NAVSHIPS 91331

SERVICE AND REPAIR MANUAL

for

RADIO RECEIVING EQUIPMENT NAVY MODEL RDZ/RDZ-1

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BUREAU OF SHIPS NAVY DEPARTMENT

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18-A

LIST OF EFFECTIVE PAGES

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DEPARTMENT OF THE NAVY
BUREAU OF SHIPS
WASHINGTON 25, D. C.

IN REPLY REFER TO
Code 993-100
7 June 1950

From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation and Maintenance of the Subject Equipment

Subj: Service and Repair Manual for Radio Receiving Equipment, Navy Model RDZ/RDZ-1, NAVSHIPS 91331

1. NAVSHIPS 91331 is the Service and Repair Manual for the subject equipment and is in effect upon receipt.

2. When superseded by a later edition, this publication shall be destroyed.

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D. H. CLARK
Chief of Bureau

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PREFACE

This Service and Repair Manual is designed to help you quickly locate and efficiently repair troubles with a minimum of time and effort. Make use of the Table of Contents and the Index to locate the information needed.

FOR GENERAL INFORMATION ON THE RDZ/RDZ-1 AND ITS ASSOCIATED UNITS — SEE Section 1

FOR CHARACTERISTICS AND CIRCUIT DESCRIPTION, LOOK FOR THE FUNCTIONAL SECTION IN — Section 2

FOR A LISTING OF FIELD CHANGES AND MODIFICATIONS — SEE Section 2

FOR TROUBLE-SHOOTING CHARTS AND PROCEDURES — SEE Section 3

FOR FUNCTIONAL SCHEMATIC DIAGRAMS, VOLTAGE AND RESISTANCE CHARTS — SEE Section 3

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SAFETY NOTICE

The attention of officers and operating personnel is directed to Chapter 67 of the Bureau of Ships Manual or superseding instructions on the subject of radio-safety precautions to be observed.

This equipment employs voltages which are dangerous and may be fatal if contacted by operating personnel. Extreme caution should be exercised when working with the equipment.

While every practicable safety precaution has been incorporated in this equipment, the following rules must be strictly observed:

KEEP AWAY FROM LIVE CIRCUITS:

Operating personnel must at all times observe all safety regulations. Do not change tubes or make adjustments inside equipment with high voltage supply on. Under certain conditions dangerous potentials may exist in circuits with power controls in the off position due to charges retained by capacitors. To avoid casualties always remove power and discharge and ground circuits prior to touching them.

DON'T SERVICE OR ADJUST ALONE:

Under no circumstances should any person reach within or enter the enclosure for the purpose of servicing or adjusting the equipment without the immediate presence or assistance of another person capable of rendering aid.

DON'T TAMPER WITH INTERLOCKS:

Do not depend upon door switches or interlocks for protection but always shut down motor generators or other power equipment. Under no circumstances should any access gate, door, or safety interlock switch be removed, short-circuited, or tampered with in any way, by other than authorized maintenance personnel, nor should reliance be placed upon the interlock switches for removing voltage from the equipment.

RESUSCITATION

AN APPROVED POSTER ILLUSTRATING THE RULES FOR RESUSCITATION BY THE PRONE PRESSURE METHOD SHALL BE PROMINENTLY DISPLAYED IN EACH RADIO, RADAR, OR SONAR ENCLOSURE. POSTERS MAY BE OBTAINED UPON REQUEST TO THE BUREAU OF MEDICINE AND SURGERY.

REPORT OF FAILURE

Report of failure of any part of this equipment, during its entire service life, shall be made to the Bureau of Ships in accordance with current regulations using form NAVSHIPS 383 (revised) except for Marine Corps equipment in which case the "Signal Equipment Failure Report" form shall be used and distributed in accordance with instructions pertaining thereto. The report shall cover all details of the failure and give the date of installation of the equipment. For procedure in reporting failures see Chapter 67 of the Bureau of Ships Manual or superseding instructions.

ORDERING PARTS

All requests or requisitions for replacement material should include the following data:

1. Standard Navy stock number or, when ordering from a Marine Corps or Signal Corps supply depot, the Signal Corps stock number.
2. Name and short description of part.

If the appropriate stock number is not available the following shall be specified:

1. Equipment model or type designation, circuit symbol, and item number.
2. Name of part and complete description.
3. Manufacturer's designation.
4. Contractor's drawing and part number.
5. JAN or Navy type number.

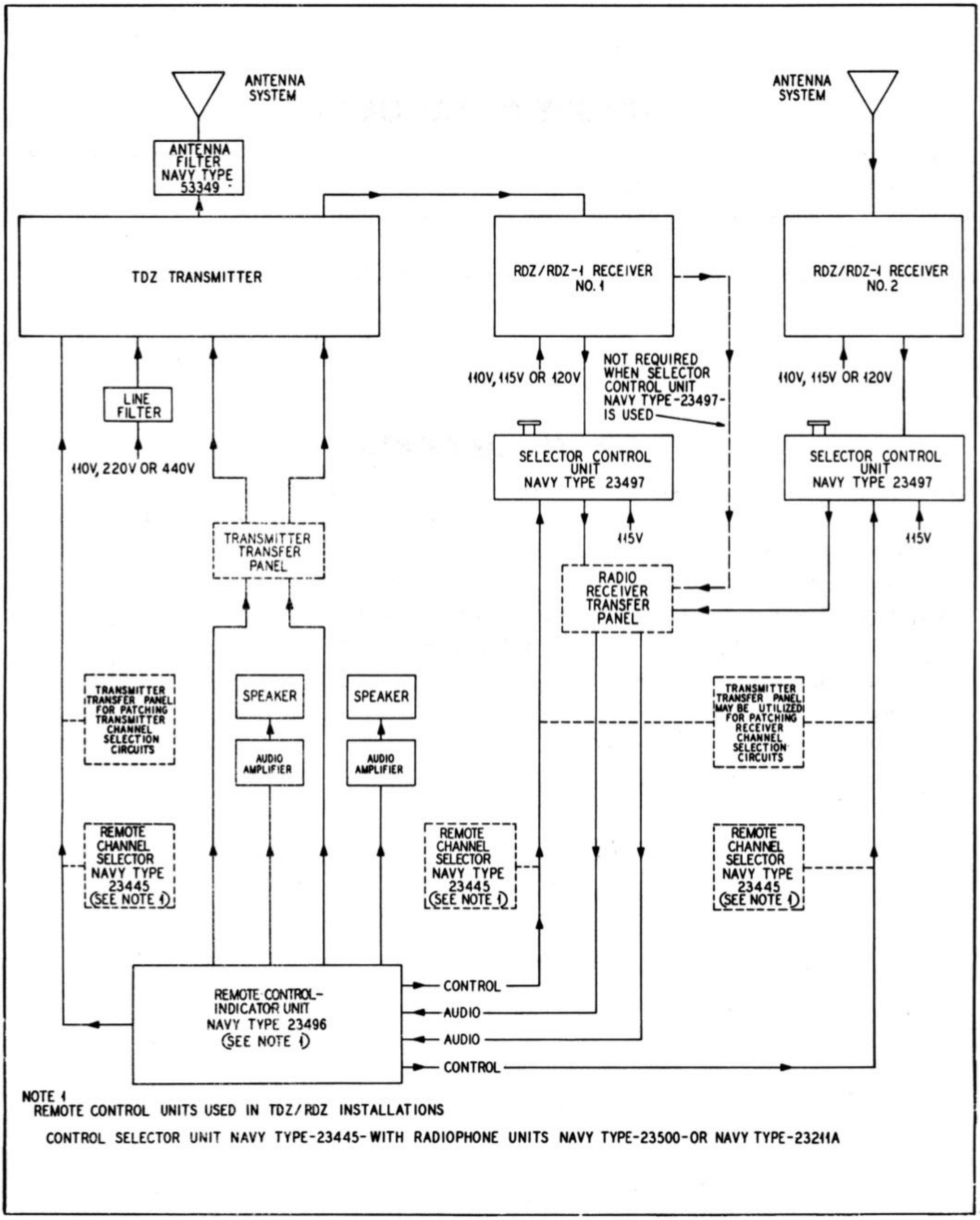

Figure 1-1. Block Diagram of a Basic System for RDZ/TDZ Installation

SECTION 1

GENERAL DESCRIPTION

THE SYSTEM

1–1. RDZ/TDZ SYSTEM.

The RDZ/TDZ system is a general communications system which operates in the v-h-f/u-h-f region and covers the frequency range of approximately 225 to 400 mc. It is designed for ship and shore operation, and is to be employed in conjunction with other mobile and airborne equipment which covers this frequency band.

Simplicity of operation is made possible by automatic channel selection. The system is rapidly tunable to any one of ten preset, crystal-controlled channels by the turning or dialing of a switch.

1–2. TYPES OF INSTALLATION.

The RDZ/TDZ system is extremely flexible. The basic shipboard system, shown in figure 1–1, consists of one TDZ Transmitter and two RDZ Radio Receivers. However, it can be expanded to include a number of TDZ Transmitters and RDZ Radio Receivers to meet any installation requirement. The RDZ/TDZ system is primarily intended for voice, but if desired, it may be used for MCW or in conjunction with teletype equipment. The RDZ Radio Receiver provides convenient connections for a panoramic-type adapter for visual monitoring of the signal spectrum over the operating range.

The basic system shown in figure 1–1 employs two antennas. In such a system the antennas are usually connected as indicated, one antenna being connected to the TDZ and the No. 1 RDZ/RDZ-1 and the other antenna to the No. 2 RDZ/RDZ-1. In more elaborate systems, additional antennas are used, depending on the individual requirements of the installation. Future plans include the use of a multi-coupler which will make it possible to use four transmitters or receivers, or any combination thereof, with one antenna.

Note that figure 1–1 shows connections from the transmitter and receivers to the various remote control units through transfer panels. This type of installation is provided on ships which require these facilities.

Normally, Navy Type—23496 Remote Control-Indicator Unit is employed for remote control of the RDZ/TDZ system. In certain installations, Navy Type—23445 Remote Channel Selector and Navy Type—23500 Radiophone Unit are used. The Navy Type—23211A Radiophone Unit is frequently used in place of the Navy Type —23500, where the installation is exposed to the weather. Some installations may use all or any combination of these remote control units.

1–3. TABULAR LIST OF UNITS.

TABLE 1–1 gives the description, Navy type number, dimensions, and weight for the major units used in RDZ/TDZ installations.

TABLE 1–1

TABULAR LIST OF UNITS

Quantity	*Name of Unit*	*Navy Type Number*	*Overall Dimensions (Inches)*			*Weight (lbs.)*
			Height	*Width*	*Depth*	
1	RDZ/RDZ-1 Radio Receiver, which consists of:	–46275	$13\frac{1}{8}$	22	$22\frac{5}{32}$	150
	Preselector and Converter Unit	–46273	$8\frac{1}{2}$	$8\frac{1}{2}$	$14\frac{3}{16}$	20
	IF/AF Unit	–46274	$8\frac{23}{32}$	$11\frac{5}{16}$	$13\frac{1}{8}$	17
	Rectifier Power Unit	–20407	$8\frac{9}{32}$	$18\frac{1}{2}$	$5\frac{1}{2}$	37
	RF Filter Unit	–53280	$6\frac{15}{32}$	$20\frac{9}{16}$	$2\frac{7}{8}$	10
	Automatic Tuning Unit	–23491	6	$8\frac{7}{16}$	$4\frac{1}{16}$	6
	Cabinet	–10511	$13\frac{1}{8}$	22	$18\frac{5}{16}$	50
	Front Panel Assembly	–10512	$10\frac{1}{2}$	22	$19\frac{11}{16}$	10
2	Crystal Oven	–40148 –40148A	$2\frac{1}{4}$	$3\frac{21}{32}$	$2\frac{19}{32}$	$\frac{3}{4}$
100	Crystals (Package)	–40162	$1\frac{1}{2}$	$9\frac{1}{4}$	$5\frac{1}{4}$	2
1x	Remote Channel Selector	–23492	$4\frac{9}{16}$	$5\frac{1}{4}$	$3\frac{5}{16}$	2
1xx	Selector Control Unit See list of units which are common to the RDZ/TDZ	–23497	8	9	$11\frac{1}{2}$	19
1	TDZ Radio Transmitter, which includes:	–52342	$32\frac{1}{16}$	$24\frac{3}{4}$	$25\frac{11}{16}$	760
	Test Harness for:					
1	Bottom Drawer	–62205	(10 ft. long)			
1	Middle Drawer	–62204	(10 ft. long)			
1	Top Drawer	–62206	(10 ft. long)			
1	Relay Sub-Assembly	–62210	(4 ft. long)			
1	Audio Stage	–62207	(4 ft. long)			
1	Low Power R-F Stage	–62208	(4 ft. long)			
1	High-Voltage Rectifier	–62208	(4 ft. long)			
1	Inter-Stage Coaxial Cable	–62209	(40 in. long)			
1	RF Filter	–53349	$5\frac{7}{8}$	$7\frac{1}{2}$	$1\frac{5}{16}$	
1	Crystal Oven	–40148 –40148A	$2\frac{1}{4}$	$3\frac{21}{32}$	$2\frac{19}{32}$	$\frac{3}{4}$
100	Crystals (Package)	–40161† –40162‡				
	Units common to RDZ/TDZ:					
*	Remote Channel Selector	–23445	$6\frac{7}{8}$	$6\frac{7}{8}$	$4\frac{1}{8}$	$6\frac{1}{4}$
*	Remote Control-Indicator Unit	–23496	10	12	8	14
**	Radiophone Unit	–23500	8	12	7	$16\frac{3}{8}$
**	Radiophone Unit	–23211A	22	12	5	25
1	Crystal Oven Extractor	–10552				

TABLE 1-1.

TABULAR LIST OF UNITS (Cont.)

Quantity	*Name of Unit*	*Navy Type Number*	*Overall Dimensions (Inches)*			*Weight (lbs.)*
			Height	*Width*	*Depth*	
	Antenna	-66147	25	22	4½	
	or					
	Antenna Model AT-150/SRC	-	22 5/16	17 5/16	6	9
	or					
	Antenna Model AS-390/SRC	-	15⅞	23	23	3½

x Interim unit which will permit selection of channels at only one remote location. This unit not normally employed and is not shown in figure 1-1. (See Paragraph 2-10.)

xx The -23497 is not employed in installations not requiring remote operation, or where the -23492 is used.

* Must be used with Navy Type—23497 for remote control of the RDZ/RDZ-1.

** Used in conjunction with Navy Type—23445.

† Equipment 1 to 100.

‡ Equipment 101 to 3500.

Total weight of all test harnesses, uncrated and unwrapped—100 lbs.

1-4. ELECTRON TUBE COMPLEMENT.

TABLES 1-2 and 1-3 list the quantities, types, and functions of the electron tubes used in Radio Receiving Equipment Navy Model RDZ/RDZ-1.

TABLE 1-2

QUANTITIES AND TYPES OF ELECTRON TUBES RADIO RECEIVER RDZ/RDZ-1

Quantity	*Type*
1	JAN OD3/VR-150
1	JAN 5U4G
7	JAN 6AB7
4	JAN 6AC7
2	JAN 6AK5
2	JAN 6F4
1	JAN 6H6
1	JAN 6SN7W
1	JAN 6V6GT/G
1	JAN 956

TABLE 1-3

SYMBOLS, TYPES, AND FUNCTIONS OF ELECTRON TUBES RADIO RECEIVER RDZ/RDZ-1

Symbol	*Type*	*Function*
V101	JAN 6AC7	Oscillator and Frequency Tripler or Quadrupler
V102	JAN 6AC7	1st Frequency Doubler
V103	JAN 6AK5	2nd Frequency Doubler
V104	JAN 6AK5	3rd Frequency Doubler
V105	JAN 6F4	4th Frequency Doubler
V106	JAN 6F4	1st Detector
V107	JAN 956	R-F Amplifier
V201	JAN 6AC7	Frequency Scan Amplifier
V202	JAN 6AB7	1st I-F Amplifier
V203	JAN 6AB7	2nd I-F Amplifier
V204	JAN 6AB7	3rd I-F Amplifier
V205	JAN 6AB7	4th I-F Amplifier
V206	JAN 6AB7	5th I-F Amplifier
V207	JAN 6H6	2nd Detector and Noise Limiter
V208	JAN 6AB7	1st A-F Amplifier
V209	JAN 6AC7	Video Amplifier
V210	JAN 6SN7W	Silencer and Silencer Amplifier
V211	JAN 6AB7	2nd A-F Amplifier
V212	JAN 6V6GT/G	Output A-F Amplifier
V301	JAN 5U4G	Rectifier
V302	JAN OD3/ VR-150	Voltage Regulator

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SECTION 2

CHARACTERISTICS AND CIRCUIT ANALYSIS

RADIO RECEIVER RDZ/RDZ-1

2-1. CHARACTERISTICS.

Radio Receiver RDZ/RDZ-1 is a superheterodyne which covers the effective operating range of 232 to 400 mc. in one band. Any amplitude-modulated signal (voice or MCW) may be received, but Radio Receiver RDZ/RDZ-1 is designed primarily for voice reception. The RDZ/RDZ-1 is quickly and accurately tuned to any ten preset frequencies within the operating frequency range. A crystal-controlled oscillator operating with suitable multiplier circuits is used to obtain the heterodyning frequency, reducing drift to a minimum. Other features include: variable intermediate-frequency bandwidth, input meter, noise-limiter and silencer circuits, and special input and output filters for isolating the RDZ/RDZ-1 from interference. Three types of outputs are available: frequency scan, video scan, and audio. The RDZ/RDZ-1 can be operated from both local and remote positions, as required.

Type of Receiver—Superheterodyne.

Number of Bands—One.

Frequency Range:

Total Band—200 to 400 mc., except 222 to 232 mc. See R-F AMPLIFIER AND CONVERTER SECTION, Paragraph 2-4.

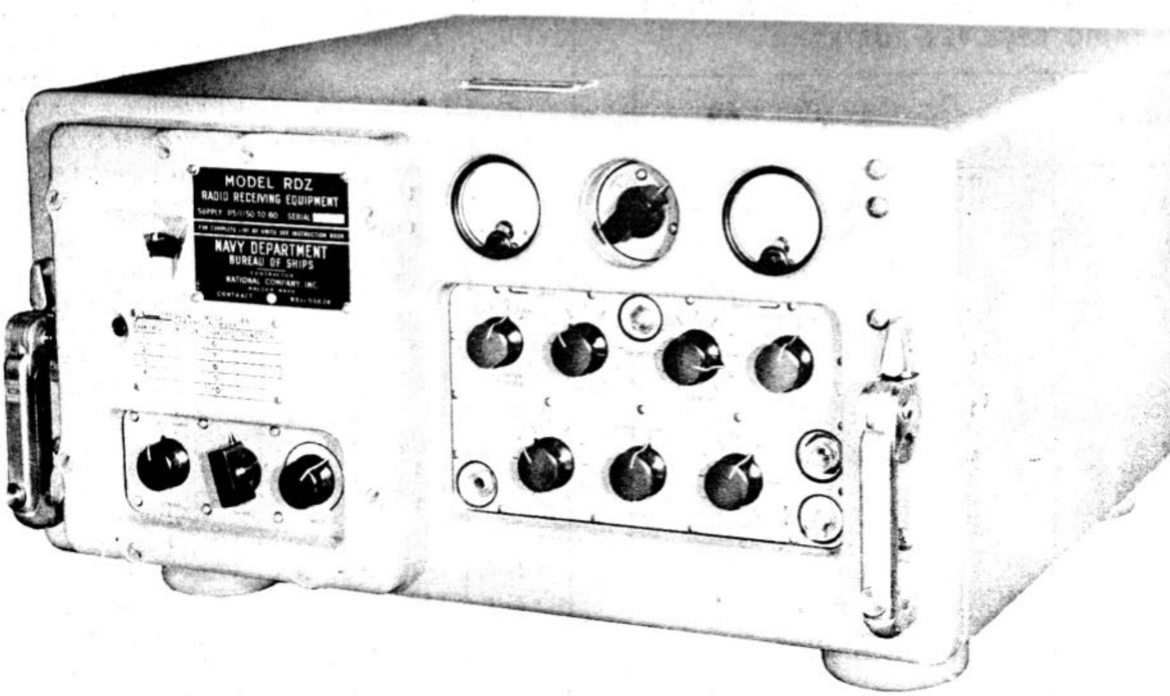


Figure 2-1. Radio Receiving Equipment Navy Model RDZ/RDZ-1, Front View

Number of Preset Frequencies—Any ten preset frequencies within the tuning range.

Intermediate Frequency—15.1 mc. $\pm$10 kc., variable bandwidth of 125 or 250 kc. at 6 db down.

Type of Reception—Amplitude modulation (voice or MCW); however, Radio Receiver RDZ/RDZ-1 is designed primarily for voice reception.

Maximum Output:

Audio Channel — Approximately 60 milliwatts (6 volts) into a 600-ohm load, or 600 milliwatts into a 30-ohm load; maximum distortion, 7 percent.

Phone Jack—Approximately 1.5 volts (4 milliwatts) into a 600-ohm load; maximum distortion, 7 percent.

Video Channel—1.5 volts into a 1000-ohm load, with maximum distortion of 7 percent (signal modulation 30 percent at 1000 cycles).

Frequency Scan Channel—10,000 microvolts minimum across a 50-ohm load.

Input Impedance—50 ohms.

Output Impedance:

Audio Channel—600 ohms (See Paragraph 2–6 of this section).
Phone Jack—600 ohms.
Video Channel—1000 ohms.
Frequency Scan Channel—50 ohms.

R-F Oscillator Data:

A crystal-controlled oscillator operating into multiplier circuits is used to obtain the heterodyning frequency.
Type CR-1 crystals may be used with Radio Receiver RDZ/RDZ-1; however, Navy Type—40162 crystals used in conjunction with Navy Type—40148 or —40148A crystal oven are normally employed.

Crystal frequencies of 4.48–7.1 mc. are used to cover the tuning range of 200–326 mc. with a total frequency multiplication of 48. Crystal frequencies of 5.32–6.49 mc. cover the tuning range of 326–400 mc. with a total frequency multiplication of 64.

Stability Data:

The over-all frequency stability under any combination of the following conditions does not exceed 0.007 percent when Navy Type—40162 crystals and the crystal oven are employed.

Variations in line voltage of 103.5–126.5 volts when Radio Receiver RDZ/RDZ-1 is operated on the 115-volt tap.
Ambient temperature variations from minus 15° to plus 50° centigrade.
Relative humidity variations from 30 to 95 percent.

Input Voltage 110/115/120 volts, single phase, 50/60 cycles per second.

Current Consumption:

Normal—Approximately 1.6 amperes.
Maximum—Approximately 2.7 amperes.

Power Consumption:

Normal—Approximately 175 watts.
Maximum—Approximately 300 watts.

2–2. GENERAL CIRCUIT ANALYSIS.

Radio Receiver RDZ/RDZ-1 contains the basic circuits usually found in any superheterodyne receiver designed for military use. The functional block diagram shown in figure 2–3 clearly shows the conventional lineup: r-f amplifier, 1st detector, i-f amplifiers, 2nd detector, audio section, and power supply. Other features found in communications receivers are also included: noise limiter, audio filter, and silencer circuits.

Less conventional features found in Radio Receiver RDZ/RDZ-1 are the method of tuning the equipment, and the means by which the heterodyning frequency is obtained. Radio Receiver RDZ/RDZ-1 is accurately and rapidly tuned to any one of ten preselected frequencies by an electro-mechanical system. The heterodyning frequency is the output of the frequency-multiplier circuits, which are similar to those used in many transmitters. The output of the crystal-controlled oscillator is fed to a series of frequency-doubler circuits to obtain the required heterodyning frequency.

NOTE

The symbols 1, A, A1, etc., shown on the schematic diagrams throughout this section denote test points for trouble localization and will be discussed further in Section 3.

Radio Receiver RDZ/RDZ-1 provides three types of output signals (see figure 2–2), which make it adaptable to many uses. The frequency scan amplifier provides an output voltage which may be coupled to a radio-frequency measuring unit (panoramic adapter). The video amplifier provides a convenient means of viewing the signal after detection. The phone jack and provisions for remote audio are also included.

2–3. FIELD CHANGES—RDZ.

TABLE 2–1 lists the modifications for Radio Receiver RDZ/RDZ-1. All receivers must be modified as shown in these field changes. Kits, as required, are available through regular supply channels.

TABLE 2–1

FIELD CHANGES FOR RDZ/RDZ-1 RADIO RECEIVER

Field Change Number	*Serial Numbers Affected*	*Changes Made and Reason For*	*Kit Needed*
No. 1–RDZ	1–896 inclusive. (CNA-46275.)	Removal of 5 $\mu\mu$f. capacitor, C149; to improve frequency stability of oscillator V101.	No
No. 2–RDZ	1–50 inclusive. (CNA-46275.)	Addition of auxiliary absorption loop; to decrease tuning inductance in the tank circuit of V106 and thereby minimize loss in gain at high ambient temperatures.	Yes
No. 3–RDZ	1–2348 inclusive of Navy Type No. CNA-46275 and 1–1100 inclusive of Navy Type No. CQC-46275.	Addition of bonding for Autotune unit; to insure a good ground connection from the Autotune-blister cover to the main front-panel cover.	Yes
No. 4–RDZ	All serial numbers RDZ/RDZ-1.	Addition of a dummy load for the SCAN receptacle when a scanning unit is not used. When the SCAN receptacle is not terminated, standing waves cause instability in the i-f amplifier circuits. The dummy load consists of a 47-ohm resistor in series with a .01-μf. capacitor.	Yes
No. 5–RDZ	All shipboard equipments.	Replacement of i-f transformers when high ambient temperatures cause deformation of present i-f transformer coil forms.	Yes

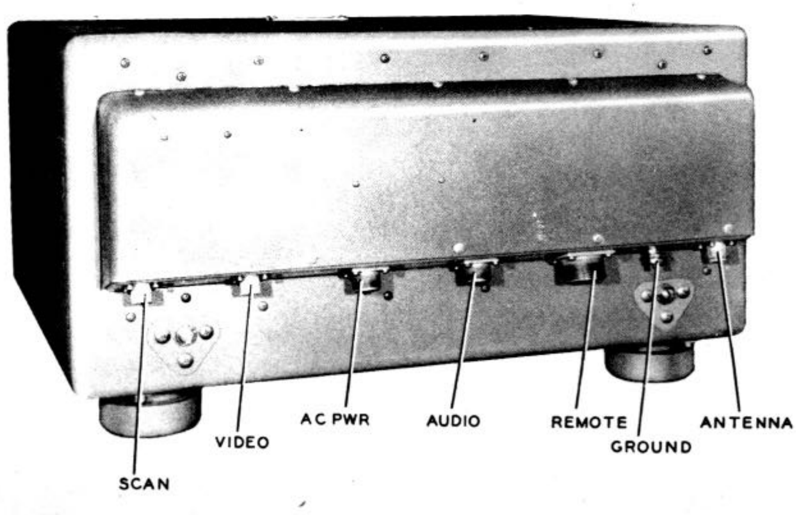


Figure 2–2. Radio Receiver RDZ/RDZ-1, Rear View, Showing Receptacles

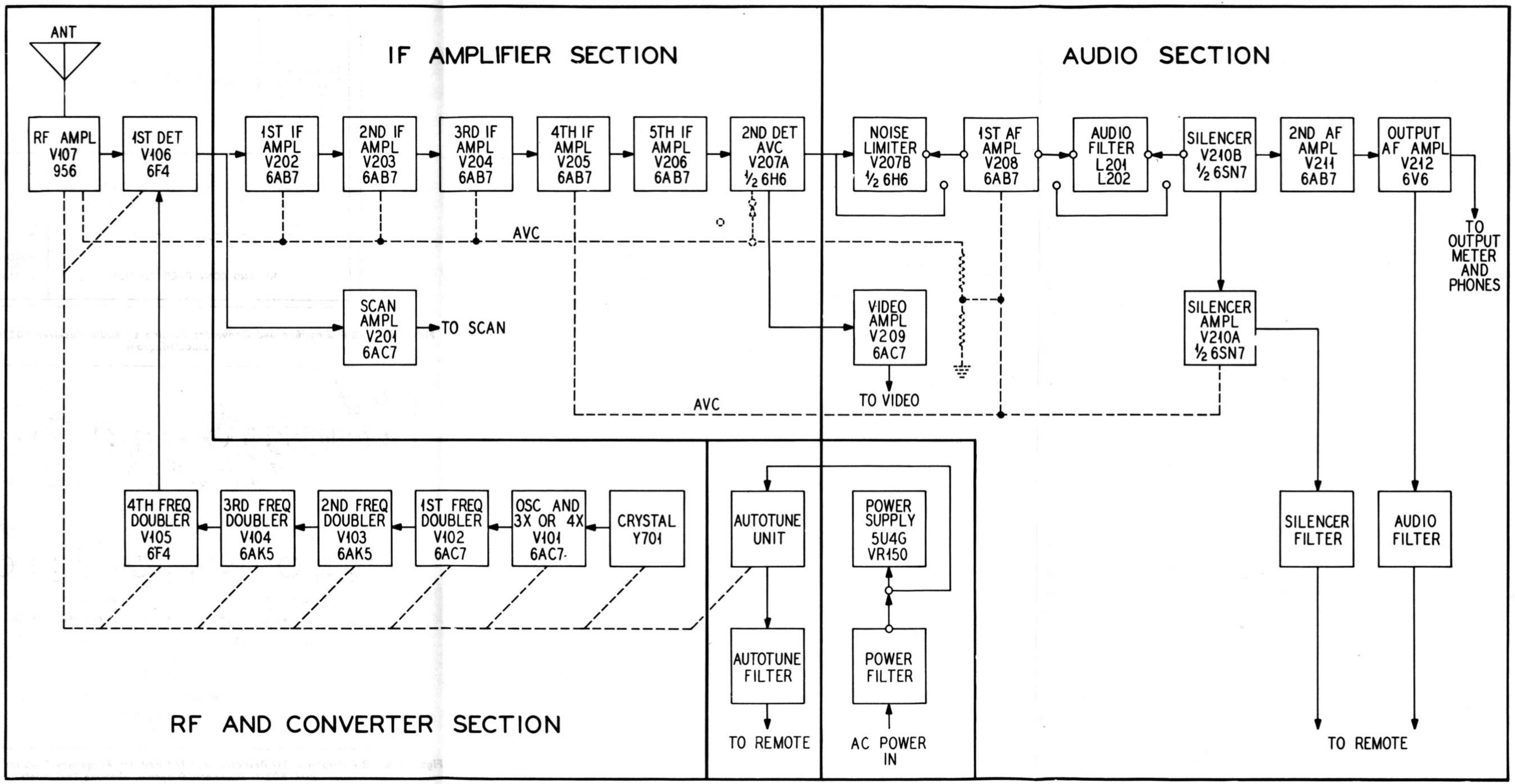


Figure 2-3. Radio Receiver RDZ/RDZ-1, Functional Block Diagram

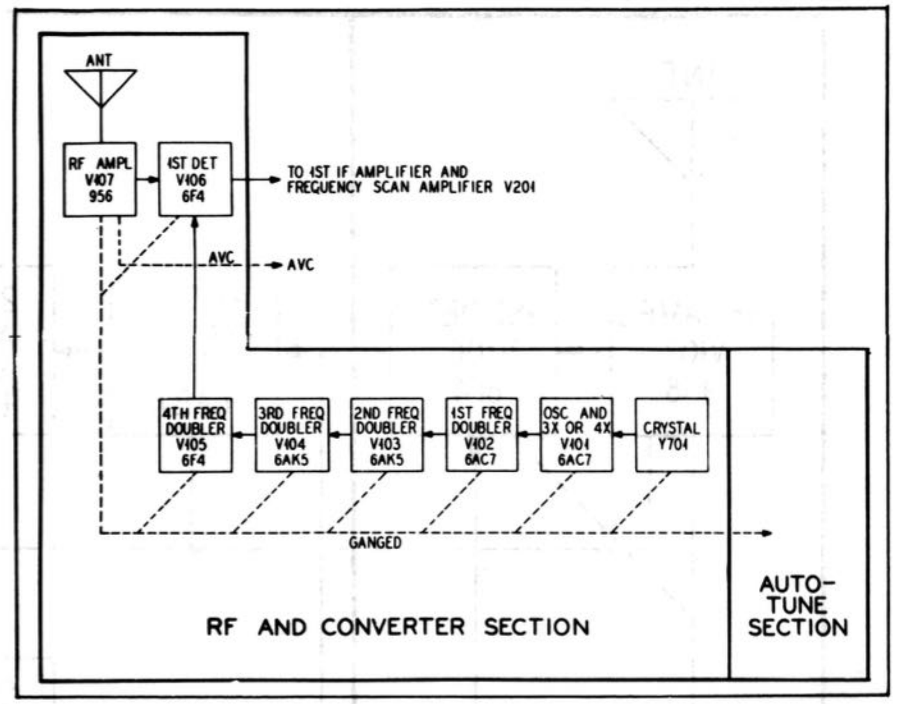


Figure 2-4. R-F Amplifier and Converter Section of Radio Receiver RDZ/RDZ-1, Functional Block Diagram

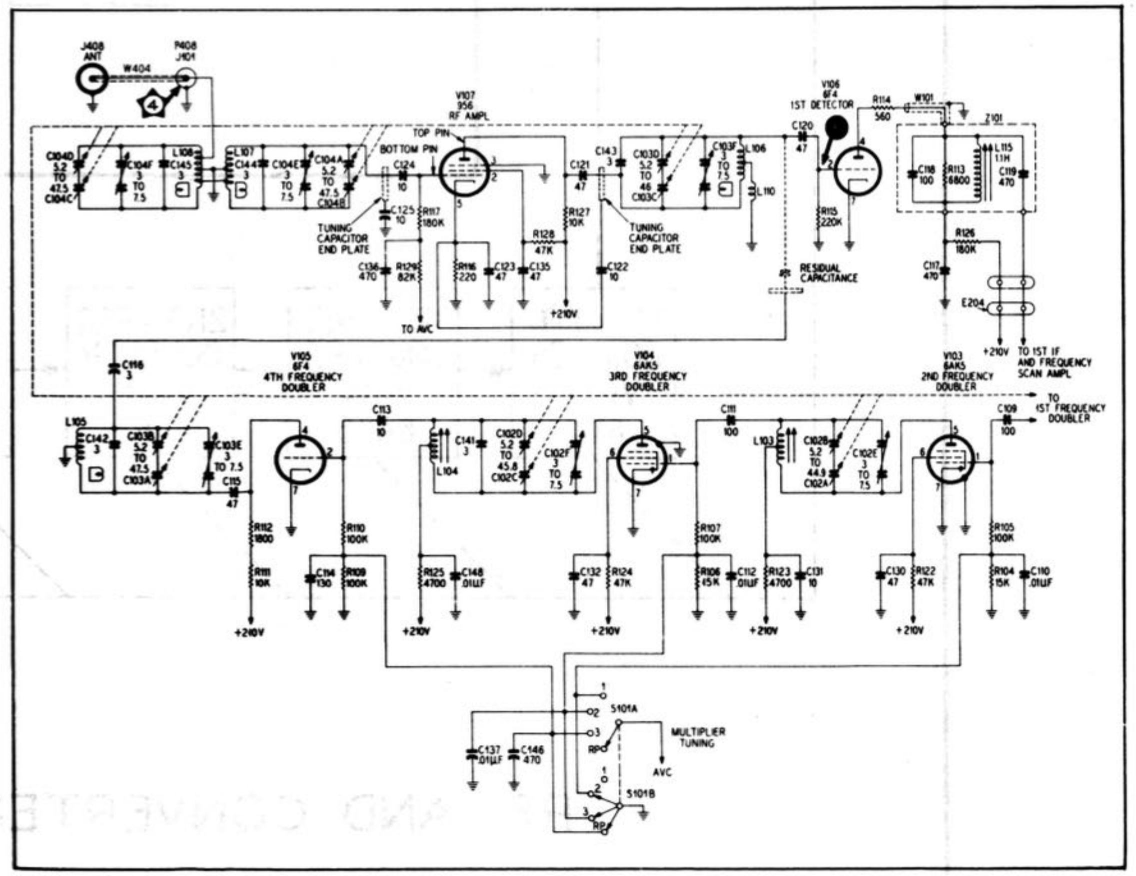


Figure 2-5. R-F Amplifier, 1st Detector, and 3rd and 4th Frequency Doublers of Radio Receiver RDZ/RDZ-1, Schematic Diagram, Showing Test Points

2-4. R-F AMPLIFIER AND CONVERTER SECTION.

The r-f amplifier, 1st detector, crystal oscillator and frequency tripler or quadrupler, and four frequency doublers are employed in this section. See figure 2-4.

The preselector network, r-f amplifier tank circuit, crystal oscillator, and all frequency multipliers are ganged together. They are accurately tuned by the Autotune system.

CAUTION

The frequency-indicating dial has been adjusted to track by bending of the tuning-capacitor rotor plates at the factory. Do not alter these adjustments.

The antenna leadin, a coaxial cable, is connected through antenna input jack J101, directly to the gang-tuned preselector network. The r-f amplifier, V107, is an "acorn" type 956 pentode with remote cut-off characteristics, designed for u-h-f use. See figure 2-5. Capacitors C122 and C125 are used to detune an undesirable wave trap formed by the components of this circuit. The r-f amplifier circuit is otherwise conventional.

The signal from the plate of the r-f amplifier is fed to the grid of the 1st detector, V106, through a single-tuned tank circuit. See figure 2-5. Inductor L110 is used to increase receiver gain at the lower frequencies by decreasing the selectivity of this tank. Intermediate-frequency transformer Z101 is essentially a band-pass filter tuned to 15.1 mc., the intermediate frequency of this receiver.

The crystal oscillator, V101, resembles an "electron-coupled" oscillator. See figure 2-6. Resistor R102 in series with the cathode serves to limit tube current when no grid excitation is present to produce grid bias. The oscillator plate tank is tuned to either the third or fourth harmonic of the crystal frequency, as required to produce the heterodyning frequency needed. Capacitor C106 tends to prevent parasitic oscillations by keeping the rotor of capacitor C101 at r-f ground.

Crystals of 4.48 to 7.1 mc. are used with a frequency multiplication of 48 to cover the tuning range of 200 to 326 mc., and crystals of 5.32 to 6.49 mc. are used with a frequency multiplication of 64 to cover the tuning range of 326 to 400 mc. However, crystals of 4.94 to 5.15 mc., covering the 222 to 232-mc. tuning range, cannot be used since the third harmonic of these crystals correspond approximately to the intermediate frequency (15.1 mc.). For example, the third harmonic of the 5.033-mc. crystal is 15.1 mc., and, therefore, will block the intermediate-frequency amplifiers.

The four frequency doublers, V102, V103, V104, and V105, are similar and are conventional in design. See figures 2-5 and 2-6. The MULTIPLIER TUNING switch, S101, provides a convenient means of checking grid excitation to the 2nd, 3rd, and 4th multiplier stages. A portion of the grid voltage is taken off and connected to the input meter, M201. This feature is used when trouble-shooting or aligning the frequency multipliers. The 4th frequency doubler, V105, type 6F4, is coupled to the grid of the 1st detector, V106, by residual capacitance. The heterodyning frequency is 15.1 mc. above the incoming r-f signal.

NOTE

The physical location and size of all parts used in Radio Receiver RDZ/RDZ-1 are carefully selected to give stable operation. Use exact replacement parts only, and replace the wiring and parts in their original positions.

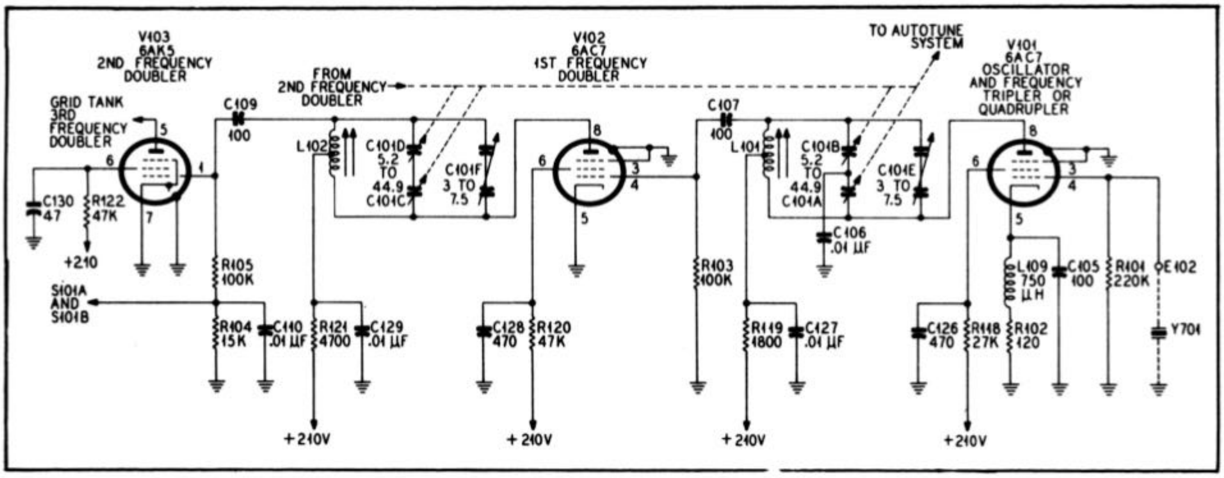


Figure 2-6. Oscillator and Frequency Tripler or Quadrupler and 1st and 2nd Frequency Doublers of Radio Receiver RDZ/RDZ-1, Schematic Diagram

Field Change No. 1–RDZ, effective for Serial No. 1 to 896 inclusive (CNA-46275 only), was made to improve stability of oscillator V101. The field change consists of the removal of a 5-$\mu\mu$f. capacitor, C-149, which is connected between the grid and cathode of V101. No kit is required.

Field Change No. 2–RDZ, effective for Serial No. 1 to 50 inclusive (CNA-46275 only), was made to decrease the tuning inductance in the tank of V106 and thereby minimize the loss in gain at high ambient temperatures. The field change consists of the addition of an auxiliary absorption loop. A kit is available through supply channels.

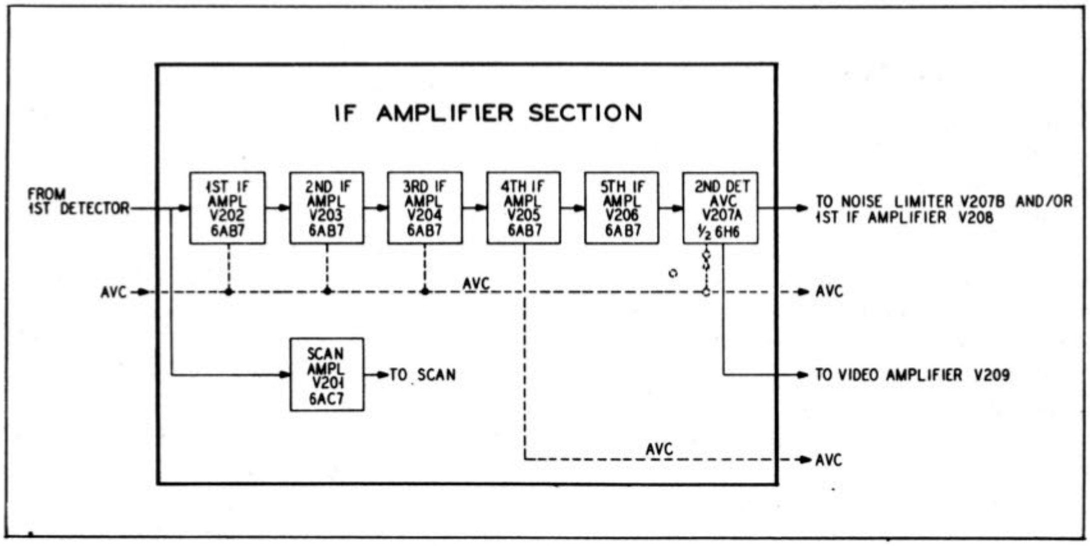


Figure 2–7. Intermediate-Frequency Amplifier Section of Radio Receiver RDZ/RDZ-1, Functional Block Diagram

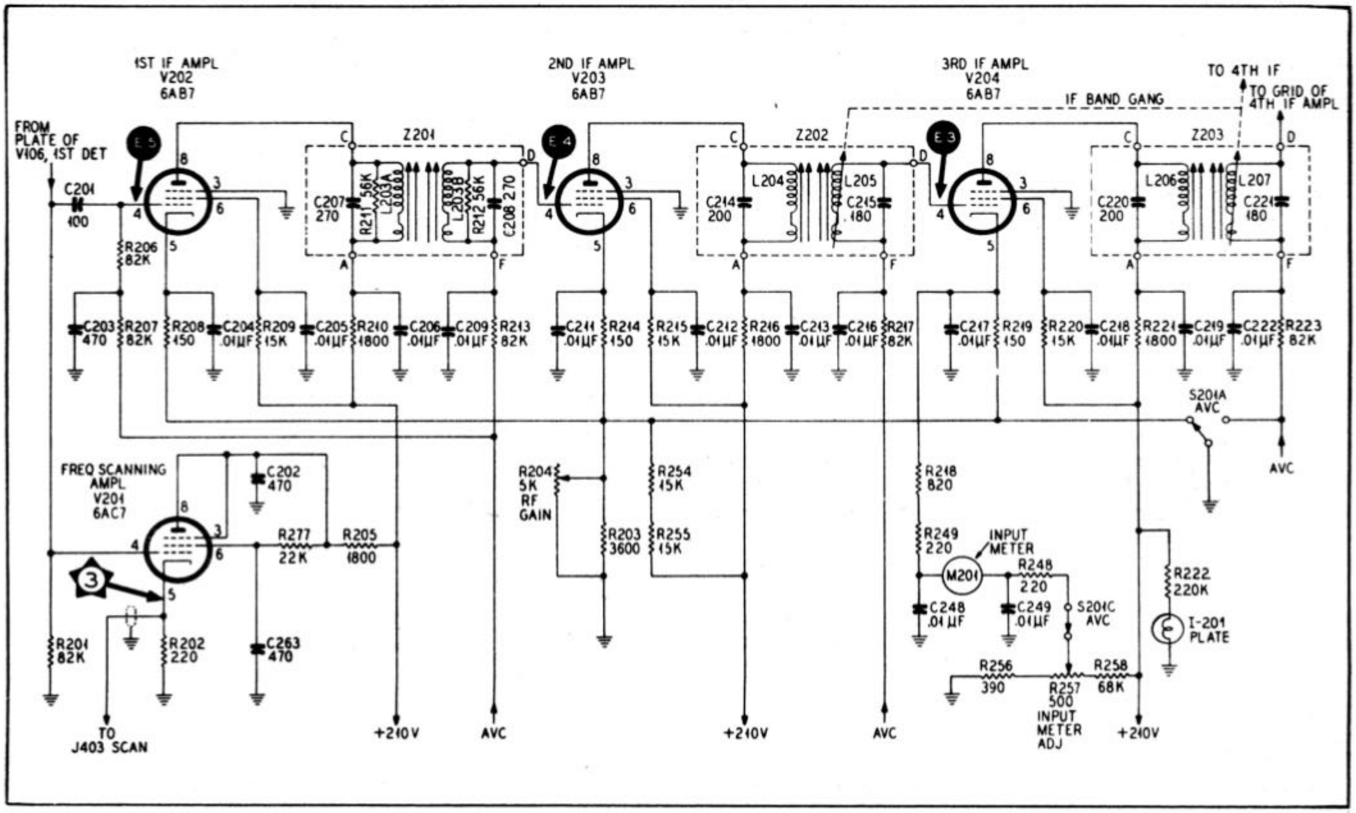


Figure 2–8. Frequency Scan and 1st, 2nd and 3rd I-F Amplifiers of Radio Receiver RDZ/RDZ-1, Schematic Diagram, Showing Test Points

2–5. INTERMEDIATE-FREQUENCY AMPLIFIER SECTION.

This functional section is comprised of the frequency-scan amplifier, five intermediate-frequency amplifiers, and the 2nd detector. See figure 2–7.

The intermediate-frequency output (nominal center frequency of 15.1 mc.) from the 1st detector is applied through intermediate-frequency transformer Z201 to the grid of frequency-scan amplifier V201, a type 6AC7 used as a cathode-follower. See R-F AMPLIFIER AND CONVERTER SECTION, paragraph 2–4, and figure 2–8. The signal is taken from the cathode of V201, and brought out through a shielded lead to jack J403 (SCAN), where it may be applied to a radio-frequency measuring unit (panoramic adapter).

Field Change No. 4–RDZ, effective for all RDZ/RDZ-1: when a scanning unit is not used with Radio Receiver RDZ/RDZ-1, standing-wave voltages are present at jack J403 (SCAN), since the receptacles are not suitably terminated. These standing waves radiate energy into various circuits and cause regeneration, resulting in spurious oscillations and instability in the intermediate-frequency amplifiers. The standing waves are reduced by the installation of a dummy load and shielding. The dummy load consists of a 47-ohm resistor in series with a .01-μf. capacitor. Kits for this modification (Field Change No. 4–RDZ/RDZ-1) are available through regular supply channels.

The five i-f amplifiers use type 6AB7 pentodes. Automatic-gain-control voltage is supplied from the 2nd detector, V207A, to the grids of the 1st, 2nd, and 3rd i-f amplifiers. The 4th i-f amplifier is supplied a portion of the a-v-c voltage from across the voltage-divider network, R241 and R242. See figures 2–11 and 4–15. The IF BAND switch provides two selectivity positions. It mechanically varies the coupling between the primary and secondary of i-f transformers Z202, Z203, and Z204, for the 3rd, 4th, and 5th i-f amplifiers respectively. See figures 2–8 and 2–9. In the BROAD position of the IF BAND switch, the over-all i-f bandwidth is approximately 250 kc. at 6 db down; and in the NARROW position, it is approximately 125 kc. at 6 db down.

Associated with V204, the 3rd i-f amplifier, is input meter M201. See figure 2–8. It is operative when a-v-c switch S201 is in the ON position, and is used for two purposes. For normal receiver operation it indicates relative signal strength, and for trouble-shooting or alignment it reads relative grid excitation to the 2nd, 3rd, or 4th frequency doubler. Input meter M201 measures the cathode voltage drop across resistor R219. With no signal input, variable resistor R257 is adjusted for a zero reading on the meter; then as a-v-c voltage is applied to the grid of V204, driving the grid negative, its cathode current decreases, with a subsequent decrease in the voltage drop across resistor R219. For alignment of the frequency multipliers, MULTIPLIER TUNING switch S101 connects the a-v-c bus to read relative grid excitation to the 2nd, 3rd, or 4th frequency doubler. See figure 2–5.

Field Change No. 5–RDZ, effective for all RDZ/RDZ-1: the i-f transformer coil forms originally supplied were made of polystyrene and are subject to deformation from high temperatures. If inspection indicates deformation of these coils, replace them with the improved type which employ ceramic forms.

