DEPARTMENT OF THE ARMY TECHNICAL MANUAL

DEPARTMENT OF THE AIR FORCE TECHNICAL ORDER

TM 11-5506
TO 31R2-2FRC6-5

RADIO SETS AN/FRC-6 AND AN/FRC-6A





DEPARTMENTS OF THE ARMY AND THE AIR FORCE

APRIL 1956

WARNING

EXTREMELY DANGEROUS VOLTAGES EXIST IN THE FOLLOWING UNITS:

Transmitters T–215A/FRC–6 and T–264/FRC–6A	600-volt circuits
Radio Receivers R–276A/FRC–6 and R–368/FRC–6A	250-volt circuits

TECHNICAL MANUAL
No. 11-5506
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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., *6 April 1956*

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***This manual supersedes TM 11-5506, 14 March 1949, including C 1, 1 March 1951, C 2, 14 August 1951, and C 3, 29 July 1954.**

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual contains instructions for the installation, operation, maintenance, and repair of Radio Set AN/FRC–6(*) (fig. 1).

b. Official nomenclature followed by (*) is used to indicate all models of the equipment item covered in this manual. Thus, Radio Set AN/FRC–6(*) represents Radio Sets AN/FRC–6 and AN/FRC–6A; Console C–559(*)/FRC–6 represents Consoles C–559A/FRC–6, C–559B/FRC–6, and C–559D/FRC–6; Radio Set Control C–560(*)/FRC–6 represents Radio Set Controls C–560A/FRC–6 and C–560B/FRC–6; Power Supply PP–420(*)/FRC–6 represents Power Supplies PP–420A/FRC–6, PP–420B/FRC–6 and PP–420C/FRC–6; and Power Supply PP–421(*)/FRC–6 represents Power Supplies PP–421A/FRC–6 and PP–421B/FRC–6; Remote Control Unit C–408(*)/FR represents Remote Control Units C–408/FR and C–408A/FR.

c. Forward comments on this publication directly to Commanding Officer, The Signal Corps Publications Agency, Fort Monmouth, N. J.

2. Forms and Records

a. Unsatisfactory Equipment Reports. DA Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in AR 700–38.

b. Damaged or Improper Shipment Report. DD Form 6, Report of Damaged or Improper Shipment, will be filled out and forwarded as prescribed in SR 745–45–5 (Army); Navy Shipping Guide, Article 1850–4 (Navy); and AFR 71–4 (Air Force).

c. Preventive Maintenance Forms.

(1) DA Form 11–238, Operator First Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 24).

(2) DA Form 11–239, Second and Third Echelon Maintenance Check List for Signal Corps Equipment (Radio Communication, Direction Finding, Carrier, Radar) will be prepared in accordance with instructions on the back of the form (fig. 25).

Section II. DESCRIPTION AND DATA

3. Purpose and Use

a. Radio Set AN/FRC–6(*) is a complete operating radio set, less primary power source, designed for fixed station operation. It provides two-way communication by voice or tone with similar fixed or mobile equipment over a range of at least 20 miles over open country.

b. The set operates in the frequency range of 30 to 40 megacycles (mc), utilizing frequency modulation (fm) with one fixed frequency output (crystal controlled). Primary power is 110-volt, 60-cycle, single-phase alternating current (ac) supplied from an external source. The set may be operated from a remote location by means of a control line (a pair of telephone wires) up to a maximum distance of 10 miles. The block diagram of the AN/FRC–6(*) is shown in figure 2.

4. System Application

Radio Set AN/FRC–6(*) is normally intended for communication with mobile units operating within its range. Figure 3 graphically illustrates the Signal Corps equipment with which Radio Set AN/FRC–6(*) can communicate.

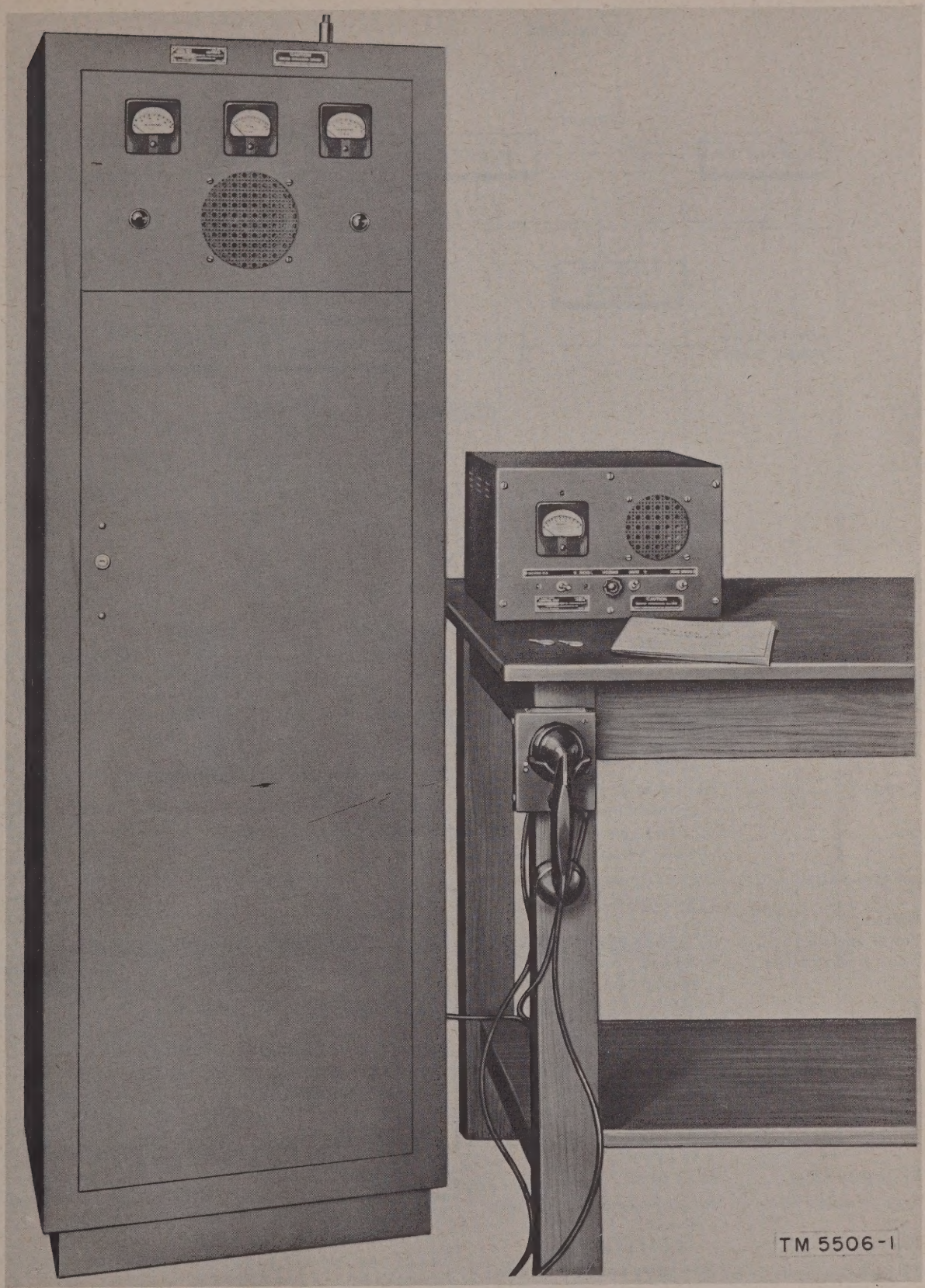


Figure 1. Radio set AN/FRC–6.

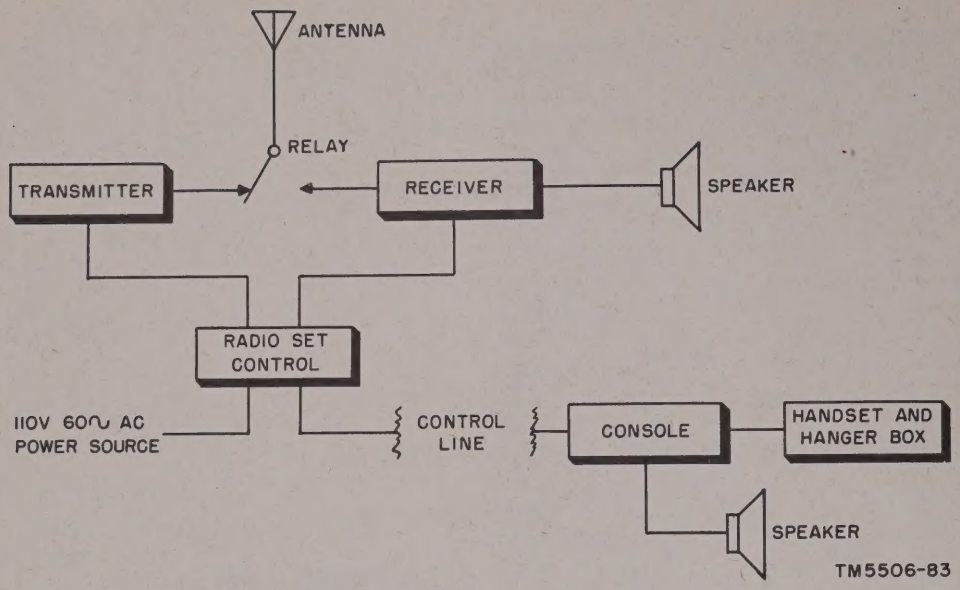


Figure 2. Radio set AN/FRC–6(*), block diagram.

5. Technical Characteristics

Power input:	
Rack	150 watts (standby); 325 watts (transmit) at 110 volts, 60 cycles, single-phase.
Console	30 watts at 110 volts, 60 cycles, single-phase.
Antenna	Modified ground-plane (Antenna AS–412/FRC–6).
Type of transmitter	Crystal-controlled, frequency modulated.
Transmitter:	
Power output	50 watts (approximately).
Type of modulation	Frequency modulation resulting from phase modulation.
Frequency range	30 to 40 mc.
Frequency deviation	±15 kc maximum.
Number of tubes	10, including rectifiers.
Receiver:	
Type	Dual conversion superheterodyne with two crystal oscillators.
Frequency range	30 to 40 mc.
Type of signals received	Frequency-modulated, voice or tone.
Number of tubes	14, including rectifier.
Control line	Two wires not over 10 miles in length, balanced to ground.
Audio response	400 to 3,000 cycles within ±3 db of the response at 1,000 cycles.
Operating range	20 miles minimum over open terrain.

6. Common Name Assignments

A list of common name assignments for the components of Radio Set AN/FRC–6(*) is given below.

Nomenclature	Common name
Antenna AS–412/FRC–6	Antenna.
Power Supply PP–420(*)/FRC–6	Transmitter power supply.
Power Supply PP–421(*)/FRC–6	Receiver power supply.
Rack MT–658A/FRC–6 or MT–785/FRC–6A.	Rack.
Radio Set AN/FRC–6(*)	Radio set.
Radio Receiver R–276A/FRC–6 or R–368/FRC–6A.	Receiver.
Radio Transmitter T–215A/FRC–6 or T–264/FRC–6A.	Transmitter.
Radio Set Control C–560(*)/FRC–6	Radio set control.
Remote Control Unit C–408(*)/FR or Console C–559(*)/FRC–6.	Console.
Meter and speaker panel (part of rack).	Rack control panel.

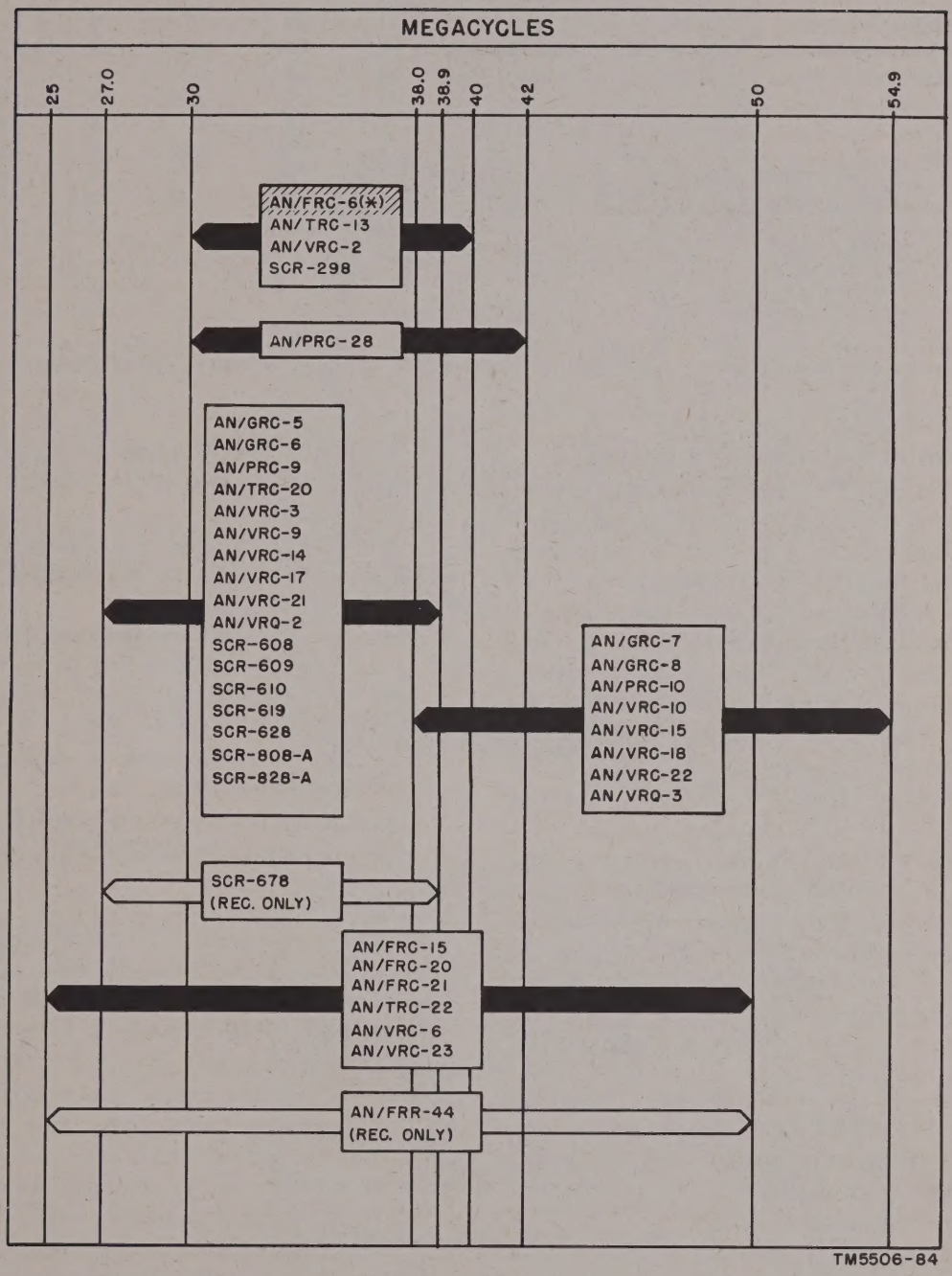


Figure 3. Frequency chart.

7. Components

Component	Required No.	Dimensions (in.)			Volume (cu ft)	Weight (lb)
		Height	Width	Depth		
Antenna AS–412/FRC–6	1	36	6	6	2.3	8
Rack, completely assembled	1	68⅛	22½	15	13.3	173
Rack control panel and cables	1	68⅛	22½	15	13.3	106
Receiver	1	9	18½	9	.867	21
Transmitter	1	9	18½	9	.867	38
Radio set control	1	5¼	18½	6	.337	8
Console	1	8¾	13	12	.789	33
Handset and hanger box	1	9	4⅜	4⅜	.094	3
Technical Manual 11–5506	2	10¼	7⅞	1	----------	1
Set of running spares (par. 13).						
Total						392

Note. This list is for general information only. See appropriate supply publications for information pertaining to requisition of spare parts.

8. Description of Radio Set AN–FRC–6(*)

a. Radio Set AN/FRC–6(*) consists of an upright rack with a suitable antenna system and interconnecting cables. A console for the remote control of the receiver and transmitter may be located up to a distance of 10 miles from the rack. Connection between the console and rack is made by a control line such as a pair of telephone wires.

b. The antenna may be mounted on a pole, the side of a building, or other suitable elevation and connected by coaxial cable to the rack. This antenna is described in TM 11–5023, Antenna AS–412/FRC–6.

c. The rack contains the main operating components of the radio set. These components are the transmitter, receiver, and radio set control.

d. The console is connected to the rack by the control line. This console provides all the operating controls for the radio set.

9. Racks

(fig. 16)

a. Rack MT–658A/FRC–6 (part of the AN/FRC–6) is a sheet metal cabinet 5 feet 8 inches high, fitted with front and rear doors. It contains the following components:

(1) A rack control panel is located at the top of the rack above the front door.

(2) Radio Transmitter T–215A/FRC–6 is mounted inside the rack, below the rack control panel.

(3) Radio Receiver R–276A/FRC–6 is mounted inside the rack, below the transmitter.

(4) Radio Set Control C–560A/FRC–6 is mounted inside the rack, below the receiver.

b. Rack MT–785/FRC–6A (part of the AN/FRC–6A) is similar to the MT–658A/FRC–6 with the following exceptions:

(1) The 3 meters on the rack control panel have circular faces.

(2) The transmitter used is Radio Transmitter T–264/FRC–6A.

(3) The receiver used is Radio Receiver R–368/FRC–6A.

(4) The radio set control used is Radio Set Control C–560B/FRC–6.

10. Consoles

a. Console C–559(*)/FRC–6 (fig. 10). Console C–559(*)/FRC–6 is included with all the later procurements of both Radio Sets AN/FRC–6 and AN/FRC–6A. This console is in a sheet metal cabinet, approximately 12 by 13 by 8¾ inches. Mounted on the front panel are a decibel meter, a loudspeaker, a red pilot light, two amber pilot lights, three toggle switches, and a control knob. Connected to the console is a telephone-type handset and hanger box designed for vertical mounting. The console will operate the rack components from a distance of up to 10 miles over a control line (a pair of telephone wires).

b. Remote Control Unit C–408(*)/FR. Earlier procurements of Radio Set AN/FRC–6 were supplied with Remote Control Unit C–408(*)/FR in place of Console C–559(*)/FRC–6. Remote Control Unit C–408/FR was procured on Order

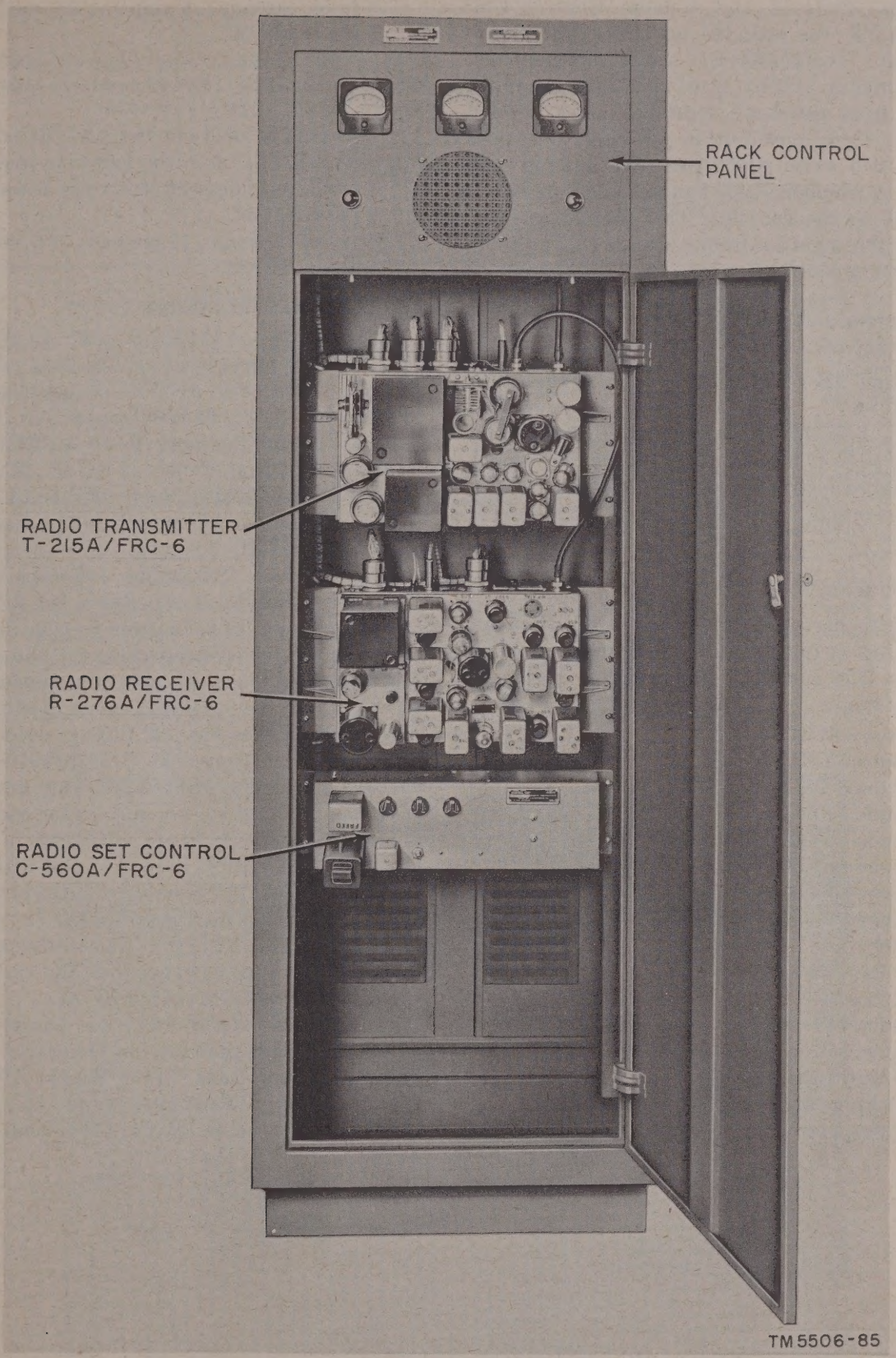


Figure 4. Component layout of rack MT–658A/FRC–6.

No. 5010–Phila–48 and Remote Control Unit C–408A/FR was procured on Order No. 11922–Phila–48. This console is in a sheet metal cabinet, approximately 12¾ by 13 by 9 inches. Mounted on the front panel are a decibel meter, a loudspeaker, three push-button switches, one push switch, two white pilot lights, and one red pilot lamp. A telephone-type handset and hanger box connects to the console. This console also can operate the radio set from a distance of up to 10 miles over a control line.

11. Antenna AS–412/FRC–6

(fig. 15)

Antenna AS–412/FRC–6 is part of Radio Set AN/FRC–6(*). It is a modified ground-plane antenna, designed to operate in the frequency range of 30 to 40 megacycles. It is nondirectional. For detailed instructions on the antenna installation, operation, and maintenance refer to TM 11–5023.

12. Spare Parts

a. Spare parts for Radio Set AN/FRC–6 are packed in a carton and are included in the case that contains the console. Following is a list of running spares:

1 tube 5U4G.
1 tube 5Y3GT.
1 tube 6C8G.
1 tube 6H6GT.
1 tube 6K6GT/G.
1 tube 6K8GT.
3 tubes 6SG7.
1 tube 6V6GT.
1 tube 7A8.
1 tube 7C5.
2 tubes 7C7.
1 tube 7F7.
1 tube 8O7.
1 Lamp LM–52.
1 lamp incandescent 120 volts, 7 watts.
4 fuses, cartridge, 10 amperes, 250 volts.
5 fuses, cartridge, 5 amperes, 25 volts.
5 Fuses FU–50.

Note. For equipment using Console C–559B/FRC–6, procured on Order No. 16806–Phila–51, one spare fuse, 1.5 ampere, Bussman type AGC is added.

b. Spare parts for Radio Set AN/FRC–6A differ from the AN/FRC–6 in the following items only:

1 lamp, incandescent, 115 volts, 6 watts.
2 Fuses FU–50.
4 fuses, cartridge, 10 amperes, 250 volts.
2 Fuses FU–52.

13. Differences in Models

a. Radio Sets AN/FRC–6 and AN/FRC–6A. The external appearance of the two models is similar. Radio Set AN/FRC–6 contains Rack MT–658A/FRC–6, Radio Transmitter T–215A/FRC–6, Radio Receiver R–276A/FRC–6, and Radio Set Control C–560A/FRC–6. Radio Set AN/FRC–6A contains Rack MT–785/FRC–6A, Radio Transmitter T–264/FRC–6A, Radio Receiver R–368/FRC–6A, and Radio Set Control C–560B/FRC–6. The major difference between Radio Set AN/FRC–6 and Radio Set AN/FRC–6A is in the type of connectors used in the transmitter and in the connections to the antenna (fig. 7, 8, and 9). There are also a few minor differences between the types and values of some of the circuit components (fig. 122 through 125).

b. Consoles. Consoles C–559A/FRC–6, C–559B/FRC–6, and C–559D/FRC–6 are similar and interchangeable; there are only minor component differences between them. Console C–559C/FRC–6 is not usually issued or used with Radio Set AN/FRC–6(*). Remote Control Units C–408/FR and C–408A/FR are used in place of Console C–559(*)/FRC–6. (Remote Control Units C–408(*)/FR were included with the earlier procurements of Radio Set AN/FRC–6.)

c. Transmitter Power Supplies. Power Supply PP–420C/FRC–6 procured on Order No. 41269–Phila–52 differs from Power Supply PP–420B/FRC–6 in that it is mounted by four tapped No. 10–32 holes spaced on 8½- by 7-inch centers.

CHAPTER 2
INSTALLATION

Section I. SERVICE UPON RECEIPT OF RADIO SET AN/FRC–6(*)

Warning: The following installation procedures are to be performed only by qualified maintenance personnel.

14. Siting
(fig. 5)

The best location for radio equipment depends on local conditions, such as: the type of housing available, and the terrain. Signals from Radio Transmitter T–215A/FRC–6 or T–264/FRC–6 have a greater range if the antenna is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor locations for radio reception and transmission because the surrounding high terrain absorbs radio frequency (rf) energy. Weak or otherwise undesirable signals may be expected if the set is operated under or close to steel bridges, underpasses, hospitals, power lines, or power units. If possible, choose a location on elevated ground with adequate flat area to make installation easier. Normally, transmission over water is better than over land. When locating the antenna, avoid obstructions that are 2° to 3° above the horizontal plane of the antenna in the direction of the desired transmission. This is approximately 200 to 300 feet at a distance of 1 mile from the antenna. If possible, avoid locating the radio set near field hospitals or other sources of radio interference.



Figure 5. Siting Antenna AS–412/FRC–6.

15. Shelter Requirements

The shelter for Radio Set AN/FRC–6(*), when possible, should provide the facilities outlined in *a* through *d* below.

a. Permanent type housing.

b. Floors should be level and dry and carefully checked as to their ability to sustain the weight of the complete equipment.

c. Space requirements for the rack should provide a clearance of at least 3 feet on all sides to allow space for personnel to work and to allow proper ventilation of the radio set. Ceiling height should be at least 8 feet. The console should be mounted on a desk or table so that there is circulation of air around both sides and the rear of the cabinet.

d. The shelter should not contain unsuppressed fluorescent lighting, sparking electrical apparatus, radar equipment, or any other impulse-generating devices. Such noise-generating equipment can seriously reduce the efficiency of the radio set.

16. Unpacking

a. Packaging Data. When packed for export, the components of Radio Set AN/FRC–6(*) are placed in moisture-vaporproof containers and packed in two wooden crates as follows:

Crate No.	Height (in.)	Width (in.)	Depth (in.)	Volume (cu ft)	Unit weight (lb)	Contents
1 of 2	71½	25¾	18½	19. 7	160	Rack (empty).
2 of 2	38	22¾	24¼	12. 1	315. 5	Transmitter, receiver, radio set control, rack control panel, console unit, handset and hanger box, all cables, vacuum tubes (removed from units), spare tubes, lamps and fuses.
Total (lb)					475. 5	

b. Removing Contents.

Caution: Be careful when cutting metal straps, taking off sides and top of containers and removing components from cases. For unpacking, choose a location that is free from dust, dirt, and moisture, preferably within the building where the equipment is to be installed.

(1) Remove and save the packing slip.

(2) Cut and bend back the metal straps.

(3) Remove the nails with a nail puller and remove the top of the shipping container.

(4) Lift out the packaged units.

(5) Slit the waterproof barrier at the seams and remove it from around the outer carton.

(6) Slit the seal of the outer carton and remove the moisture-vaporproofed package.

(7) Slit the seams of the moisture-vaporproof barrier and remove the inner carton.

(8) Open the inner carton and remove all the fiberboard cells and pads.

(9) Remove the equipment from the inner carton.

17. Checking

a. Immediately after uncrating the radio set, check the items against the packing slip to be certain that the proper items, in the proper quantity, have been received.

b. Inspect the interior and exterior of both the rack and console for loose screws, nuts and other hardware. Pay particular attention to mounting screws that hold the heavier pieces of equipment in place, such as chassis, power transformers, loudspeakers, etc. Be sure that all knobs are tight on their shafts and that the grid or plate caps of the vacuum tubes are firmly in place.

c. Look for broken or cracked insulators and vacuum tubes. Sometimes components become detached during shipment and are tossed about in the cabinet.

d. Make a visual inspection of the set for damaged or broken wiring and connections. The wiring in the rack may be reached through the rear door.

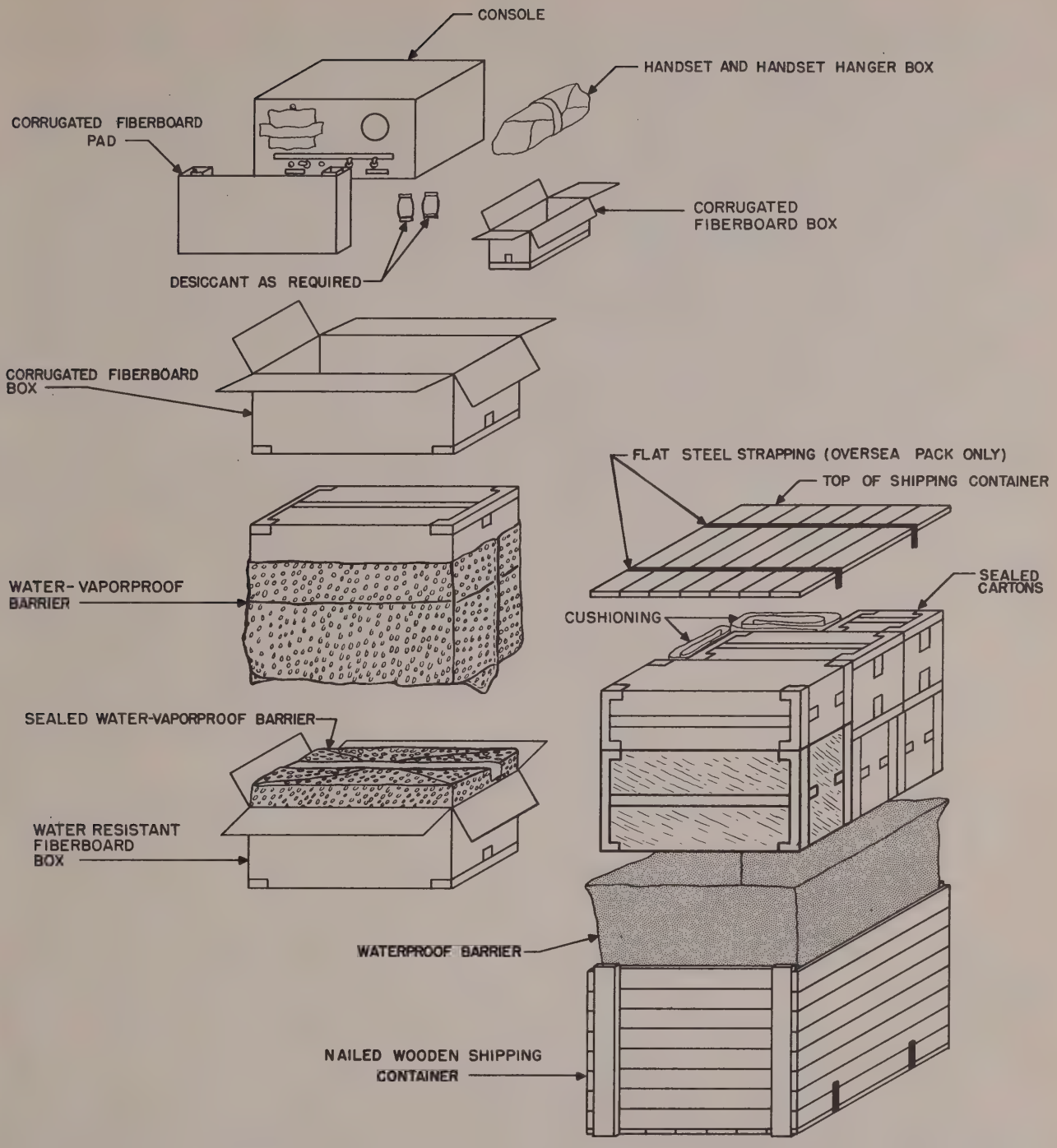


Figure 6. AN/FRC–6(*) packaging, box 2 of 2.

18. Installation of Rack

If possible, fasten the rack to the floor. Four holes are provided in the base of the rack to accommodate 1½ by ¼-inch lag screws for wooden floors. If concrete floors are used, holes must be drilled in the floor with a star drill, and expansion bolts must be used. Leave the front and rear doors of the rack open until installation is complete.

a. Rack Control Panel. Remove the six mounting bolts, lock washers, and nuts from the side lips of the meter panel. Fit the panel into the opening above the front door of the rack. From the inside of the lip on the meter panel, feed the

mounting bolts through the holes in the rack. Place a lock washer and a hexagonal nut on each bolt and tighten securely. Fit the power cable into its proper place and secure it with the snap fasteners bolted to the rack.

b. Transmitter. Prepare the transmitter for mounting by inserting two type 807 tubes in sockets for V107 and V108, and two type 5U4G tubes in sockets for V109 and V110 (figs. 64 and 66). The tubes are packed in a separate carton to avoid breakage during shipment. Remove the top three mounting bolts, lock washers, and hexagonal nuts from the vertical channel inside the rack on the right side, facing the equipment from the front. Loosen the top three mounting bolts on the left channel approximately ¼ inch. Lift the transmitter so that the mounting slots slide under the heads of the mounting bolts on the left hand channel. The connector jacks should be at the top and the vacuum tubes should be facing the front of the rack. Insert the three mounting bolts through the slots in the transmitter mounting bracket into the mounting holes in the right hand channel. Place a lock washer and a hexagonal nut on the end of each bolt. Tighten the mounting bolts on both channels and then tighten the nuts securely with a wrench.

c. Receiver. Insert one type 6C8G tube in the socket for V212 and fasten the grid cap connector. Follow the procedure outlined in *b* above and mount the receiver with the connecting jacks that face the top and the vacuum tubes that face the front of the rack. Use the three mounting bolts on each channel directly below the transmitter unit.

d. Radio Set Control. Use the two mounting bolts on each channel to mount the radio set control directly below the receiver. Mount the unit with the relay to the left and with the knobs facing the front of the rack. Use two mounting bolts on each channel directly below the receiver unit. Place a lock washer and a hexagonal nut on the end of each bolt. Tighten the mounting bolts on both channels and then tighten the nuts securely with a wrench.

e. Antenna Connections.

(1) For Radio Set AN/FRC–6 on Order No. 11922–Phila–48 (fig. 7), mount the bracket that holds antenna Radio Frequency Jack UG–22B/U and a length of 50-ohm Radio Frequency Cable RG–8/U on the vertical channel inside the rack on the right side, facing the equipment from the front. Screws, nuts, and lock washers will be found on the vertical channel near the top of the rack in the holes to be used. Connect the coaxial plug on the other end of Radio Frequency Cable RG–8/U to the transmitter jack marked ANTENNA and tighten the locking collar. Two adapters are provided for use with this fitting: one for use with Antenna AS–412/FRC–6, and one for use with a 7⅛-inch gas-filled rigid line (Radio Frequency Jack UG–22B/U). Connect the adapter to be used to the antenna and fasten the unused adapter in the space provided on the bracket.

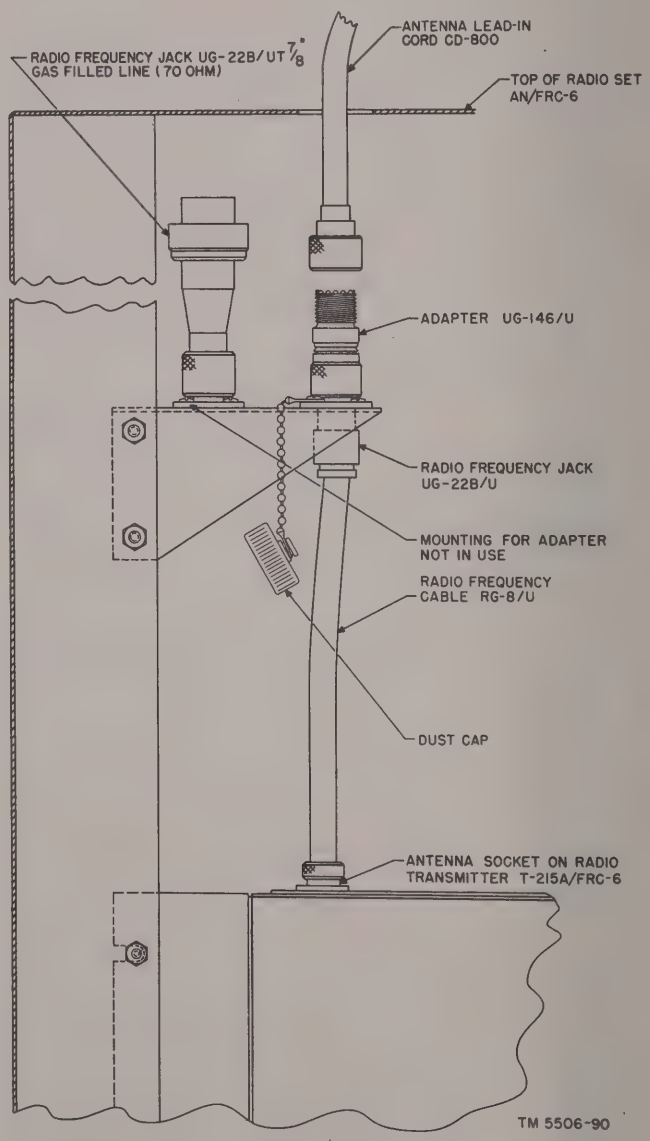


Figure 7. Antenna connections for equipments on Order No. 11922–Phila–48.

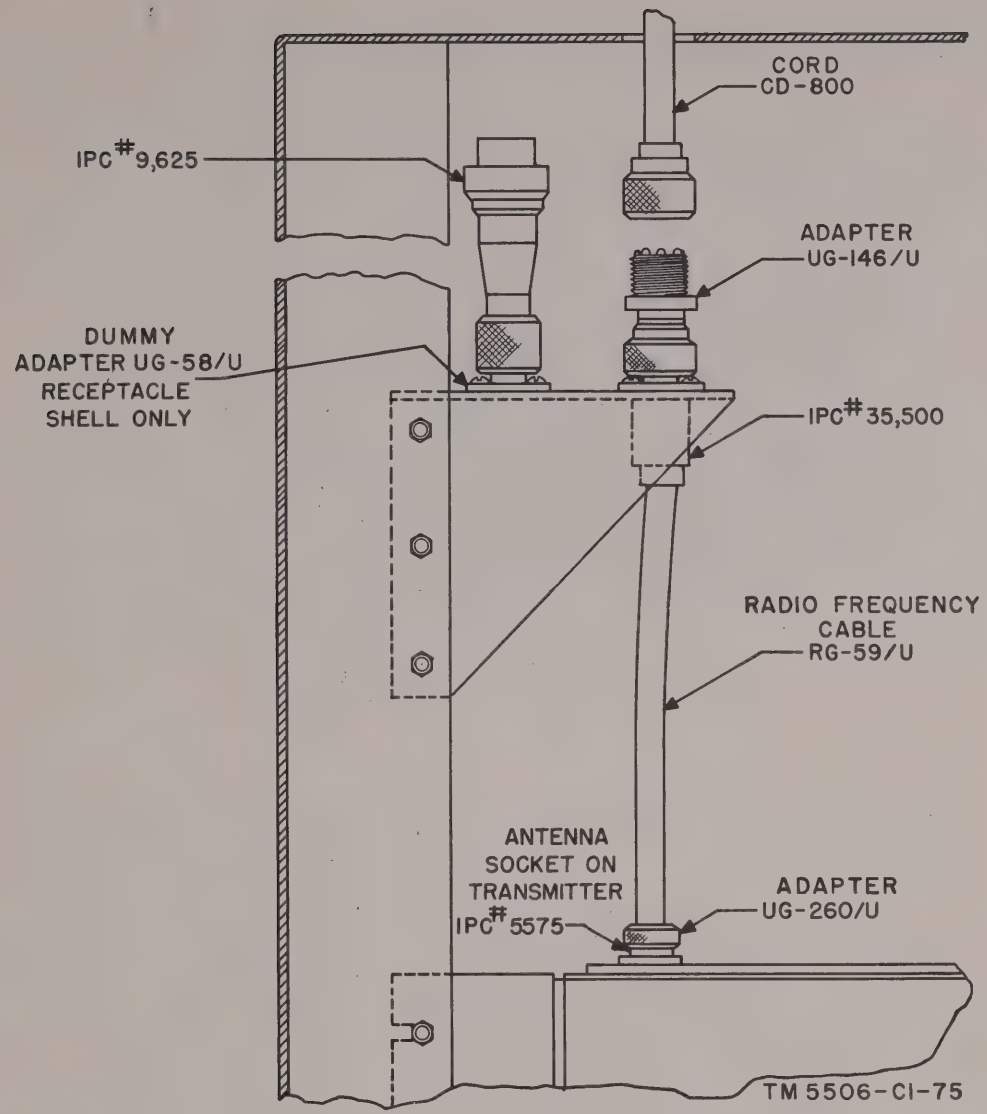


Figure 8. Antenna connections for equipments on Order No. 20591–Phila–49.

(2) For Radio Set AN/FRC–6A on Order No. 20591–Phila–49 (fig. 8), an IPC No. 35500 connector is used in place of Radio Frequency Jack UG–22B/U, and 72-ohm Radio Frequency Cable RG–59/U is used in place of Radio Frequency Cable RG–8/U.

(3) For Radio Set AN/FRC–6A on Orders No. 3349–Phila–52 and 37214–Phila–53, the connections are as shown in figure 9

19. Installation of Console Cabinet

(fig. 10)

No fastening is required for the console cabinet. Place the console on the top rear surface of a desk or table, with sufficient space around it for ventilation (fig. 1). The front panel should face the operator, and writing space should be provided for the operator to make entries in log sheets.

20. Installation of Handset Box

(fig. 11)

Remove the handset box cover and mount the handset box on the vertical surface of the desk at the left hand of the operator (fig. 1). Holes are provided in the hanger box for mounting with wood screws.

21. Connections and Interconnections

The only interconnections to be made are in the rack. After the separate components are mounted in the rack, shape the cable carefully and move it

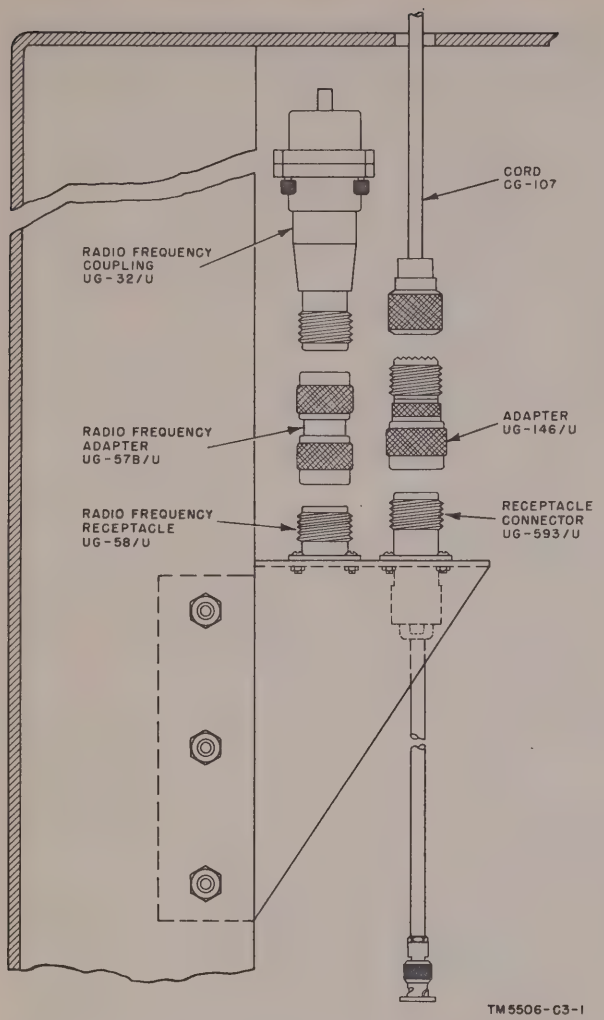


Figure 9. Antenna connection for equipments on Orders No. 3349–Phila–52 and 37214–Phila–53.

into exact position. Make sure that the cable clamps are snapped into position to secure the cable to the right hand vertical channel as viewed from the rear.

a. Interconnections in Rack (fig. 12 and 13). The plugs that terminate various sections of the cable are all polarized and laced in such a fashion that only one plug will fit any given socket. Insert the plugs carefully into the proper sockets in the transmitter and receiver units. Where locking collars are provided, tighten them to the socket to insure permanent connection at the plug. Connect the lower end of the cable to the radio set control by fastening each of the spade-tongue connectors to the proper terminal on the radio set control terminal strip. Each of the terminals is numbered; a corresponding number is on the sleeve of the correct wire to be attached to the terminal. Connect the coaxial cable with a plug on each end between the receptacle marked RECEIVER on the top panel of the transmitter and the receptacle marked ANTENNA on the top panel of the receiver. Installation of the antenna lead cable is discussed in paragraph 18*e*. Interconnections for Rack MT–658A/FRC–6 (Radio Set AN/FRC–6) are shown in figure 12; interconnections for Rack MT–785/FRC–6A (Radio Set AN/FRC–6A) are shown in figure 13.

b. Power Connections (fig. 14). No power disconnect switch is provided on the rack. For permanent installation, connect a source of 110-volt, 60-cycle ac to the fuse block mounted on the rear of the control unit through a 30-ampere safety switch mounted on the wall immediately adjacent to the rack. To supply power to the console, plug the power cord attached to the unit into a nearby convenience outlet providing 110-volt, 60-cycle ac.

c. Antenna Connections (fig. 7, 8, and 9). Provision is made for the use of either Antenna AS–412/FRC–6 or a ⅞-inch gas-filled coaxial transmission line. When Antenna AS–412/FRC–6 is to be used, connect Adapter UG–146/U to the appropriate antenna adapter mounted inside the rack near the top. Attach the connector on the end of the antenna lead-in to the adapter and tighten the screw. When a ⅞-inch gas-filled line is used, solder the line to the appropriate adapter in accordance with procedures outlined for the specific line used. Connect a heavy wire or copper strap from one of the vertical mounting members of the rack to a water pipe or other suitable ground (fig. 14).

d. Control Line (fig. 14). The console must be connected to the rack by a pair of wires. If the console is located at a distance from the rack, use a telephone line. Connect one end of the line to terminals 1 and 2 on the rear of the console. Connect the opposite end of the line to terminals 7C and 8C on the bottom row of terminals at the rear of the radio set control, located at the bottom of the rack.

e. Handset (fig. 11). The handset is connected to the MIC jack on the console by plug P401.

22. Installation of Antenna AS–412/FRC–6 (fig. 15)

Antenna AS–412/FRC–6 is mounted and assembled according to the instructions contained in TM 11–5023. Connections from the antenna to the rack are made as described in paragraph 21*c*.



Figure 10. Console C–559(*)/FRC–6.

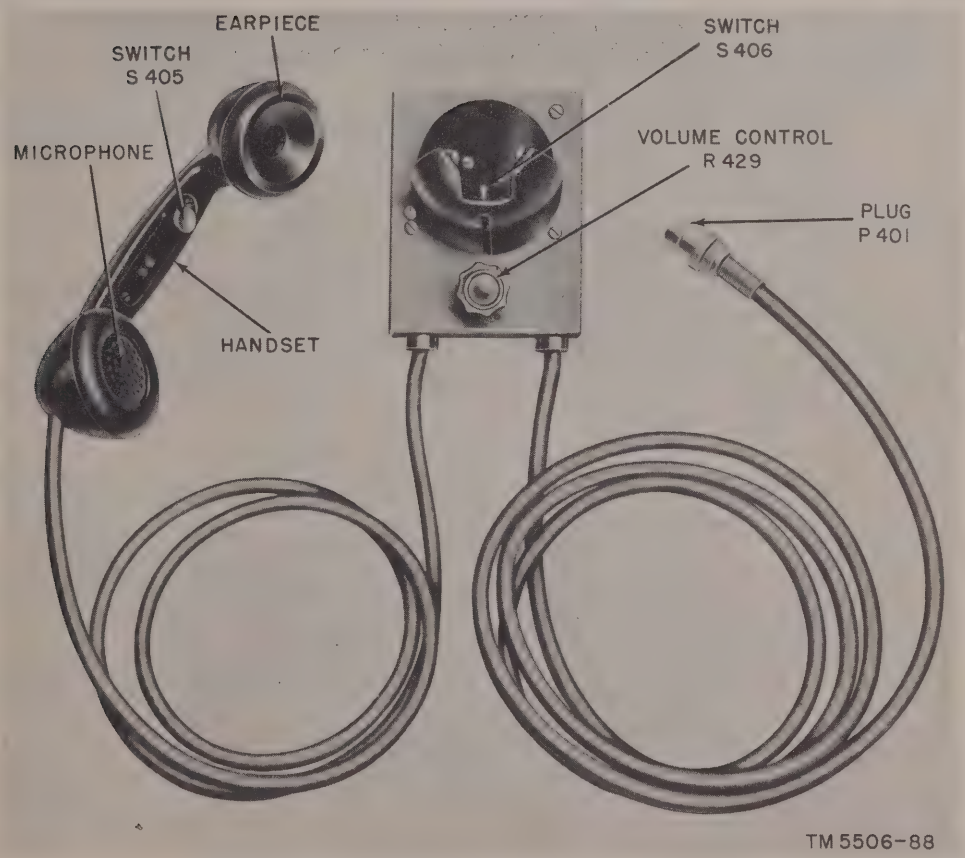
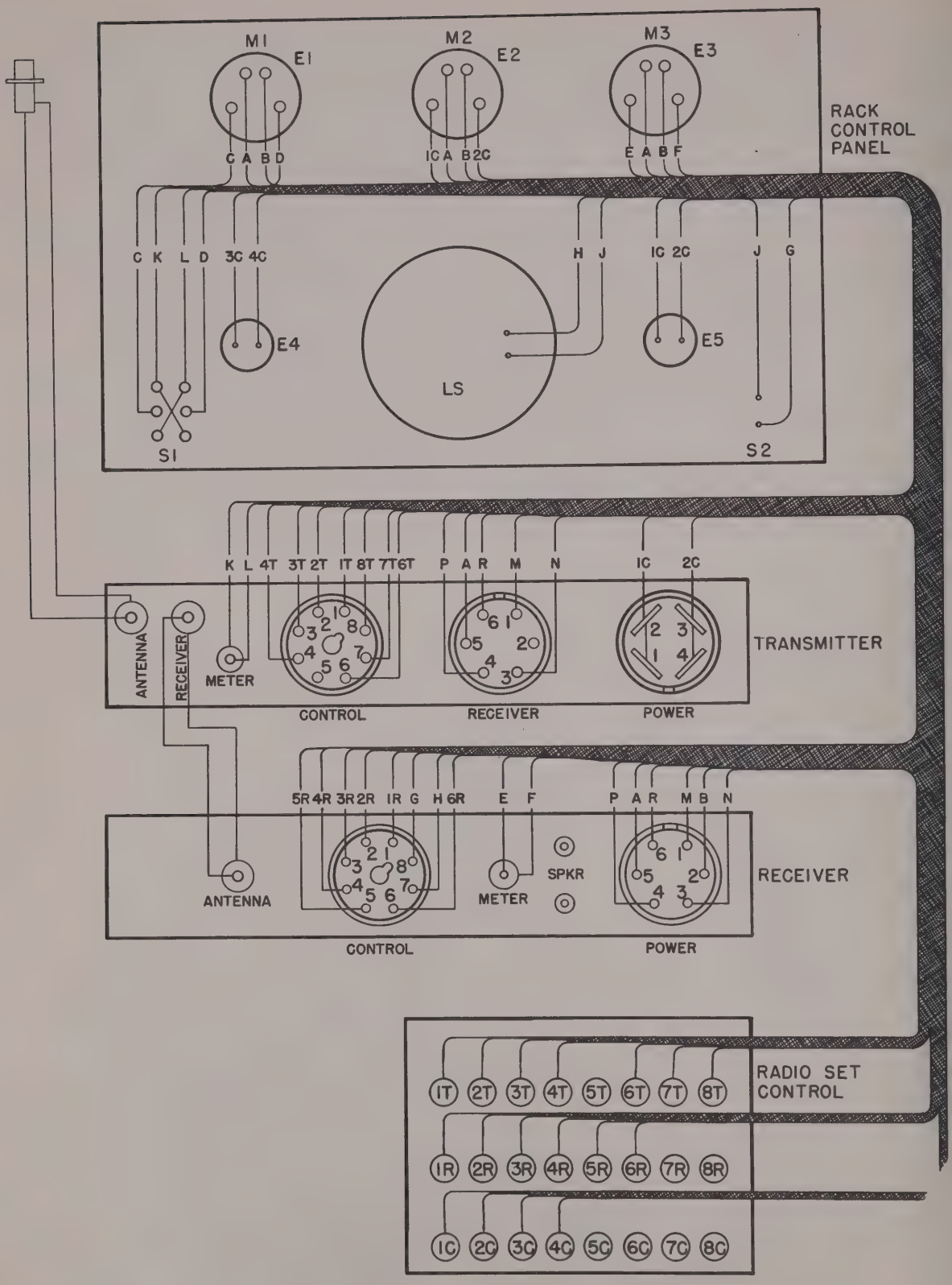


Figure 11. Handset and hanger box.



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Figure 12. Rack MT–658A/FRC–6, interconnections.

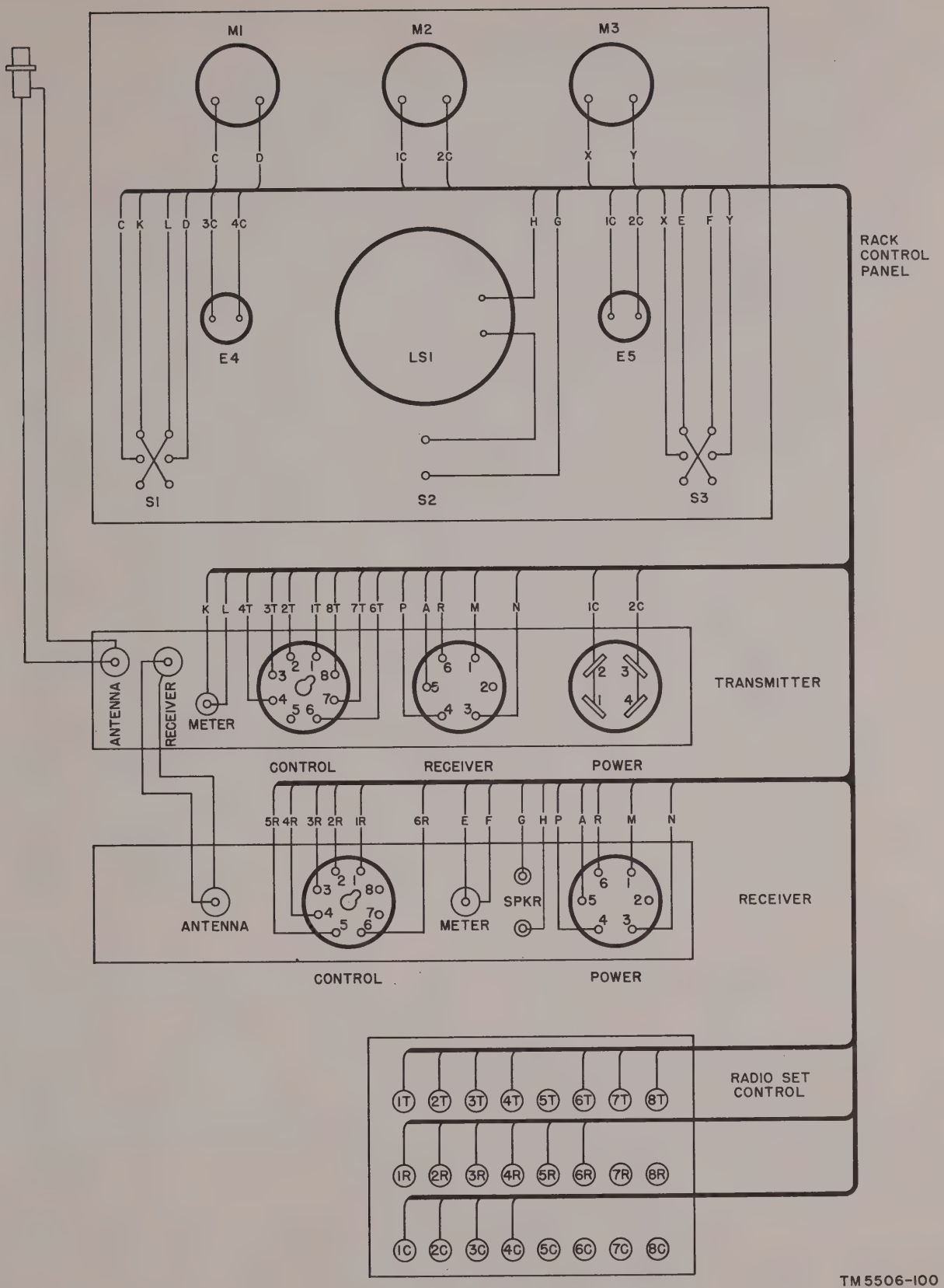


Figure 13. Rack MT–785/FRC–6A, interconnections.

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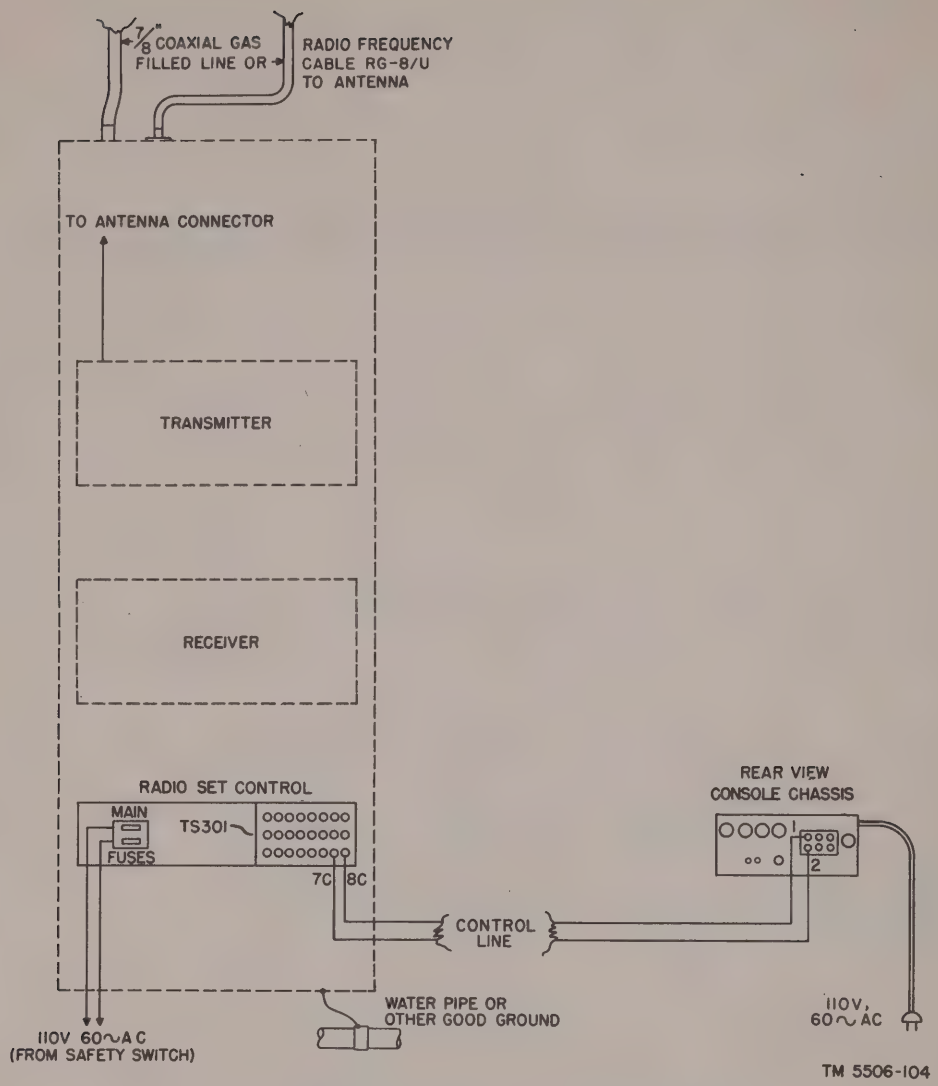


Figure 14. Radio Set AN/FRC-6(*) external connections.

23. Service upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraphs 16 and 17 for uncrating, unpacking, and checking the equipment.

b. Check the used or reconditioned equipment for tags or other indications that pertain to changes in the wiring of the equipment. If any changes have been made in the wiring, note them in this manual, preferably on the schematic diagram.

c. Check the operating controls for ease of rotation.

d. Perform the installation and connection procedures given in paragraphs 18 through 22.

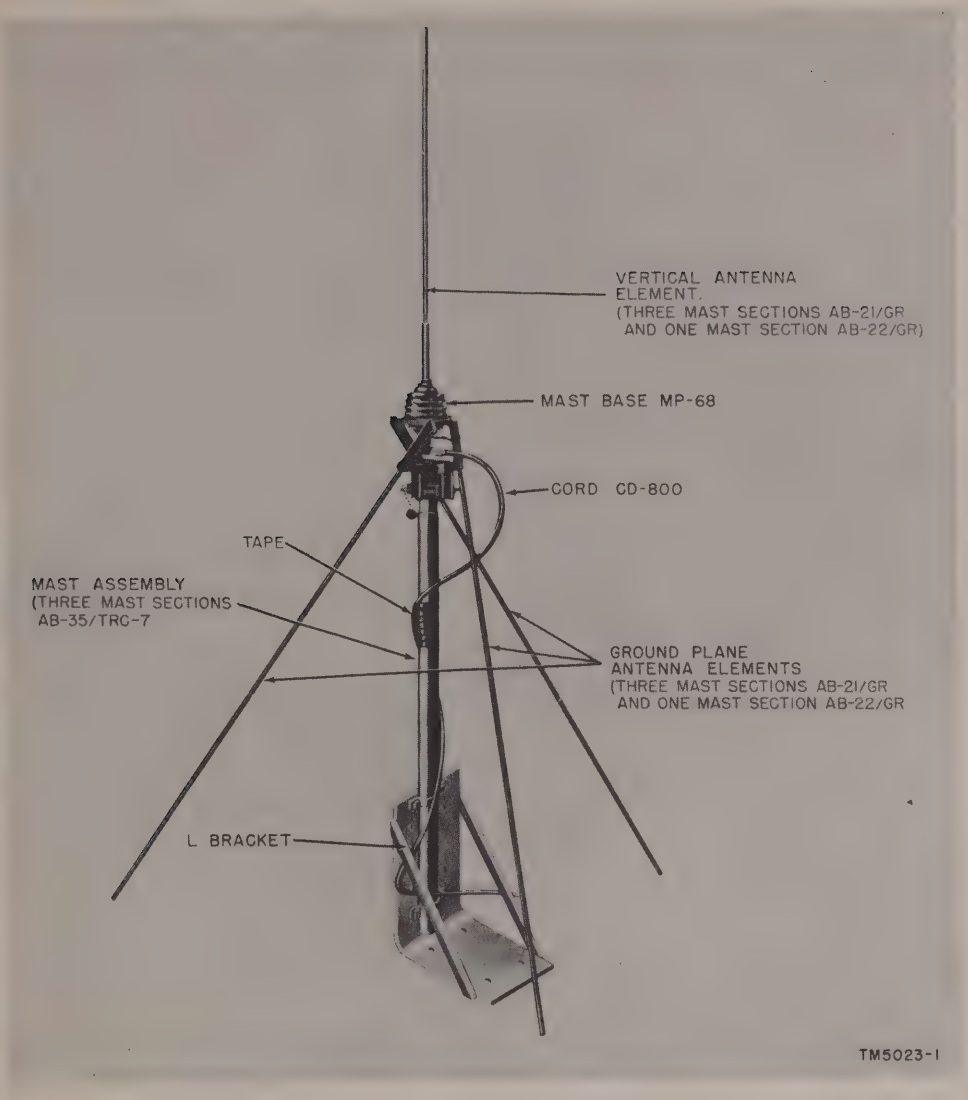


Figure 15. Antenna AS–412/FRC–6.

Section II. INITIAL ADJUSTMENT OF EQUIPMENT

24. Extent of Initial Adjustment

Personnel performing the procedures described in this section should be familiar with the use of controls and instruments and with the operating procedures described in paragraphs 25 through 32.

a. The procedures outlined in paragraphs 18 through 22 must be performed before Radio Set AN/FRC–6(*) can be used for the routine operation described in paragraphs 25 through 38.

b. For a change in assigned frequency, the procedures (for crystal changing) outlined in paragraphs 34 through 38 are to be followed. These alignment techniques are to be performed only by trained personnel.

c. After installation, turn on power at the rack

(par. 25 through 32) and check for the following normal readings:

(1) For receiver tuning meter M3, the readings should be as follows:

METER SWITCH setting	Circuit element connected	Typical meter reading (with zero signal input and 110 volts line voltage)
1	Control grid of if amplifier (pin 4 of V206)	0
2	Control grid of 1st limiter (pin 4 of V207)	6
[a] 3	Control grid of 2d limiter (pin 4 of V208)	30
[a] [b] 4	Dc output of discriminator (pin 9 of T208)	0
5	Dc output of one section of discriminator (pin 8 of T208)	15

[a] For Radio Receiver R–368/FRC–6A at position 3 or 4 of the meter switch, the reading is 15.

[b] In Rack MT–785/FRC–6A if meter reads backwards, throw meter reversal switch S3 to reverse the direction of current through the meter.

(2) For power line voltmeter M2, the normal reading is 110 volts.

(3) For transmitter tuning meter M1, the reading should be as follows:

METER SWITCH setting	Circuit element connected	Typical meter reading for Radio Transmitter T–215A/FRC–6	Typical meter reading for Radio Transmitter T–264/FRC–6A
1	Grid of oscillator	28	18
2	Grid of 1st quadrupler	29	25
3	Grid of 2d quadrupler	43	14
4	Grid of doubler	15	7
5	Grid of power amplifier	32	21
[a] P. A.	Cathodes of power amplifier stage	35	37
[b] MOD.	Control grids of modulator stage	38	17

[a] Normal position of the meter reversal switch is toward the front of the rack.

[b] Normal position of the meter reversal switch is toward the rear of the rack.

CHAPTER 3
OPERATION

Section I. CONTROLS AND INSTRUMENTS

25. General

Paragraphs 26 through 32 locate, illustrate, and describe the use of the various controls that are provided for the proper operation of the equipment. It is important to know the function of every control. The actual operation of the equipment is discussed in paragraphs 33 through 41.

26. Rack Control Panel

(figs. 16 and 17)

The control panels of Racks MT–658A/FRC–6 and MT–785/FRC–6A are basically similar. Rack MT–658A/FRC–6 has square-shaped meters; Rack MT–785/FRC–6A has round meters and an additional meter reversal switch (S3). The following chart lists the controls and instruments of both types of racks and indicates their function.

Controls and instruments	Functions
Receiver tuning meter (M3) (fig. 20).	Monitors the control grid circuits of the following receiver stages: Position 1. If amplifier (V206). Position 2. 1st limiter (V207). Position 3. 2d limiter (V208). Position 4. Monitors the dc output of both sections at the discriminator (V209). Position 5. Monitors dc output of one section of the discriminator (V209).
Power line voltmeter (M2).	Indicates the ac line voltage.
Transmitter tuning meter (M1).	Monitors the control grid circuits of following transmitter stages: Position 1. Oscillator (V101). Position 2. 1st quadrupler (V104). Position 3. 2d quadrupler (V105). Position 4. Doubler (V106). Position 5. Power amplifier and current (V107 and V108). P. A. position. Power amplifier cathode current (V107 and V108). MOD. position. Modulator grid current (V102 and V103).
Green pilot light (E5)	Indicates that 110 volts ac is applied to both receiver and transmitter.
Red pilot light (E4)	Indicates transmitter is in transmit condition.
Loudspeaker cutoff switch S2 (fig. 17 and 18).	Connects or disconnects loudspeaker.
Meter reversal switch S1	Reverses transmitter tuning meter connections. Set switch forward in the P. A. position. For all other readings set switch to the rear.
Meter reversal switch S3 (on the MT–785/FRC–6A).	Reverses current through the receiver tuning meter when checking discriminator tuning. (Position 4 of METER SWITCH on the receiver.)

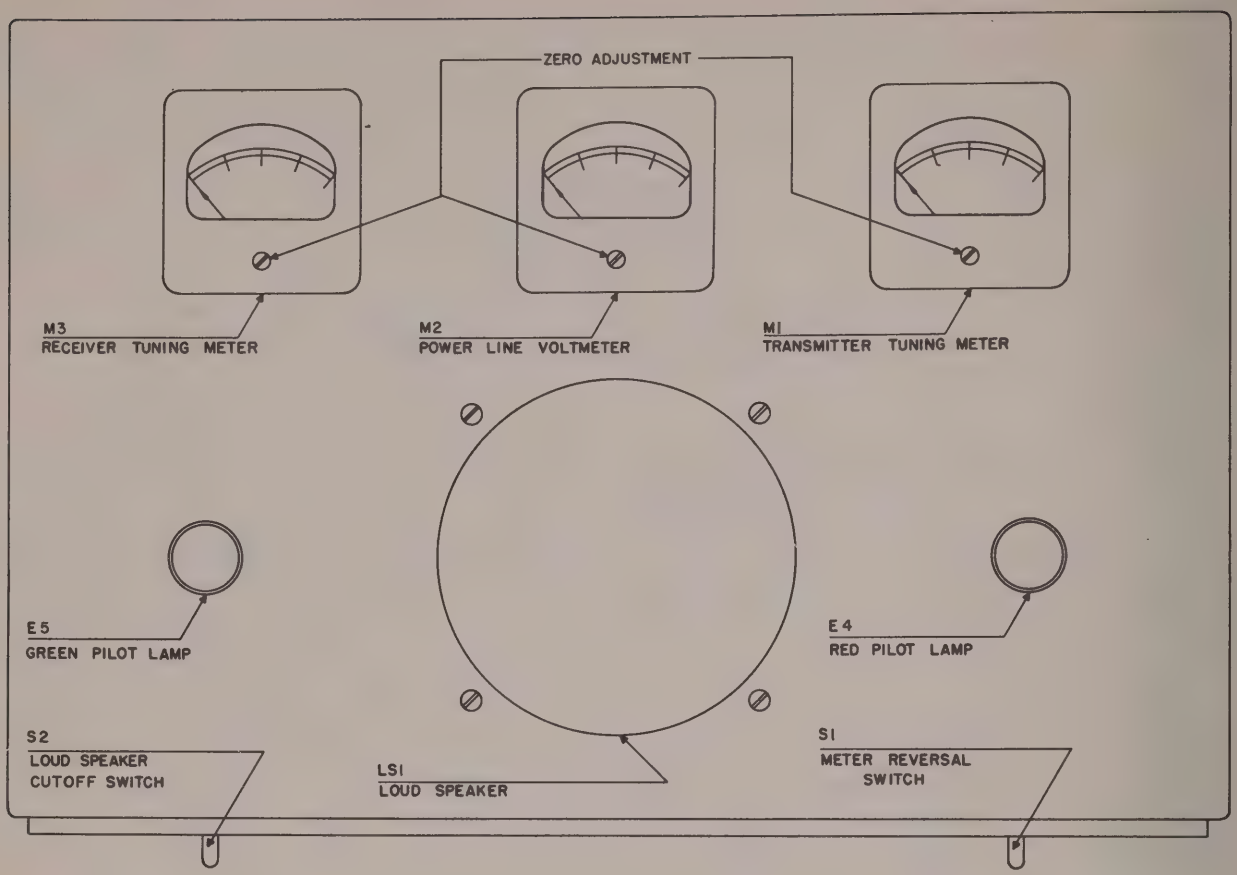


Figure 16. Rack MT-658A/FRC-6, rack control panel.

27. Transmitter Controls and Instruments

(figs. 18 and 19)

The controls of Radio Transmitters T–215A/FRC–6 and T–264/FRC–6A are basically similar. Minor differences in jack layout can be readily seen by referring to figures 18 and 19. The following chart lists the controls and instruments of the transmitter and indicates their function.

Controls and instruments	Functions
ANTENNA jack (J105).	Makes connection between the transmitter and antenna cabling.
RECEIVER jack (J104).	Makes antenna connection between the transmitter and receiver.
METER jack (J103)	Makes connection between the transmitter and the transmitter meter reversal switch (S1) of the rack control panel.
METER SWITCH (S101).	Controls output of various stages of transmitter when connected to transmitter tuning meter (M1) of rack control panel (par. 26). For METER SWITCH positions 1, 2, 3, 4, 5, and MOD., transmitter meter reversal switch S1 (fig. 16 and 17) on rack control panel must be toward rear of rack. For P. A. position, transmitter meter reversal switch must be forward. METER SWITCH positions and functions as follows:

Position	*Function*
1	Oscillator (V101) grid voltage.
2	1st quadrupler (V104) grid voltage.

