UNCLASSIFIED

TECHNICAL MANUAL

FOR

MODEL RG-1

RECEIVER GENERATOR

DELTA ELECTRONICS, INC.
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ALEXANDRIA, VIRGINIA

D93-83

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SECTION 1

GENERAL

1.1 The Delta Electronics Model RG-1 Receiver/Generator is a portable combination signal generator and receiver designed for use with impedance measuring bridges in broadcast antenna measurements. The signal generator has high output power. The receiver's metering and AGC circuits are optimized for null detector service and the receiver is heavily shielded to provide maximum null accuracy. The major features of the RG-1 are:

BATTERY POWER SUPPLY = Heavy duty Ni-Cad batteries with a built-in charger (115 Vac) provide an average 8 hours continuous operation. The batteries may be recharged many hundreds of times and will normally never require replacement.

HI-LEVEL SIGNAL GENERATOR = A linear power amplifier provides a minimum of 2 watts rf output (10 volts at 50 ohms) CW or 90% AM modulated (internal modulator).

TRACKING RECEIVER = The solid state receiver is tuned by the same oscillator used for the signal generator for 1 knob tuning. High Q ceramic IF filters provide sharp selectivity for rejection of interfering signals.

METERING = A High gain metering circuit with optimum time constant meters the receiver IF output for null indication for bridge measurements. The same meter also monitors the generator rf output voltage and the battery voltage.

1.2 The Model RG-1 provides unprecedented convenience of measurement and transportability when used in conjunction with any conventional impedance bridge in the broadcast band. The high level generator helps in overcoming the interfering signals on the antenna. When combined with the Delta Electronics Model OIB-1 Operating Impedance Bridge a dramatic improvement in signal to noise ratio is realized. The Model OIB-1's unique patented circuit places the generator directly in parallel with the interfering signals on the antenna so that the interfering signals must compete with the 2 watt output of the generator; in other bridges the generator signal is attenuated by the measuring network before being compared with the interfering signals.

SECTION 2

SPECIFICATIONS

MODEL AND NAME:	RG-1 RECEIVER/GENERATOR
FREQUENCY RANGE:	0.5 to 1.7 MHz in 2 Bands BAND 1 0.5 to 1.1 MHz BAND 2 1.1 to 1.7 MHz
FREQUENCY ACCURACY:	±2%
FREQUENCY CONTROL:	High Stability 5 MHz Variable Master Oscillator with crystal controlled converters to generate output and receiver L.O. signals.
CONTROLS:	TUNING Main Dial calibrated in 10 kHz steps VERNIER Nominal ±30 kHz in 5 kHz steps for incremental measurements.
IMPEDANCE (INPUT & OUTPUT):	50 ohms - Type BNC receptacles.
GENERATOR:	Solid State Linear Amplifier
OUTPUT LEVEL:	Adjustable: 10V RMS (2 watts) into 50Ω >20V RMS open circuit
MODULATION:	250 Hz, 90% A.M.
CONTROLS:	OFF-CW-MOD Switch GEN LEVEL Output Control
DETECTOR:	Solid State Super-Het. 455 kHz IF with ceramic piezoelectric filters. Special AGC circuit for bridge null indication.
SENSITIVITY:	5 µV Nominal
SELECTIVITY:	-3 dB at ±1.3 kHz Nominal -45 dB at ±10 kHz Nominal
BFO:	Variable frequency BFO
CONTROLS:	BFO Off/On and Pitch Control RF GAIN RF and IF gain control AF GAIN AF gain control
OUTPUT:	Internal Speaker or Headphones connected to front panel telephone jack.
METERING:	Sensitive Front Panel Meter Monitors: Receiver - AGC Metering for sensitive null indication. Generator - Meters RF output voltage (25V FS). Battery - Meters DC Voltage as indication of battery charge
CONTROL:	RCVR-GEN-BAT Switch
POWER:	Internal 12.6 Vdc rechargeable NI-CAD batteries for 8 hour operation. Internal charger for operation from 100-130 Vac (14 hour charge from full discharge).
PHYSICAL:	Heavy gage weatherproof aluminum case. Size: 13.5"W, 8"D, 12"H (Exc. Handle). Weight: 21 pounds (with battery supply).

SECTION 3

THEORY OF OPERATION

3.1 SYSTEM OPERATION

3.1.1 Figure 6-1 is the Schematic Diagram of the complete RG-1. This diagram shows the inter-relationships between the various subassemblies and the frequencies at the different subassemblies. The Variable Frequency Oscillator, A2, generates the control signal for both the receiver and generator to assure tracking of both sections. The VFO tunes over the frequency range of 5 to 4.4 MHz.

3.1.2 The output from the VFO is fed to the two converters (A3 and A7) where it is subtracted from a crystal controlled converter oscillator signal to produce the desired output signal. Two oscillators in each converter (5.5 and 6.1 MHz for the Generator Converter, A7; and 5.995 and 6.555 MHz for the Receiver Converter, A3) provide the two output bands (Low Band = 0.5→1.1 MHz; High Band = 1.1→1.7 MHz). The two converter's oscillators are offset by 455 kHz to provide the receiver local oscillator (L.O.) signal for the 455 kHz I.F. amplifier.

3.2 VARIABLE FREQUENCY OSCILLATOR

Figure 6-2 is the Schematic Diagram for the Variable Frequency Oscillator, A2. The oscillator, Q1*, drives the output buffed stage, Q2. The frequency determining tank circuit is designed to provide vernier dial linearity independent of the setting of the main tuning dial, C2.

3.3 CONVERTER

3.3.1 Figure 6-3 is the Schematic Diagram for the two converters A3 and A7 (the circuits are essentially identical). The first two stages, Q1 and Q2, form an isolation amplifier that produces greater than 100 dB isolation. This large amount of isolation is required to prevent the generator output signal from leaking back into the generator receiver stages thru the common VFO connection.

3.3.2 In the generator converter, A7, the first stage, Q1, also serves as a modulator stage to modulate the generator's output.

3.3.3 Band switch, S1, turns on either of the two crystal controlled oscillators by grounding the emitter of Q4 or Q5. The converter signal selected is mixed with the VFO signal in the mixer stage, Q3. The output filter following the mixer stage removes the undesired harmonics and spurious signals and passes on the desired signal which is the VFO's frequency subtracted from the converter frequency. Since the frequency conversion is one of subtraction, the output frequency increases as the VFO frequency decreases.

3.4 RECEIVER RF AMP

3.4.1 Figure 6-4 is the Schematic Diagram of the receiver's rf Amplifier, A4. The AGC controlled rf amplifier, Q1, is coupled to the receiver input connector thru the tuned circuit formed by L1 and L2 as selected by the band switch. The output of Q1 is another tuned circuit (L3 or L4) to provide additional selectivity.

*NOTE: In this discussion the prefix ("A2", "A3", etc) is omitted from the reference designation. For instance, transistor Q1 in the Variable Frequency Oscillator A2 is properly identified as "A2Q1".

3.4.2 The amplified rf signal is converted to the IF frequency by mixing with the L.O. signal in mixer stage Q2. The L.O. signal is 455 kHz above the rf signal; the difference signal is fed thru the tuned IF transformer, TI, to the IF/AF amplifier, A5.

3.5 IF/AUDIO AMPLIFIER

3.5.1 Figure 6-5 is the Schematic Diagram of the IF/Audio Amplifier, A5. The first three stages (Q1, Q2 and Q3) are the AGC'd IF amplifier. High selectivity at 455 kHz is produced by the piezoelectric ceramic filters FL1, FL2, and FL3. The output of the IF amp is detected by diodes CR1 and CR2 and, after appropriate filtering, is fed to the integrated circuit audio amplifier AR1.

3.5.2 Transistor Q4 performs two separate circuit functions: First, the dc component of the signal detected by CR1 and CR2 is amplified by Q4 and is fed back to the preceding stages as the AGC signal. Second, a sample of the 455 kHz IF signal is fed into Q4 thru capacitor C8. The amplified IF signal is detected by diode CR3 and drives the metering circuit thru emitter follower Q6. This method of metering signal level provides a meter indication that is particularly well suited to null indication for bridge measurements.

3.5.3 Transistor Q5 is the beat frequency oscillator (BFO). The frequency is controlled by ceramic filter FL4. The output frequency is varied around 455 kHz by varying the transistor's base bias and thus it's input impedance.

