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TECHNICAL MANUAL

*for*

**ELECTRONIC FREQUENCY  
CONVERTER  
CV-2353/U**

DEPARTMENT OF THE NAVY

NAVAL ELECTRONICS SYSTEMS COMMAND

*Approved: 15 MAY 1969*

## LIST OF EFFECTIVE PAGES

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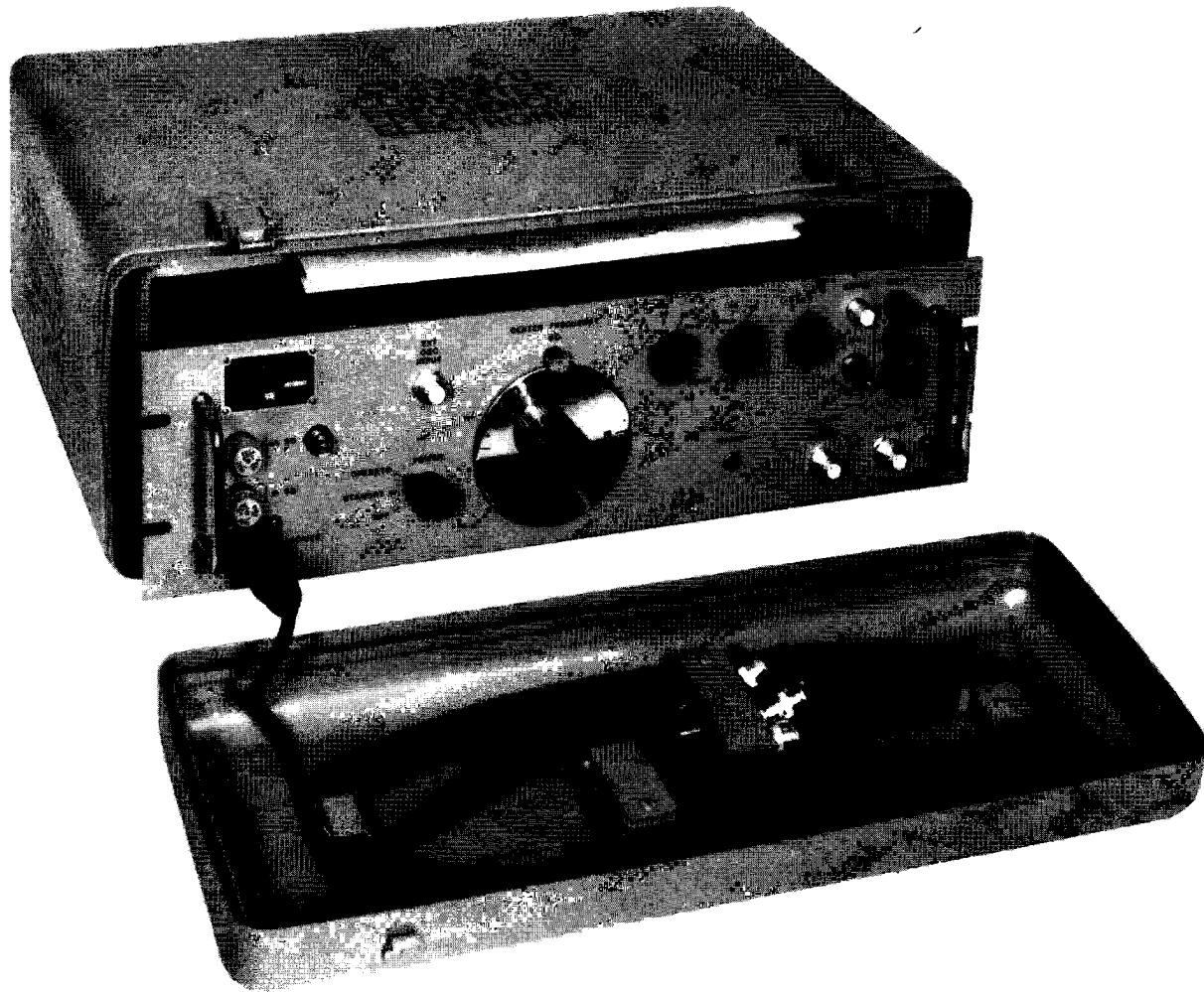


Figure 1-1. Electronic Frequency Converter CV-2353/U

SECTION 1  
GENERAL INFORMATION

1-1. SCOPE.

This Technical Manual is in effect upon receipt. It does not supersede any other publications. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-2. GENERAL DESCRIPTION.

The Electronic Frequency Converter CV-2353/U (figure 1-1) is a range extending device that mixes test signals between 100 cps and 2 megacycles with an externally supplied oscillator signal to develop a 2.5-megacycle output signal. The output signal is applied to a radio frequency, single-sideband spectrum analyzer where the power components of the test signal can be analyzed. The converter also contains a 3-megacycle oscillator that is used by the spectrum analyzer.

1-3. REFERENCE DATA.

a. Table 1-1 lists the characteristics of the input and output signals of the converter.

b. The converter is designed to operate with a spectrum analyzer whose i-f frequency is 500 kilocycles.

c. The converter operates on 115-volt, single phase, 50, 60 or 400 cycle power.

1-4. EQUIPMENT SUPPLIED.

Table 1-2 lists the equipment supplied with the converter.

1-5. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

Table 1-3 lists the equipment required but not supplied.

1-6. PREPARATION FOR RESHIPMENT.

No extraordinary precautions are required to prepare the converter for reshipment.

TABLE 1-1. SIGNAL CHARACTERISTICS

	FREQ RANGE	VOLTAGE (IN VOLTS)	IMPEDANCE (IN OHMS)	CONNECTOR
INPUT TEST SIGNAL	100 cps to 2 megacycles	0.01 to 3	600 ± 10% Balanced	J101 and J102
			600 ± 10% Unbalanced	J101 and J103
			75 Unbalanced	J103 and J104
EXTERNAL OSCILLATOR	2.5 to 4.5 megacycles	0.1 to 0.3 rms	50	J403
OUTPUT SIGNAL	2.5 megacycles	0.01 at min attenuation	50	J203
LOCAL OSCILLATOR	2.985 to 3 megacycles	0.3 ± 15% rms	50	J107

TABLE 1-2. EQUIPMENT SUPPLIED

QTY	NOMENCLATURE		OVERALL DIMENSIONS (IN)			VOLUME	WEIGHT
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH	(CU FT)	(LB)
1	Converter, Frequency Electronic	CV-2353/U	5-15/64	19	12-15/32	0.72	16
1	Combination Case	E1184	7-1/8	20-1/8	14-3/4	1.2	12
3	Coaxial Cable			72 long		-	0.22
1	Power Cable	CA301		96 long		-	0.56
1	Tuning Wand	MPI (C2734-2)		6 long		-	0.03
2	Technical Manual for Converter, Frequency, Electronic	CV-2353/U	11	8.5	3/8	-	-

TABLE 1-3. EQUIPMENT REQUIRED BUT NOT SUPPLIED

QTY	DESCRIPTION	SUGGESTED MODEL OR EQUIVALENT	REQUIRED USE
1	VTVM	Hewlett Packard 400 D	To measure signal amplitudes.
1	Frequency Counter	Hewlett Packard HP5244L	Troubleshooting and alignment.
1	Multimeter	50,000 ohms/volt input resistance with a lower range of 1 volt full scale.	Voltage and resistance checks.
1	Oscilloscope	Tektronix 543 with Type B plug-in.	Troubleshooting local oscillator.
1	50 ohm resistive termina- tions with BNC connector.	-	Troubleshooting and alignment.

## SECTION 2 INSTALLATION

### 2-1. UNPACKING AND HANDLING.

No special precautions are required for the unpacking and handling of the converter. Standard procedures and techniques are adequate.

### 2-2. POWER REQUIREMENTS.

The converter operates from a 115-volt  $\pm 10\%$ , 50/60/400 cycle, single phase power source. Power consumption is 40 watts.

### 2-3. SITE SELECTION. (Fig. 2-1.)

The converter can be placed in any suitable working area with normal lighting and ventilation. It is designed for mounting in a standard 19-inch relay rack. In selecting a site, consideration should be given to the fact that the converter does not operate independently, but operates in conjunction with a spectrum analyzer, an oscillator, and a source of test signals. Therefore, arrangement of all of the units should be considered to achieve the optimum configuration. Because the cables supplied are 6-feet long, the converter should be situated so that the cables will conveniently reach the associated equipment.

### 2-4. CABLE ASSEMBLIES.

a. The equipment is supplied with four cables (table 1-2). The three coaxial cables are each 6 feet long. They are used to connect signals from the converter to the spectrum analyzer and the external variable frequency oscillator. All three cables are identical and may be used interchangeably.

b. The 8-foot power cable is connected between the POWER jack (14, figure 3-1) and a source of 115-volt, 50/60/400 cycle, single-phase power.

### 2-5. INSPECTION AND ADJUSTMENT.

a. Check the fuse and mechanical operation of controls (figure 3-1). Failure of any control to operate properly is sufficient cause for failure of the converter to pass this test.

(1) Remove the caps from the fuseholders and check that both fuses are rated at 1/4 ampere. Visually inspect the fuses for any defects. Replace the fuses and caps.

(2) Operate the CENTER FREQUENCY KC control over its entire range. It should move smoothly without binding or sticking.

(3) Operate all switches to all positions. Switches should operate smoothly and seat positively in each position.

(4) Check that all internal cables are securely connected.

b. Check the electrical operation of the converter as follows:

(1) Connect the power cable between the POWER jack and source of the 115-volt 50/60/400 cycle power.

(2) Place the POWER switch in the STANDBY position. The power-on indicator should light to indicate that the converter is energized.