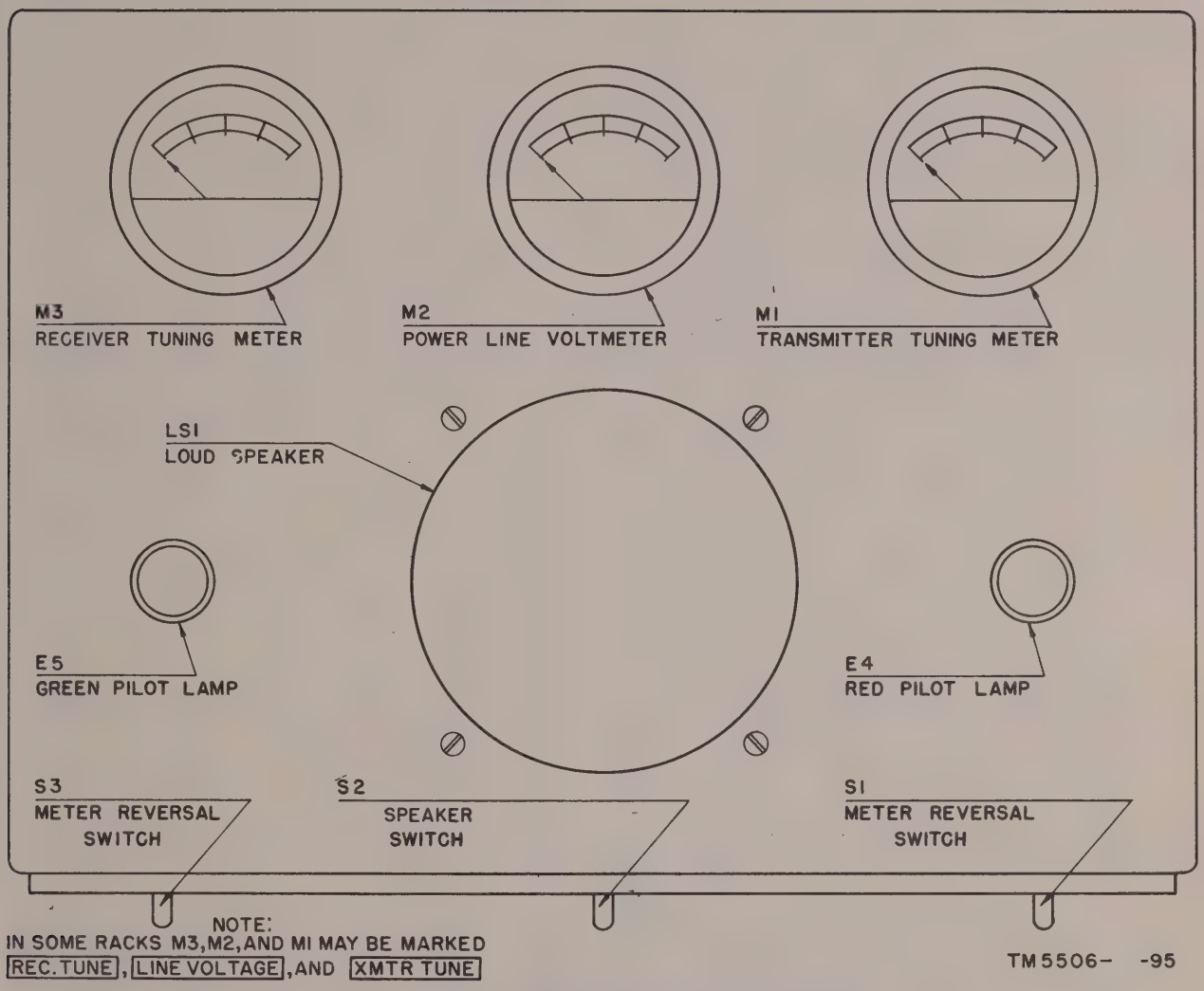
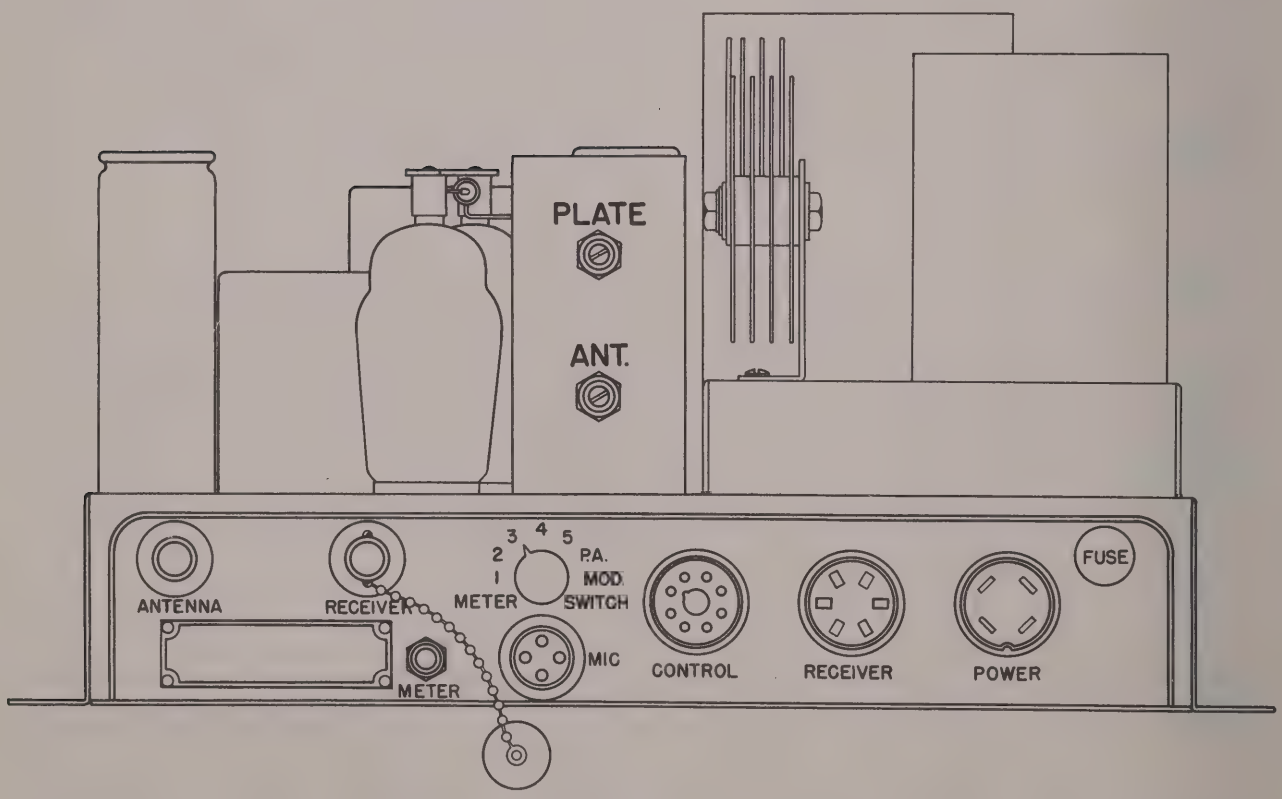


Figure 17. Rack MT-785/FRC-6A, rack control panel.

Controls and instruments	Functions	
	Position	*Function*
METER SWITCH (S101)—Con.	3	2d quadrupler (V105) grid voltage.
	4	Doubler (V106) grid voltage.
	5	Power amplifier (V106 and V107) grid voltage.
	P. A.	Power amplifier cathode voltage.
	MOD.	Modulators (V102 and V103) grid voltage.
MIC jack (J102)	Makes connection between transmitter and handset and hanger box. (When operating from the rack, hold down switch on hanger box.)	
CONTROL jack (P102).	Makes connection between the transmitter and radio set control.	
RECEIVER jack (J101).	In Rack MT–658A/FRC–6: Makes connection from the transmitter to receiver POWER jack (P201), receiver tuning meter (M3) in rack, power line voltmeter (M2) in rack, and transmitter tuning meter in rack. In Rack MT–785/FRC–6A: Makes connection from the transmitter to POWER jack (J201) on the receiver (fig. 20).	
POWER jack (P101)	Makes connection from the transmitter to 110-volts ac input in radio set control and to green pilot light (E5) of the rack.	
FUSE (F101)	Protects the power input circuit of transmitter from overloads.	



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Figure 18. Radio Transmitter T–215A/FRC–6, control layout.

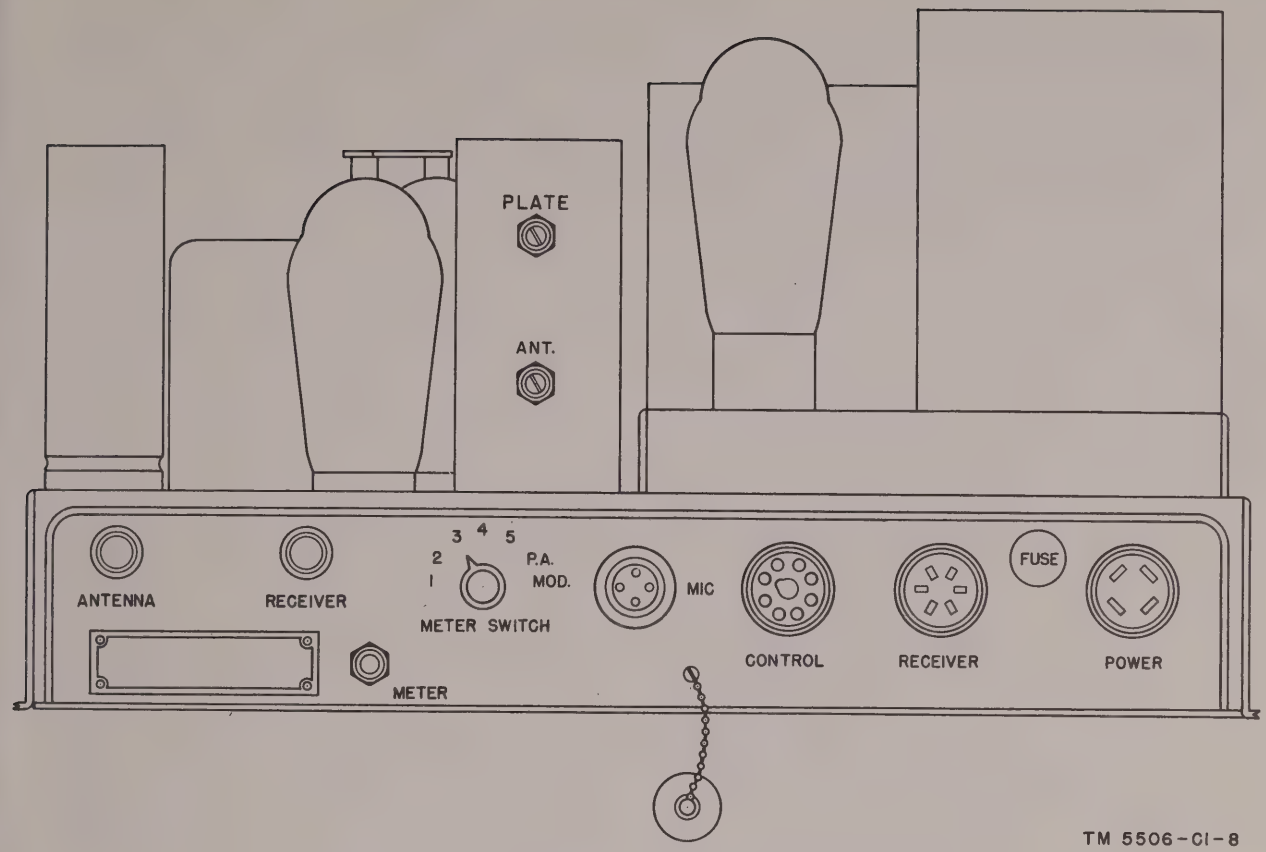


Figure 19. Radio Transmitter T–264/FRC–6A, control layout.

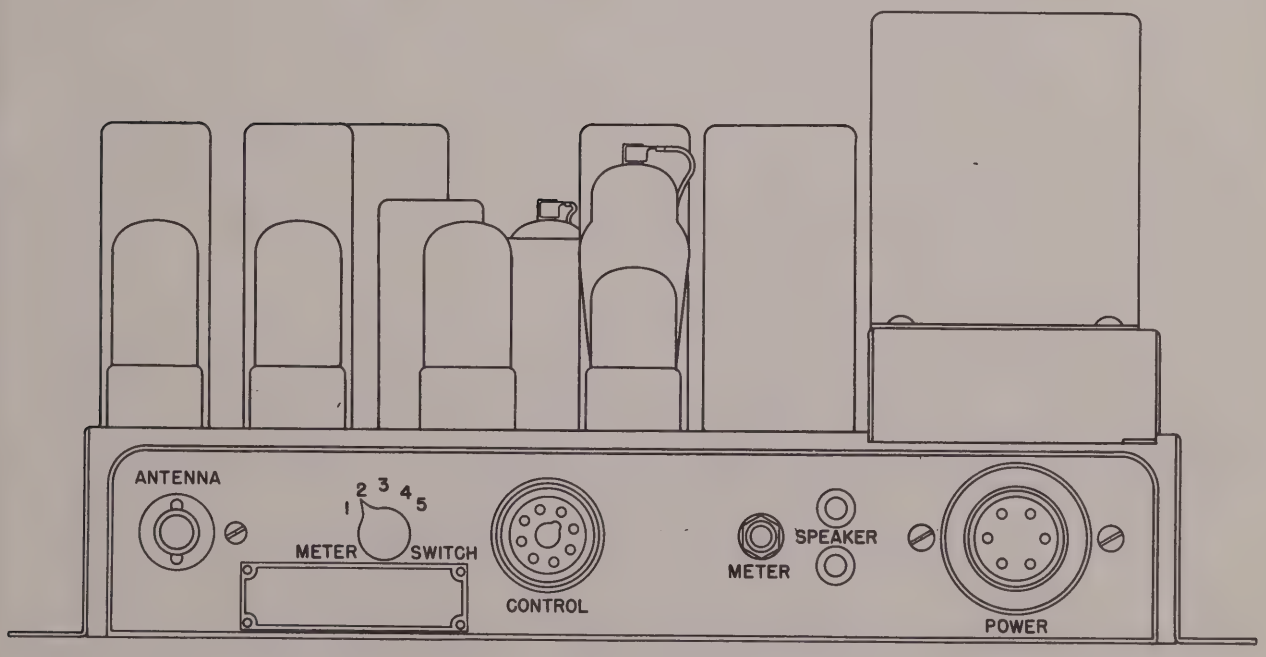


Figure 20. Radio Receiver R–276A/FRC–6, control panel layout.

28. Receiver Controls and Instruments
(fig. 20)

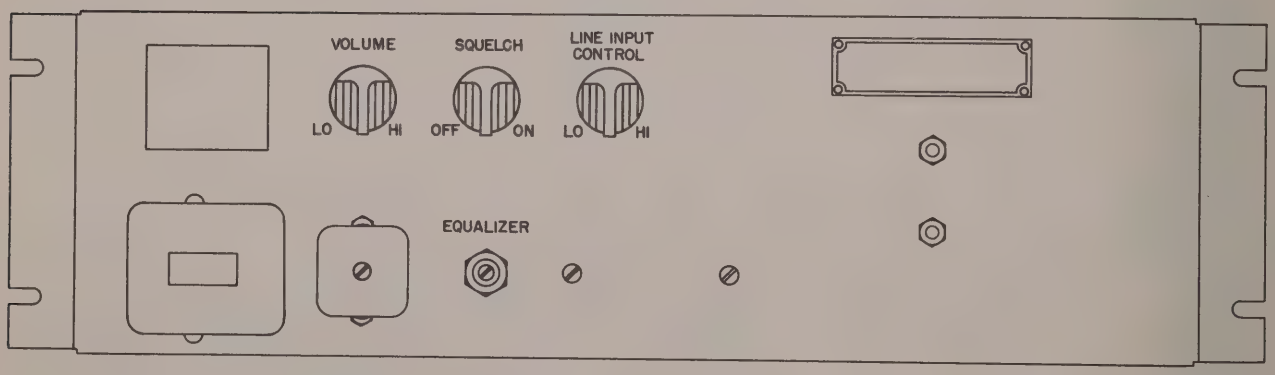
The controls and instruments of Radio Receivers R–276A/FRC–6 and R–368/FRC–6A are identical. The following chart lists the controls and instruments of both models and indicates their function.

Controls and instruments	Functions
ANTENNA jack (J201).	Makes connection between the receiver and RECEIVER jack (J105) of transmitter.
METER SWITCH (S201).	Connects various stages of receiver to receiver tuning meter (M3) of rack control panel. METER SWITCH positions and functions as follows: *Position* — *Function* 1 — If amplifier (V206) control grid voltage. 2 — 1st limiter (V207) control grid voltage. 3 — 2d limiter (V208) control grid voltage. 4 — Dc output voltage of both sections of discriminator (V209). (If receiver tuning meter (M3) reads backwards, reverse the position of the meter reversal switch on the rack.) 5 — Dc output of one section of discriminator (V209).
SPEAKER jacks (J206 and J207).	Makes connection between receiver and loudspeaker (LS1) on rack control panel.
POWER jack (P201).	For connection of power to receiver from RECEIVER jack (J101) of transmitter.

29. Radio Set Control C–560(*)–FRC–6
(fig. 21)

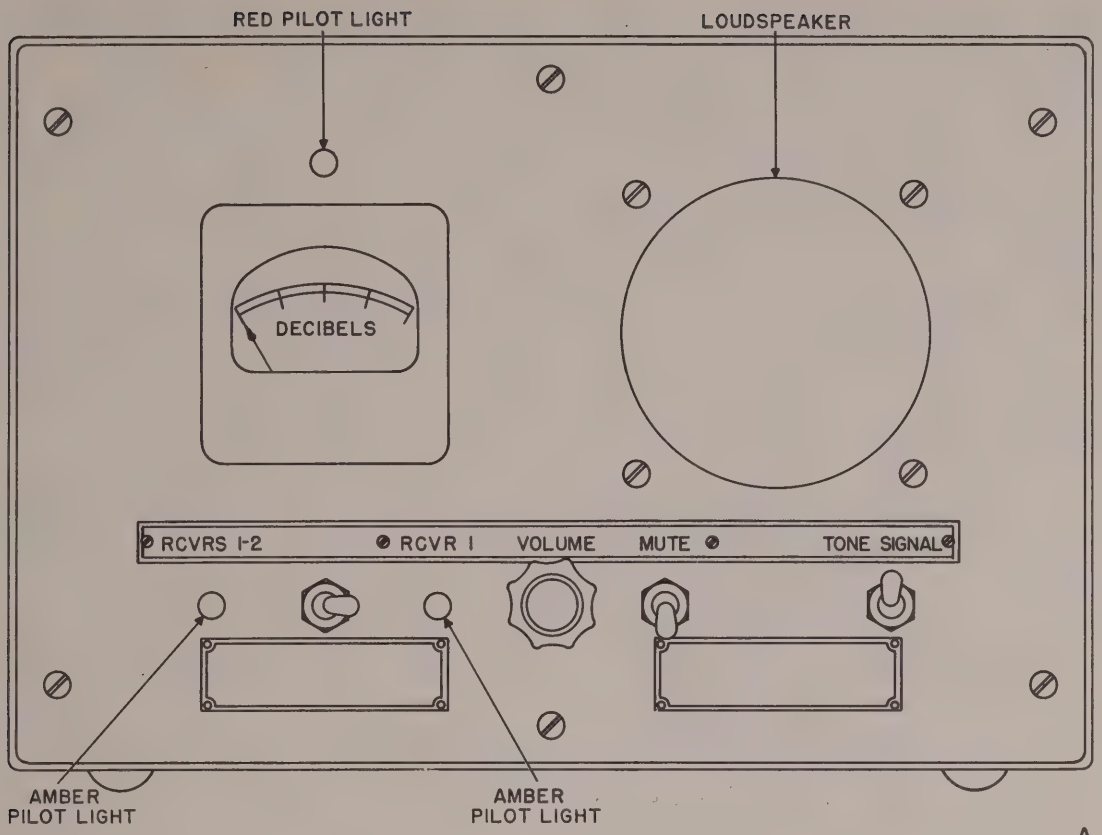
The following table lists the controls of the radio set control and indicates their function.

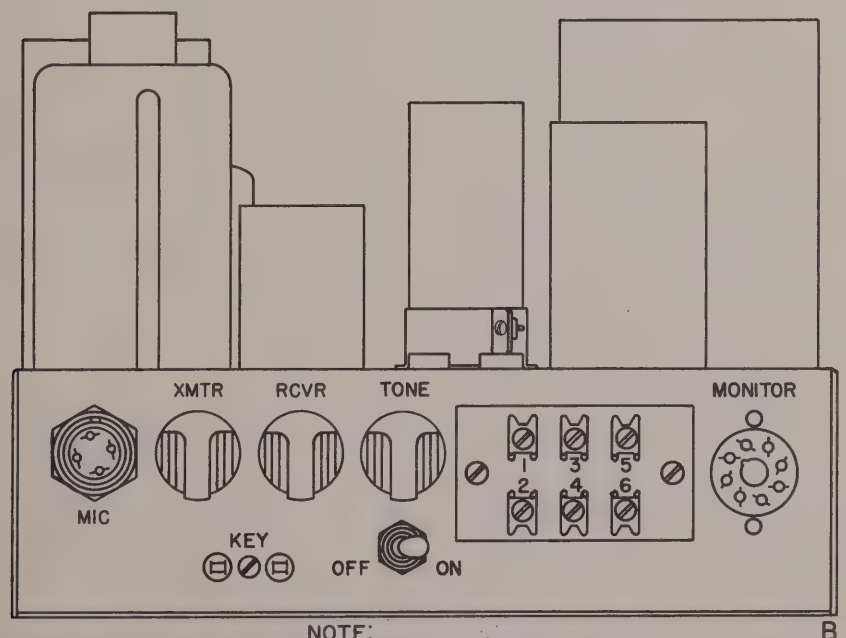
Controls	Functions
VOLUME control (R304) (LO and HI not marked on B models).	Controls audio output of the receiver.
SQUELCH control (R305).	Controls squelch circuit to reduce noise level at loudspeaker.
LINE INPUT CONTROL (R306) (LO and HI not marked on B models).	Controls audio input to transmitter.
EQUALIZER control (R301).	Adjusts impedance of line between the console and rack.



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Figure 21. Radio Set Control C–560(*)/FRC–6, panel layout.





NOTE:
FOR EQUIPMENT PROCURED ON ORDER NO. 16806-PHILA-51
TWO FUSES ARE MOUNTED ON THE REAR PANEL DIRECTLY
UNDER TERMINAL BOARD. ONE FUSE IS MARKED SPARE FUSE.

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Figure 22. Front and rear panel layout of Console C-559A/FRC-6.

30. Console Controls and Instruments
(fig. 22)

The controls and instruments of Consoles C–559A/FRC–6, C–559B/FRC–6, and C–559D/FRC–6 are identical. The charts in *a* and *b* below list the controls and instruments on the front and rear panels of the console and indicate their function.

a. Front Panel Controls and Instruments of Console.

Controls and instruments	Functions
Red pilot light (E403)	Indicates transmitter is on air.
DECIBLES meter (M401).	Indicates audio input level to transmitter (in transmit position) or audio output level from receiver (in receive position).
Amber pilot light, RCVR 1 (E402, right hand lamp).	When lighted, indicates functioning of RCVR 1. (Toggle switch S403 must be toward right to light lamp E402 only.)
Amber pilot light, RCVRS 1–2 (left hand light).	Lights at the same time as the other amber pilot light when toggle switch is toward left and indicates operation of both receivers.
Receiver toggle switch (S403).	Operates RCVRS 1–2 in left hand position (both amber lights light); operates RCVR 1 in right hand position (only right hand amber light lights). Toggle switch can be in either position to operate AN/FRC–6(*) (only one receiver is issued with equipment).
VOLUME control (R428).	Controls audio level to console loudspeaker.
MUTE switch (S404)	In up position, reduces audio input to console loudspeaker to a preset level; in down position, full volume is heard from console loudspeaker.
TONE SIGNAL switch (S404).	When depressed, sends tone signal to transmitter to alert receiving stations (press-to-talk button on handset must be depressed). Switch is maintained in off or up position by spring tension.
Loudspeaker (LS401)	Produces audio output at console.

b. Rear Panel Controls and Instruments of Console.

Controls and instruments	Functions
MIC jack (J401)	Makes connection for handset and hanger box.
XMTR volume control (R403).	Adjusts voice level fed to transmitter.
RCVR volume control (R404).	Adjusts volume of audio signal from receiver.
TONE control (R405)	Adjusts volume of tone to proper level.
MONITOR jack (J403).	Makes connection to monitoring receiver.
Terminal strip (TS401)	Makes connection to external speaker, foot switch, and control line to rack. (The speaker and foot switch not issued nor normally used with the AN/FRC–6(*).)
KEY jack (J404)	Makes connection to telegraph key to control tone oscillator.
OFF-ON switch (S401)	Controls ac input to console.

31. Controls and Instruments of Remote Control Unit C–408–FR
(fig. 23)

Remote Control Unit C–408/FR was procured on Order No. 5010–Phila–48 (used in place of Console C–559(*)/FRC–6 or Remote Control Unit C–408A/FR). Basically the controls are similar to Console C–559(*)/FRC–6 described in paragraph 30. The charts in *a* and *b* below list the controls on the front and rear panels of Remote Control Unit C–408/FR and indicate their function.

a. Front Panel Controls and Instruments.

Controls and instruments	Functions
DECIBELS meter	Indicates audio input level to the transmitter (in transmit position) or audio output level from receiver (in receive position).
Red pilot light	Indicates that the transmitter is on the air.

Controls and instruments	Function
Right pilot light (B2)	Lights when RCVR 1 button is depressed.
Left pilot light (B1)	Lights (along with right light) when RCVRS 1–2 button is depressed.
RCVRS 1–2 push button.	When depressed, full volume is heard in console loudspeaker from both receivers.
RCVR 1 push button [a]	When depressed, full volume is heard only from RCVR 1.[b]
MUTE 1–2 push button.	When depressed, the loudspeaker volume from one or both receivers is reduced to a low but audible level.
SPEAKER LEVEL control.	Controls level of input to console loudspeaker.

[a] Only on Console C–559(*)/FRC–6.
[b] This is the normal operating control for the AN/FRC–6(*).

b. Rear Panel Controls.

Controls	Functions
MIC jack	Makes connection for handset and hanger box.
TRANS volume control.	Adjusts voice level fed to transmitter.
REC volume control	Adjust level of audio signal from the receiver.
TONE control	Adjust volume of tone to proper level.
MONITOR jack	Makes connection to monitoring receiver.
Terminal strip	Provides connection to external speaker, control line, foot switch, and external relay. (The speaker, foot switch, and external relay not normally issued nor used with the AN/FRC–6(*).)
KEY jack	Makes connection for telegraph key.
OFF-ON switch*	Controls ac input voltage to console.

* Labeled OUT-IN on Remote Control Unit C–408A/FR.

32. Controls and Instruments of Remote Control Unit C–408A/FR

(fig. 23)

Remote Control Unit C–408A/FR was procured on Order No. 11922–Phila–48. It is used in place of Console C–559(*)/FRC–6 or Remote Control Unit C–408/FR. The charts in *a* and *b* below list the controls on the front and rear panels of Remote Control Unit C–408A/FR.

a. Front Panel Controls and Instruments.

Controls and instruments	Functions
RCVRS 1–2 push button	Provides full audio output from both receivers to console loudspeaker (only one receiver used with AN/FRC–6(*)).
MUTE 1–2 push button	Decreases full volume from both receivers to low but audible level.
MUTE RCVR 2 TONE SIG. UP push button.	Mutes RCVR 2 if TONE SIGNAL—INTER-COMM switch is in up position.
SPEAKER LEVEL control.	Adjusts audio input to console loudspeaker with left push button depressed.
TONE SIGNAL—INTER-COMM switch.	In up position (TONE SIGNAL), turns tone oscillator on. In down position (INTER-COMM), connects two consoles in parallel for intercommunication but transmitter is not turned on. (INTER-COMM action is normally not used with AN/FRC–6(*).)
FREQ–1—FREQ–2 switch (on Remote Control Unit C–408A/FR only).	Selects frequency of operation for receiver and transmitter by regulating the amount of current in dc control line. FREQ–1 position only is needed with AN/FRC–6(*).
DECIBELS meter	Indicates audio level on control line.
Red pilot light	Indicates when console push-to-talk circuit is energized.
RCVRS 1–2 light	Indicates when RCVR 1–2 button is depressed.
MUTE RCVR 2 light	Indicates when MUTE RCVR 2 button is depressed.

b. Rear Panel of Console.

Control	Function
TRANS volume control.	Varies audio output level from the console amplifier to the control line when in transmit position.
REC volume control	Varies output level of tone oscillator.
OUT-IN switch	In IN position, decreases output of console by inserting 10–db pad in input line in receive condition (IN position of switch)[a].
KEY jack	Provides connection for keying the tone oscillator.
MIC jack	Provides connection for handset and hanger box.

[a] The 10–db pad is not normally used with the AN/FRC–6(*).

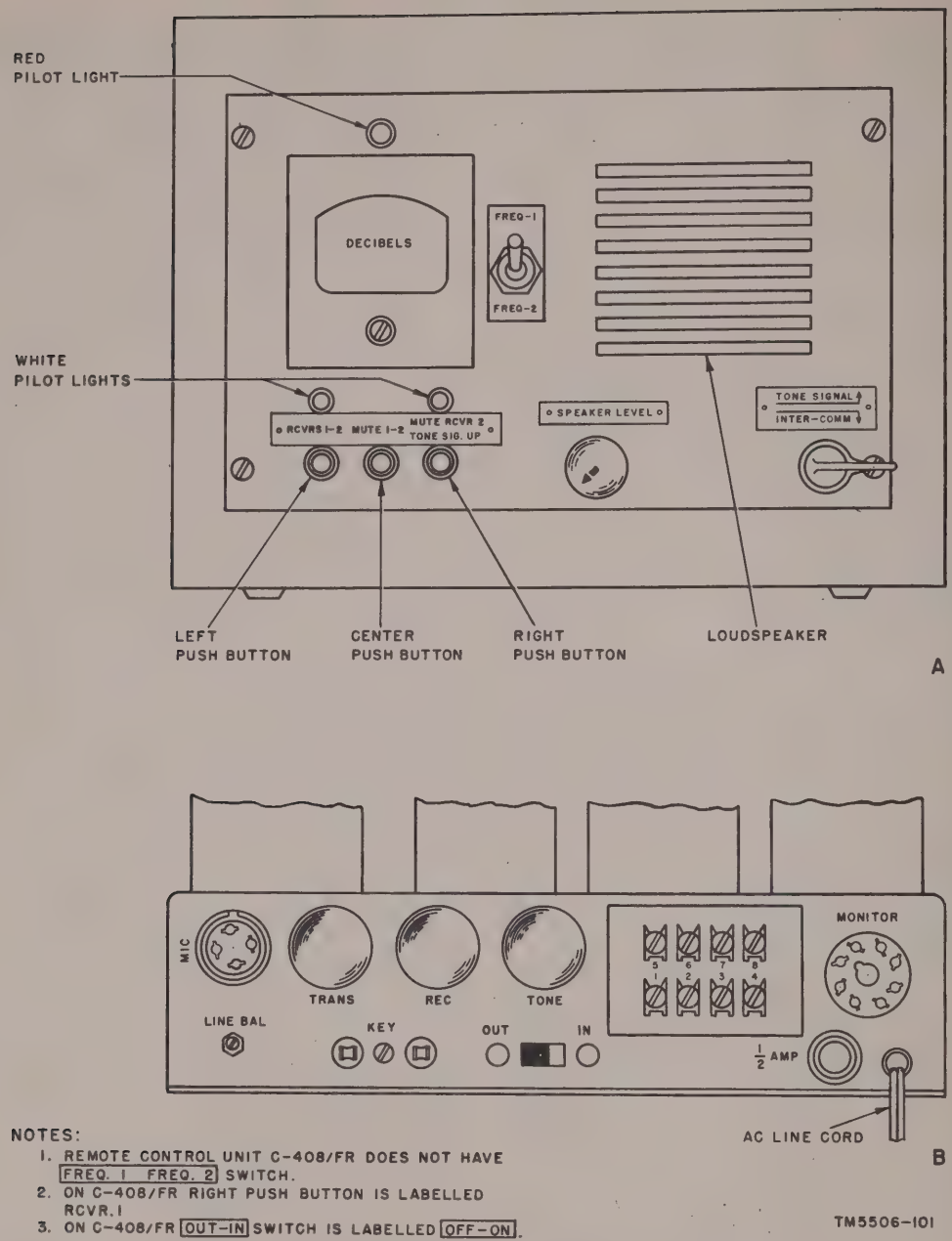


Figure 23. Panel layout of Remote Control Unit C–408A/FR.

Section II. OPERATION UNDER USUAL CONDITIONS

33. Types of Operation

a. Radio Set AN/FRC–6(*) may be operated either locally or remotely. When operating remotely, voice transmission will be used more frequently, although provision has been made for modulated carrier wave transmission at the console station. For operation directly from the rack, only voice can be used. With the handset and hanger box connected at the rack, the switch on the hanger box must be held down to permit transmission.

b. To operate the equipment for either type of operation, perform the following procedures:

(1) The preliminary starting procedure (par. 34).

(2) The operating procedure (par. 35).

(3) The antijamming procedure (par. 36).

(4) The stopping procedure (par. 37).

34. Initial Adjustment and Preliminary Starting Procedure

Before starting the equipment, perform the preliminary operations listed below. It is assumed that the equipment has been connected as described in paragraph 21. With the console in a remote location, another operator is required for the initial adjustment.

Caution: The EQUALIZER and LINE INPUT CONTROL (on the radio set control) are to be adjusted only by qualified personnel (par. 121 and 122). They are not to be adjusted by operators.

a. Rack Control Panel. Move the loudspeaker switch to the forward or off position.

b. Transmitter. Turn the METER SWITCH knob to position 1. Insert proper transmitting crystal in holder.

c. Receiver. Turn the METER SWITCH knob to position 1. Insert proper receiving crystal in holder.

d. Radio Set Control.

(1) Remove the ac power plug. If the line cord is provided with a switch (not part of the radio set), turn this switch off.

(2) Turn the VOLUME control fully counterclockwise (LO position).

(3) Turn the SQUELCH control fully counterclockwise (OFF position).

e. Console.

Note. Panel markings on Remote Control Unit C–408(*)/FR are shown in parenthesis.

(1) Make sure that the handset is hung properly on the hanger box.

(2) Turn the VOLUME (or SPEAKER LEVEL) control fully counterclockwise.

(3) Turn the TONE, RCVR (or REC), and XMTR (or TRANS) control fully counterclockwise (back of console).

(4) Turn the OFF-ON switch to OFF. (Disconnect the power cord on remote Control Unit C–408A/FR.)

35. Operating Procedure

Note. If an abnormal indication is obtained during the operating procedure, refer to the equipment performance check list (par. 56) for corrective measures.

The radio set is ready for operation after the preliminary starting procedures (par. 34) have been completed. When the remote control point is at some distance from the rack, an operator at each location is required. These operators will need telephone or a similar means of communication during all initial stages of operation. Detailed operating procedures are given in *a* through *e* below.

a. General.

(1) Plug in the ac power cord at the rack (or turn on the external safety switch, if provided). The green pilot light (on rack) lights to indicate that heater voltage and plate voltage are applied to the receiver and that heater voltage is applied to the transmitter.

(2) On the rear of Console C–559(*)/FRC–6 or Remote Control Unit C–408/FR, turn the OFF–ON switch to ON (or plug in ac power cord for Remote Control Unit C–408A/FR). One of the two pilot lights on the front of the console should light.

(3) Allow about 30 seconds warmup time for all components of the equipment.

b. Rack Receiver Operation.

(1) Set the loudspeaker switch (rack control panel) to the on (or rear) position, away from the operator.

(2) Turn the VOLUME control (radio set control) clockwise to three-fourths maximum.

(3) After the warmup period has expired, a loud hissing noise (back ground noise) should be heard in the loudspeaker if no signal is being received.

(4) Rotate the SQUELCH control (radio set control) clockwise to the point where background noise suddenly stops, or where weak signals will not be heard. Make this adjustment carefully.

(5) Do not adjust the VOLUME control until a signal is heard; then vary the setting of the knob to provide suitable volume (average readings of 0 db with occasional peaks of +4 db on the decibel meter of the console). Be careful not to increase the volume to the point where the DECIBELS meter on the front of the console panel will become damaged. The proper setting is normally determined at the time of initial alignment, and only slight changes of the setting should be made.

(6) Make no further changes in the normal settings for the LINE INPUT CONTROL and the EQUALIZER adjustments of the radio set control. These

settings are determined at the time of initial alignment and should not be changed.

(7) Rotate the METER SWITCH (on receiver) to each of the five positions; note the meter indications. Check the indications obtained against those obtained during initial alignment, or, if necessary, against the typical readings from the table in paragraph 24*c*.

c. Console Receive Operation.

Caution: Do not press the push button on the handle of the handset until the operator at the main unit is ready to test the transmitter.

(1) *Console C–559(*)/FRC–6 receive operation.*

(*a*) Rotate the VOLUME control on the front panel clockwise to a setting one-half of the maximum rotation.

(*b*) Set the MUTE switch to the down position.

(*c*) Rotate the RCVR control (on the rear of the chassis) clockwise to increase the volume heard on the console loudspeaker. Make the adjustment to provide suitable loudspeaker volume when a voice-modulated signal is received. If received voice signals indicate higher than —10 db on the DECIBELS meter, request the operator at the main unit to reduce the output of the receiver; then readjust the RCVR control again for comfortable loudspeaker volume.

(*d*) Lift the handset from the hanger, but do not depress the push button on the handle. The received signal should no longer be heard through the loudspeaker but should be heard through the earpiece on the handset. Adjust the volume to the earpiece by rotating the volume knob on the handset hanger box (clockwise rotation increases the volume).

(*e*) Return the handset to the hanger. The signal should again be heard on the loudspeaker.

(*f*) Set the MUTE switch to the up position. The volume heard on the speaker should be substantially reduced but still understandable.

(*g*) The switch marked RCVRS 1–2 and RCVR 1 should be left in the RCVR 1 position unless more than one receiver is used. If two receivers are used, the installing personnel will provide instructions for the proper use of this switch.

(2) *Remote Control Unit C–408/FR receive operation.* This operation is similar to operation of Console C–559(*)/FRC–6. The major differences are in panel markings and types of controls (par. 31, 32).

(3) *Remote Control Unit C–408A/FR receive operation.*

(*a*) Set FREQ–1—FREQ–2 switch to FREQ–1.

(*b*) Rotate SPEAKER LEVEL knob on front panel clockwise to a setting of one-half of the maximum rotation.

(*c*) Adjust the REC knob (on back of chassis) for suitable console loudspeaker volume when a voice-modulated signal is received. If received voice signals indicate higher than —10 db on the meter, reduce the receiver output (turn the receiver VOLUME control counterclockwise).

(*d*) Lift the handset from the hanger box without depressing the push button; the signal should disappear from the loudspeaker and should now be heard in handset. Adjust the handset volume by rotating the volume knob on the hanger box (clockwise rotation increases volume).

(*e*) Return the handset to the hanger box. The signal should now be heard at the loudspeaker.

(*f*) Press the MUTE 1–2 button. The volume from the loudspeaker should be reduced but still understandable.

(*g*) Press RCVRS 1–2 button. Full volume is again heard in the loudspeaker.

(*h*) To turn off receiver No. 2, push MUTE RCVR 2 button and push TONE SIGNAL—INTER-COMM switch to up position. Only one receiver will be heard. (The AN/FRC–6(*) is procured with one receiver.)

(*i*) If two receivers are to be used, the second receiver can be turned on by using the following procedure: Push RCVRS 1–2 button and momentarily depress the push-to-talk button on the handset.

(*j*) To provide intercommunication (local operation between two consoles), push down the TONE SIGNAL—INTER-COMM. (Intercommunication is possible only between Remote Control Units C–408A/FR and is not used in normal operation of Radio Set AN/FRC–6(*).)

d. Rack Transmitter Operation.

(1) Throw the meter reversal switch (S1) to the forward position (toward the operator).

(2) Turn the transmitter METER SWITCH to the P. A. position.

(3) Tell the operator at the remote control point to press the push button on the handle of the handset and to hold it depressed for approximately 2 seconds. While the button is depressed, the loudspeaker in the rack should be silent and the red pilot lamp should light. Quickly observe the indication on the transmitter tuning meter to be sure that excessive current is not being drawn by the power amplifier tubes.

(4) Set the meter reversal switch (S1) to the rear position.

(5) Turn the transmitter METER SWITCH to position 1.

(6) Tell the operator at the remote control point to again press the push button on the handle of the handset for a 2-second period. Compare the indication obtained on the transmitter tuning meter with the reading obtained during the initial alignment, or, in the absence of such tables, against the typical reading found in paragraph 118.

(7) Repeat the procedure outlined in (6) above with the transmitter METER SWITCH in positions 2, 3, 4, 5, and MOD.

(8) With the transmitter METER SWITCH in the P. A. position and with the meter reversal switch operated forward toward the operator, repeat the procedure outlined in (6) above.

(9) If all the above indications are normal, close and lock the doors of the rack and advise the operator at the remote control point that the main unit is ready for operation.

e. Console Transmit Check.

(1) Remove the handset from the hanger and press the push button on the handle. The red pilot light should light. With one finger of the same hand that holds the handset, hold down the TONE SIGNAL switch on Console C–559(*)/FRC–6. (Remote Control Unit C–408/FR has a push button TONE SIGNAL switch; Remote Control Unit C–408A/FR has a push-type TONE SIGNAL switch.) With the other hand, rotate the TONE knob on the rear of the chassis clockwise until the needle of the DECIBELS meter on the front panel indicates 0 db. Release the TONE SIGNAL switch. No further adjustment of the TONE knob is necessary.

(2) Place the handset with the earpiece against the ear and with the mouthpiece close to, but not touching, the lips. Press the push button. While talking in a normal voice such as will be used during operation, adjust the XMTR knob (or TRANS knob) on the rear of the chassis. Observe the deflection of the DECIBELS meter. Proper setting of the XMTR knob (or TRANS knob) is for zero voice peaks at regular intervals on the meter, with occasional peaks rising to not more than +4 db. The console is now ready for normal operation.

36. Antijamming Procedures for the Operator

The receiver is highly selective and crystal-controlled for operation on a fixed frequency. There are no tuning controls; therefore, there is very little that the operator may do to overcome the effects of the jamming process. When the receiver is being jammed by unwanted signals, notify the trick chief or non-commissioned officer in charge. Continue to operate the equipment. One or more of the following procedures may be used for maximum readthrough of the desired signal during the jamming process.

a. If the jamming signal is weak, vary the SQUELCH control to make the receiver less sensitive. If the reception does not improve, rotate the control to the OFF position.

b. If the jamming signal is weaker than the desired signal, operate the VOLUME control clockwise. This will increase the strength of the

received signal and may permit readthrough. If not, operate the control counterclockwise. The jamming signal may be eliminated entirely.

c. If the jamming process continues to be so effective that it is impossible to copy the desired signal, use another means to get the message through.

37. Stopping Procedure

a. Rack. Leave all controls at their normal operational settings. Set the external power cut-off switch to the OFF position or disconnect the ac power cord. The green pilot light should go out, indicating that power has been removed from the rack.

b. Console. On Console C–559(*)/FRC–6 or Remote Control Unit C–408/FR, operate the OFF-ON switch on the rear of the chassis to the OFF position. On Remote Control Unit C–408A/FR, turn the external switch to OFF or disconnect ac power cord. The white pilot light should go out.

Section III. OPERATION UNDER UNUSUAL CONDITIONS

38. General

The operation of Radio Set AN/FRC–6(*) may be difficult in regions of extreme cold, heat, humidity, sand, mud, snow, etc. In paragraphs 39 through 41 instructions are given on procedures for minimizing the effect of these unusual operating conditions.

39. Operation in Arctic Climates

Subzero temperatures and climatic conditions associated with cold weather may affect the efficient operation of the equipment. Instructions and precautions for operation under such adverse conditions follow:

a. Handle the equipment carefully.

b. Keep the equipment warm and dry. When possible, keep the equipment turned on at all times.

40. Operation in Tropical Climates

When operated in tropical climates, radio equipment may be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground and when it is set up in swampy areas, moisture conditions are more acute than normal. Ventilation is usually very poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than that of the surrounding air. To minimize this condition, keep the equipment turned on.

41. Operation in Desert Climates

a. Conditions similar to those encountered in tropical climates often prevail in desert areas. Use the same measures to insure proper operation of the equipment.

b. The main problem which arises with equipment operation in desert areas is the large amount of sand or dirt and dust which enter the moving parts of radio equipment. The best procedure is to house the equipment in a dustproof shelter. Since such a building is seldom available and would require air conditioning, the next best precaution is to make the building in which the equipment is located as dustproof as possible with available materials.

c. Never tie power cords, signal cords, or other wire connections to the outside or inside of a tent. Desert areas are subject to sudden wind squalls which may jerk the connections loose or break the lines.

d. Be careful to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (par. 44–47).

CHAPTER 4

ORGANIZATIONAL MAINTENANCE

Section I. PREVENTIVE MAINTENANCE

42. General

The tools, parts, supplies, and test equipment necessary to perform organizational maintenance are found in Tool Equipments TE–41 and TE–113. No tools or tool equipment sets are supplied with Radio Set AN/FRC–6(*). The spare parts supplied are listed in paragraph 12.

43. Definition of Preventive Maintenance

Preventive maintenance is work performed on equipment (usually when the equipment is not in use) to keep it in good working order so that breakdowns and needless interruptions in service will be kept to a minimum. Preventive maintenance differs from trouble shooting and repair, since its object is to prevent certain troubles.

44. General Preventive Maintenance Techniques

a. Use #000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning. If the dry cloth or brush will not remove the dirt, use the following technique: When cleaning all surfaces including electrical contacts, use a cloth or brush moistened with Cleaning Compound (Federal Stock No. 7930–395–9542); when the contacts are clean, wipe them dry with a *dry* cloth.

Warning: Prolonged breathing of Cleaning Compound fumes is dangerous. Make sure adequate ventilation is provided. Cleaning Compound is flammable; do not use near a flame.

45. Use of Preventive Maintenance Forms

a. DA Forms 11–238 and 11–239 are preventive maintenance check lists to be used by the operator as directed by his commander.

b. Items not applicable to Radio Set AN/FRC–6(*) are lined out on figures 24 and 25. References in the ITEM block in the figures are to paragraphs in this manual which contain additional maintenance information.

46. Use of First Echelon Maintenance Form (fig. 24)

a. DA Form 11–238 is a preventive maintenance check list to be used by the operator as directed by his commander.

b. Items not applicable to first echelon maintenance are lined out on figure 24.

c. The operator should limit first echelon maintenance to the operations listed below:

(1) Carefully remove any dirt or moisture from components of the AN/FRC–6 (daily).

(2) Check for normal operation (par. 33–37) and take meter readings (daily).

(3) Visually check all cabling, coaxial transmission lines, the antenna, and meters for obvious faults (weekly).

47. Use of Second Echelon Maintenance Form (fig. 25)

a. DA Form 11–239 is a preventive maintenance check list to be used by the operator as directed by his commander.

b. Items not applicable to the AN/FRC–6(*) are llned out on figure 25. References in the ITEM block of figure 25, are to paragraphs in this manual which contain additional maintenance information.

c. The procedures to be followed are given below:

(1) Perform the procedures given in paragraph 46*c*.

(2) Open the front and rear doors of the rack and visually check the equipment.

(3) Turn off the power to the rack and carefully remove all dust from the interior and exterior.

OPERATOR FIRST ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE	EQUIPMENT SERIAL NO.
AN/FRC-6(*)	

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

DAILY

NO.	ITEM	CONDITION S	M	T	W	T	F	S
1	~~COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).~~							
2	~~LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.~~							
3	CLEAN DIRT AND MOISTURE FROM ~~ANTENNA,~~ MICROPHONE, ~~HEADSETS, CHESTSETS,~~ KEYS, ~~JACKS, PLUGS, TELEPHONES, CARRYING BAGS,~~ COMPONENT PANELS. PAR. 46c(1)							
4	~~INSPECT SEATING OF READILY ACCESSIBLE "PLUG-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.~~							
5	~~INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.~~							
6	CHECK FOR NORMAL OPERATION. PAR. 46c(2)							

WEEKLY

NO.	ITEM	CONDITION	NO.	ITEM	CONDITION
7	~~CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS.~~		13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
8	INSPECT CASES, ~~MOUNTINGS,~~ ANTENNAS, ~~TOWERS,~~ AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 46c(3)		14	~~CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.~~	
9	INSPECT CORD, CABLE, WIRE, ~~AND SHOCK MOUNTS FOR CUTS,~~ BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 46c(3)		15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 46c(3)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS.~~ PAR. 46c(3)		16	~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.~~	
11	~~INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.~~		17	~~CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.~~	
12	~~INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWER STATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.~~		18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	

19 IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.

DA FORM 1 MAY 51 11-238 REPLACES QA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE.

TM5506-102

Figure 24. DA Form 11-238.

SECOND AND THIRD ECHELON MAINTENANCE CHECK LIST FOR SIGNAL CORPS EQUIPMENT

RADIO COMMUNICATION, DIRECTION FINDING, CARRIER, RADAR

INSTRUCTIONS: See other side

EQUIPMENT NOMENCLATURE: AN/FRC-6 (*)

EQUIPMENT SERIAL NO.:

LEGEND FOR MARKING CONDITIONS: ✓ Satisfactory; X Adjustment, repair or replacement required; (X) Defect corrected.
NOTE: Strike out items not applicable.

NO.	ITEM	CONDITION
1	~~COMPLETENESS AND GENERAL CONDITION OF EQUIPMENT (receiver, transmitter, carrying cases, wire and cable, microphones, tubes, spare parts, technical manuals and accessories).~~	
2	~~LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.~~	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, ~~HEADSETS, CHESTSETS,~~ KEYS, ~~JACKS, PLUGS, TELEPHONES, CARRYING BAGS,~~ COMPONENT PANELS. PAR. 46c(1)	
4	~~INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS.~~	
5	~~INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION.~~	
6	CHECK FOR NORMAL OPERATION. PAR. 46c(2)	
7	CLEAN ~~AND TIGHTEN~~ EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, ~~SHOCK MOUNTS, ANTENNA MOUNTS,~~ COAXIAL TRANSMISSION LINES, ~~WAVE GUIDES, AND CABLE CONNECTIONS.~~ PAR. 47c(3)	
8	INSPECT CASES, ~~MOUNTINGS,~~ ANTENNAS, ~~TOWERS,~~ AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, ~~AND MOISTURE.~~ PAR. 46c(3)	
9	INSPECT CORD, CABLE, WIRE, ~~AND SHOCK MOUNTS FOR CUTS,~~ BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 46c(3)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS ~~AND REFLECTORS~~. PAR. 46c(3)	
11	~~INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.~~	
12	~~INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES.~~	
13	~~INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.~~	
14	~~CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES.~~	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 46c(3)	
16	~~INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.~~	
17	~~CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.~~	
18	~~CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.~~	
19	~~ELECTRON TUBES - INSPECT FOR LOOSE ENVELOPES, CAP CONNECTORS, CRACKED SOCKETS; INSUFFICIENT SOCKET SPRING TENSION; CLEAN DUST AND DIRT CAREFULLY; CHECK EMISSION OF RECEIVER TYPE TUBES.~~	
20	~~INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.~~	
21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 47c(2)	
22	~~INSPECT RELAY AND CIRCUIT BREAKER ASSEMBLIES FOR LOOSE MOUNTINGS; BURNED, PITTED, CORRODED CONTACTS; MISALIGNMENT OF CONTACTS AND SPRINGS; INSUFFICIENT SPRING TENSION; BINDING OF PLUNGERS AND HINGE PARTS.~~	
23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, ~~MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS.~~ PAR. 47c(2)	
24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 47c(2)	
25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 47c(2)	
26	~~CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE.~~	
27	~~INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS.~~	
28	~~CHECK SETTINGS OF ADJUSTABLE RELAYS.~~	
29	~~LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.~~	
30	~~INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR.~~	
31	~~CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS.~~	
32	~~INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL LEAKAGE.~~	
33	~~BEFORE SHIPPING OR STORING - REMOVE BATTERIES.~~	
34	~~INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.~~	
35	~~INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.~~	
36	~~INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.~~	
37	~~MOISTURE AND FUNGIPROOF.~~	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION.	

DA FORM 1 MAY 51 11-239 REPLACES DA AGO FORM 419, 1 DEC 50, WHICH IS OBSOLETE. 06—16—64382-1

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Figure 25. DA Form 11–239.

(4) Check the meter readings (par. 118 and 119) taken for the previous week and note whether any have changed.
(5) Replace tubes or crystals only when meter readings indicate the possibility that these components are weak or defective.

Section II. LUBRICATION AND WEATHERPROOFING

48. Lubrication

The radio set does not require lubrication. Never apply oil or grease to any part of this unit.

49. Weatherproofing

a. General. Signal Corps equipment, when operated under severe climatic conditions such as prevail in tropical, arctic, and desert regions, requires special treatment and maintenance. Fungus growth, insects, dust, corrosion, salt spray, excessive moisture, and extreme temperatures are harmful to most materials.

b. Tropical Maintenance. A special moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. This treatment is explained in TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment, and TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

c. Arctic Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained in TB SIG 66, Winter Maintenance of Signal Equipment, and TB SIG 219, Operation of Signal Equipment at Low Temperatures.

d. Desert Maintenance. Special precautions necessary to prevent equipment failure in areas subject to extremely high temperatures, low humidity, and excessive sand and dust are explained in TB SIG 75, Desert Maintenance of Ground Signal Equipment.

50. Rustproofing and Painting

a. When the finish on the rack or on any case or panel has been badly scarred or damaged, rust and corrosion can be prevented by touching up bared surfaces. Use #000 sandpaper to clean the surface down to the bare metal; obtain a bright smooth finish.

Caution: Do not use steel wool. Minute particles frequently enter the case and cause harmful internal shorting or grounding of circuits.

b. When a touch-up job is necessary, apply paint with a small brush. Remove rust from the case by cleaning corroded metal with Cleaning Compound. In severe cases, it may be necessary to use the Cleaning Compound to soften the rust and to use sandpaper to complete the preparation for painting. For further information on painting equipment refer to TM 9–2851, Painting Instructions for Field Use.

Section III. TROUBLESHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

51. Extent of Instructions

a. Troubleshooting at an organizational level is limited to the localizing of defective parts that are readily replaceable at an organizational level (tubes, fuses, cables, etc.), or to the sectionalizing of defective units that must be replaced as a unit (receiver, transmitter, power supply, or console). The procedures outlined are designed to determine first the defective unit and then the nature of the fault within the unit. If the fault can be determined through organizational procedures, corrective measures are indicated. If the fault cannot be determined through organizational procedures, reference is made to the necessary field maintenance instructions.

b. The techniques that are utilized for organizational trouble shooting include visual inspection, operational tests, tube tests, and simple continuity checks. The material is presented in the order which the repairman would normally use to service a defective radio set. When the procedures indicated are not sufficient to determine the source of trouble, troubleshooting at a field maintenance level (par. 100 through 122) will be required.

52. Inspection

a. When failure is encountered and the cause is not immediately apparent, check as many of the items listed in *b* and *c* below as is practicable before starting a systematic operational check of the equipment. Do not, however, disassemble the set for a complete inspection without some knowledge of the operational symptoms. If possible, obtain information from the operator of the

equipment regarding performance at the time trouble occurred.

b. Complete failure of the radio set often may be caused by one or more of the following faults:

(1) Power cable not making connection to power source.
(2) Worn, broken, or disconnected cords or plugs.
(3) Blown fuses.
(4) Switches set wrong.

c. Partial failure of the radio set often may be caused by one or more of the following faults:

(1) Faulty relay contacts.
(2) Defective tubes.
(3) Inactive crystal.
(4) Improperly sited antenna (par. 14).

53. Interchangeable Tubes

A preferred type tube, type 5Y3WGTA, has been developed as a direct replacement for tube type 5Y3GT. This tube may be used interchangeably in the rectifier stage of Console C–559A/FRC–6. The older type tube should be used until stocks are exhausted.

54. Electron Tube Replacement Procedure

Recent studies of maintenance practices have disclosed that more than one-third of all electron tubes are needlessly discarded as faulty. All personnel concerned will use the information given below as a guide in replacing tubes.

a. Inspect all the cabling, connections, and general condition of the equipment before attempting removal of electron tubes.

b. Isolate the trouble, if possible to a particular unit or section of the equipment.

c. Do not discard tubes because they have been in use for a certain length of time or because they fall on, or slightly below the *GOOD* value when checked on a tube tester. Some new tubes register near the low end of the *GOOD* value on a tube tester scale. These tubes may provide satisfactory performance over a long period of time at this value.

d. If a tube tester is not available, troubleshoot by the tube substitution method as follows:

(1) Replace the suspected tubes, one at a time, with tubes known to be good. Note the sockets from which the original tubes were removed. If the equipment starts to operate normally, discard the last tube removed.

Note. The oscillator circuits for instance may function better with one tube than with another, even though both tubes are new. Do not discard any of the tubes (V101, V401 and V202) until further testing shows it to be defective.

(2) Replace the original tubes, one at a time, in their sockets. If the equipment stops operating during this procedure, discard the tube just replaced. *Do not leave a new tube in the equipment if the equipment operates satisfactorily with the original tube. Do not replace tubes merely because they have been used for a specified length of time.*

Note. If tube substitution does not correct the trouble, reinsert the original tubes in their sockets before forwarding the equipment for repair.

55. Troubleshooting by Using Equipment Performance Checklist

a. Purpose and Use. The equipment performance checklist (par. 56) is the beginning of a systematic troubleshooting technique designed to isolate trouble with a minimum of waste effort. Operate the equipment as directed in the checklist, check for the normal indications listed, and, if an abnormal indication is obtained, follow the corrective measure outlined in the final column of the checklist.

b. Corrective Measures. In a few cases, the nature of the possible abnormal indications permits immediate localization of trouble to a particular part, so that the corrective measure indicates the specific part to be repaired or replaced. In most cases, however, the possible abnormal indications provide only for sectionalization of the trouble to a particular unit or group of parts. In these latter cases, the corrective measures call for the performance of additional testing procedures to localize the trouble. When the procedure referred to is beyond the scope of organizational maintenance personnel, reference is made to specific paragraphs in this manual and troubleshooting at a field maintenance level is required.

56. Equipment Performance Check List

	Item No.	Unit	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Console	TONE SIGNAL switch	Set to center or neutral position.		
	2	do	OFF-ON switch	Set to OFF position.		
	3	do	RCVRS 1–2 switch	Set to RCVR 1 position.		
	4	do	VOLUME control	Set to midposition.		
	5	do	MUTE switch	Set to up position.		
	6	Rack control panel	External power switch	Set to off position.		
	7	do	Loudspeaker cut-off switch	Set to forward or on position.		
	8	do	Meter reversal switch	Set to rear position (transmitter METER switch set to P. A.).		
	9	do	VOLUME control	Set to midposition.		
	10	do	SQUELCH control	Set to OFF position.		
	11	do	LINE INPUT control	Set to LO position.		
	12	do	External power switch	Set to on position	Pilot lamp on rack control panel lights. Filaments in transmitter and receiver tubes light. Meter (M2) indicates line voltage.	Check power source fuses and cabling (fig. 12 and 13). Check cable and connectors between radio set control and transmitter, and receiver. Check power source.
	13	Console	OFF-ON switch	do	Amber (or white) pilot light for RCVR 1 lights.	Check fuse, cabling, and connectors.
	14	Radio set control	VOLUME control	Adjust VOLUME control to suitable level.	Output from speaker on rack control panel increases and decreases as the VOLUME control is varied.	Check VOLUME control (fig. 21) and cabling to radio set control.
	15	do	SQUELCH control	Rotate SQUELCH control clockwise until background noise stops suddenly. Do not move control any further than necessary for complete quieting.	Background noise disappears completely.	Check SQUELCH control R305 (fig. 21). Check squelch circuit tubes, V210, V211, V212 (fig. 118, 119). Check components of entire squelch circuit (fig. 125). Make voltage and resistance checks of squelch circuit (fig. 85).
	16	Console	VOLUME control (SPEAKER LEVEL control on C–408(*)/FR).	Rotate VOLUME control in either direction.	Volume level in console speaker varies.	Check console VOLUME control R304 (fig. 130).

EQUIPMENT PERFORMANCE	17	----do----	Press-to-talk button on handset.	Press button----	Red pilot lamp lights on console and on rack. Relay click is heard in radio set control, console and transmitter. Transmitter tuning meter M3 (fig. 16) indicates.	Check handset switch S405 (fig. 11). Check rectifier tube (v 404) in console. Check RY1 in console (fig. 130). Check tuning of transmitter. Check Fuse F101 in transmitter.
	18	----do----	MUTE switch----	Operate MUTE switch while signal is being received.	Decrease in volume of received signal.	Check switch.
	19	----do----	TONE SIGNAL switch----	Operate TONE SIGNAL switch with handset button depressed.	Decibel meter should indicate constant O–db reading.	Adjust TONE knob on rear of console for O–db reading.
	20	Handset hanger box.	Handset hanger assembly---	Raise handset from hanger--	Incoming signal is now heard in earpiece of handset. Speaker is cut off.	Check contacts of hanger switch (S406). Check earpiece (fig. 11).
	21	Transmitter----	Voice test----	Remove handset from hanger box. Press handset button. Speak clearly into microphone.	Voice heard loudly and clearly in receiver tuned to transmitter frequency.	Replace handset box assembly, operate transmitter from rack control panel or plug handset directly into transmitter to determine unit at fault. Trouble shoot equipment (par. 100 through 112).
	22	Receiver----	----do----	Tune receiver to a frequency that is being used for communication or testing.	Voice signals are received loudly and clearly at the rack and at the console.	Check receiver tubes, crystal and connections. Trouble shoot equipment (par. 100 through 112).
STOP	23	Console----	OFF-ON switch----	Set to OFF position----	Console pilot light goes out.	
	24	Rack control panel-	External power switch----	----do----	Pilot light on rack control panel goes out.	

CHAPTER 5

THEORY

Section I. SYSTEM THEORY

57. General

a. Radio Sets AN/FRC–6 and AN/FRC–6A are used for point to point radio communication on a single fixed frequency. These radio sets are primarily designed for remote control operation from the console unit.

b. Radio Set AN/FRC–6(*) consists of an antenna, rack, and console (fig. 4). The rack contains the rack control panel, transmitter, receiver, and the radio set control in an interconnected system.

58. Schematic Diagrams

The functional schematic diagrams furnished in this chapter contain particular stages from the individual components. These functional or partial diagrams are intended as an aid for understanding the theory of the radio set. Although not discussed in detail, complete schematic disgrams will be found in the back of this manual (fig. 122 through 130). The schematic diagrams contain the entire picture for the overall working of the radio set and should be consulted freely when reading this chapter.

Section II. TRANSMITTERS

59. Block Diagram of Transmitter
(fig. 26)

a. The crystal oscillator stage provides a fixed submultiple of the output frequency around which modulation occurs. A phase shifting network between the oscillator and the modulator provides an rf voltage for the control grids of the modulator tubes that differ in phase by some angle approximating 90°. The signal grids of modulator tubes V102 and V103 are fed 180° out of phase with audio-frequency (af) voltage developed across the secondary of the audio input transformer.

b. Electronic mixing in the modulator develops an fm signal at the output of the modulator, deviating a small amount above and below the center, or crystal, frequency. Both the center frequency and the amount of deviation are multiplied four times by first quadrupler tube V104. The process is repeated in second quadrupler tube V105. Doubler tube V106 doubles the output of the second quadrupler, both the center frequency and the amount of deviation caused by modulation.

c. The multiplication factor of the original crystal frequency and the amount of original deviation is 32. This gives an output frequency between 30 and 40 mc and a deviation of approximately 15 kilocycles (kc) with 100 percent modulation. The final amplifier tubes, V107 and V108, increase the signal level to 50 watts.

60. Oscillator
(fig. 27)

a. The oscillator stage of the transmitter is made up of quartz crystal Y101, vacuum tube V101 (7C7) connected as a triode, and an output network consisting of transformer assembly T101. Oscillation is maintained by feedback through the plate to grid capacity of tube V101.

b. Grid bias is provided by grid leak resistor R101, and R102 serves as a meter shunt when METER SWITCH (S101) is in position 1 to measure oscillator grid current. Bypass capacitor C101 prevents rf currents from entering the meter circuits.

c. B+ voltage is applied through dropping resistor R103 and the upper half of L101 (fig. 28) to the plate of V101. Capacitor C108 bypasses R103 to ground. Tube V101 is used as a triode with pins 2, 3, and 4 tied together. Capacitor

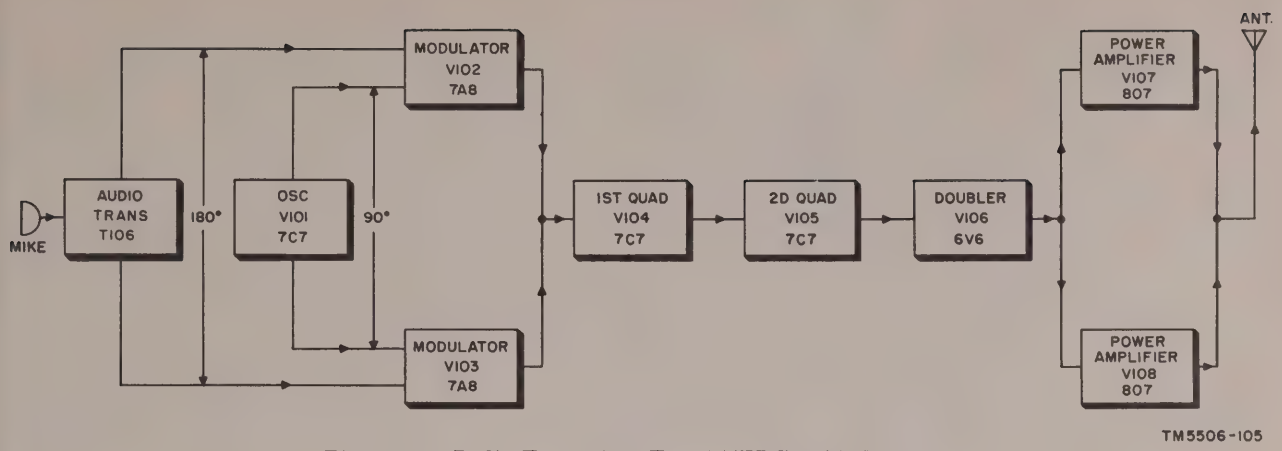


Figure 26. Radio Transmitter T–215A/FRC–6, block diagram.

C102 is used only at operating frequencies below 33 mc. When used, this capacitor parallels the plate tuning capacitor across the inductance of L101.

d. Resistor R104 and capacitor C106 form a phasing network for the modulator input. The voltage at the upper end of R104 is in phase with the top end of coil L101; this voltage is applied to the control grid (pin 4) of modulator tube V102 through coupling and direct-current (dc) blocking capacitor C104. The voltage at the lower end of L101 is 180° out of phase with the top of L101 with respect to the center tap on L101; voltage is applied from the junction of C106 and R104 to the control grid (pin 4) of V103 through coupling and dc blocking capacitor C107; the voltage on the control grid of V103 has been additionally shifted by some angle approximating 90°. Thus, the modulator tubes are fed out of phase by some angle approaching 90°. For purposes of discussion, the modulator grid voltages will be considered out of phase by 90° and not by their actual phase difference of some angle less than 90 degrees.

e. Transformer assembly T101 contains C103, C104, C105, C106, C107, C108, L101, R103, R104, R105, R106, and R107.

61. Modulator
(fig. 28)

a. Two type 7A8 tubes (V102 and V103) are connected as balanced modulators. The control grids (pin 4) are excited out of phase by the rf output of the crystal oscillator (pin 8 and pin 1 of T101, respectively). The signal grids (pin 6) of the two tubes are fed 180° out of phase by af voltage from the secondary of input transformer T106 through a high-frequency (hf) discrimination network composed of resistors R135, R136, R137, and R138 and capacitors C138 and C139.

b. The electronic mixing of the rf and af components in V102 and V103 causes a phase shift that is proportional to the af amplitude and the audio frequency. In figure 29, if line OA_1 represents the rf voltage on grid F102, then OA_2 will represent the rf grid voltage on V103, 90° out of phase. With no af voltage applied, OA will represent the output voltage of the modulator.

c. Grid current passing through resistors R105, R106, and R107 (fig. 29) provides grid bias for the modulator tubes. Resistor R107, bypassed by C105, serves as a meter shunt when S101 is in the MOD. position measuring modulator grid current. In addition, capacitor C105 places the junction of R105 and R106 at rf ground potential.

d. When the af voltage is applied to the signal grids, the transconductances of V102 and V103 will vary 180° out of phase with each other. When the transconductance of V102 increases, that of V103 will decrease, and vice versa. Therefore, when the transconductance of V102 is a maximum and the output is represented by OB_1, the output of V103 will be a minimum and will be represented by OB_2 (fig. 29). The combined output will be OB phase shifted by θ degrees. With the reverse condition and the transconductance of V103 a maximum, the output of V103 is represented by OC_2 and the output of V102 is represented by OC_1. The combined output will be OC phase shifted by θ degrees. In going from the condition of no af signal to maximum and then to minimum af signal, a shift in phase is developed in proportion to the af signal amplitude.

e. The phase shift, in turn, creates a frequency shift that is proportional not only to the amplitude

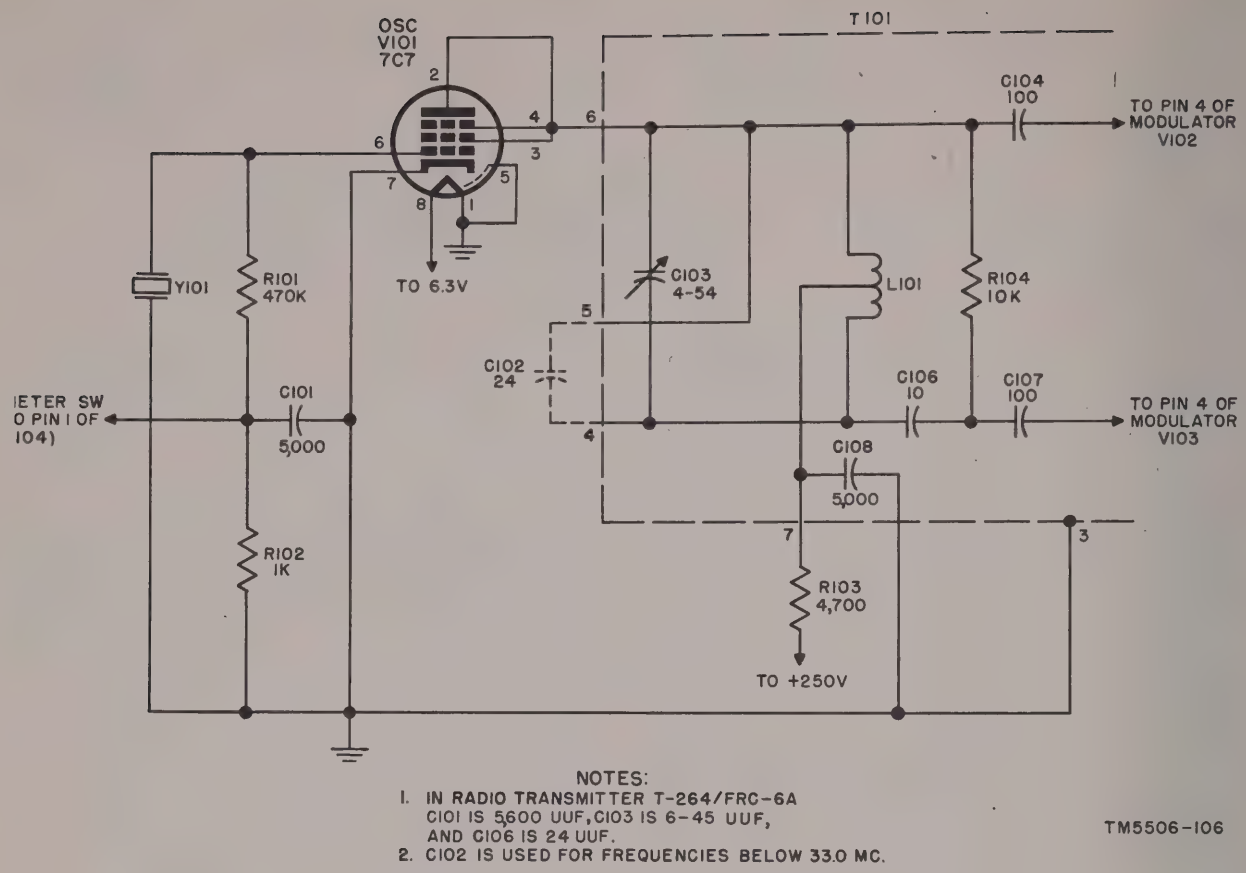


Figure 27. Transmitter oscillator diagram.

of the audio signal, but also to the audio frequency. This rising frequency characteristic makes necessary the insertion of a resistance-capacitance (rc) hf attenuation network in the audio input leads. This network makes the amplitude of the audio signal, as applied to the modulator, inversely proportional to its frequency, thus compensating for the frequency shift in the modulator, which is *directly* proportional to the audio frequency. This results in a modulator output the frequency deviation of which is proportional only to the amplitude of the audio signal applied to the microphone. The output is then a frequency-modulated signal. Additional attenuation of the high frequencies is required in the receiver to obtain satisfactory audio response.

f. The plates (pin 2) of the two tubes are connected in parallel and receive plate voltage through the tuning inductance of T102 and decoupling resistor R113. Capacitor C113 tunes the plate circuit to the crystal frequency. The low-potential end of the plate inductance is bypassed to ground by capacitor C115.

g. The screen grids (pin 5) of both tubes are supplied potential through dropping resistors R113 and R112 connected in parallel and are bypassed by C111. The anode grids (pin 3) of the tubes connected in parallel receive voltage through dropping resistors R109 and R110 and are bypassed to ground by capacitor C110. The cathodes are connected in parallel, and self-bias is obtained across cathode resistor R108, connected from the cathodes to ground. Capacitor C109A bypasses the cathodes to ground.

h. The modulator is coupled to the first quadrupler by coupling capacitor C112 connected from the high-potential end of the plate inductance (L102) to the control grid (pin 6) of the first quadrupler tube (V104).

i. Transformer assembly T102 contains C112, C113, C114, C115, L102, R114, and R115.

62. First and Second Quadruplers

(fig. 30 and 31)

The first and second quadruplers multiply the oscillator frequency by 16. The functions of the two stages are similar.

a. Radio Transmitter T–215A/FRC–6.