3.6 POWER AMPLIFIER

3.6.1 Figure 6-6 is the Schematic Diagram of the Power Amplifier, A6. Transistor Q1 receives the signal from the Generator Converter, A7, and drives the push-pull power amplifier stage, Q2 and Q3.

3.6.2 Diode CR2 detects the output rf voltage and drives the metering circuit. Transistor Q4 is a phase shift RC oscillator which generates the modulation signal of approximately 250 Hz. The audio signal is coupled to the Generator Converter thru emitter follower Q5.

SECTION 4

OPERATING INSTRUCTIONS

4.1 GENERAL

The Model RG-1 is very simple to operate. It consists of a transistorized radio receiver combined with a signal generator. The receiver controls and the controls common to the receiver and generator are labeled in black on the front panel and the signal generator controls are labeled in red.

4.2 POWER SUPPLY

4.2.1 The unit is powered by an internal Ni-Cad rechargeable battery. Power is applied when the POWER switch is thrown to the ON position. When the batteries are completely charged the unit will operate for a nominal eight hours with the generator and audio levels reduced. Four hours continuous operation is typical at sustained maximum generator and audio levels. The condition of battery charge is indicated when the METER switch is on the BAT position. The meter indicates within the green band for a satisfactory charge condition. The POWER switch should always be turned OFF whenever not operating to minimize battery drain. The large power drain imposed by the signal generator does not permit the extremely long battery life typical of common transistorized portable receivers. A switch automatically turns the power off whenever the lid of the case is closed to prevent accidental storage of the unit while turned on.

4.2.2 The battery is recharged with a built in charger by connecting the ac cord (supplied) to the front panel receptacle and plugging into any standard 115 V, 50/60 Hz source. The charger operates regardless of the position of the POWER switch. The unit may be operated while on charge; however, at full generator output the discharge from the batteries exceeds the charging rate of the battery charger so that a net battery discharge may result. From full discharge, a charging period of 14 hours is required to completely charge the batteries. Leaving the unit on charge for a longer period of time will not cause any damage since the batteries' charge is automatically limited. A Ni-Cad battery will typically lose 50% of its charge in three months; thus, after a long period of storage the unit should be recharged before use.

4.3 CONNECTIONS

The GEN OUT connector connects to the input of the rf bridge.

CAUTION: The high output level of the Model RG-1's generator may damage some bridges. If used with other than a Delta Electronics Model OIB-1 Operating Impedance Bridge, check the bridge's operating instructions before applying full (10V across 50 ohms, 20V open circuit) voltage to the bridge.

Rf voltage is often developed across broadcast towers by coupling from nearby operating transmitters. When measurements are being made with an Operating Impedance Bridge (Delta Model OIB-1 or equivalent) the voltage across the tower is connected directly to the bridge's input terminal. If the voltage is greater than 30 V rms it may damage the RG-1's generator even if the generator isn't turned on. Such voltage will be indicated on the RG-1's meter when the METER *switch is on the* GEN *position. If the meter reads greater than full scale when the RG-1* GEN OUT *is connected to the bridge, immediately disconnect the* GEN OUT *cable and do not attempt to use the RG-1's generator under these circumstances.*

The RCVR IN connector attaches to the bridge's output or "detector" terminal. Special four foot double shielded coaxial leads are supplied with the RG-1 for these two connections. These leads should be used to provide maximum shielding against stray coupling which may cause bridge reading inaccuracies. Longer double shielded leads are available from Delta Electronics on special order or may be assembled with UG-88/U BNC plugs and Amphenol 21-738 coaxial cable. A Delta Part No. D81-13 adapter (optional accesory) is required for connecting the GEN OUT to the Delta Model OIB-1 IN when this bridge is used. Adapters for BNC to the connector type required for other bridges are available either from Delta Electronics or from the bridge's manufacturer.

4.4 RECEIVER

4.4.1 TUNING. The frequency range is covered in two bands as selected with the BAND switch. The LOW band covers 0.5 to 1.1 MHz, the HIGH band covers 1.1 to 1.7 MHz. The main TUNING dial is calibrated in 10 kHz increments. The VERNIER dial is calibrated in 5 kHz increments and has a nominal tuning range of ± 30 kHz.

4.4.2 BFO. The BFO circuit is turned off when the BFO knob is clicked into the full counterclockwise position. When turned on, the BFO control varies the frequency of the Beat Frequency Oscillator. Since the BFO signal is indicated on the metering circuit, the meter circuit may not be used to indicate a null when the BFO is being used.

4.4.3 RF GAIN CONTROL. When the RF GAIN control is in the full clockwise position maximum rf gain is available and the internal AGC has maximum effect. As the RF GAIN control is rotated counterclockwise, the gain is reduced and the AGC circuit has less effect. This control must be reduced to prevent overloading of the receiver front end with extremely strong signals.

4.4.4 AF GAIN. The AF GAIN controls adjusts the output level of the audio amplifier (maximum output when control fully clockwise). Plugging headphones into the PHONE connector on the front panel disconnects the speaker and transfers the audio into the headphones.

4.4.5 METER. When the METER switch is on the RCVR position the meter monitors the receiver's IF signal level. The metering circuit has been carefully designed to serve as a null indicator for making bridge measurements. Under most circumstances a bridge reading may be made using the meter indication instead of listening for an aural null.

4.5 GENERATOR

4.5.1 TUNING. The generator tracks frequency exactly with the receiver tuning.

4.5.2 SWITCHING. The GEN switch controls the output of the generator. In the CW position, the generator is turned on without modulation. In the MOD position the generator output is AM modulated with a 250 Hz tone. This low frequency tone is used to maximize the sharpness of the null by minimizing dispersion of the sidebands. In the OFF position, all power is removed from the generator's power amplifier to minimize battery drain.

4.5.3 LEVEL CONTROL. The GEN LEVEL control sets the generator output level (maximum in clockwise position). The output voltage is direct reading (25V rms full scale) on the meter when the METER switch is in the GEN position. Since the battery drain is a function of generator level, the level should be held at the minimum required to maximize operating time.

SECTION 5
MAINTENANCE

5.1 GENERAL

The Model RG-1 Receiver/Generator is considerably more complex than a conventional transistorized receiver and thus is more difficult to adjust and/or repair. The techniques required to align the various stages and filters require special equipment and skills that are not normally available in the field. The RG-1 should be returned to the factory for any repairs or adjustments required other than the adjustments described below (VFO caliabration and Receiver RF Amp alignment):

5.2 VFO CALIBRATION

5.2.1 In the event the main TUNING dial requires recalibration, the VFO (A2) must be realigned. First be sure the dial and capacitors are properly lined up; with the dial against the stop in the full counter-clockwise direction the index mark at the end of the dial scale should be aligned with the index line on the window, the receiver tuning capacitor (C3, See Figure 5-2) should be fully meshed, and the VFO main tuning capacitor (C2, visiable under front edge of the VFO circuit board, A2, Figure 5-2) should be fully open. The vernier capacitor (C1, located under the VFO circuit board, A2, Figure 5-2) should be half-meshed when the VERNIER knob is mid-scale (straight up); the capacitor should engage (mesh further) as the knob is rotated clockwise. After making the visual checks, reinstall the cover on the VFO and rf amplifier sections before proceeding with the electrical adjustments (holes are provided in the cover for the alignment adjustments).

5.2.2 A method of accurately measuring the output frequency to an accuracy greater than 1 kHz is required to align the VFO. A communications receiver with a built in 100 kHz crystal controlled calibration oscillator is satisfactory for measuring the frequency. Starting with the battery fully charged, turn the RG-1 on and turn the generator on CW. Connect a piece of wire to the GEN OUT connector to serve as a radiating antenna and set the GEN LEVEL to the minimum required to produce a good signal in the receiver (connecting the generator directly to the receiver with coax is dangerous, if the generator output is accidently turned full-on the receiver's front end could easily be burned out). Set the TUNING dial to 1100 (LOW BAND) and adjust coil A2L1 (See II, Figure 5-2) to set the output frequency to 1.1 MHz. Set the dial to 600 and adjust capacitor A2C7 (See I, Figure 5-2) to set the output frequency to 0.6 MHz. Repeat these two steps alternately until the frequency is within 1 kHz at both ends of the dial. Leave the VERNIER dial set to mid-scale during these adjustments.

5.3 RECEIVER ALIGNMENT

5.3.1 If the receiver sensitivity is low, the receiver may require realignment. The internal generator provides a convenient source of signal, connect the GEN OUT to the RCVR IN thru a 50 dB (approximate) 50 Ohm pad, a suitable pad is shown in Figure 5-1.

