(USAF) T.O. 31R2-2GRT3-2

FORMERLY AN16-30GRT3-2

(NAVY) AN16-30GRT3-2

HANDBOOK

SERVICE INSTRUCTIONS

RADIO TRANSMITTING SET AN/GRT-3

(RADIO RECEPTOR CO., INC.)

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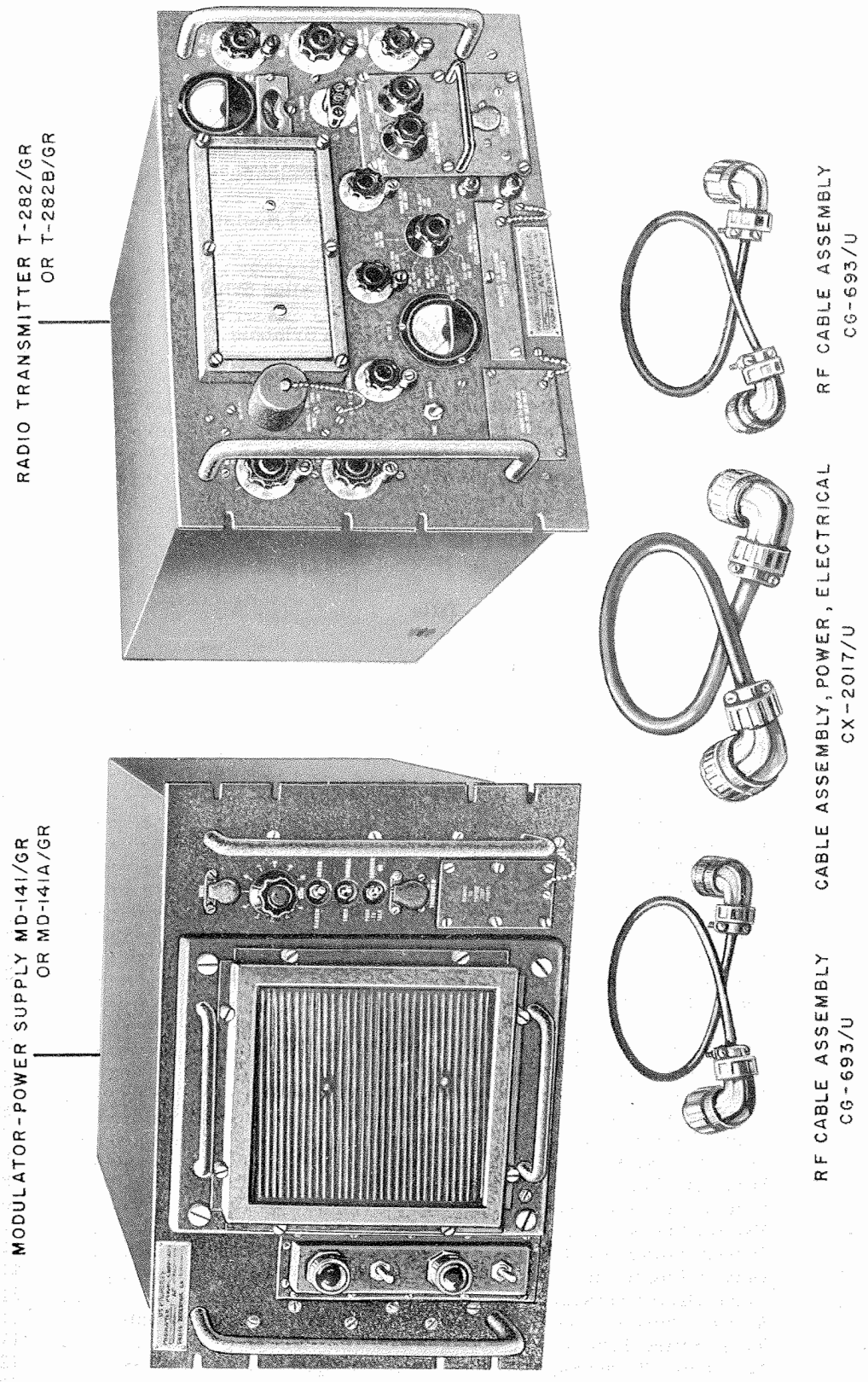

Figure 1-1. Radio Transmitter, Modulator-Power Supply, and Interconnecting Cables

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. GENERAL.

1-2. This Handbook of Service Instructions describes Radio Transmitting Set AN/GRT-3, which includes Radio Transmitter T-282/GR (or T-282B/GR or T-282C/GR or T-604A) and Modulator-Power supply MD-141/GR (or MD-141A/GR). Government furnished Equipment includes a mounting rack, an antenna system, crystals, a microphone, a headphone set, and cable assemblies. In addition to the information contained in this handbook, more data is available in the Handbook of Operating Instructions, the Handbook of Overhaul Instructions and the Parts Catalog for this equipment.

1-3. PURPOSE. Radio Transmitter T-282/GR (or T-282B/GR or T-282C/GR or T-604A) is a single channel ground UHF (ultra high frequency) transmitter which covers the frequency range from 225 mc (megacycles) to 399.9 mc. It is designed for single channel operation, and can be used for transmission of either voice or tone amplitude modulated signals. It is intended for installation in control towers and airway stations of the USAF.

1-4. LIMITATIONS. When used with Radio Receiver R-361/GR, or an equivalent receiver, the transmitter is capable of establishing two-way communication with aircraft equipped with Radio Set AN/ARC-33, or similar airborne radio sets. It may also be used for two-way communication with other uhf ground communication radio sets.

1-5. DIFFERENCE IN MODELS. Radio Transmitter T-282/GR is identical to Radio Transmitter T-282B/GR, with the exception of minor electrical differences as noted herein. All references to Modulator-Power Supply MD-141/GR are also applicable to Modulator-Power Supply MD-141A/GR, with the exception of the duty cycle (determined by transformer T202). Modulator-Power Supply MD-141A/GR may be operated continuously at temperatures ranging from -29°C (-20°F) to +55°C (+131°F). Modulator-Power Supply MD-141/GR must be operated intermittently (ratio of "carrier on" to "carrier off" of one minute to five minutes, at temperatures exceeding +30°C (+86°F).

CAUTION

Modulator-Power Supply MD-141/GR may be permanently damaged if it is operated continuously at temperatures above +30°C (+86°F).

Radio Transmitter T-604A is similar to Radio Transmitter T-282C/GR except for cabinet finish and the addition of one resistor (R827). A 2800-ohm 5-watt resistor, located between terminal 8 and terminal 3 of the Push-To-Talk Relay, is included in the T-604A. Radio Transmitters T-282/GR, T-282B/GR, and T-282C/GR do not incorporate R827 in their respective circuits.

1-6. REFERENCE SYMBOL DESIGNATIONS. Reference symbol designations have been assigned to all electrical parts used in this equipment. Where a reference symbol designation enclosed in parentheses follows another in the text, the parenthetic one is that used on units manufactured by an alternate supplier.

1-7. BRIEF THEORY OF OPERATION. The transmitter is a single channel crystal-controlled unit capable of supplying 100 watts into a 52-ohm load. The transmitter circuitry consists of a crystal-controlled oscillator, frequency multipliers, buffer amplifier, power amplifier, and monitoring facilities. An antenna change-over relay, receiver muting, and push-to-talk voice operation are also provided.

1-8. The modulator-power supply consists of a modulator and power supply in one integral unit. The modulator has provisions for a 50-ohm or 600-ohm input impedance. The 50-ohm input impedance is for local operation using a T-17 or similar type carbon microphone; the 600-ohm input impedance is used for remote operation over a 600-ohm line or for remote emergency voice operation using up to five miles of Field Wire W-110-B, or equal. Audio amplifiers are used to amplify the incoming signal to the desired level for modulating the power amplifier in the transmitter. Automatic modulation limiting maintains the average modulation at a high level. The power supply provides high and low d-c voltages as well as bias and filament voltages for the modulator and transmitter. Protective relays and fuses have been provided to prevent damage to the equipment.

1-9. FREQUENCY RANGE. The equipment will operate over a frequency range of 225 mc to 399.9 mc, inclusive.

1-10. TUNING. The transmitter can be tuned to any frequency in the uhf band, extending from 225 to 399.9 mc, inclusive. Individual channels are spaced 100 kc (kilocycles) apart. Tuning is accomplished by changing the oscillator crystal and retuning the r-f (radio frequency) circuits. See the applicable Handbook of Operating Instructions.

1-11. CRYSTAL. The oscillator crystal is a CR-27/U type, operated in a thermostatically controlled crystal oven. The crystal frequency is determined as follows:

$$\text{crystal frequency} = \frac{\text{operating frequency}}{36}$$

1-12. ANTENNA COUPLING. The antenna coupling circuit is unbalanced, one side being grounded. It is designed to work into a 52-ohm transmission line of the coaxial type.

1-13. POWER OUTPUT. The nominal power output of the transmitter's r-f carrier (without modulation) is 100 watts into a 52-ohm non-inductive load. The carrier is amplitude voice or tone modulated.

1-14. MODULATION. An audio signal input of 45 decibels below one milliwatt is sufficient to permit 95-percent modulation. Automatic modulation limiting is provided to keep the modulation at approximately 95 percent when changes in input level to the microphone or telephone line vary up to 20 db (decibels).

1-15. AUDIO RESPONSE. The audio frequency response of the equipment, for broad band transmission, does not vary more than 4 db between 200 and 20,000

TABLE 1-1. POWER INPUT REQUIREMENTS

Voltage Supply	120 W, 95 Percent Modulated Carrier			Carrier Off		
	Amperes	Watts	Power Factor	Amperes	Watts	Power Factor
115	12.5	1250	0.87	3.4	380	0.97
230	6.25	1250	0.87	1.7	380	0.97

cps (cycles per second). When using narrow band transmission, the response is down less than 5 db at 400 cps and 3,000 cps, with 1,000 cps as reference level, and down a minimum of 10 db at 200 cps and 5,000 cps.

1-16. AUDIO DISTORTION. The audio distortion does not exceed 10 percent when: the r-f carrier is modulated 95 percent; the audio input signals are between 200 and 20,000 cps; the audio input level is 45 db below one milliwatt; and the automatic modulation limiting circuit is in operation.

1-17. MONITORING. The power output and percentage modulation of the equipment may be checked on a calibrated meter. Side tone output permits the operator to aurally monitor the audio component of the transmitted signal.

1-18. REMOTE OPERATION. The equipment may be operated over a Field Wire W-110-B, or equal, up to five miles long, terminated in a T-17 microphone, or other suitable line termination equipment.

1-19. VOLTAGE SUPPLY. This equipment will operate on either of the following a-c voltage supplies: 105 to 125 V, single phase, operating at 50 to 60 cps; or, 210 to 250 V, single phase, operating at 50 to 60 cps.

1-20. FILAMENT VOLTAGE. All tubes in this equipment are operated from secondary windings of transformers within the transmitter and the modulator-power supply. A pair of 2.5-volt windings supply four of the rectifier tube filaments and a third 5-volt winding supplies filament voltage for a fifth rectifier tube. All other tubes are operated from 6.0 and 6.3-volt windings.

1-21. POWER REQUIREMENT. Table 1-1 is a summary of the power input requirements, with the "BUCK-BOOST" switch, on the rear of the modulator-power supply, turned to the "BOOST" position.

1-22. TEMPERATURE RANGE. This equipment will

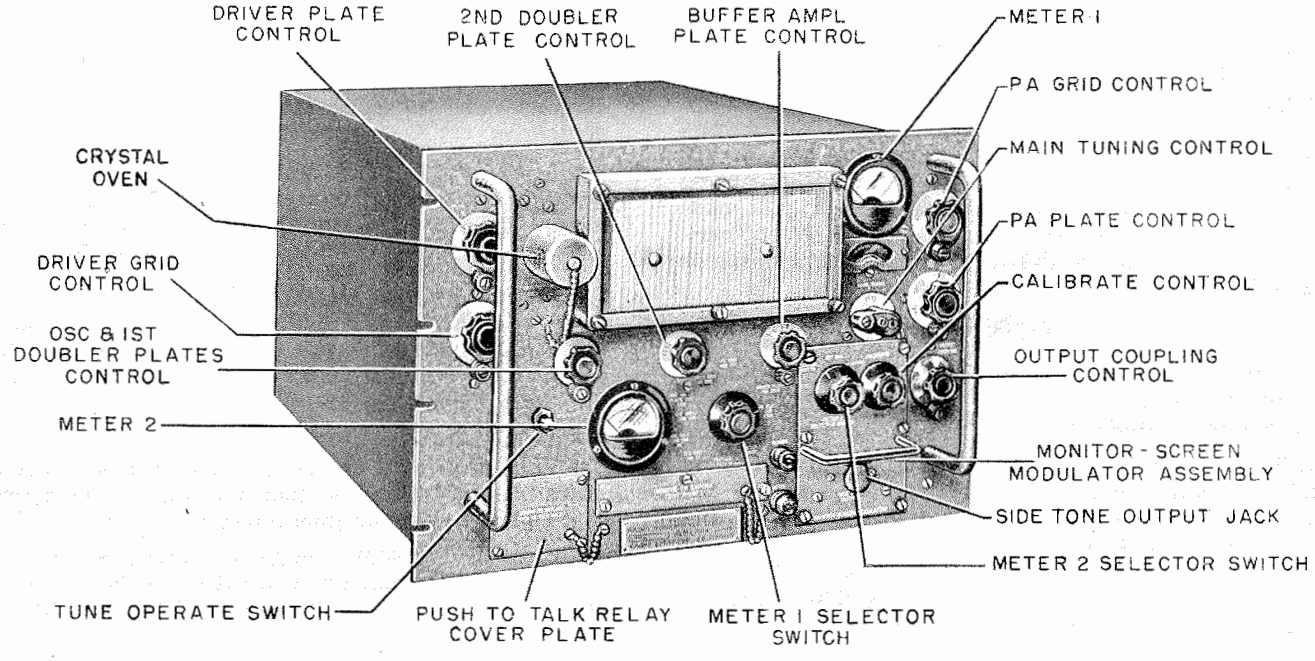

Figure 1-2. Radio Transmitter, Front Panel

operate satisfactorily on continuous duty at temperatures ranging from -29°C (-20°F) to +55 C (+131 F), except as noted in paragraph 1-6.

1-23. STABILITY. The over-all frequency stability for the entire frequency range is ±10 kc.

1-24. WARM-UP PERIOD. The equipment will be ready for operation five minutes after it is turned on and should be within 10 kc of the required frequency after twenty minutes.

1-25. TUBE COMPLEMENT. Table 1-2 lists all tubes used in the transmitter. Table 1-3 lists all tubes used in the modulator-power supply.

1-26. Table 1-4 lists all fuses used in the transmitter. Table 1-5 lists all fuses used in the modulator-power supply.

1-27. OPERATING AND ADJUSTMENT CONTROLS. Tables 1-6 and 1-7 list the various front and rear panel controls and adjustment points of the transmitter and modulator-power supply (figures 1-2 through 1-4).

TABLE 1-2. TUBE COMPLEMENT OF RADIO TRANSMITTER T-282/GR, AND T-282C/GR

Quantity	JAN Type Number T-282/GR	JAN Type Number T-282C/GR	Reference Symbol	Function
1	6AH6	6AH6	V601	Oscillator-tripler
1	5763	5763	V602	First doubler
1	5763	5763	V603	Second doubler
1	5763	5763	V706	Screen modulator
1	832A	832A	V604	Buffer amplifier
1	4X150A	4X150A	V901	Tripler-driver
2	4X150A	4X150A	V902	Power amplifier
			V903	Power amplifier
1	12AT7	12AT7WA	V701A	Side-tone amplifier
			V701B	Modulation monitor amplifier
1	12AX7	5751	V702A	Modulation monitor amplifier
			V702B	Modulation monitor rectifier
3	0B2	0B2WA	V703	Voltage regulator
			V704	Voltage regulator
			V705	Voltage regulator

TABLE 1-3. TUBE COMPLEMENT OF MODULATOR-POWER SUPPLY

Quantity	JAN Type Number	Reference Symbol	Function
1	6C4	V301	Narrow band amplifier
1	12AX7	V302	Phase inverter
2	6BA6	V303	Audio frequency amplifier
		V304	Audio frequency amplifier
2	6AQ5	V305	Modulator driver
		V306	Modulator driver
2	811-A	V201	Modulator
	or	V202	Modulator
	811		
1	6AL5W	V203	Automatic modulator limiter
1	5R4WGY	V105	Bias voltage rectifier
2	3B28	V101	High voltage rectifier
		V102	High voltage rectifier
2	3B28	V103	Low voltage rectifier
		V104	Low voltage rectifier

TABLE 1-4. FUSE COMPLEMENT OF RADIO TRANSMITTER T-282/GR AND T-282C/GR

Quantity	Bussman Type	Rating	Reference Symbol	Function
1	MJB	1/100 amp, 250 V (T-282/GR) 1/32 amp, 250V (T-282C/GR)	F801	"METER 1" protection
1	MDL	Slow-Blow, 1 amp, 250 V	F803	B801 blower motor protection
2	MJW	1/16 amp, 250 V	F901	V901 screen protection
			F902	V902, V903 screen protection

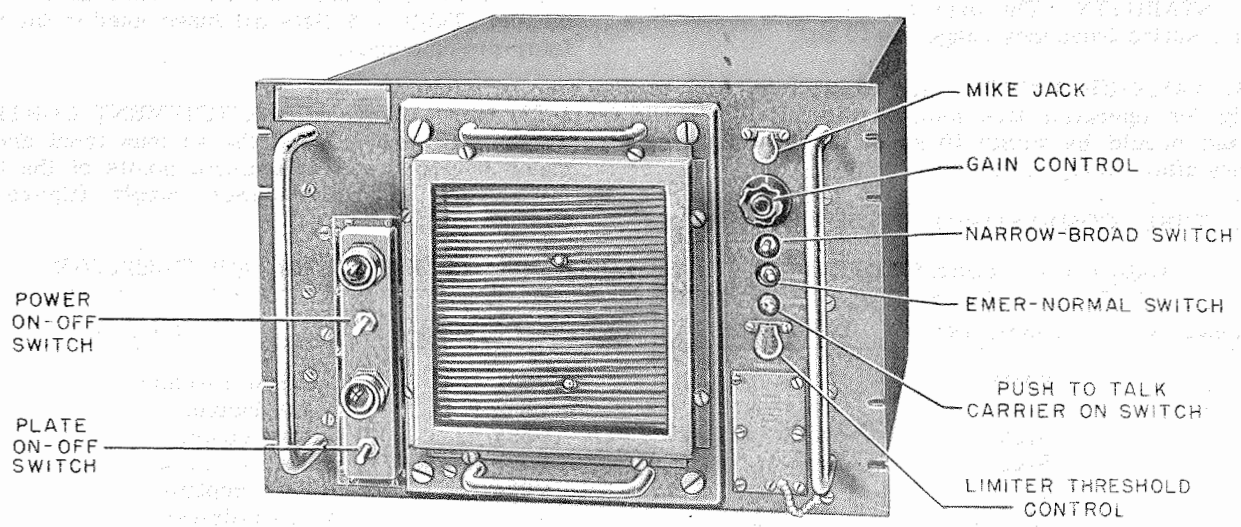

Figure 1-3. Modulator-Power Supply, Front Panel

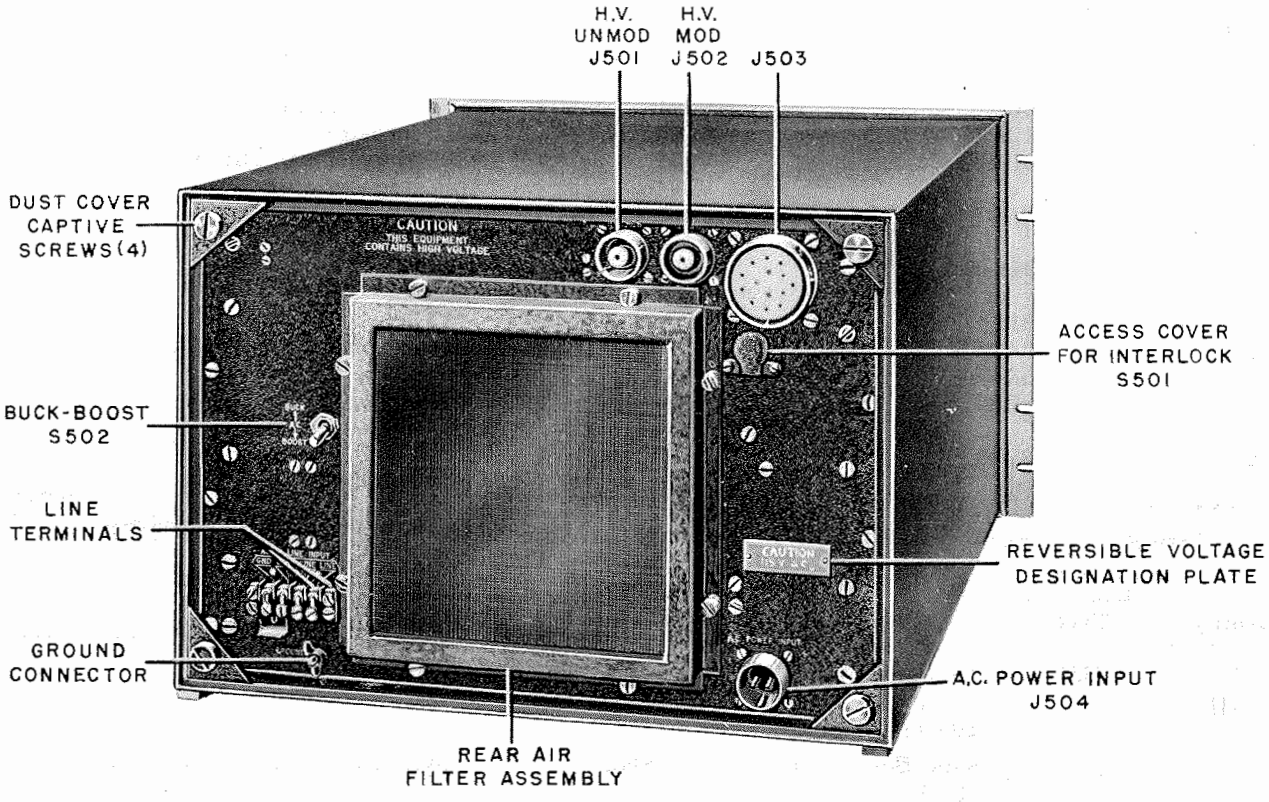

Figure 1-4. Modulator-Power Supply, Rear View

TABLE 1-5. FUSE COMPLEMENT OF MODULATOR-POWER SUPPLY

Quantity	Bussman Type	Rating	Reference Symbol	Function
2	MDL	Slow-Blow, 1 amp, 250 V	F101 F103	B401 blower motor protection Low voltage power supply protection
2	MTH	8 amp, 250 V	F102 F201	High voltage power supply protection 230 V supply line
1	AGC	3 amp, 250 V	F104	Filament and bias supply protection
1	ABC	15 amp, 250 V	F202	115 V supply line

TABLE 1-6. CONTROLS OF RADIO TRANSMITTER

Name	Function
METER 1 SELECTOR SWITCH	Selects circuit to be metered
METER 2 SELECTOR SWITCH	Selects power output or percentage modulation indication
METER 1	Indicates plate and grid currents
METER 2	Indicates power output or percent modulation
CALIBRATE	Control to calibrate "METER 2" before reading percent modulation
SIDE TONE OUTPUT	Jack to connect headset plug for monitoring transmission
TUNE-OPERATE	Switch to reduce power output
MAIN TUNING	Tuning control
DRIVER PLATE	Tuning control
DRIVER GRID	Tuning control
OSC & 1st DOUBLER PLATES	Tuning control
2nd DOUBLER PLATE	Tuning control
BUFFER AMPL PLATE	Tuning control
PA GRID	Tuning control
PA PLATE	Tuning control
OUTPUT COUPLING	Tuning control

TABLE 1-7. CONTROLS OF MODULATOR-POWER SUPPLY

Name	Function
POWER ON-OFF	Turns power on and off
PLATE ON-OFF	Turns plate voltage on and off
MIKE	Jack to insert microphone plug
GAIN	Controls audio gain

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TABLE 1-7. CONTROLS OF MODULATOR-POWER SUPPLY (CONT)

Name	Function
NARROW-BROAD	Switches narrow band amplifier in or out
EMER-NORMAL	Switches connections on line input transformer
PUSH TO TALK-CARRIER ON	Switch to keep carrier on or to permit control with microphone switch
LIMITER THRESHOLD	Controls modulation limiting
BUCK-BOOST	Switch to increase or decrease voltage supplied to primary of all power transformers

SECTION II

SPECIAL TEST EQUIPMENT AND SPECIAL TOOLS

2-1. SPECIAL TOOLS.

2-2. No special tools are required for the maintenance of this equipment.

2-3. SPECIAL TEST EQUIPMENT.

2-4. SPECIAL 4-MC TRANSFORMER ASSEMBLY. (See figure 2-1.) The special 4-mc transformer assembly is required when adjusting the transmitter for optimum modulation linearity. The secondary circuit of the assembly is tuned to the beat note (difference frequency) between the output of the transmitter and an r-f signal generator; the signal generator is tuned to a frequency, differing from that of the transmitter, by approximately 4 mc (special assembly tuning slug at approximately mid-adjustment point). Figure 2-1 includes the schematic diagram of the assembly as well as construction details and material requirements.

2-5. SPECIAL CRYSTALS. Four type CR-27/U crystals are required for testing and aligning the transmitter. The frequency of the crystals and the resultant transmitter output frequency is given in Table 2-1.

TABLE 2-1. SPECIAL CRYSTALS

Crystal Frequency (in Mc)	Transmitter frequency (in Mc)
6.06	218
6.25	225
7.00	252
11.11	400
11.39	410

2-6. CABLE FABRICATION.

2-7. Three specially fabricated cables are required to interconnect the transmitter and modulator-power supply for test purposes. They are similar in construction to the cables furnished with the equipment. Their extra length permits the transmitter and modulator-power supply to be moved, as required, while trouble shooting the equipment on a work bench. A set of special cables includes one special power cable assembly (paragraph 2-8) and two special r-f cable-assemblies (paragraph 2-9).

2-8. SPECIAL POWER CABLE ASSEMBLY. (See figure 2-2.) The illustration gives fabrication instructions and material requirements for a cable to replace Power Cable Assembly CX-2017/U. One such cable is required.

2-9. SPECIAL R-F CABLE ASSEMBLY. (See figure 2-3.) The illustration gives fabrication instructions and material requirements for cables to replace R-F Cable Assemblies CG-693/U. Two identical cables are required. One cable interconnects the "HV MOD" connectors and the other cable interconnects the "HV UNMOD" connectors on the rear of the transmitter and modulator-power supply units.

2-10. STANDARD TEST EQUIPMENT.

2-11. Table 2-2 lists the test equipment recommended for trouble shooting, preventive maintenance, and adjustments.

TABLE 2-2. TEST EQUIPMENT RECOMMENDED FOR MAINTENANCE

Fig. No.	Name	Mfr Designation	Alternate	Application
5-6, 6-1	Audio Oscillator	Hewlett-Packard Model 200	Sylvania No. 145	Check modulator chassis
6-1, 6-4	A-C Voltmeter	General Electric No. AP-9	Triplett No. 630	Measure line voltage input
6-1, 6-4	Wattmeter	General Electric No. AP-9	Weston No. 432	Measure power input
6-1, 6-4	Variac	Superior Elec. Power-stat Type 1226	General Radio Type V-20HM	Vary input voltage
6-2	Cathode Ray Oscilloscope	Dumont No. 303	RCA WO-79A	Check modulation
5-6	Tube Tester	Hickock Model 536	Sylvania Type 220	Check tubes
5-6, 6-1	Multimeter	Triplett Model 630-A	Simpson Model 260	Output indication, voltage and resistance measurements

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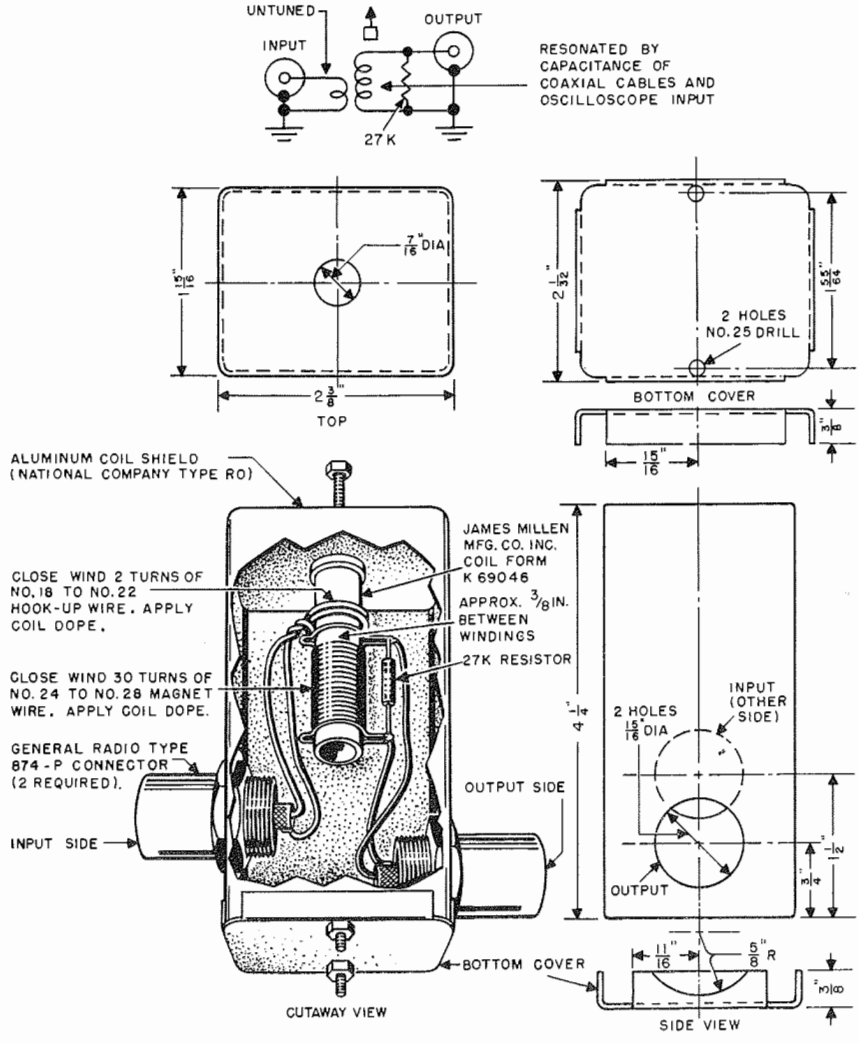
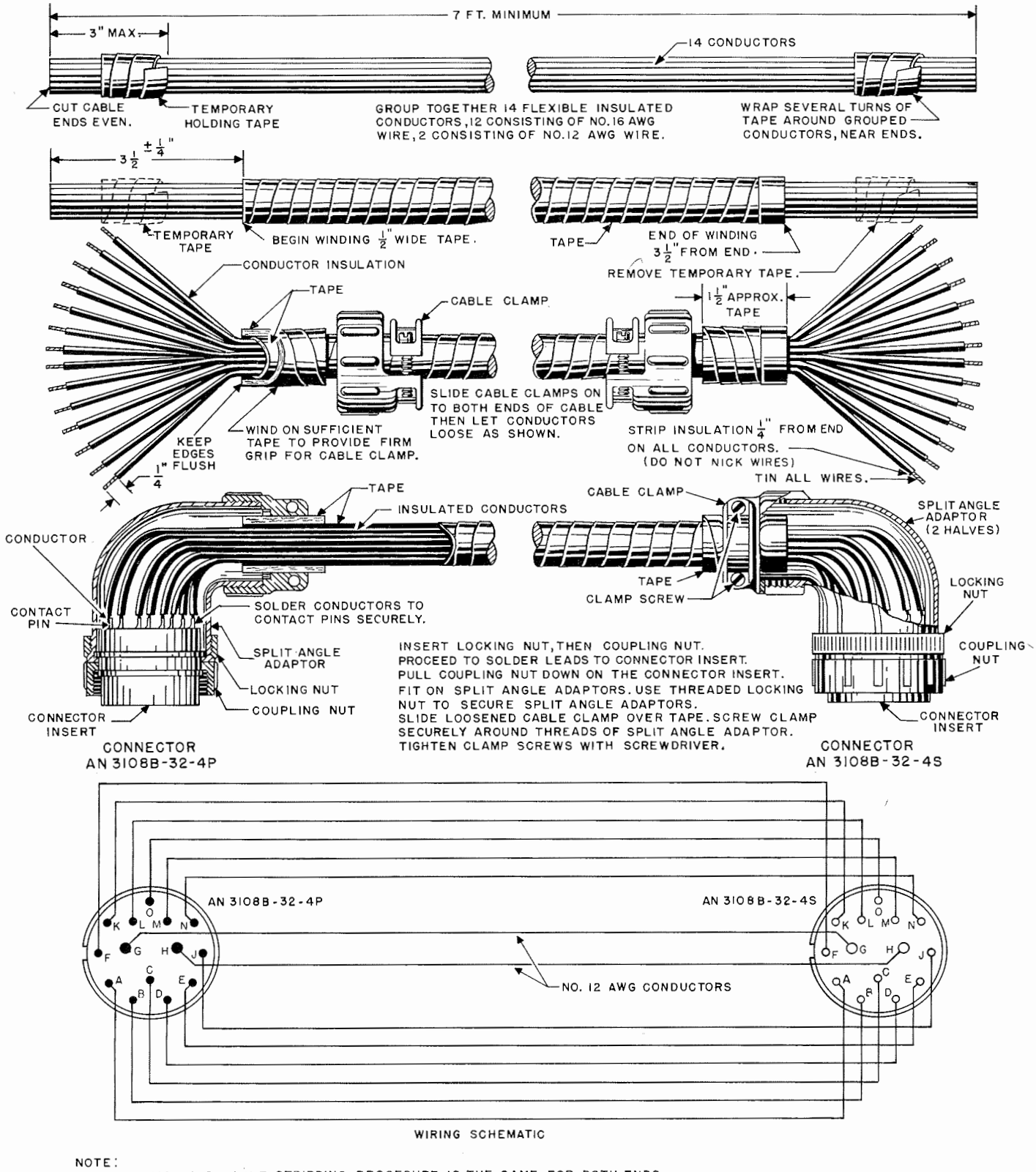


Figure 2-1. Special 4-Mc Transformer Assembly



NOTE:
ASSEMBLY AND CABLE STRIPPING PROCEDURE IS THE SAME FOR BOTH ENDS.

Figure 2-2. Special Power Cable Assembly

TABLE 2-2. TEST EQUIPMENT RECOMMENDED FOR MAINTENANCE (CONT)

Fig. No.	Name	Mfr Designation	Alternate	Application
6-1	Vacuum Tube Voltmeter	Hewlett-Packard Model 410B	General Radio Type 1800-A	Measure a-c, d-c, and r-f voltages
6-1, 6-3	Frequency Meter	BC221		Check frequency
6-1	Distortion Analyzer	Hewlett-Packard Model 330B	General Radio Type 736-A	Measure audio distortion
5-6, 6-1	Dummy Antenna	M.C. Jones Model 631	Bird Electronic Corp, Termaline Coaxial Resistor, Model 82	Dummy antenna
5-6, 6-1	A-C Vacuum Tube Voltmeter	Ballantine Model 300	Hewlett-Packard Model 400C	Check percentage modulation
6-2	Mixer Rectifier	General Radio Type 874-MR		Convert carrier to 4 mc.
6-2	Adapter (two required)	General Radio Type 841-Q1		For r-f connector interconnection.

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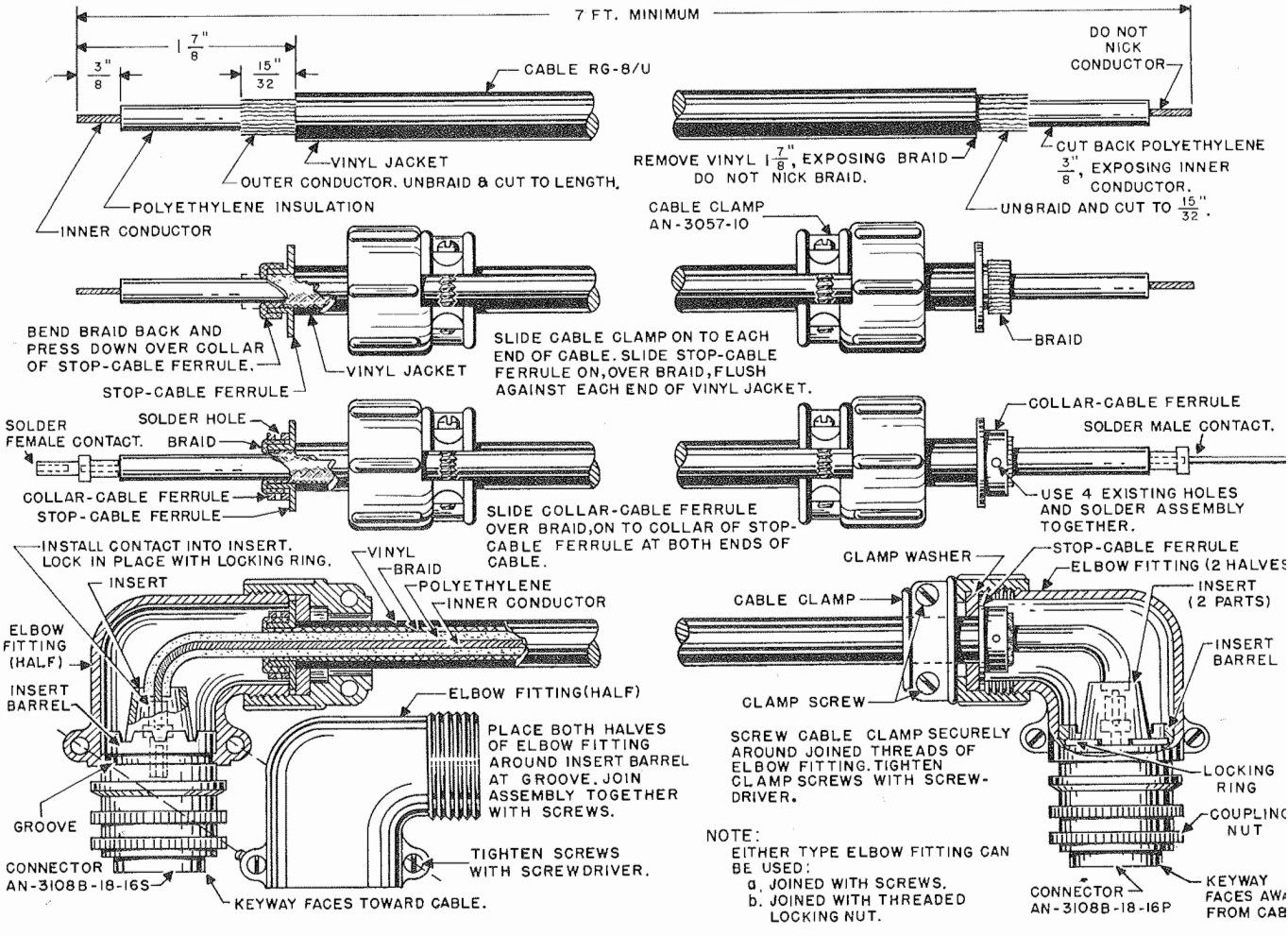


Figure 2-3. Special R-F Cable Assembly

TABLE 2-2. TEST EQUIPMENT RECOMMENDED FOR MAINTENANCE (CONT)

Fig. No.	Name	Mfr Designation	Alternate	Application
6-2	Adapter	JAN type UG-29B/U	JAN type UG-29A/U	For r-f connector interconnection.
6-2	Signal Generator	Hewlett-Packard Model 608-A	Measurements Corp. No. 80	Check modulation.
5-6, 6-1	Power Output Indicator	M. C. Jones Electronic Micromatch Model MM 562		Power output indicator.
6-1	Power Output Indicator	M. C. Jones Electronic Micromatch Model MM 560		Measure exciter r-f power output
6-2	Patch Cord	General Radio Type 874-R32		Interconnecting cable for modulation check.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. SELECTING AN OPERATING SITE.

3-2. Communication with Radio Transmitter Set AN/GRT-3 is accomplished in the 225 to 400-mc band. Radio waves at these frequencies tend to travel in straight lines. For this reason, line-of-sight transmission paths are of major importance, as signal strength attenuates rapidly over paths which have obstructions between the receiver and the transmitter. Although the radio waves bend slightly around these obstructions, reliable communication occurs only when line-of-sight paths exist. Line-of-sight transmission is attained when the receiving antenna is theoretically within optical range of the transmitter antenna. The most important factors limiting line-of-sight transmission are the curvature of the earth and intervening hills.

3-3. CURVATURE OF THE EARTH. The curvature of the earth limits the distance over which line-of-sight occurs. For example, with both the receiving and transmitting antennas located 40 feet above sea level, the maximum distance that can be spanned before the line-of-sight is obstructed by the curvature of the earth is approximately 18 miles. This is based on the assumption that the altitude of the intervening terrain is also at sea level. In order to obtain a line-of-sight path 50 miles long, the height of both antennas must be at least 315 feet above sea level and the altitude of the intervening terrain must be at sea level. To determine the maximum distance between two radio stations with the intervening terrain at sea level, the following formula is used, in which D = distance in miles, A = height in feet of one antenna, and B = height in feet of the other antenna.

$$D = \sqrt{2A} + \sqrt{2B}$$

3-4. INTERVENING OBSTRUCTIONS. Intervening hills, buildings and densely wooded areas in a transmission path reduce signal strength when they obstruct the line-of-sight. Radio waves bend over these obstructions slightly, but bending is accomplished by a loss in signal strength; the greater the bending, the greater the loss. Certain combinations of communication sites and intervening hills may provide satisfactory signals due to reflections, but this condition is realized only by chance, or by complex calculation with detailed terrain maps. It can be predicted reliably that satisfactory communication will be obtained if line-of-sight transmission prevails. If line-of-sight does not exist, the path must be tested first to determine if the site is suitable. Weak or otherwise undesirable signals may be expected if the equipment is operated close to steel bridges, power lines or power units. If possible, choose a location on a hilltop or elevation. Flat ground is desirable. Normally, transmission over water is better than over land.

3-5. HOUSING.

3-6. The best location for radio equipment depends on the tactical situation and local conditions such as the need to house the equipment where its shelter cannot be seen, the type of housing available, and the terrain. The shelter for Radio Transmitting Set AN/GRT-3 must meet the following requirements:

a. The floor must be capable of sustaining the weight of the equipment in a level position without vibration and with adequate drainage.

b. Sufficient space must be available in front of the mounting rack to install and remove the components.

c. Sufficient space must be available in back of the mounting rack to permit access to interconnecting cords and cables and to permit replacement of the fuses and tubes, accessible only from the rear. Sufficient space must be left to provide a passageway to the rear of the equipment.

d. Except for the above limitations, the equipment may be located anywhere convenient to the transmission lines and external connections.

e. Adequate natural and/or artificial light should be provided so that all panel designations are legible and controls visible.

3-7. UNCRATING.

3-8. When equipment is received, select a location where it may be unpacked without exposure to the elements and which is convenient to the permanent or semi-permanent installation of the equipment.

CAUTION

Be careful in uncrating, unpacking, and handling the equipment; it is easily damaged. If it should become damaged or exposed, a complete overhaul might be required or the equipment might be rendered useless.

3-9. Instructions follow for uncrating and unpacking the transmitter and the modulator-power supply (figure 3-1):

a. Place the packing case as near the operating position as convenient.

b. Cut and fold back the steel straps.

c. Remove the nails with a nail puller. Remo the top and one side of the packing case. Do not tempt to pry off the sides and top as such act might damage the equipment.

d. Remove any excelsior or corrugated paper cove ing the inner corrugated fiberboard carton.

e. Carefully remove the equipment from the car and place it on the workbench or near its fi location.

f. Inspect the equipment for possible damage curred during shipment.

g. Check the contents of the packing case agai the master packing slip.

NOTE

Save the original packing case and containers. They can be used again when the equipment is repacked for storage or shipment.

3-10. EQUIPMENT REQUIRED FOR INSTALLATIC

3-11. The transmitter and modulator-power sup may be used independently or in conjunction w Radio Receiver R-361/GR. See Table 3-1 for equi ment which is supplied. The wrenches used with t transmitter are located on the left side, rear secti of the transmitter. The wrench for the modulato power supply is located on the back of the front acce door. (Table 3-2 lists the equipment required not furnished.)

TABLE 3-1. EQUIPMENT SUPPLIED

Quantity	Name of Unit	Govt Type Designation	Description
1	Radio Transmitter	T-282/GR (or T-282B/GR)	Complete with tubes
1	Modulator-Power Supply	MD-141/GR (or MD-141A/GR)	Complete with tubes
1	Cable Assembly, Power, Electrical	CX-2017/U (28 inches long)	Multi-conductor, with connectors
2	R-F Cable Assembly (26 inches long)	CG-693/U	High voltage conductor, with connectors
1	Wrench		Bristo, No. 4 (for transmitter)
1	Wrench		Bristo, No. 6 (for transmitter)
1	Wrench		Bristo, No. 8 (for transmitter)
1	Wrench		Bristo, No. 10 (for transmitter)
1	Wrench		Bristo, 1/4 inch (for transmitter)
1	Wrench		Bristo, No. 10 (for modulator-power supply)

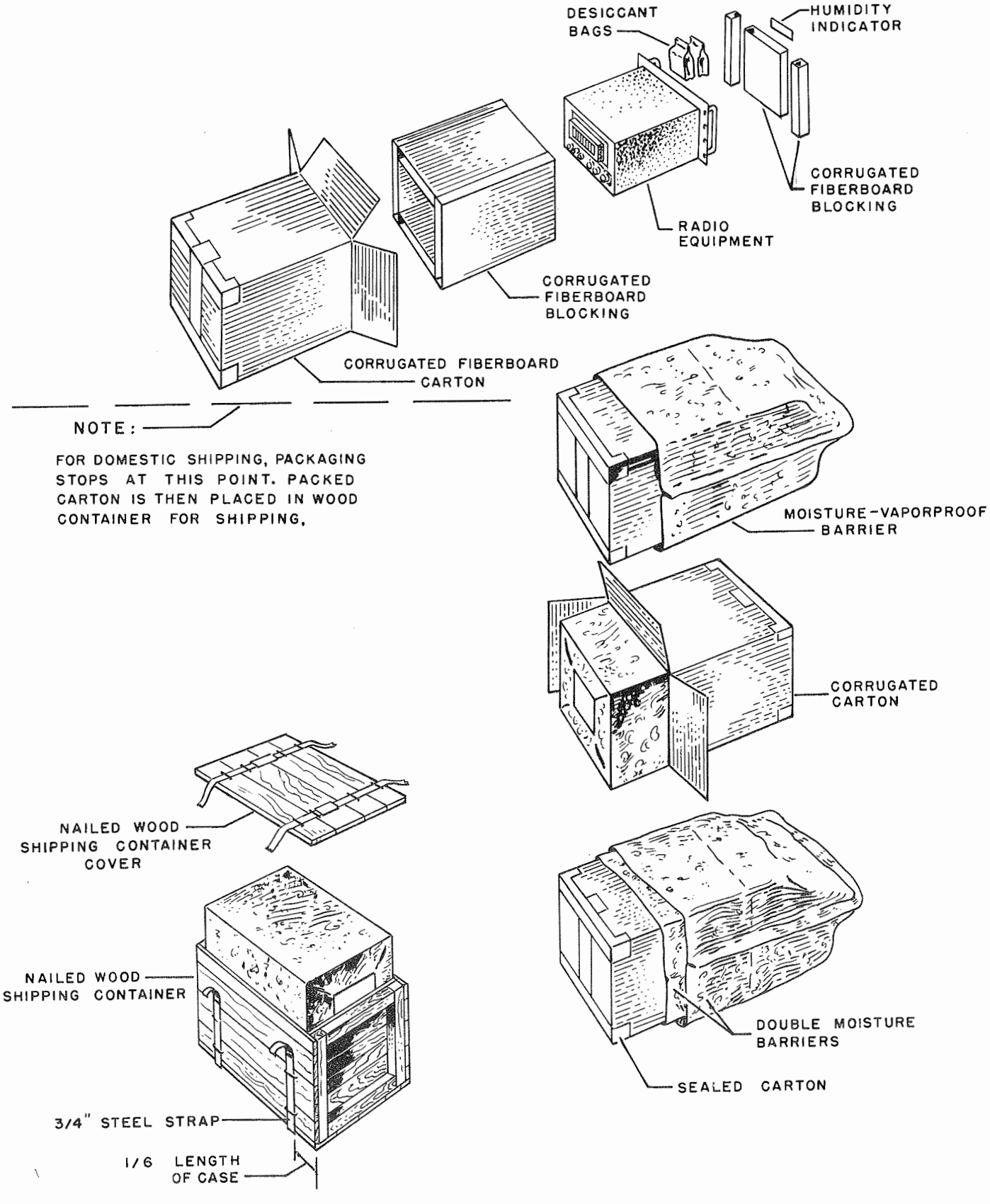


Figure 3-1. Radio Transmitter and Modulator-Power Supply, Packing Diagram

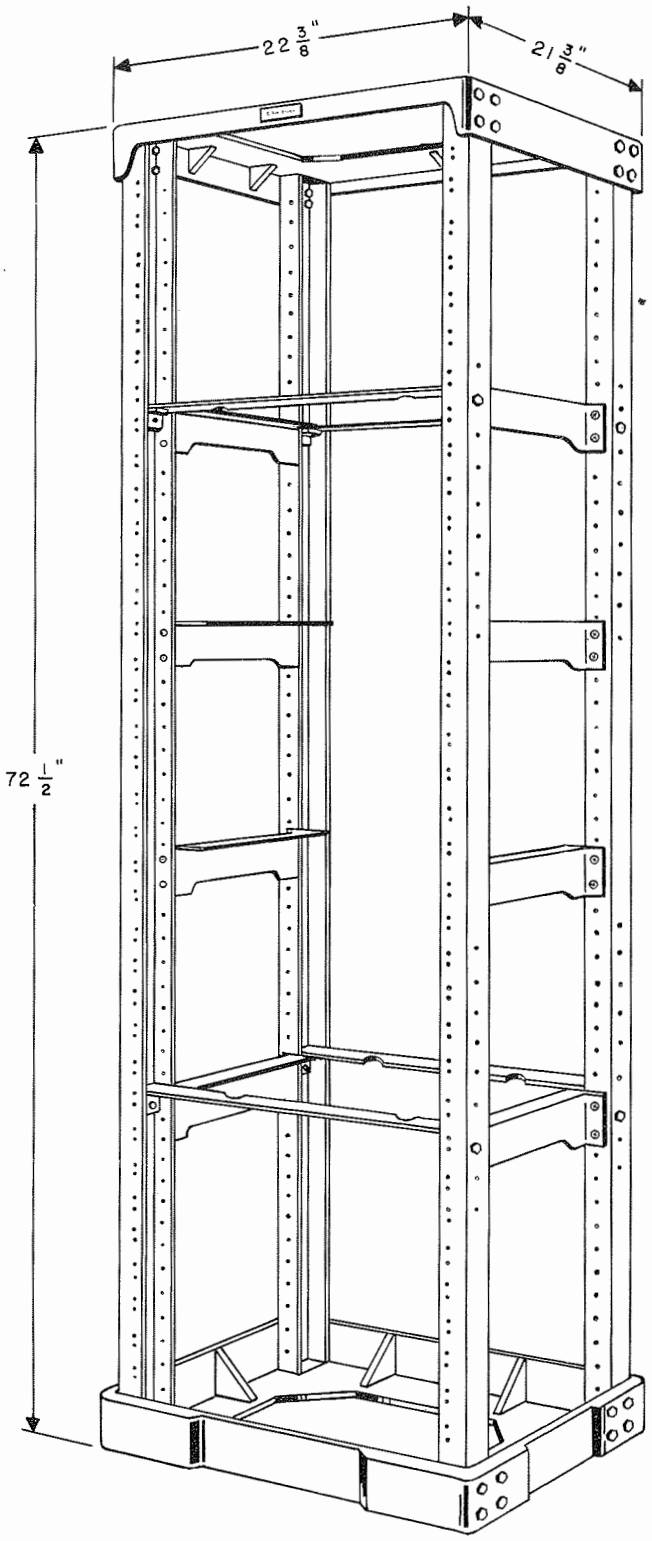


Figure 3-2. Rack MT-686/GR

3-12. RACK AND DISTRIBUTION PANEL.

3-13. Rack MT-686/GR is intended to house t transmitting equipments, consisting of two tra mitters and two modulator-power supplies. If sirable, two receivers, one transmitter and modulator-power supply may be placed in one ra Distribution Panel J-390/GR, mounted in Ra MT-686/GR, furnishes a junction from which prima power can be distributed and from which audio a control connections can be made to external uni

3-14. RACK MT-686/GR. (See figures 3-2 and 3- Rack MT-686/GR is shipped in knocked down fo and must be assembled by the maintenance personn In order to assemble the rack, a No. 3 Phill screwdriver and three open end wrenches (siz 7/16 in., 9/16 in., and 5/8 in.) are required.

3-15. Table 3-3 lists the parts supplied to assem Rack MT-686/GR. All of the major structural pa are stamped with item numbers. The front channe are symmetrically punched and may be used in eith the right or left position. The rear channels are a symmetrically punched and may be used in eith the right or left hand rear position. All chass supports (Item E) are symmetrically punched a may be used on either the right or left side. T four vertical members are most easily assembl to the top and bottom with the rack channels in horizontal position. Assemble the rack as follow

a. Place the top member (B, figure 3-3) and botto member (A) pieces on the floor so that by tippi each up, the rack would appear to be laying on back. The front edge of the top member (B) is t edge with the name plate while the front edge of t bottom member (A) is the edge adjacent to the "Ite A" number.

b. Tip the bottom up and slide a front channel (into the corner cut-out. The front channel is t edge with the series of holes placed in groups two along the entire length.

c. Insert four of the 1-1/4-inch bolts (T) throu the holes at the side of the bottom member (A) a through the mating channel holes, then place lo washers (G) and nuts (S) (with flat sides towar lock washers) on them. Turn nuts to within two tur of being tight.

d. Slide the other front channel (C) into the oth front corner cut-out and repeat step c.

e. Tip the top member (B) up and insert the tw front channels into the corner cut-outs, then bolt, in step c, for both channels.

f. Slide a rear channel (D) into both a top corne cut-out and its mating bottom cut-out. The tappe surfaces of the rear channels should face the fro of the rack.

g. Repeat step c, then bolt the channel to the to in similar fashion.

h. Repeat steps f and g for the other rear channe

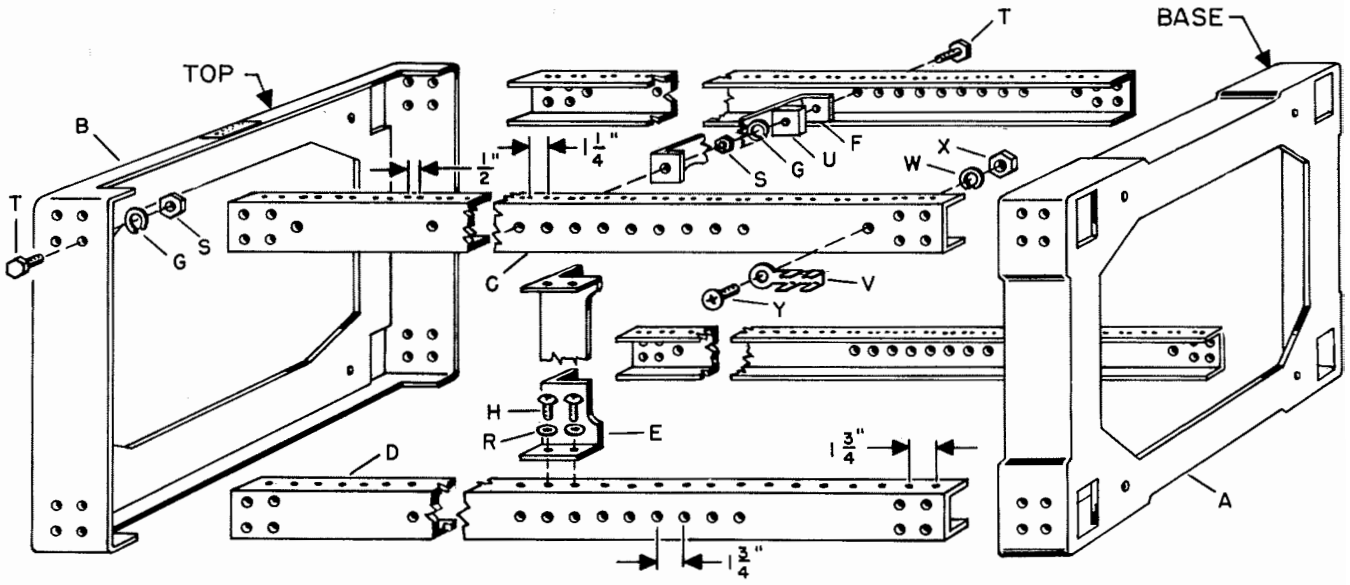
i. Set the rack up and make a temporary pan layout on the front surface of the rack by very accu rately scribing a mark on the front channels midwa between the two panel holes (1/2-inch separatio where the panels of two units meet. Make prope allowances for blank panels.

TABLE 3-2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

Quantity	Name of Unit	Govt Type Designation	Description
1	Antenna	AT-197/GR, or AS-505/GR	For transmitter or receiver
1	Mast	AB-158/GR	Antenna support
1	R-F Cable Assembly	CG-597/U	R-f transmission line
1	R-F Cable Assembly	CG-707/U	Connection between antenna jack J909 and antenna cable CG-597/U
1	Set of Crystals	CR-27/U	Frequency range from 6.250000 mc to 11.108333 mc.
1	Power Cable Assembly	CX-1541/U	A-c power line
1	Distribution Panel	J-390/GR	For power and audio distribution
1	Power Cable Assembly		From distribution panel to a-c supply
1	Microphone	T-17	Double-button carbon, push-to-talk
1	Headphone Set	CW-49507	600 ohms, complete with PL-55 plug
1	Antenna Transfer Cable		Connects antenna to receiver through relay in transmitter
5 mi	Field Wire	W-110-B	Muting cable to receiver and telephone line for remote operation
1	Rack	MT-686/GR	Equipment mounting

TABLE 3-3. LIST OF PARTS FOR RACK MT-686/GR

Item	Quantity	Name
A	1	Base member
B	1	Top member
C	2	Front channel
D	2	Rear channel
E	8	Chassis support
F	4	Tie bar
G	40	3/8-in. split ring lock washer
H	96	5/8-in. No. 12-24 Phillips Head machine screw
J	64	No. 12 flat washer
R	32	No. 12 split ring lock washer
S	40	No. 3/8-24 hex nut
T	40	No. 3/8-24, 1-1/4-in., hex head cap screw
U	8	Support block
V	1	Soldering lug
W	1	1/4-in. split ring lock washer
X	1	No. 1/4-20 hex nut
Y	1	3/4-in. No. 1/4-20 Phillips Head machine screw



NOTES:

1 - RACK IS ASSEMBLED ON ITS SIDE AS SHOWN
2 - NOTCH IN REAR OF TIE BARS MUST FACE FORWARD.
3 - GROUNDING LUG, ITEM V, SHOULD BE PLACED UNDER ITEM Y, IN BOTTOM OF EITHER FRONT CHANNEL.

Figure 3-3. Assembly of Rack MT-686/GR

j. Carefully bolt all four pairs of chassis supports (E) at the front channel so that the upper or supporting surfaces of the chassis supports are directly opposite the scribe marks. Loosely bolt the rear of the chassis supports to the rear channels. Use 5/8-inch No. 12 bolts (H) and lock washers (R) with Item R under the head of Item H.

k. Bolt two tie bars (F) across the front of the rack and two across the back of the rack with the two notches toward the inside of the rack. Place them directly in front of and in back of the chassis supports (E) and at the same level as the chassis supports so that they cause no interference with insertion of the units. These tie bars should be as nearly equi-space from the top to the bottom of the rack as the layout will permit. The tie bars are bolted in place with 1-1/4-inch cap screws (T), lock washers (G), and hex nuts (S) with support blocks (U) between the lock washers and the tie bar.

NOTE

The support blocks have one corner rounded. Place this corner in the inside corner of the angles of the tie bar ends.

1. Tighten all screws, starting with those on the rear ends of the chassis supports (E) and then progressing to the tie bars (F), to the bottom (A), and to the top (B).

3-16. DISTRIBUTION PANEL J-390/GR. Distribut Panel J-390/GR occupies a space 5-1/4-in. high 19-in. wide by 5-1/4-in.deep. It is intended for pa mounting in Rack MT-686/GR (figure 3-4). T three horizontal metallic bars are for primary pov distribution. The center and bottom bars are 115-volt operation; the top and bottom bars are 230-volt operation. If, in 230-volt operation, a groun neutral is used, the center bar is grounded by me of the notched switch blade attached to the end of center bar. Two receptacles mounted on the back the panel are available for convenience outlets. C wire from these outlets is permanently connec to the bottom bar. The other wire should be chan from the center bar to the top bar when chang to 230-volt operation. The voltage indication pl on the back of the panel is engraved 115 V on o side and 230 V on the other and should be turned indicate the voltage being used. Forty terminals a available on two terminal strips for connecting co trol and audio services. Connect the external ea ground to the stud located between the two convenien outlets on the rear of the panel.

3-17. INSTALLATION OF TRANSMITTER AND MO ULATOR-POWER SUPPLY.

3-18. After removal of the equipment from the packing cases, as explained in paragraphs 3-8 a 3-9, proceed as follows:

3-19. POWER INPUT CONNECTIONS. Measure the voltage of the 50-60 cps power line. The voltage required for operation of this equipment is 105-125 or 210-250 volts. Examine the reversible designation plate, on the rear of the modulator-power supply (figure 1-4) which indicates the line voltage for which the power input circuits have been wired. If the voltage so designated does not agree with the power line voltage, proceed as follows:

a. Stand the modulator-power supply on its front panel handles.

b. Loosen the four captive screws that hold the dust cover in place and remove the dust cover.

c. Loosen the screws holding link O-202 in place (figure 3-5) and shift the link to the proper position for the measured line voltage.

d. Remove the reversible designation plate from the rear panel. Turn it over and replace it on the panel.

e. Put the dust cover back on the modulator-power supply and tighten the captive screws.

WARNING

Observe safety precautions. High voltages are used in the operation of this equipment. Equipment must be grounded before connection is made to power line.

3-20. Connect an a-c voltmeter across the terminals of the nearest supply junction point (eg, within Distribution Panel J-390/GR, see paragraph 3-16); set the "BUCK-BOOST" switch as follows:

a. If the nominal line voltage is 115 volts, but less than 115 volts is measured, set the "BUCK-BOOST" switch (rear panel of the modulator-power supply) to "BOOST." If the measured voltage is above 115 volts, set the switch to "BUCK."

b. If the nominal line voltage is 230 volts, but less than 230 volts is measured, set the "BUCK-BOOST" switch to "BOOST." If the measured voltage is above 230 volts, set the switch to "BUCK."

c. If the local source of supply voltage is known to have poor voltage regulation, correct, at least once an hour, for line voltage variations by following the above instructions.

3-21. PLACEMENT OF MODULATOR-POWER SUPPLY IN RACK. Lift the unit to the level of the chassis supports of Rack MT-686/GR and slide it into the rack until the front panel edges are in close contact with the front channels of the rack. Secure the front panel to the rack with the 5/8-inch No. 12-24 binding head machine screws and No. 12 flat washers furnished with the rack.

WARNING

The modulator-power supply weighs approximately 170 pounds and the transmitter has a weight of approximately 70 pounds. Two men are required to handle the equipment properly.

3-22. PLACEMENT OF TRANSMITTER IN RACK. Install the transmitter in the same manner as the modulator-power supply.

3-23. ANTENNA SYSTEM.

3-24. The antenna system for the transmitter consists of Antenna AT-197/GR or Antenna AS-505/GR and interconnecting r-f cable(s). If the transmitter is used in conjunction with Radio Receiver R-361/GR, an antenna transfer cable assembly, between the receiver and transmitter, permits the use of one antenna for both transmitting and receiving.

3-25. ANTENNA AT-197/GR. (See figure 3-6.) Antenna AT-197/GR is an omni-directional discone type antenna with a gain approximately the same as that of a half-wave dipole tuned to maximum efficiency; however, no tuning is required for operation over the entire frequency range of 225 to 399.9 mc.

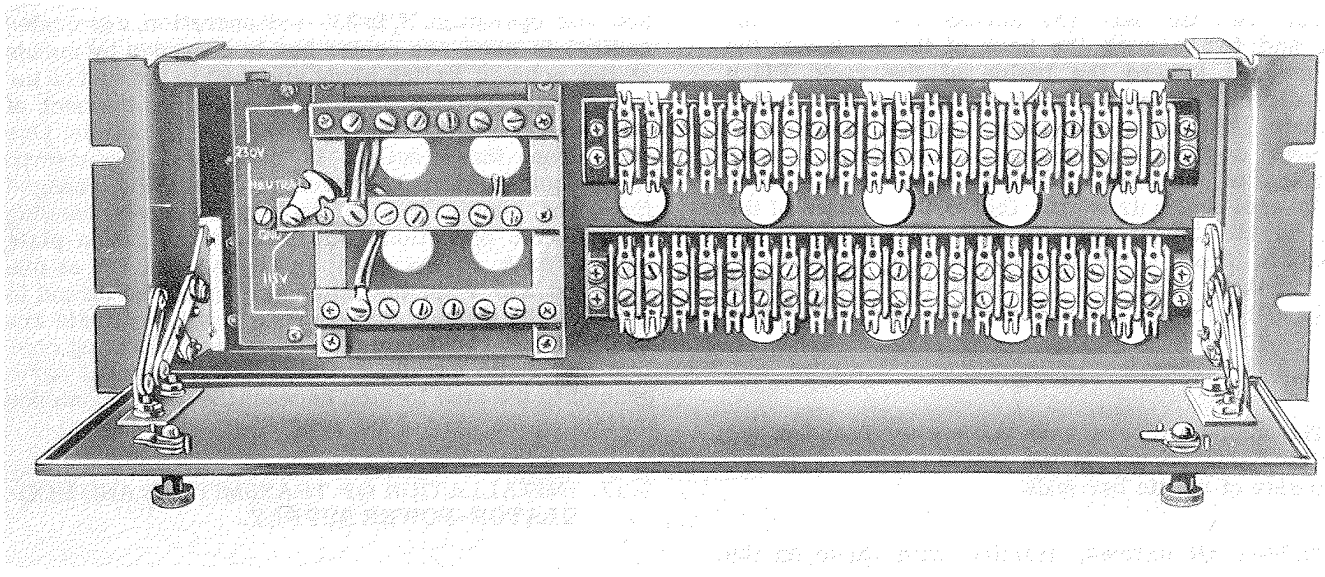
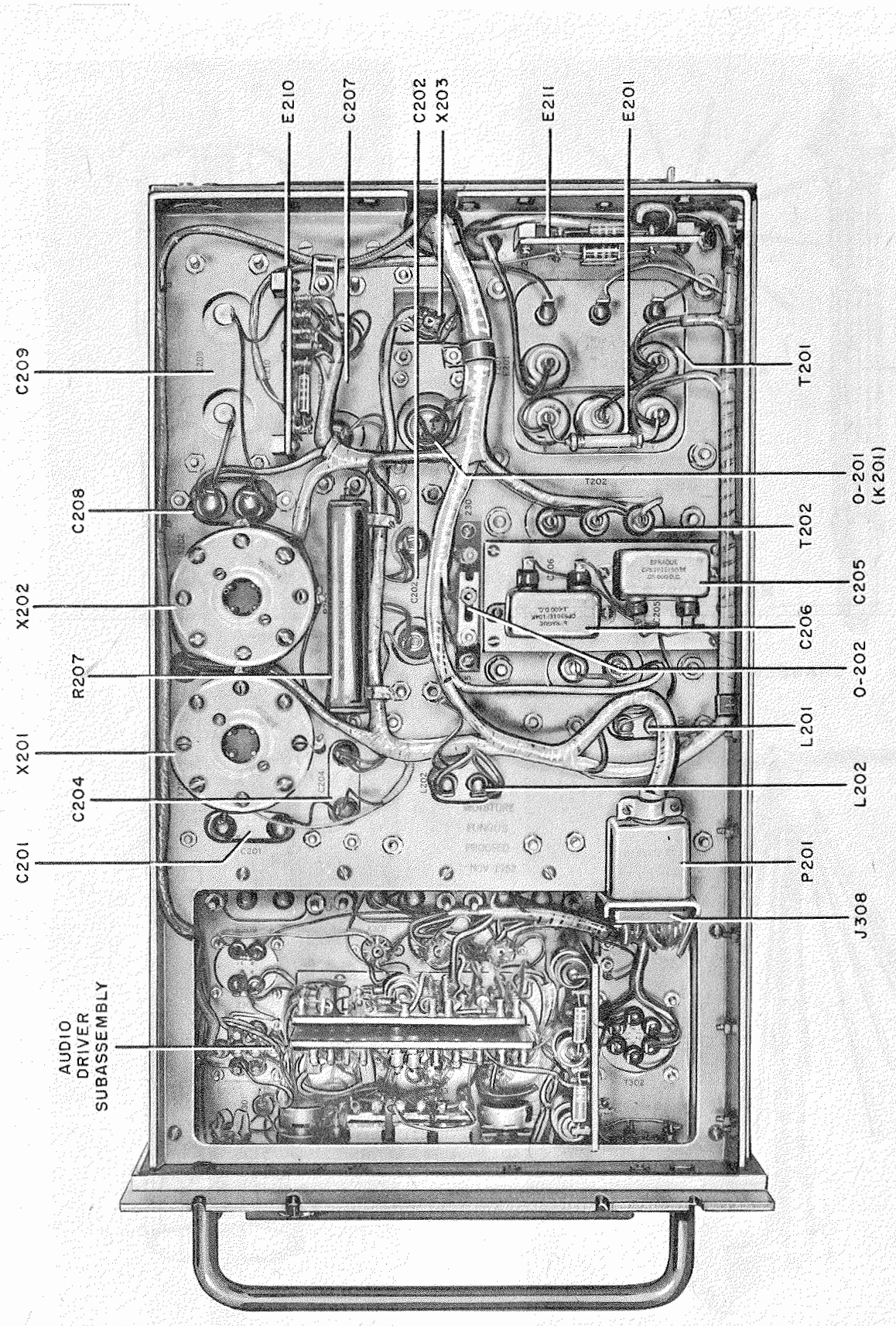


Figure 3-4. Distribution Panel J-390/GR


E210
C207
C202
X203
E211
E201
C209
T201
C208
T202
O-201
(K201)
X202
T202
C205
C206
R207
O-202
X201
L201
C204
L202
C201
P201
J308
AUDIO
DRIVER
SUBASSEMBLY

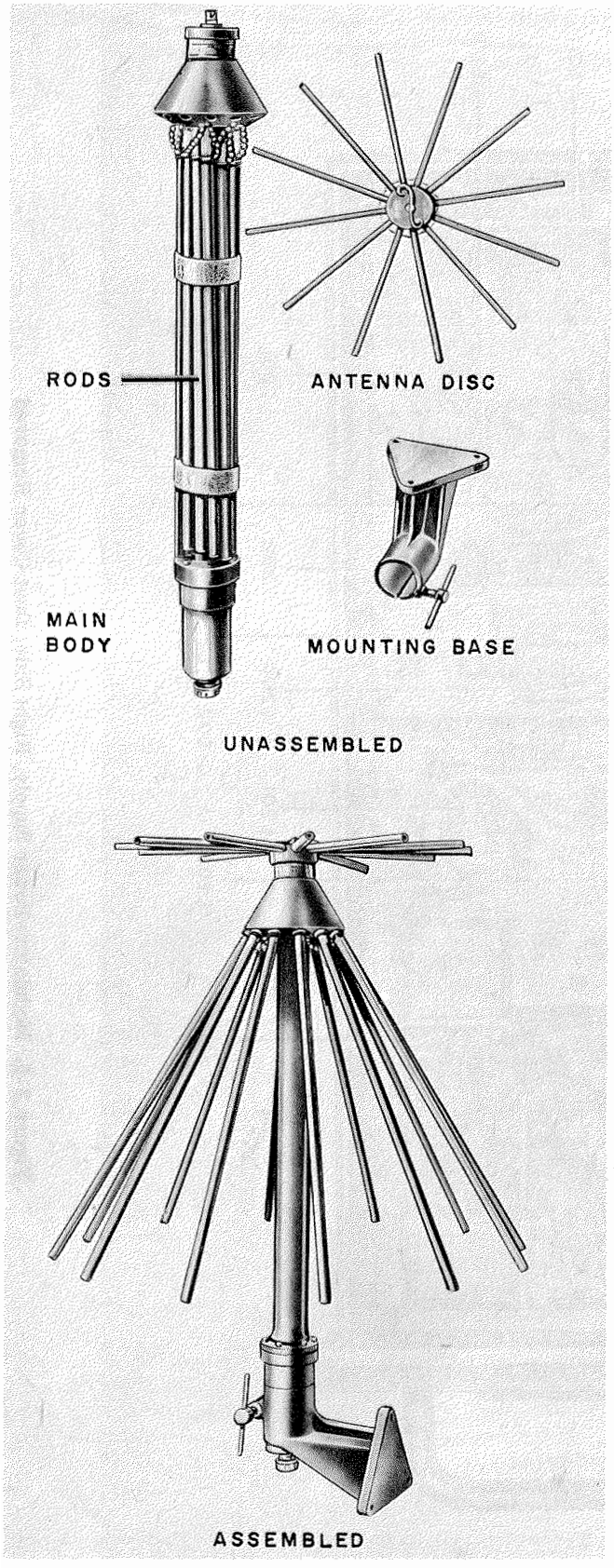


Figure 3-6. Antenna AT-197/GR

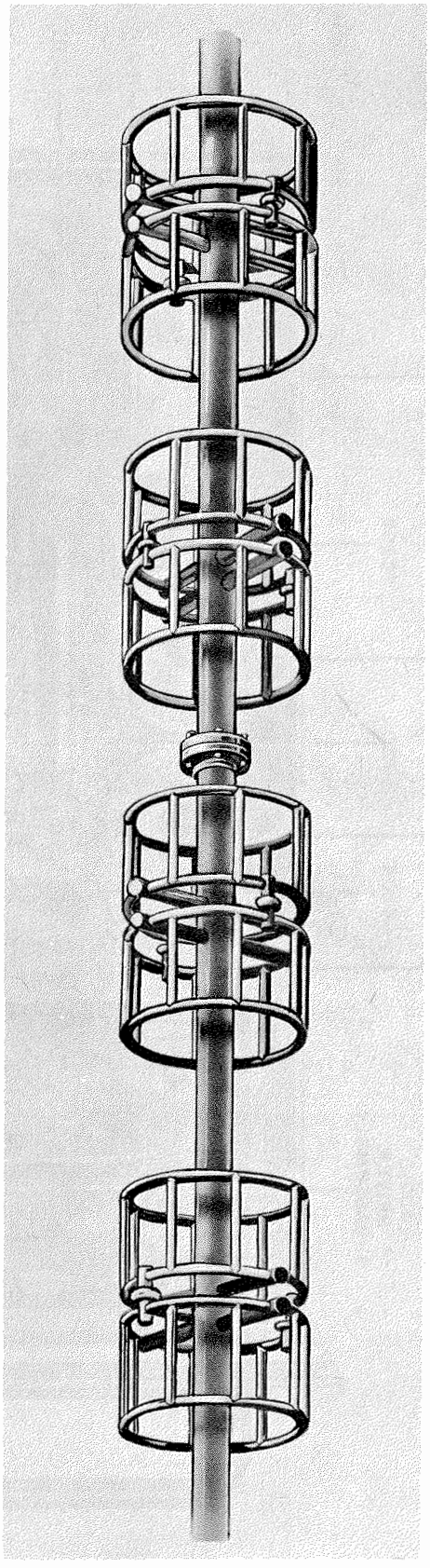


Figure 3-7. Antenna AS-505/GR

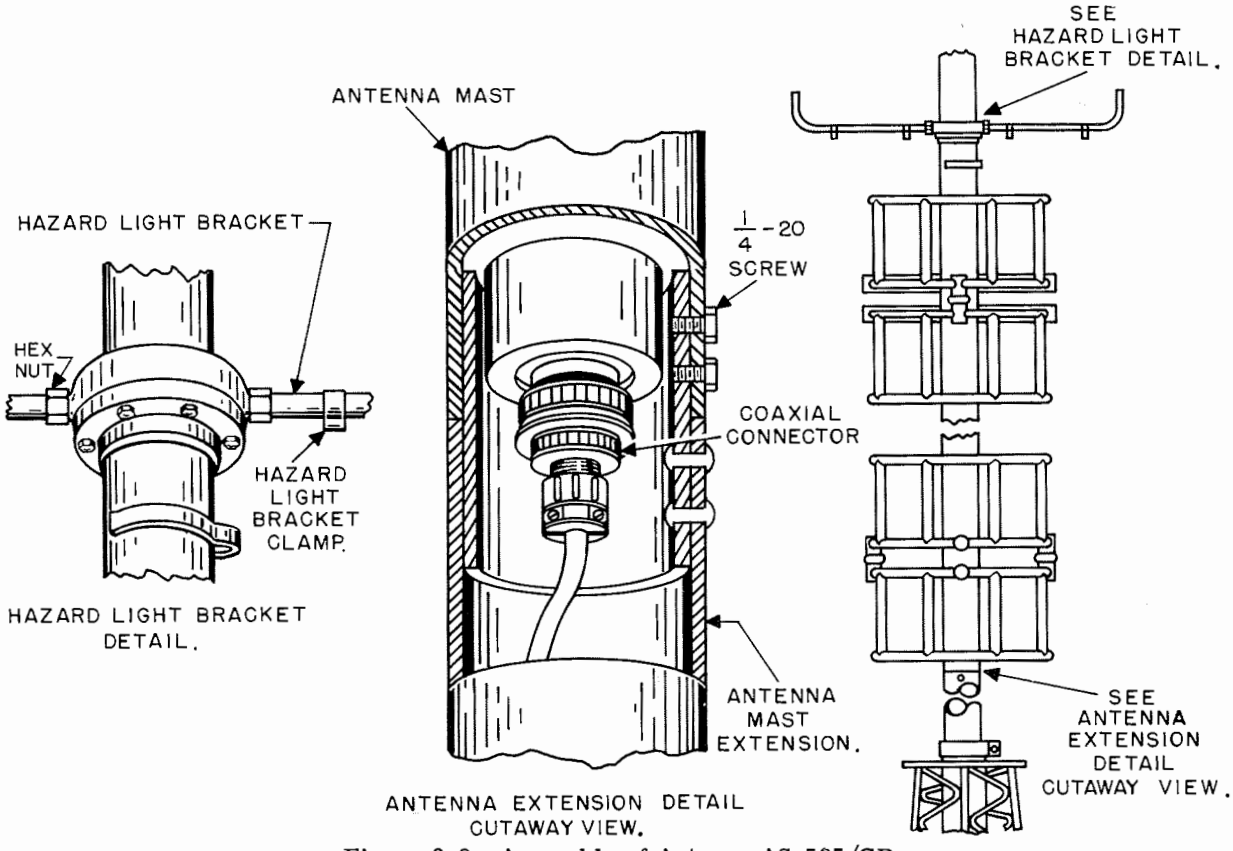


Figure 3-8. Assembly of Antenna AS-505/GR

3-26. Antenna AT-197/GR is composed of a simulated disc and cone separated by a glass insulator. The "disc" and "cone" sections of the antenna are formed by protruding lengths of hollow, round stock. The disc is mounted horizontally above the simulated cone. The cone consists of twelve rods. In the disassembled state, these rods are attached to the metal support by means of flexible ball chains and are secured to the center support by two web straps. One end of each rod is equipped with a Dzus type fastener by which it may be attached to the metal support. The use of metal rods decreases the weight and surface area and therefore greatly reduces the wind resistance. The disc, which is composed of twelve rods screwed into a ring at equal intervals about the circumference, fastens to the metal support by means of a Dzus fastener. The center support slides into the mounting bracket where it is secured by a screw type clamp. The antenna normally mounts on the crossarm of Mast AB-158/GR, each of the three mounting holes on the bracket accommodating one of the members of the serpentine type crossarm though it may also be secured by means of lag screws at the top of a wooden pole. Mast AB-158/GR will accommodate four of these antennas plus one Antenna AS-505/GR. The coaxial transmission line is led up through the antenna support and the center conductor is terminated at the center of the disc; the outer conductor is terminated at the apex of the cone.

3-27. Assemble Antenna AT-197/GR as follows (figure 3-6):

a. Place the simulated disc on the top end of tl antenna main body and secure it in place by a on quarter turn of the disc on the Dzus type fastene

b. Remove the web straps securing the cone ro to the main body.

c. Assemble the cone by inserting the twelve co rods into the twelve sockets, locking them in pla with a one-quarter turn.

d. Secure the mounting base to the crossarm tower.

e. Insert the lower end of the center support i the mounting bracket and tighten the screw cla to secure the antenna in position.

f. Remove the dust cap from the coaxial fitting the lower end of the center support.

g. Secure the r-f cable to the mast and connect it to t coaxial fitting on the lower end of the center suppo

h. If the supplied cable is not the correct leng see paragraph 3-30 for instructions on fabricat an alternate cable.

3-28. ANTENNA AS-505/GR. (See figures 3-7 a 3-8.) Antenna AS-505/GR is a four bay stacl vertical array consisting of four squirrel-cage t antennas mounted on a vertical column three inc in diameter. The bays are mounted on the colu by metallic supports which serve as insulators c to the configuration of the antennas and the electri lengths of the elements. Each bay is in effec vertically polarized wide band dipole and is fed two points to obtain omni-directional radiation in horizontal plane. The beam lobe is tilted upw at an angle of 5.5 degrees.

