touch the soldering iron to the lead at the solder connection. Do not lay the iron directly on the board, to do so may damage it.

2) When the solder begins to melt, pull the lead out of the board gently. This should leave a clean hole in the board. If not, the hole can be cleaned by reheating the solder and inserting a small sharp object, such as a ferrous pick, or wooden toothpick to clear it.

3) Form the leads of the new component to fit the holes in the board. Cut the leads so they protrude very slightly from the back side of the board. Insert the leads into the holes in the board, with the component body in correct placement.

4) Grip one lead with long-nosed pliers near the component, then apply the iron and a small amount of solder to make the connection. Use a minimum amount of heat. Repeat this procedure for the remaining lead, or leads.

CAUTION: These etched wiring boards (also called printed circuit boards) use plated-thru holes which must not be damaged by use of excessive heat during repair, otherwise connection to the circuitry on the back side of the board will be lost.

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5 kW OPERATION *

METER	METER RANGE
Modulator Plates	0.05 to 0.25 Amperes
Filaments	7.1 to 7.5 V (Lowest for new tubes)
Q4	10 to 30 mA
Q5	200 to 500 mA
4-400 Grid	10 to 20 mA
4-400 Plate	200 to 300 mA
PA Grid	180 to 220 mA
PA Plate Voltage	5000 to 5400
PA Plate Current	1.1 to 1.2 Amperes
Output Power	5000 Watts

1 kW OPERATION

PA Plate Voltage	2300 to 2500
PA Plate Current	0.54 to 0.55 Ampere
Output Power	1100 Watts

500 W. OPERATION

PA Plate Voltage	1700 to 1750
PA Plate Current	0.38 to 0.41 Ampere
Output Power	550 to 570 Watts

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*All readings are based on 5000 Watts output, into a known load.

BC-5H TYPICAL METER READINGS

TABLE 6.1

Warning, disconnect primary power prior to servicing.

Audio Driver Power Supply-

TB4-1 to ground, Voltage-Audio Input Stage	-535
TB4-3 to ground, Voltage-Audio Output Stage	+180
TB4-6 to TB4-7, Supply Voltage	235 AC

Audio Driver

TB1-4 to ground, Feedback	+90
TB1-6 to ground, Feedback	+90
TB1-7 to ground, Modulator Bias Cont.	-220
TB1-8 to ground, Modulator Bias Cont.	-220
TB2-1 to ground, Output Stages	+180
TB2-3 to ground, Circuit, Common	-530
TB3-1 to ground, Modulator Grid	-230
TB3-3 to ground, Modulator Grid	-230

Audio Input Relay Panel

TB13-1 to TB13-2, Audio Level	Low Power	230 AC
	High Power.....	0
TB13-4 to ground, Modulator Bias		-565
TB13-5 to ground, Modulator Bias		-565
TB13-6 to ground, Modulator Bias		-565

BC-5H, PERTINENT VOLTAGE MEASUREMENTS

TABLE 6.2

Warning, disconnect primary power prior to servicing.

	CARRIER	50% MOD.	95% MOD.
Left Modulator	180	580	1130
Right Modulator	180	550	1070
Multi-meter- Fil Volt			
PA	7.4	7.4	7.4
Mod	7.4	7.4	7.4
Q4	14.5	14.5	14.5
Q5	290	290	290
4-400 Grid	24.5	24.5	24.5
4-400 Plate	280	280	280
PA Grid	195	195	195
Plate Volts, PA.....	5350	5300	5250
Plate Current, PA....	1.15	1.15	1.15
Power Forward	5.5	5.5	5.5
Reflected			

BC-5H, METER READINGS

TABLE 6.3

	LINE VOLTS	LINE CURRENT	POWER	POWER FACTOR
Carrier	232-232-232	26-26-26	10.7kW	95% Lead
50% Mod.	232-232-232	32.8-32.8-32.8	13.2kW	95.5% Lead
95% Mod.	232-232-232	38.8-38.8-38.8	15.6kW	96% Lead

BC-5H, POWER DEMAND MEASUREMENTS

TABLE 6.4

Warning, disconnect primary power prior to servicing.

ELECTRICAL PARTS LIST

BASIC BC-5H AM TRANSMITTER

994 6521 006

SYMBOL	DESCRIPTION	GATES PART NO.
C601	Cap. 2uF 7.5kV	510 0272 000
C621, C622, C668	Cap. 4uF	510 0411 000
C627	Cap. 8uF 3kV	510 0612 000
C632	Cap. Var. 13.5/320pF	927 3071 001
C639 thru C644	Cap. .01uF 1kV	516 0082 000
C506	Cap. 16uF 450 V (IPA Scr. Sup.)	522 0133 000
K616	High Voltage Grounding Relay	992 1860 000
L601	Mod. Reactor Gates Spec. #815 1152 001	482 0039 000
L602	RF Choke Assy	931 9560 002
L608	Plate Tuning Coil Assy	Det. by Freq.
L612	Reactor, 8 Hy AC3141	476 0212 000
L620, L621	Build-Out Assy Mod. Xfmr	992 2007 000
M601, M602	Meter, 0-2 Amp DC	632 0478 001
M603	Meter, 0-6kV 0-1 mA DC	632 0479 001
M604	Multi-meter, Gates Spec. #814 3808 001	632 0591 001
M605	Meter, 0-2 Amp DC	632 0478 001
M606	Meter, Power/ VSWR, 0-100 uA Gates Spec. #814 3964 001	632 0595 001
R651	Res. 250 ohm 200 W, WW.	542 0357 000
R652	Res. 250 ohm 225 W, WW, Adj.	552 0208 000
S601	Switch, N.O. Push-button, Indicator, Red	604 0246 000
S602	Switch, N.C. Push-button, Indicator, White	604 0247 000
S603, S604	Switch, N.O. Push-button, Indicator, Amber	604 0248 000
S605	Switch, N.O. Push-button, Indicator, Red	604 0246 000
S606	Switch, N.C. Push-button, Indicator, White	604 0247 000
S609	Switch Blade, PA Disconnect	810 8060 000
S613	Switch, Inter-lock.	604 0380 000
S621	Switch, Select #1411 (Mod)	914 9494 001
S622	Sw. Selector #1407 (Mod)	914 9494 002

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Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.
T601	Mod. Trans. Gates Spec. #814 6729 001	478 0284 000
T605	Transformer, H.V. Plate	472 0577 000
T607	Auto-former Step-down, Gates Spec. #814 3384 001	474 0077 000
TB609	Term. Board 4 Terminals, (Blower)	614 0094 000

MF SOLID STATE EXCITER

994 6520 001

SYMBOL	DESCRIPTION	GATES PART NO.
A1	Lamp, Neon	396 0062 000
C18	Cap. 1000uF, 100 V.	524 0122 000
C19 thru C21	Cap. .01uF, 1kV, Cer. Disc	516 0082 000
F1	Fuse, 1 A.	398 0017 000
J1, J2	Receptacle, BNC UG-290A/U	612 0237 000
J3	Receptacle, Male, P315-DB	610 0049 000
J4	Receptacle, BNC UG-1094/U	612 0317 000
P1, P2	Plug, BNC UG-88C/U	610 0393 000
P3	Plug, Female S-315-CCT	612 0102 000
Q7	Transistor, 40322	380 0057 000
S1	Sw. SPST, Rocker, Cent. Off	604 0289 000
S2	Sw. DPDT, Toggle	604 0032 000
T2	Trans. Power, Gates Spec. #814 3572 001	472 0571 000
XA1	Pilot Lamp Assy, Clear	406 0347 000
XF1	Fuseholder	402 0022 000
XQ7	Socket, Transistor	404 0206 000

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Oven Assembly only, Type #NE200	558 0031 000
Oven Assembly, NE200 complete with two (2) PC Oscillators, less Xtals	700 0049 000
Crystal, Type #NE6A, Gates Spec. #814 1966 001	

NOTE: See special information listed in Tech. Manual regarding the requirements for ordering this crystal.

Warning, disconnect primary power prior to servicing.

P.C. BOARD, SOLID STATE EXCITER

992 1827 001

SYMBOL	DESCRIPTION	GATES PART NO.
C1,C2	Cap., 02 uF 600 V.	516 0084 000
C3	Cap., .001 uF 1 kV, Disc	516 0054 000
C5	Cap., 0.1 uF 50 V.	516 0411 000
C6	Cap., 20 uF 100 V.	522 0268 000
C7	Cap., 0.1 uF 50 V.	516 0411 000
C8	Cap., 20 uF 100 V.	522 0268 000
C9	Cap. Vari. 500/1600 pF Type 309	500 0849 000
C10,C11	Cap.,Padder (Det. by Opr. Freq.)	
C12	Cap., .25 uF 100 V, 10%	508 0280 000
C13 thru C16	Cap.,Padder (Det. by Opr. Freq.)	
C17	Cap., 30 pF 500 V, 5%	500 0812 000
C22,C27	Cap., 20 uF 100 V.	522 0268 000
L1,L2	Coil (Det. by Opr. Freq.)	
Q1 thru Q3	Transistor, 40314	380 0053 000

SYMBOL	DESCRIPTION	GATES PARTS NO.
R1,R2	Res., 15 K ohm, 1/2 W, 5%	540 0077 000
R3	Res., 10K ohm, 1/2 W, 5%	540 0073 000
R4	Res., 9.1 K ohm, 1/2 W, 5%	540 0072 000
R5	Res., 2.4 K ohm, 1 W, 5%	540 0341 000
R6	Pot., 10 K ohm, 2 W.	550 0067 000
R7	Res., 3 K 1/2 W, 5%	540 0060 000
R8	Res., 180 1/2 W, 5%	540 0031 000
R9	Res., 62 K ohm, 1/2 W, 5%	540 0092 000
R10	Res., 3 K ohm, 1/2 W, 5%	540 0060 000
R11	Res., 1 K ohm, 1/2 W, 5%	540 0049 000
R12	Res., 47 ohm, 1/2 W, 5%	540 0017 000
R13,R14	Res., 2.7 ohm, 1 W, 5%	540 0270 000
R15	Res., 1 ohm, 5 W.	542 1057 000

Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
R16	Res., 820 ohm, 1 W, 5%	540 0330 000	T1	Xfmr. Assy.	914 4481 001
R20	Res., 1 K ohm, 2 W, 5%	540 0611 000	X1	Socket, Octal	404 0065 000
R21	Res., 3.6 K ohm, 1 W, 5%	540 0345 000	XQ1 thru XQ3	Socket Transistor	404 0066 000
R22	Res., 12 ohm, 1 W, 5%	540 0286 000			

REGULATOR/POWER SUPPLY BOARD ASSEMBLY

992 1828 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
CR1	Rectifier 70 V, 1 Amp	384 0198 000	R17	Res., 1.2 K ohm, 5 W.	542 0032 000
CR2,CR3	Diode, Zener 1N3031B	386 0034 000	R18	Res., 1 K ohm, 1 W, 5%	540 0332 000
CR4	Diode Zener 1N3024B	386 0058 000	R19	Res., 200 ohm, 1/2 W. 5%	540 0032 000
Q6	Transistor 40321	380 0056 000	XQ6	Transistor Socket	404 0066 000

BINARY DIVIDER
(FOR USE WITH SOLID STATE EXCITER ON FREQUENCY BELOW 1 MC ONLY)

992 1618 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C101	Cap., 50 pF 500 V (W) 5%	500 0818 000	C103	Cap., 50 pF 300 V (W) 5%	500 0836 000
C102	Cap.,1000 pF 100 V (W) 5%	500 0844 000	C104	Cap., 50 pF 500 V (W) 5%	500 0818 000

Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C105	Cap., 5000 pF, 300 V (W) 5%	500 0858 000	R105	Res., 4.7 K ohm, 1/2 W, 10%	540 0186 000
C106	Cap., 150 pF, 500 V (W) 5%	500 0761 000	R106	Res., 2.7 K ohm, 1/2 W, 10%	540 0183 000
CR101, CR102	Diode, Silicon TI-71	384 0132 000	R107	Res., 4.7 K ohm, 1/2 W, 10%	540 0186 000
Q101 thru Q103	Transistor 2N2369	380 0083 000	R108	Res., 12 K ohm, 1/2 W, 10%	540 0191 000
R101	Res., 6.2 K ohm, 1/2 W, 5%	540 0068 000	R109	Res., 6.2 K ohm, 1/2 W, 5%	540 0068 000
R102	Res., 12 K ohm, 1/2 W, 5%	540 0191 000	R110	Res., 470 K ohm, 1/2 W, 10%	540 0210 000
R103	Res., 2.7 K ohm, 1/2 W, 10%	540 0183 000	R111	Res., 6.2 K ohm, 1/2 W, 5%	540 0068 000
R104	Res., 470 ohm, 1/2 W, 10%	540 0174 000			

HEAT SINK & Q4 ASSEMBLY

992 2521 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C26	Cap., .04 uF 100 V, 10%	508 0253 000	R21	Res., 430 ohm, 1 W, 5%	540 0323 000
Q4	Transistor, 2N3583	380 0124 000			

HEAT SINK & Q5A & B ASSEMBLY

992 2522 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C24, C25	Cap. .04uF, 100 V, 10%	508 0253 000	R22, R23	Res, 430 ohm, 1 W, 5%	540 0323 000
Q5A, Q5B	Transistor 2N3583	380 0124 000			

IPA (4-400A) ENCLOSURE PARTS

992 1781 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C604	Cap, .002uF 12.5kV	504 0152 000	R646	Res. 240 ohm, 1 W, 5%	540 0317 000
C608, C609	Cap. Type "G" (Det. by Freq)	-------	R647	Res. 620 ohm, 1 W, 5%	540 0327 000
C633	Cap. .0005uF, 1200 V.	500 0449 000	R655, R656	Res. 150 ohm, 2 W, 5%	540 0591 000
C634	Cap. .0002uF, 1200 V.	500 0447 000	S614, S615	Sw. Door Interlock	604 0380 000
L604A, L604B	RF Choke, #7949	494 0101 000	T603	Transformer, Fil, F516	472 0111 000
L605	IPA Tuning Inductor	992 1792 000	TB612	Terminal Board 3 Terminals.	614 0070 000
L611	Grid Coil Assy (4-400A)	914 4122 000			
L622	RF Choke	494 0098 000			
R613	Res. 2k ohm 160 Watt	542 0327 000			
R614	Res. 1k ohm 160 Watt	542 0325 000			
R627	Res. 3.5k ohm, 20 Watt	542 0410 000			
R636, R637	Res. 1.0 ohm	542 1074 000			

Warning, disconnect primary power prior to servicing.

