NAVSHIPS 92456 (NON-REGISTERED)

Instruction Book

for

SINGLE SIDEBAND CONVERTER
CV-216/URR

NATIONAL COMPANY, INC.
MALDEN 48, MASSACHUSETTS

BUREAU OF SHIPS DEPARTMENT OF THE NAVY

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IN REPLY REFER TO
Code 993-100
25 March 1955

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

Subj: Instruction Book for Single Sideband Converter CV-216/URR, NAVSHIPS 92456

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SECTION 1 – GENERAL DESCRIPTION

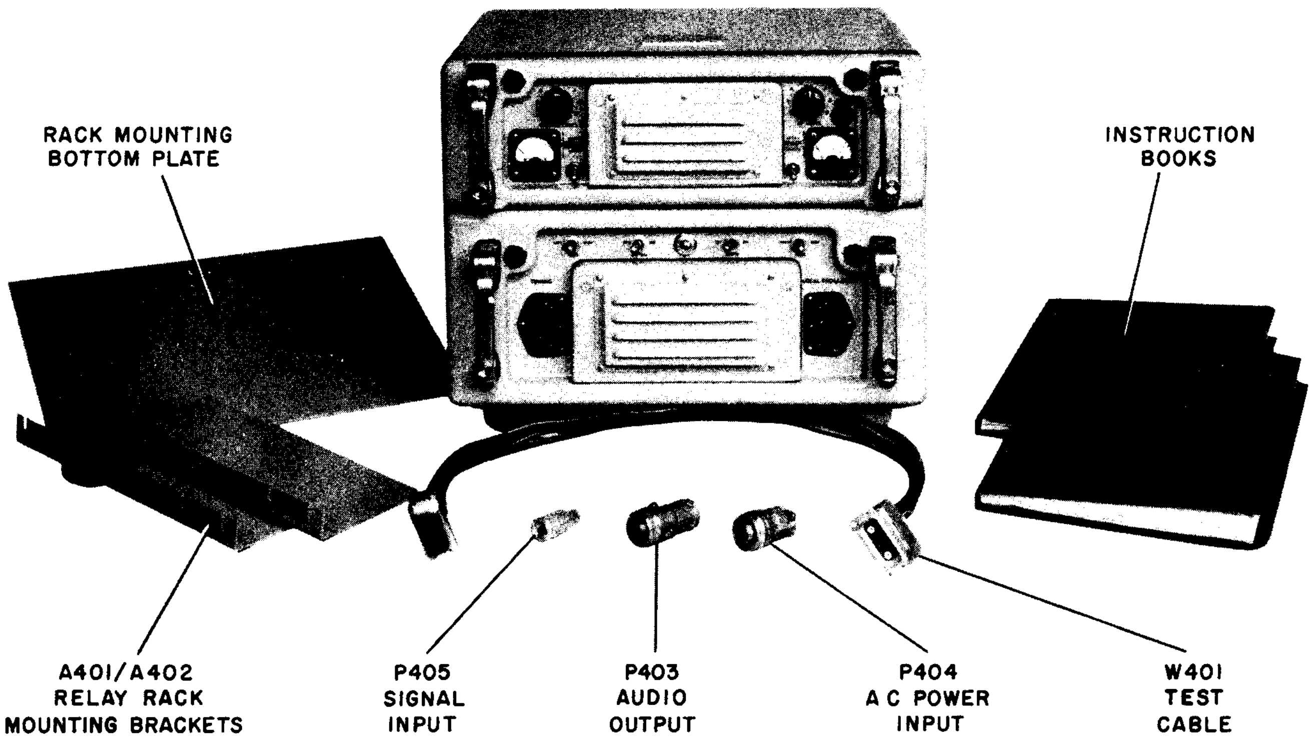


Figure 1—1. Single Sideband Converter CV-216/URR

SECTION 1
GENERAL DESCRIPTION

1. INTRODUCTION.

The CV-216/URR is a converter or an adapter which is to be connected to a superheterodyne communications receiver so that single sideband signals may be received. The Converter operates from the intermediate frequency output of a Navy general purpose receiver having a final intermediate frequency centered on 200 kilocycles/second. The output can be connected to phones, speaker and other audio devices. See Figure 1-1.

a. SCOPE OF THIS MANUAL.–This instruction book describes the CV-216/URR Single Sideband Converter only. For the description and operation of the general purpose receiver, refer to the instruction book supplied with that equipment.

b. PURPOSE.–The primary purpose of the CV-216/URR is to reproduce the audio intelligence contained in one sideband of single and double sideband transmissions. With the CV-216/URR attached to a Navy general purpose receiver, the following types of reception are possible:

(1) A2. One sideband of MCW (tone modulation) signal.

(2) A3. One sideband only of conventional double sideband amplitude modulated signals having any degree of modulation from low levels up to 100% modulation.

(3) F2. One sideband only of a double sideband phase modulated signal having any degree of phase modulation up to one radian.

(4) A3a. One sideband only of single sideband suppressed carrier transmissions having any degree of carrier suppression from a full carrier to a level 26 db below that of a full carrier.

c. TERMINOLOGY AND DEFINITIONS.–The terms appearing in the following glossary are defined as applicable to this equipment.

(1) CARRIER.–A radio-frequency wave which is modulated by an audio signal at the transmitting source. The transmitted AM signal includes the carrier and two sidebands. In this manual unless otherwise specified, the term "carrier" will refer to the carrier intermediate-frequency at 25 kilocycles/second (±10 cycles) produced by the carrier frequency converter stage of the CV-216/URR.

(a) SUPPRESSED CARRIER.–A carrier whose amplitude has been reduced at the transmitting source. A carrier may be completely or partially suppressed.

(b) RECONDITIONED CARRIER.–A carrier which, if originally suppressed, is amplified to full carrier strength. In the CV-216/URR reconditioning takes place at the intermediate frequency level (25 kilocycles/second ±10 cycles).

(2) CONVERSION.–The heterodyning or mixing process by which the 200-kilocycles/second input signal is reduced or converted to a lower frequency. In the CV-216/URR the input signal is mixed with a tuning oscillator signal of 225 kilocycles/second (±10 cycles) which produces an intermediate frequency in the 25 kilocycles/second range.

(3) DEMODULATION.–The process by which the carrier IF signal is recombined with one sideband to produce audio intelligence. A local oscillator may be used to supply the carrier signal provided its frequency is very close to that of the original carrier signal. A translation of a few cycles, however, is not objectionable.

(4) INPUT SIGNAL.–The 200 kilocycles/second signal which is taken from the final intermediate frequency stage of a communications receiver external to the CV-216/URR.

(5) LOCAL OSCILLATOR.–The oscillator which is used for demodulation instead of using the carrier signal. The exact frequency of the local oscillator in the CV-216/URR depends upon the carrier IF, which is determined by the passband of the carrier filter. This passband is 25 kilocycles/second plus or minus 10 cycles.

(6) PHASE MODULATION.–A system of modulation in which the phase angle of the carrier is varied by the audio modulating wave. The phase angle is varied by an amount which is proportional to the amplitude of the modulating audio signal and at a rate proportional to the modulating signal frequency.

(7) RECEIVER.–The receiver referred to in this manual is a conventional superheterodyne receiver which, together with the CV-216/URR, makes possible the reception of single sideband signals. The require-

ments of this receiver are:

(*a*) A final IF stage of 200 kc. at 0.025 to 0.5 volts.

(*b*) A 70-ohm output impedance with a coaxial transmission line connector.

(8) SIDEBANDS.–Side frequencies produced with the carrier when the carrier is modulated by an audio signal.

(*a*) LOWER SIDEBAND.–The band of side frequencies all of which are lower in frequency than the carrier. Unless otherwise specified, the term "lower sideband" will refer to the lower sideband intermediate-frequency signal produced by the lower sideband frequency converter stage of the CV-216/URR. Its frequency range is from 20 to 24.5 kilocycles/second.

(*b*) UPPER SIDEBAND.–The band of side frequencies all of which are higher in frequency than the carrier frequency. Unless otherwise specified, the term "upper sideband" will refer to the upper sideband intermediate-frequency signal produced by the upper sideband frequency converter stage. Its frequency range is from 25.5 to 30 kilocycles/second.

(9) TUNING OSCILLATOR.–The oscillator whose signal is heterodyned with the input signal to produce the carrier and sideband intermediate frequencies. Its center value is 225 kilocycles/second, but this may be varied by the automatic-frequency-control system to compensate for shifts in the input signal and oscillator.

d. BASIC PRINCIPLES.–The CV-216/URR uses superheterodyne type of circuits to convert the carrier and sideband signals to an intermediate frequency. A sideband is separated from its carrier and other sideband by appropriate filters. If suppressed, the carrier is reconditioned to a full carrier at the intermediate frequency level and then recombined with the sideband to obtain audio intelligence. The audio output may be connected to headphones or to other audio devices.

2. DESCRIPTION AND EQUIPMENT ARRANGEMENT.

The CV-216/URR is shown complete in Figure 1–1. The equipment includes:

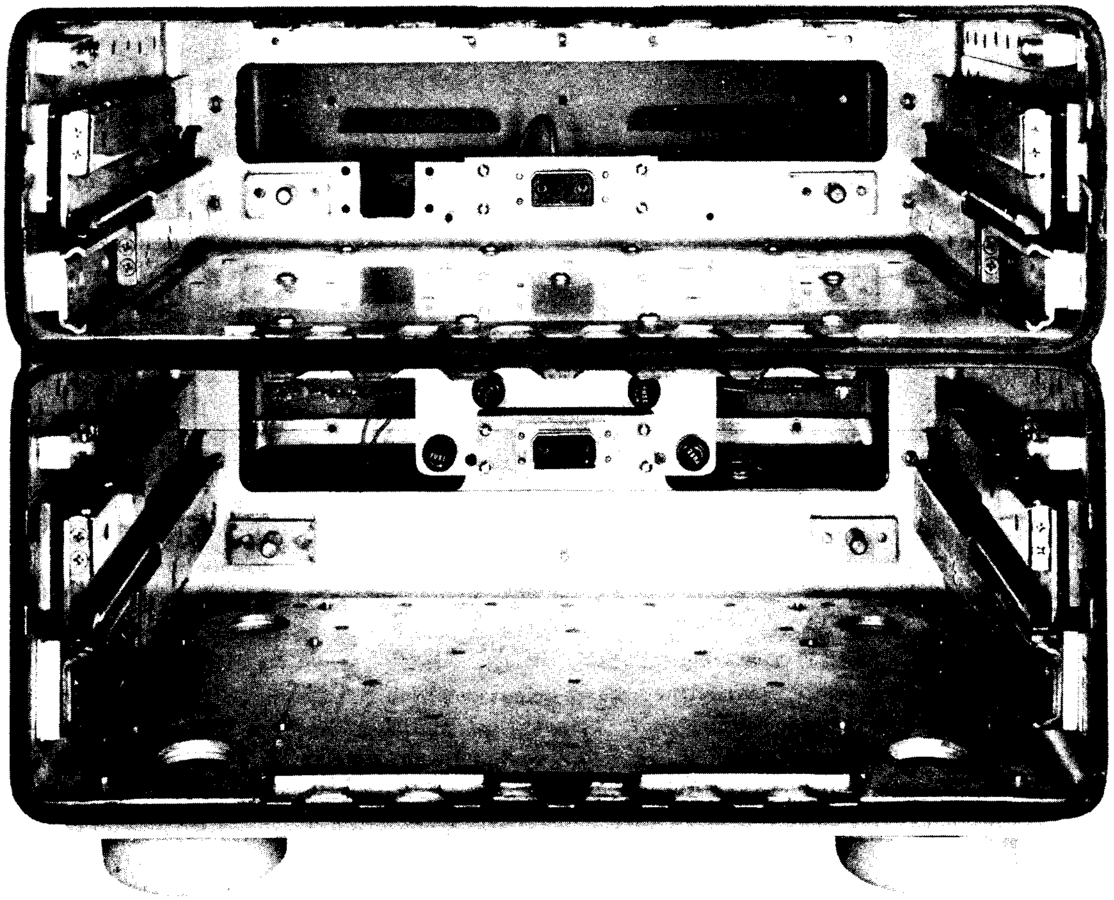


Figure 1–2. CV-216/URR Cabinet, Chassis Assemblies Removed

a. Two chassis assemblies mounted in a single cabinet fitted with shock mounts.

b. A pair of auxiliary angle brackets for relay rack mounting.

c. Three plugs which are to be connected to three cables external to the equipment. These plugs mate with receptacles mounted on the cable filter assembly at the rear of the cabinet.

d. One test cable.

e. Two instruction books.

f. A bottom plate to cover holes when shock mounts are removed. The equipment may be mounted on a firm horizontal surface, or in a standard relay rack by attaching the brackets. Both chassis assemblies consist of a front panel and chassis. All necessary operating controls and visual instruments are located on the front panels of both chassis assemblies. Those controls which require only periodic adjustments are located behind front-panel doors. Figure 4–1 shows the location of all panel-mounted controls. A cable filter assembly is mounted on the rear of the cabinet. This assembly filters the AC input and the audio output cables.

Both chassis have sliding mechanisms to permit easy withdrawal of the assemblies from the cabinets. The tilt mechanism on each chassis assembly enables each to be tilted 120° up or down from the horizontal position. The mechanism locks at the horizontal, 45°, 90° and 120° positions in both directions.

The CV-216/URR is designed for shipboard use and will give reliable performance under the adverse conditions associated with shipboard use, namely, temperature, humidity, shock and vibration. All openings are drip-proof and all outside removable covers and doors are sealed with gaskets. The equipment rests on four shock mounts and all electrical components are rigidly mounted to withstand vibration and shock. Wherever possible the electrical components were se-

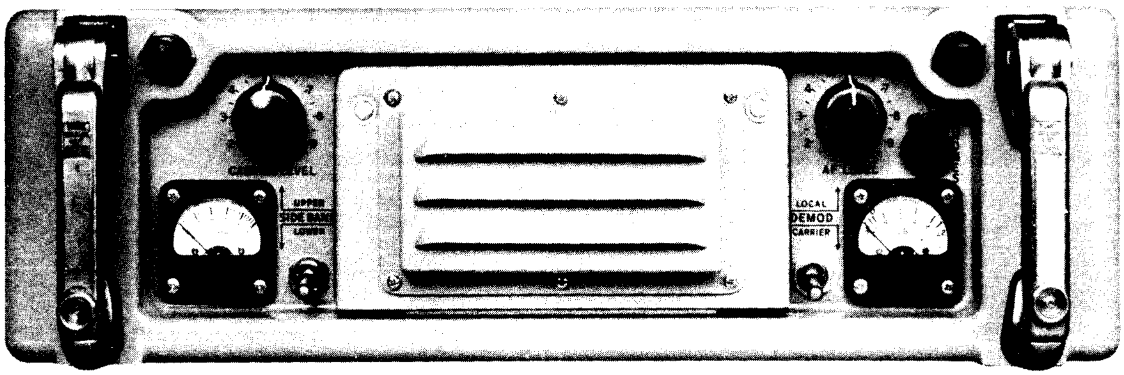


Figure 1–3. Upper Chassis, Front View

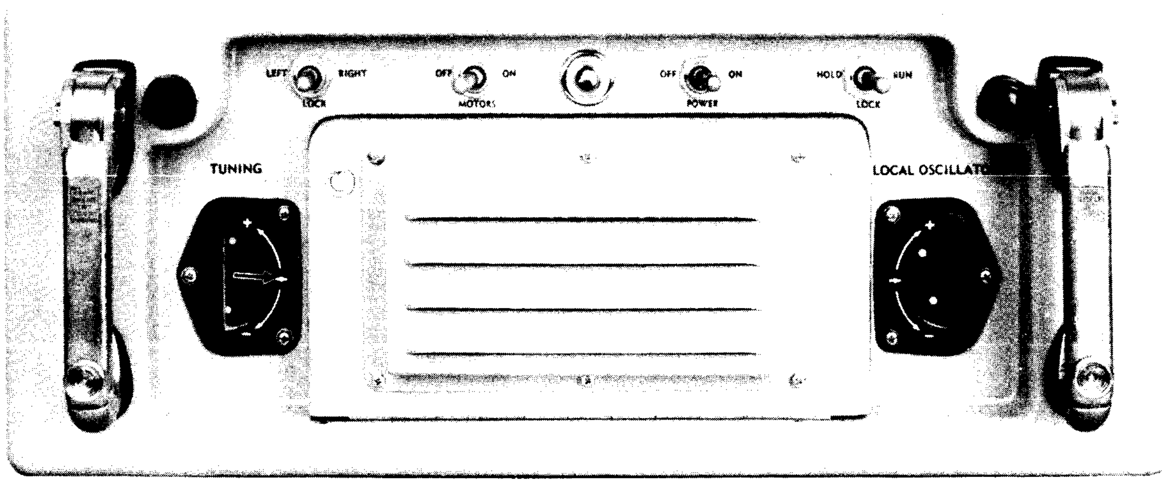


Figure 1–4. Lower Chassis, Front View

lected to resist, or to compensate for, temperature changes. A thermostatically-controlled fan is located in each chassis to prevent excessive increase in temperature.

3. DESCRIPTION OF SUB-UNITS.

The major sub-units of the CV-216/URR are the upper and lower chassis assemblies, the cable filter assembly and the cabinet.

a. CABINET.—The cabinet is manufactured out of an aluminum alloy and has a gray enamel finish. Figure 1—2 is a photograph of the cabinet with both chassis assemblies removed. The shock mounts are removed when the equipment is mounted in a relay rack and a bottom plate is attached to cover the shock mount holes.

b. UPPER CHASSIS ASSEMBLY.—The upper chassis assembly includes the front panel and the circuit components mounted on the chassis. See Figure 1—3. The circuits located in the upper chassis include the carrier and sideband channels; the automatic-frequency-control circuits (excluding the servo amplifier and the motor circuits), the AGC circuits and one fan motor circuit.

c. LOWER CHASSIS ASSEMBLY.—The lower chassis assembly includes the front panel and the circuit components mounted on the lower chassis. See Figure 1—4. The circuits located in the lower chassis include the two oscillators and the two oscillator amplifiers, the two servo amplifier and motor circuits, the noise silencer, the power supply, and a fan motor.

d. CABLE FILTER ASSEMBLY. *(See Figure 1—5.)*—The cable filter assembly is located at the rear of the cabinet. The audio output line and the incoming AC line are filtered by this assembly. All input and output cables are connected at the bottom of the cable filter assembly. The power line fuses F401 and F402, and two spares F403 and F404, are located within this assembly. Access to all filter components is gained by removing the cover at the rear of the cabinet.

4. REFERENCE DATA.

a. NOMENCLATURE.—Single Sideband Converter CV-216/URR.

b. CONTRACT.—NObsr-52642 dated 26 June 1951

c. CONTRACTOR.—National Company, Inc., Malden, Massachusetts, U.S.A.

d. COGNIZANT NAVAL INSPECTOR.—Inspector of Navy Material, Boston, Mass.

e. NUMBER OF PACKAGES INVOLVED PER

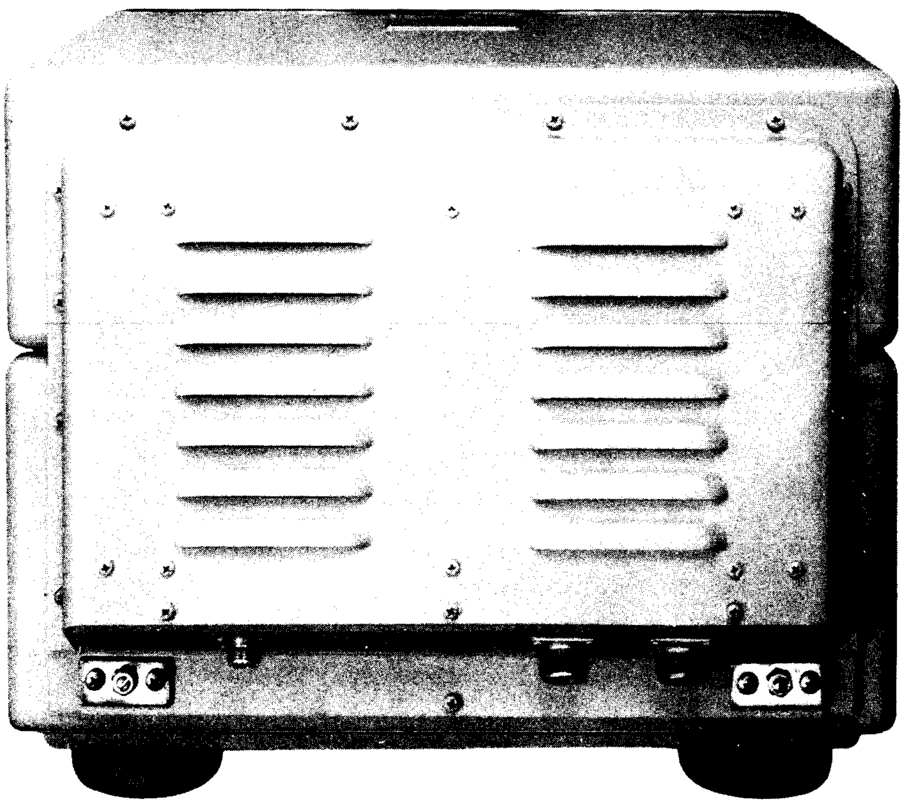


Figure 1—5. Rear View of Cabinet

EQUIPMENT.—One crate containing Single Sideband Converter CV-216/URR, and one set of Equipment Maintenance Parts.

f. TOTAL CUBICAL CONTENTS.

(1) CRATED.—8.65 cu. ft

(2) UNCRATED

(*a*) CV-216/URR.—2.66 cu. ft.

(*b*) Equipment Maintenance Parts —.56 cu. ft.

g. TOTAL WEIGHT.

(1) CRATED.—

(2) UNCRATED

(*a*) CV-216/URR - 120 lbs.

(*b*) Equipment Maintenance Parts —10 lbs.

h. INPUT FREQUENCY.—200 kc.

i. TYPE OF FREQUENCY CONTROL.—Automatic, motor-controlled.

j. TYPE CIRCUIT.—Superheterodyne.

k. INTERMEDIATE FREQUENCY.

(1) CARRIER.—25 kc. ±10 cycles.

(2) UPPER SIDEBAND.—25.5 to 30 kc.

(3) LOWER SIDEBAND.—20 to 24.5 kc.

l. OUTPUTS.

(1) AUDIO.

(*a*) LINE.—60 to 300 milliwatts
120 to 600 ohms impedance, balanced.

(*b*) PHONES.—60 milliwatts into 600 ohms impedance, balanced.

(2) EXTERNAL AGC.—Adjustable from 0 to 10 volts.

m. INPUT IMPEDANCE.—70 ohms, unbalanced.

n. OUTPUT IMPEDANCE.

(1) LINE.—120 to 600 ohms, balanced.

(2) PHONES.—600 ohms, balanced.

o. TYPE OF RECEPTION.

(1) A2.—MCW

(2) A3.—Voice.

(3) F2.—Single-sideband, phase modulation (0 to one radian).

(4) A3a.—Single-sideband, suppressed carrier.

p. FREQUENCY STABILITY DATA.—Automatic frequency control maintains local oscillator within ± 1 cycle per second of carrier frequency.

q. CHARACTERISTICS OF POWER SUPPLY REQUIRED FOR OPERATION.

(1) TYPE.—Self-contained, full-wave rectifier.

(2) VOLTAGES.105, 115 and 125 volts, 50 to 60 cycles, single phase, alternating current.

(3) CURRENT AND POWER FACTOR REQUIRED AT EACH SPECIFIED VOLTAGE:

(*a*) 105 volts:
P.F. — 0.974
Current — 1.64 amps.

(*b*) 115 volts:
P.F. — 0.974
Current — 1.5 amps

(*c*) 125 volts:
P.F. — 0.974
Current — 1.38 amps.

r. MAXIMUM PERMISSIBLE AMBIENT TEMPERATURE 69°C.(149°F.)

TABLE 1–1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	AN DESIGNATION	OVERALL DIMENSIONS (IN.)			VOLUME CU. FT.	WEIGHT LBS
			HEIGHT	WIDTH	DEPTH		
1	Single Sideband Converter, including: 1 set (3) plugs for external cables, 1 pair relay rack mounting brackets, 1 bottom plate, 1 test cable	CV-216/URR	13 3/4	17 1/8	17 9/16	2.5	120
2	Instruction Books	Navships 92456					

TABLE 1–2. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	NAVY OR AN DESIGNATION	PURPOSE	REQUIRED CHARACTERISTICS
1	Receiver, Navy General Purpose complete with instruction book		Supplies input signal to CV-216/URR	1. Final IF stage at 200 kc. 2. IF output at .025 to .5 volts to match a 70-ohm input impedance
1	Input cable	RG-13/U	Connects receiver to CV-216/URR	
1	Power cable	MCOS–2	AC power line feed	
1	Audio output cable	MCOS–3	Connects output of CV-216/URR to external audio devices	
1	Headphones, with cord and plug		Monitoring and tuning	600 ohms
1	Speaker or other audio devices		To listen to audio output	120 to 600 ohms

TABLE 1–3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVERALL DIMENSIONS (IN.)			VOLUME CU. FT.	WEIGHT LBS.
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Single Sideband Converter	CV-216/URR	19	23 7/8	33 1/8	8.65	170

TABLE 1–4. ELECTRON TUBE COMPLEMENT

TUBE	QUANTITY
5654	2
5726	3
5750	3
5751	5
5814	13
5Y3WGTA	2
6AK6W	1
6AU6WA	4
0A2WA	1
0B2WA	1

SECTION 2
THEORY OF OPERATION

1. GENERAL DESCRIPTION AND THEORY.

Single Sideband Converter CV-216/URR is a converter or an adapter which is to be connected to a Navy general purpose receiver so that single sideband signals may be received. The Converter operates from the 200-kc. intermediate frequency output of the receiver. The output of the receiver must be between 0.025 and 0.5 volts with an impedance of 70 ohms with a coaxial transmission line connector. The audio output produced by the CV-216/URR may be connected to headphones or to an external speaker or other audio devices. With the CV-216/URR attached to the receiver, the following types of reception are possible:

a. Either sideband of single or double sideband amplitude-modulated transmissions.

b. Either sideband of single or double sideband suppressed-carrier transmissions.

c. One sideband of double sideband phase-modulated signals.

Single sideband communications is based on the fact that all of the transmitted intelligence is contained in either sideband. Radio theory relates that, in the process of AM transmissions, if a constant frequency carrier signal is modulated by an audio signal, other frequencies in addition to the carrier are produced. If a single audio sine wave is used as the modulating signal, the resultant modulated wave will contain three frequency components. They are:

(1) A carrier-frequency component (F) which has the same frequency as the original carrier.

(2) A frequency component which is the sum of the carrier frequency and the frequency of the audio modulating signal (F+A). This signal is called the upper side frequency.

(3) A frequency component which is the difference of the carrier frequency and the frequency of the audio modulating signal (F-A). This signal has the same amplitude as the upper side frequency and is called the lower side frequency.

For example, if a 2000-kc. carrier is modulated by a 5-kc. signal, the resultant AM wave will include three components which are (1) the 2000 kc. carrier; (2) a frequency 5 kc. above the carrier, or 2005 kc., and (3) a frequency 5 kc. below the carrier, or 1995 kc.

The modulating signal is not ordinarily a single frequency but is made up of a number of components of different frequencies simultaneously produced, as during a musical program. Each modulating audio frequency will produce a pair of side frequencies. When the carrier is modulated by a band of audio modulation frequencies, applied individually or simultaneously, the side frequencies lie in bands, called the upper sideband and lower sideband. Each side frequency of the upper sideband has the same amplitude as the corresponding side frequency of the lower sideband. Each is separated from the carrier frequency by the same amount.

Each sideband contains identical energy and each contains all of the transmitted intelligence. Therefore, if one sideband were removed from the AM signal, the remaining sideband would contain all of the information. The transmission of one sideband with a full or suppressed carrier is called single sideband transmission.

When one sideband is completely suppressed at the transmitter, a substantial saving in radiated power is obtained as well as effectively halving the bandwidth required in the RF spectrum. RF channels can be spaced twice as close than with standard AM transmissions. In consequence, the received noise is approximately cut in half, thereby improving the signal-to-noise ratio. This enables the receiver to produce intelligible audio from weak input signals. When the carrier is suppressed, all the energy generated by the transmitter is applied to the sidebands. This entails no loss of intelligence since all information is contained in the sidebands. Therefore considerably less output power is required by the transmitter than would be required by a corresponding standard AM signal. An additional increase in efficiency is obtained by suppressing the carrier in that no RF energy is radiated during standby periods in message transmission.

In the reception of single sideband transmissions, one or more frequency converters shift the frequency down to the AF level. A detector is not used as in conventional superheterodyne receivers to obtain audio from the IF. In the CV-216/URR, two frequency conversions are made. The first uses a pentagrid converter which shifts the input signal (centered at 200 kc.) to 25 kc. The second frequency conversion uses a balanced modulator arrangement in which one IF sideband signal beats against a carrier to produce audio.

When an unwanted sideband is eliminated, suitable filters must separate the sideband and carrier components. The CV-216/URR has three filters, one for each sideband and one for the carrier. Thus, demodulation may be effected with either sideband of double sideband transmissions. If the carrier has been suppressed to any degree at the transmitter, it must be reinserted for demodulation. The frequency of the reinserted carrier should be very nearly that of the original carrier. However, a translation of a few cycles from zero is not particularly objectionable. A partially suppressed carrier may be amplified and used for direct demodulation. When used in this manner, it is called "the reconditioned carrier".

2. DETAILED CIRCUIT ANALYSIS.

Figure 2–1 is a block diagram illustrating the basic operation of the CV-216/URR. As shown in the diagram, separate channels isolate the carrier and one sideband. A switching arrangement permits the selection of either the upper or lower sideband of double-sideband transmissions. The carrier and one sideband are separated and converted to a lower frequency. In the demodulation circuits the carrier and the sideband are combined to produce audio. A local oscillator, having the same frequency as the carrier may be beat against the sideband instead of using the transmitted carrier. Selection of either type of carrier signal is accomplished by means of a switch. The automatic frequency control circuits maintain the tuning oscillator and the local oscillator at a high degree of stability.

Figure 2–2 is the overall block diagram of the equipment. The input signal, centered at 200 kilocycles, passes through input filter Z101. If the upper sideband is selected, the input signal is mixed in upper sideband frequency converter tube V101 with the signal from tuning oscillator V303A. Upper sideband filter Z102 suppresses the carrier, lower sideband and other undesired signal components, and passes only the upper sideband intermediate frequency band of 25.5 to

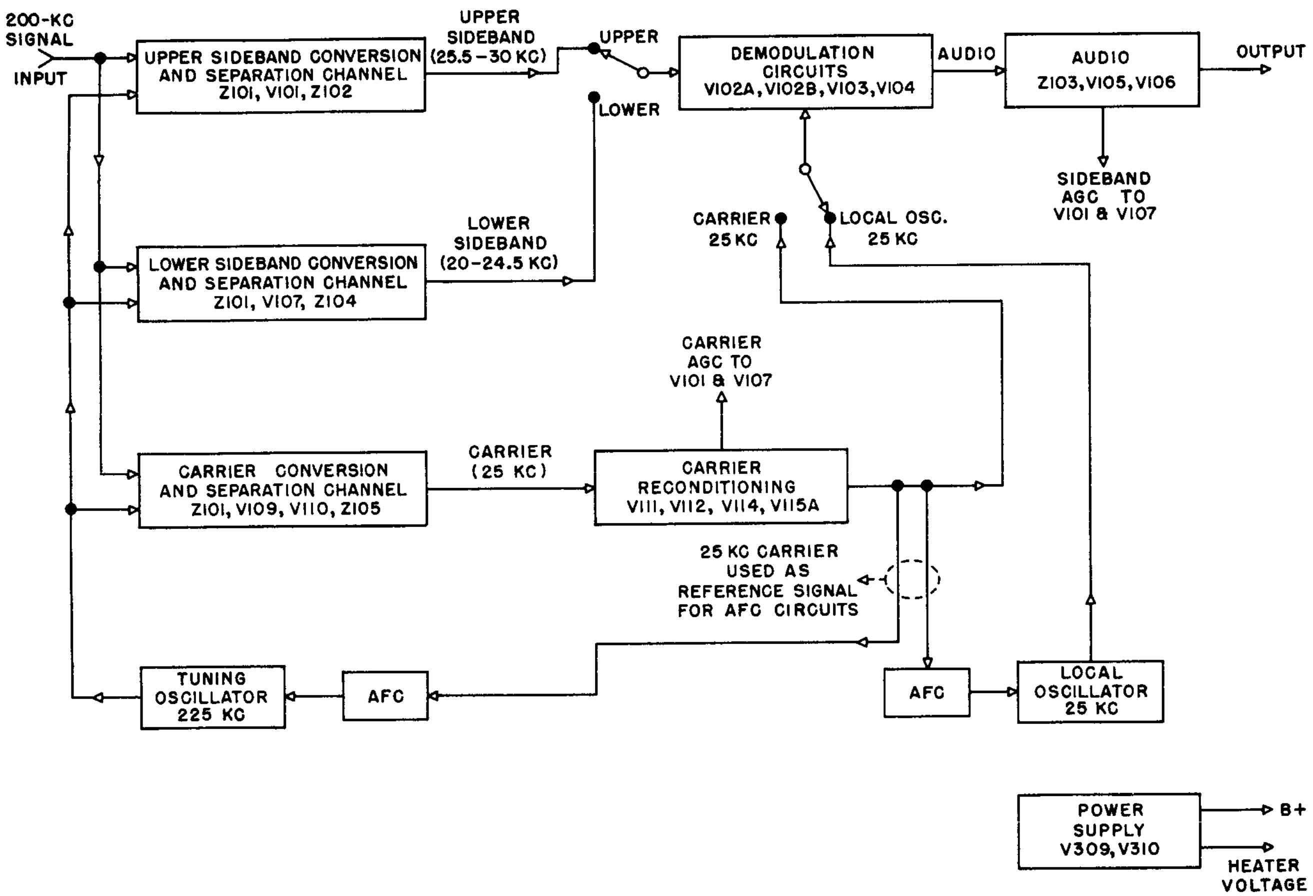


Figure 2–1. CV-216/URR, Basic Block Diagram

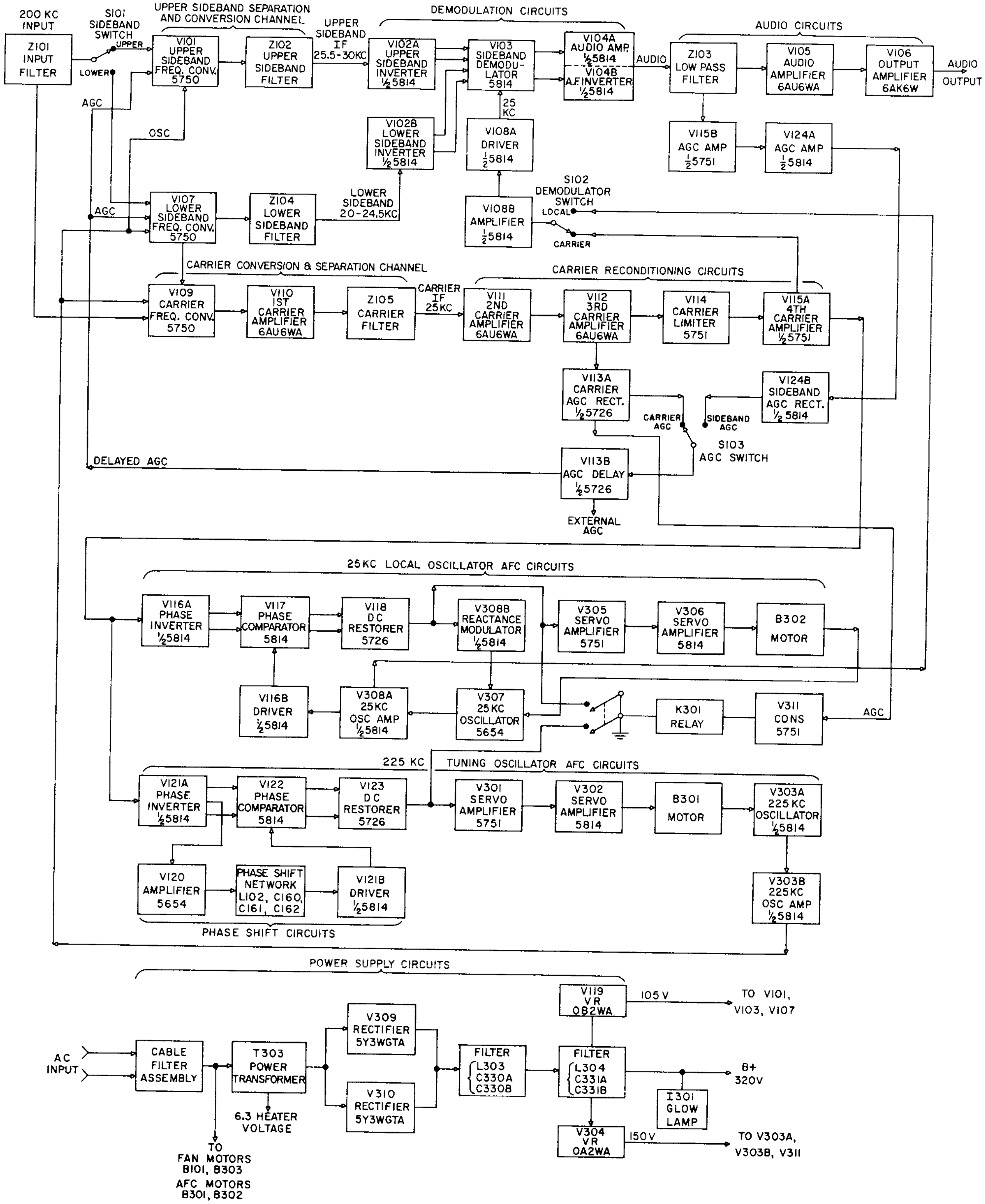


Figure 2–2. CV-216/URR, Overall Block Diagram

30 kilocycles. Filter Z102 feeds the signal to phase inverter V102A which provides two signal voltages 180° out of phase for application to sideband demodulator V103 in the following stage. In the sideband demodulator, the double-ended upper sideband mixes with the injection voltage from local (25-kilocycle) oscillator V307 or with the transmitted carrier (which has been reconditioned at a frequency of 25 kilocycles) to produce audio. The resulting signal is filtered and amplified to remove undesired signals. This process of mixing, demodulation, filtering and amplifying produces an audio signal in the range of 500 to 5000 cycles.

If the lower sideband is selected, the process of mixing, separation and amplification is identical to that of the upper sideband. The lower sideband separation circuit is traced from input filter Z101 through frequency converter V107 and filter Z104. Filter Z104 eliminates the carrier signal, the upper sideband and all other undesired signal components passing only the lower sideband intermediate frequency band of 20 to 24.5 kilocycles. The lower sideband then passes through V102B, V103, V104, Z103, V105 and V106 for the resultant audio output.

Referring again to block diagram, Figure 2–2, it will be seen that the input signal at the output of filter Z101 is routed also to carrier frequency converter tube V109. Here the signal mixes with the injection voltage from the tuning (225-kilocycle) oscillator, undergoes amplification in V110 and filtering in Z105. Z105 passes only the desired carrier intermediate frequency centered at 25 kilocycles. Two stages of amplification, V111 and V112, limiter V114 and another stage of amplification, V115A, serve to recondition the carrier, if originally suppressed.

After the carrier has been reconditioned, it may be mixed with the sideband signal in sideband demodulator V103 to produce audio. The carrier signal used for demodulation appears at the output of fourth carrier amplifier V115A and is routed to the demodulator through amplifier V108A and driver V108B. If the carrier signal is not suitable for demodulation, a 25-kilocycle signal generated by local oscillator V307 may be used instead. Selection of either the carrier signal or the local oscillator signal is made by means of Demodulator switch S102.

Referring to the AFC circuits on block diagram Figure 2–2, it will be noted that fourth carrier amplifier V115A supplies the 25-kilocycle signal to the local (25-kilocycle) oscillator AFC circuits and to tuning (225-kilocycle) AFC circuits. The latter AFC circuits maintain the tuning oscillator at the proper frequency for mixing with the input signal in frequency converters V101, V107 and V109. The mixing of these two signals produces an IF signal within the passband of carrier filter Z105. This frequency is at or within a few cycles of 25 kilocycles. If either the tuning oscillator signal or the input signal should deviate and result in an IF frequency other than the center frequency of Z105, the AFC circuit activates motor B301. The motor turns a variable capacitor in the oscillator tuned circuit until the proper mixing frequency is obtained.

When the local oscillator is used for demodulation, instead of the carrier signal, it is essential that the oscillator frequency be as close to the carrier frequency as possible if the original intelligence is to be faithfully reproduced. It is the function of the local oscillator AFC circuits to keep the local oscillator at the same frequency as the input carrier as it appears at the output of fourth carrier amplifier V115A. If the local oscillator is not at the same frequency as the input carrier, the AFC circuit will activate motor B302 and reactance modulator V308B. These two elements function in unison to bring the local oscillator frequency to the same value as the carrier frequency.

AGC voltage is obtainable both from the sideband and the carrier channels. Selection of sideband or carrier AGC is made by means of the AGC switch. Both AGC circuits supply delayed AGC voltage to the two sideband converters, V101 and V107, and also to an external connector so that AGC is available for use in the associated receiver. Non-delayed carrier AGC voltage is applied to carrier-operated noise silencer V311. This voltage normally keeps V311 cut off. Should the transmitted carrier fade to a level insufficient for proper limiting and automatic frequency control, V311 conducts and energizes relay K301. This relay disables the two AFC motors and the reactance modulator. In this manner, noise is prevented from operating the motors when the carrier drops below the noise level.

The following paragraphs are a detailed stage-by-stage analysis of the entire circuitry.

a. SIDEBAND SEPARATION CHANNEL. *(See Figures 2–3 and 7–7.)*—The sideband separation channel has two major functions: (1) to convert the sideband component of the input signal to an intermediate frequency in the 25.5 to 30 kilocycle frequency range and (2) to separate one sideband from the carrier and other sideband. The circuits include input filter Z101, sideband frequency converters V101 and V107, and sideband filters Z102 and Z104. The upper sideband frequency converter and filter stages are identical in operation to the corresponding lower sideband stages, except that filter Z102 is designed to pass the upper sideband frequency range of 25.5 to 30 kilocycles, whereas filter Z104 passes the lower sideband frequency range of 20 to 24.5 kilocycles. For this reason, only the upper sideband circuits are shown on Figure 2–3 and are used in the following discussion.

Only one sideband may be separated at a time when double sideband signals are transmitted. Sideband switch S101 determines the sideband to be used.

If the upper sideband is selected, the input signal centered at 200 kilocycles is fed through filter Z101 to the upper sideband frequency converter, V101, where it mixes with the tuning oscillator signal. The resulting signal components then pass through filter Z102 which suppresses all but the components in the 25.5 to 30-kilocycle range. If the lower sideband signal is selected, this signal traces its course through filter Z101, frequency converter V107 and filter Z104. The latter passes only the lower sideband components in the frequency range from 20 to 24.5 kilocycles.

(1) INPUT FILTER Z101.–Filter Z101 has a pass-band of 190 to 210 kilocycles. The transformer formed by coils L101A and L101B is a double-tuned, low Q transformer which can be adjusted for wide band-width with negligible loss. The signal, at the filter output, connects to the signal grids of three pentagrid converter tubes, V101, V107 and V109.

(2) UPPER SIDEBAND FREQUENCY CONVERTER V101 AND FILTER Z102.–Upper sideband frequency converter V101 is a 5750 pentagrid converter. The input signal, taken from filter Z101, is routed to the control grid (pin 7) through capacitor C103 and resistor R178. The tuning oscillator signal connects to the injection grid (pin 1) through capacitor C104 for mixing with the input signal. The mixing of these signals produces, after filtering through Z102, an intermediate upper sideband signal in the frequency range 25.5 to 30 kilocycles. The output of filter Z102 feeds the upper sideband inverter V102A.

Plate supply voltage for V101 is applied through resistor R108. Capacitor C107A by-passes RF voltages in the B+ line. R107 is the plate load resistor. Regulated screen voltage is applied through resistor R179. Capacitor C105A by-passes the RF in the screen supply line. R104 is the grid bias resistor, R105 is the cathode bias resistor and C139A is the cathode by-pass capacitor.

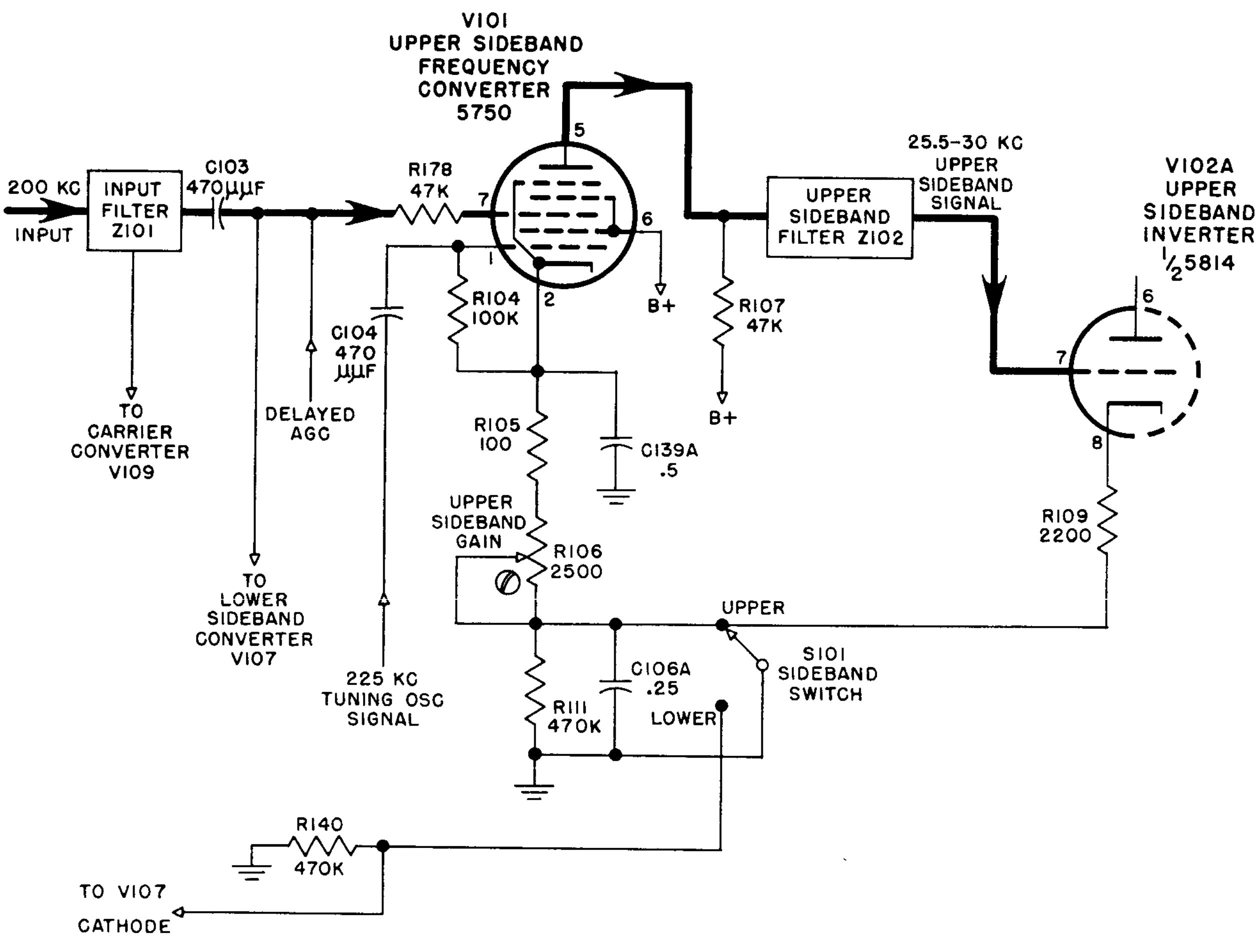


Figure 2–3. Upper Sideband Separation Channel, Simplified Schematic Diagram

The Upper Sideband Gain control R106 adjusts the gain of V101, and the Lower Sideband Gain control R139 adjusts the gain of V107, so that equal power may be obtained from each sideband.

Sideband switch S101 selects the desired sideband from the input signal as follows:

When switch S101 is in the UPPER position, resistor R140 is connected into the cathode circuit of lower sideband frequency converter V107. This places a higher negative bias on the grid of V107 sufficient to cut the tube off. At the same time, resistor R111, which produces the same cutoff bias on the upper sideband frequency converter, V101, is shorted to ground enabling V101 to conduct. Conversely, when switch S101 is in the LOWER position, R140 is shorted so that V107 will operate, whereas R111 is connected into the cathode circuit of V101 disabling that tube. Capacitors C106A and C106B respectively filter R111 and R140. Sideband switch S101 also controls the conduction of sideband phase inverters V102A and V102B in a similar manner.

b. SIDEBAND DEMODULATION CIRCUITS. (See *Figures 2–4 and 7–7.*)—The stages including V102, V103, V104 and Z103 comprise the sideband demodulation section. These circuits function as a group to mix one of the sidebands with a 25-kilocycle signal to produce audio. The mixing of the sideband IF signal with the 25-kilocycle local oscillator signal or the carrier signal takes place in sideband demodulator V103. Since V103 operates in push-pull it requires two signals 180° out of phase to be applied to its grids. The operation of the sideband phase inverter V102 in the preceding stage meets this requirement. The output of the sideband demodulator feeds V104, whose function is to cancel the 25-kilocycle signal and to amplify the audio component. Filter Z103 suppresses the remaining undesired frequencies.

Since both sidebands undergo similar processing, the following description of the demodulation and amplifying of the upper sideband signal applies as well to the lower sideband.

(1) SIDEBAND INVERTER V102.—One section of V102 operates as the lower sideband phase inverter, the other section as the upper sideband phase inverter. The output of filter Z102 connects directly to the grid of upper sideband phase inverter V102A, one-half of a 5814 twin triode. This stage furnishes two equal voltages, 180° out of phase, from the single-ended sideband signal, for application to sideband demodulator V103. This is accomplished in the following manner. The operation of the phase inverter is based upon the fact that a signal voltage applied to the grid or cathode undergoes a 180° phase inversion upon passing through an ordinary amplifier. In the phase inverter, a portion of the sideband signal is taken off the cathode of V102A and applied to one grid of the sideband demodulator. The plate output of the phase inverter is placed on the other grid of the side-

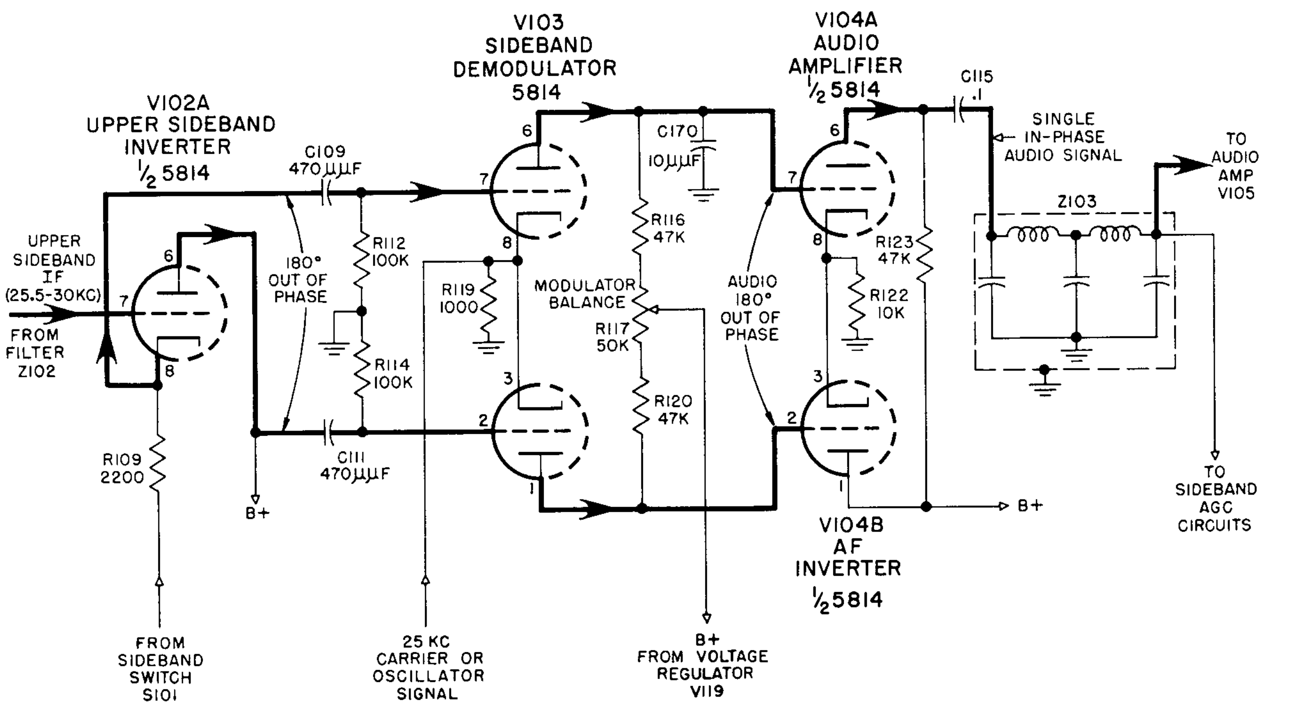


Figure 2–4. Sideband Demodulation Circuits, Simplified Schematic Diagram

band demodulator. Since the signal voltages across resistors R112 and R114 are equal, the voltages applied to the grids of the sideband demodulator are equal. Therefore these two sideband voltages, 180° out of phase, operate the sideband demodulator in push-pull with minimum harmonic distortion. Sideband switch S101 controls the operation of the inverter by grounding either R109 or R110, allowing the desired inverter to conduct. When Sideband switch S101 is in the UPPER postion, resistor R109 is grounded, allowing upper sideband inverter V102A to conduct. When the switch is in the LOWER position, resistor R110 is grounded, allowing lower sideband inverter V102B to conduct. See Figure 2–3.

Upper sideband phase inverter V102A is coupled to the sideband demodulator through capacitors C109 and C111 and load resistors R112 and R114. The lower sideband phase inverter V102B is coupled through C110 and C111. The B+ voltage is fed through resistors R121, R115 and R113 and is filtered by capacitors C112A and C113A.

(2) SIDEBAND DEMODULATOR V103.–In this stage the sideband IF signal is mixed or demodulated with its carrier in order to obtain the audio intelligence originally transmitted. The carrier IF signal at 25 kilocycles is usually used for demodulation except when atmospheric conditions make the carrier, unsuitable. Demodulator switch S102 permits the selection of either the local oscillator signal or the carrier signal. See Figure 2–8.

The output of the sideband phase inverter, either V102A or V102B, furnishes a signal to each grid of the sideband demodulator, a 5814 twin triode. The 25-kilocycle carrier signal is injected to both cathodes. The demodulation process produces, at the output of V103, signal components with the sum and difference frequencies, the frequency of the input sideband signal as well as the oscillator signal. All frequencies except the desired difference frequency are suppressed in the following stages. The 25-kilocycle carrier signal appears at the grids of V104 as two equal in-phase voltages; the sideband IF signal appears as two equal voltages 180° out of phase, as do the sum and difference frequencies. The demodulator output voltages maintain the same phase relationship across load resistors R116 and R120. Capacitor C170 corrects for phase shift errors in the double-ended sideband signals which occur at the phase inverter and maintains the two audio signals at the required 180° phase difference. Modulator Balance control R117 is adjustable so that optimum balance may be attained between the signals applied to the grids of V104.

The B+ supply, applied through resistor R118 and filtered by C112B, is kept at a constant value by voltage regulator tube V119.

(3) AF INVERTER V104B, AF AMPLIFIER V104A AND FILTER Z103.–The output of sideband demodulator is applied to AF inverter V104B and AF amplifier V104A, a 5814 twin triode. V104B functions as a cathode follower, V104A as an audio-frequency amplifier.

The purpose of V104A and V104B is opposite to that of the phase inverter V102. That is, this stage takes the double-ended audio signal and unites them into a single in-phase signal. At the same time the 25-kilocycle signal is suppressed. Any remaining undesired signals are removed by filter Z103, which cuts off sharply above 6 kilocycles.

The difference frequency or audio signal applied to the grid of the cathode follower section V104B, is equal to, but 180° out of phase with the audio signal on the grid of V104A. The cathode of V104B assumes the same polarity as its grid. Since the cathode of V104A is tied to the cathode of V104B, they have the same polarity. The grid of V104A is of the opposite polarity. Thus when the grid of V104B is negative, the cathodes of V104A and V104B will be negative. The grid of V104A, 180° out of phase with the grid of V104B, is positive. Therefore V104A will amplify the audio signal. The sum frequency undergoes the same process but it is suppressed by filter Z103.

The carrier (or local oscillator) signal, applied to the cathodes of demodulator V103, appears as two equal in-phase signals at the grids of V104A and V104B. The cathode of V104B is at the same polarity as the grid, and the cathode of V104A assumes this polarity. The grid of V104A is at the same polarity as the grid of V104B because of their in-phase application. Therefore it is at the same polarity as the two cathodes. Consequently, the cathode and grid of V104A are at the same potential and polarity which means that there is no current flow at the output of V104A due to the 25-kilocycle signal. Thus the 25-kilocycle signal is effectively eliminated in the AF inverter stage. The output of V104A is applied to the audio amplifier stage V105 through capacitor C115 and audio filter Z103. Filter Z103 also supplies audio voltage to the sideband AGC circuits.

V104A and V104B both draw their plate supply through resistor R121. Resistor R122 is the cathode bias resistor and R123 is the plate load resistor.

c. AUDIO FREQUENCY AMPLIFIER CIRCUIT. *(See Figure 2–5.)*–Audio amplifier V105 is a 6AU6WA pentode. This stage amplifies the audio signal derived from the output of filter Z103. These two elements are coupled by AF Level control R128, a front-panel mounted control which adjusts the amplitude or the volume of the audio at the output of the converter. V105 drives final amplifier V106, a 6AK6W pentode. After amplification by these two stages, the audio signal is suitable for application to external audio devices. The two audio stages are coupled by capacitor C117.

By using degenerative feedback, the output produces an audio signal whose gain is independent of changes in load impedance. A portion of the output at the plate of V106 is fed back to the cathode of V105 through resistor R136 appearing across R130. Capacitor C118 provides a degenerative feedback path for any remaining 25-kilocycle signal components to minimize their effect.

Amplifier V105 draws its plate supply through the network consisting of resistors R125, R126, R127 and R132. This line is filtered of RF currents by capacitors C113B and C116B. Screen supply is obtained through the same network and also through resistor R131. Capacitor C116A is the screen by-pass. The cathode bias is set by the B+ voltage obtained from the drop across resistor R129. Audio output tube V106 also gets its plate and screen supply through the network consisting of resistors R125, R126, R127 and capacitor C113B. R135 is the cathode bias resistor and C113C is the cathode by-pass capacitor.