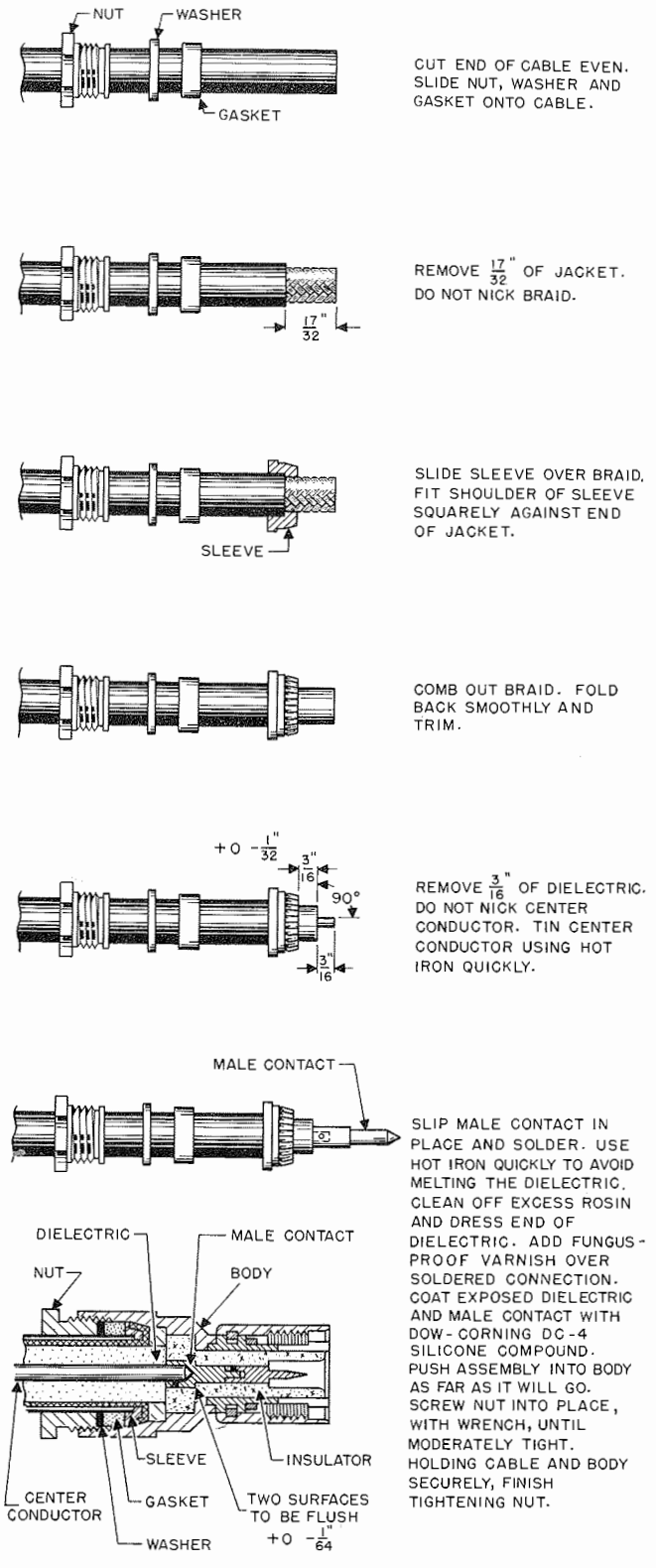


Figure 3-9. R-F Cable Assembly CG-597/U, Fabrication

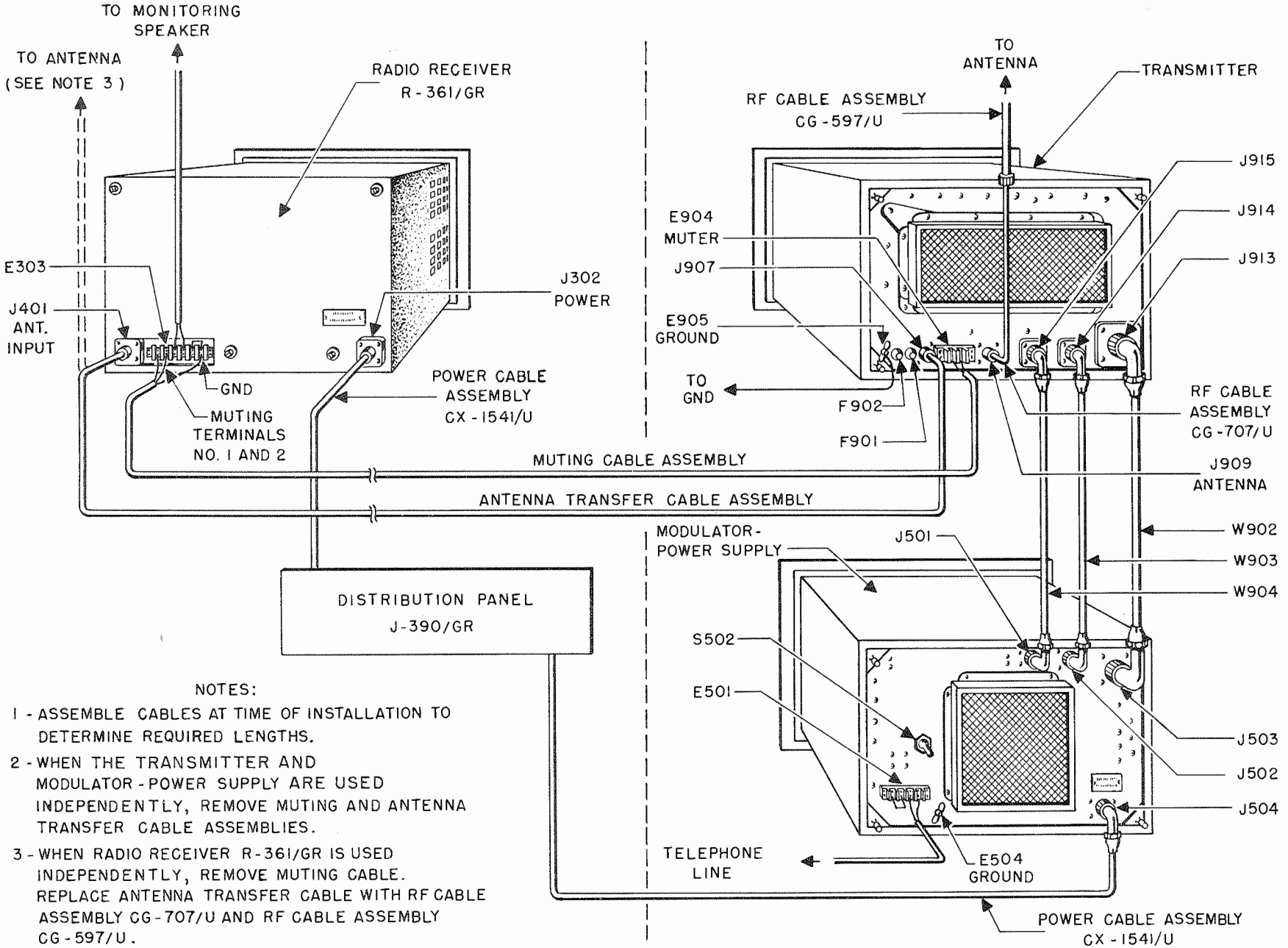
3-29. Antenna AS-505/GR is shipped in a wooden crate about ten feet long. Cradle supports at either end of the crate support the column to prevent damage to the antenna. The crate should be saved for future shipping of the antenna. Check all items for possible damage. Hazard lights may be attached to one Antenna AS-505/GR when several are grouped in one location. Assembly of the antenna (with hazard lights) is as follows (figure 3-8):

CAUTION

Open the top of the crate, being careful not to damage the crate or its contents.

a. Screw one hex nut onto each hazard light bracket as far as possible.
b. Screw the long end of each of the two hazard light brackets into the holes provided in the flange in the center of the antenna column as far as it will go.
c. Back the hex nuts up against the antenna mast to lock the bracket securely.
d. Attach hazard lights to the brackets and fasten the a-c cord, by means of the clips provided, to the brackets and the column.
e. Carry the mast extension to the top of Mast AB-158/GR and pass the end of R-F Cable CG-597/U through the extension so that the cable emerges through the end that has the insert riveted within.
f. Use a piece of wire or light rope to tie the end of the r-f cable to the mast so that it will not fall away.
g. Set the mast extension in the receptacle provided for it, on top of Mast AB-158/GR.
h. Tighten the clamp securely around the column shank.
i. Use a gin pole or other lifting device to lift the antenna into a vertical position above the mast extension.
j. Connect the r-f feed cable connector to the connector within the antenna column.
k. Lower the antenna onto the mast extension and rotate it until the holes line up with the tapped holes in the insert.
l. Use six No. 1/4-20 machine screws to connect the antenna to the insert. Bolt down securely.
m. This completes the installation of Antenna AS-505/GR.

3-30. ANTENNA TRANSMISSION LINE. The parts for the r-f cable, between the transmitter and the antenna, are in bulk form. To fabricate this cable, affix one connector UG-495/U to each end of the required length of RG-17/U coaxial transmission line. This cable should be no longer than is necessary to reach from the transmitter to the antenna. Figure 3-9 shows the procedure for mounting the connectors to the ends of the cables. When installing the cables, make all bends sufficiently large in radius to avoid damaging the cable structure. Since the RG-17/U cable is too stiff to make the turn required from the mounting rack (MT-686/GR) to the rear panel of the transmitter, a 2-foot cable of smaller diameter, CG-707/U, is used; it is designed to attach to the end of cable CG-597/U, and is complete with proper connector plugs.



NOTES:

1 - ASSEMBLE CABLES AT TIME OF INSTALLATION TO DETERMINE REQUIRED LENGTHS.

2 - WHEN THE TRANSMITTER AND MODULATOR-POWER SUPPLY ARE USED INDEPENDENTLY, REMOVE MUTING AND ANTENNA TRANSFER CABLE ASSEMBLIES.

3 - WHEN RADIO RECEIVER R-361/GR IS USED INDEPENDENTLY, REMOVE MUTING CABLE. REPLACE ANTENNA TRANSFER CABLE WITH RF CABLE ASSEMBLY CG-707/U AND RF CABLE ASSEMBLY CG-597/U.

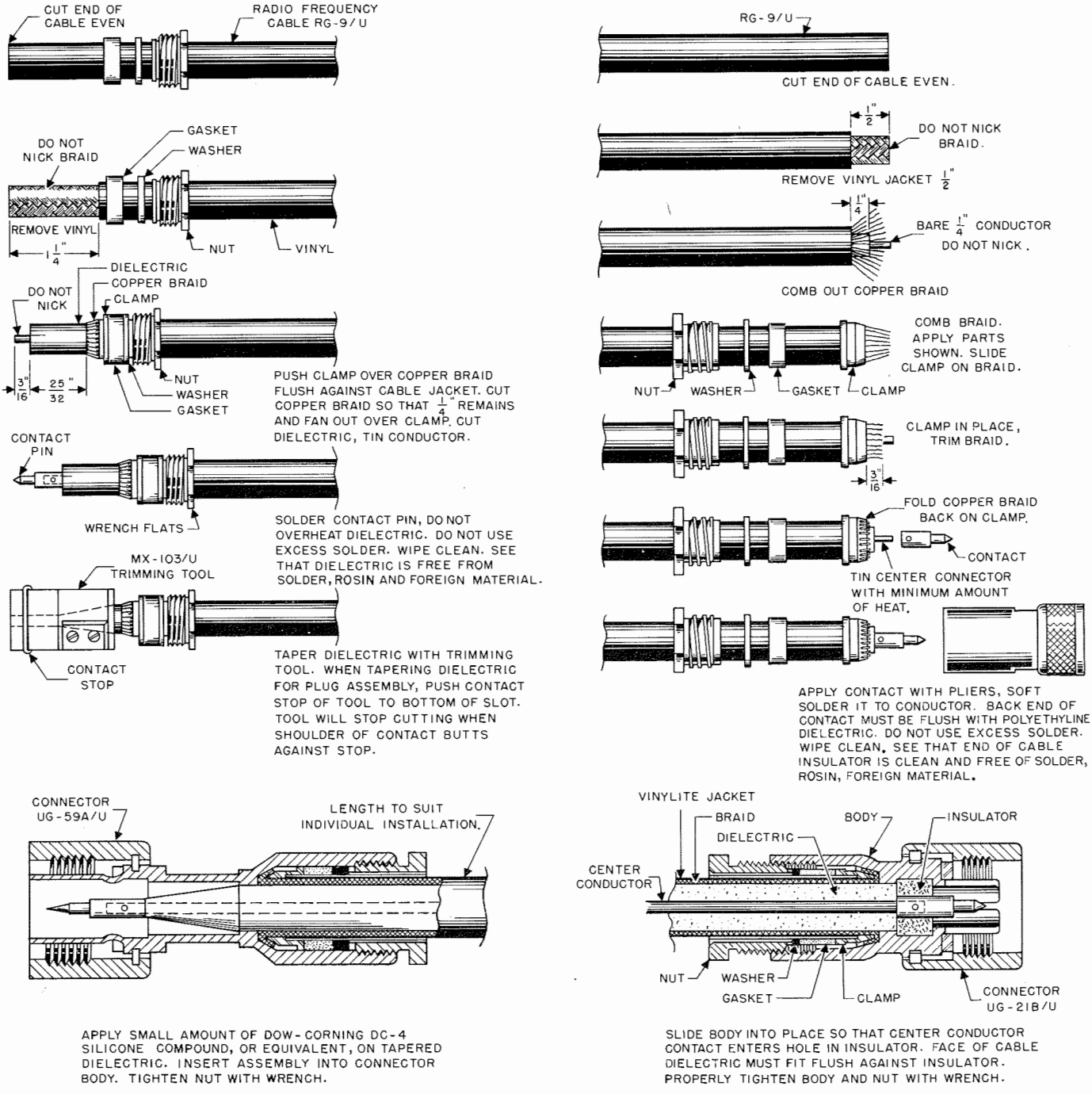


Figure 3-11. Antenna Transfer Cable Assembly, Fabrication

3-31. CABLE CONNECTIONS.

3-32. If the transmitter is used in conjunction with Radio Receiver R-361/GR, two interconnecting cables are required (figure 3-10.) These are in addition to the three cables linking the transmitter with the modulator-power supply, power cables, telephone line (for remote operation), and r-f transmission lines. Refer to table 3-4 for the required cables and their connections, in addition to paragraphs 3-34 and 3-35. All cable connections are made at the rear of the transmitter and the modulator-power supply.

3-33. An antenna transfer cable assembly (figure 3-11) connects the "ANT. INPUT" jack J401 on the rear of the receiver to the "ANT. INPUT" jack J907 on the rear of the transmitter; the antenna, AT-197/GR or AS-505/GR, is then switched from the transmitter to the receiver by the operation of the antenna transfer relay within the transmitter. A muting cable assembly (figure 3-12) connects the "MUTING" terminals on the rear of the receiver to the "MUTER" terminals on the rear of the transmitter; when "transmitting", shorting contacts, on the push-to-talk relay within the transmitter, silence the receiver by placing a

TABLE 3-4. CABLE CONNECTIONS

Quantity	Name of Cable	Govt Type Designation	Purpose
1	Cable Assembly, Power, Electrical (28 inches)	CX-2017/U	Connects J503 on modulator-power supply to J913 on transmitter
1	R-F Cable Assembly (26 inches long)	CG-693/U	Connects "H.V. MOD" J502 on modulator-power supply to "H.V.MOD" J914 on transmitter
1	R-F Cable Assembly (26 inches long)	CG-693/U	Connects "H.V. UNMOD" J501 on modulator-power supply to "H.V. UNMOD" J915 on transmitter
1	Power Cable Assembly	CX-1541/U	Connects "A.C. POWER INPUT" J504 on modulator-power supply to horizontal metallic bars of Distribution Panel J-390/GR
1	Power Cable Assembly		Connects convenience outlet on distribution panel to source of a-c supply voltage.
Up to 5 mi (As required)	Field Wire	W-110-B	Connects "LINE" terminals on modulator power supply to remote operating point
1	R-F Cable Assembly	CG-707/U	Connects "TO ANTENNA" J909 on transmitter to R-F Cable Assembly CG-597/U
1	R-F Cable Assembly	CG-597/U	Connects R-F Cable Assembly CG-707/U to antenna
1	Muting Cable Assembly		Connects "MUTER" terminals on transmitter to "MUTING" terminals on Radio Receiver R-361/GR
1	Antenna Transfer Cable Assembly		Connects "ANT. INPUT" J907 on transmitter to "ANT. INPUT" J401 on Radio Receiver R-361/GR

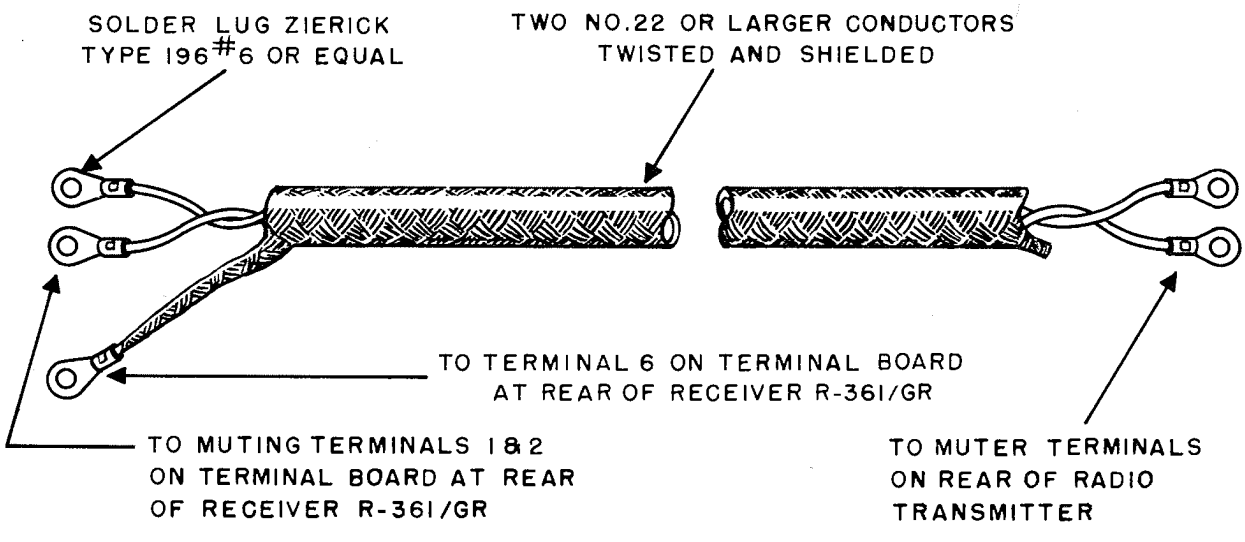


Figure 3-12. Muting Cable Assembly, Fabrication

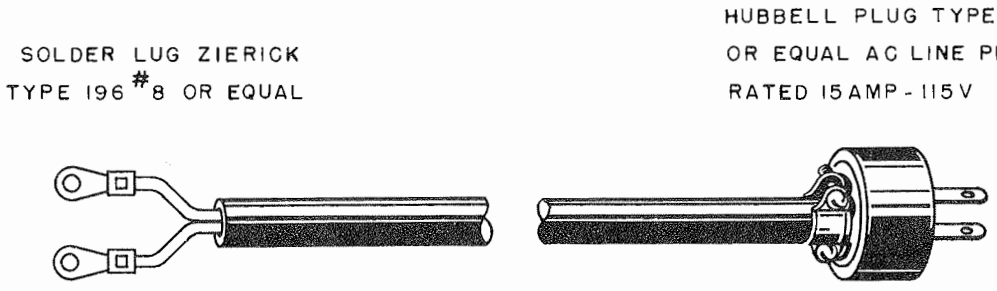


Figure 3-13. Power Cable Assembly, Fabrication

short-circuit across its audio output. Two power cables are required. One connects from the "A.C. POWER INPUT" connector J504 on the rear of the modulator-power supply to the horizontal metallic bars on Distribution Panel J-390/GR used for primary power distribution; the other from the convenience outlet on the rear of the distribution panel to the nearest junction box or other source of primary power (figure 3-13).

3-34. TELEPHONE LINE. Connect Field Wire W-110-B, or equal, to the two "LINE" terminals on the terminal board at the rear of the modulator-power supply. Refer to the applicable Handbook of Operating Instructions for information on how to set the controls for normal remote operation and for emergency operation.

3-35. EQUIPMENT GROUNDING. Make a secure ground connection, using copper braid or wire, number 12 gage or heavier, between the grounding studs at the rear of the equipment, and a good earth ground such as underground water pipes or rods driven into the ground.

3-36. TUNING PROCEDURE.

3-37. See the applicable Handbook of Operating Instructions for tuning procedure instructions.

SECTION IV

THEORY OF OPERATION

4-1. GENERAL SYSTEM OPERATION.

4-2. Electrically, the transmitter consists of an exciter unit that drives a two stage amplifier consisting of a driver and push-pull power amplifier. The monitor-screen modulator assembly is comprised of the screen modulator and circuits for measuring the power output and percentage modulation, and for aural monitoring of the audio component of the transmitter signals.

4-3 Mechanically, the transmitter is divided into front and rear sections. The front section consists of the exciter, the monitor-screen modulator, the front panel on which all of the transmitter operating controls are located, and a blower for cooling the electrical components. The rear section consists of castings that contain the electrical components of the driver and power amplifier stages; and a rear panel on which are mounted all connectors for interconnection with the modulator-power supply, Radio Receiver R-361/GR (if used), and the antenna system. The adjustable portions of tuned circuits, in both sections, are driven through flexible shafts, couplers, and gears, controlled from the front panel.

4-4. Electrically, the modulator-power supply consists of an audio section, comprising input circuits, voltage amplifiers, and a push-pull modulator. Also high, low and bias voltage supplies are located in this unit. A blower is provided for cooling the electrical components.

4-5 Mechanically, the modulator-power supply consists of a power supply chassis; modulator chassis, which contains a driver subassembly; front panel on which are mounted most of the modulator-power supply operating controls; rear panel on which are mounted all connectors for interconnection with the transmitter, the a-c power supply, and telephone line.

4-6. R-F CIRCUITS. The frequency of the r-f carrier is controlled by a crystal oscillator which operates at 1/36th the carrier frequency. Frequency multiplication and amplification occurs in the oscillator stage itself (functions as a tripler) and in the

five r-f stages that follow. The output of the power amplifier is delivered to the antenna through an antenna transfer relay, low pass filter, and directional coupler.

4-7. AUDIO CIRCUITS. The input circuit is designed for local voice operation or for operation from a remote point over a telephone line. The audio signal goes through a phase inverter, two push-pull amplifiers, and terminates in the push-pull modulator which is used to plate modulate the power amplifier. A special audio screen modulator (located in the transmitter unit) supplements the plate modulator in order to secure 95-percent m ulation without excessive distortion. Automatic m ulation limiting keeps the percentage modulatior approximately the same level when the audio ir level varies between wide limits.

4-8. SIGNAL CIRCUITS. (See figure 4-1.) Ta 4-1 lists the signal circuits (r-f and audio), th location, and function.

4-9. AUXILIARY CIRCUITS. Table 4-2 lists auxiliary circuits, their location, and function.

TABLE 4-1. SIGNAL CIRCUITS

Name	Location (As seen from front panel)	Function
Oscillator	Exciter subassembly, front section, transmitter	Crystal controlled r-f generator crystal freq $= \frac{\text{radio freq}}{36}$
First and Second Doublers	Exciter subassembly, front section, transmitter	Harmonic generators. Output of 2nd doubler is 12 times the freq of the crystal.
Buffer Amplifier	Exciter subassembly, front section, transmitter	Intermediate power amplifier.
Driver	Left side, rear section of transmitter	Intermediate power amplifier and tripler.
Power Amplifier	Right side, rear section of transmitter	Provides modulated r-f carrier with nominal output of 100 watts.
Narrow Band Amplifier	Driver subassembly, modulator chassis on right side of modulator-power supply	Overcomes attenuation of band pass filter Z301.
Phase Inverter	Driver subassembly, modulator chassis on right side of modulator-power supply	Changes audio signal from single ended to push-pull output and amplifies.
Audio Frequency Amplifier	Driver subassembly, modulator chassis on right side of modulator-power supply	Voltage amplifier. Bias controlled by modulation limiter rectifier.
Modulator Driver	Driver subassembly, modulator chassis on right side of modulator-power supply	Provides excitation for modulator stage.
Modulator	Modulator chassis on right side of modulator-power supply	Provides audio power to plate modulate the power amplifier.
Screen Modulator	Monitor-screen modulator assembly, transmitter	Provides audio power to screen modulate the power amplifier.

TABLE 4-2. AUXILIARY CIRCUITS

Name	Location (As seen from front panel)	Function
Automatic Modulation Limiting	Modulator chassis on right side of modulator-power supply	Portion of modulator output is rectified and used as bias on audio frequency amplifier stage to maintain modulator output at constant level.
Line Adjustment ("BUCK-BOOST")	Modulator chassis on right side of modulator-power supply	Provides line voltage correction.

(continued on page 2

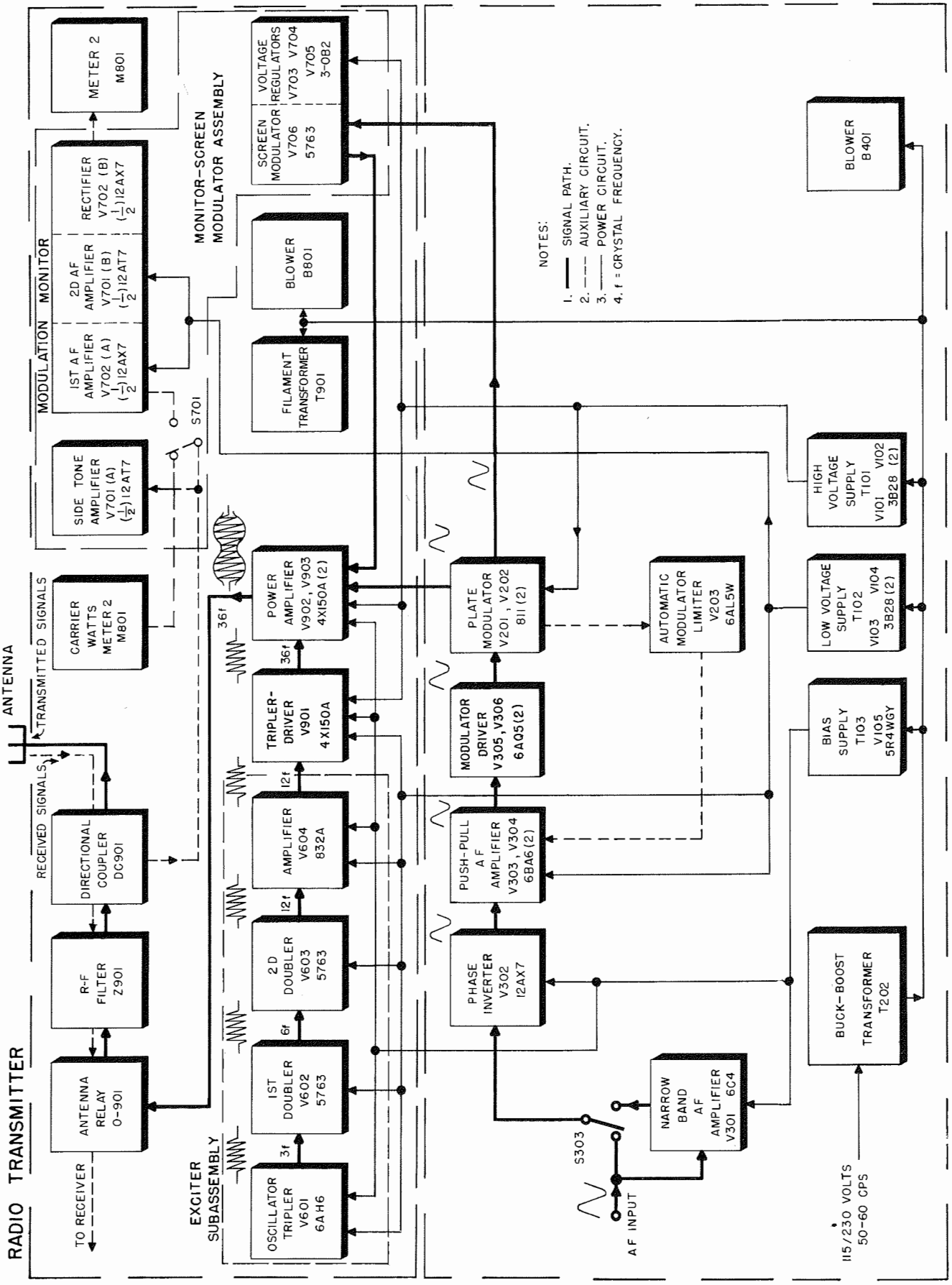


Figure 4-1. Radio Transmitter and Modulator-Power Supply, Block Diagram

TABLE 4-2. AUXILIARY CIRCUITS (CONT)

Name	Location (As seen from front panel)	Function
Metering	"METER 1 SELECTOR SWITCH" on front panel of transmitter	Provides switching to check plate and grid currents of transmitter circuits.
Voltage Measurements	Front panel of transmitter and of modulator-power supply	Pin jacks used in conjunction with test leads (jumpers) to measure critical voltages in r-f and audio circuits. Can use "METER 1" on front panel of transmitter.
Monitor	Monitor-screen modulator assembly, transmitter	Measure power output and percentage modulation. Listen to audio component of transmitted signal.
Ventilation	Air filters front and rear of transmitter and modulator-power supply. Blower motor, front of each unit.	Keep dust out and provide cooling.
Interlocks	All front and rear panel access points	High voltage safety precaution.
Antenna Switching	Relay, bottom, right side, rear section of transmitter	Switches antenna from receiver to transmitter when carrier turned on.
Low Pass R-F Filter	Bottom, right side, rear section of transmitter	Attenuates harmonics of r-f carrier.
Muting	"MUTER" terminals on rear of transmitter	Silences receiver during transmission.
Power Supply	Power supply chassis on left side of modulator-power supply	Provides filament, B plus and bias voltages for r-f, audio, and auxiliary circuits.
Time Delay	Relay, front, power supply chassis	Permits warm-up of rectifier tubes before application of plate voltage.
Push-to-talk Relay	Behind cover plate, lower left corner, front panel of transmitter	Button on microphone permits "push-to-talk" operation.

4-10. FUNCTIONAL OPERATION OF ELECTRONIC COMPONENTS.

4-11. Paragraphs 4-12 through 4-62 provide a description and essential information on the function of each electrical part, as well as the theory of operation of each stage. The discussion is in the order of signal sequence and is further explained by simplified schematics.

4-12. AUDIO INPUT. The audio section has provisions for a 50-ohm or 600-ohm input impedance. The 50-ohm input impedance is for local operation using a T-17 or similar type carbon microphone; the 600-ohm input impedance is used for remote operation over a 600-ohm line or for remote emergency voice operation using up to five miles of Field Wire W-110-B, or equivalent.

4-13. NORMAL 600-OHM LINE INPUT. (See figure 4-2.) Input transformer T301 has two primaries, a low impedance microphone winding, terminals 1 and 2, and a 600-ohm split winding, terminals 3, 4, 5, and 6. Normal operation is from a 600-ohm line. Under this condition, "NORMAL-EMER" switc S301, is operated to the "NORMAL" position; "NAI ROW-BROAD" switch, S303, to the "NARROW" pos tion for voice transmission, to the "BROAD" positi for an extended range of modulation; and "PUSH T TALK-CARRIER ON" switch, S302 (figure 4-3), the "CARRIER ON" position. Switch S301 connec terminal 5 of the 600-ohm primary of transform T301 to terminal 4, which is grounded by link O-5 on terminal board E501, thus establishing the groun ed center tap essential for balanced line operatio The telephone line connects through the "LINE terminals on E501 to terminals 3 and 6 of trans former T301. If unbalanced input is required, t telephone line is connected between the center te minal "CTR" and either one of the "LINE" termina on E501. Switch S302, in the "CARRIER ON" positio keeps the push-to-talk relay energized and permi the transmitter to emit a continuous carrier. (Se figure 4-20.) The output of the secondary of trans former T301 is controlled by dual potentiomet "GAIN" control R306A and R306B in combinati with R308, which maintains a substantially co stant load of about 50,000 ohms on the transforme

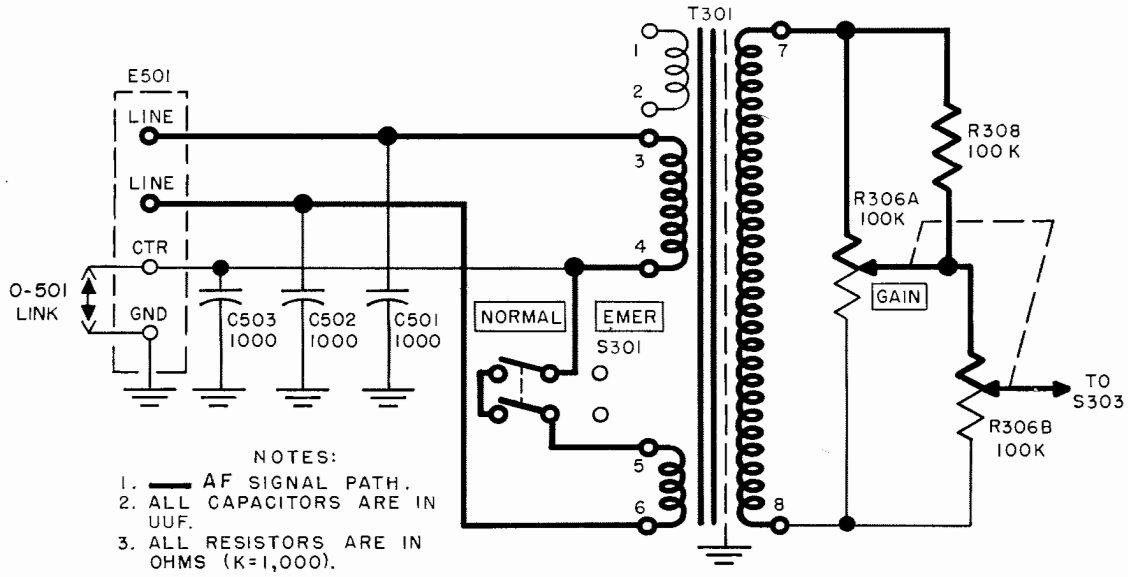


Figure 4-2. Modulator-Power Supply, Normal 600-Ohm Line Input, Simplified Schematic

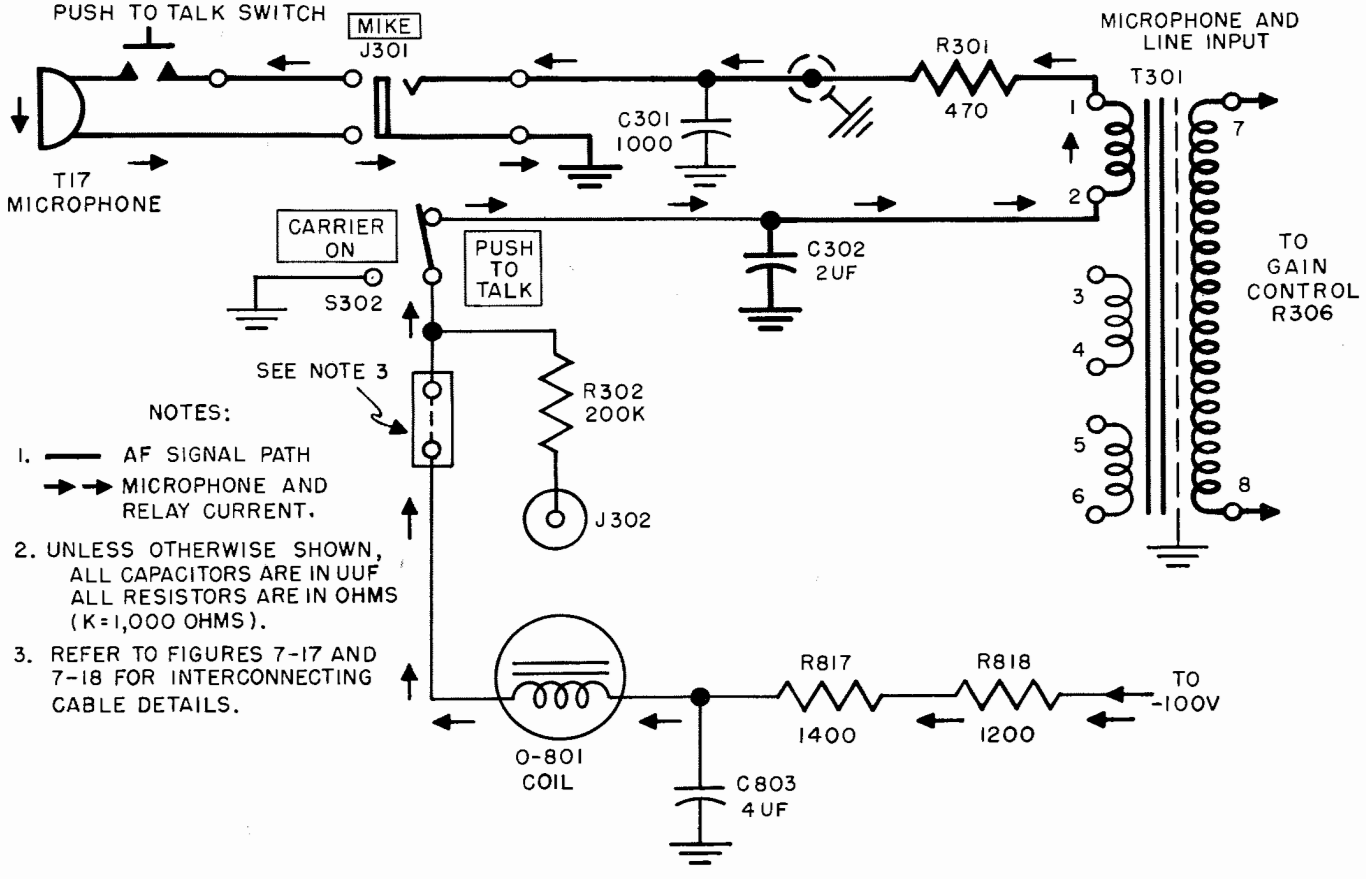


Figure 4-3. Modulator-Power Supply, Local Voice Operation, Simplified Schematic

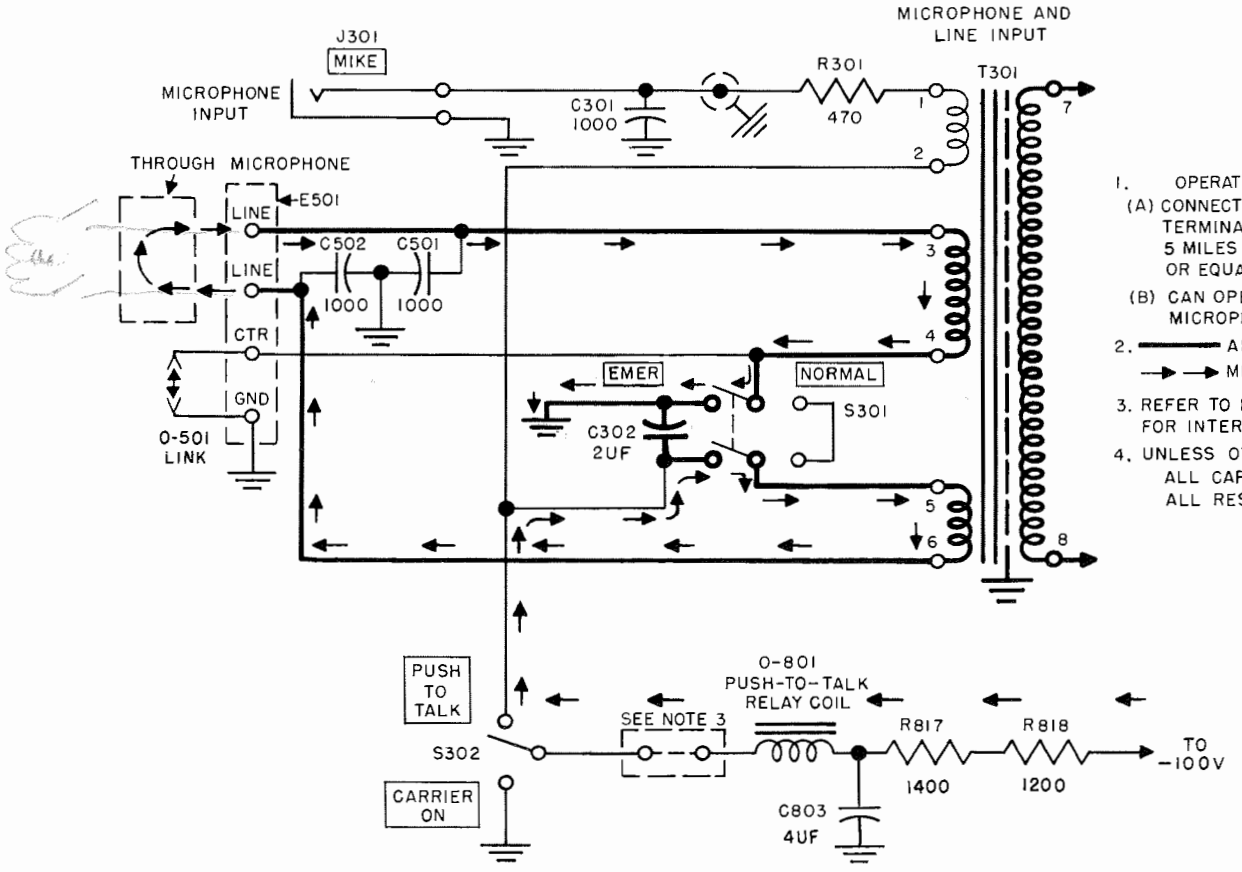


Figure 4-4. Modulator-Power Supply, Emergency Voice Operation, Simplified Schematic

4-14. LOCAL VOICE OPERATION. (See figure 4-3.) When the equipment is to be used for voice transmission at the transmitter, the T-17 microphone is plugged into "MIKE" jack J301, "EMER-NORMAL" switch S301 (figure 4-2) is operated to the "NORMAL" position, and "PUSH TO TALK-CARRIER ON" switch S302 to the "PUSH TO TALK" position. Pressing the microphone button completes the push-to-talk relay circuit to ground through the 50-ohm primary of audio input transformer T301, terminals 1 and 2, and thence through the microphone. The d-c current for push-to-talk relay, O-801, furnished by the minus 100-volt bias supply through dropping resistors R817 and R818, is also used for microphone current. Audio current does not pass through the push-to-talk relay, being bypassed to ground through capacitor C302. Resistor R302 is a meter multiplier and J302 is a test point for measuring the microphone circuit voltage (see paragraph 4-62).

4-15. EMERGENCY VOICE OPERATION. (See figure 4-4.) This type of operation permits push-to-talk operation from either the "MIKE" or 600-ohm "LINE" input terminals. Depressing the button on the T-17 microphone permits modulation and turns on the carrier during emergency remote operation; the carrier is always on during normal remote operation.

4-16. When it is desired to use a carbon micr phone on the 600-ohm line for remote voice tran mission (see Handbook of Operating Instructions the "NARROW-BROAD" switch S303 is operated the "NARROW" position (figure 4-6) and the "EME NORMAL" switch S301 to the "EMER" positic which grounds terminal 4 and connects termina 5 and 2 of T301 to "PUSH TO TALK-CARRIER O switch S302. Operating S302 to the "PUSH TO TAL position and depressing the push-to-talk button the hand microphone completes the push-to-ta relay coil and microphone current circuit. T current flow sequence (figure 4-4) is as follow minus 100-volt source, through dropping resisto R817 and R818, through coil of push-to-talk rel O-801, through "PUSH TO TALK-CARRIER O switch S302, through "EMER-NORMAL" switch S30 through one winding of microphone and line inp transformer T301 (terminals 5 and 6), through o side of the field wire, through the microphone, ba through the other side of the field wire, and throu another winding of T301 (terminals 3 and 4), a finally through "EMER-NORMAL" switch S301 ground.

4-17. NARROW BAND AMPLIFIER. (See figure 4-5 The output at "GAIN" control potentiometer R306 is now coupled through capacitor C305 (and C3 in modulator-power supplies having serial numbe

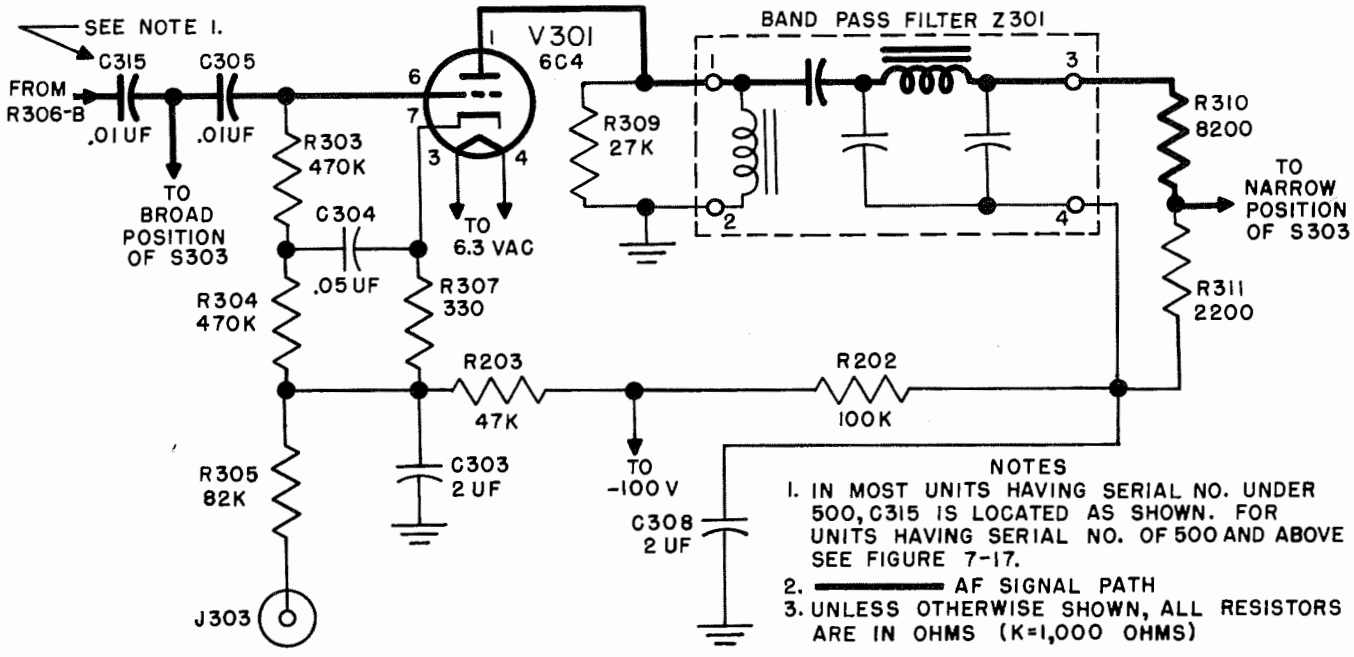


Figure 4-5. Modulator-Power Supply, Narrow Band Amplifier, Simplified Schematic

under 490) to the grid of band-pass amplifier tube V301 (6C4). Band-pass filter Z301, shunted by resistor R309 at the input and resistors R310 and R311 at the output, provides the load for this stage and restricts the output to a frequency range of 400 to 3,000 cps. Voltage divider action of resistors R310 and R311 provides an over-all gain of unity for the entire stage. Capacitor C303 is a hum filter. Resistor R303 is the grid resistor, R307 the cathode resistor, and resistor R304 and capacitor C304 a grid decoupling filter. Resistor R305 is a meter multiplier and J303 is a test jack (see paragraph 4-62).

4-18. PHASE INVERTER. (See figure 4-6.) The purpose of this stage is to convert from single ended to push-pull output in order to drive the following push-pull amplifier. V302A (1/2 12AX7) amplifies the signal applied to its grid in the normal manner. A small part of the amplified signal is fed back to the control grid of V302B (1/2 12AX7). Note that since the signal at the plate of V302A is 180 degrees out of phase with the signal at its own grid, the signals at the grids of V302A and V302B must be 180 degrees out of phase. Hence, the signals at the plates of the two tubes are 180 degrees out of phase.

4-19. The signal from "GAIN" control R306B is coupled through "NARROW-BROAD" switch S303 and capacitor C315 (in units having serial numbers above 489) to the grid of amplifier tube V302A. R313 is the cathode resistor of this stage. Resistors R316 and R317 comprise the load for the stage and form a voltage divider which supplies a reduced signal voltage through coupling capacitor C309 to the grid of phase inverter tube V302B. R312 and R314 are, respectively, the grid and cathode resistors of the phase inverter. Capacitors C306 and C307 are, respectively, the high frequency compensating cathode bypass capacitors of tubes V302A and V302B, having sufficient capacitance to permit full amplification at high audio frequencies and reduced amplification at low audio frequencies. Note that the "low" side of plate load resistors R317 and R318 are at ground potential. The "low" sides of grid resistors R312 and R338, "GAIN" control variable resistor R306A and R306B, and cathode resistors R313 and R314 are at a negative d-c potential with respect to ground. Since the d-c bias supply is on continuously when the "POWER" switch S403 is turned "ON", tubes V302A, V302B, and V301 (6C4) always have plate potential applied, i.e., the plate is positive with respect to its cathode, the plate being at ground potential. Capacitor C308 is a hum filter. The output of tubes V302A and V302B are coupled by capacitors C310 and C311 to the grids of push-pull a-f amplifier tubes V303 (6BA6) and V304 (6BA6).

4-20. A-F AMPLIFIER. (See figure 4-7.) The out of phase signals from the phase inverter are applied to the control grids of the two tubes, which are connected in push-pull, and amplified in the normal manner. Resistors R319 and R320 are the grid resistors of V303 and V304, and R326 and R327 the plate load resistors. R322 is the common cathode resistor. Bias is also applied to this stage at the common terminal of resistors R319 and R320 by the d-c voltage drop across resistor R206 which is the load for the modulation limiter rectifier tube V203 (6AL5W) (see paragraph 4-23). Resistors R323, R324, and R325 form a screen voltage divider network.

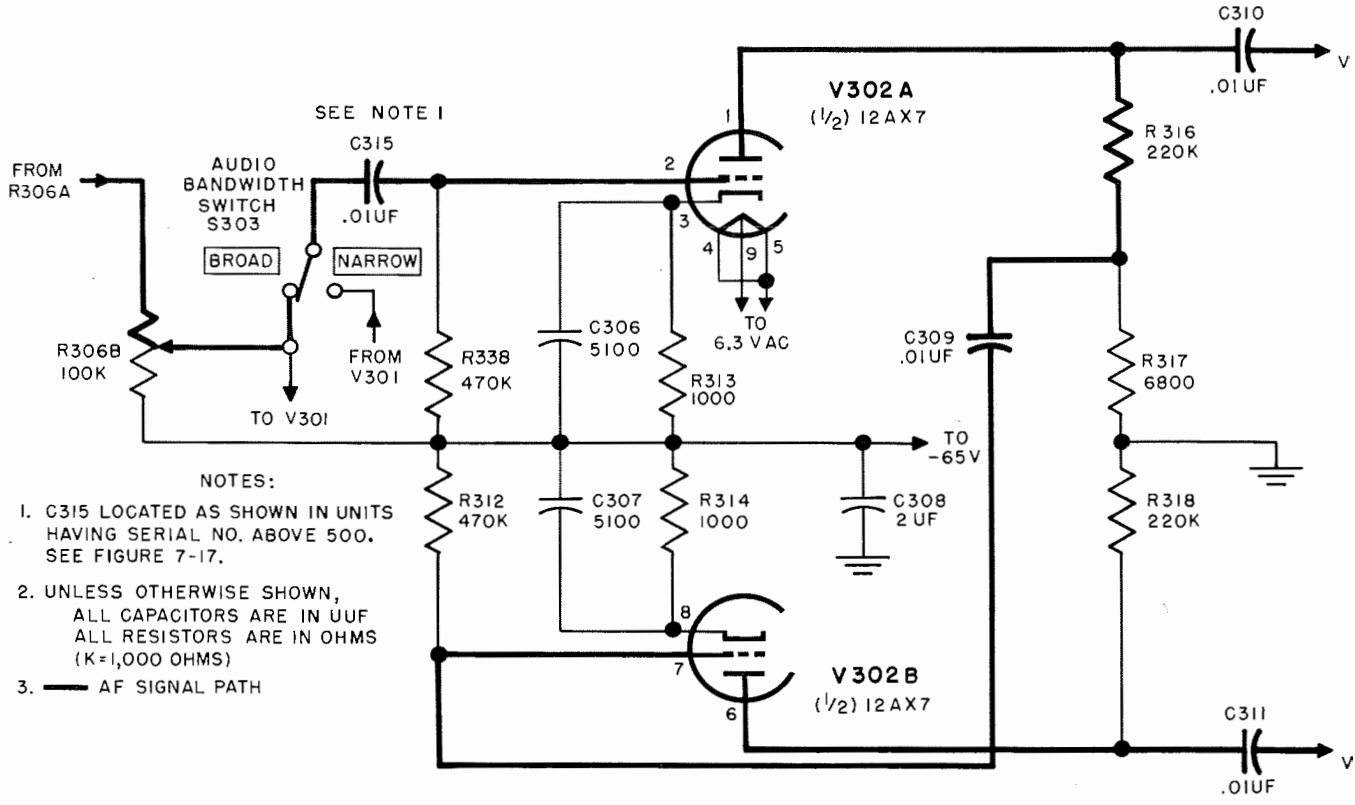


Figure 4-6. Modulator-Power Supply, Phase Inverter, Simplified Schematic

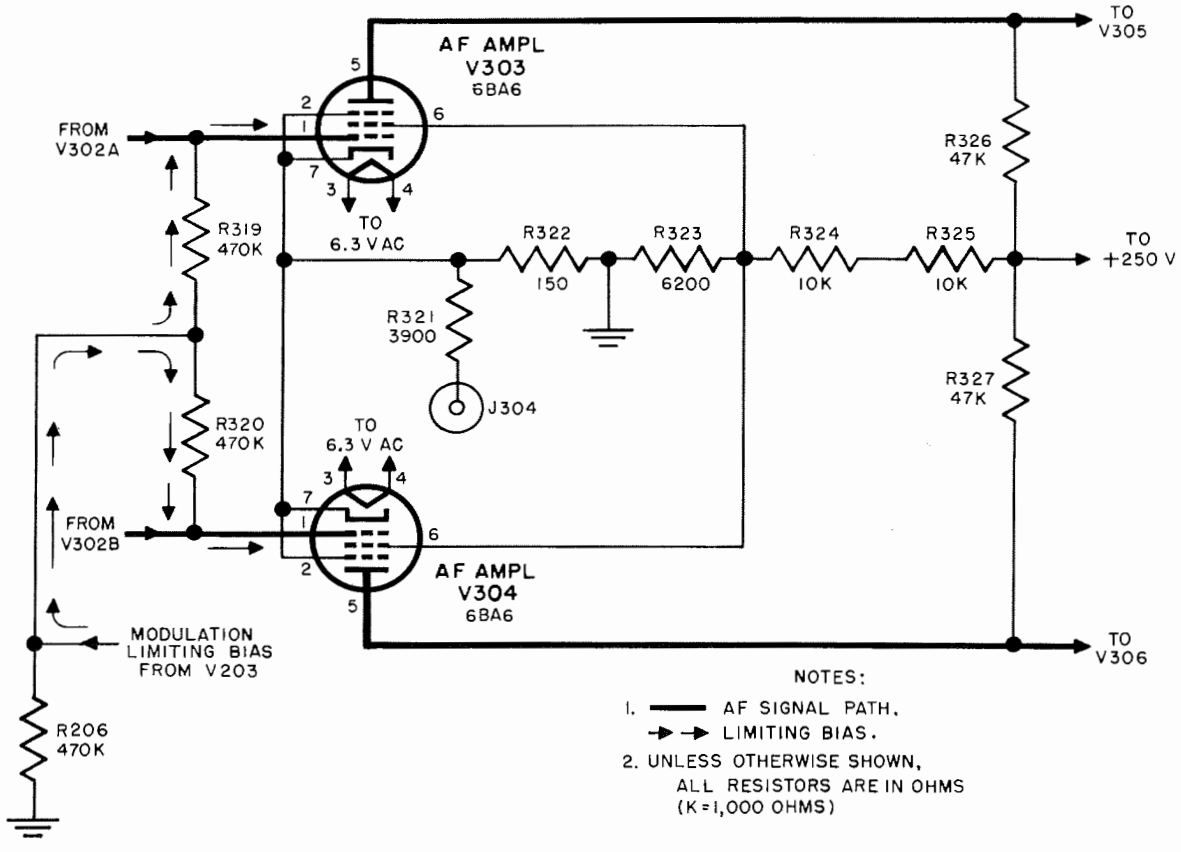


Figure 4-7. Modulator-Power Supply, A-F Amplifier, Simplified Schematic

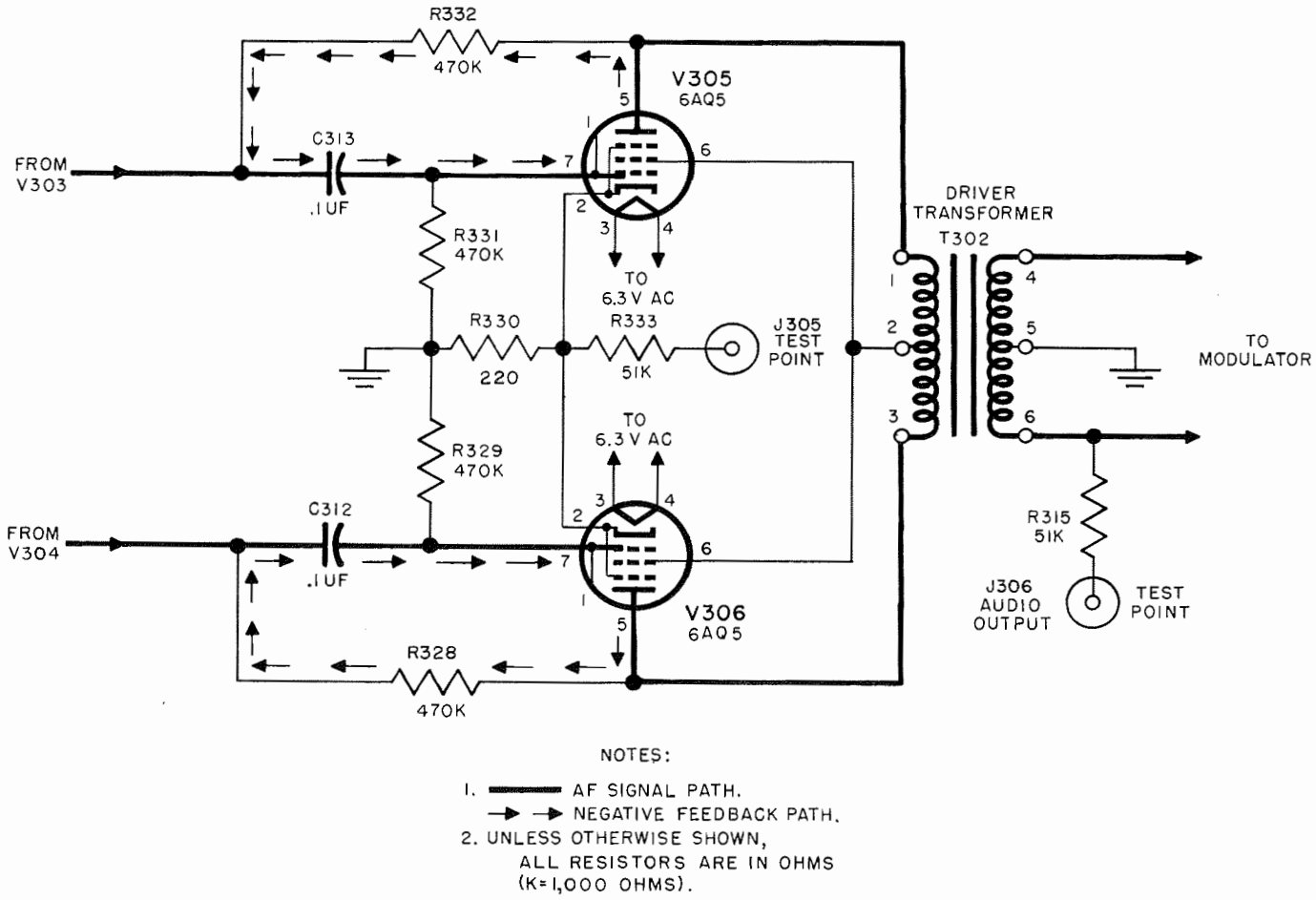


Figure 4-8. Modulator-Power Supply, Modulator Driver, Simplified Schematic

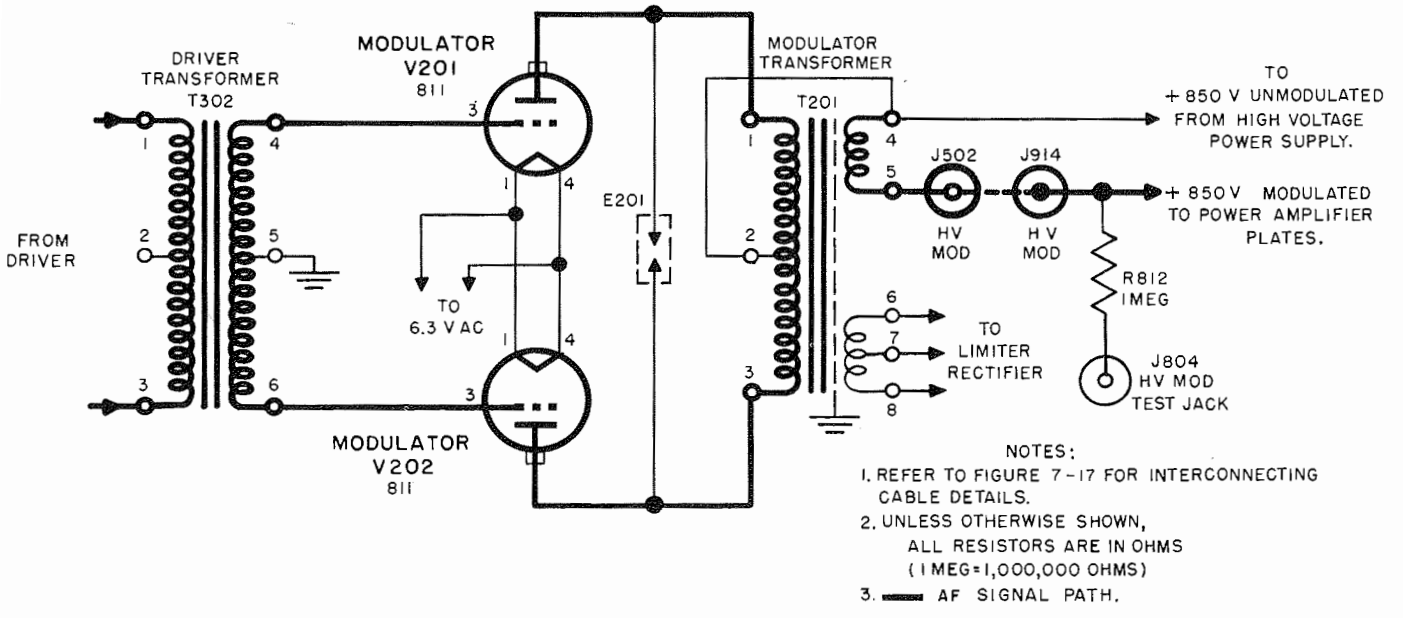


Figure 4-9. Modulator-Power Supply, Modulator, Simplified Schematic

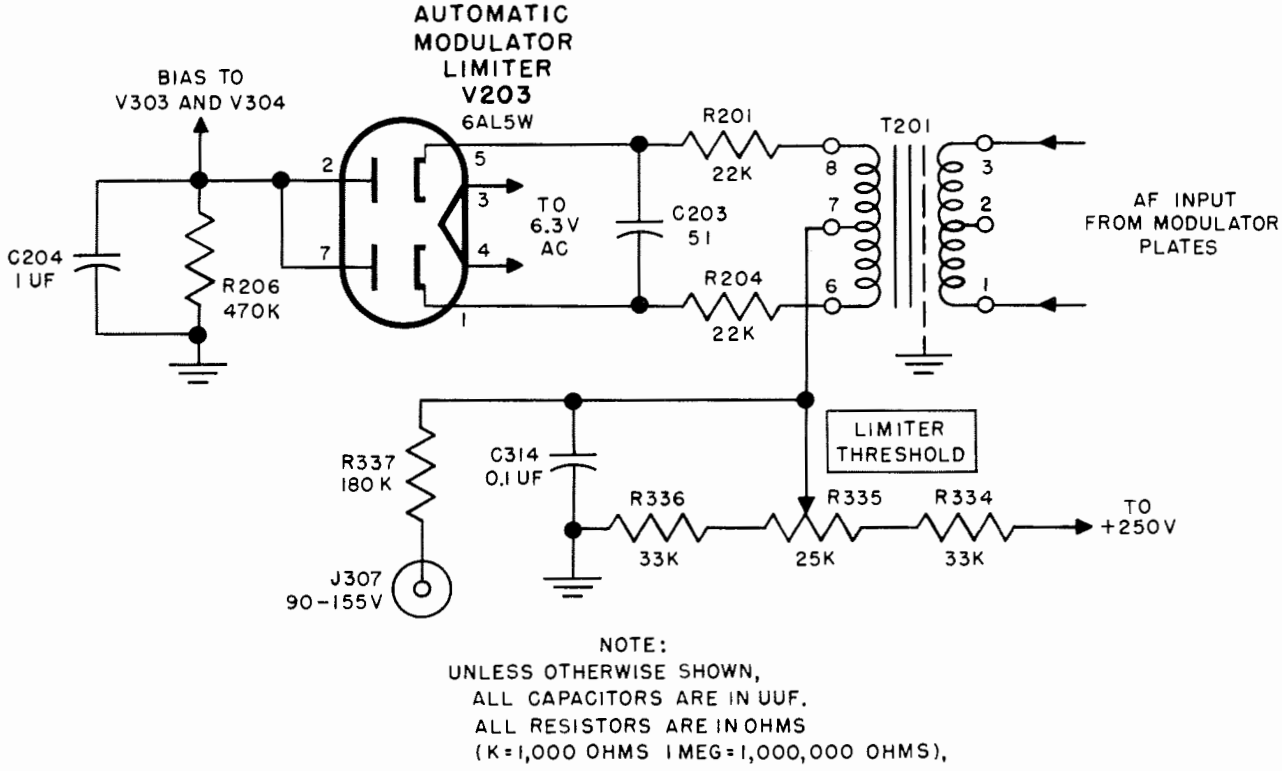


Figure 4-10. Modulator-Power Supply, Automatic Modulation Limiter, Simplified Schematic

Resistor R321 is a meter multiplier and J304 is a test jack for measuring the cathode self-bias (see paragraph 4-62).

4-21. MODULATOR DRIVER. (See figure 4-8.) Capacitors C313 and C312 couple the output of tubes V303 and V304 to the push-pull connected driver amplifier tubes V305 and V306 (each a 6AQ5), which furnish excitation for the modulator tubes (paragraph 4-22). R329 and R331 are the grid resistors. R330 is the common cathode resistor. Resistors R328 and R332 provide inverse feedback from the plates back to the grid circuit. The output of the stage is coupled by driver transformer T302 to the modulator stage. Resistors R333 and R315 are meter multipliers. J305 and J306 are test jacks for checking the cathode self-bias and the audio output (see paragraph 4-62).

4-22. MODULATOR. (See figure 4-9.) The output of driver transformer T302 is fed to the grids of the zero-bias class B push-pull modulator tubes V201 and V202 (each an 811). The secondary of modulation transformer T201, whose terminals are numbered 4 and 5, delivers modulated high voltage through connector J502 to the power amplifier in Radio Transmitter T-282/GR; the voltage can be measured at test jack J804 through meter multiplier resistor R812 (see paragraph 4-61).

4-23. AUTOMATIC MODULATION LIMITER. (See figure 4-10.) A separate modulation transformer secondary winding, whose terminals are marked 6, 7, and 8, supplies signal voltage to the automatic modulator limiter rectifier tube V203 (6AL5W). This tube has an adjustable positive d-c delay voltage applied to its cathode by means of the bleeder string comprising resistors R334, R336, and "LIMITER THRESHOLD" variable resistor R335 across the 250-V d-c supply. If the peak signal voltage is less than the delay voltage obtained from R335, tube V203 does not conduct, there is no d-c voltage drop across resistor R206, and the amplifier stage consisting of tubes V303 and V304 operates only on the bias developed by its cathode bias resistor.

4-24. When the peak signal voltage applied to tube V203 exceeds the delay voltage, the tube conducts, and a negative d-c voltage to ground is produced across R206, filtered by capacitor C204. This applies a negative bias to the grids of V303 and V304 and reduces their gain. The entire action is similar to delayed automatic volume control action in a radio receiver. Thus the push-pull stage, comprising tubes V303 and V304, and the limiter rectifier stage, comprising tube V203, serve as a gain reduction system which functions to limit the gain of the modulating system whenever the output signal exceeds a level which is predetermined by the adjustment of "LIMITER THRESHOLD" variable resistor R335. Resistors R201 and R204, and capacitor C203, form a high frequency compensation network for the modulation limiter rectifier stage. Capacitor C314 is an audio filter. The delay voltage (90 to 155 volts) can be checked at test jack J307 (see paragraph 4-62).

4-25. SCREEN MODULATION CIRCUIT. (See figure 4-11.) Component parts of the screen modulator circuit are located within the monitor-screen modulator assembly. Triode connected screen modulator tube V706 (5763) is operated as a cathode follower.

V703, V704, and V705 (each an OB2) are voltage regulator tubes; they are used to drop the plus 850-volt d-c voltage down to the potential required by the plate of V706.

4-26. The screens of power amplifier tubes V902 and V903 (each a 4X150A) derive their d-c and audio voltages directly from the cathode of V706 (which operates as a cathode follower). In order to minimize audio distortion in the power amplifier, the audio voltage fed to the screens must: (1) come from a low-impedance generator and (2) must be in phase with the audio voltage applied to the plate circuit. The output (cathode) circuit of a cathode follower looks like a low impedance while the input (grid) circuit has a high impedance. Therefore, a-c and d-c voltages applied at the input of the cathode follower are available at the output, with the required low impedance source (generator) for a-c, as well as d-c, voltages. The cathode follower has a voltage gain (between the grid input and cathode output) of approximately 0.9. The audio voltage applied to the grid of V706 is derived from a voltage divider which includes "MOD LIN" control R723; adjustment of the control provides a convenient means for varying the audio voltage applied to the grid and, hence, to the power amplifier screens. In operation, R723 is adjusted for linear modulation. The power amplifier plate current is adjusted by varying the d-c voltage applied to the screens. This is conveniently accomplished by varying the d-c voltage on the grid of the cathode follower by means of "PA CUR" control R719, a potentiometer which is connected to the plus 250-volt supply; the d-c voltage at the cathode (of V706) will "follow" the grid voltage and thus change the d-c screen potential. Table 6-12 includes the adjustment procedure for the two above described controls, R723 and R719.

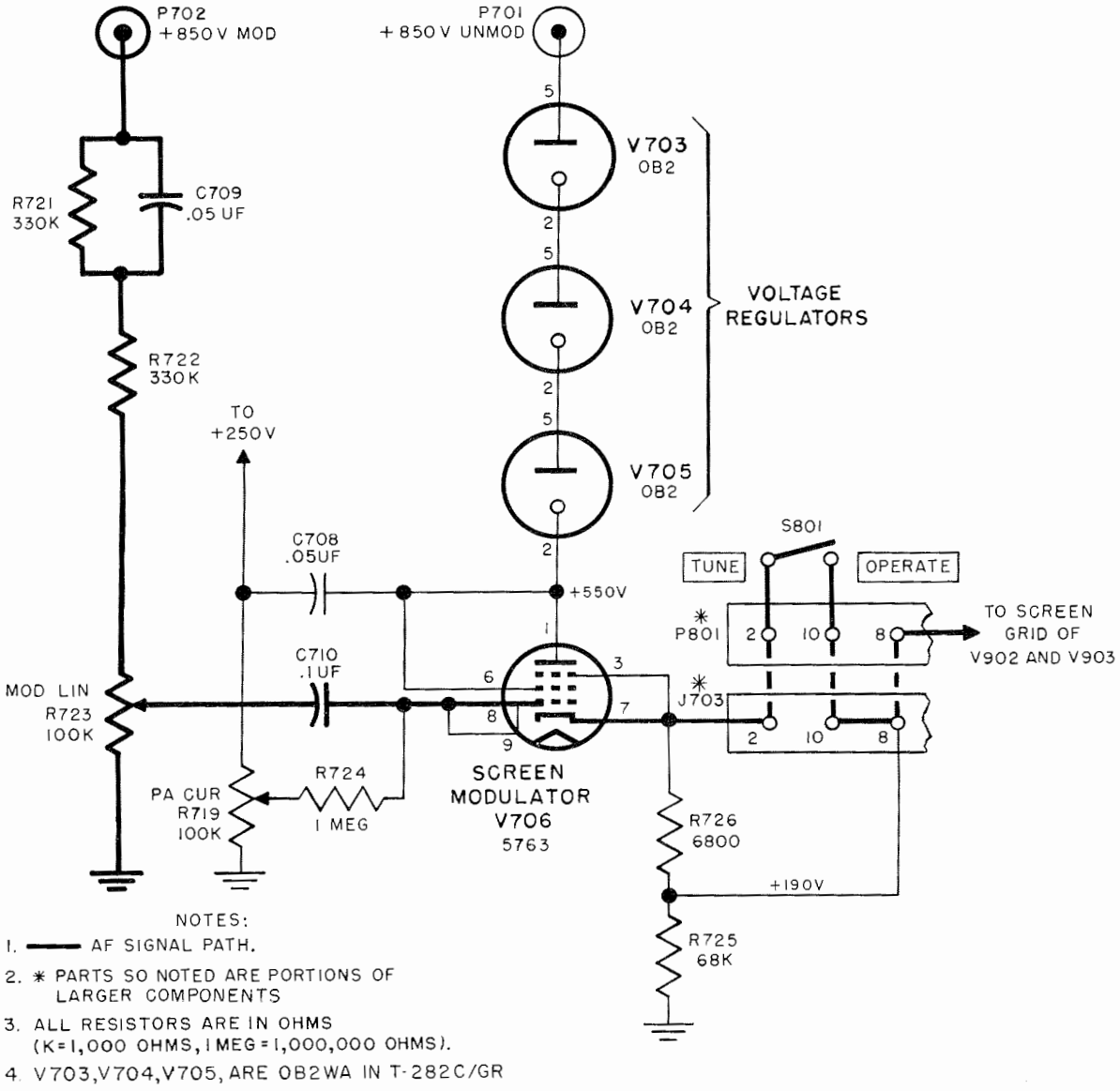


Figure 4-11. Radio Transmitter, Screen Modulator, Simplified Schematic

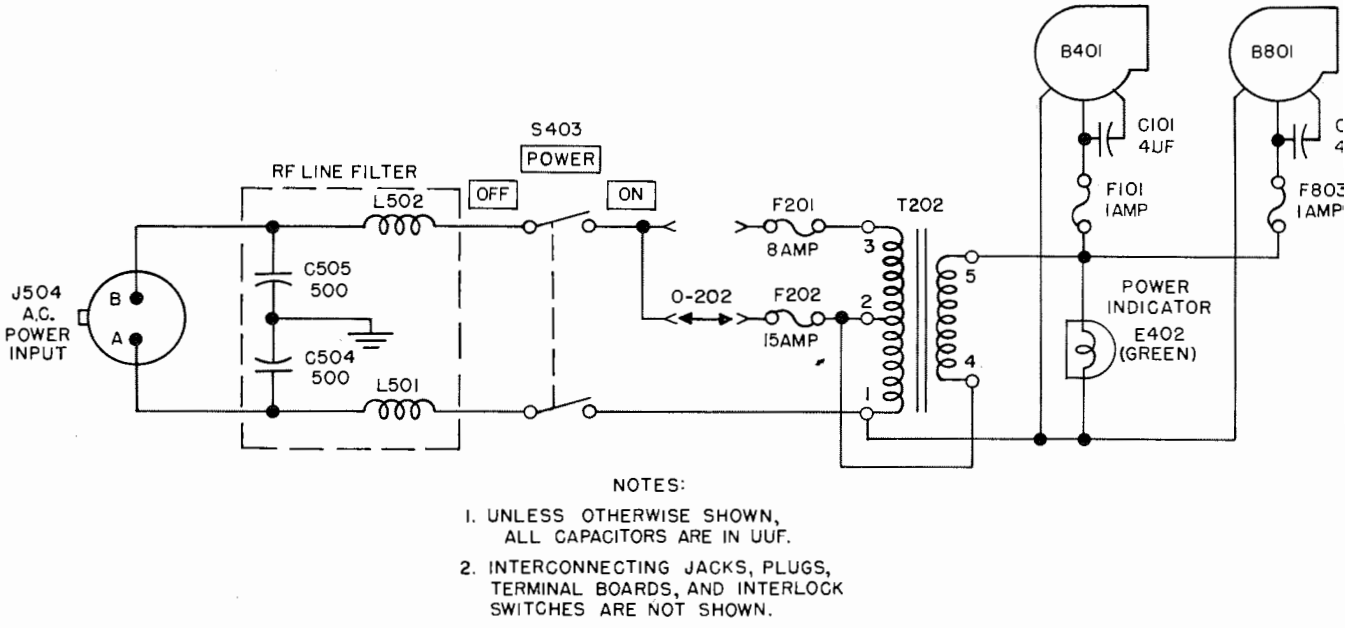


Figure 4-12. Radio Transmitter and Modulator-Power Supply, 115/230-Volt Operation, Simplified Schematic

4-27. V706 derives its plate supply voltage from the unmodulated plus 850-volt supply at connector P701; series connected voltage regulator type tubes V703, V704, and V705 drop the voltage down to about 550 volts. The d-c voltage drop across V706 cathode load resistor R725 (about 190 volts under normal operating conditions) supplies screen voltage for V902 and V903. Resistor R726, normally shorted out by "TUNE-OPERATE" switch S801, is also in series with the cathode of V706. When it is desired to operate the power amplifier stage at reduced power, as in preliminary tuning, "TUNE-OPERATE" switch S801 is operated to the "TUNE" position which makes R726 effective in the cathode circuit. This produces a voltage divider which lowers the screen voltage and reduces the power output from the power amplifier stage. "PA CUR" control R719 is connected between 250 volts and ground. In order to set the d-c potential of the power amplifier screens (connected to the cathode of V706) to the right level, positive voltage is taken from the arm of R719 and applied to the control grid of V706 through audio frequency load resistor R724. Modulated high voltage d-c comes in through connector P702. Resistors R721, R722, and "MOD LIN" control R723 comprise a d-c voltage divider. Capacitor C709 bypasses R721, hence, only R722 and R723 function as an audio voltage divider. The audio component is coupled from the arm of R723, through blocking capacitor C710, to the control grid of V706. The above described design permits separate adjustments to be made of the d-c and audio potentials applied to the screens of V902 and V903.

4-28. 115/230-VOLT OPERATION. (See figure 4-12.) The a-c input power enters the equipment through connector J504 and an r-f line filter consisting of inductors L501 and L502, and capacitors C504 and C505. If the equipment is to be operated off a 115-volt a-c line, the 115/230-V link, O-202 (see paragrap 3-19), is connected in the 115-volt position. Whe the "POWER" switch S403 is operated to the "ON position, a-c power is applied between the commo (terminal 1) and the tap (terminal 2) on the primar of transformer T202, through fuse F202, lightin green indicator light E402 and starting blower B40 through its fuse F101, and blower B801 in the trans mitter through its fuse F803. For 230-volt operatio the power is applied through link O-202 to the entir primary of transformer T202 through fuse F20 including 115 volts between the primary tap (termin 2) and the common, lighting green "POWER" in dicator light E402 and starting the blowers exact as for 115-volt operation. C101 and C801 are th starting capacitors for blowers B401 and B80 respectively.

4-29. LINE ADJUSTMENT CIRCUIT. (See figur 4-13.) When "BUCK-BOOST" switch S502 is in th "BOOST" position, the 5-volt secondary of the lin adjustment transformer T202 (a modified auto-trans former) is placed in series with half of the primar winding and in the same phase so that if the voltag between the primary tap and one end of the primar is as low as 105 volts, the rest of the equipme will receive no less than 110 volts. Should th voltage between the tap and one end of the primar of the transformer be as high as 125 volts, oper ating "BUCK-BOOST" switch S502 to the "BUCK position will reduce the delivered voltage to 12 volts. Thus the supply voltage for the high and lo d-c power supplies, as well as the bias and filame supplies, can be kept between the limits of 110 120 volts even though the line voltage may vary be tween 105 and 125 volts or between 210 and 250 volt

4-30. BIAS SUPPLY. (See figure 4-14.) The adjuste voltage obtained from transformer T202 is applie

through front access door interlock switch S402, terminal K on connectors J503, P910, P909 and J913, inlet air-filter interlock switch S601, monitor-screen modulator interlock switch S803, air interlock switch S602, terminal E on connectors J913, P909, P910 and J503, fuse F104 and air interlock switch S101 to the primary of filament and bias transformer T103. High voltage a-c is delivered to bias rectifier tube V105 (5R4WGY). The rectified output of tube V105 is filtered by input capacitor C103, reactor L201, and capacitor C202. Reactor L201 is resonated by capacitors C205 and C206 thus increasing the series impedance in the capacitor input filter network and thereby improving the filtering. Resistor R205, in series with R202 and R203, drops the voltage furnished to the cathodes of V301 and V302, and capacitors C201, C303, and C308 filter the above cathode voltages. Part of the d-c voltage filtered by reactor L201 is delivered through dropping resistor R207 and terminal J of connectors J503, P910, P909 and J913 to a bleeder string in the transmitter comprising resistors R806, R807, R808, R809, R810 and R811. The voltage can be measured at test jack J807 through meter multiplier resistor R814 as described in paragraph 4-61. Approximately minus 100-volts operating bias is provided for V901, minus 60-volts operating bias for V902 and V903, minus 35-volts operating bias for V604, and minus 100-volts blocking bias through isolating resistor R816 for the grid circuit of V601. Voltage dropping resistors R817 and R818, shunted by filter capacitor C803, provide filtered d-c for the coil of push-to-talk relay O-801 and the microphone circuit.

4-31. Failure to properly close the air-filter interlocks S402, S601, S803 and/or failure of the blowers to operate will cause air interlocks S101 and S602 to open; this will interrupt the a-c supply to filament and bias transformer T103 and no d-c bias voltage will be developed.

4-32. LOW VOLTAGE D-C SUPPLY. (See figure 4-15.) Closing of the contacts of plate contactor O-201 (K201) applies 115 volts a-c to the primary of the low voltage power transformer T102 through fuse F103. The stepped up voltage of the secondary of transformer T102 is rectified by tubes V103 and V104 (each a 3B28) and filtered by reactor L102, capacitors C105 and C207. Resistor R101 drops the voltage so that the potential at the output end of L102 is 300 volts, which is delivered to the plate circuit of tube V604 and metered at test jack J806 through meter multiplier resistor R813. Resistor R102 drops the voltage to 250 volts which is applied to the grid of tube V706 and the plate circuits of tubes V303, V304, V305, V306, V601, V602, V603, V701A, V701B, and V702A. This voltage is metered at test jack J808 through meter multiplier resistor R815. (See paragraph 4-61.) Capacitor C102 tunes L102 to anti-resonance at twice the power line frequency (100 to 120 cps) producing a high

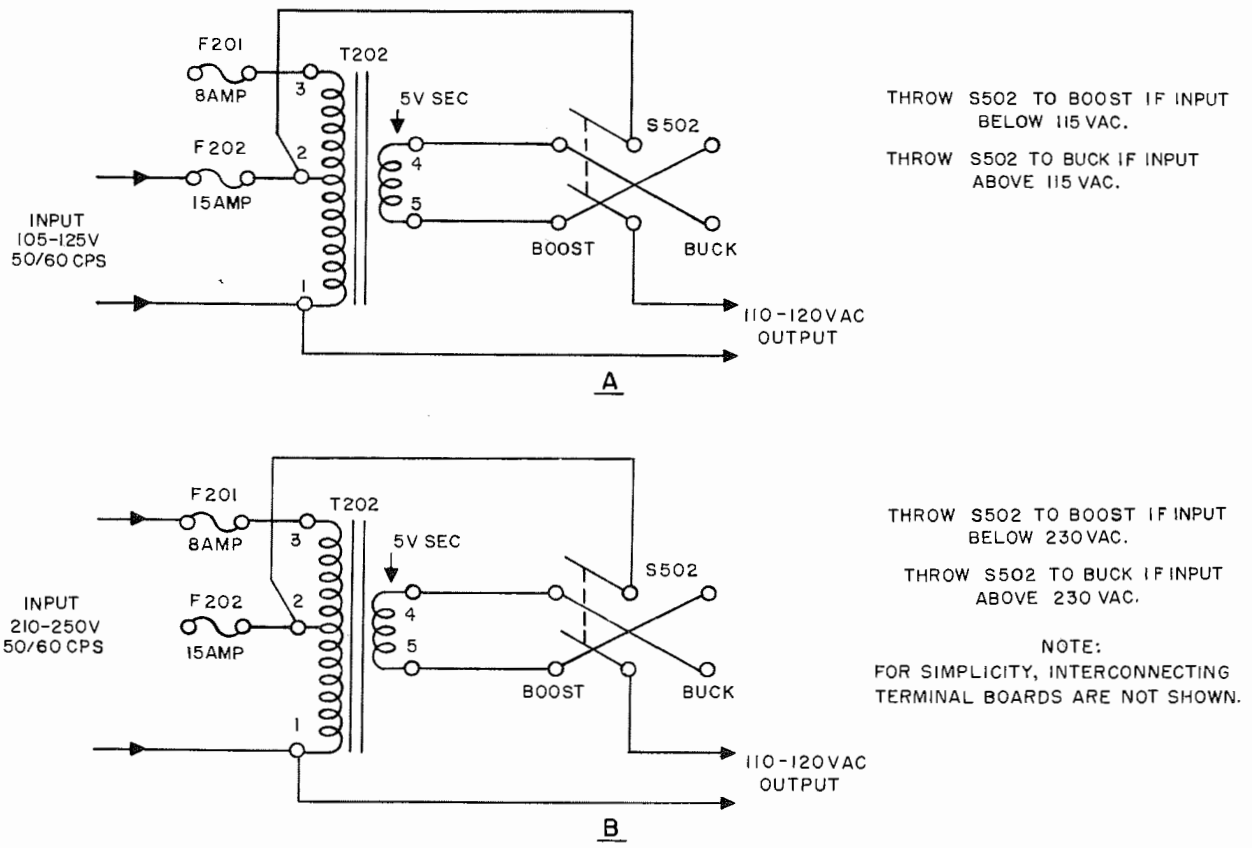
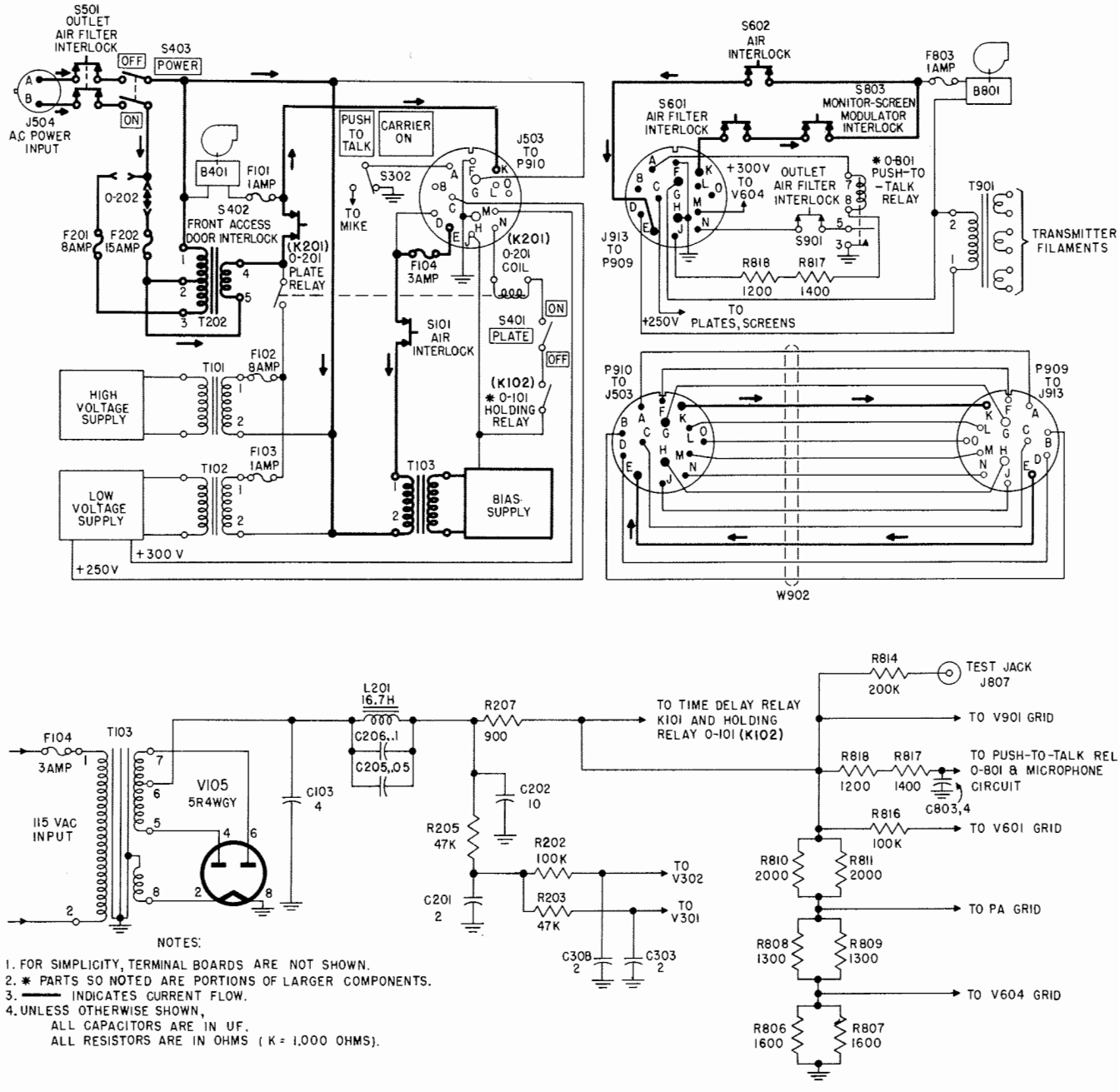


Figure 4-13. Modulator-Power Supply, Line Adjustment Circuit, Simplified Schematic



NOTES:
1. FOR SIMPLICITY, TERMINAL BOARDS ARE NOT SHOWN.
2. * PARTS SO NOTED ARE PORTIONS OF LARGER COMPONENTS.
3. ——— INDICATES CURRENT FLOW.
4. UNLESS OTHERWISE SHOWN,
   ALL CAPACITORS ARE IN UF.
   ALL RESISTORS ARE IN OHMS (K = 1,000 OHMS).