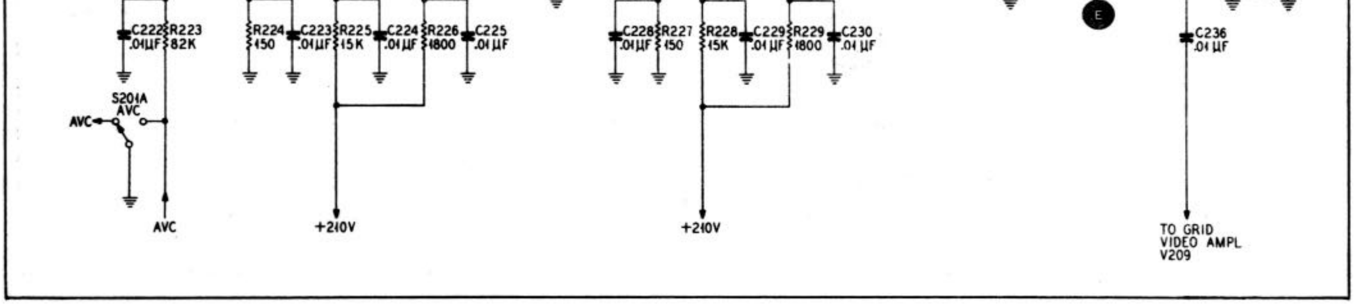


Figure 2–9. 4th and 5th I-F Amplifiers and 2nd Detector of Radio Receiver RDZ/RDZ-1, Schematic Diagram, Showing Test Points

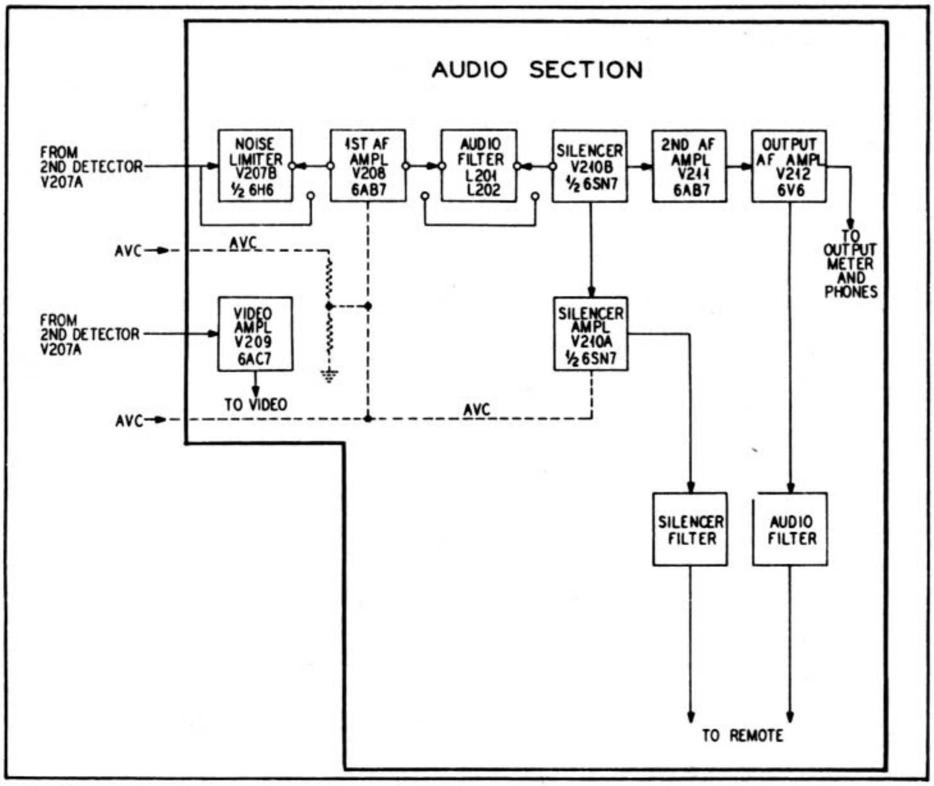


Figure 2–10. Audio Section of Radio Receiver RDZ/RDZ-1, Functional Block Diagram

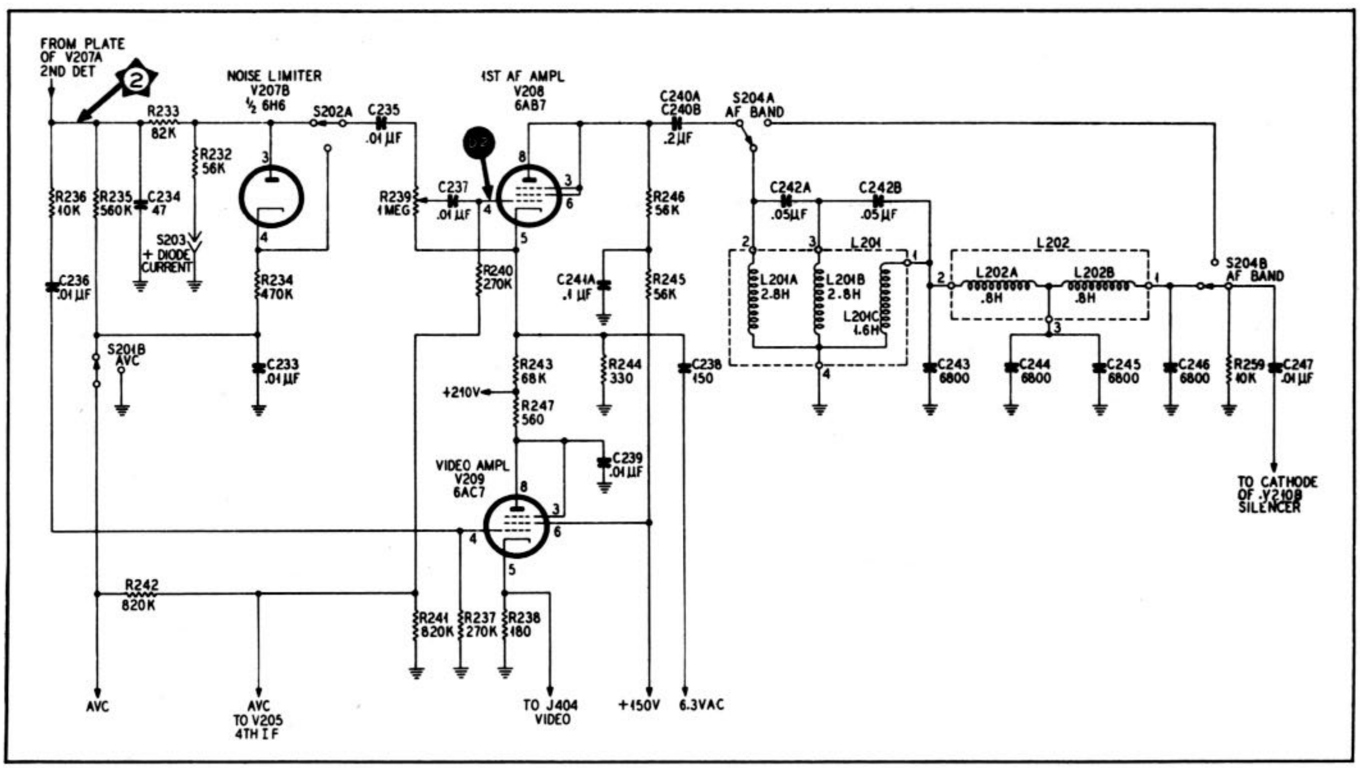


Figure 2–11. Noise Limiter, 1st A-F Amplifier, Video Amplifier, and Audio Filter of Radio Receiver RDZ/RDZ-1, Schematic Diagram, Showing Test Points

2-6. AUDIO SECTION.

This section consists of a noise limiter, video amplifier, silencer and silencer amplifier, and three stages of audio amplification. See figure 2–10. Three audio output indications are available—the video amplifier which provides a convenient means of monitoring the signal visually, output meter M202, and phone jack J201.

One-half of a type 6H6, V207B, is used as a diode-type noise-peak limiter. See figure 2–11. The values of the parts used are chosen so that for a normal signal input the plate of V207B is positive with respect to its cathode by an amount which depends directly on the a-v-c voltage applied to the cathode of V207B. Since the time constant of the a-v-c circuit is long compared to the duration of a noise peak, the cathode is held essentially constant at the normal a-v-c level while the noise appears on the plate of the limiter as a negative voltage, driving it negative with respect to the cathode. Thus, the noise limiter is made nonconducting for the duration of any static, pulses, or other electrical noises. The noise limiter is placed in the circuit when switch S202 (NL/OM) is set to the NL or NL/OM position. Capacitor C238 is used to reduce any objectionable hum introduced by the noise limiter.

The rectified signal (audio) from the plate of V207A, the 2nd detector, is fed to the grid of the video amplifier, V209, a type 6AC7 used as a cathode-follower. See figure 2–11. The signal is taken from the cathode of V209 and brought out through a shielded cable to jack J404 (VIDEO). This jack provides a convenient connection for monitoring the signal visually.

The 1st a-f amplifier, V208, a type 6AB7 pentode, is used as a triode amplifier. See figure 2–11. A portion of the a-v-c voltage is supplied to the grid through resistor R242.

The a-f band filter may be switched in or out of the signal path by means of switch S204 (AF BAND). The filter is a combination of a high-pass filter network followed by a low-pass filter network, the frequencies below 350 cycles and above 3500 cycles being attenuated.

The two sections of a type 6SN7W tube are employed as the silencer amplifier, V210A, and the silencer, V210B. See figure 2–12. The grid and plate of the silencer are tied together, making this stage essentially a series-diode silencer (squelch) circuit. The silencer amplifier acts essentially as a control tube for the silencer. With no signal input, resistor R252 (SILENCER) adjusts the cathode bias voltage of the silencer amplifier to a point where it draws heavy plate current, thereby reducing its plate voltage. Since the plate of the silencer is coupled through resistor R263 to the plate of the silencer amplifier, the silencer plate voltage is reduced to the point where the plate is negative with respect to its cathode and the

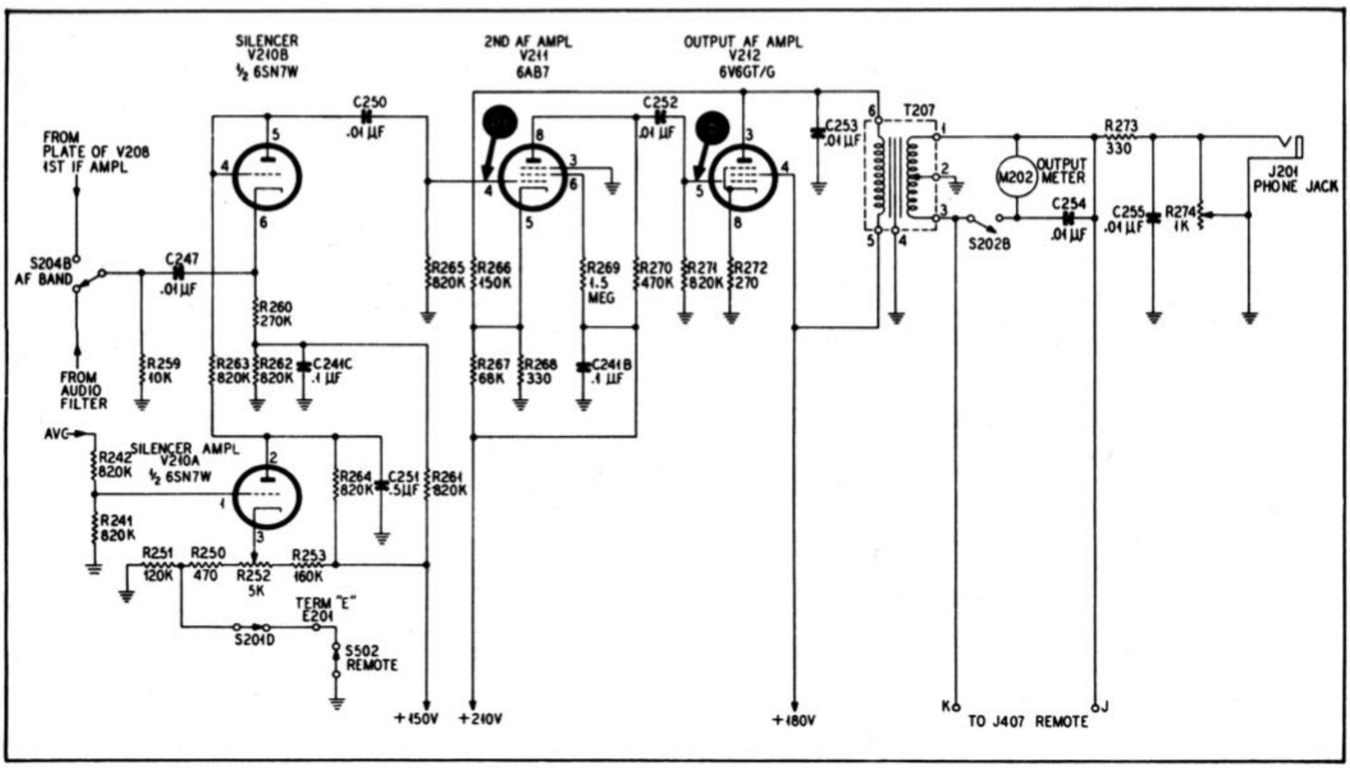


Figure 2–12. Silencer, Silencer Amplifier, 2nd A-F Amplifier, and Output Amplifier of Radio Receiver RDZ/RDZ-1, Schematic Diagram, Showing Test Points

silencer is cut off. When a signal is received, negative voltage (a.v.c.) is applied to the grid of the silencer amplifier, the plate current is reduced, and the plate voltage of both tubes increases, allowing the silencer to conduct.

The 2nd a-f amplifier, V211, a type 6AB7 pentode, is resistance-coupled to the output a-f amplifier, V212, a type 6V6 beam-power tube, the audio output being taken off through transformer T207. See figure 2–12. Degenerative feedback is supplied from the plate of V212 to the cathode of V211 through resistor R266, which tends to make the audio output constant for load variations of 30 to 600 ohms.

Output meter M202 is switched into the circuit by switch S202B (NL/OM) in either the OM or NL/OM position. Variable resistor R274 is used as the volume control for the phone circuit, jack J201 (PHONE).

Band-pass filters are used in the output of both the audio and silencer circuits. See figure 3–8. These filters minimize interference both to and from Radio Receiver RDZ/RDZ-1.

NOTE

Some earlier models of Radio Receiver RDZ/RDZ-1 have slightly different silencer circuits. See figure 2–13.*a.* and 2–13.*b.* An inherent characteristic of this earlier type silencer circuit causes hum to be introduced; for this reason all silencer circuits must be modified to agree with the later design.

These earlier model silencer circuits which require modification can be readily identified, since a connection was used on terminal F of terminal strip E201 (figure 3–17) which the later model circuit did not require. Referring to figure 2–13.*a.* and 2–13.*b.*, note that the values of three resistors (R250, R251, and R253) are changed for this modification. Resistor R250 is changed from 270K to 470 ohms, R251 from 1K to 120K ohms, and R253 from 120K to 160K ohms.

2–7. POWER-SUPPLY SECTION.

The power supply furnishes the three d-c voltages required for the RDZ/RDZ-1 Radio Receiver. See figure 2–14. To minimize interference from outside sources, the a-c input is brought in through a filter network, as shown in figure 3–5. Switch S301 adjusts the primary of power transformer T301 for an input voltage of 110, 115, or 120 volts, a.c. Tube V301, a type 5U4G, is employed as a full-wave rectifier, the output of which is filtered by the tuned-choke, two-section filter network. The +210-volt supply is obtained from the output of this filter. The +150-volt regulated supply is tapped off the plate of V302, a VR150 tube, which is furnished

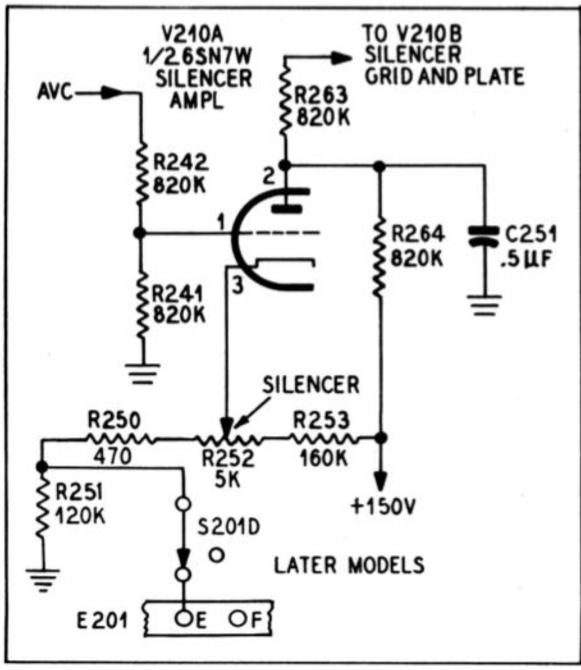


Figure 2–13a. Schematic Diagram of Silencer Circuits Before Modification (See Note preceding paragraph 2–7)

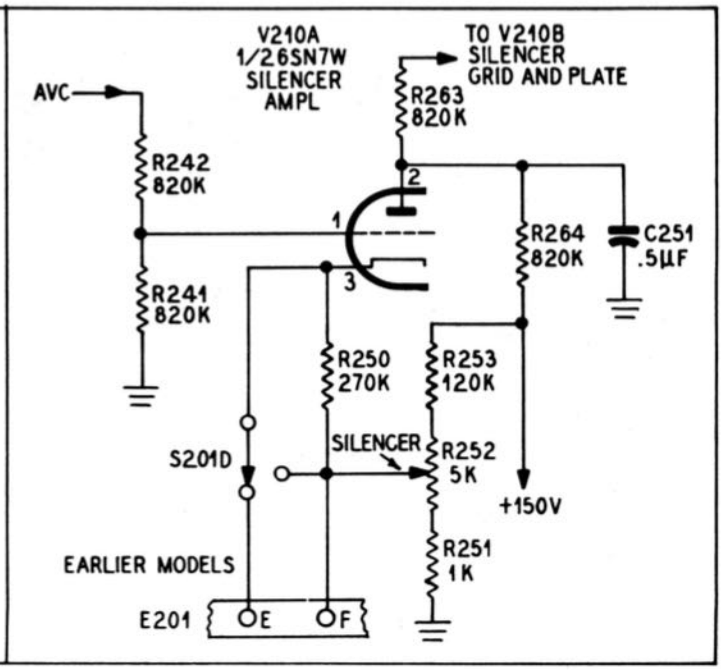


Figure 2–13b. Schematic Diagram of Silencer Circuits After Modification (See Note preceding paragraph 2–7)

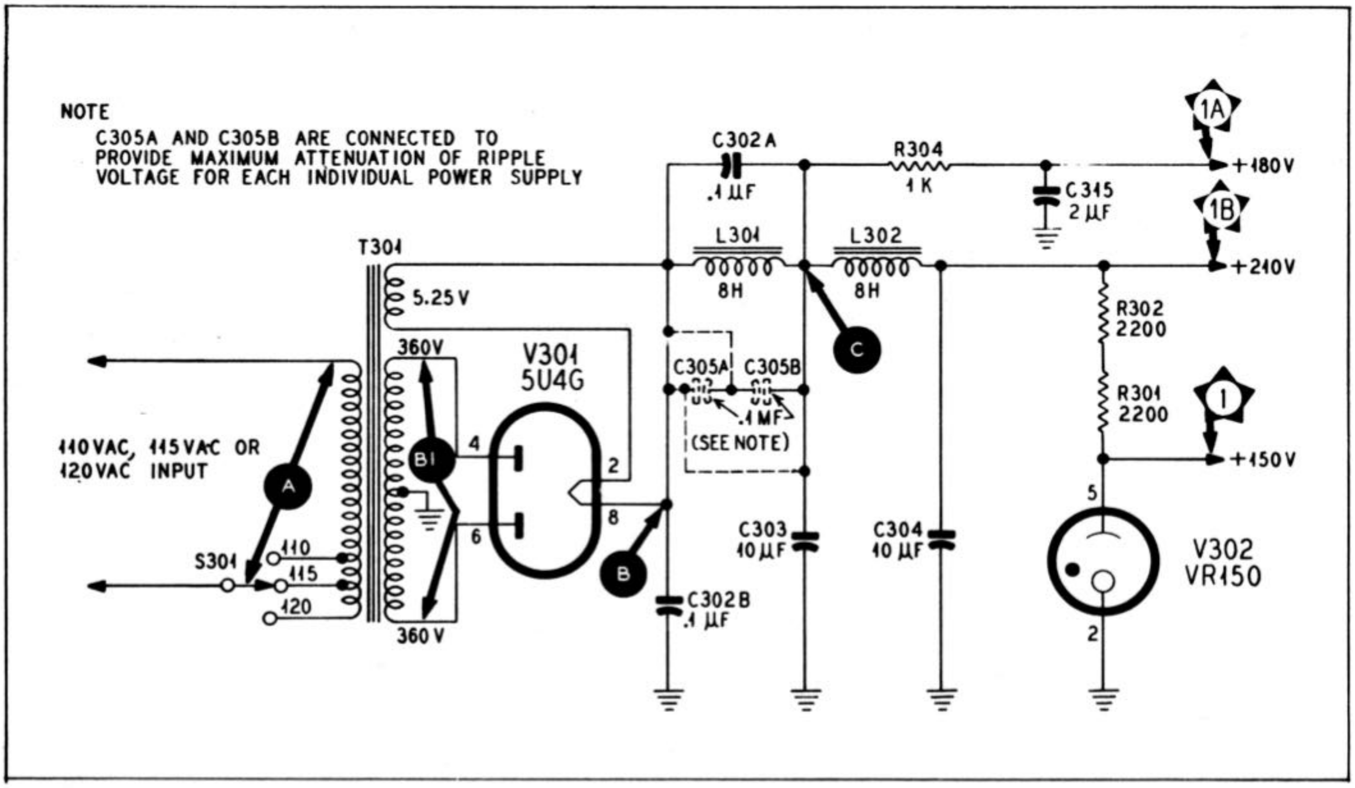


Figure 2–14. Power Supply for Radio Receiver RDZ/RDZ-1, Simplified Schematic Diagram, Showing Test Points

plate voltage from the +210-volt supply through voltage-dropping resistors R301 and R302. The 180-volt supply for the output a-f amplifier is obtained from a tap between chokes L301 and L302. Resistor R304 and capacitor C315 provide the filter action required for this supply.

2–8. AUTOTUNE SYSTEM.

The Autotune system selects the crystal for the desired channel frequency and tunes the r-f and converter sections so that any one of ten fixed channel frequencies can be automatically selected by a switch on the receiver or at a remote operating position. Crystal frequencies are chosen to produce a nominal intermediate center frequency of 15.1 mc. The heterodyning frequency is 15.1 mc. above the received signal. The crystals are thermostatically stabilized at the correct operating temperature by Crystal Oven Navy Type—40148 or —40148A.

A simplified schematic diagram of the Autotune system is shown in figure 2–15. When the CHANNEL SELECTOR switch, S602, is turned to the desired channel, with the LOCAL-REMOTE switch S603 in LOCAL position for local operation, relay K601 is energized through switch S604. When K601 operates, it applies 110 volts, a.c., to motor B601, which operates to drive the various mechanisms of the Autotune system.

The Autotune mechanism is arranged generally as follows: Three shafts are driven by the motor. One shaft is connected through a friction clutch to a motor-stopping cam. Another shaft is connected through a friction clutch to drive the stop-ring drum, main dial, and main tuning capacitor. The remaining shaft is connected through a friction clutch to drive the cam drum, crystal switches, the channel-indicating dial, the seeking switch, and the stopping ratchet. A clutch-release knob is mounted on the main dial, to allow the cam drum to be set to the proper position for channel selection.

The normal operating sequence is as follows: With the channel selected and the motor energized by K601, the relay arm closes a set of contacts to hold K601 closed, and also disengages the stopping ratchet so that the mechanism can turn freely. As the motor slowly turns, the motor-stopping cam turns, releasing a set of contacts which simultaneously open the starting path to relay K601 and provide a parallel path for power to motor B601 to keep it operating when relay K601 is later de-energized. An additional contact removes power from a remote indicating lamp (used when Navy Type —23492 Remote Channel Selector is utilized) to indicate the system is operating. While the motor-stopping cam is turning, the other shafts and mechanisms are also turning. When the SEEKING switch is turned to the de-

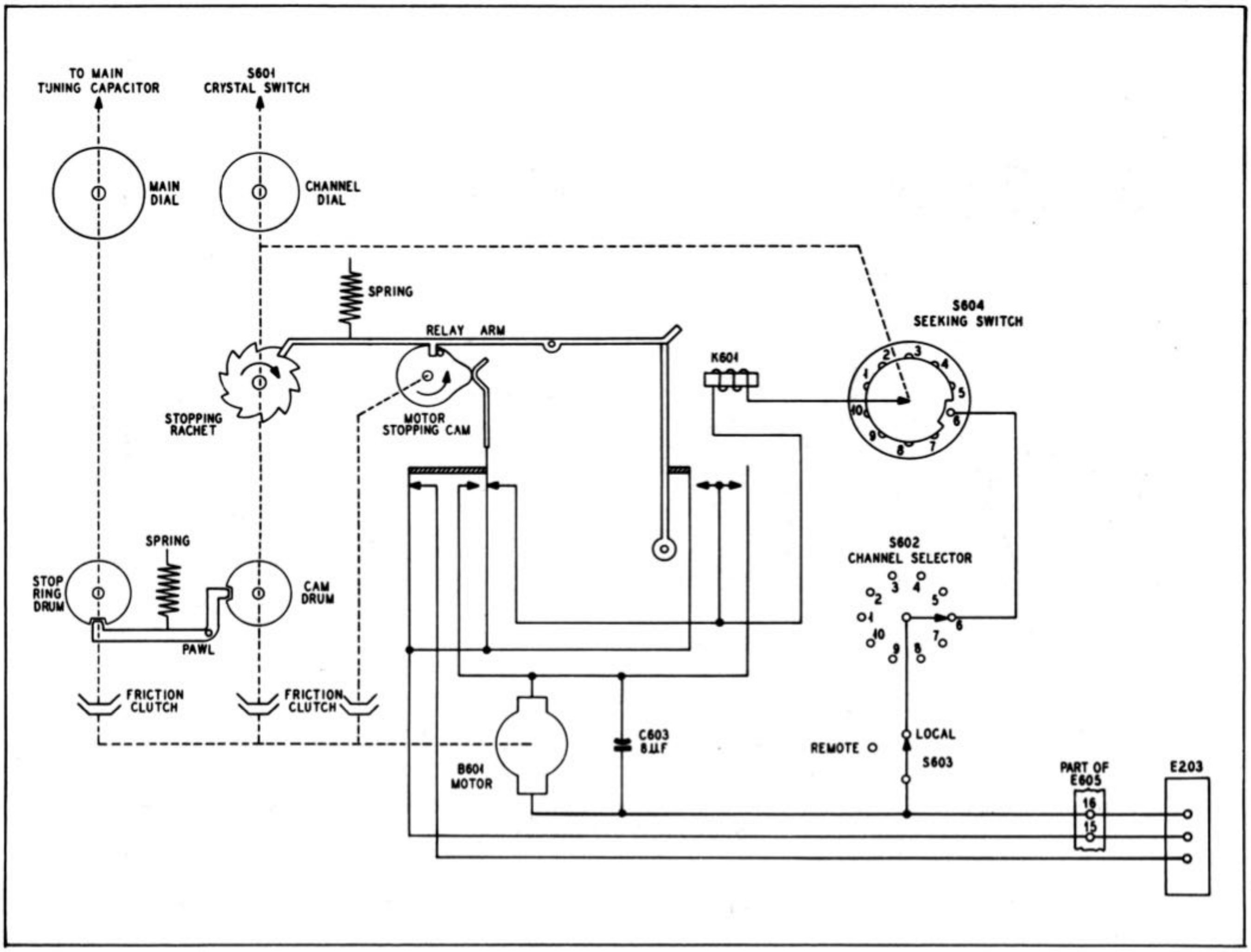


Figure 2–15. Autotune System for Radio Receiver RDZ/RDZ-1, Simplified Schematic Diagram

sired channel, relay K601 is de-energized, but the motor still operates through the parallel path provided previously; however, the relay arm is pulled back by spring tension to engage the stopping ratchet. The stopping ratchet prevents the cam drum from moving, as well as the channel dial, seeking switch, and crystal switches. When the cam drum is stopped, one of the ten notched selector discs engages its pawl which, in turn, engages one of the ten discs on the stop-ring drum, thus stopping the main dial and main tuning capacitor at the desired setting.

When the friction-clutch-linked shafts are stopped, the clutch allows the motor to continue to turn until the motor-stopping cam completes one revolution. The design is such that the motor turns two complete revolutions while the motor-stopping cam turns one revolution. The main capacitor setting is made on the second revolution so that the tuning may be changed from a low to a high frequency in adjacent channels. When the stopping cam completes its single revolution, the contacts to the motor are opened, stopping the motor, and the remote indication lamp is energized to indicate that the system is ready for operation.

Field Change No. 3–RDZ, effective for Serial No. 1 to 2348 of Navy Type No. CNA-46275 and Serial No. 1 to 1100 of Navy Type No. CQC-46275, inclusive, was made to insure a good ground connection from the Autotune blister cover to the main front panel. Kits for Field Change No. 3–RDZ are available through regular supply channels.

FILL OUT FAILURE REPORT FORM

NAVSHIPS 383 FOR ALL FAILURES

THE ANTENNA SYSTEM

2-9. ANTENNAS AND TRANSMISSION LINES.

Three different antennas are employed in the various RDZ/TDZ installations, depending on the individual requirements of each system. Changes in antenna location and/or the type of antenna employed will often improve an installation. The RDZ/TDZ Antennas should have a minimum clearance of three feet above or six feet below the BN/BK Antenna, six feet from the TDQ/RCK Antenna, and twelve feet above or sixteen feet below the TBS Antenna.

a. Antenna Navy Type—66147.

Antenna Navy Type—66147 (see figure 2-16) is a half-wave, center take-off, vertically mounted dipole with an impedance of 50 ohms. The antenna unit covers the entire frequency band of 200 to 400 mc., no adjustment of the unit being required. One of the dipole rods is connected to the outer conductor of the transmission line and is grounded to the antenna mounting. The "live" rod is brought in through the insulated stud and is connected to the center conductor of the transmission line. This type of antenna is somewhat directional, the sensitivity being the highest in the directions perpendicular to the dipole axis; however, for practical usage a relatively wide angle is available.

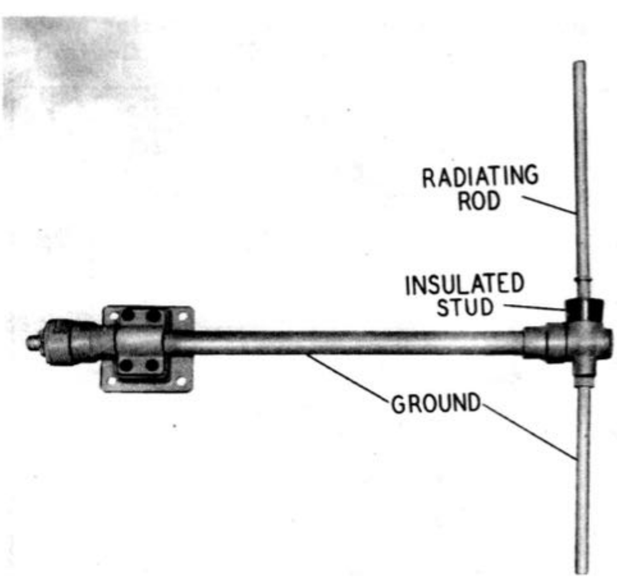


Figure 2-16. Antenna Navy Type -66147

b. Antenna Model AT-150/SRC.

Antenna Model AT-150/SRC (see figure 2-17) is usually used where the installation is such that the antenna will be below the superstructure of the ship. Electrically, it is a broad-band dipole antenna with the same characteristics as Navy Type—66147.

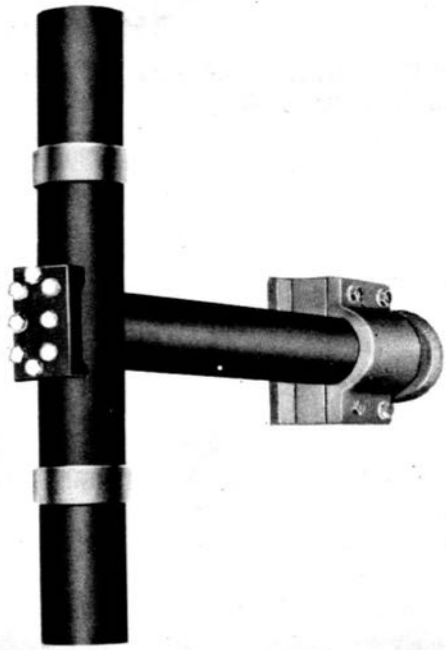


Figure 2-17. Antenna AT-150/SRC

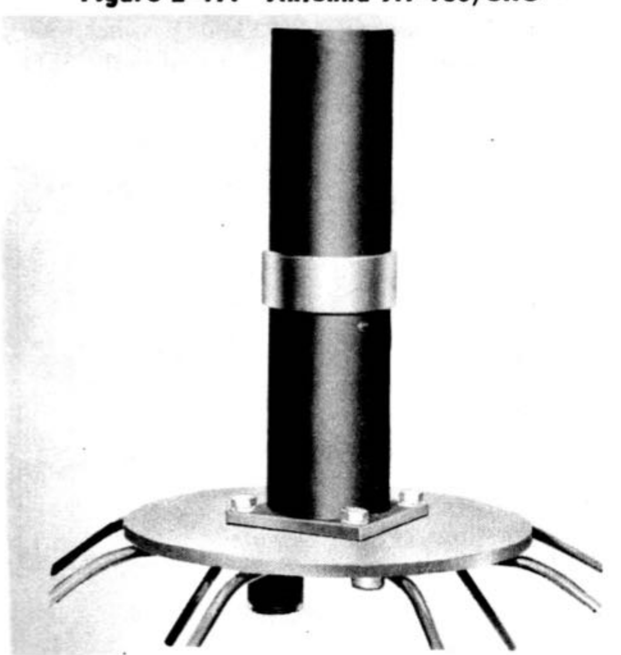


Figure 2-18. Antenna AS-390/SRC

c. Antenna Model AS-390/SRC.

Antenna Model AS-390/SRC (see figure 2-18) is an unbalanced, broad-band antenna. It is usually employed in installations where the antenna is mounted above all other antennas or the superstructure on shipboard.

d. Transmission Lines.

The coaxial transmission line is of the solid dielectric type, having approximately 50 ohms impedance to match the antenna to Radio Receiver RDZ/RDZ-1.

Many of the early RDZ/TDZ antenna installations can be greatly improved by modification of the transmission line. This is accomplished by making the run as short as is practical with a minimum number of connections and by using RG-18/U instead of RG-10/U.

THE REMOTE CONTROL UNITS

2-10. REMOTE CHANNEL SELECTOR UNIT NAVY TYPE—23492.

The Navy Type—23492 Remote Channel Selector Unit (figure 2-19) provides facilities for channel selection, squelch release, phone or speaker connections, and audio-level control of the RDZ/RDZ-1. This unit may be used only in installations that require remote operation from only a single station. A 16-wire cable is required between the —23492 and the RDZ/RDZ-1 which it controls.

The CHANNEL selector switch, S501, is a ten-position rotary type. See figure 2-20. The REMOTE CONTROL neon bulb, I501, indicates when the RDZ/RDZ-1 has completed its tuning cycle. Variable resistor R504 is employed as the VOLUME control for PHONE jack J503 and SPEAKER connection J502. With switch S603 in REMOTE position, the CHANNEL selector switch, S501, effectively duplicates the action of CHANNEL selector switch S602. Switches S602 and S603 are located in the RDZ/RDZ-1. See AUTOTUNE SYSTEM, Paragraph 2-8. With the LOCAL REMOTE switch, S603, in REMOTE position, power is connected to the SEEKING switch, S604, through S501. The complete tuning cycle is accomplished as explained in Paragraph 2-8. The REMOTE CONTROL neon bulb, I501, is extinguished during the tuning cycle by the action of relay K601. Very few of these units are found on ships.

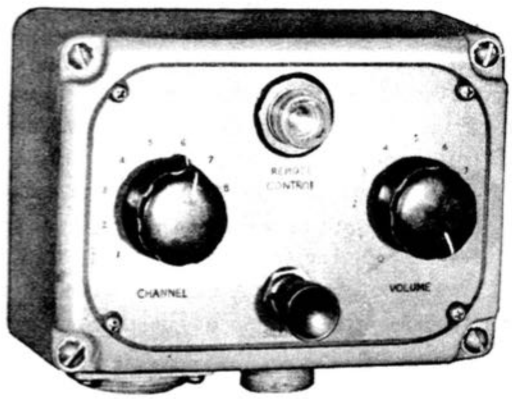


Figure 2-19. Remote Channel Selector Navy Type -23492, Front View, Showing Controls

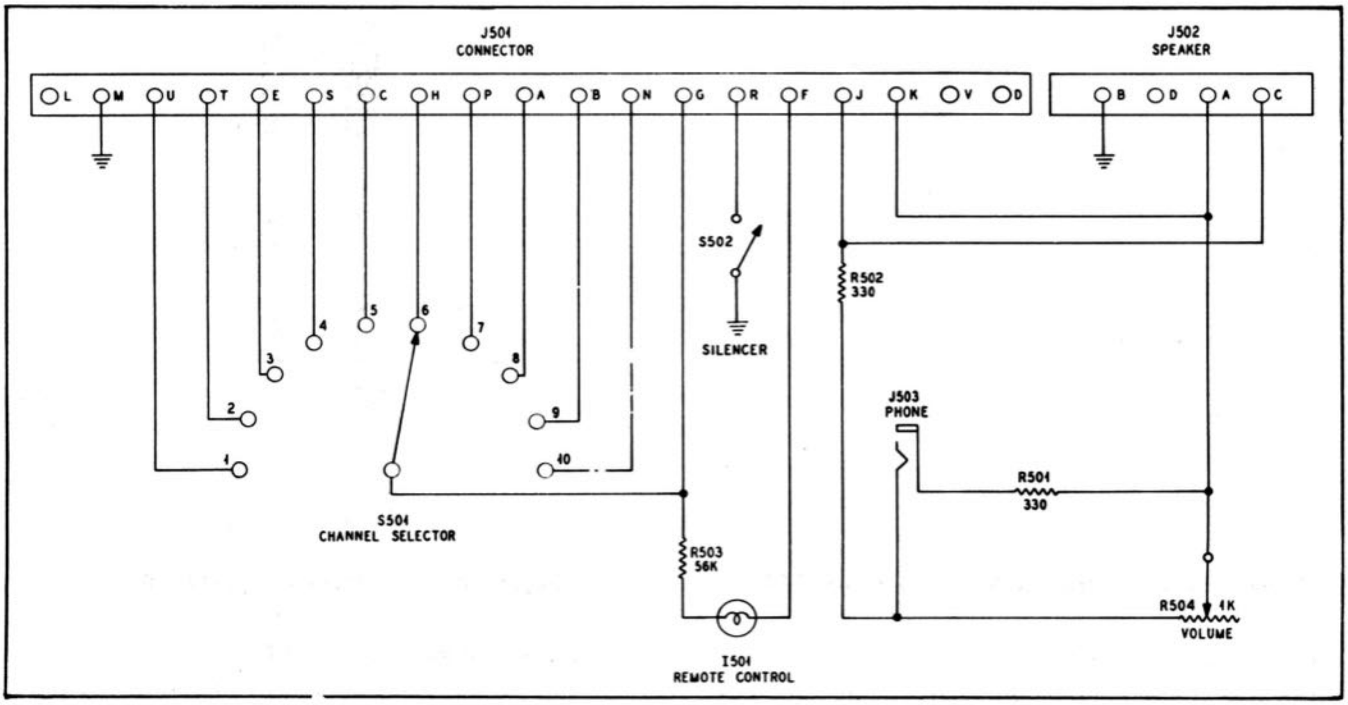


Figure 2-20. Remote Channel Selector Navy Type -23492, Schematic Diagram

2-11. REMOTE CHANNEL SELECTOR NAVY TYPE—23445.

This selector unit (figure 2-21) is contained in a cast-aluminum housing suitable for bulkhead or top of table mounting. A telephone dial, a synchro indicator, and an OFF-ON switch are mounted on the front panel. A card holder containing a set of cards on which frequency data is marked for easy reference is also mounted on the front panel.

The Remote Channel Selector (figure 2-22), when connected into a system with which it was designed to operate, provides for the selection of any channel in the controlled equipment (either RDZ or TDZ) from a remote position. The OFF-ON switch, S301, places the unit electrically in the system. The telephone-type dial, N301, is essentially an automatic switch which makes and breaks an electrical circuit a certain number of times, depending upon the number dialed. When the dial is moved in a clockwise direction to the finger stop, the main spring winds up with sufficient tension to return the dial to its normal position, and the off-normal contacts are closed. As the dial is released the impulse contacts are rapidly opened and closed a number of times corresponding to the number dialed. On return to the normal position, the off-normal contacts are again opened.

The Remote Channel Selector must be used in conjunction with Selector Control Unit Navy Type—23497 to operate Radio Receiver RDZ/RDZ-1 from a remote position. See Paragraph 2-13. Other facilities must also be furnished for a handset. Radiophone Units Navy Type—23500 or —23211A are usually employed for this purpose. See Paragraphs 2-14 and 2-15.

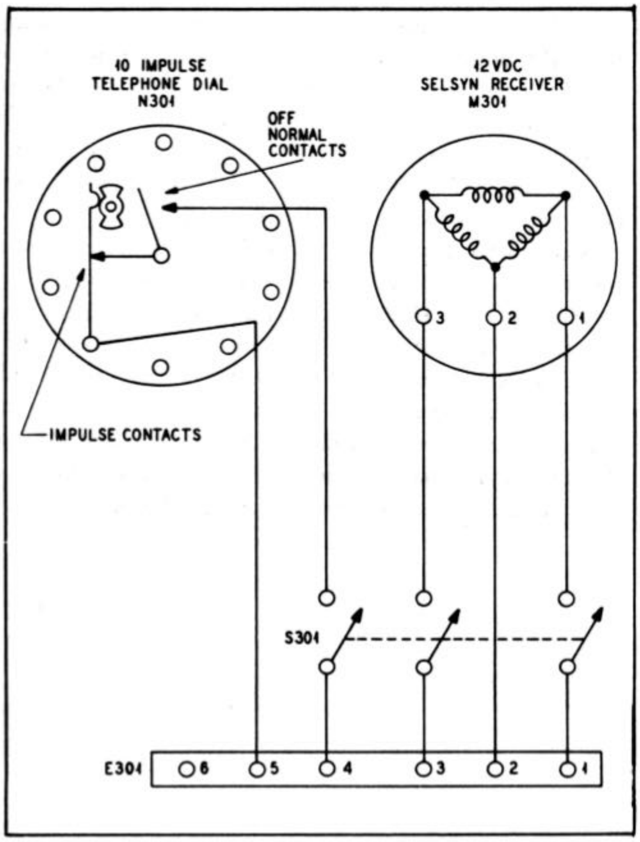


Figure 2-22. Remote Channel Selector Navy Type -23445, Schematic Diagram

Figure 2-21. Remote Channel Selector Navy Type -23445, Front View, Showing Controls

2-12. REMOTE CONTROL-INDICATOR UNIT NAVY TYPE—23496.

The Navy Type—23496 Remote Control-Indicator Unit (see figures 2-23 and 2-24) provides the facilities for complete operation of one TDZ Radio Transmitter and two RDZ/RDZ-1 Radio Receivers.

The controls for this unit are mounted on the front panel. When the LOCAL-REMOTE switch, S603, mounted on the front of Radio Receiver RDZ is set to the REMOTE position, Control Indicator Unit Navy Type—23496 may be operated. A START-STOP switch, S405, enables the TDZ to be energized or de-energized from the remote position. The POWER INDICATOR lamp, I401, is connected into the circuit to indicate that primary voltage is applied to the TDZ and this control unit. A KEY jack, J403, is provided for placing the hand key plug into the front panel. Two HANDSET jacks, J401 and J402, are employed for connecting handsets into the circuit. Receiver switches S401 and S402 enable the operator to connect either receiver on either HANDSET jack J401 or J402, or connect both handset jacks to one receiver. The INCREASE AUDIO LEVEL knobs adjust variable resistors R403 and R404 for the desired audio level input to each of the handsets. Transformer T401 serves as the microphone input transformer. Capacitor C401 serves as a filter to isolate d-c voltage from the audio circuit. The push-to-talk button on the handset used energizes relay K401, completing the circuit to the CARRIER ON indicator lamp I402 and disabling the two speakers, which may be used if desired. The SPKR MUTING switch, S404, is provided to mute either one or both of the speakers.

A telephone-type dial is provided for remote channel selection for either of the two RDZ/RDZ-1 Radio Receivers or the TDZ Radio Transmitter. When unit selector switch (RECEIVER) S403 is placed at RECEIVER NO. 1, RECEIVER NO. 2, or TRANSMITTER position, the receiver or transmitter selected may be dialed for the desired channel. Switch S403 returns to its OFF, or normal, position after channel selection has been made. Three selsyns (synchros) I403, I404, and I405, are used to indicate the frequency channel to which each of the receivers or the transmitter is tuned. These d-c selsyns are marked RECEIVER NO. 1, RECEIVER NO. 2, and TRANSMITTER so that each may be associated with the proper unit.

The telephone-type dial is essentially an automatic switch which makes and breaks a certain number of times, depending on the number (channel) dialed. When the dial is moved in a clockwise direction to the finger stop, the main spring winds up with sufficient tension to return the dial to its normal position, and the off-normal contacts are closed. When the dial is released the impulse contacts are rapidly opened and closed a number of times, corresponding to the number dialed. On return to the normal position, the off-normal contacts are again opened.

A Navy Type—23497 Selector Control Unit must be used with each RDZ/RDZ-1 operating in conjunction with Navy Type—23496 Remote Control-Indicator Unit.

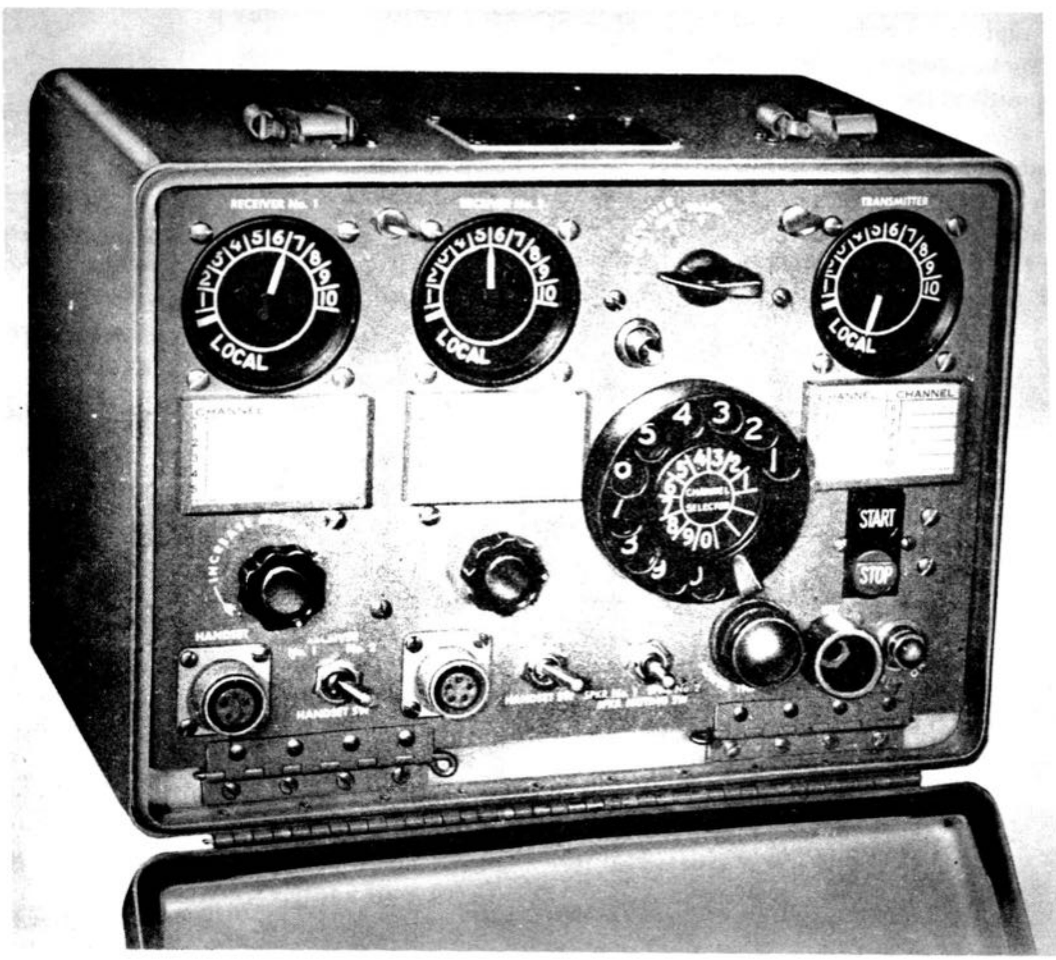


Figure 2–23. Remote Control-Indicator Unit Navy Type –23496, Front View, Showing Controls

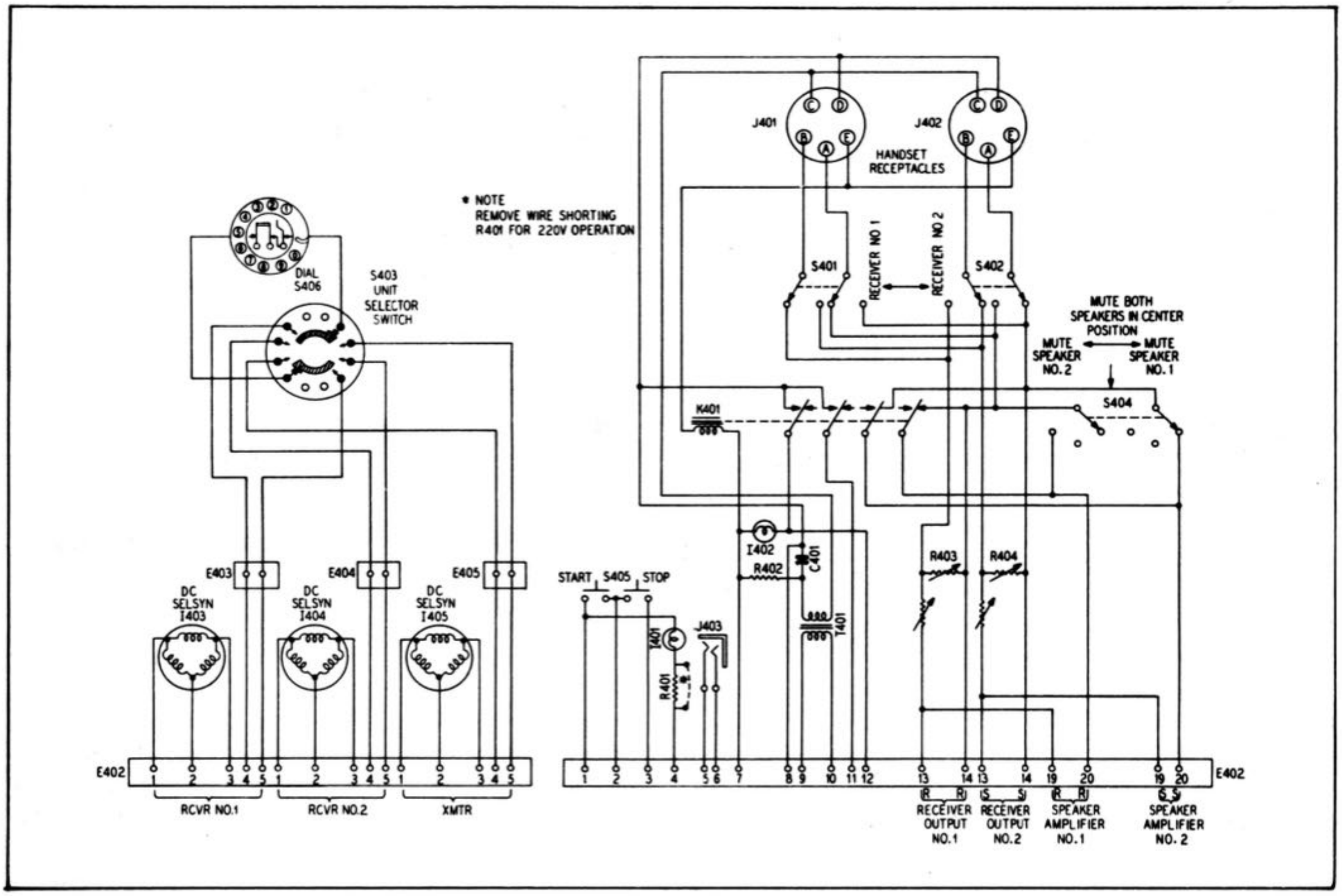


Figure 2–24. Remote Control-Indicator Unit Navy Type –23496, Schematic Diagram

THEORY

2–13. SELECTOR CONTROL UNIT NAVY TYPE—23497.