IPA (4-400A) DECK

992 1791 001

SYMBOL	DESCRIPTION	GATES PART NO.
C602	Cap. .002uF,	500 0452 000
C605, C606	Cap. .01uF, 600 V.	500 0436 000
C607	Cap. .01uF, 1200 V.	500 0458 000
L613	RF Choke, 2.5uH	494 0076 000
R611	Res. 100 ohm, 10 W.	542 0060 000
R612	Res. 100 ohm, 2 W. 10%	540 0728 000
TB607	Term. Board, 6 Terminals	614 0114 000
V603	Tube, 4-400A	374 0010 000
XV603	Socket, tube	404 0055 000

PA AND MODULATOR ENCLOSURE PARTS

992 1783 001

SYMBOL	DESCRIPTION	GATES PART NO.
C612, C613	Cap. .02uF, 1kV	504 0023 000
C614	Cap. Variable, 19/488pF	520 0065 000
C615	Cap. Type F1L (Det. by Freq)	----
C615B	Cap. 500pF, (Padder to be used as needed)	500 0643 000
C616	Cap. .03uF, 600 V, Type H.	500 0657 000
C628, C629	Cap. .002uF, 1200 V, #1996	504 0152 000
C635, C636	Cap. .01uF, 1kV, Discap	516 0082 000
C647, C648	Cap. Feed-thru 1000pF, 500 V.	516 0228 000
L603	RF Choke Assy	938 2101 000
L606 and R621	Grid parasitic Suppressor Assy.	913 5894 001
L607 and R622	Plate parasitic Suppressor Assy.	913 5894 002
L618	Coil Assembly, Dual PA Fil.	938 2090 001
R601 thru R604	Res. 100k ohm 160 Watt	542 0346 000
R621, R622	Res. 100 ohm (Part of parasitic suppressor Assy)	----
R644, R645	Res. 1.1k ohm, 1 W. 5%	540 0333 000
R649, R650	Res. 5k ohm, 50 Watt	542 0219 000

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Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.
S607	Sw., Pressure 1820-2	604 0280 000
S616	Sw., Interlock 22AC2	604 0380 000
T602	Mod. Fil. Tran Gates Spec. #814 3386 001	472 0578 000
T604	PA Fil. Tran. Gates Spec. #814 3385 001	472 0579 000
V601, V602, V604	Mod. and PA tubes, 3CX2500F3	374 0093 000
XV601, XV602, XV604	Socket, part of Mechanical Assembly.	

TANK AND LOADING ENCLOSURE

992 1782 001

SYMBOL	DESCRIPTION	GATES PART NO.
C611	Cap. Vacuum, 20kV, VC25	512 0143 000
C617A/B	Cap. Vacuum, Type JCS, (Det. by Freq)	----
C618 thru C620	Cap. Mica, Type G3, (Det. by Freq)	----
C630	Cap. .001uF, 20kv, Type 293	504 0258 000
C631	Cap. 10kV, Type 292 (Det. by Freq)	----
K619	Relay, DPDT 230 VAC coil	574 0034 000
L608	Plate Tuning Coil Assembly (Det. by Freq)	----
L609	Coil, 26FB2843	931 6138 047
L610	Output Loading Coil, 26VC2144	931 6583 002
L615	Mod. Mon. Pick-up Coil	938 0503 001
L617	Variable Coil Assembly	938 0823 001
L619	2nd Harmonic Tuning Coil	938 3192 001
R628	Res. 50 ohm, 50 W. Adj.	552 0085 000
S612	Sw., Interlock 22AC2	604 0380 000

Warning, disconnect primary power prior to servicing.

IPA/PA BIAS & 4-400A SCREEN SUPPLY

992 1777 001

SYMBOL	DESCRIPTION	GATES PART NO.
C501	Cap. 2uF, 600 V.	510 0344 000
C502, C503	Cap. 4uF, 600 V.	510 0345 000
C504	Cap. 2uF,	510 0347 000
C505	Cap. Plug-in, 30/30uF, 500 V.	524 0315 000
C506	Cap 16 uF 450 V.	522 0133 000
C507	Cap 4 uF 1kV	510 0499 000
CR501 thru CR504	Rectifier, 3kV PIV, 67-6136	384 0199 000
F501	Fuse, 3 Amp 250 V, 3AG	398 0020 000
K501	Relay, DPDT, 230 VAC, 50/60 Hz	574 0034 000
L501, L502	Choke, 6 Hy	476 0016 000
R501, R502	Res. 50 ohm, 10 W, WW	542 0058 000
R503	Res. 25k ohm, 20 Watt	542 0149 000
R504	Res. 5k ohm,	542 0088 000
R507	Res. 15k ohm,	542 0099 000
R509	Res. 10k ohm, 10 Watt	542 0095 000
R510	Res. 10 ohm, 1 W. 5%	540 0284 000
T501	Transformer, Power.	472 0069 000
TB501	Term. Board, 8 Terminals	614 0075 000
XC505	Socket, PS6	404 0494 000
XF501	Fuseholder	402 0021 000

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Warning, disconnect primary power prior to servicing.

994 7040 001

SYMBOL	DESCRIPTION	GATES PART NO.
C8	Cap., 20uF 250 V.	522 0377 000
C9	Cap., 1.0uF 600 V.	506 0025 000
C19	Cap., 20uF 250 V.	522 0377 000
C20, C21	Cap., 1.0uF 600 V.	506 0025 000
CR3	Diode 1N914	384 0134 000
CR4	Diode Zener 1N3015	386 0097 000
CR6, CR7	Diode, 1N914	384 0134 000
CR8	Diode 1000 PIV 1N5054	384 0368 000
CR11	Diode Zener 1N3015	386 0097 000
CR12, CR14, CR15	Diode 1N914	384 0134 000
CR16	Diode 1000 PIV 1N5054	384 0368 000
L1, L2	Choke, 15 Hy 75 MA	476 0308 000
Q5 thru Q10	Transistor DTS804	380 0205 000
R16	Res., 10K ohm, 25 W, 5%	542 0191 000
R17	Res., 10K ohm, 2 W, 5%	540 0635 000
R18	Res., 5K ohm, 10 W.	542 0088 000
R19	Res., 10 ohm	540 0563 000
R21	Res., 510 ohm, 1/2 W.	540 0042 000
R22	Res., 200K ohm, 1/2 W.	540 0104 000
R23	Res., 1/2W. 5% (Value Det. by Test)	
R24	Res., 15 K ohm	540 0639 000
R38	Res., 15 K ohm, 25 W, 5%	542 0193 000
R45	Res., 5 K ohm, 10 W.	542 0088 000
R46	Res., 10 K ohm, 25 W, 5%	542 0191 000
R48	Res., 510 ohm, 1/2 W.	540 0042 000
R49	Res., 10 ohm	540 0563 000
R50	Res., 10 K ohm, 2 W, 5%	540 0635 000
R51	Res., 200 K ohm, 1/2 W.	540 0104 000
R52	Res., 15 K ohm	540 0639 000

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Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
TB1	Term. Bd.	614 0052 000	TB3	Term. Bd.	614 0093 000
TB2	Term. Bd.	614 0047 000	XQ5 thru XQ10	Socket Transistor	404 0294 000

AUDIO DRIVER PC BOARD

992 3592 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1	Cap., 25uF 6 V.	522 0178 000	C17	Cap., 200uF 15 V.	522 0231 000
C2	Cap., 5uF 25 V.	522 0236 000	C18	Cap., 20uF 50 V.	522 0256 000
C3	Cap., 25uF 6 V.	522 0178 000	C19 thru C23	Not used.	
C4	Cap., 0.1uF 600 V.	506 0022 000	C24	Cap., 20uF 50 V.	522 0256 000
C5	Cap., .05uF 1 kV, Disc	516 0087 000	CR1	Diode, Zener 1N5363 30 V, 1 W.	386 0224 000
C6	Cap., 200uF 15 V.	522 0231 000			
C7	Cap., 20uF 50 V.	522 0256 000	CR2	Diode, Zener 1N3027B 20V, 1 W.	386 0030 000
C8,C9	Not used.				
C10	Cap.,6-60	508 0333 000	CR5	Diode 1000 PIV 1N5054	384 0368 000
C11	Not used.				
C12	Cap., 25uF 6 V.	522 0178 000	CR10	Diode Zener 1N3027B 20 V, 1 W.	386 0030 000
C13	Cap., 5uF 25 V.	522 0236 000			
C14	Cap., 25uF 6 V.	522 0178 000	CR13	Diode 1000 PIV 1N5054	384 0368 000
C15	Cap., 0.1uF 600 V.	506 0022 000	Q1, Q2	Transistor 2N3704	380 0088 000
C16	Cap., .01uf 1 kV, Disc	516 0087 000	Q3, Q4	Transistor D40C5	380 0152 000

Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PARTS NO.
R1	Pot., 10K ohm, 1/4 W.	550 0337 000
R2	Res., 39 K ohm, 1/4 W, 5%	540 0950 000
R3	Res., 47 ohm,1/4 W. 5%	540 0880 000
R4	Res., 4.3 K ohm, 1/4 W, 5%	540 0927 000
R5	Res., 10 K ohm, 1/4 W, 5%	540 0936 000
R6, R7	Res., 1.8 K ohm, 1/4 W. 5%	540 0918 000
R8	Res., 2.2 Megohm 2 W, 5%	540 0691 000
R9	Res., 51 K ohm, 1/2 W, 5%	540 0090 000
R10	Res., 10 K ohm, 1/2 W, 5%	540 0073 000
R11	Res., 1 K ohm, 1/2 W, 5%	540 0049 000
R12	Res., 150 ohm, 2 W, 5%	540 0591 000
R13	Res., 7.5 K ohm, 10 W, 5%	542 0091 000
R14	Res., 300 ohm, 1 W, 5%	540 0319 000
R15	Res., 5.1 K ohm, 1 W, 5%	540 0349 000

SYMBOL	DESCRIPTION	GATES PART NO.
R20	Res., 510 ohm, 1/2 W.	540 0042 000
R30	Res., 4.3 K ohm, 1/4 W, 5%	540 0927 000
R31	Res., 47 ohm, 1/4 W, 5%	540 0880 000
R32, R33	Res.,1.8 K ohm, 1/4 W, 5%	540 0918 000
R34	Res., 39 K ohm, 1/4 W, 5%	540 0950 000
R35	Res., 10 K ohm, 1/4 W, 5%	540 0936 000
R36	Res., 51 K ohm, 1/2 W, 5%	540 0090 000
R37	Res., 2.2 Megohm, 2W. 5%	540 0691 000
R39	Res., 10 K ohm, 1/2 W, 5%	540 0073 000
R40	Res., 150 ohm, 2 W, 5%	540 0591 000
R41	Res., 300 ohm, 1 W, 5%	540 0319 000
R42	Res., 7.5 K ohm, 10 W, 5%	542 0091 000
R43	Res., 5.1 K ohm, 1 W, 5%	540 0349 000
R44	Res., 1 K ohm, 1/2 W, 5%	540 0049 000

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Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
R47	Res., 510 ohm, 1/2 W	540 0042 000	XQ1 thru XQ4	Socket, Transistor	404 0066 000
T1	Transformer	478 0118 000			

AUDIO DRIVER POWER SUPPLY

992 2069 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1 thru C4,C7, C8	Cap., 190 uF, 350 V.	524 0129 000	R1 thru R4	Res., 150K ohm, 2 W.	540 0766 000
F1	Fuse, 2 A	398 0058 000	R5	Res., 50K ohm, 50 W.	542 0232 000
L1	Choke, Filter 6 Hy C14X	476 0016 000	R6	Res., 100 ohm, 10 W.	542 0060 000
L2	Reactor C-17X	476 0025 000	R7	Res., 2 K ohm, 25 W, Lug Type	542 0183 000
L3,L4	Choke, Filter 6Hy, C14X	476 0016 000	T1	Transformer Gates Spec. 814 5769 001	472 0591 000
			TB1	Term. Bd 7 terms.	614 0115 000
			XF1	Fuseholder Indicator	402 0083 000

RECTIFIER P.C. BOARD

992 2070 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
CR1 thru CR16	Diode 1N2071	384 0020 000			

Warning, disconnect primary power prior to servicing.

FRONT DOOR LEFT, MOD. SECTION

992 1927 001

SYMBOL	DESCRIPTION	GATES PART NO.
C638	Cap., .01 uF, 1 kV, DD-103	516 0082 000
CR602	Diode, 1N2071	384 0020 000
R607, R615	Rheostat Mod.Fil. 7.5 ohm 150 W.	552 0403 000
R640, R641	Pot., 5 Meg-ohm, 2 W.	914 9494 005
R642, R643	Pot., 5K ohm, 2 W.	550 0065 000
S620	Switch, Selector	914 9494 001

RELAY PANEL ASSEMBLY

992 1779 001

SYMBOL	DESCRIPTION	GATES PART NO.
C623	Cap., 16 uF 450 V.	522 0031 000
CR601	Diode, 1N2071	384 0020 000
F601, F602	Fuse, Cartridge, 3 A, NON-3	398 0180 000
F603, F604	Fuse, Cartridge, 10A, NON-10	398 0182 000
F605, F606	Fuse, Cartridge, 15A, NON-15	398 0183 000
K601 thru K605	Relay, DPDT 6 V. DC	574 0033 000
K607	Contactor 3 pole, NO, 230V, 50/60 Hz Coil	570 0136 000
K611	Relay, Latching, DPDT, 230V, 50/60 Hz	574 0038 000
K613	Relay, DPDT 230 VAC Coil	574 0034 000
K614	Relay, 230V DC	572 0048 000
K615	Contactor 3 pole, NO, 230V, 50/60 Hz Coil	570 0136 000
R605, R606	Res.,Adj 5 ohm,50W.	552 0082 000
R610	Res.,Adj 50 ohm, 50 W.	552 0085 000
R616	Res., Adj 5 ohm, 50W.	552 0082 000

Warning, disconnect primary power prior to servicing.

SYMBOL	DESCRIPTION	GATES PART NO.
R620	Res. Adj. 1 ohm, 50 W.	552 0550 000
R623	Res. 12k ohm, 1 W. 10%	540 0481 000
R624	Potentiometer, 5k ohm 2W	550 0065 000
R625	Res. 4.7k ohm 2 W. 10%	540 0748 000
R632 thru R635	Res. 100k ohm 1 W. 10%	540 0492 000
TB602	Term. Board, 8 terminals	614 0098 000
TB610, TB611	Term. Board, 10 terminals	614 0054 000
XF601 thru XF606	Fuseblock	402 0015 000

RIGHT HAND SIDE PANEL

992 1780 001

SYMBOL	DESCRIPTION	GATES PART NO.
CR603 thru CR605	Silicon Rect. Column, Dblr. 11.2k PIV per leg.	384 0185 000
H601, H602	Heater Element 52-59 Amps	584 0171 000
---	Overload Relay Type OR	582 0033 000
K612	Relay, PA Voltage changer	942 0133 000
K617	Contactor, 3 pole, 230 VAC, 50/60 Hz, CRA231/U	570 0088 000
K620	Contactor, 3 pole, 208/230 VAC, 50/60 Hz, CRA-031/U	570 0102 000
R608, R609	Meter Multiplier MM3, 3 Megohm	914 3422 001
R617 thru R619	Res. 1.0 ohm, 100 Watt	542 0282 000
TB601	Term. Board, 10 Terminals	614 0100 000
TB603	Term. Board, 8 Terminals	614 0098 000
TB604	Term. Board, 4 Terminals	614 0094 000
TB605	Term. Board, 2 Terminals	614 0046 000
TB606	Term. Board, 8 Terminals	614 0098 000
TB608	Input Terminal Board (Part of Mech. Assembly)	

Warning, disconnect primary power prior to servicing.

