TM 11-863

INSTRUCTION BOOK

FOR

RADIO RECEIVER R-391/URR

MANUFACTURED BY
COLLINS RADIO COMPANY
ORDER NO. 14214-P-51
23 OCTOBER 1953

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WARNING

HIGH VOLTAGE

is used in the operation
of this equipment.

DEATH ON CONTACT

may result if operating personnel
fail to observe safety precautions.

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LIST OF ILLUSTRATIONS

ARTIFICIAL RESPIRATION

GENERAL PRINCIPLES

1. Seconds count! Begin at once! Don't take time to move the victim unless you must. Don't loosen clothes, apply stimulants or try to warm the victim. Start resuscitation! Get air in the lungs! You may save a life!

2. Place the victim's body in a prone position, so that any fluids will drain from the respiratory passages. The head should be extended and turned sideward *never flexed forward;* the chin shouldn't sag, since obstruction of the respiratory passages may occur.

3. Remove any froth or debris from the mouth with your fingers. Draw the victim's tongue forward.

4. Begin artificial respiration. Continue it rhythmically and without any interruption until natural breathing starts or the victim is pronounced dead. Try to keep the rhythm smooth. Split-second timing is not absolutely essential.

5. When the victim starts breathing, or when additional help is available loosen the clothing; remove it, if it's wet; keep the victim warm. Shock should receive adequate attention. Don't interrupt the rhythmical artificial technique for these measures. Do them only when you have help or when natural breathing has started.

6. When the victim is breathing, adjust your timing to assist him. Don't fight his efforts to breathe. Synchronize your efforts with his. After resuscitation, keep him lying down until seen by a physician or until recovery seems certain.

7. Don't wait for mechanical resuscitation! If an approved model is available, use it, but, since mechanical resuscitators are only slightly more effective than properly performed "push-pull" manual technique, *never* delay manual resuscitation for it.

BACK-PRESSURE ARM LIFT METHOD

1. *Position of Victim.* Place the victim in the prone (face-down) position. Bend his elbows; place one hand upon the other. Turn his face to one side, placing his cheek upon his hands.

2. *Position of Operator.* Kneel on your left or right knee, at the victim's head, facing him. Your knee should be at the side of the victim's head close to his forearm, your foot should be near his elbow. Kneel on both knees if you find it more comfortable, with one knee on each side of the head. Place your hands on the flat of the victim's back so that their heels are just below the lower tip of his shoulder blades. With the tip of your thumbs touching spread your fingers downward and outward. (See A)

3. *Compression Phase.* Rock forward until your arms are approximately vertical and allow the weight of the upper part of your body to exert a slow, steady, even, downward pressure upon your hands. This forces air out of the lungs. Keep your elbows straight and press almost directly downward on the back. (See B)

4. *Expansion Phase.* Release the pressure, avoid any finish thrust, and commence to rock backward slowly. Place your arms upon the victim's arms just above the elbows, and draw his arms upward and toward you. Apply just enough lift to feel resistance and tension at the victim's shoulders.

Don't bend your elbows. As you rock backward, the victim's arms will be drawn toward you. (The arm lift expands the chest by pulling on the chest muscles, arching the back and relieving the weight on the chest.) Drop the arms gently to the ground or floor. This completes the cycle. (See C and D). Now, repeat the cycle.

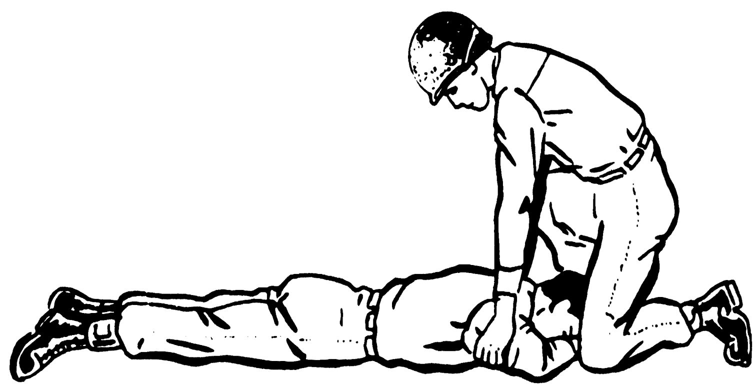
5. *Cycle Timing and Rhythm.* Repeat the cycle 10 to 12 times per minute. Use a steady uniform rate of Press, Release, Lift, Release. Longer counts or about equal length should be given to the "Press" and "Lift" steps of the compression and expansion phases. Make the "Release" periods of minimum duration.

6. *Changing Position or Operator.*
(*a*) Remember that you can use either or both knees or can shift knees during the procedure, provided you don't break the rhythm. Observe how you rock forward with the back-pressure and backward with the arm-lift. The rocking motion helps to sustain the rhythm and adds to the ease of operation.

(*b*) If you tire and another person is available, you can "take turns." Be careful not to break the rhythm in changing. Move to one side and let your replacement come in from the other side. Your replacement begins the "Press-Release" after one of the "Lift-Release" phases, as you move away.

A **Position of operator and victim**

B **Compression phase**



C **Expansion phase (arm lift)**

D **Expansion phase (arm release)**

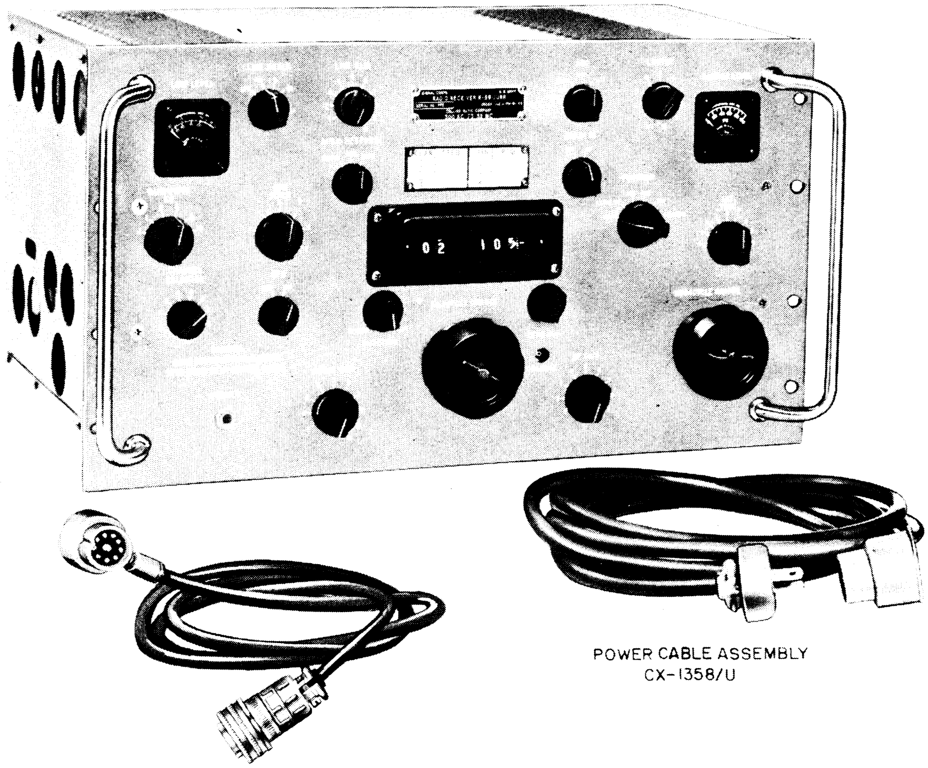


Figure 1. Radio Receiver R-391/URR.

This instruction book will be replaced by TM 11-863 which, when published, will be listed in SR 310-20-4 and SR 310-20-7.

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1. Scope

This instruction book contains instructions for the installation, operation, maintenance, and repair of Radio Receiver R-391/URR (fig. 1). In addition to these instructions there are two appendixes covering a list of references and an identification table of parts.

2. Forms and Records

The following forms will be used for reporting unsatisfactory conditions of Army materiel and equipment.

a. 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, and AFR 71-4 (Air Force).

b. DA AGO Form 468, Unsatisfactory Equipment Report, will be filled out and forwarded to the Office of the Chief Signal Officer as prescribed in SR 700-45-5.

c. AF Form 54, Unsatisfactory Report, will be filled out and forwarded to Commanding General, Air Materiel Command, Wright-Patterson Air Force Base, Dayton, Ohio, as prescribed in SR 700-45-5 and AFR 65-26.

d. DA AGO 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. 23).

e. DA AGO 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. 24).

Section II. DESCRIPTION AND DATA

3. Purpose

a. Radio Receiver R-391/URR (fig. 1) is a high-performance, exceptionally stable, general-purpose receiver for use in both fixed and mobile service. The receiver provides reception of radiotelegraph, voice, and frequency-shift keyed signals within a frequency range of .5 to 32 mc (megacycles). It is one of a series of receivers, consisting of Radio Receivers R-389/URR, R-390/URR, and R-391/URR, which possess a number of features in common, among which are unitized construction and interchangeable subchassis. In the unitized construction employed, the r-f (radio frequency), i-f (intermediate frequency), audio, oscillator, and power-supply circuits are situated on individual removable subchassis (figs. 9 through 15) mounted on a front panel and main frame assembly (fig. 8). These subchassis can be removed readily for trouble shooting and repair in a minimum of time, by the use of ordinary hand tools only. All of the subchassis can be interchanged between any receivers bearing the same model number, while certain subchassis are interchangeable between the various models in the series. The a-c (alternating-current) power-supply subchassis (Power Supply PP-621/URR), the 455-kc (kilocycle) i-f subchassis, and the a-f (audio-frequency) subchassis are identical in, and interchangeable among all models of the series. All of the subchassis, with the exception of the front panel, rear panel and main frame, are interchangeable between the R-390/URR and R-391/URR receivers. Radio Receiver R-391/URR employs an Autotune system for automatic tuning of any one of eight preset channels. A change in channel frequency may be made in approximately 15 seconds by means of the Autotune system.

b. Radio Receiver R-391/URR furnishes an output of 500 mw (milliwatt) of a-f power to a local 600-ohm load, and 10 mw of a-f power for application to a 600-ohm balanced line. Operation is possible from an input of either 115 or 230 volts ±10 percent, 48—62 cycles, through the use of Power Supply PP-621/URR, or of 28 volts dc (direct current) through the use of Dynamotor DY-78/URR (not furnished with the receiver). Power Supply PP-629/URR (fig. 16) is employed with but is not usually supplied with Radio Receiver R-391/URR. This supply furnishes 24 volts dc to operate to autotune motor. If Dynamotor DY-78/URR is used as a primary source of power, Power Supply PP-629/URR is not required.

c. Connectors and terminals on the back panel (fig. 21) are provided for use of the receiver with auxiliary equipment. A 50-ohm, i-f output connection is provided for carrier-shift teletypewriter, single sideband, or other auxiliary equipment. Agc (automatic gain control) and diode-detector load connections are available for use in diversity combining systems. Connections are also provided for external manual r-f gain control. A break-in relay for disabling the receiver circuits is operated by grounding a provided terminal.

d. The receiver is permeability tuned by varying the degree of insertion powdered-iron cores into the tuning coils, through a system of gears, cams, and racks. The calibration of Radio Receiver R-391/URR is accurate to within 3/10 kc, an accuracy which permits use of the receiver as a highly precise frequency meter.

4. System Application

a. Space-diversity Receiving System.

(1) Two or three Radio Receivers R-391/URR can be connected as shown in figure 2 as a space-diversity receiving system for reception of voice signals. This system provides uniform-strength output to a loudspeaker or headset, regardless of fading of signals.

(2) Rhombic or doublet antennas spaced approximately 600 feet apart are connected to the BALANCED ANTENNA 125 ohm jacks (J108) of the two receivers.

(3) The detector diode load of receiver B is made to be common to both receivers by connecting terminals 14 of both receivers together and removing the jumper between terminals 14 and 15 of receiver A. The audio system of receiver B only is used. A loudspeaker is connected in the manner shown from terminal 6 to ground. A balanced line may be connected between terminals 10 and 13 to supply audio to some remote location.

(4) In the presence of a strong signal on the antenna of receiver A, agc voltage produced in this set increases and by means of the common connection between terminals 4 (of both receivers) is applied to the controlled stages of both receivers. Thus, the weak signal on the antenna of receiver B is further decreased by reducing the gain of the controlled stages of this receiver. The opposite would be true when the signal on the antenna of receiver B is stronger than that of the antenna of receiver A. A jumper (for normal reception) is removed from terminals 3 and 4 of both receivers and is placed between terminals 4 and 5. This connects a crystal diode into the circuits to prevent loading of the agc circuit of the controlling receiver by the agc circuit of the passive receiver.

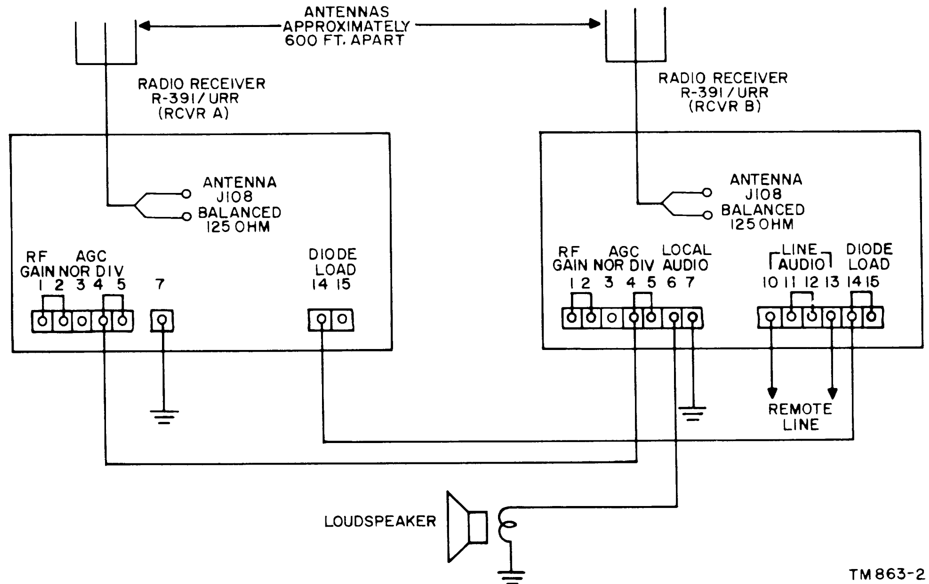


Figure 2. Space diversity receiving system, block diagram.

b. Space-diversity Radioteletype System, Type 1. Figure 3 shows two Radio Receivers R-391/URR connected in a space-diversity radioteletype system. The doublet or rhombic antennas feed the incoming frequency-shift signals to the receivers, where they are converted to a frequency of 2125 cycles for the MARK condition and 2975 cycles for the SPACE condition of the radioteletype terminal equipment sending contacts. The outputs taken from the line audio outputs of the receivers are applied to Radioteletype Terminal Equipment AN/FGC-1, which provides diversity combining and produces neutral signals for operation of teletypewriter equipment. The receivers are connected for normal operation as described in paragraph 17.

c. Space-diversity Radioteletype System, Type 2. Two Radio Receivers R-391/URR also can be used in the type of space-diversity radioteletype system shown in figure 4. The doublet or rhombic antennas feed the incoming frequency-shift signals to the receivers, where the carrier frequency is converted to a 455-kc intermediate frequency. This i-f signal, taken from the 50-ohm i-f output circuit of the receivers, then is fed to Frequency Shift Converter (CV-116/URR, which provides diversity combining and produces neutral signals for operation of teletypewriter equipment. The receivers are connected for normal operation as described in paragraph 17.

5. Technical Characteristics

Type of circuit...	Triple-conversion superheterodyne on eight lowest-frequency bands; double-conversion superheterodyne on all other bands.
Frequency range	.5 to 32 mc. (in 32 steps).
Types of signals received	A1-cw, A2-mcw, A3-Voice, F1-Frequency-shift keying.
Type of tuning...	Automatic tuning by selection of one of eight preset channels; frequency read directly on counter-type indicator.
Method of calibration	Built-in crystal-controlled calibration oscillator.
Calibration points	Every 100 kc.

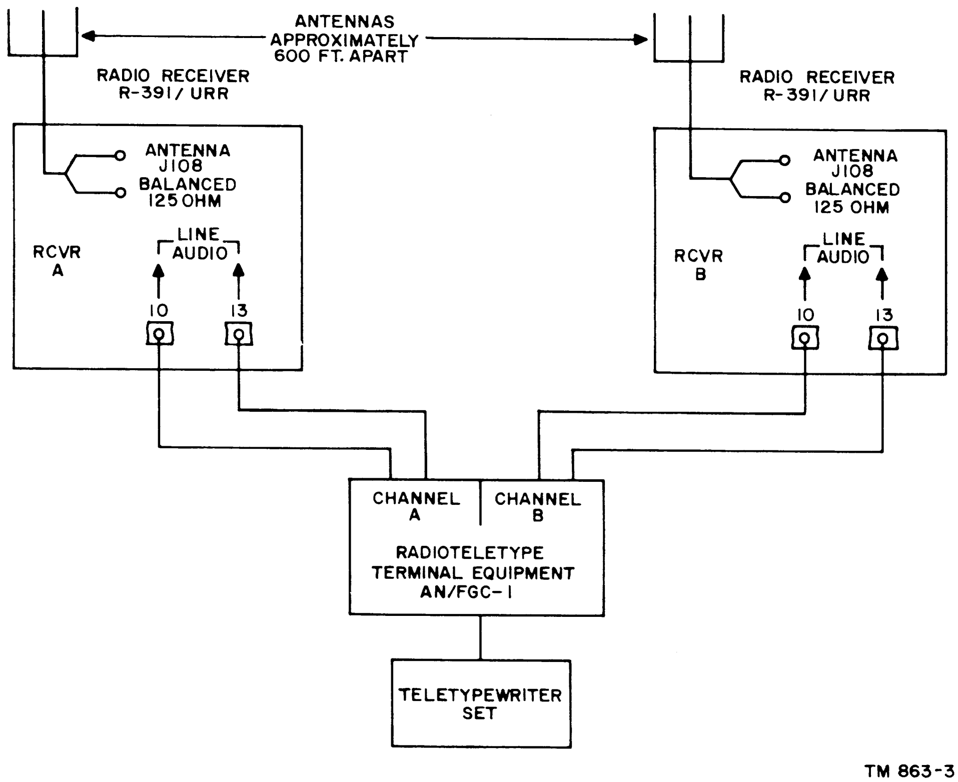


Figure 3. Space-diversity radioteletype system, type 1, block diagram.

Audio power output:
- 600-ohm unbalanced line 500 mw.
- 600-ohm balanced line 10 mw.
- Phones .... 5 mw.

I-f selectivity .... 100 cps to 16-kc bandwidth, in 6 steps.

Intermediate frequencies:
- First variable i-f (used only on eight lowest-frequency bands) ..... 9 to 18 mc.
- Second variable i-f (all bands) 2 to 2.5 mc on lowest step; 2 to 3 mc on all other steps.
- Third (fixed) i-f .... 455 kc.

Sensitivity:
- A-m signals ... 3 uv or better.
- C-w signals ... 1 uv or better.

Power source .... 115/230 volts ac ±10%, 48-62 cps through Power Supply PP-621/URR, or 28.5 volts dc through Dynamotor DY-78/URR (not supplied). 115/230 volts ac ±10%, 48-62 cps through Power Supply PP-629/URR, for use with Autotune system.

Power input:
- 115/230 volts ac .... 270 watts total; 170 watts with oven heaters off.
- 28.5 volts dc, with Dynamotor DY-78/URR .... 8 amperes; 5.8 amperes with oven heaters off.

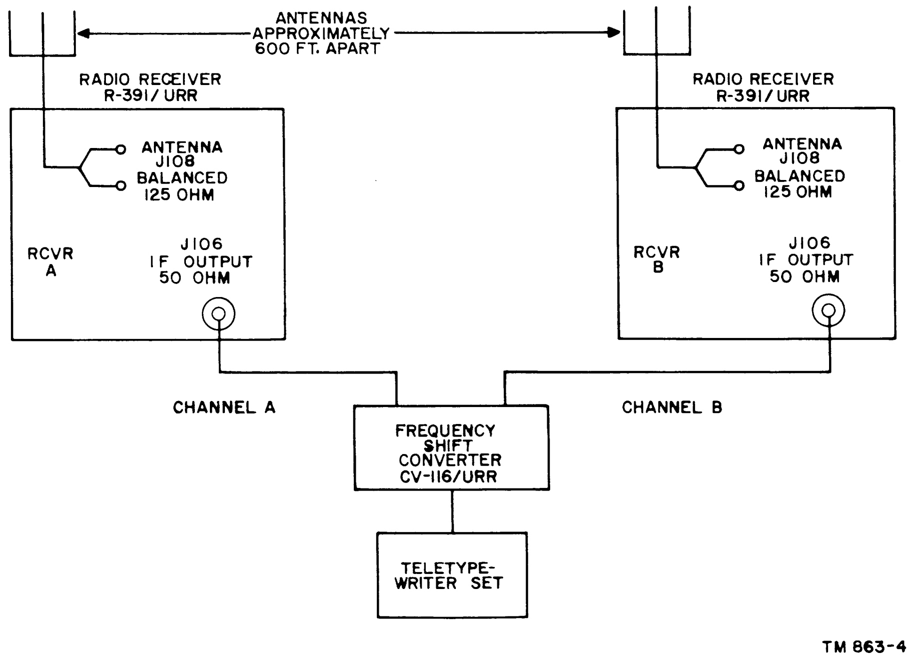


Figure 4. Space-diversity radioteletype system, type 2, block diagram.

24 volts dc, with Power Supply PP-629/URR	3 amperes (for autotune system only).
Number of tubes	33 (including ballast tube 3TF7).
Antennas:	
Unbalanced	Random length vehicular-mounted whip or straight-wire.
Balanced	125-ohm nominal terminating impedance; matches 70- to 200-ohm lines or unbalanced transmission lines using adapters.
Temperature range	−40° C (−40° F) to 55° C (131° F).
Altitude	Up to 10,000 ft.
Weight	82½ lb (including Power Supply PP-621/URR).

6. Packaging Data (fig. 5)

When packed for export or domestic shipment, Radio Receiver R-391/URR is wrapped in paper and placed in an inner corrugated fiberboard carton. Cleated wooden spacers are used to hold the receiver securely within the carton and to prevent damage to the controls and connections on the front and back panels. In the space between the back panel of the receiver and the rear wooden spacer are stored two instruction books, eight 8-unit bags of silica gel, a package containing Power Cable Assembly CX-1358/U and a package containing Electrical Special Purpose Cable Assembly CX-2083/U. The inner corrugated fiberboard carton is inclosed in a sealed, moisture-vaporproof barrier, and is placed in an outer, tight-fitting corrugated cardboard carton. This outer carton is wrapped in moisture-resistant paper sealed with tape, placed in a wooden crate containing excelsior, and secured with steel straps. The complete package is 21 inches high by 32 inches wide by 32 inches long, giving it a volume of approximately 12.4 cubic feet. An exploded view of the packaging for Radio Receiver R-391/URR is shown in figure 5. The running spares for the receiver are shipped in a separate, paper-wrapped corrugated fiberboard carton.

Note. Items may be packaged in a manner different from that shown, depending on the supply channel.

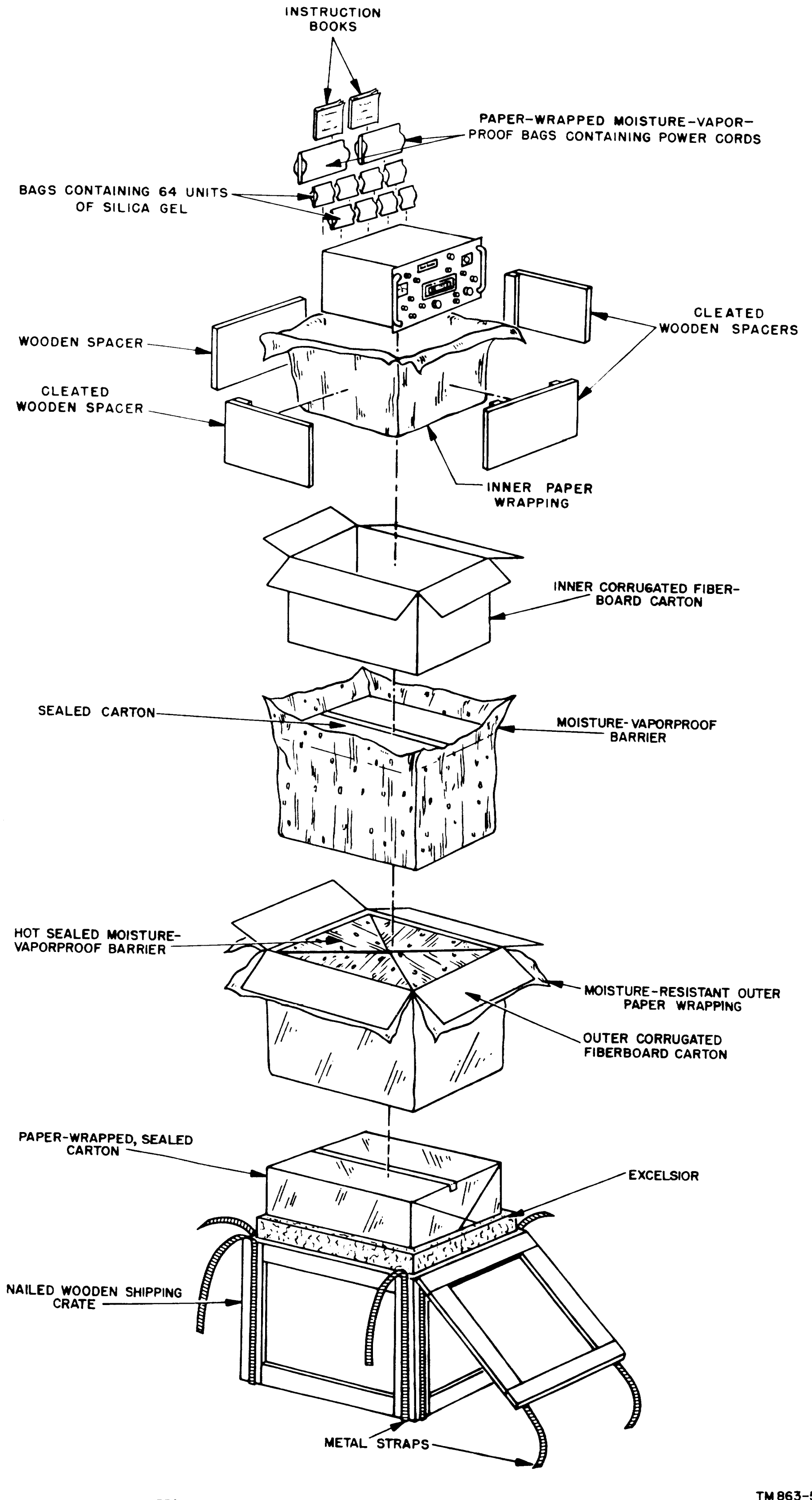


Figure 5. Radio Receiver R-391/URR, packaging.

7. Table of Components

Component	Required No.	Weight (in.)	Depth (in.)	Length (in.)	Volume (cu ft)	Unit wt
Radio Receiver R-390/URR	1	10½	17¼	19	2.0[a]	67½
Power Supply PP-621/URR	1	5⅞	4⅛	6¾		15
Power Cable Assembly CX-1358/U (fig. 1)	1			96		.677
Electrical Special Purpose Cable Assembly CX-2083/U (fig. 1)	1			84		
Instruction books	2					
Set of spare tubes	1 (31)					
Set of spare fuses	1 (12)					
Set of spare lamps	1 (4)					
Total					2	

a Includes Power Supply PP-621/URR.

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

8. Description of Radio Receiver R-391/URR

a. Radio Receiver R-391/URR (fig. 1) is a 33-tube superheterodyne receiver designed for reception of c-w, voice, and radioteletype signals within a frequency range of .5 to 32 mc. The receiver is designed for mounting in a standard 19-inch rack, such as Electrical Equipment Cabinet CY-1119/FRR. The structural parts of the receiver are of aluminum.

b. All operating controls are located on the front panel (fig. 22), which has a grey semi-gloss finish. Two handles are provided at the outer edges of the panel to facilitate removal of the receiver from the rack or case. The two large knobs at the bottom of the panel marked MEGACYCLE CHANGE and KILOCYCLE CHANGE are used to tune the receiver to the desired frequency. Above the KILOCYCLE CHANGE knob is a counter-type frequency indicator. The numbers shown indicate the frequency in kilocycles. The two left-hand number wheels of the counter are operated by the MEGACYCLE CHANGE control; and three right-hand number wheels are operated by the KILOCYCLE CHANGE control. The operation of these controls, once having been preset, is under control of the CHANNEL SELECTOR switch, located on the left-hand side of the panel. This control is an eight-position switch for automatic selection (through use of the autotune mechanism) of any one of eight preset frequency channels. Both the MEGACYCLE CHANGE and KILOCYCLE CHANGE control knobs have locking keys. These keys are always locked when using automatic tuning. In the upper left-hand corner of the front panel is a meter for indicating the level in vu (volume units) of the line audio output of the receiver. The carrier-level meter, located in the upper right-hand corner of the panel, indicates the relative strength of incoming signal and signal peaks. Distributed about the panel are 16 bar-knobs for controlling the various functions of the receiver. These controls include the LINE METER-OFF and range switch, LINE GAIN control, AGC time-constant switch, LIMITER-OFF and threshold control, AUDIO RESPONSE selector switch, BREAK IN circuit OFF-ON switch, BANDWIDTH KC selector switch, BFO PITCH control, FUNCTION switch, ANT. TRIM control, CHANNEL SELECTOR switch, BFO OFF-ON switch, AUTOTUNE REMOTE-LOCAL switch, frequency-indicator ZERO ADJ. LOCAL GAIN control, and R-F GAIN control. The jack in the lower-left-hand corner of the panel is provided for connecting a pair of headphones to the receiver local audio output. Directly below the ZERO ADJ control is located an aperture, identified as CHANNEL, through which is seen a channel indicator. After a channel has been selected by the CHANNEL SELECTOR switch, and the Autotune mechanism comes to a stop, this indicator shows what channel is being used.

c. On the back panel of the receiver (fig. 21) are mounted special tools, antenna input connectors, operating and spare fuses, power connector, remote control connector, autotune connector, an i-f output connector, an oven off-on control, terminal strips for connection of external circuits, and, under a protective cover, trimmer adjustments for the crystal oscillators.

d. Radio Receiver R-391/URR is comprised of a number of interchangeable assemblies (figs. 6 and 7), including the main frame and seven removable subchassis. Three of the subchassis, the r-f subchassis, i-f subchassis, and crystal-oscillator subchassis, are mounted on the upper deck of the main frame. Mounted in three compartments on the lower deck are the vfo subchassis, a-f subchassis, calibration-oscillator subchassis, and Power Supply PP-621/URR (a-c power supply). The subchassis are connected to the main frame and/or to each other by cables terminating in locking-type connectors. Mounted on the r-f subchassis are the gears, camshafts, and racks of the mechanical tuning system (fig. 9). Mounted on the main frame is a casting to which are attached the parts of the Autotune system (fig. 8).

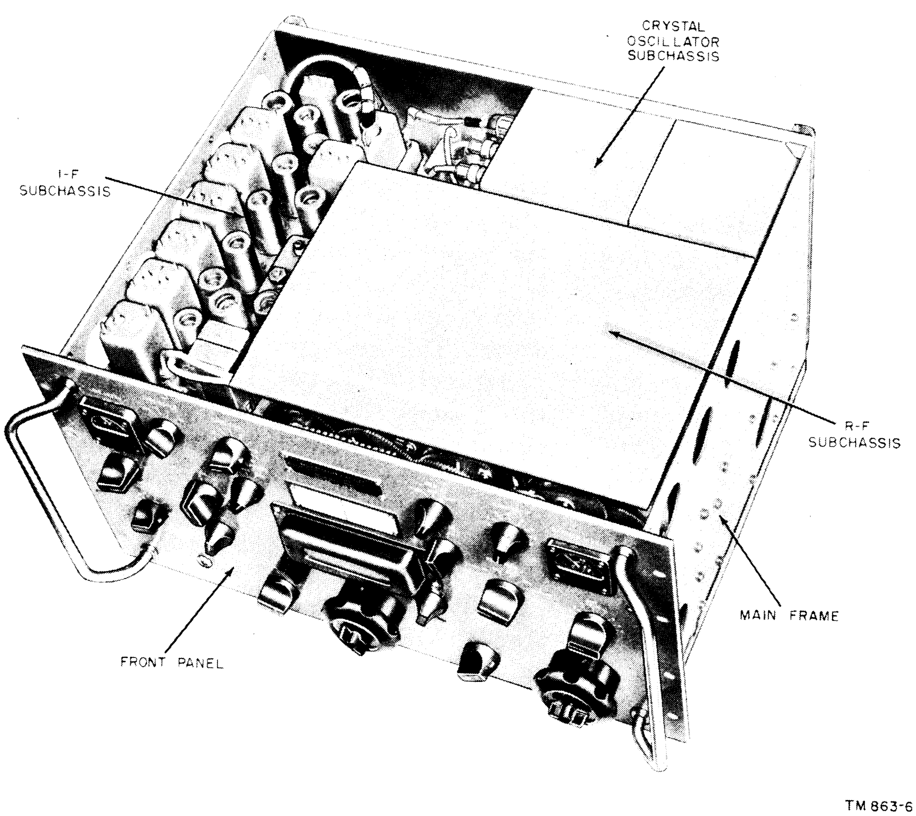


Figure 6. Radio Receiver R-391/URR, showing location of subchassis.

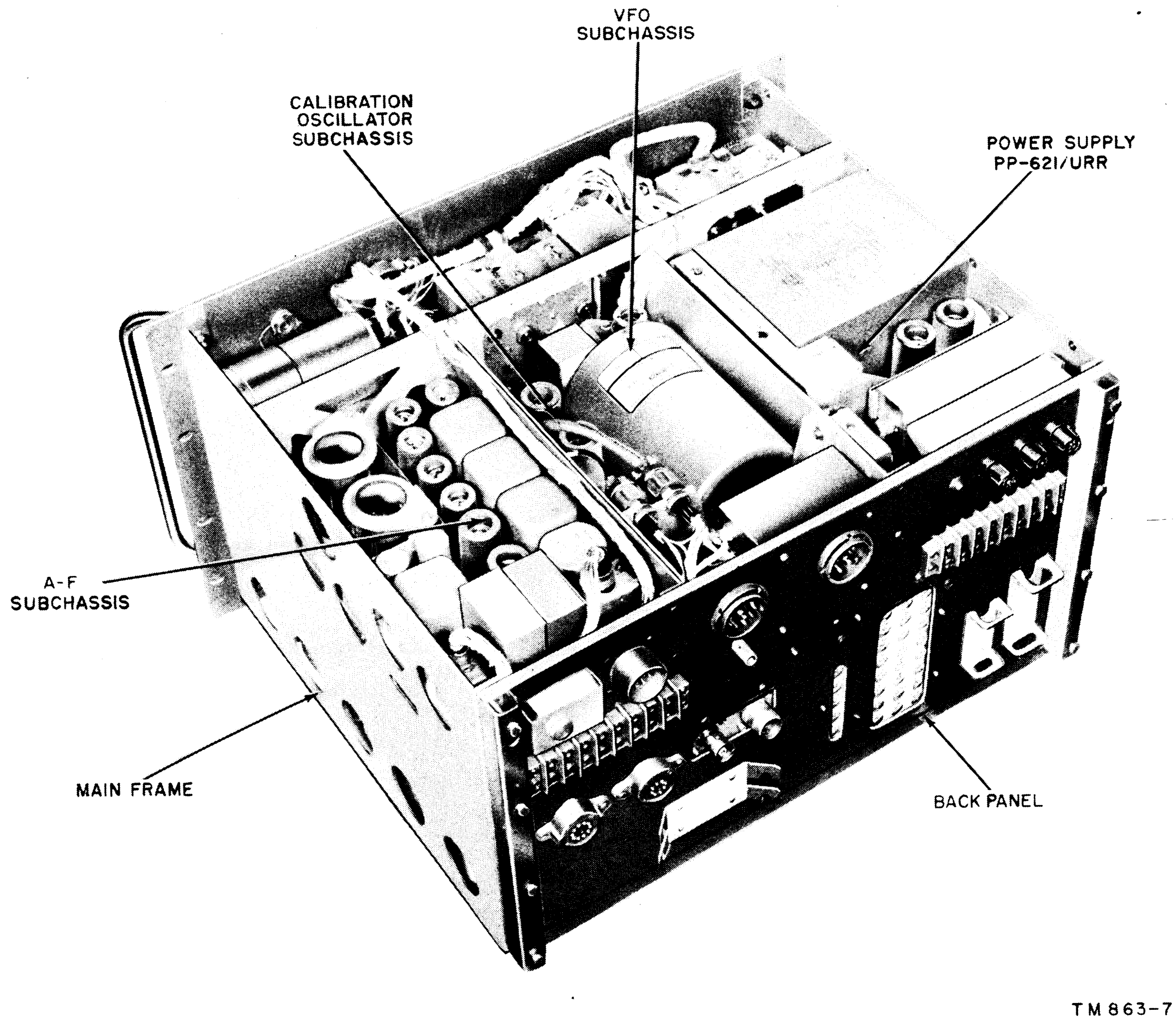


Figure 7. Radio Receiver R-391/URR, showing location of subchassis.

9. Description of Cases and Cabinets Used with Radio Receiver R-391/URR

Two cases and two rack-type cabinets (not supplied) are available for use with the receiver. However, the receiver may be mounted in any standard 19-inch rack, provided that adequate ventilation is furnished and that the entire weight of the receiver is not supported by the front panel alone when the receiver is used in mobile service.

a. Cabinet CY-917/URR. This is a lightweight, table-top cabinet designed for general fixed-station use.

b. Case CY-979/URR. This case is constructed more rigidly than the CY-917/URR, and embodies shock-absorbing mountings for mobile, table-top installations.

c. Electrical Equipment Cabinet CY-1119/FRR. The electrical equipment cabinet is a floor-mounted, rack-type installation designed for fixed-station use. Seventy inches of panel space is provided for accommodating several components. One-man installation is possible through the use of shelf-type angle brackets.

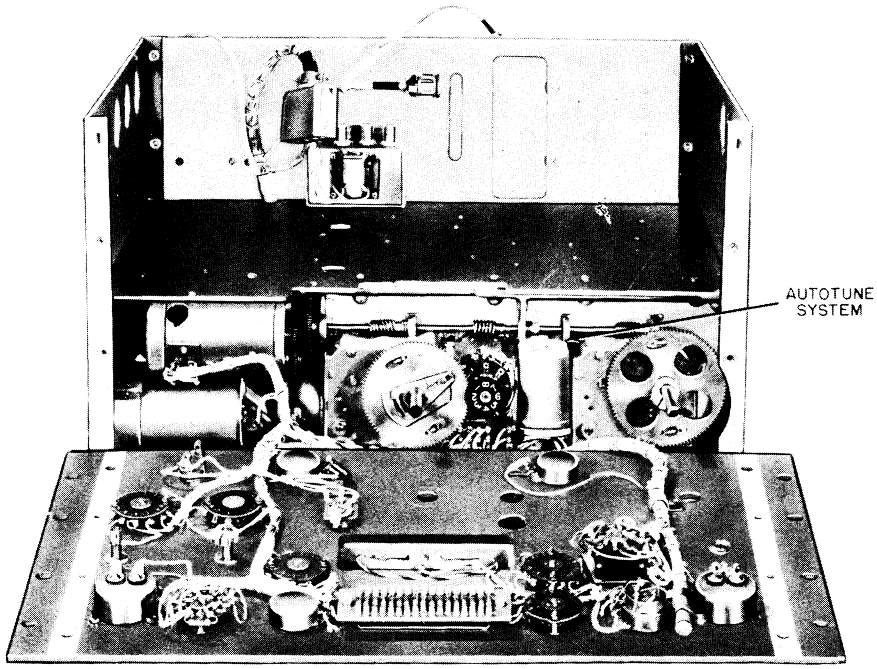


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Figure 8. Radio Receiver R-391/URR, front panel and main frame.

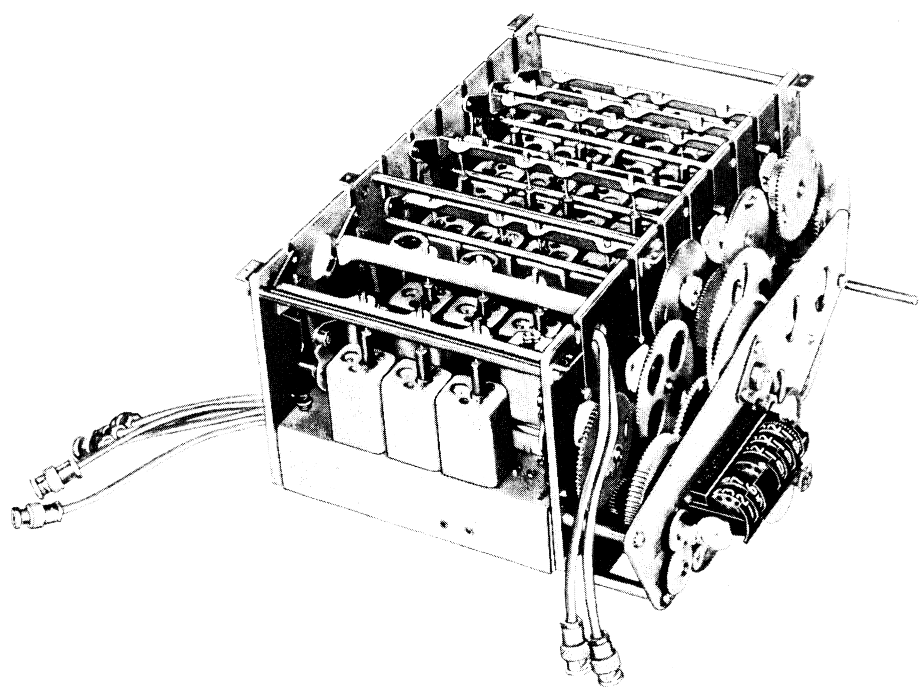

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Figure 9. R-f subchassis.

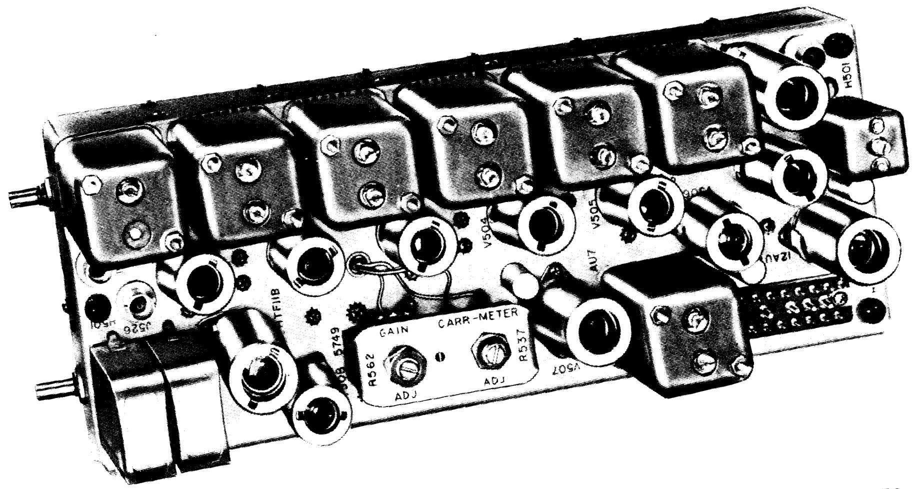

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Figure 10. I-f subchassis.

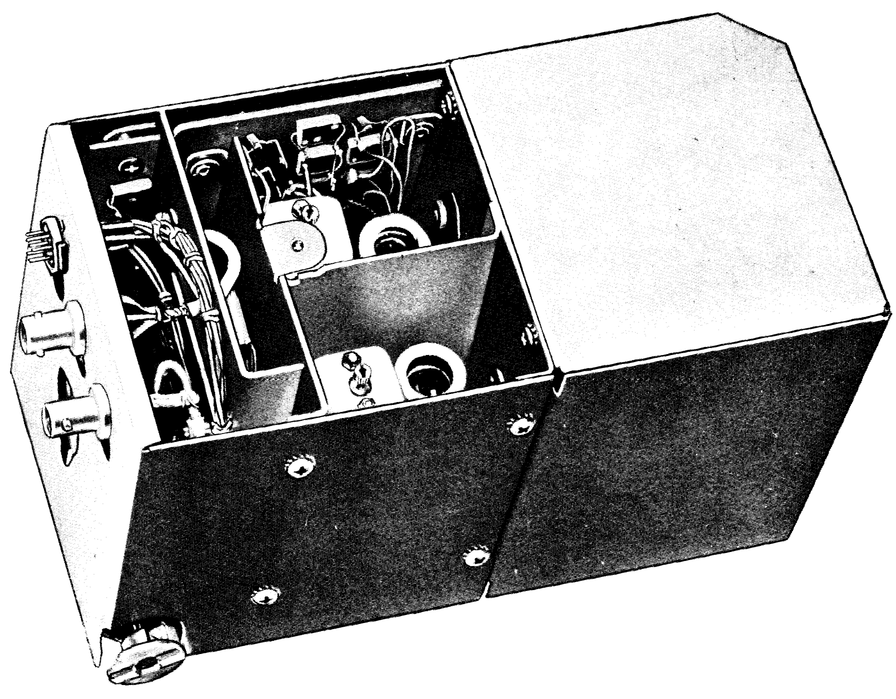

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Figure 11. Crystal-oscillator subchassis.

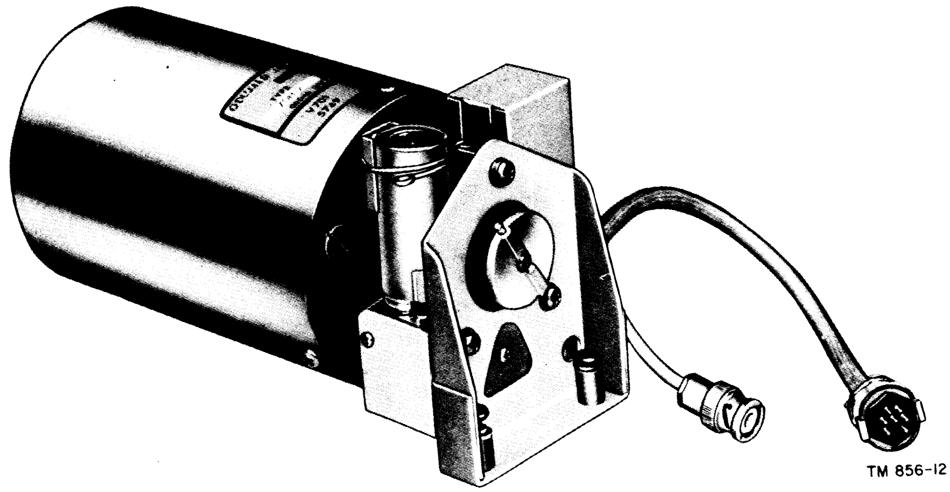

Figure 12. Vfo subchassis.

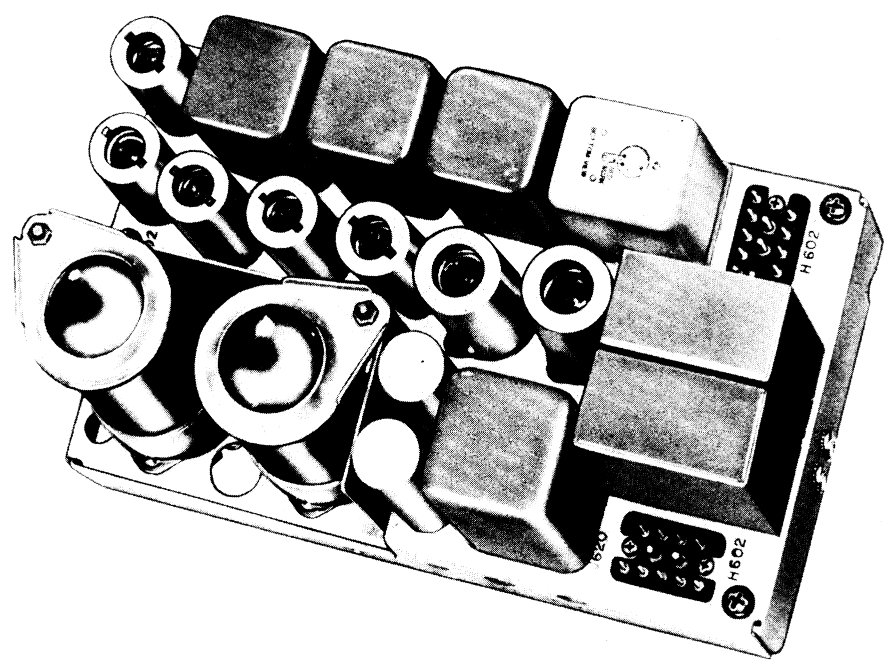

Figure 13. A-f subchassis.

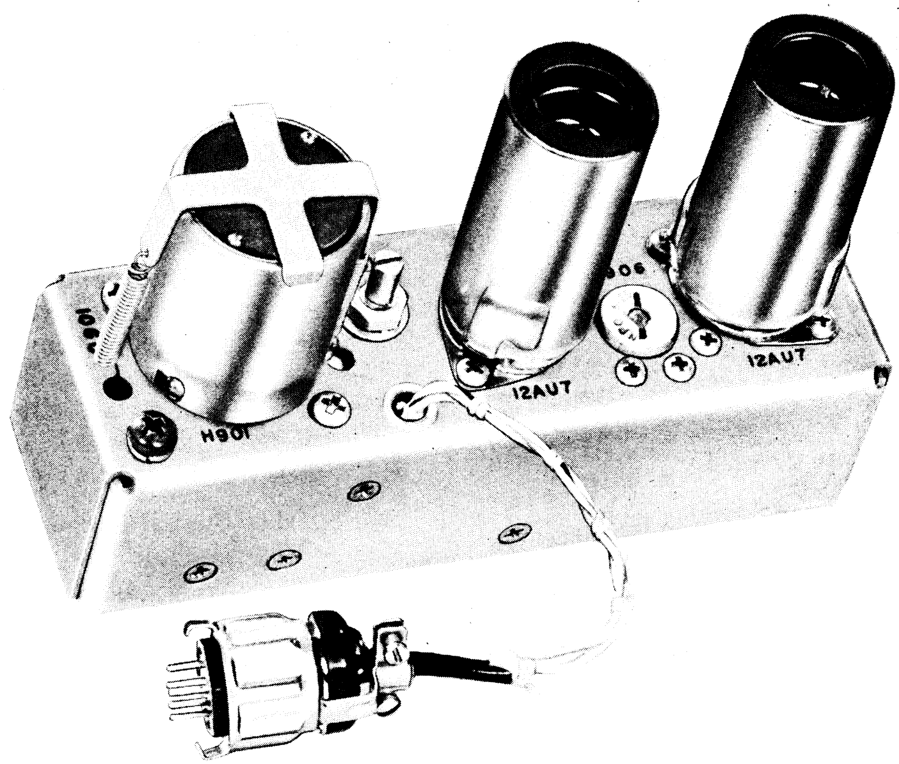

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Figure 14. Calibration-oscillator subchassis.

d. Electrical Equipment Cabinet CY-1216/U. This cabinet is of rugged construction, and includes shock-absorbing mountings for mobile installations. 48 inches of panel space is provided for accommodating several components. When either electrical equipment cabinet is used with more than one receiver, always use a 1¾-inch blank strip between the receivers to provide adequate ventilation.

Caution: When Radio Receiver R-391/URR is installed in any case other than those described above, adequate ventilation must be provided. In mobile use the receiver must be supported in the manner provided in Case CY-979/URR and Electrical Equipment Cabinet CY-1216/U. For mobile applications of the receiver in cabinets other than Case CY-979/URR and Electrical Equipment Cabinet CY-1216/U, support must be provided at the rear of the receiver, so that the front panel does not carry the entire weight.

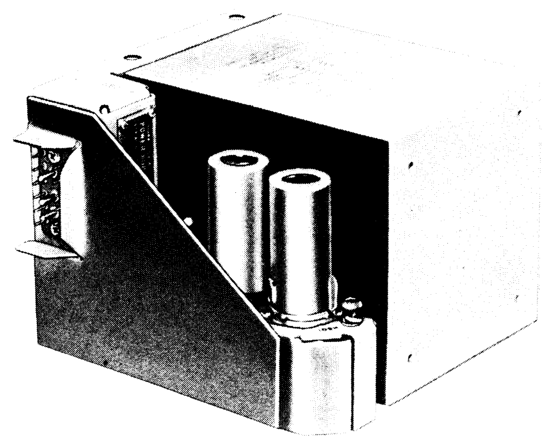

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Figure 15. Power Supply PP-621/URR.

10. Description of Power Supply PP-621/URR (a-c power supply) (fig. 15)

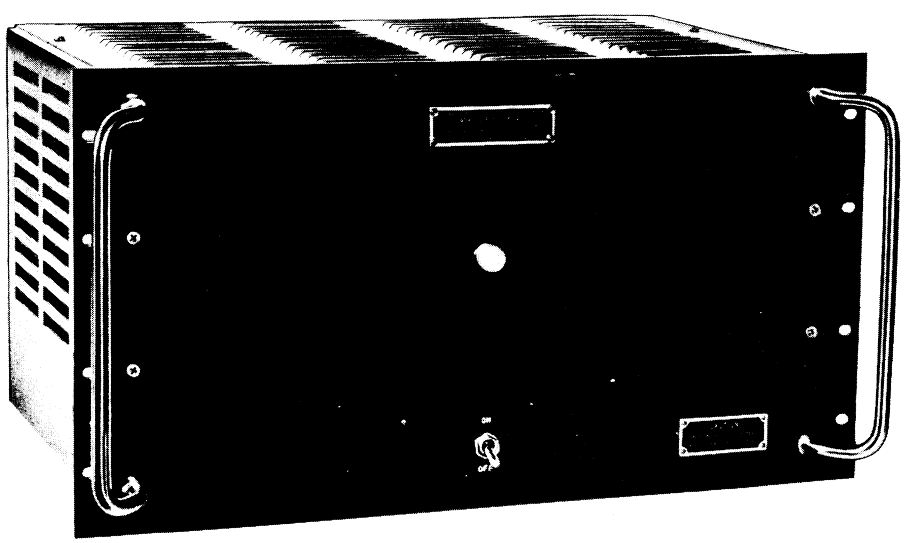
a. Power Supply PP-621/URR, consisting of a power transformer, two 26Z5W rectifier tubes, and associated circuits mounted on a removable subchassis, is mounted in a compartment on the lower deck of the main frame. The power supply furnishes the proper voltages for operation of Radio Receiver R-391/URR from a 115- or 230-volt, ±10%, 48- to 62- cycle source. Switch S801 on the top of the subchassis can be locked in the proper position to connect input power for either 115-volt or 230-volt operation.

b. Power Cable Assembly CX-1358/U (fig. 1) is used when the receiver is operated from a 115-volt or 230-volt a-c source. It is made up of an 8-foot, two-conductor cable terminated in a screw-locking plug at one end and a standard parallel-prong a-c plug at the other end. The screw-locking plug has a center lead screw for securing the cable plug to the POWER connector of the receiver.

11. Description of Power Supply PP-629/URR (fig. 16)

a. Power Supply PP-629/URR, consisting of a power transformer, selenium rectifier, and associated circuitry, is housed within a grey semi-gloss enamel finished case. This supply is not furnished with the receiver, but is required to furnish the 28-volt d-c supply for use with the autotune. Power Supply PP-629/URR operates from a 115- or 230-volt a-c source. A switch on the top of the chassis can be locked in the proper position to connect input power for either 115-volt or 230-volt operation. The switch on the front panel is used as the ON-OFF switch for the unit.

b. Electrical Special Purpose Cable Assembly CX-2083/U (fig. 1) is used to connect the receiver with Power Supply PP-629/URR to supply 24 volts for the autotune motor. It is made up of a 7-foot, 2-conductor cable terminated in a screw-locking plug at one end and a plug at the other end. The screw-locking plug employs a center lead screw for securing the power cable to the REMOTE CONTROL connector of the receiver.



28VDC

TM 863-16

Figure 16. Power Supply PP-629/URR.

12. Running Spares

A group of running spares is furnished with each receiver. Spares are provided for all normally expendable items such as tubes, dial lamps, and fuses. The following is a list of running spares:

2 tubes, type 3TF7.
6 tubes, type 6AJ5.
2 tubes, type 6AK6.
1 tube, type 6BH6.
3 tubes, type 6BJ6.
6 tubes, type 6C4W.
1 tube, type 12AT7.
3 tubes, type 12AU7.
1 tube, type 26Z5W.
1 tube, type 5651.
4 tubes, type 5749/6BA6W.
1 tube, type 6082.
4 dial lamps, type GE 327.
6 fuses, 3/8-ampere, type 3AG.
6 fuses, 3-ampere, type 3AG.

13. Additional Equipment Required

The following material is *not* supplied as a part of Radio Receiver R-391/URR, but is required for its operation.

Antenna:
- Balanced — Doublet or rhombic.
- Unbalanced... Straight-wire or random length whip.

Low-impedance transmission line:
- Balanced — 125 or 200 ohms.
- Unbalanced... 70-ohm coaxial cable.

Headset .... Headset Navy Type CW-49507, or equivalent 600-ohm headset.

Cord .... Headset Cord CX-1334/U, or equivalent.

Speaker ..... 600 ohms.

Adapter Connector UG-970/U. Adapts Plug PL-259 on unbalanced antenna lead-in to BALANCED ANTENNA 125 OHM connector J108.

Adapter Connector UG-971/U.. Adapts Plug Connector UG-573/U on unbalanced antenna lead-in to J108.

Power Supply PP-629/URR ..... For use with Autotune system.

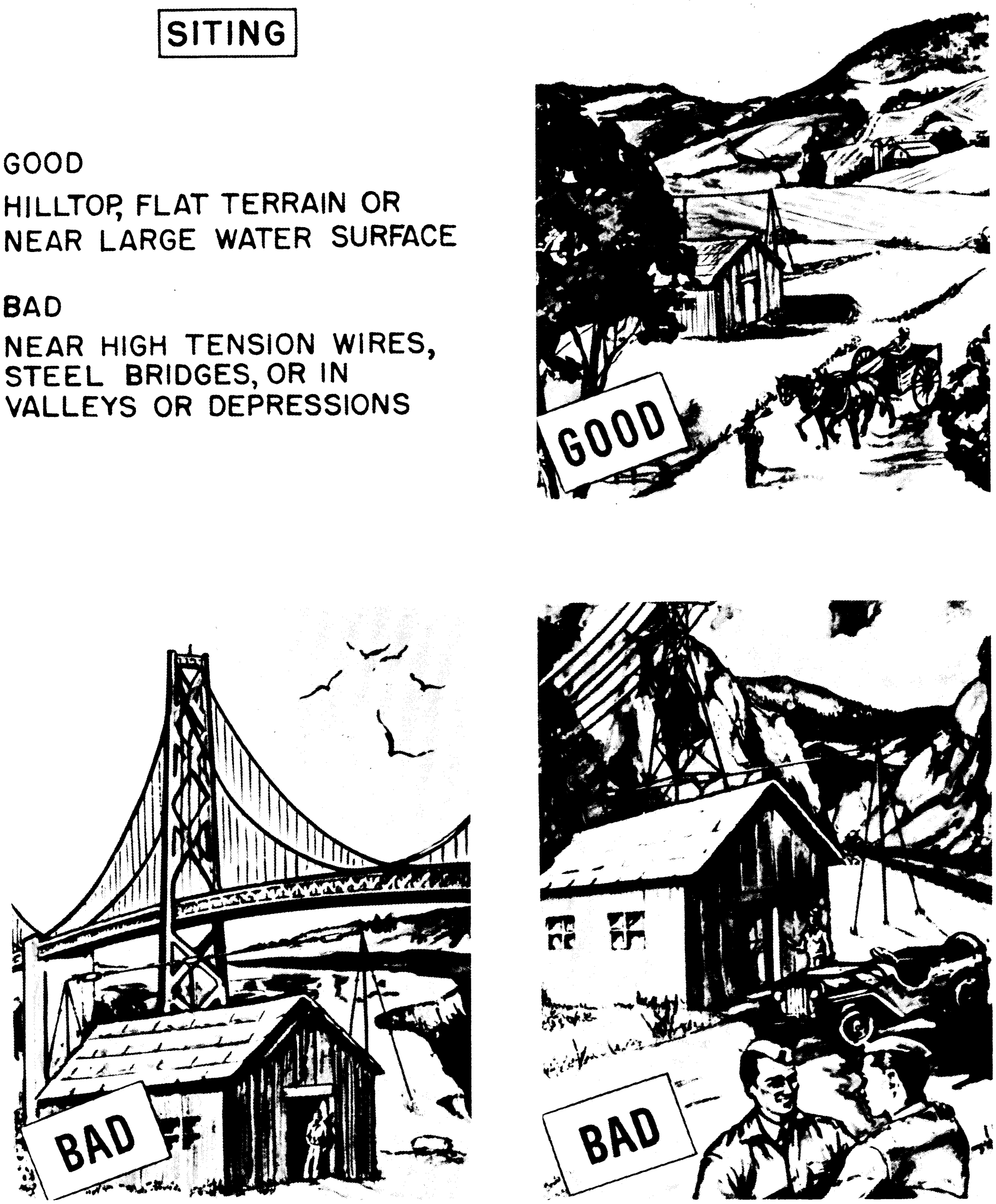


Figure 17. Radio Receiver R-391/URR, siting.

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF RADIO RECEIVER R-391/URR

14. Siting (fig. 17)

a. External Requirements. The location of radio equipment depends upon the tactical situation and local requirements, such as the necessity of operating the equipment from an installation where it cannot be seen, from an installation in a vehicle or a shelter, and from an installation which has ready access to messengers. In addition to these factors, the terrain demands consideration before an operating location is decided upon. The prime consideration for establishing the most efficient communication is the location of the antenna. It should be in a location which is high and clear of hills, buildings, cliffs, densely wooded areas, and other obstructions. Depressions, valleys, and other low places are poor sites for radio reception, because the high surrounding terrain absorbs r-f energy. Clear, strong signals cannot be expected if the antenna is located under or close to a steel bridge, underpass, power line, or power unit. Flat ground having good conductivity is desirable.

b. Interior Requirements. If the receiver is to be installed for fixed service, the shelter must meet the following requirements:

(1) The receiver is to be mounted in Electrical Equipment Cabinet CY-1119/FRR or in a standard rack.

(2) For table-top installations, a table or bench capable of supporting the weight of the equipment must be available.

(3) The receiver must be located in a position convenient to the 115- or 230-volt a-c power outlet, if it is to be installed for a-c operation.

(4) Adequate lighting for day and night operation must be provided. Position the receiver so that the panel designations may be read easily by the operating personnel. Artificial lighting should be installed so that the light falls directly upon the panel. A portable drop lamp and extension cord are convenient assets for maintenance personnel.

(5) Adequate ventilation always must be provided.

15. Uncrating, Unpacking, and Checking New Equipment

Note. For used or reconditioned equipment, refer to paragraph 19.

a. General. The equipment is packed identically for both export and domestic shipment. When new equipment is received, select a site where the equipment can be unpacked without exposure to the elements, and which is convenient for the installation of the equipment.

Caution: Be careful uncrating, unpacking, and handling the equipment. If it becomes damaged, a complete overhaul might be required, or the equipment might be rendered useless.

b. Uncrating and Unpacking Export and Domestic Shipments.

(1) Place the packing case as near the operating position as is convenient.

(2) Cut and fold back the metal straps.

(3) Remove nails with a nail puller. Remove the top and one side of the wooden shipping crate. Do not attempt to pry off side and top, as this might damage the equipment.

(4) Remove excelsior covering the paper-wrapped sealed carton inside the crate, and take out the carton.

(5) Remove the paper covering from carton, open the outer corrugated fiberboard carton and withdraw the inner carton inclosed in the moisture-vapor-proof barrier.

(6) Slit open the seams of the moisture-vaporproof barrier and remove the inner corrugated fiberboard carton.

(7) Open the inner carton and remove the four wooden spacers.

(8) Remove the bags of silica gel, the instruction books, and the packages containing power cords, from space at rear of receiver.

(9) Withdraw the paper-wrapped receiver from the inner carton, place it on a workbench or near its final location, and remove the paper wrapping.

c. Checking.

(1) Check contents of cartons against master packing slip.

(2) Check front panel of receiver for damage to knobs or to glass windows of meters and frequency-indicator dial.

(3) Make a written record of both front-panel autotune control positions by reference to the frequency indicator. While checking the mechanical operation of the Autotune mechanism, rotate each control to test smoothness of movement. Any binding or jamming indicates abnormal mechanical operation. Unlock the autotune controls. The autotune mechanisms that operate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls are unlocked by turning their respective locking keys approximately two revolutions counterclockwise. The mechanisms are locked by turning the locking keys clockwise until they become tight, without using undue force. Do not force the controls to rotate. If they do not turn easily, examine for bent parts or other damage.

(4) Rotate MEGACYCLE CHANGE control knob until the left-hand portion of the frequency-indicator dial rotates from 00 through 32.

(5) Rotate KILOCYCLE CHANGE control knob until the right-hand portion of the frequency-indicator dial rotates from 000 through 999.

(6) Turn CHANNEL SELECTOR switch through each position, noting whether it turns freely. Return to original position.

(7) Return autotune controls to settings recorded as directed in subparagraph (3), above, and tighten locking keys. Both autotune locking keys must be locked before the power is turned on or the position of the CHANNEL SELECTOR switch is changed. The control positions would be lost if the controls were allowed to rotate with the locking keys loose.

(8) Remove top and bottom dust covers by removing the sixteen screws and lock washers that secure covers to main frame.

(9) Inspect subchassis on upper and lower decks of receiver for loose tube shields and broken tubes. See that all connectors are firmly seated; loose connectors are a common cause of improper operation in radio equipment. Replace dust covers.

(10) Remove the three fuses on rear panel, and see that they are of the proper ratings (fig. 21). Make sure that fuses are firmly seated after replacing them.

Caution: To avoid serious damage to the receiver, do not use any fuse rated above the value specified.

(11) Inspect for bent or broken connectors and terminals on rear panel. Check to see that all special tools are in place in their holders (fig. 21). Remove small cover at lower right-hand corner, and check to see that the spare fuses of proper ratings are in place.

(12) Check contents of box containing running spares for damaged parts.

d. Power Supply PP-629/URR. Uncrate and unpack Power Supply PP-629/URR by following the instructions in subparagraph *b* above. When unpacked, check the fuses for proper seating, and make sure they are of proper value (fig. 20).

16. Installation of Radio Receiver R-391/URR

Radio Receiver R-391/URR is shipped with all tubes, crystals, and fuses in place, and no further internal installation is required. Subparagraphs *a, b, c,* and *d* below contain instructions for installing the receiver for fixed and mobile use.

a. Fixed, Table-top Installation. When housed in Cabinet CY-917/URR or a similar well-ventilated case for fixed operation, the receiver can be placed on any sturdy table or bench.

b. Fixed, Cabinet Installation. To install the receiver in a standard cabinet, such as Electrical Equipment Cabinet CY-1119/FRR, remove the top and bottom dust covers of the receiver. Remove one of the blank panels from the cabinet and install the receiver. Secure the front panel to the cabinet with the bolts removed from the blank panel. Insert them in the four elongated holes located along the vertical edges of the receiver front panel.

c. Mobile, Table-top Installation. When the receiver is housed in Case CY-979/URR for mobile operation, the case must be securely bolted to a table or shelf which is fastened rigidly to the vehicle body. Sufficient room must be allowed for ventilation, for access to the connections on the back panel, and for withdrawal of the receiver from the case for servicing. Adequate lighting facilities must be provided, to permit reading of the control names and positions, during day and night operation.

d. Mobile, Cabinet or Rack Installation. When the receiver is installed in Electrical Equipment Cabinet CY-1216/U for mobile operation, the cabinet must be securely bolted to the vehicle body. Adequate ventilation must be provided and sufficient room must be allowed for access to back panel connections and for withdrawal of the receiver for servicing. Provision for lighting must be made to permit reading of control names and positions, during day and night operation.

17. Connections

Each Radio Receiver R-391/URR is shipped with jumpers between terminals 1 and 2, 3 and 4, 11 and 12, and 14 and 15. These four jumpers are required for normal operation.

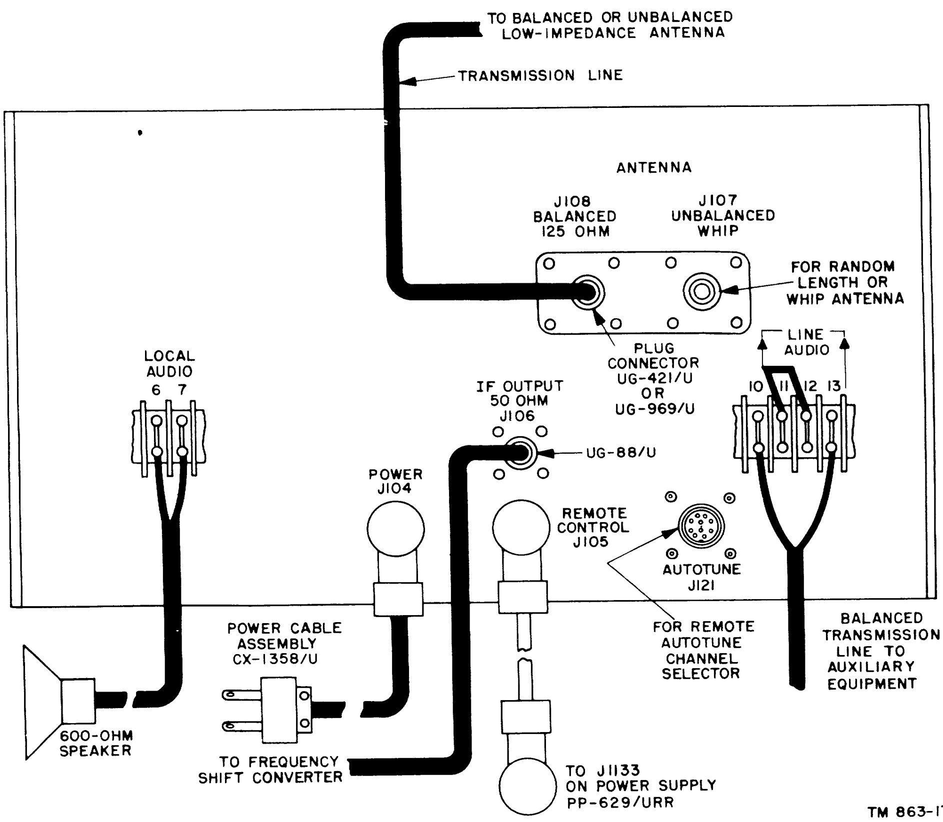


Figure 18. Radio Receiver R-391/URR, cording diagram.

Warning: The voltages used are sufficiently high to endanger human life. To prevent shock hazard for personnel touching outside metallic parts of the receiver, connect terminal 16 (marked GND) on the rear panel (fig. 21) to ground.

a. Power Input (fig. 18). For 115- or 230-volt, 48- to 62-cps operation, connect Power Cable Assembly CX-1358/U between the power source and POWER receptacle J104. Connect Electrical Special Purpose Cable Assembly CX-2083/U between J1133 on Power Supply PP-629/URR and REMOTE CONTROL receptacle J105 on the receiver.

Caution: Check to see that 115 VAC- 230 VAC switch S801 (fig. 84), on Power Supply PP-621/URR, is in the proper position for operation of the receiver from the available power source. The switch is reached easily when the dust cover is removed from the bottom of the receiver. Check 115 VAC- 230 VAC switch S1101 (fig. 86) for proper position.

b. Antenna (fig. 18). The antenna is connected to either the UNBALANCED WHIP or BALANCED ANTENNA 125 OHM connector on the back panel as follows:

(1) *UNBALANCED WHIP connector.* When a whip antenna is to be used, for vehicular installations, or a random length wire is to be used in fixed installations, the lead-in must be connected to UNBALANCED WHIP connector J107 (Receptacle Connector UG-568/U) by means of a type Plug Connector UG-573/U. The whip antenna lead-in should be as short a length as possible of Radio Frequency Cable RG-8/U or RG-11/U.

(2) *BALANCED ANTENNA 125 OHM connector.* BALANCED ANTENNA 125 OHM connector J108, Receptacle Connector UG-422/U, furnishes input to the receiver through a tuned antenna transformer. This connector is used for all balanced antennas, such as a balanced doublet, and should be used for unbalanced, low-impedance transmission lines. Connect the balanced coaxial cable, Radio Frequency Cable RG-22, from 50 to 175-ohm balanced antennas to J108 with Plug Connector UG-421/U, or, when Cable RG-86/U transmission line is used, use Plug Connector UG-969/U. Two right-angle adapters (fig. 19) are available for connecting unbalanced coaxial cable to the BALANCED ANTENNA 125 OHM connector. Adapter Connector UG-970/U adapts unbalanced coaxial lead-in terminated in Plug PL-259 to the connector, while Adapter Connector UG-971/U is used to connect unbalanced coaxial lead-in terminated in Plug Connector UG-573/U. Adapter Connector UG-971/U and Plug Connector UG-573/U are preferred and should be used when available.

c. Audio Output (fig. 18).

(1) A 600-ohm headset or speaker may be connected as indicated below:

(*a*) Insert the headset plug into the PHONES jack on front panel (fig. 22), or connect headset between PHNS terminals 7 and 8, on back panel.

(*b*) Connect the speaker between LOCAL AUDIO terminals 6 and 7 on the back panel.

(2) A 600-ohm balanced line for telephone and similar applications may be connected as follows:

(*a*) For normal balanced-line operation, connect the line between LINE AUDIO terminals 10 and 13 on the back panel. Do not remove jumper on terminals 11 and 12.

(*b*) If a balancing bridge is to be used, for long-distance line applications,

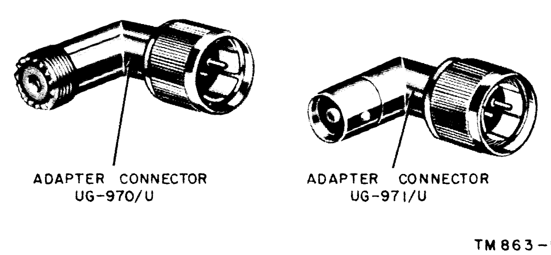


Figure 19. Adapter Connectors UG-970/U and UG-971/U.

remove the jumper from terminals 11 and 12 on rear panel and connect the bridge between these terminals. Connect the balanced line between terminals 10 and 13.

d. Auxiliary Connections (fig. 21).

(1) *Break-in relay.* Connection to the break-in relay is completed through BRK IN terminal 9 on rear panel. The break-in relay operates to disable the receiver when the BREAK IN switch on the front panel is set at ON and terminal 9 on rear panel is grounded remotely.

(2) *External diode load.* DIODE LOAD terminals 14 and 15 on the rear panel are provided to facilitate detector diode-load combining for diversity reception. Terminals 14 and 15 must be connected together for normal receiver operation.

(3) *External r-f gain control.* For external control of the r-f gain of the receiver, the internal RF GAIN control is disconnected and a 10,000-ohm potentiometer is connected externally. To substitute the external control for the internal RF GAIN control, remove the jumper between RF GAIN terminals 1 and 2 on rear panel and connect the external control between terminal 1 and terminal 7 (ground).

(4) *Agc circuit.* For external agc of the receiver, remove the jumper between AGC terminals 3 and 4 on rear panel, connect the negative terminal of the source to terminal 4, and connect the other terminal of the source to terminal 7 (ground).

18. System Connections

a. Space-diversity Reception of Voice Signals. To connect two Radio Receivers R-391/URR for space-diversity reception of voice signals, proceed as follows:

(1) Refer to paragraph 17 for normal operating and auxiliary connections for the desired mode of operation.

(2) Connect terminal boards on rear panels of both receivers as shown in figure 2.

b. Space-diversity Reception of Radioteletype Signals, Type 1. To connect two Radio Receivers R-391/URR for space-diversity reception of radioteletype signals using the audio output of the receivers, proceed as follows:

(1) Refer to paragraph 17 for normal operating and auxiliary connections for the desired mode of operation.

(2) Connect LINE AUDIO terminals 10 and 13 of each receiver to the input of each channel in Radioteletype Terminal Equipment AN/FGC-1 as shown in figure 3.

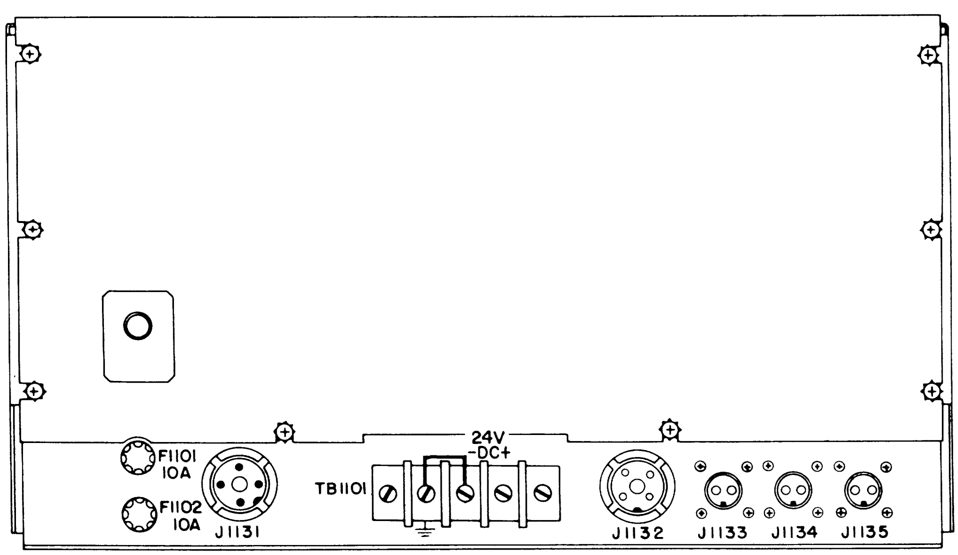


Figure 20. Power Supply PP-629/URR, back panel.

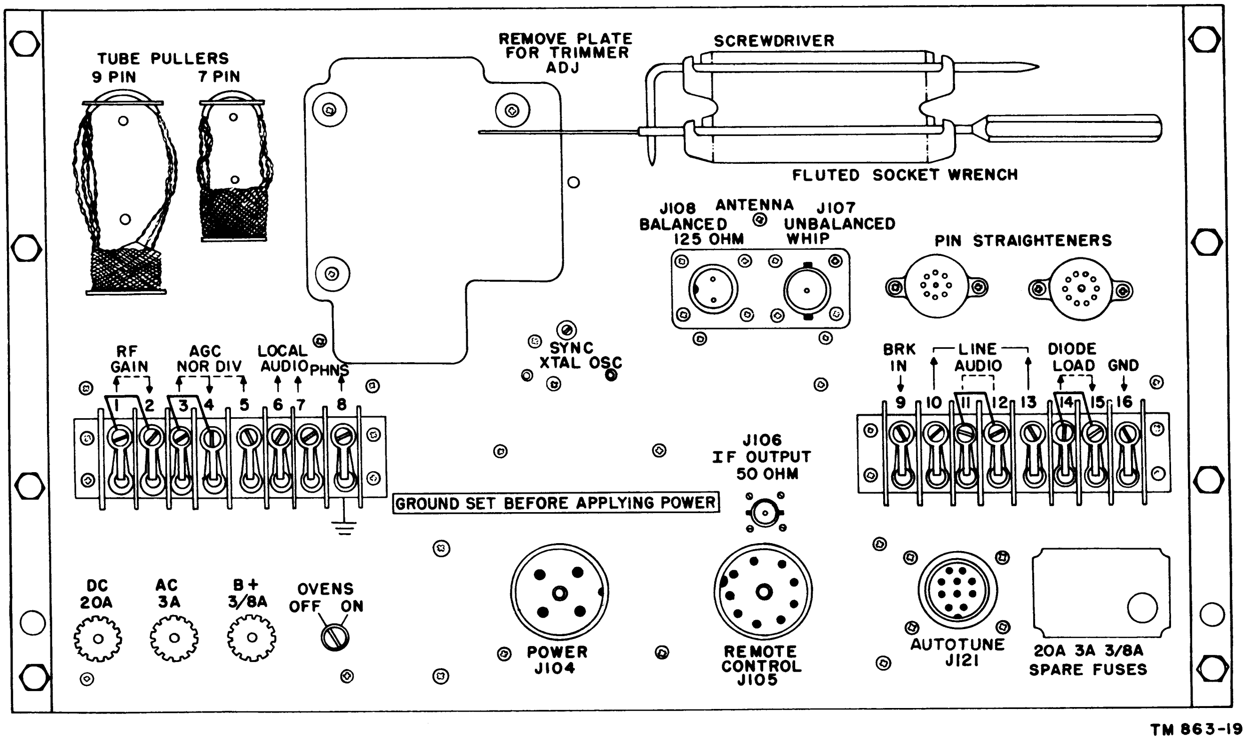


Figure 21. Radio Receiver R-391/URR, back panel.

c. Space-diversity Reception of Radioteletype Signals, Type 2. To connect two Radio Receivers R-391/URR for space-diversity reception of radioteletype signals using the i-f outputs of the receivers, proceed as follows:

(1) Refer to paragraph 17 for normal operating and auxiliary connections for the desired mode of operation.

(2) Connect IF OUTPUT 50 OHM connector J106 of each receiver to the input of each channel in Frequency Shift Converter CV-116/URR as shown in figure 4.

19. Service Upon Receipt of Used or Reconditioned Equipment

a. Follow the instructions in paragraph 15 for uncrating, unpacking, and inspecting the equipment.

b. Examine the used or reconditioned equipment for tags or other indications pertaining to changes in the wiring of the equipment. If any changes in the wiring have been made, note the change in this instruction book, preferably on the schematic diagrams.

c. Check the MEGACYCLE CHANGE and KILOCYCLE CHANGE knobs for ease of rotation. If lubrication is required, refer to the lubrication instructions in paragraph 114.

Section II. CONTROLS AND INSTRUMENTS

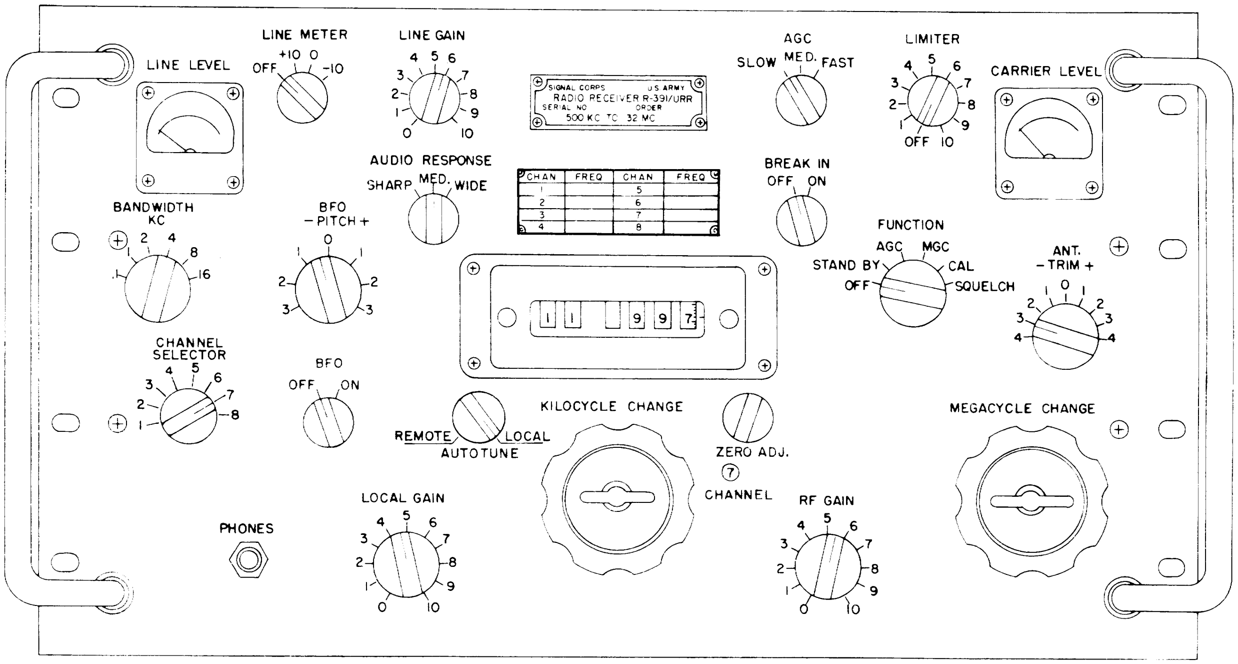


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Figure 22. Radio Receiver R-391/URR, front panel.

20. General

Haphazard operation or improper setting of the controls can cause damage to the receiver. For this reason, it is important to know the function of every control. The actual operation of the equipment is discussed in the next section of this instruction book.

21. Radio Receiver R-391/URR Controls (figs. 21 and 22)

The controls of the radio receiver and their functions are listed in the following table:

Control	Function
LINE LEVEL meter (M101)	Indicates level of balanced-line output.
LINE METER off-on and range switch (S101)	In OFF position, switch disconnects LINE LEVEL meter from balanced-line output. In +10 position, 10 db (decibels) is to be added to LINE LEVEL vu (volume units) reading; in 0 position, LINE LEVEL meter is read directly in vu; in −10 position, 10 db is to be subtracted from LINE LEVEL vu reading.
LINE GAIN control (R103)	Controls level of a-f signal applied to balanced-line output terminals.
AGC SLOW-MED.-FAST time constant switch	Determines rapidity of change in gain of receiver for a certain change of signal strength.
LIMITER off-on switch and threshold control (S105 and R124)	In the ON position, peak signal impulses are cut off in order to reduce static interference. Increased reduction of signal peaks is obtained at clockwise positions of control.

21. Radio Receiver R-391/URR Controls (figs. 21 and 22) (Contd)

Control	Function
CARRIER LEVEL meter (M102)	Indicates level of incoming r-f signal. Indication of 0 db when RF GAIN control is fully on corresponds to an input signal of 2 to 5 microvolts.
BANDWIDTH switch (S501)	Selects width of the pass band in KC for 455-kc i-f amplifier stages.
BFO PITCH control (Z502)	Varies frequency of bfo.
AUDIO RESPONSE switch (S102)	Varies response of audio amplifier. In SHARP position, an 800-cps band-pass filter is inserted into audio circuit; in MED position, a 3500-cps low-pass filter is inserted; in WIDE position, no filter is used.
BREAK IN OFF-ON switch (S106)	In ON position, break-in relay control circuit is connected to REMOTE CONTROL receptacle J105 and balanced-line output is disconnected from J105.
FUNCTION switch (S107)	When rotated to any position other than OFF, connects receiver to power source and selects desired receiver function. The positions and functions are as follows: *Position* — *Function* STAND BY — Receiver disabled but filaments remain lighted and oscillators remain on; receiver ready for instant use. AGC — Gain is controlled automatically for normal reception. MGC — Agc disabled; gain is controlled manually by RF GAIN control or an external gain control. CAL — Calibration oscillator enabled to supply signals at 100-kc points. SQUELCH — Squelch circuit is connected for silencing receiver when input signal falls below threshold determined by setting of RF GAIN control.
ANT. TRIM	Provides means of tuning out the reactive component of the antenna.
BFO OFF-ON switch (S103)	In ON position, places bfo in operation.
ZERO ADJ.	When turned clockwise, disengages frequency-indicator dial from KILOCYCLE CHANGE control for calibration purposes.
LOCAL GAIN control (R104)	Controls level of audio-frequency signal applied to PHONES jack and LOCAL AUDIO.
RF GAIN control (R123)	Controls gain of r-f and i-f amplifiers. When squelch circuit is operative, controls squelch threshold.
KILOCYCLES CHANGE control	Tunes receiver to any frequency within a band, and changes reading of last three digits on frequency-indicator dial. The tuning may be done manually when the locking key is turned counterclockwise. When the key is turned fully clockwise, the control is locked and is under the control of the autotune. Frequency range of control slightly greater than 1 mc; when tuned to frequency higher or lower than that indicated by first two digits, plus or minus sign is displayed in space between megacycle and kilocycle readings indicating (respectively) addition or subtraction of one megacycle in reading of first two digits to obtain true reading.
MEGACYCLE CHANGE control	Selects any one of 32 tuning steps; changes reading of first two digits of frequency-indicating dial. The tuning may be done manually when the locking key is turned counterclockwise. When the key is turned fully clockwise, the control is locked and is under the control of the autotune.
OVENS OFF-ON switch (S108)	Screw-driver adjustment. In ON position, 26 volts ac or dc is applied to crystal oven HR401 and vfo oven HR701.
PHONES jack (J103)	Connects headset to local audio output.

Control	Function
CHANNEL SELECTOR (S110)	This switch is employed to select the frequency channel on which operation is desired. The numerals that are engraved on the panel around the switch designate the eight autotune channels available. The frequency corresponding to any one of these channels may be readily changed to any frequency within the range of .5 mc to 32 mc.
AUTOTUNE REMOTE-LOCAL (S109)	This switch is employed to select either remote or local control of channel selection. When the receiver is employed in a system which has special provisions for remote control, this switch is placed at the REMOTE position. At all other times, it is placed at the LOCAL position.
POWER receptacle (J104)	Connects 115 to 230 volts ac to receiver.
REMOTE CONTROL receptacle (J105)	Provides connection for 24 volts dc for autotune motor.
AUTOTUNE receptacle (J121)	Provides connection for remote control of autotune system.
IF OUTPUT jack (J106)	Provides 455-kc signal for auxiliary equipment.
UNBALANCED WHIP ANTENNA receptacle (J107)	Provides connection for whip or random length of antenna.
BALANCED ANTENNA 125 OHM receptacle (J108)	Provides connection for balanced antenna or unbalanced low-impedance transmission lines.
Switch S801 (fig. 84)	Located in Power Supply PP-621/URR, provides selection of 115 or 230 VAC operation.
CHANNEL indicator	Shows CHANNEL selected by autotune.
Terminal strip TB102	
Terminal 1	Provides connection for external control of r-f gain. Provides manual r-f gain control when connected to terminal 2.
Terminal 2	Provides connection for external control of r-f gain.
Terminal 3	Provides normal agc, when connected by a jumper to terminal 4.
Terminal 4	Provides connection for external agc to agc line, when jumper is removed.
Terminal 5	Provides connection to receiver agc voltage for external application.
Terminal 6	Provides connection for local audio output.
Terminal 7	Provides ground connection.
Terminal 8	Provides connection for reduced local audio output, when used with headset.
Terminal strip TB101	
Terminal 9	Provides connection for break-in operation.
Terminal 10	Provides connection of line audio to balanced line.
Terminal 11	Provides connection for external balancing circuit, or is connected to terminal 12.
Terminal 12	Provides connection for external balancing circuit, or is connected to terminal 11.
Terminal 13	Provides connection of line audio to balanced line.
Terminal 14	Provides connection for external detector diode load (negative), or is connected to terminal 15.
Terminal 15	Provides connection for internal detector diode load to external detector, or is connected to terminal 14.
Terminal 16	Provides connection to ground.

21. Radio Receiver R-391/URR Controls (figs. 21 and 22) (Contd)

Control	Function
REMOTE CONTROL receptacle J105	
Pin A	Balanced line audio output through BREAK-IN switch S106.
Pin B	Break-in relay control circuit.
Pin C	No connection.
Pin D	Not used.
Pin E	Ground.
Pin F	No connection.
Pin H	Reduced local audio output for headset.
Pin J	Balanced line audio output through BREAK IN switch S106.
Pin K	Carrier control circuit.

22. Power Supply PP-629/URR Controls (fig. 20)

The controls of the external d-c power supply are listed in the following table:

Control	Function
Switch S1101 (fig. 86)	Provides selection of 115 or 230 VAC operation.
ON-OFF switch S1102 (fig. 87)	In the ON position it connects the power supply to the 115 or 230 a-c source.
Receptacles, J-1133, J1134, J1135.	Provides connections for up to 3 Radio Receivers R-391/URR.
Receptacle J1131.	Provides connection to a-c power source.
Receptacle J1132.	Provides 24 VDC and 115/230 VAC output.
Terminal board TB1101.	Provides 24 VAC output.

Section III. OPERATION UNDER USUAL CONDITIONS

Warning: The voltages employed are sufficiently high to endanger human life. Every precaution should be taken by personnel to minimize the danger of shock. See that GND terminal 16 on rear panel (fig. 21) is grounded.

23. Starting Procedure

Caution: The a-c power supply of the receiver must be set to the correct a-c input voltage. Refer to paragraph 17. Make sure that all of the external connections to the receiver are satisfactory for the desired type of operation outlined in paragraph 16.

a. If the receiver is operated under low-temperature conditions, or in a location where there is considerable variation in temperature, set the screwdriver-adjusted OVENS ON-OFF switch on the back panel to ON. When the set is operated in a temperature-regulated building or when maximum frequency stability is not required, set OVENS ON-OFF switch to OFF. When the receiver is secured in cabinet and is protected by dust covers, remove the top and bottom dust covers of the receiver to provide adequate ventilation.

b. Place AUTOTUNE REMOTE-LOCAL switch to LOCAL.

c. Turn FUNCTION switch to AGC. Allow receiver to warm up for several minutes before operating. If the CHANNEL SELECTOR is positioned to the same channel on which operation was last performed, the Autotune will not cycle, and the operational procedure may be continued without delay. Whether or not this condition exists may be determined by comparing position of the CHANNEL SELECTOR switch with that of the CHANNEL indicator (numbered disk). If a new channel is selected, or if the CHANNEL SELECTOR switch has been re-positioned between equipment operations, the Autotune will cycle, and it is necessary to allow the autotune to stop before continuing any operational procedure.

24. Presetting Frequency Channels

To set up any one of the eight frequency channels, tighten all Autotune locking keys; then proceed as follows:

a. With FUNCTION switch in AGC position, turn CHANNEL SELECTOR switch to position assigned to desired frequency.

(1) Unlock Autotune locking keys.

(2) Set BANDWIDTH control at .1-KC position.

(3) Set AUDIO RESPONSE control at MED.

(4) Turn BFO switch to ON.

b. Turn FUNCTION switch to CAL position. In this position, a note will be heard at every multiple of 100 kc as KILOCYCLE CHANGE control is rotated. The pitch of the note depends upon the setting of the BFO PITCH control.

c. Adjust MEGACYCLE CHANGE and KILOCYCLE CHANGE controls for reading on frequency-indicator dial at 100-kc point nearest frequency desired for reception.

d. Turn ZERO ADJ. control clockwise as far as it will go.

e. Adjust KILOCYCLE CHANGE control for maximum indication on CARRIER LEVEL meter. Maximum should be obtained with only a slight adjustment of the control in either direction.

f. Turn ZERO ADJ. control counterclockwise to stop. Dial is now accurately calibrated for readings near selected 100-kc point.

g. Rotate KILOCYCLE CHANGE control until desired frequency in kilocycles is obtained on frequency-indicator dial.

h. Tighten Autotune locking keys.

i. Rotate CHANNEL SELECTOR switch to determine whether autotune mechanism positions itself correctly for each frequency-channel set up. It is necessary to determine whether the autotune mechanism is operating at correct speed. Time at least one complete channeling process; if the total time is more than 15 seconds, the tap on transformer T1101 (part of of Power Supply PP-629/URR) should be repositioned until the 15-second interval is obtained (par. 137).

25. Voice Reception

a. Set BFO to OFF, LINE GAIN to 0, RF GAIN to 10, LOCAL GAIN to 5, BANDWIDTH KC to 8, AUDIO RESPONSE to MED., AGC to MED., and LIMITER to OFF.

b. To maintain tuning accuracy of at least .3 kc, calibrate dial as directed in paragraph 29.

c. Adjust ANT. TRIM control for maximum reading on CARRIER LEVEL meter.

d. Adjust LOCAL GAIN control for desired volume level.

e. If noise is excessive, rotate LIMITER control clockwise as needed.

f. When signal is fading rapidly, set AGC switch to FAST.

g. If interference is encountered, set BANDWIDTH switch to 4-KC position, or, if necessary, to 2-kc position.

h. When it is desired to quiet the receiver between transmission, set FUNCTION switch to SQUELCH and rotate RF GAIN control counterclockwise from full-on position, as necessary to reduce high-level noise. Avoid reducing gain to such an extent that desired signal is also eliminated.

Note. Do not use SQUELCH if desired signals are weak or subject to fading.

i. When balanced-line output circuit is being used to feed telephone line or other equipment, set LINE METER switch to required range and adjust LINE GAIN control for desired reading on LINE LEVEL meter.

j. If break-in relay is connected to transmitter control circuits and receiver is to be disabled during periods of transmission, set BREAK IN switch to ON.

26. Tone-modulated Radiotelegraph Reception

For reception of tone-modulated radiotelegraph signals, operate the controls in the same manner as for voice reception, with the following exceptions:

a. Set BFO switch to ON.

b. Adjust BFO PITCH control for comfortable pitch.

c. Set BANDWIDTH KC switch to 2-kc position, or to lower position, to reduce adjacent-channel interference.

d. Do not use SQUELCH for tone-modulated radiotelegraph signals.

27. Unmodulated Radiotelegraph Reception

Operate the receiver controls in the same manner as for voice reception, with the following exceptions:

a. Set BFO switch to ON.

b. Adjust BFO PITCH control for comfortable pitch.

c. If signal interference is encountered, set BANDWIDTH KC switch to next lower position. For greatest degree of selectivity, set BANDWIDTH switch to 1 or .1-kc position and AUDIO RESPONSE switch to SHARP. Readjust BFO PITCH control for loudest signal.

d. For manual gain control only, set FUNCTION switch to MGC and control sensitivity solely with RF GAIN control.

e. Use SLOW position of AGC time-constant switch for reception of machine code transmission.

f. To reduce effects of fading, set FUNCTION switch to AGC and turn AGC switch to SLOW. For full sensitivity, rotate RF GAIN control to position marked 10.

28. Manual Operation of Radio Receiver R-391/URR

If the Autotune mechanism fails to function correctly, Radio Receiver R-391/URR may be operated manually. To disengage Autotune mechanism, rotate locking keys, located in center of MEGACYCLE CHANGE and KILOCYCLE CHANGE control knobs, approximately two turns counterclockwise. The two controls may then be operated manually to secure correct frequency selection. However, as soon as is practicable, the receiver should be returned to field maintenance activity.

29. Frequency-indicator Calibration (manual operation)

To maintain the tuning accuracy of the receiver, calibrate the frequency indicator at the point nearest the frequency desired for reception, whenever the MEGACYCLE CHANGE control is operated to select another band. Calibration is accomplished by the use of the internal calibration oscillator as follows:

a. Set the BANDWIDTH to the .1-KC position.

b. Set AUDIO RESPONSE to MED.

c. Set RF GAIN control to 10.

d. Set LOCAL GAIN control to 5.

e. Set the BFO switch to ON.

f. Turn FUNCTION switch to CAL.

g. Adjust MEGACYCLE CHANGE and KILOCYCLE CHANGE controls for a reading on the frequency indicator at the 100-kc point nearest the frequency desired for reception.

h. Turn the ZERO ADJ. clockwise as far as it will go.

i. Rotate ANT. TRIM to obtain indication on CARRIER LEVEL meter.

j. Adjust KILOCYCLE CHANGE control for maximum indication on the CARRIER

LEVEL meter. Maximum should be obtained with only a slight adjustment of the control in either direction. If a maximum reading is not obtained within the limits of travel of the KILOCYCLE CHANGE control, as set by the ZERO ADJ. knob, the vfo tuning shaft must be synchronized as described in paragraph 119*d*.

k. Turn the BFO PITCH control to produce zero beat.

l. Turn the ZERO ADJ. counterclockwise to stop. The dial now is calibrated accurately.

30. Stopping Procedure

a. When the receiver is not to be used for a short interval but is to be maintained in a state of readiness, turn the FUNCTION switch to STAND BY.

Note. The FUNCTION switch should not be left too long on the STAND BY position. Under this condition of operation, with the filaments energized and no plate voltage applied, vacuum tubes may develop cathode poisoning. This phenomenon decreases tube emission because of a deposit which forms between the cathode sleeve and the oxide coating on the outside of the sleeve.

b. Turn the FUNCTION switch to OFF.

Caution: Never turn the FUNCTION switch to OFF while the Autotune system is cycling.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

31. General

The operation of Radio Receiver R-391/URR may be difficult in regions where extreme heat, cold, humidity and moisture, sand conditions, etc. prevail. Procedures are given in paragraphs 32, 33, and 34 for minimizing the effects of these unusual operating conditions.

32. Operation in Arctic Climate

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

a. Handle the equipment carefully.

b. Keep the equipment warm and dry.

c. Wear a knitted woolen cap over the earphones when operating in the open air with headsets that do not have rubber earpieces. Frequently, when headsets without rubber earpieces are worn, the edges of the ears may freeze without the operator being conscious of this condition. Never flex rubber earpieces, since this action may render them useless. If water gets into the receivers, or if water condenses within them, it may freeze and impede the action of the diaphragms. When this happens, unscrew the bakelite cap, and remove the ice and moisture.

d. When the equipment has been exposed to cold and is brought into a warm room, it will sweat until it reaches room temperature. When the equipment has reached room temperature, dry it thoroughly. This condition also can develop when the equipment warms up during the day after exposure during a cold night.

33. Operation in Tropical Climate

When operated in a tropical climate, radio equipment can be installed in tents, huts, or, when necessary, in underground dugouts. When equipment is installed below ground level, and when it is set up in swampy areas, moisture conditions are more acute than those normally met in the tropics. Ventilation usually is poor, and the high relative humidity causes condensation of moisture on the equipment whenever the temperature of the equipment becomes lower than the surrounding air. To minimize this condition, place lighted electric bulbs under the receiver. The receiver never should be enclosed to such an extent that adequate circulation of air is prevented.

34. Operation in Desert Climate

a. Conditions similar to those encountered in a tropical climate 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, dust, or dirt which enters the moving parts of the equipment. The ideal preventive precaution is to house the equipment in a dustproof shelter. Since, however, such a building seldom is 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. Hang wet sacking over the windows and doors, cover the inside walls with heavy paper, and secure the side walls of tents with sand, to prevent their flapping in the wind.

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

d. Take care to keep the equipment as free from dust as possible. Make frequent preventive maintenance checks (ch. 3). Pay particular attention to the lubrication of the equipment. Excessive amounts of dust, sand, or dirt that come into contact with oil and grease result in grit, which will damage the equipment.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

35. Tools and Materials

The tools and materials contained in Tool Equipment TE-41 (the ordinary hand tools and materials normally available to organizational maintenance personnel) are required for organizational maintenance of Radio Receiver R-391/URR. In addition, Solvent, Dry Cleaning (SD) (Federal P-S-661) should be available.

36. Special Tools Supplied with Radio Receiver R-391/URR (fig. 21)

The special tools supplied with the receiver are mounted on the back panel, as shown in figure 21. The use of these tools is described in subparagraphs *a* through *d*, below. Spare 20-ampere, 3-ampere and 3/8-ampere fuses are mounted on the rear panel of the receiver, under a protective cover.

a. Tube Pullers. Two cable grip type tube pullers are furnished: one for 7-pin miniature tubes and the other for 9-pin miniature tubes. To remove a tube, slide a tube puller of the proper size over the tube envelope. Pull upward on the tool and at the same time, wobble the tube slightly. After the tube has been removed from the socket, remove the tube from the tool by pushing the tube toward the handle.

b. Right-angle Phillips Screwdriver. The No. 8 right-angle screwdriver is used to remove the screws which secure dust covers, front panel, removable subchassis, terminal strips, etc.

c. Fluted Socket Wrench. The No. 8 fluted socket wrench is used for removing the front-panel bar knobs and the MEGACYCLE CHANGE and KILOCYCLE CHANGE knobs, and for loosening the collars which secure the camshafts and gears in the mechanical tuning system.

d. Pin Straighteners. The 7-pin and 9-pin straighteners are attached to the back panel. When a miniature tube is inserted into the receiver, either after maintenance or for replacement purposes, it first should be inserted into the proper pin straightener to aline the pins properly.

Section II. PREVENTIVE MAINTENANCE SERVICES

37. 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 the prevention of certain troubles rather than their correction. See AR 750-5.

38. General Preventive Maintenance Techniques

a. Use #0000 sandpaper to remove corrosion.

b. Use a clean, dry, lint-free cloth or a dry brush for cleaning.

(1) If necessary, except for electrical contacts, moisten the cloth or brush with solvent (SD); then wipe the parts dry with a cloth.

(2) Clean electrical contacts with a small brush moistened with carbon tetrachloride; then wipe them dry with a clean cloth.

Caution: Repeated contact with carbon tetrachloride or prolonged breathing of the fumes is dangerous. Make sure adequate ventilation is provided.

c. If available, dry compressed air can be used at a line pressure not exceeding 60 pounds per square inch to remove dust from inaccessible places; be careful, however, to avoid causing mechanical damage to delicate parts.

d. For further information on preventive maintenance techniques, refer to TB SIG 178.

39. Use of Preventive Maintenance Forms

a. The decision as to what items on DA AGO Forms 11-238 and 11-239 are applicable to this equipment is a tactical decision to be made in the case of first echelon maintenance by the communication officer/chief or his designated representative and, in the case of second and third echelon maintenance, by the individual making the inspection. Instructions for the use of each form appear on the reverse side of the form.

b. Circled items in figures 23 and 24 are partially or wholly applicable to Radio Receiver R-391/URR. Paragraph references in the ITEM column indicate paragraphs in text which give additional or detailed information.

40. Performing Preventive Maintenance

Caution: Tighten screws, bolts, and nuts carefully. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

a. Performing Exterior Preventive Maintenance. Preventive maintenance is performed on the exterior of the equipment as follows:

(1) Check the equipment against the table of components (par. 7), list of running spares (par. 12), and list of additional equipment required (par. 13), to see that no components or parts are missing. Observe the general condition of the equipment.

(2) Use a clean, lint-free cloth to remove dust, dirt, moisture, and grease from the whip antenna and base, headset, glass windows of the front-panel meters, front and back panels, and dust covers.

(3) Inspect for proper seating of the antenna lead-in cable, headset and power-cord plugs, and fuses on the back panel. See that connections to the terminal boards on the back panel are secure.

(4) Operate the controls to check for binding, scraping, excessive looseness, and positive action. Rough action or binding of MEGACYCLE CHANGE and KILOCYCLE CHANGE controls indicates a damaged tuning system or the need for cleaning and lubrication.

(5) Check for normal operation of the receiver (par. 49).

(6) Clean and tighten the exterior of the case, POWER and REMOTE CONTROL connectors, and whip antenna base. Use a clean, lint-free cloth. Remove grease, if necessary, with a cloth dampened in solvent (SD); then wipe the parts dry.

(7) Inspect the case, front and back panels, and whip antenna for moisture and corrosion. Remove rust spots on the antenna base with #0000 sandpaper. Touch up the bare spots (par. 43).

(8) Inspect the antenna lead-in cable, power cable, headset cord, and all other external cables for cuts, breaks, fraying, deterioration, kinks, and strain. Repair the cuts in the insulation by covering them with rubber tape held in place by electrician's tape. Replace or repair torn cables.

(9) Inspect the antenna for bends, corrosion, loose fit, and cracked or broken insulators. If the antenna is bent, straighten it, if possible; if the antenna cannot be straightened, replace it. Tighten the antenna. Replace cracked or broken ceramic insulator.

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.

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*). PAR. 40a (1)							
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. 40a (2)							
(4)	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 40a (3)							
(5)	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 40a (4)							
(6)	CHECK FOR NORMAL OPERATION. PAR. 40a (5)							

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. PAR. 40a (6)		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. 40a (7)		(14)	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 40a (11)	
(9)	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 40a (8)		(15)	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 40a (12)	
(10)	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 40a (9)		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, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 40a (10)		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. PAR. 40a (13)

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

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Figure 23. DA AGO 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	EQUIPMENT SERIAL NO.

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

NO.	ITEM	CONDITION	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).* PAR. 40 a (1)		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. PAR. 40 b (1)	
2	LOCATION AND INSTALLATION SUITABLE FOR NORMAL OPERATION.		20	INSPECT FILM CUT-OUTS FOR LOOSE PARTS, DIRT, MISALIGNMENT AND CORROSION.	
3	CLEAN DIRT AND MOISTURE FROM ANTENNA, MICROPHONE, HEADSETS, CHESTSETS, KEYS, JACKS, PLUGS, TELEPHONES, CARRYING BAGS, COMPONENT PANELS. PAR. 40 a (2)		21	INSPECT FIXED CAPACITORS FOR LEAKS, BULGES, AND DISCOLORATION. PAR. 40 b (2)	
4	INSPECT SEATING OF READILY ACCESSIBLE "PLUCK-OUT" ITEMS: TUBES, LAMPS, CRYSTALS, FUSES, CONNECTORS, VIBRATORS, PLUG-IN COILS AND RESISTORS. PAR. 40 a (3)		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. PAR. 40 b (3)	
5	INSPECT CONTROLS FOR BINDING, SCRAPING, EXCESSIVE LOOSENESS, WORN OR CHIPPED GEARS, MISALIGNMENT, POSITIVE ACTION. PAR. 40 a (4)		23	INSPECT VARIABLE CAPACITORS FOR DIRT, MOISTURE, MISALIGNMENT OF PLATES, AND LOOSE MOUNTINGS. PAR. 40 b (4)	
6	CHECK FOR NORMAL OPERATION. PAR. 40 a (5)		24	INSPECT RESISTORS, BUSHINGS, AND INSULATORS, FOR CRACKS, CHIPPING, BLISTERING, DISCOLORATION AND MOISTURE. PAR. 40 b (5)	
7	CLEAN AND TIGHTEN EXTERIOR OF COMPONENTS AND CASES, RACK MOUNTS, SHOCK MOUNTS, ANTENNA MOUNTS, COAXIAL TRANSMISSION LINES, WAVE GUIDES, AND CABLE CONNECTIONS. PAR. 40 a (6)		25	INSPECT TERMINALS OF LARGE FIXED CAPACITORS AND RESISTORS FOR CORROSION, DIRT AND LOOSE CONTACTS. PAR. 40 b (6)	
8	INSPECT CASES, MOUNTINGS, ANTENNAS, TOWERS, AND EXPOSED METAL SURFACES, FOR RUST, CORROSION, AND MOISTURE. PAR. 40 a (7)		26	CLEAN AND TIGHTEN SWITCHES, TERMINAL BLOCKS, BLOWERS, RELAY CASES, AND INTERIORS OF CHASSIS AND CABINETS NOT READILY ACCESSIBLE. PAR. 40 b (7)	
9	INSPECT CORD, CABLE, WIRE, AND SHOCK MOUNTS FOR CUTS, BREAKS, FRAYING, DETERIORATION, KINKS, AND STRAIN. PAR. 40 a (8)		27	INSPECT TERMINAL BLOCKS FOR LOOSE CONNECTIONS, CRACKS AND BREAKS. PAR. 40 b (8)	
10	INSPECT ANTENNA FOR ECCENTRICITIES, CORROSION, LOOSE FIT, DAMAGED INSULATORS AND REFLECTORS. PAR. 40 a (9)		28	CHECK SETTINGS OF ADJUSTABLE RELAYS.	
11	INSPECT CANVAS ITEMS, LEATHER, AND CABLING FOR MILDEW, TEARS, AND FRAYING.		29	LUBRICATE EQUIPMENT IN ACCORDANCE WITH APPLICABLE DEPARTMENT OF THE ARMY LUBRICATION ORDER.	
12	INSPECT FOR LOOSENESS OF ACCESSIBLE ITEMS: SWITCHES, KNOBS, JACKS, CONNECTORS, ELECTRICAL TRANSFORMERS, POWERSTATS, RELAYS, SELSYNS, MOTORS, BLOWERS, CAPACITORS, GENERATORS, AND PILOT LIGHT ASSEMBLIES. PAR. 40 a (10)		30	INSPECT GENERATORS, AMPLIDYNES, DYNAMOTORS, FOR BRUSH WEAR, SPRING TENSION, ARCING, AND FITTING OF COMMUTATOR. PAR. 40 b (9)	
13	INSPECT STORAGE BATTERIES FOR DIRT, LOOSE TERMINALS, ELECTROLYTE LEVEL AND SPECIFIC GRAVITY, AND DAMAGED CASES.		31	CLEAN AND TIGHTEN CONNECTIONS AND MOUNTINGS FOR TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS. PAR. 40 b (10)	
14	CLEAN AIR FILTERS, BRASS NAME PLATES, DIAL AND METER WINDOWS, JEWEL ASSEMBLIES. PAR. 40 a (11)		32	INSPECT TRANSFORMERS, CHOKES, POTENTIOMETERS, AND RHEOSTATS FOR OVERHEATING AND OIL-LEAKAGE. PAR. 40 b (11)	
15	INSPECT METERS FOR DAMAGED GLASS AND CASES. PAR. 40 a (12)		33	BEFORE SHIPPING OR STORING - REMOVE BATTERIES.	
16	INSPECT SHELTERS AND COVERS FOR ADEQUACY OF WEATHERPROOFING.		34	INSPECT CATHODE RAY TUBES FOR BURNT SCREEN SPOTS.	
17	CHECK ANTENNA GUY WIRES FOR LOOSENESS AND PROPER TENSION.		35	INSPECT BATTERIES FOR SHORTS AND DEAD CELLS.	
18	CHECK TERMINAL BOX COVERS FOR CRACKS, LEAKS, DAMAGED GASKETS, DIRT AND GREASE.		36	INSPECT FOR LEAKING WATERPROOF GASKETS, WORN OR LOOSE PARTS.	
			37	MOISTURE AND FUNGIPROOF. PAR. 40 b (12)	
38	IF DEFICIENCIES NOTED ARE NOT CORRECTED DURING INSPECTION, INDICATE ACTION TAKEN FOR CORRECTION. PAR. 40 a (13)				

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

TM 863-23

Figure 24. DA AGO Form 11-239.

(10) Check for looseness of the front-panel control knobs. Tighten them with the fluted socket wrench provided.

(11) Use a clean, damp cloth to clean the glass windows of the front-panel meters and frequency indicator; then wipe them dry. Clean the nameplate.

(12) Inspect the front-panel meters and the frequency indicator for cracked or broken glass windows.

(13) If deficiencies noted are not corrected during inspection, indicate action taken for correction.

b. Performing Interior Preventive Maintenance. To perform interior maintenance, proceed as follows:

Caution: Disconnect all power before performing the following operations. Upon completion, reconnect power and check for satisfactory operation.

(1) Remove the tubes from their sockets, one at a time, and inspect for loose envelopes and cracked sockets. Remove dust and dirt from the tube envelopes. Check the tubes for emission and short-circuited electrodes; use Electron Tube Test Set TV-7/U. Straighten the tube pins in the pin straighteners on the back panel. Replace the tubes carefully; check for adequate spring tension in the individual pin sockets. See that the tubes are seated firmly in the sockets in an upright position, and that the tube shields are replaced correctly. See that corrugated metal inserts are replaced in the vfo tube shield, and that the shield is tightened down so that movement is not possible.

(2) Inspect fixed capacitors C101 and C103 on the main frame (fig. 7), and C546 and C547 on 455-kc i-f subchassis (fig. 6), for leaks, bulges, and discoloration.

(3) Inspect the antenna relay for a loose mounting; burned, pitted, or corroded contacts; misalinement of contacts and springs; and insufficient spring tensions.

(4) Inspect variable capacitors for dirt, moisture, misalinement of plates, and loose mountings.

(5) Inspect resistors for cracks, chipping, blistering, discoloration, and moisture.

(6) Inspect terminals of large fixed capacitors and resistors for corrosion, dirt, and loose contacts.

(7) Clean and tighten the connectors in the receiver (figs. 94 and 98).

(8) Inspect terminal strips for loose connections, cracks, and breaks.

(9) On motor B101, inspect the brushes for wear, spring tension, arcing, and correct fit on the commutator.

(10) Clean and tighten connections and mountings for transformers, chokes, potentiometers, and rheostats.

(11) Inspect transformer T801 (fig. 84) of Power Supply PP-621/URR for overheating and leakage. Inspection should be made soon after shutting down the receiver.

(12) Check the condition of moistureproof and fungiproof material in the receiver (par. 42*b*).

Section III. LUBRICATION AND WEATHERPROOFING

41. Lubrication

No lubrication is to be performed on Radio Receiver R-391/URR at organizational maintenance level. Lubrication instructions are contained in paragraph 114.

42. 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 fully in TB SIG 13 and TB SIG 72.

c. Winter Maintenance. Special precautions necessary to prevent poor performance or total operational failure of equipment in extremely low temperatures are explained fully in TB SIG 66 and TB SIG 219.

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 fully in TB SIG 75.

43. Rustproofing and Painting

a. When the finish on the front panel or case has been badly scarred or damaged, touch up bare surfaces. Use dry-cleaning solvent (SD) to remove dirt and grease.

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, remove loose paint from the case and front panel, and apply paint with a small brush. Paint used will be No. 2610 semigloss gray enamel. When a front-panel marking has been obliterated, use a fine brush and white enamel to replace the marking.

Section IV. TROUBLE SHOOTING AT ORGANIZATIONAL MAINTENANCE LEVEL

44. General

a. The troubleshooting and repairs that can be performed at organizational maintenance level (operators and repairmen) are necessarily limited in scope by the tools, test equipment, and replaceable parts issued, and by the existing tactical situation. Accordingly, trouble shooting is based on the performance of the equipment and the use of the senses in determining such troubles as burned-out tubes, overheated transformers, etc.

b. The purpose of the paragraphs that follow in this section is to assist the operator in determining which of the subchassis of the receiver, is at fault, and in localizing the fault in that assembly to the defective stage or part, such as a tube or fuse. Repair will be limited to the replacement of those parts included in the running spares.

45. Visual Inspection

a. Failure of the equipment to operate properly may be caused by one or more of the following faults:

(1) Improperly connected, worn, or broken power cable (par. 47).

(2) Improperly connected, worn, or broken speaker or headset cord.

(3) Burned-out fuse.

(4) Grounded or broken antenna or antenna lead-in.

(5) Improperly connected antenna lead-in.

(6) Defective tube (check voltage-regulator tube first).

(7) Improperly connected or seated external or internal interconnecting cables.

(8) Loose connection on terminal strips on back panel.

b. When the receiver fails to operate and the cause is not immediately apparent, check as many of the above items as is practicable before starting a detailed examination. If possible, obtain information from the operator of the receiver regarding performance at the time the trouble occurred.

c. When visually inspecting the tubes for burned-out filaments, it may be discovered that more than one tube is not lighted. This condition can be caused by one filament burning out in a circuit having several filaments in series. All filaments, except the four connected directly across the 25.2-volt filament supply, are connected in series circuits which include two, three, or four filaments. In a series circuit, an open filament in one stage will cause another stage to appear defective. Tubes V605, V606, V801, and V802, oven heaters HR401, HR701, and HR901, and indicating lamps I-101 and I-102 are connected directly across the 25.2-volt filament supply. Cold-cathode, gas-filled tubes V608 and V609, also known as glow-discharge voltage regulators, do not require heated filaments. Figures 25 and 26 show the locations of all tubes in Radio Receiver R-391/URR. As an aid in locating trouble caused by an open filament circuit, the reference designations of the tubes in each filament circuit are listed below.

Series filament circuits (fig. 34)

V202, V203, V204, and V205
V401, V402, and V201
V501, V502, V503, and V504
V505, V506, and V511
V507 and V510
RT512, V508, and V701
V601 and V602
V603, V604, V607, and V509
V901 and V902

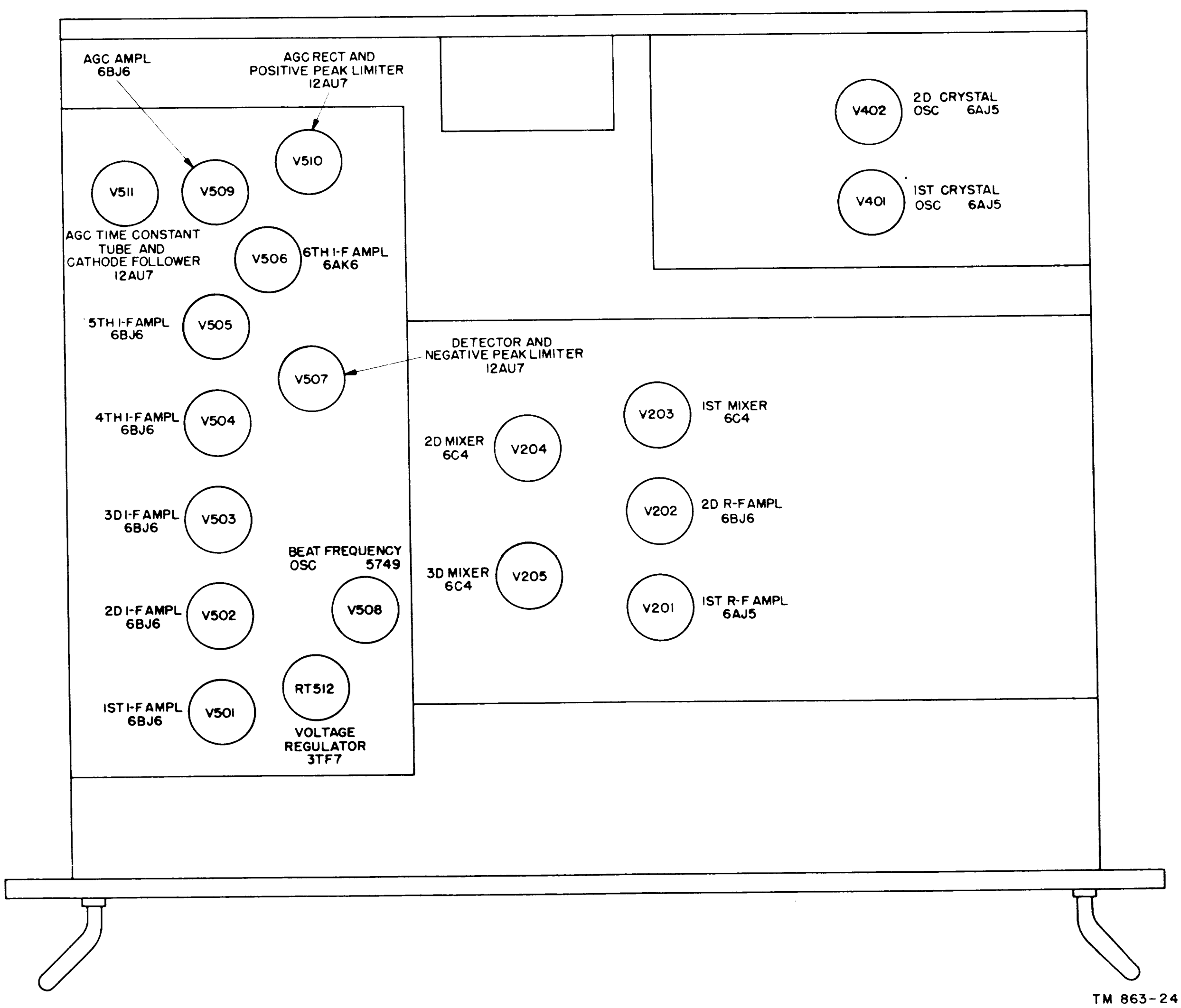


Figure 25. Radio Receiver R-391/URR, top deck tube location.

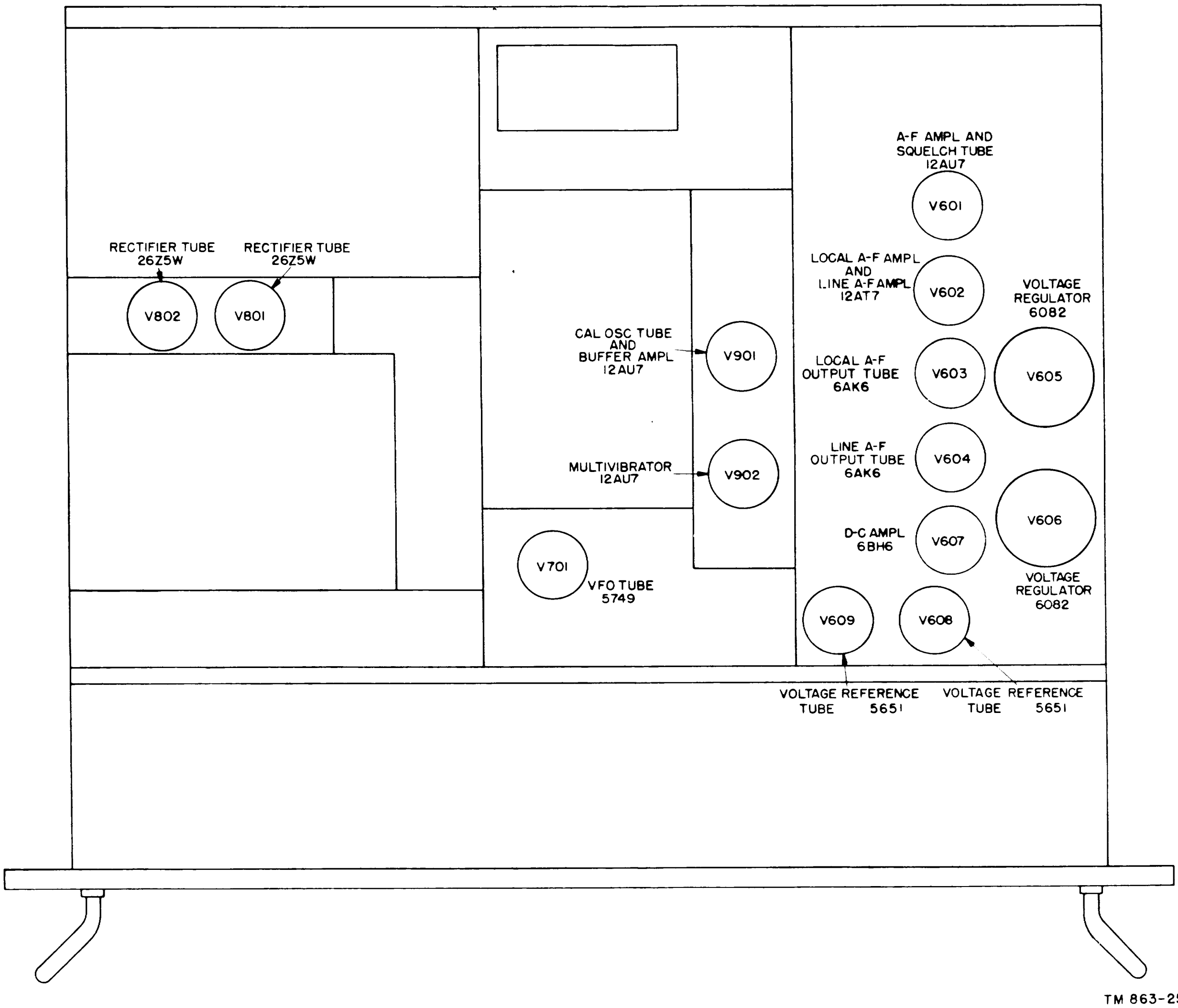


Figure 26. Radio Receiver R-391/URR, bottom deck tube location.

46. Subchassis Testing

Make the simple tests outlined in subparagraphs *a*, *b*, and *c* below to determine in which subchassis the trouble lies. When an abnormal indication in these tests is obtained, further checking of the tubes, connectors, and fuses of the suspected subchassis often will disclose the source of the trouble.