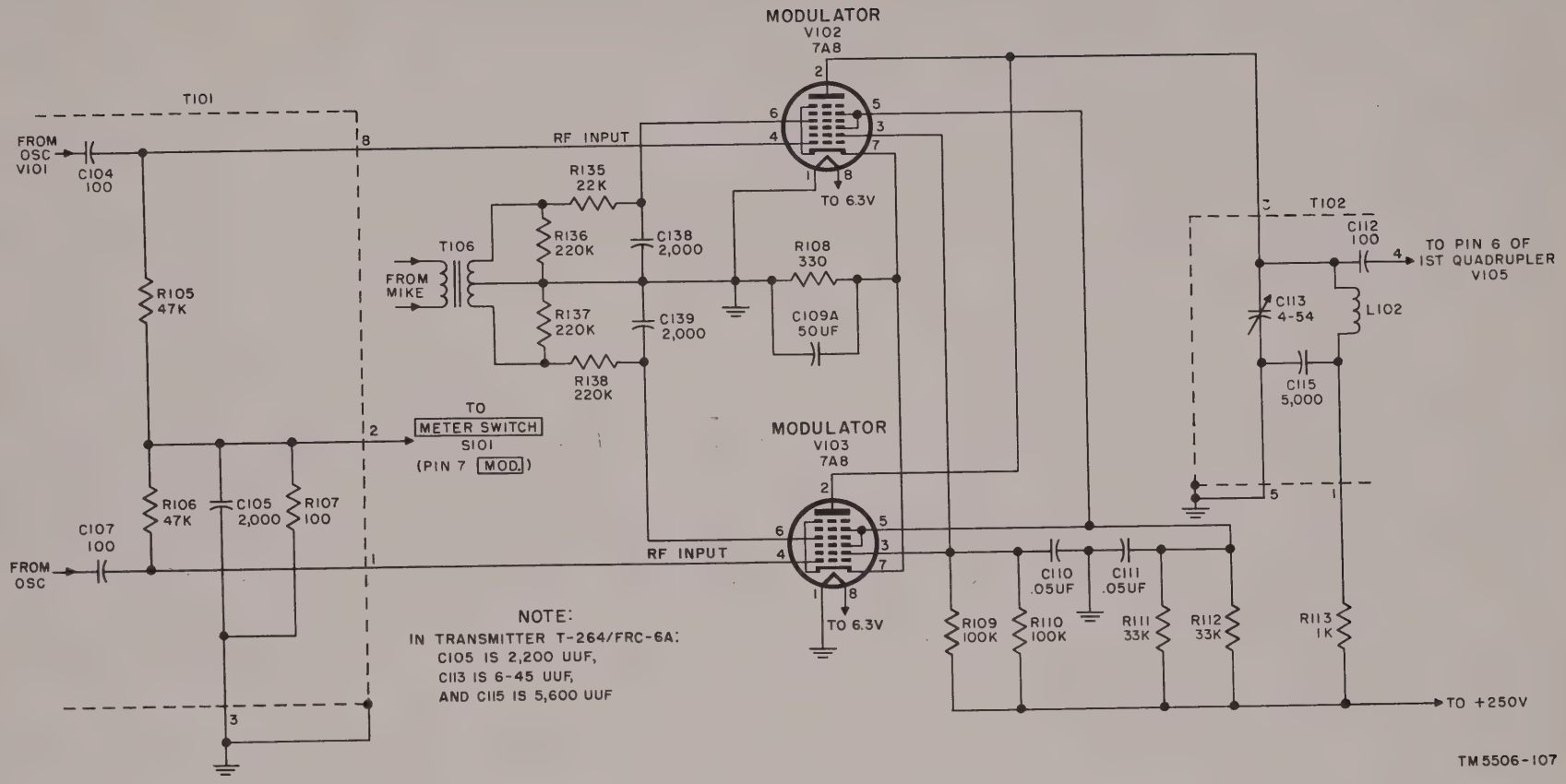


Figure 28. Phase modulator, functional diagram.

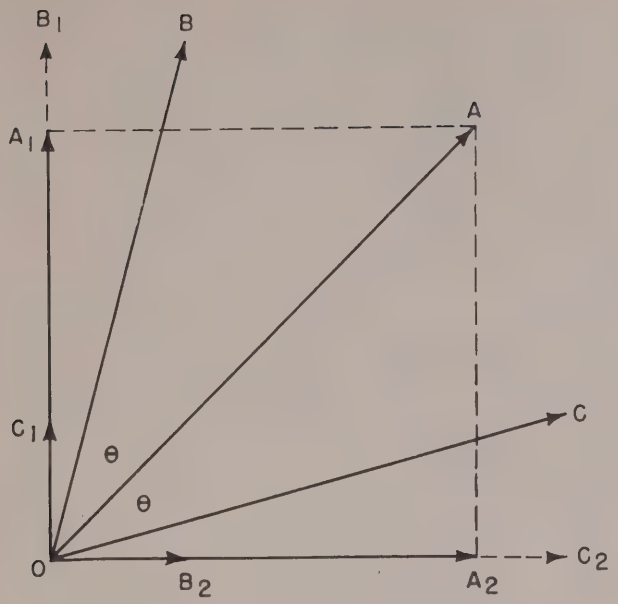


Figure 29. Vector diagram of modulator circuit.

(1) *First quadrupler.* Grid current flowing through grid resistor R114 and meter resistor R115 provides operating bias. Resistor R115 is the meter shunt resistor with switch S101 operated in position 2. In position 2, M1 (the transmitter tuning meter) indicates first quadrupler grid current. Capacitor C114 acts as an rf bypass capacitor for the meter circuit. Plate voltage for V104 is applied through plate decoupling resistor R117 and coil L103. The parallel resonant tank circuit of L103 and variable capacitor C118 make up the plate load. This tank circuit is resonated at four times the crystal frequency. Capacitor C119 keeps the lower end of L103 at rf ground potential. Capacitors C117, C118, C119, and C120, inductor L103, resistors R118 and R119 are in transformer assembly T103. R116 is the screen grid dropping resistor. capacitor C116 bypasses the screen grid to ground. The output voltage developed across L103 and C118 is coupled to the control grid (pin 6) of V105 through coupling capacitor C117.

(2) *Second quadrupler.* Grid current flowing through R118 and R119 provides grid bias voltage for V105. Resistor R119 is the meter shunt resistor with S101 operated to position 3; M1 then indicates second quadrupler grid current. Capacitor C120 acts as an rf bypass capacitor for the meter circuit. Tube V105 receives plate voltage through decoupling resistor R121 and coil L104. Variable capacitor C123 and inductor L104 are resonated at 16 times the crystal frequency. Capacitor C124 places the lower end of L104 at rf ground potential. Transformer assembly T104 contains C122, C123, C124, C125, L104, R122, and R123. Resistor R120 is the screen grid dropping resistor. Capacitor C120 bypasses the screen grid to ground. The output voltage developed across the plate tank circuit is coupled through C122 to the control grid (pin 5) of V106.

b. Radio Transmitter T–264/FRC–6A (fig. 31). The first and second quadrupler stages of T–264/FRC–6A differ from the T–215A/FRC–6 in the following circuit features:

(1) *First quadrupler.* The plate load is a parallel resonant tank circuit made up of variable capacitor C118A and the primary of transformer L103. Coupling from V104 to V105 is through the mutual inductance of the primary and secondary of transformer L103. Capacitor C117 is not used in the T–264/FRC–6A.

(2) *Second quadrupler.* The grid load of V105 consists of the secondary of transformer of L103 resonated at four times the crystal frequency by variable capacitor C118B. Grid biasing resistors R118 and R119 are connected between the lower end of the secondary of L103 and ground. The plate load of V105 consists of variable capacitor C123A and the primary of transformer L104. Coupling from V105 to V106 (the doubler) is through the mutual inductance of the primary and secondary of L104. Capacitor C122 is not used in the T–264/FRC–6A.

63. Doubler

(fig. 32)

a. The doubler stages of T–215A/FRC–6 and T–264/FRC–6A are electrically identical.

b. The grid circuit of the doubler (V106) is returned to ground through the secondary of L104 (in T–264/FRC–6A only), biasing resistor R122, and meter resistor R123. Resistor R123 is the

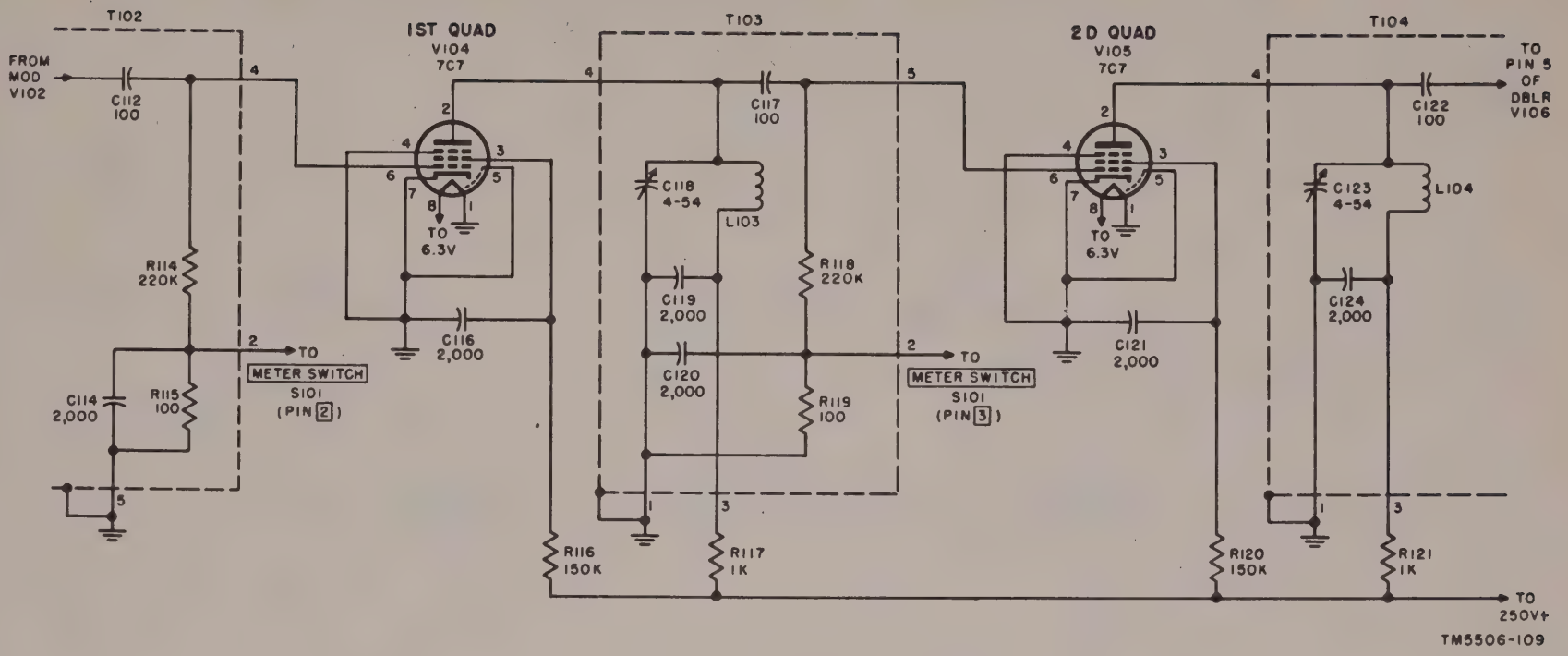


Figure 30. First and second quadrupler of Radio Transmitter T–215A/FRC–6.

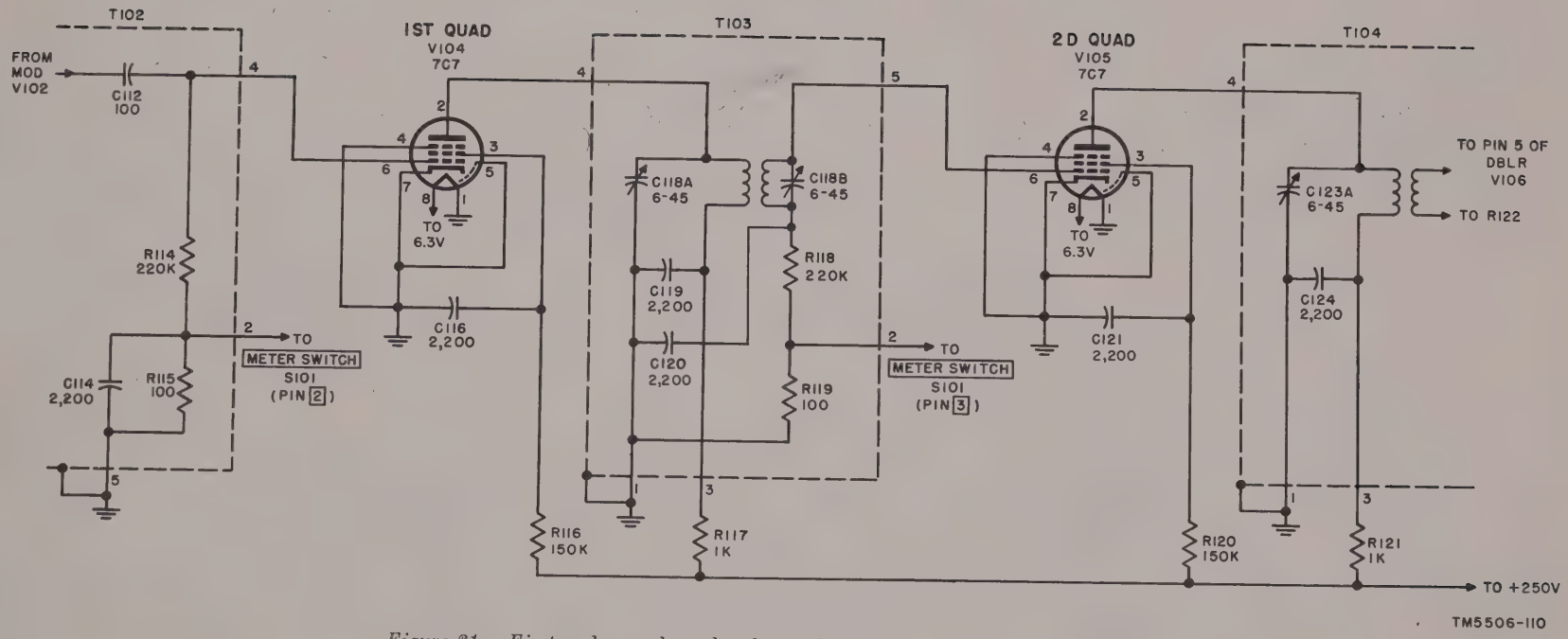


Figure 31. First and second quadruplers of Radio Transmitter T–264/FRC–6A.

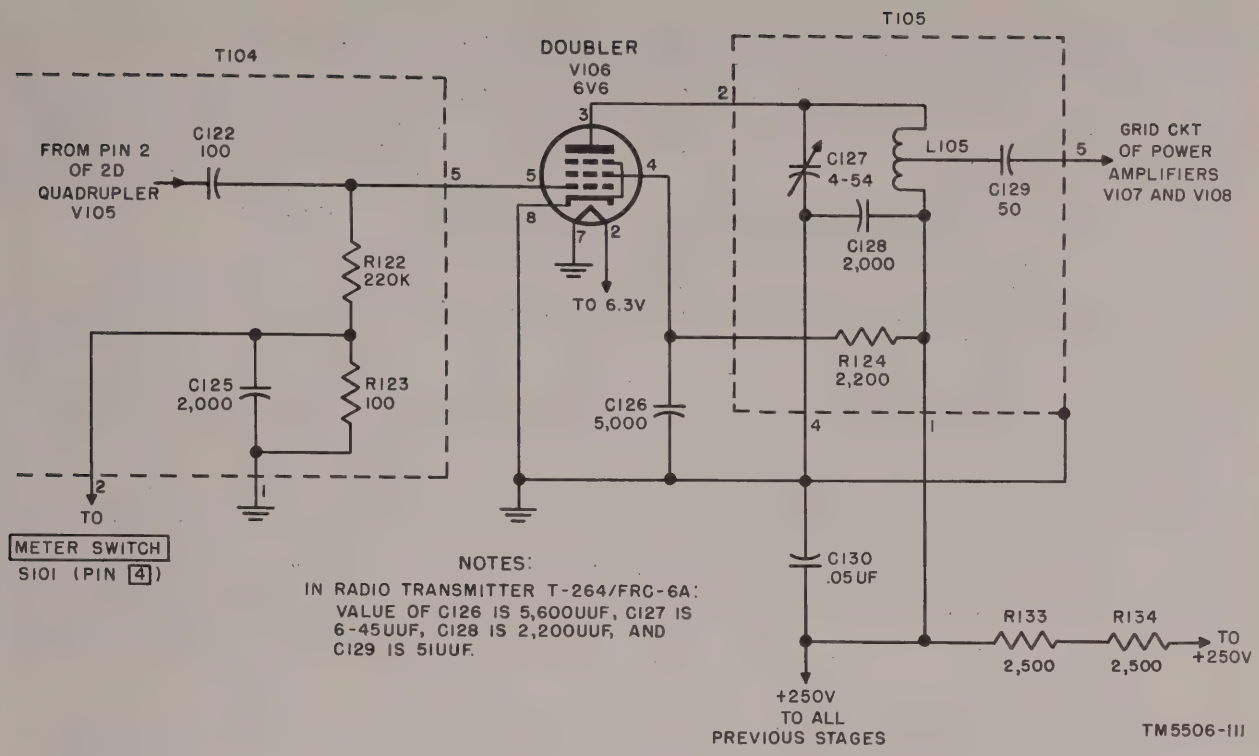


Figure 32. Doubler stage.

meter shunt resistor with M1 operated in position 4; M1 then indicates doubler grid current. Tube V106 receives plate voltage through L105. The plate load is the parallel tank circuit of L105 and variable capacitor C127 resonated at 32 times the crystal frequency. Capacitor C128 places the lower end of L105 at rf ground potential. Transformer assembly T104 contains C127, C128, C129, L105, and R124. Resistor R124 is the screen grid dropping resistor. Capacitor C126 bypasses the screen grid to ground. Resistors, R133 and R134 act as B+ voltage-dropping resistors for all stages preceding the power amplifier (V107 and V108). Resistors R133 and R134, bypassed by C130 also serve as plate decoupling between the power amplifier and all previous stages. From a tapped connection on L105, the output of V106 is coupled through C129 to the control grids (pin 3) of the power amplifiers (V107 and V108).

64. Power Amplifier

(fig. 33)

The power amplifier consists of tubes V107 and V108 with their control grids and plates connected in parallel.

a. Grid current from tubes V107 and V108 flows to ground through choke coil L107, grid biasing resistor R127, and meter resistor R132. Most of the grid bias voltage is developed across R127. Filter E101 acts as a parasitic suppressor for V107; E102 acts as a parasitic suppressor for V108. Resistor R132 is the meter shunt resistor; with S101 in position 5, M1 indicates power amplifier grid current. Capacitor C137 bypasses R132 to ground. Choke coil L107 prevents rf currents from entering the grid leak biasing network.

b. High B+ (in excess of 600 volts) voltage is applied to the plates of V107 and V108 through choke coil L108, plate inductor L106, and parasitic suppressors E103 and E104. The plate circuit contains L106 and variable capacitors C133 and C134 resonated at 32 times the crystal frequency.

c. Screen grid voltage for both tubes is applied through R128, R129, R130, and R131 connected in series. In the T–215A/FRC–6, C136 serves as the screen grid bypass capacitor for tubes V107 and V108; in T–264/FRC–6A, an additional capacitor C145 is used (connected to pin 2 of V107).

d. Parallel resistors R125 and R126 serve as meter shunt resistors; these resistors are in the common cathode circuit of V107 and V108 and are by-passed by C131 and C132 to protect transmitter tuning meter M1 from rf when S101 is in the P. A. position. Position P. A. of S101 indi-

cates power amplifier cathode current with switch S1 (of the rack-control panel) in the forward position. With S1 in the forward position, current is reversed through M1 thus permitting a meter reading. For all other transmitter readings, S1 is operated in the rear position.

e. The output of the power amplifier stage is fed through the pi-network of L106, C133, and C134, and coupled by C135 to the antenna after first passing through antenna relay O103 and ANTENNA jack J105.

65. Power Supply PP–420(*)/FRC–6

(fig. 34)

Power Supplies PP–420A/FRC–6 and PP–420B/FRC–6 are electrically similar. Primary voltage of 110 volts 60 cycles ac is applied to the primary windings of transformers T107 and T108.

a. Transformer T108 is a stepdown transformer with three separate secondary windings. The first winding delivers 5 volts ac to the filaments of rectifier tubes 5U4G (V109 and V110). The second provides 6.3 volts ac for the heaters of the transmitter tubes. The third applies an alternating voltage across a bridge rectifier composed of selenium rectifiers. The dc output of the bridge rectifier supplies operating current to relays O101, O102, and O103.

Note. Relay O101 is not used in the T–264/FRC–6A.

b. Transformer T107 is a stepup transformer. The center tap of the secondary is connected to ground through R141, and the outside secondary terminals deliver high-voltage ac to the plates of the rectifier tubes. Tubes V109 and V110 each function as a half-wave rectifier with both plates connected in parallel to increase the current carrying capacity of the tube. The two tubes are connected in a conventional full-wave rectifier circuit, and the dc output of the rectifier is fed to the low-pass filter made up of reactor L109 and capacitors C140, C141, C142, and C143.

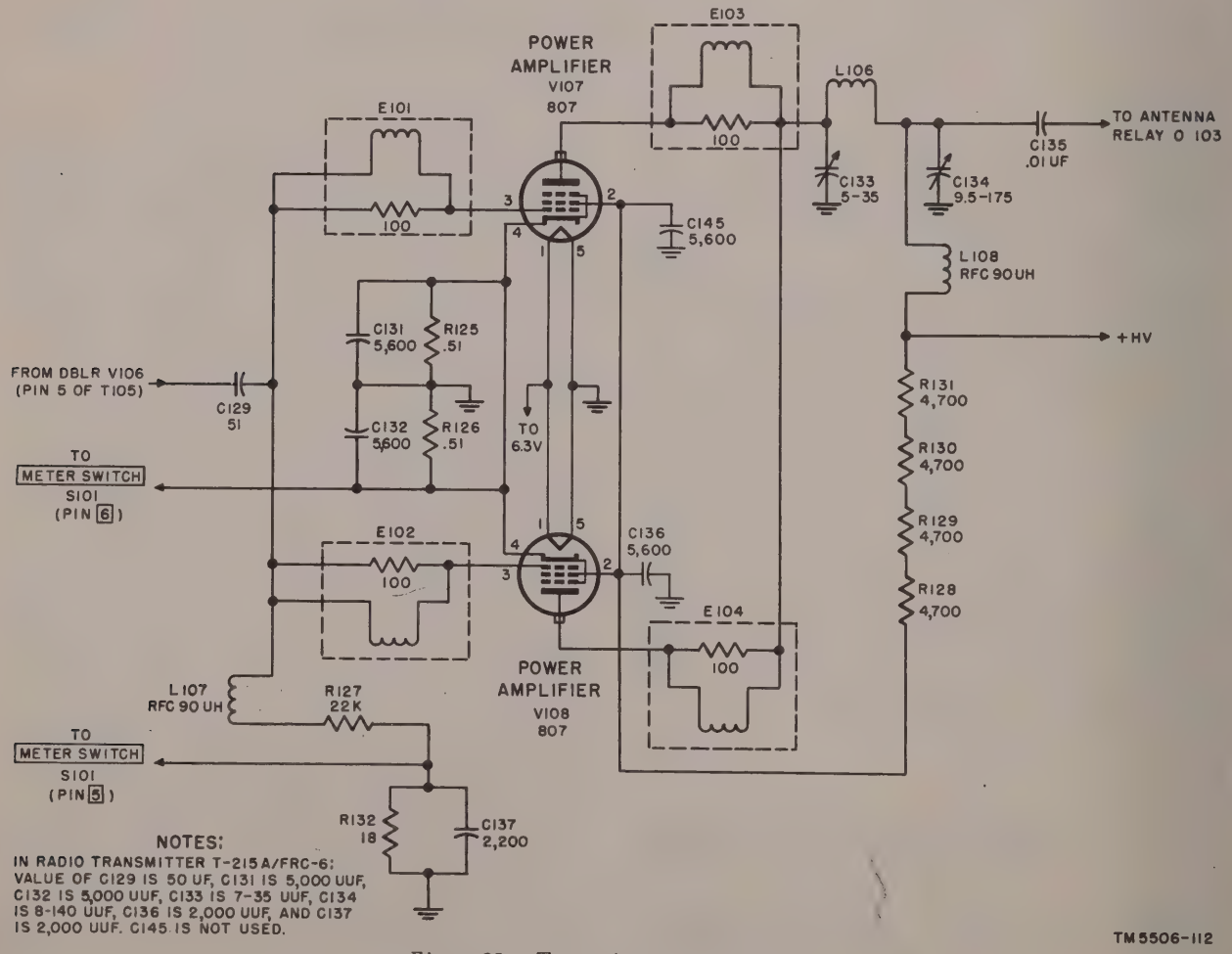


Figure 33. Transmitter power amplifier.

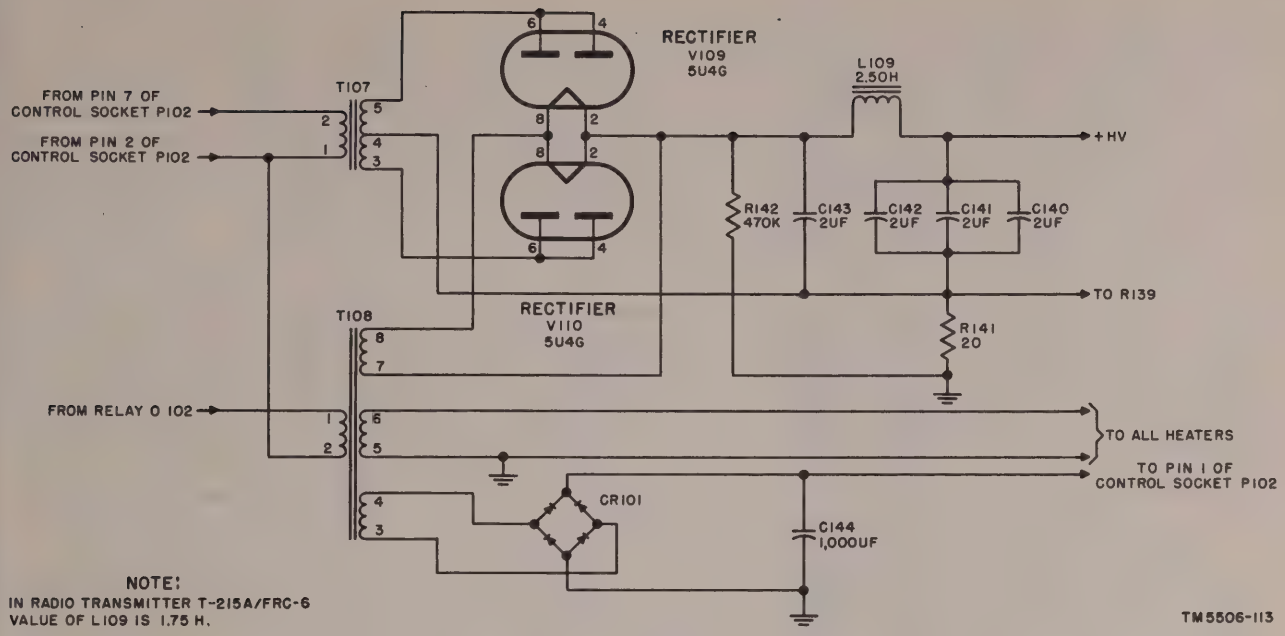


Figure 34. Transmitter power supply.

c. The components of the filter are mounted on the transmitter chassis. The low-pass filter attenuates the ripple component of the rectifier output. Positive voltage is applied to the plates and screens of the transmitting tubes from the junction of L109 and capacitors C140, C141, and C142. The negative output is grounded through resistor R141. The voltage drop across R141 is used to supply microphone current when a local microphone is used (a microphone connected to J102 on the transmitter). When relays O102 and O103 are deenergized, resistor R142 dissipates the charge of capacitor C143.

Section III. RECEIVER

66. Block Diagram of Receiver
(fig. 35)

a. The signal voltage induced in the antenna is amplified by the rf amplifier tube, V201, and fed to the mixer tube, V203. A generated signal 4.3-mc lower in frequency than the received signal is also fed to the mixer stage from the hf oscillator tube, V202. The output circuit of V203 is tuned to the difference frequency (4.3 mc) and is amplified by the intermediate-frequency (if) amplifier tube, V204.

b. The signal is then fed to the converter tube, V205, which serves as a mixer and crystal oscillator. The crystal for the oscillator portion of V205 is cut to either 4.755 mc or 3.845 mc. When the signal generated by the oscillator is combined with the 4.3-mc signal from V204, a difference frequency of 455 kc is obtained. The signal thus obtained is amplified by the 455-kc amplifier tube, V206, and fed to the first limiter tube, V207. An interconnection between the grid of the first limiter and the grid of the squelch amplifier gives the first limiter control over the operation of the squelch amplifier. The output of the first limiter is fed to the second limiter tube, V208. Both limiter tubes work together as amplifiers in the case of extremely weak signals and as peak leveling limiters on average or above average signals. Thus, a signal of constant amplitude varying only in frequency is applied to the discriminator tube, V209. In the discriminator tube, the variations in frequency resulting from modulation are converted to af voltages.

c. The output from the discriminator is filtered and fed to the noise amplifier tube, V210, where it is amplified and then rectified by V211. The voltage thus obtained is used in the operation of the squelch tube, which is one half of V212. The other half of V212 is the first af amplifier, which receives its excitation directly from the output of the discriminator and amplifies the audio voltage before it is fed to the second af amplifier. Part of the bias for the first audio tube is controlled by the squelch tube so that when no signal is received

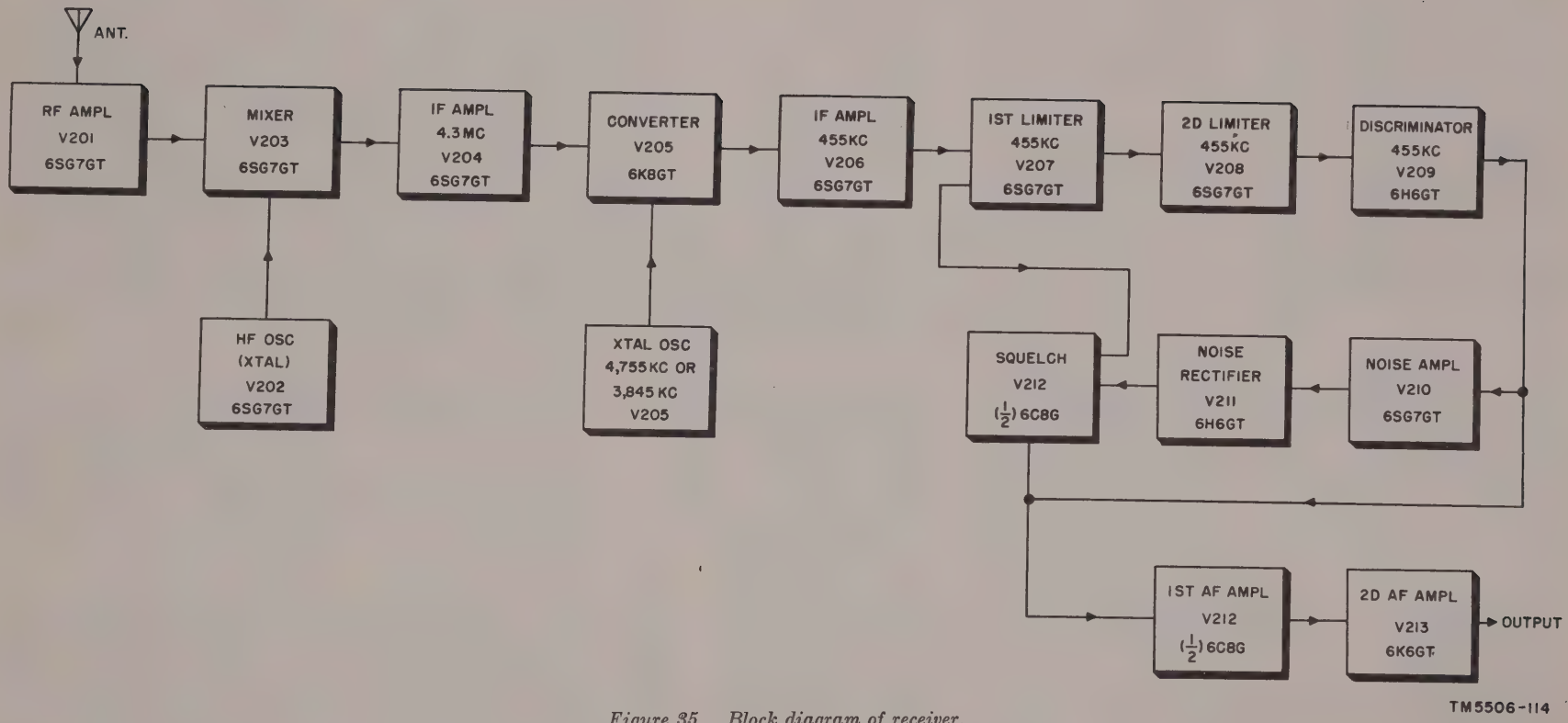


Figure 35. Block diagram of receiver.

by the antenna, the squelch tube increases the bias on the first audio tube beyond the cutoff point. With the first audio tube inoperative, no signal is sent to the second af amplifier tube, V213, and the loudspeaker output is reduced to zero.

d. Tube V213 functions as a class A audio power amplifier and provides sufficient output to drive the loudspeaker.

67. Rf Amplifiers

a. Radio Receiver R–276A/FRC–6 (fig. 36).

(1) Rf signals from the antenna are inductively coupled from L201 to L202 in the control grid (pin 4) circuit of rf amplifier V201 (6SG7GT). Variable capacitor C201 resonates L202 to the rf input frequency. Capacitor C202 serves as a dc blocking capacitor and also couples rf currents to the cathode. The grid return resistor is R201; if the rf signal becomes excessively large, grid current will flow and provide added bias for V201.

(2) Plate voltage is applied through plate decoupling resistor R206 and the coil in plate unit T201. The plate load is a parallel resonant circuit made up of the coil in T201 and variable capacitor C206. Capacitor C207 places the lower end of the tank coil at rf ground potential. This plate tank circuit is tuned to the rf input frequency. Resistor R302 is the screen grid dropping resistor. Capacitor C204 bypasses the screen grid to ground.

(3) Normal bias voltage is developed across cathode resistor R202. Capacitor C203 serves as the cathode bypass capacitor.

(4) The rf output of V201, as developed across the plate tank circuit, is coupled through C208 and C207 and appears across R207 in the control grid (pin 9) circuit of mixer tube V203.

(5) Transformer assembly T201 contains an rf coil, C206, C207, C208, and R207.

b. Radio Receiver R–368/FRC–6A (fig. 37). The rf amplifier stage of the R–368/FRC–6A differs from that of the R–276A/FRC–6 in the following circuit features:

(1) Grid return resistor of R201 is not used in the R–368/FRC–6A.

(2) The rf output of V201 is coupled to V203

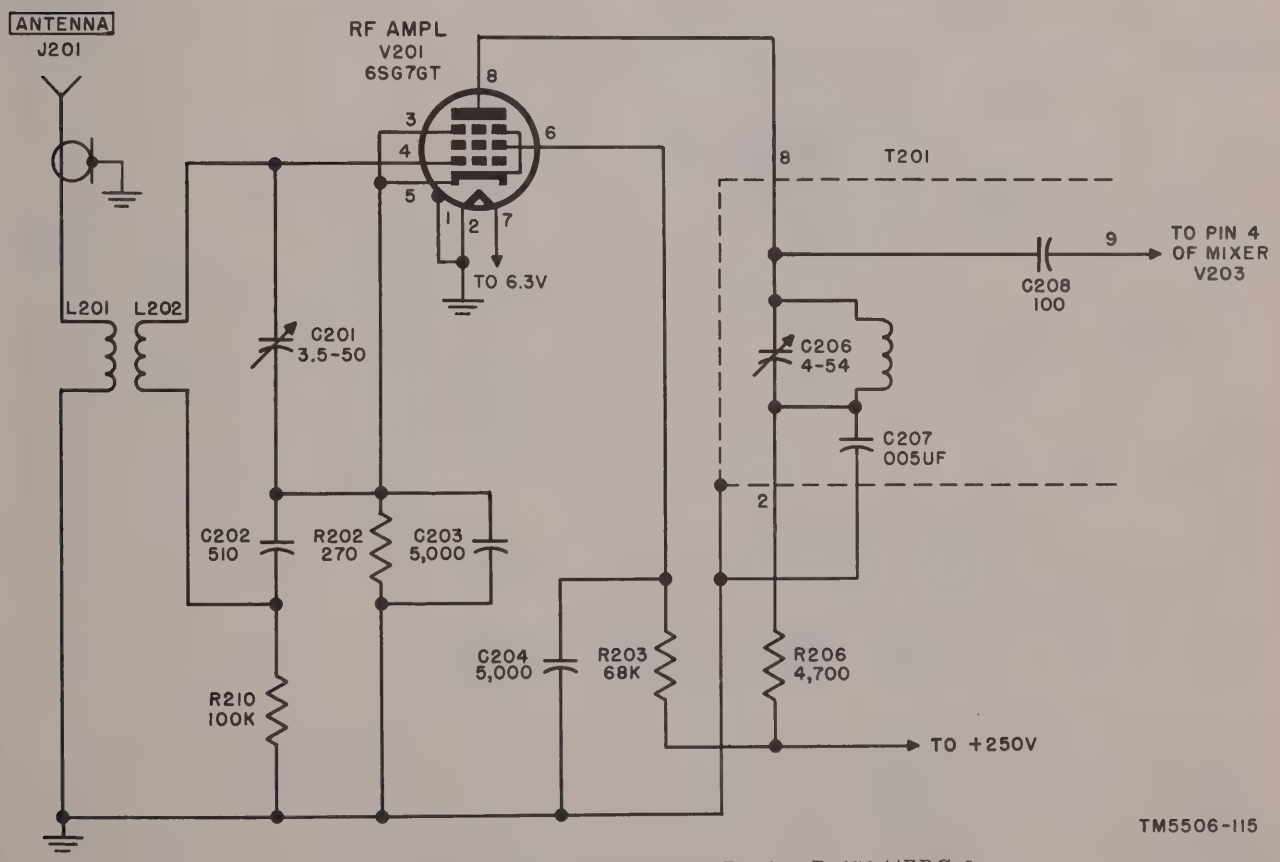


Figure 36. Rf amplifier stage of Radio Receiver R–276A/FRC–6.

through an rf transformer and coupling capacitor C208. The secondary of this transformer is tuned to the rf input frequency by capacitor C270. A tertiary winding, resonated by C274, is used as a wave trap for unwanted frequencies.

(3) Transformer assembly T201 contains C274, C206, C207, C208, C270, R206, and the tertiary winding.

68. Hf Oscillator

The hf oscillator, which generates the signal that beats with the incoming rf signal, is a modified tri-tet crystal oscillator. This stage uses a 6SG7GT type tube (V202) in both Radio Receivers R–276A/FRC–6 and R–368/FRC–6A.

a. Hf Oscillator of Radio Receiver R–276A/FRC–6 (fig. 38).

(1) Crystal Y201 is connected between the control grid (pin 4) of V202 to ground through the lower coil in transformer assembly T202. This lower coil is connected between pins 3 and 9 of T202. This coil has a natural resonance at a frequency slightly lower than the lowest crystal frequency used. Resistor R207 acts as the grid biasing resistor.

(2) The screen grid (tube pin 6) acts as the oscillator plate. B+ voltage is applied to the oscillator plate through dropping resistor R204. Most of the positive rf voltage feedback to sustain crystal oscillations is through C205 to ground and then through the resonant inductor to the cathode side of crystal Y201. The inductor being slightly off resonance, permits just enough in phase rf current feedback to maintain crystal oscillation.

(3) The crystal output is electron coupled to the plate (pin 8) of V202. Plate voltage is applied through decoupling resistor R208 and the coil connected between pins 2 and 8 of T202. Variable capacitor C211 resonates this coil at four or five times the crystal frequency. Crystal

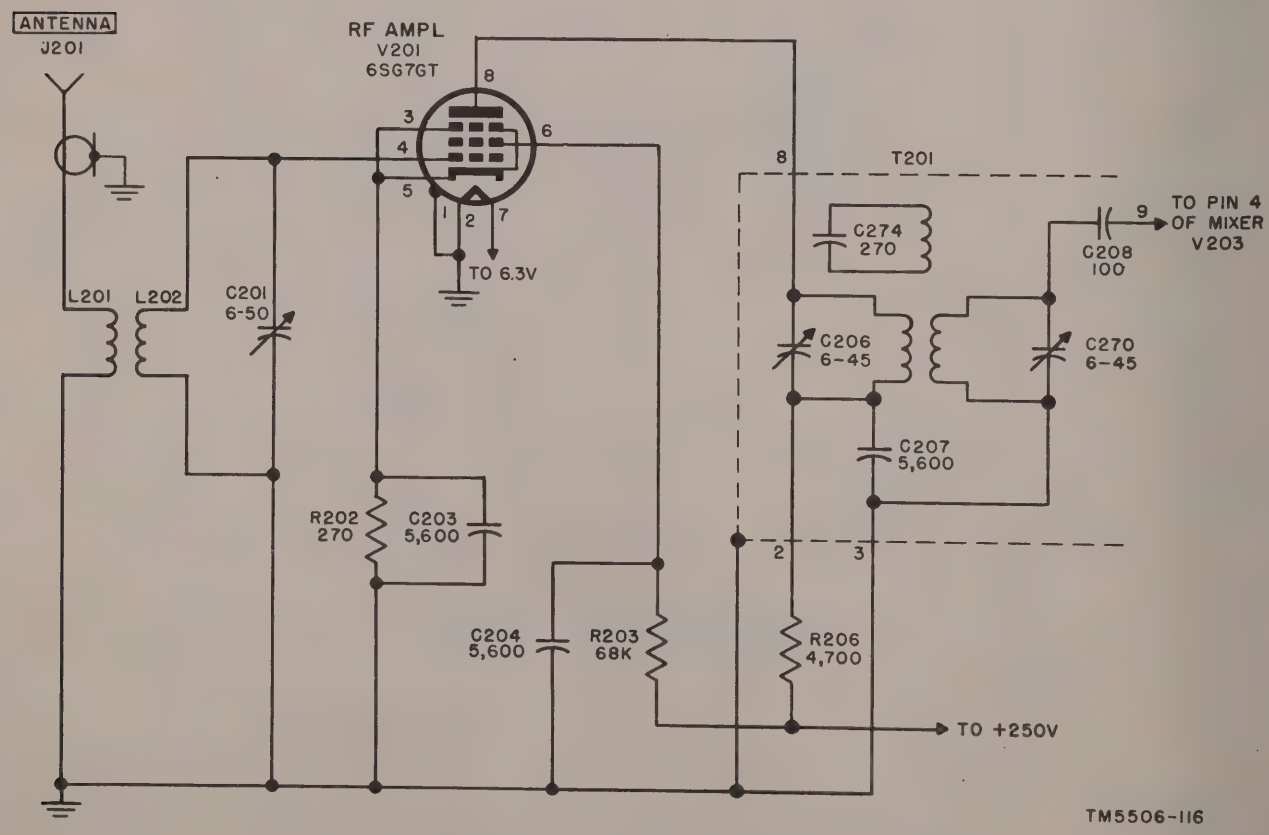


Figure 37. Rf amplifier stage of Radio Receiver R–368/FRC–6A.

frequency may be determined as follows:

(*a*) For channel frequencies between 30 and 37-mc, subtract 4.3-mc and divide by 4.

(*b*) For channel frequencies between 37 and 40-mc, subtract 4.3-mc and divide by 5.

(4) Capacitor C209 couples the multiplied crystal frequency output to the control grid (pin 4) of mixer tube V203.

(5) Transformer assembly T202 contains two inductors and capacitors C210 and C211.

b. Hf Oscillator of Radio Receiver R–368/FRC–6A (fig. 39). The hf oscillator of the R–368/FRC–6A differs from the R–276A/FRC–6 in the following circuit features:

(1) Transformer assembly T202 contains the following components:

(*a*) Variable capacitors C211 and C273.

(*b*) Fixed capacitor C210.

(*c*) Unlettered transformer with primary coil connected between pins 2 and 8 of T202 and the secondary coil connected between pins 4 and 3 of T202.

(2) The multiplied frequency, output of V202 is coupled by transformer action through C209 to the control grid (pin 4) of mixer tube V203.

69. Mixer

(fig. 40)

a. Two input signals are impressed on the control grid (pin 4) of mixer tube V203 (6SG7GT). The signal input from the rf amplifier is from pin 9 of T201. The other input is coupled through C209 from the plate (pin 8) of the hf oscillator tube. As the two frequencies combine in the mixer tube, the difference frequency (4.3-mc) is passed by the two inductively coupled, tuned circuits of T203 to the grid of 4.3-mc if amplifier tube V204. The resonant circuits reject all frequencies other than a narrow band centered at 4.3-mc.

b. Resistor R207 acts as the grid leak resistor between the rf signal grid (pin 4) and ground.

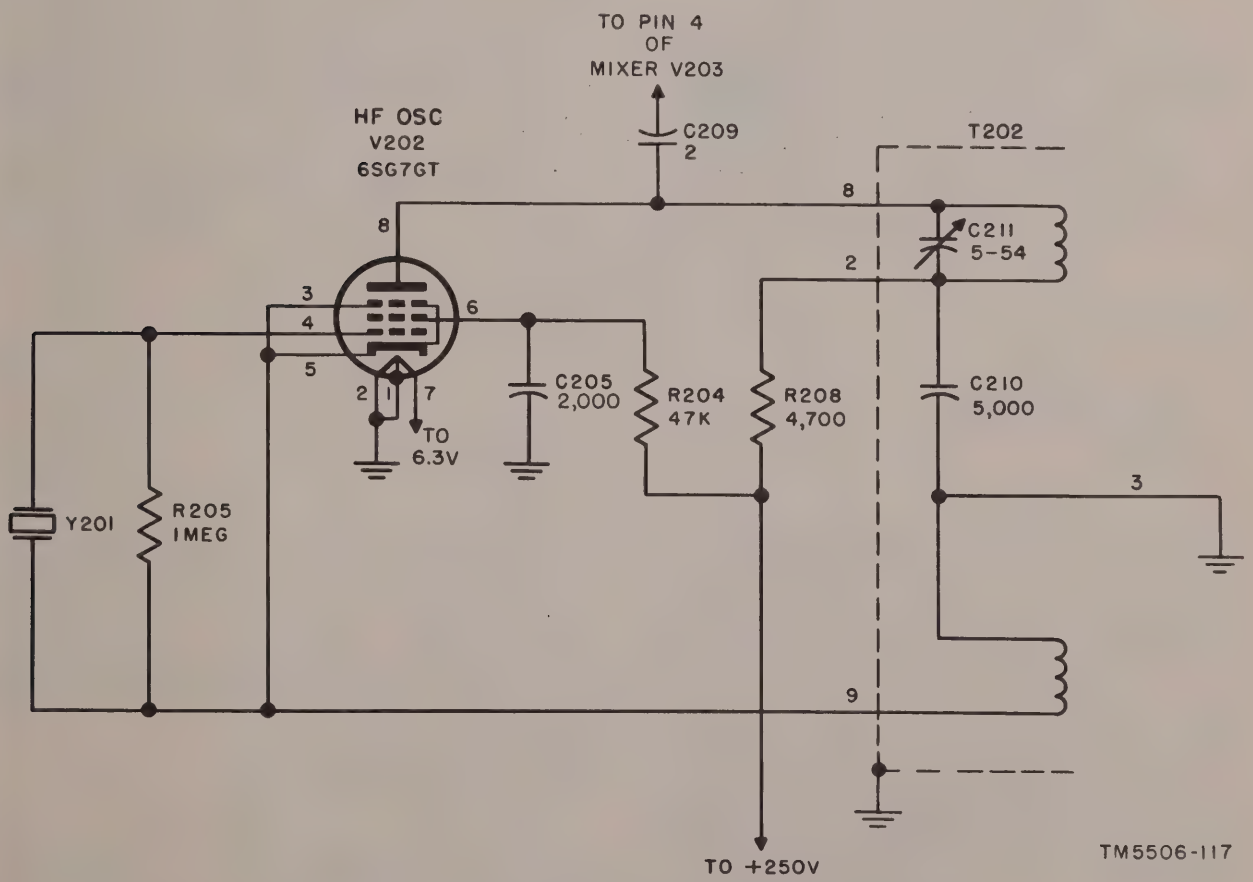


Figure 38. Hf oscillator stage of Radio Receiver R–276A/FRC–6.

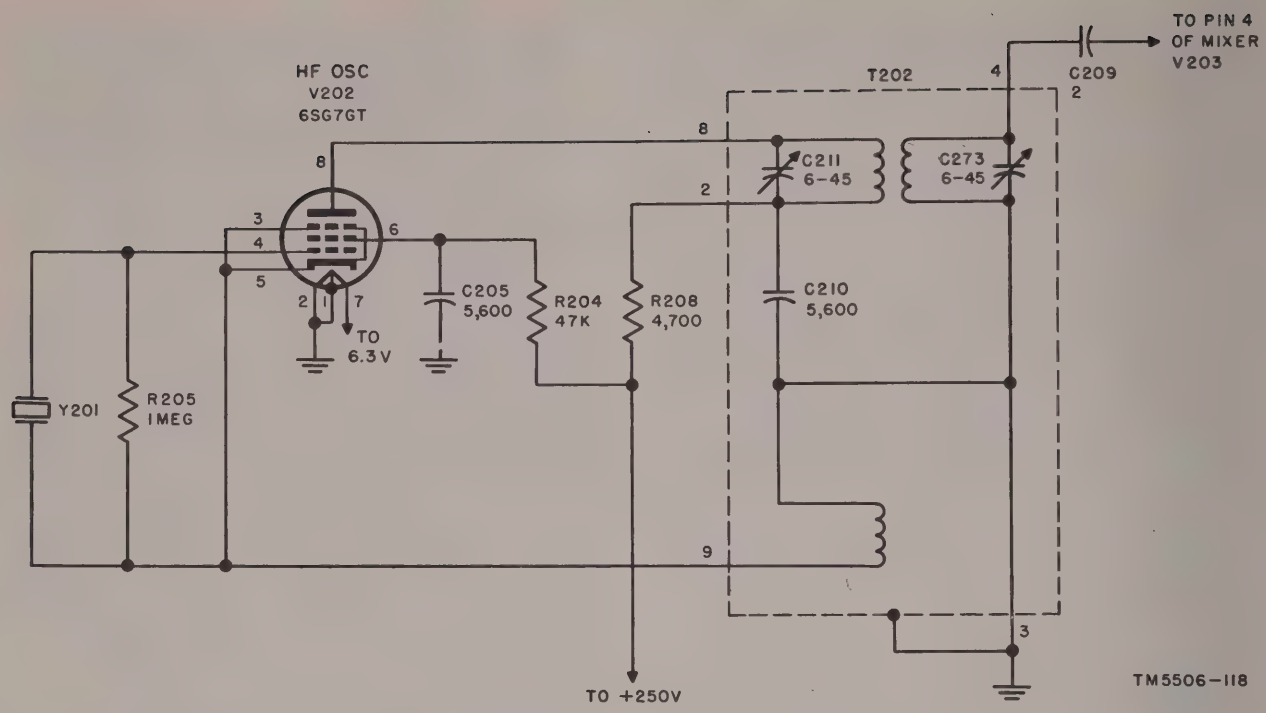


Figure 39. Hf oscillator stage of Radio Receiver R-368/FRC-6A.

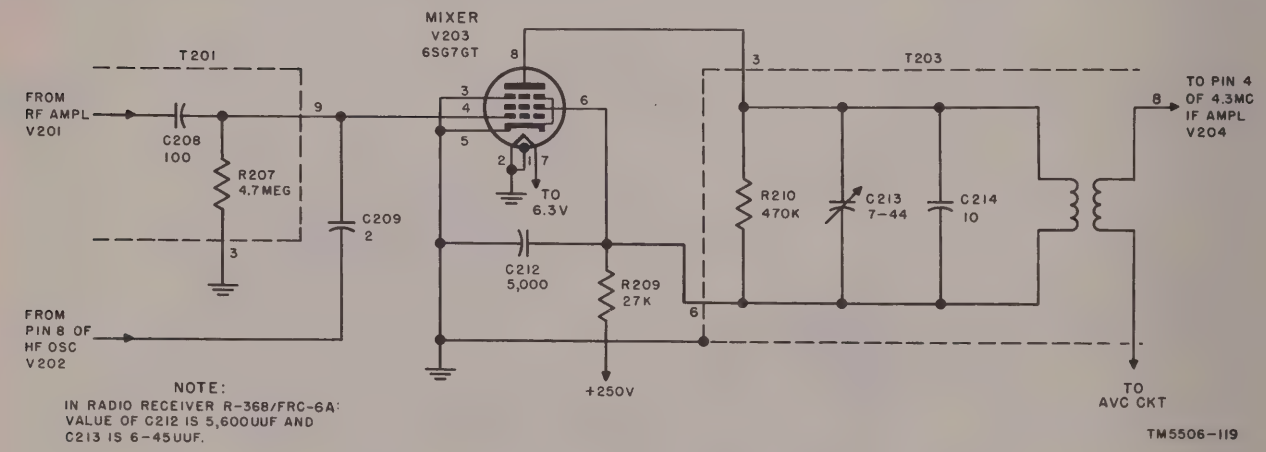


Figure 40. Mixer.

c. Screen and plate potentials are obtained through dropping resistor R209, which isbypassed to ground by C212. The plate potential is applied from R209 through the inductance of the plate tuned circuit and its associated shunt resistor, R210. Resistor R210 broadens the band-pass characteristics of T203. The primary of T203 is resonated at 4.3-mc by fixed capacitor C214 paralleled by variable trimmer C213. The secondary is resonated by fixed capacitor C216 paralleled by variable trimmer C217. Automatic volume control is applied to the control grid of 4.3-mc if amplifier tube V204 from pin 8 of T205 through decoupling resistor R211 and its associated filter capacitor, C215.

d. Transformer assembly T203 contains C213, C214, C215, C216, C217, R210, R211 and the coupling transformer.

70. If Amplifier, 4.3-mc
(fig. 41)

a. The 4.3-mc output from the mixer tube is fed to the control grid (pin 4) of 4.3-mc if amplifier V204 (6K8) through transformer action. This

high if provides good image rejection because of the wide separation between the desired and image frequencies. The secondary of the transformer in T204 is resonated at 4.3-mc by fixed capacitor C216 and variable trimmer C217. Resistor R211, bypassed by C215, acts as an automatic volume control (avc) filter network. Avc voltage is applied to the control grid (pin 4) of V204 from pin 8 of T205 through R211 and its associated filter capacitor, C215. Vacuum tube V204 amplifies the 4.3-mc signal and the output is coupled through the band-pass network contained in transformer assembly T204. Variable trimmer capacitor C220 and fixed capacitor C221 resonate the transformer primary (in T204) to 4.3-mc; resistor R214 broadens the band-pass characteristics of this tuned tank circuit. B+ voltage is applied to the plate and screen of V102 through the common voltage-dropping resistor R213. From pin 6 of T204, the dc path to the plate is through the shunt arrangement of R214 and the primary of the tuned transformer in T204. Capacitor C219 bypasses R213 to ground and also places the lower end of the primary tank circuit (in T204) at rf ground potential.

b. The 4.3-mc if output is coupled by transformer action to the grid cap of converter tube V205.

c. Bias is developed across cathode dropping resistor R212. Capacitor C218 bypasses the cathode to ground.

d. Transformer assembly T204 contains C220, C221, C222, C223, C224, R214, R215, and the coupling transformer.

71. Converter V205
(fig. 42)

A dual section tube, V205 (6K8), is used in the converter stage. The hexode section functions as a mixer, combining the incoming 4.3-mc signal from the if amplifier with the 4.755- or 3.845-mc signal generated by the triode section of V205. The 4.3-mc input is to the cap on the top of V205, and injection of the generated signal is accomplished internally in the tube between the cathode and first grid, each of which is common to both sections. The output of the mixer tube is tuned to the difference frequency of 455-kc.

a. The secondary coil in T204 is tuned to 4.3-mc by fixed capacitor and variable trimmer C224. Resistor R215 is the grid return from the grid cap of V205. The oscillator section has a quartz crystal, Y202, connected from the plate (pin 6) to grid (pin 5) in a Pierce oscillator circuit. Bias is obtained between grid and cathode by grid current flowing through R216. Plate voltage is applied through the plate load resistor, R218.

b. The first grid and cathode of both sections being common, the rf voltage on the oscillator grid modulates the electron stream in the hexode section, combining the generated signal with the incoming signal. Bias for the hexode is built up across cathode resistor R217, which is bypassed to ground by capacitor C225. Screen and plate

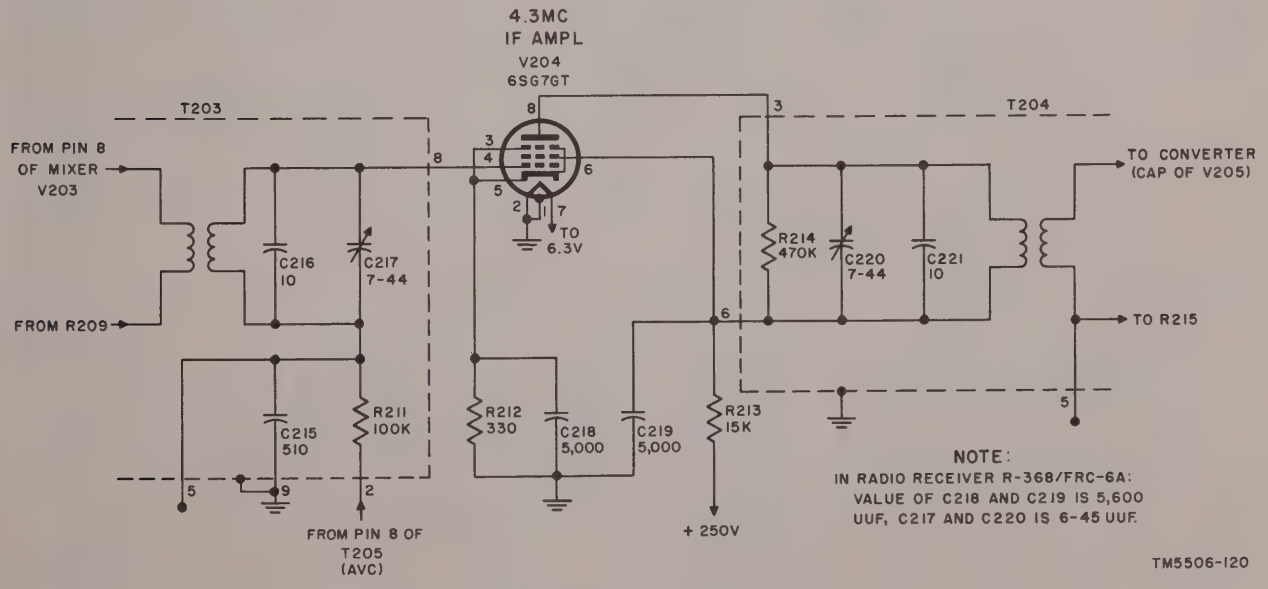


Figure 41. If amplifier, 4.3-mc.

voltages are dropped by resistor R219 and bypassed to ground by C228. Voltage is applied to the plate of the hexode from R219 through the inductance of T205. The plate circuit of the hexode section is tuned to 455 kc by the inductance of T205 paralleled by fixed capacitor C227 and trimmer capacitor C226. Coupling from the plate of the hexode section to the grid of the following if amplifier stage is through capacitor C229.

c. Transformer assembly T205 contains C226, C227, C229, C230, R220, R221, R222, and the inductor (connected between pins 9 and 10).

72. If Amplifier, 455-kc

(fig. 43)

a. The 455-kc if amplifier, V206, a 6SG7GT, performs two functions:

(1) When vf signals are applied to the control grid (pin 4 of V206), an avc voltage is developed by grid current flow through R221 to ground. This provides a negative avc voltage at the grid end of R221. Capacitor C230 bypasses R222 to ground. Resistor R220 is in series with R211 and makes up part of the avc filter network. This avc voltage is applied through the avc filter network to the control grid of the 4.3-mc if amplifier.

(2) Tube V206 functions as a conventional if amplifier at 455-kc.

b. Signal voltage is applied between the control grid (pin 4) and ground. At normal signal strengths, R221 serves as a normal grid return resistor. Resistor R222, bypassed to ground by C230, is a multiplier resistor in series with tuning meter M1 when METER SWITCH S201 is operated to position 1; the meter will then indicate avc voltage applied to pin 4 of V206.

c. B+ voltage is applied through common dropping resistor R224 to the plate (pin 8) and the screen (pin 6) of V206. Capacitor C232 bypasses R224 to ground. The primary inductor (connected between pins 1 and 7 of T206) is resonated at 455-kc by fixed capacitor C233 and trimmer capacitor C234; resistor R225 is used to broaden the band pass of this parallel resonant circuit.

d. Normal bias voltage is developed across R223 (connected between the cathode pin 5 and ground). Capacitor C231 bypasses R223 to ground.

e. The 455-kc output of V206 is coupled by transformer action to the control grid pin 4 of V207.

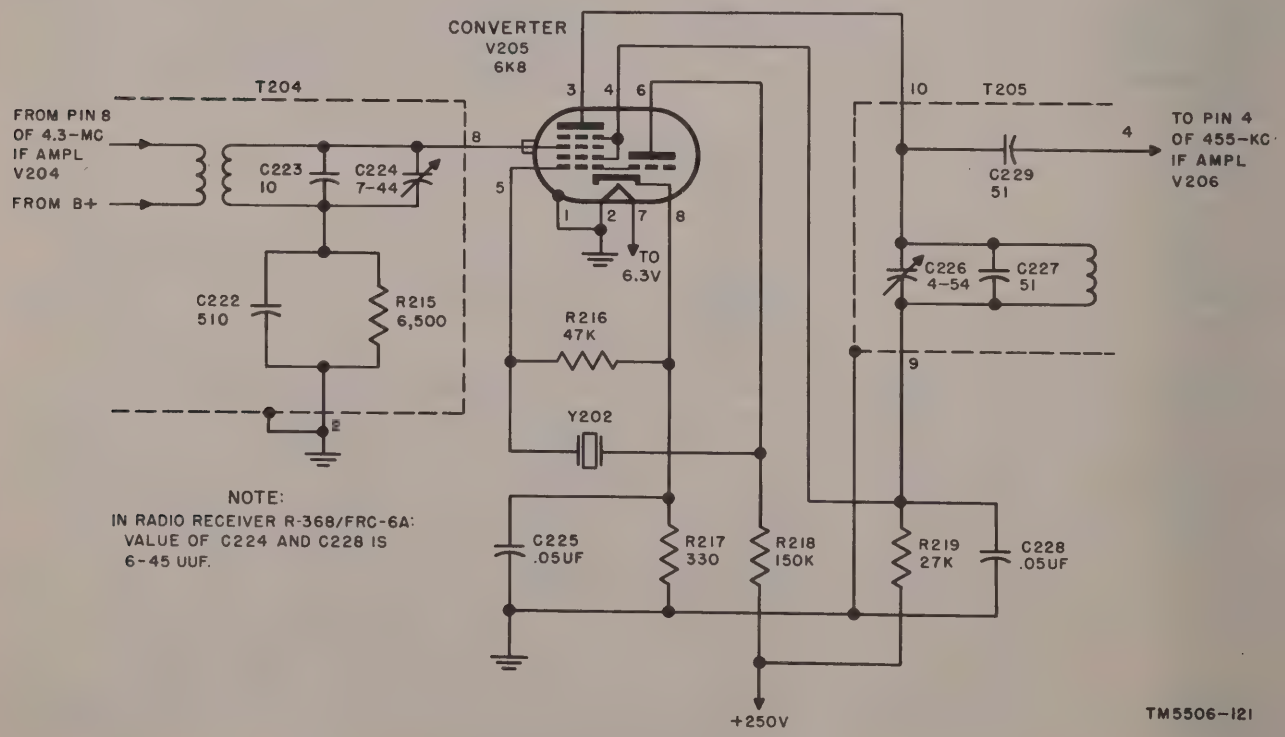


Figure 42. Converter.

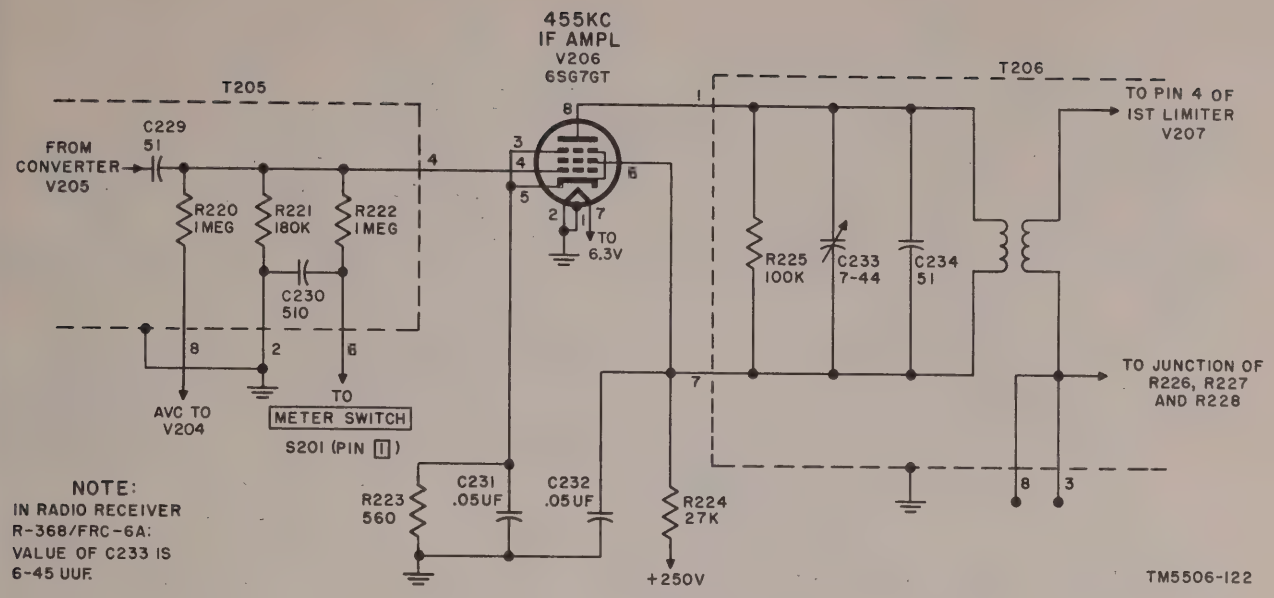


Figure 43. If amplifier, 455-kc.

f. Transformer assembly T206 contains C233, C234, C235, C236, C237, R227, R228, R229, and the coupling transformer.

73. First Limiter
(fig. 44)

a. The first and second limiter tubes remove all traces of amplitude variation from the received signal. To accomplish this, both tubes are operated with reduced plate and screen potentials. The output of either tube is limited by plate current saturation, which occurs when the positive peaks of the input signal cause grid current flow in the tube, and by plate current cutoff, caused by the negative peaks of the input signal. Weak signals are amplified in a normal manner. Resistor R227 is a multiplier resistor in series with the tuning meter (M1) when METER SWITCH S201 is rotated to position 2. When in position 2, the METER SWITCH indicates first limiter grid current.

b. The secondary coil of T206 is resonated at 455-kc by fixed capacitor C235 and trimmer capacitor C236. The control grid (pin 4) of first limiter tube V207 (6SG7GT) receives the 455-kc input signal from pin 9 of T206. When signal is applied, the rectified grid current through resistor R228 biases V207. This bias voltage is applied to the plate of noise rectifier V211 through R226 and R238. It is this voltage that disables the squelch circuit when a signal is received.

c. The plate and screen potential is dropped by resistor R230 through the primary inductor in T207. This primary inductor is resonated at the 455-kc intermediate frequency by fixed capacitor C240 and variable trimmer capacitor C239. Capacitor C238 bypasses R230 to ground for rf; C238 also places the lower end of primary tuned circuit at rf ground potential.

d. The output of V207 is coupled by transformer action to the control grid (pin 4) of V208.

e. Transformer assembly T207 contains C239, C240, C241, C242, C243, R231, R232, and the coupling transformer.

74. Second Limiter and Discriminator
(fig. 45)

a. The second limiter uses the same circuit as the first limiter to further reduce amplitude variations. The secondary of T207 is resonated to 455 kc by fixed capacitor C241 and variable trimmer capacitor C242. The 455-kc signals from pin 9 of T207 are applied to the control grid (pin 4) of second limiter tube V208 (6SG7GT). Bias for the second limiter tube is developed by rectified grid current flowing through R232 to ground Capacitor C243 bypasses R232 to ground for rf. Resistor R231 is the meter multiplier resistor connected in series with the tuning meter (M1) when METER SWITCH S201 is in position 3, indicating second limiter grid voltage. The plate and screen voltage is dropped by resistor R233, which is bypassed to ground through C244. Plate voltage is applied from R233 to the tube plate (pin 8) through the primary windings of the two if transformers in T208.

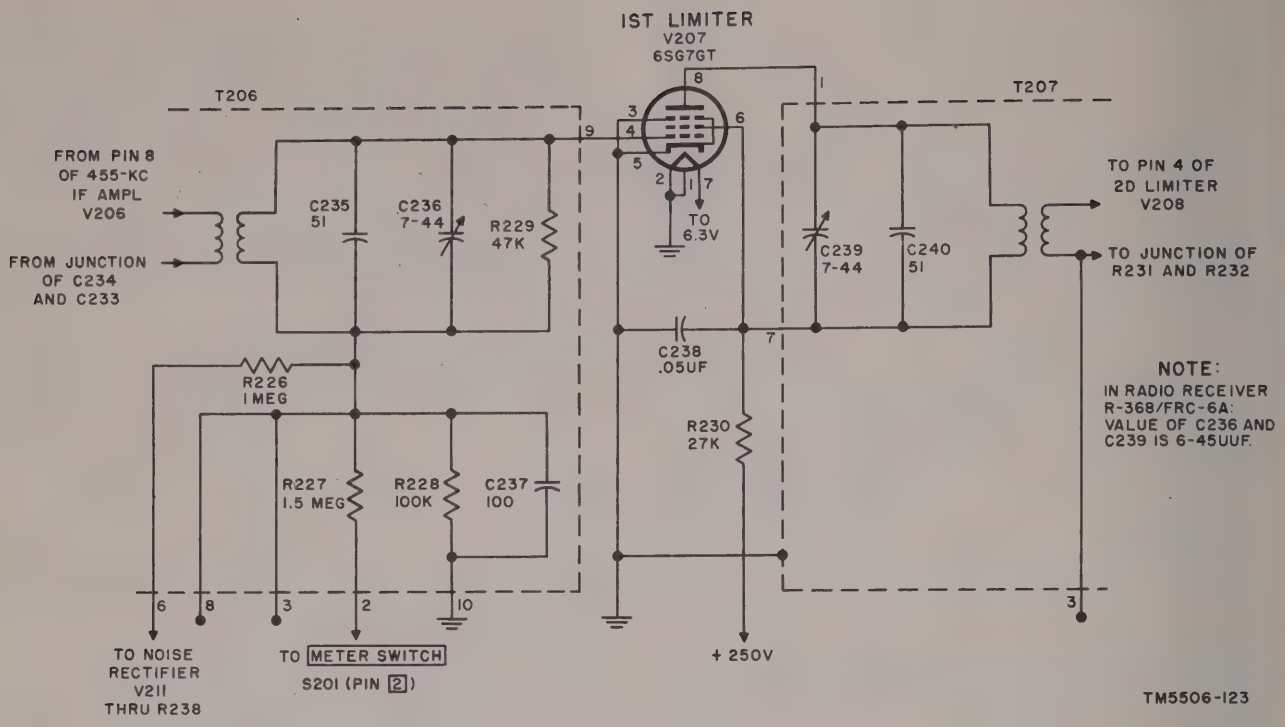
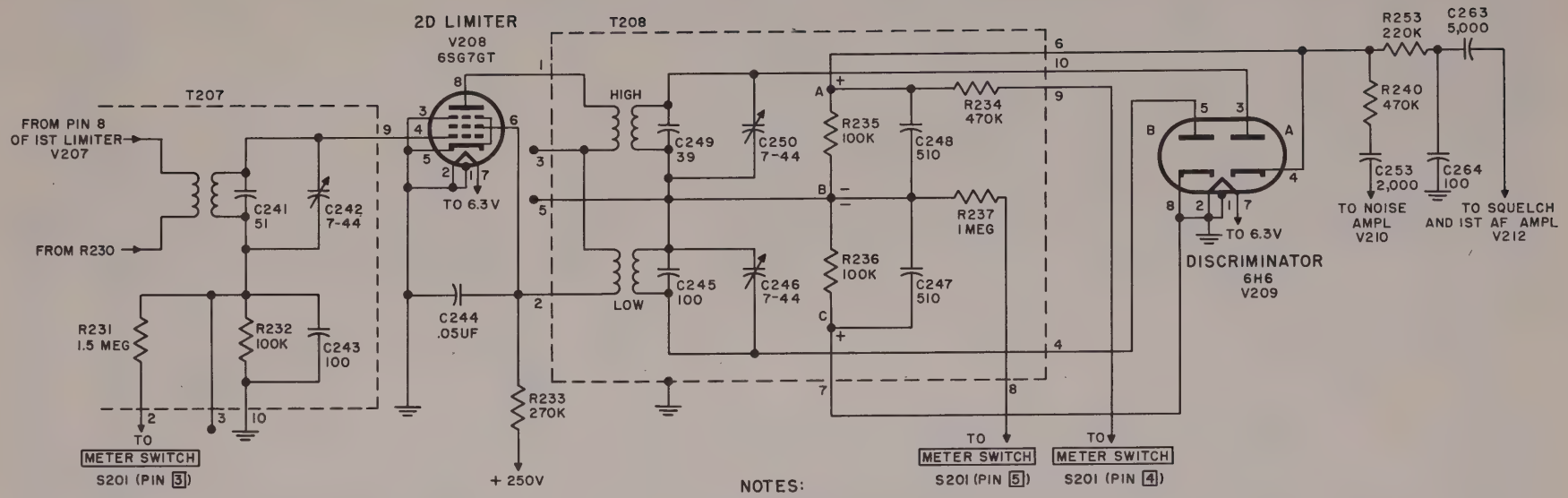


Figure 44. First limiter.

b. Discriminator tube V209 (6H6GT) transforms the frequency variations of the 455-kc signal into af variations. The discriminator transformer, in transformer assembly T208, is made up of two separate if transformers incased in one metallic housing. The secondary inductance of one is resonated to a frequency about 480 kc by parallel fixed capacitor C249 and variable trimmer capacitor C250. This is referred to as the *high* transformer. The secondary inductance of the other, or *low* transformer is resonated about 430-kc by parallel fixed capacitor C245 and variable trimmer capacitor C246. The discriminator is a differential rectifier, and the output of the high transformer (pin 10 of T208) is applied to one plate (pin 3) of V209; the output of the low transformer (pin 4 of T208) is connected to the other plate (pin 5) of V209. Resistor R236, shunted by C247, serves as load for the low-frequency (lf) section of the discriminator. Resistor R235, shunted by C248, is the load for the hf section. The audio output of the discriminator is built up across the two load resistors in series (R235 and R236) and connected between the two cathodes of V209 (pins 4 and 8). Output to the following stages is from pin 6 of T208 to R253 (fig. 45).

c. The voltage drop across the two load resistors, R235 and R236, is from A to B and C to B, as indicated in figure 45. Thus, with no modulation of the signal, the intermediate frequency is exactly 455 kc. Equal and opposite voltages are built up across the two load resistors, and the output to the following stage is zero. When modulation occurs (fig. 46), the output of one transformer increases as the other decreases, swinging back and forth at the rate of the modulation. This causes a corresponding increase of voltage across one load resistor and a drop across the other. The resulting alternating voltage delivered to the following stages from pin 6 and 7 of T208 is the algebraic sum of the voltages built up across R235 and R236. This voltage varies in amplitude at the same rate as the modulation, the amount of voltage developed being determined by the deviation of the signal above and below 455 kc. The deviation corresponds to the percentage of modulation of the incoming signal. The if transformers of T208 are operated on the straight line portion of their individual response curves to provide undistorted output with full swing (15 kc) of the carrier. The discriminator audio output is applied through the deemphasis filter network (R253 and C264) through coupling capacitor C263 to the first audio amplifier stage.

d. Resistor R237 is a meter multiplier in series with the tuning meter when S201 is operated to



NOTES:

1. IN RADIO RECEIVER R-368/FRC-6A:
   VALUE OF C242, C246, AND C250 IS 6-45 UUF. VALUE OF C253 IS 2,200 UUF.
2. IN RADIO RECEIVER R-368/FRC-6A ON ORDERS NO. 3349-P-52 AND 37214-PHILA-53:
   RESISTOR R255 (2.2 MEGOHMS) IS CONNECTED IN SERIES BETWEEN PIN 4 OF V209 AND JUNCTION OF R253 AND R240. RESISTOR R256 (470K OHMS) IS CONNECTED FROM PIN 4 OF V209 TO GROUND.