PA PLATE VOLTAGE EXTENSION KIT

994 4719 002

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
R1 thru R6	Res. 500k ohm, 2 W. 1%	544 1367 000	R10	Res. 5.1k ohm, 1/2 W, 5%	540 0066 000
R7	Res. 20k ohm, 10 Watt	542 0103 000	TB1	Term. Board, 2 Terminals	614 0046 000
R8	Res. 15k ohm, 10 Watt	542 0099 000			
R9	Potentiometer, 10k ohm	550 0067 000			

PA PLATE CURRENT EXTENSION KIT

937 8674 002

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
	Carbon Block, #26	398 0301 000		Res., 5 ohm, 50 Watt, Adj.	552 0082 000
	Potentiometer, 100 ohm, CLU-1011	550 0055 000		Res. 25 ohm, 10 Watt	542 0057 000
	Res 5.1K ohm ½ W	540 0066 000		Res. 20 ohm, 10 Watt	542 0056 000

LEFT REAR BLOWER FRAME ASSEMBLY

992 1784 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
B601	Blower, 230VAC 50 Hz, 1 Phase, CXH33A27B	432 0072 000			

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Warning, disconnect primary power prior to servicing.

RIGHT REAR BLOWER FRAME ASS'Y

992 1785 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
B602	Fan, 230 VAC 50/60 Hz, 1 Phase	430 0031 000			

VSWR TRIGGER

992 1812 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1	Cap. .02 uF, 600 V, DD203	516 0084 000	R6	Res. 110k ohm, 1/2 W. 5%	540 0098 000
C2	Cap. 20-20uF, 250 V	522 0050 000	R7, R8	Res. 20k ohm, 1 W. 5%	540 0363 000
CR1	Diode, 1N2071	384 0020 000	T1	Transformer, Power, R-30X	472 0008 000
J1 thru J4	Jack, #3501	612 0420 000	TB1	Term. Board, 8 Terminals	614 0075 000
K1	Relay, DPDT, 2500 ohm coil	574 0138 000	V1	Tube, 12AU7A	370 0195 000
P3, P4	Plug, #3501	610 0412 000	XV1	Socket, Tube	404 0044 000
R1	Res. 470k ohm 1/2 W. 10%	540 0210 000			
R2	Potentiometer, 10k ohm	552 0255 000			
R3, R4	Potentiometer, 500k ohm, 2 W.	550 0077 000			
R5	Res. 33 ohm, 1 W. 10%	540 0450 000			

1287

Warning, disconnect primary power prior to servicing.

DIRECTIONAL WATTMETER

992 1815 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1, C2	Cap.(Strap)	814 3853 001	P1, P2	Plug, phone, #3501	610 0412 000
J1, J2	Jack,phone,	612 0420 000	T1	Transformer Assembly	927 2340 001

PRINTED WIRING BOARD FOR DIRECTIONAL WATTMETER

992 1816 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C3	Cap. 360pF, 500 V.	500 0832 000	R1, R2, R4, R5	Res, 51 ohm, 1/2 W. 5%	540 0018 000
C4, C5	Cap.11 -110pf Trimmer	518 0056 000	R7, R8	Res. 10k ohm, 1/2 W. 5%	540 0073 000
C6	Cap. 350pF, 500 V.	500 0832 000			
CR1, CR2	Diode, 1N914	384 0134 000			

Rev. 6/74

AUDIO AND BIAS CHANGE ASSEMBLY

992 2669 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1	Cap. 10uF, 25V.	522 0239 000	R8, R9	Res. 100 ohm 1/2 W.	540 0025 000
K606, K618, K632	Relay, DPDT, 230 VAC, 50/60 Hz coil	574 0181 000	R10	Res. 1k ohm, 1/2 W.	540 0049 000
			R11	Attenuator, 600 ohm, "T"	554 0292 000
R1, R2	Res. 220 ohm, 1/2 W.	540 0033 000	R12, R13	Res. 620 ohm, 1/2 W.	540 0044 000
R3, R4	Res. 1800 ohm, 1/2 W.	540 0055 000	R638, R639	Potentiometer, 2.5 Megohm	550 0081 000
R5, R6	Res. 100 ohm, 1/2 W.	540 0025 000	TB613, TB614	Term. Board, 6 Terminals	614 0073 000
R7	Res. 820 ohm, 1/2 W.	540 0047 000			

Warning, disconnect primary power prior to servicing.

POWER REDUCTION KIT, 5KW/500 W

992 2289 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
R1, R2	Res. 360 ohm, 1/2 W. 5% (For input level Change)	540 0038 000	R651A, R651B	Res. 1k ohm, 200 W, Adj.	552 0210 000
R3, R4	Res. 1k ohm, 1/2 W. 5% (For input level Change)	540 0049 000	R652	Res. 1k ohm, 200 W.	542 0359 000

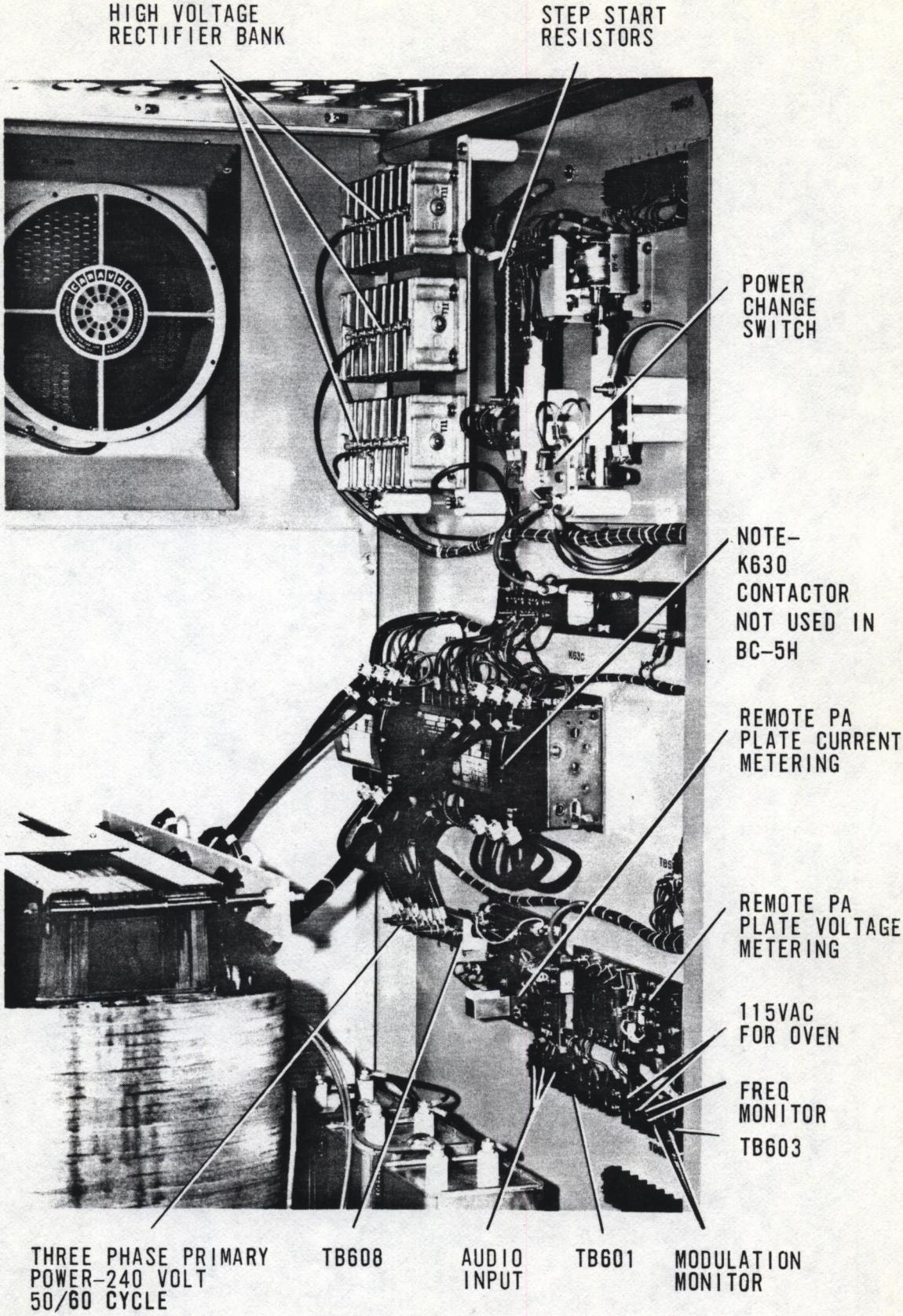
MOD GRID BOARD ASSY.

992 3606 001

SYMBOL	DESCRIPTION	GATES PART NO.	SYMBOL	DESCRIPTION	GATES PART NO.
C1 thru C4	Cap. .05uF 1 kV	516 0087 000	L1, L2	Choke	494 0196 000
CR1 thru CR4	Diode 1N5054	384 0368 000	R1 thru R4	Res. 2200 ohm 2 W 5%	540 0619 000
			R5, R6	Res. 47 ohm 2 W	540 0579 000

1087

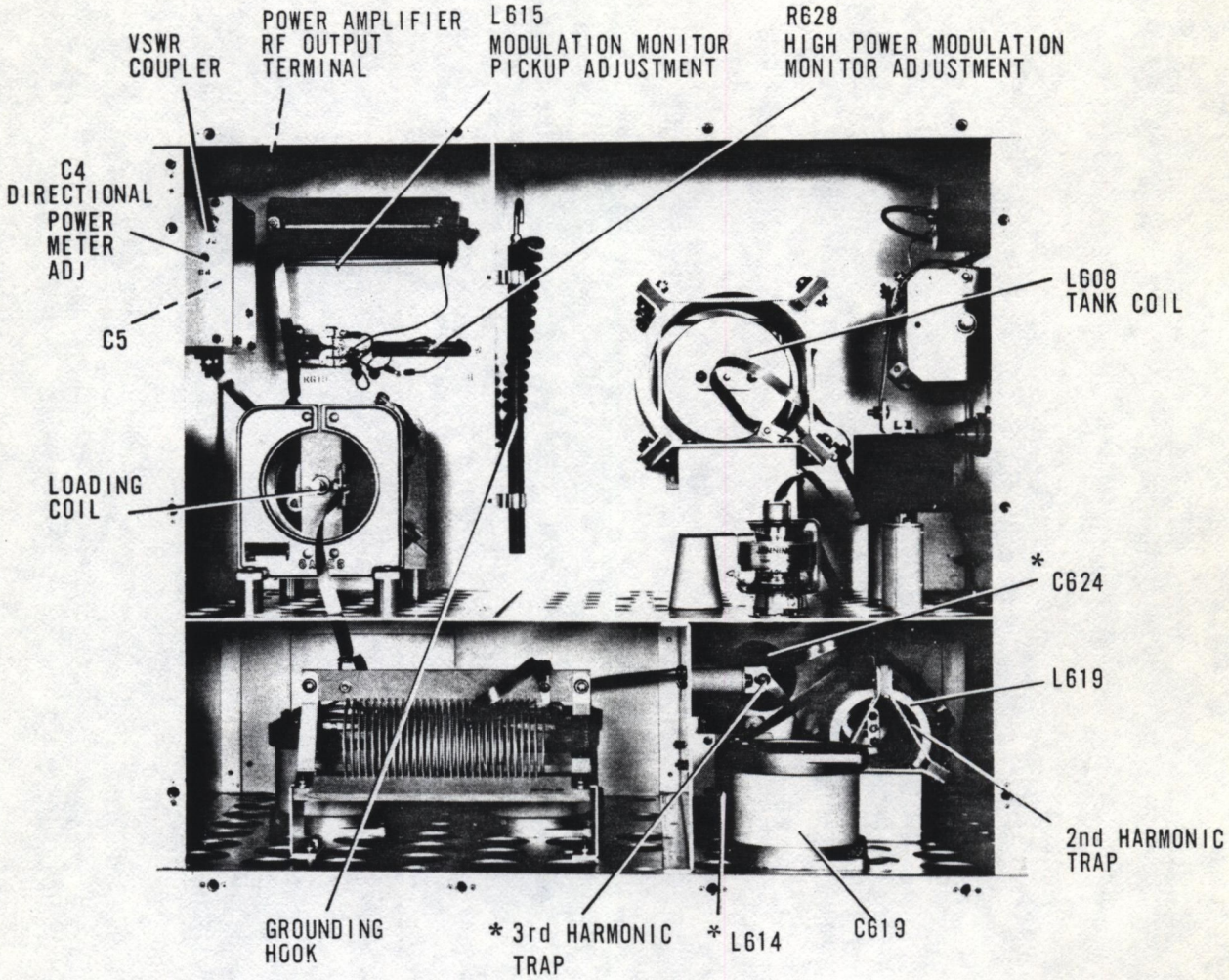
Warning, disconnect primary power prior to servicing.



POWER PANEL

FIG. 2.1

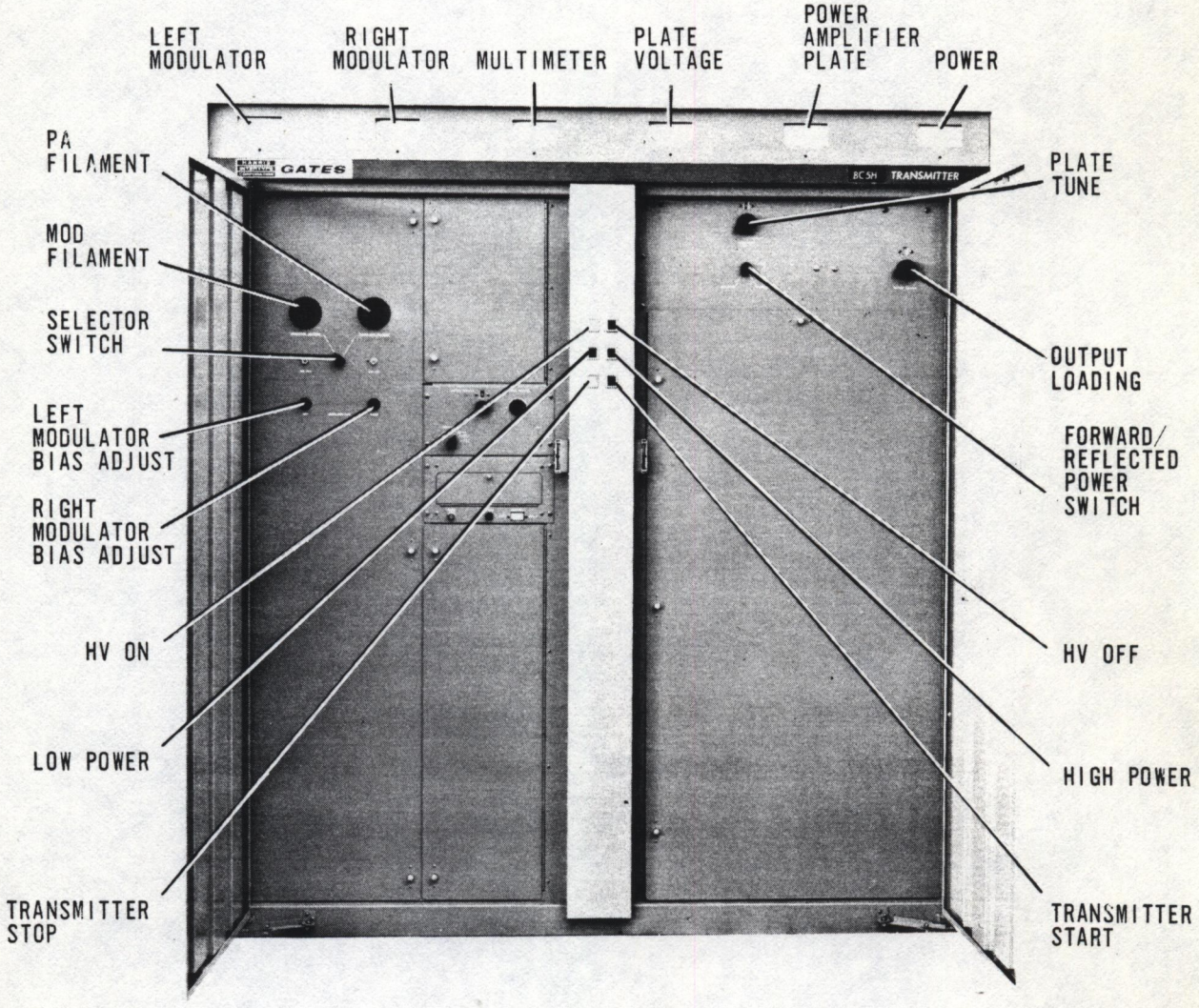
Warning, disconnect primary power prior to servicing.