Navy Type—23497 Selector Control Unit (see figure 2–25) must be employed when either Navy Type —23496 Remote Control-Indicator Unit or Navy Type —23445 Remote Channel Selector (see Paragraphs 2–11 and 2–12) are used to operate the RDZ/RDZ-1 Radio Receiver from a remote position, except when the RDZ/RDZ-1 is used in conjunction with Remote Channel Selector Navy Type—23492.

The Navy Type—23497 Selector Control Unit is contained in a fabricated aluminum case, which is suitable for bulkhead or top-of-table mounting. The front panel is hinged to allow access to the unit for servicing. It also mounts two fuses, the OFF-ON switch, and the pilot lamp.

This unit is essentially a switching central for remote operation. It supplies the data required to tune the equipment to the selected channel; it indicates, at the remote position, the channel to which the equipment is tuned; it shows when the equipment is being operated from the local position; it provides facilities to render inoperative the RDZ/RDZ-1 silencer circuits. When the telephone-type dial on the remote control unit is moved in a clockwise direction to the finger stop, the impulse contacts remain closed (normal position) and the off-normal contacts are closed. See figure 2–26. This causes relay K101 to be energized, which in turn, energizes slow-release relay K103. The contacts of relay K103 break the circuit between the minor switch and the controlled equipment and at the same time energize the release magnet. When the dial is released the impulse contacts are rapidly opened and closed a number of times corresponding to the channel number dialed. The opening of the impulse contacts returns relay K101 to the normal position (open), which de-energizes relay K103 and at the same time energizes relay K102. Relay K103, being slow to release, remains energized for .2 second. As the impulse contacts again close relay K101 is re-energized, completing the circuit to relay K103 before time has elapsed for its contacts to release. Relay

Figure 2–25. Selector Control Unit Navy Type –23497, Front View

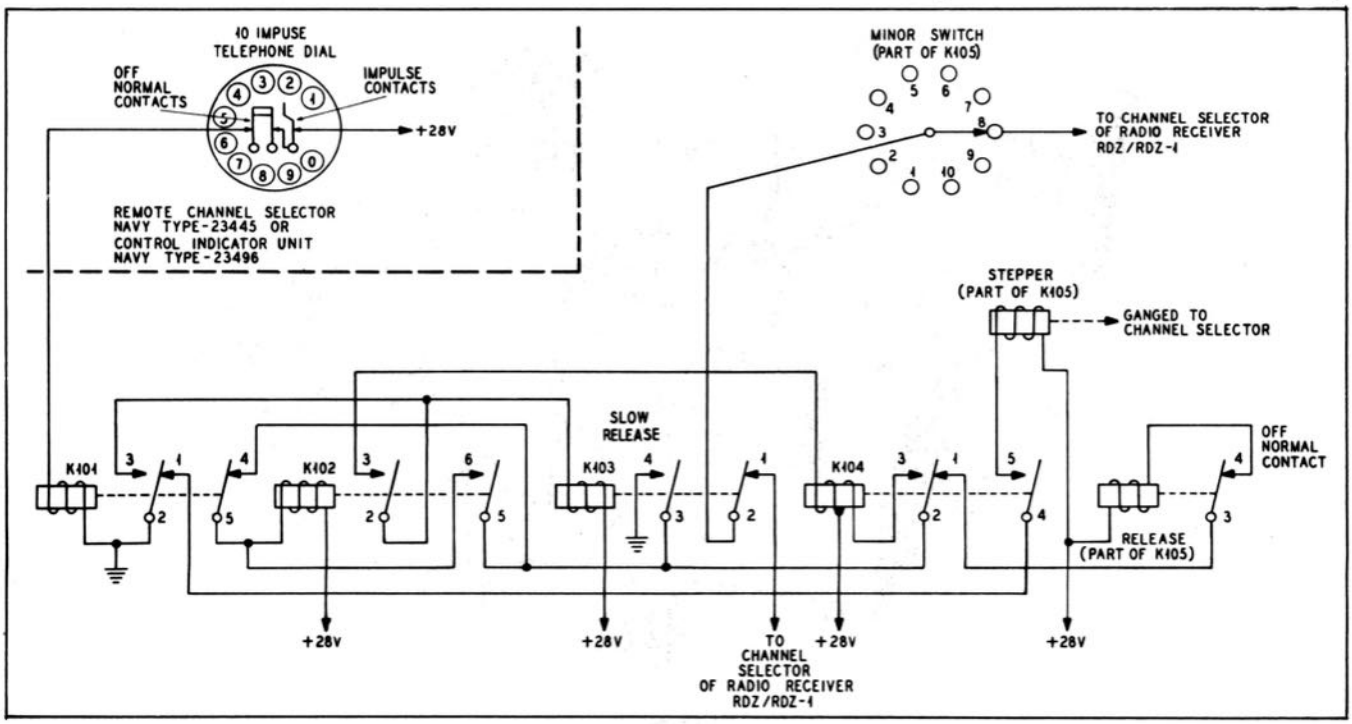


Figure 2–26. Channel Selector for Selector Control Unit Navy Type –23497, Simplified Schematic Diagram

K102, which is held in by one contact, closes relay K104, completing a path to the stepper magnet. Each additional pulse from the dial causes relay K101 to open and close, thereby advancing the minor switch one step by applying a ground to the stepper switch through relay K104.

2–14. REMOTE RADIOPHONE UNIT NAVY TYPE—23500.

This unit (see figure 2–27) is designed for installation in sheltered locations. Located on the front panel are the following controls: TRANSMITTER START-STOP button, POWER ON red indicator lamp, CARRIER ON green indicator lamp, KEY jack, HANDSET or HEADSET jacks, PUSH TO CUT SQUELCH button, and EARPHONE LEVEL knob.

2–15. REMOTE RADIOPHONE UNIT NAVY TYPE—23211A.

This unit (see figure 2–28) is contained in a housing suitable for bulkhead mounting, and is designed for use in outside locations which are exposed to the weather. Access to the controls is obtained by opening the front cover, which is hinged to the unit. All controls are mounted on the front panel, including a means of permanently mounting and connecting a handset. Located on the front panel are the following: MASTER START power on red indicator lamp; START ON-OFF switch controls; CARRIER ON green indicator lamp; ON-OFF KEY CIRCUIT switch; NOISE SUPPRESSION NORMAL-ON switch; INCREASE EARPHONE LEVEL control; LOCAL-EXTENSION; LOCAL CHEST MIC extension; LOCAL HEADSET jack; LOCAL CHEST SET jack.

Figure 2–27. Radiophone Unit Navy Type –23500, Front View, Showing Controls

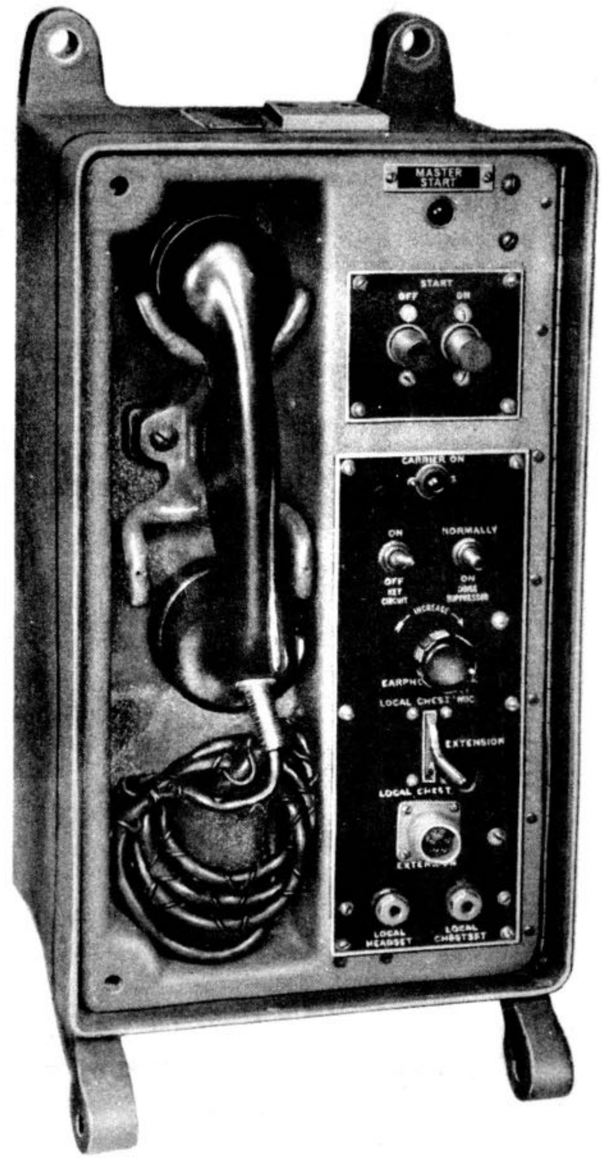


Figure 2–28. Radiophone Unit Navy Type –23211A, Front View, Showing Controls

FILL OUT A FAILURE REPORT

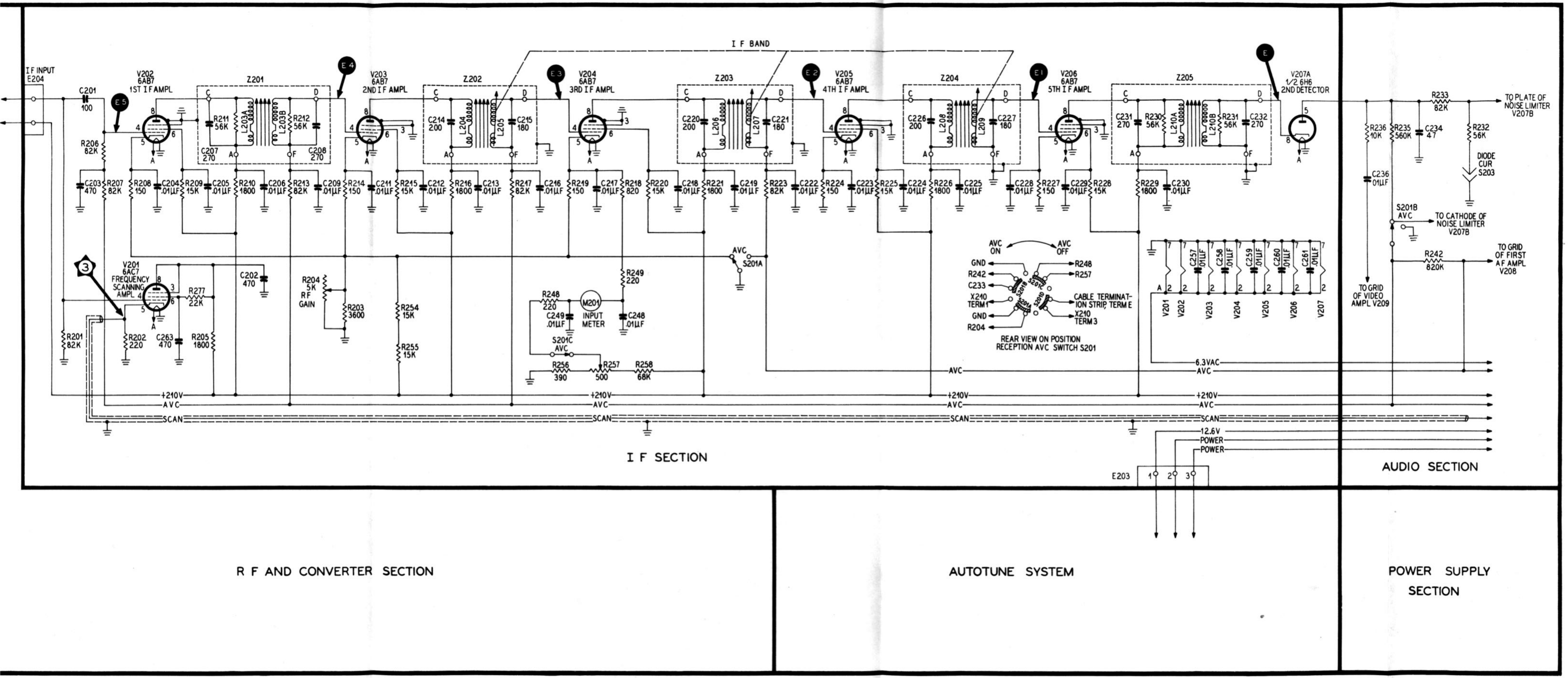
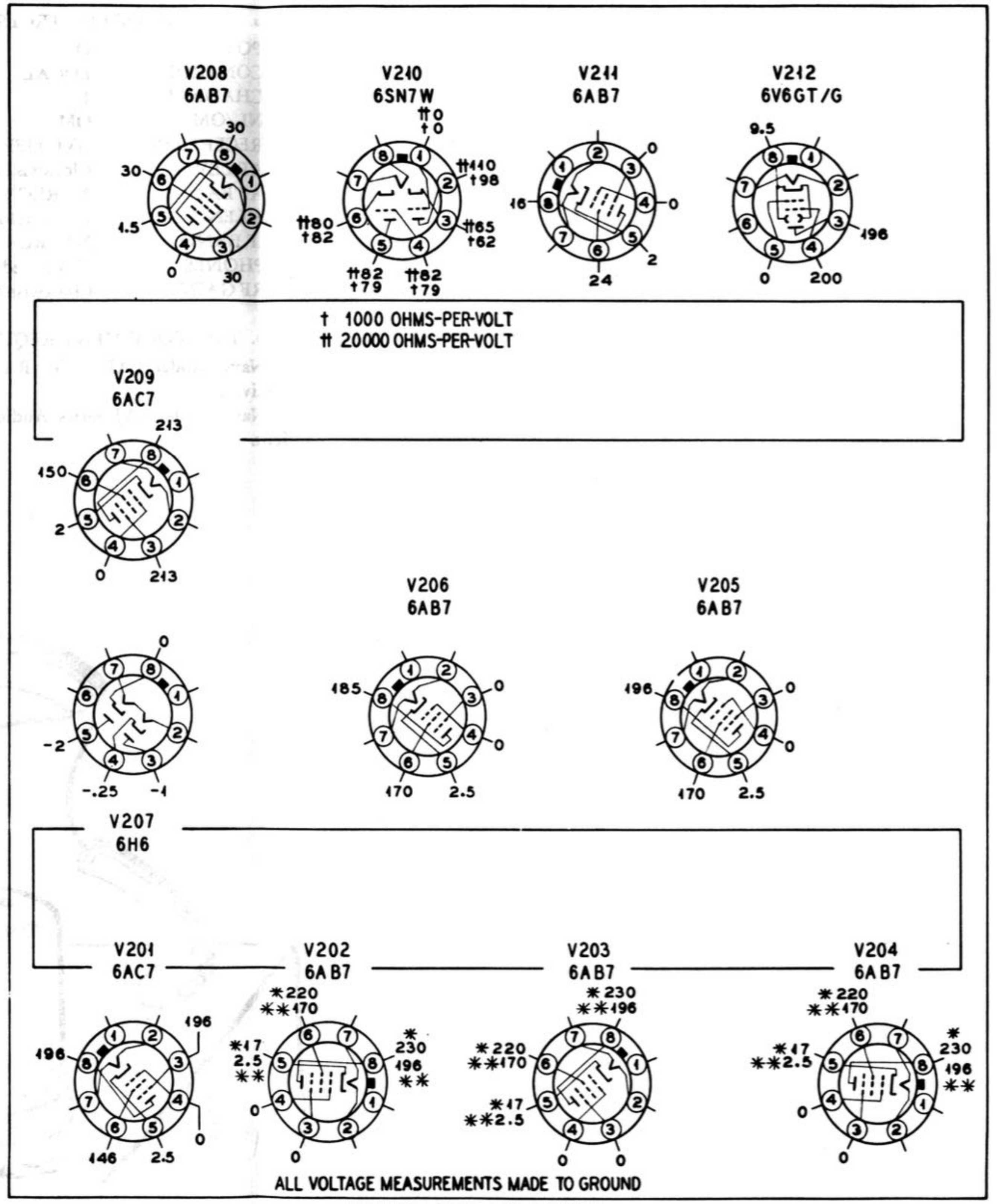
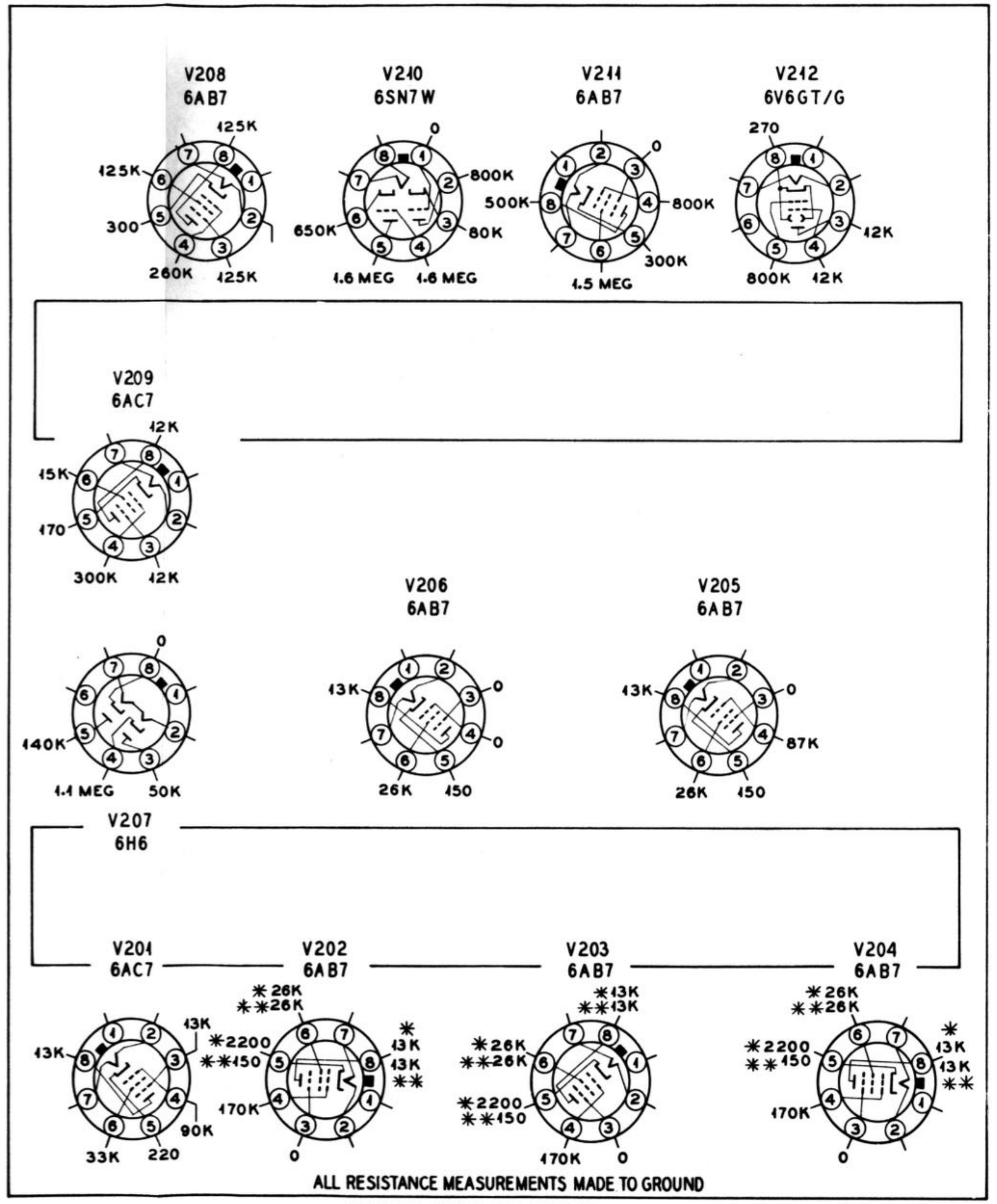


Figure 3–11. Radio Receiver RDZ/RDZ-1, Trouble-Shooting Schematic Diagram for Intermediate-Frequency Amplifier Section



BOTTOM VIEW OF CHASSIS
VOLTAGE CHART

* RF GAIN AT 0
** RF GAIN AT 10



BOTTOM VIEW OF CHASSIS
RESISTANCE CHART

Figure 3–12. Radio Receiver RDZ/RDZ-1, Audio and I-F Amplifier Sections Voltage and Resistance Charts

3–9. TROUBLE-SHOOTING THE R-F AND CONVERTER SECTION.

a. SETTING OF CONTROLS.

POWER	ON
CONTROL	LOCAL
CHANNEL	1
NL/OM	OM
RECEPTION	AVC OFF
AF LEVEL	Clockwise to 10
AF BAND	NARROW
SILENCER	Counterclockwise to 0
IF BAND	NARROW
PHONES	To desired audio level
RF GAIN	Clockwise ¾ turn.

b. TEST EQUIPMENT REQUIRED.

Navy Model LAF Series R-F Signal Generator or equivalent.

Navy Model LAJ Series Audio Oscillator or equivalent.

Navy Model OE Series Volt-Ohm-Milliammeter or equivalent.

Tube Tester TV-3/U, Navy Model OZ Series or equivalent.

Headphones Navy Type—49016 or equivalent.

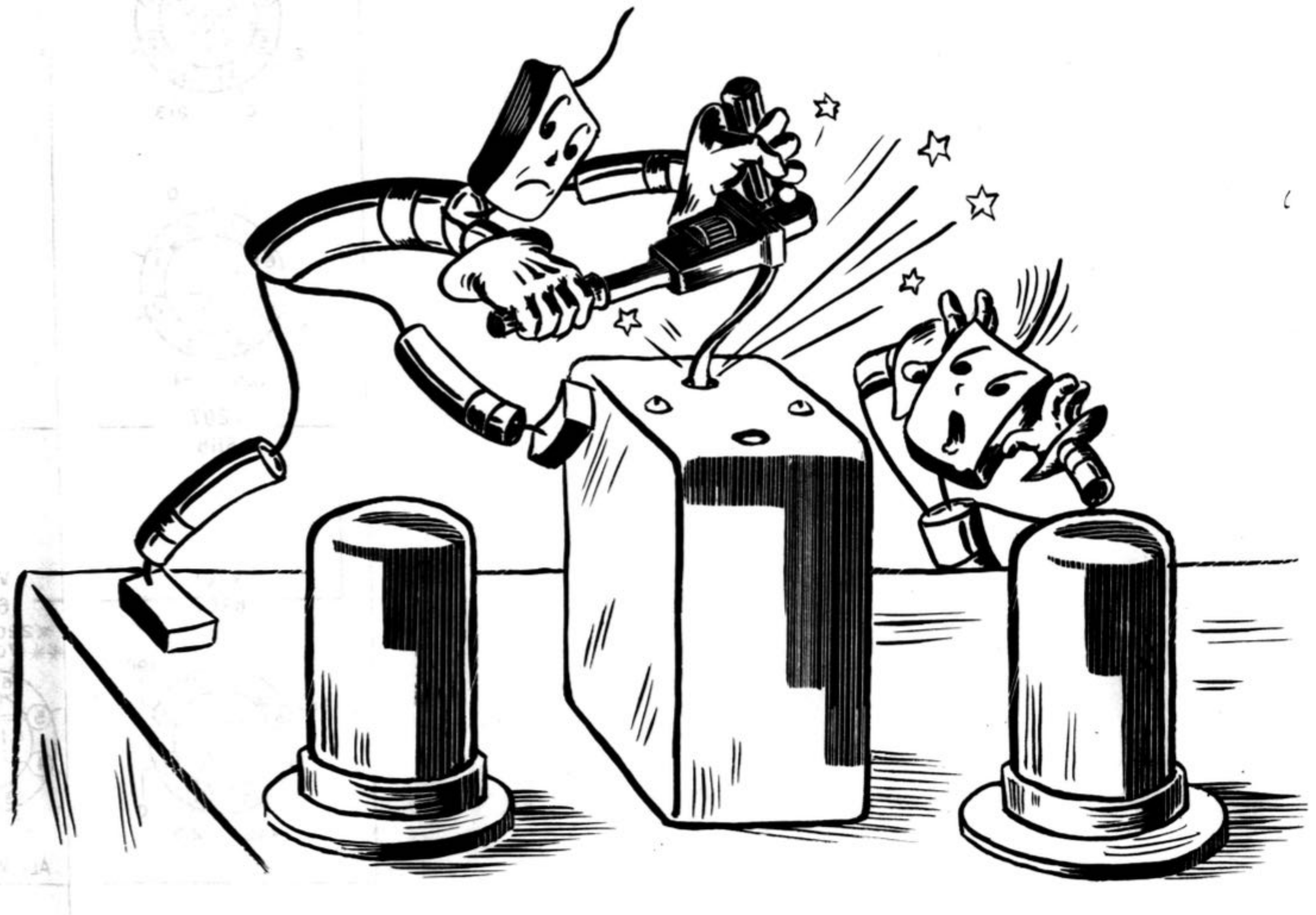
c. PROCEDURE.

1. Remove antenna input connector P408 from J101 (see figure 3–13), and connect antenna input adapter to J101. See Section 4, Paragraph 4–12, for fabrication of this adapter.

2. Set the LAF to the frequency of the channel being checked and the CW-OFF-PULSE switch to CW position. Set the LAJ for 1000 cycles, the ATTENUATOR clockwise ½ turn, and connect the LAJ between the EXT MOD jack and chassis of the LAF.

3. For each channel check as indicated in CHART 4, turn the LAF CW-OFF-PULSE switch to OFF position, and adjust RF GAIN control for less than –10 db as read on OUTPUT meter M202.

4. Plug headphones in PHONES jack.



USE THE RIGHT TOOL FOR THE RIGHT JOB!

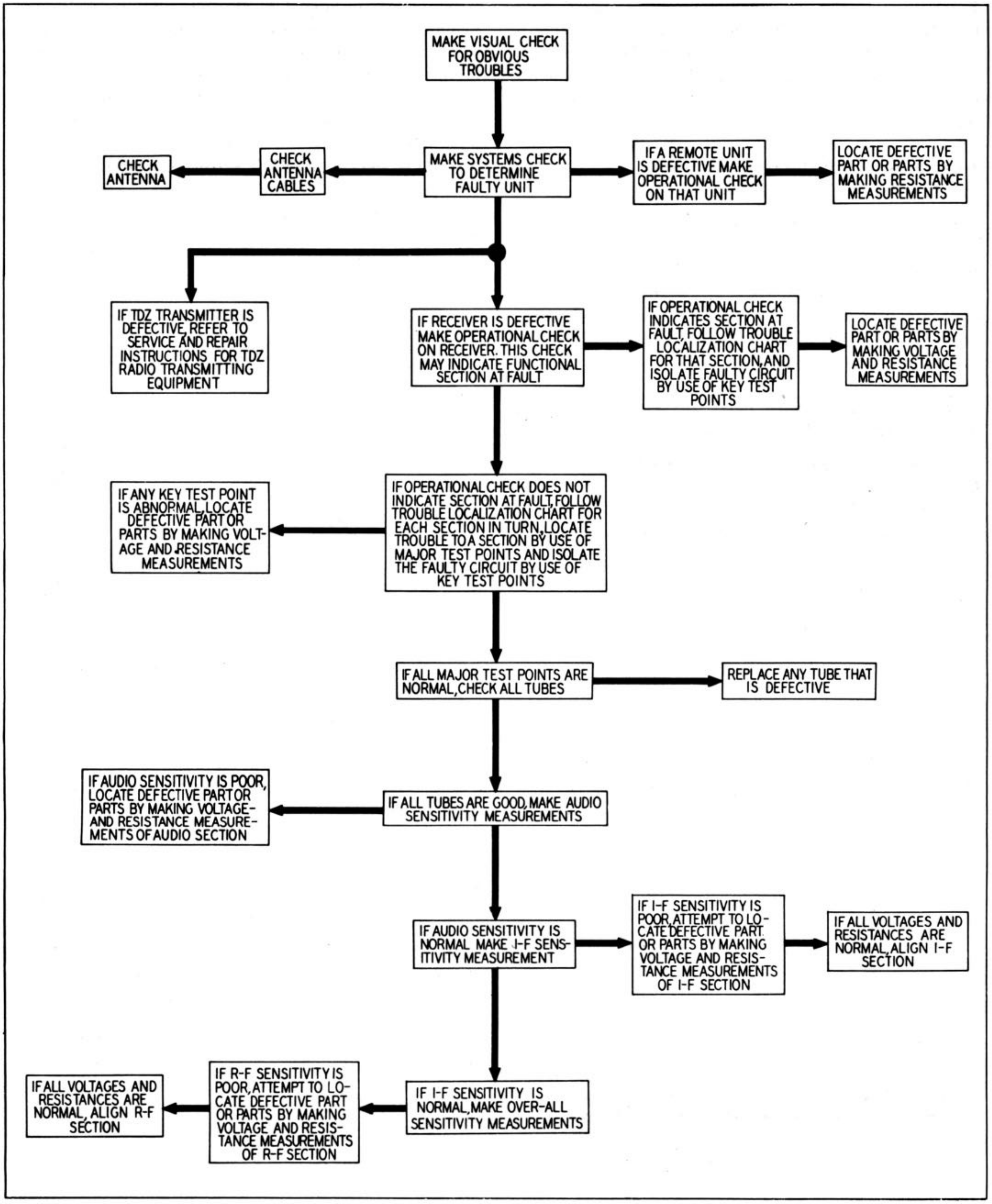


Figure 3–1. Block Diagram Outlining Trouble Localization Procedure for RDZ/RDZ-1 and Its Associated Units

SECTION 3

TROUBLE LOCALIZATION

GENERAL

3–1. METHOD OF TROUBLE LOCALIZATION.

This section gives a logical, systematic procedure for quickly locating trouble in the RDZ/RDZ-1 Radio Receiver and its associated units. It is based on a method of trouble-shooting which uses a minimum number of checks. These checks are arranged so that the simpler troubles are found before the more extensive, time-consuming tests are made. The over-all outline of the procedure used for localizing trouble is presented in block diagram form in figure 3–1, and is discussed in the following paragraphs.

a. USE OF VISUAL CHECK.

A visual check as outlined in Paragraph 3–2 is made first to locate obvious troubles (such as loose cabling, patch cords, etc.) even before the equipment is turned on. The visual check also includes an inspection with the equipment turned on so that evidence of overheated components, absence of primary power, etc., may be detected without needless testing.

b. USE OF SYSTEMS CHECK.

A systems check as outlined in Paragraph 3–3 is then performed to determine which unit in the system is at fault. This check quickly indicates whether the trouble exists in one of the remote control units, the antenna system, the RDZ/RDZ-1, or the TDZ Transmitter.

c. USE OF OPERATIONAL CHECK.

If the systems check indicates that a remote control unit is defective, make the operational check for remote control units as outlined in Paragraph 3–12 to determine the faulty circuit. Then, by use of the resistance charts for that remote unit, the defective part can be quickly located.

If the systems check indicates that the antenna system is defective, the trouble is localized to the antenna or to its connecting cables by trouble-shooting the antenna system as outlined in Paragraph 3–11.

If the systems check indicates that the RDZ/RDZ-1 is defective, make the operational check for the RDZ/RDZ-1 as outlined in Paragraph 3–4 to determine which functional section of the receiver is at fault. The faulty circuit in that functional section is then isolated by following the step-by-step trouble-shooting procedure outlined in Paragraph 3–6, 3–7, 3–8, 3–9, or 3–10. Once the faulty circuit is isolated, the defective part is found by making voltage and resistance checks, using the voltage and resistance charts furnished with each trouble-shooting chart.

If the systems check indicates that the TDZ Transmitter is defective, refer to Service and Repair Manual for Navy Model TDZ Transmitting Equipment.

d. USE OF TROUBLE-LOCALIZATION.

Where the operational check for the RDZ/RDZ-1 does not immediately indicate the faulty functional section, follow the trouble-shooting chart for each functional section in the following order: power-supply section, audio section, intermediate-frequency amplifier section, r-f and converter section, and the Autotune system.

Each functional section is assigned one or more major test points (1, 2, 3, etc.). When used as directed in the trouble-shooting charts, these test points quickly localize the trouble to a particular functional section, except for a few obscure troubles such as poor sensitivity, and intermittents which are located as described in Paragraph 3–1.*e.*

After the faulty functional section is found, key test points (A, B, C, etc.) are employed to isolate the faulty circuit within that functional section. When necessary, secondary test points (A1, A2, A3, etc.) are used to further isolate the faulty circuit.

After the faulty circuit is isolated, the defective part within that circuit is located by voltage and resistance checks, using the voltage and resistance charts furnished with each trouble-localization chart.

Whenever trouble is found by this procedure, it should be corrected before further tests are made.

NOTE

A FAILURE REPORT must be filled out for the failure of any part of the equipment, whether caused by defective or worn parts, improper operation, or external influences. See page 4–0, Section 4, for instructions concerning the use of this form.

e. USE OF SENSITIVITY CHECKS.

It is possible for all major test points to show normal indications, yet the sensitivity of the RDZ/RDZ-1 still be poor. This condition is usually indicative of misalignment or caused by changes in parts values that lowers the gain of the RDZ/RDZ-1, and yet permits it to operate. When all major tests have been made and no abnormal indications obtained proceed as follows:

1. Remove all electron tubes and check them in a tube tester or replace them with others known to be in good operating condition.

2. Make the sensitivity measurements outlined in Paragraph 4–17, Section 4, to determine which functional section is the cause of poor sensitivity.

3. After the faulty functional section is determined, make complete voltage and resistance measurements of that functional section, to find the faulty part which may be causing the trouble. This is the only possible way to locate an intermittent fault which does not occur long enough to permit detection by the previous checks.

4. If no defective parts can be found, then proceed with the alignment instructions for the faulty section as given in Paragraphs 4–18 and 4–19, Section 4.

THE RDZ/TDZ SYSTEM

3–2. VISUAL CHECKS.

When trouble is reported in the RDZ/TDZ system, a careful visual check should be made first. Note and correct such apparent trouble indications as loose or broken wires, cables, terminals, or evidence of physical damage to components. Make certain that all transmitter drawers are securely locked, that the power cords are plugged into a power source, and that all controls are positioned in accordance with the type of operation to be used (local or remote).

Check for indications of primary power in the RDZ/RDZ-1 as follows: With the POWER switch in the ON position, note the visual evidence of primary power indicator lamps, dial lights, etc., and observe whether there is any smoke and/or burning odors. If there is no indication of primary power in the RDZ/RDZ-1, proceed to the operational check for the RDZ/RDZ-1, Paragraph 3–4.

Check for indications of primary power in the TDZ Transmitter as follows: Set the EMERGENCY OPERATE-STOP switch to OPERATE, and press the START button. This should energize the primary power circuits; the master start relay and the various blower motors in the TDZ Transmitter should be heard to operate; and the POWER ON indicator should light after approximately 60 seconds. If there is no indication of power, press the OVERLOAD RESET button, located on the front panel of the bottom drawer of the transmitter. If there is still no indication of power, set the EMERGENCY OPERATE-STOP switch at STOP and check the fuses as directed in Service and Repair Manual for Navy Model TDZ Transmitting Equipment, Section 3, Paragraph 3–3.*a.*

3–3. SYSTEMS CHECK.

The systems check is made to determine which unit in the system is at fault; that is, a remote control unit, the antenna system, the RDZ/RDZ-1, or the TDZ Transmitter.

a. SUBSTITUTE UNITS.

When spare units are available, substitute them for the units employed in the faulty system as directed in steps 1 through 4. Make the substitutions in the order given. If spare units are not available, proceed directly with step 5.

1. Replace the remote control unit from which trouble was first reported either by actual physical replacement or by operating the system from another remote point. If the remote control unit is found to be faulty in this manner, refer to the operational check for remote control units, Paragraph 3–12.

2. Replace the antenna system, using the antenna system normally employed with an adjacent system. If the antenna is found to be faulty, proceed with the check for the antenna system, Paragraph 3–11.

3. Substitute a spare RDZ/RDZ-1; if the system is restored to normal operation, refer to the operational check for the RDZ/RDZ-1, Paragraph 3–4.

4. If another TDZ Transmitter is available and is not being employed in any operating circuit, substitute it for the transmitter in the system being checked. If the system is restored to normal operation, proceed with an operational check of the faulty transmitter. Refer to Service and Repair Manual for Navy Model TDZ Radio Transmitting Equipment, Section 3, Paragraph 3–4.

NOTE

Do not interrupt the communication service of another transmitter in order to make the substitution called for in step 4. If a transmitter is not available, omit this step and proceed with step 5.

5. If spare units are not readily available, make the following emergency operational check for the RDZ/RDZ-1 and/or the TDZ Transmitter as required.

b. CHECK RDZ/RDZ-1 RADIO RECEIVER.

Plug the headphones in the PHONES jack and make the following preliminary settings of controls:

POWER	OFF
CONTROL	LOCAL
CHANNEL	1
I-F BAND	BROAD
NL/OM	OM
PHONES	Clockwise to 10
SILENCER	Counterclockwise to 0
RECEPTION	AVC ON
AF LEVEL	Counterclockwise to 0
AF BAND	BROAD
RF GAIN	Counterclockwise to 0

Step	*Instructions*	*Normal Indication*
1	Turn POWER switch to ON position.	Neon lamp glows in two to five seconds.
2	Slowly advance AF LEVEL knob.	Background noise increases and OUTPUT meter reading rises as AF LEVEL knob is advanced.
3	Turn RECEPTION switch to AVC OFF.	Background noise decreases and OUTPUT meter reading drops.
4	Slowly advance RF GAIN knob.	Background noise increases and OUTPUT meter reading rises as RF GAIN knob is advanced.

If the indications above are not obtained, the RDZ/RDZ-1 is faulty. This systems check is not complete, but it does cover most indications of abnormal operation. If the systems check points to a faulty receiver, or if it is otherwise suspected, refer to the operational check for the RDZ/RDZ-1 Radio Receiver, Paragraph 3–4.

c. CHECK TDZ TRANSMITTER.

With the equipment OFF, plug the microphone in the MICROPHONE jack, place the LOCAL-REMOTE switch in the LOCAL position, and set the EMERGENCY switch to the OPERATE position.

Step	*Instructions*	*Normal Indication*
1	Depress START button.	Blower motors and starting relay can be heard to operate after approximately 60 seconds, red indicator glows, and CHANNEL indicator points to channel as indicated by control A.
2	Press CARRIER LOCK-MOMENTARY switch to MOMENTARY position.	Note reading on OUTPUT indicator.
3	Disconnect antenna transmission line from ANTENNA connector, and connect ME-11/U Wattmeter. Set ME-11/U to 60-watt scale. Push microphone push-to-talk button.	OUTPUT indicator should read as in step 2 above. If it does not, trouble is indicated in antenna system. Refer to Paragraph 3–11.
4	Whistle sharply into microphone.	Power indication as shown on ME-11/U drops 20 to 25%.

If the indications above are not obtained, the TDZ Transmitter is faulty. This systems check for the TDZ is not complete, but it does cover most indications of abnormal operation. If the systems check points to a faulty TDZ, or if it is otherwise suspected, refer to Service and Repair Manual for Navy Model TDZ Radio Transmitting Equipment.

RADIO RECEIVER RDZ/RDZ-1

3-4. OPERATIONAL CHECK.

If the RDZ/RDZ-1 is disconnected from the remote control units the silencer circuit will be inoperative. Under these conditions, terminal E on terminal board E201 must be grounded to the chassis. See figure 3-17.

A visual check of the RDZ/RDZ-1 may be made before or concurrent with the operational check. Carefully examine the top and bottom of the chassis for visual signs of overheating, arcing, or broken or defective parts. Check cable connectors, look for broken wires or worn insulation, and check all electron tubes to determine whether they are properly seated in their sockets.

CAUTION

REPLACEMENTS OF ALL PARTS MUST BE MADE WITH EXACT REPLACEMENT PARTS. THE REPLACED PART AND ALL WIRING MUST BE RETURNED TO THE ORIGINAL POSITIONS AFTER TESTS OR REPAIRS ARE MADE.

Plug headphones into the PHONES jack of the RDZ/RDZ-1, and make the following preliminary settings of controls:

POWER	OFF
CONTROL	LOCAL
CHANNEL	2
I-F BAND	BROAD
NL/OM	OM
PHONES	Clockwise to 10
SILENCER	Counterclockwise to 0
RECEPTION	AVC ON
AF LEVEL	Counterclockwise to 0
AF BAND	BROAD
RF GAIN	Counterclockwise to 0

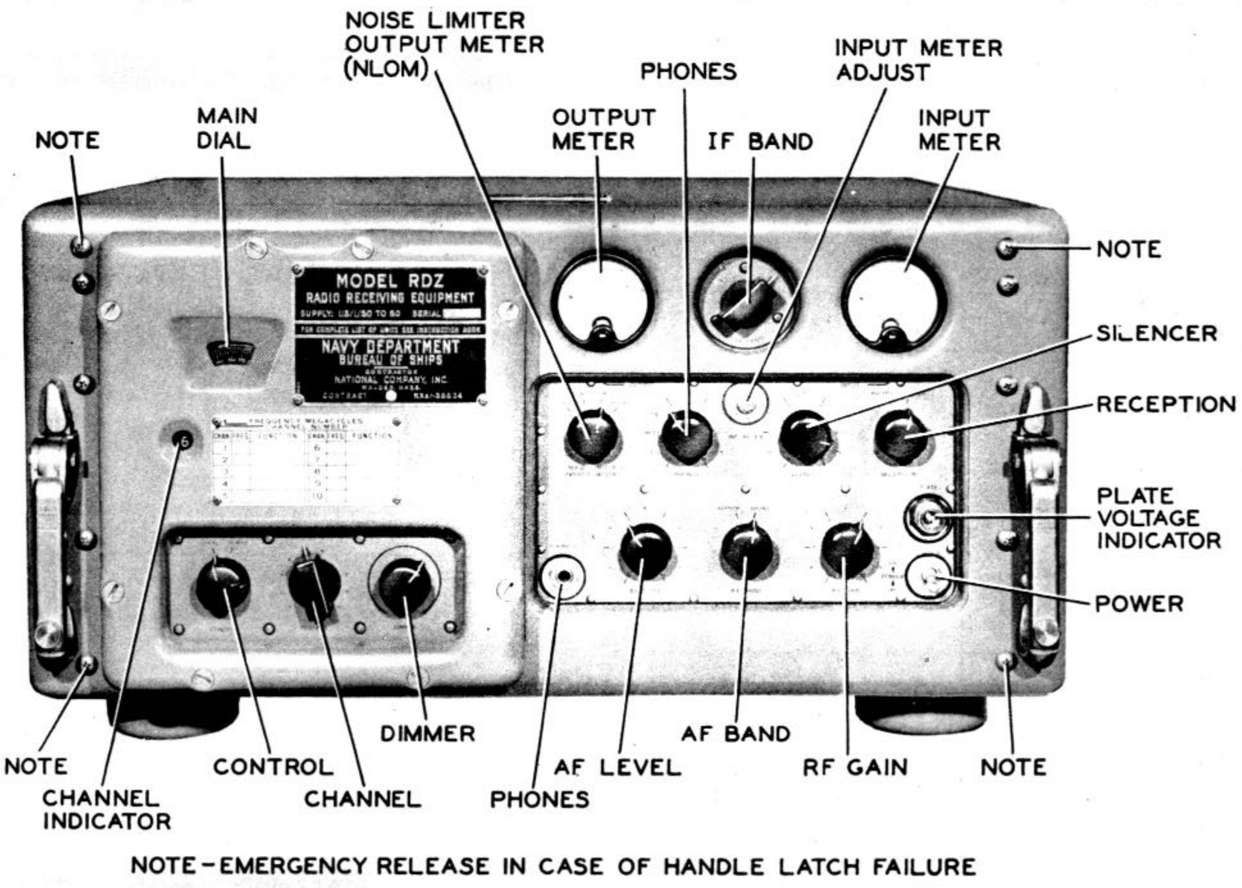


Figure 3-2. Radio Receiver RDZ/RDZ-1, Front View, Showing Operating Controls

OPERATIONAL CHECK

Step	*Instructions*	*Normal Indication*	*Procedure*
1	Turn POWER switch to ON position.	Neon lamp I201 glows in two to five seconds. Tube filament and dial lamps light.	If normal, proceed to step 2. If all normal indications are missing, check voltage between terminals H and I on terminal strip E201, see figures 3–5 and 3–17. If voltage is not present at this point, check fuses F401 and F402. If, after replacement, fuse again fails, refer to analysis of continuous fuse failure, Paragraph 3–5.
2	Turn CHANNEL switch to position 1.	1. Motor B601 is heard to operate. 2. Channel indicator dial shows proper channel selected. 3. Tuning dial turns to approximately the proper frequency. 4. Motor B601 stops after tuning cycle is completed.	If normal, proceed to step 3. If abnormal, refer to trouble-shooting instructions for Autotune system, Paragraph 3–10.
3	Remove front cover from RDZ/RDZ-1 and turn switch S101 (see figures 3–14 and 3–16) to each of its three test positions.	INPUT meter reads at least .15 in each position.	Steps 3 and 4: If normal, proceed to step 5. If abnormal in all ten positions, refer to trouble-shooting section for Autotune system, Paragraph 3–10. If one or several channels give abnormal readings, replace crystals for those channels, then proceed to trouble-shooting instructions for r-f and converter section, Paragraph 3–9.
4	Repeat step 3 for each of the 10 channels.	Same as step 3.	
5	Slowly advance AF LEVEL knob.	Background noise increases and OUTPUT meter reading rises as AF LEVEL knob is advanced.	Steps 5 through 7: If normal, proceed to step 8. Abnormal indications for these steps usually signify trouble of such a nature that it may be in any one of several sections. Refer to trouble-shooting instructions for power-supply section, Paragraph 3–6.
6	Turn RECEPTION switch to AVC OFF.	Background noise decreases and OUTPUT meter reading drops.	
7	Slowly advance RF GAIN knob.	Background noise increases and OUTPUT meter reading rises as RF GAIN knob is advanced.	
8	Return RECEPTION switch to AVC ON and turn NLOM switch to NLOM.	Definite decrease in background noise and drop in OUTPUT meter reading.	If normal, proceed to step 9. If abnormal, refer to step 3 of trouble-shooting chart for audio section, Chart 2.
9	Return NLOM switch to OM and slowly turn SILENCER knob clockwise to the point where background noise is sharply reduced.	With no signal input, background noise is sharply reduced.	If abnormal, proceed to step 4 of trouble-shooting chart for audio section, Chart 2.

3-5. ANALYSIS OF CONTINUOUS FUSE FAILURE.

a. CAUSE.

Continuous fuse failure may be caused by a short circuit in the R-F Filter (a-c power), the Autotune system; power-supply section, or associated d-c distribution to other circuits of the RDZ/RDZ-1.

b. LOCALIZATION.

The short circuit is localized to a functional section as follows:

1. Turn the POWER switch to the OFF position, *disconnect the power cord,* remove connections 15 and 16 of terminal strip E605 (figures 3-3 and 3-17), and remove link from switch S301 (figure 3-4).

2. Replace the defective fuse, connect the a-c power cord, leaving the POWER switch in OFF position, and check for 115 volts a.c. at terminals H and I of terminal strip E201. See figure 3-17. If the fuse does not blow, reverse the a-c power cord in its socket and recheck the voltage at H and I of E201. If the fuse has again burned out, in either or both instances, trouble is caused by a short in the a-c power section of the r-f filter unit in the line in which the fuse is located. See figures 3-3 and 3-18. The defective part can be located by resistance checks. Disconnect the a-c power cord before proceeding with resistance checks.

3. If the fuse did not burn out in step 2 above, turn the POWER switch to the ON position, and check for 115 volts a.c. at terminals H and I of E201. If the fuse does not burn out, reverse the a-c power cord in its socket and again check the voltage at H and I of E201. If the fuse has again burned out, in either or both instances, the trouble is caused by a short in POWER switch S205 or its associated wiring. Disconnect the a-c power cord and check resistances from terminal H to chassis and terminal I to chassis to further isolate the short.

4. If the short is not isolated in step 3 above, turn the POWER switch to the OFF position, disconnect the a-c power cord, replace connections 15 and 16 of terminal strip E605, replace the power cord, and return POWER switch to ON position. A burned out fuse denotes trouble in the Autotune system. See figure 3-19. Remove the a-c power cord and check resistances from terminal 15 to chassis and terminal 16 to chassis to further isolate the short.