TM5506-124

Figure 45. Second limiter and discriminator.

position 5 to indicate the voltage across the lower load resistor. Resistor R234 is a meter multiplier in series with the tuning meter when S201 is operated to position 4 to indicate the differential voltage across the two load resistors in series.

75. Noise Amplifier and Rectifier (fig. 47)

a. General.

(1) The output of the discriminator contains either the desired voice frequencies (300 to 3,000 cycles per second (cps)) when a signal is received, or undesirable high-frequency noise voltages when no signal is being received. When no signal is being received, the noise voltage operates the squelch circuit to cut off the first af amplifier. When a signal is received, negative voltage from the first limiter disables the squelch circuit and allows the audio signal to be amplified. The output of the discriminator is fed through an audio-frequency selective filter (R240, C253 and R239) to the control grid (pin 4) of noise amplifier tube V210 and through a deemphasis network to the control grid (pin 5) of first audio amplifier V212. The components in this network are R253, C264, C263, R248, R247, and C261 (fig. 48).

(2) The noise component of the output of V209 is amplified by noise amplifier tube V210 (6SG7GT). The output of V210 is rectified by noise rectifier tube V211. The negative peaks are rectified by one section of V211; the positive peaks are rectified by the other section of V211. The combined output is a positive voltage and is used to operate the squelch tube.

b. Noise Amplifier.

(1) The noise impulses are coupled from the output of V209 by high pass filter composed of R240 and C253 and applied to the grid (pin 4) of V210. They are amplified in a conventional manner by the vacuum tube, and the amplified noise component is developed across the tuned load circuit composed of inductance L203 shunted by capacitor C256. The tuned circuit is resonated in the range of noise frequencies. The impedance of the tuned plate circuit is low at all but the noise frequencies, so that the operation of the circuit depends on noise and not on audio signal. The output is coupled to the plate of one diode section (pin 5) and the cathode of the other diode (pin 4) of V211 through coupling capacitor C257.

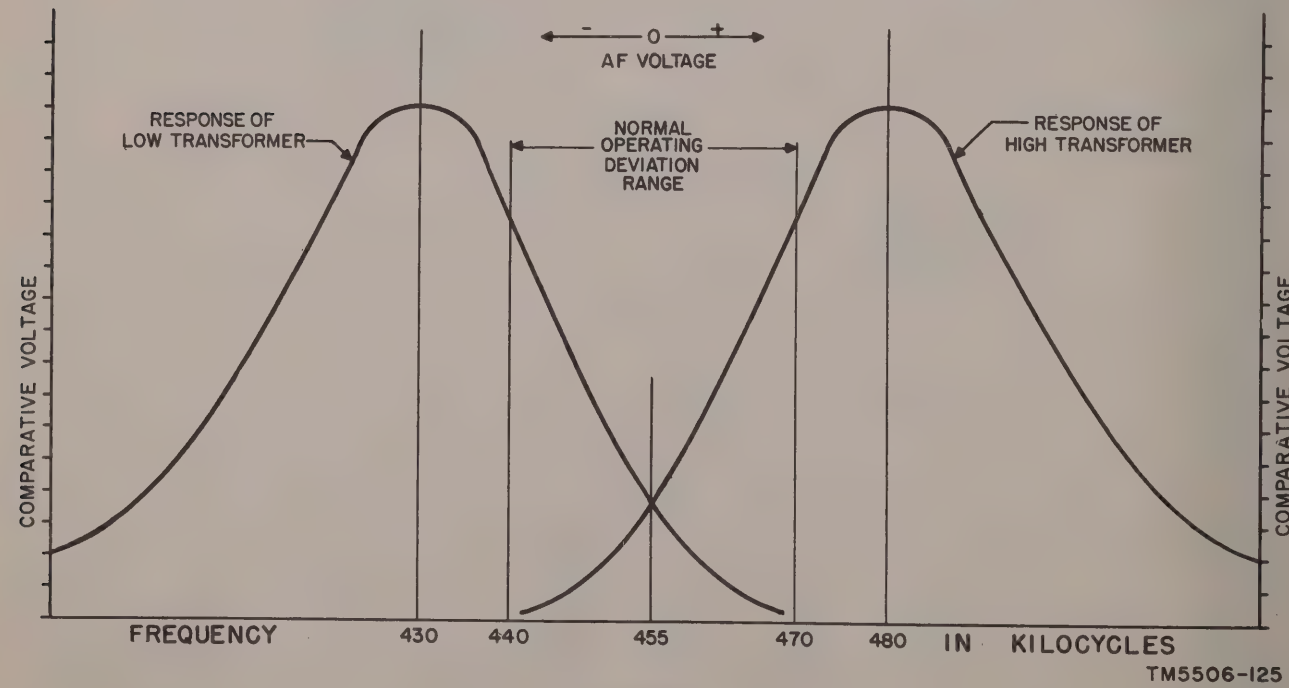


Figure 46. Discriminator response curve.

(2) The amount of gain used in V210 is controlled by adjusting the bias applied to the grid. This is the SQUELCH control on the radio set control chassis. Cathode bias is developed across variable resistor R305 connected from cathode (pin 5) to ground. The cathode is bypassed to ground by capacitor C254. Resistor R305 is located in the radio set control, and connection is made through the control cable (pins 5 and 6 of J205). Resistor R239 is the grid resistor. Plate and screen potential is dropped by resistor R243 and bypassed to ground by C255A. The voltage from R243 is applied to the plate through L203.

c. Noise Rectifier.

(1) The amplified noise impulses applied to V211 are rectified in one direction by one diode and in the opposite direction by the other diode. Tube V211 is a twin diode connected as shown in figure 48.

(2) On negative alternations of the noise signal, the diode section between cathode (pin 4) and plate (pin 3) conducts. The cathode (pin 4) is now negative with respect to ground. Rectified slate current charges C259. The voltage built up across C259 is negative with respect to ground.

(3) On positive alternations of the noise impulse, the diode section between cathode (pin 8) and plate (pin 5) attempts to conduct. Electrons tend to leave the upper plate of C258 and pass through the left diode section and pile up on the plate of capacitor C257 nearest tube pin 5 (the plate). This builds up a positive voltage across C258 with respect to ground.

(4) The voltages developed across C259 and C258 appear across R241 and make the grid of the squelch tube positive with respect to ground. This positive potential is applied to the grid of the squelch tube through low-pass filter made up of R242 and C260. The squelch tube conducts and cuts off the audio amplifier. The low-pass filter eliminates the possibility of stray intermediate-frequency or voice impulses operating the squelch and prevents disabling the squelch circuit by short duration noise pulses.

76. Squelch and First Af Amplifier
(fig. 48)

The squelch and first af amplifier are combined in a twin triode type tube, V212 (6C8G). The first section functions as a direct-coupled amplifier, which provides cutoff bias for the second section when no rf signal is being received. The second functions as a class A audio amplifier when signals are being received and is made completely inoperative by the squelch tube when no signal is being received.

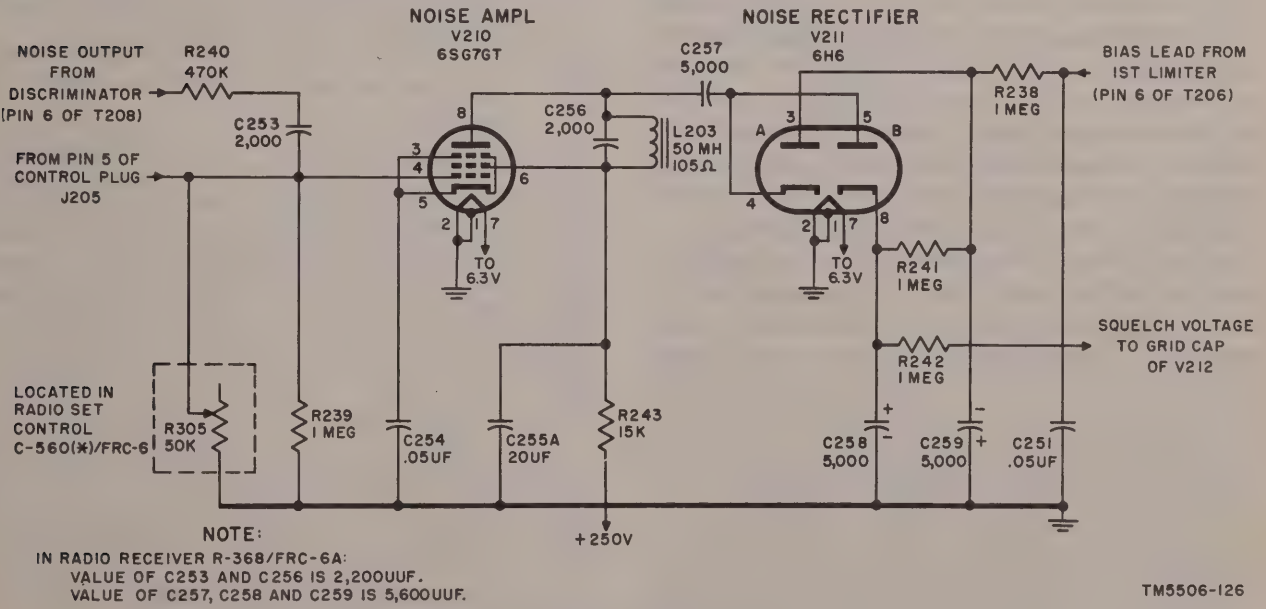


Figure 47. Noise amplifier and noise rectifier.

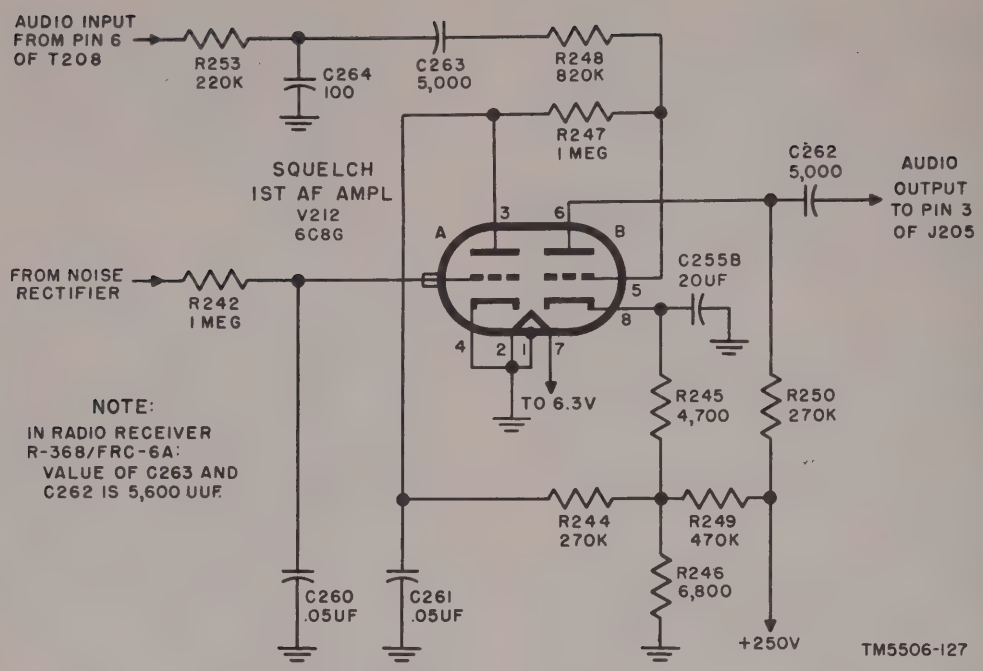


Figure 48. Squelch and first af amplifier.

a. Squelch. When signals are being received, the noise level is greatly reduced in the receiver. Thus, there is no noise input to the noise amplifier and no rectified noise voltage occurs across capacitors C258 and C259. The positive voltage applied to the grid of the squelch tube is replaced by a negative voltage supplied by the rectified grid current of V207 through R228. This voltage is coupled to the noise rectifier through resistors R226, R238, R241, and R242. The negative voltage on the grid reduces the plate current to zero. The voltage drop across the squelch plate resistor, R244, becomes zero. Thus, the first audio tube is permitted to operate normally as an amplifier on its own cathode bias. Resistors R249 and R246 form a voltage divider across the high-voltage supply. Grid resistor R247 connects the plate of the squelch tube to the grid of the first audio, so that any voltage drop across R244 is applied to the grid of the first audio and increases its bias above that provided by the cathode-biasing resistor, R245. Capacitor C261 prevents sudden changes in the squelch voltage applied to the grid of the first audio tube, such as would be caused by noise surges or voice modulation getting through the noise filter, from affecting squelch action.

b. First Af Amplifier. When signals are received, the audio output of the discriminator is fed to the first audio tube grid from pin 6 to T208 through a band pass filter composed of the low-pass section, R253 and C264, and a high pass section, R248 and C263. The band-pass filter removes all objectionable noise appearing at frequencies above and below the voice range. The amplifier output of the audio section of V212 appears across load resistor R250 and is coupled to the grid of the second audio tube by capacitor C262 connected from the plate (pin 6) of V212 to pin 3 of the control socket, J205, and through the control cables to a volume control potentiometer (R304) located in the radio set control. The rotating arm of the potentiometer is wired back through the control cable to pin 4 of J205 (fig. 82).

77. Second Af Amplifier
(fig. 49)

a. Second af amplifier tube V213 (6K6GT) is used to provide loudspeaker operation of the receiver. Audio input signals are applied through capacitor C263 to the control grid (pin 5) from pin 4 of the control socket, J205. Grid resistor R251 is connected from grid to ground. Bias is provided by cathode resistor R252 bypassed to ground by C255C.

b. In Radio Receiver R–276A/FRC–6, high voltage is applied to the plate through L204 and the primary of T209. (Coil L204 is not used in the R–368/FRC–6A.) Screen grid voltage is applied directly to pin 4 of V213. Capacitor C265 and L204 (in R–276A/FRC–6 only) further reduce the high audio frequencies and improve the receiver's rejection of annoying noise.

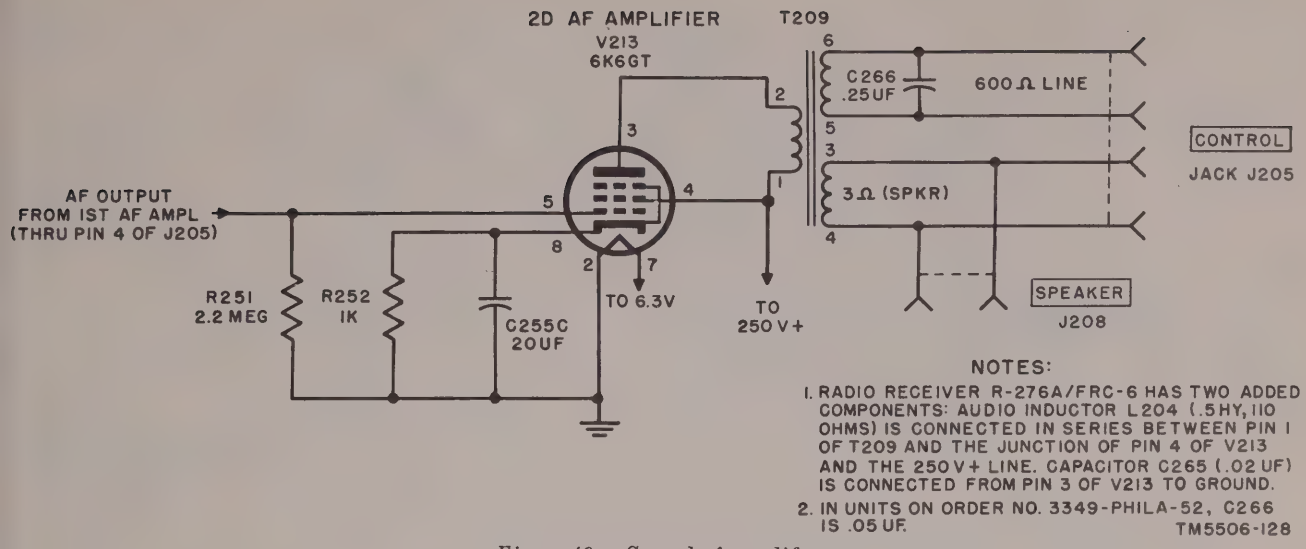


Figure 49. Second af amplifier.

c. Transformer T209 has two secondaries. One winding provides for direct operation to the voice coil of a 3-ohm loudspeaker and the other is designed to operate into a 600-ohm line for remote operation. Capacitor C266 is shunted across the 600-ohm coil of T209 (connected between pins 1 and 2 of T209) and is used to assist in removing high-frequency noise.

78. Power Supply PP–421(*)/FRC–6

(fig. 50)

a. All power requirements for the receiver are supplied by Power Supply PP–421(*)/FRC–6. The 110-volt, 60-cycle ac input is fed to transformer T210.

b. The primary of T210 (connected between pins 1 and 2) is connected to the 110-volt, ac line through fuse F201 and pins 1 and 6 of power receptacle P201. Capacitor C267 bypasses the transformer primary to ground and thus reduces the possibility of rf signals and noise impulses from entering the receiver through the powerlines.

c. Two stepdown secondary coils are provided. One secondary coil (connected between pins 8 and 9 of T209) heats the filaments of full-wave rectifier tube V214 (5Y3WGT). The other secondary coil (connected between pins 6 and 7 of T210) provides 6.3 volts ac filament voltage for all the other receiver tubes.

d. The step-up secondary winding (connected between pins 5, 4, and 3 of T210) is center-tapped to ground (at pin 4). The two outside terminals (pins 3 and 5) are connected to the plates of V214 in a conventional full-wave rectifier circuit.

e. The rectifier output (dc) is taken from the cathode of V214 (pin 8) and sent through the low-pass filter composed of L205, C268A, and C268B. This filter circuit reduces the ripple component of the rectifier output before it is applied to the plates and screen grids of the receiver tubes. Bleeder resistor R254 protects the filter capacitors against excessive voltage buildup when the heater-type receiver tubes are warming up. Resistor R254 also improves the voltage regulation of the B+ supply and furnishes a discharge path for C268A and C268B to ground, when the radio set is turned off.

f. The B+ voltage connection is from the output of the filter to pin 4 of POWER receptacle P201, to pin 4 of J201 on the interconnecting cable, to pin 4 of P101 on the interconnecting cable. From pin 4 of P101, the connection is to pin 4 of RECEIVER receptacle J101 (in the transmitter). The receiver B+ voltage is now applied through the normally closed contacts of transmitter relay O 101 back to pin 3 of J101. The B+ voltage circuit is continued through pin 3 of P101 through the interconnecting cable to pin 3 of receiver connections J201 and P201. From pin 3 of P201, B+ is applied to all receiver stages through the red-bodied, pin-type plug P203, which mates with jack J203.

g. The negative output (grounded) is connected to pin 5 of POWER receptacle P201. Receiver filament voltage of 6.3 volts ac is applied between ground and the yellow-bodied pin plug, P204, and its mating jack, J204. This 6.3-volt filament supply is for all receiver tubes except rectifier tube V214.

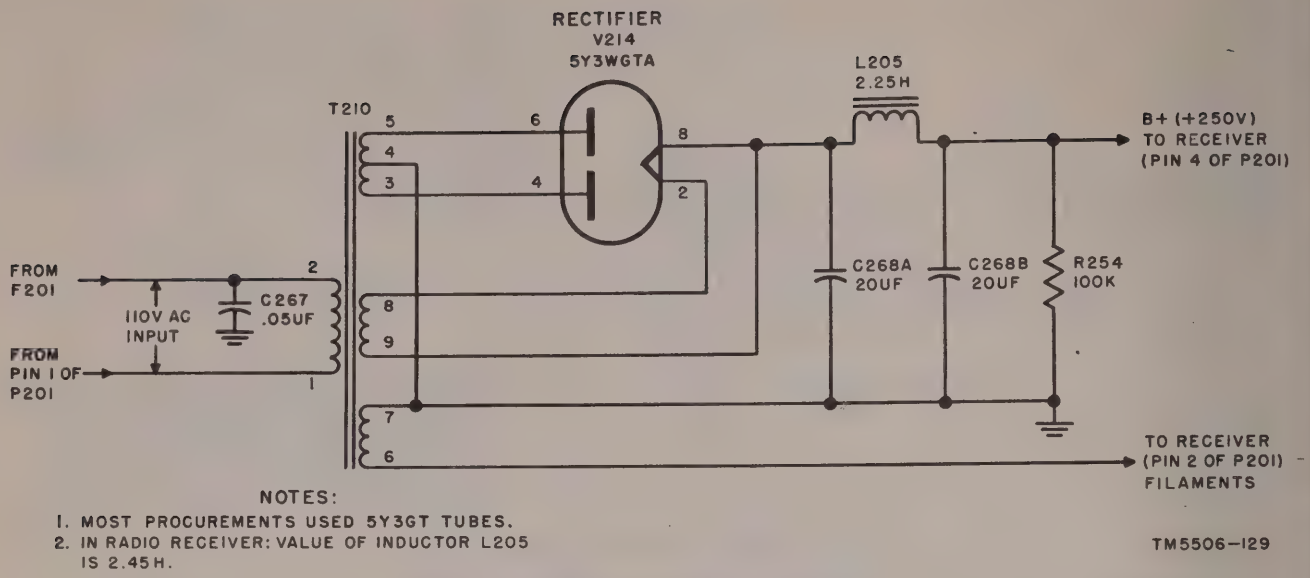


Figure 50. Power Supply PP-421(*)/FRC-6.

Section IV. RADIO SET CONTROL

79. Block Diagram of Radio Set Control C-560(*)/FRC-6

(fig. 51)

a. Radio Set Control C-560(*)/FRC-6 is connected to the console by the control line. The control relay is operated by a direct current of 8 milliamperes (ma) applied to the control line by the console. When the control relay is operated, the receiver is made inoperative, and the transmitter is placed in operation. Audio signals sent over the control line from the console pass through the line isolation transformer, the control relay contacts, and the line control to the audio input of the transmitter. The LINE INPUT CONTROL provides for adjustment of the level of the audio signal for proper modulation of the transmitter. Compensation for the hf attenuation caused by the distributed series inductance and shunt capacitance of the line is provided by the line EQUALIZER, which is adjusted to provide an equal amount of lf attenuation.

b. Two main fuses are mounted on the radio set control and provide main line protection for the transmitter and receiver power supply units. When the dc component is removed from the line, the control relay is deenergized and the direction of transmission of audio signals along the control line is reversed. With the control relay thus in the deenergized position, the transmitter is made inoperative and the receiver is put into normal operating condition. Audio signals from the receiver are fed through the control relay contacts, through the line isolation transformer, and to the control line to the console.

c. Two receiver controls are mounted on the radio set control. The receiver VOLUME control (R304) is adjusted to provide correct audio level to the control line. The SQUELCH control (R305) is adjusted to provide zero output signal to the line when only noise is received.

80. Transmission Control Circuits

(fig. 52)

With the radio set control in the operate or transmit condition, control relay O 301 is operated by a direct current of 8 ma applied to the control line by the console when the press-to-talk button is operated. The primary of the line isolation transformer, T301, isolates the control current from the transmitter yet permits the transfer of the audio signals from the console to the audio input of the transmitter through contacts 2 and 3 of O 301 to the L-type adjustable pad made up of variable resistors R306A and R306B. Capacitor C304 couples the output of the pad to the audio input of the transmitter through pin 6T on terminal strip TS301 of the radio set control. Contacts 4 and 5 of O 301 ground pin 4T of terminal strip TS301, and thus operate relays O 102 and O 103 (in the transmitter) (fig. 122) and put the transmitter on the air. Capacitor C302 is an audio bypass and dc block across the winding of

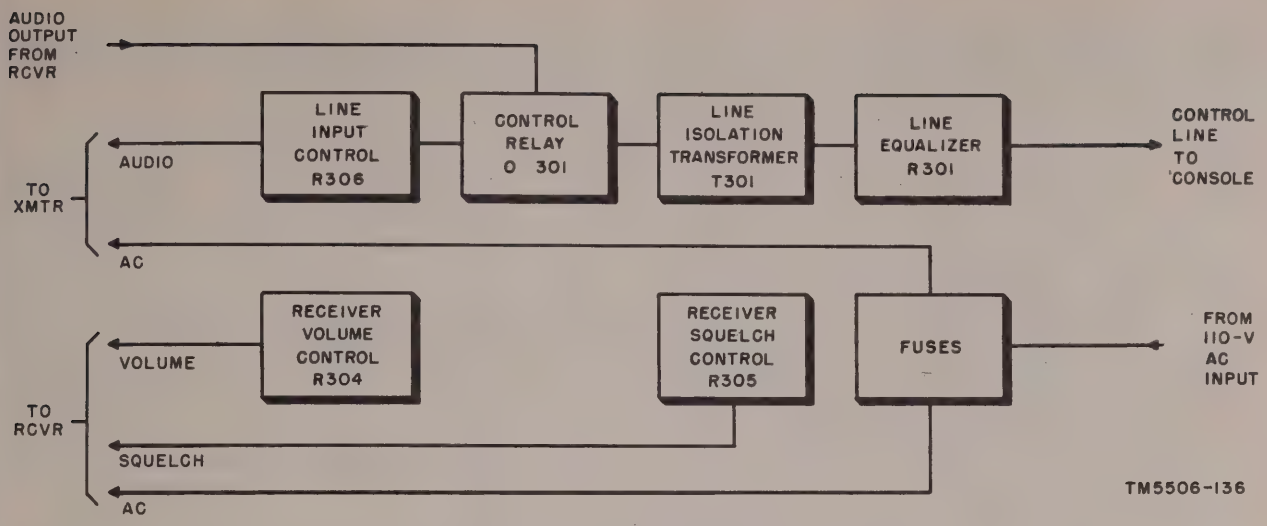


Figure 51. Radio Set Control C–560(*)/FRC–6, block diagram.

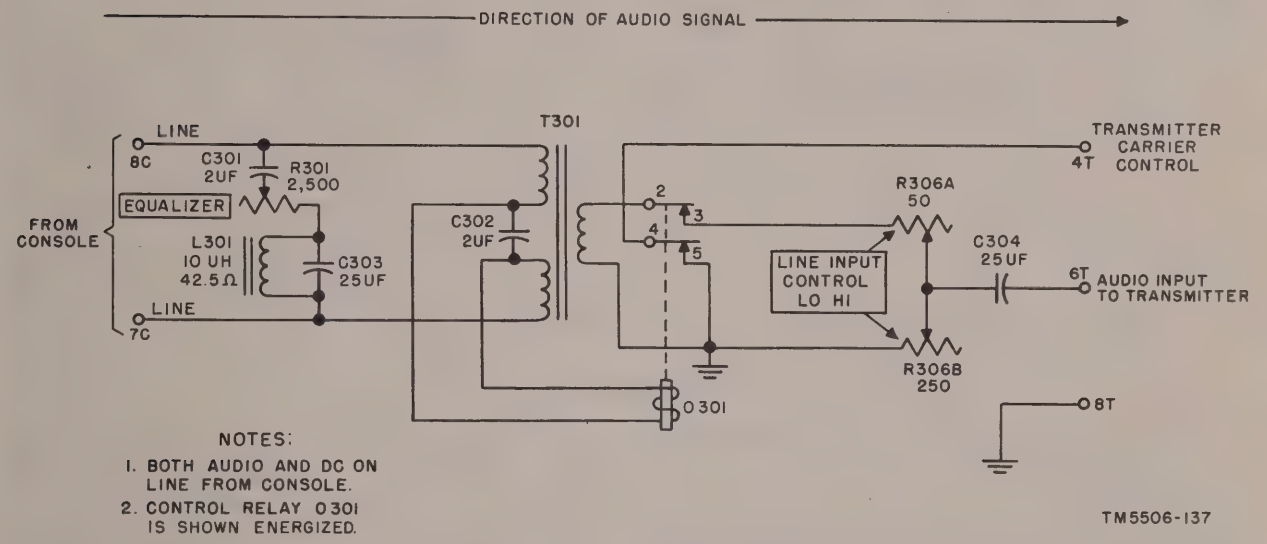


Figure 52. Transmission control circuits of Radio Set Control C–560(*)/FRC–6.

the control relay. Capacitor C301 is a blocking capacitor that prevents equalizer inductance L301 from short circuiting the winding of relay O 301. The equalizer is composed of inductance L301 and capacitor C303, connected in parallel as an anti-resonant circuit. The frequency of the tuned circuit is approximately 3 kc. Frequencies above the resonant frequency are attenuated because of the decrease of the reactance of capacitor C303. Frequencies below the resonant frequency are attenuated because of the decrease of the reactance of L301. Adjustment of EQUALIZER rheostat R301 allows control of the amount of lf attenuation applied to the control line.

81. Reception Control Circuits

(fig. 53)

Removal of control current from the console releases relay O 301 and opens relay control contacts 4 and 5 and closes contacts 1 and 2. This cuts off the transmitter and places the receiver in operation. Audio signals from the output of the receiver are fed through an L-pad made up of series resistor R303 and shunt resistor R302, through the closed contacts of O 301 to what now becomes the primary winding of T301. The output of the secondary windings of T301 is applied to the control line and thus fed to the console. Operation of the line equalizer circuits composed

of C301 and R301 in series and L301 and C303 in parallel is described in paragraph 74. Capacitor C302 bypasses the audio signals across the winding of O 301. Volume control resistor R304 and squelch control resistor R305 are both adjustable and are located in the radio set control.

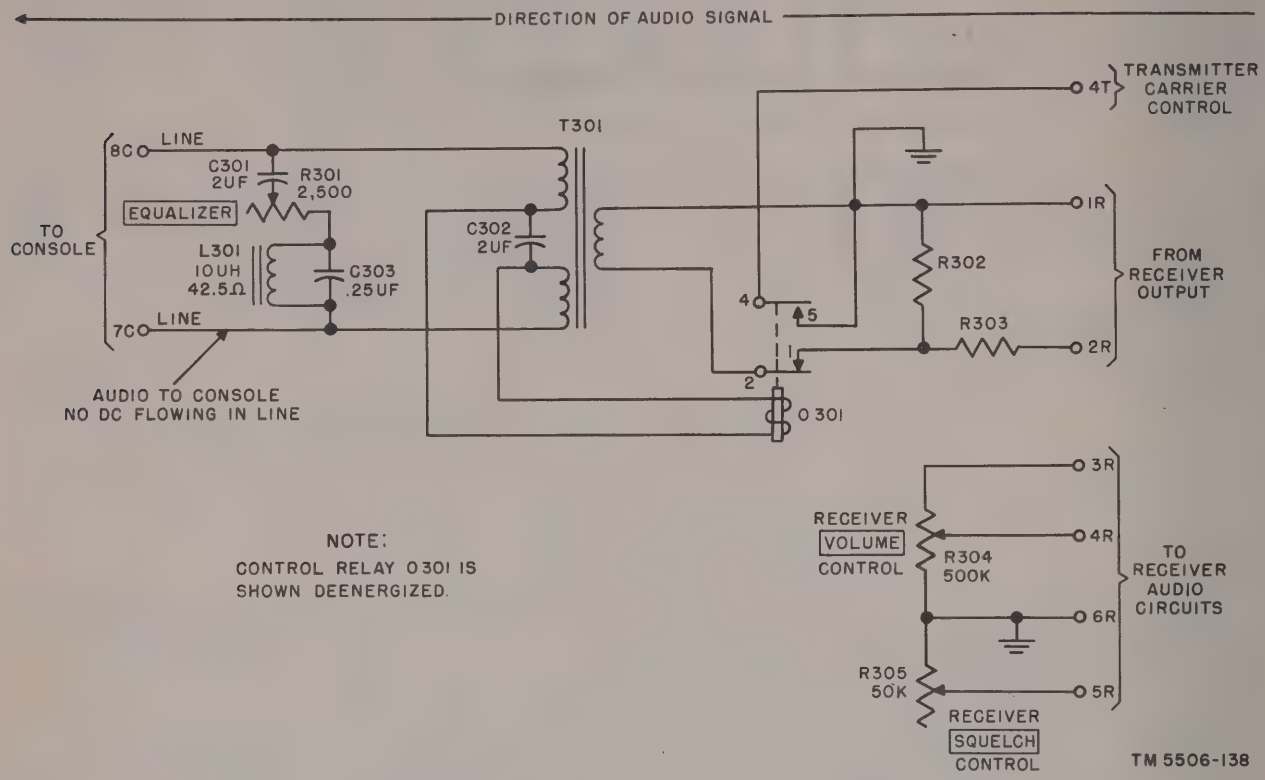


Figure 53. Reception control circuits of Radio Set Control C-560(*)/FRC-6.

Section V. CONSOLE C-559(*)/FRC-6

82. Block Diagram of Console C-559(*)/FRC-6

(fig. 54)

Console C-559(*)/FRC-6, used with the radio set control located in the rack, is designed for operation of the radio set from a point either next to the rack or separated from the rack by a distance of not over 10 miles of control line. Operation of the relay in the radio set control with the relay located in the console changes the direction of transmission along the control line between the console and the main unit. Operation of the control relay, O 401, is outlined in paragraphs 93 and 94. With the control relay in the unoperated or receive position as shown in the block diagram, audio signals from the output of the receiver are fed over the control line through the B segments of the relay and through the A segments of the relay to the audio amplifier. The amplifier increases the level of the incoming signal to compensate for losses incurred in the line, and the output is fed through the C segments of the relay to the loudspeaker. When the control relay is energized to the transmit position, signals from the microphone are fed to the preamplifier through the A segments of the relay. After amplification,

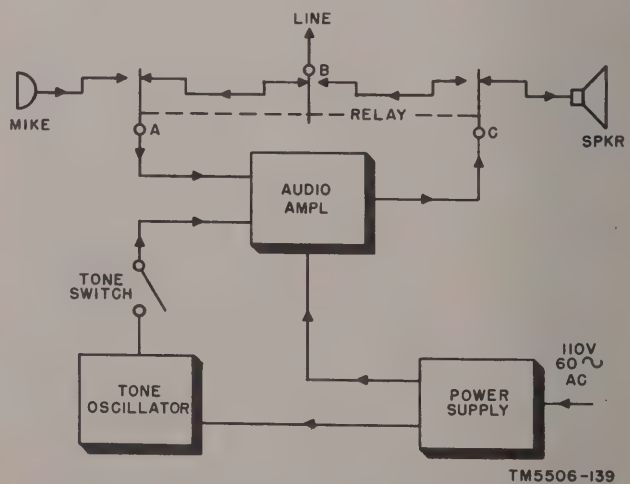


Figure 54. Console C-559(*)/FRC-6, block diagram.

the signals are fed through the C segments to the B segments and then over the line to the rack where they are applied to the transmitter. With the relay in the transmit condition, audio tone from the tone oscillator is injected into the audio amplifier when the tone switch is closed. The tone is used for signaling and is fed to the transmitter from the audio amplifier output in the same manner as voice signals. Filament and plate power for the tone oscillator and preamplifier and direct current for operation of the control relay are provided by the power supply.

83. Console C–559(*)/FRC–6, First Audio Amplifier

(fig. 55)

a. First audio amplifier V401 uses a type 7C7 tube, V401. Input voltage is applied (through pin 2 of control relay O 401) between the control grid (pin 6) and ground. Resistor R408 serves as a grid return resistor.

b. Plate voltage is applied to the tube through plate load resistor R411. Resistor R410 is the screen grid dropping resistor; capacitor C405 is the screen bypass to ground. Resistor R425 is the common dropping resistor for both plate and screen. Output voltage is fed to the grid of the second audio (the power amplifier stage) through coupling capacitor C406.

c. Resistor R409 is the cathode-biasing resistor. Capacitor C404 is the cathode bypass to ground.

84. Console C–559(*)/FRC–6, Second Audio Amplifier

(fig. 56)

a. The second audio amplifier, V402, uses a type 7C5 tube in a conventional transformer coupled output stage. Either of two voltages is applied to the control grid (pin 6) of V402: the voltage from the first audio amplifier or the voltage from the tone oscillator.

b. Input voltage from the first audio amplifier is coupled through C406 to pin 6 of V402. Input voltage from first audio amplifier V401 or tone oscillator V403 is developed across R413; this developed voltage is applied between the control grid (pin 6) of V402 and ground. Resistor R412 is an isolation resistor in series with the control grid of V402 and the output of the tone oscillator.

c. B+ voltage is applied through the primary of T401 to the plate (pin 2) of V402. Screen grid voltage is applied directly from the 250-volt dc supply to the screen grid (pin 3). Resistor R414, bypassed to ground by C408C, acts as the cathode-biasing resistor.

d. The amplified output of V402 is coupled by T401 to pins on control relay O 401. Details on the control action of O 401 are given in paragraph 94. The single primary coil of T401 has a rated impedance of 5,000 ohms. Transformer T401 has two secondary windings with functions as follows:

(1) One secondary winding (connected between pins 3 and 4) of T401 supplies the output at 500 ohms for the control line.

(2) The other secondary winding (connected between pins 5 and 6 of T401) supplies the output at 3.2 ohms for the speaker in the front panel of the console.

85. Console C–559(*)/FRC–6, Tone Oscillator

(fig. 57)

a. In a 2-way radio system, a transmitted warning note of signal is often used to alert the operating personnel at the receiving location. For this purpose, a tone oscillator is provided in the console. Its output can be applied to the transmitted signal by operating the TONE SIGNAL switch on the

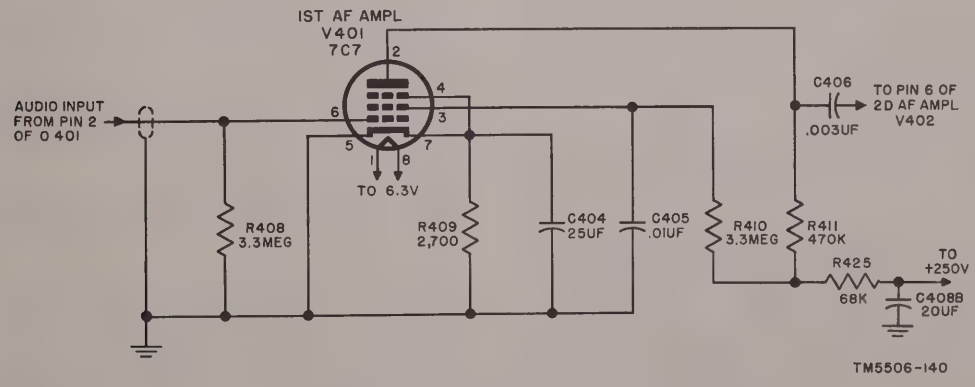


Figure 55. Console C–559(*)/FRC–6, first audio amplifier.

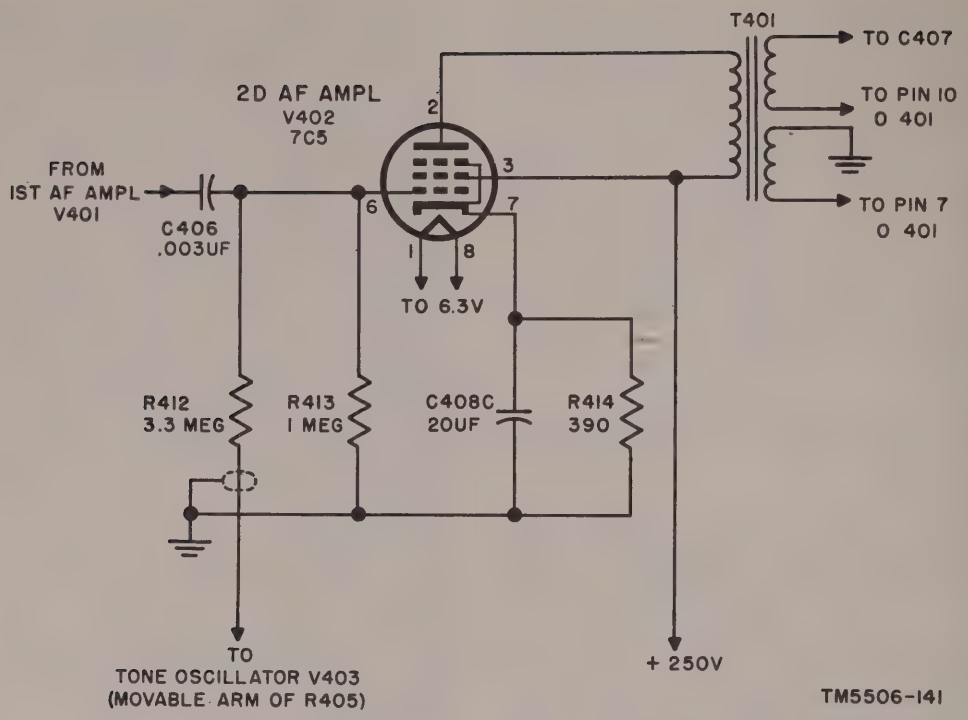


Figure 56. Console C–559(*)/FRC–6, second audio amplifier.

front panel of the console and pressing the push-to-talk switch. Tone oscillator V403 uses a twin-triode 7F7 type tube.

b. The basic frequency of the oscillator is determined by the antiresonant circuit made up of L401 shunted by fixed capacitor C411. The tuned circuit is connected in the grid circuit of the first triode section of V403 between the grid (pin 4) and ground. Any disturbance in the tuned circuit caused by induction or other means is amplified by the first triode and appears across plate load resistor R415, with an 180° phase shift from the original disturbance or impulse.

c. The output of the triode (control grid (pin 4) and plate (pin 3)) is coupled through C410 to the af voltage-divider network consisting of fixed resistors R418 and R419 and variable resistor R405. That portion of the voltage applied between the control grid (pin 5) to ground across R419 is in phase with the output voltage developed across R415. Resistor R419 also serves as a grid return resistor for the control grid (pin 5) of the right triode.

d. Additional amplification and additional phase shift of 180° occur in the right triode, making a total phase shift of 360°. The amplified output voltage appears across plate load resistor R416 and is coupled back in phase to the grid of the left triode section through coupling capacitor C409. The flywheel action of the tuned circuit will then provide an impulse of opposite polarity, and the entire process is again repeated; thus, oscillation is sustained.

e. Output voltage to the audio amplifier is tapped off potentiometer R405 by its rotating arm (the TONE control). Resistor R405 is connected between coupling capacitor C410 and ground. Capacitor C410 couples the tone oscillator output to the control grid (pin 6) of V402.

f. B+ voltage to the plate (pin 6) of the right triode is applied through dropping resistor R416. The B+ path to the plate of the left triode (pin 3) is through dropping resistor R415.

g. With TONE SIGNAL switch S404 closed to ground, bias for the first triode is provided by cathode-biasing resistor R417. With the TONE SIGNAL switch open, resistor R420 is connected into the cathode circuit; R420, because of its high resistance (1 megohm), effectively blocks the tube, thus stopping oscillations.

86. Console C–559(*)/FRC–6, Power Supply (fig. 58)

a. All power requirements of the console are provided by transformer T402 and its associated rectifier circuit. With plug P403 connected to a source of 110-volt, 60-cycle, single-phase ac, and with ON-OFF switch S401 closed, power is ap-

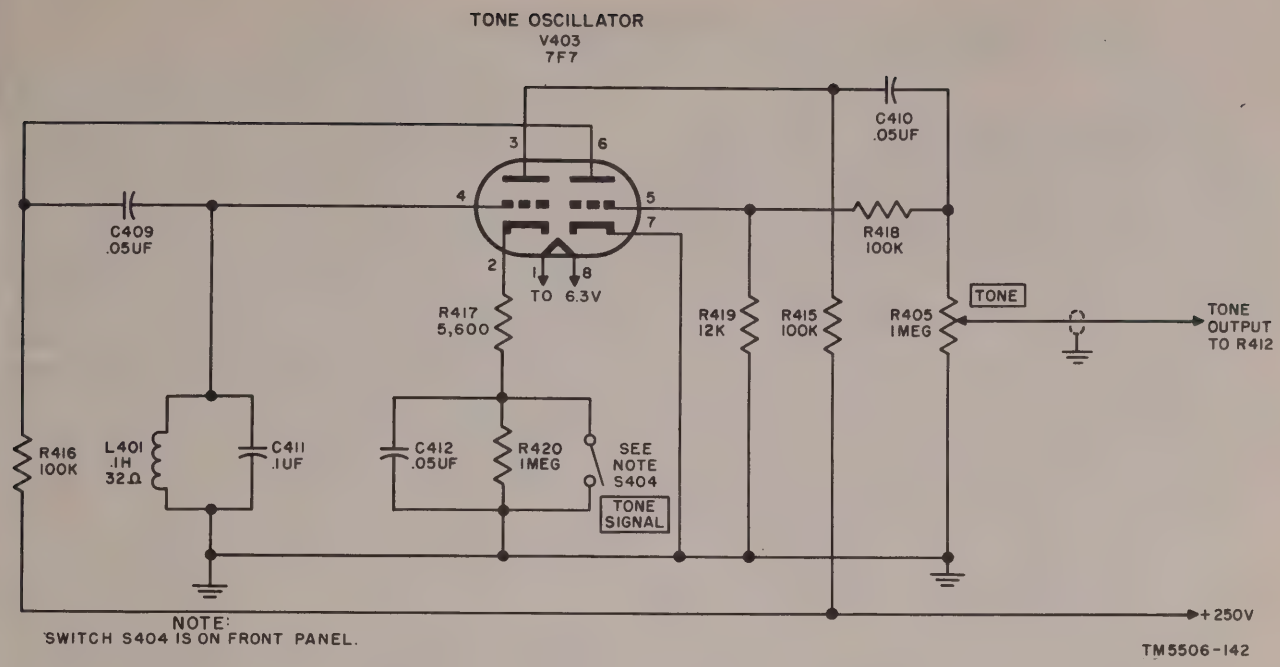


Figure 57. Console C–559(*)/FRC–6, tone oscillator.

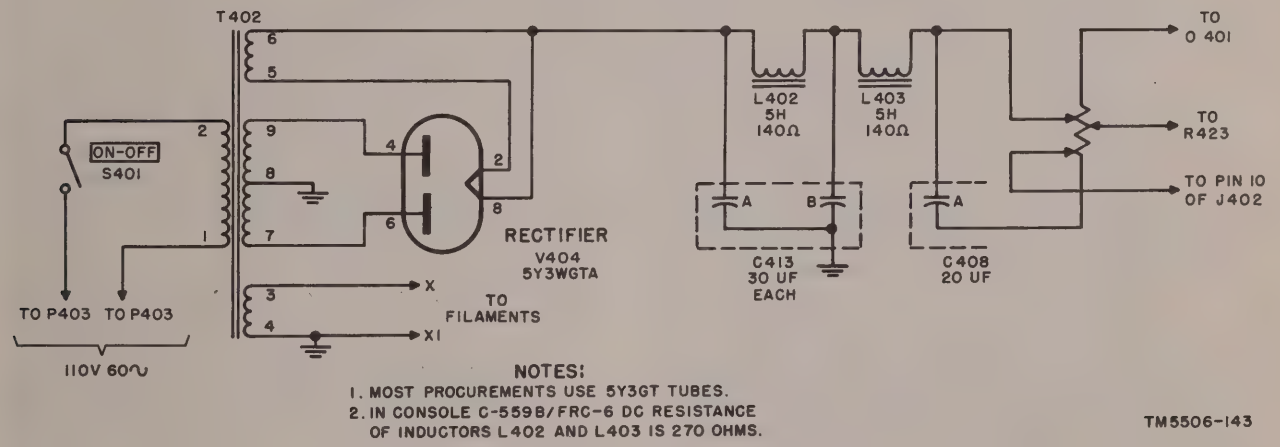


Figure 58. Console C–559(*)/FRC–6, power supply.

plied to the primary of transformer T402. Input power transformer T402 has three secondary windings.

b. The secondary winding connected between pins 4 and 3 of T402 provides 6.3 volts ac for the heaters of V401, V402, V403, and meter lamp E404. (Meter lamp E404 is not used in the C–559D/FRC–6.) The secondary winding, connected between pins 5 and 6 of T402, provides 5 volts ac for the heater of full-wave rectifier tube V404 (5Y3WGT).

c. The rectifier tube functions as a full-wave rectifier, and ac voltage is applied to the two plates 180° out of phase by the high-voltage (middle) secondary winding of T402 (connected to pins 7, 8, and 9 of T402). Each plate conducts current only during the half-cycle when its applied voltage is positive.

d. The rectifier voltage is applied to the low-pass filter from pin 8 of V404 (positive or B+ point) and the center tap of the high-voltage winding, which is connected to ground (negative or B— point).

e. The low-pass filter, consisting of inductors L402 and L403 and capacitors C413A, C413B, and C408A, smooths out the ripple component of the rectifier output (B+).

f. Resistor R424 serves a dual purpose as a bleeder and a voltage divider. Thus, voltage regulation of the rectifier output is improved and adjustable voltage output taps are provided for O401, O301 (in the radio set control), and E402.

Section VI. REMOTE CONTROL UNIT C–408(*)/FR

87. General

a. Remote Control Unit C–408(*)/FR performs the same control functions as Console C–559(*)/FRC–6. Units differ in such items as nomenclature assignments, parts layout, reference symbols, panel markings, and slight wiring differences. For detailed illustration of circuit differences, refer to the main schematic diagrams (figs. 127, 129, and 130).

b. The block diagram of Console C–559(*)/FRC–6 (fig. 54) also applies to the C–408(*)/FR. The tubes in Remote Control Unit C–408(*)/FR have no assigned reference symbols; they are simply designated first audio amplifier, second audio amplifier, tone oscillator, and rectifier.

88. Remote Control Unit C–408(*)/FR, First Audio Amplifier

(fig. 129)

a. Remote Control Unit C–408/FR.

(1) The first audio amplifier uses a pentode type 7C7 tube functioning as a class A voltage amplifier. Input voltage is applied from pin 12 of control relay RY1; voltage application at the tube is between the control grid (pin 6) and ground. Resistor R9 serves as the grid return resistor.

(2) Plate voltage is applied to the tube through plate load resistor R12. Resistor R11 is the screen grid dropping resistor; capacitor C13 is the screen grid bypass capacitor. Resistor R26 serves as the common dropping resistor for both screen grid and plate voltage. Output voltage is fed to the grid of the second audio (the power amplifier) through coupling capacitor C14.

(3) Resistor R10 is the cathode-biasing resistor; capacitor C12 is the cathode bypass to ground.

b. Remote Control Unit C–408A/FR. The first audio amplifier stage of the C–408A/FR differs from the C–408/FR only as follows:

(1) The control grid input circuit contains an rf filter composed of inductor L1 and capacitor C21 for blocking from the grid any rf that may be present on the audio line.

(2) Coupling capacitor C12 couples one side of the input to the cathode. One side of capacitor C12 is connected directly to the cathode, and the other side of C12 is connected to the low end of R29, the input level control. One side of the input circuit is fed to the grid and the other side to the cathode through C12. The complete input circuit is balanced to ground.

c. Similarity of Consoles. The first audio amplifier stage of the C–408(*)/FR is very similar to the first audio stage of the C–559(*)/FRC–6 (par. 76). Reference symbols used in the first audio of the C–408/FR and C–408A/FR differ from those in the C–559(*)/FRC–6 as follows:

C–408/FR	C–408A/FR	C–559(*)/FRC–6
C12	C12	C404.
C13	C13	C405.
C14	C14	C406.
	C21	
	L1	
R9	R9	R408.
R10	R10	R409.
R11	R11	R410.
R12	R12	R411.
	OUT-IN switch.	
Term. 12 of RY1	Term. 12 of RY1	Term. 2 of O 401.

Note. Use of the above chart adapts figure 55 for use with the C–408(*)/FRC

89. Remote Control Unit C–408(*)/FR, Second Audio Amplifier

(figs. 56 and 129)

a. Remote Control Unit C–408/FR.

(1) The second audio amplifier uses a 7C5 beam-power type of tube in a conventional transformer coupled output stage. The 7C5 operates as a class A power amplifier. Either of two voltages is applied to the control grid (pin 6) of the second audio amplifier: the voltage from the first audio amplifier or the voltage from the tone oscillator.

(2) Input voltage from the first audio amplifier is coupled through C14 to pin 6 of the 7C5. Input voltage from the first audio amplifier (7C7) or from the tone oscillator (7F7) is developed across R14; this developed voltage is applied between the control grid (pin 6) of the 7C5 and ground. Resistor R13 is an isolation resistor between the control grid of the 7C5 and the output of the tone oscillator.

(3) B+ voltage is applied through the primary of T2 to the plate (pin 2) of the 7C5. Screen grid voltage is applied di-

rectly from the 250-volt dc supply to the screen grid (pin 3). Resistor R15, bypassed to ground by electrolytic capacitor C11, acts as the cathode-biasing resistor.

(4) The amplified output of the second audio amplifier is coupled by T2 to pins on control relay RY1. Details on the control action of RY1 are given in paragraphs 95 and 96. The single primary coil has a rated impedance of 5,000 ohms. Transformer T2 has two secondary windings with functions as follows:

(*a*) The 500-ohm secondary winding of T2 applies the amplified output of the second audio amplifier to pin 21 of RY1 and through C6 to pin 7 of RY1. With the relay in the transmit condition, this output goes to the control line.

(*b*) The other secondary winding of T2 is connected between pin 18 of RY1 and ground. It is the output for the speaker on the front panel.

b. Remote Control Unit C–408A/FR. The second audio amplifier of the C–408A/FR differs from the C–408/FR only in the addition of capacitor C22 connected from the plate of the 7C5 to ground. Capacitor C22 is used to decrease the high-frequency audio response of output transformer T2.

c. Similarity of Consoles. The second audio amplifier stage of the C–408(*)/FR is very similar to the second audio of the C–559(*)/FRC–6 (par. 77). Reference symbols used in the second audio of the C–408(*)/FR differ from those in the C–559(*)/FRC–6 as indicated in the following chart:

C–408(*)/FR	C–559(*)F/RC–6
7C5	7C5.
Undesignated	V402.
C11	C408C.
C14	C406.
C22 (in the C–408A/FR only).	
R13	R412.
R14	R413.
R15	R414.
RY1	O 401.
Term. 18 of RY1	Term. 7 of O 401.
Term. 21 of RY1	Term. 10 of O 401.
Undesignated	TS401.
Term. 1 (remote speaker)	Term. 6 of TS 401 (remote speaker).
T2	T401.

Note. Use of the above chart adapts figure 56 for use with the C–408(*)/FR

90. Remote Control Unit C–408(*)/FR, Tone Oscillator

(figs. 57 and 129)

The tone oscillator of the C–408(*)/FR functions exactly like the tone oscillator of the C–559(*)/FRC–6 (par. 85). Reference symbols employed in the C–408(*)/FR (par. 90) tone oscillator differ from those in the C–559(*)/FRC–6 as indicated in the following chart:

C–408(*)/FR	C–559(*)/FRC–6
Undesignated	V403.
7F7	7F7.
C15	C409.
C16	C412.
C17	C411.
C18	C410.
CH3	L401.
R5	R405.
R16	R415.
R17	R416.
R18	R417.
R19	R418.
R20	R419.
R21	R420.
TONE SIGNAL—INTER-COMM (in the C–408A/FR).	TONE SIGNAL.
TONE (in the C–408/FR)	TONE SIGNAL.

Note. Use of the above chart adapts figure 57 for use with the C–408(*)/FR.

91. Remote Control Unit C–408(*)/FR, Power Supply

(fig. 58)

The power supply of the C–408(*)/FR is similar to the power supply of the C–559(*)/FRC–6 (par. 86). Minor differences exist in the primary of the power supply transformer and the size of the electrolytic capacitors used. Reference symbols used in the C–408(*)/FR power supply differ from those used with the C–559(*)/FRC–6 as indicated in the following chart:

C–408(*)/FR	C–559(*)/FRC–6
Undesignated	
5Y3GT	5Y3WGT (V404).
C7	C413A.
C8	C413B.
C9	C408A.
C10	C408B.
C11	C408C.
CH1	L402.
CH2	L403.
R26	R425.
T1	T402.

Note. Use of the above chart adapts figure 58 for use with the C–408(*)/FR.

92. Purpose and Extent of Instructions

a. Interunit theory is presented to provide an understanding of the interrelations of the several units in the various operations of the radio set. Such an understanding will help maintenance personnel when troubleshooting to sectionalize troubles to a defective unit and, in some cases, to localize trouble to a defective part within a unit.

b. Paragraphs 93 through 99 describe the switching circuits that reverse the direction of transmission along the control line which connects the rack with the console. The reversal is accomplished from the console at the remote control point by pressing or releasing the press-to-talk button on the handset. The receive condition of the circuit, with the direction of the audio from the rack to the console, is described in paragraphs 93, 95, and 97. The transmit condition, with the direction of the audio signal from the console to the rack, is described in paragraphs 94, 96, and 98.

93. Receive Condition Using Console C–559 (*)/FRC–6

(fig. 59)

a. The release of the press-to-talk button on the handset opens the relay energizing circuit, which starts from the top of R424 (B+), goes through the winding of relay O 401 to pin 1 of handset connector J401, through press-to-talk switch S 405 and resistor R 432 to ground (B—). When O 401 is deenergized, contacts 16 and 17 open and remove positive potential from the control line.

b. With no direct current in the control line, relay O 301 in the radio set control is deenergized. With O 301 deenergized, contacts 4 and 5 open and deenergize the transmitter relays. These relays open the transmitter B+ circuit and close the receiver B+ circuit. The audio from the receiver is applied to terminals 1R and 2R of TS 301. Contacts 1 and 2 of O 301 close and apply the audio from the L-pad, consisting of R302 and R303, to the primary of T301. From the secondary, signals are fed to terminals 7C and 8C of TS301 on the radio set control, through the control line, to terminals 1 and 2 of the console terminal TS401.

c. The signal is applied across a resistive load consisting of R407, C403A, R406, and R402 through the closed contacts 13–12 and 15–16 of O 401. Meter M401 measures the input level. The voltage developed across R406 is applied through C402 and C403C across potentiometer R404. Blocking capacitor C402 prevents dc potential from being applied to R401 when two receivers are being used.

d. That portion of the signal between the variable contact of R404 and ground is applied to the grid of the first audio amplifier through contacts 1 and 2 of the relay. The signal is then amplified by the two amplifier stages and appears across the 3-ohm winding of output transformer T401. From the 3-ohm output of the console, the signal passes through closed contacts 7 and 8 of O 401 to pin 4 of handset connector J401.

e. If handset hanger switch S406 is closed (as it is when the handset is in the hanger), the circuit is completed to pin 3 of P401 through contacts 12 of J402 and P402 to speaker volume control R428 to the ground return. Part of the voltage across R428 is applied to loudspeaker LS401.

f. When the handset is picked up, handset hanger switch S406 is released and the circuit between pins 3 and 4 of P401 is opened (cutting off the speaker). The signal passes from pin 4 through the closed contacts of S406, through the volume control resistor network that consists of R429, R430, and R431 to ground return. From the rotating arm of R429, the signal passes through the earpiece of the handset and returns through ground to the output of the amplifier.

94. Transmit Condition Using Console C–559 (*)/FRC–6

(fig. 60)

a. Depressing press-to-talk switch S405 closes the circuit that energizes relay O 401. With O 401 operated, a current of 8 ma is fed from the variable tap on R424 through R423, closed contacts 17 and 16 of O 401, to one side of the control line (terminal 2 of TS401).

b. Return to the grounded side of the dc supply from the control line (terminal 1 of TS401) is through closed contacts 13 and 14 of O 401, through resistors R421 and R422 to pins 1 of J401 and P401, through press-to-talk switch S405 on the handset, and through the microphone parallel by R432 to ground. Ground is connected to ground in the console through the bodies of P401 and J401.

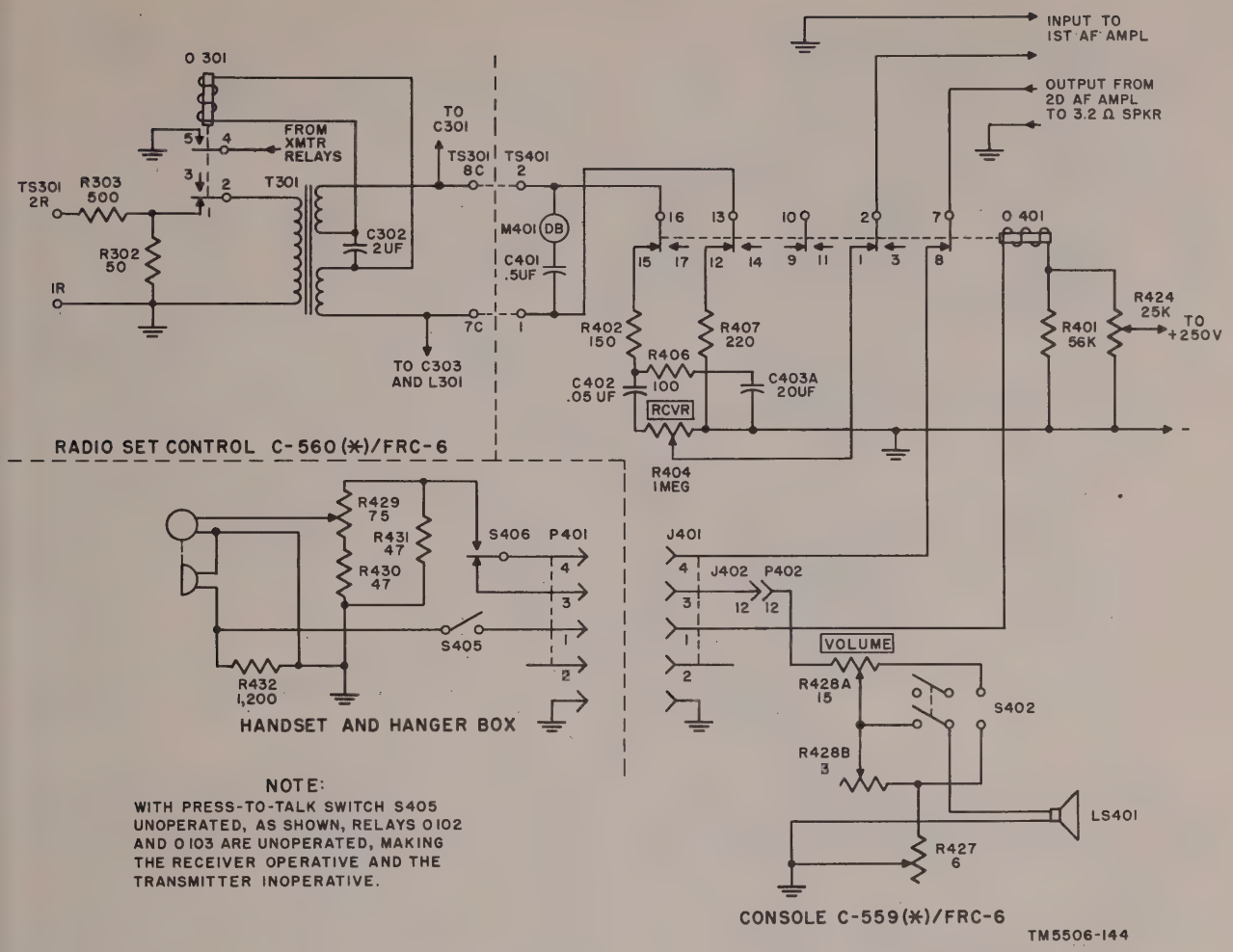


Figure 59. Radio Set AN/FRC–6A, receive control circuits.

c. The 8-ma current in the control line energizes relay O 301 in the radio set control. With relay O 301 energized, contacts 4 and 5 are closed.

d. When contacts 4 and 5 of O 301 close, transmitter relay O 102 operates and removes plate voltage from the receiver and applies power to the primary of the plate transformer in the transmitter; relay O 103 also operates and applies plate voltage to the transmitter and transfers the antenna from the receiver to the transmitter.

e. Voice impulses striking the diaphragm of the microphone cause the microphone impedance to vary with the voice impulses. Thus, a varying voltage drop across the microphone is impressed across R432. The alternating component is applied across transmitter volume control resistor R403 through blocking capacitor C414 and pins 2 of P401 and J401.

f. A portion of the voltage developed across R403 is fed to the input of the audio amplifier from the rotating arm of R403 through closed contacts 3 and 2 of O 401. The signal is then amplified by the two amplifier stages and appears across the 500-ohm winding of the output transformer.

g. The audio output is applied to one side of the control line (terminal 1) through closed contacts 14 and 13 of relay O 401, and to the opposite side of the line (terminal 2) through closed contacts 10 and 11, and 17 and 16 of O 401.

h. Capacitor C401 blocks the direct current in the line from the decibels meter. The meter indicates the level of the signal on the control line.

i. The signal from the console goes over the control line and appears between terminals 7C and 8C of TS301 of the radio set control. Transformer T301 transfers the audio impulses on the line to the audio input of the transmitter through closed contacts 2 and 3 of relay O 301, the LINE INPUT CONTROL (R306), and blocking capaci-

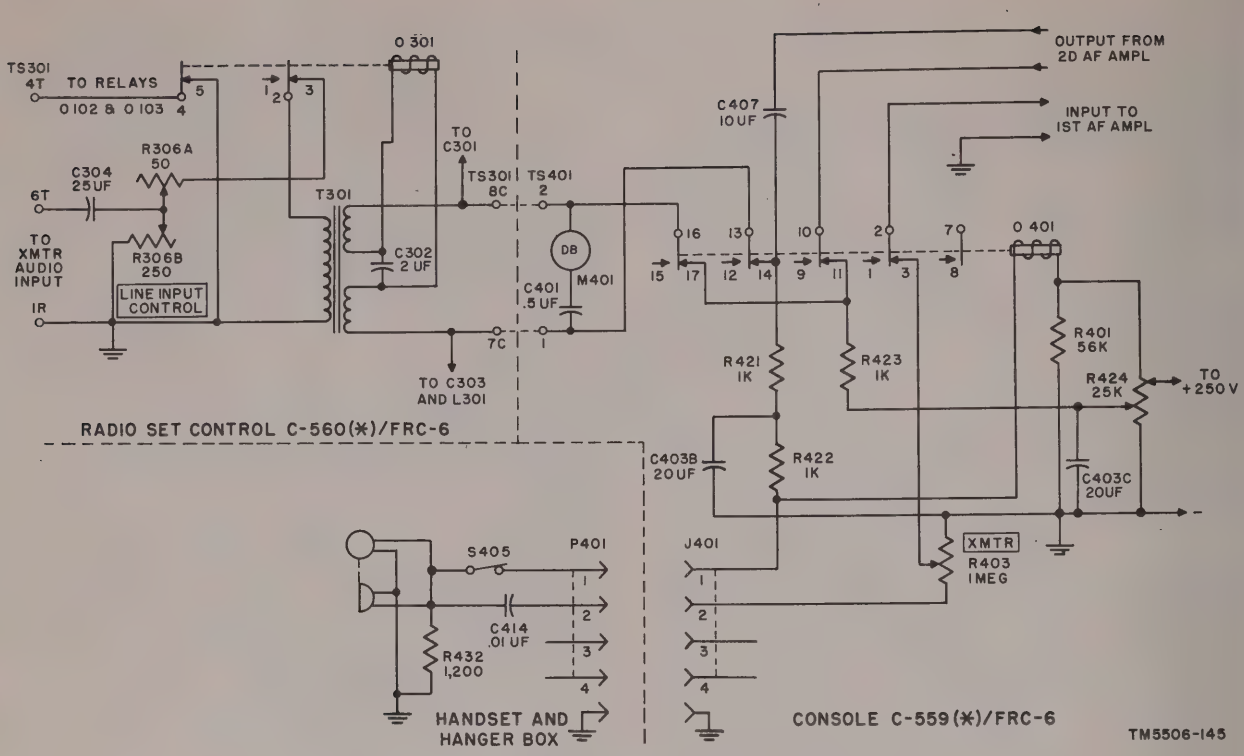


Figure 60. Radio Set AN/FRC–6A, transmit control circuits.

tor C304 to terminals 1R and 6T of the radio set control. From here the signal goes to the input to the transmitter through the rack wiring (figs. 12 and 13).

95. Receive Condition Using Remote Control Unit C–408/FR

(fig. 61)

In the receive condition of the radio set, the receiver, transmitter, radio set control, and handset and hanger box function identically (par. 87). Remote Control Unit C–408/FR performs its control functions in the manner described below.

a. The release of the press-to-talk switch (S405) on the handset opens the relay energizing circuit. This deenergizing of RY1 removes positive potential from the control line.

b. Receiver output from the radio set control (fig. 59) is applied through the control line across terminals 3 and 4 on the console chassis (fig. 61). Audio current may be considered as entering on pin 4. Audio current flows through closed contacts 6 and 8 of RY1, R2, R6, C3, R7, and contacts 5 and 3 of RY1 to the other side of the control line (fig. 130).

Note. Positive potential from the low current tap on R28 (fig. 130) can be applied (if neither the RCVRS 1–2 nor the MUTE 1–2 button is depressed) to the junction of R6 and C3 through pins 10 and 7 of the front panel connectors, and switches SW4 and SW5. This places 4 ma on the control line for a function not used with Radio Set AN/FRC–6(*).

c. The voltage developed across R6 also appears across R4 through C2 and C3. Audio voltage across R4 (receiving level control) is tapped off and applied to the control grid of the first audio amplifier through relay contacts 13 and 12.

d. After amplification by the first and second audio amplifiers, the audio output appears across the 3-ohm secondary of T2. From T2, the signal is applied to the handset and hanger box through closed relay contacts 18 and 19 and pin 4 of the console microphone socket and its mating plug P401.

e. With the handset left in the hanger box, hanger switch S406 remains connected between pins 3 and 4 of P401 and the microphone socket. From pin 3 of the microphone jack, audio voltage is applied through pin 12 of the 12-pin front panel connectors to a loudspeaker control network (R35, R36, and R37) on the front panel.

f. When the RCVR 1 push button (SW6) or the RCVRS 1–2 button (SW4) is depressed, the audio signal passes through the tapped portion of R35, through the speaker coil to ground. Re-

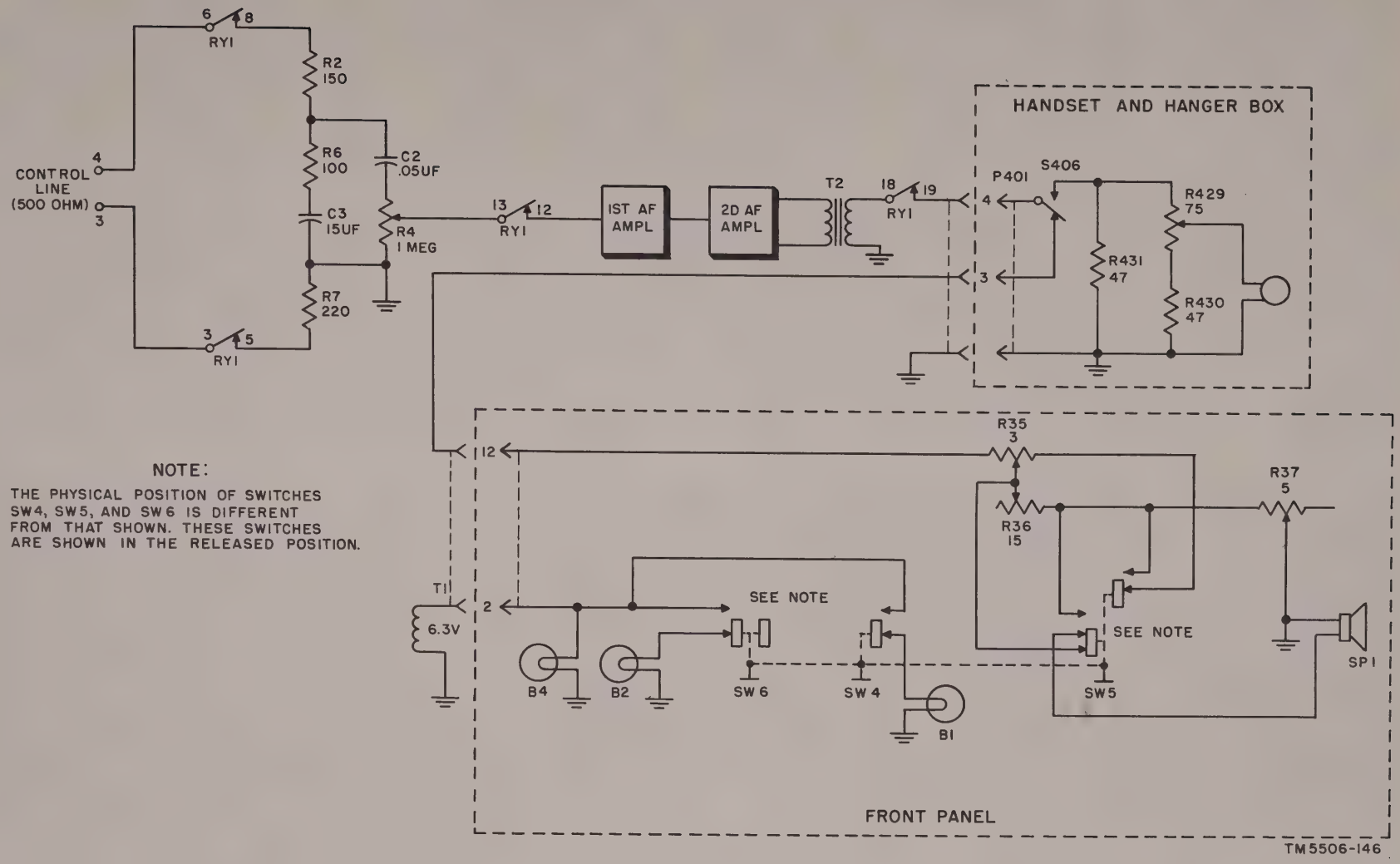


Figure 61. Remote Control Unit C-408/FR, receive circuits.

sistors R36 and R37 are connected in parallel with the speaker coil. The audio voltage developed across these resistors is the voltage applied to the speaker coil. During normal operation of Radio Set AN/FRC-31, the RCVR 1 button is depressed. The audio voltage applied to the speaker is controlled by the SPEAKER LEVEL control, R35 and R36, on the front panel of the console.

g. When the MUTE 1–2 button (SW5) is depressed, the audio current must pass through an additional resistance (R35) in series with the voice coil, so that the audio output is decreased. Resistor R5 is connected across the voice coil and determines the level of the muted signal.

h. Voltage from the filament winding of T1 is applied to the front panel through pin 2 of the front panel connectors. When the unit is operating, voltage is applied to meter light B4. When SW6 is depressed, voltage is applied to right pilot light B2. When SW4 is depressed, SW6 is mechanically released so that voltage is removed from B2 and is applied to left pilot light B1. Lights B1 and B2 indicate which switch is depressed.

i. When the handset is removed from the hanger box, S406 is operated. This cuts off the audio from the front panel and applies it to the resistive network of R431, R429, and R430. Voltage across part of R429 and R430 is applied to the earpiece of the handset. The setting of R429 determines the level of the signal applied to the earpiece.