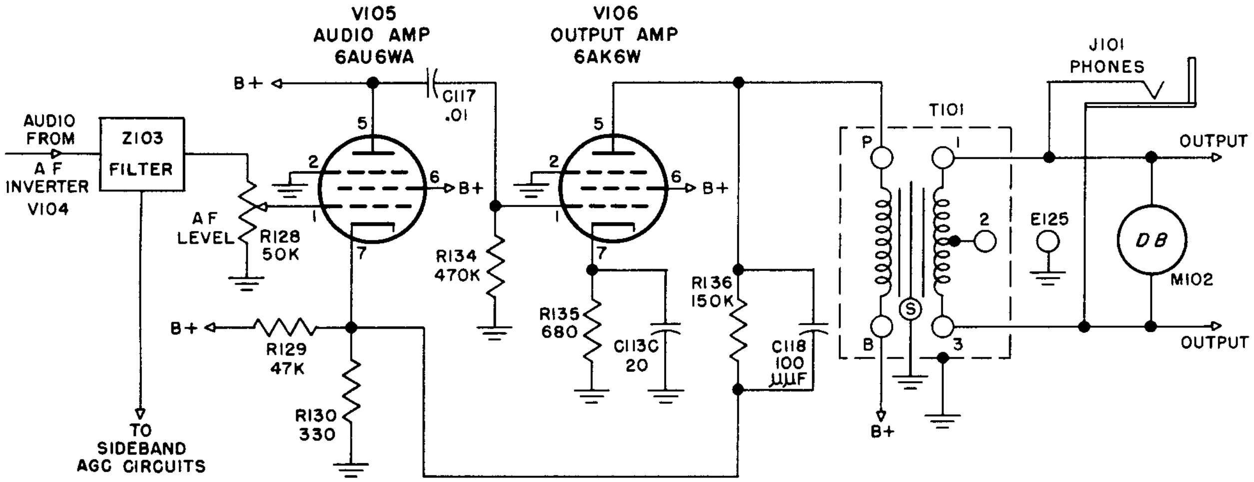


Figure 2–5. Audio Amplifier and Output Circuits, Simplified Schematic Diagram

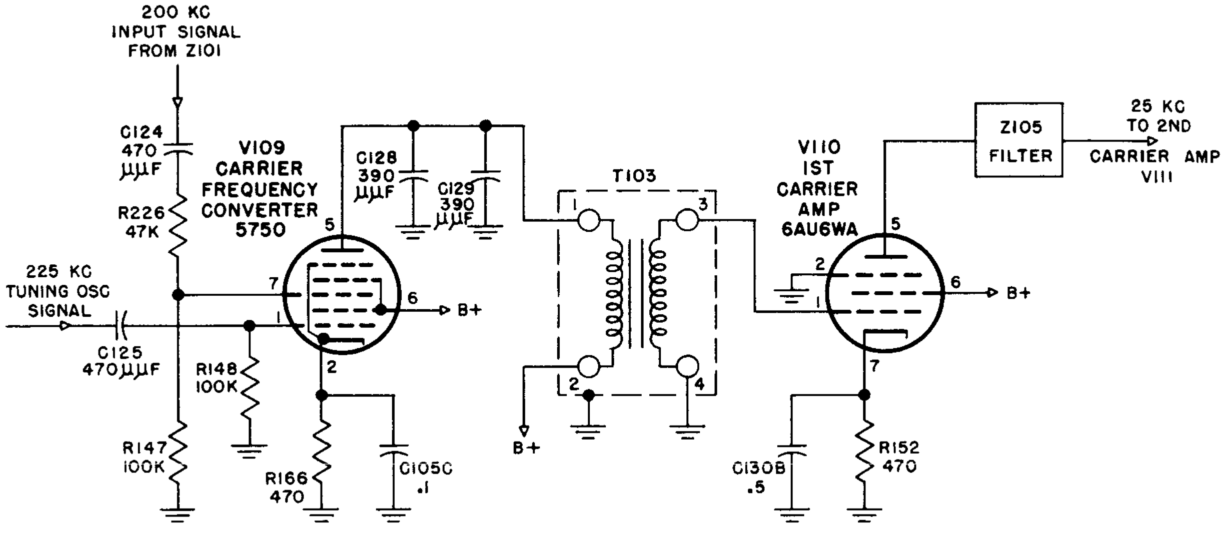


Figure 2–6. Carrier Separation Channel, Simplified Schematic Diagram

The input grid voltage for V106 is developed across resistor R134.

The audio output is fed through transformer T101 and the cable filter assembly to the audio output connector, J403/P403. See Figure 7–9. The output circuit is designed for operation with from one to five 600-ohm loads connected in parallel. Phones jack J101 is connected across output transformer T101 for monitoring and tuning purposes. Meter M102 reads the audio output power level. The meter is calibrated in decibels with respect to one milliwatt into a 600-ohm load. The secondary winding of the output transformer is provided with a center tap. In the event that the terminal equipment attached to the CV-216/URR is not grounded, this center tap should be connected to solder link E125.

d. CARRIER SEPARATION CHANNEL. *(See Figure 2–2.)*—The function of this channel is (1) to convert the carrier of the incoming signal to an intermediate frequency of 25 kilocycles, and (2) to produce, by filtering, a pure carrier signal devoid of sidebands. Included in the carrier separation channel are carrier frequency converter V109, the first carrier amplifier V110 and filter Z105. The 200-kilocycle signal, taken from input filter Z101, is mixed with the tuning oscillator signal in carrier frequency converter V109. The ouput of V109 is amplified in V110 and filtered in Z105. A pure 25-kilocycle signal appears at the output of filter Z105.

(1) CARRIER FREQUENCY CONVERTER V109. *(See Figures 2–6 and 7–7.)*—Carrier frequency converter V109 uses a 5750 pentagrid converter. In this stage, as in the sideband converters, the input signal mixes with the tuning oscillator signal. The 200-kilocycle input at the output of filter Z101 appears at grid 7 of V109 through capacitor C124 and resistor R226. The 225-kilocycle oscillator signal, taken from the output of oscillator amplifier V303B, is injected at grid 1 of V109 through coupling capacitor C125. The output of V109 is coupled to the following stage, the first carrier amplifier V110, through transformer T103. C128 and C129 are fixed tuning capacitors which, in conjunction with the primary of transformer T103, form a tuned circuit resonant for 25 kilocycles. V109 draws its plate and screen supply through the filter network consisting of resistors R149 and R150 and capacitors C126 and 127A. R148 is the grid resistor. R166 is the cathode bias resistor. Capacitor C105C by-passes RF currents from the cathode.

(2) FIRST CARRIER AMPLIFIER V110 AND FILTER Z105.—First carrier amplifier V110, a 6AU6WA pentode, amplifies the output of carrier frequency converter V109. The amplification is necessary in order to offset the appreciable loss of amplitude in the following narrow band pass filter Z105. Z105 is a narrow band-pass filter which effectively filters out the sideband frequency components and other undesired frequencies and transmits a pure carrier signal at 25 kilocycles.

The output of filter Z105 is directly coupled to the second carrier amplifier, V111.

Screen and plate supply for V110 is applied through resistors R153 and R154. The B+ line is filtered by capacitor C130A. R152 is the cathode bias resistor, which is filtered by capacitor C130B.

e. CARRIER RECONDITIONING CIRCUITS *(See Figure 2–2.)*—The output of filter Z105 is applied to the carrier reconditioning circuits, which include second carrier amplifier V111, third carrier amplifier V112, carrier limiter V114 and fourth carrier amplifier V115A. The purpose of these stages is to amplify the carrier to a predetermined level. The reconditioned carrier serves two purposes. First, it is used as a reference signal for the automatic frequency control circuits and secondly, it is used for demodulation with a sideband to obtain audio.

(1) SECOND AND THIRD CARRIER AMPLIFIERS V111 AND V112. *(See Figures 2–7 and 7–7.)*—The output of filter Z105 feeds the 25-kilocycle signal through two stages of amplification, V111 and V112, two 6AU6WA pentodes. The function of these two stages is to amplify the carrier to a predetermined level. Carrier Level control R157 is placed in the cathode circuit of both amplifiers to adjust the carrier signal to full carrier level. A suppressed carrier, having any degree of suppression from a full carrier to 30 db below that of a full carrier, may be boosted to full carrier level. For suppressed carriers, the Carrier Level control is advanced until the carrier level meter M101 reads the desired value.

Plate and screen supply to V111 is fed through resistors R158 and R159. C131B is the RF by-pass capacitor. B+ is applied to the cathode through resistors R124, R155 and R156 which are filtered by capacitor C131A.

The two amplifiers are coupled through transformer T104. Capacitors C133 and C134 are fixed tuning capacitors which, in conjunction with the secondary of transformer T104, form a tuned circuit resonant for 25 kilocycles.

Plate supply to V112 is applied through resistor R164 and the primary of transformer T105. Capacitor C132B is the plate supply filter. Screen supply is applied through resistors R163 and R164. Capacitor C135B is the screen supply filter, R162 is the cathode bias resistor and C135A is the cathode by-pass capacitor.

(2) CARRIER LIMITER V114.—A 5751 twin triode operates as a double-acting limiter to remove amplitude variations from the 25-kilocycle carrier signal

before application to the AFC and demodulation circuits.

The input to the first limiter section emanates from the third carrier amplifier V112 through transformer T105 and capacitor C140. The input signal develops a voltage across R173 which appears at the grid (pin 2) of V114. When the input signal to V114 drives grid 2 in a positive direction, this tube section conducts normally with no limiting. Because of the cathode follower arrangement, the alternating cathode-to-ground voltage across resistor R174 closely follows all the variations in the input signal. Therefore when the grid rises in a positive direction, the cathode also rises in a positive direction. Because of the direct connection, the cathode (pin 8) of the other section of V114 also rises in a positive direction, and eventually cuts this section off eliminating positive peaks of the signal. On negative swings of the input signal, as grid 2 becomes increasingly negative, the first section of the limiter cuts off, whereas the second section conducts normally. Capacitor C141A couples the two sections of the limiter. B+ is supplied to V114 through resistor R176.

(3) FOURTH CARRIER AMPLIFIER V115A.—The output of carrier limiter V114 appears at the grid of fourth carrier amplifier V115A, one section of a 5751 twin triode. The purpose of the fourth carrier amplifier is to amplify the carrier so that it is of proper level to energize the automatic-frequency-control circuits. Also, its ouput is used for demodulation with one sideband in sideband demodulator V103.

The input to V115A is developed across grid resistor R177, the grid voltage being determined by the signal strength. The amplified carrier appears across R180 at the output of V115A. B+ to the fourth carrier amplifier is applied through resistors R121, R181 and R180, and filtered by capacitor C141B.

f. SIDEBAND DEMODULATOR CARRIER INJECTION CIRCUITS. *(See Figure 2–2.)*—The purpose of the carrier injection circuits is to present the carrier

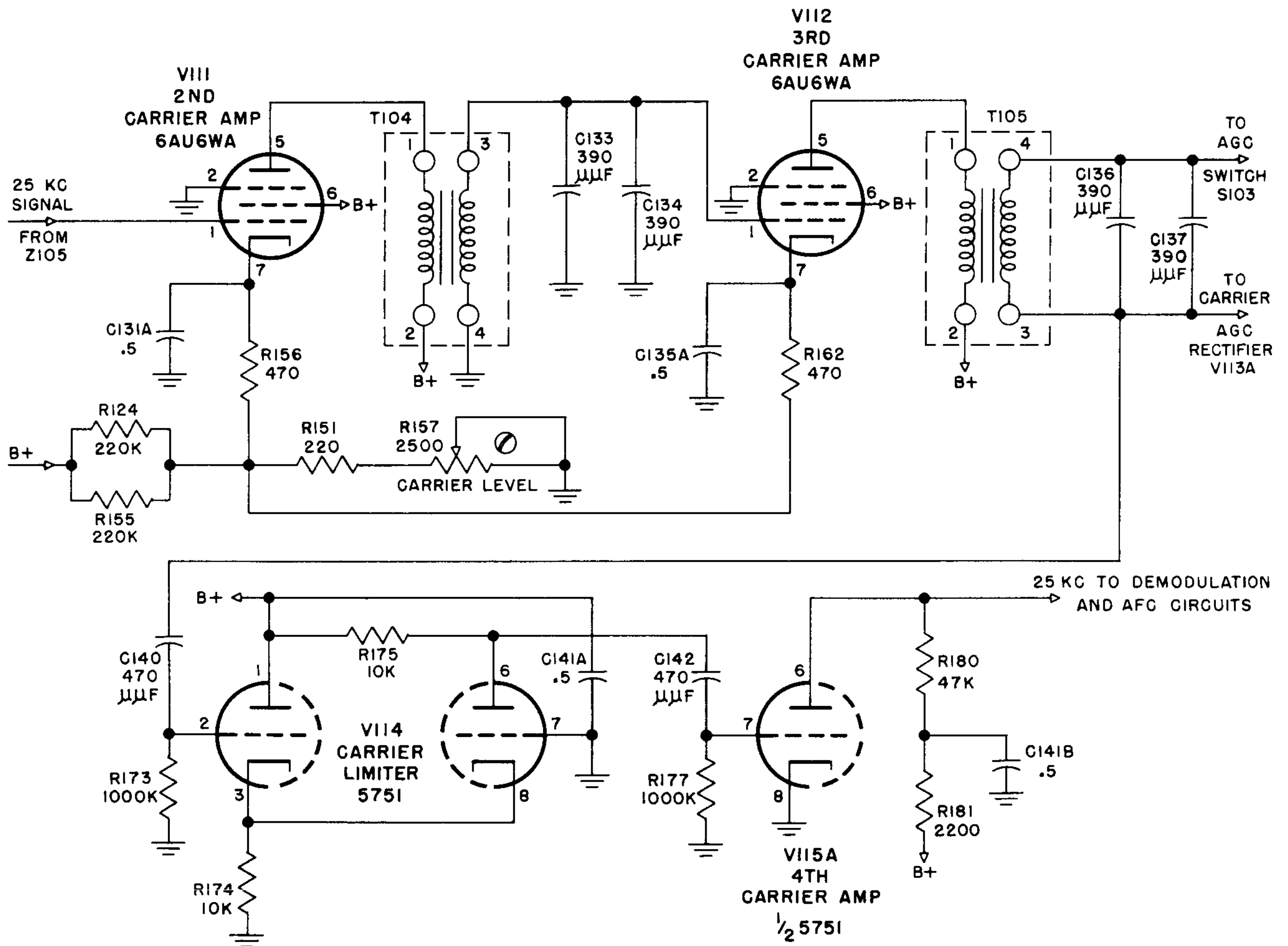


Figure 2–7. Carrier Reconditioning Circuits, Simplified Schematic Diagram

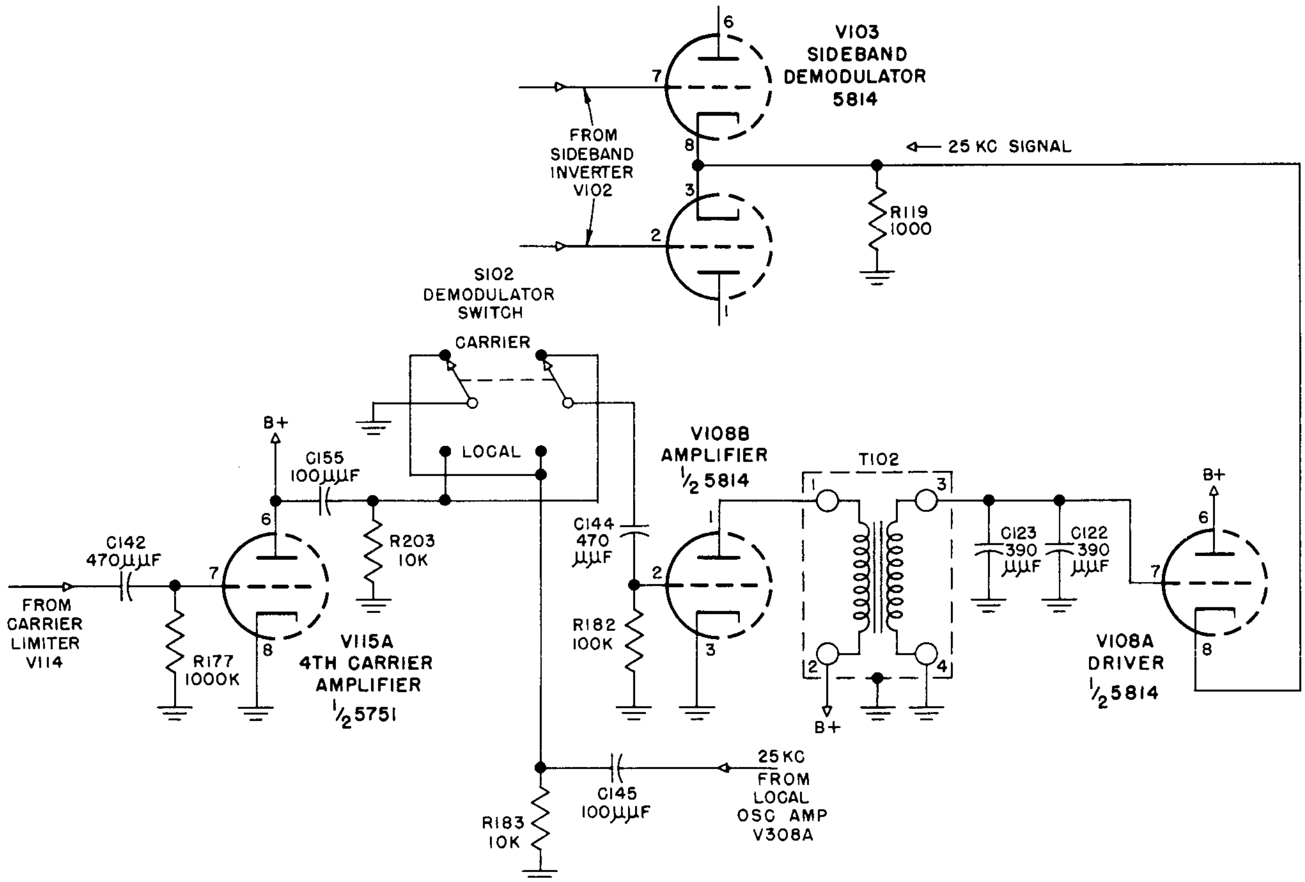


Figure 2–8. Sideband Demodulator Carrier Injection Circuits, Simplified Schematic Diagram

IF signal, or the local oscillator signal, to the sideband demodulator V103 in the proper phase, amplitude and matching impedance. In sideband demodulator V103, the carrier is recombined with one sideband to produce the audio originally transmitted. If the signal carrier is used for demodulation, the circuit to the sideband demodulator emanates from the output of the fourth carrier amplifier V115A, through switch S102, amplifier V108B and driver V108A, to the cathode of V103. Under many conditions the local oscillator is more suitable than the carrier for demodulation. At times, the carrier signal cannot be used because of carrier attenuation beyond 16 db, severe noise conditions, carrier fading, etc. Under these conditions the audio may be unintelligible. Improvement in audio will generally result if the local oscillator supplies the 25-kilocycle signal for demodulation. Selection of the carrier or oscillator signal is made with Demodulator switch S102. The local oscillator signal is applied to sideband demodulator through Demodulator switch S102, amplifier V108B and driver V108A. Capacitor C145 and resistor R183 form a high impedance network to reduce the oscillator signal voltage in order to minimize spurious modulations at switch S102.

(1) AMPLIFIER V108B. *(See Figure 2–8.)*—The purpose of amplifier V108B is to amplify the 25-kilocycle carrier signal or the local oscillator signal, whichever is used for demodulation. Demodulator switch S102 connects the desired signal to the grid of V108B through capacitor C144. V108B uses one section of a 5814 twin triode. Plate voltage is derived through resistor R145 and the primary of transformer T102. Capacitor C121B bypasses RF currents from the B+ line.

(2) DRIVER V108A.—The function of driver V108A is to drive the sideband demodulator by supplying the latter with the 25-kilocycle signal. V108A uses one section of a 5814 twin triode. Transformer T102 couples the output of amplifier V108B to the input of driver V108A. Capacitors C122 and C123 are fixed tuning capacitors which, in conjunction with the secondary of transformer T102, form a tuned circuit resonant for 25-kilocycles. The DC voltage developed across the demodulator cathode resistor R119 keeps the sideband demodulator cut off except during large negative

swings of the injection voltage. During the negative swings, current flows for a short period in the sideband demodulator. These pulses are mixed with the sideband signal to obtain an audio output. The cathode follower arrangement of V108A matches the high impedance of transformer T102 to the low input impedance of sideband demodulator V103.

B+ is supplied to V108A through resistor R144. Capacitor C121A filters RF currents from the B+ line.

g. AGC CIRCUITS. *(See Figure 2–2.)*—The purpose of the AGC circuits is to reduce the gain of the sideband channels on strong signals to prevent overloading of the converter circuits. Also, AGC minimizes the effects of fluctuations in signal strength because of fading. Delayed AGC voltage controls the gain of two sideband converters V101 and V107. This voltage may be obtained from either the sideband channel or from the carrier channel. An AGC switch S103 permits the selection of either source of AGC voltage. AGC voltage from the sideband channel should only be used on signals whose modulation is constant or can maintain a fairly constant average value, such as in multiple-tone keying. For voice, better results will be obtained by using the AGC voltage generated by the carrier channel.

Delayed AGC is made available at pin B of audio output connector P403/J403 for use in the associated communications receiver. If the receiver which supplies the 200-kilocycle input to the CV-216/URR uses a conventional AGC diode, this diode must be disconnected if carrier-attenuated signals are being received.

Non-delayed AGC from the carrier channel controls the operation of the carrier-operated noise silencer V311.

(1) CARRIER AGC. (See Figure 2–9.)—The circuits which produce the carrier AGC voltage include

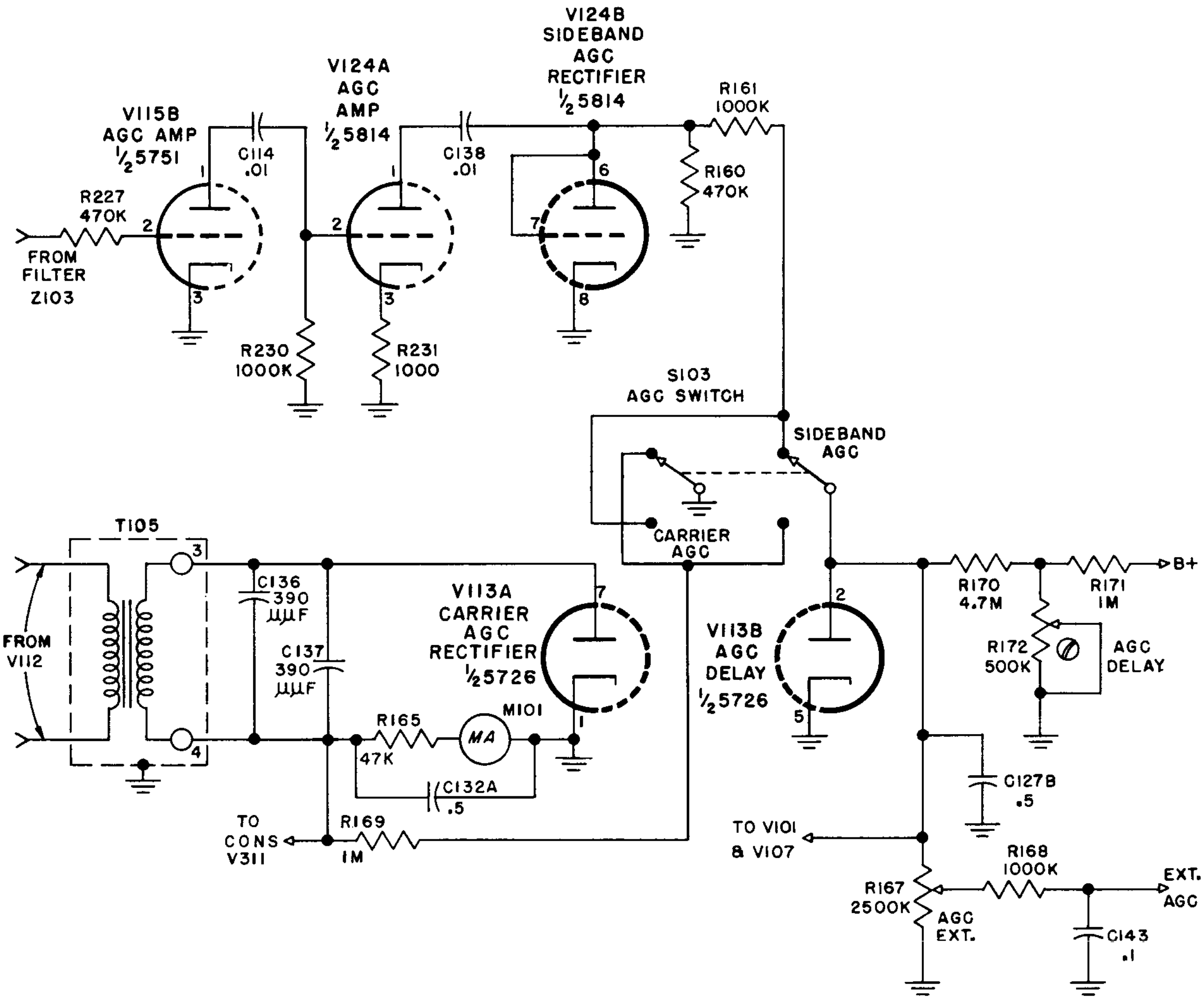


Figure 2–9. AGC Circuits, Simplified Schematic Diagram

AGC rectifier V113A, and the AGC delay diode V113B, twin halves of a 5726 dual diode. The output of the third carrier amplifier V112 feeds a 25-kilocycle signal to AGC diode V113A through transformer T105 and tuning capacitors C136 and C137. On each positive half cycle of the signal voltage, as the plate of AGC diode V113A becomes positive with respect to the cathode, the diode passes current. On negative swings of the input signal the diode does not conduct. Thus, a rectified voltage appears across the diode load resistor R165. Capacitor C132A filters out the variations in the diode ouput, so that a smooth DC voltage appears across R165. The output of V113A feeds the delay diode V113B and also the carrier-operated noise silencer.

The rectified input to delay diode V113B is injected at the plate through resistor R169 and switch S103. The function of diode V113B is to delay the immediate and automatic application of AGC to the sideband frequency converters, V101 and V107. It is important that the full gain potentialities of the converter be available to weak sideband signals, since all of the transmitted intelligence is contained in the sidebands. Therefore, the AGC voltage to the sideband frequency converters is withheld until the input signal reaches a predetermined level. The delay is effected by placing on the plate of the delay diode V113B a B+ voltage through the voltage dividing network consisting of resistors R170, R171, and AGC Delay control R172. Under weak signal conditions, the B+ voltage places a positive charge on the plate of the delay diode. This causes the delay diode to conduct thereby virtually shorting to ground the AGC voltage produced by the carrier AGC rectifier V113A. As the incoming signal increases in magnitude, more AGC voltage is produced by rectifier V113A. The increasing AGC voltage, applied to the plate of the delay diode, drives it increasingly negative until it is sufficiently negative to overcome the positive voltage produced by the B+. The delay diode then ceases to conduct and thus no longer shorts the AGC voltage through rectifier V113B. Instead, the delayed AGC voltage now controls the gain of sideband frequency converters V101 and V107. The amount of delay can be adjusted by AGC Delay control R172.

Another AGC output is obtained from V113A and fed to the carrier-operated-noise-silencer V311 (CONS) through P101. (see paragraph 2j).

Delayed AGC is made available for application to external equipment through AGC EXT. control R167, resistor R168, capacitor C143 and audio output connector J403/P403. The latter is located on the cable filter assembly mounted on the rear of the cabinet. The AGC EXT. control adjusts the level of the AGC voltage available for external use.

(2) SIDEBAND AGC. *(See Figure 2–9.)*—The sideband AGC circuits include AGC amplifier V115B which uses one half of a 5751 twin triode; AGC amplifier V124A which uses one half of a 5814 twin triode; sideband AGC rectifier V124B, diode connected half of a 5814, AGC switch S103 and AGC delay diode V113B described in the previous sub-paragraph. The voltage to be used for sideband AGC is taken from the audio output of filter Z103 through resistor R227. The audio is amplified in the two AGC amplifiers V115B and V124A and rectified in the sideband AGC rectifier V124B. The rectified voltage developed across resistor R160 is then delivered to the plate of the AGC delay diode V113B, through resistor R161 and AGC switch S103. Like the carrier AGC, the sideband AGC is used to control the gain of the two sideband frequency converters, V101 and V107. The application of sideband AGC to the frequency converters is delayed in exactly the same manner as was the carrier AGC, described in the previous subparagraph.

AGC amplifier V115B draws its plate supply through resistor R229. AGC amplifier V124A draws its plate voltage through R232. The two amplifiers are coupled by capacitor C114. Resistors R230 and R231 are the grid and cathode resistors respectively of amplifier V124A. AGC amplifier V124A is coupled to sideband rectifier V124B through capacitor C138.

h. TUNING (225-KC.) OSCILLATOR AUTOMATIC-FREQUENCY-CONTROL CIRCUITS.—The circuits in the tuning oscillator frequency-control system are shown in the block diagram, Figure 2–2, and the simplified schematic diagram, Figure 2–10. The network consisting of capacitors C160, C161, C162, C159, C163, C164 and coil L102 will be referred to in the following description as the "phase-shift network."

The purpose of the tuning oscillator AFC circuits is to correct the tuning oscillator when the 200-kc. input signal drifts from its assigned center frequency or when the tuning oscillator itself tends to drift. The operation of the AFC system is dependent upon the mixing process of the tuning oscillator and the input signal which takes place in carrier frequency converter V109. The mixing (conversion) process produces an IF carrier signal of 25 kc. plus or minus 10 cycles. The carrier IF signal at the output of fourth carrier amplifier V115A is used as the reference frequency for the AFC circuits.

The AFC system operates when the mixing process in carrier frequency converter V109 produces an IF which is not at the center frequency of carrier filter Z105. When the mixing produces the correct IF value, the tuning oscillator AFC circuits function as follows: The output of the fourth carrier amplifier V115A supplies the carrier IF signal (at or near 25 kc.) to phase inverter V121A. The phase inverter produces two signals 180° out of phase and at the same carrier IF. This double-ended signal is applied to the grids of phase comparator V122. A signal 90° out of phase with the plate and cathode of the phase inverter V121A, is taken off at the junction of capacitor C167 and resistor R214. This signal is passed through the phase-shift circuit consisting of amplifier V120, the phase-shift network and driver V121B and finally applied to the cathode of the phase comparator V122. As long as this signal is at the resonant frequency of the phase-shift network, no phase-shift will take place. Therefore, the 90° phase relation in phase comparator V122 between the signals on the grids and the signal at the cathode is maintained. Under this condition, the output of the phase comparator is balanced. Equal voltages are applied to the plates of DC restorer V123. The equal output currents of the DC restorer flowing in opposite directions in resistor R225 cancel and the voltage between points A and B will be zero. Therefore, when the correct IF is being produced, no correcting voltage is made available to the oscillator tuning motor B301.

If either the tuning oscillator signal or the 200-kc. input signal should shift, the mixing process in the carrier frequency converter V109 produces a carrier IF signal which is above or below the resonant frequency of the phase-shift network. When the signal taken off at the junction of capacitor C167 and resistor R214 is applied to the phase-shift network a phase shift occurs. Therefore the signal at the cathode of the phase comparator is no longer 90° out of phase with the signals on its grids. This causes unequal conduction in the phase comparator producing a DC voltage between points A and B. Motor B301 is energized by this voltage and rotates capacitor C309 in the oscillator tuning circuit. The oscillator frequency is corrected by this operation to the proper mixing frequency which will produce the correct carrier IF. When this frequency is reached, no phase shift will take place in the phase-shift network. The voltage at A and B will be zero and the motor will stop.

The following is a step-by-step summary of the tuning oscillator AFC circuit when operating to correct the oscillator frequency. Refer to block diagram, Figure 2–2.

(1) The tuning oscillator and the 200-kc. input signal mix in carrier converter V109 and produce an (incorrect) carrier IF.

(2) After passing through the carrier channel (V109-V115A) the IF is applied to phase inverter V121A.

(3) The phase inverter produces two carrier IF signals 180° out of phase. These two signals are applied to the grids of phase comparator V122.

(4) A third signal at the output of the phase inverter, 90° out of phase with the other two signals, is applied to the phase-shift circuit.

(5) Since this signal is not at the proper IF (the resonant frequency of the network), a phase-shift occurs.

(6) This signal, applied to the common cathode of the phase comparator, is now no longer 90° out of phase with the signals on the grids. An unbalanced output at V122 is produced.

(7) The resultant voltage is ultimately applied to tuning motor B301 which changes the oscillator frequency by rotating capacitor C309 in the oscillator tuning circuit.

(8) When the proper mixing frequency is produced, the correct IF will be applied to the phase-shift network. No phase-shift will occur and the output of the phase comparator will not produce a resultant voltage. Consequently, the motor will stop.

The direction in which motor B301 will turn depends upon whether the incorrect IF is above or below the resonant frequency of the phase-shift network. The latter determines which sections of V122 and V123 conduct the heaviest. The polarity of the voltage at A and B depends upon which section of V123 conducts the heaviest. Also, the magnitude of the voltage at A and B depends upon the amount of phase shift. If the IF and the resonant frequency differ very little, the phase-shift will be small and the corrective voltage applied to the motor very little. This follows since the motor needs to tune the oscillator by a small amount to correct a small phase-shift. If the difference between the IF and the resonant frequency is great, the phase-shift will be larger. This will produce a greater corrective voltage sufficient for motor B301 to rotate capacitor C309 to the right position.

The resonant frequency of the phase-shift network may be varied by means of AFC adjust control C163. When this control is varied the motor will automatically shift the oscillator frequency so that the conversion process will produce an IF of the new resonant frequency.

The voltage appearing at the output of DC restorer V123 is applied to the motor through servo amplifiers V301 and V302. See Figure 2–13. If this voltage is zero the conduction in the two sections of both servo amplifiers V301 and V302 will be equal. Both amplifiers produce a pulsating current by virtue of the 60 cycle AC supply of 300 volts applied to the plates of V301 and V302. The pulsating current, flowing through transformer T301 will be equal on both sides of the center tap, resulting in the complete cancellation of all magnetic effects. Therefore, if there is zero voltage at the output of DC restorer V123, motor B301 will not turn.

As soon as deviations occur in the carrier IF, the output voltage of DC restorer V123 is one polarity, A is negative and B is positive or vice versa, and this voltage is applied to the grids of servo amplifier V301. Each grid is now at opposite polarity, causing one section of V301 to conduct more than the other. The unequal outputs of V301, applied to the grids of V302, cause unequal conduction to take place in V302. As a result, unequal currents will flow in the two sections of the primary of transformer T301. The resulting induced voltage will cause motor B301 to turn and tune the oscillator until the voltage output at the DC restorer is zero.

The direction in which the motor rotates depends upon which section of servo amplifier V302 is conducting the most. As explained above, the direction of the frequency shift of the carrier IF (above or below center frequency) determines the polarity of the voltage at the DC restorer (V123) output. The polarity of the voltage, in turn, determines which sections of the servo amplifiers conduct the most.

Resistor R303 and capacitor C302 constitute an anti-hunt circuit which prevents large voltage changes from being applied directly to the motor. The anti-hunt circuit permits large changes in voltage at the DC restorer output to be applied to motor B301 at a relatively slow rate. Without the anti-hunt circuit, if a voltage suddenly appeared at the output of V123, the torque delivered by this voltage would cause the motor to accelerate rapidly, causing the voltage to be reduced toward zero. But at the zero point the motor would continue to turn because of momentum, again tuning the oscillator off the proper frequency and causing a voltage of the opposite polarity to appear at the output of DC restorer V123. This voltage would stop the motor and send it speeding in the opposite direction with the same result. The motor would continue to oscillate back and forth or "hunt" like this indefinitely. The anti-hunt circuit prevents sudden voltage changes at the output of DC restorer V123 to be fed to the motor directly in order to minimize "hunting".

The motor may be rotated in either direction by means of the Motor Run switch S303. If the switch is thrown, for example, to the RIGHT position, the grid-cathode circuit of one section of servo amplifier V302 will be shorted. This will cause one section of V302 to conduct more than the other section and produce unequal currents flowing in the two parts of the primary of transformer T301. The resultant current will produce an induced voltage in the secondary, thus activating motor B301. The motor will rotate tuning capacitor C309 in the tuning oscillator circuit in a clockwise direction, as viewed through the glass window on the left side of the lower front panel. See Figure 4–2. If the switch is thrown to the LEFT position, the grid-cathode circuit of the other section of servo amplifier V302 is shorted and capacitor C309 will rotate in a counterclockwise direction. With the switch in the LOCK position, the motor control circuit is in its normal operating condition. The input to the first servo amplifier V301 is also shorted when switch S303 is in the RIGHT or LEFT position in order to prevent the anti-hunt capacitor from accumulating a charge which would rotate the motor from the desired resting place after switch S303 is thrown to the LOCK position.

Motors switch S302, through which the 115 volt supply is fed to one of the field coils of both AFC motors, also shorts the input leads of V301 when in the OFF position. This switch should be in the OFF position during the warm-up period and also during the tuning of the attached receiver, for at such times, voltages appear at the input of V301 and V305 and cause both AFC motors to turn. Also, during the tuning process these voltages charge the anti-hunt circuits and the charge, retained by the capacitors C302 and C315, would activate the motors even after the tuning has been completed.

(1) PHASE INVERTER V121A. *(See Figure 2–10.)*– Phase inverter V121A uses one section of a 5814 twin triode. The principle of operation of V121A is the same as that of sideband inverter V102. Its function is to split the 25-kc. carrier signal into two signals 180° out of phase for application to the grids of phase comparator V122 which operates in push-pull.

The input of phase inverter V121A is taken from fourth carrier amplifier V115A through coupling capacitor C165. The output is applied to phase comparator V122 through capacitors C168 and C169. One signal is taken off the plate of V121A and the other off the cathode. The voltage drops across equal resistors R219 and R220 are equal, producing equal voltages at the grids of phase comparator V122.

Another signal, 90° out of phase with the other two, is tapped off at the junction of resistor R214 and capacitor C167. This signal after passing through the phase-shift circuit, is applied to the cathode of phase comparator V122.

B+ is supplied to V121A through resistors R215 and R216 and is filtered by capacitor C166B. Resistors R209 and R218 are the grid and cathode bias resistors, respectively.

(2) PHASE COMPARATOR V122.–The function of phase comparator V122 is to detect phase differences between the signals on its grids and the signal on its cathodes.

The input to phase comparator consists of three signals. They are:

(a) The signal taken off at the plate of phase inverter V121A and applied to one grid (pin 2) of the phase comparator.

(b) The signal taken off at the cathode of V121A

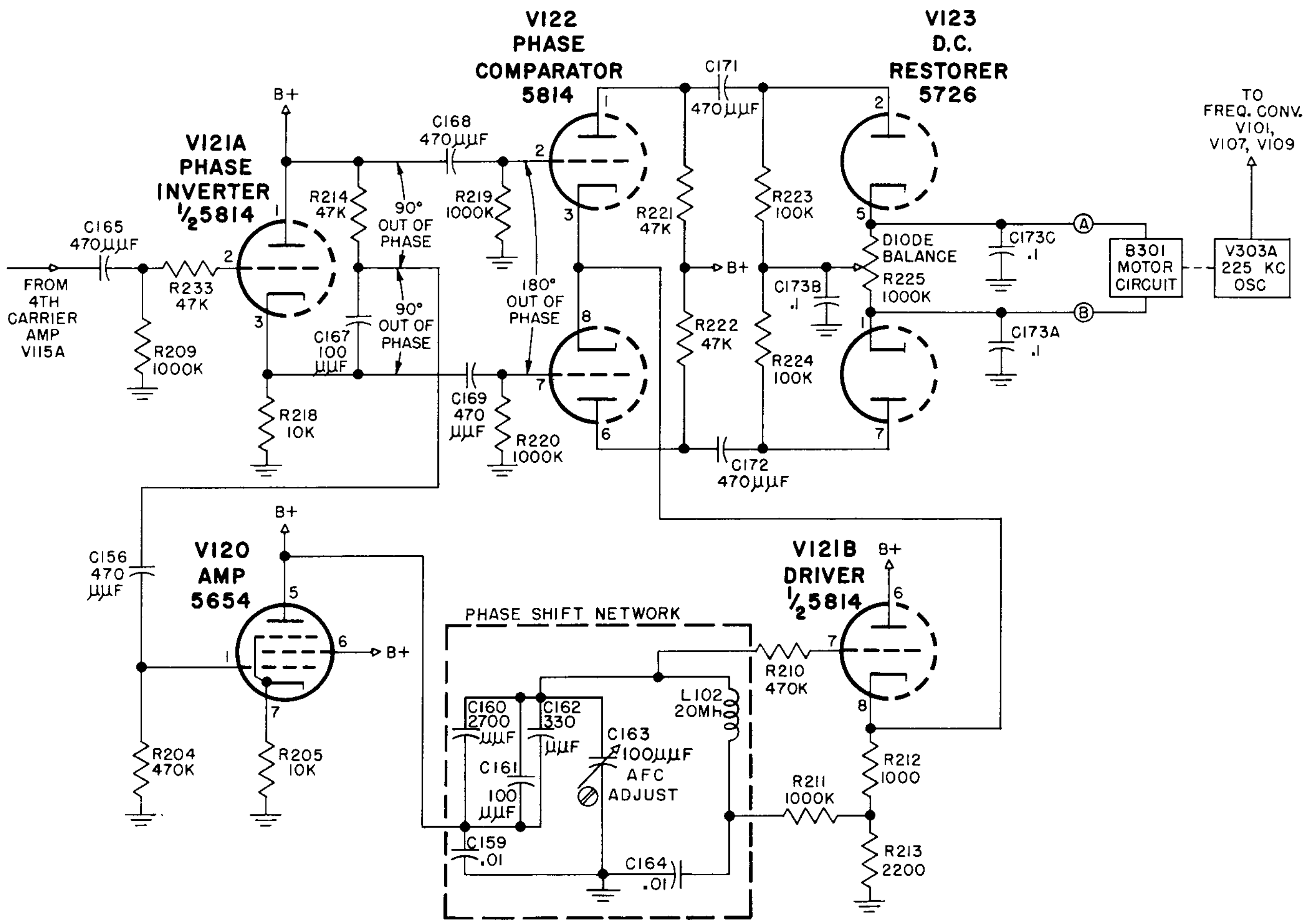


Figure 2-10. Tuning (225-Kc.) Oscillator AFC Circuits, Simplified Schematic Diagram

and applied to the other grid (pin 7) of the phase comparator. This signal is 180° out of phase with the signal on the first grid (pin 2).

(c) The signal taken off at the junction of resistor R214 and capacitor C167. This signal is 90° out of phase with the other two signals. It is passed through the phase shift circuit and applied to the common cathode connector (pins 3 and 8) of the phase comparator.

The signal at the cathodes is applied as pulses from driver V121B in the phase-shift circuit. Conduction takes place in the phase comparator only on strong negative pulses. If these pulses are 90° out of phase with the signals on the grids both sections of the phase comparator will conduct equally. The shaded area on Figure 2-11 (a) shows graphically the equal pulses of plate current flow when the grid and cathode signals have a 90° phase difference. The equal voltages developed across resistors R223 and R224 will cause the two sections of DC restorer V123 to conduct equally. The resultant voltage between points A and B(Figure 2-10) will be zero.

Figure 2-11 (b) shows graphically the relative magnitudes of the plate current flow in an example when the cathode signal is at a phase difference of other than 90°. One section of the phase comparator will conduct more than the other. The unequal voltages across resistors R223 and R224 will cause unequal conduction in the two sections of the DC restorer. Motor B301 will be activated by the resultant voltage appearing at the output of DC restorer V123.

The polarity of the voltage at A and B depends upon the direction (above or below 90°) of the phase shift. The polarity of the voltage at A and B determines the direction in which motor B301 will turn. The magnitude of the voltage is determined by the amount of phase shift above or below 90°.

B+ is applied to the plates of V122 through resistors R221 and R222.

(3) THE PHASE SHIFT CIRCUIT. *(See Figure 2-10.)*—The phase-shift circuit comprises amplifier V120; the phase-shift network, consisting of capacitors

C159, C160, C161, C162, C163 and C164 and coil L102; and driver V121B. The input of V120 is taken off at the junction of capacitor C167 and resistor R214 (90^o out of phase with both cathode and plate outputs of V121A) and is fed to V120 through capacitor C156. V120 is a 5654 pentode that couples the output of phase inverter V121A to the succeeding stages. V120 amplifies and passes the signal on to the phase shift network. As long as the signal passing through the phase shift network is at the resonant frequency of the network, no phase shift of the signal occurs. If the signal is off resonance, a phase shift takes place and is introduced into the cathodes of phase comparator V122. The resonant frequency of the phase shift network may be varied by means of the AFC Adjust control C163. When this control is varied, the following sequence of operations takes place:

At the instant the control is varied, the resonant frequency of the phase shift circuit changes to a value different than the carrier signal at the output of the carrier filter Z105. Therefore, the phase relations in phase comparator V122 will be upset as explained above. As a result a voltage appears between points A and B and activates motor B301, which rotates capacitor C309 until the oscillator frequency is at a value which, when mixed with the input signal, produces an IF with the same frequency as the phase shift network. At that instant the signals on the grids and the signal on the cathode of phase comparator V122 have the same frequency and a 90^o phase difference. Therefore no voltage appears between points A and B to activate motor B301. The AFC circuits remain inactive as long as the carrier IF signal has this same frequency set by the AFC Adjust control. The AFC circuits correct the oscillator if any other value is produced. This control should be adjusted so that the resonant frequency of the phase shift network corresponds to the frequency which carrier filter Z105 will most readily pass. A peak reading on Carrier Level meter indicates the correct position of the AFC Adjust control.

Extreme care should be used in adjusting this control. When this control is turned too far in either direction, the motor rotates the oscillator tuning capacitor C309 to an extreme position which makes the oscillator frequency unsuitable for mixing. An extreme

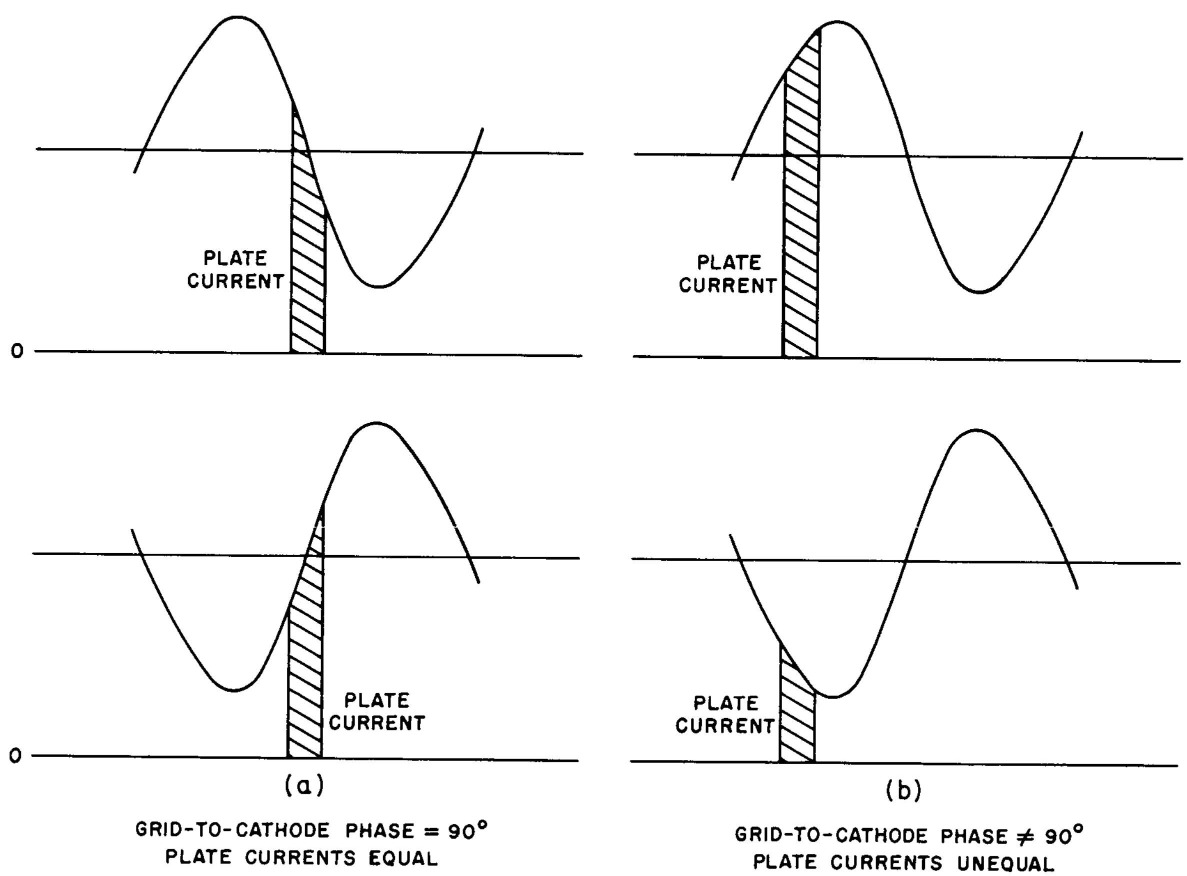


Figure 2–11. Diagram of Plate Current Flow in Phase Comparator V122

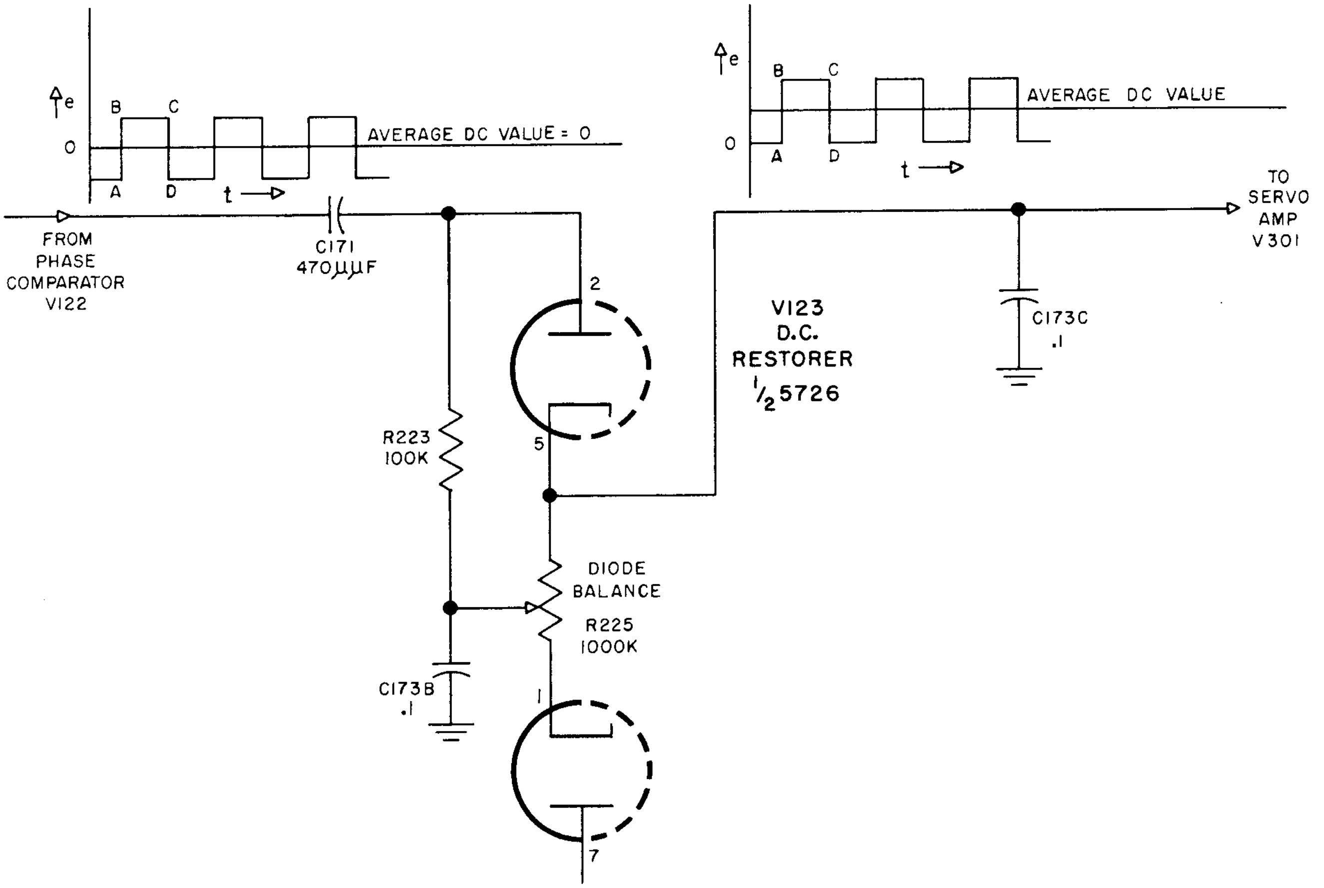


Figure 2–12. DC Restorer V123, Simplified Schematic Diagram

excursion of oscillator frequency will result in an IF which carrier filter Z105 will not pass. In that case, no carrier signal is available either for demodulation or AFC purposes.

Driver V121B, which applies pulses to phase comparator V122, is contained in one section of a 5814 twin-triode. Its cathode follower arrangement matches the output impedance of the phase-shift-network to the cathode input impedance of phase comparator V122.

Plate voltage for amplifier V120 is applied through resistors R207 and R208 and is filtered by capacitor C157B. Screen supply is applied through resistors R206 and R208 and is filtered by capacitors C157A and C157B. R204 and R205 are the grid and cathode bias resistors, respectively.

Plate voltage for driver V121B is supplied through resistor R217 and is filtered by capacitor C166A. R211 furnishes the DC bias for the grid of V121B.

(4) DC RESTORER V123. *(See Figure 2–12.)*—The output of phase comparator V122 is applied to DC restorer V123, a 5726 twin-diode. The function of the DC restorer is to establish the DC value of the output pulses of phase comparator V122.

The output of phase comparator V122, passing through C171 and C172, takes on a wave form symmetrical around a zero level. The DC restorer produces a DC level proportional to the peak value of the signal pulses at the output of the phase comparator.

The DC restorer or clamping circuit establishes the DC value in the following manner: The pulses at the output of one section of phase comparator V122, resembling roughly a square wave, is passed through capacitor C171. This process ordinarily would pass only the AC components of the wave. At point A the conduction of V123 is at a minimum. As the voltage rises in a positive direction from A to B, one diode conducts heavily until point B is reached. As the peak voltage of the pulse drops from C to D the conduction reduces and reaches a minimum of D. Thus, the bottoms of the wave are "clamped" to a value of zero volts and the average value of the coupled wave is above the zero level. The output at the plate is of the same shape as the input voltage.

This process is the same for the wave passed through capacitor C172 and applied to the other diode section. If the conduction in each diode section is identical, the resultant voltage across R225 is zero. If the conduction in each diode section is not the same, a resultant voltage is developed across resistor R225 and applied to the motor circuits. Capacitors C173A and C173C integrate the pulses into a smooth average DC. The magnitude of this DC will vary proportionally to the amount of phase shift between the signals in phase comparator V123.

Diode Balance control R225 is adjustable in order to balance the two sections of the DC restorer V123 for zero output when no AFC correction is needed.

(5) SERVO AMPLIFIERS, V301 AND V302. *(See Figures 2–13 and 7–8.)*—DC restorer V123 is coupled to servo amplifier V301, a 5751 twin triode, which functions as a voltage amplifier. Servo amplifier V302, a 5814 twin triode, is used as a power amplifier and feeds one field coil of motor B301 through transformer T301.

With no input signal from DC restorer V123, both sections of V301 and V302 will conduct equally producing equal and cancelling currents on both sides of the center tap of the primary of transformer T301. Both tubes are energized by the 300-volt 60 cycle AC plate supply brought through the center tap of transformer T301. A DC voltage appearing at the input of V301 will upset the balanced circuit since the two grids will then be of opposite polarity. The resultant current of the two unequal currents flowing in the primary of transformer T301 will produce a voltage in the secondary, thus activating motor B301.

The motor circuit may be balanced by shorting the input leads (Motors switch S302 in OFF position) and adjusting Motor Balance control R307 for a null in a set of headphones or for a null reading on an AC voltmeter either of which may be plugged into Motor Indicator jack J301. Resistor R308 isolates the jack from the motor control circuit so that insertion of test equipment will not disturb the operation of the motor.

Capacitor C304 forms a tuned circuit for 60 cycles with the primary of T301 and presents a high impedance to radio frequencies. Capacitor C305 is a radio frequency by-pass capacitor. R306 and R331 are the cathode bias resistors for servo amplifiers V301 and V302, respectively.

(6) MOTOR B301.—Motor B301 is a two-phase drag-cup motor operated at 115 volts AC at 60 cycles. One field coil is fed 115 volts from the alternating current line. Capacitors C317A and C318A in one side of the line produce the necessary 90° phase shift between the coils for operation of the motor. The other

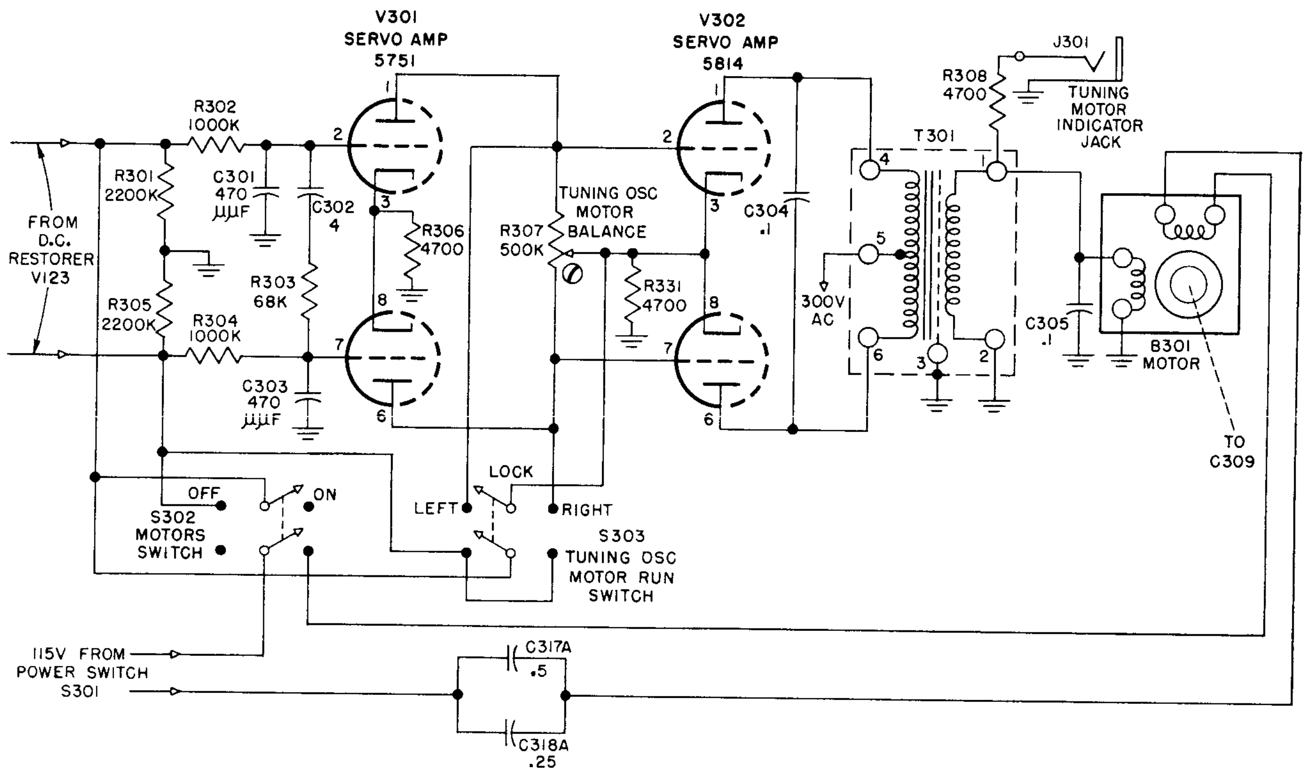


Figure 2–13. Servo Amplifiers V301 and V302 and Motor B301, Simplified Schematic Diagram

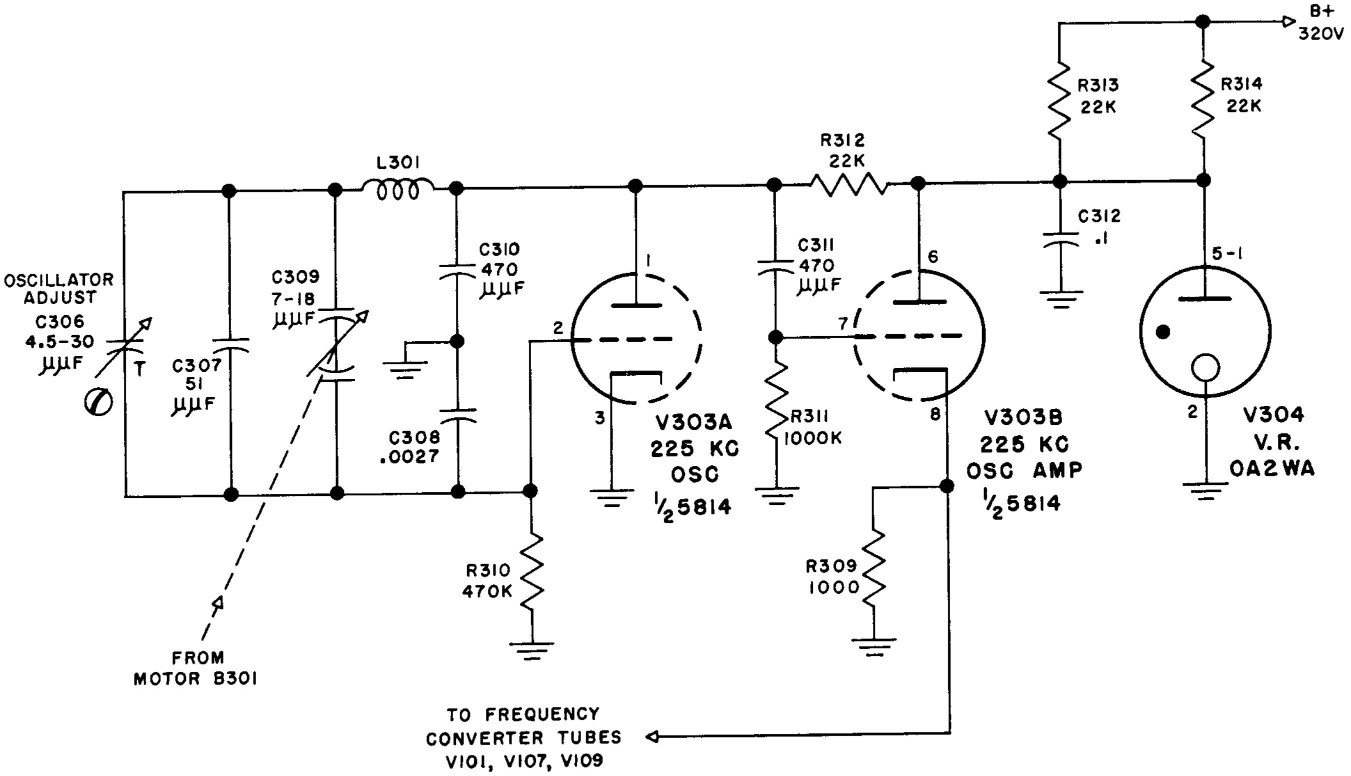


Figure 2–14. Tuning (225-Kc.) Oscillator V303A and Oscillator Amplifier V303B, Simplified Schematic Diagram

coil is energized if a voltage appears at the secondary of transformer T301. The motor may be rotated in either direction by means of Motor Run switch S303.