* NOT USED IN BC-5H

RF SECTION

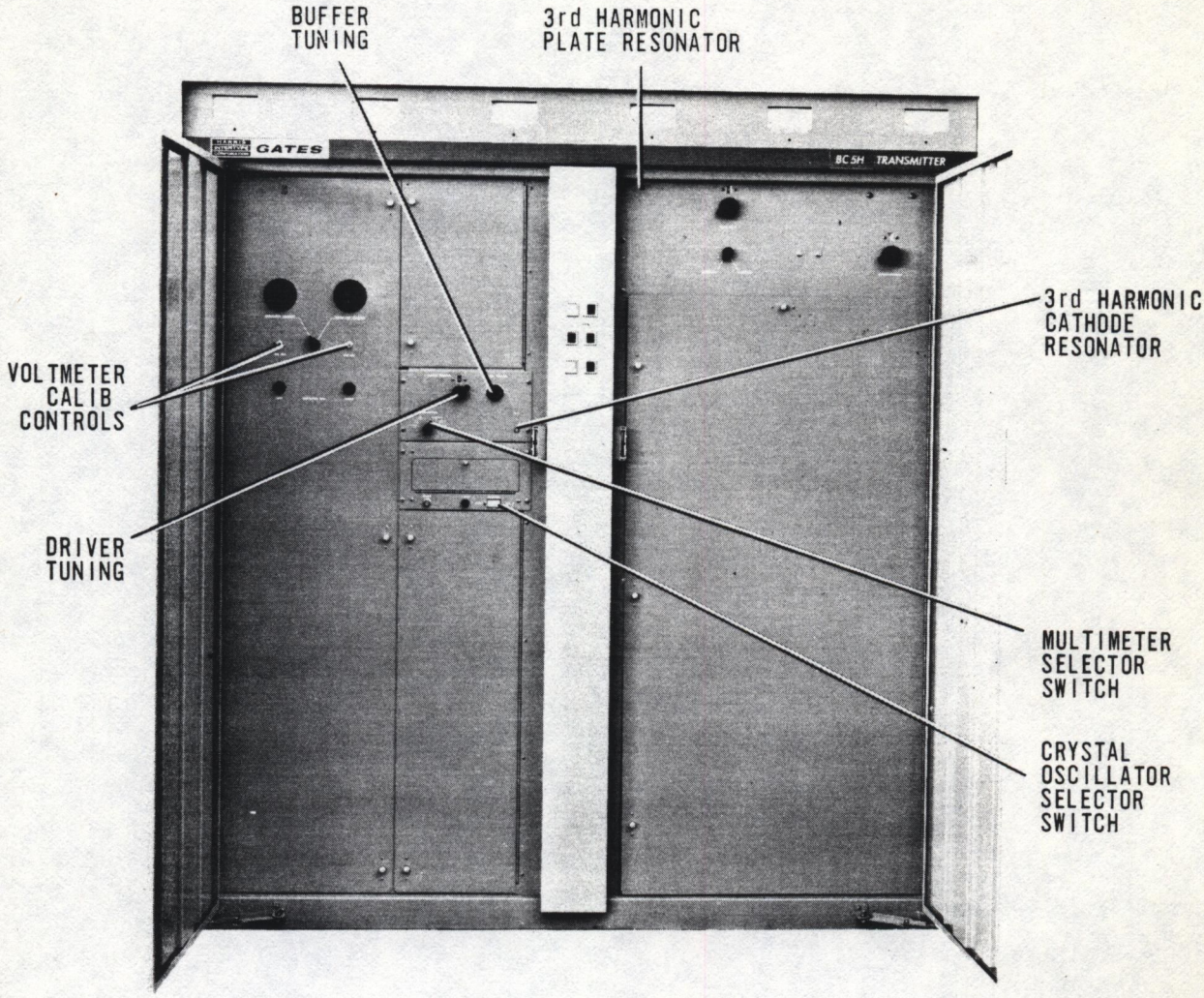
FIG. 2.2



PRIMARY DOORS OPEN (A)

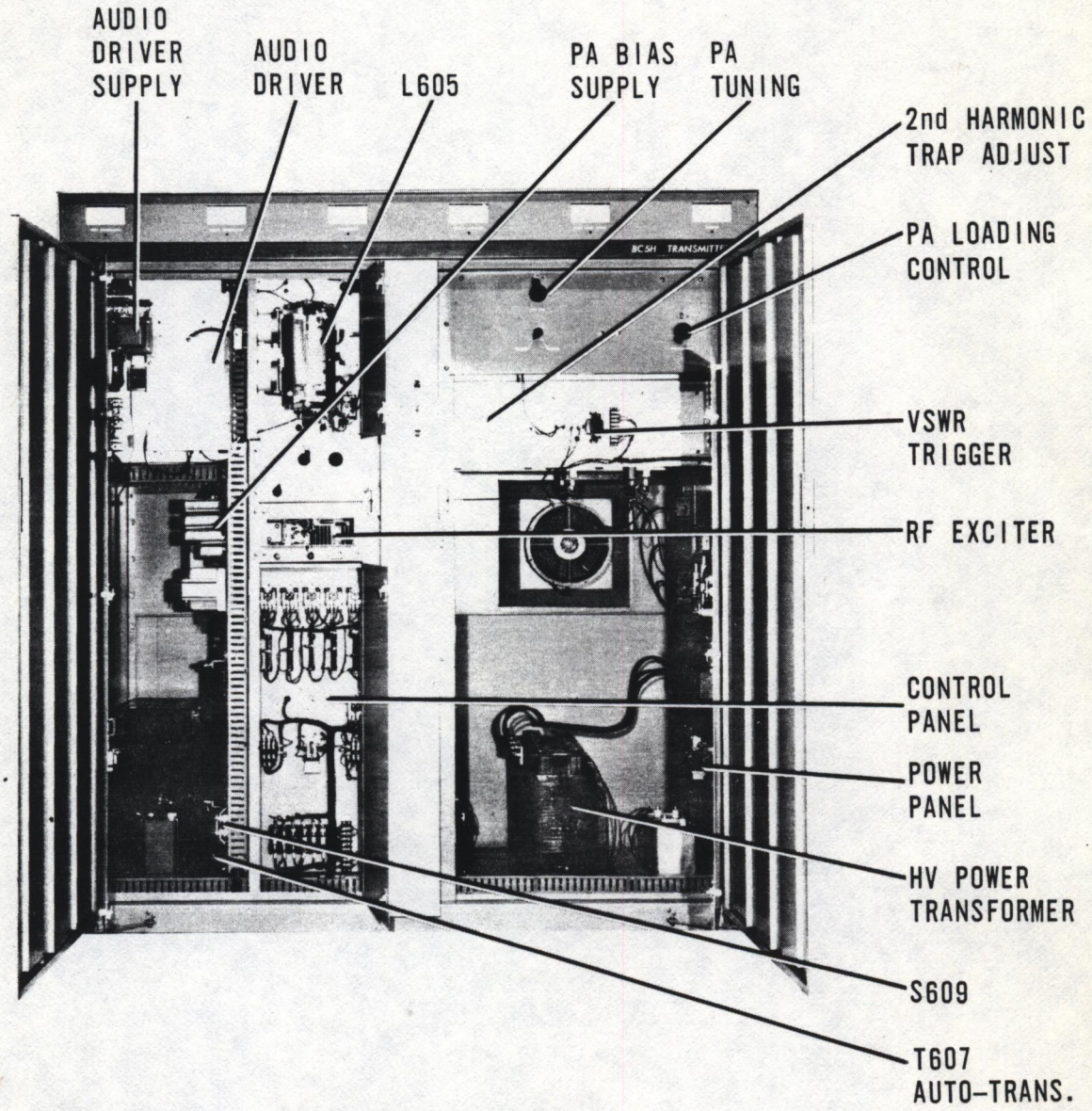
FIG. 2.3

Warning, disconnect primary power prior to servicing.



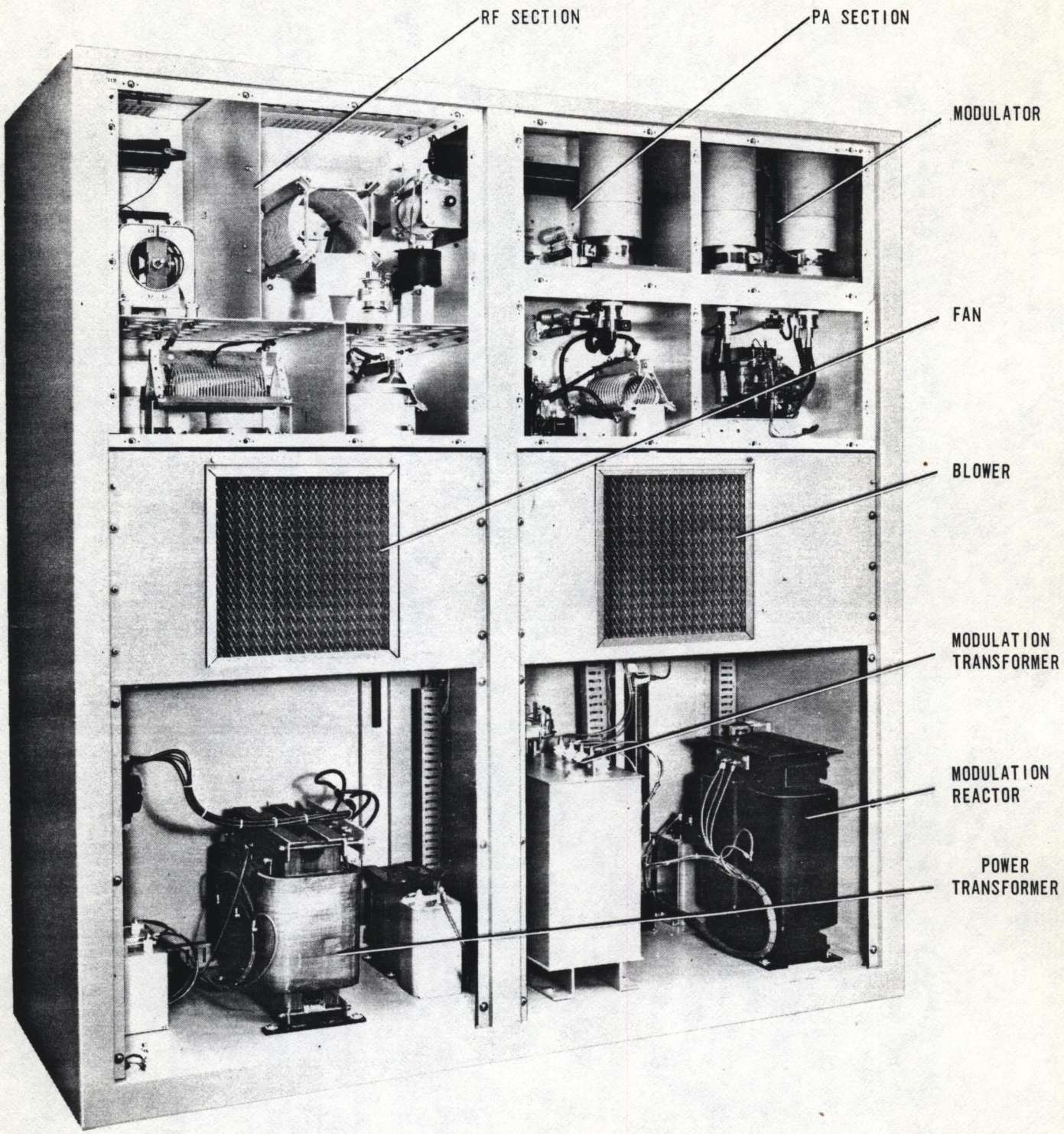
PRIMARY DOORS OPEN (B)