Figure 4-14. Bias Supply, Simplified Schematic

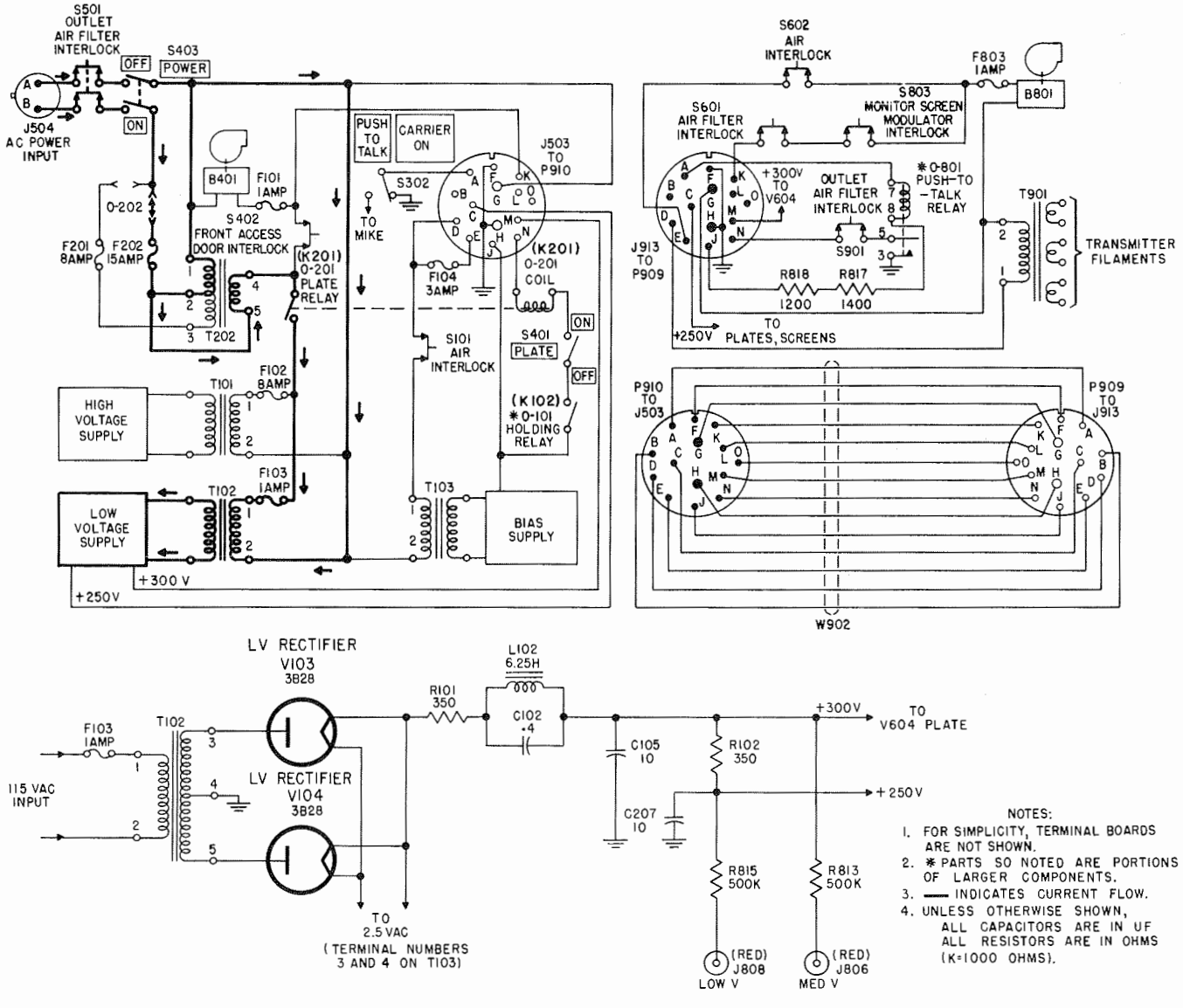


Figure 4-15. Low Voltage D-C Supply, Simplified Schematic

series impedance in the filter circuit. The filaments of V103 and V104 receive their power from the secondary winding of transformer T103, terminals 3 and 4. The secondary center-tap of transformer T102 is grounded, providing the negative return of the low voltage power supply.

4-33. HIGH VOLTAGE D-C SUPPLY. (See figure 4-16.) Voltage is applied through fuse F102 to the primary of high voltage transformer T101. The secondary applies a high a-c voltage to rectifier tubes V101 and V102 (each a 3B28). The rectified current is filtered by reactors L101 and L202, and capacitors C104 and C209. Capacitor C208 tunes L202 to anti-resonance at twice the power line frequency (100 to 120 cps) producing a high series impedance in the filter circuit. Resistors R208, R209, R210, and R211 constitute a bleeder. The filtered voltage is applied to the modulator tubes V201 and V202. Unmodulated high voltage d-c is also delivered to the transmitter through connector J501. The filaments of V101 and V102 receive their power from the secondary of bias and filament transformer T103, terminals 11 and 12. The center-tap (terminal 4) of the high voltage secondary of T101 is grounded, providing the negative return of the high voltage power supply.

4-34. FILAMENT CIRCUIT OF AUDIO SECTION. (See figure 4-17.) The secondary of bias and filament transformer T103, terminals 9 and 10, supplies heater current for tubes V301, V302, V303, V304, V305, V306, V201, V202 and V203. The center tap is grounded, providing a return path for the plate current of tubes V201 and V202 to the negative terminal of the high voltage power supply.

4-35. TRANSMITTER FILAMENT CIRCUITS. (See figure 4-18.) All filaments and heaters in the transmitter are supplied from filament transformer T901,

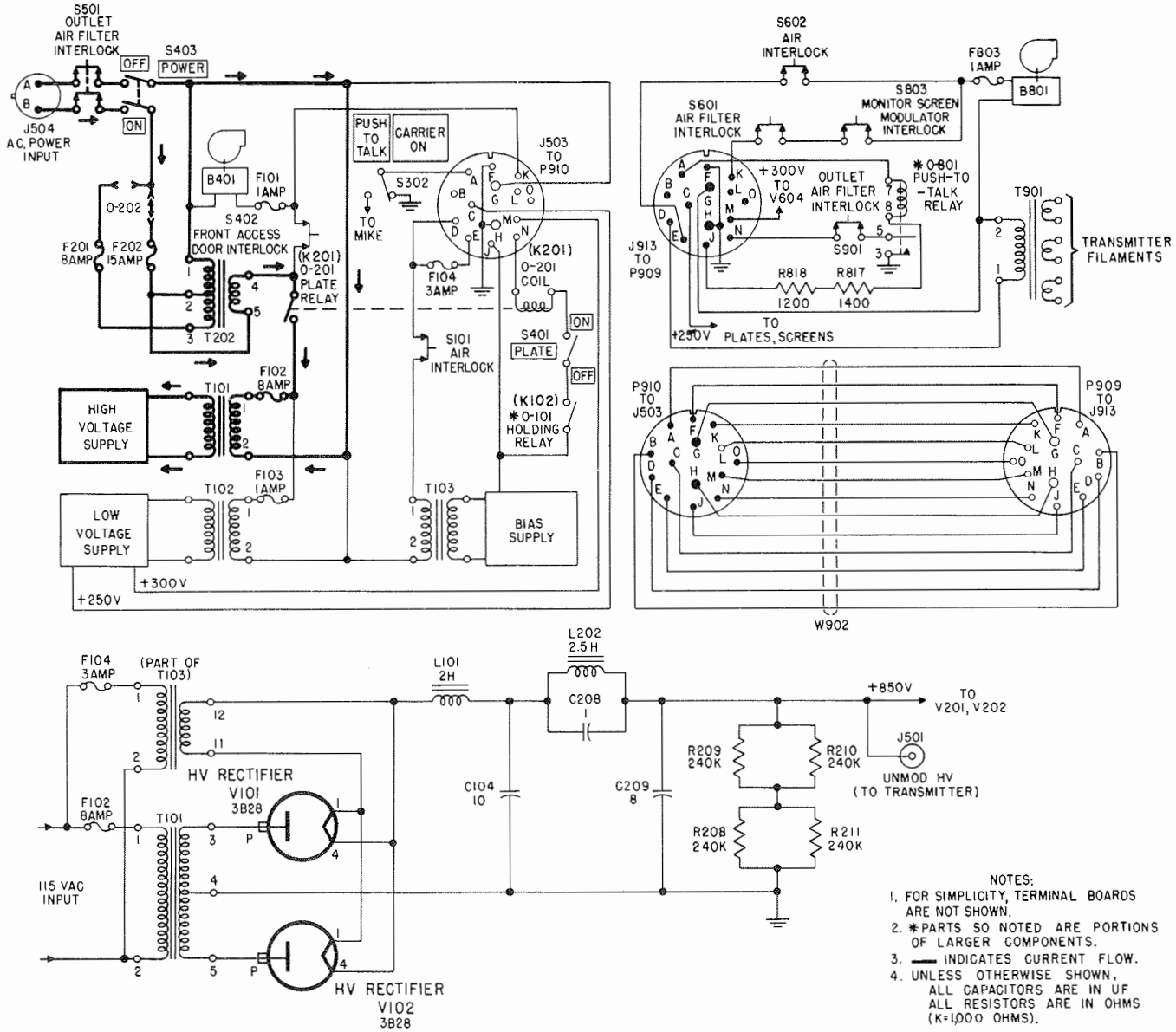


Figure 4-16. High Voltage D-C Supply, Simplified Schematic

which in turn receives 115-V ac through terminals K, G, E, and D of connectors J913, P909, P910 and J503; through interlock switches S402, S601, S803, S602; and fuse F104. The secondary of T901, whose terminals are marked 5 and 6, supplies 6.3-V ac to the heaters of V601, V602, V603, V604, V701, V702, A601 (crystal oven). The secondary, whose terminals are marked 4 and 3, supplies 6.0-V ac to the heaters of V901, V902 and V903 and also to antenna relay coil 0-901 through push-to-talk relay 0-801 contacts. (See paragraph 4-38.) The secondary, whose terminals are marked 7 and 8, supplies 6.0-V ac to the heater of V706.

4-36. CONTROL CIRCUITS. (See figure 4-19.) Power is applied to the equipment through "A.C. POWER INPUT" connector J504, outlet air filter interlock switch S501, "POWER" switch S403, and "BUCK-BOOST" transformer T202. The modulator-power supply blower motor B401 receives its power through

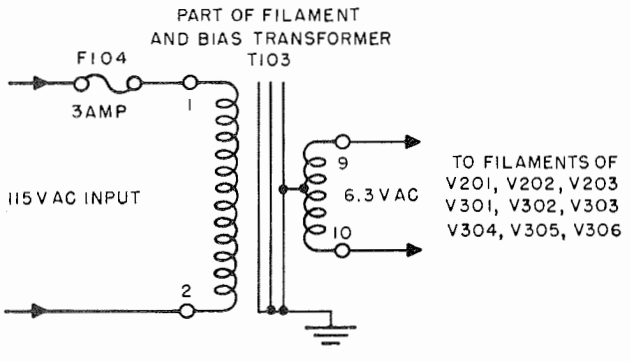


Figure 4-17. Modulator-Power Supply, Filament Circuit of Audio Section, Simplified Schematic

normally closed front access door interlock switch S402 and fuse F101. In a similar manner, power is applied to the transmitter blower motor B801 through a fuse and interlock switches in the following sequence: through front access door interlock switch S402, then through normally closed inlet air-filter and monitor-screen modulator interlock switches S601 and S803, and finally through fuse F803, to B801. When blower motor B801 starts up, air interlock switch S602 (an air vane) closes and power is fed to the transmitter filament transformer T901. Similarly, when blower motor B401 operates, air interlock switch S101 closes, and power is fed to filament bias transformer T103, which then provides filament voltage and minus 100 V for bias. Fuse F104 protects T901 and T103.

4-37. The heater element of time delay relay K101 is heated by 6.3 volts a-c from filament-bias transformer T103. (See figure 4-20, step 1.) After approximately one minute, the bimetallic element will close, energizing holding relay O-101 (K102). (See figure 4-20, step 2.) One set of contacts on relay O-101 (K102) breaks the K101 heater circuit and then applies minus 100 V to the coil, keeping it energized. (See figure 4-20, step 3.) Another set of contacts furnishes minus 100 V to the coil of plate relay O-201 (K201) when "PLATE" switch S401 is turned "ON". Relay O-201 (K201) is energized when the outlet air-filter interlock switch S901 is closed and the push-to-talk relay energized, thus completing the circuit from minus 100 V to ground. (See figure 4-20, step 4.) To energize push-to-talk relay O-801, the minus 100 V supply is fed to the relay coil through voltage dropping resistors R817 and R818 and back to ground through "PUSH TO TALK-CARRIER ON" switch S301. (See figure 4-20, step 5.) The position of S301 is dependent on the type of audio input operation selected as was described in paragraphs 4-12 through 4-16.

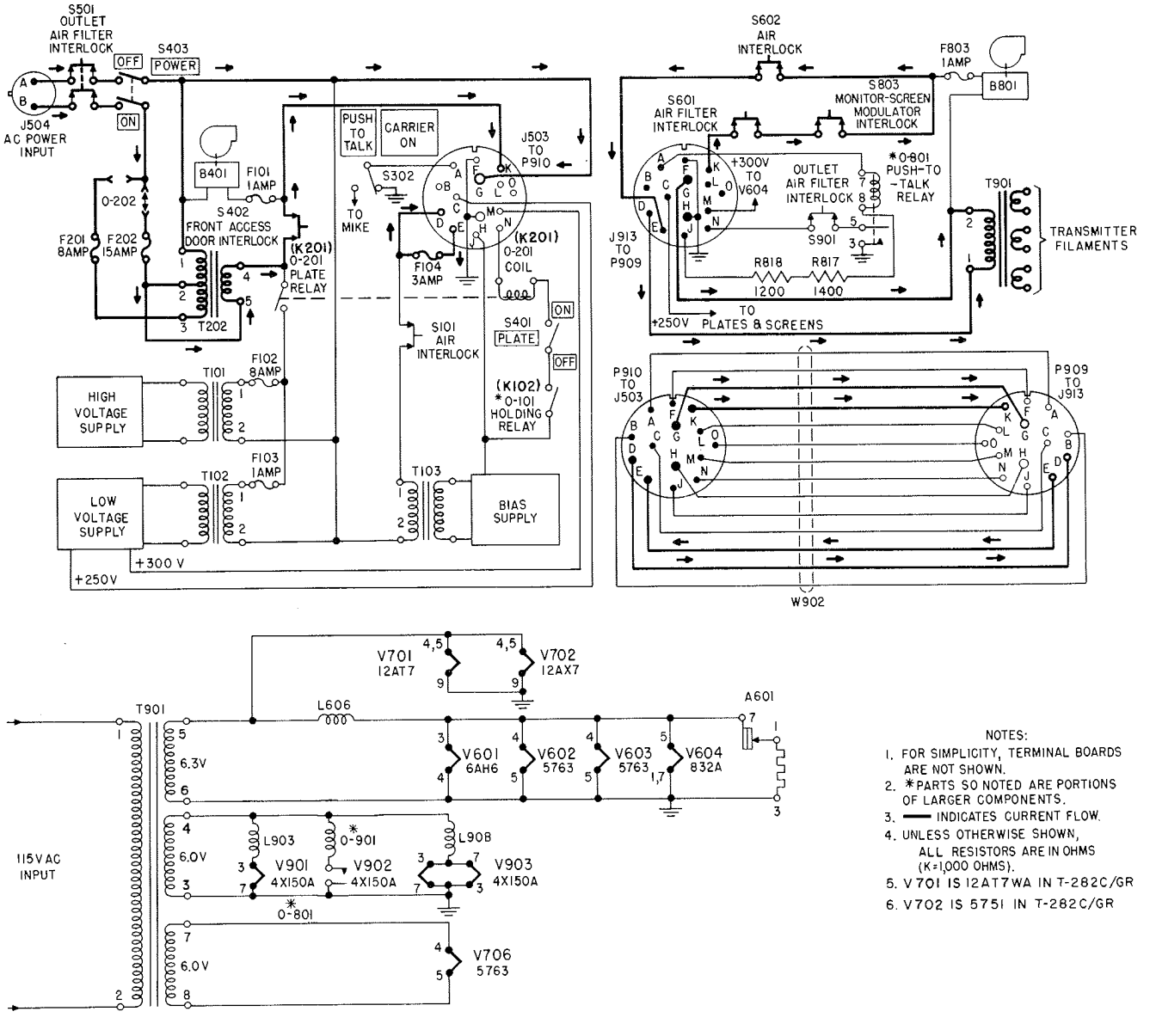


Figure 4-18. Radio Transmitter, Filament Circuits, Simplified Schematic

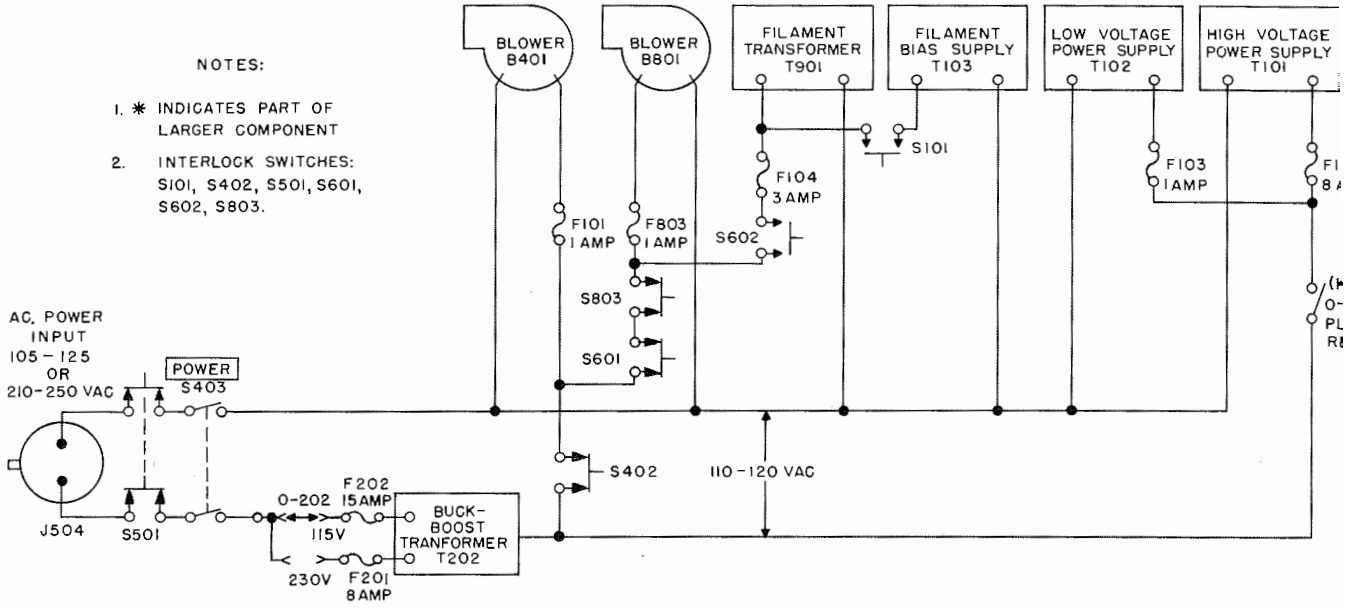


Figure 4-19. Radio Transmitter and Modulator-Power Supply, Blower and Transformer Supply Circuits, Simplified Schematic

4-38. Energizing the coil of push-to-talk relay O-801 accomplishes the following functions through its four pairs of contacts (figure 4-20, step 6):

a. Completes coil circuit of plate relay O-201 (K201) back to ground, which in turn permits a-c power to be fed to T101 and T102, the plate transformers for low and high voltage power supplies.

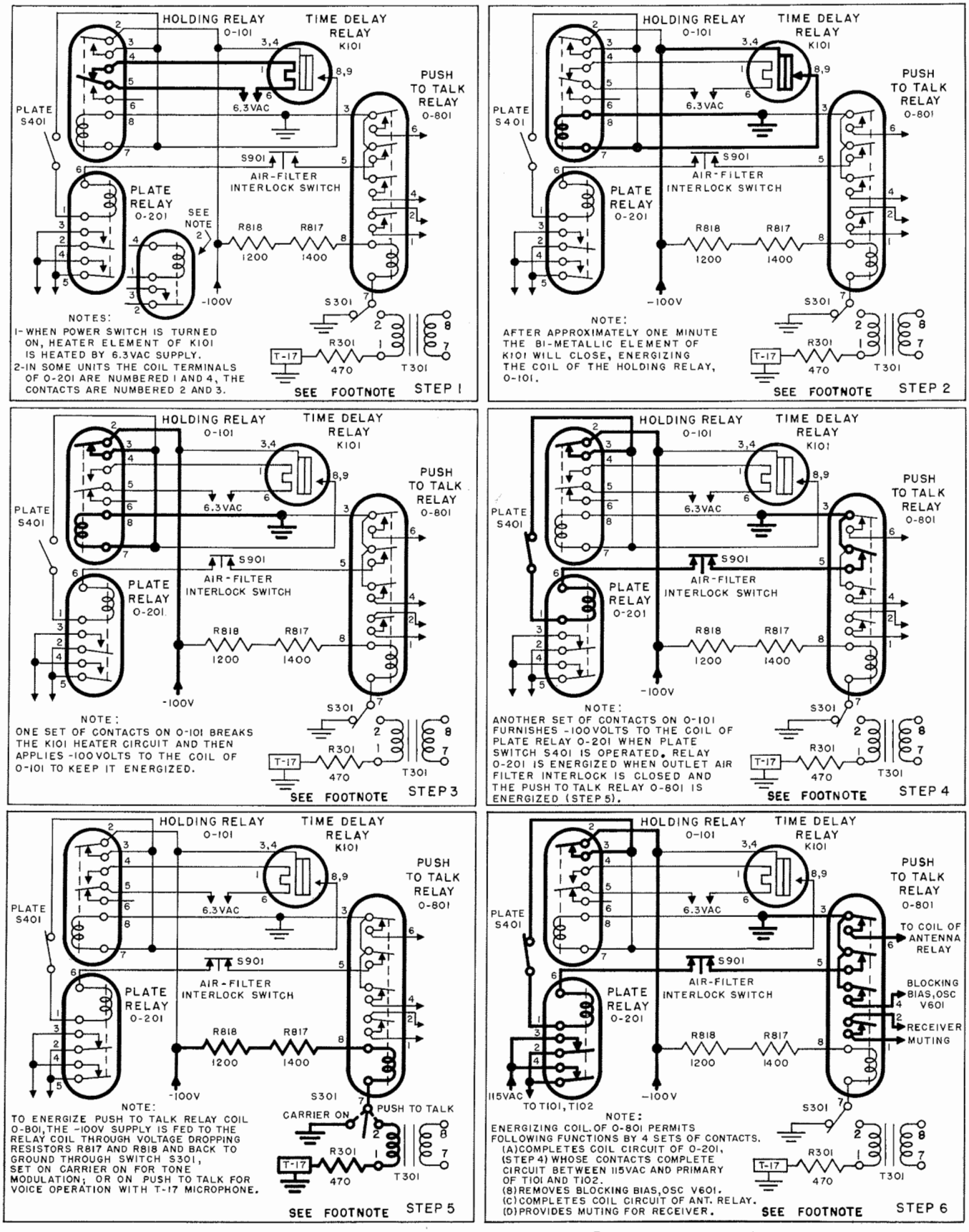
b. Removes blocking bias in the oscillator-tripler circuit, V601.

c. Switches antenna relay from the receive position to the transmit position by energizing antenna relay O-901, whose coil receives its power from filament transformer T901.

d. Provides muting for Radio Receiver R-361/GR, or equal.

4-39. OSCILLATOR-TRIPLER. (See figure 4-21.) Crystal Y601 in crystal oven A601, together with the cathode and first and second grids of tube V601 (6AH6), comprise a modified form of Pierce oscillator derived from a Colpitts oscillator. Note that the resonant circuit which represents the electrical characteristics of the crystal is shunted by capacitors C601 and C605 in series, forming the capacitive voltage divider, with cathode connected to the common point, which is characteristic of the Colpitts oscillator. The relative values of C601 and C605 (in this case equal) control the amount of feedback used to sustain oscillations. C602 serves as a blocking capacitor. Resistor R603 is the screen dropping resistor, C605 the screen bypass, and L601 an r-f choke to keep radio frequencies from the power supply. Resistor R601 is the grid resistor of the oscillator, and resistor R602 and capacitor C603 comprise a grid circuit decoupling filter. When the transmitter is operating, the "low" side of R602 is grounded (through R801 and relay O-801) and V601 operates class C with grid leak bias. (See paragraph 4-38, step b.) R801 is the grid current metering shunt, and feed-through capaci C604 is an r-f bypass. Grid No. 3 is at grou potential and hence serves as an electrostatic shie for the plate circuit of the tube which is therefo only electron-coupled to the rest of the tube. T plate load coil L602 is tuned by capacitors C60 and C606 to the third harmonic of the crystal fr quency. Capacitor C608A is ganged to capacit C608B. C606 is a trimmer used to adjust tracki with the other circuits at the high frequency e of the band. Tracking at the low frequency end adjusted by permeability tuning of L602. R-f cho L603 and capacitor C607 are a plate decoupli network. Both grid No. 2 and the plate of V601 r ceive their d-c potentials from the plus 250-vo output of the low voltage supply.

4-40. FIRST DOUBLER. (See figure 4-22.) Capacit C609 couples the output of the oscillator-tripl stage to the grid of the class C first doubler tu V602 (5763), operating with grid leak bias. R6 is the grid resistor and R605 is the cathode resist which protects the tube from high plate curren in the event of loss of excitation due to oscillat failure or other cause. C610 is the cathode bypa capacitor. R606 is the screen dropping resist and C611 its bypass capacitor. The plate load in pedance of this stage is comprised of coil L6 tuned by capacitor C608B and trimmer capacit C612 to a frequency double that of the signal its grid (six times the crystal frequency). Lo frequency tracking of this stage is adjusted permeability tuning of L604 and high frequen tracking by adjustment of trimmer capacitor C61 R-f choke L605 and capacitor C613 comprise a de coupling filter. Both the screen grid and plate V602 receive their d-c potentials from the plu 250-volt output of the low voltage supply.



SYMBOLS 0-101 & 0-201 BECOMES K102 & K201 ON UNITS SUPPLIED BY H-W.

Figure 4-20. Radio Transmitter and Modulator-Power Supply, Relay Operation, Simplified Schematic

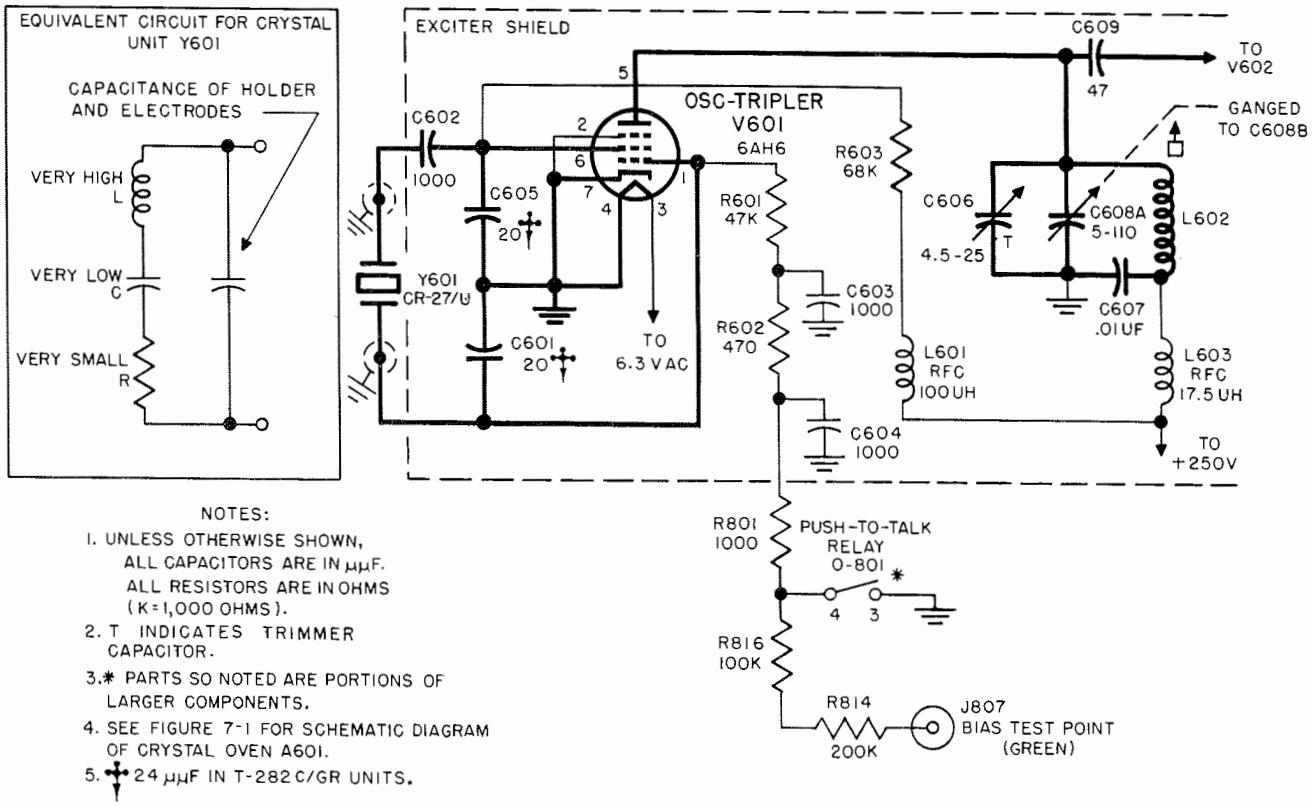


Figure 4-21. Radio Transmitter, Oscillator-Tripler, Simplified Schematic

4-41. SECOND DOUBLER. (See figure 4-23.) Capacitor C614 couples the output of the first doubler stage to the grid of the class C second doubler tube V603 (5763), which is grid leak biased. Resistor R607 is the grid resistor of the stage. R608 and C615 comprise a grid decoupling filter. R802 is the grid current metering shunt, and feedthrough capacitor C616 an r-f bypass. Resistor R609 is the cathode protective resistor and capacitor C617 its bypass. R610 is the screen dropping resistor and capacitor C619 its bypass. Plate tank coil L607 is tuned by capacitor C621 to a frequency double that of the signal on its grid (12 times the crystal frequency). C621 is a split stator capacitor grounded at its center. The opposite ends of coil L607 are therefore at equal but opposite polarities with respect to ground. The presence of capacitor C622 serves to improve the symmetry of the entire circuit with respect to ground so that the coupling to the following push-pull stage is symmetrical and balanced. If plate voltage is fed to the exact electrical center of the balanced, tuned plate circuit, circulating currents within the tank circuit will cancel out at the center of the tank coil and no r-f current will appear on the plate supply load. If the plate voltage is not fed at the exact electrical center of the tank coil, cancellation of r-f currents will not be complete at the center of the coil and r-f current will appear on the plate supply load. Resistor R611 and capacitor C627 comprise a decoupling network which serves to prevent r-f currents from flowing to the power supply should the center tap on the tank coil, L607, be inexactly placed. The above described circuitry eliminates the possibility of circuit instability due to undesirable interstage coupling through the power supply. Both screen and plate of V603 receive their d-c potentials from the plus 250-volt output of the low voltage supply.

4-42. BUFFER AMPLIFIER. (See figure 4-24.) The buffer amplifier stage consists of the push-pull beam power amplifier tube V604 (832A) operating as a class C amplifier. The stage is capacitively coupled by capacitors C623 and C624 to the plate coil L607 (figure 4-23) of the previous stage. V604 derives part of its bias from a voltage divider in the bias supply through decoupling filter R612 and C625. The remainder of its operating grid bias is provided by grid current flow through resistors R613 and R614 when the tube receives excitation from the previous stage. Resistor R805 is a grid current metering shunt. Feedthrough capacitor C626 is an r-f filter. The screens of both halves of V604 are fed through dropping resistors R615 and R619, bypassed by capacitor C628. The plate load of the stage consists of coil L608 tuned by capacitor C629. The center tap of L608 is fed through isolating resistor R617 which, with C630, comprises a decoupling filter. R826 is a screen and plate current metering shunt resistor. Resistor R618 and capacitor C630 comprise a decoupling filter, and feedthrough capacitor C631 an r-f filter. The screens and plates of V604 receive their d-c voltage from the plus 300-volt output of the low voltage supply. The output of the buffer stage is inductively coupled into coil L609 and out of the exciter chassis subassembly through connector J601 and r-f transmission line assembly W601 to the tripler driver V901 within the rear section of the transmitter.

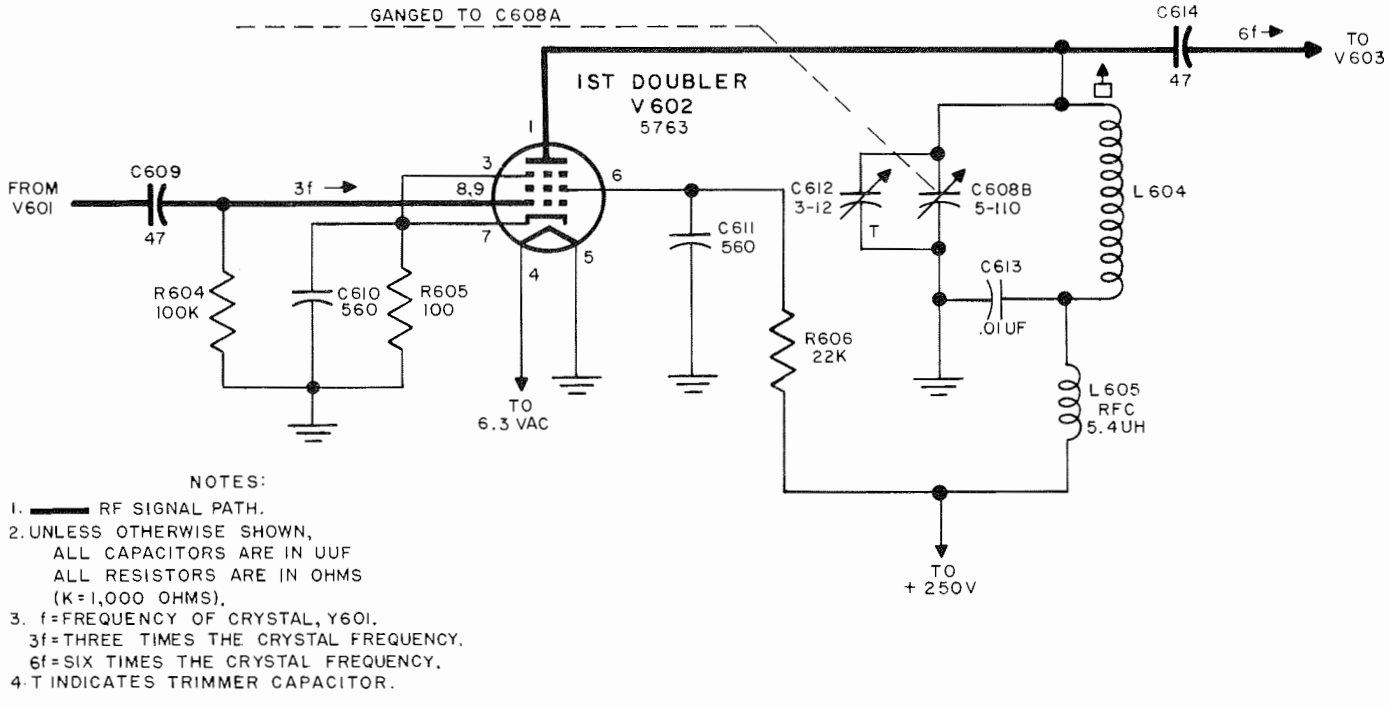


Figure 4-22. Radio Transmitter, First Doubler, Simplified Schematic

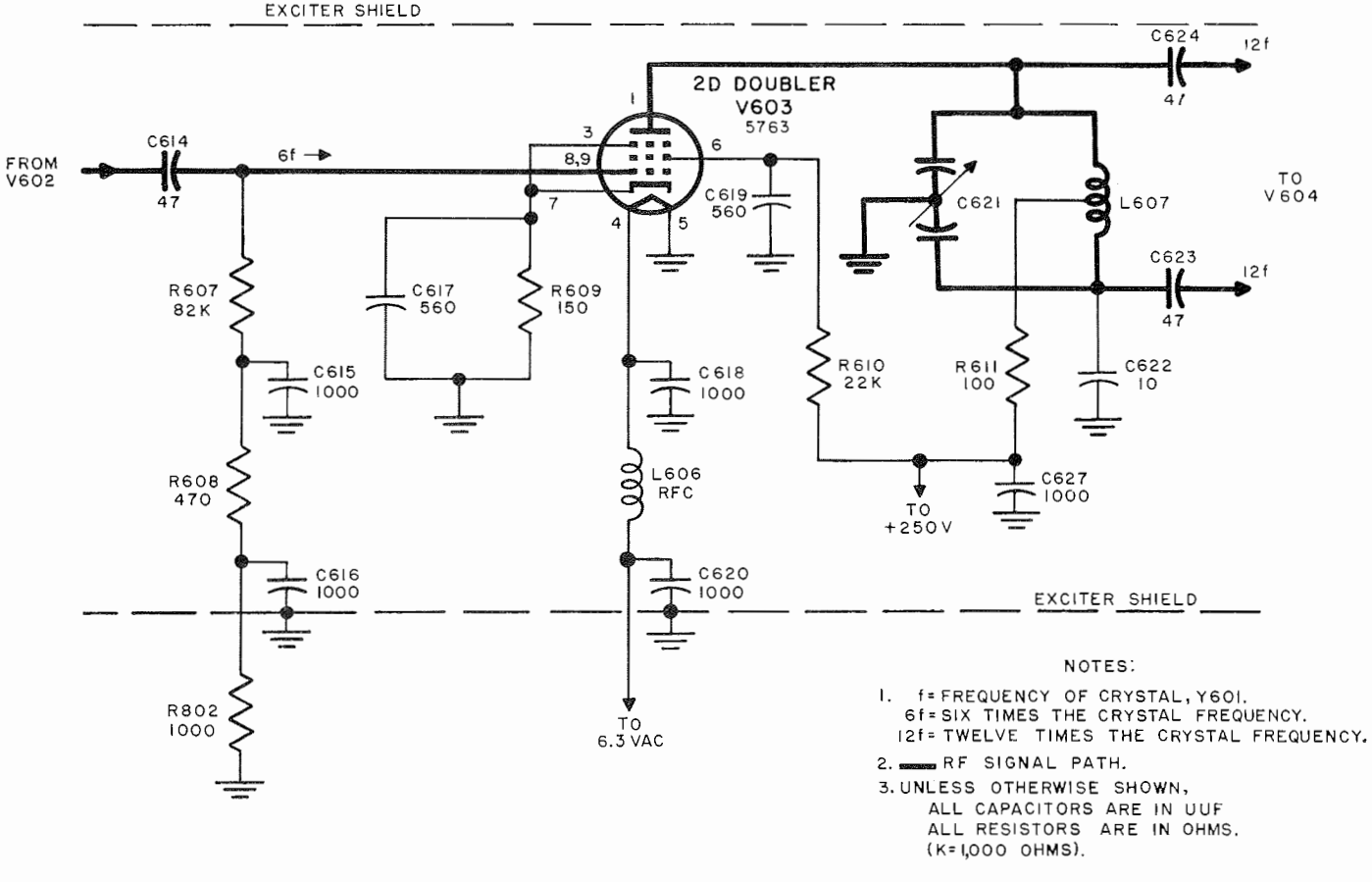


Figure 4-23. Radio Transmitter, Second Doubler, Simplified Schematic

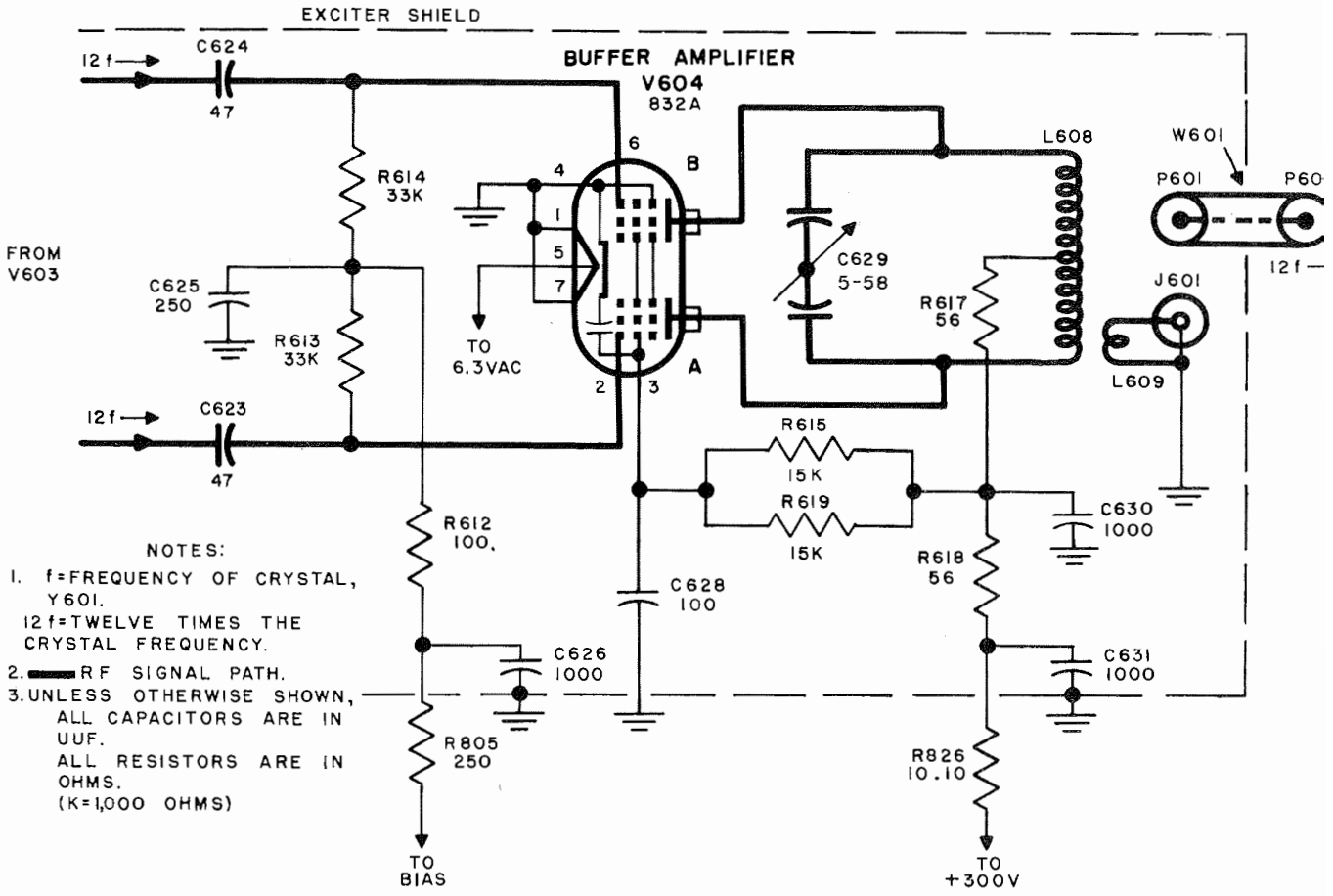


Figure 4-24. Radio Transmitter, Buffer Amplifier, Simplified Schematic

4-43. TRIPLER-DRIVER. (See figure 4-25.) The signal from connector J901 feeds into the lower portion of an r-f capacitive voltage divider comprised of C926 and C917. This provides an input impedance match for effective coupling into the grid tank circuit of tube V901 (4X150A); tuning coil L902 is the inductive branch; stray wiring and tube capacitance comprise the capacitive portion of the tank circuit. V901 operates as a class C frequency tripler; part of its bias is derived from the minus 100-volt bias supply; the balance of the required bias is developed by grid current flow through grid resistors R901 and R902. C901 and C902 function as r-f bypass capacitors for the above described grid bias circuit. Screen dropping resistors R903 and R907, bypassed by capacitor C904 (part of tube socket assembly for V901) are fed from the plus 250-volt supply through feedthrough capacitor C905. Unmodulated plus 850-volts dc is applied to the plate circuit through feedthrough capacitor C907 and r-f choke coil L904. Capacitor C922 and choke coil L911 comprise an r-f filter. U901 is an adjustable tuning stub assembly which serves as the plate load of the stage. (See paragraphs 4-44 and 4-45.) It is tuned to three times the frequency on the grid of V901 (36 times the crystal frequency). Capacitor C906 is constructed as part of tuning assembly U901 and provides an r-f ground for one side of the resonant circuit. The output of this sta is coupled to the power amplifier via capacitor C92 connector J916, and r-f transmission line W9 (which is terminated with connectors P908 and P901

4-44. TUNED STUB ASSEMBLIES. Convention tuned circuits, comprised of inductance and capa itance, are not generally used at extremely hi frequencies, eg., above 300 mc, since the physic size of inductors and capacitors would be too sma and the resultant circuit efficiency would be t low to be practical. Tuned circuits, at extreme high frequencies, may consist of transmissi lines or coaxial cavities. The practical physic size of transmission lines, as well as their inhe ently high Q (ratio of inductive reactance to r resistance), contribute to their successful use with the 225 to 400-mc frequency range of this equipmer

4-45. Three tuned transmission lines are employ in the input and output stages of the transmitte They are used in the driver plate, as well as t power amplifier grid and plate circuits. Each the transmission lines consists of a semicircul silver-plated bus bar having a rectangular cross section; the power amplifier plate transmissi line assembly consists of two such lines in parall so as to secure the balanced construction require

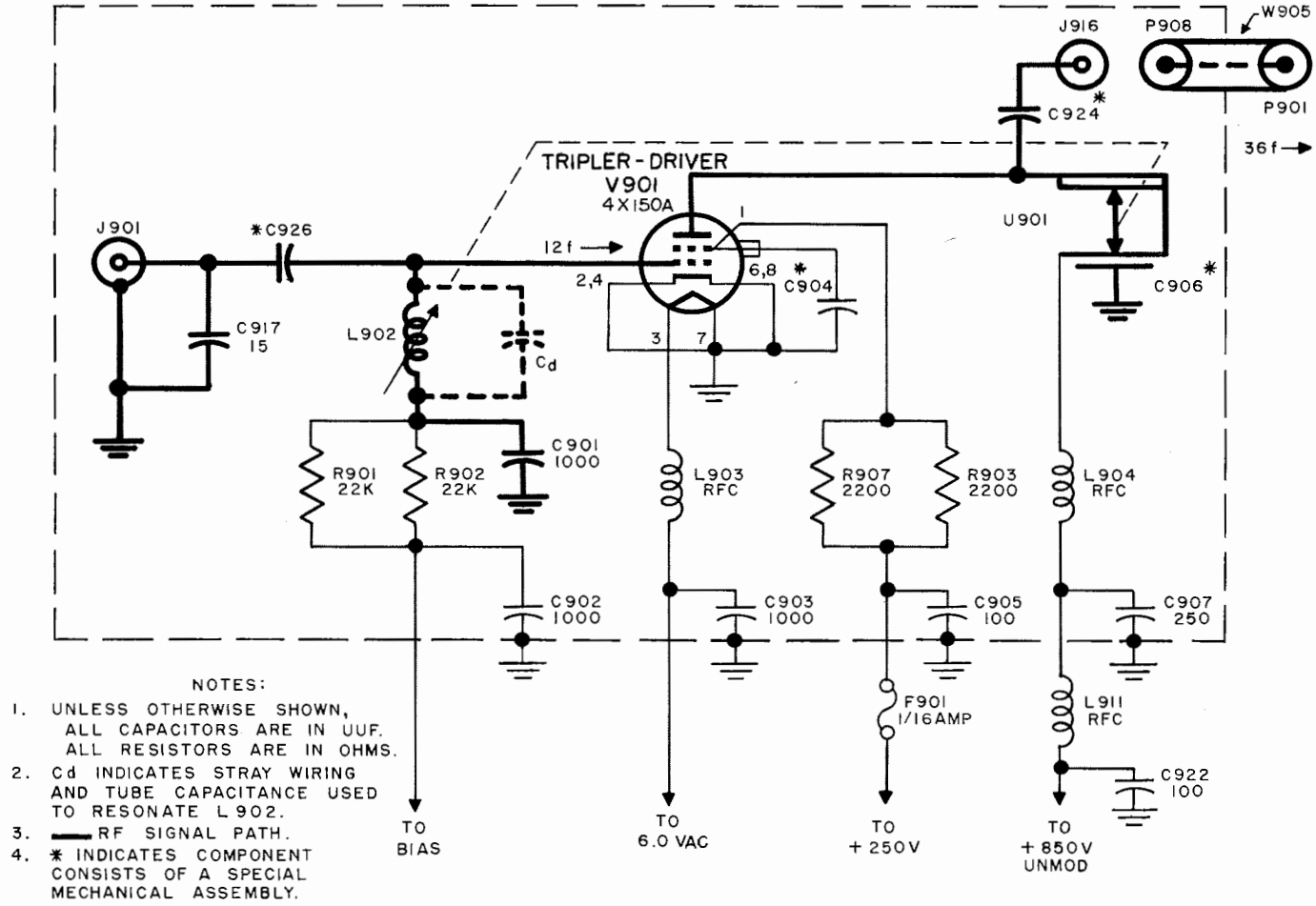


Figure 4-25. Radio Transmitter, Tripler-Driver, Simplified Schematic

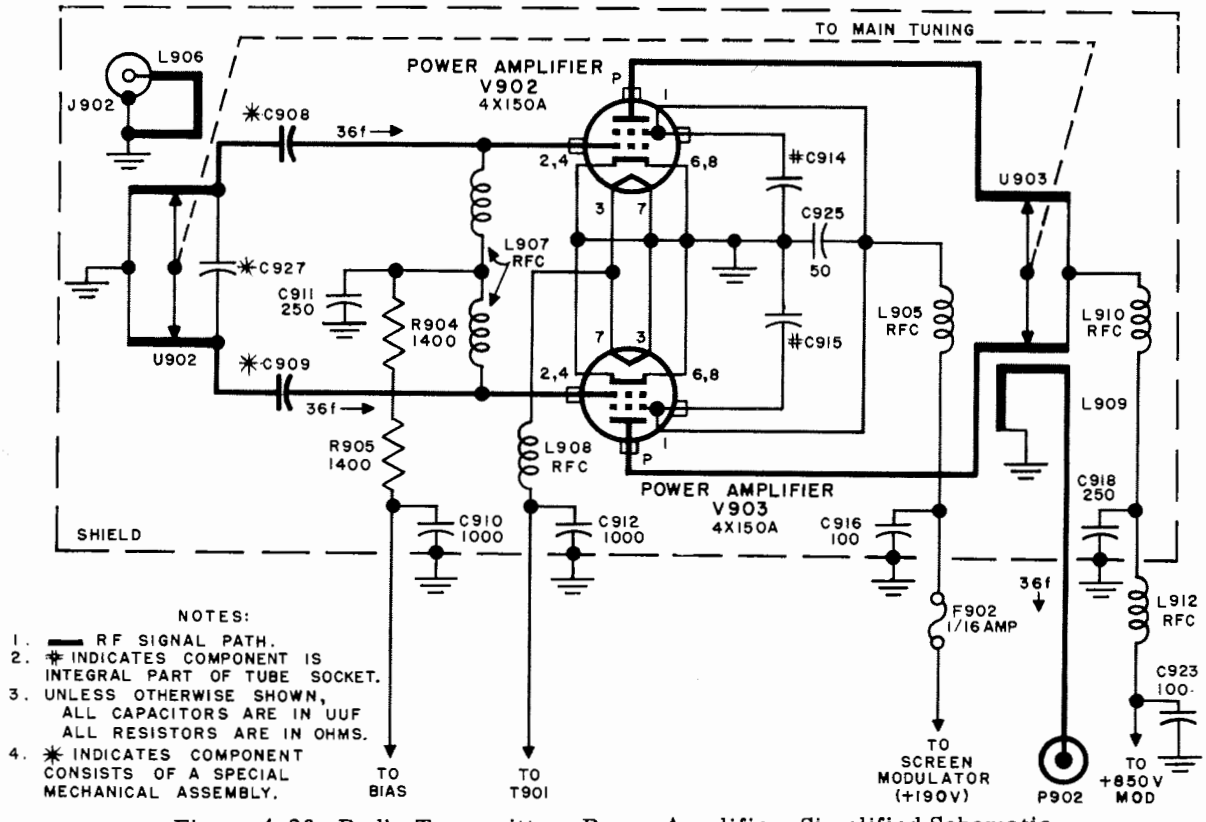


Figure 4-26. Radio Transmitter, Power Amplifier, Simplified Schematic

for push-pull output. Each transmission line is slightly less than a quarter wavelength long and shorted at one end through a shorting "stub," hence the name, tuned stub assembly. The equivalent electrical circuit of such a transmission line, looking in from the open end, resembles an inductor. The transmission line, as a whole, is made a quarter wavelength long, electrically, by lumped capacitance at the open end. The required capacitance of the assembly is supplied by stray wire and tube capacitance and (in the power amplifier grid) by the insertion of capacitance across the open end of the line. The resultant assembly is tuned (resonated) to the operating frequency by changing the position of the shorting stub.

4-46. POWER AMPLIFIER. (See figure 4-26.) The r-f power from the tripler-driver stage is received through connector J902 and coupled into r-f tuning stub U902 through L906, which is a part of a balanced coupling loop (see paragraph 4-49). R-f tuning stub U902, in parallel with C927, is used for tuning the grid circuit of the power amplifier, tubes V902 and V903 (each a 4X150A), to resonance. Capacitors C908 and C909, in conjunction with the input capacitance of V901 and V902, comprise an r-f voltage divider which minimizes the loading effect of the tube input capacitance on tuning stub U902. Part of the bias for the stage is derived from the minus 100-volt bias supply. The remainder of the operating bias is obtained from grid current flow through grid resistors R904 and R905, filtered by capacitor C911 and decoupled by feedthrough capacitor C910. Center-taped r-f choke L907 permits the application of d-c bias voltage without r-f loading of the power amplifier grid circuit. The plate tank circuit consists of tuning stub assembly U903 which is tuned by a movable shorting bar. Modulated dc is supplied to both plates at the short-circuited end of the tuning stub through a decoupling filter comprising feedthrough capacitor C918, radio frequency choke coils L910 and L912, and bypass capacitor C923. In order to obtain 95-percent modulation with type 4X150A tubes, a special screen modulation circuit is incorporated in the equipment, described in paragraphs 4-25 through 4-27. C914 and C915 (part of tube socket assembly for V902 and V903) are screen bypass capacitors. R-f coil L905 with capacitors C916 and C925 comprise an r-f decoupler.

4-47. ANTENNA COUPLING CIRCUITS. (See figure 4-27.) L909, whose coupling may be varied, is part of a balanced coupling loop and transfers power from the tuned plate circuit U903 of the power amplifier to an r-f transmission line. The transmission line terminates in coaxial relay O-901, which acts like a single-pole-double-throw switch. When transmitting, the r-f power passes through the relay into r-f filter Z901. The output from the filter goes through directional coupler DC901 and terminates in connector J909 labeled "TO ANTENNA" on the rear of the transmitter. When receiving, incoming signals progress from the connector labeled "TO ANTENNA" to the directional coupler, through the r-f filter, and into the coaxial relay. The relay, having switched from the transmit to the receive condition, passes the incoming signal on to "ANT INPUT" connector J907 on the rear of the transmitter; the signal is then delivered to Radio Receiver R-361/GR, or a similar receiver.

4-48. The r-f transmission line, between the balanced coupling loop and coaxial relay, is terminated by connector P902. Relay connections are made through connectors J904 (relay armature), J903 (transmit), and J905 (receive), all three being part of the relay. The low-pass r-f filter is terminated by connectors P904, at the relay end, and by J906 at the end adjacent to the directional coupler. The directional coupler connectors are P905, which mates with J906, and J909, which protrudes through the rear panel of the transmitter and is labeled "TO ANTENNA."

4-49. BALANCED COUPLING LOOP. In coupling power from the unbalanced output of the driver stage to the push-pull power amplifier grid circuit and in turn from the push-pull power amplifier plate

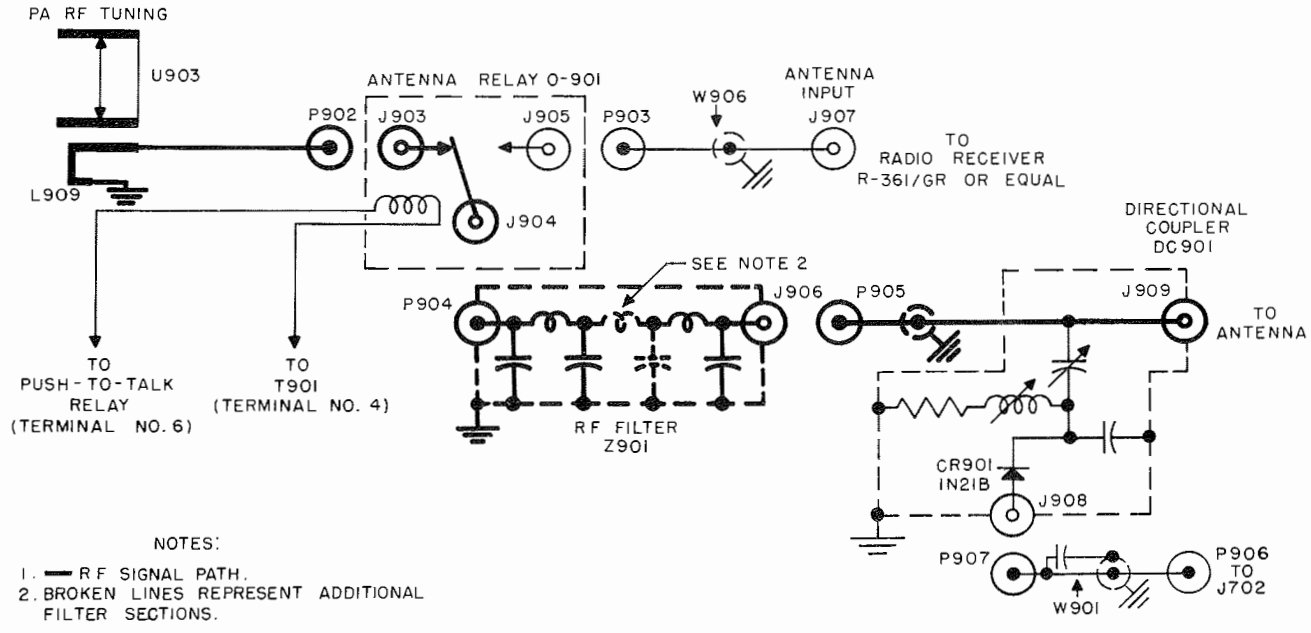


Figure 4-27. Radio Transmitter, Antenna Coupling Circuits, Simplified Schematic

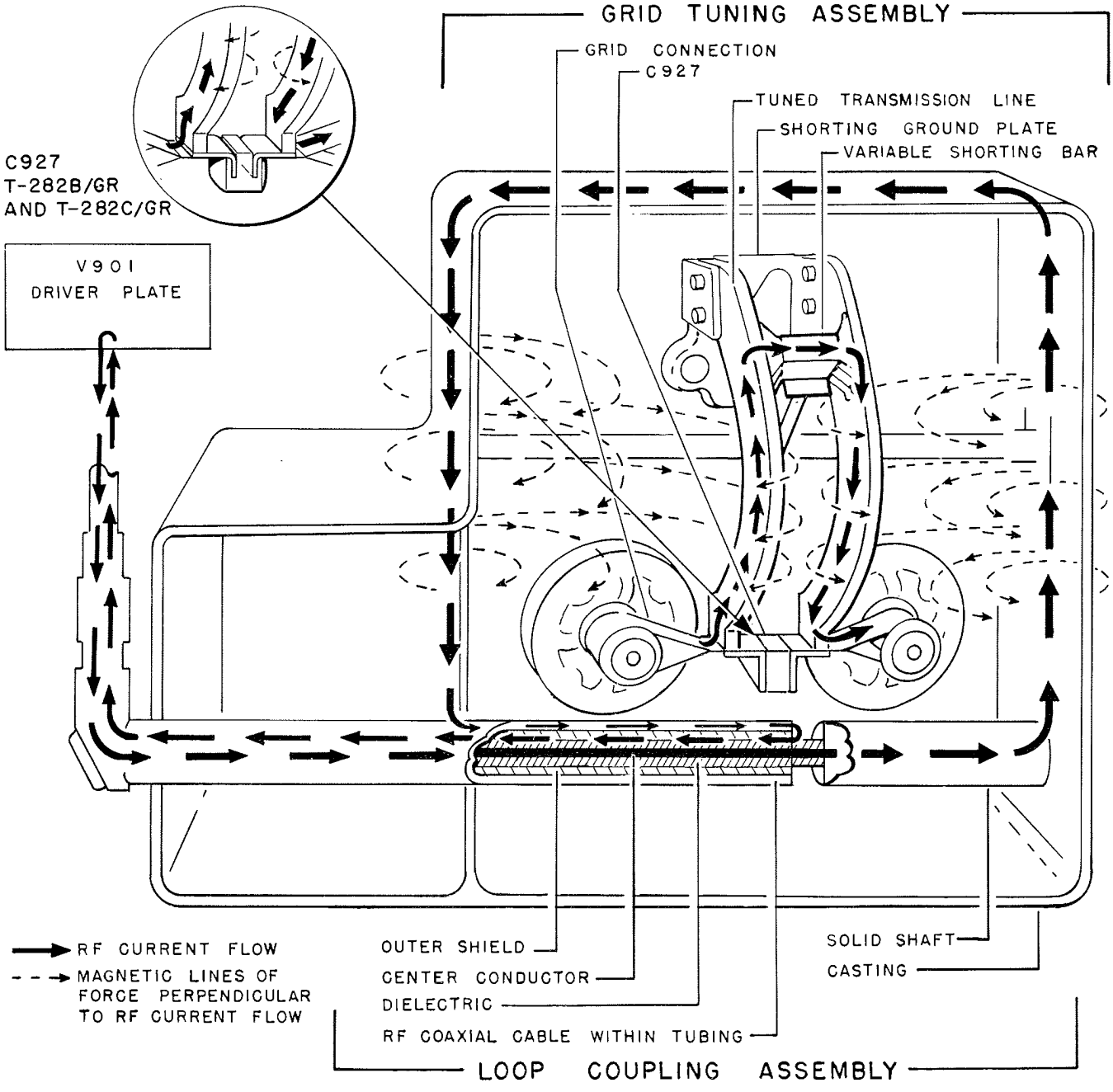


Figure 4-28. Radio Transmitter, Power Amplifier Input Circuit

circuit to the unbalanced line leading to the antenna, the balanced structures shown in figures 4-28 and 4-29, respectively, are employed. These produce magnetic coupling to the resonant lines which constitute the tank circuits of grid and plate, without disturbing the electrical symmetry which exists. Magnetic lines of force are set up by the r-f current which flows through input coupling loop L906 and the side walls of the grid casting (figure 4-28); these lines of force, in turn, induce an r-f current flow in the tuned transmission line, U902. Similarly, magnetic lines of force are set up by the r-f current which flows through the tuned transmission line in the plate circuit; the resultant r-f current in the output coupling loop is fed to the antenna system as described in paragraph 4-47.

4-50. R-F FILTER. (See figure 4-30.) The low-pass r-f filter Z901 is designed to minimize harmonic radiation from the transmitter. It consists of sections of transmission line used as circuit elements. The approximate equivalent circuit is similar to that of a filter using lumped elements of inductance and capacitance. The filter is replaceable as an entire unit.

4-51. MONITORING CIRCUITS. Directional coupler DC901 converts modulated r-f power into an a-c voltage (modulation) superimposed on a d-c voltage which is used to indicate power output, percentage modulation and produce a side tone output that duplicates the modulation applied to the r-f carrier.

4-52. DIRECTIONAL COUPLER. (See figure 4-31.) The coupler consists of a short section of transmission line from which a sample of the transmitter power is obtained by a combination of inductive and capacitive coupling. The two components of coupling are additive in the forward direction (toward the antenna) and subtractive (cancel each other) in the reflected direction. The sample of power is rectifi by crystal diode CR901 (1N21B). With reasonab small standing wave ratios (less than 2 to 1), t resultant output from CR901 is proportional to t power radiated by the antenna. This d-c outpu which varies at an audio rate (due to modulatio is conveyed to connector J702 of the monitor-scre modulator assembly; cable W901, which is terminat by connectors P907 and P906, links J908 (of DC90 to J702.

4-53. R-F POWER MEASUREMENT. (See figu 4-32.) Rectified carrier output from directional cou ler DC901 goes through connectors P906 and J7

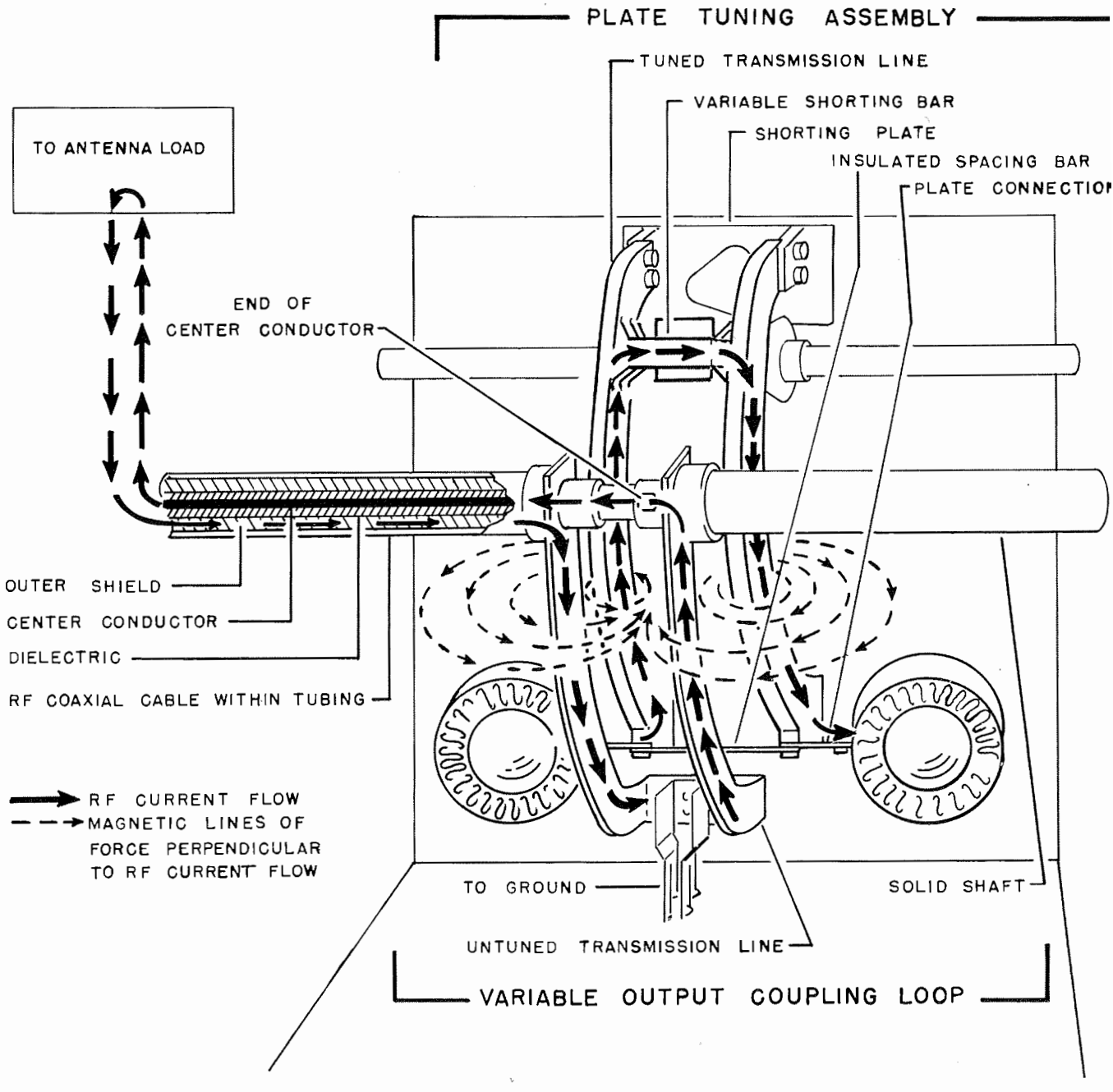
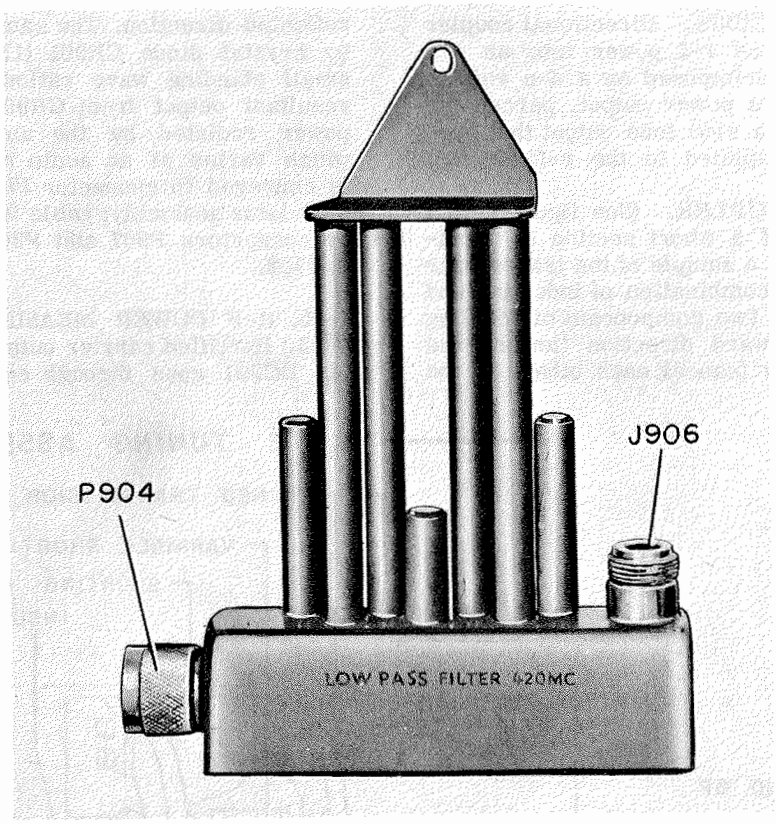
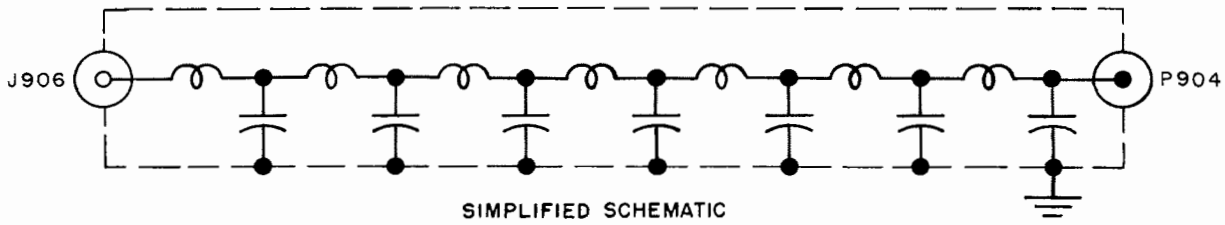


Figure 4-29. Radio Transmitter, Power Amplifier Output Circuit



RF FILTER Z901



SIMPLIFIED SCHEMATIC

Figure 4-30. Radio Transmitter, R-F Filter

to the rotor of "METER 2 SELECTOR SWITCH" S701. When the switch is operated to the "CARRIER WATTS" position, "PWR CAL" resistor R701, in series with "METER 2," serves as the meter multiplier and factory calibrator adjustment for r-f power measurements.

4-54. PERCENT MODULATION MEASUREMENT. (See figure 4-33.) Before modulation measurements can be made, "METER 2" must be calibrated. "METER 2 SELECTOR SWITCH" S701 is operated to the "SET CAL" position, completing a circuit from J702 through "CALIBRATE" variable resistor R702, resistor R703 and "METER 2" to ground. "CALIBRATE" variable resistor R702 is used to adjust meter deflection to the "CAL" position on "METER 2." Resistor R703 protects the meter from burn-out should the "CALIBRATE" control R702 be turned down too far.

4-55. When "METER 2 SELECTOR SWITCH" S701 is operated to the "% MOD" position, the audio frequency component of the input from the directional coupler DC901 is coupled from "CALIBRATE" variable resistor R702 through capacitor C701 to the grid of amplifier tube V702A (1/2 12AX7). Resistors R703 and R704 in series with "CALIBRATE" resistor R702 form a voltage divider to ground. R707 is the grid resistor of the stage and R709 the plate load resistor. Cathode bias is provided in the grounded part of "MOD CAL" variable resistor R716 (factory adjustment) which is also part of an inverse feedback circuit from tube V701B (1/2 12AT7). The output of tube V702A is coupled by capacitor C702 to the grid of amplifier V701B. The grid resistor of this stage is R711 and the plate load resistor is R712. Bias is supplied to the stage by cathode resistor R714. Part of the output of the stage is coupled from the plate of the tube through capacitor C704 and dropping resistor

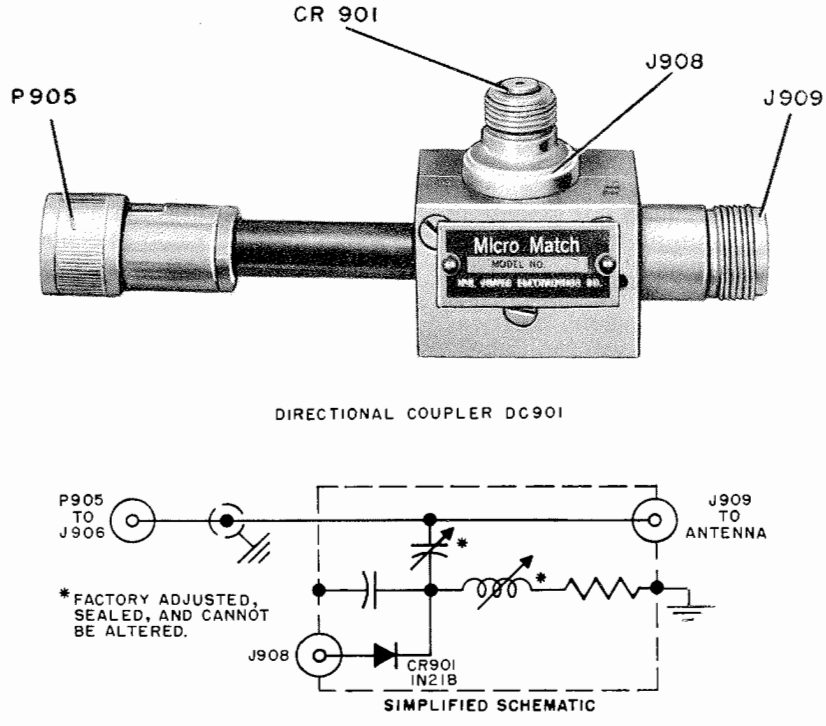


Figure 4-31. Radio Transmitter, Directional Coupler

R715 to variable resistor R716, thus providing inverse feedback to the cathode circuit of V702A. The magnitude of the inverse feedback is so great that the over-all gain of amplifiers V701B and V702A is very small. V701B and V702A receive their d-c plate voltage from the plus 250-volt supply through a filter comprising resistor R710 and capacitor C703.

4-56. Capacitor C705 couples the output of tube V701B to tube V702B (1/2 12AX7) which is connected as a diode and provides the rectified current measured by "METER 2," using R717 as a meter multiplier resistor. When the modulation monitor is properly calibrated and the carrier is 100-percent modulated, this rectified current will cause the pointer of "METER 2" to deflect to the 100-percent mark. In the absence of any modulation, current still flows through diode connected V702B. This zero-signal current is balanced out by bleeding some of the cathode current of V701B off through the meter circuit and resistor R713. The directions of these two currents are opposite, and therefore, cancel one another.

4-57. AURAL MONITORING. (See figure 4-34.) The audio component of the input to the monitor circuit is coupled to the grid of amplifier tube V701A (1/2 12AT7) through "SIDE TONE" variable resistor R705 which functions as a volume control. R708 is the cathode bias resistor and the primary of transformer T701 is the plate load. The output from the secondary of T701 is brought to "SIDE TONE OUTPUT" jack J701 where headphones may be plugged in. Resistor R803 and capacitor C802 form a humbucking circuit which cancels out some of the power supply ripple voltage in the plate circuit of tube V701A.

4-58. METERING CIRCUITS. "METER 1" on the transmitter functions as a milliammeter and measures the grid and plate currents in most of the r-f stages when "METER 1 SELECTOR SWITCH" S802 is in positions 1 through 8. (See paragraph 4-59.) When "METER 1 SELECTOR SWITCH" is in position 9, the terminals of "METER 1" are brought out to meter jacks J809 and J810. Jumpers between the meter jacks and several other jacks provide for the measurement of voltages at certain test points. (See paragraph 4-60.) All pin jacks are located behind cover plates on the front panel of the transmitter and the modulator-power supply (figures 4-35 and 4-36). Fuse F801 provides protection for the "METER 1" circuit.

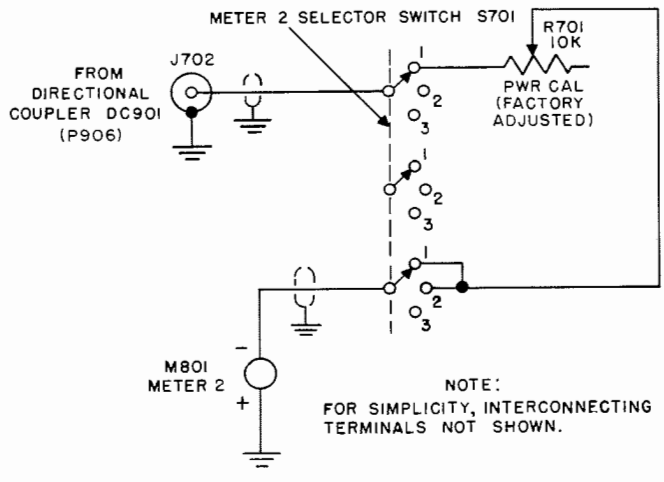


Figure 4-32. Radio Transmitter, R-F Power Measurement, Simplified Schematic

4-59. CURRENT MEASUREMENTS. (See figure 4-37.) Meter shunt resistors are inserted in series with those circuits in which the d-c current is to be measured. When "METER 1" is connected across each one in turn, the current divides between the meter and the shunt. Meter multiplier resistor R819 permits the use of larger values of meter shunts. Values of the shunts have been so selected that the actual current in each metered circuit is equal to the meter reading multiplied by the factor indicated on the front panel adjacent to each position of "METER 1 SELECTOR SWITCH" S802. See table 4-3 for the shunts used and their function.

4-60. VOLTAGE MEASUREMENTS. Color coded pin jacks are used for voltage measurements. Red indicates positive polarity, i.e. connection to the positive side of "METER 1," through J809, or connection to a test point where the voltage is positive with respect to ground. Black indicates connection to the negative terminal of "METER 1," through J810, or connection to ground through "GND." jack J805. Green indicates connection to a point where the voltage is negative with respect to ground.

4-61. TRANSMITTER VOLTAGE MEASUREMENTS. (See figure 4-35.) Pin jacks provide convenient test points for measuring the voltage at several points within the transmitter. Make measurements as indicated below and by referring to Table 4-4.

a. Take off "REMOVE TO EXPOSE TEST POINTS" plate on front panel of transmitter.

b. Set "METER 1 SELECTOR SWITCH" S802 on position No. 9.

c. For voltages that are positive with respect to ground, connect one test lead from the test point jack (red) to "+METER 1" jack J809 (red); connect another test lead between "-METER 1" jack J810 (black) and "GND." jack J805 (black).

d. For voltages that are negative with respect to ground, connect one test lead from the test point jack (green) to "-METER 1" jack J810 (black); connect another test lead between "+METER 1" jack J809 (red) and "GND." jack J805 (black).