96. Transmit Condition Using Remote Control Unit C–408/FR

(fig. 62)

In the transmit condition, the receiver, transmitter, radio set control, and the handset and hanger box function as described in paragraph 94. Remote Control Unit C–408 performs its transmitting control as follows:

a. Depressing press-to-talk switch S405 closes the circuit that energizes RY1. This causes current to flow in the circuit from B+, through R8, and the coil of RY1 to ground through pin 1 of microphone jack P401, S405, and the microphone (shunted by R432). Resistor R28 provides a constant load across B+ and improves the voltage regulation. Audio current from the handset microphone flows through C414 and pin 2 of microphone jack P401 to ground through variable resistor R3. Audio voltage is tapped off R3 and applied to the first af amplifier. Audio from the output of the amplifier is applied to the handset earphone through R430 nad R429. Because R430 and R429 are also across the earphone of the handset, audio voltage is provided for sidetone.

b. After amplification, the modulation voltage is taken off at the 500-ohm secondary of T2. One side of this secondary is connected to the control line terminal (pin 3) (on the amplifier chassis) through C6 and closed relay contacts 3 and 4; the other side of the 500-ohm secondary is connected to pin 4 of the terminal board on the amplifier chassis through closed relay contacts 21 and 23.

c. Relay contacts 17 and 15 are closed and thus provide an alternating-current path through red pilot light B3 (which indicates the transmit condition of the console). The ac path is from the 6.3-volt winding of T2, through relay contacts 15 and 17, and pins 8 and 2 of the 12-pin front panel connectors.

d. The decibels meter is connected across the control line in the following manner. From the control line terminal (pin 4), connection is made through dc blocking capacitor C1 to pin 6 of the 12-pin front panel connectors, through the meter to pin 3 of the 12-pin front panel connectors, to control line terminal (pin 3).

e. The dc voltage for operating the relays in the radio set control is placed on the control line in the following manner. Positive potential is tapped from R25. A current path exists through R24, contacts 7 and 6 of RY1, control line terminal 4, through the control line, terminal 3 of the control line, contacts 3 and 4 of RY1, R22, R23, contacts 1 of the microphone socket and P401, S405, and the microphone shunted by R432 to ground.

97. Receive Condition Using Remote Control Unit C–408A/FR

(fig. 61)

Remote Control Unit C–408A/FR performs its receiving control function in a manner similar to the other control unit and consoles (C–408/FR and C–559(*)/FRC–6). The main differences between the C–408/FR and the other units are that the following are included in this unit: an adjustable balanced input control for a 2-frequency transmitter, intercommunication between parallel consoles, a 12-decibel (db) pad can be placed across the input line, and a MUTE RCVR 2 switch (in place of the RCVR 1 switch). Some

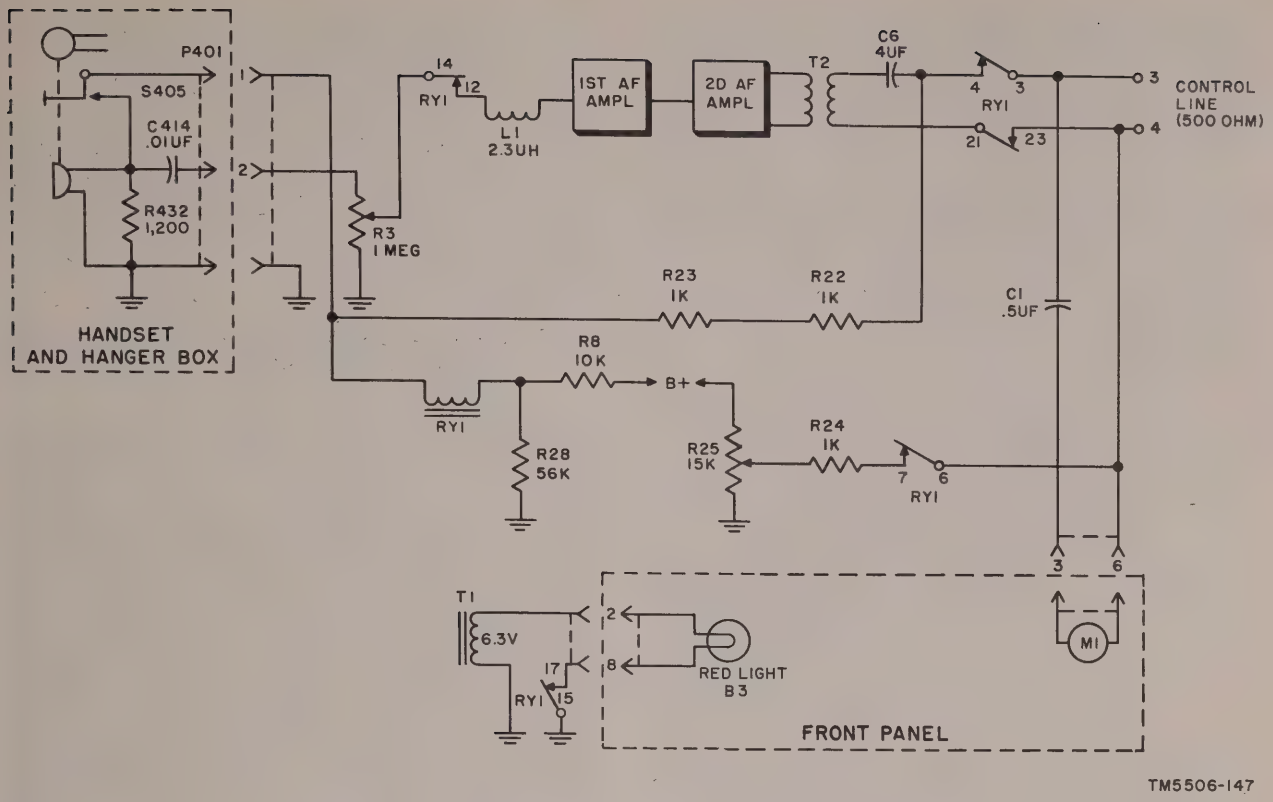


Figure 62. Transmit circuits of Remote Control Unit C–408/FR.

of the part designations of this unit are different from those in the other units. In the receive condition, the equipment in the rack operates as described in paragraph 93.

a. Audio current in the control line has two possible paths through the input circuit, depending upon the position of SW1.

(1) When OUT-IN switch SW1 is at OUT, current can enter at terminal 4 and flow through rf choke L2, contacts 6 and 8 of RY1, R2, R6, C3, SW1, contacts 3 and 5 of RY1, (C20 is jumpered), rf choke L3, to control line terminal (pin 3). Receiving level control R4 is connected, through blocking capacitor C2, across the whole line. Audio voltage is tapped off R4 and applied to the grid of the first af amplifier.

(2) When SW1 is at IN, current can enter at terminal 4 and flow through L2, SW1, R2, R6, C3, R28, R29, contacts 5 and 3 of RY1, and L3 to the other side of the control line terminal (pin 3). In this condition, the receiving level control is across approximately one-third of the line impedance (R6, C3, and R28). The input voltage, and therefore the output, will be reduced.

(3) Line balance control R6 is adjustable, so that each side of the line can be balanced to ground. When the line is properly balanced, noise voltages induced in the line will be cancelled out (equal and opposite voltages from each side of the line to ground). Resistor R6 is adjusted so that minimum noise is heard in the output of the amplifier.

(4) Decibels meter M1 is connected across the line through capacitor C1. It indicates the level of the signal on the line.

b. From receiving level control R4, the signal passes through contacts 13 and 12 of RY1 and through rf choke L1 and appears on the grid of the first af amplifier. The signal is amplified by the two stages and appears across the secondary of T2 (between pin 18 of RY1 and ground). In the receive condition, the signal goes through contacts 18 and 19 of RY1 and appears between pins 4 of microphone socket P401 connectors and ground. From here, the signal is applied to either the handset or the front panel, depending on the position of switch S406.

c. If the handset is picked up from the hanger, S406 applies the signal across the earphone of the handset and its parallel resistors. Resistor R429 can be adjusted for proper level of the signal in the earphone.

d. If the handset is left off the hanger, switch S406 applies the signal through pin 3 of P401 and pin 12 of the front panel connector to SPEAKER LEVEL control R2. The path for audio current to ground depends on the position of the MUTE 1–2 section of switch SW1.

(1) When the MUTE 1–2 switch is in the released position, the speaker coil is shunted across part of R2A, R2B, and R1 (from the variable arm of R2 to ground). This is the normal position of the switch, and R2 controls the speaker level.

(2) When the MUTE 1–2 section of switch SW1 is depressed, R2B is short-circuited and the speaker is switched across only a portion of R1. Because this places a lower value of resistance across the speaker, the output is reduced.

e. Depressing any section of SW1 mechanically releases the other sections of the switch.

(1) For normal operation of the radio set, the RCVR 1–2 button is depressed. This lights the left hand white pilot light (I 1) and breaks the mute circuit for a second receiver. Voltage for the pilot lamp comes from the filament winding of T1 through pin 2 of the panel connector.

(2) When the MUTE 1–2 button is depressed, the speaker output is decreased as explained in *d* above. It also breaks the mute circuit for a second receiver.

(3) When the MUTE RCVR 2—TONE SIG UP button is depressed, the right hand white pilot light is lighted. Because the other two sections are released, a dc path exists from the low-current tap of R25, through pin 10 of the front panel connector, the MUTE 1–2 and RCVR 1–2 sections of SW1, to the TONE SIGNAL—INTER-COMM switch S2. When this switch is pushed up (the TONE SIGNAL position), the path is completed through pin 7 of the front panel connectors to the input network (control line). Thus, with both these switches (the MUTE RCVR 2—TONE SIG UP switch and the TONE SIGNAL—INTER-COMM switch) actuated, a dc voltage is placed on the control line to mute a second receiver. This function is not used with Radio Set AN/FRC–6(*).

f. The frequency switch S3 has no direct control function in the receive condition. It should be in the FREQ–2 position when used with this radio set. It is provided to place either a high or low current on the control line circuit for control purposes with other radio sets.

98. Transmit Condition Using Remote Control Unit C–408A/FR

(fig. 63)

Remote Control Unit C–408A/FR performs its transmitting control function in a manner similar to Consoles C–559(*)/FRC–6 and Remote Control Unit C–408/FR (pars. 94 and 96). In the transmit condition, the equipment in the rack operates as described in paragraph 94.

a. When the press-to-talk switch is pressed, relay RY1 is energized because a current path is completed from B+ through R8, the winding of RY1, pin 1 of the microphone P401 connectors, switch S405, and the microphone shunted by R432 to ground. The ground circuit is completed back to the amplifier chassis through the shield of the wire and the bodies of the jack and plug.

b. The audio from the microphone is coupled through capacitor C414, pin 2 of the microphone P401 connectors and appears across sending level control R3. From R3 the signal is applied through relay contacts 14 and 12, rf choke L1 to the grid of the first af amplifier. After the signal is amplified by the two amplifier stages, it appears across output transformer T2. One side of the secondary goes to control line terminal (pin 3) through relay contacts 21 and 23, contacts 4 and 3 of RY1, and rf choke L2. The other side of the secondary goes to the other side of the control line terminal (pin 4) through capacitor C6, relay contacts 7 and 6, and L3.

c. The voltage that supplies the current to the control line can be applied in three ways.

(1) If there is a jumper between the high-current tap on R25 and the junction of R24 and C4 (fig. 130), the direct current is applied to the control line through it. If the jumper is not in the control unit, the control current is applied in one of the ways described below.

(2) When switch S3 is at FREQ–2, a path exists from the high-current tap of R25, through pin 4 of the front panel con-

nectors, through S3, through a normally closed contact of S2, through pin 6 of P2 and S01, to R24. This is the normal operating condition.

(3) If switch S3 is at FREQ–1, a path exists from the low-current tap of R25, through pin 10 of the front panel connectors, S3, normally closed contacts of S2, pin 6 of P2 and S01, to R24. The amount of current in the control line for this position of the frequency switch is too small to operate the relays in the radio set control of Radio Set AN/FRC–6(*).

d. When relay RY1 is actuated, contacts 15 and 17 close and allow current to flow from the filament winding of T1, through contact 2 of the front panel connector, through red pilot light I4, through pin 8 of the front panel connector, the relay contacts and through ground to the other side of the winding. This red pilot light indicates that the remote control unit is in the transmit condition (relay energized). The path for the direct current through the control line from R24 back to the other side of R25 is as follows: through contacts 4 and 3 of RY1, L2, the control line, L3, contacts 6 and 7 of RY1, resistors R22 and R23 to ground. Capacitors C4 and C5 are audio bypass capacitors.

e. TONE SIGNAL—INTER-COMM switch S2 is not often used with the AN/FRC–6(*). In the TONE SIGNAL position, the cathode of the 7F7 tone oscillator is grounded through pin 1 of the front panel connector, which permits the stage to operate. If the press-to-talk switch is pressed at the same time, the transmitter will be tone modulated. This tone can be used for signal purposes. The INTER-COMM position is described in paragraph 99.

99. Console Intercommunications Circuits Using Remote Control Unit C–408A/FR

When two consoles are connected in parallel to operate one radio set, it is possible to communicate between consoles without keying the radio equipment. This discussion will deal with either one of the consoles. The operation of each console is exactly the same. Intercommunication is possible if the dc voltage used to key the transmitter is not put on the control line when the console is put in the transmit condition.

a. The intercommunication is performed by moving switch S2 on the console front panel to the INTER-COMM position. This switches one side of the control line from the FREQ–1—FREQ–2 switch (source of the dc control line

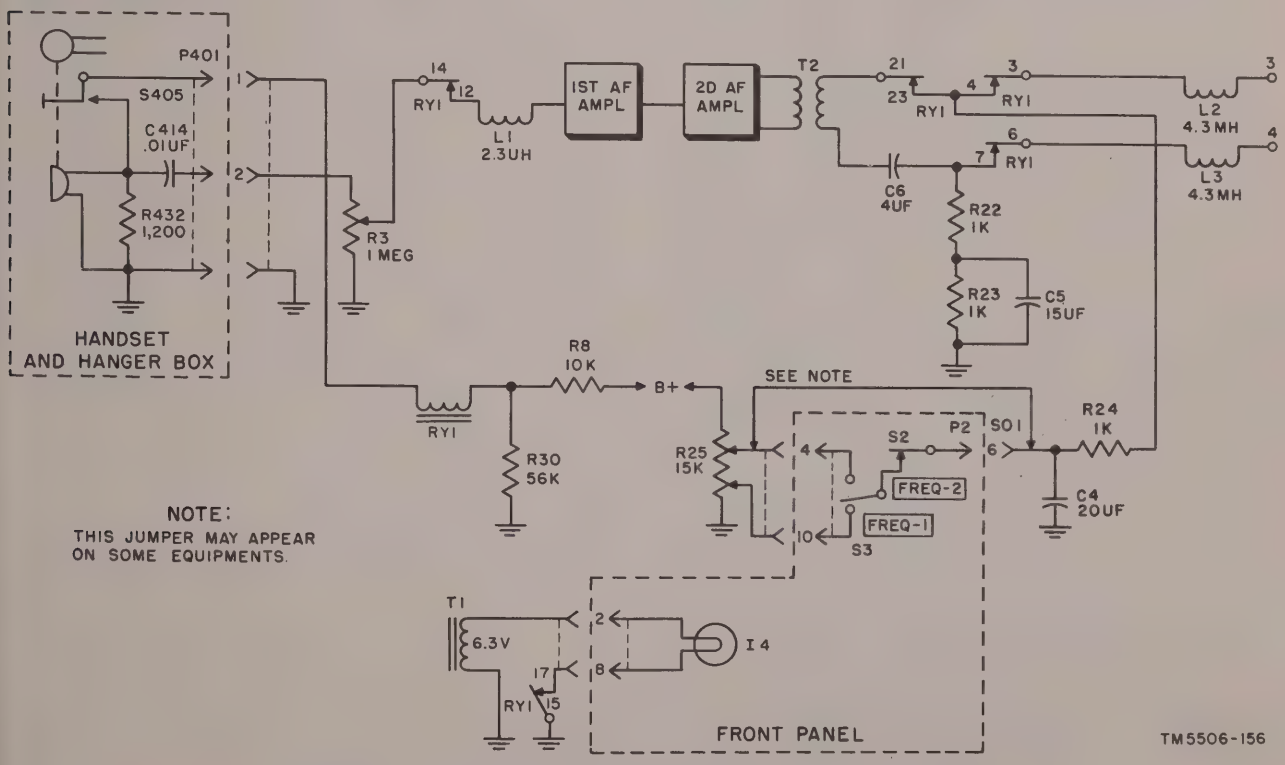


Figure 63. Transmit condition of Remote Control Unit C–408A/FR.

voltage) to ground through resistor R3; therefore, dc control voltage is not placed on the control line and relay O 301 (controlling the transmitter) is not energized. The other section of S2 grounds terminal 6 of terminal board on console chassis which is connected to one side of the relay coil and this energizes RY1.

b. With the relay energized, the output of the handset microphone is applied to the control line as outlined in paragraph 98. Because no dc voltage is put on the line, the transmitter is not keyed. In the receive condition (RY1 deenergized), the console operates in the normal manner as outlined in paragraph 97.

CHAPTER 6

FIELD MAINTENANCE

Note. This chapter contains information pertinent to field maintenance. The amount of repair that can be performed by units having field maintenance responsibility is limited only by the tools and test equipment available and by the skill of the repairman.

Section I. GENERAL TROUBLESHOOTING TECHNIQUES

Warning: When servicing Radio Set AN/FRC–6(*), be extremely careful of the high voltages exposed. Voltages as high as 600 volts are present at certain points in Radio Transmitters T–215A/FRC–6 and T–264/FRC–6A and their associated power supplies. Be sure that all power is turned off before touching any of the high-voltage connections.

100. Extent of Instructions

Troubleshooting at a field maintenance level includes all the techniques outlined for organizational maintenance (pars. 42–56) and any other techniques that may be required to isolate a defective part. The field maintenance instructions are not complete in themselves but supplement the instructions described in paragraphs 42 through 56. The systematic troubleshooting procedure, which begins with the operational and sectionalization checks that can be performed at organizational level (pars. 55 and 56), must be completed by means of sectionalizing, localizing, and isolating techniques described in paragraphs 103 through 112. Paragraph 103 provides sectionalizing procedures that must be performed at the field maintenance level to determine whether the trouble is in the transmitter, receiver, radio set control, or console. Paragraphs 104 through 112 describe localizing and isolating techniques that must be performed within a unit, such as a receiver or transmitter, at the field maintenance level.

101. Troubleshooting Techniques

a. General. To be effective, troubleshooting must be systematic. It is seldom possible to observe a trouble symptom and diagnose the cause immediately. Generally, it will be necessary to perform a sequence of operational checks, observations, and measurements before a fault will be revealed. If the proper sequence is employed, the trouble will be traced first to a unit, then to a portion of the unit, and finally to the defective part. The sequence of procecures is referred to commonly as the sectionalization, localization, and isolation of trouble.

b. Sectionalization. The first procedure when troubleshooting is to sectionalize the trouble to a unit of the radio set. Determine the defective unit through visual checks or operational procedures (pars. 52–56).

c. Localization. After the defective unit is determined, make additional checks and measurements to localize the trouble to a portion of the unit. As in the case of sectionalization, use inspection, short circuit tests, and operational techniques first; then, use the specialized testing procedures of paragraphs 100 through 112 as applicable.

Caution: Do not apply power to a set or unit unless the operational symptoms are known and are of such a nature as to eliminate the possibility of further damage when power is applied. If the symptom is not known or indicates the possible existence of short circuits, make resistance checks, before applying power (figs. 70, 71, 85, 86, 103, 104, 105, 111, 112, and 113).

d. Isolation. After trouble has been localized to a stage or circuit, use visual inspection, voltage measurements, and resistance measurements (pars. 101–112) to determine the defective part.

102. Test Equipment Required

The test equipments required to troubleshoot

Radio Set AN/FRC–6(*) are listed below. The technical manual that covers the test equipment and a common usage name are given for each piece of equipment.

Test equipment	Technical manual	Common name
Audio Oscillator TS–382A/U	TM 11–2684A	Audio oscillator.
Electronic Multimeter TS–505/U	TM 11–5511	Vtvm
Electron Tube Test Set TV–2/U	TM 11–2661	Tube tester
Frequency Meter TS–480/U	TM 11–5042	Frequency meter
Multimeter TS–297/U	TM 11–5500	Multimeter
or		
Multimeter TS–352/U	TM 11–5527	Multimeter
Panoramic Indicator IP–173/U	TM 11–5086	Indicator
Radio Frequency Wattmeter TS–118/AP	TM 11–1036	Wattmeter
RF Signal Generator Set AN/URM–25	TM 11–5551	If signal generator
Signal Generator AN/URM–48	TM 11–1257	Rf signal generator.
Spectrum Analyzer TS–723/U		Analyzer.

103. Sectionalizing Trouble

a. Methods of Sectionalizing Trouble to a Unit. In troubleshooting the AN/FRC–6(*), first determine the unit (transmitter, receiver, radio set control, console, or rack) at fault. When this has been determined, the trouble may then be isolated to a particular stage, and then by voltage and resistance checks to a particular component. The chart shown below indicates operations to be performed on the AN/FRC–6(*) to help determine which of the units is defective.

b. Chart for Sectionalizing Trouble.

Symptom	Operation	Indication	Action
1. All necessary switches on but set does not operate.	Check whether pilot lights on rack control panel (fig. 16) and console are lighted (fig. 10).	Pilot light on console lights. Pilot light on rack control panel lights. No pilot lights lighted.	Check radio set control (par. 79) and ac power source. Check console (par. 82). Check ac power source.
2. Set does not transmit.	Plug handset (fig. 11) into transmitter and operate.	Transmitter now operates. Transmitter still does not operate.	Troubleshoot console (par. 111), radio set control (par. 109), and associated cabling (fig. 15) and connectors. Check handset and troubleshoot transmitter (par. 104).
3. Set does not receive.	Connect test speaker (if available) to SPEAKER jacks on front panel of receiver (fig. 20).	Set now receives. Set still does not receive.	Troubleshoot console (par. 111) and radio set control (par. 109). Check connectors and cabling between receiver and console (fig. 15). Troubleshoot receiver (par. 106).
4. Set transmits and receives weakly.	Substitute temporary antenna and transmission line* for those normally used.	Set now operates correctly. Reception and transmission still weak.	Check antenna and transmission line (fig. 6). Check console (par. 82) and radio set control (par. 79). Troubleshoot receiver (par. 106) and transmitter (par. 104) individually.

*Temporary antenna can be a dipole $\left(\text{Length (in feet)} = \frac{468}{\text{Frequency (mc)}}\right)$ center-fed with coaxial cable (RG–8/U).

Section II. TROUBLESHOOTING RADIO TRANSMITTERS T–215(*)/FRC–6 AND T–264/FRC–6(*)

104. Localizing Trouble in Transmitter

Warning: Be extremely careful when making voltage measurements. Voltages in excess of 600 volts are present in the transmitter when it is in transmit condition. These voltages are dangerous and can be fatal. Never attempt to work on the equipment without taking all safety precautions.

Note. Before attempting to troubleshoot the transmitter, study paragraphs 59 through 65 so as to fully understand the function and operation of the transmitter circuits. For quick localization of trouble in the transmitter, use the chart in paragraph 105.

A quick check of the transmitter may be made by setting the meter switch to indicate the currents of the various stages. The readings thus secured may then be checked against those taken when the equipment was operating correctly, or against the chart in paragraph 118. Starting with position 1, the meter switch is rotated to read the current of each succeeding stage until an abnormal reading is obtained. The trouble will generally be found in either the stage being checked or the preceding one.

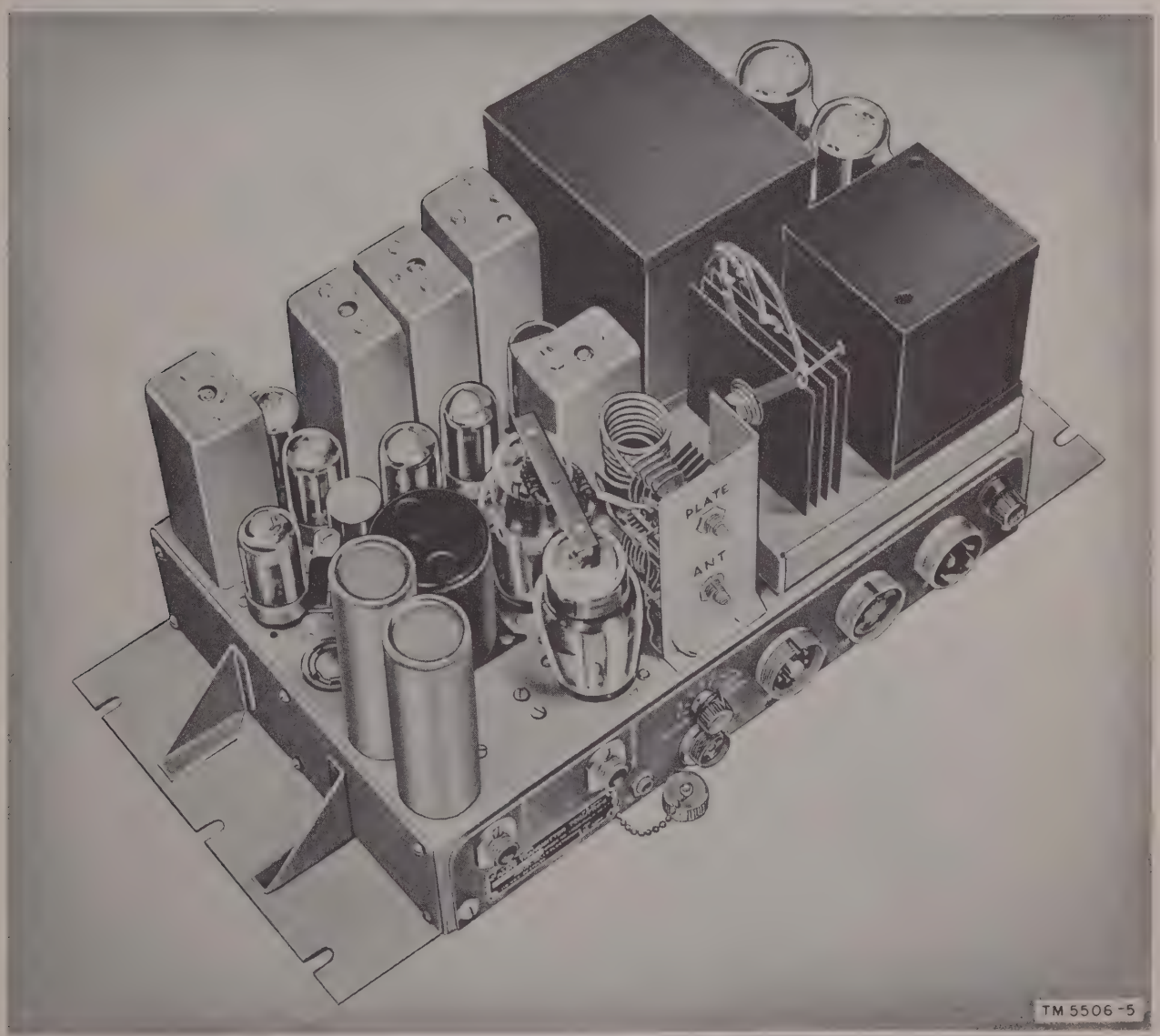


Figure 64. Radio Transmitter T–215A/FRC–6, top view.

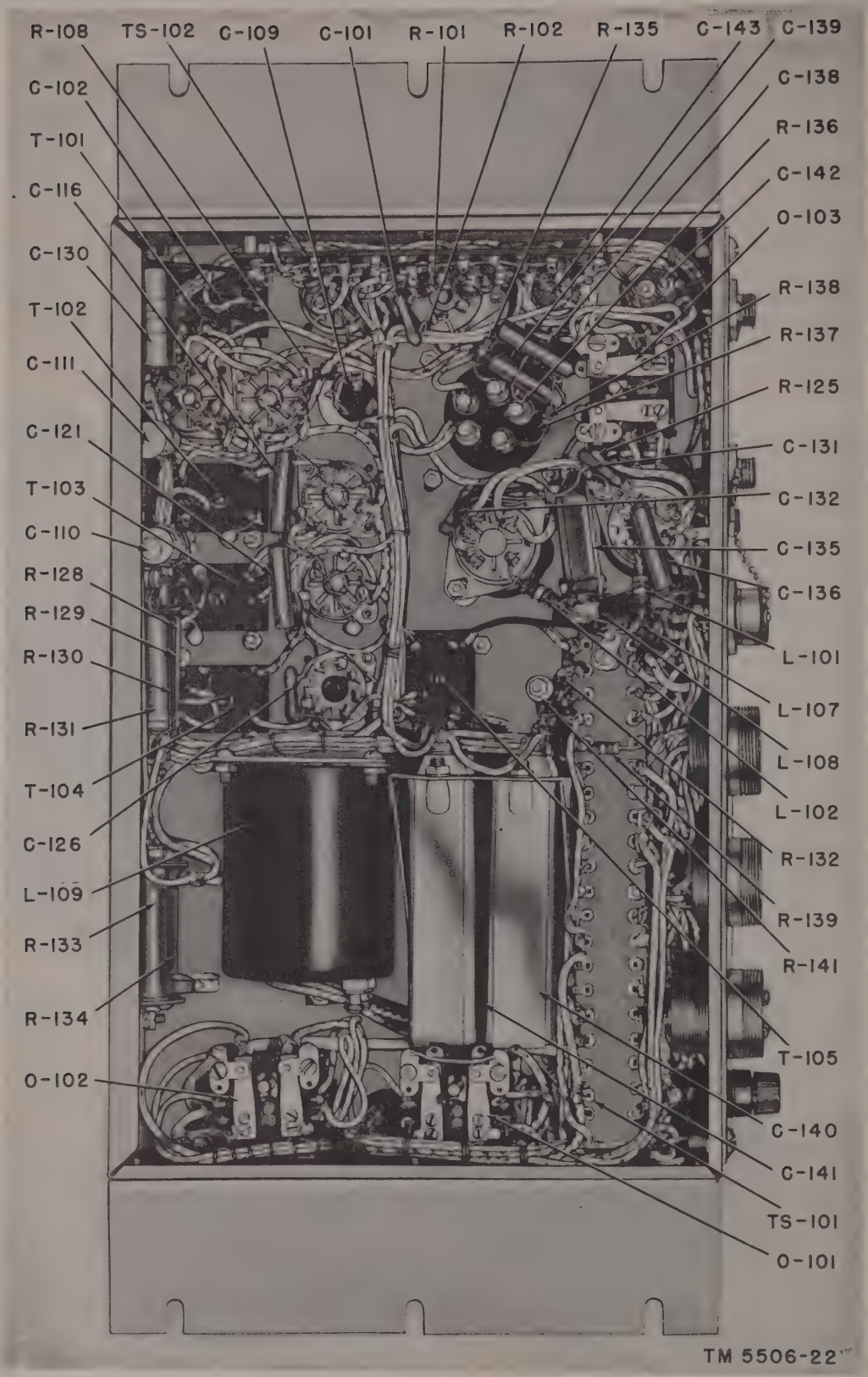


Figure 65. Radio Transmitter T–215A/FRC–6, bottom view.

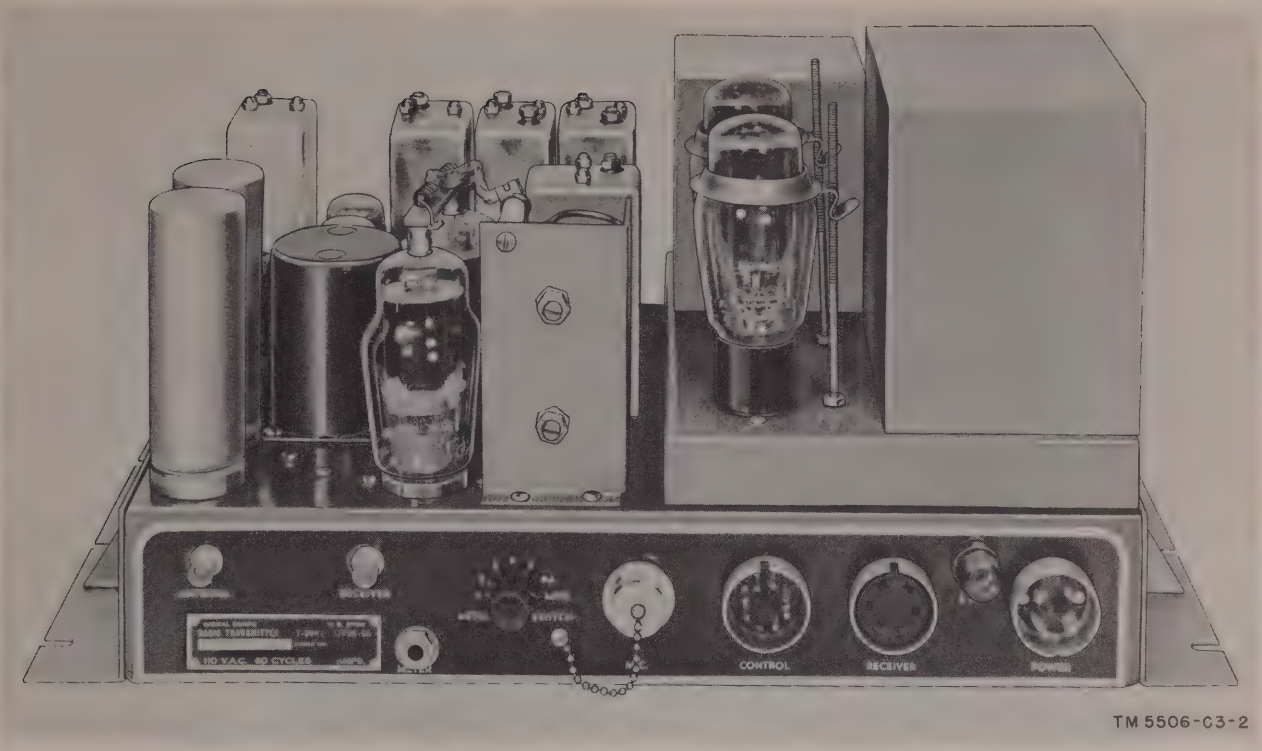


Figure 66. Radio Transmitter T–264/FRC–6A, front view.

a. Power Supply PP–420A/FRC–6. Information on the power supply is given in paragraph 65. The first procedure is to establish whether the power supply is functioning correctly. First turn on the main power to the set and observe whether tubes V109 and V110 light. If no power is evident, then check the fuses in the radio set control and the fuse in the front panel of the transmitter unit. If the filaments of tubes V109 and V110 do light, then attach a voltmeter (set on the 1,000-volt scale) with the positive lead to the ungrounded terminals of high-voltage capacitor C142 or C143, and the negative leads to chassis. Press the handset button and observe the reading, which should be approximately 550 volts. If the indicated voltage is much lower than 550 volts, there is either a short in the transmitter or a defective power supply. This can easily be determined as follows: remove the power plug from the unit. Take a resistance reading between capacitor C142 or C143 and chassis. If the power supply is normal, this reading should be 470,000 ohms. If lower resistance is evident, then look for a short in capacitor C140, C141, C142, or C143, the power supply, or the terminal board in the transmitter. The resistance readings on the power supply are indicated in figures 70 and 71. If the power supply is found to be normal, then attach an ohmmeter to capacitor C142 or C143 and manually close relay O 103, located in the upper left front corner as viewed from the bottom of the chassis. This resistance reading with the relay closed should be about 470,000 ohms. A reading lower then this indicates a short in some other section of the transmitter. This short can best be located by resistance measurement; use the data given in figures 70 and 71.

b. Oscillator. The technical information on the oscillator is given in paragraph 60. The oscillator circuit consists of a crystal (Y101), vacuum tube V101, (7C7) and rf transformer (T101). With the transmitter, receiver, and console fully connected, with power applied, and with the METER SWITCH in position 1, make the following checks on the oscillator; use the right-hand meter (M1):

(1) Operate the press-to-talk switch on the handset (for 2 or 3 seconds at a time) and tune T101 with a screwdriver. If no reading can be obtained on the meter, then the oscillator is not functioning. When the oscillator is properly tuned, this reading should be about 28 microamperes.

(2) Remove tube V101 (7C7) and test it in a tube checker. If a tube checker is not

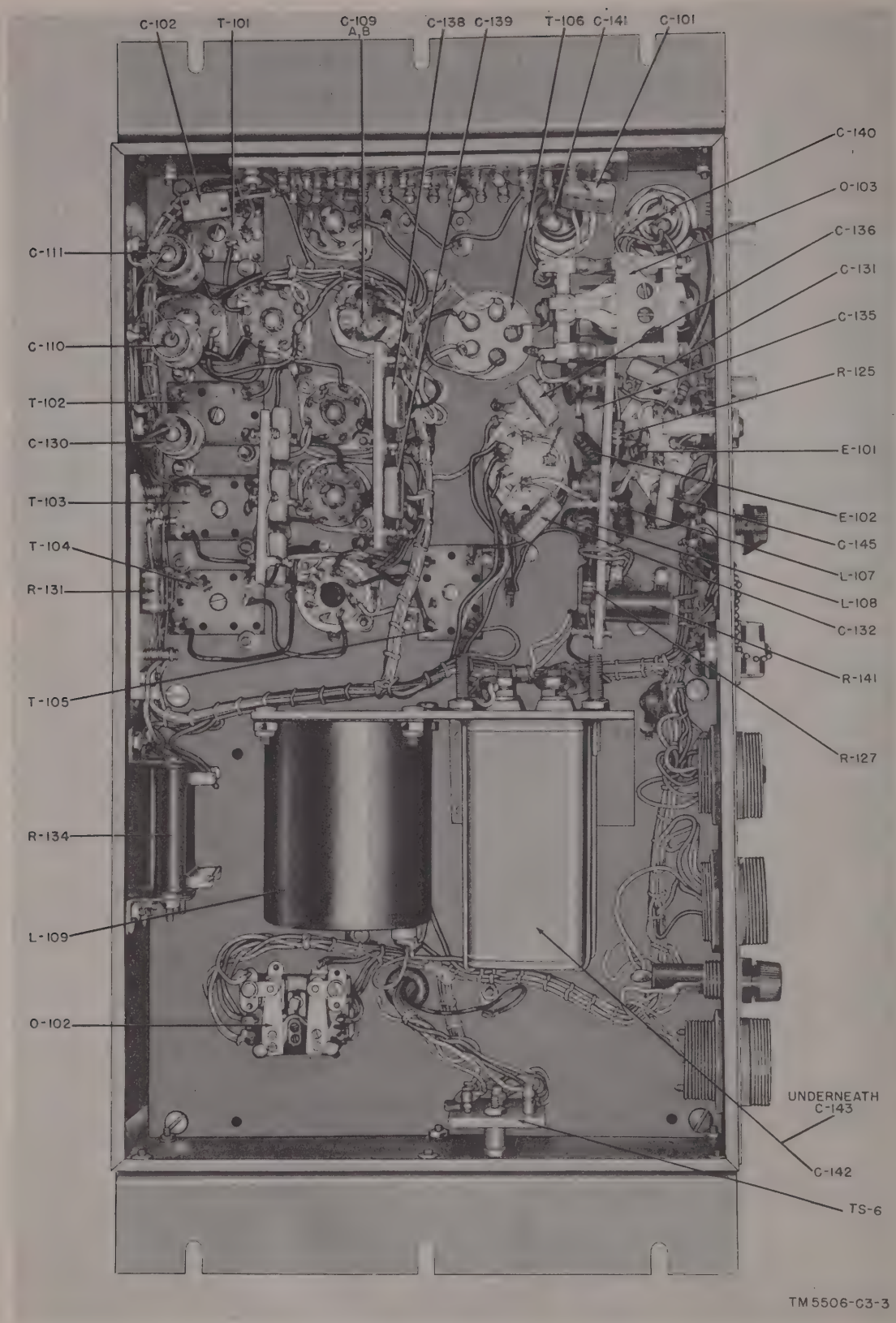


Figure 67. Radio Transmitter T–264/FRC–6A, bottom view.

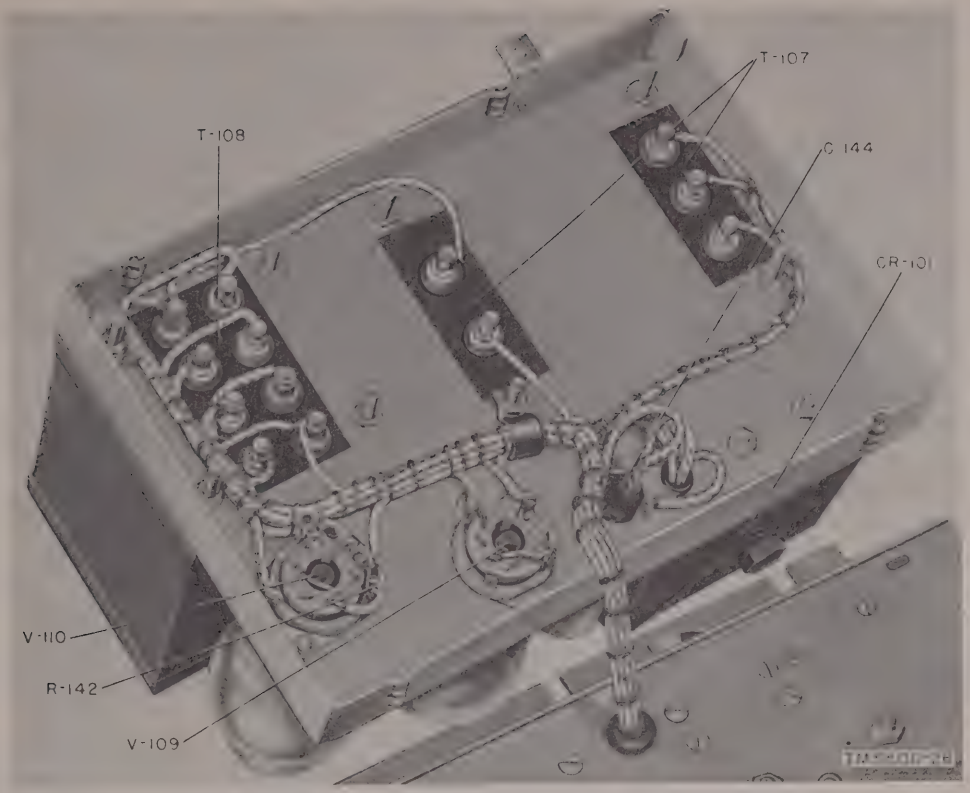


Figure 68. Power Supply PP–420A/FRC–6, bottom view.

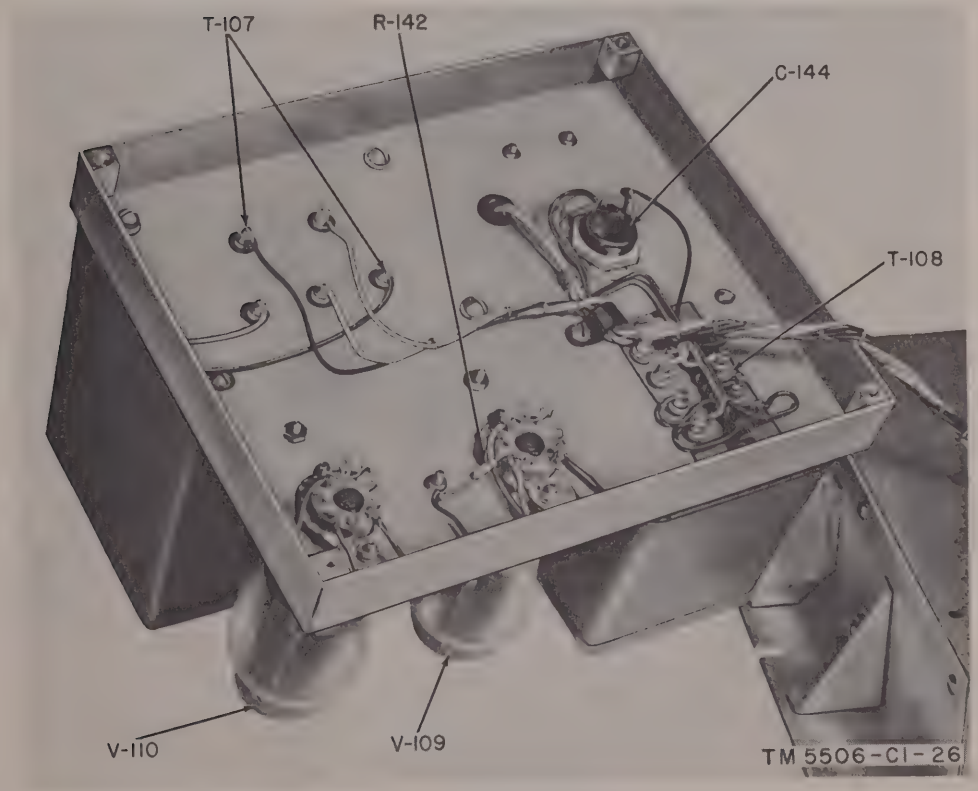


Figure 69. Power Supply PP–420B/FRC–6, bottom view.

available, replace the tube with one that is known to be good.

(3) If the oscillator still fails to operate, remove crystal Y101 and test it in another transmitter or crystal checker, if one is available. Otherwise, replace with another crystal that is known to be good.

(4) If after the above operations the oscillator fails to operate, it will be necessary to take voltage and resistance measurements; use data given in figures 70 and 71. Also check T101 components for continuity; use the partial schematic (fig. 27).

c. Modulator. Technical information on the modulator is given in paragraph 61. The basic components of the modulator are microphone transformer T106, two 7A8 tubes (V102 and V103), and a transformer (T102). With the METER SWITCH set in position 2 and the oscillator properly tuned, resonate T102. The normal meter reading should be about 29 microamperes. Troubleshoot the modulator as follows:

(1) Remove the two 7A8 tubes (V102 and V103) and test them in a tube checker, or test by substituting two 7A8 tubes that are known to be good.

(2) Check voltage and resistance readings against those given in figures 70 and 71.

(3) If pin 2 on V102 fails to show voltage readings, test T102 for open winding. The dc resistance of this winding is about 5 ohms.

(4) If the rf portion of the modulator functions properly but the transmitter fails to operate, then test for open winding in the microphone transformer or for trouble in the console unit and its connecting wires.

d. Quadruplers. Technical information on the quadruplers is given in paragraph 62. There are two quadrupler circuits. The first quadrupler consists of a 7C7 tube (V104) and transformer

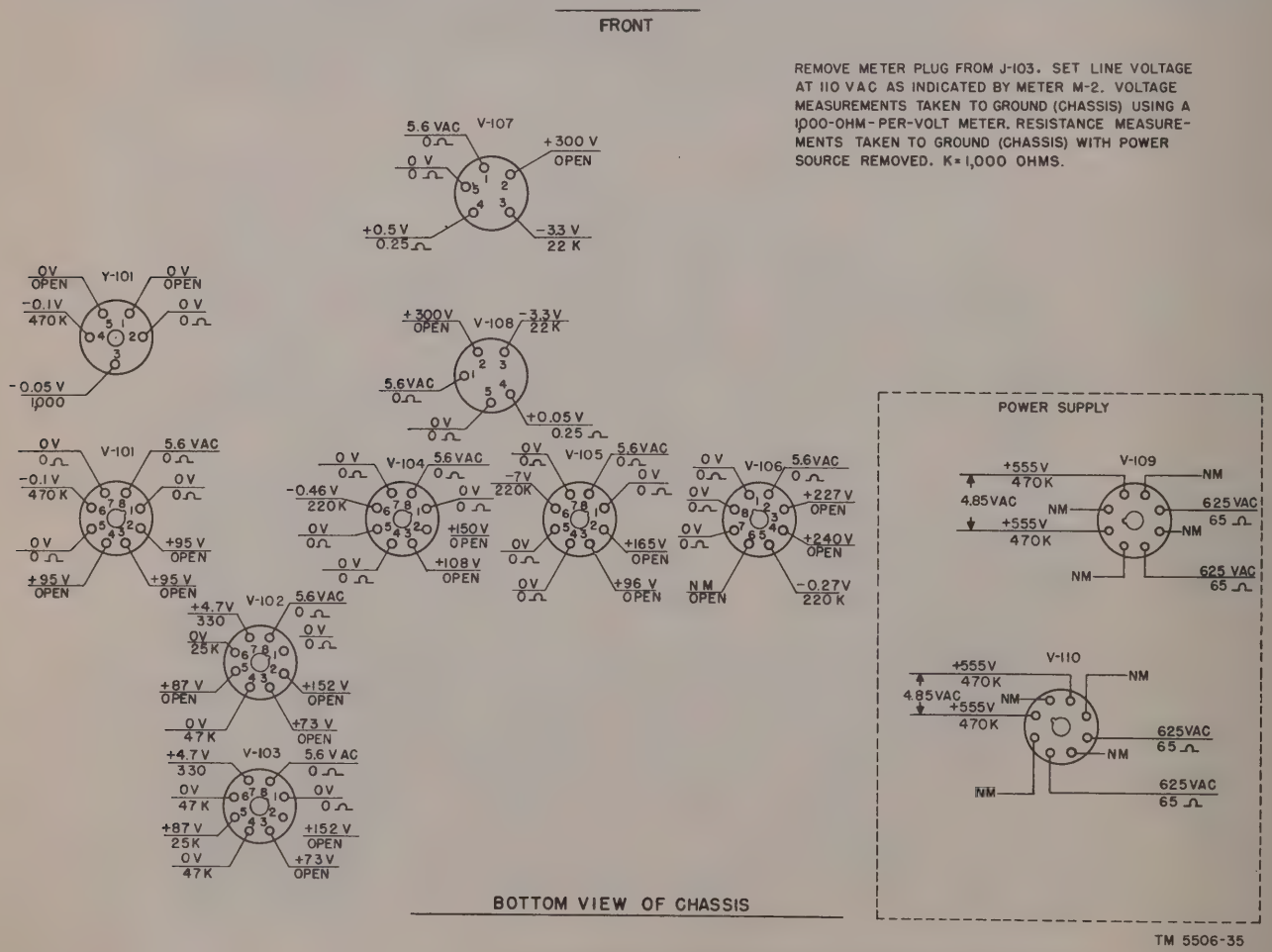


Figure 70. Radio Transmitter T-215A/FRC-6, tube socket voltage and resistance diagram.

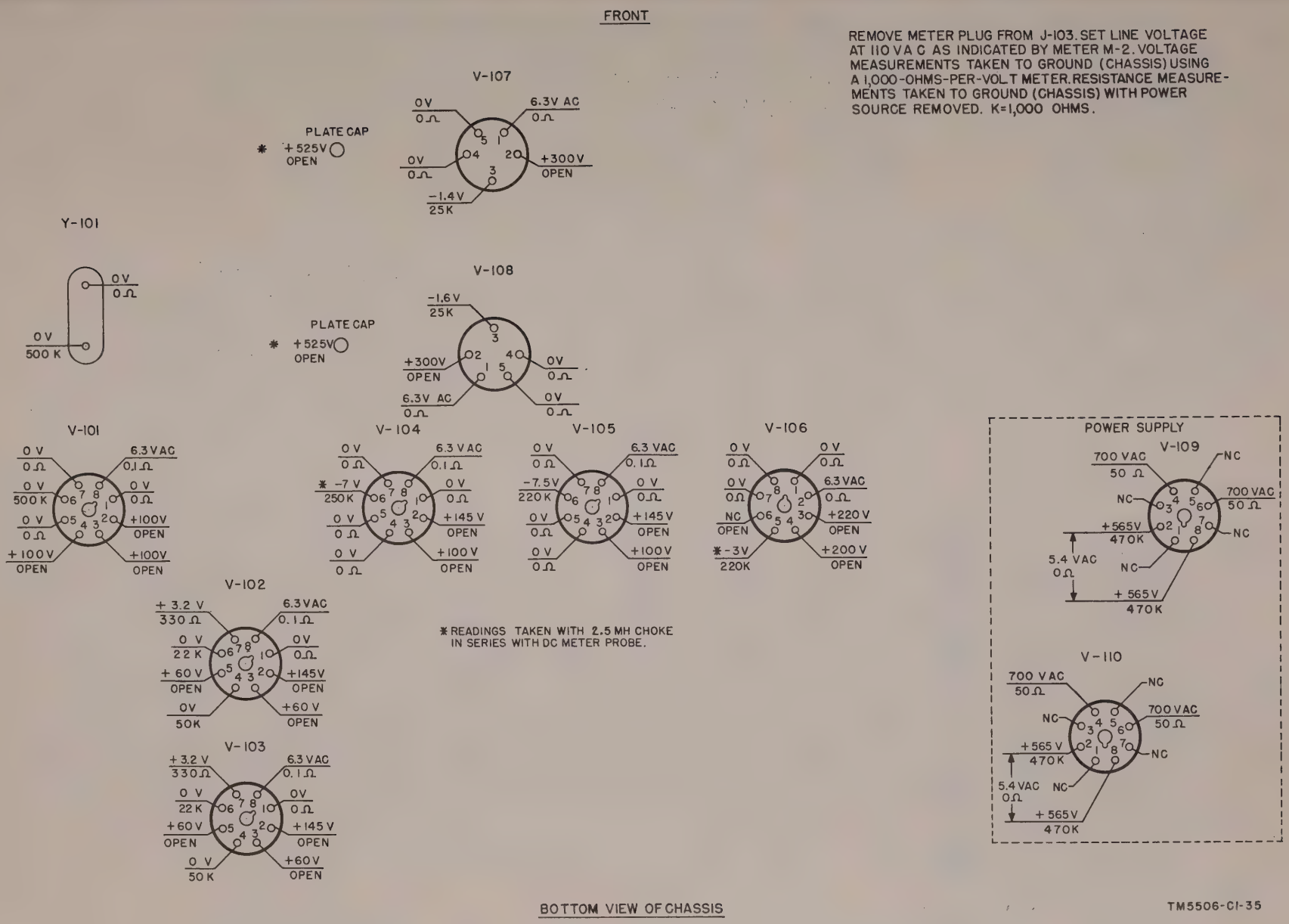
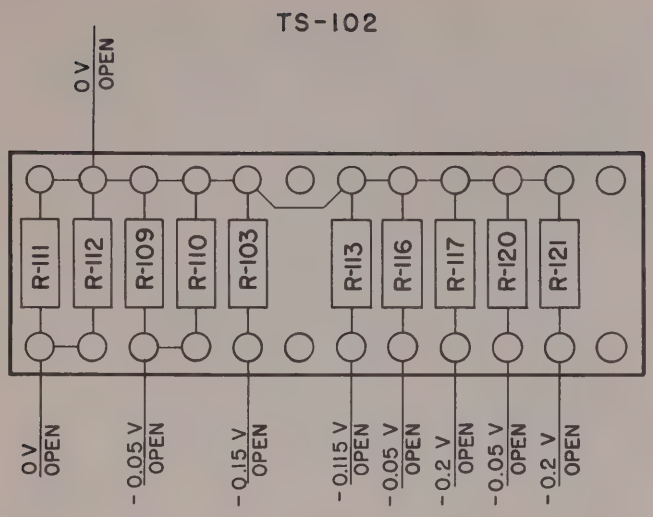


Figure 71. Radio Transmitter T-264/FRC-6A, tube socket voltage and resistance diagram.



ALL MEASUREMENTS TAKEN WITH VOLUME CONTROL AT "HI", SQUELCH CONTROL AT "OFF" AND LINE INPUT CONTROL AT "HI"; ALL PLUGS, SOCKETS, TUBES, AND CABLES IN PLACE WITH RECEIVER OPERATING AND TRANSMITTER INOPERATIVE. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE OF 110 V AS INDICATED ON METER M-2. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED.

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Figure 72. Radio Transmitter T–215A/FRC–6, resistor board diagram.

T103; the second quadrupler consists of a 7C7 tube (V105) and transformer T104. With the METER SWITCH in position 3 and T103 properly tuned to the correct harmonic, the meter should read approximately 43 microamperes. With the METER SWITCH in position 4 and T104 properly tuned, the meter should read approximately 15 microamperes. Troubleshooting in both quadrupler circuits is identical, as follows:

(1) Check tubes by testing them in a tube checker or by replacement with tubes known to be good.

(2) Make resistance and voltage measurements; use the data given in figures 70 and 71. Failure in the first quadrupler will make the second quadrupler inoperative.

e. Doubler. Technical information on the doubler is given in paragraph 63. The doubler consists of a 6V6 tube and transformer T105. With the METER SWITCH in position 5 and the doubler properly tuned, the meter should read approximately 32 microamperes. Failure to obtain this reading indicates improperly tuned previous quadrupler stages or improper functioning of the doubler stage. Troubleshooting this stage is done in the same manner as in the quadrupler stages.

f. Power Amplifier. Technical information on the power amplifier is given in paragraph 64. The tube complement of the power amplifier consists of two 807 tubes connected in parallel (V107 and V108). The tuning of this circuit is done with the METER SWITCH in the P. A. position. When the power amplifier is properly resonated and loaded to the antenna or dummy load, the meter should read approximately 30 microamperes. If a dummy antenna is used, it should consist of one 52-ohm, 100-watt noninductive resistor in series with a 1.5-ampere rf meter. This dummy load is wired between the antenna terminal and chassis ground with the shortest leads physically possible. To take P. A. meter readings, place the meter reversal switch on the rack in the forward position. Most of troubleshooting in the power amplifier consists of checking tubes and making resistance and voltage measurements. Be sure that the correct tank coil is being used for the proper frequency. The correct coil for each group of frequencies is given in paragraph 118.

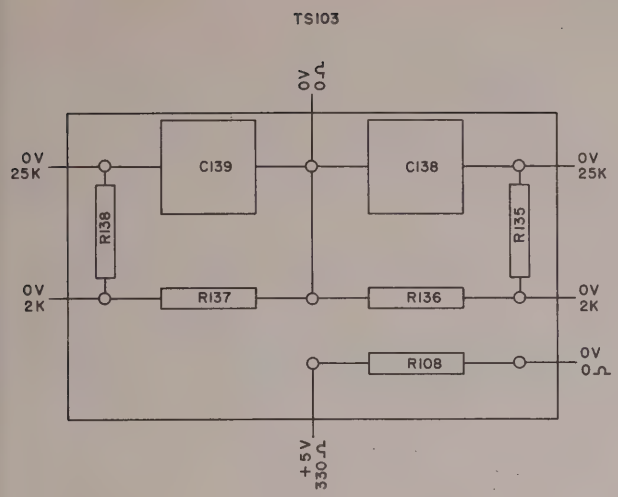


Figure 73. Radio Transmitter T–264/FRC–6A, TS–103, resistor-capacitor board diagram.

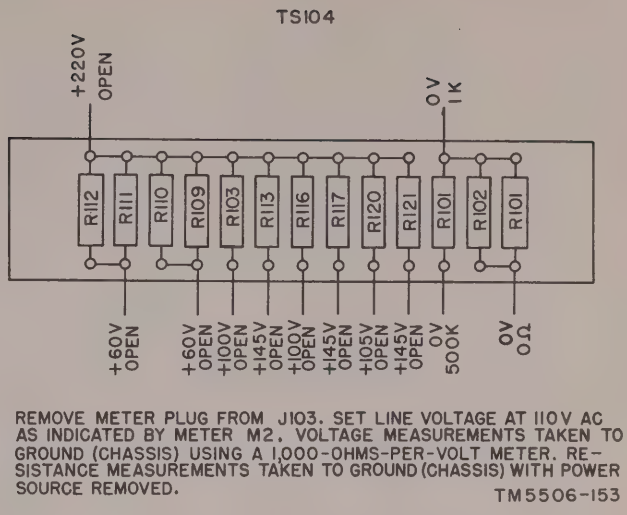


Figure 74. Radio Transmitter T–264/FRC–6A, TS–104, resistor-capacitor board diagram.

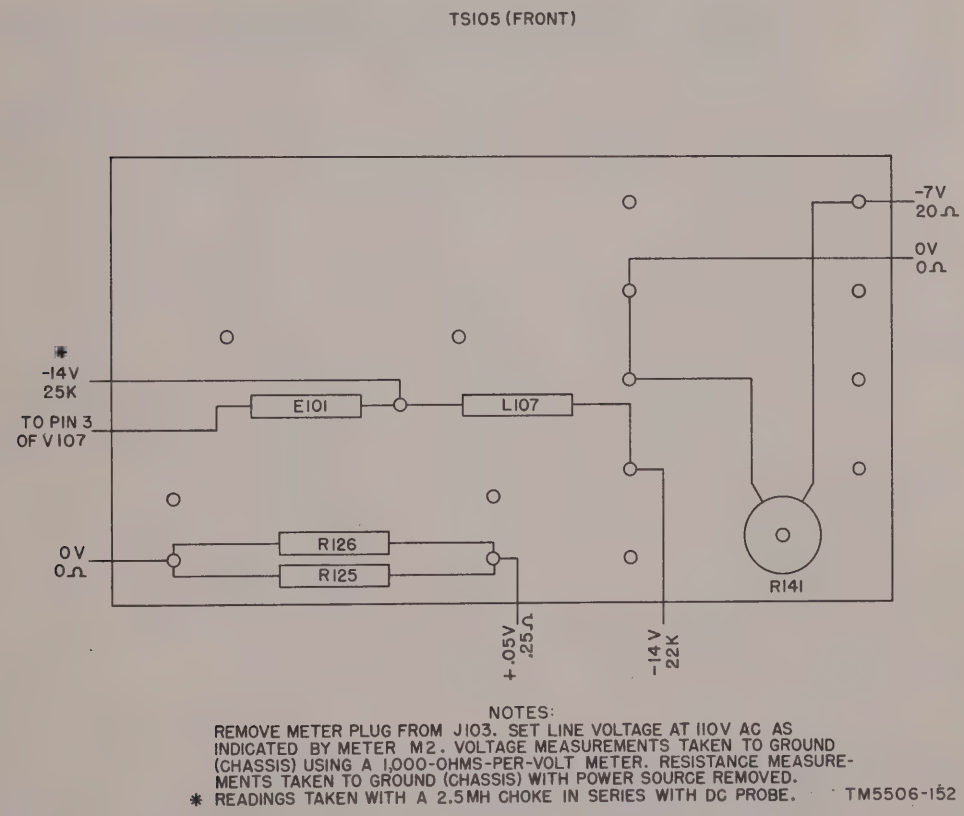


Figure 75. Radio Transmitter T–264/FRC–6A, TS–105, (front) resistor-capacitor board diagram.

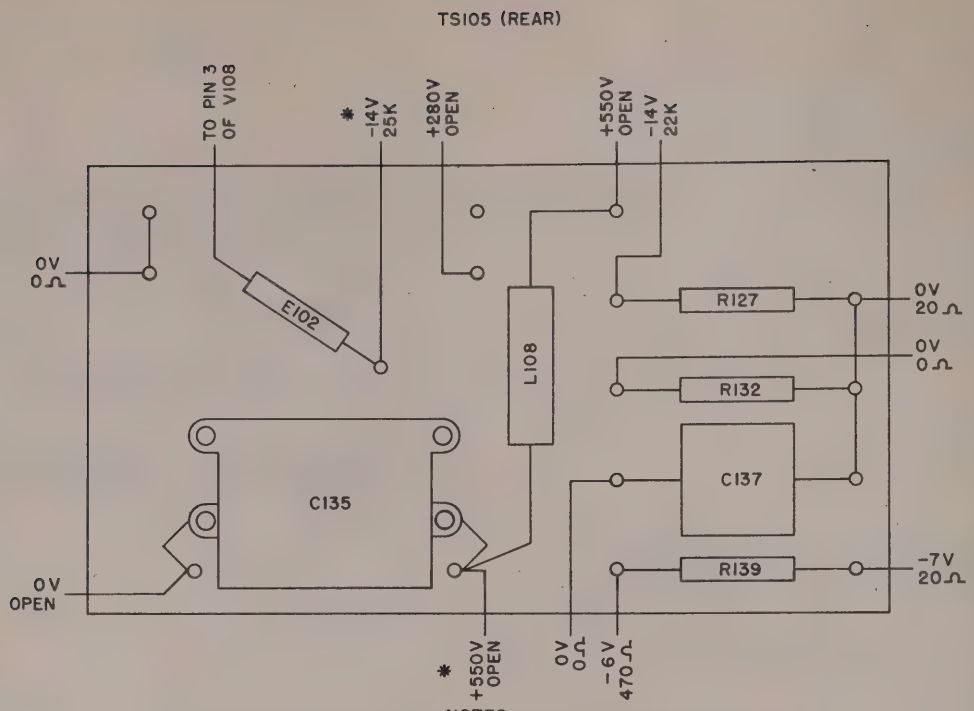


Figure 76. Radio Transmitter T–264/FRC–6A, TS–105, (rear) resistor-capacitor board diagram.

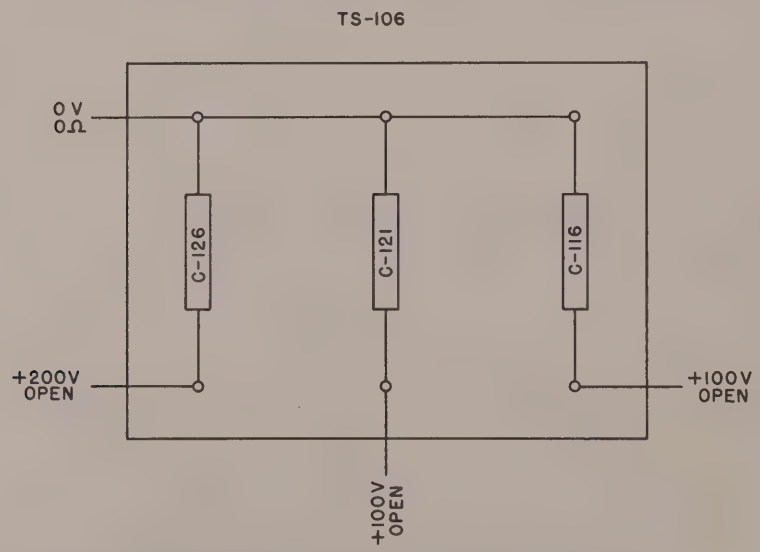


Figure 77. Radio Transmitter T–264/FRC–6A, TS–106, capacitor board diagram.

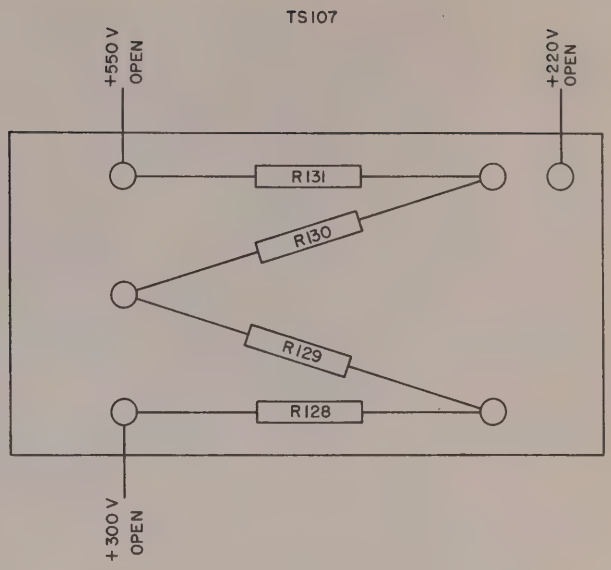


Figure 78. Radio Transmitter T–264/FRC–6A, TS–107, resistor board diagram.

(A) RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110 V AC AS INDICATED BY METER M2.
(B) 6 VOLTS INPUT TO 18 FOOT POWER CABLE.
(C) OUTPUT LOAD AT TRANSMITTER 34 Ω. TM5506-150

105. Transmitter Trouble Location Chart

Symptom	Probable trouble	Correction
1. Transmitter and receiver not operating.	Main fuse or power supply fuses open	Replace fuses.
	Power cable circuit open	Repair cable.
	Relay circuits defective	Repair relay circuits.
2. Low or zero reading on meter M1 on P. A. position.	Defective tube V107 or V108	Replace tube V107 or V108.
	Power supply defective	Repair power supply or replace rectifier tubes V109 and V110.
	Capacitor C136 shorted	Replace capacitor.
	Antenna loading too light	Retune or repair antenna circuits.
3. Abnormally high meter reading on P. A. position.	No rf excitation from preceding stages	Repair or retune the preceding stages.
	Plate circuit not tuned to correct frequency.	Retune plate circuit.
	Capacitor C129 shorted	Replace capacitor.
4. Low or zero meter reading on position 5.	No rf excitation from preceding stages	Repair or retune preceding stages.
	Capacitor C137 shorted	Replace capacitor C137.
	Tube V107 or V108 defective	Replace tube V107 or V108.
5. Low or zero meter reading on position 4.	Defective tube V106	Replace tube V106.
	Capacitor C126 shorted	Replace capacitor C126.
	No rf excitation from preceding stages	Repair or retune preceding stages.
6. Low or zero meter reading on position 3.	Defective tube V105	Replace tube V105.
	Capacitor C121 shorted	Replace capacitor C121.
	No rf excitation from preceding stages	Repair or retune preceding stages.
7. Low or zero meter reading on position 2.	Defective tube V104	Replace tube V104.
	Capacitor C116 shorted	Replace capacitor C116.
	No rf excitation from preceding stages	Repair or retune preceding stages.
8. Low or zero meter reading on MOD. position.	Tube V102 or V103 or both defective	Replace tube V102 or V103 or both.
	Capacitor C115 shorted	Replace capacitor C115.
	No rf excitation from preceding stage	Repair or retune oscillator stage.
9. Low or zero meter reading on position 1.	Tube V101 defective	Replace tube V101.
	Capacitor C108 shorted	Replace capacitor C108.
	Crystal defective	Replace crystal.
	Oscillator stage defective	Check all parts in oscillator.

106. Localizing Trouble in Receiver

Before attempting to do any troubleshooting in the receiver, study paragraphs 66 through 78 to understand fully the function and operation of the various circuits of the receiver. For localizing trouble in the receiver, the unit has been divided into 11 circuits, namely: power supply, second af amplifier, squelch and first af amplifier, noise amplifier and noise rectifier, second limiter and discriminator, first limiter, 455-kc and if. amplifier, converter, 4.3-mc if. amplifier, mixer and hf oscillator, and rf amplifier. The power to the receiver is furnished through relay O 101 in the transmitter and is supplied by the interconnecting cables between the transmitter and receiver. An observation of all glass type tubes will indicate whether all tube filaments are lighted and may often save time in troubleshooting. All measurements are made with the VOLUME and SQUELCH controls turned fully on. With equipment turned on, by rotating the METER SWITCH from position 1 through 5 and checking the readings of the left hand meter (M3) against normal readings in the chart of paragraph 119, the particular circuit at fault can easily be localized. Once it has been determined which part of the receiver is not functioning, check the tubes in the circuit or replace each with a tube that is known to be good. If after replacing tubes the receiver fails to operate, make resistance and voltage checks against the values given in figures 85 through 90.

a. Power Supply. The receiver power supply is located on the top right hand side of the receiver as viewed from the front. The power supply is self-contained, and the power is supplied to the receiver through the two banana plugs (P203 and P204). The 258 volts from the power supply is fed to pin 4 of the power receptacle, through a pair of normally closed contacts of relay O 103 in the transmitter unit, back to pin 3 of the power receptacle, and then to the red-bodied pin-type

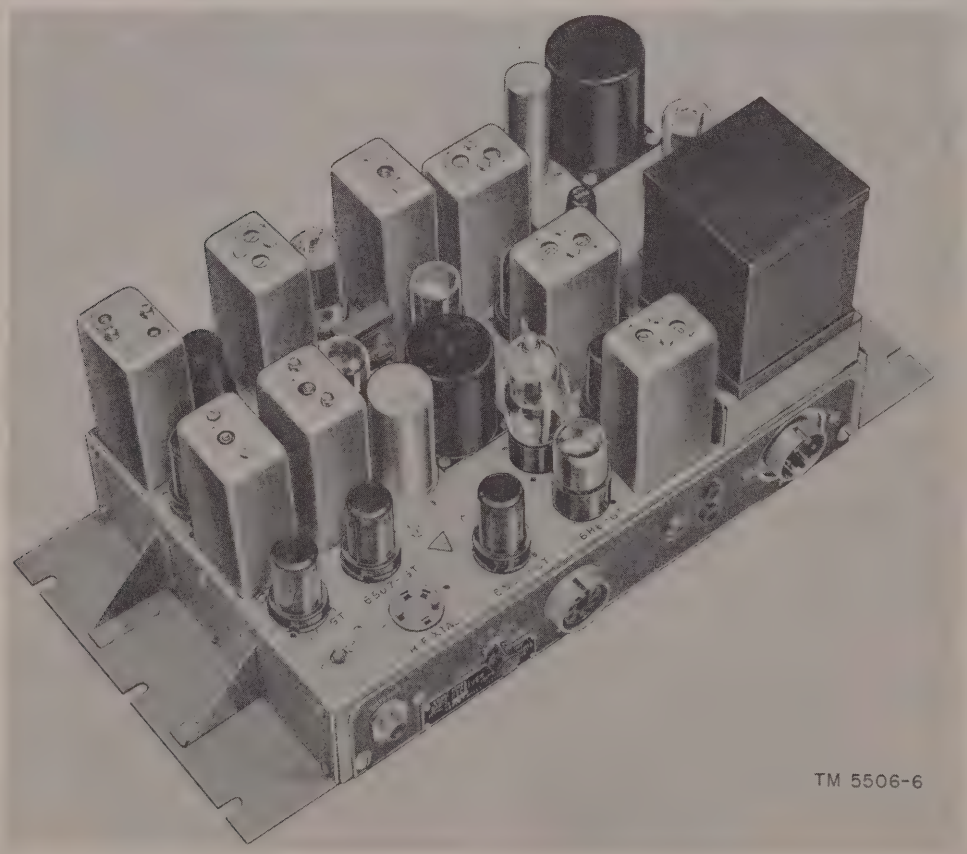


Figure 79. Radio Receiver R–276A/FRC–6, top view.