Warning: To prevent electrical shock or harmful short circuits, turn off the receiver before removing the plugs or touching any circuits (other than those specified below) to obtain an audible signal.

a. Power-Supply and A-f Subchassis. Set the FUNCTION switch at MGC and the AUDIO RESPONSE switch at MED. Rotate the RF GAIN, LOCAL GAIN, and LINE GAIN controls to their extreme clockwise positions. Remove tubes V507 and V510 and, with a pointed metallic probe with an insulated handle, touch tube-socket pin 1 of V510. A loud click in the speaker or headset indicates that the power supply and a-f subchassis are functioning. Replace the tubes after the test. If the a-f subchassis and power supply are functioning, proceed with the test described in subparagraph *b* below; if these units are not functioning, check the following:

(1) Fuses F101 and F102.
(2) Power cable connection.
(3) Speaker or headset.
(4) Tubes V801 and V802 (when a-c power supply is used).
(5) Tubes V601 through V606.
(6) Cables connectors on a-f subchassis (fig. 80).

b. I-f Subchassis. Remove plug P226 from receptacle J526 and touch the contact of the receptacle with the probe. A loud click from the speaker or headset indicates that the a-f and i-f circuits are functioning. Replace the plug. If the i-f subchassis is functioning, proceed with the testing of the r-f subchassis (subpar. *c* below). If the subchassis is not functioning, check the following:

(1) Tube V510.
(2) Tubes V501 through V507.
(3) Connector P117 on the i-f subchassis.

c. R-f Subchassis. The connection of the antenna to the antenna receptacle while the receiver is turned on should produce a loud clicking sound in the speaker or headset. When no sound is produced, check tubes V201 through V205. Additional test can be made by turning FUNCTION control to CAL and tuning to calibration signals.

47. Tube-testing Techniques

a. General. When Electron Tube Test Set TV-7/U, or equal, is available, test the tubes (according to the instructions supplied with the tester) for shorts, leakage, and either emission or mutual conductance. If a tube tester is not available, a similar receiver in good operating condition can be used to test the tubes by the substitution method described in subparagraph *b*, below. If another receiver is not available, the tubes can be checked by substituting spares, as described in subjaragraph *c* below. Observe the following precautions when removing and replacing tubes:

(1) Test each tube and replace it in its socket before removing another tube. However, if it is necessary to remove more than one tube for testing, mark each one so that it can be replaced, if satisfactory, in the proper socket.
(2) Remove the tube shields by pressing down and turning 1/4 turn counterclockwise. The vfo tube shield is held in place by a special clamp. See that the corrugated metal insert is in place when replacing the vfo tube shield.
(3) Use the proper tube puller, and extract the tubes carefully. Avoid excessive movement of the tube from side to side during extraction, as miniature tube pins are bent easily.
(4) Straighten the pins with the pin straighteners on the rear panel of the receiver; then replace tubes in the receiver.
(5) Do not discard tubes that were replaced with new tubes when employing tube substitution method. These tubes should be checked on tube checker; if good, they may be used in less critical circuits.

b. Checking Tubes by Substitution in a Similar Receiver. Tune a similar receiver, which is in good operating condition, to a voice signal that is not subject to fading; a signal on one of the lower-frequency bands is preferred. Turn the FUNCTION switch to AGC and the RF GAIN control to position marked 10. Make the substitutions from the faulty receiver to a corresponding position in the good receiver, one tube at a time; tap the tube under test, and, if noise or abnormal change in volume is observed, replace the tube. A considerable decrease in indication on the CARRIER LEVEL meter, or a noticeable decrease in volume or quality of the signal emitted from the speaker or headset, indicates a weak or otherwise defective tube. However, different test results for the following tubes must be observed.

(1) When tube V509 or V510 (agc circuit) is weak, a decreased indication on the CARRIER LEVEL meter with an increase in volume may be noted. A weak V511 (agc time constant circuit) will cause an increase in indication on the CARRIER LEVEL meter without any change in volume. A weak section V511 (i-f cathode follower) will produce a weak signal at

IF OUTPUT 50 OHM connector J106. After testing tubes V507 and V510 (noise limiters) in the usual manner, tune the receiver away from the test signal, and, if noise is received, rotate the LIMITER control clockwise; the tubes under test and tubes that are known to be good should be equally effective in reducing noise. After testing these tubes, return the LIMITER control to OFF, and retune the receiver to the test signal. To test V508, turn BFO switch to ON, and while turning BFO PITCH control through its entire range, listen for the beat note.

(2) Tubes V801 and V802 of the a-c power supply; V605, V606, and V607 of the a-f subchassis; and V701 of the vfo subchassis are checked by listening to the audio output and observing the indication on the CARRIER LEVEL meter (subpar. *b* above). Visually inspect V608 and V609; if they do not glow properly, they will cause abnormal B+ voltage. When testing tubes V901 and V902, turn the FUNCTION switch to CAL, tune through several 100-kc points, and observe the indication on the CARRIER LEVEL meter.

(3) Tubes in the a-f circuits are tested by listening to the volume and quality of the output signal of the a-f channels. When testing tubes V601, V602, and V603 (local a-f ampl), listen to the output signal of the local audio channel. When testing V601, also test the squelch circuit by tuning between stations to see if it is operating properly, i.e., eliminating all interchannel noise and static. When testing tubes V602 (line a-f ampl) and V604, listen to the output signal from the balanced-line circuit and observe the indication on the LINE LEVEL meter. Generally, small changes in LINE LEVEL meter indication may be expected because of the inherent differences among tubes.

c. Checking Tubes by Substituting Spares. Replace the tubes in the faulty receiver, one at a time, with the respective spare tubes, following the same general procedure outlined in subparagraphs *b*(1), (2), and (3) above.

48. Trouble Shooting by Using Equipment Performance Checklist

a. General. The equipment performance checklist (par. 49) will help the repairman to locate trouble in the equipment. The list gives the items to be checked, the conditions under which the item is checked, the normal indications and tolerances of correct operation, and the corrective measures to be taken. *To use this list, follow the items in numerical sequence.*

b. Action or Condition. For some items, the information given in the *Action or condition* column consists of various switch and control settings with which the items are to be checked. For other items, it represents an action that must be taken to check the normal indication given in the *Normal indications* column.

c. Normal Indications. The normal indications listed include the visible and audible signs that the repairman should perceive when he checks the items. If the indications are not normal, the operator or repairman should apply the recommended corrective measures.

d. Corrective Measures. The corrective measures listed are those that the operator or repairman can make without turning in the equipment for repairs. A reference in the table to a paragraph indicates that the trouble cannot be corrected during operation, and that trouble shooting by an experienced repairman is necessary. If the receiver is completely inoperative or if the recommended corrective measures do not yield results, trouble shooting is necessary. However, if the tactical situation requires that communication be maintained and if the receiver is not completely inoperative, the operator must maintain the receiver in operation as long as it is possible to do so.

49. Equipment Performance Checklist

	Item No.	Item	Action or condition	Normal indications	Corrective measures
PREPARATORY	1	Antenna	Lead-in wire connected.		
	2	Loudspeaker or headset	Loudspeaker connected to LOCAL AUDIO terminals 6 and 7 or headset connected to PHONES jack.		
	3	600-ohm line	Connected to terminals 10 and 13. If 600-ohm line is not available, connect headset to terminals for test purposes.		
	4	Power cable	Connected between receiver and power source.		
	5	AUDIO RESPONSE switch	Set at MED.		
	6	BANDWIDTH switch	Set at 4 or 8-KC.		
	7	RF GAIN	Set at 10.		
	8	LOCAL GAIN control	Set at 5.		
PREPARATORY	9	CHANNEL SELECTOR switch (S110)	Set at any position other than the one last used.		
	10	AUTO-TUNE REMOTE-LOCAL switch (S109)	Set at LOCAL.		
	11	Terminal strips	The following pairs of terminals on the rear terminal strips are connected together; 1 and 2, 3 and 4, 11 and 12, 14 and 15. External ground is connected to terminal 16 as a safety precaution.		

49. Equipment Performance Checklist (Contd)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
START	12	FUNCTION switch	Turn to AGC.	Dial lamps light.	Check power cable (par. 50).
		Power Supply PP-629/URR ON-OFF switch	Turn to ON.		Check dial lamps and fuses.
					Refer to paragraph 99.
				Rushing noise or signal is heard in speaker or headset. Autotune system cycles and selects frequency channel in accordance with position of CHANNEL SELECTOR switch (S110).	Test tubes. Check connectors between subchassis. Check Electrical Special Purpose Cable Assembly CX-2083/U. Check fuse F103. Connection at J105 on rear panel. Power Supply PP-629/URR, check that ON-OFF switch is at ON and that the red indicator lamp, I-1101, is lighted. Refer to paragraph 99.
				CHANNEL indicator is positioned in accordance with CHANNEL SELECTOR switch.	Refer to paragraph 99.
EQUIPMENT PERFORMANCE	13	CHANNEL SELECTOR control	Set to each channel, in turn.	Normal signal output on each band.	Refer to paragraph 99.
	14	ANT. TRIM	Rotate control.	Obtain peak indication on CARRIER LEVEL meter for each band.	Refer to paragraph 99.
	15	LOCAL GAIN control	Rotate control in either direction.	Volume at loudspeaker or headset increases or decreases.	Refer to paragraph 99.
	16	LINE METER switch	Set to 0.		
		LINE GAIN control	Rotate control.	Output level to 600-ohm line or headset and LINE LEVEL meter increases or decreases.	If headset level varies and pointer of LINE LEVEL meter is sticking, tap meter lightly. Refer to paragraph 99. If local output is satisfactory but line output is weak, check tubes V602 and V604. Refer to paragraph 99.

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE	17	RF GAIN control	Rotate control.	Audio output and CARRIER LEVEL METER indication increases or decreases.	Refer to paragraph 99.
	18	FUNCTION switch	Turn to MGC.	With no signal input, noise level should increase and CARRIER LEVEL does not operate.	Refer to paragraph 99. Refer to paragraph 99.
			Turn to AGC, and tune through several different signals.	Output volume nearly constant.	
			Record frequency-indicator reading. Unlock keys of MEGACYCLE CHANGE and KILOCYCLE CHANGE controls. Turn FUNCTION switch to CAL, and then operate the KILOCYCLE CHANGE control manually throughout the band. Return control to original position and lock keys after check.	Deflection on CARRIER LEVEL meter at each 100-kc reading.	Reset ANT. TRIM control. Refer to paragraph 99.
			Turn FUNCTION switch to SQUELCH, and then operate the CHANNEL SELECTOR switch.	No reception of noise while tuning between stations.	If noise is high, turn the RF GAIN control counterclockwise until the squelch circuit is effective enough to reduce the noise.
			Return FUNCTION switch to AGC and RF GAIN to 10 after check.		Refer to paragraph 99.
	19	LIMITER control	Turn clockwise.	Noise peaks are reduced in amplitude.	Refer to paragraph 99.
	20	BREAK IN relay switch	Turn to ON. Short BRK IN terminal 9 on rear panel to ground momentarily.	LINE LEVEL meter is disabled and break-in relays function to silence receiver.	Refer to paragraph 99.

49. Equipment Performance Checklist (Contd)

	Item No.	Item	Action or condition	Normal indications	Corrective measures
EQUIPMENT PERFORMANCE				Line audio output circuits from receiver REMOTE CONTROL receptacle are disconnected from receiver output.	
	21	LINE METER switch	Turn to +10.	Line level is 10 vu above LINE METER indication.	Refer to paragraph 99.
			Turn to 0.	LINE METER indicates the line level controlled by the LINE GAIN control.	
			Turn to —10.	Line level is 10 vu below LINE METER indication.	
			Turn to OFF.	LINE LEVEL meter is disconnected. Line audio output is still connected.	
	22	BFO OFF-ON control and BFO PITCH control	Turn on the BFO switch to ON. Tune in a c-w signal, and vary the BFO PITCH control.	Tone of signal varies.	
	23	BANDWIDTH switch	Turn from 16 to .1 KC.	Selectivity becomes sharper. Only low-frequency audio tones are heard in the counterclockwise positions.	Refer to paragraph 99.
	24	AUDIO RESPONSE switch	Operate through three positions.	Permits amplification of nearly full audio-frequency range in WIDE position, middle and low frequencies in MED. position, and 800 cps in SHARP position.	Refer to paragraph 99.
STOP	25	OVENS switch	Turn to OFF.	Oscillator ovens are turned off.	

	Item No.	Item	Action or condition	Normal indications	Corrective measures
S T O P	26	FUNCTION switch	Turn to STANDBY.	Receiver is silent. Filament circuits and oscillator circuits are kept on for immediate reception.	
			Turn to OFF.	Turns off all receiver circuits.	
	27	Power Supply PP-629/U ON-OFF switch	Turn to OFF.	Pilot lamp goes off.	

50. Checking Power Cables

A defective power cord is often the cause of an inoperative receiver. The repairman can often save a great deal of time by checking this cable first. Subparagraphs *a* and *b* below indicate the method of checking Power Cable Assembly CX-1358/U and Electrical Special Purpose Cable Assembly CX-2083/U.

a. Power Cable Assembly CX-1358/U. Remove the connector from the a-c input, and, with the cable assembly still attached to POWER receptacle J104, connect an ohmmeter across the terminals of the a-c connector. Turn the FUNCTION switch to OFF; the ohmmeter should indicate infinity. With the FUNCTION switch set to STANDBY, the ohmmeter indication should be about 1.5 ohms for 115-volt a-c input and 3.5 ohms for 230-volt a-c input. If these conditions are not obtained, remove the cable assembly from the receiver receptacle, and check for a short circuit in the cord by measuring between the two terminals of the a-c connector; check for a break or an open circuit by measuring between terminals A and D at the receiver cord of the cable and the a-c connector. If these tests show that the cable assembly is good, the fault may be assumed to be in the receiver, or in other external connections.

b. Electrical Special Purpose Cable Assembly CX-2083/U. Remove the cable assembly from Power Supply PP-629/URR and from the receiver. Check for a short circuit in the cord by measuring between terminals A and B of the power supply and D and E of the receiver end; check for a break or an open circuit by measuring between the associated terminals of the receptacle and lugs. If these tests show that the cable assembly is good, the fault may be assumed to be in the receiver, or in Power Supply PP-629/URR.

CHAPTER 4
THEORY

Section I. THEORY OF RADIO RECEIVER R-391/URR

51. Principles of Operation

a. Radio Receiver R-391/URR provides c-w mcw, and a-m reception over a frequency range of .5 to 32 mc. The receiver is basically a superheterodyne of the multiple conversion type. Triple conversion is employed for the lower frequencies (.5 to 8 mc) and double conversion for the higher frequencies (8 to 32 mc).

b. The receiver normally operates from a self-contained power supply designed to operate at a nominal input of 115 or 230 volts over a frequency range of 48 to 62 cps. However, provision is made to use Dynamotor DY-78/URR in place of the a-c power supply for 28-volt, d-c operation.

c. The Autotune system of Radio Receiver R-391/URR operates on a nominal supply of 24 volts, dc, as normally supplied by Power Supply PP-629/URR. In cases where Dynamotor DY-78/URR is employed as the self-contained power supply for the receiver, Power Supply PP-629/URR is not required for autotune operation.

d. The tuning system of Radio Receiver R-391/URR provides linear tuning over the entire frequency range of the receiver. Permeability tuning (insertion of powdered-iron cores into coils) and a system of Autotune-driven gears and cams make possible linear tuning and the use of a counter-type indicator on the front panel to show the frequency selected.

52. Block Diagram (fig. 27)

a. The block diagram shows the signal path from the antenna to the output. A schematic diagram (fig. 118) shows details of the circuits in the same order. A schematic diagram of each subchassis and the interconnecting wiring is shown in figure 116.

b. Power Supply PP-621/URR provides dc for the antenna and break-in relays, ac to the filament and oven circuits, and B+ voltage to the voltage-regulator circuit. All B+ voltages supplied to the receiver are regulated. The voltage-regulator circuit consists of series regulator V605 and V606, d-c amplifier V607, and voltage-reference tubes V608 and V609. The power supply consists of a transformer, with two primary windings connected in series for 230-volt a-c operation or connected in parallel for 115-volt a-c operation and rectifiers V801 and V802. D-c voltage for the break-in relay circuits is provided by dry-disk rectifier CR801.

c. R-f signals are fed to the receiver from either a balanced or unbalanced antenna. Antenna relay K101 grounds the antenna input for break-in operation and during calibration. This relay also operates to protect the antenna circuits of the receiver during standby operation. If the balanced antenna input is used, the r-f signals pass through one of several antenna transformers (selection of which is determined by the operating frequency of the receiver) and are fed to first r-f amplifier V201. If the unbalanced antenna input is used, the signals are capacitor coupled to secondary of the antenna transformers and are applied to first r-f amplifier V201.

d. The calibration oscillator subchassis, composed of V901 and V902, supplies a signal at every 100-kc point within the frequency range of the receiver. A 1000-kc crystal-oscillator stage, one-half of V901, provides a signal for synchronizing multivibrator stage V902 at 100 kc. A buffer-amplifier stage, one-half of V901, isolates the multivibrator from the loading effects of the r-f circuit and increases the strength of the higher 100-kc harmonics. When the FUNCTION switch is in the CAL posi-

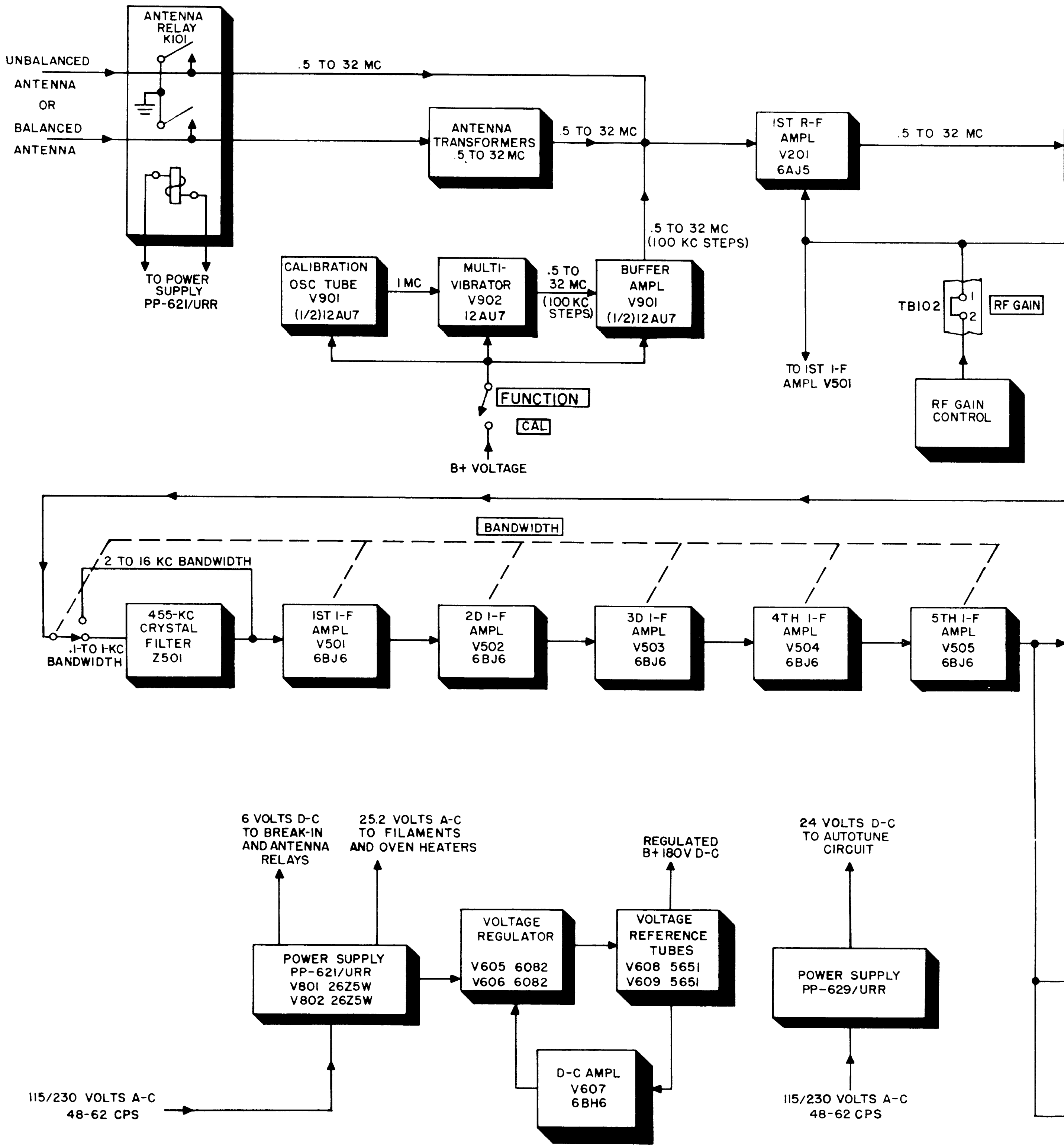


Figure 27. Radio Re

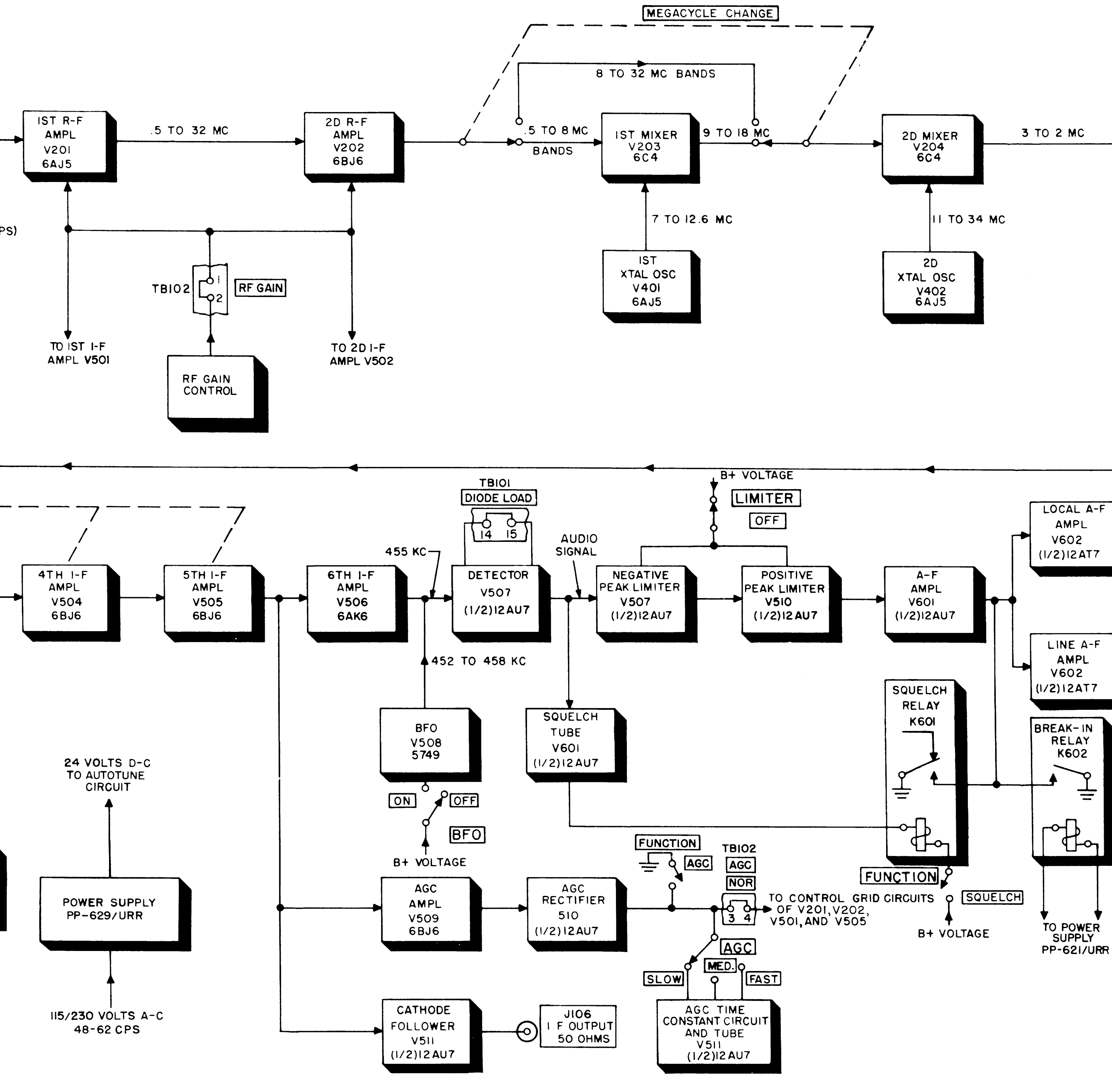
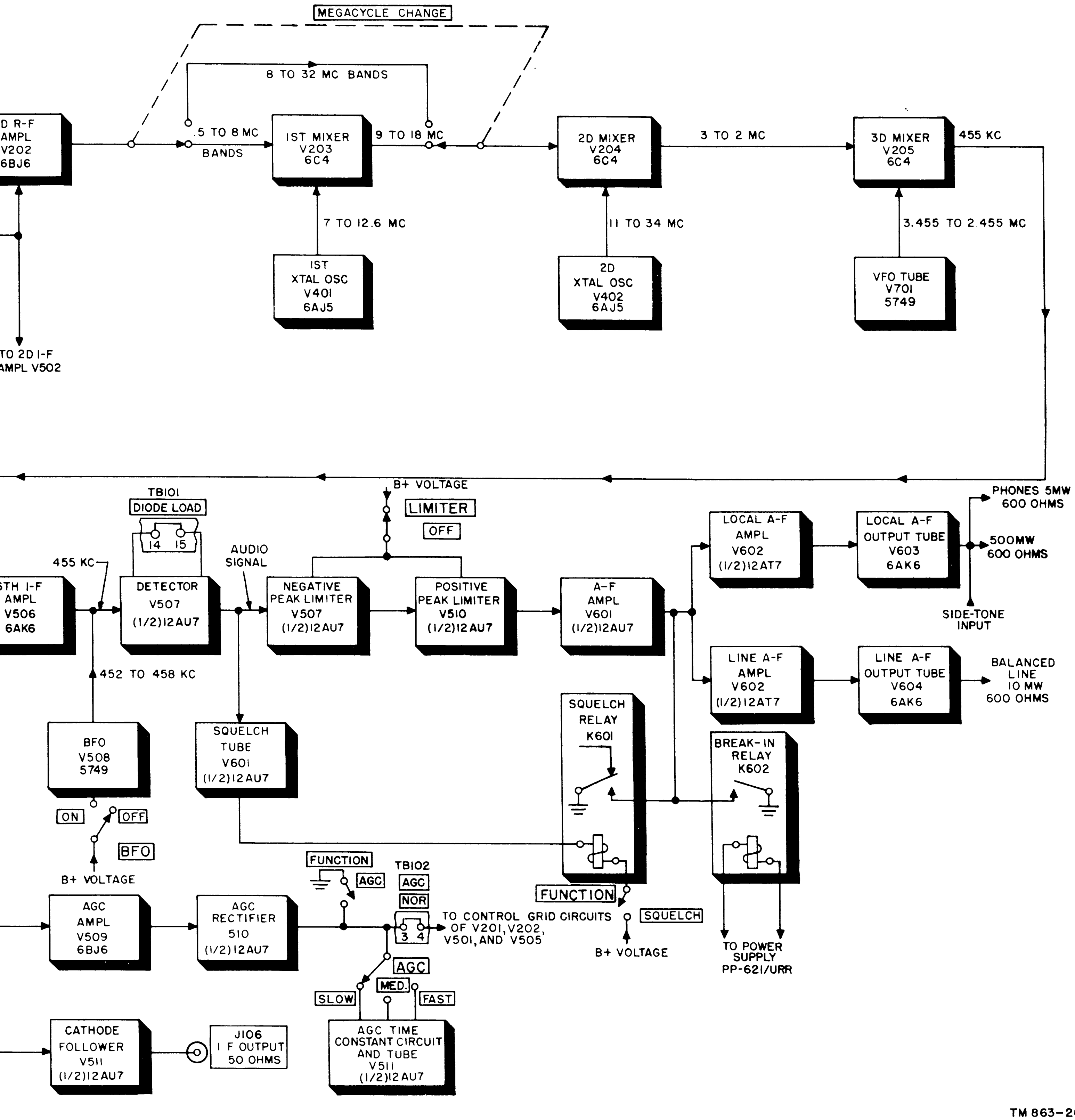


Figure 27. Radio Receiver R-391/URR, block diagram.



ver R-391/URR, block diagram.

tion, B+ voltage enables the calibration oscillator circuits.

e. The output of first r-f amplifier V201 is coupled to the grid of second r-f amplifier V202. The gain of the first and second r-f amplifiers is controlled manually by the RF GAIN control and automatically by the automatic gain control voltage. These stages amplify the r-f signals before applying them to the mixer circuits. The output of the second r-f amplifier (.5 to 32 mc) is fed to either the first or second mixer, depending on the MEGACYCLE CHANGE control setting. For frequencies from .5 to 8 mc, the r-f signal is mixed with the output of first crystal oscillator V401 in first mixer stage V203 to produce an i-f signal which is variable in frequency from 9 to 18 mc. For frequencies from 8 to 32 mc, the r-f signal is fed directly from the output of the second r-f stage to second mixer V204. The heterodyning signal for this mixer is supplied from second crystal oscillator V402. The i-f range of the second-mixer-output signal is 3 to 2 mc. It should be noted that the intermediate frequency at the output of the second mixer decreases as the input signal frequency increases. The input to third mixer V205 always has a frequency range of 3 to 2 mc except on the .5- to 1-mc band, in which case it has a frequency range of 2.5 to 2 mc. The output of vfo tube V701 is mixed with the input signal in the third mixer to produce a fixed frequency of 455 kc. The frequency range of the vfo is from 3.455 to 2.455 mc on all ranges of the receiver except the .5- to 1-mc range, in which case the upper frequency limit is 2.955 mc.

f. The 455-kc output signal of the third mixer is applied to the grid of first i-f amplifier V501 either directly or through crystal filter Z501, depending on the bandwidth desired. For the two narrow pass bands, .1 and 1 kc, the crystal filter is used. Four additional degrees of selectivity which do not use the crystal filter are accomplished in the i-f stages by the BANDWIDTH switch which varies the coupling between the primary and secondary circuits of the i-f transformers. The i-f amplifier consists of six stages, V501 through V506, which, together with the associated transformers, provide the required pass band. The output of fifth i-f amplifier V505 is divided to supply a 455-kc signal to each of three stages: sixth i-f amplifier V506, agc amplifier V509, and the cathode follower, one-half of V511. The output signal of the sixth i-f amplifier is demodulated in the detector circuit, one-half of V507. An external diode load may be connected from DIODE LOAD terminal 14 and ground with the jumper between terminal 14 and 15 removed. The output of the fifth i-f amplifier is amplified in agc amplifier V509, and the resulting signal is rectified by the agc rectifier, one-half of V510. When the FUNCTION switch is set for AGC operation, the gain of r-f amplifiers V201 and V202 and of i-f amplifiers V501 and V505 is controlled automatically by a d-c voltage developed by the agc rectifier, one-half of V510, to keep the output level of the receiver relatively constant and independent of signal-strength variation at the antenna. Thus for strong signals, the grid bias is high and the gain of the controlled stages is reduced and for weak signals the grid bias is reduced and gain of the controlled stages is increased. The response rate of the agc circuits can be controlled to satisfy reception requirements through the use of the AGC switch, the agc time constant circuit, and one-half of tube V511. For MGC operation, the agc bus is grounded by the FUNCTION switch. The cathode follower, one-half of V511, provides a low-impedance connection (50 ohms) from the output of the i-f stages for use when the receiver is employed for frequency-shift teletypewriter and single-sideband reception. To facilitate operation in the reception of radiotelegraph signals, in certain system applications and in calibration, bfo tube V508 provides a signal in the frequency range of 452 to 458 kc. This signal is mixed with the 455-kc i-f output signal of the sixth i-f amplifier to produce a beat frequency in the output of the detector which is in the a-f range. The output of the detector, one-half of V507, is coupled to the a-f amplifier, one-half of V601 through a negative peak limiter, one-half of V507, and a positive peak limiter, one-half of V510 which prevent noise peaks from exceeding average signal level. If operation without limiting is desired, the limiters can be disabled by a front-panel control.

g. In addition to supplying signals to the limiter, the detector, one-half of V507, supplies a d-c signal to the squelch tube, one-half of V601, which is a voltage amplifier. The average d-c output voltage of the squelch tube varies in proportion to the average signal level. When the signal level drops below some predetermined noise level established by the setting of the RF GAIN control and when the FUNCTION switch is set for SQUELCH operation, this voltage operates squelch relay K601, which short-circuits the output of the a-f amplifier V601 to quiet the receiver output. The output of the a-f amplifier can also be shorted to ground by break-in relay K602, when the FUNCTION switch is set to STANDBY, or to either MGC, AGC, or SQUELCH when the BREAK IN switch is set to ON and an external circuit provides a ground. The output from the a-f amplifier, one-half of V601 is divided and applied through separate gain controls to a local a-f amplifier, one-half of V602, and a line a-f amplifier, one-half of V602. The output of the local a-f amplifier supplies signals to local a-f output tube V603, which has connections for a speaker or a headset and for side tone signals from an associated transmitter to permit monitoring. The line a-f amplifier supplies signals to line a-f output tube V604, which has connections for a balanced line.

h. Power Supply PP-629/URR supplies 24 volts dc for operation of the Autotune system. The voltage is adjustable in order to increase or decrease the time necessary for cycling. The power supply is capable of supplying three Radio Receivers R-391/URR.

Section II. CIRCUIT ANALYSIS

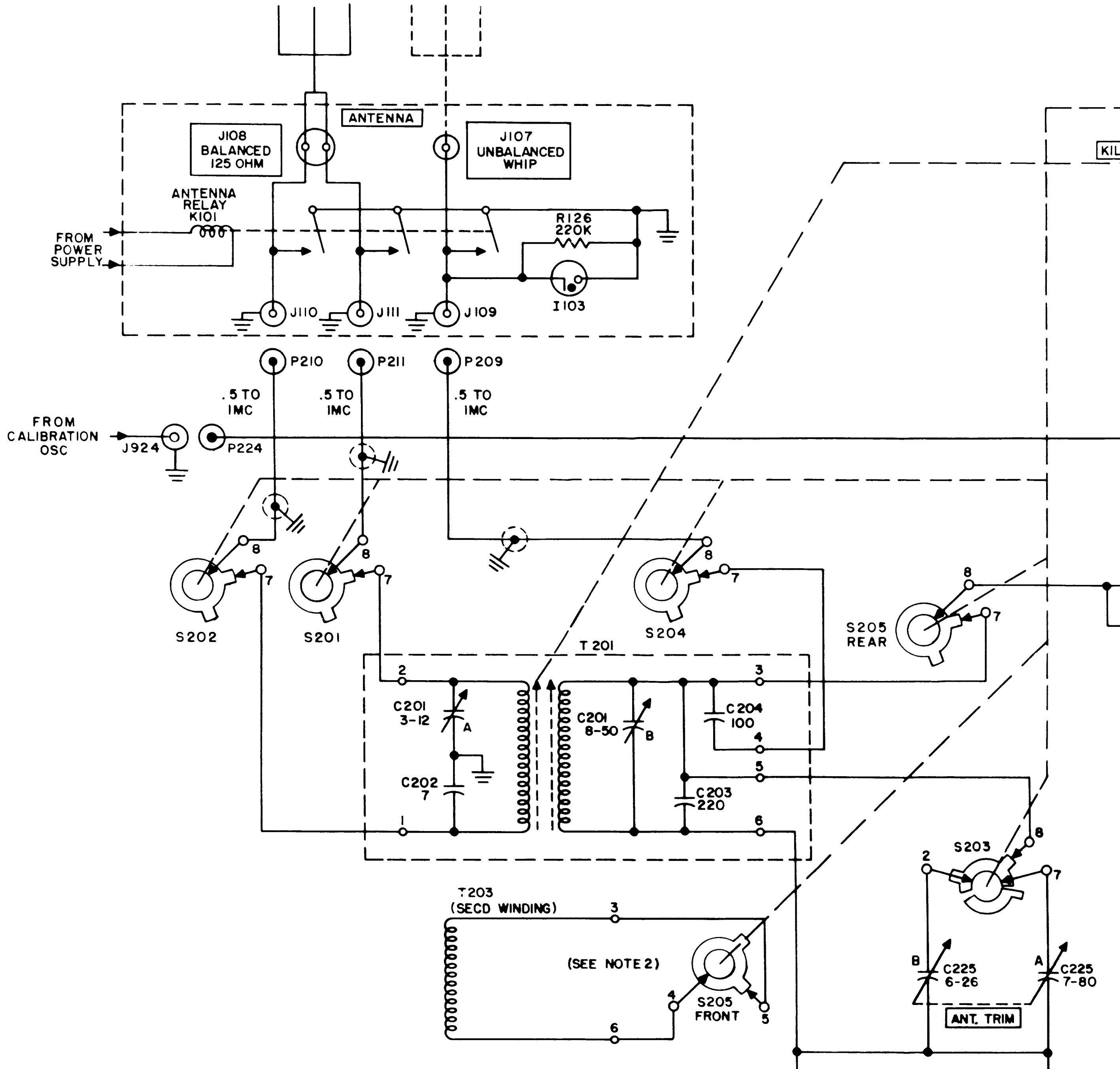
53. General

Radio Receiver R-391/URR employs unitized construction consisting of seven subchassis which are mounted onto a main frame. Certain components of unrelated electrical circuits sometimes are located on the same subchassis. The circuit analysis given in the following paragraphs is based upon the signal path established in the block diagram (fig. 27) and the over-all schematic diagram (fig. 118). However, in performing trouble-shooting procedures and repairs, the technician must remember that the physical location of a component is often quite removed from the circuit in which it is effective. For example, although the voltage regulator is effectively a part of the power supply, it is actually located on the a-f subchassis. The reason this is done is to utilize space efficiently. To determine on which subchassis a particular component is located, refer to figure 116.

54. Antenna Circuit (fig. 28)

The purpose of the antenna circuit is to provide means for matching antennas having different characteristics to the input of first r-f amplifier V201.

a. Antennas which have a nominal, balanced, terminal impedance of 50 to 175 ohms and which terminate in two wires (such as twin lead or dual-conductor coaxial cable) are connected through J108, to the primary winding of one of six antenna transformers. One lead connects through J110, P210, and S202, and the other lead connects through J111, P211, and S201. Six transformers (T201 through T206) are employed to cover the frequency range of .5 to 32 megacycles. The transformer in use for a given band is selected by the operation of S201, S202, S203, S204 and S205. Since the theory of operation is identical for all bands, only one band is shown in the schematic diagram, figure 28. The conditions shown are for the .5- to 1-mc band. This means of simplification will be followed in the discussion of all succeeding stages unless otherwise indicated. Primary winding L201 is balanced to ground by fixed capacitor C202 and section A of variable capacitor C201. The 125-ohm input impedance of T201 is essentially resistive, but the reactive component depends critically upon the adjustment of the ANT. TRIM capacitor C225, in parallel with C203. By suitable adjustment, the reactive component may be made less than 20 ohms over the entire frequency range of the transformer. However, at higher frequencies it may be considerably higher. The primary and secondary windings of T201 are magnetically coupled and electrostatically shielded.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. IN THE FIRST BAND SWITCH POSITION (.5 TO 1MC) T203 SECD WINDING IS SHORT CIRCUITED.
3. ALL SWITCHES ARE VIEWED FROM END OPPOSITE THE KNOB.
4. SWITCH S107 IS SHOWN IN AGC POSITION.
5. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION IN THE .5- TO 1-MC RANGE.

Figure 28. Antenna circuit and first

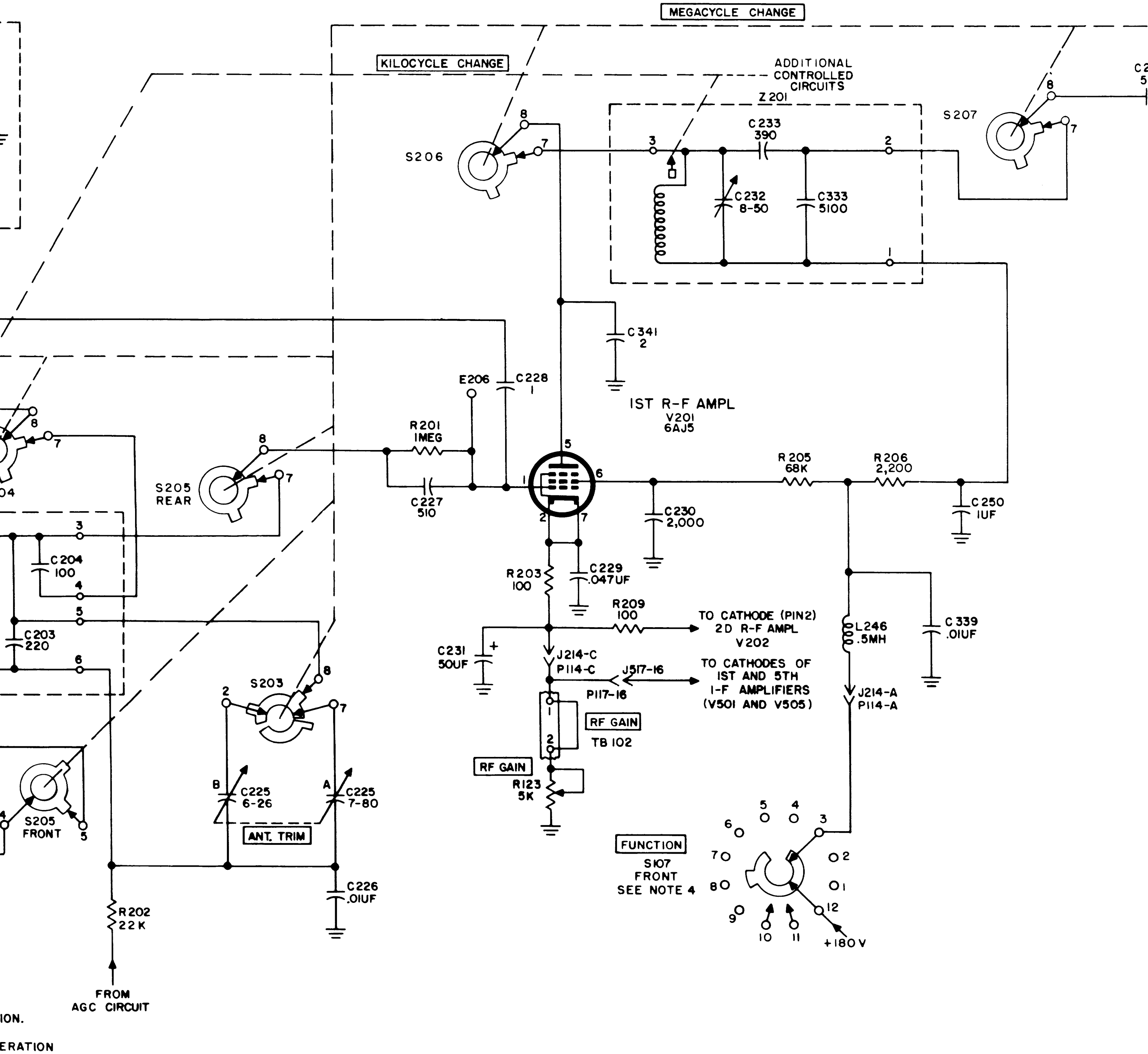
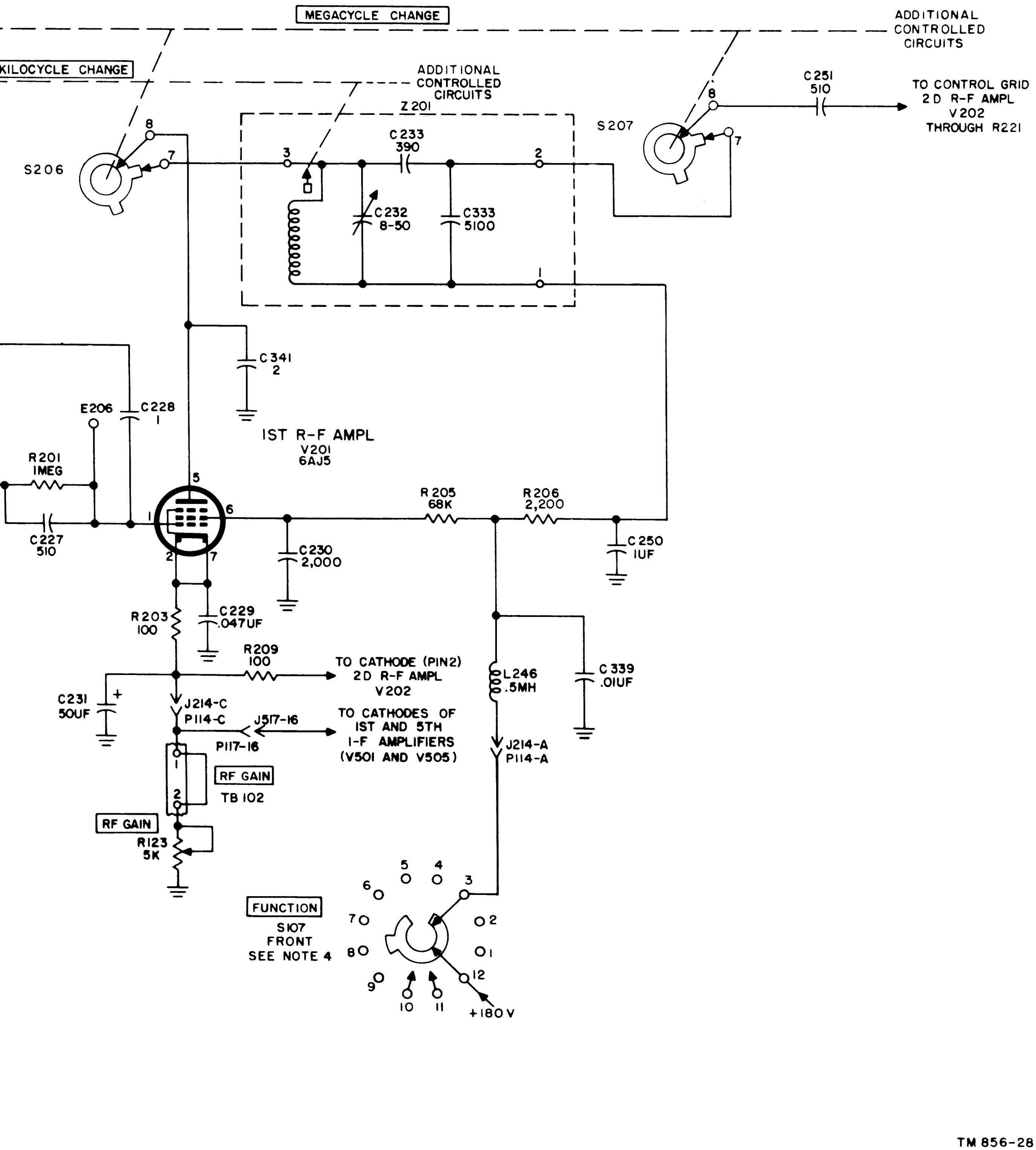


Figure 28. Antenna circuit and first r-f amplifier, schematic diagram.



st r-f amplifier, schematic diagram.

Transformer T201 contains a powdered-iron core which is movable for purposes of achieving resonance for any desired signal within the range of .5 to 1 mc. Movement of this tuning core in conjunction with other tuning cores throughout the equipment (par. 84), is effected by rotating the KILOCYCLE CHANGE control. The voltage developed across L202 is applied, through switch S205 (rear) and coupling capacitor C227, to the control grid (pin 1) of first r-f amplifier V201. When an unbalanced antenna such as a random length whip is used connection is provided from J107 through J109 and P209, and through switch S204, capacitor C204, switch S205 (rear) and coupling capacitor C227, to the control grid of V201. When this type antenna is used it is connected to secondary winding L202 of T201. The B section of capacitor C201 is provided for alinement purposes. Switch S203 connects either section A or B of C225 in parallel with fixed capacitor C203.

b. In addition to its basic function as part of the antenna transformer, the secondary winding of T201 along with R201 provides a d-c path for biasing the grid of the first i-f amplifier. To prevent reactive effects between the transformer in use and the transformer next lower in frequency range, the latter is short-circuited by S205 (front). In the case shown, there is no lower frequency range so L206 is shorted instead. Antenna relay K101 is operated through the break-in relay circuit, and it grounds both antenna-input circuits when an associated transmitter is in operation, during calibration, and during standby operation. Resistor R126 prevents the gradual accumulation of a static electrical charge on the antenna and, if an unusually strong charge is induced (such as might be caused by transmission from an adjacent transmitter) glow tube I-103 becomes momentarily conductive and passes the charge to ground.

c. Switches S201 through S205 are sections of a six-position band switch which is operated by the MEGACYCLE CHANGE control. When the bandswitch is rotated to a new position, the following events occur simultaneously.

(1) One of the six antenna transformers is inserted into the input circuit (depending on the operating frequency selected).

(2) Both, or either, of the two sections of ANT. TRIM capacitor C225 is added to the antenna circuit, as required.

(3) One of the unused transformer secondary windings is short-circuited.

d. The antenna circuit is designed to cover a range of .5 to 32 mc in six bands, as follows: .5 to 1 mc, 1 to 2 mc, 2 to 4 mc, 4 to 8 mc, 8 to 16 mc, and 16 to 32 mc. The transformer used for each band is T201 through T206, respectively.

55. First R-f Amplifier V201
(fig. 28)

The first r-f amplifier uses a miniature pentode tube, type 6AJ5, to increase the amplitude of the signals from the antenna before they are applied to the second r-f stage. The following discussion will be concerned only with the .5- to 1-mc band.

a. Grid bias for the first r-f amplifier is supplied from the agc circuit through FUNCTION switch S107 (when set to AGC), decoupling resistor R202 (which is bypassed by C226), the secondary winding (L202) of T201, the contacts of S205 (rear), and grid resistor R201 (which is bypassed by C227). R201 absorbs most of the grid bias developed by V201 when strong off-tune signals are present and prevents this bias voltage from backing up into the agc line and blocking off the receiver. When the FUNCTION switch is rotated to the MGC position, the agc line is grounded and tube bias is controlled completely by the MGC position, the agc line is grounded and tube bias is controlled by the RF GAIN potentiometer R123 and cathode resistor R203. To prevent degeneration in the first r-f stage, a low-impedance signal circuit from cathode to ground is provided by capacitor C229. Since RF GAIN potentiometer R123 also controls the gain of second r-f amplifier V202 (through R209) and of first and fifth i-f amplifiers V501 and V505 (through P117-16, and J517-16), decoupling is necessary. This is accomplished by C231, which provides a low-reactance path to ground at radio and intermediate frequencies and acts as a noise filter when the RF GAIN control is operated. An external gain control may be connected between terminals 1 and 7 (GND) of TB102 (fig. 21), provided the jumper between terminals 1 and 2 is removed. The screen grid (pin 6) potential is obtained through voltage-dropping resistor R205 from the output of the 180-volt supply through L246, J214-A, and P114-A, and FUNCTION switch S107 (front). To prevent variations in screen-grid voltage caused by screen-current changes, r-f signal voltages that appear on the screen are bypassed to ground through capacitor C230. R-f choke L246 and bypass capacitor C339 function as a low-pass inductance-capacitance filter to prevent r-f signals induced in the wiring from entering the common B+ circuits. Plate voltage is applied to V201 through voltage dropping resistor R206, tank coil L213, and bandswitch S206, and the power supply is decoupled from the plate circuit of the tube by capacitor C250. A very small value of capacitance, C341, is added to the interelectrode capacitance between the plate of V201 and ground so that its value equals that of V202. This is done to provide tracking in the 16 to 32 megacycle range. Voltage for the plate and screen circuits is applied through FUNCTION switch S107 (front), in all positions except STANDBY and OFF.

b. Signals from the antenna circuit are applied, through coupling capacitor C227, to the control grid (pin 1) of the first r-f amplifier. The amplified signals appearing at the plate (pin 5) of the first r-f amplifier are applied to tuned circuit Z201. Capacitor C341 is a fixed tuning capacitor used to compensate for stray inductance in the plate circuit. The output of the first r-f stage is not taken from across the entire resonant circuit, but is connected to the junction point of C233 and C333, two series capacitors which serve as a voltage divider across the coil. This circuit arrangement provides a high Q (since it reduces loading) and an increased stability (since it limits gain) and minimizes any detuning that the gain control might cause as a result of tube capacitance variation in the following stage. In addition, tracking at the higher frequency ranges is facilitated by the fact that the tube and circuit-wiring capacitance is across only a portion of the resonant circuit. The output signals of the first r-f amplifier are applied, through band switch S207 and coupling capacitor C251, to the grid circuit of the second r-f amplifier. L213 is permeability tuned for resonance by the operation of the KILOCYCLE CHANGE controls and C232 is provided for alinement.

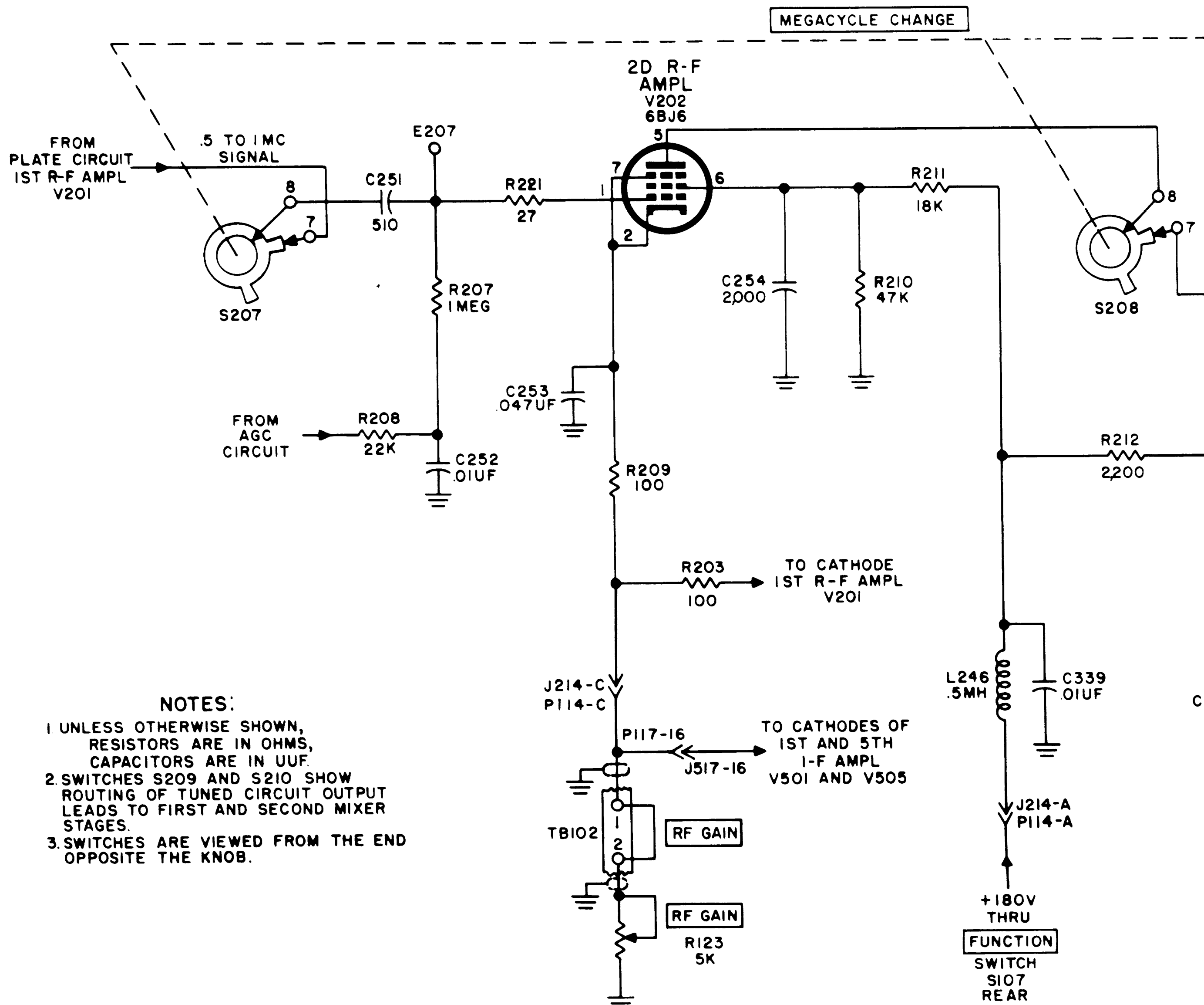
c. In addition to the normal r-f signals, a calibration signal (par. 63) can be applied to the grid circuit of V201 through J924, P224, and coupling capacitor C228. Pin E206 (fig. 68) provides an easily accessible connection to the grid circuit for test purposes.

d. Switches S206 and S207 are sections of the six-position band switch mentioned previously (par. 84), and are controlled by the MEGACYCLE CHANGE control. Selection of one of the six tuned circuits in the output circuit of the first r-f amplifier is made with this control. The frequency range of each tuned circuit is as follows: Z201, .5 to 1 mc; Z202, 1 to 2 mc; Z203, 2 to 4 mc; Z204, 4 to 8 mc; Z205, 8 to 16 mc; Z206, 16 to 32 mc. The core in each tuned circuit is movable and is controlled by the KILOCYCLE CHANGE and the MEGACYCLE CHANGE controls through the differential except for the .5- to 1-mc and the 1- to 2-mc band when it is controlled by the KILOCYCLE CHANGE control.

56. Second R-f Amplifier V202
(fig. 29)

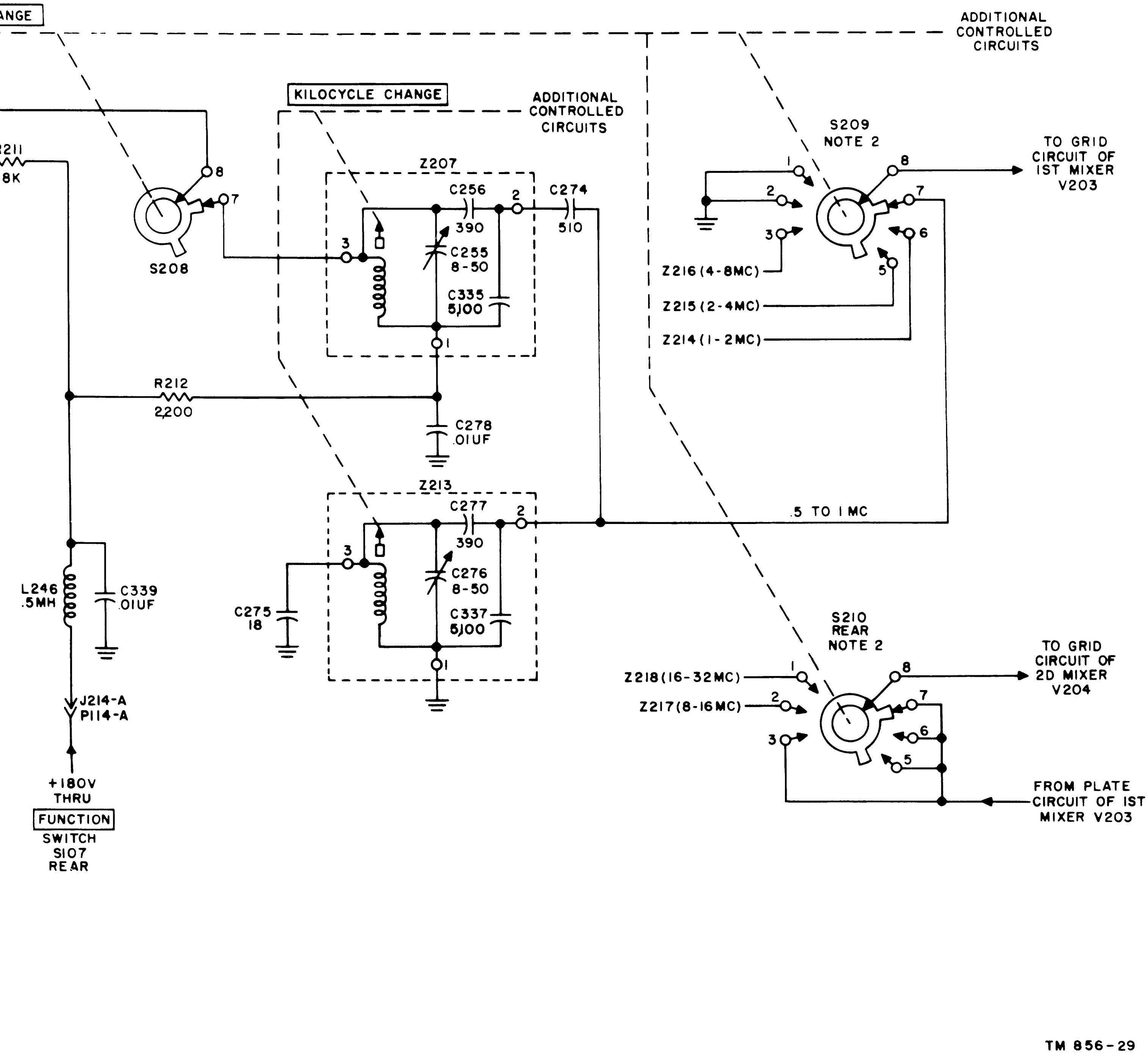
The second r-f amplifier has a miniature pentode tube, type 6BJ6, which amplifies the signal voltages from the first r-f amplifier.

a. The grid return to the agc circuit is through parasitic suppressor R221, grid bias resistor R207 and a decoupling network consisting of R208 and C252. The cathode (pin 2) and suppressor grid (pin 7) are connected together and return to ground through cathode resistor R209 and RF GAIN control R123. C253 is the cathode bypass capacitor. Provision for external RF GAIN control is at terminals 1 and 2 of TB102 which normally are connected together by a jumper. The RF GAIN control is common to the first and second r-f stages and the first and fifth i-f stages. Connection to the latter is made through P117-16 and J517-16. R203 isolates the first r-f stage from the circuit. The screen grid (pin 6) is bypassed for rf by C254 and is connected to the junction of



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES S209 AND S210 SHOW ROUTING OF TUNED CIRCUIT OUTPUT LEADS TO FIRST AND SECOND MIXER STAGES.
3. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.

Figure 29. Second r-f amplifier,



ure 29. Second r-f amplifier, schematic diagram.

R210 and R211 which form a voltage divider across the 180-volt supply. The plate (pin 5) circuit is completed to B+ through S208, L219 and decoupling resistor R212 which is bypassed by C278. Additional filtering of the supply voltage is accomplished by L246 and C339 which also prevent r-f signal voltages from entering the power supply circuits.

b. The signal is applied through band switch S207, coupling capacitor C251, and parasitic suppressor R221, to the control grid (pin 1) of second r-f amplifier V202. The amplified signal appearing at the plate is applied, through S208, to tuned circuit Z207. As described for the first r-f amplifier plate circuit, capacitors C256 and C335 are connected in series as a voltage-divider circuit. In order to achieve greater selectivity than is obtainable from one tuned circuit, the junction of these capacitors is coupled, through capacitor C274, to the grid of the first mixer and to another tuned circuit, Z213, which is identical to Z207 and contains a voltage divider, made up of capacitors C277 and C337. The values of the capacitors have been selected so that only one-tenth of the output voltage is applied to the control grid (pin 6) of the first mixer, V203; [illegible] this is equivalent to connecting the grid of V203 to a tap nine-tenths of the windings on coils L225 and L219, grid loading and detuning are reduced (because tube input capacitance is made negligible by the use of a large tuning capacitance across the grid), and thus high selectivity is obtained. Tuned circuits Z207 and Z213 are individually shielded, to prevent coupling between coils L219 and L225; a separate slug for each circuit is mounted on the .5- to 1-mc tuning rack. Trimmer capacitors C255 and C276, and test point E207 (fig. 68) connected to the grid of V202, are provided for repair and alinement purposes.

c. In addition to tuned circuits Z207 and Z213, which cover the .5- to 1-mc range, five pairs of inductors cover the additional ranges: Z208 and Z214, 1 to 2 mc; Z209 and Z215, 2 to 4 mc; Z210 and Z216, 4 to 8 mc; Z211 and Z217, 8 to 16 mc; and Z212 and Z218, 16 to 32 mc. Triple conversion is used in the frequency range of .5 to 8 mc, and double conversion is used in the frequency range of 8 to 32 mc. Therefore, in the frequency range of .5 to 8 mc, the output from the second r-f amplifier is fed through switch S209 to the grid of first mixer V203, and in the frequency range of 8 to 32 mc, the output is fed through switch S210 directly to the grid of second mixer V204. The resonant circuits are tuned by varying the degree of insertion of powdered-iron cores.

57. First Mixer V203 (fig. 30)

The first mixer stage has a miniature triode, type 6C4. On frequency ranges from .5 to 8 mc, the signals from the output of the second r-f amplifier are applied to the control grid (pin 6). The output of the first crystal oscillator V401 is applied to the cathode (pin 7), and the two signals are heterodyned in the mixer stage to produce a signal of 9 to 18 mc in the plate circuit. The frequency of this signal is variable and is the sum of the frequencies of the two input signals (par. 110).

a. Grid bias for V203 is developed across R213, and R214 is a parasitic suppressor. The cathode circuit, composed of the secondary transformer T401 and resistor R404 in series to ground, provides cathode bias. Bypass capacitor C404 prevents degeneration across R404. B+ to the plate of the first mixer is fed through tank coil L231, decoupling resistor R215 which is bypassed for rf by C304 and L246 in series, to which B+ (180 volts) is applied through J214-A and P114-A. Capacitor C305 provides fixed tuning. L246 and C339 serve as an r-f filter, as described in the analysis of the second r-f amplifier stage (par. 56*a*). C306 is for alinement purposes.

b. The first mixer functions only over the .5- to 8-mc range; therefore, throughout this range of frequencies the signal voltage from the second r-f amplifier stage is applied through S209 to the control grid of the first mixer. The injection signal from the first crystal oscillator is a fixed frequency for each frequency range, and is applied through T401, J401, and P221, to the cathode (pin 7) of V203. T401 serves to isolate the mixer from the oscillator, and to match to the low-impedance cathode circuit of the mixer to the comparatively high output impedance of the oscillator plate circuit. The plate circuit is tuned over the 9- to 18-mc range by changing the positions of the powdered-iron cores in Z219, Z220, and Z221. Capacitors C306, C309, and C311 are provided for purposes of alinement. The 9- to 18-mc signal from the plate of the mixer is fed, through C307, Z220, C310, Z221, and S210, to the grid circuit of second mixer V204. C308 is for fixed tuning and provides equivalent capacitance to that of the coaxial cable across Z220 and Z221. The rear section of S210 connects the output of first mixer V203 to second mixer V204 for the .5- to 8-mc range (four bands), and connects the output of second r-f amplifier V202 to the second mixer for the 8- to 32-mc range (two bands). In the 8- to 32-mc range, the front section of S210 grounds the output circuit of V203.

c. The powdered-iron cores which tune coils L231, L232, and L233 of circuits Z219, Z220, and Z221, move simultaneously to a predetermined position when the MEGACYCLE CHANGE knob is turned. In addition, the three tuned circuits are mounted on a movable platform, the position of which is controlled by the KILOCYCLE CHANGE knob (par. 84). E208 (fig. 68) is provided for test and alinement purposes.

58. First Crystal Oscillator V401
(fig. 31)

The first crystal oscillator provides the injection signal to first mixer V203 on the eight lower frequency bands. For simplicity, the circuitry for operation on only the first band, .5 to 1 mc, is shown in figure 31. The oscillator uses a type 6AJ5 miniature pentode, connected in a special electron-coupled Colpitts type circuit where a highly selective crystal is substituted for the conventional reasonant circuit.

a. Bias is developed by crystal current through resistor R401. Since no crystals are in the circuit after the first eight bands, protective bias must be provided to prevent damage to V401 on the remaining higher frequency bands. Resistor R402 provides the required negative bias for the control grid (pin 1) by virtue of the positive potential on the cathode (pin 2). The grid is returned to ground through R401. Voltage for the screen grid and the plate is applied through common choke L406 and resistor R403. Resistor R409 is a voltage dropping resistor for the screen grid (pin 6) and C438 is the screen r-f bypass capacitor. The B+ voltage to the plate is fed through the primary winding of T401. Both the plate and screen circuits are decoupled from the power supply by R403 and C403.

b. The oscillator is a triode consisting of the cathode (pin 2), the control grid (pin 1), and the screen grid (pin 6). The screen grid acts as the oscillator anode. The control grid is connected to crystal Y401 through the contact marked 0 of switch section S402. Capacitor C438 returns the signal to ground. The proportion of the signal voltage, which is fed from the screen grid (or anode) to the control grid to maintain oscillation at the fundamental crystal frequency of 9 mc, is determined by the electrical position of the cathode relative to the electrical center of the tuned circuit; this position is fixed by the voltage-divider action of series-connected capacitors C401 and C402. R-f choke L401, by offering a high-impedance path to the r-f signal, isolates the bias resistor, R402, from the crystal circuit, and thus prevents unnecessary loading, which might stop oscillation. Since the output of the oscillator is coupled into the plate circuit by virtue of the electron flow within the tube, variations in plate loading have little effect on oscillator stability. Capacitors C414 and C415, in parallel, are connected by means of switch S404 to the primary winding of T401 for adjustment to obtain the maximum output at the resonant crystal frequency of 9 mc. The 9-mc signal is magnetically coupled to the secondary winding of T401, and is applied, through jack J421 to the cathode of first mixer tube V203. Bias resistor R404 and bypass capacitor C404 are a part of the cathode circuit of V204.

c. Only five crystals and five trimmer capacitors are used to cover the frequency range of .5 to 8 megacycles in eight steps (fig. 118 part 1). The table below shows the crystal symbol, its fundamental frequency, the trimmer section in use, and the step of switches S402 and S404. The step corresponds to the reading of the two left hand digits of the frequency indicator on the front panel.

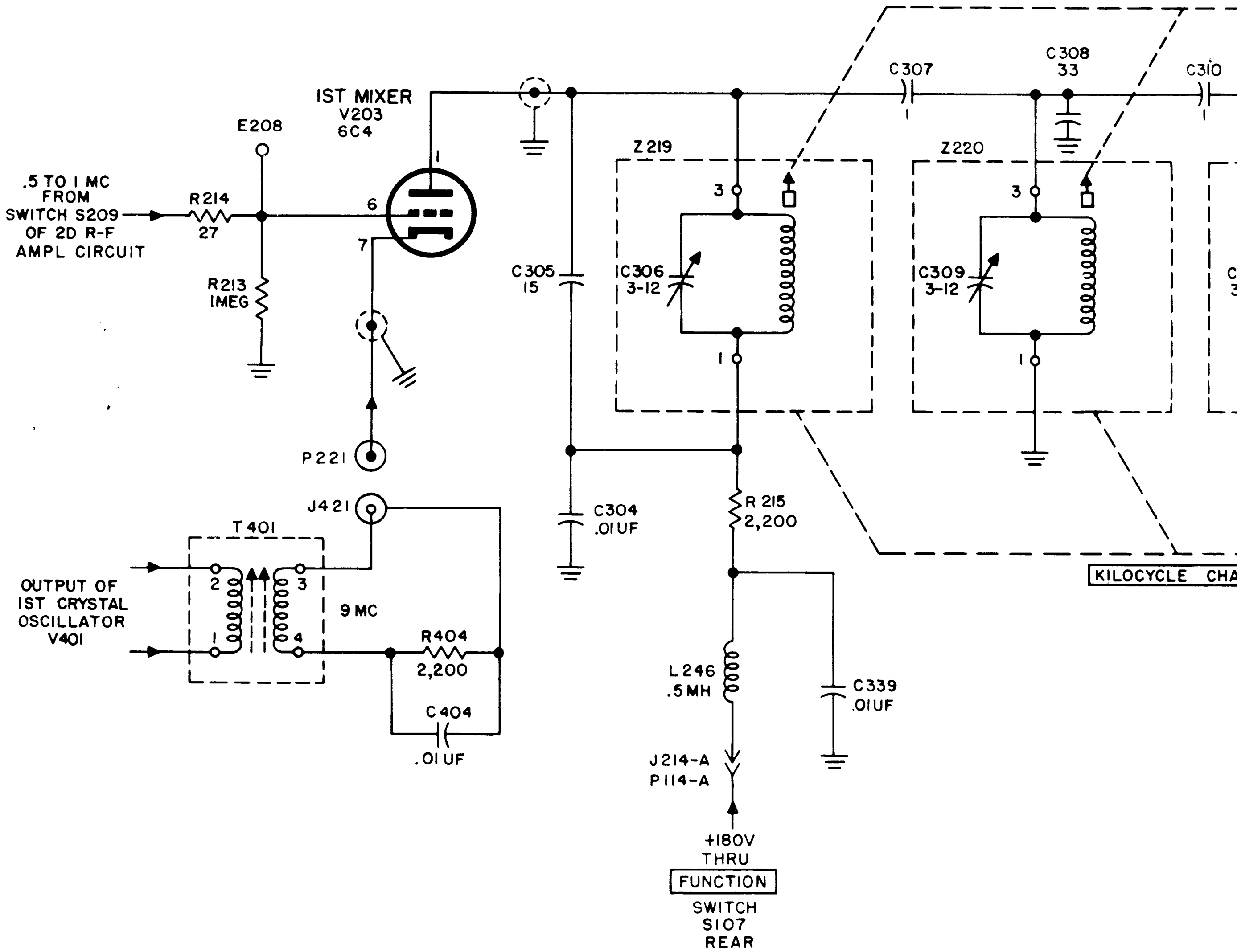


Figure 30. First mix

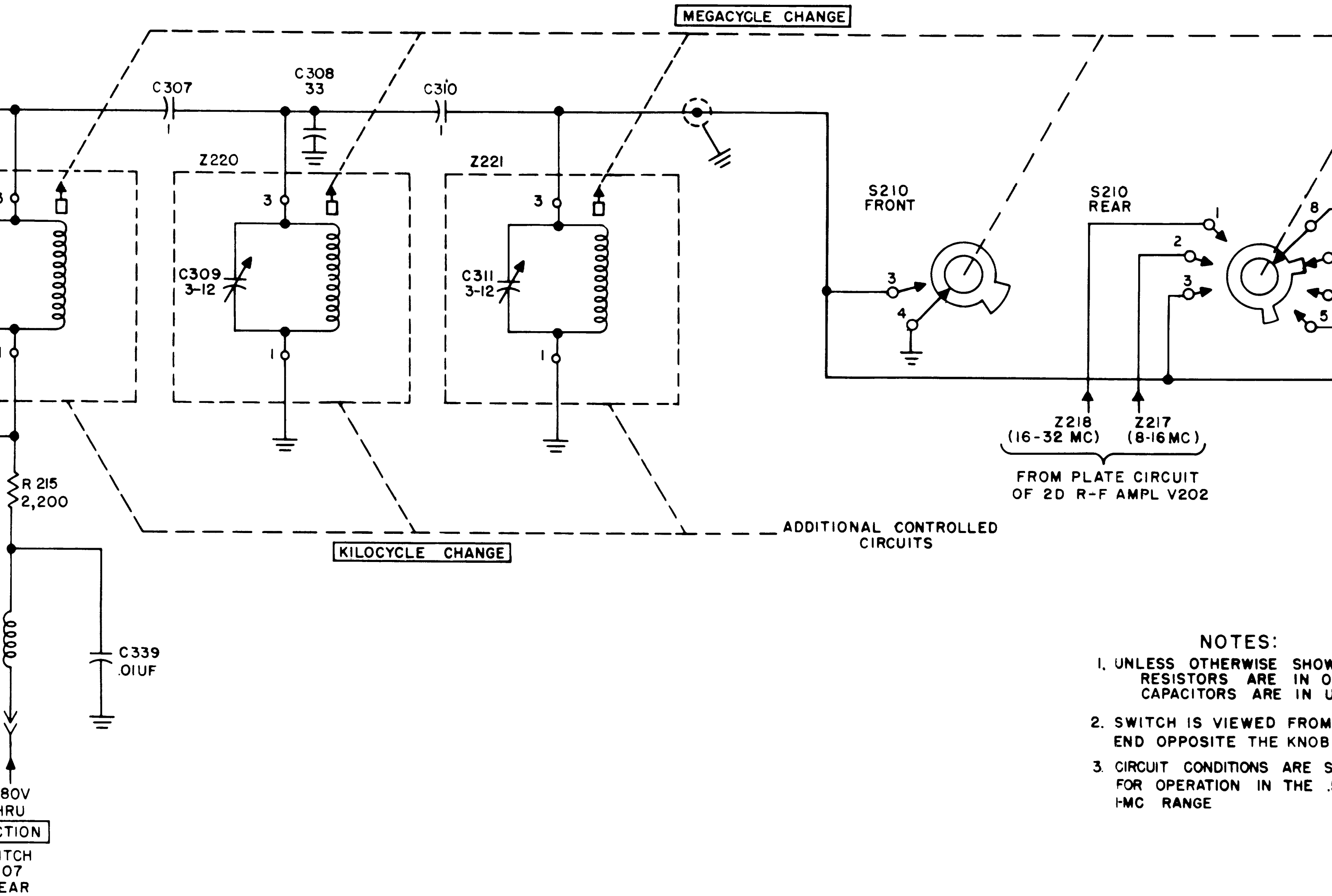
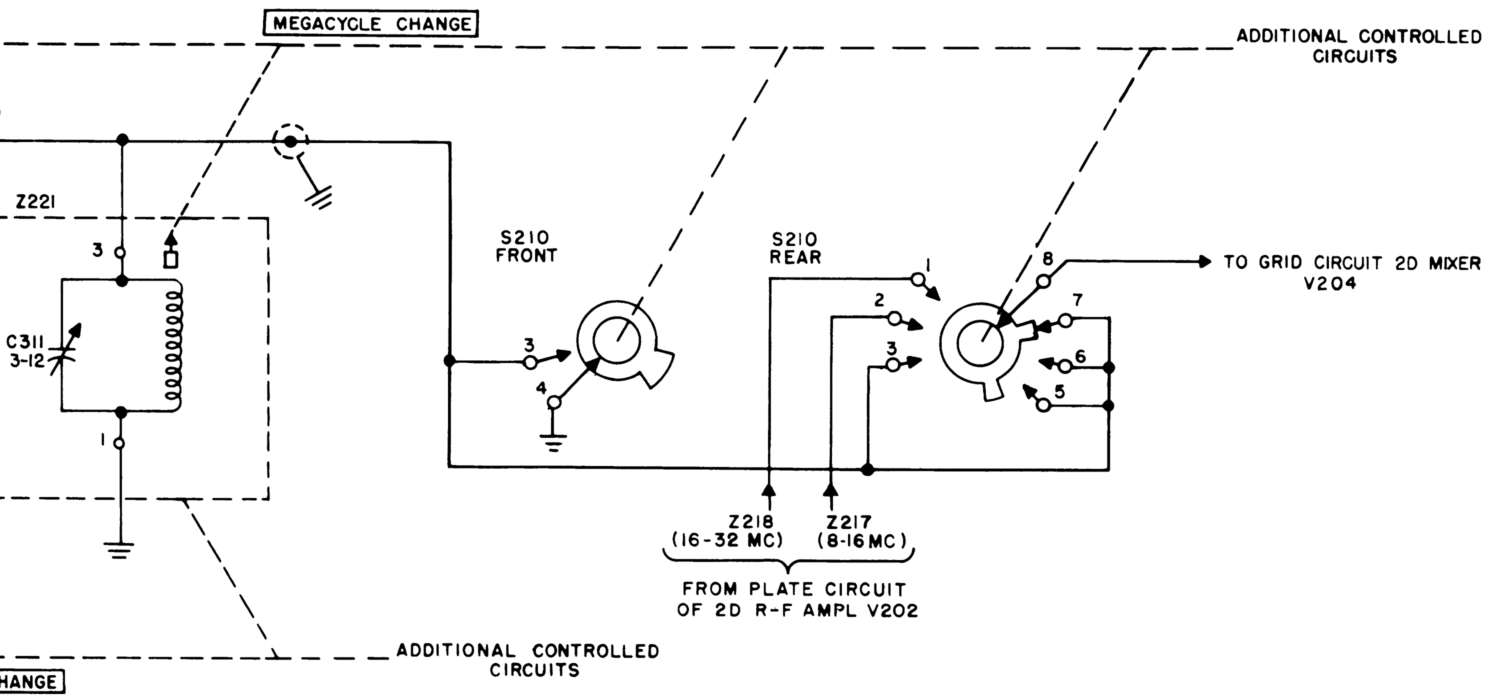


Figure 30. First mixer stage, schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.
3. CIRCUIT CONDITIONS ARE SHOWN FOR OPERATION IN THE .5-TO 1-MC RANGE

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ixer stage, schematic diagram.

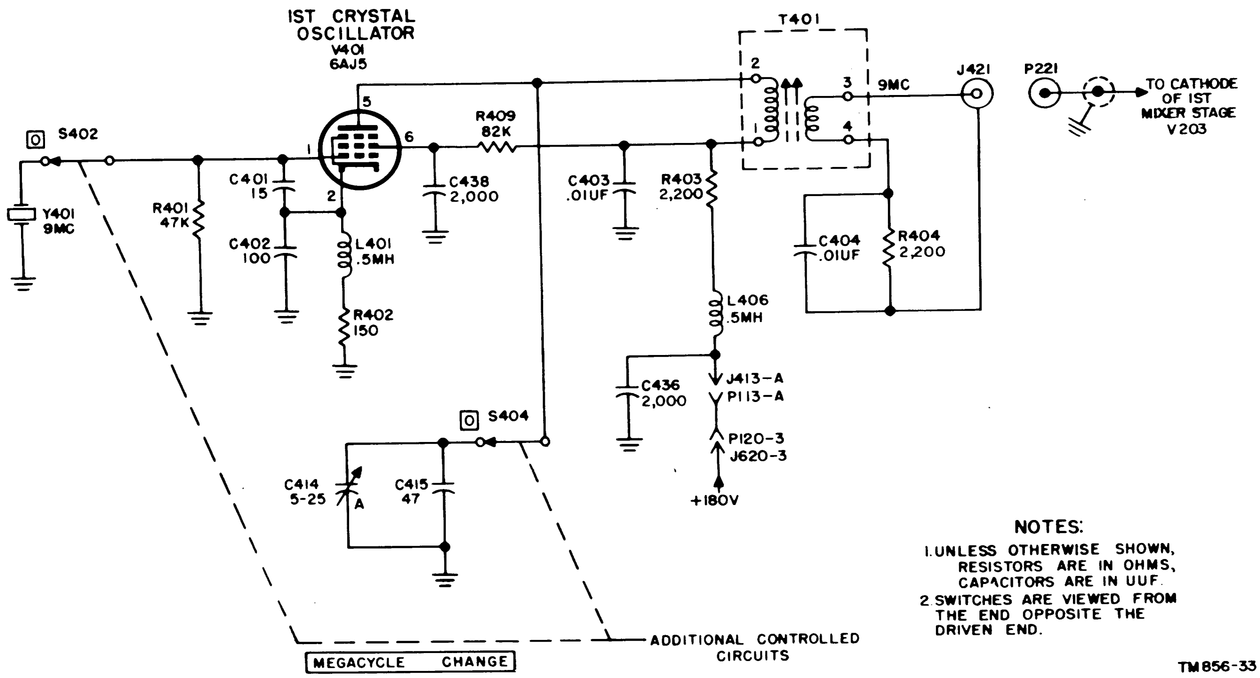


Figure 31. First crystal oscillator, schematic diagram.

Crystal Symbol	Fundamental frequency in mc	Trimmer Section	Step
Y401	9	C414 and C415	0 and 6
Y402	8	C414 and C416	1 and 5
Y403	10	C414	2 and 7
Y404	12.6	C414 and C417	3
Y405	7	C414 and C418	4

59. Second Mixer V204 (fig. 31)

The second mixer stage uses a miniature triode, type 6C4. On the eight lower-frequency bands, signals from first mixer tube V203 (or from the output of the second r-f amplifier on the 8- to 36-mc range) are applied to the control grid (pin 6) of the mixer. The output of second crystal oscillator V402 is applied to the cathode (pin 7). The two signals heterodyne in the stage to produce a signal of 2.5 to 2 mc in the plate circuit when the receiver is set to the .5- to 1-mc band, and 3 to 2 mc on all other bands. The frequencies in the plate circuit are variable, and are the difference between the signal frequency applied to the grid and the oscillator frequency injected at the cathode (par. 110).

a. Grid bias is developed across R216, and cathode bias is developed across resistor R408 which is bypassed for rf by capacitor C408. B+ voltage is applied to the plate through P114-A, J214-A, L246, R217, and L234. Decoupling from the power supply is provided by resistor R217 and capacitor C313. L248 and C339 serve as an r-f filter, as described in paragraph 54.

b. Unlike the first mixer, the second mixer functions for all bands. Signals are selected from the first mixer or the second r-f stage by switch S210 (rear) (fig. 30) and are applied through capacitor C312 to the control grid (pin 6) of V204. The injection signal from the second crystal oscillator is applied to the mixer cathode (pin 7) through T402, which serves to isolate the mixer from the oscillator, and to match the low-impedance cathode circuit of the mixer to the comparatively high output impedance of the oscillator plate circuit. The signal from the mixer plate is applied through coupling capacitors C316, C319, and C322 to the grid of third mixer V205.

c. Since the output frequency of the plate circuit is variable over a range of 3 to 2 mc, it is necessary to tune the circuit to resonance. This is achieved by positioning powdered-iron cores in coils L234 of Z222, L236 of Z223, and

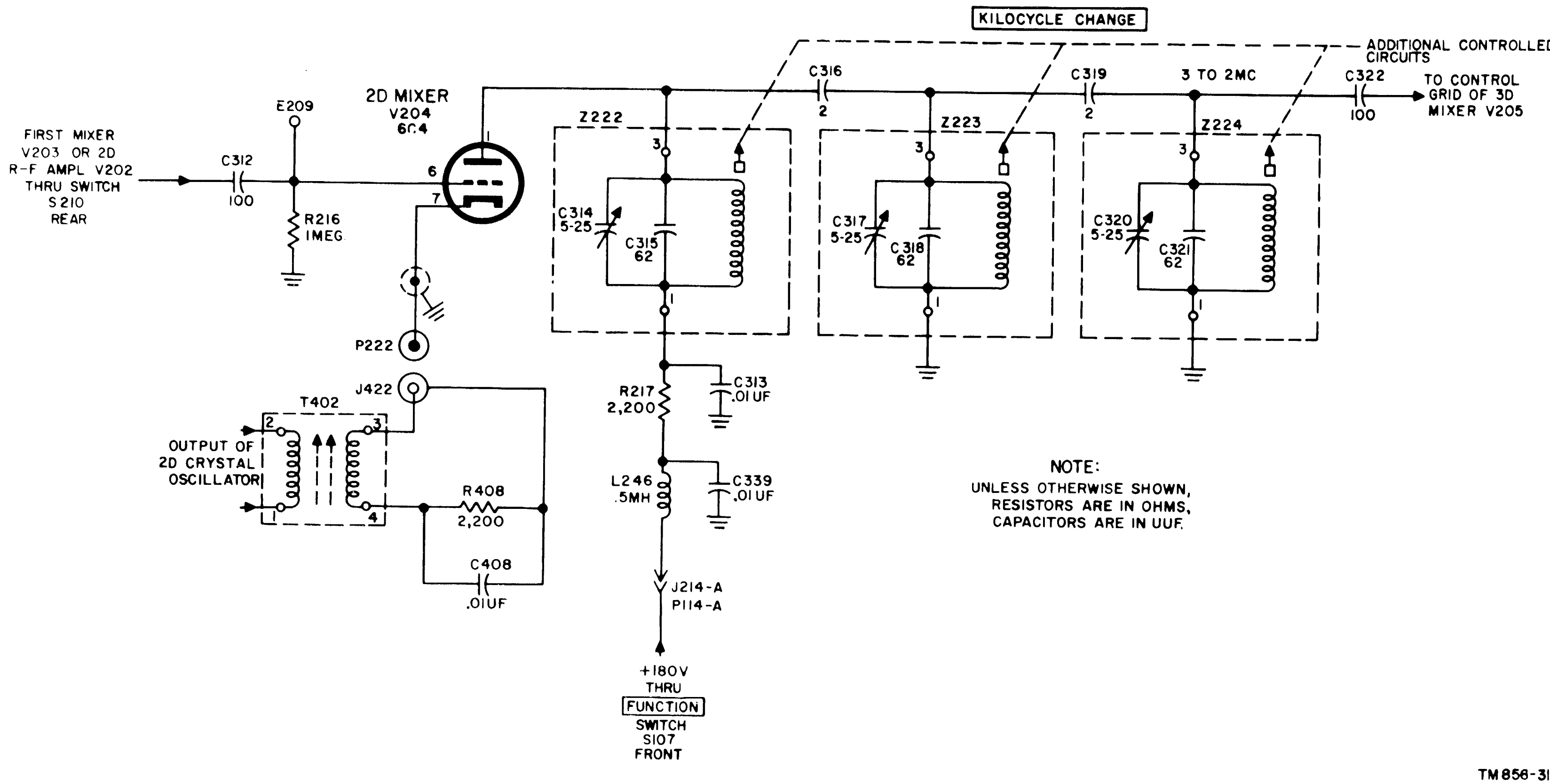


Figure 32. Second mixer stage, schematic diagram.

L238 of Z224. Test pin E209 (fig. 59) in the grid circuit, capacitor C314 in parallel with C315, C317 in parallel with C318, and C320 in parallel with C321, in the tuned circuits, are provided for repair and alinement purposes.

60. Second Crystal Oscillator V402
(fig. 33)

The second crystal oscillator provides injection signal to second mixer V204 on all 32 frequency bands. For simplicity, the circuitry of the first band, .5 to 1 mc, is shown in figure 33. This oscillator uses a type 6AJ5 miniature pentode in a Colpitts circuit employing crystals as the frequency determining element of the grid circuit.

a. Bias is developed by crystal current flowing through R405 in the grid (pin 1) circuit. Additional bias is developed by cathode resistor R406 in the cathode (pin 2) circuit. R410 is the screen grid (pin 6) voltage dropping resistor and C409 is the screen grid bypass capacitor. B+ voltage is fed to the plate through the primary of T402. Both the screen and plate circuits are decoupled from the power supply by R407 and C407. Additional filtering is provided by L406 and C436.

b. The oscillator is a triode consisting of the cathode (pin 2), the control grid (pin 1) and the screen grid (pin 6). The screen grid acts as the anode for the oscillator and is at ground potential for the signal voltage. Feedback voltage from the screen grid to the control grid is taken from the cathode and applied to the junction of series capacitors C405 and C406 which form a voltage divider. The values of these two capacitors are selected so that the feedback is not at the electrical center of the tuned circuit in order to produce sustained oscillations. L402, an r-f choke in the cathode circuit, offers a high impedance path to the r-f signal which isolates the bias resistor R406 and prevents unnecessary loading of the crystal circuit. Electron coupling of the r-f signal into the plate circuit eliminates the effects on the stability by variations in the plate load. Capacitors C420 and C419 are placed across the primary of T492 by switch S403 to permit adjustment for maximum output at the resonant crystal frequency of 12 mc. The signal is coupled through T402 to the cathode circuit of second mixer tube V204 through jack J422.

c. In response to the operation of the MEGACYCLE CHANGE control, switch section S401, at the position marked 0, connects crystal Y406, cut to 12-mc frequency, to the control grid (pin 1) at the same time that switch section S403 connects capacitors C419 and one section C420 into the plate (pin 5) circuit for alinement purposes. To facilitate the use of a fewer number of crystals and to avoid the use of fragile crystals required to cover the higher frequency ranges, the fundamental frequencies of 18 crystals, or their harmonics, may be selected by switch section S401. S403 selects the trimmer section of C420 used with each crystal. The table below shows the crystal symbol, its fundamental frequency, and the step or position of S401. The step corresponds to the reading of the two left hand digits of the frequency indicator on the front panel.

Crystal Symbol	Fundamental f in mc	Step S401
Y406	12	0, 1, 9, and 21
Y407	15	2 and 12
Y408	6.2	3
Y409	14	4, 11, and 25
Y410	8	5 and 13
Y411	9	6, 15, and 24
Y412	10	7, 17, and 27
Y413	11	8, 19, and 30
Y414	13	10 and 23
Y415	8.5	14
Y416	11.333	31
Y417	10.666	29
Y418	10.333	28
Y419	9.666	26
Y420	12.5	22
Y421	11.5	20
Y422	10.5	18
Y423	9.5	16

The following table shows the step or position of S403 and the trimmer section which is used to resonate the plate inductance.

Step S403	Trimmer Section
0, 1, and 9	C420 and C419
2 and 12	C420 and C421
3 (thru C433), 6, and 15	C420 and C422

Step S403	Trimmer Section
4 and 11	C420 and C423
5 and 13	C420 and C424
7 and 17	C420 and C425
8	C420 and C426
10	C420 and C427
14	C420 and C428
16	C420 and C429
18	C420 and C430
19	C420 and C431
20	C420 and C432
21	C420
22	C420
23	C420
24	C420
25	C420
26	C420
27	C420
28	C420
29	C420
30	C420
31	C420

d. The 24 trimmers contained within C420 are adjustable for the required output frequencies. The adjustments are described in the alinement procedure in chapter 5. As indicated in paragraph 104, 10 bands operate directly at the fundamental frequency, 13 at the second harmonic, and 9 at the third harmonic of the corresponding crystals. In order to achieve frequency tripling on the fourth band, series capacitor C433 is used to decrease the total capacitance introduced into the tuned primary of T402. In addition to decreasing the number of crystals required, frequency doubling and tripling eliminate the need for the extremely delicate crystals for the higher frequencies.

61. Third Mixer V205 (fig. 34)

The third mixer stage uses a miniature triode, type 6C4. Signals from second mixer V204 and variable frequency oscillator V701 are heterodyned in this stage to produce an intermediate or difference frequency of 455 kc for application to the first i-f amplifier grid circuit.

a. Bias voltage for the grid of this stage is developed across grid resistor R218. Cathode

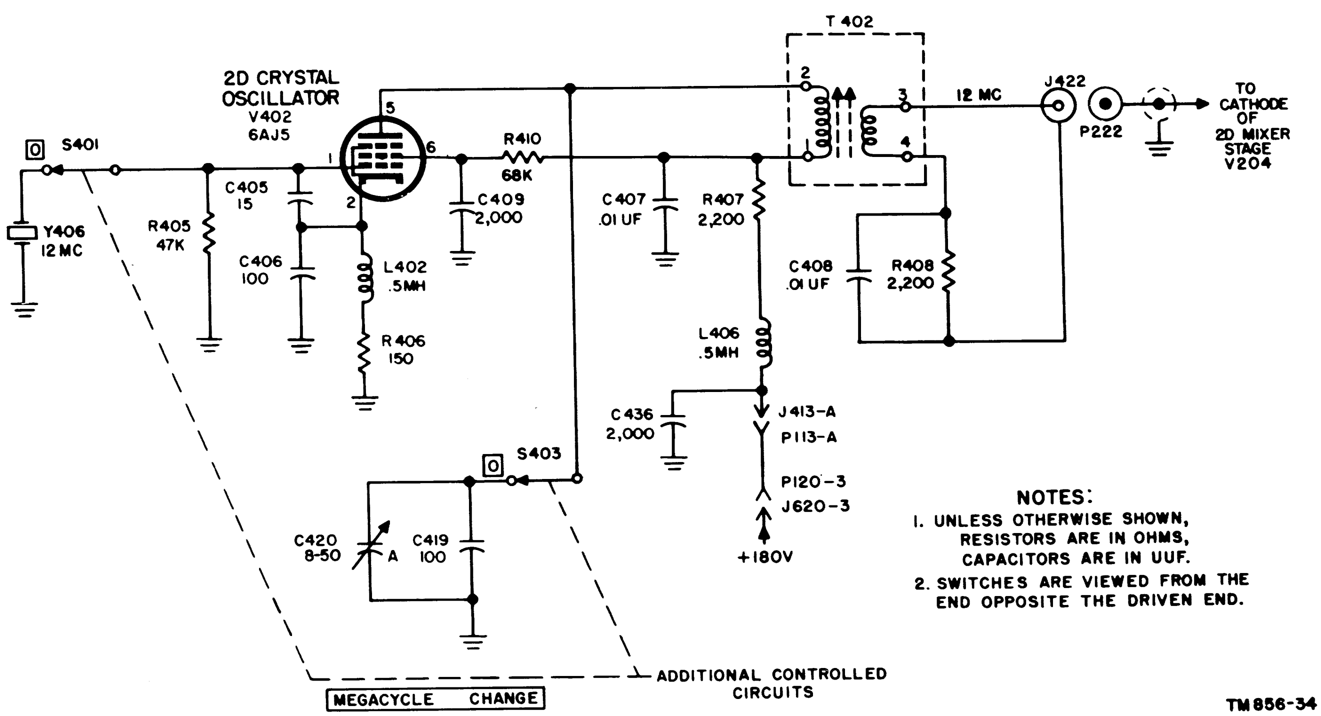


Figure 33. Second crystal oscillator, schematic diagram.

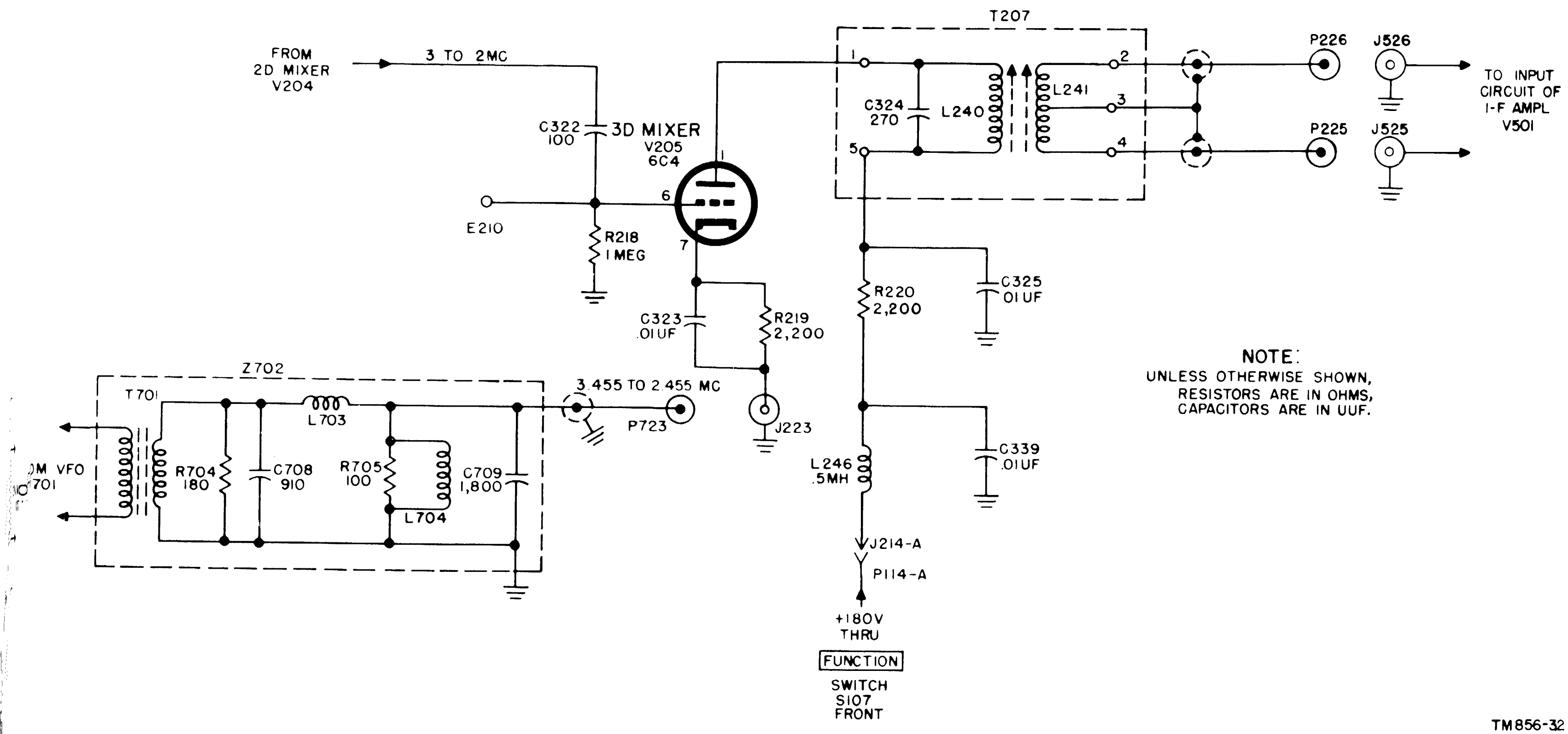


Figure 34. Third mixer stage, schematic diagram.

bias is developed across resistor R219 and the combined resistances of the secondary components of Z702. L704 is wire wound on R705. The combined resistances of the parallel group is less than .1 ohm, and provides the d-c return for the cathode. B+ voltage is applied to the plate (pin 1) through P114-A, J214-A, L246, decoupling network R220 and C325, and through primary winding L240 of T207. L246 and C339 serve as an r-f filter, as described in the analysis of the second r-f amplifier (par. 56).

b. The output signal (3 to 2 mc) of the second mixer stage V204 is applied to the grid of the third mixer through coupling capacitor C322. The vfo signal 3.455 to 2.455 mc is applied, from tuned circuit Z702 (composed of T701 and an impedance matching network made up of R704, C708, L703, R705, L704, and C709) to the cathode of V205 through P723, J223, and coupling capacitor C323. The r-f plate circuit of the third mixer consists of resonant circuit T207 (composed of fixed tuning capacitor C324, primary winding L240, and secondary winding L241). Transformer T207 has a broad pass band at 455 kc. A screwdriver-adjusted powdered-iron core is provided for alinement purposes. It should be noted that secondary winding L241 is center-tapped. The center tap is connected to the shields of a pair of coaxial cables whose center conductors are connected to the ends of the winding. The shields become grounded when this stage is connected to the next stage, through P226 and P225 (par. 64). The 455-kc output signal of the third mixer is applied to the first i-f amplifier circuit.

62. Variable Frequency Oscillator V701 (fig. 35)

The variable-frequency oscillator uses a miniature pentode tube, type 5749, connected as a Hartley oscillator to produce the injection signals for the third mixer stage. The oscillator grid (pin 1) is capacitively coupled by C704 to tank circuit Z701. The cathode (pin 7) provides oscillator plate current feedback to sustain oscillation through a tap near the ground end of L702. The screen grid (pin 6) acts as the anode of the oscillator and is held at r-f ground potential by C705. Thus, the screen grid is effectively an electrostatic shield between the grid and the plate (pin 5). The suppressor grid (pin 2) has negligible effect, but is grounded to help reduce the interelectrode capacitance of the vfo tube. The signal appearing at the plate (by electron coupling) is applied through Z702 to the cathode of the third mixer. This oscillator arrangement is exceedingly stable and insensitive to load variations.

a. Bias for the control grid is developed by the flow of grid current through R701. Capacitor C704 prevents the grid-bias circuit from shorting to ground through low-resistance coils L701 and L702. A positive potential is applied to screen grid (pin 6) through voltage-dropping resistors R703, and R702 is filtered by capacitors C705 to insure oscillator frequency stability. Capacitor C705 is also a low impedance return for signal to the grounded side of Z701. The potential on the plate (pin 5) is applied through R703 and the primary winding of T701. R703 together with C706 and C707 form a low-pass filter to isolate the oscillator stage from the power supply.

b. The signal developed by the triode portion of the vfo modulates the electron flow to the plate and appears across the primary of T701. The amplified signal is magnetically coupled to the secondary which is a part of the cathode circuit of the third mixer stage, where it heterodynes with the vfo to produce a fixed frequency output of 455 kc. In addition to T701, Z702 contains R704, C708, L703, L704, and C709 which form a band-pass filter. Z702 matches the low impedance cathode circuit of third mixer V205 to the relatively high impedance of vfo tube V701 and attenuates any harmonics of the oscillator output frequencies. L704 provides a low-impedance path for the d-c cathode current of the mixer stage, and it has negligible effect on the value of the load resistor, R705, over the frequency range of the vfo.

c. Tuning unit Z701 is enclosed within a hermetically sealed can; the temperature of the tuning unit is maintained at a constant level by a heating element which is wound around the can, and which is designated HR701 on figure 118 Part one. The can should not be opened under any circumstances; the

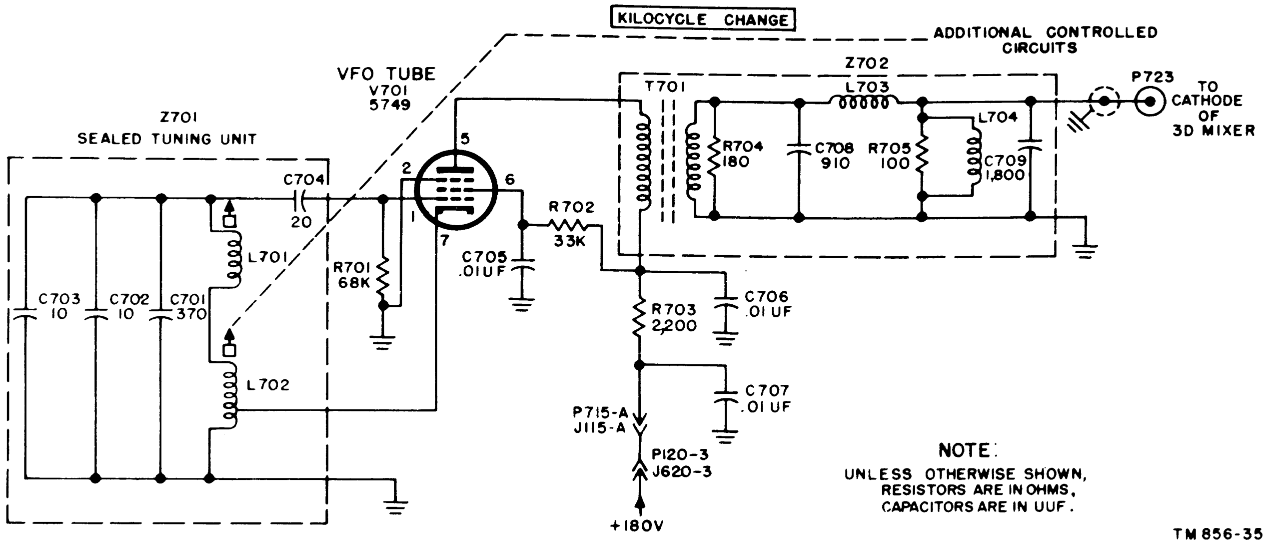


Figure 35. Variable frequency oscillator, schematic diagram.

tuning unit is adjusted accurately under laboratory conditions at the factory, and any attempt to perform adjustments except under these conditions would affect the accuracy of the unit seriously. The tuned circuit includes capacitors C701, C702, and C703 connected across the series-connected coils. These capacitors are selected carefully with regard to temperature coefficient, so as to achieve a high degree of frequency stability. When the temperature at the receiver location varies over a rather wide range, the stability of the receiver may be increased by turning on the oven heater switch at the rear of the receiver. The oven current is controlled by thermostat switch S701 to maintain a constant oven temperature of 75° C.

d. As the receiver is tuned from the lowest to the highest frequency within a particular band, a powdered-iron slug within coil L702 is moved to change the frequency of the vfo over a range of 3.455 to 2.455 mc. The slug is moved through the range in exactly 10 turns of a precision lead screw that is coupled mechanically to the KILOCYCLE CHANGE control knob on the front panel. The frequency of the oscillator varies linearly over its entire range because of a precision factory-adjusted mechanism. The inductance of trimmer coil L701 is also factory-adjusted to obtain a one-megacycle range for ten turns of the tuning screw. The variation in the inductance of the coil is obtained by adjusting the core of the coil by means of a screwdriver.

63. Crystal Filter (fig. 36)

a. To distinguish between adjacent signals, and to prevent interference from signals of a frequency close to that of the desired carrier may, at times, require a pass band as narrow as 100 cps in the 455-kc i-f amplifier. Crystal filter Z501 provides the filtering action necessary to establish the two narrow pass bands of .1 and 1 kc. It is a part of the bandwidth control system that provides the required degree of selectivity for all modes of operation within the capability of Radio Receiver R-391/URR.

b. The crystal filter has a crystal which is cut for a frequency of 455 kc. The circuit consists basically of one half of the secondary L241 (between terminals 3 and 4), crystal Y501, resistors R502 and R561, and capacitor C502.

c. The inductance L and capacitance C are used primarily to tune out, or cancel, the effects of capacitance found in the grid circuits of the first i-f tube V501, the wiring, and the adjacent components. This is done to reduce the crystal load circuit to one which is essentially purely resistive, and thus to prevent the crystal from tending to resonate. A variable neutralizing capacitor is connected between one end of the crystal holder for Y501 and the other half of secondary L241 (terminals 2 and 3). This capacitor feeds a voltage whose amplitude is equal and whose phase is opposite that of the voltage applied from jack J525 across the crystal holder capacitance to the control grid of V501, from jack J526. This out-of-phase voltage serves to neutralize effectively the capacitance of the crystal holder. For the two narrow pass bands, the 455-kc output signal from the third mixer is fed to the input of first i-f amplifier V501 through the crystal filter circuit. (For the remaining four pass bands, the signal is fed directly to V501.) The output of the third mixer stage is coupled magnetically by transformer T207, through connectors P225 and P226 and jacks J525 and J526 (fig. 32), to crystal filter Z501. When the BANDWIDTH control S501 is in the .1- and 1-KC positions the 455-kc signal is applied to Z501; on the remaining four positions of the control marked 2, 4, 8, and 16 KC, the signal is applied to the control grid (pin 1) of V501 through coupling capacitor C503. Note that with the switch in the last four positions, C503 short-circuits crystal Y501, but, in the first two positions, C503 serves as a low-impedance connection at the intermediate frequency to resistor R561.

d. With the BANDWIDTH switch in the .1-KC position, the crystal is loaded principally by R502 and C502, but R561 is shunted across R502 through C503. This reduces the total resistance in the circuit; the RC combination which represents the crystal series load becomes essentially capacitive, and the crystal tunes more sharply to resonance. With the BANDWIDTH switch in the 1-KC position, the crystal is loaded principally by R502 and C502, and R561 is removed from the circuit. Since this RC combination is essentially resistive, the circuit Q is lowered, and the width of the pass band is increased. The ratio between the crystal impedance and the resistive load (1-KC position) and the ratio between the crystal impedance and the capacitive load (.1-KC position) are such as to maintain the same gain in the circuit in both cases.

64. 455-kc I-f Amplifier

The i-f amplifier system, which has a very high gain, consists of six voltage-amplifier stages. The first five i-f stages use 6BJ6 miniature pentode tubes V501 through V505; associated i-f transformers are T501 through T505. The output of the fifth i-f stage supplies signals through the sixth i-f stage V506 to the detector V507, through the agc amplifier V509 to the agc rectifier, one-half of V510, and, through the cathode follower, one-half of V511, to the 50-ohm i-f output jack, J512 (fig. 43). The gain of the i-f amplifier is controlled manually by the RF GAIN control with the FUNCTION switch set to MGC. The gain is controlled automatically by the agc circuits, when the FUNCTION switch is in the AGC, CAL, or SQUELCH position. When six amplifier stages using the same power supply are tuned to approximately the same frequency (as is the case in this amplifier), oscillation may occur as a result

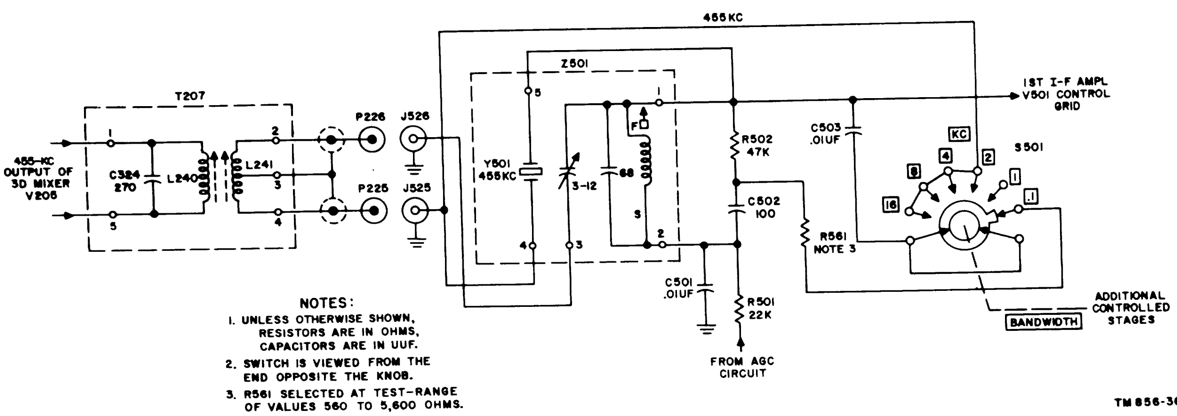


Figure 36. Crystal filter, schematic diagram.

of coupling between stages, through the common impedance of the power supply. To prevent this, decoupling networks are used in the grid and plate circuits of all i-f stages. Additional filtering is provided by choke L503 and capacitors C530 and C531 in the power supply circuit. In addition to the selectivity obtained by the use of crystal filter Z501, four degrees of selectivity are obtainable by varying the coupling between the primary and secondary windings of each of the i-f transformers by means of the BANDWIDTH switch.

65. First I-f Amplifier V501 (fig. 37)

The first i-f stage (fig. 37) uses a type 6BJ6 miniature pentode tube as a voltage amplifier of 455-kc signals.

a. The control-grid circuit of V501 consists of the winding L in the crystal filter (Z501) and R501, which is bypassed by C501. Resistor R501 is connected to the agc circuit. The control grid (pin 1) is returned to the agc circuit or ground through the inductor in Z501, a decoupling network consisting of R501 and C501, terminals 4 and 3 of TB102 and the rear section of the FUNCTION switch S107. Voltage from the agc circuit is applied to terminal 3 of TB102 which for normal operation is connected to terminal 4 by a jumper. In the OFF, STANDBY, MGC, CAL and SQUELCH positions of the FUNCTION switch, the agc voltage is grounded. In the MGC, CAL and SQUELCH positions of the switch, the d-c return path for the grid is through the inductor in Z501 and resistor R501. Under these conditions, the gain of the stage is controlled by the value of the cathode bias (at pin 2) which is established by the setting of the RF GAIN control R123. Minimum bias is limited by R503. Capacitor C505 bypasses the cathode to ground. C504 and L501 are a low pass filter used to prevent interference of signals between this and other stages which use the common RF GAIN control. External control of the r-f gain can be used by removal of the jumper between terminals 1 and 2 of TB102 and connecting a 5000-ohm potentiometer between terminal 1 and ground. In the AGC position of the FUNCTION switch, the voltage from the agc circuit is applied to the control grid and the gain of the stage is controlled automatically by the average signal level as described in paragraph 72. However, the RF GAIN control is still effective under these conditions. The suppressor grid (pin 7) is connected to the cathode. The screen grid (pin 6) is bypassed to ground by C506 and is connected to the junction of R504 and R505 which form a voltage divider across the 180 volt supply. The plate (pin 5) circuit is completed to B+ through the primary of T501 and decoupling resistor R506 which is bypassed by C507. Additional filtering of the supply voltage is accomplished by L503 and capacitors C530 and C531, a pi type filter which prevents r-f signals from entering the power supply circuits. The resistor connected across the primary of T501 is used to achieve the required band-pass characteristics for this stage.

b. The 455-kc i-f signal from the third mixer, V205, is fed to the control grid (pin 1) of V501 either through crystal filter Z501, or directly from the third mixer stage through the contacts of BANDWIDTH switch S501 and coupling capacitor C503. The amplified signal at the plate (pin 5) is coupled by T501 to the control grid of second i-f amplifier V502.

c. Three degrees of selectivity are obtainable by connecting one of three windings in transformer T501, through the contacts of BANDWIDTH switch S502. Two of these windings have a series resistor (R507 and R508). These windings and resistors of T501 contribute to the final selectivity of the i-f amplifier system. They are discussed in more detail in paragraph 68.

66. Second I-f Amplifier V502 (fig. 37)

The second i-f amplifier uses a miniature pentode tube, 6BJ6 as a voltage amplifier.

a. The grid (pin 1) returns to ground through a portion of the secondary winding of T501. Fixed bias is obtained in the cathode (pin 2) circuit by plate current flowing through resistors R510 and R562 which are in series to ground. C509 is the cathode bypass capacitor which is used to prevent degeneration in the cathode circuit. The gain of the stage is preset by a screwdriver adjustment of R562 during alinement procedure (par. 128). The suppressor grid (pin 7) is connected to the cathode. The screen grid (pin 6) is bypassed to ground by C510 and is connected to B+ through voltage dropping resistor R512 to the pi type filter described in the preceding stage discussion (par. 65). The plate (pin 5) circuit is completed to B+ through the primary of T502, decoupling resistor R513 (which is bypassed by C507) and the filter.

b. The output of the first i-f amplifier is applied through T501 to the grid of the second i-f amplifier. The signal is amplified and applied to the third i-f stage through T502. To achieve the required bandwidth of the i-f amplifiers (4 kc on either side of the intermediate frequency of 455 kc) and at the same time maintain the required receiver sensitivity (2 to 5 microvolts) a comparatively large number of voltage amplifiers must be employed.

c. Four degrees of selectivity can be selected by connecting one of four windings in transformer T502, through the contacts of BANDWIDTH switch S503. Two of these windings have series resistors (R514 and R515). These components contribute to the final selectivity of the i-f amplifier system and are discussed in more detail in paragraph 68.

67. Third and Fourth I-f Amplifiers V503 and V504 (fig. 38)

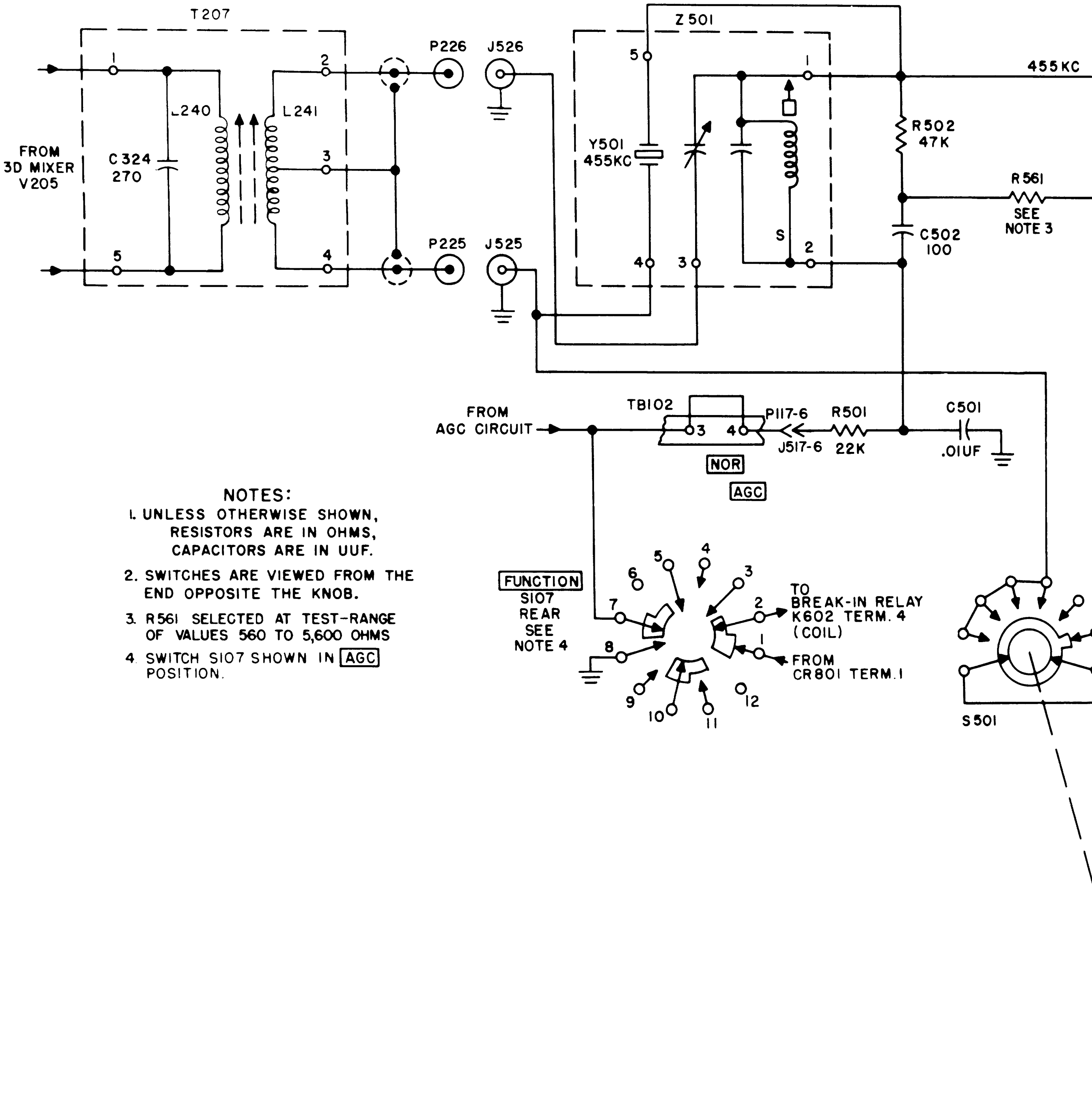
The third and fourth i-f stages each uses a miniature pentode tube, 6BJ6. Their operation is the same as that of the second i-f stage, except for certain differences, which are discussed below.

a. Cathode bias for V503 and V504 is decreased as the BANDWIDTH control is rotated from the .1-KC position to the 16-KC position, to prevent the gain of the i-f stages from decreasing. (In the ordinary i-f stage, as bandwidth is increased the overall stage gain is decreased.) Resistors R518 through R521 are connected, by means of the slider of BANDWIDTH control S504, to fixed bias resistors R517 and R526 of the cathodes (pin 2) of V504 and V505, respectively. The resistors are introduced in series with the fixed bias resistors to decrease the control-grid bias and thereby increase the gain proportionately as the bandpass is increased. These resistors are selected to meet gain requirements for individual i-f amplifiers during manufacture. If these resistors require replacement, the original values should be duplicated. The cathodes are bypassed to ground by capacitors C514 and C513. The suppressor grids (pin 7) are connected to the cathodes.

b. The signal from the second i-f amplifier is fed through coupling capacitor C512 to the control grid (pin 1) of V503 which is returned to ground by R516. This grid leak resistor is necessary because the common gain adjusting resistors are used in the cathode circuits of V503 and V504. A sudden strong signal or a noise impulse at the grid of V503 causes it to draw grid current momentarily before the agc circuit can take control and reduce the signal strength. This grid current, flowing through the common cathode circuit of V503 and V504, produces an additional bias voltage which would block V504. Thus, no signal would reach the agc circuit and the receiver would remain blocked until the input signal to V503 was reduced. R516 limits the flow of grid current to a very small amount which has negligible effect on the cathode bias and prevents blocking. R522 and R527 are voltage dropping resistors for screen grids (pin 6) of V503 and V504, respectively. The screen grids are bypassed to ground by capacitor C515 and C518. The plates (pin 5) are connected to B+ through the primary windings of T503 and T504. R523 with C516 and R528 with C519 decouple the plate circuits from the common B+ circuits.

c. The 455-kc signal is coupled to the control grid of V503 from the previous amplifier, V502, through capacitor C512. The amplified signal at the plate is coupled by T503 to the control grid (pin 1) of V504. The amplified signal at the plate (pin 5) is fed in a similar manner through T504 to the control grid of V505.

d. Four degrees of selectivity can be selected by connecting one of four windings in transformers T503 and T504, through BANDWIDTH switches S505 and S506. A small capacitor across each primary and an R-C network in series with each secondary provide the required passband. Two of the windings in



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.
3. R561 SELECTED AT TEST-RANGE OF VALUES 560 TO 5,600 OHMS
4. SWITCH S107 SHOWN IN AGC POSITION.

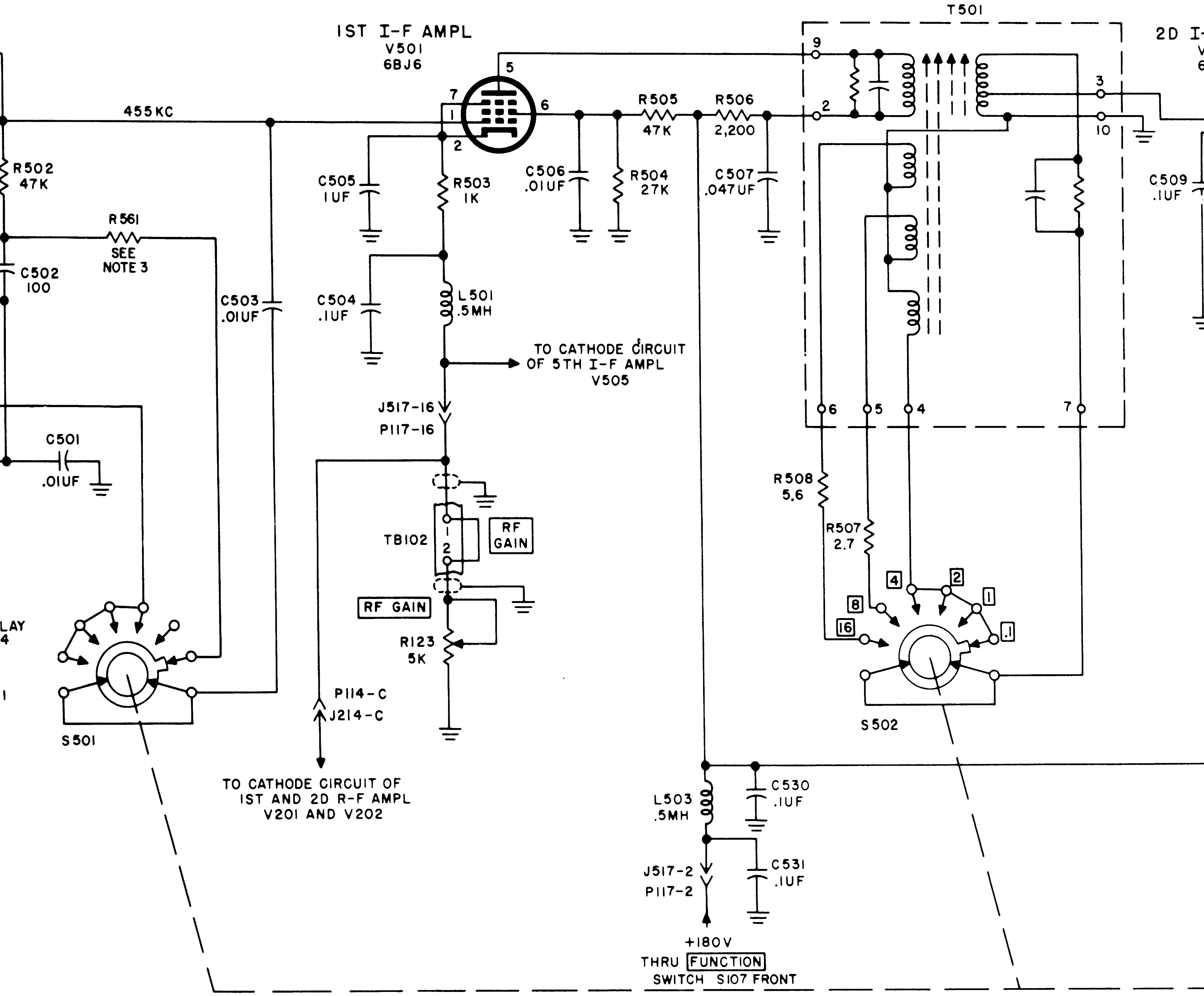
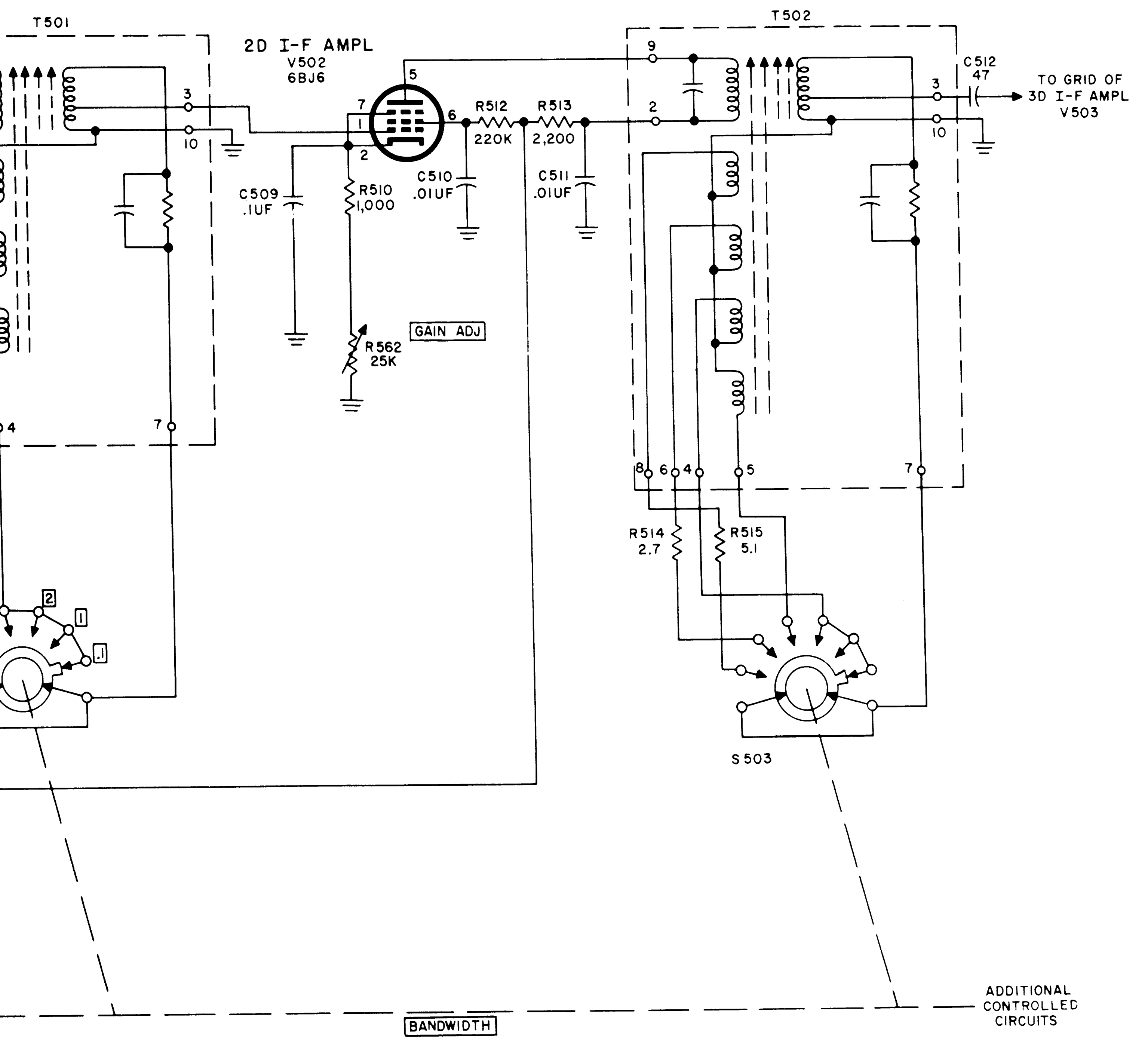


Figure 37. First and second i-f amplifiers, schematic diagrams.