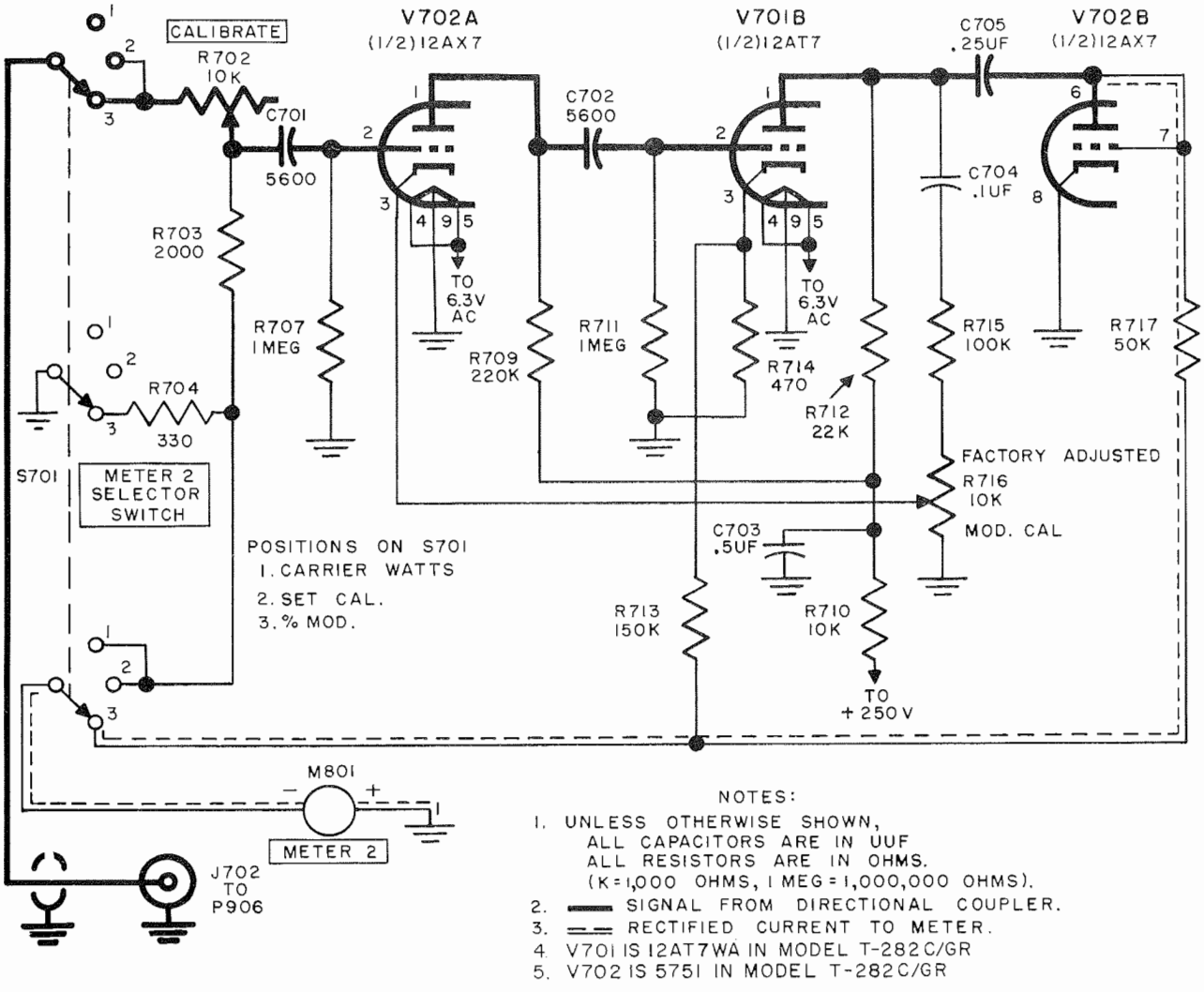


Figure 4-33. Radio Transmitter, Percent Modulation Measurement, Simplified Schematic

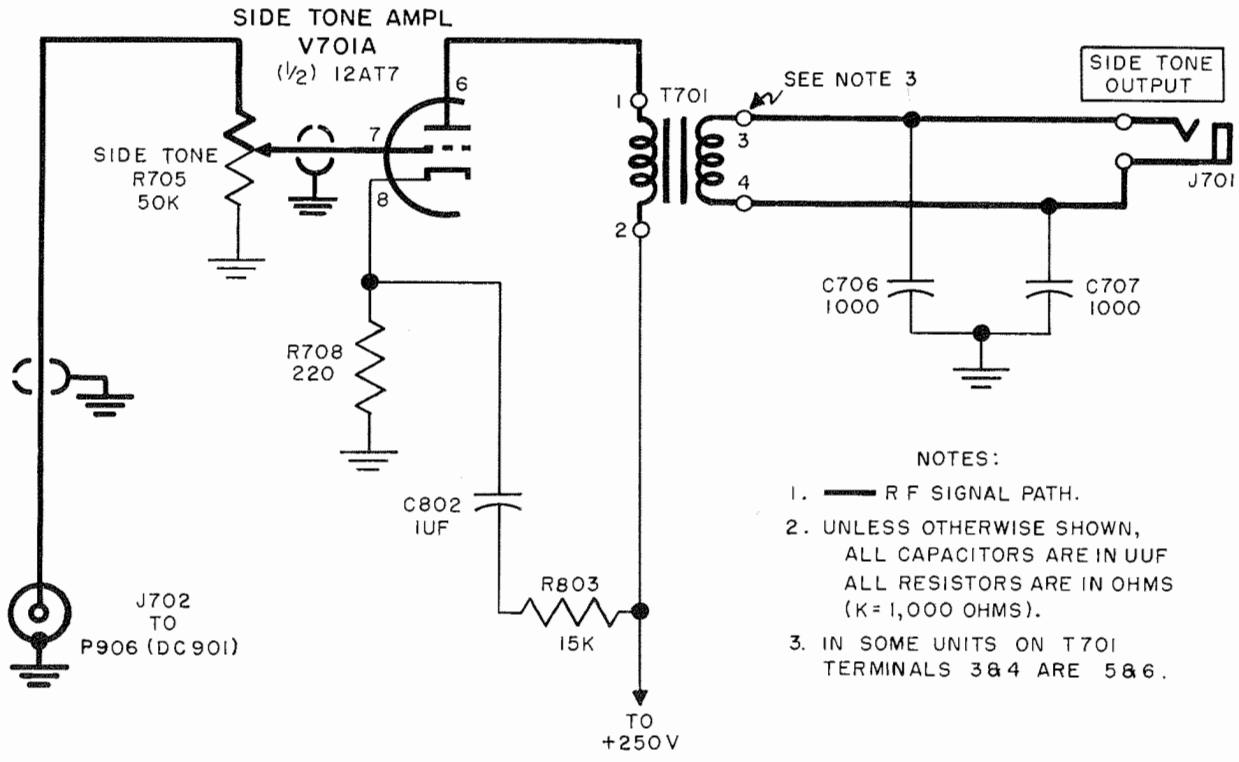


Figure 4-34. Radio Transmitter, Side Tone Output Circuit, Simplified Schematic

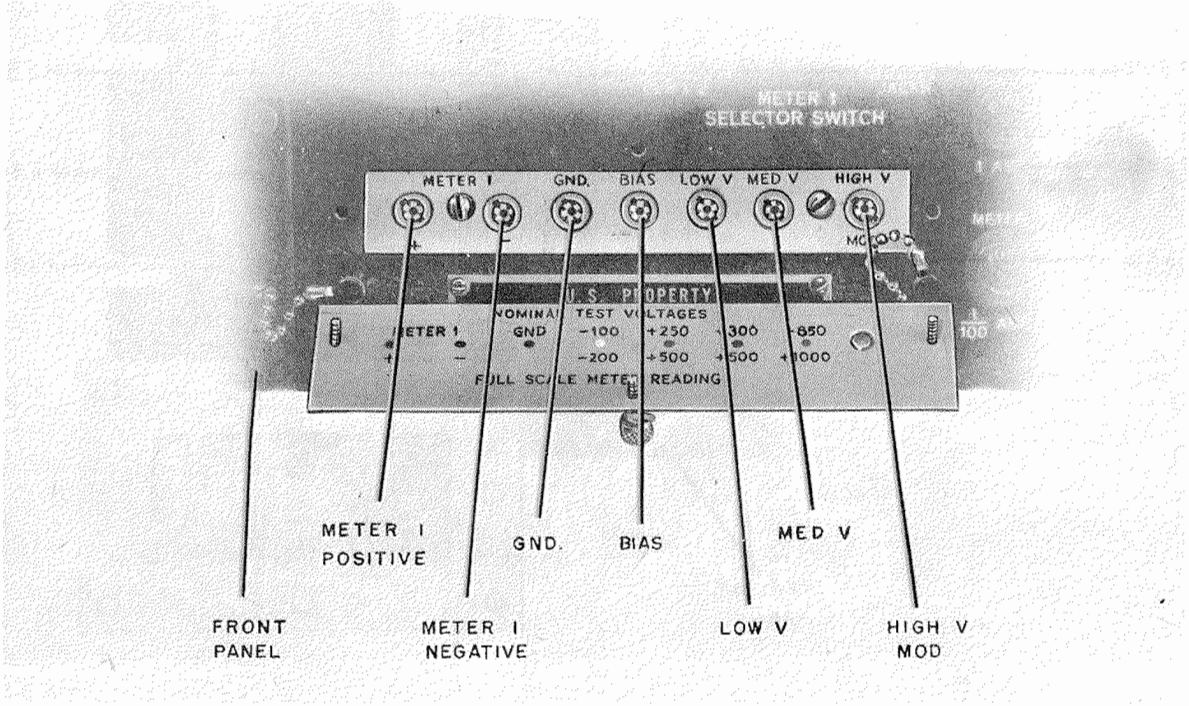


Figure 4-35. Radio Transmitter, Front Panel Meter Jacks

TABLE 4-3. "METER 1" SHUNTS

Switch Position	Shunt Symbol Number	Function
1	R801	V601 osc grid current
2	R802	V603 second doubler grid current
3	R805	V604 buffer amplifier grid current
4	R826	V604 buffer amplifier plate current
5	R822	V901 driver grid current
6	R823	V902 and V903 power amplifier grid current
7	R824	V901 driver plate current
8	R820, R821	V902 and V903 power amplifier plate current

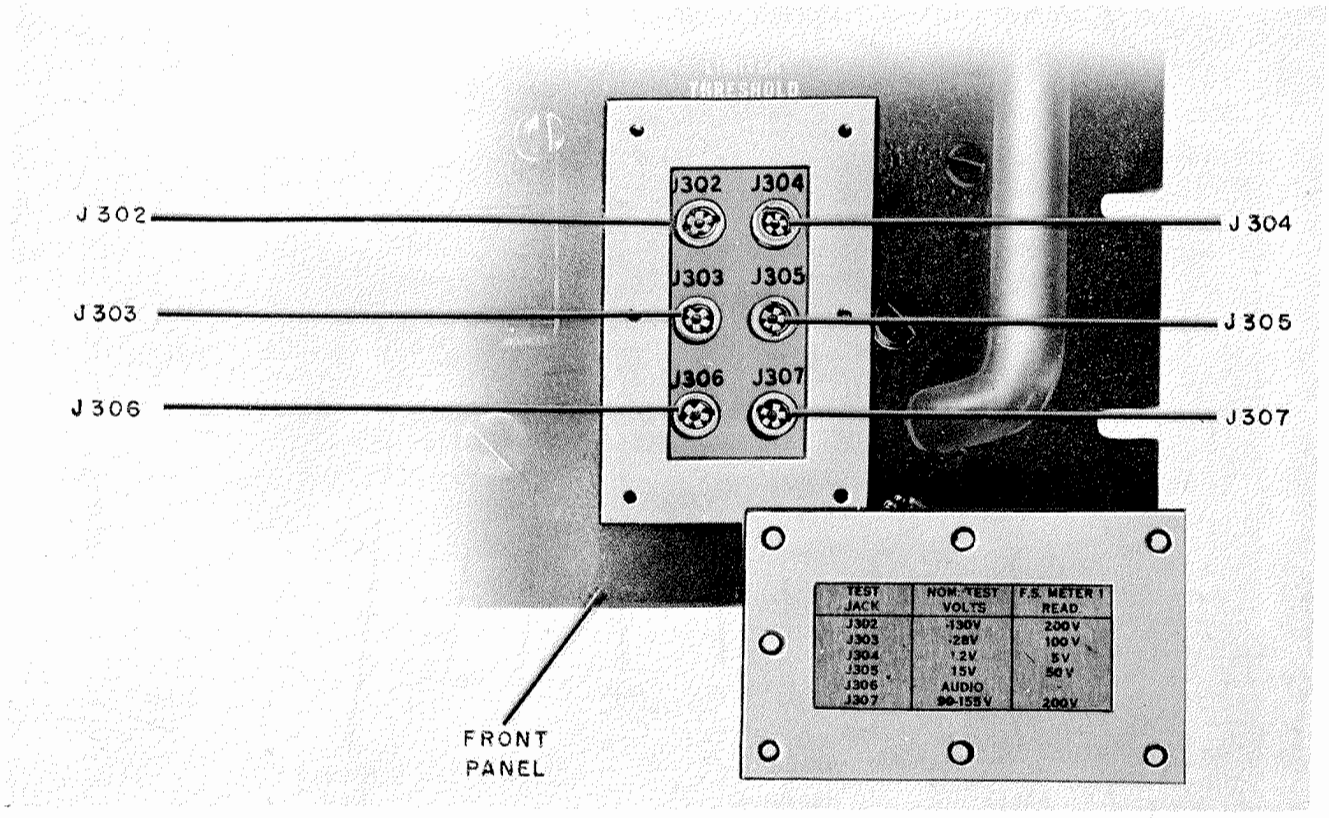


Figure 4-36. Modulator-Power Supply, Front Panel Meter Jacks

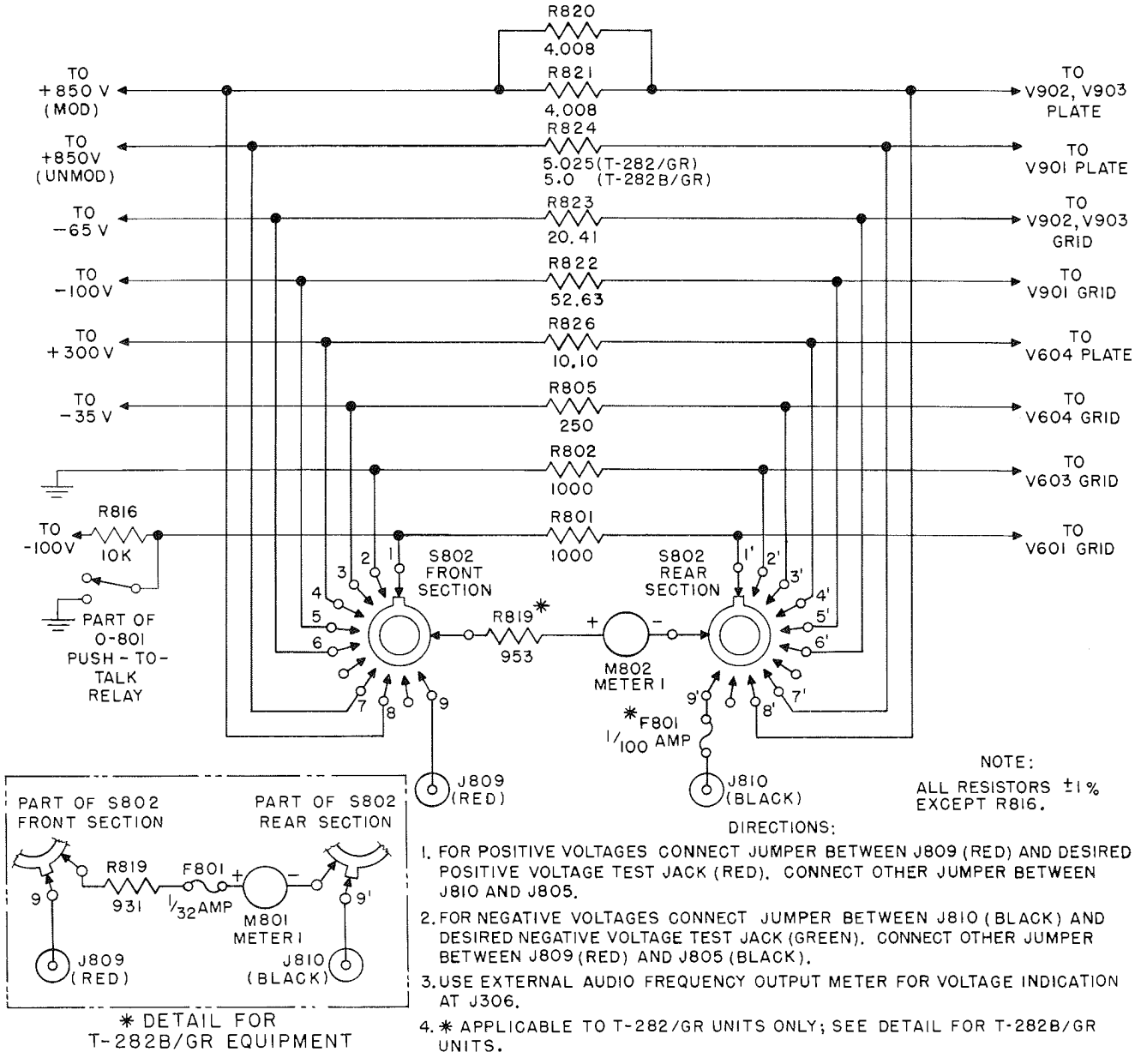


Figure 4-37. Radio Transmitter, Current and Voltage Measurements, Simplified Schematic

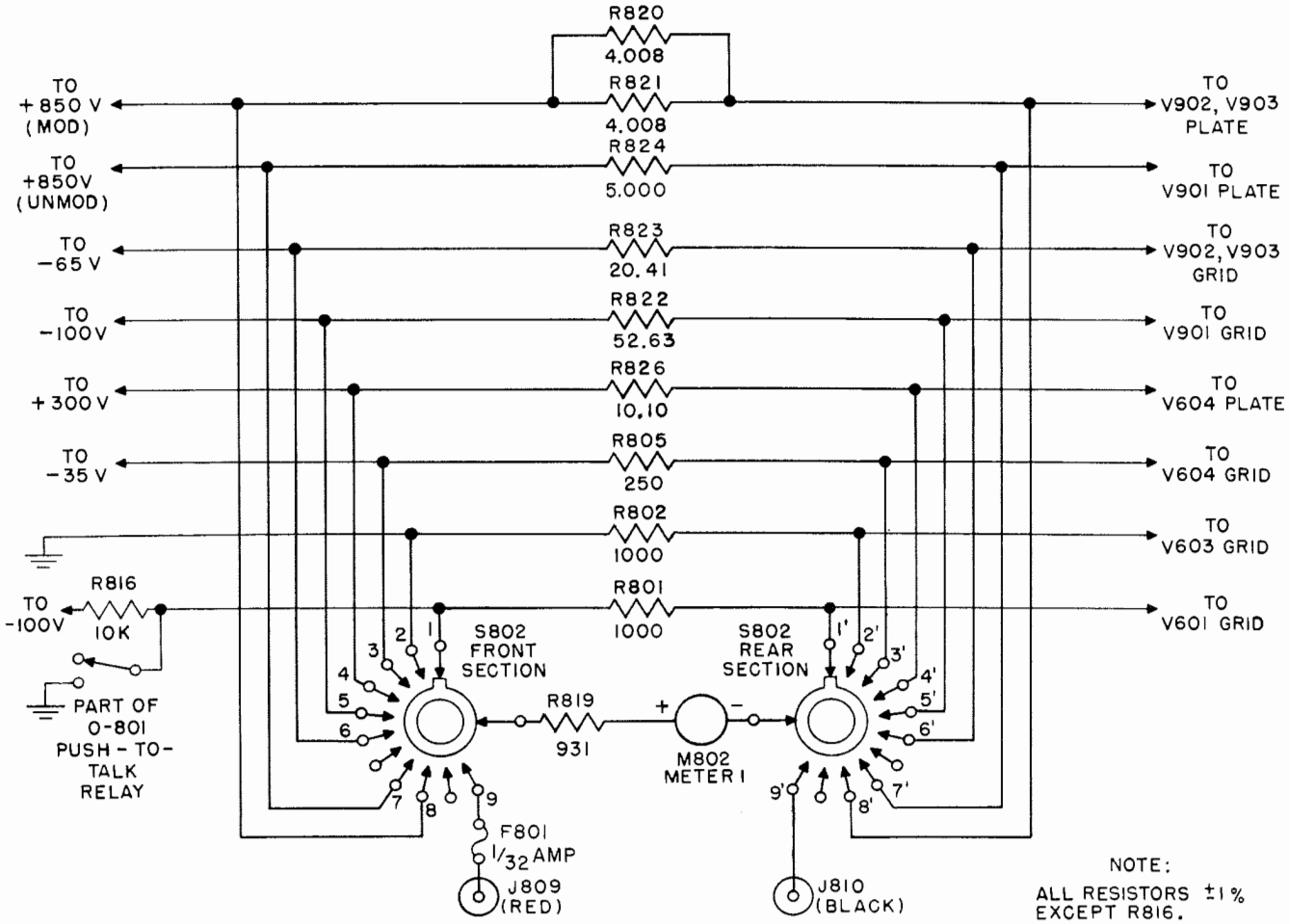
4-62. MODULATOR-POWER SUPPLY VOLTAGE MEASUREMENTS. (See figure 4-36.) Pin jacks provide convenient test points for measuring the voltage at several points within the modulator-power supply. Make measurements as indicated below and by referring to Table 4-5.

a. Take off "REMOVE TO EXPOSE TEST POINTS" plates on the front panels of the transmitter and the modulator-power supply.

b. Set "METER 1 SELECTOR SWITCH" S802 (located on the front panel of the transmitter) on position No. 9.

c. For voltages positive with respect to ground, connect one test lead from the test point jack (red) on the modulator-power supply to "+ METER 1" jack J809 (red) on the transmitter; connect another test lead between "- METER 1" jack J810 (black) and "GND." jack J805 (black), both on the transmitter.

d. For voltages negative with respect to ground, connect one test lead from the test point jack (green), on the modulator-power supply, to "- METER 1" jack J810 (black) on the transmitter; connect another test lead between "+ METER 1" jack J809 (red) and "GND." jack J805 (black), both on the transmitter.



DIRECTIONS:

1. FOR POSITIVE VOLTAGES CONNECT JUMPER BETWEEN J809 (RED) AND DESIRED POSITIVE VOLTAGE TEST JACK (RED). CONNECT OTHER JUMPER BETWEEN J810 AND J805.
2. FOR NEGATIVE VOLTAGES CONNECT JUMPER BETWEEN J810 (BLACK) AND DESIRED NEGATIVE VOLTAGE TEST JACK (GREEN). CONNECT OTHER JUMPER BETWEEN J809 (RED) AND J805 (BLACK).
3. USE EXTERNAL AUDIO FREQUENCY OUTPUT METER FOR VOLTAGE INDICATION AT J306.
4. * APPLICABLE TO T-282/GR UNITS ONLY; SEE DETAIL FOR T-282B/GR UNITS.

Figure 4-37A. Radio Transmitter T-282C/GR, Current and Voltage Measurements, Simplified Schematic

TABLE 4-4. TRANSMITTER VOLTAGE MEASUREMENTS

Name	Jack	Color Code	Voltage Measured or Function	Multiplier Resistor	Full Scale Meter Reading
HIGH V MOD	J804	Red	Modulated high voltage	R812	1,000 V
GND	J805	Black	Ground terminal		
MED V	J806	Red	Low voltage supply, +300 volts	R813	500 V
BIAS	J807	Green	Bias supply	R814	-200 V
LOW V	J808	Red	Low voltage supply, +250 volts	R815	500 V
+ METER 1	J809	Red	Positive side of "METER 1"	R819	*
- METER 1	J810	Black	Negative side of "METER 1"	None	*

* Dependent on connection to test jacks J804 through J808.

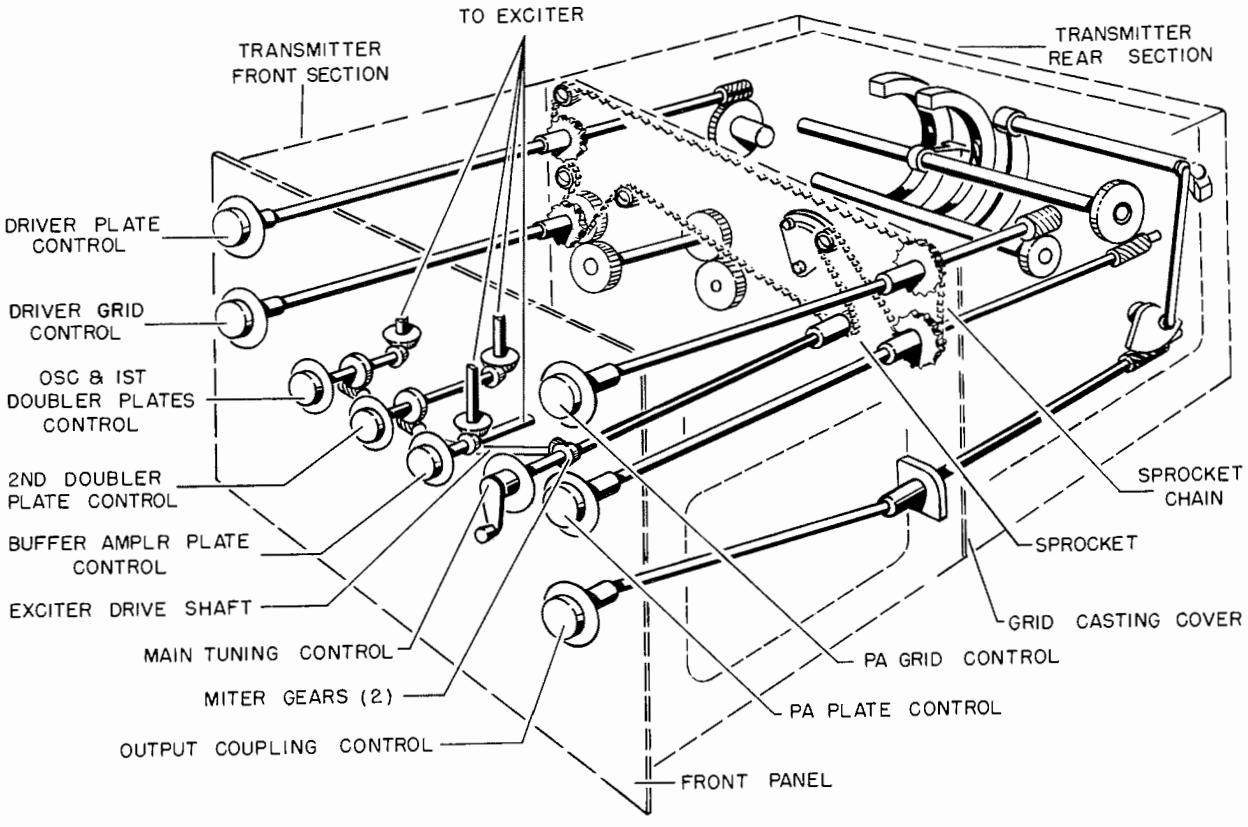


Figure 4-38. Radio Transmitter, Tuning Control Drive Mechanism

TABLE 4-5. MODULATOR-POWER SUPPLY VOLTAGE MEASUREMENTS

Jack	Color Code	Voltage Measured or Function	Multiplier Resistor	Full Scale Meter Reading
J302	Green	Microphone and control circuit	R302	-200 V
J303	Green	V301 cathode	R305	-100 V
J304	Red	V303 and V304 cathode	R321	5 V
J305	Red	V305 and V306 cathode	R333	50 V
J306	Green	Audio signal test	R315	*Use external meter
J307	Red	V203 delay voltage	R337	200 V

* Jack J306 must be connected to external output meter, eg. Triplett Model 630-A Multimeter or General Radio Type 583-A Output Meter.

4-63. FUNCTIONAL OPERATION OF MECHANICAL COMPONENTS.

4-64. Paragraphs 4-65 through 4-67 provide a description and essential information on the tuning mechanisms within the equipment, i.e. tuning linkages.

4-65. TUNING CONTROL DRIVE MECHANISM. (See figure 4-38.) All tuned circuits, within the transmitter, are resonated at the required frequencies by individual front panel controls. In addition, most of the controls are ganged together in such a manner that the circuits are roughly tuned with a single front panel control; this eliminates the possibility of tuning individual circuits to an undesired harmonic and thus transmitting on the wrong frequency and/or radiating spurious frequencies.

4-66. Each transmitter front panel tuning control is coupled to its respective variable capacitor, inductor, or tuned stub assembly, through individual shafts and gears. The "MAIN TUNING" control is coupled through miter gears to an exciter subassembly drive shaft which is parallel to the front pa A sprocket is secured to the end of the main tu control drive shaft. The sprocket drives a c which turns on other sprockets that are attac to the front of the grid casting cover.

4-67. All transmitter front panel controls, ex the "BUFFER AMPLR PLATE" and "OUTP COUPLING" controls, are ganged together and coa set with the "MAIN TUNING" control; as the "M TUNING" control is rotated to obtain the des operating frequency, pins on the exciter subass bly worm wheels, and pins on the chain sprock engage and drive stop collar pins on the indivi tuning control shafts. When the desired set is obtained, the "MAIN TUNING" control dial is then made finger tight. This prevents an the individual tuning controls from "driving" "MAIN TUNING" control. Fine tuning, by me of the individual front panel controls, is lim to 20-percent of the range (of the "MAIN TUNI control) by stop collar pins on the individual tu control shafts.

SECTION V

ORGANIZATIONAL AND SQUADRON MAINTENANCE

5-1. GENERAL.

5-2. The trouble shooting and repair work that can be performed at the organizational maintenance level is necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes and fuses, loose connections, etc. The paragraphs which follow in this section help in determining which component, chas subchassis, or section of the equipment is at f and in localizing the fault in that component to defective stage or item, such as a tube or f See Table 2-2 for required test equipment.

5-3. VISUAL INSPECTION.

5-4. Failure of this equipment to operate prope will usually be caused by one or more of the foll ing faults:

a. Improperly connected Power Cable Assembly CX-1541/U between the modulator-power supply and Distribution Panel J-390/GR.
b. Improperly connected power cable assembly between the distribution panel and the primary source of power.
c. Worn, broken, or disconnected cables between the transmitter and the modulator-power supply.
d. Wires broken because of excessive vibration.
e. Defective tubes.
f. Inactive (dirty or cracked) crystal.
g. Relay contacts burned because of excessive overloads.
h. Defective air interlocks.
i. Missing or defective fuses.
j. Interlocks open due to air filters not being properly secured.
k. Defective microphone.
l. Defective "GAIN" control on front of the modulator-power supply.
m. Defective tuning mechanism.
n. Defective antenna system.
o. Dirt clogged air filter - See par. 5-54.

5-5. When failure is encountered and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination of the components. If possible, obtain information from the operator of the equipment regarding performance at the time trouble occurred.

NOTE

All interlock switches have three terminals, one of which is not used (S501 is comprised of two switches which are ganged together). When replacing a switch, make certain it is wired exactly the same as the one it replaces. If necessary, the required terminals can be determined, before installation, by using an ohmmeter; an open circuit will exist between the desired terminals before the lever (push rod or air vane) is pushed; a closed circuit (zero ohms) will be secured when the lever is pushed (as in normal transmitter operation).

5-6. REFERENCE SYMBOLS. The electrical parts of the equipment have been assigned reference symbol numbers by series, which indicate the physical location of the parts within the assembled equipment. The tabulation which follows in Table 5-1 will be helpful in identifying the location of parts when the reference symbol number is known.

NOTE

The symbol numbers assigned to certain components do not conform to the series numbers given in Table 5-1, due to their functions as connectors between units. These include the following: P601 (transmitter, rear section), W601 (between exciter subassembly and transmitter, rear section), E801, E802, and E803 (transmitter, rear section), and P801 (monitor-screen modulator).

TABLE 5-1. REFERENCE SYMBOL NUMBERS

Serial Numbers	Location of Component
100	Modulator-power supply, power chassis
200	Modulator-power supply, modulator chassis
300	Modulator-power supply, driver subassembly
400	Modulator-power supply, front panel
500	Modulator-power supply, rear panel
600	Transmitter, exciter subassembly
700	Transmitter, monitor-screen modulator
800	Transmitter, front section
900	Transmitter, rear section

5-7. MINIMUM PERFORMANCE STANDARDS.

5-8. Table 5-2 serves as a checklist of minimum performance standards. In addition, it will help the operator to locate trouble without removal of the equipment from its operating position. Make the checks and adjustments in the sequence indicated. Each step presumes satisfactory completion of all previous steps. Refer to paragraphs 5-36 through 5-52 on how to make simple repairs; these paragraphs also give the location and explain how to remove all fuses, tubes, and plug-in type relays.

NOTE

Do not operate transmitter unless an antenna or dummy load is connected at the "TO ANTENNA" connector.

5-9. SYSTEM TROUBLE ANALYSIS.

5-10. The tests given in paragraphs 5-11 through 5-19 will aid in isolating the faulty component, section, or subassembly of the equipment. To be effective the procedure should be followed in the order given.

CAUTION

Remember that servicing procedure should cause no further damage to the equipment. To prevent further damage from possible short circuits, make the resistance measurements that follow with the "POWER" switch on the modulator-power supply turned "OFF."

TABLE 5-2. MINIMUM PERFORMANCE STANDARDS, ORGANIZATIONAL

Item	Action or Condition	Minimum Performance	Localization of Trouble
1. Antenna	R-f Cable Assemblies CG-597/U and CG-707/U connected.	The actions and/or conditions performed in steps 1 through 3 are part of the pre-starting procedure.	
2. POWER switch	Operate to "OFF" position.		
Power cable assemblies	Power Cable Assembly CX-1541/U connected between modulator-power supply and Distribution Panel J-390/GR; other cable connected between distribution panel and a-c supply (115 or 230 V, 50-60 cps).		
3. PLATE switch	Operate to "OFF" position.		
PUSH TO TALK-CARRIER ON switch	Operate to "CARRIER ON" position.		
TUNE-OPERATE switch	Operate to "TUNE" position.		
METER 1 SELECTOR SWITCH	Operate to position "1."		
METER 2 SELECTOR SWITCH	Operate to "CARRIER WATTS" position.		
NORMAL-EMER switch	Operate to "NORMAL" position.		
NARROW-BROAD switch	Operate to "NARROW" position.		
OUTPUT COUPLING control	Set at extreme clockwise position.		
4. POWER switch	Operate to "ON" position.	Green indicator light will glow.	Rotate pilot light dimmer max counterclockwise. Check pilot light, fuses F201 and F202.
		Blowers will operate.	Check fuses F101 and F803.
		Tube filaments will light.	Check fuse F104.
5. PLATE switch	Operate to "ON" position.	Red indicator light will glow if at least one minute has elapsed since turning "POWER" switch to "ON" position.	Tube V105. Check following relays by replacing with spares: push-to-talk O-201 (K201), time delay K101, and holding relay O-101 (K102).
6. Tuning controls	Tune transmitter to approx 399 mc. See the applicable Handbook of Operating Instructions for tuning instructions.	At least 90 watts output indication on "METER 2".	See Table 5-3, steps 5 through 13.

(continued on next page

TABLE 5-2. MINIMUM PERFORMANCE STANDARDS, ORGANIZATIONAL (CONT)

Item	Action or Condition	Minimum Performance	Location of Trouble
7. METER 2 SELECTOR SWITCH	Operate to "% MOD" position.		
CALIBRATE control	Tune until pointer of "METER 2" indicates "CAL" at right end of bottom scale.	Ability to indicate "CAL" on meter.	"CALIBRATE" control R702 defective.
8. PLATE switch	Operate to "OFF" position.	Red indicator light will go off.	Check "PLATE" switch S401 for short.
9. PUSH TO TALK-CARRIER ON switch	Operate to "PUSH TO TALK" position.	The actions performed in this step are required before continuing with the next step.	
MIKE jack	Plug-in type T-17 microphone.		
LIMITER THRESHOLD control	Set at max counter-clockwise position.		
METER 2 SELECTOR SWITCH	Operate to "% MOD" position.		
10. PLATE switch	Operate to "ON" position.		
GAIN control	Depress push-to-talk button on microphone. Talk into mouthpiece at voice level approx that used for normal conversation. Turn "GAIN" control from max counterclockwise to max clockwise position.	Reading on "METER 2" increases as "GAIN" control is turned in clockwise direction. Max indication of at least 100 percent modulation when "GAIN" control at max clockwise position.	Check microphone, "GAIN" control R306, and following tubes: V301, V302, V303, V304, V305, V306, V201, V202, V703, V704, V705, V706.
11. LIMITER THRESHOLD control	Set at max clockwise position.		
GAIN control	Depress push-to-talk button on microphone. Talk into mouthpiece at voice level approx that used for normal conversation. Turn "GAIN" control from max counterclockwise to max clockwise position.	Reading on "METER 2" increases as "GAIN" control is turned in clockwise direction. Levels off at about 60 percent modulation as "GAIN" control approaches max clockwise position.	Check tubes V203, V303, V304.
12. SIDE TONE OUTPUT jack	Plug in headset.		
T-17 microphone	Depress push-to-talk button and talk into mouthpiece.	Will hear own voice in headset.	Check tube V701 (12AT7).

(continued on next page)

TABLE 5-2. MINIMUM PERFORMANCE STANDARDS, ORGANIZATIONAL (CONT)

Item	Action or Condition	Minimum Performance	Localization of Trouble
13. NORMAL-EMER switch	Operate to "EMER" position.		
LINE terminals rear of modulator-power supply	Connect T-17 microphone.		
GAIN control	Depress push-to-talk button on microphone. Talk into mouthpiece at voice level approx that used for normal conversation. Turn "GAIN" control from max counterclockwise to max clockwise position.	Reading on "METER 2" increases as "GAIN" control is turned in clockwise direction.	Open circuit in C302.

5-11. CHECKING MODULATOR-POWER SUPPLY PRIMARY POWER CIRCUITS. (See figures 1-4 and 3-10.) If none of the tubes light up (or if barely discernible) with the "POWER" switch turned "ON," replace fuse F201 for 230-volt a-c input or F202 for 115-volt a-c input. If the trouble is not corrected, immediately turn the "POWER" switch to "OFF." Check the input circuits of the modulator-power supply by performing the following steps in the sequence indicated.

a. Disconnect all cables and cords from the modulator-power supply and the transmitter.

b. Turn the "POWER" switch on the front of the modulator-power supply to the "ON" position.

c. Measure the resistance across the terminal of the "AC POWER INPUT" connector J504, rear of the modulator-power supply. Normal indications are approximately 0.5 ohms when link O-202, on buck-boost transformer T202, is set for 115-volt operation and approximately 0.8 ohms when set for 230-volt operation (resistance of T202 and blower B401). Infinite resistance indicates an open circuit in L501, L502, rear interlock S501, "POWER" switch S403, or poor connections.

d. Turn the "POWER" switch to the "OFF" position. Connect the ohmmeter test leads between the chassis and one side of "AC POWER INPUT" connector J504. Connect the test leads between the chassis and the other side of the connector. The normal indication, between either side of the connector and the chassis, is infinite resistance. Zero resistance indicates a short in C504 or C505.

e. If the above tests indicate that the a-c input circuit of the modulator-power supply is satisfactory, proceed with paragraph 5-12.

5-12. CHECKING MODULATOR-POWER SUPPLY FILAMENT CIRCUITS. (See figures 1-3, 5-1, 5-2.) If the tests in paragraph 5-11 indicate that the a-c input circuit of the modulator-power supply is satisfactory, check the filament circuits by performing the following steps in the sequence indicated.

a. Remove all tubes, the pilot lights, and the time delay relay K101, from the modulator-power supply. See paragraphs 5-41, 5-44, and 5-51 for instructions on removal of tubes.

b. Unsolder all wires from terminal No. 9 and of transformer T103 (figure 5-2). Connect the te leads of an ohmmeter first between the chass and terminal No. 9, and then between the chass and terminal No. 10 of T103. Normal indicati is zero ohms. Infinite resistance indicates that th filament winding is open.

c. If a reading of zero ohms was indicated in st b, connect the ohmmeter test leads between t chassis and wires disconnected from terminal No. and then between the chassis and the wires di connected from terminal No. 10. Normal indicati is infinite resistance.

d. If zero resistance was indicated in step c, short exists in the filament circuit external to t filament winding of the transformer. Carefully che the filament wiring for broken insulation and e cessive solder at tube socket pins.

e. If normal indications were observed in ste b and c of this paragraph, resolder the wires pr viously removed, in step b, and proceed with t next step.

f. Unsolder the wires from terminal No. 11 and of T103. Connect the ohmmeter test leads betwe the above terminals. Normal indication is ze ohms. Infinite resistance indicates that this filame winding is open.

g. If a reading of zero ohms was indicated in t last step, connect the ohmmeter test leads betwe the chassis and the wires disconnected from termi No. 11 of T103. Normal indication is infinite r sistance. Zero resistance indicates a short-circ exists in the filament wiring to the high volta rectifier tubes V101 and V102. See step d of th paragraph.

h. Connect the ohmmeter test leads between t chassis and the wires disconnected from termi No. 12 of T103. Normal indication is approximate 240,000 ohms. Zero resistance indicates a sho circuit exists in the filament wiring to the hi voltage rectifier tubes V101 and V102. A low val of resistance, other than zero ohms, indicates a sh in the high voltage filter circuit. See paragraph 5-

i. If normal indications were observed in steps through h, resolder the wires previously remove in step f, and proceed with step j.

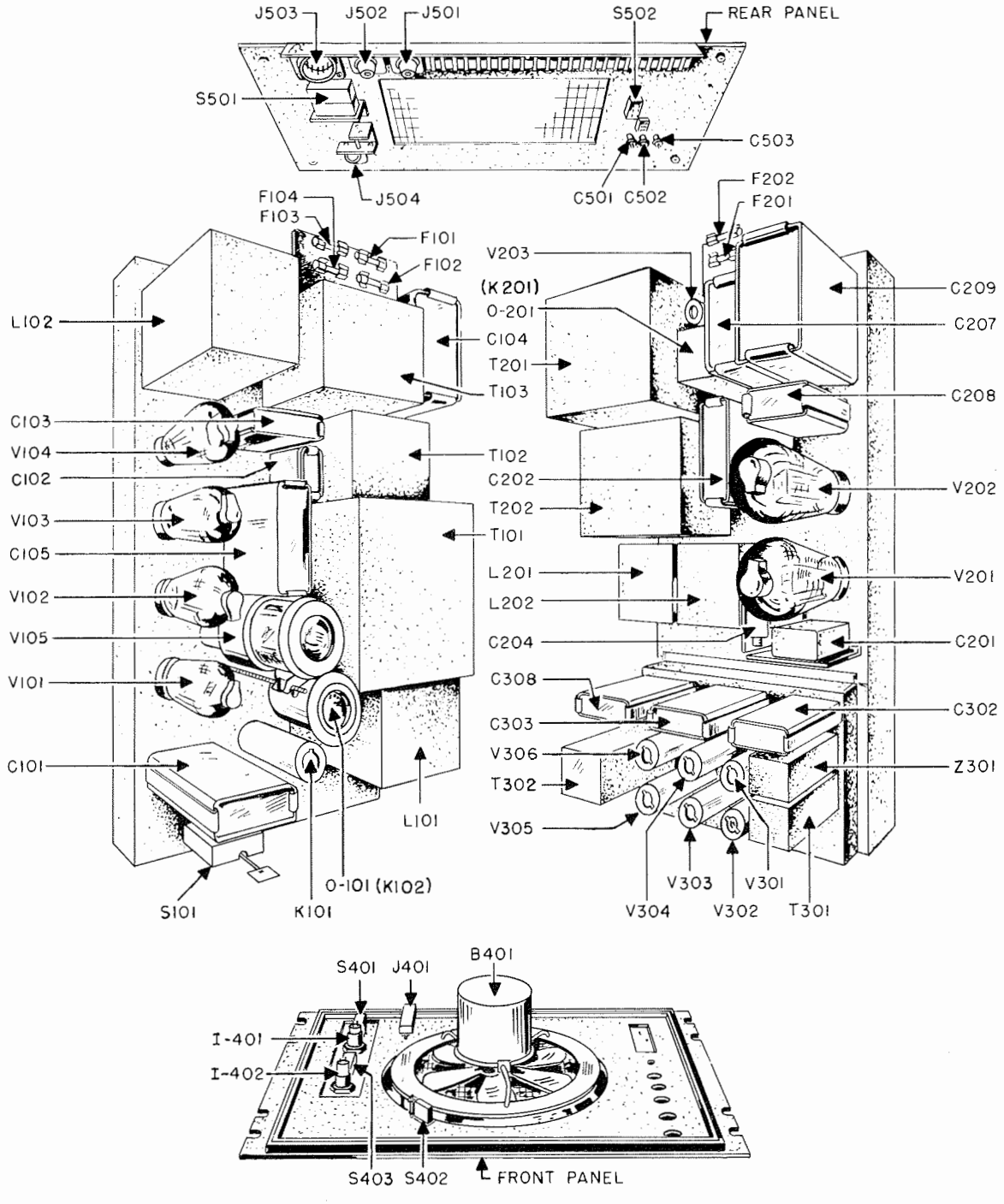


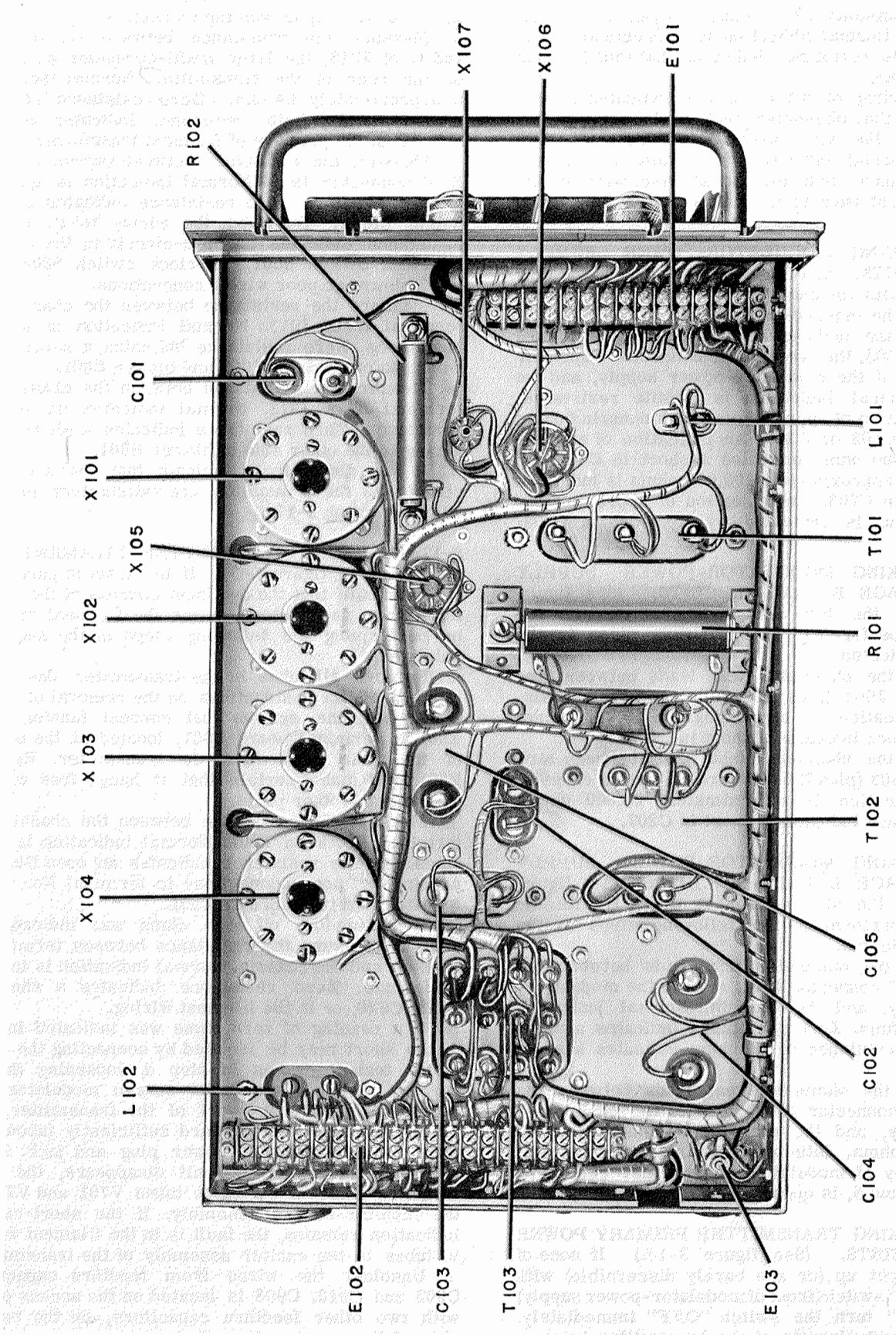
Figure 5-1. Modulator-Power Supply, Parts Location of Electrical Components

j. Unsolder the wires from terminal No. 3 and 4 of T103. Connect the ohmmeter test leads between the above terminals. Normal indication is zero ohms. Infinite resistance indicates that this filament winding is open.

k. If a reading of zero ohms was indicated in the previous step, connect the ohmmeter test leads between the chassis and the wires disconnected from terminal No. 3 of T103. Normal indication is infinite resistance. Zero resistance indicates a short-circuit exists in the filament wiring to the low voltage rectifier tubes V103 and V104. See step d of this paragraph.

l. Connect the ohmmeter test leads between the chassis and the wires disconnected from terminal No. 4 of T103. Normal indication is approximately 20,000 ohms. Zero resistance indicates a short-circuit exists in the filament wiring to the low voltage rectifier tubes V103 and V104. Any other value of resistance indicates a short in the d-c filter circuit. See paragraph 5-14 for a method of checking the d-c filter circuit.

m. If normal indications were observed in steps j through l, resolder the wires previously removed, in step j, and proceed with the next step.


X107
X106
E101
R102
C101
L101
X101
X105
T101
X102
R101
X103
T102
X104
C105
C102
L102
C104
E102
C103
T103
E103

n. Unsolder the wire from terminal No. 8 of T103. Connect the ohmmeter test leads between the terminal and ground. Normal indication is approximately 0.1 ohms. Infinite resistance indicates that this filament winding is open.

o. If a reading of 0.1 ohms was indicated in step n, connect the ohmmeter test leads between the chassis and the wire disconnected from terminal No. 8. Normal indication is infinite resistance. Zero resistance indicates a short-circuit exists in the filament wire to the bias rectifier tube V105.

5-13. CHECKING MODULATOR-POWER SUPPLY BIAS CIRCUITS. (See figure 1-4.) Check the bias voltage circuits for shorts by performing the following steps in the sequence indicated.

a. Connect the ohmmeter test leads between terminal J of J503, the large multi-conductor connector on the rear of the modulator-power supply, and the chassis. Normal indication is infinite resistance.

b. An indication of approximately 950 ohms indicates a short in C103 or C202. An indication of approximately 47,000 ohms indicates a short in C201. An indication of approximately 100,000 ohms is indicated by a short in C303. An indication of approximately 150,000 ohms is indicated by a short in C308.

5-14. CHECKING MODULATOR-POWER SUPPLY LOW VOLTAGE B PLUS CIRCUITS. (See figure 1-4.) Check the low voltage B plus circuits for shorts by performing the following steps in the sequence indicated.

a. Connect the ohmmeter test leads between terminal M of J503 (plus 300 volts) and the chassis. Normal indication is approximately 20,000 ohms. Zero resistance indicates a short in C105.

b. Connect the ohmmeter test leads between terminal C of J503 (plus 250-volt circuit) and the chassis. Normal indication is approximately 20,000 ohms. Zero resistance indicates a short in C207.

5-15. CHECKING MODULATOR-POWER SUPPLY HIGH VOLTAGE B PLUS CIRCUITS. (See figure 1-4.) Check the high voltage B plus circuits for shorts by performing the following steps in the sequence indicated.

a. Connect the ohmmeter test leads between the "HV UNMOD" connector J501, rear of the modulator-power supply, and the chassis. Normal indication is 240,000 ohms. Zero resistance indicates a short in C209. A resistance of 18 ohms indicates a short in C104.

b. Connect the ohmmeter test leads between the "HV MOD" connector J502, rear of the modulator-power supply, and the chassis. Normal indication is 240,000 ohms. Infinite resistance indicates that the secondary of modulation transformer T201, terminal No. 4 and 5, is open.

5-16. CHECKING TRANSMITTER PRIMARY POWER INPUT CIRCUITS. (See figure 3-10.) If none of the tubes light up (or are barely discernible) with the "POWER" switch (front of modulator-power supply) turned "ON," turn the switch "OFF" immediately. Check the input circuits of the transmitter by performing the following steps in the sequence indicated.

a. Disconnect all cables and cords from the modulator-power supply and the transmitter.

b. Measure the resistance between terminals D and G of J913, the large multi-conductor connector on the rear of the transmitter. Normal indication is approximately 3.4 ohms. Zero resistance indicates a short, and infinite resistance indicates an open circuit, in the primary of filament transformer T901.

c. Measure the resistance between terminals G and K of connector J913. Normal indication is approximately 37 ohms. Zero resistance indicates a short within blower B801 or the wiring to it. Infinite resistance indicates an open-circuit in the blower, interlock switch S601, interlock switch S803, fuse F803 blown, or poor wiring connections.

d. Measure the resistance between the chassis and terminal G of J913. Normal indication is infinite resistance. Zero resistance indicates a short in the wiring to one side of T901 and blower B801.

e. Measure the resistance between the chassis and terminal K of J913. Normal indication is infinite resistance. Zero resistance indicates a short in the wiring to the other side of blower B801.

f. If the above tests indicate that the a-c input circuits of the transmitter are satisfactory, proceed with paragraph 5-17.

5-17. CHECKING TRANSMITTER FILAMENT CIRCUITS. (See figure 5-3.) If the tests in paragraph 5-16 indicate that the a-c input circuits of the transmitter are satisfactory, check the filament circuits by performing the following steps in the sequence indicated.

a. Remove all tubes in the transmitter. See paragraph 5-46 for instructions on the removal of tubes.

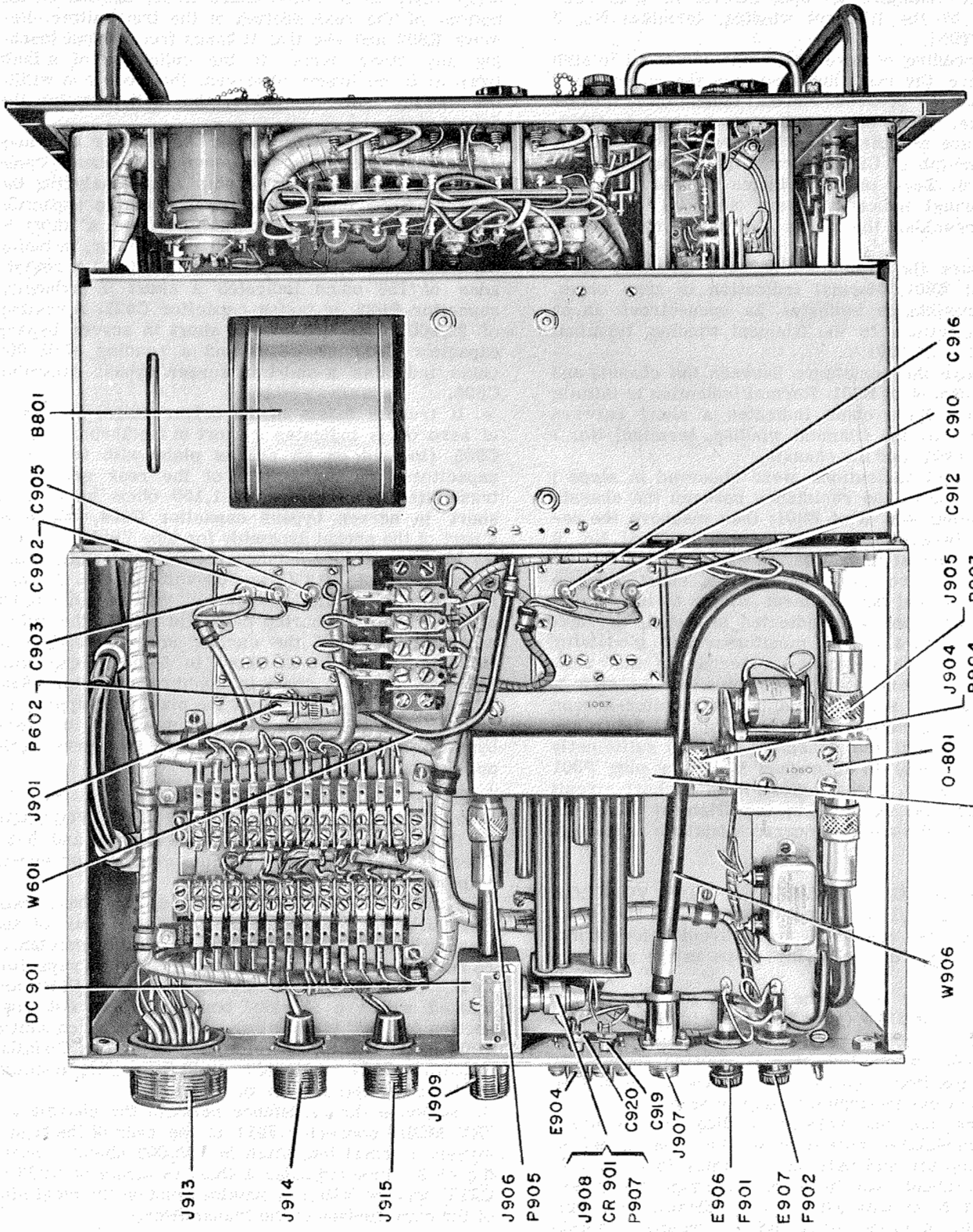
b. Loosen the screws that connect fanning strip E801 to terminal board E901, located at the bottom of the rear section of the transmitter. Remove E801 and make certain that it hangs free without touching any other parts.

c. Measure the resistance between the chassis and terminal No. 7 on E901. Normal indication is zero ohms. Infinite resistance indicates an open filament winding or poor connections to terminal No. 5 and 6 of filament transformer T901.

d. If a reading of zero ohms was indicated in step c, measure the resistance between terminal 7 of E801 and the chassis. Normal indication is infinite resistance. Zero resistance indicates a short in C618, C620, or in the filament wiring.

e. If a reading of zero ohms was indicated in step d, the short may be isolated by connecting the ohmmeter test leads, as in step d, loosening the six screws holding the monitor-screen modulator assembly to the front panel of the transmitter, and pulling the assembly forward sufficiently (about one inch) to disengage its power plug and jack. If the indication of a short-circuit disappears, the fault is in the filament wiring to tubes V701 and V702 in the monitor-screen assembly. If the short-circuit indication remains, the fault is in the filament wiring to tubes in the exciter assembly of the transmitter.

f. Unsolder the wires from feedthru capacitors C903 and C912. C903 is located on the access plate, with two other feedthru capacitors, on the bottom side of the rear section of the transmitter. C912 is located on another access plate, with two other


B801
C905
C902
C903
P602
J901
W601
DC 901
J913
J914
J915
J909
J906
P905
E904
J908
CR 901
P907
C920
C919
J907
E906
F901
E907
F902
C916
C910
C912
J905
P903
J904
P904
O-801
Z901
W906

feedthru capacitors, also on the bottom side of the rear section of the transmitter. Measure the resistance between the chassis and the wire unsoldered from C903. Normal indication is zero ohms. Infinite resistance indicates an open-circuit or poor connections to the filament winding, terminal No. 3 and 4 of T901.

g. If a reading of zero ohms was indicated in step f, measure the resistance between the chassis and the center tab of C903. Normal indication is infinite resistance. Zero ohms indicates a short in C903.

h. Measure the resistance between the chassis and the center tab of C912. Normal indication is infinite resistance. Zero ohms indicates a short in C912.

i. If normal indications were observed in steps g and h, resolder the wires that were removed in step f.

j. Measure the resistance between terminal No. 8 and 9 of E901. Normal indication is zero ohms. Infinite resistance indicates an open-circuit in or poor connections to the filament winding, terminal No. 7 and 8, of T901.

k. Measure the resistance between the chassis and terminal No. 8 of E901. Normal indication is infinite resistance. Zero ohms indicates a short between the wiring to the filament winding, terminal No. 7 and 8, of T901, and the chassis.

l. If normal indications were observed in steps j and k, measure the resistance between the chassis and terminal No. 8 of E801; then measure the resistance between the chassis and terminal No. 9 of E801. Normal indication, in each case, is infinite resistance. Zero ohms indicates a short between the chassis and the filament wiring to tube V706.

m. If zero ohms was indicated in step l, the fault may be isolated to the monitor-screen modulator assembly or to a source external to that unit. Connect the ohmmeter test leads as in step l, loosen the six screws holding the monitor-screen modulator assembly to the front panel of the transmitter, and pull the assembly forward sufficiently (about one inch) to disengage its power plug P801 from jack J703. If the indication of a short-circuit disappears, the fault is in the filament wiring to tube V706 in the monitor-screen modulator assembly.

5-18. CHECKING TRANSMITTER LOW VOLTAGE B PLUS CIRCUITS. (See figures 3-10 and 5-3.) Check the low voltage B plus circuits for shorts by performing the following steps in the sequence indicated.

a. Measure the resistance between the chassis and terminal C of J913 (plus 250-volt circuit). Normal indication is 100,000 ohms. A resistance of less than 40,000 ohms indicates a shorted bypass or tuning capacitor. Isolate the trouble by following the instructions in steps b through e below.

b. Loosen the six screws holding the monitor-screen modulator assembly to the front panel of the transmitter and pull the assembly forward sufficiently (about one inch) to disengage its power plug P801 from jack J703. If the indication of a fault (step a) is no longer observed, the trouble is within the monitor-screen modulator assembly. A resistance measurement of 9,000 ohms (step a) indicates that capacitor C703 is shorted.

c. If no indication of a short within the monitor-screen modulator assembly was indicated in step b, resecure the assembly to the front panel of the transmitter. Loosen the screws that connect fanning strip E802 to terminal board E901, located on the bottom of the rear section of the transmitter. Remove E802 and see that it hangs free without touching any other parts. If the indication of a fault (step a) is no longer observed, the trouble is within the exciter unit; otherwise, the fault is within the driver stage.

d. Shorted capacitors within the exciter unit may be further isolated by observing the exact value of resistance measured in step a and analyzing the results. Zero ohms indicates a short in capacitor C632. A reading of 56 ohms indicates a short in bypass capacitors C607, C613 or C627, or, in tuning capacitors C606, C608A, C608B or C612. A resistance of 156 ohms indicates a short in balancing capacitor C622 or tuning capacitor C621. A reading of 22,000 ohms indicates a short in screen bypass capacitor C611 or C619, and a reading of 68,000 ohms indicates a short in screen bypass capacitor C605.

e. If trouble exists in the driver stage, a reading of zero ohms indicates a short in feedthru capacitor C905 (located on an access plate with two other capacitors, on the bottom of the rear section of transmitter); a reading of 1,100 ohms indicates a short in screen bypass capacitor C904, which is a part of the socket assembly for tube V901.

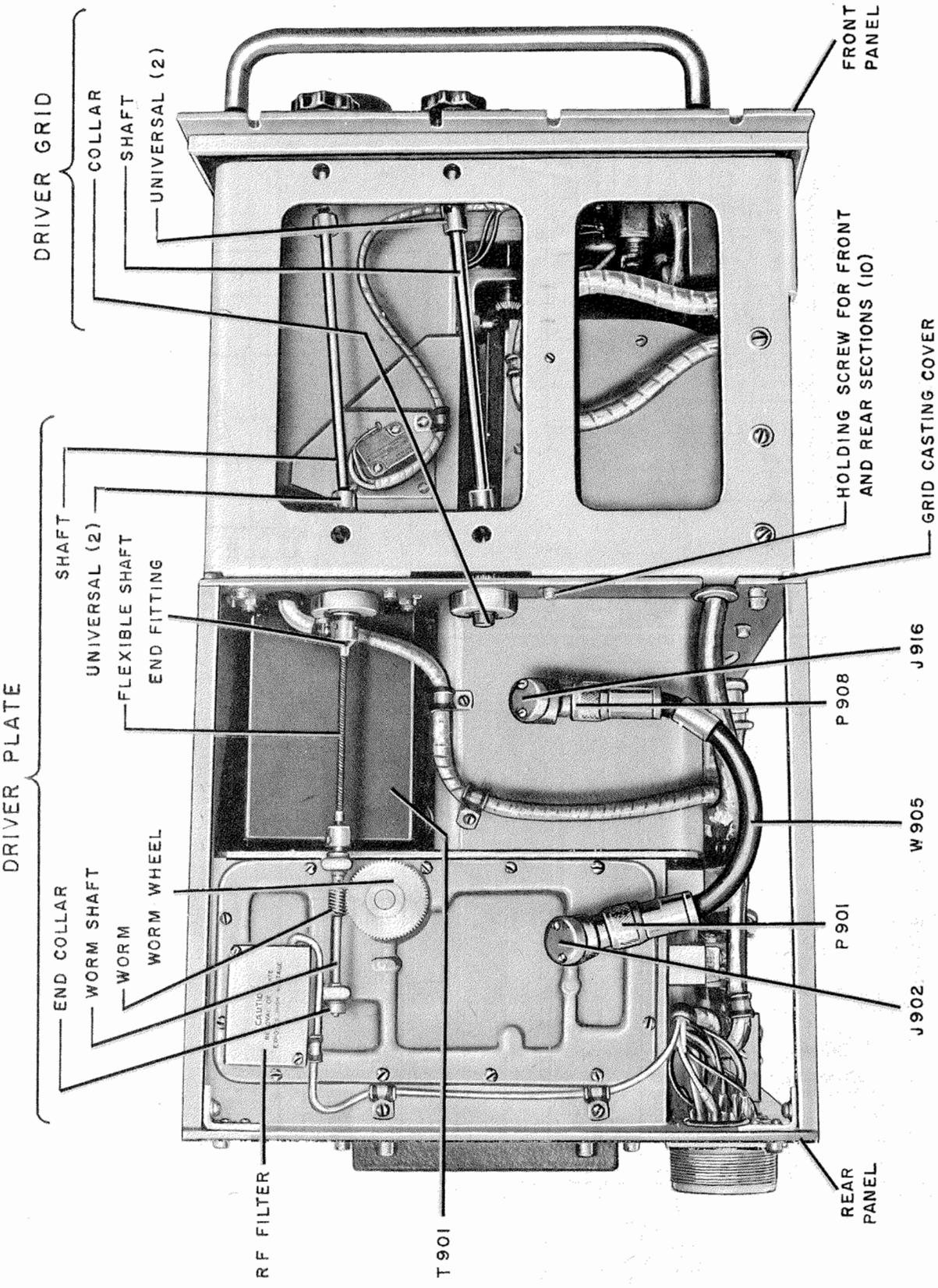
f. Measure the resistance between the chassis and terminal M of J913 (plus 300-volt circuit). Normal indication is infinite resistance. Values under 8,000 ohms indicate a shorted capacitor within the buffer amplifier stage of the exciter unit. A reading of 10 ohms indicates a short in feedthru capacitor C631; 66 ohms, a short in feedthru capacitor C630; 122 ohms, a short between the plate and suppressor grid of tube V604; and 6,800 ohms, a short in screen bypass capacitor C628 or between the screen grid and cathode of tube V604.

5-19. CHECKING TRANSMITTER HIGH VOLTAGE B PLUS CIRCUITS. (See figures 5-4 and 5-5.) Check the high voltage B plus circuits for shorts by performing the following steps.

a. Measure the resistance between the chassis and "HV UNMOD" connector J915 at the rear of the transmitter. Normal indication is infinite resistance. A reading of 5 ohms indicates a short in capacitor C922, C907, C906, or C924. C922 and C907 are located within a shielded box on the left side rear section of the transmitter. Plate bypass capacitor C906 is part of the driver tuning assembly. Coupling capacitor C924 is located within the casting containing the plate circuits for the driver.

b. Measure the resistance between the chassis and "HV MOD" connector J914 at the rear of the transmitter. Normal indication is 760,000 ohms. A reading of 2 ohms indicates a short in capacitor C923 or C918, located within a shielded box on the right side of the rear section of the transmitter.

5-20. GENERAL PRECAUTIONS. Whenever the equipment is serviced, observe the following warning:


DRIVER GRID
COLLAR
SHAFT
UNIVERSAL (2)
FRONT PANEL
HOLDING SCREW FOR FRONT AND REAR SECTIONS (10)
GRID CASTING COVER
SHAFT
UNIVERSAL (2)
FLEXIBLE SHAFT
END FITTING
J916
P908
W905
P901
J902
DRIVER PLATE
END COLLAR
WORM SHAFT
WORM
WORM WHEEL
RF FILTER
T901
REAR PANEL

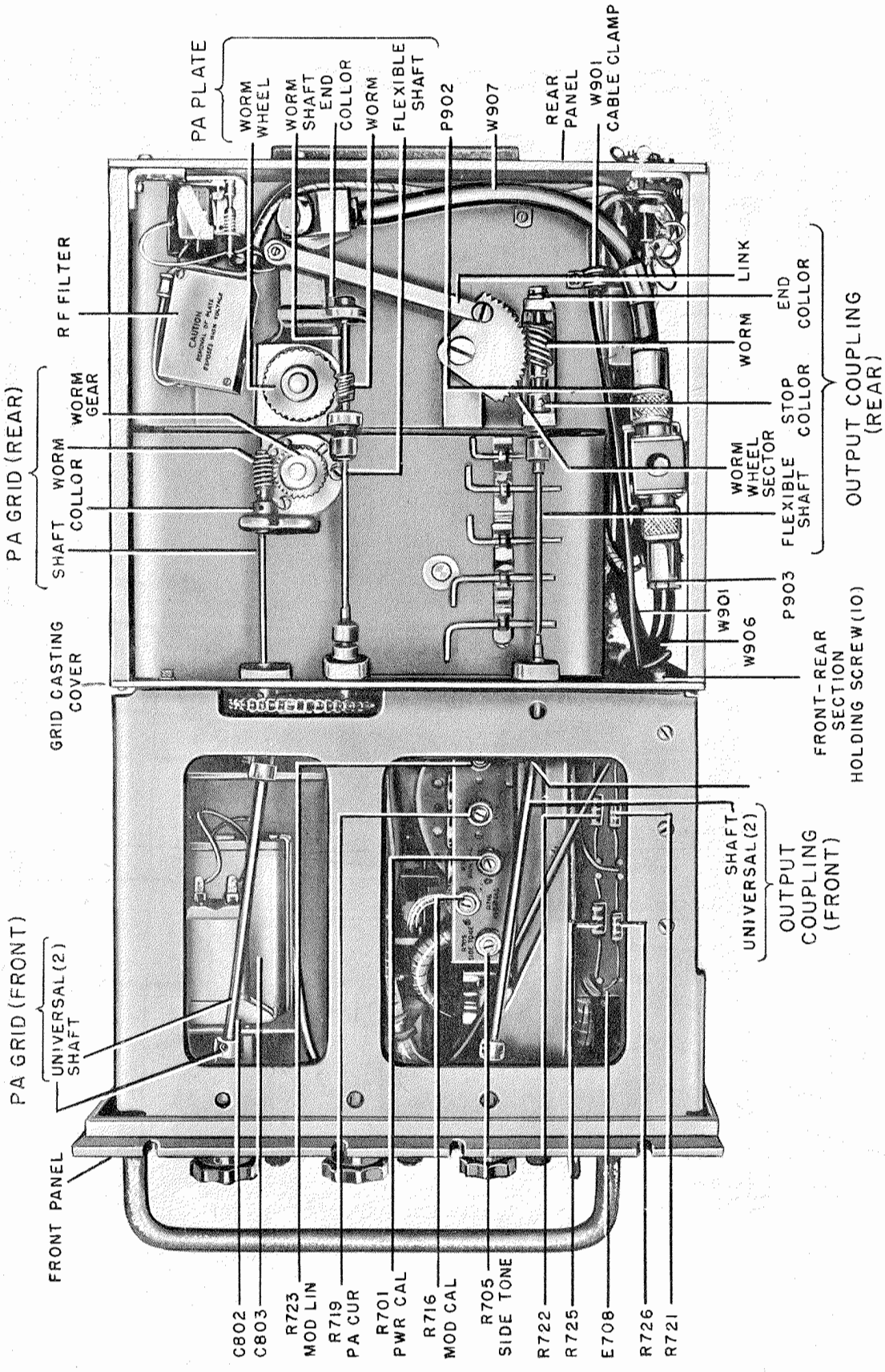


Figure 5-5. Radio Transmitter, Right Side, Dust Cover Removed

WARNING

Be careful when the dust covers are removed; dangerous voltages are exposed.

Observe the following precautions while servicing the equipment:

CAUTION

Failure to observe the following precautions will result in damage to the equipment.

a. Before a part is unsoldered, note the position of the leads. If the part, such as a transformer, has a number of connections, tag each of the leads to it.
b. Be careful not to damage other leads by pulling or pushing them out of the way.
c. Do not allow drops of solder to fall into the equipment, since they may cause short circuits.
d. A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.
e. When a part is replaced in r-f circuits, it must be placed exactly as the original. A part which has the same electrical value but different physical size, may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased output or possibly in parasitic oscillations.

5-21. SYSTEM TROUBLE ANALYSIS CHART. (See figures 5-6, 7-15, and 7-16.) Table 5-3 outlines the step-by-step procedure necessary to determine or isolate a faulty section within the transmitter or modulator-power supply. This determination is done by means of major test points. A star-encircl Arabic numeral is used to indicate a major test po designation. These points are indicated in figur 7-15 and 7-16. Make the checks in the sequen indicated in Table 5-3. Each step presumes sati factory completion of all previous steps.

NOTE

Do not operate transmitter unless an antenna or dummy load is connected at the "TO ANTENNA" connector.

5-22. To gain access to the wiring and termin boards, remove the equipment from its mounti rack. Set the transmitter and modulator-power supp down on the front panel handles on top of a suitab work bench. Remove the dust covers by looseni the screws at each corner at the rear of the equi ment. If it is necessary to operate the equipme while trouble shooting, use extra long interconnec ing cables so that the transmitter and modulato power supply may be moved about at will. Ref to paragraphs 2-6 through 2-9 for cable fabricati instructions.

WARNING

Be extremely careful when servicing the transmitter or modulator-power supply, because of the high voltages that are exposed. With the "PLATE" switch turned "OFF," potentials as great as 850 volts are still present in the equipment due to charged filter capacitors. Keep one hand in the pocket when measuring socket voltages with a voltmeter probe. Before touching any part after the voltage is shut off, short the part to ground.

TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause of Abnormal Indication
1. Power Source	 Terminal No. 1 and 2, terminal board E101, power supply chassis.	Set selector switch on Triplett Multimeter Model 630-A to 300 V AC. Connect meter across test point.	Set "POWER" switch to "ON." Set "PLATE" switch to "OFF."	Meter should read 115 V (±10 V) or, 230 V (±20 V), depending on line voltage used.	No primary power supplied to the modulator-power supply. Open in Power Cable Assembly CX-1541/U Outlet air-filter interlock switch S501 open. Open circuit in feedthru capacitor C504 or C505, in line filter choke L501 or L502. Poor connections at test point or terminal No. 2 and 3 of terminal board E102.

(continued on page 71)

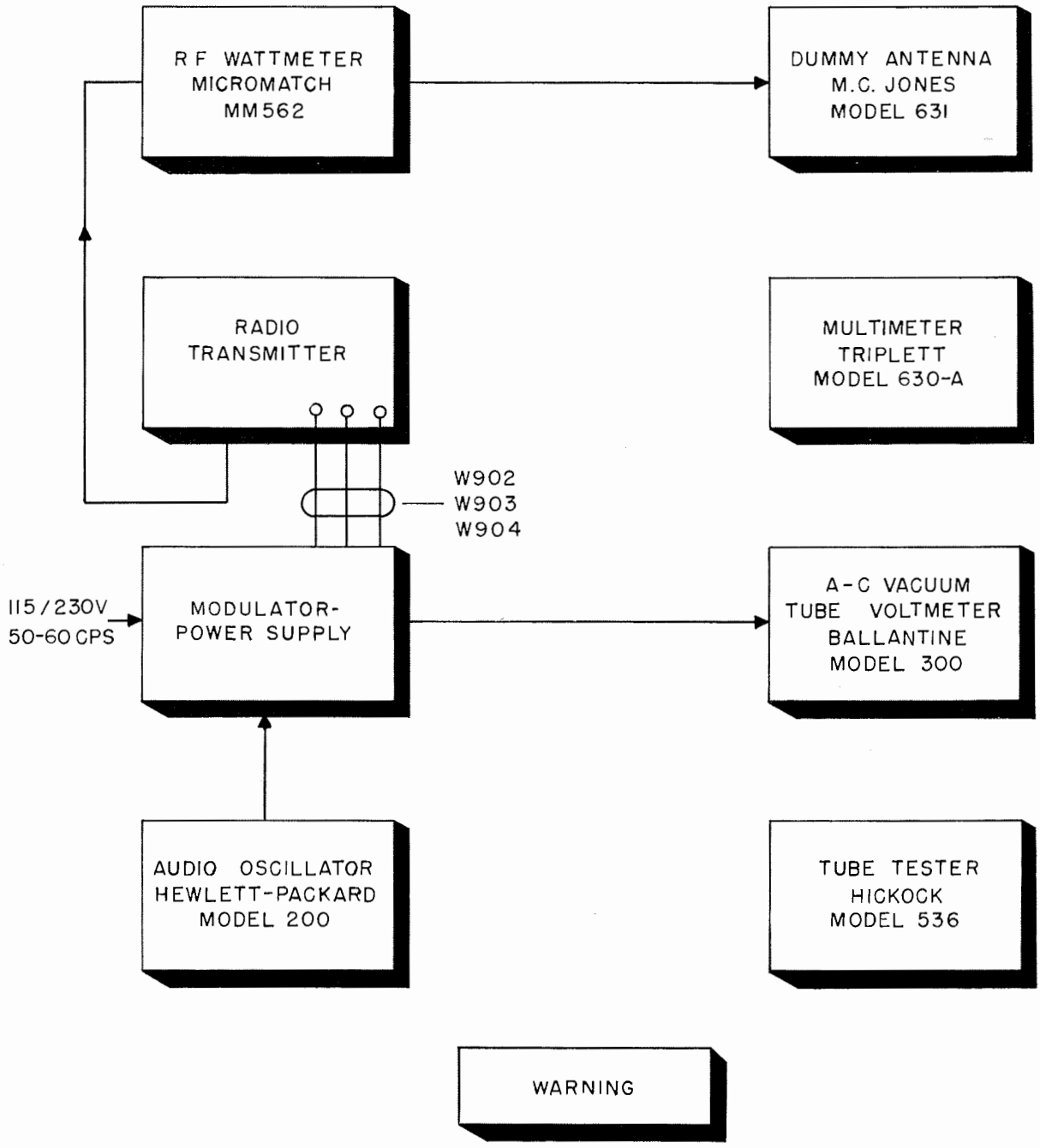


Figure 5-6. Radio Transmitter and Modulator-Power Supply, Systems Trouble Analysis, Recommended Test Set-Up

TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause of Abnormal Indicatior
2. Bias Supply	 "BIAS" jack J807 on front of transmitter.	Jumper between "+METER 1" and "GND" test jacks; jumper between "-METER 1" and "BIAS" test jacks (front of transmitter).	Set "METER 1 SELECTOR SWITCH" to "9."	-110 V reading on "METER 1." Meter reads -200 V dc full scale.	Open interlock switch; see that all air filters are well secured to front and rear panels. Check connectors at each end of Power Cable Assembly CX-2017/U. Air interlock switches S101 and S602 (air vanes) energized by blowers B401 and B801, will be open if blowers not operating; check blower fuses F101 and F803. Defective rect tube V105. Short in filter capacitor C103 or C202.
3. Low Voltage Power Supply	 "LOW V" jack J808 on front of transmitter.	Jumper between "+METER 1" and "LOW V" test jacks. Jumper between "-METER 1" and "GND" test jacks.	Set "TUNE-OPERATE" switch to "TUNE." Set "OUTPUT COUPLING" control at max clockwise position. Set "PUSH TO TALK-CARRIER ON" switch to "CARRIER ON." Set "PLATE" switch to "ON."	250 V reading on "METER 1." Meter reads +500 V dc full scale.	Fuse F103 open. Defective rectifier tube V103 or V104. Defective relay O-101 (K102), O-201 (K201), O-801, or K101. "PUSH TO TALK CARRIER ON" switch S302 or "PLATE" switch S401 defective. Short in filter capacitor C105 or C207.
4. High Voltage Power Supply	 "HIGH V" jack J804 on front of transmitter.	Jumper between "+METER 1" and "HIGH V MOD" test jacks. Jumper between "-METER 1" and "GND" test jacks.	Same as step 3.	850 V reading on "METER 1." Meter reads +1000 V dc full scale.	Fuse F102 open. Defective rect tube V101 or V102. Check "HV MOD" connectors at rear of equipment. Short in filter capacitor C104 or C209.
5. Crystal	 "METER 1 SELECTOR SWITCH" on "1."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "1." Open dial locks on all tuning controls. Tune "MAIN TUNING" control to output freq (36 times the crystal freq) and make dial lock finger tight.	Reading on "METER 1" of between 0.02 ma (at 400 mc) and 0.05 ma (at 225 mc). Actual crystal current is meter reading times 2.	Defective crystal Y601 or tube V601.

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TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause of Abnormal Indication
6. Oscillator and First Doubler Stages	 "METER 1 SELECTOR SWITCH" on "2."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "2." Tune "OSC & DOUBLER PLATES" control for max reading on "METER 1," and lock control.	Reading on "METER 1" of between 0.23 ma (at 400 mc) and 0.36 ma (at 225 mc). Actual second doubler grid current is meter reading times 2.	Tube V601,V602, or V603.
7. Second Doubler Stage	 "METER 1 SELECTOR SWITCH" on "3."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "3." Tune "2nd DOUBLER PLATE" control for max reading on "METER 1" and lock control.	Reading on "METER 1" of between 0.06 ma (at 400 mc) and 0.28 ma (at 225 mc).	Tube V603 or V604.
8. Buffer Amplifier Stage	 "METER 1 SELECTOR SWITCH" on "4."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "4." Tune "BUFFER AMPLR PLATE" control for min reading on "METER 1."	Approx 0.6 ma reading on "METER 1." Actual buffer amplifier plate current is meter reading times 100.	Tube V604 or V901.
9. Exciter to Driver Coupling Circuits	 "METER 1 SELECTOR SWITCH" on "5."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "5." Tune "DRIVER GRID" control for max reading on "METER 1." Readjust "BUFFER AMPL PLATE" and "DRIVER GRID" controls for max reading on "METER 1." Lock both controls.	Approx 0.7 ma reading on "METER 1." Actual driver grid current is meter reading times 20.	Tube V901. Check connectors on r-f cable connected between output of exciter (J601) and input to driver (J901).
10. Driver Stage	 "METER 1 SELECTOR SWITCH" on "7."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "7." Tune "DRIVER PLATE" control for min reading on "METER 1." If no min reading observed, proceed with next step.	Reading on "METER 1" of between 0.83 ma (at 400 mc) and 0.40 ma (at 225 mc). Actual driver plate current is meter reading times 200.	Fuse F901 open. Tube V901,V902, or V903.

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TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause of Abnormal Indicatio
11. Driver to Power Amplifier Coupling Circuits	11 "METER 1 SELECTOR SWITCH" on "6."	No external test equipment required.	Set "METER 1 SELECTOR SWITCH" to "6." Tune "PA GRID" control for max reading on "METER 1." Readjust "DRIVER PLATE" and "PA GRID" controls for max reading on meter. If resultant reading on meter greater than 0.4 ma, detune "PA GRID" control until meter reads 0.4 ma.	Approx 0.4 ma reading on "METER 1." Actual power amplifier grid current is meter reading times 50.	Tube V902 or V903. Check connectors on r-f cable connected between output of driver (J916) and input to power amplifier (J902).
12. Power Amplifier & Output Coupling Circuits. Part I	12 "TO ANTENNA" connector J909.	Connect directional coupler power output indicator, and dummy antenna, at "TO ANTENNA" connector J909, rear of transmitter. (See figure 5-6.) Set selector switch on power indicator to "FOR" position.	Set "METER 1 SELECTOR SWITCH" to "8." Tune "PA PLATE" control for max reading on power indicator (with "TUNE-OPERATE" switch to "TUNE").	Approx reading on power indicator: 225 mc - 75 w 300 mc - 50 w 400 mc - 55 w	Tube V902 or V903. Fuse F902 open. Tubes V703, V704, V705, or V706 Antenna relay O-901, r-f filter Z901, or directional coupler DC901, defective.
13. Power Amplifier & Output Coupling Circuits Part II	Same as step 12.	Same as step 12.	Set "TUNE-OPERATE" switch to "OPERATE." Tune "PA PLATE" control for max indication on power indicator. If above indication is less than 100 w, manipulate "PA PLATE" and "OUTPUT COUPLING" controls until indication of at least 100 w is achieved.	At least 100 watt reading on power indicator and "METER 2." Between 0.50 and 0.62 on "METER 1."	Tube V902, V903, V703, V704, V705, or V706. "TUNE-OPERATE" switch S801. See applicable Handbook of Operating Instructions, Section III. If reading on "METER 1" not between 0.50 and 0.62 ma, readjust "PA CUR." control R719 (within monitor-screen modulator assembly) so that approx 0.50 ma can be secured at 400 mc.

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TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause of Abnormal Indication
14. Driver Assembly on Modulator Chassis of Modulator Power Supply	 "LINE" terminals, rear of MD-141/GR.  Audio output test jack J306.	Set freq dial on Hewlett-Packard Audio Osc Model 200 to 1000 cps. Connect to major test point 13. Set range switch on Ballantine Model 300 Voltmeter to 0.01 volt full scale. Connect voltmeter to output terminals of audio osc. Set selector switch on Triplett Model 630-A Multimeter to 300 V AC and connect between major test point 14 and J805 (on T-282/GR). Turn amplitude control on audio osc until an input level reading of 0.001 V is obtained on Ballantine voltmeter.	Set "NORMAL-EMER" switch to "NORMAL." Set "LIMITER THRESHOLD" control at max counterclockwide position. Set "GAIN" control at max clockwise position. Set "NARROW-BROAD" switch to "NARROW." Note reading on multimeter while turning "GAIN" control in counterclockwise direction.	At least 50 V reading on the multimeter. Reading on multimeter will gradually decrease when "GAIN" control is turned in counterclockwise direction; will indicate zero output at max counterclockwise setting of control.	Tube V301,V302, V303,V304,V305, or V306. "GAIN" control R306 defective. See Table 6-2, step No. 18 through 23.
15. Plate Modulator Stage	 	Same as step 14 except multimeter and 10,000 ohm resistor connected between major test point 4 and "GND." test jack. Set multimeter selector switch to 12 V AC; use "OUTPUT" and "COMMON" jacks.	Same as step 14. Note reading on multimeter while turning "LIMITER THRESHOLD" control in clockwise direction.	At least 7.5 V reading on the multimeter. Reading on multimeter will gradually decrease when "LIMITER THRESHOLD" control turned in clockwise direction; will indicate approx 2.4 V at max clockwise setting of control. Actual value of modulation voltage equal above values times 100.	Tube V201,V202, or V203. "LIMITER THRESHOLD" control R335 defective. See Table 6-2, step No. 24 and 25.

(continued on next page)

TABLE 5-3. SYSTEMS TROUBLE ANALYSIS, ORGANIZATIONAL (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Positions	Normal Indication	Possible Cause o Abnormal Indicatic
16. Screen Modulator Stage	13 15 Term. No. 12 of term. board E901, bottom, rear sect of transmitter.	Same as step 14 except multimeter connected between major test point 15 and the chassis; keep multimeter test leads dressed away from transmitter to reduce undesired feedback.	Same as step 14 except do not turn "GAIN" control.	Approx 110 V reading on the multimeter.	Tube V703, V704, V705, or V706. Factory adjusted "PA CUR." control R719 or "MOI LIN" control R723 defective or not properly adjusted.

5-23. TRANSMITTER METER READINGS. Table 5-4 is a resumé of typical readings indicated on "METER 1" and "METER 2."

5-24. REMOVAL OF ASSEMBLIES AND SUBASSEMBLIES.