The motor, when activated, varies the capacity of C309 in the tuning (225-kc.) oscillator circuit. Coupling to C309 is accomplished by mechanically mated gears on the motor shaft and capacitor shaft.

(7) TUNING (225-KC.) OSCILLATOR V303A AND AMPLIFIER V303B. *(See Figure 2–14.)*—Oscillator V303A utilizes one section of a 5814 twin triode. The oscillator tuning circuit is composed of coil L301, tuning capacitor C309 and capacitors C306, C307, C308 and C310 in a series tuned Colpitts circuit. The voltage drop across capacitors C308 and C310 establish feedback and phase reversal necessary for oscillator operation. Capacitor C307 has a negative temerature-capacitance characteristic to compensate for temperature changes in the oscillator circuit. Tuning Oscillator Adjust control C306 is the oscillator trimmer capacitor.

The tuning oscillator signal is fed to the three frequency converters V101, V107 and V109 through oscillator amplifier V303B which uses the other section of the 5814 tube. V303A is coupled to V303B through capacitor C311. V303B functions as a cathode follower to match the impedance of the oscillator circuit to the impedance of the conversion stages.

The plate supply is maintained at a constant level by the OA2WA voltage regulator tube V304.

R312 is the plate-dropping resistor and R310 is the grid bias resistor for oscillator V303A. R309 is the cathode bias resistor and R311 is the grid bias resistor for oscillator amplifier V303B.

i. THE LOCAL (25-KC.) OSCILLATOR AUTOMATIC-FREQUENCY-CONTROL CIRCUITS *(See Figures 2–2, 7–7 and 7–8.)*—The function of the local oscillator AFC circuits is to maintain the local oscillator at the same frequency as the input IF carrier which appears at the output of fourth carrier amplifier V115A. In single sideband reception, if the local oscillator is used instead of the carrier signal for demodulation, it is essential that the oscillator have the same frequency or very nearly the same frequency as the carrier in order to faithfully reproduce the original intelligence. The local oscillator AFC system in this equipment is designed to keep the local oscillator frequency within ±1 cycle of the carrier frequency.

The elements of the local oscillator AFC circuits are shown in the simplified schematic diagram, Figure 2–15. Essentially, the circuit compares the input IF carrier (25-kc.) with the local oscillator signal. If the two are not identical within ±1 cycle, the oscillator frequency is corrected by means of reactance tube V308B, which introduces reactance into the oscillator tuning circuits and changes the oscillator frequency to the correct value. The motor control circuit then physically tunes the oscillator so that it will oscillate at the correct frequency without the use of the reactance tube.

The carrier signal, at or near 25 kc., is applied from the output of fourth carrier amplifier V115A to phase inverter V116A, which produces two signals 180° out of phase for application to the grids of phase comparator V117. The oscillator signal from local oscillator V307 is fed to the cathodes of the phase comparator through oscillator amplifier V308A and driver V116B. With no AFC correction needed, the carrier frequency and the oscillator frequency are the same and they are 90° out of phase. The two sections of the phase comparator conduct equally and apply equal voltages to the plates of the D.C. restorer, V118. The equal voltages cause the two sections of V118 to conduct equally and the rectified voltages across each side of the center tap of resistor R198 cancel. Thus, when the oscillator and carrier frequencies are the same and at a 90° phase difference, no resultant voltage appears at A and B.

On the other hand, if the oscillator and carrier frequencies are not the same, the two signals mix in phase comparator V117, producing an audio voltage at A and B. The frequency of this voltage is the difference between the oscillator and carrier frequencies. The audio signal applied to the grids of reactance modulator V308B, causes the latter to introduce into the oscillator tuning circuit varying values of capacity and produce varying values of oscillator frequency. At one instant the varying oscillator signal has the same frequency as the carrier. At this point they lock in the phase comparator V117 at a random phase difference. As the oscillator frequency approaches the carrier IF, the audio frequency reduces and at the lock-in instant a pure DC remains on the grid of the reactance modulator. The DC is produced by the phase difference in the phase comparator. Its magnitude is exactly sufficient for the operation of the reactance modulator to keep the oscillator frequency locked to the carrier IF. At the same time however, motor B302 is activated by this phase-difference voltage and rotates capacitor C325 in the oscillator tuning circuit. When the oscillator signal, at the cathode of the phase comparator, is at the correct phase difference (90°) with the signals on the grids, the voltage at A and B becomes zero. Therefore, the voltage on the grid of the reactance modulator also becomes zero and the motor will stop. At this point the resonant frequency of the oscillator circuit is at the same frequency as the carrier IF and at a 90° phase difference without the correcting influence of the reactance modulator.

The following is a step-by-step summary of the local oscillator AFC circuit when operating to correct the local oscillator.

(1) The carrier IF signal at the fourth carrier amplifier V115A is applied to phase inverter V116A.

(2) The phase inverter V116A produces two signals 180° out of phase for application to the grids of phase comparator V117.

(3) The local oscillator signal is applied to the common cathode of the phase comparator. We will assume that the oscillator signal has shifted to an incorrect frequency.

(4) Since the oscillator frequency is not at the same frequency as the carrier and consequently not at the proper phase difference, an unbalanced output of the phase comparator will result.

(5) A resultant audio voltage is produced at the output of the DC restorer and is applied to the grid of reactance modulator V303B.

(6) The reactance modulator changes the oscillator frequency by virtually "inserting" varying amounts of capacity into the oscillator tuning circuit. When the oscillator and carrier frequency are the same they lock in phase comparator V117 at some phase difference.

(7) At this point the audio voltage on the grid of the reactance modulator reduces to a pure DC. The magnitude of this DC voltage is proportional to the amount of phase difference between the carrier IF and the oscillator signal. Its magnitude is exactly the value necessary for the operation of the reactance modulator to keep the two frequencies locked.

(8) The phase-difference voltage is also fed to the motor circuit. The motor, activated by this voltage, rotates capacitor C325 in the oscillator tuning circuit until the oscillator and carrier IF signals are at the proper phase relation (90°) in phase comparator V117.

(9) As the phase difference approaches the correct value, the voltage on the grid of the reactance modulator reduces toward zero. When the proper phase relation is obtained the voltage will be zero and the motor will stop.

The voltage appearing at the output of the DC restorer is applied to motor B302 through the motor control circuit consisting of servo amplifiers V305 and V306. These amplifiers have exactly the same function and operate in the same manner as the servo amplifiers in the tuning oscillator AFC motor control circuit. See paragraph 2h(5), this section. The anti-hunt network for the local oscillator motor control circuit consists of capacitor C315 and resistor R317.

The motor may be rotated in one direction only by means of Motor Run switch S306. When S306 is in the RUN position the grid and cathode in one section of servo amplifier V306 are grounded, causing this section to conduct heavily. Unequal currents flow on each side of the center tap of the primary of transformer T302 and the net current produces a voltage in the secondary to rotate motor B302.

In the HOLD position the motor control leads and the reactance tube leads are grounded. In this position the motor cannot be activated and no AFC is available to the local oscillator. With S306 in the LOCK position the servo amplifier circuit is in its normal operating condition. The power to motor B302 may be turned on or off by means of the Local Oscillator Motor switch S304. Motors switch S302 turns both AFC motors on or off.

The following sub-paragraphs describe the individual stages in the local oscillator AFC circuits.

(1) PHASE INVERTER V116A. *(See Figure 2–15.)* –The operation of phase inverter V116A is exactly as described in paragraph 2h(1), Section 2 for phase inverter V121A. Phase inverter V116A utilizes one section of a 5814 twin triode. The two voltages 180° out of phase, are produced for the push-pull operation of phase comparator V117. The output voltage at the cathode of phase inverter V116A is applied to one grid of V117 and the output of V116A at the plate is applied to the other grid of V117. Equal voltages are developed across R191 and R193 and are 180° out of phase when applied to the grids of the phase comparator V117.

B+ voltage is applied through resistors R189 and R190 and is filtered by capacitor C146A. The two stages, V116A and V117, are coupled by capacitors C147 and C148. R192 is the cathode bias resistor for V116A.

(2) PHASE COMPARATOR V117.–Phase comparator V117 is a 5814 dual triode. Its function is to detect phase differences between the signals on its grids (carrier IF) and the signal on its cathodes (local oscillator).

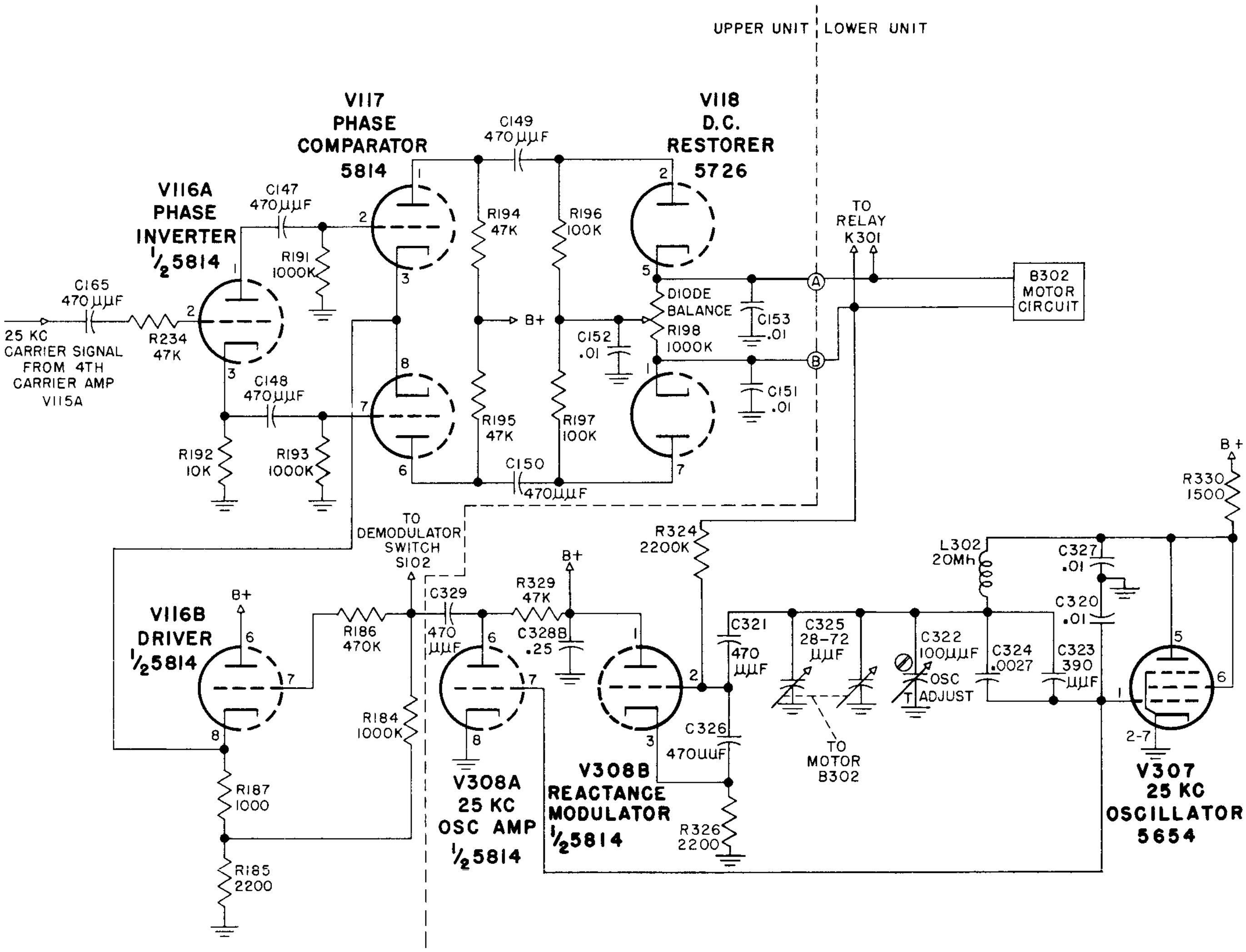


Figure 2–15. Local (25-Kc.) Oscillator AFC Circuits, Simplified Schematic Diagram

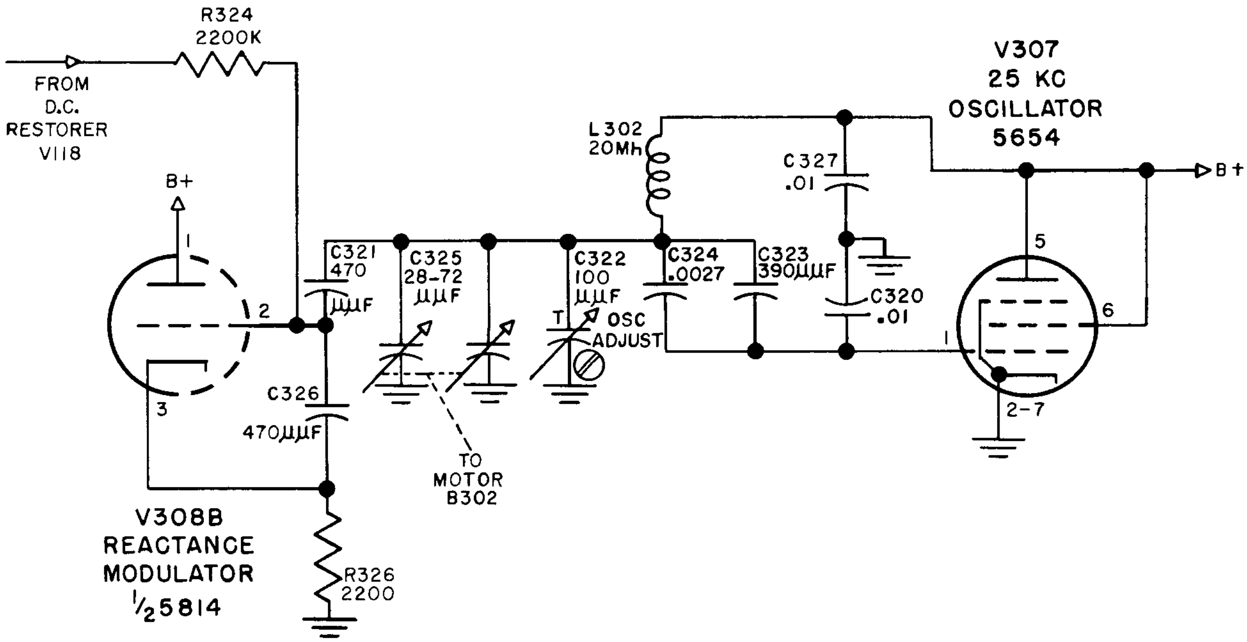


Figure 2–16. Reactance Modulator V308B and Oscillator V307, Simplified Schematic Diagram

The input to the phase comparator consists of three signals:

(a) The signal taken off the plate of phase inverter V116A and applied to one grid (pin 2) of the phase comparator V117.

(b) The signal taken off the cathode of the phase inverter applied to the other grid (pin 7) of the phase comparator. The signal on pin 7 is 180° out of phase with the signal on pin 2.

(c) The local oscillator signal is applied through amplifier V308A and driver V116B to the cathode of the phase comparator V117. This signal is 90° out of phase with the other two signals.

If the oscillator signal is at the same frequency as the carrier IF on the grids and has a 90° phase difference with the carrier IF, the output of the phase comparator is balanced. If the oscillator frequency and the carrier IF are not the same, the continually varying phase difference causes a varying unbalanced output of the phase comparator. The resultant varying voltage activates reactance modulator V308B. The latter immediately functions to bring the oscillator frequency to the same value as the carrier IF. When the two frequencies lock at some phase difference in the phase comparator, a pure DC, caused by the phase difference, remains on the grid of the reactance tube. This voltage is proportional to the amount of phase difference. It is exactly sufficient for the operation of the reactance modulator to keep the oscillator frequency locked to the carrier IF. This voltage, however, is also applied to motor B302 which operates to correct the phase difference by rotating capacitor C325 in the oscillator tuning circuit. When the two signals again have the 90° phase difference in the phase comparator, the output of the latter will again be balanced. Therefore no resultant voltage is produced to activate the reactance modulator or the motor.

The output of the phase comparator is applied to the DC restorer V118 across resistors R194, R195, R196 and R197. V117 is coupled to V118 through capacitors C149 and C150. B+ is supplied to V117 through resistors R194 and R195.

(3) DC RESTORER V118.—The output of phase comparator V117 is applied to DC restorer V118. The purpose and operation of DC restorer V118 is exactly the same as described for DC restorer V123. See paragraph 2h(4). Also, diode balance control R198 is adjusted in the same manner as R225. See paragraph 2h(4).

(4) REACTANCE MODULATOR V308B. *(See Figures 2–16 and 7–8.)*—The audio output of DC restorer V118 is applied to the grid of reactance modulator V308B, one section of a 5814 dual triode. The function of the reactance modulator V308B is to keep the local oscillator signal at the same frequency as the carrier IF signal. If the frequency of the carrier should change or if the local oscillator frequency should drift from the carrier frequency, the reactance modulator corrects the oscillator frequency so that it again coincides with the carrier.

The reactance modulator effects the change in the oscillator frequency as follows: it is characteristic of cathode followers that by placing a varying voltage on its grid, the gain of the tube is varied. The gain of cathode follower may be varied between the limits of zero and a value approaching unity. Reactance modulator V308B, operating as a cathode follower, receives its varying voltage on its grid from the audio output of DC restorer V118. At zero gain, which is when the reactance modulator is cut off, the reactance modulator can be considered as disconnected from the circuit. The total capacitance of C326 is connected across the oscillator tuning circuit, thereby changing the frequency of the oscillator. At unity gain the cathode and grid of the reactance modulator are at the some potential and phase. Therefore, both plates of capacitor C326 are at the same potential and no current will flow through C326. Thus, at unity gain capacitor C326 may be considered disconnected since it does not affect the oscillator tuning circuit. From above, it is seen that, at zero gain, maximum capacity is placed in the oscillator tuning circuit, and at unity gain minimum capacity is placed in the circuit. Intermediate values of gain between zero and unity will place intermediate values of capacitor C326 into the oscillator tuning circuit in series with resistor R326.

When the oscillator and carrier IF are not at the same frequency, the resulting unbalanced conduction of the phase comparator and DC restorer causes a varying voltage to be placed on the grid of the reactance modulator. The varying (audio) voltage varies the gain of V308B and consequently varying values of capacity are inserted into the oscillator tuning circuit. The frequency of the oscillator then rapidly approaches and locks to the carrier frequency at a phase difference in the phase comparator. As the oscillator frequency approaches that of the carrier, the audio rate on the grid of the reactance tube decreases. At the lock-in instant a DC voltage appears on the grid. This DC is a result of the constant phase difference between the signals in the phase comparator. The voltage is exactly sufficient for the operation of the reactance modulator to keep the oscillator frequency locked to the carrier IF.

However, this voltage is also applied to motor B302 through servo amplifiers V305 and V306. Motor B302, activated by this voltage, rotates capacitor C325 in the proper direction to correct the phase difference to 90°. As the signals approach the required 90° phase difference in the phase comparator, the DC voltage on the grid of the reactance modulator reduces toward zero. At the 90° point the voltage on the grid becomes zero and motor B302 stops.

Plate supply for reactance modulator V308B is applied through resistor R327 and is filtered by capacitor C328A. R326 is the cathode bias resistor. The reactance modulator is coupled to the oscillator circuit through capacitor C321.

(5) THE 25-KC. OSCILLATOR V307. *(See Figure 2–16.)*—Oscillator V307, a 5654 pentode, is connected in a highly stable series-tuned circuit. The oscillator frequency is essentially that of the resonant frequency of coil L302 and capacitors C324, C327 and C320. The voltage drop across C320 and C327 establish the feedback and phase reversal necessary for oscillator operation.

The high Q of coil L302 and the loose coupling between the oscillator tube and the tuned circuit provide a very highly stable circuit. The values of C327 and C320 are very large compared to the grid-to-cathode and the plate-to-cathode capacitance of the 5654 tube and consequently, any change in the grid-to-cathode capacitance of the tube due to voltage or temperature variations become negligible. The presence of temperature-compensating capacitor C323 also aids in maintaining the stability of the oscillator circuit. This capacitor, having a negative temperature-capacitance characteristic, exhibits a rise in capacitance with a lowering of temperature, and a lowering of capacitance with a rise in temperature.

The output frequency of oscillator V307 is maintained at a value which is the difference of the tuning oscillator frequency (225-kc) and the 200-kc input signal frequency, the difference being near 25 kc. Plate and screen supply for V307 is applied through resistors R328 and R330 and is filtered by capacitor C328B. R325 is the grid bias resistor. Local Oscillator Adjust control C322 is an adjustable trimmer capacitor.

(6) OSCILLATOR AMPLIFIER V308A AND DRIVER V116B. *(See Figure 2–15.)*—The local oscillator signal, which is compared with the carrier signal in phase comparator V117, is applied to the latter through oscillator amplifier V308A and driver V116B.

Oscillator amplifier V308A, one half of a 5814 twin triode, is directly coupled to oscillator V307. The amplified local oscillator signal is applied to driver V116B through coupling capacitor C329 and resistor R186. The 25-kc. signal which is used for demodulation with a sideband signal is taken off at the junction of resistor R186 and capacitor C329 and applied to the demodulation circuits through capacitor C145 and resistor R183. (See paragraph 2f, Section 2.) Plate supply to V308A is applied through R328 and R329 and filtered by C328B.

The output of oscillator amplifier V308A is applied to driver V116B through coupling capacitor C329. Driver V116B, one half of a 5814 twin-triode, functions as a cathode follower to match the high impedance of the oscillator circuit to the low input impedance of phase comparator V117. The bias for V116B is developed across resistor R187 and R184 is the grid return. Resistor R186 is a limiting resistor to prevent the grid from going positive, in which case there would be an appreciable amount of grid current flow which would adversely affect the oscillator circuit. Plate supply for driver V116B is applied through resistor R188 and is filtered by capacitor C146B.

(7) SERVO AMPLIFIERS V305 AND V306. *(See Figure 2–17.)*–DC restorer V118 is coupled to servo amplifier V305 through the filtering circuit consisting of resistors R315 and R318 and capacitors C314 and C316. The function and operation of the servo amplifier circuit, which consists of servo amplifiers V305 and V306, is exactly the same as for the tuning (225-kc.) oscillator servo and motor circuit. See paragraph 2h(5), Section 2. All corresponding components in the two circuits have the same value except for the anti-hunt circuit capacitor. The smaller value of capacitor C315 gives the local oscillator anti-hunt circuit a smaller time constant.

The servo amplifier and motor circuit may be balanced by shorting the input leads (Motor Run switch S306 in HOLD position) and adjusting Motor Balance control R321 for a null in a set of headphones or for a zero reading on an AC voltmeter either of which may be plugged into Osc. Motor Indicator jack J302.

(8) MOTOR B302.–Motor B302 is the same type as motor B301. See paragraph 2h(6), this section. The 90° phase difference between the motor windings is effected by capacitors C317B and C318B.

When AFC correction is needed, motor B302 is activated and varies the capacity of C325 in the local oscillator tuning circuit.

j. CARRIER-OPERATED NOISE SILENCER V311 (CONS). *(See Figure 2–18.)*–The purpose of the carrier-operated noise silencer V311 is to activate relay K301, which shorts the motor circuit input leads when the carrier drops to a level insufficient for proper limiting and control. This operation prevents random running of the motors by noise when the carrier drops below the noise level. If the motors are allowed to be run by random noise pulses, they may change the tuning oscillator frequency to values which will produce a carrier IF outside the passband of the carrier filter.

With the CONS Level control R335 in its fully clock-

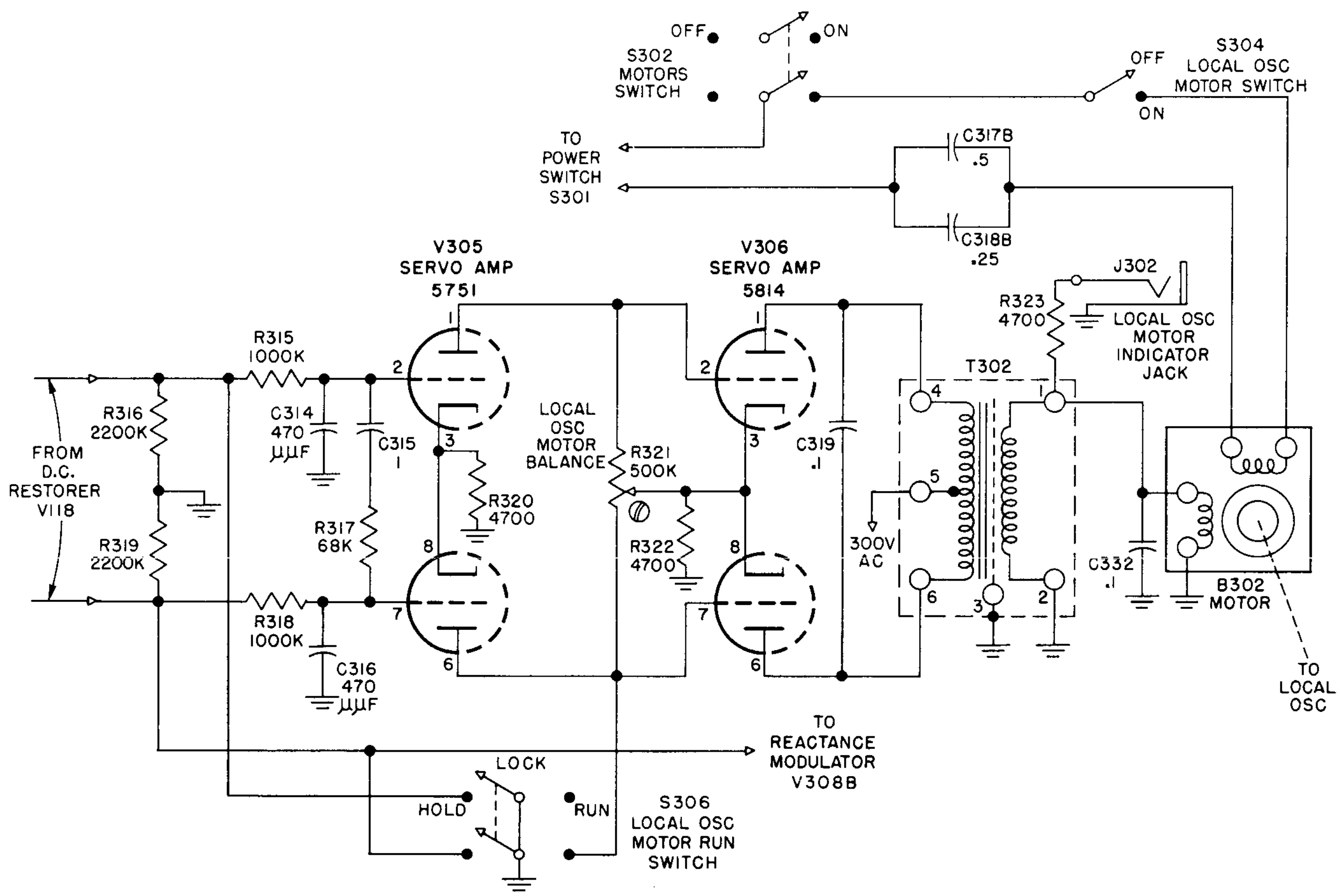


Figure 2–17. Servo Amplifiers V305 and V306 and Motor B302, Simplified Schematic Diagram

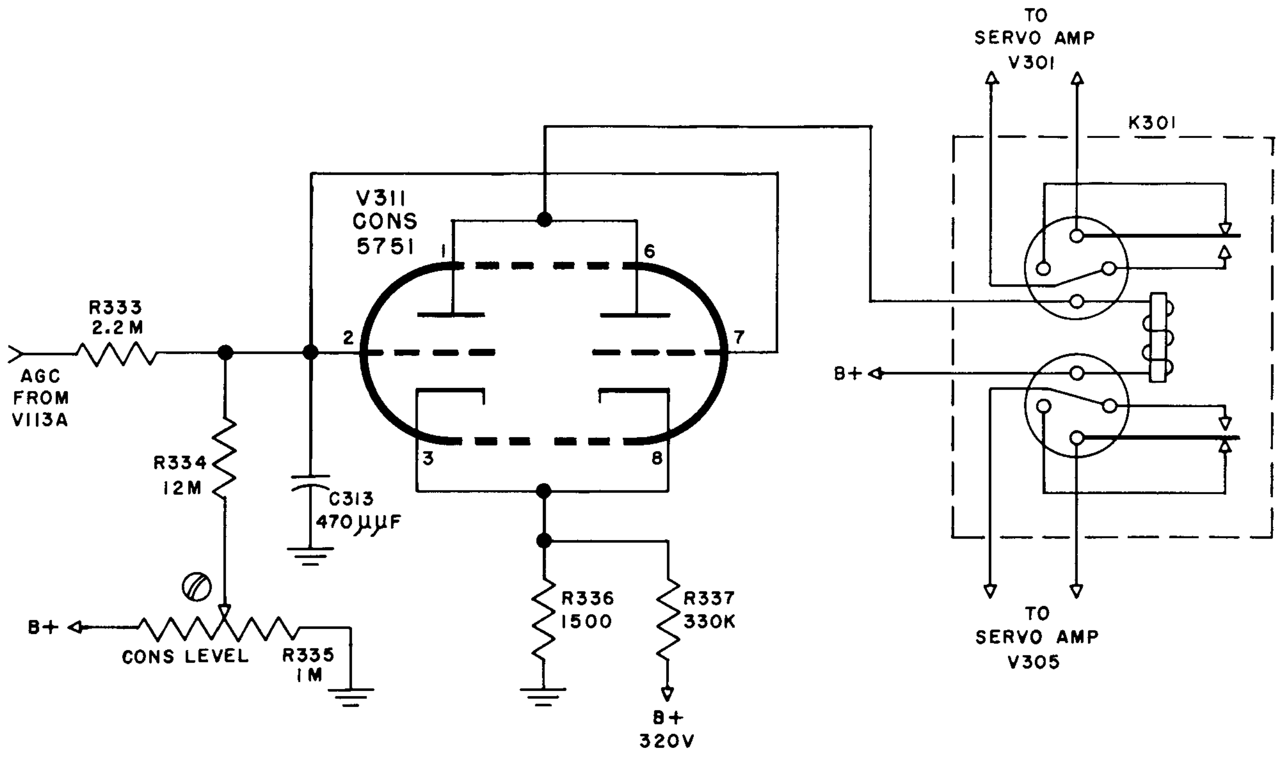


Figure 2–18. CONS V311, Simplified Schematic Diagram

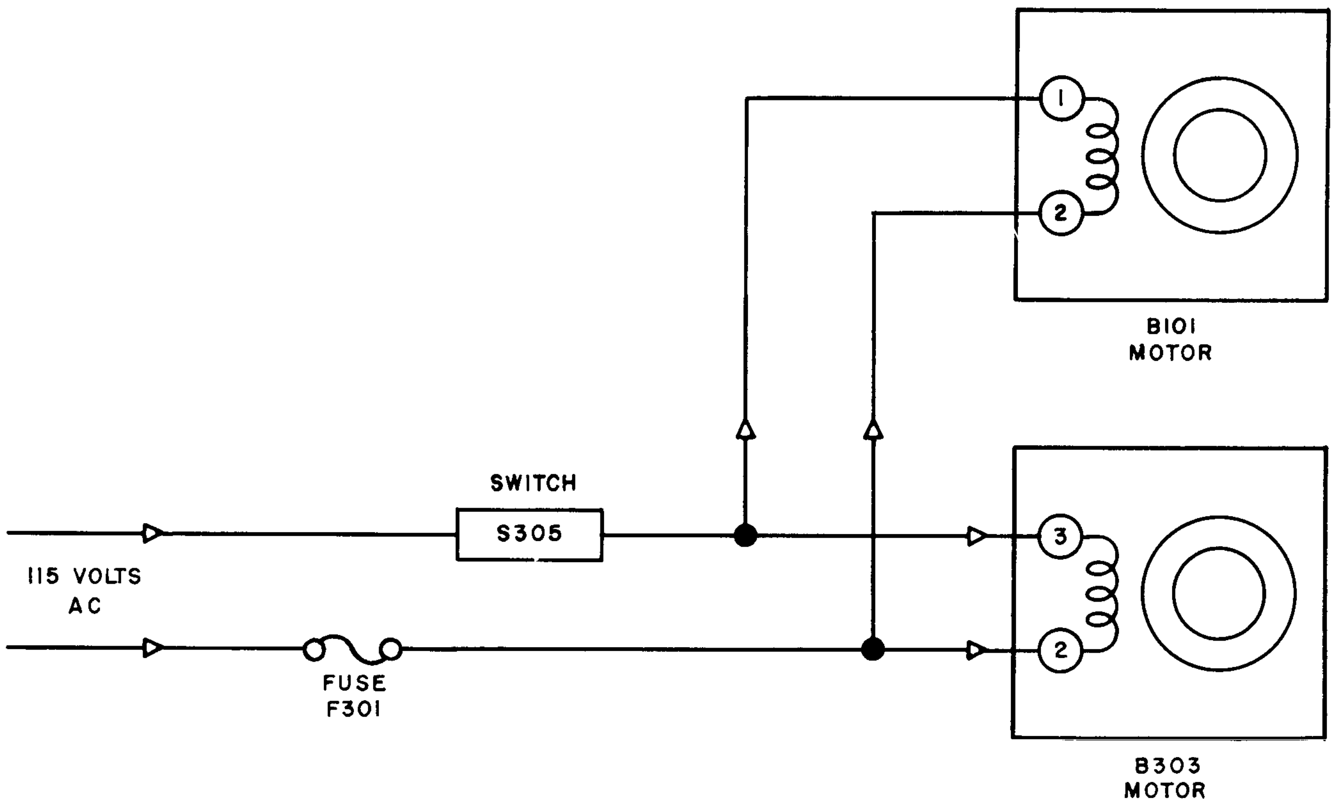


Figure 2–19. Fan Motors B101 and B303, Simplified Schematic Diagram

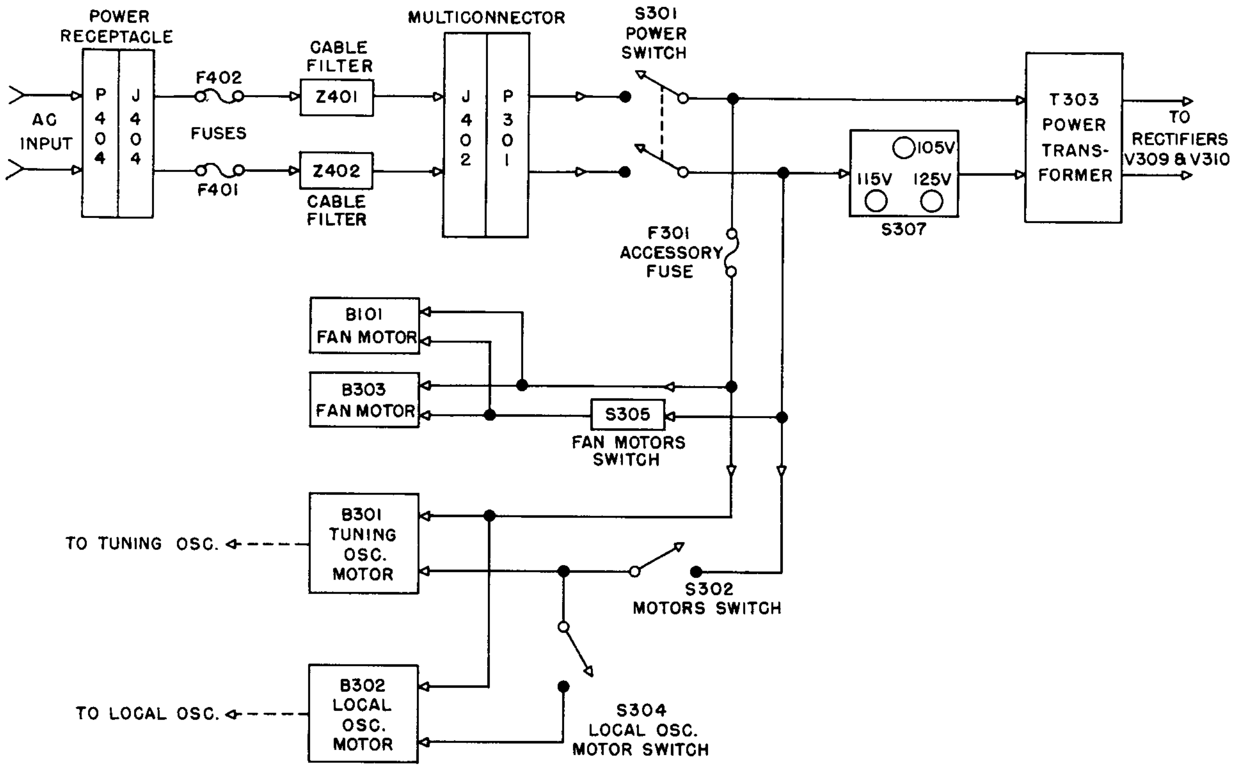


Figure 2-20. Power Circuits, Simplified Block Diagram

wise positon, the CONS is set to short the AFC motor circuits when the signal falls approximately to the threshold level of the limiter. Other settings will cause the motors to be shorted at higher signal levels. Only by careful analysis of prevailing atmospheric conditions and with intimate knowledge of the capabilities of the equipment, should technical personnel vary this control from the extreme clockwise position. There is no permanent setting of the CONS Level control. Each time this control is set it is to conform to existing operating conditions. When conditions do not require its use, it should be turned to its fully clockwise position.

V311 uses the two sections of a 5751 twin triode connected in parallel. The input to grid (2) of V311 is tapped off the AGC circuit at the output of V113A. With the carrier at sufficient strength the AGC circuit supplies a negative bias at the grids, through resistor R333, which keeps the tube cut off. A reduction of the carrier signal below the threshold automatically reduces the AGC voltage applied to the grids of V311, thus allowing V311 to conduct. The output voltage energizes relay K301, the contacts close and the input to both servo amplifiers V301 and V305 is shorted. Under this condition no AFC is available to either oscillator.

As the carrier level increases, the AGC voltage increases until V311 is again cut off and K301 is de-energized and its contacts open. Regulated plate voltage is supplied from the OA2WA voltage regulator V304.

k. FANS MOTORS B101 AND B303. *(See Figure 2-19.)*—Both the upper and lower chassis assemblies contain shaded pole fan motors, B101 in the upper and B303 in the lower. Both motors are controlled by thermo-switch S305 which automatically turns on both fan motors whenever the ambient temperature inside the cabinet reaches about 50° C. (120°F.). The fan motors will not shut off until the temperature drops to 41° C. (105°F.) The fans draw the cooler outside air into the cabinet through air filters in the front panel doors.

l. POWER SUPPLY CIRCUITS. *(See Figure 2-20.)* —Power for the CV-216/URR may be drawn from a 105, 115 or 125-volt, 50 to 60 cycle AC line. Line power is brought to the power supply by way of connector P404/J404, located on the underside of the cable filter assembly. Both sides of the AC power line are filtered for unwanted radio frequencies by filter Z401 and Z402 also located in the cable filter assembly. Circuit protection is provided by two fuses, F401 and F402, which are mounted inside the cable filter assembly with two spares F403 and F404.

The AC power line is turned on or off by Power switch S301 which is located on the lower front panel assembly. Glow lamp I301 will light when the power is turned on and the rectifier tubes have warmed up. Power for the AFC motors and the fan motors is tapped off the AC line. The fan and AFC motors are protected by fuse F301 which is mounted on the lower front panel adjacent to spare fuse F302.

Power is applied to the primary of transformer T303 through the proper tap of S307. This will be either the 105, 115 or 125 volt tap depending upon the line voltage. There are three secondary windings in transformer T303. One winding supplies 5 volts to the heaters of the two 5Y3WGTA rectifier tubes, V309 and V310. A second winding supplies heater voltage at 6.3 volts to all other tubes. The third winding supplies 300 volts to the plates of the rectifiers, V309 and V310, and 300 volts to the servo amplifiers in both AFC sections, through fuses F303 and F304.

The two 5Y3WGTA rectifiers V309 and V310 provide full-wave rectification of the high voltage from the center-tapped 600 volt secondary winding. The filtered output is used for screen and plate voltage. The OA2WA gaseous regulator tube V304 is used with resistor R313 and R314 to regulate the tuning oscillator and amplifier and the CONS B+ voltage; the OB2WA regulator tube V119 operates with resistors R201, R202 and R228 and furnishes regulated plate supply to sideband demodulator V103 and screen voltage to the two sideband frequency converters V101 and V107.

m. CABLE FILTER ASSEMBLY. *(See Figure 7–7.)*— The cable filter assembly contains radio-frequency noise filter circuits for the audio output and power input circuits. All components of the cable filter assembly are mounted on an aluminum plate attached to the rear of the cabinet.

The audio output is connected to terminals 3 and 4 of multiconnector P101/J401. The two audio output leads, taken off terminals 3 and 4, are each filtered by the assembly consisting of coils L401, L402, L403 and L404 and capacitors C401 and C402. The filter is designed to pass audio and suppress sharply all frequencies above 6 kc. The audio signal is connected to terminals A and D of audio output connector J403/P403. Terminal B provides AGC for external use.

The two AC power input leads, taken off connector P404/J404, are each filtered by Z401 and Z402 and are connected to terminals 9 and 10 on multiconnector J402/P301. All frequencies above 60 cycles are sharply attenuated by these two filters.

All external connections to the equipment except for headphones and meters are made to connectors mounted on the bottom of the cable filter assembly. These connectors are: the signal input connector P405/J405; the audio output connector P403/J403 and the AC power input connector P404/J404.

All connections external to each chassis assembly are made at multiconnectors P101/J401 in the upper assembly and P301/J402 in the lower assembly. Inter-assembly connections are made between these two multiconnectors.

One test cable is provided so that inter-assembly connections may be made when one chassis is withdrawn from the cabinet.

Access to all filter assembly components and the multiconnectors is readily made by removing the filter cover. The AC power line fuses F401 and F402 and spares F403 and F404 are also located within the filter assembly unit.

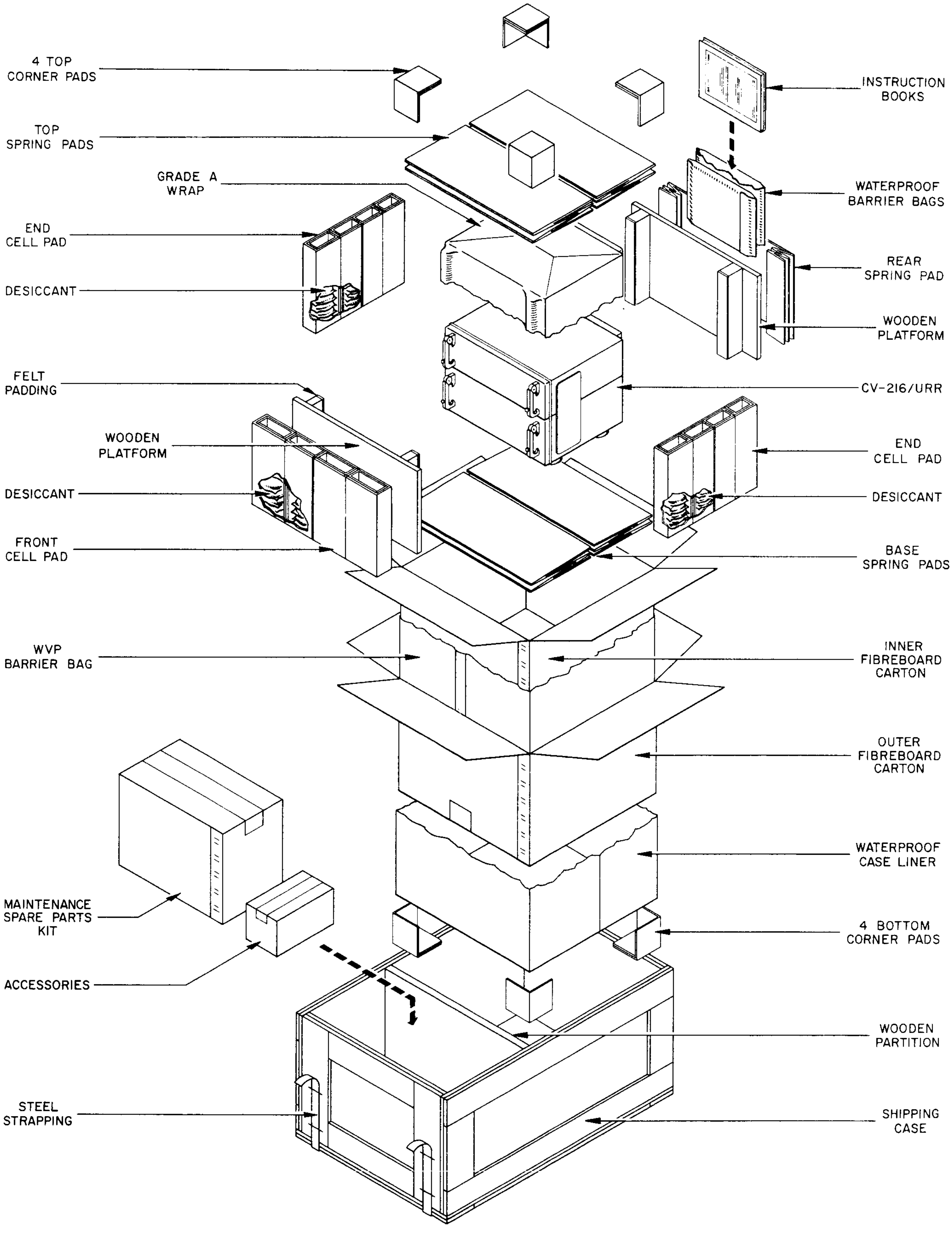


Figure 3–1. Unpacking Instructions

SECTION 3
INSTALLATION

1. UNPACKING.

The CV-216/URR Single Sideband Converter complete with accessories and a set of equipment maintenance parts is contained in one wooden crate. Refer to Table 1–1 for the itemized list of components.

Refer to Figure 3–1 for unpacking instructions.

After the equipment has been unpacked, thoroughly inspect all units inside and out for signs of any damage incurred during shipment. See Figure 3–2 for instructions for removing the chassis from the cabinet.

2. INSTALLATION.

a. LOCATION.–The equipment should be securely mounted in a well ventilated area. Consideration should be given to accessibility of the various external connections required. For ease of operation, the CV-216/URR should be placed adjacent to the associated communications receiver. There should be enough clearance at the rear of the cabinet so that the cable filter assembly and the external connectors are readily accessible. Sufficient space should also be provided at the front so that each sub-assembly may be withdrawn from the cabinet and tilted or removed. See Figure 3–3 for the outline dimensions of the equipment and required clearances.

b. TABLE OR BENCH MOUNTING.–If a table, bench or other firm horizontal surface is available, the equipment may be mounted so that it rests on the four shock mounts provided with the equipment. To fasten the equipment down, proceed as follows:

NOTE

If no clearance is provided at the rear of the cabinet, make all external connections at the cable filter assembly before fastening the equipment down. See Figure 3–5.

Step 1. Remove both chassis assemblies. See Figure 3–2.

Step 2. Place the cabinet in the desired location.

Step 3. Drill four 3/8" clearance holes in the bench in line with the holes in the centers of the shock mounts.

Step 4. Drop a 3/8" diameter bolt through the hole in the center of each shock mount and through the hole in the bench. The bolt should be long enough to project one inch below the bench.

Step 5. From underneath the bench, place on the bolt, in order, a 3/8" flat washer, a 3/8" lock washer and a hex nut and tighten.

c. RELAY RACK MOUNTING. *(See Figure 3–4.)*– The following is the method of preparing the equipment for mounting in a standard 19" relay rack:

Step 1. Remove the four shock mounts from the bottom of the cabinet.

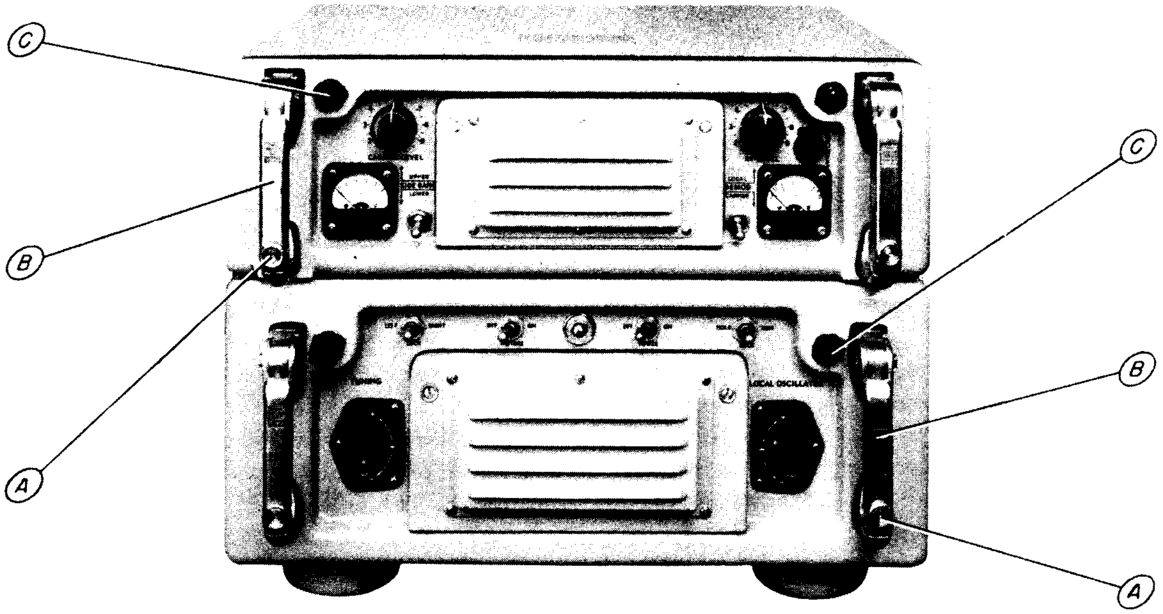
Step 2. Detach the aluminum plate from each side of the cabinet by removing the six Phillip's head machine screws.

Step 3. Use the six screws and the same holes to attach the angle brackets to the converter.

Step 4. Attach the aluminum plate to the bottom of cabinet to cover the shock mount holes.

Step 5. Install the equipment in the rack using eight no. 10–32 bolts (not supplied with the equipment).

d. EXTERNAL CONNECTIONS.–*(See Figure 3–5.)*– All input and output cables are connected at the bottom of the cable filter assembly at the rear of the cabinet. The three external connections are the AC power input, the signal input and the audio output. All plugs which are connected to external cables are listed in Table 3–1. The cables are not supplied with the equipment.

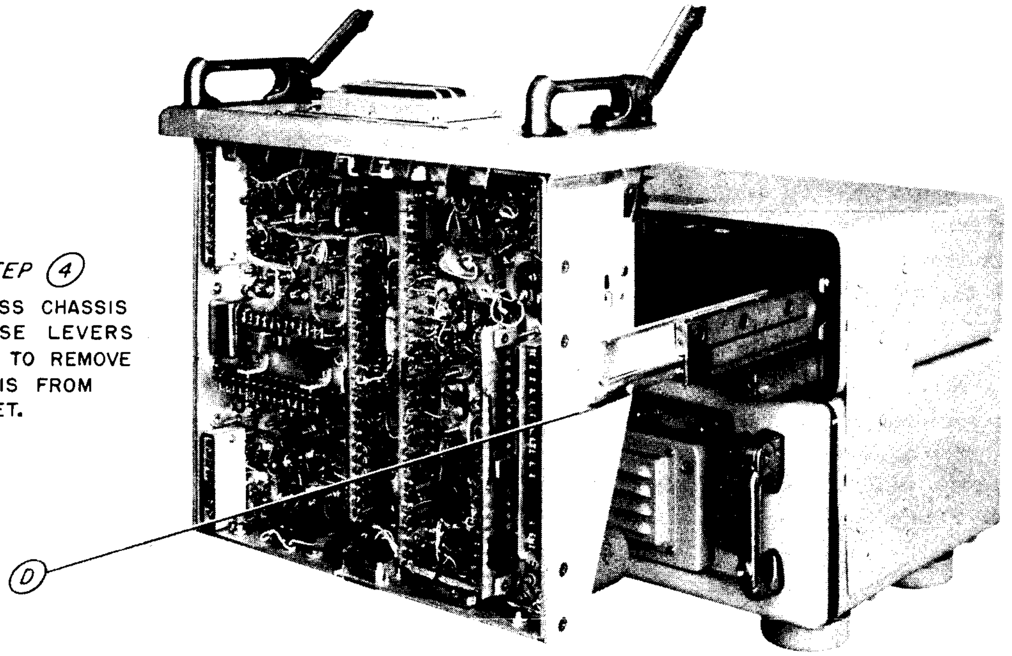


STEP (1)
SLIDE LATCH HANDLE FASTENER BUTTONS AT (A) UPWARD TO UNLOCK HANDLES.

STEP (2)
RAISE LATCH HANDLES AT (B) TO RELEASE AND WITHDRAW CHASSIS TO LOCKED POSITION.

STEP (3)
PRESS TILT LEVERS AT (C) TO UNLOCK PIVOT MECHANISM AND TILT CHASSIS TO ANY ONE OF THE SIX POSSIBLE LOCKED IN POSITIONS.

STEP (4)
DEPRESS CHASSIS RELEASE LEVERS AT (D) TO REMOVE CHASSIS FROM CABINET.



STEP (5)
TO REPLACE CHASSIS IN CABINET FOLLOW THE ABOVE PROCEDURE IN REVERSE.

Figure 3-2. Instructions for the Operation of the Chassis Slide-Tilt Mechanism

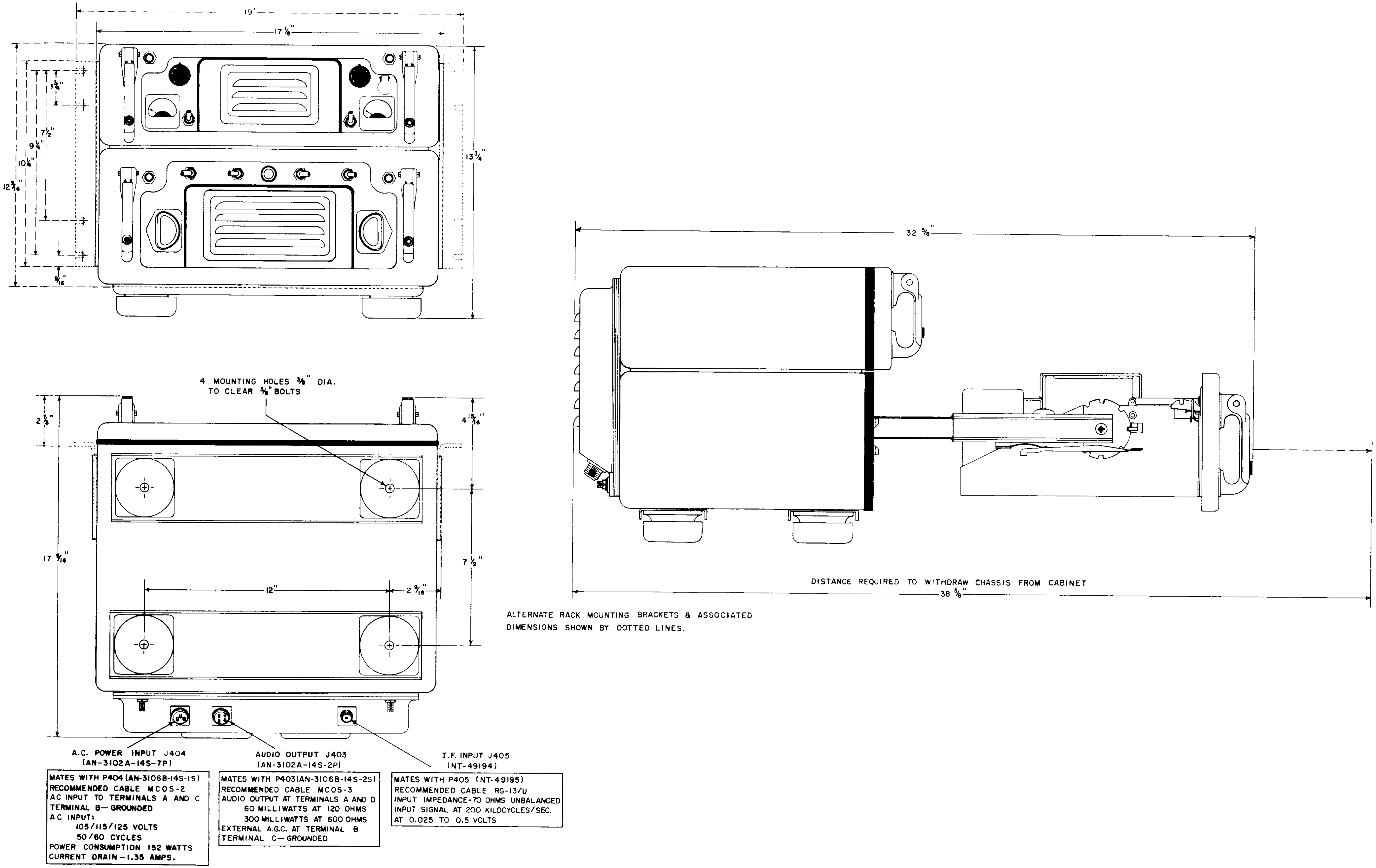


Figure 3–3. CV-216/URR, Dimensional Outline Drawing

TABLE 3-1. EXTERNAL CONNECTION DATA

SYMBOL DESIGNATION OF PLUG	TYPE	FUNCTION	RECOMMENDED CABLE
P403	AN-3106B-14S-2S	Audio output AGC	MCOS-3 (3-wire) Shielded single-wire
P404	AN-3106B-14S-7S	AC power input	MCOS-2
P405	NT-49195	Signal input	RG-13/U

(1) POWER INPUT CONNECTION.-The AC power input cable is connected to plug P404 which mates with jack J404 on the bottom of the cable filter assembly. See Figure 3-6 for the method of connecting the cable to plug P404.