T501
2D I-F AMPL
V502
6BJ6
C509
.1UF
R510
1,000
C510
.01UF
R512
220K
R513
2,200
C511
.01UF
GAIN ADJ
R562
25K
T502
C512
47
TO GRID OF
3D I-F AMPL
V503
R514
2.7
R515
5.1
S503
BANDWIDTH
ADDITIONAL
CONTROLLED
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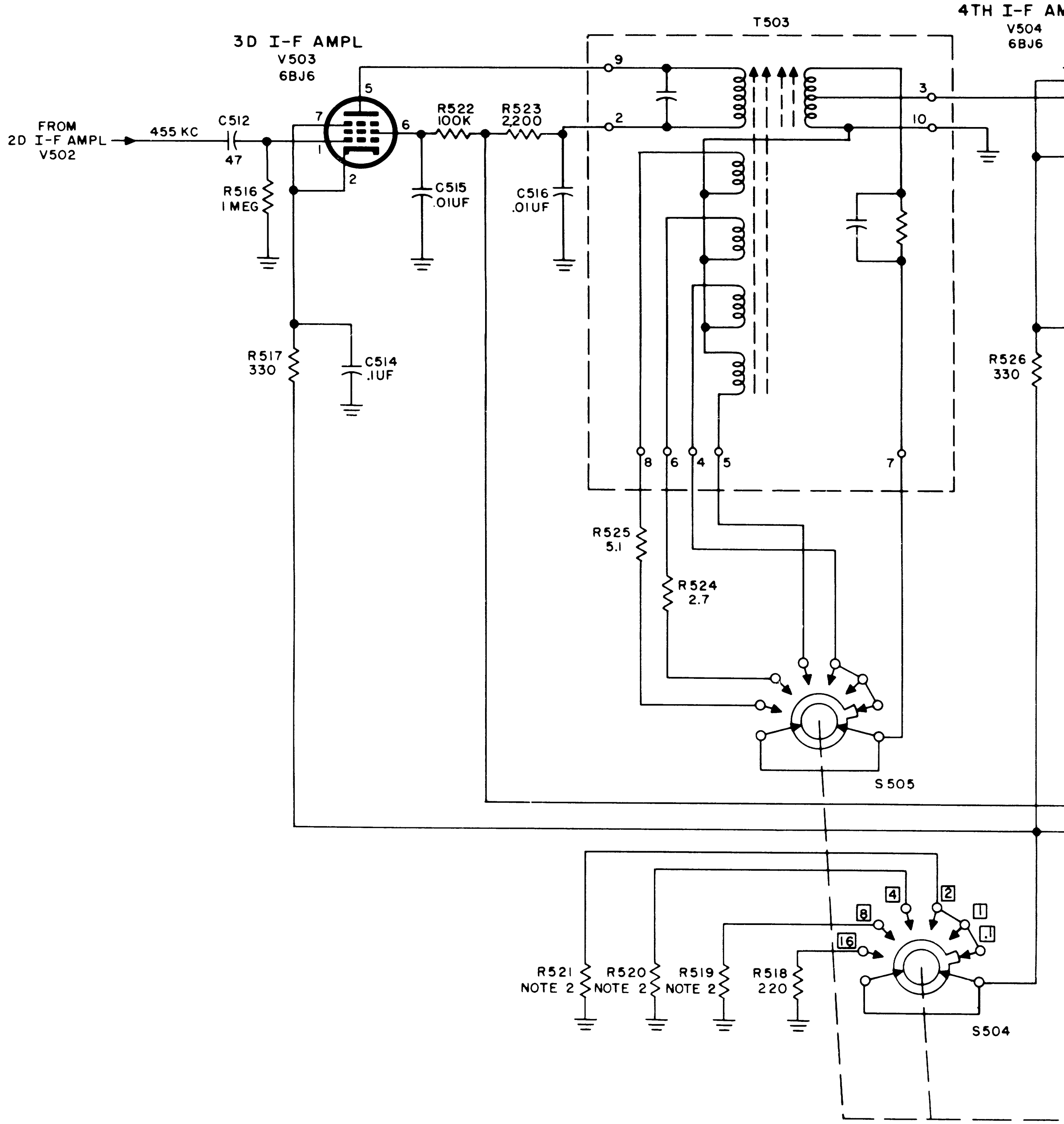
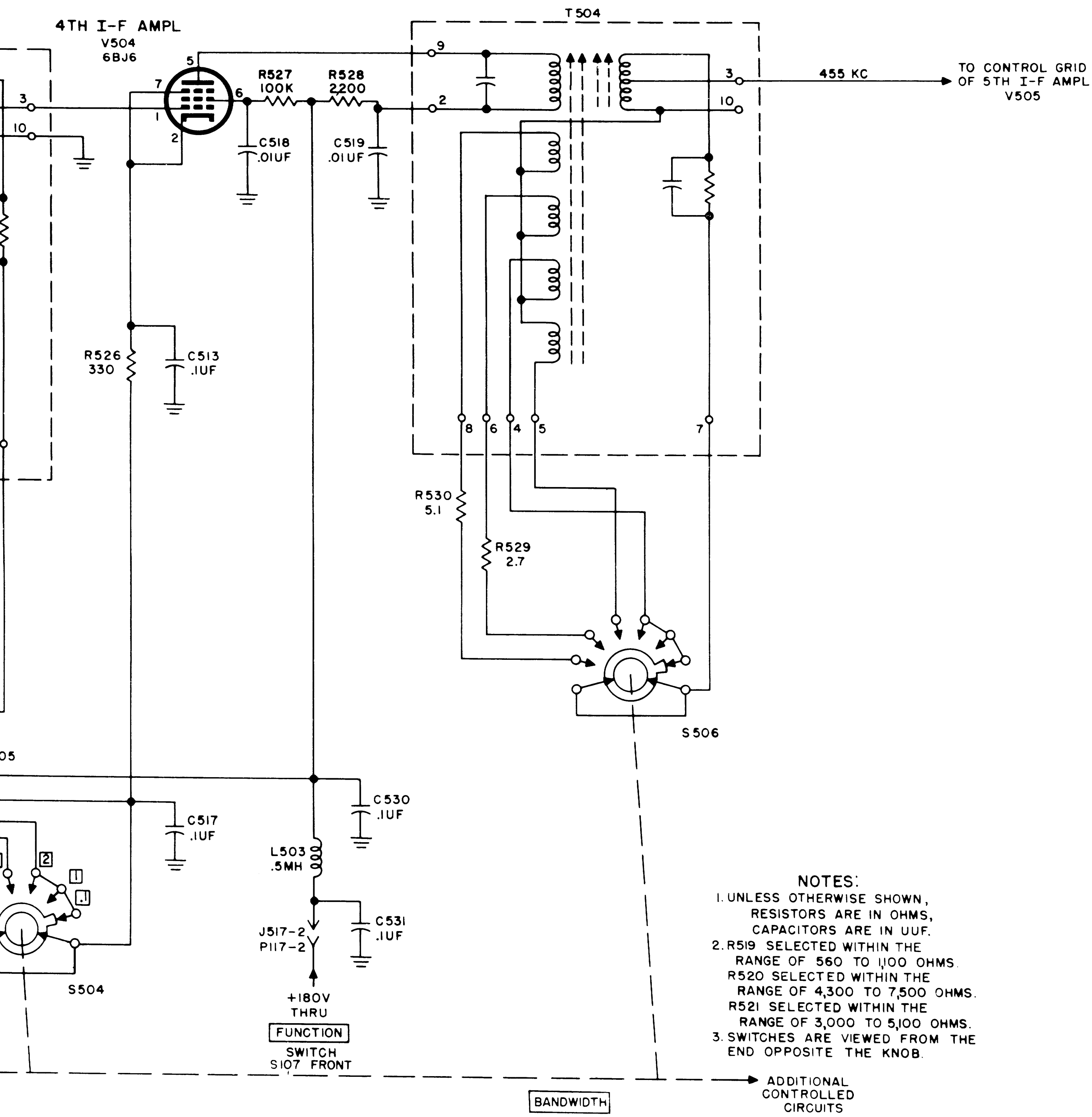


Figure 38. Third and fourth i-f a



...ird and fourth i-f amplifiers, schematic diagram.

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each transformer have series resistors. Resistors R524 and R525 are used for T503, and resistors R529 and R530 are used for T504. These components contribute to the final selectivity of the i-f amplifier system and are discussed in more detail in paragraph 68.

68. Fifth I-f Amplifier V505
(fig. 39)

The fifth i-f amplifier uses a miniature pentode tube, 6BJ6. This stage is similar in operation to the previous i-f stages, except for certain differences which are discussed below.

a. The grid (pin 1) of V505 returns to the agc circuit through part of the secondary winding of T504, resistor R509, and FUNCTION switch S107. I-f signals are isolated from the agc circuits by decoupling resistor R509 which is bypassed to ground by C508. The operation of the FUNCTION switch and agc circuit are the same for this stage as described for the first i-f amplifier stage (par. 65). The cathode (pin 2) is connected to the suppressor grid (pin 7) and returns to ground through bias limiting resistor R531, the RF GAIN control terminals 1 and 2 of TB102 and the RF GAIN control R123. C520 is the cathode bypass capacitor. The operation of the RF GAIN control is the same as that described for the first i-f stage except that the level of the signals at this stage is much higher and therefore additional isolation of the cathode circuit from the other controlled stages is provided by L501. The screen grid (pin 6) is bypassed to ground by C521 and is connected to the junction of R511 and R532 which form a voltage divider across the 180-volt supply. The plate (pin 5) circuit is completed to B+ through the primary of T505 and decoupling resistor R533 which is bypassed by C522. Additional filtering of the supply voltage is accomplished by L503 and capacitors C530 and C531, a pi type filter which prevents r-f signals from entering the power supply circuits.

b. The 455-kc signal from the previous amplifier, V504, is coupled, through T504, to the control grid of V505. The output of the plate of V505 is coupled by T505 to the control grid of V506.

c. The band-pass of the i-f amplifier system can be varied in six steps by the BANDWIDTH control over a range extending from .1 KC to 16 KC. This range is obtained by the effects of the crystal filter (Z501) and by controlling the mutual coupling between the windings of the interstage transformers (T501 through T505). The operation of the crystal filter is discussed in paragraph 60. Mutual coupling in the transformers is controlled by the use of coils wound on the same form as the primary or secondary winding. Three of these coils are used in T501 (fig. 118 part 2) while four are used in the remaining i-f transformers. The effect of these coils is to aid or oppose (depending on how they are connected) the mutual coupling which exists between the primary and secondary of the transformer. When the mutual inductance is increased, the bandwidth is broadened and when the mutual inductance is decreased, the bandwidth is narrowed. The coils shown schematically nearest to the secondary windings are effective in obtaining the widest bandwidth. One coupling coil at a time is connected in each transformer to produce a given degree of inductive coupling.

d. A series coupling circuit, that includes contacts of BANDWIDTH switch, a selected coupling coil, and a capacitor connected in parallel with a resistor is connected across each secondary winding to obtain a given bandwidth. Resistors of different values in series with the coupling coils also may be included, when needed, to increase the bandwidth. Each of the primary and secondary windings is covered by a magnetic cup, and is alined by a powdered iron slug.

(1) When the BANDWIDTH switch is in the position marked .1, 1, or 2, transformer coupling circuits remain unchanged; narrow bandwidths for the .1-KC and 1-KC positions depend on circuit changes in crystal filter Z501. In these three positions of the BANDWIDTH switch, the coupling coil mounted at the greatest distance from the primary winding of transformer T501 is in the circuit. Transformers T502, T503, T504 and T505 include those coupling coils which are phase opposing. These provide the sharpest

selectivity, because the smallest degree of coupling exists between the primary and secondary windings.

(2) When the BANDWIDTH switch is in the 4-KC position, the coupling circuit of transformer T501 remains the same as noted in subparagraph (1) above. Coupling coils that are at the greatest distance from the primary windings of T502, T503, T504, and T505 are connected phase-aiding to increase the inductive coupling between the respective primary and secondary windings.

(3) When the BANDWIDTH switch is in the 8-KC position, the middle coupling coil of transformer T501 and series resistor, R507 are connected into the coupling circuit. The coupling coils in the second positions from the primary windings of transformers T502 through T505 and series resistors R514, R524, R529, and R534 are included in the remaining coupling circuits. In this switch position, the windings of transformer T501 are not coupled as closely as the windings of T502, T503, T504, and T505, so that the single-peak frequency response of T501 fills in between the double-peak frequency response of the succeeding circuits, which are overcoupled.

(4) When the BANDWIDTH switch is on the 16-KC position the nearest coupling coil of transformer T501 and coupling coils that are nearest the primary windings of the four other transformers are included in the coupling circuits. Resistor R508 is in series with the coupling coil of transformer T501, and resistors R515, R525, R530, and R535 are in series with the coupling coils of T502, T503, T504, and T505. As in the 8-KC position, the first circuit provides sharper selectivity than the succeeding circuits, in order to compensate for double-peak frequency response caused by overcoupling.

69. Sixth I-f Amplifier V506
(fig. 39)

The sixth i-f amplifier uses a miniature pentode tube, 6AK6. This stage is similar in operation to the previous i-f stages, except for certain differences, which are discussed below.

a. Cathode bias (adjustable by a screwdriver control) is provided by resistor R536 and potentiometer R537, in series. The cathode is bypassed to ground by capacitor C523. The control grid (pin 1) of this stage is returned to ground through part of the secondary of T505. B+ voltage to the screen grid (pin 6) and the plate (pin 5) is supplied from the same d-c potential source through decoupling resistor R538. The screen and plate return circuits are bypassed to ground by C524.

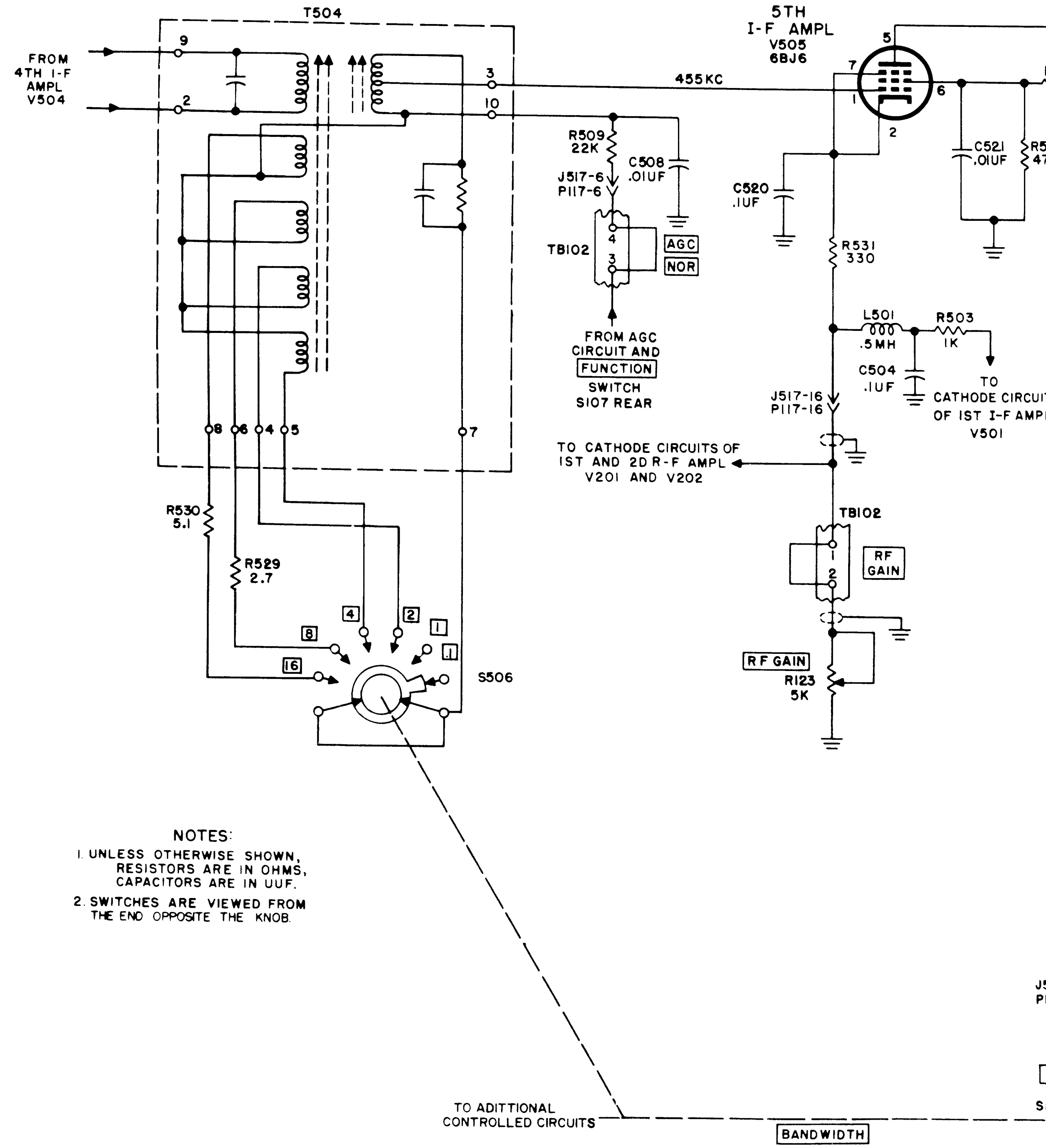
b. The 455-kc signal from fifth i-f amplifier V505 is applied through T505 to the control grid of V506, through C539 to the grid of agc amplifier V509, and to the grid of the cathode follower, section B of V511. The amplified signal appearing at the plate of V506 is coupled inductively by T506 to the detector, section A of V507.

c. Capacitor C525 neutralizes the interelectrode capacitance between the plate and the control grid of the sixth i-f amplifier. This prevents the output signal from beat-frequency oscillator V508 (which is applied to the secondary of T506) from appearing in the output of the cathode follower. In addition to providing fixed bias, variable resistor R537, designated CARR-METER ADJ, is used in the carrier level meter (M102) circuit discussed (par. 83).

d. Transformer T506 does not have provision for varying the selectivity. The 22,000-ohm resistor across the primary winding, together with the coil and capacitor across the secondary winding, permits any degree of bandwidth selected in the previous stages to pass through the transformer to the detector without attenuation.

70. Detector and Limiter Circuits
(fig. 40)

The function of the detector is to demodulate the 455-kc i-f signal, in order to recover the



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.

Figure 39. Fif

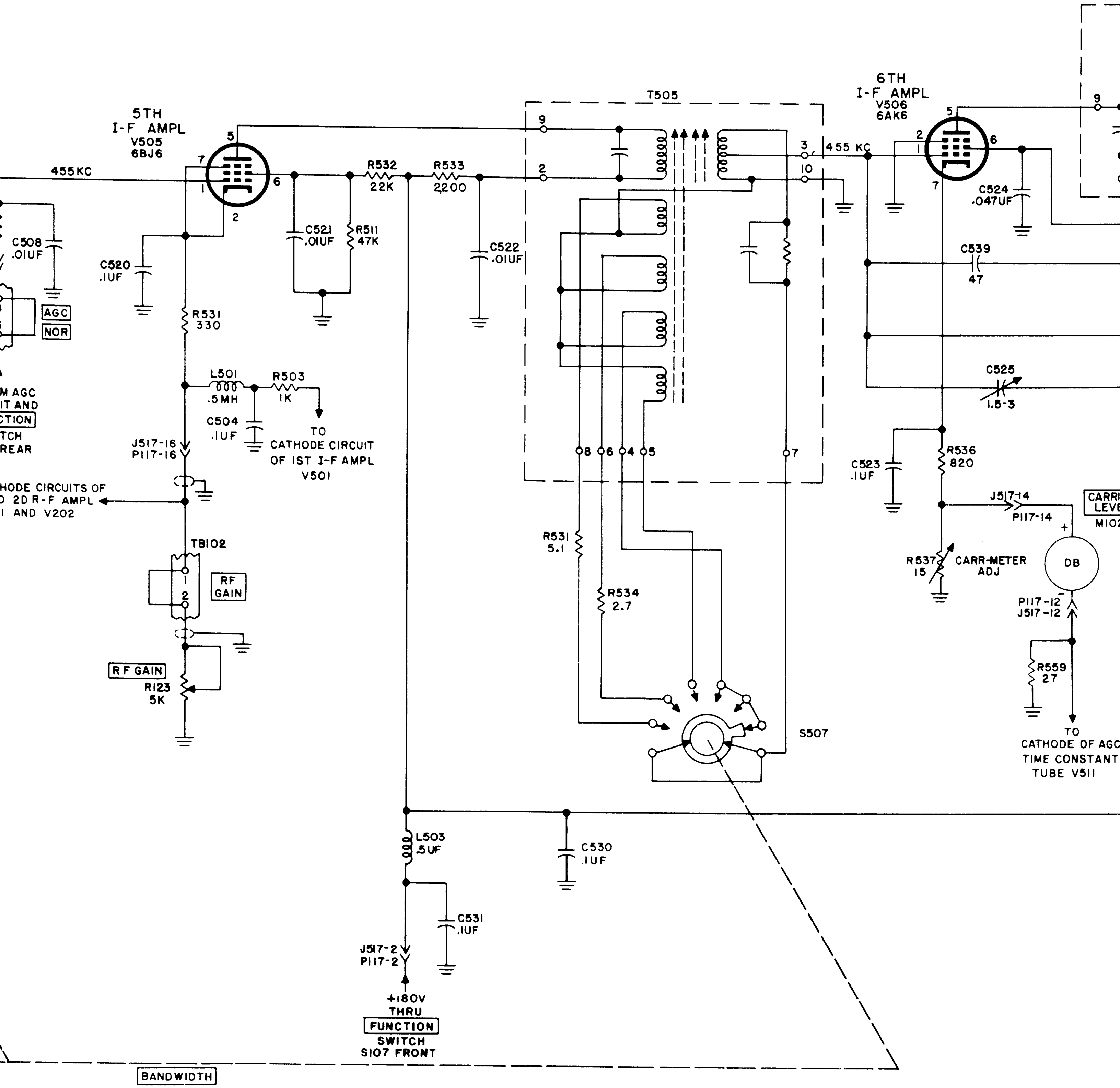
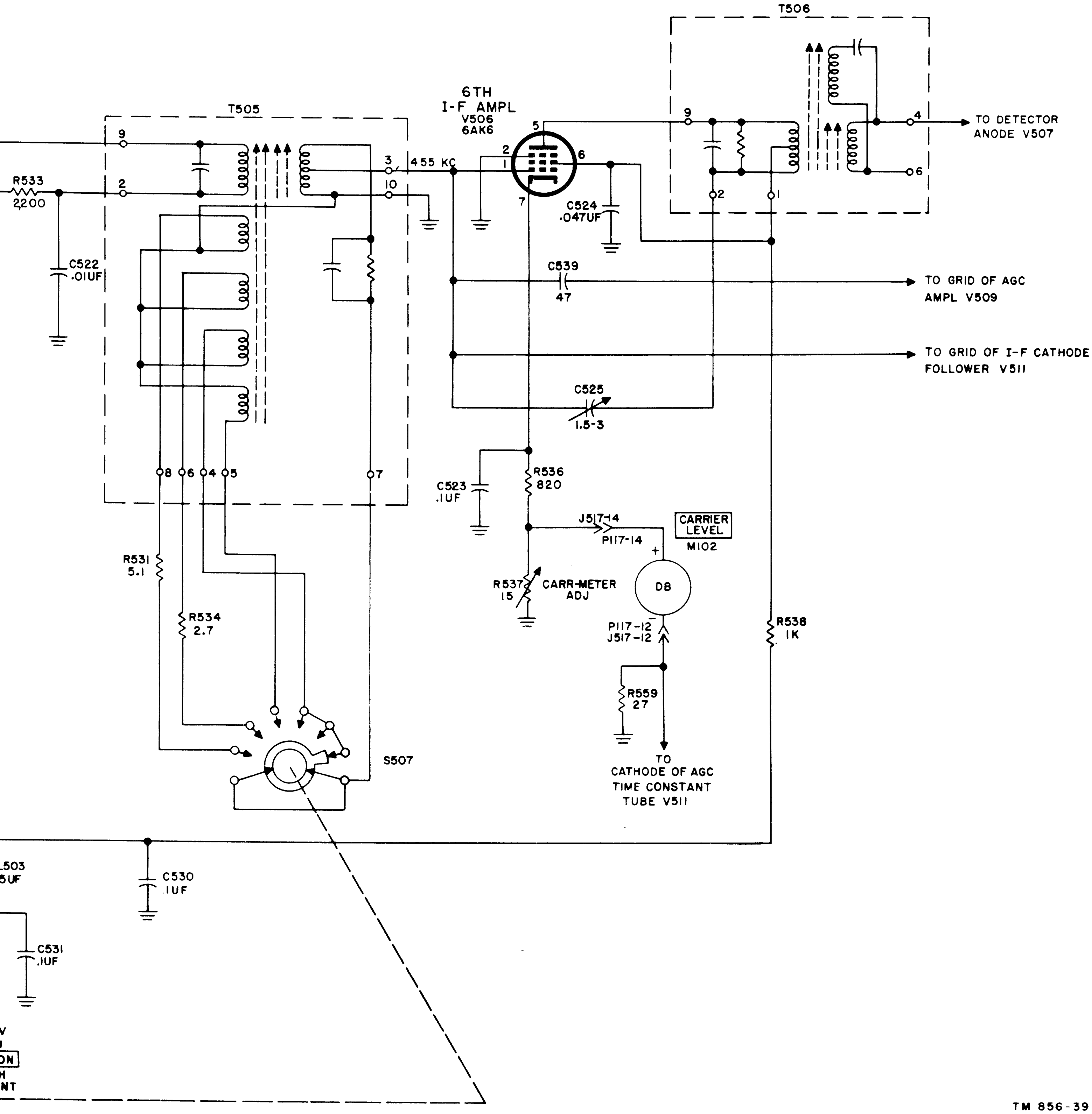


Figure 39. Fifth and sixth i-f amplifiers, schematic diagram.



sixth i-f amplifiers, schematic diagram.

intelligence from the signal for all types of operation of Radio Receiver R-391/URR. The function of the limiter is to minimize interference by removing noise peaks which exceed the amplitude of modulation. The detector and limiter circuits are discussed together because the output of the detector always is applied through the limiter circuit to a-f amplifier, section A of V601.

a. Detector. The detector supplies an audio signal for application to the limiter and a-f stages.

(1) The detector uses one-half of V507, a type 12AU7 miniature twin-triode tube, connected as a half-wave diode rectifier. The plate and control grid (pins 1 and 2) act as an anode, which is connected to the secondary of T506. The ground-return circuit from the secondary includes choke L502 and the diode load, which consists of resistors R539 and R540. The cathode (pin 3) is grounded.

(2) The i-f signal from the sixth i-f amplifier is applied through T506 to the detector anode. During each positive half-cycle of the i-f signal, the anode is positive and the tube conducts. Choke L502 and capacitor C526 block the i-f signals from the diode load, but permit the audio variations to pass, so that an a-f voltage appears across the load. Audio output is taken from two points: The a-f voltage developed across R540 is applied, through coupling capacitor C527, to the negative-peak limiter, one-half of V507. The a-f voltage developed across both R540 and R539 is applied, through a jumpered connection on TB101, to the control grid of the squelch tube, one-half of V601. The d-c voltage developed across the diode load is of negative polarity. LIMITER control R124, shunted across the load, provides an adjustable, negative voltage, for use in setting the operating level (threshold) of the limiters.

(3) The output of the bfo is coupled to the detector plate through capacitor C536. The bfo signal beats with the i-f input signal to produce a beat note (par. 71).

b. Limiter. The limiter couples the audio signals from the detector to the audio stages. When limiter switch S105 is on, the peak amplitude of the detector output is limited to eliminate noise peaks above a certain threshold.

(1) The limiter circuit employs two triode tube sections, connected as diode series limiters, to provide limiting of both positive and negative noise peaks. The negative-peak limiter uses one-half of V507, a type 12AU7 miniature twin triode tube, and the positive-peak limiter uses one-half of V510, another 12AU7 tube. When LIMITER control R124 is turned to OFF, switch S105, which is ganged to the limiter potentiometer, grounds the parallel-connected cathodes through R544, and it also removes the ground connection to the junction of resistors R541 and R542; this permits the anodes to assume a positive potential, since +180 volts now is applied through L503 and R543. With the anodes of both diodes at a positive potential and both cathodes grounded, a direct current flows through both diodes. The a-f signal voltage that is applied to the anode of section B of V507 superimposes itself on (modulates) the dc flowing through this diode and, as a result, the a-f signal appears across cathode resistor R544. Since this resistor is common to both diode circuits, the a-f signal is also superimposed on the dc flowing through section B of V510 and appears across R542 at the anode. From this point, the signal is coupled through C529 to the grid of the first a-f amplifier section A of V601. L503 together with C530 and C531 is a decoupling network and, in the OFF position of S105, R543 and C528 perform the same function. The purpose of C551 is to bypass to ground any i-f component that might be present in the output of the detector stage. R125

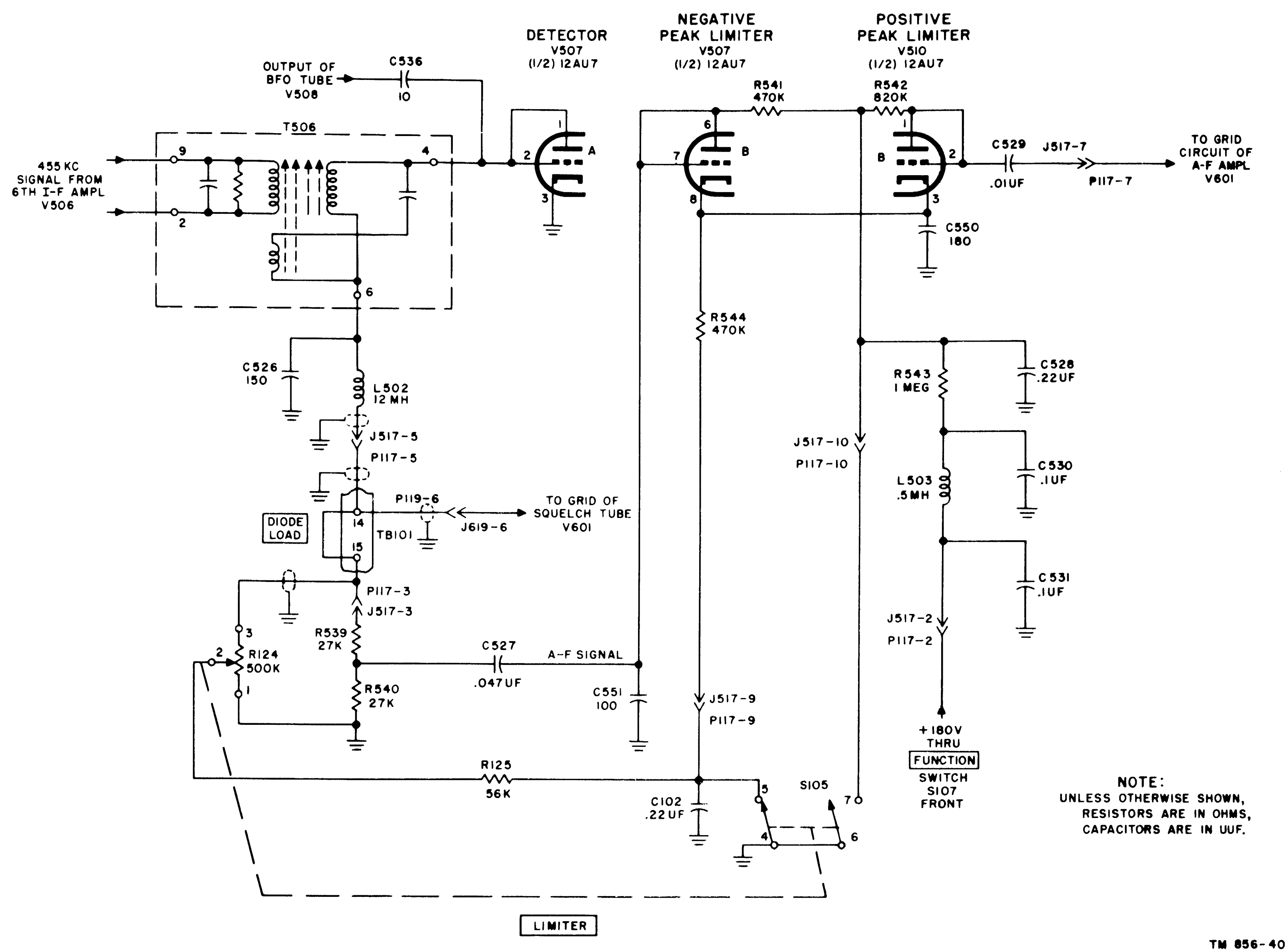


Figure 40. Detector and limiter circuits, schematic diagram.

prevents excessive loading of the detector output as a result of the grounding of cathode resistor R544.

(2) When the LIMITER control is turned in a clockwise direction, switch S105 grounds the junction of anode resistors R541 and R542 and removes the ground on the cathodes of the diodes. As a result, the cathodes assume a negative threshold potential which is adjustable by means of LIMITER potentiometer R124. The diodes thus are converted into negative (one-half of V507) and positive (one-half of V510) peak limiters. Again, a direct current flows through the diodes and as long as it flows, the a-f signal is transferred through the diodes as before. However, any negative-going impulse that drives the anode of V507 more negative than the cathode will cut off the diode, and that impulse will be limited to an amplitude equal to the threshold voltage. Similarly, any positive impulse that overcomes the threshold potential on the cathode of V510 will cut off that diode, and the positive impulse will be limited. As the LIMITER control is turned toward position 10, a lower negative threshold voltage is applied to the diodes, and more severe limiting results. Since the threshold voltage at any given setting of the LIMITER control varies with the average amplitude of the diode load signal, the limiting action automatically adjusts itself — at low modulation levels greater limiting takes place, and at high modulation levels less limiting takes place. C102 and R125 decouple the limiter circuit from the detector circuit. C550 stabilizes the threshold voltage at the cathodes.

71. Bfo Tube V508 (fig. 41)

To facilitate accurate tuning of signals and to permit the reading of radiotelegraph signals, the bfo is used. When the BFO control S103 is set to ON, the bfo generates a signal which is mixed with the 455-kc i-f signal at the input to the detector, one-half of V507. The two signals heterodyne to produce an audible beat frequency in the output of the receiver. The bfo employs a miniature pentode tube, type 5749, connected as a Hartley oscillator, and its operation is similar to that of vfo (par. 62).

a. Bias for the control grid (pin 1) is developed by the flow of grid current through R545. Capacitor C532 prevents short circuiting the grid-bias voltage to ground through the low-resistance tank coils of Z502. A positive potential of about 90 volts is applied to the screen grid (pin 6) through contacts 4 and 2 of BFO switch (S103) and voltage-dropping resistors R548 and R546. These resistors are bypassed by capacitors C534 and C535, to insure oscillator frequency stability. Capacitor C534 also provides a low-impedance signal path to the ground side of Z502. The bfo output signal is developed (by electron coupling to the plate) across resistor R547. The decoupling network formed by R548 and C535 isolates the oscillator from the power supply. When the BFO control is turned to OFF, the plate and screen circuits of the oscillator are removed from B+.

b. The oscillator section is a triode in which the screen grid (pin 6) acts as the anode. The control grid (pin 1) is connected, by capacitor C532, to tuned circuit Z502, which consists of a tank coil (two inductors connected in series) and a tank capacitor (three capacitors connected in parallel). The cathode of V508 (pin 2) is connected to a tap on the tank coil. The feedback voltage required to produce and sustain oscillation is induced in the coil by the flow of cathode current through the portion of the coil that is connected between the tap and ground. This voltage is applied to the control grid through coupling capacitor C532. Since the oscillator output is coupled into the plate circuit by the electron flow within the tube, variations in plate load have little effect on oscillator stability. The amplified signal from the plate is coupled, through capacitor C536, to the anode of the detector, one-half of V507.

c. Capacitors C532 and C533 form a voltage-divider network which improves frequency stability by placing the grid input capacitance of V508 across only part of the tank coil. The three capacitors across the series-connected

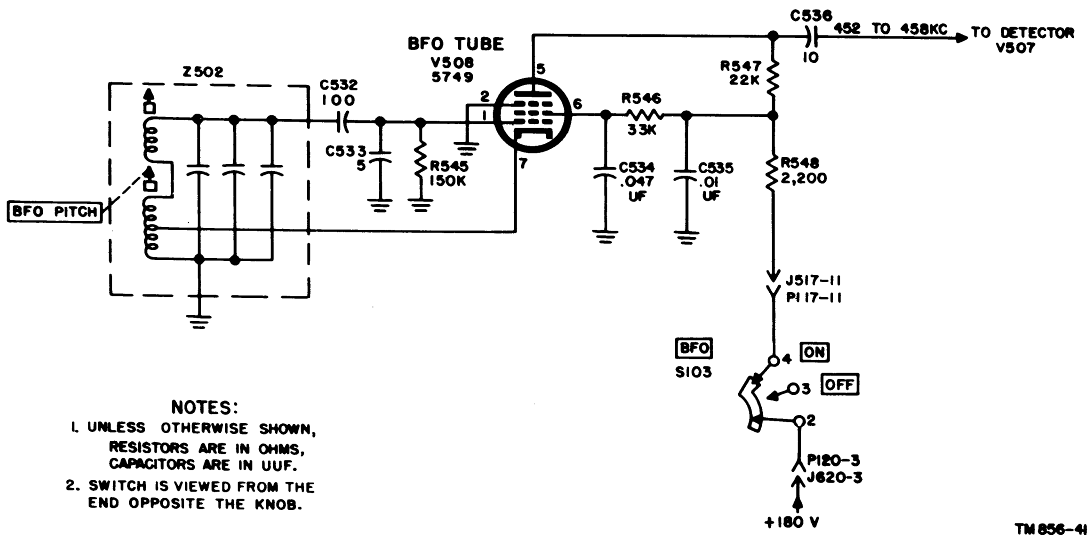


Figure 41. Beat-frequency oscillator, schematic diagram.

coils are selected carefully for the correct temperature coefficient to insure frequency stability over a wide range of temperature. The tuning unit, Z502, is inclosed within a hermetically sealed can. The can should not be opened under any circumstances. The tuning unit has been adjusted accurately, baked, and sealed under laboratory conditions at the factory, and any attempt to perform adjustments except under these conditions will affect the accuracy of the unit seriously.

d. The audio frequency produced by this mixing action in the second detector may be varied over an audible range by varying the oscillator frequency over a range of 452 to 458 kc. This is accomplished by varying the degree of insertion of the powdered-iron core within the coil of Z502 (BFO PITCH control). The frequency of the oscillator is caused to vary linearly over its entire range through the action of a special factory-adjusted mechanism. When the control knob on the front panel is set to 0, the output of the bfo is exactly 455 kc and therefore no heterodyne frequency is produced in the detector. Thus, the zero position of the control knob represents a bfo frequency of 455 kc, and the calibration indicates the number of kilocycles separation (±3) from the bfo frequency. A screwdriver adjustable slug in the trimmer coil is used to obtain the proper frequency range during alinement and adjustment.

72. Agc Circuit (fig. 42)

When FUNCTION switch S107 is turned to AGC, or SQUELCH, the agc circuit is operative. In the MGC (manual gain control) position, the agc control line is disabled (grounded). This is also true in the STANDBY, and CAL (calibrate) positions. The agc circuit develops a negative d-c potential which is related in amplitude to the strength of the incoming signal. To maintain the receiver output at a constant level regardless of signal-strength variations, this negative d-c potential is used to bias the grid of the first and second r-f amplifiers, V201 and V202, and the first and fifth i-f amplifiers, V501 and V505. (In this discussion these tubes will be designated as the *controlled tubes.*) The delayed-action system functions to prevent the application of agc bias to the controlled tubes during the reception of weak signals, so that maximum receiver gain may be realized. The time-constant system permits three degrees of response to be selected by the AGC control. Depending on the type of fading experienced and the type of signals being received, the control is set to FAST, MED., or

SLOW, and thus insures maximum effectiveness of the agc circuit. (A fading signal is an incoming r-f signal that is alternately strong and weak over a given period of time.) The circuit makes use of a miniature pentode tube, type 6BJ6 (V509) and two miniature twin-triode tubes type 12AU7 (one-half of V510 and one-half of V511). Agc amplifier V509 is a voltage amplifier operating at 455 kc; one-half of V510, connected as a diode, is used as a rectifier.

a. Agc Amplifier. This stage (V509), except for certain modifications, is similar in operation to i-f amplifiers V501 through V506 (pars. 61 through 65).

(1) The 455-kc signal from the secondary of T505 in the fifth i-f amplifier stage is coupled to the control grid (pin 1) of V509, producing grid bias across R551 at high signal inputs. This resistor also serves as a d-c return path to ground. Cathode bias is developed across R552, which is bypassed by capacitor C540. The screen grid is supplied with d-c potential through voltage-dropping resistor R533; C541 is the screen grid bypass capacitor. The suppressor grid (pin 7) is connected as a part of the delayed agc circuit. The plate (pin 5) receives d-c potential through the decoupling circuit consisting of R554 and the coil of Z503 together with C542.

(2) The amplified signal from the plate is developed across the high impedance of tuned circuit Z503. The signal is coupled, through C543, to the anode of agc rectifier, one-half of V510. The coil of Z503 has a powdered-iron core which is adjusted for maximum output during alinement.

b. Delay Agc System. The purpose of delaying agc action is to prevent the application of negative bias to the control tubes unless the i-f signal has sufficient strength to produce adequate input to the detector V507. Maximum gain is therefore available for the reception of weak signals.

(1) The agc function is made dependent on the strength of the received signal by the action of the circuit consisting of voltage divider R558, R556, and R555, the suppressor grid of V509, and the agc rectifier, one-half of V510. This circuit produces a positive potential on the agc bus which is too small to overcome the negative grid bias produced by the cathode resistors of the controlled tubes.

(2) During the positive peaks of i-f signal, the agc rectifier V510 offers low impedance to ground; therefore positive peaks do not generate voltage in the diode circuit. During intervals when the applied voltage is negative, the diode is not conducting and a pulsating negative voltage is developed in the anode circuit across resistor R555. This pulsating voltage is filtered by resistor R556 and capacitor C544. C544 also presents a low-impedance path to ground for i-f signal at the suppressor grid of V509. Under this condition, the potential at the junction of R556 and R558 is nearly at ground potential due to the high voltage drop across R558 produced by the negative voltage from the agc rectifier and the flow of current into the suppressor grid (pin 7) of V509.

(3) However, if a strong signal is applied through C543 to the agc rectifier a greater negative d-c voltage will be developed across R555, in opposition to the positive voltage appearing at the junction of R556 and R557. For input voltages greater than the threshold value, the negative voltage will exceed the positive voltage, and the flow of suppressor-grid current will cease. When this occurs, the negative voltage that is in excess of the positive voltage is applied through R557 and the time-constant circuit to the agc line, and thus the gain of the controlled tubes is decreased.

(4) The agc voltage is fed, through the AGC NOR terminals 3 and 4 (fig. 21), to the grid circuits of the four controlled tubes. Resistors R202, R208, R501, and R509 and capacitors C226,

C252, C501, and C508 form decoupling circuits which isolate i-f and r-f circuits from each other and the agc line. The agc line is short-circuited to ground when FUNCTION switch S107 is turned to the MGC, STANDBY, and CAL positions. In the MGC position of S107, the gain of the receiver is controlled solely by RF GAIN control R123. Terminals 3 and 4 normally are connected together by a jumper. Crystal CR101 prevents loading of the agc circuit of the controlling receiver by agc circuits of other receivers in diversity systems. The voltage supplied by the agc circuit of the controlling receiver further reduces the gain in the passive receiver.

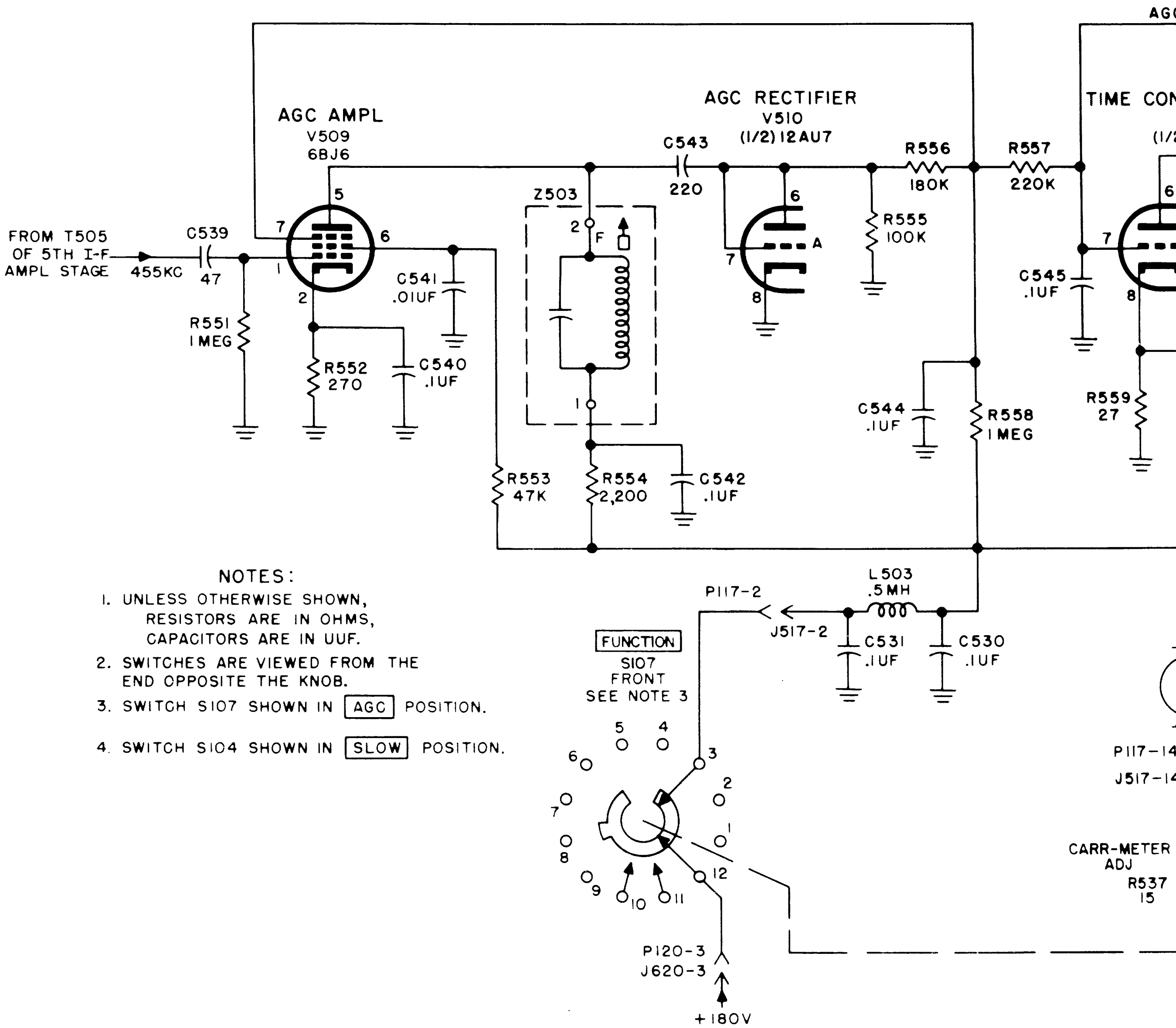
c. Time-constant System. The time constant of the agc line, the time required for the agc voltage to drop to 37 percent of its initial value when the signal is removed, is adjustable in three steps by AGC switch S104. In the FAST position, the time constant is .01 second; in the MED. (medium) position, .49 second; and in the slow position, 4 seconds.

(1) *FAST.* In the FAST position, the ability of the agc control voltage to follow fading is maximum; therefore this position is excellent for communication work where rapid nonselective fading prevails. The negative agc voltage from the i-f signal filter (resistor R556 and capacitor C544) is applied to the second filter (resistor R557 and capacitor C545) for a-f filtering. The time constant is determined solely by the capacitance and resistance connected to the agc line.

(2) *MED.* In the medium position, capacitors C546 and C547 are connected across C545 by switch S104, so that the time constant of the agc line is increased.

(3) *SLOW.* In the SLOW position, the ability of the receiver to follow fading is minimum, but this position is very useful for telegraphy work since the agc holds receiver gain constant between code groups. When AGC switch S104 is in this position, capacitors C546 and C547 are still used to determine the time constant, but their capacitance appears to be about 10 times as large as in the MED. position. This apparent increase in value is achieved by Miller effect in the triode section, one-half of V511, a miniature duo-triode 12AU7. One-half of V511 is a d-c amplifier with the control grid connected to the agc line; plate (pin 6) is connected through load resistor R560 to B+. The amplified agc voltage across R560 is applied to capacitor C546. The capacitance between control grid (pin 7) and plate (pin 6), in this case 2 microfarads, is multiplied by the gain of the tube to give a total apparent input capacitance between control grid and cathode (pin 8) of 26 μf. This capacitance, together with the remaining capacitance and resistance of the agc line, further increases the time constant. Cathode resistor R559 serves as part of the bridge circuit for the CARRIER LEVEL meter M102.

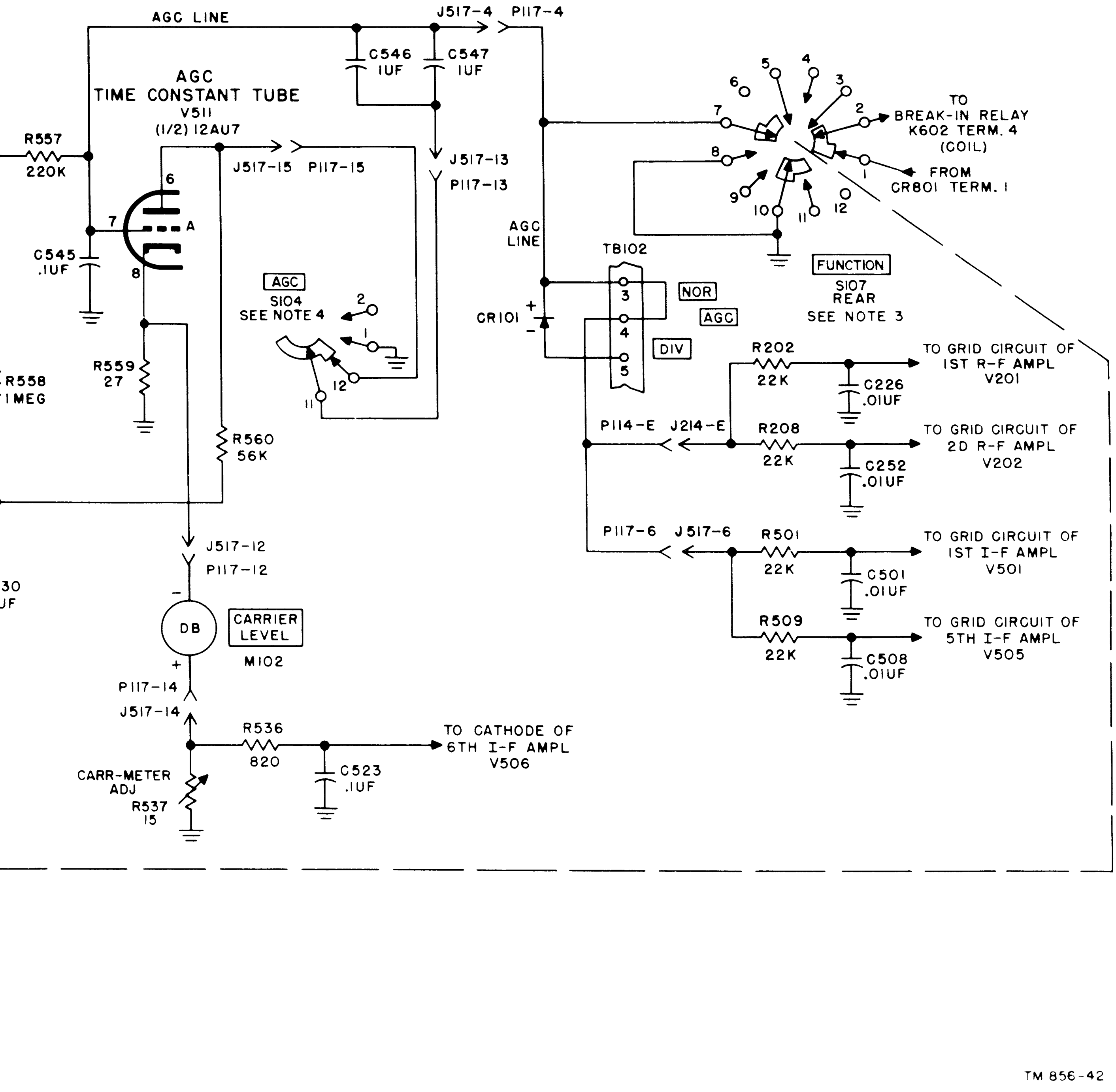
d. CARRIER LEVEL Meter Circuit. The CARRIER LEVEL meter indicates the relative strength of incoming carrier signal to assist in tuning, calibration, and alinement. B+ voltage is applied to the plates of V506 and section A of V511, through a decoupling and filtering network consisting of C530, L503 and C531. R538 provides additional decoupling for sixth i-f amplifier V506 and R560 is the plate load resistor for agc time constant tube V511. The cathode (pin 7) of V506 returns to ground through minimum bias resistor R536 and CARR-METER ADJ R537. The cathode resistor for V511 is R559. The CARRIER LEVEL meter, M102, is connected between the cathode of V511 and the junction of R536 and R537. For simplification, the remaining circuit elements of the sixth i-f amplifier and those of the time constant tube are not shown on the simplified schematic (fig. 43). The equivalent resistances of V506 and V511 are shown as resistors connected by dashed lines to the cathodes and plates of the tubes. The input to



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.
3. SWITCH S107 SHOWN IN AGC POSITION.
4. SWITCH S104 SHOWN IN SLOW POSITION.

Figure 42. Agc circuit, sche



42. Agc circuit, schematic diagram.

the circuit is the agc voltage from the agc rectifier, one-half of V510. The circuit arrangement is a bridge with the plate circuits of V506 and V511 as the upper arms and the cathode circuits as the lower arms. V506 is a pentode and has a relatively high value of resistance which is constant. The voltage drop across this resistance is constant and provides, with R536 and R537, a steady reference voltage to CARRIER LEVEL meter M102. The equivalent resistance of the agc time constant tube, which is in series with R599, is changed readily. In the absence of agc voltage, as a result of no carrier being received or the carrier level being below the threshold of the agc circuit, no bias is applied to the control grid (pin 7) of V511. Under these conditions, the voltage drop across the triode and the pentode is the same since they are effectively in parallel across the same power supply. No difference of potential exists across meter M102. When a signal is received, agc voltage is developed. The amplitude of the agc voltage is dependent on the signal level. The higher the level of the signal, the larger the agc voltage developed. The agc voltage is applied to the grid of V511. Under those conditions, the cathode-to-plate current is decreased and the voltage drop across the tube is increased. This results in a change of potential at the cathode, and, since no change occurs in the pentode, a voltage difference is produced across the meter terminals which represents the relative level of the signal being received.

73. Cathode Follower (fig. 44)

The cathode follower, one-half of V511, uses a section of miniature duo-triode 12AU7 tube to couple 455 kc from the high-impedance secondary winding of T505 to a low-impedance cable. This matching is necessary when operating Radio Receiver R-391/URR with external equipment such as frequency shift teletypewriter or single side band equipment.

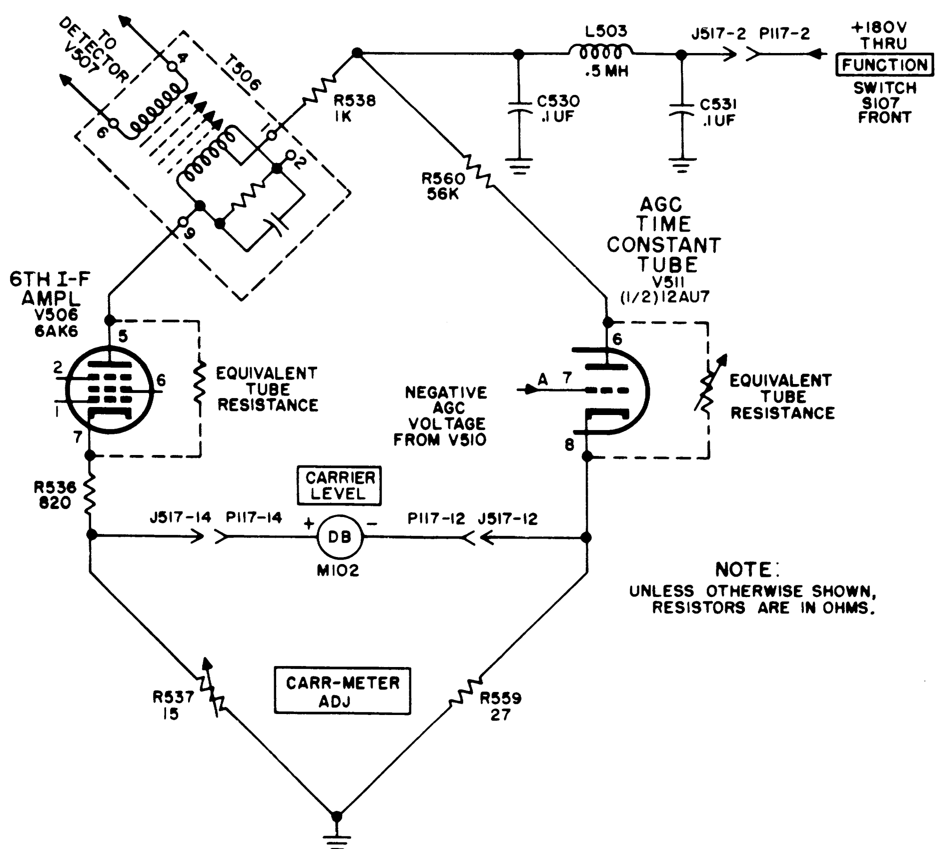


Figure 43. Carrier level meter circuit, simplified schematic diagram.

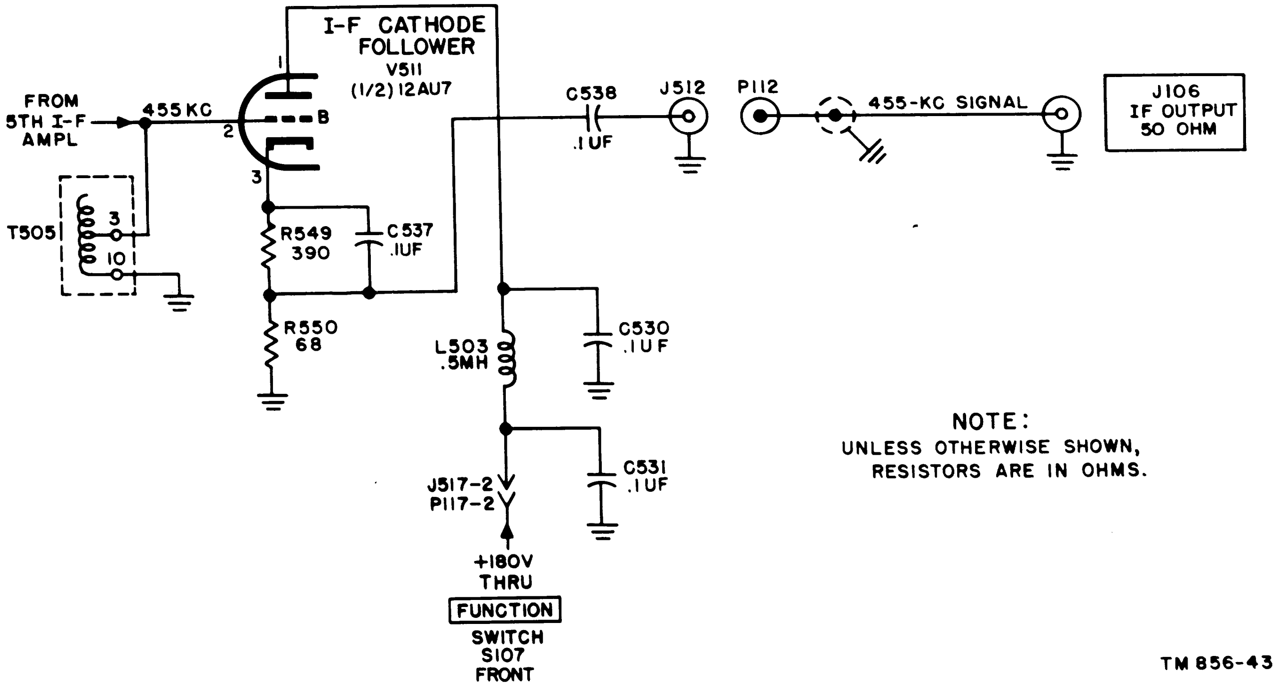


Figure 44. Cathode follower, schematic diagram.

a. The cathode (pin 3) is connected, through bias resistor R549 and load resistor R550, to ground. Since capacitor C537 offers a low-impedance path to the i-f signal, the signal is developed only across R550. The plate (pin 1) is connected directly to 180 volts through a pi type filter consisting of C530, L503, and C531.

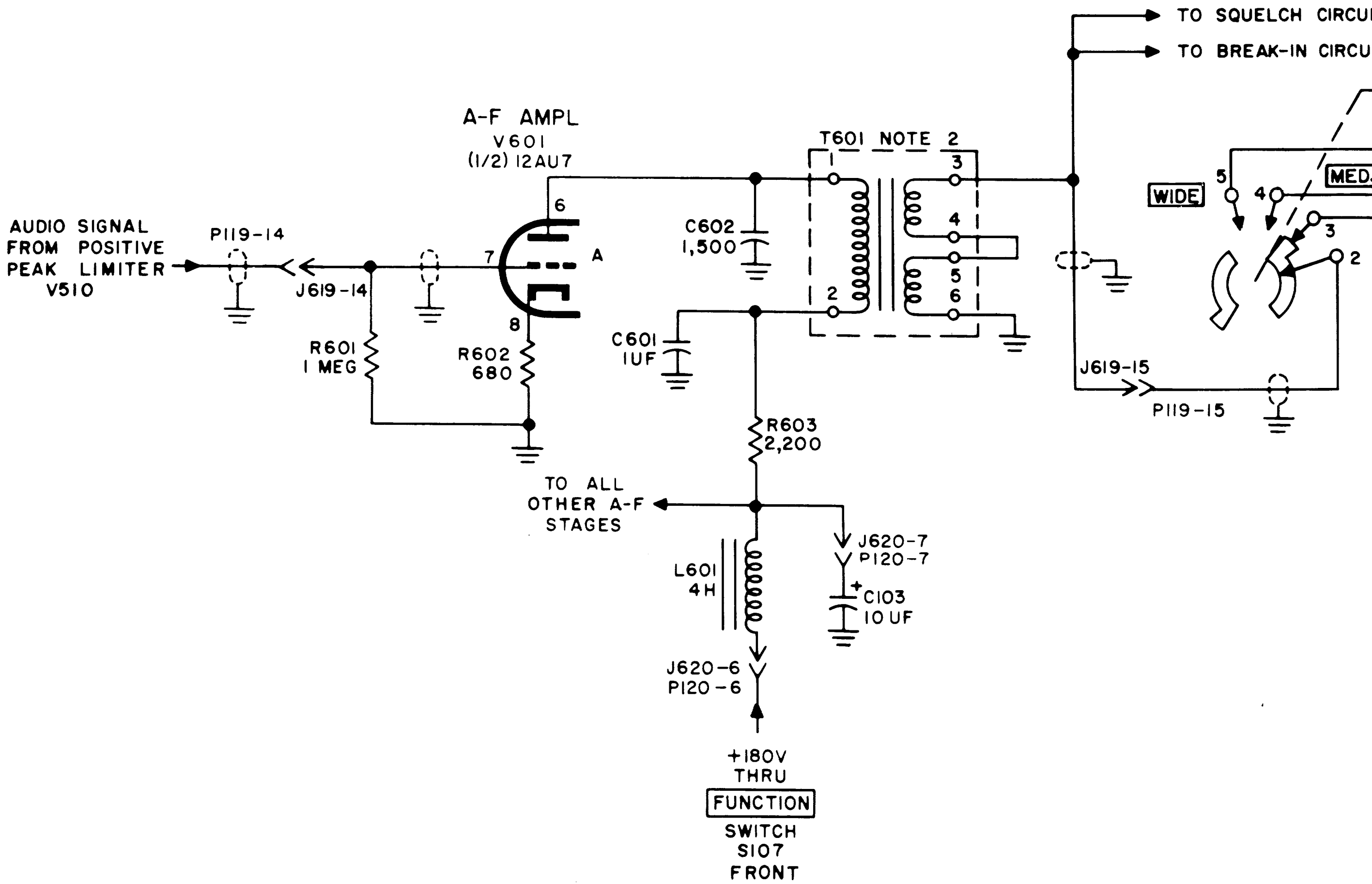
b. The control grid receives the 455-kc signal from T505 in the output circuit of fifth i-f amplifier V505. The plates serves as the ground return for signal current, since all signal at the plate is returned to the cathode by filter L503, C530, and C531. The i-f output signal is developed across R550, the cathode load resistor, and is applied through C538, jack J512, plug P112, and the coaxial cable, to 50 OHM IF OUTPUT receptable J106.

c. The cathode follower is particularly well suited to this application since external load variations have no effect on the input circuit, and no gain or distortion is introduced in this type of circuit.

74. A-f Amplifier and Filter Circuit
(fig. 45)

A-f Amplifier, one-half of V601, amplifies the audio signal from the positive-peak limiter and applies the signal through the filter circuit to the local audio and the line audio channels. The filter circuit selects the range of audio frequencies that are applied to the local and line audio channels. The filter circuits eliminate certain audio frequencies from the local and line audio channels; thus noise and interfering signals are reduced appreciably in the output circuits and greater intelligibility of received signals results.

a. Bias voltage for the a-f ampl, one-half of V601, is developed across cathode resistor R602, which is connected between cathode (pin 8) and ground. The control grid (pin 7) returns to ground through resistor R601. B+ is applied to the plate (pin 6) through choke L601, a decoupling circuit (resistor R603 and capacitor C601), and the primary of transformer T601. Additional decoupling and filtering for all the a-f stages is provided in the B+ line by choke L601 and capacitor C103. The decoupling circuits, by presenting a low-impedance path to ground for the a-f signal, prevent audio modulation of the B+ voltage which would cause interference in other circuits.



TO SQUELCH CIRCU
TO BREAK-IN CIRCU
A-F AMPL
V601
(1/2) 12AU7
T601 NOTE 2
AUDIO SIGNAL FROM POSITIVE PEAK LIMITER V510
P119-14
J619-14
R601 1 MEG
R602 680
C602 1,500
C601 1UF
R603 2,200
TO ALL OTHER A-F STAGES
L601 4H
J620-7
P120-7
C103 10 UF
J620-6
P120-6
+180V THRU
FUNCTION
SWITCH S107 FRONT
WIDE
MED
J619-15
P119-15

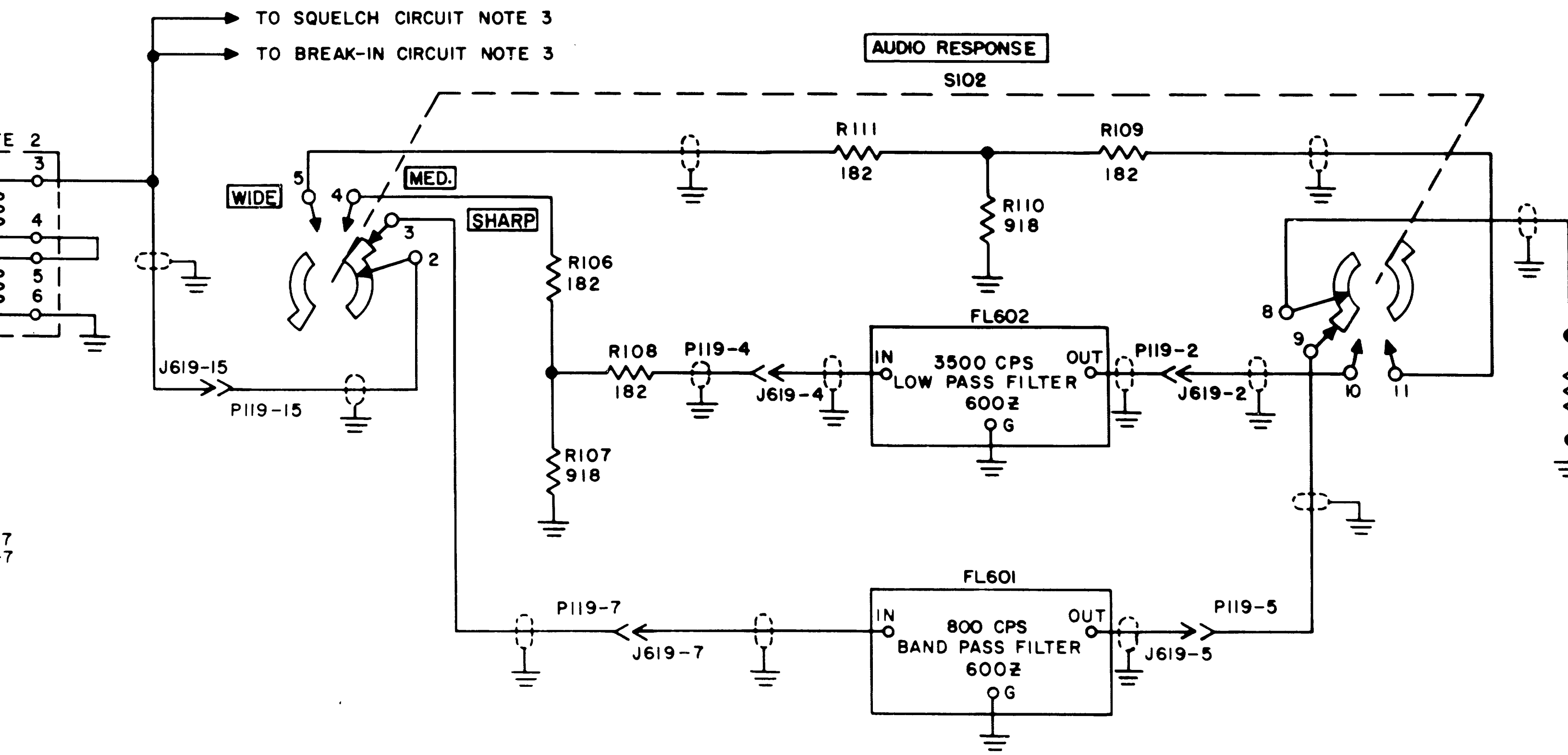
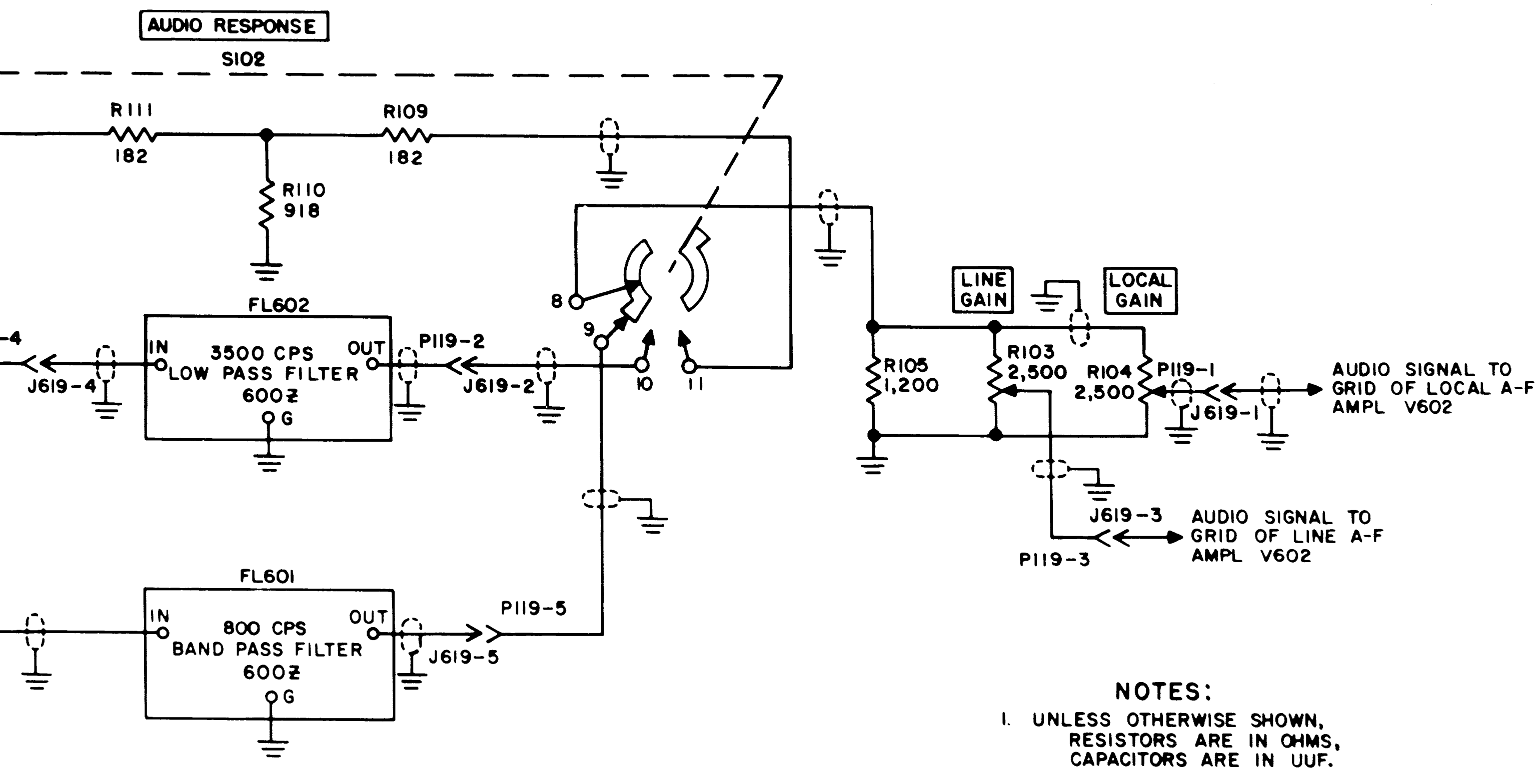


Figure 45. A-f amplifier, schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. 600 OHMS IMPEDANCE (Z) AS MEASURED BETWEEN TERMINALS 3 AND 6. 10,000 OHMS IMPEDANCE (Z) AS MEASURED BETWEEN TERMINALS 1 AND 2.
3. SQUELCH OR BREAK-IN CIRCUIT WHEN ENERGIZED GROUNDS OUTPUT OF V601.
4. SWITCH IS VIEWED FROM THE END OPPOSITE THE KNOB.

TM 856-44

chematic diagram.

b. The audio signal output from the limiters is developed across grid resistor R601 and applied to the control grid of section A of V601. After amplification, the signal appears across the primary of transformer T601. Capacitor C602, which is in parallel with the primary of transformer T601, improves the frequency characteristics of the stage by correcting the transformer impedance in the middle and upper a-f ranges. From the secondary of transformer T601, which has a nominal impedance of 600 ohms to match the input of the filter circuits, the signal is applied through the filter to LINE GAIN potentiometer R103, LOCAL GAIN potentiometer R104, and resistor R105, which are connected in parallel and also have a nominal impedance of 600 ohms to match the output of the filter circuit. The portion of the signal voltage that is applied to the line audio channel depends on the position of the arm of LINE GAIN potentiometer R103, and the portion of the signal voltage that is applied to the local audio channel depends on the position of the arm of LOCAL GAIN potentiometer R104.

c. Before the signal arrives at the LINE GAIN and LOCAL GAIN potentiometers, it passes through AUDIO RESPONSE switch S102. In the WIDE position of this switch, no frequency-selective circuits are inserted into the signal path; in the MED. position, the low-pass filter is inserted; and in the SHARP position, the band-pass filter is inserted. These filters determine the range of frequencies which will be applied to the input of the succeeding stages. To maintain the same signal level regardless of the setting of switch S102, attenuator pads are connected into the circuit in the WIDE and MED. positions of the switch. These pads, consisting of R106, R107, and R108 in the MED. position, and R109, R110, and R111 in the WIDE position, bring the total insertion loss in these positions up to that in the SHARP position. The MED. position of the switch is for use when the greatest intelligibility of voice reception is desired. Filter FL602 attenuates the higher audio frequencies as well as noise or adjacent-channel interference that might appear when the WIDE position is used. In addition, filter FL602 is used with the line audio channel to prevent cross talk (or splattering) in telephone lines as a result of the presence of high-frequency audio components which tend to couple into adjacent lines, through the capacitance between the lines. In the SHARP position the input to the local and line audio channels is fed through an 800-cps band-pass filter (FL601). This filter is designed to attenuate by at least 6 db all signals below 600 cps and above 1000 cps, and by at least 30 db all signals below 400 cps and above 1200 cps. When utilized by the operator, this circuit facilitates the reading of radio telegraph signals by excluding noise and adjacent-channel interference.

75. Local Audio Channel (fig. 46)

The local audio channel consists of two stages of class A amplification. The first stage, local a-f amplifier one half of V602, amplifies the audio signal from the a-f amplifier and applies this signal to the second stage. The second stage, local a-f output tube V603, amplifies the power of the audio signal from the local a-f amplifier to a suitable level for operating a loudspeaker or a headset. Three different types of feedback are incorporated in this channel to obtain the required output impedance and frequency response.

a. Bias voltage for the local a-f amplifier is developed across resistors R604 and R609, which are connected in series between cathode (pin 3) and ground. The control grid (pin 2) returns to ground through LOCAL GAIN potentiometer R104. B+ is applied to the plate (pin 1) through plate load resistor R605 and a low pass filter consisting of choke L601 and capacitor C103. This circuit provides filtering and prevents audio signals from entering the common power supply circuits. Bias voltage for V603 is developed across resistors R608 and R609, which are connected in series between cathode (pin 7) and ground. The control grid (pin 1) returns to ground through resistor R607. B+ voltage from the filter circuit is applied directly to the screen grid (pin 6) and through the primary of transformer T602 to the plate (pin 5).

b. The signal voltage from the a-f amplifier is developed across the total resistance of LOCAL GAIN potentiometer R104. A portion of this signal voltage, depending on the position of the potentiometer arm, is applied to the control grid (pin 2) of V602. The signal is amplified in V602 and appears across plate load resistor R605. The signal then is applied to the control grid (pin 1) of V603, through coupling capacitor C603, where it is power amplified. The output from the stage is impedance matched to 600 ohms by transformer T602. The primary of transformer T602 is shunted by capacitor C604, which improves the frequency characteristics of the stage by correcting the transformer impedance in the middle and upper audio-frequency ranges. The secondary winding consists of two single windings connected in series by a jumper between terminals 4 and 5. One end (terminal 6) is connected to ground. The signal across the secondary winding is applied across resistors R127 and R128, which are connected in series between terminal 3 of transformer T602 and ground. The signal across resistors R127 and R128 is applied to pin H on REMOTE CONTROL jack J105 and terminal 6 of TB102. The REMOTE CONTROL jack (pin H) is for side tone connection from an associated transmitter. The signal from terminal 6 of TB102 normally is applied to a speaker, and the signal from terminal 8, which is at a lower power level because of the voltage divider action of resistors R127 and R128, normally is applied to a headset. To facilitate connections, the signal from terminal 8 of TB102 is also available at PHONES jack J103 on the front panel of the radio receiver.

c. Negative voltage feedback, negative current feedback, and positive voltage feedback circuits are incorporated in the local audio channel to obtain the required output impedance. The negative-voltage-feedback loop consists of resistors R606, R604, and R609. This circuit reduces the internal impedance of the amplifier and the overall gain, and results in improved stability. Harmonic distortion, noise, and hum also are reduced, since they are fed back with the original signal and reduced in amplitude in proportion to the reduced gain. Negative current feedback is produced by unbypassed resistors R608 and R609 in the cathode circuit of V605 and R604 in the cathode circuit of the local a-f amplifier. This negative current feedback increases the internal impedance of the amplifier. The ratio between the amounts of the two types of feedback is ad-

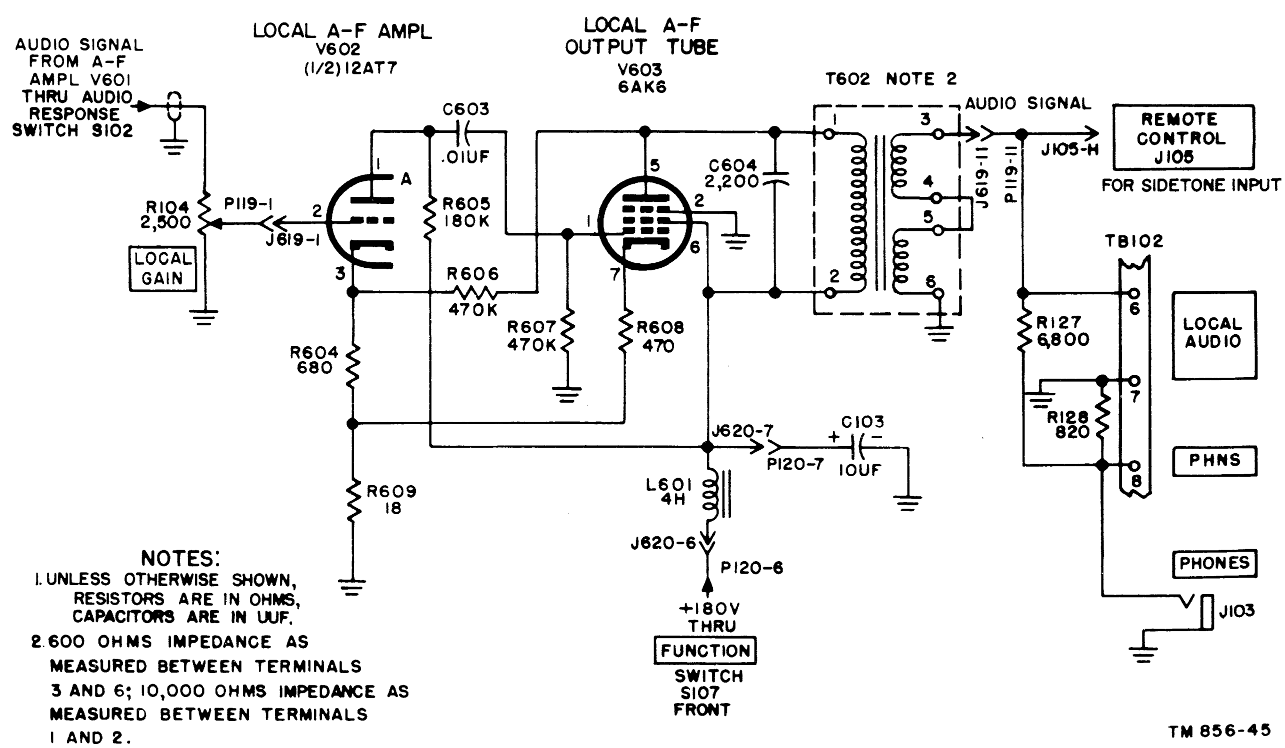
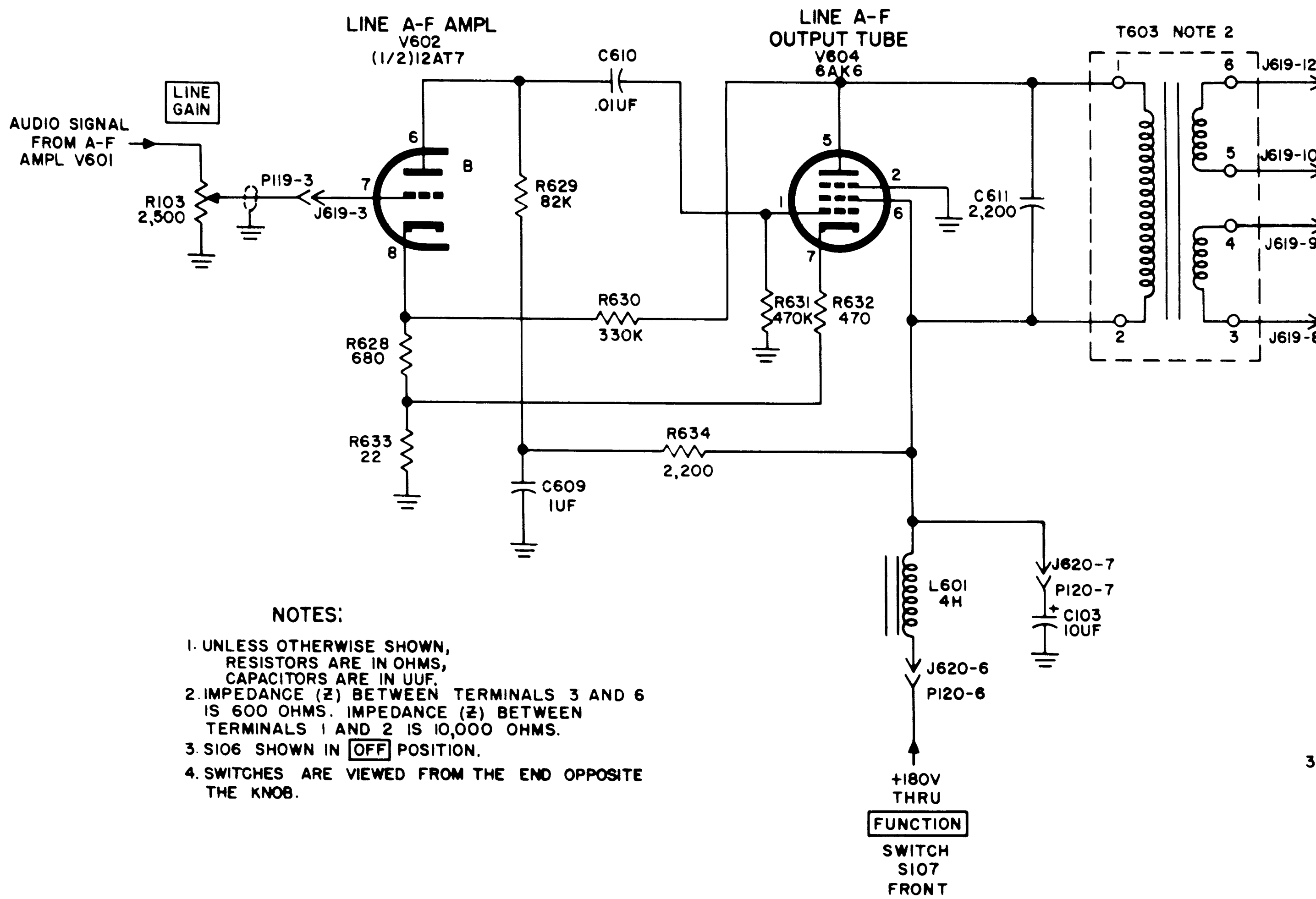


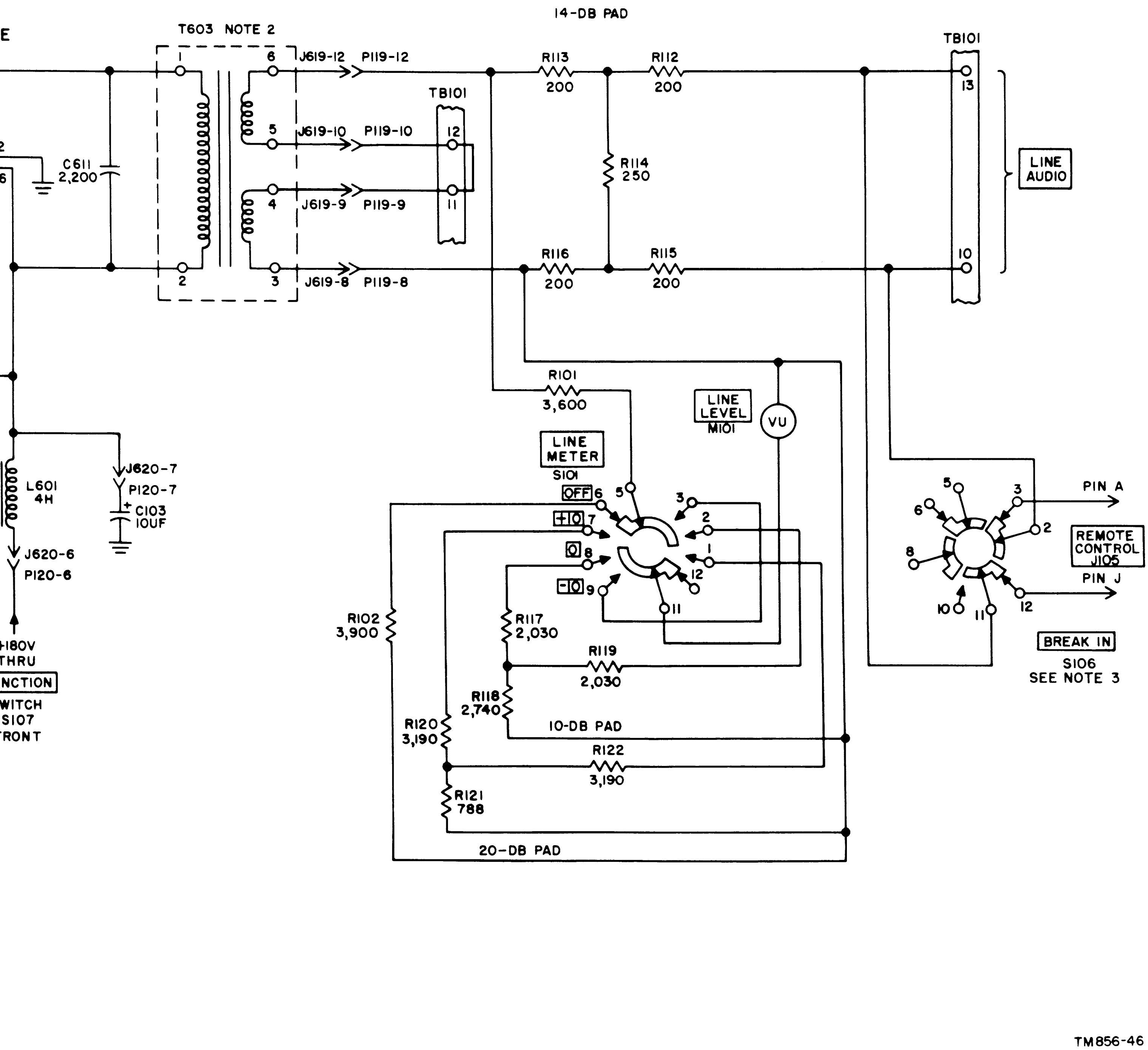
Figure 46. Local audio channel, schematic diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF.
2. IMPEDANCE (Z) BETWEEN TERMINALS 3 AND 6 IS 600 OHMS. IMPEDANCE (Z) BETWEEN TERMINALS 1 AND 2 IS 10,000 OHMS.
3. S106 SHOWN IN OFF POSITION.
4. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.

Figure 47. Line audio channel, schematic d



'igure 47. Line audio channel, schematic diagram.

justed to set the internal impedance of the amplifier to 600 ohms. A small amount of positive voltage feedback is applied to the cathode through resistor R606. This eliminates the negative feedback at the cathode that is introduced through resistor R604. The gain of the local a-f amplifier is therefore equivalent to that produced in a similar amplifier stage employing a cathode bypass capacitor and no negative current feedback.

76. Line Audio Channel (fig. 47)

The line audio channel is similar to the local audio channel, which was explained in the previous paragraph; however, it is designed to feed a balanced line having an impedance of 600 ohms, and it has provision for monitoring the output level of the channel with a LINE LEVEL meter, M101.

a. Bias voltage for the line a-f amplifier is developed across resistors R628 and R633, which are connected in series between the cathode (pin 8) and ground. The control grid (pin 7) is connected to ground through LINE GAIN potentiometer R103. B+ voltage is applied to the plate (pin 6) through plate load resistor R629 and a decoupling circuit consisting of resistor R634 and capacitor C609. The B+ voltage is obtained from the power supply through a low pass filter consisting of filter choke L601 and capacitor C103, which provides filtering and prevents audio signals from entering the common power supply circuits. Bias voltage for V604 is developed across resistors R632 and R633, which are connected in series between the cathode (pin 7) and ground. The control grid (pin 1) is connected to ground through resistor R631. B+ voltage is applied directly to the screen grid (pin 6) and through the primary of transformer T603 to the plate (pin 5).

b. The signal path through line a-f amplifier and line a-f output tube, is identical with the signal path through local a-f amplifiers. The three types of feedback circuits explained in paragraph 75 are also applicable to section B V602 and V604. The output circuit of the line audio channel differs from that of the local audio channel in that terminals 4 and 5 of transformer T603 are connected directly to terminals 11 and 12 of TB101. A jumper is normally connected between these terminals of TB101 except under conditions where a balancing network is required to correct the terminal impedance of a line connected to terminals 10 and 13 to 600 ohms. The end terminals (3 and 6) of the transformer are connected to an H-type attenuator, consisting of resistors R112 through R116, which reduces the output from approximately 250 milliwatts so that a maximum of 10 milliwatts (+10 dbm) of a-f power is supplied to a 600-ohm balanced line connected to terminals 10 and 13 of TB101, as well as to terminals A and J of REMOTE CONTROL receptacle J105. (The H-type attenuator is used to reduce the power level by 14 db to permit the use of a meter having a 4-db sensitivity and still achieve a −10 dbm output level.) Output is applied to the remote-control receptacle only when the break-in relay switch, S106, is in the OFF position. LINE LEVEL meter M101 is connected across the output-transformer secondary, to indicate the level of the signal being applied to the balanced line. This meter is calibrated in vu which are based on a zero reference level pure sine wave of milliwatt into 600 ohms or 0 dbm. For example, a reading of −20 vu or +3 vu would be equivalent to −20 dbm or +3 dbm. The face of the meter has two scales: the upper scale is calibrated to read directly in vu when LINE METER switch S101 is set to 0 vu; the lower scale is calibrated from 0 to 100, ending at a point opposite 0 vu on the upper scale. When the output of the receiver is fed into a telephone line, the meter circuit is used to show the line input level. Meter M101 has an impedance of 3,900 ohms. Resistor R101 is connected in series with M101 to match its impedance to the amplifier and to obtain the ballistic characteristic necessary for following audio-amplitude changes. To change the range of the meter, switch S101 selects either of two pads or permits direct connection to the meter. For the −10 vu range, the connection is direct; for the 0 vu range, a pad consisting of R117, R118, and R119 is used; and for the +10 vu range a pad consisting of R120, R121, and R122 is used. Pads are used as range multipliers to maintain the impedance match. A fourth position of the switch, OFF, disconnects the meter from the circuit and substitutes R102 in its place to maintain the impedance match required across the secondary winding of T603.

77. Squelch Circuit (fig. 48)

The squelch circuit utilizes one-half of a 12AU7 dual-triode tube which is connected as a d-c amplifier. The squelch circuit eliminates noise signals in the output of the audio amplifiers when signals are not being received, or when the signal level of the desired carrier is too low for useful reception.

a. Fixed cathode bias is developed across resistor R612, which is also part of a voltage-divider circuit consisting of resistors R612 and R613 connected between B+ and ground. B+ voltage is only supplied to the plate (pin 1) of V601 through the coil of relay K601 and the voltage divider when the FUNCTION switch S107 is in the SQUELCH position.

b. In the absence of a carrier-frequency signal or when a weak carrier-frequency signal is being received no negative bias is applied to the grid (pin 2) of V601. The tube conducts and plate current flows through the coil of relay K601 energizing the relay and closing contacts 1 and 2. Contact 1 is connected to terminal 3 of T601, and contact 2 is connected to ground; therefore, when these contacts close the secondary winding of transformer T601 is shorted, and the audio amplifiers are disabled. When a carrier-frequency signal of sufficient level is received, the voltage across the diode load (resistors R539 and R540) becomes more negative. This negative voltage, which is applied to the control grid (pin 2) of V601 through resistor R610, causes the plate current to decrease. When the plate current decreases, relay K601 is de-energized and contacts 1 and 2 open; the ground is thereby removed from terminal 3 of transformer T601 and the received signal appears in the output of the audio amplifiers. Bypass capacitor C605, between the grid (pin 2) of V601B and ground, prevents chattering of the relay which might be caused by audio frequency signals. The position of the RF GAIN control determines the level to which the incoming signal must rise before it can operate the relay circuit.

c. A carrier-control circuit also is incorporated in relay K601. When an adequate signal is received, relay K601 is de-energized, contact 1 makes with contact 3. With the FUNCTION switch, S107 and BREAK IN switch S106 set to SQUELCH and OFF positions, respectively, the closing of these contacts will complete the carrier-control circuit of a transmitter through terminal K of REMOTE CONTROL receptacle J105.

78. Calibration Oscillator
(figs. 49, 50, and 51)

The function of the calibration oscillator and the associated circuits is to provide a secondary standard frequency in 100-kc steps in the frequency range .5 to 32 mc, for use in calibrating Radio Receiver R-391/URR. The calibration oscillator, one-half of V901, supplies a crystal controlled 1-mc signal to synchronize multivibrator V902.

a. Resistor R901 provides d-c bias to the control grid (pin 1) and limits crystal current. B+ is applied to the plate (pin 1), through series dropping resistor R902, from a low pass filter L902 and C907, when the FUNCTION switch (S107) is set to the CAL position.

b. The calibration oscillator uses one one-half of a miniature dual-triode tube, type 12AU7 V901, as a Pierce oscillator. The crystal (Y901), connected between the control grid and the plate circuit, takes the place of the conventional tuned circuit. D-c plate voltage is blocked from the crystal by capacitor C904. Capacitor C905 is used to make the plate circuit look capacitive rather than purely resistive. To maintain oscillation at the resonant frequency of the crystal circuit, feedback is applied through the total capacitance existing between the control grid (pin 2) and cathode (pin 3). The amount of feedback is fixed by the voltage-divider action of the crystal impedance at resonance and parallel capacitors C901 and C903. Capacitor C901 is variable and it permits adjustment of the resonant frequency over a small range. Its use is described in paragraph 136. L902 and C907 serve to isolate the power supply from the r-f circuits.

79. Multivibrator V902 (fig. 50)

The 1-mc signal from the calibration oscillator is used to synchronize the multivibrator

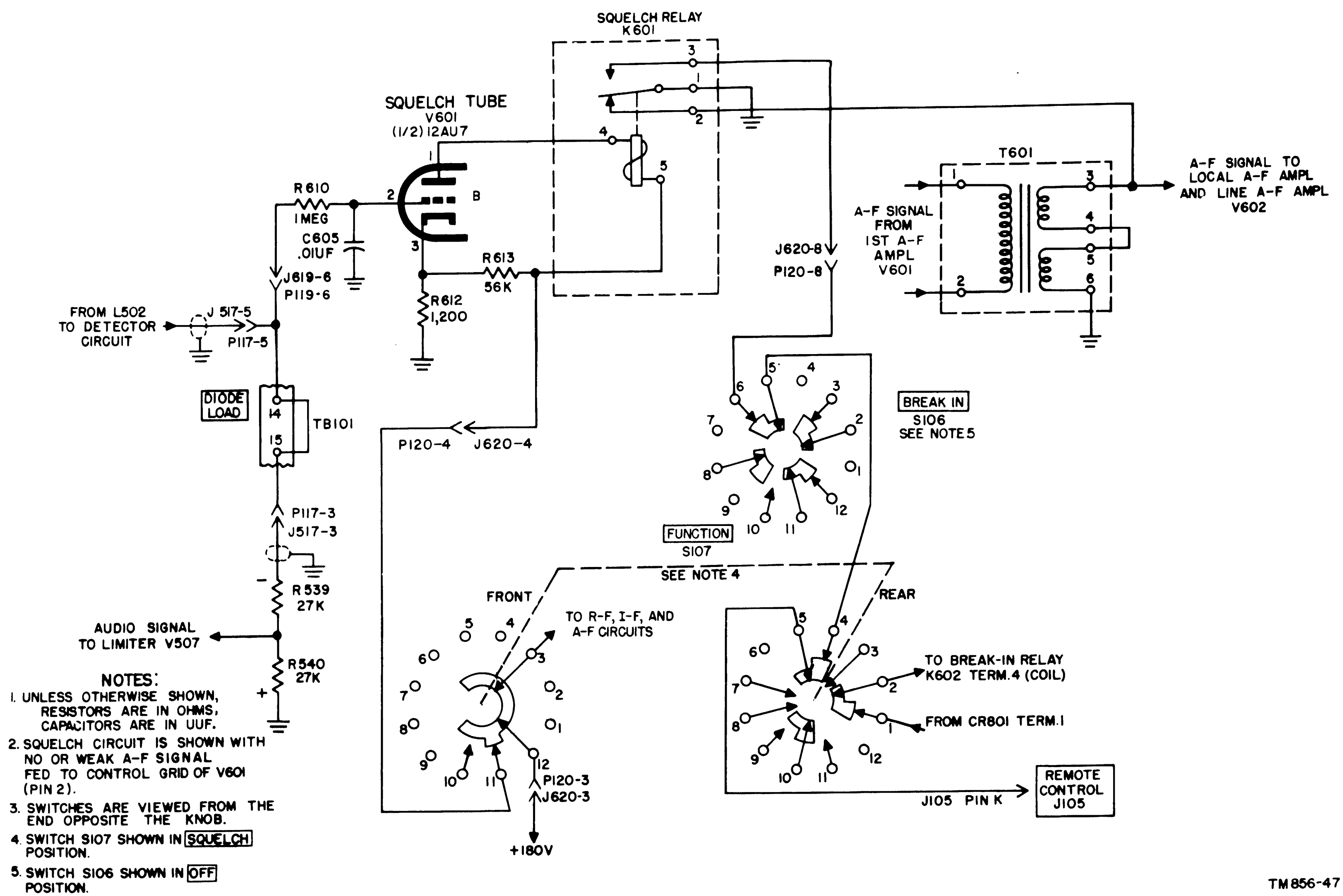


Figure 48. Squelch circuit schematic diagram.

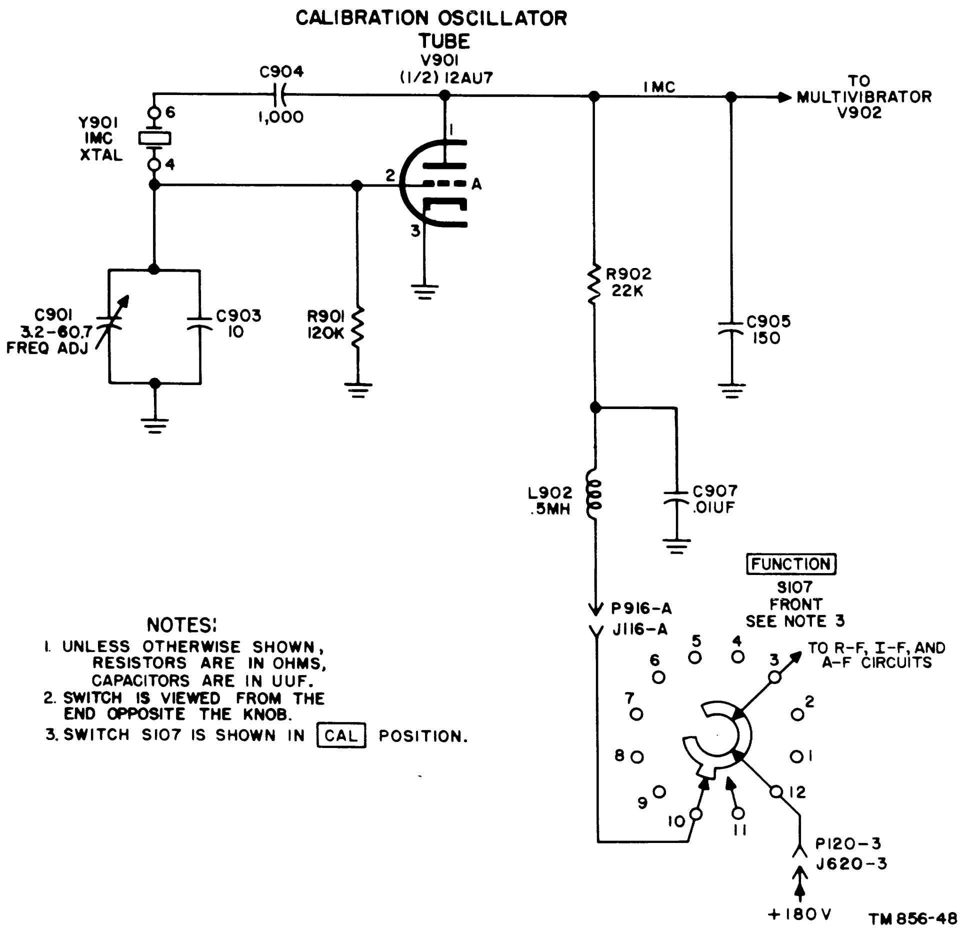


Figure 49. Calibration oscillator, schematic diagram.

at 100 kc. Since the multivibrator output (a square wave) is composed of a large number of harmonics, it is capable of supplying all the calibrating signals required to cover the frequency range .5 to 32 mc.

a. Initial positive bias for the control grids (pins 2 and 7) is supplied from B+ through filter choke L902, voltage-dropping resistor R904, and grid resistors R906 and R908. Choke L902 and resistor R904 are bypassed by C907 and C913, respectively, to provide a low impedance path to ground for r-f signals. A positive voltage, greater than that applied to the grids, is applied to the plates (pins 1 and 6) through resistors R903, R905, and R907. All B+ voltages are applied thru FUNCTION switch S107, front, when set to the CAL position.

b. The output of the calibration oscillator is coupled, by means of capacitor C906, to the multivibrator, a free-running relaxation-type oscillator employing a miniature dual-triode tube, type 12AU7. Oscillation is sustained by the feedback from the plate of one tube section to the grid of the other tube section. The free-running frequency prior to synchronization by the crystal oscillator is determined by the time constants of R906 and C908 for tube section A, and of R908, C909, and C912 for tube section B. Grid coupling capacitors C908, C909, and C912 are not of the same value, since compensation must be made for the grid input impedance of buffer amplifier V901, which is effectively across one tube section of the multivibrator. C912, being adjustable, permits synchronization at 100 kc. This adjustment is made and set permanently by the manufacturer, and no readjustment will be required.

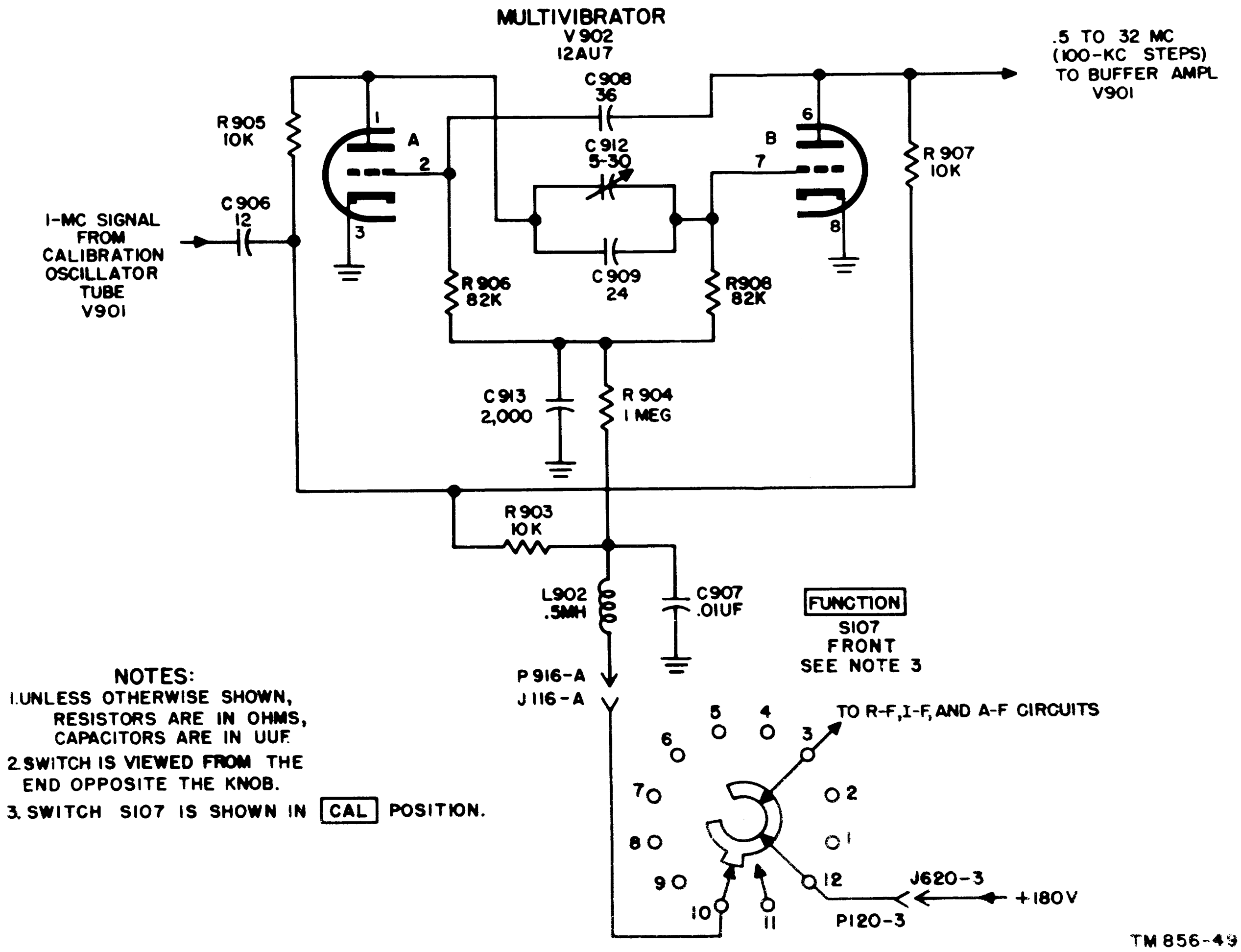


Figure 50. Multivibrator schematic diagram.

80. Buffer Amplifier (fig. 51)

The buffer amplifier is a triode section of a dual-triode tube, type 12AU7. The buffer amplifier amplifies and distorts the output of the multivibrator, and isolates the multivibrator from the first r-f amplifier.

a. Resistor R911, connected to pin 7, serves as the grid return, and cathode resistor R909, connected to pin 8, maintains a constant bias on the control grid. Cathode bypass capacitor C911 offers a low-impedance path to ground for r-f signals. B+ is applied to the plate (pin 6) through a filter circuit composed of choke L902 and bypass capacitor C907, and through resistor R910 and choke L901. To increase the higher harmonics in the vicinity of 25 mc and thus to flatten the overall frequency response, L901 and R910 form a low-Q resonant circuit with the output capacitance of V901.

b. The 100-kc signal from the multivibrator is applied, through capacitor C910, to the buffer-amplifier control grid. The output from the plate (pin 7) is applied to the input circuit of the first r-f amplifier, V201.

81. Power Circuits

The power circuits provide regulated B+ voltage to all stages, heater voltages for the filaments of all tubes, d-c voltage to operate relay circuits, and a-c voltage for the crystal-oven heater circuits. The power supply consists of two sections or components, Power

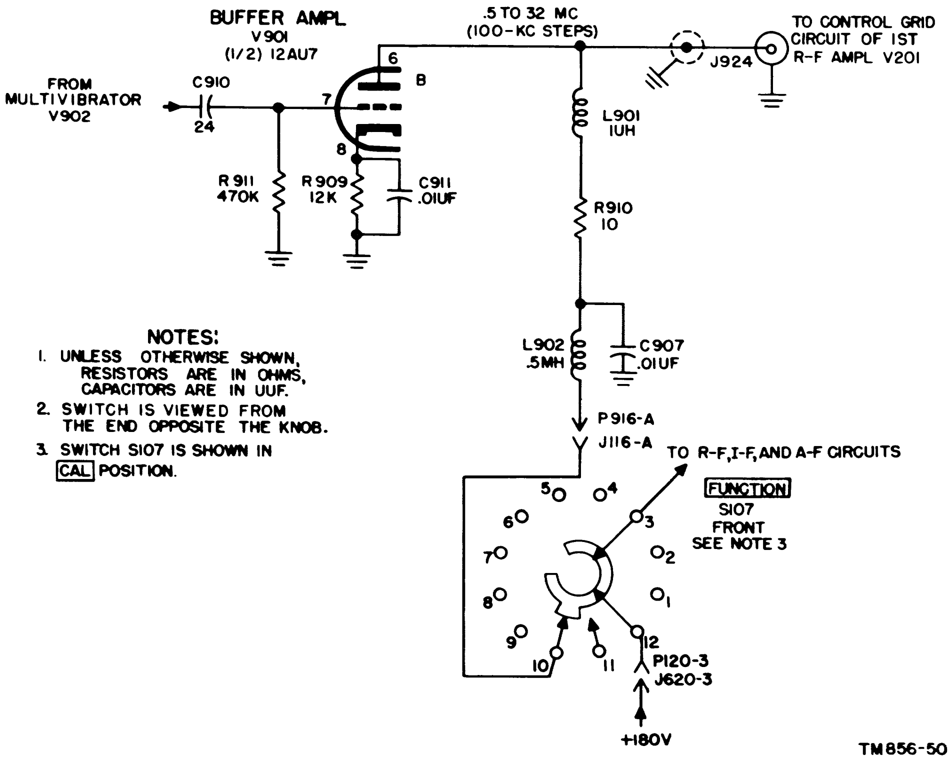


Figure 51. Buffer amplifier, schematic diagram.

Supply PP-621/URR and the voltage regulator. Operation of the FUNCTION switch (S107) connects the a-c power input to the power supply in all positions except OFF.

a. Power Supply PP-621/URR (fig. 52).

(1) The power supply operates from either 115 or 230 volts, 48 to 62 cycles and supplies a 300-volt, unregulated, rectified voltage to the voltage-regulator circuits, 6 volts dc to the relay circuits, and 25.2 volts ac to the filament and oven-heater circuits. Primary power is connected to the power supply through receptacle J104. The primary of transformer T801 is connected, through the line filter (FL101), 3-ampere a-c fuse F101, switch S801, and FUNCTION switch S107 to terminals A and D of power receptacle J104. A pi-type filter, FL101, provides adequate filtering of each side of the line to prevent the entrance of noise and interference from external sources. Transformer T801 contains two separate primary windings to permit selection, by use of switch S801, of either 115-volt or 230-volt operation. For 115-volt operation S801 connects the two primary windings in parallel and for 230-volt operation, S801 connects the windings in series.