FIG. 2.4



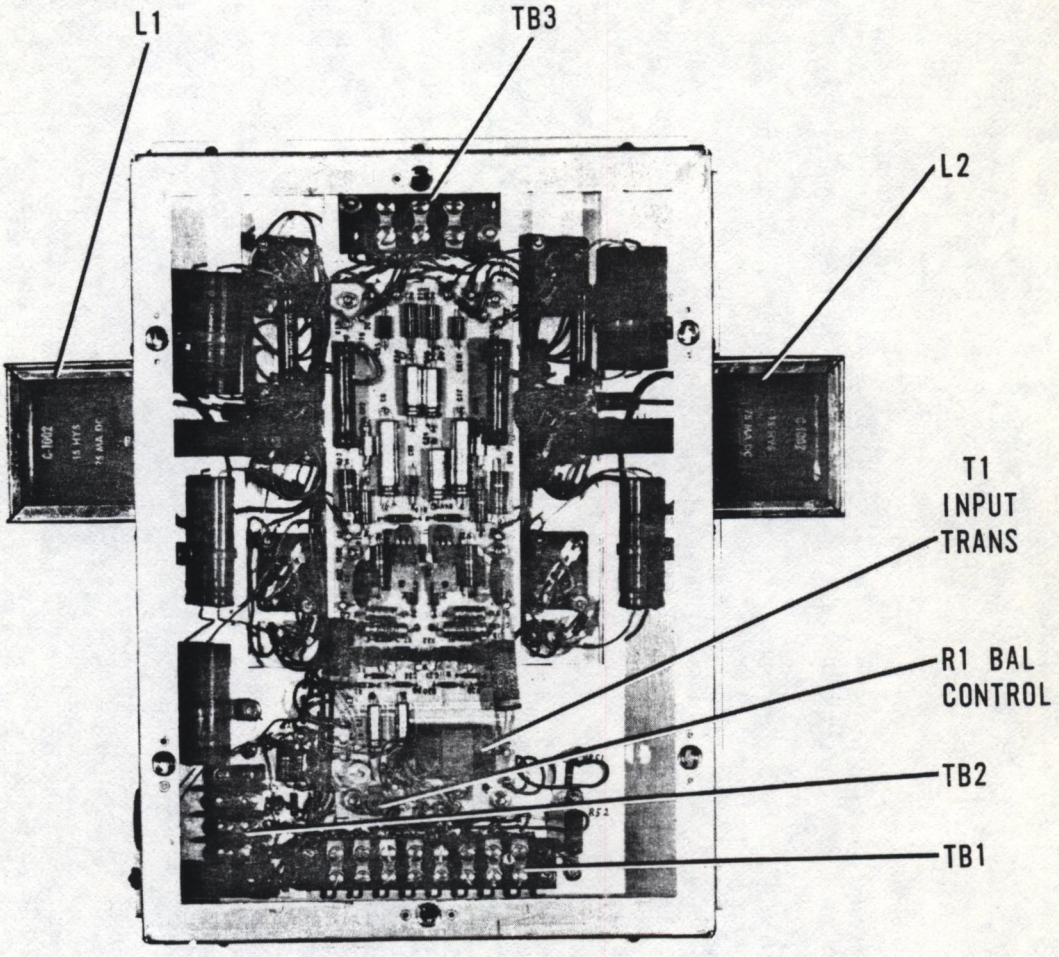
SECONDARY DOORS OPEN

FIG 2.5



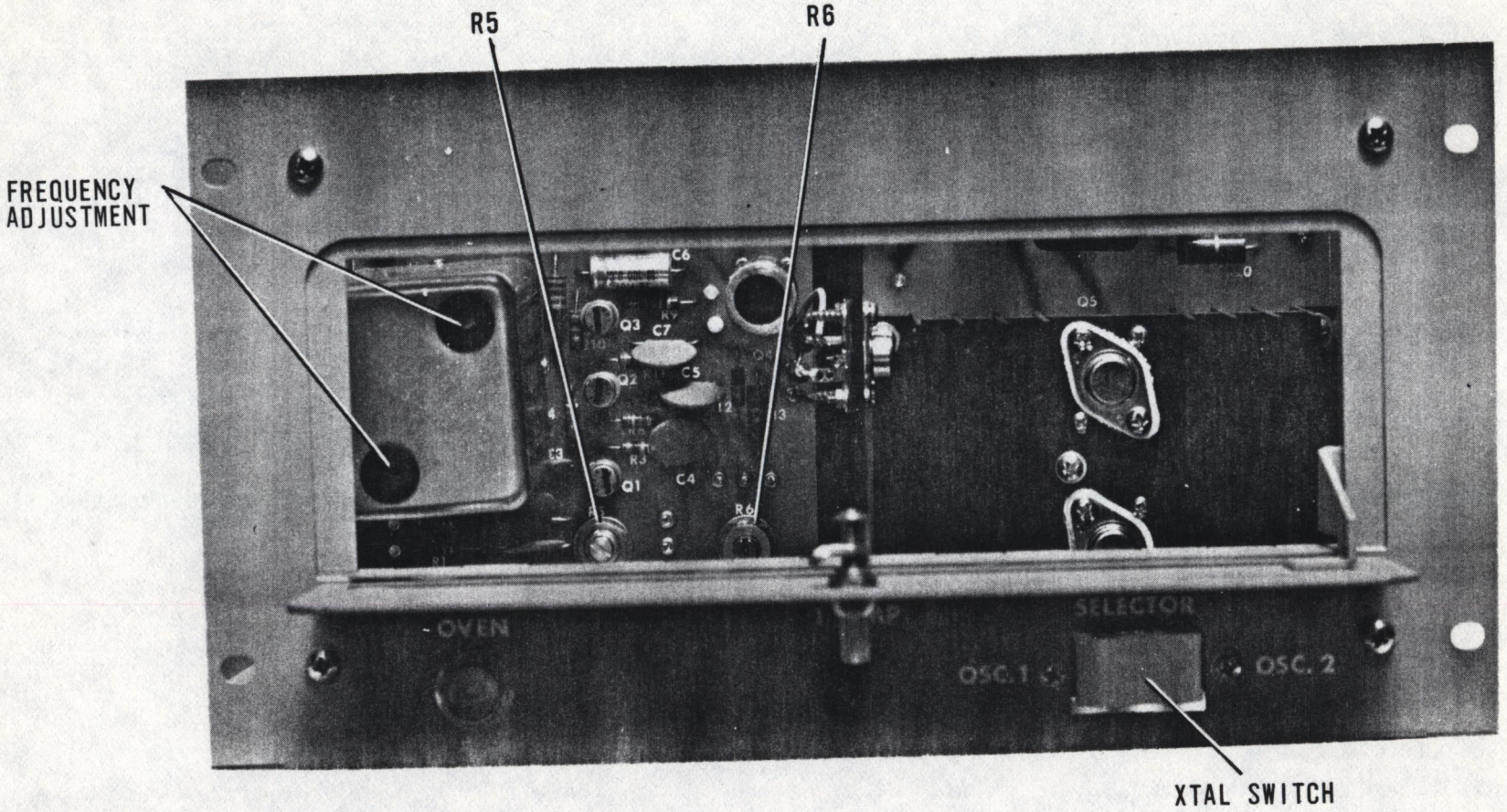
REAR VIEW
FULL ACCESS
FIG 2.6

Warning, disconnect primary power prior to servicing.

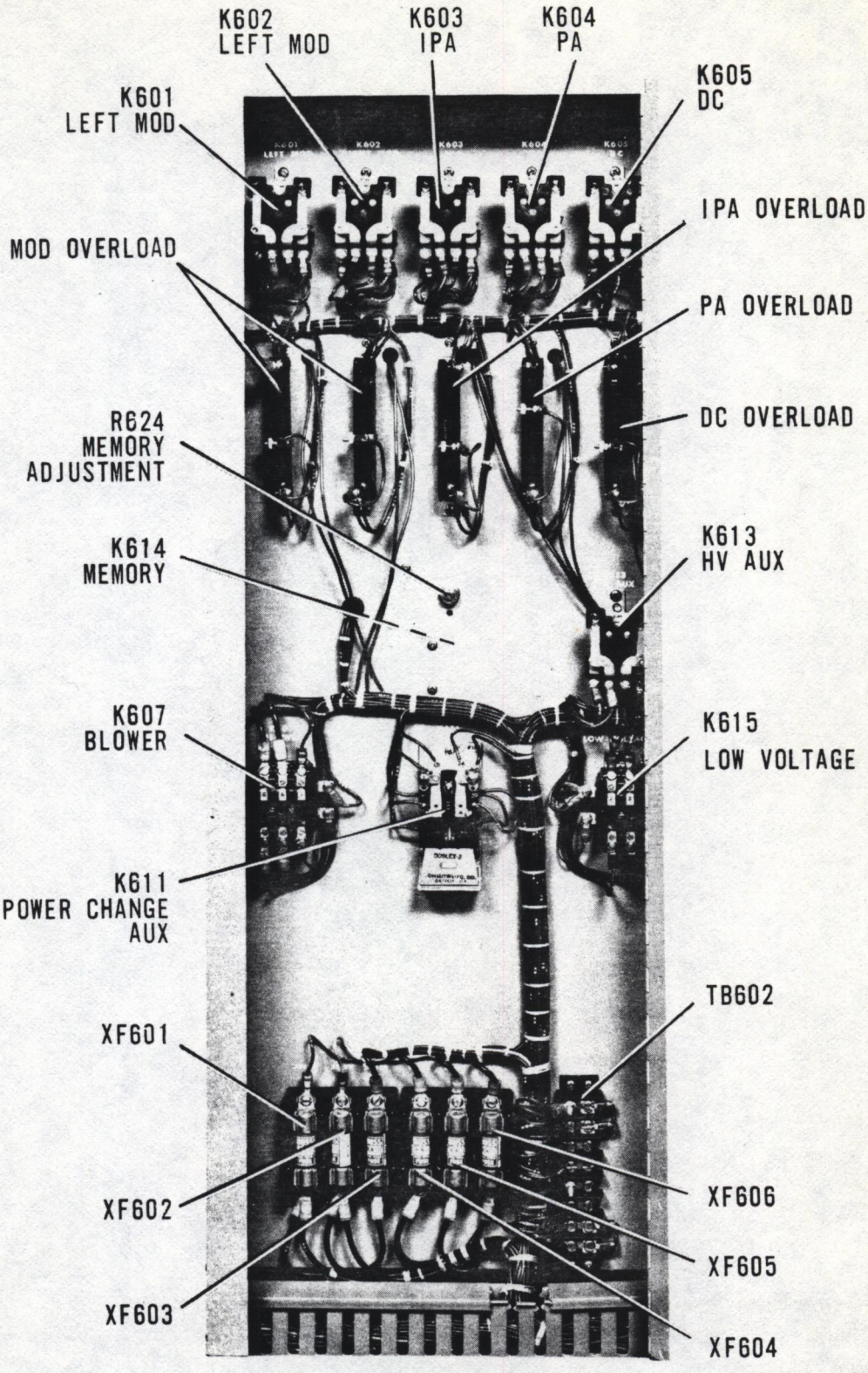


AUDIO DRIVER
FIG. 3.1

Warning, disconnect primary power prior to servicing.



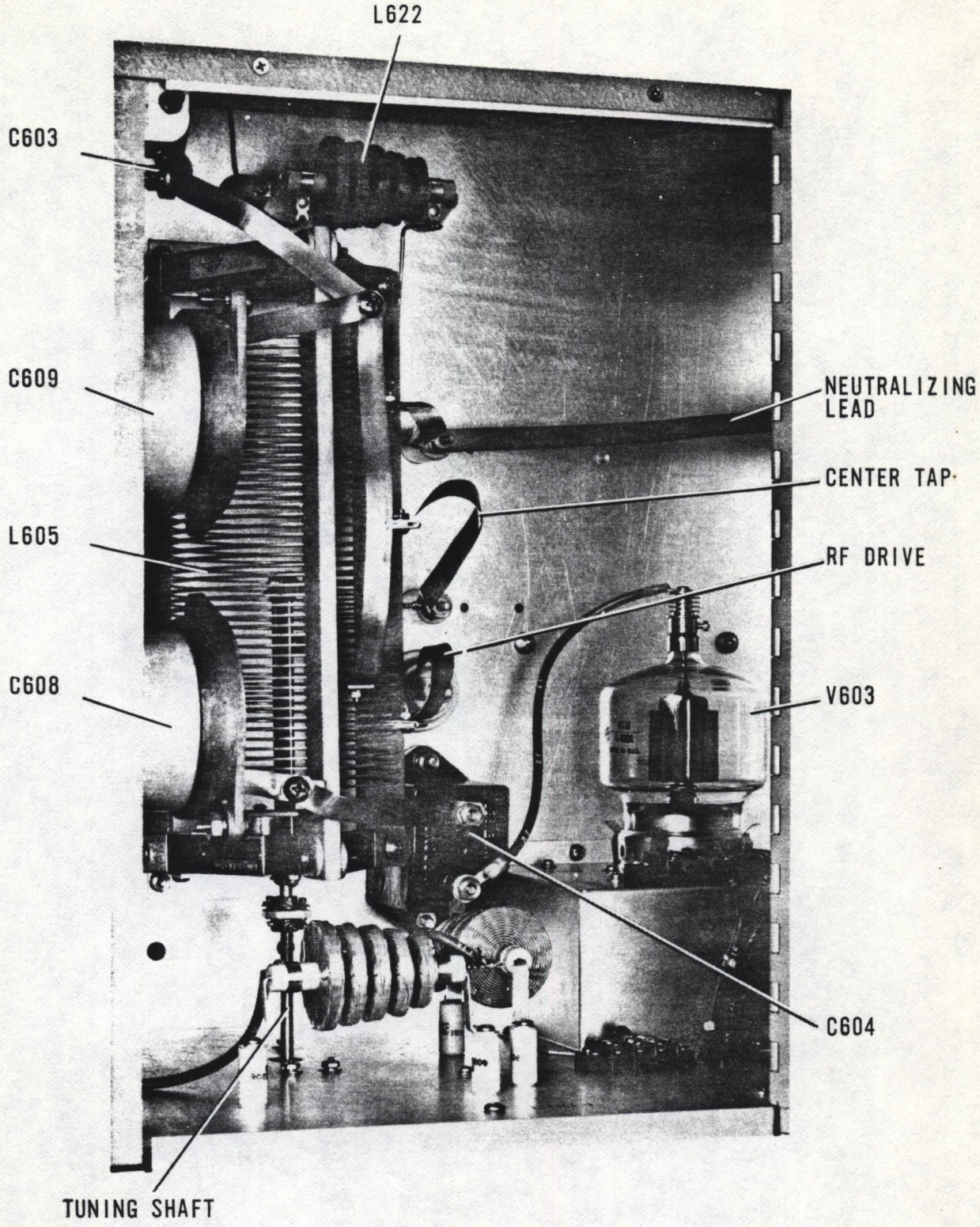
EXCITER
ACCESS DOOR OPEN
FIG. 3.2



CONTROL PANEL

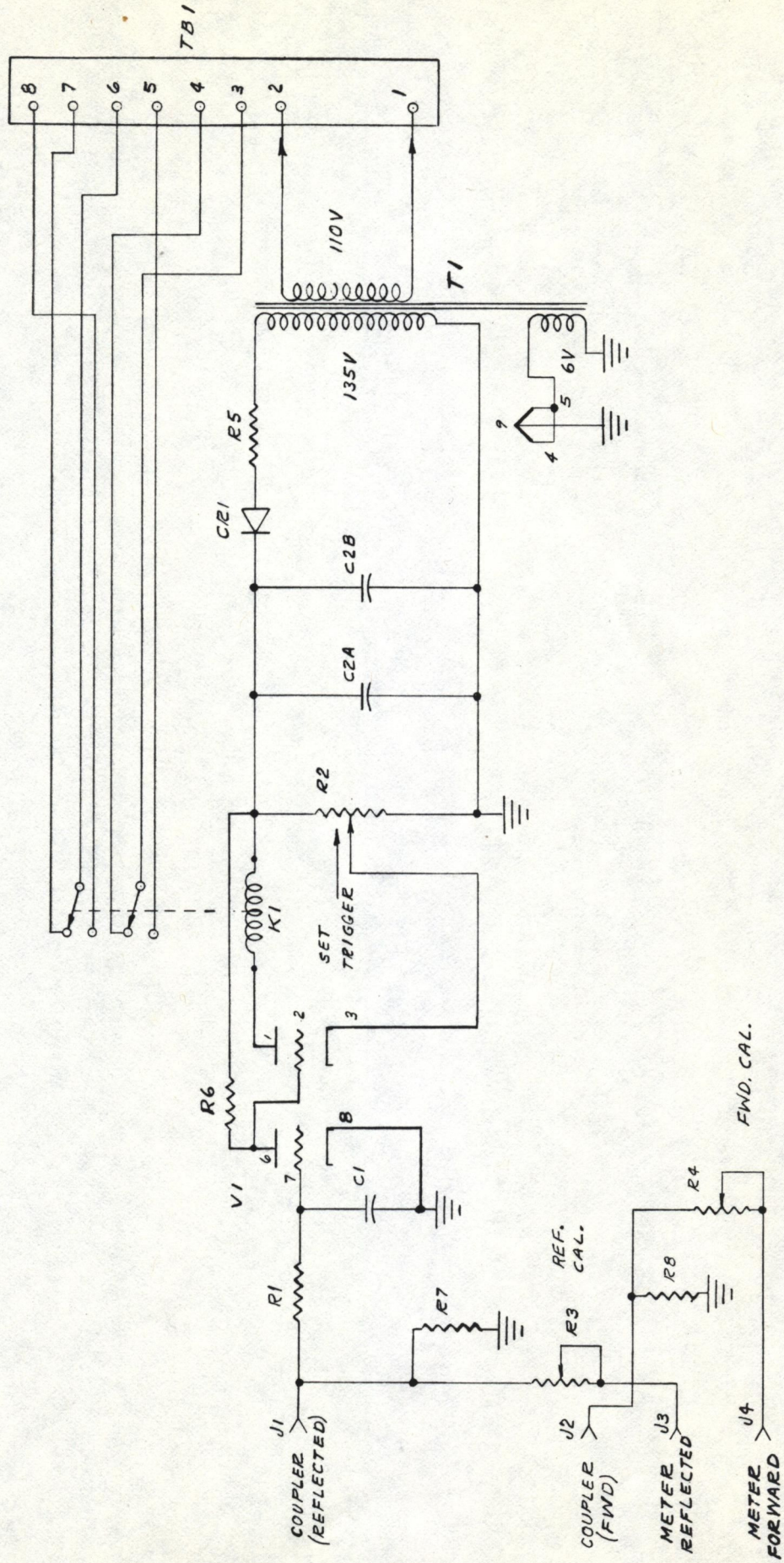
FIG. 3.3

Warning, disconnect primary power prior to servicing.