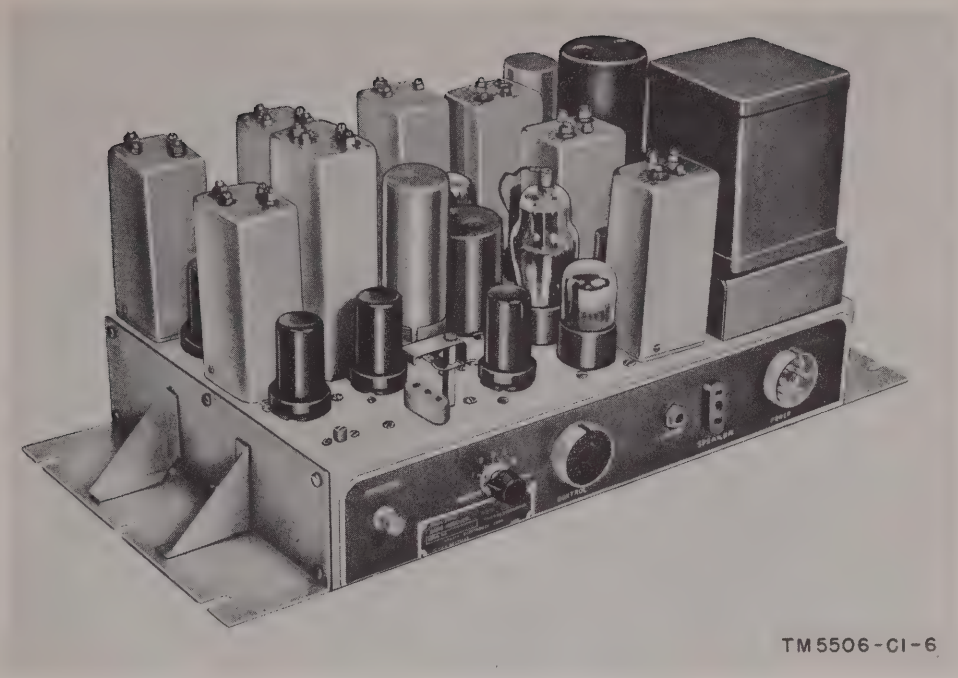


Figure 80. Radio Receiver R–368/FRC–6A, top view.

plug, P203. The 6.3 volts ac is connected between ground and the yellow-bodied pin-type plug, P204. Localizing trouble in the power supply should be accomplished as follows:

(1) If power is on but filaments do not light, check fuse F201.

(2) If fuse is good but there is still no filament voltage, check relay O 101 in the transmitter and interconnect cable.

(3) If the above methods fail to put the power supply in operation, remove the power supply from the receiver chassis and check resistances and voltages against those given in figures 85 through 90.

b. Second Af Amplifier. Troubleshoot the second af amplifier by injecting a 1,000-cycle audio test signal into the plate and grid circuit of this stage and check the result.

Note. Place an isolating capacitor (0.05 microfarad at 600 volts dc) in series with the *hot* lead from the audio signal generator.

(1) Place the test signal on the plate of V213; signal should be heard faintly in the loudspeaker. If signal is not heard, check T209, voice coil on speaker, loudspeaker switch S2, and interconnecting cable.

(2) If the signal is heard in the loudspeaker, change the point of signal injection from the plate to the grid of V213. The signal from the loudspeaker should be much louder (reduce output from audio signal generator if necessary). If there is not a substantial increase in the signal level, check V213 and T209. If these components are not at fault, make voltage and resistance checks (fig. 85).

c. Squelch and First Af Amplifier. Dual-triode tube V212 (6C8G) makes up the squelch and first af amplifier (par. 76). The most common trouble in this circuit is a defective 6C8G. The best check on the squelch circuit is to measure the voltage across 1-megohm resistor R241 with a vacuum-tube voltmeter. With the SQUELCH control all the way off, this voltage should read about 5 volts. With the control fully on, it should be about 80 volts. Improper alinement of the discriminator greatly affects the operation of the squelch circuit. If difficulty is encountered in the squelch circuit after all resistance and voltage measurements of V212 have been checked against figures 85 and 86, then a careful resistance check should be made on all resistors (refer to the partial schematic diagram (fig. 48).

d. Noise Amplifier and Noise Rectifier. The noise amplifier consists of V210 (6SG7GT), inductance L203, and variable cathode control (SQUELCH control in radio set control) and associated circuit components. The noise rectifier

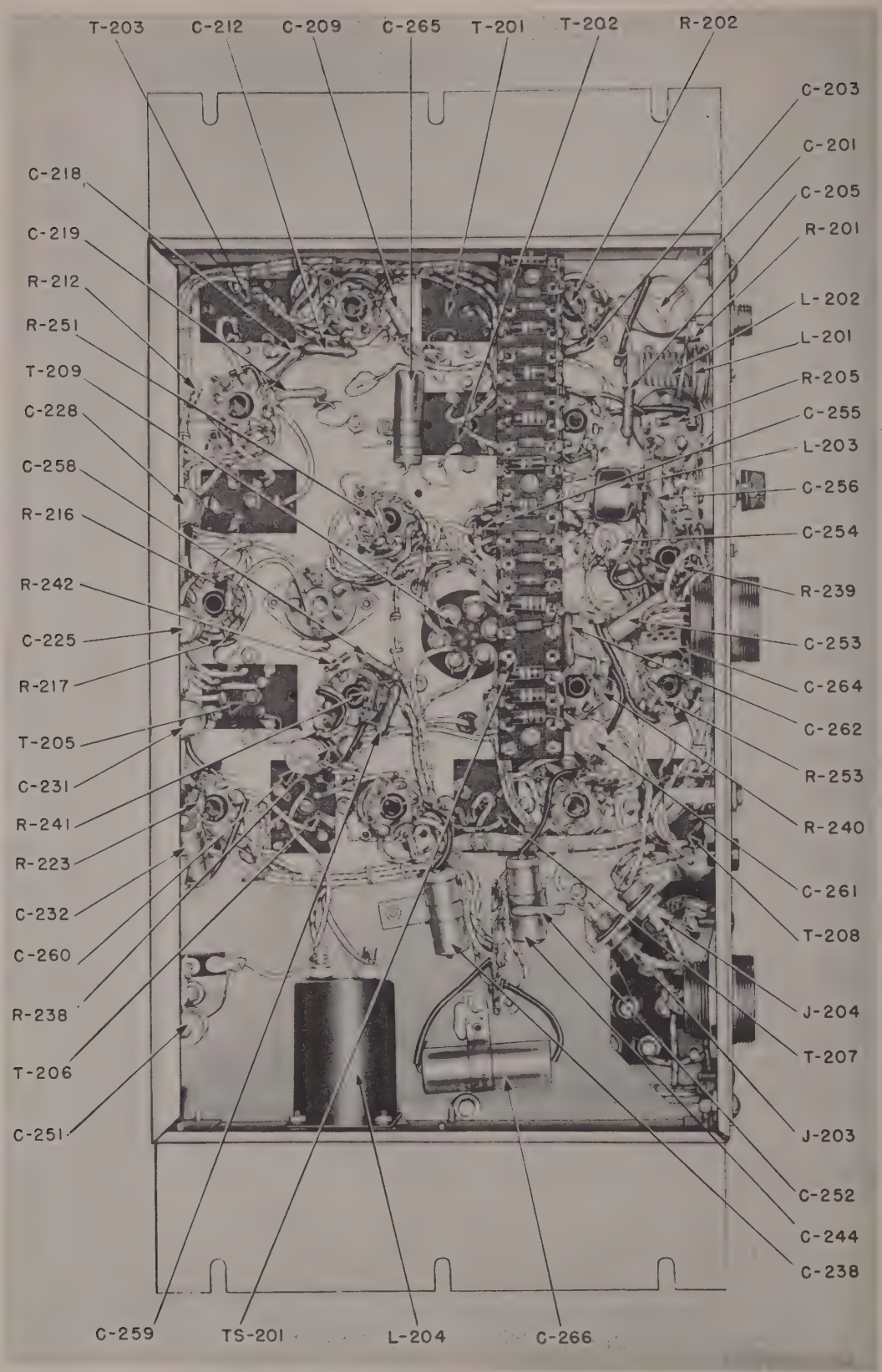


Figure 81. Radio Receiver R–276A/FRC–6, bottom view.

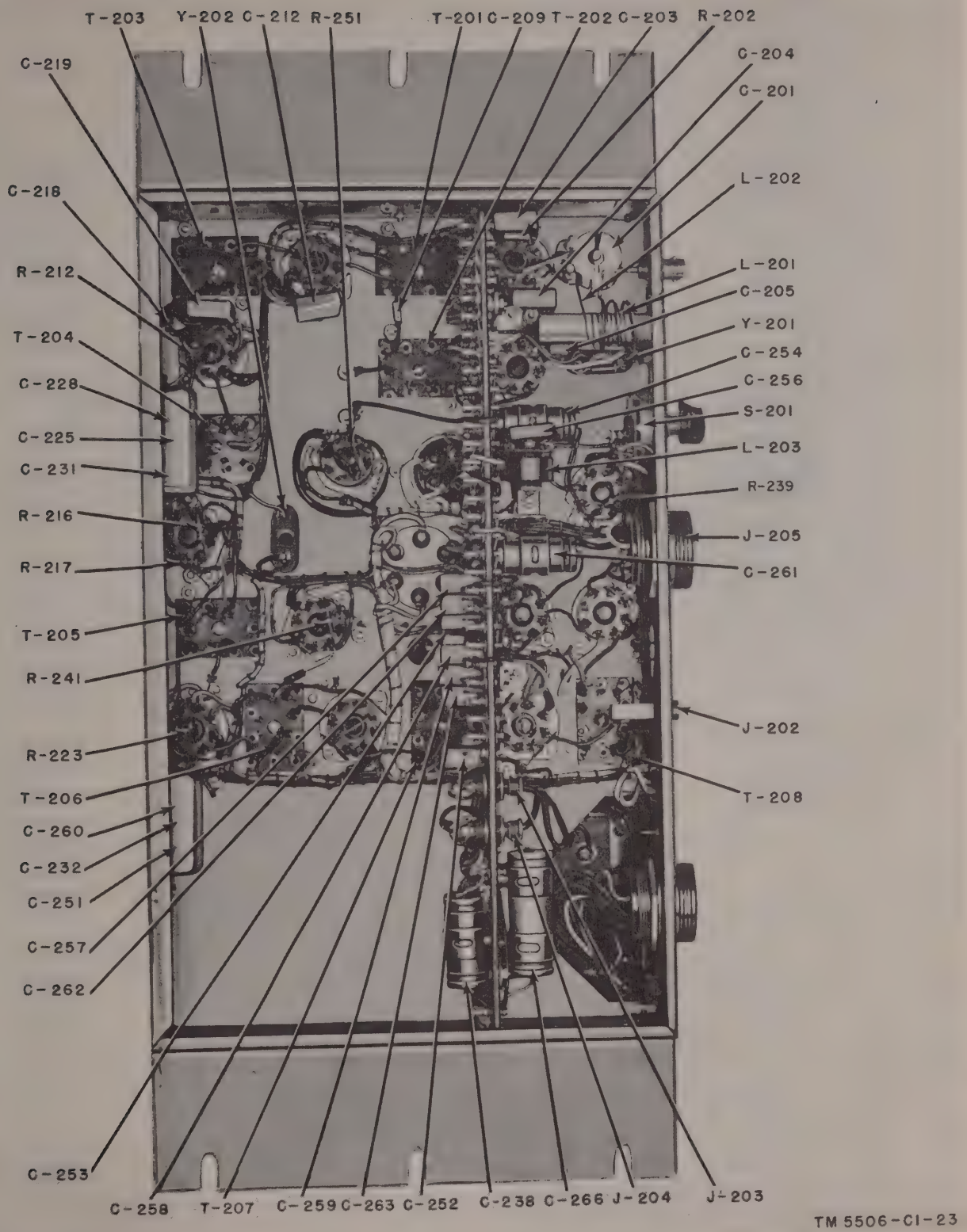


Figure 82. Radio Receiver R-368/FRC-6A, bottom view.

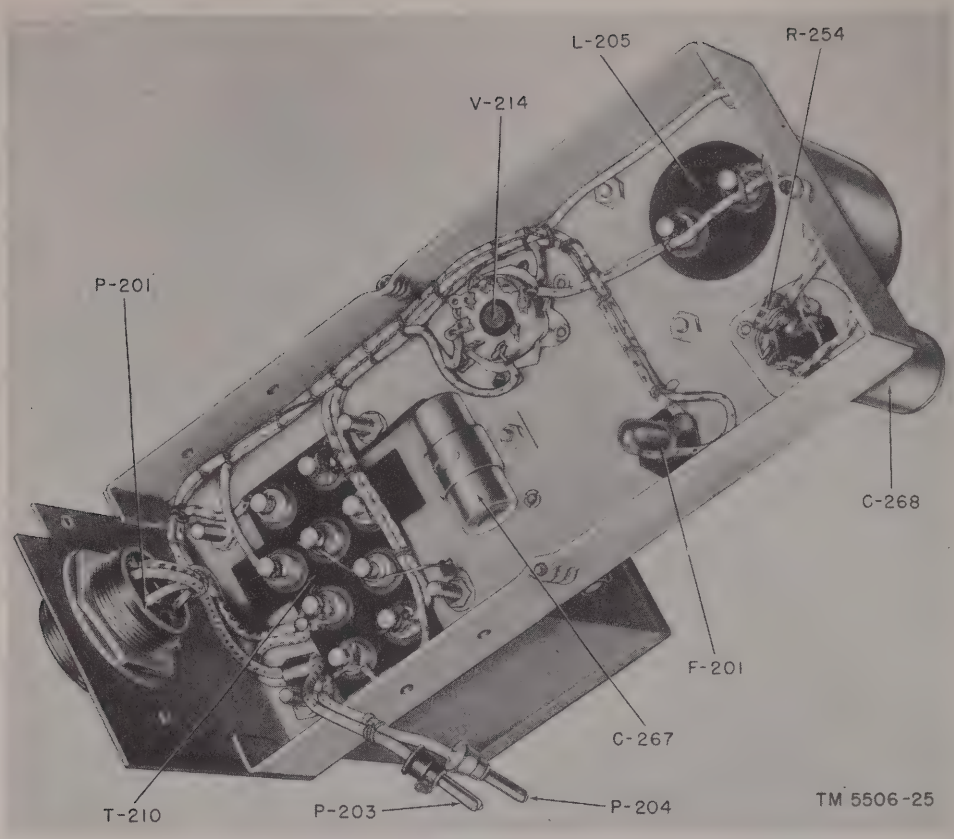


Figure 83. Power Supply PP–421A/FRC–6, bottom view.

is a dual-diode tube (6H6GT). The most common troubles in this circuit are—

(1) Defective 6SG7GT or 6H6GT tube.
(2) Open inductor L203.
(3) Open or defective SQUELCH control, R305, on local control unit.
(4) Shorted or open wiring between SQUELCH control on radio set control and the receiver.

e. Second Limiter and Discriminator. Troubleshooting the second limiter and discriminator may be accomplished by injecting a 455-kc test signal into the grid circuit of each stage in turn and observing the results.

(1) Place the test signal on the grid of second limiter tube V208; with the receiver METER SWITCH set to position 3, the indication on receiver tuning meter M3 should vary as the output from the signal generator is raised or lowered. If there is no change in the meter reading or the meter does not indicate at all, first check V208, then make voltage and resistance measurements (figs. 85 and 86).
(2) To troubleshoot the discriminator, first attempt the alinement procedure (par. 119). If the discriminator does not tune correctly, first check V209, then make voltage and resistance measurements (figs. 85 and 86).

f. First Limiter. Troubleshooting the first limiter is accomplished by the same procedure as used with the second limiter except that the receiver METER SWITCH is set to position 2, and the test signal is placed on the grid of V207.

g. 455-kc If. Amplifier. With the test signal placed on the grid of V206 and the METER SWITCH set to position 1, troubleshoot the 455-kc if. amplifier stage in the same manner as the limiter stages.

h. Converter. Check the operation of the converter stage by placing a vacuum-tube voltmeter to pin 5 of V205 and chassis and noting the reading. An indication of —0.7 volt indicates that the converter is operating correctly. If this indication is not received, check the crystal, tube V205, and make voltage and resistance measurements (figs. 85 and 86).

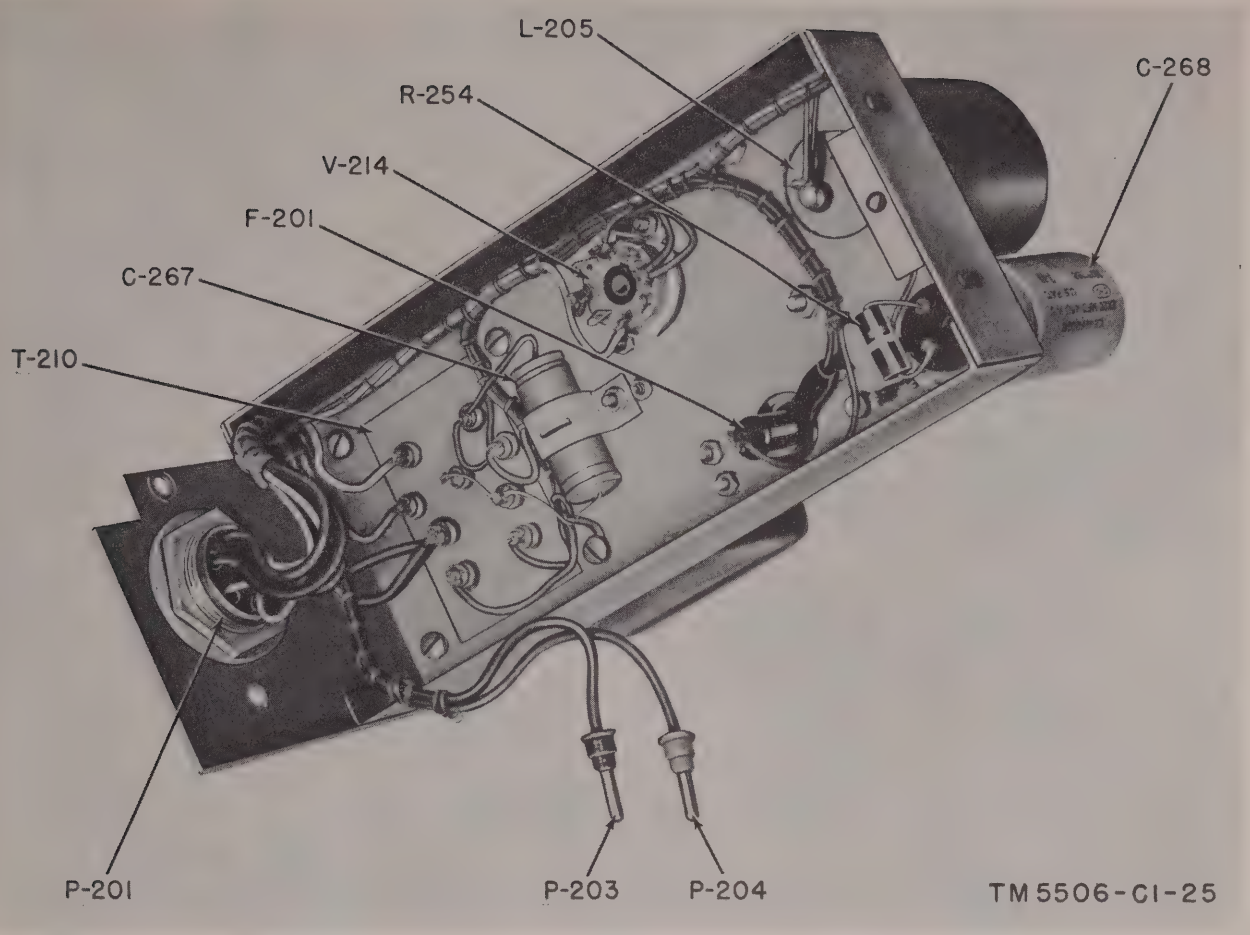


Figure 84. Power Supply PP–421B/FRC–6, bottom view.

i. 4.3. mc If. Amplifier. Place a 4.3-mc test signal on the grid of V204 and leave the receiver tuning METER SWITCH on position 1. The receiver tuning meter should indicate more or less current as the output from the signal generator is raised or lowered. If the meter indication is small or zero, check V204 and make voltage and resistance measurements (figs. 85 and 86).

j. Hf Oscillator. Troubleshoot the hf oscillator by placing an rf test signal on the plate of V203. This signal should be the same frequency as the channel frequency stamped on the crystal. With the receiver METER SWITCH on position 1, raising or lowering the output of the signal generator should cause the meter indication to vary up or down. If this does not happen, check Y201 and V202. If these components are not at fault, make voltage and resistance measurements (figs. 85 and 86).

k. Mixer. To troubleshoot the mixer stage, place the same test signal used in *j* above on the grid of V203. With the receiver METER SWITCH on position 1, tuning mixer transformer T203 to resonance should cause a higher indication on the receiver tuning meter (it may be necessary to reduce the output from the signal generator). If this indication is not received, check V203, and make voltage and resistance measurements (figs. 85 and 86).

l. Rf Amplifier. With the test signal connected to the receiver ANTENNA jack and the receiver METER SWITCH on position 1, check V201 and troubleshoot the rf stage in the same manner as the mixer stage.

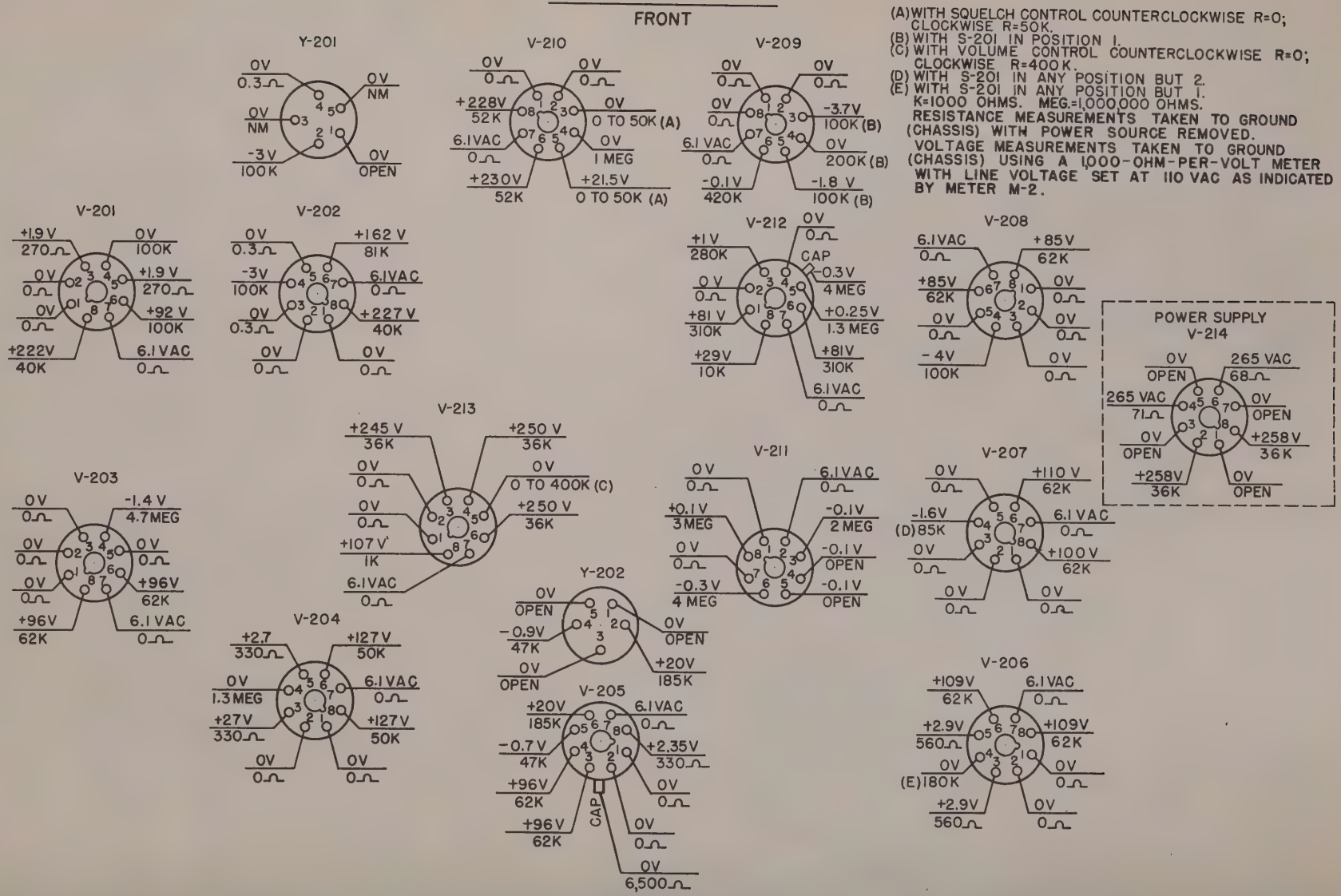


Figure 85. Radio Receiver R-276A/FRC-6, tube socket voltage and resistance diagram.

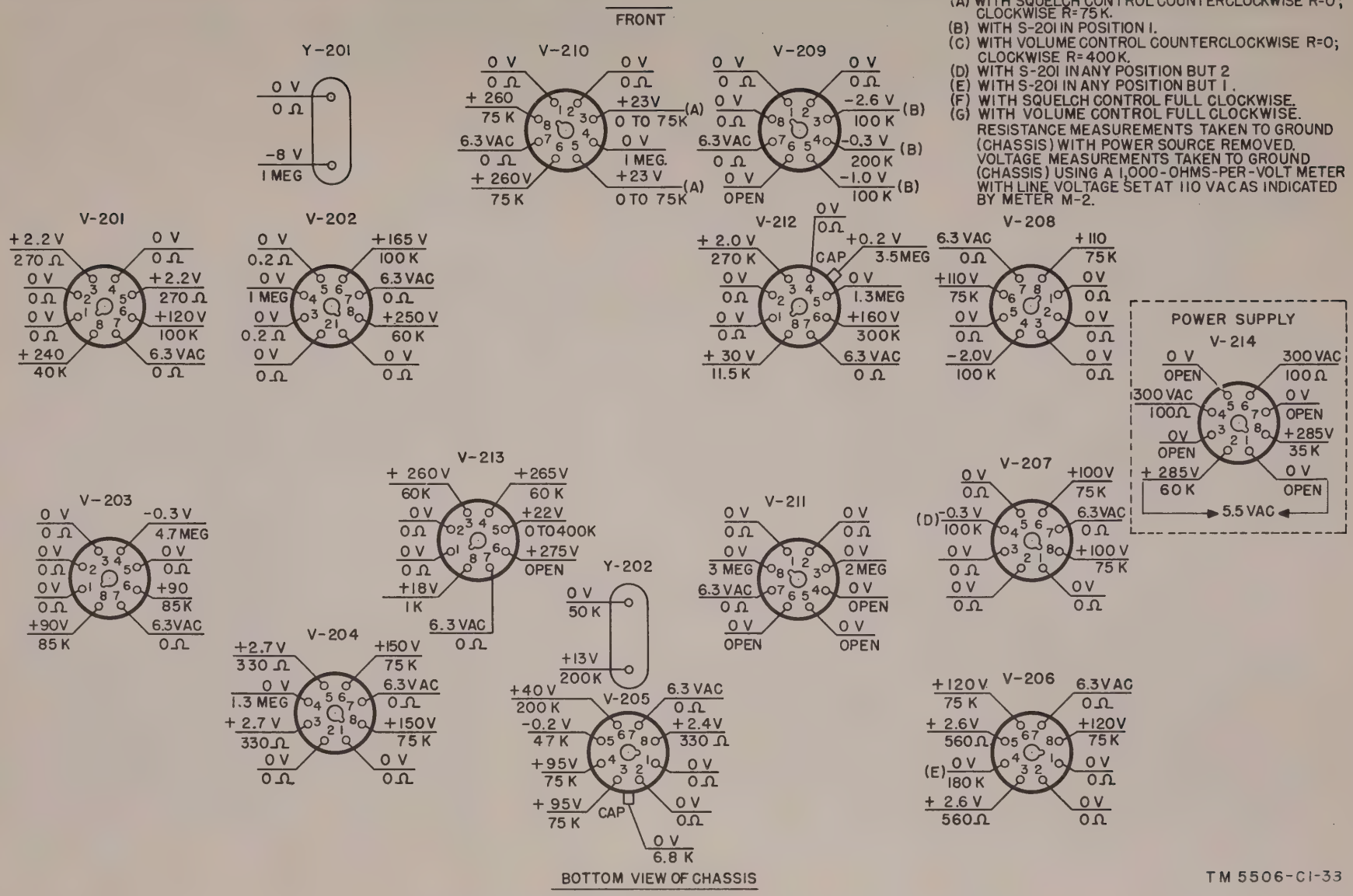
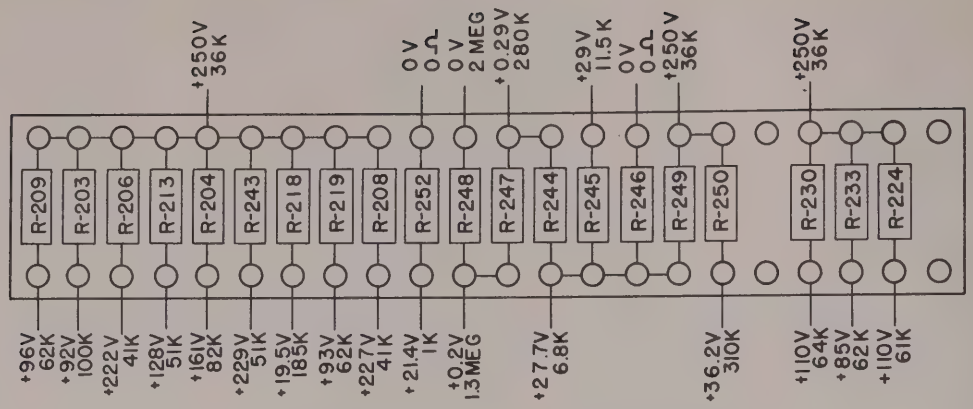


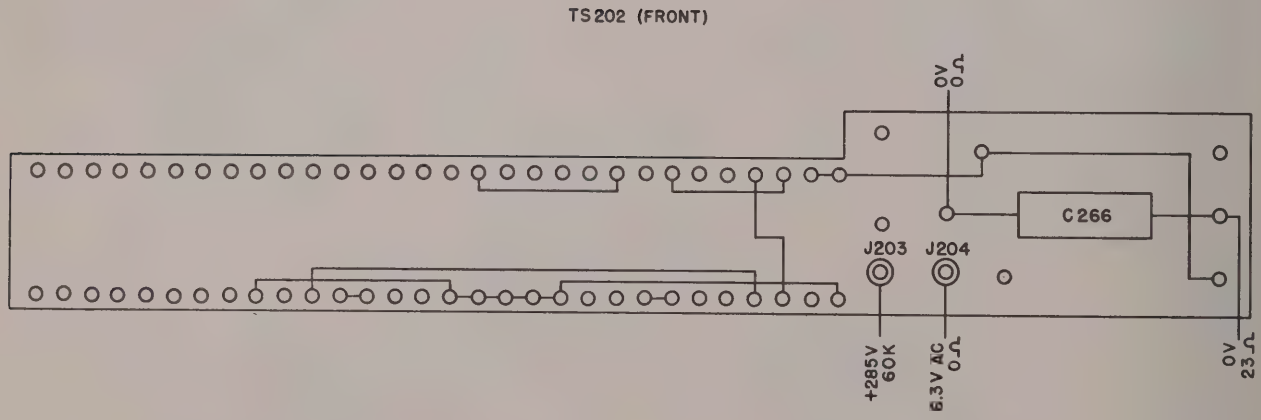
Figure 86. Radio Receiver R-368/FRC-6A, tube socket voltage and resistance diagram.



VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000 OHM - PER-VOLT METER WITH LINE VOLTAGE SET AT 110 VAC AS INDICATED BY METER M-2. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. K=1,000 OHMS. MEG=1,000,000 OHMS.

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Figure 87. Radio Receiver R-276A/FRC-6, resistor board diagram.

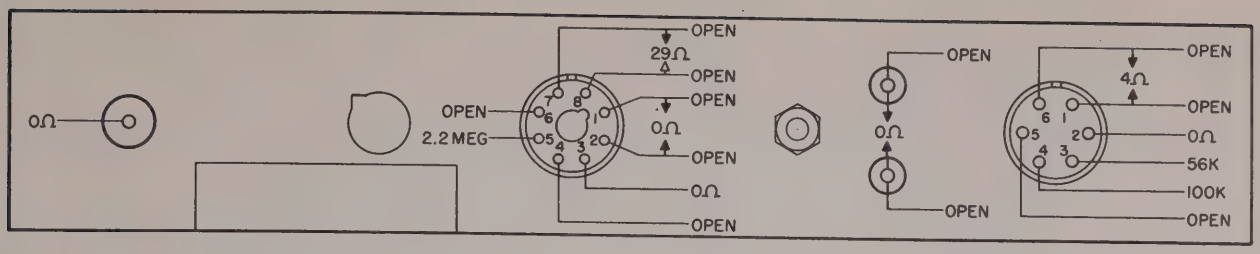


NOTES:

(A) RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110V AC AS INDICATED BY METER M2.
(B) SQUELCH CONTROL FULL CLOCKWISE.
(C) VOLUME CONTROL FULL CLOCKWISE.

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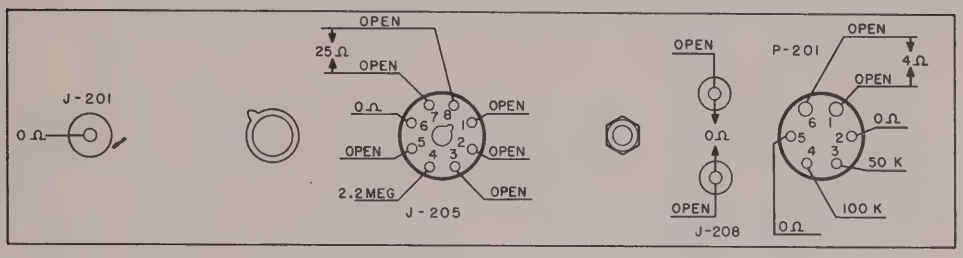
Figure 88. Radio Receiver R-368/FRC-6A, TS-202 (rear), resistor-capacitor board diagram.



ALL PLUGS AND CABLES REMOVED AND RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) EXCEPT WHERE OTHERWISE INDICATED. K=1,000 OHMS. MEG=1,000,000 OHMS

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Figure 89. Radio Receiver R-276A/FRC-6, connector resistance diagram.



NOTES:
ALL PLUGS AND CABLES REMOVED AND RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) EXCEPT WHERE OTHERWISE INDICATED. K=1,000 OHMS MEG=1,000,000 OHMS.

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Figure 90. Radio Receiver R-368/FRC-6A, connector resistance diagram.

107. Receiver Trouble Location Chart

Symptom	Probable trouble	Correction
1. Receiver dead	Main fuse or power supply fuses open	Replace fuses.
	Cables to control units or transmitter open.	Replace or repair cables and check wiring.
	Relay circuits defective	Repair relay circuits.
2. Power on receiver but no sound from speaker.	Tube V213 defective	Replace tube V213.
	Capacitor C265 shorted*	Replace capacitor C265.
	Inductor L204 open*	Replace inductor L204.
	Output transformer T209 defective	Replace transformer T209.
	Open voice coil in speaker	Replace speaker.
	Defective speaker switch S2	Replace speaker switch S2.
	Control cable to control unit open or defective.	Replace or repair cable and check wiring.
	Capacitor C262 open	Replace capacitor C262.
	Capacitor C263 open	Replace capacitor C263.
	Volume control R304 on radio set control defective.	Replace volume control.
	Defective power supply	Repair power supply.
3. Receiver operative but squelch inoperative.	Defective squelch control	Replace squelch control.
	Tube V212 defective	Replace tube V212.
	Noise amplifier or noise rectifier inoperative.	Repair noise amplifier or noise rectifier.
	Discriminator improperly alined	Realine discriminator circuit.

*Refers to Radio Receiver R-276A/FRC-6 only.

Symptom	Probable trouble	Correction
4. Low or no meter-reading on position 5.	Tube V209 defective	Replace tube V209.
	No output from the second limiter	Repair or realine the preceding stages and discriminator transformer.
5. Low or no meter reading on position 3.	Defective tube V208	Replace tube V208.
	No output from the first limiter	Repair and realine the preceding stages and discriminator transformer.
6. Low or no meter reading on position 2.	Tube V207 defective	Replace tube V207.
	Capacitor C238 shorted	Replace capacitor C238.
	No output from 455-kc amplifier	Repair or realine preceding stages and first limiter transformer.
7. Low or no meter reading on position 1.	Tube V206 defective	Replace tube V206.
	Capacitor C232 shorted	Replace capacitor C232.
	No output from converter tube V205	Repair or realine preceding stages.

108. Localizing Trouble in Radio Set Control

The radio set control (pars. 79–81) is located below the receiver in the rack. This unit serves as tie point between the transmitter and console and between the receiver and console. It also provides a fuse block to protect the main power entering the system, a relay (O 301) to switch from receive to transmit, an equalizer network and its control, a line input control, a squelch control, and a volume control. The transmitter circuits of the radio set control include relay O 301, LINE INPUT CONTROL, and EQUALIZER network. The receiver circuits include relay O 301, VOLUME control, and SQUELCH control. Localizing trouble in the radio set control can be accomplished by checking resistances and voltage readings against the values given in figures 93 and 94. The cover can be removed easily from relay O 301 for visual inspection.



Figure 91. Radio Set Control C–560(*)/FRC–6, top view.

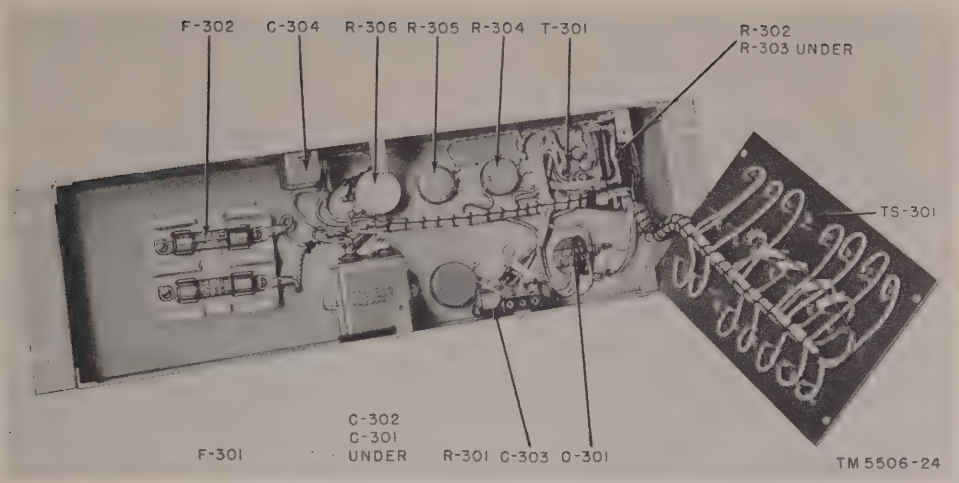
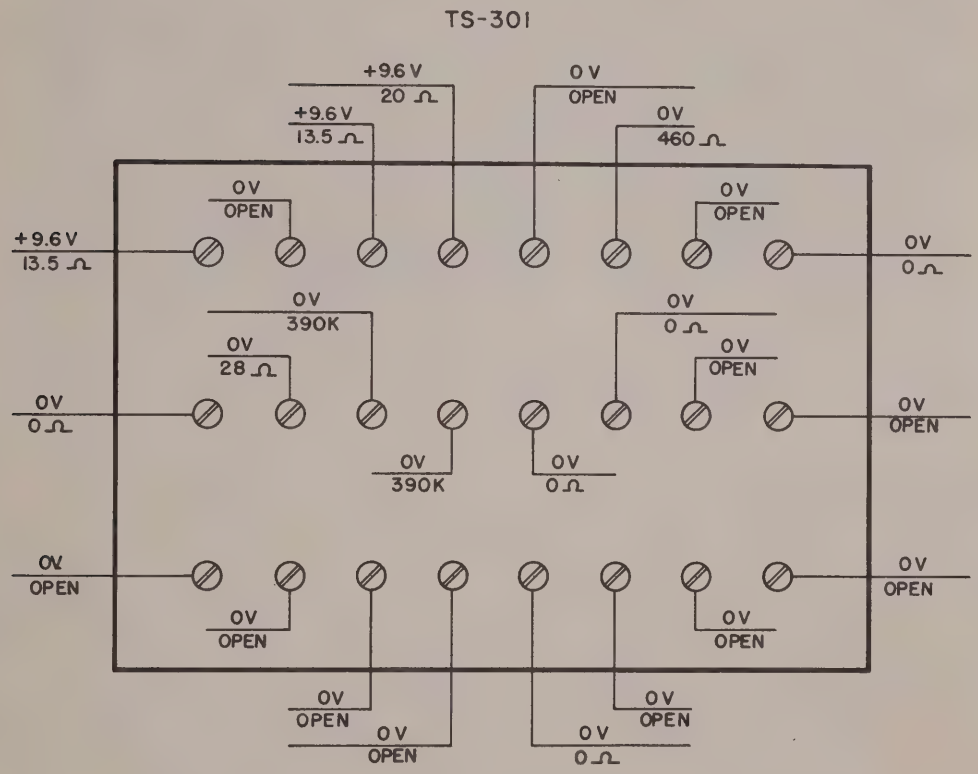


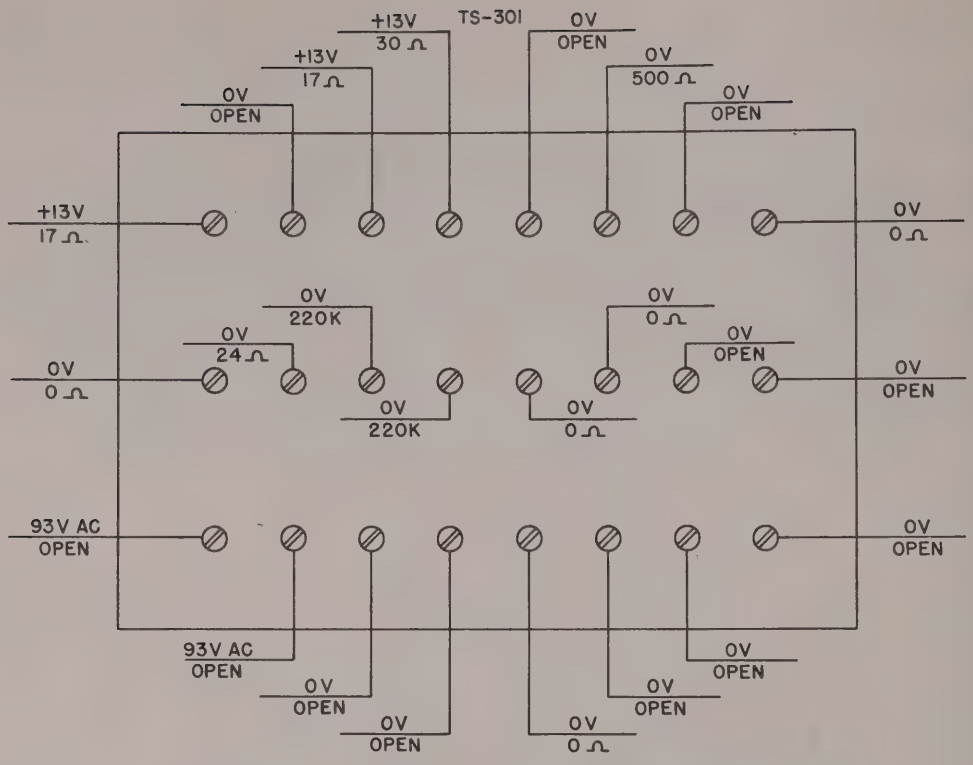
Figure 92. Radio Set Control C–560A/FRC–6, bottom view.



ALL MEASUREMENTS TAKEN WITH VOLUME CONTROL AT "HI", SQUELCH CONTROL AT "OFF," AND LINE INPUT CONTROL AT "HI"; ALL PLUGS, SOCKETS, TUBES, AND CABLES IN PLACE WITH RECEIVER OPERATING AND TRANSMITTER INOPERATIVE. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE OF 110V AS INDICATED ON METER M-2. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. K=1,000 OHMS.

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Figure 93. Radio Set Control C–560A/FRC–6, terminal board resistance and voltage diagram.



ALL MEASUREMENTS TAKEN WITH VOLUME CONTROL AT "HI", SQUELCH CONTROL AT "OFF", AND LINE INPUT CONTROL AT "HI"; ALL PLUGS, SOCKETS, TUBES AND CABLES IN PLACE WITH RECEIVER OPERATING AND TRANSMITTER INOPERATIVE. VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1000-OHM-PER-VOLT METER WITH LINE VOLTAGE OF 110V AS INDICATED ON METER M-2. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED.

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Figure 94. Radio Set Control C-560B/FRC-6, terminal board resistance and voltage diagram.

109. Radio Set Control Trouble Location Chart

Symptom	Probable trouble	Correction
1. Power supplied to the equipment but pilot lamps and tubes do not light.	Open fuses	Replace fuse or fuses.
	Poor or broken power cord	Repair or replace cord.
	Loose connections on fuse block	Clean and tighten connections on fuse block.
	Loose connections on terminal board TS301 on terminal screws 1 and 2.	Clean and tighten connections on terminals 1 and 2 on terminal board.
2. Receiver continues to operate after handset button has been depressed.	No voltage between lugs 7 and 8 on TS301 when handset button is depressed.	Repair broken line connections or repair the console.
	Open winding in relay O 301. Sticky relay O 301.	Repair or replace relay O 301.
	Open winding in transformer T301	Replace transformer T301.
3. Receiver and speaker in rack operate but no sound in speaker on console.	Defective console	Repair console.
	Open transformer T301	Replace transformer T301.
	Poor or dirty contacts in relay O 301	Clean contacts in relay O 301.
4. Audio signal on line from console but signal does not reach transmitter.	Open capacitor C304	Replace capacitor C304.
	Defective line input control	Replace line input control.
	Open winding in transformer T301	Replace transformer T301.
	Poor contacts or defective relay O 301	Repair or replace relay O 301.
	Poor contacts on terminal 7, 8, or 6 on terminal board TS301.	Clean and tighten terminals on terminal board.
5. Excessive hum on line between console and main unit.	EQUALIZER control not properly adjusted.	Adjust EQUALIZER control for minimum hum.
	Defective equalizer network	Replace equalizer network.

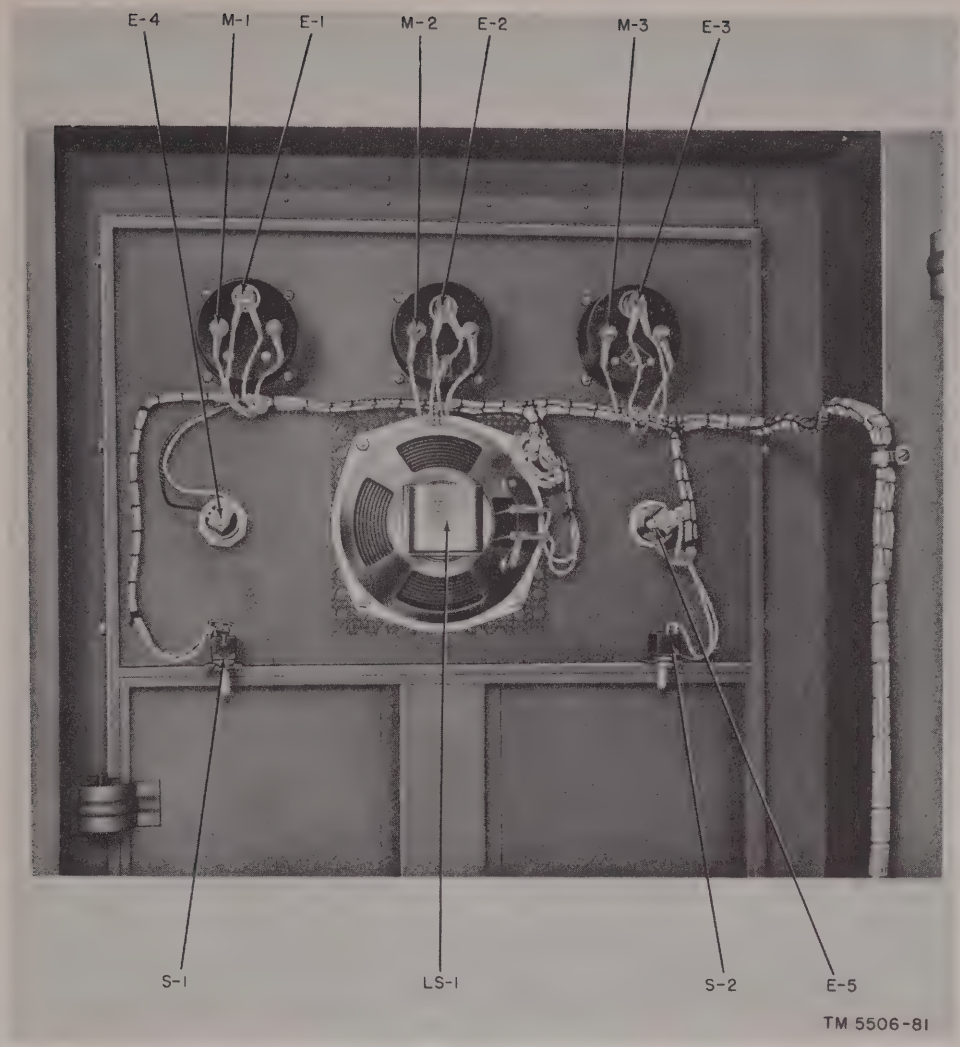


Figure 95. Radio Set AN/FRC–6, meter-speaker panel, rear view.

110. Localizing Trouble in Meter and Speaker Panel

(figs. 95 and 96)

The panel consists of interconnecting cables, three meters, and a speaker. Localize the trouble the trouble on this panel by a continuity check of the connecting cables. The meters can be checked by substituting a meter that is known to be good.

111. Localizing Trouble in Console Unit

(figs. 97–113)

The console (pars. 82–91) consists of a self-contained power supply, audio amplifier, tone oscillator, control circuits, and a handset. This unit permits the operation of the radio set at a remote position. This unit also facilitates the operation of two separate receivers jointly or one receiver alone, if desired. For localizing trouble in the console, the unit has been broken down into five sections: power supply, audio amplifier, tone oscillator, control circuits, and handset.

a. Power Supply. The power supply consists of power transformer T402, tube V404 (5Y3GT), two chokes L402 and L403, and two multiple section filter capacitors, C413 and C408. Trouble-shooting is as follows:

(1) Test the 5Y3GT or replace it with a tube known to be good.

(2) Check voltage at junction of L403 and R425. This voltage should be 280 volts dc.

(3) With the 5Y3GT removed, check the ac voltage between ground and pin 4 of V404 socket; measure between chassis and pin 6 of same socket. These two voltages should be about equal and

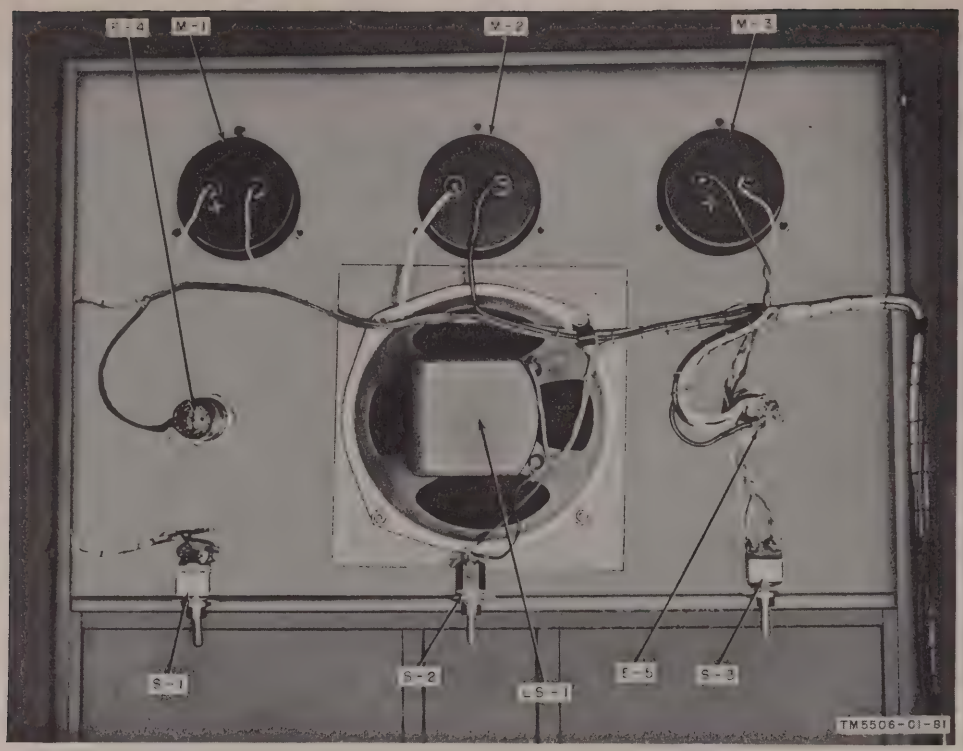


Figure 96. Radio Set AN/FRC–6A, meter-speaker panel, rear view.

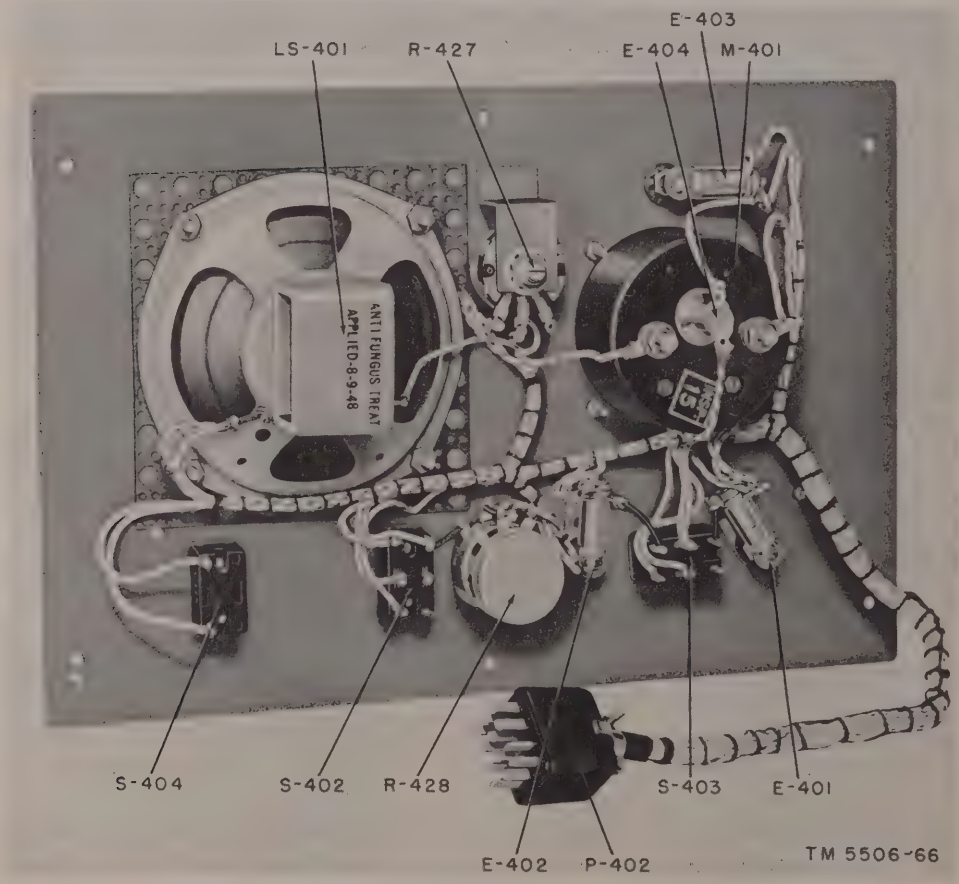


Figure 97. Console C–559A/FRC–6, front panel, rear view.

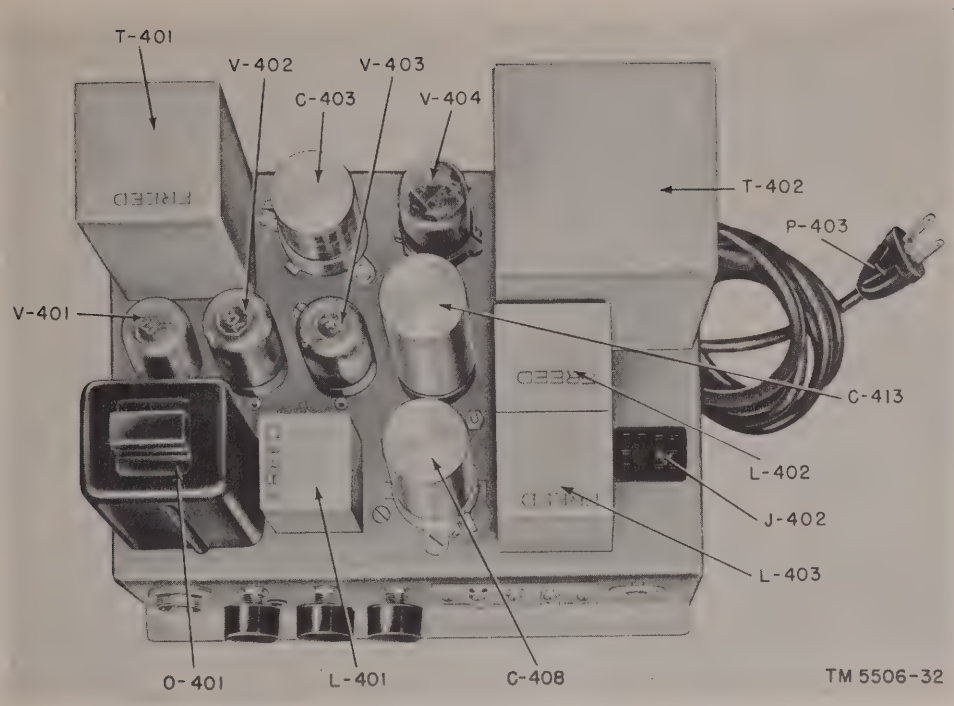


Figure 98. Console C–559A/FRC–6, top view.

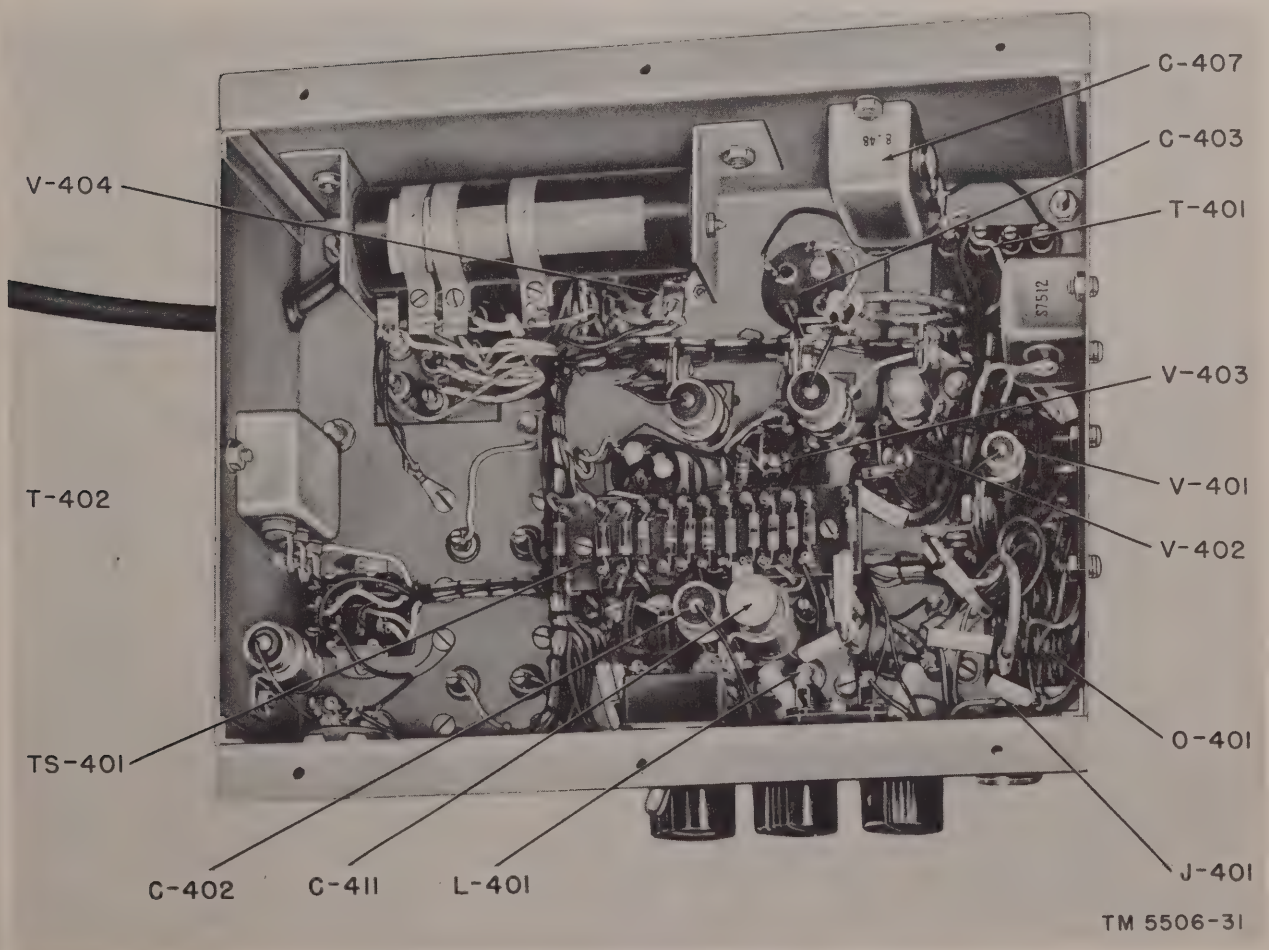


Figure 99. Console C–559A/FRC–6, bottom right view.

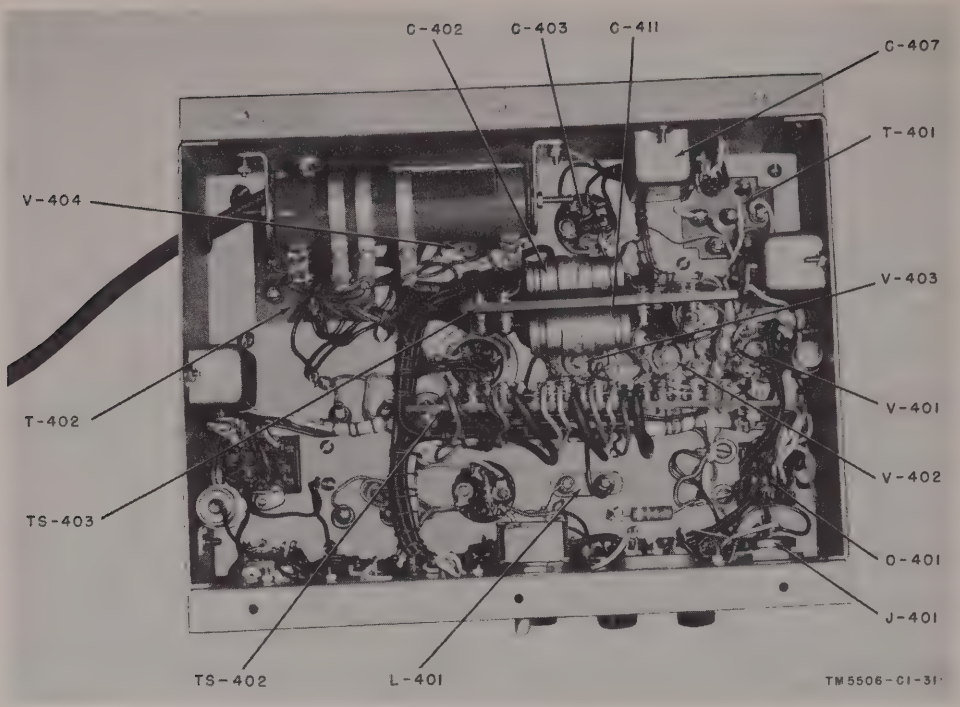


Figure 100. Console C–559B/FRC–6, bottom right view.

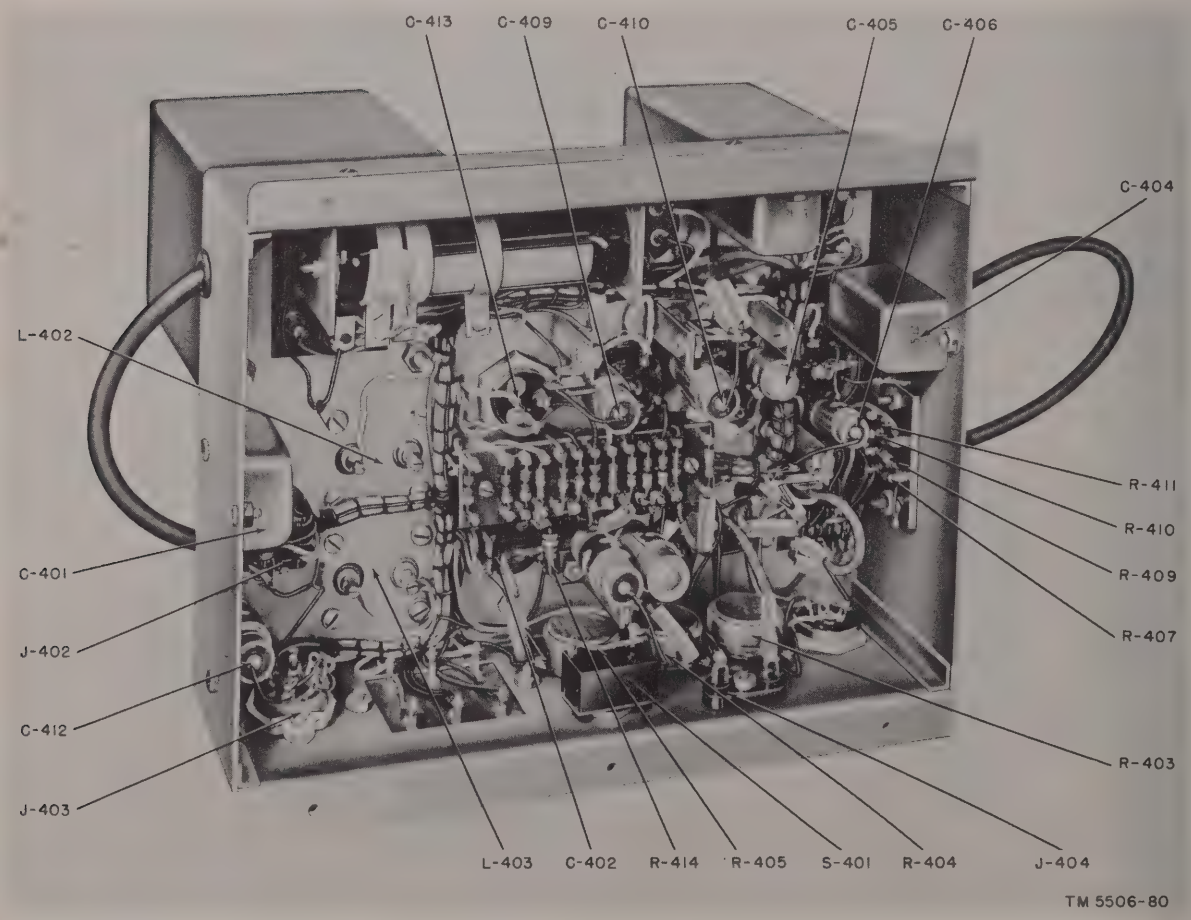


Figure 101. Console C–559A/FRC–6, bottom view.

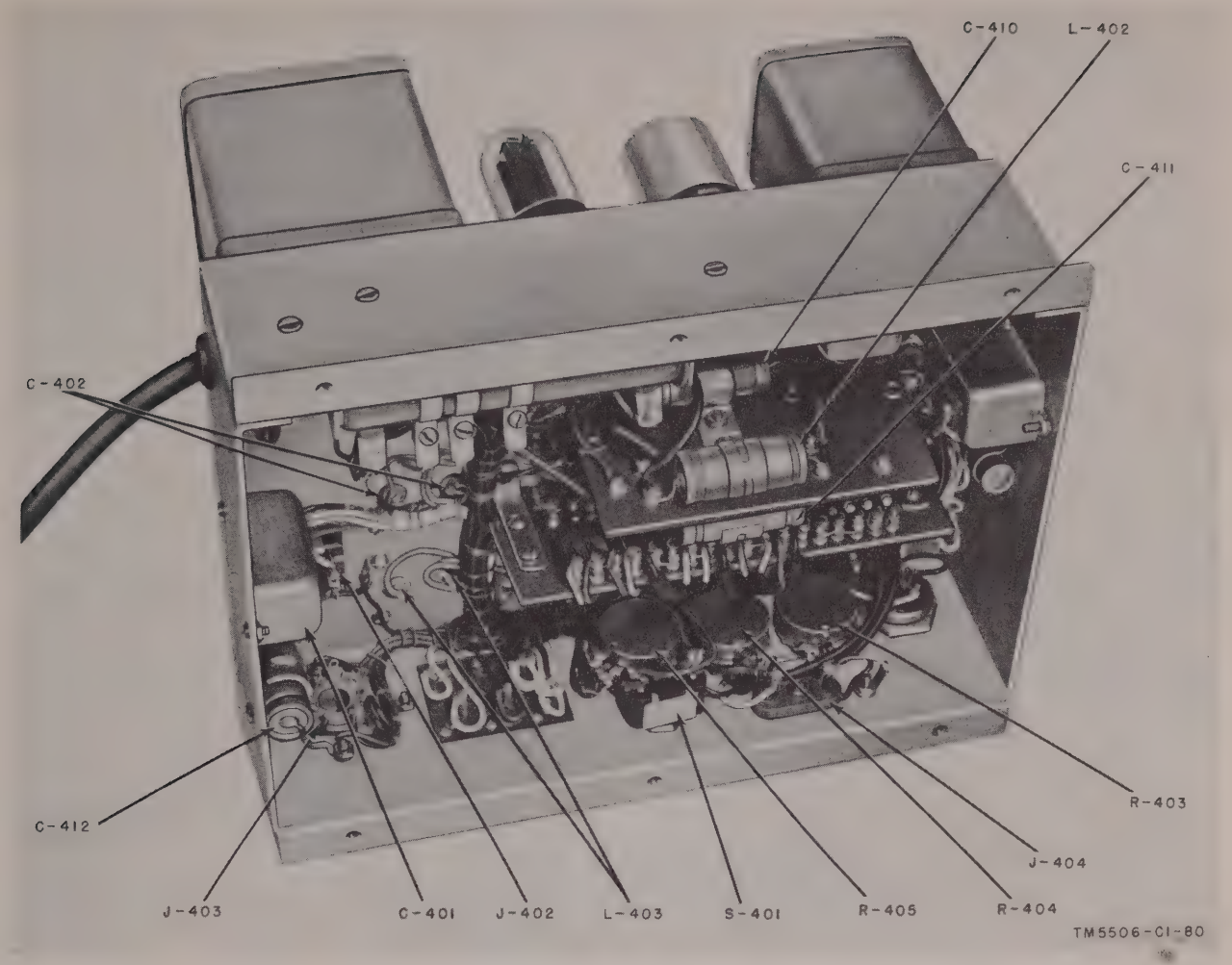


Figure 102. Console C-559B/FRC-6, bottom left view.

should read about 275 volts ac. Voltages much lower than this indicate a defective transformer T402.

(4) Check capacitors C408 and C413 for possible shorts.

b. Audio Amplifier. V401, first af amplifier, and V402, second af amplifier, together with output transformer T401, constitute the audio amplifier. When it has been established that the audio amplifier is at fault, the following troubleshooting procedures should be followed:

(1) Test tubes V401 and V402 in a tube tester or by substituting tubes that are known to be good.

(2) With the power off, make resistance measurements against data given in figures 103 through 105.

(3) With power on, make voltage measurements against data given in figures 103 through 105.

(4) If the above procedures fail to localize the fault, then it is necessary to make point-to-point signal tracing with an audio generator. When using the audio generator, be sure to insert a capacitor (about 0.1 microfarad) in the output lead of the generator to protect the audio generator against plate or B+ voltages. Turn the ON-OFF switch on the console to ON and the MUTE switch to the down (normal) position. Set the audio generator to about 400 cycles and connect the ground lead of the generator to the chassis of the console unit. Now with

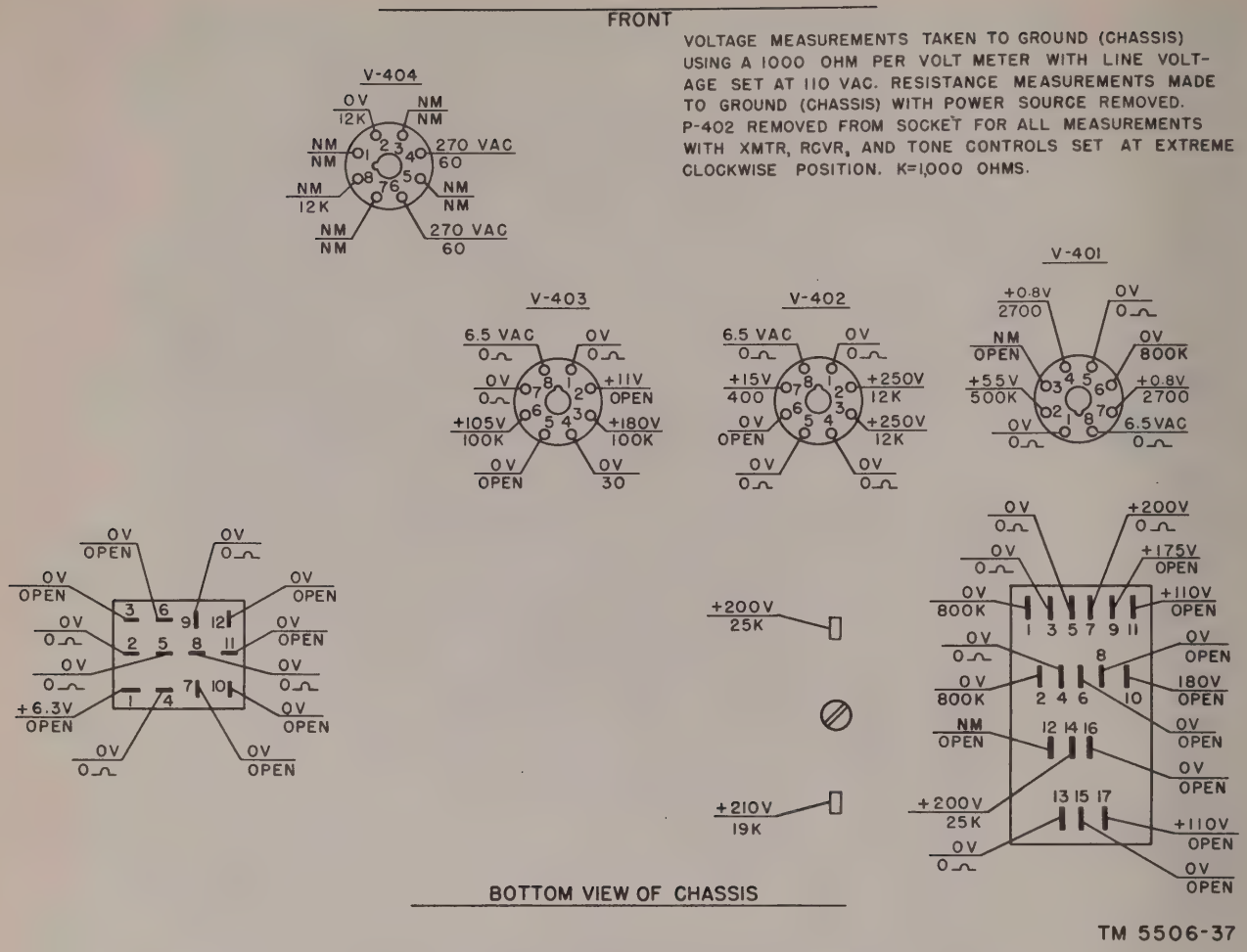


Figure 103. Console C–559A/FRC–6, tube socket voltage and resistance diagram.

the audio generator prod, start tracing the signal at the output transformer, T401, and then to V402, then to V401, and through relay contacts on O 401. The following defective parts will usually be found:

(*a*) Open windings in output transformer T401.