(2) The ends of the high voltage secondary (terminals 5 and 7) of transformer T801 are connected to the plates (pins 1 and 6) of rectifiers V801 and V802, respectively. The center tap of transformer T801 (terminal 6) is grounded. The tubes, V801 and V802, are connected as diodes in a full-wave rectifier circuit. Each cathode (pins 3 and 8) has a protective resistor between it and the common connection at J818 terminal 5. These resistors (R801, R802, R803 and R804) limit the maximum current of each diode. The low voltage secondary (terminals 8 and 10) of

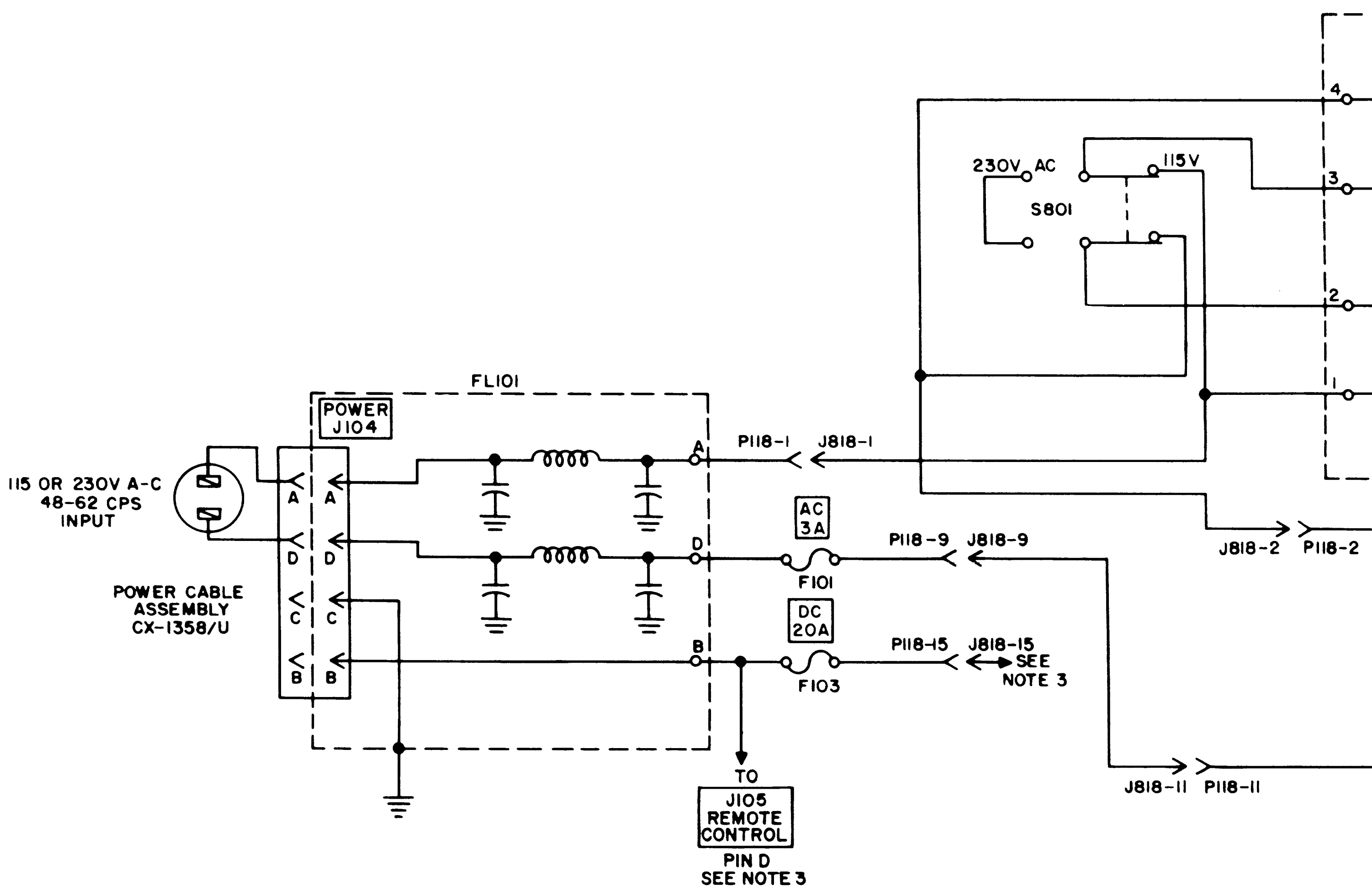
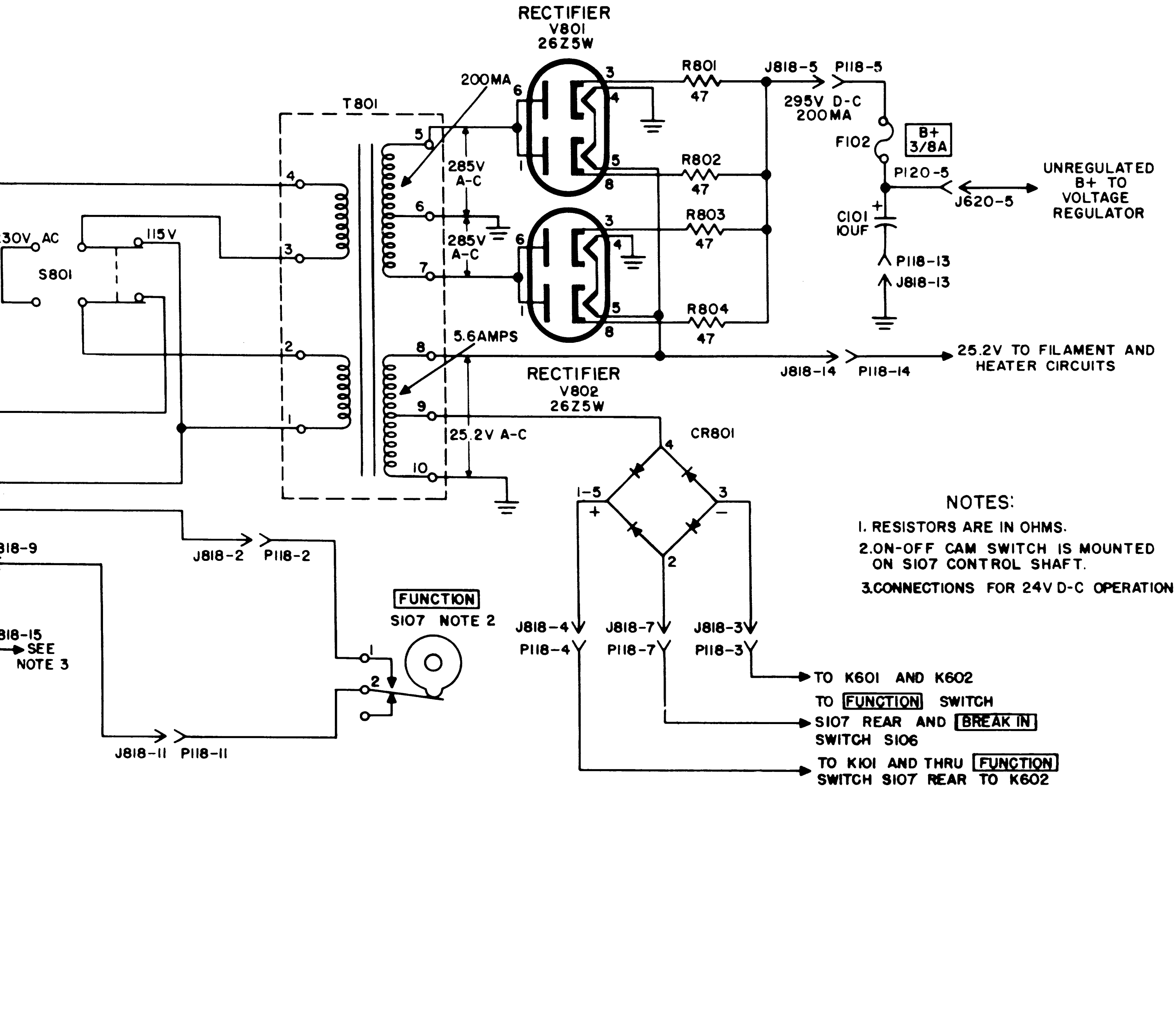


Figure 52. Power Supply PP-621/URR, schem



2. Power Supply PP-621/URR, schematic diagram.

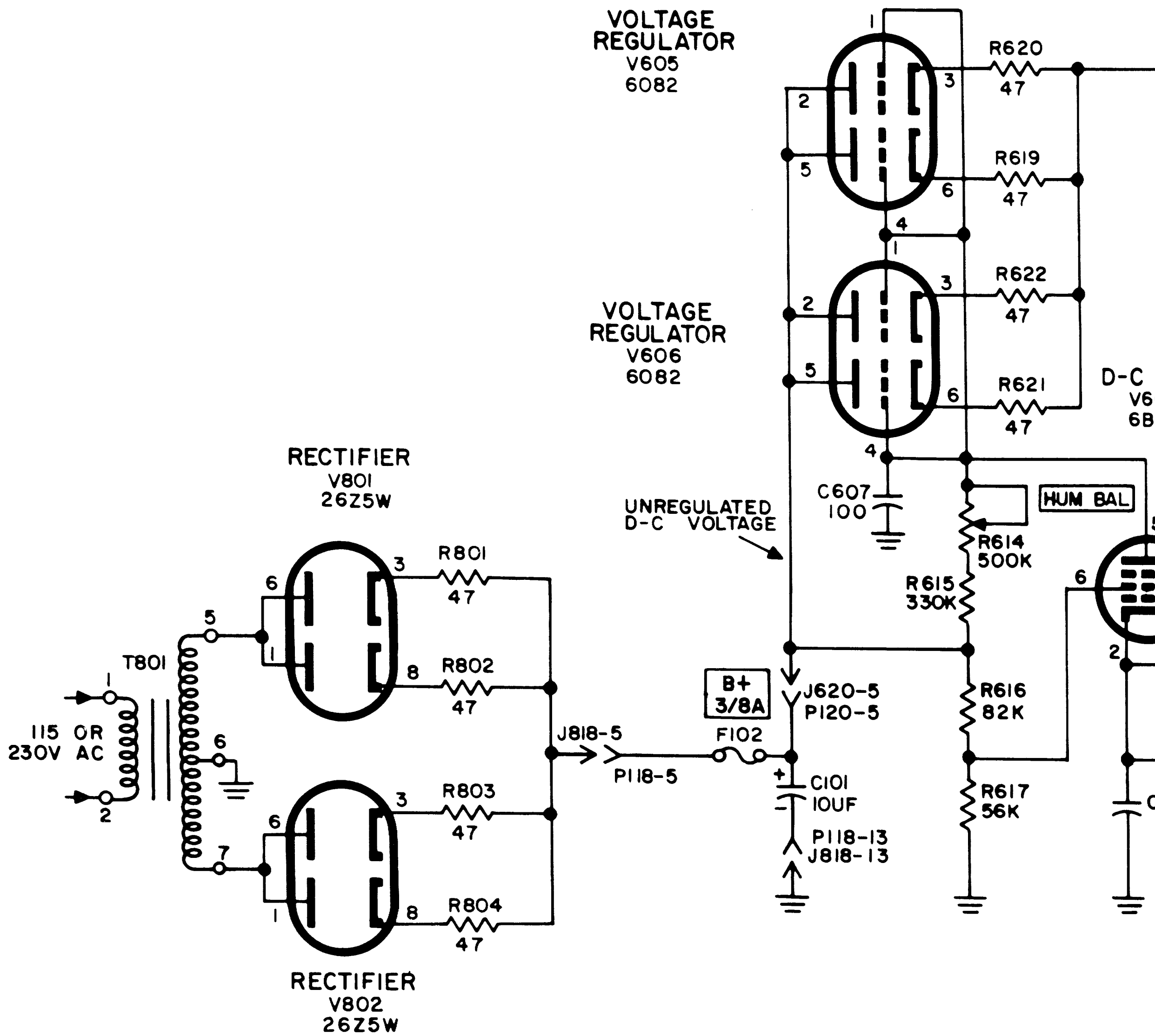


Figure 53. Volt

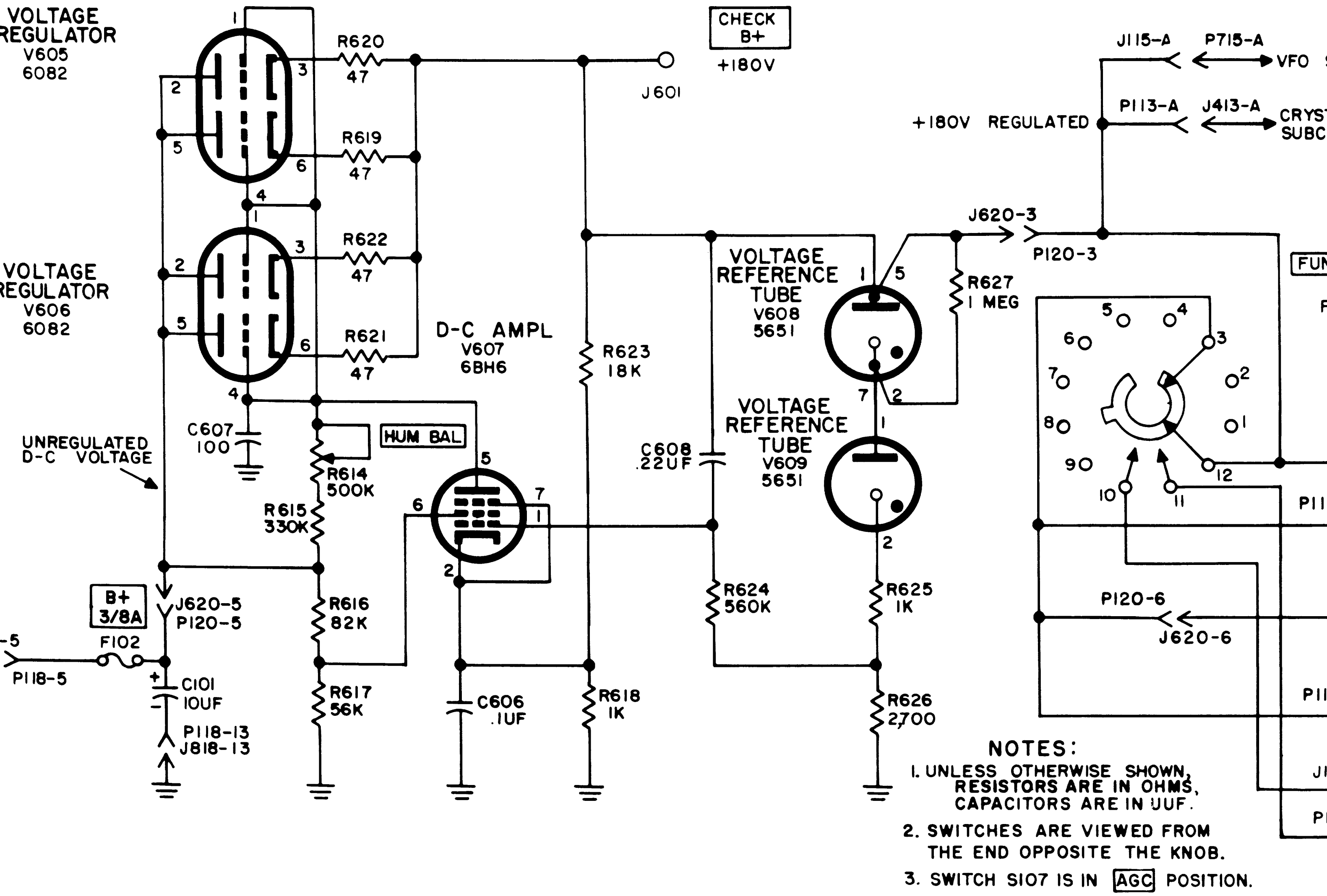
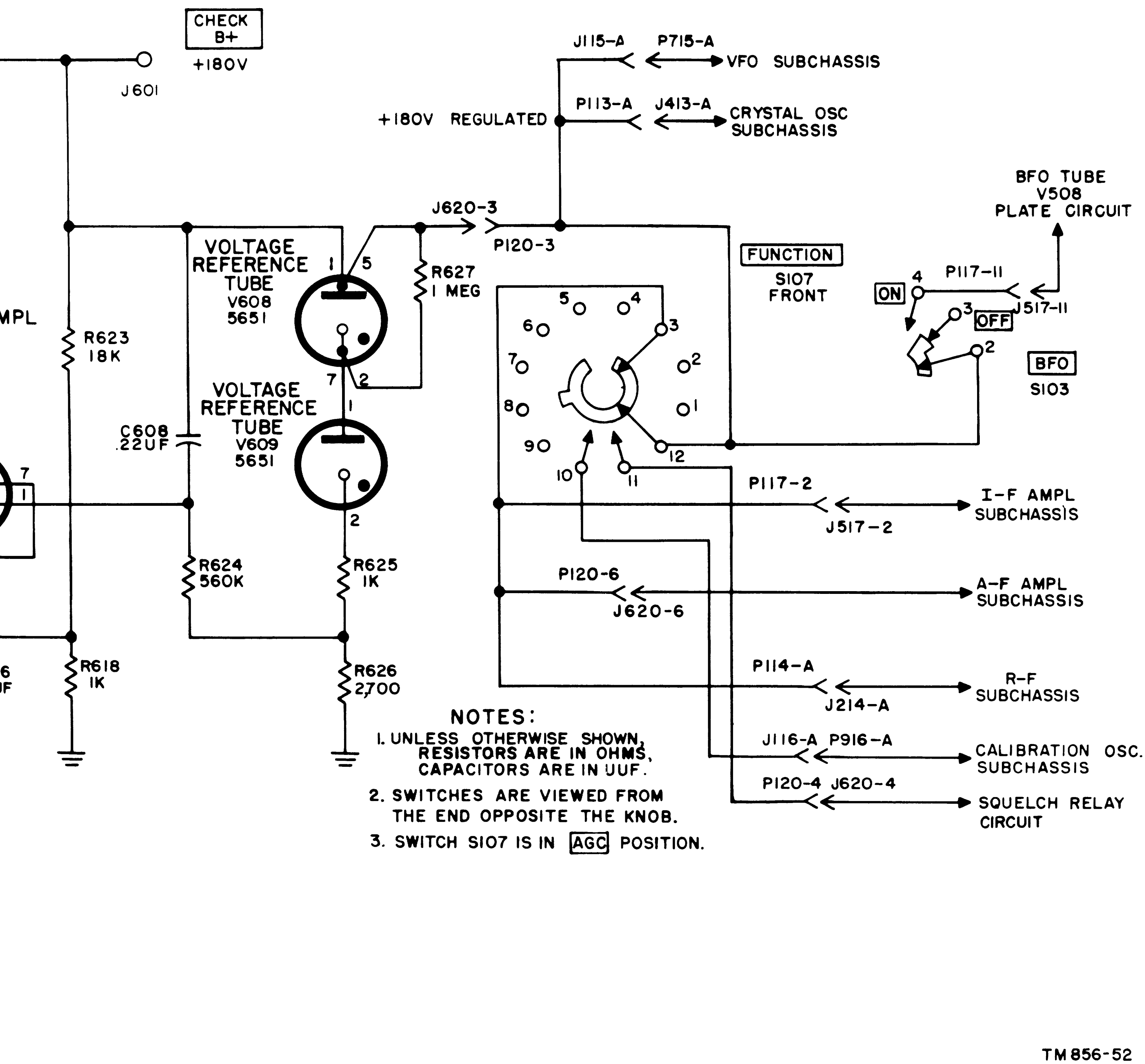


Figure 53. Voltage regulator circuit, schematic diagram.



e regulator circuit, schematic diagram.

T801 supplies 25.2 volts to the rectifier tube heaters, all remaining heaters, dial lamps, and oven heater circuits. A tap (terminal 9) on this winding provides 12 volts to a dry disc rectifier (CR801), the d-c output of which supplies 6 volts for operation of the antenna relay K101 and the break-in relay K602 through the FUNCTION and BREAK IN switches. The high voltage d-c output from the power supply is filtered by input capacitor C101 before being applied to the voltage regulator circuits.

b. Voltage Regulator (fig. 53). The function of the voltage regulator is to insure that the output voltage of Power Supply PP-621/URR remains constant, regardless of changes of load current drawn from Power Supply PP-621/URR or changes in the input voltage. The output from the power supply is fed to the voltage regulator through a 3/8-ampere fuse, F102. The voltage-regulator circuit includes the following: two dual-triode tubes, type 6082 (V605 and V606), which function as a variable series resistance to regulate the d-c output voltage; a miniature pentode tube, type 6BH6 (V607), which is a d-c amplifier to control the series resistance of V605 and V606 in accordance with voltage variations originating either in the power supply or in the receiver B+ load; and two cold-cathode tubes, type 5651 (V608 and V609), which provide a constant reference voltage for V607. The voltage regulator supplies a regulated 180 volts dc to the vfo and crystal oscillator subchassis, to the bfo stage when BFO switch S103 is set to ON, and, through FUNCTION switch S107, to the squelch circuit and to the i-f, a-f, r-f, and calibration oscillator circuits. The four plates of V605 and V606 (pins 2 and 5) are all tied together and connected directly to the unregulated dc; the four cathodes (pins 3 and 6) are connected in parallel by four resistors (R619 through R622), to balance the distribution of load current. The voltage appearing at the cathodes is determined by the voltage drop across the tube resistance, which is controlled by the bias appearing on the four parallel-connected grids. If either the unregulated voltage or the regulated voltage changes, V607 will convert the change into a comparative bias-voltage change, and the resistance of the series regulators will change in a direction to correct the initial change. A series circuit consisting of voltage reference tubes V608 and V609 and resistors R625 and R626 is connected across the voltage-regulated output circuit. Resistor R627 across V608 insures that both reference tubes receive proper starting voltage. A characteristic of these tubes is that the voltage drop across their terminals remains nearly constant in spite of changes in current. Therefore, any voltage variation that takes place across the series circuit appears across R625 and R626. The drop across R626 is applied, through resistor R624, to the control grid (pin 1) of V607, and amplified variations are produced across plate load resistors R614 and R615. Resistor R618, which is bypassed by C606, provides a fixed positive bias to the cathode (pin 2). These amplified voltage variations then are applied to the parallel-connected control grids of V605 and V606. The circuit operates in the following manner: If the d-c voltage at the control grid of V607 increases, because of an increase of current in the load, the voltage on the plate circuit will drop, producing a less positive voltage on the parallel-connected grids of V605 and V606, which increases the resistance of the tubes, and, consequently, the voltage drop across the tubes. Thus the output voltage from the cathode circuit of V605 and V606 will decrease by an amount equal to the positive bias fed to the d-c amplifier control grid. The reverse action will take place when the current in the load decreases. The action is automatic and produces a nearly constant output voltage. In addition to controlling voltage variations caused by changes in load, the voltage regulator serves to eliminate ripple and hum components that are not removed completely by the RC filter, and variations due to line-voltage changes. Compensation for 120-cps ripple is provided through capacitor C608, which applies the ripple voltage to the control grid (pin 1) of the d-c amplifier. The screen grid (pin 6) is connected, through a voltage divider (resistors R616 and R617), to the unregulated voltage ahead of the regulator tubes. Therefore the screen-grid voltage varies in phase with the control-grid voltage of the d-c amplifier. This increases the effectiveness of the amplifier in maintaining constant output

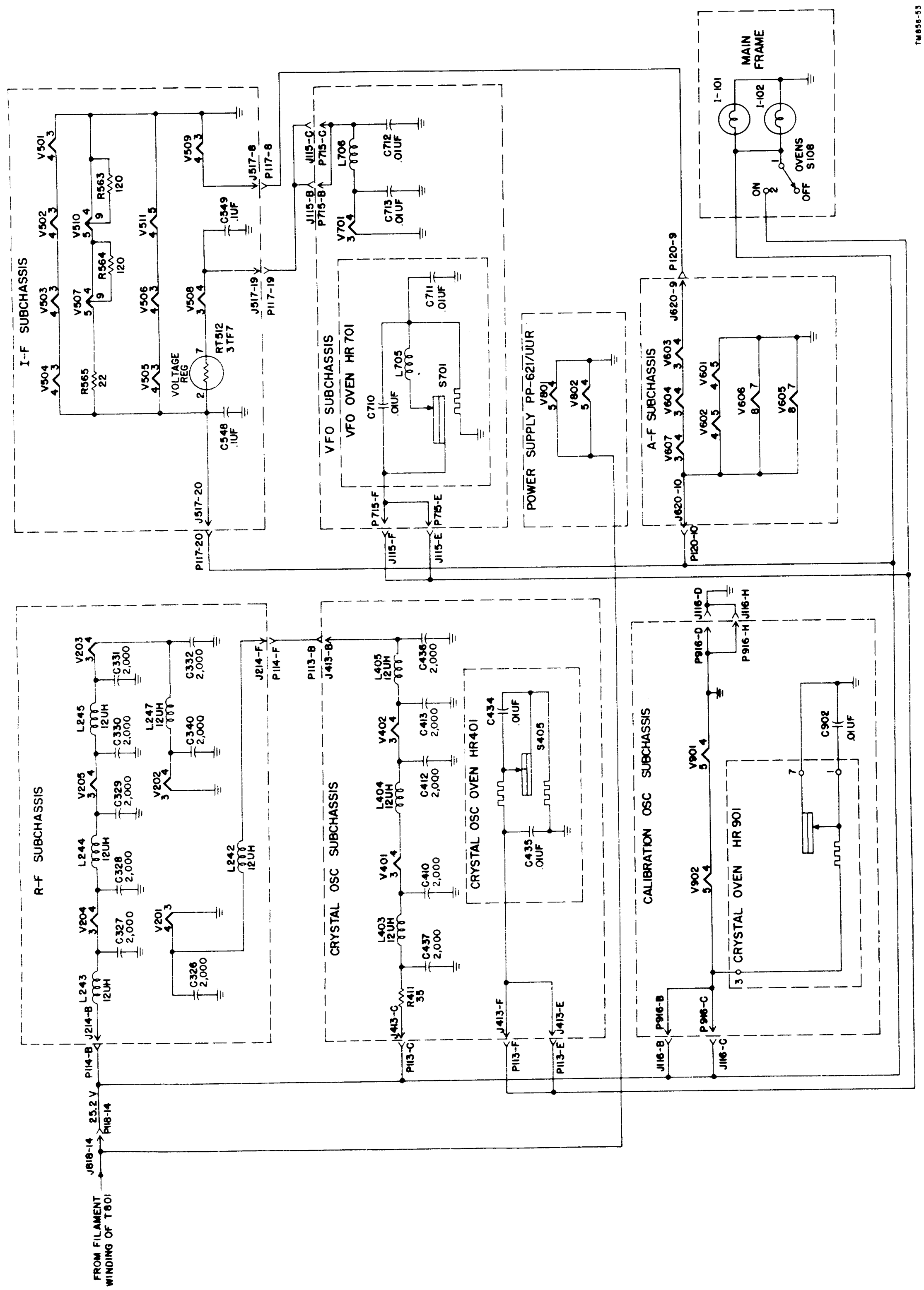


Figure 54. Filament and oven heater circuits, schematic diagram.

voltage. R614, HUM BAL control, is an adjustment for presetting the amount of the ripple voltage fed back to the control grids of V605 and V606 to minimize the hum in the output, and with R615 applies B+ to the plate of V607. Capacitor C606 adjusts the phase of the hum components of the cathode voltage to produce more complete hum cancellation in the output.

c. Filament and Oven Heater Circuits (fig. 54). Filament voltages of 6.3, 12.6, and 25.2 volts are required for the tubes in the receiver. Dial lamps I 101 and I 102 and filaments that require 25.2 volts are connected in parallel with the filament winding. The filaments requiring 6.3 or 12.6 volts are connected in series circuits. To prevent interstage coupling of high-frequency signals through the filament circuits, the following capacitor and choke coil combinations are used: L242 and C326; L243 and C327; L244, C328, and C329; L245, C330, and C331; L247, C332, and C340; L403, C437, and C410; L404 and C412; L405, C413, and C436; and L706, C712, and C713. Limiting resistor R411 limits the voltage across V401, V402, and V201 to 18 volts. To maintain constant heater voltage and thus stabilize the operation of the vfo tube (V701) and the bfo tube (V508), ballast tube 3TF7 is connected in series with the filaments of V701 and V508. 25.2 volts is applied to the crystal oscillator and the vfo oven when the OVENS switch S108 is set to ON, and to the calibration-oscillator oven at all times. The crystal-oscillator oven (HR401), the vfo oven (HR701) and the calibration oscillator oven (HR901) serve to further improve the stability of the vfo, the calibration-oscillator, and the crystal-oscillator circuits. The ovens are thermostatically controlled by thermostatic switches S405 and S701, in the crystal-oscillator and vfo oven circuits, respectively, and by the unmarked switch in the calibration-oscillator oven circuit. To prevent electrical interference due to arcing at the contacts of the thermostatic switches, capacitors C434, C435, C710 and C711, and coil L705 are connected across the contacts.

82. Function Switch S107 (fig. 55)

a. The FUNCTION switch performs simple switching operations which affect the entire operation of Radio Receiver R-391/URR. Each mode of operation and each stage is affected by the position of the segments of the front and rear sections of this switch. A thorough understanding of the switch is essential for successful trouble-shooting and maintenance.

b. Figure 55 shows the six positions of the FUNCTION switch. For clarification of its operation, only those circuits which are closed by the switch segments are identified. For example, although a jumper connects terminals 8 and 10 together and to ground, a ground connection is only shown to terminal 10 in the STANDBY position since, the segment does not contact terminal 8 in this position. The table below shows the circuits affected in each of the positions of the switch as related to the control knob indication. The primary power is applied to Power Supply PP-621/URR through a cam-operated switch section at the front of S107 in all positions except OFF. The following chart shows the completed contacts and circuits for the six positions of FUNCTION switch S107.

Position	Switch contacts shorted		Circuits
	Front	Rear	
OFF	None	None	Primary power is disconnected from the receiver (fig. 52).
STANDBY	None	9 to 10	Primary power is applied to the receiver (fig. 52). Terminal 2 of CR801 is grounded, applying 6 volts dc to antenna relay K101 grounding the antenna input at J107 and J108. +180 volts dc is removed from the r-f, i-f, and a-f stages.
AGC	12 to 3	1 to 2	+180 volts dc is applied to the r-f, and a-f stages. Agc voltage at contact 7 of S107 is not grounded. Ground is removed from terminal 2 of CR801 removing energizing voltage to antenna relay K101. Contacts 1 and 2 of S107 connect terminal 1 of CR801 and contact 8 of S106 to terminal 4 (coil) of break-in relay K602. Break-in operation is made available par. 83).

82*b* (contd)

Position	Switch contacts shorted		Circuits
	Front	Rear	
MGC	12 to 3	3 to 2	The conditions for MGC are the same as for AGC except the agc bus is grounded through contact 7.
CAL	12 to 3 12 to 10	8 to 9	+180 volts dc is applied to the r-f, i-f, a-f, and calibration oscillator stages. Terminal 2 of CR801 is grounded applying 6 volts dc to antenna relay K101 grounding the antenna input at J107 and J108.
SQUELCH	12 to 3 12 to 11	1 to 2 4 to 5	The conditions for SQUELCH are the same as for AGC except +180 volts dc is applied to the squelch tube V601. Carrier control circuit is made available (par. 83).

83. Control Circuits (fig. 56)

a. When using Radio Receiver R-391/URR in connection with a transmitter, it is necessary to disable certain receiver circuits during transmission to prevent damage and to silence the receiver. When FUNCTION switch S107 is set to STANDBY, segment 2 is across terminals 9 and 10 (fig. 56), and ground is applied to terminal 2 of rectifier CR801, thus antenna grounding relay K101 is energized. The movable contacts of this relay are connected to ground, therefore the contacts short circuit the antenna input at receptacle J107 or J108. No r-f energy can enter the input circuits of Radio Receiver R-391/URR. When FUNCTION switch S107 is at CAL position the r-f input is shorted to ground in the same manner as described above, except that segment 1 is across terminals 9 and 8. This prevents r-f signals from entering Radio Receiver R-391/URR to produce false beat notes with the output of the calibration oscillator. When FUNCTION switch S107 is at AGC, MGC, or SQUELCH, the coil of break-in relay K602 is in parallel with the coil of antenna grounding relay K101. By applying a ground connection, by means of auxiliary equipment, to terminals 9 of TB101 or B of REMOTE CONTROL jack J105 and by turning BREAK IN switch S106 to ON, segment 3 is across terminals 8 and 10, the antenna grounding relay K101 and break-in relay K602 are energized. The antenna input and audio output are short-circuited to ground. Thus Radio Receiver R-391/URR is disabled during the operation of a local transmitter if it is connected for remote operation. With the BREAK IN switch in the OFF position, line audio output is applied to terminals A and J of REMOTE CONTROL receptacle J105 to permit remote net operation. To permit carrier control operation, FUNCTION switch S107 must be set to SQUELCH (terminals 4 and 5 are connected), and BREAK IN switch is set to OFF (terminals 5 and 6 are connected). The carrier control line is terminated at K of REMOTE CONTROL jack J105. When BREAK IN switch S106 is at the ON position, the carrier control line terminating at K of REMOTE CONTROL jack J105 is disabled by opening the lead from contact 3 of relay K601.

b. Diode rectifier CR101 is used when Radio Receiver R-391/URR is connected in diversity systems (fig. 2). Its function prevents the agc circuits of the passive receiver from loading down the agc circuits of the controlling receiver and to further reduce the gain of the passive receiver by placing the agc voltage on its controlled stages. The crystal diode permits agc current flow in one direction only, thus the active set has agc control over the auxiliary equipment.

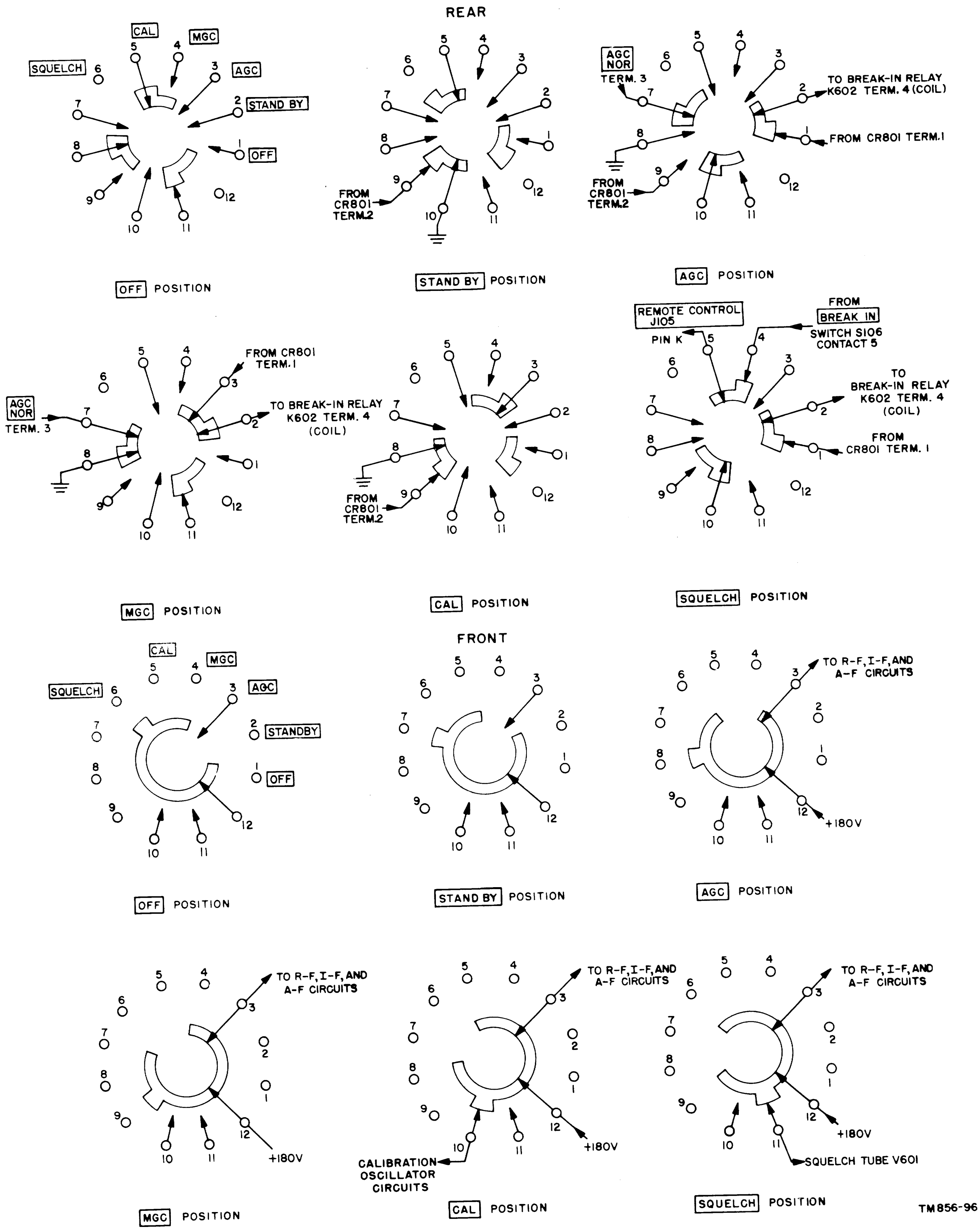


Figure 55. FUNCTION switch S107, schematic diagram.

Section III. ANALYSIS OF THE AUTOTUNE-DRIVEN MECHANICAL TUNING SYSTEM

84. General Principles of Operation (fig. 57)

a. The Autotune-driven mechanical tuning system of Radio Receiver R-391/URR controls the permeability-tuning and switching elements to provide continuous tuning of the receiver over a range of .5 to 32 mc, in 32 steps (bands). Each band is tuned over a range of 1 mc except for the first band, which is tuned from .5 to 1 mc. The frequency selected is indicated on a counter-type dial, which shows the frequency in kilocycles. Figure 57 shows a simplified block diagram of the tuning system.

b. Operation of the Autotune-driven MEGACYCLE CHANGE knob is limited to approximately ten turns by its multiturn positioning head. As the positioning head rotates, the first variable i-f frequency is varied from 9 to 18 mc for the frequency range of .5 to 8 mc. (On the other ranges, although the slug (tuning-core) racks are moved, this circuit is disabled.) At the same time, the switches in the first and second crystal oscillators are rotated through 32 positions. The r-f band switch is operated, by rotation of the megacycle-change multiturn positioning head, through a Geneva system and an overtravel coupler. In addition, the starting point from which a given slug rack is moved by the kilocycle-change multiturn positioning head is established, through a differential, by the megacycle-change multiturn positioning head. The slug racks thus affected are those controlling the ranges 16 to 32 mc, 8 to 16 mc, 4 to 8 mc, and 2 to 4 mc.

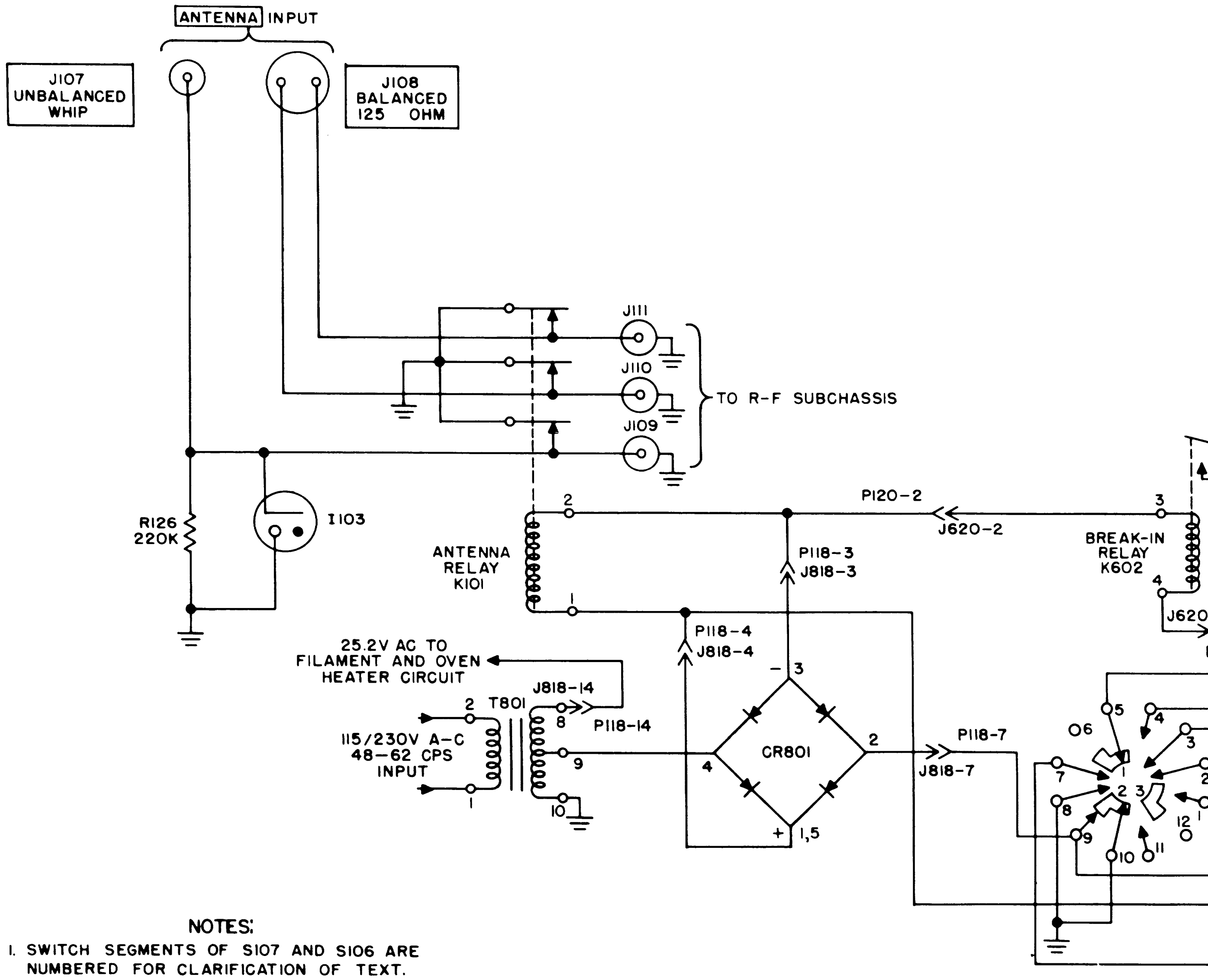
c. The Autotune-driven KILOCYCLE CHANGE knob is connected directly through its positioning head, to the vfo and, through the gear train, to the first variable i-f can rack, and the antenna, r-f amplifier, and second variable i-f slug racks. The KILOCYCLE CHANGE knob also is connected to the same differential as the MEGACYCLE CHANGE knob to provide movement of the slug rack in the four bands mentioned in subparagraph *b* above from the starting point established by the MEGACYCLE CHANGE knob. A ZERO ADJ. knob on the front panel permits correction, over a small range, between the kilocycle reading on the counter and the mechanical and electrical tuning system.

85. Functional Analysis

a. It is not intended to give a detailed analysis of the mechanical design considerations involved in developing the tuning system, but rather, to provide suitable information to promote a general conception of its functioning by the repairman who might be faced with the problem of making repairs or adjustments. A careful study of the material in paragraph 119 relating to mechanical alinement should be made in connection with the following analysis. Figure 58 shows a more detailed block diagram of the Autotune-driven mechanical tuning system. As discussed in the theory paragraphs covering the antenna, r-f, and variable i-f circuits, the rate at which the frequency-determining elements of each stage must be changed varies. For example, to cover the .5- to 1-mc band in the r-f stages requires the movement of slugs in coils of T201, Z201, Z207, and Z213 from one extreme to the other, or a distance of approximately 1 inch. However, the slugs in coils Z219, Z220, and Z221 move less than 1/8 inch in covering this range. Therefore it is necessary to achieve these various lengths of travel by mechanical gearing, under the control of a single multiturn positioning head.

b. Reference to the block diagram (fig. 58) will show which of the circuits are controlled by each of the two positioning heads. Starting at the right-hand side of the drawing, it can be seen that the kilocycle-change multiturn positioning head varies the position of the variable-frequency-oscillator slug, the second variable i-f slug rack, the first variable i-f can rack, the r-f slug rack covering the .5- to 1-mc range, and the r-f slug rack covering the 1- to 2-mc range.

c. The megacycle-change multiturn positioning head through the Geneva system and over travel coupler, varies the positions of switches



NOTES:

1. SWITCH SEGMENTS OF S107 AND S106 ARE NUMBERED FOR CLARIFICATION OF TEXT.
2. SWITCHES ARE VIEWED FROM THE END OPPOSITE THE KNOB.
3. SWITCH S107 SHOWN IN STAND BY POSITION.
4. SWITCH S106 SHOWN IN OFF POSITION.

Figure 56. Break-in

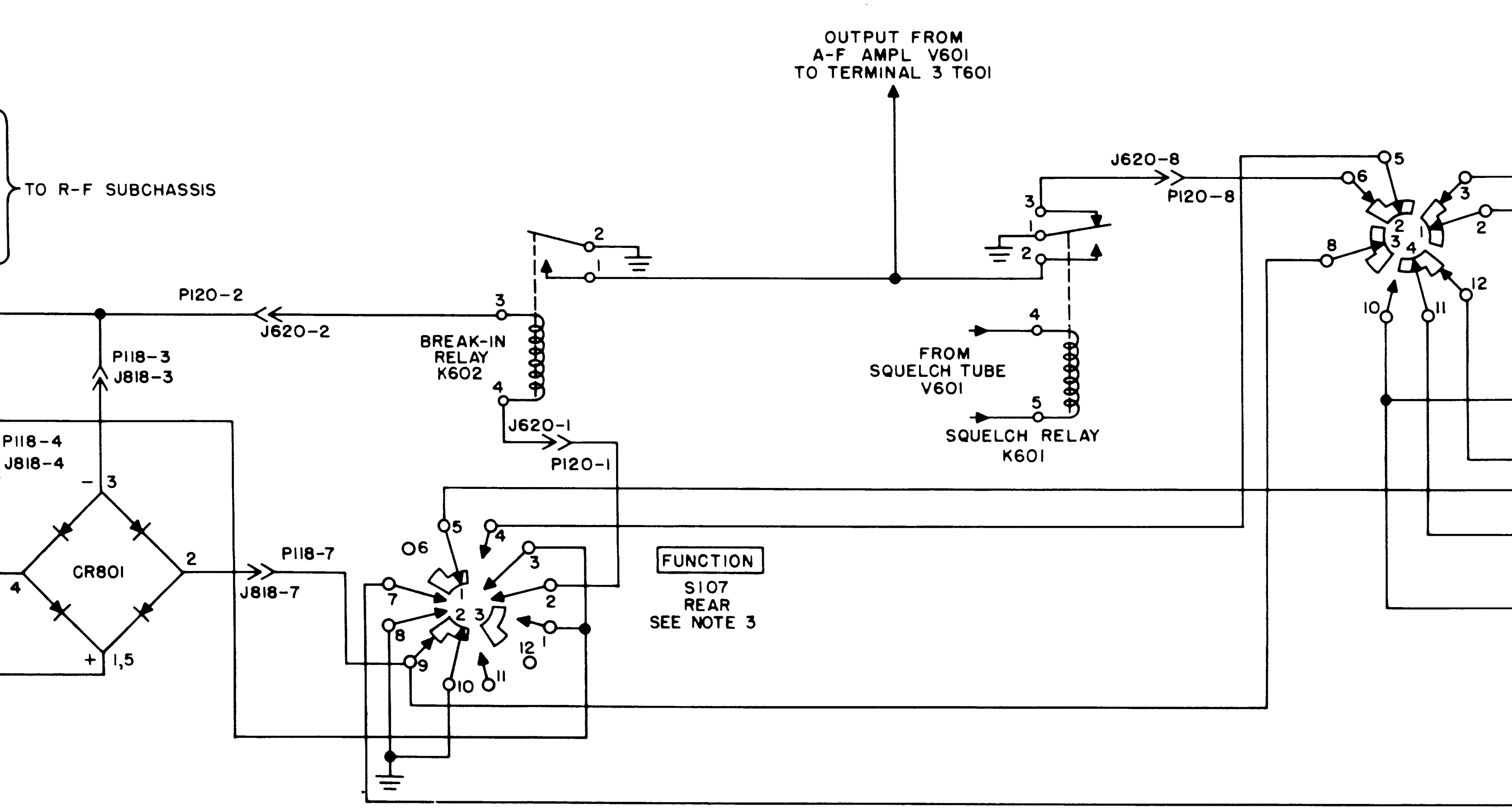
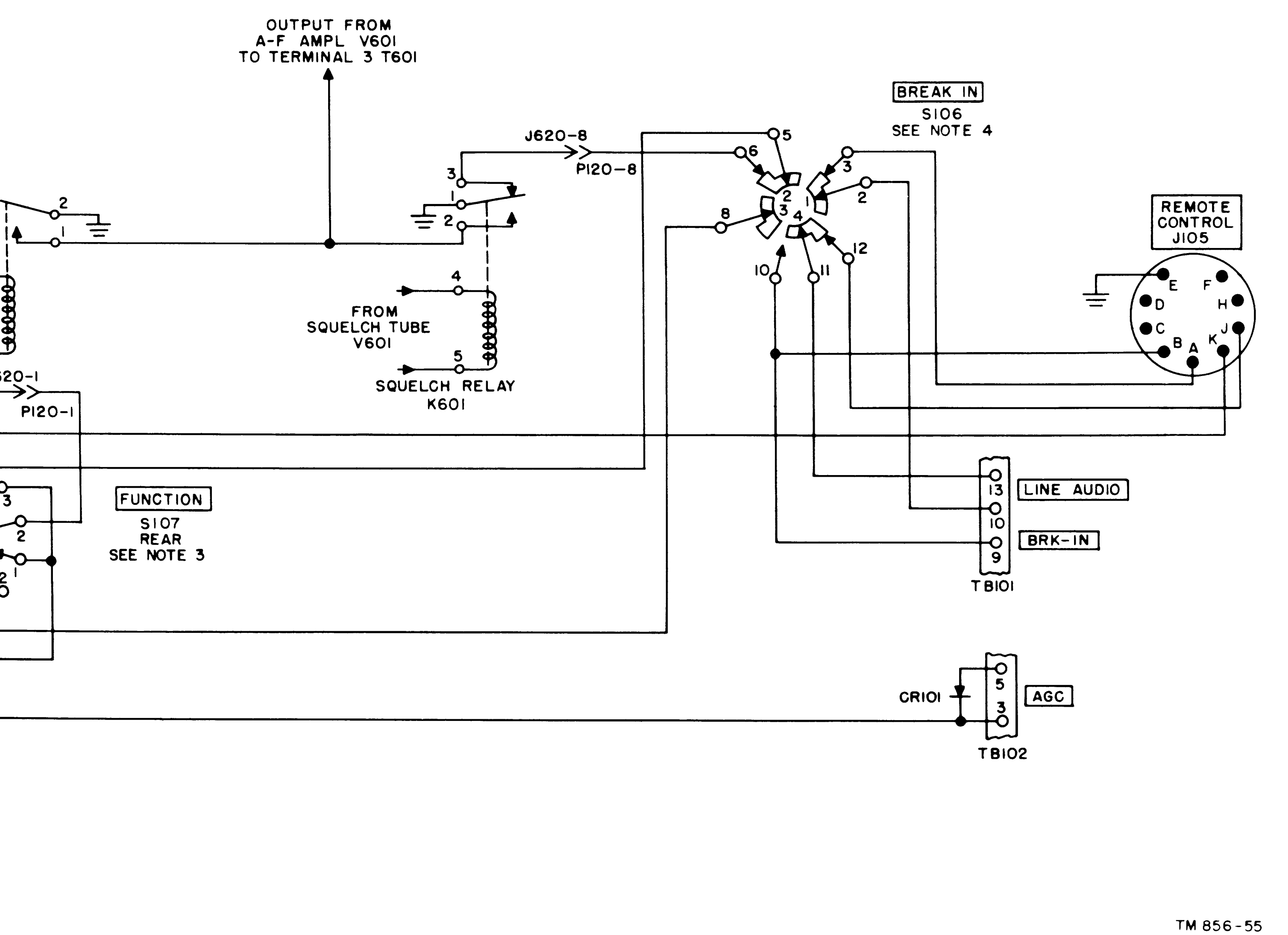


Figure 56. Break-in circuit, functional diagram.



-in circuit, functional diagram.

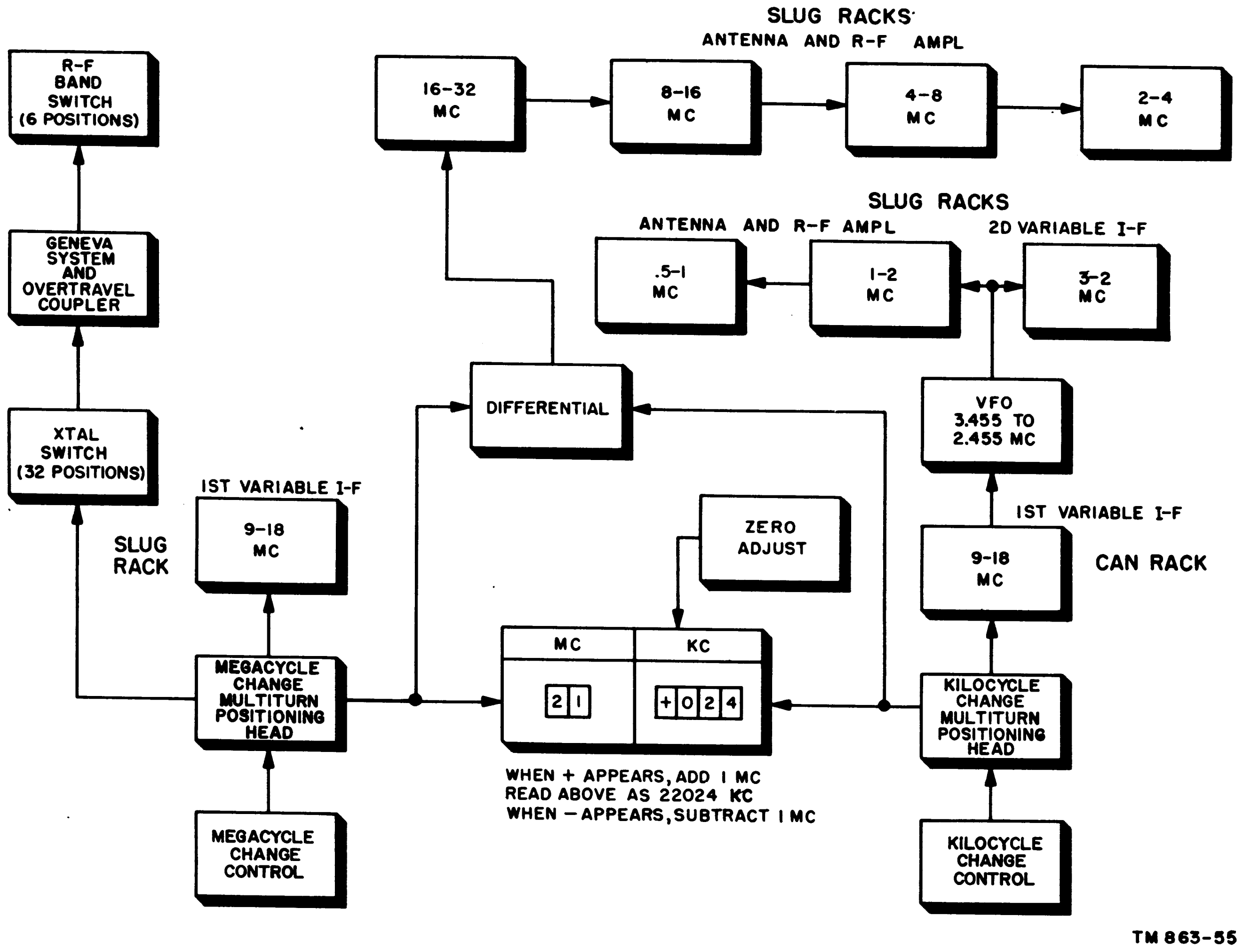


Figure 57. Tuning system, mechanical block diagram.

S201 through S210. This head also selects the proper crystal frequency for the first and second crystal oscillator stages, by operating the 32-position switch through a system of gears. The megacycle-change multiturn positioning head rotates switches S401 through S404 in the first and second crystal oscillators through 32 steps of frequency coverage. These 32 steps are covered by only 6 transformers or coils, for each stage. Since each set of coils has a frequency ratio of 2 to 1, it is necessary to have the positions of the switches change only 6 times for 32 steps of frequency coverage. This is accomplished by a lost-motion coupler; a gear large enough to have many teeth but from which most of the teeth have been removed except a few which are approximately geometrically spaced around the perimeter of the gear. A driven gear associated with this gear will rotate only when it is engaged by one of the teeth on the lost-motion gear. The megacycle-change multiturn positioning head also influences, through the differential, the point at which the motion imparted by the kilocycle-change multiturn positioning head begins. The first variable i-f slug rack is driven by the megacycle-change multiturn positioning head. The first variable i-f cans are mounted on a rack which is driven by the kilocycle-change multiturn positioning head, as required, to keep these circuits in alinement during tuning.

d. The megacycle-change multiturn positioning head drives switch S205. The front section of the switch is used to short-circuit the secondary winding of the unused adjacent antenna transformer (next lower in frequency) to prevent interaction with the one being used. The chart below indicates the winding in use and the corresponding winding which is short-circuited for each of the six positions of S205.

Secondary winding in use	Secondary winding shorted	Switch position
L202	L206	1
L204	L202	2
L206	L204	3
L208	L206	4
L210	L208	5
L212	L210	6

e. During discussion of the antenna and r-f circuits (par. 54) a reference was made to the relationship between the trimmer-capacitor sections (A and B) of C225. A section of switch S203 selects the proper capacitor for tuning out the reactance reflected into the secondaries of the antenna transformer. The chart below shows the capacitor or capacitors connected for each position of the switch.

Position	C225 Section A	C225 Section B
1	in	in
2	in	in
3	in	out
4	in	out
5	out	in
6	out	in

f. Upon inspection of the various gears employed, note that each gear in the Geneva system actually is composed of two gears which are adjacent to each other and are loaded by a spring in opposite directions. This is done to achieve a constant tension at the point where the gear is driven or at which it drives an associated gear. In this manner, lost motion, or backlash, as a result of play between the gear teeth, is prevented. All gears and cams employed are precision-cut, and are designed to give many years of trouble-free service.

g. The calibration oscillator is not a part of the tuning system. It provides calibration signals which are used in correcting for small errors in tuning made by the mechanical tuning system. By the use of the proper calibration signal and the ZERO ADJ. control, the receiver counter reading can be made to coincide with the frequency of the received signal.

h. The ZERO ADJ. knob, which is used when correcting dial calibration, actually controls a friction clutch which permits tuning over a small range (about 6 kc) on either side of the counter reading without moving the frequency indicator.

86. Detailed Analysis (fig. 59)

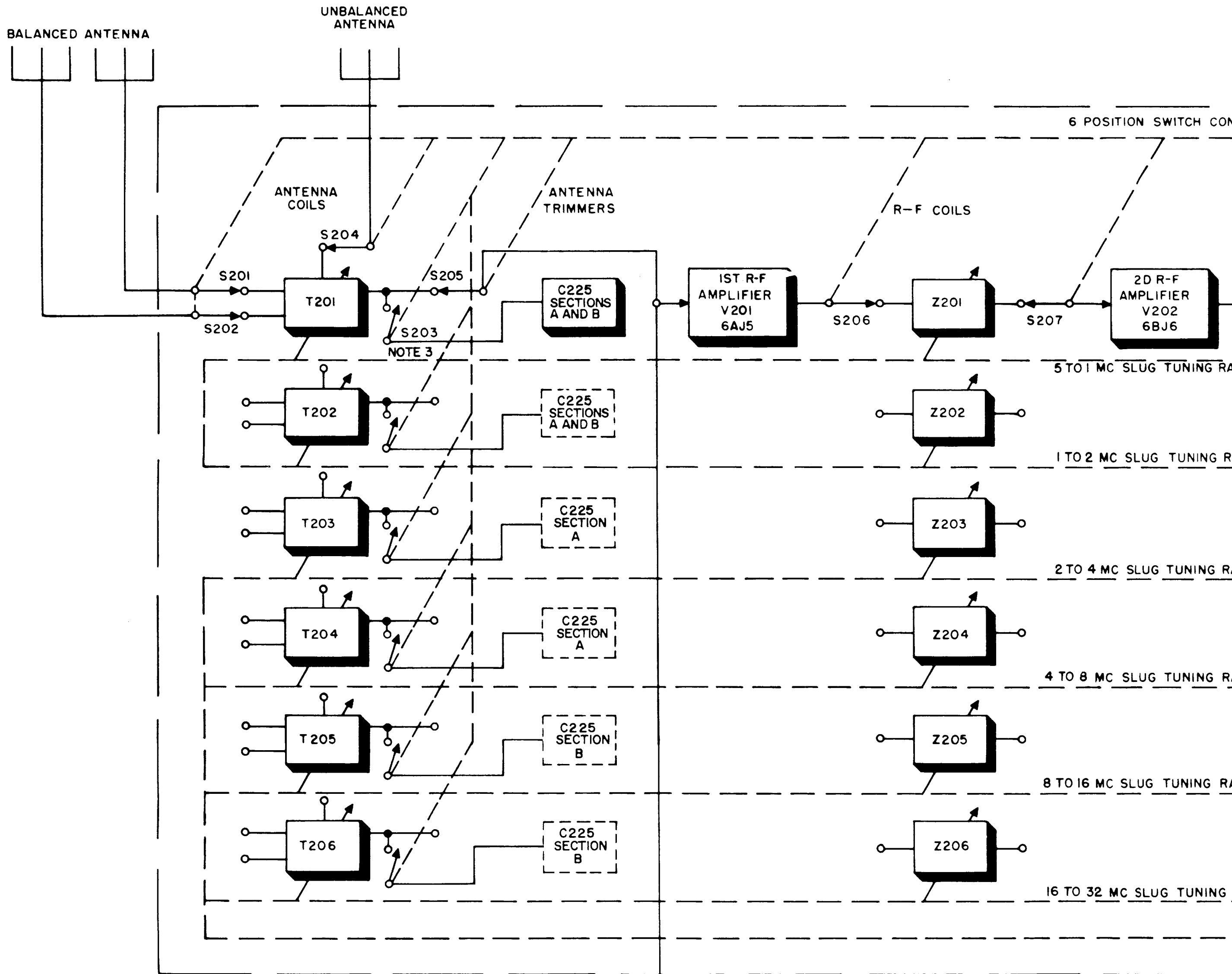
a. General. To facilitate an understanding of the function and interrelation of the components of the mechanical gearing system and the electrical tuning system, the gears in figure 59 have been given letter designations as well as the number of teeth in each gear. The cams which operate the slug racks are shown as single units. To achieve stable operation, each slug rack has a roller at both ends and identical cams mounted on each end of the cam shafts.

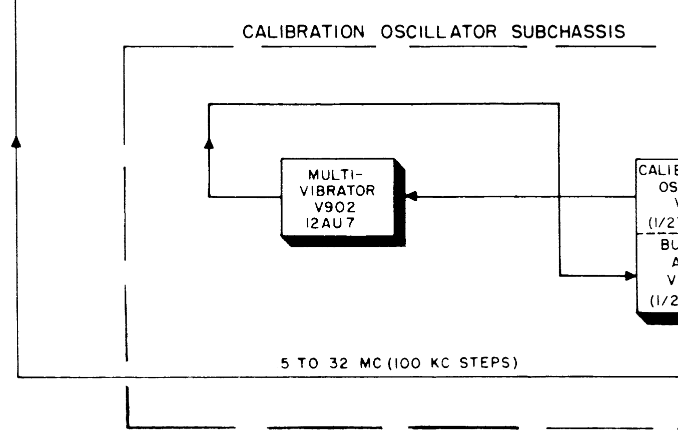
b. Megacycle Change Control.

(1) As the Autotune-driven MEGACYCLE CHANGE control turns, it is limited to 10½ turns by its multiturn positioning head. The mc counter wheels show the frequency band or step selected by the Autotune-driven MEGACYCLE CHANGE control. As the control is rotated, the wheels are driven through gears (A), (B), (C), (D), (E), (F), (RR), (SS), (TT), (UU), (VV), (WW), and (XX).

(2) The control operates the first variable i-f slug-rack cam through gears (A), (B), (C), (D), (E), (F), and (G). At the same time, the 32 position crystal oscillator switches are operated by the control through gears (A), (B), (C), (D), (E), an Oldham coupler, gears (H) and (J). The Oldham coupler is used to correct slight misalinement between the ends of the shafts which are mechanically coupled at the crystal oscillator subchassis.

(3) The 6-position r-f band switches are also operated by the Autotune-driven MEGACYCLE CHANGE control through gears (A), (B), (C), (D), (E), (K), the Geneva system (L), gears (M), (N), and (P). The Geneva system provides an intermittent motion so that the switch is turned to only one of its six positions. The gear (L) rotates continuously as the control is turned. However, the gears (M), (N), and (P) are driven only during the part of the rotation of the gear (L) when the teeth of lost motion gear (GGG) engage the teeth of the gear (M).





NOTES:

1. APPLICABLE TO ALL BANDS EXCEPT .5 TO IMC BAND. ON .5 TO IMC BAND FREQUENCY RANGE IS 2.5-2MC.
2. REFER TO THE TEXT FOR CHART SHOWING FREQUENCY FOR EACH BAND SETTING OF THE RECEIVER.
3. VARIABLE CAPACITOR C225, SECTIONS A AND B IS APPLIED THROUGH S203 AS FOLLOWS:
   - BANDS I AND 2 – BOTH SECTIONS,
   - BANDS 3 AND 4 – SECTION A ONLY,
   - BANDS 5 AND 6 – SECTION B ONLY.

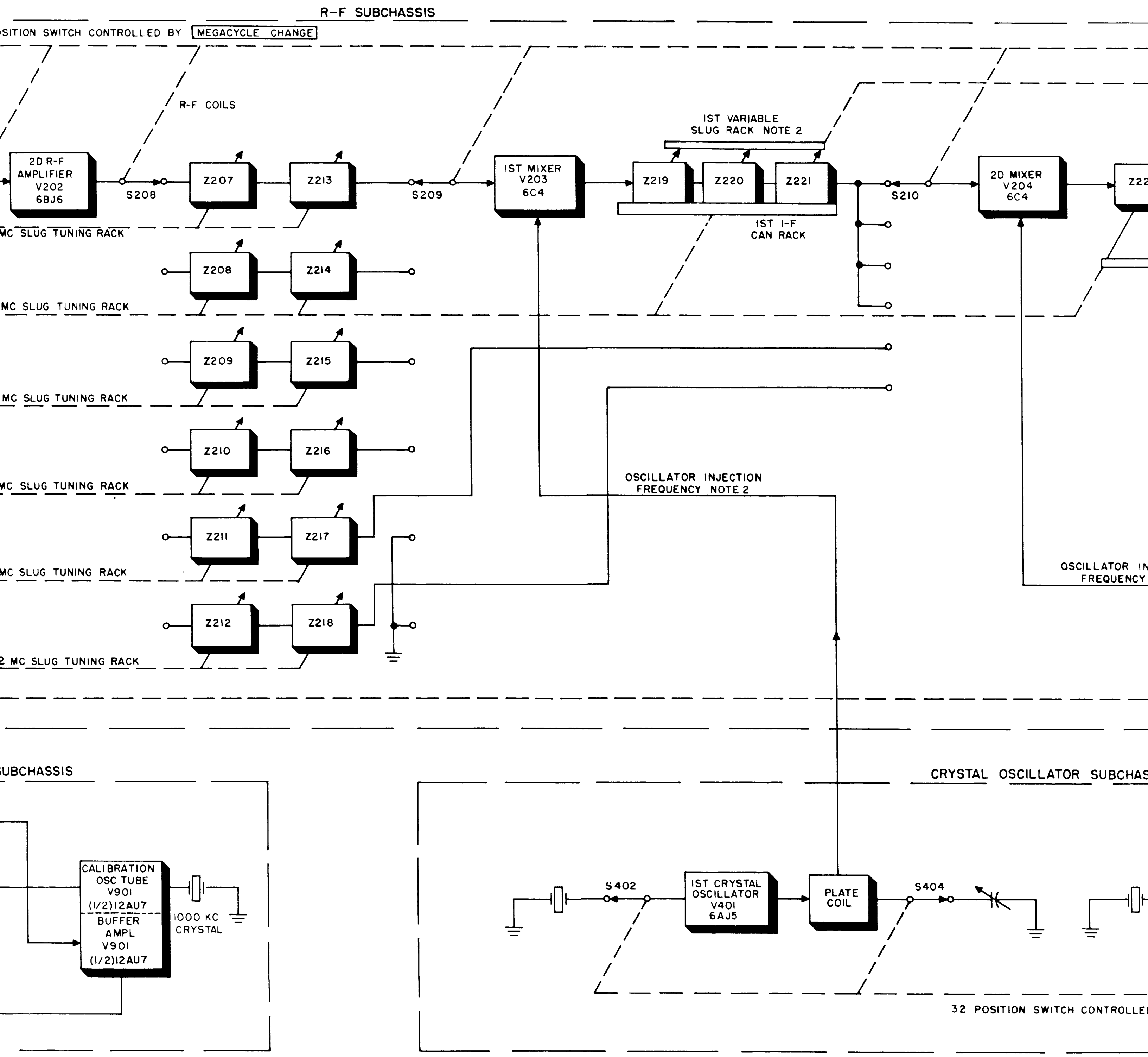
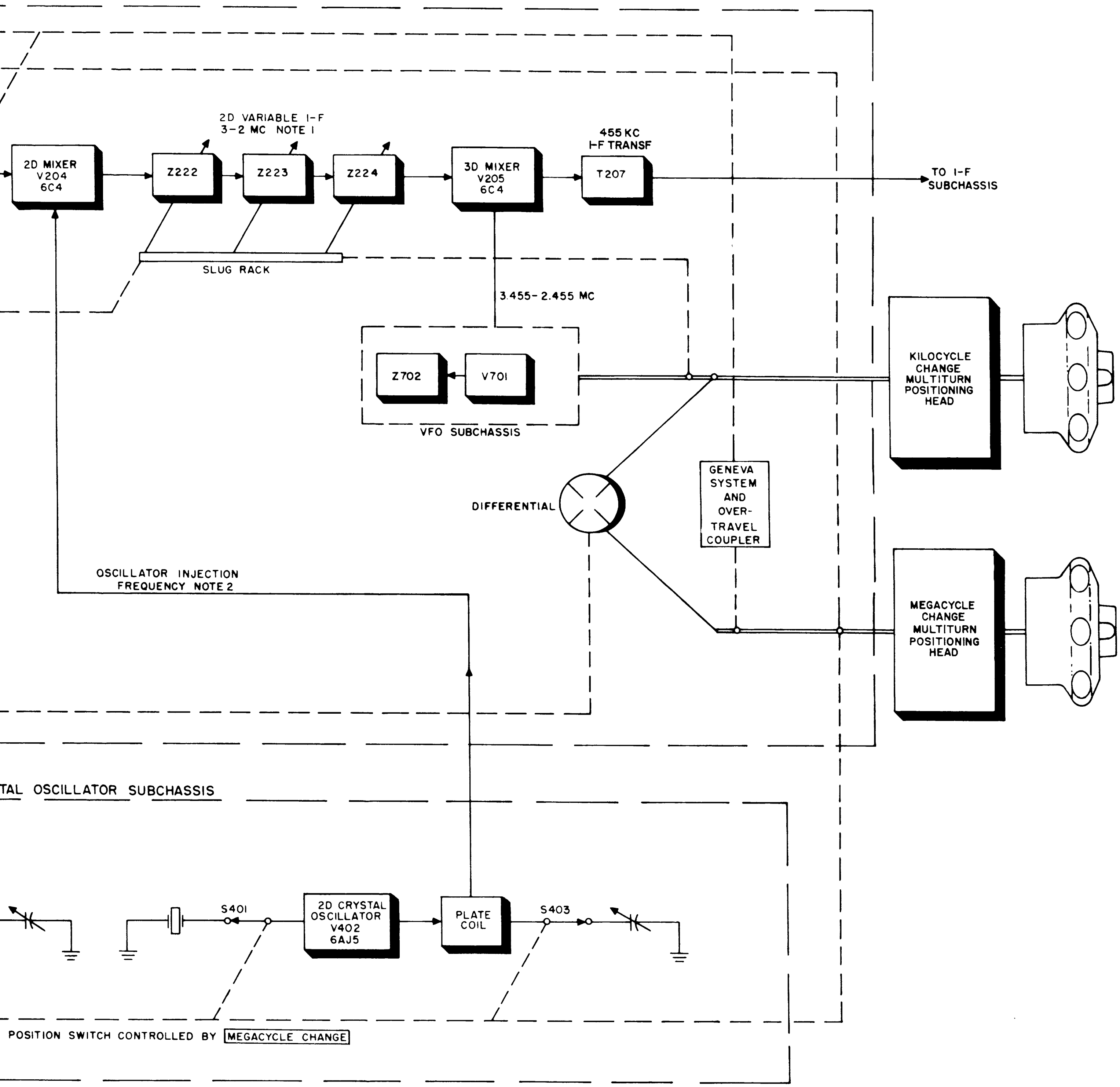


Figure 58. Tuning system, with associated stages, block diagram.



2D VARIABLE I-F
3-2 MC NOTE I
455 KC
I-F TRANSF
2D MIXER
V204
6C4
Z222
Z223
Z224
3D MIXER
V205
6C4
T207
TO I-F
SUBCHASSIS
SLUG RACK
3.455-2.455 MC
Z702
V701
VFO SUBCHASSIS
KILOCYCLE
CHANGE
MULTITURN
POSITIONING
HEAD
GENEVA
SYSTEM
AND
OVER-
TRAVEL
COUPLER
DIFFERENTIAL
MEGACYCLE
CHANGE
MULTITURN
POSITIONING
HEAD
OSCILLATOR INJECTION
FREQUENCY NOTE 2
TAL OSCILLATOR SUBCHASSIS
S401
2D CRYSTAL
OSCILLATOR
V402
6AJ5
PLATE
COIL
S403
POSITION SWITCH CONTROLLED BY MEGACYCLE CHANGE

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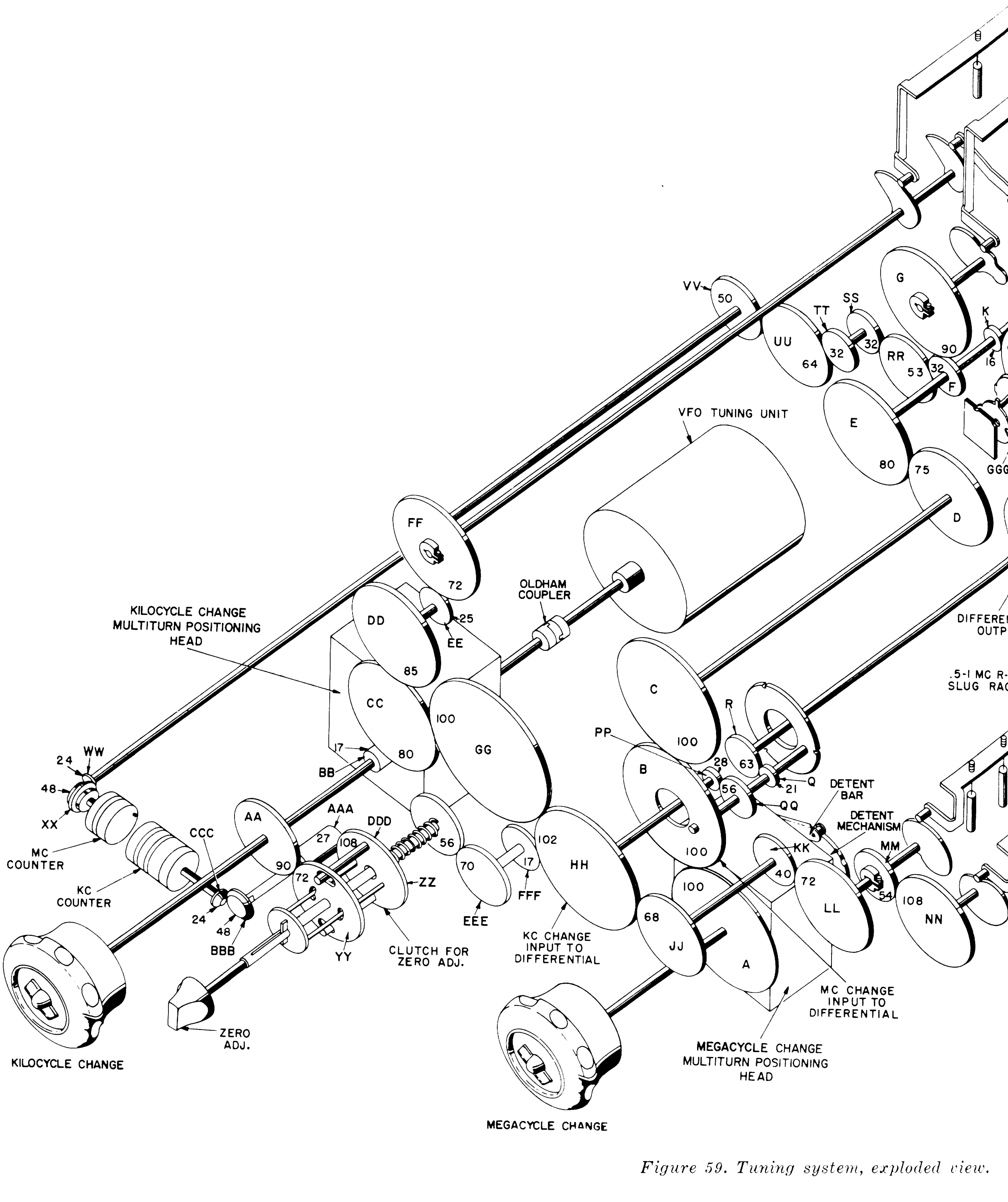

Figure 59. Tuning system, exploded view.

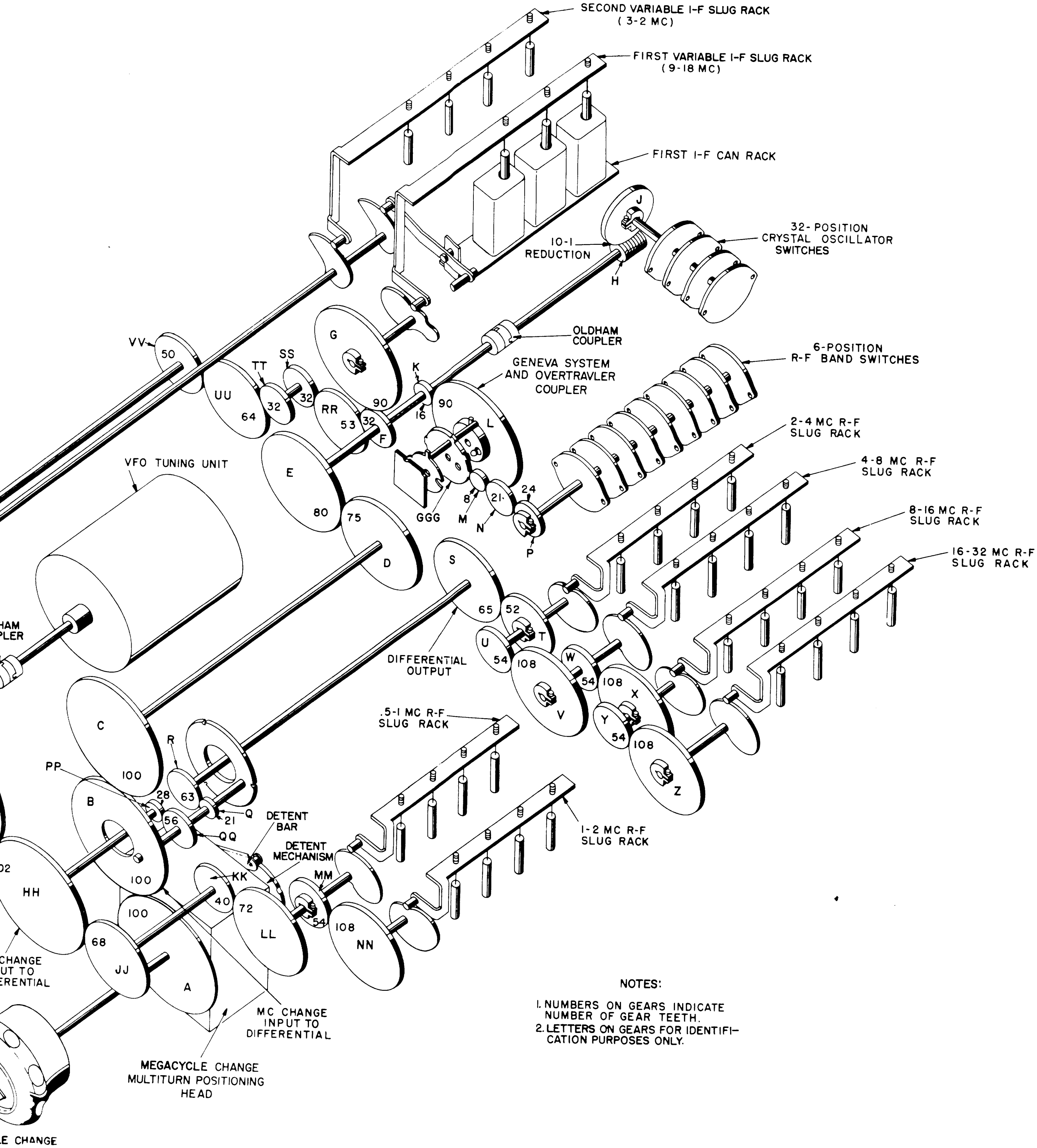

Figure 59. Tuning system, exploded view.

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(4) The 2-4 mc, 4-8 mc, 8-16 mc, and 16-32 mc r-f slug racks are moved by both the Autotune-driven MEGACYCLE CHANGE and KILOCYCLE CHANGE controls through a differential gear system. The 2-4 mc r-f slug rack cam is operated by the Autotune-driven MEGACYCLE CHANGE control through gears (A), (B), (Q), (R), (S), and (T). The 4-8 mc slug rack cam is operated through gears (A), (B), (Q), (R), (S), (T), (U), and (V). The 8-16 mc r-f slug rack cam is rotated through gears (A), (B), (Q), (R), (S), (T), (U), (V), (W), and (X). The 16-32 mc r-f slug rack cam is turned through gears (A), (B), (Q), (R), (S), (T), (U), (V), (W), (X), (Y), and (Z).

(5) In each of the steps of frequency coverage, it is necessary to have an exact reference or stopping position for the circuit elements controlled by the Autotune-driven MEGACYCLE CHANGE. This is accomplished by the detent bar and the detent mechanism. The detent mechanism has three equally spaced notches around its edges (fig. 63). The detent mechanism is rotated by the megacycle-change multiturn positioning head and the detent bar provides an effective stop at each notch.

c. Kilocycle Change Control.

(1) The KILOCYCLE CHANGE control is limited to 10½ turns by its multiturn positioning head. The kc counter wheels show the frequency selected by the Autotune-driven KILOCYCLE CHANGE control. To permit overlapping of each band selected, the frequency range of this control is greater than 1 mc. As the Autotune-driven KILOCYCLE CHANGE control is rotated, the wheels are driven through gears (AA), (YY), (ZZ), (AAA), (BBB), and (CCC).

(2) The vfo tuning unit is connected through an Oldham coupler to the Autotune-driven KILOCYCLE CHANGE control.

(3) As the Autotune-driven KILOCYCLE CHANGE control is rotated, the second variable i-f slug rack cam and the first variable i-f can rack cam are operated through gears (BB), (CC), (DD), (EE), and (FF).

(4) The 2-4 mc, 4-8 mc, 8-16 mc, and 16-32 mc r-f slug racks are moved by the Autotune-driven KILOCYCLE CHANGE control through a differential gear system. The r-f slug rack cams mentioned above are operated through the same gears mentioned in *b*(4) above except for gears (A) and (B). These two gears are replaced by gears (BB), (CC), (GG), (HH), (PP), and (QQ).

(5) The .5-1 mc r-f slug rack cam is operated through gears (BB), (CC), (GG), (HH), (JJ), (KK), and (LL). The 1-2 mc r-f slug rack cam is operated through gears (BB), (CC), (GG), (HH), (JJ), (KK), (LL), (MM), and (NN).

(6) The gear (EEE) is shown engaged with the gear (HH) through the gear (FFF). The gear (EEE) does not normally engage gear (DDD) but during disassembly and reassembly procedures, it prevents loss of synchronization between the Autotune-driven KILOCYCLE CHANGE control and the Autotune-driven MEGACYCLE CHANGE control through the differential to the 2-4 mc, 4-8 mc, 8-16 mc and 16-32 mc slug racks. One side of the gear (EEE) is covered with green paint. When the green is visible, the synchronization is locked.

d. ZERO ADJ. Control. The ZERO ADJ. control provides a means of correcting errors in calibration. A locking screw operated by the knob releases the clutch and locks the gear (ZZ). Tuning over a range of approximately 6 kilocycles is possible without moving the three right hand number wheels on the counter type frequency indicator. Operation of the knob in a counterclockwise direction engages the clutch and unlocks the gear (ZZ).

e. Multiturn Positioning Heads. The multiturn positioning heads are designed to tune to any one of eight previously selected frequency channels. Since the frequency for a given channel can be in the same megacycle step or band or in some megacycle step at any point within the range of the receiver, both the MEGACYCLE CHANGE and the KILOCYCLE CHANGE controls must be operated by the autotune system. Therefore, two positioning heads are used. When a channel is selected, both heads operate simultaneously until the designated stops on both are reached.

87. General Analysis of Autotune System

a. The Autotune system consists of four major parts: an Autotune drive motor, a control mechanism, two positioning mechanisms, and a system of gears and shafts mounted on a common casting. The control and positioning mechanisms (heads) are driven through worm gears on a common drive shaft, which is driven through four spur gears by the Autotune motor, B101, as shown in figure 88.

b. The control head, shown in figures 60 and 61, controls the rotation of the Autotune motor. When a channel is selected, the control head causes the Autotune motor to rotate in a counterclockwise direction until a position corresponding to the channel selected is reached by cam drums in the two positioning heads. The control head then causes the motor to reverse its direction of rotation until stopping drums and counter drums in the positioning heads have reached a position which corresponds to the preselected frequency on that channel. The control head then shuts off the motor until the next channel selection is made.

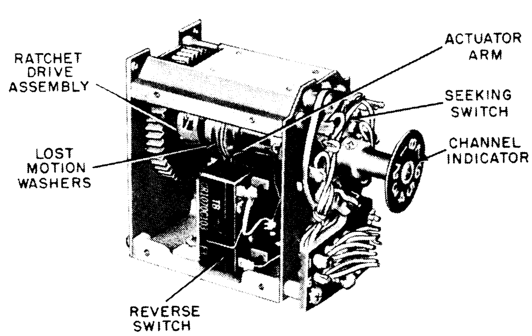


Figure 60. Autotune system, control head, left dust cover removed.

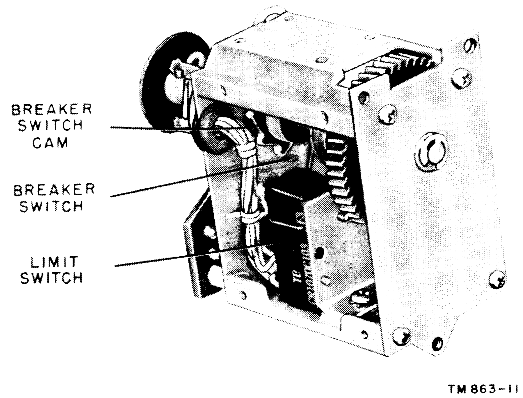


Figure 61. Autotune system, control head, right dust cover removed.

c. The positioning mechanisms used in this equipment are of the multiturn type, as shown in figures 62 and 63. This multiturn positioning head is capable of driving tuning elements requiring approximately ten revolutions to cover their complete tuning range. The special detent mechanism shown in figure 62 is found only on the MEGACYCLE CHANGE positioning head. Multiturn positioning heads, each of which permits precise angular setting of its tuning elements, are coupled to the KILOCYCLE CHANGE and MEGACYCLE CHANGE tuning mechanisms in the receiver. Each positioning head is provided with an Autotune locking key which, when unlocked, permits manual adjustment of the tuning element with respect to the positioning head. After each positioning head and its tuning element has been set to a selected frequency on each of the eight channels, a selection of any channel by rotation of the CHANNEL SELECTOR switch, S110, activates the Autotune system, which then automatically returns all tuning elements to the frequency-selection originally made for that channel.

d. Anti-backlash construction in the multiturn positioning heads makes it possible to approach the final settings of all tuning controls from any direction, and, when the locking keys are tightened, the Autotune system repositions the controls to the preselected settings with great accuracy.

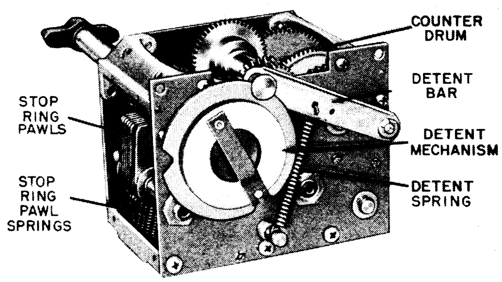


Figure 62. Autotune system, multiturn positioning head, front view.

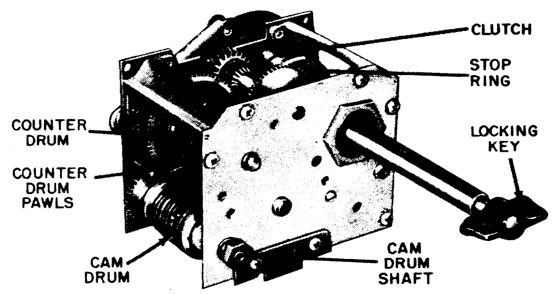


Figure 63. Autotune system, multiturn positioning head, rear view.

88. Detailed Analysis of Autotune System

The Autotune control head, shown in figures 60 and 61, is the mechanism which controls the sequence of operations during an Autotune cycle. It turns the Autotune motor on when a new channel has been chosen, reverses the Autotune motor after all Autotune-controlled dials have been returned to zero, and shuts off the Autotune motor after a new channel has been properly set up. The control head consists of four mechanically driven switches mounted on supporting castings: the seeking switch, the cam switch, the limit switch, and the reverse switch. This control head is mechanically driven by a worm gear on the main Autotune line shaft. In order to understand the theory of operation of the Autotune control head, it will be necessary to consider a typical Autotune cycle from the viewpoint of this head.

a. Refer to figure 64. This figure illustrates the action of relay K102 and all switches concerned with operation of Autotune system, during an Autotune cycle. At shutoff, the various switching mechanisms are positioned as illustrated in section A of figure 64. The channel set up is channel 1. Section B of figure 64 illustrates switch and relay positioning the instant after a new channel has been selected on the CHANNEL SELECTOR switch, and before the Autotune motor has started to rotate. The new channel selected in this example is channel 2. The explanation that follows is applicable regardless of which new channel is chosen. It can be seen in section B of figure 64 that the CHANNEL SELECTOR switch has been set to the position marked 2. This action grounds one end of the winding of relay K102, through contacts 3 and 4 of the limit switch, contact 2 of the seeking switch, contacts 10 and 12 of the CHANNEL SELECTOR switch, and contacts 3 and 2 of the REMOTE-LOCAL switch. Since the other end of the winding of relay K102 is continuously supplied with 28 volts, this relay becomes energized, and it connects the proper voltages to the field and armature windings of the Autotune motor for counterclockwise rotation.

(1) Immediately after the Autotune motor starts to rotate, the switch actuator arm is released to its center position, as shown in section C of figure 64. This causes the limit switch to assume its unactuated position. In this position, 24 volts is applied, through its contacts 1 and 2, to contacts of relay K102, as a second source of d-c voltage. While this action is taking place, the seeking switch and the cam of the breaker switch are rotating clockwise simultaneously with the Autotune motor. These two switches are driven through a ratchet drive assembly, and can rotate in one direction only.

(2) After the Autotune system has been rotating in this direction long enough for the positioning heads to return all Autotune-controlled dials to their maximum counterclockwise positions, the lost-motion washers in the control heads cause the actuator arm to actuate the reverse switch. The result is that the grounding circuit, through contacts 1 and 2 of the reverse switch, is removed from the winding of relay K102, and the relay relies strictly, at this time, on the grounding circuit

provided through the breaker switch and the seeking switch, in order to remain energized. Prior to the time the reverse switch is actuated, the action of the breaker switch and seeking switch has no effect on the circuit. The seeking switch may pass the desired channel several times, but the unactivated reverse switch keeps the system operating.

(3) When the proper number of revolutions have been spent to cause the reverse switch to become actuated, as explained in subparagraph (2) above, the next time the seeking switch passes over the desired channel, relay K102 becomes de-energized. The breaker switch is connected in parallel with the seeking switch, and provides more accurate timing for de-energizing of the relay. At this instant, counterclockwise rotation of the Autotune motor stops, and the cam drum in each of the positioning heads stops (after being ratchet-driven) at the desired channel position. This condition is illustrated in section D of figure 64.

(4) Immediately when K102 de-energizes, the voltage being applied to the armature of the Autotune motor reverses in polarity, due to action of the relay. The Autotune motor reverses its direction of rotation almost instantaneously. The actuator arm again is released to assume its center position, and the reverse switch is placed in an unactuated position. These conditions are illustrated in section E of figure 64.

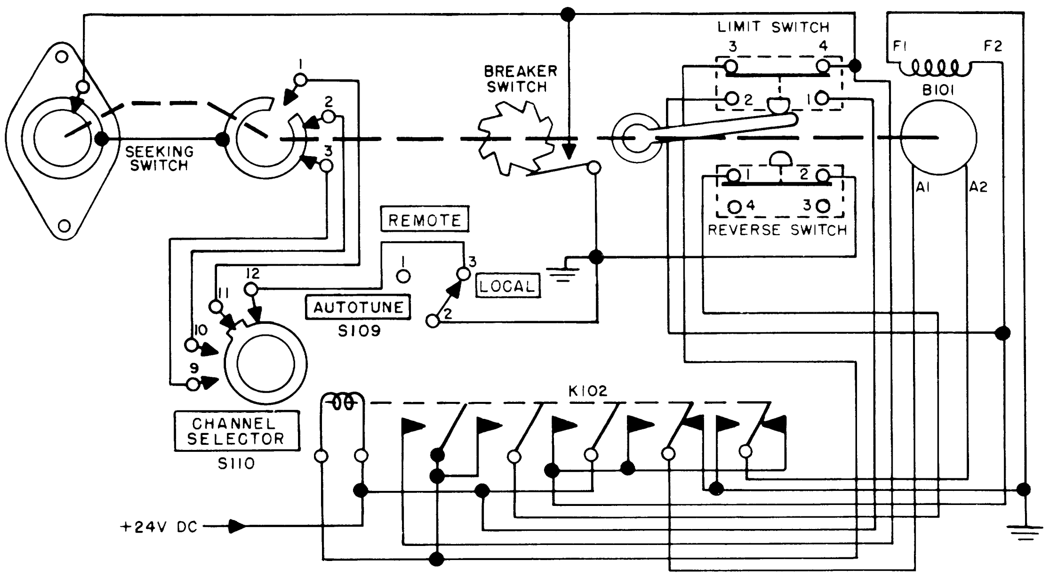
(5) Since the Autotune motor has reversed its direction of rotation, the positioning heads are also reversed, and are now rotating clockwise. Terminals F2 and A2 of the Autotune motor are now supplied with 24 volts, dc, through contacts 1 and 2 of the limit switch. This clockwise rotation continues uninterrupted while the positioning heads set up their tuning elements to the preset positions on that particular channel. Once this is accomplished, the lost-motion washers in the control head cause the actuator arm to operate and actuate the limit switch. This removes 24 volts, dc, from the Autotune motor, and all rotation stops. Channel 2 is now properly set up, as illustrated in section F of figure 64. The Autotune system is now ready for a new channel selection.

b. Although several different models of Autotune units exist, all are fundamentally similar in construction and operation. The unit shown in simplified form in figure 65 will be used for explanation of the mechanical operation of multiturn Autotune units.

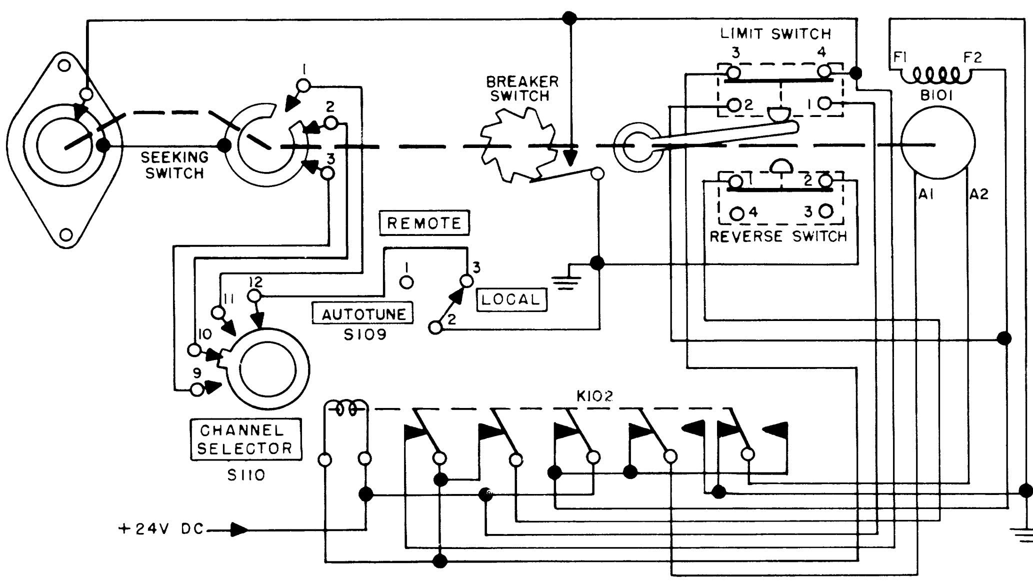
(1) The multiturn shaft (1) extends from the back of the Autotune unit, and is coupled to the component to be driven. The shaft also extends from the front of the unit, and a knob is usually attached to it for manual tuning and channel setting.

(2) An electric motor turns multiturn drive worm 2, and simultaneously drives the control unit, which is not shown in figure 65. The control unit contains switches which control the Autotune motor. The drive worm (2) rotates the shaft (1) through the gears (3 and 4), and the cam drum (5) is rotated by a gear attached to gear (6), through gear (7) and a gear on the cam-drum shaft.

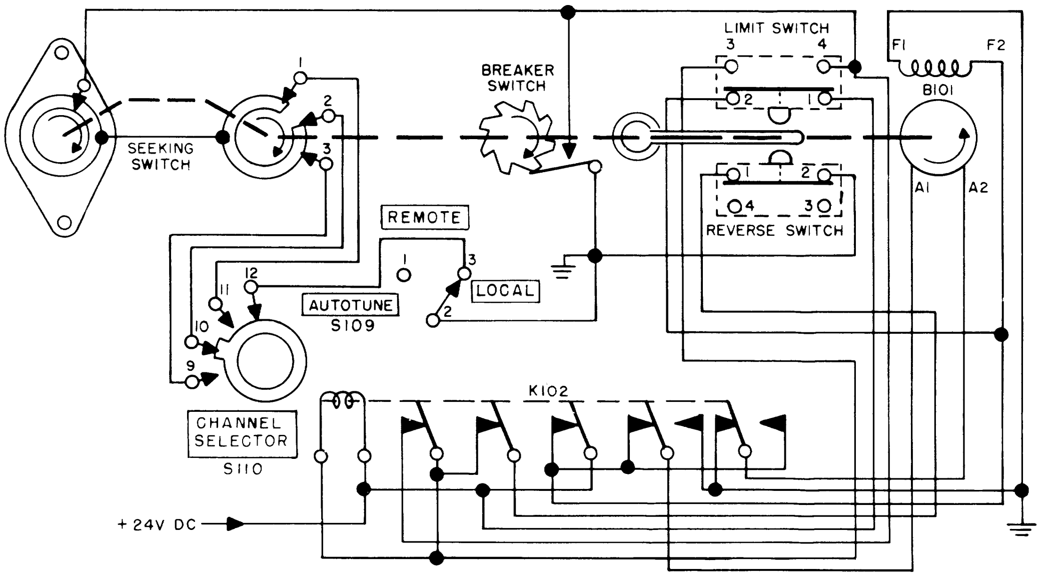
(3) The position of the counter drum (8) determines in which revolution a pawl will be released against a stop ring (9). The counter drum is driven by a gear (10), which is located on the multiturn shaft (1), through the gears (11 and 12), and the differential gear arrangement (13, 14, and 15). The small planetary gear, (14), is attached to the counter drum. As the sun gear (13) is rotated, the planetary gear (14) rides around between the ring gear (15) and driving gear (13). Thus the counter drum rotates somewhat more slowly than driving gear (13). The friction-clutch gear (16) is driven by gear 11, and is friction-coupled to the counter-drum shaft. It turns the counter drum at an


LIMIT SWITCH
3
4
F1
F2
B101
BREAKER SWITCH
2
1
SEEKING SWITCH
1
2
3
REVERSE SWITCH
A1
A2
REMOTE
LOCAL
AUTOTUNE
S109
12
11
10
9
CHANNEL SELECTOR
S110
K102
+24V DC

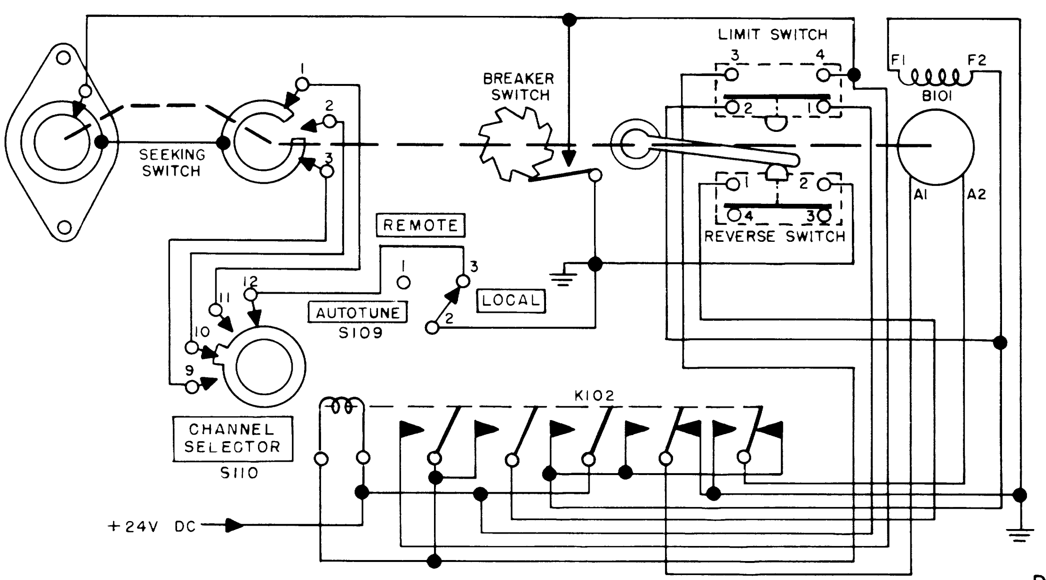
A


LIMIT SWITCH
3
4
F1
F2
B101
BREAKER SWITCH
2
1
SEEKING SWITCH
1
2
3
REVERSE SWITCH
A1
A2
REMOTE
LOCAL
AUTOTUNE
S109
12
11
10
9
CHANNEL SELECTOR
S110
K102
+24V DC

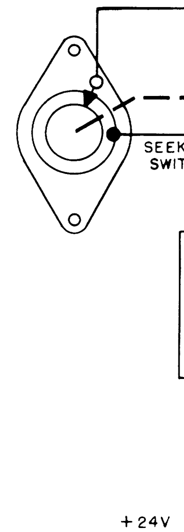
B



C



D



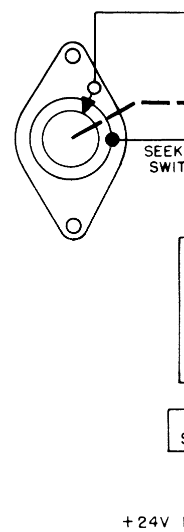
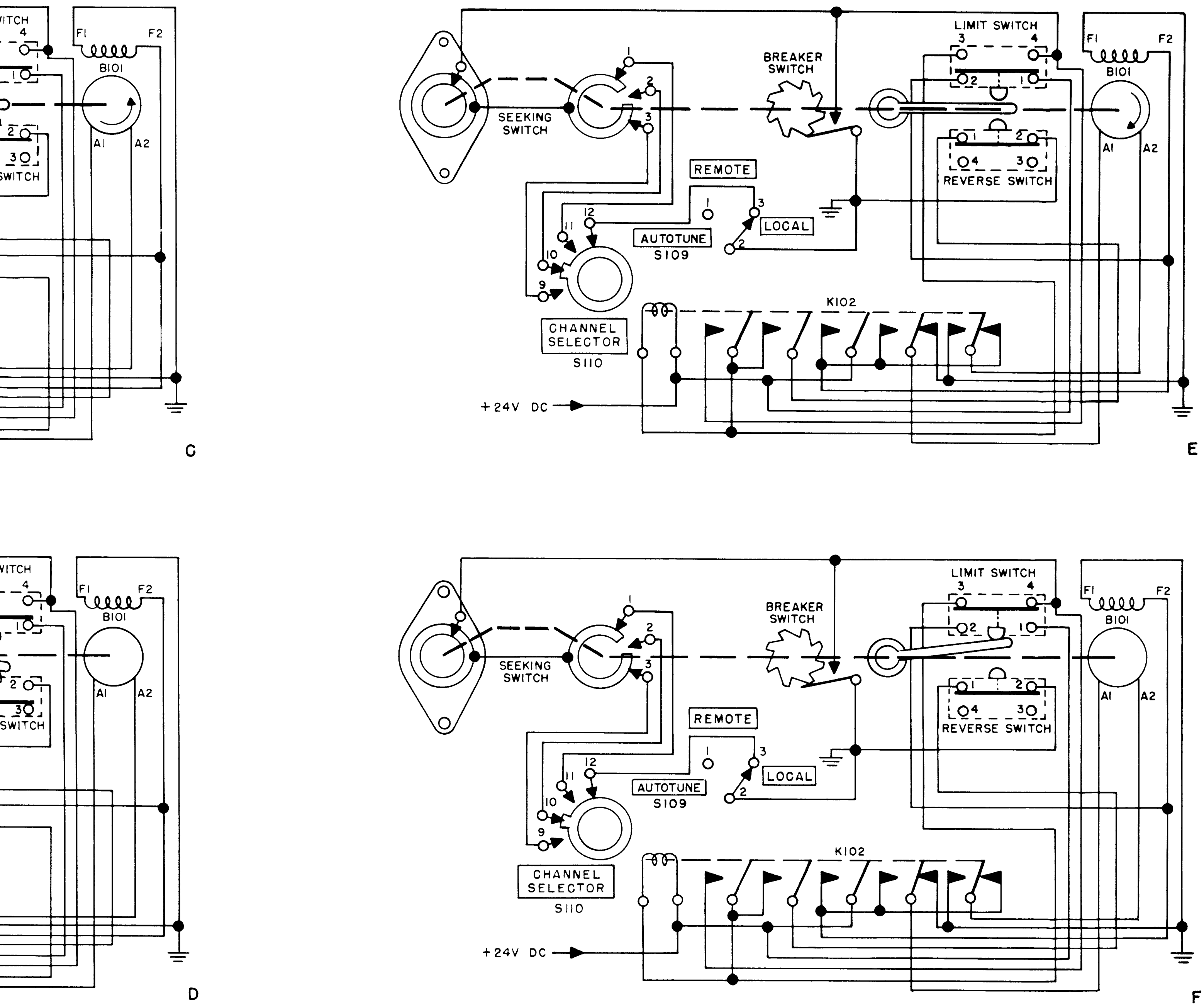


Figure 64. Sequential schematic diagram of Autotune control head.



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rol head.

increased rate of speed only when the direction of rotation is reversed and the pin on gear 15 is free to move between the arms of the stop (17).

(4) At any other time, gear 16 drives nothing; it merely slips against the counter-drum shaft.

(5) To establish a dial setting, the CHANNEL SELECTOR switch is turned to the channel number for which the setting is desired. The Autotune motor is started, and, by means of the driving gears, turns the cam drum clockwise so that each slot in the drum passes beneath its respective pawl heel. During this first half-cycle, the pawl lifting mechanism prevents any pawl heels from falling into slots in the cam drum.

(6) As the cam drum turns clockwise and the other drum mechanism revolves counterclockwise, gear 18, coupled to gear 13, drives gear 19 clockwise. After a few revolutions of the multiturn shaft (1), a pin on gear 19 pushes the stop anchor assembly (20) so that the push rod (21) rotates the home-stop pawl (22) clockwise to halt the rotation of the multiturn shaft (1) by means of the home stop (23).

(7) Now the clutch (24) slips while the cam drum (5) continues to rotate until a slot on the cam drum is beneath the correct pawl. At this time, a seeking switch on the control unit, synchronized with the motion of the cam drum, operates the motor relay to reverse the motor in preparation for the second half-cycle.

(8) During the first half-cycle, no pawl toe must be allowed to fall into the counter drum. If, as the cam-drum slots pass beneath their respective pawls, a pawl toe was allowed to drag on the counter-ring drum, that particular counter ring might be rotated out of position, and the dial setting associated with that ring would be changed. Therefore, during the first half-cycle, the pawls are prevented from contacting the cam drum by the pawl lifting mechanism (25, 26, and 27). As gear 6 turns, pins protruding from the front of the gear pull on the pawl-lifter lever (25). This causes the pawl-lifter arm (26) to rotate the pawl-lifter rod (27) just enough to lift all the pawls (28 and 29), away from the drums (8 and 9).

(9) However, when the motor reverses for the second half-cycle, the pawl-lifter lever (25) is pushed back to its original position, and the flat portion of the pawl-lifter rod (27) appears beneath the pawls, allowing them to operate normally.

(10) As the motor reverses, the ratchet (30) allows the cam drum (5) to remain in a position corresponding to the channel selected. The toe of the pawl which has been released by the cam drum rides on its ring on the counter drum until it falls into the slot. The tail of the large pawl (29) releases a stop-ring pawl (28), which rides on its ring on the stop-ring drum (9). When this pawl falls into the stop-ring slot, the multiturn shaft (1) is halted, and the clutch slips until the control unit stops the driving motor.

(11) The desired dial setting may now be made. A thumbscrew and locking bar assembly (not shown in figure 65) extending from the shaft (1) must be loosened about two revolutions; this disengages the stop-ring drum from the shaft. In this condition, the ring engaged by a pawl may slip while the shaft is turned, but the other stop rings, which are not retained by pawls, will turn with the shaft and remain in their previous positions with respect to the shaft. After the dial setting is made, the thumbscrew is again tightened, and the setup is complete.

(12) At any time this particular dial setting is again required, the CHANNEL SELECTOR switch may be turned to the proper channel number, and the process just described will be partially repeated. The drive mechanism returns the stop-ring drum and counter drum

to home-stop position and turns the cam drum to the proper position to select a pawl corresponding to the desired channel. The motor reverses and the counter drum rotates until the toe of the pawl whose heel is over a slot in the cam drum falls into the counter-drum slot. A stop-ring pawl is released, and, since the stop-ring drum is rotating faster than the counter drum, the top of the stop-ring pawl falls very quickly into its stop ring.

(13) The multiturn shaft (1) is now exactly in the desired position, and, therefore, so is the shaft being positioned.

(14) As before, the motor continues to run, slipping the clutch (24), until the control unit stops it, but the shaft remains in the desired position.

(15) Dial settings may be made at any time, but, during automatic cycling, the thumbscrew must be tight. If it is not, the stop-ring drum may not be turned by friction against the outer surface of the clutch. If this condition occurs, the home-stop mechanism will not be actuated, and, when the motor reverses, the stop-ring drum and the counter drum will not be in their proper positions to begin the second half-cycle. Nor are those drums likely to turn during the last half of the cycle. If the screw is tightened slightly, the drums may rotate, but, on an automatic setup for a particular channel, the stop-ring may be pushed out of position as a pawl toe falls in to stop the drum.

(16) In any case, during automatic cycling, the lock *must* be tightened.

(17) During manual setting, the control knob may be rotated to the extreme clockwise position. In this event, the home stop mechanism will halt rotation of the multiturn shaft (1). As the shaft is rotated clockwise during manual setting, gear 19, which is associated with the home-stop mechanism, is slowly turning counterclockwise. A pin on gear 19 contacts the stop anchor assembly (20), so that the push rod (21) rotates the home-stop pawl (22) counterclockwise to half rotation of the multiturn shaft.

89. Power Supply PP-629/URR
(fig. 117)

a. D-c voltage for operation of the Autotune system is supplied by Power Supply PP-629/URR. The power supply consists of a power transformer, a dry disk rectifier, an indicator lamp, fuses, input and output receptacles, and a terminal board.

b. Power transformer T1101 has two primary windings which are connected in parallel for 115-volt a-c operation or in series for 230-volt a-c operation. Selection of input voltage is made by switch S1101. The remainder of the primary input circuit consists of ON-OFF switch S1102, fuses F1101, F1102, and receptacles J1131 and J1132. 115- or 230-volt a-c power is connected between contacts A and D of either receptacle. The secondary of T1101 is tapped to permit adjustment of the output voltage. Terminal 5 is connected to full-wave rectifier CR1101. The selected tap is also connected to the rectifier.

c. The principle of a dry disk rectifier is that oxides of certain metals will permit the flow of current in one direction (called forward) and offer a large resistance in the opposite direction (reverse). Because of this principle, each of the four sections of CR1101 can be considered as a diode rectifier. The diodes are connected in a bridge rectifier circuit and conventional current flow is in the direction of the arrows at the instant the a-c source connected to an arrow is positive in polarity. In this fashion two opposite diodes will conduct and at the next instant the other diodes will conduct, thereby providing full-wave rectification. The output of the rectifier is applied through resistor R1101 to panel indicator lamp I 1101 and to contacts C and B on receptacles J1131 and J1132. The d-c voltage is also applied to the terminals marked plus and minus on TB1101, and to contacts A and B of receptacles J1133, J1134 and J1135.

d. Taps provided on the secondary of transformer T1101, are necessary in order to keep the cycling time of the Autotune system at 15 seconds.

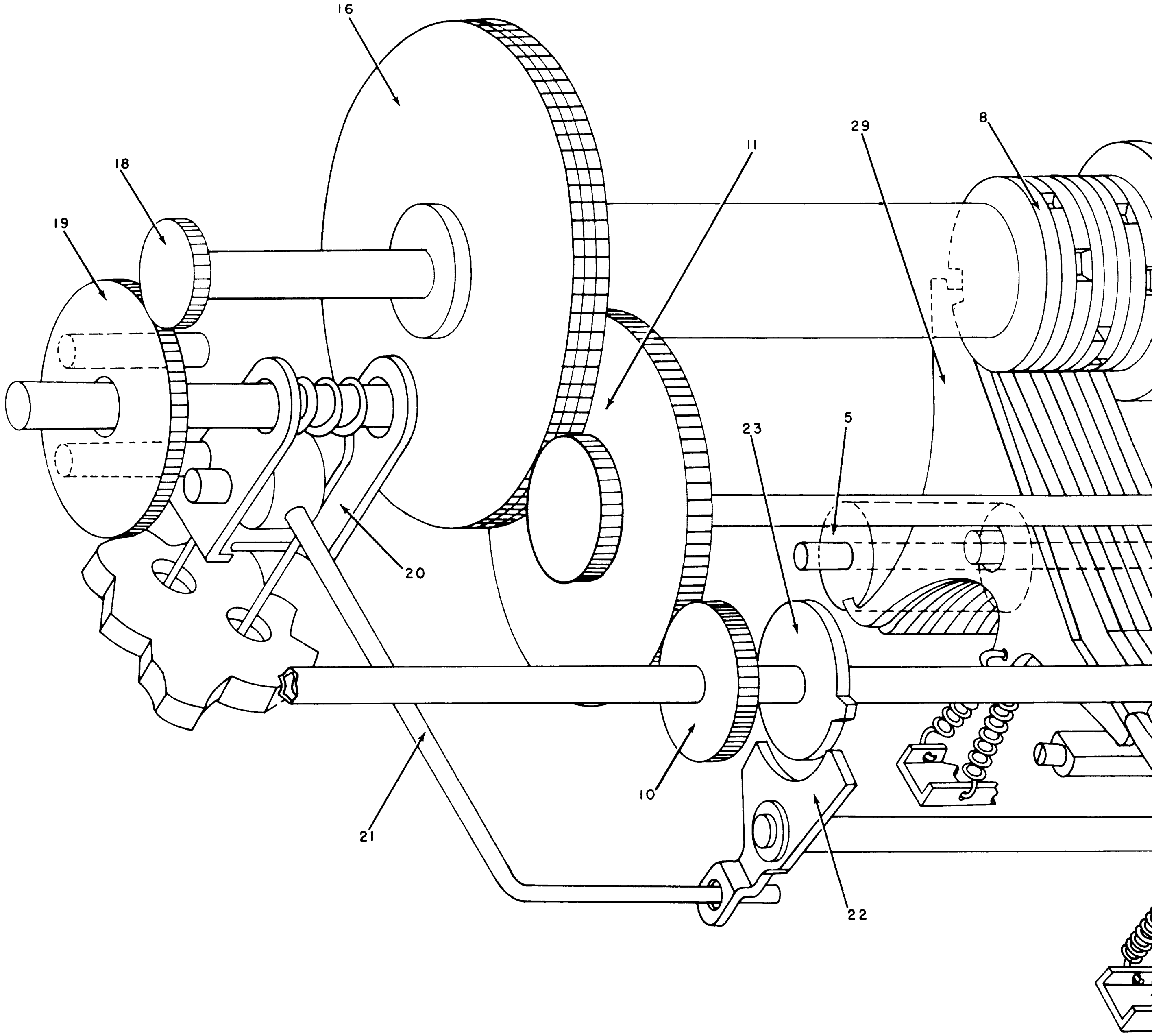


Figure 65. Mechanical diagr

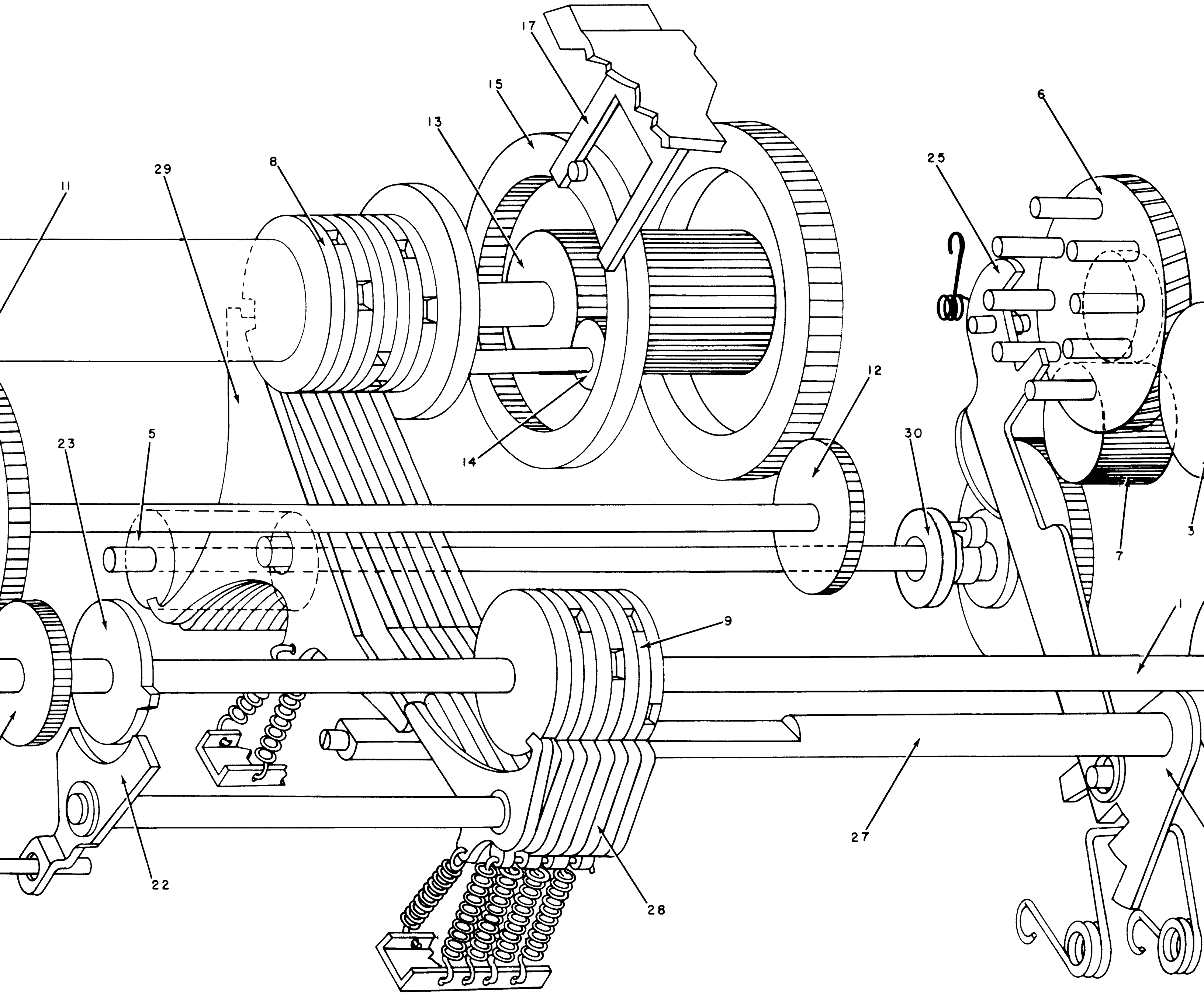


Figure 65. Mechanical diagram of multiturn positioning head.

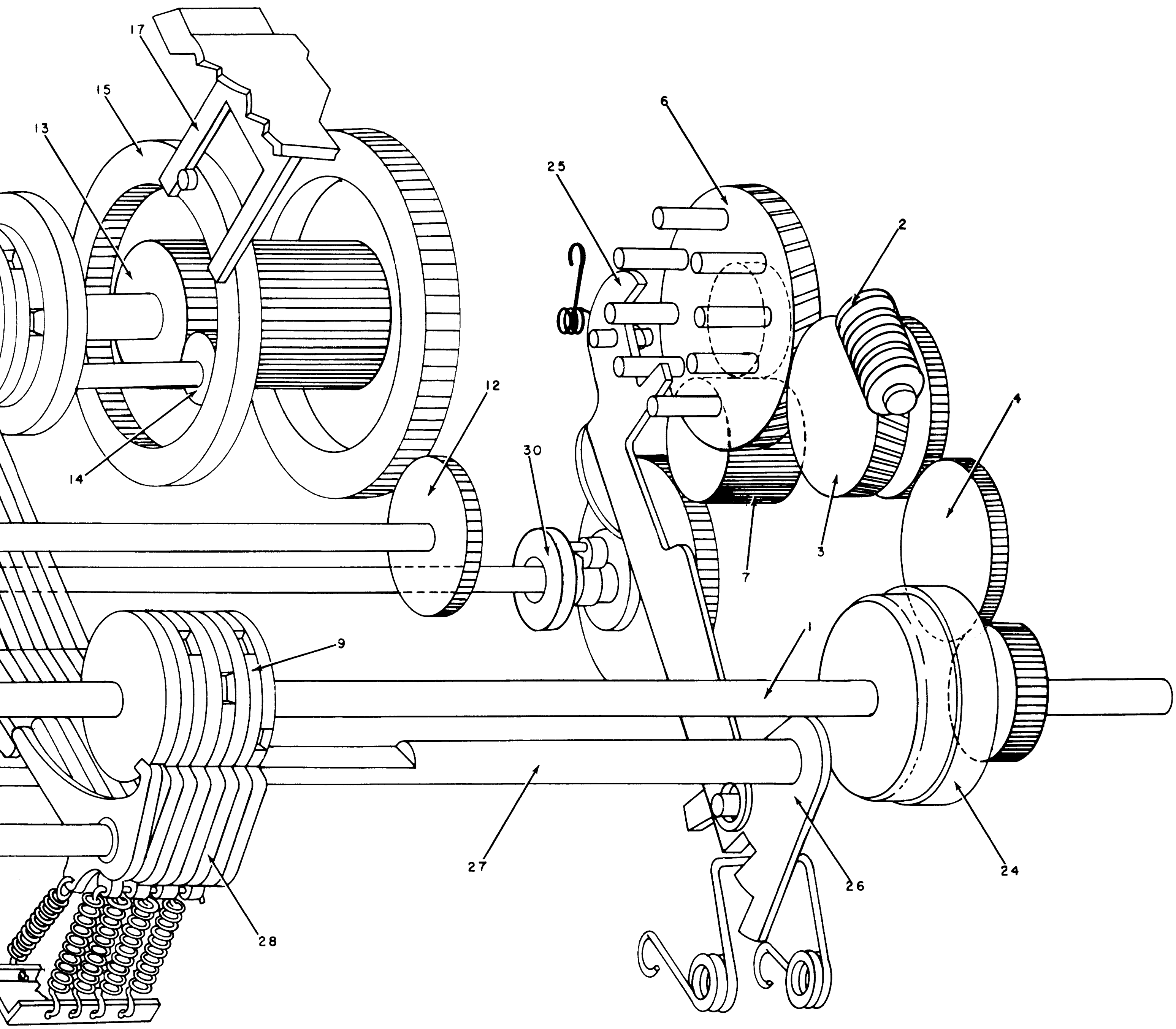


diagram of multiturn positioning head.

CHAPTER 5

FIELD MAINTENANCE INSTRUCTIONS

This chapter contains information for 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. TROUBLE SHOOTING AT FIELD MAINTENANCE LEVEL

Warning: When servicing the receiver, avoid contact with the power supply and plate circuits. The high voltages present in these circuits can cause serious injury.

90. Trouble-shooting Procedure

a. General. The first step in servicing a defective Radio Receiver R-391/URR is to sectionalize the fault. Sectionalization consists of tracing the fault to the subchassis responsible for the abnormal operation of the receiver, or to the front panel and main frame. The second step is to localize the fault. Localization means tracing the fault to the malfunctioning *circuit* on the subchassis or front panel and main frame. Finally, by voltage, resistance, and continuity measurements, the defective *part* is isolated. Some faults, such as burned-out resistors, shorted transformers, and loose connections often can be located by sight, smell, and hearing. The majority of faults, however, must be located by *checking voltage and resistance.*

b. Detailed Procedure. The tests listed below are to be used as a guide in isolating the source of the trouble. To be effective, the procedure should be followed in the order given. Remember that the servicing procedure should cause no further damage to the receiver. The procedure is summarized in the subparagraphs below, which contain references to paragraphs having detailed information for carrying out the tests.

(1) *Visual inspection.* It is often possible to locate troubles within an equipment by inspecting the condition of the wiring and detail parts for visible evidence of failure. Since this inspection (par. 96) can be quickly and simply carried out, and is capable of yielding such rapid results, obviating the need for involved tests, it is the first to be applied in the trouble-shooting procedure. Visual inspection is of further value in that it can possibly avoid additional damage to the receiver that might occur through improper servicing methods.

(2) *Checking B+ and filament circuits for shorts.* These measurements (par. 97) prevent further damage to the receiver from possible short circuits. Also, since this test gives an indication of the condition of the filter circuit, its function is more than preventive.

(3) *Operational test.* After it has been determined in the preceding test that a short is not present in the receiver, an operational test (par. 98) is carried out. By using the information gained from observing the symptoms of faulty operation, it is sometimes possible to determine the exact nature of the fault.

(4) *Trouble-shooting chart.* The trouble-shooting chart (par. 99) presents a systematic method for checking out the receiver by eliminating possible sources of trouble until the actual trouble is finally resolved.

(5) *Signal substitution.* Signal substitution (pars. 101 through 106) when used in conjunction with the trouble-shooting chart, provides an effective method for methodically tracking down trouble in a receiver.

(6) *Stage gain charts.* These charts (par. 108) are useful in localizing obscure, hard-to-find troubles.

(7) *Intermittents.* In all these tests the possibility of intermittents should not be overlooked. If present, this type of trouble may be made to appear by tapping or jarring the subchassis or parts under test. It is possible that the trouble is not in the receiver itself, but in the installation (mounting, antenna, ground, auxiliary equipment, or vehicle), or the trouble may be due to external conditions. In this event, test the installation, if possible.

91. Trouble-shooting Data

Take advantage of the material supplied in this instruction book. It will help in the rapid location of faults. Consult the following trouble-shooting data:

Fig. or par. No.	Description
Par. 45	List of series filament circuits.
Fig. 25	Radio Receiver R-391/URR, top deck, tube location.
Fig. 26	Radio Receiver R-391/URR, bottom deck, tube location.
Figs. 62 and 63	Autotune system, front and rear views of control head and multiturn positioning head.
Figs. 66 and 67	Fabrication of bench-test cables.
Par. 108	Stage-gain charts.
Par. 109	D-c resistances of transformers and coils.
Par. 110	R-f and variable i-f frequency scheme.
Figs. 68 through 85	Top and bottom views of receiver subchassis, showing locations of parts.
Figs. 86 and 87	Power Supply PP-629/URR, top and bottom views.
Figs. 88 and 89	Radio Receiver R-391/URR, main frame.
Figs. 90 and 91	Tube-socket voltage and resistance diagrams.
Fig. 92	Terminal board voltage and resistances.
Fig. 64	Autotune control head, sequented schematic diagram.
Fig. 65	Multiturn positioning head, mechanical schematic diagram.
Fig. 116	Subchassis and interconnection diagram.
Fig. 118	Radio Receiver R-391/URR, schematic diagram.

92. Test Equipment and Tools Required for Trouble Shooting

a. The test equipment required for trouble-shooting Radio Receiver R-391/URR is listed below. The technical manuals asociated with the test equipment, where applicable, are also listed.

Test Equipment	Technical manual
Multimeter TS-297/U, or equal	TM 11-550
Electron Tube Test Set TV-7/U, or equal	TM 11-5083 (when published)
R.F. Signal Generator Set AN/URM-25, or equal	TM 11-5521
Audio Oscillator TS-382/U, or equal	TM 11-2684
Electronic Multimeter TS-505/U, or equal	TM 11-5511
Multimeter TS-352/U, or equal	TM 11-5527

b. The tools and materials contained in Tool Equipment TE-113 are required for field maintenance of Radio Receiver R-391/URR.

93. Bench Testing

a. When a cause of equipment failure has been sectionalized to a subchassis, as determined by visual inspection, operational test, or the use of the trouble-shooting chart, a bench test of the faulty subchassis may be required to locate the trouble through voltage readings. Since the undersides of the subchassis are not accessible for trouble shooting when the subchassis are mounted in the receiver, it may be necessary to remove the subchassis under test and connect them to the receiver circuits by the use of extension cables. Directions for the fabrication of the extension cables are given in figures 66 and 67. The amount and type of extension needed can be determined from the table in subparagraph *b* below.

b. To prepare a subchassis for bench testing, remove the subchassis from the receiver according to the instructions contained in paragraph 112. *Exercise care to avoid the possibility of disturbing the synchronization of the gear train with the r-f subchassis, crystal oscillator subchassis, and vfo subchassis.* Connect the extension cables between the receiver and subchassis according to the table below.

Caution: When the subchassis are operated outside the receiver, dangerous voltages are exposed at the tube-socket pins and other points on the under sides of the chassis. Observe the rules for servicing in the presence of high voltage to prevent possible injury.

Subchassis	Cable No.	Connect between
R-f	1	P209 — J109
	1	P210 — J110
	1	P211 — J111
	1	J223 — P723
	1	P224 — J924
	1	P225 — J525
	1	P226 — J526
		P221 — J421
		P222 — J422
	2	J214 — P114
A-f	3	J619 — P119
	4	J620 — P120
A-c power supply	5	J818 — P118
Crystal oscillator	6	J413 — P113
	1	J421 — P221
	1	J422 — P222
Vfo	7	P715 — J115
	1	P723 — J223
Calibration oscillator	7	P916 — J116
	1	J924 — P224
I-f	1	J512 — P112
	1	J525 — P225
	1	J526 — P226
	8	J517 — P117

94. General Precautions

When a receiver is to be serviced, observe the following precautions very carefully:

a. When the receiver is removed from the case, cabinet, or rack for servicing, connect an adequate ground to the main frame and to any subchassis operated outside the main frame before connecting the power cord.

b. Make certain that the receiver is disconnected from the power source or is turned off before contacting high-voltage circuits or changing connections.

c. After disconnecting auxiliary equipment and before testing the receiver, connect pairs of terminals on the back-panel terminal strips as shown in figure 21.

d. After disconnecting tuning shafts for removal of a subchassis, avoid turning the shafts or tuning controls unless necessary for trouble shooting or adjustment. Careful handling may eliminate the need for synchronization. It will be helpful to make a note of the positions of the front-panel controls indicated in the removal procedure upon removal of a subchassis, since a control may be inadvertently disturbed during servicing.

e. Careless replacement of parts often makes new faults inevitable. Note the following points:

(1) Before unsoldering a part, note the position of the leads. If the part has a number of connections, tag each of its leads.

(2) Be careful not to damage other leads while pulling or pushing them out of the way.

(3) Do not allow drops of solder to fall into the receiver, since they may cause short circuits.

(4) A carelessly soldered connection may create a new fault. It is very important to make well-soldered joints, since a poorly soldered joint is one of the most difficult faults to find.

(5) *When a part is replaced in the r-f or i-f circuits, it must be placed in the exact position of the original part. A part that has the same electrical value but different physical size may cause trouble in high-frequency circuits. Give particular attention to proper grounding when replacing a part. Use the same ground as in the original wiring. Failure to observe these precautions may result in decreased gain or, possibly, in oscillation of the circuit.*

f. Before taking voltage measurements or performing signal tracing, always check the value of the regulated d-c voltage. Approximately 180 volts dc should be obtained at B+

180 VDC jack, J601, located on the a-f subchassis (fig. 81). This jack is accessible through the main frame of the receiver, at the side.

95. Trouble-shooting Notes

a. To avoid the necessity for removing a subchassis when voltage is to be measured or signal injected at a tube-socket pin that does not have a test point, remove the tube, insert into the desired contact a short length of thin insulated wire having both ends bared, and replace the tube. Connection to a voltmeter or signal generator then can be made through the exposed end of the wire. The r-f tuning coils and transformers on the r-f subchassis can be readily removed, if necessary, to permit measurement of voltage or resistance at the socket contacts, or measurement of the continuity of the coils. Instructions for the removal of the coils and transformers are contained in paragraph 106*q*.

b. If trouble is suspected in the r-f subchassis, perform as much detailed trouble shooting as possible, to make certain that the trouble is in the subchassis before removing it, as replacement of the r-f subchassis is a difficult and time-consuming procedure.

c. When it is suspected that injection voltage from the first and second crystal oscillators and vfo is not being supplied to the first, second, and third mixers, check the 3TF7 voltage-regulator tube. If the tube does not glow, or if an excessive glow is noted, replace the tube.

d. When the filament of a particular tube fails to light, trouble may be in another tube in the same series filament circuit. Refer to the series filament circuit diagram (fig. 54).

e. When trouble appears to be in regulator tube V605 or V606, first observe that tubes V608 and V609 are glowing normally, and then check B+ voltage at the B+ 180 VDC jack before testing the regulator tubes in the tube tester.

96. Visual Inspection

When a receiver is brought in from the field for check or repair, remove the top and bottom dust covers, and inspect it as follows, observing the precautions described in paragraph 94.

a. Inspect all cables, plugs, and receptacles. *Check to see that all connectors are seated properly.* This is important, because improperly seated connectors are a frequent cause of abnormal operation in equipment. Repair or replace any connectors or cables that are broken or otherwise defective.

b. Inspect for burned insulation and resistors that show signs of overheating. Look for wax leakage and any discoloration of apparatus and wires.

c. Inspect for broken connections to tube sockets, plugs, and other apparatus, as well as for defective soldered connections. Examine for bare wires touching the chassis or adjoining wires.

d. Make sure that all tubes are in their correct positions, as shown in figures 25 and 26. Replace or interchange any tubes that are not of the type called for in the illustrations. Replace broken tubes. Inspect for loose tube-socket contacts.

e. Inspect the fuses and replace, if necessary, with fuses of correct rating and type. Check carefully for short circuits (par. 97) wherever a blown fuse is found.

f. Operate the tuning mechanism both manually and with the Autotune system. See that the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls turn freely. Rough operation or binding indicates a damaged tuning system or need for cleaning and lubrication (par. 114).

g. Check all switches and controls for ease of operation.