The power to be fed to this connection may originate from a 105, 115 or 125 volt AC source of 50 to 60 cycles, single phase. The voltage tap board S307, located at the rear of the power transformer T303 in the lower chassis assembly, has a movable link which must be attached to the proper voltage tap corresponding to the input voltage before energizing the equipment.

(2) SIGNAL INPUT CONNECTION.-The input signal to the Converter emanating from the external communications receiver is applied through P405 to mating connector J405 on the bottom of the cable filter assembly. See Figure 3-7 for method of installing the cable to plug P405.

The receiver used with the CV-216/URR must have the following requirements:

(a) The final IF stage must be 200 kc.

(b) The IF output voltage must be within the limits of 0.025 volts and 0.5 volts.

(c) The IF output must match a nominal impedance of 70 ohms with a coaxial transmission line connector.

(3) AUDIO OUTPUT CONNECTION.-The audio output cable is attached to plug P403 which mates with connector J403. See Figure 3-8 for the method of connecting the cable to plug P403. The audio output is designed for operation with from one to five 600-ohm loads connected in parallel. Various types of audio equipment such as headphones, speaker, facsimile, etc. may be connected to the output. The audio line is connected to pins A and D of connector J403.

(4) EXTERNAL AGC.-AGC voltage generated in the converter may be applied to the associated receiver provided that the latter has suitable interconnecting facilities. This connection is necessary for the reception of suppressed-carrier transmissions.

Step 1. Connect a suitable cable, preferably shielded, to terminals B and C of plug connector P403. The shield connects to terminal C.

Step 2. Connect the other end of the cable to the appropriate connector of the receiver, ground the shield.

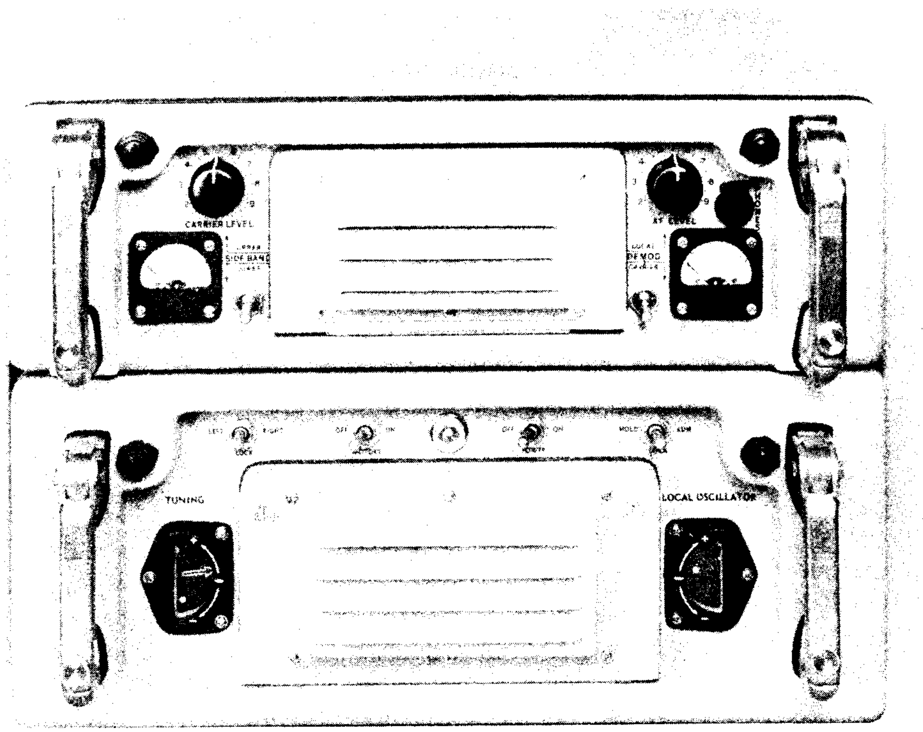


Figure 3–4. CV-216/URR, Front View, Shock Mounts Removed, Relay Rack Mounting Brackets Attached

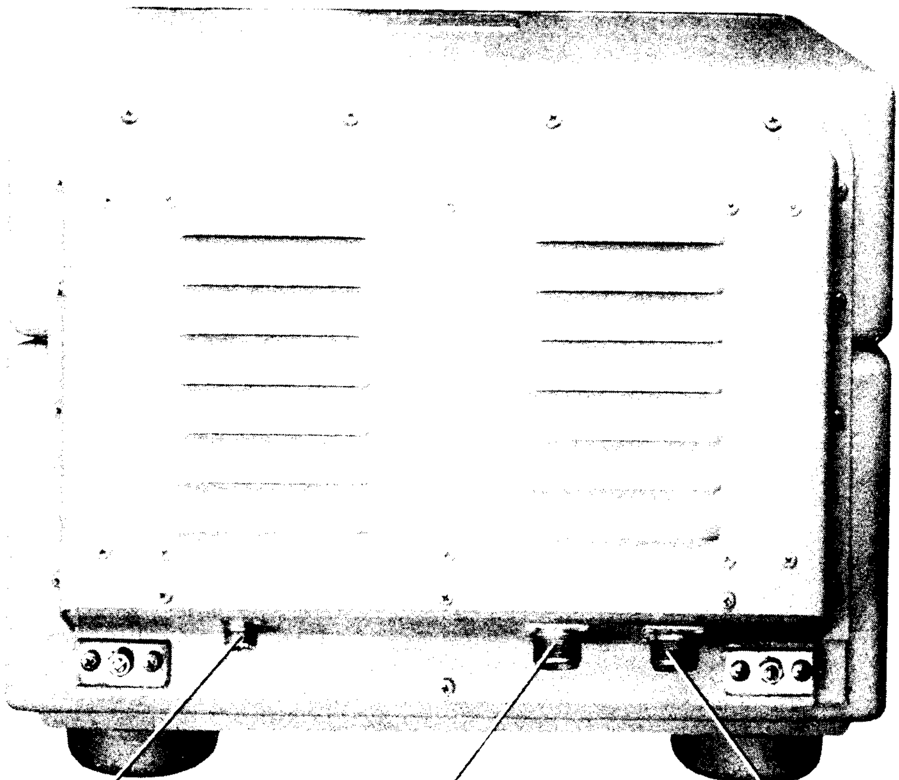
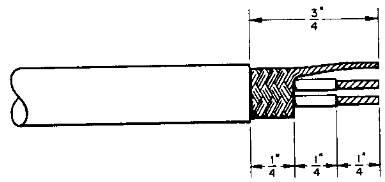


Figure 3–5. Rear View, Showing Location of External Connections

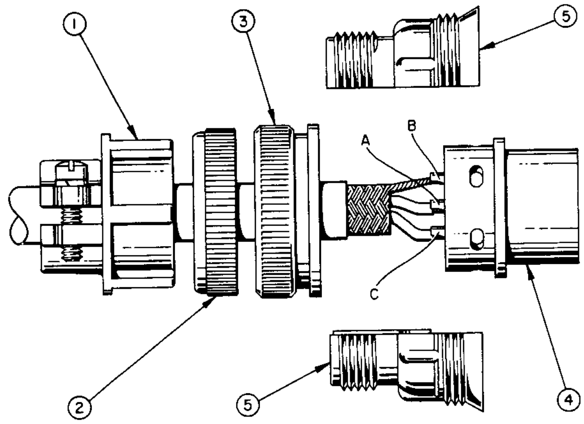
A – CUT BACK THE OUTER SHEATH TO DIMENSIONS SHOWN. REMOVE THE INSULATION FROM THE TWO INNER CONDUCTORS. UNBRAID THE SHIELD AND TWIST INTO A PIGTAIL.

A



B – PASS CABLE THROUGH CABLE CLAMP ①, ASSEMBLY NUT ②, AND COUPLING NUT ③. SOLDER THE CONDUCTORS INTO PINS A AND C OF THE BARREL ASSEMBLY ④. SOLDER THE PIGTAIL INTO PIN B.

B



C – SLIDE COUPLING NUT ③ OVER BARREL ASSEMBLY ④ AND ENGAGE HALVES OF SPLIT SHELL ⑤ WITH HOLES IN BARREL ASSEMBLY. SCREW ASSEMBLY NUT ② ONTO THE ASSEMBLED SPLIT SHELL. SCREW CABLE CLAMP ① ONTO SPLIT SHELL AND TIGHTEN SCREWS TO HOLD CABLE SECURELY.

C

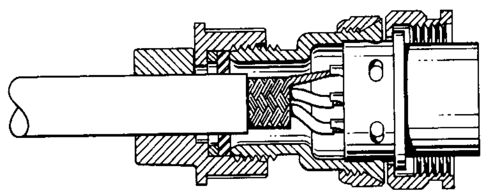


Figure 3–6. Installation of Connector P404 on Cable MCOS-2 for A.C. input

A– CUT END OF CABLE EVEN. REMOVE VINYL JACKET $1\frac{1}{8}$".

B– BARE $\frac{5}{8}$" OF CENTER CONDUCTOR. TIN EXPOSED CONDUCTOR AND BRAID. SLIDE BACK SHELL AND COUPLING RING ON CABLE.

C– SCREW THE PLUG SUB-ASSEMBLY ON CABLE. SOLDER THIS ASSEMBLY TO BRAID THROUGH SOLDER HOLES. SOLDER CENTER CONDUCTOR TO CONTACT. DO NOT USE EXCESSIVE HEAT.

D– FOR FINAL ASSEMBLY, SLIDE COUPLING RING OVER PLUG SUB-ASSEMBLY, THEN POSITION BACK SHELL WITH SUFFICIENT CLEARANCE TO PERMIT FREE ROTATION OF COUPLING NUT AND TIGHTEN SET SCREW.

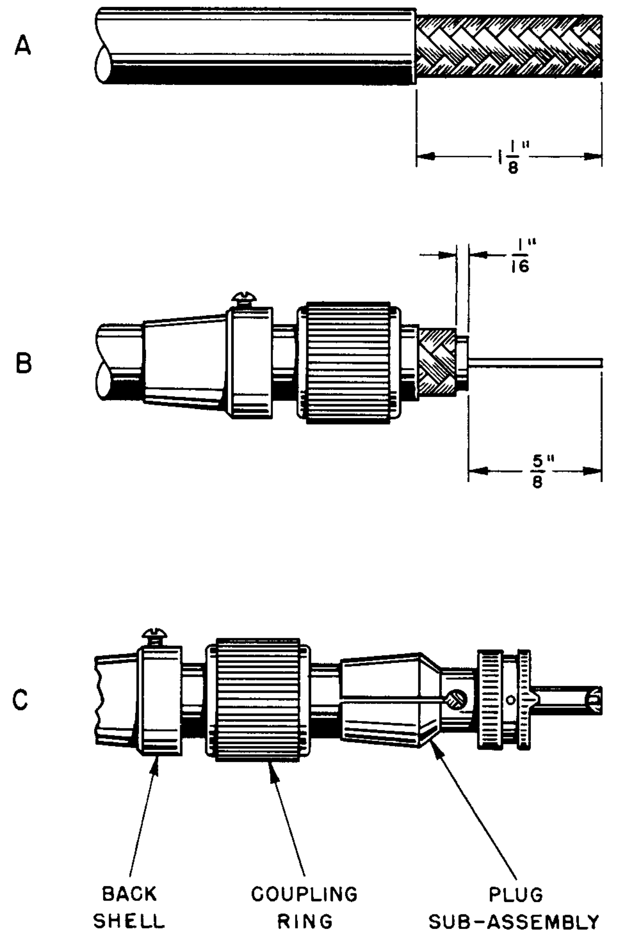
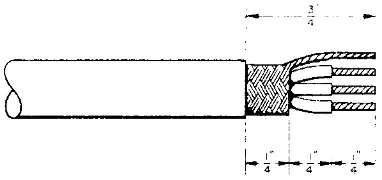


Figure 3–7. Installation of Connector P405 on Cable RG-13/U for Signal Input

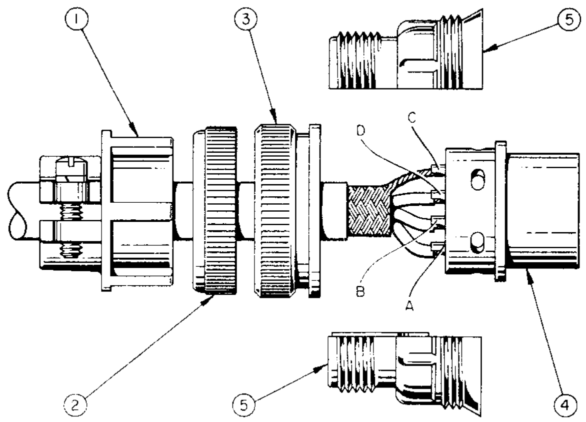
A – CUT BACK THE OUTER SHEATH TO DIMENSIONS SHOWN. REMOVE THE INSULATION FROM THE THREE INNER CONDUCTORS. UNBRAID THE SHIELD AND TWIST INTO A PIGTAIL.

A



B – PASS CABLE THROUGH CABLE CLAMP (1), ASSEMBLY NUT (2), AND COUPLING NUT (3). SOLDER THE CONDUCTORS INTO PINS A, B AND D OF THE BARREL ASSEMBLY (4). SOLDER THE PIGTAIL INTO PIN C.

B



C – SLIDE COUPLING NUT (3) OVER BARREL ASSEMBLY (4) AND ENGAGE HALVES OF SPLIT SHELL (5) WITH HOLES IN BARREL ASSEMBLY. SCREW ASSEMBLY NUT (2) ONTO THE ASSEMBLED SPLIT SHELL. SCREW CABLE CLAMP (1) ONTO SPLIT SHELL AND TIGHTEN SCREWS TO HOLD CABLE SECURELY.

C

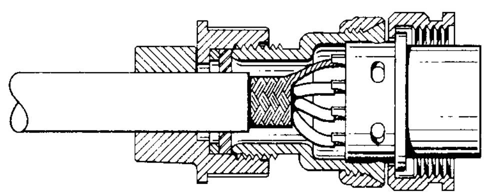


Figure 3–8. Installation of Connector P403 on Cable MCOS-3 and Shielded Cable for Audio Output and AGC

3. INITIAL ADJUSTMENTS.

This paragraph is for the information of technicians who install, adjust and test the operation of the equipment before turning it over to operating personnel. The equipment needed for preparing the equipment for operation includes a standard 600-ohm set of headphones, a AC voltmeter and a screwdriver. Refer to Figure 3–9 for the location of chassis-mounted adjustments. Refer to Figure 3–2 for chassis slide mechanism instructions. Refer to Figure 4–1 for the location of all front-panel mounted controls.

a. ADJUSTMENTS PRIOR TO ENERGIZING THE EQUIPMENT.

(1) VOLTAGE TAPS.–Voltage tap board S307 selects the proper primary of power transformer T303 for use with 105, 115 or 125 volts. S307 is located at rear of the power transformer T303. When shipped from the factory, the tap is set at 115 volts. Determine the average AC line voltage by measurement with an AC voltmeter. Set the tap at the position which most nearly corresponds to the measured line voltage. Operation with varying line voltage is not critical and momentary surges will not harm the equipment.

(2) GROUNDING OF THE AUDIO OUTPUT.–The audio output of the CV-216/URR is ungrounded. However, if the audio terminal equipment is ungrounded or requires a balanced input, the center tap of transformer T101 may be grounded. To ground the center tap, connect a jumper wire from terminal 2 of T101 to the adjacent ground lug, E125, provided for this purpose. If the input of the terminal equipment is grounded, it may be undesirable to ground the audio output of the CV-216/URR.

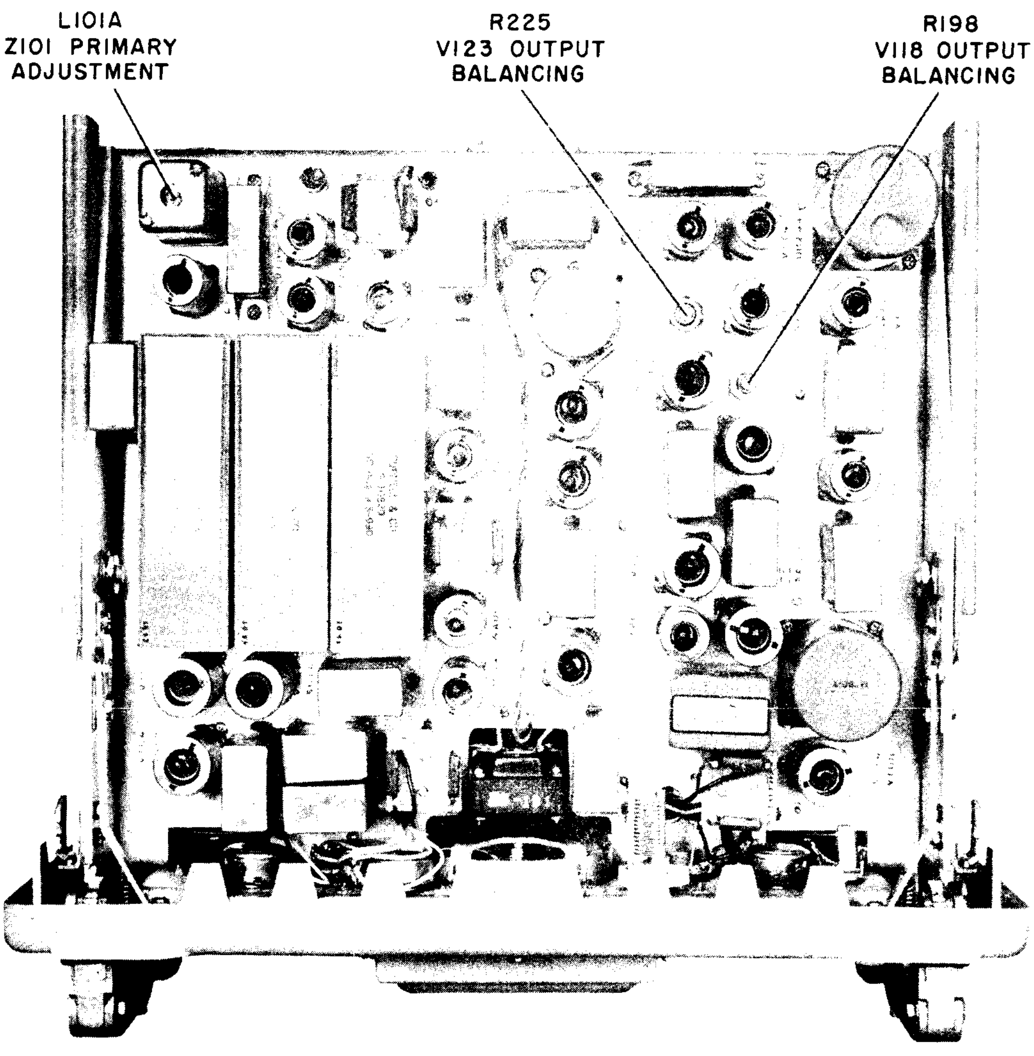


Figure 3–9. Top View of Upper Chassis Assembly, Location of Initial Adjustment Devices

(3) MOTORS SWITCH S302.—To prevent random running of the motors during the warm-up period, it is advisable to turn Motors switch S302 to the OFF position before energizing. However, the equipment will suffer no damaging affects if this switch is ON.

(4) MOTOR SWITCH S304.—Turn local oscillator motor switch ON. This switch is located behind the lower front panel door.

b. PREPARING THE SINGLE SIDEBAND CONVERTER FOR OPERATION.—The paragraphs below cover all initial adjustments and tests.

(1) ELECTRICAL ADJUSTMENTS.—Perform all adjustments described in paragraph 3 of Section 7.

(2) SETTING THE EXTERNAL AGC LEVEL.—In installations where Converter-generated AGC is applied to the associated receiver, the AGC level is set as follows: (The AGC in the receiver must be disabled for this type installation.)

Step 1. Set the EXT AGC control on the front panel fully counterclockwise. With the AGC EXT control in this position no external AGC is furnished to the receiver.

Step 2. After energizing both the receiver and the converter and allowing sufficient warm-up time, tune in a signal.

Step 3. Advance the EXT AGC control until a pronounced drop in audio level occurs in the receiver. When this condition exists, the external AGC is controlling the gain of the receiver circuits. The EXT AGC control may then be set to the desired threshold level.

(3) PERFORMANCE TEST.—To check the equipment as it will be used in actual operation when receiving single-sideband signals, proceed as follows:

Step 1. Connect the 200 kc. signal from the receiver to the input circuit of the CV-216/URR.

Step 2. Turn Power switch S301 ON.

Step 3. Tune receiver to incoming signal. Adjust the tuning dial for peak reading on Carrier Level meter M101.

Step 4. Turn Motors switch ON. Motors will turn slightly, adjusting the oscillators to the incoming signal. (See Section 7, paragraph 3b.)

Step 5. Insert a pair of headphones in Phones jack J101.

Step 6. Listen to signal with Sideband switch S101 in the UPPER position and then in the LOWER position. The audio signal in both positions should be the same and of equal power if a double sideband signal is being received. (See Section 7, paragraph 3c.) Audio may be varied by means of AF Level control R128.

Step 7. Throw Demod. switch S102 to LOCAL and listen to signal. Then throw the switch to the CARRIER position. No difference in frequency or amplitude of the audio signal should be apparent.

After satisfactory completion of the foregoing tests the equipment can be turned over to operating personnel.

SECTION 4
OPERATION

1. INTRODUCTION.

The Single Sideband Converter CV-216/URR is a converter or an adapter which, when connected to a communications receiver, makes possible the reception of one sideband of single and double sideband transmissions. The Converter operates from the final IF stage of the receiver and this IF must be 200 kc. The IF output voltage of the receiver must lie within the limits of 0.025 and 0.5 volts.

With the Converter attached to a receiver which meets the above requirements the following types of reception are possible:

a. One sideband only of conventional double sideband amplitude modulated signals having any degree of modulation from low levels up to 100% modulation (A3).

b. One sideband of single or double sideband suppressed-carrier transmissions (A3a).

c. One sideband of an MCW (tone modulation) signal (A2).

d. One sideband of double sideband phase-modulated signals having any degree of phase-modulation up to one radian (F2).

By attaching appropriate terminal equipment, facsimile and teletype signals may be received when the transmitter uses A2 and F2 methods. This is the type of transmission in which audio modulating tones are used to modulate the carrier.

For a brief review of single sideband theory, see Section 2, paragraph 1.

Briefly, the operation consists of tuning in the signal at the receiver and selecting one sideband of the signal at the Converter. The audio intelligence appears at the output of the Converter and may be applied to headphones, speaker and/or other audio devices.

2. CONTROLS.

The following sub-paragraphs briefly describe all the controls and operating devices of the CV-216/URR. All controls except the two diode balance controls and the AGC switch are mounted on the front panel. Figure 4-1 identifies all the front panel controls. See Figure 3-9 for the location of the diode balance controls and the AGC switch. The controls behind the access doors are semi-operating controls which require infrequent adjustment as outlined in Section 5 and 6. Detailed procedures for adjustment of the semi-operating controls are given in Section 7. In the descriptions given below the function of each control is described. Refer to the appropriate paragraph in Section 2 for analysis of the circuit which includes the control.

a. POWER SWITCH S301.—This switch is the On-Off control of the entire equipment.

b. GLOW LAMP I301.—This is the B+ indicator. It will light when the power is turned on and the two rectifiers are warmed up.

c. SIDEBAND SWITCH S101.—This switch enables the operator to select either sideband of a double sideband signal.

d. SIDEBAND GAIN CONTROLS R106 AND R139.—The gain level of the upper sideband channel may be raised or lowered by upper sideband gain control R106. R139 controls the gain level of the lower sideband channel. The change in gain is indicated on the audio level meter.

e. MODULATOR BALANCE R117.—This control balances the output of sideband demodulator V103.

f. AF LEVEL CONTROL R128.—This is a conventional audio level control adjusting the level of the audio signal at the input of audio amplifier V105, and thus controlling the amplitude of the audio output of the equipment.

g. AUDIO LEVEL METER M102.—This meter indicates the power level, in db, at the audio output of the equipment.

h. PHONES JACK J101.—This jack is connected across the audio output transformer T101 for monitoring and tuning purposes.

i. CARRIER LEVEL R157.—The level of an attenuated carrier may be boosted by adjusting this control. When receiving a suppressed carrier signal, the control is advanced until the carrier level meter reads between 1/4 and 1/2 scale. The carrier signal will then be at a full carrier level.

j. CARRIER LEVEL METER M101.—The carrier

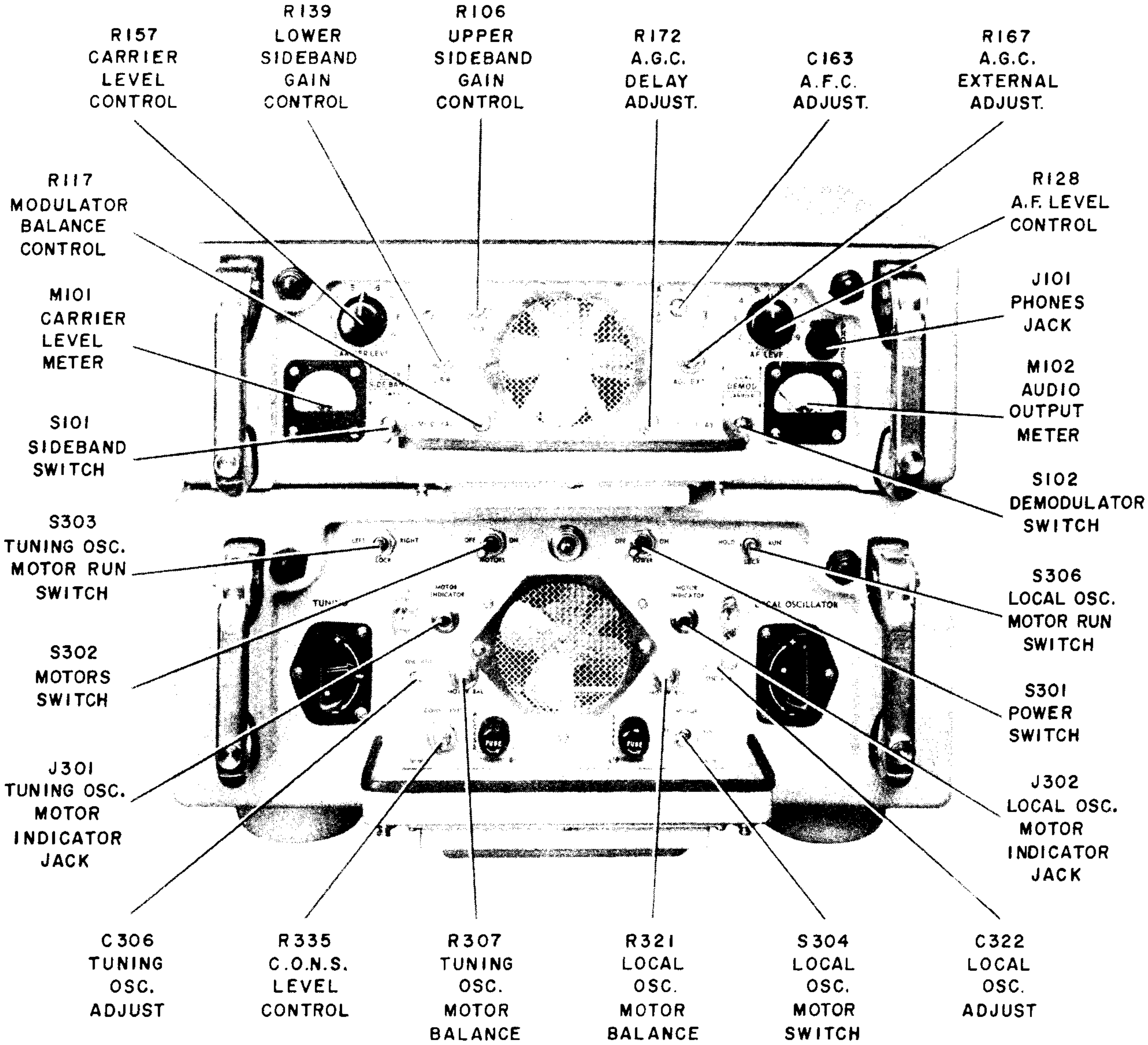


Figure 4–1. CV-216/URR, Identification of Front Panel Controls.

level meter indicates the carrier IF level and is used for tuning and adjusting the equipment. When tuning in a signal, a peak reading on the meter signifies that the IF frequency is at the center of the carrier filter.

k. DEMODULATOR SWITCH S102.

(1) CARRIER POSITION.–When the Demodulator switch is in the CARRIER position, the audio is reproduced with the greatest fidelity, provided that the incoming signal is not hampered by atmospheric conditions. Unless these disturbances prohibit the use of the carrier signal for demodulation, this mode of operation should always be used.

(2) LOCAL POSITION.–By placing the Demodulator switch in the LOCAL position, the input carrier signal is grounded and replaced by the local carrier for demodulation. This mode of operation is utilized during periods of deep carrier fade, noise and other carrier disturbances. Under these conditions, the input carrier may become useless for demodulation. The most favorable mode of operation may be determined at any time by switching the Demodulator switch from CARRIER to LOCAL. The more intelligible signal will signify the better mode of operation.

l. AGC SWITCH S103.–This switch selects the source of AGC voltage, either from the sideband channel or the carrier channel, for application to the sideband frequency converters and to external equipment.

m. AGC DELAY R172.–This control adjusts the amount of delay applied to the AGC voltage for the sideband frequency converters. The range is from minimum delay to maximum with maximum at the extreme clockwise position.

n. AGC EXTERNAL R167.–The level of the AGC voltage to be applied externally is set by this control.

o. DIODE BALANCE CONTROLS R198 AND R225.– Diode balance control R198 adjusts the output of the double diode V118 so that zero voltage appears at the output of the diodes when no AFC correction is needed. R225 has the same function with the diodes of V123.

p. AFC ADJUST C163.–This control is used to initially adjust the frequency of the tuning oscillator to maintain the IF of the equipment within the passband of carrier filter Z105. Thereafter, the AFC circuit will function to keep the IF frequency at the center frequency of the carrier filter.

q. MOTOR BALANCE CONTROLS R307 AND R321.– Motor Balance control R307 balances the output of servo amplifier V301 so that no voltages are applied to motor B301 when automatic frequency control for the tuning oscillator is not needed. Motor Balance control R321 balances the output of servo amplifier V305 so that no voltages are applied to motor B302 when automatic frequency control for the local oscillator is not needed.

r. MOTOR INDICATOR JACKS J301 AND J302.– The two motor indicator jacks are to aurally monitor the outputs of the two servo channels. A null in the audio tone indicates the respective motor control circuit is properly balanced for correct automatic frequency control.

s. MOTORS SWITCH S302.–This switch controls the application of power to both AFC motors.

t. TUNING OSCILLATOR MOTOR RUN SWITCH S303.

(1) LOCK POSITION.–This is the normal operating position of this control. In the LOCK position the tuning oscillator is maintained at the proper frequency by the AFC for mixing with the incoming signal.

(2) LEFT AND RIGHT POSITIONS.–With switch S303 in the RIGHT position, the motor rotates clockwise; in the LEFT position, counterclockwise. This switch can be used to rotate the arrow on the dial to the index mark during tuning operations. When the arrow is at the index mark, the variable tuning capacitor is at the center of its range.

u. TUNING OSCILLATOR ADJUST C306.–This is the trimmer capacitor in the 225-kilocycle oscillator tuned circuit.

v. MOTOR DIALS.–The tuning oscillator dial, located on the left side of the lower front panel, indicates the position of the variable capacitor C309 in the tuning oscillator circuit. The oscillator is properly tuned for mixing with the incoming signal when the arrow on the dial is pointing at the index mark. The local oscillator dial, located on the right side of the lower front panel, indicates the position of variable capacitor C325 of the local oscillator tuned circuit. The capacitor is at the center of its range when the arrow on the dial is pointing at the index mark.

w. LOCAL OSCILLATOR MOTOR SWITCH S304.– The local oscillator AFC motor is turned on and off by this switch.

x. LOCAL OSCILLATOR MOTOR RUN SWITCH S306.

(1) LOCK POSITION.–This is the position used during normal operating conditions. In this position the motor can be activated by voltages caused by frequency shifts. When energized by these voltages, the motor rotates the tuning capacitor in the local oscillator tuned circuit until the local oscillator has the same frequency as the carrier IF signal. The local oscillator thus controlled, may be substituted for the carrier at any time for demodulation with little loss in fidelity.

(2) RUN POSITION.–When this switch is placed in the RUN position, the motor rotates in a clockwise direction only thereby changing the frequency of the local oscillator. The rotation of the capacitor in the oscillator tuned circuit may be observed by means of the dial on the right side of the lower front panel. This motor run switch permits running in only one direction so that if the dial indicates that the index mark has been passed in a clockwise direction, it will be necessary to continue rotation in this direction until the arrow again appears in the window. See Figure 4–2. When the switch is placed in the LOCK position, the motor will again assume its correct AFC position.

(3) HOLD POSITION.–The local oscillator motor cannot be activated by AFC voltages while in the HOLD position. The local oscillator, therefore, is without AFC while in this position and consequently oscillates at its free-running frequency, regardless of any frequency shifts of the incoming signal. This position is used on occasions when the local oscillator supplies the carrier signal to the demodulation circuits, and the incoming carrier is useless as a reference voltage for the AFC circuits. To prevent random running of the motors due to noise pulses in the absence of the carrier, this position of the Motor Run switch places the local oscillator at its free-running frequency. If the incoming signal should shift frequency while the switch is in the HOLD position, distortion of the audio will result, since the local oscillator is no longer supplying a true carrier signal to the demodulation circuits. However, the audio should be intelligible.

y. LOCAL OSCILLATOR ADJUST C322.–This is the trimmer capacitor in the local oscillator tuned circuit.

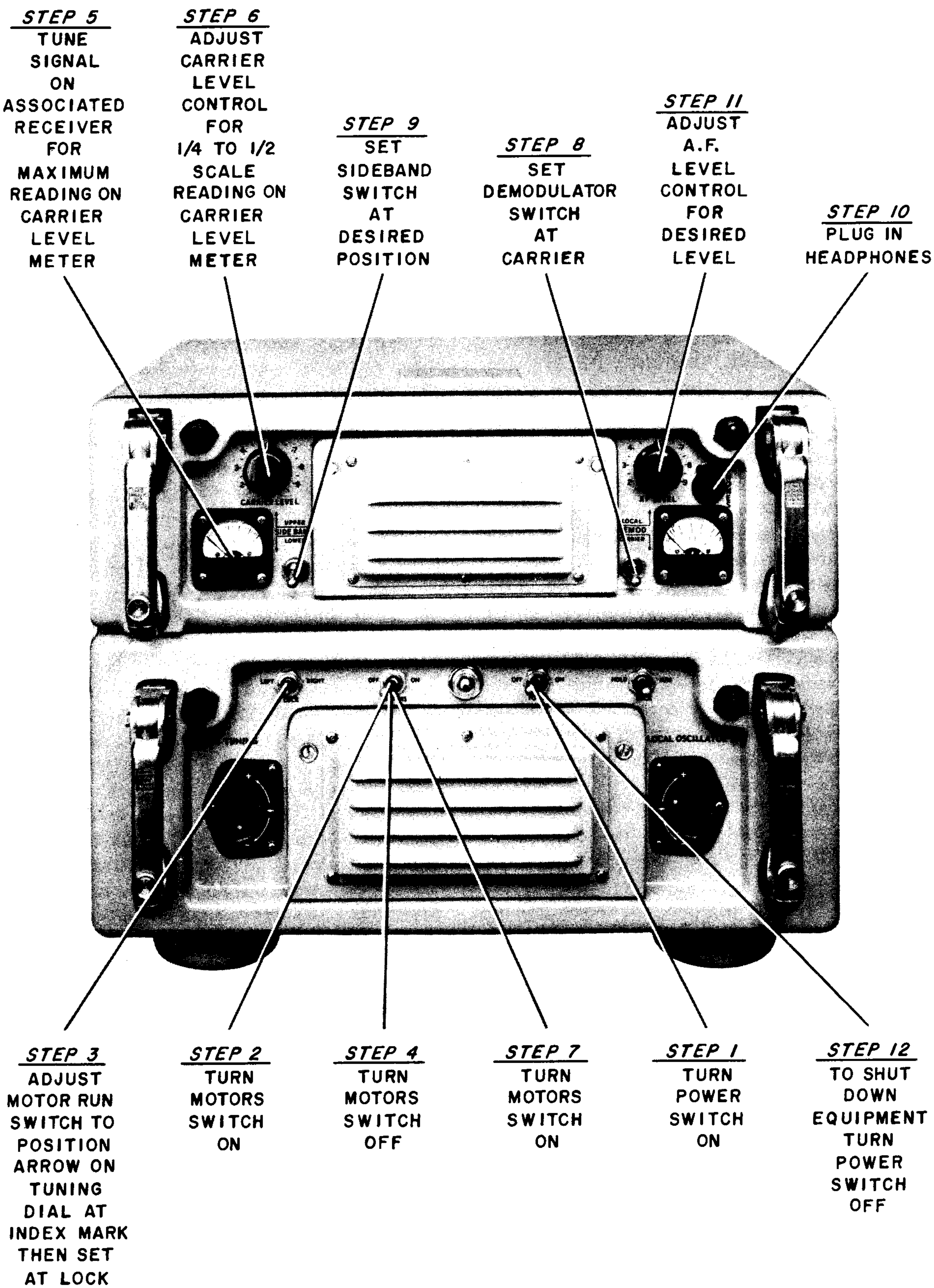


Figure 4–2. CV-216/URR, Operating Instructions

z. CONS LEVEL R335.–This control adjusts the threshold of CONS operation. When the carrier drops below the threshold, relay K301 disables both AFC motor circuits.

3. OPERATING INSTRUCTIONS.

a. ROUTINE OPERATING INSTRUCTIONS.–The following paragraphs give the operating instructions governing the various modes of reception of the equipment.

The sequence of adjustments for receiving all types of emission is identical. However, AGC modifications in the associated receiver may be required in order to receive signals of the suppressed-carrier type.

NOTE

Before energizing the equipment refer to Figure 4–1 and make the following adjustments:
(1) Place Motors switch in the OFF position;
(2) place both oscillator Motor Run switches in the LOCK positions.

The following instructions are shown pictorially on Figure 4–2.

Step 1. Turn Power switch ON. When the power supply rectifiers warm up, the glow lamp indicator will light.

Step 2. Turn Motors switch ON.

Step 3. Using the tuning oscillator Motor Run switch rotate the motor until the arrow on the tuning dial is at the index mark. In the RIGHT position the arrow will rotate clockwise; in the LEFT position, counterclockwise. Then place switch in LOCK position.

Step 4. Turn Motors switch OFF.

NOTE

If the Motors switch is left ON while tuning the receiver, the positions of the arrows will be disturbed and might necessitate resetting of the motors.

Step 5. Turn receiver on and tune signal for peak reading on the Carrier Level meter.

Step 6. Adjust the Carrier Level control to obtain a 1/4 to 1/2 scale reading on the Carrier Level meter.

Step 7. Turn Motors switch ON.

Step 8. Place Demodulator switch to CARRIER.

Step 9. Select the desired sideband by placing Sideband switch in either the UPPER or LOWER positions.

Step 10. Plug in headphones.

Step 11. Listen to signal and adjust AF Level control for the desired level.

The Converter, after these adjustments have been made, is in its normal operating condition. No further adjustments will be necessary except possibly the Sideband switch. The operator may at any time switch from the LOWER to the UPPER and vice versa by means of this switch. During the reception of double sideband transmissions, the operator may find that one sideband is more intelligible than the other. For adjustments to improve reception during periods of adverse atmospheric conditions, see paragraph 3b, this section.

NOTE

Whenever tuning from one frequency to another Steps 3 to 7 should be followed. Also, if the operator should notice that the arrow on the tuning dial is not near the index mark (see Figure 4–3), he should retune the equipment by following Steps 3 to 7.

b. OPERATION UNDER ADVERSE CONDITIONS.–For operation under normal conditions, the CONS should be in its fully counterclockwise position. In this position the CONS will disable the motors before the incoming carrier drops to a level insufficient for proper operation of the AFC. However, during periods of deep fade and severe noise, the noise pulses may be of sufficient amplitude to run the motors. In this case, the CONS relay would remain inactive and the motors would run at random. As a result, when the carrier returns the motors are not properly positioned to control the oscillators and therefore the audio will be severely affected or even be completely absent. If this should happen the tuning motor AFC circuit would have to be reset as described in paragraph la, Section 5. To prevent such occurrences under adverse conditions, the operator should try advancing the CONS Level control to a point where the CONS relay will be activated and disable the motors at a signal level above the noise pulses. The operator will have to experiment somewhat to find this point.

If it is impossible to obtain satisfactory reception by means of the CONS, rotate the CONS Level control to its extreme counterclockwise position and try the following adjustments. If any one adjustment produces satisfactory and usable audio, do not proceed any further.

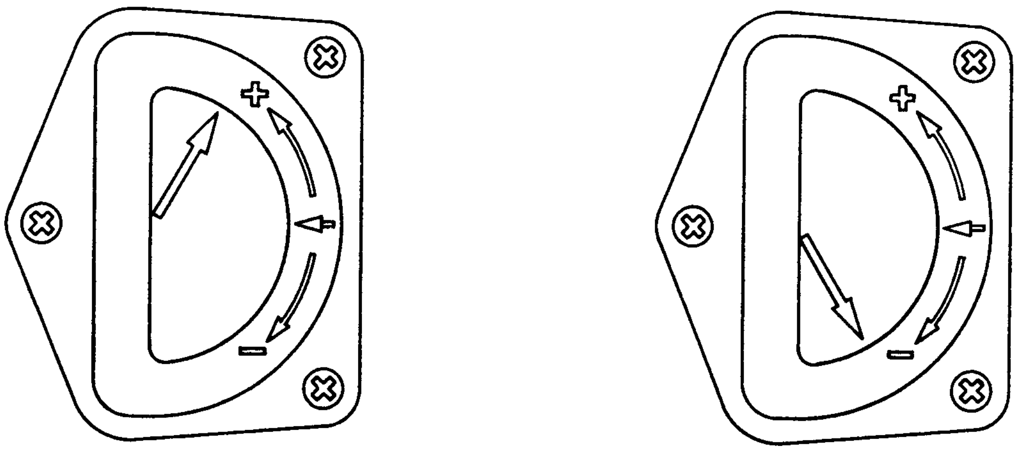
Step 1. By means of Sideband switch try both sidebands to see if one is more noise free or less distorted than the other.

Step 2. Substitute the local oscillator for the carrier by placing the Demodulator switch in the LOCAL position.

Step 3. If the audio is still unsatisfactory, run the local oscillator tuning dial arrow to the index mark by placing the Motor Run switch in the Run position;

then on HOLD. When this switch is in the HOLD position, the carrier signal is no longer applied to the local oscillator AFC circuit. The local oscillator assumes it natural free-running frequency.

When conditions permit, return the equipment to its normal mode of operation. That is, place the Demodulator switch in the CARRIER position and put the local oscillator Motor Run switch in the LOCK postion.



(A)

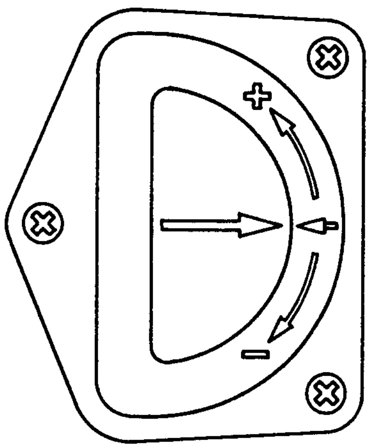


Figure 4–3. Tuning Oscillator Motor Dial, Correct and Incorrect Settings

SECTION 5
OPERATOR'S MAINTENANCE

1. ROUTINE CHECKS.

The procedure for making routine checks as outlined in Table 5–1 is to be followed by the operating personnel at the beginning of each watch. These checks are to be made with the Converter in a normal operating condition.

The routine checks consist of checking external cables and connections; observing the Carrier Level meter to see if the carrier is of sufficient strength for proper operation of the equipment and checking the tuning oscillator to see if it is operating near the center of its range.

If the corrective measures described below for the operator do not rectify the faulty operation, the operator should inform the technician so that further tests and corrective maintenance may be made.

TABLE 5–1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
Glow Lamp	Observe lamp.	No light or intermittent light indicates: 1. No power. 2. Poor lamp. 3. No B± 4. Loose power cable connection. 5. Blown fuses, F401, F402 and F301.
AFC Tuning Motor Dial	Observe dial on left side of lower front panel.	Arrow on dial should be at or very close to index mark.
Carrier Level Meter M101	Observe meter.	Meter reading should be between 1/4 and 1/2 scale.
External Connections	Inspect all cables for loose connections and damage. Inspect signal output connection of associated receiver.	

a. RESETTING THE TUNING OSCILLATOR MOTOR. –If the arrow on the tuning dial is at a considerable distance from the index mark, the AFC circuit is operating close to the limit of its range. See Figure 4–3. If allowed to remain in this condition, there is danger of the motor losing control of the tuning oscillator. The tuning oscillator motor should be reset at the earliest possible opportunity when the equipment is not in use.

A possible cause for the shifting of the arrow is that the associated receiver is not tuned exactly to the signal. To correct this fault proceed as follows:

Step 1. Reduce receiver gain so there is no signal input to the converter.

Step 2. Place the tuning oscillator Motor Run switch in the proper position (either LEFT or RIGHT) to rotate arrow to the index mark and then place the switch in the LOCK position.

Step 3. Turn Motors switch to OFF leaving the Motor Run switch in the LOCK position and the arrow at the index mark.

Step 4. Tune the receiver for a peak reading on the Carrier Level meter.

Step 5. Turn Motors switch ON.

The motor should now hold the tuning dial in the correct position with the arrow near or at the index mark. If the arrow returns to its original incorrect position, notify a technician so that further adjust-

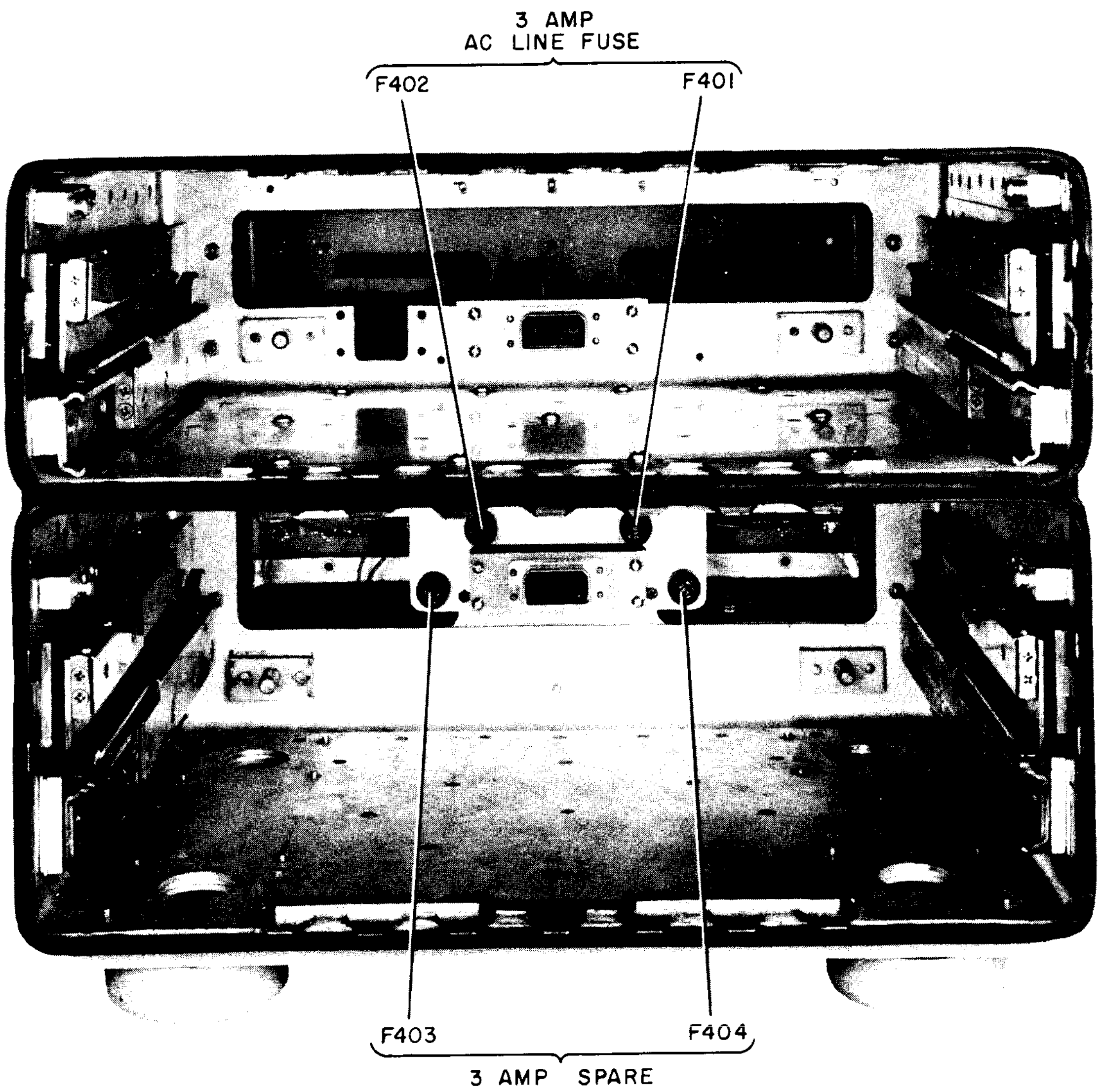


Figure 5–1. Location of Power Line Fuses

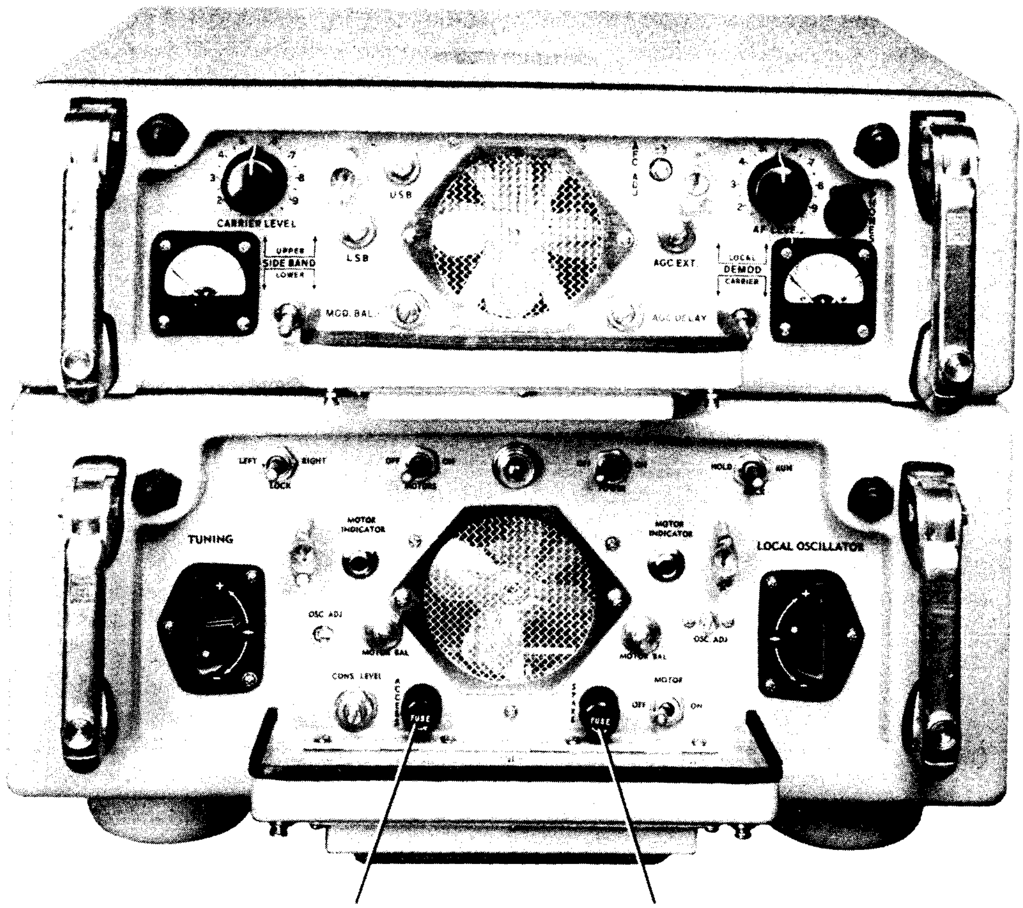


Figure 5–2. Location of Motor Fuses

ments may be made.

b. INSPECTION OF EXTERNAL CONNECTIONS.–The external connections at the rear of the cabinet should be inspected for any loose or broken connectors. The cables should be carefully examined for any damage. If the power cable is loose or broken the glow lamp on the front panel will not light or will light intermittently. A faulty signal input cable will cause erratic readings on the Carrier Level meter, or there might be no reading at all. A poor audio output connection or an imperfect cable will adversely affect the audio device connected to the Converter.

2. EMERGENCY MAINTENANCE.

These paragraphs include instructions and precautions covering the replacement of electron tubes and fuses which may be replaced by the operator.

Notice to Operators

Operators shall not perform any of the following emergency maintenance procedures without proper authorization.

a. REPLACEMENT OF FUSES.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse burns out immediatley after replacement, do not replace it a second time until the cause has been corrected.

(1) PROBABLE CAUSES OF FUSE FAILURE.–Fuses F401 and F402 protect the power input circuit. If one or both of these fuses blow, the Converter will

become inoperative. The following is a list of probable causes of the failure of these fuses.

(a) The power input cable may be damaged.

(b) Any of the circuits of transformer T303 may be shortcircuited.

(c) Short-circuit in the wiring of the power input circuit from switch S301 to transformer T303.

Fuse F301 protects the two fan motors and the two AFC motors. When this fuse blows, the motors can not be energized. If this fuse blows, the coils of all motors should be inspected for short circuits.

(2) LOCATION OF FUSES. *(See Figure 5–1, 5–2 and 5–3.)*—The AC power line fuses F401 and F402 are located in the cable filter assembly at the rear of the cabinet. The easiest way to replace these fuses is by pulling out the lower chassis and reaching into the cable filter assembly from the front of the cabinet. Two spare fuses, F403 and F404, are located in the same area. See Figure 3–2.

Motor fuse F301 is located, with a spare, on the lower front panel behind the access door. Fuses F303 and F304 are located, with spare F305, on the chassis stiffener of the lower unit. Fuse F303 protects the 300-volt line from the secondary of transformer T303 to the center tap of the primary of transformer T301. Fuse F304 protects the 300-volt line from the secondary of transformer T303 to the center tap of the primary of transformer T302.

b. REPLACEMENT OF ELECTRON TUBES.—The location and identification of all electron tubes are shown in Figures 5–4 and 5–5. Access to tubes in either chassis may be gained by sliding the chassis assembly out of the cabinet.

(1) LOCATING DEFECTIVE TUBES.—If the equipment fails and the glow lamp remains lighted, a defective tube may be the cause of the trouble. To locate the tube, the operator should pull out each chassis assembly and inspect all tubes. A cold tube or a tube which is not glowing is defective and must be replaced with a pre-tested tube of the same type. If it is impossible to determine by inspection which tube is defective, a tube tester should be used.

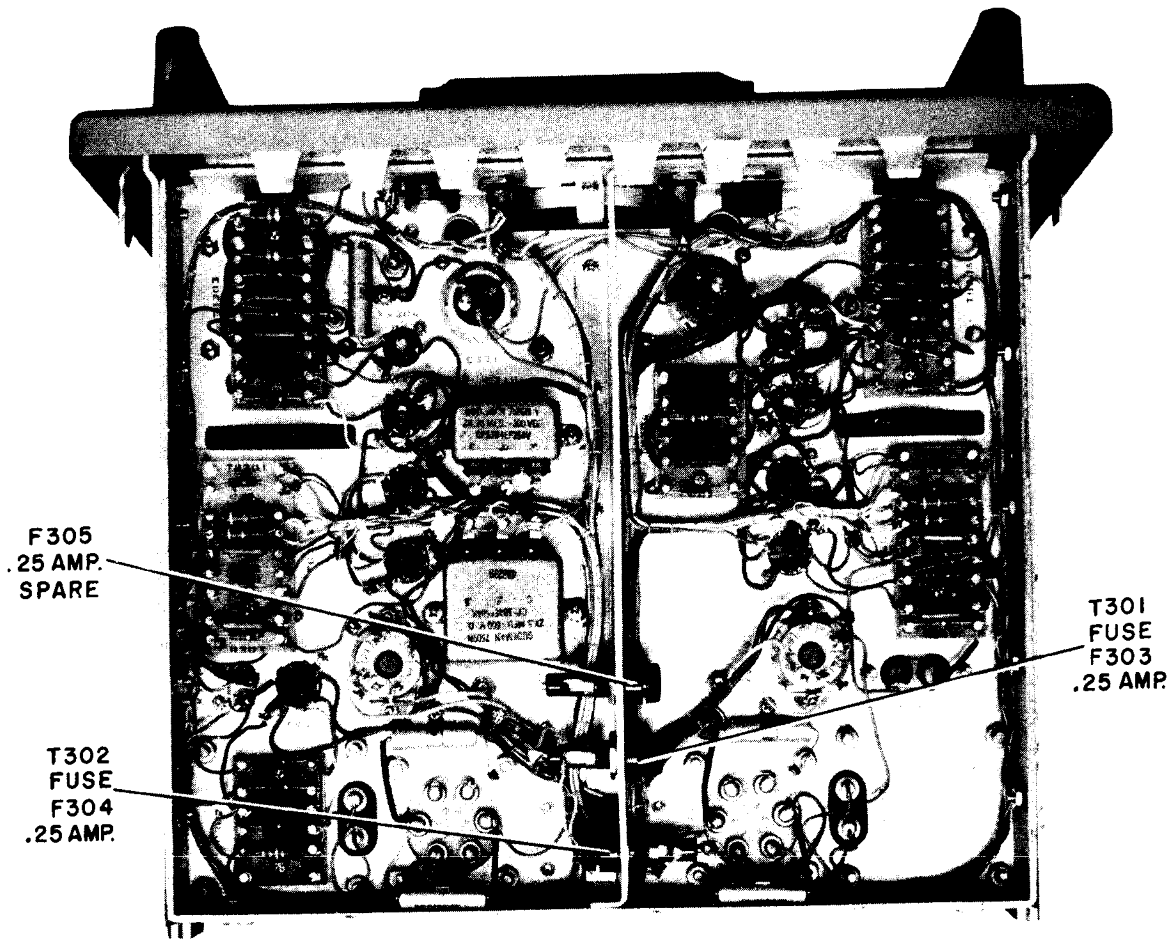


Figure 5–3. Location of Fuses Protecting Transformers T301 and T302

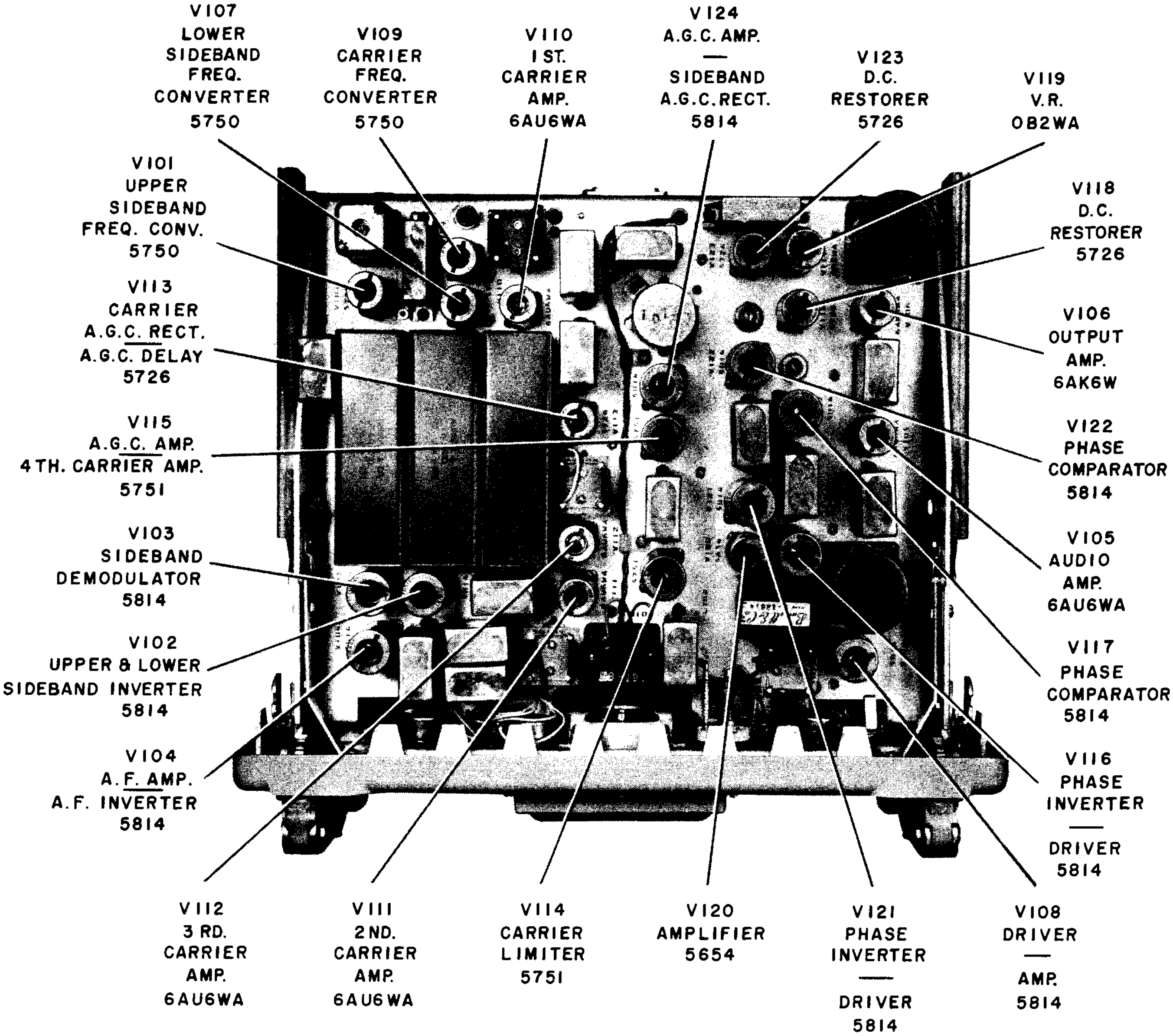


Figure 5–4. Tube Locations, Upper Chassis

(2) REPLACEMENT WITH NON-RUGGEDIZED EQUIVALENTS.–Wherever possible, reliable or ruggedized tubes are used in the Converter. If any of these tubes becomes defective, they should be replaced with tubes of the same type and ruggedized quality. However, if continued operation of the equipment becomes necessary and a ruggedized replacement is not available, a non-ruggedized equivalent tube may be substituted. Table 5–2 lists the ruggedized tubes and their lower quality counterparts which may be substituted. For peak performance of the equipment, ruggedized tubes should be obtained as soon as possible.