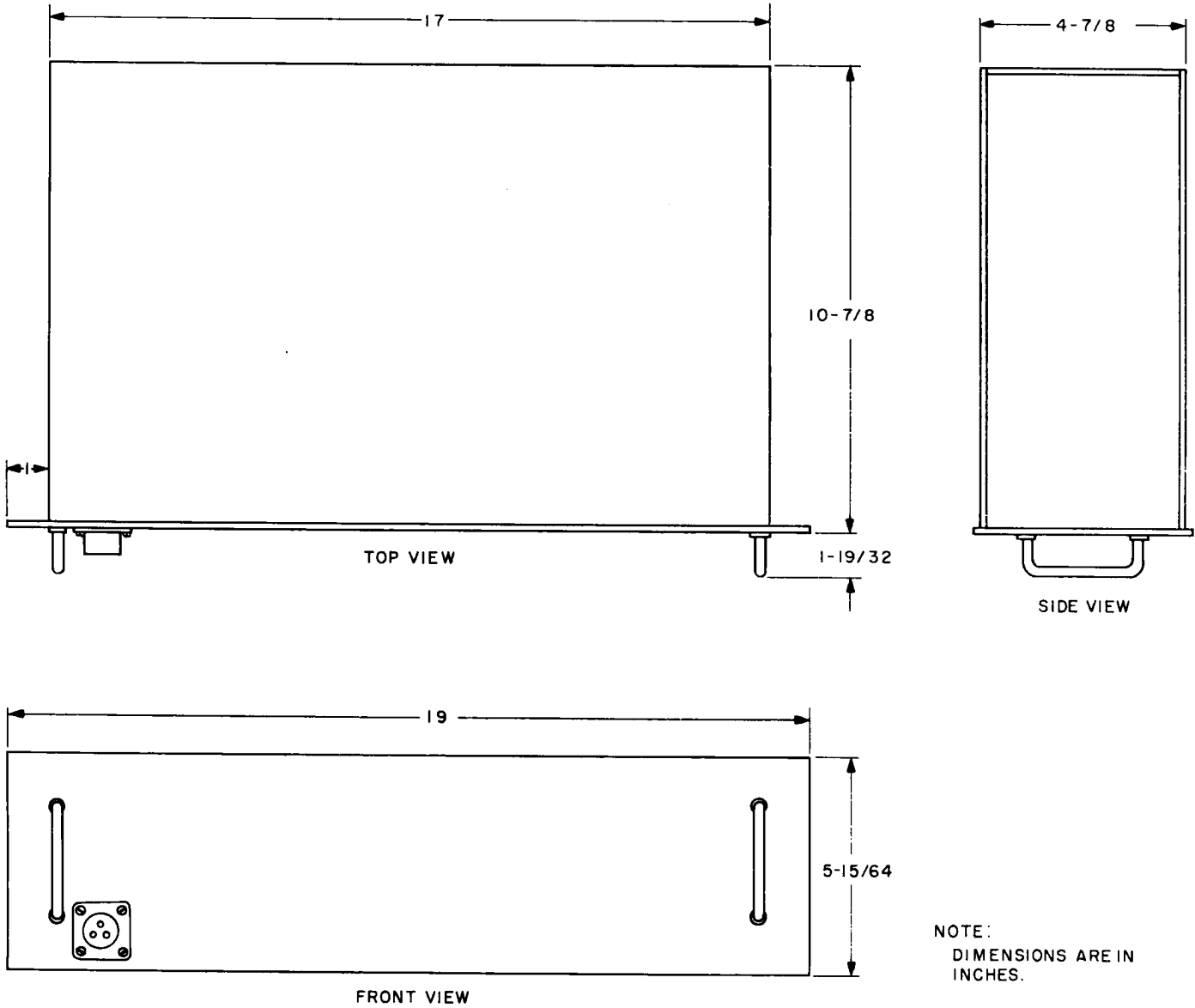


Figure 2-1. Electronic Frequency Converter CV-2353/U Outline Drawing

SECTION 3  
OPERATION

## 3-1. FUNCTIONAL OPERATION.

a. The converter mixes a test signal between 100 cps and 2 megacycles with an external oscillator signal to develop a 2.5 megacycle signal. The resultant signal is applied to a spectrum analyzer where power as a function of frequency can be analyzed. In addition, the converter contains an oscillator that generates a 3-megacycle signal also applied to the spectrum analyzer.

b. In the operate mode, the converter handles test signals in the 100 cps to 2 mc range. In the standby mode, the converter routes external oscillator signals up to 40 mc to the spectrum analyzer without mixing.

## 3-2. PREPARATION FOR USE.

After the converter is installed, check the electrical operation by proceeding as described in paragraph 2-5b.

## 3-3. OPERATING PROCEDURES.

a. DESCRIPTION OF CONTROLS. The operating controls and indicators are listed below and illustrated in figure 3-1.

(1) 1/4 A. SB fuse 2F301 (1, figure 3-1) - protects input power line in the event of a converter short circuit.

(2) Power on indicator, 05301 (2) - indicates that a-c power has been applied.

(3) EXT OSC. INPUT jack, J107 (3) - input jack for the external oscillator signal.

(4) CENTER FREQUENCY KC control, R404 (4) - varies the internal oscillator between 2985 kc and 3000 kc.

(5) INPUT ATTENUATOR DB switches, S101, S102, and S103 (5) - adjusts the amplitude of the input test signal.

(6) SIGNAL INPUT-75  $\Omega$  jack J104 (6) - input jack for test signal.

(7) SIGNAL INPUT - 600  $\Omega$  jacks, J101 and J102 (7) - the jacks to which a balanced 600-ohm impedance input test signal is connected.

(8) SIGNAL INPUT-GND jack, J103 (8) - ground connections for 75-ohm and 600-ohm unbalanced input, test signals.

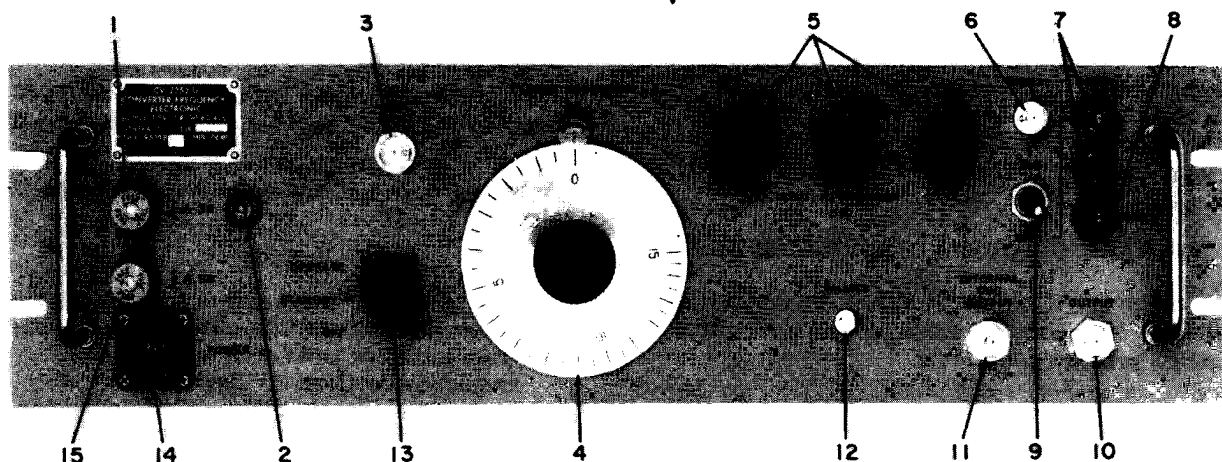


Figure 3-1. Front Panel

(9) SIGNAL INPUT switch, S104 (9) - establishes internal circuit to accept either 75-ohm or 600-ohm impedance input.

(10) OUTPUT jack, J203 (10) - jack at which test signal output is available.

(11) INTERNAL OSC. OUTPUT jack, J403 (11) - jack at which internal oscillator or switched external oscillator signal output is available.

(12) BALANCE control, R127 (12) - controls oscillator leakage signal amplitude at mixer output.

(13) POWER switch, S301 (13) - establishes mode of operation.

(14) POWER jack, J303 (14) - jack to which a-c power cable is connected.

(15) 1/4 A. SB fuse, F302 (15) - line fuse.

b. SEQUENCE OF OPERATION.

(1) BEFORE USE. - Before using the converter, proceed as follows:

(a) The spectrum analyzer that is to be used with the converter must develop a 500 kc i-f signal. Check by applying signals to the SIGNAL INPUT and EXT OSC INPUT jacks that differ by 500 kc. Observe the spectrum analyzer screen. The amplitude of the oscillator input signal should be 0.3-volt rms.

(b) Make the connections described in paragraph 3-4a.

(c) Place the POWER switch in the STANDBY position. The power-on indicator should light.

(2) DURING USE. - Except for the front panel power-on indicator, there are no other indicators that require frequent monitoring.

(3) AFTER USE. - Although the converter is transistorized, it is recommended that the POWER switch remain in the STANDBY position if the unit is going to be used intermittently. If it will not be used for a long time, place the POWER switch in the OFF position.

3-4. SUMMARY OF OPERATING PROCEDURES.

a. INITIAL CONNECTIONS. - To connect the converter to the spectrum analyzer and the external oscillator, proceed as follows:

(1) Connect a coaxial cable between the EXT OSC INPUT jack (3, figure 3-1) and the output of a variable frequency generator or signal generator.

(2) Connect a coaxial cable between the INTERNAL OSC. OUTPUT jack (11) and the oscillator input of the spectrum analyzer.

(3) Connect a coaxial cable between the OUTPUT jack (10) and the spectrum analyzer signal input.

(4) Connect the input test signal to the SIGNAL INPUT jacks. Select the proper jacks as follows:

(a) If the test signal impedance is 600-ohms balanced to ground, connect the signal between the SIGNAL INPUT-600  $\Omega$  jacks (10). Place the SIGNAL INPUT switch (9) in the 600  $\Omega$  position.

(b) If the test signal impedance is 600-ohms unbalanced, connect a jumper between either of the SIGNAL INPUT-600  $\Omega$  jacks (10) and the SIGNAL INPUT-GND jack (8). Connect the signal between the ungrounded and the grounded SIGNAL INPUT-600  $\Omega$  jacks. Place the SIGNAL INPUT switch (9) in the 600  $\Omega$  position.

(c) If the test signal impedance is 75 ohms, connect the signal to the SIGNAL INPUT-75  $\Omega$  jack (6). Place the SIGNAL INPUT switch (9) in the 75  $\Omega$  position.

(5) Connect the power cable to the POWER jack (14).

b. POWER OFF MODE OPERATION. - If it is desired to operate in the frequency range of 2 to 40 mc, place the POWER switch (13, figure 3-1) in the OFF position. The external oscillator signal is routed directly to the spectrum analyzer via INTERNAL OSC. OUTPUT jack (11). No further operation of the converter is required.

c. STANDBY MODE OPERATION. - If it is desired to operate intermittently in the 100 cps to 2 mc range, place the POWER switch (13) in the STANDBY position. The POWER ON indicator (2) will light. Signal routing is the same as for power off mode (paragraph 3-4b, above). In addition, the internal oscillator is energized and ready for use.

d. OPERATING MODE OPERATION. To operate with signal frequencies in the 100 cps to 2 mc range, proceed as follows:

(1) Adjust the INPUT ATTENUATOR DB switches (5, figure 3-1) for maximum attenuation.

(2) Place the POWER switch (13) in the OPERATE position. The power on indicator (2) will light.

NOTE

The operation of the converter is intimately associated with the operation of a spectrum analyzer and external variable frequency oscillator. Because the converter can operate with various analyzers and oscillators, the operating procedure described in this manual can only be of a general nature. Refer to the applicable spectrum analyzer and variable frequency oscillator manuals to determine the specific operating procedures required.

(3) Set the frequency of the external oscillator so that it is 2.5 megacycles higher than the test signal.

(4) Adjust INPUT ATTENUATOR DB switches (5) until the desired amplitude signal is obtained.

(5) The carrier frequency should now be displayed in the center of spectrum analyzer scope display. If not, adjust the CENTER FREQUENCY KC control (4) and the external oscillator frequency until the carrier frequency display is properly positioned. For test signal frequencies higher than the maximum sweep width of the analyzer, the carrier frequency displayed when either of the sidebands is displayed.

(6) The carrier frequency amplitude should be less than the amplitude of the sidebands when a 10 millivolt rms input signal is displayed. If not,

use a screwdriver to adjust the BALANCE control (12) for minimum carrier amplitude.