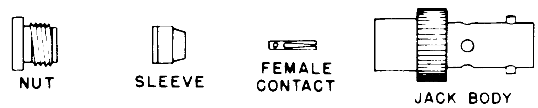
97. Checking B+ and Filament Circuits for Shorts

a. To prevent damage to a receiver sent in for repair, always check the resistance of the high-voltage circuits before applying power to the equipment. Repeated burning out of B+ 3/8A fuse, F102, is an indication of a short in one of the high-voltage circuits. Disconnect Power Cable Assembly CX-1358/U from the a-c power input, and test the cable assembly (par. 50). After it has been determined that

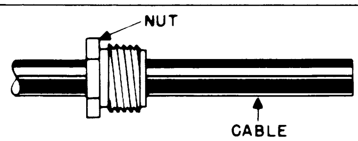
NOTE:

INSTRUCTIONS ARE GIVEN BELOW, IN STEP-BY-STEP SEQUENCE, FOR ATTACHING RADIO FREQUENCY JACK UG-89/U TO ONE END OF THE CABLE. RADIO FREQUENCY PLUG UG-88/U IS ATTACHED TO OTHER END OF CABLE BY FOLLOWING SAME PROCEDURE AS FOR FEMALE CONNECTOR, EXCEPT THAT A MALE CONTACT AND PLUG BODY ARE SUBSTITUTED.

ASSEMBLING RADIO FREQUENCY JACK UG-89/U

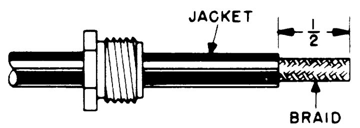


STEP 1



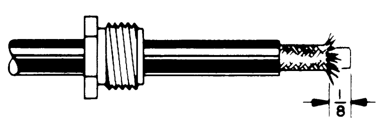
CUT END OF CABLE EVEN.

STEP 2



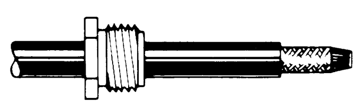
REMOVE OUTER JACKET 1/2"—*DON'T NICK BRAID.*

STEP 3



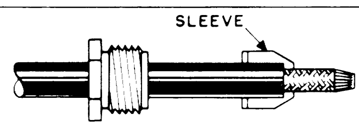
PUSH BRAID BACK, AND REMOVE 1/8" OF INSULATION AND CONDUCTOR.

STEP 4



TAPER BRAID.

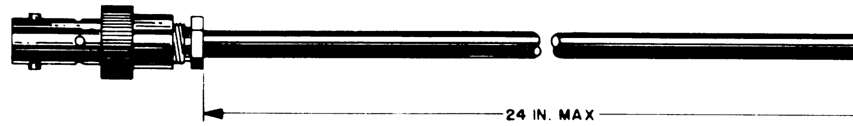
STEP 5



SLIDE SLEEVE OVER TAPERED BRAID. FIT INNER SHOULDER OF SLEEVE SQUARELY AGAINST END OF JACKET.

Figure 66. Assembly i

CABLE NO. 1



COMPLETED CABLE

	CUT END OF CABLE EVEN.
	REMOVE OUTER JACKET 1/2"—*DON'T NICK BRAID.*
	PUSH BRAID BACK, AND REMOVE 1/8" OF INSULATION AND CONDUCTOR.
	TAPER BRAID.
	SLIDE SLEEVE OVER TAPERED BRAID. FIT INNER SHOULDER OF SLEEVE SQUARELY AGAINST END OF JACKET.

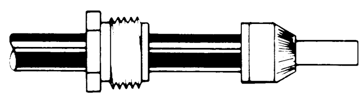
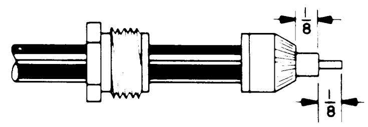
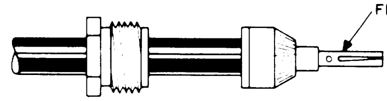
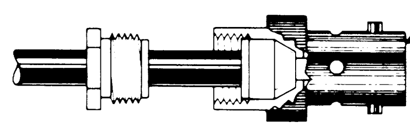
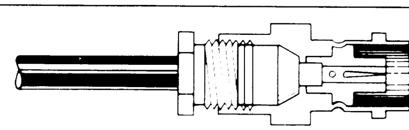
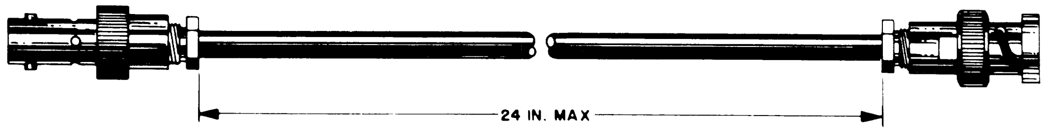
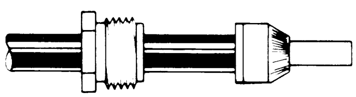
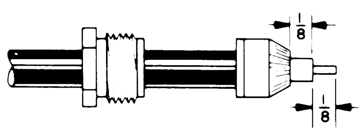
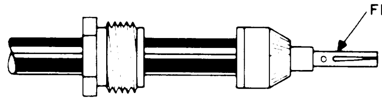
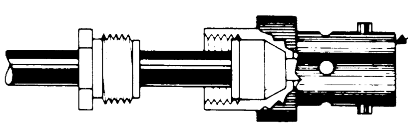
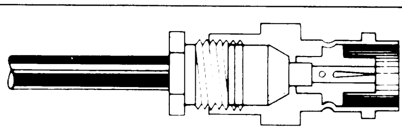
STEP 6		WITH SLEEVE I BRAID, FOLD BA AND TRIM 3/32
STEP 7		BARE CENTER *NICK CONDUCT*
STEP 8		TIN CENTER CO FEMALE CONTA REMOVE EXCES *DIELECTRIC IS AND SWOLLEN ELECTRIC ENT*
STEP 9		PUSH INTO BO SLIDE NUT INT PLACE, WITH W TIGHT. HOLD C RIGIDLY AND R
STEP 10		ASSEMBLED C

Figure 66. Assembly instructions for cable No. 1.

CABLE NO. 1



COMPLETED CABLE

STEP 6		WITH SLEEVE IN PLACE, COMB OUT BRAID, FOLD BACK SMOOTH AS SHOWN, AND TRIM 3/32".
STEP 7		BARE CENTER CONDUCTOR 1/8" – *DON'T NICK CONDUCTOR.*
STEP 8		TIN CENTER CONDUCTOR OF CABLE. SLIP FEMALE CONTACT IN PLACE AND SOLDER. REMOVE EXCESS SOLDER. *BE SURE CABLE DIELECTRIC IS NOT HEATED EXCESSIVELY AND SWOLLEN SO AS TO PREVENT DIELECTRIC ENTERING BODY.*
STEP 9		PUSH INTO BODY AS FAR AS IT WILL GO. SLIDE NUT INTO BODY AND SCREW INTO PLACE, WITH WRENCH, UNTIL MODERATELY TIGHT. HOLD CABLE AND SHELL RIGIDLY AND ROTATE NUT.
STEP 10		ASSEMBLED CONNECTOR.

TM 856-58

structions for cable No. 1.

NOTES:

1. THE MULTI-CONDUCTOR EXTENSION CABLES ARE TO BE FABRICATED OF NO. 18 TO 22 GAGE SHIELDED, STRANDED WIRE (SUPRENANT) FOR AUDIO CONDUCTORS INDICATED BY ◌, NO. 18 GAUGE STRANDED WIRE FOR CONDUCTORS MARKED [a], AND NO. 22 GAGE STRANDED WIRE FOR ALL OTHER CONDUCTORS. INSULATION MUST BE RATED AT 600V.

2. CONNECTORS SHOWN VIEWED FROM REAR. COVERS TO BE USED WITH FEMALE CONNECTORS. AMPHENOL 86-834 COVER USED WITH 26-192 CONNECTOR.

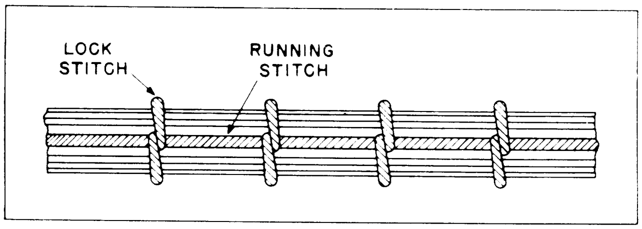
3. CABLES TO BE LACED WITH NO. 6 VINYLITE LACING CORD AS SHOWN IN INSERT.

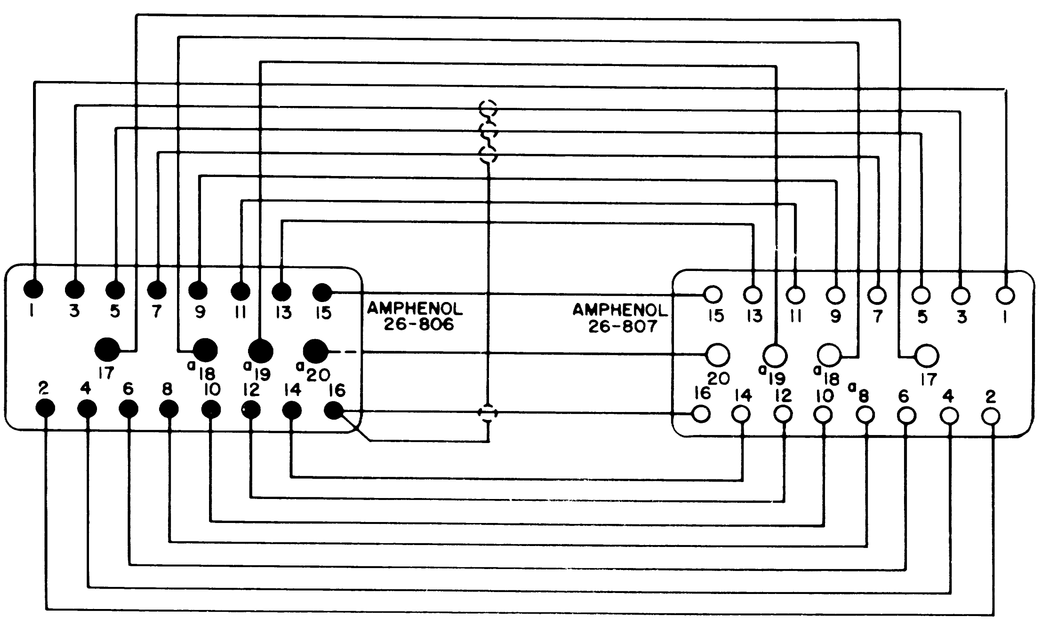
4. MAXIMUM LENGTH OF ALL CABLES IS 24 IN.

5. CHECK CONTINUITY AFTER COMPLETING FABRICATION.

6. LABEL EXTENSION CABLES FOR IDENTIFICATION.

7. NORMALLY, ONE EACH OF EXTENSION CABLES IS REQUIRED. IF VFO AND CALIBRATION OSC SUBCHASSIS ARE OPERATED OUTSIDE RECEIVER AT SAME TIME, TWO NO. 7 CABLES ARE NEEDED.





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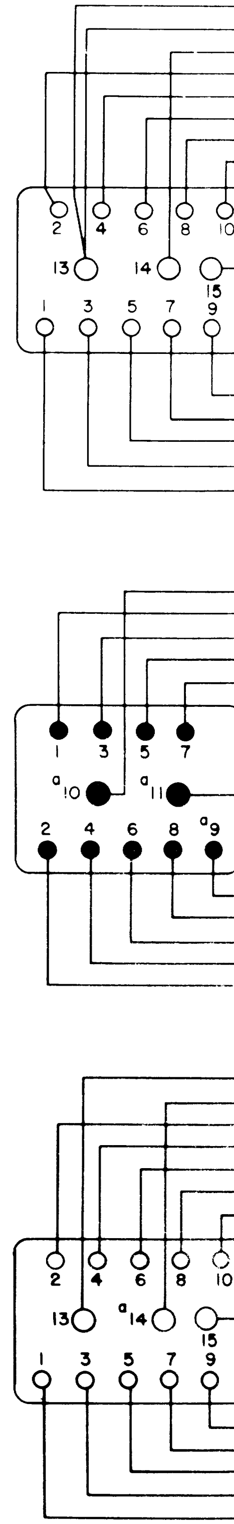

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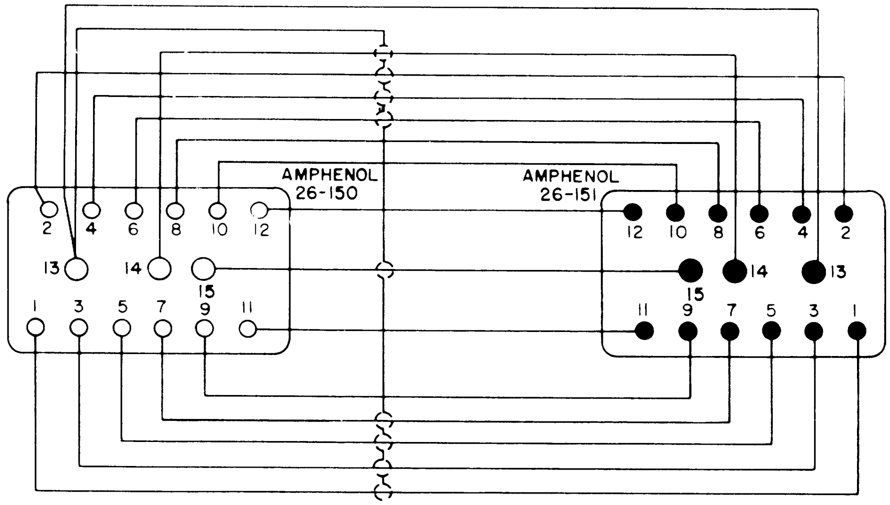

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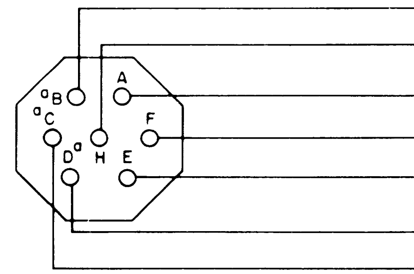

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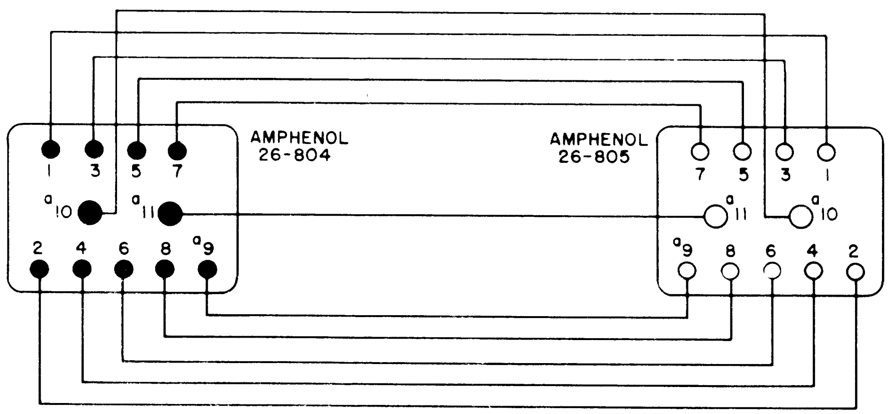

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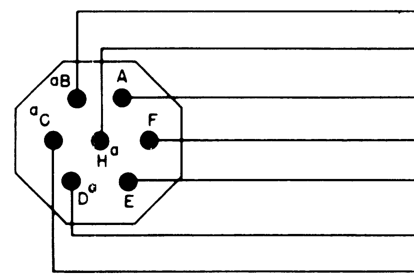

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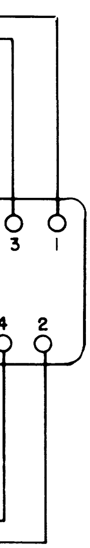
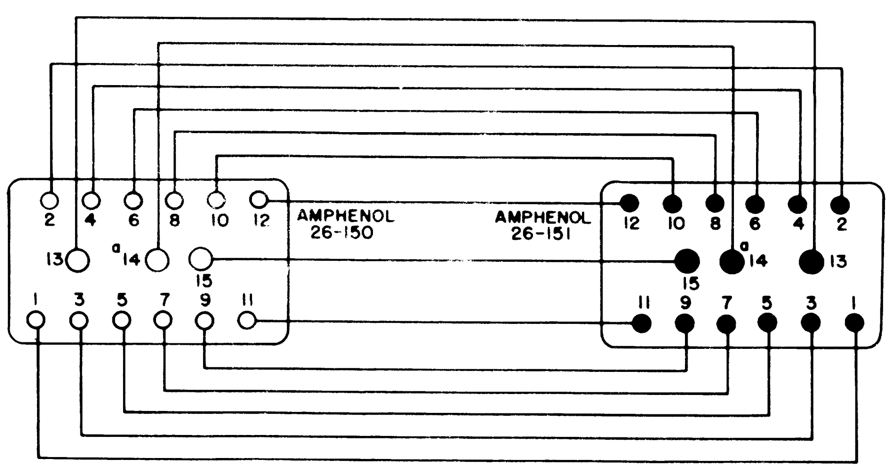




CABLE NO.5

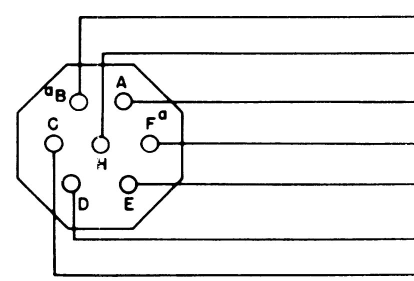
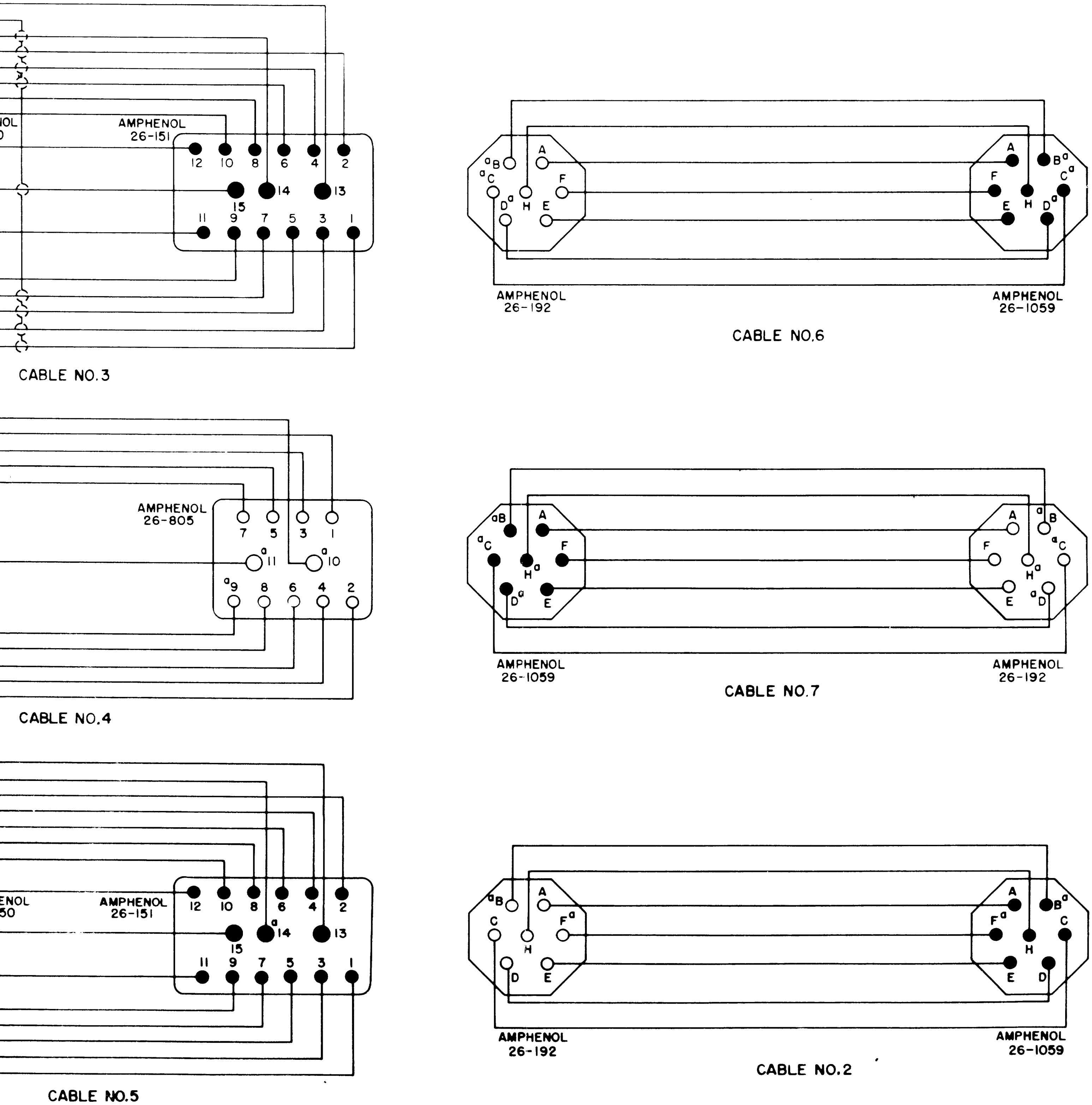


Figure 67. Assembly instructions for multi-conductor cables.



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ctions for multi-conductor cables.

the cable assembly is normal, set the FUNCTION switch at AGC and check the high-voltage circuits as follows:

(1) The resistance measured between the chassis and tube-socket pin 2 or 5 of regulator tube V605 and V606 should be approximately 140,000 ohms. This measurement can be taken at the 3/8A fuseholder by leaving the fuse in place. If the resistance is low, check capacitor C101 (fig. 89) for a short circuit or leakage. If the resistance is abnormally high or infinite, check for an open circuit caused by a break in wiring, poor connector contact, or, possibly, an open capacitor C101.

(2) The resistance measured between the chassis and the B+ 180 VDC jack J601 should be approximately 19,000 ohms with the FUNCTION switch at OFF or STANDBY, approximately 9,400 ohms with the FUNCTION switch at AGC, MGC, or CAL, and approximately 8,500 ohms with the FUNCTION switch at SQUELCH. If the resistance is low, check for a short-circuited or leaking bypass capacitor, or for a short circuit in the wiring of one of the plate or screen-grid circuits of the individual subchassis. If the resistance measured is greater than normal, an open screen-grid bleeder and/or dropping resistor is indicated.

(3) If the tests outlined in subparagraphs (1) and (2), above, indicate that a short circuit is present in the receiver, determine in which subchassis it is located, as follows:

(*a*) Turn the FUNCTION switch to OFF.

(*b*) Disconnect all interconnecting cables that carry power to the subchassis.

(*c*) Replace any blown fuses.

(*d*) Check to see that the 115V-230V switch on Power Supply PP-621/URR is in the proper position for the available a-c power source, and connect Power Cable Assembly CX/1358/U between the receiver and power source. Turn the FUNCTION switch to AGC.

(*e*) Reconnect (one at a time) the cables that carry power to the individual subchassis in the following order: Power Supply PP-621/URR, a-f subchassis, i-f subchassis (turn the BFO switch to ON), vfo subchassis, crystal-oscillator subchassis, r-f subchassis, and crystal-calibrator subchassis (turn the FUNCTION switch to CAL.) If the B+ 3/8A fuse blows after the power cable is connected to a subchassis and, in the case of the i-f and r-f subchassis, the BFO and FUNCTION switches, respectively, are turned to the positions indicated, there is probably a short circuit in that subchassis.

b. If the tests performed as instructed in subparagraphs *a*(1), (2), and (3) above reveal no trouble, the filament circuits should be checked as follows:

(1) See that all the necessary interconnecting cables are in position and properly connected.

(2) Turn the FUNCTION switch to AGC, and check the filament circuits as described in paragraph 45. A short in the low-voltage or filament circuits will be evidenced by the repeated burning out of AC 3A fuse, F101. In addition to a defective filament circuit, a short circuit to ground in oven heater HR401, HR701, or HR901, or dial lamps I 101 or I 102 will seriously affect the low-voltage circuit. If an abnormal filament circuit is indicated, test the tubes, by using one of the techniques described in paragraph 47.

98. Operational Test

a. Operate the equipment as described in the Equipment Performance Checklist (par. 49). This checklist is important because it frequently aids in sectionalizing the trouble without the need for further testing. Check for overheated parts, faulty controls, and intermittent operation. Observe closely the readings of the CARRIER LEVEL and LINE LEVEL meters. A normal reading on the CARRIER LEVEL meter usually indicates satisfactory operation of the agc circuit and all stages up to and including the fifth i-f amplifier. If the LINE LEVEL meter reading is normal, satisfactory operation of the remaining stages, except for second a-f amplifier, section A of V602, and the local audio channel output stage, V603, is indicated. These latter stages can be checked by listening with a 600-ohm headset or speaker.

b. To check the audio and i-f stages quickly, connect a headset to the PHONES jack on the front panel. Turn the FUNCTION switch to AGC. Starting at the 16-KC position of the BANDWIDTH switch, set the switch in turn to each lower position. If the volume of the rushing sound heard in the head set decreases noticeably with each lower setting, the i-f and audio stages are operating. This test does not necessarily indicate normal operation.

c. The calibration-oscillator signal can be used as a convenient means of quickly localizing trouble in the receiver. Typical methods are described in subparagraphs (1) and (2) below.

(1) To check the centering of the r-f band switch, S201 through S210, (fig. 70) and crystal-oscillator band switch, S401 through S404, (fig. 72) contacts, connect a headset to the PHONES jack on front panel. Set the FUNCTION switch at CAL. Note the reading of frequency-indicator. Unlock the KILOCYCLE CHANGE control and set it to any 100-kc position. Unlock the MEGACYCLE CHANGE control, and, starting with the lowest detent position of the MEGACYCLE CHANGE control, turn the control to each detent position in succession. Adjust the BFO PITCH control as necessary to obtain a signal in the headset. If no audible signal is heard in a detent position, trouble in contacts of the r-f band switch or crystal-oscillator band switch is indicated. Rotate MEGACYCLE CHANGE and KILOCYCLE CHANGE controls to obtain original frequency-indicator reading, and lock key.

(2) The LINE LEVEL meter, LINE METER switch, and LINE GAIN control are checked as follows: connect a headset to the PHONES jack on the front panel, note reading of frequency-indicator, unlock KILOCYCLE CHANGE control, and adjust the KILOCYCLE CHANGE control for an even 100-kc reading on the dial. Set the FUNCTION switch at CAL and turn the BFO switch to ON; an audible tone should be heard in headset. Set the LINE METER switch to −10 and adjust the LINE GAIN control so that the LINE LEVEL meter reads 0 vu (upper scale). Turn LINE METER switch to 0. Reading on LINE LEVEL meter should drop to −10 vu. Readjust the LINE GAIN control for a 0-vu reading on LINE LEVEL meter. Turn the LINE METER switch to +10. The LINE LEVEL meter reading should drop to −10 vu. If indications described above are not obtained, check the LINE LEVEL meter and 10-db pads, R106 through R122, (fig. 93) the LINE METER switch, and the LINE GAIN control. Rotate KILOCYCLE CHANGE control to obtain original frequency-indicator reading, and lock key.

d. The synchronization of the tuning shafts can be quickly checked. Note reading of the frequency-indicator, unlock the MEGACYCLE CHANGE and the KILOCYCLE CHANGE control keys, and proceed as follows:

(1) Set the frequency-indicator reading so that the first two digits are zeros and the last three digits read an even 100 kc or multiple thereof.

(2) Set the FUNCTION switch at CAL.

(3) Advance the RF GAIN control until the reading is obtained on the CARRIER LEVEL meter.

(4) Raise the .5- to 1-mc slug rack (fig. 94) slightly with the hand; the CARRIER LEVEL meter reading should decrease.

Caution: To prevent damage, do not raise or depress the slug rack too strongly.

(5) Depress the .5- to 1-mc slug rack slightly with the hand; the meter reading should decrease. If the reading increases when the slug rack is either raised or depressed, the camshaft is out of synchronization.

(6) Repeat the procedures described in subparagraphs (1) through (5) above for each slug rack, setting the megacycle digits on the frequency-indicator at a reading within the band covered by the slug rack being checked.

(7) Rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls to obtain the original frequency-indicator reading, and lock the keys.

e. If the receiver is not synchronized, refer to paragraph 119.

99. Trouble-shooting Chart

The following chart is supplied as an aid in locating trouble in the radio receiver and Power Supply PP-629/URR. This chart lists the symptoms that the repairman observes, either visually or audibly while making simple tests. The chart also indicates how to localize trouble quickly to the audio, i-f, or r-f stage that is defective, and also to defective parts within the autotune system, which are localized in steps 13 through 18. The signal-substitution tests outlined in paragraphs 101 through 106 can then be used to supplement this procedure to aid in locating the defective stage. Once the trouble has been localized to a stage or circuit, a tube check and voltage and resistance measurements of the stage or circuit should ordinarily suffice to isolate the defective part.

Symptom	Probable trouble	Correction
1. When FUNCTION switch is in AGC position, receiver fails to operate and dial lamp does not light.	1. Open AC 3A fuse (F101) on rear panel of receiver.	1. Replace fuse. If it blows again, check power supply, filament, and oven circuits for shorts. Check primary power connections.
2. Dial lamp lights, but CARRIER LEVEL meter does not deflect. No reception.	2. No B+ voltage. Open B+ 3/8A fuse (F102) on rear panel of receiver.	2. Replace fuse. If it blows again, test capacitor C101 for short. Test plate and screen-grid circuits for shorts (par. 97).
3. No receiver output. CARRIER LEVEL meter rises and dips as KILOCYCLE CHANGE control is rotated.	3. Fault is in signal circuit after 5th i-f stage.	3. Connect headset in series with a .1-UF capacitor across grid circuit and plate circuits of successive audio stages to localize defective stage. Stage may also be localized by signal substitution (par. 101). Test tube of defective stage (note series filament circuits (par. 45). If necessary, check voltages and then resistances of circuits within a stage (figs. 90, 91, and 92) to locate a defective part.
4. A-f circuits function satisfactorily, but no signal output is obtained when 455-kc modulated signal is applied to i-f input (J525 or J526, fig. 74).	4. Faulty i-f stage.	4. Test i-f stages by signal substitution method (par. 99). Test tubes. When necessary, localize fault by voltage and resistance measurements (fig. 90, 91, and 92).

Symptom	Probable trouble	Correction
5. I-f circuits respond to 455-kc signal but no station is received.	5. Crystal oscillator band switch or vfo tuning shaft out of synchronization. Faulty mixer, oscillator, or r-f stages.	5. Check synchronization of band switch and tuning shaft (par. 119). Test mixer stages, r-f stages, and crystal oscillators by signal substitution method (par. 101).
6. No beat frequency heard when BFO switch is turned on and BFO PITCH control varied.	6. Faulty bfo.	6. Test tube V508. Check voltages at tube-socket pins (fig. 90). Check BFO switch.
7. No calibration signal when FUNCTION switch is at CAL.	7. Defective calibration oscillator.	7. Test tubes V901 and V902. Substitute crystal Y901 for one that is known to be good. Check voltages and resistances of oscillator circuits (fig. 91).
8. Excessive hum from a-c power supply.	8. Defective filter capacitor or electronic voltage regulator.	8. Adjust HUM BAL control, R614 (par. 118). Check C101. Test tubes V605, V606, and V607 (see par. 95*e*). Check voltage across reference tubes V608 and V609. Check C607 for capacitance and leakage. Check voltage and resistance of electronic voltage regulator (fig. 90).
9. Weak signal.	9. Low voltage. Weak tubes.	9. Check power-input voltage. Check B+ voltage at J601 (fig. 81). Test tubes. Check gain of each stage to localize trouble (par. 108). Check for shorted capacitors. If no fault is indicated by a thorough check of tubes and voltages when the output is weak, aline tuning circuits (section III of this chapter).
10. Noisy receiver.	10. Noisy antenna location. Poor connection or shorting elements within a tube.	10. Short-circuit antenna to ground by setting FUNCTION switch to CAL (receiver must not be tuned to even 100-kc frequency, or calibration signal will interfere with test). A considerable decrease in noise indicates noisy signal from antenna. Use insulated prod to tap each tube. If tapping a tube causes increase in noise in the output, try different tube.
	Loose connection at a terminal or within a part.	Tap the parts. Move terminals slightly, and listen for noisy output. Noise indicates that a connection should be soldered or that a part needs replacing.

99. Trouble-shooting Chart (contd)

Symptom	Probable trouble	Correction
11. Receiver output noisy when controls are operated.	11. Dirty switch contacts. Poor contact at rotor of a gain control.	11. Clean switch contacts. Clean and lubricate control, or replace.
12. Distorted signal.	12. Weak tube. Incorrect voltage on tube. Leaky capacitor, such as C603 or C610.	12. Check tubes and replace if necessary. Check voltages and resistance in a-f subchassis (fig. 90). Use headset connected in series with a .1-UF capacitor to check signal across grid and plate circuits of audio stages and, thus, to localize trouble.
13. Autotune completely inoperative.	13. Open fuse F103 (DC 20A).	13. Replace fuse.
	Connection to receiver at REMOTE CONTROL receptacle J105. Absence of 28 volt d-c input to REMOTE CONTROL receptacle J105.	Tighten connector. Check for broken connections in receptacle. Check Electrical Special Purpose Cable Assembly CX-2083/U. Refer to step 18 on Power Supply PP-629/URR.
	FUNCTION switch S107.	Clean switch contacts (fig. 93).
	CHANNEL SELECTOR switch S110, and seeking switch in control head. Broken or dirty switch contacts.	Clean switch contacts. Replace switches if defective (figs. 80 and 93).
	Relay K102.	Replace if defective (fig. 93).
	Motor B101.	Clean brushes and commutator. Check motor leads, field and commutator windings.
	Limit switch in control head. Dirty or broken contacts.	Replace if defective (fig. 61).
	AUTOTUNE REMOTE-LOCAL switch S109. Broken wire or dirty contacts.	Clean switch contacts (fig. 93). Resolder connection. Replace switch if defective.
14. Autotune operates intermittently.	14. Breaker switch in control head. Dirty contacts or defective switch.	14. Clean switch contacts (fig. 61). Replace switch if defective.
	Relay K102.	Replace if defective.
	CHANNEL SELECTOR switch S110. Dirty contacts.	Clean switch contacts.
	Limit switch in control head. Broken or dirty contacts.	Replace if defective.
15. Autotune recycles or shuts off at end of first half-cycle.	15. Breaker switch in control head. Check for broken or dirty contacts.	15. Clean switch contacts. Replace switch if defective.
	Limit switch in control head. Broken or dirty contacts.	Replace switch if defective.
	Relay K102.	Replace if defective.

Symptom	Probable trouble	Correction
	Seeking switch in control head. Broken or dirty contacts.	Clean switch contacts. Replace switch if defective.
	CHANNEL SELECTOR switch S110. Check for dirty contacts.	Clean switch contacts.
16. Autotune heads (one or more) do not position properly, or either of the shafts associated with the heads rotate when an attempt is made to tighten the locking key.	16. Correct pawl not engaged properly for channel selected.	16. Manually rotate locked positioning head throughout its entire range, and try to engage a pawl in a stop ring. If pawl cannot be engaged in this manner, proceed with synchronization of autotune as described in par. 120. If indication remains abnormal after synchronization, check head for foreign matter which might restrict movement of pawls, such as hardened grease, dirt, or metallic particles.
	Weak, broken, or loose pawl spring.	Replace defective pawl spring.
	Pawls do not line up properly with stop rings.	Replace bent, broken, or stuck pawl.
	Clutch on stop-ring shaft assembly slips.	Replace defective clutch.
17. Autotune does not complete a cycle in 15 seconds.	17. Incorrect tap position in secondary of transformer T1101, located in Power Supply PP-629/URR.	17. Reposition tap as described in par. 137.
18. Autotune system of receiver fails to operate, or Power Supply PP-629/URR red indicator lamp I1101 fails to light when ON-OFF switch S1102 is set at ON.	18. Indicator lamp I1101.	18. Replace defective lamp.
	Faulty power cord or receptacle J1131.	Check cord and receptacle. Replace if defective.
	Open fuse F1101 or F1102.	Replace fuse. If fuse still blows check for short circuit.
	Defective ON-OFF switch.	Replace if defective.
	Defective 115-230 switch S1101.	Replace if defective.
	Transformer T1101. Open primary or secondary.	Replace transformer.
	Rectifier CR1101.	Replace rectifier.
	Resistor R1101.	Replace resistor.
	Broken or poor connection at terminal board TB1101.	Resolder connection.

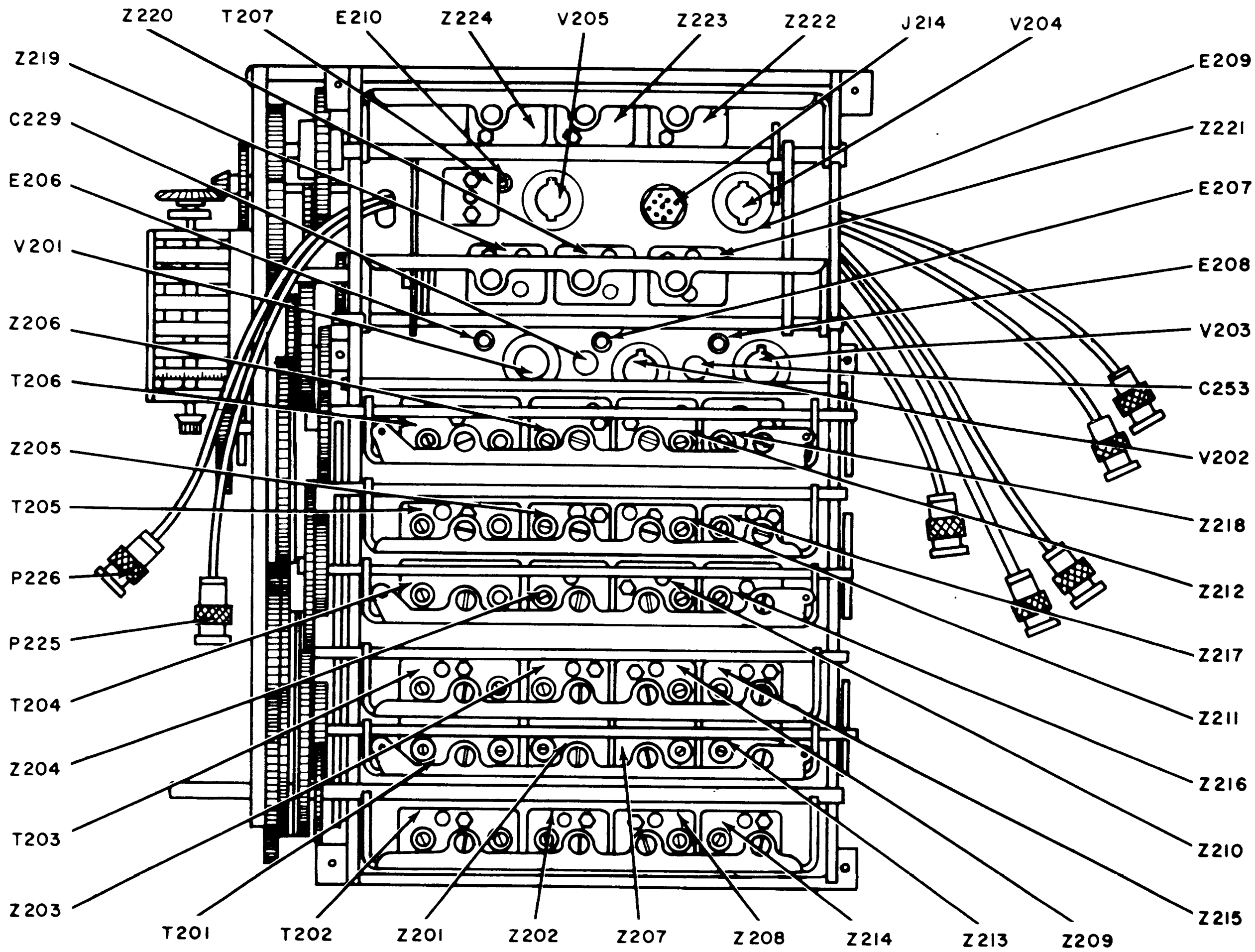


Figure 68. R-f subchassis, top view.

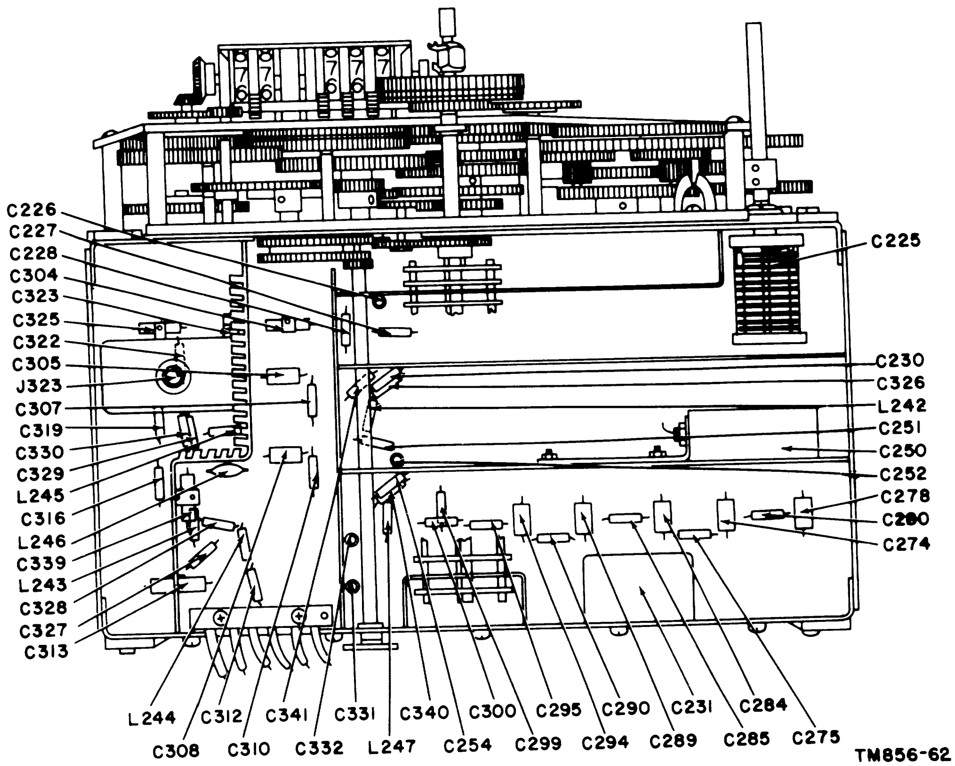


Figure 69. R-f subchassis, bottom view (first of two illustrations).

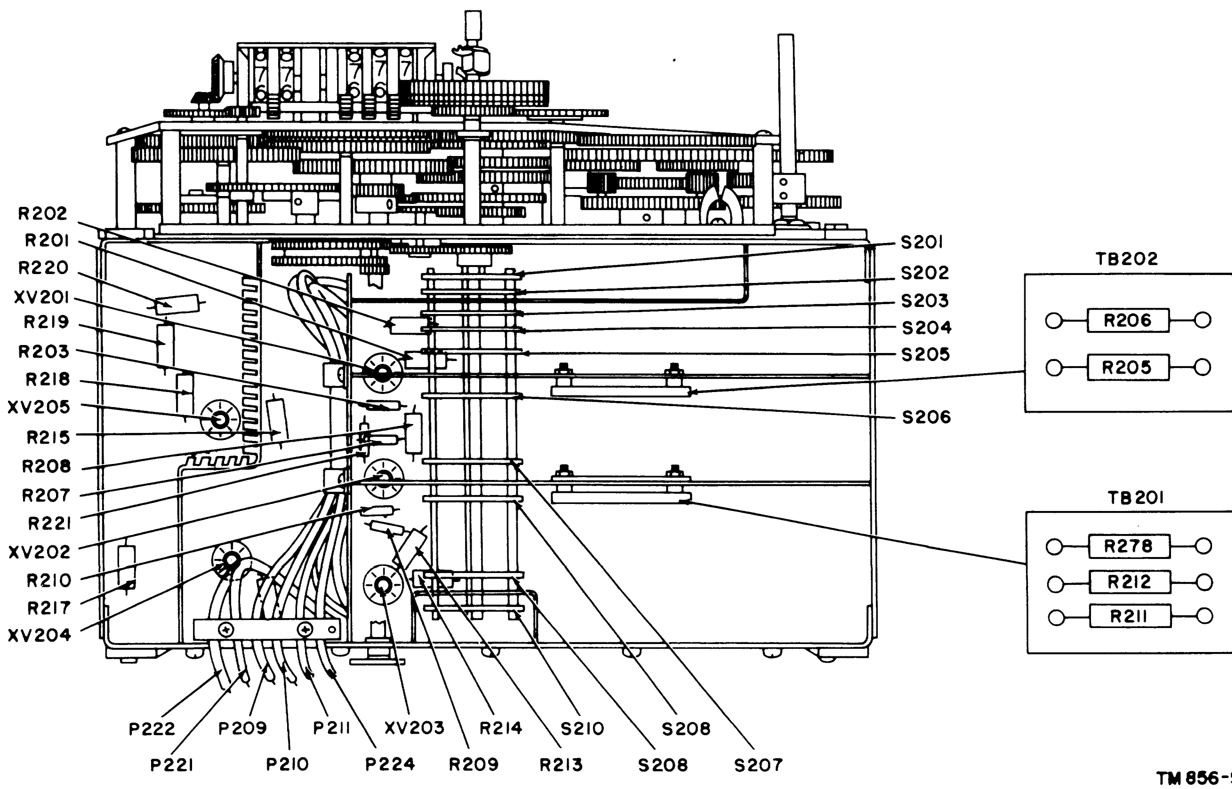


Figure 70. R-f subchassis, bottom view (second of two illustrations).

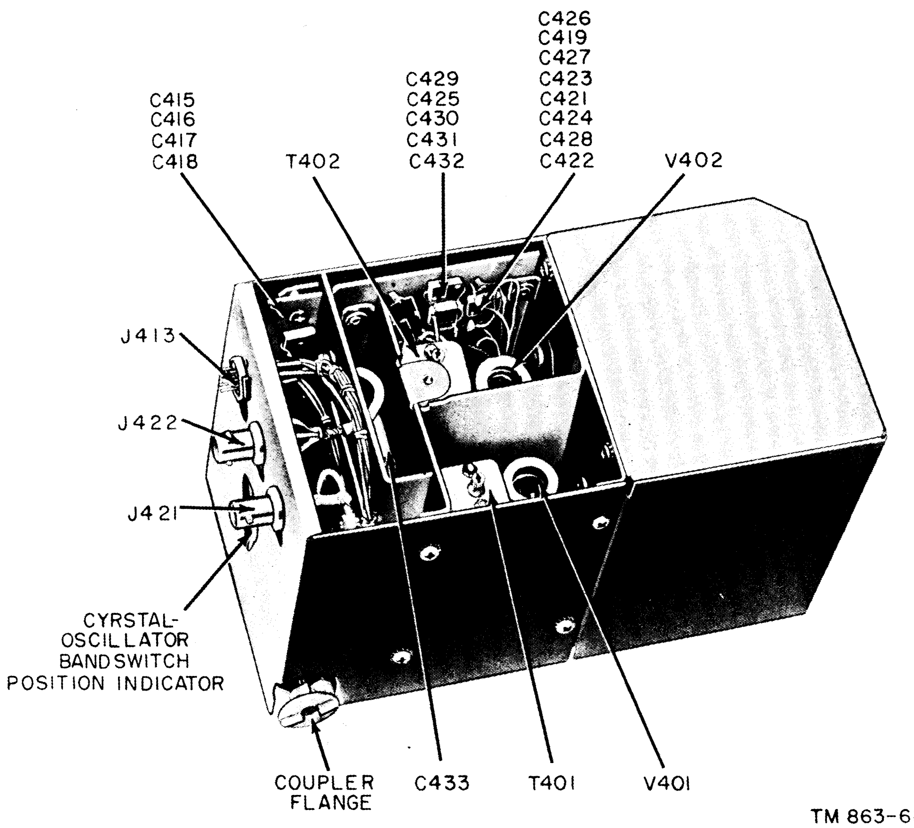


Figure 71. Crystal-oscillator subchassis, top view.

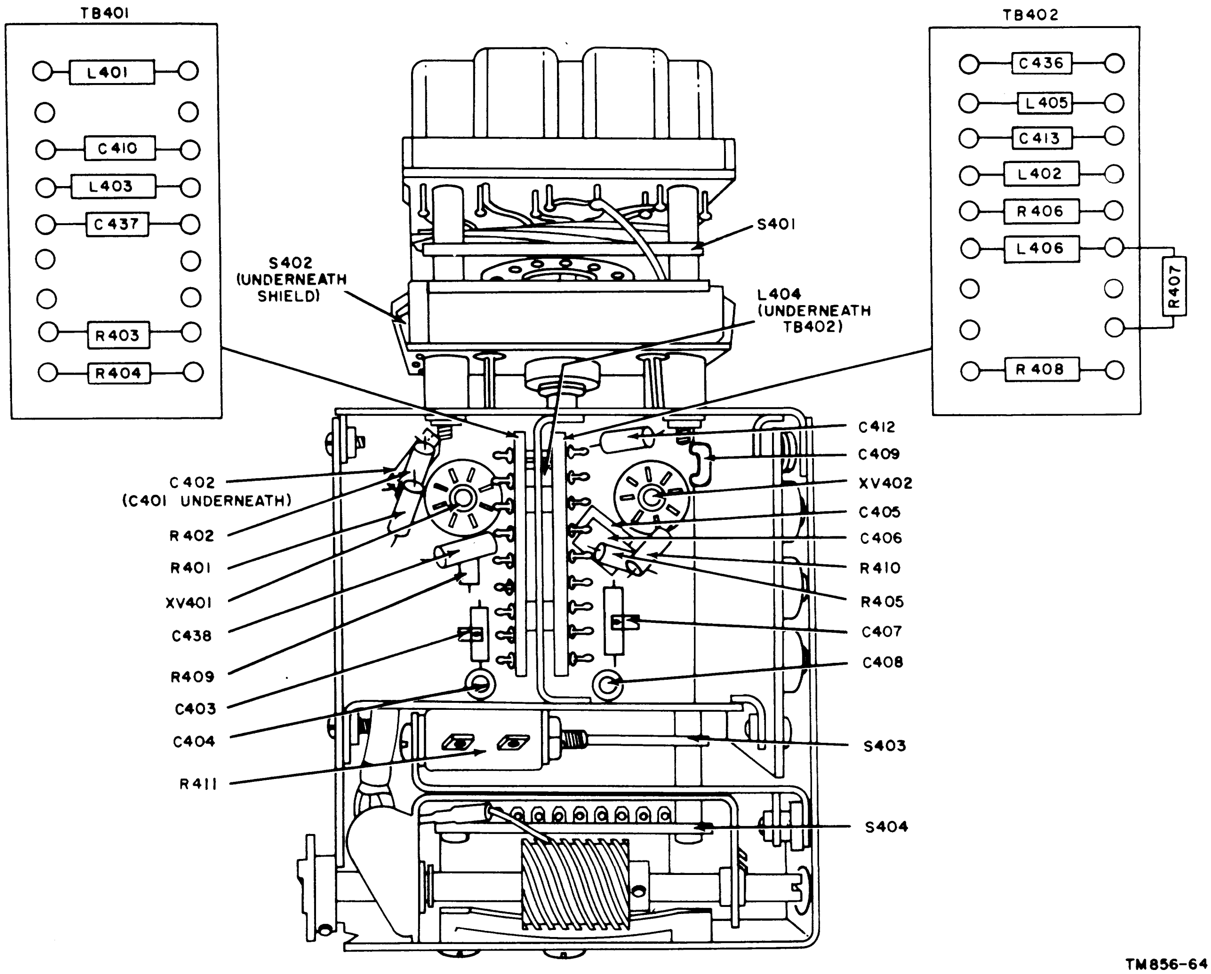


Figure 72. Crystal-oscillator subchassis, bottom view.

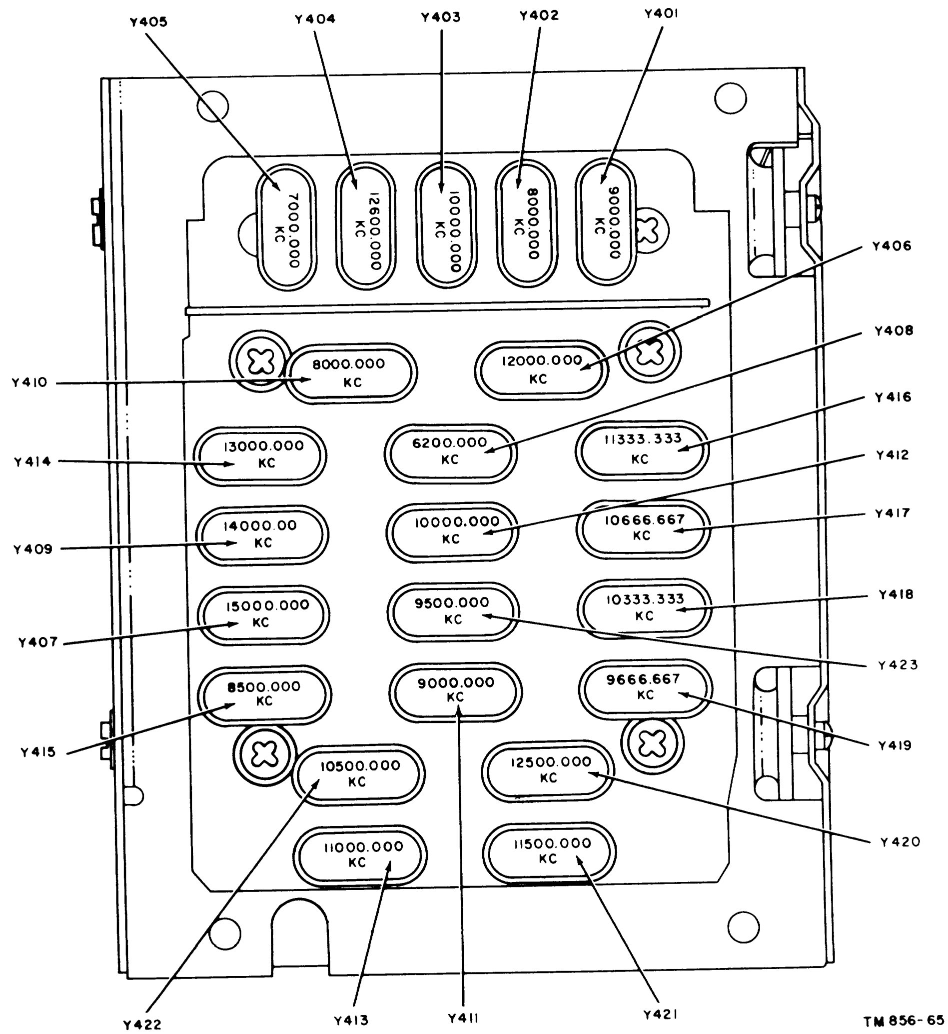


Figure 73. Crystal-oscillator subchassis, location of crystals.

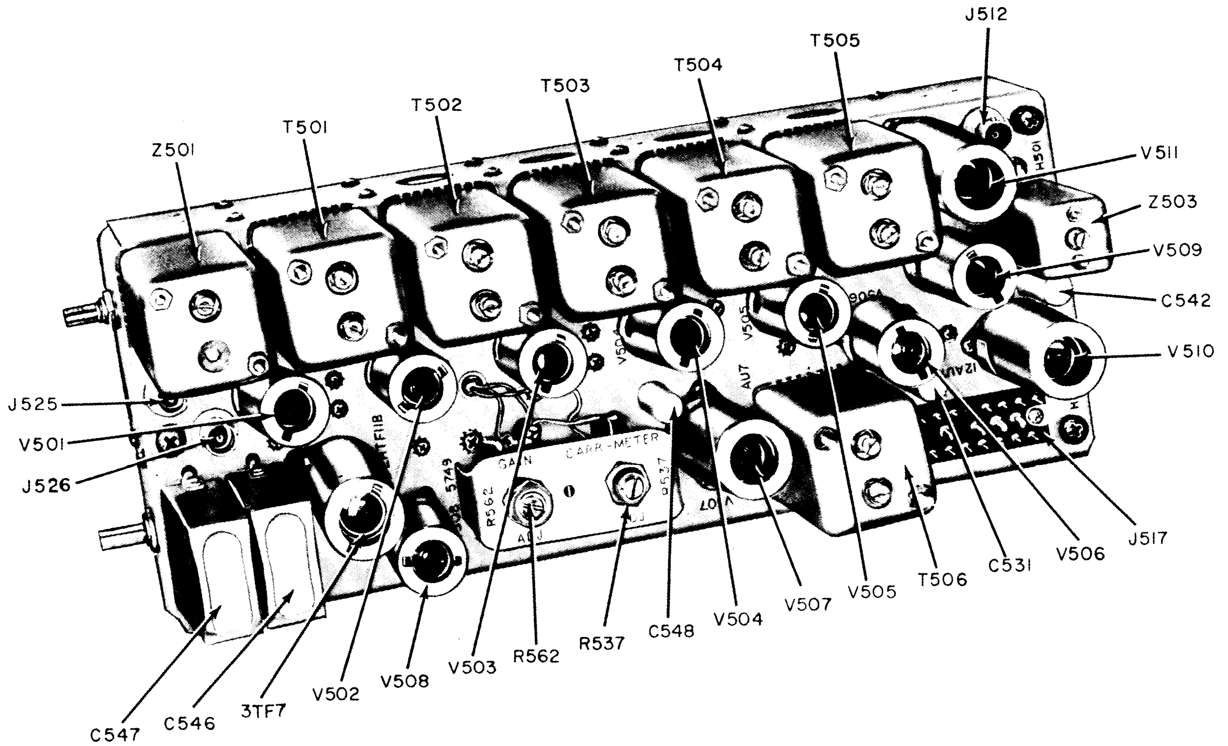


Figure 74. I-f subchassis, top view.

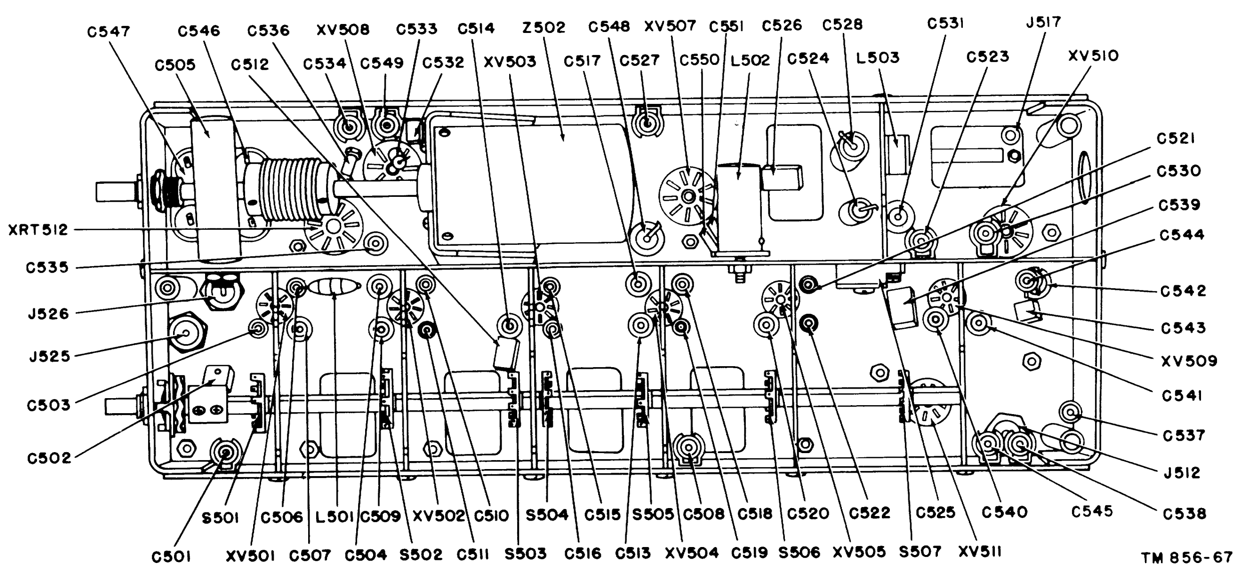


Figure 75. I-f subchassis, bottom view (first of two illustrations).

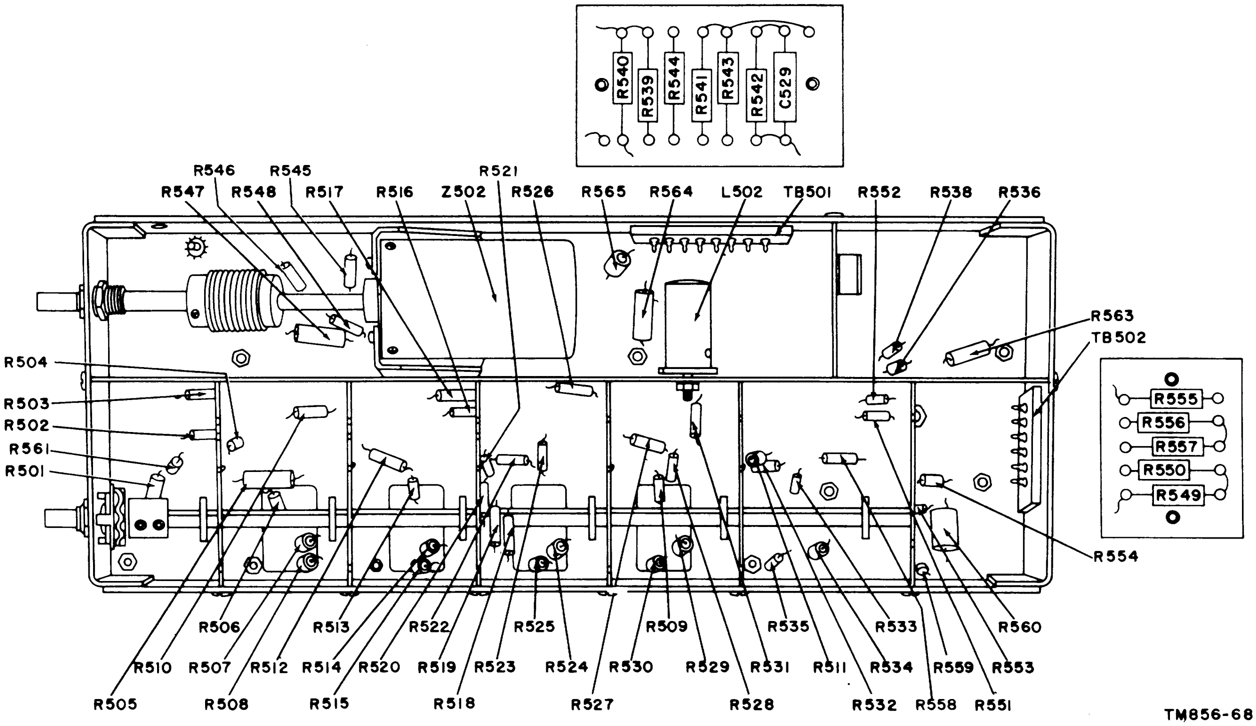


Figure 76. I-f subchassis, bottom view (second of two illustrations).

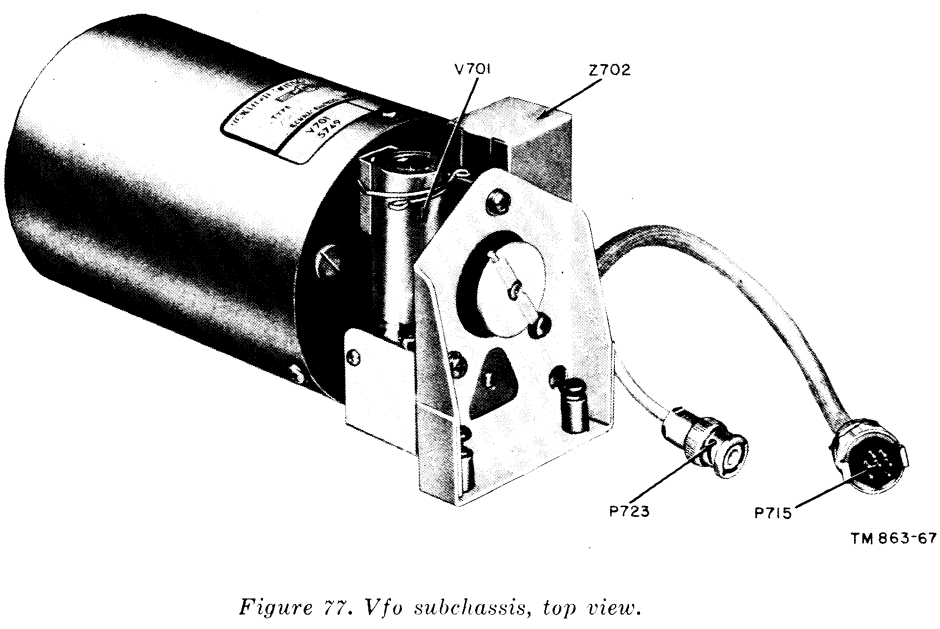


Figure 77. Vfo subchassis, top view.

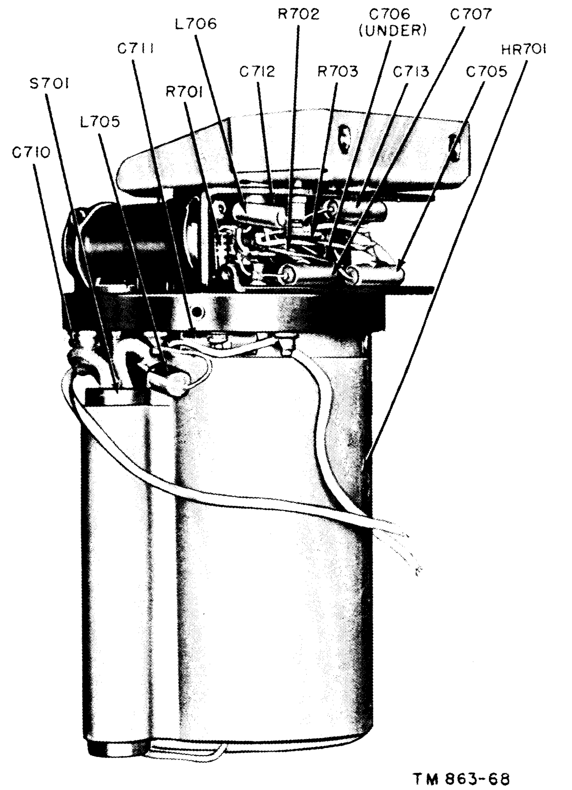


Figure 78. Vfo subchassis, bottom view.

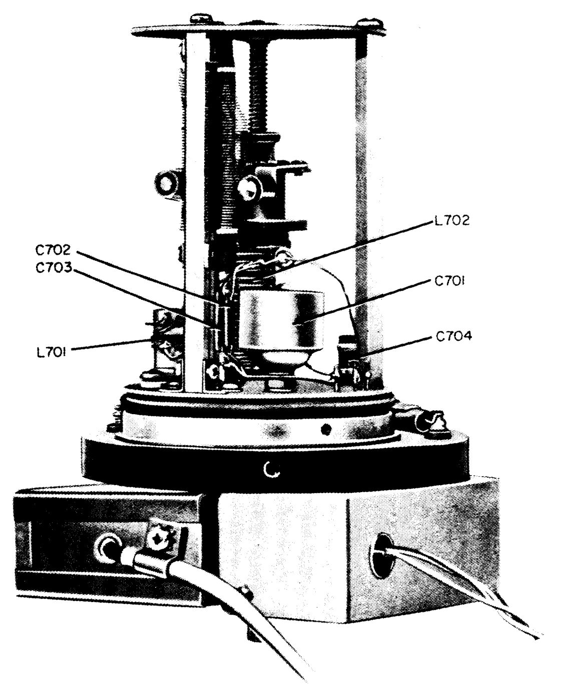


Figure 79. Vfo subchassis, sealed circuit, cover removed.

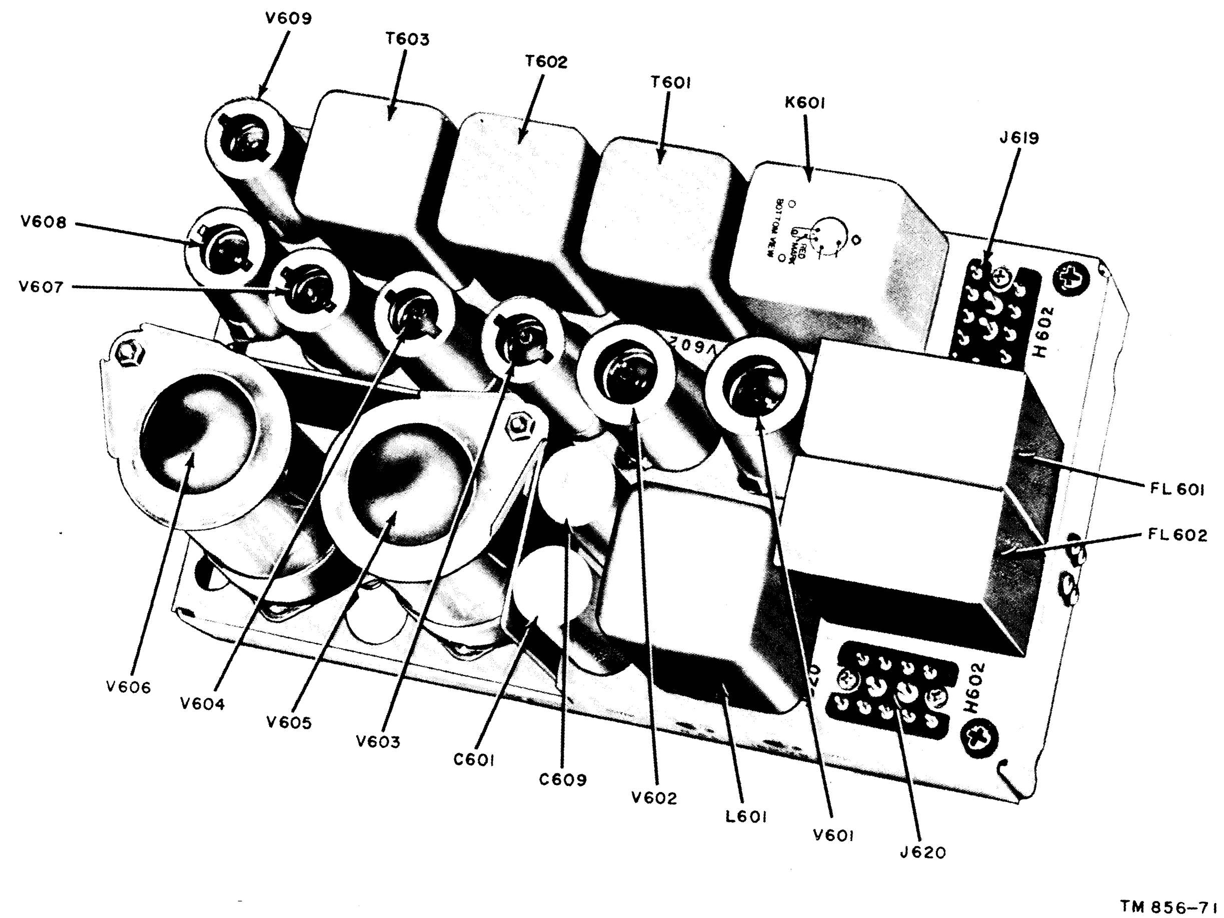


Figure 80. A-f subchassis, top view.

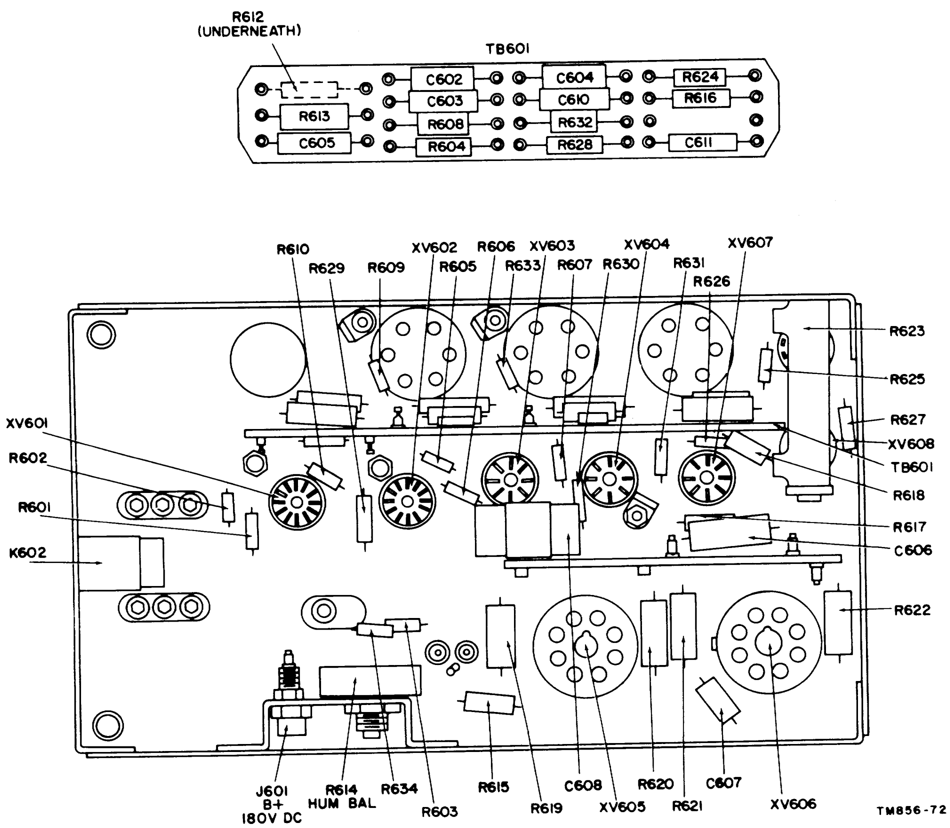


Figure 81. A-f subchassis, bottom view.

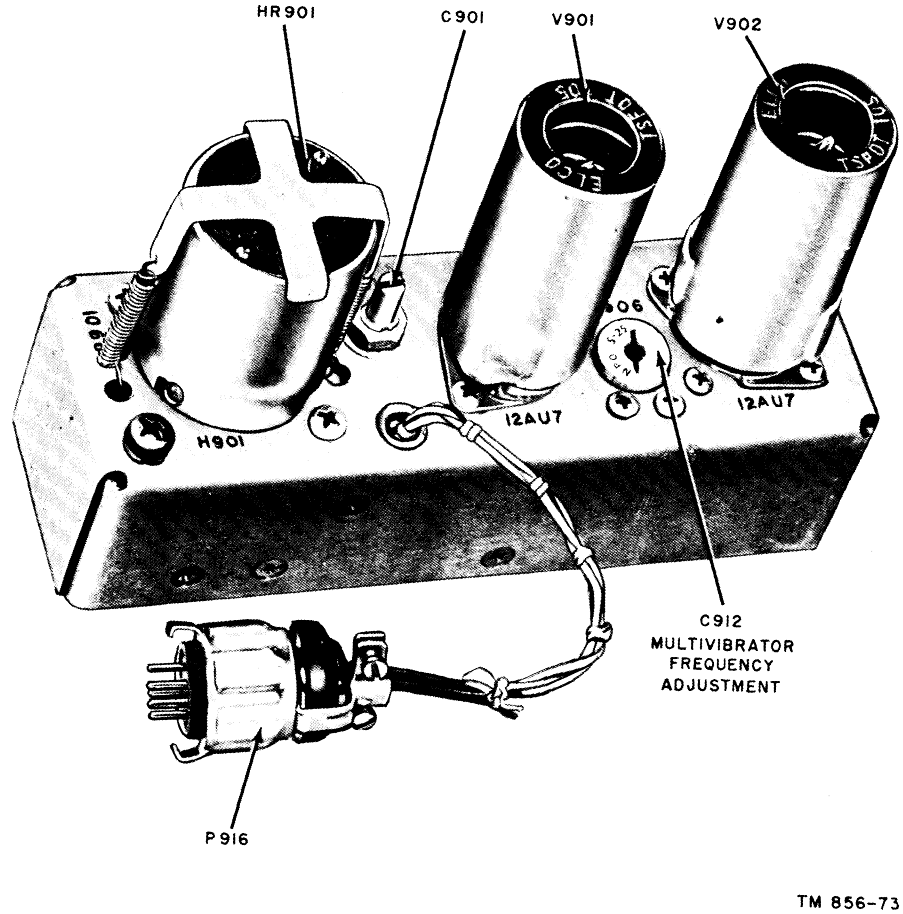


Figure 82. Calibration-oscillator subchassis, top view.

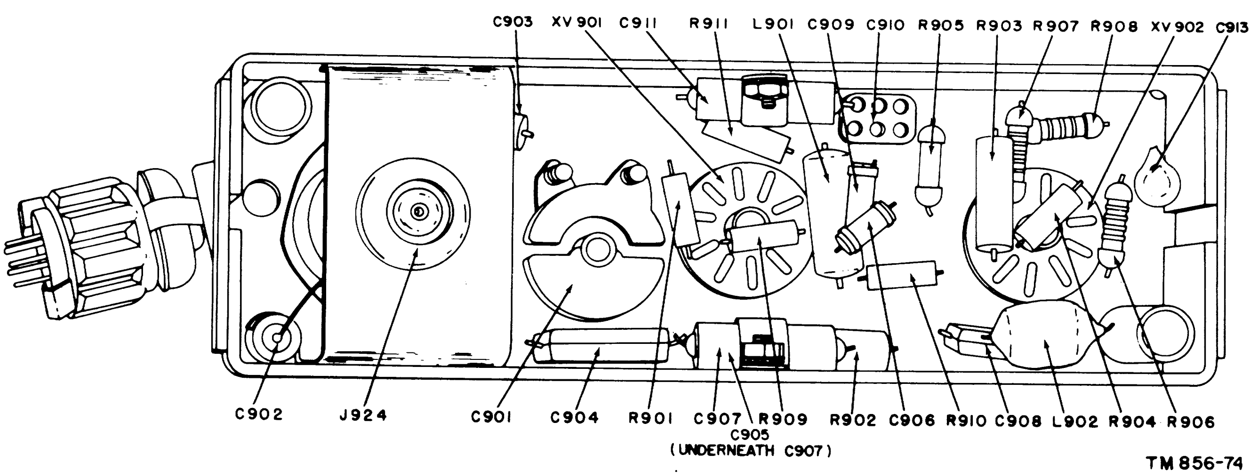


Figure 83. Calibration-oscillator subchassis, bottom view.

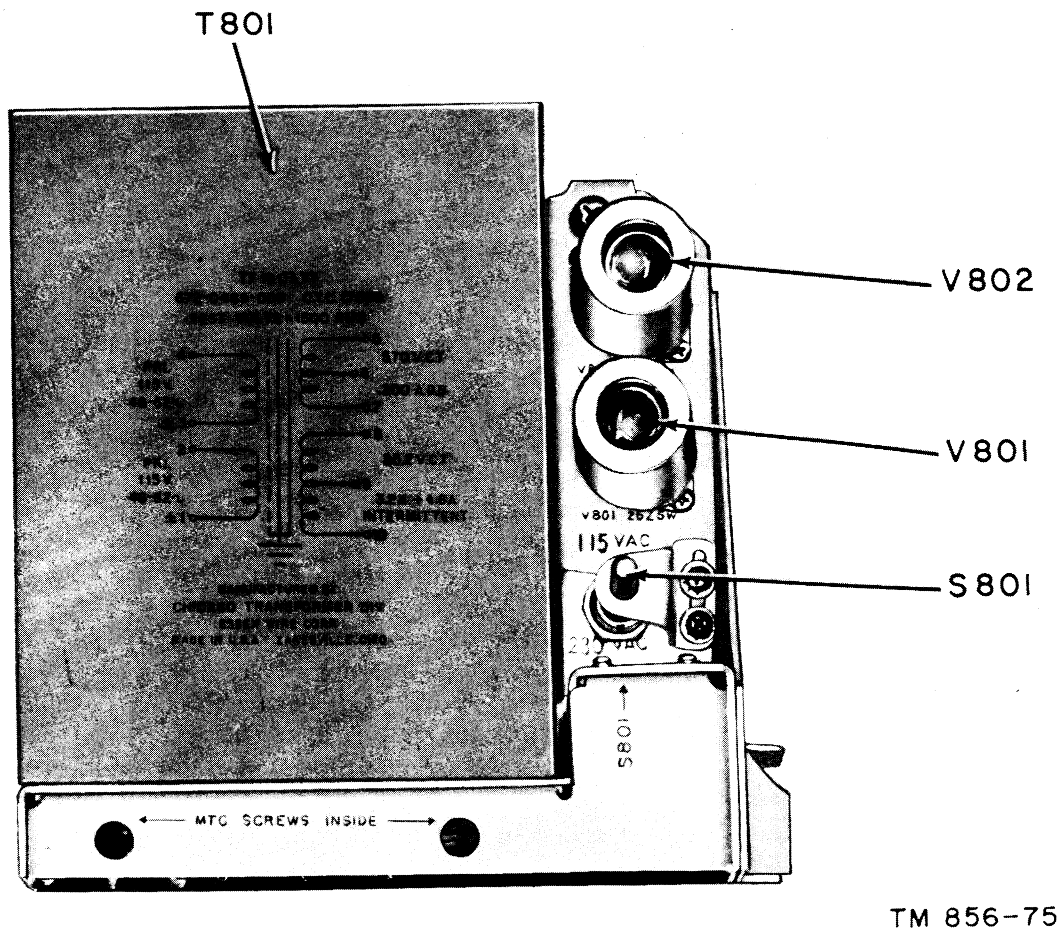


Figure 84. Power Supply PP-621/URR, top view.

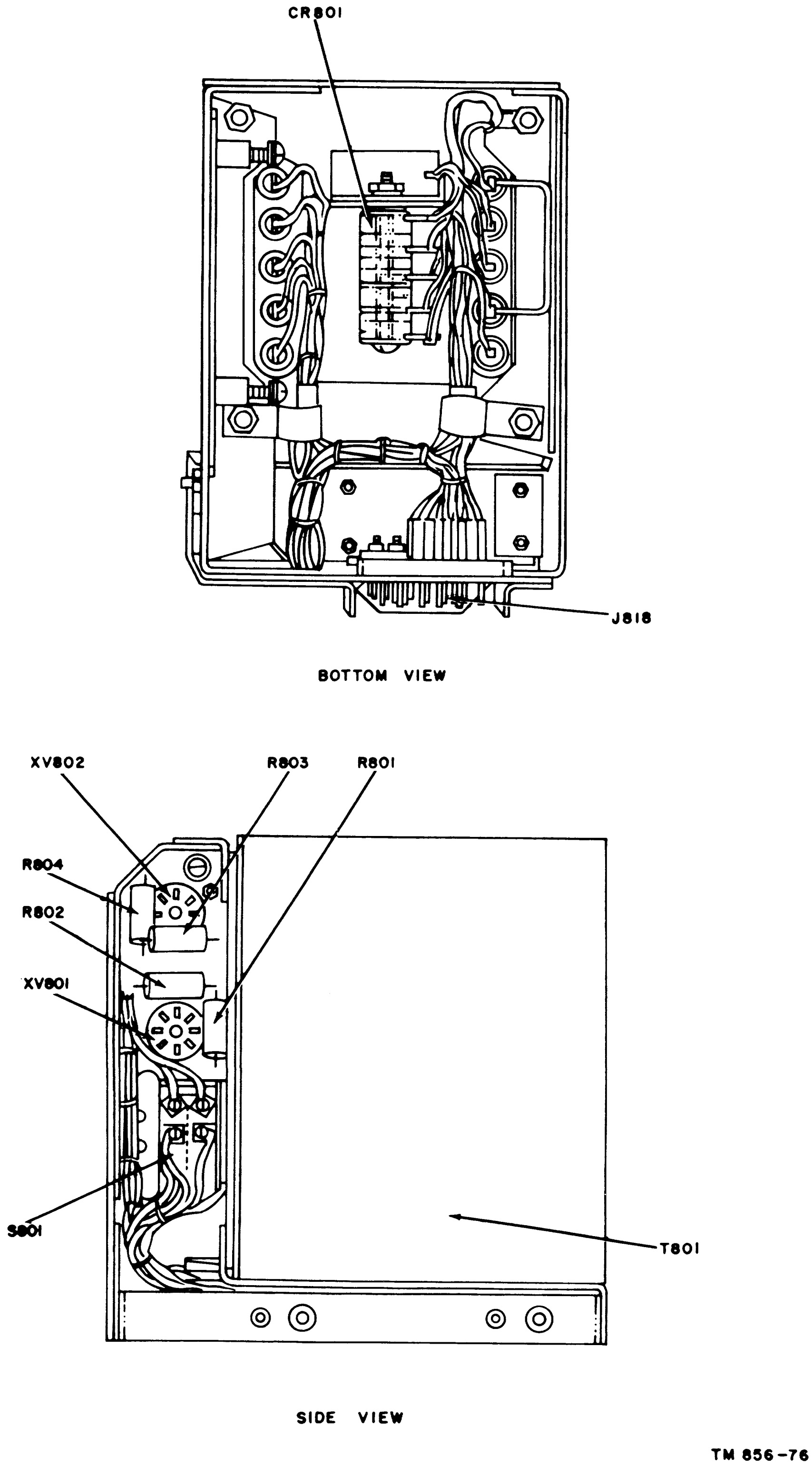


Figure 85. Power Supply PP-621/URR, bottom view.

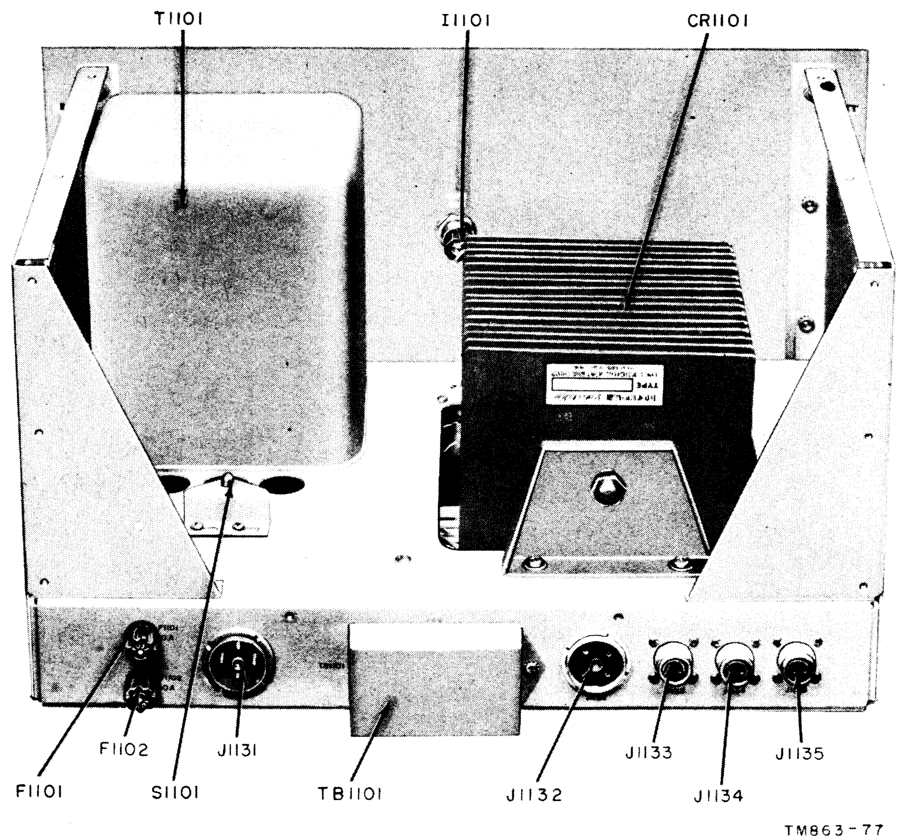


Figure 86. Power Supply PP-629/URR, rear view, covers removed.

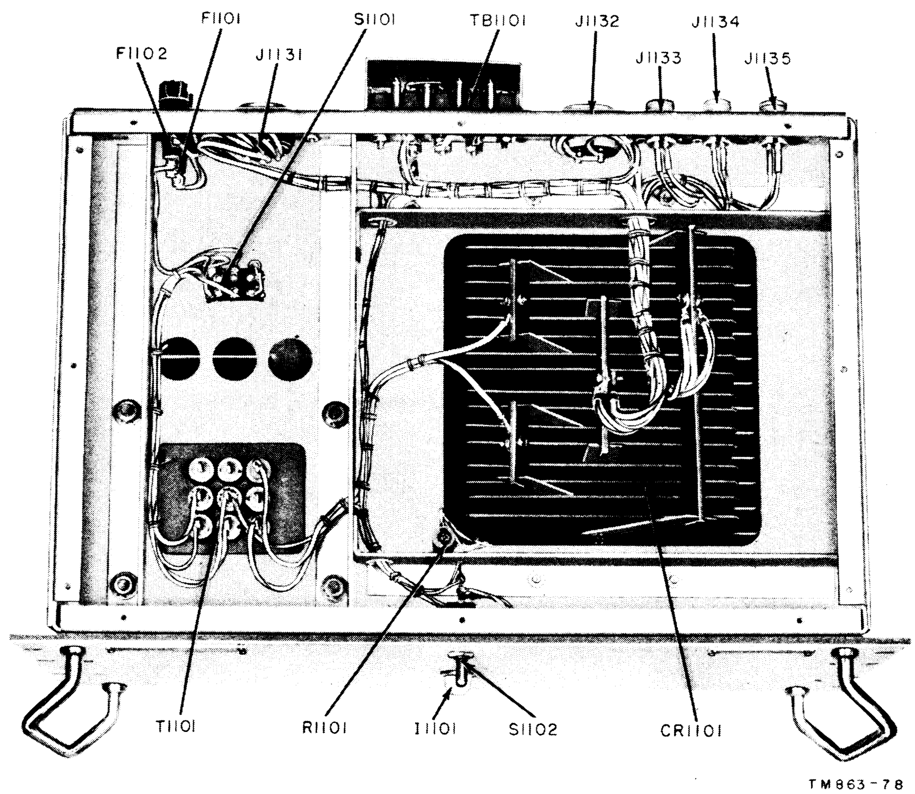


Figure 87. Power Supply PP-629/URR, bottom view, cover removed.

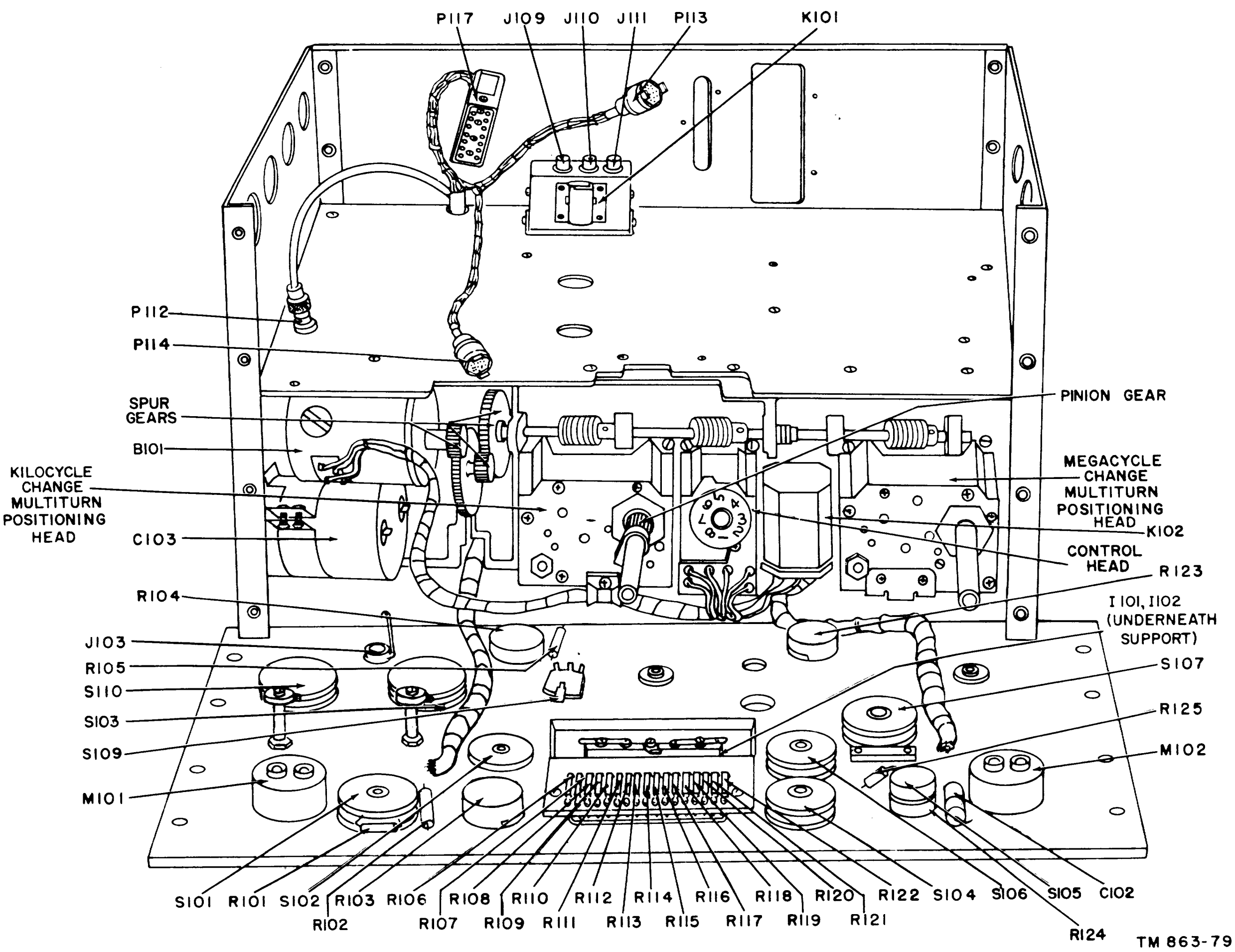


Figure 88. Front panel and main frame, top view.

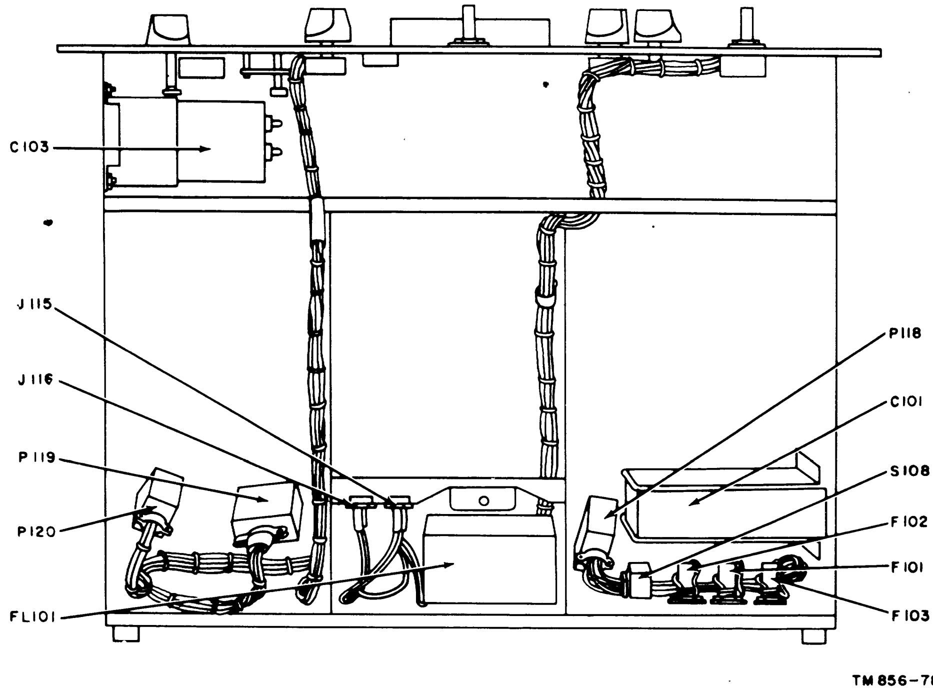


Figure 89. Front panel and main frame, bottom view.

100. Voltage and Resistance Checks

Voltage and resistance diagrams for the various subchassis of the receiver are shown in figures 90, 91 and 92. These drawings show the values that should be obtained at the tube-socket pins and terminal boards. If a value, as read on the multimeter, varies (outside of reasonable tolerance limits) from the value given in the diagrams, the amount of variance should be noted and used to aid in determining which part is at fault. For instance, if a 100,000-ohm resistance reading is indicated at a given tube-socket pin on a diagram, and the actual reading is 30,000 ohms on the meter, the circuit diagram of the subchassis should be examined for the presence of a resistor in the circuit under test that could, if defective, account for the incorrect reading. Such a resistor would then be suspected and should be checked. Another possibility would be that a capacitor has shorted out and is shunting a resistor. There are many ways of using the voltage and resistance diagrams, depending on the resourcefulness of the repairman.

101. Signal Substitution Notes

a. Signal substitution for Radio Receiver R-391/URR requires an audio oscillator, such as Audio Oscillator TS-382/U, for checking the line and local audio channels, and a signal generator, such as R.F. Signal Generator Set AN/URM-25, to provide a source of modulated r-f and i-f signals for checking the r-f, variable i-f, and fixed i-f stages. In addition to producing an i-f signal of 455 kc, the signal generator should cover an r-f range of at least 400 kc to 32 mc. The signal generator should be capable of furnishing an r-f signal output at any level between 1 microvolt and 1 volt.

b. A multimeter, such as Electronic Multimeter TS-505/U, and tube tester, such as Electron Tube Test Set TV-7/U, are needed to isolate the defective part after the faulty stage has been indicated by signal substitution.

c. For the tests described in paragraphs 102 through 106 inclusive, connect the ground lead of the audio oscillator or signal generator to the subchassis being tested, and connect the signal output lead through a capacitor (approximately .05 uf) (microfarad), to the point specified. The bench-testing information contained in paragraph 93 and the information contained in paragraph 95*a* indicate the method of preparing the subchassis for signal tracing.

d. Note the volume, and listen for distortion from the speaker or headset at various points in the signal-substitution procedure. Make certain that the LIMITER control is in the OFF position; if it is in the ON position, it may be the cause of the distortion. When working back from the output to the input stages, decrease the output of the signal generator as much as possible. If possible, compare results with a receiver known to be in good condition.

e. Check the wiring and soldering in each stage during the procedure.

f. A tuning shaft that is out of synchronization or a trimmer adjustment that is misalined may cause reduced output or may prevent any output. Synchronization of the shafts and cams (par. 119*a*) should be checked, and the position of the r-f and crystal oscillator band switches should be checked (par. 119*b* and *c*) before the adjustment of individual tuning circuits (pars. 121 through 126) is attempted.

g. When trouble is localized in a given stage, first test the tube, if such a test is indicated. Then measure the voltage and, finally, the resistance of the circuits of that stage (figs. 90, 91 and 92).

h. Trouble in a circuit or stage does not always change the voltage and resistance measurements at the tube socket. Instructions included in this paragraph merely serve as a guide, and suggest other procedures, such as voltage and resistance measurements of individual parts.

i. When testing, remove only *one* tube at a time. Check the type number of the tube, test the tube, and, if it is not defective, return it to its proper socket before removing another tube.

j. At each step it is assumed that all previous steps were completed satisfactorily. Isolate and clear any trouble discovered before proceeding with succeeding steps.

k. Refer to the notes in paragraph 95 while performing the tests.

102. Local-audio-channel Tests

a. Pin 5 of V603 (Plate of Local A-f Output Tube). Apply an a-f signal to pin 5 of tube V603 (fig. 80). Listen to the signal from a headset or speaker connected to the local audio output. The volume should be very low. If no signal is audible, check the connections to output transformer T602 (fig. 80), and test capacitor C604 for a short circuit (fig. 81).

b. Pin 1 of V603 (Grid of Local A-f Output Tube). Apply the signal to pin 1 of V603 (fig. 80). Listen for an increased output over that obtained in the preceding step (subpar. *a* above). If no signal is audible, test the tube and the voltages at the socket pins. When the signal is distorted or when there is a positive d-c voltage on the control grid with respect to the chassis, test capacitor C603 for leakage (fig. 81).

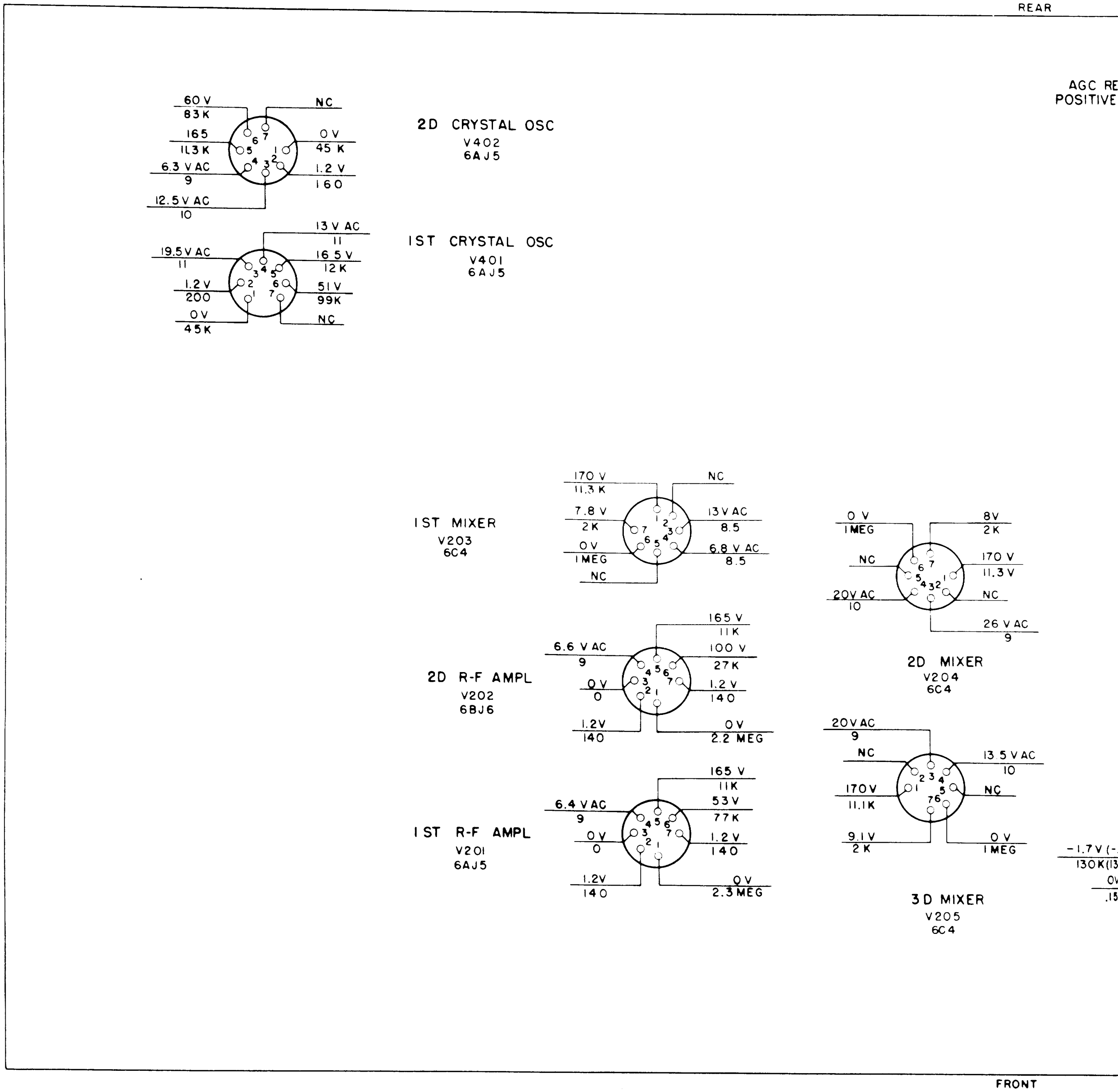
c. Pin 1 of V602 (Plate of Local A-F Amplifier). Connect the output of the generator to pin 1 of V602 (fig. 80). If the signal output decreases, test capacitor C603 (fig. 81).

d. Pin 2 of V602 (Grid of Local A-f Amplifier). Turn the LOCAL GAIN control fully on. Apply the signal to pin 2 of V602 (fig. 80). The output signal should be much louder than that obtained in the previous step (subpar. *c* above). If the signal is weak, check the tube and the voltages at the tube-socket pins (fig. 91).

103. Line-audio-channel Tests

Connect the headset to the LINE AUDIO output, terminals 10 and 13 of the rear terminal strip (fig. 21). After the LINE LEVEL meter has been checked, using Multimeter TS-352/U, it may be used as an output indicator. Rely on the headset, however, to detect noise and distortion.

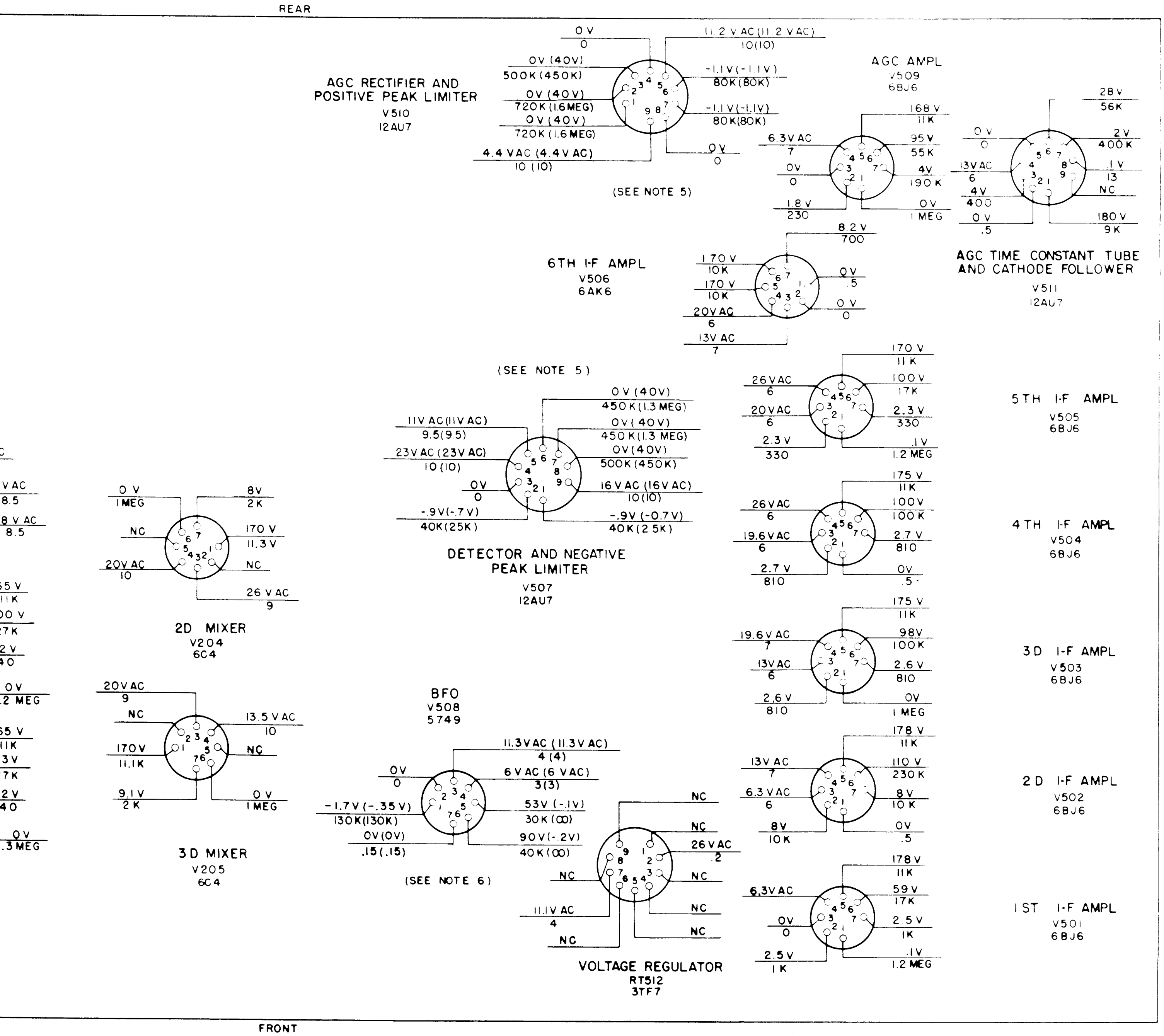
a. Pin 5 of V604 (Plate of Line A-f Output Tube). Insert the audio- oscillator signal at pin 5 of V604 (fig. 80). The volume should be very low, as heard in the headset. If no signal is audible, check the leads to output transformer T603 (fig. 80). The center leads of the secondary winding must be connected by a jumper between terminals 11 and 12 of the rear terminal strip (fig. 21). Test capacitor C611 (fig. 81).



NOTES:

1. UNLESS OTHERWISE SHOWN,
   RESISTORS ARE IN OHMS AND ARE MEASURED FROM SOCKET PIN TO GROUND WITH A 20,000 OHMS-PER-VOLT METER (SUCH AS MULTIMETER TS-352/U).
   VOLTAGES ARE DC AND ARE MEASURED FROM SOCKET PIN TO GROUND WITH A VTVM (SUCH AS ELECTRONIC MULTIMETER TS-505/U).
   READINGS ARE THE SAME ON ALL BANDS.
2. NC INDICATES NO CONNECTION.
3. ∞ INDICATES INFINITY.
4. UNLESS
   SET
   [AUDI
   TO [I
5. READING
   AT [C
6. READING

Figure 90. Radio Receiver R-391/URR, top deck tube volta



TES:

AND ARE MEASURED FROM SOCKET
,000 OHMS-PER-VOLT METER
S-352/U).
RE MEASURED FROM SOCKET
VM (SUCH AS
TS-505/U).
ON ALL BANDS.
ION.

4. UNLESS OTHERWISE NOTED, SET CONTROLS AS FOLLOWS: SET S801 TO 115-VOLTS A-C, [FUNCTION] TO [AGC], [AUDIO RESPONSE] TO [MED], [RF GAIN] TO [10], [LOCAL GAIN] TO [10], AND [BANDWIDTH] TO [8-KC].
5. READINGS IN PARENTHESES ARE MADE WITH [LIMITER] AT [OFF], OTHER READINGS ARE WITH [LIMITER] AT [10].
6. READINGS IN PARENTHESES ARE MADE WITH [BFO] AT [OFF].

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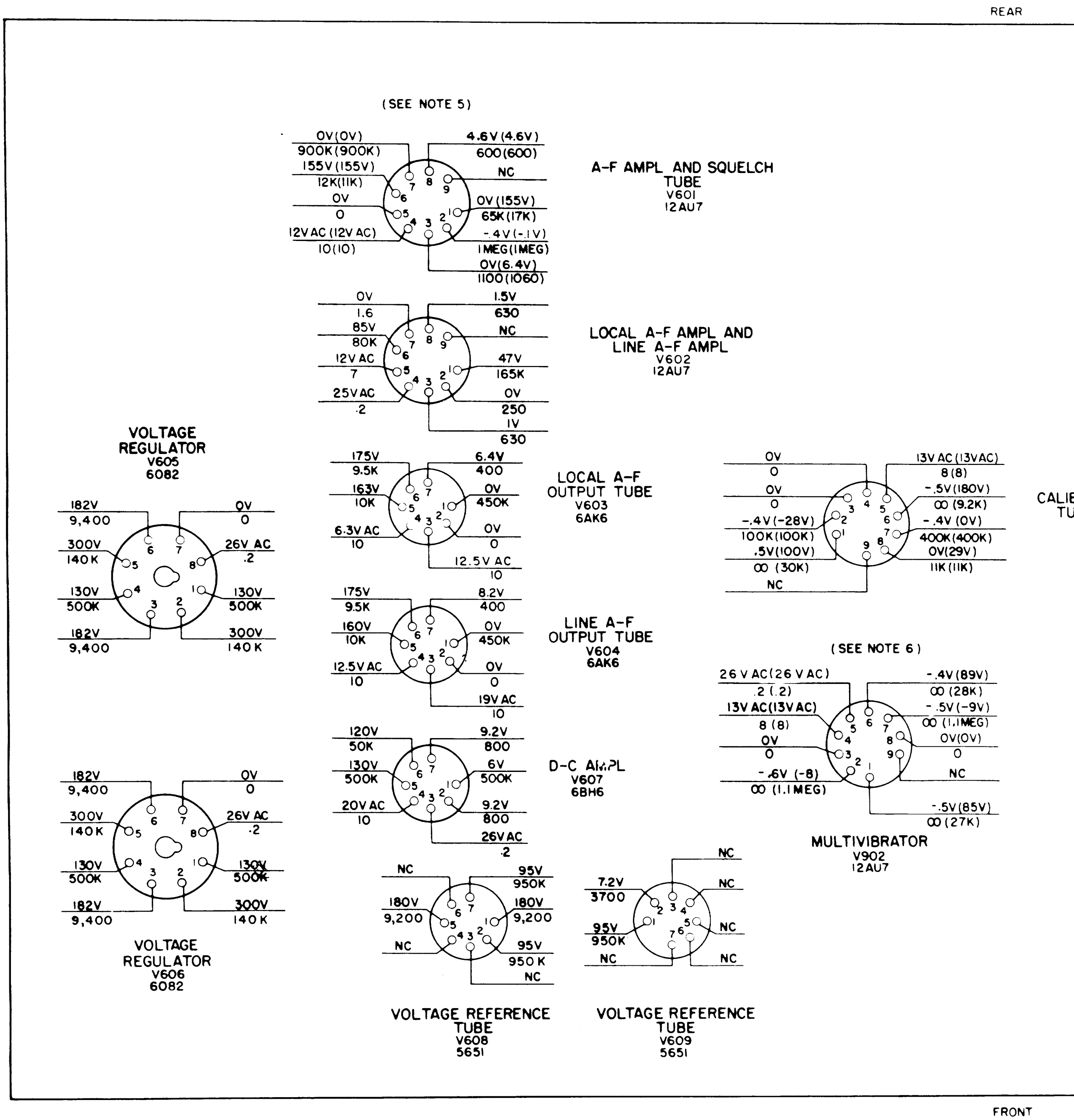
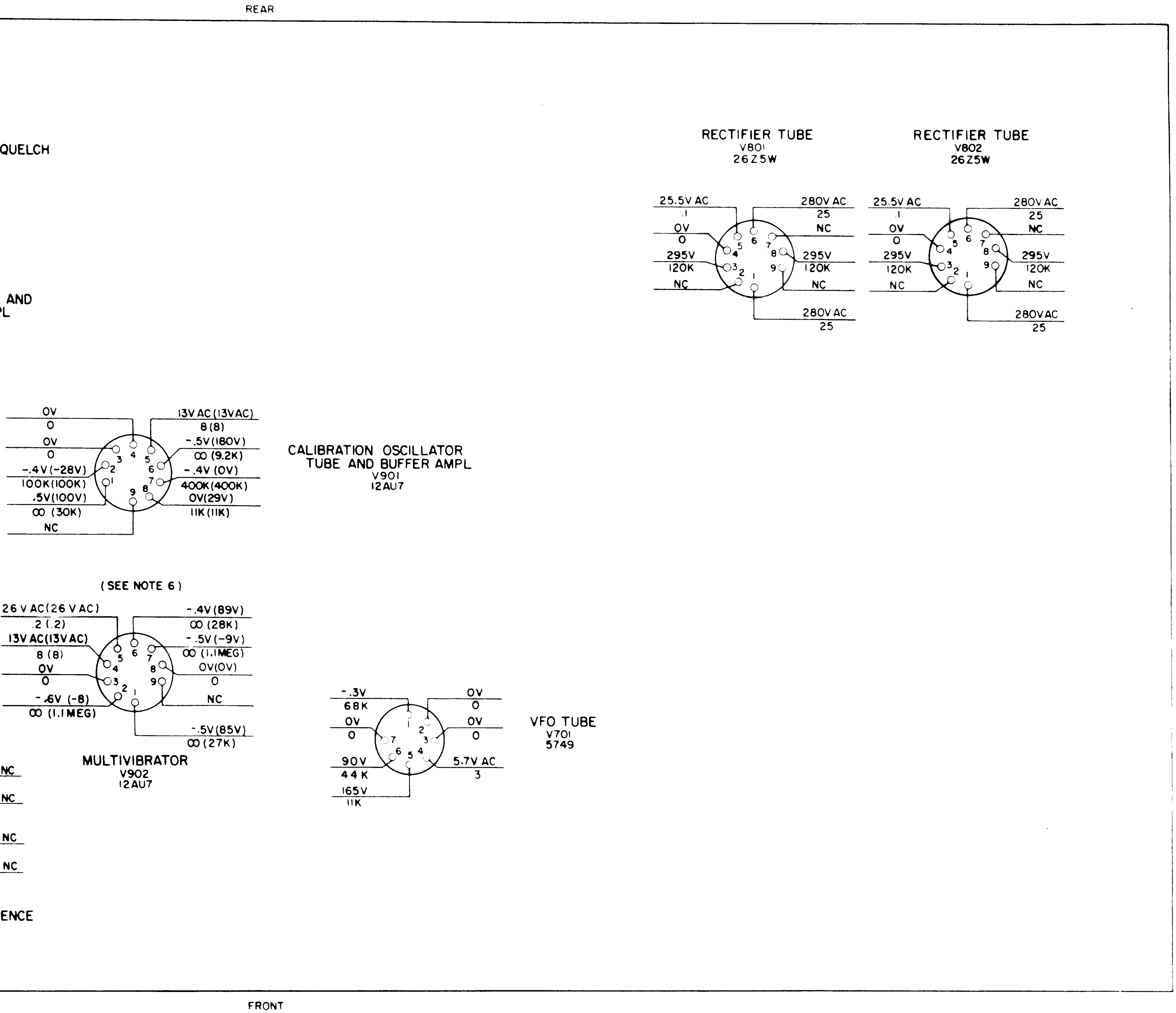
dio Receiver R-391/URR, top deck tube voltage and resistance diagram.



NOTES:

1. UNLESS OTHERWISE SHOWN
   RESISTORS ARE IN OHMS AND ARE MEASURED FROM SOCKET PIN TO GROUND WITH A 20,000 OHM-PER-VOLT METER (SUCH AS MULTIMETER TS-352/U).
   VOLTAGES ARE DC AND ARE MEASURED FROM SOCKET PIN TO GROUND WITH A VTVM (SUCH AS ELECTRONIC MULTIMETER TS-505/U).
   READINGS ARE THE SAME ON ALL BANDS.
2. NC INDICATES NO CONNECTION.
3. ∞ INDICATES INFINITY.
4. UNLESS OTHERWISE NOTED, SET CONTROL
   SET S801 TO 115-VOLTS AC, [FUNCTI
   [AUDIO RESPONSE] TO [MED], [RF GAIN]
   TO [10], AND [BANDWIDTH] TO [8-KC].
5. READING IN PARENTHESIS ARE MADE WI
6. READINGS IN PARENTHESIS ARE MADE WI

Figure 91. Radio Receiver R-391/URR, bottom dec



KET

NIC

4 UNLESS OTHERWISE NOTED, SET CONTROLS AS FOLLOWS:
SET S801 TO 115-VOLTS AC, [FUNCTION] TO [AGC], [AUDIO RESPONSE] TO [MED], [RF GAIN] TO [10], [LOCAL GAIN] TO [10], AND [BANDWIDTH] TO [8-KC].

5 READING IN PARENTHESIS ARE MADE WITH [FUNCTION] SWITCH AT [SQUELCH].

6 READINGS IN PARENTHESIS ARE MADE WITH [FUNCTION] AT [CAL]

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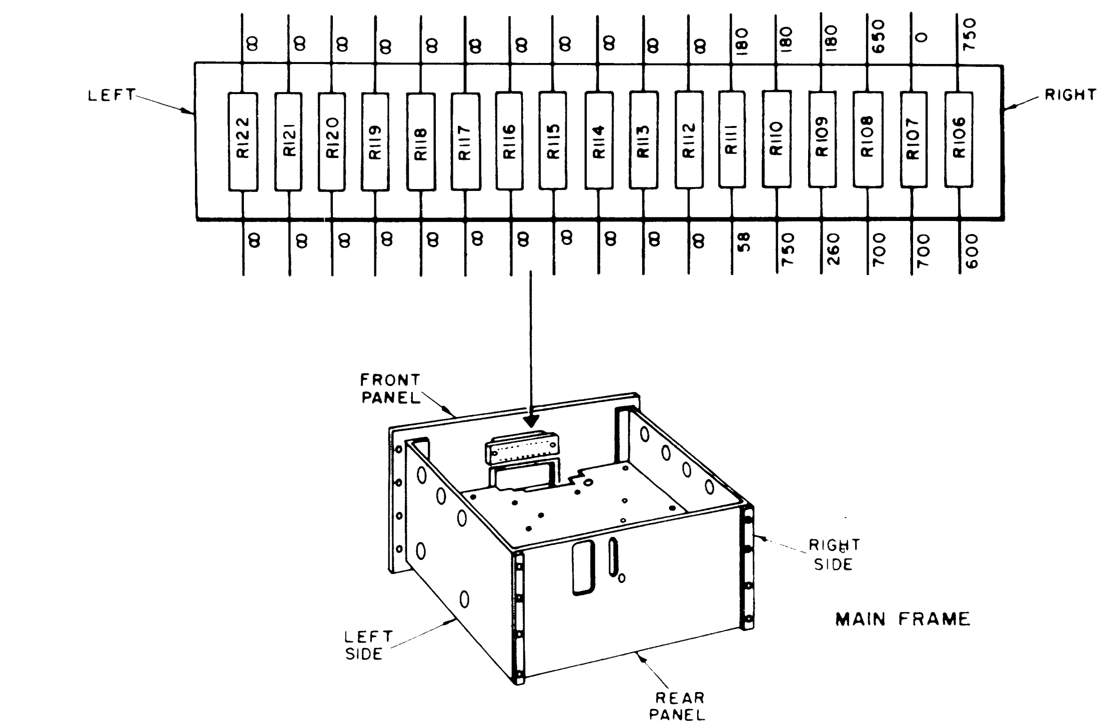
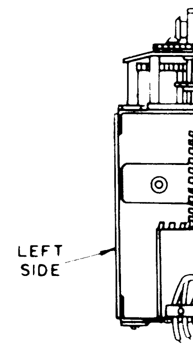
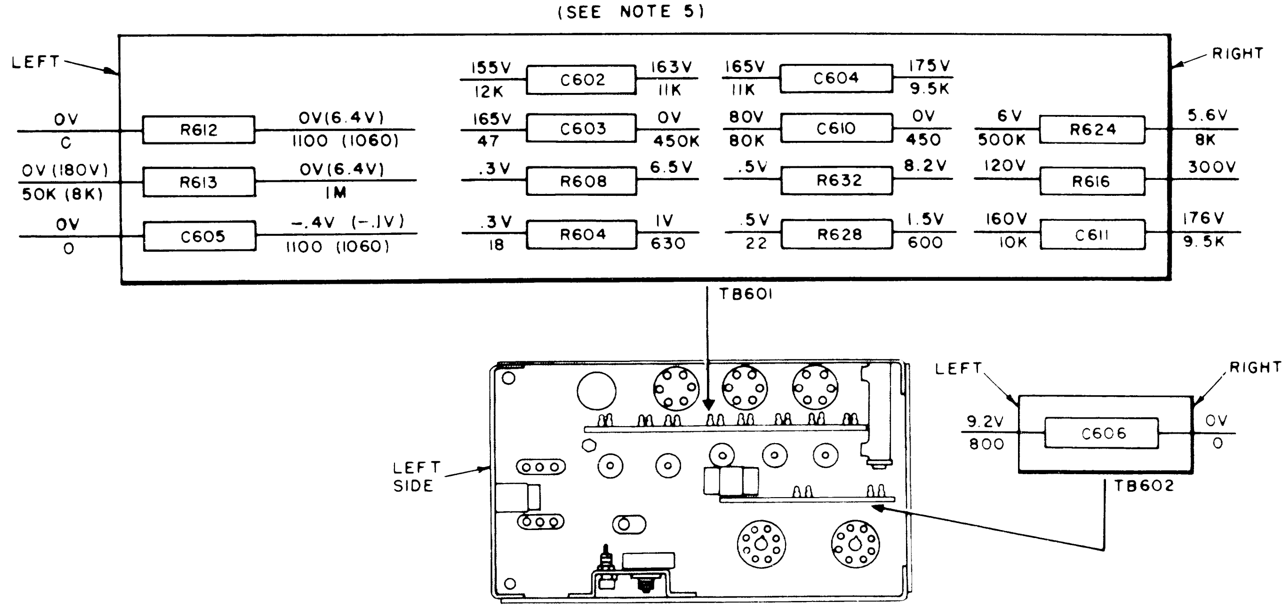
. Radio Receiver R-391/URR, bottom deck tube voltage and resistance diagram.