5-25. Step-by-step instructions follow for remov the power supply and modulator chassis from modulator-power supply. Instructions for separat the front and rear sections of the transmitter, as w as removal of the exciter and monitor-screen modu tor assemblies, are given in paragraphs 5-30 and 5-

TABLE 5-4. TYPICAL TRANSMITTER METER READINGS

Selector Switch	Switch Position	Current Measured	Meter Reading ***			Actual Current		
			225 mc	300 mc	400 mc	225 mc	300 mc	400 mc
1	1	Crystal	0.10	0.08	0.06	0.20	0.16	0.12
1	2	V603 grid	0.35	0.36	0.23	0.70	0.72	0.46
1	3	V604 grid	0.28	0.26	0.30	1.40	1.30	0.32
1	4	V604 plate	0.63	0.56	0.69	63	56	69
1	5	V901 grid	0.81	0.71	0.66	16.2	14.2	13.2
1	6	PA grid	0.40	0.40	0.32	20	20	16
1	7	V901 plate	0.40	0.60	0.83	80	120	166
1	* 8	PA plate	0.38	0.39	0.32	190	195	160
1	** 8	PA plate	0.57	0.58	0.51	285	290	255
2	* "CARRIER WATTS"		75 w	50 w	55 w			
2	** "CARRIER WATTS"		150 w	130 w	125 w			

* "TUNE-OPERATE" switch in "TUNE" position.

** "TUNE-OPERATE" switch in "OPERATE" position.

*** All meter readings in milliamperes unless otherwise indicated.

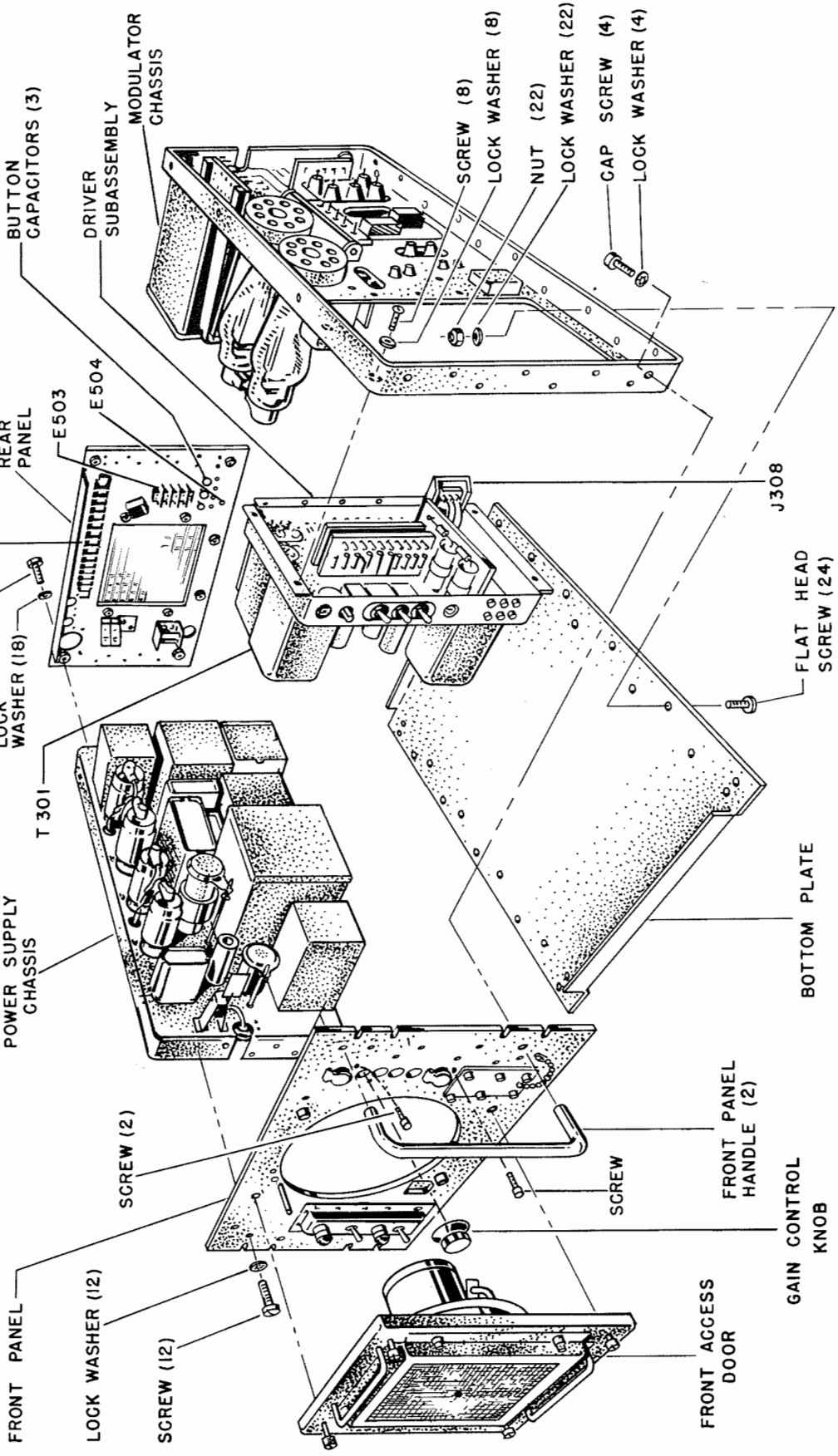


Figure 5-7. Modulator-Power Supply, Removal of Assemblies and Subassemblies

5-26. REMOVAL OF POWER SUPPLY CHASSIS. (See figure 5-7.) Except for switches, indicator lights, connectors and terminal boards, all components comprising the modulator-power supply are mounted on two chassis. The power supply chassis is to the left and the modulator chassis is to the right (when facing the front panel). In order to remove the power supply chassis, place the modulator-power supply on a workbench and perform the following steps in the sequence indicated.

a. Remove the "GAIN" control knob by loosening the set screw with a Bristo No. 10 wrench.

b. Remove the front panel handles, each secured by two hex cap screws, accessible at rear of the front panel.

c. Remove the rest of the front panel screws that hold the chassis to the front panel, 6 each side (total of 12), 2 near "GAIN" control, and one near "LIMITER THRESHOLD" control.

d. Remove the rear panel screws that hold the chassis to the rear panel (9 each side, total of 18).

e. Remove the 12 screws that hold the lower side of chassis to the bottom plate of the modulator-power supply.

f. Disconnect the row of terminals on terminal board E101 that are closest to the front panel. E101 is located at the lower front end of the power supply chassis.

g. Disconnect the row of terminals on terminal board E102 that are closest to the rear panel. E102 is located at the upper rear end of the power supply chassis. Disconnect the red lead (green tracer) from standoff E103 and the black lead from the ground lug, both near E102.

h. Push the front and rear panels back sufficiently to remove the power supply chassis.

5-27. REMOVAL OF MODULATOR CHASSIS. (See figure 5-7.) In order to remove the modulator chassis, place the modulator-power supply on a workbench and perform the following steps in the sequence indicated.

a. Perform steps a through e, paragraph 5-26.

b. Push back the rear panel and disconnect the upper row of terminals on terminal board E502. The terminal board is located on the upper rear of the rear panel near the modulator chassis.

c. Push back the rear panel and disconnect the outside row of terminals on terminal board E503. The terminal board is located on back of the rear panel near the modulator chassis.

d. Push back the rear panel, unsolder the three shielded leads from the three button type capacitors located between terminal boards E501 and E503, and remove the plastic cable clamp. Disassemble the solder lug from "GROUND" post E504; remove the three black leads from the lug.

e. Push the front and rear panels back an inch or two, and remove the modulator chassis.

5-28. REMOVAL OF AUDIO DRIVER SUBASSEMBLY. (See figure 5-7.) In order to remove the driver subassembly from the modulator chassis, place the modulator chassis on a workbench and perform the following steps in the sequence indicated.

a. Remove the screws (two each end) that secure the subassembly chassis to the modulator chassis.

b. Remove the four screws that secure one side the subassembly chassis to modulator chassis.

c. Unsolder the three shielded leads from termi numbers 3, 4, and 6 of transformer T301 (on driv subassembly).

d. Remove the cable clamp, adjacent to filter Z3 (on the driver subassembly).

e. Disconnect plug P201 from jack J308 (on brack bottom of subassembly).

f. If the modulator chassis was not previously r moved (paragraph 5-27), remove the front panel scre and "GAIN" control knob; push panel back so as clear the control shafts and toggle switch handl protruding from the driver subassembly. Remo the subassembly from the modulator chassis.

5-29. SEPARATION OF TRANSMITTER FRONT AI REAR SECTIONS. (See figure 5-8.) In order separate the front and rear sections of the tran mitter, set the transmitter on a workbench, a perform the following steps in the sequence indicate Follow the instructions given in steps j through r remove the grid casting cover after the front a rear sections of the transmitter have been separate

a. Disconnect plug P601 from jack J601 at rear the exciter subassembly.

b. Remove W601 cable clamp, located on scr casing support.

c. Loosen the No. 6 Bristo set-screws and th remove the universal joints and 6 control shaf between the front panel controls and the grid cas ing cover.

d. Disconnect plug P907 from jack J908 (part the directional coupler on the bottom, rear secti of transmitter). Take care that crystal diode CR9 does not fall out of J908 (figure 5-3).

e. Remove the W901 cable clamp, located on t right side, rear section of the transmitter.

f. Pull the rubber grommet and cable W901 throu the hole in the grid casting cover.

g. Disconnect fanning strips E801, E802, and E8 (bottom, rear section of transmitter) from termi boards E901, E902, and E903.

h. Remove the ten screws that secure the t sections together.

i. Pull the front section away from the rear sectio maneuver the front section so as to permit t sprocket chain to clear the front section.

j. To remove the grid casting cover, follow t procedure given in steps k through r.

k. Remove the 28 round head screws in grid cas ing cover.

l. Remove the two sprockets on the right side the grid casting cover. Each sprocket is held by collar (with two set-screws).

m. Disconnect the flexible shaft end fitting (two se screws) from the shaft on the left side of the gr casting cover (driver plate tuning).

n. Disconnect the white-green and white-black lea from terminals 1 and 3 of terminal board E9(bottom, rear section of the transmitter.

o. Remove the two cable clamps, each side of t grid casting cover, adjacent to the rubber gromm near filament transformer T901.

p. Record the color code of the leads connect to T901 terminals for use during reassembly grid casting cover.

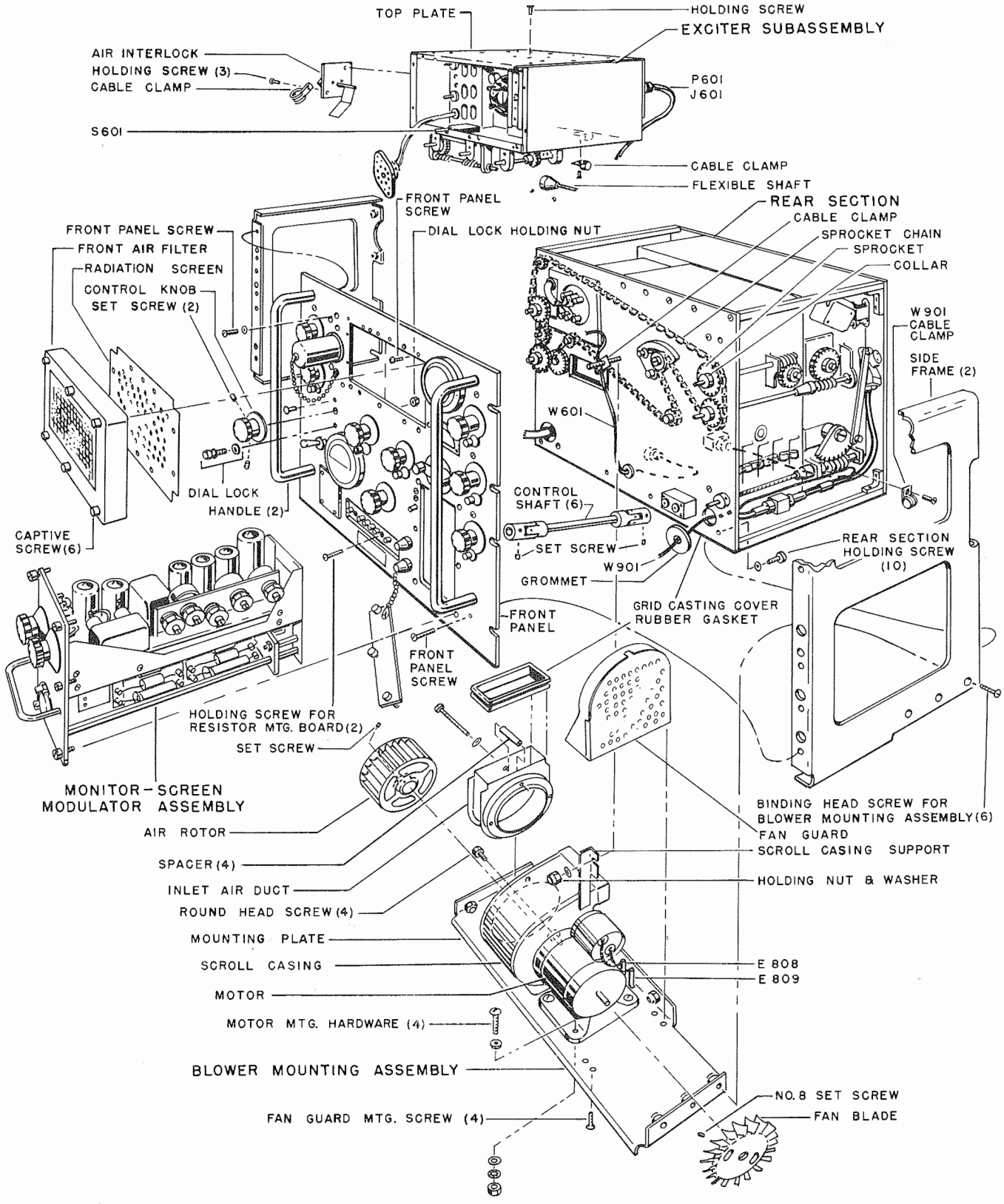


Figure 5-8. Radio Transmitter, Removal of Assemblies and Subassemblies

q. Disconnect the leads from T901 and pull them through grommet in grid casting cover.
r. The grid casting cover may now be lifted off the casting which houses the driver and power amplifier input circuits.

5-30. REMOVAL OF EXCITER SUBASSEMBLY. (See figure 5-8.) In order to remove the exciter subassembly from the transmitter, it is necessary to remove the front panel of the transmitter. Set the transmitter on a workbench and perform the following steps in the sequence indicated.
a. Remove the front air filter and radiation screen, thus exposing six front panel screws. Remove the screws.
b. Remove six front panel screws, three above and three below the crystal socket.
c. Disconnect the two wires from the front air filter interlock switch S601, located on the left side of the exciter subassembly.
d. Loosen the set-screws in all front section universal joints and remove the control shafts. There are two control shafts on the left side of the front section of the transmitter, and four on the right side.
e. Remove the W901 cable clamp, located on the right side of the rear section of the transmitter.
f. Disconnect plug P907 from jack J908 (part of the directional coupler on the bottom, rear section of the transmitter). Take care that crystal diode DC901 does not fall out of J908 (figure 5-3).
g. Remove the air interlock mounting plate (held by three screws), located on the left side of the exciter subassembly.
h. Remove the eight front panel screws, four on each side, in line with the front panel handles.
i. Disconnect plug P601 from jack J601 at rear of exciter subassembly.
j. Pull the front panel forward and rest it on its handles.
k. Remove the cable clamp, located on the right side of the exciter subassembly. If necessary, remove the monitor-screen modulator assembly so as to gain access to the screw which secures the clamp.
l. Remove the cable clamp, located at center of exciter subassembly.
m. Disconnect the seven leads, six from exciter subassembly feedthrough capacitors, and one to ground lug.
n. Loosen the flexible shaft coupling at the end near the center of the exciter subassembly.
o. Loosen the nuts at the rear of the front panel which are used to secure the exciter dial locks.
p. Loosen the set-screws in the following dial knobs and remove the knobs: "OSC & 1ST DOUBLER PLATES," "2ND DOUBLER PLATE," and "BUFFER AMPLIFIER."
q. Three front panel screws, previously covered by the dial knobs, are now exposed. Remove the screws.
r. The exciter subassembly may now be completely separated from the rest of the transmitter.

5-31. REPLACEMENT OF EXCITER SUBASSEMBLY. (See figure 5-8.) Replace the exciter subassembly by performing the steps of procedure which follow:

a. Trim all leads that were snipped off or unsoldere Clean all terminals to which connections will be mad in the steps that follow.
b. Seat the rubber gasket over the air duct. Ta down the gasket to the metal duct with several piec of adhesive tape.
c. Remove the top plate of the exciter subassembl It will then be possible to look down through the e citer subassembly while maneuvering it into positi over the air duct.
d. Maneuver the exciter subassembly over the a duct. Work the top of the rubber gasket (use a sma screw driver) into the bottom of the duct in the e citer subassembly (look down through top of excit subassembly).
e. Replace the three front panel screws (step q paragraph 5-30). Replace the dial knobs and di lock screws (steps o and p of paragraph 5-30). Th step must be taken before the front panel is swu back into place, in order to have access to the re of the panel while securing the dial lock holding nut
f. Reverse the procedure steps required for remov of the exciter subassembly (see paragraph 5-3(
g. When swinging the front panel into position, pu the left side of the panel in first, so as to clear t large cable near the front frame.
h. When replacing the air interlock mounting plat see that the edge of the air interlock "flap" is paral to the mounting plate. The "flap" must clear t rubber gasket.

NOTE

It will be necessary to bend the "flap" forward or backward, if the air interlock switch does not function properly (due to previous accidental bending of the "flap"). This can be determined after the transmitter has been completely reassembled (except for the dust cover) and connected to a modulator-power supply, with the "POWER" switch turned "ON."

5-32. REMOVAL OF TRANSMITTER BLOWER MO TOR. (See figure 5-8.) In order to remove the blow from the transmitter, set the transmitter on a wor bench, and perform the following steps in the sequen indicated.
a. Remove the nut which holds the scroll casi bracket of the blower assembly to the grid casti cover (accessible through the top front section the transmitter).
b. Turn the transmitter so that the top side is the workbench (bottom side up). Remove the s binding head screws (three on each end) which h the blower mounting assembly to the front secti of the transmitter.
c. Remove the three Bristo cap screws which h the blower mounting assembly to the grid casti cover (use 1/4 in. Bristo wrench).
d. Lift the blower mounting assembly out of t transmitter; tilt the mounting plate forward (ne front panel). If necessary, move the resistor mounti board (back of the front panel) out of the way removing the mounting screws (accessible by removi the test point cover plate on the front panel).

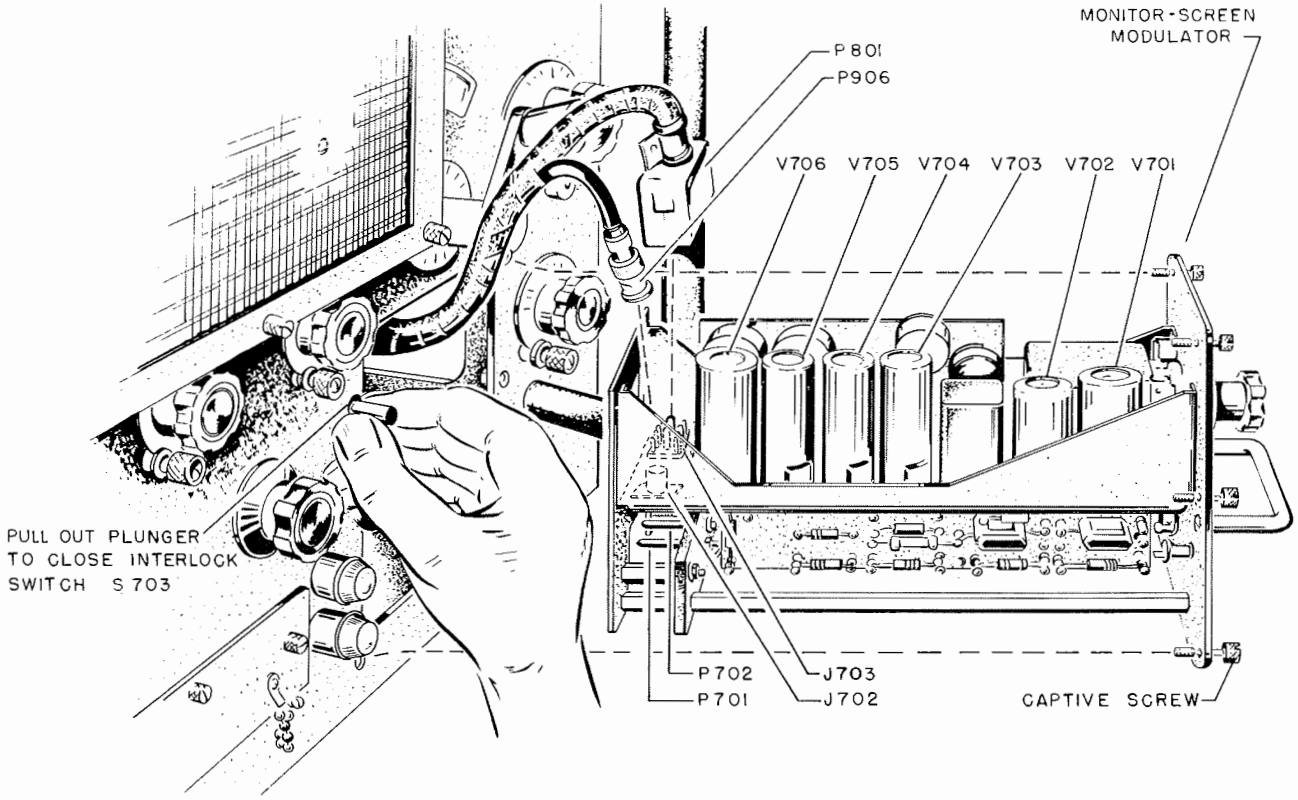


Figure 5-9. Radio Transmitter, Removal of Monitor-Screen Modulator Assembly and Tube Location

e. Disconnect the four leads which are connected to the standoff insulators on the blower mounting plate (two red leads to E808; black and orange (or yellow) leads to E809).

f. Remove the fan guard, secured to the mounting plate by four mounting screws.

g. Loosen the No. 8 set-screw and remove the fan blade from the motor shaft.

h. Remove the inlet duct, secured to the scroll casing by four mounting screws (which pass through spacers).

i. Loosen the two 1/4 in. Bristo set-screws and remove the air rotor from the motor shaft.

j. Remove the scroll casing, secured to the motor end plate by four round head screws.

k. Remove the motor, secured to the mounting plate by four screws (with companion nuts and washers).

5-33. REPLACEMENT OF TRANSMITTER BLOWER MOTOR. (See figure 5-8.) Replace the motor by performing the steps of procedure which follow.

a. Trim all leads that were snipped off or unsoldered. Clean all terminals to which connections will be made, in the steps which follow.

b. Reverse steps e through k of paragraph 5-32.

c. Seat the rubber gasket over the inlet duct. Tack down the gasket to the metal duct with several pieces of adhesive tape.

d. Reverse steps a through d of paragraph 5-32.

e. Remove the top plate of the exciter subassembly. In addition to the screws in the top of the plate, it is necessary to remove three front panel screws; two of the screws are accessible by removing the front air filter and radiation screen; the third screw (same color as front panel) is located above the crystal socket cover.

f. Work the top of the rubber gasket (use a small screw driver) into the bottom of the duct in the exciter subassembly (look down through top of exciter subassembly).

g. Replace top plate of exciter subassembly.

5-34. REMOVAL OF MONITOR-SCREEN MODULATOR ASSEMBLY. (See figure 5-9.) In order to remove the monitor-screen modulator assembly from the transmitter, perform the following steps in the sequence indicated.

a. Loosen the six front panel captive screws on the transmitter that secure the assembly to the front panel of the transmitter.

b. Grasp the handle on front panel of assembly and pull out as far as the cables will permit.

c. Remove the cable clamp at rear of assembly; disconnect plug P801 from jack J703.

d. Disconnect plug P906 from jack J702, at rear of assembly.

e. The assembly may now be pulled forward to remove it completely from the transmitter.

5-35. MINOR REPAIR AND ADJUSTMENT.

5-36. The repairs that follow consist of replacing fuses, pilot lamps, tubes, crystals, and simple adjustments. If a very low output is indicated by

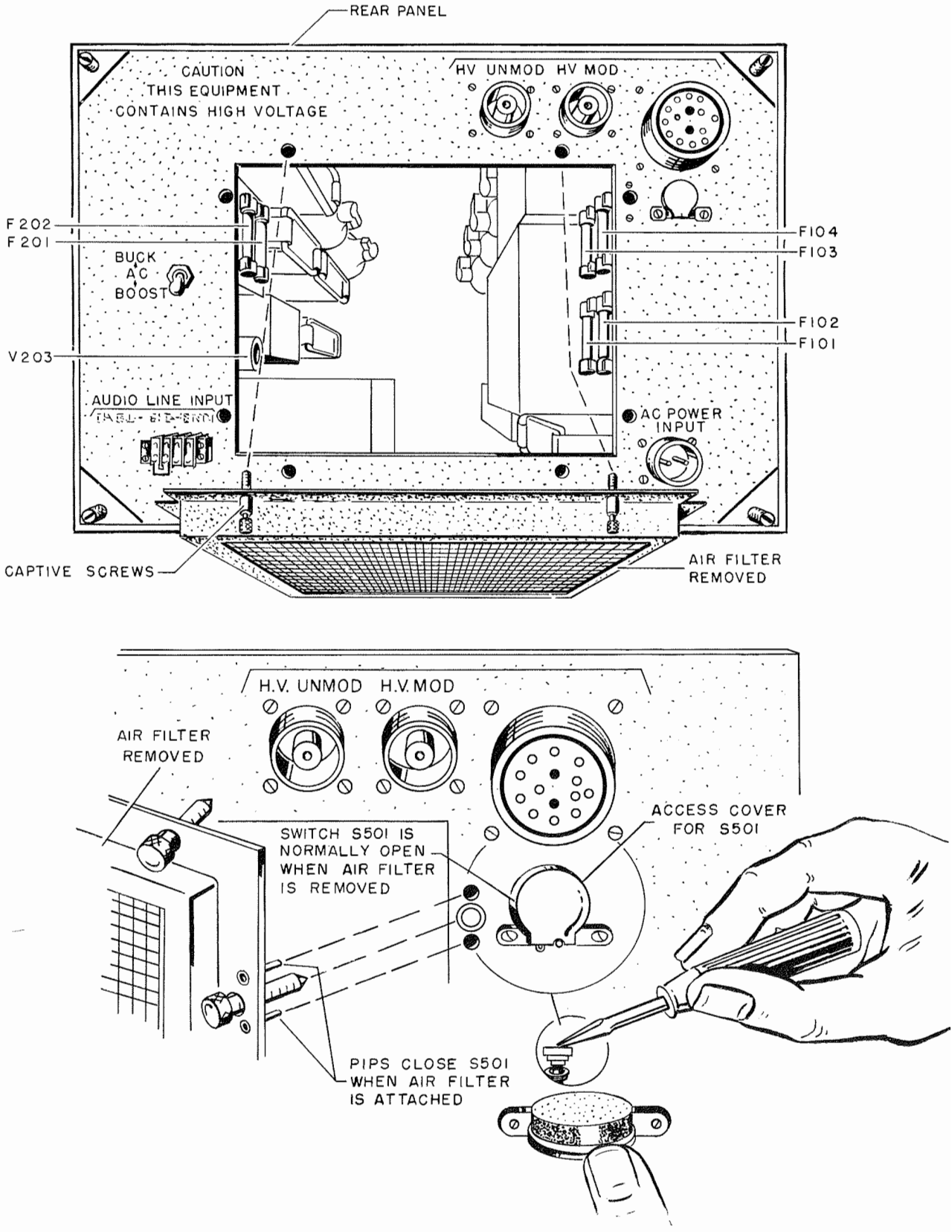


Figure 5-10. Modulator-Power Supply, Removal of Rear Air Filter, Fuse Location, and Emergency Operation of Interlock Switch

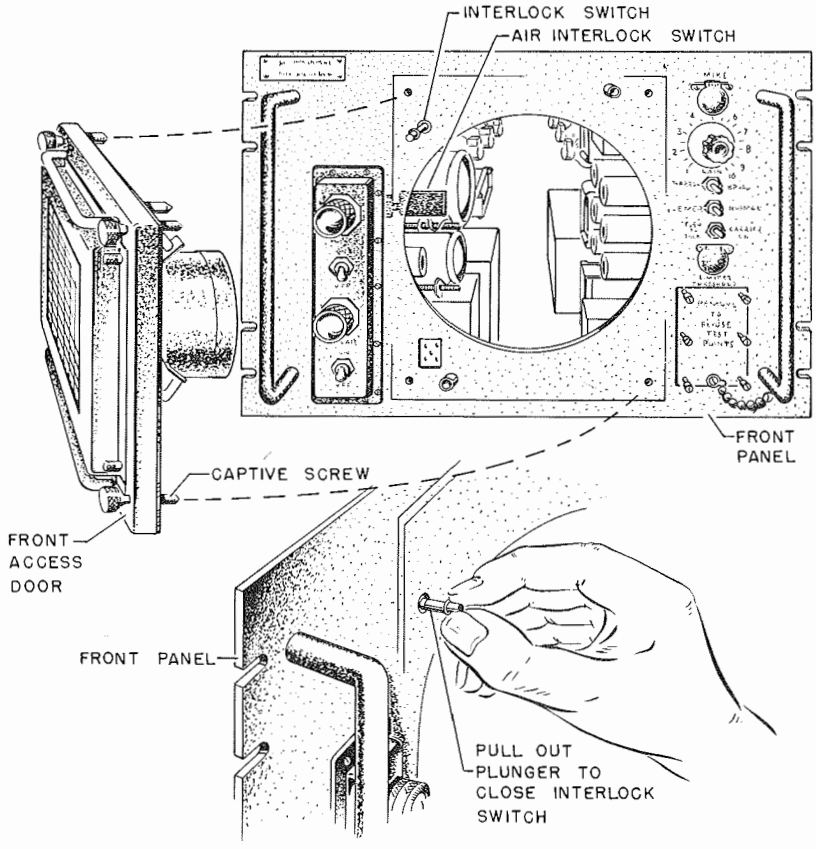


Figure 5-11. Modulator-Power Supply, Removal of Front Access Door and Emergency Operation of Interlock Switches

"METER 2" when "METER 2 SELECTOR SWITCH" is on the "CARRIER WATTS" position, or, if normal output is indicated by "METER 2" but communications cannot be established with nearby ground stations, make the following checks.

5-37. CHECKS TO MAKE IF POWER INDICATOR LIGHT (GREEN) DOES NOT GO ON.

5-38. If the green indicator light does not go on with the "POWER" switch in the "ON" position, make the following checks in the sequence indicated.
a. Turn the "POWER" switch to "ON" and rotate the knurled cap of the "POWER" indicator lamp counterclockwise as far as it will go.
b. Check the bulb by replacing with one known to be good.
c. If the equipment is operating on 115 volts, check fuse F202. If the equipment is operating on 230 volts, check fuse F201. To gain access to the fuses, turn the "POWER" switch to the "OFF" position and remove the air filter at the rear of the modulator-power supply by loosening eight captive screws, two on each side. The fuses are located on a mounting board which may be reached after the filter has been removed (figure 5-10).
d. Check to see that the power cables are securely connected.
e. If the green indicator light remains unlit after making the above checks, the equipment requires servicing by maintenance personnel.

5-39. CHECKS TO MAKE IF PLATE INDICATOR LIGHT (RED) DOES NOT GO ON.

5-40. With the green indicator light on, turn the "PLATE" switch to "ON." If the red light is not visible after approximately one minute time delay, with the "PUSH TO TALK-CARRIER ON" switch set to "CARRIER ON," or push-to-talk button on microphone depressed, check to see that the blower in the transmitter and the blower in the modulator-power supply are operating. Should either blower be inoperative, check fuse F803 in the transmitter unit and fuse F101 in the modulator-power supply unit. F803 is accessible on the front panel of the transmitter and F101 is mounted on a terminal board inside the modulator-power supply, accessible by removing the rear air filter (figure 5-10). If the blowers still remain inoperative after checking the fuses, servicing by maintenance personnel is required.

5-41. If the red indicator light is unlit and the blowers are operating, make the following checks:
a. Rotate the knurled dimmer cap of the "PLATE" indicator lamp (holds red jewel).
b. Check the bulb by replacing it with one known to be good.
c. Make certain that all air filter interlocks are shut by checking the filters at the front and rear of the equipment (four altogether), to see that captive screws, holding them in place, are tight.

d. Turn the "POWER" switch to "OFF" and replace tube V105, accessible by removing the front access door of the modulator-power supply (loosen captive screws, one in each of four corners) (figure 5-11). V105 is held in position by a retainer ring, or "hat" with a ring tab which automatically locks itself into the threads of the adjacent threaded rod when the retainer ring is seated on top of the component (figure 5-12). This ring can be removed by placing the thumb on top of the threaded rod and the index finger on the outer edge of the ring tab. By pressing the thumb and index finger together, the retainer ring will come off. To replace the retainer ring, place the hole in the ring tab over the screw and apply pressure downward at the spot where the tab joins the ring. Continue exerting pressure until the ring fits snugly over the tube.

e. Replace thermal relay K101, accessible by removing the front access door of the modulator-power supply (figure 5-1). The relay is covered by a metal tube shield. To remove the shield, press down gently and turn counterclockwise 1/8th of a turn and then lift off. If the relay does not release easily, rock it slightly and then pull it from the socket.

f. Replace the holding relay O-101 (K102), next to relay K101. Refer to step d of this paragraph for directions on how to remove the retaining ring.

g. Replace the push-to-talk relay at the front of the transmitter by removing the cover plate (figure 1-2) and pulling out the old relay from its octal base tube socket.

h. After making the above checks, if the red indicator light remains unlit, the equipment requires servicing by maintenance personnel.

5-42. CHECKS TO MAKE IF THE GREEN AND RED INDICATOR LIGHTS ARE ON AND NO POWER IS REACHING THE ANTENNA.

5-43. If both indicator lights are on but no power reaches the antenna, make the following checks in the sequence indicated.

a. Check fuses F901 and F902, accessible on the rear of the transmitter (figure 5-13).

b. Check fuses F102 and F103, accessible by removing the rear air filter of the modulator-power supply (figure 5-10).

5-44. Check rectifier tubes in the modulator-power supply as follows:

a. Remove the front access door of the modulator-power supply by loosening the four captive screws, one in each corner.

b. Pull out the push rod on the access door interlock; push the air vane, for the air interlock, forward.

c. Examine tubes V101, V102, V103 and V104, the four large tubes, each with a plate cap on top of its glass envelope, located on the left side, within the modulator-power supply (figure 5-1). See if they become hot after a few minutes operation. Remove any tube that is cold ("POWER" switch set to "OFF" position), and replace with one known to be good.

NOTE

The filaments of the above tubes cannot be seen through the opening left by removal of the front access door. The tubes may be examined by touching them after opening the access door and air interlock switches, and turning the "POWER" switch, located on the front panel, to the "OFF" position. A good tube will be warm (hot after several minutes operation) and a tube with an open filament will be cold.

d. To remove a tube, take off the plate cap, pres down gently on the glass envelope and turn counter clockwise 1/8th of a turn; then lift the tube out its socket. If the tube does not release easily, roc it slightly and then pull out.

5-45. Check tubes in the transmitter in the sequenc that follows:

a. Remove the air filter (front of the transmitte by loosening its captive screws. Take off the radia tion screen by removing the screws holding it place (figure 5-14). Close the front air filter inter lock switch (pull out the push rod) and examine eac tube within the exposed chamber to see if it is li Remove any tube which shows no light and replac it with one known to be good.

b. Turn the "PLATE" switch to the "OFF" positio Remove the air filter, at the rear of transmitte by loosening its twelve captive screws. Take off th two radiation screens by unscrewing the flat hea screws holding them in place (figure 5-15). Clos the rear air filter interlock switch (pull out the pus rod) and see if the tubes become hot after a fe minutes operation. Remove any tube which is co and replace it with one known to be good.

NOTE

The above tubes are so constructed that their filaments cannot be seen. Examine them by touching the glass envelope, just above the metal base, after opening the interlock switch and turning the "POWER" switch to the "OFF" position.

5-46. Use the following procedures to gain acces and remove tubes within the transmitter:

a. Tubes V601, V602, V603 and V604 are accessib by removing the air filter and radiation screen the front of the transmitter (figure 5-14).

b. Tubes V901, V902 and V903 are accessible removing the air filter and radiation screens at th rear of the transmitter (figure 5-15). Loosen th knurled thumb nut holding the metal strap arou the plate of the tube. Place the fingers around th tube and pull it gently out of the tube socket. the tube does not release easily, rock it slight and pull out.

c. All miniature tubes in this equipment are covere by metal shields. To remove shields, press dow gently and turn counterclockwise 1/8th of a tur then lift off. If the tubes do not release easily, roc them slightly and then pull out. Label each tube a soon as it is removed so that it can be replaced its proper socket.

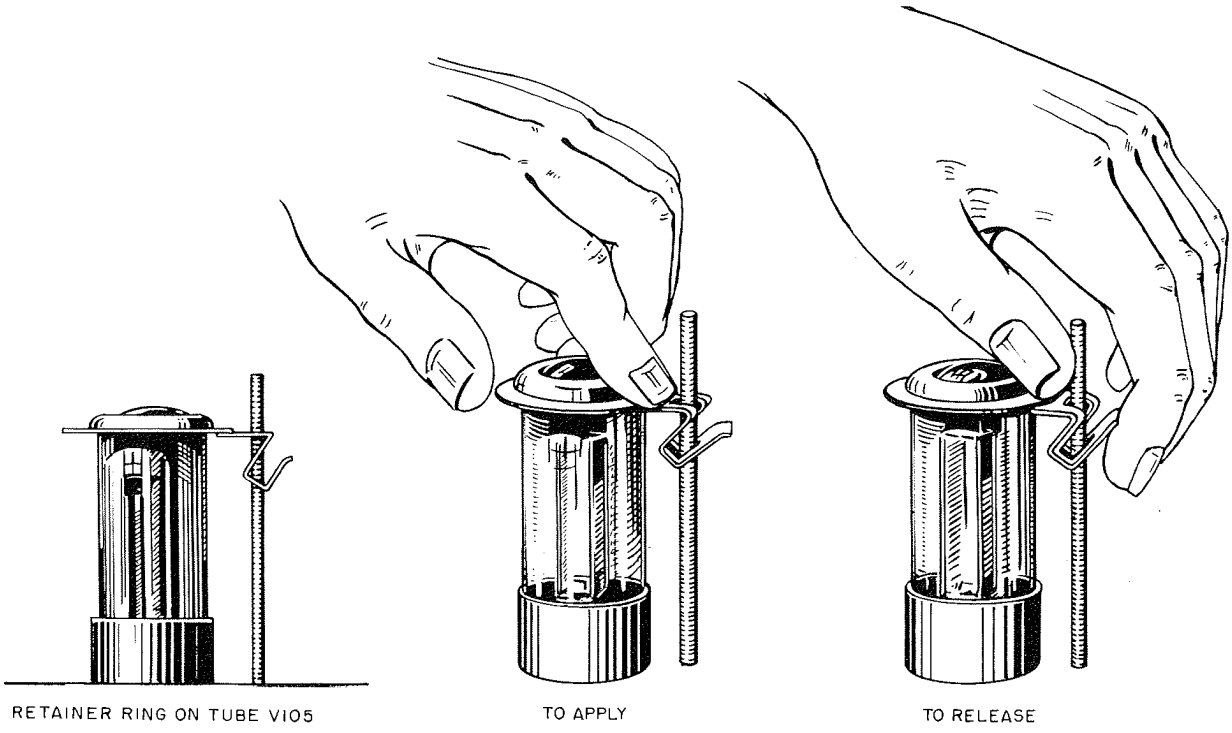


Figure 5-12. Modulator-Power Supply, Operation of Retainer Rings

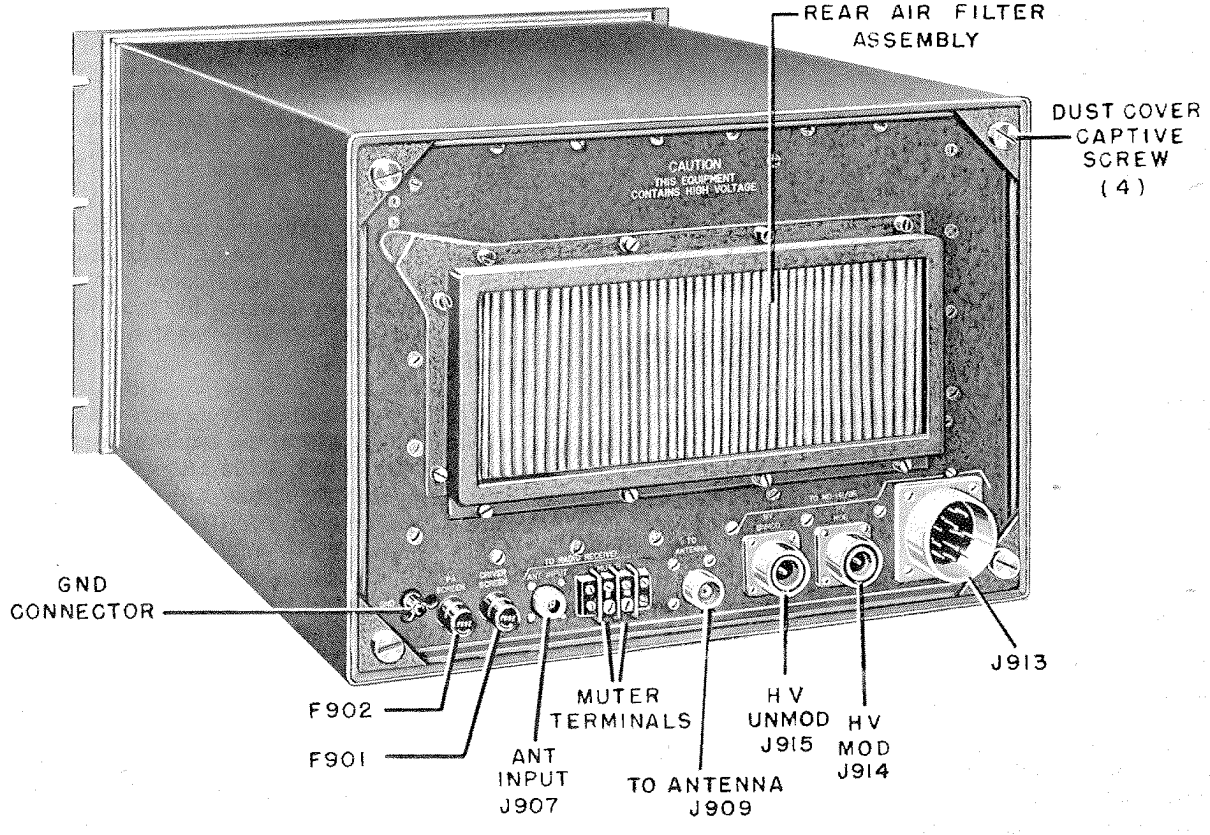


Figure 5-13. Radio Transmitter, Rear View

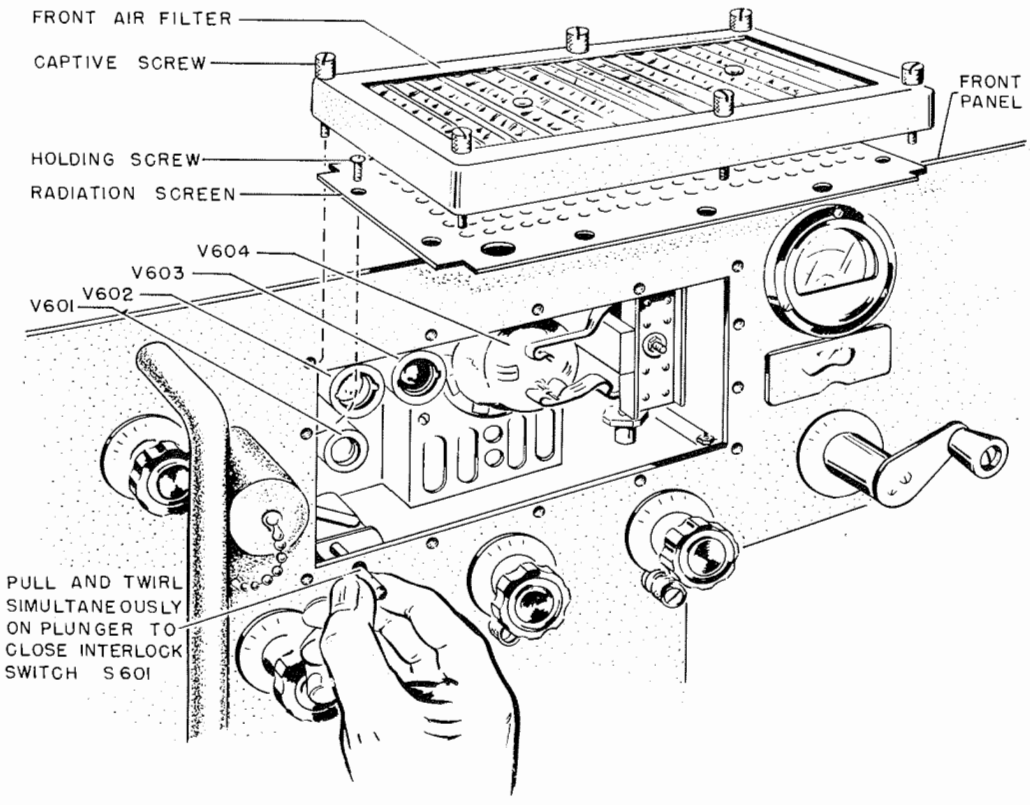


Figure 5-14. Radio Transmitter, Removal of Front Air Filter, Tube Location, and Emergency Operation of Front Air-Filter Interlock Switch

5-47. If after replacing any unlit tubes in the transmitter no output is secured in the antenna, proceed as follows:

a. Set "METER 1 SELECTOR SWITCH" on "1." If a reading is observed on "METER 1," proceed with paragraph 5-48, step b. If no reading is observed, replace the crystal with one of the same frequency known to be good, by performing the following steps in the sequence indicated.

b. The crystal is contained in an oven. This assembly is accessible from the front panel of the transmitter. By removing the crystal socket cover designated "CRYSTAL OVEN," the crystal and oven assembly may be removed by a straight forward pull.

c. Two different type ovens are in use.

d. Remove crystal from Type JKO-2R oven as follows (see figure 5-16):

1. Remove three screws at bottom.
2. Hold base with one hand and pull cover off.
3. Continue to hold oven base and pull heating element from it. Crystal unit CR-27/U will be exposed.

e. Remove crystal from Type TCO-2G oven as follows:

1. Loosen three screws.
2. Twist and pull base from cover.
3. Pull or pry crystal unit CR-27/U from socket.

f. Replace crystal. To obtain correct crystal frequency for a desired operating frequency, use the following formula:

$$\text{crystal frequency} = \frac{\text{operating frequency}}{36}$$

g. Reassembly of crystal oven is reverse of di assembly.

h. After replacing the crystal, align the three pins the base with the three openings on the resistance a thermostat assembly. Press the cover closed and r place the three screws. Make certain the cover carefully aligned with the base before securing t screws, since the screws strip very easily.

5-48. If no output is secured in the antenna aft replacing the crystal, perform the following ste in the sequence indicated.

a. Replace tube V601 (figure 5-14). Replace tub V103 and V104 (in the modulator-power supply). the set does not work after replacing the abo tubes, it requires servicing by maintenance personn

b. Set "METER 1 SELECTOR SWITCH" on "2 If a reading is observed on "METER 1," proce with the next step. If no reading is observed, che tuning of "OSC & 1ST DOUBLER PLATE" contr Replace tubes V601, V602 and V603, one at a tir (see figure 5-14). If the set does not operate aft replacing the above tubes, it requires servicing maintenance personnel.

c. Set "METER 1 SELECTOR SWITCH" on "3 If a reading is observed on "METER 1," proce with the next step. If no reading is observed, che tuning of "2nd DOUBLER PLATE" control. Repla tubes V603 and V604, one at a time (figure 5-1 If the set does not operate after replacing t above tubes, it requires servicing by maintenan personnel.

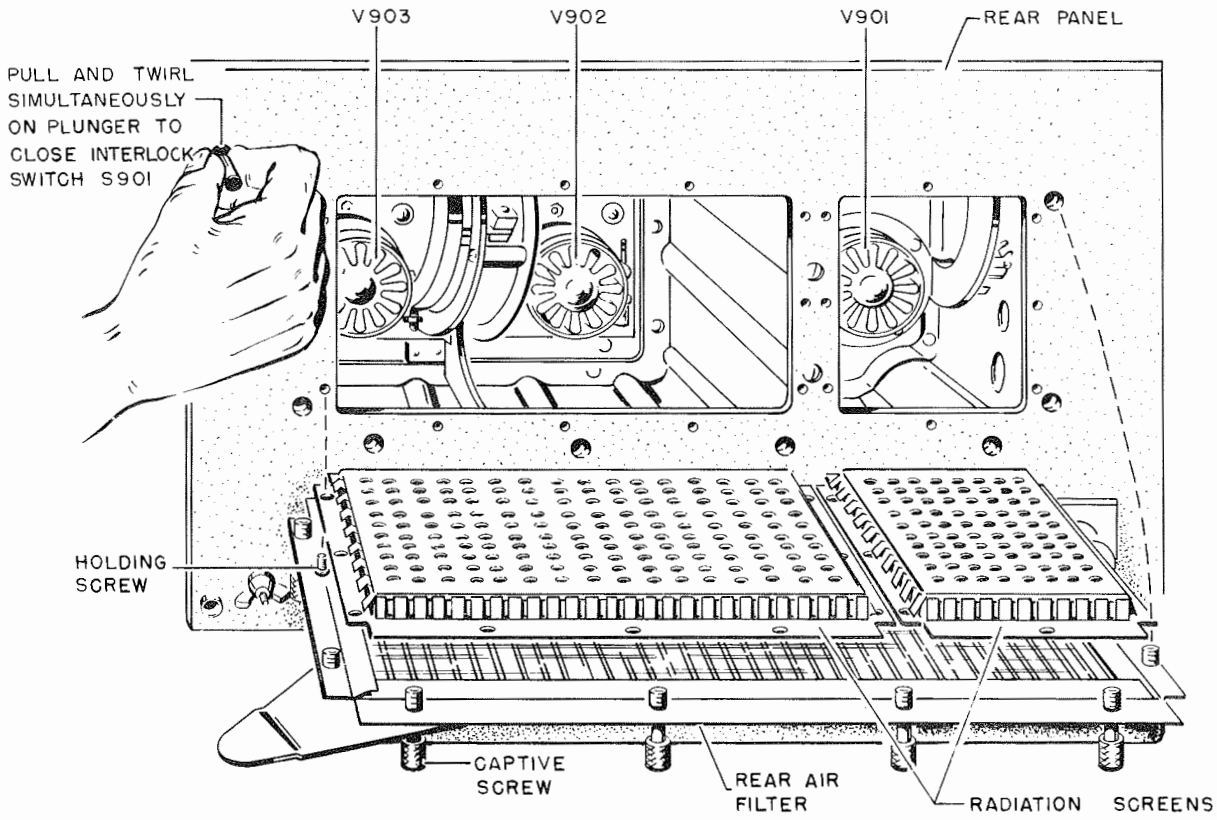


Figure 5-15. Radio Transmitter, Removal of Rear Air Filter, Tube Location, and Emergency Operation of Rear Air-Filter Interlock Switch

d. Set "METER 1 SELECTOR SWITCH" on "5." If a reading is observed on "METER 1," proceed with the next step. If no reading is observed, check tuning of "BUFFER AMPL PLATE" and "DRIVER GRID" controls. Replace tubes V604 and V901, one at a time (figures 5-14 and 5-15). If the set does not operate after replacing the above tubes, it requires servicing by maintenance personnel.

e. Set "METER 1 SELECTOR SWITCH" on "6." If a reading is observed on "METER 1," proceed with the next step. If no reading is observed, check tuning of "DRIVER PLATE" and "PA GRID" controls. Replace tubes V901, V902 and V903, one at a time (figure 5-15). Replace tubes V101 and V102 (in the modulator-power supply). If the set does not operate after replacing the above tubes, it requires servicing by maintenance personnel.

WARNING

With the power turned on, most of the tubes within the transmitter and modulator-power supply will become very hot. Exercise care while working inside the equipment.

f. Set "METER 1 SELECTOR SWITCH" on "8." Normal indication on "METER 1" is a reading of approximately 0.56 milliamperes. Replace tubes V902, V903, V703, V704, V705 and V706, one at a time.

NOTE

If power reaches the antenna after replacement of tubes V902 and V903, retune the transmitter. Internal adjustment must be made by maintenance personnel if "METER 1" does not read between 0.50 and 0.62 milliamperes after replacement of V902 and V903. See Table 5-3, step 13.

g. Tubes V703, V704, V705 and V706 are accessible by removing the monitor-screen modulator assembly. Loosen the six front panel captive screws on the transmitter that secure the assembly in place (figure 5-9). Grasp handle on front panel of assembly and pull out until vacuum tubes are exposed.

h. If power does not reach the antenna after making the above checks, it requires servicing by maintenance personnel.

5-49. CHECKS TO MAKE IF POWER IS REACHING ANTENNA AND NO VOICE IS HEARD IN HEADPHONES.

5-50. If no voice is heard in headphones plugged into the "SIDE-TONE OUTPUT" jack while talking into the microphone plugged into the "MIKE" jack, and voice communications can be established with nearby ground stations, replace tube V701 located within the monitor-screen modulator assembly. If replacement of V701 does not correct the fault, unit requires servicing by maintenance personnel. If communications cannot be established with nearby ground stations, proceed with the next paragraph.

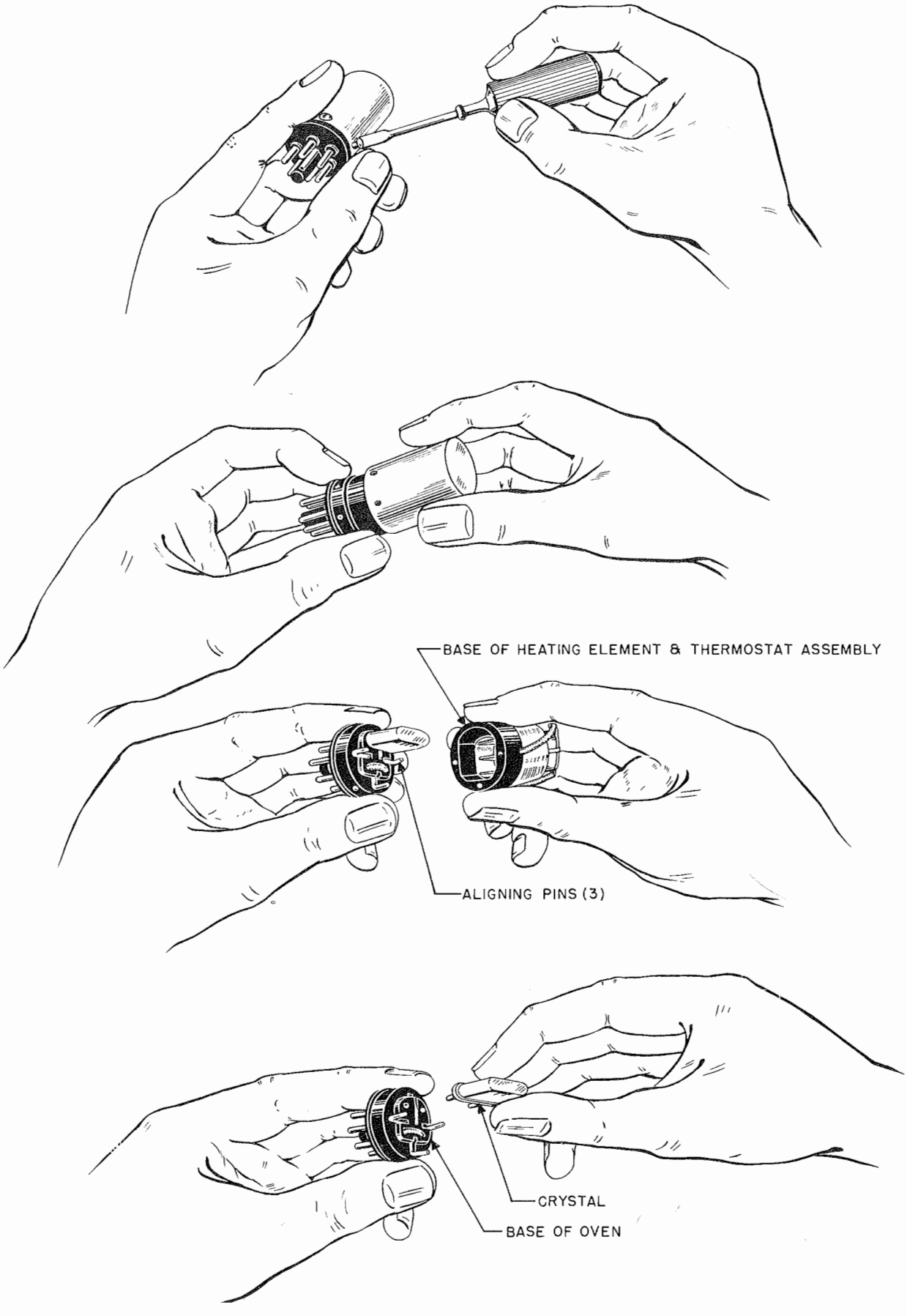


Figure 5-16. Radio Transmitter, Crystal Oven and Assembly (Type JKO-2R)

TABLE 5-5. INSPECTION SCHEDULE

Component	Inspection	Time
Modulator-Power Supply	Check operation of "POWER" and "PLATE" indicator lights.	Daily
Radio Transmitter	Check if power is reaching antenna and voice can be heard in the headphones plugged into "SIDE TONE OUTPUT" jack.	Daily
Antenna	Visually inspect antenna system for obvious abnormalities. Connections should be mechanically secure.	Weekly
Modulator-Power Supply and Radio Transmitter	Clean all accessible parts without removing dust covers or air filters. Check cable assemblies at rear of the equipment. Connections should be mechanically secure.	Weekly
Crystal Oven and Crystal Unit	Check to see that outside of crystal unit is hot after a few minutes' operation.	Weekly
Crystal Oven and Crystal Unit	Check prongs of crystal unit for corrosion.	Monthly
Modulator-Power Supply and Radio Transmitter	Check minimum performance as per Table 5-2. Clean all air filters (see paragraph 5-53).	Monthly

5-51. Check the tubes on the modulator chassis of the modulator-power supply as follows:

a. Remove the front access door of modulator-power supply by loosening the four captive screws, one in each corner.

b. Close the front access door and air interlock switches (figure 5-11).

c. Examine the eight tubes on the chassis to the right (modulator chassis); there are six small tubes with shields located near the front panel and two large tubes with plate caps on top of the glass envelopes, located at the top center of the chassis. Remove any tube that is not lighted and replace with one known to be good.

WARNING

Open the front access door and air interlock switches before reaching inside the equipment to replace tubes. In addition to the above precaution, turn the "POWER" switch to the "OFF" position.

d. If no voice is heard in the headphones after replacing any unlit tubes, and communications still cannot be established with nearby ground stations, replace each of the above eight tubes with a new one known to be good. Replace only one tube at a time. Make certain the replacement tube is in its socket before another tube is removed. By following this procedure, the possibility of misplacing a tube will be eliminated.

e. To remove the two large tubes, V201 and V202, take off the plate caps, press down gently on the glass envelopes and turn counterclockwise 1/8th of a turn, then lift out of the sockets. If the tubes do not release easily, rock them slightly and then pull out.

f. Refer to step c of paragraph 5-46 for instructions on replacement of miniature tubes. If the set does not operate after making all the above checks, it requires servicing by maintenance personnel.

5-52. CHECKS TO MAKE IF POWER IS REACHING ANTENNA AND VOICE IS HEARD IN EARPHONES, BUT "SET-CAL" AND "% MOD" DO NOT READ ON METER #2.

a. If "METER #2" does not indicate with transmitter on and modulated, with "METER #2 SELECTOR SWITCH" at either "SET-CAL" or "% MOD", remove "MONITOR-SCREEN MODULATOR" as in paragraph 5-34a.

b. Pull out plunger to close interlock switch S703 (see figure 5-9). The transmitter blower will go on and filament voltage will be supplied to V701 and V702.

c. There are 2 sections in both V701 and V702, and both sections of each tube should light. Replace tube with one light or no lights. If this does not correct fault, or if both sections of each tube were lit, try changing the tubes.

d. If both tubes have been changed and circuit is still defective, unit requires servicing by maintenance personnel.

5-53. CLEANING OF AIR FILTERS.

5-54. Normally, the four air filters must be cleaned once a month. Weekly attention will be required in dusty locations. Operation in desert areas will necessitate daily cleaning of the filters. Clean filters by performing the following steps.

a. Remove any one of the four air filter assemblies (filter and holding frame) from the equipment.

b. Remove the filter from its holding frame. The filter will fall out of the frame or require a slight push.

NOTE

A rubber gasket is cemented to the filters within the transmitter. Occasionally, gasket cement will cause the filter to stick within the frame; work the filter out of the frame by running a screwdriver around the edge of the filter. Do not remove gasket (on the transmitter filter).

c. Clean filter by washing it in carbon tetrachloride.

WARNING

Wash filter in well ventilated area. Fumes from carbon tetrachloride are toxic.

d. Air-dry the filter.
e. Dip the filter (from the modulator-power supply) in S.A.E. 30 oil, and drain. Oil the outside of the filter (if from the transmitter) and drain; do not permit oil to get on the rubber gasket.
f. Put the filter back into its holding frame. Be sure the filter is not reversed; observe the direction of the arrow on the edge of the filter frame.
g. Put the filter assembly back on the equipment.
h. Remove a second air filter assembly and repeat steps b through g.
i. Repeat steps b through g with the third and fourth air filter assemblies.

5-55. LUBRICATION.

5-56. No lubrication is required when perforn preventive maintenance or during reassembly moving parts. The blower motors, in the tra mitter and modulator-power supply, have sea bearings which do not require further lubricat The transmitter is tuned manually; all moving pa (of the tuning mechanism) rotate at a very speed and at infrequent intervals of time. The fore, no lubrication is required or used on gears and bearings that are part of the transmit tuning mechanism.

5-57. INSPECTION SCHEDULE.

5-58. The items requiring regular inspection listed in Table 5-5.

SECTION VI

FIELD AND FASRON MAINTENANCE

6-1. GENERAL.

6-2. The first step in servicing a defective equipment is to sectionalize the fault by tracing the trouble to the component, subassembly, or section responsible for the abnormal operation. The second step is to localize the fault by tracing the trouble to the defective part responsible for the abnormal condition. Some faults such as burned-out resistors, r-f arcing, and shorted transformers can often be located by sight, smell, and hearing. The majority of faults however, must be localized by voltage and resistance measurements. Refer to Section II for the required test equipment.

6-3. MINIMUM PERFORMANCE STANDARDS.

6-4. Table 6-1 is provided to indicate adjustment procedures and minimum performance standards for a repaired transmitter and/or modulator-power supply in the field. In order to make the required checks, the conditions given below should be adhered to unless otherwise noted. Refer to figure 6-1.
a. The power supply at 115 or 230 volts, 50 to 60 cps.
b. The "BUCK-BOOST" switch set to the "BOOST" position.
c. The "POWER" switch set to the "ON" position.
d. The "PLATE" switch set to the "ON" position.
e. The "NARROW-BROAD" switch set to the "NARROW" position.
f. The "EMER-NORMAL" switch set to the "NORMAL" position.
g. The "PUSH TO TALK-CARRIER ON" switch set to the "CARRIER ON" position.
h. The "TUNE-OPERATE" switch set to the "TUNE" position.

NOTE

Do not operate the transmitter unless an antenna or dummy load is connected at "TO ANTENNA" connector.

6-5. SYSTEM TROUBLE ANALYSIS, FIELD.

6-6. The tests that follow aid in isolating a sou of trouble in the field. To be effective the p cedures should be followed in the order giv Remember that servicing procedures should ca no further damage to the equipment. First, trouble should be localized to a single stage circuit; then the trouble may be isolated within t stage or circuit by appropriate voltage, resistan and continuity measurements.

6-7. VISUAL INSPECTION. The purpose of vis inspection is to locate any visual trouble (paragr 5-3). Through this inspection alone, the repairm may frequently discover the trouble or determ the stage in which the trouble exists. This inspect is valuable in avoiding additional damage to equipment which might occur through improper se icing methods and in forestalling future failur

6-8. RESISTANCE MEASUREMENTS OF POW CIRCUITS. These measurements, paragraphs 5- through 5-19, prevent further damage to the equ ment from possible short circuits.

6-9. OPERATIONAL TEST. The operation of equipment is important because it frequently indica the general location of trouble (see Table 5-2). many instances the information gained will determ the exact nature of the fault. In order to util this information fully, all symptoms must be terpreted in relation to one another.

6-10. INTERMITTENTS. The possibility of inte mittents should not be overlooked. If present, t type of trouble may be made to appear by tappi or jarring the equipment. The condition can further aggravated by heating the suspected pa with an electric heater or by increasing the a supply voltage, using a variac between the a-c supp

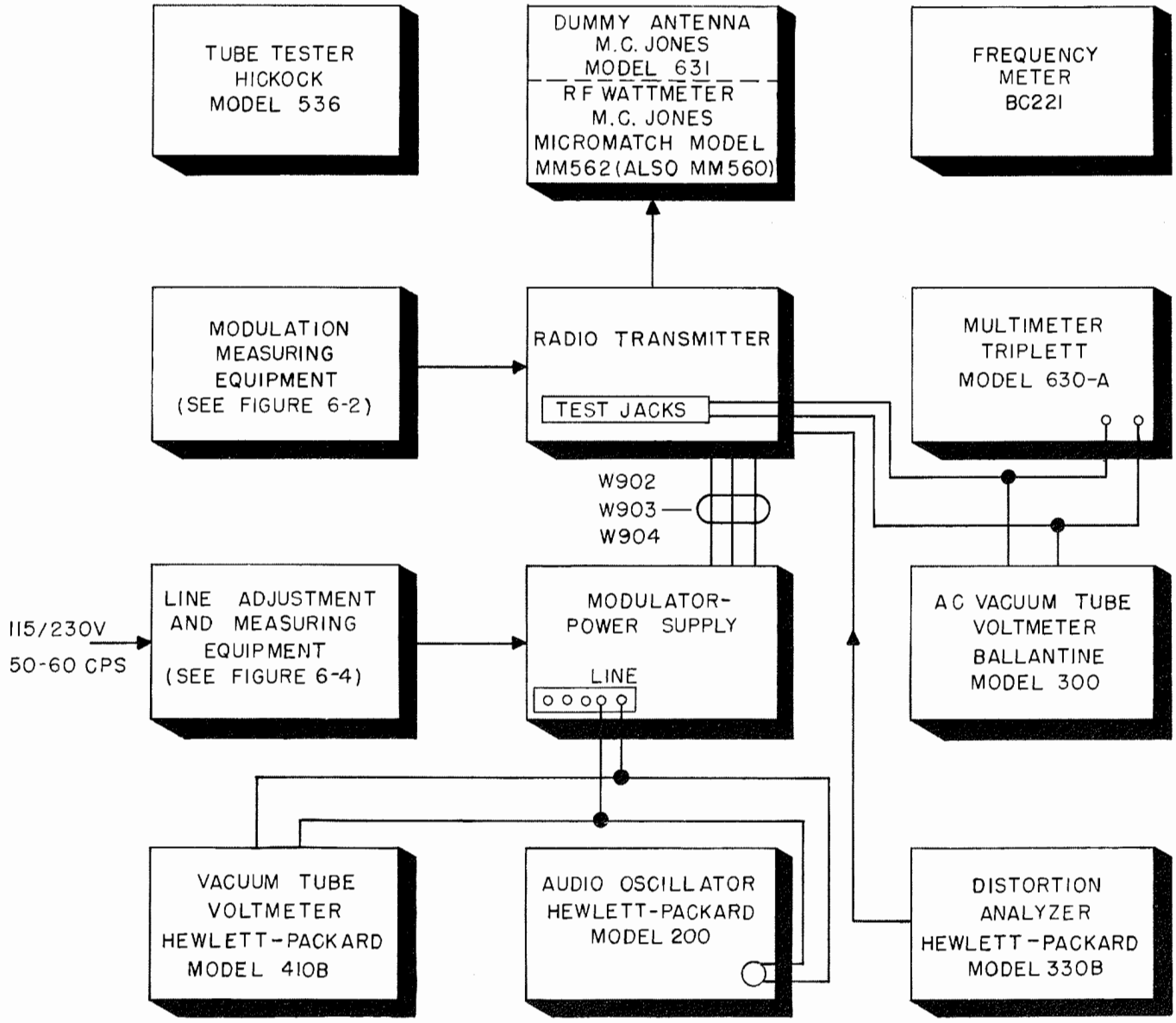


Figure 6-1. Radio Transmitter and Modulator-Power Supply, Minimum Performance, Recommended Test Set-Up

and the input to the equipment. It is possible that the trouble is not in the equipment itself but in the installation, eg., the mounting, or the trouble may be due to external conditions. In this event, test the installation, if possible.

6-11. SYSTEMS TROUBLE ANALYSIS CHART. (See figures 7-15 and 7-16). Table 6-2 outlines the step-by-step procedure necessary to determine or isolate a faulty circuit within a component. An encircled capital letter is used to designate a secondary test point, for example (A). An encircled letter and subscript Arabic numeral is used to designate a minor test point, for example (A1).

6-12. All measurements made in Table 6-2 are performed under the same conditions as for Table 6-1. Refer to paragraph 6-4 for conditions of measurement.

6-13. EXCITER SUBASSEMBLY RESISTANCE MEASUREMENTS.

6-14. Use Table 6-3 as an aid to determine if open or short circuits exist in the exciter subassembly. Figures 6-5 through 6-8 will aid in locating electrical parts. The preliminary steps and general procedure are as follows:

a. Remove the exciter subassembly from the transmitter (see paragraph 5-30).

b. Label each tube, indicating the socket into which it is plugged and then extract all tubes and crystal oven A601.

c. Measure the resistance (Triplett Multimeter Model 630-A, or equal) between each feedthrough capacitor (bottom of subassembly) and the chassis. These measurements must be made with all leads disconnected, as described in step m of paragraph 5-30.

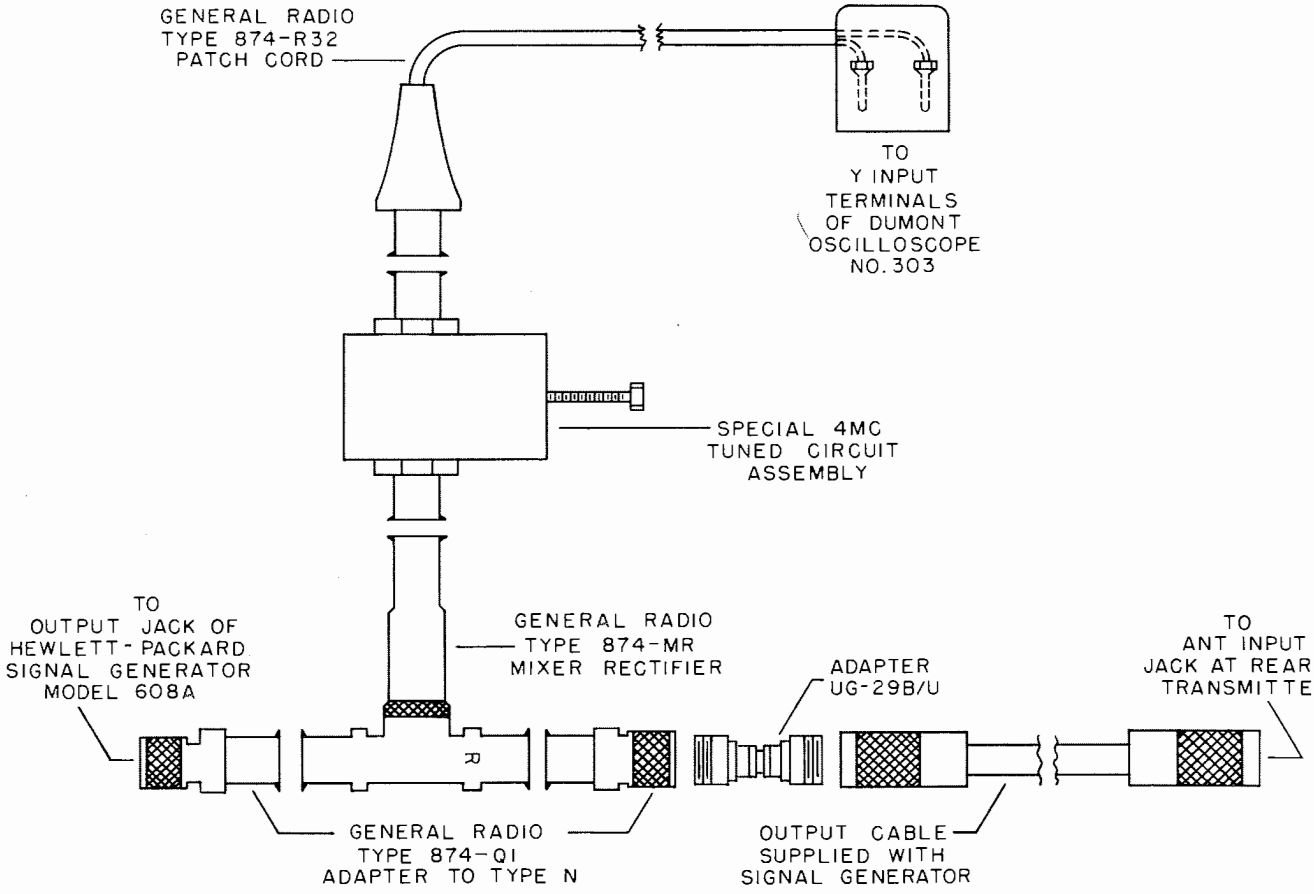


Figure 6-2. Radio Transmitter, Recommended Set-Up for Checking Modulation Linearity

d. Measure the resistance between the terminals of each tube socket and the appropriate feedthrough capacitor, or chassis, as indicated in Table 6-3.

e. Refer to the last column of Table 6-3 for possible causes of abnormal resistance measurements. Locate the fault and make necessary repairs before proceeding with any additional trouble shooting.

f. Insert each tube and the crystal oven into the same socket from which it was removed.

g. Reassemble the exciter subassembly by following the instructions given in paragraph 5-31.

6-15. DRIVER-POWER AMPLIFIER ASSEMBLY VOLTAGE AND RESISTANCE MEASUREMENTS.

6-16. Paragraphs 6-17 and 6-18 will aid the maintenance man in localizing trouble that has been found to exist within or adjacent to the driver and power amplifier stages.

6-17. DRIVER-POWER AMPLIFIER ASSEMBLY VOLTAGE MEASUREMENTS. (See figure 6-9). Table 6-4 gives the step-by-step procedure for making voltage measurements that will determine if the required filament, screen and plate voltages are being furnished to the assembly. Measurements are made at center tabs of six feedthrough capacitors, located on two access plates on the bottom of t rear section of the transmitter, and at the input two r-f filters, one on each side of the rear secti of the transmitter. It is necessary to remove t cover plate from each r-f filter in order to g access to make the voltage measurements. T preliminary steps and general procedure are follows:

a. Set the transmitter down, on its front pa handles, on a convenient workbench.

b. Remove the dust cover.

c. Connect the transmitter to the modulator-pow supply with the three interconnecting cables furnish with the equipment, or with specially fabrica cables (paragraphs 2-6 through 2-9).

d. Connect a Termaline Model 82 Coaxial Resis (dummy antenna) to the antenna connector on rear of the transmitter labeled "TO ANTENNA

e. Connect the "AC POWER INPUT" connector, the rear of the modulator-power supply, to a su able source of a-c power and set the equipm controls for normal remote operation.

WARNING

High voltage is used in the operation of this equipment. Death on contact may result if operating and maintenance personnel fail to observe safety precautions.

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
1. Oscillator Grid Current	None			Set "METER 1 SELECTOR SWITCH" to "1."	Between 0.02 ma at 400 mc and 0.08 ma at 225 mc, reading on "METER 1."	Defective crystal Y601 or tube V601.
2. Second Doubler Grid Current	None			Set "METER 1 SELECTOR SWITCH" to "2."	Not less than 0.17 ma reading on "METER 1."	Check tuning of "OSC & 1st DOUBLER PLATES" control. Tube V601, V602, or V603.
3. Buffer Amplifier Grid Current	None			Set "METER 1 SELECTOR SWITCH" to "3."	Not less than 0.02 ma reading on "METER 1" above 300 mc. Not less than 0.12 ma reading below 300 mc.	Check tuning of "2nd DOUBLER PLATE" control. Tube V603 or V604.
4. Buffer Amplifier Plate Current	None			Set "METER 1 SELECTOR SWITCH" to "4."	Between 0.45 and 0.80 ma reading on "METER 1."	Check tuning of "BUFFER AMPL PLATE" control. Tube V604 or V901.
5. Driver Grid Current	None			Set "METER 1 SELECTOR SWITCH" to "5."	Not less than 0.5 ma reading on "METER 1."	Check tuning of "DRIVER GRID" control. Tube V901. Check connectors on r-f cable between output of exciter (J601) and input to driver (J901).
6. Driver Plate Current	None			Set "METER 1 SELECTOR SWITCH" to "7."	Between 0.35 ma at 225 mc and 0.95 ma at 400 mc reading on "METER 1."	Check tuning of "DRIVER PLATE" control. Fuse F901 open. Tube V901, V902, or V903.

(continued on the next page)

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
7. Power Amplifier Grid Current	None			Set "METER 1 SELECTOR SWITCH" to "6."	Not less than 0.20 ma reading on "METER 1." Detune "PA GRID" control if reading above 0.4 ma.	Check tuning of "PA GRID" control. Tube V902 or V903. Check connectors on r-f cable between output of driver (J916) and input to power amplifier (J902).
8. Power Amplifier Plate Current	None			Turn "TUNE-OPERATE" switch to "OPERATE" position. Set "METER 1 SELECTOR SWITCH" to "8."	Between 0.5 and 0.62 ma, reading on "METER 1."	Check tuning of "PA PLATE" control. Tube V902 or V903. Fuse F902 open. Tubes V703, V704, V705, or V706.
9. Power Output	None			Set "METER 2 SELECTOR SWITCH" to "CARRIER WATTS."	Minimum reading of 100 watts on "METER 2."	Check antenna system.
10. Overall Frequency Accuracy. Part I.	None				If frequency accuracy of crystal Y601 doubtful, replace with one known to be good. If no replacement available, check Y601 as per next step.	Y601.
11. Overall Frequency Accuracy. Part II.	BC 221 Frequency Meter with headset.	Wrap insulated wire, from output term. of BC 221, around crystal oven A601 (front panel access cover removed). See figure 6-3.	Check frequency by zero-beating against signal picked up from Y601.	Not critical.	±0.250 kc of frequency indicated on crystal holder.	Y601.

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
12. Power Input	Superior Elec. Powerstat Type 1226. General Electric Wattmeter No. AP-9, 10/20 amp, 115/230 volt. General Electric AC Voltmeter No. AP-9, 150/230 volt scales. Hewlett-Packard Model 200 Audio Oscillator.	Connect input of variac to source of a-c power and output to "AC POWER INPUT" connector J504 on rear of modulator-power supply. Connect current coils of wattmeter in series with the line and the voltage coil across the line. Connect a-c voltmeter across voltage terminals of wattmeter. See figure 6-4 for power input connections. Connect audio oscillator to "LINE" terminals on rear of modulator-power supply.	Turn control knob on variac in clockwise direction, from initial extreme counterclockwise position, until a-c voltmeter reads same voltage indicated on voltage designation nameplate on rear modulator-power supply. Set audio oscillator for 1,000 cps and output control for reading of 95 percent on "METER 2."	Set "PUSH TO TALK-CARRIER ON" switch to "CARRIER ON" position. Set "METER 2 SELECTOR SWITCH" to "SET CAL" and adjust "CALIBRATE" control for a reading of "CAL" on "METER 2." Set "GAIN" control to extreme clockwise position. Set "LIMITER THRESHOLD" control to extreme counterclockwise position. Set "METER 2 SELECTOR SWITCH" to "% MOD" and adjust audio oscillator for reading of 95 percent on "METER 2."	Less than 1,500 watt reading on wattmeter.	See paragraphs 5-9 through 5-19.
13. Modulation	Triplett Multimeter Model 630-A. Ballantine Model 300 Voltmeter. 10,000 ohm, 1/2 w resistor.	Connect multimeter, voltmeter and resistor (in parallel) between "HIGH V" and "GND." test jacks J804 and J805 (front of transmitter).	Set controls on multimeter for 3 V AC range; use "OUTPUT" and "COMMON" jacks. Set voltmeter for 10 VOLTS FULL SCALE.	Same as step 12.	Reading on "METER 2" should agree with calculated value: Percentage modulation = $1.41 \frac{\text{a-c volts}}{\text{d-c volts}}$	See Table 6-2, steps 18 through 25.

(continued on the next page)

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

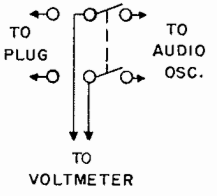
Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
14. Side Tone Output	Hewlett-Packard Model 200 Audio Oscillator. Triplett Multimeter Model 630-A. PL-55 plug. 600 ohm resistor.	Connect audio oscillator to "LINE" terminals on rear of modulator-power supply. Connect multimeter "OUTPUT" terminals across phone plug. Connect resistor across phone plug. Insert phone plug into "SIDE TONE OUTPUT" jack.	Set controls on multimeter for 3 V AC range. Set audio oscillator for 1,000 cps and output control for reading of 95 percent on "METER 2."	Note reading on multimeter with "SIDE TONE" monitor gain control, R705, at extreme clockwise and counterclockwise positions. At end of this check, reset R705 for 0.78 V (1 mw) output.	At least 0.78 V (1 mw) reading on multimeter when R705 at extreme clockwise position. Not more than 0.245 V (0.1 mw) reading on multimeter when R705 at extreme counterclockwise position.	Tube V701A. Control R705.
15. Side Tone Frequency Response	Ballantine Model 300 Voltmeter. DPDT toggle or knife switch. 600 ohm resistor. Hewlett-Packard Audio Oscillator Model 200. PL-55 plug.	Remove plug P906 from jack J702 at rear of monitor-screen modulator assembly; connect audio oscillator to J702. Wire switch as follows:  Connect resistor across plug and insert into "SIDE TONE OUTPUT"	Set controls on audio oscillator for 1,000 cps and reading of 0.78 V (1 mw) on voltmeter (across plug). Throw switch and note reading on voltmeter when connected across audio oscillator. Set audio oscillator controls for 200 cps and same voltage output as when on 1,000 cps. Throw switch and record reading when voltmeter connected to "SIDE TONE	Same as at completion of step 14.	Not more than 6 db total change in voltage across "SIDE TONE OUTPUT" jack.	T701 defective.

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
15. Side Tone Frequency Response (cont)			Repeat at 400, 3,000, 5,000, 10,000 and 20,000 cps.			
16. Automatic Modulation Limiting	Hewlett-Packard Audio Oscillator Model 200. Ballantine Model 300 Voltmeter. 600 ohm resistor.	Connect resistor across "LINE" terminals on rear of modulator-power supply. Connect audio oscillator to "LINE" terminals on rear of modulator-power supply. Connect voltmeter across output terminals of audio oscillator.	Adjust voltmeter for 1 V full scale range. Adjust audio oscillator controls for 1,000 cps and reading of 0.138 V (-45 dbm) on voltmeter.	Set "METER 2 SELECTOR SWITCH" to "% MOD." Set "THRESHOLD" control at extreme counterclockwise position. Adjust "GAIN" control for a reading of approximately 120 percent modulation (pointer at "CAL" of "METER 2"). Set "THRESHOLD" control at extreme clockwise position.	Minimum reading of 60 percent on "METER 2."	See Table 6-2, steps 19 and 25.
			Readjust voltmeter for 10 V full scale range. Readjust audio oscillator for reading of 1.38 V (-25 dbm) on voltmeter.	Turn "THRESHOLD" control counterclockwise until "METER 2" reads 95 percent modulation.		
			Readjust voltmeter for 1 V full scale range; readjust audio oscillator for reading of 0.138 V (-45 dbm) on voltmeter.			

(continued on the next page)

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
17. Frequency Response. Broad.	Ballantine Model 300 Voltmeter. Two 600 ohm resistors. Hewlett-Packard Audio Oscillator Model 200. PL-55 plug. Hewlett-Packard Model 410 B VTVM.	Connect one resistor across "LINE" terminals on rear of modulator-power supply. Connect other resistor across plug. Connect audio oscillator across "LINE" terminals on rear of modulator-power supply. Connect Hewlett-Packard vtvm across output terminals of audio oscillator. Connect Ballantine voltmeter across plug and insert into "SIDE TONE OUTPUT" jack.	Set selector switch on Hewlett-Packard vtvm for 1 V AC. Set range switch on Ballantine voltmeter for 1 V full scale. Adjust audio oscillator controls for 1,000 cps and reading of 0.138 V (-45 dbm) on Hewlett-Packard vtvm. Note reading on "DB" scale of Ballantine voltmeter.	"GAIN" control same as at completion of step 16. Set "NARROW-BROAD" switch to "BROAD" position. Adjust "SIDE TONE" control R705, within monitor-screen modulator assembly, for reading of 0.78 V (1 mw) on Ballantine vtvm.	Not more than 4 db total change in reading on Ballantine voltmeter, after correction. To correct audio frequency response of side tone monitor, subtract its readings (step 15) from the readings taken in this step; observe polarity of numbers when subtracting (see figure 7-5).	T201, T301 or T302 defective.
			Readjust audio oscillator controls for 200 cps and 0.138 V reading on Hewlett-Packard vtvm. Record Ballantine voltmeter reading on "DB" scale.			
			Repeat at 400, 5,000, 10,000, and 20,000 cps.			