> *Caution: Never connect the* GEN OUT *directly to the* RCVR IN*; if the generator level is accidently turned full-on the receiver front-end may be damaged.*

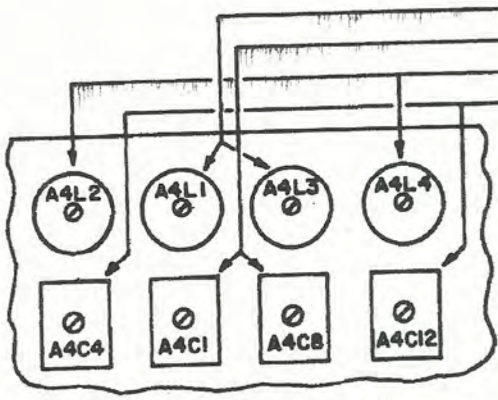
5.3.2 Set the ANT trimmer to mid-range and the RF GAIN control full clockwise. With the GEN LEVEL control full conter-clockwise throw the GEN switch to CW; METER switch to RCVR. Advance the GEN LEVEL control until the meter reads approximately half-scale; as the circuit is aligned, reduce the GEN LEVEL as required to keep the meter reading about half-scale.

5.3.3 Before proceeding with the receiver alignment, peak up the IF transformer A4T1. The transformer is located on the receiver rf amplifier board and is accessed thru the receiver converter board A3 (Figure 5-2). Remove the cover from the A3 compartment; facing the printed circuit board the access hole for A4T1 is located in the lower right-hand corner of the A3 board. Adjust A4T1 with an insulated straight blade alignment tool for a maximum meter reading (TUNING set to any frequency on either band). Replace the cover on the A3 compartment.

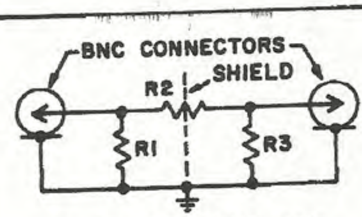
5.3.4. The receiver alignment trimmers are located on printed circuit board A4. The adjustments are accessible under the removable cover located on the rear right-hand side of the chassis above the Receiver Converter (A3) shield can (See III, Figure 5-2). A non-metallic straight blade alignment tool should be used for adjusting the trimmers.

5.3.5. The alignment trimmers are identified and the tuning frequencies given in Figure 5-1. First set the BAND switch to <u>LOW</u> and adjust the Low Band trimmers. Adjust the inductors at the low frequency for a maximum meter reading, then adjust the capacitors at the higher frequency for a maximum meter reading. Repeat the inductor and capacitor adjustments alternately until no further improvement is obtained, then set the BAND switch to <u>HIGH</u> and align the other set of trimmers. When alignment is completed, re-install the cover plate over the trimmer access hole.

BAND	DESCRIPTION	ADJUSTMENT FREQ.
LOW	INDUCTORS	600 kHz
	CAPACITORS	1000 kHz
HIGH	INDUCTORS	1200 kHz
	CAPACITORS	1600 kHz



TRIMMER IDENTIFICATION



R1, R3 47Ω ± 10%, 2W
R2 8.2kΩ ± 10%, 1/2W

ATTENUATOR FOR RECEIVER ALIGNMENT (SEE PARAGRAPH 5.3.1)

FIGURE 5-1

RECEIVER ALIGNMENT

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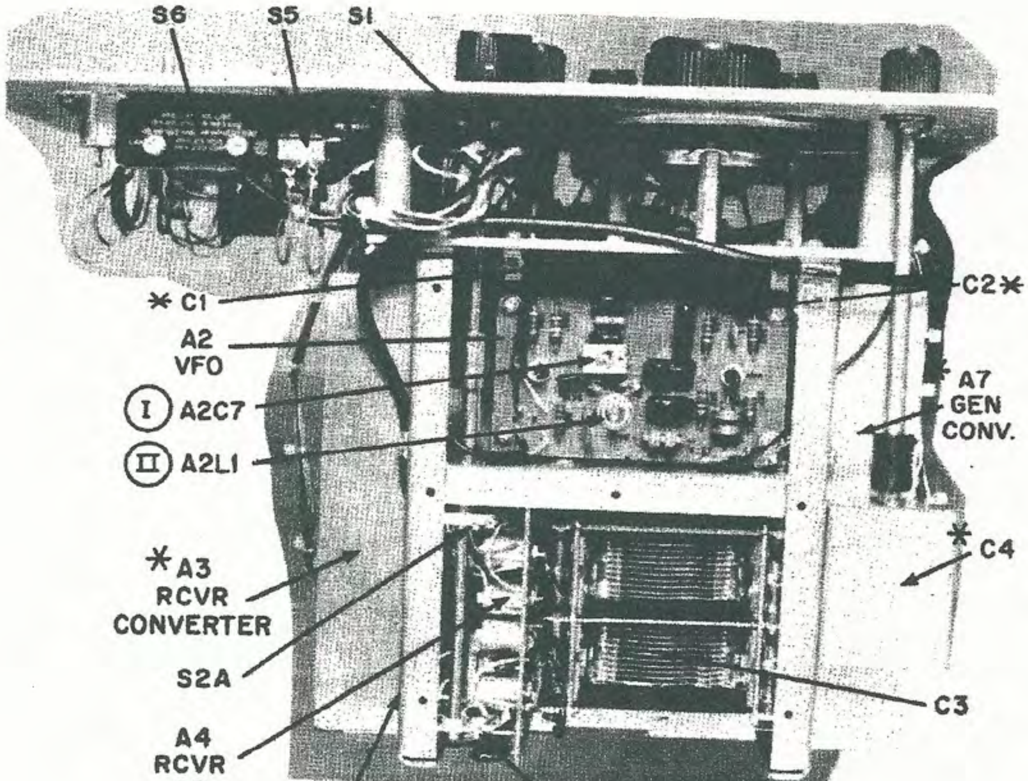


NOTE: ◯ CIRCLED ROMAN NUMERALS REFER TO TEXT, SECTION 5.
* NOT VISABLE.