RF DRIVER

FIG. 3.4



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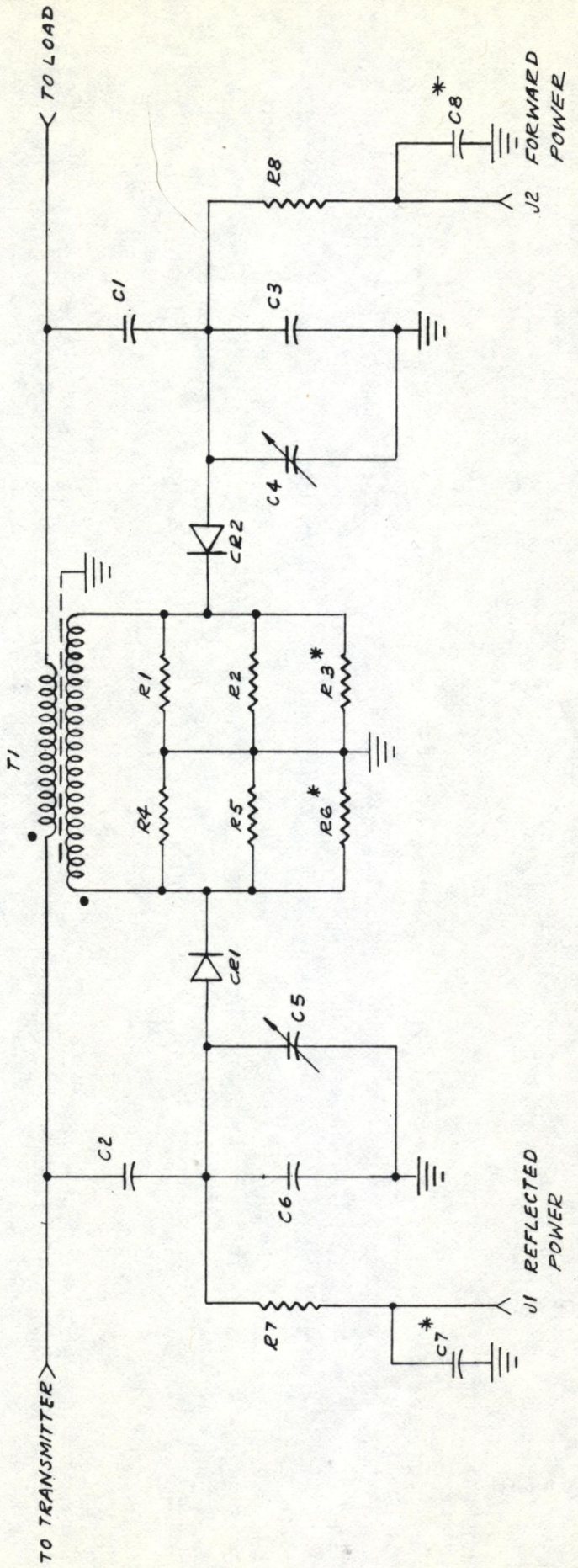
123 Hampshire Street, Quincy, Illinois 62301

Warning, disconnect primary power prior to servicing.

VSWR TRIGGER
5/10/50KW
827 1997 001



NOTE:
* THESE TWO RESISTORS & TWO CAPACITORS USED WITH 50KW UNIT ONLY!

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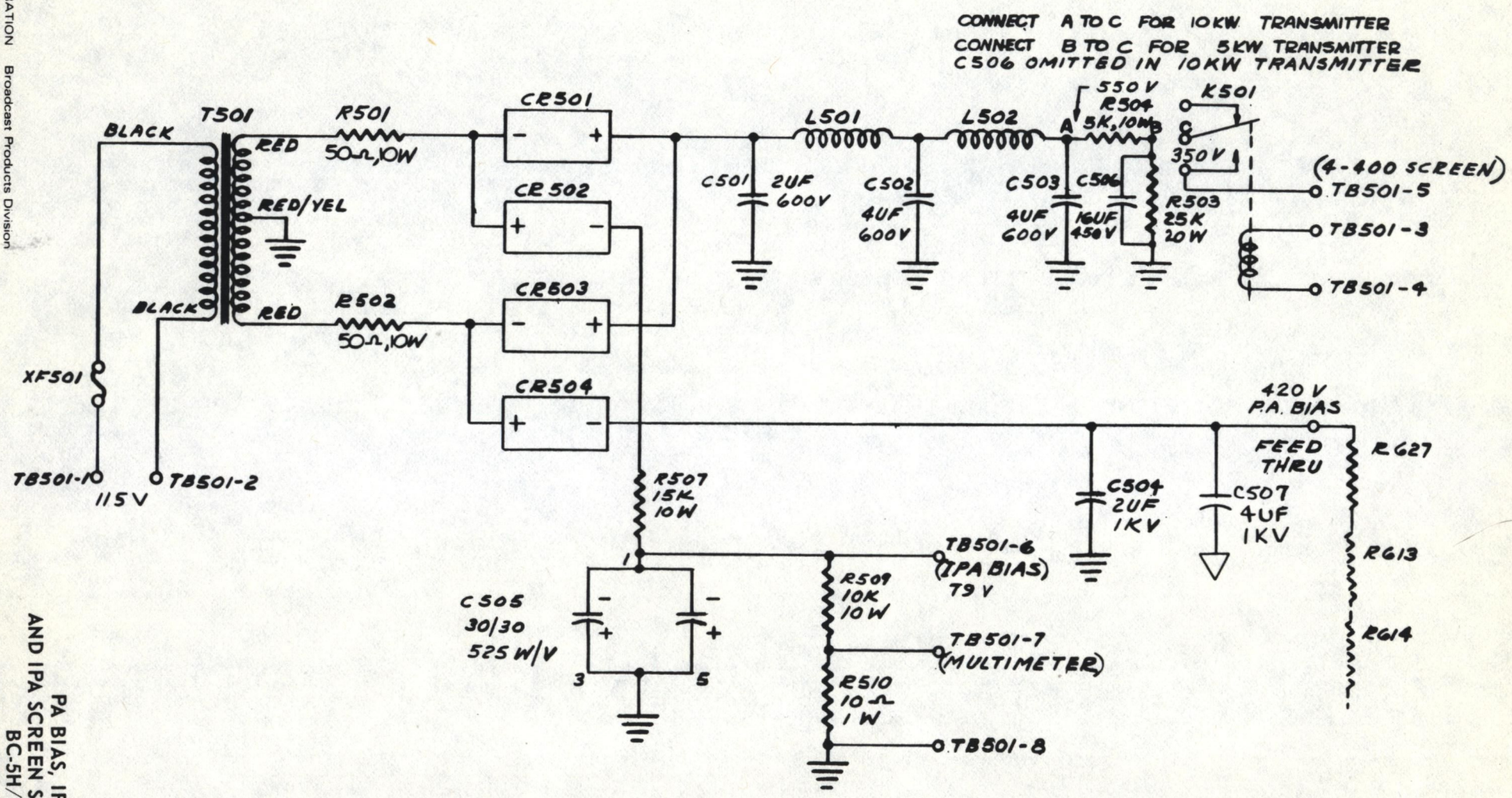
123 Hampshire Street, Quincy, Illinois 62301

DIRECTIONAL WATTMETER
5/10/50KW
827 1998 001

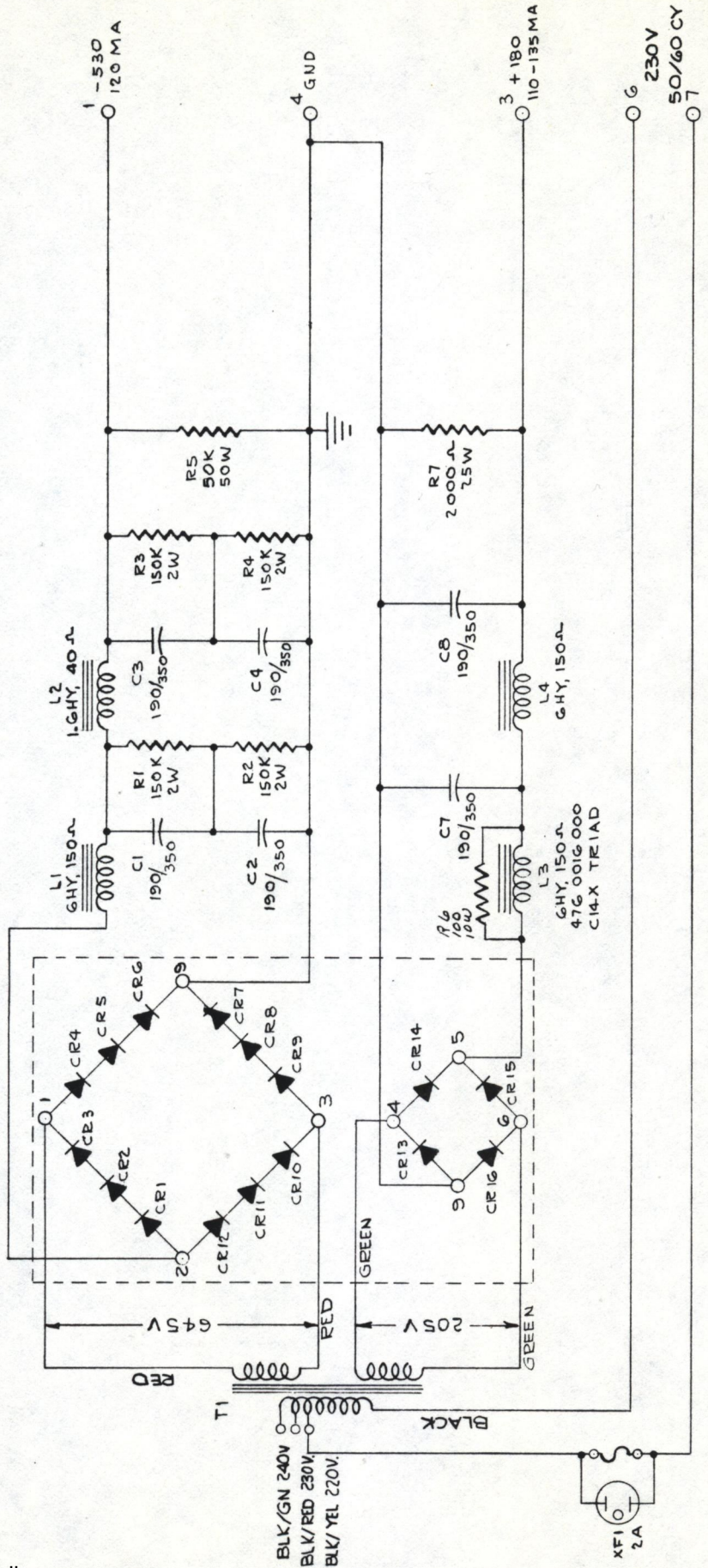
Warning, disconnect primary power prior to servicing.

HARRIS CORPORATION Broadcast Products Division
123 Hampshire Street, Quincy, Illinois 62301



PA BIAS, IPA BIAS AND IPA SCREEN SUPPLY
BC-5H/BC-10H
827 2046 001

NOTE: BIAS VOLTAGES ARE MEASURED WITHOUT RF EXCITATION



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POWER SUPPLY, AUDIO DRIVER
BC-5H/BC-10H
827 3124 001

Warning, disconnect primary power prior to servicing.

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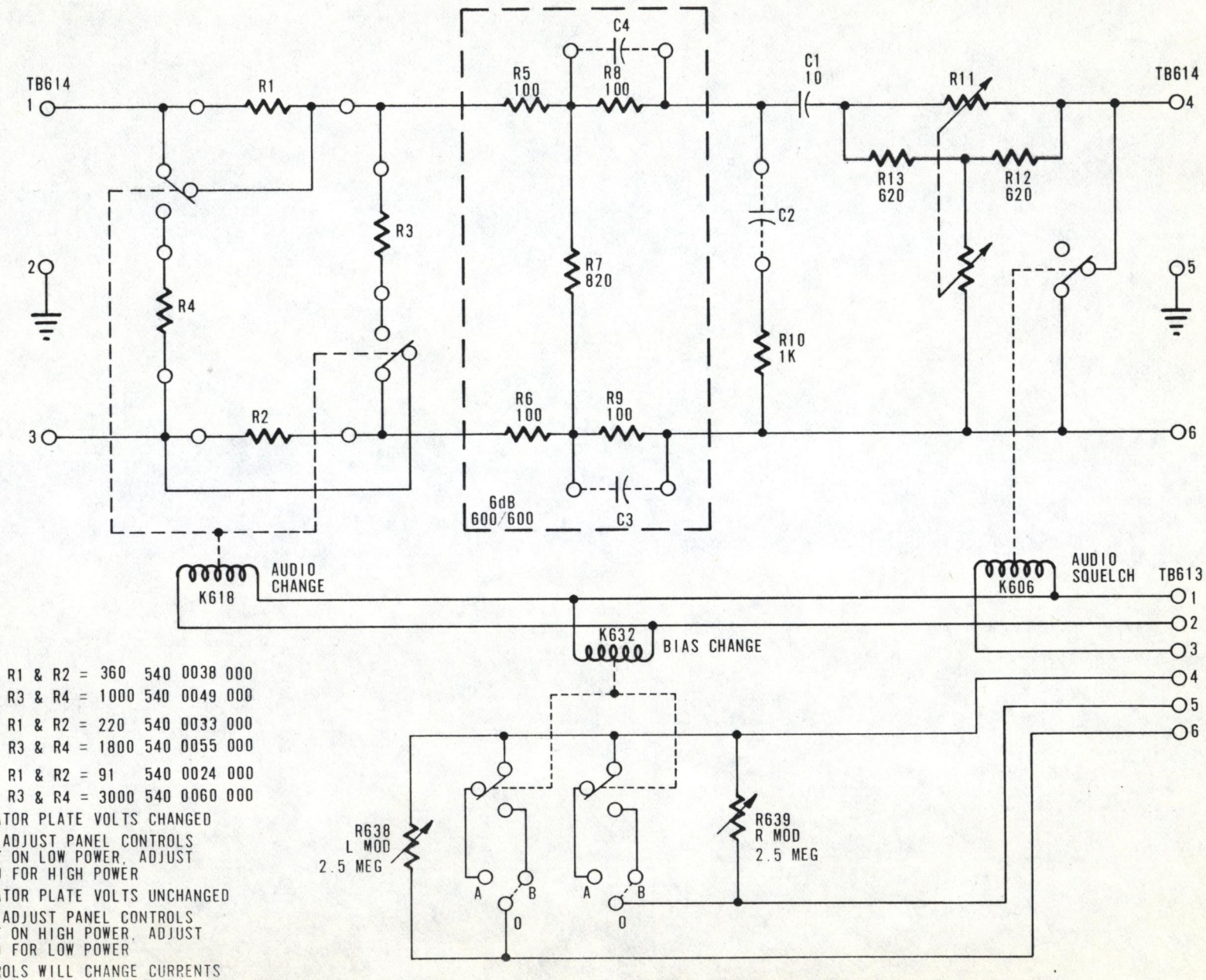
123 Hampshire Street Quincy Illinois 62301

Warning, disconnect primary power prior to servicing.