(continued on the next page)

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
18. Frequency Response. Narrow.	Same as step 17.	Same as step 17.	Same as step 17 except checks made only at 200, 400, 1,000, 3,000, and 4,000 cps.	Adjust "GAIN" control for reading of 0.78 V (1 mw) on Ballantine voltmeter when audio oscillator controls are adjusted for 1,000 cps and reading 0.138 V (-45 dbm) on Hewlett-Packard vtvm. Set "NARROW-BROAD" switch to "NARROW" position. Set "THRESHOLD" control at extreme counterclockwise position.	With reference to db level at 1,000 cps, (on Ballantine voltmeter) the output shall be down at least 10 db at 200 and 5,000 cps; down less than 4 db at 400 and 3,000 cps.	V301. Short-circuit in C303.
19. Overall Distortion	Same as step 17. Hewlett-Packard Distortion analyzer Model 330B.	Same as step 17 with the following exception: connect "AF INPUT" terminals or distortion analyzer (in place of Ballantine voltmeter) across plug.	Same as step 17. Distortion Analyzer: a. Set amplifier switch (labeled METER-DISTORTION-SET LEVEL-NOISE) to "SET LEVEL" position. b. Set "R.M.S. VOLTS-DB" switch to 100% position. c. Set "AF-RF" switch to "AF" position. d. Slowly turn "INPUT" control clockwise until meter reads exactly full scale (1.0).	Same as step 17 except "LIMITER THRESHOLD" control turned clockwise for "METER 2" reading of 90 percent modulation (do not readjust "SIDE TONE" control R705).	Not more than 12 percent distortion at any audio frequency.	Check audio interstage coupling and cathode bypass capacitors for open or short circuit.

(continued on the next page)

TABLE 6-1. MINIMUM PERFORMANCE STANDARDS, FIELD (CONT)

Check or Adjustment	Test Equipment Required	Test Equipment Connections	Test Equipment Control Settings	Radio Transmitter & Modulator-Power Supply Control Settings	Minimum Performance	Localization of Trouble
19. Overall Distortion (cont)			e. Set "RANGE" switch to "X10." f. Set amplifier switch to "DISTORTION." g. Set "FREQUENCY" control for reading of "100" on the tuning dial. The meter reading will fall off. h. Tune "BALANCE" control and "FREQUENCY" vernier until min reading is obtained. Tuning becomes sharper as the meter reading decreases. Repeat the tuning of these two controls until no further reduction can be obtained. Keep decreasing setting of voltmeter switch as necessary to have large meter deflections. i. Read distortion directly in percentages. For example, if the meter reads 1.5 with the voltmeter switch in the 3% position, the distortion is 1.5 percent.			

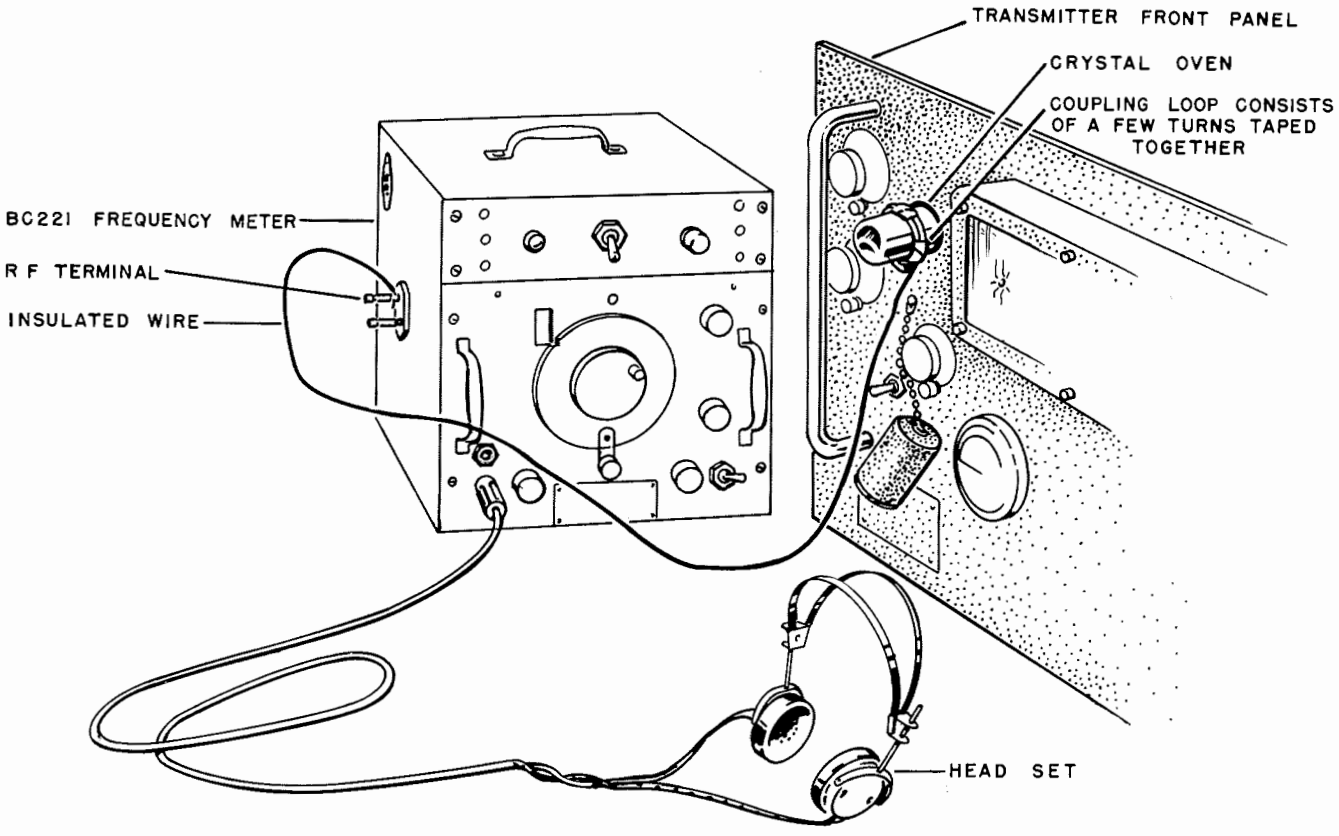


Figure 6-3. Radio Transmitter, Recommended Set-Up for Checking Crystals

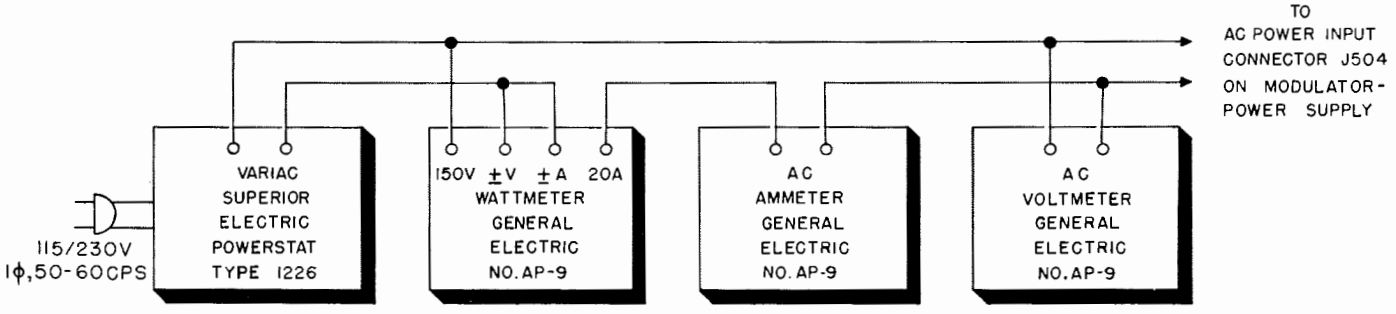


Figure 6-4. Radio Transmitter and Modulator-Power Supply, Recommended Set-Up for Line Adjustment and Power Input Measurement

f. Measure the voltage between each feedthrough capacitor, Table 6-4, and the chassis.

g. Refer to the last column of Table 6-4 for possible causes of abnormal voltage measurements. Locate the fault and make necessary repairs before proceeding with any additional trouble shooting.

6-18. DRIVER-POWER AMPLIFIER ASSEMBLY MEASUREMENTS. (See figure 6-9). Use Table 6-5 as an aid to determine if open or short circuits exist in the driver-power amplifier assembly. The preliminary steps and general procedure are as follows:

a. Set the transmitter down, on its front panel handles, on a convenient workbench.

b. Remove the dust cover.

c. Turn the "POWER" switch (front of the modulator-power supply) to the "OFF" position. Disconnect the power cable assembly from the "AC POWER INPUT" connector at the rear of the modulator-power supply.

d. Make a sketch, indicating color coding and location of wires connected to feedthrough capacitors C903, C902, C905, C912, C910 and C916; they are located on two access plates on the bottom of the rear section of the transmitter.

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
POWER INPUT CIRCUITS					
1. Input of Line Adjustment Transformer T202	(A) Bottom of F201 or F202 (F201 if 230 V input; F202 if 115 V input). (B) Terminal 9 of E102.	Set controls on Triplett Multimeter Model 630-A for 300 V AC range. Connect between secondary test points A and B.	Set "PLATE" switch to "OFF" position. Set "POWER" switch to "ON" position.	115 or 230 V reading on the multimeter.	Fuse F201 or F202 open. Check following terminal board connections: 14 and 16 on E502, 3 and 12 on E102, 3 and 4 on E101.
2. "POWER" Indicator Lamp (green)	(A_1) Pilot lamp E402.	None.	Set "PLATE" switch to "OFF" position. Set "POWER" switch to "ON" position.	Pilot lamp E402 lights.	Pilot lamp dimmer closed; rotate dimmer to maximum counterclockwise position. Burned out pilot light. Rear air filter interlock of modulator-power supply, S501, open. Check 1, 2 and 6 on E101, 11 and 18 on E102. Check a-c line.
BIAS SUPPLY AND TIME DELAY					
3. Time Delay	(C) Pilot lamp E401.	None.	Set "PLATE" switch to "ON" position. Set "PUSH TO TALK-CARRIER ON" switch to "CARRIER ON" position.	Pilot lamp E401 will light approximately one minute after turning "POWER" switch "ON." If indication normal, proceed with step 5.	Pilot lamp dimmer closed; rotate dimmer to maximum counterclockwise position. Burned out pilot light. Faulty contacts or open coil on time delay relay K101, holding relay O-101 (K102), push-to-talk relay O-801, or plate contactor relay O-201 (K201).
4. Bias Supply	(B_1) Same as major test point 2 (step 2, Table 5-3).	Same as step 2, Table 5-3.	Same as step 2, Table 5-3.	Same as step 2, Table 5-3.	Same as step 2, Table 5-3.

(continued on the next page)

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
LOW VOLTAGE POWER SUPPLY					
5. Plus 250 Volts	(D) Same as major test point 3 (step 3, Table 5-3).	Same as step 3, Table 5-3.	Same as step 3, Table 5-3.	Same as step 3, Table 5-3.	L102, R101, R102, or R815 open. See step 3, Table 5-3.
6. Plus 300 Volts	(C_1) "MED V" jack J806 on front of transmitter.	Jumper between "+METER 1" and "MED V" test jacks; jumper between "-METER 1" and "GND" test jacks.	Same as step 5.	300 V reading on "METER 1." Meter reads +500 V dc full scale	R813 open. T102 open. Open circuit between terminals 3 and 4 of T103.
HIGH VOLTAGE POWER SUPPLY					
7. Filtered High Voltage	(E) Same as major test point 4 (step 4, Table 5-3).	Same as step 4, Table 5-3.	Same as step 4, Table 5-3.	Same as step 4, Table 5-3.	L101, L202, or R812, open. See step 4, Table 5-3.
8. Unfiltered High Voltage	(D_1) Standoff E103.	Set controls on Triplett Multimeter Model 630-A for 1,200 V DC range. Connect black lead (common) to chassis and red lead to test point.	Same as step 7.	870 volt reading on multimeter.	T101 defective. Open circuit between terminals 11 and 12 of T103.
EXCITER SUBASSEMBLY					
9. Crystal	(E_1) Same as major test point 5 (step 5, Table 5-3).	None.	Same as step 5, Table 5-3.	Same as step 5, Table 5-3. If indication normal, proceed with step 10.	Defective crystal Y601 or tube V601. See Table 6-3, steps 1, 2, 4, 7, and 9 for resistance measurements.
10. Oscillator-Tripler and First Doubler	(F_1)	None.	Same as step 6, Table 5-3.	Same as step 6, Table 5-3.	Tube V601, V602, or V603. See Table 6-3, steps 3, 8,

(continued on the next page)

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
EXCITER SUBASSEMBLY (CONT)					
10. Oscillator-Tripler and First Doubler (cont)	Same as major test point 6 (step 6, Table 5-3).				10, 11, 12, and 13 for resistance measurements.
11. Second Doubler	(G1) Same as major test point 7 (step 7, Table 5-3).	None.	Same as step 7, Table 5-3.	Same as step 7, Table 5-3.	Tube V603 or V604. See Table 6-3, steps 5, 14, 15, 16, 17, 18, and 19 for resistance measurements.
12. Buffer Amplifier	(F) Same as major test point 8 (step 8, Table 5-3).	None.	Same as step 8, Table 5-3.	Same as step 8, Table 5-3.	Tube V604 or V901 (in rear section of transmitter). See Table 6-3, steps 6, 18, 19, 20, and 21 for resistance measurements.
DRIVER AND POWER AMPLIFIER					
13. Driver Grid Circuit	(H1) Same as major test point 9 (step 9, Table 5-3).	None.	Same as step 9, Table 5-3.	Same as step 9, Table 5-3.	Tube V901. Check connectors on r-f cable connected between output of exciter (J601) and input to driver (J901). See Table 6-5, steps 1, 2, 10, and 11 for resistance measurements.
14. Driver Plate Circuit	(G) Same as major test point 10 (step 10, Table 5-3).	None.	Same as step 10, Table 5-3.	Same as step 10, Table 5-3.	Fuse F901 open. Tube V901, V902, or V903. See Table 6-4, steps 3 and 4 for voltage measurements. See Table 6-5, steps 3, 4, 9, and 12 for resistance measurements.
15. Power Amplifier Grid Circuit	(I1) Same as major test point 11 (step 11, Table 5-3).	None.	Same as step 11, Table 5-3.	Same as step 11, Table 5-3.	Tube V902 or V903. Check connectors on r-f cable connected between output of driver (J916) and input to power amplifier (J902).

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
DRIVER AND POWER AMPLIFIER (CONT)					
16. Power Amplifier Plate Circuit	(H) Same as major test point 12 (step 12, Table 5-3).	Connect directional coupler, power output indicator, and dummy antenna, at "TO ANTENNA" connector J909, rear of transmitter. (See figure 5-6.) Set selector switch on power indicator to "FOR" position.	Set "TUNE-OPERATE" switch to "OPERATE." Set "METER 1 SELECTOR SWITCH" to "8."	Between 0.5 and 0.62 ma reading on "METER 1." Actual current is meter reading times 500.	Tube V902 or V903. Fuse F902 open. Screen modulator tube V703, V704, V705, or V706 (see step 26).
OUTPUT COUPLING CIRCUITS					
17. Antenna Relay, R-F Filter, Directional Coupler	Same as step 16.	Same as step 16.	Set "METER 2 SELECTOR SWITCH" to "CARRIER WATTS."	At least 100 watt reading on power indicator.	Tube V902 or V903. Check connectors P902, J903, J904, P904, J906, P905, J909. Antenna relay O-909, r-f filter Z901, directional coupler DC901. Check for continuity to ground, terminal 6 of push-to-talk relay O-801, when energized.
AUDIO DRIVER SUBASSEMBLY					
18. Overall	(I) J306 on front of modulator-power supply. (J) "LINE" terminals at rear of modulator-power supply.	Connect Hewlett-Packard Audio Oscillator Model 200 and Ballantine Voltmeter Model 300 across secondary test point J. Set range switch on voltmeter to 1 VOLT FULL SCALE. Set audio oscillator controls for 1,000 cps and 0.2 V reading on voltmeter. Set controls on Triplett	Set "TUNE-OPERATE" switch to "OPERATE." Set "PUSH TO TALK-CARRIER ON" switch to "CARRIER ON." Set "GAIN" and "THRESHOLD" controls at extreme clockwise position.	Approx 25 V reading on multimeter. If indication normal, proceed with step 24.	If low, see steps 20 through 23. If high, see steps 19 and 25.

(continued on the next page)

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
AUDIO DRIVER SUBASSEMBLY (CONT)					
18. Overall (cont)		Multimeter Model 630-A for 30 V AC range and connect between secondary test point I and ground using "OUTPUT" and "COMMON" meter jacks.			
19. Limiter Threshold Control	(J1) J307 on front of modulator-power supply.	Connect one test lead between minor test point J_1 and "+ METER 1" test jack and another test lead between "GND." and "-METER 1" test jacks.	Set "METER 1 SELECTOR SWITCH" on "9." Turn "THRESHOLD" control from extreme counter-clockwise to extreme clockwise position.	Voltage indication on "METER 1" will vary from 155 V (at start) to 90 V at extreme clockwise position. Full scale meter reading is 200 V.	Check R334, "THRESHOLD" control R335 and R336.
20. Modulator Driver Stage	(K1) J305 on front of modulator-power supply.	Same as step 19 except connect first test lead to minor test point K_1.	Same as step 19.	Voltage indication on "METER 1" of 15 V. Full scale meter reading is 50 V.	V305 or V306, R329, R330, R331. T302.
21. Audio Amplifier Stage	(L1) J304 on front of modulator-power supply.	Same as step 19 except connect first test lead to minor test point L_1.	Same as step 19.	Voltage indication on "METER 1" of 1.2 V. Full scale meter reading is 5 V.	V303 or V304. R319 through R327.
22. Narrow Band Amplifier	(M1) J303 on front of modulator-power supply.	Connect one test lead between minor test point M_1 and "-METER 1" test jack; connect other test lead between "+ METER 1" and "GND." test jacks.	Same as step 19.	Voltage indication on "METER 1" of 28 V. Full scale meter reading is 100 V.	V301. Short circuit in C303. See step 2, Table 5-3.

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
AUDIO DRIVER SUBASSEMBLY (CONT)					
23. Input Transformer	(N1) Pin 2 of V302.	Connect Hewlett-Packard Audio Oscillator Model 200 and Ballantine Voltmeter Model 300 across secondary test point J. Set range switch on voltmeter to 1 VOLT FULL SCALE. Set audio osc controls for 1,000 cps and 1 V reading on voltmeter.	Set "NARROW-BROAD" switch to "BROAD." Set "GAIN" control to extreme clockwise position.		Check T302, "GAIN" control R306, R338, and C315.
		Without making any other changes, reconnect the voltmeter between minor test point N_1 and ground.		Approx 6 V reading on voltmeter.	
			Turn "GAIN" control slowly to extreme counterclockwise position.	Reading on voltmeter will slowly reduce to 0 volts.	
MODULATOR CHASSIS					
24. Plate Modulator	(E) (J)	Set freq dial on Hewlett-Packard Audio Oscillator Model 200 to 1,000 cps; connect to secondary test point J. Set range switch on Ballantine Voltmeter Model 300 to 0.01 VOLTS FULL SCALE; connect to output terminals of audio osc. Set selector switch on	Set "NORMAL-EMER" switch to "NORMAL." Set "LIMITER THRESHOLD" control at extreme counterclockwise position. Set "GAIN" control at extreme clockwise position. Set "NARROW-BROAD" switch to "NARROW."	At least 50 V reading on the multimeter.	Tube V201 or V202. Modulation transformer T201.

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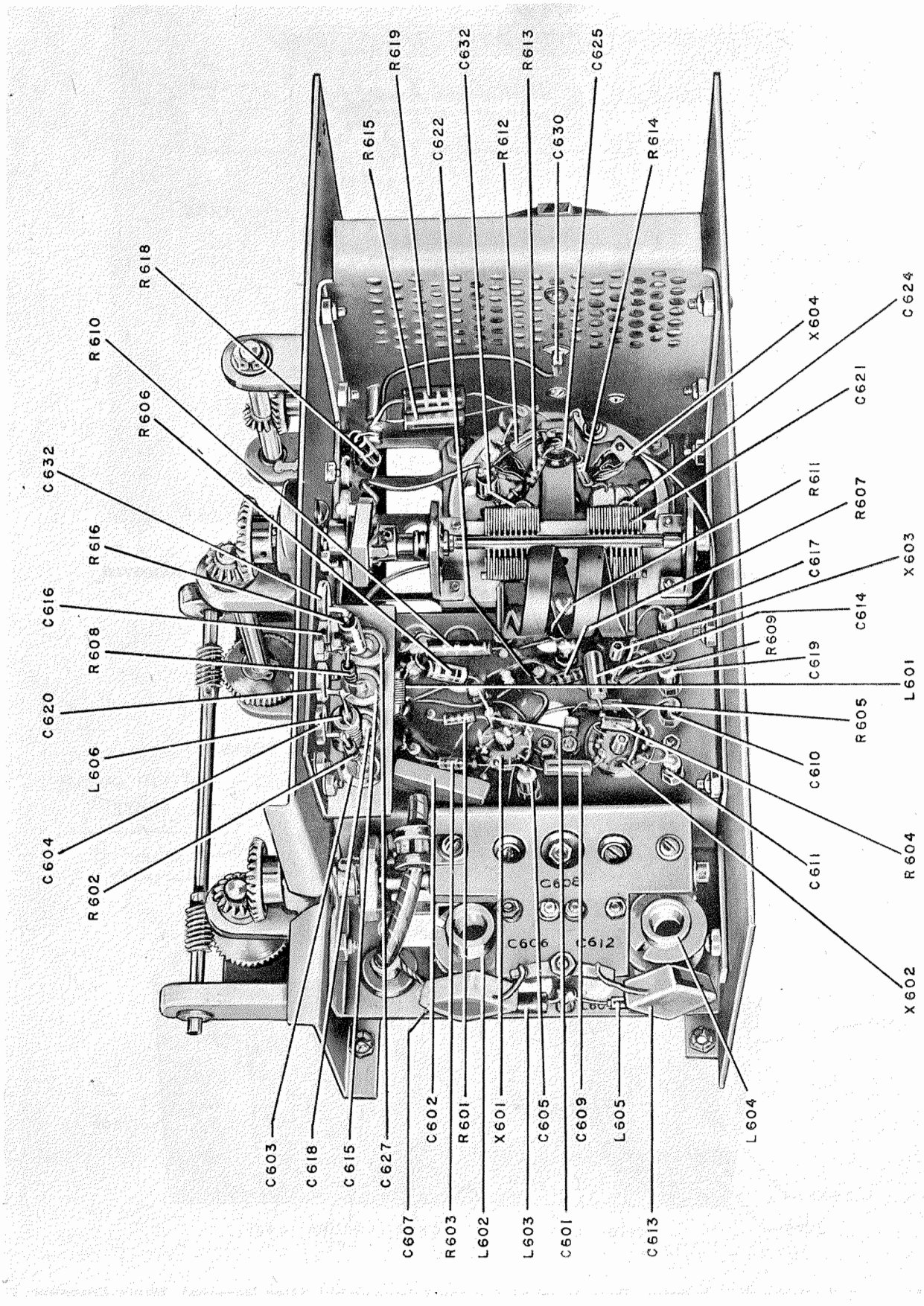
TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
MODULATOR CHASSIS (CONT)					
24. Plate Modulator (cont)		Triplett Multimeter Model 630-A to 300 V AC; connect between secondary test point E and "GND." test jack. Turn amplitude control on audio osc until a reading of 0.001 V is obtained on the voltmeter.			
25. Modulation Limiter Rectifier	(J) (O_1) "Hot" side of C204 (terminal with blue leads).	Same as step 24 except multimeter connected between minor test point O_1 and chassis; selector switch on 12 V AC range. Keep multimeter test leads dressed away from modulator chassis.	Same as step 24.	Reading of 0 V on multimeter.	Tube V203. Short circuit in C203 or C204. R201, R204, or R206 defective.
			Note reading on multimeter while turning "LIMITER THRESHOLD" control in clockwise direction.	Reading on multimeter increases to 4.5 V at extreme clockwise position of control.	
MONITOR-SCREEN MODULATOR ASSEMBLY					
26. Screen Modulator	(J) (K) Same as major test point 15 (step 16, Table 5-3).	Same as step 24, except multimeter connected between secondary test point K and chassis; selector switch on 300 V AC range. Keep test leads away from transmitter to reduce undesired	Same as step 24.	Approx 110 V reading on multimeter.	Tube V703, V704, V705, or V706. Factory adjusted "PA CUR." control R719 or "MOD LIN" control R723 defective or misaligned. See Table 6-7, steps 2, 4, 6, 8, 10, 11, and 12.

TABLE 6-2. SYSTEMS TROUBLE ANALYSIS, FIELD (CONT)

Step	Test Points	Test Equipment Control Positions	Radio Transmitter & Modulator-Power Supply Control Settings	Normal Indication	Possible Cause of Abnormal Indication
MONITOR-SCREEN MODULATOR ASSEMBLY (CONT)					
27. Side Tone Output	(J) (L) "SIDE TONE OUTPUT" jack J701.	Same as step 24, except multimeter and 600 ohm resistor connected across phone plug and then inserted into secondary test point L. Set multimeter selector switch on 3 V AC range.	Same as step 24.	Approx 0.8 V (1 mw) reading on multimeter.	Tube V701. "SIDE TONE" control R705 defective or misadjusted. T701 defective. Short circuit in C706 or C707. Open circuit in R708.
28. Modulation Monitor	(E) (J)	See Table 6-1, step 13.	See Table 6-1, step 13.	See Table 6-1, step 13.	Tube V701 or V702. "CALIBRATE" control R702 or "MOD CAL" control R716 defective or misaligned. See Table 6-7, steps 5 and 7.
29. Power Output Monitor	(H)	Same as step 16.	Set "METER 2 SELECTOR SWITCH" to "CARRIER WATTS."	Indication on "METER 2" should be within 5 percent of reading on Micromatch Model MM 562 Power Indicator.	"PWR CAL" control R701 defective or misaligned.


R619
C632
R613
C625
R615
C622
R612
C630
R614
R618
R610
R606
C632
R616
C616
R608
C620
L606
C604
R602
C624
X604
C621
R611
R607
C617
X603
C614
R609
C619
L601
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C610
C611
R604
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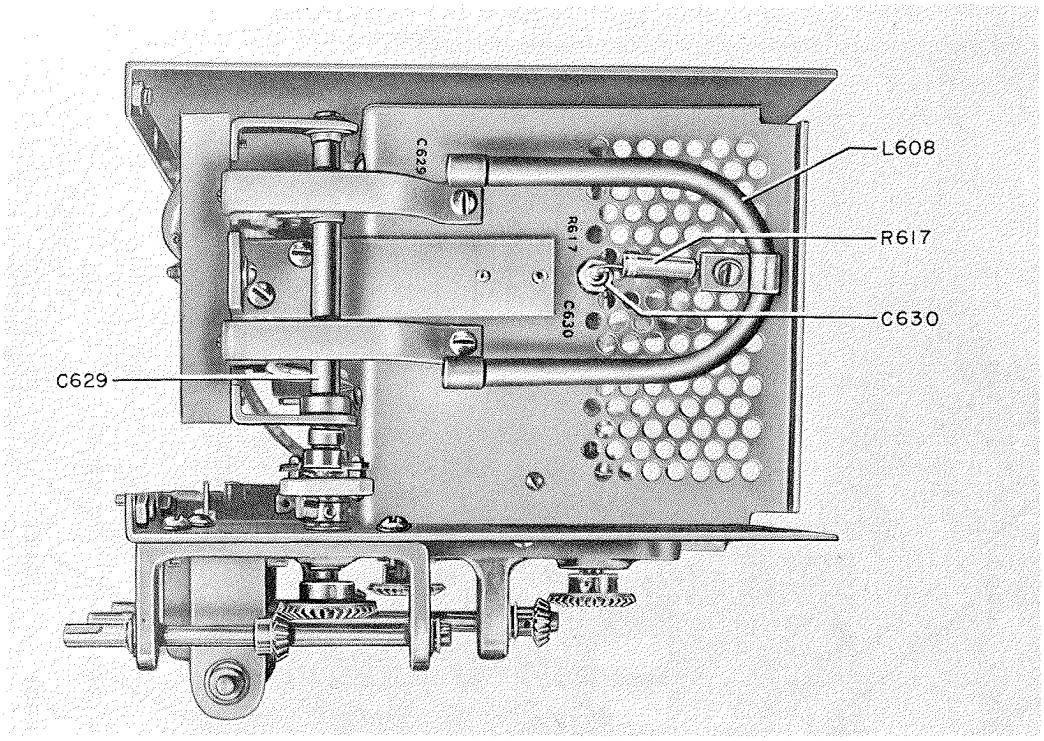

Figure 6-6. Radio Transmitter, End View of Exciter Subassembly with Cover Removed, Location of Electrical Parts

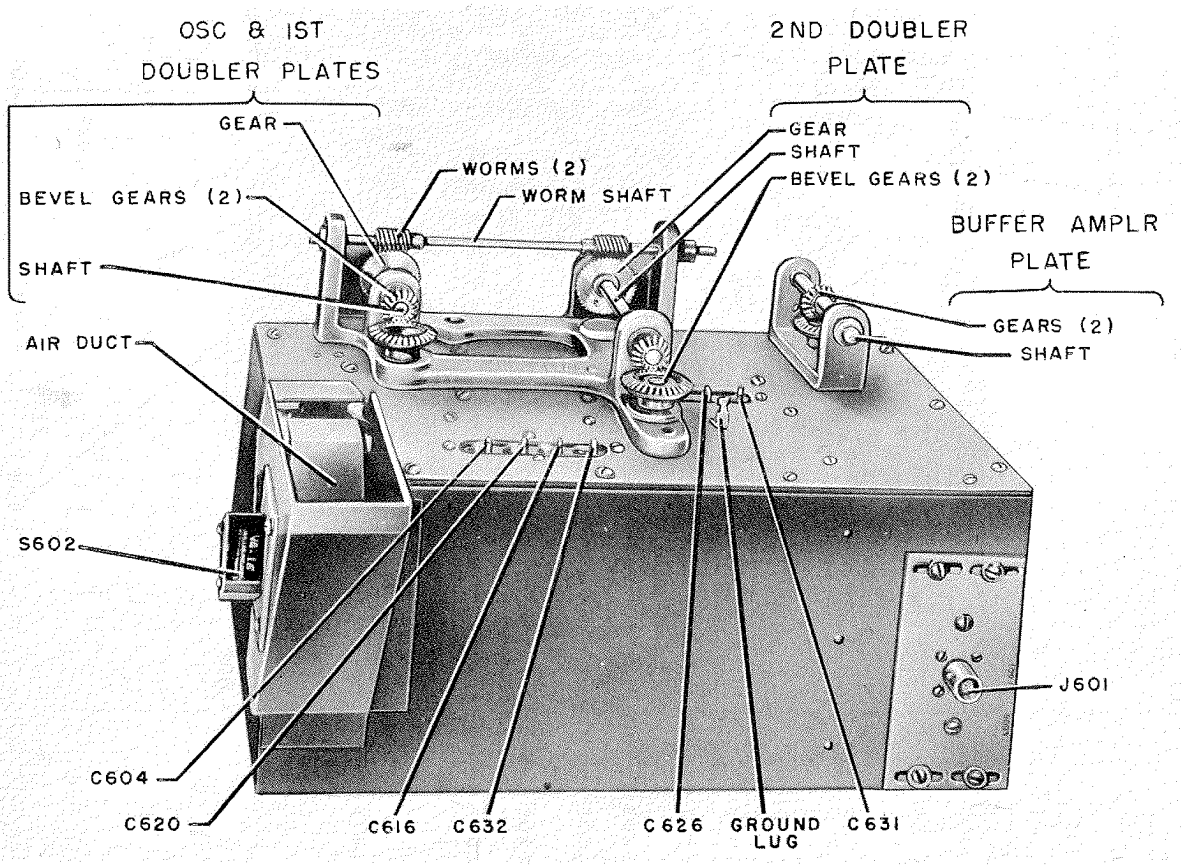

Figure 6-7. Radio Transmitter, Rear View of Exciter Subassembly After Removal, Parts Location

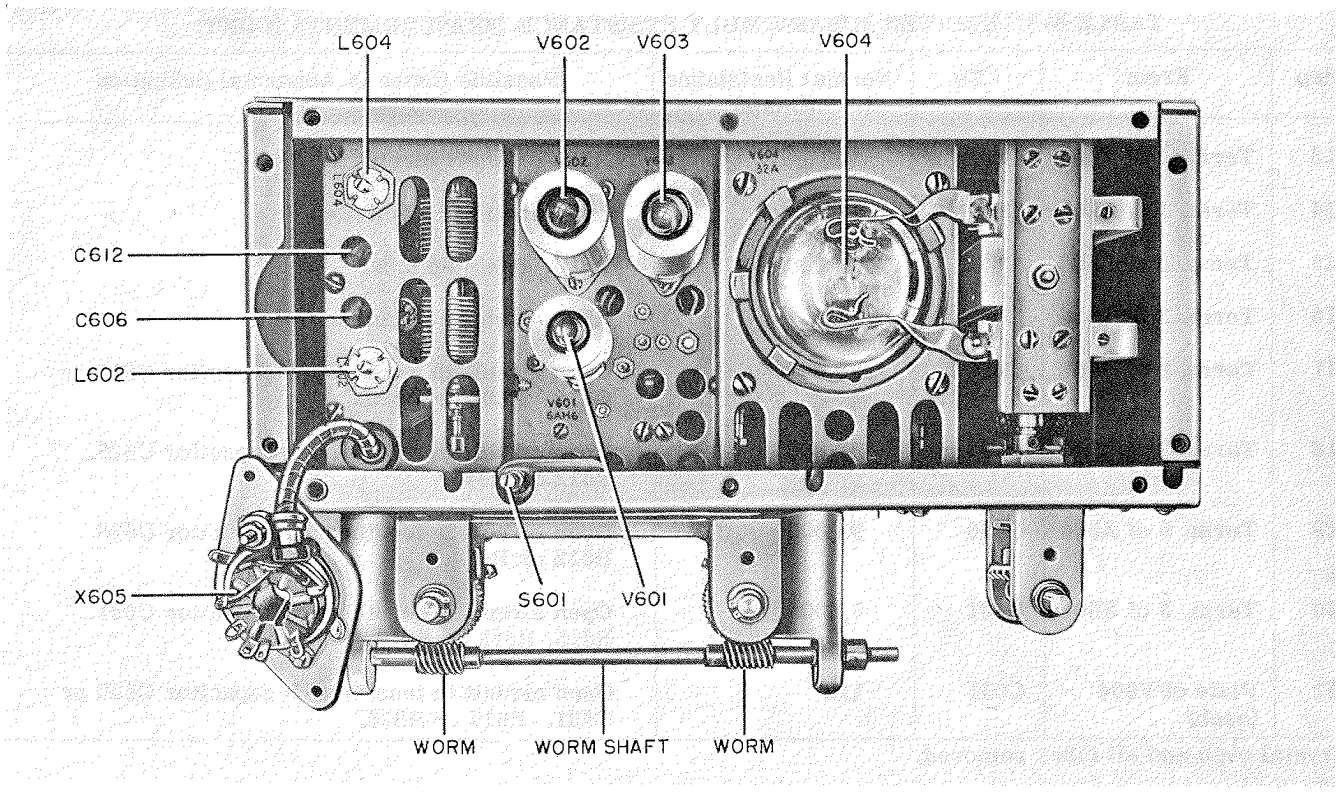

Figure 6-8. Radio Transmitter, Front View of Exciter Subassembly After Removal, Parts Location

TABLE 6-3. EXCITER SUBASSEMBLY RESISTANCE MEASUREMENTS

Step	From	To	Normal Resistance (Ohms)	Possible Cause of Abnormal Indication
1	C604	Chassis	Infinity	Short circuit in C601, C603 or C604.
2	C620	Chassis	*Infinity	Short circuit in C618 or C620.
3	C616	Chassis	Infinity	Short circuit in C615 or C616.
4	C632	Chassis	Infinity	Short circuit in C605, C606 (adjustment screw too tight), C607, C608 (bent plates), C611, C612 (adjustment screw too tight), C613, C619, C621 (bent plates), C622, C627 and C632.
5	C626	Chassis	Infinity	Short circuit in C625 or C626.
6	C631	Chassis	Infinity	Short circuit in C628, C630 or C631.
7	Term. 1 of X601	C604	47,000	Open circuit in feedthrough capacitor C603 or C604. R601 or R602.
8	Term. 5 of X601	C632	58	Open circuit in feedthrough capacitor C627 or C632. L602, L603 and R616.
9	Term. 6 of X601	C632	68,000	L601 and R603. See step 8.
10	Term. 1 of X602	C632	58	L604 and L605. See step 8.
11	Term. 6 of X602	C632	22,000	R606. See step 8.
12	Term. 8 of X602	Chassis	100,000	R604.

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TABLE 6-3. EXCITER SUBASSEMBLY RESISTANCE MEASUREMENTS (CONT)

Step	From	To	Normal Resistance (Ohms)	Possible Cause of Abnormal Indication
13	Term. 3 of X602	Chassis	100	R605 or short circuit in C610.
14	Term. 1 of X603	C632	160	L607 and R611. See step 8.
15	Term. 6 of X603	C632	22,000	R610. See step 8.
16	Term. 3 of X603	Chassis	150	R609 or short circuit in C617.
17	Term. 8 of X603	C616	82,000	Open circuit in feedthrough capacitor C615 or C616. R607 or R608.
18	Term. 2 of X604	C626	33,000	Open circuit in feedthrough capacitor C626. R612 or R613.
19	Term. 6 of X604	C626	33,000	Open circuit in feedthrough capacitor C626. R612 or R614.
20	Term. 3 of X604	C631	7,600	Open circuit in feedthrough capacitor C631. R615, R618 or R619.
21	Plate of V604 (each)	C631	112	Open circuit in feedthrough capacitor C630 or C631. R617 or R618.

*Crystal oven and all tubes removed.

TABLE 6-4. DRIVER-POWER AMPLIFIER ASSEMBLY VOLTAGE MEASUREMENTS

Step	Test Point	Normal Voltage (To Chassis)	Possible Cause of Abnormal Indication
1	C903	6.0 V ac	Short circuit in C903. See Table 6-5, step 1.
2	C902	-110 V	Short circuit in C902. See Table 6-5, step 2. See Table 5-3, step 2.
3	C905	+250 V	Short circuit in C905. See Table 6-5, step 3. See Table 6-2, step 5.
4	C922	+850 V	Short circuit in C907 or C922. See Table 6-5, step 4. See Table 6-2, steps 7 and 8.
5	C912	6.0 V ac	Short circuit in C912. See Table 6-5, step 5.
6	C910	-90 V	Short circuit in C910 or C911. See Table 6-5, step 6. See Table 5-3, step 2.
7	C916	+250 V	Fuse F902 blown. Short circuit in C916 or C925. See Table 6-2, step 26.
8	C923	+850 V	Short circuit in C918 or C923. See Table 6-5, step 16. See Table 6-2, step 7.

e. Disconnect the wires from the above capacitors.

f. Remove the cover plate from each r-f filter (one on each side of the rear section of the transmitter). Disconnect the wires that enter the filters and are connected to C922 (filter on right side) and C923 (filter on left side).

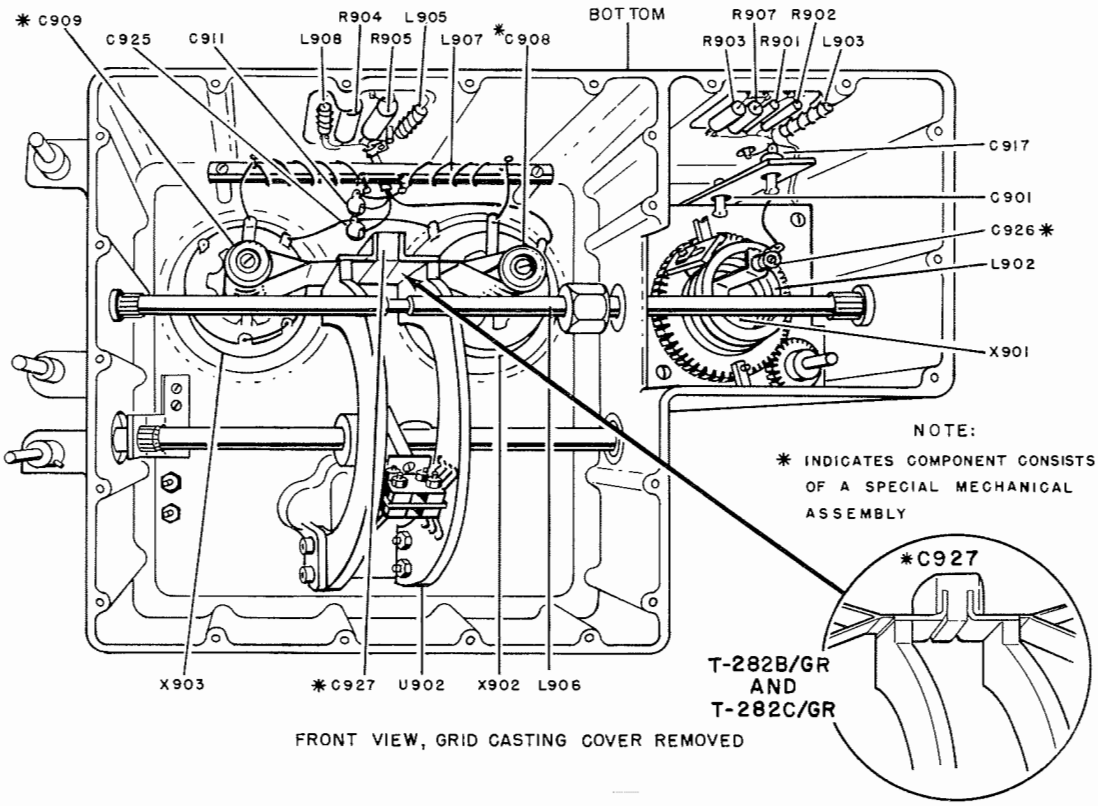
g. Remove the air filter and two radiation screens at the rear of the transmitter.

h. Label each tube, indicating the socket into which it is plugged, and then extract the three tubes.

i. Measure the resistance (using a Triplett Multimeter Model 630-A, or equal) between each capacitor (steps d and f) and the chassis.

j. Measure the resistance between the terminals of the tube sockets (top side) and the appropriate capacitors, as indicated in Table 6-5.

k. Refer to the last column of Table 6-5 for possible causes of abnormal resistance measurements. Locate the fault and make necessary repairs before proceeding with any additional trouble shooting.



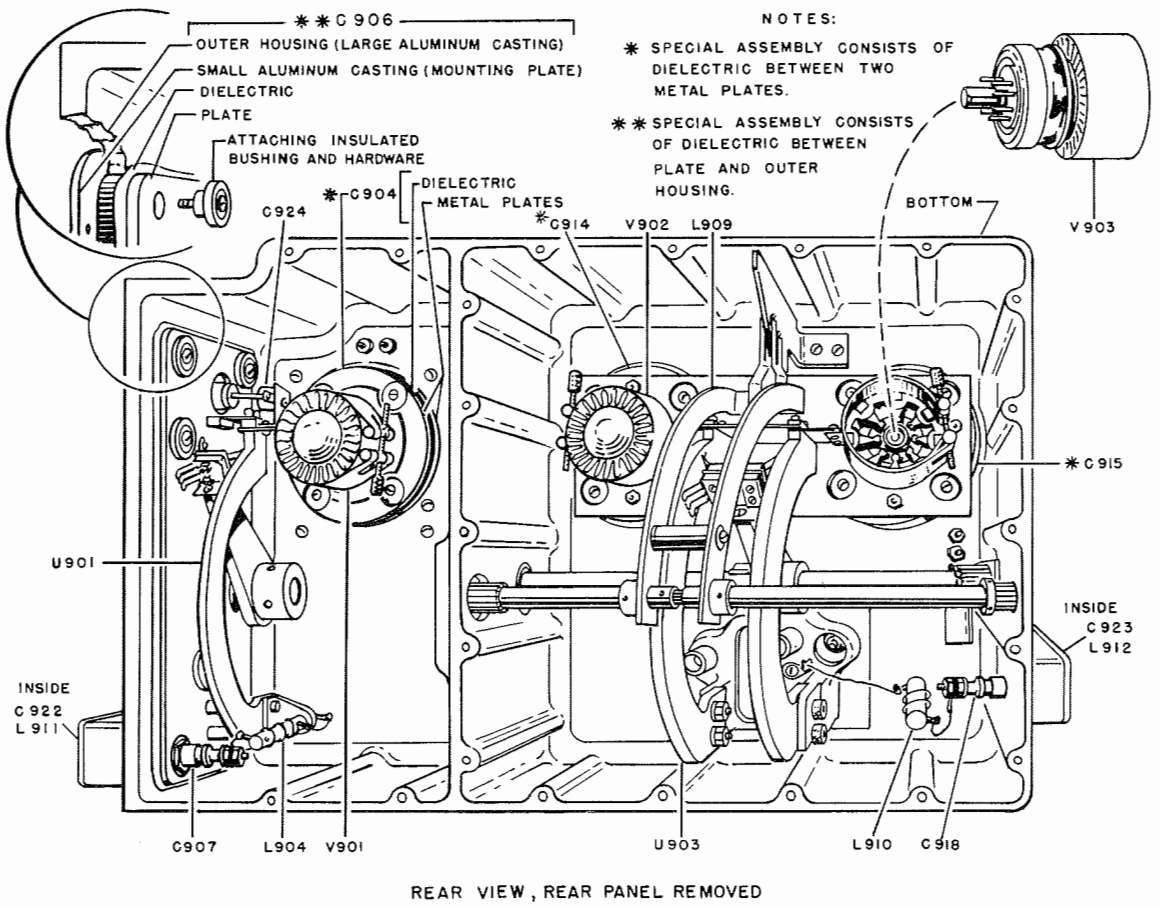
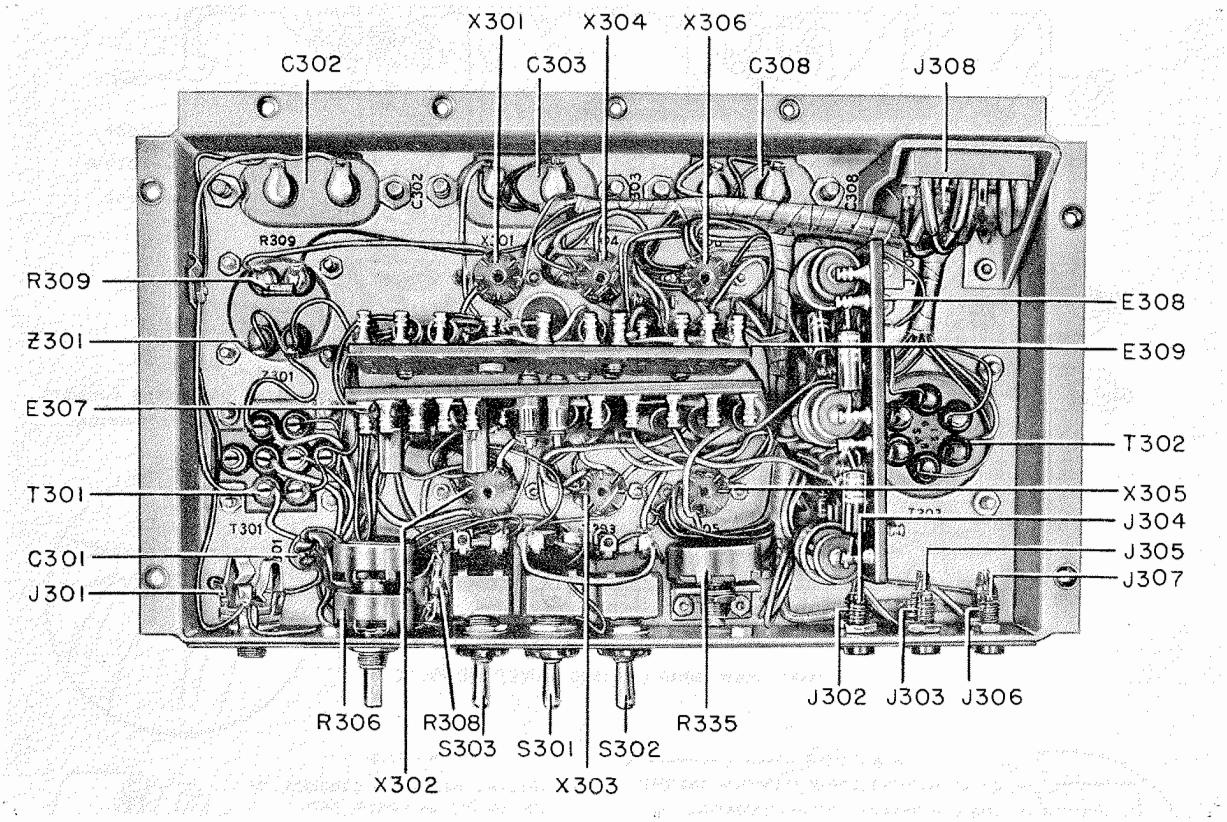


Figure 6-9. Radio Transmitter, Driver-Power Amplifier Assembly, Location of Electrical Parts



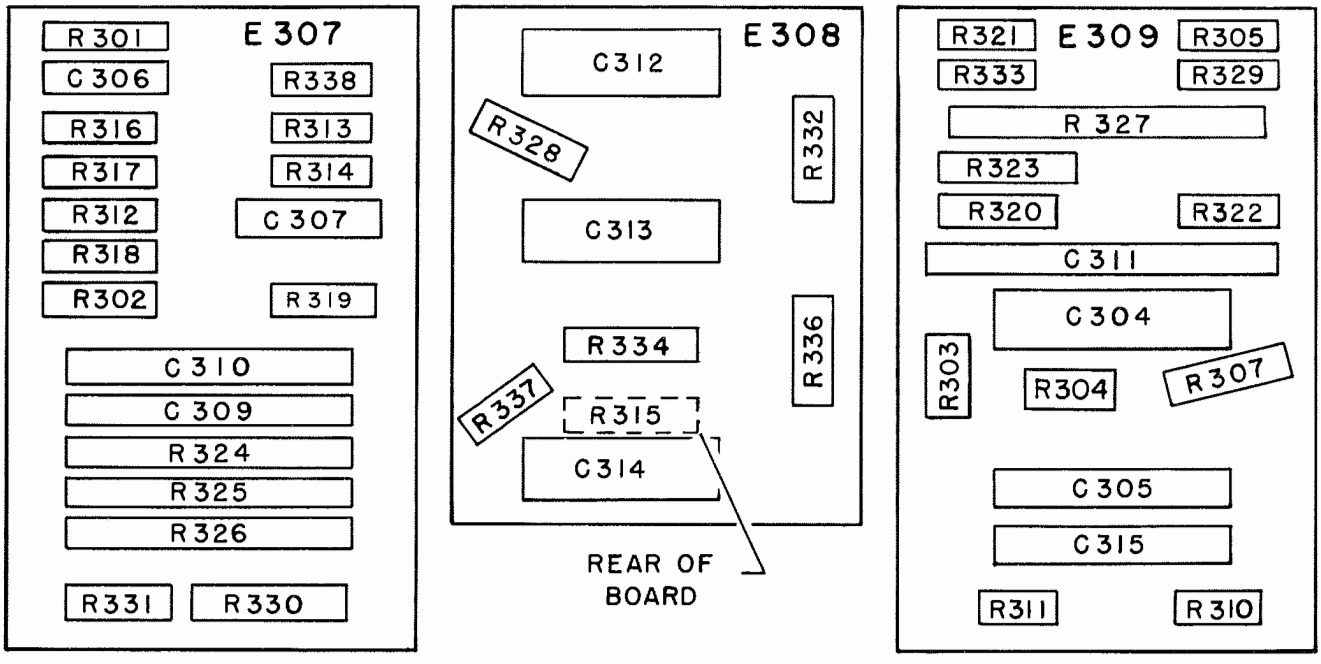


Figure 6-10. Modulator-Power Supply, Audio Driver Subassembly, Location of Electrical Parts

l. Insert each tube into the same socket from which it was removed.
m. Reconnect the wires previously disconnected (steps d, e and f).
n. Replace the rear radiation screens, air filter, and dust cover (if all repairs are completed on the transmitter).

6-19. AUDIO DRIVER SUBASSEMBLY RESISTANCE MEASUREMENTS.

6-20. Use Table 6-6 and figure 6-10 as aids to determine if faulty electrical parts exist in the audio driver subassembly. The preliminary steps and general procedure are as follows:
a. Turn the "POWER" switch (front of the modulator-power supply) to the "OFF" position. Disconnect the power cable assembly from the "AC POWER INPUT" connector at the rear of the modulator-power supply.
b. Place the modulator-power supply, bottom side down, on a convenient workbench.
c. Remove the dust cover.
d. Remove the front access door.
e. Label each tube on the audio driver subassembly (total of six), indicating the socket into which it is plugged, and then extract the tubes.
f. Disconnect plug P201 from jack J308 (bottom of subassembly).
g. Measure the resistance (using a Triplett Multimeter Model 630-A, or equal) between each terminal of J308 (except terminals 4, 8, 11 and 13) and the chassis.
h. Refer to the last column of Table 6-6 for possible causes of abnormal resistance measurements. Locate the fault and make necessary repairs before proceeding with any additional trouble shooting.
i. Insert each tube into the same socket from which it was removed. Reconnect plug P201 to jack J308.
j. Replace the front access door and dust cover (if all repairs completed on modulator-power supply).

6-21. MONITOR-SCREEN MODULATOR ASSEMBLY RESISTANCE MEASUREMENTS.

6-22. Use Table 6-7 and figure 5-9 as aids to determine if faulty electrical parts exist in the monitor-screen modulator assembly. The preliminary steps and general procedure are as follows:
a. Remove the monitor-screen modulator assembly from the transmitter (see paragraph 5-34).
b. Label each tube, indicating the socket into which it is plugged, and then extract the six tubes.
c. Measure the resistance (using a Triplett Multimeter Model 630-A, or equal) between each terminal of jack J703 (top rear of chassis) and the chassis. Terminal 11 of J703 does not have any connections.
d. Measure the resistance from P701 and P702 (rear of assembly) to the chassis.
e. Refer to the last column of Table 6-7 for possible causes for abnormal resistance measurements. Locate the faults and make necessary repairs before proceeding with any additional trouble shooting.
f. Insert each tube into the same socket from which it was removed.
g. Reassemble the monitor-screen modulator assembly by reversing the steps in paragraph 5-34.

6-23. REMOVAL OF SUBASSEMBLIES.

6-24. Detailed information on removal of subassem blies is given in paragraphs 5-24 through 5-34. Fi ures 5-7 through 5-11 illustrate the parts to disconnected before removing these sections.

6-25. CIRCUIT BREAKDOWN.

6-26. A detailed circuit breakdown according to fun tion is given in paragraphs 4-1 through 4-9 und "General System Operation." The circuits describ are as follows:
a. Oscillator.
b. First and second doublers.
c. Buffer amplifier.
d. Tripler.
e. Power amplifier.
f. Narrow band amplifier.
g. Phase inverter.
h. Audio frequency amplifier.
i. Modulator driver.
j. Modulator.
k. Screen modulator.
l. Modulation limiting.
m. Line adjustment ("BUCK-BOOST").
n. Metering.
o. Monitor.
p. Interlocks.
q. Antenna switching.
r. Low pass r-f filter.
s. Muting.
t. Power supply.
u. Time delay.
v. Push-to-talk.

6-27. VOLTAGE AND RESISTANCE CHARTS.

6-28. All resistance measurements are made w interconnecting cables disconnected (power cab assembly and three cables between transmitter a modulator-power supply). All voltage measureme are made under the following conditions.
a. The supply voltage at 115 V and 60 cps.
b. The "BUCK-BOOST" switch set to the "BOOS position.
c. The "GAIN" control set to the extreme counte clockwise position.
d. The "NARROW-BROAD" switch set to the "NA ROW" position.
e. The "NORMAL-EMER" switch set to the "NO MAL" position.
f. The "LIMITER THRESHOLD" control set to t extreme counterclockwise position.
g. "METER 2 SELECTOR SWITCH" set to t "CARRIER WATTS" position.
h. No audio signal input at the "MIKE" jack or t "LINE" terminals.
i. The "PUSH TO TALK-CARRIER ON" switch s to the "CARRIER ON" position.
j. The transmitter tuned for an output frequency 400 mc.
k. The "TUNE-OPERATE" switch set to the "OPE ATE" position.
l. The transmitter adjusted for an output of 100 wat

TABLE 6-5. DRIVER-POWER AMPLIFIER ASSEMBLY RESISTANCE MEASUREMENTS

Step	From	To	Normal Resistance (Ohms)	Possible Cause of Abnormal Indication
1	C903	Chassis	*Infinity	Short circuit in C903.
2	C902	Chassis	Infinity	Short circuit in C901, C902, or C926.
3	C905	Chassis	Infinity	Short circuit in C904 or C905. C904 is a special subassembly attached to the driver tube socket X901; see applicable Parts Catalog for detailed parts location.
4	C922	Chassis	Infinity	Short circuit in C906, C907, C922, or C924. C906 is part of the driver tuned plate circuit; see applicable Parts Catalog for detailed parts location.
5	C912	Chassis	*Infinity	Short circuit in C912.
6	C910	Chassis	Infinity	Short circuit in C908, C909, C910, or C911. C908 and C909 are special assemblies attached to the power amplifier tuned grid circuit; see applicable Parts Catalog for detailed parts location.
7	C916	Chassis	Infinity	Short circuit in C914, C915, C916, or C925. C914 and C915 comprise a special assembly, attached to power amplifier tube sockets X902 and X903; see applicable Parts Catalog for detailed parts location.
8	C923	Chassis	Infinity	Short circuit in C918 or C923.
9	** Term. 1 of X901	C905	1,100	Open circuit in feedthrough capacitor C905. R903 or R907.
10	** Term. 3 of X901	C903	0	Open circuit in feedthrough capacitor C903. L903.
11	** Grid connection of X901	C902	11,000	Open circuit in feedthrough capacitor C902. L902, R901, or R902.
12	Plate connector for V901	C922	0	Open circuit in feedthrough capacitor C907. L904 or L911.
13	** Term. 1 of X902	C916	0	Open circuit in feedthrough capacitor C916. L905.
14	** Term. 3 of X902	C912	0	Open circuit in feedthrough capacitor C912. L908.
15	** Grid connection of X902	C910	2,800	Open circuit in feedthrough capacitor C910. L907, R904 or R905.
16	Plate connector for V902	C923	0	Open circuit in feedthrough capacitor C918. L910 or L912.

* Tubes removed.

** Remove tube and measure from top of tube socket.

TABLE 6-6. AUDIO DRIVER SUBASSEMBLY RESISTANCE MEASUREMENTS.

Step	Test Point	Normal Resistance To Chassis (Ohms)	Possible Cause of Abnormal Indication
1	Term. 1 of J308	0	Poor connection at terminal on J308 or at ground lug.
2	Term. 2 of J308	Infinity	Short circuit in C310 or C311
3	Term. 3 of J308	Infinity	Short circuit in C308 or bandpass filter Z301.
4	Term. 5 of J308	Infinity	Short circuit in C303.
5	Term. 6 of J308	24,000 ("THRESHOLD" control at max clockwise rotation). 29,000 ("THRESHOLD" control at max counterclockwise rotation).	Short circuit in C314. R323, R324, R325, R334, R335 ("THRESHOLD" control) or R336
6	Term. 7 of J308	0 (with "PUSH TO TALK-CARRIER ON" switch set to "CARRIER ON").	S302.
7	Term. 7 of J308	Infinity (with "PUSH TO TALK-CARRIER ON" switch set to "PUSH TO TALK").	Short circuit in C301 or C302.
8	Term. 9 of J308	20,000	R323, R324, R325, R334, R335 ("THRESHOLD" control) or R336.
9	Term. 10 of J308	81	Open or shorted turns between terminals 4 and 5 of T302.
10	Term. 12 of J308	81	Open or shorted turns between terminals 5 and 6 of T302.
11	Term. 14 of J308	* Infinity	Check filament wiring.
12	Term. 15 of J308	* Infinity	Check filament wiring.

* Tubes removed.

TABLE 6-7. MONITOR-SCREEN MODULATOR ASSEMBLY RESISTANCE MEASUREMENTS.

Step	Test Point	Normal Resistance To Chassis (Ohms)	Possible Cause of Abnormal Indication
1	Term. 1 of J703	0	Poor connections.
2	Term. 2 of J703	75,000	R725 or R726.
3	Term. 3 of J703	150,000 (when "METER 2 SELECTOR SWITCH" set to "% MOD").	Short circuit in C705. R713 or R714 defectiv
4	Term. 4 of J703	75,000	Same as step 2.
5	Term. 5 of J703	Infinity	Check filament wiring to V701 and V702.
6	Term. 6 of J703	Infinity	Check filament wiring to V706.

(continued on the next page

m. All voltages measured with a Triplett Multimeter Model 630-A, or equal (20,000 ohms per volt). Range switch set so that readings fall in the upper or right-hand half of the scale wherever possible).
n. All voltages are dc except where noted.

6-29. TRANSMITTER TUBE SOCKET VOLTAGES AND RESISTANCES. (See figure 7-12.) Table 6-8 is a tabulation of typical voltage and resistance measurements at all transmitter tube sockets. See paragraph 6-28 for conditions of measurement.

TABLE 6-7. MONITOR-SCREEN MODULATOR ASSEMBLY RESISTANCE MEASUREMENTS (CONT)

Step	Test Point	Normal Resistance To Chassis (Ohms)	Possible Cause of Abnormal Indication
7	Term. 7 of J703	100,000	Short circuit in C702, C703, C704 or C705. R719 ("PA CUR." control) defective.
8	Term. 8 of J703	68,000	R725.
9	Term. 9 of J703	220	R708.
10	Term. 10 of J703	68,000	Same as step 8.
11	P701	Infinity	Check wiring to pin 5 of X703.
12	P702	760,000	Short circuit in C709 or C710. R721, R722 or R723 ("MOD LIN" control) defective.

TABLE 6-8. TRANSMITTER TUBE SOCKET VOLTAGES AND RESISTANCES

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V601 (6AH6)	1	y -2.0	160K
	2	0.0	0.0
	3	6.3 ac	0.0
	4	0.0	0.0
	5	233	100K
	6	114	168K
	7	0.0	0.0
V602 (5763)	1	x 238	100K
	2	No connection	No connection
	3	2.4	100
	4	6.3 ac	0.0
	5	0.0	0.0
	6	175	122K
	7	2.4	100
	8	y -12.0	100K
	9	y -12.0	100K
V603 (5763)	1	x 238	100K
	2	No connection	No connection
	3	4.0	150
	4	6.3 ac	0.0
	5	0.0	0.0
	6	183	122K
	7	4.0	150
	8	y -44	80K
	9	y -44	80K
V604 (832A)	1	0.0	0.0
	2	y -50	35K
	3	227	Infinite
	4	0.0	0.0
	5	6.3 ac	0.0
	6	y -50	35K
	7	0.0	0.0
	Cap 1	x 285	Infinite
	Cap 2	x 285	Infinite

(continued on the next page)

TABLE 6-8. TRANSMITTER TUBE SOCKET VOLTAGES AND RESISTANCES (CONT)

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V701 (12AT7) or (12AT7WA)	1	140	130K
	2	0.0	1.0 meg
	3	1.4	470
	4	6.3 ac	0.0
	5	6.3 ac	0.0
	6	230	100K
	7	*0.0 -0.2	*11K
	8	1.4	220
	9	0.0	0.0
V702 (12AX7) or (5751)	1	140	230K
	2	0.0	1.0 meg
	3	1.3	5000 Variable
	4	6.3 ac	0.0
	5	6.3 ac	0.0
	6	-0.4	200K
	7	-0.4	200K
	8	0.0	0.0
	9	0.0	0.0
V703 (OB2) or (OB2WA)	1	No connection	No connection
	2	780	Infinite
	3	No connection	No connection
	4	No connection	No connection
	5	880	Infinite
	6	No connection	No connection
	7	No connection	No connection
V704 (OB2) or (OB2WA)	1	No connection	No connection
	2	670	Infinite
	3	No connection	No connection
	4	No connection	No connection
	5	775	Infinite
	6	No connection	No connection
	7	No connection	No connection
V705 (OB2) or (OB2WA)	1	No connection	No connection
	2	565	Infinite
	3	No connection	No connection
	4	No connection	No connection
	5	670	Infinite
	6	No connection	No connection
	7	No connection	No connection
V706 (5763)	1	565	Infinite
	2	No connection	No connection
	3	190	70K
	4	190	70K
	5	190	70K
	6	565	Infinite
	7	190	70K
	8	140	1 meg
	9	140	1 meg
V901 (4X150A)	1	240	100K
	2	0.0	0.0
	3	6.0 ac	0.0
	4	0.0	0.0
	5	No connection	No connection
	6	0.0	0.0
	7	0.0	0.0
	Grid	y -135	13K
	Plate	x 1350	Infinite

* Dependent upon setting of side tone output gain control R705.

(continued on the next page)

TABLE 6-8. TRANSMITTER TUBE SOCKET VOLTAGES AND RESISTANCES (CONT)

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V902 (4X150A)	1	180	70K
	2	0.0	0.0
	3	6.0 ac	0.0
	4	0.0	0.0
	5	No connection	No connection
	6	0.0	0.0
	7	0.0	0.0
	Grid	y -115	4000
	Plate	x 1350	760K
V903 (4X150A)	1	180	70K
	2	0.0	0.0
	3	6.0 ac	0.0
	4	0.0	0.0
	5	No connection	No connection
	6	0.0	0.0
	7	0.0	0.0
	Grid	y -115	4000
	Plate	x 1350	760K

y - 33K carbon isolation resistor attach to probe end.

x - Pull out crystal oven Y601 for this measurement or R. F. voltage may burn out meter.

6-30. MODULATOR-POWER SUPPLY TUBE SOCKET VOLTAGES AND RESISTANCES. (See figure 7-13.) Table 6-9 is a tabulation of typical voltage and resistance measurements at all tube sockets within the modulator-power supply. See paragraph 6-28 for conditions of measurement.

TABLE 6-9. MODULATOR-POWER SUPPLY TUBE SOCKET VOLTAGES AND RESISTANCES

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V101 (3B28)	1	860	240K
	1 to 4	2.5 ac	
	2	No connection	No connection
	3	No connection	No connection
	4	860	240K
	Cap	1000 ac	20
V102 (3B28)	1	860	240K
	1 to 4	2.5 ac	
	2	No connection	No connection
	3	No connection	No connection
	4	860	240K
	Cap	1000 ac	20
V103 (3B28)	1	390	19.5K
	1 to 4	2.5 ac	
	2	No connection	No connection
	3	No connection	No connection
	4	390	19.5K
	Cap	450 ac	35
V104 (3B28)	1	390	19.5K
	1 to 4	2.5 ac	
	2	No connection	No connection
	3	No connection	No connection
	4	390	19.5K
	Cap	450 ac	35

(continued on the next page)

TABLE 6-9. MODULATOR-POWER SUPPLY TUBE SOCKET VOLTAGES AND RESISTANCES (CONT)

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V105 (5R4WGY)	1	No connection	No connection
	2	0.0	0.0
	2 to 8	5.0 ac	
	3	No connection	No connection
	4	25 ac	2700
	5	No connection	No connection
	6	190 ac	2400
	7	No connection	No connection
	8	0.0	0.0
V201 (811)	1	3.1 ac	0.0
	1 to 4	6.3 ac	
	2	No connection	No connection
	3	2.4 ac	81
	4	3.1 ac	0.0
	Cap	860	240K
V202 (811)	1	3.1 ac	0.0
	1 to 4	6.3 ac	
	2	No connection	No connection
	3	2.4 ac	81
	4	3.1 ac	0.0
	Cap	860	240K
V203 (6AL5W)	1	155	45K
	2	0.0	470K
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	155	50K
	6	No connection	No connection
	7	0.0	470K
V301 (6C4)	1	-0.35	220
	2	No connection	No connection
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	No connection	No connection
	6	-21	1 meg
	7	-29	100K
V302 (12AX7)	1	-26	220K
	2	-66	*600K
	3	-70	150K
	4	3.1 ac	0.0
	5	3.1 ac	0.0
	4, 5 to 9	6.3 ac	
	6	-27	220K
	7	-66	600K
	8	-70	150K
	9	3.1 ac	0.0
V303 (6BA6)	1	0.0	1.0 meg
	2	1.1	150
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	140	50K
	6	52	5000
	7	1.1	150

* 150K in units having serial numbers below 490.

(continued on the next page

TABLE 6-9. MODULATOR-POWER SUPPLY TUBE SOCKET VOLTAGES AND RESISTANCES (CONT)

Tube Number	Pin Number	Voltage	Resistance to Ground (Ohms)
V304 (6BA6)	1	0.0	1.0 meg
	2	1.1	150
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	140	50K
	6	52	5000
	7	1.1	150
V305 (6AQ5)	1	No connection	No connection
	2	14.5	220
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	245	20K
	6	250	20K
	7	0.0	470K
V306 (6AQ5)	1	No connection	No connection
	2	14.5	220
	3	3.1 ac	0.0
	4	3.1 ac	0.0
	3 to 4	6.3 ac	
	5	245	20K
	6	250	20K
	7	0.0	470K

TABLE 6-10. TRANSMITTER TERMINAL BOARD VOLTAGES AND RESISTANCES

Terminal Board	Terminal Number	Voltage	Resistance to Ground (Ohms)
E901	1	No connection	No connection
	2	No connection	No connection
	3	No connection	No connection
	4	No connection	No connection
	5	120 ac	Infinite
	5 to 6 on E902	120 ac	
	6	0.0	1.2
	7	6.3 ac	0.0
	8	180	68K
	9	180	68K
	8 to 9	6.0 VAC	
	10	0.0	Infinite
	11	0.0	Infinite
	12	190	70K
E902	1	No connection	No connection
	2	No connection	No connection
	3	-110	2500
	4	-71	1600
	5	120 ac	Infinite
	6	120 ac	Infinite
	7	0.0	Infinite
	8	0.0	6500
	9	250	100K
	10	300	Infinite
	11	-110	2500
	12	0.0	0.0
E903	1	860	800K
	2	860	800K
	3	870	Infinite
	4	870	Infinite

6-31. TRANSMITTER TERMINAL BOARD VOLTAGES AND RESISTANCES. (See figure 7-12.) Table 6-10 is a tabulation of typical voltage and resistance measurements at the three terminal boards located on the bottom of the rear section of the transmitter. See paragraph 6-28 for conditions of measurement.

6-32. MODULATOR-POWER SUPPLY TERMINAL BOARD VOLTAGES AND RESISTANCES. (See figu 7-13.) Table 6-11 is a tabulation of typical volta and resistance measurements at three readily a cessible terminal boards within the modulator-pow supply (dust cover removed). Terminal board E1 is located at the front of the power supply chass E102 at the rear of the power supply chassis, a E502 on the upper inside of the rear panel. S paragraph 6-28 for conditions of measurement.

TABLE 6-11. MODULATOR-POWER SUPPLY TERMINAL BOARD VOLTAGES AND RESISTANCES

Terminal Board	Terminal Number	Voltage	Resistance to Ground (Ohms)
E101	1		Infinite
	2		Infinite
	1 to 2	115 ac	
	3		Infinite
	4		Infinite
	3 to 4	115 ac	
	5		Infinite
	3 to 5	120 ac	
	6		Infinite
	3 to 6	120 ac	
	7		Infinite
	3 to 7	120 ac	
	8		Infinite
	9		Infinite
	3 to 9	120 ac	
	10	-100	10K
	11	-100	10K
	12	No connection	No connection
	13	No connection	No connection
E102	1	No connection	No connection
	2		Infinite
	3		Infinite
	2 to 3	115 ac	
	4		Infinite
	5		Infinite
	6		Infinite
	7	3.1 ac	0.0
	8	3.1 ac	0.0
	7 to 8	6.3 ac	
	9		Infinite
	4 to 9	120 ac	
	5 to 9	120 ac	
	6 to 9	120 ac	
	10	300	20K
	11		Infinite
	9 to 11	120 ac	
	12	-100	Infinite
	13	250	
	14		Infinite
	9 to 14	120 ac	
	15	0.0	0.0
	16		Infinite
	9 to 16	120 ac	
	17	-175	Infinite
	18		Infinite
	9 to 18	115 ac	
	19	-100	10K
	20	No connection	No connection

(continued on the next page

TABLE 6-11. MODULATOR-POWER SUPPLY TERMINAL BOARD VOLTAGES AND RESISTANCES (CONT)

Terminal Board	Terminal Number	Voltage	Resistance to Ground (Ohms)
E502	1	No connection	No connection
	2	No connection	No connection
	3	0.0	0.0
	4	-175	Infinite
	5		0.0
	6		0.0
	5 to 6	6.3 ac	
	7	-100	Infinite
	8	250	20K
	9	0.0	0.0
	10		Infinite
	11		Infinite
	12	-100	10K
	13	0.0	15K
	14		Infinite
	15		Infinite
	16		Infinite
	15 to 16	115 ac	
	17		Infinite
	16 to 17	115 ac	
	18		Infinite
	16 to 18	120 ac	
	19	No connection	No connection
	20	No connection	No connection

6-33. ALIGNMENT.

6-34. Table 6-12 gives instructions necessary to make adjustments within the transmitter after repairs (including tube replacement) have been completed. Connect a dummy antenna and power output measuring equipment at the "TO ANTENNA" connector, rear of transmitter (figure 5-6). Set the "TUNE-OPERATE" switch to the "TUNE" position and the "METER 2 SELECTOR SWITCH" to "CARRIER WATTS" position. Refer to figures 5-4, 5-5, 5-9, 6-5, 6-6, 6-7, 6-8, 6-9, for mechanical and electrical parts location.

TABLE 6-12. TRANSMITTER ALIGNMENT

Circuit	Pretuning Procedures	Tuning Procedures
Exciter, Second Doubler Stage	1. Remove transmitter inlet air filter and radiation screen. 2. Remove top plate of exciter, held by 17 screws on top and 3 screws through front panel.	1. L607: a. Adjust coil by spreading or pushing together, to vary spacing between turns. b. Required spacing between turns is 5/16 inch. 2. After completion of above procedure, reassemble by reversing steps of pretuning procedures.
Exciter, Oscillator & First Doubler Stages	1. Loosen set-screws in stop collar, rear end of "MAIN TUNING" shaft, until collar rotates freely. 2. Loosen set-screws in universal, at end of "MAIN TUNING" shaft, until universal turns freely on shaft; this disengages rear section drives.	1. L602: a. Turn "MAIN TUNING" dial until C608 is at max capacitance (plates fully meshed). b. Tune slug in L602 (accessible through opening left by removal of crystal oven socket) for dip in multimeter reading.

(continued on the next page)

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
Exciter, Oscillator & First Doubler Stages (cont)	3. Disconnect lead from term. 9 of fanning strip E802, bottom, rear section of transmitter. 4. Set selector switch on Triplett Multimeter Model 630-A to 120 DCMA; connect between disconnected lead and term. 9 of E802. 5. Remove crystal oven socket mounting plate (two screws); let socket mounting plate and crystal oven hang free. 6. Replace crystal Y601 with special 6.06 mc test crystal (operating frequency of 218 mc).	2. L604: Tune slug in L604 (accessible through opening left by removal of crystal oven socket) for max reading on "METER 1," "METER 1 SELECTOR SWITCH" on "2." 3. Retune L602 for max reading on "METER 1." 4. C606: a. Replace 6.06 mc test crystal with 11.4 mc test crystal (operating frequency of 410 mc). b. Turn "MAIN TUNING" dial until C608 is at min capacitance (plates fully unmeshed). c. Tune trimmer C606 (accessible through lower hole between L602 and L604) for dip in multimeter reading. 5. C612: Tune trimmer C612 (accessible through upper hole between L602 and L604) for max reading on "METER 1." 6. Retune C606 for max reading on "METER 1." 7. Repeat steps 1 through 6 until retuning of slugs and trimmers cause no further increase in readings on "METER 1."
Exciter Output & Coupling-Loop	1. Remove plug P601 from jack J601 at rear of exciter. 2. Replace Y601 with crystal required for output frequency of 400 mc. 3. Loosen four screws in plate at rear with off-set screw driver (J601 is in center of plate). 4. Connect Micromatch MM-560 power output indicator and 50-ohm dummy antenna to J601.	1. L609: a. Adjust "MAIN TUNING" dial until C608 meshed approx 10 percent. b. Tune "OSC & 1ST DOUBLER PLATES" control for max reading on "METER 1," "METER 1 SELECTOR SWITCH" on "2." c. Tune "2ND DOUBLE PLATE" control for max reading on "METER 1," "METER 1 SELECTOR SWITCH" on "3." d. Tune "BUFFER AMPLR PLATE" control for min reading on "METER 1," "METER 1 SELECTOR SWITCH" on "4." e. Retune "BUFFER AMPLR PLATE" control C629, for max power output indication on power indicator. f. Adjust (slide) plate, rear of exciter, for max power output indication. (continued on the next page)

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
Exciter Output & Coupling Loop (cont)		g. Alternately tune "BUFFER AMPLR PLATE" control and adjust rear plate until max power output indication is obtained. h. When the max exciter power output is obtained, carefully tighten the four screws in the rear plate. 2. After completion of above procedure, reassemble by reversing steps of pretuning procedure.
MAIN TUNING Control. Part I.	1. Replace Y601 with 7 mc crystal, required for output freq of 252 mc.	1. Set "MAIN TUNING" control at extreme counterclockwise position. 2. Rotate "MAIN TUNING" control in clockwise direction until an increase in current is noted on "METER 1," position "2." 3. Maximize the above reading by tuning "OSC & 1ST DOUBLER PLATES" control. Note dial reading. 4. Turn the "OSC & 1ST DOUBLER PLATES" control to the extreme clockwise position. Adjust the "MAIN TUNING" control until the "OSC & 1ST DOUBLER PLATES" control reads 8 divisions higher than the reading noted in step 3 (the "MAIN TUNING" control will "drive" the "OSC & 1ST DOUBLER PLATES" control). Make "MAIN TUNING" dial lock finger tight. 5. Retune "OSC & 1ST DOUBLER PLATES" control for max reading on "METER 1." 6. Tune "2ND DOUBLER PLATE" control for max reading on "METER 1," "METER 1 SELECTOR SWITCH" on "3." 7. Tune "BUFFER AMPLR PLATE" control for min reading on "METER 1," "METER 1 SELECTOR SWITCH" on "4." 8. Loosen front panel screw (directly above "MAIN TUNING" panel marking). Disengage dial gear (rear of front panel) and rotate until it reads 252 mc. Reengage and tighten gear. 9. Loosen "MAIN TUNING" dial lock and turn control to position 15 divisions (on knob skirt) below 225 mc dial calibration. Make dial lock finger tight. Rotate main tuning shaft stop collar to extreme counterclockwise position. Tighten set screw. (continued on the next page)

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
MAIN TUNING Control. Part I. (cont)		10. Reset "MAIN TUNING" dial to 252 m 11. Repeat tuning procedure steps 5, 6 and 7.
MAIN TUNING Control. Part II.	1. Tighten set-screws in universal of "MAIN TUNING" shaft. Do not turn control, except as necessary to get at set-screws. Make sure set-screws fall on shaft flats by revolving chain drive.	
NOTE The "DRIVER GRID," "DRIVER PLATE," "PA GRID," and "PA PLATE" controls are adjusted while tuned to a transmitter operating freq of 252 mc. Mechanical stops are adjusted so as to center the tuning range (90 divisions) of each of the controls properly.		
DRIVER GRID Control	1. Set "DRIVER GRID" control to extreme counterclockwise position. Rotate control back 45 divisions clockwise and make dial lock finger tight (control now at middle of range). 2. Remove collar at end of driver grid shaft, rear of grid casting cover. 3. Loosen universal at end of driver grid shaft. 4. Disengage driver spur gears, front of grid casting cover, by pushing sprocket shaft. 5. Turn driver gear to extreme clockwise position.	1. Rotate driver gear counterclockwise and "peak" at first increased reading encountered on "METER 1" when switch on position "5." 2. Reengage gears and reassemble by reversing steps 2 through 4 in adjacent column.
DRIVER PLATE Control	1. Remove driver plate worm wheel. 2. Set "DRIVER PLATE" control to extreme counterclockwise position. Rotate control back 45 divisions (clockwise) and make dial lock finger tight. Control is now at middle of its range.	1. Tune driver plate wiper arm shaft for min reading on "METER 1," position "7." 2. Replace worm wheel and tighten set-screws on shaft flats.
PA GRID Control	1. Remove power amplifier grid worm wheel. 2. Set "PA GRID" control to extreme counterclockwise position. Rotate control back 45 divisions (clockwise) and make dial lock finger tight. Control is now at middle of its range.	1. Tune power amplifier grid wiper arm shaft for max reading on "METER 1," position "6." 2. Replace worm wheel (without moving shaft) and tighten set-screws on shaft flats.

(continued on the next page

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
PA PLATE Control	1. Remove power amplifier plate worm wheel. 2. Set "PA PLATE" control to extreme counterclockwise position. Rotate control back 45 divisions (clockwise) and make dial lock finger tight. Control is now at middle of its range.	1. Tune power amplifier plate wiper arm shaft for max power on "METER 2." 2. Set "TUNE-OPERATE" switch to "OPERATE." Readjust power amplifier plate wiper arm for max power output on "METER 2." 3. Replace worm wheel and tighten set-screws on shaft flats.
OUTPUT COUPLING Control	1. Set "OUTPUT COUPLING" control to extreme clockwise position. 2. Remove rear air filter and larger of the two radiation screens. 3. Loosen the four No. 4 Bristo set-screws in output coupling loop collars figure 6-9).	1. Push coupling loop forward as far as it will go. 2. Retighten the four No. 4 Bristo set-screws in the output coupling loop collars.
Screen Modulator Potentiometers	1. Connect General Radio Type 874-MR Mixer Rectifier at "TO ANTENNA INPUT" connector, rear of transmitter (receive side of antenna relay normally connected to antenna input of a companion receiver); mixer rectifier thus driven with a sample of power from transmitter (due to leakage across antenna relay). Connect Hewlett-Packard VHF Signal Generator Model 608A and Dumont Oscilloscope No. 303 (via special transformer assembly) as shown in figure 6-2. 2. Connect output of Hewlett-Packard Audio Oscillator Model 200 to "LINE" terminals, rear of modulator-power supply. 3. Connect 10,000 ohm resistor between "HIGH V" and "GND.," test jacks J804 and J805, front of transmitter. 4. Connect hor input terminals of oscilloscope to J804 and J805 (J805 to "low" or "ground" side of hor input terminals).	1. "PA CUR" control R719: a. Tune up transmitter to 400 mc. b. Adjust R719 for 0.5 ma reading on "METER 1," position "8" (with transmitter tuned for min of 100 watts indication on "METER 2," with "TUNE-OPERATE" switch on "OPERATE"). 2. "MOD LIN" control R723: a. Retune transmitter to 225 mc. b. Adjust signal gen for max output at a freq approx 4 mc above or below transmitter output freq. c. Adjust oscilloscope vert amplifier gain control for max gain. d. Slowly readjust freq control of signal gen for max vert deflection on oscilloscope. e. If vert deflection more than two inches, reduce oscilloscope vert amplifier gain. f. Adjust audio osc controls for 1,000 cps and low output. g. Set "METER 2 SELECTOR SWITCH" to "% MOD." h. Adjust "GAIN" control (front of modulator-power supply) for 95 percent modulation indication on "METER 2." (continued on the next page)

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
Screen Modulator Potentiometers (cont)		i. Adjust oscilloscope hor amplifier gain control for hor deflection of approx two inches (external sweep). j. Repeat step d. k. Adjust R723 for linear modulation i.e., straight sided trapezoidal pattern on oscilloscope.
Monitor: Power Output Calibration Adjustment	1. Connect calibrated power output indicator (±5%) and dummy antenna at "TO ANTENNA" connector. Cable between "TO ANTENNA" connector and directional coupler (of power output indicator) must not exceed 8 inches in length.	1. Adjust "OUTPUT COUPLING" and "PA PLATE" controls for exactly 100 watts output indication on calibrated power output indicator. 2. Set "METER 2 SELECTOR SWITCH" on "CARRIER WATTS." 3. Adjust "PWR CAL" control R701 (right side of monitor-screen modulator) for indication of exactly 100 watts on "METER 2."
Monitor: Percent Modulation Calibration Adjustment	WARNING Make following connections with "POWER" switch on front of modulator-power supply turned "OFF." 1. Connect output of Hewlett-Packard Audio Oscillator Model 200 to "LINE" terminals, rear of modulator-power supply. 2. Connect 10,000 ohm resistor between "HIGH V" and "GND." test jacks J804 and J805, front of transmitter. 3. Set range switch of Triplett Model 630-A multimeter to 12 V AC. Connect leads (use "OUTPUT" and "COM" multimeter jacks) to J804 and J805.	1. Set audio osc amplitude control to "10" and set freq control on 1,000 cps. 2. Adjust "GAIN" control (front of modulator-power supply) for reading of 5.4 volts on multimeter. 3. Turn "PLATE" switch, front of modulator-power supply, to "OFF." 4. Reset multimeter range switch to 12 V DC. Use multimeter "V-Ω-A" and "COM" jacks. Leads to remain connected to J804 and J805. 5. Turn "PLATE" switch "ON" and note multimeter reading. 6. Calculate percentage modulation from formula: Percent modulation = $1.41 \frac{\text{a-c volts}}{\text{d-c volts}}$ 7. Set "METER 2 SELECTOR SWITCH" to "SET CAL" position.