FIGURE 5-2
COMPONENT LOCATIONS TOP VIEW
DELTA ELECTRONICS, INC. ALEXANDRIA, VIRGINIA

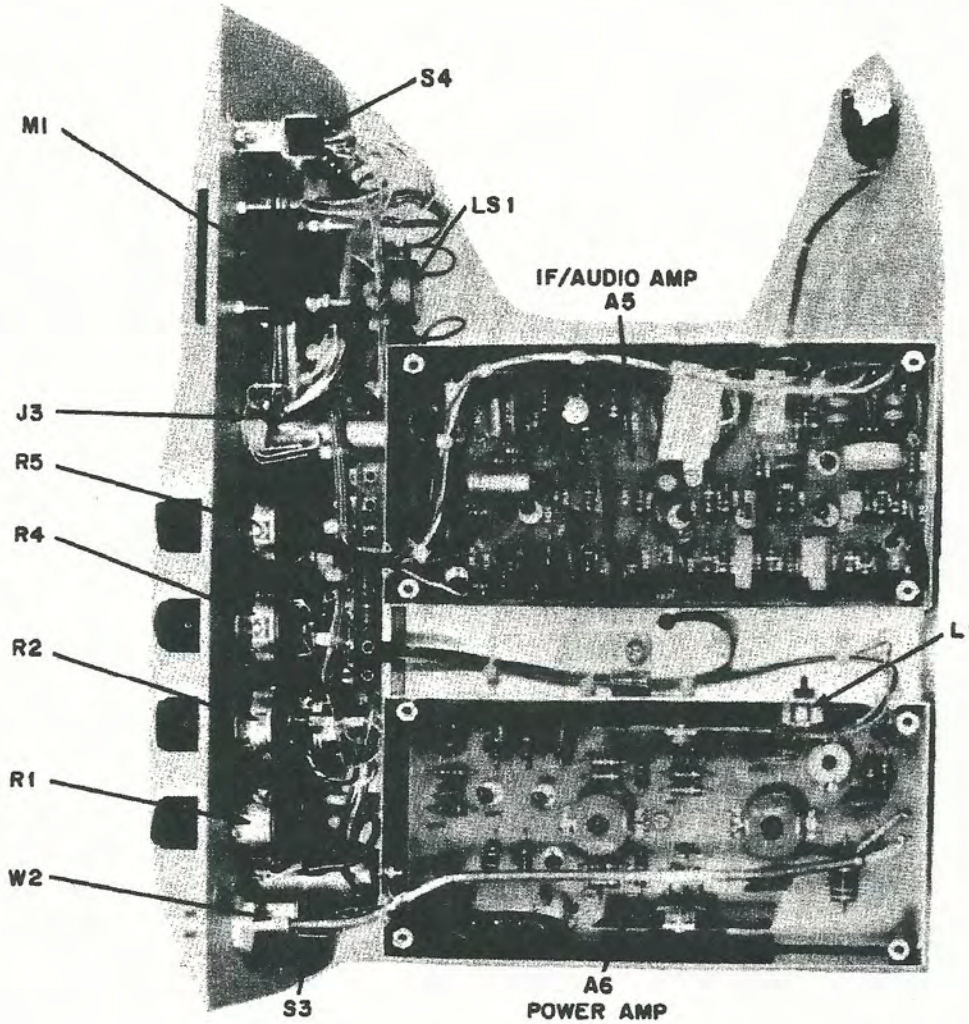


FIGURE 5-3

COMPONENT LOCATIONS
BOTTOM VIEW

DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA

D93-83

SECTION 6

LIST OF MATERIALS

6.1 INTRODUCTION

6.1.1 Maintenance parts in the system are identified by reference designations. These designations are used on the photographs, schematics, and Lists of Materials to identify the components; and, wherever practical, the reference designation is marked adjacent to the component itself on either the chassis or printed circuit board. The letter(s) in the reference designation identify the class of item such as a resistor, coil, or transistor, or identify a subassembly such as a plug-in amplifier. The number differentiates between parts or subassemblies of the same class.

6.1.2. Reference designations for the parts of a subassembly consist of the part's standard reference designation (with the numbers starting with "1" for each subassembly) preceded by the reference designation for the subassembly. For instance, A3R5 identifies resistor number 5 in subassembly number 3. When all of the prefixes are identical on a schematic or printed circuit board they may be omitted for brevity and a note to that effect is placed on the drawing or circuit board.

6.1.3. Due to the complexity of the circuit, the List of Materials and Schematic Diagrams have been broken down into the individual subassemblies or circuit functions. The breakdown is:

CIRCUIT	LIST OF MATERIALS	SCHEMATIC
Final Assembly	6.2, Page 6-2	Figure 6-1, Page 6-10
A2, VFO	6.3, Page 6-3	Figure 6-2, Page 6-11
A3 & A7, Converter	6.4, Page 6-4	Figure 6-3, Page 6-12
A4, rf Amp	6.5, Page 6-6	Figure 6-4, Page 6-13
A5, IF/AF Amp	6.6, Page 6-7	Figure 6-5, Page 6-14
A6, Pwr. Amp.	6.7, Page 6-9	Figure 6-6, Page 6-15

6.2 LIST OF MATERIALS - FINAL ASSEMBLY
(REFERENCE FIGURE 6-1)

Reference Designation	Description	Manufacturer	Part No.
A1	Unassigned (U/A)		
A2[1]	VFO SUBASSY	Delta	D33-22-1
A3[1]	RCVR CONV. SUBASSY	Delta	D33-26-2
A4[1]	RCVR RF AMP SUBASSY	Delta	D33-23-1
A5[1]	IF/AUDIO AMP SUBASSY	Delta	D33-24-1
A6[1]	PWR AMP SUBASSY	Delta	D33-25-1
A7[1]	GEN CONV SUBASSY	Delta	D33-26-1
C1	CAP, VAR, 8-200 pF	Hammarlund	HFA-200A
C2	CAP, VAR, 8.3-100 pF	Hammarlund	MC-100S
C3	CAP, VAR, Dual 350 pF	TRW	882923B
C4	CAP, VAR, 100 pF	Hammarlund	MAPC-100-B
C5	CAP, FIX, CER, 0.005µF	Sprague	5GA-D50
J1, J2	U/A		
J3	CONNECTOR, PHONE JACK	Switchcraft	13A
J4	CONNECTOR, POWER RECPT.	Switchcraft	AC3G
L1	COIL, RF, FIX, 1.8 mH	Delta	D63-26-1
LS1	LOUD SPEAKER, 3.2 Ohms	Jensen	3X5K5
M1	METER, 100µAdc	Delta	D02-12-1
P1	CONNECTOR, Plug	C. Jones	P-304-CCT
PS1[2]	POWER SUPPLY, BATTERY	Delta	D34-11-1
PS1BT1[2]	BATTERY	Delta	D05-40-1
PS1C1[2]	CAP, FIX, 500µF, 50 Vdc	Mallory	HC5005A
PS1CR1[2]	DIODE BRIDGE	Motorola	MDA920-2
PS1F1[2]	FUSE, 1/2 A		3AG-1/2 A
PS1F2[2]	FUSE, 1 A		3AG-1 A
PS1J1[2]	CONNECTOR, RECPT.	C. Jones	S-304-AB
PS1R1[2]	RES, ADJ, 50, 25w	IRC	Type 2 DA
PS1T1[2]	TRANSFORMER, PWR	Thordarson	27V68
R1	RES, VAR, 100k LOG.		RV4NAYSD104C
R2	RES, VAR, 50k W/Switch		RV4NBYSD503A
R3	Same as R1		
R4	RES, FIX, 6.8 k ± 10%, 1/2W		RC20GF682K
R5	RES, VAR, 500 k Log		RV4NAYSD504C

NOTES: 1. Subassembly, see separate List of Material
2. Power Supply PS1 includes items PS1BT1 thru PS1T1

Reference Designation	Description	Manufacturer	Part No.
R6	RES, FIX, 82k±10%, 1/2W		RC20GF823k
R7	RES, FIX, 1.8k±10%, 1/2W		RC20GF182k
R8	RES, FIX, 15k±10%, 1/2W		RC20GF153k
R9	RES, FIX, 10±10%, 1/2W		RC20GF100k
S1	SWITCH WAFER, 6PDT	CTS	T9
S2A, S2B	Same as S1		
S3	SWITCH, DP3T	Stackpole	RS-16
S4	Same as S3		
S5	SWITCH, DPDT	Stackpole	RS-50
S6	SWITCH, SPDT	Microswitch	BZ-2RS
W1	CABLE ASSY, COAXIAL	Delta	D51-5-2
W2	CABLE ASSY, COAXIAL	Delta	D51-7-1

6.3 LIST OF MATERIALS - A2, VARIABLE FREQUENCY OSCILLATOR (REFERENCE FIGURE 6-2)

Reference Designation	Description	Manufacturer	Part No.
A2C1	U/A		
A2C2	U/A		
A2C3	CAP, FIX, CER, 0.01μF, 25V	Sprague	HY-520
A2C4	CAP, FIX, MICA,1800pF, 500V		CM-06-F-182k
A2C5	CAP, FIX, MICA,3300pF, 500V		CM-06-F-332k
A2C6	CAP, FIX, MICA, 8200pF, 500V		CM-07-F-822k
A2C7	CAP, VAR, MICA, 1.5 - 20pF	Elmenco	PC402
A2C8	CAP, FIX, MICA, 100pF, 500V		CM-05-F-101J
A2C9	CAP, TEMP COMP, SELECTED		
A2C10	CAP, FIX, MICA, 1pF, 500V	Elmenco	DM-15-010k
A2C11	CAP, FIX, CER, 0.1μF, 16V	Sprague	HY-450
A2C12	Same as A2C11		
A2L1	COIL, rf, VAR, 6.5-9.8μH	Cambion	3341-5
A2L2	COIL, rf, FIX (RFC), 0.5 MH	Cambion	2952-5
A2L3	Same as A2L2		
A2Q1	TRANSISTOR		2N3415
A2Q2	Same as A2Q1		
A2R1	RES, FIX, 12k±10%, 1/2 W		RC20GF123k
A2R2	RES, FIX, 82k±10%, 1/2 W		RC20GF823k
A2R3	RES, FIX, 470±10%, 1/2 W		RC20GF471k
A2R4	RES, FIX, 150k±10%, 1/2 W		RC20GF154k
A2R5	RES, FIX, 470k±10%, 1/2 W		RC20GF474k
A2R6	Same as A2R3		
A2R7	Same as A2R3		

6.4 LIST OF MATERIALS - A3, A7 CONVERTER
(REFERENCE FIGURE 6-3)

Note: The subassembly designation (A3 or A7) is omitted from the reference designation except where the component value is different for the two subassemblies. For complete reference designations, prefix with "A3" for the Receiver Converter (P/N:D33-26-2); or with "A7" for the Generator Converter (P/N:D33-26-1).