(*b*) Open capacitors C402 and C406.

(*c*) Open or corroded contacts on relay O 401.

(*d*) Open controls R403 and R404.

c. Tone Oscillator. Troubleshooting the defective tone oscillator can best be accomplished as follows:

(1) Test tube V403 in a tube checker or by replacement with a tube that is known to be good.

(2) Make resistance measurements against data given in figures 103 through 105.

(3) With power turned on, make voltage measurements of V403 against data given in figures 103 through 105.

(4) Check L401 for open circuit.

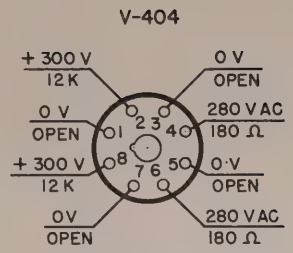
(5) By shunting with good capacitors, check C409, C410, and C411 for possible open circuits.

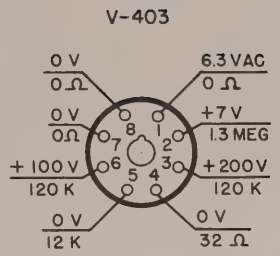
(6) Inspect for other possible causes of trouble, such as defective switch S404, poor connection of pin 1 in plug P402 or jack J402, and for defective TONE control R405.

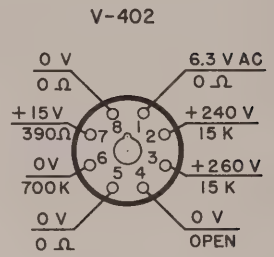
d. Control Circuits. The control circuits consist of relay O 401, switches, and pilot lights. Except for relay O 401, these controls are located on the front panel and the rear of the console chassis. Troubleshooting this phase of the console unit can be done by first finding which control fails to function properly and then tracing that particular phase of the circuit. Care and repair of the relay is described in paragraph 115.

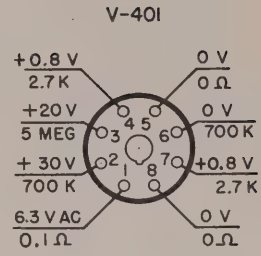
FRONT

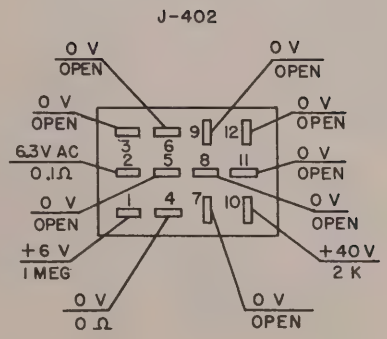
VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHMS-PER-VOLT METER WITH LINE VOLTAGE SET AT 110 V AC. RESISTANCE MEASUREMENTS MADE TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. P-402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH XMTR, RCVR, AND TONE CONTROLS SET AT EXTREME CLOCKWISE POSITION. K = 1,000 OHMS.



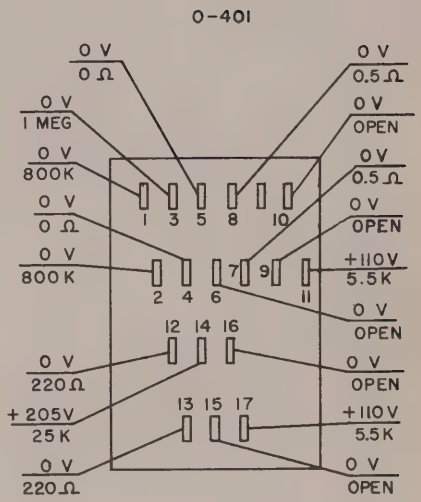












BACK

BOTTOM VIEW OF CHASSIS

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Figure 104. Console C-559B/FRC-6, tube socket voltage and resistance diagram.

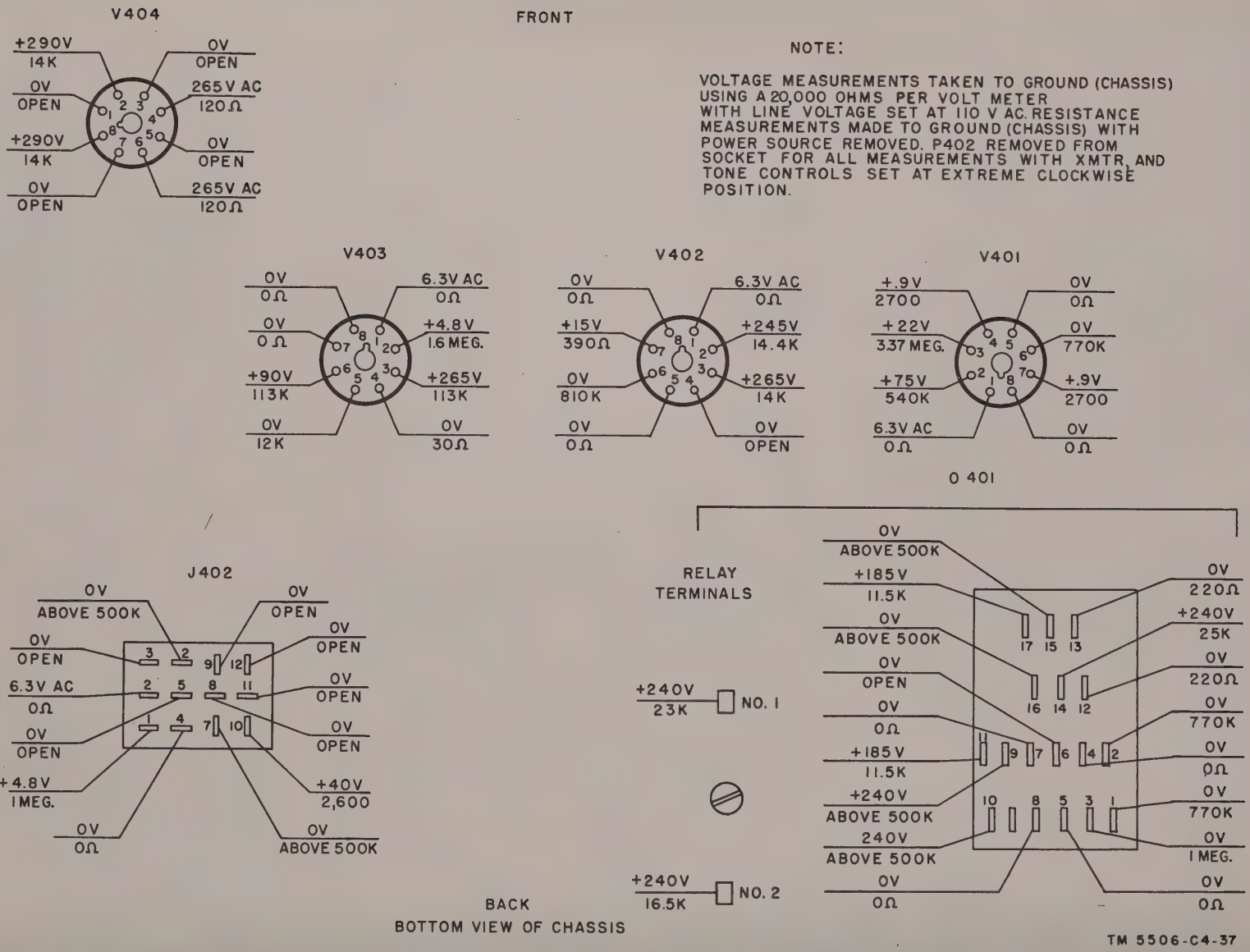
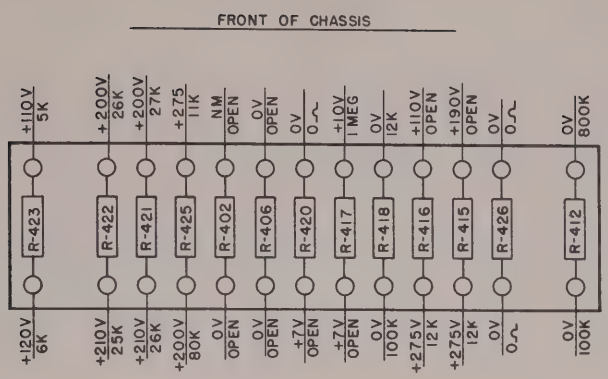


Figure 105. Console C-559D/FRC-6, tube socket voltage and resistance diagram.



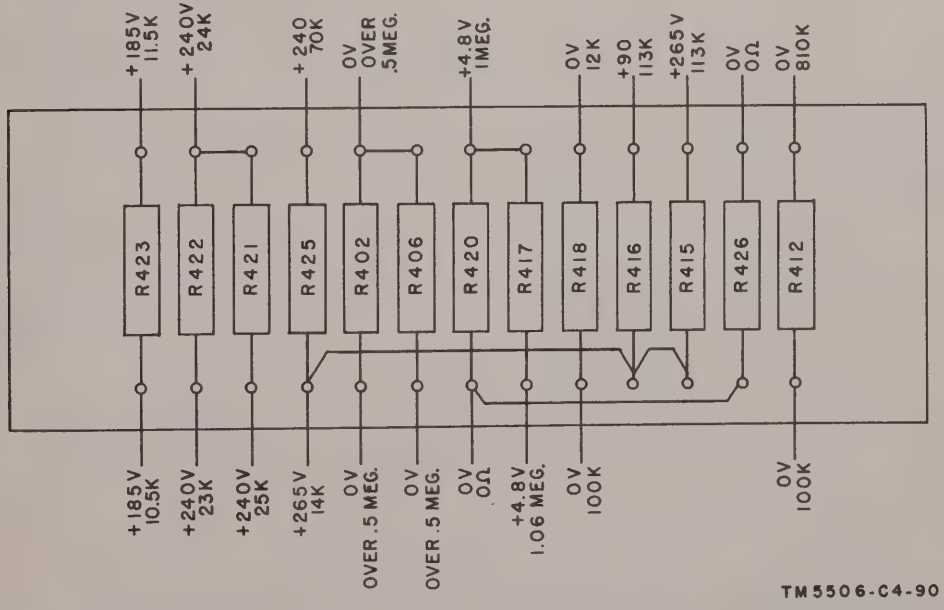
VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110V AC. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. P-402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH XMTR, RCVR, AND TONE CONTROLS SET AT EXTREME CLOCKWISE POSITION. K=1,000 OHMS. MEG=1,000,000 OHMS.

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Figure 106. Console C-559A/FRC-6, resistor board diagram.

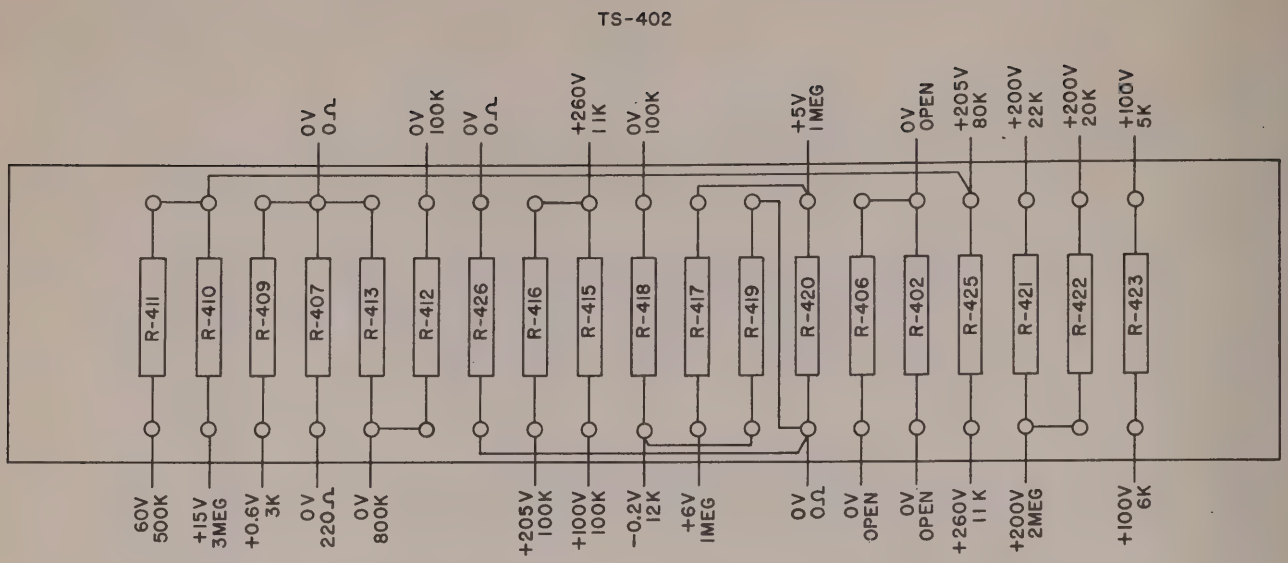
NOTE:

VOLTAGE MEASUREMENTS TAKEN TO CHASSIS USING A 20,000-OHM-PER-VOLT METER WITH LINE VOLTAGE AT 110 V AC. RESISTANCE MEASUREMENTS TAKEN TO CHASSIS WITH POWER SOURCE REMOVED. P402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS. TRANSMITTER, RECEIVER, AND TONE CONTROLS ARE SET AT EXTREME CLOCKWISE POSITION.



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Figure 107. Console C-559D/FRC-6, TB401, resistor board diagram.

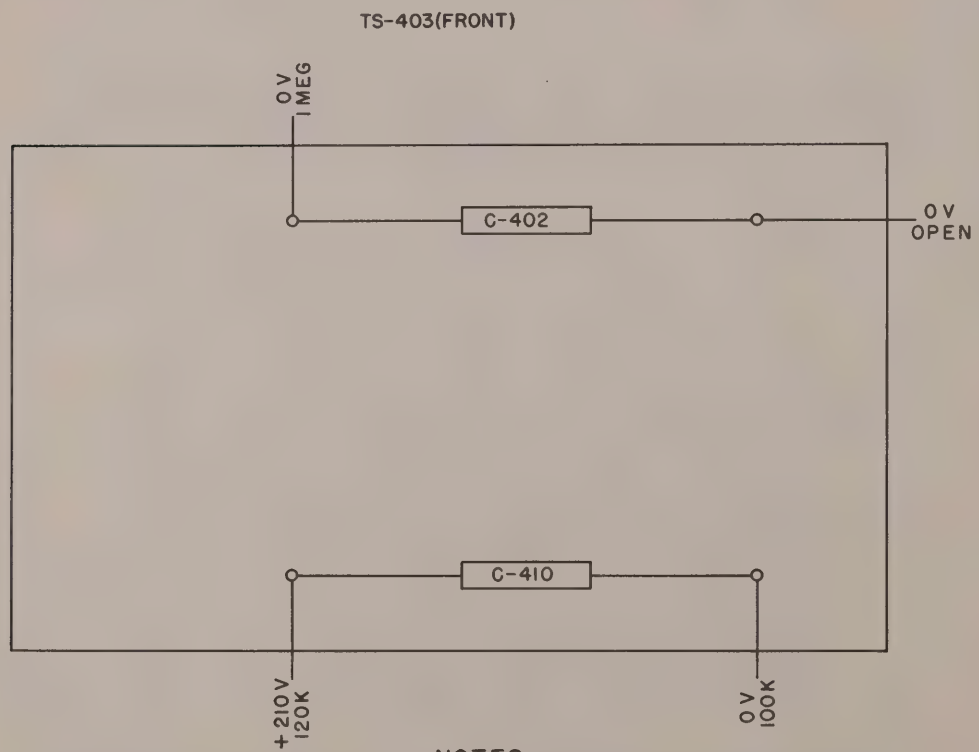


NOTE:

VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110 V AC. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. P-402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH XMTR, RCVR AND TONE CONTROLS SET AT EXTREME CLOCKWISE POSITION.

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Figure 108. Console C-559B/FRC-6, TS402, resistor board diagram.

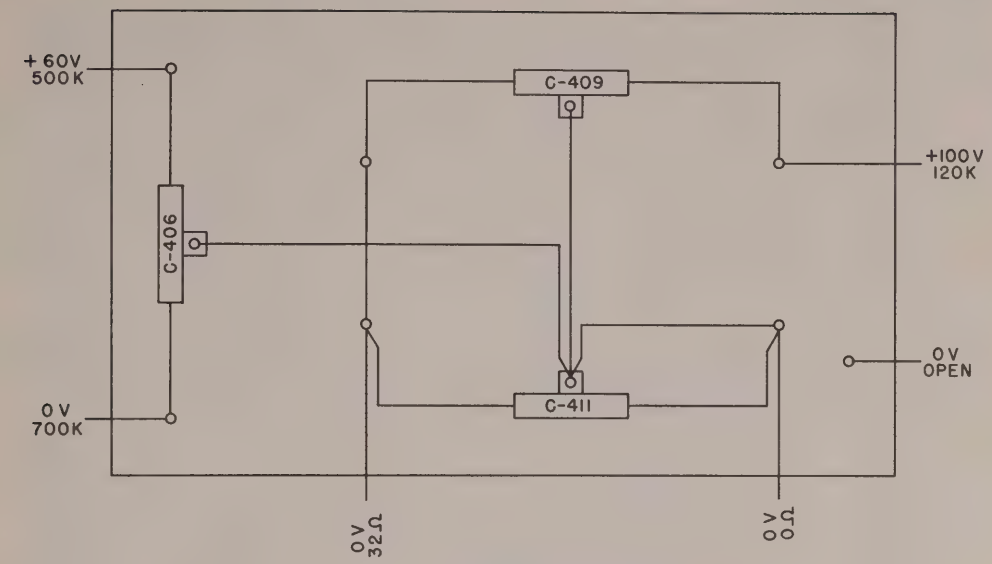


NOTES:

VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110 V AC. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. P-402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH XMTR, RCVR, AND TONE CONTROLS SET AT EXTREME CLOCK-WISE POSITION.
K=1,000 OHMS. MEG=1,000,000 OHMS.

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Figure 109. Console C-559B/FRC-6, TS403 (front), capacitor board diagram.



NOTE:
VOLTAGE MEASUREMENTS TAKEN TO GROUND (CHASSIS) USING A 1,000-OHM-PER-VOLT METER WITH LINE VOLTAGE SET AT 110 V AC. RESISTANCE MEASUREMENTS TAKEN TO GROUND (CHASSIS) WITH POWER SOURCE REMOVED. P-402 REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH XMTR, RCVR, AND TONE CONTROLS SET AT EXTREME CLOCK-WISE POSITION.

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Figure 110. Console C–559B/FRC–6, TS403 (rear), capacitor board diagram.

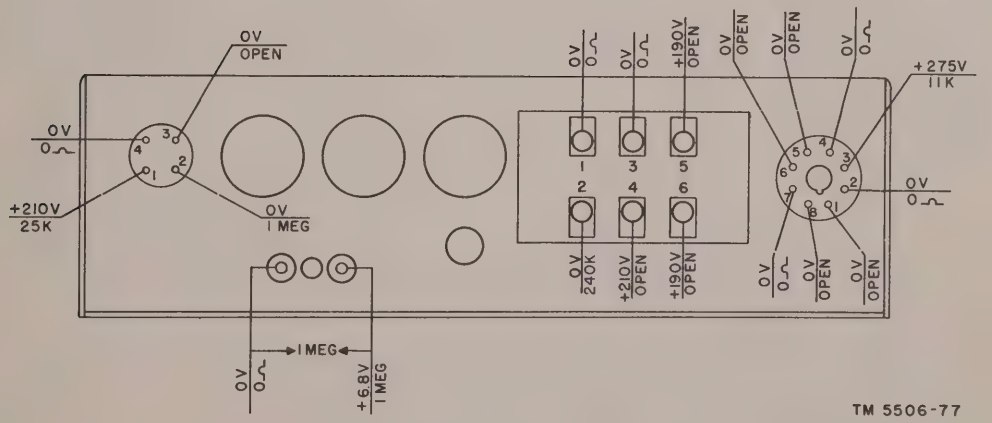


Figure 111. Console C–559A/FRC–6, connector voltage and resistance diagram.

e. Handset (fig. 114). The handset unit consists of a handset with switch earpiece control R429, switch S406, three resistors R430, R431, and R432, capacitor C414, and plug P401. Localizing trouble in this unit consists mainly of making continuity checks on cables, switches, and plugs.

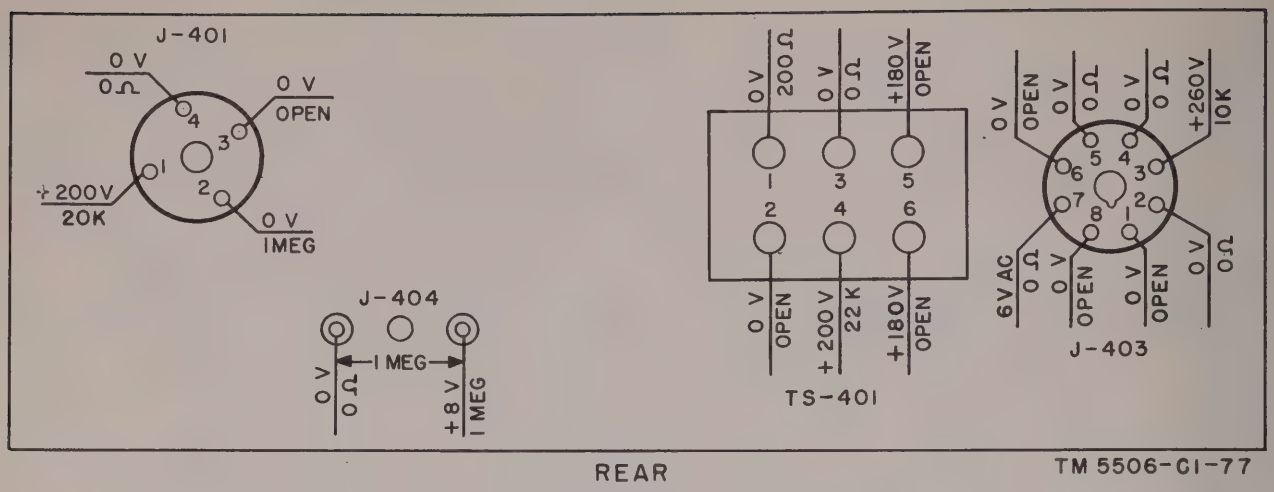


Figure 112. Console C–559B/FRC–6, connector voltage and resistance diagram.

NOTE:

VOLTAGE MEASUREMENTS TAKEN TO CHASSIS USING A 20,000-OHM-PER-VOLT METER WITH LINE VOLTAGE TAKEN AT 110 V AC. RESISTANCE MEASUREMENTS TAKEN TO CHASSIS UNLESS OTHERWISE SHOWN; VOLTAGE SOURCE IS REMOVED FOR ALL RESISTANCE MEASUREMENT. P402 IS REMOVED FROM SOCKET FOR ALL MEASUREMENTS WITH TRANSMITTER, RECEIVER, AND TONE CONTROLS SET AT EXTREME CLOCKWISE POSITION.

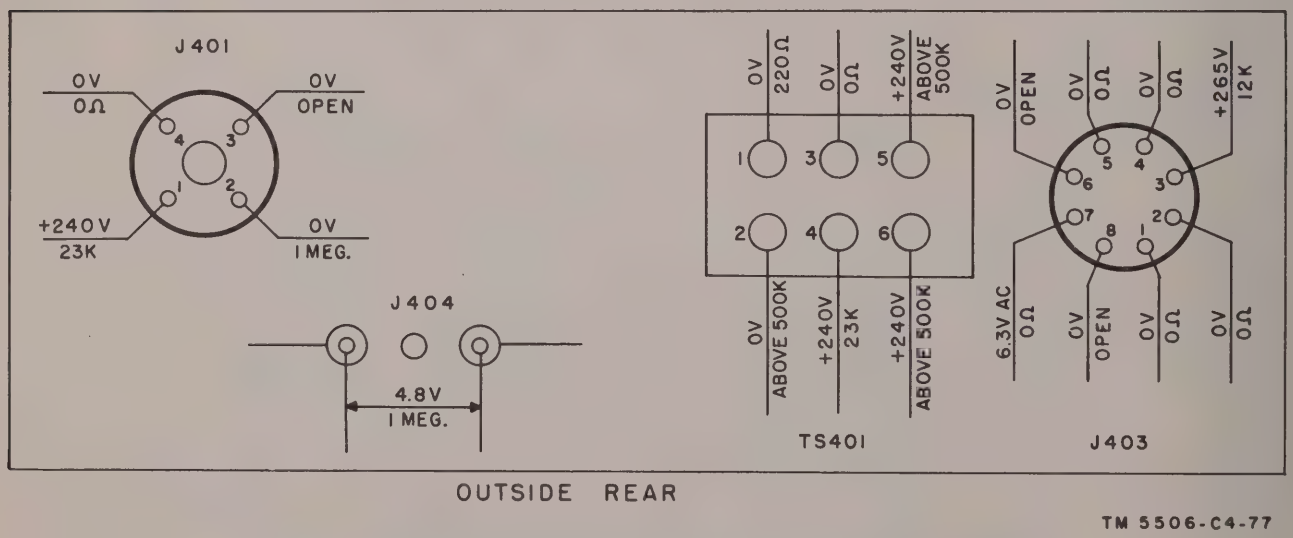


Figure 113. Console C–559D/FRC–6, connector voltage and resistance diagram.

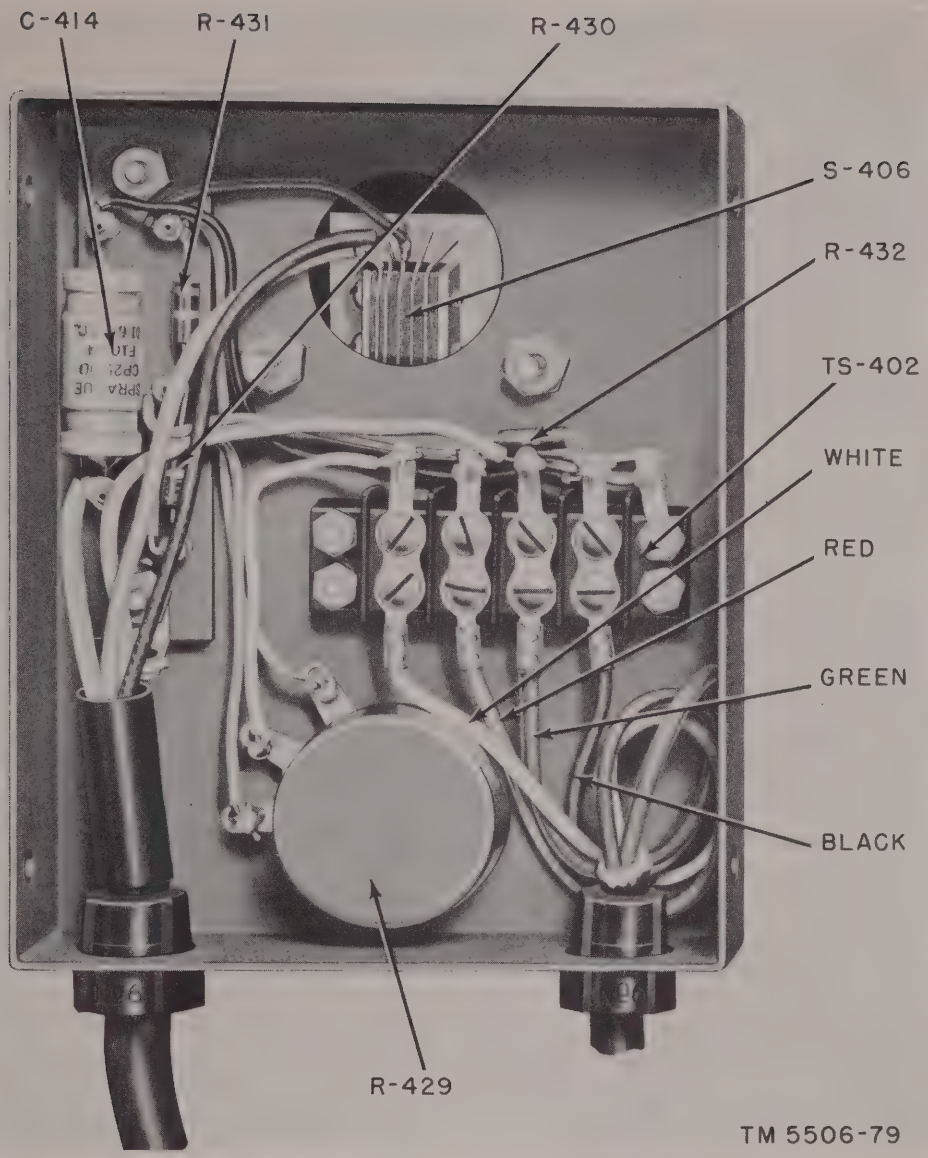


Figure 114. Handset and hanger box, rear view.

112. Console Trouble Location Chart

(figs. 97–113)

Symptom	Probable trouble	Correction
1. Power on, console MUTE switch in down (normal) position but no audio from receiver or no audio to transmitter.	Defective tubes	Test tubes; replace with good tubes (fig. 98).
	Defective line between console and main unit.	Repair line between console and main unit.
	Defective power supply	Repair power supply.
	Defective audio amplifier	Repair audio amplifier.
	Open resistor R424	Replace resistor R424 (fig. 107).
2. Receiver signal received, tone oscillator signal transmitted, but no voice transmittable from handset.	Defective tube V401	Replace tube V401.
	Dirty or corroded contacts in relay O 401.	Clean contacts on relay O 401.
	Bad connections in P401 or J401.	Repair connections in P401 or J401 (fig. 99).

Symptom	Probable trouble	Correction
	Open capacitor C406	Replace capacitor C406 (fig. 101).
	Defective handset microphone	Replace defective microphone.
	Defective handset cord	Repair or replace handset cord.
3. Transmitted signal normal, receiver in main unit normal, but no signal received from receiver in console.	Defective speaker	Replace speaker (fig. 97).
	Defective contacts on relay O 401	Clean relay contacts.
	Defective MUTE switch	Replace switch.
	Defective RCVR 1—RCVRS 1–2 switch, S403.	Replace switch.
	Defective RCVR control R404	Replace control (fig. 102).
	Open capacitor C402	Replace capacitor C402 (fig. 98).
4. Transmitted and received signals normal but no tone signal when TONE SIGNAL switch is depressed.	Defective tube V403	Replace tube V403.
	Open inductor L401	Replace inductor L401.
	Open capacitor C411, C409, or C410.	Replace defective capacitor (figs. 100 and 101).
	Defective TONE control R405	Replace TONE control.
	Defective TONE SIGNAL switch S404.	Replace switch S404.
	Poor connections of pin 1 in J402 or P402.	Clean or repair poor connection in P402 or J402 (fig. 98).

Section IV. REPAIR AND REFINISHING

113. Repair Procedures

a. Tagging Leads. Tagging leads are essential to assure that wiring is made correctly when a part is replaced. Before unsoldering leads from a terminal, tie all leads together that are attached to the terminal, and with small tags or short pieces of adhesive tape, identify the wire or group of wires by terminal number or by some other positive means. Before removing any connections, do this to all terminals that are to be stripped. Do not depend upon color coding of the leads or upon memory. Identify every lead that is to be removed.

b. Soldering. Removing the preservative coating that has been applied to all parts and connections is absolutely essential before any soldering is done. Before soldering any connections, carefully scrape all parts that will be touched by the solder. Even the small amount of varnish remaining on a wire or terminal will carbonize with the heat and create a defective soldered joint. Scrape the affected parts with a penknife, razor, file, or sandpaper until all traces of rust corrosion, paint or varnish are removed. Wipe the scraped parts clean with a dry, lint-free cloth.

c. Parts and Substitutions. When damaged parts must be replaced, identical parts should be used whenever possible. If identical parts are not available and the damaged component is beyond repair, a substitution must be made. The part substituted must have identical electrical properties and must be of equal or higher voltage and current rating. The physical size and location of mountings must be considered. Relocation of substituted parts is not recommended because unstable operation may result.

d. Mounting and Soldering. Locate the new or repaired part in the same position and, wherever possible, in the same mounting as that formerly occupied by the damaged part. Fasten all mountings securely. Tin all surfaces to be soldered. Wrap wires around the proper terminals for mechanical support. Solder each terminal with very little solder, and use sufficient heat to make the solder flow evenly around the tinned surfaces.

114. Refinishing

a. Panels and Painted Surfaces. The painted surfaces of the panels and cabinets may become scarred or scratched in transit or normal usage. Such damage should be repaired immediately to prevent further damage from rust or corrosion. Clean the immediate area thoroughly with No. 000 sandpaper until the bright surface of the metal is reached. Apply paint with a small brush until all the affected area is evenly covered.

b. Weatherproofing. Wherever a break occurs in the protective coating, such as when surfaces are scratched or scraped for repair to the equipment, the surface must be refinished (par. 50).

Section V. APPARATUS ADJUSTMENTS

115. Relays

A relay is considered normal if the following conditions exist: the exterior is free from dirt or dust; the contacts are not burned, pitted, or corroded; the contacts are lined up and correctly spaced; the moving parts travel freely and function satisfactorily; the connections to the relay are tight; the wire insulation is not frayed or torn; the relay assembly is securely mounted; and the field coil shows no signs of overheating. Inspect the relay for defects. Check the mechanical action of the relay to be sure that when the moving and stationary contacts come together they make positive contact and are directly in line with each other. If the contacts are dirty or corroded, clean them. To clean relay contacts, use a clean blade of a burnishing tool. Place the blade between the contacts of the relay, press the contacts together with slight pressure, and move the blade back and forth as necessary to obtain desired results. When contacts are sufficiently dirty to require further cleaning, remove remaining dirt with cleaning compound applied with a toothpick or similar material. Again burnish; use a clean blade of the burnishing tool. If a burnishing tool is not available, apply cleaning compound with a toothpick; then clean with the flat side of a clean dry toothpick or similar material. Dry and polish the contacts by drawing a strip of smooth, hard-finish paper between the contacts; apply slight pressure to press the contacts together. Do not use soft paper which will disintegrate and leave small particles on the contact surfaces.

116. Meters

Because meters are very delicate pieces of apparatus, do not attempt to take one apart for repair. If a meter is found sticky or defective, replace it with a new one. However, all meters should be checked to see that they zero-set properly. Do this by turning off all power to the equipment, and with a small screwdriver, adjusting the zero adjustment screws on the front face of each meter for a zero setting of the meter pointer. When replacing the bulb in an illuminated meter, be sure to use a bulb of the proper physical size.

Section VI. ALINEMENT

Caution: Because of the dangerous voltages existing in this equipment, be extremely careful not to touch the plate caps of the 807 tubes exposed inductance L106, or any other points where high voltage exists in the equipment.

117. Test Equipment Required

The following test equipments are required for alinement of Radio Set AN/FRC–6 (*).

Item	Technical manual
Signal Generator AN/URM–48	TM 11–1257.
Signal Generator AN/URM–25	TM 11–5551.
Audio Oscillator TS–382A/U	TM 11–2684A.
Voltmeter ME–30A/U	
RF Wattmeter TS–118/AP	TM 11–1036.

118. Transmitter

(figs. 65, 67, 77, and 78)

a. Preliminary Procedure.

(1) Determine the value of the crystal (Y101) to be used by dividing the desired carrier frequency by 32. For example: the carrier frequency to be used is 32.64 mc. The crystal to be used will be 32.64/32, which is 1.020 mc or 1,020 kc. Plug the proper crystal in its socket. If the operating frequency is between 30.0 and 33.0 mc, capacitor C102 must be connected across terminals 4 and 5 of T101. Set ANT. capacitor (C134) to three-fourths maximum capacity, and PLATE capacitor (C133) to one-half maximum capacity.

(2) Connect the proper tank coil (L106) in the power amplifier. Use the proper number of turns for the operating frequency as outlined below:

Frequency range (mc)	Number of turns
30.0–32.2	8
32.2–35.5	7
35.5–37.6	6
37.6–40.0	5

(3) Connect RF Wattmeter TS–118/AP or a dummy antenna to the transmitter at the antenna connector, J106. (A

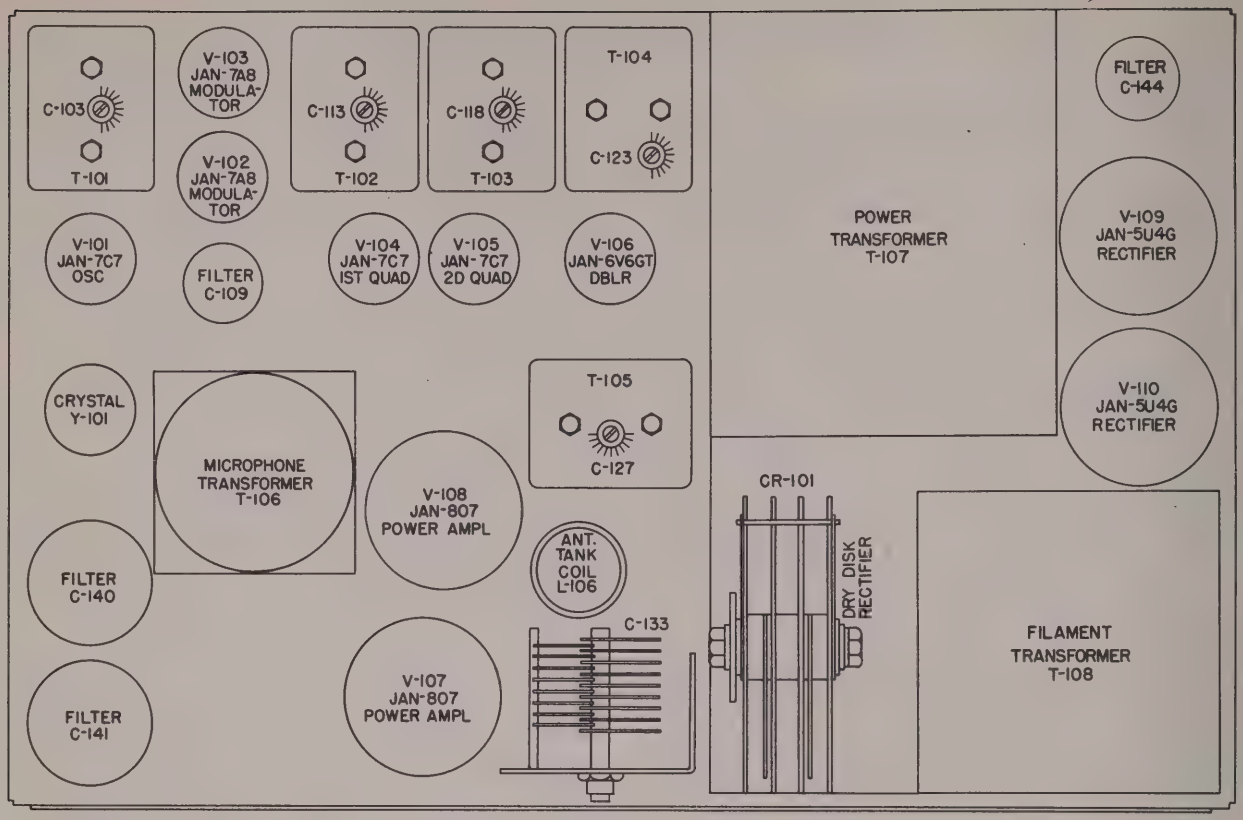
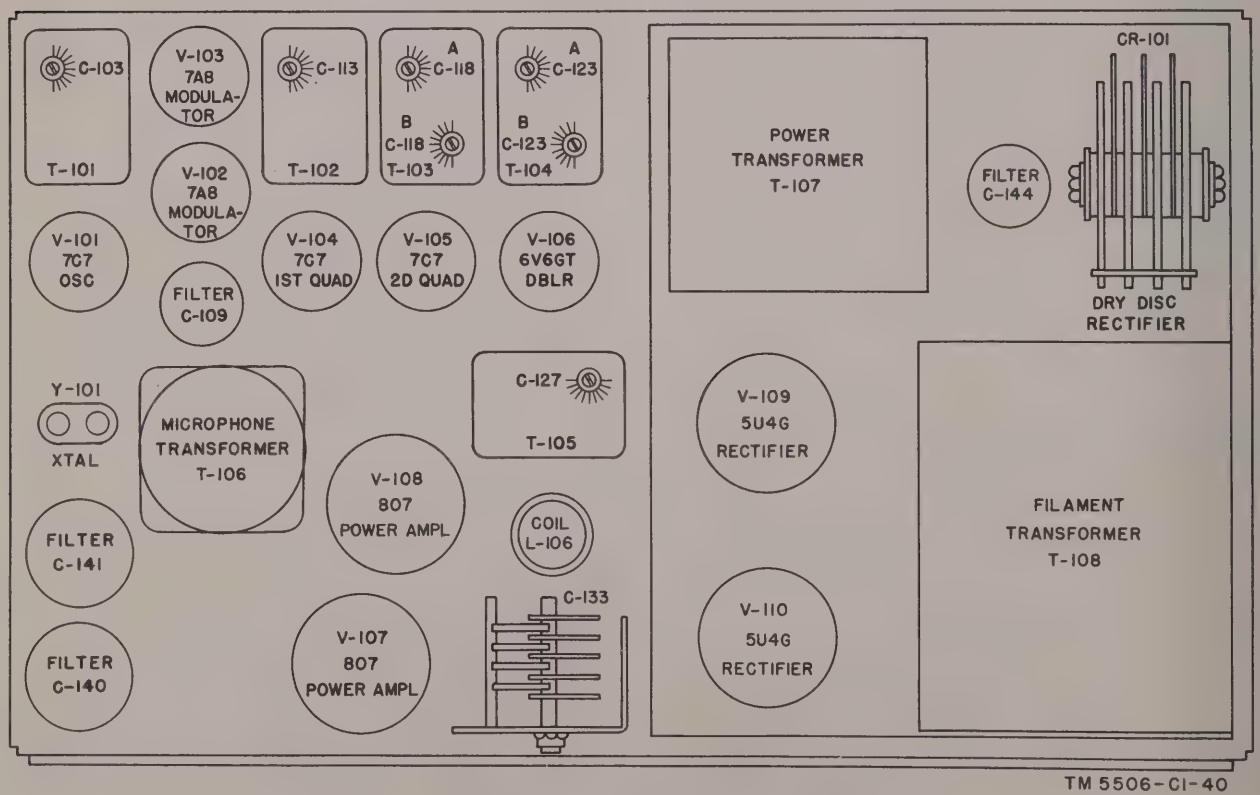


Figure 115. Radio Transmitter T–215A/FRC–6, component layout.

TM 5506-40



TM 5506-C1-40

Figure 116. Radio Transmitter T–264/FRC–6A, component layout.



Figure 117. Radio Transmitter T–215A/FRC–6, frequency control.

suitable dummy antenna may be made up of a noninductive ceramic resistor of approximately 75 ohms, capable of dissipating 50 watts, connected in series with an rf meter capable of reading 1.5 amperes. This dummy load is attached between antenna post J105 and the ground side of J105. Make the leads as short as possible.)

(4) Rough setting of the controls (fig. 117) should be made before the plate voltage is applied to the transmitter. Rotate capacitors C103, C113, C118, C123, and C127 so that the slot in the tuning shaft points to the carrier frequency. For example: the slot in the tuning shaft shown in figure 117 points to 32.8 mc. If the transmitter were to be alined on this frequency, all slots should be set on 32.8 as a rough setting. Make all tuning adjustments with a nonmetallic tuning tool.

b. Oscillator Alinement. Set the METER SWITCH (figs. 18–20) to position 1. Depress the press-to-talk button on the handset to apply plate voltage to the transmitter. Do not apply plate voltage for periods longer than 2 or 3 seconds or damage from excessive plate current in the 807 tubes may result. Rapidly tune C103 on T101 for maximum current as indicated on the transmitter tuning meter, M1 (figs. 16 and 17). Rotate the control slightly counterclockwise beyond the peak to assure stable operation and starting, causing a decrease of approximately 2 microamperes. Normal meter reading for position 1 of the METER SWITCH is 28 microamperes.

c. Modulator Alinement. Set the METER SWITCH to position 2. Tune the modulator output to the same frequency as the crystal by tuning C113 on the top of T102 for maximum deflection of meter M1. The meter should read approximately 29 microamperes.

d. First Quadrupler. Set the METER SWITCH to position 3. Tune the plate circuit to four times the frequency of the modulator stage by tuning C118 on top of T103. Tune for maximum deflection of meter M1. If the carrier frequency is near the edge of the band, a second peak will be found by rotating C118 over its entire tuning range. The correct peak, however, is that which occurs when the slot in the tuning shaft points more nearly to the correct carrier frequency as plotted in figure 117. Normal meter reading is 43 microamperes.

e. Second Quadrupler. Set the METER SWITCH to position 4. Tune the output circuit to a frequency 4 times the frequency of the first quadrupler, or 16 times the crystal frequency. Turn C123 on the top of T104 for maximum reading on meter M1. By rotating C123 180°, several peaks will be observed. The correct peak is that at which two conditions exist: highest meter deflection and the slot in the shaft points nearest to the rough setting for the carrier frequency. Normal meter reading is 15 microamperes.

f. Doubler. Set the METER SWITCH to position 5. The output of the doubler is to be tuned to a frequency twice the output of the second quadrupler, or 32 times the crystal frequency. As with the previous stages, tune C127 on the top of T105 so that maximum reading on M1 is obtained and the slot falls near the rough setting for the carrier frequency. A calibrated wavemeter held in the vicinity of the bases of the 807 tubes will greatly assist in the selection of the proper peak to use. Be careful not to keep the plate voltage applied for more than short periods of 2 or 3 seconds. The normal meter reading is 32 microamperes.

g. Power Amplifier. Set the METER SWITCH to the P. A. position. Operate the meter reversal switch (figs. 16 and 17) to the forward position. Use a screwdriver of suitable size and adjust the ANT. capacitor, C134, to maximum capacity. Operate the press-to-talk switch and quickly ad-

just the PLATE capacitor, C133, for minimum reading on meter M1. Reduce the capacity of C134 slightly and readjust C133 for minimum reading. Continue reducing the capacity of C134 in small steps; each time readjust C133 for minimum reading until meter M1 reads about 30 microamperes. The meter in the dummy antenna should now read more than 0.8 amperes. Disconnect the dummy antenna and connect the antenna system. Retune the ANT. and PLATE capacitors, if necessary, to obtain a reading of 30 microamperes on meter M1. Be sure that the PLATE capacitor is tuned for a minimum reading on meter M1.

h. Typical Transmitter Meter Readings.

METER SWITCH position	Circuit	Alinement control	Meter reading
1	Oscillator grid current	T101	28
2	First quadrupler grid current	T102	29
3	Second quadrupler grid current.	T103	43
4	Double grid current	T104	15
5	Power amplifier grid current	T105	32
P. A.	Power amplifier cathode current.	Plate	30
MOD.	Modulator grid current	---	35

Note. Slight deviations from these figures are permissible; however, any deviation of more than 20 percent should be considered as sufficient cause for realinement or possible tube replacement.

119. Receiver

(fig. 79)

On the control unit, turn the VOLUME control two-thirds clockwise and the SQUELCH control completely counterclockwise.

a. Crystals. Select the proper crystals for the operating frequency as derived from the following formulas:

(1) The frequency of the hf oscillator crystal, Y201, is determined by the operating frequency. For operating frequencies between 30 and 37 mc, subtract 4.3 mc from the operating frequency and divide by 4. The fourth harmonic will be used to mix with the incoming signal to produce a 4.3-mc signal. For operating frequencies between 37 and 40 mc, subtract 4.3 mc and divide by 5. The fifth harmonic mixed with the incoming signal will produce a 4.3-mc signal.

(2) The converter crystal, Y202, must be ground to either 4.755 mc or 3.845 mc, which are the sum and difference, respectively, of the two intermediate frequencies, 4.3 mc and 455 kc. Either crystal beating against 4.3-mc signals will produce a 455-kc signal.

b. 455-kc Amplifier and Limiters. Use a 0.05 microfarad (μf) capacitor in series; apply 455 kc between the grid cap of V205 and ground. Set the METER SWITCH to position 2, and with a nonmetallic tuning rod, adjust C226 on the top of T205, and C236 and C233 on the top of T206, respectively, for maximum deflection of tuning meter M3. Set the METER SWITCH to position 3 and tune C242 and C239 on the top of T207 for maximum deflection of the meter. Repeat the tuning outlined above; decrease the generator output as required to insure sharp tuning at the peaks. An input signal of approximately 350 microvolts should provide a meter indication of 15 microamperes on meter M3.

c. Discriminator. With the 455-kc generator coupled to the grid of V205 through a 0.05-μf capacitor as in *b* above, increase the input to 10,000 microvolts. Set the METER SWITCH to position 5. Set C246 on the top of T208 to minimum capacity (counterclockwise), and set C250 also on the top of T208 to maximum capacity (clockwise). Rotate C246 clockwise to the peak current indicated on M3. Observe the reading and continue clockwise rotation until the meter deflection drops to a value two-thirds of the observed peak value. Set the METER SWITCH to position 4. Rotate C250 counterclockwise until the meter indicates zero. A check of correct tuning may be made by checking the current value with the signal generator set on 440 kc and again on 470 kc. The two values should be equal and of opposite polarity. For one of the readings, the leads to M3 must be reversed to obtain an up-scale indication. Normal current for these two readings is 28 microamperes.

d. 4.3-mc If Amplifier. Set the METER SWITCH to position 2. Apply a 4.3-mc signal through a 0.05-μf capacitor to the grid (pin 4) of V203. Adjust the tuning of the signal generator slightly for maximum indication on M3. This compensates for minor discrepancies in the crystal frequencies. Tune capacitors C217 and C213 on the top of T203, and C224 and C220 on the top of T204 for maximum deflection of M3. An input signal of approximately 8 microvolts should indicate 15 microamperes on M3.

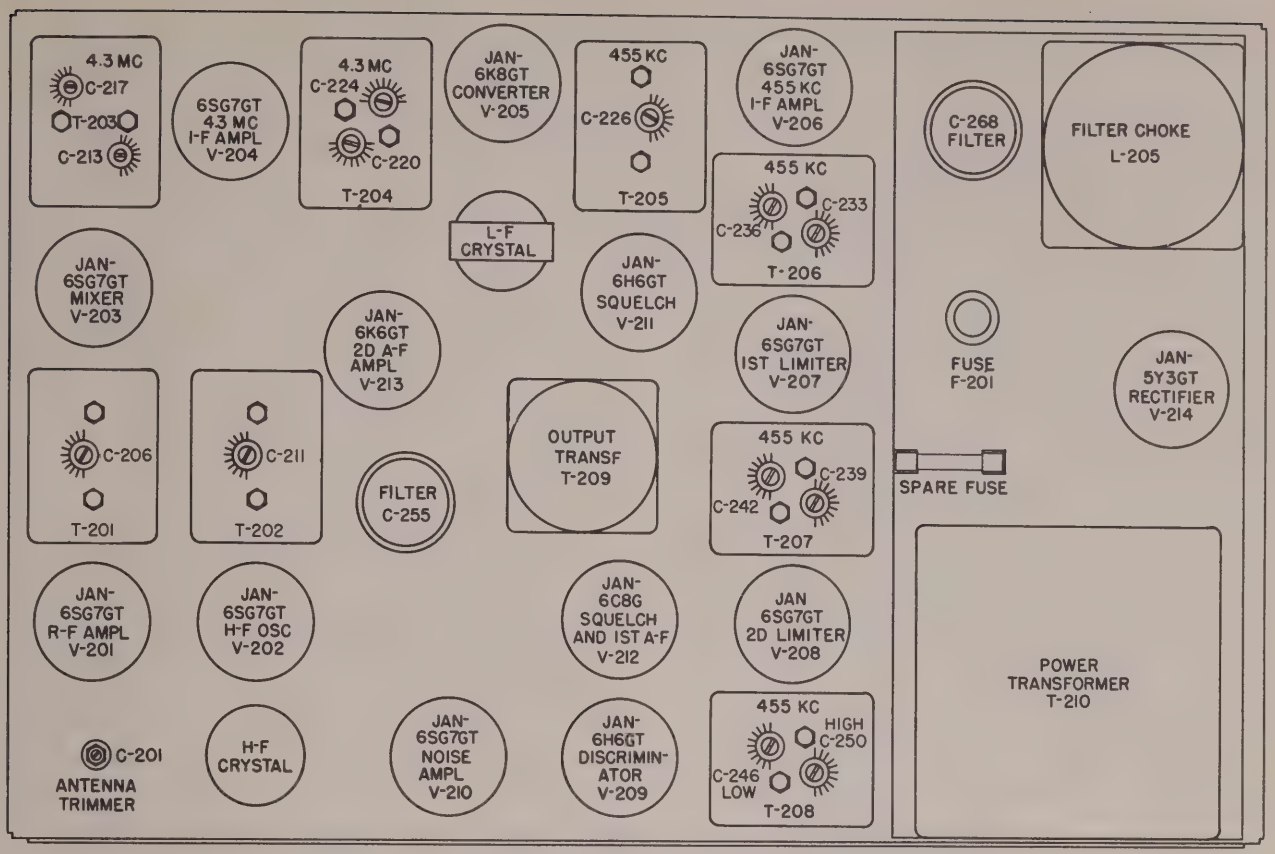
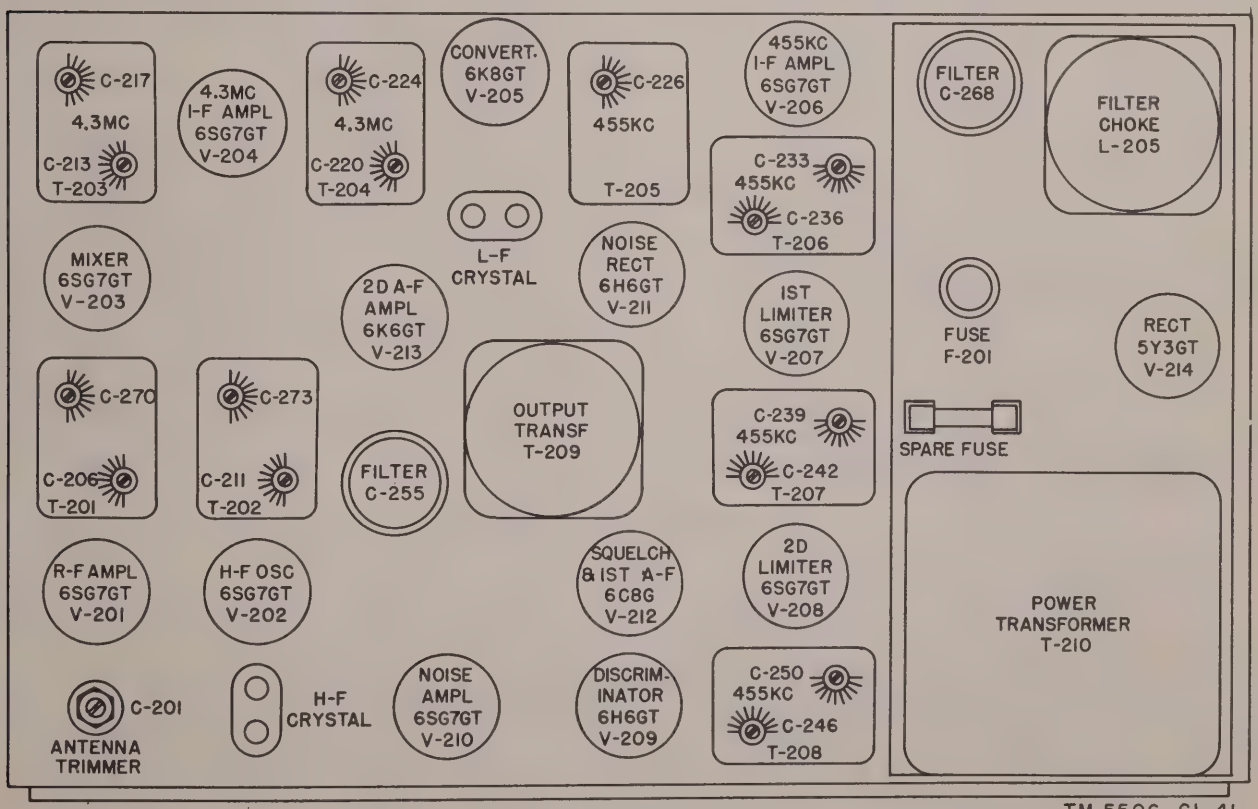


Figure 118. Radio Receiver R-276A/FRC-6, component layout.

TM 5506-41



TM 5506-C1-41

Figure 119. Radio Receiver R-264/FRC-6A, component layout.

e. Rf Circuits. Set the METER SWITCH to position 2. Connect the hf generator directly to the antenna receptacle, J201. Make the leads as short as possible, and be sure the shield of the cable is well-grounded to the chassis. Set capacitor C206 on the top of T201 and C211 on the top of T202 to the approximate setting for the operating frequency as described in paragraph 118*a*(4). With the signal generator set on the desired operating frequency, readjust the generator tuning slightly one way or the other for maximum deflection of M3. Tune C296, C211, and antenna trimmer capacitor C201 for maximum deflection of M3. As tuning progresses, decrease the output of the signal generator until final readjustment of C206, C211, and C201 are made with a signal input of 1 microvolt or less. Improper tuning of C206 and C201 to a harmonic of the oscillators is evidenced by a steady reading of the meter which does not decrease as the desired signal is decreased. Realinement is necessary.

f. Typical Receiver Meter Readings.

METER SWITCH position	Circuit	Alinement control	Meter reading
1	455-kc if. amplifier grid current.	T203	15
2	First limiter grid current	T204 T205 T206	
3	Second limiter grid current.	T207	15
4	Discriminator (high)	T208	0
5	Discriminator (low)	T208	(*c* above)

Note. Slight deviations from these figures are permissible however, any deviation of more than 10 percent should be considered as sufficient cause for realinement or possible tube replacement.

120. Alinement With a Test Transmitter

Connect the antenna. With an unmodulated signal from a distant transmitter being received, retune the discriminator in accordance with paragraph 119, except that the received signal substitutes for the use of the 455-kc signal generator. After the discriminator is alined, set the METER SWITCH to position 2 and retrim C201 and the capacitors on T201 through T206 for maximum indication on M3. Set the METER SWITCH to position 3 and trim the capacitors on T207 for maximum deflection of M3. The receiver is now in exact alinement with the test transmitter. If the unmodulated carrier of the test transmitter drifts off frequency, an indication of approximately 2 microamperes per kilocycle of drift would be indicated on M3 with the METER SWITCH in position 4.

121. Equalizer

The equalizer is designed for maximum attenuation of the low frequencies to compensate for the normal attenuation of the high voice frequencies by the line. Depress the press-to-talk button on the handset and speak into the microphone in a normal voice so that peak values of 0 are indicated by the decibel meter on the remote control unit. Starting at the extreme counterclockwise position, rotate the slotted shaft of the EQUALIZER adjustment clockwise to that point at which the voice sounds most natural and understandable as heard at a receiving point. This setting should not be changed unless the length or characteristics of the line are changed.

122. Audio Input Level

The correct setting of the LINE INPUT CONTROL is determined by listening tests. With the press-to-talk switch depressed, talk into the microphone loud enough to cause the decibel meter to read zero on peaks. The LINE INPUT CONTROL should be rotated counterclockwise just to, but not beyond, that point at which the received volume at the distant receiver starts to drop. No further adjustment should be made except when the characteristics or length of the control line is changed.

Section VII. FINAL TESTING

123. Preliminary Tests

The preliminary tests on Radio Set AN/FRC–6 consist of visual, mechanical, and electrical tests and inspection of all components to insure that no damage will be incurred when the power is turned on in the completely assembled equipment. This means careful inspection of all parts that have been replaced or repaired, checking for good mechanical mounting of parts and good electrical soldered connections. Make sure that placement or movement of parts, lugs, or wires has not developed any electrical shorts that may do further damage when the power is turned on in the equipment. Check all mounting screws for secure mounting of receiver, transmitter, radio set control, and meter-speaker panel. Inspect all inter-

connect cables in the main unit, making sure that all have been properly inserted into their respective sockets and connectors. Make sure the antenna connector is wired to a suitable antenna or proper dummy load. Check wiring between the main unit and the console. Make sure the handset plug is inserted into the console.

124. Final Testing Procedures

Final testing is performed on the equipment after repair to assure that the equipment will operate properly. After reassembly and after preliminary tests are made on the equipment, turn on the power and observe all meters for possible excessive current flow; inspect the underside of the chassis for any possible overheating of components. When everything appears normal, realine the transmitter and receiver by following the procedures given in paragraphs 117 through 122.

a. Equipment Required for Final Testing.

Item	*Technical manual*
Signal Generator AN/URM–25	TM 11–5551
Signal Generator AN/URM–48	TM 11–1257
Audio Oscillator TS–382A/U	TM 11–2684A
RF Wattmeter TS–118/AP	TM 11–1036
Voltmeter ME–30A/U	

b. Receiver Tests.

(1) *Sensitivity.*

(*a*) Turn the power on to the receiver and allow a 10-minute warmup period.

(*b*) Inject a test signal into the ANTENNA jack of the receiver (0.35 microvolts modulated ±15 kc modulated at 400 cycles per second).

(*c*) Measure the power output across the 3-ohm winding of the output transformer.

(*d*) Remove the modulation from the test signal and again measure the power output.

(*e*) Note the ratio of the two power outputs.

(*f*) Make the above measurements with carrier frequencies of 30, 35, and 40 mc.

(*g*) Check the results with the chart in paragraph 125.

(2) *Intermediate-frequency bandwidth.*

(*a*) Inject an unmodulated 4.3-mc signal through a blocking capacitor, into the control grid of the mixer tube.

(*b*) Measure the amount of signal needed to produce a reading of 15 microamperes (μa) on M3 with the METER SWITCH set to position 1.

(*c*) Increase the output of the signal generator to twice the value noted in (*b*) above and detune the signal generator until meter M3 again reads 15 μa.

(*d*) The frequency change made in (*c*) above is the if. bandwidth two times down.

(*e*) Increase the output 1,000 times and again retune the signal generator until the meter again reads 15 μa.

(*f*) Check these readings against the chart in paragraph 125.

(3) *Frequency response.*

(*a*) Inject a 10-μv voice-frequency (vf) signal (30–40 mc) into the ANTENNA jack of the receiver and tune the receiver to the signal.

(*b*) Set the modulation to ±15 kc deviation cycles per second (cps) and adjust the VOLUME control until the output as measured across the 3-ohm winding is 1 watt.

(*c*) Keep the input signal set at 10 μv and the deviation at ±15 kc and record the output from the output transformer at the following frequencies: 150 cps, 400 cps, 1,000 cps and 2,500 cps.

(*d*) Check the results with the chart in paragraph 124.

(4) *Audio distortion.* Inasmuch as high-fidelity reception is not required for the AN/FRC–6, a listening test is usually sufficient.

(5) *Squelch.* With zero signal being fed into the receiver, adjust the SQUELCH control until the receiver noise just disappears. Inject just enough signal into the receiver to activate the receiver and check the level of signal with the chart in paragraph 125.

c. Transmitter Tests.

(1) *Modulation sensitivity.* A sufficient modulation check can be made by listening to the signal from the transmitter, on a receiver.

(2) *Power output.* Power output is measured by RF Wattmeter TS–118/AP. In the absence of this equipment, power may be measured by connecting a 75-ohm, 50-watt resistor, in series with a 0–1.5 rf ammeter across the ANTENNA terminals and using the formula I^2R.

d. Systems Tests. With the transmitter, receiver, radio set control, console, and antenna properly connected, make systems checks as follows: with the power turned on in the equipment, check to see whether the following conditions exist:

(1) The green pilot light is lighted.
(2) The red pilot light is lighted when the microphone button is pressed.
(3) The transmitter delivers power if the microphone button is pressed.
(4) The receiver is rendered inoperative when the microphone button is pressed.
(5) The VOLUME control decreases the noise level to zero.
(6) The SQUELCH control quiets the receiver with no signal coming in.
(7) A tone signal is present when the TONE SIGNAL switch is held in the on position.
(8) All meters in the main unit and the console function properly.
(9) All controls on the front panel and back of the console are operating properly.
(10) Meter reversal switch and speaker switch on the meter-speaker panel of the rack are functioning properly.

125. Standards of Final Test

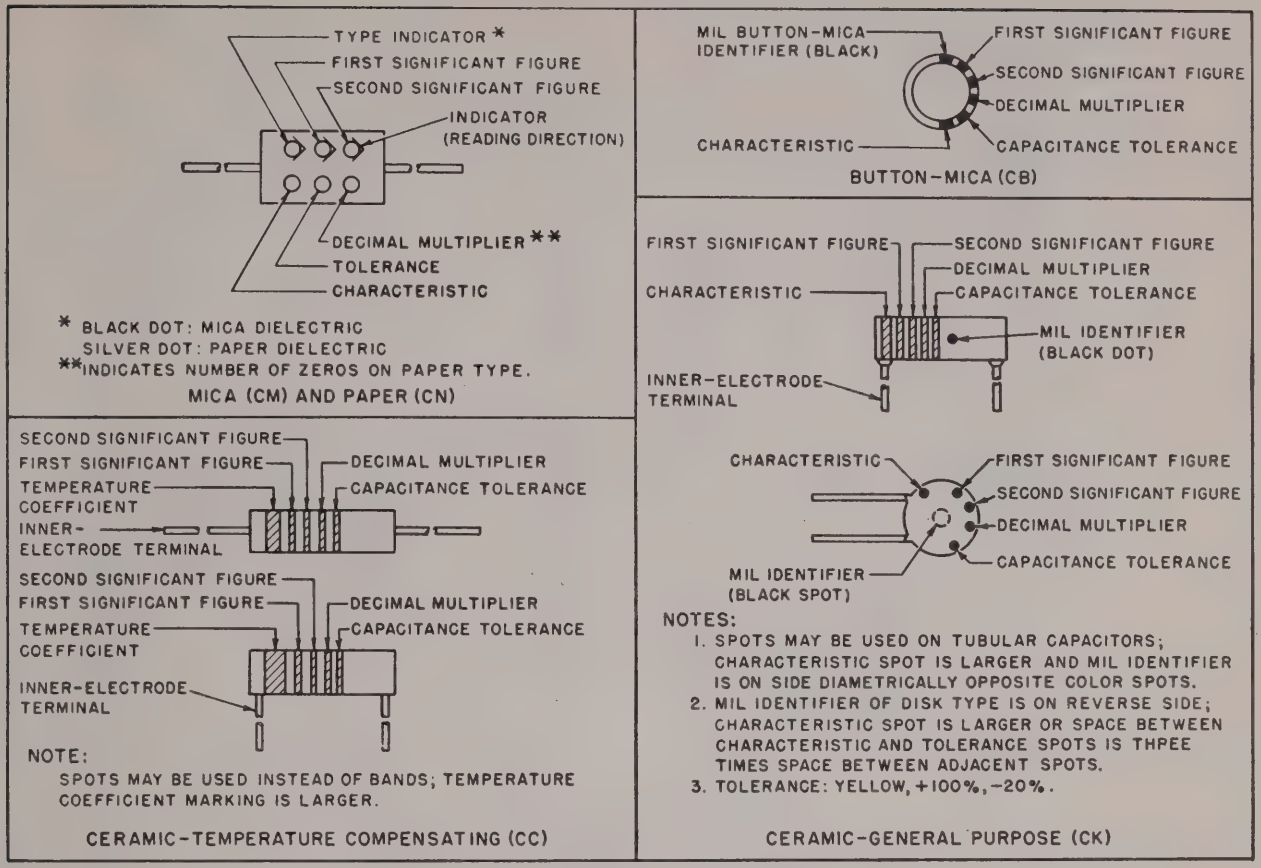
a. Receiver.

Test	Requirements to be met
Sensitivity	Output signal-plus-noise to noise ratio of not less than 10 db.
If. bandwidth	Shall be ±15 kc deviation at the points of 2 db attenuation and shall not be greater than 107 kc at the 60-db points.
Frequency response	The overall audio response from 400 to 3,000 cps shall be within ±3db of the response at 1,000 cps. The response shall attenuate rapidly above 3,500 cps and below 300 cps.
Audio distortion	At 1 watt, output shall have 10 percent or less distortion.
Squelch	A 0.2-microvolt signal should open the squelch at minimum. At least 0.6 microvolt should open the squelch at maximum.

b. Transmitter.

Test	Requirements to be met
Modulation sensitivity	Shall be capable of a frequency deviation of ±15 kc from the nominal carrier frequency, using a modulating frequency of 2,500 cps.
Power putput	The power output should not be less than 50 watts over the frequency range of 30 to 40 mc.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



CAPACITOR COLOR CODE

COLOR	SIG FIG.	MULTIPLIER		CHARACTERISTIC[1]				TOLERANCE[2]					TEMPERATURE COEFFICIENT (UUF/UF/°C)
		DECIMAL	NUMBER OF ZEROS	CM	CN	CB	CK	CM	CN	CB	CC		
											OVER 10UUF	10UUF OR LESS	CC
BLACK	0	1	NONE		A			20	20	20	20	2	ZERO
BROWN	1	10	1	B	E	B	W				1		-30
RED	2	100	2	C	H		X	2		2	2		-80
ORANGE	3	1,000	3	D	J	D			30				-150
YELLOW	4	10,000	4	E	P								-220
GREEN	5		5	F	R						5	0.5	-330
BLUE	6		6		S								-470
PURPLE (VIOLET)	7		7		T	W							-750
GRAY	8		8			X						0.25	+30
WHITE	9		9								10	1	-330(±500)[3]
GOLD		0.1						5		5			+100
SILVER		0.01						10	10	10			

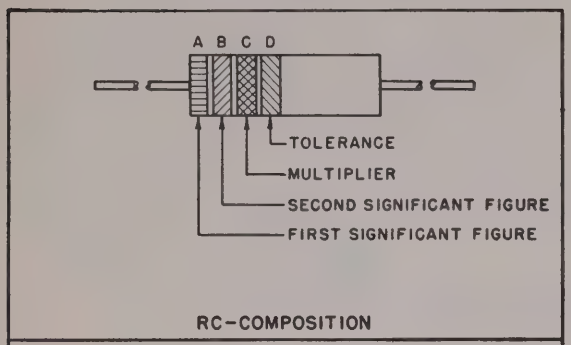
1. LETTERS ARE IN TYPE DESIGNATIONS GIVEN IN MIL-C SPECIFICATIONS.
2. IN PERCENT, EXCEPT IN UUF FOR CC-TYPE CAPACITORS OF 10 UUF OR LESS.
3. INTENDED FOR USE IN CIRCUITS NOT REQUIRING COMPENSATION.

STD-CI

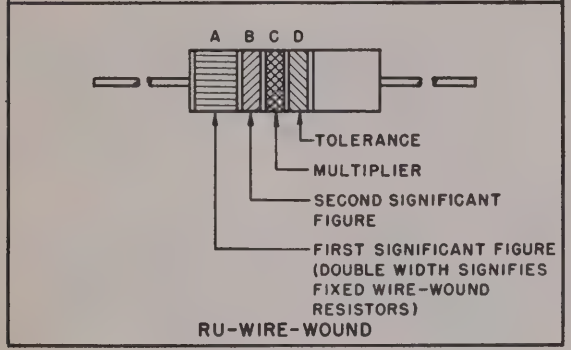
Figure 120. MIL STD capacitor color code.