MAIN FRAME





A-F SUBCHASSIS

Figure

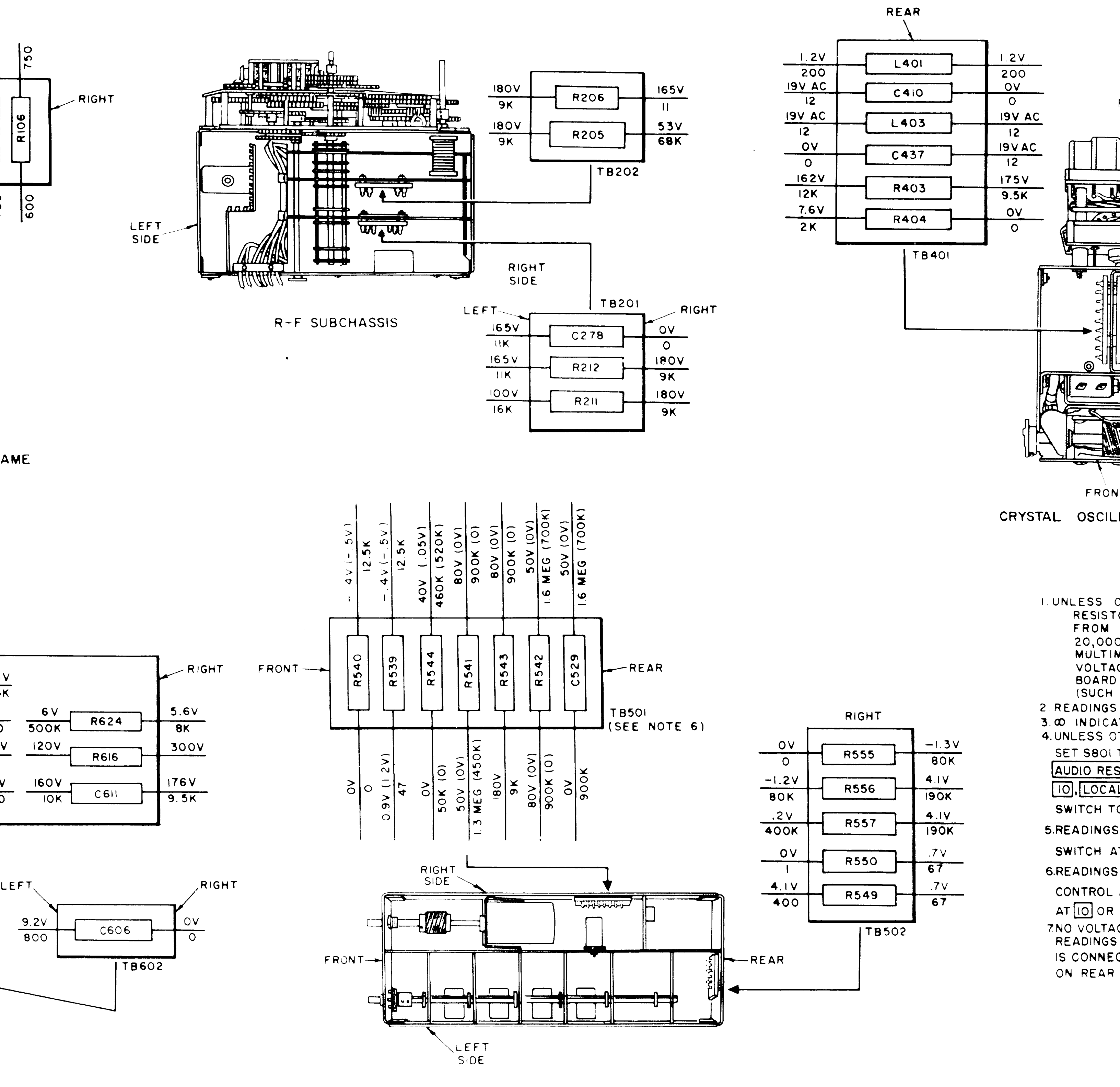
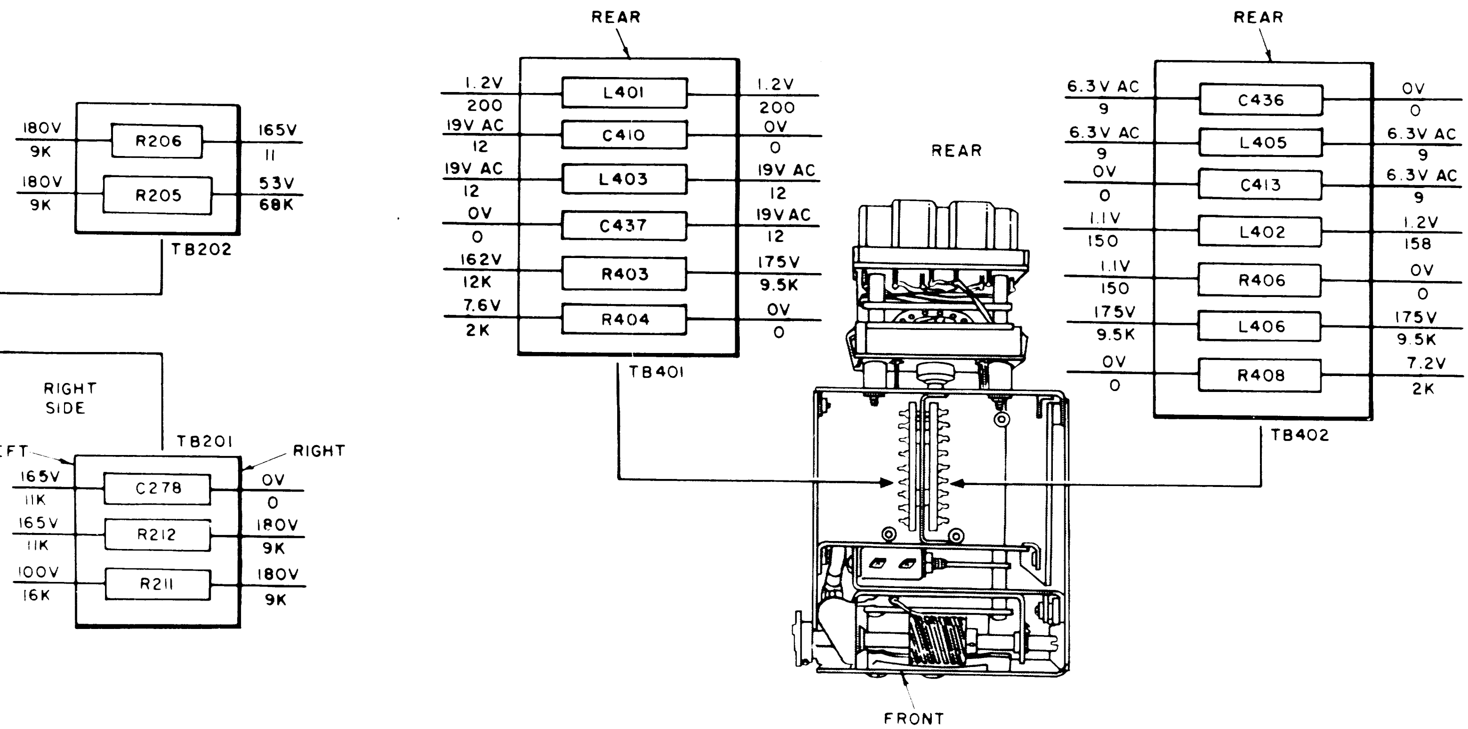
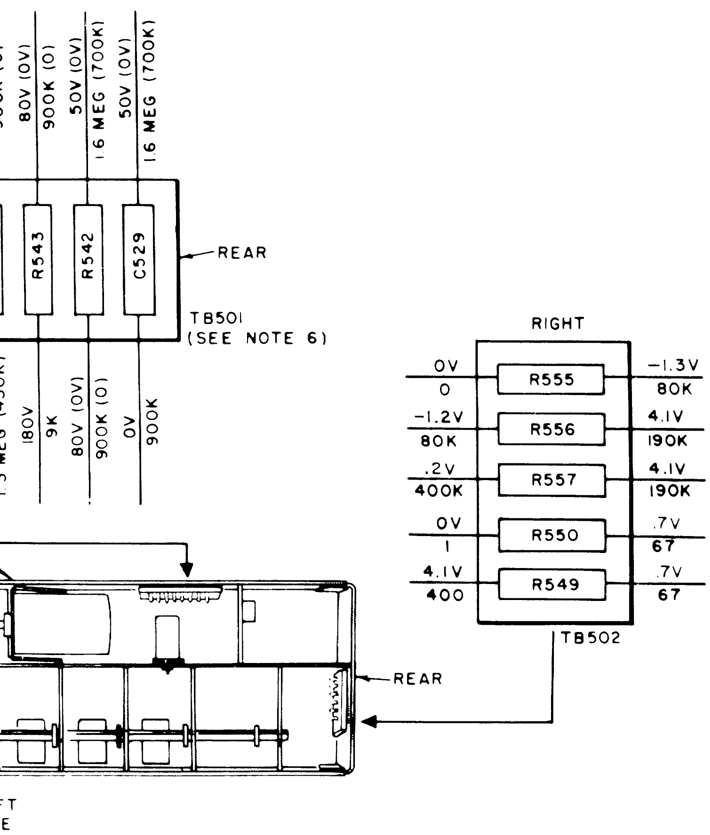


Figure 92. Terminal boards, voltage and resistance diagram.



CRYSTAL OSCILLATOR SUBCHASSIS



I-F SUBCHASSIS

NOTES:

1. UNLESS OTHERWISE SHOWN,
   RESISTORS ARE IN OHMS, AND ARE MEASURED FROM BOARD TERMINAL TO GROUND WITH A 20,000 OHMS-PER-VOLT METER (SUCH AS MULTIMETER TS-352/U).
   VOLTAGES ARE DC AND ARE MEASURED FROM BOARD TERMINAL TO GROUND WITH A VTVM (SUCH AS ELECTRONIC MULTIMETER TS-505/U).
2. READINGS ARE THE SAME ON ALL BANDS.
3. ∞ INDICATES INFINITY.
4. UNLESS OTHERWISE NOTED, SET CONTROLS AS FOLLOWS: SET S801 TO 115-VOLTS A-C, FUNCTION SWITCH TO AGC, AUDIO RESPONSE SWITCH TO MED., RF GAIN CONTROL TO 10, LOCAL GAIN CONTROL TO 10, AND BANDWIDTH SWITCH TO 8.
5. READINGS IN PARENTHESIS ARE MADE WITH FUNCTION SWITCH AT SQUELCH.
6. READINGS IN PARENTHESIS ARE MADE WITH LIMITER CONTROL AT 10, OTHER READINGS ARE WITH LIMITER AT 10 OR OFF.
7. NO VOLTAGE READINGS ARE TAKEN, ALL RESISTANCE READINGS ARE MADE WHILE A 600-OHM LOUDSPEAKER IS CONNECTED TO LOCAL AUDIO TERMINALS 6 AND 7 ON REAR PANEL.

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and resistance diagram.

b. Pin 1 of V604 (Grid of Line A-f Output Tube). Apply the signal to pin 1 of V604 (fig. 80). The output signal should be much louder than that obtained in the previous step (subpar. *a* above). If the output is unsatisfactory, check the tube and the voltages at the tube-socket pins (fig. 91). If the grid bias is incorrect, as indicated by distortion or excessive plate current, check capacitor C610 for leakage (fig. 81). Check the operation of the LINE METER switch and the LINE METER switch and the LINE LEVEL meter.

c. Pin 6 of V602 (Plate of Line A-f Amplifier). Apply the audio-oscillator signal to pin 6 of V602 (fig. 80). Rotate the LINE GAIN control fully on. If the signal output decreases noticeably, test capacitor C610 (fig. 81).

104. A-f Amplifier Tests

a. Pin 6 of V601 (Plate). Introduce the signal from the audio oscillator at pin 6 of V601 (fig. 80). Set the AUDIO RESPONSE switch to MED. The signal output should be somewhat less than that obtained when the signal was applied to pin 7 of V602. If no signal is heard, or if the signal is weak, check capacitor C602 (fig. 81) for a short circuit, and check the connections to the AUDIO RESPONSE switch.

b. Pin 7 of V601 (Grid). Apply the signal to pin 7 of V601 (fig. 80). The output signal should be much louder than that obtained in the preceding step (subpar. *a* above). If the signal is weak, test the tube and the voltages at the tube-socket pins (fig. 91).

105. I-f Subchassis Tests

a. Pins 1 and 2 of V510 (Anode of Positive-peak Limiter). Introduce an a-f signal at pins 1 and 2 of V510 (fig. 74). If no signal is audible, or if the signal is weak, check capacitor C529 (fig. 76). Check the seating of connectors P117 and P119 in connectors J517 and J619, respectively (figs. 74 and 80).

b. Pin 3 of V510 (Cathode of Positive-peak Limiter). Apply the a-f signal to pin 3 of V510 (fig. 74). A weak signal may indicate that V510 is defective or that resistor R542 or R544 is open (fig. 76).

c. Pins 6 and 7 of V507 (Anode of Negative-peak Limiter). Apply the a-f signal to pins 6 and 7 of tube V507 (fig. 74). If the signal is weak, check V507 and resistor R541.

d. Pins 1 and 2 of V507 (Anode of Detector). Introduce a 455-kc modulated signal from the signal generator at pins 1 and 2 of V507 (fig. 74). If there is no output signal, or if the signal is weak, check the tube and the jumper connection between terminals 14 and 15 of the rear terminal strip (fig. 21). If the trouble persists, check the voltage and resistance of the circuit components (fig. 90).

e. Pin 5 of V506 (Plate of Sixth I-f Amplifier. Apply the 455-kc modulated signal to pin 5 of V506 (fig. 74). A weak output signal may indicate that transformer T506 is not alined properly, or that it has an open or short-circuited winding.

f. Pin 1 of V506 (Grid of Sixth I-f Amplifier). Apply the signal to pin 1 of V506 (fig. 74). The output signal should be somewhat louder than that obtained in the preceding step. If the signal is weak, check the tube and tube-socket voltages (fig. 91). Test cathode-bypass capacitor C523 and screen-grid capacitor C524 (fig. 75) for an open circuit by temporarily shunting capacitors of like value across them.

g. Pins 5 and 1 (Plate and Grid of First Five I-f Amplifiers). Set the FUNCTION switch at MGC, turn the RF GAIN control fully on, and set the BANDWIDTH switch at the 4-KC position. Apply the 455-kc modulated signal in turn to pins 5 and 1 of the first five 455-kc i-f amplifiers, proceeding from the fifth stage to the first (fig. 74). Correct any faults found in a stage before proceeding to the next.

106. R-f Subchassis Tests

a. Pin 1 of V205 (Plate of Third Mixer). Introduce the 455-kc modulated signal at pin 1 of V205 (fig. 68). If no signal is heard, check transformer T207 and the signal connections to the i-f subchassis (figs. 68 and 69).

Note. For the remainder of the signal substitution tests, tune the receiver to a frequency of 2 mc in the 1- to 2-mc band by setting the frequency-indicator reading at 01 + 000.

b. Pins 6 and 7 of V205 (Grid and Cathode of Third Mixer). Apply a 2-mc modulated signal to test point E210 (fig. 68). If no output signal is heard, connect an antenna or a 2-mc signal source to the antenna terminals of the receiver, and, at the same time, apply a strong 2,455-kc unmodulated signal to pin 7 of V205 (fig. 68). The reception of static or signal when the 2,455-kc signal is substituted for the receiver oscillator signal indicates a faulty vfo. To check for injection voltage from the vfo, set the FUNCTION switch at STAND BY, and measure the d-c voltage using the VTVM at test point E210 (fig. 68). The voltage should be between 3 and 11 volts dc (this is a reference voltage only). This voltage is present because tube V205 is rectifying the vfo oscillator signal. If the voltage is within these limits, injection voltage from the vfo is available. Measure the amount of injection voltage from the vfo by disconnecting P723 (fig. 98) and connecting the a-c probe of Electronic Multimeter TS-505/U to the contact of the plug. The voltage should measure approximately 2 to 3 volts ac for normal operation. When the trouble is in the vfo, check its tube (V701), check for loose coupling at the oscillator tuning shaft (par. 119*d*), and check the tube-socket voltages. If no output signal is heard when the 2,455-kc unmodulated signal is applied to pin 7 of V205, check the third mixer, V205, and its tube-socket voltages (fig. 90).

c. Pin 1 of V204 (Plate of Second Mixer). With the FUNCTION switch at MGC, apply the modulated 2-mc signal to pin 1 of V204 (fig. 68). A weak output signal may indicate that plate resonant circuits Z222, Z223, and Z224 are not synchronized with the other tuning circuits (par. 119*a*) or are not individually alined correctly.

d. Pins 6 and 7 of V204 (Grid and Cathode of Second Mixer). Apply a 10-mc modulated signal to test point E209 (grid) (fig. 68). If no output signal is audible, either the second mixer stage or the second crystal oscillator stage is defective. To determine which stage is at fault, apply a strong, 12-mc unmodulated signal to pin 7 while the antenna terminals are connected to an antenna or to a 2-mc signal source. The reception of static or signal when the 12-mc signal is applied indicates a faulty second crystal oscillator. Check for injection voltage from the second crystal oscillator by measuring the d-c voltage with the vtvm at test point E209 (fig. 68), with the FUNCTION switch at STAND BY. A reading of 3 to 11 volts indicates that injection voltage is available from the second crystal oscillator. The amount of injection voltage available is determined by disconnecting P222 from J422 (fig. 71) and measuring the voltage at the contact of J422, using the a-c probe of the multimeter. A reading of approximately 2 to 3 volts ac indicates normal output from the second crystal oscillator. If normal output is not obtained, test tube V402, the tube-socket voltages (fig. 90), the alinement of the oscillator circuits, and the oscillator crystals (par. 107). Check synchronization (par. 119*c*). If a crystal is defective, the band or bands associated with that crystal will be inoperative. If no output is heard when the signal is applied to pin 7, check second mixer V204 and its tube-socket voltages (fig. 90).

e. Pin 1 of V203 (Plate of First Mixer). With the FUNCTION switch at MGC, apply a 10-mc modulated signal to pin 1 of V203 (fig. 68). If the output signal is weak, check the synchronization of the first i-f slug rack and the first i-f can rack. Alinement of the individual slugs for resonant circuits Z219, Z220, and Z221 (fig. 68) may be required.

f. Pins 6 and 7 of V203 (Grid and Cathode of First Mixer). Apply a 2-mc modulated signal to test point E208 (grid) (fig. 68). If no signal is audible, apply a strong, 8-mc unmodulated signal to terminal 7 of V203 while the antenna input is connected to an antenna or to a 2-mc signal source. Then, if static or signal is audible, a faulty first crystal oscillator is indicated. Turn the FUNCTION switch to STANDBY and check for injection voltage from the first crystal oscillator at test point E208; if a reading of between 3 and 11 volts dc is obtained, injection voltage is available from the first crystal oscillator. Disconnect P221 from J421 (fig. 71) and measure the a-c voltage at the contact of J421. The output from the first crystal oscillator is normal if a reading of approximately 2 to 3 volts, ac, is obtained. If the output is abnormal, check tube V401 (fig. 71), the tube-socket voltages (fig. 90), the alinement of the oscillator circuits and the oscillator crystals (par. 107). Check synchronization of crystal oscillator (par. 119*c*). However, if the set is still dead, or if the output is weak, check first mixer V203 and its tube-socket voltages (fig. 90).

g. Pin 5 of V202 (Plate of Second R-f Amplifier). With the FUNCTION switch at MGC, apply a 2-mc modulated signal to pin 5 of V202 (fig. 68). If the output is abnormal, check the tuning circuits that couple the plate of the second r-f stage to the grid of the first mixer and bandswitch section S208 (fig. 70).

h. Pin 1 of V202 (Grid of Second R-f Amplifier). Apply the signal to test point E207 (grid) (fig. 68). The audio signal output should be much louder than in the preceding step (subpar. *g* above). If the signal is weak, check tube V202 and its socket voltages (fig. 90).

i. Pin 5 of V201 (Plate of First R-f Amplifier). Apply the 2-mc signal to pin 5 of V201 (fig. 68). If the output signal is weak, inspect the tuning circuits that couple the plate of the first r-f stage to the grid of the second r-f stage and bandswitch section S206 (fig. 70). Check voltages (fig. 90).

j. Pin 1 of V201 (Grid of First R-f Amplifier). Apply the 2-mc modulated signal to test point E206 (grid) (fig. 68). The output signal should be louder than that obtained in the preceding step (subpar. *i* above). If the signal is weak, test tube V201 and its socket voltages (fig. 90).

k. Antenna Input Circuits. Connect the 2-mc modulated output of the signal generator, in turn, to UNBALANCED WHIP antenna input J107 and to BALANCED 125 OHM antenna input J108. If the signal is weak, check the antenna tuning circuits and connections. Check break-in relay K101 by setting the FUNCTION switch at CAL and the frequency-indicator reading at an even 100-kc point, to obtain a calibration signal, and switching the FUNCTION switch back and forth between the CAL and MGC positions several times. Tone should be heard in the headphones at the MGC position, while at the CAL position no tone should be heard.

107. Checking Oscillator Crystals

If it is suspected that an oscillator crystal is faulty, it can be readily checked by the use of a second Radio Receiver R-391/URR in good operating condition, as follows:

a. To check crystals of second crystal oscillator, disconnect plug P222 from the crystal-oscillator subchassis, and connect the contact of J422 to the UNBALANCED antenna input of the second receiver.

b. Note frequency-indicator reading of receiver under test. Unlock MEGACYCLE CHANGE control key and set the MEGACYCLE CHANGE control to the frequency at which crystal to be checked is connected in the circuit (par. 110).

c. Tune the second receiver to the frequency of the crystal in the receiver under test, and set its BFO switch to ON. An audible signal should be heard in a headset connected to PHONES jack. Rock the KILOCYCLE CHANGE knob to identify the signal. If no signal is heard, the crystal should be replaced.

d. Rotate MEGACYCLE CHANGE control of receiver under test to obtain original frequency-indicator reading. Lock key.

e. Check the first crystal-oscillator crystals in the same manner as described in subparagraphs *a*, *b*, and *c*, above, except that the contact of J421 is connected to the second receiver.

108. Stage Gain Charts

The stage gain charts in subparagraphs *a* and *b* below list the minimum and maximum voltages required at each of the r-f and i-f stages of the receiver to produce a voltage of 7 volts across the diode load. Use these charts as a standard when trouble-shooting to check the overall gain of the receiver and the gain of each r-f or i-f stage or group of stages. When the receiver output is low, and the tubes are operating satisfactorily (as indicated by a tube checker), localize the defective stage by checking the signal voltage level of each stage against the chart while using the signal substitution method of trouble shooting, or by measuring the individual stage gain. To obtain the stage-gain readings, connect a d-c voltmeter, such as Electronic Multimeter TS-505/U, between terminals 14 (DIODE LOAD) and 16 (GND) of the terminal strip on the back of the receiver (fig. 21). Terminal 14 must be jumpered to terminal 15. Connect the ground lead of the r-f signal generator to the receiver ground, and connect the generator output lead through a .1-uf capacitor to the receiver points indicated in the chart. When checking the 455-kc i-f stages, access to the injection points can be gained by operating the subchassis outside the receiver, using the extension cables (par. 93), or by inserting a short length of wire into the tube-socket terminal (par. 95*a*). Check the output from the signal generator required to obtain the diode-load reference voltage of 7 volts against the figures given in the charts. The lowest figure is the minimum and the highest is the maximum that should be required over the specified frequency range for normal operation. However, a reading that is slightly outside this range does not necessarily indicate improper functioning.

a. R-f Subchassis Stages.

Signal generator output connection	BALANCED ANT	Test point E206 (1st r-f grid V201)	Test point E207 (2d r-f grid V202)	Test point E208 (1st mixer grid V203)		Test point E209 (2d mixer grid V204)			Test point E210 (3d mixer grid V205)	
Frequency (mc)	.5-32	.5-32	.5-32	.5-8	9-18	9-18	3-2	8-32	3-2	.455
Signal generator output (microvolts)	1-4	4-16	28-78	40-62	36-53	43-59	23-28	41-71	92-117	22-50

b. I-f Subchassis Stages.

Signal generator output connection	Signal-generator output (microvolts)			
	2-KC BANDWIDTH	4-KC BANDWIDTH	8-KC BANDWIDTH	16-KC BANDWIDTH
1st i-f grid V501	130 to 180			
2d i-f grid V502	1,500 to 1,900	1,400 to 2,000	880 to 1,400	860 to 1,700
3d i-f grid V503	2,300 to 5,000	3,000 to 5,000	1,100 to 2,000	770 to 1,300
4th i-f grid V504	7,000 to 12,000	7,000 to 11,500	6,000 to 8,700	5,200 to 7,600
5th i-f grid V505	16,000 to 20,000	16,000 to 18,000	23,000 to 28,000	32,000 to 38,000
6th i-f grid V506	420,000 to 500,000	420,000 to 500,000	420,000 to 500,000	420,000 to 500,000

109. D-c Resistances of Transformers and Coils

The d-c resistances of the transformer windings and the coils in Radio Receiver R-391/URR and Power Supply PP-629/URR as measured with an ohmmeter (such as that incorporated in Multimeter TS-352/U) are listed below:

a. Radio Receiver R-391/URR.

Transformer or coil	Terminals	Ohms
FL101	A-A	less than .5
	D-E	
K101		17
L242		1
L243		1
L246		7
T201	1-2	.3
	3-6	2.5
T202	1-2	.2
	3-6	1.8
T203	1-2	.2
	3-6	1.1
T204	1-2	.1
	3-6	.3
T205	1-2	.1
	3-6	.18
T206	1-2	.2
	3-6	.1
T207	1-5	2.8
	2-4	4.5
Z201		2.4
Z202		1.9
Z203		1.1
Z204		.4

Transformer or coil	Terminals	Ohms
Z205		.2
Z206		.18
Z207		2.4
Z208		1.8
Z209		1
Z210		.3
Z211	1-3	.15
Z212		.1
Z213		2.5
Z214		1.8
Z215		1.1
Z216		.3
Z217		.2
Z218		.1
Z219		.2
Z220		.2
Z221		.2
Z222		1.6
Z223		1.6
Z224		1.6
L401		7
L402		7
L403		1
L404		1
L405		1
L406		7
T401	1-2	a
	3-4	
T402	1-2	a
	3-4	
L501		7
L502		4.5
L503		7
T501	2-9	.8
	3-7	3.1
	3-10	.5
	4-10	.1
	5-10	.1
	6-10	.1
T502, T503, T504, and T505	2-9	.8
	3-7	3.1
	3-10	.5
	4-10	.1
	5-10	.1
	6-10	.1
	8-10	.1
T506	1-2	.05
	1-9	.9
	4-6	1.2

Transformer or coil	Terminals	Ohms
Z501	1-2	5
Z503		5.5
Z502	C532 through coil to pin 7 of V508.	1.7
	Pin 7 of V508 through coil to gnd.	.1
FL601	IN - OUT	50
	IN - Gnd	24
	OUT - Gnd	24
FL602	IN - OUT	37
	IN - Gnd	230
	OUT - Gnd	250
K601	4-5	10K
K602	3-4	8
L601		90
T601	1-2	850
	3-4	24
	5-6	26
T602[b] and T603[b]	1-2	850
	3-4	24
	5-6	26
T801	1-2	.7
	3-4	.7
	5-6	25
	6-7	25
	5-7	50
	8-9	.1
	9-10	.1
	8-10	.2
L901		.7
L902		7

[a]Resistance too low for reading.
[b]Readings taken with speaker disconnected.

b. Power Supply PP-629/URR.

Transformer or coil	Terminals	Ohms
T1101	1-2	less than 1
	3-4	less than 1
	5-9	less than 1
	5-8	less than 1
	5-7	less than 1
	5-6	less than 1

110. R-f and Variable I-f Frequency Scheme

Band (mc)	Position of switch S201	Range of antenna and r-f coils (mc)	Position of switch S401	1st xtal-osc crystal freq (mc)	1st xtal-osc output freq (mc)	1st variable i-f range (mc)	2d xtal-osc crystal freq (mc)	2d xtal-osc output freq (mc)
.5-1	1	.5-1	0	9	9	9.5-10	12	12
1-2	2	1-2	1	8	8	9-10	12	12
2-3	3	2-4	2	10	10	12-13	15	15
3-4			3	12.6	12.6	15.6-16.6	6.2	18.6
4-5	4	4-8	4	7	7	11-12	14	14
5-6			5	8	8	13-14	8	16
6-7			6	9	9	15-16	9	18
7-8			7	10	10	17-18	10	20
8-9	5	8-16	8	Not in use after first eight frequency bands			11	11
9-10			9				12	12
10-11			10				13	13
11-12			11				14	14
12-13			12				15	15
13-14			13				8.0	16
14-15			14				8.5	17
15-16			15				9.0	18
16-17	6	16-32	16				9.5	19
17-18			17				10	20
18-19			18				10.5	21
19-20			19				11	22
20-21			20				11.5	23
21-22			21				12	24
22-23			22				12.5	25
23-24			23				13	26
24-25			24				9	27
25-26			25				14	28
26-27			26				9.666	29
27-28			27				10	30
28-29			28				10.333	31
29-30			29				10.666	32
30-31			30				11	33
31-32			31				11.333	34

The range of the 2d variable i-f is from 2.5 to 2.0 mc for the .5 to .1-mc band, and from 3.0 to 2.0 mc on all other bands.

111. B+ Voltage Distribution
(fig. 115)

The input voltage from the power line to the power supply is controlled by FUNCTION switch S107 (fig. 52). In addition, this switch also controls the application of B+ to the various circuits, with the exception of the first and second crystal oscillators and the vfo. B+ is always connected to these circuits, so that the temperature of the components will remain constant. In the MGC and the AGC positions of S107, regulated B+ voltage is applied to all circuits of the receiver except the calibration oscillator and the squelch circuit. In the CAL position of the switch, the plate circuit of the calibration oscillator is energized, and the d-c output of the dry-disk rectifier is applied to the antenna relay. In the SQUELCH position, B+ is connected to all receiver circuits as well as to the plate circuit of the squelch tube, section B of V601. In the STANDBY position, all B+ circuits except those to the oscillators are disconnected, and d-c voltage is applied to the antenna relay.

Section II. REPAIRS

112. Removals and Replacements

Subparagraphs *a* through *dd* below contain directions for removing and replacing the subchassis and various detail parts of the receiver for bench-testing or repair. All the subchassis, except the r-f subchassis, can be removed from the receiver without prior removal of any of the other assemblies. While the r-f, i-f, and vfo subchassis are outside the receiver, avoid changing the positions of the KILOCYCLE CHANGE, bfo, and vfo tuning shafts, if possible. Disturbing the positions of these shafts will necessitate synchronization. Make any necessary presettings of the receiver controls, where possible, before removing the subchassis. Subchassis mounting screws are color-coded with green heads. In most cases these are captive screws, and need be loosened only until they are free of the main frame, to remove the subchassis. When replacing the subchassis, the captive screws should first be started one at a time, in order to locate the subchassis before tightening the screws all the way. The reference designations of the coaxial plugs are marked on bands fastened to the cables, near the plugs. To remove a coaxial plug, press the plug in slightly and twist counterclockwise to release; then pull the plug straight out. Where coaxial plugs are not readily accessible, scissors-type Tube Puller TL-201, supplied with Tool Set TE-41, can be used for removal of the plugs. To remove 7-pin plugs P113, P114, P715, and P916, first twist the metal shell slightly counterclockwise to release the clamp, then pull the plug. When replacing multi-contact plugs, make sure that the pins are properly alined with the jack contacts, as the pins are easily bent. When loosening the clamp screws, be careful not to overdraw the screws, thereby allowing the nuts to drop off. Do not tighten clamp screws too far, as the threads may be stripped. Make sure that the Bristo wrench is fully inserted into the screw to avoid stripping the slots in the head.

a. Removal of Front Panel (figs. 22 and 93). To gain access to the wiring and parts on the back of the front panel, or to prepare for removal of the r-f subchassis or the Autotune components, it is necessary to remove the front panel. Proceed as follows:

(1) Remove the top and bottom dust covers from the receiver.
(2) Remove the two handles from the front panel by removing the nuts and washers that secure the handles at the rear of the panel.
(3) Place wooden blocks under the side plates of the receiver main frame, in back of the front panel, so that the panel is clear of the bench and the receiver is tilted backward.
(4) Remove the locking keys from the MEGACYCLE CHANGE and KILOCYCLE CHANGE control knobs. Rotate these control knobs fully counterclockwise (to home stop position), then rotate the knobs clockwise until the knob setscrews are pointed to the right. Make a note of the positions of the following controls: MEGACYCLE CHANGE, KILOCYCLE CHANGE, BANDWIDTH, BFO PITCH, and ANT. TRIM.
(5) Position the ANT. TRIM control at −4, and remove the knob.
(6) Position the BFO PITCH control at 0. Position the BANDWIDTH control at 16 KC. Loosen the collars on the BANDWIDTH and BFO PITCH control shafts.
(7) Remove the KILOCYCLE CHANGE and MEGACYCLE CHANGE control knobs.
(8) Remove the ZERO ADJ. knob.
(9) Remove the four flat-head Phillips screws that secure the front panel to the main frame.
(10) Remove the front panel by grasping the edges and carefully drawing it straight out from the receiver. Replace the handles and carefully place the panel face down on the bench, resting on the handles.

b. Replacement of Front Panel. To replace the front panel, proceed in the reverse order of removal. When replacing the ZERO ADJ. knob,

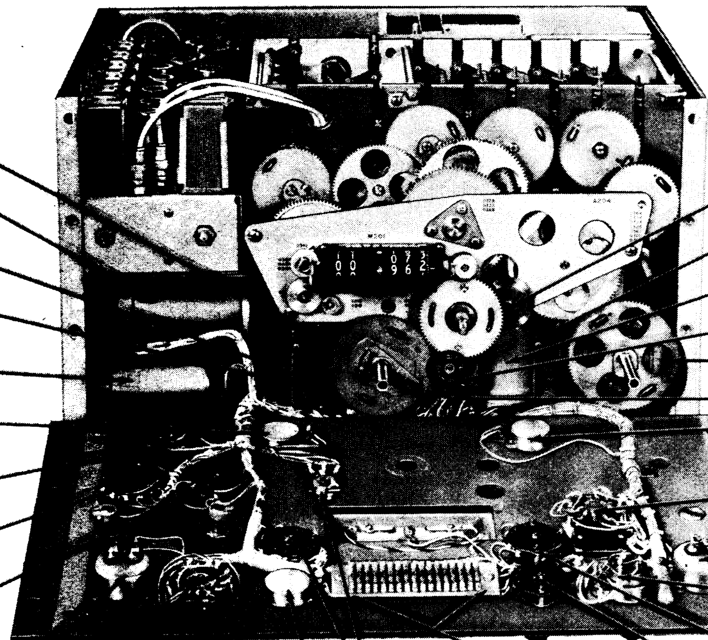


Figure 93. Radio Receiver R-391/URR, front panel removed.

make certain that the threaded cap located on the end of the shaft is rotated clockwise finger-tight. Place the knob on the shaft so that the spring-loaded moveable part of the stop mechanism fits into the notch in the knob. Rotate the knob clockwise until the stop is reached. Allow the knob to rotate counterclockwise approximately 1/16 of an inch and tighten the set screw in the knob.

c. Removal of R-f Subchassis. (figs. 93 and 94). To remove the r-f subchassis, first disconnect coaxial connector P723 from J223 on bottom deck of receiver (fig. 98), using scissors-type Tube Puller TL201, and with the front panel removed as described in subparagraph *a*, above, proceed as follows:

(1) Invert the offset gear (fig. 97) so that green surface is toward front and the gear is meshed with the clutch gear fig. 97).

Note. The offset gear is used to maintain synchronization of the gear train when the r-f subchassis is removed from the receiver.

(2) Disengage the following coaxial connectors on the top deck of receiver: P209 from J109, P210 from J110, P211 from J111, P221 from J421, P222 from J422, P224 from J924, P225 from J525, and P226 from J526 (it may be necessary to temporarily remove V501 and its shield in order to disengage this connector).

(3) Remove the dust cover from the top of the r-f subchassis; then disconnect P114 from J214.

(4) Rotate the KILOCYCLE CHANGE control shaft slightly counterclockwise to stop position. Note the frequency-indicator reading.

(5) Behind the main drive gear on the MEGACYCLE CHANGE control shaft is located a gear plate in which is secured a Phillips-head screw (fig. 95). Remove this screw, which positions the detent, and rotate MEGACYCLE CHANGE control to detent position (frequency-indicator reads 00 on left-hand side). Using a screwdriver, move the detent up tight against the detent stop. Replace the screw.

(6) Remove the two green color-coded screws that secure the subchassis to the end plate of the main frame. These screws are ½-inch long; make certain that only these screws are used when replacing the subchassis.
(7) Loosen the three green color-coded captive screws at the top of the subchassis, two at the left-hand corners and one in the upper right-hand corner.
(8) Lift the subchassis up and out of the receiver, disengaging the Oldham coupler on the crystal-oscillator bandswitch shaft. The floating disk of the coupler will drop down; take steps to prevent its loss. The subchassis should be placed on its side or top of the test bench but never in such a position that it is supported by the gear train that extends beyond the frame of the subchassis.

Caution: When the r-f subchassis is removed from the receiver, the tension of the loading springs on the MEGACYCLE CHANGE control split gear and KILOCYCLE CHANGE control split gear (counter drive gear) (fig. 93) is relieved, allowing springs to hang loosely from gears. Remove the springs and retain them in an envelope to prevent their loss. The two loading springs of the KILOCYCLE CHANGE split gear are shorter than those of the MEGACYCLE CHANGE split gear.

d. Replacement of R-f Subchassis (figs. 93 and 94). To replace the r-f subchassis, proceed as follows:

(1) Coat the coupler flange on the crystal-oscillator bandswitch drive shaft (fig. 103) lightly with grease, and place the floating disk against the grease-coated surface of the flange. Grease will hold disk in place while flange is mated with flange on crystal-oscillator subchassis.
(2) Replace the loading springs.
(3) See that the ridges on the coupler flanges are positioned 90 degrees apart; then carefully slide the r-f subchassis into place, mating the flanges of the coupler. Make certain that the number showing on the crystal-oscillator bandswitch position indicator (fig. 71), located below J422, coincides with the megacycle reading (first two digits) on the frequency-indicator dial.
(4) Loosen the two collar clamps located behind the KILOCYCLE CHANGE counter drive gear (fig. 93). Locate the small pinion gear behind these

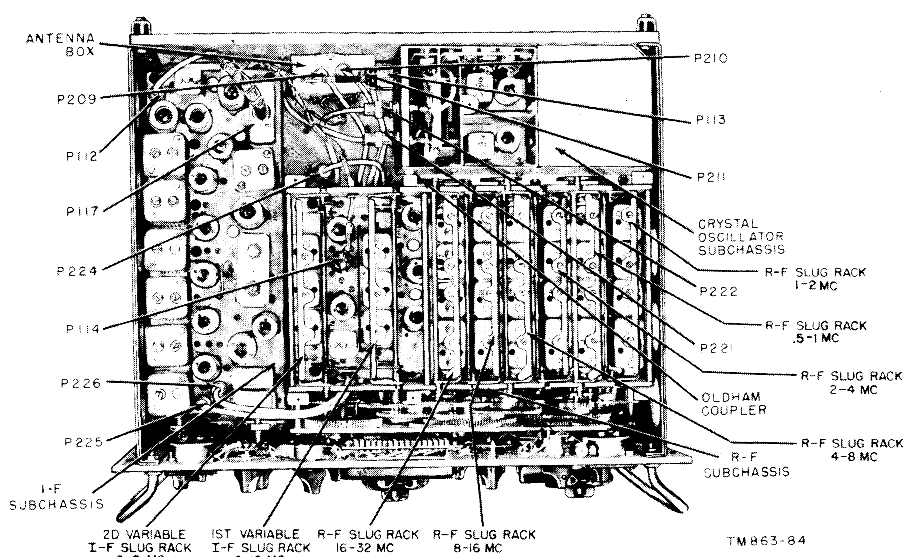


Figure 94. Radio Receiver R-391/URR, top view, dust cover and shields removed.

clamps, and move it forward as far as possible. This allows proper meshing of the r-f subchassis gear and KILOCYCLE CHANGE gear mechanism, as described in subparagraph (7), below.

(5) Partially tighten the three green color-coded captive screws at the top of subchassis.

(6) Replace the two green color-coded screws removed in subparagraph *c*(6), above. Finish the tightening of the captive screws.

(7) Load the large brass split gear (fig. 97) driven by the pinion gear on the KILOCYCLE CHANGE control shaft through the intermediate gear as follows: rotate the back half of the gear counterclockwise while holding the front half of the gear motionless until the circumference of the hole which anchors the spring in the back half of the gear coincides with the end of the slot in the front half of the gear (fig. 96) and the teeth of both halves are alined. Maintain the tension of the spring by inserting the head of a flat screwdriver between the teeth of the two halves of the gear.

(8) Engage the pinion gear (fig. 88) with the intermediate gear (fig. 97) by pushing back the clamp on the hub of the pinion gear. The intermediate gear should be centered on the pinion gear.

(9) Rotate the KILOCYCLE CHANGE knob counterclockwise until the stop is reached; the frequency indicator should read the reference setting noted during removal. If not, set it at the reference setting by rotating the pinion gear. Tighten the clamp on the split gear.

(10) Load the counter drive gear (fig. 93) on the KILOCYCLE CHANGE control shaft by rotating the back half of the gear counterclockwise until the hole that anchors the spring is alined with the slot in the front half and the teeth are alined as described in subparagraph (7), above. Maintain the loading by holding the halves of the gear with the hand.

(11) Engage the loaded counter drive gear with the clutch gear (fig. 97), centering the two gears. Make sure that the loading is maintained while engaging the gears. Tighten the clamp on the front gear.

(12) Load the MEGACYCLE CHANGE control drive gear (fig. 93) in same manner as described in step (10), above. Then slide the loaded gear toward the casting, and mesh it with the driven gear on the r-f subchassis, while making sure the gear teeth are centered.

(13) Turn the MEGACYCLE CHANGE control shaft counterclockwise to the stop, then turn back clockwise approximately $\frac{1}{4}$ turn. Tighten the clamp.

(14) Replace the detent (see subpar. *c*(5) above) to the proper position, and replace the Phillips-head screw.

(15) Reconnect the following coaxial connectors: P209, P210, P211, P221, P222, P224, P225, and P226.

(16) Reconnect P114 with J214, and replace dust cover over r-f subchassis.

(17) Reconnect P723 with J223.

(18) Reverse the offset gear so that the green-painted side is toward the subchassis. (fig. 97).

(19) Replace the front panel as described in subparagraph *b*, above.

(20) Check the synchronization of the receiver (par. 119).

e. Removal of Crystal-oscillator Subchassis (fig. 94). To remove the crystal-oscillator subchassis, proceed as follows:

(1) Remove the top dust cover of the receiver.

(2) Disconnect plugs P113, P221, and P222 from J413, J421, and J422, respectively, on the crystal-oscillator subchassis.

(3) Remove the cover from the top of the subchassis.

(4) Rotate the MEGACYCLE CHANGE control until the setscrew in the clamp of the crystal-oscillator band switch

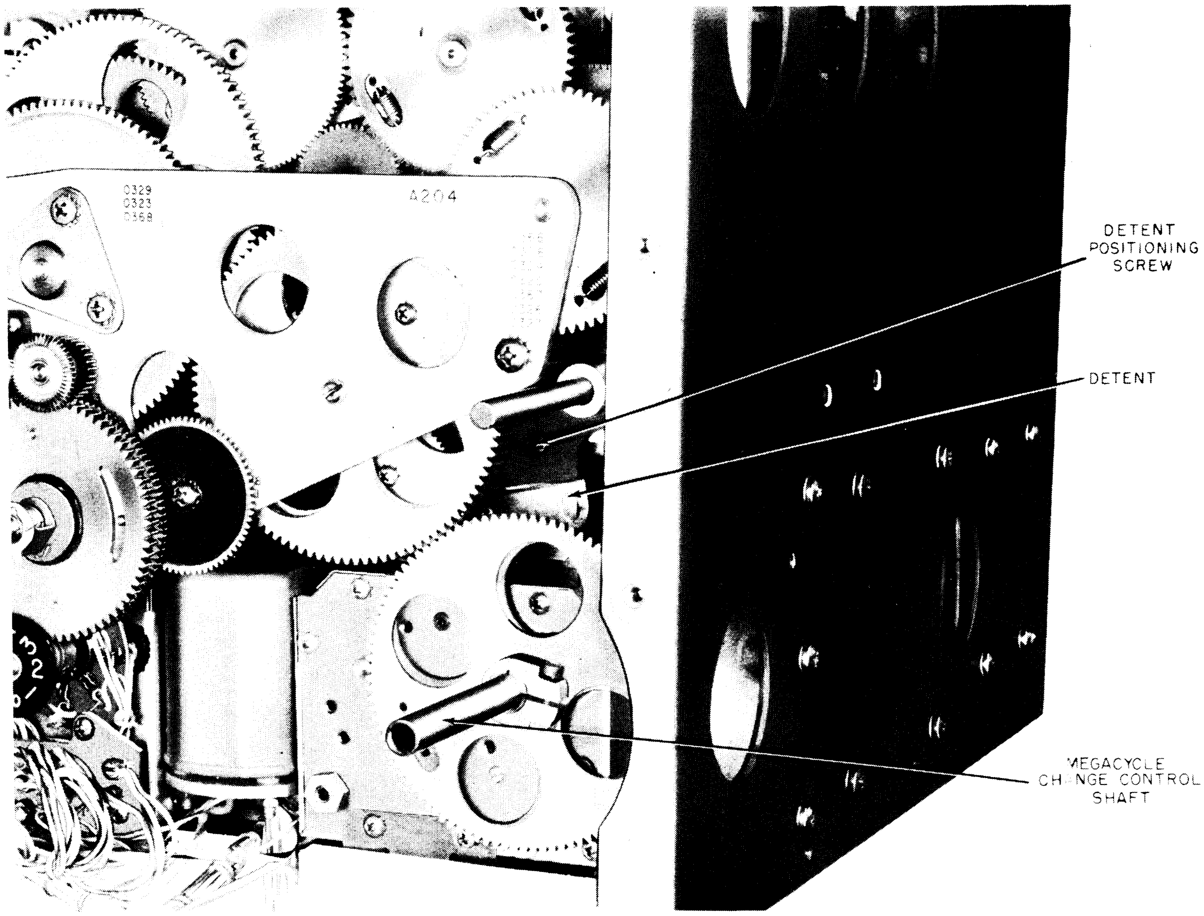


Figure 95. Radio Receiver R-391/URR, showing detent location.

coupler is accessible. Loosen the setscrew and push back the flange.

(5) Remove the two green color-coded screws that secure the subchassis to the rear panel of the receiver. These screws are 5/16-inch long. When replacing the subchassis, make sure that only these screws are used, as screws of greater length can possibly cause a short circuit in the crystal-oscillator subchassis.

(6) Loosen the two green color-coded captive screws inside the subchassis, one near tube V401 and the other near the point where the switch shaft enters the subchassis.

(7) Lift the subchassis straight up from the receiver. The floating disk of Oldham coupler will drop down; take steps to prevent its loss.

f. Replacement of Crystal-oscillator Subchassis. To replace the crystal-oscillator subchassis, proceed as follows:

(1) Coat the coupler flange on the crystal-oscillator band switch drive shaft (located on the r-f subchassis) lightly with grease. Place the floating disk against the grease-coated surface of the flange. Grease will hold the disk in place until the flanges of the couplers are mated.

(2) Lower the subchassis carefully into place, and start the two green color-coded captive screws.

(3) Replace 5/16-inch color-coded screws in the back panel. Complete the tightening of the captive screws.

(4) See that the ridges on the coupler flanges are positioned 90° apart and

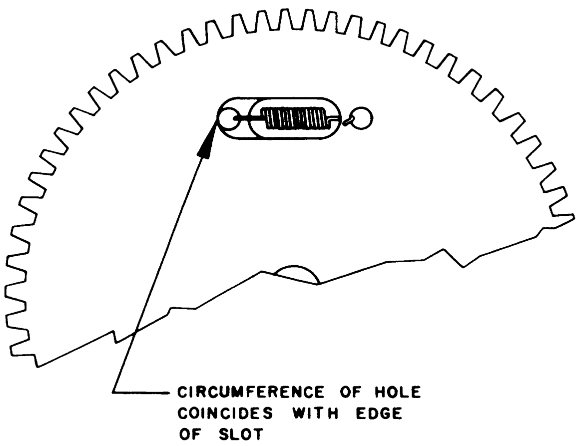


Figure 96. Loading of split gear.

that the number showing on the crystal-oscillator band switch position indicator (below J422 (fig. 71)) agrees with the megacycle reading on the frequency indicator. Mate the flanges and secure the clamp.

(5) Complete the replacement by reversing the procedure described in steps (3), (2), and (1), in that order, of subparagraph *e*, above.

(6) Check synchronization of the crystal oscillator (par. 119*c*).

g. Removal of I-f Subchassis. To remove the i-f subchassis (fig. 94) proceed as follows:

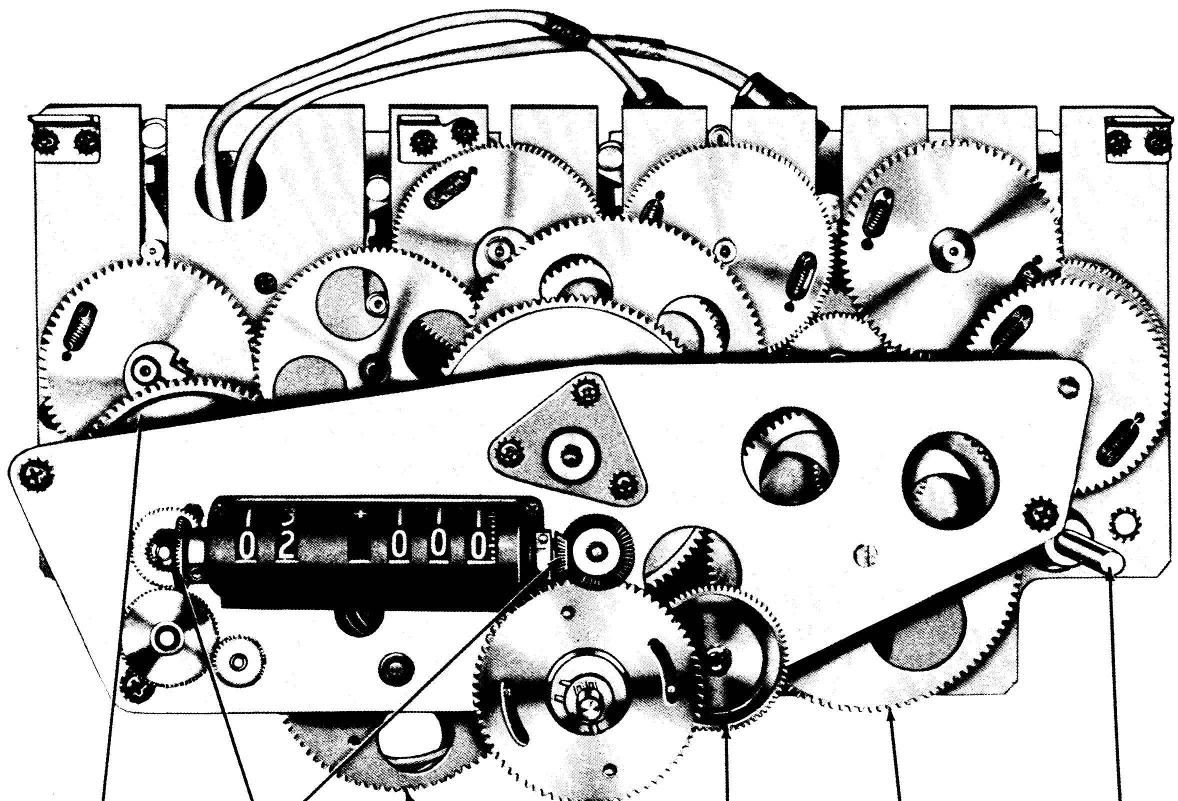


Figure 97. Location of gears.

(1) Remove the top dust cover of the receiver.

(2) Rotate the BANDWIDTH control so that the clamp that secures the control shaft in back of the panel is accessible. Make a note of the control position.

(3) Set the BFO PITCH at 0.

(4) Loosen the clamp setscrews on the BANDWIDTH and BFO PITCH control shafts, and uncouple the shafts by pulling outward on the control knobs.

(5) Disconnect coaxial connectors P225, P226, and P112 (fig. 94) from J525, J526, and J512, respectively, located on top of the i-f subchassis. (fig. 74).

(6) Disconnect plug P117 (fig. 94) from J517 (fig. 74).

(7) Loosen the three green color-coded captive screws, one at the front-center of the subchassis and two at rear corners.

(8) Lift the subchassis straight up from the receiver. Do not disturb the positions of the BANDWIDTH and BFO PITCH tuning shafts after the subchassis is removed from receiver, unless necessary for performing tests.

h. Replacement of I-f Subchassis. To replace the i-f subchassis, proceed in the reverse order of removal. Before recoupling the BANDWIDTH and BFO PITCH control shafts, make certain that the controls are set at the positions noted during removal. Check the calibration of the bfo (par. 119).

i. Removal of Power Supply PP-621/URR. To remove the power supply subchassis (fig. 98), proceed as follows:

(1) Remove the bottom dust cover from the receiver.

(2) Disconnect large connector P118 (fig. 98) from J818 (fig. 85).

(3) Loosen the two captive screws accessible through holes indicated by arrows marked MTG SCREWS INSIDE (fig. 84).

(4) Loosen the green color-coded captive screw in the corner of the subchassis, near tube V802.

(5) Remove the four green color-coded screws that secure the power transformer to the side of the main frame.

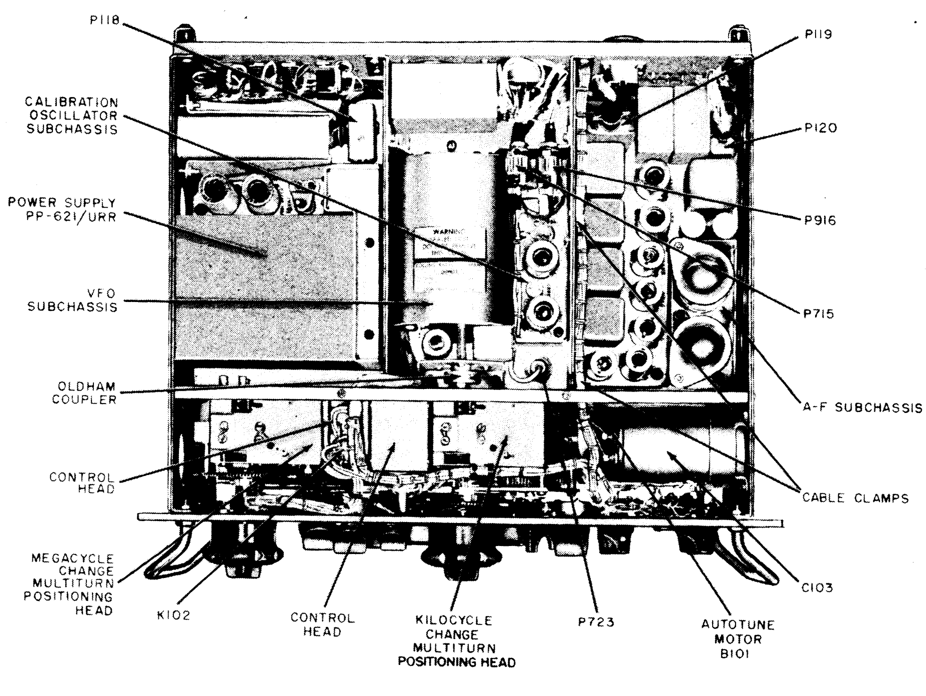


Figure 98. Radio Receiver R-391/URR, bottom view, dust cover removed.

These screws are 7/16-inch long; make sure that only these screws are used when replacing the subchassis.

(6) Lift the subchassis straight up from the receiver.

j. Replacement of Power Supply PP-621/URR. To replace the power supply subchassis, proceed in the reverse order of removal. When tightening the color-coded screws, start the screws in the following order: the two hidden screws, the one captive screw, and then the four 7/16-inch screws.

k. Removal of Vfo Subchassis. To remove the vfo subchassis (fig. 98) proceed as follows:

(1) Remove the bottom dust cover of the receiver.

(2) Disconnect plug P715 and coaxial connector P723 (fig. 98) from J115 (fig. 89) and J223 (fig. 69), respectively. Use scissors-type Tube Puller TL201 for removing P723.

(3) Remove the small loading spring from the Oldham coupler on the vfo tuning shaft. Take precautions to prevent loss of spring.

(4) Rotate the KILOCYCLE CHANGE control so that the ridge in the flange or the coupler nearest the vfo subchassis is vertical.

Note. If synchronization of the vfo tuning shaft and KILOCYCLE CHANGE control is to be maintained, do not disturb the position of the shaft during the succeeding steps or after the vfo subchassis has been removed.

(5) Loosen the two green-coded captive screws in the front mounting bracket of the subchassis, and loosen the single color-coded captive screw in the rear bracket.

(6) Carefully remove the subchassis from the receiver, lifting straight up to disengage the coupler and then tilting slightly to clear the receiver. The floating disk will drop down from the coupler; take steps to avoid its loss.

l. Replacement of Vfo Subchassis. To replace the vfo subchassis, proceed as follows:

(1) If the position of the vfo tuning shaft has been disturbed while the subchassis was removed from the receiver or if a new vfo is to be installed, synchronize the shaft as described in paragraph 119*d*.

(2) If the position of the shaft has not been disturbed, place the floating disk on the flange of the vfo drive shaft (on the main frame). Position the ridge on the coupler flange of the vfo tuning shaft 90° from that of the flange on the drive shaft, and carefully insert the vfo subchassis into place, tilting it slightly to clear the receiver frame.

(3) Tighten the three green color-coded screws on the subchassis mounting brackets.

(4) Replace the loading spring on the coupler.

(5) Connect P715 and P723 to J115 and J223, respectively.

(6) Replace the dust cover on the receiver.

m. Removal of Calibration-oscillator Subchassis. To remove the calibration-oscillator subchassis (fig. 98), proceed as follows:

(1) Remove the bottom dust cover from the receiver.

(2) Disconnect plugs P715 and P916 (fig. 98) from J115 and J116, respectively (fig. 89). Move the cable attached to P715 to position free of the subchassis.

(3) Disconnect coaxial connector P224 (fig. 94) from J924 on the top deck of the receiver (fig. 88).

(4) Loosen the two green color-coded captive screws at opposite ends of the subchassis.

(5) Carefully lift the subchassis out of the receiver.

n. Replacement of Calibration-oscillator Subchassis. To replace the calibration-oscillator subchassis, proceed in the reverse order of removal.

o. Removal of A-f Subchassis. To remove the a-f subchassis (fig. 98), proceed as follows:

(1) Remove the bottom dust cover from the receiver.

(2) Disconnect plugs P119 and P120 (fig. 98) from J619 and J620, respectively (fig. 80).

(3) Remove the screw from the cable clamp that secures the cable at side of the a-f subchassis.
(4) Loosen the screw in the clamp that secures the cable to the casting at the front end of the a-f subchassis, and swing the clamp free of the cable.
(5) Loosen the three green color-coded captive screws, one at the front end of the subchassis and two at the rear corners.
(6) Move aside the cable from which the clamps were removed, lift the subchassis straight up, and then tilt the front down slightly to remove the subchassis from the receiver.

p. Replacement of A-f Subchassis. To replace the a-f subchassis, proceed in the reverse order of removal.

q. Removal of R-f Tuning Coils and Transformers. To remove the r-f tuning coils and transformers (fig. 68) for measurement of voltage and resistance at the sockets or banana-pin contacts, proceed as follows:

(1) Remove the slug rack (fig. 94) associated with the coil or transformer, as follows: Unhook the spring located at each end of rack. Use a bent paper clip hooked through end of the spring to anchor the spring temporarily to the end plates of the subchassis. Be careful that the springs do not fly into the subchassis.
(2) Insert the Phillips screwdriver supplied with the receiver into the two holes in the coil or transformer can, and loosen the screws until they are free of the subchassis.
(3) Withdraw the coil or transformer from the subchassis.

r. Replacement of R-f Tuning Coils and Transformers. Replace the r-f tuning coils and transformers in the reverse order of removal described in subparagraph *q* above.

s. Removal of Antenna Box. To remove the antenna box (fig. 94) for trouble shooting or repair proceed as follows:

(1) Disconnect coaxial connector P209 from J109, P210 from J110, and P211 from J111 (figs. 88 and 94).
(2) Unsolder the leads from the winding of break-in relay K101.
(3) Remove the three screws that secure the antenna box to the back panel of receiver.

t. Replacement of Antenna Box. Replace the antenna box in the reverse order of removal described in subparagraph *s*, above.

u. Removal of Autotune Casting Assembly. To remove the Autotune casting assembly, it is necessary to remove the front panel, r-f subchassis, and i-f subchassis. Remove the front panel as described in subparagraph *a*, above; then remove the r-f subchassis as described in subparagraph *c*, above; then remove the i-f subchassis, starting with paragraph *g*, above.

(1) Note and remove the four color-coded wires connected to the Autotune motor B101 terminal board (fig. 88).
(2) Remove the three screws, located on the bottom deck, which secure capacitor C103 (fig. 88), mounting clamps. Place capacitor C103 to one side.
(3) Remove the three screws on each side of the main frame which help to secure the Autotune casting.
(4) Remove the six screws located on the top of the r-f subchassis mounting shelf which help to secure the Autotune casting. Carefully lift the Autotune casting from the chassis.

v. Replacement of Autotune Casting Assembly. To replace the Autotune casting assembly proceed in the reverse order of removal.

w. Removal of Autotune Control Head. To remove the Autotune control head (figs. 60 and 61), it is necessary to remove the front panel and r-f subchassis. Remove the front panel as described in subparagraph *a*, above. Remove the r-f subchassis as described in subparagraph *c*, above.

(1) Note and disconnect the color-coded wires on the control head terminal board (fig. 60).
(2) Remove the two slotted screws and one Phillips-head screw which secure the head to the casting.

(3) Remove the control head.

x. Replacement of Autotune Control Head. To replace the control head, proceed in the reverse order of removal.

y. Removal of Multiturn Heads. To remove either of the multiturn heads (figs. 62 and 63), it is first necessary to remove the front panel and r-f subchassis. Remove the front panel as described in subparagraph *a,* above; then remove the r-f subchassis as described in subparagraph *c,* above.

(1) To remove the megacycle change multiturn head, remove the two slotted head screws and the one Phillips-head screw which secure the head to the casting.
(2) To remove the kilocycle change multiturn head, remove the two slotted-head screws and the one Phillips-head screw which secure the head to the casting. Remove the head by disengaging the Oldham coupler on the rear of the head. The floating disk of the coupler will drop; take steps to prevent its loss.

z. Replacement of Multiturn Heads. To replace the MEGACYCLE CHANGE head, reverse the procedure in subparagraph *y* (1), above. To replace the KILOCYCLE CHANGE head, proceed as follows:

(1) Coat the coupler flange (on rear of head) lightly with grease, and place the floating disk against the grease-coated surface of the flange. Grease will hold the disk in place while the flange is mated with the flange on the vfo subchassis.
(2) See that the ridges on the coupler flanges are positioned 90° apart; then carefully position the head into place, mating the flanges of the coupler. Replace the screws.
(3) Replace the r-f subchassis as described in subparagraph *d,* above.
(4) Replace the front panel as described in subparagraph *b,* above.

aa. Removal of Autotune Motor. To remove the Autotune motor (B101), it is necessary to remove the front panel and r-f subchassis. Remove the front panel as described in subparagraph *a,* above. Remove the r-f subchassis as described in subparagraph *c,* above.

(1) Note and remove the four color-coded wires soldered to the motor terminal board (fig. 88).
(2) Remove the two screws which help secure the motor in position.
(3) Remove the nut which helps secure the motor in position. It will be necessary to maintain a slight pull on the motor, while loosening this nut, in order to expedite removal of the motor.

bb. Replacement of Autotune Motor. To replace the motor, proceed in the reverse order of removal.

cc. Removal of Relay K102. To remove relay K102 (fig. 88), it is necessary to remove the front panel as described in subparagraph *a,* above.

(1) Note and remove the color-coded wires connected to the bottom of the relay.
(2) Remove the three nuts which secure the relay to the casting. Lift the relay out.

dd. Replacement of Relay K102. To replace the relay, reverse the order of removal. Note that a red dot is located between the two terminals (as viewed from the bottom). The terminals, starting clockwise with the first terminal to the right of the red dot, are numbered from 1 consecutively to agree with the schematic diagram (fig. 118, part 2) and the silk-screened relay schematic located on the top of the relay.

113. Disassembly and Reassembly of Autotune Mechanism

Note. Only those organizations authorized to disassemble the multiturn positioning head should do so.

a. Disassembly of Multiturn Positioning Head (fig. 109). The only difference between the two multiturn heads is the addition of the detent assembly to the rear of the MEGACYCLE CHANGE head. If it is desired to disassemble the MEGACYCLE CHANGE head, it will be necessary to proceed as in subparagraph (1) below. If the KILOCYCLE CHANGE head is to be disassembled, proceed with subparagraph (4) below. The index numbers employed correspond to those assigned in figure 109.

(1) Remove the snap-ring (A) from the detent-bar standoff.

(2) Remove the spring (B) from the detent-spring standoff, and remove the detent spring and detent bar (C).

(3) Using a No. 8 Bristo wrench, loosen the screw (D) at the detent coupling, and remove the detent mechanism (consisting of the locking collar (E), the screw (D), the lock washer (F), the nut (G), the spacer (H), the notched plate (I), the two shims (J), the spacer (K), and the rear plate assembly (L), all of which may be disassembled, if desired).

(4) Remove the two Phillips-head screws (1) and the shakeproof washers (2). Lay the Bristo wrench holder (3) to one side.

(5) Remove the twelve Phillips-head screws (4), holding the right dust cover (5), the left dust cover (6), and the top dust cover (7).

(6) Remove the locking key (8).

(7) Remove the cam-drum nut (9) and the lock washer (10). Prevent the shaft from rotating by inserting a No. 10 Bristo wrench in the Bristo socket in the end of the shaft. (This is a left-hand thread.)

(8) Remove the safety wires (11) from the four spring anchor screws (12), and remove the screws.

(9) Remove the five Phillips-head screws (13) and the five shakeproof washers (14).

(10) Carefully remove the front-plate assembly (15).

(11) Remove the front ball-bearing assembly (16), the felt washer (17), and the home-stop actuator gear assembly (18).

(12) Remove the felt oiler (19) and the cam-shaft sleeve (20).

(13) Remove the four Phillips-head screws (21), the four lock washers (22), the upper-right standoff assembly (23), and the upper-left standoff assembly (24).

(14) If the pawls are not in the lifted position, insert a screw driver into the slot in the front end of the pawl-lifter-assembly shaft (25), and turn the shaft clockwise so that the mechanism is actuated and the pawls are lifted.

(15) Remove the cam-drum assembly (26).

(16) Remove the pawl-shaft nuts (27), the shakeproof washers (28), and the retaining rings (29).

(17) Remove the stop-ring shaft assembly (30), and carefully lay aside the rear-ball-bearing assembly (31).

(18) Remove the three Phillips-head screws (32) and the three lock washers (33), holding the lower-plate-standoff assembly (34) to the rear-plate assembly. Remove the lower-plate-standoff assembly.

(19) Remove the retaining ring (35), the retaining-ring washers (36), and all the shims (37) under the retaining-ring washers. The cam-shaft (38) and ratchet-pawl assembly (39) may then be removed from the rear-plate assembly.

(20) Disengage the toggle spring (40) which holds the pawl-lifter assembly (41) to the rear-plate assembly, from the post (42).

(21) Remove the worm-shaft assembly (43). The worm-gear assembly (44) may then be removed from the worm-shaft assembly.

(22) Using a No. 10 Bristo wrench, unscrew both pawl shafts, each a little at a time, until the shaft assemblies (45 and 46), the home-stop mechanism (consisting of 48, 49, 50, 51, 52, 53, and 54), and the counter-drum (47) can be removed. If the shaft assemblies (45 and 46) together with the home-stop mechanism, are to be disassembled, proceed with subparagraph (23) below; if not, proceed with subparagraph (28) below.

(23) Disengage the stop-ring-pawl heels from the counter-drum-pawl tails.

(24) Remove the stop-anchor assembly (48) from the counter-drum-pawl shaft (45).

(25) Loosen the setscrew (49) on the stop-anchor assembly (48), to remove the push rod (50).

(26) Disengage the push-rod from the home-stop pawl (51), by removing the retaining wire (52) and the push-rod spacer (53).

(27) Free the stop-return spring (54) from the stop-anchor assembly (48).

(28) Remove the shim (55), the cam-drive-gear assembly (56), and the felt washer (57) from the counter-drum assembly (47).

(29) Disengage the toggle spring (58) from the pawl-lifter assembly, remove the pawl-lifter assembly (41) from the rear-plate assembly by removing the snap-ring (59) at the rear of the pawl-lifter-assembly shaft (25).

(30) Remove the snap-rings (60) from the post (61), and remove the toggle spring (58).

(31) Using a No. 6 Bristo wrench, loosen the screws (62) and remove the pawl-lifter-assembly shaft (25) from the pawl-lifter-assembly (41).

b. Reassembly of Multiturn Positioning Head. The index numbers are the same as those employed in the disassembly procedure. Refer to figure 109.

(1) Using a No. 6 Bristo wrench, attach the pawl-lifter assembly (41) to the pawl-lifter-assembly shaft (25). Tighten the setscrews (62).

(2) Replace the toggle spring (58) on the post (61), and replace the snap-rings (60).

(3) Replace the pawl-lifter-assembly (41); then replace the snap-ring (59).

Note. If the home-stop mechanism has been disassembled, proceed with subparagraph (4) below; if not, proceed with subparagraph (9) below.

(4) Attach the stop-return spring (54) to the stop-anchor assembly (48).

(5) Engage the push-rod (50) with the home-stop pawl (51). Replace the push-rod spacer (53) and the retaining wire (52).

(6) Insert the push-rod (50) in the stop-anchor assembly (48), and tighten the setscrew (49).

(7) Attach the stop-anchor assembly (48) to the counter-drum-pawl shaft.

(8) Engage the stop-ring-pawl heels with counter-drum-pawl tails.

(9) Replace the shim (55), the cam-drive-gear assembly (56), and the felt washer (57) on the counter-drum assembly (47).

(10) Simultaneously, replace the shaft assemblies (45 and 46) (with home-stop mechanism in position) and the counter-drum (47) on the rear-plate assembly. Using a No. 10 Bristo wrench, turn the Bristo sockets in the ends of the shafts, each a little at a time, until the counter-drum pawls are alined with the counter-drum rings.

(11) Re-engage the toggle spring (40) with the post (42).

(12) Replace the ratchet-pawl (39) on the cam-shaft (38), and reposition the assembly on the rear-plate assembly. Replace the shims (37), the retaining-ring washer (36), and the retaining ring (35), all of which are associated *only* with the cam-shaft assembly.

(13) Replace the worm-gear assembly (44) on the worm-shaft assembly (43).

(14) Replace the worm-shaft assembly on rear panel. Replace the retaining ring (29).

(15) Replace the shims (37), the retaining-ring washers (36), and the retaining ring (35), all of which are associated *only* with the counter-drum assembly (47).

(16) Replace the lower-plate-standoff assembly (34). Replace the lock washers (33) and the Phillips-head screws (32), all of which secure the standoff assembly to the rear-plate assembly. Make certain both ends of the spring (54) are positioned in the holes (63) of lower-plate-standoff assembly.

(17) Reattach the rear-ball-bearing assembly (31) on stop-ring shaft as-

sembly (30). Position the stop-ring shaft in place on rear-plate assembly.

(18) Replace the washers (28) and the pawl-shaft nuts (27); hand-tighten only.

(19) Replace the cam-drum assembly (26).

(20) Replace the upper-right-standoff assembly (23) in position on the rear-plate assembly, making certain the counter drum (47) is in such a position as to insure that the post (on ring gear) will fall between the stops (64) on standoff assembly.

(21) Replace the cam-shaft sleeve (20) and the felt oiler (19).

(22) Replace the home-stop actuator gear assembly (18), the felt washer (17), and the front ball-bearing assembly (16).

(23) Replace the front-plate assembly (15).

(24) Replace the five shakeproof washers (14) and the five Phillips-head screws (13).

(25) Adjust the position of the pawl stacks until the pawls line up with their respective rings.

(26) Tighten all of the spring-anchor screws (12). Using a 2-inch length of #22 wire (11) for each set of screws, make a loop in the form of a figure "8" through the heads of the screws, and twist the ends of the wire together.

(27) Replace the cam-shaft nut (9) (finger-tight) and its lock washer (10). Tighten the nut, at the same time holding the cam shaft in position with the Bristo wrench. (This is a left-hand thread.)

(28) Replace the locking key (8).

(29) Replace the Bristo wrench holder (3), the washers (2), and the Phillips-head screws (1).

(30) Synchronize the home-stop mechanism as follows: Place the MEGACYCLE CHANGE knob on the multiturn shaft, and tighten its setscrew. Replace the locking key, but do not lock. Using a screwdriver, rotate the pawl-lifter shaft (25) clockwise. Rotate the stop-ring shaft clockwise until the home-stop pawl begins to rotate. Stop rotation before the home-stop pawl has been fully actuated. With a Bristo wrench, loosen the set screws in the idler gear on the worm-shaft assembly (43). Push this gear back and out of mesh with the drive gear on the stop-ring-shaft assembly. Rotate the counter-drum assembly clockwise until the home-stop-pawl just contacts the home-stop ring. Rotate the stop-ring shaft clockwise so that the tab on the home-stop ring just contacts the home-stop-pawl toe. Mesh the idler gear assembly with the drive gear again, and tighten the setscrews.

(31) Check the adjustment by rotating the stop-ring shaft to the counterclockwise home-stop position. The home-stop-pawl toe should fully engage the tab on the home-stop ring. Rotate the stop-ring shaft fully clockwise and then counterclockwise again, to check for the same condition. If adjustment is incorrect, repeat the entire procedure.

(32) Rotate the multiturn shaft counterclockwise until the home-stop is actuated. Now rotate the shaft clockwise until the home-stop is actuated again, while observing whether the slots in any counter-drum rings fail to pass beneath their respective counter-drum-pawl toes. With a pointed tool, rotate any misalined rings about 1/4 turn counterclockwise. Apply a tangential pressure in the slot and be careful not to score the ring.

(33) Lubricate multiturn head in accordance with paragraph 114.

Note. The following three steps are used only when replacing the detent mechanism.

(34) Replace the detent mechanism, and, using a No. 8 Bristo wrench, tighten the screw (D).

(35) Reattach the detent-spring (B) on the detent bar (C), and connect the spring to its standoff.

(36) Replace the snap-ring (A).

(37) Replace the right dust cover (5), the left dust cover (6), and the top dust cover (7), using twelve Phillips-head screws (4).

c. Disassembly of Autotune Control Head. After the control head has been removed from the Autotune casting, refer to figure 110 and accomplish the following disassembly procedure. The index numbers used in the following procedure correspond to those assigned to the parts in the figure.

Note. Only those organizations authorized to disassemble the Autotune control head, should do so.

(1) Remove the eight Phillips-head screws (1); then remove the right dust cover (2) and the left dust cover (3).

(2) Loosen the setscrew (4), and pull the channel indicator (5) off its shaft.

(3) Remove the three Phillips-head screws (6), and separate the terminal board (7) from control head.

(4) Remove the Phillips-head screw (8) and pull the seeking switch (9) forward off its shaft. Do not unsolder any wires at this time unless it is necessary for repair.

(5) Remove the two Phillips-head screws (10), together with the shakeproof washers (11), and the two studs (12), together with the lock washers (13).

(6) Carefully pull the front plate (14) forward until it is disengaged from the main shaft.

(7) Unscrew the nut (15), and then pull the lug (16) off the end of the screw.

(8) Unsolder and tag all of the wires connected to the terminals of the breaker switch (17), the reverse switch (18), and the limit switch (19).

Note. It is not recommended that the wires be unsoldered from the seeking switch or the terminal board unless repair on these particular items is necessary.

(9) Remove the two Phillips-head screws (20), together with the two lock washers (21), and separate the breaker switch (17) from the front plate (14).

(10) Remove the two screws (22), and separate the top casting (23) from the rear plate (24).

(11) Remove the two retaining rings (25) and (26) from end of the main shaft (27) and the bearing (28).

(12) Disengage the main shaft (27), with its attached parts, from the rear plate (24).

(13) Loosen the setscrew (29), and slide the cam (30) off the main shaft (27).

(14) Slide the ratchet-and-gear assembly (31) off the main shaft (27).

(15) Slide the bearing (28) out of the ratchet-and-gear assembly.

(16) Remove the retaining ring (32) from the groove in the main shaft (27).

(17) Slide the bushing (33), with its attached parts, off the main shaft (27).

(18) Remove the retaining ring (34) from the bushing (33).

(19) Slip the shims (35), the spring washer (36), the special washer (37), the spacer (38), and the actuator arm (39) off the bushing (33).

(20) Slide the lost-motion washers (40) off the main shaft (47).

(21) Remove the two screws (41), and separate the rear plate (24) from the bottom casting (42).

(22) Remove the two Phillips-head screws (43), together with the shakeproof washers (44), and separate the bracket (45) from the bottom casting.

(23) Remove the four Phillips-head screws (46), together with the lock washers (47), and separate the reverse switch (18) and the limit switch (19) from the bracket (45).

d. Reassembly of Autotune Control Head. After this control head has been disassembled, repaired, and cleaned, refer to figure 110 and accomplish the following reassembly procedure. The index numbers assigned to parts in the following procedure are identical with those used during the disassembly procedure, and also appear on the referenced figure.

(1) Properly position the reverse switch (18) and the limit switch (19) on the bracket (45). Secure these two switches to the bracket, using the four Phillips-head screws (46), together with the four lock washers (47).

(2) Secure the bracket (45) to the bottom casting (42), using the two Phillips-head screws (43), together with the two shakeproof washers (44).

(3) Attach the rear plate (24) to the bottom casting (42), using the two screws (41).
(4) Slide the lost-motion washers (40) onto the main shaft (27).
(5) Slide the actuator arm (39), the spacer (38), the special washer (37), the spring washer (36), and the shims (35) on the bushing (33).
(6) Insert the retaining ring (34) into its slot in the bushing (33).
(7) Slide the bushing (33), with its attached parts, onto the main shaft (27).
(8) Insert the retaining ring (32) into its slot in the main shaft (27).
(9) Slide the bearing (28) into the ratchet-and-gear assembly (31).
(10) Slide the ratchet-and-gear assembly (31) onto the main shaft (27).
(11) Slide the cam (30) onto the main shaft (27), and secure with the setscrews (29).
(12) Insert the end of the main shaft (27) and the bearing (28) properly into their hole in the rear plate (24), and secure them in position with the retaining rings (25 and 26).
(13) Properly position the top casting (23), and secure it to the rear plate (24) with the two screws (22).
(14) Properly position the breaker switch (17) on the front plate (14), and secure with the two Phillips-head screws (20), together with the two lock washers (21).
(15) Properly solder all removed wires to the terminals of the breaker switch (17), the reverse switch (18), and the limit switch (19). Make certain that as each wire is replaced, it corresponds to the terminal from which it was removed, as tagged upon removal.
(16) Replace the lug (16) on end of the screw, and secure with the nut (15).
(17) Replace the front plate (14), engaging the bearing in the front plate with the main shaft (27), and secure with the two studs (12), together with the two shakeproof washers (13), and the two Phillips-head screws (10), together with the two lock washers (11). Make certain the rubber grommet (48), with the contained cabling, is properly inserted into its slot in the front plate.
(18) Carefully slide the seeking switch (9) onto the main shaft (27), and secure it to the front plate (14), with one Phillips-head screw (8).
(19) Properly position the terminal board (7), and secure in place with the three Phillips-head screws (6).
(20) Slide the channel indicator (5) onto the main shaft (27), and secure with the setscrew (4).
(21) Rotate the main shaft (27), using the gear of the ratchet assembly (31). All of the parts should rotate freely without binding, with the exception of the slip-clutch action of the actuator arm. While rotating the main shaft, check to make certain that the breaker switch (17) snaps open simultaneously with an open position on the seeking switch (9). It may be necessary to temporarily loosen the setscrews (29) and reposition the cam (30) on its shaft. Check to make certain that the lost-motion washers (40) become effective between limits approximately 2¼ revolutions of the spur gear.
(22) Lubricate the control head in accordance with paragraph 114.
(23) Replace the left dust cover (3), and secure with the four Phillips-head screws (1).
(24) Replace the right dust cover (2), and secure with the four Phillips-head screws (1).

e. Disassembly of Autotune Motor (fig. 111). After the Autotune motor has been removed, disassemble as follows:

(1) Drive out the taper pin (1) and remove the spur gear (2).
(2) Remove the two retainer clips (3), the brush-holder caps (4), and the brushes (5).
(3) Remove the two frame screws (6), together with the two lock washers (7), and take off the front housing (8).
(4) Feed the field leads (9) through the

hole in the rear housing (10), and remove the frame-and-field assembly (11).

(5) Pull the armature (12) from the rear housing (10), and remove the bearings (13 and 14).

(6) Remove the two screws (15), the two lock washers (16), and then remove the filter cover (17).

f. Reassembly of Autotune Motor.

(1) Wearing rubber gloves or fingerstalls, remove the pre-lubricated bearings (13) and (14) from their packages, and press them on the shaft of the armature (12).

(2) Insert the armature assembly into the rear housing (10), making certain that the bearing (14) is properly seated.

(3) Feed the field leads (9) through the hole in the rear housing (10), and place the frame-and-field assembly (11) in position.

(4) Replace the front housing (8) in position, and secure with the two frame screws (6) and the lock washers (7).

(5) Insert the two brushes (5), the brush-holder caps (4), and the retainer clips (3). Observe standard Signal Corps instructions for correct seating and running-in procedures.

(6) Place the spur gear (2) on the end of the shaft (hub inward), and secure with the tapered pin (1).

(7) Replace and secure the filter cover (17), using the two screws (15) and the two lock washers (16).

114. Lubrication of Mechanical Tuning System

The only parts of the receiver that require lubrication are the mechanical tuning system (which includes the Autotune mechanism, gear train, and the slug racks and can rack), and the BFO PITCH control-shaft bearing. The receiver is lubricated initially at the factory and should be lubricated thereafter once every 6 months under normal operating conditions. The lubrication interval should be shortened only if the need is indicated by inspection, or if abnormal conditions or activities are encountered. When the equipment is operated in a hot, arid climate, it may be necessary to lubricate the porous bronze bearings about twice as often as indicated. It must be remembered that over-lubrication can often cause more harm than no lubrication. Check the condition of the mechanical tuning system whenever the receiver is withdrawn from the case or rack for servicing. Rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls manually throughout their ranges, checking for ease of operation. Check for lack of lubrication on gears, edges of cams, cam rollers, guide slots, and bearings; inspect for gritty grease and oil. Operate the BFO PITCH control; if operation is rough or uneven, check the lubrication of the control-shaft bearing. Operate the receiver on Autotune, checking for excessively noisy or irregular Autotune operation.

Caution: Never attempt to lubricate the sealed oscillator (vfo), regardless of possible noisy operation of the unit during tuning. Unstable operation of the oscillator may result.

a. Cleaning Before Lubrication. Remove the covers from the r-f and crystal-oscillator subchassis. If the Autotune mechanism is to be lubricated, the front panel must also be removed (par. 112*a*) to permit access to the gear train for cleaning and lubrication. Use a thin, long-handled brush having medium bristles, dipped in Solvent, Dry Cleaning (SD). Remove the dirt, oil, and grease from the gears, cams, guide slots, and bearings. To gain access to all of the gear teeth while cleaning, rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE knobs. After dipping the brush in solvent (SD) remove the excess to prevent the solvent from dripping onto connecting cables, wiring, or other electrical parts. Use a clean, lint-free cloth moistened with solvent (SD) to remove grease from the metal casting and chassis. Thoroughly wipe all parts with a clean, dry, lint-free cloth before proceeding with lubrication. Generally, it is necessary to clean the Autotune mechanism before lubrication only if excessively noisy or irregular operation indicates dirt in the mechanism.

b. Detailed Lubrication Instructions. Lubricate the gear train, slug racks, and can rack as indicated in figure 99. To apply oil to the bearings, dip a length of wire into the oil to collect a small drop at the end, and transfer the oil to the bearing by touching the end of the wire to the edge of the bearings. Avoid the use of excessive amounts of oil. A standard grease gun and a thin, long-handled brush should be used for applying grease to gear teeth, edges of cams, and tuning rack guide slots. Rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls as necessary to expose all gear teeth. To gain access to the Autotune mechanism for lubrication, remove the receiver front panel (par. 112*a*), the Autotune positioning heads and control head (pars. 112*w* and *y*), and then remove the dust covers from the heads (par. 113). Lubricate the Autotune mechanism as indicated in figures 100, 101 and 102.

115. Parts Lubricated by Manufacturer

Prior to delivery of Radio Receiver R-391/URR, the following parts are lubricated by the manufacturer:

Gears, cams, and guide slots—Grease, MIL-G-7421.

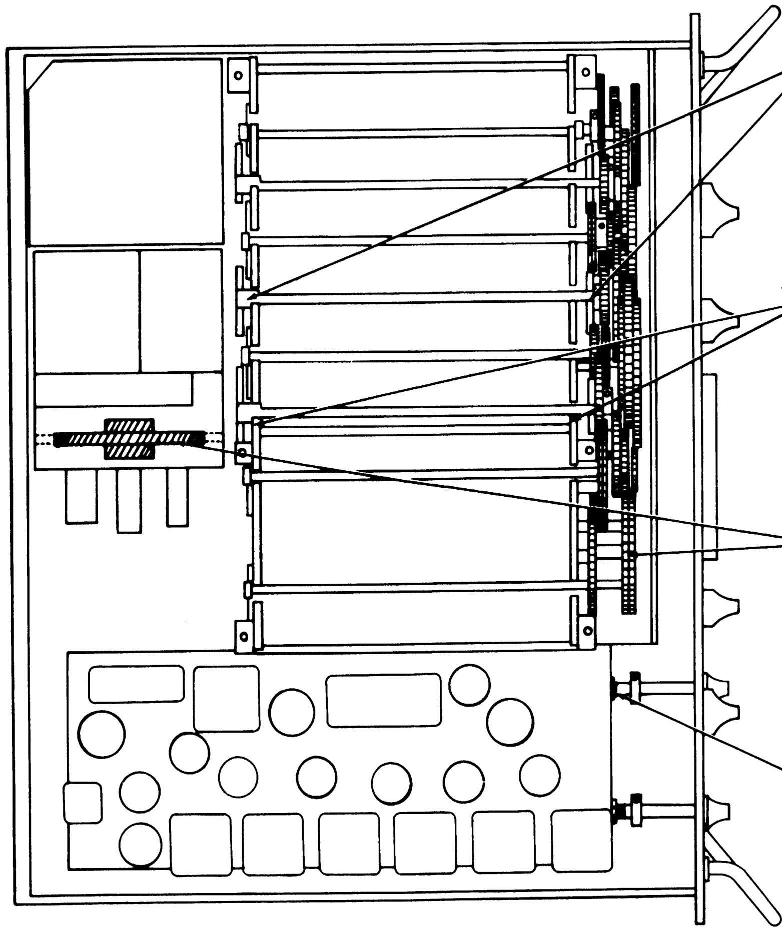
Bearings and cam rollers—Lubricating Oil, General Purpose, Low Temperature, MIL-L-7870.

Autotune mechanism—Lubricating Oil, General Purpose, Low Temperature, AN-O-6a, and Grease, Aircraft and Instruments, MIL-G-3278.

116. Refinishing

Instructions for touch-up painting are given in paragraph 43, and instructions for refinishing badly marred panels or exterior cabinets are contained in TM 9-2851.

LUBRICANTS	INTERVAL
MIL-L-7870-LUBRICATING OIL GENERAL PURPOSE, LOW TEMPERATURE	6M-6 MONTHS
MIL-G-7421-GREASE	

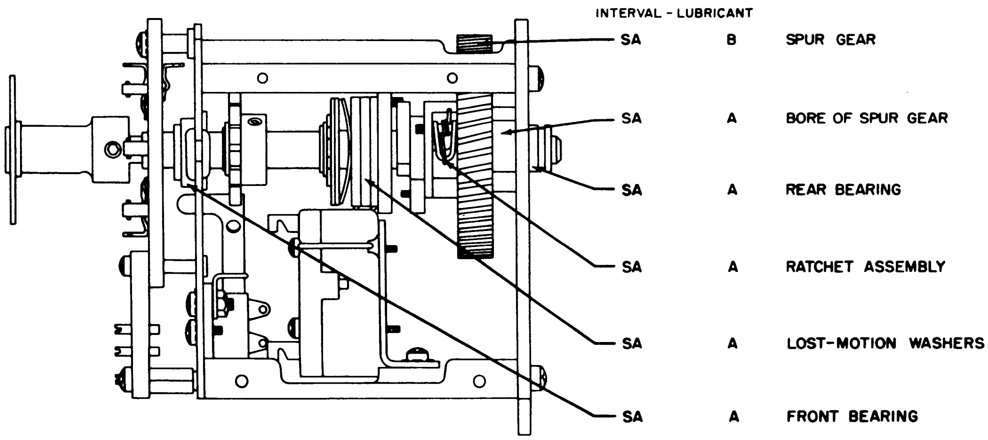


NOTE:

CLEANING-SOLVENT, DRY-CLEANING, ONLY WILL BE USED TO CLEAN PARTS. BEFORE LUBRICATING CLEAN SURFACES OF PARTS WITH LINTLESS CLOTH LIGHTLY DAMPENED WITH SOLVENT, DRY-CLEANING. DO NOT ALLOW CLEANING FLUID TO GET ON OTHER PARTS OF RECEIVER.

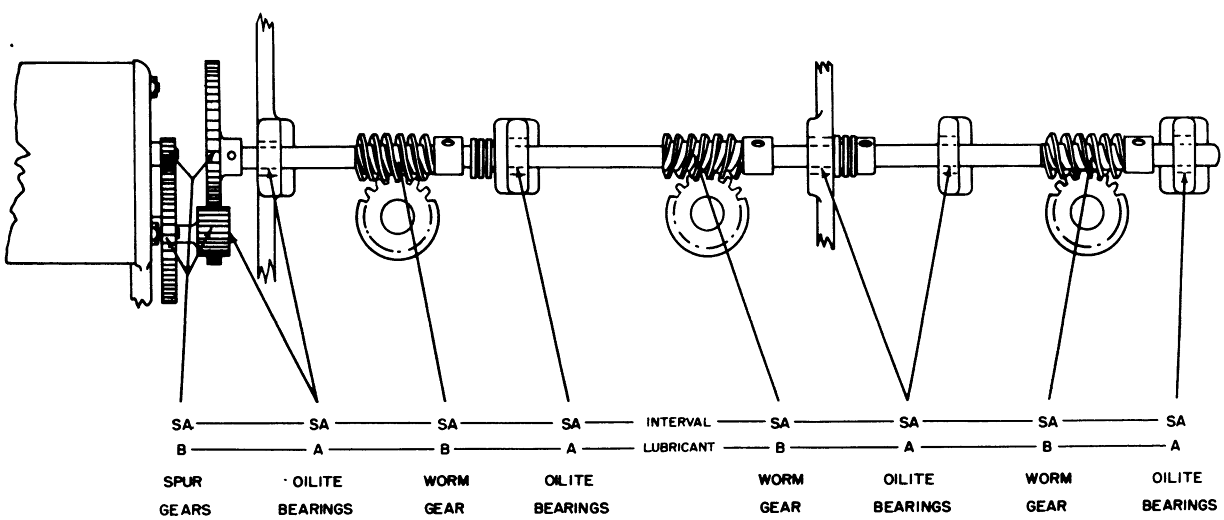
TM856-82

Figure 99. Lubrication of gear train, slug racks, and can racks.



REMOVE FROM CASTING TO SERVICE

NOTE:
ALL LUBRICANTS ARE TO BE APPLIED, USING A SMALL CAMEL HAIR BRUSH, IN AMOUNTS WHICH EACH LUBRICATION POINT WILL RETAIN. REMOVE ALL EXCESS.



LURICANTS	INTERVAL
A-AN-O-6a OIL	SA-SEMIANNUALLY
B-MIL-G-3278 GREASE	

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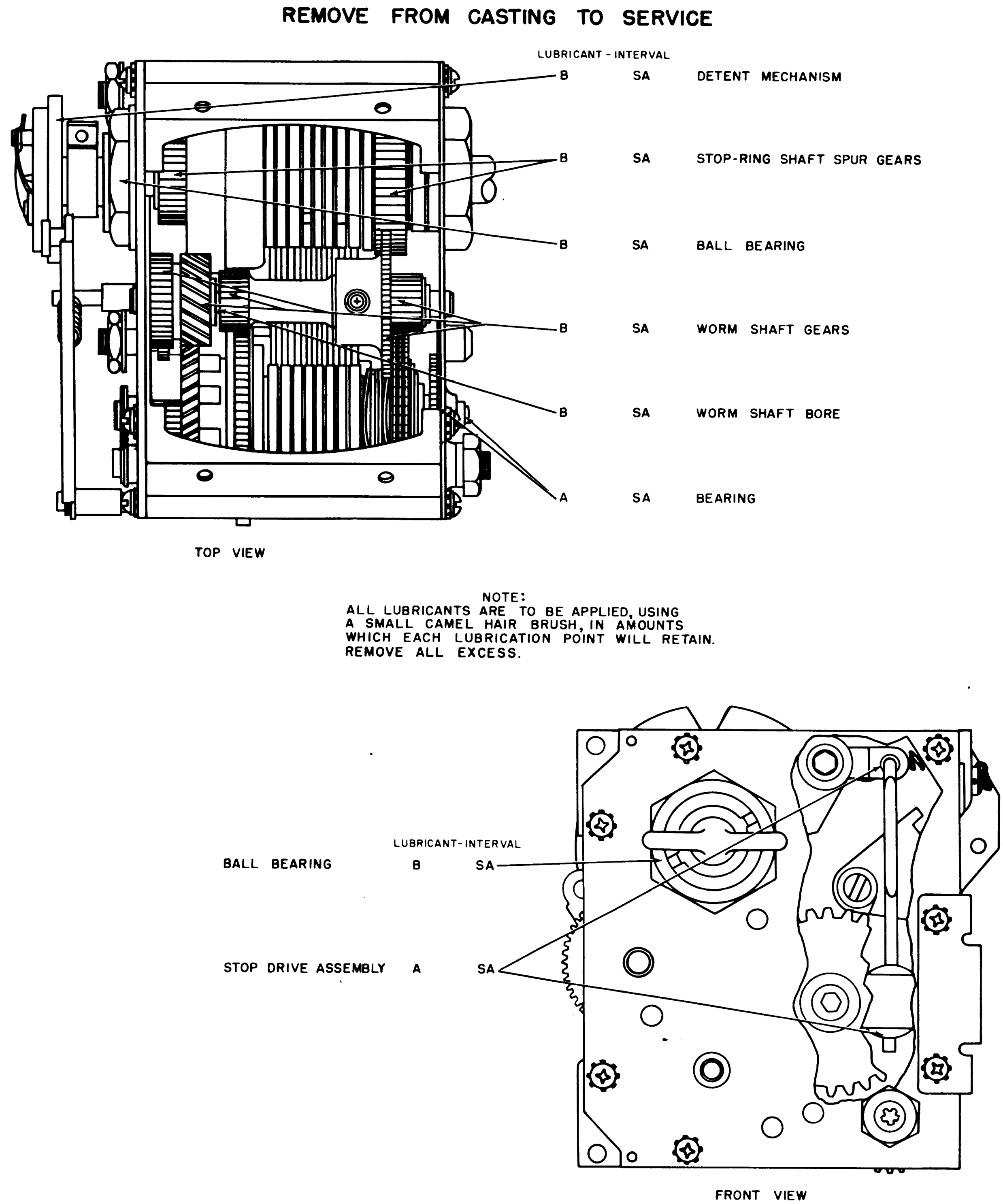
Figure 100. Lubrication of control head and line shaft.

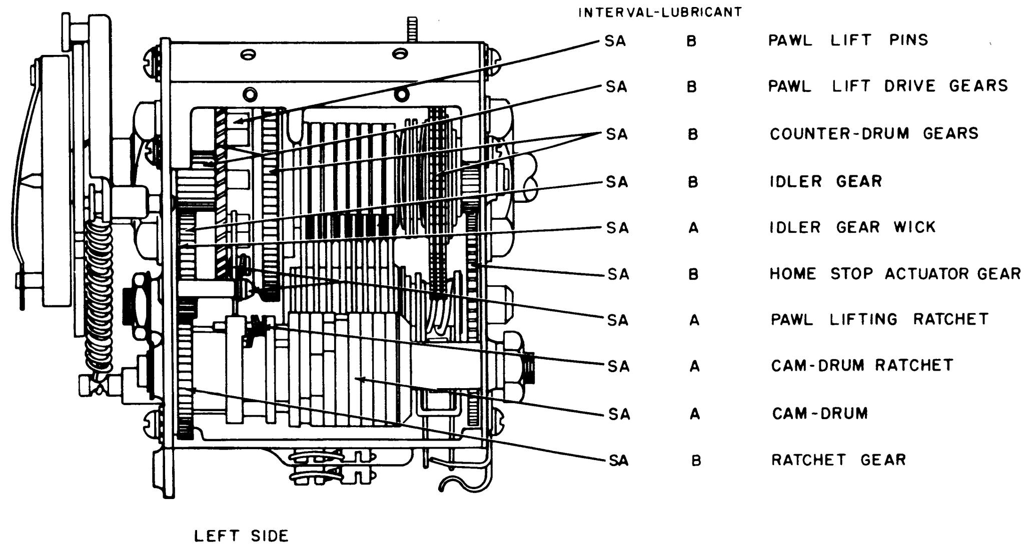


LUBRICANTS	INTERVAL
A-AN-O-6a OIL	SA-SEMIANNUALLY
B-MIL-G-3278 GREASE	

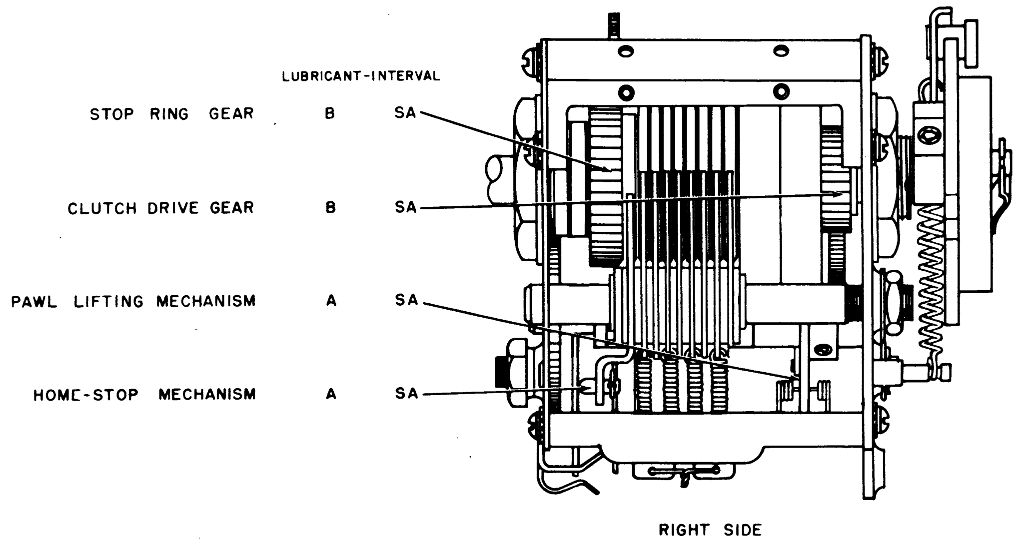
TM 863-89

Figure 101. Lubrication of multiturn positioning head, front and top views.

REMOVE FROM CASTING TO SERVICE



NOTE:
ALL LUBRICANTS ARE TO BE APPLIED, USING A SMALL CAMEL HAIR BRUSH, IN AMOUNTS WHICH EACH LUBRICATION POINT WILL RETAIN. REMOVE ALL EXCESS.



LUBRICANTS	INTERVAL
A-AN-O-6a OIL	SA-SEMIANNUALLY
B-MIL-G 3278 GREASE	

TM 863-90

Figure 102. Lubrication of multiturn positioning head, left and right side views.

Section III. ALINEMENT AND ADJUSTMENT PROCEDURES

117. Test Equipment and Tools Required for Alinement and Adjustment

a. Signal Generator. The signal generator must be an accurately calibrated instrument such as R.F. Signal Generator Set AN/URM-25, capable of producing r-f signals within a frequency range of .455 to 32 mc. The attenuator must be capable of varying the output of the signal generator over a range of approximately 1 microvolt to 1 volt.

b. Output Meter. The output meter should be a vacuum-tube voltmeter, such as Electronic Multimeter TS-505/U, having a high resistance input. It must have a d-c voltage range suitable for measuring 2 to 10 volts and a high-frequency probe for measuring 1 to 10 volts ac.

c. Volt Ohmmeter. A volt ohmmeter is required for checking the synchronization of the crystal-oscillator band switch and line voltage measurements. Multimeter TS-352/U is suitable for this purpose.

d. Vtvm. A vacuum-tube voltmeter that has a .01- to .1-volt a-c range, such as Electronic Multimeter ME-6/U, is required for performing the regulated-voltage hum adjustment.

e. Variable Autotransformer. A variable autotransformer, such as Transformer CN-16/U, is required for performing the regulated-voltage hum adjustment.

f. Resistors. A 75-ohm and a 95-ohm, noninductive, ¼-watt resistors must be available for connecting R.F. Signal Generator Set AN/URM-25 to the balanced antenna input when alining the r-f subchassis.

g. Tools. A bakelite alinement tool is required for adjusting transformer cores and trimmer capacitors. The No. 8 Bristo wrench and the Phillips screwdriver supplied with the receiver are required for adjustments during synchronization of the tuning shafts. In addition to the No. 8 Bristo wrench, a No. 10 Bristo wrench, which is secured by means of a holder to the multiturn positioning head, is also required for synchronization of the Autotune system.

Note. Before performing the alinements, allow the receiver to warm up for a period of 1 hour.

118. Regulated-voltage Hum Adjustment

If objectionable hum is noted in the output of the receiver, adjust the regulated voltage for minimum hum as follows:

a. Connect Power Cable Assembly CX-1358/U between the receiver and a variable autotransformer, such as Transformer CN-16/U.

b. Connect a voltmeter (such as Multimeter TS-352/U), set at 100- to 200-volt a-c range, across the output of the autotransformer.

c. Connect a vtvm (such as Electronic Multimeter ME-6/U), set at .01- to .1-volt a-c range, between B+ 180 VDC jack J601 (fig. 81) and ground.

Warning: Avoid contact with the B+ 180 VDC jack when the receiver is turned on; the high voltage present at this jack constitutes a danger to personnel.

d. Make certain that the receiver is grounded; then connect the autotransformer to 115-volt, 60-cycle source.

e. Check to see that switch S801 on Power Supply PP-621/URR is set at the 115V position; then turn on the receiver and allow it to warm up.

f. Adjust the autotransformer for an accurate 115-volt line-voltage reading on the vtvm.

g. Insert the screwdriver in the slot of HUM BAL control R614 (fig. 81), accessible through the right side plate of the main frame, and adjust for minimum reading on Multimeter ME-6/U.

119. Mechanical and Electrical Synchronization

The receiver tuning shafts, consisting of the 6-position r-f band-switch shaft, slug-rack camshafts, crystal-oscillator band-switch shaft, and the vfo tuning shaft, must be in synchronization with the gear train before any attempt is made to aline the receiver. Perform the synchronization in the order of the procedures given below.

Note. The synchronization procedures detailed in paragraphs 119 through 129 are all based upon manual tuning of both the KILOCYCLE CHANGE and MEGACYCLE CHANGE controls. To accomplish these procedures, first note the reading of the frequency-indicator. Then, rotating the two locking keys at least two turns counterclockwise, the procedures may be followed. After completing the procedures, reset the two controls to their original positions, and lock the keys.

a. Camshafts. The camshafts are synchronized properly if the index lines etched on the rear plate of the r-f subchassis bisect the holes in each of the rear cams (fig. 103), with the MEGACYCLE CHANGE control set at the third detent position, and the KILOCYCLE CHANGE control approximately 1/4 turn from the stop in the extreme counterclockwise position. Proceed as follows:

Note. The camshafts are secured to the drive gears by clamps at the hubs of the gears. To position a camshaft, it is necessary to loosen the clamp which, except for the 8—16-mc shaft, is located at the end of the individual shaft at the front of the r-f subchassis. To avoid loss of the nut, do not loosen the clamp more than necessary. Be careful not to strip the screw thread.

(1) Rotate the MEGACYCLE CHANGE control counterclockwise as far as it will go, then turn the control clockwise through the two detent positions to the third detent position. Remove the crystal-oscillator subchassis (par. 112*e*), so that the cams are visible from the rear of the receiver.

(2) If 1- to 2-mc camshaft (fig. 103) is not positioned properly, loosen the clamp on the front of the shaft and rotate the rear cam until the index line bisects the hole in the cam. Tighten the clamp.

(3) Position the camshaft for .5- to 1-mc slug rack (fig. 94), if necessary, in the same manner as described in subparagraph (2), above.

(4) Check the position of the 8- to 16-mc camshaft. It it is not alined properly, it is necessary to loosen the clamp on the front of the 2- to 4-mc shaft to position the 8- to 16-mc cam, since gear for the 8- to 16-mc shaft is pinned through the shaft. After positioning the 8- to 16-mc cam, position the 2- to 4-mc cam while holding the 8- to 16-mc cam in place. Then tighten the clamp on the 2- to 4-mc shaft.

(5) If necessary, position the 4- to 8-mc and 16- to 32-mc cams (fig. 103) in the same manner as described in subparagraph (2), above.

(6) To position the first variable i-f cam (fig. 103), loosen the clamp nearest the front plate of the r-f subchassis on the crystal-oscillator band-switch shaft. Adjust the position of the cam; then tighten the clamp.

(7) Position second variable i-f cam (fig. 103), if necessary, in the same manner as for 1—2-, 5—1-, 4—8-, and 16—32-mc cams.

(8) Check the reading of the frequency indicator. If a reading of 02 is not centered within two left-hand spaces of the indicator, loosen the clamp on the bevel gear on shaft extending from left side of the indicator (fig. 97). Set the two number wheels for reading of 02, and retighten bevel-gear clamp.

(9) If reading of 000 does not appear in last three spaces of frequency-indicator dial, loosen clamp securing the bevel gear on shaft extending from right side of indicator. Set the three number wheels for reading of 000.

b. Six-position R-f Band Switch. The procedure for checking and synchronizing the r-f band switch is as follows:

(1) Adjust the KILOCYCLE CHANGE control for a reading of 000 in the last three spaces of the frequency indicator.

(2) Rotate the MEGACYCLE CHANGE control counterclockwise as far as it will go, beyond the first detent position.

(3) Connect the ohmmeter, set at the X1 scale, between test point E208 (grid of tube V203, fig. 68) and ground.

(4) Rotate the MEGACYCLE CHANGE control clockwise through eight detent positions. The meter should read more than 50 ohms in each position.

(5) Rotate the MEGACYCLE CHANGE control clockwise from the eighth detent position to the ninth detent position. The ohmmeter should show a

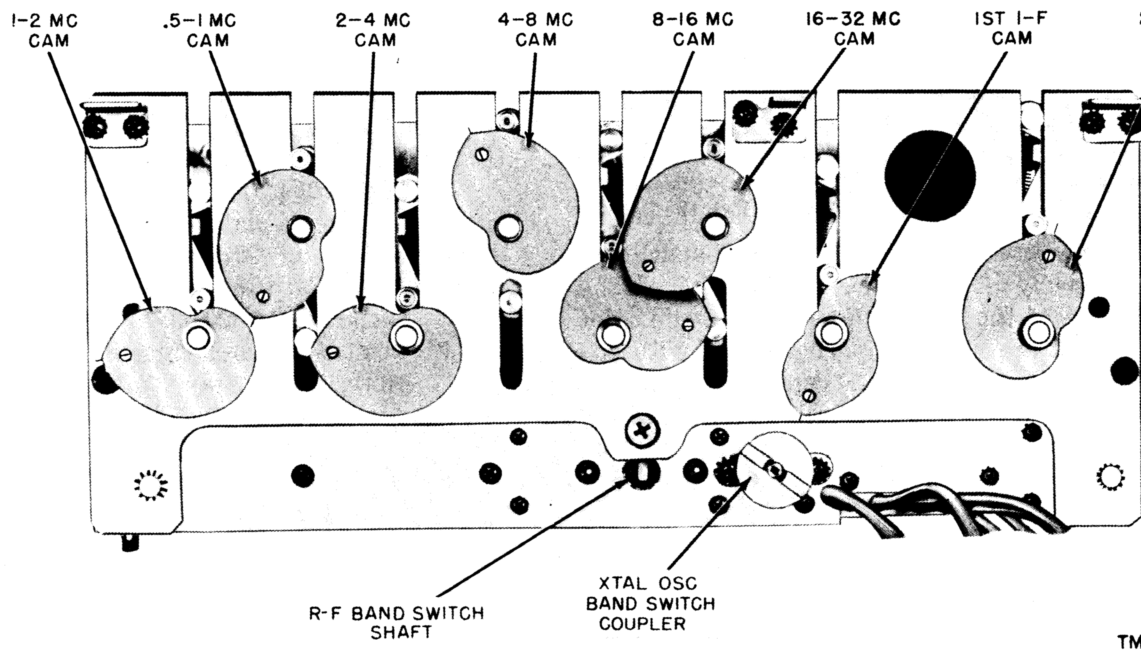


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Figure 103. R-f subchassis, rear view.

reading. If it does not, proceed with the procedures outlined in subparagraphs (6), (7), (8), and (9) below. If the indication is normal, the crystal-oscillator band switch is in synchronization; in this case, proceed with synchronization of the crystal-oscillator band switch as described in subparagraph *c* below.

(6) Rotate the MEGACYCLE CHANGE control counterclockwise as far as it will go; then turn the control clockwise through the two detent positions to the third detent position.

(7) Remove the r-f subchassis (par. 112*c*).

(8) Loosen the clamp on the front of the six-position switch shaft, located on the bottom of the r-f subchassis, and rotate the shaft until the switch contacts are centered at position 3 by inserting long-nosed pliers in the hole at the rear of the subchassis (fig. 103) and turning the shaft. Positions of the switch contacts are shown in the schematic diagram (fig. 118, part 1). Tighten the clamp after adjustment.

c. Crystal-oscillator Band Switch. The crystal-oscillator band switch should be checked and synchronized as follows:

(1) The rotor of the crystal-oscillator band switch is positioned correctly when the number centered in the slot of the switch position indicator (fig. 71) agrees with the reading of the megacycle portion (first two digits) of the frequency indicator.

(2) If the indication is incorrect, loosen the clamp on the flange of the Oldham coupler and rotate the SYNC XTAL OSC control (fig. 21) to center the proper reading in the slot.

d. Vfo Tuning Shaft. Synchronize the vfo tuning shaft as follows:

(1) Turn on the receiver and allow it sufficient time to warm up.

(2) Loosen the clamp on the side of the Oldham coupler that is closest to the front panel, so that the vfo tuning shaft may turn freely.

(3) Set the receiver controls for normal voice reception, and connect a headset to the PHONES jack.

(4) With the first two digits of the frequency-indicator dial at any setting, slowly rotate the KILOCYCLE CHANGE control clockwise, starting from its lowest frequency setting, until the background noise is heard in the headset. Adjust the KILOCYCLE CHANGE control for maximum background noise.

(5) Note the reading of last three digits on the frequency-indicator dial.

(6) Turn the FUNCTION switch to CAL, and the BFO switch to ON. Set the BFO PITCH control at 0, and set the frequency-indicator dial reading at the nearest 100-kc point to reading noted in subparagraph (5), above.

(7) Adjust the vfo shaft slightly by hand until zero beat is obtained. It should not be necessary to turn the vfo shaft more than one full turn in either direction to obtain zero beat.

Caution: The vfo will be damaged permanently if the shaft is turned too far in either direction.

(8) Tighten the clamp that secures the flange of the coupler.

120. Synchronization of Autotune Mechanism

After any repairs have been made to either of the multiturn units or to the control head, the Autotune system should be synchronized. Before replacing the front panel, proceed as follows:

a. Replace the Autotune knobs and locking keys. Do not tighten the keys.

b. Insert a #10 Bristo wrench through the small hole in left side of receiver, and continue this motion until the wrench engages and properly seats in the socket in the end of the Autotune line shaft.

c. Manually rotate the line shaft, using the Bristo wrench, in a counterclockwise direction. Continue this rotation until the circular CHANNEL indicator dial (fig. 22) and the two camshaft nuts, located on the lower left corners of the multiturn positioning heads, are rotaing simultaneously.

d. Continue to rotate the line shaft in a counterclockwise direction, and observe the action of the small indicator flag behind the seeking switch, located on the front of the control head. Stop the rotation of the line shaft as near as possible to the position where the indicator flag snaps suddenly to the right. This action occurs with an audible snap.

e. Rotate the line shaft clockwise $3\frac{1}{2}$ to $3\frac{5}{8}$ revolutions, and stop.

f. Rotate positioning heads to home stop, first clockwise and then counterclockwise. This is done to make certain that a stop-ring slot is engaged by its stop-ring pawl toe in each of the positioning heads. Test for this condition by tightening each of the locking keys. If any one of the shafts rotates as its key is being tightened, the associated head will not have a stop-ring slot engaged by a stop-ring pawl toe, and it will be necessary to loosen the locking keys and repeat steps *c, d,* and *e* until none of the shafts will rotate when the locking keys are tightened.

g. Synchronize each multiturn head by inserting a #10 Bristo wrench into the end of the positioning-head camshaft. Without unduly forcing the wrench, rotate the shaft as far as possible counterclockwise, hold the shaft in place, and rotate the nut on the shaft clockwise $\frac{1}{4}$ to $\frac{1}{2}$ turn. Continue to rotate the shaft counterclockwise as far as possible, without unduly forcing the wrench, and tighten the nut.

h. Remove all the locking keys and knobs.

i. Replace the panel and its plugs, terminals, leads, locking nuts, etc.

j. Rotate all Autotune shafts fully counterclockwise.

k. Replace and tighten all knobs on their respective shafts. Make certain that each knob and indicator, whose position was marked at the time of its removal, is replaced and tightened in its original position.

l. Replace the Autotune locking keys.

m. Place the CHANNEL SELECTOR switch at any other channel position, and check that the Autotune cycles correctly.

121. Alinement of 455-kc I-f Stages (fig. 104)

a. Turn on R.F. Signal Generator Set AN/URM-25 or equivalent, and connect it to test point E210 (control grid of third mixer tube, V205).

b. For an output meter, connect the grounded lead of vtvm, such as Electronic Multimeter TS-505/U, to the receiver chassis, and connect the other lead to the DIODE LOAD terminal, 14, of rear terminal strip (fig. 21). Set the function switch of the voltmeter for measuring negative d-c voltage.

c. Set the BANDWIDTH switch to the .1-KC position, RF GAIN control to 10, BFO switch to OFF, and FUNCTION switch to MGC. Allow the receiver to warm up for several minutes.

d. Tune the signal generator to 455 kc (unmodulated); then adjust its frequency control for peak reading on the vtvm. To obtain peak reading, it may be necessary to set the attenuation of the signal generator for high amplitude output signal (3 volts). If a reading on the vtvm is obtained, proceed with subparagraph *e* below. If unable to secure a reading, perform the procedure outlined in subparagraph (1) and, if necessary, subparagraph (2), below, to secure approximate alinement before proceeding with subparagraph *e*.

(1) With the signal generator tuned to 455 kc and the attenuator set for full output, turn the receiver BANDWIDTH switch to the 16-KC position. If the output reading is not yet obtained; proceed with subparagraph (2). If the output is obtained, adjust the cores of transformers T506 through T501 and T207, in that order, for peak reading on the vtvm. Then, set the BANDWIDTH switch at the next lower position, and repeat the adjustment of the transformer cores for peak output. Repeat this procedure for each setting of the BANDWIDTH switch until peak output is obtained at .1-KC position of the switch; then proceed with subparagraph *(e)* below.

Note. The frequency will decrease as the slugs are screwed farther into the coils, and will increase as the slugs are withdrawn.

(2) It should be necessary to perform the procedure outlined in subparagraphs *(a)* through *(e)* below only when the transformer cores have been displaced greatly from their normal positions within the coils. Set the BANDWIDTH switch to the 2-KC position, and proceed as follows:

(a) Tune the signal generator to 455 kc, and set the attenuator for maximum output. Remove the sixth i-f amplifier tube, V506 (fig. 74), and wrap a thin wire lead around pin 1 (grid). Replace the tube, and connect the other end of the lead to the signal generator output.

(b) Adjust the cores of transformer T506 for peak reading on the vtvm.

(c) Apply the signal generator output to the fifth i-f amplifier, V505, in same manner as described in subparagraph *(a)* above for V506, and adjust the cores of transformer T505 for maximum.

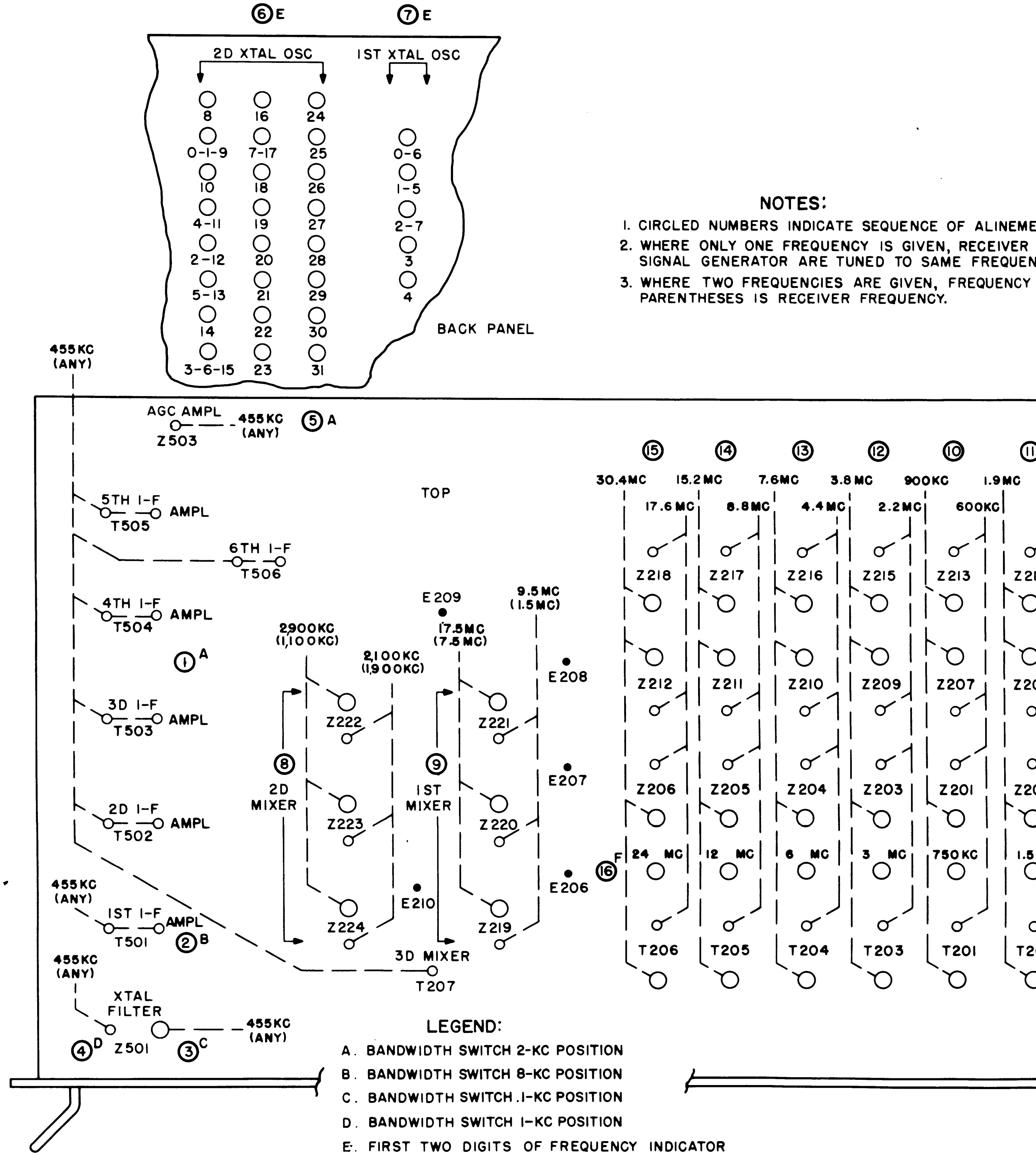
(d) Repeat the above procedure for each remaining set of i-f tubes and transformers in following order: V504 and T504, V503 and T503, V502 and T502, V501 and T501, and V205 and T207.

(e) Set the BANDWIDTH switch to .1-KC position, and proceed with the procedure outlined in subparagraph *e* below.

e. With the signal generator output connected to the test point, set the generator frequency at 455 kc. While adjusting the attenuator of the signal generator to maintain an output of approximately 6 volts, as read on the vtvm, carefully tune the generator to the exact frequency required to obtain peak output reading on the vtvm. Do not disturb this frequency setting while carrying out the procedures outlined in subparagraphs *f*, *g*, and *h* below. Check the setting repeatedly during these steps to make sure it has not been changed.

f. Set the BANDWIDTH switch to the 2-KC position.

g. Adjust the cores of transformers T506, T505, T504, T503, T502, and T207, in that



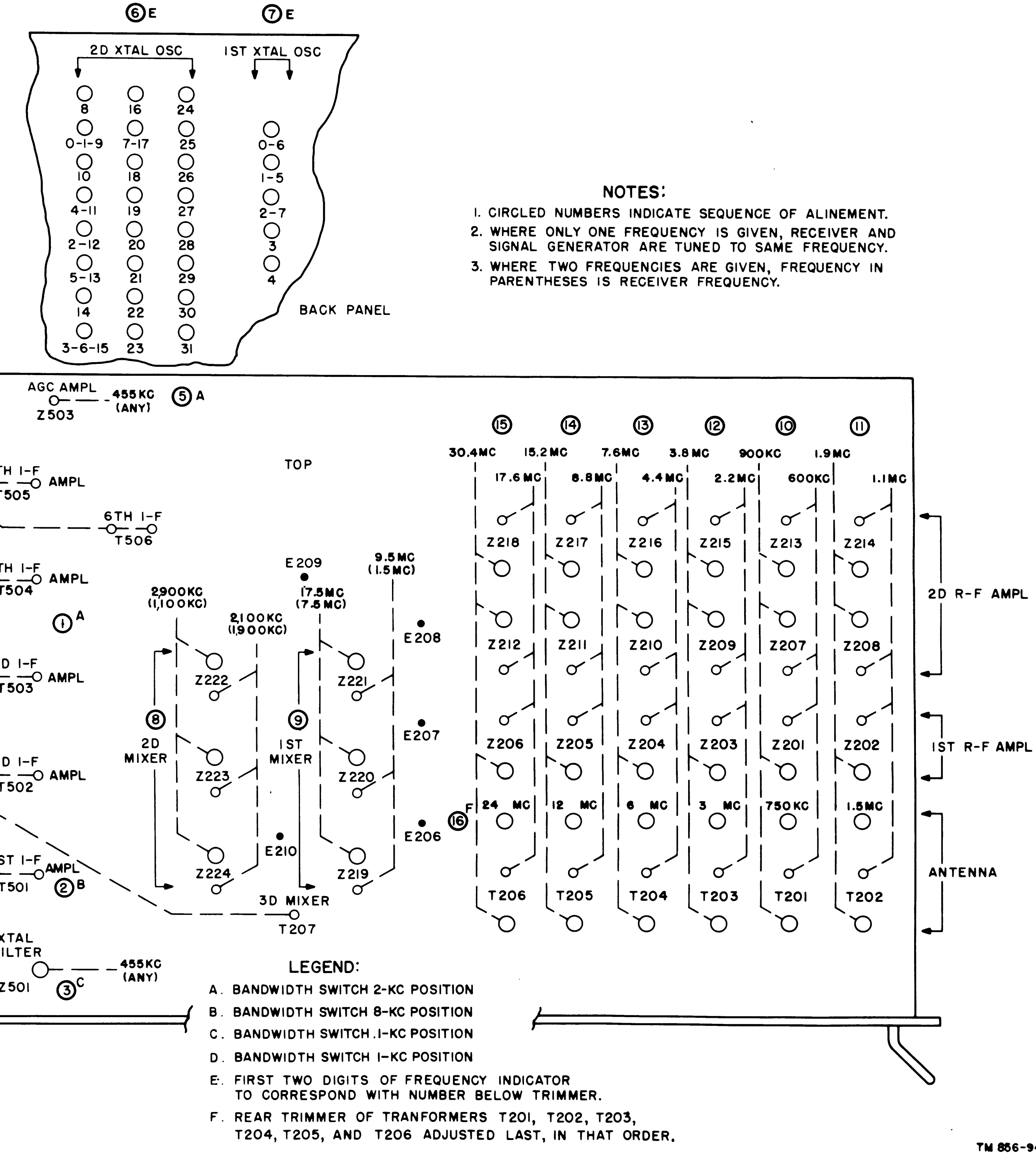
NOTES:

1. CIRCLED NUMBERS INDICATE SEQUENCE OF ALINEME
2. WHERE ONLY ONE FREQUENCY IS GIVEN, RECEIVER SIGNAL GENERATOR ARE TUNED TO SAME FREQUEN
3. WHERE TWO FREQUENCIES ARE GIVEN, FREQUENCY PARENTHESES IS RECEIVER FREQUENCY.

LEGEND:

A. BANDWIDTH SWITCH 2-KC POSITION
B. BANDWIDTH SWITCH 8-KC POSITION
C. BANDWIDTH SWITCH .1-KC POSITION
D. BANDWIDTH SWITCH 1-KC POSITION
E. FIRST TWO DIGITS OF FREQUENCY INDICATOR TO CORRESPOND WITH NUMBER BELOW TRIMMER.
F. REAR TRIMMER OF TRANFORMERS T201, T202, T203, T204, T205, AND T206 ADJUSTED LAST, IN THAT ORDER.

Figure 104. Radio Receiver R-391/URR, alinement chart.



NOTES:

1. CIRCLED NUMBERS INDICATE SEQUENCE OF ALINEMENT.
2. WHERE ONLY ONE FREQUENCY IS GIVEN, RECEIVER AND SIGNAL GENERATOR ARE TUNED TO SAME FREQUENCY.
3. WHERE TWO FREQUENCIES ARE GIVEN, FREQUENCY IN PARENTHESES IS RECEIVER FREQUENCY.

LEGEND:

A. BANDWIDTH SWITCH 2-KC POSITION
B. BANDWIDTH SWITCH 8-KC POSITION
C. BANDWIDTH SWITCH .1-KC POSITION
D. BANDWIDTH SWITCH 1-KC POSITION
E. FIRST TWO DIGITS OF FREQUENCY INDICATOR TO CORRESPOND WITH NUMBER BELOW TRIMMER.
F. REAR TRIMMER OF TRANFORMERS T201, T202, T203, T204, T205, AND T206 ADJUSTED LAST, IN THAT ORDER.

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Figure 104. Radio Receiver R-391/URR, alinement chart.

order, for peak output reading, while continuously adjusting the attenuator of the signal generator to maintain a reading of approximately 6 volts on the vtvm. Repeat these adjustments until no further increase in output is noticeable.

h. Change the setting of the BANDWIDTH switch to the 8-KC position, and adjust the cores of transformer T501 for maximum output. Repeat the adjustment of cores until no further increase in output can be produced.

i. Return the BANDWIDTH switch to the .1-KC position.

j. Set the attenuator of the signal generator for a reading of approximately 6 volts on the vtvm, and note the attenuator setting. Turn the generator in one direction away from the frequency required for peak reading, increasing the output of the generator to restore the vtvm reading to its original value. Continue tuning the generator in this direction until the voltage output required to obtain the original reading on the vtvm is 1,000 times as much as the voltage required at peak frequency.

k. Adjust the phasing capacitor in the crystal filter, Z501, for minimum vtvm reading, and note the position of the capacitor slot.

l. Tune the signal generator to the opposite side of the frequency required for peak output, and set the attenuator for increased output, as directed in subparagraph *j* above.

m. Adjust the phasing capacitor for minimum reading, and note the position; then set the capacitor approximately halfway between the two noted settings. To avoid possible incorrect readings caused by tuning through the positions of minimum or maximum capacitance, the two settings for minimum output must be less than 45° apart.

n. With the BANDWITH switch in the .1-KC position, tune the signal generator to obtain peak output. Set the BANDWIDTH switch to the 1-KC position. Adjust the core of the tuning coil in the crystal filter, Z501, until the frequency reading required for obtaining peak output with the BANDWIDTH switch in 1-KC position corresponds exactly with the frequency reading required for peak output with the BANDWIDTH switch in the .1-KC position. Retune the signal generator, and alternately change positions of the BANDWIDTH switch as required to complete this adjustment.

o. Set the BANDWIDTH switch to the .1-KC position, and tune the signal generator for maximum output as described in subparagraph *e* above. Do not disturb this frequency setting during the adjustment of the agc tuning circuit in the following steps.

p. Disconnect the vtvm lead from terminal 14 of the rear terminal strip, and connect it to terminal 4 of the rear terminal strip (fig. 21).

q. Set the FUNCTION switch to AGC, and the BANDWIDTH switch to the 2-KC position.

r. Adjust the core of Z503 for a maximum voltage reading on the vtvm, while adjusting the attenuator of the signal generator to maintain a peak reading of approximately 2 volts. Upon completing this adjustment, disconnect the meter.

Note. If a signal generator is not available, the procedures given in subparagraphs *e* through *r* above may be followed by using the output of the calibration oscillator and the CARRIER LEVEL meter by utilizing the RF GAIN control as an attenuator. The frequency of the calibration oscillator must be checked, as described in paragraph 136, before using it for alinement.