Reference Designation	Description	Manufacturer	Part No.
C1	CAP, FIX, MICA, 100pF, 500V		CM-05-F-101k
C2	CAP, FIX, MICA, 68pF, 500V		CM-05-E-680k
C3	CAP, FIX, CER, 0.01µF, 25V	Sprague	HY-520
C4	Same as C1		
C5	Same as C3		
C6	CAP, FIX, MICA, 22pF, 500V		CM-05-E-220k
C7	CAP, FIX, MICA, 110pF, 500V		CM-05-F-111k
C8	CAP, FIX, MICA, 220pF, 500V		CM-05-F-221k
C9	CAP, FIX, MICA, 82pF, 500V		CM-05-E-820k
A3C10	CAP, FIX, MICA, 470pF, 500V	Elmenco	DM-15-471k
A7C10	CAP, FIX, CER, 0.005µF, 50V	Sprague	TG-D50
C11	CAP, FIX, MICA, 240pF, 500V		CM-05-F-241k
C12	CAP, VAR, MICA, 8-60pF	Elmenco	PC-404
C13	CAP, FIX, MICA, 150pF, 500V		CM-05-F-151k
C14	CAP, FIX, MICA, 200pF, 500V		CM-05-F-201k
C15	CAP, FIX, CER, 0.1µF, 25V	Sprague	HY-550
C16	CAP, FIX, MICA, 180pF, 500V		CM-05-F-181J
C17	Same as C15		
C18	Same as C13		
C19	Same as C14		
C20	Same as C12		
C21	Same as C3		
A3C22	Same as C3		
A7C22	U/A		
A3C23	CAP, FIX, CER, 0.022µF, 16V	Sprague	HY-425
A7C23	U/A		
C24	Same as C15		
A3C25	Same as C3		
A7C25	U/A		
A3C26	CAP, FIX, MICA, 2700pF, 500V		CM-06-F-272J
A7C26	U/A		
L1	COIL, RF, FIX (RFC), 500µH	Cambion	2952-5
L2	COIL, RF, VAR, 10.2-13.8µH	Cambion	3387-12
L3	COIL, RF, VAR, 37.6-56.5µH	Cambion	3387-17
L4	Same as L3		
L5	COIL, RF, VAR, 6.9-9.4µH	Cambion	3387-10

Reference Designation	Description	Manufacturer	Part No.
L6	COIL, RF, VAR, 3.3-4.5μH	Cambion	3387-6
L7	Same as L1		
Q1	TRANSISTOR		2N3415
Q2	Same as Q1		
Q3	Same as Q1		
Q4	Same as Q1		
Q5	Same as Q1		
R1	RES, FIX, 2.7k±10%, 1/2 W		RC20GF272k
R2	RES, VAR, 100±20%, 3/4W	IRC	Type 150
R3	RES, FIX, 120k±5%, 1/2W		RC20GF124J
R4	RES, FIX, 15k±10%, 1/2W		RC20GF153k
R5	RES, FIX, 1k±10%, 1/2W		RC20GF102k
R6	RES, FIX, 56±10%, 1/2W		RC20GF560k
R7	Same as R3		
R8	RES, FIX, 12k±10%, 1/2W		RC20GF123k
R9	Same as R5		
R10	Same as R6		
R11	Same as R4		
R12	RES, FIX, 22±10%, 1/2W		RC20GF220k
A3R13	RES, FIX, 470±10%, 1/2W		RC20GF471k
A7R13	U/A		
R14	RES, FIX, 330k±10%,1/2W		RC20GF334k
R15	RES, FIX, 470±10%, 1/2W		RC20GF471k
R16	RES, FIX, 330±10%, 1/2W		RC20GF331k
R17	Same as R14		
R18	Same as R15		
R19	Same as R15		
A3Y1	CRYSTAL UNIT, 5.995 MHz	INTNL.XTAL	Type CS-700
A7Y1	CRYSTAL UNIT, 5.5 MHz	INTNL.XTAL	Type CS-700
A3Y2	CRYSTAL UNIT, 6.555 MHz	INTNL.XTAL	Type CS-700
A7Y2	CRYSTAL UNIT, 6.1 MHz	INTNL.XTAL	Type CS-700

6.5 LIST OF MATERIALS - A4, RF AMPLIFIER (REFERENCE FIGURE 6-4)

Reference Designation	Description	Manufacturer	Part No.
A4C1	CAP,VAR, MICA, 1.5-20pF	Elmenco	PC-402
A4C2	CAP,FIX, MICA, 470pF, 500V		CM-06-F-471J
A4C3	CAP,FIX, MICA, 15pF, 500V		CM-05-C-150k
A4C4	Same as A4C1		
A4C5	CAP,FIX,CER, 0.1µF, 16V	Sprague	HY-450
A4C6	CAP,FIX, MICA, 910pF, 500V		CM-06-F-911k
A4C7	CAP,FIX, MICA, 33pF, 500V		CM-05-E-330k
A4C8	Same as A4C1		
A4C9	CAP, FIX, MICA, 750pF, 500V		CM-06-F-751J
A4C10	CAP, FIX, MICA, 68pF, 500V		CM-05-E-680J
A4C11	Same as A4C7		
A4C12	Same as A4C1		
A4C13	Same as A4C5		
A4C14	CAP,FIX,CER, 0.01µF, 25V	Sprague	HY-520
A4L1	COIL, RF, VAR	Delta	D63-22-1
A4L2	COIL, RF, VAR	Delta	D63-22-2
A4L3	COIL, RF, VAR	Delta	D63-22-3
A4L4	COIL, RF, VAR	Delta	D63-22-4
A4L5	COIL, RF, FIX (RFC), 1mH	Cambion	2952-6
A4L6	Same as A4L5		
A4Q1	TRANSISTOR		2N3860
A4Q2	TRANSISTOR		2N3856A
A4R1	RES, FIX, 22k±10%, 1/2W		RC20GF223k
A4R2	RES, FIX, 15k±10%, 1/2W		RC20GF153k
A4R3	RES, FIX, 1.8k±10%, 1/2W		RC20GF182k
A4R4	RES, FIX, 18k±10%, 1/2W		RC20GF183k
A4R5	RES, FIX, 4.7k±10%, 1/2W		RC20GF472k
A4R6	RES, FIX, 3.9k±10%, 1/2W		RC20GF392k
A4T1	TRANSFORMER, IF, 455 kHz	Miller	2042