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)

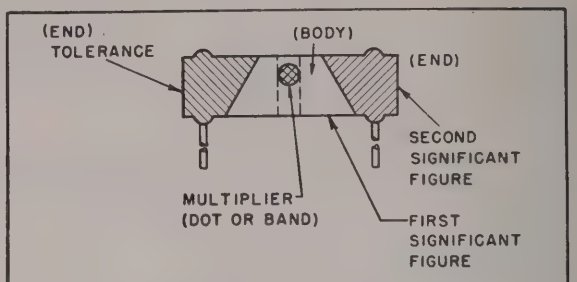


RC-COMPOSITION

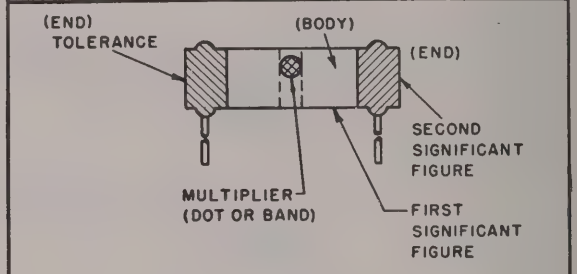


RU-WIRE-WOUND

RADIAL-LEAD RESISTORS (UNINSULATED)



RZ-COMPOSITION



RZ-COMPOSITION

RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

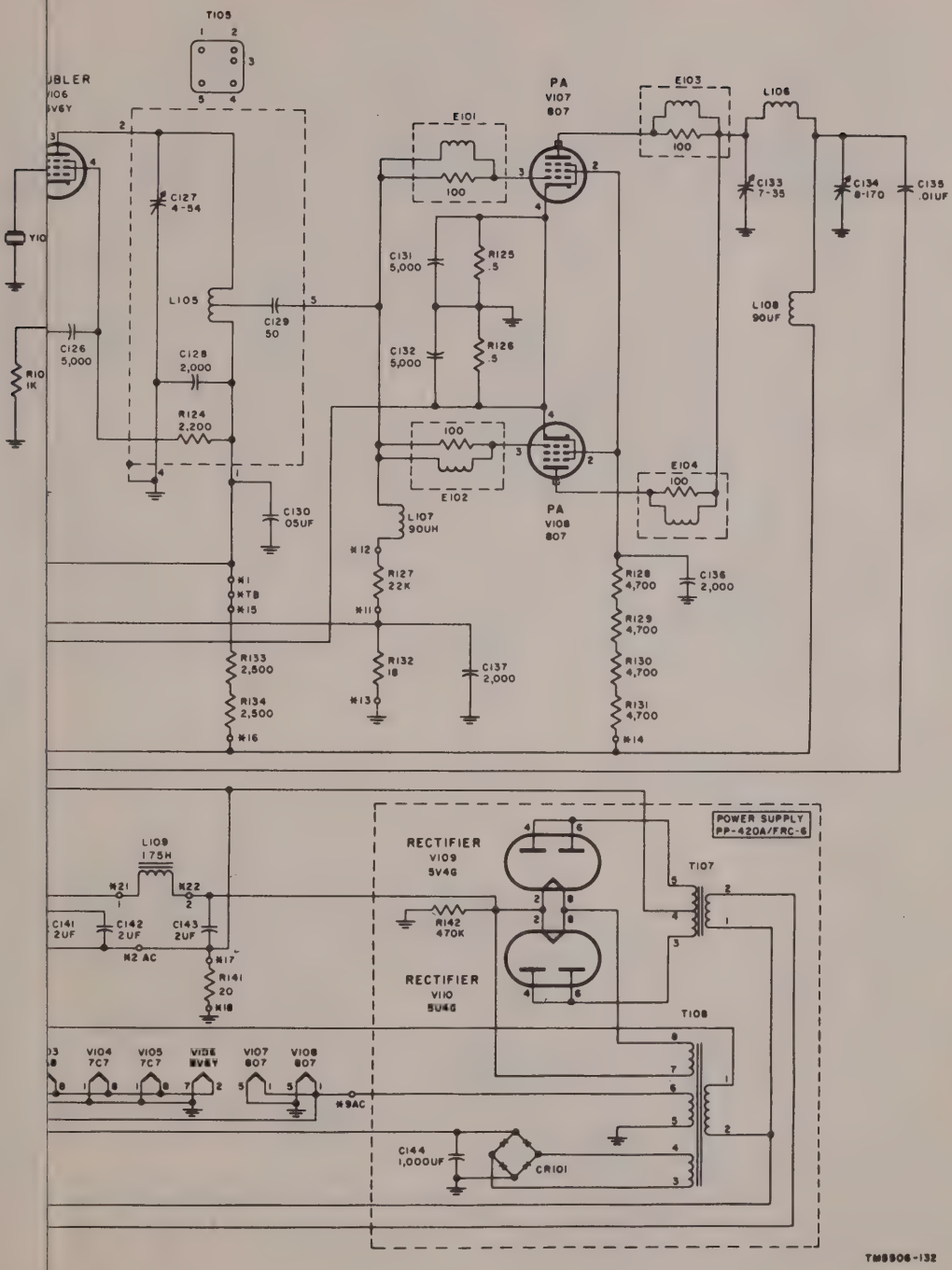
*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND, BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

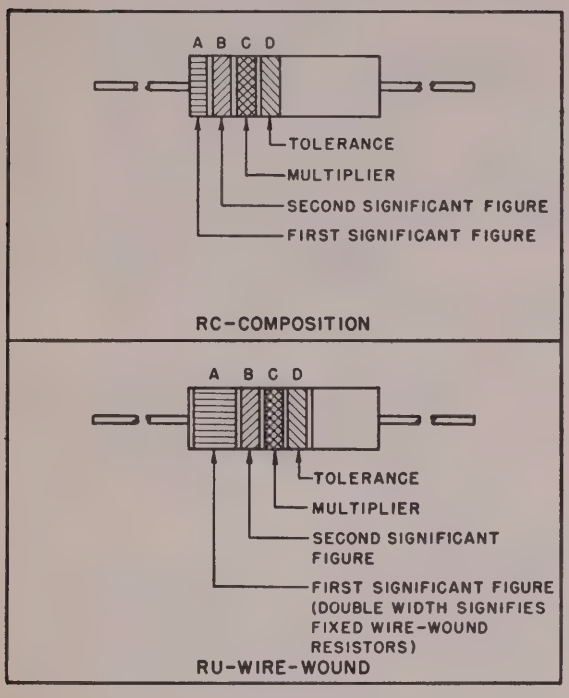
STD-RI

Figure 121. MIL STD resistor color code.

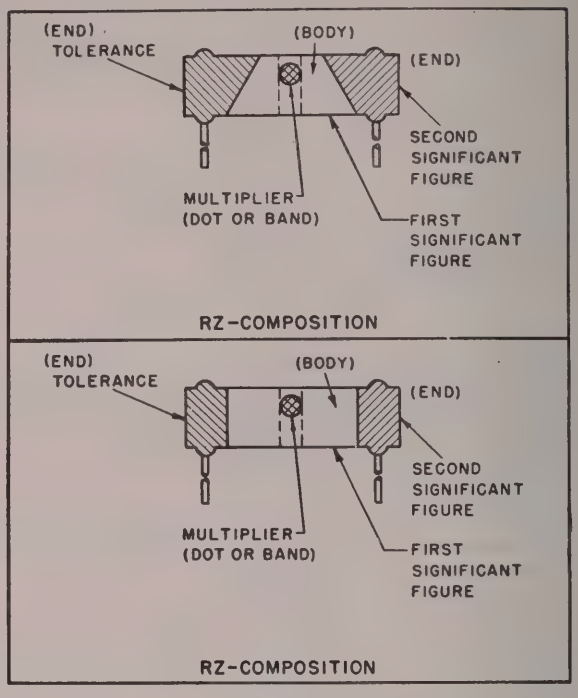

T105
UBLER
V106
6V6Y
PA
V107
807
E101
E103
L106
100
C127
4-54
C133
7-35
C134
8-170
C135
.01UF
Y10
C131
5,000
R125
.5
L105
C129
50
L108
90UF
C126
5,000
C132
5,000
R126
.5
R10
1K
C128
2,000
R124
2,200
E102
E104
PA
V108
807
C130
05UF
L107
90UH
#12
R127
22K
#1
#TB
#15
#11
R128
4,700
C136
2,000
R129
4,700
R133
2,500
R132
18
C137
2,000
R130
4,700
R134
2,500
R131
4,700
#13
#16
#14
L109
175H
#21
#22
C141
2UF
C142
2UF
C143
2UF
#2 AC
#17
R141
20
#18
POWER SUPPLY
PP-420A/FRC-6
RECTIFIER
V109
5V4G
T107
R142
470K
RECTIFIER
V110
5U4G
T108
V104
7C7
V105
7C7
V106
6V6Y
V107
807
V108
807
#9AC
C144
1,000UF
CR101
TM5506-132

RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

AXIAL-LEAD RESISTORS (INSULATED)



RADIAL-LEAD RESISTORS (UNINSULATED)



RESISTOR COLOR CODE

BAND A OR BODY*		BAND B OR END*		BAND C OR DOT OR BAND*		BAND D OR END*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1	BODY	± 20
BROWN	1	BROWN	1	BROWN	10	SILVER	± 10
RED	2	RED	2	RED	100	GOLD	± 5
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000		
GREEN	5	GREEN	5	GREEN	100,000		
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	GOLD	0.1		
WHITE	9	WHITE	9	SILVER	0.01		

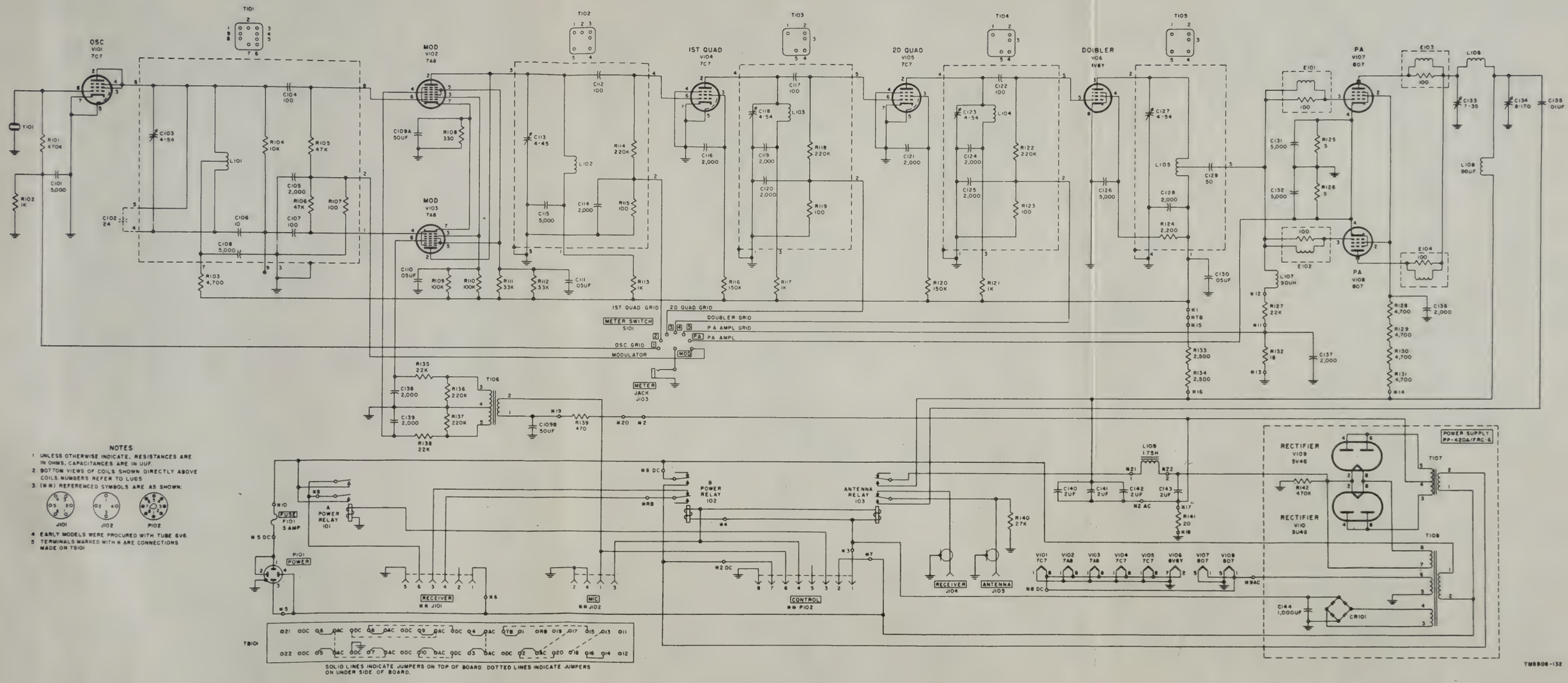
*FOR WIRE-WOUND-TYPE RESISTORS, BAND A SHALL BE DOUBLE-WIDTH. WHEN BODY COLOR IS THE SAME AS THE DOT (OR BAND) OR END COLOR, THE COLORS ARE DIFFERENTIATED BY SHADE, GLOSS, OR OTHER MEANS.

EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

EXAMPLES (BODY MARKING):
10 OHMS ±20 PERCENT: BROWN BODY; BLACK END; BLACK DOT OR BAND, BODY COLOR ON TOLERANCE END.
3,000 OHMS ±10 PERCENT: ORANGE BODY; BLACK END; RED DOT OR BAND; SILVER END.

STD-RI

Figure 121. MIL STD resistor color code.

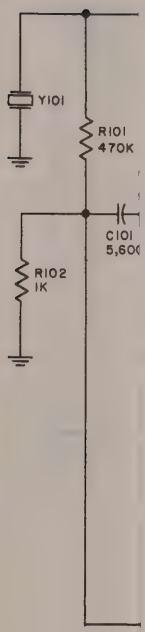


NOTES:
1. UNLESS OTHERWISE INDICATE, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. BOTTOM VIEWS OF COILS SHOWN DIRECTLY ABOVE COILS. NUMBERS REFER TO LUGS.
3. (#) REFERENCED SYMBOLS ARE AS SHOWN.

J101 J102 P102

4. EARLY MODELS WERE PROCURED WITH TUBE 6V6.
5. TERMINALS MARKED WITH # ARE CONNECTIONS MADE ON TS101.

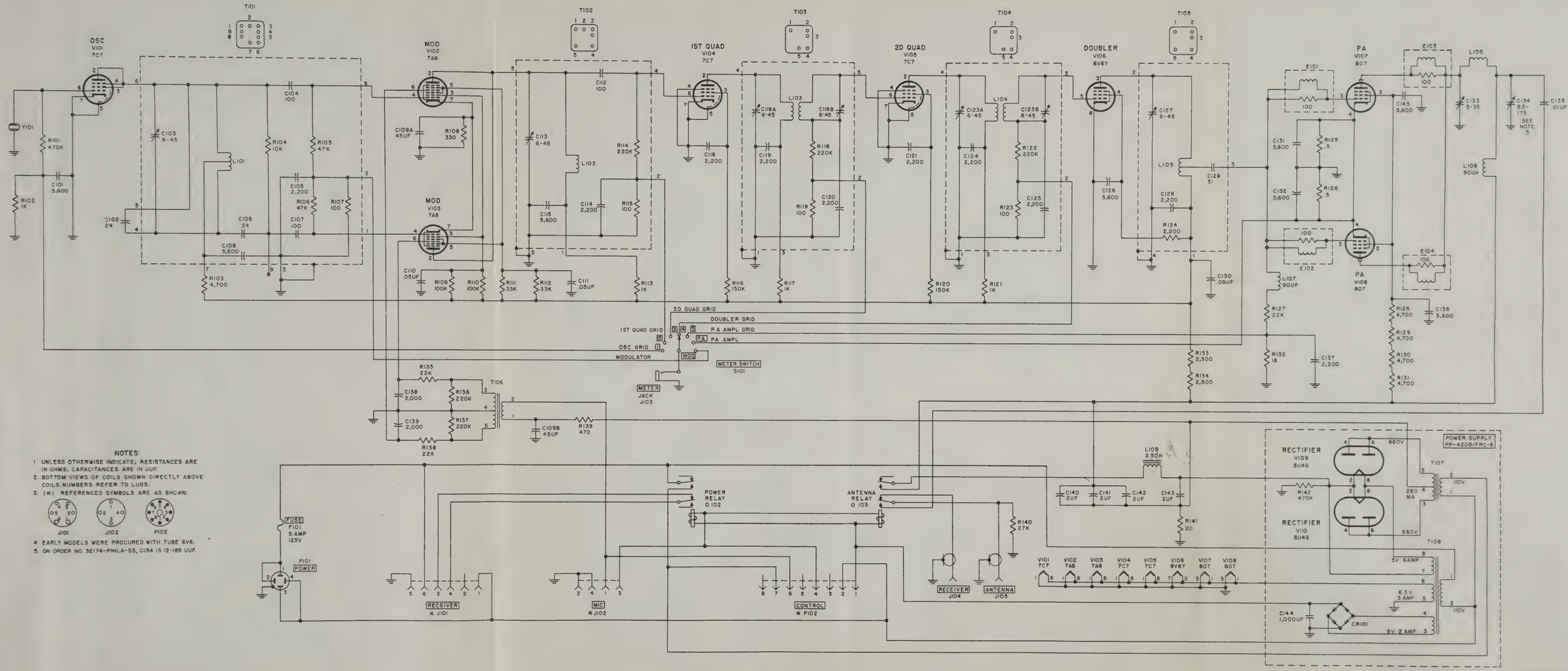
Figure 122. Radio Transmitter T–215A/FRC–6, schematic diagram.



1. UNLESS
IN OHMS,
2. BOTTOM
COILS. N
3. (*) RE



4. EARLY M
5. ON ORDE



NOTES:

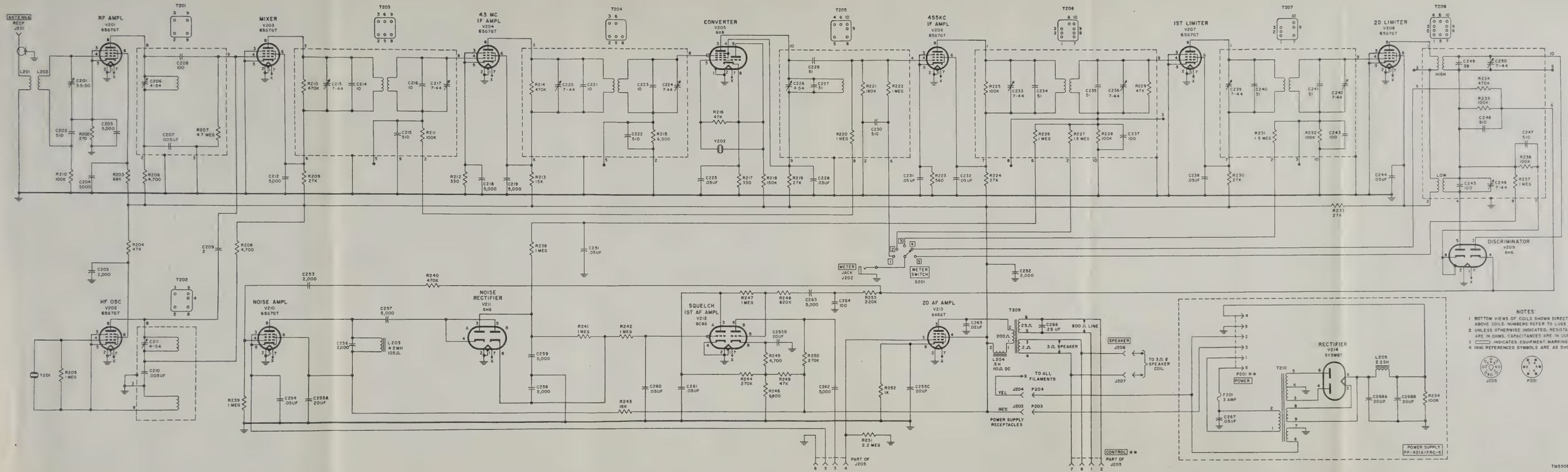
1. UNLESS OTHERWISE INDICATED; RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
2. BOTTOM VIEWS OF COILS SHOWN DIRECTLY ABOVE COILS NUMBERS REFER TO LUGS.
3. (*) REFERENCED SYMBOLS ARE AS SHOWN:

4. EARLY MODELS WERE PROCURED WITH TUBE 6V6.
5. ON ORDER NO. 32174-PHILA-53, C134 IS 12-185 UUF.

Figure 123. Radio Transmitter T-264/FRC-6A, schematic diagram.

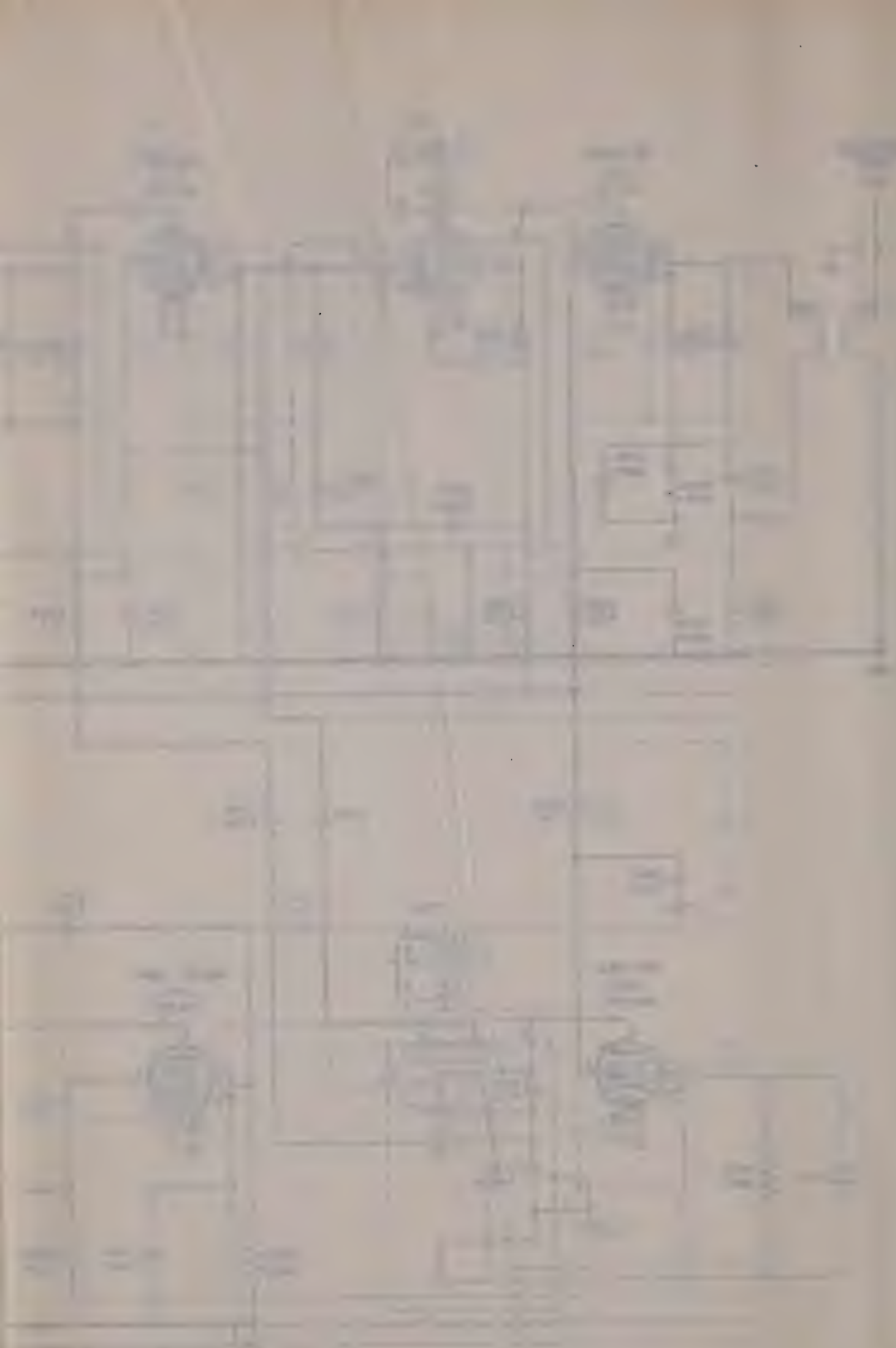



ANTENNA
RECP
J201
L201

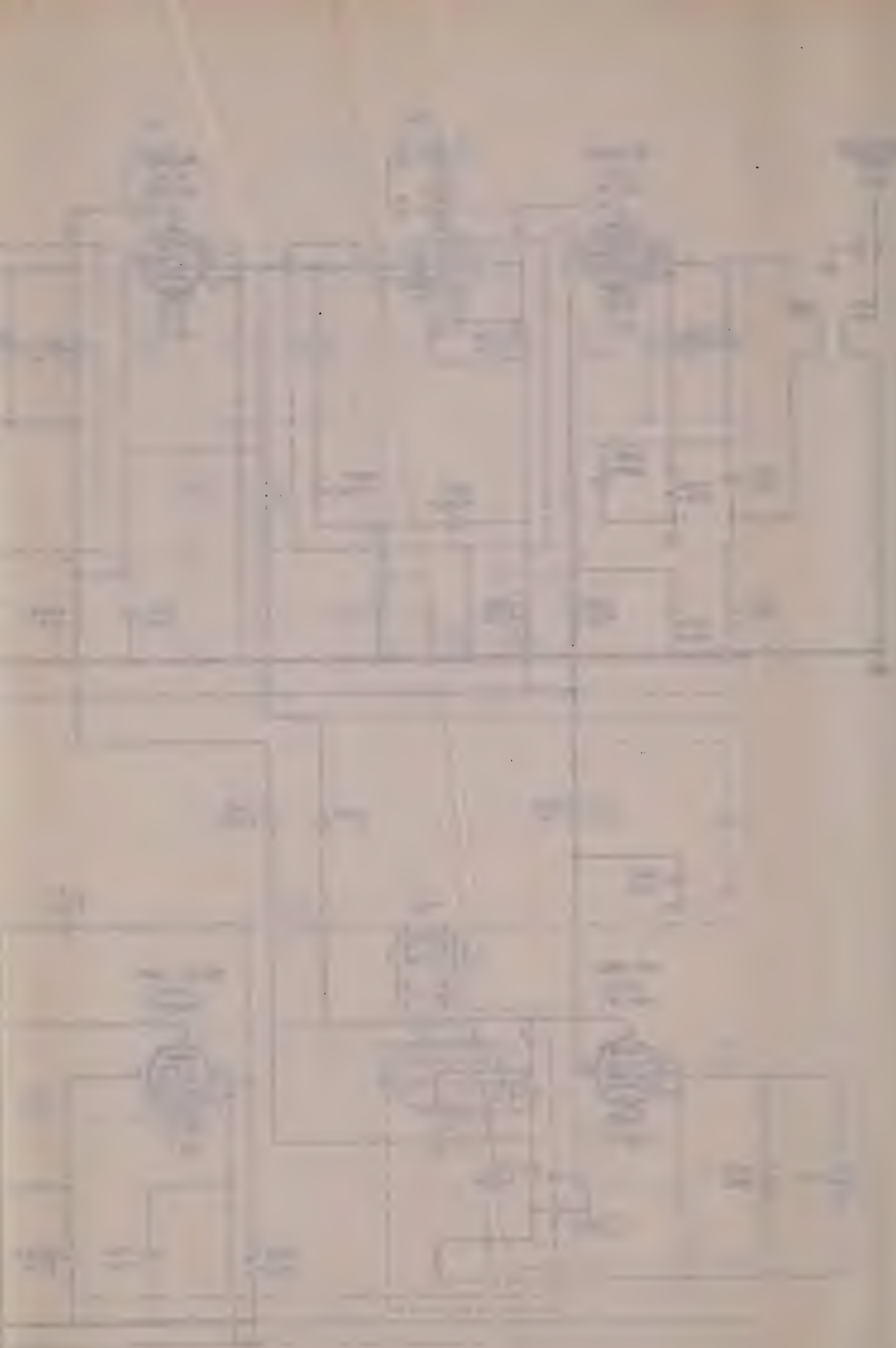


NOTES:
1. BOTTOM VIEWS OF COILS SHOWN DIRECTLY ABOVE COILS. NUMBERS REFER TO LUGS.
2. UNLESS OTHERWISE INDICATED, RESISTANCE ARE IN OHMS; CAPACITANCES ARE IN UUF.
3. ▭ INDICATES EQUIPMENT WARNING.
4. (WW) REFERENCED SYMBOLS ARE AS SHOWN.

Figure 124. Radio Receiver R–275A/FRC–6, schematic diagram.







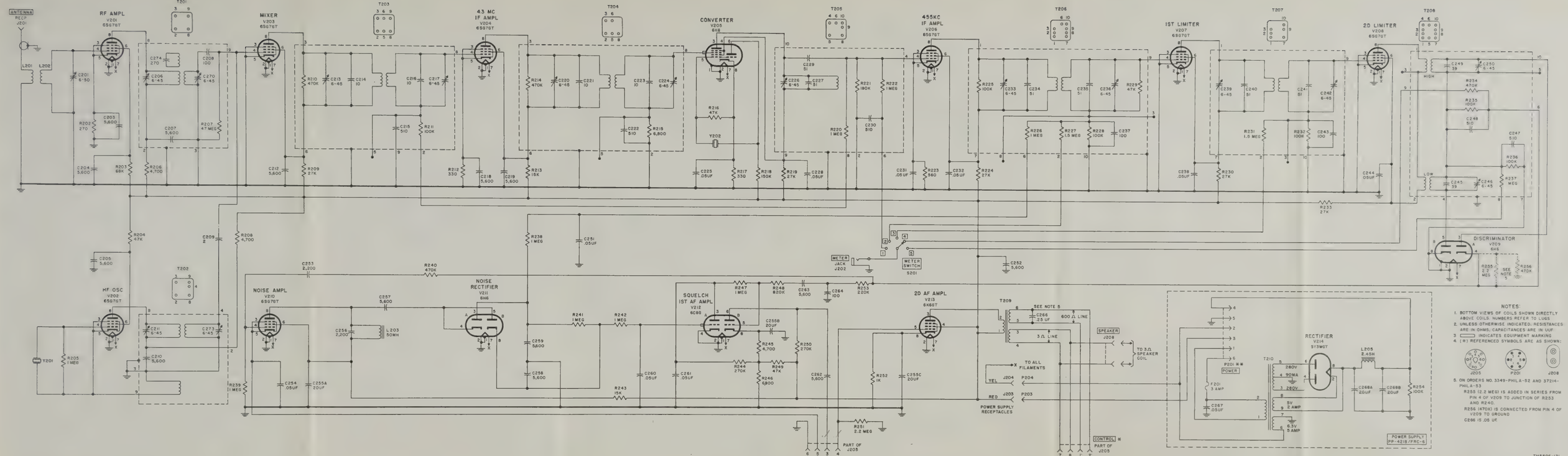


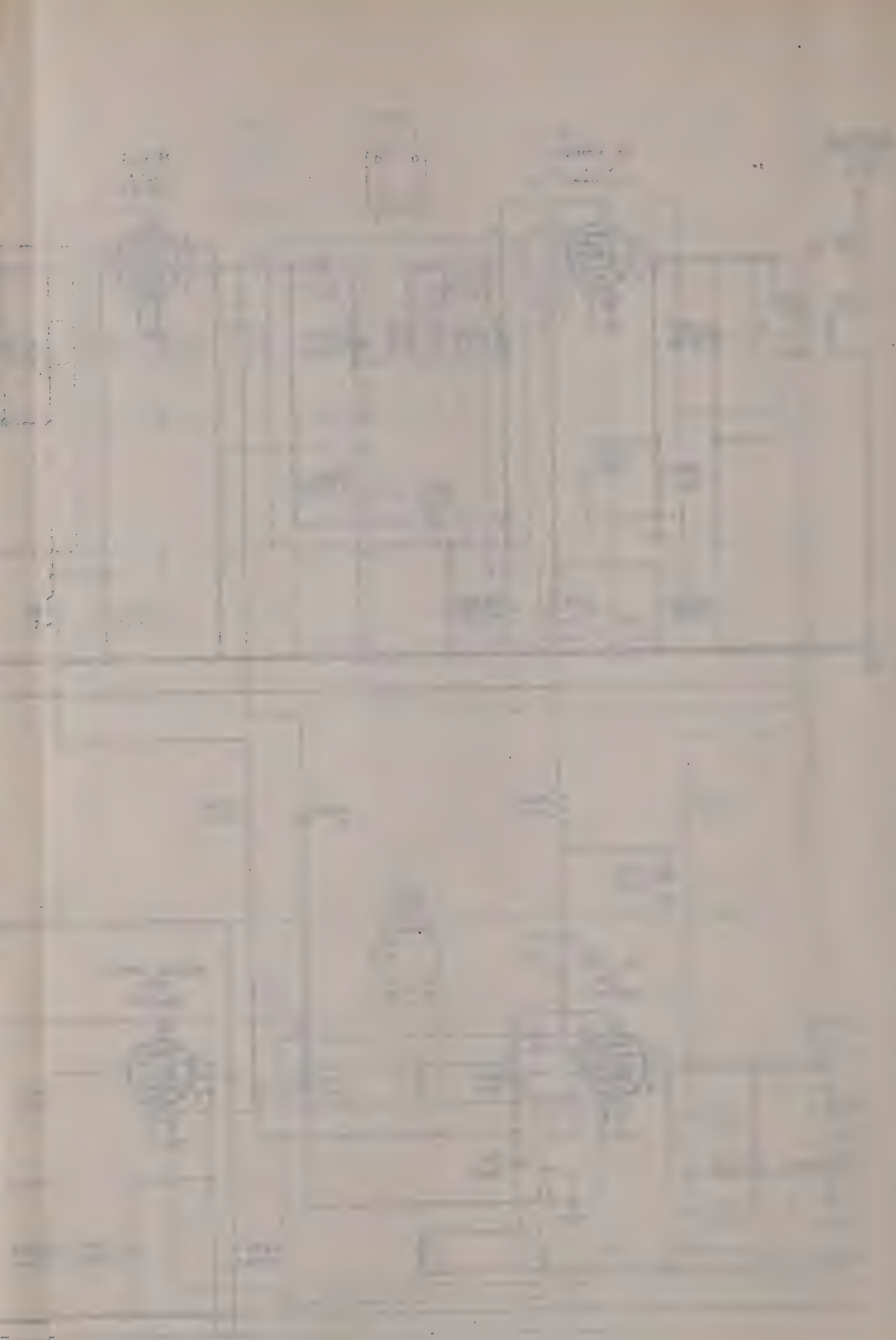
Figure 125. Radio Receiver R-368/FRC-6A, schematic diagram.

NOTES:

1. BOTTOM VIEWS OF COILS SHOWN DIRECTLY ABOVE COILS. NUMBERS REFER TO LUGS.
2. UNLESS OTHERWISE INDICATED, RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF.
3. ▭ INDICATES EQUIPMENT MARKING
4. (#) REFERENCED SYMBOLS ARE AS SHOWN:

5. ON ORDERS NO. 3349-PHILA-52 AND 37214-PHILA-53:
   R255 (2.2 MEG) IS ADDED IN SERIES FROM PIN 4 OF V209 TO JUNCTION OF R253 AND R240.
   R256 (470K) IS CONNECTED FROM PIN 4 OF V209 TO GROUND
   C266 IS .05 UF.

TM5506-131



CHAPTER 7

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

126. General

When it becomes neccssary to reship Radio Set AN/FRC–6 after installation, disassemble and repack the equipment in the original manner. Paragraph 127 describes the procedure to be followed for disassembly.

127. Disassembly

To disassemble the equipment for repacking, follow the procedure outlined in paragraphs 16 through 22. The following is a step-by-step procedure for disassembly.

a. Remove all external connections, such as antenna, ground, ac power, and interconnections between the rack and the remote console.

b. To work in the back of the main unit, remove all plugs, disconnect all connectors, and unfasten all spade lugs at the control unit terminal board.

c. Check the radio set control to be sure that no wires are attached to the terminal board. Tighten all screws on the board. Remove the control from the rack by taking out the two screws that hold it to the rack on one side and by loosening the two screws on the other side. Replace the two screws in the rack and tighten them to prevent loss.

d. Remove the transmitters and receivers in the same manner.

e. Remove the antenna jack support from the rack member, and replace the mounting screws in the rack.

f. Remove the rack control panel and interconnect the cable from the rack by unsnapping the cable clamps and remove the screws that hold the panel to the rack. Replace the mounting screws in the panel and tighten to prevent loss.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

128. General

The demolition procedure outlined in paragraph 129 will be used to prevent the enemy from using or salvaging this equipment. Demolition of the equipment will be accomplished only upon order of the commander.

129. Methods of Destruction

a. Smash. Smash tubes, coils, and transformers; use sledges, axes, pickaxes, hammers, crowbars or heavy tools.

b. Cut. Cut cords and cables; use axes, handaxes, or machetes.

c. Burn. Burn transmitters, receivers, control units, consoles, connecting cables and technical manuals; use gasoline, kerosene, oil, flamethrowers, or incendiary grenades.

d. Bend. Bend panels and chassis; use sledge hammers and crowbars.

e. Explode. If explosives are necessary, use grenades, or TNT.

f. Dispose. Bury or scatter the destroyed parts.

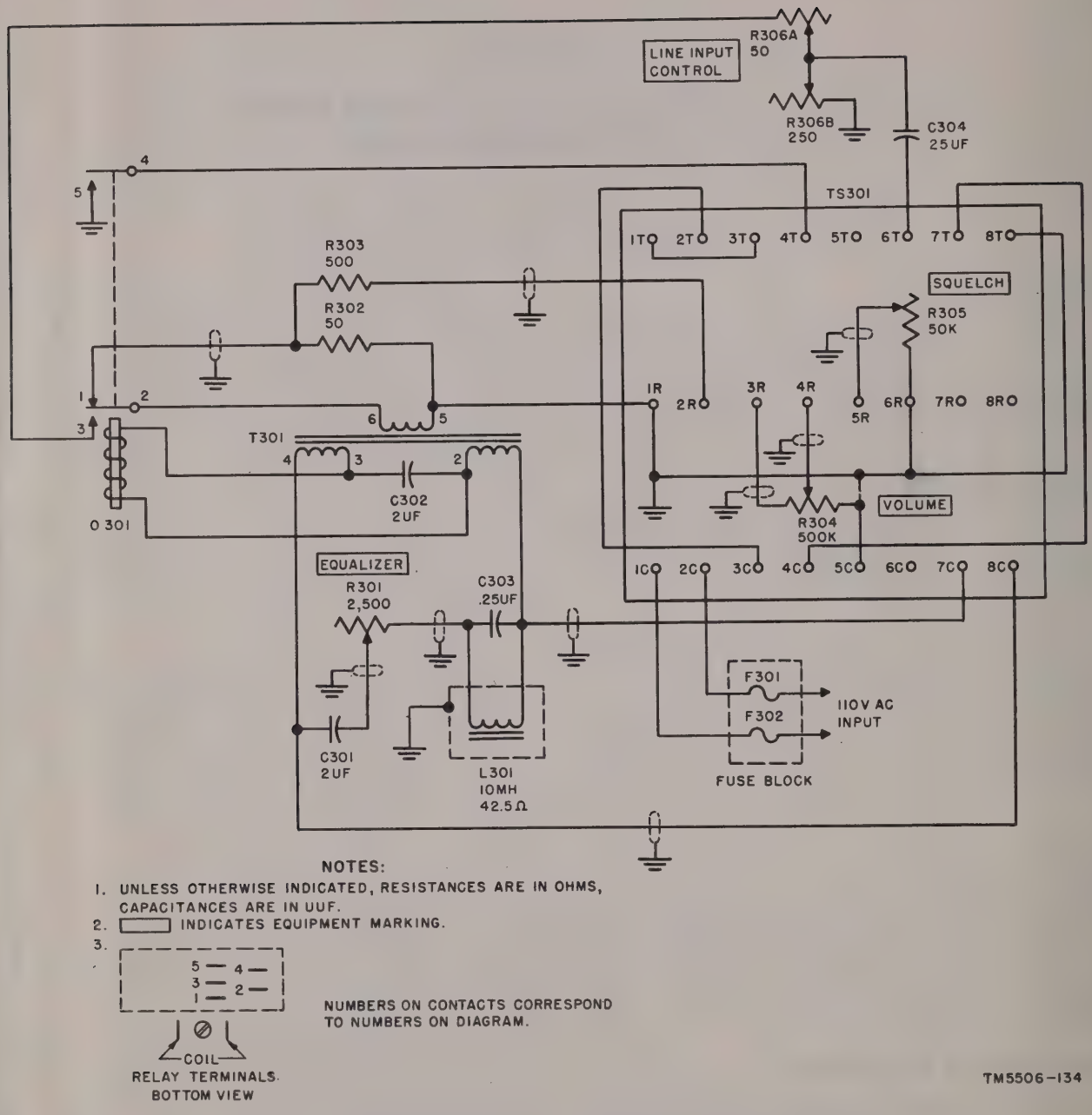


Figure 126. Radio Set Control C-560A/FRC-6, schematic diagram.

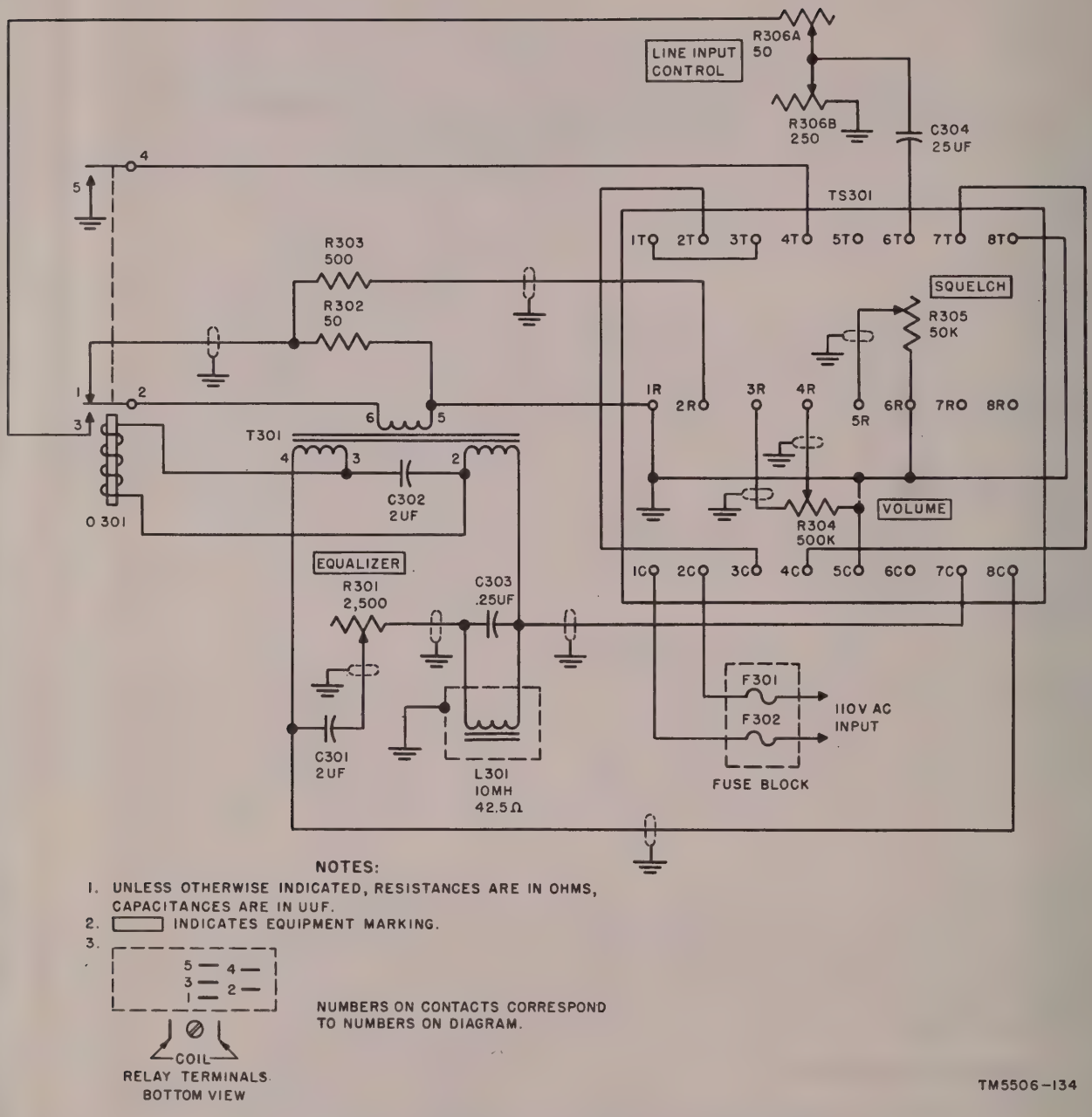


Figure 126. Radio Set Control C-560A/FRC-6, schematic diagram.

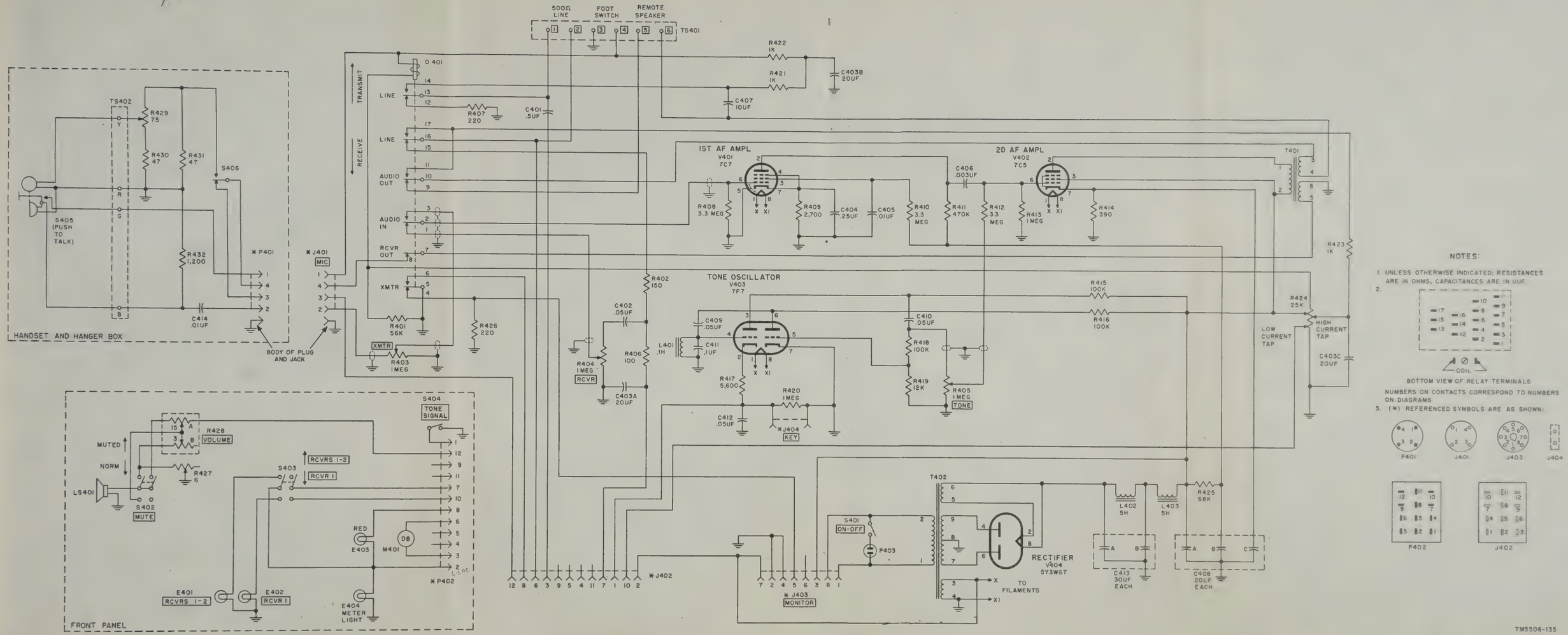
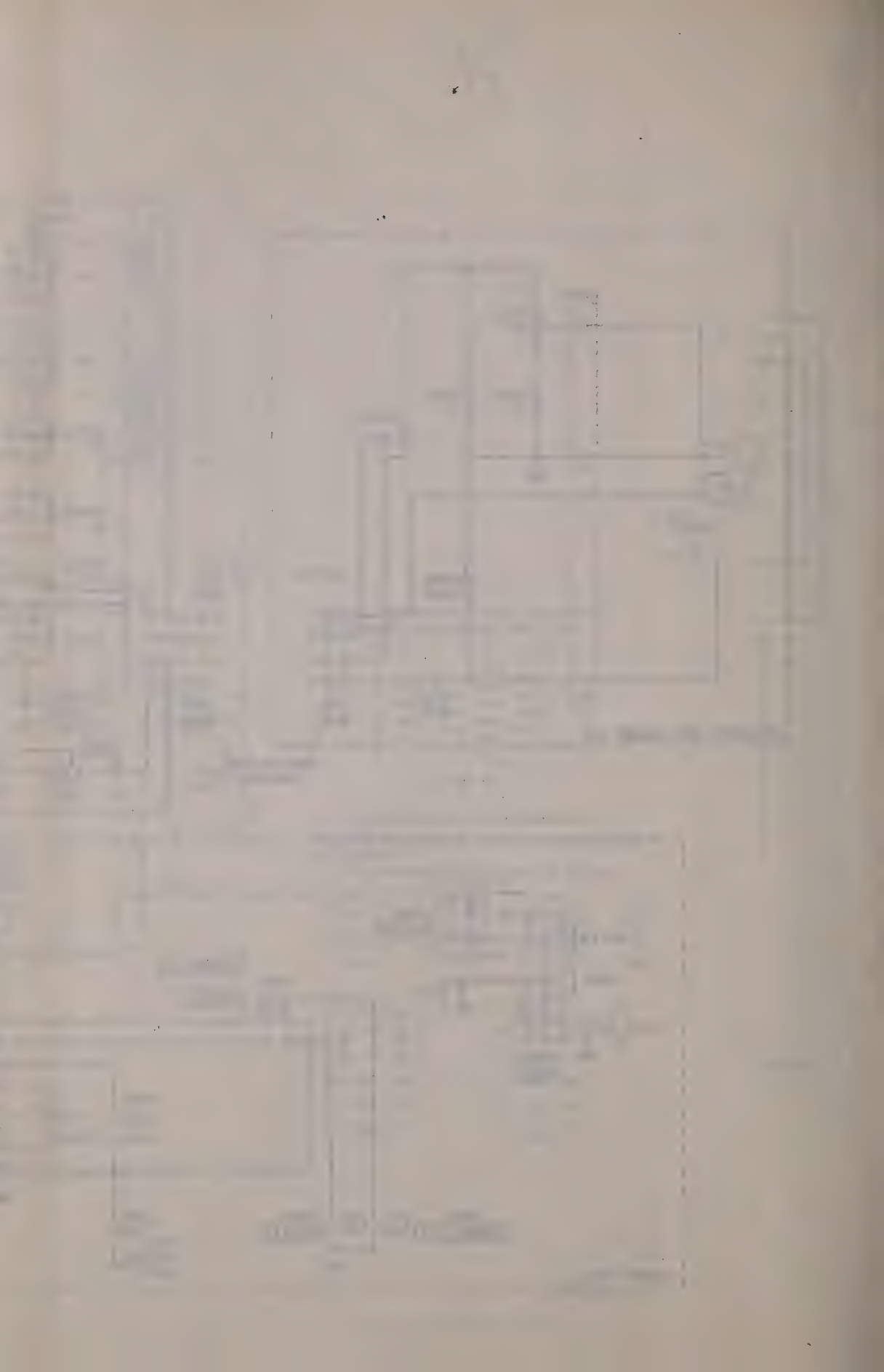


Figure 127. Console C-559(*)/FRC-6, schematic diagram.



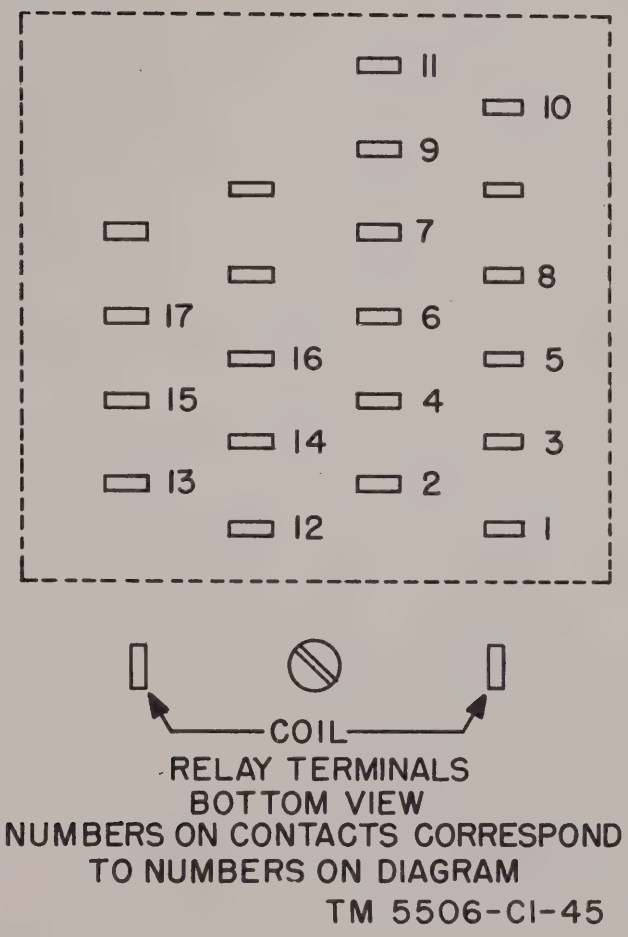


Figure 128. Console C-559B/FRC-6, detailed view of relay terminals.



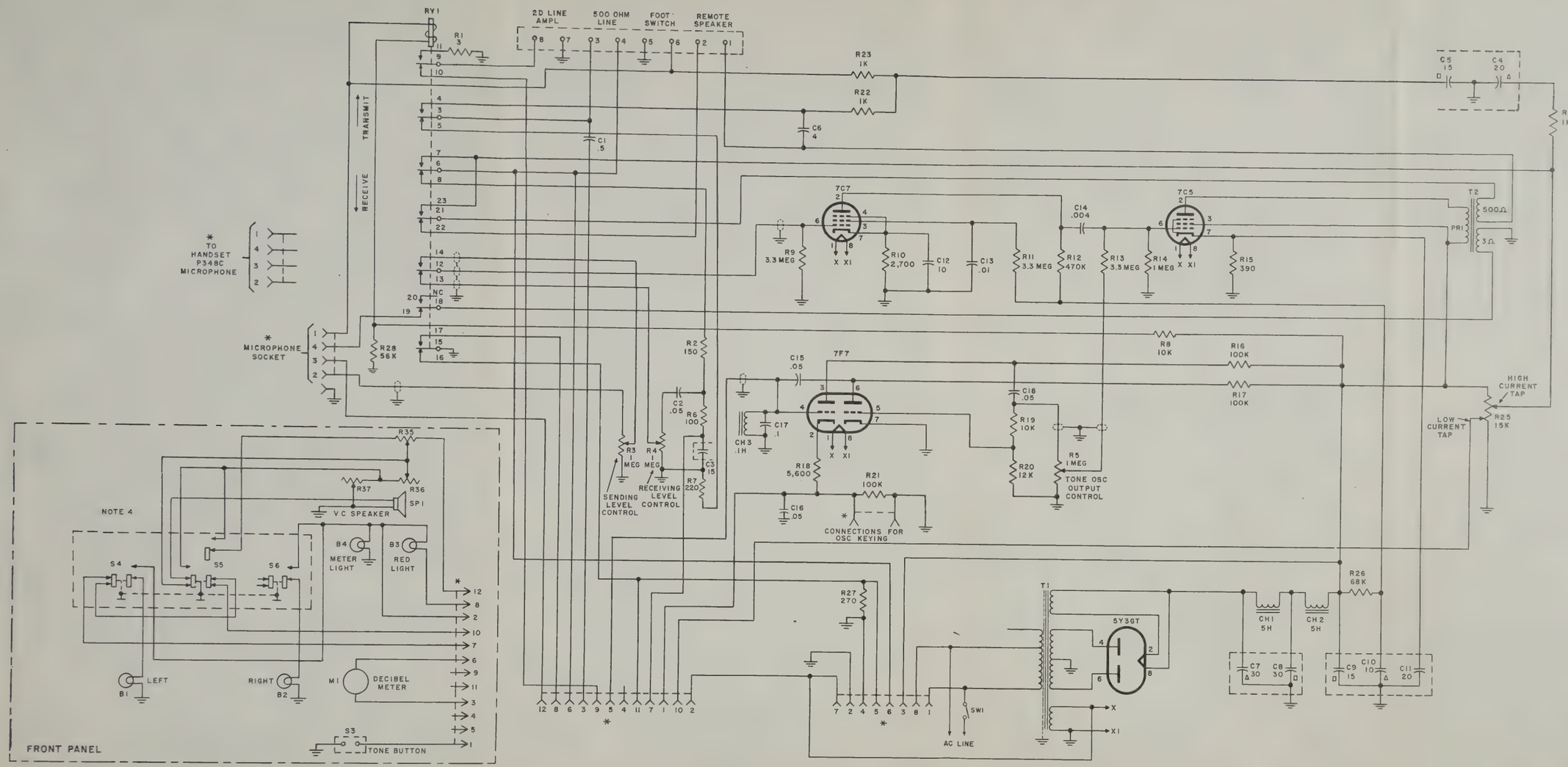


Figure 129. Console C-408/FR, schematic diagram.

NOTES:

1. UNLESS OTHERWISE INDICATED', RESISTANCES ARE IN OHMS, CAPACITANCES ARE IN UUF

2. DUMMY, NC, COIL

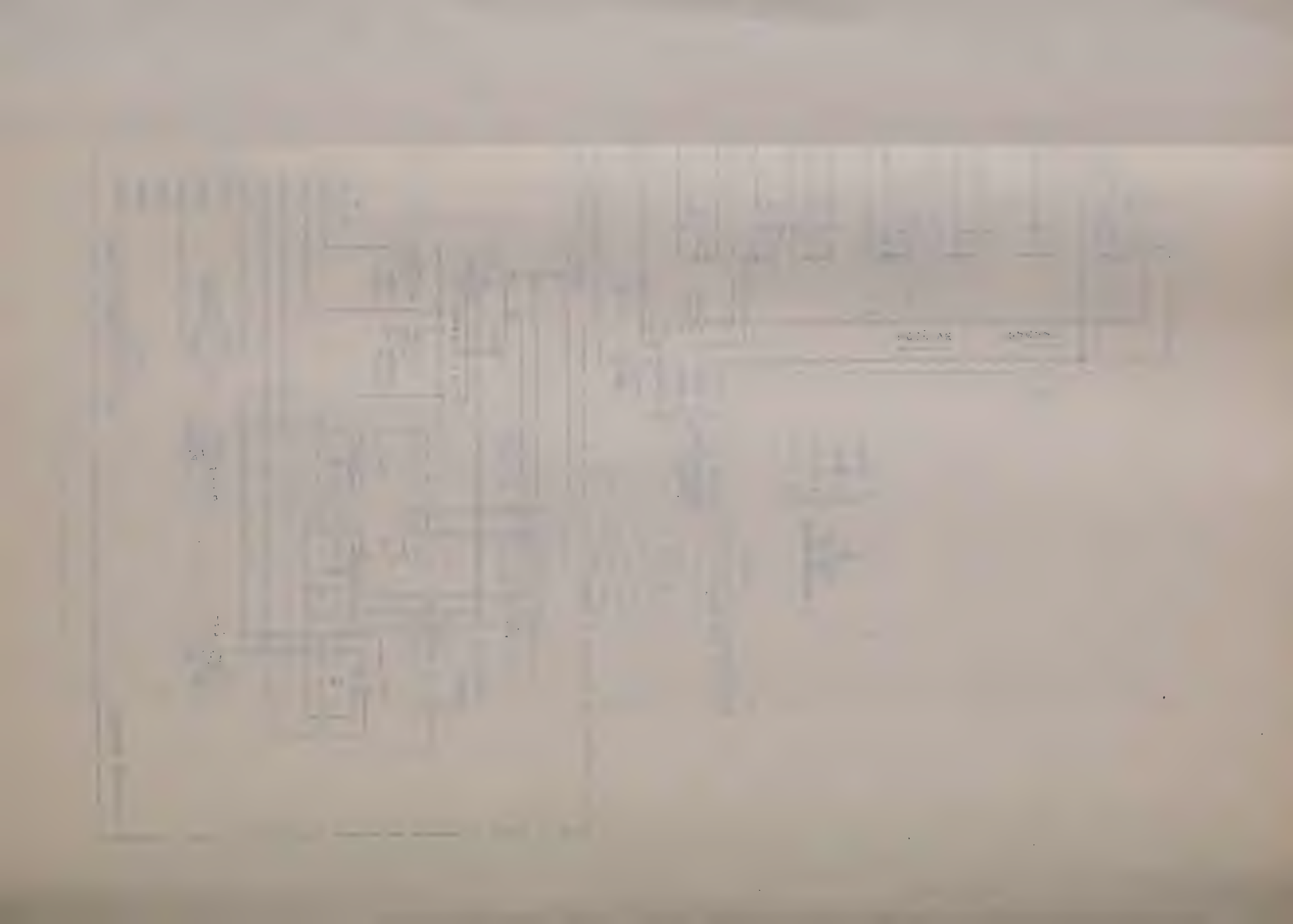
BOTTOM VIEW OF RELAY TERMINALS

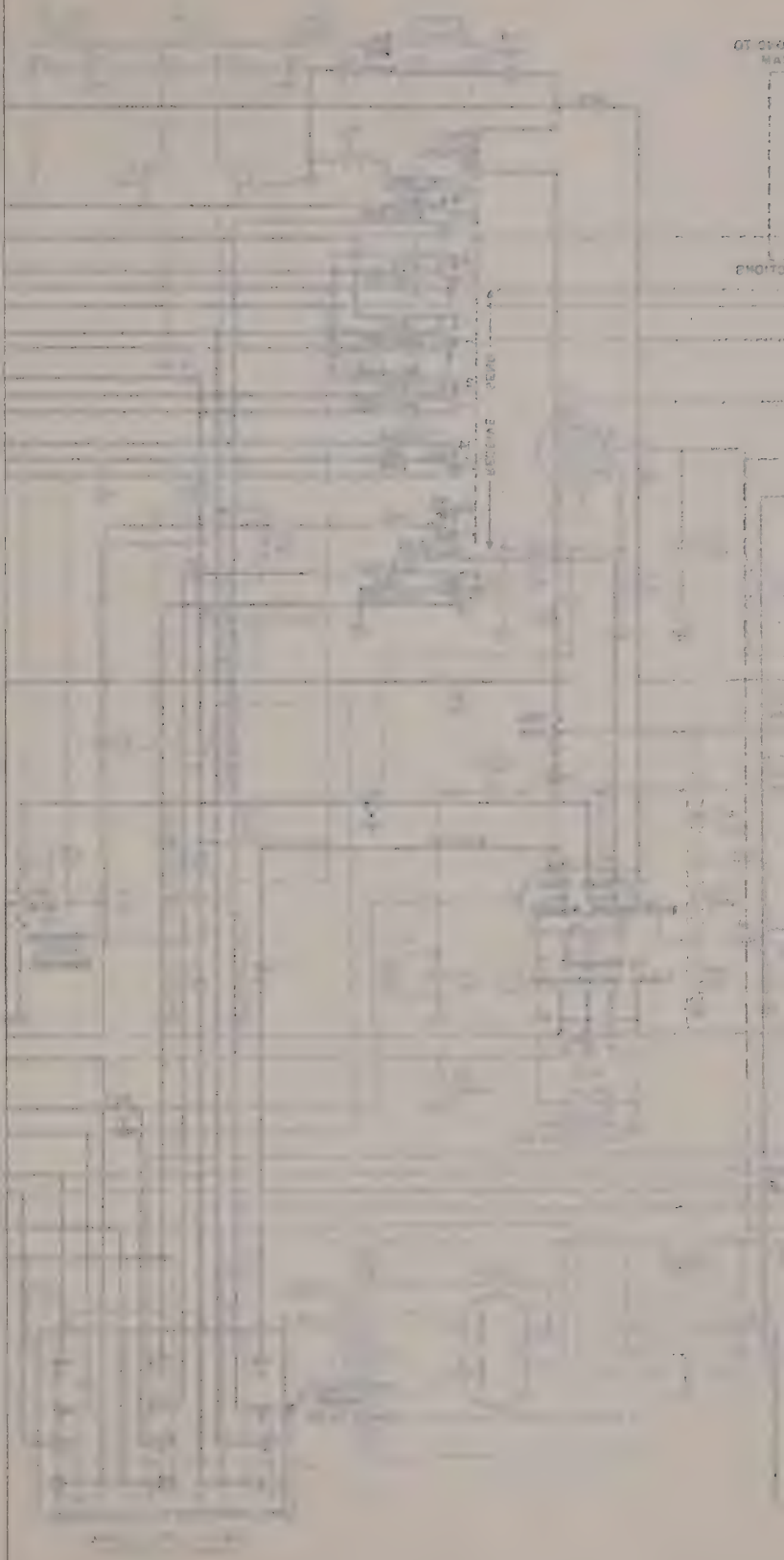
NUMBERS ON CONTACTS CORRESPOND TO NUMBERS ON DIAGRAMS.

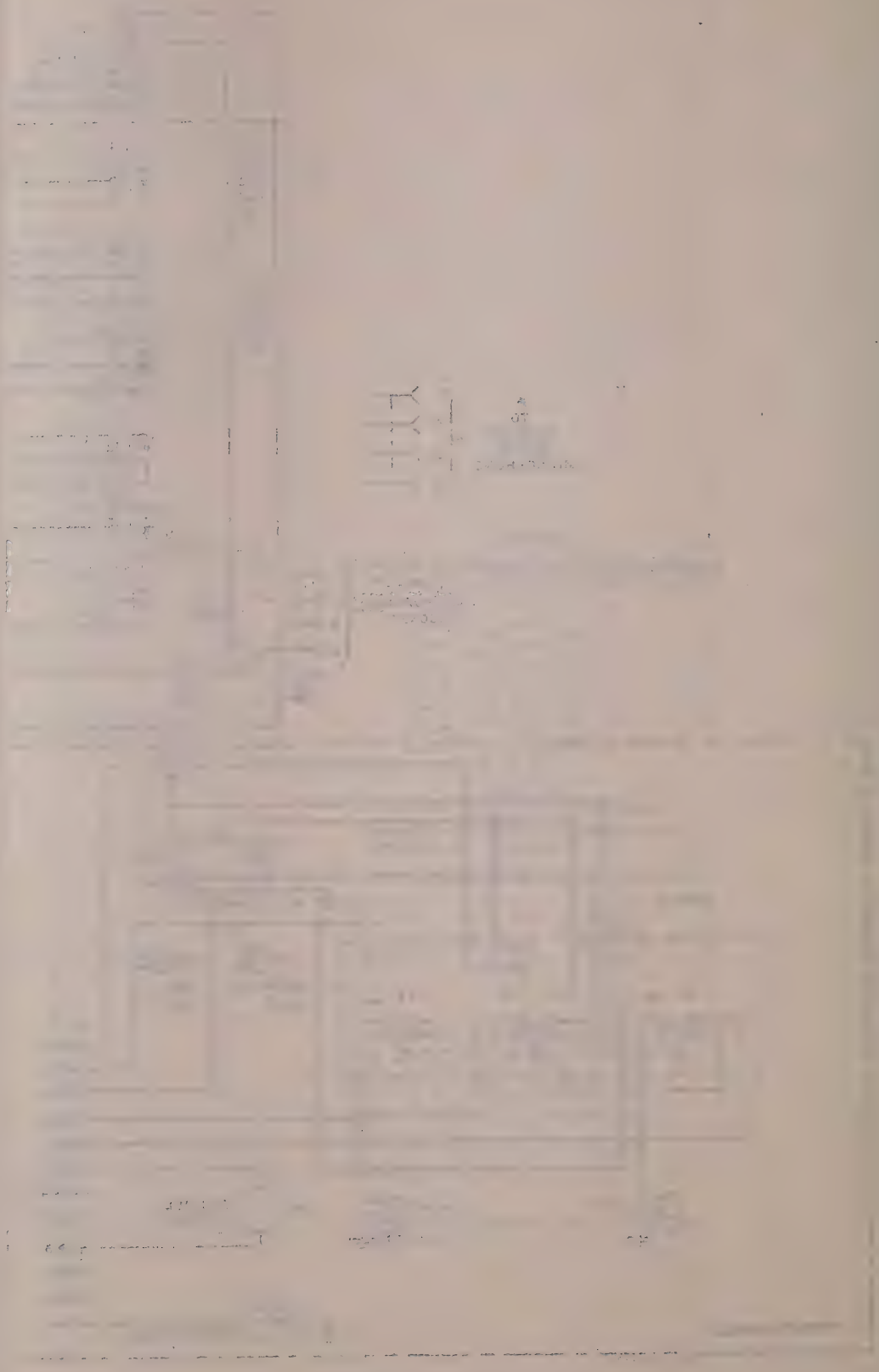
3. (*) REFERENCED SYMBOLS ARE AS SHOWN

4. PUSH SWITCH SHOWN WITH ALL BUTTONS RELEASED.

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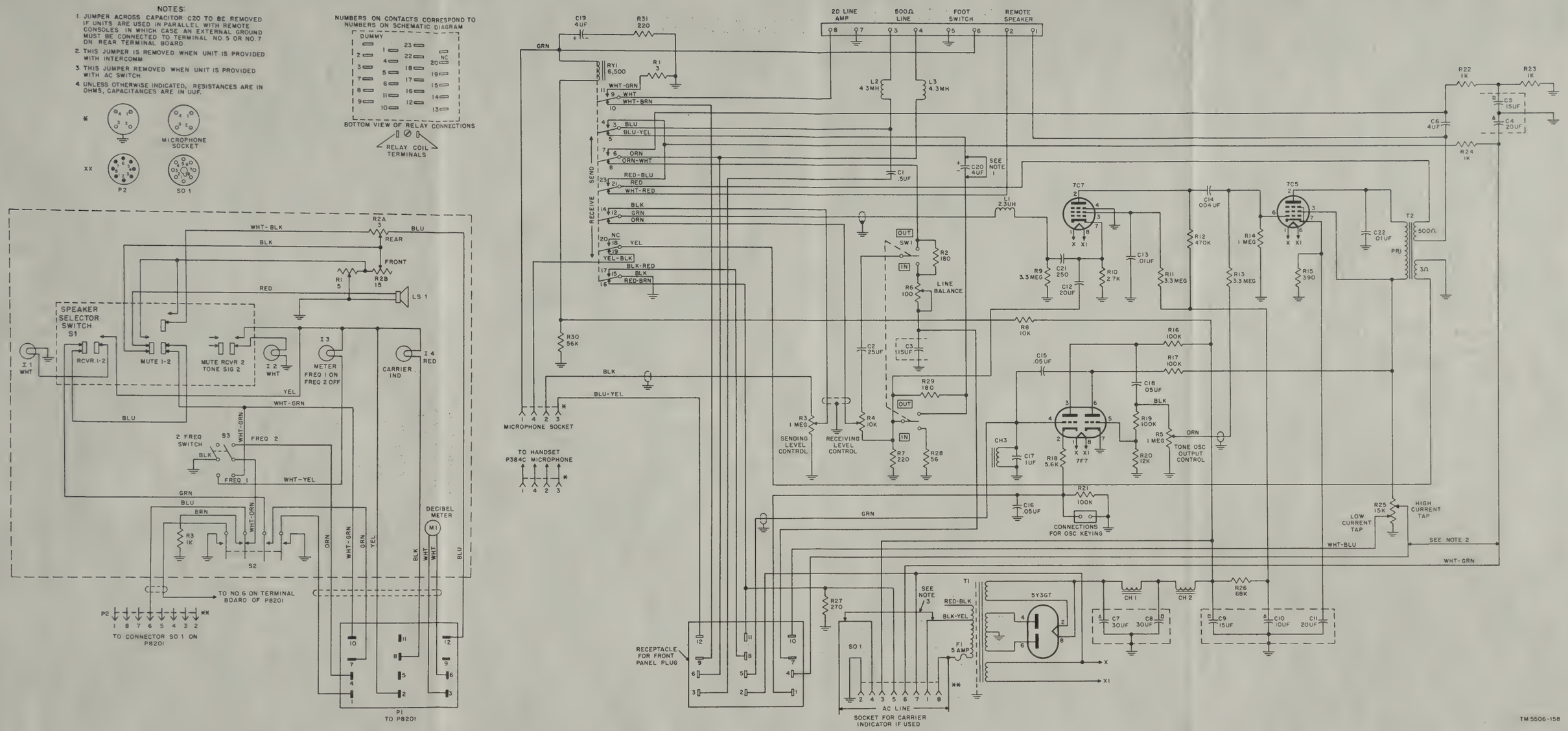
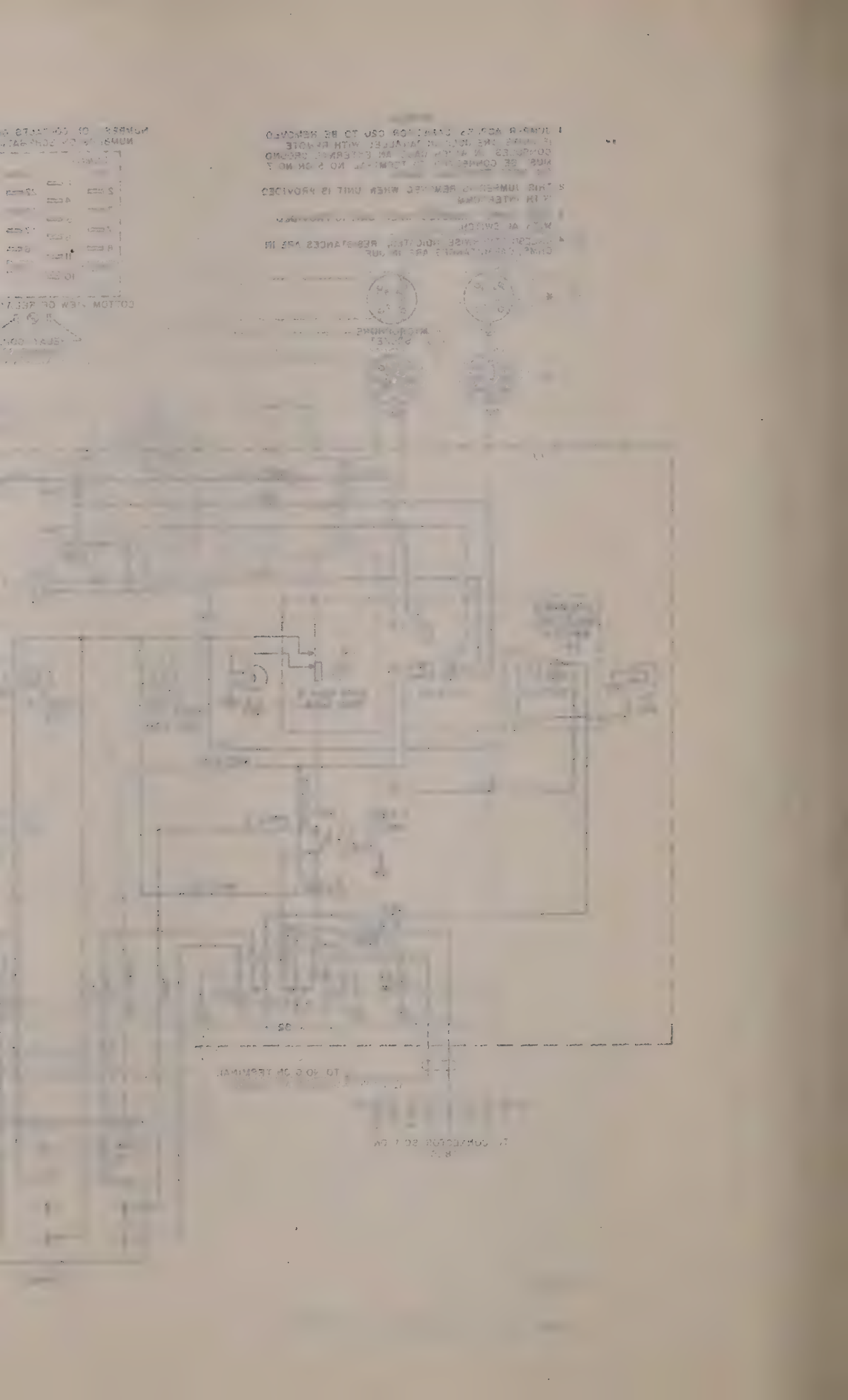


Figure 130. Console C-408A/FR, schematic diagram.



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[AG 413.44 (7 Feb 56)]

By order of the Secretaries of the Army and the Air Force:

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CNGB (1)
Tec Svc, DA (1) except CSIGO (30)
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Corps (2)
Tng Div (2)
Ft & Cp (2)
Gen & Br Svc Sch (5) except Sig Sch (25)
Gen Depots (2) except Atlanta Gen Depot (None)
Sig Sec, Gen Depots (10)
Sig Depots (20)
Trans Terminal Comd (2)
Army Terminal (2)
OS Sup Agencies (2)
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Sig Lab (5)
Mil Dist (1)
Units organized under following TOE's:
11–7R, Sig Co, Inf Div (2)
11–16R, Hq & Hq Co, Sig Bn, Corps or ABN Corps (2)
11–57R, Armd Sig Co (2)
11–127R, Sig Rep Co (2)
11–128R, Sig Depot Co (2)
11–500R (AA–AE), Sig Svc Org (2)
11–557C, Abn Sig Co (2)
11–587R, Sig Base Maint Co (2)
11–592R, Hq & Hq Co, Sig Base Depot (2)
11–597R, Sig Base Depot Co (2)
30–500R (AA–AG), CIC Org (2)

NG: State AG (6); units—same as Active Army except allowance is one copy to each unit.
USAR: None.
For explanation of abbreviations used, see SR 320–50–1.

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