(continued on the next pa

TABLE 6-12. TRANSMITTER ALIGNMENT (CONT)

Circuit	Pretuning Procedures	Tuning Procedures
Monitor: Percent Modulation Calibration Adjustment (cont)		8. Adjust "CALIBRATE" control for "CAL" on "METER 2." 9. Set "METER 2 SELECTOR SWITCH" to "% MOD" position. 10. Adjust "MOD CAL" control R716 until "METER 2" indicates calculated value of percentage modulation. R716 is located on right side of monitor-screen modulator. 11. Turn "POWER" switch "OFF." Disconnect test equipment.

6-35. MAINTENANCE AND INSPECTION SCHEDULE.

6-36. Preventive maintenance should be performed at the intervals indicated in Table 6-13, unless these intervals are reduced by the local commander. This is in addition to the Inspection Schedule of Table 5-5.

6-37. OVERHAUL SCHEDULE. The nature of the components comprising the equipment is such, that regular overhaul is not required.

TABLE 6-13. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE

Component	Inspection	Time
Modulator-Power Supply and Radio Transmitter	Check minimum performance as per Table 6-1, steps 1 through 9.	Quarterly
Crystal Oven A601 and Crystal Y601	Check prongs for corrosion.	Quarterly
Modulator-Power Supply and Radio Transmitter	a. Inspect all tubes for cracks in the glass bulb and base and for bent and broken prongs. Clean with carbon tetrachloride; if necessary, clean prongs with crocus cloth. Test tubes with tube tester. b. Inspect fuse ends for evidence of burning, corrosion, and looseness. Clean fuse ends with clean cloth. c. Make sure base of pilot lamps are not loose. d. Carefully clean all chassis that are accessible by removal of dust cover. e. Check meter selector switches, S701 and S802, for dirt, corrosion, loose contacts, and unsatisfactory operation. f. Check multiple connectors for dirt, corrosion, and loose contacts. g. Check "GAIN," "LIMITER THRESHOLD," "CALIBRATE," and "SIDE TONE" output gain (R705) controls for unsatisfactory electrical and mechanical operation.	Semi-annually

(continued on the next page)

TABLE 6-13. PREVENTIVE MAINTENANCE AND INSPECTION SCHEDULE (CONT)

Component	Inspection	Time
Modulator-Power Supply and Radio Transmitter (cont)	h. After the equipment has been thoroughly and carefully cleaned, make visual inspection of parts and wiring for rust, corrosion, loose connections, frayed and burned insulation, loose screws, burned and charred resistors and coils. Check tube sockets for broken contacts, terminal boards for broken lugs and signs of burning. Inspect and tighten all loose control dial set-screws. i. Check MFP (moisture-fungus proof) coatings for breaks. Retouch with brush if necessary; use TUF-ON-74 MFP varnish or equivalent.	
Modulator-Power Supply and Radio Transmitter	Check minimum performance as per Table 6-1, all steps.	Annually

6-38. FLIGHT TEST FOR ENTIRE SYSTEM.

6-39. PURPOSE. The purpose of the flight test is to provide proof of equipment performance.

6-40. SCOPE. The flight test is limited to a technical evaluation of equipment performance and is not intended to provide facility check.

6-41. APPLICATIONS. Flight test of this equipment is required after initial installation, modification resulting in deviation from original operational standards, and after overhaul.

6-42. CONDITIONS.

a. This equipment will meet T. O. specifications with particular emphasis on transmitter power output. Transmitter power output will be checked prior to and after the completion of the flight test. The variation between the beginning and the end of the flight test will not exceed 1%.

b. Aircraft altitude — maximum.

c. The flight pattern will be radial from the site until loss of communications occurs. Determine maximum range of communications for communications evaluation. This range will not be less than 130 nautical miles.

d. Equipment in aircraft utilized in the flight test will meet T. O. specifications with particular emphasis on receiver sensitivity. Receiver sensitivity will be tested prior to and after completion of the flight test. The variation between the beginning and the end of the flight test will not exceed 1%.

e. The activity supporting the aircraft utilized in the flight test will furnish performance figures of receiver sensitivity of the airborne equipment prior to and after the completion of the flight test, to the activity whose equipment is being flight tested.

f. There will be a minimum of one flight.

6-43. RECORDS.

a. The following data will be recorded on the flight test report:

1. Organization (facility being tested).
2. Type of test (after installation, modification, o overhaul).
3. Date of flight test.
4. Altitude of aircraft at time of test.
5. Type and serial number of aircraft used flight test.
6. Flight number (1st, 2nd, etc.).
7. Type of airborne equipment used in flight tes
8. Serial number of airborne equipment.
9. Type of airborne antenna utilized.
10. Airborne receiver sensitivity (prior to and aft completion of flight test).
11. Type of ground antenna utilized.
12. Ground component serial numbers.
13. Frequency utilized in flight test.
14. Ground transmitter power output (prior to a after completion of flight test).
15. Maximum range of communications recorded

b. One report for each radial flight is required.

c. Completed copies of the flight test report will prepared at the activity being checked and will made a permanent part of the facility acceptan records.

d. AFTO Form 73 will be utilized in recording th flight test data.

6-44. PROCUREMENT OF FORMS.

a. The subject AFTO Form will be procured, required, in accordance with the procedures contain within Air Force Manual 67-1 for implementation the test prescribed by this technical order.

6-45. DISTRIBUTION OF FORMS.

a. Distribution of filled-in AFTO Form 73 will as follows:

1. One copy to plant in place records.
2. Two copies to the installation activity.
3. One copy to the cognizant major command.
4. One copy to the activity supporting the te aircraft.

6-46. DISPOSITION OF FORMS.

a. AFTO Form 73 will be disposed of as prescrib in AFM 181-5, Chapter 3, Section C, paragraph 126

GROUND - AIR COMMUNICATIONS FLIGHT TEST REPORT

ORGANIZATION	DATE

TYPE OF TEST

☐ AFTER INSTALLATION ☐ AFTER MODIFICATION ☐ AFTER OVERHAUL

AIRCRAFT

SERIAL NR	TYPE	ALTITUDE	FLIGHT NR
		ft.	

AIRBORNE EQUIPMENT DATA

TYPE	SERIAL NR	ANTENNA TYPE

TRANSMITTER POWER OUTPUT		RECEIVER SENSITIVITY	
WATTS *(Prior to test)*	WATTS *(After test)*	UVOLTS INPUT FOR RATED OUTPUT *(Prior to test)*	UVOLTS INPUT FOR RATED OUTPUT *(After test)*

GROUND EQUIPMENT DATA

COMPONENT TYPES	SERIAL NUMBERS
TRANSMITTER ANTENNA TYPE	RECEIVER ANTENNA TYPE

TRANSMITTER POWER OUTPUT		RECEIVER SENSITIVITY	
WATTS *(Prior to test)*	WATTS *(After test)*	UVOLTS INPUT FOR RATED OUTPUT *(Prior to test)*	UVOLTS INPUT FOR RATED OUTPUT *(After test)*

FLIGHT TEST DATA

FREQUENCY UTILIZED	MAXIMUM RANGE OF COMMUNICATIONS RECORDED ☐ ☐ NAUTICAL MILES

REMARKS

PREPARED BY *(Name & Title)*	SIGNATURE

AFTO FORM 15 APR 56 73

SECTION VII

DIAGRAMS

7-1. GENERAL.

7-2. This section contains schematic and wiring diagrams used as reference material for the text and necessary for the servicing of this equipment. In addition voltage and resistance charts are present to facilitate trouble shooting. Other information, su as typical response curves and characteristics various circuits, is included so that factory test co ditions can be re-established.

TABLE 7-1. STATE OF RELAYS UNDER OPERATING CONDITIONS

Relay Ref Symbol	Initial 60 Sec*	"POWER" On "PLATE" Off	"POWER" & "PLATE" On, Carrier Off**	"POWER" & "PLATE" On, Carrier On***	Function
K101	E	N	N	N	Time delay.
O-101 (K102)	N	E	E	E	Replaces K101 after initial 60 second time delay.
O-201 (K201)	N	N	N	E	Plate transformer connector.
O-801	N	N	N	E	Push-to-talk.
O-901	N	N	N	E	Transmit-receive antenna switching.

Note: "N" - De-energized "E" - Energized

* After turning "POWER" switch "ON".

** Push-to-talk relay de-energized (S302 on "PUSH TO TALK" position, "MIKE" button open).

*** Push-to-talk relay energized, i.e., S302 set to "CARRIER ON" position (or to "PUSH TO TALK" position with "MIKE" button depressed).

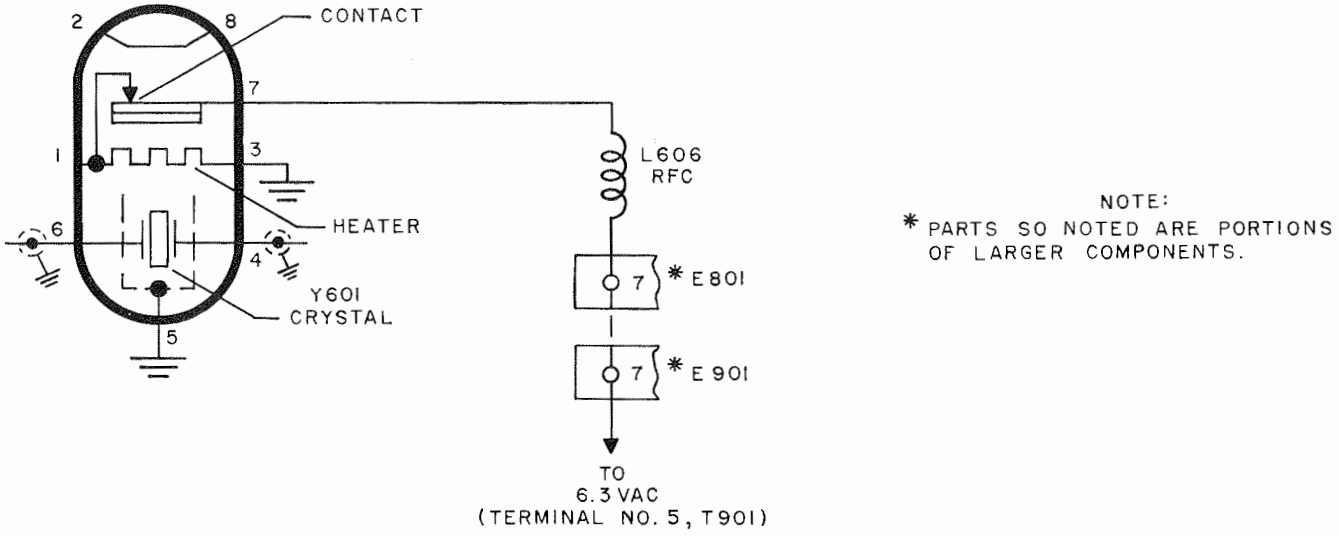


Figure 7-1. Radio Transmitter, Crystal Oven Control, Simplified Schematic

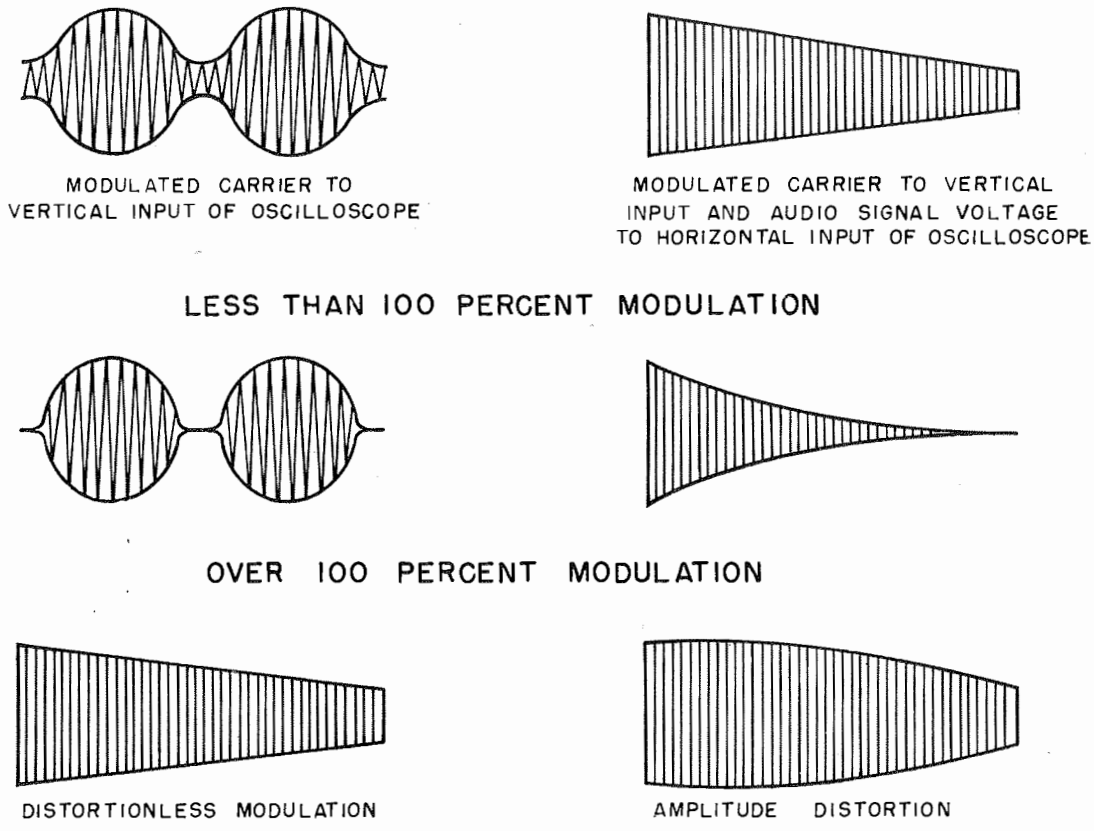


Figure 7-2. Modulated Carrier, Wave Form Diagrams

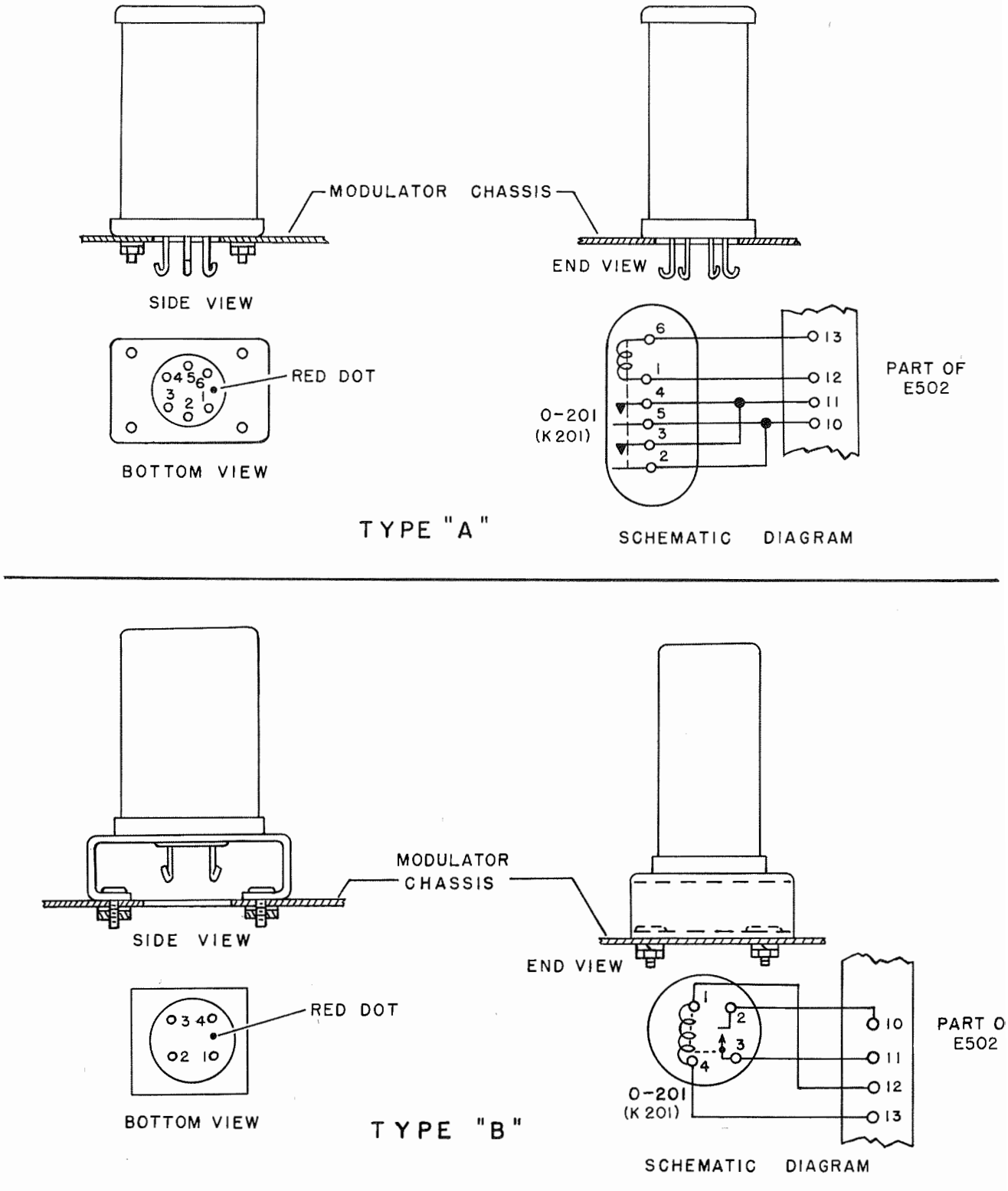


Figure 7-3. Modulator-Power Supply, Mounting and Connection of Plate Relay

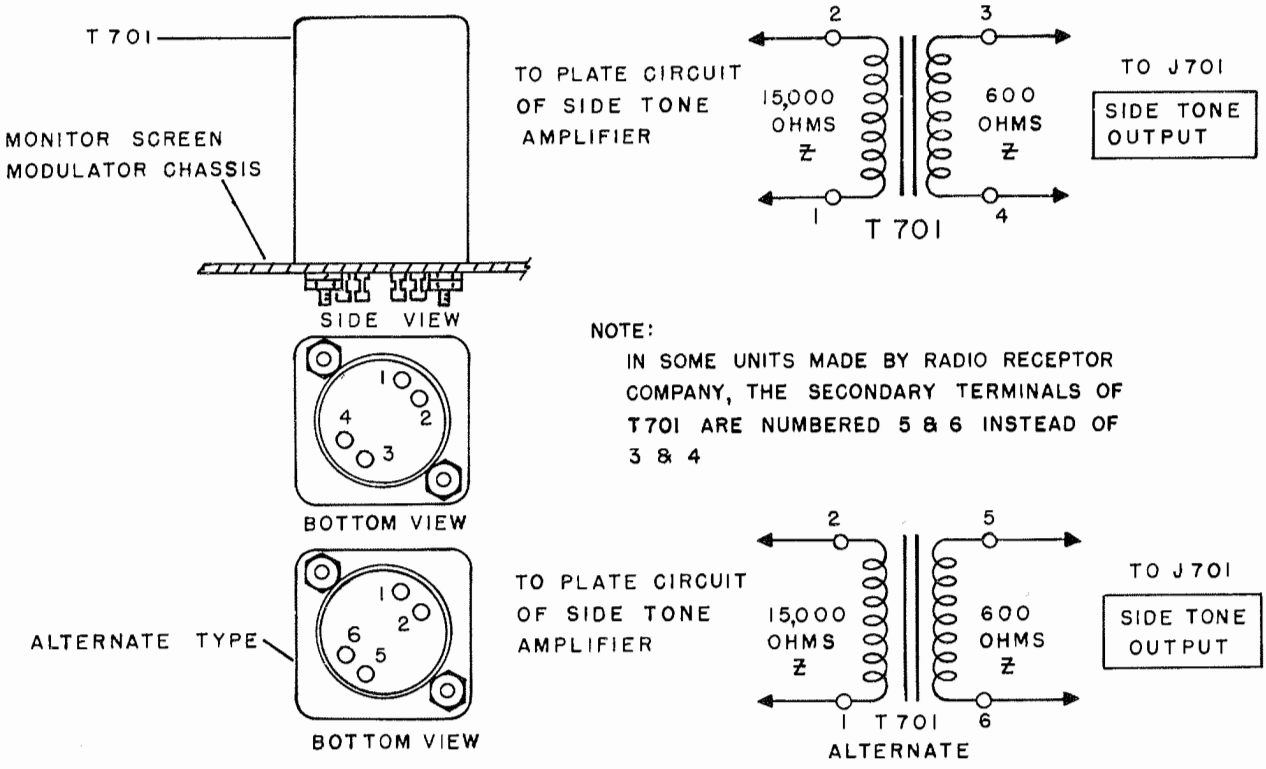


Figure 7-4. Radio Transmitter, Mounting and Connection of Side Tone Output Transformer

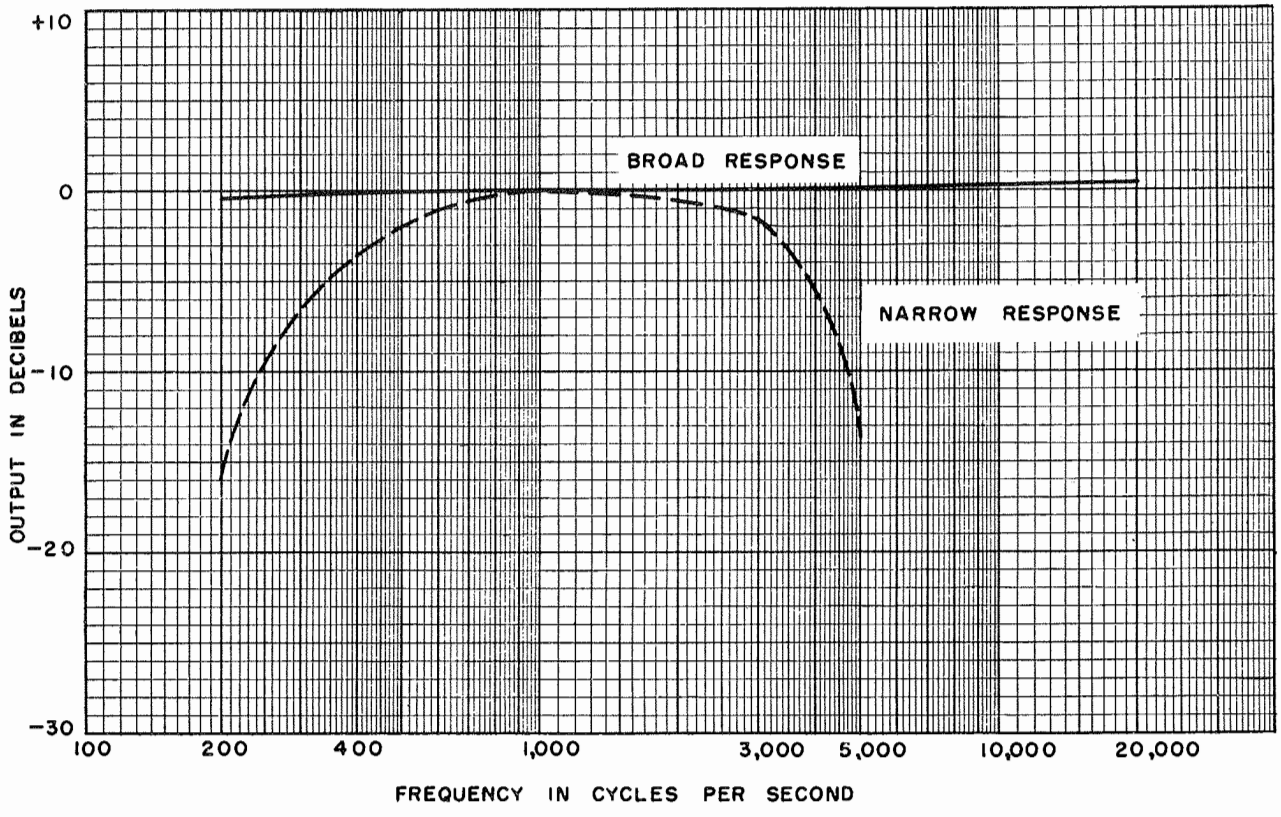


Figure 7-5. Radio Transmitter and Modulator-Power Supply, Typical Frequency Response

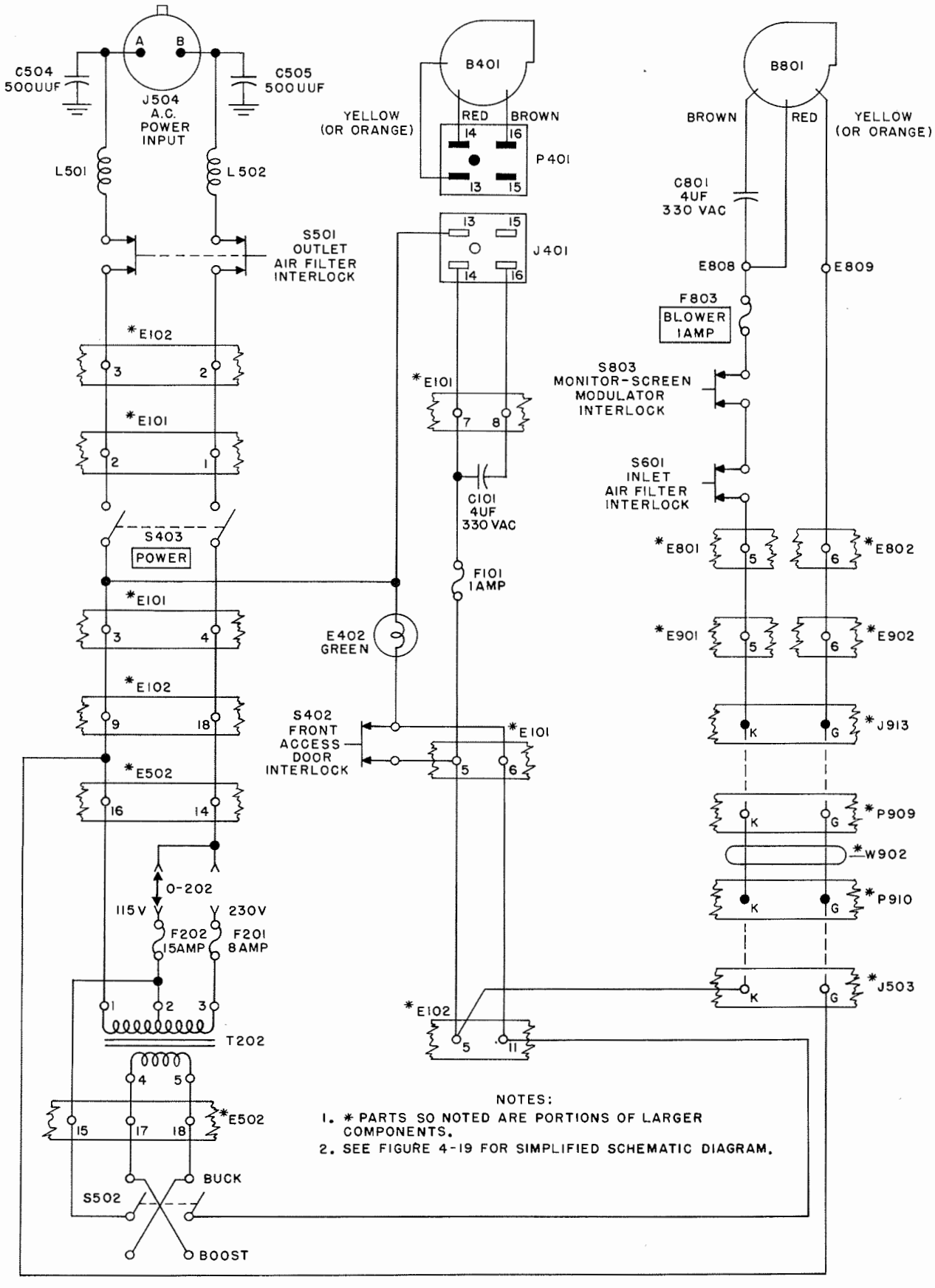


Figure 7-6. Blower Motor Control, Schematic Diagram

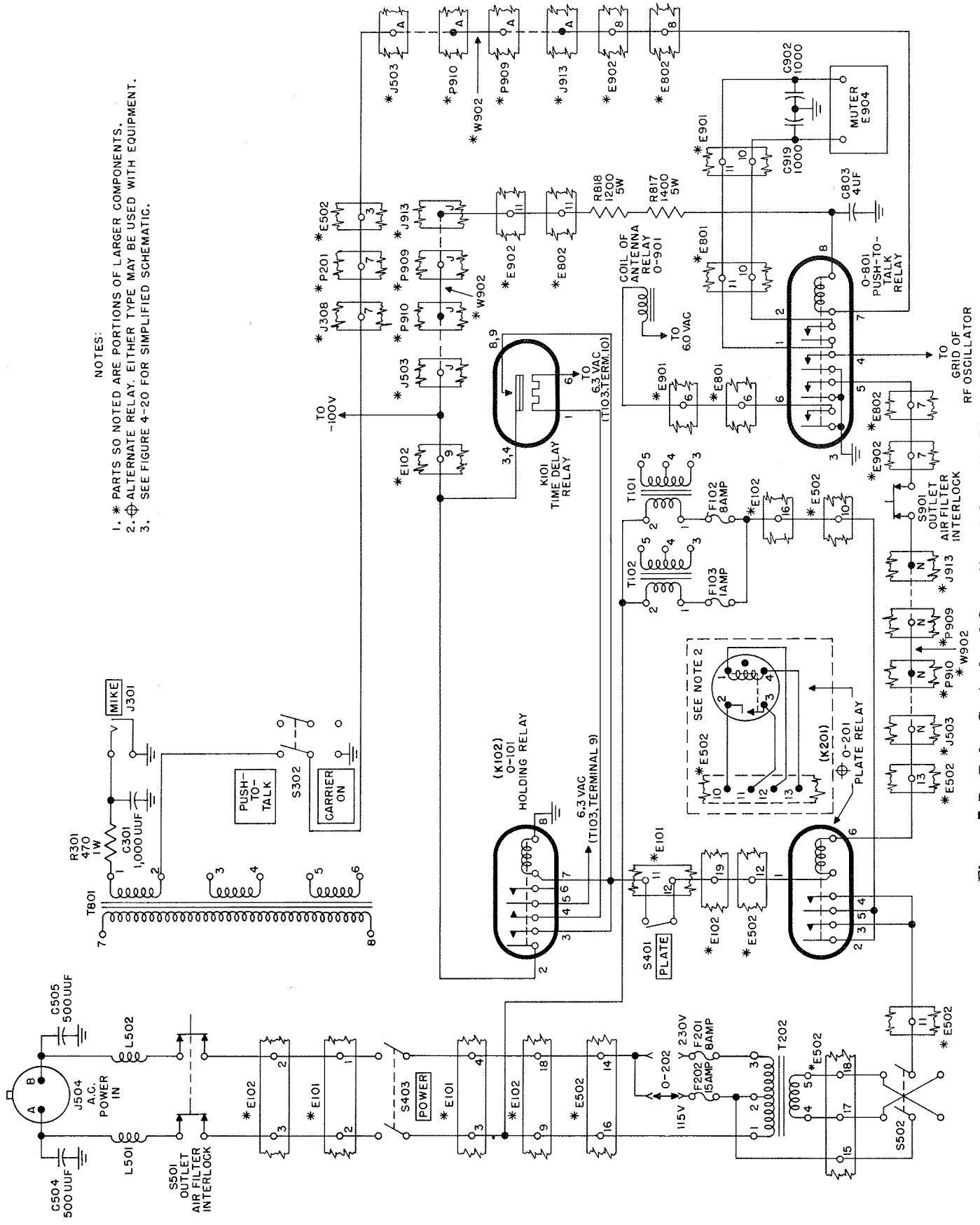
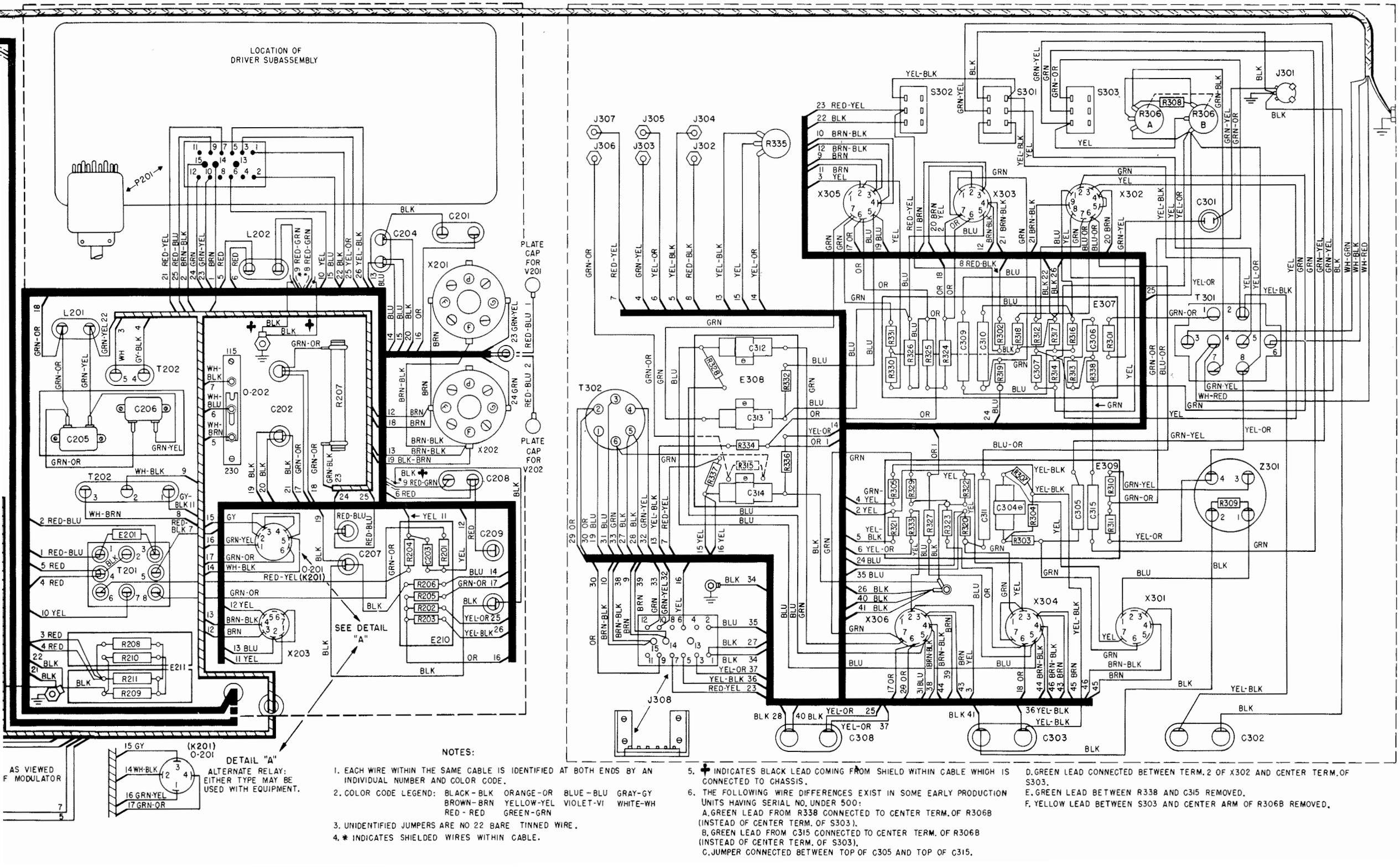


Figure 7-7. Relay Control and Operation, Schematic Diagram

MODULATOR CHASSIS

DRIVER SUBASSEMBLY



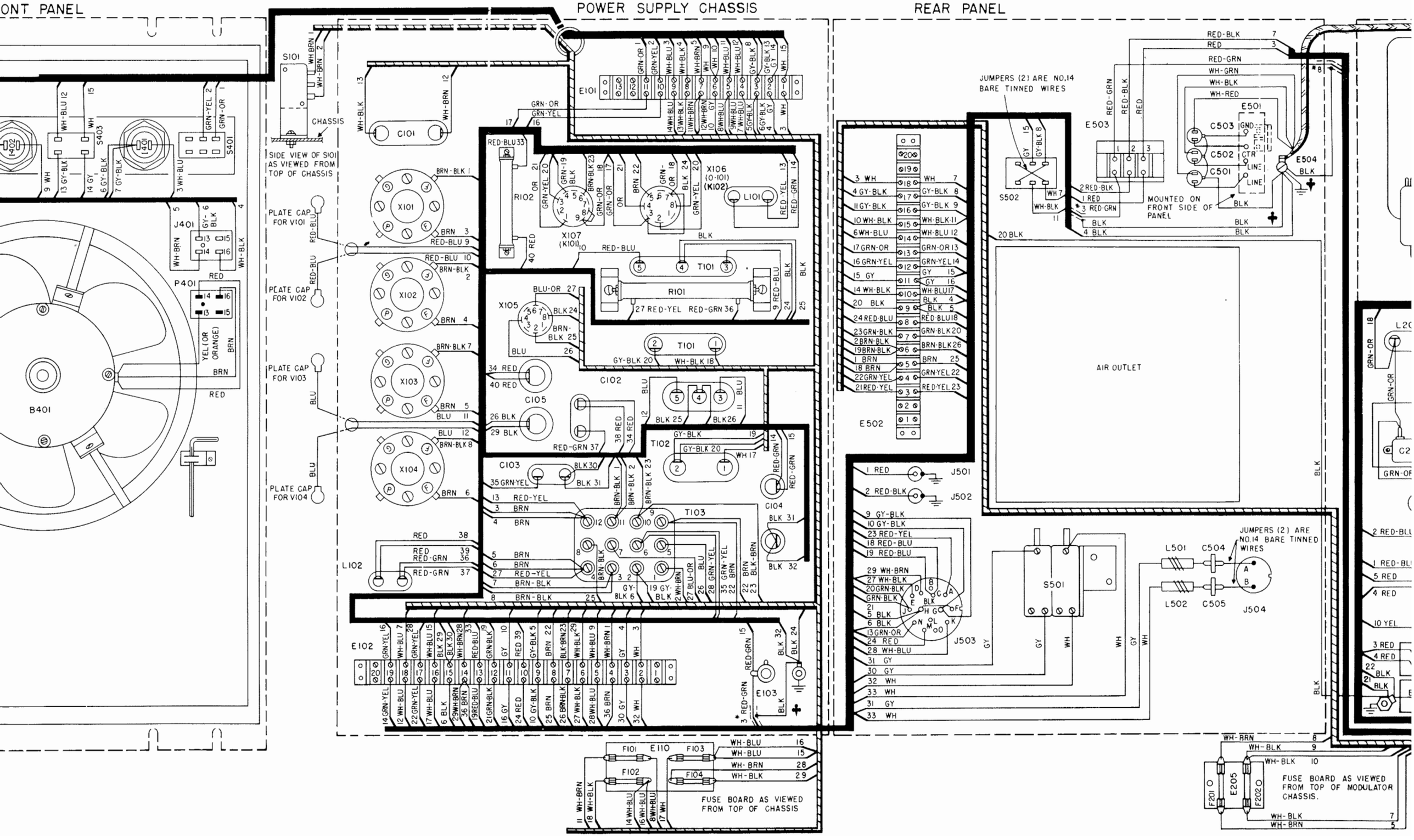
NOTES:

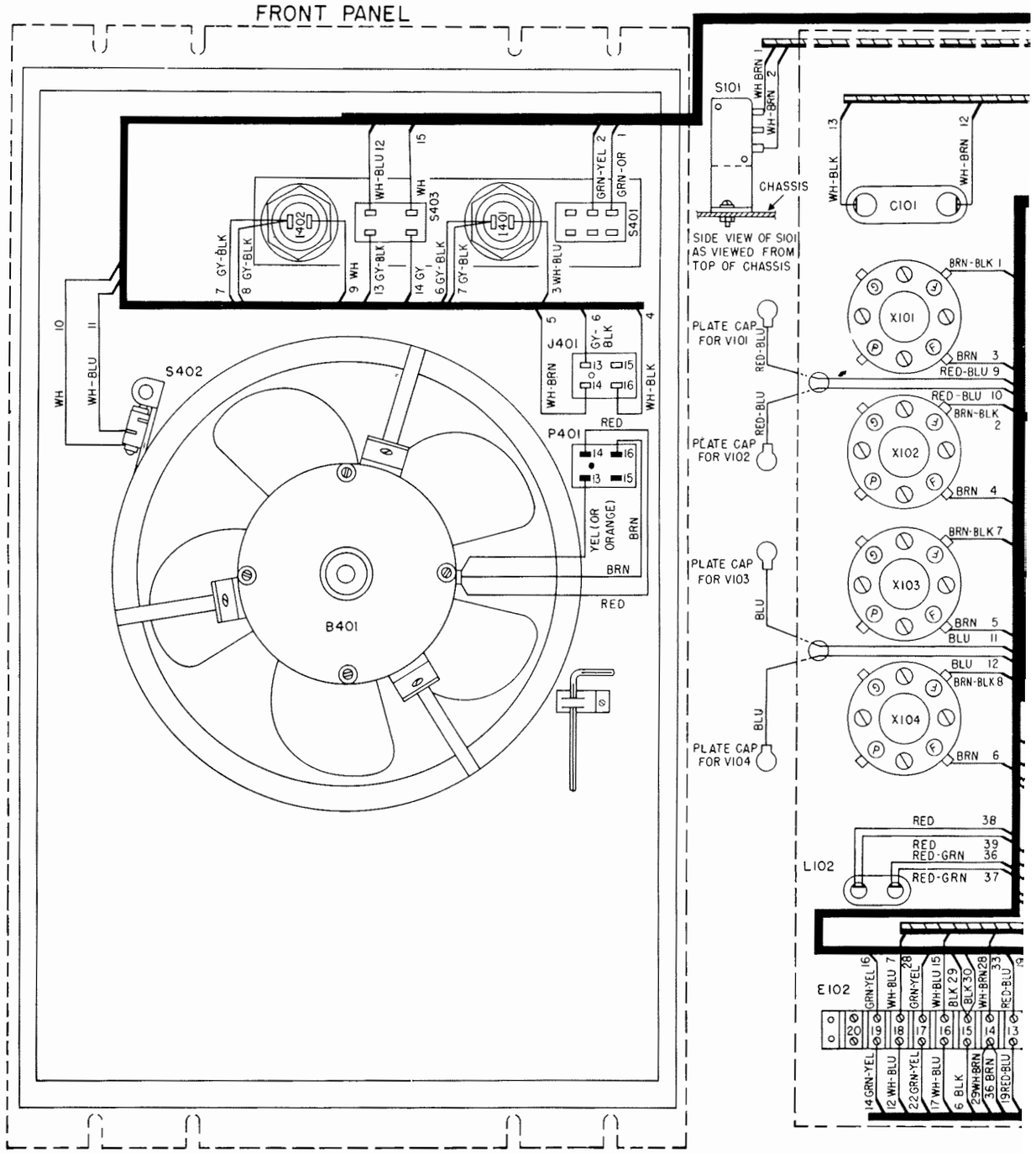
1. EACH WIRE WITHIN THE SAME CABLE IS IDENTIFIED AT BOTH ENDS BY AN INDIVIDUAL NUMBER AND COLOR CODE.
2. COLOR CODE LEGEND: BLACK - BLK, ORANGE - OR, BLUE - BLU, GRAY - GY, BROWN - BRN, YELLOW - YEL, VIOLET - VI, WHITE - WH, RED - RED, GREEN - GRN
3. UNIDENTIFIED JUMPERS ARE NO 22 BARE TINNED WIRE.
4. * INDICATES SHIELDED WIRES WITHIN CABLE.
5. ✚ INDICATES BLACK LEAD COMING FROM SHIELD WITHIN CABLE WHIGH IS CONNECTED TO CHASSIS.
6. THE FOLLOWING WIRE DIFFERENCES EXIST IN SOME EARLY PRODUCTION UNITS HAVING SERIAL NO. UNDER 500:
   A. GREEN LEAD FROM R338 CONNECTED TO CENTER TERM. OF R306B (INSTEAD OF CENTER TERM. OF S303).
   B. GREEN LEAD FROM C315 CONNECTED TO CENTER TERM. OF R306B (INSTEAD OF CENTER TERM. OF S303).
   C. JUMPER CONNECTED BETWEEN TOP OF C305 AND TOP OF C315.
   D. GREEN LEAD CONNECTED BETWEEN TERM. 2 OF X302 AND CENTER TERM. OF S303.
   E. GREEN LEAD BETWEEN R338 AND C315 REMOVED.
   F. YELLOW LEAD BETWEEN S303 AND CENTER ARM OF R306B REMOVED.

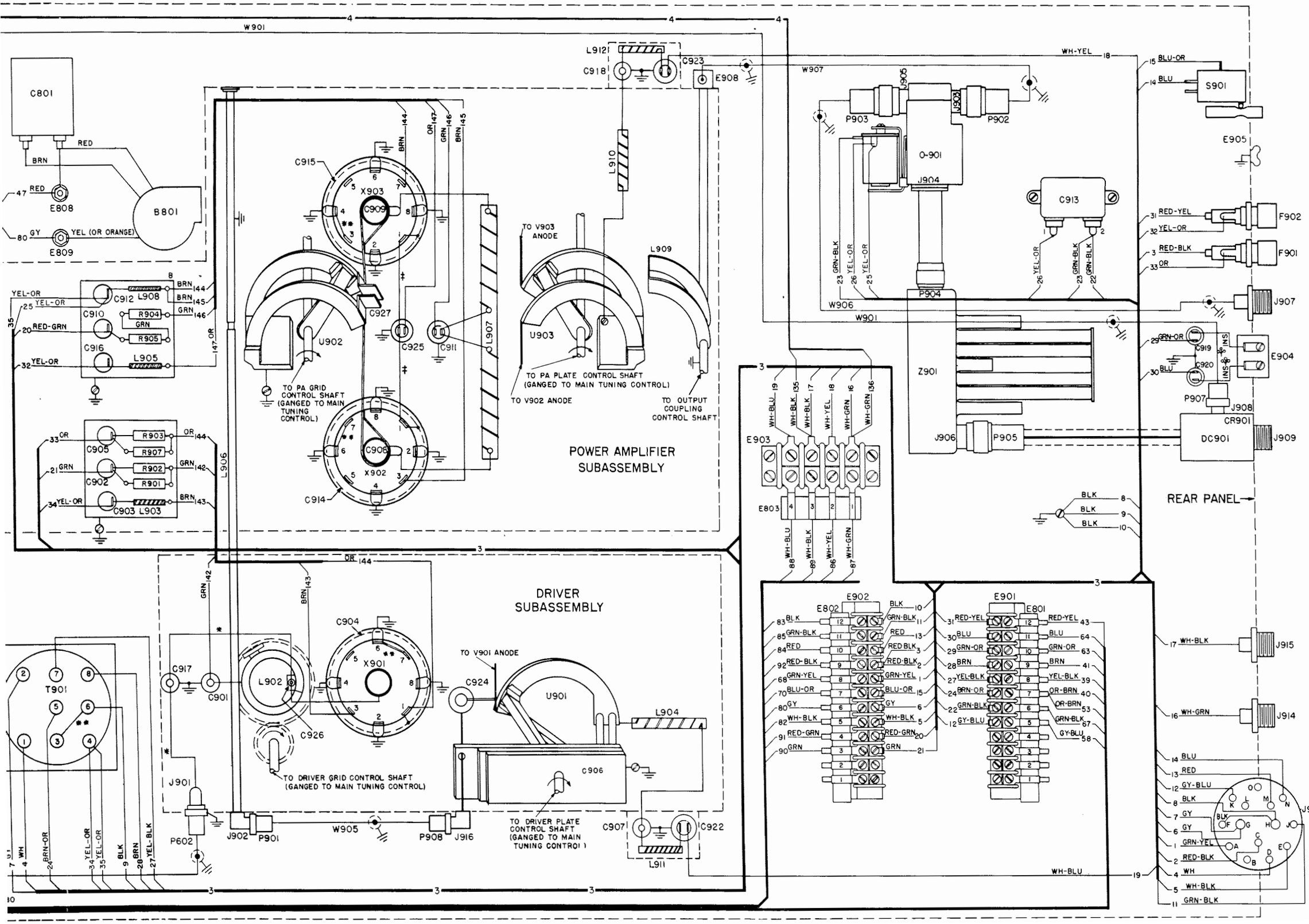
ONT PANEL

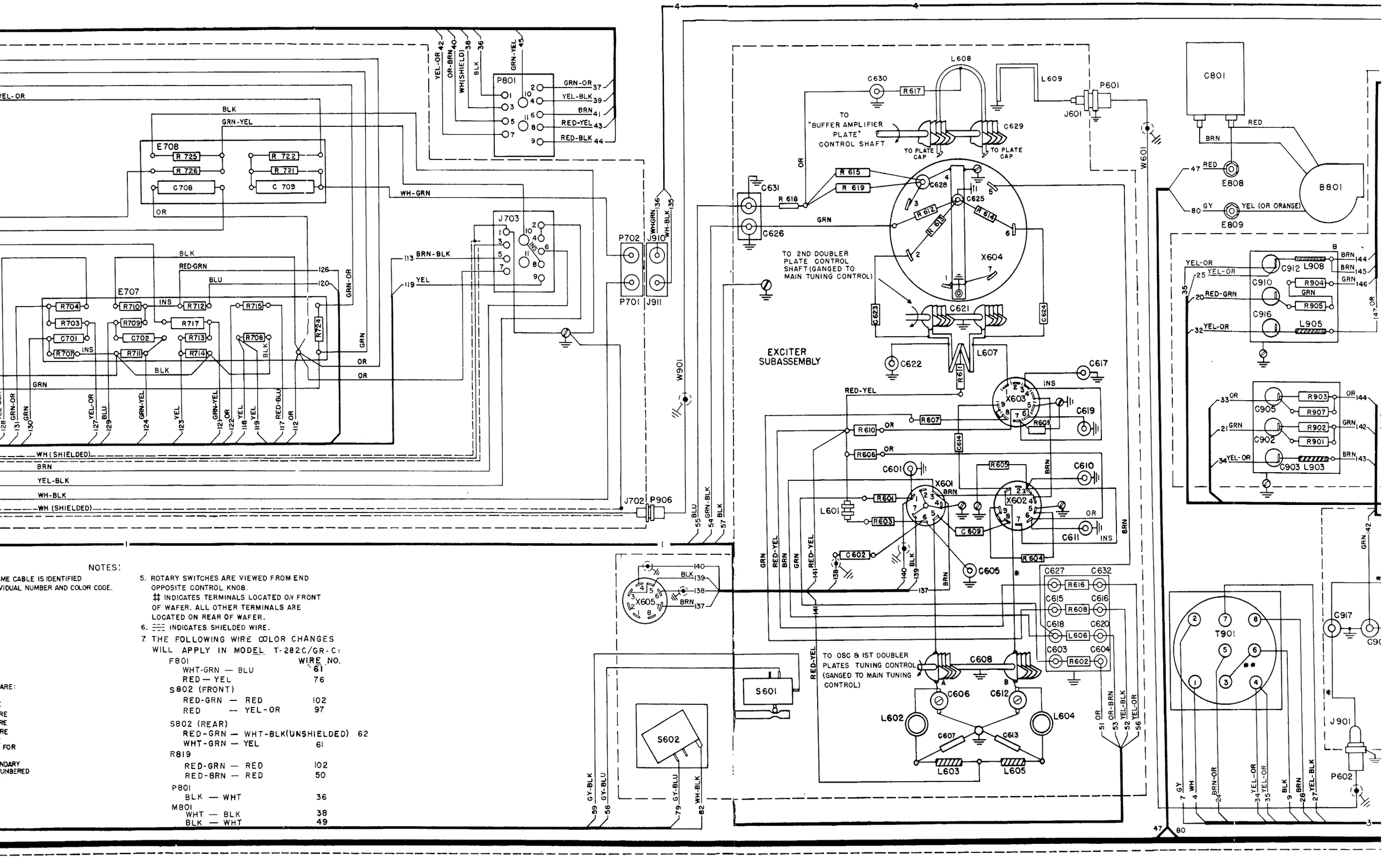
POWER SUPPLY CHASSIS

REAR PANEL




FRONT PANEL
S101
WH BRN 1
WH-BRN 2
CHASSIS
SIDE VIEW OF S101 AS VIEWED FROM TOP OF CHASSIS
WH-BLK 13
WH-BRN 12
C101
WH-BLU 12
15
GRN-YEL 2
GRN-OR 1
S403
S401
1402
1401
7 GY-BLK
8 GY-BLK
9 WH
13 GY-BLK
14 GY
6 GY-BLK
7 GY-BLK
3 WH-BLU
10
11
WH
WH-BLU
S402
5
GY- 6
BLK
4
J401
WH-BRN
WH-BLK
13
15
14
16
RED
P401
14
16
13
15
YEL (OR ORANGE)
BRN
BRN
RED
B401
BRN-BLK 1
X101
PLATE CAP FOR V101
RED-BLU
BRN 3
RED-BLU 9
RED-BLU 10
BRN-BLK 2
X102
PLATE CAP FOR V102
BRN 4
BRN-BLK 7
X103
PLATE CAP FOR V103
BLU
BRN 5
BLU 11
BLU 12
BRN-BLK 8
X104
PLATE CAP FOR V104
BLU
BRN 6
RED 38
RED 39
RED-GRN 36
RED-GRN 37
L102
E102
GRN-YEL 16
WH-BLU 7
28
GRN-YEL
WH-BLU 15
BLK 29
BLK 30
WH-BRN 28
33
RED-BLU
20
19
14 GRN-YEL
12 WH-BLU
22 GRN-YEL
17 WH-BLU
6 BLK
29 WH-BRN
36 BRN
19 RED-BLU


W901
C801
RED
BRN
47 RED
E808
B801
80 GY
YEL (OR ORANGE)
E809
C915
X903
C909
L910
L912
C918
C923
E908
W907
WH-YEL
18
P903
J905
J903
P902
O-901
J904
P904
C913
W906
W901
TO V903 ANODE
L909
U903
TO PA PLATE CONTROL SHAFT (GANGED TO MAIN TUNING CONTROL)
TO V902 ANODE
TO OUTPUT COUPLING CONTROL SHAFT
POWER AMPLIFIER SUBASSEMBLY
C912 L908
C910
R904
GRN
R905
C916
L905
YEL-OR
RED-GRN
C927
U902
C925
C911
L907
TO PA GRID CONTROL SHAFT (GANGED TO MAIN TUNING CONTROL)
C905
R903
R907
C902
R902
R901
C903 L903
L906
X902
C908
C914
Z901
E903
WH-BLU
WH-BLK
WH-YEL
WH-GRN
E803
J906
P905
DC901
J909
CR901
J908
P907
C919
C920
INS
E904
J907
F902
F901
S901
E905
BLU-OR
BLU
RED-YEL
YEL-OR
RED-BLK
OR
GRN-OR
REAR PANEL
BLK
DRIVER SUBASSEMBLY
C904
X901
C917
C901
L902
C926
TO DRIVER GRID CONTROL SHAFT (GANGED TO MAIN TUNING CONTROL)
TO V901 ANODE
C924
U901
L904
C906
TO DRIVER PLATE CONTROL SHAFT (GANGED TO MAIN TUNING CONTROL)
C907
C922
L911
T901
J901
P602
J902
P901
W905
P908
J916
E902
E802
E901
E801
J915
J914
J913
WH-BLK
GRN-BLK
GRN-YEL
RED-BLK
GY
GY-BLU



NOTES:

ME CABLE IS IDENTIFIED
VIDUAL NUMBER AND COLOR CODE.

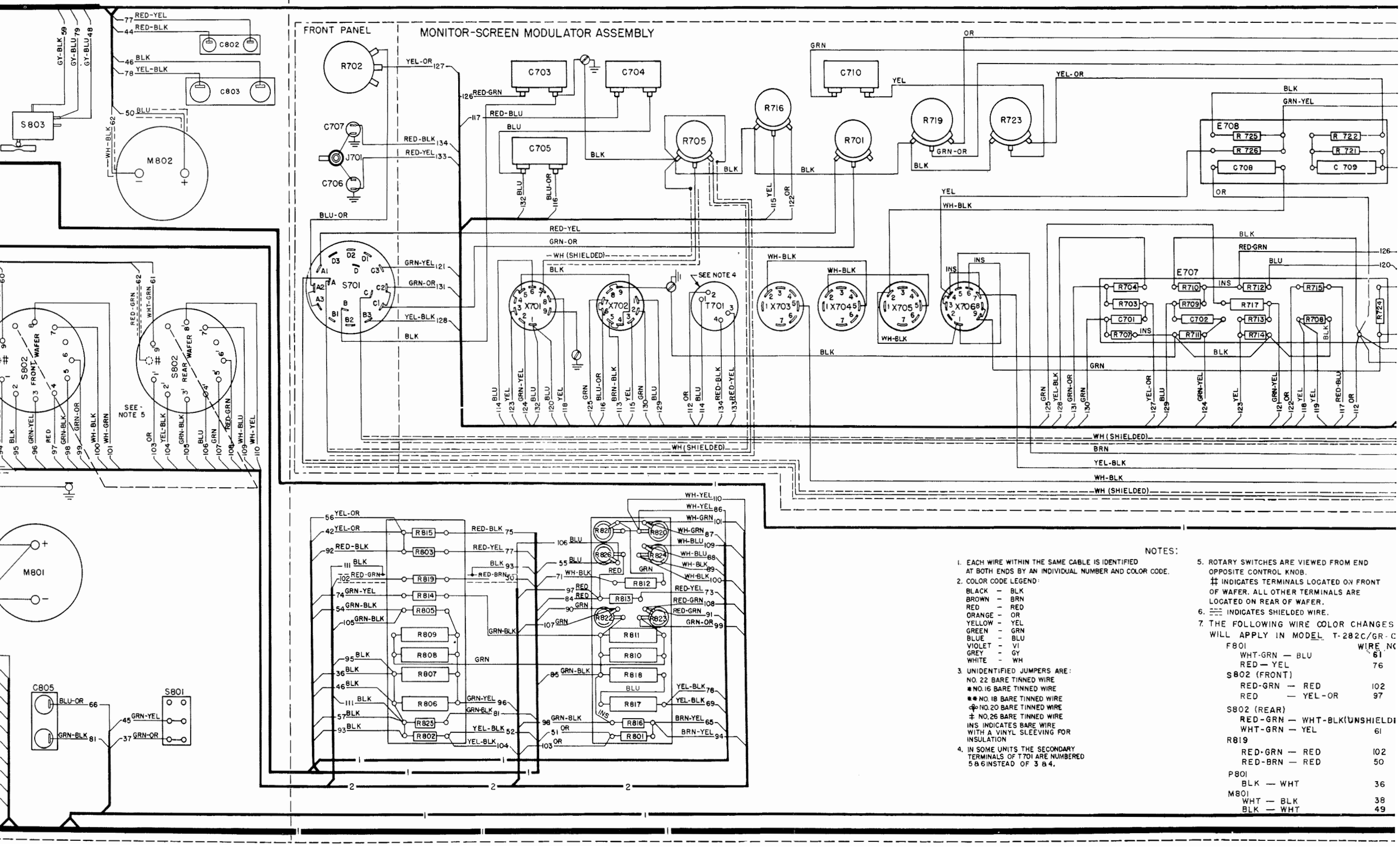
ARE:

FOR

NDARY
UMBERED

5. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
   # INDICATES TERMINALS LOCATED ON FRONT OF WAFER. ALL OTHER TERMINALS ARE LOCATED ON REAR OF WAFER.
6. ⋍⋍ INDICATES SHIELDED WIRE.
7. THE FOLLOWING WIRE COLOR CHANGES WILL APPLY IN MODEL T-282C/GR-C:

	WIRE NO.
F801	
WHT-GRN — BLU	61
RED — YEL	76
S802 (FRONT)	
RED-GRN — RED	102
RED — YEL-OR	97
S802 (REAR)	
RED-GRN — WHT-BLK(UNSHIELDED)	62
WHT-GRN — YEL	61
R819	
RED-GRN — RED	102
RED-BRN — RED	50
P801	
BLK — WHT	36
M801	
WHT — BLK	38
BLK — WHT	49



NOTES:

1. EACH WIRE WITHIN THE SAME CABLE IS IDENTIFIED AT BOTH ENDS BY AN INDIVIDUAL NUMBER AND COLOR CODE.
2. COLOR CODE LEGEND:

BLACK	–	BLK
BROWN	–	BRN
RED	–	RED
ORANGE	–	OR
YELLOW	–	YEL
GREEN	–	GRN
BLUE	–	BLU
VIOLET	–	VI
GREY	–	GY
WHITE	–	WH

3. UNIDENTIFIED JUMPERS ARE:
   NO. 22 BARE TINNED WIRE
   * NO. 16 BARE TINNED WIRE
   ** NO. 18 BARE TINNED WIRE
   ⊕ NO. 20 BARE TINNED WIRE
   ‡ NO. 26 BARE TINNED WIRE
   INS INDICATES BARE WIRE WITH A VINYL SLEEVING FOR INSULATION
4. IN SOME UNITS THE SECONDARY TERMINALS OF T701 ARE NUMBERED 5 & 6 INSTEAD OF 3 & 4.
5. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
   # INDICATES TERMINALS LOCATED ON FRONT OF WAFER. ALL OTHER TERMINALS ARE LOCATED ON REAR OF WAFER.
6. ⫴ INDICATES SHIELDED WIRE.
7. THE FOLLOWING WIRE COLOR CHANGES WILL APPLY IN MODEL T-282C/GR-C

	WIRE NO
F801	
WHT-GRN — BLU	61
RED — YEL	76
S802 (FRONT)	
RED-GRN — RED	102
RED — YEL-OR	97
S802 (REAR)	
RED-GRN — WHT-BLK (UNSHIELDED)	
WHT-GRN — YEL	61
R819	
RED-GRN — RED	102
RED-BRN — RED	50
P801	
BLK — WHT	36
M801	
WHT — BLK	38
BLK — WHT	49

NOTES:
1. * PARTS SO NOTED ARE PORTIONS OF LARGER COMPONENTS.
2. ⊕ ALTERNATE RELAY. EITHER TYPE MAY BE USED WITH EQUIPMENT.
3. FOR SIMPLIFIED SCHEMATICS SEE FIGURES 4-14, 4-15, 4-16, 4-18.

BIAS SUPPLY RECTIFIER V105 5R4WGY

TO TIME DELAY RELAY K101 AND HOLDING RELAY O-101 (K102)

C505 500 UUF

L502

S501 OUTLET AIR FILTER INTERLOCK

S602 AIR INTERLOCK

S803 MONITOR-SCREEN MODULATOR INTERLOCK

S601 INLET AIR FILTER INTERLOCK

E801* E901*

E101* S402 FRONT ACCESS DOOR INTERLOCK

F201 8 AMP

T202

E502*

P909* P910* J503* E102* F104 3 AMP E102* E102* S101 AIR INTERLOCK T103

W902*

J913* P909* P910* J503*

E902* E802*

V702 12AX7 V701 12AT7 J703* P801*

T901 FILAMENT TRANSFORMER

E901* E801* L606

O-901* O-801*

V601 6AH6 V602 5763 V603 5763 V604 832A

6.3 V

L903 L908

6.0 V

V901 4X150A V902 4X150A V903 4X150A

6.0 V

V706 5763

E901* E801* P801* J703*

E901* E801* P801* J703*

TO TERMINAL 12 ON E502

TO TERMINAL 13 ON E502

(K201) O-201 PLATE RELAY

E502* SEE NOTE 2

ALTERNATE PLATE RELAY

E502* E102*

C103 4 UF

E102* E502* L201 16.7 H R207 900 E502*

C206 0.1 UF C205 .05 UF C202 10 UF

R203 47K R205 47K R202 100K C201 2 UF

P201* J308*

C303 2 UF C308 2 UF

TO V301 TO V302

J503* P910* W902* P909* J913* E902* E802*

R814 200K J807 BIAS TEST JACK

TO V901 GRID

R818 1200 R817 1400 C803 4 UF

TO PUSH-TO-TALK RELAY O-801 AND MICROPHONE CIRCUIT

R816 100K

TO V601 GRID

R810 2000 R811 2000

TO POWER AMPL GRID

R808 1300 R809 1300

TO V604 GRID

R806 1600 R807 1600

HV RECTIFIER V101 3B28

HV RECTIFIER V102 3B28

LV RECTIFIER V103 3B28

LV RECTIFIER V104 3B28

F102 8 AMP T101

F103 1 AMP T102

X X' Y Y'

L101 2H E103 E503* L202 2.5 H +850 V TO T201

C104 10 UF C209 8 UF C208 1 UF

R209 240K R210 240K R208 240K R211 240K

E503* J501 H.V. UNMOD

J806 MED V +300 V (RED)

R813 500K

R101 350 L102 6.25 H

C102 .4 UF C105 10 UF R102 350

E102* J503* P910* W902* P909* J913* E902* E802*

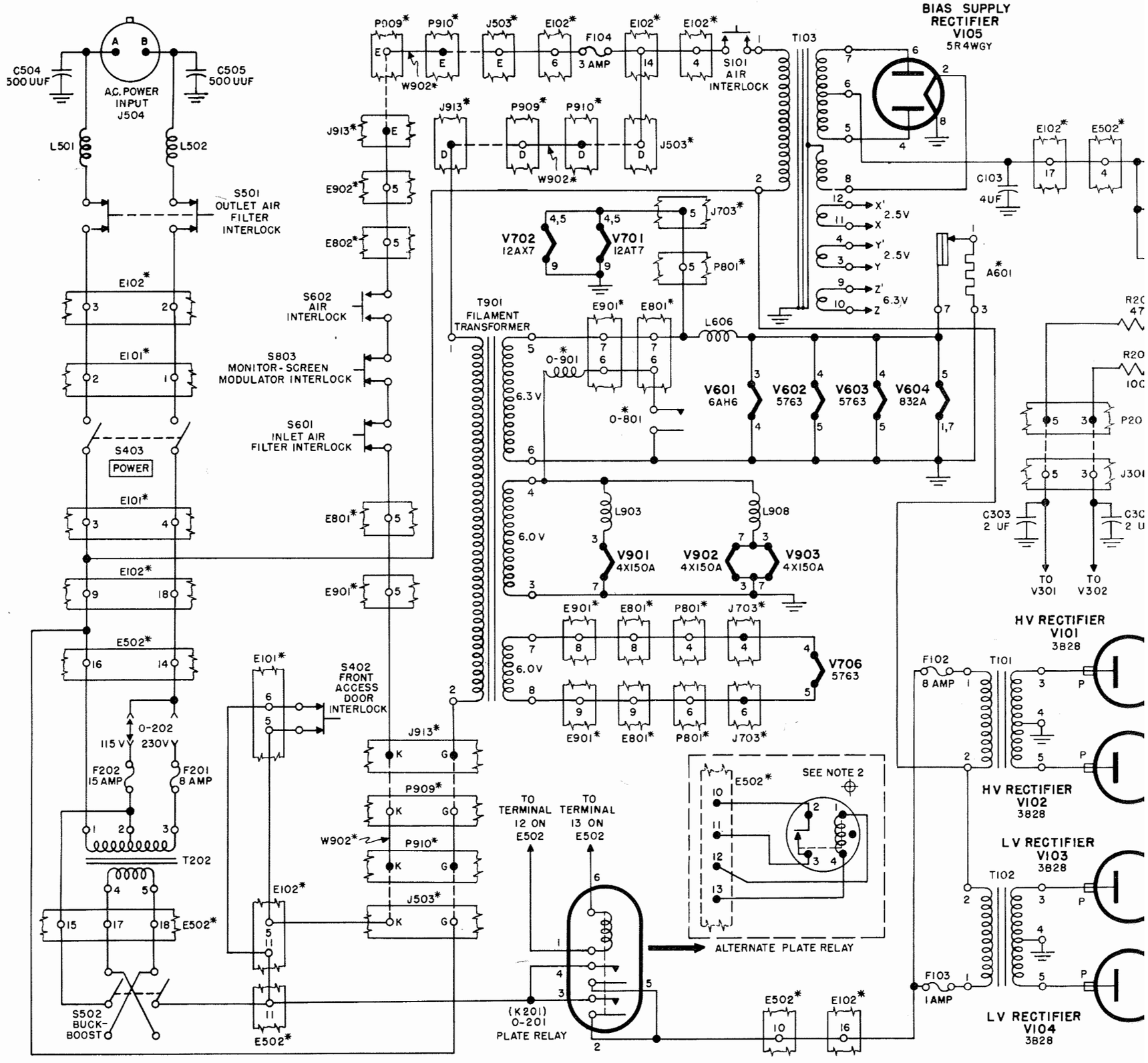
+300 V +250 V

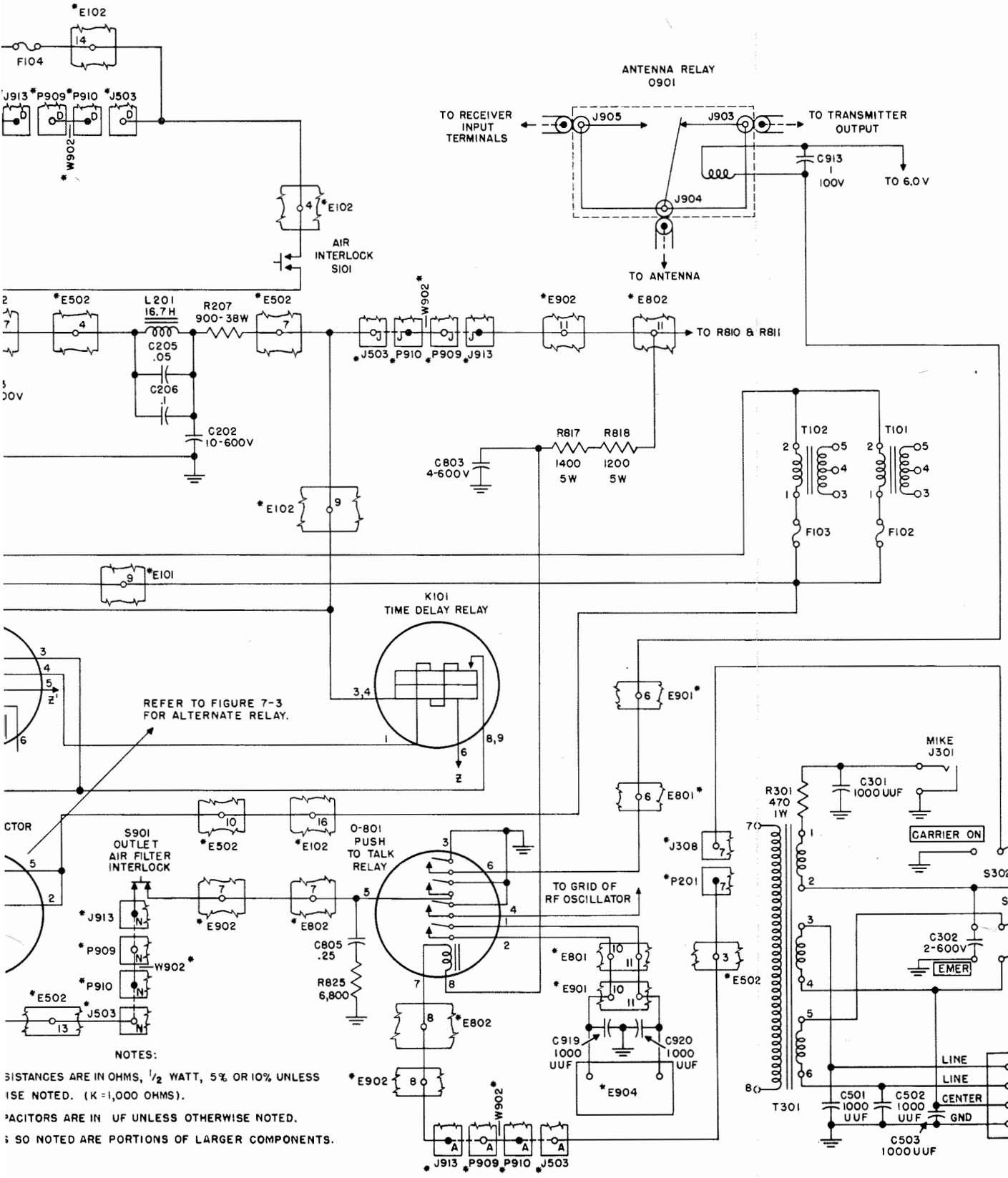
E502* P201* J308*

C207 10 UF +250 V

R815 500K

J808 LOW V +250 V (RED)


BIAS SUPPLY RECTIFIER V105 5R4WGY
C504 500 UUF
C505 500 UUF
AC. POWER INPUT J504
L501
L502
S501 OUTLET AIR FILTER INTERLOCK
S602 AIR INTERLOCK
S803 MONITOR-SCREEN MODULATOR INTERLOCK
S601 INLET AIR FILTER INTERLOCK
S403 POWER
S402 FRONT ACCESS DOOR INTERLOCK
S502 BUCK-BOOST
0-202
115 V 230 V
F202 15 AMP
F201 8 AMP
T202
F104 3 AMP
S101 AIR INTERLOCK
T103
T901 FILAMENT TRANSFORMER
W902*
V702 12AX7
V701 12AT7
A601
C103 4UF
X' 2.5V
X
Y' 2.5V
Y
Z' 6.3V
Z
L606
0-901
0-801
V601 6AH6
V602 5763
V603 5763
V604 832A
L903
L908
V901 4X150A
V902 4X150A
V903 4X150A
V706 5763
6.3 V
6.0 V
TO TERMINAL 12 ON E502
TO TERMINAL 13 ON E502
(K201) 0-201 PLATE RELAY
SEE NOTE 2
ALTERNATE PLATE RELAY
C303 2 UF
C30 2 U
TO V301
TO V302
HV RECTIFIER V101 3828
HV RECTIFIER V102 3828
LV RECTIFIER V103 3828
LV RECTIFIER V104 3828
F102 8 AMP
F103 1 AMP
T101
T102



NOTES:

RESISTANCES ARE IN OHMS, 1/2 WATT, 5% OR 10% UNLESS OTHERWISE NOTED. (K = 1,000 OHMS).

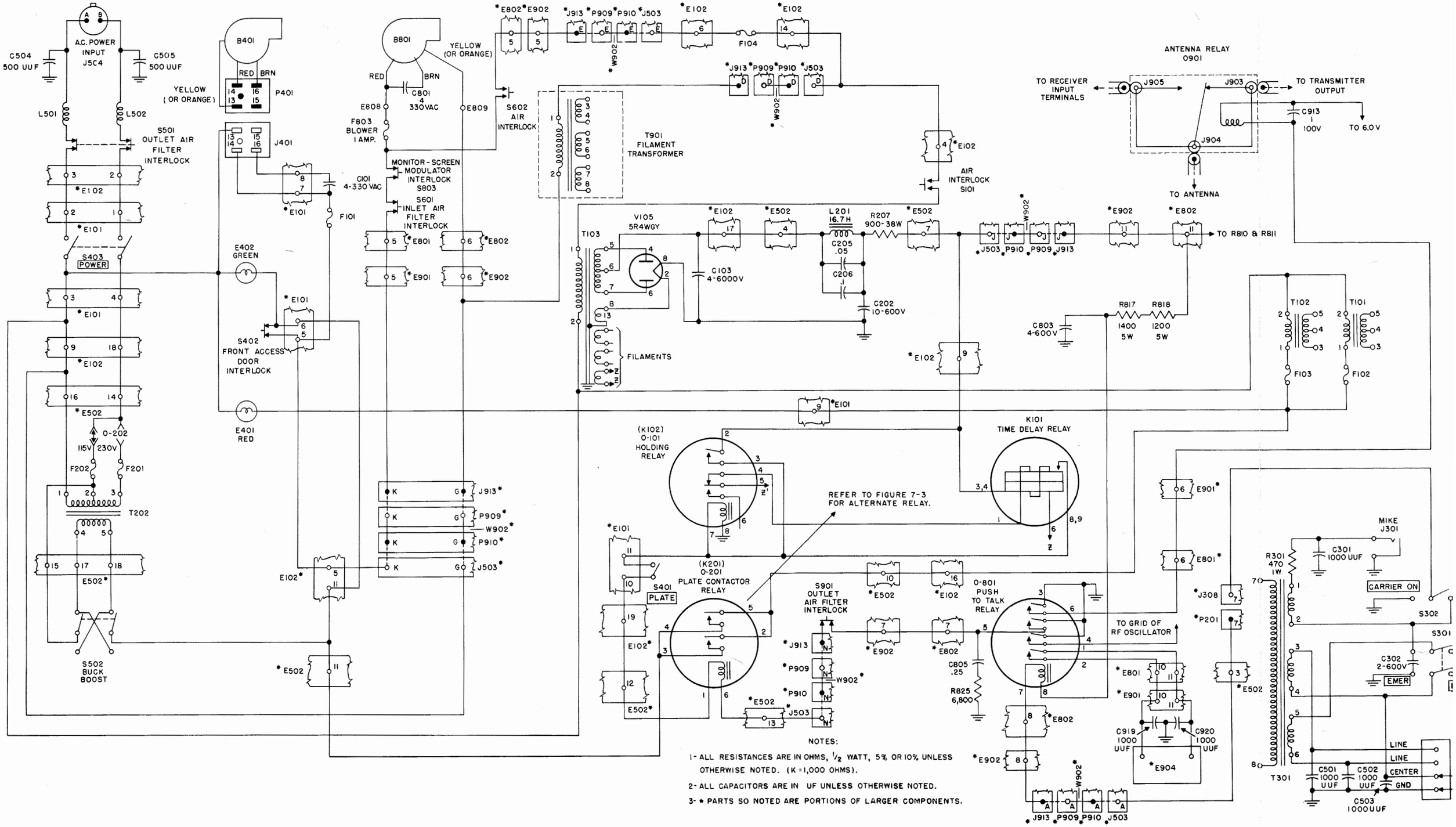
CAPACITORS ARE IN UF UNLESS OTHERWISE NOTED.

ITEMS SO NOTED ARE PORTIONS OF LARGER COMPONENTS.

B401
RED BRN
P401
YELLOW (OR ORANGE)
J401
E401 RED
E402 GREEN
S402 FRONT ACCESS DOOR INTERLOCK
E101
F101
C101 4-330 VAC
B801
YELLOW (OR ORANGE)
RED BRN
C801 .4 330 VAC
E808
E809
F803 BLOWER 1 AMP.
S602 AIR INTERLOCK
MONITOR-SCREEN MODULATOR INTERLOCK S803
S601 INLET AIR FILTER INTERLOCK
E801
E802
E901
E902
E102
F104
J913 P909 P910 J503
W902
T101 FILAMENT TRANSFORMER
AIR INTERLOCK S101
E502
L201 16.7 H
R207 900-38W
C205 .05
C206 .1
C202 10-600V
C103 4-6000V
J503 P910 P909 J913
ANTENNA RELAY K901
TO RECEIVER INPUT TERMINALS
J903
TO TRANSMITTER OUTPUT
C913 .1 100V
TO 6.0 V
J904
TO ANTENNA
TO R810 & R811
C803 4-600V
R817 1800 5W
R818 1800 5W
T102
T101
F103
F102
K101 TIME DELAY RELAY
REFER TO FIGURE 7-3 FOR ALTERNATE RELAY.
(K201) O-201 PLATE CONTACTOR RELAY
S901 OUTLET AIR FILTER INTERLOCK
O-801 PUSH TO TALK RELAY
TO GRID OF RF OSCILLATOR
C805 .25
R825 6,800
C919 1000 UUF
C920 1000 UUF
E904
J913 P909 P910 J503
W902
E901
E801
J308
P201
MIKE J301
C301 1000 UUF
R301 470 1W
CARRIER ON
S302
S301
C302 2-600V
EMER
NC
T301
C501 1000 UUF
C502 1000 UUF
C503 1000 UUF
LINE
LINE
CENTER
GND

NOTES:

1. ALL RESISTANCES ARE IN OHMS, 1/2 WATT, 5% OR 10% UNLESS OTHERWISE NOTED. (K = 1,000 OHMS).
2. ALL CAPACITORS ARE IN UF UNLESS OTHERWISE NOTED.
3. * PARTS SO NOTED ARE PORTIONS OF LARGER COMPONENTS.



NOTES:

1- ALL RESISTANCES ARE IN OHMS, 1/2 WATT, 5% OR 10% UNLESS OTHERWISE NOTED. (K = 1,000 OHMS).

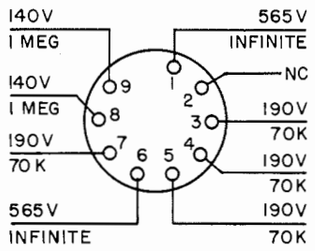
2- ALL CAPACITORS ARE IN UF UNLESS OTHERWISE NOTED.

3- * PARTS SO NOTED ARE PORTIONS OF LARGER COMPONENTS.