6.6 LIST OF MATERIALS - A5, IF/AUDIO AMP
(REFERENCE FIGURE 6-5)

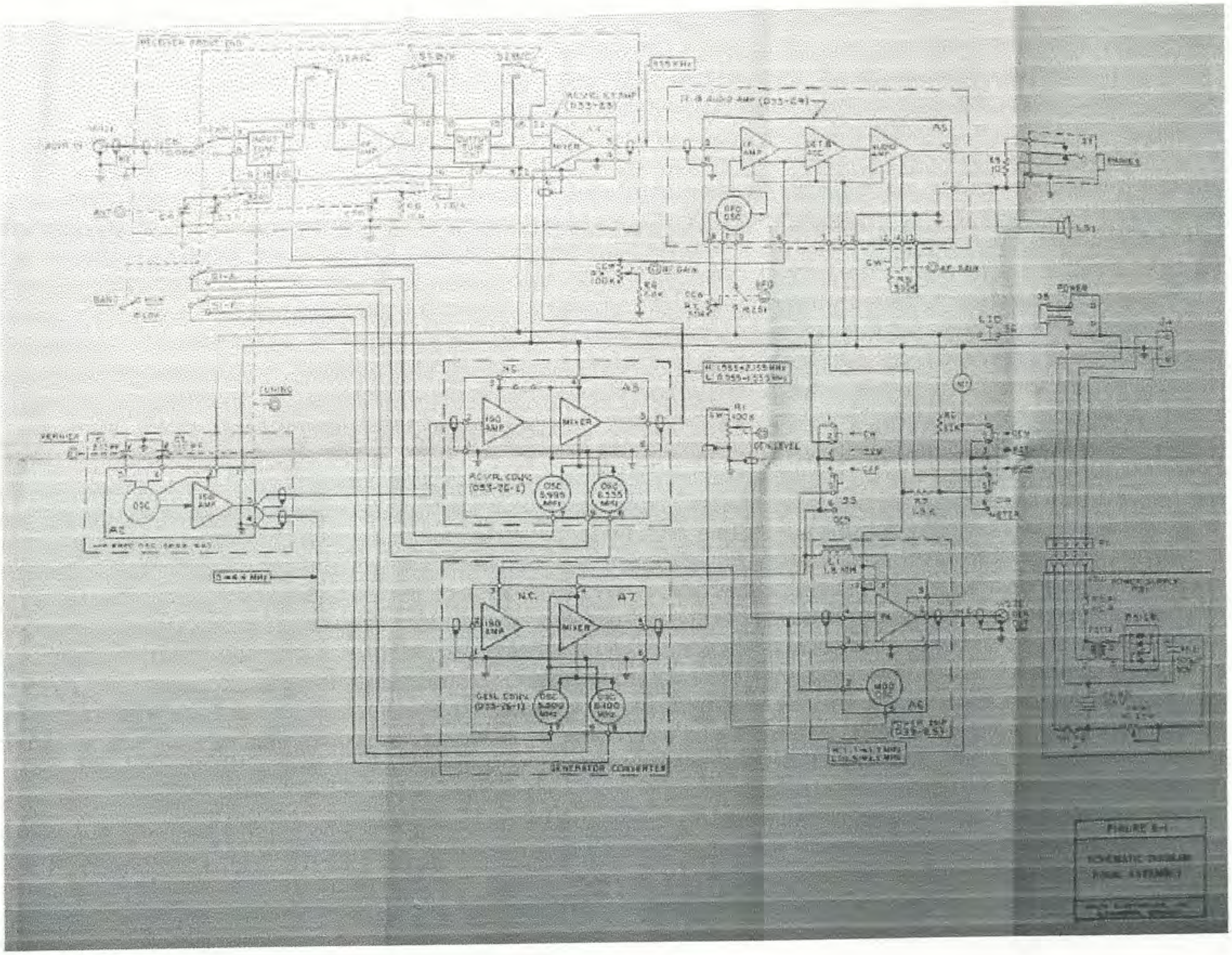
Reference Designation	Description	Manufacturer	Part No.
A5A1	AMPLIFIER, IC-AUDIO	RCA	CA3020
A5C1	CAP, FIX, CER, 0.01µF, 25V	Sprague	HY-520
A5C2	CAP, FIX, CER, 0.047µF, 16V	Sprague	HY-435
A5C3	CAP, FIX, CER, 0.1µF, 16V	Sprague	HY-450
A5C4	Same as A5C1		
A5C5	U/A		
A5C6	Same as A5C2		
A5C7	CAP, FIX, CER, 0.005µF, 1kV	Sprague	5GA-D50
A5C8	CAP, FIX, CER, 50pF, 1kV	Sprague	5GA-Q50
A5C9	CAP, FIX, CER, 0.47µF, 10V	Sprague	HY-330
A5C10	Same as A5C7		
A5C11	Same as A5C1		
A5C12	CAP, FIX, ELECTRO, 4µF, 15V	Sprague	TE-1151
A5C13	Same as A5C3		
A5C14	Same as A5C3		
A5C15	Same as A5C3		
A5C16	Same as A5C3		
A5C17	CAP, FIX, MICA, 620pF, 500V		CM-06-F-62:
A5C18	Same as A5C2		
A5C19	CAP,VAR,MICA, 90-400pF	Elmenco	PC-429
A5C20	Same as A5C2		
A5C21	Same as A5C9		
A5C22	Same as A5C12		
A5C23	Same as A5C1		
A5C24	Same as A5C9		
A5C25	CAP, FIX, ELECTRO, 100µF, 15V	Sprague	TE-1162
A5C26	CAP, FIX, CER, 0.1µF, 25V	Sprague	HY-550
A5C27	Same as A5C9		
A5C28	Same as A5C25		
A5CR1	SEMICOND, DEVICE, DIODE		1N34A
A5CR2	Same as A5CR1		
A5CR3	Same as A5CR1		
A5CR4	SEMICOND, DEVICE, ZENER, 4.3V		1N5229A
A5FL1	FILTER, CERAMIC, 455 kHz	Clevite	TF-01A
A5FL2	FILTER, CERAMIC, 455 kHz	Clevite	TO-02A
A5FL3	Same as A5FL2		
A5FL4	Same as A5FL2		
A5L1	COIL, RF, FIX (RFC), 10mH	J.W.Miller	70F102A1
A5L2	COIL, RF, FIX (RFC), 1mH	Cambion	2952-6
A5L3	Same as A5L2		
A5L4	Same as A5L2		
A5Q1	TRANSISTOR		2N3860
A5Q2	Same as A5Q1		
A5Q3	Same as A5Q1		
A5Q4	TRANSISTOR		2N3415