122. Alinement of Second Crystal Oscillator (figs. 104 and 105)

a. Connect the vtvm set for reading d-c volts, between test point E209 (grid of second mixer V204) and ground.

b. Turn the OVEN switch to ON and the FUNCTION switch to STAND BY. Allow the receiver to warm up.

c. Adjust the second crystal-oscillator trimmers (large group of trimmers on rear panel) using the table below. Set the MEGACYCLE CHANGE control for a megacycle reading on the frequency indicator indicated in first column, and adjust the trimmer designated in second column for the meter indication shown in the last column. Where a trimmer is used in the crystal oscillator circuit at more than one frequency setting of the MEGACYCLE CHANGE control, the trimmer is listed only for the first setting and is adjusted for maximum only at this setting. For subsequent frequency settings of the MEGACYCLE CHANGE control involving a previously adjusted trimmer, it is necessary only to check for an indication on the vtvm. If no indication is obtained, the crystal-oscillator band switch should be checked.

Dial reading	Adjust trimmer	Meter indication
31	31	Maximum
30	30	Maximum
29	29	Maximum
28	28	Maximum
27	27	Maximum
26	26	Maximum
25	25	Maximum
24	24	Maximum
23	23	Maximum
22	22	Maximum
21	21	Maximum
20	20	Maximum
19	19	Maximum
18	18	Maximum
17	7-17	Maximum
16	16	Maximum
15	3-6-15	Maximum
14	14	Maximum
13	5-13	Maximum
12	2-12	Maximum
11	4-11	Maximum
10	10	Maximum
09	0-1-9	
08	8	Maximum
07		Check for indication
06		Check for indication
05		Check for indication
04		Check for indication
03		Check for indication
02		Check for indication
01		Check for indication
00		Check for indication

123. Alinement of First Crystal Oscillator (figs. 104 and 105)

a. Connect the vtvm, set for reading d-c volts, between test point E208 (grid of first mixer V203) (fig. 104) and ground.

b. Turn OVEN switch to ON and FUNCTION switch to STAND BY. Allow receiver to warm up.

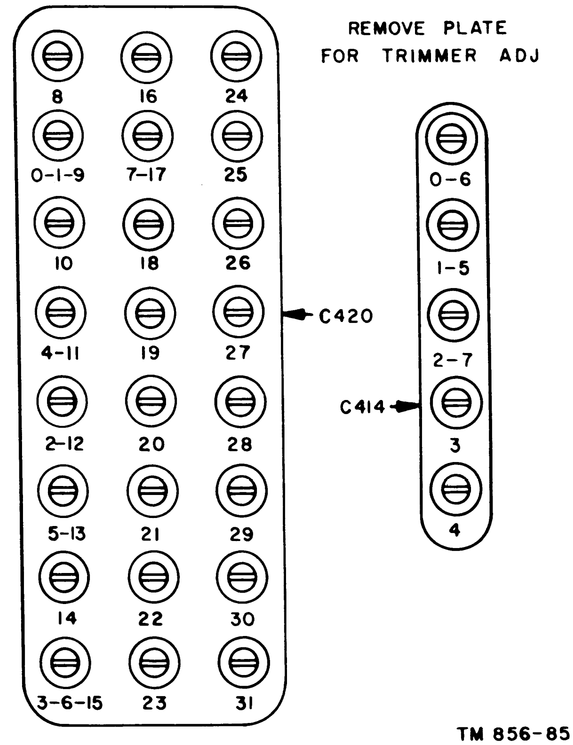


Figure 105. Crystal-oscillator trimmers.

c. Adjust first-crystal-oscillator trimmers (group of five trimmers on the rear panel, fig. 104) using table below, in manner described in paragraph 122*c*.

Dial reading	Adjust trimmer	Meter indication
07	2-7	Maximum
06	0-6	
05	1-5	
04	4	
03	3	Maximum
02		Check for indication
01		
00		

124. Alinement of Second Variable I-f Stage (fig. 104)

a. Set the vtvm to measure the negative d-c voltages of approximately 5 volts. Connect the ground lead to the receiver chassis, and the input lead to the DIODE LOAD terminals 14 and 15 of rear-terminal strip (fig. 21).

b. Connect the output lead of the signal generator to test point E209 (control grid of second mixer V204). Connect the ground lead of the signal generator to the receiver chassis.

c. Set the FUNCTION switch to AGC position, and the RF GAIN control to 10.

d. With the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls, set the frequency indicator reading to 01 900.

e. Connect the headset to the PHONES jack. Turn on the signal generator modulation (30 percent at 400 cycles), and tune the generator to approximately 2100 kc, so that the output from the receiver is audible. While observing the output meter, tune the signal generator to the exact frequency which produces peak reading on the output meter. Change the attenuator setting of the signal generator continuously to maintain a reading of less than 5 volts on the output meter.

f. Adjust the slugs of tuned circuits Z222, Z223, and Z224 for peak reading on the output meter.

g. With the KILOCYCLE CHANGE control, tune the receiver to 1100 kc.

h. Tune the signal generator to 2900 kc, and then set it to the exact frequency which produces peak reading on the output meter.

i. Adjust the three trimmers mounted within the shield cans of tuned circuits Z222, Z223, and Z224 for peak output.

j. Repeat the procedure described in subparagraphs *e* to *i*, until no increase in output can be obtained. While making all adjustments, set the attenuator of the signal generator so that the reading on the output meter is less than 5 volts.

k. In the event that no test equipment is available, the second variable i-f stage can be alined using the CARRIER LEVEL meter and the signal from the internal calibration oscillator. Disconnect coaxial connectors P209, P210, and P211 from J109, J110, and J111, respectively, on the antenna box (fig. 94); set the FUNCTION switch at CAL and the RF GAIN control at 10; and then proceed with the alinement using the receiver frequencies indicated in subparagraphs *e* and *g* above. Utilize the RF GAIN control as an attenuator to maintain the meter reading at approximately mid-scale while adjusting the tuned circuits.

125. Alinement of First Variable I-f Stage (fig. 104)

a. Connect the signal generator lead to test point E203 (control grid of first mixer tube V203). The output meter should be connected as described in paragraph 124*a*.

b. With the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls, set the frequency indicator reading to 01 500.

c. Tune the signal generator to 9.5 mc. Reduce the output of the signal generator as required to maintain an output meter reading of less than 5 volts.

d. Adjust slugs of tuned circuits Z219, Z220, and Z221 for peak output reading.

e. Adjust the MEGACYCLE CHANGE control for a reading of 07 500 on the frequency indicator.

f. Tune the signal generator to 17.5 mc. Change the attenuator setting of the signal generator continuously to maintain a reading of less than 5 volts on the output meter.

g. Adjust the three trimmers mounted within the shield cans of tuned circuits Z219, Z220, and Z221 for peak output.

h. Repeat the procedure described in subparagraphs *c* to *g* above until no increase in output can be obtained.

i. The first variable i-f stage can be alined, in the absence of test equipment, in the same manner described in subparagraph 124*k*. Use the receiver frequencies indicated in subparagraphs *b* and *e* above.

126. Alinement of R-f Stages (fig. 104)

a. Set the FUNCTION switch to AGC, and the RF GAIN control to 10.

b. Connect one lead of the vtvm to DIODE LOAD terminals 14 and 15 on the rear terminal strip (fig. 21), and the other lead to the receiver chassis. The meter should be set to measure negative d-c voltages of approximately 5 volts, with respect to chassis.

c. If preliminary adjustments (subpar. *d* below) are unnecessary, connect the signal generator to the balanced antenna input terminals as follows: connect either the antenna input terminal of BALANCED ANTENNA 125 OHM connector J108 to the receiver ground and to the ground lead of the signal generator. Connect the other antenna input terminal, through the 95-ohm noninductive series resistor, to the output lead of the signal generator. Connect a 75-ohm noninductive resistor from the output lead of the signal generator to ground. Proceed with the procedure outlined in subparagraph *e* below.

d. If preliminary adjustments are necessary because of extreme misalinement, connect the signal generator through .01-uf capacitor to points listed in the last column of the chart below, instead of connecting it to the antenna input terminals, and proceed with alinement as directed in subparagraphs *e* through *j* below and in the chart. After completing the preliminary procedure, connect the signal generator to the antenna input terminals as described in subparagraph *c,* above; then repeat the alinement, making all adjustments in the order listed in the chart.

e. With MEGACYCLE CHANGE control, set up the digits listed in the second column of chart in the first two spaces of the frequency indicator dial. With the KILOCYCLE CHANGE control, set up the digits listed in the third column in the last three spaces of the frequency indicator.

f. After setting the receiver frequency indicator reading for a group of adjustments, tune the signal generator to the frequency listed in the fourth column. To obtain the exact required frequency, tune the signal generator for peak reading on the output meter; do not depend on the calibration of the signal generator.

g. During the alinement procedure, change the setting of the signal-generator attenuator as required to maintain an output reading of less than 5 volts.

h. In alining r-f transformers, adjust the slugs for a set of transformers while the receiver is tuned to a lower frequency indicated in the chart for that set of transformers; adjust the trimmer capacitors while the receiver is tuned to a higher frequency. Adjust the slugs of the set of transformers listed in the fifth column for peak output; then, after changing the frequency settings of the receiver and signal generator, adjust the trimmer capacitors of the set of transformers listed in the sixth column for peak output. Trimmer capacitors are accessible through holes in the top of shield cans, and should be adjusted with an insulated screwdriver. In the case of antenna transformers, adjust the trimmer capacitors mounted nearest to the back of the receiver for peak output reading. Front trimmers are used to balance the antenna input circuits. *Repeat the adjustments for each set of r-f coils until no further change is noticeable.*

i. Set the ANT. TRIM control to 0.

j. Proceed with the r-f alinement by performing adjustments in the order listed in the chart below. Refer to figure 104 for location of slugs and trimmer capacitors.

1	2	3	4	5	6	7
Set of r-f coils	Megacycle reading	Kilocycle reading	Signal generator frequency (tune for peak output) in kc	Adjust slugs for peak output	Adjust trimmer capacitors for peak output	Signal generator connection (preliminary alinement only)
.5-1 mc	00	600	600	Z213		E207
				Z207		E207
				Z201		E206
				Z201		BALANCED antenna (J108)
	00	900	900		Z213	E207
					Z207	E207
					Z201	E206

1	2	3	4	5	6	7
Set of r-f coils	Megacycle reading	Kilocycle reading	Signal generator frequency (tune for peak output) in kc	Adjust slugs for peak output	Adjust trimmer capacitors for peak output	Signal generator connection (preliminary alinement only)
					T201	J108
					(front trimmer)	
1-2 mc	01	100	1,100	Z214		E207
				Z208		E207
				Z202		E206
				T202		J108
	01	900	1,900		Z214	E207
					Z208	E207
					Z202	
					T202	E206
					(front trimmer)	J108
2-4 mc	02	200	2,200	Z215		E207
				Z209		E207
				Z203		E206
				T203		J108
	03	800	3,800		Z215	E207
					Z209	E207
					Z203	E206
					T203	J108
					(front trimmer)	
4-8	04	400	4,400	Z216		E207
				Z210		E207
				Z204		E206
				T204		J108
	07	600	7,600		Z216	E207
					Z210	E207
					Z204	E206
					T204	J108
					(front trimmer)	
8-16 mc	08	800	8,800	Z217		E207
				Z211		E207
				Z205		E206
				T205		J108
	15	200	15,200		Z217	E207
					Z211	E207
					Z205	E206
					T205	J108
					(front trimmer)	
16-32 mc	17	600	17,600	Z218		E207
				Z212		E207
				Z206		E206
				T206		J108

1	2	3	4	5	6	7
Set of r-f coils	Megacycle reading	Kilocycle reading	Signal generator frequency (tune for peak output) in kc	Adjust slugs for peak output	Adjust trimmer capacitors for peak output	Signal generator connection (preliminary alinement only)
	30	400	30,400		Z218 Z212 Z206 T206 (front trimmer)	E207 E207 E206 J108

k. Connect the noninductive resistors to the BALANCED 125 ohm ANTENNA input terminals as described in subparagraph *c* above. Connect the output lead of R.F. Signal Generator Set AN/URM-25 to the junction of these resistors. Make certain that the ground lead of the signal generator is connected to the receiver chassis.

l. Set the tuning controls for the frequency-indicator reading listed in the first column of the chart in subparagraph *n* below and then tune the signal generator to this frequency for peak receiver output.

m. Adjust the front trimmer capacitor of the transformers listed in the second column of subparagraph *n* below for *minimum* output. During the alinement procedure, change the setting of the signal generator attenuator as required to increase the output reading to approximately 5 volts.

n. In the manner described in subparagraphs *k*, *l*, and *m*, above, adjust the balance trimmers in the following order:

Dial reading	Transformer (rear trimmer)
00 750	T201
01 500	T202
03 000	T203
06 000	T204
12 000	T205
24 000	T206

o. The r-f stages may be alined without test equipment by using the CARRIER LEVEL meter and calibration oscillator signal as described in subparagraph 124*k*, and using the receiver frequencies given in the preceding charts in this paragraph.

127. Calibration of Bfo

The bfo should be calibrated after replacing the front panel or i-f subchassis subsequent to removal. Calibrate the bfo as follows:

a. Set the BANDWIDTH switch at the .1-KC position, and turn the FUNCTION switch to CAL.

b. Connect the headset to the PHONES jack. Adjust the KILOCYCLE CHANGE control for maximum response on the CARRIER LEVEL meter at any 100-kc calibration check point.

c. Set the BFO switch at ON, and adjust the BFO PITCH control for zero beat; zero beat should occur at the position of the control marked 0. If not, loosen the clamp that secures the control shaft behind the front panel, and position the knob at 0; then tighten the clamp.

Note. Do not attempt to set the knob at 0 by loosening the setscrew and repositioning the knob, this will alter the range of the stop on the control shaft.

128. Adjustment of GAIN ADJ Potentiometer R562

a. Disconnect coaxial connectors P225 and P226 from J525 and J526, located on the i-f subchassis (fig. 74).

b. Connect R.F. Signal Generator Set AN/URM-25 or equivalent between J526 and the receiver ground (chassis). Turn on the signal generator and tune it to 455 kc, modulated 30 percent at 400 cycles. Adjust the attenuator for an output of 150 uv.

c. Connect a vtvm, such as Electronic Multimeter TS-505/U, between the DIODE LOAD terminal, 14, on the rear terminal strip of the receiver and the receiver ground (fig. 21). Set the function switch of the meter for measuring negative d-c voltage of −7 volts.

d. Turn the receiver FUNCTION switch to MGC and RF GAIN control to position 10. Adjust GAIN ADJ potentiometer R562 (fig. 74) for a reading of −7 volts on the vtvm. Reconnect P225 and P226 after completing the adjustment.

129. Adjustment of CARR-METER ADJ Potentiometer R537

The CARRIER LEVEL meter is zero-adjusted using the CARR-METER ADJ potentiometer as follows: set the FUNCTION switch at AGC and rotate the RF GAIN control to its extreme counterclockwise position. Adjust R537 (fig. 74) for a reading of 0 on the CARRIER LEVEL meter.

Section IV. FINAL TESTING

130. General

This section gives the final performance tests of the equipment. Repaired equipment meeting these performance tests will furnish uniformly satisfactory operation. All of the tests in this section are to be performed while operating the receiver with a 115-volt a-c input. Allow the receiver to warm up for a few minutes before making any measurements.

Warning: The voltages used are sufficiently high to endanger human life. Every precaution should be taken by personnel to minimize the danger of shock. The receiver chassis should be grounded during these tests.

131. Test Equipment Required

The test equipment required for final testing of Radio Receiver R-391/URR is listed below:

a. Electronic Multimeter TS-505/U.

b. Spectrum Analyzer TS-723/U.

c. R.F. Signal Generator Set AN/URM-25.

d. Audio Oscillator TS-382/U.

e. Electron Tube Test Set TV-2/U.

f. Multimeter TS-352/U.

g. Electronic Multimeter ME-6/U.

132. Preliminary Checks

Before testing the receiver further, perform the following preliminary checks:

a. Check to see that all controls are operative and that they do not bind.

b. Measure B+ with an electronic multimeter (such as TS-505/U), with the positive lead connected to B+ 180 VDC jack J601 (fig. 81) and the negative lead connected to terminal 16, marked GND, of the rear terminal strip (fig. 21). The meter should indicate 180 volts ±5 volts.

c. Check to see that all tubes and dial lights are lighted.

d. Check the antenna relay (par. 106*k*).

e. Check the bfo (par. 127).

133. I-f Response

To check the i-f response, proceed as follows:

a. Connect a vtvm (such as Electronic Multimeter TS-505/U) across terminals 14 and 15, marked DIODE LOAD, of rear terminal strip (fig. 21). Set the vtvm to a 2-volt scale.

b. Set the BANDWIDTH switch to the .1-KC position.

c. Set the FUNCTION switch to CAL position.

d. Set the RF GAIN control to position marked 10.

e. Note the reading of the frequency-indicator. Unlock the MEGACYCLE CHANGE and KILOCYCLE CHANGE control keys. Adjust the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls for a frequency-indicator reading of 04 400. Lock the ZERO ADJ.

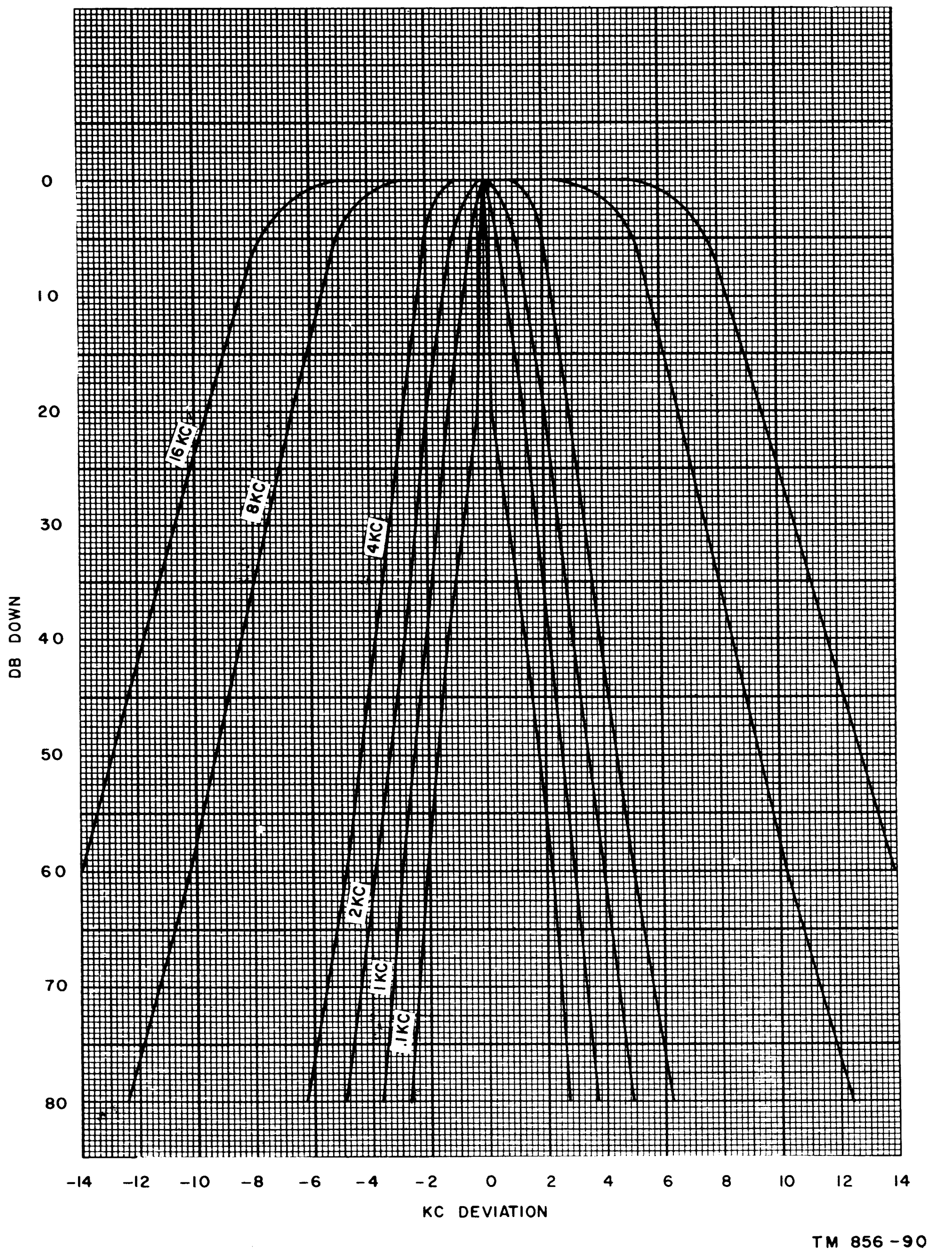


Figure 106. I-f selectivity curve for Radio Receiver R-391/URR.

f. Tune Radio Receiver R-391/URR very carefully for a maximum indication on the vtvm. Unlock the ZERO ADJ.

g. Set the BANDWIDTH switch to the 8-KC position.

h. Adjust the RF GAIN control to obtain a reference voltage of 1 volt on the vtvm.

i. Turn the KILOCYCLE CHANGE control until the vtvm indicates .7 volt. The frequency-indicator reading should be 04 396. Note the readings.

j. Turn the KILOCYCLE CHANGE control in the direction opposite to that in which it was turned in subparagraph *i* above until the vtvm indicates .7 volt. The frequency indicator reading should be 04 404. Note the readings. The voltage obtained in subparagraphs *j* and *i* represents 3-db points. Repeat the steps in subparagraphs *j* and *i* for a .5-volt indication on the vtvm. Note the readings. These are the 6-db points.

k. Repeat the procedures in subparagraphs *i* and *j* above with the BANDWIDTH switch set to the 16-KC position.

l. Compare the readings obtained for the 8 and 16-KC bandwidths with the following table and the curve shown in figure 106.

BANDWIDTH	Frequency Kilocycles		Voltage at 3-db points	Voltage at 6-db points	Reference voltage
8-KC	4	396	.5		
8-KC	4	395		.7	
8-KC	4	400			1
8-KC	4	405		.7	
8-KC	4	404	.5		
16-KC	4	492	.5		
16-KC	4	393		.7	
16-KC	4	400			1
16-KC	4	407		.7	
16-KC	4	408	.5		

m. Rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls to obtain the original frequency-indicator reading. Lock the keys.

134. Sensitivity

The test frequencies used in the sensitivity tests should be the center and the high- and low-frequency ends of each tuning range. The a-m and c-w sensitivity of the receiver at a signal plus noise-to-noise power-output ratio is 10 to 1. To check sensitivity, proceed as follows:

a. Connect Cord CG-409A/U to J102 on R.F. Signal Generator Set AN/URM-25 and to Impedance Adapter MX-1074/URM-25. Connect another Cord CG-409A/U to the other end of Impedance Adapter MX-1074/URM-25 and to Adapter UG-636/U. Connect Adapter Connector UG-636/U to Adapter Connector UG-971/U which is attached to BALANCED 125 OHM antenna jack J108.

b. Connect Electronic Multimeter TS-505/U in parallel with a 600-ohm one-watt noninductive resistor to LOCAL AUDIO terminals 6 and 7 (fig. 21).

c. Turn off the signal generator modulation.

d. Adjust the LOCAL GAIN control for a .8-volt noise indication on the vtvm.

e. Turn on the signal generator modulation.

f. Adjust the output of the signal generator for a 2.5-volt signal plus noise indication on the vtvm. The output reading of the signal generator is the a-m sensitivity for a 10- to 1-db signal plus noise-to-noise ratio.

g. Compare the readings obtained on all test frequencies with curves shown in figure 107.

Note. The CARRIER LEVEL meter may be used in lieu of Electronic Multimeter TS-505/U.

135. Over-all Audio Distortion

To check the over-all audio distortion, proceed as follows:

a. Connect Cord CG-409A/U to J102 on R.F. Signal Generator Set AN/URM-25 and to Impedance Adapter MX-1074/URM-25. Connect another Cord CG-409A/U to the other end of Impedance Adapter MX-1074/URM-25 and to Adapter Connector UG-636. Connect Adapter Connector UG-636 to Adapter Connector UG-971 which is attached to BALANCED 125 OHM antenna jack, J108.

b. Connect Audio Oscillator TS-382/U to R.F. Signal Generator Set AN/URM-25 in accordance with the instructions in the technical manual supplied with the oscillator.

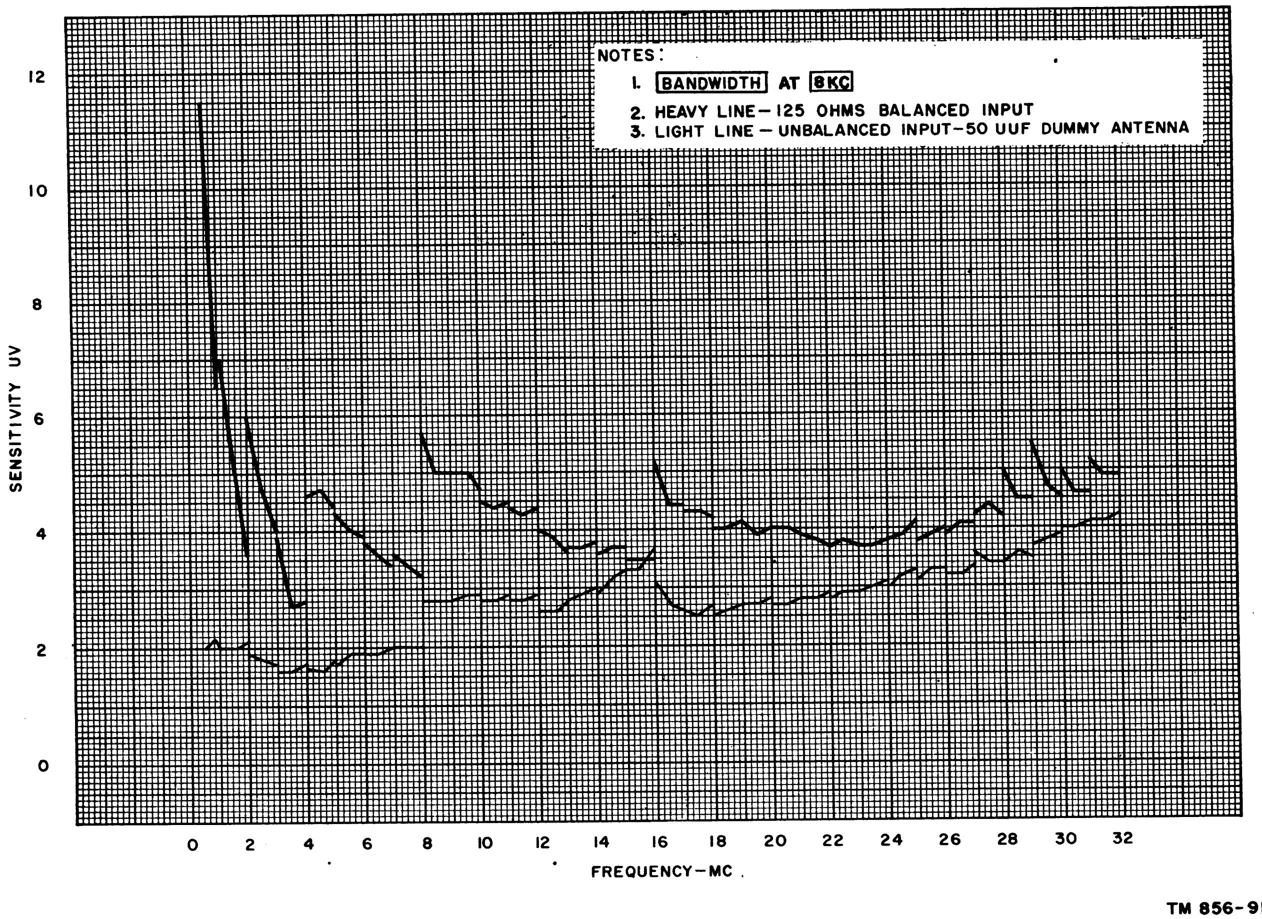
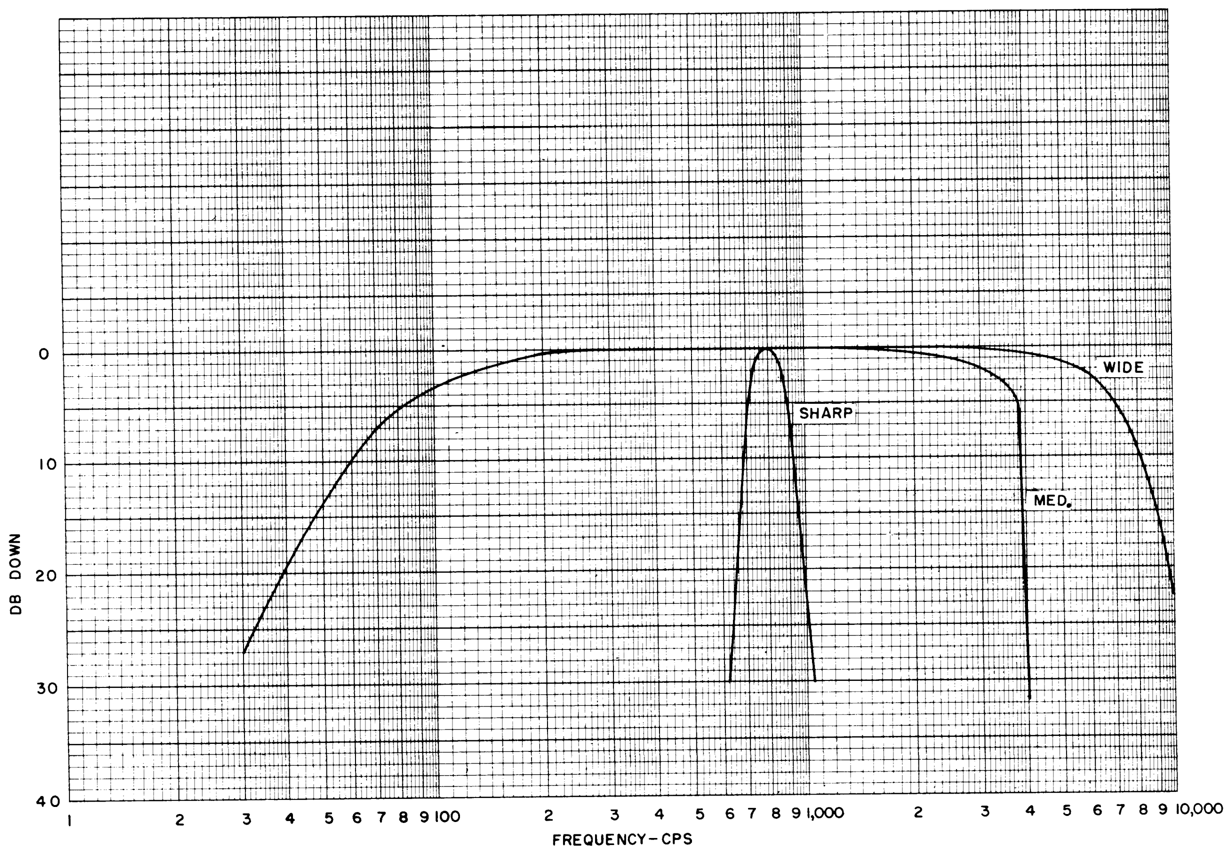


Figure 107. A-m sensitivity chart.



TM 856-92

Figure 108. Overall audio-response chart.

c. Connect a spectrum analyzer (such as Spectrum Analyzer TS-723/U) in parallel with a 600-ohm one-watt noninductive resistor to LOCAL AUDIO terminals 6 and 7, of the rear terminal strip (fig. 21), in accordance with the instructions furnished with the analyzer.

d. The output of the signal generator is modulated at 30 percent. Make sure the percentage of modulation does not vary.

e. Set the BANDWIDTH switch to 8-KC position.

f. Set the AUDIO RESPONSE switch to WIDE.

g. Set the frequency of Radio Receiver R-391/URR to the signal generator frequency.

h. Vary the audio-oscillator frequency between 30 and 10,000 cycles.

i. Note the db reading on the spectrum analyzer at 500-cycle intervals, from 100 cycles to 10,000 cycles.

j. Compare readings with the chart in figure 108.

k. Repeat the steps in subparagraphs *e* through *j* for the MED. and SHARP positions of the AUDIO RESPONSE switch.

136. Testing of Calibration Oscillator

To test the calibration oscillator, proceed as follows:

a. Set the BANDWIDTH switch to .1-KC position.

b. Set the AUDIO RESPONSE switch to MED.

c. Note the frequency-indicator reading. Unlock the MEGACYCLE CHANGE and KILOCYCLE CHANGE control keys. Turn the FUNCTION switch to CAL. In this position, a note will be heard at every multiple of 100 kc as the KILOCYCLE CHANGE control is rotated. The pitch of the note depends upon the setting of the BFO PITCH control.

d. Rotate the KILOCYCLE CHANGE control through a minimum of ten 100-kc steps. If a note is not heard exactly at the 100-kc steps, adjust capacitor C912 (fig. 82). Check at least ten 100-kc positions, to make sure a note is heard only in 100-kc steps.

e. Set the FUNCTION switch to AGC, and adjust the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls to obtain 10-mc reading (transmitting frequency of WWV) on frequency indicator. If WWV cannot be heard on 10-mc, try other frequencies such as 2.5-mc, 5-mc, 15-mc, or 20-mc.

f. Adjust capacitor C901 (fig. 82) for maximum reading on CARRIER LEVEL meter.

g. Rotate the MEGACYCLE CHANGE and KILOCYCLE CHANGE controls to obtain the original frequency indicator reading. Lock the keys.

137. Testing of Autotune Mechanism

The procedure given below should be followed after repairs have been made to the Autotune system or after synchronization of the system.

a. Lock both Autotune locking keys, and turn the FUNCTION switch to AGC.

b. Place the CHANNEL SELECTOR switch at 1, and wait until the Autotune motor stops.

c. Unlock the Autotune locking keys, and set up channel 1 to any predetermined setting. Lock the Autotune locking keys, and record the frequency indicator setting.

d. Repeat the steps in subparagraphs *b* and *c* for channels 2 through 8.

e. After all eight channels have been set up, recycle the Autotune system, and carefully note whether the frequency indicator returns to its predetermined setting, recorded in subparagraph *c*. The Autotune system should operate smoothly and return all dials to the exact predetermined settings (within 300 cps) for each of the eight channels selected.

f. Measure the exact time required for the Autotune to cycle. The correct cycling period is approximately 15 seconds; if cycling is not completed in this time, increase or decrease the voltage supplied to the Autotune motor by moving taps on transformer T1101 (fig. 117).

g. If the Autotune system is inoperative, or is abnormal in any manner, note the nature of trouble and use the trouble-shooting procedure in paragraph 99.

CHAPTER 6

SHIPMENT AND LIMITED STORAGE AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

138. Disassembly

The following instructions are presented as a guide for preparing Radio Receiver 391/URR for transportation and storage.

a. Disconnect antenna lead-in cable, Power Cable Assembly CX-1358/U, Electrical Special Purpose Cable Assembly CX-2083/U, and all connections to the auxiliary equipment, if used.

b. Disconnect the headphones from the front panel.

c. Remove the receiver and Power Supply PP-629/URR from the rack.

139. Repacking for Shipment or Limited Storage

a. The procedure for repacking for shipment or limited storage depends on the available material and the conditions under which the equipment is to be shipped or stored. Reverse the order of procedure given in paragraphs 6 and 14, for repacking.

b. Whenever practicable, place a dehydrating agent, such as silica gel, inside the receiver. Wrap the receiver and spare parts box in corrugated paper, and protect each package with a waterproof barrier. Seal the seams of the paper barrier with waterproof sealing compound or tape. Pack the protected components in a padded wooden crate, providing at least three inches of excelsior or similar material between the paper barrier and the packing case.

Section II. DEMOLITION OF MATERIEL TO PREVENT ENEMY USE

140. General

The demolition procedures outlined in paragraph 130 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.

141. Methods of Destruction

a. *Smash*. Smash the crystals, controls, tubes, coils, switches, capacitors, transformers, and headsets, using sledges, axes, handaxes, pickaxes, hammers, crowbars, or other heavy tools.

b. *Cut*. Cut cords, headsets, and wiring, using handaxes, or machetes.

c. *Burn*. Burn cords, resistors, capacitors, coils, wiring, and technical manuals, using gasoline, kerosene, oil, flame throwers, or incendiary bombs.

d. *Bend*. Bend dials, cabinet, and chassis.

e. *Explosives*. If explosives are necessary, use firearms, grenades, or TNT.

f. *Disposal*. Bury or scatter the destroyed parts in slit trenches, fox holes, or other holes, or throw them into streams.

g. *Destroy*. Destroy everything.

APPENDIX I

REFERENCES

Note. For availability of items listed, check SR 310-20-3, SR 310-20-4, and SR 310-20-5. Check Department of the Army Supply Catalog SIG 1, Introduction and Index for Signal Corps Supply Catalogs.

1. Army Regulations

AR 380-5, Military Security (Safeguarding Security Information).

AR 750-5, Maintenance of Supplies and Equipment, Maintenance Responsibilities and Shop Operation.

2. Supply

SR 725-405-5, Preparation and Submission of Requisitions for Signal Corps Supplies.

SB 11-6, Dry Battery Supply Data.

SB 11-100, Serviceability Standards for Signal Equipment in Hands of Troops.

3. Painting, Preserving, and Lubrication

TB SIG 13, Moistureproofing and Fungiproofing Signal Corps Equipment.

TB SIG 69, Lubrication of Ground Signal Equipment.

TM 9-2851, Painting Instructions for Field Use.

4. Camouflage, Decontamination, and Demolition

FM 5-20, Camouflage, Basic Principles.

FM 5-25, Explosives and Demolitions.

TM 3-220, Decontamination.

5. Other Publications

FM 24-18, Field Radio Techniques.

FM 72-20, Jungle Warfare.

SR 310-20-3, Index of Training Publications.

SR 310-20-4, Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

SR 310-20-5, Index of Administrative Publications.

SR 310-20-7, Index of Tables of Organization and Equipment, Reduction Tables, Tables of Organization, Tables of Equipment, Type Tables of Distribution, and Tables of Allowances.

SR 700-45-5, Unsatisfactory Equipment Report (Reports Control Symbol CSGLD-247 (R1)).

SR 745-45-5
Navy Shipping Guide
Article 185014
AFR 71-4
Report of Damaged or Improper Shipment (Reports Control Symbols CSGLD-66 (Army), S and A-70-6 (Navy), and AF-MC-U2 (Air Force)).

TB SIG 4, Methods for Improving the Effectiveness of Jungle Radio Communication.

TB SIG 25, Preventive Maintenance of Power Cords.

TB SIG 66, Winter Maintenance of Signal Equipment.

TB SIG 72, Tropical Maintenance of Ground Signal Equipment.

TB SIG 75, Desert Maintenance of Ground Signal Equipment.

TB SIG 178, Preventive Maintenance Guide for Radio Communication Equipment.

TB SIG 219, Operation of Signal Equipment at Low Temperatures.

TB SIG 223, Field Expedients for Wire and Radio.

TB 11-499-( )[1], Basic Radio Propagation Predictions.

[1] A new TB in this series giving propagation predictions 3 months in advance is issued monthly.

TM 11-455, Radio Fundamentals.

TM 11-466, Radar Electronic Fundamentals.

TM 11-476, Radio Direction Finding.

TM 11-483, Suppression of Radio Noises.

TM 11-486, Electrical Communication Systems Engineering.

TM 11-496, Training Text and Applicatory Exercises for Amplitude-Modulated Radio Sets.

TM 11-499, Radio Propagation.

TM 11-661, Electrical Fundamentals (Direct Current).

TM 11-681, Electrical Fundamentals (Alternating Current).

TM 11-4000, Trouble Shooting and Repair of Radio Equipment.

6. Auxiliary Equipment and Test Equipment

TM 11-300, Frequency Meter Sets SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, and AN.

TM 11-303, Test Sets I-56-C, I-56-D, I-56-H, and I-56-J.

TM 11-307, Signal Generators I-72-G, H, J, K, and L.

TM 11-321, Technical Manual Test Set I-56-E.

TM 11-2524, Oscillators I-151-A and I-151-E.

TM 11-2526, Oscilloscope BC-1060-A.

TM 11-2613, Voltohmmeter I-166.

TM 11-2624B, Voltohmmeters, TS-294/U, TS-294B/U, and TS-294C/U.

TM 11-2626, Test Units I-176, I-176-A, and I-176-B.

TM 11-2627, Tube Testers I-177 and I-177A.

TM 11-2661 (when published), Electron Tube Test Set TV-2/U.

TM 11-2684, Audio Oscillator TS-332/U.

TM 11-4700, Electrical Indicating and Measuring Instruments, Repair Instructions.

TM 11-5511, Electronic Multimeter TS-505/U.

TM 11-5527, Multimeter TS-352/U.

TM 11-5551, R.F. Signal Generator Set AN/URM-25.

APPENDIX II
IDENTIFICATION TABLE OF PARTS

1. Requisitioning of Parts

The fact that a part is listed in this table is not sufficient basis for requisitioning the item. Requisitions must cite an authorized basis, such as a specific T/O&E, T/A, SIG 7 & 8, list of allowances of expendable material, or another authorized supply basis. The Department of the Army Supply Manual applicable to the equipment covered in this manual is Organizational Maintenance Allowances, and Field and Depot Maintenance Stockage Guide SIG 7&8-R-391/URR. For an index of available supply manuals, in the Signal portion of the Department of the Army Supply Catalog, see the latest issue of SIG 1, Introduction and Index.

2. Identification Table of Parts for Radio Receiver R-391/URR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	RECEIVER, radio: A1—A2—A3 emission; freq data .5-32.0 mc, 32 bands, 8 channels (autotune); oper power requirements, ac, 110 v or 220 v, 50-60 cyc, single ph, 275 w; dc, 28 v, 10 amp; visual indication data, kilocycles 0-1000 kc, megacycles 0-32 mc, direct reading Veeder-root counter; rack mtd; o/a dimen, 19" lg x 14½" wd (front to rear over handles) x 10½" h; 33 electron tubes; first 8 bands are triple-conversion superheterodyne, remaining bands are double-conversion superheterodyne; plug-in coils: special features, 8 automatically tuned preset channels that can be selected either locally or remotely; for communication; Radio Receiver R-391/URR; Collins Rad No. EP 1994-1432.	Amplitude - modulated communications receiver.	
	AMPLIFIER ASSEMBLY: power requirements, ac, 180 v, 60 cyc, 15 w; 26 v, 1.8 amp; mtd on main chassis; o/a dimen, 12¼" lg x 4⅝" wd x 5" h; Collins Rad part/dwg No. 505 9196 015; Radio Receiver R-391/URR.	I-f amplification.	
	AMPLIFIER, AF: 500 mw and 10 mw output; oper power requirements, dc, 180 v, 65 ma, 26 v, 1.4 amp, 18.6 v, 150 ma; var freq response; 600 ohms output impedance; one 11-pin plug; one 15-pin plug; o/a dimen, 8¾" lg x 5" wd x 4" h; Collins Rad part/dwg No. 505 9533 014; Radio Receiver R-391/URR.	Audio amplifier assembly.	
	BEARING, sleeve: bronze; .314" OD x .1885" ID x .186" thk; Collins Rad part/dwg No. 500 2116 00.	Bearing sleeve.	
	BEARING, sleeve: steel; .3530" lg x .186" OD; Collins Rad part/dwg No. 500 2118 002.	Bearing sleeve.	
	BEARING, thrust: double row, radial; plain; heavy duty; .4375" OD x .192" ID x .185" thk; 8 balls; Boston Gear part No. A-01.	Thrust bearing.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	BRACKET, mounting: mts type CP61 capacitors; nonmagnetic, hot tin dipped; 2-5/16" lg x 2½" h x 49/64" wd approx o/a dimen; two .156 mtg holes spaced 1-15/16 c to c; Collins Rad, part/dwg No. 139 0119 00.	Capacitor mounting bracket.	
	BRUSH SET, electrical contact: rectangular shape, 21/64" lg x ¼" wd x .1875" h; w/pressure spring; commutator brush; Hamilton Beach Co mfg type No. AUG-61.	Autotune motor brushes.	
	CABLE, RF: coax; electrical characteristics, 75 ohms nom impedance, 18.75 $\mu\mu$f nom capacitance per ft, 1400 v rms max voltage rating; inner cond data, 1 stranded, cad bronze, silver coated, 12 strands, #36 AWG; solid teflon; outer cond data, braid, copper, silver pl; synthetic resin jacket; .156" dia o/a; Suprenant Elec cat. No. 12017.	R-f cable.	
	CALIBRATOR, frequency: xtal controlled; 100 kc range, 1 band; oper power requirements, dc, 26 v, 150 ma; 5⅜" lg x 1-11/16" wd x 1⅜" h; mtd on main chassis; Collins Rad part/dwg No. 505 8433 014. Radio Receiver R-391/URR.	Generates 100 kc over the frequency range of .5-32 mc.	
C201, C205	CAPACITOR ASSEMBLY: 1 cap., 3-12 $\mu\mu$f, 350 vdcw, 1 cap., 8-50 $\mu\mu$f, 350 vdcw; no electrical connection; o/a dimen, 1.672" lg x .918" wd; mtg hole, .290" dia; Collins Rad part/dwg No. 917 1068 00; Radio Receiver R-391/URR.	C201: Trimmers, part of T201. C205: Trimmers, part of T202.	
C209, C213, C221	CAPACITOR ASSEMBLY: 1 cap., 3-12 $\mu\mu$f, 350 vdcw, 1 cap., 5-25 $\mu\mu$f, 350 vdcw; 1.672" lg x .918" wd; mtg hole, .290" dia; Collins Rad part/dwg No. 917 1067 00.	C209: Trimmers, part of T203. C213: Trimmers, part of T204. C221: Trimmers, part of T206.	
C217	CAPACITOR ASSEMBLY: 6-24 $\mu\mu$f total capacity, 350 vdcw; 1.672" lg x .918" wd; mtg hole, .290" dia, spaced .719" x .459" to ctr; Collins Rad part/dwg No. 917 1066 00.	Trimmers, part of T205.	
C414	CAPACITOR ASSEMBLY: 5 cap., max min 5.0 $\mu\mu$f, min max 25.0 $\mu\mu$f, max max 30.0 $\mu\mu$f, 350 dc; 4⅜" lg x 25/32" wd; 2 mtg holes, .171" dia, spaced on 3.718" mtg ctr; cap. mtd on phenolic board; Collins Rad part No. 917 1065 00; Radio Receiver R-391/URR.	V401 plate trimmer.	
C420	CAPACITOR ASSEMBLY: 5 cap., max min 3.0 $\mu\mu$f, min max 12.0 $\mu\mu$f, max max 15.0 $\mu\mu$f, 350 350 vdcw, 14 cap., 350 vdcw, 5 cap., max min vdcw, 14 cap., 350 vdcw, 5 cap., max min 8.0 $\mu\mu$f to min max 50.00 $\mu\mu$f-max max 60.0 $\mu\mu$f, dia, spaced on 2.906" x 2.437" mtg ctr; cap. mtd on phenolic board; Collins Rad part No. 917 1081 00.	V402 plate trimmers.	
C202, C206, C210, C214, C218, C222	CAPACITOR, fixed: ceramic dielectric; 7 $\mu\mu$f ±1%; 500 vdcw; .400" lg x .200" dia; 2 term., radial wire leads; AN CC20CH070F per JAN spec #CC20CH070F.	C202: Part of T201 tuned circuit. C206: Part of T202 tuned circuit. C210: Part of T203 tuned circuit.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
		C214: Part of T204 tuned circuit. C218: Part of T205 tuned circuit. C222: Part of T206 tuned circuit.	
C228, C307, C310	CAPACITOR, fixed: ceramic dielectric; 1 μμf ±¼ μμf tolerance; 500 vdcw; uninsulated; .400" lg x .200" dia; 2 term., wire lead type; term. mtd, AN CC20CK010C; Centralab No. TCZ-1.	C228: V201 grid coupling capacitor C307: V203 plate coupling to Z220. C310: V203 plate coupling to Z221.	
C230, C254, C326 thru C332, C340, C409, C410, C412, C413, C436, C437, C438, C913	CAPACITOR, fixed: ceramic dielectric; 2000 μμf; 500 vdcw; 17/32" lg x ¼" dia; 2 term., wire lead type; Electrical Reactance Corp per Collins Rad part/dwg No. 913 0997 00.	C230: V201 screen grid bypass. C254: V202 screen grid bypass. C326: V201 heater bypass. C327, C328: V204 heater bypass. C329, C330: V205 heater bypass. C331, C332: V203 heater bypass. C340: V202 heater bypass. C409: V402 screen grid filter. C410: V401 heater bypass. C412, C413: V402 heater bypass. C436: B+ bypass, 180 volts. C437: Line bypass, 6.3 volts. C438: V401 screen grid bypass. C913: V902 grid filter.	
C299, C533	CAPACITOR, fixed: ceramic dielectric; 5 μμf ±¼ μμf tolerance; 500 vdcw; .400" lg x .200" dia; 2 term., wire lead type; AN CC20CH050C.	C299: V508 control grid bypass. C533: Z218 to V204 grid coupling.	
C316, C319, C341	CAPACITOR, fixed: ceramic dielectric; 2 μμf; ±½ μμf; 500 vdcw; uninsulated; .400" lg x .200" dia; per JAN spec CC20CK020D.	C316: V204 plate coupling to Z223. C319: V204 coupling to Z224. C341: V201 plate bypass.	
C333, C335, C337	CAPACITOR, fixed: ceramic dielectric; 3300 μμf ±5%; 300 vdcw; ins, glass case; 5-1/64" lg x 15/32" wd x 7/32" thk; Corning Glass No. 67.	C333: Z201 output voltage divider. C335: Z207 output voltage divider. C337: Z213 output voltage divider.	
C536	CAPACITOR, fixed: ceramic dielectric; 10 μμf ±½ μμf; 500 vdcw; uninsulated; .460" lg x .240" dia; 2 term., radial wire leads; Electro Motive per JAN CC20CH100D.	V508 plate coupling.	
C701	CAPACITOR, fixed: ceramic dielectric; 370 μμf ±1%; 500 vdcw; ¾" lg x ¾" dia; stud mtd, mtg stud 9/32" lg, No. 6-32 thd; Centralab No. 950-000.	Part of Z701 frequency setting network.	
	CAPACITOR KIT: component parts, 2 cap. Collins Rad part/dwg No. 913 0043 00, 2 cap.	Vfo tuning capacitors.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	Collins Rad part/dwg No. 913 0044 00, 2 cap. Collins Rad part/dwg No. 913 0045 00, 2 cap. Collins Rad part/dwg No. 913 0046 00, 2 cap. Collins Rad part/dwg No. 913 0047 00, 2 cap. Collins Rad part/dwg No. 913 0048 00, 2 cap. Collins Rad part/dwg No. 913 0049 00, 2 cap. Collins Rad part/dwg No. 913 0050 00, 1 bag Collins Rad part/dwg No. 025 0093 00; plastic bag, 4" x 6"; Collins Rad part/dwg No. 506 6845 001.		
C704	CAPACITOR, fixed: ceramic dielectric; 20 μμf ±2%; 500 vdcw; uninsulated; .460" lg x .240" dia; 2 term., wire lead type; Sprague TCZ-20.	Part of Z701 frequency setting network.	
C903	CAPACITOR, fixed: ceramic dielectric; 10 μμf; 500 vdcw; .400" lg x .200" dia; 2 term., radial wire leads; Electrical Reactance Corp per JAN spec No. CC20CH100F.	V901A control grid bypass.	
C906	CAPACITOR, fixed: ceramic dielectric; 12.0 μμf ±5%; 50 vdcw; .400" lg x .200" dia; 2 term., radial wire leads; Electrical Reactance Corp per JAN spec No. CC20CH120J.	V901A plate coupling to V902.	
C909	CAPACITOR, fixed: ceramic dielectric; 24 μμf ±2%; 500 vdcw; .460" lg x .240" dia; 2 term., radial wire leads; Centralab per JAN spec CC30CH240G.	V902 plate coupling to grid (pin 7).	
C231	CAPACITOR, fixed: electrolytic; 1 sect.; 50 μf; 50 vdcw; —40° C to +85° C working temp range; hermetically sealed metal can; 1-13/16" wd x 1" d x 15/16" h; 2 term.; solder lug type, 1-1/16" c to c; mtd by 2 ft on bottom, 1 hole in ea ft, 3/16" dia hole, 2⅛" c to c; Electrical Reactance Corp per JAN spec No. CE64C500G.	Tunes antenna circuit for maximum sensitivity.	
C203, C543	CAPACITOR, fixed: mica dielectric; 220 μμf ±2%; 500 vdcw; molded case, ½" lg x 9/32" wd x 11/64" d; terminal mtd; Electro Motive type 605.	C203: Part of T201 output voltage divider. C543: Agc coupling between V509 and V510A.	
C204, C284, C312, C322, C417, C419, C502, C532, C551, C607, C242, C265, C292, C402, C406	CAPACITOR, fixed: mica dielectric; 100 μμf ±2%; 500 vdcw, ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	C204: Couples UNBALANCED WHIP to sec'd of T201. C284: V203 grid coupling. C312: V204 grid coupling. C322: V205 grid coupling. C417: V401 plate r-f bypass. C419: V402 plate tank trimmer. C502: Part of crystal filter load. C532: V508 grid coupling to Z502. C551: V507B audio bypass. C607: V607 plate bypass capacitor. C242: Z204 output coupling. C265: Z210 output coupling. C292: Z216 output coupling. C402: V401 cathode phase shift. C406: V402 cathode phase shift.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C207, C216, C422	CAPACITOR, fixed: mica dielectric; 22 $\mu\mu$f ±5%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; term. data, 2 term., wire lead type; Electro Motive type 605.	C207: Couples UNBALANCED WHIP to T202. C216: Couples UNBALANCED WHIP to T204. C422: V402 plate tank trimmer.	
C208	CAPACITOR, fixed: mica dielectric; 75 $\mu\mu$f ±2%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term 0 mtd; Electro Motive type 605.	Couples UNBALANCED WHIP to T202 secondary.	
C211, C219	CAPACITOR, fixed: mica dielectric; 110 $\mu\mu$f ±2%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	C211: T203 AGC coupling. C219: T205 AGC coupling.	
C212, C421, C428	CAPACITOR, fixed: mica dielectric; 39 $\mu\mu$f ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C212: Couples UNBALANCED WHIP to T203. C421, C428: V402 plate tank trimmers.	
C220, C432	CAPACITOR, fixed: mica dielectric; 10 $\mu\mu$f ±5%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electric Motive type 605.	C220: Couples UNBALANCED WHIP to T205. C432: V402 plate tank trimmer.	
C224	CAPACITOR, fixed: mica dielectric; 5 $\mu\mu$f ±10%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	Couples UNBALANCED WHIP to T206.	
C227, C251, C274	CAPACITOR, fixed: mica dielectric; 510 $\mu\mu$f ±2%; 300 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C227: Agc decoupling. C251: V202 grid coupling. C274: V203 grid coupling.	
C233, C256, C277	CAPACITOR, fixed: mica dielectric; 390 $\mu\mu$f ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C233: Z201 output coupling. C256: Z207 output coupling. C277: Z213 output coupling.	
C236, C259, C279, C282	CAPACITOR, fixed: mica dielectric; 180 $\mu\mu$f ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C236: Z202 output coupling. C259: Z208 output coupling. C279: V203 grid coupling. C282: Z214 output coupling.	
C237, C260, C283	CAPACITOR, fixed: mica dielectric; 2200 $\mu\mu$f ±5%; 3500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C237: Z202 output voltage divider. C260: Z208 output voltage divider. C283: Z214 output voltage divider.	
C240, C263, C288	CAPACITOR, fixed: mica dielectric; 680 $\mu\mu$f; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C240: Z203 voltage divider. C263: Z209 output voltage divider. C288: Z215 output voltage divider.	
C709	CAPACITOR, fixed: mica; 1800 $\mu\mu$f; Electro Motive type 605.	Z702 output voltage divider.	
C245, C268, C297	CAPACITOR, fixed: mica dielectric; 43 $\mu\mu$f ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C245: Z205 output coupling. C268: Z211 output coupling. C297: Z217 output coupling.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C908	CAPACITOR, fixed: mica; 36 μμf, 500 vdcw; Electro Motive type 605.	Trigger coupling.	
C246, C269, C298	CAPACITOR, fixed: mica dielectric; 360 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; term. data, 2 term., term. mtd; Electro Motive type 605.	C246: Z205 voltage divider. C269: Z211 output voltage divider. C298: Z217 output voltage filter.	
C249, C272, C303, C423	CAPACITOR, fixed: mica dielectric; 56 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	C249: Z206 output voltage divider. C272: Z212 output voltage divider. C303: Z218 output voltage filter. C423: V402 plate r-f bypass.	
C275, C280, C430	CAPACITOR, fixed: mica dielectric; 18 μμf ±5%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C275, C280: V202 plate decoupling. C430: V402 plate trimmer.	
C285, C290, C305, C401, C431	CAPACITOR, fixed: mica dielectric; 15 μμf ±5%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C285, C290: V202 plate decoupling. C305: Z219 frequency tuning capacitor. C401: V401 cathode to grid feedback. C431: V402 plate trimmer.	
C289, C418, C262, C239, C287	CAPACITOR, fixed: mica dielectric; 68 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C289: V203 grid coupling. C418: V401 plate trimmer. C262: Z209 output coupling. C239: Z203 output coupling. C287: Z215 output coupling.	
C294	CAPACITOR, fixed: mica dielectric; 20 μμf ±5%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type, located on ends; term. mtd; Electro Motive type 605.	V204 grid coupling.	
C295, C300, C405, C425	CAPACITOR, fixed: mica dielectric; 12 μμf ±5%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C295, C300: V202 plate decoupling. C405: V402 cathode to grid feedback. C425: V402 plate trimmer.	
C308	CAPACITOR, fixed: mica dielectric; 33 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	Z220 bypass.	
C315, C318, C321	CAPACITOR, fixed: mica dielectric; 62 μμf ±2%; 50 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C315: Frequency setting capacitor for Z222. C318: Frequency setting capacitor for Z223. C321: Frequency setting capacitor for Z224.	
C427	CAPACITOR, fixed: mica dielectric; 82 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	V402 plate trimmer.	
C415, C424, C512, C539	CAPACITOR, fixed: mica dielectric; 47 μμf ±2%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	C415: V401 plate r-f bypass. C424: V402 plate trimmer. C512: V502 grid coupling. C539: V509 grid coupling.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C416, C429	CAPACITOR, fixed: mica dielectric; 27 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C416: V401 plate trimmer. C429: V402 plate r-f bypass.	
C426	CAPACITOR, fixed: mica dielectric; 120 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	V402 plate r-f bypass.	
C433	CAPACITOR, fixed: mica dielectric; 620 μμf ±2%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	V402 plate coupling.	
C526, C905	CAPACITOR: fixed: mica dielectric; 150 μμf ±2%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C526: Part of V507A r-f ripple filter circuit. C905: V901A plate decoupling.	
C550	CAPACITOR, fixed: mica dielectric; 180 μμf ±5%; 500 vdcw; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; Electro Motive type 605.	V507B audio bypass.	
C243, C266, C293, C708	CAPACITOR, fixed: mica dielectric; 910 μμf ±2%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C243: Z203 output voltage divider. C266: Z210 output voltage divider. C293: Z216 output voltage divider. C708: Z702 output voltage divider.	
C904	CAPACITOR, fixed: mica dielectric; 1000 μμf ±2%; 500 vdcw; molded low loss bakelite case; 51/64" lg x 15/32" wd x 7/32" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	V901A feedback coupling.	
C910, C248, C271, C302	CAPACITOR, fixed: mica dielectric; 24 μμf ±5%; 500 vdcw; molded case; ½" lg x 9/32" wd x 11/64" d; 2 term., wire lead type; term. mtd; Electro Motive type 605.	C910: V901B grid coupling to V902. C248: Z206 output coupling. C271: Z212 output coupling. C302: Z218 output coupling.	
	CAPACITOR, fixed: mica dielectric; 3000 μμf ±5%; 500 vdcw; molded case per JAN-C-5; 53/64" lg x 53/64" wd x 9/32" h; 2 term.; JAN CM30B302J.	B101 Autotune motor filter.	
C101	CAPACITOR, fixed: paper dielectric; 1 sect.; 10 μf ±10%; 600 vdcw; hermetically sealed metal case; 3¾" wd x 4½" h x 1¼" thk; 2 term., stud type, 7/16" h, located on bottom, spaced 2" c to c, on porcelain pillars; vitamin Q, bracket mtd; Sprague Y27106.	B+ filter.	
C102	CAPACITOR, fixed: paper dielectric; .22 μf ±20%; 100 vdcw; hermetically sealed in tubular metal case; 1⅛" lg x .187" dia; 2 term., wire lead type; single hole mtg clamp w/.144" hole; Sprague No. 96P22401S13.	Audio filter.	
C103	CAPACITOR, fixed: paper dielectric; 1 sect.; 10 μf ±10%; 300 vdcw; hermetically sealed metal can; 3¾" lg x 2" dia; 2 term., solder lug type; clamp mtd; GE type 28F259.	Audio decoupling.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C226, C304, C323, C325, C339, C403, C404, C407, C408, C435, C705, C706, C707, C711, C712, C713, C902, C907, C911	CAPACITOR, fixed: paper dielectric; 1 sect.; 10,000 μμf ±20%; 300 vdcw; hermetically sealed in tubular metal case; ¾" lg x .235" dia; 2 term., wire lead type; single .144" dia hole in mtg clamp; Sprague part No. 96P10303S13.	C226: Agc decoupling. C304: V203 plate bypass. C323: V205 cathode coupling capacitor. C325: V205 plate decoupling. C339: R-f bypass B+ line. C403: V401 plate decoupling. C404: V401 bypass. C407: V402 plate decoupling. C408: V402 bypass. C435: Part of HR401. C705: V701 grid bypass. C706: B+ bypass, 180 volts. C707: B+ filter, 180 volts. C711: V701 heater bypass. C712, C713: V701 heater filters. C902: HR901 crystal oven heater spark suppressor. C907: V901B plate decoupling. C911: V901B cathode bypass.	
C229, C253	CAPACITOR, fixed: paper dielectric; .047 μf ±20%; 100 vdcw; hermetically sealed in tubular metal case; 11/16" lg x .400" dia; 1 term., wire lead type; mtg, 1 bushing, ¼" lg w/5/16"-24 thd; Sprague No. 86P47301S5.	C229: V201 cathode bypass. C253: V202 cathode and suppressor grid bypass.	
C250, C601, C609	CAPACITOR, fixed: paper dielectric; 1 μf ±20%; 300 vdcw; hermetically sealed in tubular metal case; 2-1/16" lg x .750" dia; 1 term., wire lead type; mtg, 1 bushing, ¼" lg w/5/16"-24; Sprague No. 86P10503S5.	C250: B+ line bypass, 180 volts. C601: V601A plate decoupling. C609: V602B plate r-f bypass.	
C252, C278, C506, C510, C511, C515, C516, C518, C519, C521, C522, C534, C541, C603, C610, C710	CAPACITOR, fixed: paper dielectric; 10,000 μμf ±20%; 300 vdcw; hermetically sealed tubular metal case; ¾" lg x .235" dia; 2 term., wire lead type; Sprague No. 96P10303S2.	C252: V202 control grid bypass. C278: C278 B+ bypass. C506: V501 screen grid r-f bypass. C510: V502 screen grid r-f bypass. C511: V502 plate decoupling. C515: V503 screen grid r-f bypass. C516: V503 plate decoupling. C518: V504 screen grid r-f bypass. C519: V504 plate decoupling. C521: V505 screen grid r-f bypass. C522: V505 plate decoupling. C534: V508 screen grid r-f bypass. C541: V509 screen grid r-f bypass C603: Plate to grid coupling capacitor from V602A to V603.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
		C610: Plate to grid coupling capacitor from V602B to V604. C710: Thermal switch bypass.	
C313	CAPACITOR, fixed: paper dielectric; .01 μf ±20%; 300 vdcw; hermetically sealed in tubular metal case; ¾" lg x .235" dia; 2 term., wire lead type; single hole mtg clamp w/.120" dia; Sprague No. 96P10303S11.	V204 plate decoupling.	
C434, C501, C503, C508, C529, C605	CAPACITOR, fixed: paper dielectric; .01 μf ±20%; 200 vdcw; hermetically sealed tubular metal case; ¾" lg x .235" dia; 2 term., wire lead type; Sprague No. 96P10302S2.	C434: Noise suppressor for HR401. C501: V501 grid return. C503: V501 grid coupling cap. C508: V505 grid return. C529: V601A grid coupling. C605: V601B grid r-f bypass.	
C504, C509, C513, C514, C517, C520, C523, C537, C538, C540, C544, C545, C549, C606	CAPACITOR, fixed: paper dielectric; .1 μf ±20%; 100 vdcw; hermetically sealed tubular metal case; ⅞" lg x .312" dia; 2 term., wire lead type; Sprague No. 96P10401S2.	C504: R-f gain filter. C509: V502 cathode bypass. C513: V504 cathode bypass. C514: V503 cathode bypass. C517: V503 and V504 cathode return. C520: V505 cathode bypass. C523: V506 cathode bypass. C537: V511B cathode bypass. C538: V511B cathode coupling for 50-ohm i-f output. C540: V509 cathode bypass. C544: V507 cathode bypass. C545: V508 grid return. C549: V508 heater bypass. C606: V607 cathode bypass.	
C505	CAPACITOR, fixed: paper dielectric; 1 sect.; .1 μf ±20%; 100 vdcw; hermetically sealed in tubular metal case; 1-13/16" lg x .562" dia; 1 term., wire lead type; 1 bushing, ¼" lg w/5/16"-24 thd; Sprague.	V501 cathode bypass.	
C507, C524, C535	CAPACITOR, fixed: paper dielectric; .047 μf ±20%; 300 vdcw; hermetically sealed tubular metal case; ⅞" lg x .312" dia; 2 term., wire lead type; Sprague No. 9647303S2.	C507: V501 plate bypass. C524: V506 screen grid bypass. C535: V508 plate decoupling.	
C527	CAPACITOR, fixed: paper dielectric; 1 sect.; .047 μf ±20%; 200 vdcw; hermetically sealed tubular metal case; ⅞" lg x .312" lg; 2 term., wire lead type; term. mtd; Sprague No. 96P47302S2.	V507A plate coupling.	
C530, C542	CAPACITOR, fixed: paper dielectric; 1 μf ±20%; 300 vdcw; hermetically sealed in tubular metal case; 1-1/16" lg x .400" dia; 1 term., wire lead type; 1 bushing ¼" lg w/5/16"-24 thd; Sprague No. 86P10403S5.	C530: Part of 180-volt B+ filter. C542: V509 plate decoupling.	
C528	CAPACITOR, fixed: paper dielectric; .22 μf ±20%; 100 vdcw; 1⅛" lg x .400" dia; 2 term., wire lead type; Sprague No. 96P22401S2.	V507 plate decoupling.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C546, C547	CAPACITOR, fixed: paper dielectric; 1 sect.; 1 μf +40% −15%; 400 vdcw; hermetically sealed metal case; 1-5/16" lg x 49/64" wd x 2½" h; 2 term., solder lug type; bracket mtd; Sprague per JAN spec No. CP61B1EE105X.	Agc time constant.	
C548	CAPACITOR, fixed: paper dielectric; .01 μf ±20%; 200 vdcw; hermetically sealed in tubular metal case; 11/16" lg x .400" dia; 1 term., wire lead type; mtg, 1 bushing, ¼" lg w/5/16"-24 thd; Sprague No. 86P10402S5.	Heater bypass, 25 volts.	
C602	CAPACITOR, fixed: paper dielectric; 1 sect.; .0015 μf ±20%; 300 vdcw; hermetically sealed tubular metal case; 11/16" lg x .235" dia; 2 term., wire lead type; Sprague type 86P15203S1.	High-frequency bypass.	
C604, C611	CAPACITOR, fixed: paper dielectric; .0022 μf ±20%; 200 vdcw; hermetically sealed tubular metal case; ¾" lg x .235" dia; 2 term., wire lead type; Sprague No. 96P22202S2.	High-fiequency bypass.	
C608	CAPACITOR, fixed: paper dielectric; .22 μf ±20%; 100 vdcw; hermetically sealed in tubular metal case; 1⅛" lg x .562" dia; 2 term., wire lead type; single hole mtg clamp w/.144" hole; Sprague 96P22403S13.	Decoupling.	
C225	CAPACITOR, variable: air dielectric; plate meshing type; 2 sect.; capacity, 80 μμf max, 6 μμf min, 26 μμf max, 3 μμf min; o/a dimen excluding shaft and bushing, 1⅞" lg x 13/16" wd x 1⅛" h; bushing dimen, ½" lg x ⅜" dia x 32 thds/in.; shaft dimen beyond bushing, ⅜" lg x ¼" dia; 180° cw-ccw rotation; 3 term., solder lug type; single hole mtd by ⅜" dia bushing; Collins Rad part/dwg No. 922 0208 00.	ANT TRIM.	
C901	CAPACITOR, variable: air dielectric; plate meshing type; 1 sect.; 60.7 μμf max, 3.2 μμf min; 750 v rms; o/a dimen, 1-11/16" lg x ⅝" wd x ¾" h; bushing dimen, ⅜" lg x ¼" dia x 32 thds/in.; shaft dimen beyond bushing, ¼" lg x .188" dia; scdr adj; 2 term., solder lug type; single hole mtd by ¼" dia bushing; Johnson EF type 160-110-4.	FREQ ADJ control.	
C232, C235, C255, C258, C276, C281, C314, C317, C320	CAPACITOR, variable: ceramic dielectric; rotary; single sect.; 8.0-50.0 μμf; 350 vdcw; o/a dimen, .918" lg x 1.168" wd x ¼" d; 2 term., solder lug type; one .290" dia mtg hole; scdr slot adj; Erie type 557.	C232: Trimmer for Z201. C235: Trimmer for Z202. C255: Trimmer for Z207. C258: Trimmer for Z208. C276: Trimmer for Z213. C281: Trimmer for Z214. C314: Trimmer for Z222. C317: Trimmer for Z223. C320: Trimmer for Z224.	
C238, C241, C261, C264, C286, C291	CAPACITOR, variable: ceramic dielectric; rotary; single sect.; 5.0-25.0 μμf; 350 vdcw; o/a dimen, .918" lg x 1.168" wd x ¼" d; 2 term., solder lug type; one .290" dia mtg hole; scdr slot; Erie type 557.	C238: Trimmer for Z203. C241: Trimmer for Z204. C261: Trimmer for Z209. C264: Trimmer for Z210. C286: Trimmer for Z215. C291: Trimmer for Z216.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
C244, C247, C267, C270, C296, C301, C306, C309, C311	CAPACITOR, variable: ceramic dielectric; rotary, single sect.; 3.0-12.0 μμf; 350 vdcw; .918" lg x 1.168" wd x ¼" d; 2 term., solder lug type; one .290" dia mtg hole; scdr slot adj; Erie type 557.	C244: Trimmer for Z205. C247: Trimmer for Z206. C267: Trimmer for Z211. C270: Trimmer for Z212. C296: Trimmer for Z217. C301: Trimmer for Z218. C306: Trimmer for Z219. C309: Trimmer for Z220. C311: Trimmer for Z221.	
C525	CAPACITOR, variable: ceramic dielectric; rotary type; 1 sect.; 1.5-3.0 μμf; 500 vdcw; 21/32" lg x .375" wd x .845" h; 2 term., solder lug type; mtg data, two .120" dia holes in base spaced .445" c to c; scdr slot adj; Erie type TS2A.	T506 neutralizing capacitor.	
C912	CAPACITOR, variable: ceramic dielectric; rotary type, 1 sect.; max min 5 μμf, min max 25 μμf, max max 30 μμf; 350 vdcw; 19/32" lg x 17/32" wd x ¾" h; 2 term., solder lug type; mts by two .120" holes spaced 5/16" c to c scdr slot adj; Erie mfg type 557.	V902 screen bypass.	
L502	CHOKE, RF: 12.0 mh at 150 kc; 1050 turns, 36 AUG copper cond, pi universal wdg, unshielded, powdered iron core, 1-3/16" lg x ¾" sq; 2 term., solder lug type; mtd by 4-40 NC stud; National Coil Co. mfg cst No. C-0047 140.	V507A plate filter.	
L703	CHOKE, RF: 240 ma cur. rating; plate filter; v/w freq below 110 mc; cylindrical shape; 23/32" lg x ¼" dia; 2 term., wire lead type; IRC International to Collins Rad spec 240 0065 00.	Filter choke for Z702.	
L901	CHOKE, RF: 470 ma cur. rating; v/w freq below 210 mc; cylindrical shape; 23/32" lg x ¼" dia; 2 term., wire lead type; IRC mfr type No. CLA.	V901B plate filter.	
	CLUTCH ASSEMBLY, friction: contains plate-staked clutch O 336, plate friction O 337, gear staked O 338, clutch staked O 339, bushing assy clutch O 340, and shaft clutch O 302; approx o/a dimen 1-9/16" lg x 2¼" dia; Collins Rad part/dwg No. 506 1886 002.	Slip clutch mc change control.	
L242 thru L245, L247, L403 thru L405	COIL, RF: 12 μh; 50 turns, # 38E, 1 wdg, unshielded, powdered iron, ⅜" lg x 5/32" dia; 2 term., wire lead type; rf choke; Jeffers Electronics type CFIr⅜-50/38.	L242: V201 heater filter. L243: V204 heater filter. L244: V204 and V205 heater filter. L245: V203 and V205 heater filter. L247: V202 and V203 heater filter. L403: Filament filter choke. L404: Filament filter choke. L405: Filament filter choke.	
L246, L401, L402, L406, L501,	COIL, RF: 500 μh at 100 kc; 336 turns, #36; copper, nylon enamel, 3 wdg, pi wdg, powdered iron; ½" lg x ⅛" dia; 2 term., wire lead type; rf choke; National Coil Co type No. C-004, mfg No. 7109.	L246: B+ filter, 180 volts. L401: V401 cathode choke. L402: V402 cathode choke. L406, L503: B+ filter chokes. L501: V501 cathode choke.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
L503, L902		L902: B+ filter choke, 180 volts.	
L701	COIL, RF: 5 turns, #30 de, copper, 1 wdg, single layer wdg, unshielded, powdered iron core, 1¼" lg x 11/32" dia; scdr adj; 2 term., retaining ring type; mtd by 15/64" lg, No. 12-28 NF-2 shaft; osc coil; Collins Rad part/dwg No. 505 9709 001.	Oscillator coil.	
L702	COIL, RF: 28 turns, #28 de, copper, 1 wdg, single layer wdg, tapped at 9.4 turns, unshielded, 1⅝" lg x 1⅛" dia; 2 term., wire pigtail type; mtd by 2 screws thru base of coil; osc tuning coil; Collins Rad part/dwg No. 505 9729 002.	Vfo tuning coil.	
L706	COIL, RF: inductance 10 μh; 51 turns closewound, No. 34 AWG, copper, 1 wdg, single layer wdg, unshielded; 7/32" OD x ¾" lg coil dimen; 2 term. located one at ea end; term mtd; Jeffers Electronics; Collins Rad spec #240 0096 00.	V701 filament choke.	
J619	CONNECTOR, plug: 15, male, round; pol; straight type; 1.500" lg x .750" wd x .255" h o/a; 5 amps rectangular shape; phenolic insert; Amphenol cat. No. 26-151.	Provides interconnection for a-f unit.	
J620	CONNECTOR, plug: 11, male, round; pol; straight type; 1.171" dia x .750" wd x .406" h o/a; rectangular shape; phenolic insert; Amphenol cat. No. 26-804.	Provides interconnection for a-f unit.	
P112, P209 thru P211, P221, P222, P224 thru P226, P723	CONNECTOR, plug: 1, male, round; straight type; 31/32" lg x 9/16" dia o/a; radio freq connector; cylindrical shape, metal, locking type; .212" dia max cable opening; μ/μ RG-58 and RG-58A/U r-f cables; Amphenol to Collins Rad spec #357 9143 00.	P112: Plug for 455 kc i-f amplifier unit. P209: Input to S204. P210: Input to S202. P211: Input to S201. P221: Input from T401. P222: Input from T402. P224: Input to S205 rear. P225, P226: Signal output to i-f unit. P723: For output of V701.	
P113 thru P116	CONNECTOR, plug: 7, female, round; pol; straight type; 11/32" lg x 9/16" across o/a; 1 amp, 660 v ac; hex. shape, non-locking; mica-filled phenolic insert; 1 mtg hole, ½"; Amphenol mfg part No. 26-192.	P113: Crystal oscillator input and output plug. P114: R-f connector. P115: Variable frequency oscillator input and output receptacle. P116: Calibration oscillator input and output receptacle.	
J105	CONNECTOR, receptacle: 9, female, round; pol; straight type; 1" lg x 1-7/16" dia o/a; cylindrical; brass, electrotin pl, locking type; molded plastic insert; panel lock ring inc; Winchester Electronics, Inc cat. No. RA9R-PR-R.	REMOTE CONTROL receptacle.	
J106	CONNECTOR, receptacle: 1, female, round; pol; straight type; 1-1/16" lg x 11/16" sq o/a; cylindrical shape, metal, locking type; teflon insert; .161" dia max cable opening; mounting data 4 holes, 3-56NF-2 thd, .090" lg, ½" mtg/c; Collins Rad part/dwg No. 357 9165 00.	I-F OUTPUT metering receptacle in main frame.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
J107	CONNECTOR, receptacle: 1, female, round; straight type; 21/32" lg x .625" dia o/a; radio freq connector; cylindrical shape, metal, silver pl, locking type; teflon insert; 4 holes, .138" dia, holes tapped w/No. 6-32 thd, .718" mtg/c; Industrial Products Company mfg No. 82000.	UNBALANCED WHIP connector.	
J108	CONNECTOR, receptacle: 2, female, round; pol; straight type; .710" lg x .750" dia o/a; radio freq connector; cylindrical shape, silver pl, locking type; polystyrene insert; 4 holes, .125" dia, .718" mtg/c, .750" dia coupling nut w/ ¾-20 thd; u/w RG-22A/U and RG-22B/U cables; Amphenol to Collins Rad spec #357 9142 00.	BALANCED 125 OHM receptacle.	
J109, J110, J111, J223, J421, J422, J512, J525, J526, J924	CONNECTOR, receptacle: 1 female, round; straight type; 1-19/64" lg x 9/16" dia o/a; radio freq connector; cylindrical shape, brass, silver pl; high temp polystyrene insert; inc rubber O-ring lock washer, and nut; Amphenol cat. No. 31-102.	J109: Output from K101 to S204. J110: Output from K101 to S202. J111: Output from K101 to S201. J223: Vfo output from V702. J421: Output from first crystal oscillator. J422: Output from second crystal oscillator. J512: 50-ohm i-f output. J525, J526: 455 kc output from r-f. J924: Output from crystal calibrator to V201.	
J121	CONNECTOR, receptacle: 10, female, round; pol; straight; 1⅝" lg x 1⅜" wd x 1⅜" h o/a; cylindrical shape, aluminum, locking type; molded black plastic insert; 4 holes, .120" dia; Amphenol part No. AN 3102-18-1P.	AUTO TUNE channel selector.	
J214, J413, P715, P916	CONNECTOR, receptacle: 7, male, round; pol; straight type; 11/32" lg x 9/16" dia o/a; 5 amp, 250 v; cylindrical shape, steel; mica filled phenolic insert; Amphenol mfg part No. 26-1059.	J214: Input power to r-f unit. J413: Power input for crystal oscillator. P715: Power input plug for 70H2 oscillator. P916: Power plug for crystal calibrator.	
J517	CONNECTOR, receptacle: 20, male, round; pol; straight type; 1-15/16" lg x ¾" wd x 13/32" h o/a; rectangular shape, phenolic; 2 holes, ⅛" dia, 1.620" mtg/c; Amphenol mfg cat. No. 26-806.	Input and output connector for amplifier unit.	
J601	CONNECTOR, receptacle: 1, female, round; straight type; banana type connector, red, molded nylon; ¾" lg x ⅜" dia o/a; cylindrical shape; mtg nut and lock washer inc; Johnson EF type 105.	B+ 180-volt dc check jack.	
P117	CONNECTOR, receptacle: 20, female, round; pol; straight type; 1-15/16" lg x ¾" wd x 13/32" h o/a; rectangular shape, phenolic; 2 holes, ⅛" dia, 1.620" mtg/c; Amphenol mfg cat. No. 26-807.	Input and output plug for amplifier unit.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
P118, P119	CONNECTOR, receptacle: 15, female, round; pol; straight type; 1½" lg x ¾" wd x 15/32" h o/a; rectangular, phenolic; 2 holes, 5/32" dia, 1-3/16" mtg/c; Amphenol mfg cat. No. 26-150.	P118: Rectifier power input and output plug. P119: A-f unit input and output plug.	
P120	CONNECTOR, receptacle: 11, female, round; pol; straight type; 1-11/64" lg x ¾" wd x 15/32" h o/a; rectangular, phenolic; 2 holes, ⅛" dia holes, .864" mtg/c; Amphenol mfg cat. No. 26-805.	A-f unit input and output plug.	
	CONTACT ASSEMBLY, electrical: 1-15/32" lg x 11/16" wd x ⅝" h o/a; 2 term. solder lug type; mtd by two holes spaced ¼" c to c; Collins Rad part/dwg No. 505 7677 002.		
	CONTROL, receiver: automatic; controls freq; dc, 28 v; 4½" lg x 3-5/32" wd x 2¾" h o/a; bkt mtd; Collins Rad part/dwg No. 506 1761 005.	Automatic tuning control unit 96T-15.	
	CONTROL, receiver: automatic; controls freq; dc, 28 v; 4⅜" lg x 3-5/32" wd x 2-27/32" h o/a; bkt mtd; Collins Rad part/dwg No. 506 1762 005.	Automatic tuning control.	
	CONTROL, receiver: automatic; controls freq; dc, 28 v; 3-9/16" lg x 1¾" wd x 2½" h o/a; bkt mtd; Collins Rad part/dwg No. 506 1763 004.	Automatic tuning control unit 111E-3.	
	CORE, adjustable tuning: iron; 3¼" lg x ⅛" dia o/a; w/as tuning slug; Jeffers Electronics.	Part of L234, L236, and L238.	
	CORE, adjustable tuning: iron; 2½" lg x ¼" dia w/one .062" dia phosphor bronze shaft ⅞" lg o/a; Stackpole mfg type S-51.	Tuning slugs for Z202, Z208, Z214, T202, Z201, Z207, Z213, T201, Z203, Z209, Z215, and T203.	
	CORE, adjustable tuning: iron; 2½" lg x ¼" dia w/one .062" dia phosphor bronze shaft ⅞" lg o/a; Stackpole mfg type S-62.	Tuning slug for Z204, Z210, Z216, T204, Z222, Z223, and Z224.	
	CORE, adjustable tuning: iron; 2⅛" lg x ¼" dia w/one .062" dia phosphor bronze shaft ⅞" lg o/a; Stackpole mfg type S-100A.	Tuning slug for Z205, Z211, Z217, T205, Z206, Z212, Z218, T206, Z219, Z220, and Z221.	
	COUPLER: brass, alloy plate; ½" lg x ½" dia approx o/a; couples two ¼" dia shafts together and coupler is retained by four 8-36NF-2 set screws w/two per shaft; Collins Rad part/dwg No. 504 1499 001.	Coupling for band switch.	
	COUPLING, flexible: brass, plain; 1-7/32" lg x ¾" dia approx o/a; over-all dimensions w/one end mtd on 3/16" dia shaft, other end mts on ¼" dia shaft; bellows c/o 11 brass convolutions (9 active) w/ea 1/16" lg; Collins Rad part/dwg No. 015 0372 00.	Coupling for tuning shaft of Z503.	
	COUPLING, hub: steel, passivate; 5/16" lg x ⅞" dia approx o/a; over-all dimensions mts on 3/16" shaft; Collins Rad part/dwg No. 505 1319 002.	Coupling for O 358.	
	COUPLING, split hub: steel, passivate; ⅞" OD x ¼" ID x 11/32" thk approx o/a; dimensions mtd on ¼" shaft; Collins Rad part/dwg No. 506 1909 002.	Coupling for crystal oscillator assembly.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	COUPLING, split hub: aluminum, anodize; 1-3/32" OD x ¼" ID x .389" thk o/a; mts on ¼" shaft; Collins Rad part/dwg No. 506 2081 003.	Coupling for kc change control.	
	COVER, electrical connector: brass; nickel pl; 1-11/32" lg x 23/32" dia o/a; mtd by two clamps; w/as a cover for meter plug; Amphenol mfg No. 26-834.	Cover for P916.	
Y401, Y411	CRYSTAL UNIT: 1 xtal plate; 9000.000 kc; Collins Rad part/dwg No. 290 0006 00.	Control oscillator frequency.	
Y402, Y410	CRYSTAL UNIT: 1 xtal plate; 8000.000 kc; Collins Rad part/dwg No. 290 0004 00; p/o Sig C Receiver R-391/URR, .5 to 32 mc.	Control oscillator frequency.	
Y403, Y412	CRYSTAL UNIT: 1 xtal plate; 10,000.000 kc; Collins Rad part/dwg No. 290 0009 00.	Control oscillator frequency.	
Y404	CRYSTAL UNIT: 1 xtal plate; 1,2600.000 kc; Sig C Crystal Holder HC-6/U; 2 pins spaced .486" c to c; oval; metallic, ¾" lg x .345" wd x .765" h; top marked w/freq, side marked w/xtal unit No. and mfr's code No.; Collins Rad part/dwg No. 290 0018 00.	Controls oscillator frequency.	
Y405	CRYSTAL UNIT: 1 xtal plate; 7,000.000 kc; Collins Rad part/dwg No. 290 0003 00.	Controls oscillator frequency.	
Y406	CRYSTAL UNIT: 1 xtal plate; 1,2000.000 kc; Collins Rad part/dwg No. 290 0016 00.	Controls oscillator frequency.	
Y407	CRYSTAL UNIT: 1 xtal plate; 1,5000.000 kc; Collins Rad part/dwg No. 290 0021 00.	Controls oscillator frequency.	
Y408	CRYSTAL UNIT: 1 plate; 6200.000 kc; Collins Rad part/dwg No. 290 0002 00.	Controls oscillator frequency.	
Y409	CRYSTAL UNIT: 1 xtal plate; 1,4000.000 kc; Collins Rad part/dwg No. 290 0020 00.	Controls oscillator frequency.	
Y413	CRYSTAL UNIT: 1 xtal plate; 1,1000.000 kc; Collins Rad part/dwg No. 290 0013 00.	Controls oscillator frequency.	
Y414	CRYSTAL UNIT: 1 xtal plate; 1,3000.000 kc; Collins Rad part/dwg No. 290 0019 00.	Controls oscillator frequency.	
Y415	CRYSTAL UNIT: 1 xtal plate; 8500.000 kc; Collins Rad part/dwg No. 290 0005 00.	Controls oscillator frequency.	
Y416	CRYSTAL UNIT: 1 xtal plate; 1,1333.333 kc; Collins Rad part/dwg No. 290 0014 00.	Controls oscillator frequency.	
Y417	CRYSTAL UNIT: 1 xtal plate; 1,0666.667 kc; Collins Rad part/dwg No. 290 0012 00.	Controls oscillator frequency.	
Y418	CRYSTAL UNIT: 1 xtal plate; 1,0333.333 kc; Collins Rad part/dwg No. 290 0010 00.	Controls oscillator frequency.	
Y419	CRYSTAL UNIT: 1 xtal plate; 9666.667 kc; Collins Rad part/dwg No. 290 0008 00.	Controls oscillator frequency.	
Y420	CRYSTAL UNIT: 1 xtal plate; 1,2500.00 kc; Collins Rad part/dwg No. 290 0017 00.	Controls oscillator frequency.	
Y421	CRYSTAL UNIT: 1 xtal plate; 1,1500.000 kc; Collins Rad part/dwg No. 290 0015 00.	Controls oscillator frequency.	
Y422	CRYSTAL UNIT: 1 xtal plate; 1,0500.000 kc; Collins Rad part/dwg No. 290 0011 00.	Controls oscillator frequency.	
Y423	CRYSTAL UNIT: 1 xtal plate; 9500.000 kc; Collins Rad part/dwg No. 290 0007 00.	Controls oscillator frequency.	
Y901	CRYSTAL UNIT: 1 xtal plate; 1000.000 kc; Collins Rad part/dwg No. 290 0001 00.	Part of crystal calibrator unit.	
Y501	CRYSTAL UNIT, quartz: 1 xtal plate inc; 455.000 kc nom freq; JKnights part No. H-17.	Part of Z501, controls if.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
O 501	DETENT, switch: provisions for 6 switch positions; nonadj; 1-7/32" lg x 1¼" dia o/a; mts by two #4 screw holes 1-1/32" c to c; Oak type F.	Part of S504.	
	DIAL, control: movable scale type; scale data, 0 to 31, graduated 1" scale divisions, 360° arc; direct drive, .344" dia shaft; 1/16" wd x 2" dia o/a; mtd by two .140" holes .470" c to c on a rad of .315" from ctr of cir; Collins Rad part/dwg No. 505 9623 002.	Oscillator dial.	
V201, V401, V402	ELECTRON TUBE: pentode; type 6AJ5.	V201: First r-f amplifier tube. V401: First crystal oscillator. V402: Second crystal oscillator.	
V202, V501 thru V505, V509	ELECTRON TUBE: pentode; type 6BJ6.	V202: Second r-f amplifier. V501: First i-f amplifier. V502: Second i-f amplifier. V503: Third i-f amplifier. V504: Fourth i-f amplifier. V505: Fifth i-f amplifier. V509: Agc amplifier.	
V203 thru V205	ELECTRON TUBE: triode; type 6C4.	V203: First mixer. V204: Second mixer. V205: Third mixer.	
V506, V603, V604	ELECTRON TUBE: pentode; type 6AK6.	V506 Sixth i-f amplifier. V603: Local a-f output tube. V604: Line a-f output tube.	
V507, V510, V511, V601, V901, V902	ELECTRON TUBE: twin-triode; type 12AU7.	V507: Detector and negative peak limiter. V510: Agc rectifier and positive peak limiter. V511: Agc time constant tube and i-f cathode follower. V601: A-f amplifier and squelch tube. V901: Crystal calibration oscillator tube and buffer amplifier. V902: Multivibrator.	
V508, V701	ELECTRON TUBE: pentode; type 5749.	V508: Bfo tube. V701: Vfo tube.	
V602	ELECTRON TUBE: triode; type 12AT7.	Local a-f amplifier and line a-f amplifier.	
V605, V606	ELECTRON TUBE: twin-triode; type 6082.	Voltage regulators.	
V607	ELECTRON TUBE: pentode; type 6BH6.	D-c amplifier.	
V608, V609	ELECTRON TUBE: type 5651.	Voltage reference.	
	FASTENER, lock ring: .080" thk x .725" dia o/a; brass; nickel pl; mts on .510" dia shaft; Amphenol mfg cat. No. 26-1069.	Secures connectors in position.	
	FASTENER, ROLL PIN: ⅜" lg x 1/16" normal dia o/a; steel; Esna per Collins part/dwg No. 311 0357 00.	Securing couplings to shafts.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
FL601	FILTER, band-pass: 800 cps oper freq; 600 ohms input, 600 ohms output; 1-1/64" lg x 1-39/32" wd x 2-17/32" h o/a rectangular, metal; mtd by four ⅜", 6-32 NC-2 studs 1-5/16" c to c; 3 term.; Chi Trans mfg type No. 15854.	Band-pass filter.	
FL602	FILTER, low-pass: 3500 kc cutoff; 600 ohms input, 600 ohms output; 1" lg x 1-29/32" wd x 2½" h o/a; rectangular, metal; mtd by four 6-32 NC-2, ⅜" studs 1-5/16" x 9/16" c to c 3 term.; Chi Trans per Collins part/dwg No. 673 0272 00.	Low-pass filter.	
F101	FUSE, cartridge: 3 amp, 250 v; instantaneous; ferrule type; glass body; one time; 1¼" lg x ¼" dia o/a; Buss type 3AG1043.	Line fuse AC 3A.	
F102	FUSE, cartridge: ⅜ amp, 250 v; instantaneous; ferrule type; glass body; one time; 1¼" lg x ¼" dia o/a; Buss type 3AG1045A.	High-voltage fuse ⅜-A.	
F103	FUSE, cartridge: 20 amp, 25 v; instantaneous; ferrule type; glass body; one time; 1¼" lg x ¼" dia o/a; Littelfuse mfg cat. No. 1083.	Automatic tune motor protecting fuse DC20A.	
XF101, XF102, XF103	FUSEHOLDER: extractor post type; accom 1, cartridge type; phenolic body; 1.672" lg x .680" dia o/a; body threaded w/1/2-16 special thd for panel mtg; Littelfuse cat No. 342003.	XF101: Holder, fuse F101. XF102: Holder, fuse F102. XF103: Holder, fuse spare.	
	GEAR: worm; steel, passivate; helical; right-hand; 23/32" OD x ¼" ID x 1-1/16" lg o/a; mts on ¼" shaft; Collins Rad part/dwg No. 505 9560 002.	Part of worm and shaft assembly in crystal oscillator unit.	
O 303	GEAR: spur type; steel, passivate; 1-1/32" OD x .2493" ID x 5/16" lg o/a; mts on .2493" dia shaft; Collins Rad part/dwg No. 506 1879 002.	Idler gear.	
O 309	GEAR: spur type; steel, passivate; locking gear; 23/64" OD x ⅛" ID x ¼" lg o/a; mts on ⅛" shaft; Collins Rad part/dwg No. 506 1876 002.	Locking gear.	
O 334	GEAR: bevel type; brass, iridite; shaft driving; 25/32" OD x ⅛" ID x 21/64" lg o/a; mts on ⅛" shaft; Collins Rad part/dwg No. 506 1840 002.	Part of mc tuning assembly.	
	GEAR: steel, passivate; 7/16" dia x 19/32" lg approx o/a; mts on 5/16" shaft; Collins Rad part/dwg No. 506 1938 002.	Part of kc tuning assembly.	
O 335	GEAR: bevel type; brass, iridite; straight teeth; 13/32" OD x ⅛" ID x 11/32" lg o/a; mts on ⅛" dia shaft; Collins Rad part/dwg No. 506 1964 002.	Part of kc tuning assembly.	
	GEAR: spur type; commercial hard brass, iridite finish; straight teeth; 1⅜" OD x .1875" ID x 9/32" thk o/a; mts on .1875" shaft; Collins Rad part/dwg No. 506 2144 002.	Line shaft gear for automatic tune.	
	GEAR: spur type; steel, passivate; straight teeth; 17 teeth; 19/32" lg x .3405" ID x 19/32" dia o/a; mts on .3405" shaft; Collins Rad part/dwg No. 506 2134 002.	Part of kc change control.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	GEAR: spur type; steel, passivate; straight teeth; 16 teeth; 7/16" lg x ⅜" OD x .2182" ID o/a; mts on .2182" dia shaft; Collins Rad part/dwg No. 506 2168 002.	Motor pinion gear.	
O 299	GEAR ASSEMBLY: steel, passivate; 15/16" dia x 13/32" lg approx o/a; mts on .2493" shaft; Collins Rad part/dwg No. 506 1806 002.	Part of mc tuning assembly.	
O 300	GEAR ASSEMBLY: steel, iridite; 2⅝" dia x ⅜" lg approx o/a; mts on .2493" shaft; Collins Rad part/dwg No. 506 1815 002.	Drive for crystal oscillator switch.	
O 307	GEAR ASSEMBLY: c/o 1 bearing and 1 gear; 15/16" OD x 7/32" ID x ¼" thk o/a; mts on 7/32" shaft; Collins Rad part/dwg No. 506 1878 002.	Part of r-f train assembly.	
O 313	GEAR ASSEMBLY: c/o 1 roll pin, 1 bearing, 1 gear; 1-59/64" OD x 9/32" ID x 13/32" thk approx o/a; mts on 9/32" dia shaft; Collins Rad part/dwg No. 506 2080 003.	Operates switch in oscillator unit.	
O 333	GEAR ASSEMBLY: bearing, bevel gear; ⅝" dia x 19/32" lg o/a; mts on 5/16" shaft; Collins Rad part/dwg No. 506 1839 002.	Part of kc tuning assembly.	
O 341	GEAR ASSEMBLY: bearing; 7/16" lg x 15/32" o/a; mts on ⅛" shaft; Collins Rad part/dwg No. 506 1992 002.	Part of mc tuning assembly.	
	GEAR ASSEMBLY: Gear-idler O 296, idler shaft assy diff gear-assy, gear O 330, gear O 301, shaft assy O 331; 12⅛" lg x 8¾" h x 2" wd approx o/a; Collins Rad part/dwg No. 506 2117 004.	R-f gear train.	
	GEAR ASSEMBLY: bearing part/dwg No. 309 0023 00, gear part/dwg No. 506 2135 002, gear part/dwg No. 506 2146 002; 11/16" thk x 29/32" dia approx o/a; shaft mtd; Collins Rad part/dwg No. 506 2147 002.	Part of automatic tune.	
	GEAR ASSEMBLY: gear part/dwg No. 506 1819 002, gear part/dwg No. 506 2136 002, spring part/dwg No. 506 2068 002, retaining ring part/dwg No. 340 0046 00; ⅜" thk x 3-3/16" dia approx o/a; mts on .4375" dia shaft; spring-loaded, double gear; Collins Rad part/dwg No. 506 2155 003.	Part of mc change control.	
	GEAR ASSEMBLY: plate-soldered part/dwg No. 506 2139 002, gear part/dwg No. 506 1829 002, gear part/dwg No. 506 1834 002, shock arm part/dwg No. 506 1841 002; 2-27/32" dia x 9/16" thk approx o/a; mts on 5/16" dia shaft; incl shock-arm assy; Collins Rad part/dwg No. 506 2156 003.	Used to reduce starting and reverse shock between motor and auto tune.	
	GEAR, switch: steel, no finish; ⅜" dia x ¼" thk approx o/a; mts on 7/32" shaft; Collins Rad part/dwg No. 506 1883 002.	Crystal oscillator switch gear.	
	GEAR, worm: brass, chromate dip; 2¾" dia x ⅜" thk approx o/a; mts on 7/16" shaft; Collins Rad part/dwg No. 505 9564 002.	Part of crystal oscillator assembly.	
	GLOBE, light: plate glass, plain; nondiffusing; 19/32" dia x .062" h o/a; mtd by fl of indicator; Collins Rad part/dwg No. 506 2150 002.	Panel indicator globe.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	GUIDE, coupling: steel, passive per Collins Rad spec No. 580 0025 00; ⅞" dia x .140" thk approx; mts on 7/16" dia shaft; Collins Rad part/dwg No. 505 1766 002.	Coupling guide.	
	GUIDE, coupling: steel, passive per Collins Rad spec 580 0025 00; 1-3/32" dia x .140" thk approx; mts on 15/32" shaft; Collins Rad part/dwg No. 506 2082 003.	Coupling guide.	
	HOLDER SET, crystal: 16 holders; 2 term. ½" c to c; phen; rectangular; 2-13/16" sq x ⅝" thk o/a; Collins Rad part/dwg No. 505 9608 002.	Holds and furnishes contact for 16 crystals.	
	INDICATOR, frequency channel: mechanically operated; rotary wheel type, 6 wheels, ea wheel numbered 1 to 10; mtd by four .128" dia holes spaced 3.125" x 75"; 1-15/32" lg x 3½" wd x 1¼" h; Veeder-Root Cat. No. EW-75775.	Indicates operating frequency.	
J103	JACK, telephone: for 2-cond plug; shank ¼" dia; cont arrangement J1; 1-1/32" lg x 49/64" dia o/a; ⅜" mtg hole regd, 1 brass washer, 1 brass hex. nut; Mallory Cat. No. SC1A.	PHONES jack.	
	KNOB: bar; zinc alloy; black; accom shaft; round .257" dia setscrew; groove marked; ¾" lg x 15/16" dia; Collins Rad part/dwg No. 281 0093 00.	Front panel controls.	
	KNOB: bar; zinc alloy; black; accom shaft; round, .257" dia setscrew; groove marked; ⅞" lg x 1⅛" dia o/a; Collins Rad part/dwg No. 281 0094 00.	Front panel controls.	
	KNOB: round; aluminum alloy; black; accom shaft, round, .3125" dia, setscrew; 1¼" lg x 2-5/16" dia o/a; Collins Rad part/dwg No. 281 0097 00.	Front panel controls.	
	KNOB: round; aluminum alloy; black; accom shaft, round .340" dia setscrew; no insert; w/o markings; 1¼" lg x 2-5/16" dia; Collins Rad part/dwg No. 281 0098 00.	Frequency selector knobs.	
I 101, I 102	LAMP, incandescent: 28 v, 1.12 w, .04 amp; single cont, fl base; T-1-¾, clear; ⅝" max h o/a; GE Cat No. Mazda 327.	Dial lamps.	
I 103	LAMP, glow: ¼ w, 65 v ac, 90 v dc; double cont bayonet candelabra indexing base; T-4-½, clear; 1½" h max o/a; GE Cat. No. NE-48.	Antenna indicator lamp.	
M101	METER, audio level: panel mtd; scale 0 to +3 cw, 0 to —20 ccw; case sq, aluminum, steel, or plastic; 1-27/32" sq mtg fl, 1.519" dia barrel; 1" d to mtg surface; ±3% accuracy at 0 reading; black self-luminous scale markings and pointer, white background; requires external multiplier; four .125" dia holes 1.312" c to c; 2 term.; Collins Rad part/dwg No. 481 0001 00.	LINE LEVEL meter.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
M102	METER, milliammeter: panel mtd; scale 0 to 100 cw; graduated in 10-scale div, marked "DB"; rectangular, steel; 1.510" dia o/a; 1⅛" body d from mtg surface, excluding term.; ±3% accuracy; 1 ma reqd for full scale deflection; self-luminous pointer and scale markings; self-contained; mtd by four .125" dia holes 1.312" c to c; 2 screw stud term.; Collins Rad part/dwg No. 476 0066 00.	CARRIER LEVEL meter.	
	MOTOR, dc: shunt-wound gear motor; 28.5 v dc; 1/10 hp, net less than 3100 rpm; plain shaft drilled and tapped; meter 3⅝" lg x 2" dia; .2180" dia shaft; 4 solder lug term.; fixed mtg base; 3 mtg holes 8-32 NC-2; accessories c/o four .002 $\mu\mu$f cap.; Hamilton Beach Co. mfg type No. ALC-1000.	Autotune motor.	
	OSCILLATOR, RF: .5-32 mc freq range, 32 bands; xtal ckt; 180 v, 20 ma; 18.6 v, 175 ma; 16-5/16" lg x 10" wd x 5" h o/a; Collins Rad part/dwg No. 505 9655 015.	Oscillator.	
	OSCILLATOR, RF: 2455—3455, mc freq range, 1 band, 180 v, 10 ma; 6.3 v, 300 ma; 6.155" lg x 3.500" dia; Collins Rad part/dwg No. 505 9760 014.	Variable oscillator.	
HR901	OVEN, crystal: 1 xtal unit, Sig C, HC-6/U; +80°C—+90°C; 26.5 v, .30 amp; 8 term. tube pin type, located on bottom; body excluding term. 1-3/16" dia x 1¾" h; term. mtd; Bliley Elec mfg type No. TCO.	CRYSTAL OVEN HR901.	
E206 thru E210	POST, terminal: tin pl; post .437" o/a h above mtg surface, .120" OD; .040 max dia of wire hole; Stupakoff part No. 9807.	E206: Used for metering grid of V201. E207: Used for metering grid of V202. E208: Used for metering grid of V203. E209: Used for metering grid of V204. E210: Used for metering grid of V205.	
L601	REACTOR: 1 sect; 4.0 hy, 50 ma dc max; 110 ohms dc; case metal; 1-9/16" sq x 2-5/16" h; four 6-32 by ⅜" mtg studs spaced 1⅛" x 1"; 2 solder lug term.; Chicago Trans mfg type 17613.	H-v filter.	
L705	REACTOR: 1 sect; 7.5 μh; case HS, phen; ¾" lg x 19/64" dia o/a; mtd by wire leads; 2 terminations, wire pigtail type; Collins Rad part/dwg No. 240 0098 00.	Filter choke.	
CR101	RECTIFIER, metallic: germanium xtal; 1 ph input; output 150 ma max cur, half-wave rectification; cylindrical shape, .400" lg. x .175" dia; term. mtd; 2 wire lead term.; metallic case w/plastic ins cover; Raytheon type No. CK705.	Agc isolated rectifier.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
K101	RELAY, armature: cont normal by open, triple make; dc 17 ohms, 6 v; 1.528" lg x .847" wd x 1.5" h; mtd by means of bracket 1.5" sq with 4 mtg holes 1.25" x 1.19" c to c; R. B. M. Div, Essex Wire GX-5793C.	ANTENNA GROUNDING RELAY.	
K102	RELAY, armature; normal by open, double break-make, 5 amp at 27.5 dc; coil 1 wdg, dc, 100 ohm, 32.0 v dc, max; term. 8 on cont; intermittent duty; HS; 1⅝" lg x 1-7/16" wd x 2-7/16" h; mtd by three ⅜" 6-32 NC-2 studs; R.B.M. Div, Essex Wire X-5654C.	Autotune relay.	
K601	RELAY, armature: cont, single break, dc, 27 v, 1 amp; coil, 1 inductive wdg, dc, 4 ma dc; 3 term.; intermittent duty; HS; 1-9/16" lg x 1-7/16" wd x 2-3/32" h o/a; mtd by three ⅜" lg #6-32 NC-2 studs; Allied Cont SWHX-11.	SQUELCH RELAY.	
K602	RELAY, armature: cont, normally open, single, ac; coil, 1 inductive wdg, 6 v dc; 2 term.; 1-8/16" lg x 9/16" wd x 1" h; mtd by means of a bracket w/4 holes 4-40 NC-2, ¾" x ¾" c to c; R.B.M. Div, Essex Wire type SM modified.	BREAK-IN RELAY.	
R612	RESISTOR, deposited carbon: 1200 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products mfg type No. CPSE-½.	V601B cathode voltage dropping.	
R905, R907	RESISTOR, fixed: deposited carbon; 10,000 ohms ±1%; ½ w; ½" lg x .162" dia; ins; 2 wire lead term.; Wilkor Products mfg type No. CPSE-½.	V902 plate loads.	
R411	RESISTOR, fixed: WW; inductive wdg; 35 ohms ±5%; 8 w; 1" lg x 19/32" OD; 2 tab term.; JAN RW30G350.	Part of filament voltage filter decoupling network.	
R101	RESISTOR, fixed: comp; 3,600 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated 2 term.; Wilkor Products type CPSE-½.	Meter multiplier.	
R102	RESISTOR, fixed: comp; 3,900 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Load resistor.	
R105	RESISTOR, fixed: comp; 1,200 ohms ±10%; ½ w; .406" lg x .175" dia; 2 wire lead term.; JAN-R-11 RC20BF122K.	Part of filter network.	
R106, R108, R109, R111	RESISTOR, fixed: comp; 182 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Parts of attenuator pads.	
R107, R110	RESISTOR, fixed: comp; 918 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Parts of attenuator pads.	
R112, R113, R115, R116	RESISTOR, fixed: comp; 200 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Part of H attenuator pads.	
R114	RESISTOR, fixed: comp; 250 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Part of audio attenuation.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R117, R119	RESISTOR, fixed; comp; 2030 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Parts of 10-db T attenuator pads.	
R118	RESISTOR, fixed: comp; 2740 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated 2 wire lead term.; Wilkor Products type CPSE-½.	Part of 10-db T attenuator pad.	
R120, R122	RESISTOR, fixed: comp; 3190 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Parts of 20-db T attenuator pads.	
R121	RESISTOR, fixed: comp; 788 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 wire lead term.; Wilkor Products type CPSE-½.	Part of 20-db T attenuator pad.	
R125	RESISTOR, fixed: comp; 56,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF563K.	Limiter filter.	
R126, R512, R557	RESISTOR, fixed: comp; .22 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF224K.	R126: Part of 20-db T attenuator pad. R512: V502 screen grid voltage dropping. R557: Filter.	
R127	RESISTOR, fixed: comp; 6,800 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF682K.	Audio voltage divider.	
R128, R536	RESISTOR, fixed: comp; 820 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF821K.	R128: Audio voltage divider. R536: Cathode bias.	
R201, R207, R213, R216, R218, R516, R543, R551, R558, R601, R610, R627	RESISTOR, fixed: comp; 1 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; AB per RC20BF105K.	R201: Isolation resistor. R207: Isolation resistor. R213: V203 grid load. R216: V204 grid load. R218: V205 grid load. R516: V503 grid return. R543: V507B and V510B plate voltage dropping. R551: V509 grid load. R558: V510 voltage divider. R601: V601A grid return. R610: V610B grid leak. R627: V608 regulator.	
R202, R208, R501, R532, R509	RESISTOR, fixed: comp; 22,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF223K.	R202: V201 agc filter (decoupling). R208: V202 agc filter. R501: V501 control grid return. R532: V505 screen voltage dropping. R509: V505 control grid return.	
R203, R209, R705	RESISTOR, fixed: comp; 100 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN-R-11 RC20BF101K.	R203: V201 cathode bias. R209: V202 cathode bias. R705: Part of Z702.	
R205	RESISTOR, fixed: comp; 68,000 ohms ±10%; 2 w; ¾" lg x .370" dia; 2 wire lead term.; JAN spec #RC42BE683K.	V201 screen voltage dropping.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R206, R212, R215, R217, R219, R220, R403, R404, R407, R408, R506, R513, R523, R528, R533, R548, R554, R603, R634	RESISTOR, fixed: comp; 2,200 ohms ±10%; ½ w; .406″ lg x .175″ dia; ins; 2 wire lead term.; AB per RC20BF222K.	R206: V201 plate decoupling. R212: V202 plate decoupling. R215: V203 plate voltage dropping. R217: V204 plate dropping. R219: V205 cathode bias. R220: V205 plate voltage dropping. R403: V401 plate voltage dropping. R404: Part of oscillator output coupling filter network. R407: V402 plate voltage dropping. R408: Part of oscillator output coupling filter network. R506: V501 plate voltage dropping. R513: V502 plate voltage dropping. R523: V503 plate voltage dropping. R528: V504 plate voltage dropping. R533: V505 plate voltage dropping. R548: Bfo isolating and voltage dropping. R554: Isolation resistor. R603: Isolation resistor. R634: Plate voltage dropping.	
R210, R505, R511	RESISTOR, fixed: comp; 47,000 ohms ±10%; 1 w; .750″ lg x .280″ dia; ins; 2 wire lead term.; JAN spec #RC30BF473K.	R210: V202 screen decoupling. R505: V501 screen voltage dropping. R511: V505 screen grid decoupling.	
R211	RESISTOR, fixed: comp; 18,000 ohms ±10%; 2 w; ¾″ lg x .370″ dia; ins; 2 wire lead term.; JAN spec #RC42BE183K.	V202 screen voltage dropping.	
R214, R221, R559	RESISTOR, fixed: comp; 27 ohms ±10%; ½ w; .406″ lg x .175″ dia; ins; 2 wire lead term.; JAN spec #RC20BF270K.	R214: V203 control grid parasitic resistor. R221: V202 control grid parasitic resistor. R559: V511A cathode resistor.	
R401, R405, R502, R553	RESISTOR, fixed: comp; 47,000 ohms ±10%; ½ w; .406″ lg x .175″ dia; ins; 2 wire lead term.; JAN spec #RC20BF473K.	R401: V401 control grid load. R405: V402 grid load resistor. R502: Part of V501 bandwidth selectivity control. R553: V509 screen grid voltage dropping.	
R402, R406	RESISTOR, fixed: comp; 1500 ohms ±10%; ½ w; .406″ lg x .175″ dia; ins; 2 wire lead term.; JAN spec #RC20BF151K.	R402: V401 cathode bias resistor. R406: V402 cathode bias resistor.	
R409	RESISTOR, fixed: comp; 82,000 ohms ±10%; ½ w; .406″ lg x .175″ dia; ins; 2 wire lead term.; JAN spec #RC20BF823K.	V401 screen grid voltage dropping.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R410, R701	RESISTOR, fixed: comp; 68,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN spec #RC20BF683K.	R410: V402 screen voltage dropping. R701: V701 grid leak.	
R503, R538, R510, R625	RESISTOR, fixed: comp; 1,000 ohms ±10%; ½ w; .406" lg x .175" dia; 2 wire lead term.; AB part No. RC20BF102K.	R503: V501 cathode resistor. R538: V506 screen voltage dropping. R510: V502 cathode bias. R625: V609 decoupling resistor.	
R504, R539, R540	RESISTOR, fixed: comp; 27,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN spec #RC20BF273K.	R504: V501 screen grid decoupling. R539 and R540: Diode loads.	
R507, R514, R524, R529, R534	RESISTOR, fixed: comp; 2.7 ohms ±5%; ½ w; ½" lg x .156" dia; uninsulated; 2 wire lead term.; Concarbon type NF.	R507: T501 padding resistor. R514: T502 padding resistor. R524: T503 padding resistor. R529: T504 padding resistor. R534: T505 padding resistor.	
R508	RESISTOR, fixed: comp; 5.6 ohms ±5%; ½ w; ½" lg x .156" dia; uninsulated; 2 wire lead term.; Concarbon type NF.	T501 padding resistor.	
R515, R525, R530, R535	RESISTOR, fixed: comp; 5.1 ohms ±5%; ½ w; ½" lg x .156" dia; uninsulated; 2 wire lead term.; Concarbon type NF.	R515: T502 padding resistor. R525: T503 padding resistor. R530: T504 padding resistor. R535: T505 padding resistor.	
R517, R526, R531	RESISTOR, fixed: comp; 330 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN spec RC20BF331K.	R517: V503 cathode bias. R526: V504 cathode bias. R531: V505 cathode bias.	
R518	RESISTOR, fixed: comp; 220 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN spec RC20BF221K.	Cathode resistor multiplier.	
R522, R527, R555	RESISTOR, fixed: comp; .1 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term.; wire lead type; JAN spec RC20BF104K.	R522: V503 screen grid voltage dropping. R527: V504 screen grid voltage dropping. R555: V510A plate load (agc).	
R541, R544, R606, R607, R631, R911	RESISTOR, fixed: comp; .47 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN spec #RC20BF474K.	R541: V507B plate load. R544: V507 band V510B cathode voltage dropping. R606: V603 feedback voltage. R607: V603 grid return. R631: V604 grid return. R911: V910B grid return resistor.	
R542	RESISTOR, fixed: comp; .82 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN spec RC20BF824K.	V510B plate load.	
R545	RESISTOR, fixed: comp; .15 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN spec RC20BF154K.	V508 grid leak.	
R546	RESISTOR, fixed: comp; 33,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN spec RC20BF333K.	V508 screen grid filter.	
R547, R902	RESISTOR, fixed: comp; 22,000 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN spec RC30BF223K.	R547: V508 plate voltage dropping. R902: Plate load.	
R549	RESISTOR, fixed: comp; 390 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF391K.	V511B cathode bias.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R550	RESISTOR, fixed: comp; 68 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF680K.	V511B cathode load.	
R552	RESISTOR, fixed: comp; 270 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF271K.	V509 cathode bias.	
R556 R605	RESISTOR, fixed: comp; .18 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF184K.	R556: Agc filter. R605: V602A plate load resistor.	
R560, R613	RESISTOR, fixed: comp; 56,000 ohms ±10%; 2 w; ¾" lg x .370" dia; AB JAN RC42BE563K.	R560: V511A plate load. R613: V601B cathode bleeder resistor.	
R626	RESISTOR, fixed: comp; 2700 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF272K.	I-f bandwidth control.	
R563, R564	RESISTOR, fixed: comp; 120 ohms ±10%; 1 w; 750" lg x 280" dia; ins; 2 term., wire lead type; JAN RC30BF121K.	R563: V510 filament balancing resistor. R564: V507 filament balancing resistor.	
R565	RESISTOR, fixed: comp; 22 ohms ±10%; 2 w; ¾" lg x .370" dia; ins; 2 term., wire lead type; JAN RC42BF220K.	V507 and V510 filament voltage dropping resistor.	
R602, R604, R628	RESISTOR, fixed: comp; 680 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF681K.	Cathode bias resistors.	
R608, R632	RESISTOR, fixed: comp; 470 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF471K.	R608: V603 cathode bias. R632: V604 cathode bias.	
R609	RESISTOR, fixed: comp; 18 ohms ±10%; ½ w; .406" lg x .175" dia; 2 term., wire lead type; JAN RC20BF180K.	V603 cathode bias.	
R615	RESISTOR, fixed: comp; .33 meg ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF334K.	Part of hum balancing circuit.	
R616, R629	RESISTOR, fixed: comp; 82,000 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF823K.	R616: Screen voltage divider. R629: V602 plate load.	
R617	RESISTOR, fixed: comp; 56,000 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF563K.	V607 screen grid to cathode resistor.	
R618	RESISTOR, fixed: comp; 1000 ohms ±10%; 1 w; .750" lg x .280" dia; AB JAN RC30BF102K.	V607 cathode current limiting.	
R619, R620, R621, R622	RESISTOR, fixed: comp; 47 ohms ±10%; 2 w; ¾" lg x .370" dia; ins; 2 term., wire lead type; JAN RC42BE470K.	R619: V605 current limiting. R620: V605 bleeder. R621: V606 voltage divider. R622: V606 voltage control.	
R624	RESISTOR, fixed: comp; .56 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term.; wire lead type; JAN RC20BF564K.	V607 grid return.	
R630	RESISTOR, fixed: comp; .33 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF334K.	Series load from V604 plate to V602B cathode.	
R633	RESISTOR, fixed: comp; 22 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term.; wire lead type; JAN RC20BF220K.	V604 cathode load.	
R702	RESISTOR, fixed: comp; 33,000 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF333K.	V701 screen grid voltage dropping resistor.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R703	RESISTOR, fixed: comp; 2200 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF222K.	V701 plate voltage dropping resistor.	
R704	RESISTOR, fixed: comp; 180 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF181K.	T701 load.	
R901	RESISTOR, fixed: comp; .12 meg ±10%; ½ w; .406" lg x .175" dia; ins; 2 wire lead term.; JAN RC20BF124K.	V901A grid return resistor.	
R903	RESISTOR, fixed: comp; 10,000 ohms ±10%; 1 w; .750" lg x .280" dia; ins; 2 term., wire lead type; JAN RC30BF103K.	V902 plate voltage dropping.	
R904	RESISTOR, fixed: comp; 1.0 meg ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 term., wire lead type; Wilkor Products type No. CPSE-½.	V902 screen dropping resistor.	
R906, R908	RESISTOR, fixed: comp; 82,000 ohms ±1%; ½ w; 19/32" lg x .162" dia; uninsulated; 2 term., wire lead type; Wilkor Products type No. CPSE-½.	R906, R908: V902 grid return resistors.	
R909	RESISTOR, fixed: comp; 12,000 ohms ±10%; ½ w; .406" lg x .175" dia; ins; 2 term., wire lead type; JAN RC20BF123K.	V901B cathode bias.	
R910	RESISTOR, fixed: comp; 10 ohms ±10%; ½ w; .406" lg v .175" dia; ins; 2 term., wire lead type; JAN RC20BF100K.	V901B plate load.	
R623	RESISTOR, fixed: WW; 18,000 ohms ±5%; 12 w at 275°C; 2" lg x 19/32" dia; vitreous enamel; 2 term., ferrule type; panel mtd by bolt; WL M-32.	Cathode resistor.	
	RESISTOR KIT: component parts, one resistor RC20BF751J, one resistor RC20BF561J, one resistor RC20BF681J, one resistor RC20BF621J, one resistor RC20BF821J, one resistor RC20-BF911J, one resistor RC20BF122K, one resistor RC20BF182K, one resistor RC20BF222K, one resistor RC20BF272K, one resistor RC20BF-302J, one resistor RC20BF332J, one resistor RC20BF362J, one resistor RC20BF392J, one resistor RC20BF432J, one resistor RC20BF-472J, one resistor RC20BF512J, one resistor RC20BF562J, one resistor RC20BF622J, one resistor RC20BF682J; plastic bag 6" x 8"; Collins Rad part/dwg No. 506 6852 002.	I-f bandwidth control resistors.	
R512	RESISTOR, thermal: nom oper cur, .310 amp ±.020, 5 w; ballast tube type, 2⅜" lg o/a; noval base for socket mtg; Amperite type 3TF7.	Filament current VOLTAGE REGULATOR.	
R103, R104	RESISTOR, variable: comp; 1 sec., 2500 ohms ±20%; 2 w; metal case, encl, 1-5/32" dia x 19/32" d; bushing mtd, ⅜"-32 thd x ⅜" lg; CTS SL7868.	R103: V602 LINE GAIN control. R104: LOCAL GAIN control.	
R123	RESISTOR, variable: comp; 1 sect., 5000 ohms ±20%; 2 w; bushing mtd, ⅜"-32 thd x ⅜" lg; nonturn device located on 17/32" rad at 9 o'clock; CTS SW1376.	RF GAIN control.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
R124	RESISTOR, variable: 1 sect., 500,000 ohms ±20%; 2 w; linear taper; metal case, 1-5/32" dia x 1-1/32" d; mtd by bushing, ⅜"-32 thd x ⅜" lg; SPDT, 2 amp, 125 v; incl on-off switch S105; AB AB2957.	Static drain.	
R537	RESISTOR, variable: WW; 1 sect., 15 ohms ±10%; 2 w; linear taper; metal case; 1.060" dia x .440" d; bushing mtd, ⅜"-32 thd x .375" lg; Mallory type No. C.	CARR-METER ADJustment control.	
R562	RESISTOR, variable: comp; 1 sect., 25,000 ohms ±20%; 2 w; lin taper; metal; 1-5/32" dia x 19/32" d; bushing mtd, ⅜"-32 thd x ½" lg; CTS part No. 224.	I-F GAIN ADJusting control.	
R614	RESISTOR, variable: comp; 1 sect., 500,000 ohms ±20%; 2 w; metal case, 1-5/32" dia x 19/32" d; bushing mtd, ⅜"-32 thd x ⅜" lg; CTS SL7870.	V607 HUM BAL control.	
	RETAINER, bearing: brass; iridite; .187" ID x ⅜" OD x 3/16" thk; Collins Rad part/dwg No. 506 0168 002.	Bearing retainer.	
E201, E401, E402	SHIELD, electron tube: copper or brass; cylindrical shape; .810" dia x 1⅜" h; bkt mtd; JAN TS102U01.	E201: Tube shield for V201. E401: Tube shield for V401. E402: Tube shield for V402.	
E202, E203, E204, E205, E501, E502, E503, E504, E505, E506, E508, E509, E603, E604, E607, E608, E609	SHIELD, electron tube: copper or brass; cylindrical shape; .810" dia x 1¾" h; bkt mtd; JAN TS102U02.	E202: Tube shield for V202. E203: Tube shield for V203. E204: Tube shield for V204. E205: Tube shield for V205. E501: Tube shield for V501. E502: Tube shield for V502. E503: Tube shield for V503. E504: Tube shield for V504. E505: Tube shield for V505. E506: Tube shield for V506. E508: Tube shield for V508. E509: Tube shield for V509. E603: Tube shield for V603. E604: Tube shield for V604. E607: Tube shield for V607. E608: Tube shield for V608. E609: Tube shield for V609.	
E507, E510, E511, E601, E602, E901, E902	SHIELD, electron tube: copper or brass; cylindrical shape; .950" dia x 1-15/16" h; bkt mtd; JAN TS103U02.	E507: Tube shield for V507. E510: Tube shield for V510. E511: Tube shield for V511. E601: Tube shield for V601. E602: Tube shield for V602. E901: Tube shield for V901. E902: Tube shield for V902.	
E512	SHIELD, electron tube: copper or brass; cylindrical shape; .950" dia x 2⅜" h; bkt mtd; JAN TS103U03.	Shield for R512.	
	SOCKET ASSEMBLY, crystal: 5 holders; two term., spaced 5/16" along lg of board, 7/16" c to c, phenolic, rectangular, 2-9/16" lg x ⅞" wd x 11/16" d; Collins Rad part/dwg No. 505 9604 002.	Holds and furnishes contact for five crystals.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
XHR901	SOCKET, electron tube: 8 cont, copper, nonmagnetic alloy, silver pl; 1¾" lg x 1.220" wd x ½" h; mica-filled phenolic; one piece saddle, 2 mtg holes, .157" dia x 1½" c to c; Methode Mfg. Co. cat. No. SMJ-257-157.	Tube socket for HR901.	
XV201, XV202, XV203, XV204, XV205, XV401, XV402, XV501, XV502, XV503, XV504, XV505, XV506, XV508, XV509, XV603, XV604, XV607, XV608, XV609	SOCKET, electron tube: 7 cont, silver pl, miniature type; oval; 1⅜" lg x .800" wd x 1-3/16" h; plastic; one piece saddle, 2 mtg holes, .125" x .875" c to c; JAN TS108P01.	XV201: Tube socket for V201. XV202: Tube socket for V202. XV203: Tube socket for V203. XV204: Tube socket for V204 XV205: Tube socket for V205. XV401: Tube socket for V401. XV402: Tube socket for V402. XV501: Tube socket for V501. XV502: Tube socket for V502. XV503: Tube socket for V503. XV504: Tube socket for V504. XV505: Tube socket for V505. XV506: Tube socket for V506. XV508: Tube socket for V508. XV509: Tube socket for V509. XV603: Tube socket for V603. XV604: Tube socket for V604. XV607: Tube socket for V607. XV608: Tube socket for V608. XV609: Tube socket for V609.	
XV507, XV510 XV511, XV512, XV601, XV602, XV901, XV902	SOCKET, electron tube: 9 cont, copper, silver pl; miniature type; oval; .940" dia x 25/32" h; plastic; one piece saddle, 2 mtg holes, .125" dia x 1.125" c to c; JAN TS103P01.	XV507: Tube socket for V507. XV510: Tube socket for V510. XV511: Tube socket for V511. XV512: Tube socket for V512. XV601: Tube socket for V601. XV602: Tube socket for V602. XV901: Tube socket for V901. XV902: Tube socket for V902.	
XV605, XV606	SOCKET, electron tube: 8 cont, copper base, nonmagnetic alloy, silver pl; med; 1⅞" lg x 1½" wd x 9/16" h; ceramic body; one piece saddle, 2 mtg holes, .152" dia x 1½" c to c; Natl Co. cat. No. CIR-8.	XV605: Tube socket for V605. XV606: Tube socket for V606.	
	SWITCH, push button: DPST; ac, 10 amp; 125-250 v ac; momentary action; phenolic body; 1¼" lg x ½" wd x ½" h; phenolic push button; 4 term., solder lug type; two mtg holes .101" dia x .605" c to c; JAN-P-14; Electro-Snap Div of Exhibit Supply Co. part No. ES9-3CM.	LIMITER switch.	
S101	SWITCH, rotary: one sect.; 8 positions; 2 poles; 9/16" lg x 1-13/32" wd x 1-9/16" h; single mtg stud, ⅜"-32 NEF-2 thd; solder lug term.; Grigsby Allison Co, Inc. type LW.	LINE METER switch.	
S102	SWITCH, rotary: one sect.; 3 positions; 2 poles; 9/16" lg x 1-13/32" wd x 1-9/16" h; single mtg stud, ⅜"-32 NEF-2 thd; solder lug term.; Grigsby Allison Co, Inc. type LW.	AUDIO RESPONSE SHARP-MED-WIDE switch.	
S103	SWITCH, rotary: one sect.; 2 positions; 1 pole, 12 throws; 9/16" lg x 1-13/32" wd x 1-9/16" h; single mtg stud, ⅜"-32 NEF-2 thd; solder lug term.; Grigsby Allison Co, Inc. type LW.	BFO OFF ON switch.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
S104	SWITCH, rotary: one sect.; 3 positions; 1 pole, 12 throws; 9/16" lg x 1-13/32" wd x 1-9/16" h; single mtg studs, ⅜"-32 NEF-2 thd; solder lug term.; Grigsby Allison Co, Inc. type LW.	AGC FAST MED SLOW switch.	
S106	SWITCH, rotary: 1 sect.; 2 positions; 4 poles, 2 throws; 9/16" lg x 1-13/32" wd x 1-9/16" h; single mtg stud, ⅜"-32 NEF-2 thd; solder lug type; Grigsby Allison Co, Inc. type LW.	BREAK-IN relay switch.	
S107	SWITCH, rotary: 1 sect.; 6 positions; 4 poles, 4 throws; 23/32" lg x 1-13/32" wd x 1-9/16" h; single mtg stud, ⅜"-32 NEF-2 thd; solder lug type term.; Grigsby Allison Co, Inc. cat. No. 5233-4MLW-1-AC.	FUNCTION switch.	
S108	SWITCH, rotary: 1 sect.; 2 positions; 125 or 250 v, 6 amp or 3 amp; 27/32" lg x 27/32" wd x 1¾" h; single mtg stud ⅜"-32 NEF-2 thd x 11/32" dia; shaft, scdr slotted type, ½" lg x ¼" dia; solder lug type term.; AH&H type No. 81715-WE.	OVENS OFF ON switch.	
S109	SWITCH, rotary: 1 sect.; three positions; SPDT; 1-5/16" lg x ⅞" wd x 1½" h; mtd ⅜" lg stud, approx ⅜ dia; solder lug type term.; Oak type 23.	REMOTE LOCAL switch.	
S110	SWITCH, rotary: 1 sect.; 12 positions; 1 pole, 8 throws; 1-13/32" lg x 1-13/32" wd x 1-9/16" h; mtd by one ⅜"-32 NEF-2 stud x ⅜" lg; solder lug term.; Oak type K.	CHANNEL SELECTOR switch.	
S504	SWITCH, rotary: 1 sect.; 12 positions; 1 pole, 6 throws; 1/16" lg x 1¼" wd x 1-5/16" h; mtd by two No. 4 screw holes, 1.031" c to c; solder lug type term.; Oak type No. F.	I-f bandwidth.	
	SWITCH, rotary: 1 sect.; 8 positions; 1 pole, 8 throws; brass cont; silver pl cont finish; phenolic body; 1⅜" wd x 1-27/32" h; mtd by two ⅛" dia holes x 1.562" c to c; solder lug type term.; Collins Rad part/dwg No. 502 1895 003.	111A-1 seeking switch in autotune.	
S201, S202, S207, S209	SWITCH, rotary: wafer; 1 sect.; 8 positions; 1 pole, 6 throws; 1/16" lg x 15/16" wd x 1-9/16" h; mtd by 2 No. 4 screw holes 1¼" c to c; solder lug type term.; Grigsby Allison Co, Inc. type No. LW.	Band switches.	
S203	SWITCH, rotary: wafer; 1 sect.; 8 positions; 2 pole, 4 throws; 1/16 lg x 15/16" wd x 1-9/16" h; two No. 4 screw mtg holes 1⅛" c to c; solder lug type term.; Grigsby Allison Co, Inc. type No. LW.	Band switch.	
S204, S206, S208	SWITCH, rotary: wafer; 1 sect.; 8 positions; 1 pole, 6 throws; 1/16" lg x 15/16" wd x 1-9/16" h; mtd by two No. 4 screw holes 1¼" c to c; solder lug type term.; Grigsby Allison Co, Inc. type No. LW.	Band switches.	
S205	SWITCH, rotary: wafer, 1 sect.; 8 positions; 2 pole, 6 throws; 1/16" lg x 15/16" wd x 1-9/16" h; solder lug type term.; Grigsby Allison Co, Inc. type LW.	Band switch.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
S210	SWITCH, rotary: wafer; 1 sect.; 2 pos; 1/16" lg x 15/16" wd x 1-9/16" h; mtd by two No. 4 screw holes 1¼" c to c; solder lug type terms; Grigsby Allison Co, Inc. type LW.	Band switch.	
S401, S402, S403, S404	SWITCH, rotary: wafer; 1 sect.; 32 pos; one pole, 32 throws; 1/16" lg x 2.375" wd x 2.375" h; mtd by four .155" dia mtg holes spaced 2.063" c to c; solder lug type; Grigsby Allison Co, Inc., cat. No. 10940.	S401, S403: Crystal selector for V402. S402, S404: Crystal selectors for V401.	
S501, S502, S503, S505, S506, S507	SWITCH, rotary: wafer; 1 sect.; 12 pos; 1 pole, 6 throws; 1/16" lg x 1¼" wd x 1-5/16" h; mtd by two No. 4 screw holes 1.031" c to c; solder lug term.; Oak type No. F.	S501: BANDWIDTH KC. S502, S503, S505, S506, S507: I-f bandwidths.	
S402	SWITCH, thermostatic: ceramic mtg plate, metal case; 53/64" lg x 13/16" wd x 5/16" h; 26 v ac; 2 term., screw type; two .104" mtg dia holes ⅝" c to c; Stevens Mfg Co, Inc., per Collins Rad part/dwg No. 292 0037 00.	Crystal oscillator oven control.	
S701	SWITCH, thermostatic: SPST; brass case; 3-23/32" lg x .625" dia; 5 or 10 amp ac, 230 v or 115 v ac; two terminations; wire pigtail type; clamp mtd, clamp not incl; Genwal, Inc., cat. No. 17010.	Heater control for HR701.	
FL101	SUPPRESSOR, electrical noise: coil and cap. type; 110 v ac or 220 v ac, 5 amp or 2.5 amp; 2¼" lg x 7-3/16" wd x 3¼" h; incl in case, rectangular shaped, metal; mtd by four 6-32 NC-2 holes spaced 2⅜" x 4-7/16"; 4 term., 3 solder lug type, 1 stud; Sprague type 28556.	A-c line filter.	
TB101, TB102	TERMINAL BOARD: molded phenolic board; term., 8 double screw type; 4-3/32" lg x 1⅛" wd x ½" thk; four .175" dia mtg holes, spaced 3-15/16" x 27/64" c to c; Jones HB div of Cinch, type 141-Y.	Connector blocks for main frame assembly.	
T601, T602, T603	TRANSFORMER, AF: plate coupling type; pri, 10,000 ohms, secd 600 ohms, ct 300 ohms; upright, metal case; 1-9/16" lg x 1-9/16" wd x 2-3/16" h; 2 term., solder lug type; four 6-32 mtg studs ¼" lg, spaced 1" c to c; Chi Trans div, Essex Wire type 17594.	T601: Audio response. T602: Local audio output. T603: Audio output to line metering circuit.	
T207	TRANSFORMER, IF: input; shielded; 27/32" lg x 27/32" wd x 2½" h; double tuned; adj iron core tuning; 2 mtg studs, spaced .562" c to c; 5 term., solder lug type; Collins Rad part No. 278 0104 00.	455-kc i-f transformer.	
T501	TRANSFORMER, IF: interstage; shielded; 1-11/32" lg x 1-11/32" wd x 2⅞" h; double tuned; adj iron core tuning; 2 mtg studs, spaced .937" c to c; 10 term., solder lug type; Collins Rad part No. 278 0102 00.	First 455-kc i-f transformer.	
T502, T503,	TRANSFORMER, IF: interstage; shielded; 1-11/32" lg x 1-11/32" wd x 2⅞" h; double tuned; adj iron core tuning; 2 mtg studs,	T502: Second 455-kc, i-f transformer. T503: Third 455-kc, i-f transformer.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T504, T505	spaced .937" c to c; 10 term., solder lug type; Collins Rad part No. 278 0103 00.	T504: Fourth 455-kc, i-f transformer. T505: Fifth 455-kc, i-f transformer.	
T506	TRANSFORMER, IF: output; shielded; 1-11/32" lg x 1-11/32" wd x 2⅞" h; double tuned; adj iron core tuning; 2 mtg studs, spaced .937" c to c; 5 term., solder lug type; Collins Rad part No. 278 0099 00.	Sixth 455-kc, i-f transformer.	
Z501	TRANSFORMER, IF: xtal filter assy; shielded; 1-11/32" lg x 1-11/32" wd x 2⅞" h; single tuned; adj iron core tuning; mtd by two stud bolts, spaced 15/16" c to c; 5 term., solder lug type; Collins Rad part/dwg No. 278 0100 00.	Input 455-kc, i-f band-pass filter.	
Z503	TRANSFORMER, IF: tuned ckt avc ampl; shielded; 27/32" lg x 27/32" wd x 2½" h; single tuned; adj iron core tuning; mtd by two stud bolts, spaced ⅝" c to c; 2 term., solder lug type; Collins Rad part/dwg No. 278 0101 00.	Agc amplifier.	
T401	TRANSFORMER, RF: 2 wdg, single layer; 7 to 12.6 mc; untapped; rectangular shield can, aluminum; 29/32" lg x 29/32" wd x 2⅛" h; adj iron core, scdr adj; two studs spaced .625" c to c; 4 term., solder lug type; Collins Rad part No. 278 0097 00.	Plate tuning for V401.	
T402	TRANSFORMER, RF: 2 wdg, single layer; 11 to 34 mc; rectangular shield can, aluminum; 29/32" lg x 29/32" wd x 2⅛" h; adj iron core, scdr adj; two studs spaced .625" c to c; 4 term., solder lug type; Collins Rad part No. 278 0098 00.	Plate tuning for V402.	
T701	TRANSFORMER, RF: 2 wdg, 190 μh nom, secd, 5 μh nom; not tuned; unshielded; 3" lg o/a, ⅜" OD; term. mtd; 4 wire lead term.; Delavan Manufacturing Co., per Collins Rad spec 240 0097 00.	V701 oscillator transformer.	
T201	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap w/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4 and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0162 00.	.5 to 1-mc antenna coil assembly.	
T202	TUNER ASSEMBLY, RF: aluminum housing; trimmer cap. w/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4, and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0165 00.	1- to 2-mc antenna coil assembly.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
T203	TUNER ASSEMBLY, RF: aluminum housing; adj trimmer cap. w/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4, and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0168 00; part of Sig C Radio Receiver R-391/URR.	2- to 4-mc antenna coil assembly.	
T204	TUNER ASSEMBLY, RF: aluminum housing; trimmer c/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4, and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0171 00.	4- to 8- mc antenna coil assembly.	
T205	TUNER ASSEMBLY, RF: aluminum housing; trimmer w/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4, and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0174 00.	8- to 16-mc antenna coil assembly.	
T206	TUNER ASSEMBLY, RF: aluminum housing; adj trimmer cap. w/scdr adj; 1.672" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed, tubular, ceramic dielectric cap. C2, fixed mica dielectric cap. C3, dual variable ceramic cap. C4, and trimmer cap. C5; plug-in type term.; Sickles FW per Collins Rad spec 278 0177 00.	16- to 32-mc antenna coil assembly.	
Z201, Z207, Z213	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2, and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0117 00.	Covers from .5- to 1-mc frequency.	
Z202, Z208, Z214	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2, and trimmer cap. C3. plug-in type term.; Sickles FW per Collins Rad spec 278 0121 00.	Covers from 1- to 2-mc frequency.	