TO INCREASE HIGH FREQUENCY RESPONSE ADD CONDENSERS C3 & C4 (APPROX .25uF)
TO DECREASE HIGH FREQUENCY RESPONSE ADD CONDENSER C2 (APPROX.01 DISCAP)



FOR 10/1 R1 & R2 = 360 540 0038 000
5/500 R3 & R4 = 1000 540 0049 000
FOR 10/2.5 R1 & R2 = 220 540 0033 000
5/1 R3 & R4 = 1800 540 0055 000
FOR 10/5 R1 & R2 = 91 540 0024 000
5/2.5 R3 & R4 = 3000 540 0060 000

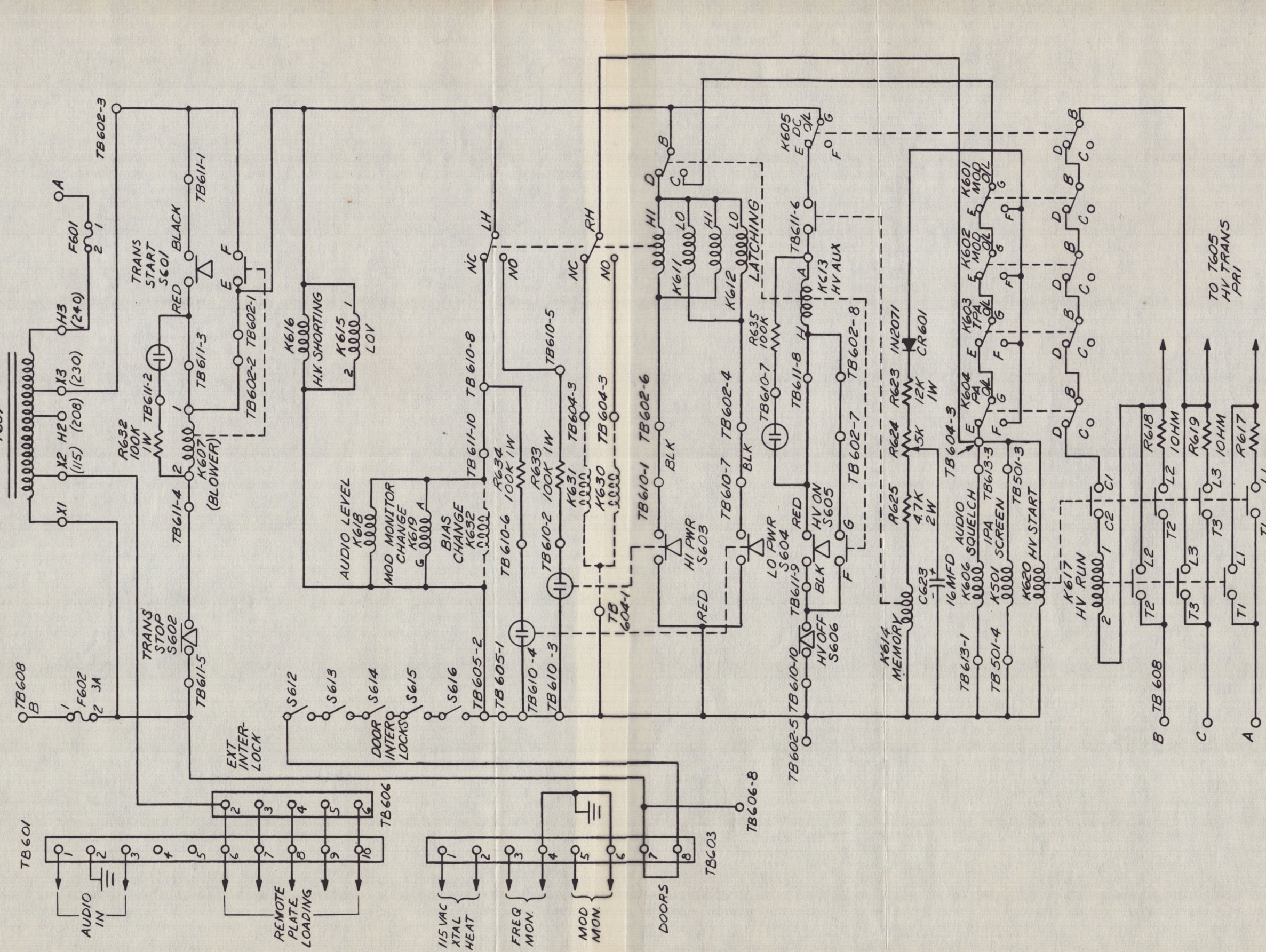
WHEN MODULATOR PLATE VOLTS CHANGED
JUMPER O-B ADJUST PANEL CONTROLS FOR CURRENT ON LOW POWER. ADJUST R638 & R639 FOR HIGH POWER

WHEN MODULATOR PLATE VOLTS UNCHANGED
JUMPER O-A ADJUST PANEL CONTROLS FOR CURRENT ON HIGH POWER. ADJUST R638 & R639 FOR LOW POWER

PANEL CONTROLS WILL CHANGE CURRENTS AT BOTH POWER LEVELS.

AUDIO AND BIAS CHANGE
BC-5H/BC-10H
827 5174 001

C



NOTE: K630 USED ON 10KW TRANSMITTER WHEN USED 10/2.5 KW. JUMPER TB604-2 TO TB604-3

K631 USED ON 10/5 AND 10/1 KW TRANSMITTERS ALONG WITH PLATE TRANSFORMER WITH EXTENDED WINDINGS AND ALSO WITH MODULATOR BIAS CHANGE ASSY

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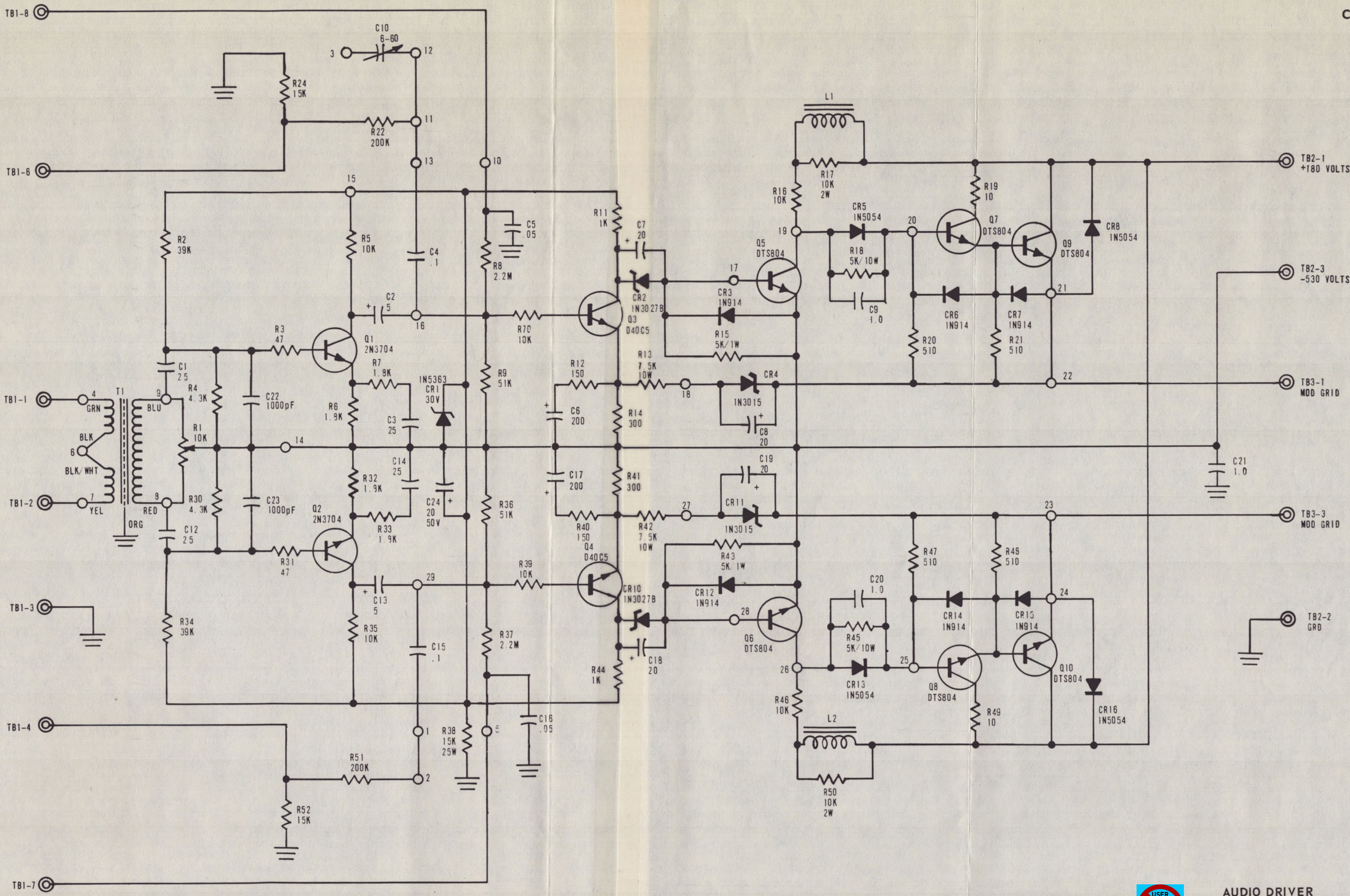
WARNING: Disconnect primary power prior to servicing.

LINE DIAGRAM
CONTROL CIRCUITS
BC-5H/BC-10H
838 2211 001



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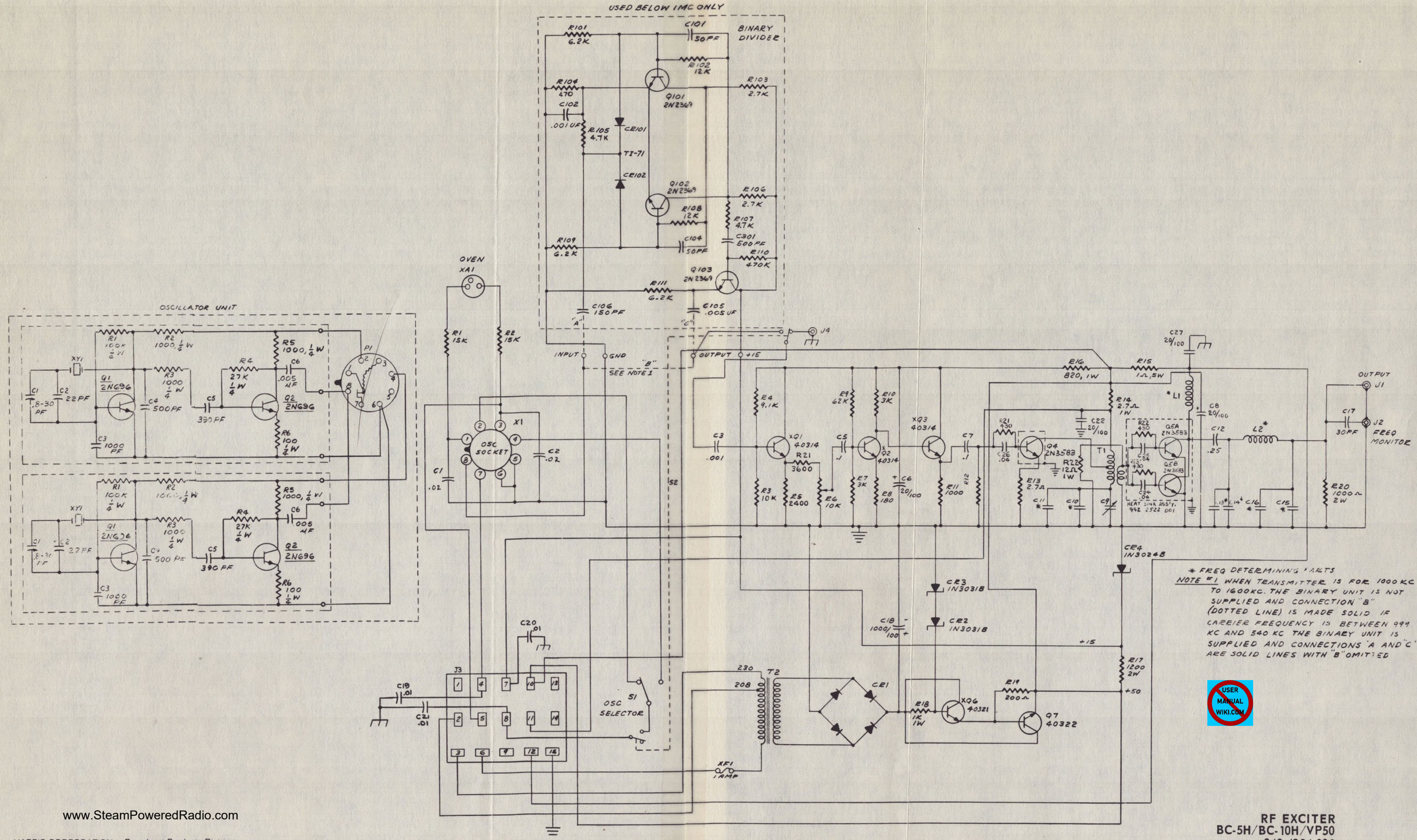
Warning, disconnect primary power prior to servicing.

AUDIO DRIVER
BC-5H/BC-10H
838 6558 001



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Warning, disconnect primary power prior to servicing.