5. If the fuse did not burn out in step 4, turn the POWER switch to OFF position, disconnect the a-c power cord, replace the link in switch S301 and remove tube V301 from its socket. With the a-c cord reconnected and the POWER switch in ON position, a burned out fuse denotes trouble in power transformer T301 or the filament circuits. In this case, disconnect the a-c power cord and check the resistances of T301 as shown in figure 3-3. If any winding is in doubt, remove the connections to that winding, recheck the resistance measurement, and check for an infinite reading from the winding to chassis. If the winding is not shorted, check from the open connection to chassis to further isolate the short.

6. If the fuse did not burn out as indicated in step 5 above, the trouble is in the power-supply section or associated d-c distribution. First, clear tube V-301 by checking it in the tube tester, then referring to figure 3-5, remove the a-c power cord from its socket and check resistance from pin 2 or 8 of V-301 to chassis (11,000 ohms). If the measurement is less than 11,000 ohms, remove connections 6, 7, and 8 from terminal strip E-302 and check for a short from these connections to the chassis on both sides of the connection to further isolate the short to the power-supply or the d-c distribution. The defective part or wiring is then located by point-to-point resistance checks.

FILL OUT A FAILURE REPORT FOR EVERY JOB. MAKE IT A HABIT.

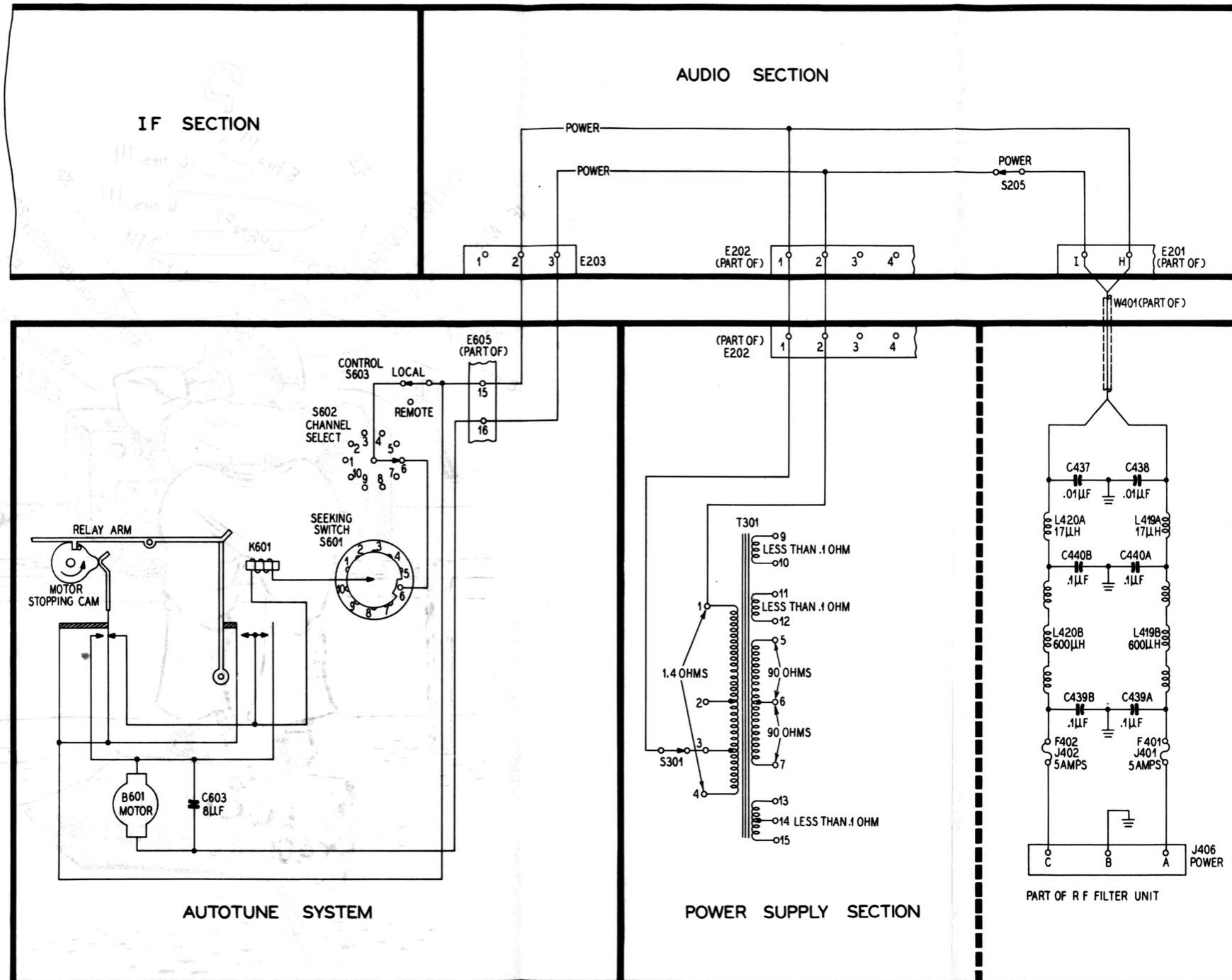
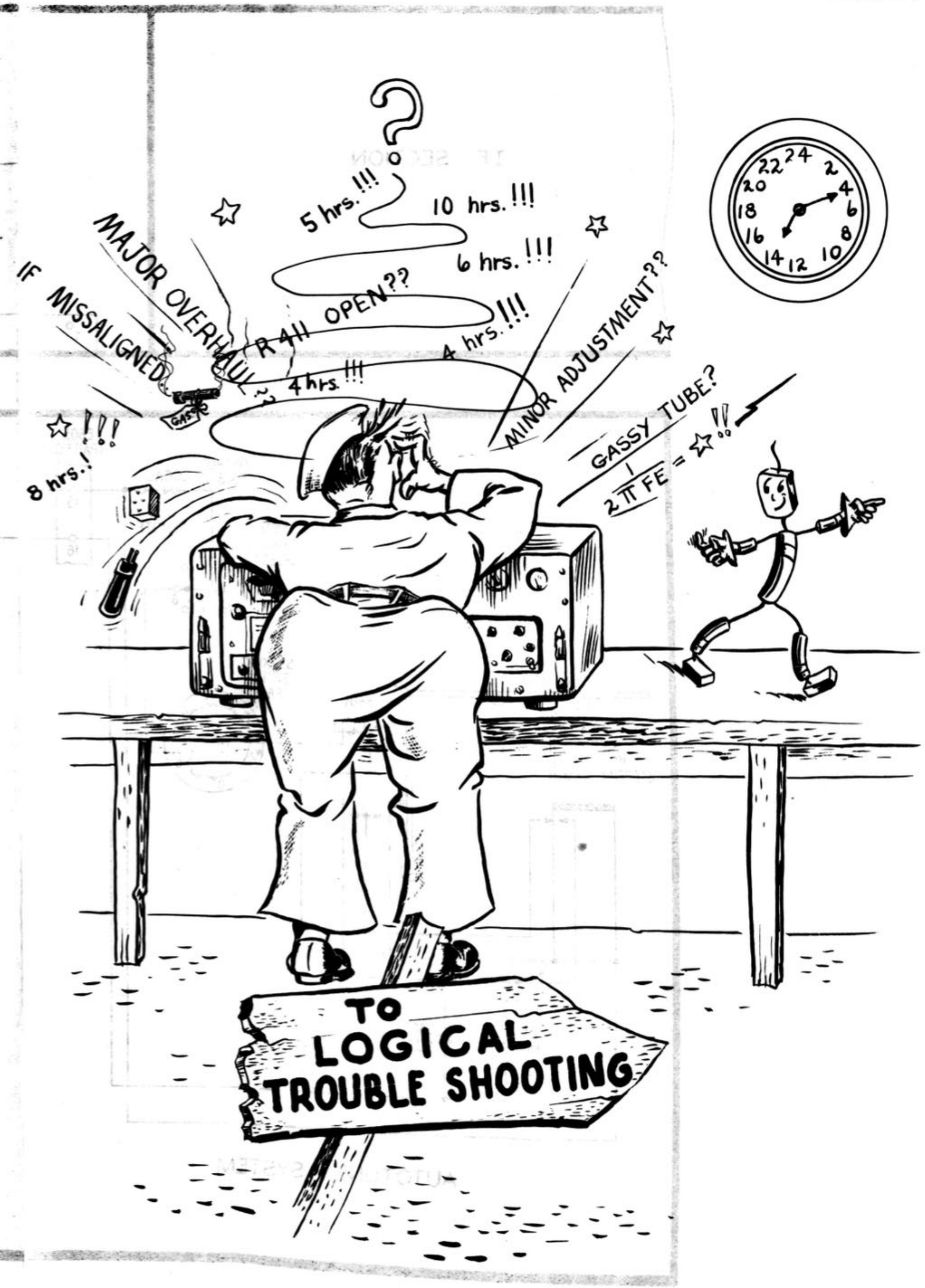


Figure 3–3. Radio Receiver RDZ/RDZ-1, 115-Volt A-C Primary Power Distribution


IF MISSALIGNED
MAJOR OVERHAUL??
R 411 OPEN??
5 hrs. !!!
10 hrs. !!!
6 hrs. !!!
4 hrs. !!!
4 hrs. !!!
8 hrs.!
MINOR ADJUSTMENT??
GASSY TUBE?
TO LOGICAL TROUBLE SHOOTING

WARNING

Voltages over 300 volts shall be measured as follows:

1. De-energize the equipment and short terminals to be measured to ground to discharge any capacitor connected to these terminals.
2. Connect meter to terminals to be measured, using a range higher than the expected voltage.
3. Energize the equipment and read the meter WITHOUT TOUCHING IT while the power is on.
4. De-energize the equipment and short terminals to ground before disconnecting meter.

NOTES:

1. MAKE SURE that you are NOT GROUNDED whenever using measuring equipment or adjusting major equipments. For example: hand rails, exposed metal decks, equipment frames.
2. Ground case of test equipment whenever possible, especially before starting measurements where test equipment must be held or adjusted during the measurement.
3. DO NOT FORGET that high voltages may be present across terminals that are normally at a low voltage. Be careful even when measuring low voltages.

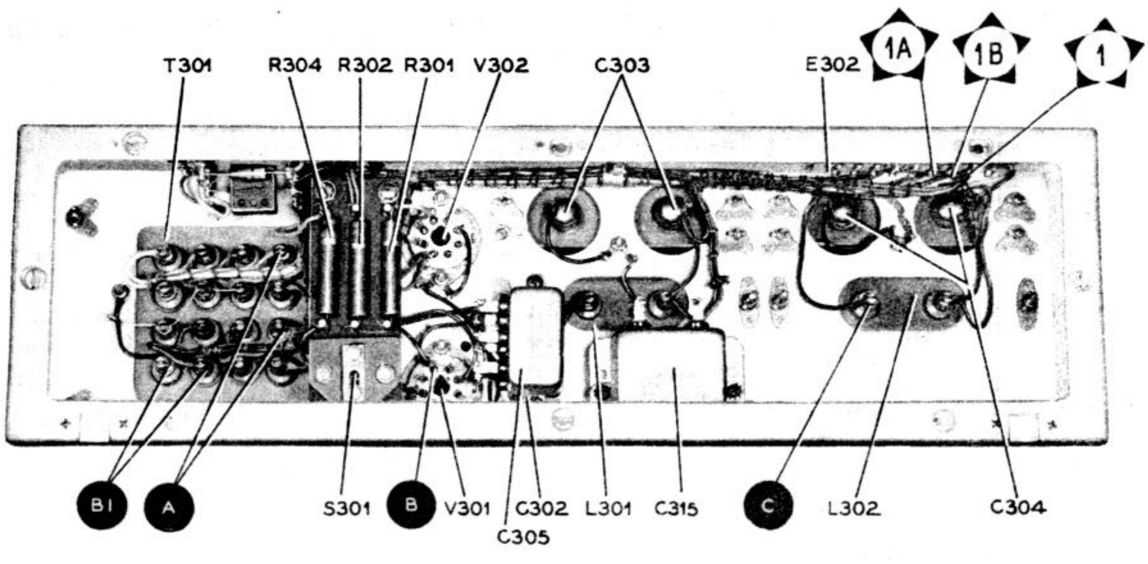


Figure 3–4. Radio Receiver RDZ/RDZ-1, Bottom View, Showing Test Points for Power-Supply Section

3–6. TROUBLE-SHOOTING THE POWER-SUPPLY SECTION.

Turn the POWER switch to the ON position. The settings of the other knobs and controls are not critical. Navy Model OE Series Analyzer or equivalent instrument is used for the voltage and resistance measurements. All voltages are measured from the given test point to the chassis, unless otherwise indicated that the measurements are made between two points. Voltage and resistance charts for the power-supply section are shown in figure 3–6.

CHART 1

TROUBLE-SHOOTING CHART FOR POWER-SUPPLY SECTION

Step	*Test Point*	*Normal Indication*	*Procedure*
1	1	+150v	Proceed to step 2.
2	1A	+180v	Proceed to step 3.
3	1B	+210v	a. If 1, 1A, and 1B are normal, proceed to trouble-shooting instructions for audio section, paragraph 3–7. b. If 1, 1A, and 1B are all zero, make visual check of tube V301. If filament is lit, proceed to step 5; if filament does not glow, proceed to step 4. c. If 1, 1A, and 1B are otherwise abnormal, unsolder terminals 6, 7, and 8 of E202, and recheck voltages; if power-supply section is normal (1 reads +150v, 1A reads +255v, and 1B reads +265v), trouble is in other sections of the RDZ. Make resistance analysis, section by section, using figures 3–12 and 3–15. d. If voltages in paragraph c above are not obtained, trouble is in power-supply section 1. If 1, 1A, and 1B are all abnormal, proceed to step 5. 2. If 1 is abnormal and 1B normal, check resistors R301 and R302, and tube V302. 3. If 1A is abnormal and 1B normal, check capacitor C315 and resistor R304. 4. If 1B is abnormal and 1A normal, check capacitor C304 and choke L302.
4	A	115v, a.c.	If normal, proceed to step 5. If abnormal, check at terminals 1 and 2 of E202 or E302; check switches S205 and S301.
5	B	+255v	If normal, proceed to step 8. If abnormal, check tube V301, and measure voltage between terminals 11 and 12 of transformer T301; voltage should be 5.25 volts, a.c. Then proceed to step 6.
6	B1	650v, a.c.	If abnormal, turn POWER switch to OFF position, and check resistance between terminals 5 and 6, and 6 and 7 of transformer T301 (normal resistance 90 ohms).
7	C	+225v	If abnormal, check choke L301 and capacitors C302A, C305A, and C305B.

Test points are shown in figures 3–4 and 3–5.
See figure 3–6 for voltage and resistance charts for this section.

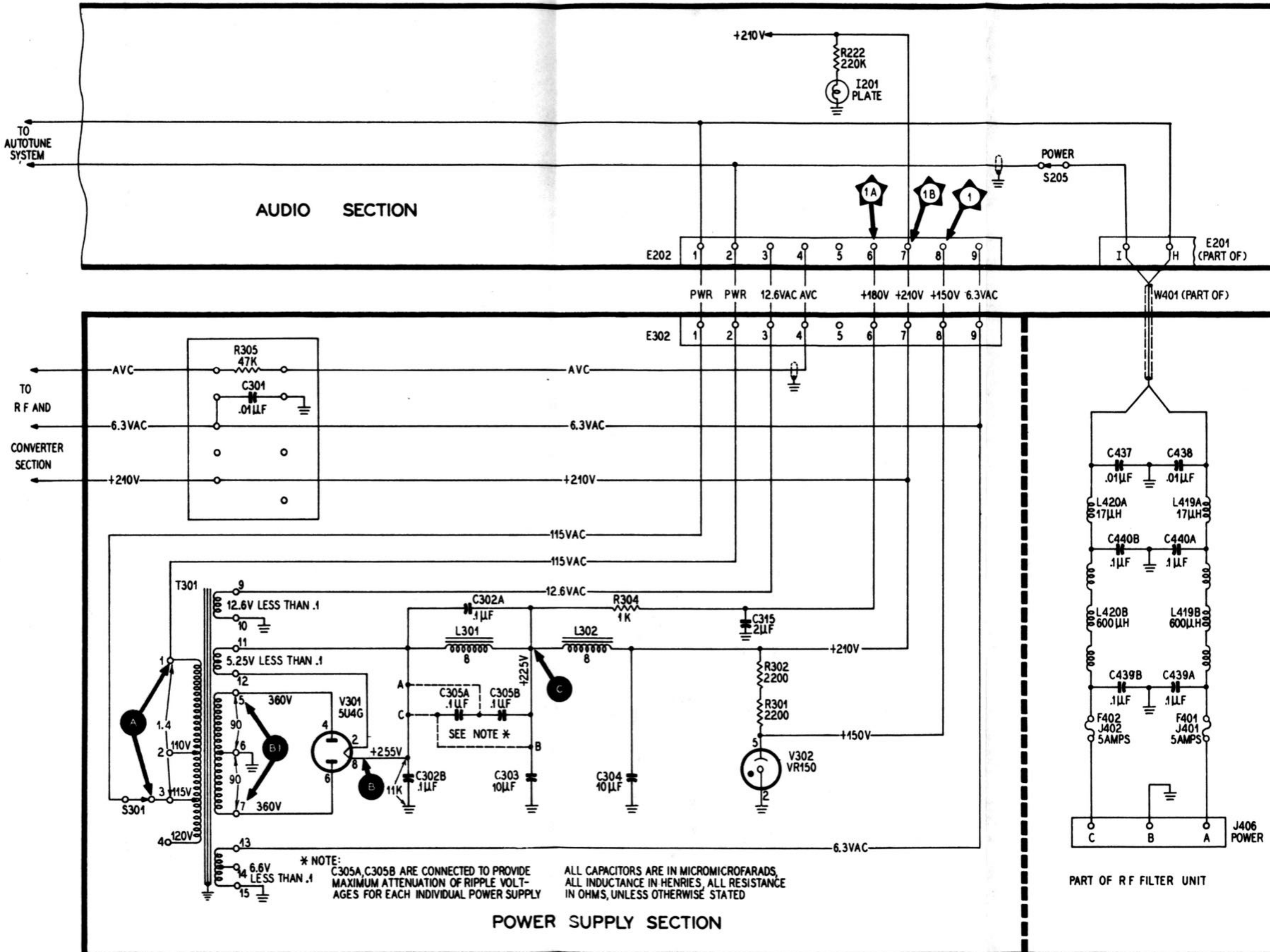
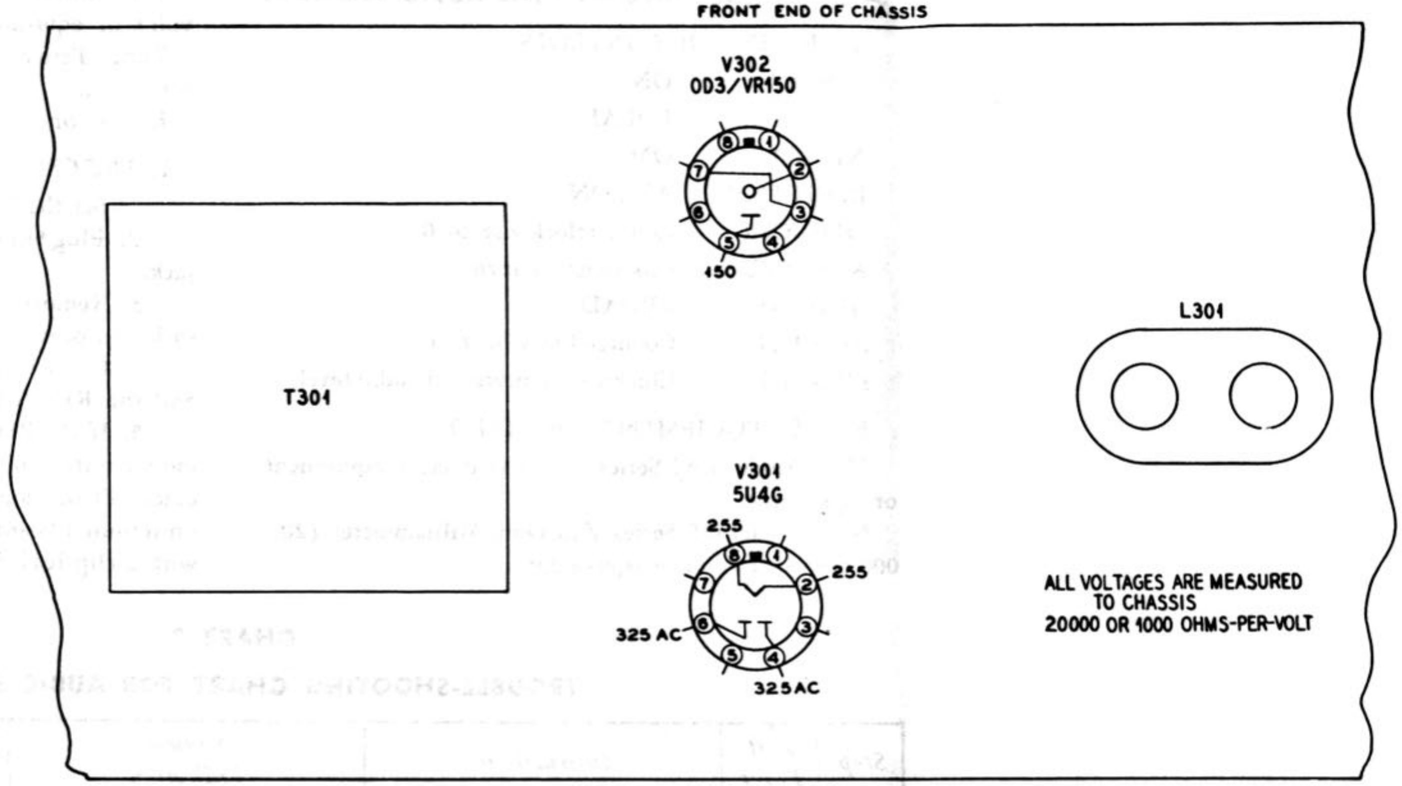


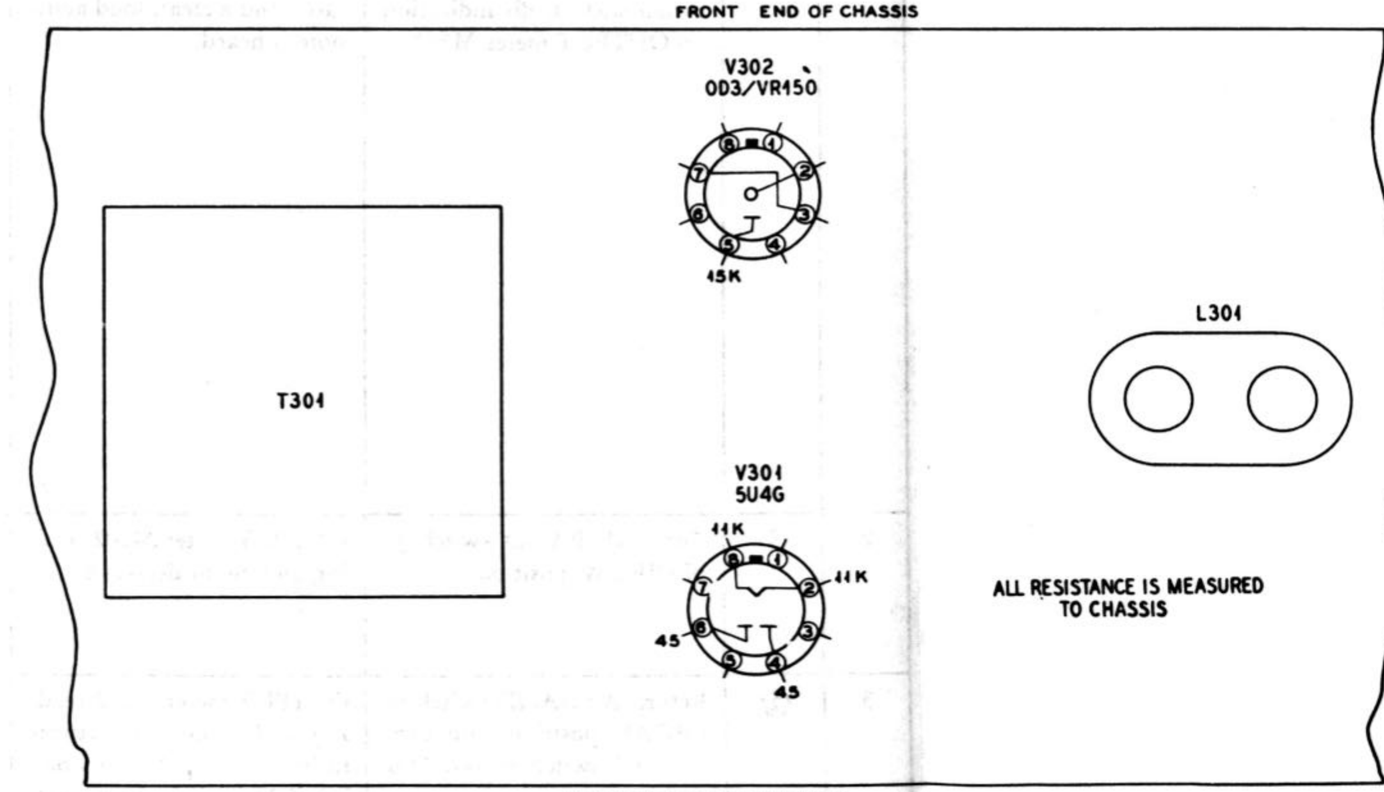
Figure 3–5. Radio Receiver RDZ/RDZ-1, Trouble-Shooting Schematic Diagram for Power-Supply Section

FRONT END OF CHASSIS



BOTTOM VIEW OF CHASSIS
VOLTAGE CHART

FRONT END OF CHASSIS



BOTTOM VIEW OF CHASSIS
RESISTANCE CHART

Figure 3–6. Radio Receiver RDZ/RDZ-1, Power-Supply Voltage and Resistance Charts

3-7. TROUBLE-SHOOTING THE AUDIO SECTION.

a. SETTING OF CONTROLS.

POWER	ON
CONTROL	LOCAL
NL/OM	OM
RECEPTION	AVC ON
SILENCER	Counterclockwise to 0
AF LEVEL	Clockwise ¾ turn
AF BAND	BROAD
RF GAIN	Counterclockwise to 0
PHONES	Clockwise to preferred audio level.

b. TEST EQUIPMENT REQUIRED.

Navy Model LAJ Series Audio Oscillator Equipment or equivalent.

Navy Model OE Series Volt-Ohm-Milliammeter (20,-000 ohms-per-volt) or equivalent.

Navy Model OCR Series Multimeter (1000 ohms-per-volt) or equivalent.

Tube Tester TV-3/U, Navy Model OZ Series or equivalent.

Headphones Navy Type—49016 or equivalent.

c. PROCEDURE.

1. Set the LAJ Audio Oscillator to 1000 cycles.
2. Plug headphones into the RDZ/RDZ-1 PHONES jack.
3. Remove 5th i-f amplifier tube, V206, from its socket to prevent noise from interfering with tests.
4. Connect the LAJ between the indicated test point and the RDZ/RDZ-1 chassis, unless otherwise shown.
5. If the RDZ/RDZ-1 is disconnected from the remote control units or associated cables, the silencer circuits will be inoperative; under these conditions, line E on terminal board E201 must be grounded to the chassis with a clip lead. See figure 3–17.

CHART 2

TROUBLE-SHOOTING CHART FOR AUDIO SECTION

Step	*Test Point*	*Instructions*	*Normal Indication*	*Procedure*
1	2	Adjust LAJ output for approximately 0 db indication on OUTPUT meter M202.	OUTPUT meter M202 indicates, and a clear, loud audio note is heard.	1. If normal, proceed to step 2. 2. If both meter M202 and audible indication are abnormal, check C254 (figure 3–9) and C255, then proceed to step 5. 3. If meter M202 reads normal and audible signal is distorted or not heard, check C255, R273, and R274 (figure 3–9). 4. If audible indication is normal and reading on meter M202 is abnormal, check M202 and C254 (figure 3–9). To check M202, set Multimeter OCR-1 to 2.5 VAC scale, and connect between C and D on terminal strip E201. See figure 3–17. or C246.
2	2	Turn AF BAND switch to NARROW position.	OUTPUT meter M202 reading and audio decreases.	If normal, proceed to step 3. If abnormal, trouble is indicated in audio filter L201 and L202 or associated capacitors C242, C243, C244, C245.
3	2	Return AF BAND switch to BROAD position, and turn NL/OM switch to NL/OM position.	OUTPUT meter M202 reading and audio first returns to level of step 1, and when NL/OM switch is turned, decreases slightly more than step 2.	If normal, proceed to step 4. If abnormal, check V207, then make voltage and resistance measurements for V207 as shown in figure 3–12.

CHART 2 (Cont.)

TROUBLE-SHOOTING CHART FOR AUDIO SECTION

Step	*Test Point*	*Instructions*	*Normal Indication*	*Procedure*
4	2	Return NL/OM switch to OM, and turn SILENCER knob slowly clockwise to point where reading on OUTPUT METER M202 drops off sharply.	OUTPUT meter M202 reading and audio first returns to level of step 1, and as SILENCER knob is turned, decreases sharply.	If normal, proceed to trouble-shooting instructions for intermediate-frequency amplifier section, paragraph 3–8. If abnormal, check V210, then make voltage and resistance measurements for V210 as shown in figure 3–12.
5	D	Return SILENCER knob counterclockwise to 0. Set Audio Oscillator LAJ output to .75v. Use Multimeter to measure .75 volt across the LAJ output jacks.	OUTPUT meter M202 reads 0 db, and a clear audio note is heard.	If normal, proceed to step 6. If abnormal, check V212, then make voltage and resistance measurements for V212 as shown in figure 3–12.
6	D1	Set Audio Oscillator LAJ as shown in step 5.	OUTPUT meter M202 reads +15 db.	If normal, proceed to step 7. If abnormal, check V211, then make voltage and resistance measurements for V211 as shown in figure 3–12.
7	D1	Reduce output of Audio Oscillator LAJ to give 0 db, as shown on OUTPUT meter M202.	OUTPUT meter M202 reads 0 db.	Proceed to step 8.
8	D2	Adjust LAJ output as in step 7.	OUTPUT meter M202 reads +14 db.	If normal, check V207, then make voltage and resistance measurements for V207 as shown in figure 3–12. If abnormal, check V210, and then make voltage and resistance measurements for V210 as shown in figure 3–12.
9	2	Adjust LAJ output for approximately 0 db indication on OUTPUT meter M202.	OUTPUT meter M202 indicates, and a clear audio note is heard.	If abnormal, check V207, then make voltage and resistance measurements for V207 as shown in figure 3–12.

Test points are shown in figures 3–7 and 3–8.
See figure 3–12 for voltage and resistance charts for this section.

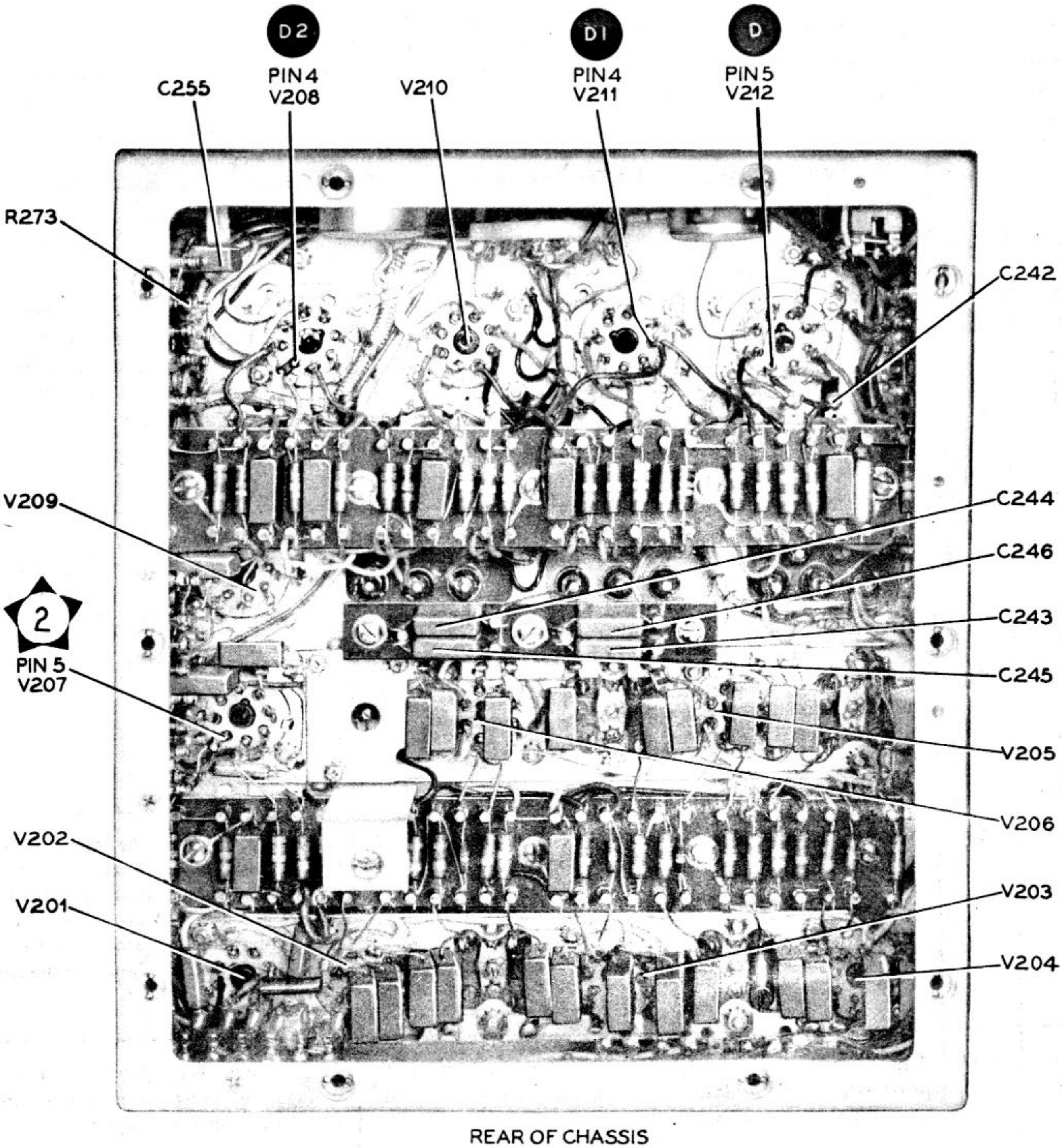


Figure 3-7. Radio Receiver RDZ/RDZ-1, Bottom View, Showing Test Points for Audio Section

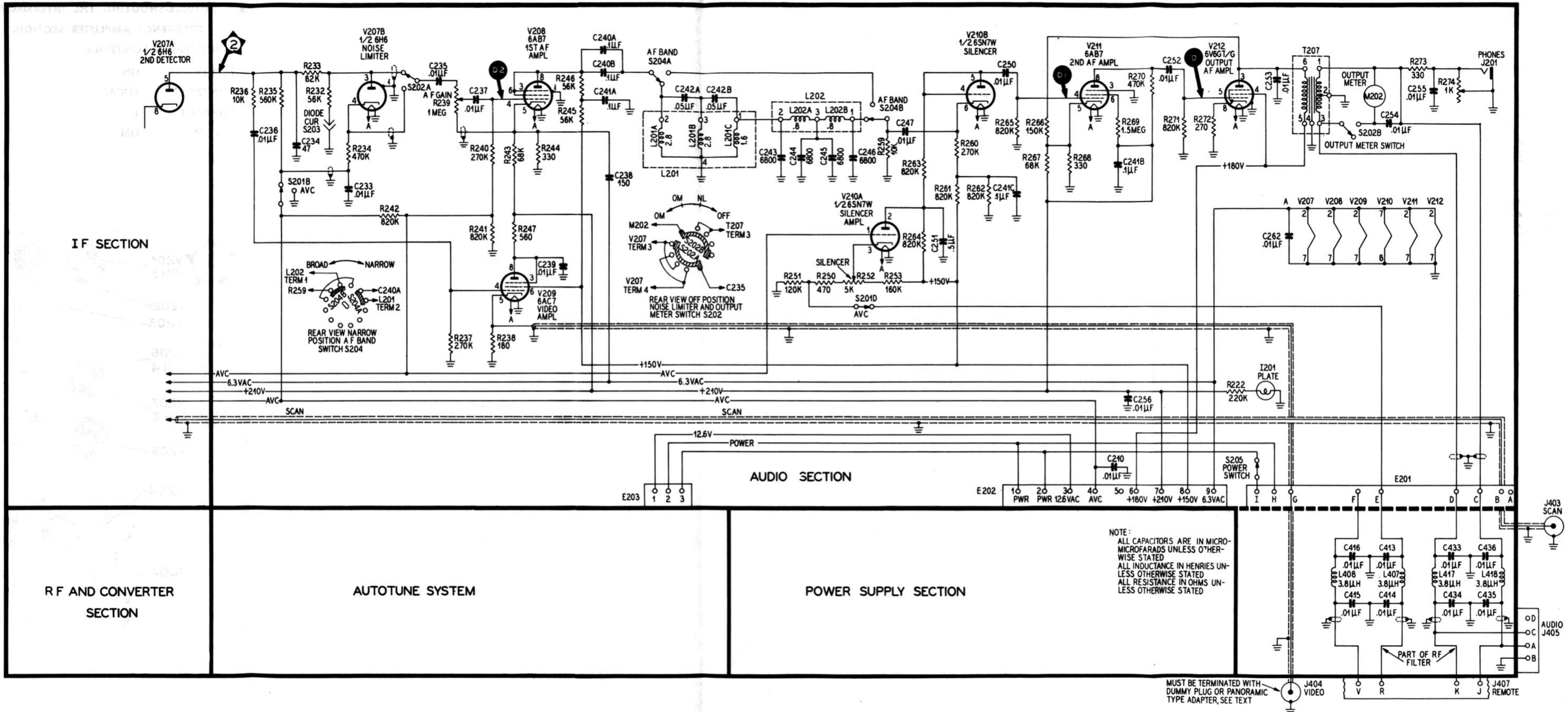


Figure 3–8. Radio Receiver RDZ/RDZ-1, Trouble-Shooting Schematic Diagram for Audio Section

b. TEST EQUIPMENT REQUIRED.

Navy Model LP Series Radio Frequency Standard or equivalent.

Navy Model LM or LR Series Heterodyne Frequency Meter or equivalent.

Vacuum-Tube Testing Equipment Navy Model OZ Series or equivalent.

Headphones Navy Type—49016 or equivalent.

c. PROCEDURE.

1. Remove connector P408 from connector J101. See figure 3–13.

2. A panoramic type adapter or a dummy scan load (Field Change No. 4 RDZ) must be plugged into the rear SCAN connector J403 when making measurements. See paragraph 4–14 if neither is available.

3. Set the LP to 15,100 kc., modulated 30 percent at 1000 cycles.

4. For each LP output setting indicated in the trouble-shooting chart turn LP MODULATION switch to OFF position and adjust RDZ/RDZ-1 RF GAIN control for –10 db indication on OUTPUT METER M202.

5. Plug headphones into RDZ/RDZ-1 PHONES jack.

6. Make all connections and measurements between indicated test points and RDZ/RDZ-1 chassis. The "hot" lead from the LP must be connected to the test point from the top of the RDZ/RDZ-1 chassis to prevent regeneration or circuit changes due to induced capacitance or interference. Use a 3-inch No. 22, stranded, insulated wire stripped 1/4 inch at both ends, remove tube from its socket, place one end of the wire in the pin hole at the test point, and replace tube. See figure 3–10. Connect the LP to this wire for check. Keep all leads as short as possible.

TESTING

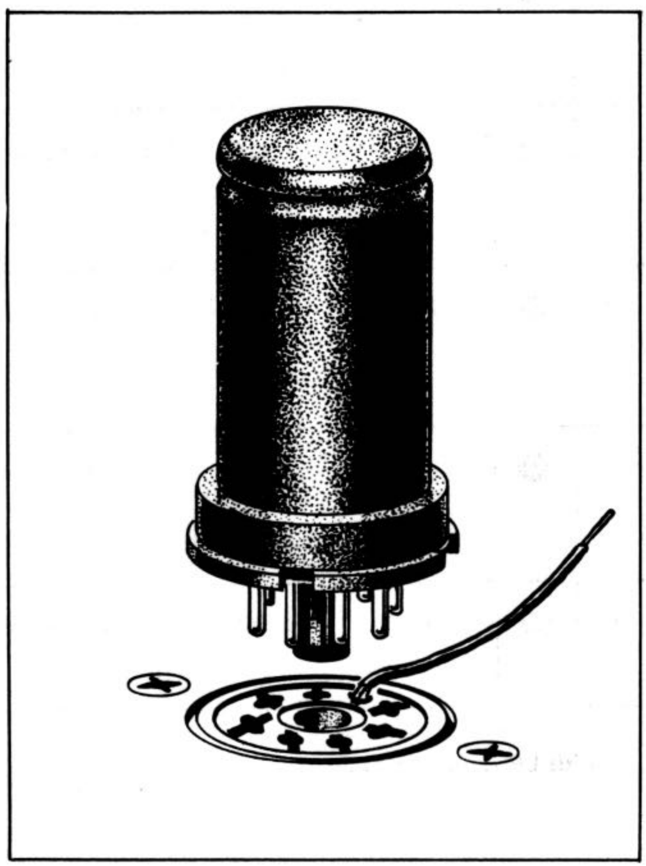


Figure 3–10. Method Used to Feed Signal Input from Top of Chassis

CHART 3

TROUBLE-SHOOTING CHART FOR INTERMEDIATE-FREQUENCY AMPLIFIER SECTION

Step	*Test Point*	*LP Output*	*RF Gain Setting**	*Normal Indication*	*Procedure*
1	3	15 μv	–10 db*	Clear audio note is heard.	If normal, proceed with paragraph 3–9. If abnormal, trouble is indicated in this section; proceed with step 2.
2	E	100,000 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 3. If abnormal, check V207, then make voltage and resistance measurements for V207 as shown in figure 3–12.
3	E1	27,000 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 4. If abnormal, check V206, then make voltage and resistance checks for V206 as shown in figure 3–12.
4	E2	1800 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 5. If abnormal, check V205, then make voltage and resistance checks for V205 as shown in figure 3–12.
5	E3	250 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 6. If abnormal, check V204, then make voltage and resistance checks for V204 as shown in figure 3–12.
6	E4	32 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 7. If abnormal, check V203, then make voltage and resistance checks for V203 as shown in figure 3–12.
7	E5	15 μv	–10 db*	Clear audio note is heard.	If normal, proceed with step 8. If abnormal, check V202, then make voltage and resistance checks for V202 as shown in figure 3–12.
8	3	15 μv	–10 db*	Clear audio note is heard.	Check V201, then make voltage and resistance checks for V201 as shown in figure 3–12.

* With LP signal unmodulated.

Test points are shown in figures 3–9 and 3–11.
See figure 3–12 for voltage and resistance measurements for this section.

HAVE YOU FILLED OUT A FAILURE REPORT?

CHART 4

TROUBLE-SHOOTING CHART FOR R-F AND CONVERTER SECTION

Step	*Test Point*	*Instructions*	*Normal Indication*	*Procedure*
1	4	Set LAF INCREASE OUTPUT to 77 db below .1 mw. Set CHANNEL switch and LAF to each of the ten channels. Reduce RF GAIN control as low as practicable to prevent overloading.	Clear audio note is heard in headphones and OUTPUT meter M202 indicates.	If normal, proceed to paragraph 3–10. If abnormal for all channels: remove covers from r-f compartment and make visual check to determine whether main capacitor is rotating as CHANNEL switch is turned. Remove crystal oven and make continuity check from pin 4 of V101 to crystal sockets for each of the ten channels. Replace crystal oven, then proceed with step 2. If abnormal for one or several channels, proceed with step 5.
2	F	Set CHANNEL switch to channel 1.	Clear audio note is heard in earphones and OUTPUT meter M202 indicates.	If normal, replace V107, then make voltage and resistance measurement for V107 as shown in figure 3–15. If abnormal, replace V106, make voltage and resistance measurements for V106 as shown in figure 3–15, then proceed with step 3.
3		Remove LAF connections and turn RECEPTION switch to AVC ON position. Turn switch S101 to position 1. See figure 3–16.	INPUT meter M201 reads at least .3.	If normal, proceed with step 4. If abnormal, check V101, V102, and V103; then make voltage and resistance measurements as shown in figure 3–15 for these tubes.
4		Turn switch S101 to position 2.	INPUT meter M201 reads at least .15.	If normal, proceed with step 5. If abnormal, check V104, then make voltage and resistance measurements for V104 as shown in figure 3–15.
5		With RECEPTION switch to AVC ON, turn switch S101 to position 3.	INPUT meter M201 reads at least .2.	If normal, proceed with step 6. If abnormal, check V105, then make voltage and resistance measurements for V105 as shown in figure 3–15.
6		Repeat step 5 for each of the nine remaining channels.	INPUT meter M201 reads at least .2.	If reading on any one or several channels is low, replace crystals for that channel. See Section 4, Paragraph 4–8.

Test points are shown in figures 3–13 and 3–14.
See figure 3–15 for voltage and resistance charts for this section.