Figure 7-11. Power Distribution and Control Circuits, Schematic

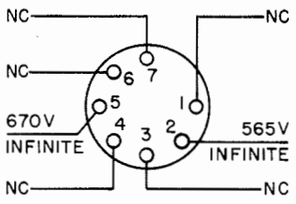
MONITOR–SCREEN MODULATOR ASSEMBLY

SCREEN MODULATOR V706
5763

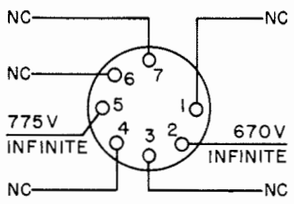


VOLTAGE REGULATORS

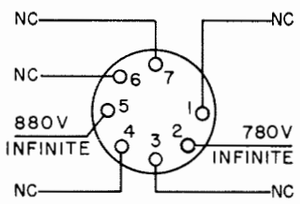
V 705
OB2 OR OB2WA



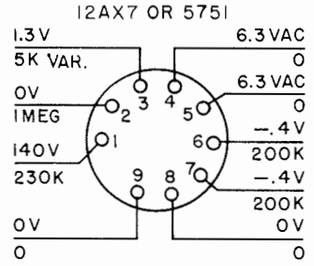
V 704
OB2 OR OB2WA



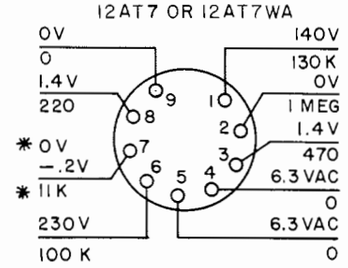
V 703
OB2 OR OB2WA



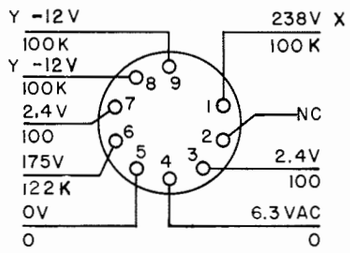
MODULATION MONITOR AMPL & MODULATION MONITOR RECT V702
12AX7 OR 5751



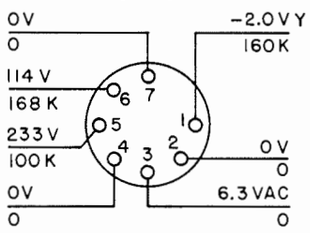
SIDE TONE AMPL & MODULATION MONITOR AMPL V701
12AT7 OR 12AT7WA



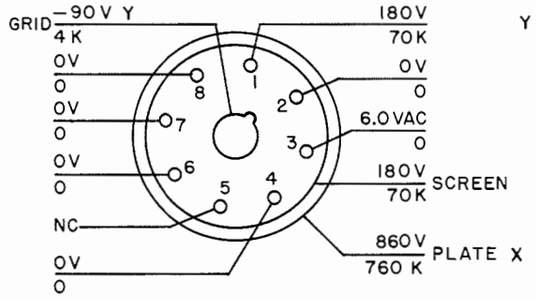
IST DOUBLER V602
5763



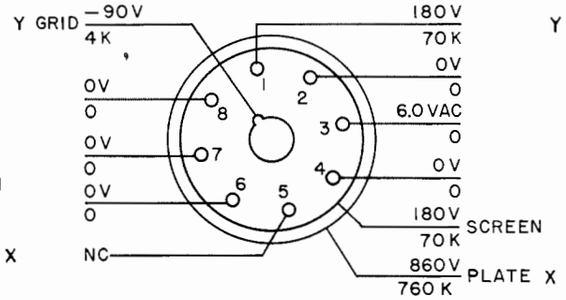
OSC TRIPLER V601
6AH6



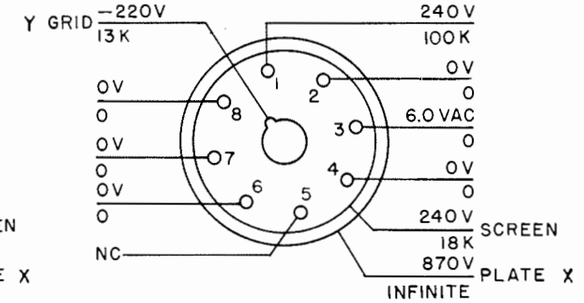
POWER AMPLIFIER V903
4X150A



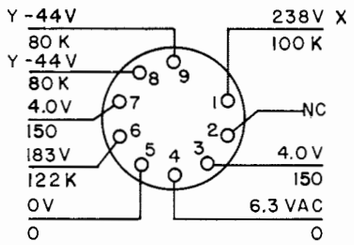
POWER AMPLIFIER V902
4X150A



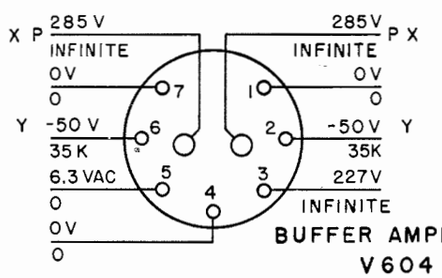
TRIPLER–DRIVER V901
4X150A



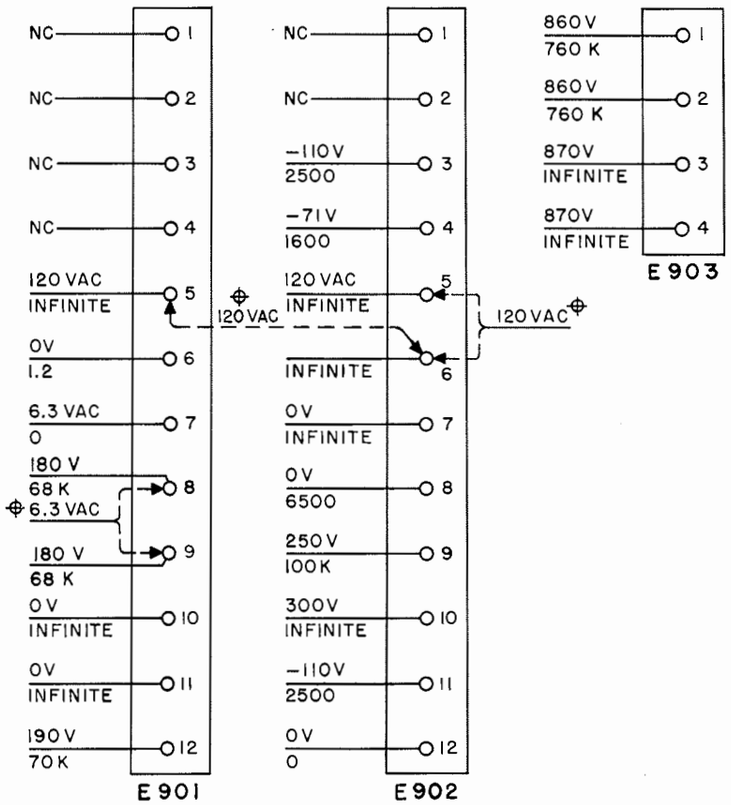
2D DOUBLER V603
5763



BUFFER AMPLIFIER V604
832A



EXCITER SUBASSEMBLY

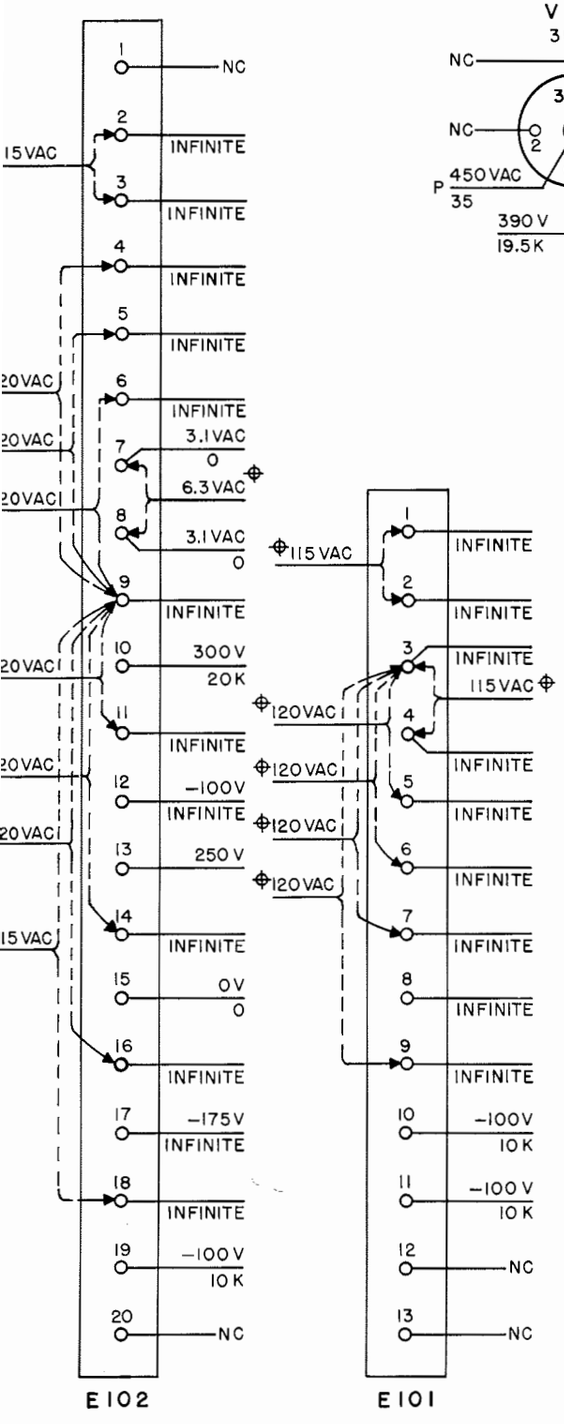


MEASUREMENT CONDITIONS:

1. ALL RESISTANCE MEASUREMENTS MADE WITH INTERCONNECTING CABLES DISCONNECTED.
2. THE SUPPLY VOLTAGE AT 115V, 60 CPS.
3. THE BUCK–BOOST SWITCH SET TO THE BOOST POSITION.
4. THE GAIN AND LIMITER THRESHOLD CONTROLS IN THE EXTREME COUNTERCLOCKWISE POSITIONS.
5. THE NARROW–BROAD SWITCH SET TO THE NARROW POSITION.
6. THE NORMAL–EMER SWITCH SET TO THE NORMAL POSITION.
7. METER 2 SELECTOR SWITCH SET TO THE CARRIER WATTS POSITION.
8. NO AUDIO SIGNAL INPUT AT THE MIKE JACK OR THE LINE TERMINALS.
9. THE PUSH TO TALK–CARRIER ON SWITCH SET TO THE CARRIER ON POSITION.
10. THE TUNE–OPERATE SWITCH SET TO THE OPERATE POSITION.
11. THE TRANSMITTER ADJUSTED FOR AN OUTPUT OF 100 WATTS AT 399 MC.
12. ALL VOLTAGES MEASURED WITH A TRIPLETT MULTIMETER MODEL 630-A, OR EQUAL (20,000 OHMS PER VOLT). RANGE SWITCH SET SO THAT READINGS FALL IN THE UPPER OR RIGHT–HAND HALF OF THE SCALE WHEREVER POSSIBLE.

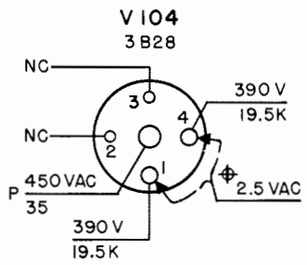
NOTES:

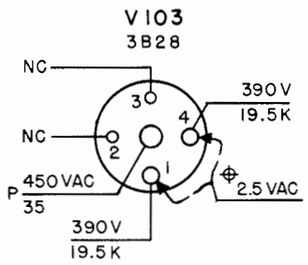
1. ALL VOLTAGES ARE DC EXCEPT WHERE OTHERWISE NOTED.
2. ALL MEASUREMENTS ARE WITH RESPECT TO GROUND EXCEPT WHERE OTHERWISE NOTED.
3. ALL RESISTANCE VALUES ARE IN OHMS (K=1,000 OHMS, 1 MEG=1,000,000 OHMS).
4. NC INDICATES NO CONNECTION.
5. * INDICATES VOLTAGE IS DEPENDENT ON SETTING OF SIDE TONE OUTPUT GAIN CONTROL R 705.
6. ⊕ INDICATES VOLTAGES MEASURED BETWEEN POINTS INDICATED.
7. P INDICATES PLATE CAP.
8. Y 33K CARBON ISOLATION RESISTOR ATTACH TO PROBE END.
9. X PULL OUT CRYSTAL OVEN Y601 FOR THIS MEASUREMENT OR R.F. VOLTAGE MAY BURN OUT METER.

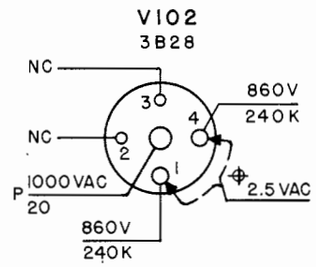


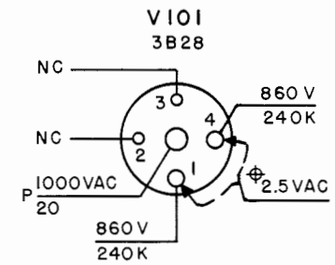
POWER SUPPLY CHASSIS

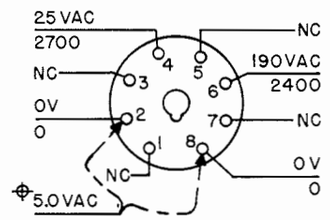
HIGH VOLTAGE RECTIFIERS







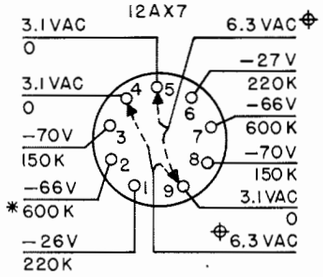




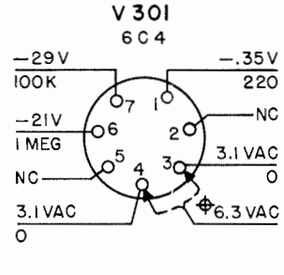
BIAS SUPPLY RECTIFIER
V105
5R4WGY

AUDIO DRIVER CHASSIS

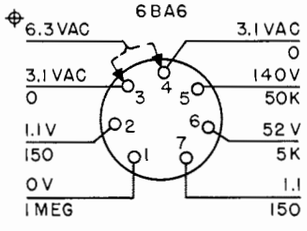
PHASE INVERTER
V302
12AX7



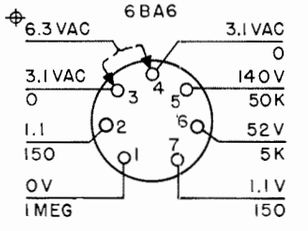
NARROW BAND AMPLIFIER
V301
6C4



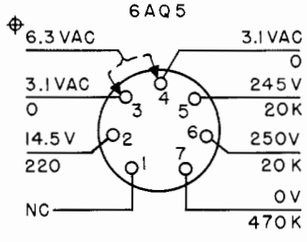
AF AMPLIFIER
V303
6BA6



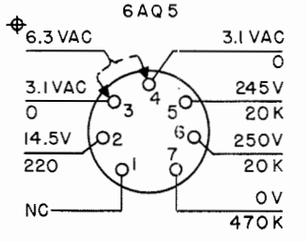
AF AMPLIFIER
V304
6BA6



MODULATOR DRIVER
V305
6AQ5

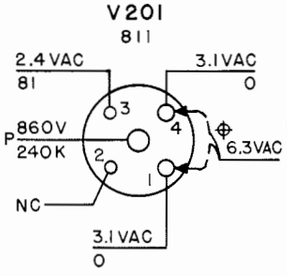


MODULATOR DRIVER
V306
6AQ5

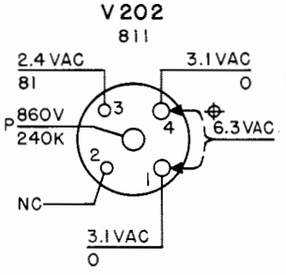


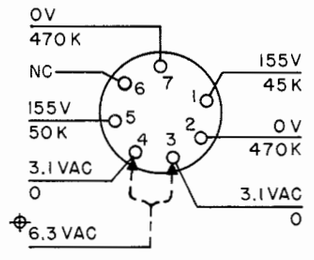
MODULATOR CHASSIS

MODULATOR
V201
811



MODULATOR
V202
811





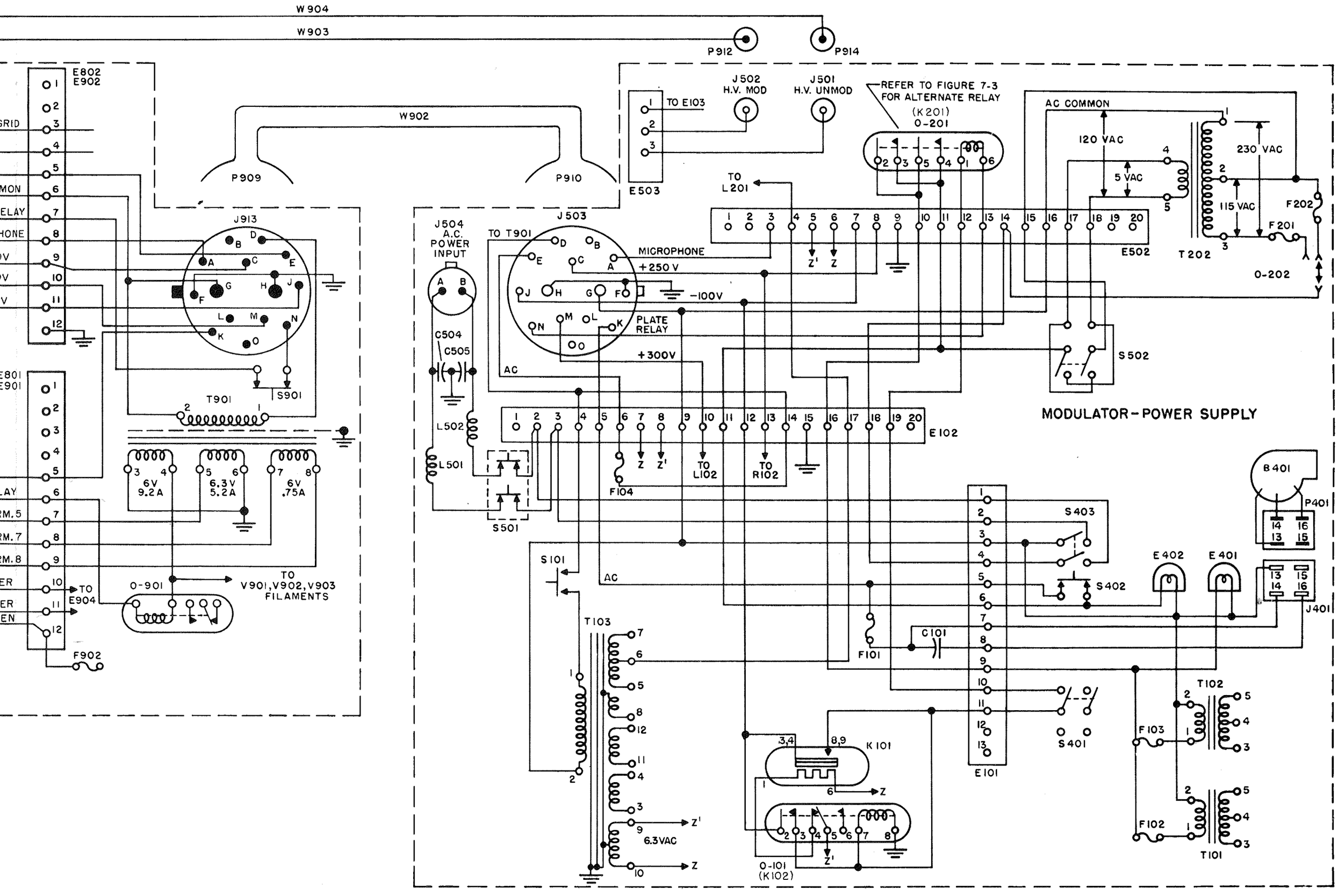
AUTOMATIC MODULATOR LIMITER
V203
6AL5W

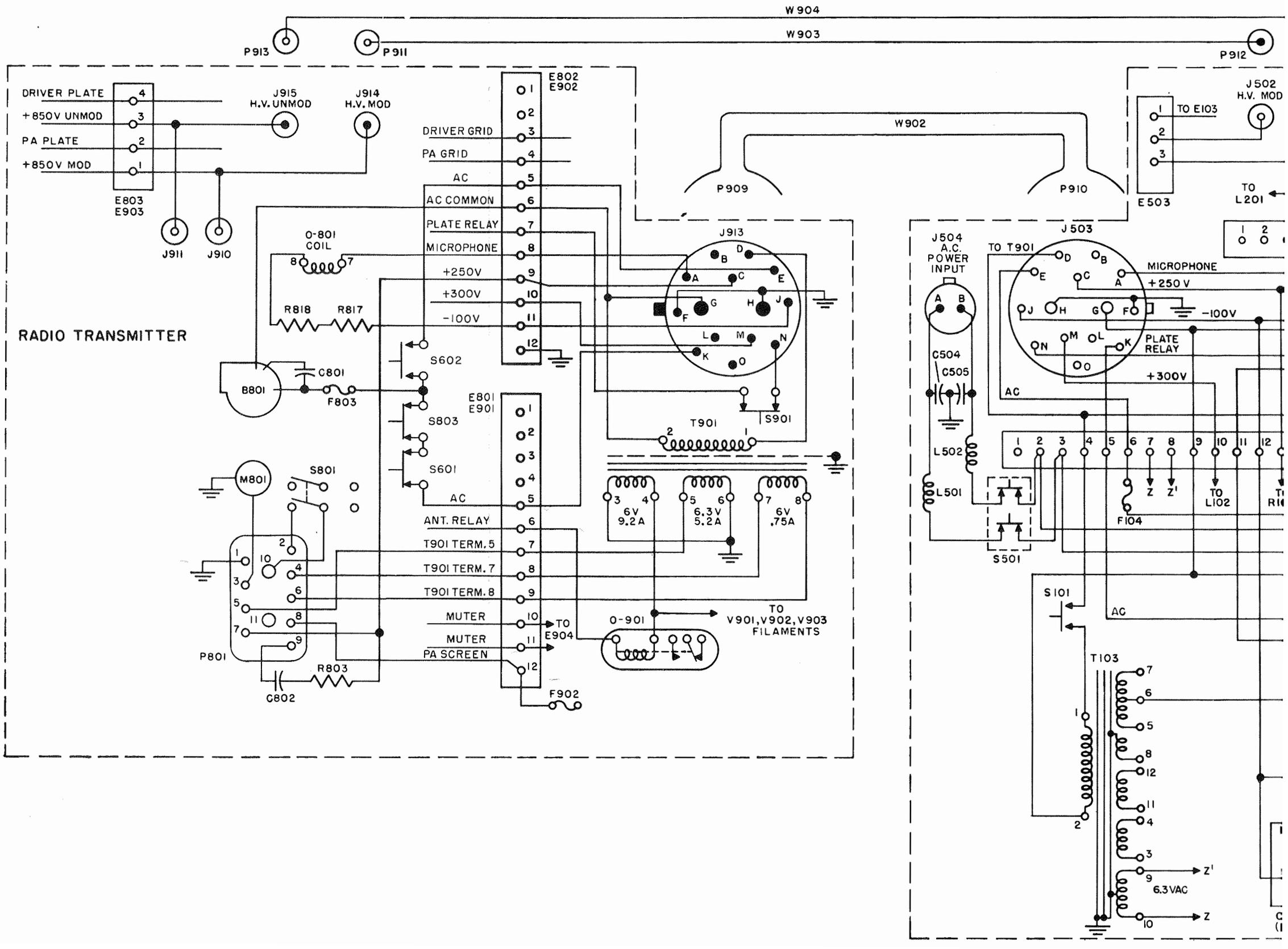
MEASUREMENT CONDITIONS:

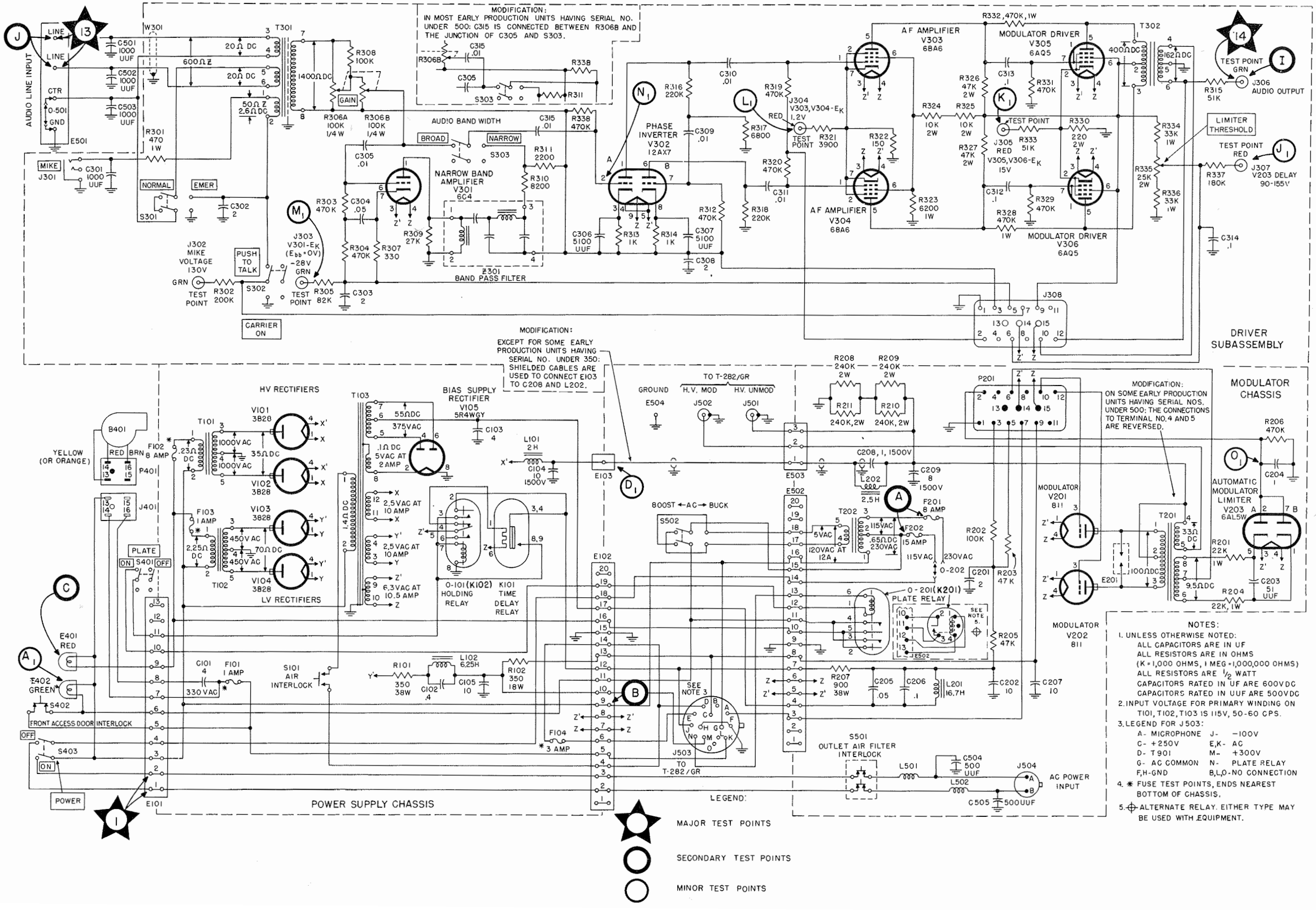
1. ALL RESISTANCE MEASUREMENTS MADE WITH INTERCONNECTING CABLES DISCONNECTED.
2. THE SUPPLY VOLTAGE AT 115V, 60 CPS.
3. THE BUCK-BOOST SWITCH SET TO THE BOOST POSITION.
4. THE GAIN AND LIMITER THRESHOLD CONTROLS IN THE EXTREME COUNTER-CLOCKWISE POSITIONS.
5. THE NARROW-BROAD SWITCH SET TO THE NARROW POSITION.
6. THE NORMAL-EMER SWITCH SET TO THE NORMAL POSITION.
7. METER 2 SELECTOR SWITCH SET TO THE CARRIER WATTS POSITION.
8. NO AUDIO SIGNAL INPUT AT THE MIKE JACK OR THE LINE TERMINALS.
9. THE PUSH TO TALK-CARRIER ON SWITCH SET TO THE CARRIER ON POSITION.
10. THE TUNE-OPERATE SWITCH SET TO THE OPERATE POSITION.
11. THE TRANSMITTER ADJUSTED FOR AN OUTPUT OF 100 WATTS AT 399 MC.
12. ALL VOLTAGES MEASURED WITH A TRIPLETT MULTIMETER MODEL 630-A, OR EQUAL (20,000 OHMS PER VOLT). RANGE SWITCH SET SO THAT READINGS FALL IN THE UPPER OR RIGHT-HAND HALF OF THE SCALE WHEREVER POSSIBLE.

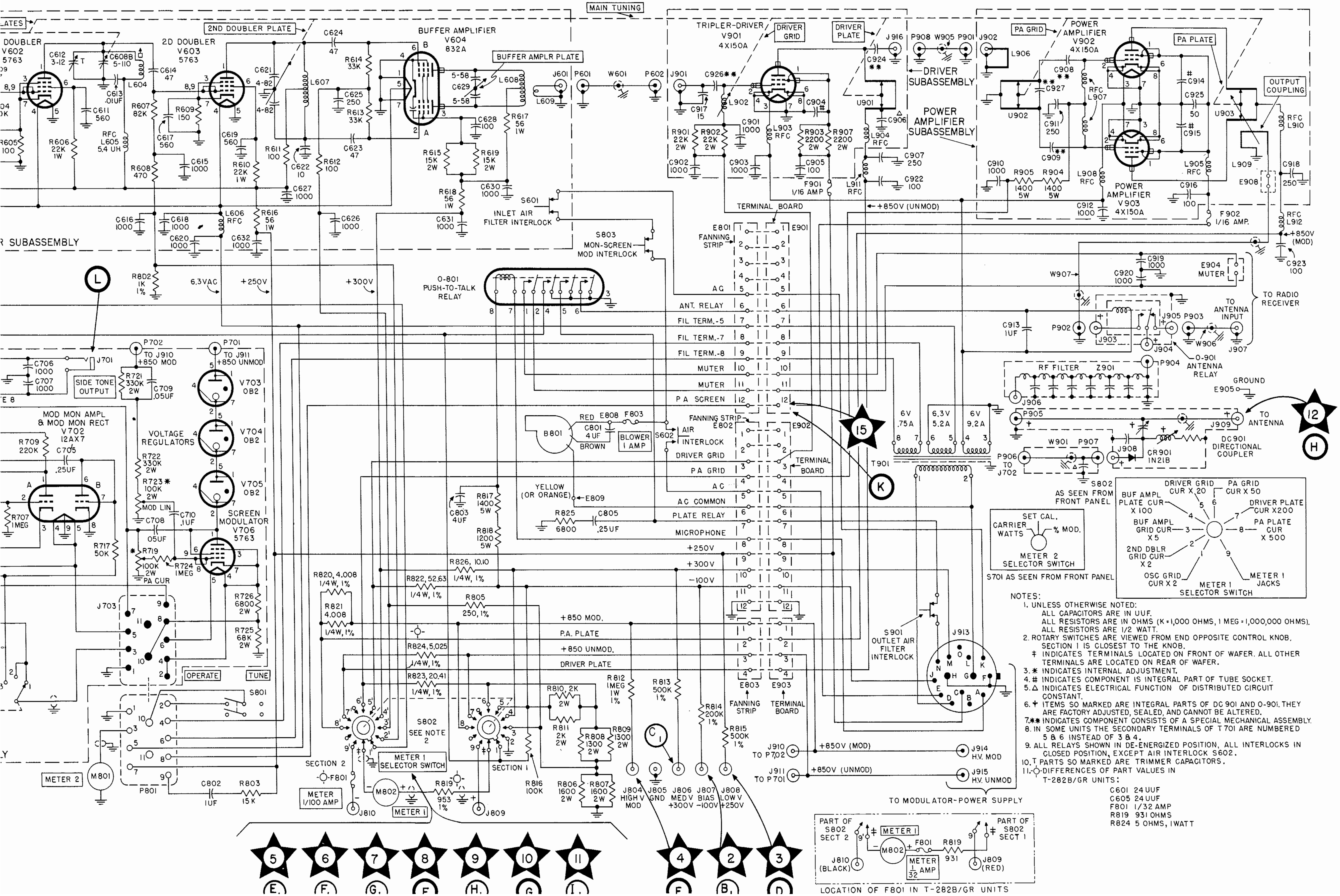
NOTES:

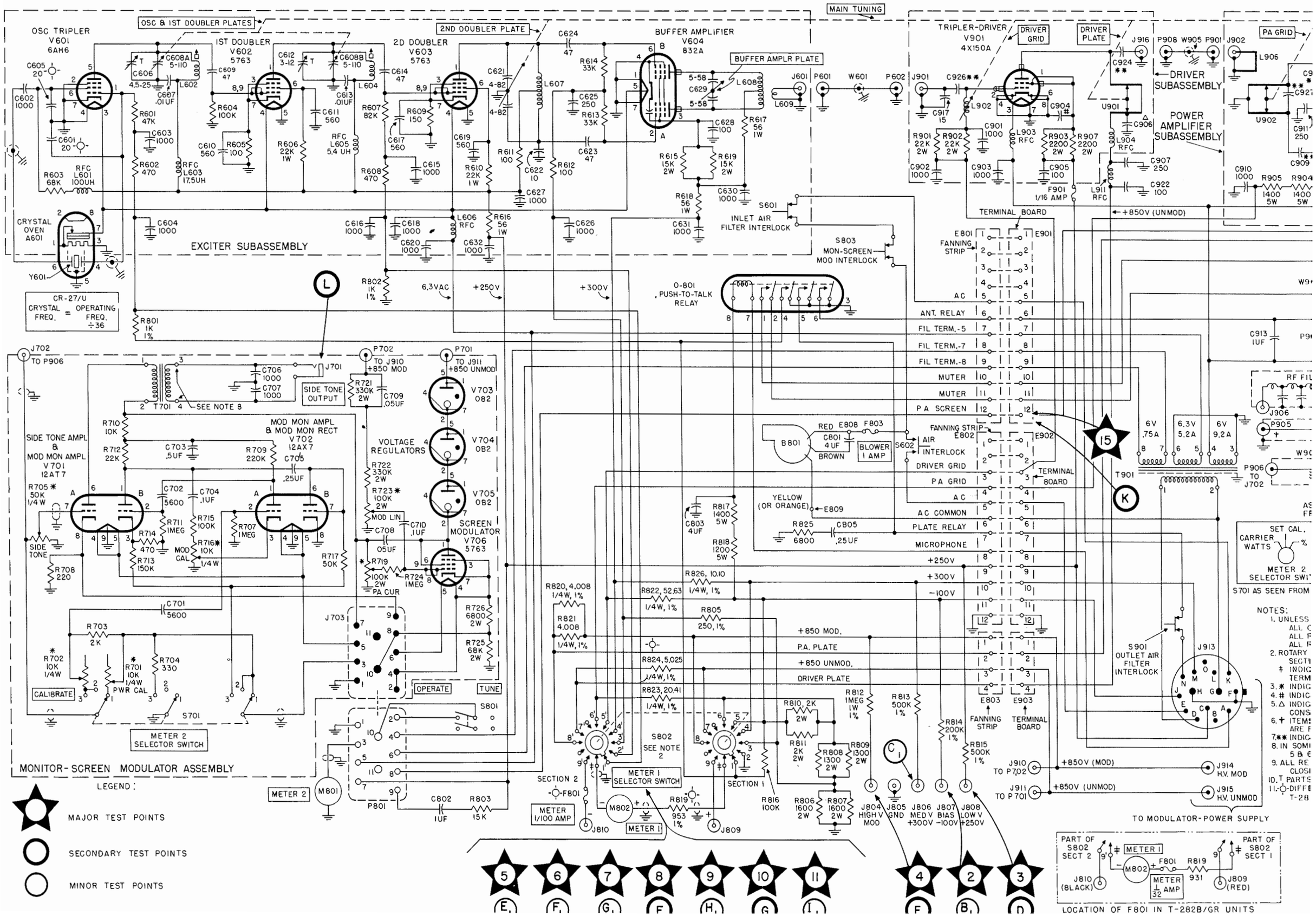
1. ALL VOLTAGES ARE DC EXCEPT WHERE OTHERWISE NOTED.
2. ALL MEASUREMENTS ARE WITH RESPECT TO GROUND EXCEPT WHERE OTHERWISE NOTED.
3. ALL RESISTANCE VALUES ARE IN OHMS (K=1,000 OHMS, 1 MEG=1,000,000 OHMS).
4. NC INDICATES NO CONNECTION.
5. * INDICATES RESISTANCE IS 150K IN UNITS HAVING SERIAL NUMBERS BELOW 490.
6. ⊕ INDICATES VOLTAGES MEASURED BETWEEN POINTS INDICATED.
7. P INDICATES PLATE CAP.

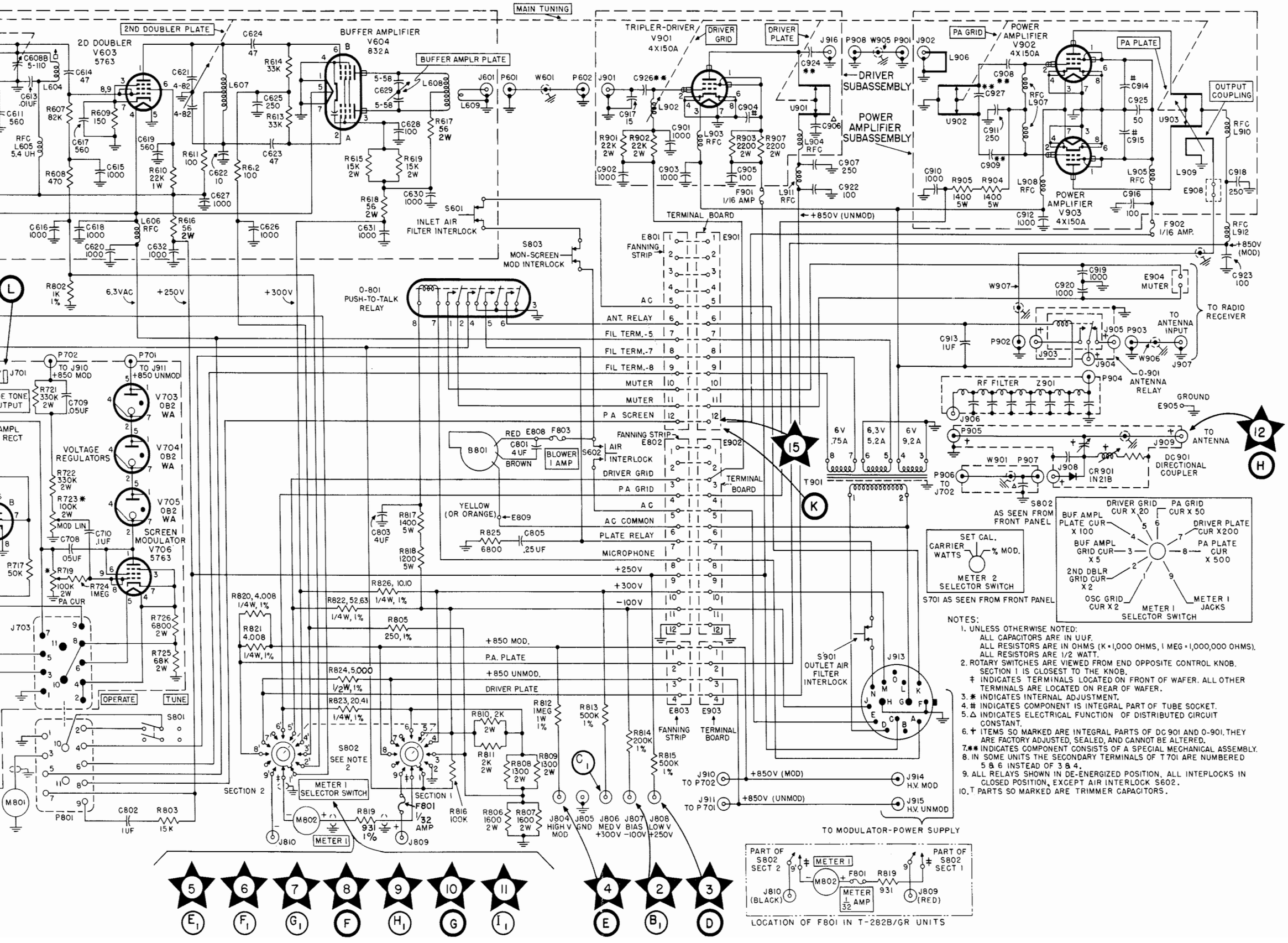

W904
W903
P912
P914
W902
P909
P910
E802
E902
GRID
MON
ELAY
HONE
V
V
V
J913
A
B
C
D
E
F
G
H
J
K
L
M
N
O
T901
S901
E801
E901
LAY
RM.5
RM.7
RM.8
ER
ER
EN
TO E904
6V 9.2A
6.3V 5.2A
6V .75A
0-901
TO V901,V902,V903 FILAMENTS
F902
J504 A.C. POWER INPUT
C504
C505
L502
L501
S501
J503
TO T901
MICROPHONE
+250 V
-100V
PLATE RELAY
+300V
AC
F104
Z
Z'
TO L102
TO R102
E102
J502 H.V. MOD
J501 H.V. UNMOD
TO E103
E503
REFER TO FIGURE 7-3 FOR ALTERNATE RELAY (K201) 0-201
TO L201
E502
AC COMMON
120 VAC
5 VAC
230 VAC
115 VAC
T202
F202
F201
0-202
S502
MODULATOR-POWER SUPPLY
S101
T103
6.3VAC
F101
C101
K101
0-101 (K102)
E101
S403
S402
S401
E402
E401
B401
P401
J401
T102
F103
F102
T101


RADIO TRANSMITTER
W904
W903
W902
P913
P911
P912
P909
P910
DRIVER PLATE
+850V UNMOD
PA PLATE
+850V MOD
E803
E903
J911
J910
J915
H.V. UNMOD
J914
H.V. MOD
E802
E902
DRIVER GRID
PA GRID
AC
AC COMMON
PLATE RELAY
MICROPHONE
+250V
+300V
-100V
ANT. RELAY
T901 TERM. 5
T901 TERM. 7
T901 TERM. 8
MUTER
MUTER
PA SCREEN
TO E904
0-801 COIL
R818
R817
S602
S803
S601
C801
B801
F803
E801
E901
M801
S801
P801
R803
C802
F902
J913
T901
S901
6V 9.2A
6.3V 5.2A
6V .75A
0-901
TO V901,V902,V903 FILAMENTS
J504 A.C. POWER INPUT
C504
C505
L502
L501
S501
J503
TO T901
MICROPHONE
+250 V
-100V
PLATE RELAY
+300V
AC
F104
TO L102
E503
TO E103
J502 H.V. MOD
TO L201
S101
T103
6.3VAC


MODIFICATION:
IN MOST EARLY PRODUCTION UNITS HAVING SERIAL NO. UNDER 500: C315 IS CONNECTED BETWEEN R306B AND THE JUNCTION OF C305 AND S303.
AUDIO LINE INPUT
LINE
LINE
CTR
0-50Ω
GND
E501
W301
600Ω Z
20Ω DC
20Ω DC
50Ω Z
2.6Ω DC
T301
1400Ω DC
R308 100K
GAIN
R306A 100K 1/4 W
R306B 100K 1/4 W
C501 1000 UUF
C502 1000 UUF
C503 1000 UUF
R301 470 1W
MIKE
J301
C301 1000 UUF
NORMAL
EMER
S301
C302 2
AUDIO BAND WIDTH
BROAD
NARROW
S303
C315 .01
C305 .01
R311 2200
R338 470K
R338
R311
C305
S303
NARROW BAND AMPLIFIER V301 6C4
R303 470K
C304 .05
R304 470K
R307 330
R309 27K
Z301 BAND PASS FILTER
J302 MIKE VOLTAGE 130V
GRN
TEST POINT
R302 200K
PUSH TO TALK
S302
CARRIER ON
J303 V301-EK (Ebb=0V) -28V GRN
TEST POINT
R305 82K
C303 2
PHASE INVERTER V302 12AX7
R316 220K
C309 .01
R317 6800
R318 220K
R320 470K
C311 .01
R312 470K
C306 5100 UUF
R313 1K
R314 1K
C307 5100 UUF
C308 2
J304 V303,V304-EK 1.2V
RED
TEST POINT
R321 3900
C310 .01
R319 470K
AF AMPLIFIER V303 6BA6
AF AMPLIFIER V304 6BA6
R322 150
R323 6200 1W
R324 10K 2W
R325 10K 2W
R326 47K 2W
R327 47K 2W
R328 470K 1W
R329 470K
C312 .1
C313 .1
R331 470K
R332, 470K, 1W
MODULATOR DRIVER V305 6AQ5
MODULATOR DRIVER V306 6AQ5
V305,V306-EK 15V
J305 RED
TEST POINT
R333 51K
R330 220 2W
T302
400Ω DC
162Ω DC
R334 33K 1W
R335 25K 2W
R336 33K 1W
LIMITER THRESHOLD
TEST POINT RED
J307 V203 DELAY 90-155V
R337 180K
R315 51K
TEST POINT GRN
J306 AUDIO OUTPUT
C314 .1
J308
DRIVER SUBASSEMBLY
MODIFICATION:
EXCEPT FOR SOME EARLY PRODUCTION UNITS HAVING SERIAL NO. UNDER 350: SHIELDED CABLES ARE USED TO CONNECT E103 TO C208 AND L202.
GROUND E504
TO T-282/GR
H.V. MOD J502
H.V. UNMOD J501
R208 240K 2W
R209 240K 2W
R211 240K,2W
R210 240K,2W
P201
MODIFICATION:
ON SOME EARLY PRODUCTION UNITS HAVING SERIAL NOS. UNDER 500: THE CONNECTIONS TO TERMINAL NO.4 AND 5 ARE REVERSED.
MODULATOR CHASSIS
R206 470K
C204 1
AUTOMATIC MODULATOR LIMITER V203 6AL5W
R201 22K 1W
R204 22K, 1W
C203 .5 UUF
T201
33Ω DC
9.5Ω DC
100Ω DC
E201
MODULATOR V201 811
MODULATOR V202 811
C208, 1, 1500V
C209 8 1500V
L202 2.5H
E503
E502
E103
D1
800ST ← AC → BUCK
S502
T202
5VAC
120VAC AT 12A
115VAC
230VAC
F202 15 AMP
.65Ω DC 230VAC
F201 8 AMP
R202 100K
R203 47K
C201 2
0-202
0-201 (K201) PLATE RELAY
SEE NOTE 5.
J E502
R205 47K
C205 .05
C206 .1
L201 16.7H
C202 10
C207 10
R207 900 38W
E102
B401
YELLOW (OR ORANGE)
RED
BRN
P401
J401
F102 8 AMP
.23Ω DC
T101
1000V AC
35Ω DC
1000V AC
V101 3B28
V102 3B28
V103 3B28
V104 3B28
HV RECTIFIERS
F103 1 AMP
2.25Ω DC
450V AC
70Ω DC
450V AC
T102
LV RECTIFIERS
T103
55Ω DC
375VAC
.1Ω DC 5VAC AT 2 AMP
2,5VAC AT 10 AMP
2,5VAC AT 10 AMP
6,3VAC AT 10.5 AMP
1.4Ω DC
BIAS SUPPLY RECTIFIER V105 5R4WGY
C103 4
L101 2H
C104 10 1500V
0-101 (K102) HOLDING RELAY
K101 TIME DELAY RELAY
PLATE
ON S401 OFF
E401 RED
E402 GREEN
S402
FRONT ACCESS DOOR INTERLOCK
OFF
S403
ON
POWER
E101
C101 4 330 VAC
F101 1 AMP
S101 AIR INTERLOCK
R101 350 38W
L102 6.25H
C102 .4
C105 10
R102 350 18W
F104 3 AMP
SEE NOTE 3
J503
TO T-282/GR
S501 OUTLET AIR FILTER INTERLOCK
L501
C504 500 UUF
L502
C505 500UUF
J504
AC POWER INPUT
POWER SUPPLY CHASSIS
LEGEND:
MAJOR TEST POINTS
SECONDARY TEST POINTS
MINOR TEST POINTS
NOTES:
1. UNLESS OTHERWISE NOTED:
ALL CAPACITORS ARE IN UF
ALL RESISTORS ARE IN OHMS
(K=1,000 OHMS, 1 MEG=1,000,000 OHMS)
ALL RESISTORS ARE 1/2 WATT
CAPACITORS RATED IN UF ARE 600VDC
CAPACITORS RATED IN UUF ARE 500VDC
2. INPUT VOLTAGE FOR PRIMARY WINDING ON T101, T102, T103 IS 115V, 50-60 CPS.
3. LEGEND FOR J503:
A- MICROPHONE
C- +250V
D- T901
G- AC COMMON
F,H-GND
J- -100V
E,K- AC
M- +300V
N- PLATE RELAY
B,L,O-NO CONNECTION
4. * FUSE TEST POINTS, ENDS NEAREST BOTTOM OF CHASSIS.
5. ⊕ ALTERNATE RELAY. EITHER TYPE MAY BE USED WITH EQUIPMENT.


MAIN TUNING
2ND DOUBLER PLATE
BUFFER AMPLIFIER
V604
832A
BUFFER AMPLR PLATE
2D DOUBLER
V603
5763
TRIPLER-DRIVER
V901
4X150A
DRIVER GRID
DRIVER PLATE
DRIVER SUBASSEMBLY
POWER AMPLIFIER SUBASSEMBLY
PA GRID
POWER AMPLIFIER
V902
4X150A
PA PLATE
OUTPUT COUPLING
POWER AMPLIFIER
V903
4X150A
INLET AIR FILTER INTERLOCK
S803 MON-SCREEN MOD INTERLOCK
0-801 PUSH-TO-TALK RELAY
TERMINAL BOARD
FANNING STRIP
AC
ANT. RELAY
FIL TERM.-5
FIL TERM.-7
FIL TERM.-8
MUTER
MUTER
P A SCREEN
AIR INTERLOCK
DRIVER GRID
P A GRID
A C
AC COMMON
PLATE RELAY
MICROPHONE
+250V
+300V
-100V
+850 MOD.
P.A. PLATE
+850 UNMOD.
DRIVER PLATE
MOD MON AMPL & MOD MON RECT
V702
12AX7
VOLTAGE REGULATORS
V703 OB2
V704 OB2
V705 OB2
SCREEN MODULATOR
V706
5763
SIDE TONE OUTPUT
MOD LIN
PA CUR
OPERATE
TUNE
METER 2
M801
S802 SEE NOTE 2
METER 1 SELECTOR SWITCH
SECTION 2
SECTION 1
METER 1/100 AMP
METER 1
J804 HIGH V MOD
J805 GND
J806 MED V +300V
J807 BIAS -100V
J808 LOW V +250V
TO MODULATOR-POWER SUPPLY
J910 TO P702
J911 TO P701
+850V (MOD)
+850V (UNMOD)
J914 H.V. MOD
J915 H.V. UNMOD
S901 OUTLET AIR FILTER INTERLOCK
J913
T901
RF FILTER Z901
TO ANTENNA INPUT
0-901 ANTENNA RELAY
TO RADIO RECEIVER
E904 MUTER
GROUND
TO ANTENNA
DC901 DIRECTIONAL COUPLER
CR901 IN21B
S802 AS SEEN FROM FRONT PANEL
SET CAL.
CARRIER WATTS
% MOD.
METER 2 SELECTOR SWITCH
S701 AS SEEN FROM FRONT PANEL
DRIVER GRID CUR X 20
PA GRID CUR X 50
BUF AMPL PLATE CUR X 100
DRIVER PLATE CUR X200
BUF AMPL GRID CUR X 5
PA PLATE CUR X 500
2ND DBLR GRID CUR X 2
OSC GRID CUR X 2
METER 1 JACKS
METER 1 SELECTOR SWITCH
NOTES:
1. UNLESS OTHERWISE NOTED:
ALL CAPACITORS ARE IN UUF.
ALL RESISTORS ARE IN OHMS (K=1,000 OHMS, 1 MEG=1,000,000 OHMS).
ALL RESISTORS ARE 1/2 WATT.
2. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB.
SECTION 1 IS CLOSEST TO THE KNOB.
‡ INDICATES TERMINALS LOCATED ON FRONT OF WAFER. ALL OTHER TERMINALS ARE LOCATED ON REAR OF WAFER.
3.* INDICATES INTERNAL ADJUSTMENT.
4.# INDICATES COMPONENT IS INTEGRAL PART OF TUBE SOCKET.
5.△ INDICATES ELECTRICAL FUNCTION OF DISTRIBUTED CIRCUIT CONSTANT.
6.✝ ITEMS SO MARKED ARE INTEGRAL PARTS OF DC 901 AND O-901. THEY ARE FACTORY ADJUSTED, SEALED, AND CANNOT BE ALTERED.
7.** INDICATES COMPONENT CONSISTS OF A SPECIAL MECHANICAL ASSEMBLY.
8. IN SOME UNITS THE SECONDARY TERMINALS OF T 701 ARE NUMBERED 5 & 6 INSTEAD OF 3 & 4.
9. ALL RELAYS SHOWN IN DE-ENERGIZED POSITION, ALL INTERLOCKS IN CLOSED POSITION, EXCEPT AIR INTERLOCK S602.
10. T PARTS SO MARKED ARE TRIMMER CAPACITORS.
11. -◇- DIFFERENCES OF PART VALUES IN T-282B/GR UNITS:
C601 24 UUF
C605 24 UUF
F801 1/32 AMP
R819 931 OHMS
R824 5 OHMS, 1 WATT
PART OF S802 SECT 2
PART OF S802 SECT 1
METER 1/32 AMP
J810 (BLACK)
J809 (RED)
LOCATION OF F801 IN T-282B/GR UNITS


EXCITER SUBASSEMBLY
OSC TRIPLER V601 6AH6
OSC & 1ST DOUBLER PLATES
1ST DOUBLER V602 5763
2ND DOUBLER PLATE
2D DOUBLER V603 5763
BUFFER AMPLIFIER V604 832A
BUFFER AMPLR PLATE
MAIN TUNING
TRIPLER-DRIVER V901 4X150A
DRIVER GRID
DRIVER PLATE
DRIVER SUBASSEMBLY
POWER AMPLIFIER SUBASSEMBLY
PA GRID
CRYSTAL OVEN A601
Y601
CR-27/U CRYSTAL FREQ. = OPERATING FREQ. ÷36
S601 INLET AIR FILTER INTERLOCK
S803 MON-SCREEN MOD INTERLOCK
TERMINAL BOARD
+850V (UNMOD)
0-801 PUSH-TO-TALK RELAY
6.3VAC
+250V
+300V
FANNING STRIP
AC
ANT. RELAY
FIL TERM.-5
FIL TERM.-7
FIL TERM.-8
MUTER
MUTER
P A SCREEN
B801
RED E808 F803
C801 4UF BROWN
BLOWER 1 AMP
S602 AIR INTERLOCK
DRIVER GRID
PA GRID
AC
AC COMMON
PLATE RELAY
MICROPHONE
+250V
+300V
-100V
YELLOW (OR ORANGE) E809
+850 MOD.
P.A. PLATE
+850 UNMOD.
DRIVER PLATE
6V .75A
6.3V 5.2A
6V 9.2A
T901
SET CAL. CARRIER WATTS
METER 2 SELECTOR SWI
S701 AS SEEN FROM
NOTES:
1. UNLESS
2. ROTARY
3. ✱ INDIC
4. # INDIC
5. △ INDIC
6. † ITEM
7. ✱✱ INDIC
8. IN SOM
9. ALL RE
10. T PARTS
11. ○-DIFFE
T-28
S901 OUTLET AIR FILTER INTERLOCK
J913
J910 TO P702
J911 TO P701
+850V (MOD)
+850V (UNMOD)
J914 H.V. MOD
J915 H.V. UNMOD
TO MODULATOR-POWER SUPPLY
J702 TO P906
P702 TO J910 +850 MOD
P701 TO J911 +850 UNMOD
SIDE TONE OUTPUT
SEE NOTE 8
SIDE TONE AMPL & MOD MON AMPL V701 12AT7
MOD MON AMPL & MOD MON RECT V702 12AX7
VOLTAGE REGULATORS
V703 0B2
V704 0B2
V705 0B2
SCREEN MODULATOR V706 5763
SIDE TONE
MOD CAL
MOD LIN
PA CUR
CAL 8RATE
PWR CAL
S701
OPERATE
TUNE
S801
METER 2 SELECTOR SWITCH
METER 2
M801
P801
J703
S802 SEE NOTE 2
SECTION 2
SECTION 1
METER 1 SELECTOR SWITCH
METER 1/100 AMP
M802
METER 1
F801
J810
J809
J804 HIGH V MOD
J805 GND
J806 MED V +300V
J807 BIAS -100V
J808 LOW V +250V
MONITOR-SCREEN MODULATOR ASSEMBLY
LEGEND:
MAJOR TEST POINTS
SECONDARY TEST POINTS
MINOR TEST POINTS
PART OF S802 SECT 2
PART OF S802 SECT 1
J810 (BLACK)
J809 (RED)
LOCATION OF F801 IN T-282B/GR UNITS



NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL CAPACITORS ARE IN UUF.
   ALL RESISTORS ARE IN OHMS (K = 1,000 OHMS, 1 MEG = 1,000,000 OHMS).
   ALL RESISTORS ARE 1/2 WATT.
2. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB. SECTION 1 IS CLOSEST TO THE KNOB.
   ‡ INDICATES TERMINALS LOCATED ON FRONT OF WAFER. ALL OTHER TERMINALS ARE LOCATED ON REAR OF WAFER.
3. ✱ INDICATES INTERNAL ADJUSTMENT.
4. # INDICATES COMPONENT IS INTEGRAL PART OF TUBE SOCKET.
5. △ INDICATES ELECTRICAL FUNCTION OF DISTRIBUTED CIRCUIT CONSTANT.
6. † ITEMS SO MARKED ARE INTEGRAL PARTS OF DC 901 AND 0-901. THEY ARE FACTORY ADJUSTED, SEALED, AND CANNOT BE ALTERED.
7. ✱✱ INDICATES COMPONENT CONSISTS OF A SPECIAL MECHANICAL ASSEMBLY.
8. IN SOME UNITS THE SECONDARY TERMINALS OF T 701 ARE NUMBERED 5 & 6 INSTEAD OF 3 & 4.
9. ALL RELAYS SHOWN IN DE-ENERGIZED POSITION. ALL INTERLOCKS IN CLOSED POSITION, EXCEPT AIR INTERLOCK S602.
10. T PARTS SO MARKED ARE TRIMMER CAPACITORS.

MONITOR-SCREEN MODULATOR ASSEMBLY

EXCITER SUBASSEMBLY

POWER AMPLIFIER SUBASSEMBLY

DRIVER SUBASSEMBLY

OSC TRIPLER V601 6AH6

OSC & 1ST DOUBLER PLATES

1ST DOUBLER V602 5763

2D DOUBLER V603 5763

2ND DOUBLER PLATE

BUFFER AMPLIFIER V604 832A

BUFFER AMPLR PLATE

MAIN TUNING

TRIPLER-DRIVER V901 4X150A

DRIVER GRID

DRIVER PLATE

PA GRID

POWER AMPLIFIER V902 4X150A

POWER AMPLIFIER V903 4X150A

CRYSTAL OVEN A601

Y601

CR-27/U CRYSTAL FREQ. = OPERATING FREQ. ÷36

SIDE TONE AMPL & MOD MON AMPL V701 12AT7WA

MOD MON AMPL & MOD MON RECT V702 5751

VOLTAGE REGULATORS V703 OB2 WA, V704 OB2 WA, V705 OB2 WA

SCREEN MODULATOR V706 5763

SIDE TONE

MOD CAL

PWR CAL

CALIBRATE

OPERATE

TUNE

METER 2 SELECTOR SWITCH

METER 2

M801

METER 1

M802

METER 1 SELECTOR SWITCH

SECTION 1

SECTION 2

SEE NOTE 2

SEE NOTE 8

S701

S801

S802

S601 INLET AIR FILTER INTERLOCK

S803 MON-SCREEN MOD INTERLOCK

S901 OUTLET AIR FILTER INTERLOCK

S602 AIR INTERLOCK

B801 BLOWER 1 AMP

F901 1/16 AMP

F801 1/32 AMP

0-801 PUSH-TO-TALK RELAY

TERMINAL BOARD

FANNING STRIP

E801 E901 E802 E902 E803 E903

AC

ANT. RELAY

FIL TERM.-5

FIL TERM.-7

FIL TERM.-8

MUTER

MUTER

P A SCREEN

DRIVER GRID

P A GRID

AC

AC COMMON

PLATE RELAY

MICROPHONE

+250V

+300V

-100V

+850 MOD.

P.A. PLATE

+850 UNMOD.

DRIVER PLATE

6.3VAC

+250V

+300V

+850V (UNMOD)

+850V (MOD)

+850V (UNMOD)

TO MODULATOR-POWER SUPPLY

J910 TO P702

J911 TO P701

J914 H.V. MOD

J915 H.V. UNMOD

J804 HIGH V MOD

J805 GND

J806 MED V +300V

J807 BIAS -100V

J808 LOW V +250V

T901

T701

SET CAL. CARRIER WATTS % MOD. METER 2 SELECTOR SWITCH

S701 AS SEEN FROM FRONT PANEL

S802 AS SEEN FROM FRONT PANEL

PART OF S802 SECT 2

PART OF S802 SECT 1

J810 (BLACK)

J809 (RED)

LOCATION OF F801 IN T-282B/GR UNITS

NOTES:

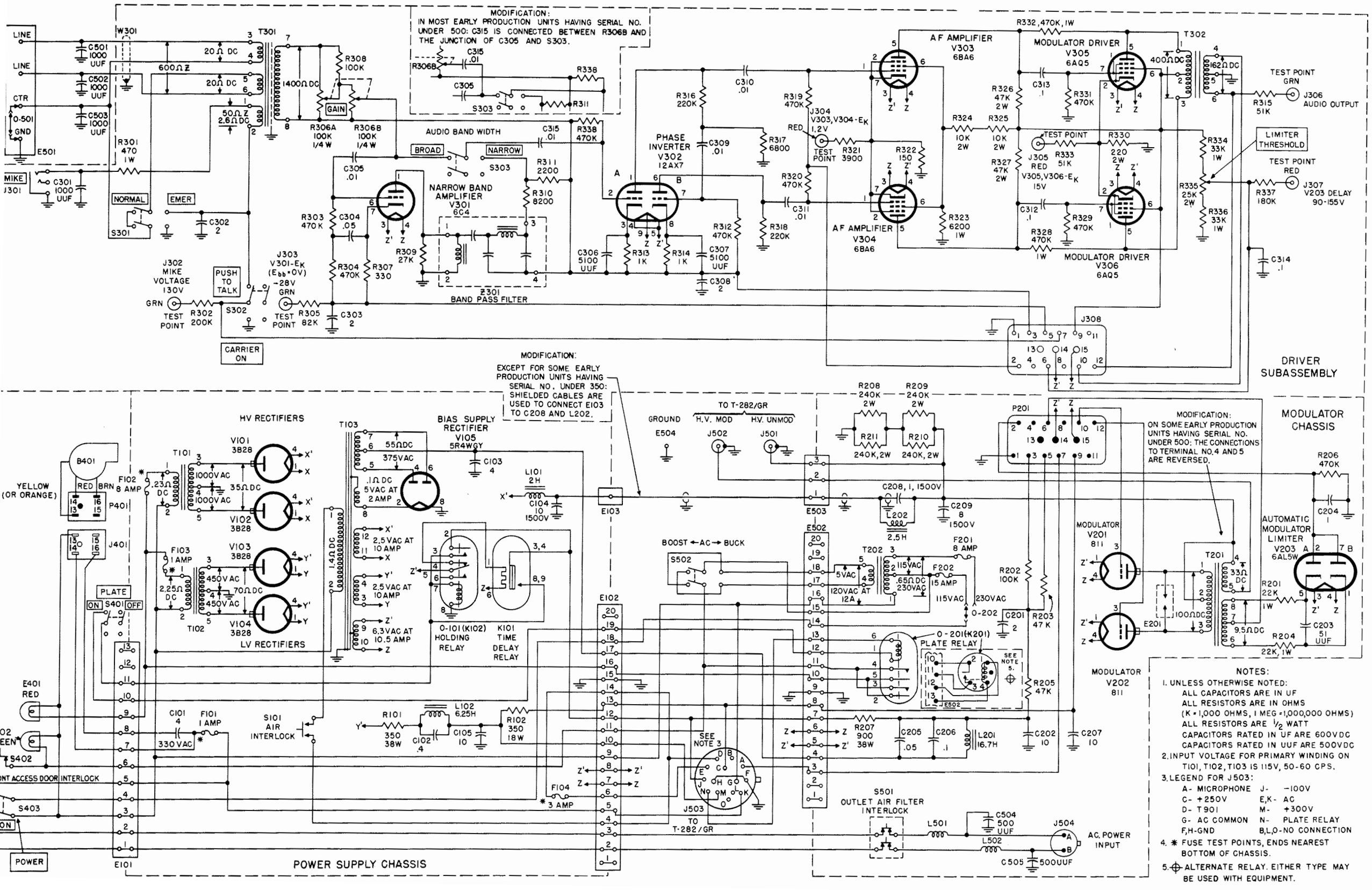
1. UNLESS OTHERWISE NOTED: ALL CAPACITORS ARE IN UUF. ALL RESISTORS ARE IN OHMS (K=1, ALL RESISTORS ARE 1/2 WATT.
2. ROTARY SWITCHES ARE VIEWED FROM SECTION 1 IS CLOSEST TO THE KN
‡ INDICATES TERMINALS LOCATED TERMINALS ARE LOCATED ON REAR
3. ✱ INDICATES INTERNAL ADJUSTMENT
4. # INDICATES COMPONENT IS INTEGRA
5. △ INDICATES ELECTRICAL FUNCTION CONSTANT.
6. ✝ ITEMS SO MARKED ARE INTEGRAL ARE FACTORY ADJUSTED, SEALED, AN
7. ✱✱ INDICATES COMPONENT CONSISTS O
8. IN SOME UNITS THE SECONDARY TER 5 & 6 INSTEAD OF 3 & 4.
9. ALL RELAYS SHOWN IN DE-ENERGIZE CLOSED POSITION, EXCEPT AIR IN
10. T PARTS SO MARKED ARE TRIMMER

LEGEND:

MAJOR TEST POINTS

SECONDARY TEST POINTS

MINOR TEST POINTS

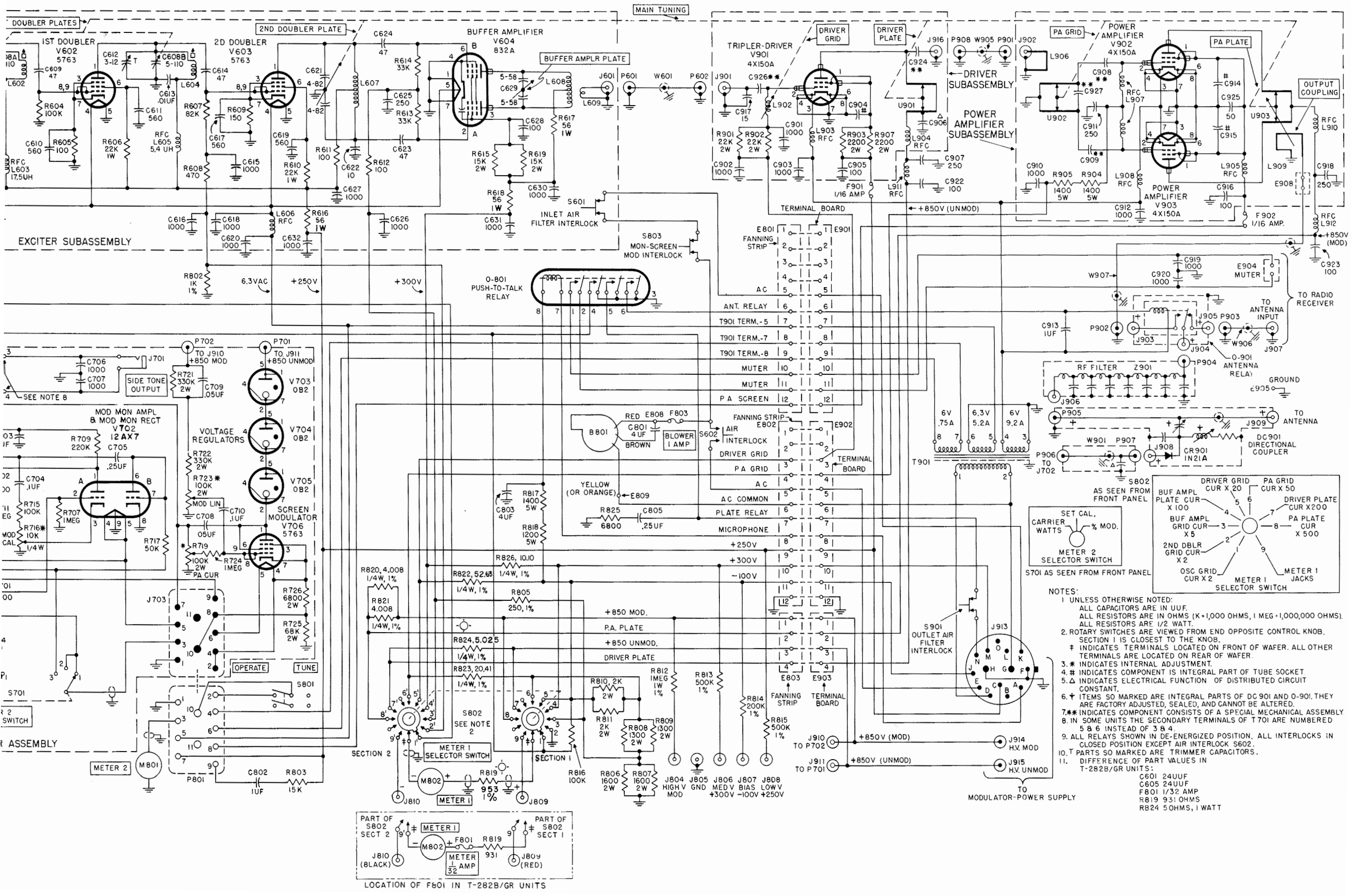


NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL CAPACITORS ARE IN UF
   ALL RESISTORS ARE IN OHMS
   (K = 1,000 OHMS, 1 MEG = 1,000,000 OHMS)
   ALL RESISTORS ARE 1/2 WATT
   CAPACITORS RATED IN UF ARE 600VDC
   CAPACITORS RATED IN UUF ARE 500VDC
2. INPUT VOLTAGE FOR PRIMARY WINDING ON T101, T102, T103 IS 115V, 50-60 CPS.
3. LEGEND FOR J503:

A- MICROPHONE		J-	-100V
C- +250V		E,K-	AC
D- T901		M-	+300V
G- AC COMMON		N-	PLATE RELAY
F,H-GND		B,L,O-	NO CONNECTION

4. ✱ FUSE TEST POINTS, ENDS NEAREST BOTTOM OF CHASSIS.
5. ⊕ ALTERNATE RELAY. EITHER TYPE MAY BE USED WITH EQUIPMENT.



NOTES:

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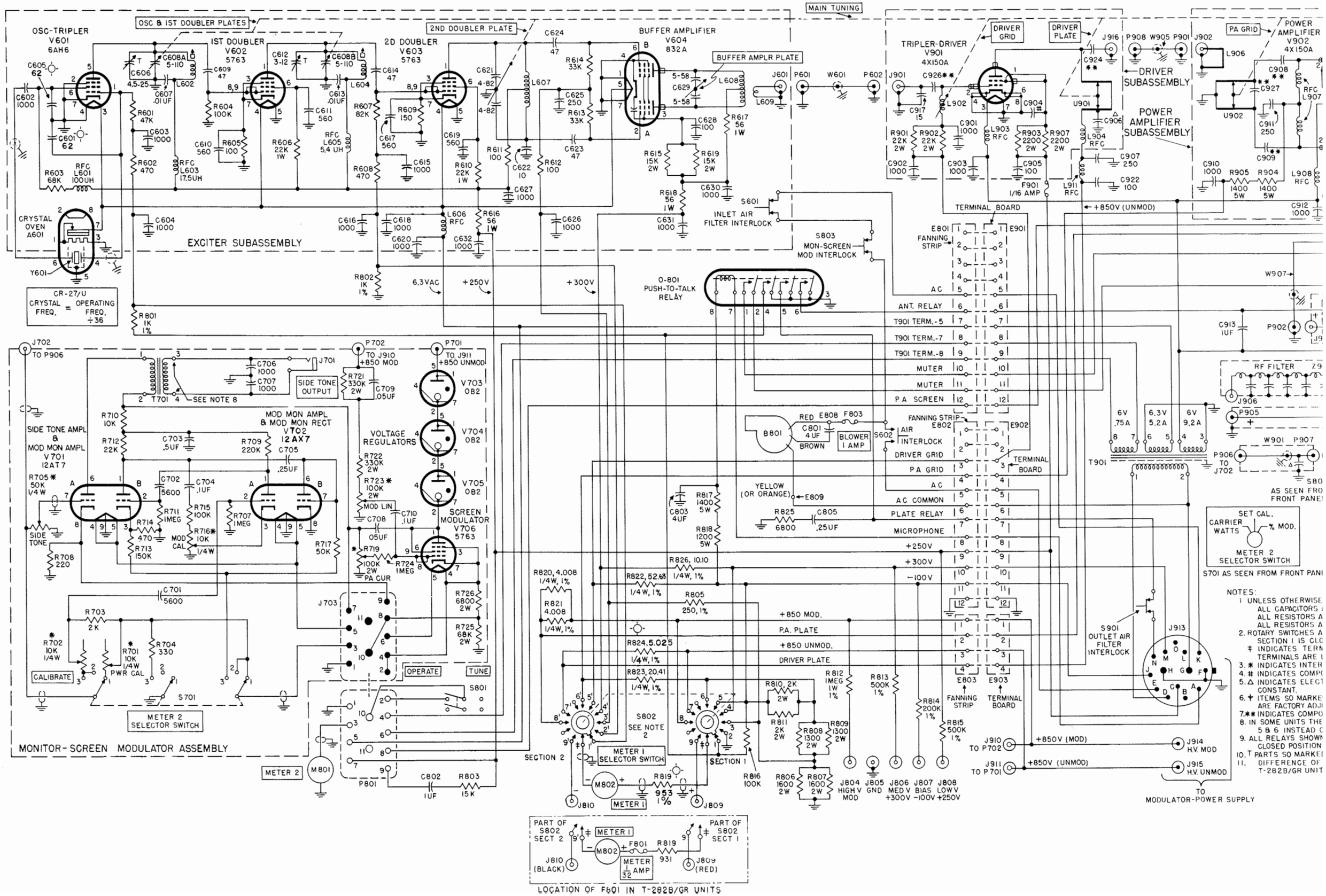
2. ROTARY SWITCHES ARE VIEWED FROM END OPPOSITE CONTROL KNOB. SECTION 1 IS CLOSEST TO THE KNOB.
   ‡ INDICATES TERMINALS LOCATED ON FRONT OF WAFER. ALL OTHER TERMINALS ARE LOCATED ON REAR OF WAFER.
3. * INDICATES INTERNAL ADJUSTMENT.
4. # INDICATES COMPONENT IS INTEGRAL PART OF TUBE SOCKET.
5. Δ INDICATES ELECTRICAL FUNCTION OF DISTRIBUTED CIRCUIT CONSTANT.
6. † ITEMS SO MARKED ARE INTEGRAL PARTS OF DC 901 AND 0-901. THEY ARE FACTORY ADJUSTED, SEALED, AND CANNOT BE ALTERED.
7. ** INDICATES COMPONENT CONSISTS OF A SPECIAL MECHANICAL ASSEMBLY
8. IN SOME UNITS THE SECONDARY TERMINALS OF T 701 ARE NUMBERED 5 & 6 INSTEAD OF 3 & 4.
9. ALL RELAYS SHOWN IN DE-ENERGIZED POSITION. ALL INTERLOCKS IN CLOSED POSITION EXCEPT AIR INTERLOCK S602.
10. T PARTS SO MARKED ARE TRIMMER CAPACITORS.
11. DIFFERENCE OF PART VALUES IN T-282B/GR UNITS:
    C601 24UUF
    C605 24UUF
    F801 1/32 AMP
    R819 931 OHMS
    RB24 50HMS, 1 WATT


EXCITER SUBASSEMBLY
OSC-TRIPLER V601 6AH6
IST DOUBLER V602 5763
2D DOUBLER V603 5763
BUFFER AMPLIFIER V604 832A
OSC & IST DOUBLER PLATES
2ND DOUBLER PLATE
BUFFER AMPLR PLATE
MAIN TUNING
CRYSTAL OVEN A601
Y601
CR-27/U CRYSTAL FREQ. = OPERATING FREQ. ÷36
6.3VAC
+250V
+300V
R802 1K 1%
R801 1K 1%
S601 INLET AIR FILTER INTERLOCK
S803 MON-SCREEN MOD INTERLOCK
O-801 PUSH-TO-TALK RELAY
TRIPLER-DRIVER V901 4X150A
DRIVER GRID
DRIVER PLATE
DRIVER SUBASSEMBLY
POWER AMPLIFIER SUBASSEMBLY
PA GRID
POWER AMPLIFIER V902 4X150A
+850V (UNMOD)
TERMINAL BOARD
E801
E901
FANNING STRIP
AC
ANT. RELAY
T901 TERM.-5
T901 TERM.-7
T901 TERM.-8
MUTER
MUTER
P.A. SCREEN
FANNING STRIP E802
E902
AIR INTERLOCK
DRIVER GRID
P.A. GRID
AC
AC COMMON
PLATE RELAY
MICROPHONE
+250V
+300V
-100V
TERMINAL BOARD
S602
B801
RED E808 F803
C801 4UF BROWN
BLOWER 1 AMP
YELLOW (OR ORANGE) E809
C803 4UF
R817 1400 5W
R818 1200 5W
R825 6800
C805 .25UF
R826, 10.10 1/4W, 1%
R822, 52.63 1/4W, 1%
R805 250, 1%
R820, 4.008 1/4W, 1%
R821 4.008 1/4W, 1%
R824, 5.025 1/4W, 1%
R823, 20.41 1/4W, 1%
+850 MOD.
P.A. PLATE
+850 UNMOD.
DRIVER PLATE
S802 SEE NOTE 2
METER 1 SELECTOR SWITCH
SECTION 2
SECTION 1
M802
J810
J809
R819 953 1%
R816 100K
R810 2K 2W
R811 2K 2W
R812 1MEG 1W 1%
R813 500K 1%
R814 200K 1%
R815 500K 1%
R806 1600 2W
R807 1600 2W
R808 1300 2W
R809 1300 2W
J804 HIGH V MOD
J805 GND
J806 MED V +300V
J807 BIAS -100V
J808 LOW V +250V
FANNING STRIP E803
TERMINAL BOARD E903
J910 TO P702 +850V (MOD)
J911 TO P701 +850V (UNMOD)
J914 H.V. MOD
J915 H.V. UNMOD
TO MODULATOR-POWER SUPPLY
S901 OUTLET AIR FILTER INTERLOCK
J913
SET CAL. CARRIER WATTS % MOD. METER 2 SELECTOR SWITCH
S701 AS SEEN FROM FRONT PANEL
6V .75A
6.3V 5.2A
6V 9.2A
T901
P902
RF FILTER Z9
J906
P905
W901 P907
P906 TO J702
S80 AS SEEN FRO FRONT PANE
W907
C913 1UF
MONITOR-SCREEN MODULATOR ASSEMBLY
J702 TO P906
P702 TO J910 +850 MOD
P701 TO J911 +850 UNMOD
J701 SIDE TONE OUTPUT
T701
SEE NOTE 8
SIDE TONE AMPL & MOD MON AMPL V701 12AT7
MOD MON AMPL & MOD MON RECT V702 12AX7
VOLTAGE REGULATORS
V703 0B2
V704 0B2
V705 0B2
SCREEN MODULATOR V706 5763
R722 330K 2W
R723* 100K 2W
MOD LIN
R719 100K 2W
PA CUR
R724 1MEG
R726 6800 2W
R725 68K 2W
R721 330K 2W
C709 .05UF
R702* 10K 1/4W
R701* 10K 1/4W PWR CAL
R704 330
CALIBRATE
OPERATE
TUNE
S801
S701
METER 2 SELECTOR SWITCH
METER 2
M801
P801
C802 1UF
R803 15K
SIDE TONE
MOD CAL
R705* 50K 1/4W
R716* 10K 1/4W
PART OF S802 SECT 2
PART OF S802 SECT 1
METER 1
F801
R819 931
METER 1/32 AMP
J810 (BLACK)
J809 (RED)
LOCATION OF F801 IN T-282B/GR UNITS
NOTES:
1. UNLESS OTHERWISE
ALL CAPACITORS
ALL RESISTORS A
ALL RESISTORS A
2. ROTARY SWITCHES A
SECTION 1 IS CLO
‡ INDICATES TERM
TERMINALS ARE
3. * INDICATES INTER
4. # INDICATES COMPO
5. △ INDICATES ELECT
CONSTANT.
6. † ITEMS SO MARKE
ARE FACTORY ADJ
7. ** INDICATES COMPO
8. IN SOME UNITS THE
5 & 6 INSTEAD C
9. ALL RELAYS SHOWN
CLOSED POSITION
10. T PARTS SO MARKE
11. DIFFERENCE OF
T-282B/GR UNIT

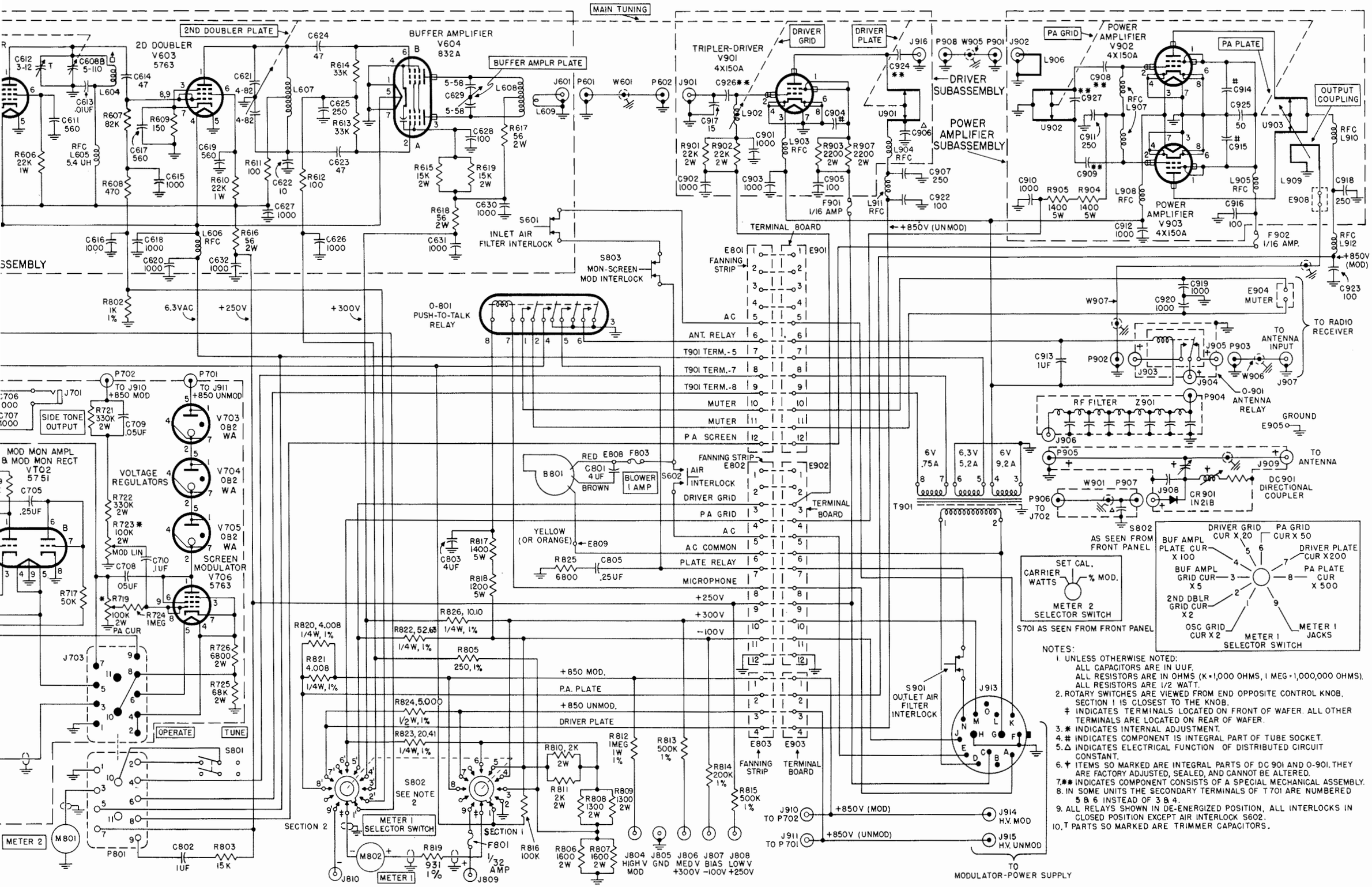


Figure 7-18A. Radio Transmitter T-282C/GR Schematic Diagram

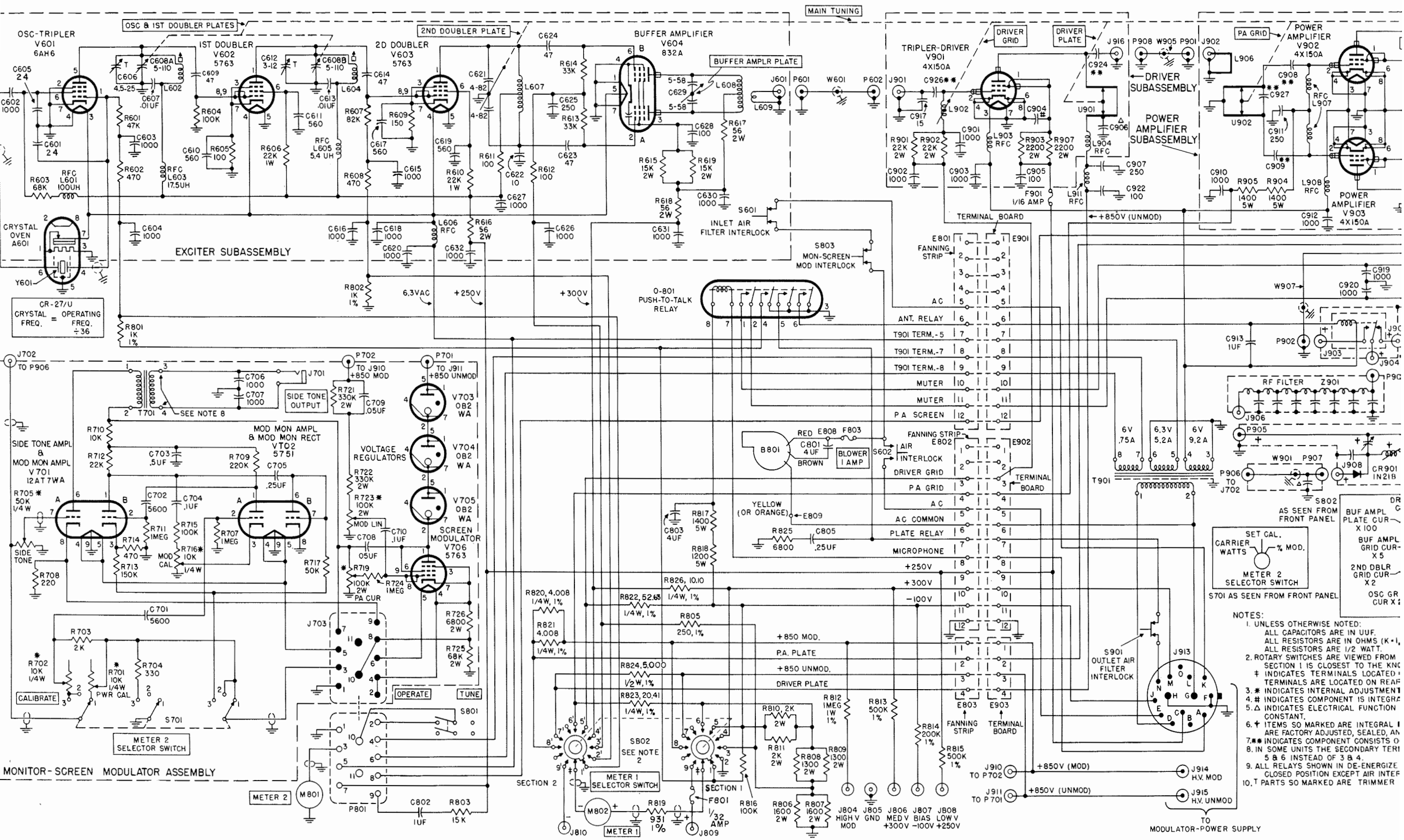


Figure 7-18A. Radio Transmitter T-282C/GR Schematic Diagram

ALPHABETICAL INDEX