RF EXCITER
BC-5H/BC-10H/VP50
842 4924 001

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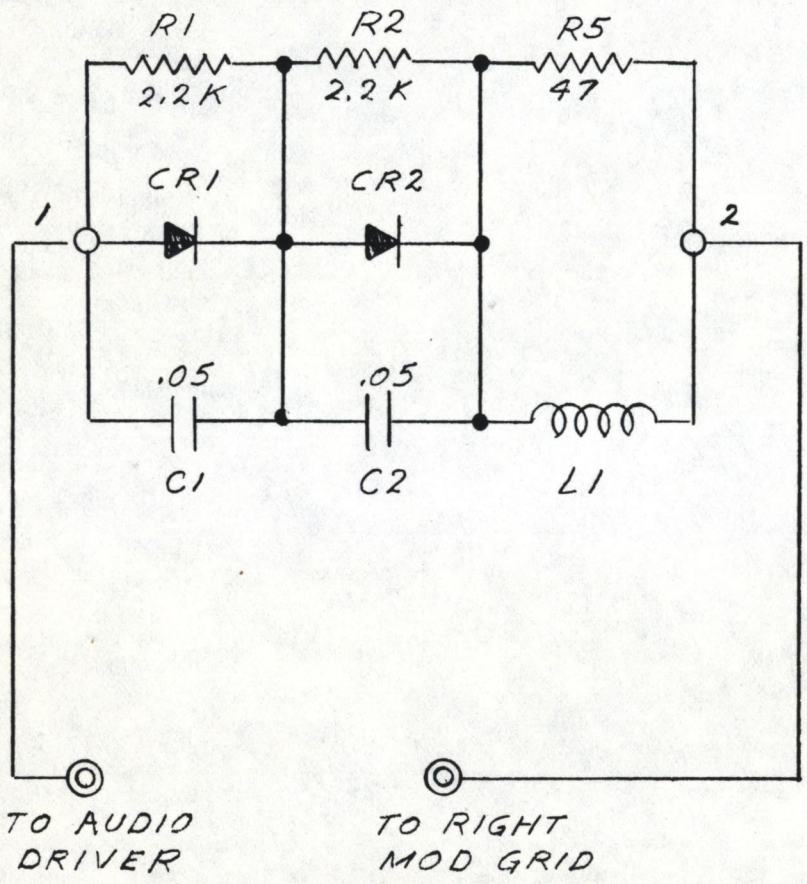
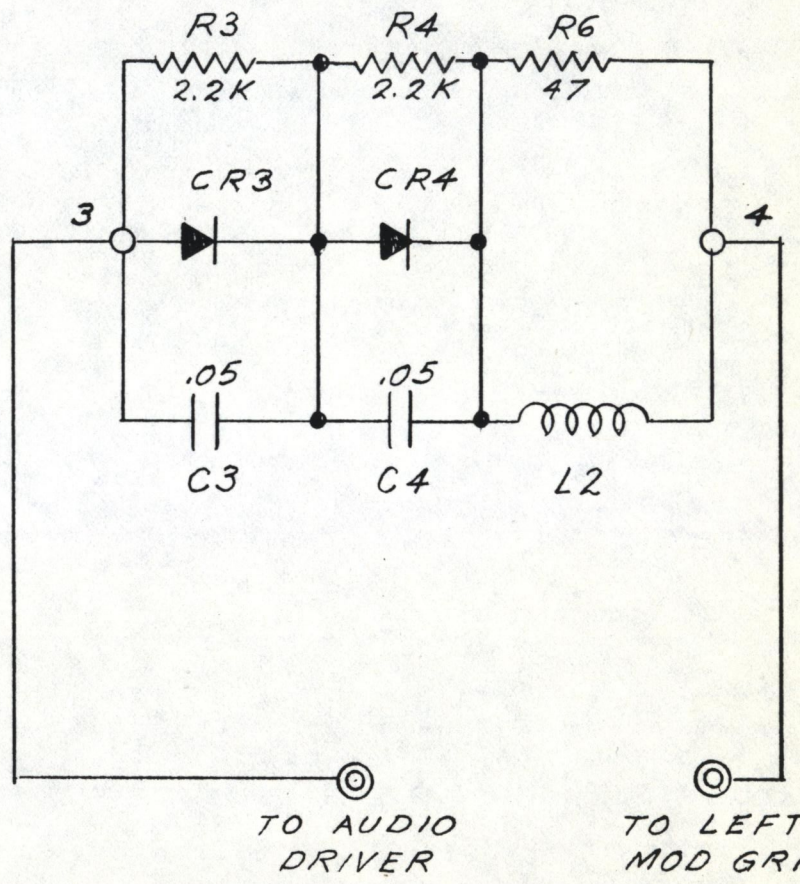
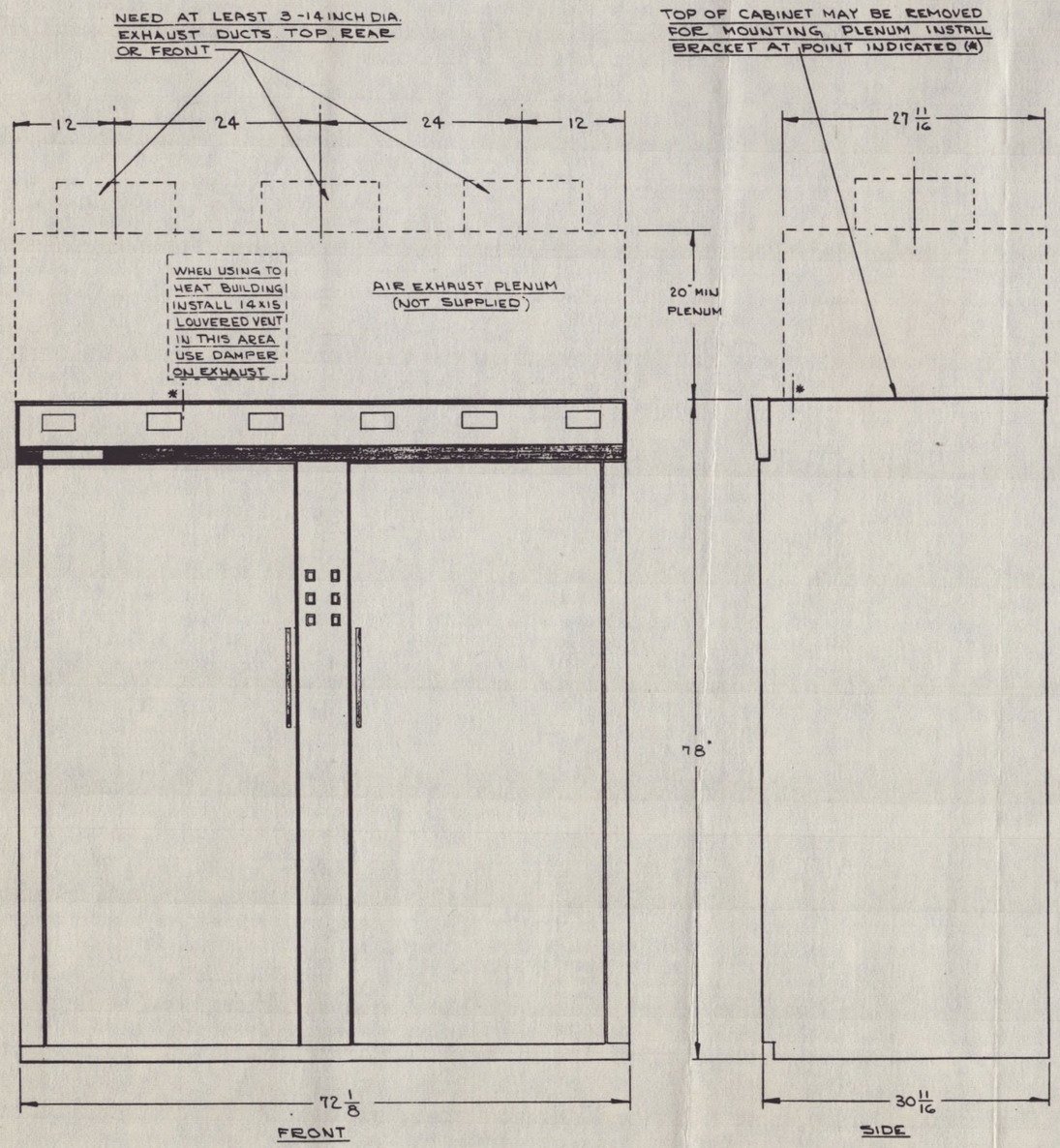
123 Hampshire Street, Quincy, Illinois 62301

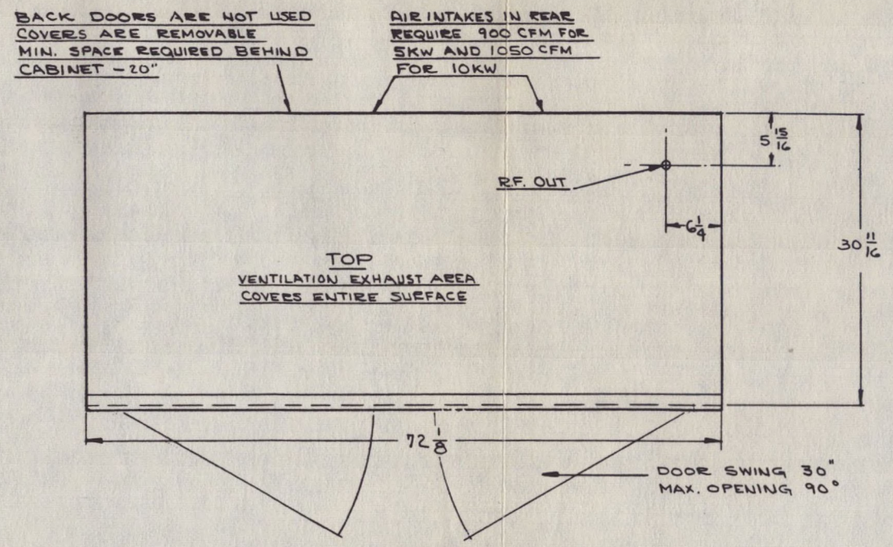
Warning, disconnect primary power prior to servicing.



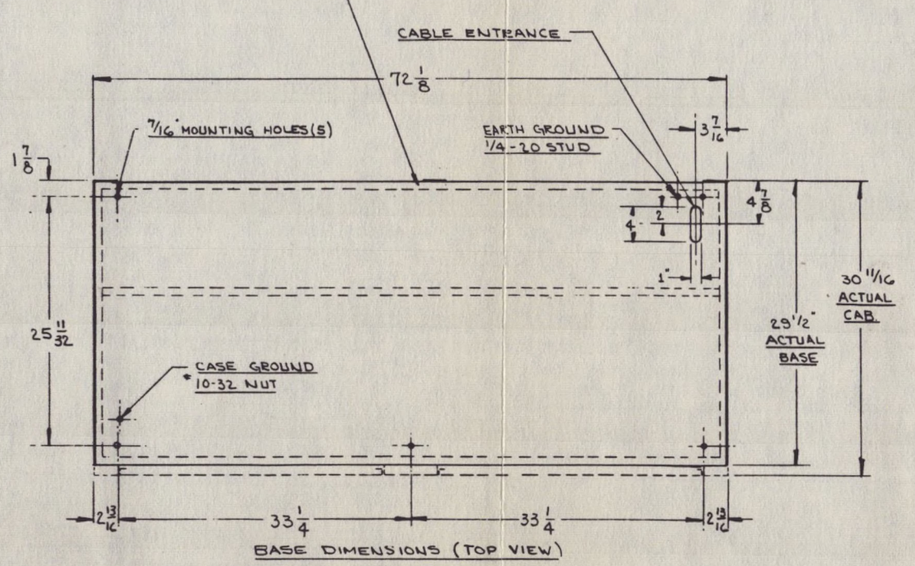


SCHEMATIC DIAGRAM
MODULATOR BOARD
BC-5H/BC-10H
828 0539 001





3100 LB. MAXIMUM WEIGHT IS SPREAD OVER 236 SQ. INCH PERIMETER FLANGE AT 13.13 LBS. PSI. BASE COMPONENTS WEIGHT CAUSES UNEVEN CENTER OF GRAVITY WHICH INCREASES LOAD IN SOME AREAS TO 28 LBS PSI.



NOTES:
AIR FILTERS
5KW - 2-15X15 PERMANENT (WASHABLE) METALLIC
10KW - 2-10X15 AND 1-15X15 PERMANENT (WASHABLE) METALLIC
THICKNESS 2" BOTH UNITS

DIMENSIONS AND INSTALLATION INFORMATION
BC-5H/BC-10H
842 5172 001

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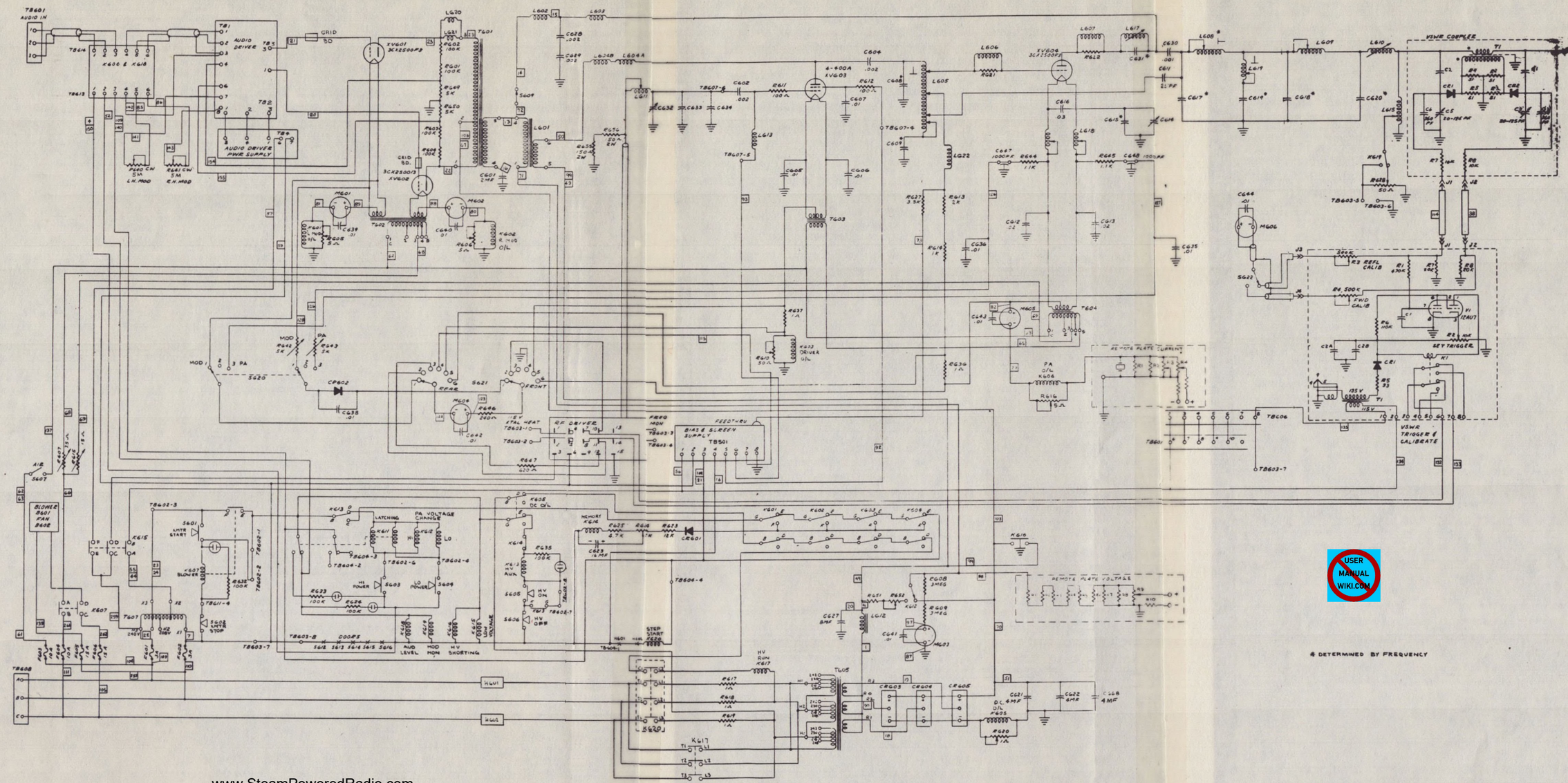
123 Hampshire Street, Quincy, Illinois 62301

Warning, disconnect primary power prior to servicing.



GATES DIVISION
HARRIS-INTERTYPE CORPORATION
123 HAMPSHIRE STREET · QUINCY, ILLINOIS 62301 U.S.A.

Warning, disconnect primary power prior to servicing.

OVERALL SCHEMATIC
BC-5H, AM TRANSMITTER
852 6196 001