2. Identification Table of Parts for Radio Receiver R-391/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
Z203, Z209, Z215	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.68" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2, and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0125 00.	Covers from 2- to 4-mc frequency.	
Z204, Z210, Z216	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2, and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0129 00.	Covers from 4- to 8-mc frequency.	
Z205, Z211, Z217	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2, and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0133 00.	Covers from 8- to 16-mc frequency.	
Z206, Z212, Z218	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1, fixed glass dielectric cap. C2 and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0137 00.	Covers from 16- to 32-mc frequency.	
Z219, Z220, Z221	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1 and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Rad spec 278 0183 00.	Covers from 9- to 18-mc frequency.	
Z222, Z223, Z224	TUNER ASSEMBLY, RF: aluminum housing; 1 trimmer cap. w/scdr adj; 1.168" lg x .918" wd x 2¼" h max; mtd by two #4-40 NC-2A tapped holes spaced .594" c to c, accom captive mach screw; principal parts c/o fixed mica dielectric cap. C1 and trimmer cap. C3; plug-in type term.; Sickles FW per Collins Radio spec 278 0141 00.	Covers from 3- to 2-mc frequency.	
Z502	TUNER, RF: slug tuning; 452 kc to 458 kc freq range; 3 term., solder lug type; 2-19/32" lg x 1½" dia; mtd by retaining nut on shaft; sealed unit; Collins Rad part/dwg No. 505 9204 004.	Bfo assembly.	
	WORM, gear: steel, cad pl; mtd on .1875" dia shaft.	Multiturn worm.	
	WORM, gear: steel, cad pl; ⅞" lg x 17/32" dia; mtd on .1875" dia shaft; Collins Rad part/dwg No. 506 0236 002.	Operates control unit.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	WRENCH: .094" dia across flats; 9½" lg x ½" dia; steel, cad or zinc pl; straight type; straight hex. handle; spcl for No. 8 Bristo setscrew; Collins Rad part/dwg No. 506 1946 002.	Wrench for removing setscrews.	

3. Identification Table of Parts for Power Cable Assembly CX-1358/U

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CABLE ASSEMBLY, power: 2 cond, stranded, #18 AWG, fillers, rubber jacket, 300 v rms max rated working voltage; 4" lg o/a; term. fittings on end, Hubbell plug type No. 7057, term. fittings on other end, 1 Winchester Electronics Connector, plug No. RA4S-PR-R; 41 strands, #34 AWG; Collins Rad part/dwg No. 505 8021 003; Power Cable Assembly CX-1358/U.	Power cable assembly.	
	CABLE, special purpose: electrical; two cond; bare copper; 41 strands #34 AWG; rubber; 300 v ac; 300" OD; Alpha Wire cat. No. 1952SC.	Main power cable.	
P2	CONNECTOR, plug: 2 male, flat cont; straight type; 1-5/32" lg excluding cont; 1-17/32" dia; cont, 10 amp or 15 amp, 250 v or 125 v cylindrical; 9/16" max cable opening; Harver Hubbell, Inc., mfg cat. No. 7057.	Main power cable male connector.	
P1	CONNECTOR, plug: 4 female, round cont; 90° angle; cont, 20 amp, 230 v ac rms; L shaped, brass, OD iridite, locking type; molded thermosetting plastic insert; .312" max cable opening; Amphenol type 164-42FS.	Main power cable female connector.	

4. Identification Table of Parts for Special Purpose Electrical Cable Assembly CX-2083/U

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CABLE ASSEMBLY, special purpose electrical: 1 cond, stranded, #16 AWG; shield, tinned copper braid; 78" lg o/a; term. fitting on 1 end, 1 Sig C socket insert plug, 164-44-FS(281) term. fitting on other end, 1 assy, connector AN-3106-12S-3P, adapter AN-3055-12-C, clamp AN-3057-3; Electrical Special Purpose Cable Assembly CX-2083( )/U (6 ft); Collins Rad No. 506 2158 003.	Autotune power cable assembly.	
	CABLE, POWER: electrical; one cond, #16 AWG, copper; 65 strands, #34 AWG; shield, tape or braid; ¼" dia o/a; Collins Rad part/-dwg No. 425 0892 00.	Autotune power cable.	

4. Identification Table of Parts for Special Purpose Electrical Cable Assembly CX-2083/U (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	CLAMP, electrical: aluminum alloy; fastening device, 2 bolt-type; 1" lg x 13/16" dia; Amphenol part No. AN3057-3.	Connects connector P2 to power cord.	
	CONNECTOR, adapter: 2 male, round cont; 2 female, round cont; straight type; ⅞" lg; 23/32" dia; body, cylindrical shaped, aluminum alloy, sand blast finish, locking type; mtg, two holes, one ⅝"-24 thd and one ½"-28 thd; 23/32" dia; Amphenol AN3055-12-3.	Adapter for connector P2.	
P1	CONNECTOR, plug: 9 male, round cont; straight type; approx 2¾" lg x approx 1½" wd x 1⅝" h; 10 amp 230 v ac rms, 15 amp 115 v ac rms; body, cylindrical shaped, brass, cad pl, locking type; molded thermosetting plastic insert; .281" max cable opening; Amphenol type No. 164-44FS(281).	Autotune power cable connector.	
P2	CONNECTOR, plug: 2 male, round cont; straight type; 1-11/16" lg; 1-1/16" dia; body, cylindrical shaped, locking type; .450 max cable opening; Amphenol AN-3106A-125-3P.	Autotune power cable connector.	

5. Identification Table of Parts for Power Supply PP-621/URR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
J818	CONNECTOR, receptacle: 15 male, round cont; straight type; 1½" lg x ¾" wd x .255" h; large cont 15 amp, small cont 5 amp, 500 v ac; body, rectangular, phenolic; mtg, 2 holes .3" dia, 1.188" c to c; Amphenol 26-151.	Input and output plug of power supply.	
V801, V802	ELECTRON TUBE: twin diode; glass envelope; full-wave rect; type 26Z5W.	Rectifier tubes.	
	POWER SUPPLY: electronic type; two 25Z5W tubes; full wave; output, dc 180 v, 12.6 v, 200 ma, 1.1 amp, unregulated; ac, 25.2 v, 5.6 amp, unregulated; input, ac, 115 v or 230 v, 48 to 62 cyc, 1-ph, 250 w; 6¾" lg x 4⅛" wd x 5⅞" h; four .218" mtg holes spaced 3.562" x 3.375" c to c; Collins Rad.	Provides 180 vdc, 200 ma; and 12.6 vdc, 1.1 amp., unregulated.	
CR801	RECTIFIER, metallic: magnesium-copper-sulphide; 1-ph bridge ckt; input, 13 v ac, 1-ph; output, 6.5 v dc, 1.1 amp full-wave rect cylindrical shaped; 2⅛" lg x 19/32" dia; 1 stud, ¼" lg 10-32 thd, located at one end; 2 solder lug type term.; Mallory type 1B16R.	Supplies break-in relay voltage.	
R801, R802, R803, R804	RESISTOR, fixed: comp; 47 ohms ±10%; 2 w; .750" lg x .370" dia; JAN RC42BE470K.	V801 cathode voltage dropping resistors.	
E801, E802	SHIELD, electron tube: copper or brass; cylindrical shaped; 1-15/16" lg x .950" dia; bkt mtd; JAN TS103U02.	Tube shields for V801.	

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
XV801, XV802	SOCKET, electron tube: 9 cont; miniature; 1⅜" lg x .940" wd x 1-3/16" h; ceramic, L-4B; one piece saddle mtg; 2 mtg holes, .125" dia, spaced 1.125" c to c; JAN TS103C01.	XV801: Socket for tube V801. XV802: Socket for tube V802.	
S801	SWITCH, toggle: DPDT; 30 amp, 230 v ac; phenolic; ¾" lg x 49/64" wd x 1-21/64" h; 6 term., solder lug type; single hole mtg type, 15/32" dia bushing, JAN ST52N.	115- and 230-volt switch.	
T801	TRANSFORMER, power: step-down and step-up; HS; metal; input, 112/230 v ac, 48 to 62 cps, 1-ph; 2 output wdg, No. 1 secd 285 v 200 ma, No. 2 secd 25.2 v 5.6 amp; 4-5/16" lg x 4⅛" wd x 5-9/32" h; 10 term.; four 10-32 NF-2 mtg studs 9/16" lg, 3.562" to 3.375" c to c; Chi Trans div 17059.	A-c and d-c power supply transformer.	

6. Identification Table of Parts for Power Supply PP-629/URR

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
	POWER SUPPLY PP-629/URR: metallic type; output 28 v dc; 17 amp; 115-230 v ac; input 115-230 v ac, .60 cyc, 1-ph; 600 w; 19" lg x 14-5/16" wd x 10-15/32" h.	28-volt, d-c power supply.	
	CABLE, power: electrical; 2 stranded #18 AWG cond; UL type SJ modified; ins and jacket per Army spec 71-4945.	Power cable.	
	CONNECTOR, plug: 2 flat male cont; straight type; 2-19/32" lg x 1.531" dia o/a; 10 amp, 250 v; 15 amp, 125 v; Hubbell 7057.	For use with power cable at power source.	
	CONNECTOR, plug: 4 female round cont; 90° angle type; 2-15/32" lg x 1-7/16" wd x 1-19/32" h o/a; Winchester part RA4S-PR-R.	For connecting power cable assembly to J1131.	
J1133	CONNECTOR, receptacle: 2 round female cont; straight type; 1¼" lg x 1-3/32" sq x .782" OD o/a; Amphenol AN3102-12S-35.	28-volt, d-c output connector.	
J1132	CONNECTOR, receptacle: 4 round female cont; straight type; 1" lg x 1-15/32" dia; 20 amp, 800 v rms; Amphenol 164-1.	28-volt, d-c and 115- to 230-volt a-c output connector.	
J1131	CONNECTOR, receptacle: 4 round male cont; straight type; 1" lg x 1-15/16" dia; 20 amp, 800 v rms; Winchester type RA4P-PR-R.	Power input receptacle.	
	COVER, fuse: aluminum; 1-13/16" lg x 1-7/16" wd x 9/16" h; Collins Rad part/dwg No. 505 8038 002.	Protects spare fuses.	
	COVER, terminal board: aluminum; 4-3/64" lg x 2-1/32" wd x 1" h; Collins Rad part/dwg No. 505 8026 002.	Protects terminal board TB1101.	
F1101	FUSE FU-21: 10 amp, 25 v; instantaneous; 1¼" lg x ¼" dia; Littelfuse type 3AG No. 314010.	A-c line fuse.	
	FUSEHOLDER: extractor post type; for cartridge type fuses; 1.672" lg x .690" dia; Littelfuse cat. No. 342003.	Holds fuses.	

6. Identification Table of Parts for Power Supply PP-629/URR (Contd)

Ref symbol	Name of part and description	Function of part	Signal Corps stock No.
I1101	LAMP, incandescent: 28 v, .17 amp; miniature bayonet type; T-3¼, clear; GE type Mazda 313.	Pilot lamp bulb.	
	LIGHT, indicator: smooth white lens; accom T-3¼ lamp, miniature bayonet base; 1-21/32" lg x 13/16" dia; 2 solder lug term.; Dialco type No. 52410-99.	Pilot lamp.	
CR1101	RECTIFIER, metallic: 1-ph full-wave ckt; input 33.5 v ac; output 28 v dc, 17.2 amp; 9¼" lg x 6" wd x 7" h o/a; Fansteel Metallur cat. No. BRO-52T.	Converts ac to dc.	
R1101	RESISTOR, fixed: WW 310 ohms ±5%; 7 w; 1" lg x 19/32" dia; JAN type RW30G311.	Current limiting resistor for pilot lamp.	
S1101	SWITCH, toggle; DPDT; 25 amp, 125 v ac; 1-1/16" lg x 49/64" wd x 1-21/64" h; 6 term.; JAN type ST52N.	115-volt to 230-volt switch.	
S1102	SWITCH, toggle: SPST; 15 amp, 125 v ac; 1-9/64" lg x 41/64" wd x 1-1/16" d; 2 term.; JAN type ST42A.	ON-OFF switch.	
	THUMBSCREW: round thumb type head; #6-32 thd, ¼" lg; 21/32" lg o/a; Collins Rad part/dwg No. 505 8039 002.	To fasten fuse cover.	
T1101	TRANSFORMER, power; step down: input 115/230 v ac, 60 cyc, 1-ph; output 1 wdg, 33.5 v; 17 amp; 6-1/16" lg x 5¼" wd x 7⅛" h; Chi Trans div, Essex Wire type No. 16669.	Converts 115 volts or 230 volts ac to 33.5 volts ac.	

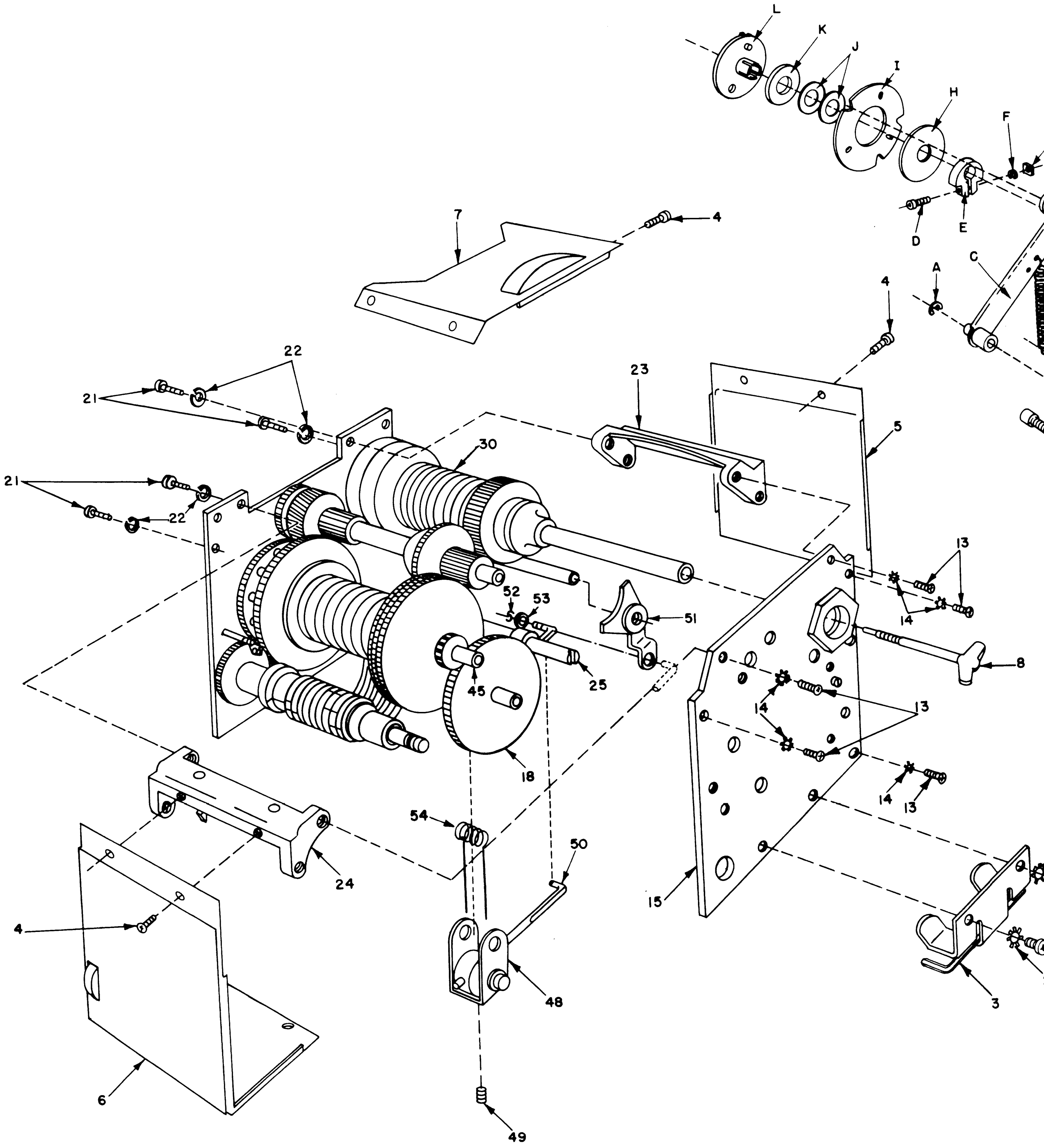
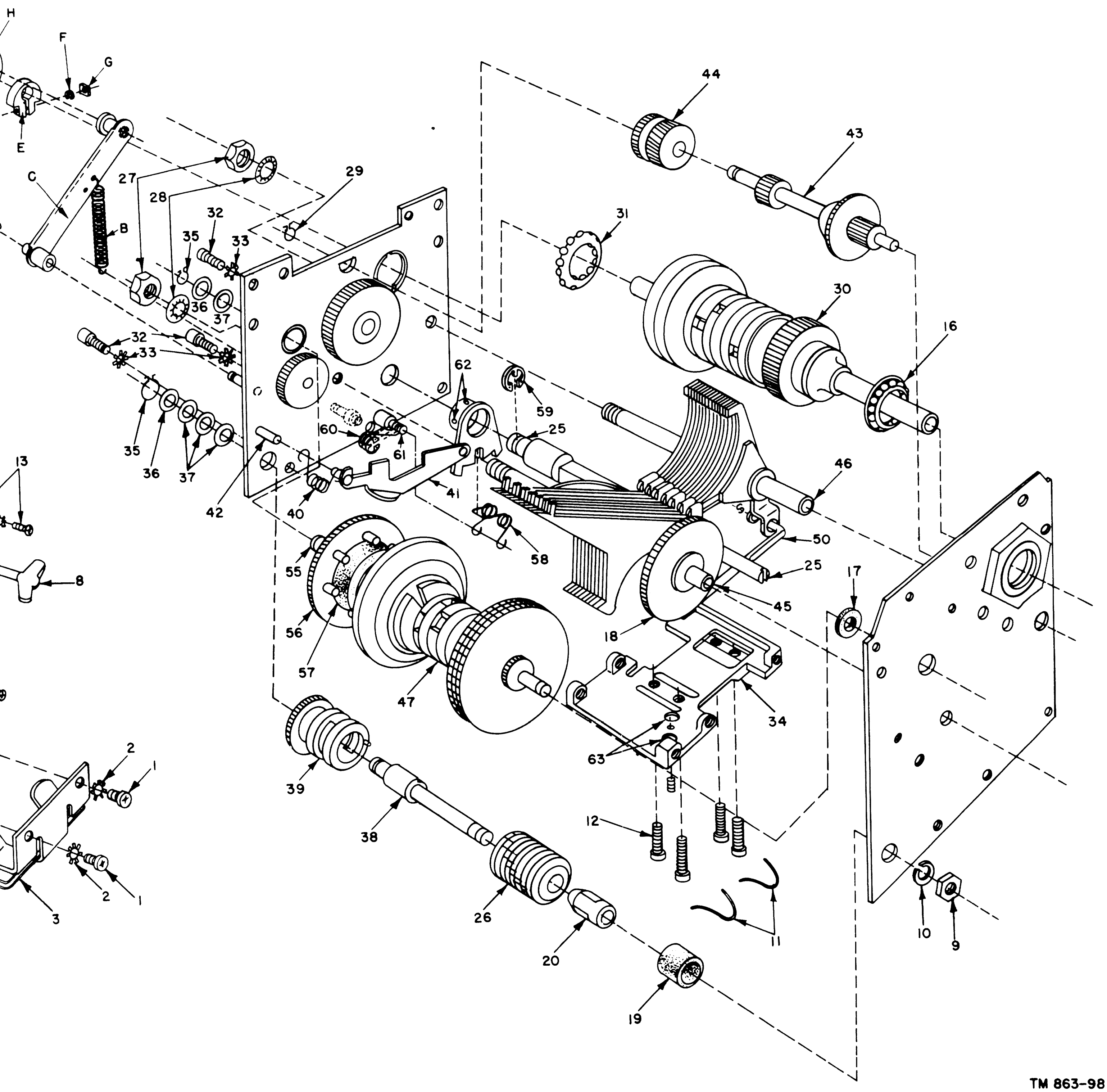


Figure 109. Disassembly of Autotune mu



Autotune multiturn positioning head.

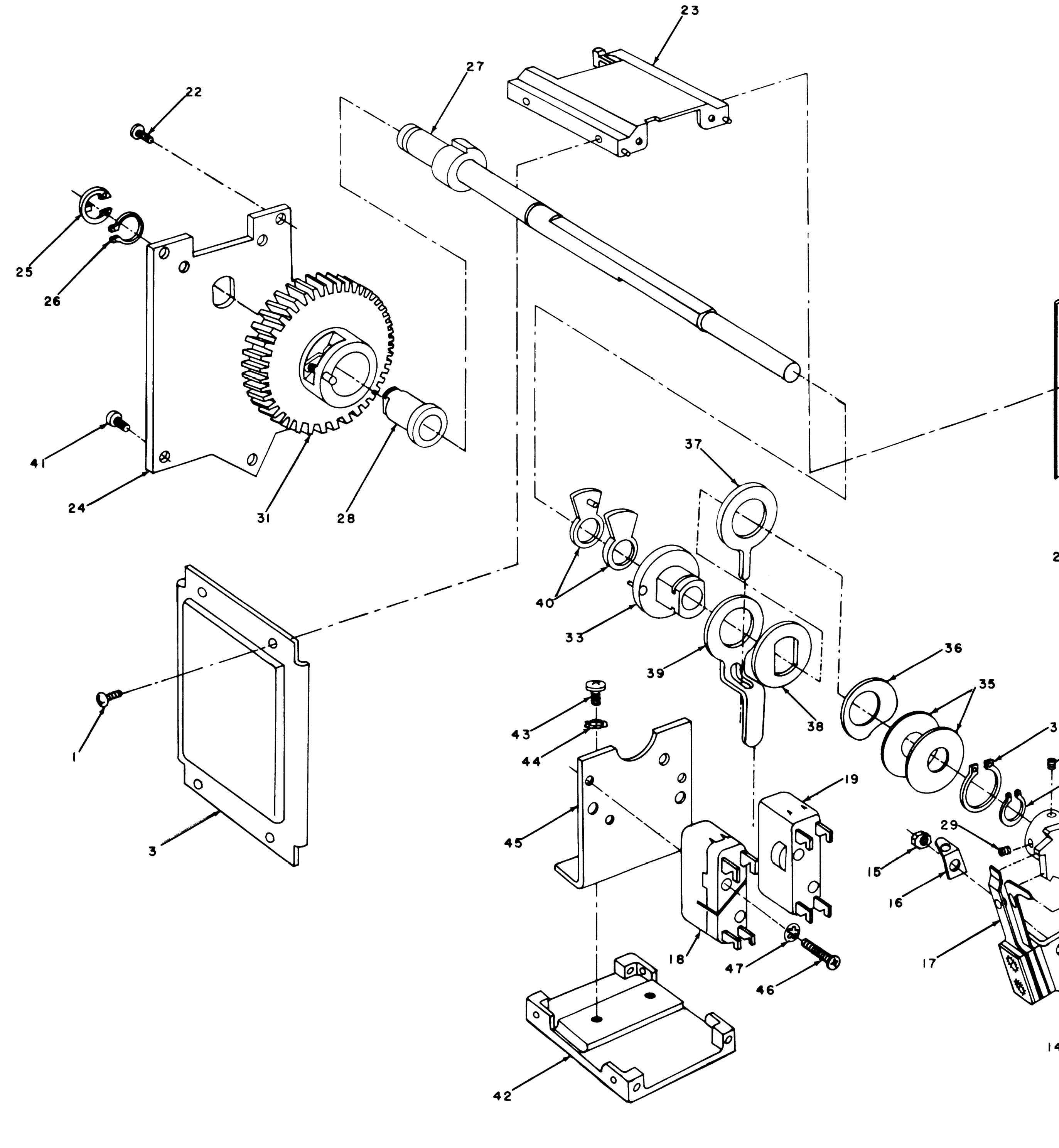
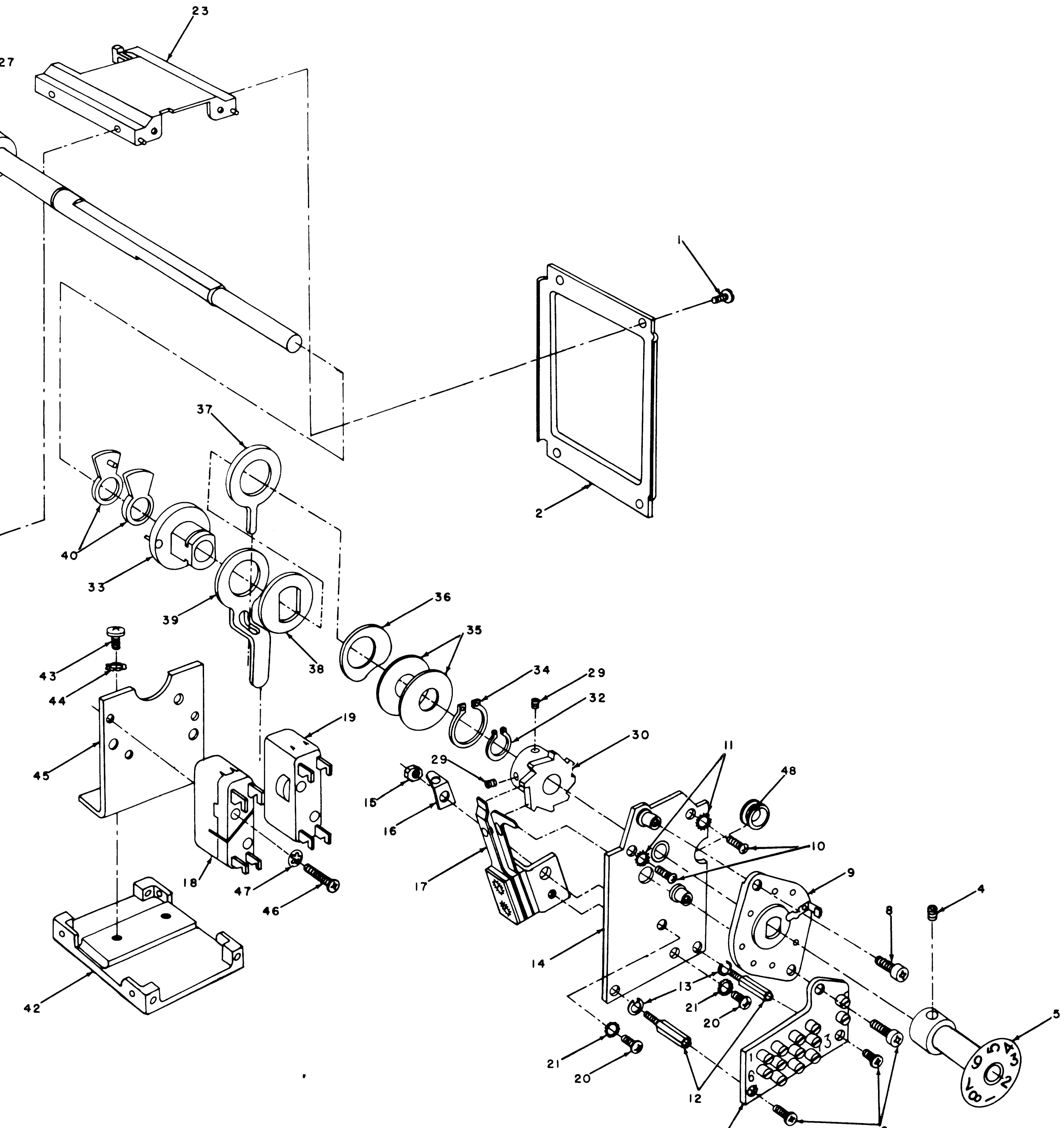


Figure 110. Dissassembly of Autotune control he



TM863-99

Figure 110. Dissassembly of Autotune control head.

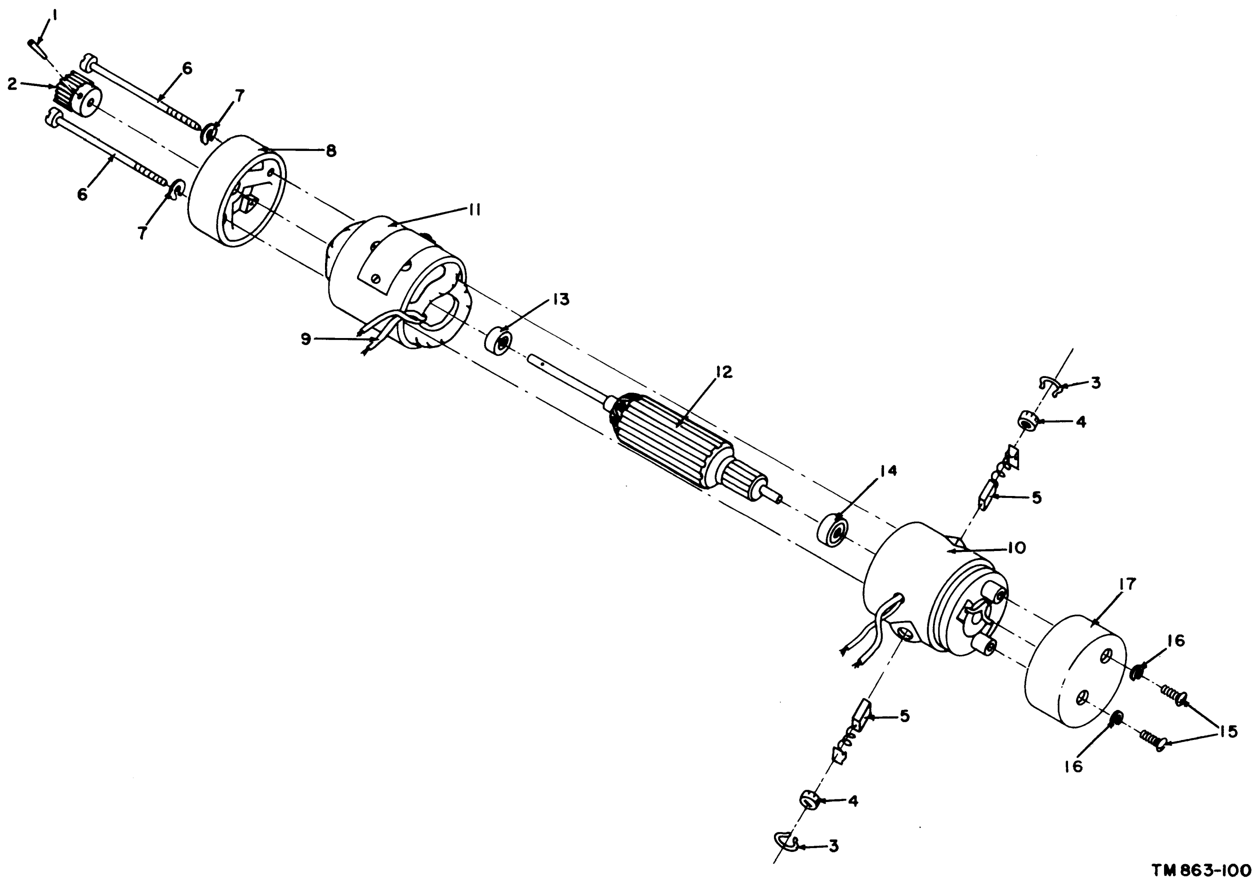
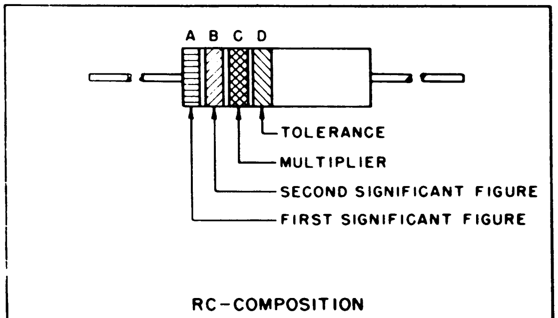
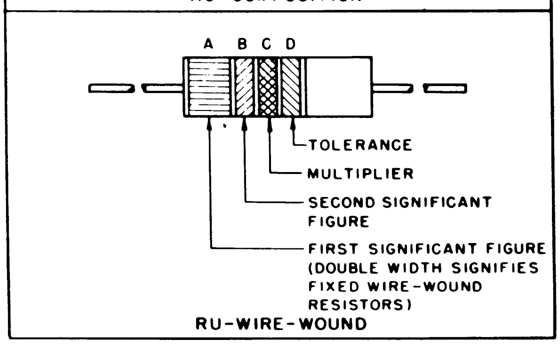


Figure 111. Disassembly of Autotune motor.

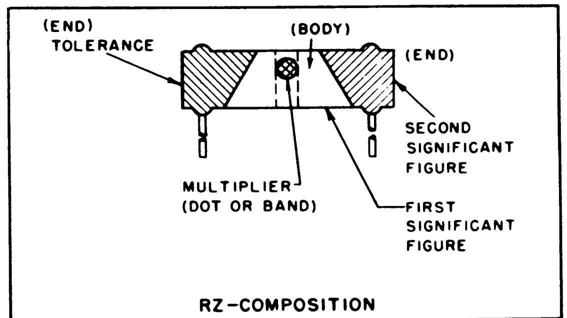
RESISTOR COLOR CODE MARKING
(MIL-STD RESISTORS)

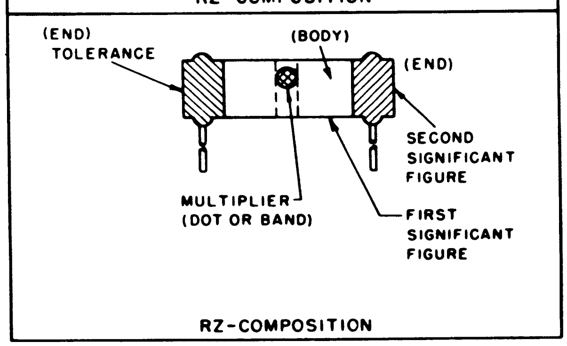
AXIAL-LEAD RESISTORS (INSULATED)





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.

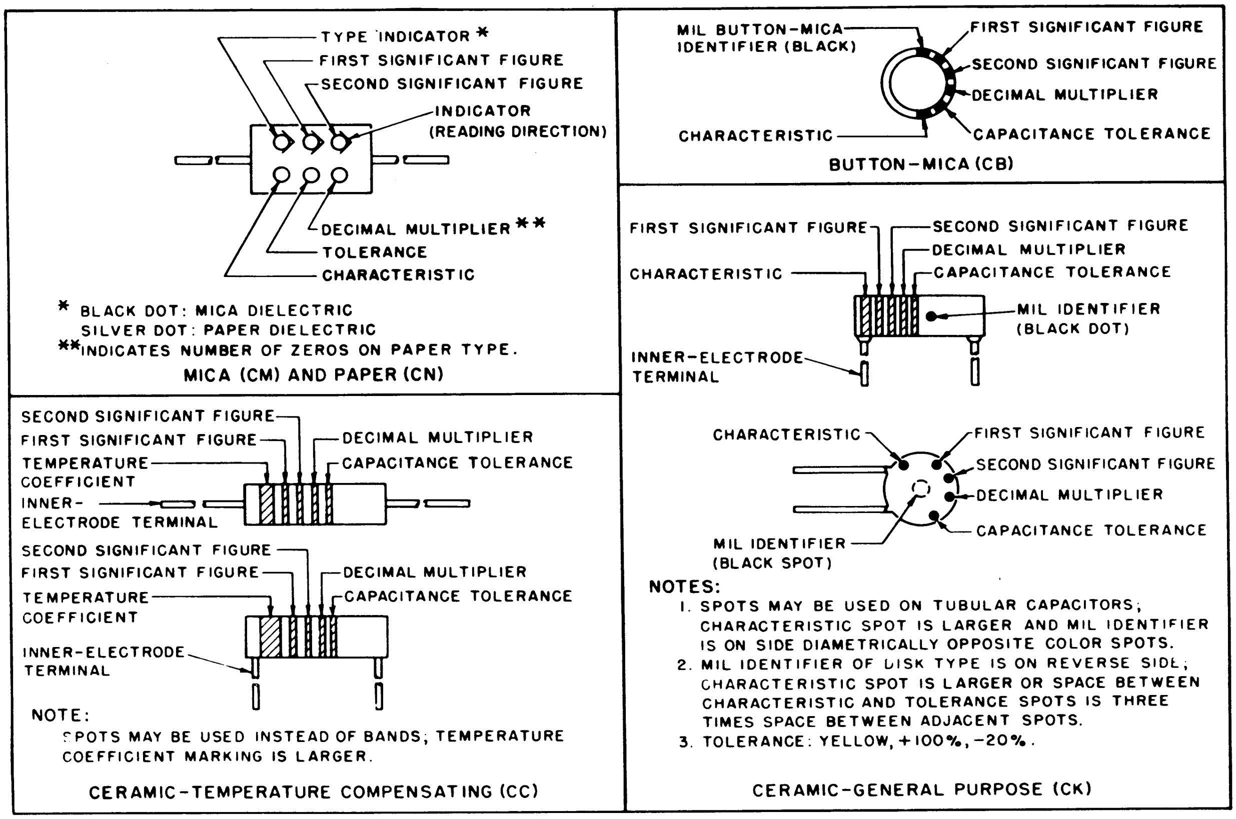
EXAMPLES (BAND MARKING):
10 OHMS ±20 PERCENT: BROWN BAND A; BLACK BAND B; BLACK BAND C; NO BAND D.
4.7 OHMS ±5 PERCENT: YELLOW BAND A; PURPLE BAND B; GOLD BAND C; GOLD BAND D.

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-R1

Figure 112. Resistor color codes.

CAPACITOR COLOR CODE MARKING
(MIL-STD CAPACITORS)



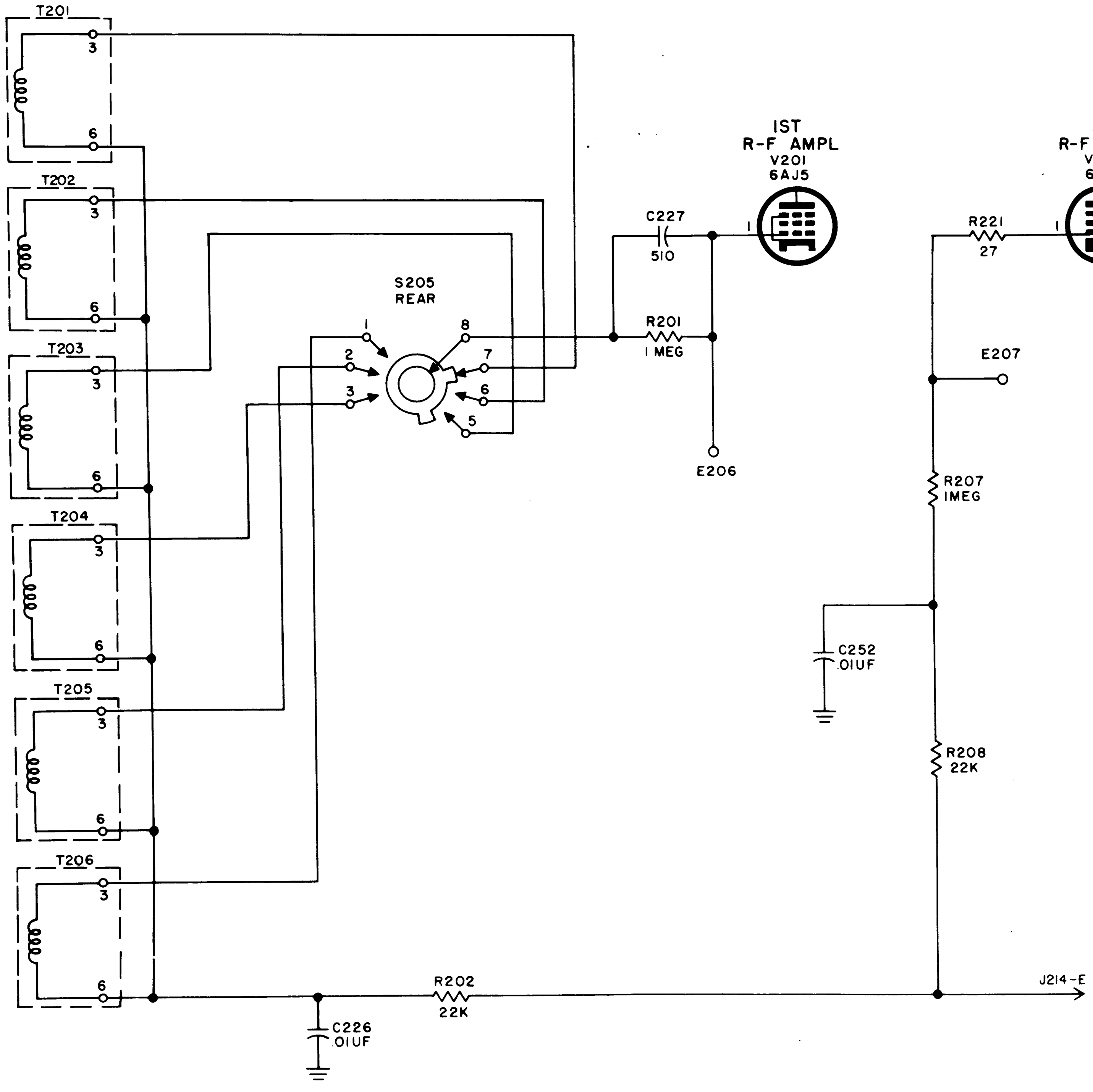
CAPACITOR COLOR CODE

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	CC 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-C1

Figure 113. Capacitor color codes.


T201
T202
T203
T204
T205
T206
S205
REAR
IST
R-F AMPL
V201
6AJ5
C227
510
R201
I MEG
E206
R221
27
E207
R207
IMEG
C252
.01UF
R208
22K
R202
22K
C226
.01UF
J214-E
R-F

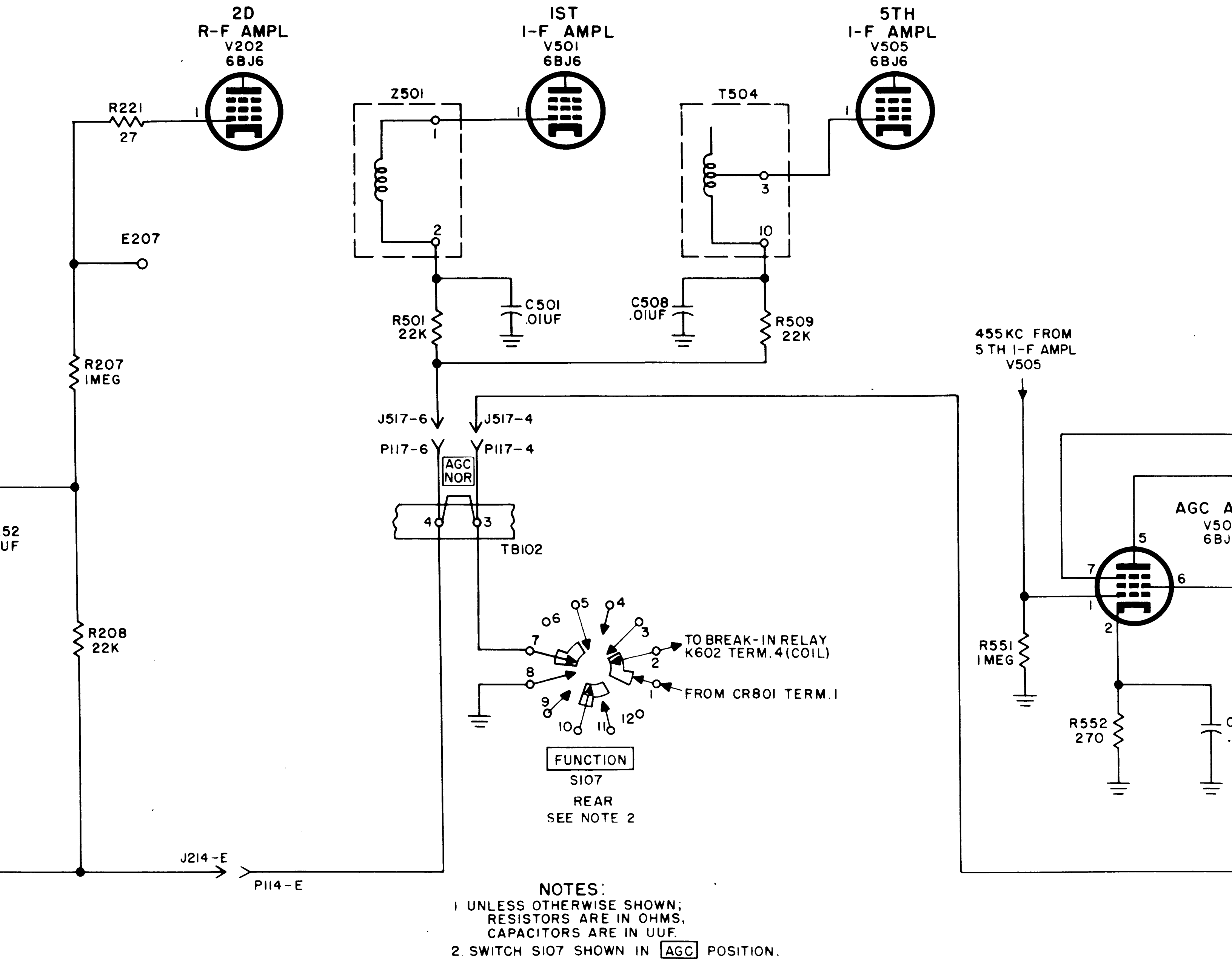
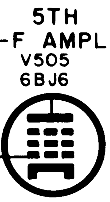
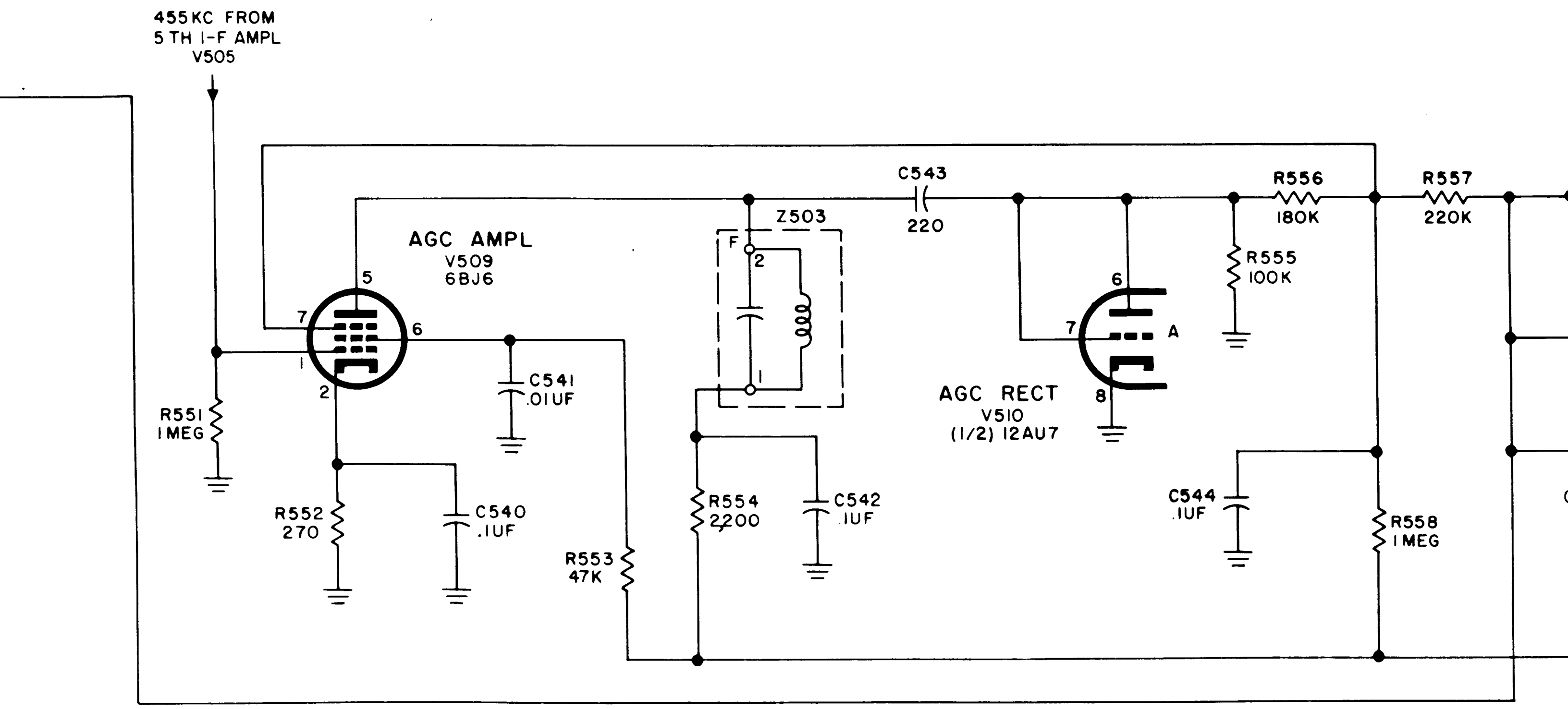
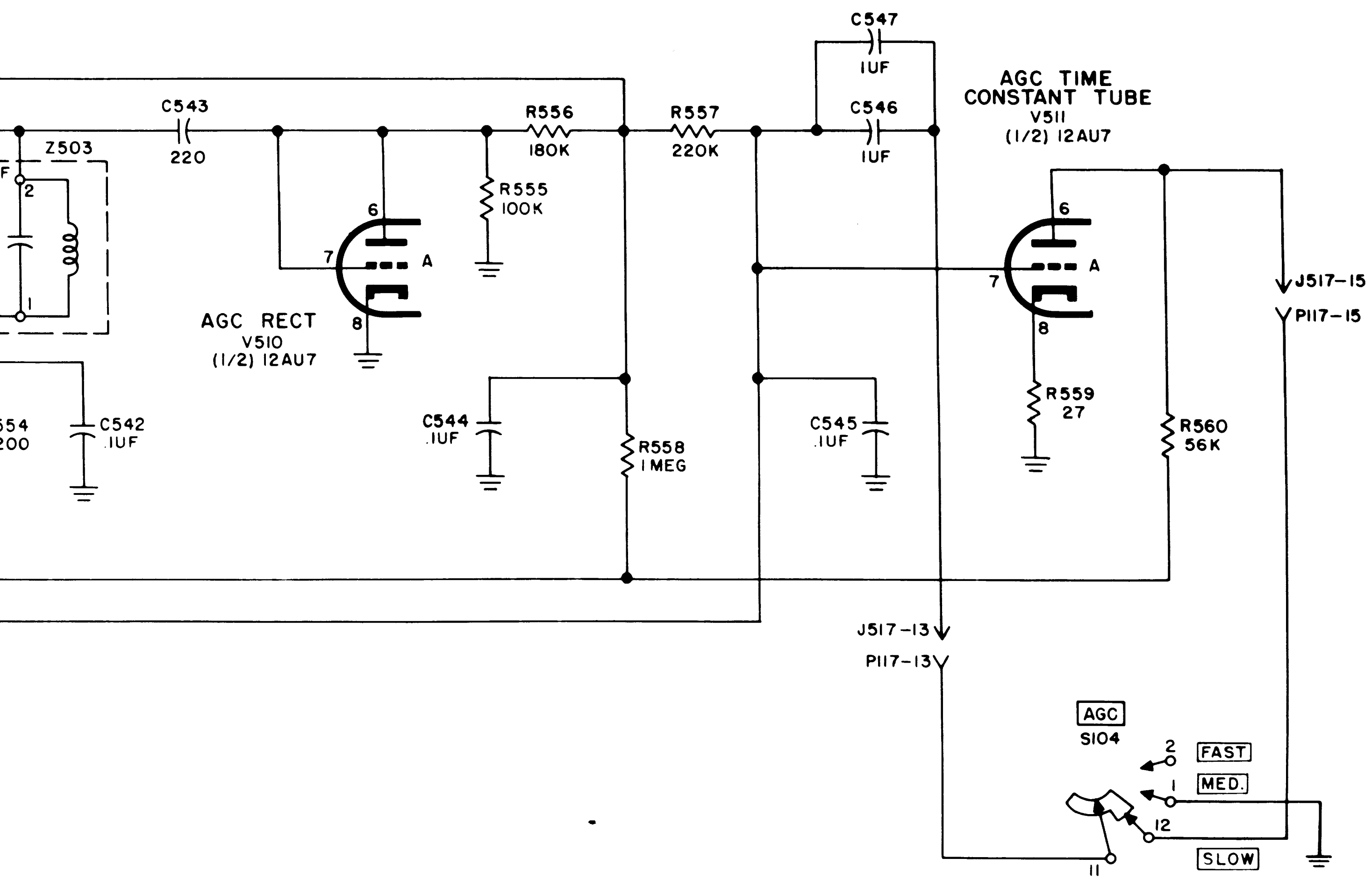


Figure 114. Agc voltage distribution.



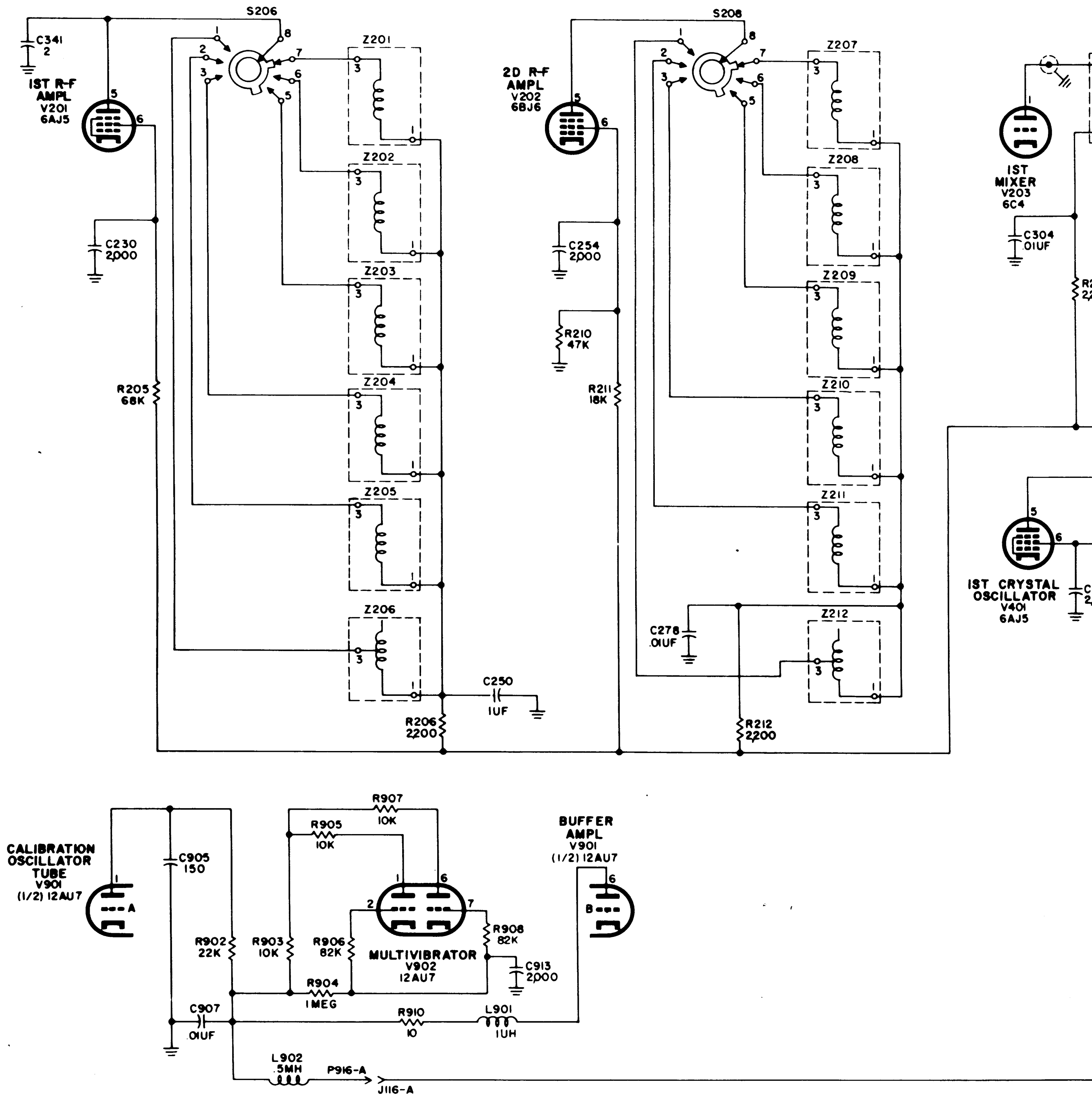


ltage distribution.



C547
1UF
AGC TIME
CONSTANT TUBE
V511
(1/2) 12AU7
C543
220
R556
180K
R557
220K
C546
1UF
Z503
R555
100K
6
7
A
8
AGC RECT
V510
(1/2) 12AU7
J517-15
P117-15
R559
27
R560
56K
C542
.1UF
C544
.1UF
R558
1MEG
C545
.1UF
J517-13
P117-13
AGC
S104
FAST
MED.
SLOW

TM 856-88



S206
C341
2
IST R-F
AMPL
V201
6AJ5
Z201
Z202
Z203
Z204
Z205
Z206
C230
2,000
R205
68K
C250
1UF
R206
2200
S208
2D R-F
AMPL
V202
6BJ6
Z207
Z208
Z209
Z210
Z211
Z212
C254
2,000
R210
47K
R211
18K
C278
.01UF
R212
2200
IST
MIXER
V203
6C4
C304
.01UF
IST CRYSTAL
OSCILLATOR
V401
6AJ5
CALIBRATION
OSCILLATOR
TUBE
V901
(1/2) 12AU7
C905
150
R902
22K
R903
10K
R905
10K
R907
10K
R906
82K
R904
1MEG
MULTIVIBRATOR
V902
12AU7
R908
82K
C913
2000
BUFFER
AMPL
V901
(1/2) 12AU7
C907
.01UF
R910
10
L901
1UH
L902
.5MH
P916-A
J116-A

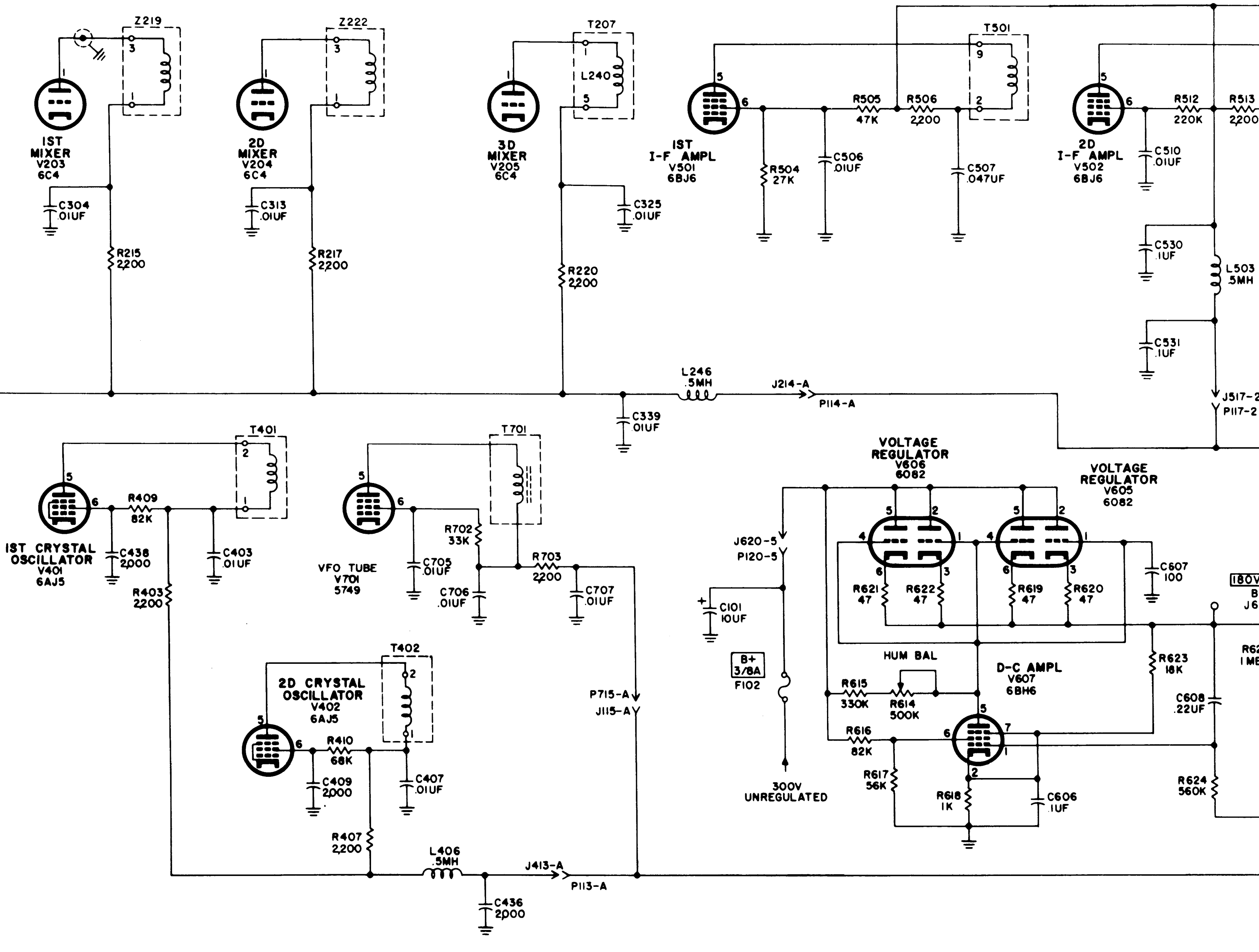


Figure 115. B+ voltage di

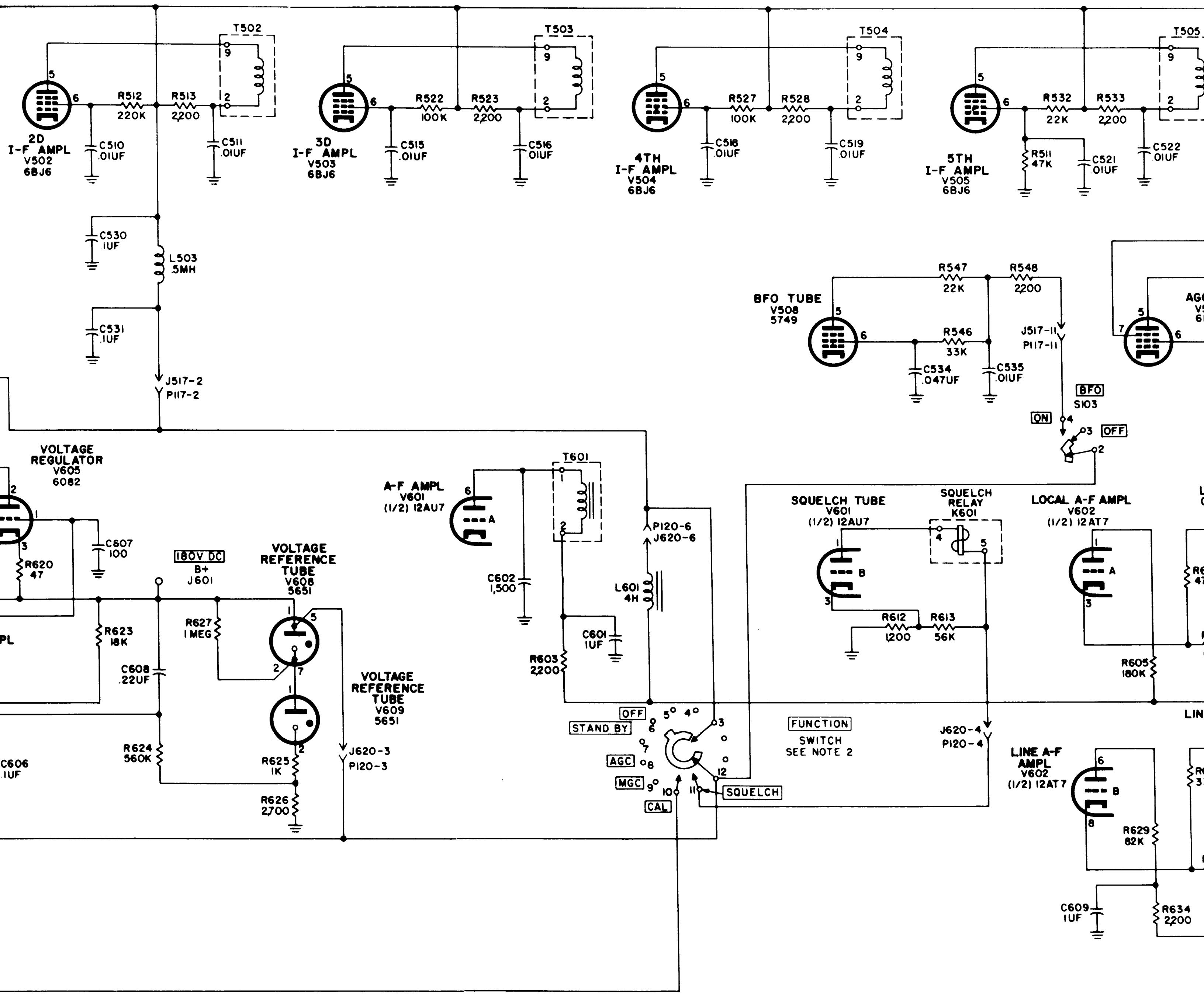
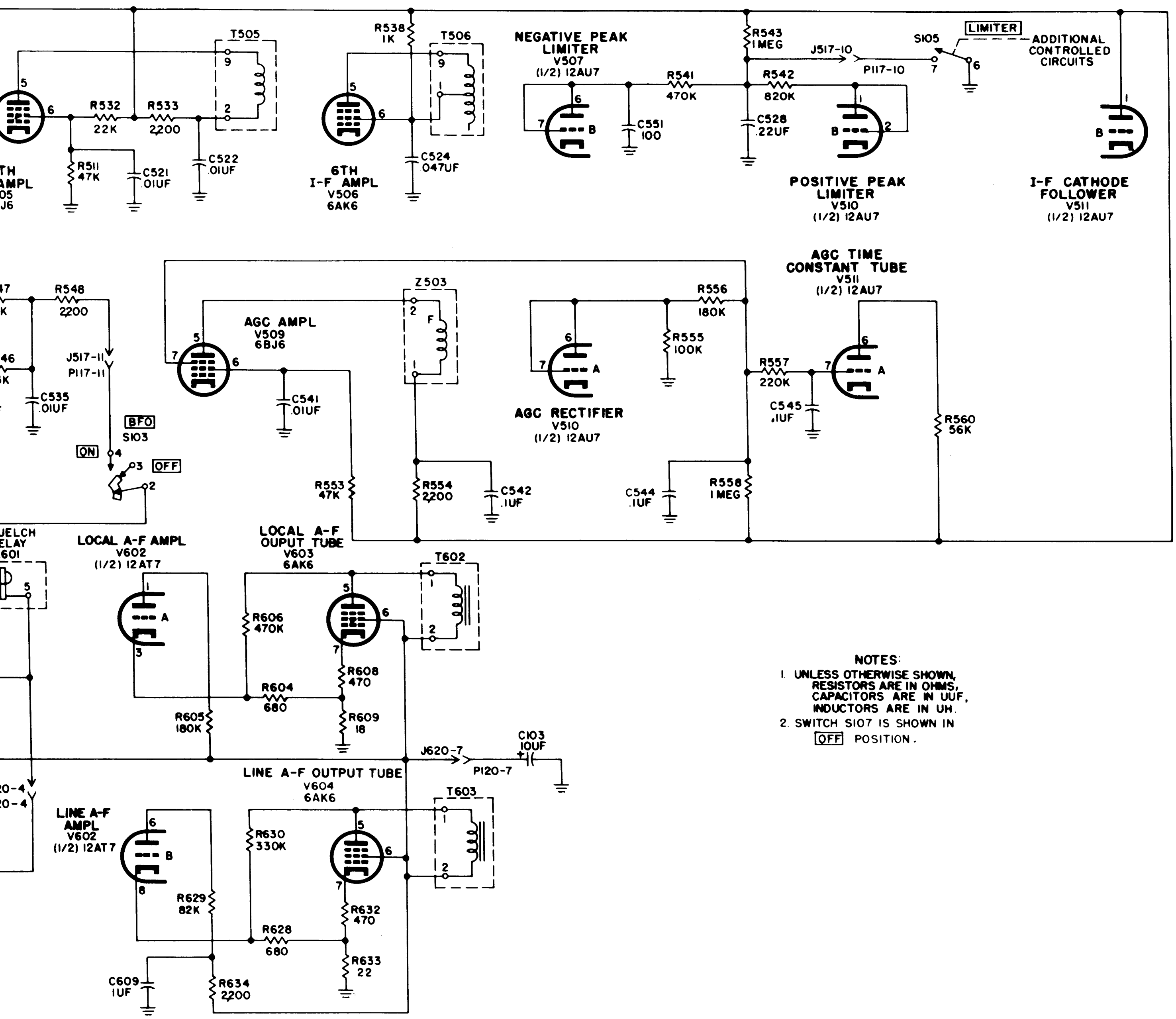


Figure 115. B+ voltage distribution.



NOTES:
1. UNLESS OTHERWISE SHOWN, RESISTORS ARE IN OHMS, CAPACITORS ARE IN UUF, INDUCTORS ARE IN UH.
2. SWITCH S107 IS SHOWN IN OFF POSITION.

TM 856-25

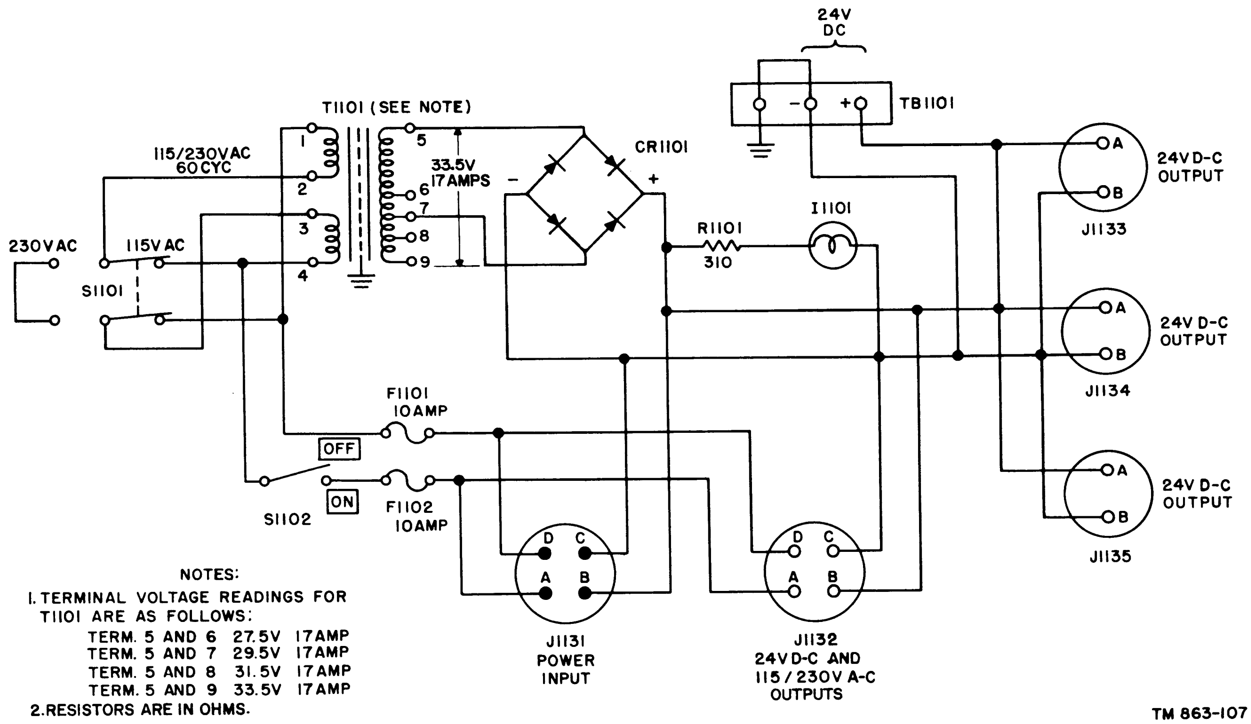
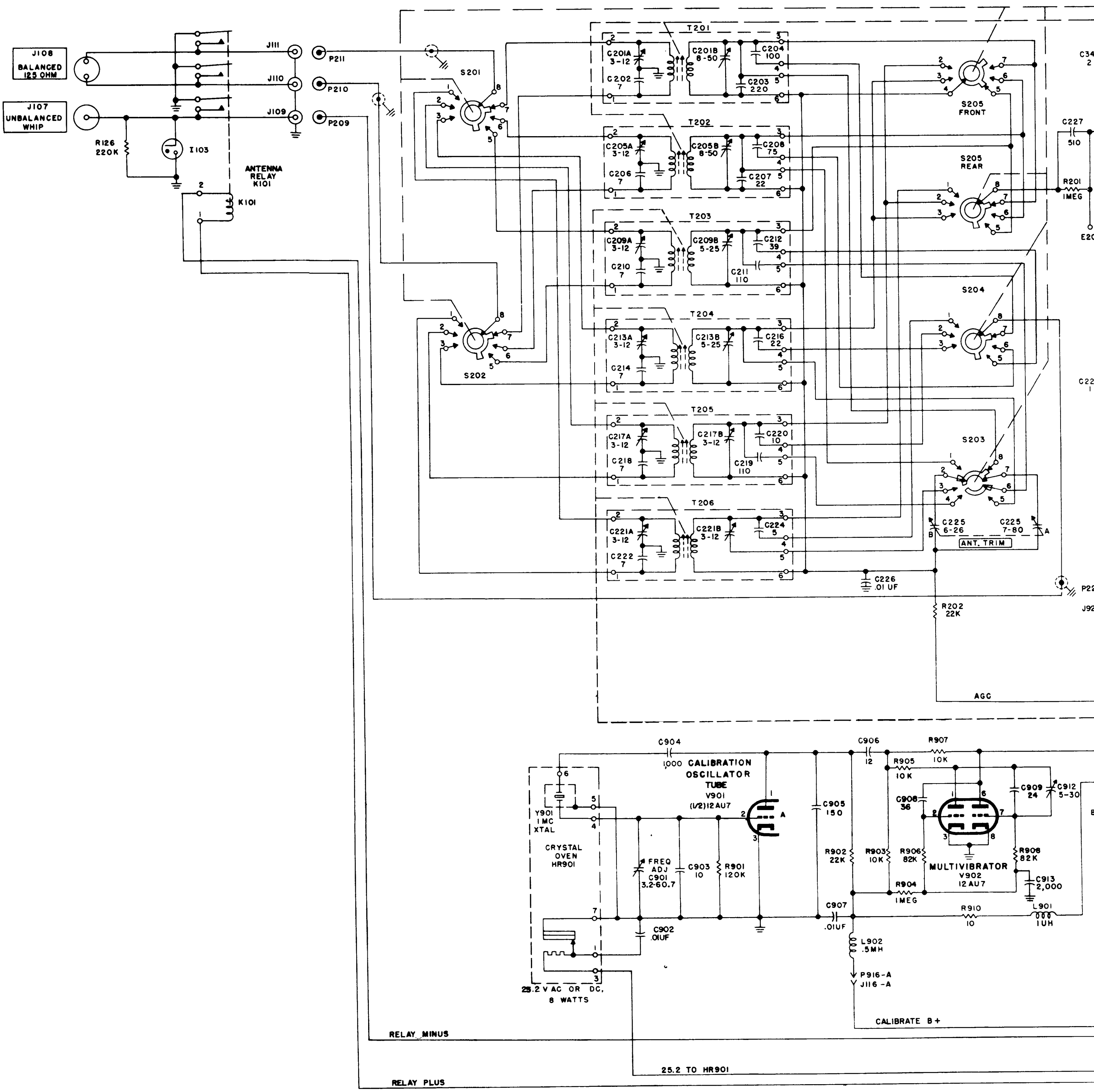


Figure 117. Power Supply PP-629/URR, schematic diagram.


J108 BALANCED 125 OHM
J107 UNBALANCED WHIP
R126 220K
I103
ANTENNA RELAY K101
J111
J110
J109
P211
P210
P209
S201
S202
T201
T202
T203
T204
T205
T206
S205 FRONT
S205 REAR
S204
S203
ANT. TRIM
C226 .01 UF
R202 22K
R201 1MEG
C227 510
AGC
C904 1000
CALIBRATION OSCILLATOR TUBE V901 (1/2)12AU7
Y901 1MC XTAL
CRYSTAL OVEN HR901
FREQ ADJ C901 3.2-60.7
C903 10
R901 120K
C902 .01UF
25.2 V AC OR DC, 8 WATTS
C905 150
C906 12
R907 10K
R905 10K
R902 22K
R903 10K
R906 82K
R908 82K
R904 1MEG
MULTIVIBRATOR V902 12AU7
C909 24
C912 5-30
C913 2,000
R910 10
L901 1UH
C907 .01UF
L902 .5MH
P916-A J116-A
CALIBRATE B+
RELAY MINUS
25.2 TO HR901
RELAY PLUS

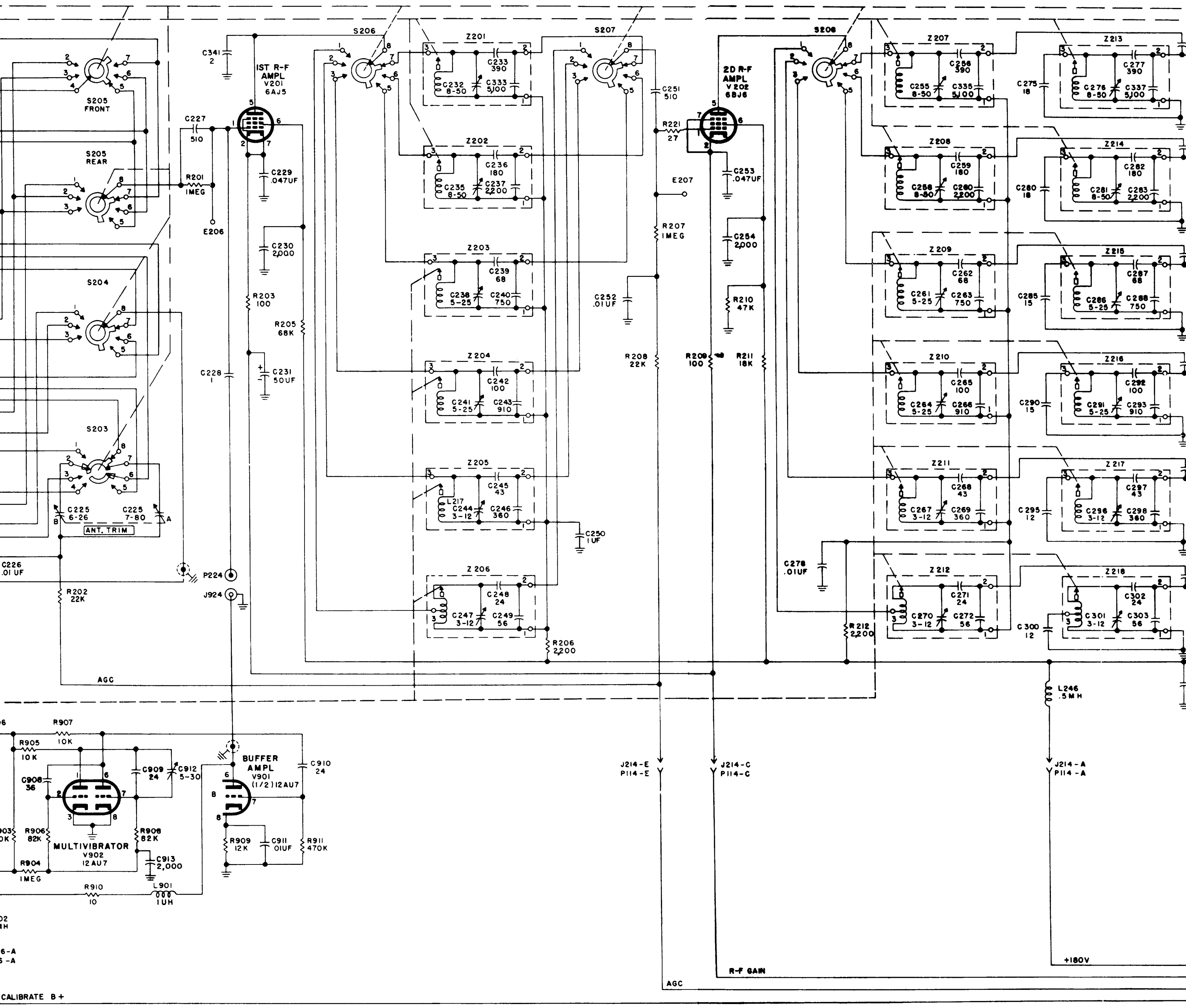
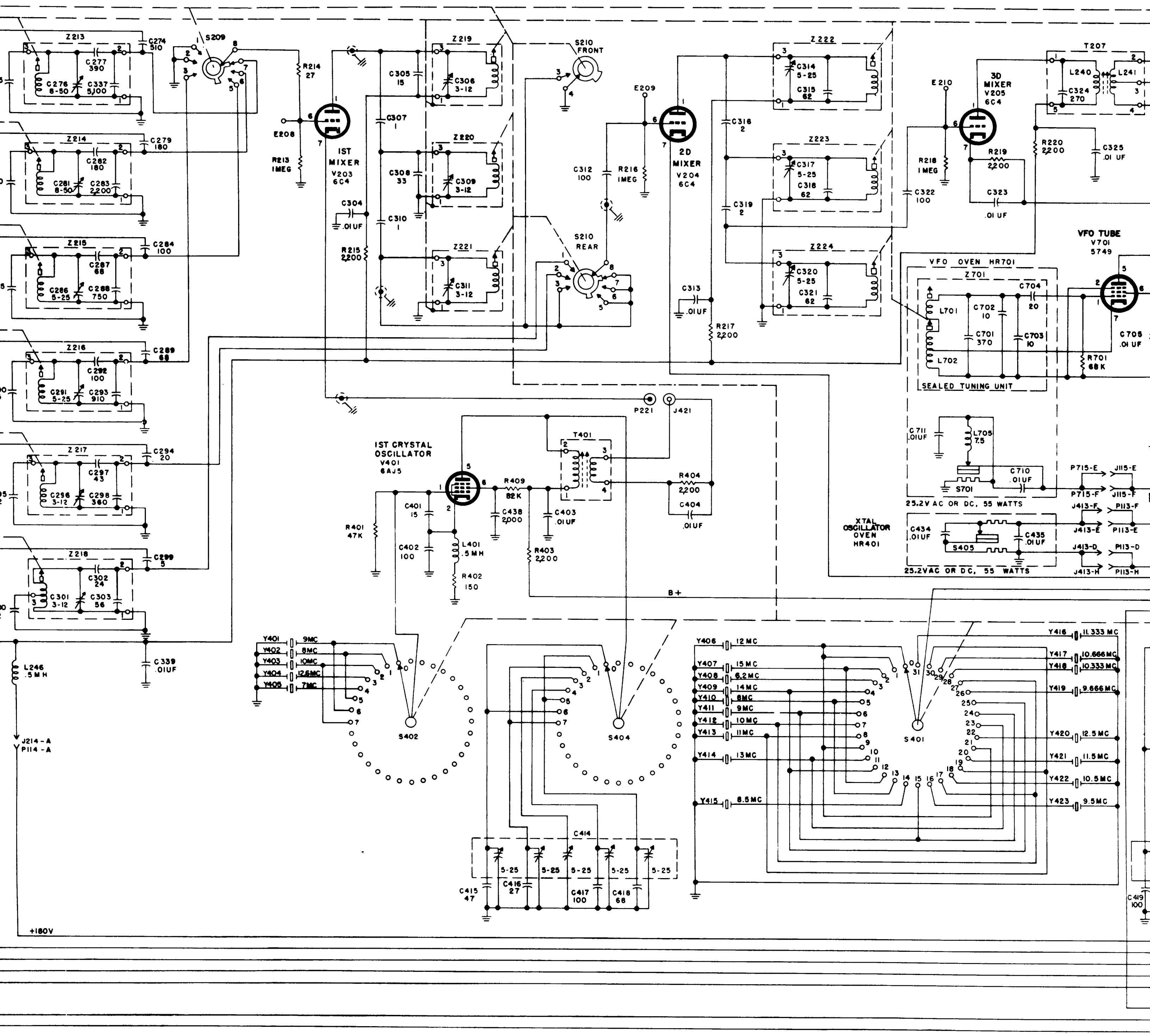
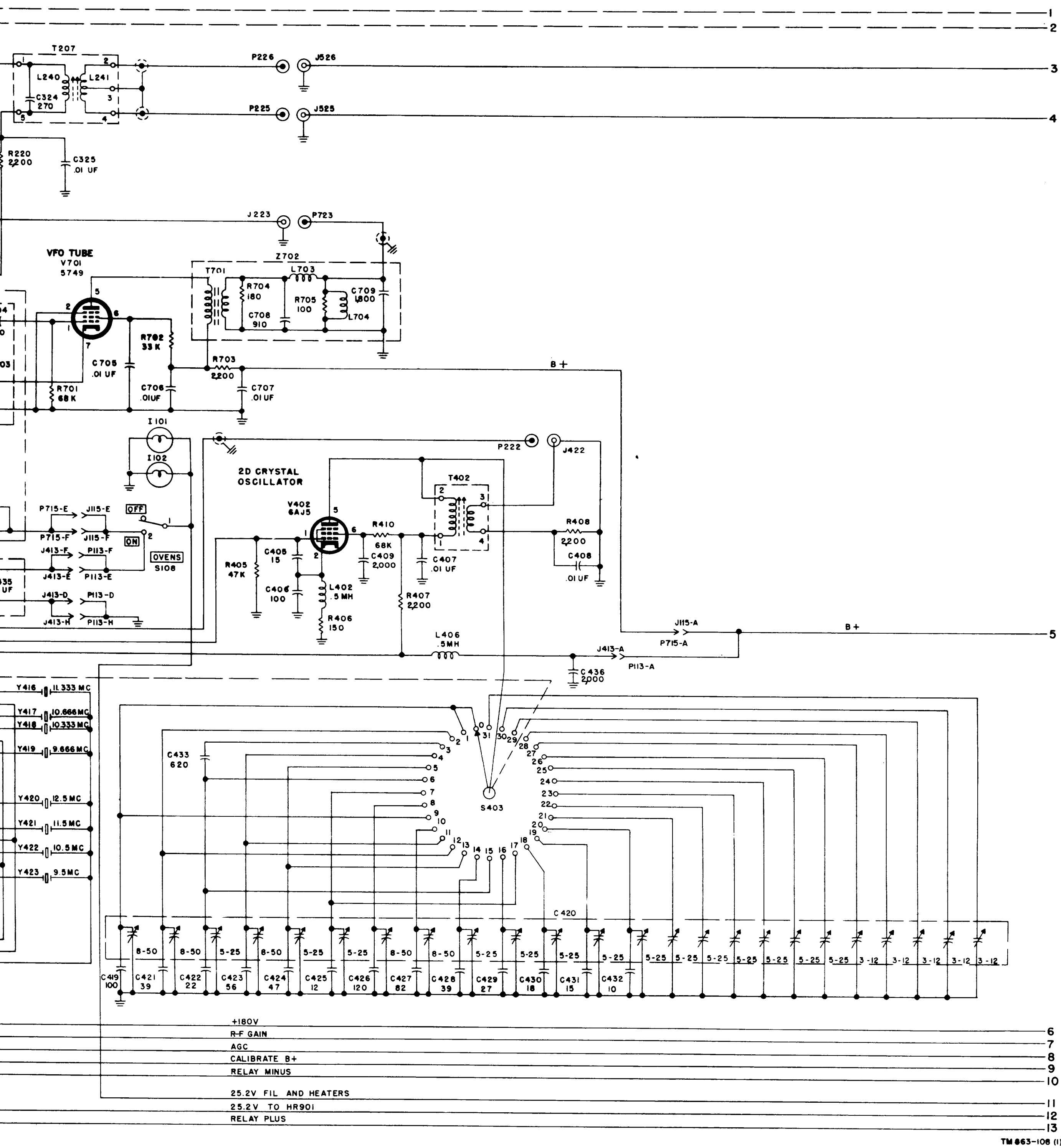


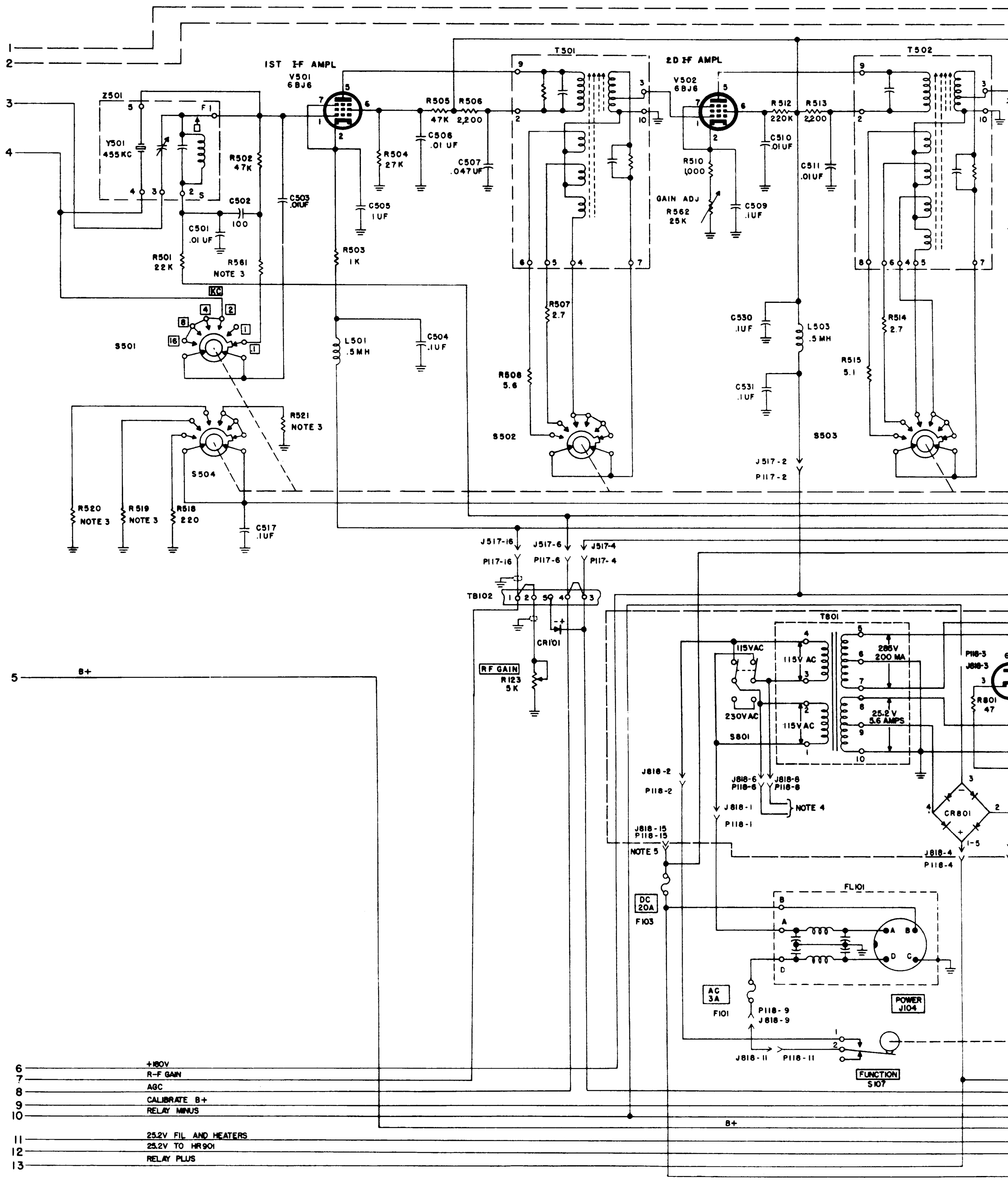
Figure 118. Radio Receiver R-391/



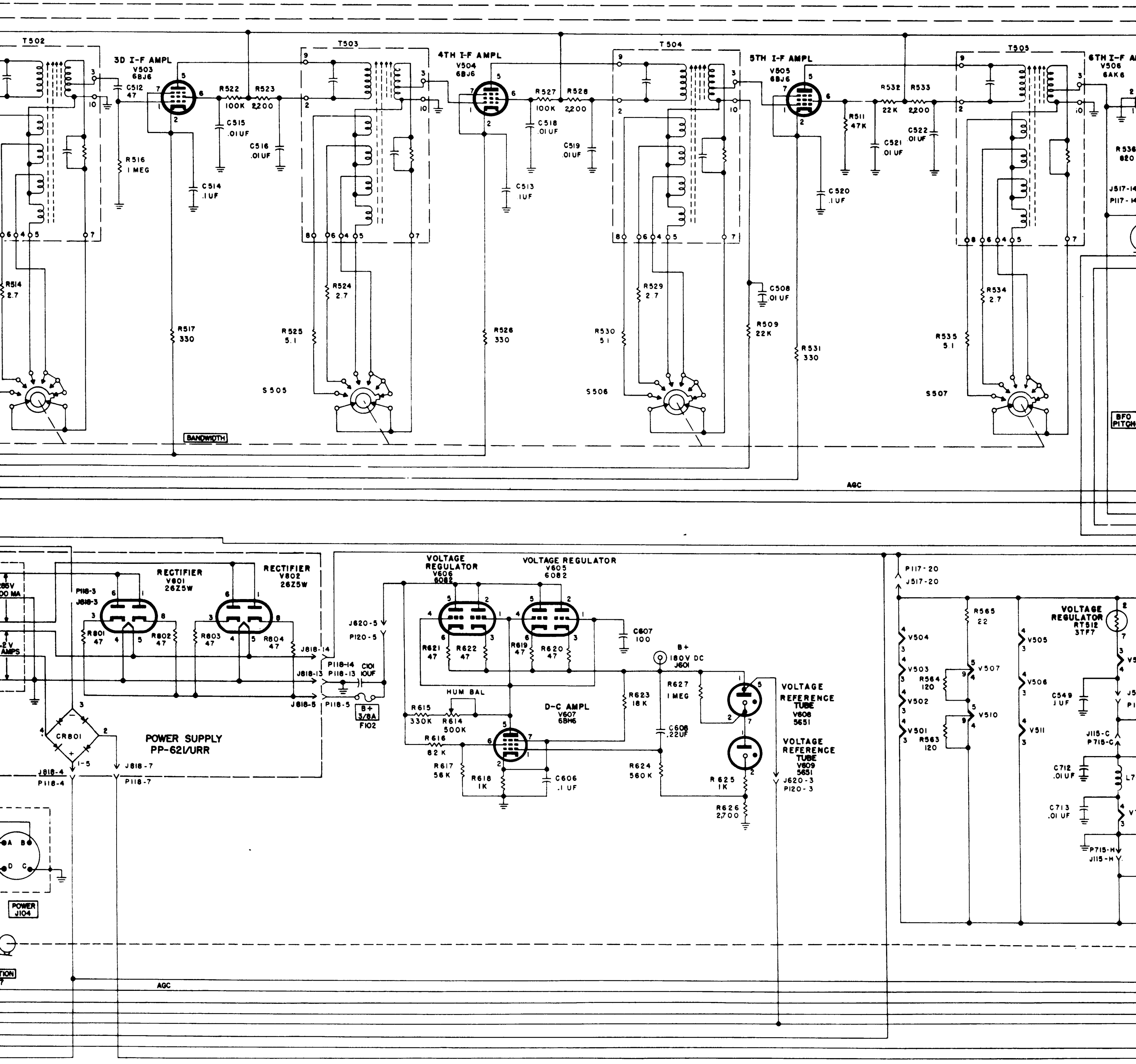
adio Receiver R-391/URR, schematic diagram. (sheet 1 of 2 sheets).


T207
L240
L241
C324 270
P226
J526
P225
J525
R220 2200
C325 .01 UF
J223
P723
VFO TUBE
V701
5749
T701
Z702
L703
R704 180
C708 910
R705 100
C709 1800
L704
R702 33 K
C705 .01 UF
R703 2200
C707 .01 UF
R701 68 K
C706 .01UF
B +
I101
I102
P222
J422
2D CRYSTAL OSCILLATOR
V402 6AJ5
T402
R410 68K
C409 2,000
C407 .01 UF
R408 2200
C408 .01 UF
R405 47 K
C405 15
C406 100
L402 .5 MH
R406 150
R407 2200
P715-E
J115-E
P715-F
J115-F
OFF
ON
OVENS S108
J413-F
P113-F
J413-E
P113-E
J413-D
P113-D
J413-H
P113-H
J115-A
P715-A
L406 .5MH
J413-A
P113-A
C436 2,000
Y416 11.333 MC
Y417 10.666MC
Y418 10.333MC
Y419 9.666MC
Y420 12.5 MC
Y421 11.5 MC
Y422 10.5 MC
Y423 9.5 MC
C433 620
S403
C420
C419 100
C421 39
C422 22
C423 56
C424 47
C425 12
C426 120
C427 82
C428 39
C429 27
C430 18
C431 15
C432 10
8-50
5-25
3-12
+180V
R-F GAIN
AGC
CALIBRATE B+
RELAY MINUS
25.2V FIL AND HEATERS
25.2V TO HR901
RELAY PLUS

TM 863-106 (1)



1ST I-F AMPL
V501 6BJ6
2D I-F AMPL
V502 6BJ6
Z501
Y501 455KC
T501
T502
R502 47K
R505 47K
R506 2,200
R504 27K
C506 .01 UF
C507 .047 UF
C505 .1UF
C503 .01UF
C502 100
C501 .01 UF
R501 22K
R561 NOTE 3
R503 1K
L501 .5MH
C504 .1UF
S501
S502
S503
S504
R521 NOTE 3
R520 NOTE 3
R519 NOTE 3
R518 220
C517 .1UF
R507 2.7
R508 5.6
R512 220K
R513 2,200
C510 .01UF
C511 .01UF
R510 1,000
GAIN ADJ
R562 25K
C509 .1UF
C530 .1UF
L503 .5MH
C531 .1UF
R514 2.7
R515 5.1
J517-2
P117-2
J517-16
P117-16
J517-6
P117-6
J517-4
P117-4
TB102
CR101
RF GAIN
R123 5K
T801
115VAC
230VAC
S801
285V 200 MA
25.2 V 5.6 AMPS
R801 47
CR801
NOTE 4
NOTE 5
J818-2
P118-2
J818-1
P118-1
J818-15
P118-15
J818-4
P118-4
J818-6
P118-6
J818-8
P118-8
DC 20A
F103
FL101
AC 3A
F101
P118-9
J818-9
J818-11
P118-11
POWER J104
FUNCTION S107
B+
+160V
R-F GAIN
AGC
CALIBRATE B+
RELAY MINUS
25.2V FIL AND HEATERS
25.2V TO HR901
RELAY PLUS



T502
3D I-F AMPL
V503
6BJ6
C512
47
R516
1 MEG
R522
100K
R523
2200
C515
.01 UF
C516
.01 UF
C514
.1 UF
R514
2.7
R517
330
BANDWIDTH
T503
4TH I-F AMPL
V504
6BJ6
R527
100K
R528
2200
C518
.01 UF
C519
.01 UF
C513
.1 UF
R524
2.7
R525
5.1
R526
330
S505
T504
5TH I-F AMPL
V505
6BJ6
R511
47K
R532
22K
R533
2200
C521
.01 UF
C522
.01 UF
C520
.1 UF
C508
.01 UF
R529
2.7
R530
5.1
R509
22K
R531
330
S506
T505
6TH I-F AMPL
V506
6AK6
R536
820
J517-14
P117-14
R534
2.7
R535
5.1
S507
BFO PITCH
AGC
RECTIFIER
V801
26Z5W
RECTIFIER
V802
26Z5W
P118-3
J818-3
R801
47
R802
47
R803
47
R804
47
J818-14
P118-14
J818-13
P118-13
C101
10UF
J818-5
P118-5
B+
3/8A
F102
CR801
POWER SUPPLY
PP-621/URR
J818-7
P118-7
J818-4
P118-4
POWER
J104
VOLTAGE REGULATOR
V606
6082
VOLTAGE REGULATOR
V605
6082
J620-5
P120-5
C607
100
R621
47
R622
47
R619
47
R620
47
HUM BAL
R615
330K
R614
500K
R616
82K
R617
56K
R618
1K
C606
.1 UF
D-C AMPL
V607
6BH6
R623
18K
B+
180V DC
J601
R627
1 MEG
C608
.22UF
R624
560K
R625
1K
R626
2,700
VOLTAGE REFERENCE TUBE
V608
5651
VOLTAGE REFERENCE TUBE
V609
5651
J620-3
P120-3
P117-20
J517-20
R565
22
V504
V503
R564
120
V507
V502
V510
V501
R563
120
V505
V506
V511
VOLTAGE REGULATOR
RT512
3TF7
C549
.1 UF
J115-C
P715-C
C712
.01 UF
C713
.01 UF
P715-H
J115-H
AGC

F

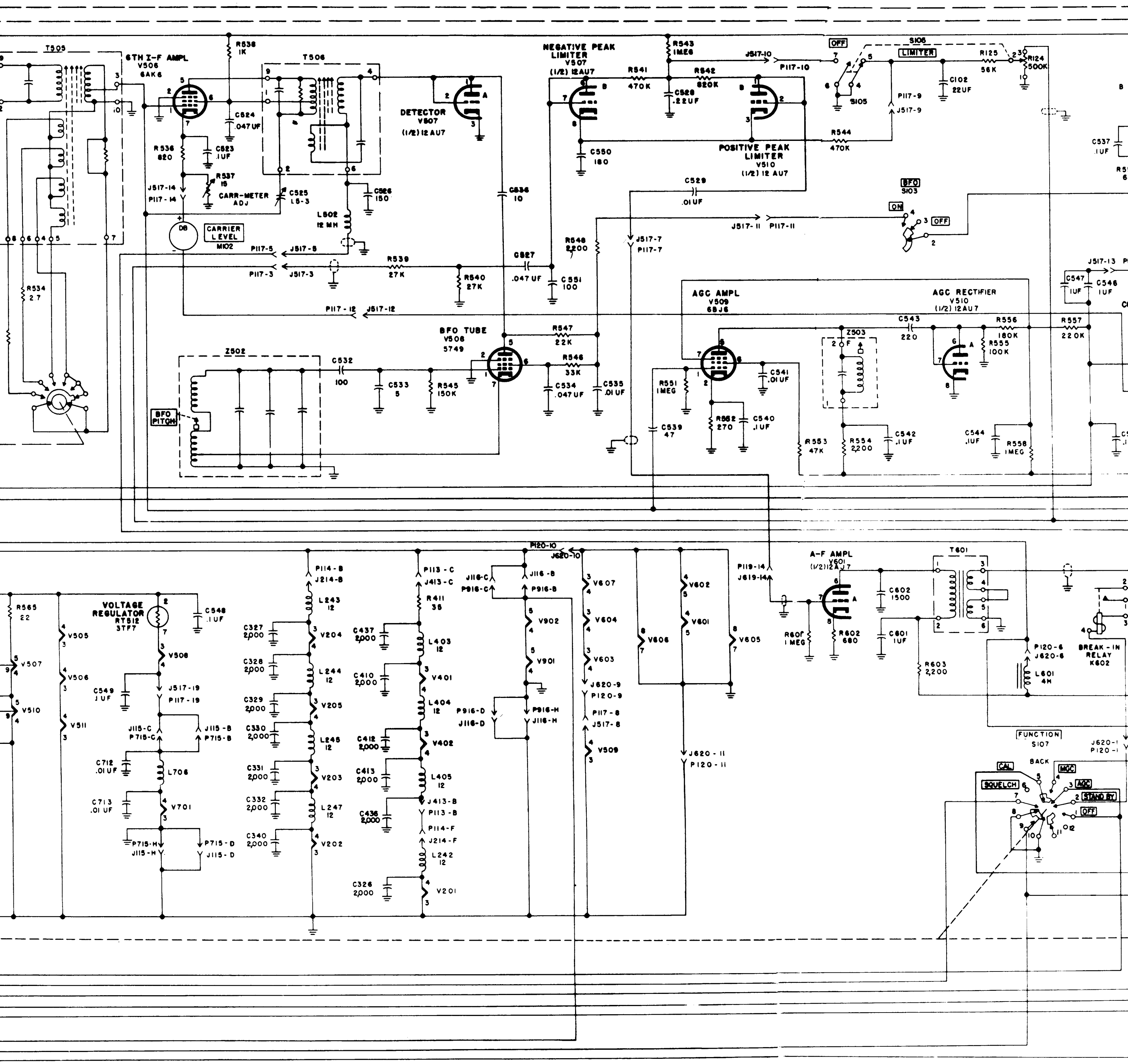
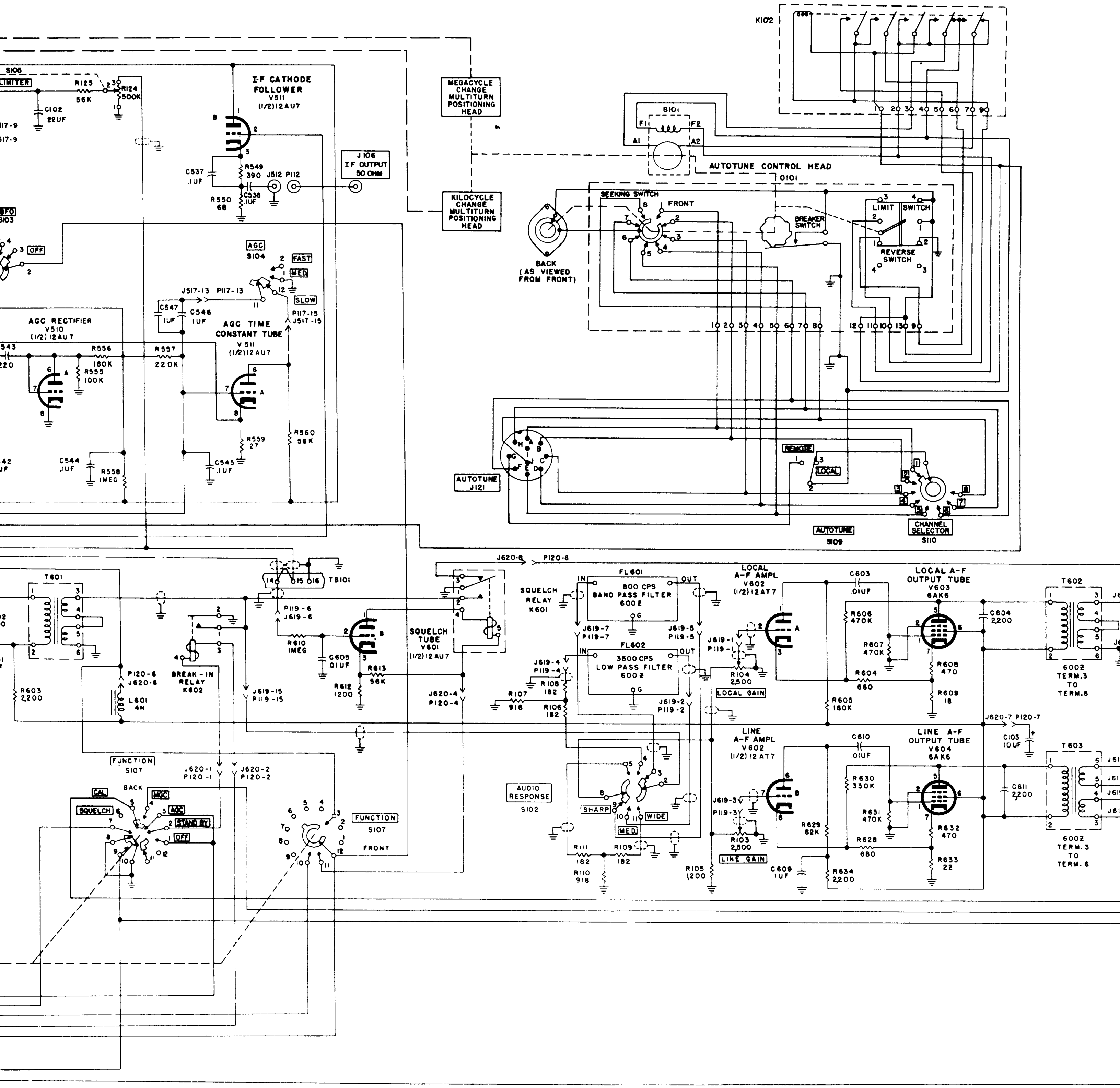
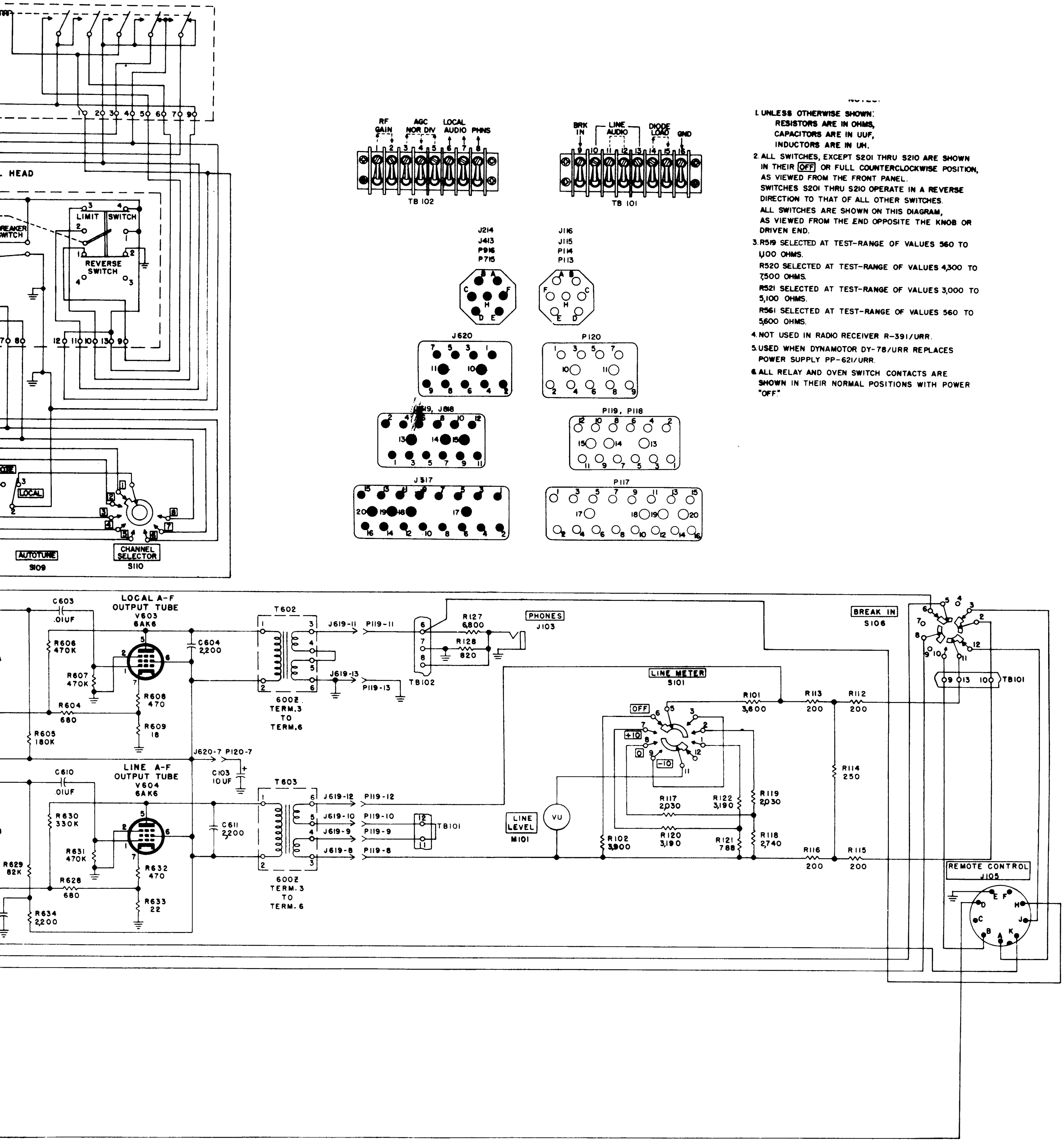


Figure 118. Radio Receiver R-391/URR, schematic diagram (sheet 2 of 2 sheets).



K102
B101
AUTOTUNE CONTROL HEAD
O101
MEGACYCLE CHANGE MULTITURN POSITIONING HEAD
KILOCYCLE CHANGE MULTITURN POSITIONING HEAD
SEEKING SWITCH
FRONT
BACK (AS VIEWED FROM FRONT)
BREAKER SWITCH
LIMIT SWITCH
REVERSE SWITCH
AUTOTUNE J121
REMOTE
LOCAL
AUTOTUNE S109
CHANNEL SELECTOR S110
S106
LIMITER
R125 56K
R124 500K
C102 22UF
I-F CATHODE FOLLOWER V511 (1/2)12AU7
C537 .1UF
R549 390
J512 P112
J106 I F OUTPUT 50 OHM
R550 68
C538 .1UF
BFO S103
OFF
AGC S104
FAST
MED
SLOW
J517-13 P117-13
P117-15 J517-15
C547 1UF
C546 1UF
AGC TIME CONSTANT TUBE V511 (1/2)12AU7
AGC RECTIFIER V510 (1/2) 12AU7
R556 180K
R555 100K
R557 220K
R559 27
R560 56K
C544 .1UF
R558 1MEG
C545 .1UF
T601
TB101
P119-6 J619-6
R610 1MEG
C605 .01UF
R612 1200
R613 56K
SQUELCH TUBE V601 (1/2)12AU7
J620-8 P120-8
SQUELCH RELAY K601
BREAK-IN RELAY K602
P120-6 J620-6
L601 4H
R603 2,200
J619-15 P119-15
J620-4 P120-4
FUNCTION S107
BACK
CAL
SQUELCH
MGC
AGC
STAND BY
OFF
J620-1 P120-1
J620-2 P120-2
FUNCTION S107
FRONT
FL601 800 CPS BAND PASS FILTER 600Ω
IN
OUT
FL602 3500 CPS LOW PASS FILTER 600Ω
J619-7 P119-7
J619-5 P119-5
J619-4 P119-4
J619-2 P119-2
R108 182
R107 918
R106 182
J619-1 P119-1
R104 2,500
LOCAL GAIN
LOCAL A-F AMPL V602 (1/2)12AT7
C603 .01UF
LOCAL A-F OUTPUT TUBE V603 6AK6
R606 470K
R607 470K
R604 680
R608 470
R605 180K
R609 18
C604 2,200
T602
600Ω TERM.3 TO TERM.6
AUDIO RESPONSE S102
SHARP
MED
WIDE
R111 182
R110 918
R109 182
J619-3 P119-3
R103 2,500
LINE GAIN
R105 1,200
C609 1UF
LINE A-F AMPL V602 (1/2) 12AT7
C610 .01UF
LINE A-F OUTPUT TUBE V604 6AK6
R630 330K
R631 470K
R629 82K
R628 680
R634 2,200
R632 470
R633 22
J620-7 P120-7
C103 10UF
C611 2,200
T603
600Ω TERM. 3 TO TERM. 6



NOTES:

1. UNLESS OTHERWISE SHOWN:
   RESISTORS ARE IN OHMS,
   CAPACITORS ARE IN UUF,
   INDUCTORS ARE IN UH.
2. ALL SWITCHES, EXCEPT S201 THRU S210 ARE SHOWN IN THEIR [OFF] OR FULL COUNTERCLOCKWISE POSITION, AS VIEWED FROM THE FRONT PANEL.
   SWITCHES S201 THRU S210 OPERATE IN A REVERSE DIRECTION TO THAT OF ALL OTHER SWITCHES.
   ALL SWITCHES ARE SHOWN ON THIS DIAGRAM, AS VIEWED FROM THE END OPPOSITE THE KNOB OR DRIVEN END.
3. R519 SELECTED AT TEST-RANGE OF VALUES 560 TO 1,100 OHMS.
   R520 SELECTED AT TEST-RANGE OF VALUES 4,300 TO 7,500 OHMS.
   R521 SELECTED AT TEST-RANGE OF VALUES 3,000 TO 5,100 OHMS.
   R561 SELECTED AT TEST-RANGE OF VALUES 560 TO 5,600 OHMS.
4. NOT USED IN RADIO RECEIVER R-391/URR.
5. USED WHEN DYNAMOTOR DY-78/URR REPLACES POWER SUPPLY PP-621/URR.
6. ALL RELAY AND OVEN SWITCH CONTACTS ARE SHOWN IN THEIR NORMAL POSITIONS WITH POWER "OFF."

INDEX