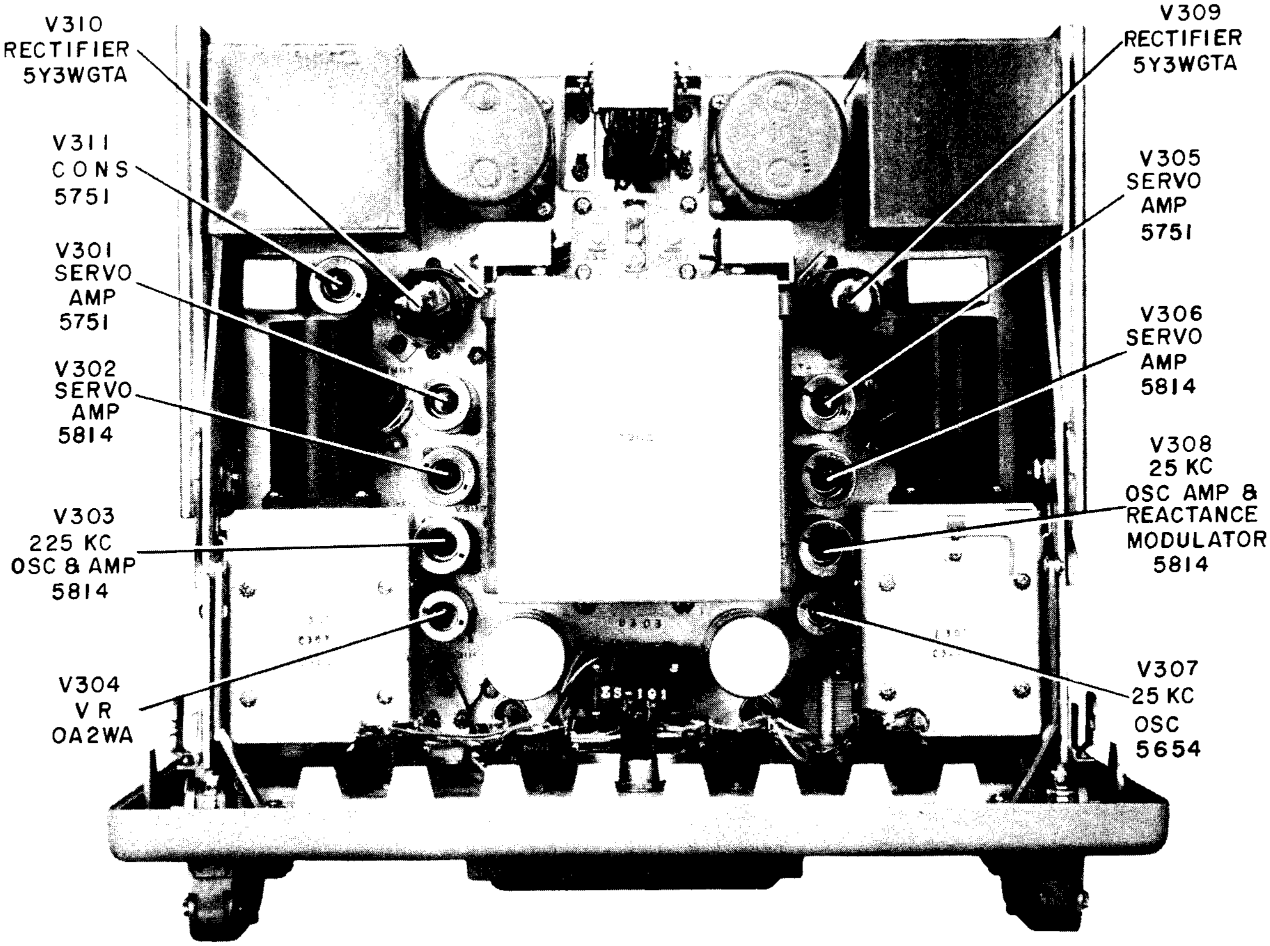


Figure 5–5. Tube Locations, Lower Chassis

TABLE 5–2. RELIABLE TUBE EQUIVALENTS

RELIABLE OR RUGGEDIZED TUBE	EQUIVALENT (NON-RELIABLE)
5654	6AK5, 6AK5W
5726	6AL5, 6AL5W
5750	6BE6
*5751	12AX7
*5814	12AU7
5Y3WGTA	5Y3GT
6AK6W	6AK6
6AU6WA	6AU6
0A2WA	0A2
0B2WA	0B2

*It is not recommended that this reliable type be replaced with its prototype. If latter is used out of necessity, replace as soon as possible with reliable version.

(3) READJUSTMENT OF CONTROLS.–If any of the tubes listed below are replaced, readjustment of some semi-operating controls may be required in order to obtain maximum performance. These adjustments should be made by maintenance personnel at the earliest opportunity after replacing the tube. See Section 7, paragraph 3 for the procedure for making the adjustments. The adjustments required for each replaced tube are listed in parentheses following the tube.

(a) Oscillator V303A and V303B (Oscillator Adjust C306)

(b) Servo Amplifier V301 and V302 (Motor Balance control R307)

(c) Oscillator V307 (Oscillator Adjust C322)

(d) Servo Amplifiers V305 and V306 (Motor Balance control R321)

(e) Sideband Demodulator V103 (Demodulator Balance R117)

(f) DC Restorer V118 (Diode Balance control R198)

(g) DC Restorer V123 (Diode Balance control R225)

SECTION 6
PREVENTIVE MAINTENANCE

1. ROUTINE MAINTENANCE CHECKS.

The following paragraphs contain information concerning maintenance which should be executed periodically for the purpose of preventing failure or impairment of the equipment. These maintenance procedures should be accomplished at the designated periods in order to assure continuity of service at peak performance. Table 6–1 is arranged to indicate what is to be done, how to do it and the precautions to be observed.

NOTE

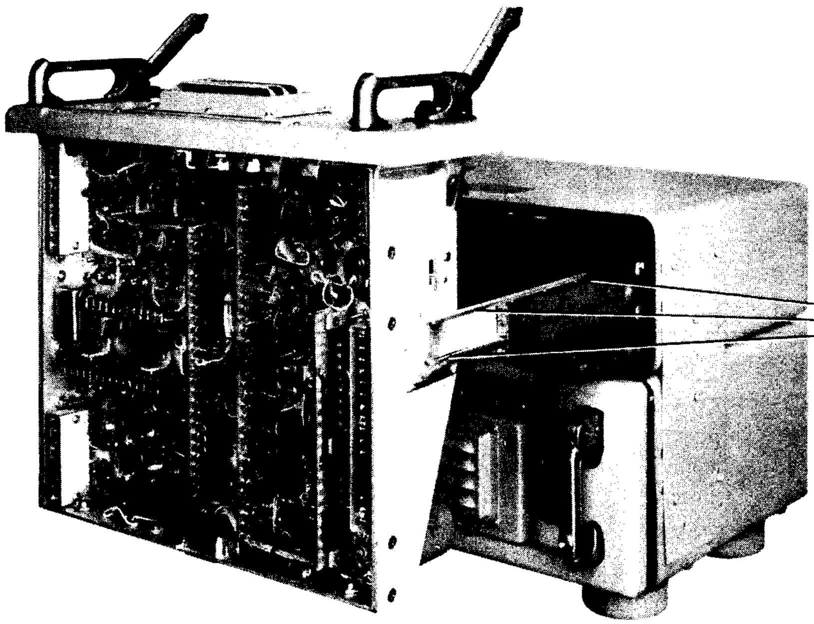
The attention of maintenance personnel is invited to the requirements of Chapter 67 of the Bureau of Ships Manual, of the latest issue.

2. ALIGNMENT OF OSCILLATORS.

Weekly alignment of the two oscillators should be performed to compensate for any drift in oscillator frequency. Oscillator drift may be caused by input signal drift, temperature, vibration, shock and other causes. The AFC circuits will correct the oscillator frequency when these conditions occur. However, gradual drifts in oscillator frequency may bring the AFC circuit to the limit of its range. If allowed to remain in this condition, there is danger of the AFC losing control. Excessive oscillator drift is indicated when the arrow on its tuning dial is a considerable distance from the index mark. See Section 7, paragraph 3b for the procedure to be followed for aligning the oscillators.

3. LUBRICATION.

Instructions for the lubrication of the slide and tilt mechanism are shown in Figure 6–1. These are the only parts of the CV-216/URR requiring lubrication.



STOCK NUMBERS

SPECIFICATION NO. AND TITLE	TYPE	GRADE	MILITARY SYMBOL	STANDARD NAVY STOCK NO. 8 OZ. TUBE	STANDARD NAVY STOCK NO. 1 LB. CAN
MIL-G-3278 AIRCRAFT AND INSTRUMENT GREASE	—	—	—	W14-G-611-5	W14-G-611-10
	—	—	—	R14-G-984-500	R14-G-982-20

* FORMERLY AN-G-25

Figure 6–1. Lubrication Data

TABLE 6-1. ROUTINE MAINTENANCE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS
EACH WATCH		
See Table 5-1, Operator's Routine Check Chart		
WEEKLY		
Alignment of oscillators	Arrow on Motor dials should be at or near index mark.	See Section 7, paragraph 3b.
MONTHLY		
Air filters	Inspect for dirt and dust particles accumulation.	Blocked-up air filters will cause excessive increases in temperature in the cabinet. Clean with Dry Cleaning Solvent MIL-S-16067.
QUARTERLY		
General inspection	Withdraw each unit from its cabinet. a. Make a careful visual inspection of interior to detect symptoms of trouble resulting from wear or overheating. b. Check for noisy components and connections.	To make this test, withdraw the unit under test from its cabinet, connect a test cable between the multiconnector on the chassis and the multiconnector on the inside of the cabinet, then tap components with a piece of insulating material. Listen for noise produced by faulty components with headphones plugged into Phones jack J101.
Sensitivity	Reading on Carrier Level meter should be between 1/4 and 1/2 scale.	See Section 7, paragraph 2d(2) for procedure.

FAILURE REPORTS

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. It should be made on Failure Report, form NAVSHIPS 383, which has been designed to simplify this requirement. The card must be filled out and forwarded to BUSHIPS. Full instructions are to be found on each card.

Use great care in filling the card out to make certain it carries adequate information. For example under "Circuit Symbol" use the proper circuit identification taken from the schematic drawings, such as T–803, in the case of a transformer, or R–207, for a resistor. Do not substitute brevity for clarity. Use the back of the card to completely describe the cause of failure and attach an extra piece of paper if necessary.

The purpose of this report is to inform BUSHIPS of the cause and rate of failures. The information is used by the Bureau in the design of future equipment and in the maintenance of adequate supplies to keep the present equipment going. The cards you send in, together with those from hundreds of other ships, furnish a store of information permitting the Bureau to keep in touch with the performance of the equipment of your ship and all other ships of the Navy.

This report is not a requisition. You must request the replacement of parts through your Officer-in-Charge in the usual manner.

Make certain you have a supply of Failure Report cards and envelopes on board. They may be obtained from the nearest District Printing and Publication Office.

Figure 7–1. Failure Reports

SECTION 7
CORRECTIVE MAINTENANCE

1. INTRODUCTION.

This section contains all the information necessary to enable maintenance personnel to locate electrical and mechanical troubles and to make repairs. All performance tests, alignment procedures and test methods as well as electrical and mechanical adjustments are included. The trouble-shooting chart, Table 7–1, will help the technician to quickly locate sources of equipment failure. Maintenance personnel should become familiar with the trouble-shooting chart so that when troubles arise they may be found and remedied in the least possible time. An explanation of the chart is given in paragraph 2 of this Section.

2. TROUBLE-SHOOTING.

a. THEORY OF LOCALIZATION.—When troubles occur in the equipment, the source of the trouble may often be quickly identified and its location established from the behavior of the equipment. The two meters, the motor dials and the glow lamp will aid in determining at all times whether or not the equipment is functioning properly. Any major defect in the equipment will reveal its presence by means of one or more of these indicators and the indicator will often pinpoint the trouble. The two meters give visual indication of the functioning of the signal circuits, the pilot light checks the power circuits, while the two tuning dials on the lower front panel will reveal malfunctioning in the motor circuits. In the trouble-shooting chart, Table 7–1, the symptoms of major troubles are shown with the possible sources of the defects. When trouble shooting and also during periods of inspection or test, check all components and wiring for any physical break-down. Look for charred insulation, discoloration and compound leakage of capacitors and resistors. If the odor of burned insulation is present, check all

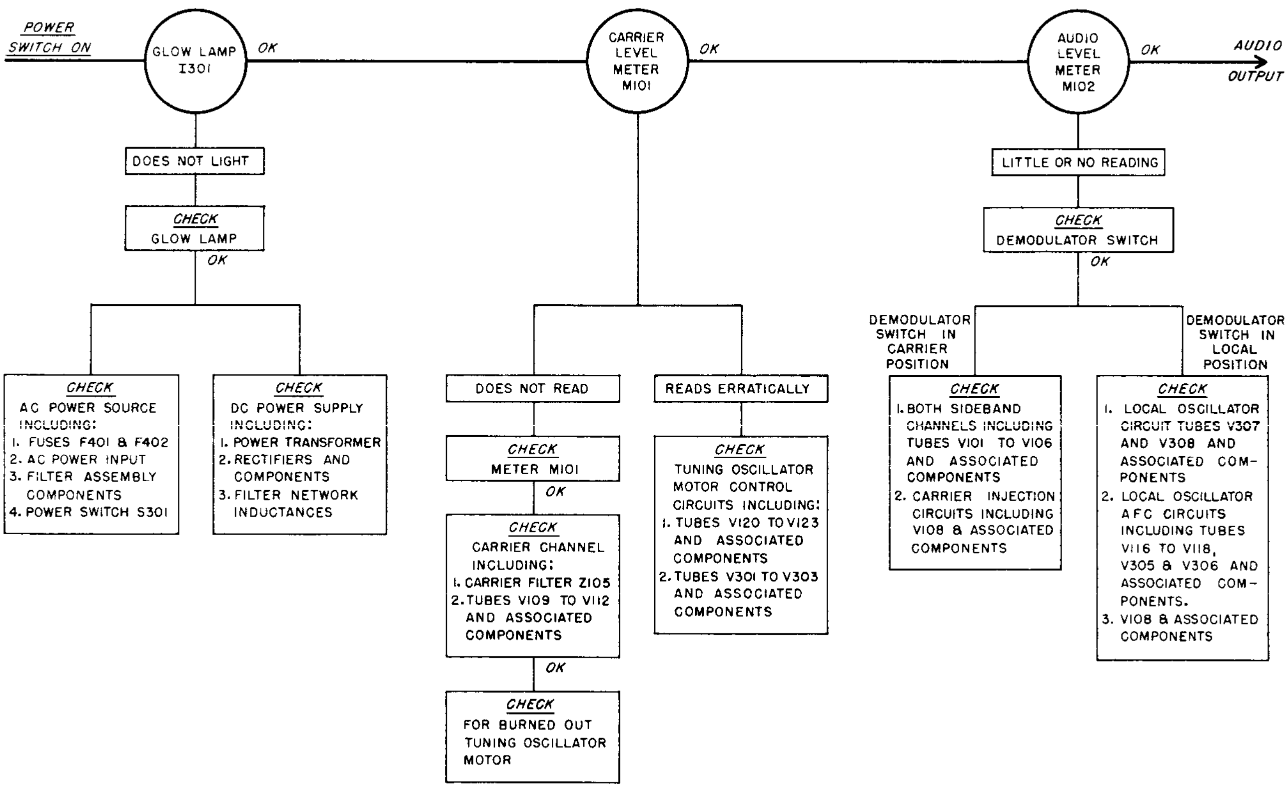


Table 7–1. Trouble Shooting Chart

insulation carefully.

The general procedure for tracking down equipment faults is as follows:

Step 1. Determine the stage or stages at fault by means of the trouble-shooting chart.

Step 2. Examine the stage in detail to determine which particular component or adjustment is causing the trouble.

Step 3. Replace or repair the defective component or adjust correctly.

Step 4. Make a thorough check of converter performance before placing equipment back into operational duty.

Reference to the overall schematic diagrams, 7–7, 7–8 and 7–9, and to the simplified schematic diagrams in Section 2 will also aid in localizing particular faults. Figures 7–13 to 7–17 will aid in locating components in the various stages.

Troubles can be located by systematically checking the equipment as outlined in the trouble-shooting chart, Table 7–1. To read these charts, start at the left hand side and follow the heavy black line to the right. Indicating devices, such as lamps and meters are shown in circles. Under each indicating device is a block in which are listed symptoms which will reveal faulty operation.

Under the symptoms block is another block in which are listed checks to be made to locate the trouble. If the indicating device does not show symptoms of trouble, proceed to the next circle on the heavy black line, and so forth.

If a chassis assembly has to be withdrawn from the cabinet in order to check a particular circuit, the test cable supplied with the equipment must be used. See paragraph 2c this Section for method of connecting the test cable.

b. ELECTRON TUBE INFORMATION.–The full complement of electron tubes used in the CV-216/URR is given in Table 1–4. The relative locations of the tubes and tube socket voltages and resistances measured between each tube pin and ground are shown in Figures 7–2 and 7–3. See Figures 5–4 and 5–5 for photographs showing the exact location of each tube. The tube operating voltages and currents are given in Table 7–2 and the rated tube characteristics are listed in Table 7–3. Access to all tubes may be readily had by withdrawing the chassis assembly as far as each mechanical stop permits. Tubes should be checked in a tube tester such as Navy model OZ series or equivalent or by replacing the tubes with ones of known quality.

c. CONNECTING THE TEST CABLE.–In order to keep the Converter energized during test procedures, the test cable must be used whenever either chassis is withdrawn from the cabinet. If the upper chassis is withdrawn, connect the test cable between connectors P101 at the rear of the upper chassis and J401 which is located on the upper part of the rear wall inside the cabinet. If the lower chassis is withdrawn, connect the test cable between connectors P301 at the rear of the lower chassis and J402 which is located on the lower rear wall inside the cabinet. Before using the cable for servicing, make a continuity check on the cable so that it may be eliminated as a possible source of trouble.

d. PERFORMANCE TESTS.–The following tests are used to check operation of the equipment section by section. These tests should be made following any readjustments to assure proper functioning prior to return to operational duty. The tests must be made in the order shown since the validity of the test of any specific section depends on the correct functioning of previous sections.

To make these performance tests, the following units of test equipment are needed:

(1) A type AN/URM-25 signal generator or equivalent which covers the frequency range from 190 to 210 kilocycles.

(2) A pair of 600-ohm headphones.

(3) A non-inductive dummy antenna. The impedance of the dummy antenna plus the internal impedance of the signal generator should equal 70 ohms.

(4) A 600-ohm dummy load. A 620-ohm carbon resistor such as Standard Navy Stock Number N16-R-49822-431 may be used.

The performance tests involve checking the three main sections of the equipment, namely, the signal circuits and the two AFC circuits. Consult Figure 7–4 for the indentification of all front panel controls.

(1) OSCILLATOR-AFC CIRCUITS PERFORMANCE TESTS.–To check the tuning oscillator AFC section, proceed as follows:

Step 1. Set the front panel controls as follows:

Power switch at OFF.

Motors switch at OFF.

Local Oscillator Motor switch at ON.

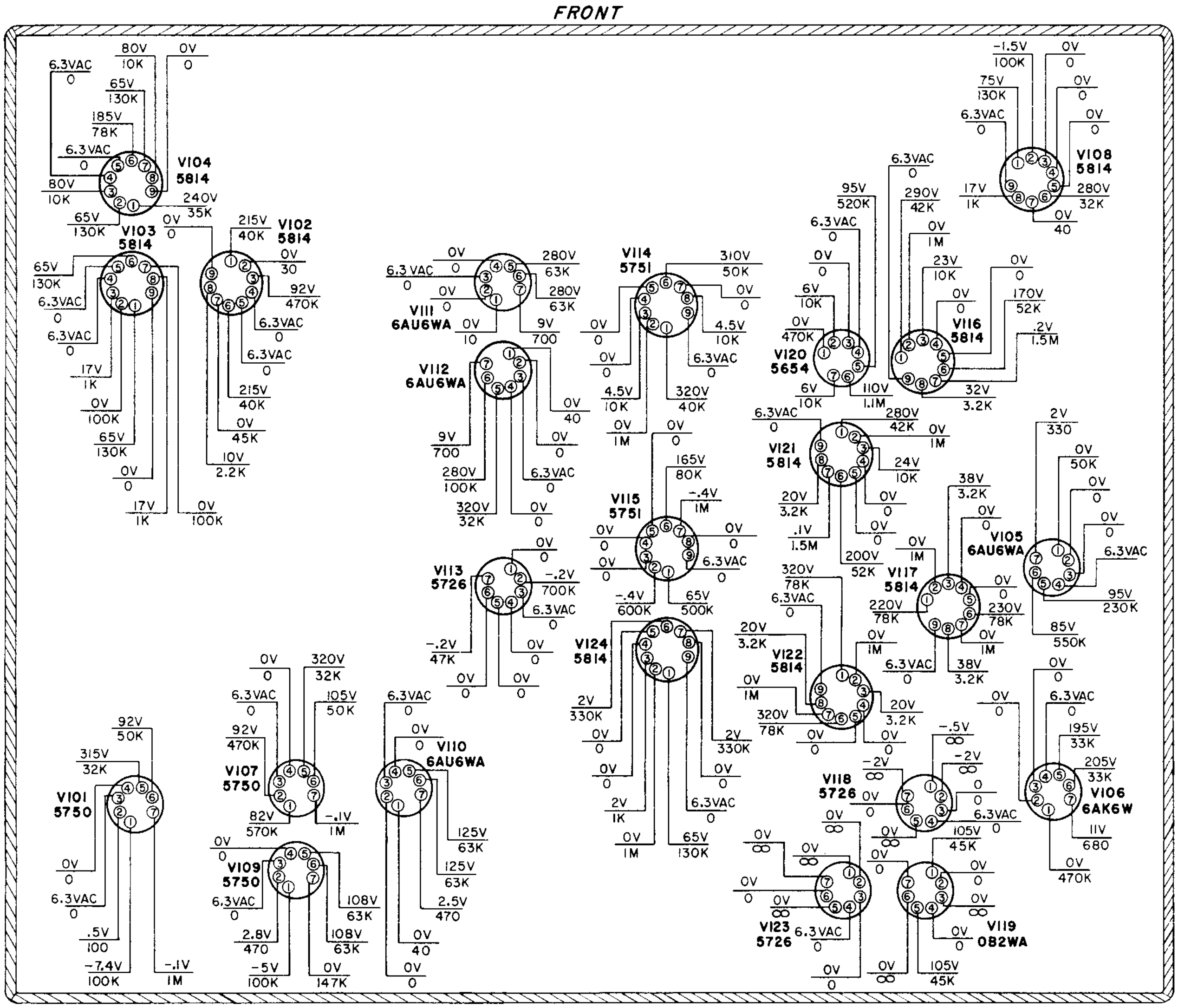
Demodulator switch on CARRIER.

Both Motor Run switches on LOCK.

Carrier Level control at its maximum clockwise position, CONS Level in its maximum counterclockwise position.

Step 2. Connect the output lead of the signal generator to the center terminal of IF input connector J405 through the dummy antenna. Connect the ground lead of the signal generator to any convenient point on the chassis of the Converter.

Step 3. Connect the 600-ohm dummy load between pins A and D of audio output connector J403.



CONDITIONS:

1. MEASUREMENTS MADE BETWEEN SPECIFIED POINT AND CHASSIS.
2. MULTIMETER AN/PSM-4 USED.
3. NO SIGNAL INPUT.
4. 115VAC INPUT FOR VOLTAGE MEASUREMENTS WITH POWER ON. UNIT DISCONNECTED FOR RESISTANCE MEASUREMENTS.
5. ALL VOLTAGES DC EXCEPT AS NOTED.
6. VOLTAGE READING SHOWN ABOVE LINE, RESISTANCE BELOW.
7. CONTROL SETTINGS:
   BALANCE CONTROLS SET AT CENTER POSITION, ALL OTHERS AT EXTREME CLOCKWISE POSITION.
   SIDEBAND SWITCH AT UPPER.
   DEMODULATION SWITCH AT LOCAL.
8. TOLERANCE ±10%.

Figure 7–2. Tube Socket Voltages and Resistances, Upper Chassis

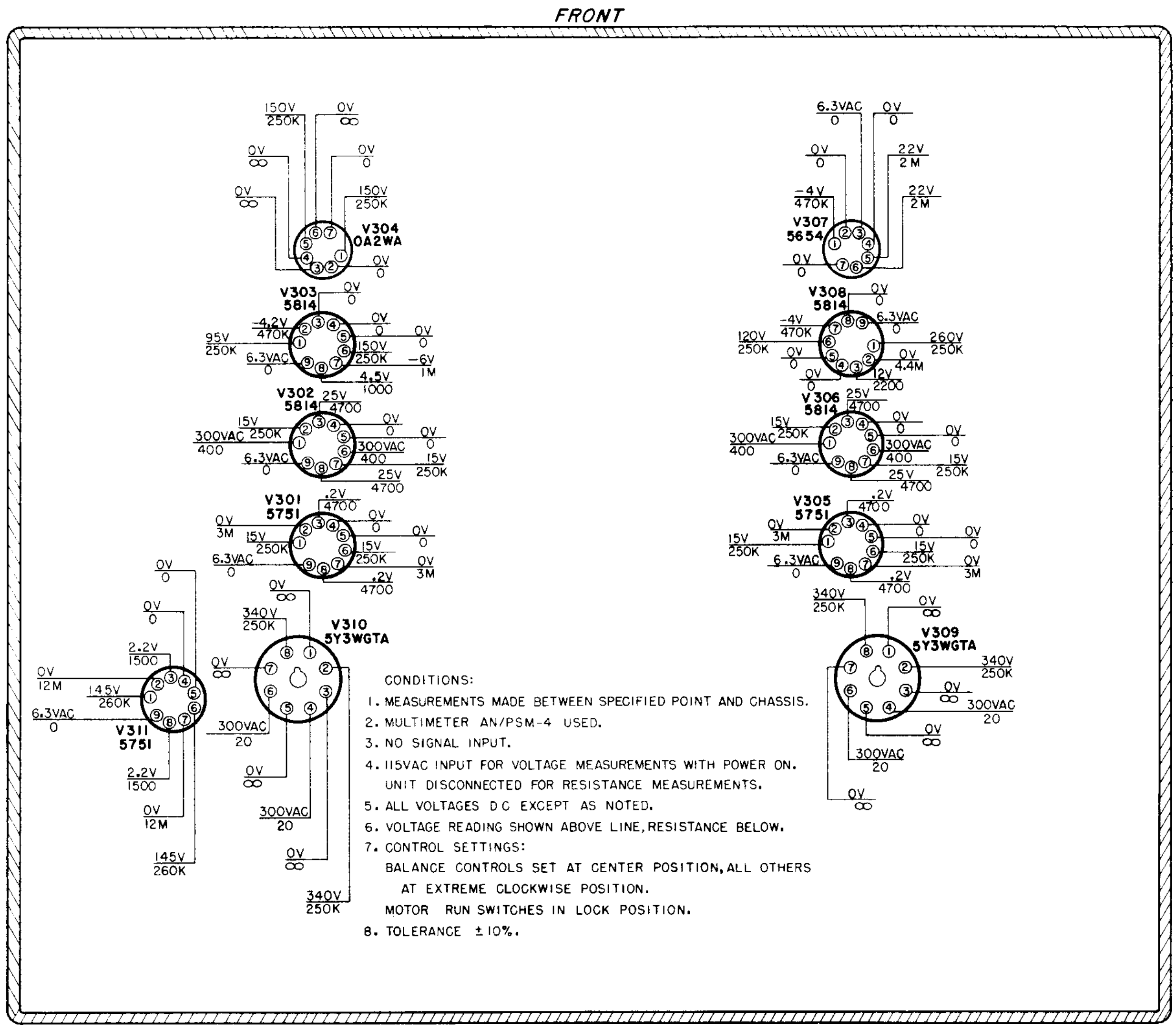


Figure 7–3. .Tube Socket Voltages and Resistances, Lower Chassis

Step 4. Turn Power ON and allow three or four minutes warm-up time.

Step 5. Turn signal generator ON and adjust the output to 200 kilocycles at 0.025 to 0.5 volts.

Step 6. Turn Motors switch ON.

Step 7. Using the Tuning Oscillator Motor Run switch run the motor until the arrow of the dial is pointing at or near the index mark. Then place this switch in the LOCK position.

Step 8. Vary the signal generator frequency slightly until a maximum is obtained on the Carrier Level meter.

Step 9. Adjust the Carrier Level control until a 1/4 to 1/2 scale reading on the Carrier Level meter is obtained.

Step 10. Very slowly adjust the signal generator to a frequency 5 kilocycles higher. The tuning oscillator motor will run to adjust the tuning oscillator to the new frequency. Then adjust the signal generator 5 kilocycles lower than the center frequency. The motor will rotate in the opposite direction to adjust the tuning capacitor.

Step 11. Modulate the input signal 30% with 1000 cycles.

Step 12. Place the Demodulator switch in the LOCAL position.

Step 13. Plug a pair of headphones into Phones jack and listen to signal. If the audio tone is steady, the local oscillator is being controlled properly by the AFC circuits. If the pitch of the signal varies gradually and continuously, the AFC circuits have lost control of the local oscillator. To reset this motor see paragraph 3b, this Section.

Step 14. Place the Local Oscillator Motor Run switch on RUN and rotate the motor to some random position. Then place the switch on LOCK. The motor should then return to its proper AFC position with the arrow pointing at or near the index mark.

Step 15. Turn Motors switch OFF.

Step 16. Turn Power OFF.

(2) SIGNAL CIRCUITS PERFORMANCE TEST.– To test the performance of the audio circuits of the equipment, proceed as follows:

Step 1. Connect the signal generator to IF input connector, J405 through the dummy antenna. Adjust the output of the generator to 200 kilocycles modulated 30% with 1000 cycles at 0.5 volt.

Step 2. Connect the dummy load resistor across pins A and D of the audio output connector J403.

Step 3. Turn Power ON and adjust the signal generator carrier for a maximum reading on the Carrier Level meter.

Step 4. Adjust the Carrier Level control for a 1/4 to 1/2 scale reading on the Carrier Level meter.

Step 5. Place both Motor Run switches in the LOCK position.

Step 6. Turn Motors switch ON.

Step 7. Plug in headphones in Phones jack.

Step 8. Place Demodulator switch in the CARRIER positon.

Step 9. Place the Sideband switch in the UPPER position.

Step 10 Listen in the headphones for audio signal. The Audio Level meter should read at least 20 db.

Step 11. Place Sideband switch in the Lower position. The Audio Level meter should read at least 20 db.

Step 12. Place the Demodulator switch in the LOCAL position.

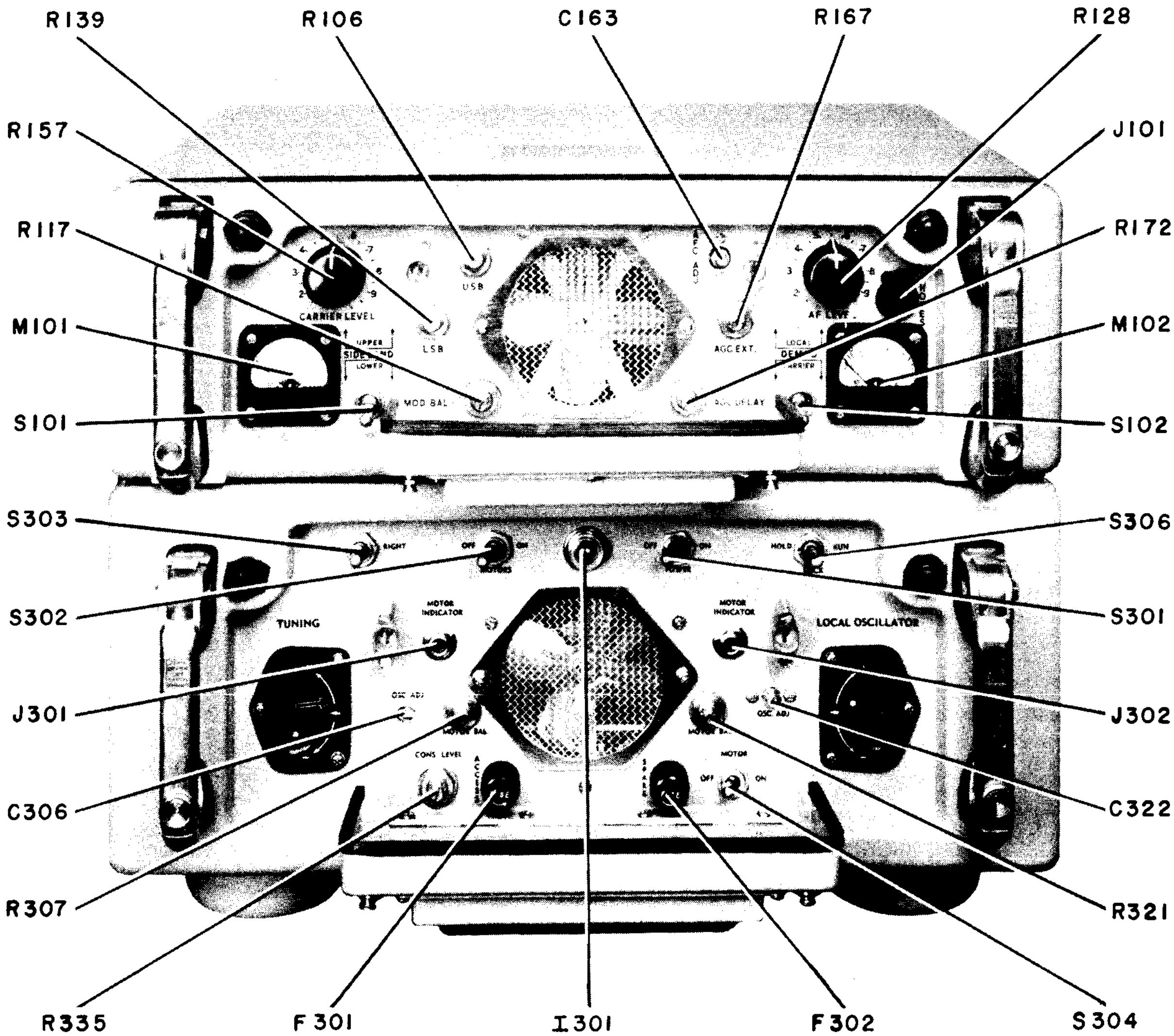


Figure 7–4. Front Panel Control Identification

Step 13. Repeat Steps 9 to 11.
Step 14. Turn Motors switch OFF.
Step 15. Turn Power OFF.
Step 16. Remove all test equipment.

3. ELECTRICAL ADJUSTMENTS.

The following sub-paragraphs give detailed instructions for making electrical adjustments of the equipment. These adjustments are to be made when the equipment is obviously in need of alignment or when major repairs have been made. In paragraph 2b(3) of Section 5 is a list of the controls to be readjusted for particular replaced tubes.

a. EQUIPMENT REQUIRED.—For making electrical adjustments, the equipment needed is the same as listed in paragraph 2d, this Section, plus an insulated alignment tool with a screwdriver blade protruding at one end and recessed at other end such as SNSN N16-T-751495-341.

NOTE

Before proceeding with the electrical adjustments, make sure that the CONS Level Control is in its maximum counterclockwise position.

b. ALIGNMENT OF THE OSCILLATORS AND THE AFC CIRCUITS.—The need for alignment can always be checked by observing the positions of the arrows on the motor dials. Alignment is required when the arrows have drifted a considerable distance from the index mark. See Figure 4–3. Both AFC circuits and both oscillators are aligned in the procedure described below. The procedure for aligning the tuning oscillator AFC circuits consists of:

(1) Adjusting the oscillator frequency to the correct frequency by means of the trimmers.

(2) Adjusting the AFC circuits so that the center of its range is at the oscillator frequency.

The sequence of the alignment adjustments is as follows:

Step 1. Set the front panel controls as follows:
CONS Level in extreme counterclockwise position.
Demodulator switch on CARRIER.
Local Oscillator Motor switch ON.
Motors switch OFF.
Motor Run switches in the LOCK positions.

Step 2. Connect the dummy load across pins A and D of audio output connector J403.

Step 3. Turn the Power ON.

Step 4. Using the Motor Run switches, run each motor until the arrows on the tuning dial are pointing at the index mark. When each arrow reaches the index mark, place each Motor Run switch on LOCK and place the Motors switch in the OFF position.

Step 5. Plug the phones into the Tuning Oscillator Motor Indicator jack.

Step 6. Adjust the Tuning Oscillator Motor Balance control for a null in the headphones.

Step 7. Plug the headphones into the Local Oscillator Motor Indicator jack.

Step 8. Place the Local Oscillator Motor Run switch in the HOLD position.

Step 9. Adjust the Local Oscillator Motor Balance control for a null in the headphones.

Step 10. Place the Local Oscillator Motor Run switch in the LOCK position.

Step 11. Remove the accessory fuse from the lower front panel and turn Motors switch ON.

Step 12. Connect the output lead of the signal generator to the center terminal of IF input connector J405 through the dummy antenna. Connect the ground lead of the signal generator to any convenient point on the chassis. Adjust the signal generator output to 0.5 volt at 200 kilocycles, unmodulated.

Step 13. Carefully adjust the Tuning Oscillator Adjust trimmer for a maximum reading on the Carrier Level Meter.

Step 14. Very slowly adjust the AFC Adjust trimmer for a null in the headphones plugged into the Tuning Oscillator Motor Indicator jack.

Step 15. Place the Local Oscillator Motor Run switch on LOCK.

Step 16. Adjust the Local Oscillator Adjust trimmer for a null in the headphones plugged into the Local Oscillator Motor Indicator jack.

Step 17. Replace the accessory fuse.

Step 18. Adjust the AFC Adjust trimmer slightly to obtain a maximum reading on the Carrier Level meter.

Step 19. Adjust the Local Oscillator Adjust trimmer carefully, if necessary, to bring the arrow to the index mark.

Step 20. Turn Motors switch OFF.

Step 21. Turn Power OFF.

Step 22. Remove all test equipment.

c. ADJUSTMENT OF THE DIODE BALANCE CONTROLS. *(See Figure 7–5.)*—If any major servicing is accomplished in either of the DC Restorer circuits, the appropriate diode balance control should be adjusted as soon as possible. Diode Balance potentiometer R198 is to be adjusted after major servicing in the DC restorer V118 circuit and R225 is to be adjusted for DC restorer V123. The procedure for adjusting the Diode Balance control R225 in the tuning oscillator AFC circuit is as follows:

Step 1. Pull out the upper chassis and connect the test cable between connector P101 on the upper chassis assembly and connector J401 on rear inside wall of the cabinet.

Step 2. Balance the tuning oscillator motor circuit as described in Steps 1 to 5 of the preceding paragraph.

Step 3. Turn Motors switch ON.

Step 4. Remove accessory fuse.

Step 5. Connect a signal generator to the IF input connector through the dummy antenna as previously described. Adjust the generator output for 0.5 volt at 200 kilocycles.

Step 6. Remove amplifier tube V120.

Step 7. Plug the headphones into the Tuning Oscillator Motor Indicator jack.

Step 8. Adjust Diode Balance control R225 for a null in the headphones.

Step 9. Replace tube V120.

To adjust the local oscillator Diode Balance control R198 proceed as follows:

Step 1. Balance the motor circuits as described in Steps 1 to 11 in paragraph 3b, this Section.

Step 2. Remove the local oscillator tube V307.

Step 3. Plug the headphones into the Local Oscillator Motor Indicator jack.

Step 4. Adjust Diode Balance control R198 for a null in the headphones.

Step 5. Turn Motors switch OFF.

Step 6. Turn Power OFF.

Step 7. Replace tube V307 and the accessory fuse.

Step 8. Remove all test equipment.

d. ADJUSTMENT OF THE AUDIO CIRCUITS.–To adjust the audio circuits, proceed as follows:

Step 1. Set the front panel controls as follows:

Power switch at OFF
Motors switch at OFF
Sideband switch on UPPER
Demodulator switch on CARRIER

Step 2. Connect the signal generator to the IF input

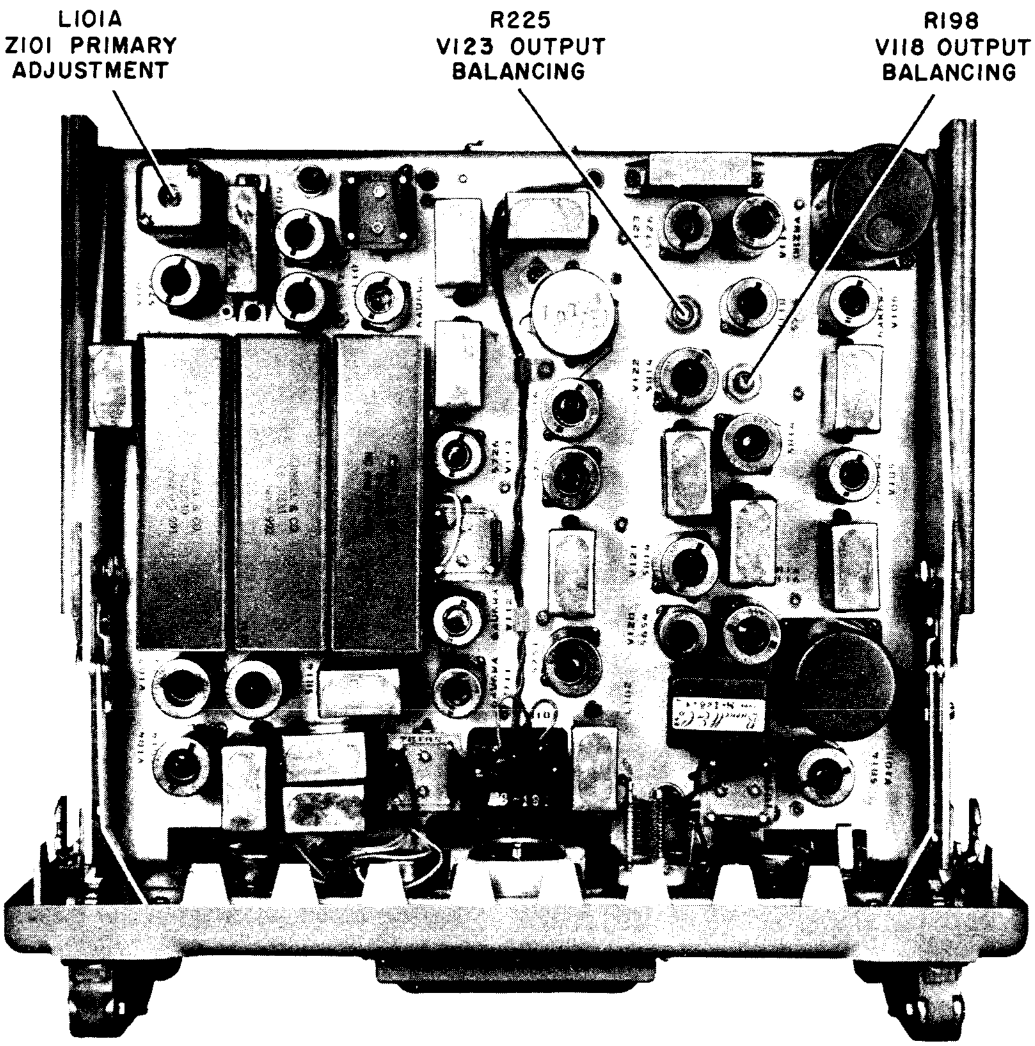


Figure 7–5. Top View, Upper Chassis, Showing Location of Alignment Adjustments

connector at the rear of the cabinet through the dummy antenna.

Step 3. Adjust the signal generator for 200-kilocycles, unmodulated at 0.5 volt output.

Step 4. Turn Power ON.

Step 5. Adjust the Carrier Level control for a 1/4 to 1/2 scale reading on the Carrier Level meter.

Step 6. Adjust signal generator frequency slightly for a peak on the Carrier Level meter.

Step 7. Place both Motor Run switches in the LOCK positions and turn Motors switch ON. Make sure both motors are controlling the oscillators properly before proceeding to the next step. If the motors are running at random, see paragraph la, Section 5 for instructions on resetting the motors. For realignment of the AFC circuits, see paragraph 3b,this Section.

Step 8. Advance the AF Level control to its full clockwise position.

Step 9. Adjust the Modulator Balance control for a minimum reading on the Audio Level meter.

Step 10. Modulate the 200-kilocycle signal generator signal with 1000 cycles at 30%. Retard the AF Level control to any convenient reading.

Step 11. Advance both Sideband Gain controls to their maximum clockwise positions.

Step 12. Compare the Audio Meter readings obtained with the Sideband switch set at Upper and Lower, respectively. If the readings on the Audio Level meter are not the same, reduce the gain of the sideband channel with the greater reading to equal the lower reading. This is done by retarding the Sideband Gain control of the higher-reading sideband. Note the Audio Level meter reading.

Step 13. Place Demodulator switch on LOCAL.

Step 14. Check the local oscillator motor dial to see if the motor is properly controlling the oscillator. The arrow should be pointing steadily at the index mark.

Step 15. Note the Audio Level meter reading. If the reading is down 2 db or more from the reading noted in Step 12, check through the components of the local oscillator injection voltage circuits as indicated on the trouble-shooting chart.

Step 16. Remove test equipment.

e. CONS ADJUSTMENT.—For directions on the adjustment of the CONS Level control, refer to paragraph 3b, Section 4.

f. AGC ADJUSTMENTS.—To set the AGC Level, proceed as follows:

Step 1. Set the front panel controls as follows:

Power switch at OFF.
Motors switch at OFF.
Demodulator switch on CARRIER.
Carrier Level control in full clockwise position.
AF Level control in full clockwise position.
AGC switch in CARRIER AGC position. See Figure 7–5 for the location of the AGC switch.

Step 2. Connect the external AGC of the Converter to the AGC connector of the associated receiver.

Step 3. Connect a signal generator to the antenna input of the receiver through the dummy antenna resistor.

Step 4. Turn the Power of the receiver and Converter ON.

Step 5. Adjust the signal generator to a signal with a frequency within the range of the receiver. Modulate this signal 30% with 1000 cycles. The generator output should be sufficient to cause a 1/4 to 1/2 scale reading on the Carrier Level meter.

Step 6. Plug a pair of headphones into the Phones jack J101.

Step 7. Rotate the AGC Delay and AGC External controls to their maximum counterclockwise positions.

Step 8. Advance the AGC External control until AGC starts to control the gain of the input signal as heard on the headphones. This will be evidenced by a marked decrease in signal level.

Step 9. Reduce the generator output about 60 db.

Step 10. Advance the AGC Delay control until the signal is perceptible in the headphones. If the signal is perceptible with the AGC Delay control in the maximum counterclockwise position, do not adjust further.

Step 11. Turn Motors switch OFF.

Step 12. Turn Power OFF.

Step 13. Remove test equipment.

g. ADJUSTMENT OF THE INPUT FILTER.—If the input filter should be replaced or become misaligned, readjust in the following manner:

Step 1. Set the front panel controls as follows:

Power switch at OFF.
Motors switch at OFF.
Demodulator switch on CARRIER.
Sideband switch on either UPPER or LOWER, AGC on Sideband AGC.

Step 2. Withdraw the upper chassis from the cabinet and connect the test cable between connector P101 at the rear of the withdrawn chassis and connector J401 on the upper rear wall inside the cabinet.

Step 3. Connect the signal generator to the IF input connector at the rear of the cabinet through the dummy antenna. Adjust the generator for a 200 kilocycle unmodulated output at 0.5 volt.

Step 4. Turn the Power ON.

Step 5. Adjust signal generator frequency for maximum reading of the Carrier Level meter. Rotate the Carrier Level control until the Carrier Level meter reads 1/4 to 1/2 scale.

Step 6. Using the alignment tool, vary the adjustable iron core of the input transformer primary, L101A for

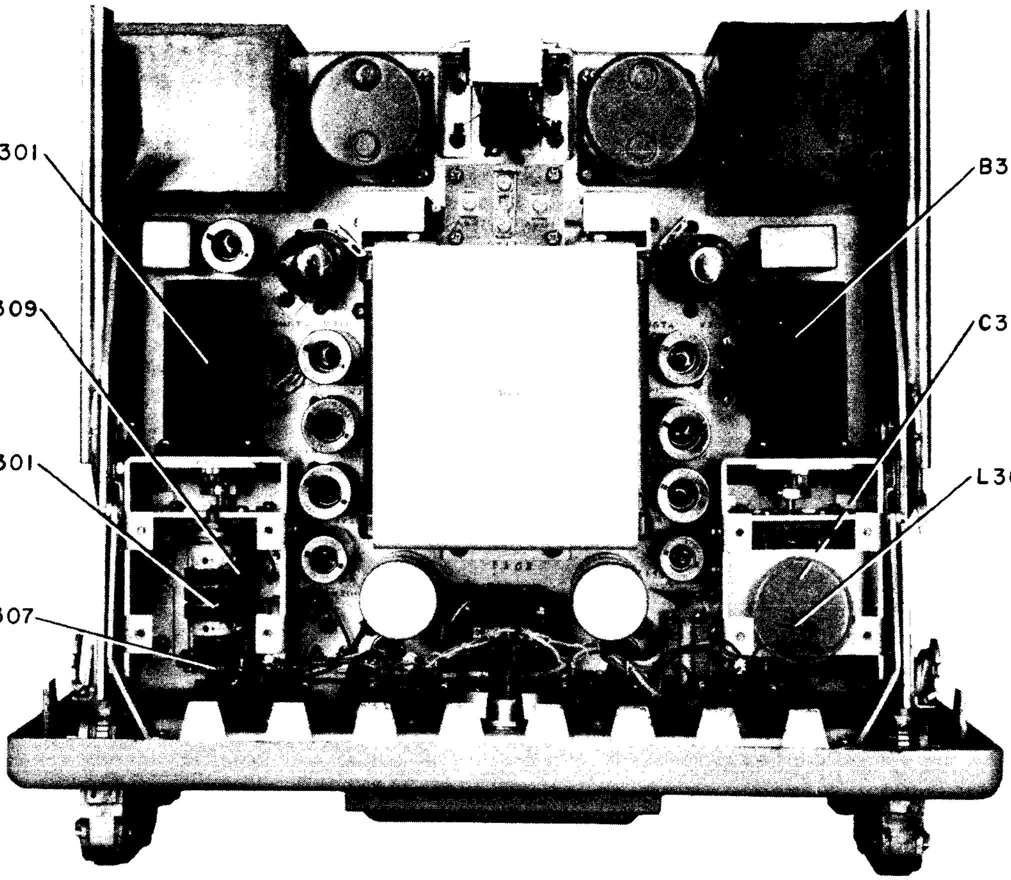


Figure 7-6. Identification of Motor-Tuning Capacitor Assembly Parts

a peak reading on the Carrier Level meter. See Figure 7-5.

Step 7. On the underside of the chassis, adjust secondary L101B of the input transformer for a peak on the Carrier Level meter.

Step 8. Remove test equipment.

4. MECHANICAL ADJUSTMENTS.

a. REMOVAL OF THE AFC MOTOR AND TUNING CAPACITOR ASSEMBLIES.–The following sub-paragraph includes the instructions for the removal of the AFC motor and tuning capacitor assemblies. The tuning oscillator motor-capacitor assembly is located on the left front corner of the lower chassis assembly and the local oscillator capacitor assembly is located in the right front corner of the lower chassis assembly. See Figure 7-6.

(1) REMOVAL OF THE TUNING OSCILLATOR AFC MOTOR AND CAPACITOR ASSEMBLY.–The major components in this assembly are AFC motor B301, variable tuning capacitor C309 and oscillator coil L301. Capacitor C307 is also located within this assembly. To remove the motor only, proceed as follows and consult Figures 7-6 and 7-15.

Step 1. Remove the cover of the assembly housing by removing the screws on the top of the assembly.

Step 2. On the underside of the chassis, disconnect the four motor leads. The black lead and green leads are attached to terminal board TB301. The yellow lead is connected to a ground stud and the gray lead is connected to capacitor C317. Tag each lead to assure correct reconnection.

Step 3. Unscrew the four Phillips head screws which hold the motor to the assembly.

To remove the entire motor-capacitor assembly proceed as follows:

Step 1. Disconnect the four motor leads as described above.

Step 2. Unsolder the two wires from the feed-through insulator on the outside of the right side of the housing.

Step 3. Inside the housing, remove the wire from the feed-through insulator on the chassis floor.

Step 4. Inside the housing remove the wire from the oscillator trimmer. This trimmer is mounted on the front panel and is designated OSC ADJ.

Step 5. Inside the housing remove the four Phillips head screws which fasten the housing to the chassis floor.

Step 6. Slide the entire assembly slightly to the rear and carefully lift from the chassis.

(2) REMOVAL OF THE LOCAL OSCILLATOR AFC MOTOR AND CAPACITOR ASSEMBLY.—The major components of this assembly are AFC motor B302, oscillator coil L302 and tuning capacitor C325. To remove the motor proceed in the following manner and consult Figures 7–6 and 7–15.

Step 1. Remove the cover of the assembly by removing the four Phillips head screws from the top of the assembly.

Step 2. On the underside of the chassis, disconnect the four motor leads as follows:

(a) Disconnect the yellow lead from the ground stud.

(b) Unsolder the black lead from terminal board TB306.

(c) Disconnect the green lead from terminal board TB306.

(d) Unsolder the gray lead from TB306.

Be sure to tag each lead for reassembly indentification.

Step 3. To remove the motor only, unscrew the four Phillips head screws which fasten the motor to the assembly housing.

The entire assembly is removed from the chassis as follows:

Step 1. Disconnect the four motor leads as described above.

Step 2. On the outside of the housing on the left, remove the two wires connected to the feed-through insulator.

Step 3. Remove the four Phillips head screws which fasten the housing to the chassis floor.

Step 4. Slide the entire assembly slightly to the rear and carefully lift out.

b. REMOVAL OF THE FAN MOTORS.—The procedure for disassembly and removal of both fan motor assemblies is identical.

To remove the fan blade only, loosen the set screw which holds the blade on the motor shaft.

To remove the motor only, first unsolder the two leads at the rear of the motor. Remove the four Phillips head screws located behind the fan blade.

To remove the entire fan motor including the spider assembly, remove the four Phillips head screws located on the front panel behind the access doors.