893969 O—50——4

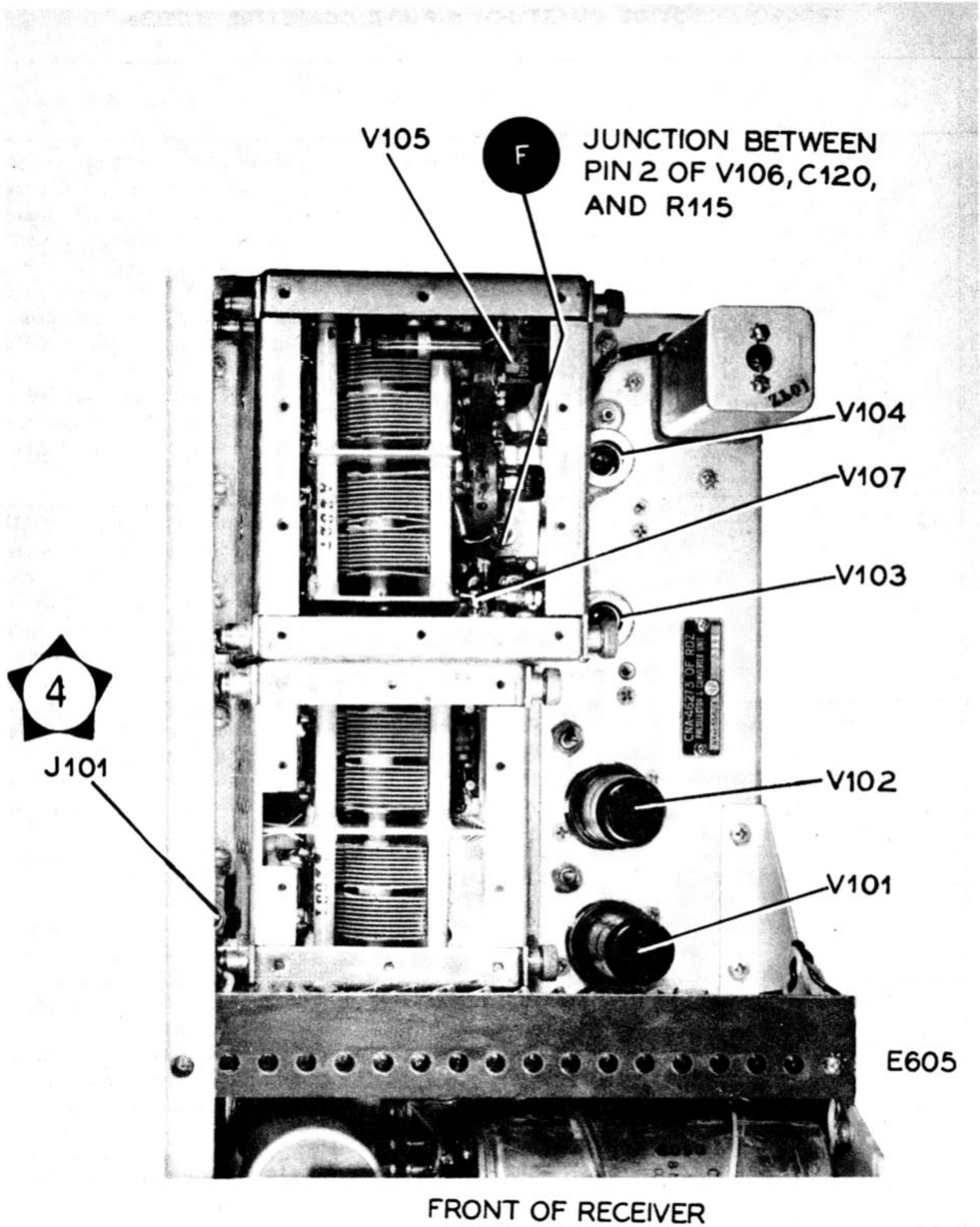


Figure 3–13. Radio Receiver RDZ/RDZ-1, Top Covers Removed, Showing Test Points for R-F and Converter Section

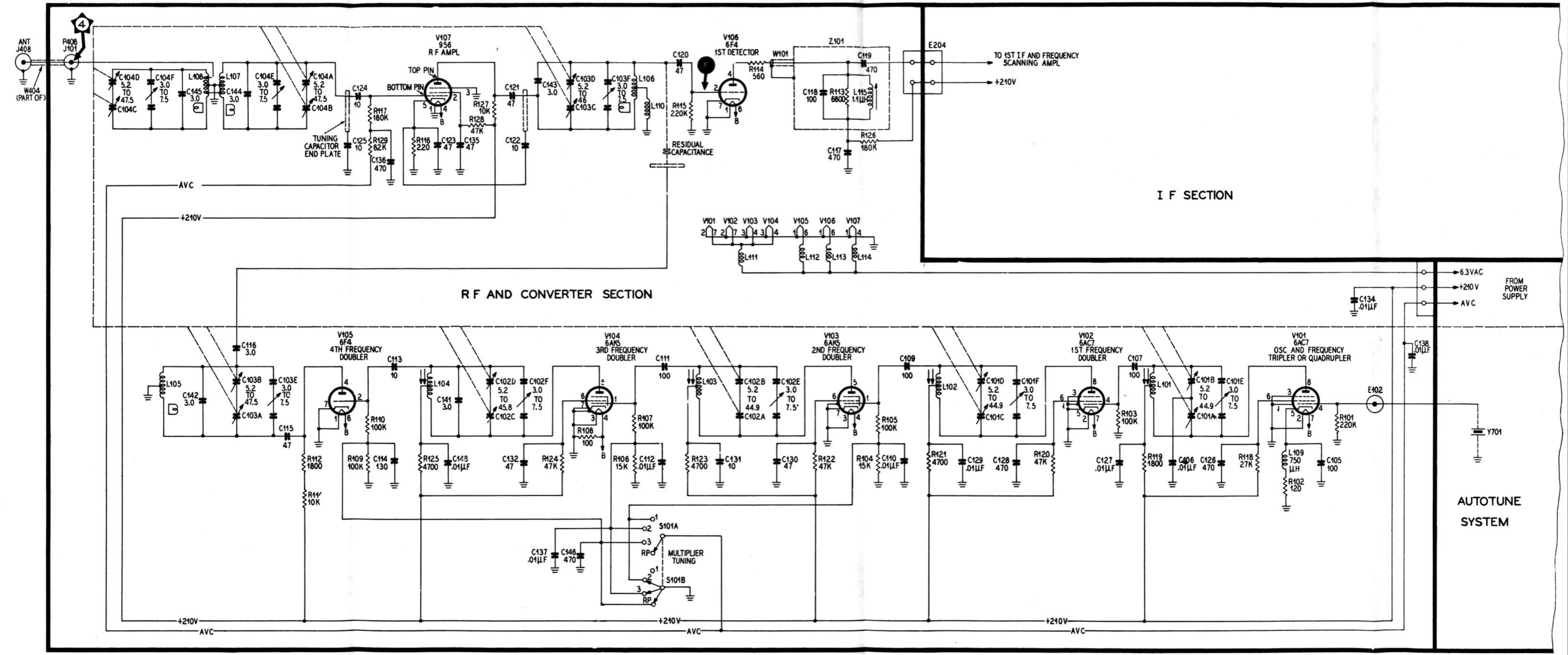
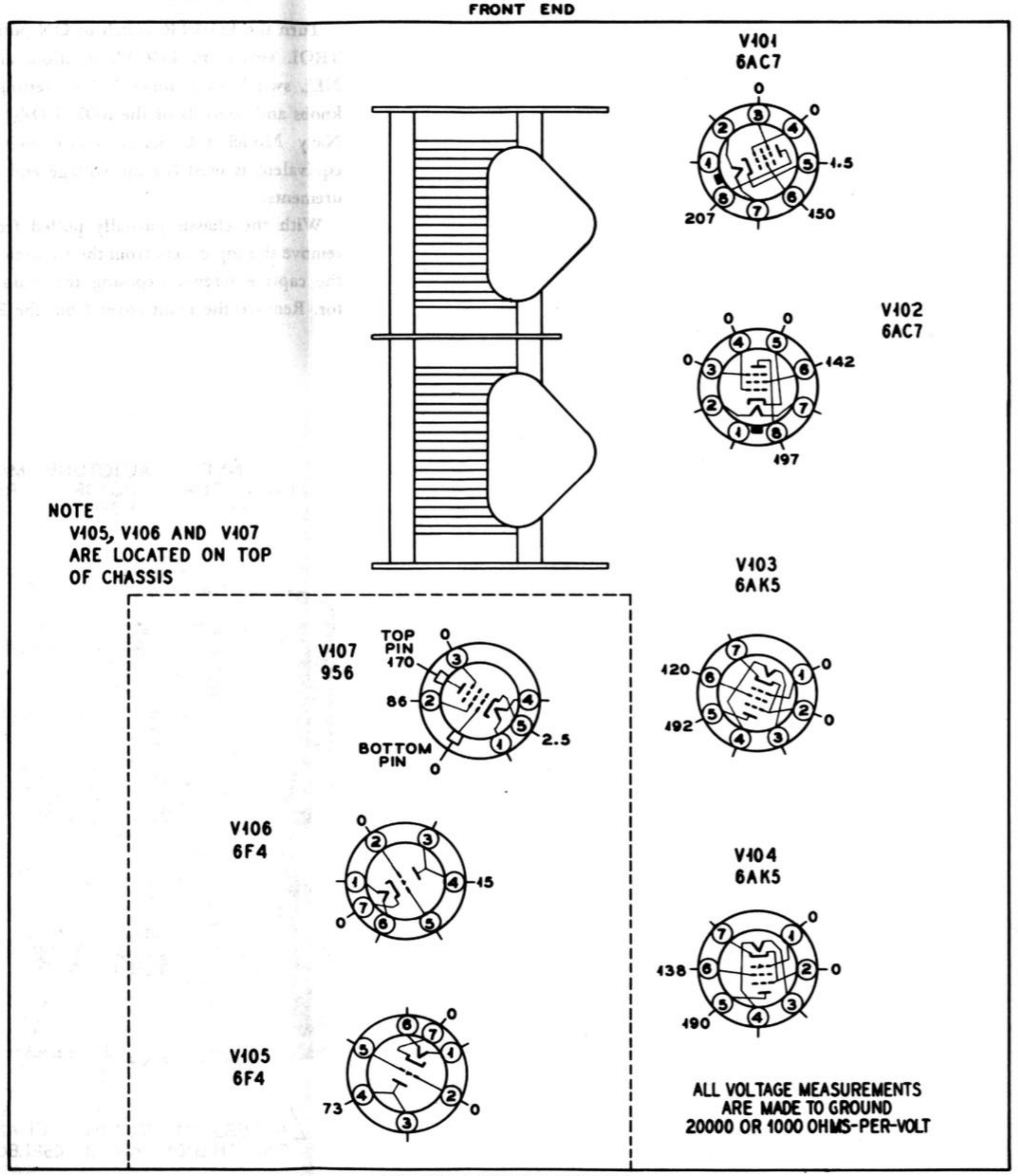
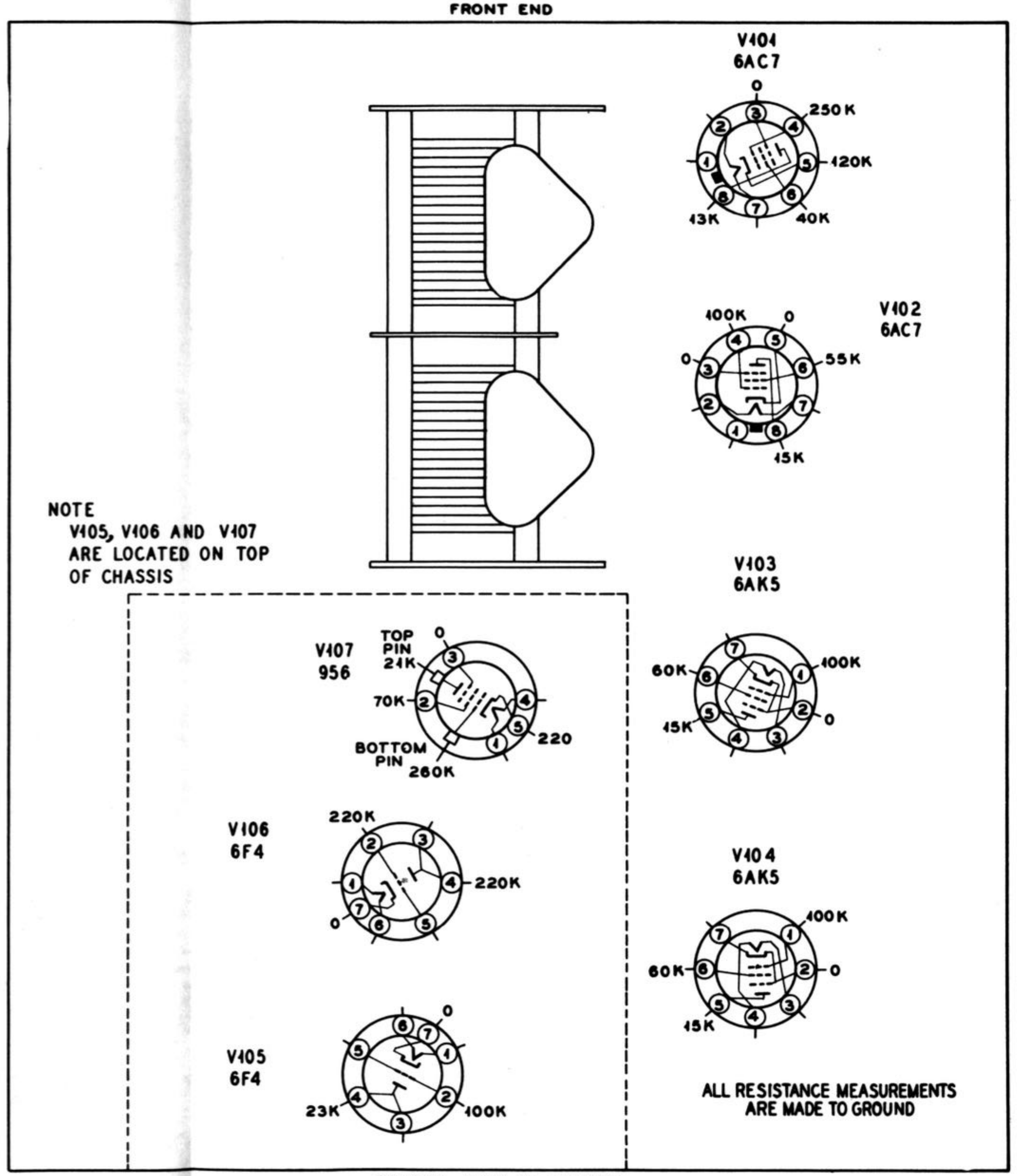


Figure 3–14. Radio Receiver RDZ/RDZ-1, Trouble-Shooting Schematic Diagram for R-F and Converter Section



BOTTOM VIEW OF CHASSIS
VOLTAGE CHART



BOTTOM VIEW OF CHASSIS
RESISTANCE CHART

Figure 3–15. Radio Receiver RDZ/RDZ-1, R-F and Converter Section Voltage and Resistance Charts

3-10. TROUBLE-SHOOTING THE AUTOTUNE SYSTEM.

Turn the POWER switch to ON position, the CONTROL switch to LOCAL position, and the CHANNEL switch to channel 2. The settings of the other knobs and controls of the RDZ/RDZ-1 are not critical. Navy Model OE Series Volt-Ohm-Milliammeter or equivalent is used for the voltage and resistance measurements.

With the chassis partially pulled from the cabinet, remove the top covers from the r-f sections by loosening the captive screws, exposing the main tuning capacitor. Remove the front cover from the RDZ/RDZ-1 by loosening the ten Dzus fasteners, allowing access to the Autotune system and switch S101. See figure 3-16.

Referring to CHART 5, turn the CHANNEL switch to channel 1, and observe whether the indications are normal as noted in the chart.

If normal indications are obtained for channel 1, turn the CHANNEL switch to each channel in turn for the nine remaining channels. If only one channel is found defective, the trouble is probably caused by improper tuning of that channel or a weak crystal. See figures 3-18 and 3-19. If abnormal indications are obtained on all channels, the trouble is in the Autotune unit proper. Refer to figure 3-19.

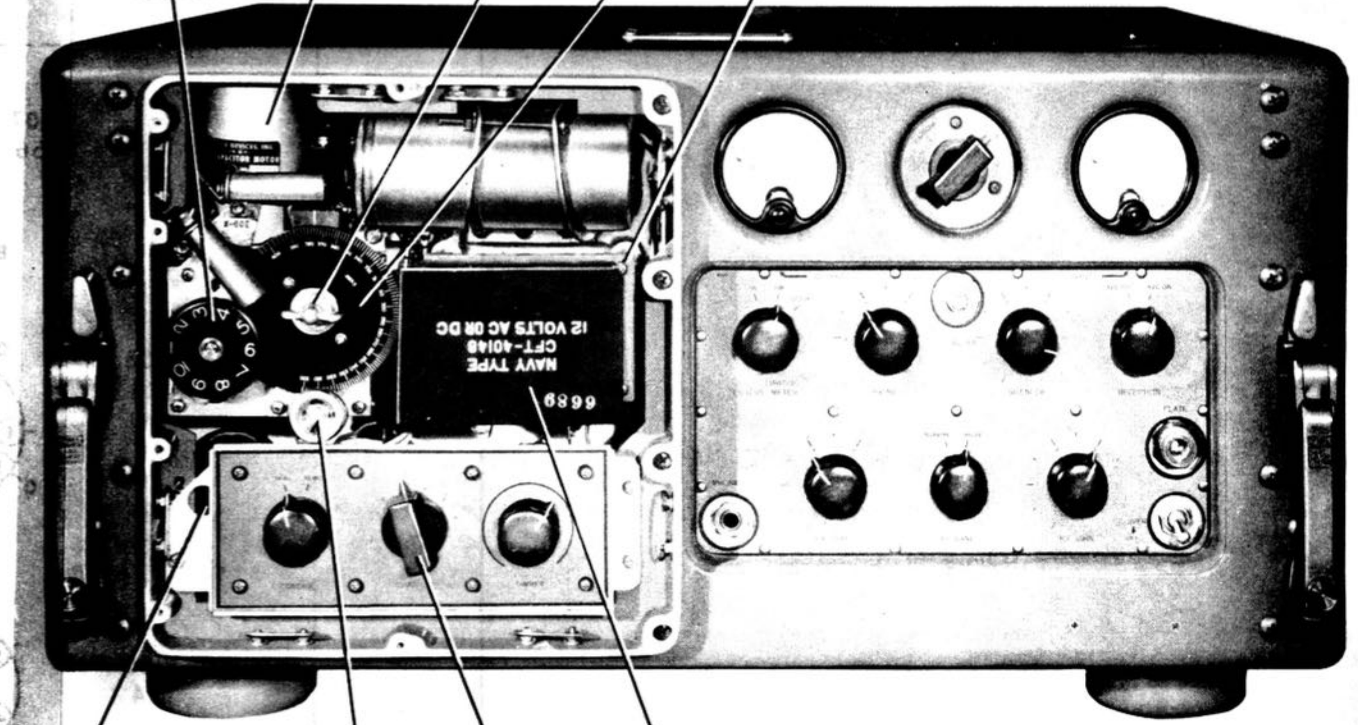


Figure 3-16. Radio Receiver RDZ/RDZ-1, Front View With Front Cover Removed

CHART 5

TROUBLE-SHOOTING CHART FOR THE AUTOTUNE SYSTEM

Observation	*Normal Indication*	*Possible Source of Trouble*	
1	Motor B601 can be heard to operate.	If motor B601 does not operate.	Defective fuses F401 and F402, defective switch S602, defective relay K601, open or shorted capacitor C603, defective motor B601, or mechanical binding of parts.
2	Channel indicator dial shows selected channel.	If indication in observation 2 is abnormal but indications in observations 3, 4, and 5 are normal.	Loose channel dial or defective seeking switch S604.
3	Main dial indicates frequency of selected channel.	If indication in observation 3 is abnormal but indications in observations 2, 4, and 5 are normal.	Loose main-dial release at center of main dial.
4	Proper crystal is selected.	If indication in observation 4 is abnormal but indications in observations 2, 3, and 5 are normal.	Broken contacts of crystal selector switch S601.
5	Main tuning capacitor turns.	If indications in observations 4 and 5 are abnormal but indications in observations 2 and 3 are normal.	Broken capacitor shaft.
		If indications in observations 2, 3, 4, and 5 are abnormal.	Improper relationship between gears and crystal selector switch S601 (possible if Autotune has been removed and improperly replaced). See Section 4, Paragraph 4–21. Defective slipping clutch on shaft to channel dial and crystal selector switch S601.
6	Motor B601 stops at completion of tuning cycle.	If motor B601 runs continuously.	Defective motor-stopping cam, defective clutch on shaft to motor-stopping cam, defective relay K601, or Autotune system is out of synchronization. See Section 4, Paragraph 4–21.*c*.
		If motor B601 stops before completion of tuning cycle.	Defective clutch on shaft to motor-stopping cam, defective relay K601, or mechanical binding of parts.

See figure 3–19 for schematic diagram.

REPORT ALL FAILURES ON FAILURE REPORT FORM NAVSHIPS 383

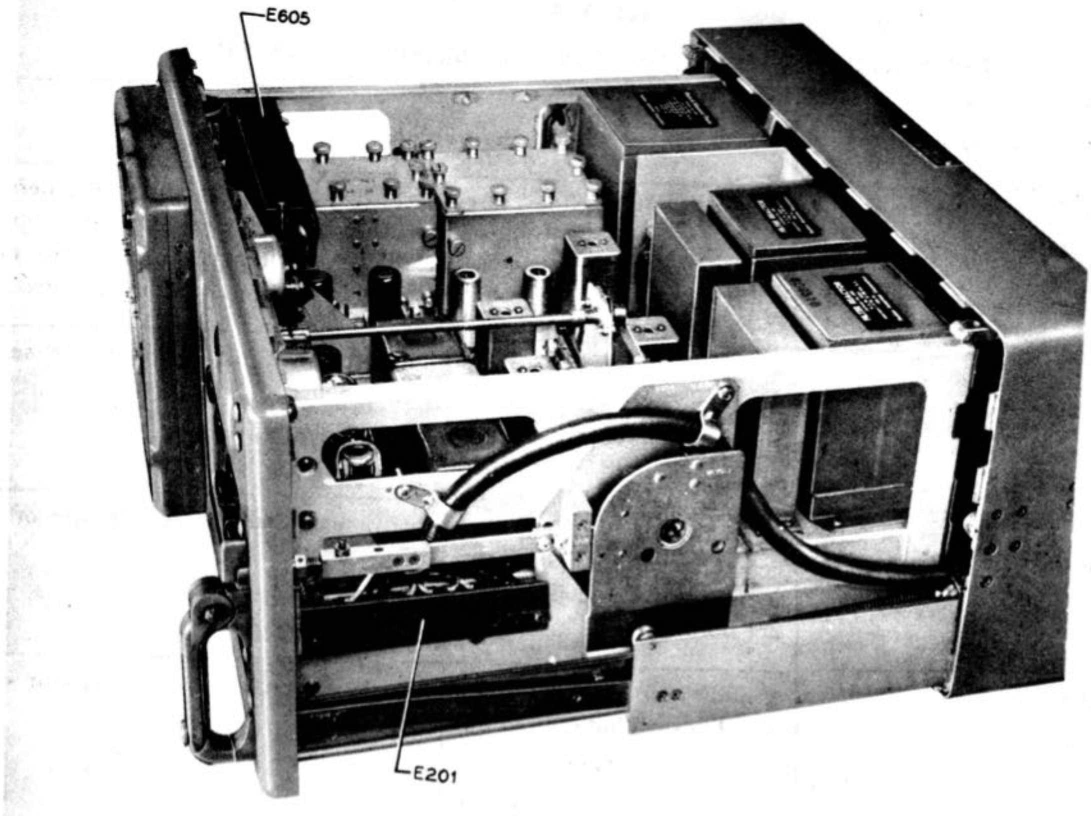


Figure 3–17. Radio Receiver RDZ/RDZ-1, View of Chassis Showing Terminal Boards

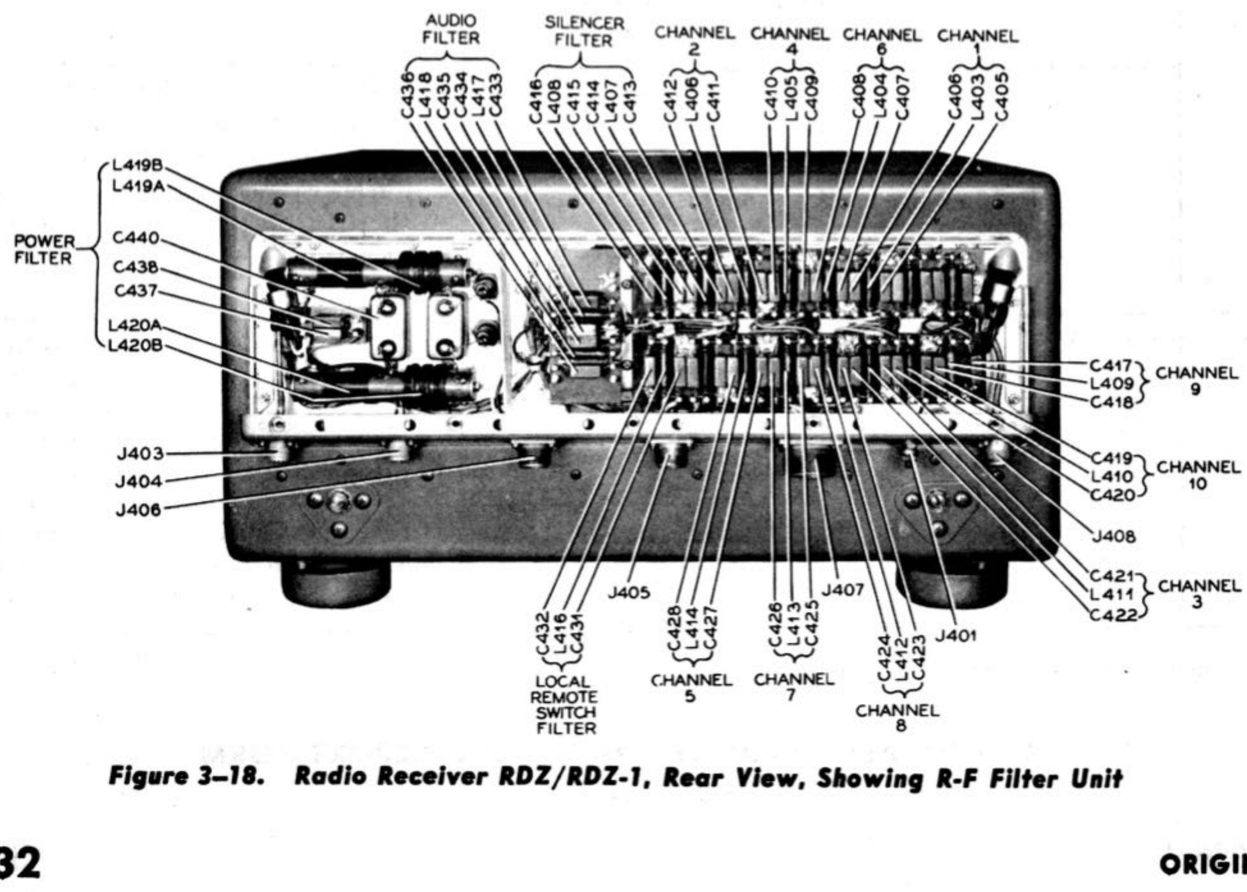


Figure 3–18. Radio Receiver RDZ/RDZ-1, Rear View, Showing R-F Filter Unit

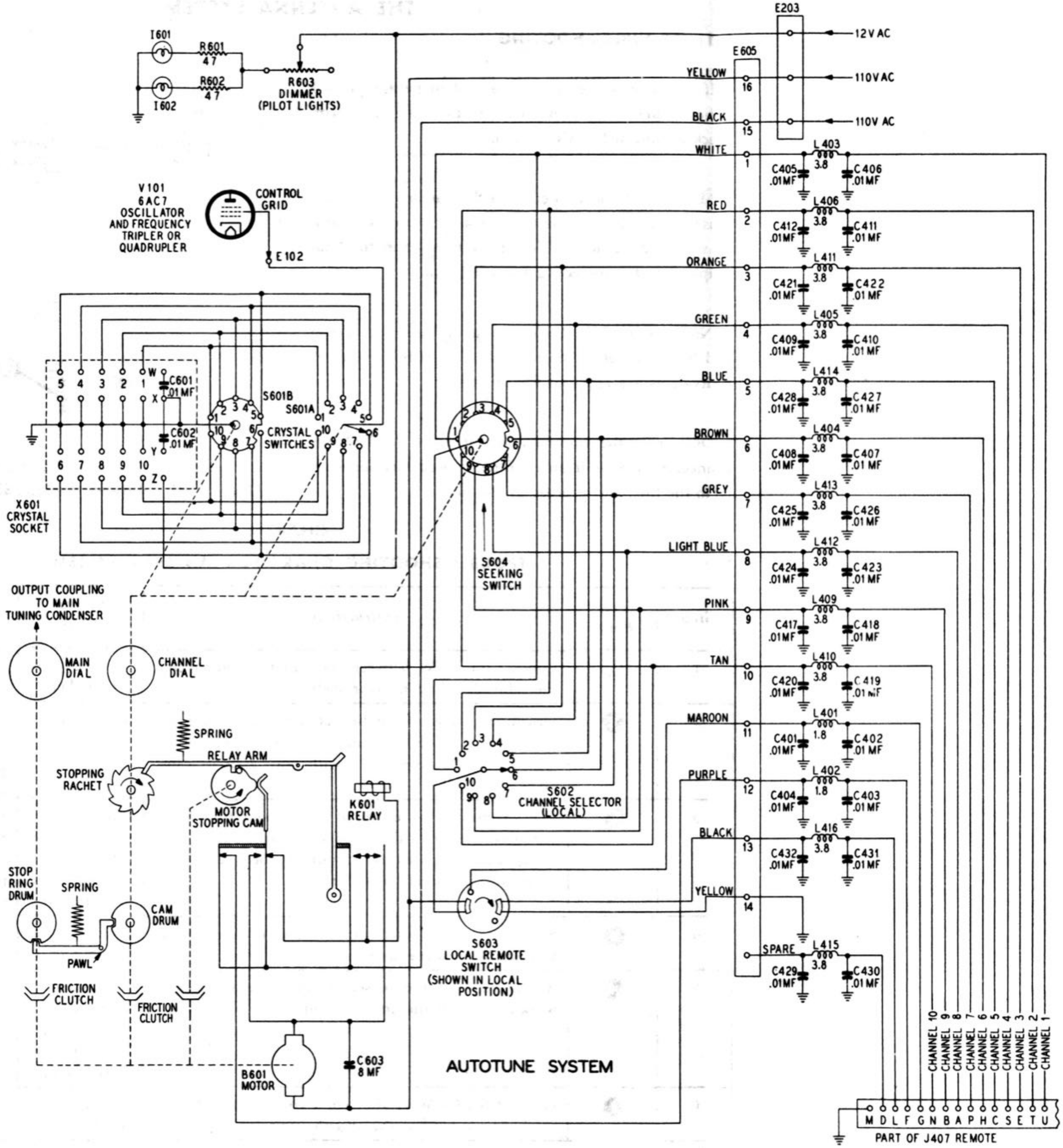


Figure 3–19. Radio Receiver RDZ/RDZ-1, Trouble-Shooting Schematic Diagram for Autotune System

THE ANTENNA SYSTEM

3-11. TROUBLE-SHOOTING.

If the systems check, as performed in Paragraph 3-3, indicates that trouble may exist in the antenna system, check as outlined in CHART 6.

Most troubles associated with the antenna system are caused by excessive moisture in the antenna unit or transmission lines. Complete information is given in Paragraph 4-41 for correcting this condition.

Navy Model OCW Series Insulation Resistance Tester and Navy Model OE Series Volt-Ohm-Milliammeter or equivalents are required for this test.

Disconnect the transmission line from ANTENNA connector J408 or if an r-f filter is used, disconnect it from the line, and proceed as follows:

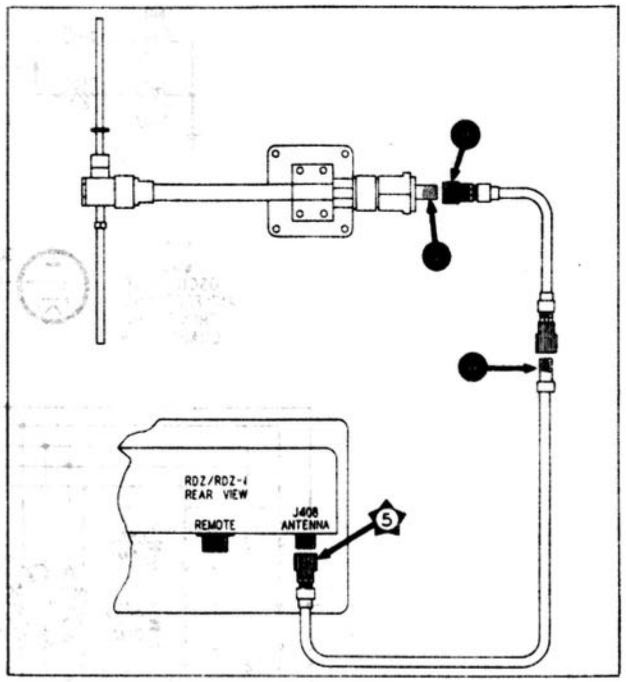


Figure 3-20. Antenna System, Showing Test Points

CHART 6

TROUBLE-SHOOTING CHART FOR ANTENNA SYSTEM

<table>
<tr><th>Step</th><th>Test Point</th><th>Instructions</th><th>Normal Indication</th><th>Procedure</th></tr>
<tr><td>1</td><td>5</td><td>Connect the OCW between the center conductor and the cable shield (connector shell).</td><td>30 megohms or higher.</td><td rowspan="6">If normal indications are obtained, trouble is not in antenna system. If any reading is low, moisture is indicated in the system or antenna insulator is corroded; refer to Paragraph 4-41.</td></tr>
<tr><td>2</td><td>G</td><td>Disconnect transmission line at next nearest connection to the RDZ/RDZ-1 and measure between center conductor and cable shield with both ends of cable open.</td><td>100 megohms or higher.</td></tr>
<tr><td>3</td><td>G</td><td>Check continuity of section of transmission line: Short center conductor to the cable shield at one end, and, using the OE, check for continuity between center conductor and shield at other end.</td><td>Resistance nominally less than 1 ohm, depending on installation.</td></tr>
<tr><td>4</td><td>H</td><td>Repeat step 2 for each section of transmission line, working toward the antenna unit.</td><td>100 megohms or higher.</td></tr>
<tr><td>5</td><td>H</td><td>Repeat step 3 for each section of transmission line, working toward the antenna unit.</td><td>Resistance nominally less than 1 ohm, depending on installation.</td></tr>
<tr><td>6</td><td>I</td><td>Connect the OCW to the center conductor and cable shield at the base of the antenna unit.</td><td>30 megohms (minimum).</td></tr>
</table>

Test points are shown in figure 3-20.

THE REMOTE CONTROL UNITS

3–12. OPERATIONAL CHECK.

This operational check is employed for the following combinations of remote units:

Group a. Remote Channel Selector Navy Type—23492.

Group b. Remote Control-Indicator Unit Navy Type —23496, and Selector Control Unit Navy Type—23497.

Group c. Remote Channel Selector Navy Type—23445, Channel Selector Unit Navy Type—23497, and Radiophone Units Navy Type—23500 and/or —23211A.

Any one or a combination of groups b and c as shown will be found in typical installations; however, each group must contain the units indicated above.

Carefully examine equipment for visual signs of defective parts or overheating, look for broken wires or worn insulation, check for loose cable connectors.

Set RDZ/RDZ-1 Radio Receiver Controls in normal operating positions. Turn CONTROL knob to REMOTE position and adjust SILENCER knob clockwise to point where background noise is sharply reduced. In groups b and c above, Selector Control Unit Navy Type —23497 is employed as a part of the remote system under check, and the POWER switch of this unit must be set to the ON position.

OPERATIONAL CHECK FOR GROUP a.

Step	*Instructions*	*Normal Indication*	*Procedure*
1	Turn CHANNEL switch to each of the ten channels.	RDZ/RDZ-1 tunes to each channel as indicated by the RDZ/RDZ-1 channel indicator. REMOTE CONTROL neon bulb on the –23492 is extinguished during the tuning cycle.	If normal proceed to step 2. If abnormal: 1. Remove the –23492 cable connections and check resistances as shown in figures 3–25. 2. Check interconnecting cable for continuity and shorts. 3. Check the RDZ/RDZ-1 Autotune system as outlined in paragraph 3–10.
2	Depress SILENCER switch and at the same time advance VOLUME control to point where background noise is discernible.	Background noise increases as VOLUME control is advanced.	If normal proceed to step 3. If abnormal, trouble may be: defective VOLUME control R-504, SILENCER switch S-502, R-501, R-502.
3	Release SILENCER switch.	Background noise is nominally reduced.	If abnormal, check S-502.

FILL OUT FAILURE REPORT FORM

NAVSHIPS 383 FOR ALL FAILURES

OPERATIONAL CHECK FOR GROUP b.

Step	*Instructions**	*Normal Indication*	*Procedure*
1	Set RECEIVER OFF—NO. 1 —NO. 2—TRANS. to NO. 1 position and dial the CHANNEL SELECTOR. Repeat for each of the ten channels.	Receiver No. 1 tunes to each of the ten channels as indicated by the RDZ/RDZ-1 channel indicator and the CHANNEL indicator dial on the –23496 for RECEIVER No. 1 shows the channel selected.	If normal, proceed to step 2. If abnormal: 1. Remove the cable connections to the –23496 and check resistances of the –23496 as shown in figure 3–22. 2. Check interconnecting cable for continuity and shorts. 3. Check the Selector Control Unit used with receiver no. 1, as outlined in CHART 7.
2	With receiver No. 1 dialed to any channel as shown in step 1, and handsets connected to the –23496, set HANDSET switches to RECEIVER No. 1 and slowly advance both INCREASE AUDIO LEVEL controls.	Background noise increases in each respective handset as the INCREASE AUDIO LEVEL controls are advanced.	If normal, proceed to step 3. If abnormal, check S401, R403 and/or R404.
3	Set RECEIVER OFF—NO. 1 —NO. 2—TRANS. to NO. 2 position and dial the CHANNEL SELECTOR. Repeat for each of the ten channels.	Receiver No. 2 tunes to each of the ten channels as indicated by the RDZ/RDZ-1 channel indicator and the CHANNEL indicator dial on the –23496 for RECEIVER No. 2 shows the channel selected.	If normal, proceed to step 4. If abnormal: 1. Remove the cable connections to the –23496 and check I404, S403 and adjacent wiring as shown in figure 3–22. 2. Check interconnecting cable for continuity and shorts. 3. Check the Selector Control Unit used with receiver no. 2 as outlined in CHART 7.
4	Repeat step 2 above for receiver no. 2.	Background noise increases in each respective handset as the INCREASE AUDIO LEVEL controls are advanced.	If abnormal, check S402.

* Each step is performed at each remote control station.

OPERATIONAL CHECK FOR GROUP c.

Step	*Instructions**	*Normal Indication*	*Procedure*
1	With ON-OFF switch in ON position, dial CHANNEL SELECTOR switch to each of the ten channels.	RDZ/RDZ-1 tunes to each channel as indicated by the RDZ/RDZ-1 channel indicator. CHANNEL INDICATOR on the –23445 indicates channel dialed.	If normal, proceed to step 2. If abnormal: 1. Remove the –23445 cable connections and check resistance as shown in figure 3–23. 2. Check interconnecting cables to the –23445 for continuity and shorts. 3. Check the Selector Control Unit as outlined in CHART 7.

OPERATIONAL CHECK FOR GROUP c. (Cont.)

Step	*Instructions**	*Normal Indication*	*Procedure*
2	Depress PUSH TO CUT SQUELCH switch and at the same time advance EARPHONE LEVEL knob to point where background noise is discernible.	Background noise increases as EARPHONE LEVEL knob is advanced.	If abnormal, make resistance checks as shown in schematic diagram, figure 3–24.
3	Release PUSH TO CUT SQUELCH switch.	Background noise is nominally reduced.	

* Each step is performed at each remote control station.

CHRONIC TROUBLES (See Paragraph 4–42)

3–13. TROUBLE-SHOOTING SELECTOR CONTROL UNIT NAVY TYPE—23497.

As shown in Paragraph 3–12, Selector Control Unit Navy Type—23497 must be used in conjunction with Remote Control-Indicator Unit Navy Type—23496 and Remote Channel Selector Navy Type—23445. If the operational check indicates trouble in these units, trouble-shoot the —23497 as follows:

CHART 7

TROUBLE-SHOOTING CHART FOR SELECTOR CONTROL UNIT NAVY TYPE—23497

Step	*Instructions*	*Normal Indication*	*Procedure*
1	Turn POWER switch to the ON position.	Red pilot light is illuminated.	If normal, proceed to step 2. If abnormal, line cord may not be connected to 115v, a-c source; check pilot light, fuses F101, F102.
2	With front cover of —23497 open, turn CONTROL knob of RDZ/RDZ-1 back and forth from REMOTE to LOCAL position.	Relay K106 can be seen to operate.	If normal, proceed to step 3. If abnormal cause may be broken wire in cable connecting the RDZ/RDZ-1 to the -23497, open coil of K106, defective LOCAL-REMOTE switch in RDZ/RDZ-1. Check +28-volt d-c rectifier output between terminal 5 of terminal board E105 and chassis.
3	Slowly rotate CHANNEL (telephone) dial of the remote control unit employed to the finger stop.	K101 can be seen to close.	If abnormal, check cable between Selector Control Unit and remote control unit; check for open coil of K101.
		K103 can be seen to close.	If abnormal, check contacts 2-3 of K101. Check for open coil of K103.
		Minor switch can be heard to release.	If abnormal, check contacts 3-4 of K105. Check release coil.
		K108 closes and CHANNEL indicator points between 1 and LOCAL.	If abnormal, check K108, contacts 1-2 of K105, contacts 1-2 and 4-5 of K106. Check cable between Selector Control Unit and remote control unit.
4	Slowly release CHANNEL dial to first impulse and hold.	K101 can be seen to close, and K102 closes.	If abnormal, check contacts 4-5 of K101, and contacts 3-4 of K103. Check for open coil of K102. If K102 chatters, check contacts 5-6 on K102.
5	Release CHANNEL dial to second impulse and hold.	K104 can be seen to close.	If abnormal, check contacts 2-3 on K101 and contacts 2-3 on K102. Check for open coil of K104. If K104 chatters, check contacts 2-3 on K104.
6	Release CHANNEL dial to normal position.	K101 can be seen to open. Minor switch can be heard to operate.	If abnormal, check contacts 4-5 of K104. Check 8-ohm stepper coil. (K105).
		Indicator points to channel dialed.	If abnormal, check contacts 7-8, 8-9, and 10-11 of K102.

After Selector Control Unit Navy Type—23497 is cleared of suspicion, the remote units are again checked as shown in Paragraph 3–12.

RESISTANCE MEASUREMENTS

All measurements made with unit disconnected from system

E101	*Resistance (Ohms)*
Terminal 1	90* to 220**
Terminal 2	200* to 170**
Terminal 3	200* to 170**
Terminal 4	37
Terminal 5	310* to 220**
Terminal 6	Infinity
Terminal 7	0
Terminal 8	480
Terminal 9	Infinity
Terminal 10	Infinity
Terminal 11	Infinity
Terminal 12	Infinity
Terminal 13	Infinity
Terminal 14	Infinity
Terminal 15	Infinity
Terminal 16	Infinity
Terminal 17	Infinity
Terminal 18	Infinity
Terminal 19	Infinity

* Channel 1.
** Channel 10.

RESISTANCE MEASUREMENTS OF RELAYS AND TRANSFORMER

	Resistance (Ohms)
K101	40 ± 10 percent
K102	125 ± 10 percent
K103	75 ± 10 percent
K104	50 ± 10 percent
K105 (Stepper)	150 ± 10 percent
K105 (Release)	20 ± 10 percent
K106	160 ± 10 percent
K107	250 ± 10 percent
K108	185 ± 10 percent
T101 (Ter. 1 to 2)	11
T101 (Ter. 3 to 5)	1.5

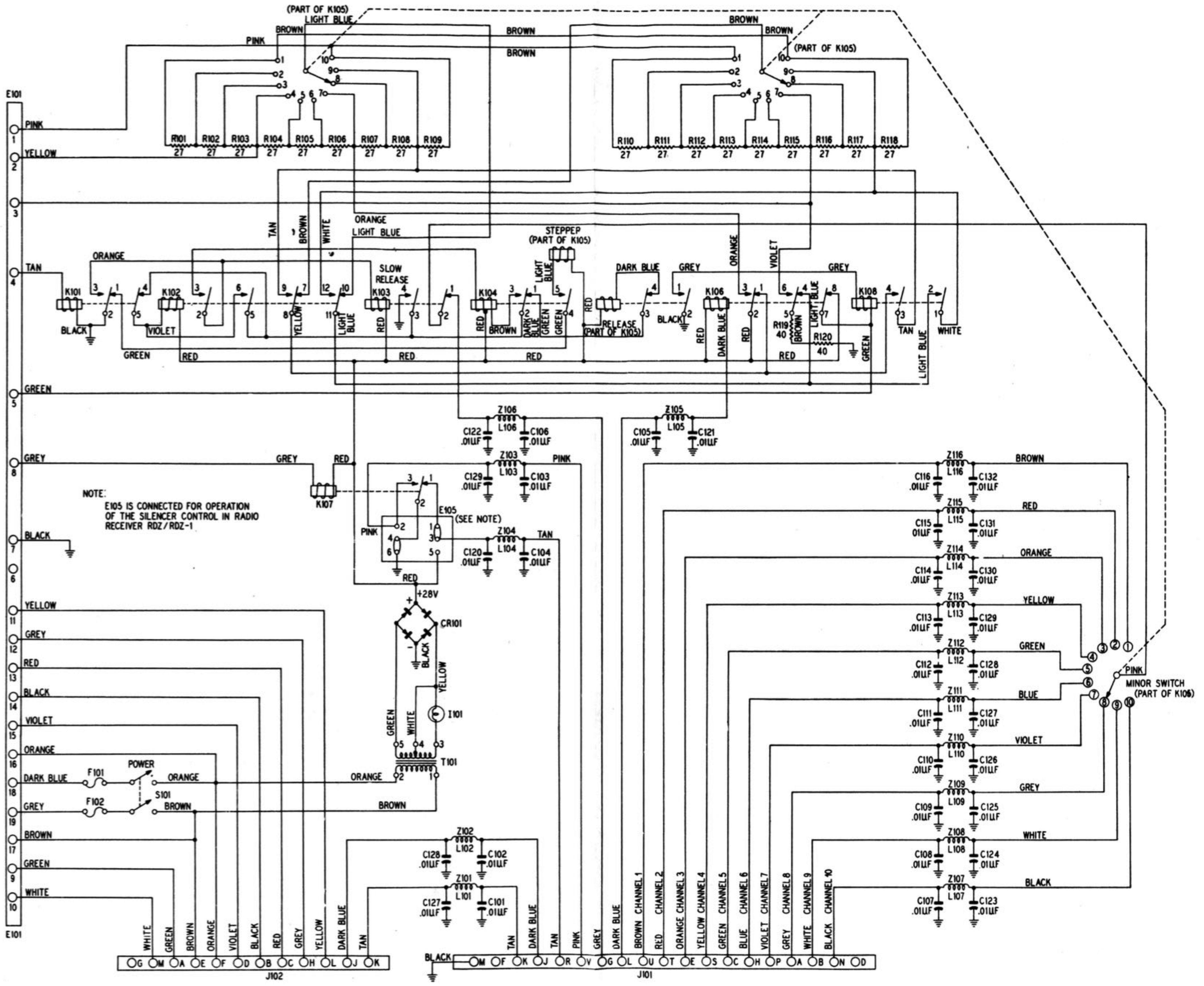


Figure 3–21. Selector Control Unit Navy Type—23497, Schematic Diagram and Resistance Measurements

RESISTANCE MEASUREMENTS

All measurements made with unit disconnected from system; handset switches S401 and S402 at RECEIVER NO. 2; MUTING switch S404 at BOTH; VOLUME LEVEL controls R403 and R404 at maximum.

E402	*Resistance in Ohms*
RCVR. 1	
1-2	80
1-3	80
2-3	80
4-5	Interrupted short (with S403 at RECEIVER NO. 1, and dial S406 actuated)
RCVR. 2	
1-2	80
1-3	80
2-3	80
4-5	Interrupted short (with S403 at RECEIVER NO. 2, and dial S406 actuated)
XMTR	
1-2	80
1-3	80
2-3	80
4-5	Interrupted short (with S403 at TRANSMITTER, and dial S406 actuated)
E401	
1-2	0 (with START button pressed)
1-3	0 (with START and STOP buttons pressed at same time)
1-4	550
5-6	Infinity (with key removed)
7-8	0 to 45,000 (as capacitor C401 discharges)
7-9, 10, 11, 13, 14, 15, 16, 17, 18, 19, 20	Infinity (with handsets removed)
7-12	40
8-9, 10, 11	Infinity
8-12	5,000 to infinity (as capacitor C401 discharges)
8-13R	Infinity
8-14R	Infinity
8-15R	Infinity

E401	*Resistance in Ohms*
8-14S	Infinity
8-19R	Infinity
8-20R	Infinity
8-19S	Infinity
8-20S	Infinity
9-10	350
9-All other terminals but 10	Infinity
10-All other terminals but 9	Infinity
11-All other terminals	Infinity
12-All other terminals but 7 and 8	Infinity
13R-14R	300
13R-13S	Infinity
13R-14S	Infinity
13R-19R	0
13R-20R	300
13R-19S	Infinity
13R-20S	Infinity
14R-13S	Infinity
14R-14S	Infinity
14R-19R	300
14R-20R	0
14R-19S	Infinity
14R-20S	Infinity
13S-14S	300
13S-19R	Infinity
13S-20R	Infinity
13S-19S	0
13S-20S	300
14S-19R	Infinity
14S-20R	Infinity
14S-19S	300
14S-20S	0
19R-20R	300
19R-19S	Infinity
19R-20S	Infinity
20R-19S	Infinity
20R-20S	Infinity
19S-20S	300

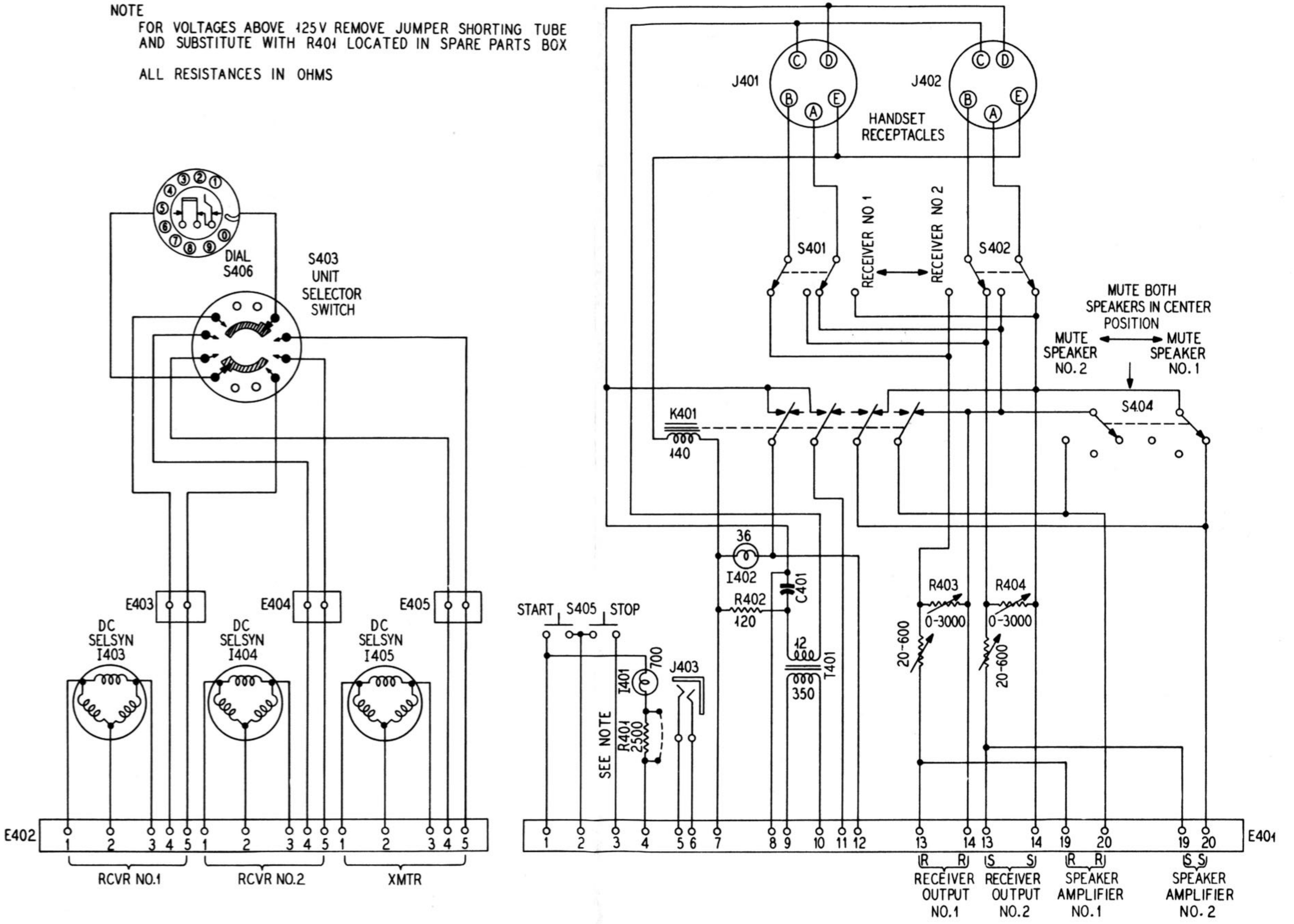


Figure 3-22. Remote Control-Indicator Unit Navy Type—23496, Schematic Diagram and Resistance Measurements

RESISTANCE MEASUREMENTS

All measurements made with unit removed from system.