### 3-5. OPERATOR'S MAINTENANCE.

a. OPERATING CHECKS. - The converter does not require checking during operation.

b. PREVENTIVE MAINTENANCE. - Preventive maintenance is described in Section 5.

c. EMERGENCY MAINTENANCE. - The only maintenance authorized for the operator is to check and replace 1/4 A. SB fuses (1 and 15, figure 3-1). They should be checked only if the power on indicator (2) does not light when power is applied.

### CAUTION

If the new fuses burn out, do not replace them. Refer to Section 4, Troubleshooting.

SECTION 4  
TROUBLESHOOTING

4-1. TROUBLESHOOTING.

This section describes the troubleshooting techniques for the converter. The information consists of a logic troubleshooting procedure in tabular form, a servicing block diagram, and the theory of operation. Converter malfunction will appear as no signal displayed on the spectrum analyzer with which the converter is operating. When troubleshooting the

equipment, refer to table 4-1 and the following illustrations:

- a. Figure 3-1. - location of front panel controls.
- b. Figure 4-6. - block diagram showing interconnection of sections and voltages to be measured at critical points.
- c. Figure 5-1. - overall schematic diagram.

TABLE 4-1. TROUBLESHOOTING CHART

STEP	SYMPTOM	PROBABLE CAUSE	REMEDY
1	Power on indicator does not light when POWER switch is in the STANDBY OR OPERATE position.	<ul style="list-style-type: none"> <li>a. Defective fuse.</li> <li>b. Defective lamp.</li> <li>c. A-c power not applied.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace fuse if defective.</li> </ul> <p style="text-align: center;"><b>CAUTION</b></p> <p>Do not replace with a fuse rated higher than 1/4 ampere. If fuse burns out again, do not replace until trouble has been located. Disconnect power and check for short circuit.</p> <ul style="list-style-type: none"> <li>b. Replace lamp if defective.</li> <li>c. Check power, source, power cable, and POWER switch S301.</li> </ul>
2	Absence of -15 volts dc at test point TP301.	Defective power supply.	Perform voltage and resistance checks to locate defective circuit element on power supply.
3	A signal between 2985 kc and 3000 kc is not observed on frequency counter connected to INTERNAL OSC. OUTPUT jack J403.	<ul style="list-style-type: none"> <li>a. Detuned oscillator.</li> <li>b. Defective oscillator.</li> <li>c. POWER switch S301 defective.</li> </ul>	<ul style="list-style-type: none"> <li>a. Adjust per paragraph 5-2b(2).</li> <li>b. Perform voltage and resistance checks to locate defective circuit elements. Adjust per paragraph 5-2b(2).</li> <li>c. Replace S301 if defective.</li> </ul>
4	With external oscillator and test signals connected, no signal is observed on an oscilloscope connected to jack J105, regardless of the position of the INPUT ATTENUATOR DB switches.	<ul style="list-style-type: none"> <li>a. Defective diodes in balanced mixer.</li> <li>b. Defective circuit elements in balanced mixer.</li> </ul>	<ul style="list-style-type: none"> <li>a. Replace CR101 through CR104 if defective.</li> <li>b. Perform resistance checks to locate defective element.</li> </ul>

TABLE 4-1. TROUBLESHOOTING CHART (Cont)

STEP	SYMPTOM	PROBABLE CAUSE	REMEDY
5	With same connections as in step 4, output is observed for only some settings of the INPUT ATTENUATOR DB switches.	Defective resistor or switch.	Perform resistance checks to determine defective circuit element.
6	With a test and external oscillator signal applied, no output is observed on the VTVM connected to the OUTPUT jack.  NOTE  A 50-ohm resistive load must be connected between the OUTPUT jack and ground before the measurement is made.	a. Detuned i-f amplifier.  b. Defective i-f amplifier.	a. Adjust the amplifier as per paragraph 5-2b(1).  b. Perform voltage and resistance checks to determine defective circuit element.

4-2. FUNCTIONAL DESCRIPTION.

The converter consists of four sections; an Attenuator-Mixer, an I-f Amplifier, a Local Oscillator, and a Power Supply (figure 4-1). Figure 5-1 is an overall schematic diagram showing all four sections. Refer to this figure for detailed circuit analysis and troubleshooting information. The following functional description uses simplified diagrams to clarify the discussion.

a. ATTENUATOR-MIXER. - The 600-ohm test-signal input, either balanced or unbalanced, is applied to the attenuator (figure 4-2). Effectively the attenuator is a variable resistor that establishes the desired input-signal, voltage level. The setting of INPUT ATTENUATOR switches S101, S102 and S103 determines the circuit resistance, hence the attenuation. The attenuator output is developed across resistor R124.

(1) The 75-ohm test-signal input is connected across an impedance-matching circuit consisting of R125 and 126. The output of this circuit is then applied to the attenuator. The operation of the attenuator is identical to that described in paragraph 4. 2a, above.

(2) The test-signal input is mixed with the external oscillator signal as shown in figure 4-3. The test signal, developed across resistor R124, (paragraph 4-2a (1)), modulates the external oscillator signal developed at the input of T101. The BALANCE control, R127, adjusts the amplitude of the test signal. The modulation causes beat frequencies to be developed in output transformer T102. The external oscillator frequency is adjusted so that one of the beat frequencies will be 2.5 megacycles.

b. I-F AMPLIFIER. - The i-f amplifier consists of three identical stages. The output of the mixer is R-C coupled to the i-f amplifier. The 2.5-megacycle beat frequency is amplified while all other input frequencies are suppressed. The 2.5-megacycle output frequency is developed between OUTPUT jack J203 and ground.

c. LOCAL OSCILLATOR. - The local oscillator, figure 4-4, is a modified Hartley, called a Colpitts oscillator. The frequency of oscillation is controlled by voltage divider R404, R407, R414 and voltage-controlled capacitor CR401.

(1) The adjustment of CENTER FREQUENCY control R404 determines the voltage across CR401. This, in turn, determines the capacitance of CR401. Because CR401 is in parallel with the oscillator tank circuit, its capacitance will affect the frequency at which the tank circuit oscillates. In summary, adjusting CENTER FREQUENCY control R404 changes the voltage across CR101, which changes its capacitance causing a shift in oscillator frequency. The oscillator frequency can be adjusted between 2985 kc and 3000 kc.

(2) The oscillator output is applied through capacitor C403 and two emitter followers (Q402 and Q403) to INTERNAL OSC. OUTPUT jack J403. Zener diode CR403 maintains a constant voltage at the collector of Q403. Hence it stabilizes the output voltage.

d. POWER SUPPLY. - The full-wave rectifier in the power supply (figure 4-5) develops -45 volts dc at the collector of control transistor Q301. Zener diode CR301 maintains the base of Q301 at a constant -30 volts dc regardless of fluctuations in the

input ac voltage. Zener diode CR302 maintains the base of transistor Q302 at a constant -16 volts dc. Thus, with the collector and base voltages of Q302 held constant, the voltage across the emitter of Q302 is a constant -15 volts dc. This is the B- supply output for the I-f Amplifier and Local Oscillator.

jacks are assigned star test point symbols. These are used to isolate functional sections when troubleshooting. Along with the star test point symbols, the diagram indicates the proper voltage and frequency at each jack.

4-3. SERVICING BLOCK DIAGRAM.

Figure 4-6 is a servicing block diagram that acts as a guide during troubleshooting. Several