TABLE 7-2. TUBE OPERATING VOLTAGES AND CURRENTS

TUBE TYPE	FUNCTION	PLATE (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPP (E)	CATH (E)	GRID (E)	HEATER A.C. (E)
5654	Amplifier V120	43	.5	47	.2	7.2	7.2	-1.3	6.3
5654	Local Oscillator V307	23	.2	--	--	0	0	-4.5	6.3
1/2 5726	Carrier AGC Rectifier V113A	-25	--	--	--	--	0	--	--
1/2 5726	AGC Delay V113B	-1.5	--	--	--	--	0	--	6.3
5726	DC Restorer V118	-40 pin 2 -42 pin 7	-- --	-- --	-- --	-- --	-.3 pin 5 -.3 pin 1	-- --	6.3
5726	DC Restorer V123	-40 pin 2 -42 pin 7	-- --	-- --	-- --	-- --	-.3 pin 5 -.3 pin 1	-- --	6.3
5750	Upper Sideband Converter V101	315	.6	92	4	.5	.5	-8 pin 1 -1.5 pin 7	6.3
5750	Lower Sideband Converter V107	320	0	105	0	92	92	82 pin 1 -1.5 pin 7	6.3
5750	Carrier Converter V109	108	.6	108	5	2.8	2.8	-6.8 pin 1 0 pin 7	6.3
5751	Carrier Limiter V114	305 pin 1 303 pin 6	1.3 .2	-- --	-- --	-- --	15 pin 3 15 pin 8	0 pin 2 0 pin 7	6.3
1/2 5751	Fourth Carrier Amplifier V115A	165	1.6	--	--	--	0	-1.5	--
1/2 5751	AGC Amplifier V115B	67	.5	--	--	--	0	-.6	6.3
5751	Servo Amplifier V301	18 pin 1 18 pin 6	.02 .02	-- --	-- --	-- --	.2 pin 3 .2 pin 8	-.7 pin 2 -.7 pin 7	6.3

TABLE 7-2. TUBE OPERATING VOLTAGES AND CURRENTS (CONT'D)

TUBE TYPE	FUNCTION	PLATE (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPP (E)	CATH (E)	GRID (E)	HEATER A.C. (E)
5751	Servo Amplifier V305	18 pin 1 18 pin 6	.02 .02	-- --	-- --	-- --	.2 pin 3 .2 pin 8	-.7 pin 2 -.7 pin 7	6.3
5751	Carrier Operated Noise Silencer V311	150	0	--	--	--	1.4	-18	6.3
1/2 5814	Upper Sideband Inverter V102A	215	4.5	--	--	--	10	0	--
1/2 5814	Lower Sideband Inverter V102B	215	0	--	--	--	92	0	6.3
5814	Sideband Demodulator V103	65 pin 1 65 pin 6	3 3	-- --	-- --	-- --	17 pin 3 17 pin 8	0 pin 2 0 pin 7	6.3
1/2 5814	Audio Amplifier V104A	185	1.3	--	--	--	80	65	--
1/2 5814	AF Inverter V104B	240	6.7	--	--	--	80	65	6.3
1/2 5814	Driver V108A	280	16	--	--	--	17	0	--
1/2 5814	Amplifier V108B	75	2.5	--	--	--	0	-2.8	6.3
1/2 5814	Phase Inverter V116A	280	2.2	--	--	--	22	0	--
1/2 5814	Driver V116B	175	6	--	--	--	35	18	6.3
5814	Phase Comparator V117	240 pin 1 240 pin 7	1.8 1.8	-- --	-- --	-- --	32 pin 3 32 pin 8	0 pin 2 -8 pin 7	6.3
1/2 5814	Phase Inverter V121A	290	2.4	--	--	--	23	0	--
1/2 5814	Driver V121B	190	6	--	--	--	32	17	6.3

TABLE 7-2. TUBE OPERATING VOLTAGES AND CURRENTS (CONT'D)

TUBE TYPE	FUNCTION	PLATE (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPP (E)	CATH (E)	GRID (E)	HEATER A.C. (E)
5814	Phase Comparator V122	240 pin 1 230 pin 6	1.8 2	-- --	-- --	-- --	32 pin 3 32 pin 8	0 pin 2 -7 pin 7	6.3
1/2 5814	AGC Amplifier V124A	75	2.3	--	--	--	2.1	-.9	6.3
1/2 5814	Sideband AGC Rectifier V124B	-25	--	--	--	--	0	-25	--
5814	Servo Amplifier V302	300 AC pin 1 300 AC pin 6	2.5 2.5	-- --	-- --	-- --	25 pin 3 25 pin 8	18 pin 2 18 pin 7	6.3
5814	Servo Amplifier V306	300 AC pin 1 300 AC pin 6	2.5 2.5	-- --	-- --	-- --	25 pin 3 25 pin 8	18 pin 2 18 pin 7	6.3
1/2 5814	225 Kc Oscillator V303A	95	2.5	--	--	--	0	-4.5	--
1/2 5814	225 Kc Oscillator Amplifier V303B	150	4.5	--	--	--	4.5	-13	6.3
1/2 5814	25 Kc Oscillator Amplifier V308A	115	3.8	--	--	--	0	-4.5	--
1/2 5814	Reactance Modulator V308B	260	5	--	--	--	12.5	-.5	6.3
5Y3WGTA	Rectifier V309	300 AC	--	--	--	--	340	--	5.2
5Y3WGTA	Rectifier V310	300 AC	--	--	--	--	340	--	5.2
6AK6W	Output Amplifier V106	195	13	205	2	0	11	0	6.3
6AU6WA	Audio Amplifier V105	100	.5	85	.2	0	2	0	6.3

TABLE 7-2. TUBE OPERATING VOLTAGES AND CURRENTS (CONT'D)

TUBE TYPE	FUNCTION	PLATE (E)	PLATE (MA)	SCREEN (E)	SCREEN (MA)	SUPP (E)	CATH (E)	GRID (E)	HEATER A.C. (E)
6AU6WA	First Carrier Amplifier V110	125	.6	125	5	0	2.5	0	6.3
6AU6WA	Second Carrier Amplifier V111	290	.4	290	.2	--	10	0	6.3
6AU6WA	Third Carrier Amplifier V112	320	1.6	280	.5	--	11.5	0	6.3
0A2WA	Voltage Regulator V304	150	--	--	--	--	0	--	--
0B2WA	Voltage Regulator V119	105	--	--	--	--	0	--	--

TABLE 7-3. RATED TUBE CHARACTERISTICS

TUBE TYPE	FILA-MENT VOLT-AGE (V)	FILA-MENT CUR-RENT (A)	PLATE VOLT-AGE (V)	GRID BIAS (V)	SCREEN VOLT-AGE (V)	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	A.C. PLATE RESISTANCE (OHMS)	VOLTAGE AMPLIFICATION (MU)	NORMAL TRANSCONDUCTANCE (MICROHMOS)
5654	6.3	0.175	180	-2	120	7.7	2.4	690K	--	5100
5726	6.3	0.3	165*	--	--	12.5	--	--	--	--
5750	6.3	0.3	250	-1.5	100	3.0	7.5	--	--	300
5751	6.3	0.3	250	-2	--	1.2	--	62,500	100	1400
5814	6.3	0.15	250	-8.5	--	10.5	--	--	17	1800
5Y3WGTA	5	2	400	--	--	140	--	--	--	--
6AK6W	6.3	0.15	180	-9	180	15	2.5	.2 megohm	--	2000
6AU6WA	6.3	0.3	250	-8	150	10.8	4.3	1 megohm	--	5100
0A2WA	--	--	150	--	--	5-30	--	--	--	--
0B2WA	--	--	108	--	--	5-30	--	--	--	--

* Per plate.

TABLE 7–4. WINDING DATA CHART

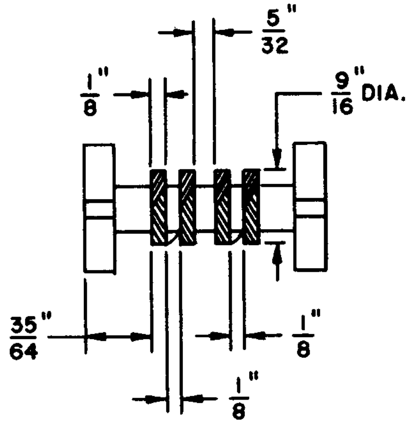
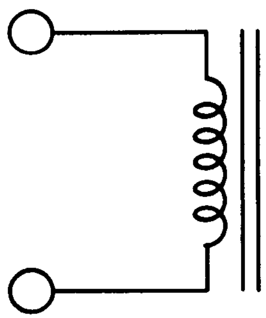
SYMBOL DESIG.	NAT. PT. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RES. IN OHMS	IMPED-ANCE RATIO	HIPOT AC VOLTS	REMARKS
L101	SB:2455		pri 2 pie universal wound	#36ESN	370	20.6			inductance 1.05 mh measured at 250 kc.
			sec 2 pie universal wound	#36ESN	370	20.6			inductance 1.05 mh measured at 250 kc. 200 kc. peak frequency. ceramic coil form. windings varnish impregnated.
L102	S981-1		single toroidal wound			3			inductance 20 mh ±1% measured at 25 kc. minimum Q 200 at 25 kc. hermetically sealed metal case

TABLE 7-4. WINDING DATA CHART (CONT'D)

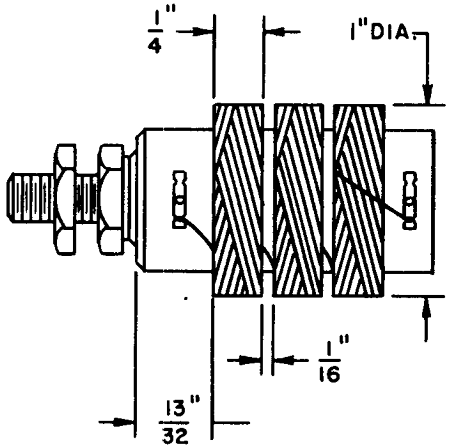
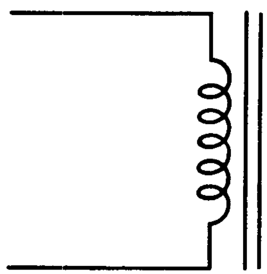
SYMBOL DESIG.	NAT. PT. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RES. IN OHMS	IMPEDANCE RATIO	HIPOT AC VOLTS	REMARKS
L301	SB2474		single 3 pie universal wound	#10-24 Litz	750	43			inductance 8 mh measured at 250 kc. ceramic coil form Q 110 ±10%
L302	S982-1		toroidal wound			5			inductance 20 mh ±1% measured at 25 kc. minimum Q 200 at 25 kc. hermetically sealed metal case

TABLE 7-4. WINDING DATA CHART (CONT'D)

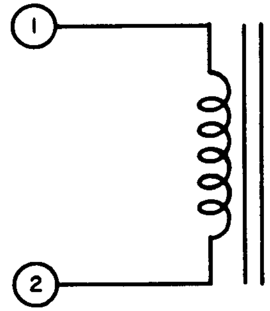
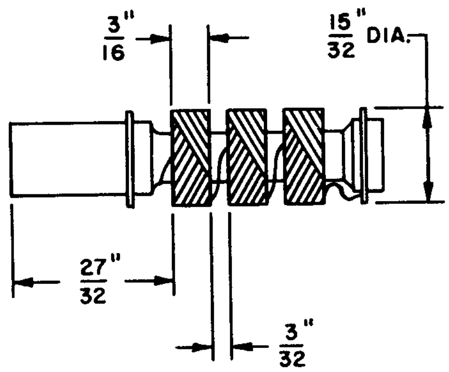
SYMBOL DESIG.	NAT. PT. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RES. IN OHMS	IMPED-ANCE RATIO	HIPOT AC VOLTS	REMARKS
L303	M135-1		single	#28E	2280	90		1750	inductance 8 henries at 200 ma. hermetically sealed metal case.
L401	SA:4012		single 3 pie univer-sal wound	#32ESS	420	7			inductance 0.5 mh measured at 790 kc. max current rating 350 ma. Q 10 at 790 kc.

TABLE 7-4. WINDING DATA CHART (CONT'D)

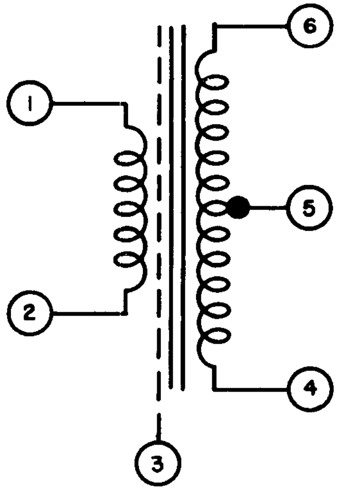
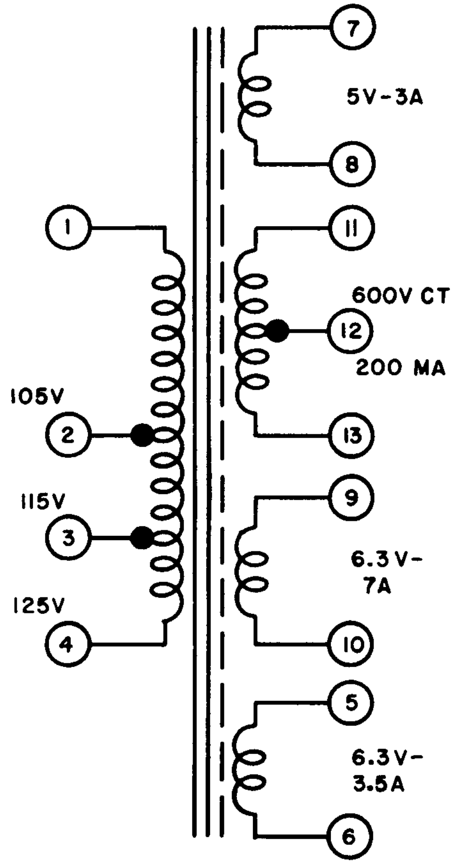
SYMBOL DESIG.	NAT. PT. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RES. IN OHMS	IMPED-ANCE RATIO	HIPOT AC VOLTS	REMARKS
T301	S989-1		pri						input 115 v, 50 – 60 cycles, single phase
			sec						450 v, 0.15 amp, CT. hermetically sealed metal case electrostatic shield brought out to separate terminal

TABLE 7-4. WINDING DATA CHART (CONT'D)

SYMBOL DESIG.	NAT. PT. NO.	DIAGRAM	WINDING	WIRE SIZE	TURNS	D.C. RES. IN OHMS	IMPED-ANCE RATIO	HIPOT AC VOLTS	REMARKS
T303	S994-1		pri					1500	input 105, 115, 125v, 50 – 60 cycles, single phase
			sec no. 1					1750	600 v at 200 ma, CT
			sec no. 2					1750	5 v at 3 amp.
			sec no. 3					1500	6.3 v at 7 amp.
			sec no 4					1500	6.3 v at 3.5 amp.

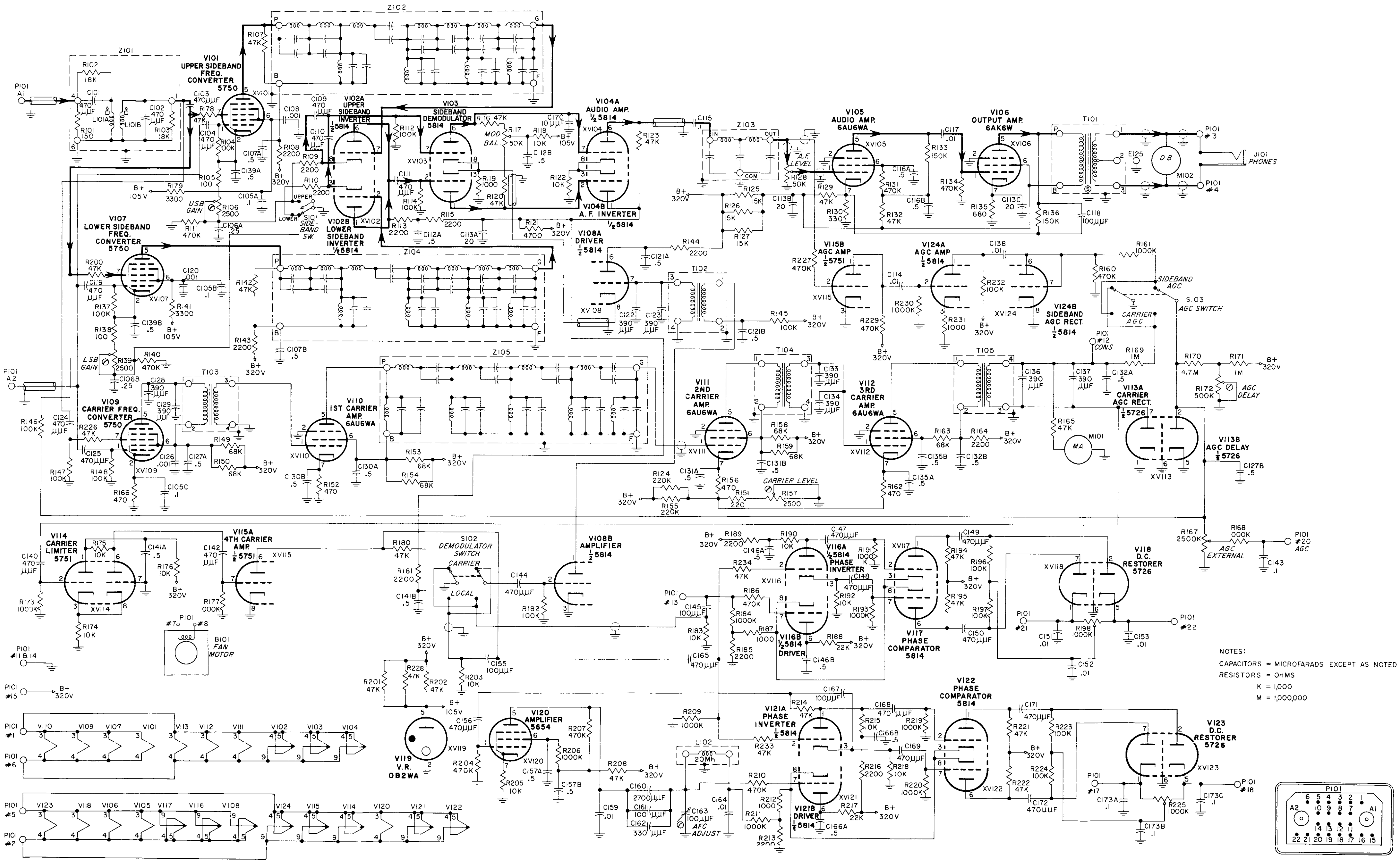


Figure 7-7. Overall Schematic Diagram, Upper Unit

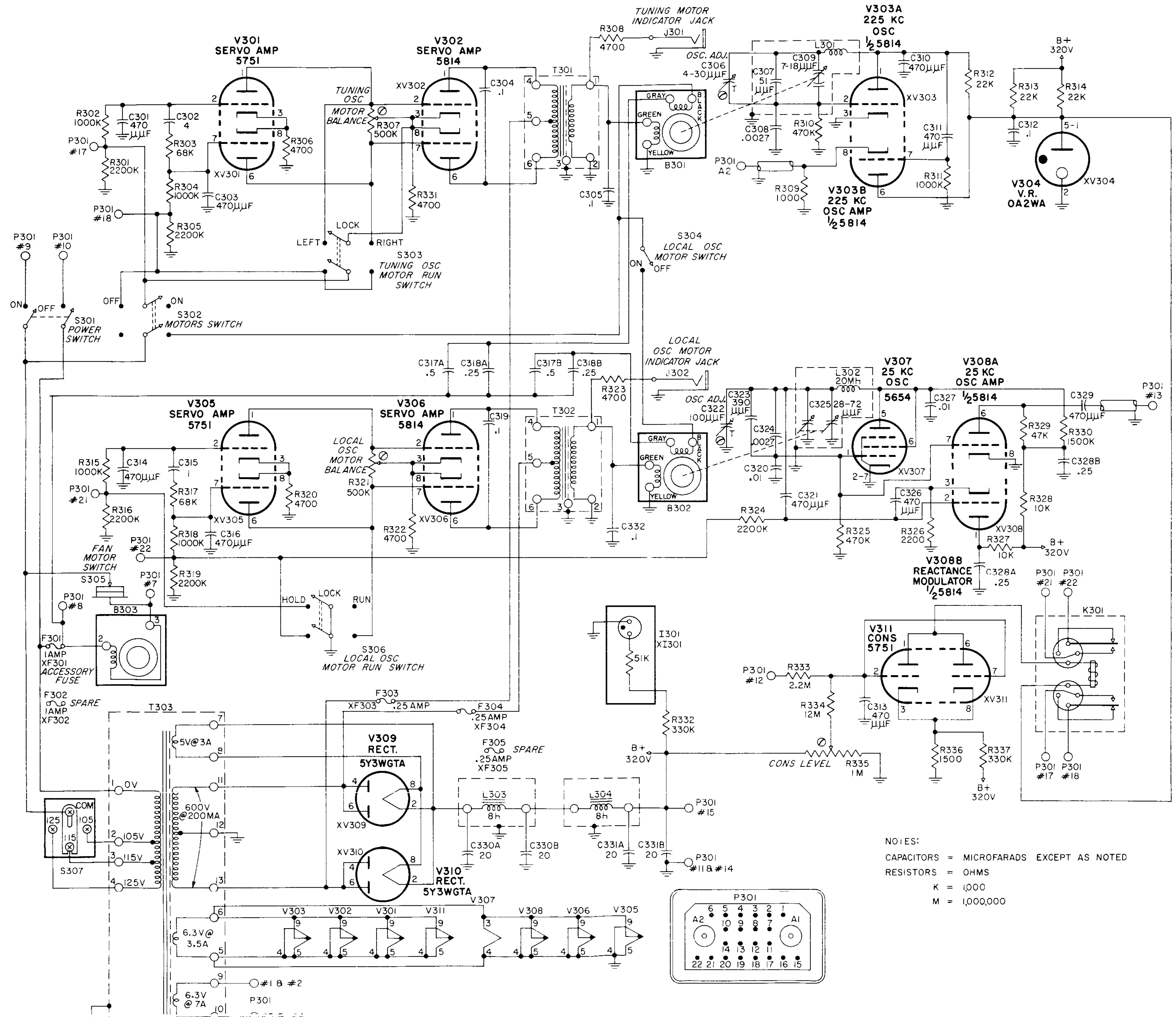


Figure 7–8. Overall Schematic Diagram, Lower Unit

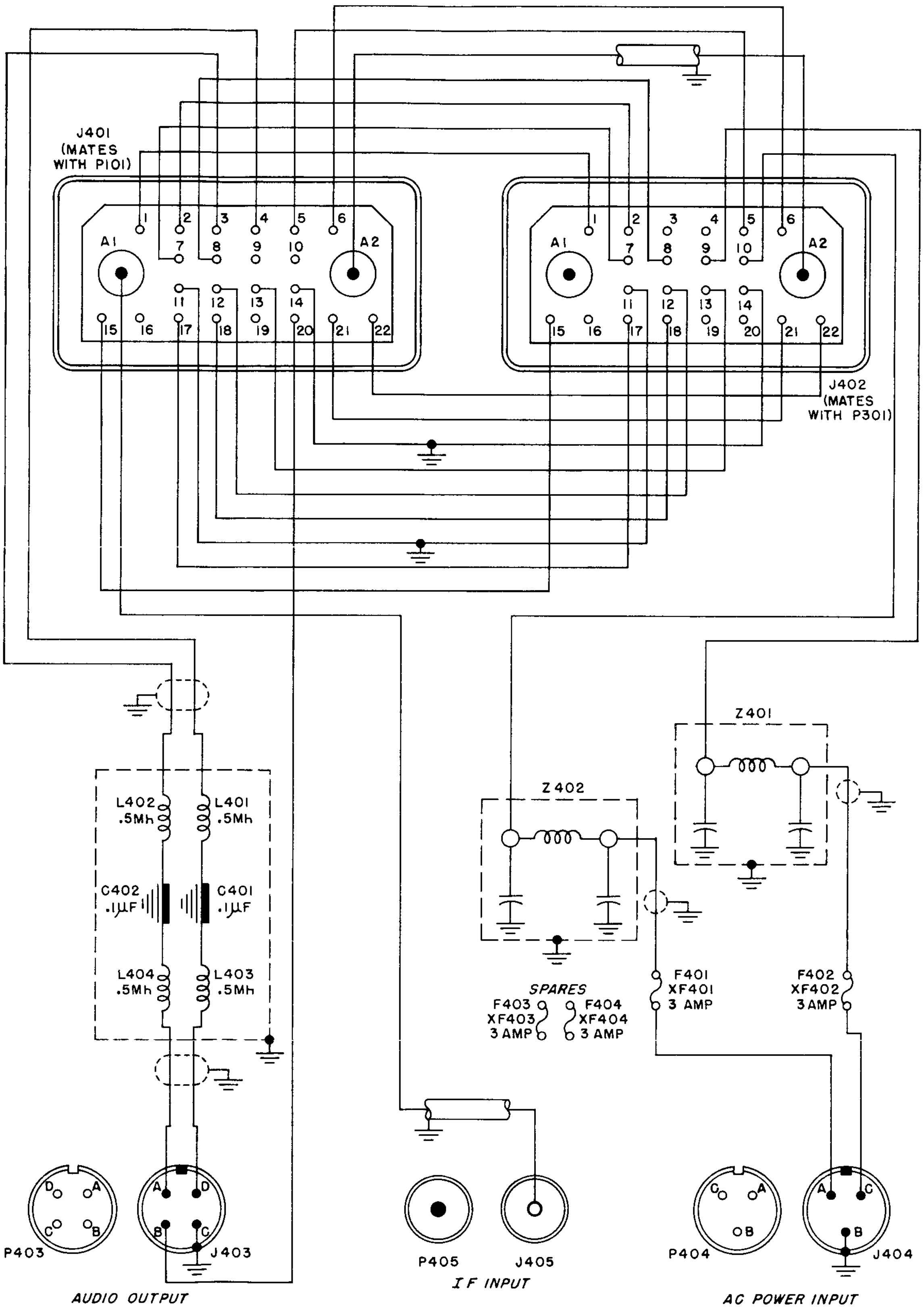
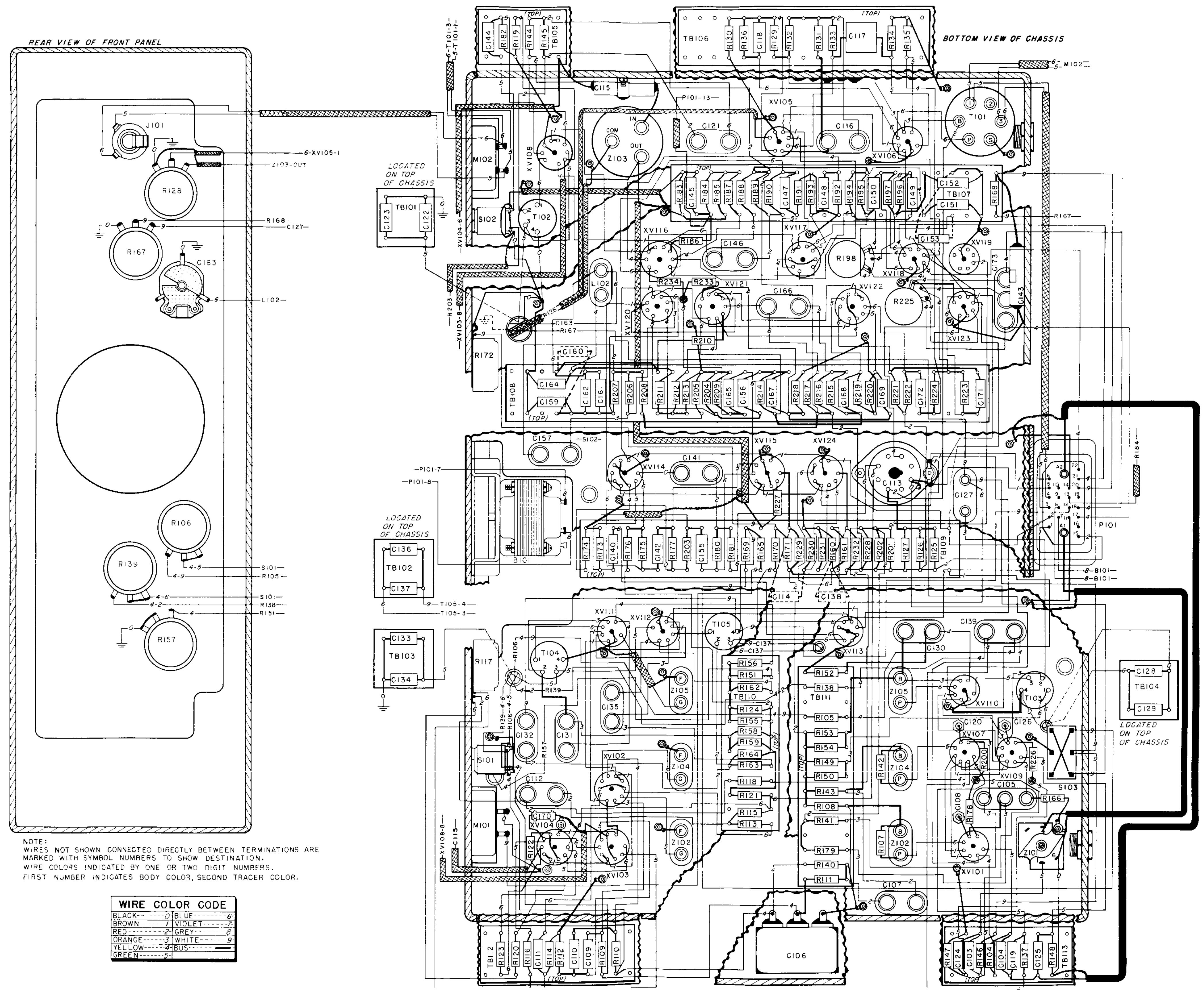


Figure 7–9. Overall Schematic Diagram, Cable Filter Assembly



NOTE:
WIRES NOT SHOWN CONNECTED DIRECTLY BETWEEN TERMINATIONS ARE MARKED WITH SYMBOL NUMBERS TO SHOW DESTINATION.
WIRE COLORS INDICATED BY ONE OR TWO DIGIT NUMBERS.
FIRST NUMBER INDICATES BODY COLOR, SECOND TRACER COLOR.

WIRE COLOR CODE

BLACK	0	BLUE	6
BROWN	1	VIOLET	7
RED	2	GREY	8
ORANGE	3	WHITE	9
YELLOW	4	BUS	———
GREEN	5		

Figure 7–10. Wiring Diagram, Upper Chassis

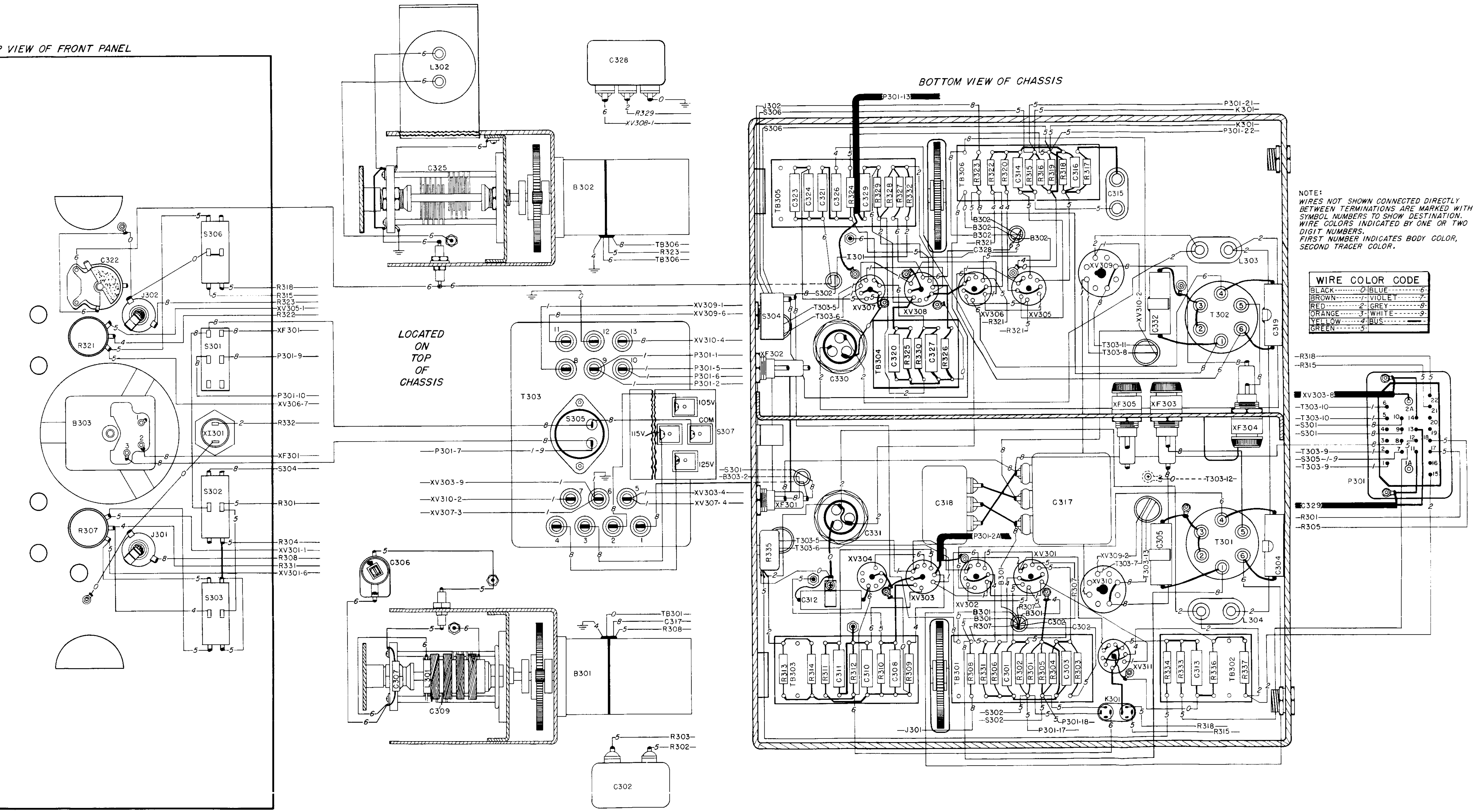


Figure 7–11. Wiring Diagram, Lower Chassis

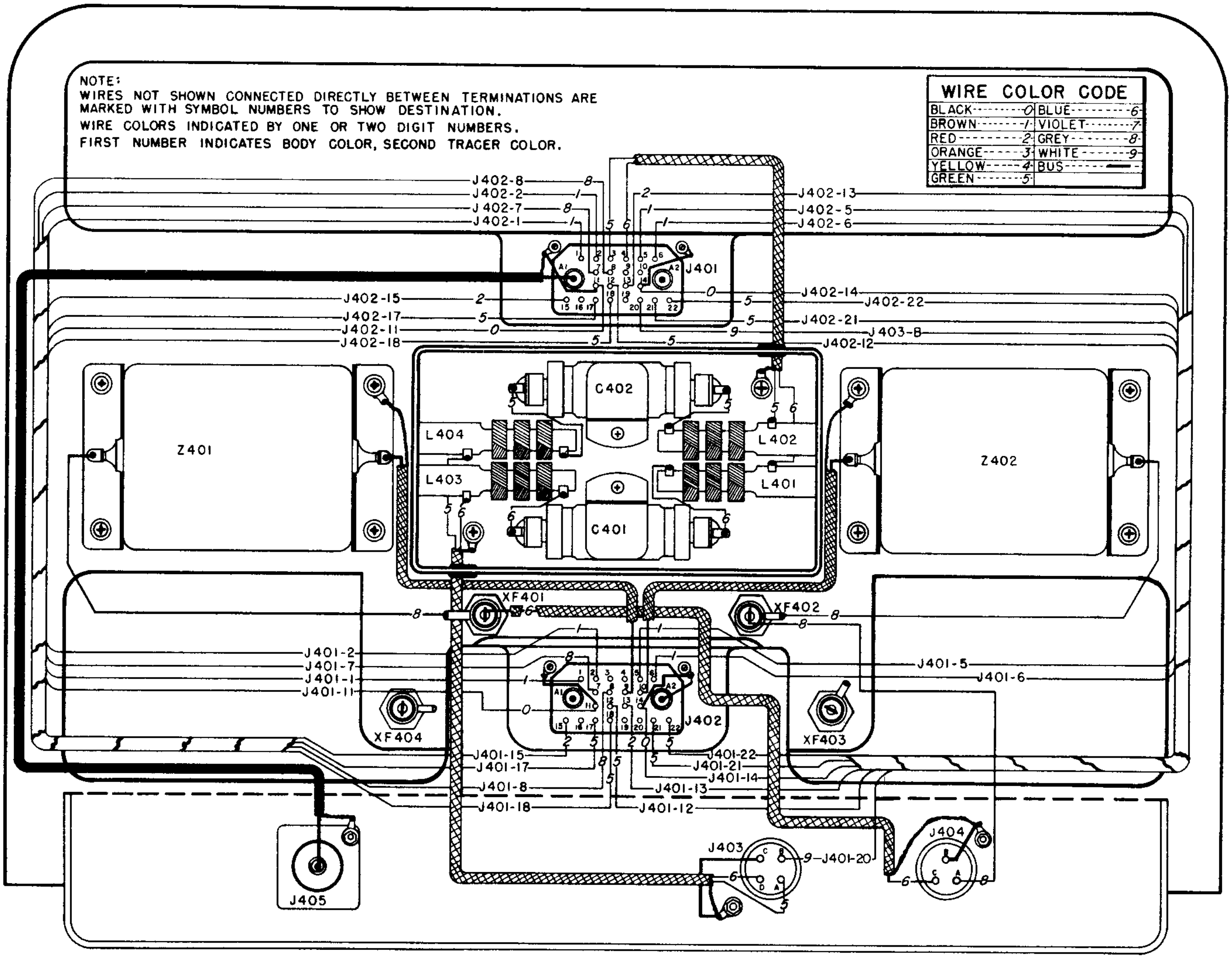


Figure 7-12. Wiring Diagram, Cable Filter Assembly

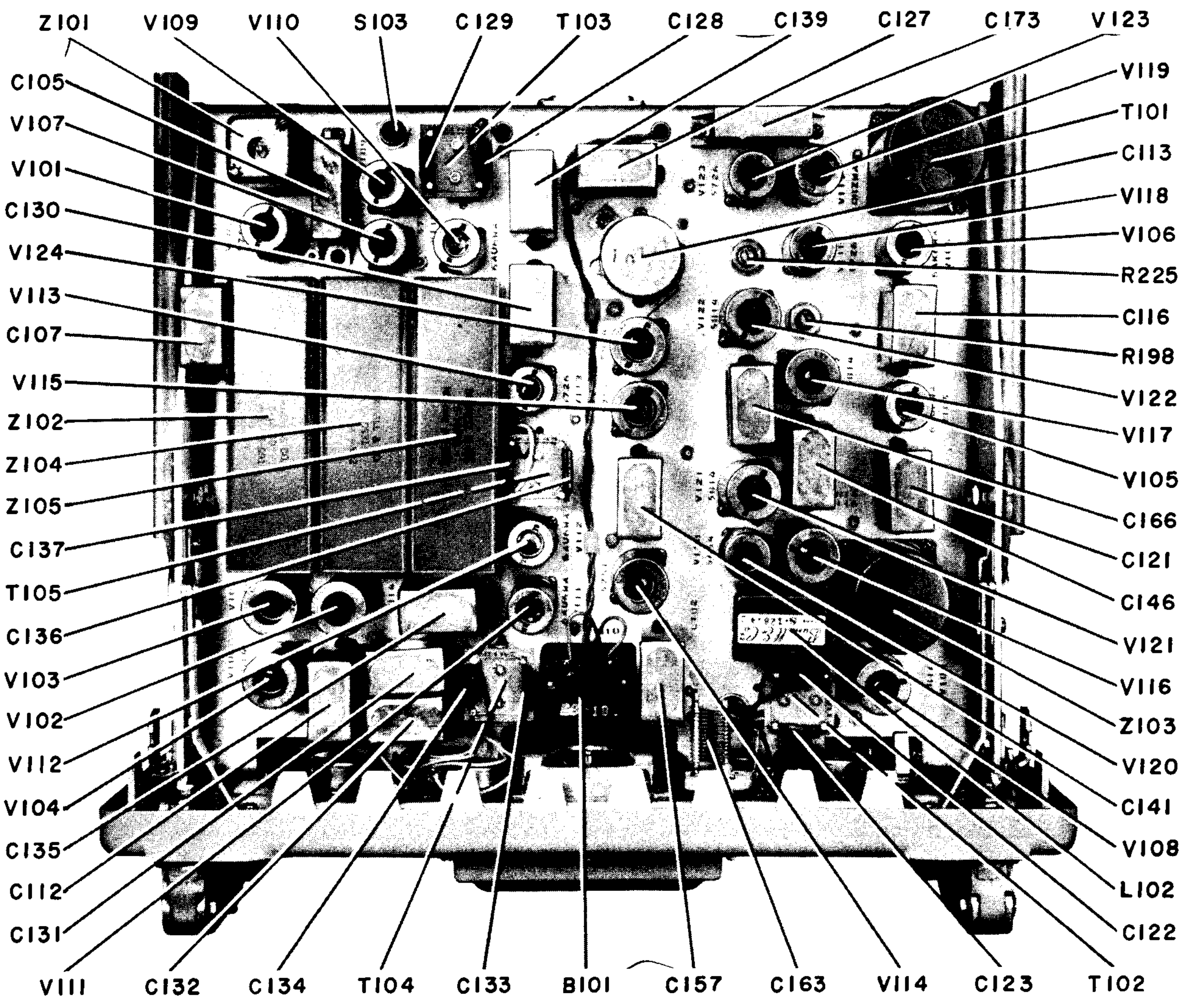


Figure 7–13. Component Locations, Top of Chassis, Upper Unit

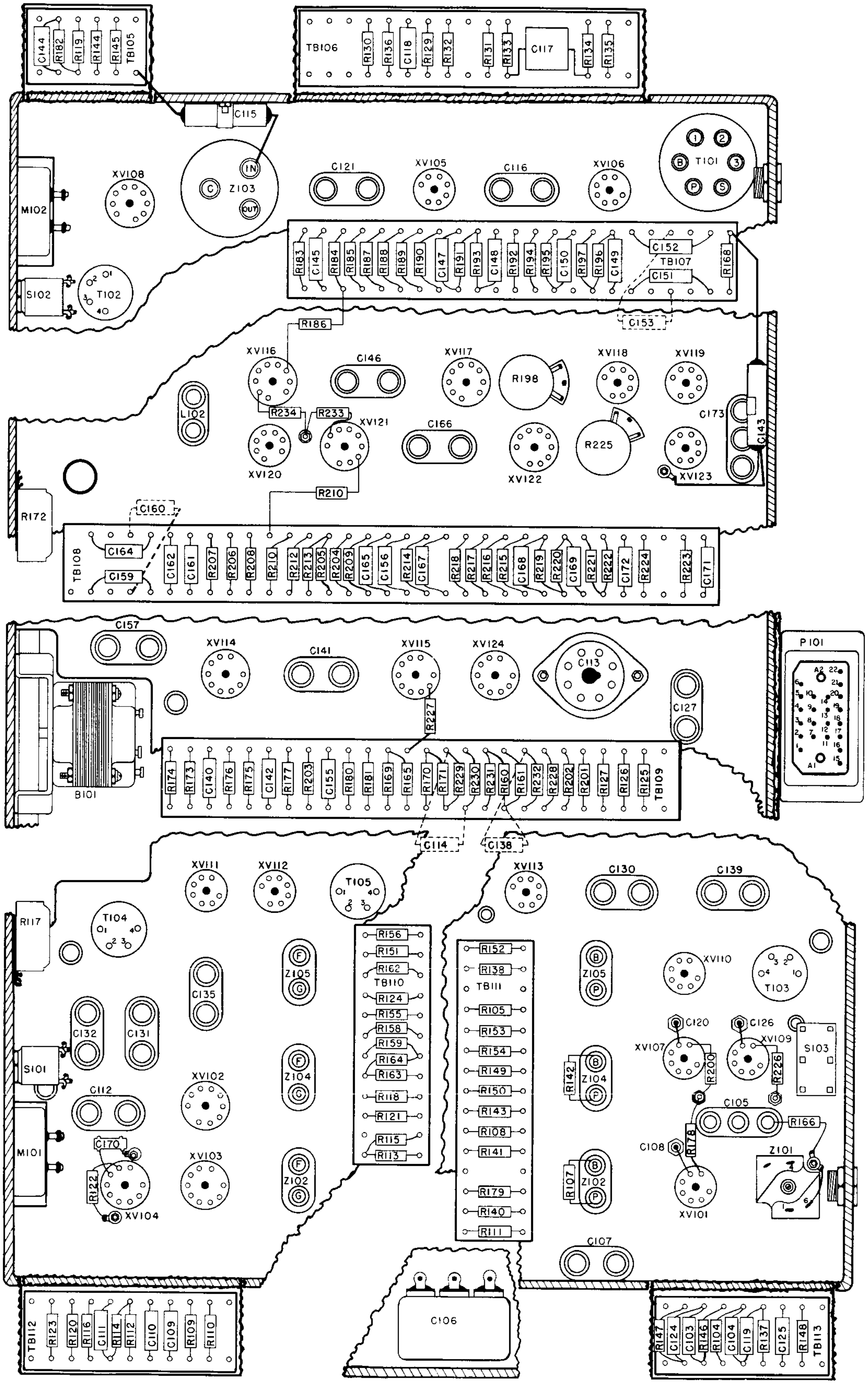


Figure 7–14. Component Locations, Bottom of Chassis, Upper Unit

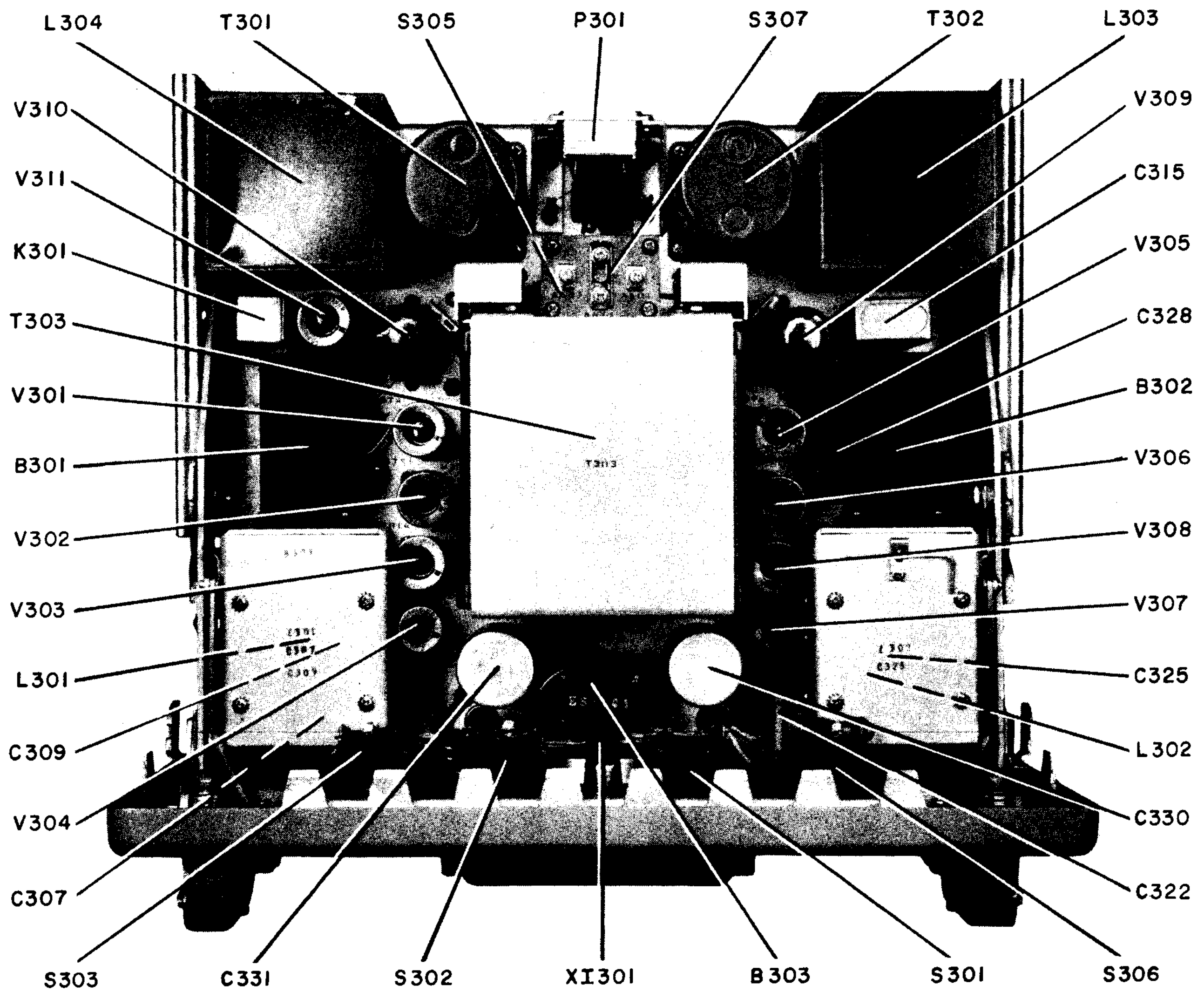


Figure 7-15. Component Locations, Top of Chassis, Lower Unit

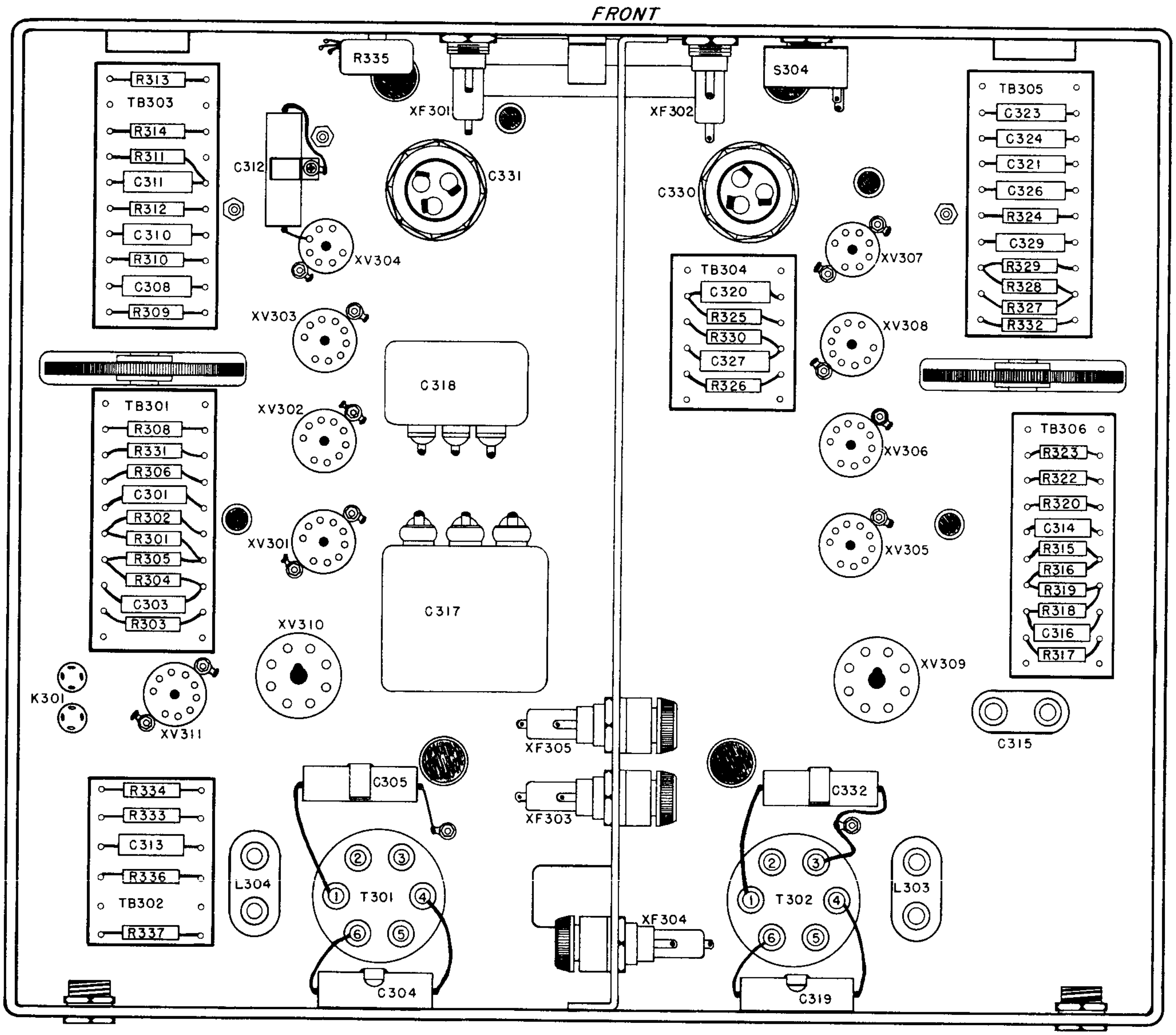


Figure 7-16. Component Locations, Bottom of Chassis, Lower Unit

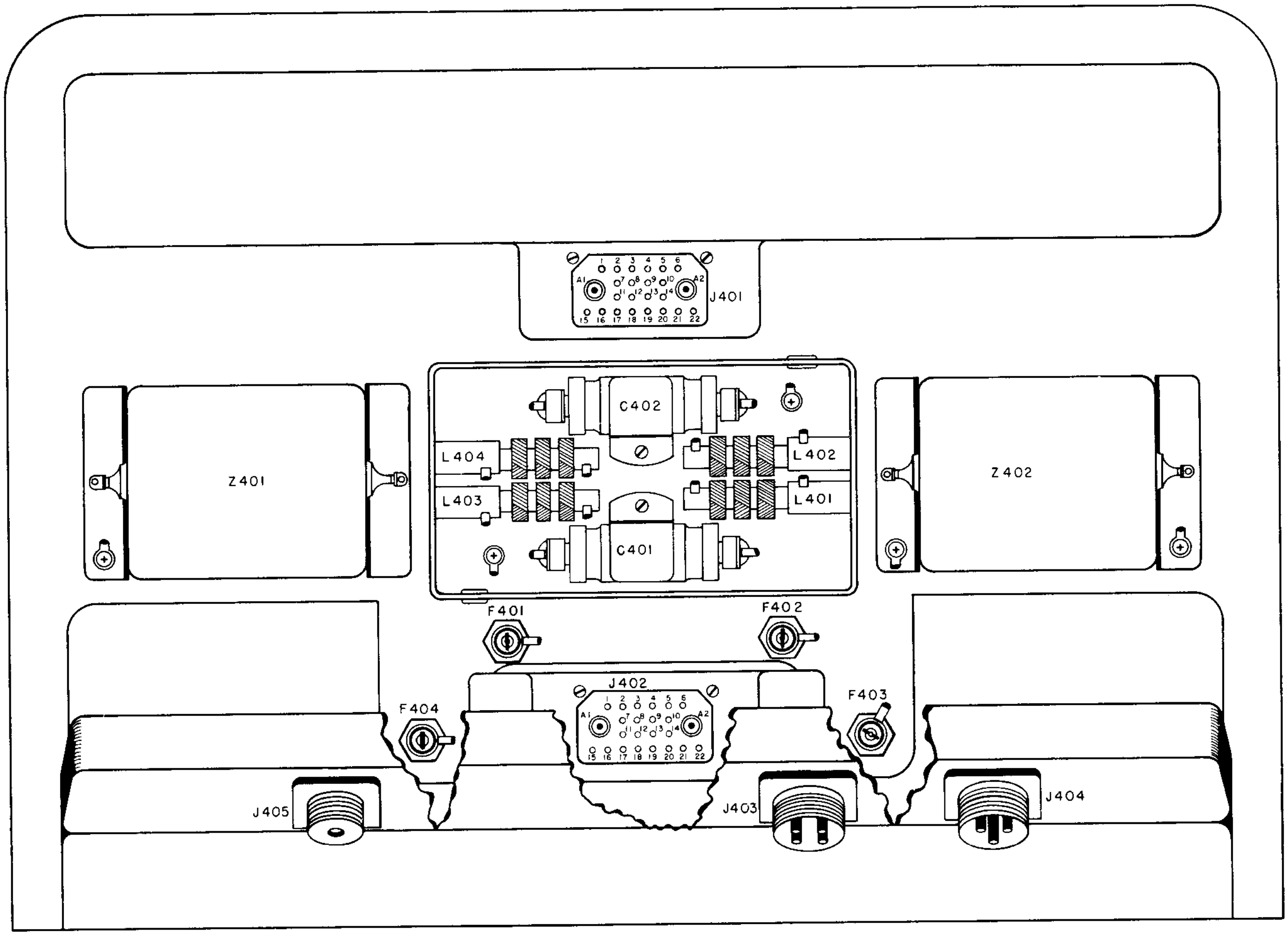


Figure 7–17. Component Locations, Cable Filter Assembly

TABLE 8–1. LIST OF MAJOR UNITS

SYMBOL GROUP	QUANTITY	NAME OF MAJOR UNIT	STANDARD NAVY STOCK NUMBER	DESIGNATION
-----------	1	Single Sideband Converter consisting of:	F16-Q-128400-100	CV-216/URR
101–299		a. The upper chassis assembly which includes the IF-AF signal circuits and the AFC circuits.	-----------------------	-----------------
301–399		b. The lower chassis assembly which includes the tuning and local oscillator motor, and the power supply.	-----------------------	-----------------
401–499		c. The cabinet including the cable filter assembly, and the test cable.	-----------------------	-----------------

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
100-400	F16-Q-128400-100 F16-Q-128400-200	CV-216/URR Converter, Single Sideband: type A3a or F3 reception; freq range 190 to 210 kc; 3 channels; 20 to 24.5 kc, 25 kc and 25.5 to 30 kc; one carrier level meter and one audio output level meter; operating power requirements: 105/115/125 VAC,50-60 cycles, single phase; internal power supply; 70 ohms input and 600 ohms output impedance; provisions for rack or table top mtg; 17 1/8" wd x 13 3/4" h x 17 9/16" d with shock mounts attached and rack hardware removed; 19" wd x 12 3/16" h x 17 9/16" d with rack hardware attached and shock mounts removed; four 3/8" dia holes on 7 1/2" x 12" centers for table top mtg; 8 slots in 2 sets of four spaced 18 1/4" apart for rack mtg; input IF frequency centered on 200 kc with a nominal overall bandwidth of 18 kc between points measured 6 db down on the selectivity curve; input carrier level within the limits of 0.025 and 0.5 volts; audio output not less than 60 milliwatts undistorted into 600 ohms load and not less than 300 milliwatts into 120 ohm load; superheterodyne circuit with filters at the input frequency, a frequency converter, a carrier channel having a carrier separation filter and limiters, amplifiers for reconditioning the carrier, a sideband channel having a sideband separation filter and detector, automatic frequency control circuits, a local oscillator for suppressed carrier detection and an audio frequency amplifier; CNA part/dwg BM:569	
		STRUCTURAL PARTS	
A401	Shop manufacture	Bracket, Mounting: 1/4" thk, 52S 1/4 hd aluminum, caustic etched w/light gray paint finish; rectangular shape w/right angle flange 1 1/8" wd; 4 7/8" lg x 1 1/8" wd x 10 1/4" h o/a; mts on side of cabinet by six 0.218" dia holes counterbored 1/2" dia x 3/32" d, four holes spaced on 7.655" x 3" centers and two holes spaced 2.718" c to c on vertical center line located 2 3/4" from flange and centered 6.358" from bottom edge; six 0.218" dia clearance holes, four located on 5.743" x 2.625" centers and two holes spaced 0.625" c to c on horizontal center line located 2.562" from bottom edge; mts in relay rack by four 1/4" wd x 1/2" d slots, top and bottom slots spaced 9 1/4" c to c, inner slots spaced 5 3/4" c to c; CNA part/dwg S700-1	Bracket for mtg equipment in relay rack (left side)
A402	Shop manufacture	Same as A401 except fabricated for right hand mtg; CNA part/dwg S700-2	Bracket for mtg equipment in relay rack (right side)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MOTORS	
B101	N17-M-57137-2569	Motor, Alternating Current: shaded pole induction type; 1/2200 hp; nominal free operating speed 3,300 rpm; speed at maximum power output 2,000 rpm; closed frame; 115 VAC, 60 cycles, single phase; rated for continuous operation; built-in thermal cut-out; round shaft 1/2" lg x 1/8" dia; motor 1 13/32" lg x 1 5/8" wd x 2" h excl shaft and term; mts by four 6-32 tapped holes spaced on 1/2" mtg/c located on shaft end; motor equipped with precision ball bearings; all metal parts to withstand 200 hr salt spray test; CNA part/dwg S985-1; CBUE type AC-470B	Upper deck fan motor
B301	N17-M-57242-1853	Motor, Alternating Current: two phase induction type; 110/115 VAC, 60 cycles, two phase, slotted shaft; closed frame; dust and vapor proof; 60° C temperature rise; 3 15/32" lg x 1 13/16" sq including 3/16" dia x 5/16" shaft w/0.045" wd x 0.047" d slot; 25 in.-oz. torque max output; CW or CCW rotation; 7 watts input at no load; 2 poles; fixed mtg flange w/four 0.157" dia mtg holes on 1.437" x 1.437" mtg/c; CNA part/dwg P811-1; CADH type 1282D-01600-02	AFC control motor (225 kc)
B302		Same as B301	AFC control motor (25 kc)
B303		Same as B101	Lower deck fan motor
		CAPACITORS	
C101	N16-C-30109-3806	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 470 mmf ±5%; 500 vdcw; temperature coefficient -100 +100 parts per million per °C; mica bakelite molded case 51/64" lg x 15/32" wd x 7/32" thk; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM20D471J; part of Z101	L101A tuning
C102		Same as C101; part of Z101	L101B tuning
C103	N16-C-30114-4276	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 470 mmf +10%, 500 vdcw; no specified temperature coefficient; mica bakelite molded case; 51/64" lg x 15/32" wd x 7/32" d max; 2 axial wire lead term, one at each end; term mtd; JAN type CM20B471K	Z101 to V101 signal input coupling
C104		Same as C103	Local osc input coupling to V101