Terminal	Resistance in Ohms	
	S301 OFF	*S301 ON*
1-2	Infinity	80
1-3	Infinity	80
1-4	Infinity	Infinity
1-5	Infinity	Infinity
2-3	Infinity	80
2-4	Infinity	Infinity
2-5	Infinity	Infinity
3-4	Infinity	Infinity
4-5	Infinity	Infinity (N301 not actuated)
4-5	Infinity	Interrupted short (N301 actuated)

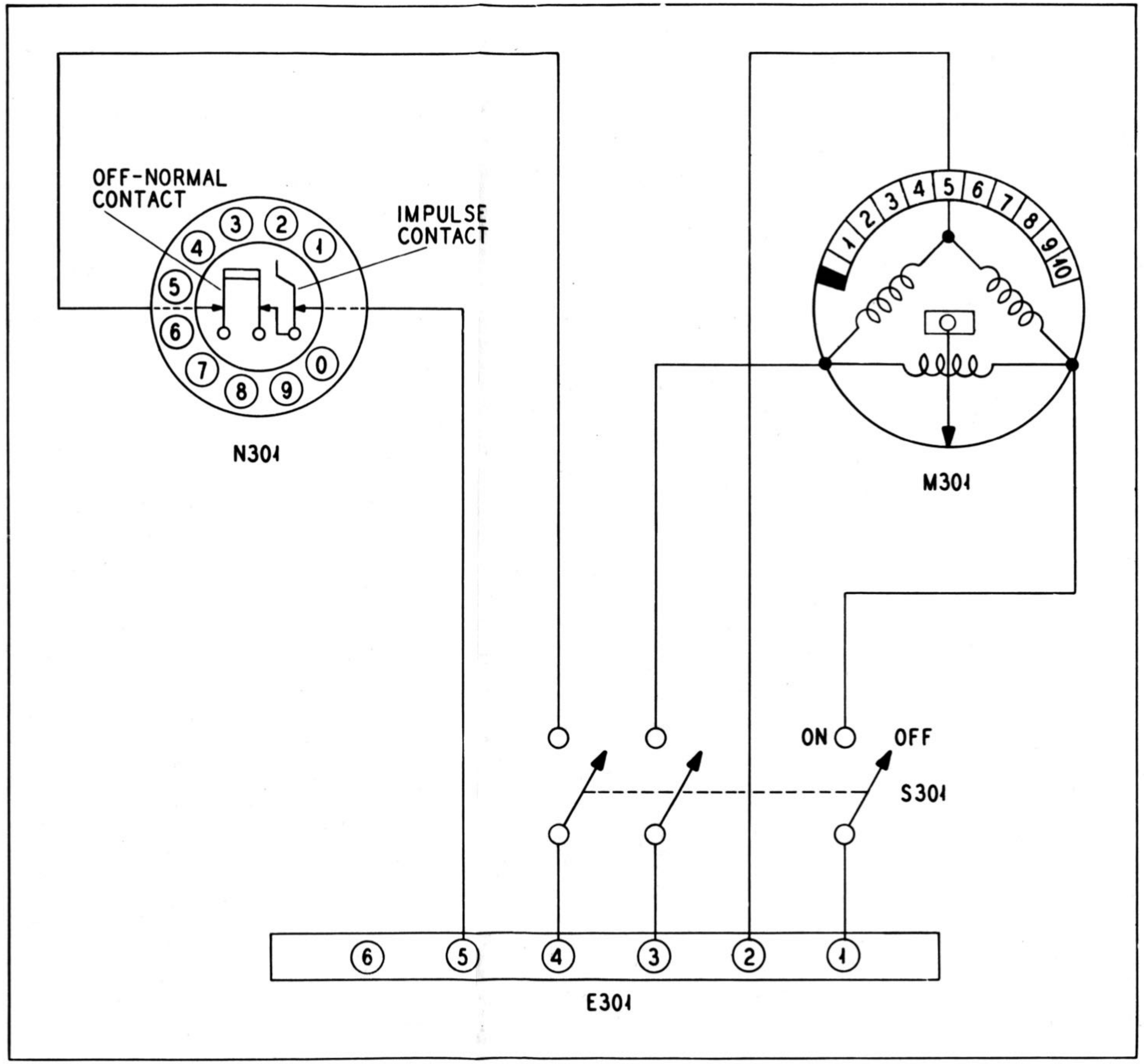


Figure 3–23.
Remote Channel Selector Navy Type—23445, Schematic Diagram and Resistance Measurements

RESISTANCE MEASUREMENTS

All measurements made with unit removed from system.

Terminal	*Resistance in Ohms*
1-2	0 (with START button depressed)
1-3	0 (with START and STOP button depressed)
1-4	500 (with jumper)
1-4	Infinity (without jumper)
5-All other terminals	Infinity
6-All other terminals	Infinity
7-8, 9, 10, 11, 13,	Infinity
7-14, 15, 16, 17,	Infinity
7-19, A, B	Infinity
7-12	30
7-C	120
7-E	200
8-D	0
8-All terminals but D	Infinity
9-10	130
9-All terminals but 10	Infinity
11-All other terminals	Infinity
12-E	200
13-14, 20, B	600 (with EARPHONE LEVEL R202 at 9)
13-15, 16	Infinity
13-19	0
14-A	600 (with EARPHONE LEVEL R202 at 9)
14-B	0
15-16	0 (when S203 is pressed)
20-19	600 (with EARPHONE LEVEL R202 at 9)
20-A	600 (with EARPHONE LEVEL R202 at 9)

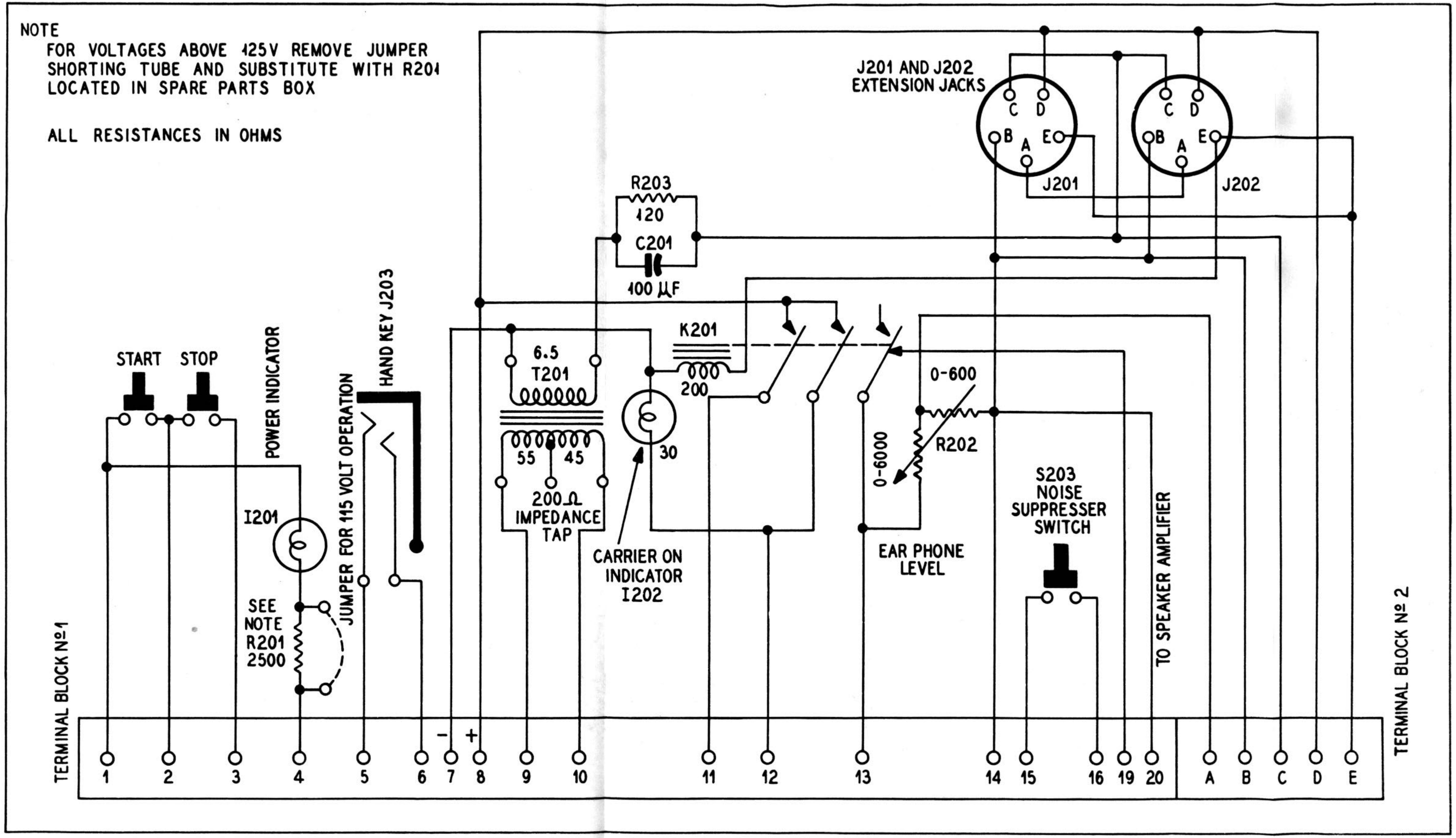


Figure 3–24. Radiophone Unit Navy Type—23500, Schematic Diagram and Resistance Measurements

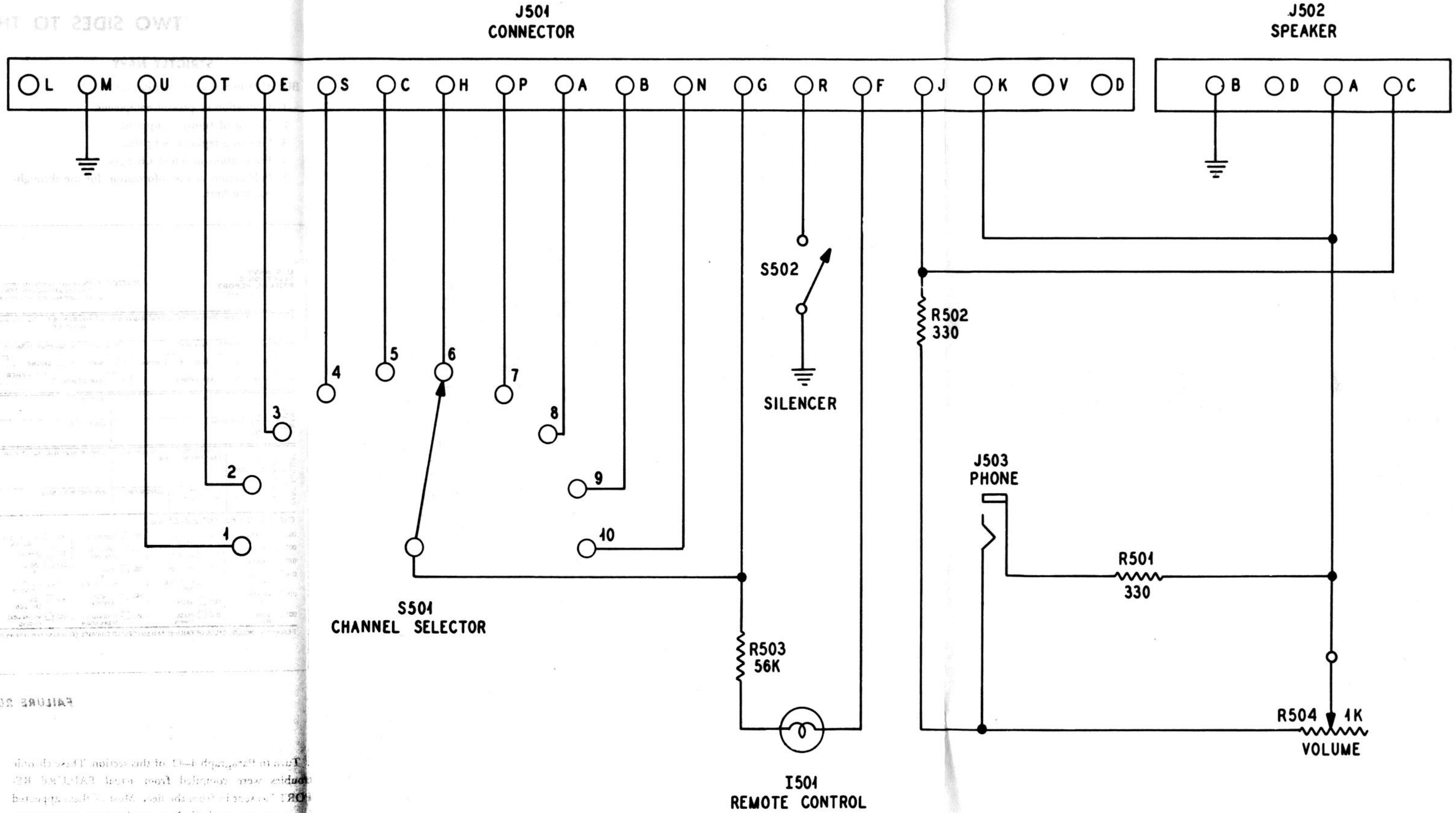


Figure 3-25. Remote Channel Selector Navy Type—23492, Schematic Diagram and Resistance Measurements

TWO SIDES TO THE FAILURE REPORT

STRICTLY NAVY

BUSHIPS uses the information for:

1. Evaluation of present equipment.
2. Design of future equipment.
3. Ordering replacement parts.
4. Preparation of Field Changes.
5. Publication of the information for use throughout the fleet.

YOUR SIDE

Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier, efficient.
3. It gives you a chance to pass your knowledge to every man of the team.
4. It prepares you for the next higher rating.

U. S. NAVY ELECTRONIC FAILURE REPORT
NAVSHIPS 383 (REV. 4-49)

NOTICE: 1. Read instructions interleaved in this pad prior to preparing report.
2. Report all failures (Electronic, electrical, and mechanical).
3. Use separate sheet to report each part failure.

REPORT—SHIPS-84
REPORT NO. ____________
DATE OF FAILURE ____________

EQUIPMENT INSTALLED IN (*Number and name of ship or station*)	REPAIRS MADE BY (*Number and name of ship, yard, tender, etc.*)	LEAVE BLANK	RFPAIRED BY (*Name and rate of person*)

SERVICE USING EQUIPMENT (*Check one*)	TYPE ACTIVITY USING EQUIPMENT (*Check one*)	EQUIPMENT CATEGORY (*Check one*)
1 ☐ NAVY 2 ☐ USCG 3 ☐ USMC 4 ☐ ARMY 5 ☐ AIR FORCE	1 ☐ SHIP 2 ☐ SHORE 3 ☐ AMPHIBIOUS 4 ☐ AIR-BORNE 5 ☐ OTHER ______ (*Specify*)	1 ☐ RADIO 2 ☐ RADAR 3 ☐ SONAR 4 ☐ TEST 5 ☐ ORDNANCE 6 ☐ NANCY AND RADIAC 8 ☐ POWER 9 ______ OTHER (*Specify*)

NAME PLATE DATA — EQUIPMENT			MAJOR UNIT INVOLVED
MODEL DESIGNATION	SERIAL NO.	NAME OF CONTRACTOR	TYPE NO. AND NAME
LEAVE BLANK	CONTRACT NO.	DATE INSTALLED	SERIAL NO.

PART FAILURE DATA (*Check one*)					
☐ TUBE	COMPLETE TUBE TYPE, OR NAME AND NAVY TYPE NO. OF PART	STANDARD NAVY STOCK NO. (*See note 10*)	SYMBOL DESIGNATION (*V-101, R-201, etc.*)	FAILED IN (*Check one*) 1 ☐ OPERATION 2 ☐ FAULTY PACKAGING 3 ☐ HANDLING 4 ______ OTHER (*Specify*)	
☐ OTHER	APPROXIMATE LIFE (*Hours*) / LEAVE BLANK	MANUFACTURER'S NAME	SERIAL NO. OF TUBE OR PART	ARMY STOCK NO. (*USMC only*)	MFRS' DATA (*See note 13*)

CHECK TYPE OF FAILURE

002 ☐ AIRLEAK	130 ☐ CHANGE OF VALUE	300 ☐ GROUNDED	360 ☐ INTERMITTENT OPERATION	225 ☐ MFR'S DEFECT	003 ☐ OPEN FILAMENT	540 ☐ PUNCTURED	620 ☐ SHORTED TO PRIMARY
007 ☐ ARCING	170 ☐ CORRODED	310 ☐ HANDLING IMPROPER	380 ☐ LEAKAGE	009 ☐ MICROPHONIC	460 ☐ OPEN PRIMARY	011 ☐ SCREEN DEFECTS	630 ☐ SHORTED TO SECONDARY
070 ☐ BROKEN	190 ☐ CRACKED	320 ☐ HIGH VOLTAGE BREAK-DOWN	013 ☐ LOOSE BASE	008 ☐ NOISY	470 ☐ OPEN SECONDARY	005 ☐ SHORTED INTERMITTENT	020 ☐ UNSTABLE OPERATION
014 ☐ BROKEN BASE	330 ☐ EXCESSIVE HUM	340 ☐ INSTALLED IMPROPERLY	012 ☐ LOOSE ELEMENTS	022 ☐ NO OSCIL-LATION	480 ☐ OVERHEATED	006 ☐ SHORTED PERMANENT	☐ OTHER (*Specify in remarks*)
015 ☐ BROKEN GLASS	001 ☐ GASSY	350 ☐ INSULATION BREAK-DOWN	004 ☐ LOW EMISSION	440 ☐ OLD AGE (*Specify in remarks*)	021 ☐ OVERLOADED	600 ☐ SHORTED TO CASE	
080 ☐ BURNED OUT	016 ☐ GLASS STRAIN		040 ☐ MECHANICAL BINDING	450 ☐ OPEN	010 ☐ POOR FOCUS	610 ☐ SHORTED TO FRAME	GPO 16—58703-1

REMARKS: INCLUDE CAUSE OF FAILURE AND SUGGESTED CHANGES (*Continue remarks on reverse side*) | LEAVE BLANK

FAILURE REPORT FORM

Turn to Paragraph 4–42. of this section. These chronic troubles were compiled from actual FAILURE REPORTS as sent in from the fleet. Most of them appeared in one or more periodic Navy publications. An examination of the troubles clearly shows how BUSHIPS has made use of the information from FAILURE REPORTS to supply you with necessary field changes, and to redesign defective or weak parts.

SECTION 4

SERVICE PROCEDURES

4–1. INTRODUCTION.

The service procedures given in this section consist of: data on periodic inspections; lubrication charts for units where applicable; outlines covering special adjustments and removal and replacement of parts; procedures for measurements and alignment of Radio Receiver RDZ/RDZ-1.

Trouble-free, dependable operation of the equipment, with a minimum of breakdowns, depends primarily on periodic inspections and proper lubrication. In this manual, these procedures have been simplified as much as possible, consistent with satisfactory operation.

Under no circumstances should alignment of Radio Receiver RDZ/RDZ-1 be attempted before measurements of all functional sections are made as outlined in Paragraph 4–17 of this section.

When repairs and replacements are necessary, don't neglect one of the most important parts of your job—MAKE OUT A FAILURE REPORT ON NAVSHIPS 383. The information that you supply pays dividends in the forms of more efficient maintenance of present equipment, and better designed equipment of the future. The tough problem that you solved today will stump another technician tomorrow. Don't keep it a secret!

RADIO RECEIVER RDZ/RDZ-1

4–2. INSPECTIONS.

The following routine checks and inspections should be followed to maintain the equipment in the best operating condition.

a. WEEKLY INSPECTIONS.

1. Set the CHANNEL selector, in turn, to each of the ten channels, both at local and remote positions. Note the frequency reading of the dial for each channel to make sure that the correct frequency is selected. If possible, listen to a transmitted signal for each channel.

2. Make certain that all tubes are tight in their sockets, and that all tube clamps are secure and in place.

3. Place hand on crystal oven to make certain it is warm.

4. Make certain that PLATE lamp and dial lamps are lit when Receiver is on.

b. MONTHLY INSPECTIONS.

1. Make all checks listed under WEEKLY INSPECTIONS above.

2. Check all master test points given in trouble charts of Section 3. Make certain that proper indication is obtained at each master check point.

3. Turn NOISE LIMITER - OUTPUT METER switch to OM, A-F GAIN and PHONES control clockwise. Operate equipment and manipulate each connecting cable while observing OUTPUT meter. An erratic deflection in the OUTPUT meter or noise in the headphones indicates cable trouble, such as loose pins, unsoldered connections, or damaged insulation.

4. Check for inactive crystals by turning RECEPTION switch to AVC ON, switch S101 to position 3, and operating the equipment on each channel in turn. Remove tube V101 while observing INPUT meter. If a crystal is inactive, there is no appreciable change in INPUT meter reading when tube V101 is placed in or taken out of its socket.

c. QUARTERLY INSPECTIONS.

1. Make all checks listed under MONTHLY INSPECTIONS above.

2. Withdraw Receiver from its cabinet, and remove all bottom and cover plates. Visually inspect all components for wear, overheating, and physical damage; inspect all insulation for frays, burns, and chars; inspect all leads for apparent short circuits and opens. Dust out chassis.

3. Remove and check all tubes (see Paragraph 4–6 of this section).

4. Check lubrication points according to Paragraph 4–3 of this section. Relubricate if quantity of lubricant appears insufficient or if lubricant is contaminated with foreign matter.

5. Make certain that meters operate without sticking.

6. While operating equipment, turn all potentiometer controls through their entire range. Check for noisy or intermittent potentiometers.

4–3. LUBRICATION.

The LUBRICATION CHART shows the points on the cabinet, front panel, and Autotune unit that require periodic lubrication. Points marked A should be lubricated annually; those marked B should not be lubricated unless the lubricant has become contaminated with foreign matter. Once the lubricant has been replaced, these points should be lubricated annually thereafter. The instructions given in the chart should be followed carefully, and no more lubricant than is specified should be used.

4–4. WITHDRAWING AND TILTING CHASSIS.

The chassis may be withdrawn from the cabinet without completely removing it, so that repairs and adjustments may be made to the top of the chassis. For adjustment and repairs to the bottom of the chassis, it may be tilted 90° after it has been withdrawn. The procedure for withdrawing and tilting the chassis is as follows:

a. WITHDRAWAL.

1. Slide the handle fastener buttons upward. See figure 4–3.

2. Lift both latch handles, and pull the chassis outward.

NOTE

If the release mechanism fails or the latch handles are broken, the chassis may be withdrawn by removing the four emergency release screws (see figure 4–3) and pulling the chassis outward.

b. TILTING.

1. To tilt the chassis so that the bottom is accessible, push both tilt levers outward toward the sides of the chassis and lift upward on the handles.

2. To regain access to the top of the chassis, simply tip the chassis back to the horizontal position.

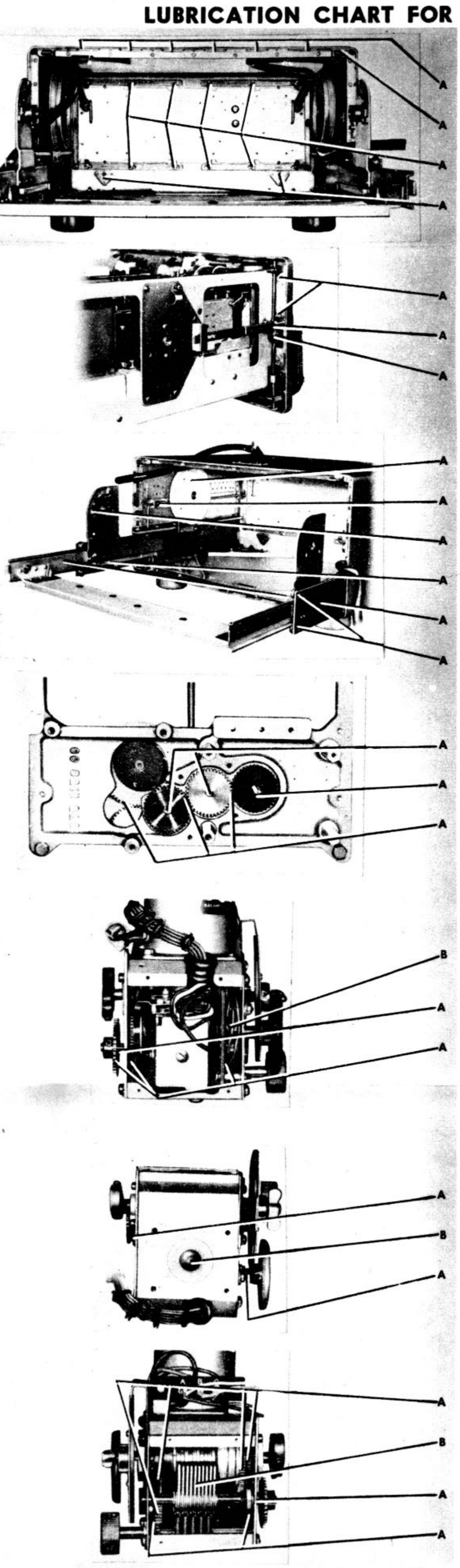
c. REPLACEMENT.

1. To replace the chassis in the cabinet, lift both latch handles at the same time, lift both horizontal blocking bars, one on each side of the chassis (see figure 4–2), and push chassis into cabinet.

2. Pull down on both latch handles to force the grounding fingers together. Then secure the handles by fastening the handle fastener buttons.

LUBRICATION

LUBRICATION CHART FOR RADIO RECEIVER RDZ/RDZ-1



A	14-P-1	APPLY THIN COAT *	GROUNDING FINGERS
A	14-P-1	APPLY THIN COAT *	ROLLER BLOCKS
A	14-P-1	APPLY THIN COAT *	LOCKING FINGERS
A	14-P-1	APPLY THIN COAT *	BEARING PLATES
A	14-P-1	APPLY THIN COAT *	GROUNDING FINGERS
A	14-P-1	APPLY THIN COAT *	TILT LEVERS, WORMS
A	14-P-1	APPLY THIN COAT *	RELEASE GEARS
A	14-P-1	APPLY THIN COAT *	CABLE PULLEY SHAFTS
A	14-P-1	APPLY THIN COAT *	LOCKING LEVERS
A	14-P-1	APPLY THIN COAT *	TILT BEARINGS
A	14-P-1	APPLY THIN COAT *	RUNNER GEARS, TRACKS
A	14-P-1	APPLY THIN COAT *	CABINET RUNNERS
A	14-P-1	APPLY THIN COAT *	BALL BEARING RACERS
		AUTOTUNE CASTING	
A	AN-G-25	APPLY THIN COAT *	CRYSTAL DRIVE BORES
A	MIL-L-644	SATURATE	OILITE BEARING
A	AN-G-25	APPLY THIN COAT *	CRYSTAL DRIVE GEARS
		AUTOTUNE UNIT	
B	AN-G-25	APPLY THIN COAT *	SEEKING SWITCH CHANNEL DRIVE SHAFT
A	MIL-L-644	SATURATE	FELT WASHER
A	AN-G-25	APPLY THIN COAT *	SPUR GEARS
A	MIL-L-644	SATURATE	OILITE BEARING
B	AN-G-25	FILL GEAR BOX	LINE SHAFT GEAR BOX
A	MIL-L-644	SATURATE	FELT WASHER
A	AN-G-25	APPLY THIN COAT *	SPUR GEARS
B	AN-G-25	APPLY THIN COAT *	PAWL STACK AT RIGHT SIDE OF AUTOTUNE HEAD
A	MIL-L-644	FEW DROPS	METAL WASHERS
A	MIL-L-644	ONE DROP	TUNING SHAFT BEARINGS—FRONT AND REAR

* Use a number 4 Artist's Salile Rigger Brush. Order by Navy Stock Number 38-B-690.

NAVY LUBRICANTS

SPECIFICATION	TITLE	QUANTITY	STOCK NUMBER	
14-P-1	PETROLATUM	1 LB.	STANDARD NAVY	14-P-98
14-P-1	PETROLATUM	5 LBS.	STANDARD NAVY	14-P-100
AN-G-25	LUBRICATING GREASE	1 LB.	AVIATION SUPPLY OFFICE	R14-G-982-20
MIL-L-644	SPECIAL PRESERVATIVE LUBRICATING	1 LB.	AVIATION SUPPLY OFFICE	R14-O-2405

LEGEND
A = LUBRICATE ANNUALLY
B = REPLACE LUBRICANT ONLY IF CONTAMINATED WITH FOREIGN MATTER. THEREAFTER, LUBRICATE ANNUALLY.

Figure 4–1.
Lubrication Chart for Radio Receiver RDZ/RDZ-1

4–5. REMOVING CHASSIS COMPLETELY FROM CABINET.

If necessary, the chassis may be completely removed from the cabinet as follows:

NOTE

Do not attempt to remove the chassis by loosening the gear tracks or racer runners.

a. REMOVAL.

1. Withdraw chassis by procedure given in Paragraph 4–4.*a.* of this section.

2. Remove the two Phillips head screws which hold fiber strip over terminal board E201 at right side of chassis.

3. Loosen the nine Phillips head screws opposite the letters A to I on E201, and loosen the Phillips head screw that grounds a lead directly above E201. Pull cable W401 from E201 and the ground screw.

4. Remove the two cable clamps which dress W401 along right side of chassis. Allow W401 to hang free.

5. Remove the two Phillips head screws which hold the fiber strip over E605 directly behind the Autotune unit.

6. Loosen the 14 Phillips head screws opposite the numbers 1 to 14 on E605, and pull cable W404 from E605.

7. Remove antenna plug P408 from antenna jack J101.

8. Remove the cable clamp which dresses W404 along left side of chassis, and allow W404 to hang free.

9. Loosen the tilt-bearing screws on each side of chassis. See figure 4–2.

10. Pull entire chassis completely free of cabinet.

b. REPLACEMENT.

1. Insert rear end of chassis into cabinet, lining up the chassis with the tilt bearings, and tighten the tilt-bearing screws.

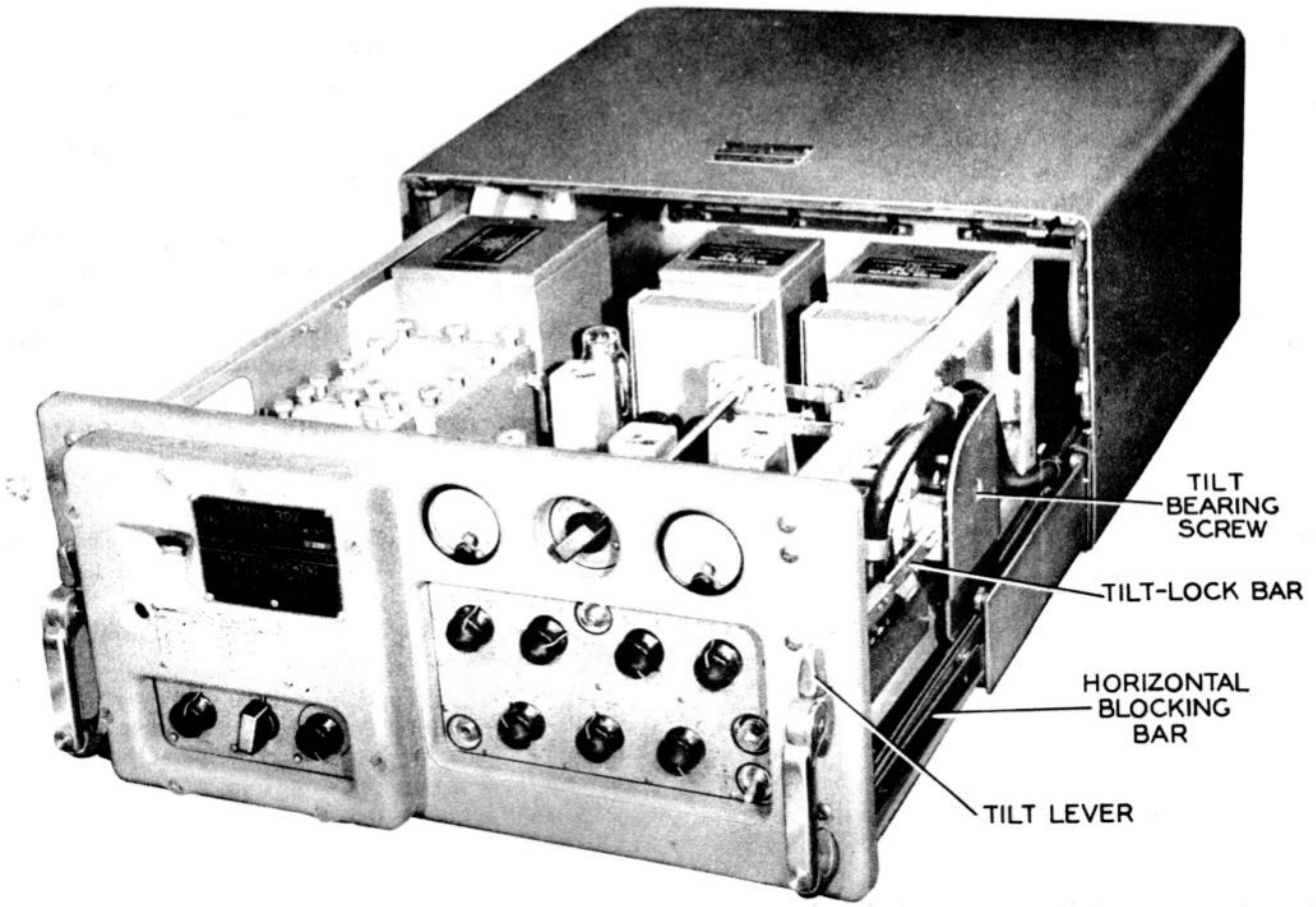


Figure 4–2. Radio Receiver RDZ/RDZ-1, Left-Top View, Showing Chassis Partially Removed from Cabinet

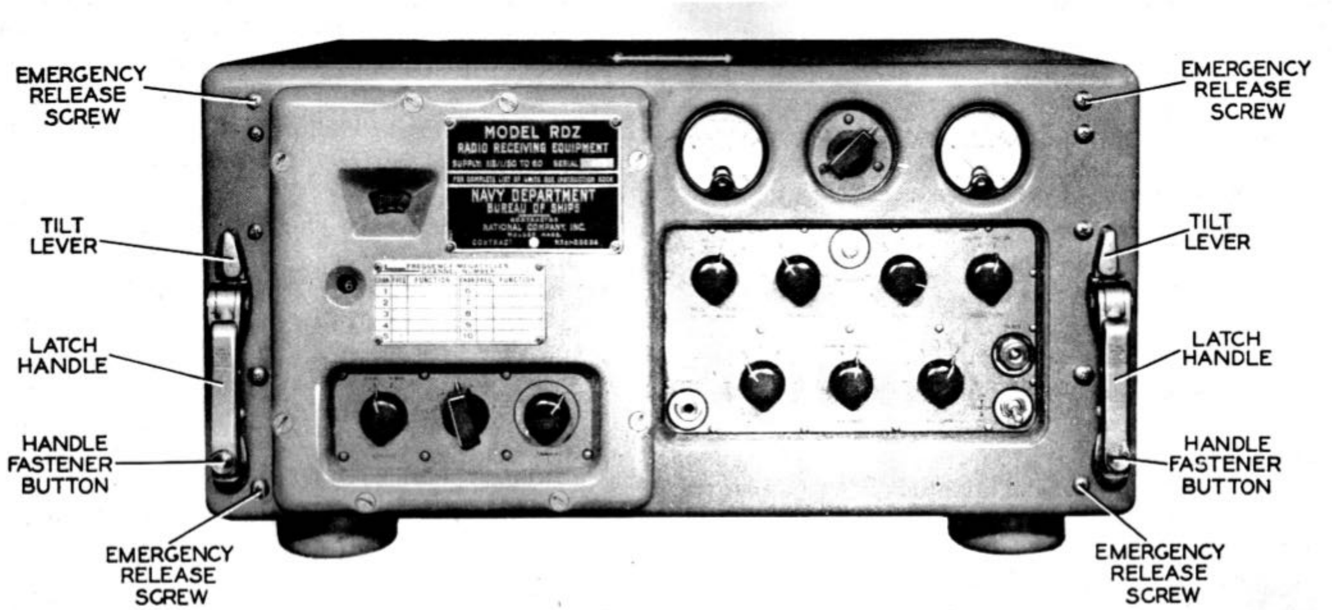


Figure 4–3. Radio Receiver RDZ/RDZ-1, Front View, Showing Release and Tilting Mechanism

2. Replace cable clamp which secures cable W404. Replace cable W404 and secure it to E605 by tightening the Phillips head screws.

3. Replace the two cable clamps which secure cable W401. Replace cable W401 and secure it to E601 by tightening the Phillips head screws.

4. Replace ground connection for cable W401.

5. Replace fiber strip over terminal strip E201.

6. Replace chassis in cabinet as outlined in Paragraph 4–4.*c*. of this section.

4–6. REMOVING AND REPLACING TUBES V105, V106, AND V107.

Special care should be exercised in removing and replacing the 956 and 6F4 acorn tubes. The 956 tube has a tiny plate clip which slips over the end pin. This clip should be slipped off before the 956 tube is removed from its socket and carefully slipped on after the tube has been replaced.

To remove any of these tubes from their sockets, simply push gently on the top of the tube and twist counterclockwise. To replace the tube, insert it into the socket, push gently, and twist clockwise. Care must be taken not to bend any of the pins or socket connections, or an open or intermittent connection may result.

4–7. REMOVING AND REPLACING FUSES.

Fuses F401 and F402 are located inside the cabinet on the rear.

WARNING

BEFORE REMOVING OR REPLACING THESE FUSES, MAKE CERTAIN THAT POWER IS REMOVED BY DISCONNECTING CABLE FROM J406.

These fuses are made accessible by withdrawing the chassis from the cabinet and tilting it 45 degrees. See Paragraph 4–4.*a*. and *b*. of this section. The fuses themselves are contained in screw-type holders, and their removal requires no special instructions.

4–8. REMOVING AND REPLACING CRYSTALS.

a. REMOVAL.

The procedure for removing the crystals is as follows:

1. Loosen the eight Dzus fasteners which secure front cover at left side to the front panel and remove cover. See figure 3–16.

2. Pull crystal oven out of its socket, using crystal puller supplied with spare parts.

3. Remove cover of crystal oven by removing the eight screws located on contact-pin side of oven.

4. Remove oven heater unit by loosening the four screws located at base of heater unit.

5. Pull out undesired crystal and insert desired crystal in its place.

b. REPLACEMENT.

Reassemble and replace crystal oven by following steps 2 through 4 above in reverse order, then replace cover plate at left side of front panel.

4–9. REMOVING AND REPLACING AUTOTUNE PARTS FOR LUBRICATION.

Before lubricating the Autotune unit of the RDZ/RDZ-1, it is necessary to remove Autotune motor B601, the Autotune head, crystal selector switch S601, and crystal socket X601.

a. REMOVAL.

1. Loosen the eight Dzus fasteners which secure front cover to front panel, and remove cover. See figure 3–16.

2. Using the crystal-oven extractor, pull crystal oven from its socket.

3. Unsolder ground lead from crystal-selector switch S601 at ground-connection point. Unsolder signal lead from S601 at point of feed-through insulator.

4. Remove the four Phillips head screws that hold crystal socket X601 to Autotune casting, and lift out socket X601 and switch S601.

5. Remove the four Phillips head screws that hold dust cover to gear train, and remove dust cover.

6. Unsolder leads to capacitor C603.

7. Remove the two slotted-head screws at top of Autotune head and the Phillips-head screw at bottom of head. (These three screws mount the Autotune head to the Autotune casting.) Pull head out of casting as far as connecting wires permit.

NOTE

Do not move either the shaft of switch S601 or the channel indicator mechanism after the Autotune head has been removed, otherwise the unit must be synchronized as outlined in Paragraph 4–21.

8. Unscrew the four 6-32 Phillips head screws that hold motor B601 to Autotune head, and lift motor B601 from Autotune head. Loosen the brackets which hold the dial lamps.

9. Remove the small Phillips head screws which hold dust covers to each side of Autotune head, and remove dust covers.

The Autotune unit may then be lubricated according to the procedure given in figure 4–1 of this section.

b. REPLACEMENT.

1. Replace dust covers on each side of Autotune head, and secure them with the small Phillips head screws.

2. Replace motor on top of Autotune head, set dial-lamp bracket in place, and replace the four 6-32 Phillips head screws.

3. Wedge shaft coupler open with a piece of heavy wire. Lift the head into place, making sure that coupling pin enters jaws of coupler. Remove wire from coupler and mount head to casting using the two slotted-head screws at the top and the Phillips head screw at the bottom.

4. Resolder leads to capacitor C603.

5. Replace dust cover over gear train and secure it with the four Phillips head screws.

6. Replace crystal socket X601 (with switch S601 attached) and mount it with the four Phillips head screws.

7. Resolder ground lead and signal leads from switch S601 to ground point and feed-through insulator, respectively.

8. Insert the crystal oven into its socket.

9. Replace front cover to front panel and secure it with the eight Dzus fasteners.

4–10. REMOVING AND REPLACING COMPLETE AUTOTUNE UNIT.

If for any reason it is necessary to remove and replace the entire Autotune unit, including the Autotune casting, proceed as follows:

a. REMOVAL.

1. Loosen the eight Dzus fasteners which secure front cover to front panel and remove cover. See figure 3–16.

2. Slide chassis about a foot out of cabinet.

3. Remove tilt-lock bar, tilt-lever, and linkage between them at left side of chassis by removing all Phillips head screws and Bristol screws. See figure 4–2. Care should be taken not to lose the small ball bearing in the channel guide at the rear end of the tilt-lock bar.

4. Remove the two Phillips head screws and lock washers on cover strip for terminal strip E605 and remove terminal-strip cover.

5. Loosen the 16 Phillips head screws which connect the 16 spade lugs to terminal strip E605 and slip off spade lugs.

6. Remove slotted mounting studs for cover strip of E605, allowing E605 to hang by its connecting wires.

7. Unsolder ground lead from crystal-selector switch S601 at ground-connection point. Unsolder signal lead from S601 at point of feed through insulator. Unsolder all leads to terminal strip E203, resistors R601 and R602, and capacitor C603. Tag all leads for identification to aid in reassembly.

8. Remove the three Phillips head screws and lock washers that hold capacitor C603 mounting bracket to casting. Remove capacitor C603 and mounting bracket.

9. Using crystal-oven extractor, pull crystal oven from its socket.

10. Remove the four Phillips head screws that hold crystal socket X601 to Autotune casting, and lift out X601 and switch S601.

11. Remove the four mounting studs for socket X601.

12. Remove the two slotted-head screws at top of Autotune head, and the Phillips head screw at bottom of head. (These screws mount the Autotune head to the Autotune casting.) Lift out Autotune head and motor.

13. Release the three fasteners which secure sub-panel on which DIMMER control, CHANNEL switch, and CONTROL switch are mounted. Remove sub-panel.

14. Remove cable support and rubber grommet which holds cable that runs from channel-selector switch S602 to terminal strip E605.

15. Remove the four Phillips head screws and lock washers at rear of Autotune casting. These screws mount the casting to the two angle brackets on the Preselector and Converter subchassis.

16. Remove the two hex-head screws at bottom corners on front of casting. Slide casting through left side of receiver.

b. REPLACEMENT.

1. Using the three screws that hold Autotune head to casting, mount Autotune unit mounting jig to casting in place of Autotune head. See figure 4–4. This jig is supplied with each RDZ/RDZ-1 and is packed with Equipment Spare Parts.

2. Fasten casting loosely to Preselector-Converter Unit and move casting around until jig shaft can readily be inserted into shaft hole at center of Preselector-Converter Unit drive gear. Tighten all screws which hold casting in place, starting with the two screws at bottom corners.

3. After all screws are tight, recheck the casting location with jig shaft. If the casting is not located properly, the ceramic shaft for the tuning capacitor will break. When it is certain that the casting is properly located, remove the jig.

4. Replace sub-panel on which DIMMER control, CHANNEL switch, and CONTROL switch are mounted. Tighten the three fasteners to secure sub-panel.

5. Replace cable support and rubber grommet which holds cable to channel selector.

6. Replace the four mounting studs for crystal socket X601, replace X601 (switch S601 attached), and mount it with the four Phillips head screws.

7. Wedge open the shaft coupler of the head with a piece of heavy wire. Lift head into place, making sure that coupling pin enters jaws of coupler. Remove wire from coupler. Make certain that the crystal-selector-switch gears mesh properly.

8. Mount head to casting, securing it with the two slotted-head screws at top and the Phillips head screw at bottom.

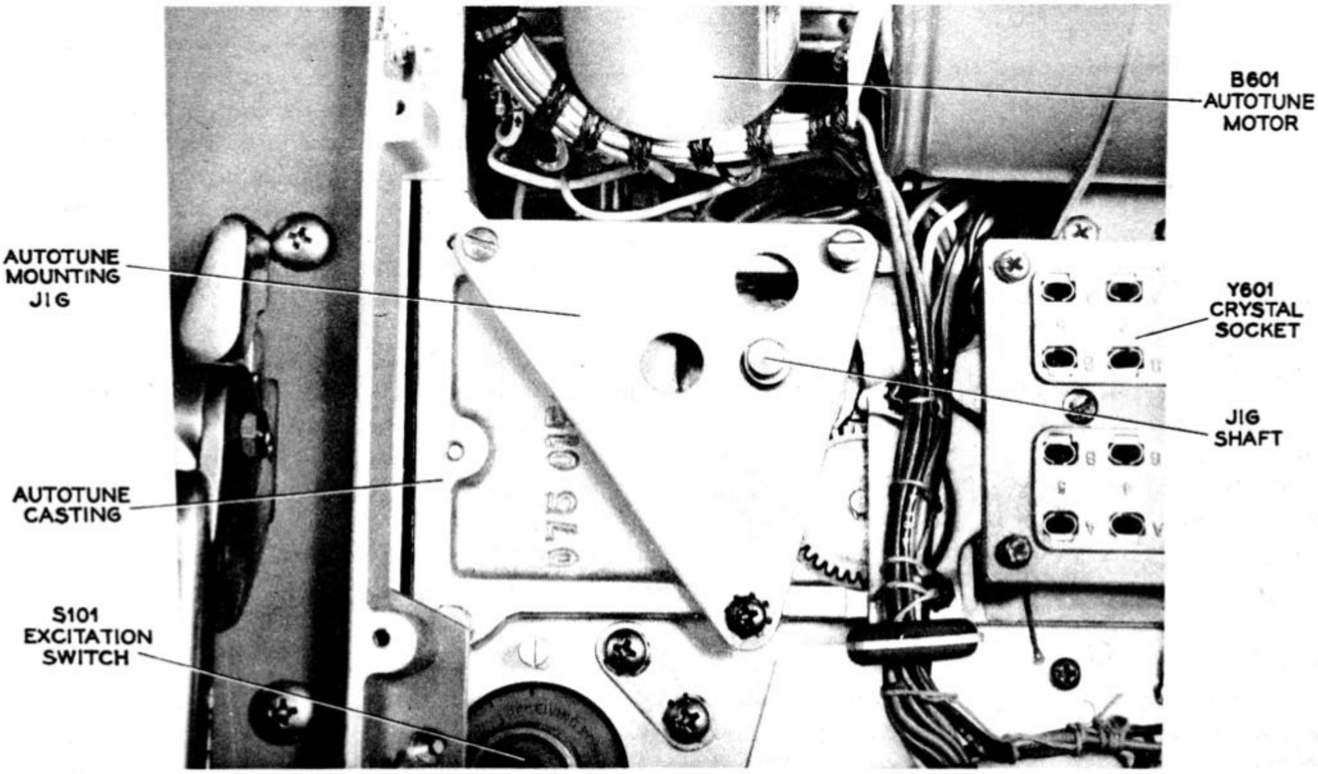


Figure 4–4. Placement of Mounting Jig for the Autotune Unit

9. Replace capacitor C603 and its mounting bracket and secure it to casting with the three Phillips head screws and lock washers.

10. Resolder ground and signal leads from switch S601 to ground point and feed-through insulator, respectively.

11. Replace terminal strip E605 and the mounting studs for its cover strip.

12. Replace the 16 spade lugs on terminal strip E605 and secure them with the Phillips head screws.

13. Place cover strip over terminal strip E605, securing it with the two Phillips head screws and lock washers.

14. Replace tilt-lock mechanism of left side of chassis and adjust linkage so that chassis is locked in tilt position and tilt-lever returns to normal position when released.

15. Replace crystal oven in its socket.

16. Replace front cover and secure it with the eight Dzus fasteners.

4–11. TEST EQUIPMENT REQUIRED FOR RDZ/RDZ-1 ALIGNMENT.

The following test equipment is recommended for the alignment of Radio Receiver Model RDZ or RDZ-1:

a. Navy Model LAF Series RF Signal Generator or equivalent.

b. Navy Model LP Series Radio Frequency Standard or equivalent.

c. Navy Model LM or LR Series Heterodyne Frequency Meter or equivalent.

d. Navy Model OBQ Series or Multimeter ME-25/U Series Electronic Multimeter or equivalent.

e. Navy Model OCR Series or TS-297/U Series Multimeters or equivalent.

f. Headphones Navy Type—49016 or equivalent, 600 ohms impedance.

g. Capacitor, fixed, mica, .001 μf.

h. Resistor, fixed, composition, 680 ohms, 1 watt.

i. Navy Model RDP Series Panoramic Adaptor or Dummy Scan Load (see Paragraph 4–14) of this section.

4–12. ANTENNA-INPUT ADAPTER.

The connector on the end of the output cable for Signal Generator Model LAF does not fit the Receiver antenna jack, J101. Adapter UG-   /U* may be used to adapt the LAF output cable to J101. If this adapter is not available, the interim substitute adapter shown in figure 4–5 may be used to connect the signal generator to J101 when making tests and adjustments. The interim adapter is easily constructed from the following standard parts:

* Number not assigned at time of publication.

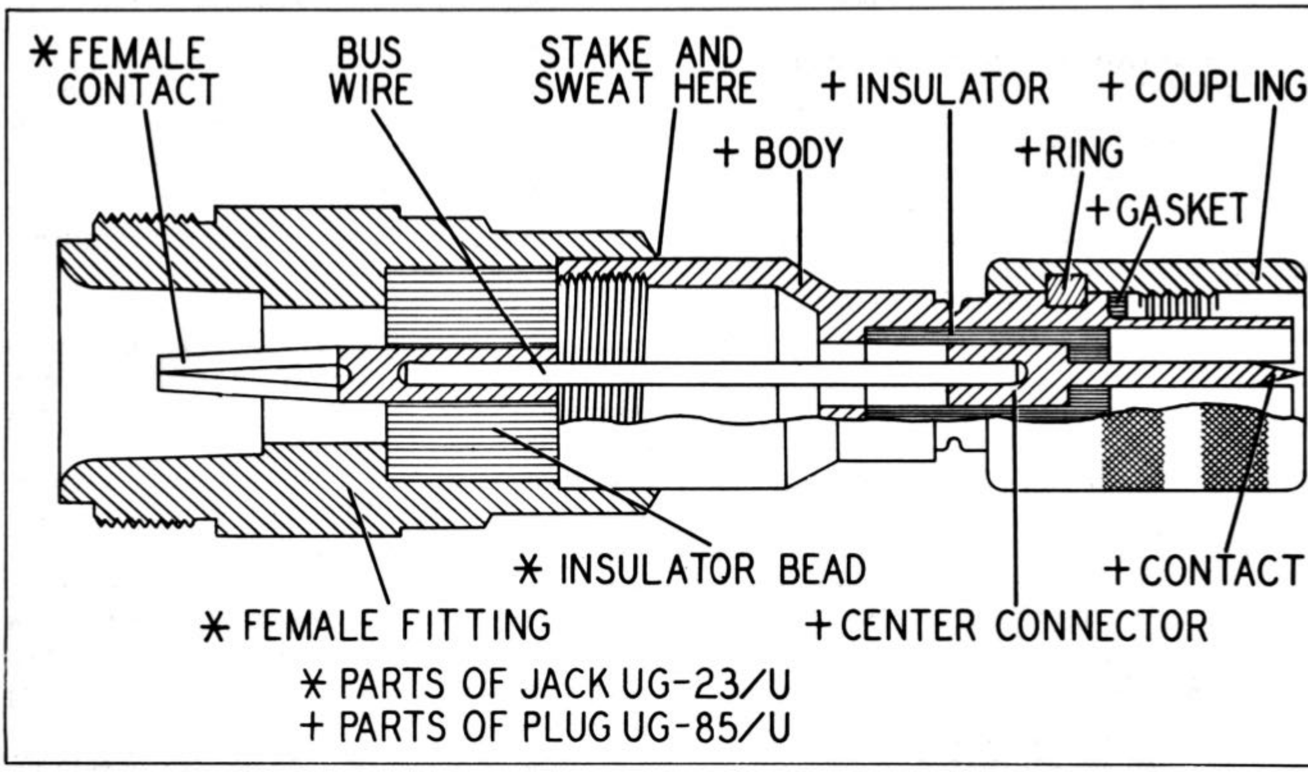


Figure 4–5. Fabrication of Interim Antenna-Input Adapter

a. PARTS REQUIRED.