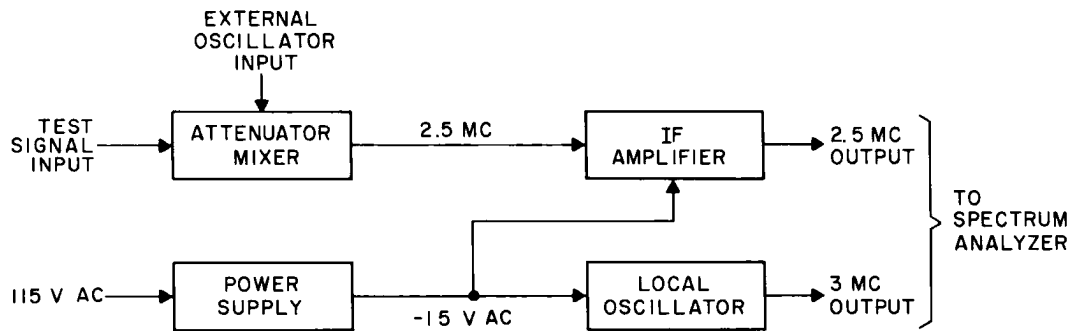


Figure 4-1. Overall Functional Block Diagram

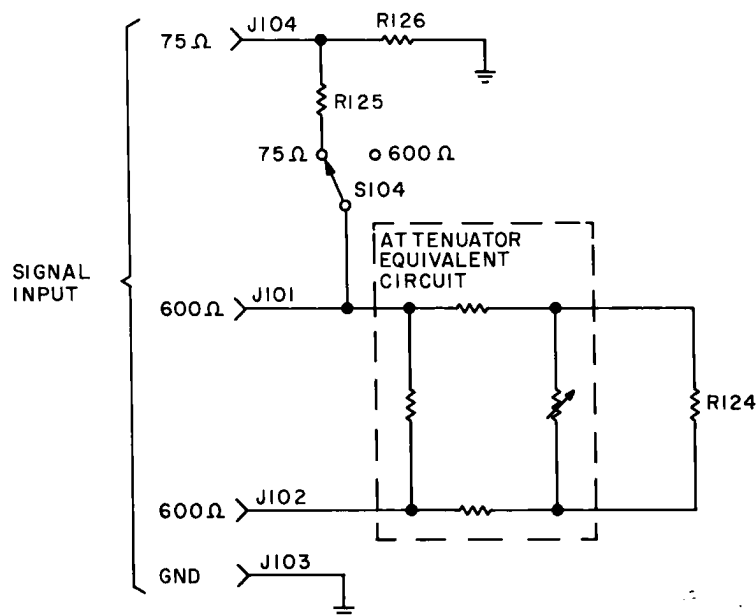


Figure 4-2. Input Circuit, Simplified Schematic Diagram

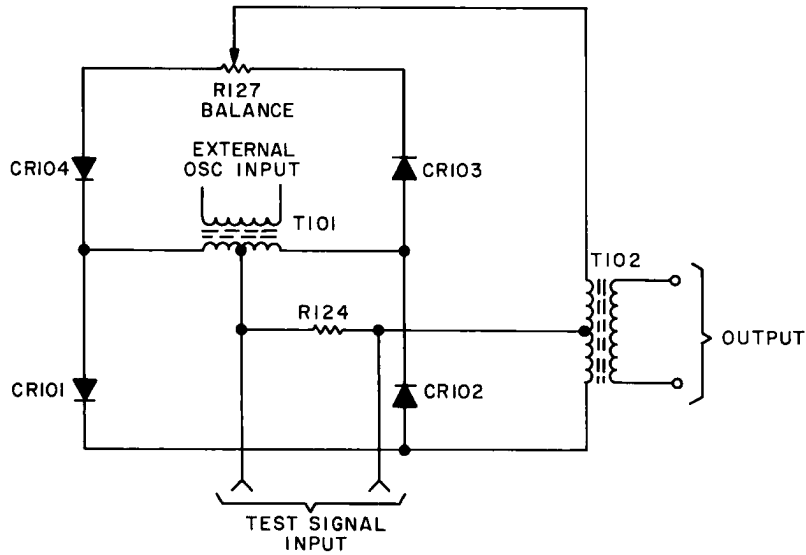


Figure 4-3. Mixer Circuit, Simplified Schematic Diagram

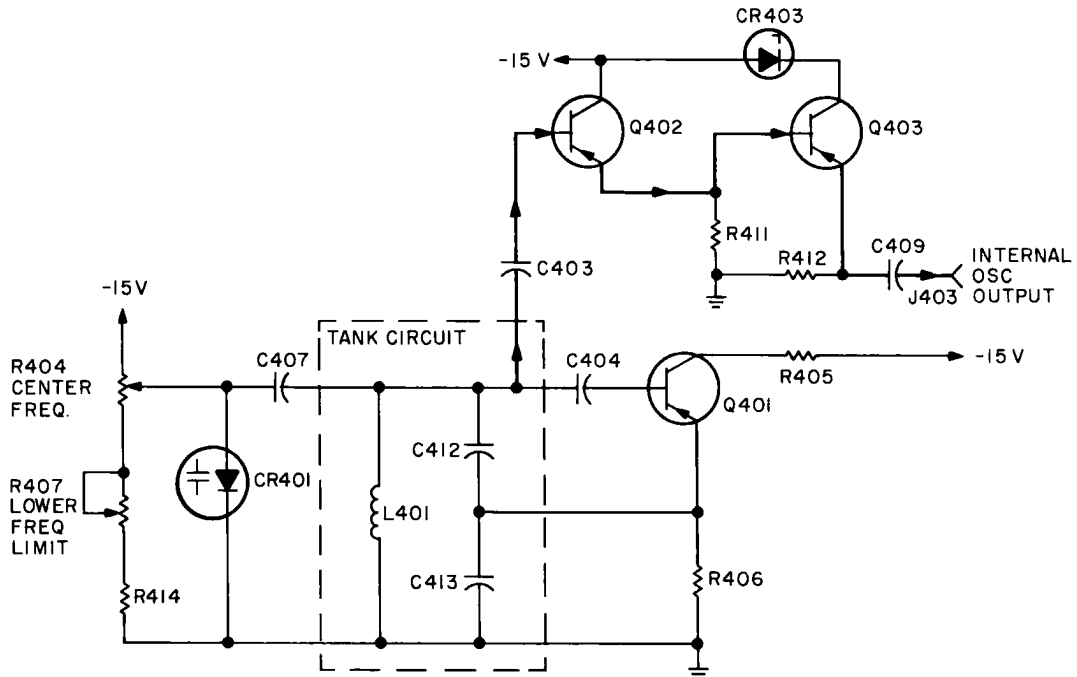


Figure 4-4. Local Oscillator, Simplified Schematic Diagram

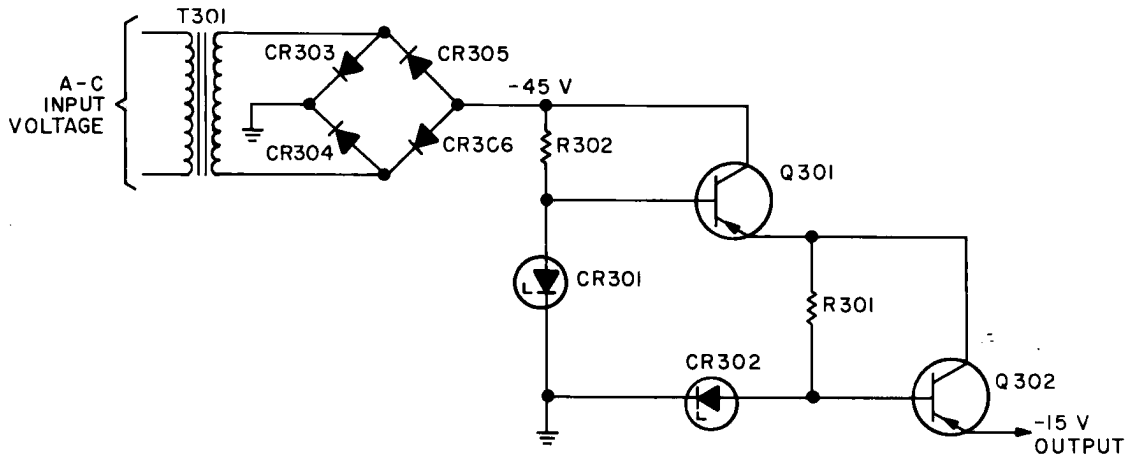


Figure 4-5. Power Supply, Simplified Schematic Diagram



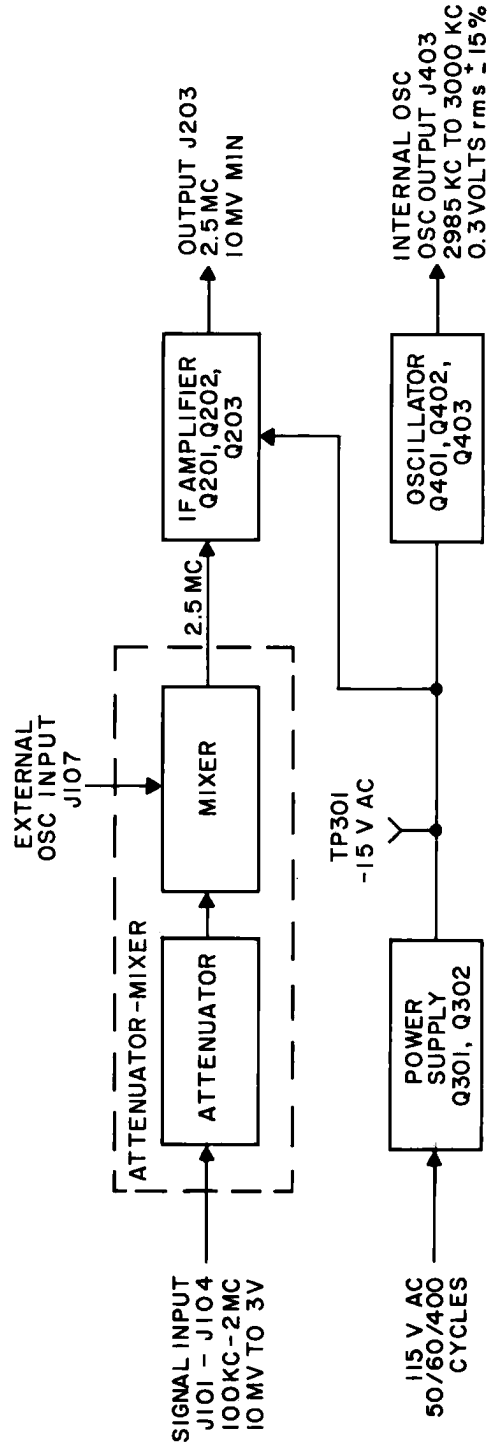


Figure 4-6. Servicing Block Diagram

SECTION 5  
MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS.

The Bureau of Ships no longer requires the submission of failure reports for all equipments. Failure Reports and Performance and Operational Reports are to be accomplished for designated equipments (refer to Electronics Installation and Maintenance Book, NAVSHIPS 900, 000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of Failure Reports.

(2) SPECIAL PROCEDURES. - There are no special procedures required before performing the preventive maintenance procedures.

(3) REFERENCE STANDARDS PROCEDURES. - Table 5-1 lists the reference standards that assure proper operation of the converter.

(4) PREVENTIVE MAINTENANCE PROCEDURES. - Perform the tests described in table 5-2 every 6 months.

NOTE

The procedures listed below consist of the minimum number of reference standards which will indicate, when completed, the relative performance of the converter. The procedures are listed in the suggested sequence of performance; however, deviation from the listed order will in no way affect the unit or result of the reference standard.

5-2. PREVENTIVE MAINTENANCE.

a. MAINTENANCE STANDARDS.

(1) TEST EQUIPMENT AND SPECIAL TOOLS. - The test equipment required to perform preventive maintenance is listed in table 1-3.

TABLE 5-1. REFERENCE STANDARDS PROCEDURES

SECTION	ACTION REQUIRED	REFERENCE
I-f Amplifier	Measure output voltage at J203.	Para. 5-2.b.(1)
Oscillator	Measure output voltage at J403.	Para. 5-2.6.(2)
Power Supply	Measure voltage at TP301.	Table 4-1, Step 2

TABLE 5-2. PREVENTIVE MAINTENANCE PROCEDURES

WHAT TO CHECK	HOW TO CHECK	CORRECT RESULTS
Controls	Operate all controls through all positions.	Smooth, positive action
Chassis	Remove dust and dirt with clean, lintless cloth or brush.	
Mechanical	Tighten all loose screws. Check for chipped, scratched or peeling paint.	
Visual	Check for discolored or cracked resistors and capacitors.	
Gain	Set the input test signal for 100 kc, 10 mv amplitude. Operate the equipment as described in paragraph 3-4 with the INPUT ATTENUATOR DB switches set for zero attenuation.	
		The amplitude of the center frequency displayed on the spectrum analyzer should be approximately 10 mv.

b. TUNING AND ADJUSTMENT. - The following tuning and adjustment procedure should be performed whenever a circuit element or entire section is replaced. The following procedures are independent of each other and may be performed in any order.

(1) I-F AMPLIFIER ALIGNMENT. - To perform the following procedure, the technician requires a VTVM, a 50-ohm resistive termination, and the tuning wand supplied with the equipment.

(a) Connect a 50-ohm resistive termination between OUTPUT jack J203 and ground.

(b) Connect a VTVM between the OUTPUT jack and ground.

(c) Connect a 100 kc, 10 mv rms test signal to the proper SIGNAL INPUT jacks (paragraph 3-4a(4)).

(d) Connect a 2.6 mc external oscillator signal to the EXT OSC. INPUT jack.

(e) Place the INPUT ATTENUATOR DB switches in the 0 position.

(f) Place the POWER switch in the OPERATE position.

(g) Adjust inductor L203 for a maximum indication on the VTVM.

#### NOTE

If adjustment of inductor L203 causes the output voltage to exceed 10 mv rms, adjust the INPUT ATTENUATOR DB switches so that the output voltage is 10 mv or less.

(h) Repeat step (g) for inductor L202.

(i) Repeat step (g) for inductor L201.

(j) Repeat steps (g), (h), and (i) in that sequence until either a maximum output voltage or 10 mv rms is obtained.

(2) INTERNAL OSCILLATOR ALIGNMENT. - To perform the following procedure, the technician requires a frequency counter and a 50-ohm resistive termination.

(a) Connect the 50-ohm resistive termination and the frequency counter between the INTERNAL OSC. OUTPUT jack and ground.

(b) Place the POWER switch in the OPERATE position.

(c) Set the CENTER FREQUENCY KC control to the 0 position.

(d) Adjust inductor L401 until the frequency counter indicates 3000 kc.

(e) Set the CENTER FREQUENCY KC control to the 15 position.

(f) Adjust lower frequency limit control R407 until the frequency counter indicates 2985 kc.

(g) Repeat steps (c) through (f) until both limit frequencies are correct.

(3) ATTENUATOR-MIXER ADJUSTMENT. - To perform the following procedure, the technician requires a jumper wire and a test signal source.

(a) Connect a jumper between SIGNAL INPUT jacks J102 and J103.