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C105	N16-C-54460-4310	Capacitor, Fixed, Paper Dielectric: 3 sections; case style no. 41, MBCA ref dwg group 1; 100,000 mmf -10% +20%, 600 vdcw per section; hermetically sealed metal case 1 1/2" h x 2 7/16" wd x 41/64" d excl term; 3 solder lug term mtd on insulated pillars located on bottom; each section internally grounded; mts by two 0.156" wd open slots, one at each end of base located on 2 1/8" mtg/c; item per JAN-C-25 spec; JAN type CP69B5EF104V	
C105A		Part of C105	V101 screen bypass
C105B		Part of C105	V107 screen bypass
C105C		Part of C105	V109 cathode bypass
C106	N16-C-53448-1665	Capacitor, Fixed, Paper Dielectric: 2 sections; case style no. 42, MBCA ref dwg group 1; 250,000 mmf -10% +20%, 600 vdcw per section; hermetically sealed metal case 2.50" lg x 1.00" wd x 1.00" d excl term; 3 solder lug term mtd on insulated pillars located on one side; no internal ground connections; mts by two 0.187" dia holes on base spaced 2.125" c to c; item per JAN-C-25 spec; JAN type CP53B4EF254V	
C106A		Part of C106	V102A cathode bias bypass
C106B		Part of C106	V102B cathode bias bypass
C107	N16-C-53697-7002	Capacitor, Fixed, Paper Dielectric: 2 sections; 0.5 mfd, +20% -10%, 400 vdcw each section; hermetically sealed metal case; 1 5/16" lg x 49/64" wd x 2 1/2" h excluding term; 2 solder lug term on bottom; impregnated and filled per JAN-C-25 spec; internal ground connection; requires external mtg clamp; JAN type CP61B6EE504V	
C107A		Part of C107	V101 B+ bypass
C107B		Part of C107	V107 B+ bypass

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C108	N16-C-18657-8640	Capacitor, Fixed, Ceramic Dielectric: case style no. 3, MBCA ref dwg group 1; 1000 mmf ±20%, 350 vdcw, no specified temperature coefficient; insulated; 0.52" lg x 0.025" dia excl term and mtg stud; one rigid wire type terminal on top; stand-off mtg, 0.343" lg mtg stud tapped 3-48; CNA part/dwg FRE-19954-1-1; CER type 720B	V101 screen bypass
C109		Same as C103	V102A cathode to V103 (pin 7) grid coupling
C110		Same as C103	V102B cathode to V103 (pin 7) grid coupling
C111		Same as C103	V102A, V102B plates to V103 (pin 2) grid coupling
C112		Same as C107	
C112A		Part of C112	V102A, V102B B+ bypass
C112B		Part of C112	V103 B+ bypass
C113	For replacement use N16-C-22638-9896	Capacitor, Fixed, Electrolytic: case style no. 13, MBCA ref dwg group 1; 3 sections; 20 mfd, 300 vdcw per section, -40 to +65°C working temperature range; hermetically sealed metal case; 1 1/2" dia x 2 1/2" h excluding term; 4 pin type term on bottom; plugs into standard medium octal socket; JAN type CE53F200N; use CE53C200N	
C113A		Part of C113	V102A, V102B, V104, V115A B+ filter
C113B		Part of C113	V105, V106 B+ filter
C113C		Part of C113	V106 cathode bypass

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C114	N16-C-33622-5222	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 10,000 mmf ±10%, 300 vdcw; no specified temperature coefficient; mica bakelite molded case; 53/64" sq x 11/32" thk; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM35B103K	V115B plate (pin 1) to V124A grid (pin 2) coupling
C115	N16-C-45773-8550	Capacitor, Fixed, Paper Dielectric: 1 section; 0.1 mfd ±10%, 400 vdcw; hermetically sealed metal case; 1 3/8" lg x 0.400" dia excl term and mtg tab; one axial wire lead term at each end; oil filled; mts by single mtg tab w/one 0.144" dia hole; no internal ground connections; CNA part/dwg S987-1; CSF type 96P10494S13	V104A to Z103 coupling
C116		Same as C107	
C116A		Part of C116	V105 screen bypass
C116B		Part of C116	V105 B+ bypass
C117		Same as C114	V105 plate to V106 grid coupling
C118	N16-C-28558-1676	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 100 mmf ±10%, 500 vdcw; no specified temperature coefficient; mica bakelite molded case; 51/64" lg x 15/32" wd x 7/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM20B101K	Part of V106 plate to V105 cathode feed-back circuit
C119		Same as C103	Local osc input coupling to V107
C120		Same as C108	V107 screen bypass
C121		Same as C107	
C121A		Part of C121	V108A plate bypass
C121B		Part of C121	V108B B+ bypass

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C122	N16-C-29898-3606	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 390 mmf ±5%, 500 vdcw; temperature coefficient -100 +100 parts per million per °C; mica bakelite molded case 51/64" lg x 15/32" wd x 7/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM20D391J	T102 secondary tuning
C123		Same as C122	T102 secondary tuning
C124		Same as C103	Z101 to V109 grid coupling
C125		Same as C103	Local osc coupling to V109 grid
C126		Same as C108	V109 screen bypass
C127		Same as C107	
C127A		Part of C127	V109 screen bypass
C127B		Part of C127	V113B diode load bypass
C128		Same as C122	T103 primary tuning
C129		Same as C122	T103 primary tuning
C130		Same as C107	
C130A		Part of C130	V110 screen bypass
C130B		Part of C130	V110 cathode bypass
C131		Same as C107	
C131A		Part of C131	V111 cathode bypass

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C131B		Part of C131	V111 screen bypass
C132		Same as C107	
C132A		Part of C132	V113A diode load bypass
C132B		Part of C132	V112 B+ bypass
C133		Same as C122	T104 secondary tuning
C134		Same as C122	T104 secondary tuning
C135		Same as C107	
C135A		Part of C135	V112 cathode bypass
C135B		Part of C135	V112 screen bypass
C136		Same as C122	T105 secondary tuning
C137		Same as C122	T105 secondary tuning
C138		Same as C114	V124A plate (pin 1) to V124B (pins 6 and 7) diode coupling
C139		Same as C107	
C139A		Part of C139	V101 cathode bypass
C139B		Part of C139	V107 cathode bypass

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
CAPACITORS (CONT'D)			
C140		Same as C103	T105 to V114A coupling
C141		Same as C107	
C141A		Part of C141	V114 plate bypass
C141B		Part of C141	V115A B+ filter
C142		Same as C103	V114 plate (pin 6) to V115A grid coupling
C143		Same as C115	External AGC filter
C144		Same as C103	S102 to V108B grid coupling
C145		Same as C118	S102 oscillator isolating
C146		Same as C107	
C146A		Part of C146	V116A B+ filter
C146B		Part of C146	V116B plate bypass
C147		Same as C103	V116A plate to V117 (pin 2) grid coupling
C148		Same as C103	V116A cathode to V117 (pin 7) grid coupling
C149		Same as C103	V117 plate (pin 1) to V118 plate (pin 2) coupling

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
CAPACITORS (CONT'D)			
C150		Same as C103	V117B plate to V118 plate (pin 7) coupling
C151		Same as C114	V118 cathode (pin 1) bypass
C152		Same as C114	V118 diode plate load bypass
C153		Same as C114	V118 cathode (pin 5) bypass
C154		Not used	
C155		Same as C118	S102 carrier isolating
C156		Same as C103	V121A plate to V120 grid coupling
C157		Same as C107	
C157A		Part of C157	V120 screen bypass
C157B		Part of C157	V120 B+ bypass
C158		Not used	
C159	N16-C-33612-3276	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 10,000 mmf ±2%, 300 vdcw; temperature coefficient -20 +100 parts per million per °C; mica bakelite molded case; 53/64" lg x 53/64" wd x 11/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM35E-103G	V120 to L102 phase shift network low impedance coupling
C160	N16-C-32135-3219	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 2,700 mmf ±2%, 500 vdcw; temperature coefficient -20 +100 parts per million per °C; case 53/64" lg x 53/64" wd x 9/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM30E272G	L102 fixed tuning

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C161	N16-C-28553-1201	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 100 mmf ±5%, 500 vdcw; temperature coefficient -200 +200 parts per million per °C; mica bakelite molded case 51/64" lg x 15/32" wd x 7/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM20C101J	L102 fixed tuning
C162	N16-C-29713-6806	Capacitor, Fixed, Mica Dielectric: case style no. 22, MBCA ref dwg group 1; 330 mmf ±5%, 500 vdcw; temperature coefficient -100 +200 parts per million per °C; low loss red bakelite case 51/64" lg x 15/32" wd x 7/32" thk max; 2 wire lead term; term mtd; item per JAN-C-5 spec; JAN type CM20D331J	L102 fixed tuning
C163	N16-C-60916-1841	Capacitor, Variable, Air Dielectric: plate meshing type; 1 section; 6 to 106 mmf; straight line capacity tuning characteristic; 1 45/64" lg x 15/16" wd x 1 3/16" h excl shaft; shaft approx 17/32" lg x 3/16" dia; screwdriver slot adjustment; 360° rotation either direction; 28 brass silver plated plates; locking type; mts by two 4-40 tapped holes 5/32" d spaced 21/32" c to c; CNA part/dwg SA:8489; CNA type SA:8489	L102 variable tuning
C164		Same as C159	L102 phase shift network to V121B cathode input low impedance coupling
C165		Same as C103	V115A plate to V116A grid and V121A grid coupling
C166		Same as C107	
C166A		Part of C166	V121 plate bypass
C166B		Part of C166	V121A B+ bypass
C167		Same as C118	V121A output phase shift
C168		Same as C103	V121A plate to V122 grid (pin 2) coupling

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C169		Same as C103	V121A cathode to V122B grid (pin 7) coupling
C170	N16-C-15915-9167	Capacitor, Fixed, Ceramic Dielectric: case style no. 2, MBCA ref dwg group 1; 10 mmf ±0.5 mmf, 500 vdcw; zero temperature coefficient; tolerance +60 -110 parts per million per °C; ceramic insulation; 0.562" lg x 0.250" dia; 2 wire lead term; JAN type CC21CH100D	V104A grid (pin 7) phase balancing
C171		Same as C103	V122 plate (pin 1) to V123 plate (pin 2) coupling
C172		Same as C103	V122 plate (pin 6) to V123 plate (pin 7) coupling
C173		Same as C105	
C173A		Part of C173	V123 cathode (pin 1) bypass
C173B		Part of C173	V123 diode plate load bypass
C173C		Part of C173	V123 cathode (pin 5) bypass
C301		Same as C103	V301 input filter
C302	For replacement use N16-C-49949-5553	Capacitor, Fixed, Paper Dielectric: 1 section; 4 mfd ±20%; 150 vdcw; hermetically sealed metal case; 1 13/16" lg x 7/8" wd x 1" h excl term and mtg tabs; 2 solder lug term on one side; impregnated and filled per JAN-C-25 spec; no internal ground connection; mts by two 3/16" dia holes spaced 2 1/8" c to c; CNA part/dwg S732-1;CAW type P30ZN, use type P30ZN in ±10%	V301 input delay
C303		Same as C103	V301 grid (pin 7) bypass

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C304		Same as C115	T301 primary 60 cycle tuning
C305		Same as C115	T301 RF bypass
C306	N16-C-64062-6985	Capacitor, Variable, Ceramic Dielectric: rotary type; single section; negative temperature coefficient 500 mmf per mf per °C; 4 to 30.0 mmf; 500 vdcw; 27/32" lg x 41/64" wd x 13/32" h; one solder lug term at each end, mts by two 0.120" dia holes on base spaced 0.438" c to c; screwdriver slot adjustment; ceramic base; JAN type CV11C300	V303A oscillator trimmer
C307	N16-C-16597-1215	Capacitor, Fixed, Ceramic Dielectric: case style no. 1, MBCA ref dwg group 1; 51 mmf, ±5%; 500 vdcw; negative temperature coefficient 750 mmf per mf per °C (tolerance +120 -210); uninsulated; 0.400" lg x 0.200" dia; one radial wire lead term at each end; term mtd; JAN type CC20UJ510J	V303A oscillator temperature compensating
C308		Same as C160	V303A plate to grid feedback
C309	N16-C-62146-2348	Capacitor, Variable, Air Dielectric: plate meshing type; 2 sections; 7 to 18 mmf total; sections series connected; each section straight line capacity tuning characteristic; 2 23/32" lg x 2 1/8" wd x 1 3/4" h excl shaft; 0.156" dia shaft extends 31/64" from one end and 47/64" from other end; gear driven adjustment; 360° rotation; insulated; bracket mtd by four 0.156" dia holes at one end, two top holes spaced 1" c to c; two bottom holes spaced 1 3/4" c to c; two solder lug terms at mtg end; CNA part/dwg SD:2473	225 kc oscillator (V303A) tuning (motor driven)
C310		Same as C103	V303A plate to grid feedback
C311		Same as C103	V303A to V303B coupling
C312		Same as C115	V303 B+bypass
C313		Same as C103	V311 grid (pin 2) bypass
C314		Same as C103	V305 input filter

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C315	N16-C-48841-9598	Capacitor, Fixed, Paper Dielectric: single section; 1 mfd, +20%, -10%; 600 vdcw; hermetically sealed metal case; 1 5/16" lg x 49/64" wd x 2 1/2" h excluding term; 2 solder lug term on bottom; impregnated and filled per JAN-C-25 spec; no internal ground connection; requires external mtg clamp; JAN type CP61B1DF105V	V305 input delay
C316		Same as C103	V305 grid (pin 7) bypass
C317	N16-C-53697-7435	Capacitor, Fixed, Paper Dielectric: 2 sections; 0.5 mfd +20%, -10%, 600 vdcw each section; hermetically sealed metal case; 2" lg x 1 3/4" wd x 1" d excl term; 3 solder lug term mtd on insulated pillars located on one side; no internal ground connections; mts by two 3/16" dia holes on base spaced 2 3/8" c to c; item per JAN-C-25 spec; JAN type CP53B4EF504V	
C317A		Part of C317	B301 phasing
C317B		Part of C317	B302 phasing
C318		Same as C106	
C318A		Part of C318	B301 phasing
B318B		Part of C318	B302 phasing
C319		Same as C115	T302 primary tuning
C320		Same as C159	V307 grid regeneration
C321		Same as C103	V308B to V307 coupling
C322		Same as C163	V307 oscillator trimmer
C323		Same as C122	V307 oscillator temperature compensating
C324		Same as C160	V307 oscillator fixed tuning

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C325	N16-C-62361-6412	Capacitor, Variable, Air Dielectric: plate meshing type; 2 sections; 14 to 36 mmf per section; sections connected in parallel; each section straight line capacity tuning characteristic; 2 23/32" lg x 2 1/8" wd x 1 3/4" h excl shaft; 0.156" dia shaft extends 31/64" from one end and 47/64" from other end; gear driven adjustment; 360° rotation; insulated; bracket mtd by four 0.156" dia holes at one end; two top holes spaced 1" c to c, two bottom holes spaced 1 3/4" c to c; three solder lug term at mtg end; CNA part/dwg SB:2490	25 kc oscillator (V307) tuning (motor driven)
C326		Same as C103	V308B input phase shift
C327		Same as C159	V307 feedback
C328		Same as C106	
C328A		Part of C328	V308B plate bypass
C328B		Part of C328	V307, V308A B+ bypass
C329		Same as C103	V308A to V116B coupling
C330	N16-C-21837-9910	Capacitor, Fixed, Electrolytic: case style no. 15, MBCA ref dwg group 1; 2 sections; 20 mfd per section; 450 vdcw; -40 to +65°C working temperature range; hermetically sealed metal case 1 3/8" dia x 2 3/4" h excluding mtg bushing; 3 solder lug term on bottom; negative term internally grounded; mts by 7/8-16 thd bushing 1/2" lg w/hex nut; JAN type CE42F200R	
C330A		Part of C330	Power supply filter
C330B		Part of C330	Power supply filter
C331		Same as C330	
C331A		Part of C331	Power supply filter
C331B		Part of C331	Power supply filter

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CAPACITORS (CONT'D)	
C332		Same as C115	T302 RF bypass
C401	N16-C-45770-3626	Capacitor, Fixed, Paper Dielectric: single section; case style no. 17, MBCA ref dwg group 1; 100,000 mmf, ±10%; 200 vdcw; hermetically sealed tubular metal can; 2 7/32" lg x 11/16" dia excluding mtg strap; has 3/8" dia bushing w/10-32 thd x 1/4" d tapped hole at each end for term; oil impregnated and filled; no internal ground connections; mts by tangential strap welded to case w/one 0.201" dia mtg hole 5/8" from center line of capacitor case; NT-484996-10; CNA part/dwg K734-1	Part of audio output noise filter network (Z403)
C402		Same as C401	Part of audio output noise filter network (Z403)
		MISCELLANEOUS ELECTRICAL PARTS	
E101	N16-S-34557-8351	Shield, Electron Tube: copper or brass, nickel plated; cylindrical shape; 1 3/4" lg x 0.930" dia; bayonet mtd by twist locking detent; includes non-magnetic spring; JAN type TS102U02	V101 shield
E102	N16-S-34576-6513	Shield, Electron Tube: copper or brass, nickel plated; cylindrical shape; 1 15/16" lg x 0.065" dia; bayonet mtd by twist locking detent; includes nonmagnetic spring; JAN type TS103U02	V102 shield
E103		Same as E102	V103 shield
E104		Same as E102	V104 shield
E105		Same as E101	V105 shield
E106		Same as E101	V106 shield
E107		Same as E101	V107 shield
E108		Same as E102	V108 shield
E109		Same as E101	V109 shield
E110		Same as E101	V110 shield
E111		Same as E101	V111 shield
E112		Same as E101	V112 shield

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MISCELLANEOUS ELECTRICAL PARTS (CONT'D)	
E113	N16-S-34520-3864	Shield, Electron Tube: copper or brass, nickel plated; cylindrical shape; 1 3/8" lg x 0.930" dia; bayonet mtd by twist locking detent; includes non-magnetic spring; JAN type TS102U01	V113 shield
E114		Same as E102	V114 shield
E115		Same as E102	V115 shield
E116		Same as E102	V116 shield
E117		Same as E102	V117 shield
E118		Same as E113	V118 shield
E119	N16-S-34607-6039	Shield, Electron Tube: copper or brass, nickel plated; cylindrical shape; 2 1/4" lg x 0.930" dia; bayonet mtd by twist locking detent; includes non-magnetic spring; JAN type TS102U03	V119 shield
E120		Same as E113	V120 shield
E121		Same as E102	V121 shield
E122		Same as E102	V122 shield
E123		Same as E113	V123 shield
E124		Same as E102	V124 shield
E125	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Lug, Solder: brass w/hot tinned finish 49/64" lg x 5/16" wd x 0.020" thk o/a; 0.144" dia hole at one end; 0.0785" dia hole at other end; two holes spaced 25/64" c to c; CNA part/dwg E903-1	For grounding term no. 2 of T101
E126	N16-K-700310-982	Knob: round, black bakelite; for 1/4" dia shaft; double 8-32 Allen set screws; white arrow marking; 1/2" lg x 1 1/16" dia o/a; cad plated brass insert; 8 notches on circumference; CNA part/dwg SA:2834	Carrier level control knob
E127		Same as E126	Audio level control knob
E128	Shop manufacture	Washer, Shoulder: round; wax impregnated bakelite Grade LTS-E-3 per JAN-P-13; 5/8" OD x 25/64" ID x 1/16" thk o/a; 0.494" dia x 1/32" thk shoulder; CNA part/dwg P017-2	Insulating washers for J101 (2 used)

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MISCELLANEOUS ELECTRICAL PARTS (CONT'D)	
E301		Same as E102	V301 shield
E302		Same as E102	V302 shield
E303		Same as E102	V303 shield
E304		Same as E119	V304 shield
E305		Same as E102	V305 shield
E306		Same as E102	V306 shield
E307		Same as E113	V307 shield
E308		Same as E102	V308 shield
E309		Same as E102	V311 shield
E310	N17-I-59627-9229	Terminal, Feedthru, Insulator: compression molded brown melamine insulation; smooth finish; rated at more than 300 V/MA; silver plated brass term, one at each end; 1 1/16" lg o/a x 1/4" dia body; 5/16" across flats of mtg hex nut; bushing mtd by 1/4-20 threaded portion of body 1/4" lg; includes hex nut and lock-washer; CNA part/dwg S962-1; Garde Mfg. Co. type M3660FT-2	Feedthru terminal (5 used)
E401	Low Failure item — if required requisition from ESO referencing NavShips 900,180A	Ferrule, Soldering: 0.064" thk 1/2 hd brass, cad plated; 0.682" dia o/a; cutout 25/64" wd x 0.731" d o/a w/end rounded on 0.390" rad from center line; CNA part/dwg FRB24368-1-2	One each used with P403 and P404
		FUSES	
F301	G17-F-16302-80	Fuse, Cartridge: 1 amp; 250 v; instantaneous; ferrule type term; glass enclosed body; one time; element visible thru glass; 1 1/4" lg x 1/4" dia; CNA part/dwg F135-3; CLF type 1040	Fan and AFC motors line fuse
F302		Same as F301	Spare
F303	N17-F-16302-40	Fuse, Cartridge: 0.25 amp; 250 v; instantaneous; ferrule type term; glass enclosed body; one time; element visible thru glass; 1 1/4" lg x 1/4" dia; CNA part/dwg F135-15; CLF type 312250	AFC motor transformer line fuse
F304		Same as F303	AFC motor transformer line fuse
F305		Same as F303	Spare

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		FUSES (CONT'D)	
F401	G17-F-16302-120	Fuse, Cartridge: 3 amp, 250 v; instantaneous; ferrule type term; glass enclosed body; one time; element visible thru glass; 1 1/4" lg x 1/4" dia; CNA part/dwg F135-9; CLF type 1043	AC line fuse
F402		Same as F401	AC line fuse
F403		Same as F401	Spare
F404		Same as F401	Spare
		HARDWARE	
H301	G41-W-2446-2	Wrench: for no. 8 Allen setscrew; 5/64" across flats; approx 1 61/64" lg x 11/16" wd; cad plated hardened steel; 90° offset; CNA part/dwg F131-7	Wrench for no. 8 Allen setscrew
		INDICATING DEVICES	
I301	G17-L-6806-130	Lamp, Glow: 1/25 w; 65 VAC striking voltage 90 VDC striking voltage; miniature bayonet base; T 3 1/4 bulb; clear; burns any position; CNA part/dwg H338-1; CG type NE-51	B+ indicator lamp
		JACKS	
J101	N17-J-39248-3224	Jack, Telephone: for 2 conductor plug w/0.250" dia x 1.00"lg shank; contact arrangement J1-A; MBCA ref dwg group 4; 1.271" lg x 1.00" wd x 0.750" h; mts by 3/8-32 thd bushing 0.375" lg; includes hex nut and washer; NT-49025B; CNA part/dwg H464-2; CMA type 49025B	Phones jack
J301		Same as J101	Tuning motor indicator jack
J302		Same as J101	Local oscillator motor indicator jack
J401	N17-C-73332-1917	Connector, Receptacle: 22 round female contacts and 2 round male coaxial contacts; polarized; straight; 2" lg x 1" h x 11/16" d excl contacts; coaxial contacts rated at 52 ohms impedance for RG-58/U cable; contacts rated at 1,700 volts, 5 amps max; rectangular shaped aluminum alloy body, cad plated with chromate conversion finish; insert material per MIL-P-14D spec; mts by four 0.0934" dia holes on 1.781" x 0.500" centers; coax and solid connectors gold plated; CNA part/dwg S801-1; CED type DPA-24C2-33S	Multiconnector

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		JACKS (CONT'D)	
J402		Same as J401	Multiconnector
J403	N17-C-72610-5434	Connector, Receptacle: 4 round male contacts; polarized; straight; 1 3/16" sq x 1 3/16" h o/a; square aluminum mtg flange w/cylindrical body w/7/8-20 coupling thd 3/8" lg; mts by four 0.120" dia holes in flange on 29/32" x 29/32" mtg/c; AN3102A-14S-2P	Audio output connector
J404	N17-C-72604-1522	Connector, Receptacle: 3 round male contacts; polarized; straight; 1 3/16" lg x 1 3/16" wd x 1 3/16" h o/a; square aluminum mtg flange w/cylindrical body w/7/8-20 thd 3/8" lg; sand blast w/clear lacquer finish; molded phenolic insert; 23/32" dia max cable opening; mts by four 0.120" dia holes in flange on 29/32" x 29/32" mtg/c; AN3102A-14S-7P	AC power input connector
J405	N17-C-73108-5890	Connector, Receptacle: 1 round female contact; polarized; straight; 1.00" sq x 1 1/16" h o/a; square mtg flange w/ cylindrical body, mts by four 0.125" dia holes in flange on 23/32" x 23/32" mtg/c; NT-49194; CNA part/dwg F506-1; CBIC type 49194	Signal input connector (external)
		RELAYS	
K301	N17-R-65104-1646	Relay, Armature: non pile-up type contacts; double pole, double throw, normally closed; contact rating 2 amps at 28 VDC or 115 VAC; 1 inductive winding; operating currect 2.3 ma, release current 0.55 ma; DC resistance 8,000 ohms; hermetically sealed in solder dipped brass and steel can; 1" sq x 1 3/4" h o/a; mts by two 4-40 studs 1/4" lg spaced 1/2" c to c located on bottom; schematic diagram stamped on side of can; CNA part/dwg S771-1; CH type 105-2C-8000	CONS relay
		COILS	
L101	N17-T-81778-5940	Transformer, Radio Frequency: 2 windings, 4 pie universal wound; primary and secondary windings each 1.05 mh inductance measured at 250 kc; each winding 370 turns no. 36ESN copper wire; each winding 20.6 ohms DC resistance; 200 kc peak freq; untapped; unshielded; windings 15/16" lg x 5/8" dia; ceramic coil form 2" lg x 3/8" dia w/1 1/16" sq x 1/4" thk shoulder at each end; adjustable powdered iron cores, double tuned, screwdriver adjustment at top and bottom; mts by two 6-32 thd studs, 3/8" lg spaced 1 1/8" c to c located on bottom, four solder loop type term located on bottom; windings varnish impregnated; CNA part/dwg SB:2455	Signal input transformer (part of Z101)

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		COILS (CONT'D)	
L101A		Part of L101	Z101 primary
L101B		Part of L101	Z101 secondary
L102	N16-C-72241-6602	Coil, Radio Frequency: 20 mh ±1% measured at 25 kc; DC resistance approx 3 ohms; toroidal wound; hermetically sealed metal case; 1 11/16" lg x 1 3/16" wd x 2 1/4" h excluding term; mts by two 6-32 tapped holes on bottom spaced diagonally on 1 1/8" x 5/8" centers; 2 solder lug term on standoff insulators located on bottom; min Q 200 at 25 kc; item per MIL-T-27 spec for Grade 1, Class A components; CNA part/dwg S981-1; CBIS type S-12814	Phase shift network inductor
L301	N16-C-76762-5741	Coil, Radio Frequency: 8 mh at 250 kc; 43 ohms DC resistance; Q 110 ±10%, current rating 100 ma; 750 turns no. 10-24 Litz wire, one winding, 3 pie wound, 250 turns per pie; untapped, unshielded; ceramic form 1 9/16" lg x 3/4" dia excl term and mtg stud; coil 7/8" lg x 1" dia; nonadjustable; 2 solder lug term on side of form; mts by 1/4-32 thd stud 11/16" lg; CNA part/dwg SB:2474	225 kc oscillator plate coil
L302	N16-C-72240-3284	Coil, Radio Frequency: 20 mh ±1% measured at 25 kc; DC resistance approx 5 ohms; toroidal wound; hermetically sealed metal case; 1.826" dia x 1 5/32" h excluding term; mts by two 6-32 tapped holes on bottom spaced 1 1/8" c to c; 2 solder lug term on standoff insulators located on bottom; min Q 200 at 25 kc; item per MIL-T-27 spec for Grade 1, Class A components; CNA part/dwg S982-1; CUT type N8801	25 kc oscillator plate coil
L303	Aviation Supply Office R16NAC-M135-1	Reactor: filter choke; one section; 8 hy; 200 ma; DC resistance 90 ohms; 1,750 v RMS; hermetically sealed metal case; 3 1/8" lg x 3" wd x 3 13/16" h excluding term and mtg studs; four 10-32 mtg studs 1/2" lg on 2 7/32" x 2 15/32" mtg/c; 2 solder post term on bottom; item per JAN-T-27 spec for Grade 1, Class A components; CNA part/dwg M135-1; CFX type 16623	Power supply filter choke
L304		Same as L303	Power supply filter choke
L401	N16-C-72159-7036	Coil, Radio Frequency: 0.5 mh measured at 790 kc; DC resistance 7 ohms; max current rating 350 ma on basis of 20°C rise in temp; 420 turns of no. 32 enamelled copper wire, single silk covered; 1 winding 3 pie wound, 140 turns per pie; untapped, unshielded; windings 3/16" lg x 15/32" dia spaced 3/32" apart; coil form 1 15/16" lg x 3/8" dia o/a; mts by 6-32 tapped axial hole in end of form; nominal Q of 10 at 790 kc; nominal self-resonant freq 5 mc; CNA part/dwg SA:4012	Part of audio output noise filter network (Z403)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		COILS (CONT'D)	
L402		Same as L401	Part of audio output noise filter network (Z403)
L403		Same as L401	Part of audio output noise filter network (Z403)
L404		Same as L401	Part of audio output noise filter network (Z403)
		METERS	
M101	N17-M-19253-1756	Ammeter:DC milliammeter;0 to 1 ma range; 25 ohms; white scale w/black markings; dielectric strength 1,500 volts rms; 1.750" sq x 0.228" thk mtg flange; round body 1.497" dia x 0.830" d excl term; two solder lug term on back; mts by four 0.125" dia holes on 1.312" mtg/c; CNA part/dwg T133-1; similar to CBNJ type 153	Carrier level meter
M102	N17-M-22715-3319	Meter, Audio Level: -12 db to +22 db range; white scale w/black figures; major marking points at -12 db, -2 db, zero db and 8 db; power level 1 milliwatt into 600 ohms; impedance at zero on scale 5,000 ohms ±10%; damping factor at zero on scale 5 to 20; response time at zero on scale 1 second; voltage at 9 on scale 0.775 volts; accuracy: ±0.4 db between -12 and +8 db only; item per MIL-M-6A spec; 1.750" sq x 0.228" thk mtg flange; round body 1.497" dia x 0.830" d excl term; two solder lug term on back; mts by four 0.125" dia holes on1.312" mtg/c;CNA part/ dwg T132-1; CBNJ type A-SP-238	Output level meter
		MECHANICAL PARTS	
O101	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Assembly, Chassis Slide and Tilt Mechanism: consists of chassis slide, tilt index plate, chassis release lever and spring; assembly formed for mtg on left side of chassis side plate; 9 1/4" lg x 3.000" h x 0.813" thk o/a; 7 notches in index plate; CNA part/dwg SB:2478	Chassis slide and tilt mechanism (left side)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
O102	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Assembly, Chassis Slide and Tilt Mechanism: consists of chassis slide, tilt index plate, chassis release lever and spring; assembly formed for mtg on right side of chassis side plate; 9 1/4" lg x 3.000" h x 0.813" thk o/a; 7 notches in index plate; CNA part/dwg SB:2479	Chassis slide and tilt mechanism (right side)
O103	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Nut, Hex: X1112 cad plated steel; 5/16-32 thd; 3/32" thk; 5/8" across flats; CNA part/dwg Q911-1	Secures O101 to chassis side plate
O104		Same as O103	Secures O102 to chassis side plate
O105	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Eccentric: cad plated steel; hex shape 3/4" across flats; 0.437" ID; round shoulder 3/16" wd x 0.560" OD located 0.031" off center; 0.3195" thk o/a; CNA part/dwg Q501-3	Eccentric bearing for O101
O106		Same as O105	Eccentric bearing for O102
O107	Shop manufacture	Bracket: 0.062" stainless steel; 2 1/64" lg x 3/8" wd x 0.193" h o/a; center section 0.890" lg offset 0.131"; two mtg holes spaced 1 25/64" c to c; one hole 0.187" dia centrally located 5/16" from one end, other 0.203" dia centrally located at other end; one clearance hole 0.125" dia w/0.010" x 45° chamfer located in offset section spaced 0.6460" from 0.187" dia mtg hole; CNA part/dwg P498-1	Tilt lock-release bearing bracket (left side)
O108		Same as O107	Tilt lock-release bearing bracket (right side)
O109	Shop manufacture	Shaft: stainless steel; 11/32" lg o/a; round, 0.123" dia section at one end 0.093" lg followed by 5/16" dia x 0.032" shoulder with remaining section 0.185" dia; 1/64" x 45° chamfer at both ends; CNA part/dwg P500-1	Tilt lock-release lever shaft (left side)
O110		Same as O109	Tilt lock-release lever shaft (right side)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0111	Shop manufacture	Lever: 0.094" stainless steel; irregular shape; 1.6085" lg x 0.625" wd x 0.422" h o/a; 90° bend at one end 0.422" lg; two 0.187" dia holes spaced 0.687" c to c; CNA part/dwg P496-3	Chassis tilt lock-release lever (left side)
0112	Shop manufacture	Lever: 0.094" stainless steel; irregular shape; 1.6085" lg x 0.625" wd x 0.422" h o/a; 90° bend at one end 0.422" lg; two 0.187" dia holes spaced 0.687" c to c; same as 0111 except 90° bend is in opposite direction; CNA part/dwg P496-4	Chassis tilt lock-release lever (right side)
0113	N17-C-201579-718	Cover, Jack: aluminum and brass w/semigloss black enamel finish; 27/32" lg x 23/32" wd x 1/4" thk o/a; mts on jack bushing by 0.380" dia hole; cover held in closed position by cad plated steel tension spring; CNA part/dwg FRE-20917-1; Croname Inc; type A-21510 w/metal parts to withstand 50 hour salt spray test in accordance with AN-QQ-S-91 spec	Phones jack cover
0114	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Fastener, Camloc: cad plated bronze; 1" lg x 27/64" wd x 1/2" d o/a; slot in center to receive locking pin; mts by two 0.200" x 100° csk holes spaced 0.750" c to c; CNA part/dwg S755-1; Camloc type 212-12ND (2700 series)	Locks ventilating fan cover on upper deck front panel(right side)
0115		Same as 0114	Locks ventilating fan cover on upper deck front panel (left side)
0116	N17-P-87240-4666	Fan: air impeller; 4 blades, 3" dia tip to tip; hub 15/32" dia x 5/16" lg w/0.125" bore; CNA part/dwg S984-1; Torrington type 0-327-4	Upper deck ventilating fan (mts on B101)
0117	N16-C-300442-625	Clamp, Electrical: electron tube clamp; stainless steel; approx 2 9/16" lg x 1 7/16" wd x 17/32" h when open; mtg bracket w/single mtg hole for 6-32 screw located 60° from loop; 115° from hinge on 27/32" rad; designed to hold item 1 1/4" dia; w/holding spurs; CNA part/dwg F892-7; CAIS type 926B-2	V309 clamp
0118		Same as 0117	V310 clamp
0119	N16-M-60911-4456	Mounting, Capacitor: non-magnetic; 1 45/64" nom lg x 49/64" max wd x 2 1/2" max h; two 6-32 spade bolts spaced 1 9/16" c to c; JAN type CP06SA5	Capacitor mounting (14 used)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0120	N16-C-300798-866	Clamp, Electrical: electron tube clamp; stainless steel; 2 11/16" lg x 3/4" h; mtg bracket w/single mtg hole for 6-32 screw located 60° from loop, 120° from hinge on 29/32" rad; designed to hold item 1 3/8" dia; CNA part/dwg F892-2; CAIS type 926C	C113 clamp
0121	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Handle, Panel: die cast zinc alloy; 4 7/8" lg x 2 7/8" wd x 1" thk o/a; mts by two 10-32 tapped holes 3/8" d spaced 3 5/16" c to c; includes 0122, 0123, 0124, 0129, 0130, 0131, 0132, 0133, 0134, 0135, 0136, 0137; CNA part/dwg SB:2471	Panel lock-tilt-release handle (right side)
0122	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Gear, Spur: cad plated steel; 20 straight teeth, 32 pitch, 0.625" pitch dia; 14 1/2° pressure angle, 0.6875" OD, 0.253" sq bore; 0.187" face; straight face; die stamped "H683"; part of 0121; CNA part/dwg H683-2	Panel release drive gear
0123	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Gear, Spur: cad plated steel; 24 straight teeth, 32 pitch, 0.750" pitch dia; 14 1/2° pressure angle, 0.8125" OD, 0.1875" bore, 0.187" face, straight face; die stamped "H681"; part of 0121; CNA part/dwg H681-2	Panel release idler gear
0124	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Receiver, Subassembly: consists of shaft, gear, sleeve bearing and gear pin; 7/8" lg x 1 1/16" dia o/a; formed for right hand mtg; includes 0125, 0126, 0127, 0128; part of 0121; CNA part/dwg SA:7223	Panel release driver gear assembly
0125	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Gear, Spur: cad plated brass; 32 teeth, 32 pitch, 1.000" pitch dia, 14 1/2° pressure angle, 0.187" straight face; 2 adjacent teeth removed; 0.500" bore; part of 0124; CNA part/dwg H682-2	Panel release driven gear
0126	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Bearing, Sleeve: SAE X1112 steel; cad plated; 1/2" lg x 1/2" OD x 0.375" ID; edges broken approx 1/64" x 45°; part of 0124; CNA part/dwg P483-1	Bearing for panel release driven gear
0127	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Shaft: SAE X1112 steel; 0.719" lg x 1" dia o/a; 0.373" dia x 0.344" lg at one end; two axial pins, 0.219" lg x 0.125" dia spaced 90° apart on 0.375" rad at larger dia end of shaft; 0.067" dia radial hole in each pin 0.063" from end; part of 0124; CNA part/dwg SA:7046	Panel release driven gear shaft
0128	Shop manufacture	Pin, Gear: stainless steel; 27/32" lg x 0.097" dia w/6-32 thd at one end 3/16" lg; 0.045" wd x 3/64" d slot on threaded end; 1/64" x 45° chamfer at both ends; part of 0124; CNA part/dwg H791-1	Pin for panel release driven gear

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0129	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Spring, Flat: 0.032 spring brass; 1 5/16" lg x 0.312" wd o/a; 3/32" dia dimple 0.032" d spaced 1/2" from one end; 0.156" wd hole w/ends rounded on 0.093" rad spaced 13/16" from dimple; ends of spring rounded on 0.156" rad; part of O121; CNA part/dwg J337-1	Provides tension on handle locking button
0130	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Button, Push: stainless steel; 9/16" dia x 0.273" lg o/a; 4-40 tapped axial thru hole; one shoulder 0.248" dia x 0.128" lg, one shoulder 0.154" dia x 0.020" lg; straight knurl on larger dia face w/1/32" x 45° chamfer; part of O121; CNA part/dwg J336-1	Panel release locking button
0131	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Lever: die cast zinc alloy w/dull nickel finish; 4.312" lg x 1.152" wd x 0.750" thk; two 0.141" dia mtg holes on common axis at one end; raised characters on depressed background read "Panel release lift levers together"; part of O121; CNA part/dwg H617-2	Panel release lever
0132	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Shaft: leaded yellow brass w/dull nickel plate; 0.575" lg x 0.250" sq; 6-32 tapped axial hole full length of shaft; part of O121; CNA part/dwg H685-2	Shaft for panel release drive gear
0133	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Washer: round, 0.750" OD x 0.119" thk o/a; 0.253" sq center hole w/sides rounded on 0.132" rad; one side of washer chamfered to 1/2" dia x 15°; dia stamped "H684"; part of O121; CNA part/dwg H684-2	Panel release drive gear washer
0134	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Washer: hex shape, flat; stainless steel; 0.187" across flats, 0.031" thk; 0.125" ID; part of O121; CNA part/dwg H679-1	Idler gear washer
0135	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Pin, Gear: stainless steel; round w/hex head; 3/4" lg o/a x 0.186" dia w/hex head at one end 0.062" lg x 0.187" across flats; 0.124" dia x 0.068" lg shoulder at other end w/0.045" dia x 3/32" d axial hole csk to 0.094" dia x 60°; part of O121; CNA part/dwg H680-1	Idler gear support
0136	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Screw, Machine: hex head; stainless steel; 1" lg o/a x 5/16" across flats of hex head; 6-32 threaded section 13/16" lg; head tapered 82° to fit csk hole and 1/64" h crown; part of O121; CNA part/dwg J368-1	Pivot for panel release lever

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0137	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Nut, Hex: stainless steel; 13/16" lg x 5/16" across flats; 6-32 thd; 82° taper to fit csk and 1/64" h crown w/center hole csk 3/16" dia x 90°; part of 0121; CNA part/dwg J369-1	Secures pivot for panel release lever
0138	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Handle, Panel: same as 0121 except formed for left side mtg; includes 0139, 0140, 0141, 0146, 0147, 0148, 0149, 0150, 0151, 0152, 0153, 0154; CNA part/dwg SB:2472	Panel lock-tilt-release handle (left side)
0139		Same as 0122 except part of 0138	Panel release drive gear
0140		Same as 0123 except part of 0138	Panel release idler gear
0141	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Receiver, Subassembly: consists of shaft, gear, sleeve bearing and gear pin; 7/8" lg x 1 1/16" dia o/a; formed for left hand mtg; includes 0142, 0143, 0144, 0145; part of 0138; CNA part/dwg SA:7224	Panel release driver gear assembly
0142		Same as 0125 except part of 0141	Panel release driven gear
0143		Same as 0126 except part of 0141	Bearing for panel release driven gear
0144		Same as 0127 except part of 0141	Panel release driven gear shaft
0145		Same as 0128 except part of 0141	Pin for 0142
0146		Same as 0129 except part of 0138	Provides tension on handle locking button
0147		Same as 0130 except part of 0138	Panel release locking button
0148		Same as 0131 except part of 0138	Panel release lever

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0149		Same as 0132 except part of 0138	Shaft for panel release drive gear
0150		Same as 0133 except part of 0138	Panel release drive gear washer
0151		Same as 0134 except part of 0138	Idler gear washer
0152		Same as 0135 except part of 0138	Idler gear support
0153		Same as 0136 except part of 0138	Pivot for panel release lever
0154		Same as 0137 except part of 0138	Secures 0153
0155	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Subassembly, Inspection Door: aluminum; 6 7/8" wd x 3 11/16" h x 1 21/32" thk; mts on front panel by hinge w/three 0.156" mtg holes spaced 1.500" c to c; includes 0156, 0157, 0158, 0159, 0160, 0161; CNA part/dwg SB:2441	Inspection door and air filter subassembly (upper deck)
0156	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Door, Inspection: aluminum; 6 3/4" lg x 3 5/8" wd x 0.765" thk o/a; top corners rounded on 5/16" rad; center cutout 4 1/4" lg x 1 15/16" wd; six 0.203" dia holes spaced on 2.625" x 2.500" mtg/c; 4 5/8" lg x 7/8" wd (when open) aluminum hinge w/removable pin spot welded to bottom edge of door; three 0.156" dia mtg holes on hinge spaced 1.500" c to c; part of 0155; CNA part/dwg S725-1 (door) and S728-1 (hinge)	Inspection door
0157	Shop manufacture	Gasket: extruded synthetic rubber, black, 45-55 shore durometer hardness; 13 3/4" lg x 3/16" wd x 1/8" thk; lengthwise open slot in one edge 1/16" wd x 1/8" d; part of 0155; CNA part/dwg S770-1	Seal for inspection door subassembly
0158	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Filter, Air: one piece aluminum frame w/filter media cloth covered aluminum, approx 20 ribs; 4 37/64" lg x 2 9/64" wd x 1/2" thk o/a; item treated to withstand 20% 200 hr salt spray test in accordance with AN-QQ-S-91 spec; part of 0155; CNA part/dwg S773-1; CBEN type P-4A	Air filter
0159	Shop manufacture	Gasket: black synthetic rubber; 45-55 shore durometer hardness; 4 3/16" lg x 3/8" wd x 1/32" thk; part of 0155; CNA part/dwg S772-3	Air filter gasket (2 used)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0160	Shop manufacture	Gasket: black synthetic rubber; 45-55 shore durometer hardness; 1 11/16" lg x 3/8" wd x 1/32" thk; part of 0155; CNA part/dwg S772-1	Air filter gasket (2 used)
0161	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Housing: aluminum; 5 3/8" lg x 2 15/16" wd x 0.8276" thk o/a; corners rounded on 3/16" rad; three 4 1/4" lg x 3/8" wd x 1/4" h louvers spaced 1/4" apart; six 0.125" dia mtg holes spaced on 2.625" x 2.500" x 2.500" centers; part of 0155; CNA part/dwg S726-1	Air filter housing
0162	Fabricate locally from bulk material under G42-C-20760	Screen: consists of 3" dia wire mesh screen soldered to irregular hex shaped bezel; 10 x 10 mesh per sq inch screen of 0.035" dia brass wire; brass bezel 3 1/4" across flats x 1/16" thk x 2 7/8" ID; two 0.129" dia mtg holes spaced 3.625" c to c; assembly nickel plated; CNA part/dwg SB:2477	Guard for ventilating fan (upper deck)
0301		Same as 0101	Chassis slide and tilt mechanism (left side)
0302		Same as 0102	Chassis slide and tilt mechanism (right side)
0303		Same as 0103	Secures 0301 to chassis side plate
0304		Same as 0103	Secures 0302 to chassis side plate
0305		Same as 0105	Eccentric bearing for 0301
0306		Same as 0105	Eccentric bearing for 0302
0307		Same as 0107	Tilt lock-release bearing bracket (left side)
0308		Same as 0107	Tilt lock-release bearing bracket (right side)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0309		Same as 0109	Tilt lock-release lever shaft (left side)
0310		Same as 0109	Tilt lock-release lever shaft (right side)
0311		Same as 0111	Chassis tilt lock-release lever (left side)
0312		Same as 0112	Chassis tilt lock-release lever (right side)
0313	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Gear, Pinion: phosphor bronze; class A; diametral pitch 96; 24 teeth; pitch diameter 0.250"; pressure angle 20°; helix angle 0; A.M.G.A. standard full depth involute top hobbled tooth form; backlash 0-0.0005" on nominal pitch circle; 0.187" wd face; hub 7/32" OD x 1/4" lg; 7/16" lg x 0.270" dia o/a; shaft mtd; four axial 1/64" wd slots in hub; CNA part/dwg Q113-1	C325 tuning assembly drive gear
0314	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Gear, Spur: natural paper base bakelite; diametral pitch 96; pitch diameter 2.500"; pressure angle 20°; helix angle 0; A.M.G.A. standard full depth involute top hobbled tooth form; backlash 0-0.0005" on nominal pitch circle; straight face 0.125" wd; 240 teeth; 2.52" OD, 0.3125" ID; mts by three 0.125" dia holes spaced 120° apart on 0.687" dia circle; CNA part/dwg Q114-1	C325 tuning assembly driven gear
0315	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Hub, Gear: commercial bronze; 29/64" lg x 1" dia o/a; 0.1565" dia reamed bore; 0.3125" dia x 7/64" lg at one end; 4 slots 1/64" wd around 0.187" dia on other end; three 4-40 tapped mtg holes spaced 120° apart on 0.687" pitch circle; CNA part/dwg Q115-1	Mounting for 0314
0316	Shop manufacture	Clamp: cad plated brass; 3/4" dia x 3/16" thk o/a; 0.219" dia center hole; 0.031" wd slot extends from one edge to 9/32" beyond center hole; quadrant shaped cutout with sides displaced 0.125" and 0.141" from center lines; 4-40 tapped and clearance hole for setscrew at right angles to slot and quadrant face spaced 1/4" from center hole; CNA part/dwg Q116-1	Shaft mounting clamp for 0313

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0317	Shop manufacture	Clamp: cad plated brass; 3/4" dia x 3/16" thk o/a; 0.188" dia center hole; 0.031" wd slot extends from one edge to 9/32" beyond center hole; quadrant shaped cutout with sides displaced 0.125" and 0.141" from center lines; 4-40 tapped and clearance hole for setscrew at right angles to slot and quadrant face spaced 1/4" from center hole; CNA part/dwg Q116-2	Shaft mounting clamp for 0315
0318	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Disk, Indicator: black paper base bakelite; 15/32" lg x 1 1/2" dia o/a; hub 3/8" lg x 9/16" dia with one 8-32 tapped radial hole for setscrew; 3/8" d x 0.156" dia axial mtg hole in hub; white fill arrow marking 5/8" lg and three white dots spaced 90° apart; CNA part/dwg S730-1	25 kc oscillator tuning indicator
0319		Same as 0313	C309 tuning assembly drive gear
0320		Same as 0314	C309 tuning assembly driven gear
0321		Same as 0315	Mounting for 0320
0322		Same as 0316	Shaft mounting clamp for 0319
0323		Same as 0317	Shaft mtg clamp for 0321
0324		Same as 0318	225 kc oscillator tuning indicator
0325	Shop manufacture	Cover: 52S-1/4 hd aluminum; 3 5/8" lg x 2.973" wd x 3/8" d o/a; two long edges bent on 1/8" rad x 3/8" lg; four 0.187" dia mtg holes spaced on 2 1/4" x 1 3/4" centers; Fahnstock clip at one end for securing Allen wrench (H301); stamped L302, C325; CNA part/dwg SB:2475	25 kc oscillator compartment cover
0326	Shop manufacture	Cover: 52S-1/4 hd aluminum; 3 5/8" lg x 2.973" wd x 3/8" d o/a; two long edges bent on 1/8" rad x 3/8" lg; four 0.187" dia mtg holes spaced on 2 1/4" x 1 3/4" centers; stamped L301, C307, C309; CNA part/dwg S737-2	225 kc oscillator compartment cover

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS(CONT'D)	
O327	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Bezel: 0.020" drawn brass; irregular shape; 2 1/4" lg x 1 13/16" wd x 7/32" thk o/a; half circle raised section 3/8" h w/7/32" wd rim around half circle cutout; curved section of rim stamped with three arrows and a "plus" and "minus" sign; one arrow points towards cutout at exact center; other two arrows each curved over 45° arc point away from center arrow; viewing bezel from front w/center mtg hole at bottom, the plus sign is located at the point of the left hand arrow and the minus sign at the point of the right hand arrow; CNA part/dwg S750-1	225 kc oscillator tuning indicator bezel
O328	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Same as O327 except location of plus and minus reversed; CNA part/dwg S750-2	25 kc oscillator tuning indicator bezel
O329		Same as O114	Locks ventilating fan cover on lower deck front panel (right side)
O330		Same as O114	Locks ventilating fan cover on lower deck front panel (left side)
O331		Same as O116	Lower deck ventilating fan (mts on B303)
O332		Same as O121 except includes O333, O334, O335, O340, O341, O342, O343, O344, O345, O346, O347, O348	Panel lock-tilt-release handle (right side)
O333		Same as O122 except part of O332	Panel release drive gear
O334		Same as O123 except part of O332	Panel release idler gear
O335		Same as O124 except includes O336, O337, O338, O339; part of O332	Panel release driver gear assembly
O336		Same as O125 except part of O335	Panel release driven gear

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0337		Same as 0126 except part of 0335	Bearing for 0336
0338		Same as 0127 except part of 0335	Panel release driven gear shaft
0339		Same as 0128 except part of 0335	Pin for 0336
0340		Same as 0129 except part of 0332	Provides tension on handle locking button
0341		Same as 0130 except part of 0332	Panel release locking button
0342		Same as 0131 except part of 0332	Panel release lever
0343		Same as 0132 except part of 0332	Shaft for panel release drive gear
0344		Same as 0133 except part of 0332	Panel release drive gear washer
0345		Same as 0134 except part of 0332	Idler gear washer
0346		Same as 0135 except part of 0332	Idler gear support
0347		Same as 0136 except part of 0332	Pivot for panel release lever
0348		Same as 0137 except part of 0332	Secures pivot for panel release lever
0349		Same as 0138 except includes 0350, 0351, 0352, 0357, 0358, 0359, 0360, 0361, 0362, 0363, 0364, 0365	Panel lock-tilt-release handle (left side)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0350		Same as 0122 except part of 0349	Panel release drive gear
0351		Same as 0123 except part of 0349	Panel release driver gear
0352		Same as 0141 except includes 0353, 0354, 0355, 0356; part of 0349	Panel release driver gear assembly
0353		Same as 0125 except part of 0352	Panel release driven gear
0354		Same as 0126 except part of 0352	Bearing for panel release driven gear
0355		Same as 0127 except part of 0352	Panel release driven gear shaft
0356		Same as 0128 except part of 0352	Pin for panel release driven gear
0357		Same as 0129 except part of 0349	Provides tension on handle locking button
0358		Same as 0130 except part of 0349	Panel release locking button
0359		Same as 0131 except part of 0349	Panel release lever
0360		Same as 0132 except part of 0349	Shaft for panel release drive gear
0361		Same as 0133 except part of 0349	Panel release drive gear washer
0362		Same as 0134 except part of 0349	Idler gear washer

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0363		Same as 0135 except part of 0349	Idler gear support
0364		Same as 0136 except part of 0349	Pivot for panel release lever
0365		Same as 0137 except part of 0349	Secures pivot for panel release lever
0366	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Subassembly, Inspection Door: aluminum, 8 1/8" wd x 4 3/16" h x 1 21/32" thk; mts on front panel by hinge w/four 0.156" dia holes spaced 2.093" c to c; includes 0367, 0368, 0369, 0370, 0371, 0372; CNA part/dwg SB:2442	Inspection door and air filter subassembly (lower deck)
0367	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Door, Inspection: aluminum; 8" lg x 4 3/16" wd x 0.765" thk o/a; top corners rounded on 5/16" rad; center cutout 7" lg x 2 7/16" wd; six 0.203" dia holes spaced on 3.125" x 2.968" x 2.968" mtg/c; 6 7/8" lg x 7/8" wd (when open) aluminum hinge w/removable pin spot welded to bottom edge of door; four 0.156" dia holes spaced 2.093" c to c; part of 0366; CNA part/dwg S775-1 (door) and S729-1 (hinge)	Inspection door
0368	Shop manufacture	Gasket: extruded black synthetic rubber; 45-55 shore durometer hardness; 15 7/8" lg x 3/16" wd x 1/8" thk; lengthwise open slot in one edge 1/16" wd x 1/8" d; part of 0366; CNA part/dwg S770-2	Seal for inspection door subassembly
0369	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Filter, Air: one piece aluminum frame w/filter media cloth covered aluminum, approx 20 ribs; 5 15/32" lg x 2 21/32" wd x 1/2" thk o/a; item treated to withstand 20% 200 hour salt spray in accordance with AN-QQ-S-91 spec; part of 0366; CNA part/dwg S727-1; CBEN type P-4A	Air filter
0370	Shop manufacture	Gasket: black synthetic rubber; 45-55 shore durometer hardness; 5 1/16" lg x 3/8" wd x 1/32" thk; part of 0366; CNA part/dwg S772-4	Air filter gasket (2 used)
0371	Shop manufacture	Gasket: black synthetic rubber; 45-55 shore durometer hardness; 2 1/4" lg x 3/8" wd x 1/32" thk; part of 0366; CNA part/dwg S772-2	Air filter gasket (2 used)
0372	Shop manufacture	Housing: aluminum; 5.937" lg x 3 7/16" wd x 0.8276" thk o/a; corners rounded on 3/16" rad; four 5 1/8" lg x 3/8" wd louvers spaced 1/4" apart; six 0.125" dia mtg holes spaced 3.125" x 2.968" x 2.968" centers; part of 0366; CNA part/dwg S774-1	Air filter housing

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0373		Same as 0162	Ventilating fan guard (lower deck)
0374	Procured on demand by nearest Naval Shore Supply Activity	Screw, Cap, Socket Head: nickel plated brass; round head 0.112" lg x 0.183" dia; socket drive; flat point; 4-40 NC-2 thd 3/8" lg; CNA part/dwg Q146-6	Set screws for 0316 and 0317
0401	N16-S-470001-110	Slide Assembly, Drawer: steel; rectangular; 11 7/8" lg x 3 3/8" wd o/a in closed position; CNA part/dwg SA:7203	Chassis slide mechanism (left side, upper cabinet)
0402	N16-S-470001-109	Slide Assembly, Drawer: steel; rectangular; 11 7/8" lg x 3 3/8" wd o/a in closed position; same as 0401 except fabricated for mtg on right side of cabinet; CNA part/dwg SA:7202	Chassis slide mechanism (right side, upper cabinet)
0403		Same as 0401	Chassis slide mechanism (left side, lower cabinet)
0404		Same as 0402	Chassis slide mechanism (right side, lower cabinet)
0405	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Slide, Chassis: cad plated steel; 9 1/16" lg x 1 15/32" wd x 0.437" h o/a; four mtg holes spaced 2.625" c to c, one hole 0.250" dia csk to 82° x 0.312" dia, three holes 0.203" dia csk to 82° x 0.385" dia; CNA part/dwg SA:7194	Chassis slide track (left side, upper cabinet)
0406	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Slide, Chassis: cad plated steel; 9 1/16" lg x 1 15/32" wd x 0.437" h o/a; four mtg holes spaced 2.625" c to c; one hole 0.250" dia csk to 82° x 0.312" dia, three holes 0.203" dia csk to 82° x 0.385" dia; same as 0405 except fabricated for right hand mtg; CNA part/dwg SA:7193	Chassis slide track (right side, upper cabinet)
0407	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Slide, Chassis: cad plated steel; 9 1/16" lg x 1.582" wd x 0.496" h o/a; four 0.203" dia mtg holes csk to 82° x 0.385" dia spaced 2.625" c to c; CNA part/dwg SA:2483	Chassis slide track (left side, bottom cabinet)