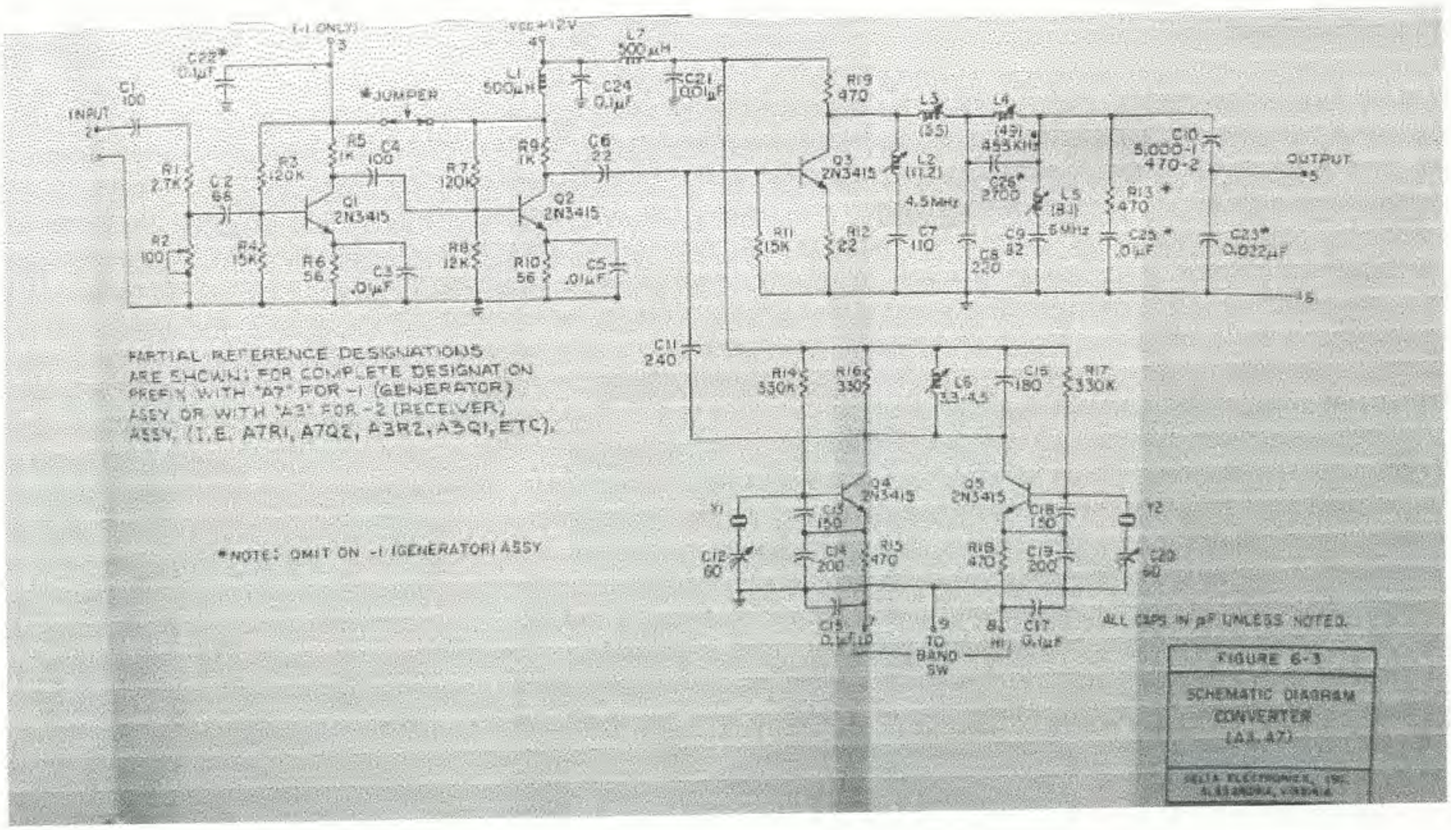
6.6 CONTINUED

Reference Designation	Description	Manufacturer	Part No.
A5Q5	TRANSISTOR		2N3605
A5Q6	Same as A5Q4		
A5R1	RES, FIX, 100k±10%, 1/2 W		RC20GF104k
A5R2	RES, FIX, 4.7k±10%, 1/2 W		RC20GF472k
A5R3	RES, FIX, 10k±10%, 1/2 W		RC20GF103k
A5R4	RES, FIX, 3.9k±10%, 1/2 W		RC20GF392k
A5R5	RES, FIX, 1k±10%, 1/2 W		RC20GF102k
A5R6	RES, FIX, 56k±10%, 1/2 W		RC20GF563k
A5R7	Same as A5R3		
A5R8	Same as A5R4		
A5R9	Same as A5R5		
A5R10	RES, FIX, 82k±10%, 1/2 W		RC20GF823k
A5R11	Same as A5R3		
A5R12	Same as A5R4		
A5R13	RES, FIX, 470±10%, 1/2 W		RC20GF472k
A5R14	RES, FIX, 220k±10%, 1/2 W		RC20GF224k
A5R15	RES, FIX, 12k±10%, 1/2 W		RC20GF123k
A5R16	RES, FIX, 22k±10%, 1/2 W		RC20GF223k
A5R17	RES, FIX, 47k±10%, 1/2 W		RC20GF473k
A5R18	Same as A5R17		
A5R19	Same as A5R3		
A5R20	RES, FIX, 100±10%, 1/2 W		RC20GF101k
A5R21	Same as A5R3		
A5R22	RES, FIX, 1.2k±10%, 1/2 W		RC20GF122k
A5R23	RES, FIX, 3.3k±10%, 1/2 W		RC20GF332k
A5R24	RES, FIX, 220±10%, 1/2 W		RC20GF221k
A5R25	RES, FIX, 1M±10%, 1/2 W		RC20GF105k
A5R26	RES, FIX, 510k±5%, 1/2 W		RC20GF514J
A5R27	RES, FIX, 0.68±10%, 2 W	IRC	Type BWH
A5R28	Same as A5R2		
A5R29	Same as A5R20		
A5R30	Same as A5R2		
A5T1	TRANSFORMER, AF	TRIAD	TY-48X

6.7 LIST OF MATERIALS - A6, POWER AMPLIFIER (REFERENCE FIGURE 6-6)

Reference Designation	Description	Manufacturer	Part No.
A6C1	CAP, FIX, CER, 0.001µF, 1kV	Sprague	5GA-D10
A6C2	CAP, FIX, CER, 0.1µF, 16V	Sprague	HY-450
A6C3	Same as A6C2		
A6C4	CAP, FIX, CER, 0.01µF, 25V	Sprague	HY-520
A6C5	Same as A6C2		
A6C6	CAP, FIX, CER, 0.047µF, 16V	Sprague	C069B160H473M
A6C7	Same as A6C6		
A6C8	Same as A6C6		
A6C9	CAP, FIX, CER, 0.22µF, 10V	Sprague	HY-325
A6C10	Same as A6C2		
A6C11	Same as A6C2		
A6C12	Same as A6C4		
A6C13	Same as A6C2		
A6CR1	SEMICOND. DEVICE, DIODE		1N5059
A6CR2	SEMICOND. DEVICE, DIODE		1N38A
A6Q1	TRANSISTOR		2N3415
A6Q2	TRANSISTOR	RCA	2N2631
A6Q3	Same as A6Q2		
A6Q4	TRANSISTOR		2N3391
A6Q5	Same as A6Q1		
A6R1	RES, FIX, 33k±10%, 1/2 W		RC20GF333k
A6R2	RES, FIX, 12k±10%, 1/2 W		RC20GF123k
A6R3	RES, FIX, 820±10%, 1/2 W		RC20GF821k
A6R4	RES, FIX, 56±10%, 1/2 W		RC20GF560k
A6R5	RES, FIX, 120±10%, 1/2 W		RC20GF121k
A6R6	Same as A6R5		
A6R7	RES, FIX, 560±10%, 1/2 W		RC20GF561k
A6R8	RES, FIX, 1± 5%, 1/2 W		RC20GF1ROJ
A6R9	Same as A6R8		
A6R10	RES, FIX, 330±10%, 2 W		RC42GF331k
A6R11	RES, FIX, 120k±10%, 1/2 W		RC20GF124k
A6R12	RES, FIX, 1k±10%, 1/2 W		RC20GF102k
A6R13	RES, FIX, 1.5k±5%, 1/2 W		RC20GF152J
A6R14	Same as A6R13		
A6R15	RES, FIX, 470k±10%, 1/2 W		RC20GF474k
A6R16	Same as A6R11		
A6R17	RES, FIX, 1.2k±10%, 1/2 W		RC20GF122k
A6R18	Same as A6R17		
A6R19	RES, FIX, 10±10%, 1/2 W		
A6R20	RES, FIX, 5.6k±10%, 1/2 W		RC20GF562k
A6R21	RES, FIX, 6.8k±10%, 1/2 W		RC20GF682k
A6L1	COIL, RF, FIX, 1.8 mH	Delta	D63-26-1
A6T1	TRANSFORMER, RF, INPUT	Delta	D63-27-1
A6T2	TRANSFORMER, RF, OUTPUT	Delta	D63-27-2


RECEIVER PROC. ING
PHONES
TUNING
VERNIER
OSC
MIXER
AMP
GENERATOR CONVERTER
POWER
FIGURE 6-1
SCHEMATIC DIAGRAM


(-1 ONLY)
VCC +12V
INPUT
OUTPUT
C1 100
C22* 0.1µF
R1 2.7K
R2 100
C2 68
R3 120K
R4 15K
R5 1K
C4 100
Q1 2N3415
R6 56
C3 .01µF
*JUMPER
R7 120K
R8 12K
L1 500µH
R9 1K
Q2 2N3415
R10 56
C5 .01µF
C6 22
L7 500µH
C24 0.1µF
C21 0.01µF
R19 470
Q3 2N3415
R11 15K
R12 22
L3 (55)
L2 (11.2)
4.5MHz
C7 110
L4 (49)
455KHz
C26* 2700
C8 220
L5 (8.1)
5MHz
C9 82
C10 5,000-1 470-2
R13* 470
C25* .01µF
C23* 0.022µF
C11 240
R14 330K
R16 330
L6 3.3-4.5
C16 180
R17 330K
Q4 2N3415
Q5 2N3415
Y1
Y2
C13 150
C14 200
C12 60
R15 470
R18 470
C18 150
C19 200
C20 60
C15 0.1µF
C17 0.1µF
LO
HI
TO BAND SW
PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH "A7" FOR -1 (GENERATOR) ASSY OR WITH "A3" FOR -2 (RECEIVER) ASSY. (I.E. A7R1, A7Q2, A3R2, A3Q1, ETC).
*NOTE: OMIT ON -1 (GENERATOR) ASSY
ALL CAPS IN pF UNLESS NOTED.
FIGURE 6-3
SCHEMATIC DIAGRAM
CONVERTER
(A3, A7)