(b) Set the INPUT ATTENUATOR DB switches for 40 db attenuation.

(c) Connect a test signal to SIGNAL INPUT jacks J101 and J103. The test signal frequency should be 2 mc; and the amplitude should be 1 volt rms.

(d) Operate the converter as described in paragraph 3-4.

(e) Note the amplitude of the sideband frequency displayed on the spectrum analyzer.

(f) Increase the amplitude of the input signal by 5 db (to approximately 1.78 volts rms).

(g) The amplitude of the sideband frequency displayed on the spectrum analyzer should increase by 5 db.

(h) Adjust the INPUT ATTENUATOR DB switches for 45 db attenuation. The amplitude of the carrier frequency should return to the level noted in step (e).

(i) If the proper amplitude is not obtained in step (h), adjust capacitor C101 until the proper amplitude is obtained.

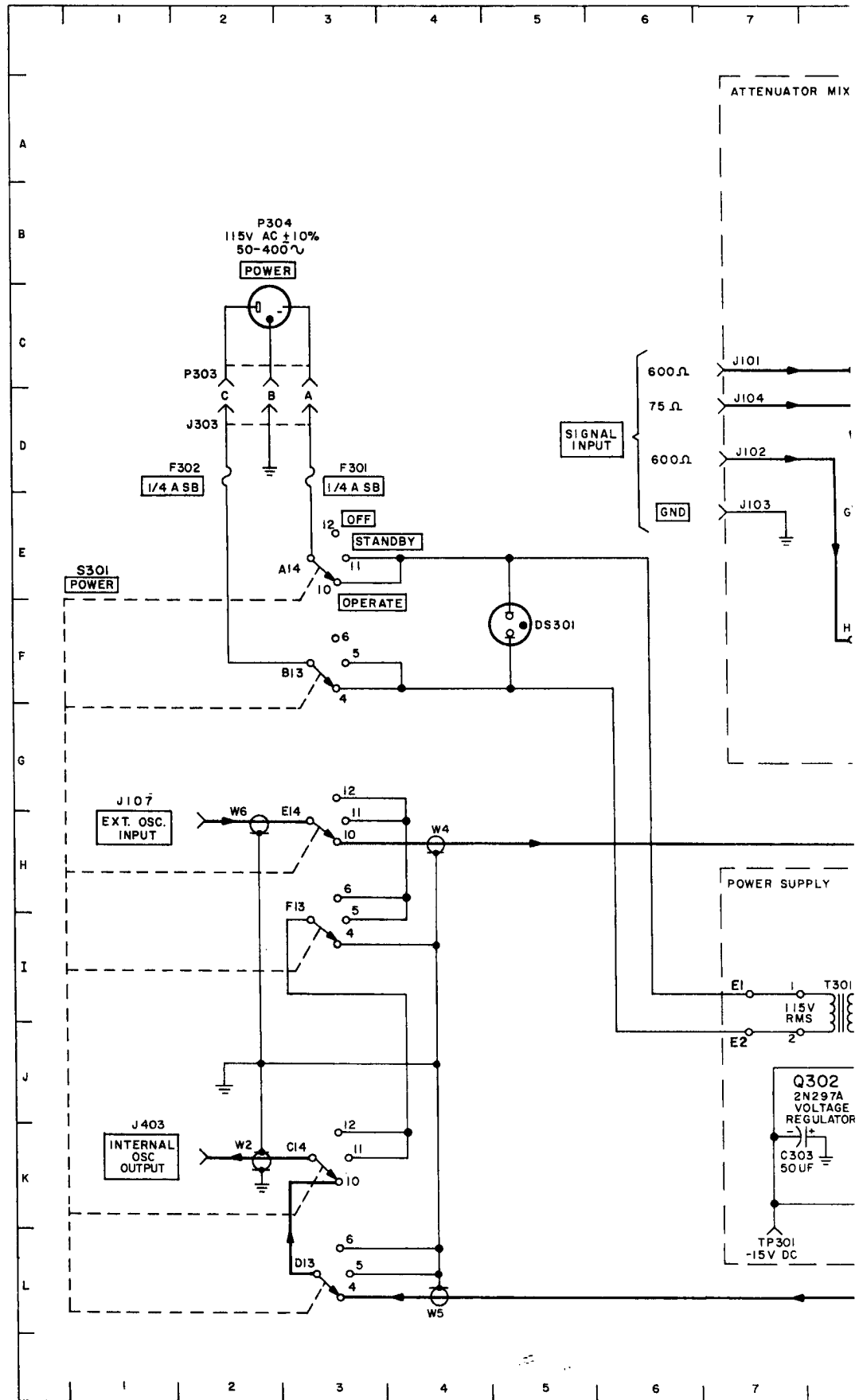
(j) Repeat steps (c) through (i) until the carrier frequency signal amplitude is proper and stable.

## PART LOCATION INDEX

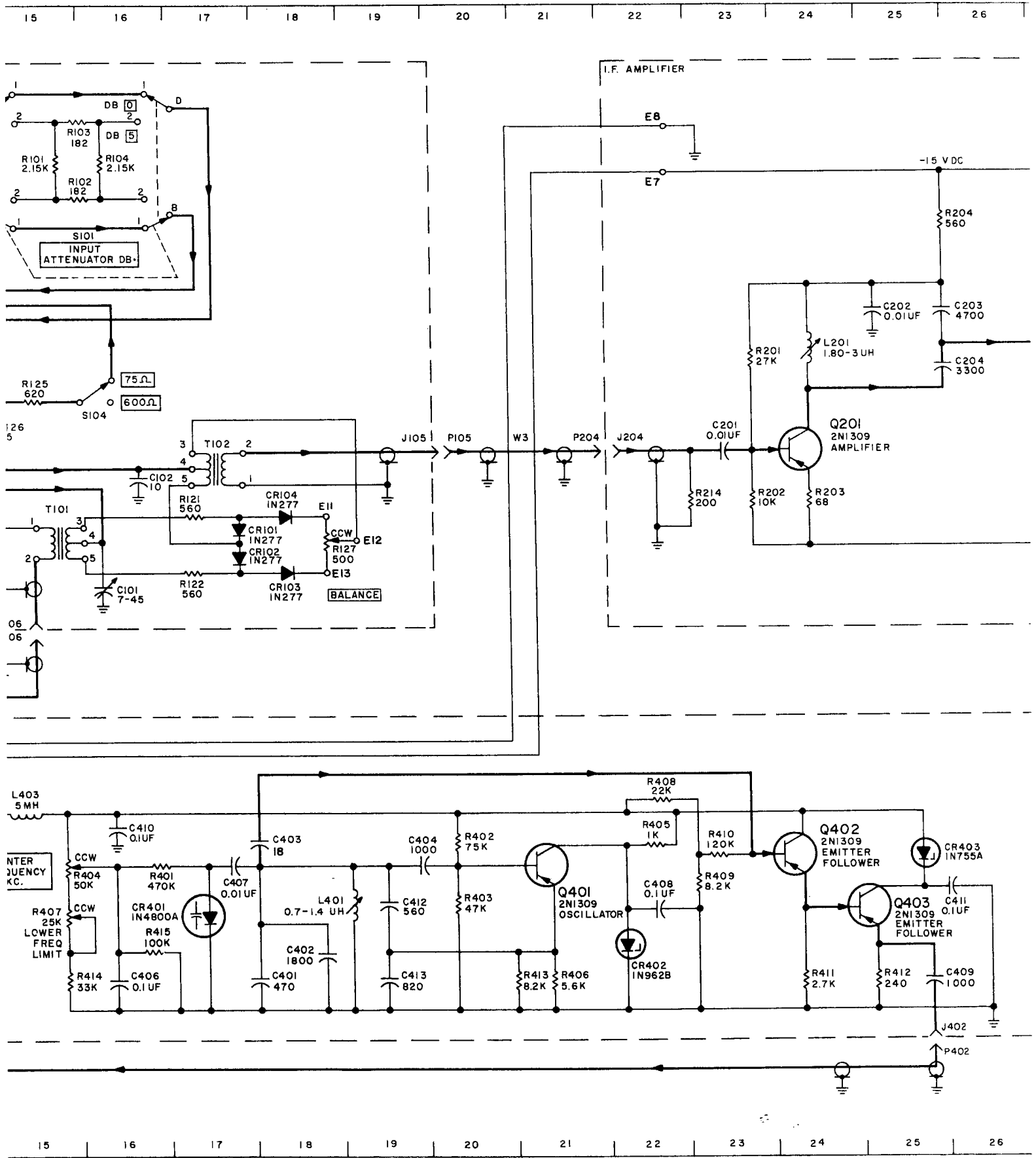
REF DESIG	LOC	REF DESIG	LOC	REF DESIG	LOC
C101	16G	E12	19F	R115	12F
C102	16E	E13	18F	R116	11E
C201	23E	F301	3D	R117	9E
C202	25C	F302	2D	R118	9E
C203	26C	J101	7C	R119	9F
C204	26D	J102	7D	R120	9E
C206	28C	J103	7E	R121	17F
C207	29C	J104	7D	R122	17G
C208	29D	J105	19E	R124	14F
C210	31C	J106	15G	R125	15D
C211	32C	J107	1G	R126	15E
C212	32D	J202	33D	R127	18F
C301	11I	J204	22E	R201	23D
C302	10K	J303	2D	R202	23F
C303	7K	J402	25L	R203	24F
C401	18K	J403	1K	R204	25B
C402	18K	L201	24D	R206	27C
C403	18J	L202	28D	R207	27F
C404	19J	L203	31D	R208	29B
C406	16K	L401	19J	R209	27F
C407	17J	L403	15I	R210	30C
C408	22J	P105	20E	R211	30F
C409	25K	P106	15G	R212	32B
C410	16I	P202	34D	R213	31F
C411	26J	P204	21E	R214	23F
C412	19J	P303	2C	R301	9K
C413	19K	P304	2C	R302	11J
CR101	17F	P402	18J	R401	16J
CR102	17F	Q201	24E	R402	20I
CR103	18G	Q202	27E	R403	20J
CR104	18F	Q203	31E	R404	15J
CR301	11J	Q301	10I	R405	22I
CR302	9J	Q302	8J	R406	21K
CR303	9I	Q401	21J	R407	15J
CR304	9J	Q402	24I	R408	22I
CR305	10I	Q403	25J	R409	23J
CR306	10J	R101	15B	R410	23J
CR401	17J	R102	16B	R411	24K
CR402	22K	R103	16A	R412	25K
CR403	25J	R104	16B	R414	15K
DS301	5F	R105	13B	R415	16K
E1	7I	R106	13A	S101	16C
E2	7J	R107	13B	S102	12C
E3	12I	R108	13B	S103	10F
E4	12I	R109	10B	S104	16E
E5	14I	R110	10A	S301	3E, F, H, I, K, L
E6	14I	R111	10B	T101	15F
E7	22B	R112	11B	T102	17E
E8	22A	R113	12E	T301	8I
E11	18F	R114	12E	TP301	7L