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0408	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Slide, Chassis: cad plated steel; 9 1/16" lg x 1.582" wd x 0.496" h o/a; four 0.203" dia mtg holes csk to 82° x 0.385" dia spaced 2.625" c to c; same as 0407 except fabricated for right hand mtg; CNA part/dwg SA:2484	Chassis slide track (right side, bottom cabinet)
0409	G77-B-999-75016-0200	Ball, Bearing: stainless steel; spherical; 0.250" dia; CNA part/dwg H613-4	Chassis slide ball bearing (48 used)
0410	Shop manufacture	Plate, Latch: steel; 1 7/8" lg x 1" wd x 1" h w/latch knob 7/16" h; two 3/16" x 1/2" elongated mtg holes spaced 5/8" c to c w/latch knob spaced 0.5620" c to c from center mtg hole; CNA part/dwg SP:2482	Locks chassis in cabinets (4 used)
0411	Shop manufacture	Strip, Grounding: 1/4 hard yellow brass, cad plated; 9 19/32" lg x 1 1/2" wd x 0.093" thk o/a; 7 teeth, 0.968" lg spaced 1.436" c to c each tapering from 0.954" wd at base to 0.437" wd at end; ends of all teeth beveled on same flat surface to 30°; four 0.250" dia mtg holes spaced 1.436" c to c; CNA part/dwg S704-1	Ground strip on top and bottom of each cabinet (4 used)
0412	Shop manufacture	Strip, Grounding: 1/4 hard yellow brass, cad plated; 1 7/8" lg x 1 1/2" wd x 0.093" thk o/a; 2 teeth formed by cutout 1" wd tapering to 0.582" at depth of 0.968"; ends of teeth beveled on same flat surface to 30°; two 0.250" dia mtg holes spaced 1.436" c to c; CNA part/dwg S706-1	Ground strip on each side of cabinet (4 used)
0413	For replacement use N17-M-75466-6756	Mount, Vibration: steel and rubber; gray paint finish; 85–100 lbs load rating; 3" sq x 1 1/2" h o/a; clearance hole for 3/8" dia bolt in center; four 0.266" dia mtg holes on 2.500" x 2.500" centers; CNA part/dwg J265-3; CAYU type C-2090; use J-265-1	Cabinet shock mount (4 used)
0414	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Pin, Guide: stainless steel; 1 13/16" lg o/a; 0.374" dia for length of 3/4" w/1/8" x 30° chamfer at end; remaining section 1/4" dia w/1/4-20 thd 5/8" lg, rounded end w/1/16" wd x 3/32" d screwdriver slot; CNA part/dwg S716-1	Chassis guide pin on inside rear of cabinets (4 used)
0415	Fabricate locally from bulk material under SNSN G42-C-20721-50	Screen: rectangular shape; 0.011" dia phosphor bronze wire; 18 mesh, 0.045" opening; four edges folded over 3/8"; 12 1/2" lg x 6 1/2" wd o/a; mts by ten 0.171" dia holes, 4 holes on 12.125" x 6.125" centers, 4 holes on 10" x 6.125" centers and one hole centrally located on each long edge; CNA part/dwg S691-1	Protective screen in cabinet rear cover
0416	Shop manufacture	Strip, Retaining: 52S-1/4 hd aluminum, caustic etch w/water dip lacquer finish; 11 3/4" lg x 3/8" wd x 1/8" thk o/a; three 6-32 tapped holes spaced 5" c to c; CNA part/dwg S692-1	Secures cabinet rear protective screen (2 used)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		MECHANICAL PARTS (CONT'D)	
0417	Shop manufacture	Strip, Retaining: 52S-1/4 hd aluminum, caustic etch w/water dip lacquer finish; 6 1/2" lg x 3/8" wd x 1/8" thk; two 6-32 tapped holes spaced 6.125" c to c; CNA part/dwg S693-1	Secures cabinet rear protective screen (2 used)
0418	Shop manufacture	Gasket: 1/16 black neoprene; 45 durometer; broad U shape; 14 7/8" lg x 9 3/4" wd o/a; twelve 7/32" dia holes on irregularly spaced mtg/c; CNA part/dwg S690-1	Hood gasket on rear of cabinet
0419	N17-C-781366-251	Clamp, Electrical: die cast aluminum w/sand blast finish; cable opening adjustable by two screws; 27/32" lg x 1 3/64" dia o/a; mts by coupling nut w/3/4-20 thd; designed to hold cable approx 9/16" dia; type AN3057-6	Cable clamp used with P403
0420		Same as 0419	Cable clamp used with P404
		PLUGS	
P101	N17-C-73628-6671	Connector, Receptacle: 22 round male contacts and 2 round female coaxial contacts, polarized; straight; 2" lg x 1" h x 25/32" d excl contacts; coaxial contacts rated at 52 ohms impedance for RG-58/U cable; contacts rated 1,700 volts, 5 amps max; rectangular shaped aluminum alloy body, cad plated with chromate conversion finish; insert material per MIL-P-14D spec; mts by four 0.0934" dia holes on 1.781" x 0.500" centers; coax and solid connectors gold plated; CNA part/dwg S802-1; CED type DPA-24C2-34P	Multiconnector
P301		Same as P101	Multiconnector
P401		Not used	
P402		Not used	
P403	N17-C-70334-5466	Connector, Plug: 4 round female contacts polarized; straight; 1 21/32" lg x 1 1/8" dia; cylindrical shape; aluminum, sand blast w/clear lacquer finish; molded phenolic insert; split shell; 1/2" dia max cable opening; multiple piece construction w/ single mtg hole for cable; 7/8-20 coupling nut thd; 3/4-20 x 3/8" lg conduit thd; type AN3106B-14S-2S	Audio output
P404	N17-C-70328-1516	Connector, Plug: 3 round female contacts; polarized; straight; 1 11/16" lg x 1 1/16" dia max; cylindrical shape; aluminum, sand blast w/clear lacquer finish; locking type; split shell, molded phenolic insert; 1/2" dia max cable opening; multiple piece construction w/single mtg hole for cable; 1/2" dia mtg	AC power input

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		PLUGS (CONT'D)	
P404 (cont'd)		hole; body mtd by 3/4-20 conduit thd; 3/8" lg thd body; 1 1/16" OD coupling nut; 7/8-20 coupling nut thd; type AN 3106B-14S-7S	
P405	N17-C-71414-2800	Connector, Plug: 1 round male contact; polarized; straight; 1 17/32" lg x 11/16" dia o/a; cylindrical shape; silver plated brass body; mica filled bakelite insert; multiple piece construction; 0.410" dia cable opening; removable back shell; NT-49195; CNA part/dwg F505-2; CBIC type 49195	Signal input
		RESISTORS	
R101	For replacement use N16-R-49624-431	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 150 ohms ±5%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF151J; part of Z101; use RC20BF151J	Z101 input line terminating resistor
R102	For replacement use N16-R-50353-431	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 18,000 ohms ±5%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF183J; part of Z101; use RC20BF183J	Z101 input bandwidth adjusting
R103		Same as R102; part of Z101	Z101 output bandwidth adjusting
R104	For replacement use N16-R-50633-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 100,000 ohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF104K; use RC20BF104K	V101 grid (pin 1) bias
R105	N16-R-49580-811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 100 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF101K	V101 cathode bias
R106	N16-R-87419-4625	Resistor, Variable: composition; 1 section; 2,500 ohms ±10%, 2 W; std A taper; 3 solder lug term; enclosed case per JAN-R-94 spec; 1 5/32" dia x 21/32" thk; 5/8" lg x 1/4" dia slotted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock; JAN type RV4ATSA252A	Upper sideband gain control (V101)

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R107	N16-R-50480-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 47,000 ohms, ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF473K	V101 plate load
R108	N16-R-50012-811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 2200 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF222K	V101 B+ dropping
R109		Same as R108	V102A cathode bias
R110		Same as R108	V102B cathode bias
R111	N16-R-50822-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 470,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF474K	V101 cutoff bias
R112		Same as R104	V102 output load
R113		Same as R108	V102 B+ dropping
R114		Same as R104	V102 output load
R115		Same as R108	V102 B+ dropping
R116		Same as R107	V103 output load
R117	N16-R-87849-4718	Resistor, Variable: composition; 1 section; 50,000 ohms ±10%; 2 W; std A taper; 3 solder lug term; enclosed case per JAN-R-94 spec; 1 5/32" dia x 21/32" thk; 5/8" lg x 1/4" dia slotted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock; JAN type RV4ATSA503A	V103 output load balancing

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R118	N16-R-50282-811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 10,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF103K	V103 B+ dropping
R119	N16-R-49922-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 1,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF102K	V103 cathode bias
R120		Same as R107	V103 output load
R121	N16-R-50130-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 4700 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF472K	V102, V104, V115A B+ dropping
R122	N16-R-50283-231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 10,000 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF103K	V104 cathode bias
R123		Same as R107	V104A plate load
R124	N16-R-50715-0231	Resistor, Fixed, Composition; body style no. 14, MBCA ref dwg group 2; 220,000 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF224K	V111 cathode bias bleeder
R125	N16-R-50337-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 15,000 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF153K	V105, V106 B+ dropping
R126		Same as R125	V105, V106 B+ dropping

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R127		Same as R125	V105, V106 B+ dropping
R128		Resistor, Variable: composition; 1 section; 50,000 ohms ±10%, 2 W; audio taper; 3 solder lug term; enclosed case per JAN-R-94; 1 5/32" dia x 21/32" thk; 7/8" lg x 1/4" dia flatted metal shaft; normal torque; insulated contact arm, no off position, mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock; JAN type RV4ATFD503C	Audio level control
R129	N16-R-50481-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 47,000 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF473K	V105 cathode bias bleeder
R130	N16-R-49706-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 330 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF331K	V105 cathode bias
R131		Same as R111	V105 screen dropping
R132		Same as R107	V105 B+ filter
R133	N16-R-50678-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 150,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF154K	V105 plate load
R134		Same as R111	V106 grid bias
R135	N16-R-49842-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 680 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF681K	V106 cathode bias
R136		Same as R133	V106 to V105 inverse feedback
R137		Same as R104	V107 grid (pin 1) bias

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R138		Same as R105	V107 cathode bias
R139		Same as R106	Lower sideband gain control
R140		Same as R111	V107 cutoff bias
R141	N16-R-50066-811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 3,300 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF332K	V107 screen dropping
R142		Same as R107	V107 plate load
R143		Same as R108	V107 plate dropping
R144		Same as R108	V108A B+ dropping
R145	N16-R-50633-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 100,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF104K	V108B B+ dropping
R146		Same as R104	V101 and V107 delayed AGC filter
R147		Same as R104	V109 grid bias
R148		Same as R104	V109 grid (pin 1) bias
R149	N16-R-50553-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 68,000 ohms ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF683K	V109 B+ dropping
R150		Same as R149	V109 B+ dropping

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R151	N16-R-49661-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 220 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF221K	V111, V112 cathode bias
R152	N16-R-49769-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 470 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF471K	V110 cathode bias
R153		Same as R149	V110 B+ dropping
R154		Same as R149	V110 B+ dropping
R155		Same as R124	V111 cathode bias bleeder
R156		Same as R152	V111 cathode bias
R157	N16-R-87419-4479	Resistor, Variable: composition; 1 section; 2,500 ohms ±10%, 2 W; std A taper; 3 solder lug term; enclosed case per JAN-R-94 spec; 1 5/32" dia x 21/32" thk; 7/8" lg x 1/4" dia flatted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock; JAN type RV4ATFD252A	Carrier level control
R158		Same as R149	V111 B+ dropping
R159		Same as R149	V111 B+ dropping
R160		Same as R111	V124B plate load
R161	For replacement use N16-R-50975-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 1 megohm ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF105K; use RC20BF105K	V124 AGC filter

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R162		Same ad R152	V112 cathode bias
R163		Same as R149	V112 screen dropping
R164		Same as R108	V112 B+ dropping
R165		Same as R107	V113A plate load
R166		Same as R152	V109 cathode bias
R167	N16-R-88408-3245	Resistor, Variable: composition; 1 section; 2.5 megohms ±10%, 1/4 W; std A taper; 3 solder lug term; enclosed case per JAN-R-94 spec; 31/32" dia x 33/64" thk; 5/8" lg x 1/4" dia slotted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 5/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock JAN type RV2ATSA255A	External AGC control
R168		Same as R161	V113A external AGC filter
R169		Same as R161	V113A AGC filter
R170	For replacement use N16-R-51173-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 4.7 megohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF475K; use RC20BF475K	V113B delayed AGC bias
R171	N16-R-50975-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 1 megohm ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF105K	V113B B+ dropping
R172	N16-R-88179-4804	Resistor, Variable, composition: 1 section; 500,000 ohms ±10%, 2 W; std A taper; 3 solder lug term; enclosed per JAN-R-94 spec; 1 5/32" dia x 21/32" thk; 5/8" lg x 1/4" dia slotted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 17/32" rad at 9 o'clock; JAN type RV4ATSA504A	AGC delay control

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R173		Same as R161	V114 grid bias
R174		Same as R118	V114 cathode bias
R175		Same as R118	V114 plate dropping
R176		Same as R118	V114 B+ dropping
R177		Same as R161	V115A grid bias
R178	For replacement use N16-R-50480-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 47,000 ohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated, resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF473K; use RC20BF473K	V101 grid (pin 7) isolating
R179		Same as R141	V101 screen dropping
R180		Same as R107	V115A plate load
R181		Same as R108	V115A plate filter
R182		Same as R104	V108B grid bias
R183		Same as R118	S102 oscillator isolating
R184		Same as R161	V116B cathode input load
R185		Same as R108	V116B, V117 cathode bias
R186	For replacement use N16-R-50822-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 470,000 ohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF474K; use RC20BF474K	V116B grid input load

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R187		Same as R119	V116B, V117 cathode bias
R188	N16-R-50373-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 22,000 ohms, ±10%, 1 W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF223K	V116B B+ dropping
R189		Same as R108	V116A B+ dropping
R190		Same as R118	V116A plate load
R191		Same as R161	V117 grid (pin 2) bias
R192		Same as R118	V116A cathode bias
R193		Same as R161	V117 grid (pin 7) bias
R194		Same as R107	V117 plate dropping
R195		Same as R107	V117 plate dropping
R196		Same as R104	V117 output load
R197		Same as R104	V117 output load
R198	N16-R-88337-8798	Resistor, Variable, Composition: 1 section; 1 megohm, ±10%, 1/4 W; std A taper; 3 solder lug term; enclosed case per JAN-R-94 spec; 31/32" dia x 33/64" thk; 5/8" x 1/4" dia slotted metal shaft; normal torque; insulated contact arm; no off position; mts by 3/8" lg 3/8-32 thd bushing w/non-turn device on 0.438" rad at 9 o'clock; JAN type RV2ATSA105A	V118 output balancing
R199		Not used	
R200		Same as R178	V107 grid (pin 7) isolating

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R201		Same as R129	V119 B+ dropping
R202		Same as R129	V119 B+ dropping
R203		Same as R118	S102 carrier isolating
R204		Same as R186	V120 grid bias
R205		Same as R118	V120 cathode bias
R206		Same as R161	V120 screen dropping
R207		Same as R111	V120 plate load
R208		Same as R107	V120 B+ dropping
R209		Same as R161	V121A grid bias
R210		Same as R186	V121B phase shift network isolating
R211		Same as R161	V121B cathode input load
R212		Same as R119	V121B, V122 cathode bias
R213		Same as R108	V121B, V122 cathode bias
R214		Same as R107	V121A phase shift output load
R215		Same as R118	V121A plate load

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R216		Same as R108	V121A plate dropping
R217		Same as R188	V121B plate dropping
R218		Same as R118	V121A cathode bias
R219		Same as R161	V122 grid (pin 2) bias
R220		Same as R161	V122 grid (pin 7) bias
R221		Same as R107	V122 plate dropping
R222		Same as R107	V122 plate dropping
R223		Same as R104	V122 output load
R224		Same as R104	V122 output load
R225		Same as R198	V123 output balancing
R226		Same as R178	V109 grid (pin 7) isolating
R227		Same as R186	V115B grid isolating
R228		Same as R129	V119 B+ dropping
R229		Same as R111	V115B plate load
R230		Same as R161	V124A grid bias
R231		Same as R119	V124A cathode bias

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R232		Same as R145	V124A plate load
R233		Same as R178	V121A grid isolating
R234		Same as R178	V116A grid isolating
R301	For replacement use N16-R-51065-818	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 2.2 megohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF225K; use RC20BF225K	V301 input load balancing
R302		Same as R161	V301 grid (pin 2) filter
R303	For replacement use N16-R-50552-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 68,000 ohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC09BF683K; use RC20BF683K	C302 limiting
R304		Same as R161	V301 grid filter
R305		Same as R301	V301 input load balancing
R306		Same as R121	V301 cathode bias
R307		Same as R172	V302 grid input balancing
R308	N16-R-50129-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 4,700 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF472K	J301 isolating
R309		Same as R119	V303B cathode bias

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R310		Same as R111	V303A grid bias
R311		Same as R161	V303B grid bias
R312	N16-R-50372-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 22,000 ohms, ±10%; 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF223K	V303A plate load
R313	N16-R-50373-0421	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 22,000 ohms ±10%, 2 W; resistance temperature characteristic letter F; 0.750" lg x 0.370" dia; insulated; one wire lead term at each end; JAN type RC42BF223K	V304 B+ dropping
R314		Same as R313	V304 B+ dropping
R315		Same as R161	V305 grid (pin 2) filter
R316		Same as R301	V305 input load balancing
R317		Same as R303	C315 limiting
R318		Same as R161	V305 grid filter
R319		Same as R301	V305 input load balancing
R320		Same as R121	V305 cathode bias
R321		Same as R172	V306 grid input balancing
R322		Same as R121	V306 cathode bias
R323		Same as R308	J302 isolating
R324		Same as R301	V308B input filter

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R325		Same as R111	V307, V308A grid (pin 7) DC return
R326		Same as R108	V308B cathode bias
R327		Same as R118	V308B plate filter
R328		Same as R118	V308A plate filter
R329		Same as R107	V308A plate load
R330	N16-R-51020-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 1.5 megohm, ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF155K	V307 plate load
R331		Same as R121	V302 cathode bias
R332	N16-R-50759-811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 330,000 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF334K	I301 voltage dropping
R333		Same as R301	V311 grid filter
R334	For replacement use N16-R-51344-811	Resistor, Fixed, Composition: body style no. 3, MBCA ref dwg group 2; 12 megohms ±10%, 1/4 W; resistance temperature characteristic letter F; 0.375" lg x 0.093" dia; insulated; resistant to humidity and salt water immersion; one axial wire term at each end; JAN type RC09BF126K; use RC20BF126K	V311 grid bias
R335		Same as R198	CONS control
R336	N16-R-49967-0811	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 1,500 ohms ±10%, 1/2 W; resistance temperature characteristic letter F; 0.406" lg x 0.175" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC20BF152K	V311 cathode bias

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		RESISTORS (CONT'D)	
R337	N16-R-50760-0231	Resistor, Fixed, Composition: body style no. 14, MBCA ref dwg group 2; 330,000 ohms ±10%, 1W; resistance temperature characteristic letter F; 0.750" lg x 0.280" dia; insulated; resistant to humidity and salt water immersion; one axial wire lead term at each end; JAN type RC30BF334K	V311 cathode bias bleeder
		SWITCHES	
S101	N17-S-72018-7719	Switch, Toggle: single-pole double throw; 5 amp at 125 v, 2 amp at 250 v; bakelite body; 1 9/32" lg x 23/32" wd x 31/32" h max including term excluding bushing; bat handle 11/16" lg; 3 solder lug term on back; single hole mtd by 15/32-32 thd bushing 15/32" lg FMS; JAN type ST12D per JAN-S-23 spec	Sideband switch
S102	N17-S-74139-4844	Switch, Toggle: double-pole double-throw; 5 amp at 125 v, 2 amp at 250 v; bakelite body; 1 9/32" lg x 23/32" wd x 31/32" h max including term excluding bushing; bat handle 11/16" lg; 6 solder lug term on back; single hole mtd by 15/32-32 thd bushing 15/32" lg FMS; JAN type ST22N per JAN-S-23 spec	Demodulator switch
S103		Same as S102	AGC switch
S301	N17-S-72828-2605	Switch, Toggle: double-pole single-throw; 0.75 amp at 125 VDC, 0.5 amp at 250 VDC; 25 amp at 125 VAC, 9 amp at 250 VAC; bakelite body; 1 21/64" lg x 49/64" wd x 1 1/16" h max including term excluding bushing; bat handle 11/16" lg; 4 solder lug term on back; single hole mtd by 15/32"-32 thd bushing 15/32" lg FMS; JAN type ST52K; JAN-S-23 spec	AC power switch
S302	N17-S-73959-1025	Switch, Toggle: double-pole double throw; 0.75 amp at 125 VDC; 0.5 amp at 250 VDC; 25 amp at 125 VAC, 9 amp at 250 VAC; bakelite body; 1 21/64" lg x 49/64" wd x 1 1/16" h max including term excluding bushing; bat handle 11/16" lg; 6 solder lug term on back; single hole mtd by 15/32-32 thd bushing 15/32" lg FMS; JAN type ST52N per JAN-S-23 spec	Motors ON-OFF switch
S303	N17-S-74692-4506	Switch, Toggle: double-pole, double-throw; three position; ON-OFF-ON; 0.75 amp at 125 VDC, 0.5 amp at 250 VDC; 25 amp at 125 VAC, 9 amp at 250 VAC; bakelite body; 1 21/64" lg x 49/64" wd x 1 1/16" h max including term excluding bushing; bat handle 11/16" lg; 6 solder lug term on back; single hole mtd by 15/32-32 thd bushing 15/32" lg FMS; JAN type ST52P per JAN-S-23	225 kc oscillator motor control switch
S304	N17-S-71415-7387	Switch, Toggle: single-pole, single-throw; 3 amp at 250 VAC or DC; bakelite body; 1 1/16" lg x 1/2" wd x 15/32" h max exclud-	Local oscillator motor switch

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		SWITCHES (CONT'D)	
S304 (cont'd)		ing term and bushing; bat handle 1/2" lg; 2 solder lug term on back at one end; single hole mtd by 15/32-32 thd bushing 15/32" lg FMS; CNA part/dwg S988-1; CAE type 8280-K16	
S305	N17-S-69834-7233	Switch, Thermostatic: bimetal type; single-pole, single-throw normally open; close at 49° ±2.7°C (120° ±5°F), open at 40.5° ±2.7° C (105° ±5° F), rated at 10 amps at 30 VDC and 125 VAC; 8 amps at 250 VAC, round body 1 1/4" dia x 1 1/16" h incl term and mtg plate; oval shape mtg plate on bottom w/two 0.170" dia holes spaced 1 15/32" c to c; two solder lug term on top; hermetically sealed non-magnetic corrosion resistant case; CNA part/dwg S961-1; CSQ type C-4391	Fan motors control switch
S306		Same as S303	Local oscillator motor run switch
S307	Shop manufacture	Terminal Board: movable bar serves as single pole 3 position switch; natural bakelite panel grade LTS-E-3; 2 1/16" lg x 1 7/16" wd x 15/16" h including term; solder lug term; mts by four 0.156" dia holes on 1.687" x 1.062" mtg/c; marked 105V, 115V and 125V; CNA part/dwg SA:8998	Power transformer primary selector switch
		TRANSFORMERS	
T101	N17-T-65842-8750	Transformer, Audio Frequency: plate coupling type; primary impedance 17,000 ohms, secondary impedance 120 ohms; DC ratings; primary 15 ma, secondary zero; hermetically sealed metal case; 1 13/16" sq x 2 1/2" h excluding term; 3 watts max operating level; frequency response: 0 db to -4 db at 100 cycles, 0 db at 1,000 cycles, 0 db to -1 db at 6,000 cycles; 6 solder lug term on bottom; electrostatic shield brought out to one term; mts by four 0.144" dia holes on 1 1/2" x 1 1/2" mtg/c; CNA part/dwg M779-1; CUT type D-3006	Audio output transformer
T102	N17-T-67419-4176	Transformer, Intermediate Frequency: 25 kc peak freq; interstage; shielded; 15/16" dia x 1 13/32" h o/a; two 4-40 mtg studs on top 11/32" lg on 9/16" centers; 4 solder stud term on bottom; item per MIL-T-27 spec for Grade 1, Class A components; CNA part/dwg S993-1; Colin-Campbell Co. type no. L-1388	V108B to V108A coupling
T103		Same as T102	V109 to V110 coupling
T104		Same as T102	V111 to V112 coupling

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		TRANSFORMERS (CONT'D)	
T105		Same as T102	V112 to V113A and V114A coupling
T301	N17-T-77712-2079	Transformer, Power, Step-Up: hermetically sealed metal case; input: 115V, 50-60 cycles, single phase; output: one winding, 450V at 0.15 amp, center tapped; 2 3/16" dia x 2 7/8" h excluding term w/2 3/16" sq mtg flange on bottom; 6 insulated solder lug term on bottom; mts by four 0.177" dia holes located on 1 13/16" x 1 13/16" mtg/c; terminals numbered 1 thru 6; electrostatic shield brought out to separate term; item per MIL-T-27 spec for Grade 1, Class A components; CNA part/dwg S989-1; CUT type K9454	V302 to B301 matching transformer
T302		Same as T301	V306 to B302 matching transformer
T303	N17-T-73645-1835	Transformer, Step-Down and Step-Up: hermetically sealed metal case; input: 105/115/125 VAC, 50-60 cycles, single phase; 4 output windings; 5 V at 3 amps, 600 V at 200 ma, 6.3 V at 7 amps, 6.3 V at 3.5 amps, 600 V winding center tapped; primary and 6.3 V windings 1,500 V RMS insulation; 600 V and 5 V windings 1750 V RMS insulation; vacuum varnish type impregnation; 5" lg x 4 1/8" wd x 4 3/4" h excl term; 13 standoff type slotted term 13/16" lg located on bottom; mts by four 10-32 thd studs 17/32" lg on 3 1/4" x 3" mtg/c; no internal shielding item per MIL-T-27 spec for Grade 1, Class A components; CNA part/dwg S994-1; CFX type 25153	Power supply transformer
		TERMINAL BOARDS	
TB101	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/4 solder post term; 1 1/4" sq x 13/32" h o/a; two 0.140" dia mtg holes spaced 0.562" c to c; stamped TB101, C123, C122; CNA part/dwg SB:2960	Terminal board
TB102	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/4 solder post term; 1 1/4" sq x 13/32" h o/a; two 0.140" dia mtg holes spaced 0.562" c to c; stamped TB102, C136, C137; CNA part/dwg SB:2961	Terminal board
TB103	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/4 solder post term; 1 1/4" sq x 13/32" h o/a; two 0.140" dia mtg holes spaced 0.562" c to c; stamped TB103, C133, C134; CNA part/dwg SB:2962	Terminal board

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		TERMINAL BOARDS (CONT'D)	
TB104	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/4 solder post term; 1 1/4" sq x 13/32" h o/a; two 0.140" dia mtg holes spaced 0.562" c to c; stamped TB104, C128, C129, CNA part/dwg SB:2963	Terminal board
TB105	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/12 solder post term; 1 7/8" lg x 1 3/16" wd x 13/32" h o/a; two 0.156" dia mtg holes spaced 1.562" c to c; stamped TB105, C144, R182, R119, R144, R145; CNA part/dwg SB:2909	Terminal board
TB106	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/28 solder post term; 5 3/8" lg x 1 3/16" wd x 13/32" h o/a; three 0.156" dia mtg holes spaced 2 1/2" c to c; stamped TB106, R130, R136, C118, R129, R132, R131, R133, C117, R134, R135; CNA part/dwg SB:2910	Terminal board
TB107	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/44 single ended and 2 double ended solder post term; 7 1/8" lg x 1 3/16" wd x 9/16" h o/a; three 0.156" dia mtg holes spaced 3.125" and 3.437" c to c; stamped TB107, R183, C145, R184, R185, R187, R188, R189, R190, C147, R191, R193, C148, R192, R194, R195, C150, R197, R196, C149, C152, C151, R168; CNA part/dwg SB:2914	Terminal board
TB108	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/60 single ended and 2 double ended solder post term; 10 3/8" lg x 1 3/16" wd x 9/16" h o/a; three 0.156" dia mtg holes spaced 4.750" c to c; stamped TB108, C164, C159, C162, C161, R207, R206, R208, R211, R212, R213, R205, R204, R209, C165, C156, R214, C167, R218, R217, R216, R215, C168, R219, R220, R169, R221, R222, C172, R224, R223, C171; CNA part/dwg SB:2915	Terminal board
TB109	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/50 single ended and 2 double ended solder post term; 8 1/8" lg x 1 3/16" wd x 9/16" h o/a; three 0.156" dia mtg holes spaced 3.750" c to c; stamped TB109, R174, R173, C140, R176, R175, C142, R177, R203, C155, R180, R181, R169, R165, R170, R171, R229, R230, R231, R160, R161, R232, R228, R202, R201, R127, R126, R125; CNA part/dwg SB:2916	Terminal board
TB110	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/22 single ended and 2 double ended solder post term; 3 11/16" lg x 1 3/16" wd x 9/16" h o/a; two 0.156" dia mtg holes spaced 2.813" c to c; stamped TB110, R156, R151, R162, R124, R155, R158, R159, R164, R163, R118, R121, R115, R113; CNA part/dwg SB:2913	Terminal board

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		TERMINAL BOARDS (CONT'D)	
TB111	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/30 solder post term; 4 11/16" lg x 1 3/16" wd x 13/32" h o/a; two 0.156" dia mtg holes spaced 2.813" c to c; stamped TB111, R152, R138, R105, R153, R154, R149, R150, R143, R108, R141, R179, R140, R111; CNA part/dwg SB:2911	Terminal board
TB112	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/22 solder post term; 3 1/2" lg x 1 3/16" wd x 13/32" h o/a; two 0.156" dia mtg holes spaced 3.125" c to c; stamped TB112, R123, R120, R116, C111, R114, R112, C110, C109, R109, R110; CNA part/dwg SB:2912	Terminal board
TB113	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/18 solder post term; 2 3/4" lg x 1 3/16" wd x 13/32" h o/a; two 0.156" dia mtg holes spaced 2.500" c to c; stamped TB113, R147, C124, C103, R146, R104, C104, C119, R137, C125, R148; CNA part/dwg SB:2908	Terminal board
TB301	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/18 solder post term; 3 1/8" lg x 1 1/2" wd x 9/16" h o/a; two 5/32" dia mtg holes spaced 1 11/16" c to c; stamped TB301, R308, R331, R306, C301, R302, R301, R305, R304, C303, R303; CNA part/dwg SB:2445	Terminal board
TB302	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/12 solder post term; 2 1/8" lg x 1 1/2" wd x 9/16" h o/a; two 5/32" dia mtg holes spaced 1 1/2" c to c; stamped TB302, R334, R333, C313, R336, R337; CNA part/dwg SB:2451	Terminal board
TB303	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/20 solder post term; 3 3/16" lg x 1 1/2" wd x 9/16" h o/a; two 5/32" dia mtg holes spaced 2 1/2" c to c; stamped R313, R314, R311, C311, R312, C310, R310, C308, R309, TB303; CNA part/dwg SB:2447	Terminal board
TB304	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/12 solder post term; 2 1/8" lg x 1 1/2" wd x 9/16" h o/a; two 5/32" dia mtg holes spaced 1 1/2" c to c; stamped TB304, C320, R325, R330, C327, R326; CNA part/dwg SB:2448	Terminal board
TB305	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/20 solder post term; 3 3/16" lg x 1 1/2" wd x 9/16" thk o/a; two 5/32" dia mtg holes spaced 2 1/2" c to c; stamped TB305, C323, C324, C321, C326, R324, C329, R329, R328, R327, R332; CNA part/dwg SB:2449	Terminal board

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		TERMINAL BOARDS (CONT'D)	
TB306	Shop manufacture	Terminal Board: 1/8" thk glass melamine w/18 solder post term; 3 1/8" lg x 1 1/2" wd x 9/16" h o/a; two 5/32" dia mtg holes spaced 1 11/16" c to c; stamped TB306, R323, R322, R320, C314, R315, R316, R319, R318, C316, R317; CNA part/dwg SB:2450	Terminal board
		ELECTRON TUBES	
V101	N16-T-75750	Tube, Electron: JAN-5750; pentagrid converter; glass; RMA T 5 1/2 envelope; 7 pins on bottom	Upper sideband converter
V102	N16-T-75814	Tube, Electron: JAN-5814; twin-triode; glass; RMA T 6 1/2 envelope; 9 pins on bottom	Upper sideband inverter
V103		Same as V102	Demodulator
V104		Same as V102	
V104A		Part of V104	Audio amplifier
V104B		Part of V104	AF inverter
V105	N16-T-56203-53	Tube, Electron: JAN-6AU6WA; pentode; glass; RMA T 5 1/2 envelope; 7 pins on bottom	Audio amplifier
V106	N16-T-56192-85	Tube, Electron: JAN-6AK6WA; pentode; glass; RMA T 5 1/2 envelope; 7 pins on bottom	Output amplifier
V107		Same as V101	Lower sideband converter
V108		Same as V102	
V108A		Part of V108	Driver
V108B		Part of V108	Amplifier
V109		Same as V101	Carrier converter
V110		Same as V105	1st carrier amplifier
V111		Same as V105	2nd carrier amplifier

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		ELECTRON TUBES (CONT'D)	
V112		Same as V105	3rd carrier amplifier
V113	N16-T-75726	Tube, Electron: JAN-5726; twin-diode, glass; T 5 1/2 envelope; 7 pins on bottom	
V113A		Part of V113	Carrier AGC
V113B		Part of V113	AGC delay
V114	N16-T-75751	Tube, Electron: JAN-5751; twin-triode; glass; RMA T 6 1/2 envelope; 9 pins on bottom	Carrier limiter
V115		Same as V114	
V115A		Part of V115	Carrier amplifier
V115B		Part of V115	Sideband AGC amplifier
V116		Same as V102	
V116A		Part of V116	Phase inverter
V116B		Part of V116	Driver
V117		Same as V102	Phase comparator
V118		Same as V113	DC restorer
V119	N16-T-52001-8	Tube, Electron: JAN-OB2WA; voltage regulator; glass; RMA T 5 1/2 envelope; 7 pins on bottom	Voltage regulator
V120	N16-T-75654	Tube, Electron: JAN-5654; pentode; glass RMA T 5 1/2 envelope; 7 pins on bottom	Amplifier
V121		Same as V102	
V121A		Part of V121	Phase inverter
V121B		Part of V121	Driver
V122		Same as V102	Phase comparator

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		ELECTRON TUBES (CONT'D)	
V123		Same as V113	DC restorer
V124		Same as V102	
V124A		Part of V124	AGC amplifier
V124B		Part of V124	Sideband AGC rectifier
V301		Same as V114	Servo amplifier
V302		Same as V102	Servo amplifier
V303		Same as V102	
V303A		Part of V303	225 kc oscillator
V303B		Part of V303	225 kc tuning oscillator amplifier
V304	N16-T-52001-3	Tube, Electron: JAN-OA2WA; voltage regulator; glass; RMA T 5 1/2 envelope; 7 pins on bottom	Voltage regulator
V305		Same as V114	Servo amplifier
V306		Same as V102	Servo amplifier
V307		Same as V120	25 kc oscillator
V308		Same as V102	
V308A		Part of V308	25 kc oscillator amplifier
V308B		Part of V308	Reactance modulator
V309	N16-T-55738-5	Tube, Electron: JAN-5Y3WGTA; rectifier; glass; RMA T 9 envelope; 8 pins on bottom	Rectifier
V310		Same as V309	Rectifier
V311		Same as V114	CONS

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		CABLES	
W401	Assemble from Component parts	Cable Assembly, Special Purpose, Electrical: twenty no. 20 AWG stranded copper conductors each w/synthetic resin insulation, two RG-58/U coaxial cables, all covered by an extruded plastic jacket, approx 19/32" OD; CED type DPA-24C2-34P connector at one end; CED type DPA-24C2-33S connector at other end; CED type DPA-CG 21/32 shell and cable clamp at each end; 3 ft lg o/a; approx 2 ft 9" lg excluding terminations; CNA part/dwg SB:2930 includes W401A, W401B, W401C	Test cable
W401A		Same as J401 except part of W401	Multiconnector
W401B		Same as P101 except part of W401	Multiconnector
W401C	Low Failure item – if required requisition from ESO referencing NavShips 900,180A	Shield, Electrical Connector: light weight drawn aluminum w/cad plated finish; rectangular shape 1 15/32" lg x 1 9/16" wd x 15/16" h including cable clamp; clip mtg; 21/32" dia max cable opening; CNA part/dwg S983-1; CED type DPA-CG-21/32; part of W401	Multiconnector shield and cable clamp
		SOCKETS	
XF301	N17-F-74266-9215	Fuseholder: extractor post type; 250 V, 15 amp; accommodates one cartridge type fuse 1 1/4" lg x 1/4" dia; bakelite body w/ nickel plated brass friction type contacts; 2 9/64" lg x 11/16" dia w/o hex nut; 2 7/32" lg w/fuse inserted; 2 solder lug term; single hole panel mtg by 1/2-24 thd body w/flat; requires 1/2" dia mtg hole w/0.468" flat; item furnished with one 21/32" OD x 1/2" ID x 1/16" thk neoprene washer, one stainless steel internal tooth lockwasher and one punched brass nickel plated w/ iridite dip hex nut 11/16" hex x 1/2-24 thd x 3/32" thk; cap marked "FUSE" with arrow pointing counterclockwise; bayonet type twist locking cap; inner solder lug band stamped "HKP 15A.250V"; end solder lug term may be rotated a total of 360°; metal parts plated per AN-QQ-S-91 spec; molded material per JAN-P-14 spec; CNA part/dwg H477-1; CFA type HKP-JE includes XF301A and B	F301 holder and cap
XF301A	N17-F-74266-9068	Fuseholder: w/o cap; extractor post type; 250 V, 15 amp; accommodates one cartridge type fuse 1 1/4" lg x 1/4" dia; molded bakelite body w/nickel plated brass friction type contacts; 1 7/8" lg x 11/16" dia w/o hex nut; 2 solder lug term; single hole panel mtg by 1/2-24 thd body w/flat; requires 1/2" dia mtg hole w/0.468" flat; item furnished with one 21/32" OD x 1/2" ID x 1/16" thk neoprene washer, one stainless steel internal tooth lockwasher and one punched brass nickel plated w/iridite dip hex nut 11/16" hex w/1/2-24 thd and 3/32" thk;	F301 holder (without cap)

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		SOCKETS (CONT'D)	
XF301A (cont'd)		accommodates bayonet type twist locking cap; inner solder lug band stamped "HKP 15A.250V"; end solder lug term may be rotated a total of 360°; metal parts plated per AN-QQ-S-91 spec; molded material per JAN-P-14 spec; CNA part/dwg H477-2; CFA type HKP-JE;part of XF301	
XF301B	N17-C-202422-0130	Cap, Fuseholder: molded bakelite and brass; brass nickel plated; 37/64" lg x 21/32" dia; bayonet type twist locking mtg; marked "FUSE" w/white filled letters on face w/arrow pointing counter-clockwise; metal parts plated per AN-QQ-S-91 spec; molded material per JAN-P-14 spec; CNA part/dwg H477-3; CFA type HKP-JE; part of XF301	F301 holder cap
XF302		Same as XF301, includes XF302A and B	Spare fuse holder and cap
XF302A		Same as XF301A except part of XF302	Spare fuse holder w/o cap
XF302B		Same as XF301B except part of XF302	Spare fuse holder cap
XF303		Same as XF301, includes XF303A and B	F303 holder
XF303A		Same as XF301A except part of XF303	F303 holder w/o cap
XF303B		Same as XF301B except part of XF303	F303 holder cap
XF304		Same as XF301, includes XF304A and B	F304 holder
XF304A		Same as XF301A except part of XF304	F304 holder w/o cap
XF304B		Same as XF 301B except part of XF304	F304 holder cap
XF305		Same as XF301, includes XF305A and B	F305 holder
XF305A		Same as XF301A except part of XF305	F305 holder w/o cap
XF305B		Same as XF301B except part of XF305	F305 holder cap
XF401		Same as XF301, includes XF401A and B	F401 holder and cap

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		SOCKETS (CONT'D)	
XF401A		Same as XF301A except part of XF401	F401 holder w/o cap
XF401B		Same as XF301B except part of XF401	F401 holder cap
XF402		Same as XF301, includes XF402A and B	F402 holder and cap
XF402A		Same as XF301A except part of XF402	F402 holder w/o cap
XF402B		Same as XF301B except part of XF402	F402 holder cap
XF403		Same as XF301, includes XF403A and B	F403 holder and cap
XF403A		Same as XF301A except part of XF403	F403 holder w/o cap
XF403B		Same as XF301B except part of XF403	F403 holder cap
XF404		Same as XF301, includes XF404A and B	F404 holder and cap
XF404A		Same as XF301A except part of XF404	F404 holder w/o cap
XF404B		Same as XF301B except part of XF404	F404 holder cap
XI301	N17-L-76743-4669	Light, Indicator: w/lens; 5/8" dia clear plastic cap; for T 3 1/4 clear bulb w/miniature bayonet base; 125 V or 250 v; chrome plated brass shell w/molded bakelite; 2 1/8" lg x 1.00" dia o/a; 11/16" dia mtg hole required; mts any position w/lamp replaceable from front of panel; threaded jewel; two solder lug term at base; internal 51,000 ohm dropping resistor; plating per AN-QQ-S-91 spec; molded material per JAN-P-14 spec; CNA part/dwg Q721-1; CAYZ type 95408-937; includes XI301A and B	I301 socket and lens
XI301A	N17-L-250181-506	Lens, Indicator Light: clear, threaded type; 5/8" dia; chrome plated brass holder; CNA part/dwg Q721-2; part of XI301; CAYZ part 95-937	XI301 lens
XI301B	N17-L-76662-4678	Light, Indicator: w/o lens; for T 3 1/4 clear bulb; 125 V or 250 V; chrome plated brass shell w/molded bakelite; 1 5/8" lg x 1.00" dia o/a; 11/16" dia mtg hole required; mts any position w/lamp replaceable from front of panel; two solder lug term at base; internal 51,000 ohm dropping resistor; plating per AN-QQ-S-91 spec; molded material per JAN-P-14 spec; CNA part/dwg Q721-	XI301 body

TABLE 8-2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		SOCKETS (CONT'D)	
XI301B (cont'd)		3; CAYZ type 95408; part of XI301	
XV101	N16-S-62603-6702	Socket, Electron Tube: 7 contacts per JAN-S-28A spec; miniature size; includes center shield; oval shape; 1 1/8" lg x 0.900" wd x 0.781" h excluding term; molded thermosetting plastic body; two 0.125" dia mtg holes spaced 0.875" c to c; includes base shield; JAN type TS102P01	V101 socket
XV102	N16-S-64063-6713	Socket, Electron Tube: 9 contacts per JAN-S-28A spec; miniature size; includes center shield; oval shape; 1 3/8" lg x 1.035" wd x 0.781" h excluding term; molded thermosetting plastic body; two 0.125" dia mtg holes spaced 1.125" c to c; includes base shield; JAN type TS103P01	V102 socket
XV103		Same as XV102	V103 socket
XV104		Same as XV102	V104 socket
XV105		Same as XV101	V105 socket
XV106		Same as XV101	V106 socket
XV107		Same as XV101	V107 socket
XV108		Same as XV102	V108 socket
XV109		Same as XV101	V109 socket
XV110		Same as XV101	V110 socket
XV111		Same as XV101	V111 socket
XV112		Same as XV101	V112 socket
XV113		Same as XV101	V113 socket
XV114		Same as XV102	V114 socket
XV115		Same as XV102	V115 socket
XV116		Same as XV102	V116 socket
XV117		Same as XV102	V117 socket
XV118		Same as XV101	V118 socket

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		SOCKETS (CONT'D)	
XV119		Same as XV101	V119 socket
XV120		Same as XV101	V120 socket
XV121		Same as XV102	V121 socket
XV122		Same as XV102	V122 socket
XV123		Same as XV101	V123 socket
XV124		Same as XV102	V124 socket
XV301		Same as XV102	V301 socket
XV302		Same as XV102	V302 socket
XV303		Same as XV102	V303 socket
XV304		Same as XV101	V304 socket
XV305		Same as XV102	V305 socket
XV306		Same as XV102	V306 socket
XV307		Same as XV101	V307 socket
XV308		Same as XV102	V308 socket
XV309	N16-S-63515-4156	Socket, Electron Tube: 8 contacts per JAN-S-28A spec; octal; oval shape; 1 7/8" lg x 1 3/8" wd x 11/16" h excluding term; ceramic body; two 0.156" dia mtg holes spaced 1.500" c to c; JAN type TS101C01	V309 socket
XV310		Same as XV309	V310 socket
XV311		Same as XV102	V311 socket
		COMPOUND TUNED CIRCUITS AND FILTERS	
Z101	For reference only	Filter, Band Pass: 200 kc operating freq; 191 kc to 201 kc nominal band width; input impedance 70 ohms, output impedance 18,000 ohms; 1 1/8" sq x 3 1/8" h including term and mtg studs; rectangular shaped aluminum shield can; mts by two 6-32 thd studs 3/8" lg spaced 1 1/8" c to c located on bottom; four solder loop type term on bottom, CNA part/dwg SB:2457; includes C101, C102, L101A, L101B, R101, R102, R103; listed for reference only	200 kc input filter network

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		COMPOUND TUNED CIRCUITS AND FILTERS (CONT'D)	
Z102	N16-F-32554-2011	Filter, Band Pass: nominal bandpass 25.5 to 30 kc; 25.5 kc no more than 4 db, 30 kc no more than 2 db down as compared to flat region; attenuation above 30 kc sufficient that 40 kc and above is attenuated at least 60 db; attenuation at 25 kc and below at least 60 db; input impedance 40,000 ohms; output to grid; hermetically sealed metal case per MIL-T-27 spec for Grade 1, Class A components; 5" lg x 1 1/2" wd x 2 1/2" h excl term and mtg studs; 4 solder lug term mtd on insulated posts spaced on 3 1/2" x 1/2" centers; four 8-32 x 1/2" lg mtg studs spaced on 4 1/2" x 1" centers; CNA part/dwg S991-1; CBIS type S-10530	Upper sideband filter
Z103	N16-F-44084-8521	Filter, Low Pass: 6 kc cut-off freq; 50,000 ohms input and output impedance; 3.00" lg x 1 3/4" dia; round steel case w/sq flange; four 0.144" dia holes on 1 1/2" centers on flange; 3 solder lug term; hermetically sealed; CNA part/dwg M788-1; CUT type D-6925	V105 audio input filter
Z104	N16-F-32533-3011	Filter, Band Pass: nominal band pass 20 to 24.5 kc; 24.5 kc more than 4 db down, 20 kc no more than 2 db down as compared to flat region; attenuation below 20 kc sufficient that 10 kc and below is attenuated at least 60 db; attenuation at 25 kc and above at least 60 db; input impedance 40,000 ohms, output to grid; hermetically sealed metal case per MIL-T-27 spec for Grade 1, Class A components; 5" lg x 1 1/2" wd x 2 1/2" h excl term and mtg studs; 4 solder lug term mtd on insulated posts spaced on 3 1/2" x 1/2" centers; four 8-32 x 1/2" lg mtg studs spaced on 4 1/2" x 1" centers; CNA part/dwg S992-1; CBIS type S-10531	Lower sideband filter
Z105	N16-F-32547-2131	Filter, Band Pass: band pass 24.94 to 25.06 kc within 4 db; attenuation below 24.5 kc and above 25.5 kc at least 60 db; input impedance 385,000 ohms; output to grid; hermetically sealed metal case per MIL-T-27 spec for Grade 1, Class A components; 5" lg x 1 1/2" wd x 2 1/2" h excl term and mtg studs; 4 solder lug term mtd on insulated posts spaced on 3 1/2" x 1/2" centers; four 8-32 x 1/2" lg mtg studs spaced on 4 1/2" x 1" centers; CNA part/dwg S990-1; CBIS type S-10529	25 kc carrier filter
Z401	N16-F-44097-7350	Filter, Low Pass: current rating 2 amps; 125 V at 60 cycles; operating temp -55°C to +85°C; continuous duty cycle; test voltage 250V/60 cycles for 2 minute duration; line voltage drop at rated load less than 1 volt; total capacity to ground 3 mfd; 2.1 mh nominal inductance; constructed of 2 pie sections in series; 0.35 ohms nominal DC resistance; insertion loss with 50 ohm system 54 db at 0.014 mc; less than 83 db at 0.05 mc, 92 db	AC line filter

TABLE 8–2. TABLE OF REPLACEABLE PARTS

REF. DESIG.	STANDARD NAVY STOCK NUMBER	NAME AND DESCRIPTION	LOCATING FUNCTION
		COMPOUND TUNED CIRCUIT AND FILTERS (CONT'D)	
Z401 (cont'd)		at 0.15 mc, 74 db at 1 mc, 59 db at 10 mc and 45 db at 100 mc; hermetically sealed metal case per MIL-T-27 spec for Grade 1, Class A components; 2 7/8" lg x 2 1/4" wd x 1 3/8" h excl mtg tabs; one mtg tab extends 1/2" from each end each w/two 0.205" dia holes spaced 1 3/4" c to c and one 0.218" hole spaced 1/4" off center; one solder lug term centrally located at each end; CNA part/dwg S986-1; CSF type no. 2JX14	
Z402		Same as Z401	AC line filter
Z403	For reference only	Network, Noise Filter: consists of 2 fixed capacitors and 4 RF chokes; includes C401, C402, L401, L402, L403 and L404; CNA part/dwg SB:2492; listed for reference only	Audio output noise filter network

TABLE 8-3. CROSS REFERENCE PARTS LIST

JAN DESIGNATIONS	KEY SYMBOL
AN3057-6	0419
AN3102A-14S-2P	J403
AN3102A-14S-7P	J404
AN3106B-14S-2S	P403
AN3106B-14S-7S	P404
CC20UJ510J	C307
CC21CH100D	C170
CE42F200R	C330
CE53F200N	C113
CM20B101K	C118
CM20B471K	C103
CM20C101J	C161
CM20D331J	C162
CM20D391J	C122
CM20D471J	C101
CM30E272G	C160
CM35E103G	C159
CP06SA5	0119
CP53B4EF254V	C106
CP53B4EF504V	C317
CP61B1DF105V	C315
CP61B6EE504V	C107
CP69B5EF104V	C105
CV11B300	C306
RC09BF104K	R104
RC09BF105K	R161
RC09BF126K	R334
RC09BF151J	R101
RC09BF183J	R102
R C09BF225K	R301
RC09BF473K	R178
RC09BF474K	R186
RC09BF475K	R170
RC09BF683K	R303
RC20BF101K	R105
RC20BF102K	R119
RC20BF103K	R118
RC20BF104K	R145
RC20BF105K	R171
RC20BF152K	R336
RC20BF154K	R133
RC20BF155K	R330
RC20BF221K	R151
RC20BF222K	R108
RC20BF223K	R312
RC20BF331K	R130
RC20BF332K	R141
RC20BF334K	R332

JAN DESIGNATIONS	KEY SYMBOL
RC20BF471K	R152
RC20BF472K	R308
RC20BF473K	R107
RC20BF474K	R111
RC30BF103K	R122
RC30BF153K	R125
RC30BF223K	R188
RC30BF224K	R124
RC30BF334K	R337
RC30BF472K	R121
RC30BF473K	R129
RC30BF681K	R135
RC30BF683K	R149
RC42BF223K	R313
RV2ATSA255A	R167
RV2AUSA105B	R198
RV4ATFD252A	R157
RV4ATFD503C	R128
RV4ATSA252A	R106
RV4ATSA503A	R117
RV4ATSA504A	R172
ST12D	S101
ST22N	S102
ST52K	S301
ST52N	S302
ST52P	S303
TS101C01	XV309
TS102P01	XV101
TS102U01	E113
TS102U02	E101
TS102U03	E119
TS103P01	XV102
TS103U02	E102
OA2WA	V304
OB2WA	V119
5Y3WGTA	V309
6AK6WA	V106
6AU6WA	V105
5654	V120
5726	V113
5750	V101
5751	V114
5814	V102

STANDARD NAVY STOCK NO.	KEY SYMBOL
F16-Q-128400-100	100-400
G17-F-16302-80	F301
G17-F-16302-120	F401
G17-L-6806-130	I301
G41-W-2446	H301
G77-B-999-75016-0200	0409
N16-C-15915-9167	C170
N16-C-16597-1215	C307
N16-C-18657-8640	C108
N16-C-21837-9910	C330
N16-C-28553-1201	C161
N16-C-28558-1676	C118
N16-C-29713-6806	C162
N16-C-29898-3606	C122
N16-C-30109-3806	C101
N16-C-30114-4276	C103
N16-C-32135-3219	C160
N16-C-33612-3276	C159
N16-C-33622-5222	C114
N16-C-45770-3626	C401
N16-C-45773-8550	C115
N16-C-48841-9598	C315
N16-C-53448-1665	C106
N16-C-53697-7002	C107
N16-C-53697-7435	C317
N16-C-54460-4310	C105
N16-C-60916-1841	C163
N16-C-62146-2348	C309
N16-C-62361-6412	C325
N16-C-63965-2800	C306
N16-C-72159-7036	L401
N16-C-72240-3284	L302
N16-C-72241-6602	L102
N16-C-300442-625	0117
N16-C-300798-866	0120
N16-E-300113-551	0105
N16-F-32533-3011	Z104
N16-F-32547-2131	Z105
N16-F-32554-2011	Z102
N16-F-44084-8521	Z103
N16-F-44097-7350	Z401
N16-K-700310-982	E126
N16-M-60911-4456	0119
N16-R-29190-2004	L303
N16-R-49580-811	R105
N16-R-49661-0811	R151
N16-R-49706-0811	R130

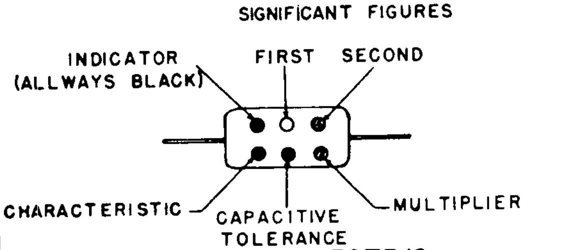
TABLE 8-3. CROSS REFERENCE PARTS LIST (CONT'D)

STANDARD NAVY STOCK NO.	KEY SYMBOL
N16-R-49769-0811	R152
N16-R-49842-0231	R135
N16-R-49922-0811	R119
N16-R-49661-0811	R151
N16-R-49967-0811	R336
N16-R-50012-0811	R108
N16-R-50066-811	R141
N16-R-50129-0811	R308
N16-R-50130-0231	R121
N16-R-50282-0811	R118
N16-R-50283-231	R122
N16-R-50337-0231	R125
N16-R-50372-0811	R312
N16-R-50373-0231	R188
N16-R-50373-0421	R313
N16-R-50480-0811	R107
N16-R-50481-0231	R129
N16-R-50553-0231	R149
N16-R-50633-0811	R145
N16-R-50678-0811	R133
N16-R-50715-0231	R124
N16-R-50759-811	R332
N16-R-50760-0231	R337
N16-R-50975-0811	R171
N16-R-50822-0811	R111
N16-R-51020-0811	R330
N16-R-87419-4479	R157
N16-R-87419-4625	R106
N16-R-87849-4718	R117
N16-R-88179-4804	R172
N16-R-88408-3245	R167
N16-S-34520-3864	E113
N16-S-34557-8351	E101
N16-S-34576-6513	E102
N16-S-34607-6039	E119
N16-S-62603-6702	XV101
N16-S-63515-4156	XV309
N16-S-64063-6713	XV102
N16-S-470001-109	O402
N16-S-470001-110	O401
N16-T-52001-3	V304
N16-T-52001-8	V119
N16-T-55738-5	V309
N16-T-56192-85	V106
N16-T-56203-53	V105
N16-T-75654	V120
N16-T-75726	V113
N16-T-75750	V101

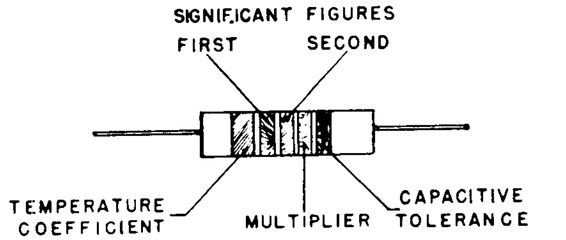
STANDARD NAVY STOCK NO.	KEY SYMBOL
N16-T-75751	V114
N16-T-75814	V102
N17-C-70328-1516	P404
N17-C-70334-5466	P403
N17-C-71414-2800	P405
N17-C-72604-1522	J404
N17-C-72610-5434	J403
N17-C-73108-5890	J405
N17-C-73332-1917	J401
N17-C-73628-6671	P101
N17-C-201579-718	O113
N17-C-202422-0130	XF301B
N17-C-781366-251	O419
N17-F-16302-40	F303
N17-F-74266-9068	XF301A
N17-F-74266-9215	XF301
N17-I-59627-9229	E310
N17-J-39248-3224	J101
N17-L-76662-4678	XI301B
N17-L-76743-4669	XI301
N17-L-250181-506	XI301A
N17-M-19253-1756	M101
N17-M-22715-3319	M102
N17-M-57137-2569	B101
N17-M-57242-1853	B301
N17-R-65104-1646	K301
N17-S-69834-7233	S305
N17-S-71415-7387	S304
N17-S-72018-7719	S101
N17-S-72828-2605	S301
N17-S-73959-1025	S302
N17-S-74139-4844	S102
N17-S-74692-4506	S303
N17-T-65842-8750	T101
N17-T-67419-4176	T102
N17-T-73645-1835	T303
N17-T-77712-2079	T301

TABLE 8-4. COLOR CODES

CAPACITOR COLOR CODE

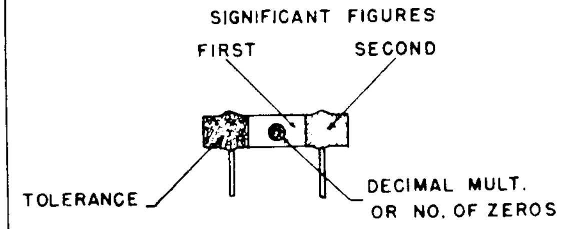


MICA-DIELECTRIC

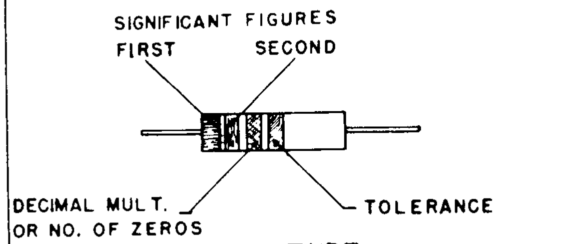


CERAMIC-DIELECTRIC

RESISTOR COLOR CODE

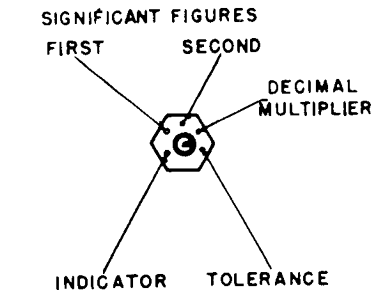


RADIAL TYPE



AXIAL TYPE

FEED-THRU TYPE CAPACITOR



CERAMIC-DIELECTRIC

RESISTORS: DECIMAL MULTIPLIER OR NO. OF ZEROS	RESISTORS: TOLERANCE	RESISTORS: SIGNIFICANT FIGURE	COLOR	CAPACITORS MICA-DIELECTRIC: SIGNIFICANT FIGURE	MICA-DIELECTRIC: MULTIPLIER	MICA-DIELECTRIC: CAPACITIVE TOL. IN %	MICA-DIELECTRIC: CHARACTERISTIC	CERAMIC-DIELECTRIC: MULTIPLIER	CERAMIC-DIELECTRIC: TEMP. COEF. IN PARTS/MEG/°C	CERAMIC-DIELECTRIC: TOLERANCE > 10 UUF IN %	CERAMIC-DIELECTRIC: TOLERANCE < 10 UUF IN UUF
.0		0	BLACK	0	1	20	A	1	0	20	2
1		1	BROWN	1	10		B	10	−30	1	
2		2	RED	2	100	2	C	100	−80	2	
3		3	ORANGE	3	1000		D	1000	−150		
4		4	YELLOW	4			E		−220		
5		5	GREEN	5			F		−330	5	.5
6		6	BLUE	6			G		−470		
7		7	VIOLET	7					−750		
8		8	GRAY	8				.01	+30		.25
9		9	WHITE					.1	−330 ± 500	10	1.0
.1	±5		GOLD		.1	5					
.01	±10		SILVER		.01	10					
	±20		NO COLOR								

TABLE 8-5. LIST OF MANUFACTURERS

MFR'S PREFIX	NAME	ADDRESS
CADH	Standard Coil Products Co.	2329 Pulaski St., Chicago, Ill.
CAE	Cutler Hammer, Inc.	1333 W. St. Paul Ave., Milwaukee, Wis.
CAIS	Birtcher Corp., The	5087 Huntington Drive, Los Angeles 32, Calif.
CAYU	Barry Corp.	179 Sidney St., Cambridge, Mass.
CAYZ	Dial Light Corp.	60 Stewart Ave., Brooklyn, N.Y.
CBEN	Air-Maze Co.	5200 Harvard Ave., Cleveland, Ohio
CBIC	Selector Industries, Inc.	401 East 138 St., Bronx, N.Y.
CBIS	Burnell & Co.	10-12 Van Cortland Ave., Bronx, N.Y.
CBNJ	International Instruments Inc.	331 East St., New Haven, Conn.
CBUE	Electro Engineering Products Co., Inc.	609 West Lake St., Chicago, Ill.
CED	Cannon Electric Development Co.	3291 Humboldt St., Los Angeles, Calif.
CFA	Bussman Mfg. Co.	2538 W. University St., St. Louis, Mo.
CFX	Freed Transformer Co.	1718 Wierfield St., Brooklyn (Ridgewood) 27, N.Y.
CG	General Electric Co.	1 River Road, Schenectady, N.Y.
CH	Signal Engineering & Mfg. Co.	156 W. 14th St., New York, N.Y.
CLF	Littlefuse, Inc.	1865 Miner St., Desplainer, Ill.
CMA	P.R. Mallory Co.	1941 Thomas St., Indianapolis, Ind.
CNA	National Company, Inc.	61 Sherman St., Malden, Mass.
CSF	Sprague Specialties	North Adams, Mass.
CSQ	Spencer Thermostat Co.	34 Forrest St., Attleboro, Mass.
CUT	United Transformer Corp.	148 Varick St., New York, N.Y.
	Camloc Fastener Corp.	22 Spring Valley Road, Paramus, N.J.
	Colin-Campbell Co.	Danbury, Conn.
	Garde Mfg. Co.	590 Eddy St., Providence, R.I.
	Torrington Mfg. Co.	100 Franklin St., Torrington, Conn.

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