The following parts are necessary for constructing the interim antenna-input adapter:

1. Jack, Type UG-23/U.
2. Plug, Type UG-85/U.
3. Wire, 1⅛-inch length of No. 18, hard-drawn, tinned copper.

b. CONSTRUCTION PROCEDURE.

Construct the antenna-input adapter as follows:

1. Twist off threaded female fitting from body of jack, Type UG-23/U, at the spun and sweated joint. Discard all of jack except insulator bead, female fitting, and female contact.
2. Remove body, ring, coupling, gasket, center connector and insulator from plug, Type UG-85/U, and discard rest of plug.
3. Tin outer surface of body for ¼ inch from cable end.
4. Insert one end of bus wire into female contact of jack, and other end of wire into center connector of plug.
5. Push plug and jack together tightly and make soldered connections at ends of wire. Sweat plug and jack together.

c. Obtain Adapter Connector UG- /U* as soon as possible, since its electrical characteristics are better than the interim adapter described above.

* Number not assigned at time of publication.

4–13. FABRICATION OF TRIMMING-TOOL COLLET.

The trimming-tool collet, shown in figure 4–6, is recommended for use with the small trimming tool supplied with the Spares of Model RDZ or RDZ-1. This collet may be machined from any available insulating material to the dimensions given in figure 4–6.

When the small end of the collet is inserted in any one of the access holes marked L105 to L108 and the first shoulder of the collet is held firmly against the surface of the preselector shield cover, the inset end of the trimming tool can be inserted through the center hole of the collet and meshed with the inductance trimmer without fumbling. When the second shoulder is used, the collet will enable quick engagement of the same tool with all the lower trimmers of the i-f transformers.

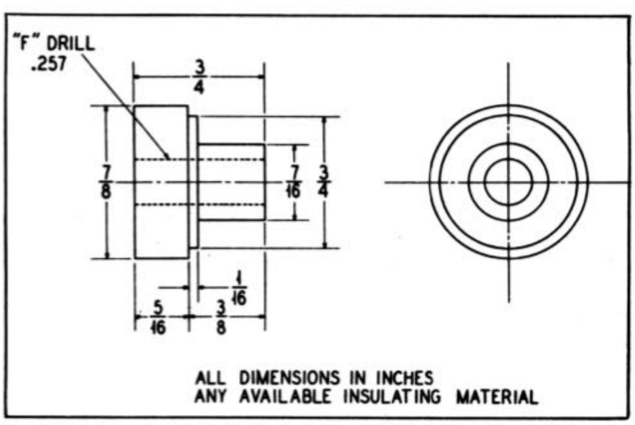


Figure 4–6. Fabrication of Trimming-Tool Collet

4–14. FABRICATION OF DUMMY SCAN LOAD.

When electrical tests and adjustments are made on Receiver Model RDZ or RDZ-1, the SCAN jack, J403, must be terminated in a suitable load to minimize standing waves in the scan-output circuit and to prevent regeneration in the i-f system. A Panoramic-type Adapter may be plugged into J403 or a dummy load may be used. Field Change No. 4-RDZ provides for such a load. If J403 is not terminated and the kit for Field Change No. 4-RDZ is not available, a temporary dummy load can be fabricated as shown below. In any case, the kit for Field Change No. 4 must be obtained at the earliest opportunity.

a. PARTS REQUIRED.

The following parts are necessary for constructing the dummy scan load:

1. Resistor, fixed, composition, 47 ohms, ½ watt.
2. Capacitor, fixed, .01 μf.
3. Plug, Navy Type 49195 (same as P403 in Spares).

b. CONSTRUCTION PROCEDURE.

To construct the dummy scan load, connect the resistor and capacitor, in series, between the inner terminal and the body of the plug. Solder all connections, and keep the leads as short as possible.

4–15. FABRICATION OF I-F COIL-CENTERING JIG.

This jig, shown in figure 4–7, is recommended for mechanically centering the i-f coils of i-f transformers Z202, Z203, and Z204. This jig can be fabricated from scrap brass material and a No. 4–40 round-head machine screw, ¾ inch long. Construct this jig as follows:

a. Obtain a cylindrical-shaped piece of brass and shape it as shown in figure 4–7. Using a No. 29 drill, drill a .136-inch hole concentrically through its axis.

b. Cut a piece of 3/16-inch, flat brass 1 inch by 1¼ inches. Using a No. 33 drill make a .113-inch hole in the position shown in figure 4–7 and using an "R" drill, make a .339-inch hole, with 11/32-inch center spacing from the first.

c. Drive the cylindrical piece of brass through the larger hole and sweat it into position. Screw the machine screw into the smaller hole.

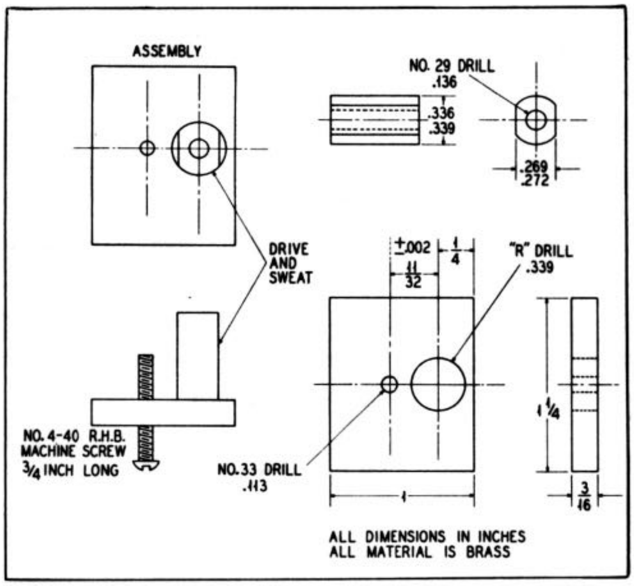


Figure 4–7. Fabrication of I-F Coil-Centering Jig

4–16. MODIFICATION OF DIODE-CURRENT SWITCH S203.

For all electrical tests and adjustments on Receiver Model RDZ or RDZ-1, a d-c vacuum-tube voltmeter is used as a resonance-peak indicator. Filtered terminals for connecting this meter are provided by modifying diode-current switch S203. Refer to figure 3–9 for physical location of S203. To make this modification, proceed as follows:

a. Remove the screw marked "+" of S203.

b. Loosen the screw marked "—" of S203.

c. Remove and discard the switch link, Part F-919, and replace the screw marked "+."

d. Cover label marked "+ DIODE CURRENT—" with label marked "+ AVC VOLTAGE—."

e. Make wiring changes as indicated in figure 4–8 of this section.

4–17. DETERMINING NEED FOR ALIGNMENT.

Whenever trouble is present in the RDZ/RDZ-1 which cannot be localized by use of the Trouble Localization Charts in Section 3 of this manual, proceed as follows:

a. TUBE TESTS.

Remove all tubes from the RDZ/RDZ-1 and test them in Tube Tester TV-3/U Series, Navy Model OZ Series or equivalent, or replace them with tubes known to be good.

b. A-F SENSITIVITY MEASUREMENTS.

When all tubes are known to be in good operating condition, make the a-f sensitivity measurements as shown in TABLE 4–1. If the a-f gain is found to be below the values shown in the chart, locate the defective part by complete voltage and resistance measurements of the audio section as shown in figure 3–12. When the a-f sensitivity is within limits, proceed to Paragraph 4–17, *c*.

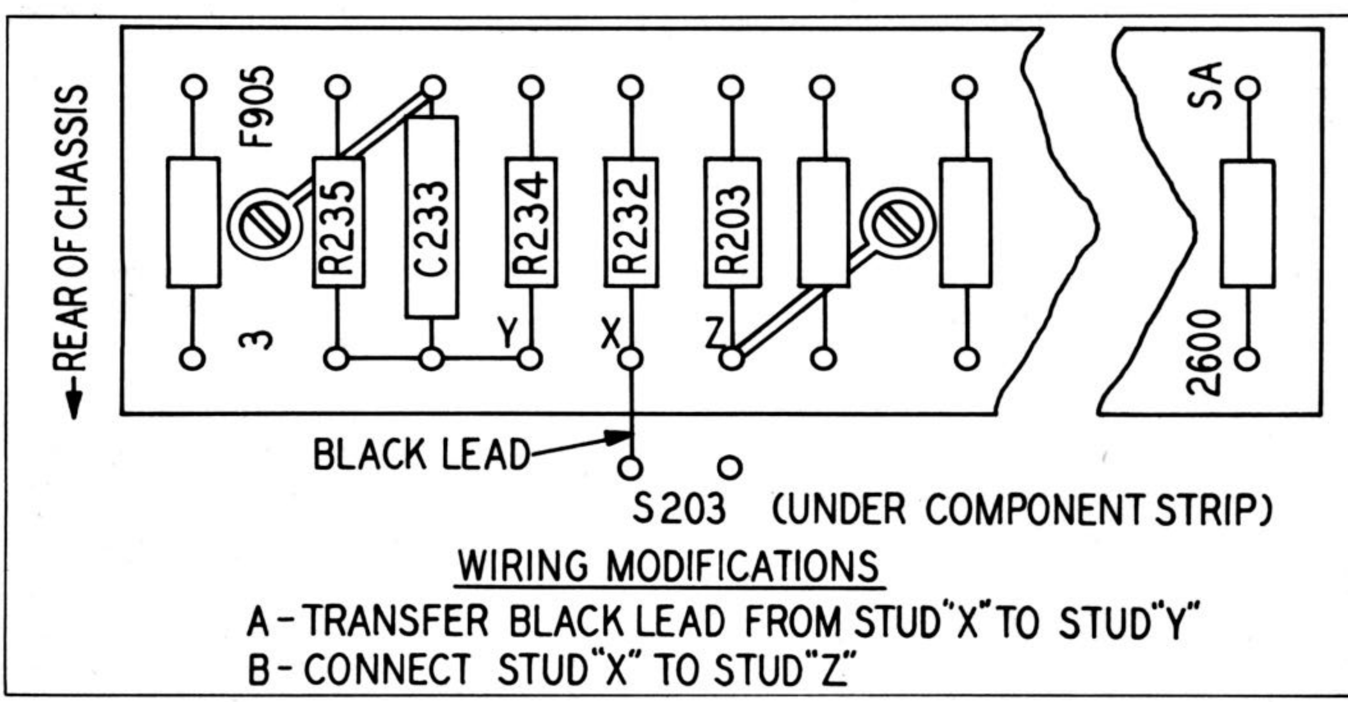


Figure 4–8. Modification of Diode Switch S203 (See paragraph 4–16)

893969 O—50——5

TABLE 4–1
A-F SENSITIVITY CHART

SIGNAL GENERATOR CONNECTIONS	1. Remove tube V206 from its socket to prevent noise interference during this check. 2. Connect Navy Model LP Series Radio Frequency Standard or equivalent through the .001-μf capacitor to pin 8 of 2nd detector V207A. See figure 3–7.
OUTPUT-INDICATOR CONNECTIONS	1. Fasten the 680-ohm resistor between terminals C and D of terminal board E201. See figure 3–17. Connect Navy Model OCR Series A-C Voltmeter across resistor.
RECEIVER-CONTROL SETTINGS	1. NL/OM switch to OM position. 2. SILENCER control to 0. 3. AF LEVEL control to 10. 4. AF BAND switch to NARROW.
A-F SENSITIVITY CHECK	1. Set MULTIPLIER and MICROVOLT control of the LP for maximum (100,000 microvolts) output. 2. Set MODULATION switch of the LP to INTERNAL for 30 percent modulation at 1000 cycles. 3. Turn METER READS switch of the LP to CARRIER, so that CARRIER control can be used for monitoring during test. 4. Tune the LP in the region of 15,100 kc. for maximum indication on the OCR. 5. Adjust CARRIER control of the LP so that meter reading coincides with SET CARRIER index. The OCR must read at least –10 db (–8 db average). If indication is not obtained, trouble is indicated in the Audio Section. Make complete voltage and resistance measurements as shown in figure 3–12, then, after cause of trouble is corrected, proceed to TABLE 4–2.

c. I-F AMPLIFIER SENSITIVITY MEASUREMENTS.

If all tubes are known to be good and if the audio sensitivity measurements are within limits as shown in TABLE 4–1, proceed as follows:

If the i-f sensitivity, bandwidths, and center frequencies meet the limits as shown in TABLE 4–2, the i-f amplifier section does not require alignment. If the limits given in TABLE 4–2 are not met, make complete voltage and resistance measurements of the i-f amplifier section as shown in figure 3–12; then proceed to Paragraph 4–18 for the i-f amplifier alignment procedure.

TABLE 4–2
I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

PRECAUTIONS	1. Allow closed receiver to warm up for at least one hour before opening chassis and for another hour after opening chassis before making measurements. Allow test equipment to warm up for a similar period. 2. The receiver chassis and signal-generator chassis should be connected to a common ground point through shortest possible leads. 3. Tuning-dial settings of Model LP should always be approached with the same direction of rotation. 4. In setting the tuning dial of Model LP, be sure to monitor the CARRIER control so that the meter indicator coincides with the SET CARRIER index. Always use Frequency Meter Model LM or LR to determine the true frequency. 5. A panoramic-type adapter or the dummy scan load must be plugged into J403 when making all measurements. See paragraph 4–14.

TABLE 4–2 (Cont.)

I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

SIGNAL-GENERATOR CONNECTIONS	1. Remove P408 from J101. 2. Use 90-ohm cable W102 on Model LP. 3. Connect the hot lead of Model LP through the .001-μf. capacitor to terminal B of E201. See figure 3–17. (Do not remove cable lug already connected to E201.) 4. Twist two turns of insulated wire around ungrounded lead of the LP, at the connection to the .001-μf. capacitor. Connect Frequency Meter Model LM or LR to the insulated wire.
OUTPUT-INDICATOR CONNECTIONS	1. Modify S203 as shown in paragraph 4–16. Connect GND test lead of Navy Model OBQ to negative AVC VOLTAGE terminal of switch S203. Connect DC VOLTS test lead of the OBQ to positive AVC VOLTAGE terminal of S203. 2. Fasten the 680-ohm resistor between terminals C and D of E201, then connect Navy Model OCR across the 680-ohm resistor. See figure 3–17. If the receiver is permanently installed, temporarily remove the two cable leads connected to terminals C and D. 3. Plug headphones into PHONES jack.
RECEIVER-CONTROL SETTINGS	1. CONTROL switch to LOCAL. 2. CHANNEL selector to lowest frequency available. 3. NOISE LIMITER-OUTPUT METER switch to OM. 4. SILENCER control to 0. 5. RECEPTION switch to AVC OFF. 6. AF BAND control to NARROW. 7. AF LEVEL control to 10. 8. PHONES control for desired level in headphones.

TABLE 4–2 (Cont.)

I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

NARROW BAND I-F SENSITIVITY CHECK	1. Set IF BAND control to NARROW. 2. Turn PLATE switch of Model LP to OFF, and adjust RF GAIN control for .3-volt (−16 db) indication on Model OCR (10-volt range). Then turn PLATE switch ON. 3. Set MULTIPLIER and MICROVOLT control of Model LP to provide output of 50 microvolts or more. Set MODULATION switch of Model LP to INTERNAL for 30 percent modulation at 1000 c.p.s. Turn METER READS switch of Model LP to CARRIER so that CARRIER control can be used for monitoring throughout tests. 4. Tune Model LP in the region of 15,100 kc. until maximum indication is obtained on Model OBQ (10-volt range). If no readable indication is obtained, increase output of Model LP until signal is heard in headphones, and retune Model LP for maximum indication on Model OBQ (10-volt range). 5. Adjust MICROVOLT control (and MULTIPLIER control, if necessary) until Model OCR reads 1.9 volts (0 db) on 10-volt scale. 6. Set Models OCR and OBQ to 2.5-volt scales and repeat steps 4 and 5. 7. Turn MODULATION switch of Model LP to OFF, and observe indication on Model OCR. Note amount that reading is above or below .6 volt (−10 db), and adjust RF GAIN control for −10 db reading on the OCR.

TABLE 4–2 (Cont.)
I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

NARROW BAND I-F SENSITIVITY CHECK (Continued)	8. Turn MODULATION switch to INTERNAL, and set MICROVOLT control for 1.9-volt (0 db) indication on Model OCR. 9. Repeat steps 7 and 8 until Model OCR reads .6 volt (–10 db when MODULATION switch is at OFF and 1.9 volts (0 db) when MODULATION switch is at INTERNAL. The final setting of MICROVOLT and MULTIPLIER controls is the narrow i-f sensitivity in microvolts and should be between 15 and 25 microvolts (19 microvolts average). 10. Proceed to NARROW BANDWIDTH AND CENTER FREQUENCY CHECK below.
NARROW BANDWIDTH AND CENTER FREQUENCY CHECK	1. Set MODULATOR switch of Model LP to INTERNAL, and adjust MICROVOLT and MULTIPLIER controls until Model OCR indicates exactly 3.8 volts (+6 db). 2. Decrease frequency of Model LP until Model OCR reads about 1.5 volts. Then carefully and slowly increase the frequency until Model OCR indicates exactly 1.9 volts (0 db). Turn on Frequency Meter Model LM or LR, and check exact frequency of Model LP by zero-beat method. Record this true frequency. 3. Turn off Model LM or LR, and increase frequency of Model LP until maximum indication is obtained on Model OCR. Slowly and carefully continue to increase the frequency until Model OCR indicates exactly 1.9 volts (0 db). Turn on Model LM or LR and check exact frequency of Model LP. Record this true frequency.

TABLE 4–2 (Cont.)
I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

NARROW BANDWIDTH AND CENTER FREQUENCY CHECK (Continued)	4. The difference between the frequency recorded in step 2 and the frequency recorded in step 3 is the narrow bandwidth, and should be between 115 kc. and 135 kc. 5. Divide the bandwidth by two and add the quotient to the frequency recorded in step 2. The sum is the true center frequency for the narrow band, and should be between 15,095 kc. and 15,115 kc. 6. Proceed to BROAD BANDWIDTH AND CENTER FREQUENCY CHECK below.
BROAD BANDWIDTH AND CENTER FREQUENCY CHECK	1. Set IF BAND control to BROAD. 2. Using Model LM or LR, set frequency of Model LP, by zero-beat method, to true center frequency of narrow band. Turn off Model LM or LR. 3. Adjust MICROVOLT control of Model LP until Model OCR indicates exactly 3.8 volts (+6 db). 4. Repeat steps 2 and 3 under NARROW BANDWIDTH AND CENTER FREQUENCY CHECK above. 5. The difference between the two frequencies recorded is the broad bandwidth, and should be between 230 kc. and 270 kc. 6. Divide the broad bandwidth by two and add the quotient to the lower limit. The sum is the true center frequency for the broad bandwidth and should be between 15,095 kc. and 15,135 kc. 7. Turn off Model LM or LR, and proceed to BROAD I-F SENSITIVITY CHECK below.

TABLE 4–2 (Cont.)

I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART

BROAD BAND I-F SENSITIVITY CHECK	1. Turn PLATE switch of Model LP to OFF, and adjust RF-GAIN control for .3-volt (–16 db) indication on Model OCR (10-volt range). Then turn plate switch ON. 2. Set MICROVOLT and MULTIPLIER controls of Model LP to provide an output of 50 microvolts or more. Set MODULATION switch of Model LP to INTERNAL for 30 percent modulation at 1000 c.p.s. Turn METER READS switch to CARRIER so that CARRIER control can be used for monitoring throughout the test. 3. Set frequency of Model LP to true center frequency of broad band, as determined in BROAD BANDWIDTH AND CENTER FREQUENCY CHECK above. Turn on Model LM or LR and use zero-beat method for setting frequency of Model LP. Turn off Model LM or LR. 4. Adjust MICROVOLT and MULTIPLIER controls of LP until Model OCR reads 1.9 volts (0 db) on 10-volt scale. 5. Set Models OCR and OBQ to 2.5-volt scales. 6. Turn MODULATION switch to OFF and observe indication on Model OCR. Note amount that reading is above or below .6 volt (–10 db), and adjust RF GAIN control for –10 db reading on the OCR. 7. Turn MODULATION switch to INTERNAL, and set MICROVOLT control for 1.9-volt (0 db) indication on OCR.
BROAD BAND I-F SENSITIVITY CHECK (Continued)	8. Repeat steps 6 and 7 until Model OCR reads .6 volt (–10 db) when MODULATION switch is at OFF and 1.9 volts (0 db) when MODULATION switch is at INTERNAL. The final setting of the MICROVOLT and MULTIPLIER controls is the broad i-f sensitivity in microvolts, and should be within 5 percent of the narrow band i-f sensitivity.

d. OVER-ALL SENSITIVITY MEASUREMENTS.

If all tubes are known to be good, and if the Audio and I-F Amplifier measurements are within the limits shown in TABLES 4–1 and 4–2, make the over-all sensitivity measurements shown in TABLE 4–3. If the limits shown in this table are met, the r-f and converter section does not require alignment. If the limits in TABLE 4–3 are not met, make complete voltage and resistance measurements as shown in figure 3–15. Proceed to Paragraph 4–19 for the r-f and converter alignment procedure.

TABLE 4–3

OVER-ALL SENSITIVITY MEASUREMENTS CHART

PRECAUTIONS	1. Allow closed Receiver to warm up for at least one hour before opening chassis, and another hour after opening chassis before making measurements. Allow test equipment to warm up for a similar period. 2. Set signal generator and Receiver tuning controls with extreme precision. Be sure PLATE adjustment of signal generator is corrected for each final frequency setting.

TABLE 4–3 (Cont.)

OVER-ALL SENSITIVITY MEASUREMENTS CHART

PRECAUTIONS (Continued)	3. The receiver chassis and signal generator GND terminal should be connected to a common ground point, through the shortest possible leads. 4. A Panoramic-type Adapter or the dummy scan load must be plugged into connector J403 during the test.
SIGNAL-GENERATOR CONNECTION	1. Connect Signal Generator Model LAF through antenna-input adapter to connector J101.
OUTPUT-INDICATOR CONNECTIONS	1. Modify S203 as shown in paragraph 4–16. Connect GND test lead of Navy Model OBQ to negative AVC VOLTAGE terminal of switch S203. Connect DC VOLTS test lead of the OBQ to positive AVC VOLTAGE terminal of S203. 2. Fasten the 680-ohm resistor between terminals C and D of E201, then connect Navy Model OCR across the 680-ohm resistor. See figure 3–17. If the receiver is permanently installed, temporarily remove the two cable leads connected to terminals C and D.
RECEIVER-CONTROL SETTINGS	1. CONTROL switch to LOCAL. 2. DIMMER control for desired illumination. 3. NOISE LIMITER-OUTPUT METER switch to OM. 4. SILENCER control to 0. 5. RECEPTION switch to AVC OFF. 6. IF BAND control to NARROW. 7. AF BAND control to NARROW. 8. AF LEVEL control to 10.

TABLE 4–3 (Cont.)

OVER-ALL SENSITIVITY MEASUREMENTS CHART

OVER-ALL SENSITIVITY CHECK	1. Turn CW-PULSE switch of Model LAF to OFF. 2. Set CHANNEL selector to desired frequency, and adjust RF GAIN control for .3-volt (–16 db) reading on model OCR (10-volt scale). 3. Set CW-PULSE switch of Model LAF to CW, and set OUTPUT attenuator to approximately 75 db below .1 volt. Tune Model LAF to selected frequency channel, and adjust until maximum indication is obtained on Model OBQ (10-volt scale). Then correct PLATE adjustment of Model LAF for this frequency setting. Retune Model LAF and readjust PLATE adjustment if necessary. 4. Reduce output of Model LAF until Receiver OUTPUT meter reads –4 db or less, and set Models OBQ and OCR to 2.5-volt scales. 5. Loosen wing screw at center of Receiver tuning dial and adjust Receiver tuning for maximum indication on Model OBQ. Tighten wing screw and repeat step 3, with reduced output from Model LAF. 6. Adjust OUTPUT attenuator of Model LAF until Model OCR reads .6 volt (–10 db). Then turn CW-PULSE switch on Model LAF to OFF. Model OCR reading should drop to .3 volt (–16 db). This reading should return to .6 volt (–10 db) when CW-PULSE switch is reset to CW.

TABLE 4–3 (Cont.)

OVER-ALL SENSITIVITY MEASUREMENTS CHART

OVER-ALL SENSITIVITY CHECK (Continued)	7. Using calibration curves for Model LAF, determine signal-generator output, in microvolts, corresponding to OUTPUT attenuator reading, and apply the given correction factor if necessary. This output in microvolts is the over-all sensitivity of the receiver, and should be between 5 and 15 microvolts. 8. Repeat steps 1 through 7 for each channel. The Receiver sensitivity for each channel should be between 5 and 15 microvolts. If proper indication is not obtained, trouble is indicated in the RF and Converter Section. Make complete voltage and resistance measurements as shown in figure 3–15, then proceed to TABLE 4–5.

4–18. I-F AMPLIFIER ALIGNMENT.

The i-f system should not be aligned until after the checks in the A-F AMPLIFIER SENSITIVITY CHART (TABLE 4–1), and I-F AMPLIFIER MEASUREMENTS CHART (TABLE 4–2) have been made and it has been determined that the i-f sensitivity bandwidths, or center frequencies do not meet the required limits. After making the preliminary checks and observing the temperature considerations below, refer to the I-F ALIGNMENT CHART (TABLE 4–4) for the alignment procedure.

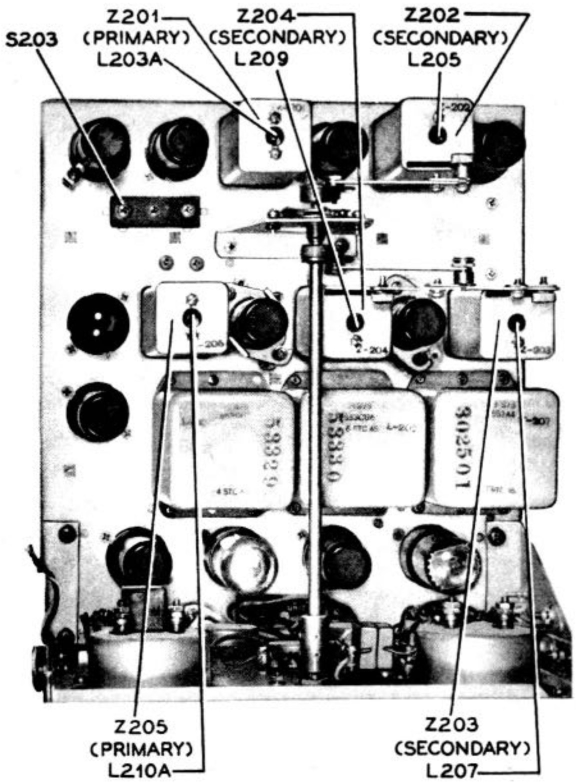
a. PRELIMINARY CHECKS.

If the sensitivity, bandwidth, and center-frequency characteristics are *extremely* poor, make the following preliminary checks:

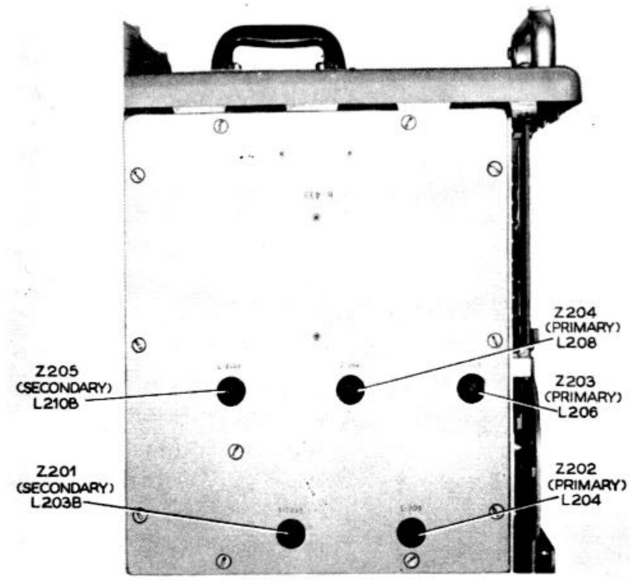
1. Set the I-F BAND control to BROAD, and visually inspect the trimmer screws at the tops of Z202, Z203, and Z204. See figure 3–9. These screws should be well centered in the holes of the transformer frames (not necessarily with the outer shields).

2. If any one trimmer screw is offset, loosen the Phillips head screw which adjusts the length of the lever arm on its control linkage, remove the top shield-securing screw, press the hub of the i-f coil jig (see paragraph 4–15 of this section) down over the trimmer screw, and secure it with the special screw. (It may be necessary to

ALIGNMENT



TOP VIEW OF CHASSIS



BOTTOM VIEW OF CHASSIS

Figure 4–9. Adjustments Used for Alignment of Intermediate-Frequency Amplifier Section, Top and Bottom Views of Chassis

lengthen the adjustment slot in the linkage, by filing, to permit proper adjustment.) Be sure that the IF BAND control remains firmly detented in the BROAD position throughout this procedure. Inspect i-f coil forms for heat deformation. The i-f coils originally supplied in the RDZ/RDZ–1 were on polystyrene forms. If inspection indicates deformation of these forms, they should be replaced with the improved i-f coils which have ceramic forms.

3. Retighten the screw on the linkage, remove the jig, and replace the shield-securing screw.

4. If subsequent measurements show that the narrow bandwidth is not within limits, adjust the two levers which connect the linkage to the crank arms, Part H-556, mounted on the I-F BAND control shaft. Adjust downward if the bandwidth is too broad, or upward if the bandwidth is too narrow. Make sure that the I-F BAND control is firmly detented in the BROAD position.

5. Remove the shield cans from Z101, Z201, and Z205 (figure 3–9), and inspect the coil forms for heat deformation. The coating on normal forms is essentially colorless and transparent. Forms slightly affected by excessive heat have a cloudy amber appearance. Forms affected by extreme heat are collapsed away from the upper trimmers, and their winding dimensions and relative positions are destroyed. If Z101, Z201, and Z205 show evidence of winding damage due to overheating, replace all six i-f coils in the IF-AF Unit.

b. TEMPERATURE CONSIDERATIONS.

The I-F ALIGNMENT CHART gives three different alignment procedures corresponding to different temperature conditions in which the Receiver is to be operated.

If the Receiver is to be operated on intermittent schedules not exceeding eight hours each, or if an exhaust blower similar to that used in Transmitter Model TDZ is installed, drifts due to temperature will be negligible and the i-f system should be aligned by following the medium-temperature procedure.

Although continuous operation without suitable heat-dissipating means is not recommended, close-to-optimum characteristics may be attained under these conditions if the i-f system is aligned by following the high-temperature procedure.

In some cases the Receiver is operated continuously for 12 hours or more during some periods without any heat-dissipating means, and then on intermittent schedules not exceeding eight hours each at other times. If it is expected that the receiver will be operated under these conditions, the i-f system should be aligned by the multi-temperature procedure.

TABLE 4-4
I-F ALIGNMENT CHART

PRECAUTIONS	1. Allow closed receiver to warm up for at least one hour before opening chassis and for another hour after opening chassis before making adjustments. Allow test equipment to warm up for a similar period. 2. The receiver chassis and signal-generator chassis should be connected to a common ground point, through shortest possible leads. 3. Tuning-dial settings of Signal Generator Model LP should always be approached with the same direction of rotation. 4. In setting the tuning dial of Model LP, be sure to monitor the CARRIER control so that the meter indicator coincides with the SET CARRIER index. Always use Frequency Meter Model LM or LR to determine the true frequency. 5. A panoramic-type adapter or the dummy scan load must be plugged into J403 when making all adjustments. 6. During the alignment, keep retarding MICROVOLTS and MULTIPLIER controls of Model LP to keep Receiver output under 4 volts (+6 db). 7. Use 10-volt ranges of Models OBQ and OCR.
SIGNAL-GENERATOR CONNECTIONS	1. Remove P408 from J101. 2. Use 90-ohm cable W102 on Model LP. 3. Connect Model LP through .001-μf. capacitor to terminal B of E201. (Do not remove cable lug already connected to E201.) 4. Twist two turns of insulated wire around ungrounded lead of Model LP, at connection to .001-μf. capacitor. Connect Frequency Meter Model LM or LR to the insulated wire.

TABLE 4-4 (Cont.)
I-F ALIGNMENT CHART

SIGNAL-GENERATOR CONNECTIONS (Continued)	tion to .001-μf. capacitor. Connect Frequency Meter Model LM or LR to the insulated wire.
OUTPUT-INDICATOR CONNECTIONS	1. Modify S203 as shown in paragraph 4-16. Connect GND test lead of Navy Model OBQ to negative AVC VOLTAGE terminal of S203. Connect DC VOLTS test lead of Model OBQ to positive AVC VOLTAGE terminal of S203. 2. Fasten the 680-ohm resistor between terminals C and D of E201, then connect Navy Model OCR across the 680-ohm resistor. See figure 3-17. If receiver is permanently installed, temporarily remove the two cable leads connected to terminals B and C. 3. Plug headphones into PHONES jack.
RECEIVER-CONTROL SETTINGS	1. Control switch to LOCAL. 2. CHANNEL selector to lowest frequency available. 3. NOISE LIMITER-OUTPUT METER switch to OM. 4. SILENCER control to 0. 5. RECEPTION switch to AVC OFF. 6. AF BAND control to NARROW. 7. IF BAND control to BROAD. 8. AF LEVEL control to 10.
TRIMMER PRESETTINGS	1. Turn each trimmer in IF-AF Unit four full turns counterclockwise.
I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION (See paragraph 4-18. *b.*)	1. Set RF GAIN control and PHONES control to 10. 2. Set frequency of Model LP to 15,100 kc. Turn on Model LM or LR and set Model LP to exact frequency by zero-beat method. Turn off Model LM or LR.

TABLE 4-4 (Cont.)
I-F ALIGNMENT CHART

I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION (Continued)	3. Turn MODULATION control of Model LP to INTERNAL for 30 percent modulation at 1000 c.p.s. Adjust MICROVOLTS and MULTIPLIER controls of Model LP until signal is heard in headphones. If no signal is heard with maximum output, turn each i-f trimmer on top of chassis one turn clockwise. If signal is still not heard, turn each i-f trimmer on bottom of chassis one turn clockwise, using trimming-tool collet. If signal is not yet heard, adjust top trimmer of Z101. 4. Adjust top (primary) adjustments of Z101 (figure 4-10), Z201, and Z205 (figure 4-9), for maximum indication on Model OBQ. Using trimming-tool collet, adjust bottom (secondary) adjustments of Z201 and Z205 for maximum indication on Model OBQ. Retard MICROVOLTS and MULTIPLIER controls of Model LP as necessary to keep indication on Model OCR under 4 volts (+6 db). 5. Adjust MICROVOLTS and MULTIPLIER controls until Receiver OUTPUT meter indicates +10 db. Then turn RF GAIN control until OUTPUT meter reads -10 db, and readjust MICROVOLTS and MULTIPLIER controls until OUTPUT meter indicates 0 db. Turn PHONES control for desired signal in headphones. 6. Turn MODULATION control of Model LP to OFF, and turn Model LM or LR on. Reset frequency of Model LP to 15,100 kc., using Model LM or LR to

TABLE 4-4 (Cont.)
I-F ALIGNMENT CHART

I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION (Continued)	zero-beat with output. Turn Model LM or LR off, and turn MODULATION control of Model LP to INTERNAL for 30 percent modulation at 1000 c.p.s. 7. Repeat step 4. 8. Repeat step 5, but set Model LP to exactly 14,975 kc. instead of 15,100 kc. 9. Adjust bottom (primary) adjustments of Z202, Z203, and Z204 for maximum indication on Model OBQ. Then adjust top (secondary) adjustments of Z202, Z203, and Z204 for maximum indication on Model OBQ. See figure 4-9. Retard MICROVOLTS and ATTENUATOR controls of Model LP as necessary to keep indication on Model OCR under 4 volts (+6 db). 10. Repeat steps 1 through 9. If any appreciable increase in Receiver output is obtained, repeat steps 1 through 9 again. 11. Vary frequency of signal generator slowly from 14,950 kc. to 15,250 kc., and observe Model OBQ. There should be a low-frequency peak, a valley, and a high-frequency peak. The two peaks should be of approximately equal amplitudes. If peaks are only slightly distorted, carefully readjust top (primary) adjustments of Z201 and Z205 at exactly 15,100 kc. until peaks are equal. If peaks are badly distorted, only one major broad peak with no apparent valley can be obtained, and the procedure in steps 12 and 13 must be followed.

TABLE 4-4 (Cont.)
I-F ALIGNMENT CHART

I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION (Continued)	12. Turn MODULATION control of Model LP to OFF, and turn Model LM or LR on. Set frequency of Model LP to 15,100 kc., using Model LM or LR to zero-beat with output. Turn Model LM or LR off, and turn MODULATION control of Model LP to INTERNAL for 30 percent modulation at 1000 c.p.s. Adjust MICROVOLTS and MULTIPLIER controls of Model LP for 0 db indication on Receiver OUTPUT meter. 13. If major peak is above 15,100 kc., turn top (primary) adjustment of Z201 *clockwise* to cause a 1-db drop in Receiver output. Then turn bottom (secondary) adjustment of Z201 *clockwise* to cause a 1-db increase in Receiver output. Readjust top (primary) adjustment of Z201 for maximum indication on Model OBQ, and recheck curve as in step 11. If peaks are still unequal, slightly readjust top (primary) adjustments of Z201 and Z205 to exactly 15,100 kc. If major peak is below 15,100 kc., follow same procedure as above but turn adjustments of Z201 *counterclockwise* instead of *clockwise.* **NOTE** The adjustments above are extremely critical and corrections are attained with barely perceptible movements of the adjustments.
I-F ALIGNMENT FOR HIGH-TEMPERATURE OPERATION (See paragraph 4-18. *b.*)	1. Follow entire procedure for I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION above, except substitute 15,110 kc. wherever 15,100 kc. is specified, and

TABLE 4-4 (Cont.)
I-F ALIGNMENT CHART

I-F ALIGNMENT FOR HIGH-TEMPERATURE OPERATION (Continued)	substitute 14,985 kc. wherever 14,975 kc. is specified. 2. Adjust both top (primary) and bottom (secondary) adjustments of Z201 counterclockwise just enough to purposely distort curve until amplitude of low-frequency peak is 5 db less than amplitude of high-frequency peak. The curve is checked by varying Model LP from 14,950 kc. to 15,250 kc. while observing Model OBQ.
I-F ALIGNMENT FOR MULTI-TEMPERATURE OPERATION (See paragraph 4-18. *b.*)	1. Follow entire procedure for I-F ALIGNMENT FOR MEDIUM-TEMPERATURE OPERATION above, except substitute 15,110 kc. wherever 15,100 kc. is specified, and substitute 14,985 kc. wherever 14,975 kc. is specified. 2. Adjust both top (primary) and bottom (secondary) adjustments of Z101 counterclockwise just enough to purposely distort curve until the amplitude in db of the low-frequency peak between the peak and valley is 1/3 the amplitude in db of the high-frequency peak between the peak and valley. The curve is checked by varying Model LP from 14,950 kc. to 15,250 kc. while observing Model OBQ.

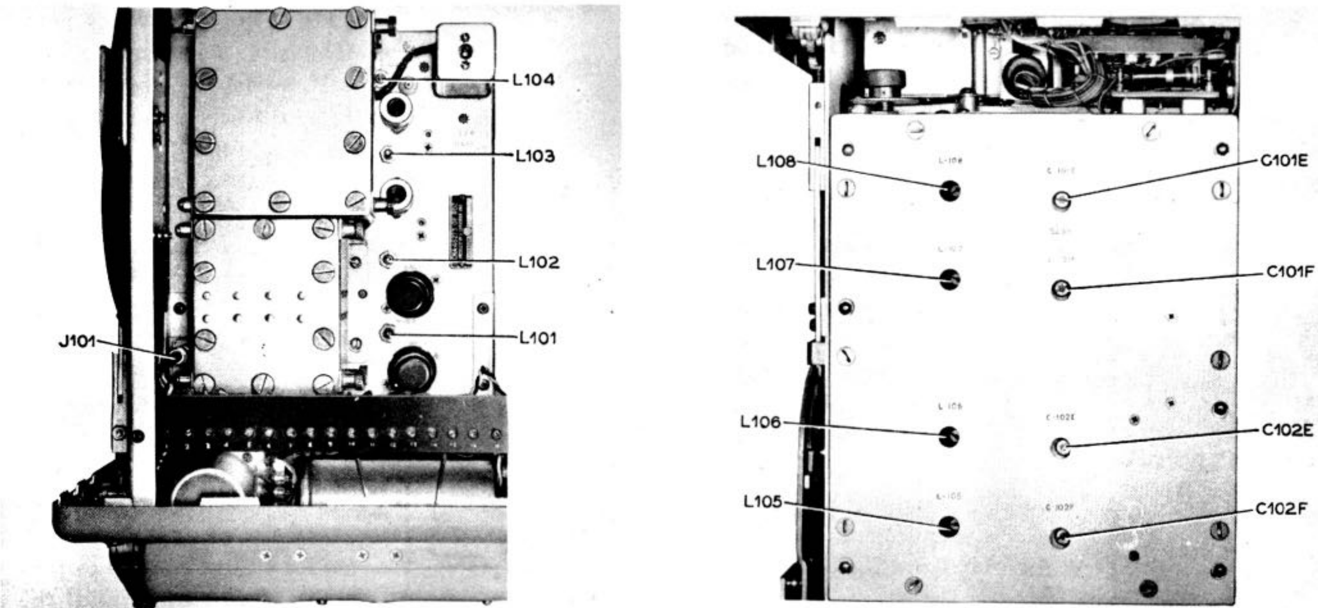
FILL OUT A FAILURE REPORT

4–19. PRESELECTOR AND CONVERTER UNIT ALIGNMENT.

No adjustment of the Preselector and Converter Unit should be made until the checks in the A-F SENSITIVITY CHART (TABLE 4–1), I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART (TABLE 4–2), and the OVER-ALL SENSITIVITY MEASUREMENTS (TABLE 4–3), have been performed. If these checks indicate that the i-f characteristics are normal, but the over-all sensitivity is poor, alignment of the Preselector and Converter Unit is in order.

If the checks described in the I-F AMPLIFIER SENSITIVITY MEASUREMENTS CHART indicate that the i-f characteristics are poor, the i-f system should be aligned first. Then the over-all sensitivity should be rechecked. If the over-all sensitivity is still poor, the Preselector and Converter Unit should be aligned, but if the over-all sensitivity is normal after aligning the i-f system, do not adjust the Preselector and Converter Unit.

The procedure for aligning the Preselector and Converter Unit is given in the PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART.



TOP VIEW OF CHASSIS

BOTTOM VIEW OF CHASSIS

Figure 4–10. Adjustments Used for Alignment of Preselector and Converter Section, Top and Bottom Views of Chassis

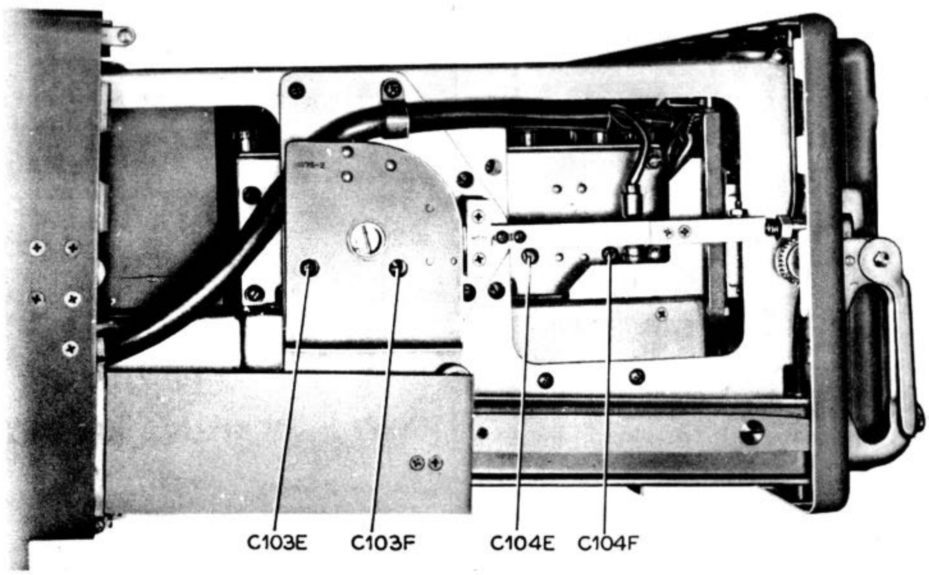


Figure 4–11. Adjustments Used for Alignment of Preselector and Converter Section, Right Side View of Chassis

TABLE 4–5

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

PRECAUTIONS	1. Allow closed Receiver to warm up for at least one hour before opening chassis and for another hour after opening chassis before making adjustments. Allow test equipment to warm up for a similar period. 2. Reset signal generator and receiver tuning controls with extreme precision. Be sure PLATE adjustment of signal generator is corrected for each final frequency setting. 3. The receiver chassis and signal-generator GND terminal should be connected to a common ground point, through shortest possible leads. 4. A panoramic-type adapter or the dummy scan load must be plugged into J403 during all adjustments. 5. When using Signal Generator Model LAF, retard OUTPUT attenuator as necessary to keep Receiver output below 1.2 volts (–4 db).
SIGNAL-GENERATOR CONNECTION	1. Connect Signal Generator Model LAF through antenna-input adapter to J101.
OUTPUT-INDICATOR CONNECTIONS	1. Modify S203 as shown in paragraph 4–16. Connect GND test lead of Navy Model OBQ to negative AVC VOLTAGE terminal of S203. Connect DC VOLTS test lead of Model OBQ to positive AVC VOLTAGE terminals of S203. 2. Fasten the 680-ohm resistor between terminals C and D of E201, then connect Navy Model OCR across the 680-ohms resistor. See figure 3–17. If receiver is permanently installed, temporarily remove the two cable leads connected to terminals B and C.

TABLE 4–5 (Cont.)

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

RECEIVER-CONTROL SETTINGS	1. CONTROL switch to LOCAL. 2. DIMMER control for desired illumination. 3. NOISE LIMITER-OUTPUT METER switch to OM. 4. SILENCER control to 0. 5. IF BAND control to NARROW. 6. AF BAND control to NARROW. 7. AF LEVEL control to 10.
CRYSTAL COMPLEMENT	1. A crystal for reception in the range of 235 mc. to 250 mc. should be connected in channel position 1 or 2 in the crystal oven. The channel containing this crystal is referred to as "tracking channel." 2. A crystal for reception in the range of 370 mc. to 390 mc. should be connected in channel position 9 or 10 in the crystal oven. The channel containing this crystal is referred to as "alignment channel." 3. Eight remaining crystals should be distributed so that the receiver frequency increases proportionately with numbered steps of CHANNEL selector.
OSCILLATOR-MULTIPLIER ALIGNMENT	1. Loosen wing screw at center of tuning dial (figure 3–16), and rotate main tuning knob until variable tuning-capacitor gang is at maximum capacity. Tighten wing screw to hold capacitor in this position. Loosen the two setscrews on tuning dial hub, turn dial to point where reference mark, immediately below 200-mc. mark, aligns with main-dial index, and tighten setscrews in dial hub. 2. Set CW-PULSE switch of Model LAF to OFF.

TABLE 4–5 (Cont.)

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

OSCILLATOR-MULTIPLIER ALIGNMENT (Continued)	3. Set RECEPTION switch of receiver to AVC ON, and set CHANNEL selector to "alignment channel." 4. Loosen wing screw at center of tuning dial, and set dial to exact frequency selected for "alignment channel." Tighten wing screw. 5. Turn MULTIPLIER TUNING switch from RECEIVING POSITION to position 1, and adjust trimmer capacitors C101E and C101F for maximum indication on Receiver INPUT meter. 6. Turn MULTIPLIER TUNING switch to position 2, and adjust trimmer capacitor C102E (figure 4–9) for maximum indication on INPUT meter. 7. Turn MULTIPLIER TUNING switch to position 3, and adjust trimmer capacitor C102F for maximum indication on INPUT meter. 8. If deflection on INPUT meter was erratic in any of the steps above, remove V101. If there is no appreciable change in deflection, substitute a more active crystal and repeat steps 1 through 7. 9. Proceed to OSCILLATOR-MULTIPLIER TRACKING below.
OSCILLATOR-MULTIPLIER TRACKING	1. Set CHANNEL selector to "tracking channel." 2. Loosen wing screw at center of tuning dial, and set dial to exact frequency selected for "tracking channel." Tighten wing screw. 3. Turn MULTIPLIER TUNING switch to position 1, and adjust inductor trimmers L101 and L102 for maximum indication on Receiver INPUT meter.

TABLE 4–5 (Cont.)

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

OSCILLATOR-MULTIPLIER TRACKING (Continued)	4. Turn MULTIPLIER TUNING switch to position 2, and adjust inductor trimmer L103 for maximum indication on INPUT meter. 5. Turn MULTIPLIER TUNING switch to position 3, and adjust inductor trimmer L104 for maximum indication on INPUT meter. 6. If deflection on INPUT meter was erratic in any of the steps above, remove V101. If there is no appreciable change in deflection, substitute a more active crystal and repeat steps 1 through 5. 7. Repeat steps 3 through 7 of OSCILLATOR-MULTIPLIER ALIGNMENT above. 8. Repeat steps 1 through 5 above. 9. Continue to repeat steps 7 and 8 above until neither the trimmer capacitors nor the inductor trimmers require readjustment in order to produce maximum indication on INPUT meter. (The last cycle of operations should be effected with the trimmer capacitors.) 10. Set MULTIPLIER TUNING switch to position 3. 11. Turn CHANNEL selector successively to each of the eight positions not used previously in steps above. Loosen wing nut, reset tuning dial for maximum INPUT meter deflection, and tighten wing nut at each of the eight CHANNEL selector settings. Do not do this on "alignment channel" or "tracking channel." 12. When suitable deflection is obtained on each of the eight CHANNEL selector positions, turn MULTIPLIER

TABLE 4–5 (Cont.)

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

OSCILLATOR-MULTIPLIER TRACKING (Continued)	TUNING switch to RECEIVING POSITION, and proceed to U-H-F ALIGNMENT below.
U-H-F ALIGNMENT	1. Set RECEPTION switch to AVC OFF, and set CHANNEL selector to "alignment channel." 2. Turn CW-PULSE switch of Model LAF to OFF, and set RF GAIN control for a .6-volt (–10 db) indication on Model OCR (2.5-volt scale). 3. Turn CW-PULSE switch of Model LAF to CW, and adjust frequency of Model LAF for maximum indication on Model OBQ (2.5-volt scale). Correct PLATE adjustment of Model LAF as frequency is varied. 4. Adjust OUTPUT attenuator of Model LAF for a 1.2-volt (–4 db) indication on Model OCR (2.5-volt scale), and readjust frequency of Model LAF for maximum indication on Model OBQ (2.5-volt scale). Correct PLATE adjustment. 5. Adjust trimmer capacitors C104F, C104E, C103F, and C103E, in order given for maximum indication on Model OBQ (2.5-volt scale). 6. Proceed to U-H-F TRACKING below.
U-H-F TRACKING	1. Set CHANNEL selector to "tracking channel." 2. Turn CW-PULSE switch of Model LAF to OFF, and adjust RF GAIN control for a .6-volt (–10 db) indication on Model OCR (2.5-volt scale). 3. Turn CW-PULSE switch of Model LAF to CW, and adjust frequency of Model

TABLE 4–5 (Cont.)

PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

U-H-F TRACKING (Continued)	LAF for maximum indication on Model OBQ (2.5-volt scale). Correct PLATE adjustment of Model LAF as frequency is varied. 4. Adjust OUTPUT attenuator of Model LAF for a 1.2-volt (–4 db) indication on Model OBQ (2.5-volt scale), and readjust frequency of Model LAF for maximum indication on Model OBQ (2.5-volt scale). Correct PLATE adjustment. 5. Adjust inductor trimmers L108, L107, L106, and L105, in order given, for maximum indication on Model OBQ (2.5-volt scale). Use inset end of small trimming tool (furnished in Spares) and trimming-tool collet (paragraph 4–13) for these adjustments. 6. Repeat steps of U-H-F TRACKING above. 7. Repeat steps 1 through 5 above. 8. Continue to repeat steps 6 and 7 above until neither the trimmer capacitors nor the inductor trimmers require readjustment in order to produce maximum indication on Model OBQ. (The last cycle of operation should be effected with the trimmer capacitor.) 9. Turn CHANNEL selector to "alignment channel." 10. Adjust frequency of Model LAF for maximum indication on Model OBQ (2.5-volt range). Correct PLATE adjustment. 11. Loosen wing screw at center of tuning dial, and carefully retune Receiver. Tighten wing screw. If the Preselector and Converter Unit has

TABLE 4–5 (Cont.)
PRESELECTOR AND CONVERTER UNIT ALIGNMENT CHART

TRACKING (Continued)	been properly aligned, the tuning dial should indicate a frequency within ±1 percent of the frequency of the "alignment channel." 12. Turn CHANNEL selector to "tracking channel" and repeat steps 10 and 11 above. If the Preselector and Converter Unit has been properly aligned, the tuning dial should indicate a frequency within ±1 percent of the frequency of the "tracking channel."

4–20. ELECTRON TUBE TESTS.

NOTE

ALL TUBES OF A GIVEN TYPE SUPPLIED WITH THE EQUIPMENT SHALL BE CONSUMED PRIOR TO THE EMPLOYMENT OF TUBES FROM GENERAL STOCK.

Tube Testers TV-3/U and Navy Model OZ Series have provisions required to check all tubes used in Radio Receiver RDZ/RDZ-1 and its associated units.

Before a 6H6 tube is tested, it should be allowed to warm up several minutes. Then, it should be given a thorough short test. If a tube tester is being used, tap the 6H6 tube several times on each position of the short-test switch.

A 6AB7 tube may be gassy even though the tube tester indicates that it is normal. The most accurate method of determining positively the condition of a 6AB7 or any other type is by substitution. Remove the tube in question from the Receiver and substitute a new tube. Allow the new tube to warm up several minutes, and check for improvement in the performance of the Receiver.

The interelectrode capacitances of different tubes of the same type may vary slightly. One or two i-f tubes can usually be replaced without affecting the i-f alignment appreciably, but if all the i-f tubes are replaced, i-f sensitivity may be poorer and realignment may be necessary. If possible, several i-f tubes should be tried, until those giving normal performance are obtained so that realignment will not be required.

The base diagrams of the tubes used in Model RDZ or RDZ-1 are shown in the socket voltage and resistance diagrams in figures 3–6, 3–12, and 3–15.

4–21. AUTOTUNE UNIT ADJUSTMENTS.

a. TUNING OF PRESET CHANNELS.

The procedure below should be followed if it becomes necessary to adjust the frequency of any channel without changing crystals.

1. Set CHANNEL selector to channel to be adjusted.
2. Remove cover plate at left side of Receiver, by loosening the ten Dzus fasteners, and loosen wing screw at center of main tuning dial. See figure 3–16.
3. Turn main tuning knob in one direction until it engages with tuning mechanism and turns tuning dial. Turn Receiver dial to setting corresponding to channel frequency for crystal in use.
4. Turn AF BAND control to NARROW, IF BAND control to NARROW, and RECEPTION switch to AVC ON.
5. Turn MULTIPLIER TUNING switch from RECEIVING POSITION to position 3.
6. Adjust Receiver dial until maximum indication is obtained on INPUT meter. This indication should be at least .2 ma.
7. Repeat step 6 with the MULTIPLIER TUNING switch in positions 2 and 1. The INPUT meter reading should be at least .15 ma. and .3 ma. respectively, and the Receiver dial readings should be practically the same. If the dial readings are not the same or if the INPUT meter readings are erratic, replace the crystal with a more active one.
8. Set MULTIPLIER TUNING switch to RECEIVING POSITION, turn NOISE LIMITER-OUTPUT METER switch to OM, and turn AF LEVEL control to 10.
9. Tune Receiver (in close vicinity of tuning-dial setting determined in step 6) until maximum indication is obtained on OUTPUT meter. If the receiver is properly aligned, this dial setting will be approximately the same as the dial setting determined in step 6. Any appreciable variation between the two dial readings is usually indicative of incorrect alignment and/or tracking of the Preselector and Converter Unit.
10. If the variation in dial settings is not greater than about .1 percent, with MULTIPLIER TUNING switch in RECEIVING POSITION, reset dial for maximum indication on OUTPUT meter. Then, tighten wing screw at center of tuning dial.
11. Check the reset position of dial by shifting to another channel and back again. If response returns to normal, replace cover at front of Receiver.

b. CHANGING FREQUENCY OF CHANNEL.

If it is necessary to change the frequency of a channel, the crystal for that channel must be replaced with one of the desired frequency and the channel must be retuned. The procedure for accomplishing this follows:

1. Set CHANNEL selector to channel to be changed.

2. Remove cover plate at left side of front panel by loosening the ten Dzus fasteners.

3. Pull crystal oven out of its socket, and remove its cover by releasing the eight screws located on contact-pin side of oven.

4. Remove oven heater unit by loosening the four screws located at base of heater unit. Identifying numbers, corresponding to channel numbers, are located on oven base underneath each crystal position.

5. Remove undesired crystal and insert desired crystal in its place. Crystal frequencies to be used for reception of desired channel frequencies are computed as follows:

(a) Add 15.1 to the desired channel frequency in megacycles.

(b) For channel frequencies up to and including 326 mc., divide the sum by 48 to obtain crystal frequency in megacycles. For channel frequencies above 326 mc., divide the sum by 64 instead of 48.

NOTE

The crystals are engraved to show crystal frequency and resultant channel frequency.

6. Reassemble crystal oven and plug it in position at front of Receiver.

7. Tune channel according to procedure given in Paragraph 4–21.*a.* of this section.

c. SYNCHRONIZING AUTOTUNE UNIT.

If the Autotune unit has been repaired, the Autotune motor may fail to stop at the channel to which the CHANNEL selector is set, when this happens the unit requires synchronization. The procedure for synchronizing the Autotune unit is as follows:

1. Remove channel-indicator dial from seeking-switch shaft, and loosen the 6-32 Phillips head screw directly under dial.

2. Rotate mounting plate for seeking switch to its extreme counterclockwise position.

3. Turn CHANNEL selector to 5 and apply power. The Autotune unit will start to operate and, if the unit is very far out of synchronization, will continue to operate.

4. Rotate seeking-switch plate slowly in clockwise direction until Autotune motor stops at channel 5.

5. Look through slot in front plate of Autotune unit, and observe square notch cut into rotor contact of rotor switch. This notch is approximately 3/16 inch square. Rotate seeking switch in clockwise direction until notch is centered on white line extending from outside edge to inside edge of stator plate of seeking switch.

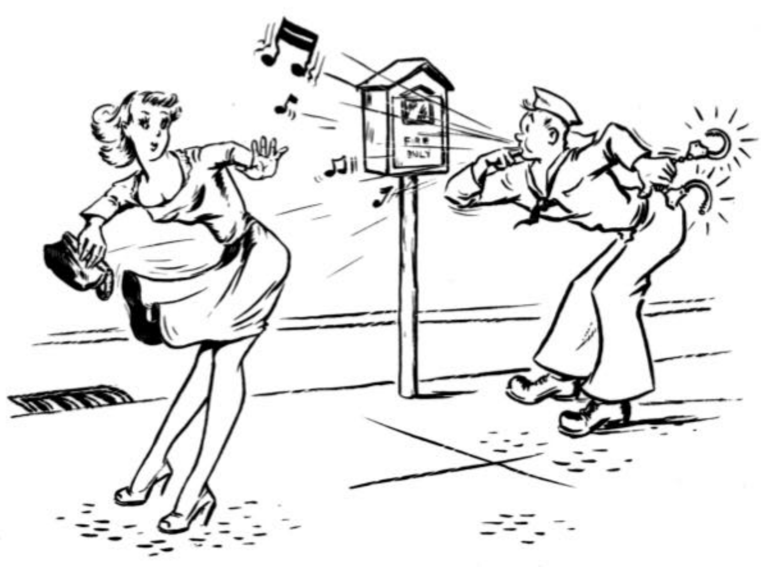
NOTE

The seeking-switch plate must be rotated to its final setting in a clockwise direction. If the plate is moved too far, do not attempt to correct the adjustment; instead, move the plate back to its extreme counterclockwise position and start over.

6. Lock seeking-switch plate by tightening the Phillips head screw.

7. Replace channel-indicator dial, and set it to position 5.

8. Check synchronization of each channel.



Remote Control

893969 O—50——6

THE REMOTE CONTROL UNITS

SELECTOR CONTROL UNIT NAVY TYPE—23497

4–22. INSPECTIONS.

The following routine checks and inspections should be made to maintain the Selector Control Unit in the best operating condition.

a. WEEKLY INSPECTIONS.

1. Check that pilot lamp is lit when equipment is on.

2. Make certain that spare fuse holders are equipped with fuses of proper value.

b. MONTHLY INSPECTIONS.

1. Make all checks listed under Weekly Inspections above.

2. With POWER switch in OFF position, manually depress armatures of all relays to make certain that they move freely without binding or dragging. Make sure that contacts come together in a positive manner and that moving and stationary contacts are directly in line with each other.

3. Inspect surfaces of relay contacts for dirt, grease, corrosion, and pits. A flashlight and mirror such as in Test-Tool Set USM-3 will be helpful in inspecting K104 and K107. If contacts need cleaning, refer to Paragraph 4–22.*d.*, of this section. If they are pitted, see Paragraph 4–22.*e.*

4. Check each interconnecting cable for loose pins, unsoldered connections, broken leads, and damaged insulation.

c. QUARTERLY INSPECTIONS.

1. Make all checks listed under Monthly Inspections above.

2. Visually inspect all components for wear, overheating, and physical damage; inspect all insulation for frays, burns, and chars; inspect all leads for apparent short circuits and opens. Dust out chassis.

3. Inspect mounting screws of relays to insure that relays are firmly attached to chassis.

d. CLEANING RELAY CONTACTS.

All relay contacts should be cleaned whenever monthly inspections reveal that cleaning is necessary. None of the relays need be removed from their mountings for this operation. A flashlight and mirror will aid in cleaning relays K104 and K107. The contacts of all relays should be cleaned as follows:

1. Dip a strip of clean wrapping paper in fresh carbon tetrachloride. Permit excess liquid to drain from paper.

2. Insert paper between contacts, hold them closed, and withdraw paper. Repeat this operation several times.

3. Insert a strip of clean wrapping paper between contacts, hold them closed, and withdraw paper. Repeat this operation until contacts are polished clean and dry.

e. REMOVING PITS ON RELAY CONTACTS.

If inspection reveals that the relay contacts are pitted or burned, they should be leveled by the following procedure:

1. If relay contacts are not readily accessible, dismount relay by removing the connecting wires and loosening the mounting screws that attach relay to the chassis. Tag all connecting wires so that they can be resoldered to proper relay terminals.

2. Polish contact surface with crocus cloth until pits are removed.

3. Apply final polish with a piece of clean, dry canvas to remove any trace of abrasive.

4. If relay was dismounted, remount it by replacing mounting screws and resoldering all connecting wires.

4–23. LUBRICATION OF MINOR SWITCH.

The minor switch should be lubricated semiannually at the points shown in the LUBRICATION CHART FOR MINOR SWITCH. See figure 4–12. Care should be taken that the lubricant is applied very lightly. Use a small camel's hair brush, and wipe off all excess oil from the brush before applying it to the equipment.

4–24. ADJUSTMENT OF RELAYS.

All relays in the Selector Control Units are adjusted in the factory. If they become misadjusted, replace them with spares, if available. Adjustments should be made only in cases of emergency.

a. ARMATURE ADJUSTMENT.

NOTE

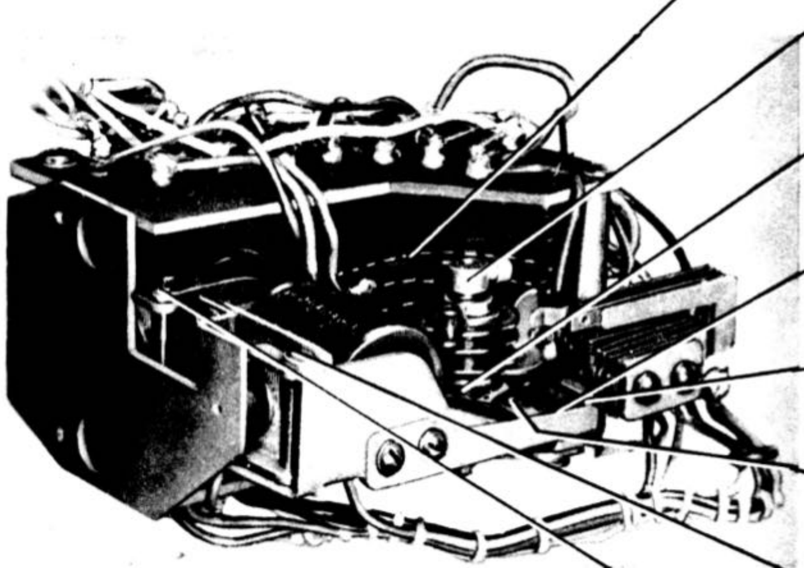
Never attempt to adjust the armature of time-delay relay K103.

1. If relay is not readily accessible, dismount relay by removing the connecting wires and loosening the mounting screws. Tag all connecting wires so that they can be resoldered to proper relay terminals.

2. Loosen locknut on screw which passes through armature, and turn screw several turns counterclockwise.

3. Insert a piece of writing paper between core of coil and armature. Hold armature against core, and tighten screw until it visibly compresses surface of paper. Do not tighten screw enough to puncture paper.

LUBRICATION CHART FOR MINOR SWITCH OF SELECTOR CONTROL UNIT NAVY TYPE—23497



SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.* MANUALLY MOVE TIPS AND ARMATURE TO DISTRIBUTE OIL.	WIPER TIPS
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	WIPER ASSEMBLY BEARING
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	RATCHET TEETH
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	PAWL GUIDE ARM BEARING
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	STEPPER ARMATURE SPRING BEARING
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	PAWL BEARING
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	STEPPER ARMATURE BEARING PIN
SA	14L17 (ORD.) OR MS-2075	APPLY LIGHTLY WITH SMALL CAMEL'S HAIR BRUSH.*	RELEASE ARMATURE BEARING PIN

* Use a number 4 Artist's Salile Rigger Brush. Order by Navy Stock Number 38-B-690.

NAVY LUBRICANTS

LUBRICANT			STANDARD NAVY STOCK NUMBER				
SPECIFICATION	SYMBOL	TITLE	4 OZ.	1 QT.	1 GAL.	5 GAL.	55 GAL.
14L17 (ORD.)		LUBRICATING OIL	10-O-2831-800	14-O-2831-810	14-O-2833-60	14-O-2833-65	
MIL-L-15016	MS-2075	LUBRICATING OIL				14-O-2586	14-O-2585

MS—Military Symbol.

LEGEND
SA SEMIANNUALLY

Figure 4–12. Lubrication Chart for Minor Switch of Selector Control Unit Navy Type –23497

4. Tighten locknut on screw, but be careful not to disturb setting of screw. After tightening locknut, test adjustment by closing armature on a new spot on paper and compare the two marks.

5. Insert three thicknesses of writing paper between armature and core. Close armature on paper. The breaking contacts should just close. If contacts do not close properly, adjust contact springs as described below.

b. CONTACT-SPRING ADJUSTMENT.

1. Grasp contact springs near their mountings with a pair of long-nose pliers. Gently twist pliers in the direction that tension is required.

2. Move pliers 1/4 inch along surface of contact spring, away from mounting, and again twist in the direction that tension is required.

3. Repeat this process until the bakelite spring bushings are reached.

4. Test closing of contacts by depressing armature against three sheets of writing paper, inserted between armature and core. The contacts should just close.

5. If contacts do not close properly, repeat steps above. If too much tension has been created, reverse process; start at bakelite bushing and work back toward mounting, twisting pliers in opposite direction.

6. If relay was removed, remount it by replacing the mounting screws and resoldering the connecting wires.

4–25. REMOVING AND REPLACING MINOR SWITCH.

a. REMOVAL.

If it becomes necessary to remove the minor switch, the procedure below should be followed:

1. Unsnap fasteners on case and open hinged front cover.

2. Unsolder each lead to minor switch, and tag each lead so that it may be reconnected to proper terminals. (This is not necessary when the switch is to be only lubricated and not completely removed.)

3. Locate link board in upper right-hand corner of the bottom of chassis contained in front cover. Remove the two 6-32 screws which hold link board to bottom of chassis.

4. Pull link board away from chassis. The two screws under link board and the one screw under resistor R119 secure the minor switch to the upper right-hand corner of the chassis. Remove these screws.

b. REPLACEMENT.

To replace the switch, follow the steps above in reverse order.

REMOTE CHANNEL SELECTOR NAVY TYPE—23492

4–26. INSPECTIONS.

The following routine checks and inspections should be followed to maintain the Remote Channel Selector in the best operating condition.

a. MONTHLY INSPECTIONS.

1. Inspect contacts of S501 for dirt, grease, and corrosion. If these conditions are found, clean contacts as described in Paragraph 4–27 of this section.

2. Make sure that switch makes positive contact in each position.

b. QUARTERLY INSPECTIONS.

1. Make all checks listed under Monthly Inspections above.

2. Inspect all wiring for loose connections and short circuits. Dust out chassis.

3. Rotate R504 over its entire range while operating equipment. Check for noisy or intermittent potentiometer.

4–27. CLEANING CHANNEL SWITCH.

If inspection reveals that the contacts of S501 are dirty or corroded, clean them with carbon tetrachloride. After all dirt and corrosion is loosened, wipe each contact to remove the residue.

MAKE THE NEXT JOB EASIER! FILL OUT A FAILURE REPORT

REMOTE CHANNEL SELECTOR NAVY TYPE—23445

4–28. MONTHLY INSPECTIONS.

The following checks and inspections should be made monthly to maintain the unit in the best operating condition.

a. Operate unit while it is connected to associated equipment. Set CHANNEL SELECTOR dial to each channel in turn. Make certain that dial selects proper channel in each position and that indicator M301 indicates correct channel.

b. Make certain that indicator M301 operates freely without sticking.

c. Snap OFF-ON switch to both positions several times to check its operation.

4–29. REMOVING AND REPLACING CHANNEL SELECTOR DIAL.

a. REMOVAL.

1. Remove the four flat-headed screws and lock washers that hold front panel to cabinet, and pull out panel.

2. Loosen the two screws which connect leads to dial mechanism, and disconnect leads.

3. Remove the three screws and washers, on back of front panel, that hold the CHANNEL SELECTOR dial to panel, and lift out dial.

b. REPLACEMENT.

To replace CHANNEL SELECTOR dial, reverse procedure above.

4–30. REMOVING AND REPLACING CHANNEL INDICATOR.

a. REMOVAL.

1. Remove the four flat-headed screws and lock washers that hold front panel to cabinet, and pull out panel.

2. Unscrew the three nuts which secure leads to indicator, and disconnect leads.

3. Remove the four screws which hold the channel indicator to panel and lift out channel indicator.

b. REPLACEMENT.

To replace channel indicator, reverse procedure above.

REMOTE CONTROL-INDICATOR UNIT NAVY TYPE—23496

4–31. INSPECTIONS.

The following routine checks and inspections should be made to maintain the Control Indicator Unit in the best operating condition.

a. WEEKLY INSPECTIONS.

Check that I401 is lit when power is on and that I402 is lit when transmitter is on.

b. MONTHLY INSPECTIONS.

1. Make check listed under Weekly Inspections above.

2. Operate unit while it is connected to associated equipment. Set CHANNEL SELECTOR dial to each channel, in turn, in each position of UNIT SELECTOR switch. Make certain that dial selects proper channel of proper equipment in each position. Make certain that each indicator indicates correct channel without sticking.

3. With POWER switch in OFF position, manually depress armature of relay K401 to make certain it moves freely without binding or dragging. Make sure that contacts come together in a positive manner and that the moving and stationary contacts are directly in line with each other.

4. Inspect surfaces of contacts of relay K401 for dirt, grease, corrosion, and pits. If contacts need cleaning, refer to Paragraph 4–32 of this section. If they are pitted, refer to Paragraph 4–33.

5. Check each interconnecting cable for broken leads and damaged insulation.

c. QUARTERLY INSPECTIONS.

1. Make all checks listed under Monthly Inspections above.

2. Inspect all components for physical damage; inspect all insulation for frays; inspect all wiring for apparent short circuits and open leads. Dust out equipment.

3. Inspect mounting screws of relay K401 to insure that it is firmly attached to panel.

4–32. CLEANING CONTACTS OF RELAY K401.

If inspection reveals that the contacts of K401 are dirty or corroded, they should be cleaned by the same method as the relays in Selector Control Unit Type CQC-23497. See Paragraph 4–22.*d.* of this section.

4–33. REMOVING PITS ON CONTACTS OF RELAY K401.

If the contacts of K401 become pitted, they should be leveled by the same method as for the relays in Selector Control Unit Type CQC-23497. See Paragraph 4–22.*e.* of this section.

4–34. ADJUSTMENT OF RELAY K401.

This relay is adjusted at the factory. If it becomes misadjusted, replace it with a spare, if available. In case of an emergency, it may be adjusted by the same procedure as described for the relays in Selector Control Unit Type CQC-23497. See Paragraph 4–24 of this section.

4–35. REMOVING AND REPLACING CHANNEL SELECTOR DIAL AND ASSOCIATED MECHANISM.

The CHANNEL SELECTOR dial S406, the UNIT SELECTOR switch S403, the mechanical linkages, and the REJECT button are all mounted to a single plate on the inside of the front cover.

a. REMOVAL.

1. Unscrew thumb-screw fasteners on hinged front cover, and open cover.

2. Unsolder all connections to CHANNEL SELECTOR dial and UNIT SELECTOR switch. Tag each wire so that it can be resoldered to proper terminal.

3. Using an Allen wrench, loosen setscrew in knob for UNIT SELECTOR switch and remove knob.

4. Remove the three nuts, screws, and lock washers which hold plate to cover. (One screw is located on each side of the UNIT SELECTOR switch and the other screw is located directly under the dial.)

5. Lift out entire plate on which CHANNEL SELECTOR dial, UNIT SELECTOR switch, linkage mechanism, and reject button are all mounted. Further disassembly of this mechanism is obvious without further instructions.

b. REPLACEMENT.

To replace assembly, follow steps above in reverse order.

4–36. REMOVING AND REPLACING CHANNEL INDICATORS.

a. REMOVAL.

To remove any one of the three channel indicators, proceed as follows:

1. Unscrew thumb-screw fasteners on hinged front cover, and open cover.

2. Remove the three nuts which secure leads to indicator.

3. Remove the four screws which hold indicator to front cover and lift out channel indicator.

b. REPLACEMENT.

To replace channel indicator, follow steps above in reverse order.

RADIOPHONE UNIT NAVY TYPE—23500

4–37. INSPECTIONS.

The following routine checks and inspections should be made to maintain the Radiophone Unit in the best operating condition.

a. WEEKLY INSPECTIONS.

Check that I201 is lit when power is on and that I202 is lit when transmitter is on.

b. MONTHLY INSPECTIONS.

1. Make check listed under Weekly Inspections above.

2. Manually depress armature of relay K201 to make certain that it moves freely without binding or dragging. Make sure that contacts come together in a positive manner and that the moving and stationary contacts are directly in line with each other.

3. Inspect surfaces of contacts of relay K201 for dirt, grease, corrosion, and pits. If contacts need cleaning, refer to Paragraph 4–38 of this section. If they are pitted, refer to Paragraph 4–39.

c. QUARTERLY INSPECTIONS.

1. Make all checks listed under Monthly Inspections above.

2. Inspect all components for physical damage; inspect all insulation for frays; inspect all wiring for apparent short circuits and open leads. Dust out equipment.

3. Inspect mounting screws of relay K201 to make sure it is firmly attached to chassis.

4–38. CLEANING CONTACTS OF RELAY K201.

If inspection reveals that the contacts of K201 are dirty or corroded, they should be cleaned by the same method as for the relays in Selector Control Unit Type CQC-23497. See Paragraph 4–22.*d.* of this section.

4–39. REMOVING PITS ON CONTACTS OF RELAY K201.

If the contacts of K201 become pitted, they should be leveled by the same method as for the relays in Selector Control Unit Type CQC-23497. See Paragraph 4–22.*e.* of this section.

THE ANTENNA SYSTEM

4–40. GENERAL.

Figure 4–13 shows the latest (May, 1950) approved transmission lines and connector plans for the antenna system.

a. TRANSMISSION LINES.

1. Installations marked "A" are used whenever possible.
2. Installation "B" is used where deviations are necessary due to limitations imposed by adjacent structures or location of the antenna unit.
3. Installation "C" is resorted to only in extreme cases.

b. CONNECTORS.

1. "Alternate" connectors may remain in use in a system if it is operating satisfactorily.
2. "Temporary substitutes" should be replaced by those in the "Specified" column at the first opportunity.

4–41. INSPECTIONS.

Most antenna-system troubles are caused by excessive moisture in the antenna unit or the transmission lines. When the antenna system is the apparent cause of trouble in the RDZ/RDZ-1 System, or when the ship is in for major overhaul or repair, make the following inspection:

a. Remove all dielectric sealing compound from outside of connectors, adapters, and clamping nuts.

b. Examine all fittings to see that they are painted with electrical insulating varnish. If varnish is damaged or cracked, repaint with Electrical Insulating Varnish, Navy Specification 52-V-13, grade CA. This varnish is stocked under Federal Standard Stock Catalog Nos.:

52-V-1240 for one-pint can
52-V-1255 for one-gallon can
52-V-1260 for five-gallon can.

c. Carefully examine transmission lines for signs of damage due to friction or mishandling which might allow moisture to seep into line.

d. Apply thin, uniform coating of Dielectric Sealing Compound, Dow Corning No. 4, Army Navy Aeronautical Specification AN-C-128, on exposed parts of all connections and on antenna insulator. This compound is stocked under:

Standard Navy Stock No. N16-C-12853-500, and can be obtained from Electronic Supply Office.
Aviation Supply Office Stock No. R52-C-3107-110, and can be obtained from Aviation Supply Office.

e. Wrap the connection with vinylite tape.

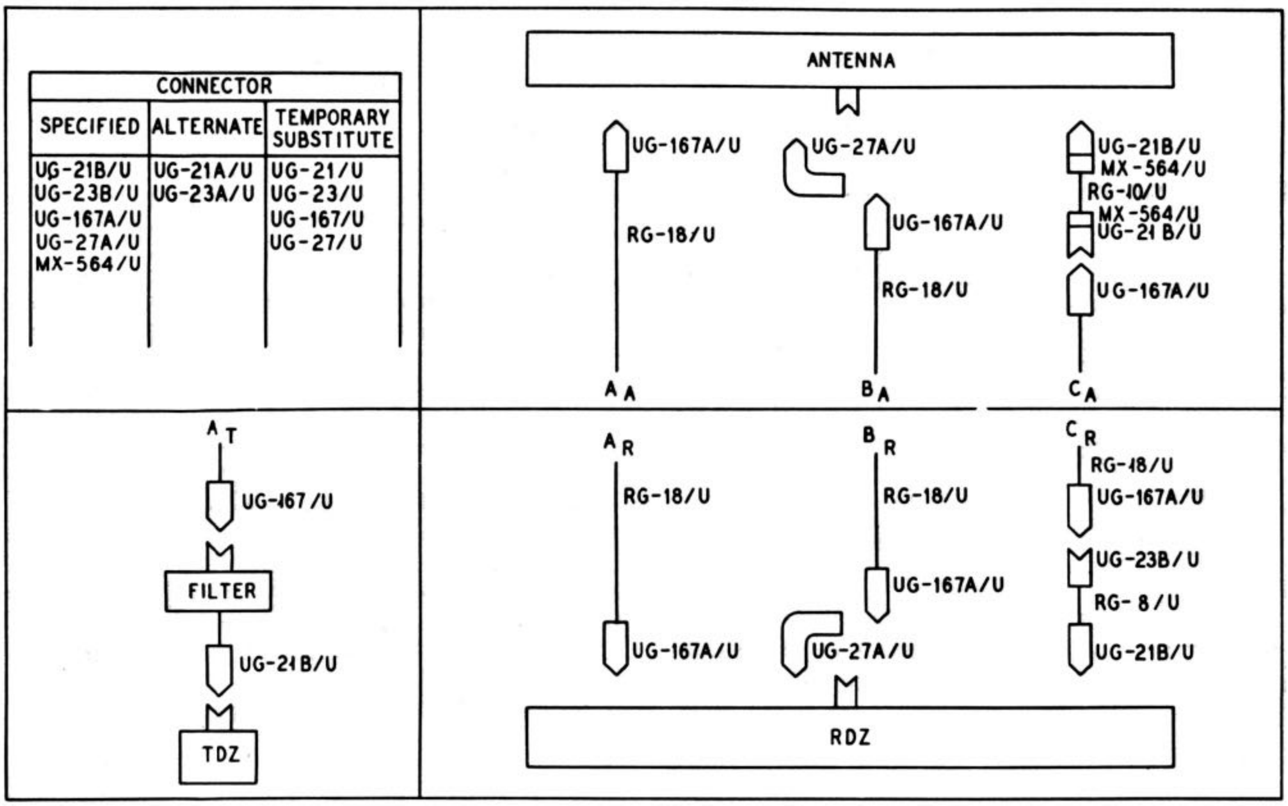


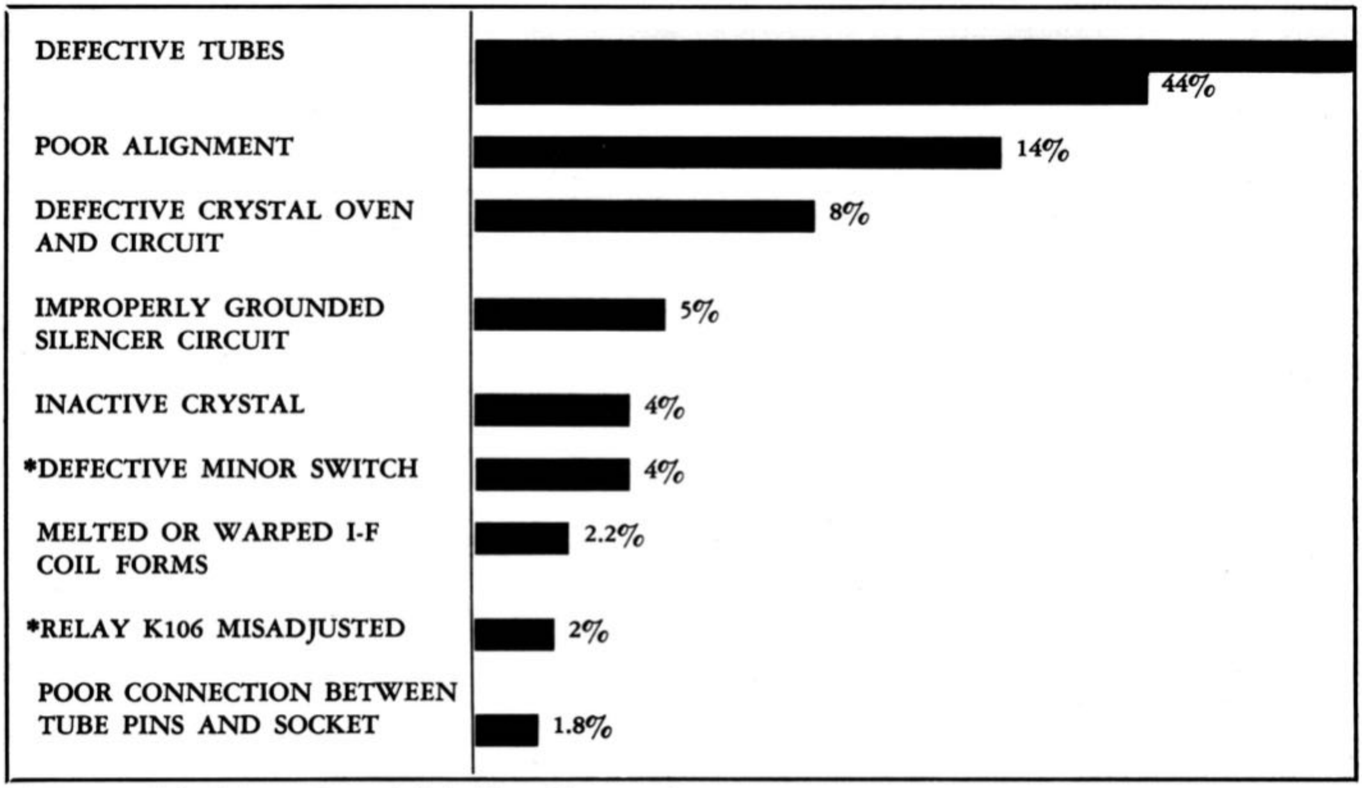
Figure 4–13. Latest (May 1950) Approved Transmission Lines and Connector Plans for the Antenna System

CASE HISTORIES

4–42. CHRONIC TROUBLES.

A total of 144 field reports of 281 Receiver failures reveals that the troubles listed in the CASE-HISTORY CHART OF CHRONIC TROUBLES caused approximately 92 percent of all the failures encountered. These troubles are listed in the first column of the chart in the order of their frequency of occurrence. The second and third columns give the exact nature of these troubles and the symptoms they produced.

The nine most common troubles are also given on the graph in figure 4–14, which shows the relative frequency of occurrence of each trouble as a percentage of the total failures reported.



* Parts used in Selector Control Unit Navy Type—23497.

Figure 4–14. Percentage of Chronic Troubles Frequently Encountered, Based on 144 Field Reports

THE INFORMATION GIVEN IN THIS PARAGRAPH IS COMPILED FROM FAILURE REPORTS TURNED IN FROM THE FLEET

CASE-HISTORY CHART OF CHRONIC TROUBLES

Troubles (In Order of Frequency of Occurrence)	*Nature of Troubles*	*Symptoms*
Defective tubes.	Low emission, shorted, or intermittent.	Weak output, no output or intermittent operation.
Poor alignment.	I-f alignment, r-f alignment, or both required.	Weak output or no output.
Defective crystal oven or circuit.	Cold oven, broken wires connecting crystal socket to pins, poor connections on oven receptacle, or dirty or poor contacts on S601.	Weak output, no output, or excessive frequency drift.
Silencer circuit inoperative.	Silencer circuit ungrounded when not using remote units, grounded when using remote units, or defective resistors.	No silencing action.
Defective crystals.	Inactive or weak crystals.	Weak output or no output on one or more channels.
Defective minor switch in Navy Type—23497.	Lubrication or replacement required.	Remote dial selected higher channel than desired.
Defective i-f coil forms.	Forms melted or warped.	No output or poor i-f selectivity.
Defective relay K106 in Navy Type CQC-23497.	Armature misadjusted or coil shorted.	Autotune motor ran continuously.
Faulty coupling between Autotune unit and tuning capacitor.	Broken ceramic shaft or broken coupler on Autotune unit.	No output and no tuning.
Poor connections between tube pins and sockets.	Bent pins or pin holders on sockets.	Intermittent operation.
Defective fuse.	Fuse missing or open.	No output.
Improperly terminated SCAN jack J403.	No Panoramic Adaptor or dummy load plugged into J403.	I-f oscillation present.
Defective RF GAIN control.	Open control or poor contact of rotor.	Noisy output when control was turned, or intermittent operation.
Faulty linkage between IF BAND control shaft and i-f transformers.	Loose coupling with excessive play, or damaged linkage.	Poor i-f selectivity.
Loose locknut on tuning dial.	Locknut not tightened sufficiently.	Dial failed to indicate proper frequency.

Figure 4-15. Radio Receiver RDZ/RDZ-1, Schematic Diagram

4–43. STOCK NUMBER REFERENCE LIST.

A cross-index of reference symbol versus Standard Navy Stock Number for the RDZ/RDZ-1 equipments is shown below. This list is complete to the date of publication of this handbook. If any numbers are missing, it is because no information was available on those items at the time of publication.

Reference Symbol	*Standard Navy Stock Number*
B-601	N17-M-54626-4867
C-101	N16-C-62368-3160
C-101-A	N16-C-62368-3160
C-101-B	N16-C-62368-3160
C-101-C	N16-C-62368-3160
C-101-D	N16-C-62368-3160
C-101-E	N16-C-62368-3160
C-101-F	N16-C-62368-3160
C-102	N16-C-62372-4757
C-102-A	N16-C-62372-4757
C-102-B	N16-C-62372-4757
C-102-C	N16-C-62372-4757
C-102-D	N16-C-62372-4757
C-102-E	N16-C-62372-4757
C-102-F	N16-C-62372-4757
C-105	N16-C-28558-1676
C-106	N16-C-33627-7703
C-107	N16-C-28558-1676
C-109	N16-C-28558-1676
C-110	N16-C-33627-7703
C-111	N16-C-28558-1676
C-112	N16-C-33627-7703
C-113	N16-C-15916-9005
C-114	N16-C-17278-5729
C-115	N16-C-16541-6981
C-116	N16-C-15532-9005
C-117	N16-C-30114-4276
C-118	N16-C-28553-1206
C-119	N16-C-30114-4276
C-120	N16-C-16541-6981
C-121	N16-C-16541-6981
C-122	N16-C-15916-9005
C-123	N16-C-16541-6981
C-124	N16-C-15916-9005
C-125	N16-C-15916-9005
C-126	N16-C-30114-4276
C-127	N16-C-33627-7703
C-128	N16-C-30114-4276
C-129	N16-C-33627-7703
C-130	N16-C-16541-6981
C-131	N16-C-15916-9005
C-132	N16-C-16541-6981
C-134	N16-C-33627-7703
C-135	N16-C-16541-6981
C-136	N16-C-30114-4276
C-137	N16-C-33627-7703
C-138	N16-C-33627-7703
C-141	N16-C-15532-9005

Reference Symbol	*Standard Navy Stock Number*
C-142	N16-C-15532-9005
C-143	N16-C-15532-9005
C-144	N16-C-15532-9005
C-145	N16-C-15532-9005
C-146	N16-C-30114-4276
C-147	N16-C-27582-1876
C-148	N16-C-33627-7703
C-201	N16-C-17085-7060
C-202	N16-C-30114-4276
C-203	N16-C-30114-4276
C-204	N16-C-33627-7703
C-205	N16-C-33627-7703
C-206	N16-C-33627-7703
C-207	N16-C-29608-2206
C-208	N16-C-29608-2206
C-209	N16-C-33627-7703
C-210	N16-C-33627-7703
C-211	N16-C-33627-7703
C-212	N16-C-33627-7703
C-213	N16-C-33627-7703
C-214	N16-C-29265-3006
C-215	N16-C-29133-4006
C-216	N16-C-33627-7703
C-217	N16-C-33627-7703
C-218	N16-C-33627-7703
C-219	N16-C-33627-7703
C-220	N16-C-29265-3006
C-221	N16-C-29133-4006
C-222	N16-C-33627-7703
C-223	N16-C-33627-7703
C-224	N16-C-33627-7703
C-225	N16-C-33627-7703
C-226	N16-C-29265-3006
C-227	N16-C-29133-4006
C-228	N16-C-33627-7703
C-229	N16-C-33627-7703
C-230	N16-C-33627-7703
C-231	N16-C-29608-2206
C-232	N16-C-29608-2206
C-233	N16-C-33627-7703
C-234	N16-C-27582-1876
C-235	N16-C-33627-7703
C-236	N16-C-33627-7703
C-237	N16-C-33627-7703
C-238	N16-C-28980-2076
C-239	N16-C-33627-7703
C-240	N16-C-53115-5980

Reference Symbol	Standard Navy Stock Number
C-241	N16-C-54460-4481
C-242	N16-C-52978-4999
C-243	N16-C-33058-5253
C-244	N16-C-33058-5253
C-245	N16-C-33058-5253
C-246	N16-C-33058-5253
C-247	N16-C-33627-7703
C-248	N16-C-33627-7703
C-249	N16-C-33627-7703
C-250	N16-C-33627-7703
C-251	N16-C-47297-3124
C-252	N16-C-33627-7703
C-253	N16-C-42767-5025
C-254	N16-C-33627-7703
C-255	N16-C-33627-7703
C-256	N16-C-33627-7703
C-257	N16-C-33627-7703
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C-259	N16-C-33627-7703
C-260	N16-C-33627-7703
C-261	N16-C-33627-7703
C-262	N16-C-33627-7703
C-263	N16-C-30114-4276
C-301	N16-C-33627-7703
C-302	N16-C-53115-5980
C-303	N16-C-51858-2076
C-304	N16-C-51858-2076
C-305	N16-C-53115-5980
C-315	N16-C-49197-3875
C-401	N16-C-33627-7703
C-402	N16-C-33627-7703
C-403	N16-C-33627-7703
C-404	N16-C-33627-7703
C-405	N16-C-33627-7703
C-406	N16-C-33627-7703
C-407	N16-C-33627-7703
C-408	N16-C-33627-7703
C-409	N16-C-33627-7703
C-410	N16-C-33627-7703
C-411	N16-C-33627-7703
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C-414	N16-C-33627-7703
C-415	N16-C-33627-7703
C-416	N16-C-33627-7703
C-417	N16-C-33627-7703
C-418	N16-C-33627-7703
C-419	N16-C-33627-7703
C-420	N16-C-33627-7703
C-421	N16-C-33627-7703
C-422	N16-C-33627-7703

Reference Symbol	Standard Navy Stock Number
C-423	N16-C-33627-7703
C-424	N16-C-33627-7703
C-425	N16-C-33627-7703
C-426	N16-C-33627-7703
C-427	N16-C-33627-7703
C-428	N16-C-33627-7703
C-429	N16-C-33627-7703
C-430	N16-C-33627-7703
C-431	N16-C-33627-7703
C-432	N16-C-33627-7703
C-433	N16-C-33627-7703
C-434	N16-C-33627-7703
C-435	N16-C-33627-7703
C-436	N16-C-33627-7703
C-437	N16-C-33627-7703
C-438	N16-C-33627-7703
C-439	N16-C-53115-6132
C-440	N16-C-53115-6132
C-601	N16-C-33627-7703
C-602	N16-C-33627-7703
E-101	N17-C-813246-101
E-102	N17-I-50220-4501
E-104	N17-C-82607-1317
E-105	N17-C-82609-1040
E-106	N17-C-82602-7049
E-107	N17-S-91665-1002
E-111	N16-S-34520-3873
E-112	N16-S-32841-1001
E-113	N16-C-302965-201
E-207	N17-C-82609-1040
E-211	N17-S-91697-1014
E-212	N17-S-91683-1401
E-213	N17-S-91697-1014
E-215	N16-C-302951-335
E-216	N16-C-302951-335
E-217	N16-C-302951-335
E-218	N16-C-302951-335
E-219	N16-C-302951-335
E-220	N16-C-302951-335
E-221	N16-C-302951-335
E-222	N16-C-302951-335
E-223	N16-C-302951-335
E-301	N17-C-82609-1040
E-605	N17-B-78087-4814
E-801	N17-S-690701-109
F-401	N17-F-16302-140
F-402	N17-F-16302-140
J-101	N17-C-73108-1252
J-201	N17-J-39248-4418
J-401	N17-F-74267-6301
J-402	N17-F-74267-6301

Reference Symbol	Standard Navy Stock Number
J-403	N17-C-73108-5890
J-404	N17-C-73108-5890
J-405	N17-C-72610-5429
J-406	N17-C-72604-1516
J-407	N17-C-72641-6097
J-408	N17-C-73109-4976
J-501	N17-C-72641-6097
J-502	N17-C-72610-5429
J-503	N17-J-39248-4418
J-1002	N17-C-71113-5520
K-601	N17-R-77101-1001
L-101	N16-C-76379-7252
L-102	N16-C-76275-9602
L-109	N16-C-74239-1072
L-110	N16-C-71627-9612
L-111	N16-C-71944-9472
L-112	N16-C-71944-9472
L-113	N16-C-71944-9472
L-114	N16-C-71944-9472
L-201	N16-F-40056-2406
L-202	N16-F-44013-9456
L-301	N16-R-29190-2218
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L-414	N16-C-72948-1360
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L-418	N16-C-72948-1360
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M-202	N17-M-22724-6701
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P-403	N17-C-71414-2800
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P-406	N17-C-70328-1545
P-407	N17-C-71415-1830
P-408	N17-C-71414-2794
P-409	N17-C-67732-2907
P-410	N17-C-71419-4088
P-411	N17-C-71419-4088
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P-502	N17-C-70334-5459
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R-103	N16-R-50633-971
R-104	N16-R-50336-811
R-105	N16-R-50633-971
R-106	N16-R-50336-811
R-107	N16-R-50633-971
R-108	N16-R-49580-811
R-109	N16-R-50633-971
R-110	N16-R-50633-971
R-111	N16-R-50283-551
R-112	N16-R-49985-811
R-113	N16-R-50201-971
R-114	N16-R-49805-811
R-115	N16-R-50714-811
R-116	N16-R-49661-811
R-117	N16-R-50696-811
R-118	N16-R-50399-811
R-119	N16-R-49985-811
R-120	N16-R-50480-971
R-121	N16-R-50129-971
R-122	N16-R-50480-971
R-123	N16-R-50129-971
R-124	N16-R-50480-971
R-125	N16-R-50129-971
R-126	N16-R-50696-811
R-127	N16-R-50282-971
R-128	N16-R-50480-971
R-129	N16-R-50588-811
R-201	N16-R-50588-811
R-202	N16-R-49661-811
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R-204	N16-R-91031-1125
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R-209	N16-R-50336-811
R-210	N16-R-49985-811

Reference Symbol	*Standard Navy Stock Number*
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R-221	N16-R-49985-811
R-222	N16-R-50714-811
R-223	N16-R-50588-811
R-224	N16-R-49625-811
R-225	N16-R-50336-811
R-226	N16-R-49985-811
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R-228	N16-R-50336-811
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R-230	N16-R-50516-811
R-231	N16-R-50516-811
R-232	N16-R-50516-811
R-233	N16-R-50588-811
R-234	N16-R-50822-971
R-235	N16-R-50858-811
R-236	N16-R-50282-971
R-237	N16-R-50741-811
R-238	N16-R-49643-811
R-239	N16-R-88338-8064
R-240	N16-R-50741-811
R-241	N16-R-50930-811
R-242	N16-R-50930-811
R-243	N16-R-50553-231
R-244	N16-R-49706-811
R-245	N16-R-50516-811
R-246	N16-R-50516-811
R-247	N16-R-49805-811
R-248	N16-R-49661-811
R-249	N16-R-49661-811
R-250	N16-R-49769-811
R-251	N16-R-50651-811
R-252	N16-R-91031-1105
R-253	N16-R-50686-591
R-254	N16-R-50337-231
R-255	N16-R-50337-231
R-256	N16-R-49733-811
R-257	N16-R-90493-8605
R-258	N16-R-50553-231
R-259	N16-R-50282-971
R-260	N16-R-50741-811
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R-266	N16-R-50678-811
R-267	N16-R-50553-231
R-268	N16-R-49706-811
R-269	N16-R-51020-811
R-270	N16-R-50822-971
R-271	N16-R-50930-811
R-272	N16-R-49689-231
R-273	N16-R-49706-811
R-274	N16-R-90754-3611
R-277	N16-R-50372-811
R-301	N16-R-50013-711
R-302	N16-R-50013-711
R-304	N16-R-49923-551
R-305	N16-R-50480-971
R-501	N16-R-49706-811
R-502	N16-R-49706-811
R-503	N16-R-50516-811
R-504	N16-R-90754-3611
R-601	N16-R-49428-551
R-602	N16-R-49428-551
R-603	N16-R-89956-7015
S-101	N17-S-61311-5881
S-201	N17-S-62522-8601
S-202	N17-S-61361-4401
S-203	N17-B-51808-1564
S-204	N17-S-62522-8601
S-205	N17-S-73082-9028
S-301	N16-R-33591-1055
S-501	N17-S-60523-1319
S-502	N17-S-57065-5219
S-601	N17-S-64672-6059
S-602	N17-S-60523-1319
S-603	N17-S-60905-9341
S-604	N17-S-60524-1649
T-101	N16-C-76224-7252
T-102	N16-C-76194-7646
T-207	N16-R-28963-1728
T-301	N17-T-73880-6350
W-101	N16-C-12452-1241
W-202	N16-C-12308-1876
W-401	N17-C-48796-9301
W-404	N17-C-48888-7599
W-405	N17-L-62758-8501
X-101	N16-S-63517-6441
X-102	N16-S-63517-6521
X-103	N16-S-62603-6680
X-104	N16-S-62603-6680

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X-106	N16-S-62646-6947
X-107	N16-R-33591-1153
X-201	N16-S-63517-6481
X-202	N16-S-63517-6441
X-203	N16-S-63517-6441
X-204	N16-S-63517-6441
X-205	N16-S-63517-6481
X-206	N16-S-63517-6481
X-207	N16-S-63517-6521
X-208	N16-S-63517-6481
X-209	N16-S-63517-6481
X-210	N16-S-63517-6441

Reference Symbol	*Standard Navy Stock Number*
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X-212	N16-S-63517-6441
X-213	N17-L-76743-4654
X-301	N16-S-63517-6481
X-302	N16-S-63517-6481
X-601	N16-S-55063-7902
X-602	N17-L-52201-1017
Z-103	N16-T-98163-2501
Z-201	N17-T-68135-2591
Z-202	N17-T-68135-2601
Z-203	N17-T-68135-2611
Z-204	N17-T-68135-2611
Z-205	N17-T-68135-2591

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