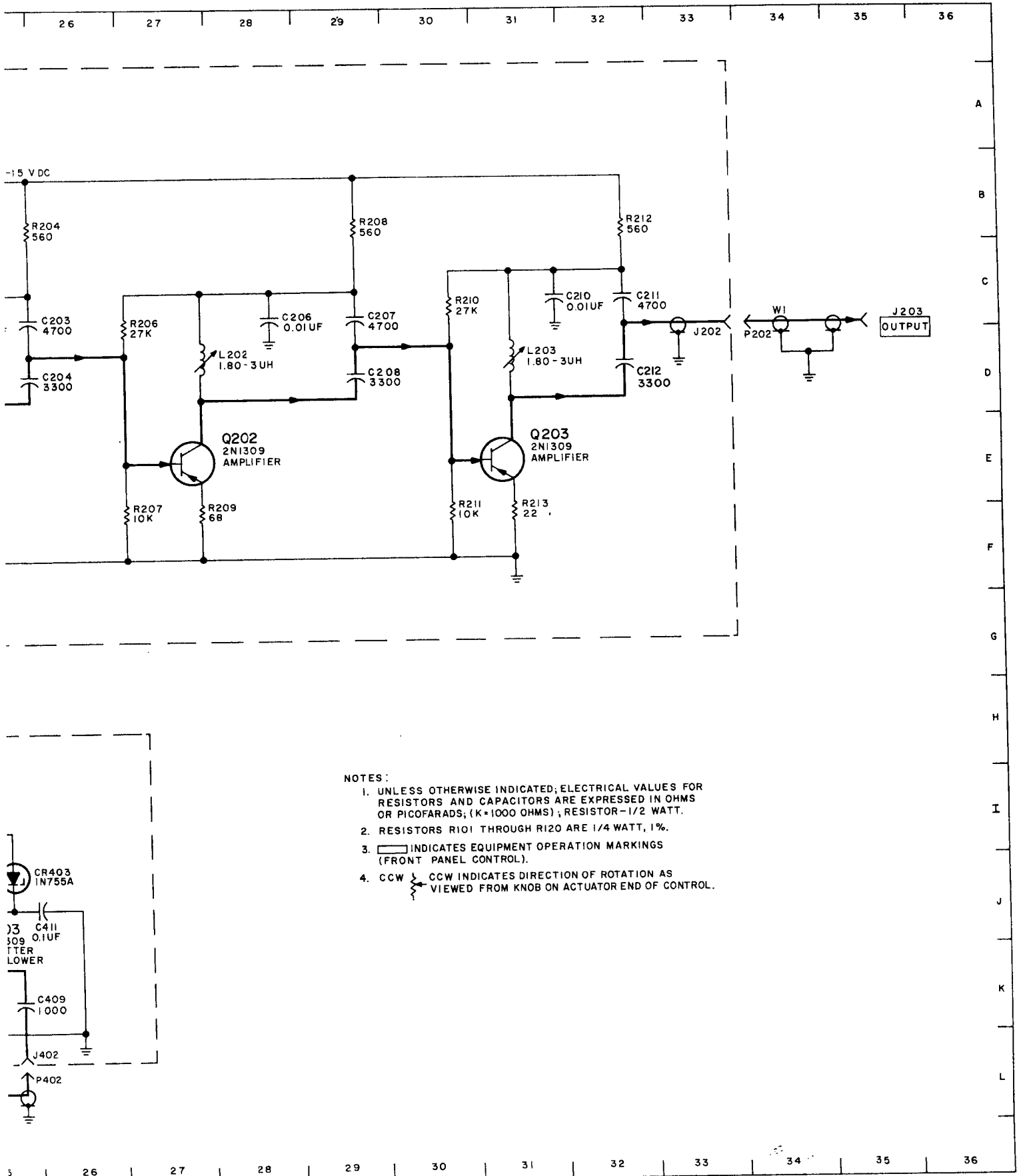
NDEX

REF DESIG	LOC
R115	12F
R116	11E
R117	9E
R118	9E
R119	9F
R120	9E
R121	17F
R122	17G
R124	14F
R125	15D
R126	15E
R127	18F
R201	23D
R202	23F
R203	24F
R204	25B
R206	27C
R207	27F
R208	29B
R209	27F
R210	30C
R211	30F
R212	32B
R213	31F
R214	23F
R301	9K
R302	11J
R401	16J
R402	20I
R403	20J
R404	15J
R405	22I
R406	21K
R407	15J
R408	22I
R409	23J
R410	23J
R411	24K
R412	25K
R414	15K
R415	16K
S101	16C
S102	12C
S103	10F
S104	16E
S301	3E, F, H, I, K, L
T101	15F
T102	17E
T301	8I
TP301	7L











NOTES:

1. UNLESS OTHERWISE INDICATED; ELECTRICAL VALUES FOR RESISTORS AND CAPACITORS ARE EXPRESSED IN OHMS OR PICO FARADS; (K=1000 OHMS); RESISTOR-1/2 WATT.
2. RESISTORS R101 THROUGH R120 ARE 1/4 WATT, 1%.
3.  INDICATES EQUIPMENT OPERATION MARKINGS (FRONT PANEL CONTROL).
4.  CCW INDICATES DIRECTION OF ROTATION AS VIEWED FROM KNOB ON ACTUATOR END OF CONTROL.

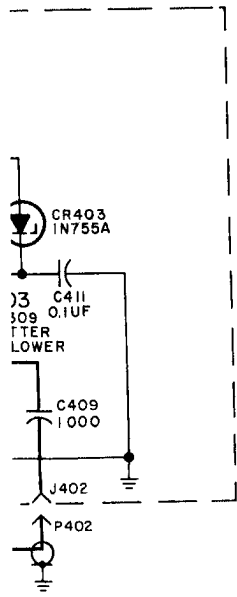


Figure 5-1. Electronic Frequency Converter, Overall Schematic Diagram



5-3. REPAIR AND REPLACEMENT.

None of the parts of the converter should be repaired. All parts are to be replaced. Standard techniques are adequate. No special procedures are required for assembly, disassembly or replacement. After replacing a defective part, refer to the adjustment procedures in paragraph 5-2b to assure proper operation of the equipment.

5-4. ILLUSTRATIONS.

a. PART LOCATION. - To facilitate the location of parts when replacement is necessary, the following illustrations are provided:

(1) Front view of operating controls and indicators, figure 3-1.

(2) Bottom view of Electronic Frequency Converter CV-2353/U, figure 5-2.

(3) Top view of printed circuit boards, figure 5-3.

b. OVERALL SCHEMATIC DIAGRAM. - Figure 5-1 is an overall schematic diagram of the equipment. The major signal paths are indicated by heavy lines and the direction of signal flow by arrows.

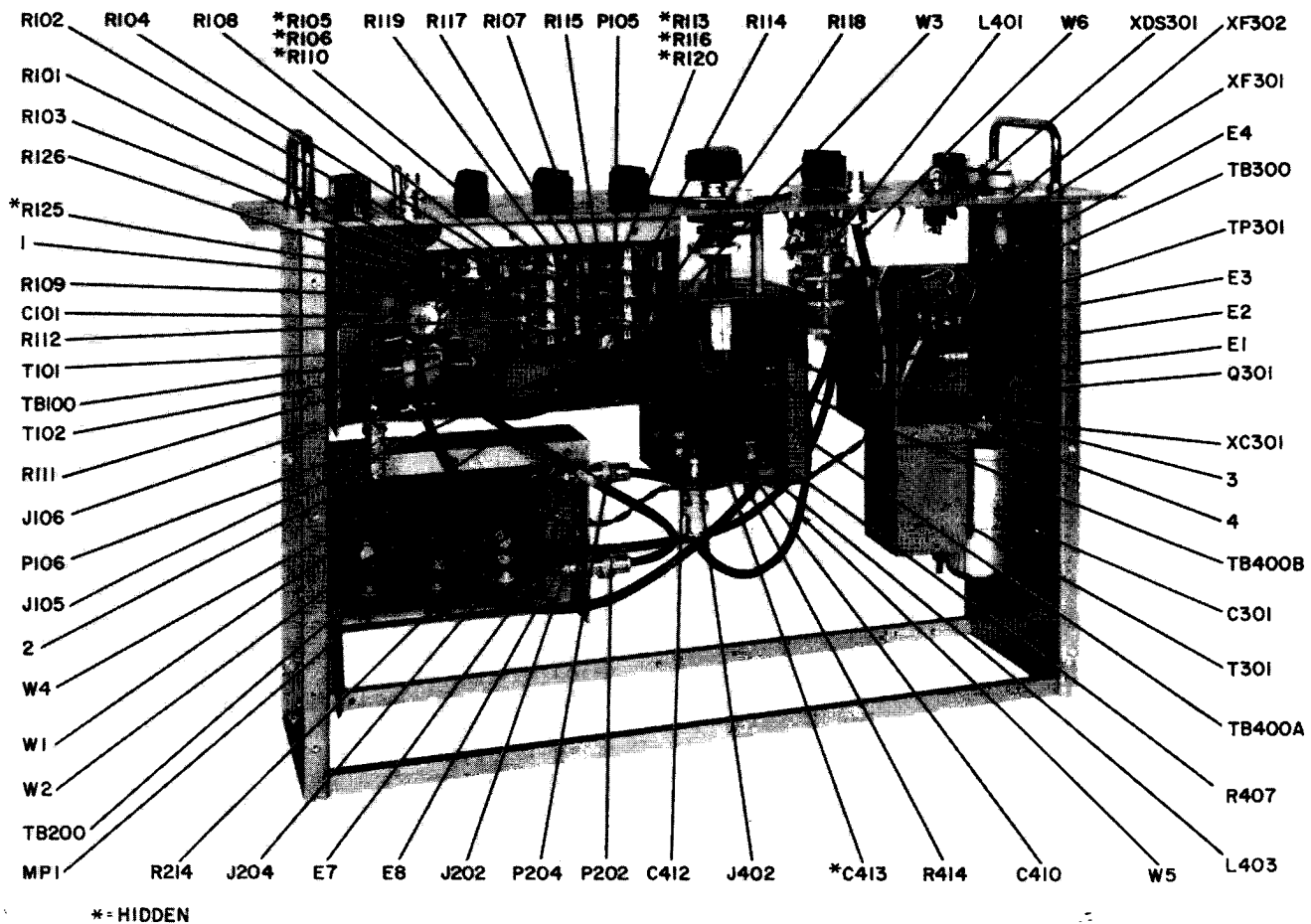


Figure 5-2. Electronic Frequency Converter, Bottom View

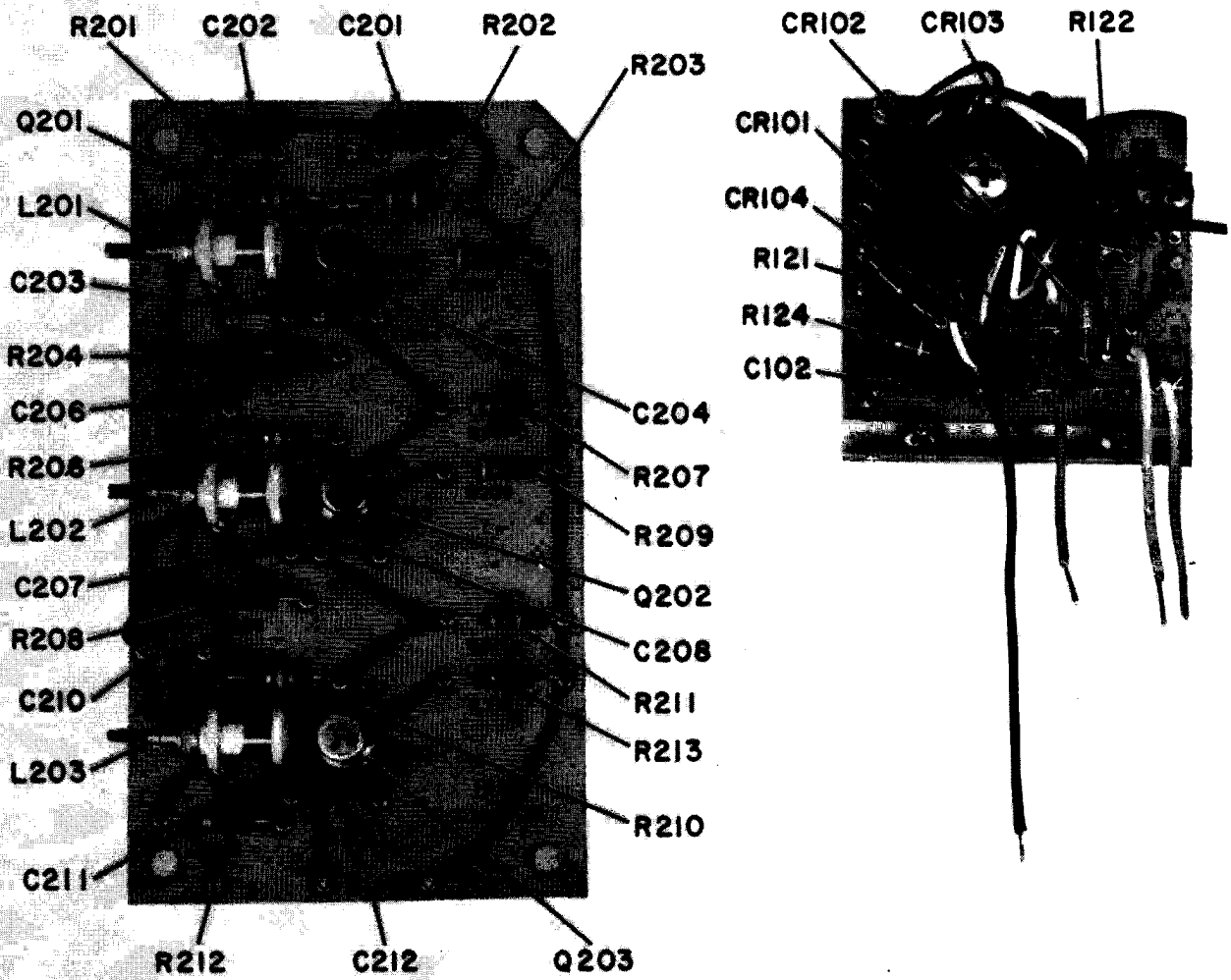


Figure 5-3. Printed Circuit Board Parts Location (Sheet 1 of 2)

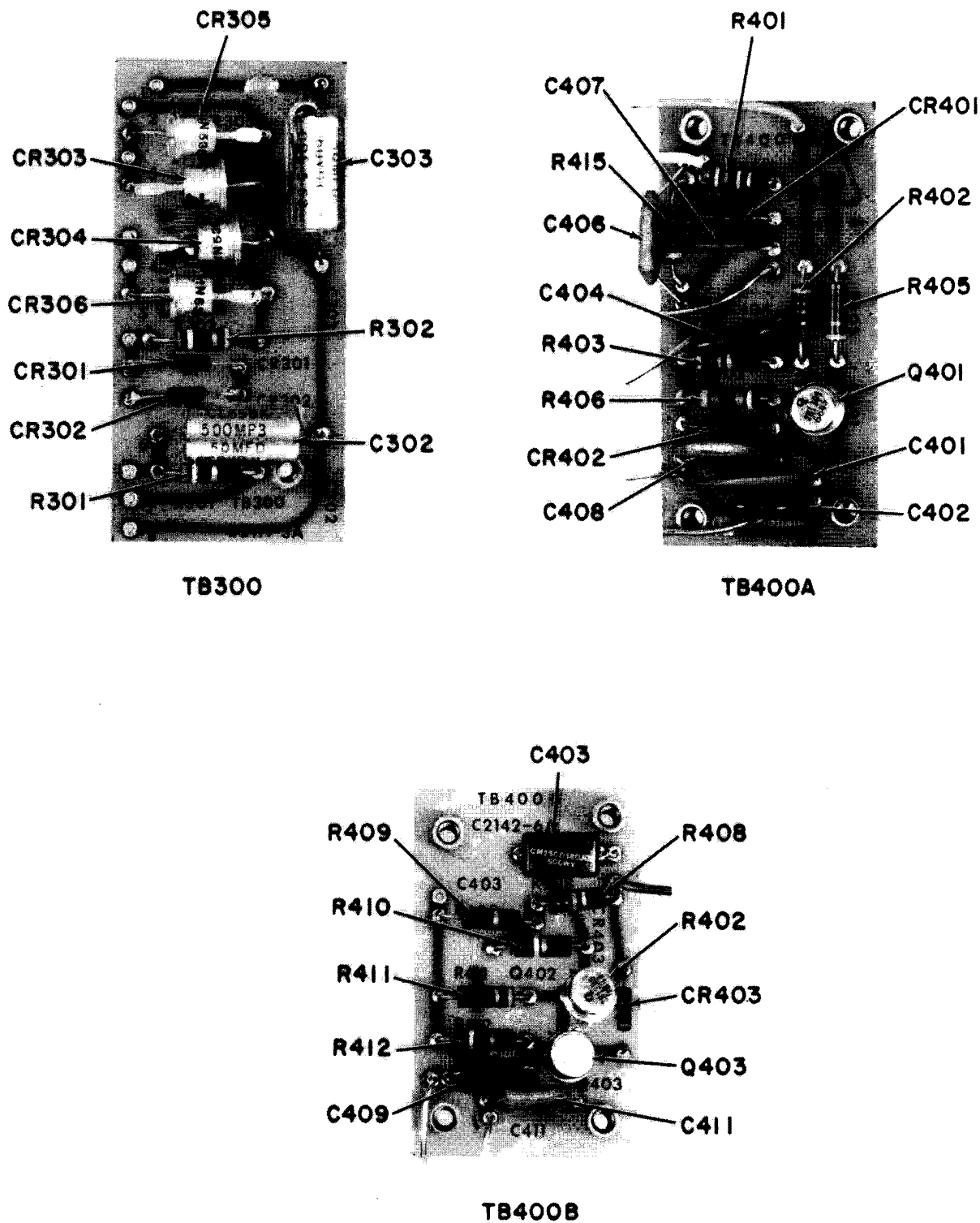


Figure 5-3. Printed Circuit Board Parts Location (Sheet 2 of 2)



TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## ATTENUATOR MIXER, D2174 (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
CR102		SEMICONDUCTOR DEVICE: SAME AS CR101	5-3, SH. 1
CR103		SEMICONDUCTOR DEVICE: SAME AS CR101	5-3, SH. 1
CR104		SEMICONDUCTOR DEVICE: SAME AS CR101	5-3, SH. 1
C101		CAPACITOR: 81349 NO. CV11D450	5-2
C102		CAPACITOR: 81349 NO. CM15D100J	5-3, SH. 1
E11		TERMINAL, TEFLON: 12615 NO. 29P1071	5-1
E12		TERMINAL, TEFLON: SAME AS E11	5-1
E13		TERMINAL, TEFLON: SAME AS E11	5-1
J101		CONNECTOR, BINDING POST: RED; 58470 NO. DF30RC	3-1
J102		CONNECTOR, BINDING POST: SAME AS J101	3-1
J103		CONNECTOR, BINDING POST: BLACK; 58474 NO. DF30BC	3-1
J104		CONNECTOR: 81349 NO. UG1094A/U	3-1
J105		CONNECTOR: 81349 NO. UG909A/U	5-2
J106		CONNECTOR: SAME AS J105	5-2
J107		CONNECTOR: SAME AS J105	3-1
P105		CONNECTOR: 81349 NO. UG88/U	5-2
P106		CONNECTOR: SAME AS P105	5-2
R101		RESISTOR: 81349 NO. RN60B2151F	5-2
R102		RESISTOR: 81349 NO. RN60D1820F	5-2
R103		RESISTOR: SAME AS R102	5-2
R104		RESISTOR: SAME AS R101	5-2
R105		RESISTOR: 81349 NO. RN60B1151F	5-2
R106		RESISTOR: 81349 NO. RN60B4220F	5-2
R107		RESISTOR: SAME AS R106	5-2
R108		RESISTOR: SAME AS R105	5-2
R109		RESISTOR: SAME AS R105	5-2
R110		RESISTOR: SAME AS R106	5-2
R111		RESISTOR: SAME AS R106	5-2
R112		RESISTOR: SAME AS R105	5-2

TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## ATTENUATOR MIXER, D2174 (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
R113		RESISTOR: 81349 NO. RN60B7320F	5-2
R114		RESISTOR: 81349 NO. RN60B1471F	5-2
R115		RESISTOR: SAME AS R114	5-2
R116		RESISTOR: SAME AS R113	5-2
R117		RESISTOR: SAME AS R105	5-2
R118		RESISTOR: SAME AS R106	5-2
R119		RESISTOR: SAME AS R106	5-2
R120		RESISTOR: SAME AS R105	5-2
R121		RESISTOR: 81349 NO. RC20GF561J	5-3, SH. 1
R122		RESISTOR: SAME AS R121	5-3, SH. 1
R124		RESISTOR: 81349 NO. RC20GF242J	5-3, SH. 1
R125		RESISTOR: 81349 NO. RC20GF621J	5-2
R126		RESISTOR: 81349 NO. RC20GF750J	5-2
R127		RESISTOR: 81349 NO. RV4NAYSG501A	3-1
S101		SWITCH, ROTARY: 4 POLE, 2 POSITION; 71590 NO. PA1012	3-1
S102		SWITCH, ROTARY: 8 POLE, 3 POSITION; 71590 NO. PA1026	3-1
S103		SWITCH, ROTARY; SAME AS S102	3-1
S104		SWITCH: 96906 NO. MS25098-23	3-1
TB100		PRINTED CIRCUIT BOARD: 06181 NO. B2177	5-2
T101		TRANSFORMER, MIXER: 06181 NO. C2170-1	5-2
T102		TRANSFORMER, MIXER: 06181 NO. C2170-2	5-2

## IF AMPLIFIER, C2127

2		AMPLIFIER, IF: 06181 NO. C2127	5-2
C201		CAPACITOR: 81349 NO. CK63AW103K	5-3, SH. 1
C202		CAPACITOR: SAME AS C201	5-3, SH. 1
C203		CAPACITOR: 81349 NO. CK62AW472K	5-3, SH. 1
C204		CAPACITOR: 81349 NO. CK62AW332K	5-3, SH. 1
C206		CAPACITOR: SAME AS C201	5-3, SH. 1
C207		CAPACITOR: SAME AS C203	5-3, SH. 1

TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## IF AMPLIFIER, C2127 (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
C208		CAPACITOR: SAME AS C204	5-3, SH. 1
C210		CAPACITOR: SAME AS C201	5-3, SH. 1
C211		CAPACITOR: 81349 NO. CK62AW472K	5-3, SH. 1
C212		CAPACITOR: SAME AS C204	5-3, SH. 1
E7		TERMINAL, TEFLON: SAME AS E11	5-2
E8		TERMINAL, TEFLON: SAME AS E11	5-2
J202		CONNECTOR: SAME AS J104	5-2
J203		JACK, OUTPUT: 06181 NO. C2152	3-1
J204		CONNECTOR: SAME AS J104	5-2
L201		INDUCTOR, VARIABLE: 1.80 - 3.00 UH; 71279 NO. 3370-10	5-3, SH. 1
L202		INDUCTOR, VARIABLE: SAME AS L201	5-3, SH. 1
L203		INDUCTOR, VARIABLE: SAME AS L201	5-3, SH. 1
MP1		TOOL, TUNING: 06181 NO. C2734-2	5-2
P202		CONNECTOR: SAME AS P105	5-2
P204		CONNECTOR: SAME AS P105	5-2
Q201		TRANSISTOR: 81349 NO. 2N1309	5-3, SH. 1
Q202		TRANSISTOR: SAME AS Q201	5-3, SH. 1
Q203		TRANSISTOR: SAME AS Q201	5-3, SH. 1
R201		RESISTOR: 81349 NO. RC20GF273J	5-3, SH. 1
R202		RESISTOR: 81349 NO. RC20GF103J	5-3, SH. 1
R203		RESISTOR: 81349 NO. RC20GF680K	5-3, SH. 1
R204		RESISTOR: 81349 NO. RC20GF561K	5-3, SH. 1
R206		RESISTOR: SAME AS R201	5-3, SH. 1
R207		RESISTOR: SAME AS R202	5-3, SH. 1
R208		RESISTOR: SAME AS R204	5-3, SH. 1
R209		RESISTOR: SAME AS R203	5-3, SH. 1
R210		RESISTOR: SAME AS R201	5-3, SH. 1
R211		RESISTOR: SAME AS R202	5-3, SH. 1
R212		RESISTOR: SAME AS R204	5-3, SH. 1

TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## IF AMPLIFIER, C2127 (Cont)

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
R213		RESISTOR: 81349 NO. RC20GF220J	5-3, SH. 1
R214		RESISTOR: 81349 NO. RC20GF201J	5-3, SH. 1
TB200		PRINTED CIRCUIT BOARD: 06181 NO. C2129-1	5-2

## POWER SUPPLY, C2122

3		POWER SUPPLY: 06181 NO. C2122	5-2
CA301		CABLE ASSEMBLY, POWER: 06181 NO. B2153	
CA301P303		CONNECTOR: 96906 NO. MS3106A14S7S	5-1
CA301P304		CONNECTOR: 81349 NO. UP121M	5-1
CA301W301		CABLE: 81349 NO. C0-03LG (3/18) 0260	
CR301		SEMICONDUCTOR DEVICE: 81349 NO. 1N972B	5-3, SH. 2
CR302		SEMICONDUCTOR DEVICE: 81349 NO. 1N966B	5-3, SH. 2
CR303		SEMICONDUCTOR DEVICE: 81349 NO. 1N538	5-3, SH. 2
CR304		SEMICONDUCTOR DEVICE: SAME AS CR303	5-3, SH. 2
CR305		SEMICONDUCTOR DEVICE: SAME AS CR303	5-3, SH. 2
CR306		SEMICONDUCTOR DEVICE: SAME AS CR303	5-3, SH. 2
C301		CAPACITOR: 81349 NO. CE51E501G	5-2
C302		CAPACITOR: 81349 NO. CL65BK50MP3	5-3, SH. 2
C303		CAPACITOR: SAME AS C302	5-3, SH. 2
DS301		LAMP: 96906 NO. MS25252NE2D	3-1
E1		TERMINAL, TEFLON: SAME AS E11	5-2
E2		TERMINAL, TEFLON: SAME AS E11	5-2
E3		TERMINAL, TEFLON: SAME AS E11	5-2
E4		TERMINAL, TEFLON: SAME AS E11	5-2
F301		FUSE, CARTRIDGE: 1/4 AMP, 250 V; 71400 NO. 3AG	3-1
F302		FUSE, CARTRIDGE: SAME AS F301	3-1
J303		CONNECTOR: 96906 NO. MS3102A14S7P	3-1
Q301		TRANSISTOR: 81349 NO. 2N297A	5-2
Q302		TRANSISTOR: SAME AS Q301	5-2
R301		RESISTOR: 81349 NO. RC20GF392K	5-3, SH. 2



TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## POWER SUPPLY, C2122

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
R302		RESISTOR: SAME AS R301	5-3, SH. 2
S301		SWITCH, ROTARY: 2 POLES, 5 SECTIONS; 27191 NO. 399713JC	3-1
TB300		PRINTED CIRCUIT BOARD: 06181 NO. C2119-2	5-2
TP301		JACK, TIP: 83330 NO. 1505-102	5-2
T301		TRANSFORMER: 81349 NO. TF4RX02EA	5-2
XC301		SOCKET: 81349 NO. TS101P01	5-2
XDS301		LIGHT, INDICATOR: ACCOMODATES NEON LAMP, P/N MS25252NE2D; 72619 NO. LH74LC130M	5-2
XF301		FUSEHOLDER: ACCOMODATES 1/4 AMP, 3AG FUSE; 71400 NO. FHN26G	5-2
XF302		FUSEHOLDER: SAME AS XF301	5-2

## OSCILLATOR, C2132

4		OSCILLATOR: 06181 NO. C2132	5-2
CR401		SEMICONDUCTOR DEVICE: 81349 NO. 1N4800A	5-3, SH. 2
CR402		SEMICONDUCTOR DEVICE: 81349 NO. 1N962B	5-3, SH. 2
CR403		SEMICONDUCTOR DEVICE: 81349 NO. 1N755A	5-3, SH. 2
C401		CAPACITOR, FIXED, CERAMIC DISC: 470 PF, $\pm 5\%$ , 1000 WVDC; 56289 NO. 10TCUT47	5-3, SH. 2
C402		CAPACITOR: 81349 NO. CM20E182J	5-3, SH. 2
C403		CAPACITOR: 81349 NO. CM15C180J	5-3, SH. 2
C404		CAPACITOR: 81349 NO. CM20E102J	5-3, SH. 2
C406		CAPACITOR, FIXED, CERAMIC DISC: 0.1 UF, $\pm 20\%$ 50 WVDC; 56289 NO. TG-P10	5-3, SH. 2
C407		CAPACITOR: SAME AS C201	5-3, SH. 2
C408		CAPACITOR: SAME AS C406	5-3, SH. 2
C409		CAPACITOR: SAME AS C404	5-3, SH. 2
C410		CAPACITOR: SAME AS C201	5-2
C411		CAPACITOR: SAME AS C406	5-3, SH. 2
C412		CAPACITOR: 81349 NO. CM06E561J	5-2
C413		CAPACITOR: 81349 NO. CM06E821J	5-2
E5		TERMINAL, TEFLON: SAME AS E11	5-1

TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

OSCILLATOR, C2132

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
E6		TERMINAL, TEFLON: SAME AS E11	5-1
J402		CONNECTOR: SAME AS J104	5-2
J403		CONNECTOR: SAME AS J105	3-1
L401		INDUCTOR, VARIABLE: 0.7 - 1.4 UH; 06181 NO. B2137A	5-2
L403		INDUCTOR, FIXED: 5MH; 71895 NO. 2500-62	5-2
P402		CONNECTOR: SAME AS P105	5-2
Q401		TRANSISTOR: SAME AS Q201	5-3, SH. 2
Q402		TRANSISTOR: SAME AS Q201	5-3, SH. 2
Q403		TRANSISTOR: SAME AS Q201	5-3, SH. 2
R401		RESISTOR: 81349 NO. RC20GF474K	5-3, SH. 2
R402		RESISTOR: 81349 NO. RC20GF753K	5-3, SH. 2
R403		RESISTOR: 81349 NO. RC20GF473K	5-3, SH. 2
R404		RESISTOR: VARIABLE: 10 TURNS, 50K; 12697 NO. 26JA50K	3-1
R405		RESISTOR, 81349 NO. RC20GF102K	5-3, SH. 2
R406		RESISTOR: 81349 NO. RC20GF562J	5-3, SH. 2
R407		RESISTOR: 81349 NO. RV4LAYS253A	5-2
R408		RESISTOR: 81349 NO. RC20GF223K	5-3, SH. 2
R409		RESISTOR: 81349 NO. RC20GF822K	5-3, SH. 2
R410		RESISTOR: 81349 NO. RC20GF124K	5-3, SH. 2
R411		RESISTOR: 81349 NO. RC20GF272K	5-3, SH. 2
R412		RESISTOR: 81349 NO. RC20GF241J	5-3, SH. 2
R414		RESISTOR: 81349 NO. RC20GF333J	5-2
R415		RESISTOR: 81349 NO. RC20GF105J	5-3, SH. 2
TB400A		PRINTED CIRCUIT BOARD: 06181 NO. C2142-1	5-2
TB400B		PRINTED CIRCUIT BOARD: 06181 NO. C2142-4	5-2

TABLE 6-1. MAINTENANCE PARTS LIST (Cont)

## CABLE ASSEMBLIES

REF DESIG	NOTES	NAME AND DESCRIPTION	FIG. NO.
W1		CABLE ASSEMBLY: 06181 NO. 2152W1	5-2
W2		CABLE ASSEMBLY: 06181 NO. 2152W2	5-2
W3		CABLE ASSEMBLY: 06181 NO. 2152W3	5-2
W4		CABLE ASSEMBLY: 06181 NO. 2152W4	5-2
W5		CABLE ASSEMBLY: 06181 NO. 2152W5	5-2
W6		CABLE ASSEMBLY: 06181 NO. 2152W6	5-2

TABLE 6-2. LIST OF MANUFACTURERS

MFR CODE	NAME	ADDRESS
06181	Probescope Co., Inc.	211 Robbins Lane Syosset, N. Y. 11791
12615	U. S. Terminals, Inc.	7504 Camargo Road Cincinnati, Ohio 45243
12697	Clarostat Mfg. Co., Inc.	Lower Washington Street Dover, N. H. 03820
27191	Cutler-Hammer, Inc. Power Distribution and Control Division	4201 N. 27th St. Milwaukee, Wis. 53216
56289	Sprague Electric Co.	Marshall Street North Adams, Mass. 01247
58474	Superior Electric Co.	383 Middle Street Bristol, Conn. 06010
71279	Cambridge Thermionic Corp.	445 Concord Ave. Cambridge, Mass. 02138
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	2536 W. University St. St. Louis, Mo. 63017
71590	Globe-Union, Inc. Centralab Division	P. O. Box 591 Milwaukee, Wis. 53201
71895	Delavan Mfg. Co.	811 Fourth Street West Des Moines, Iowa 50265
72619	Dialight Corp.	60 Stewart Ave. Brooklyn, N. Y. 11237
81349	Military Specification	
83330	Herman H. Smith, Inc.	812 Snediker Ave. Brooklyn, N. Y. 11207
96906	Military Standards	