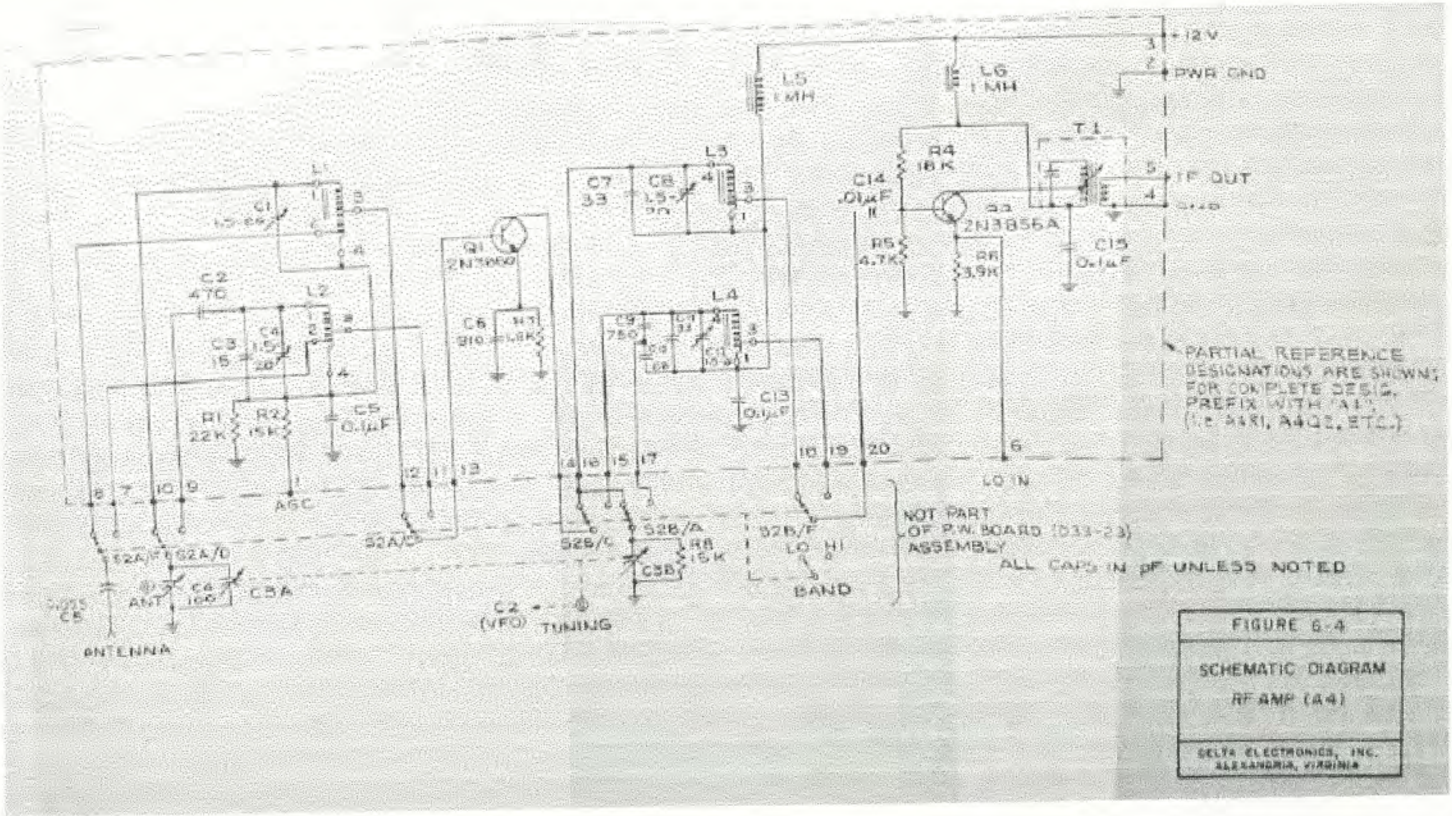
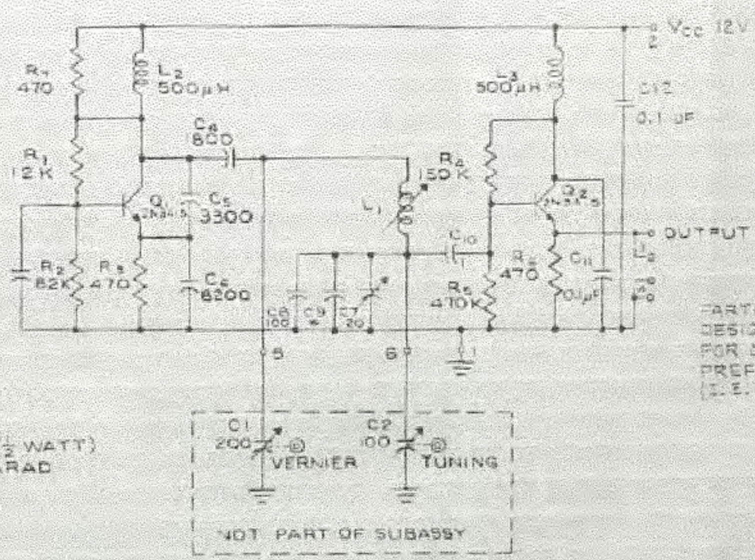


FIGURE 6-4

SCHEMATIC DIAGRAM RF AMP (A4)



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN: FOR COMPLETE DESIGNATION PREFIX WITH "A2" (I.E. A2R1, A2Q2, ETC.

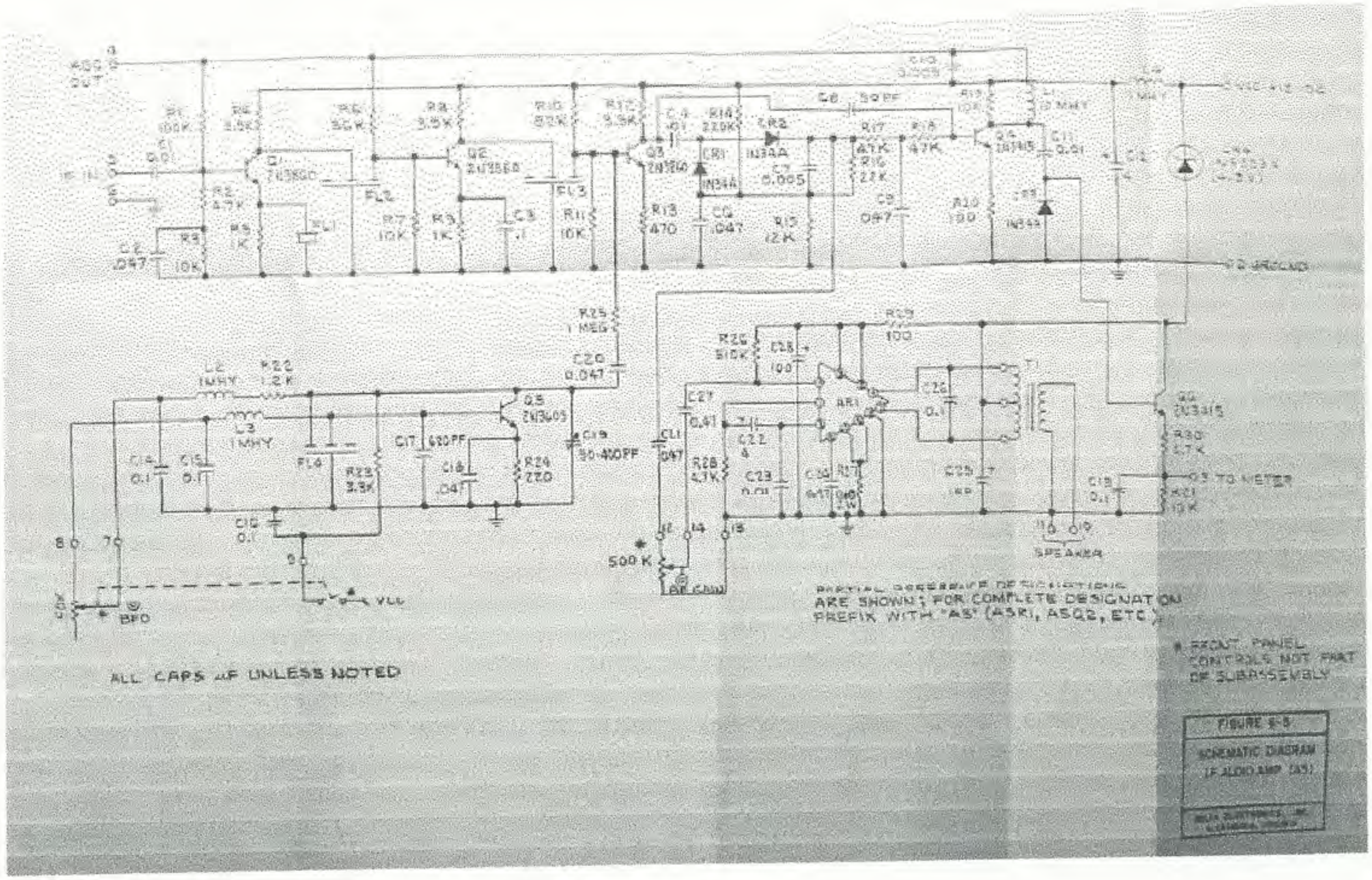
UNLESS OTHERWISE NOTED:
ALL RESISTORS IN OHMS (½ WATT)
ALL CAPACITORS IN PICOFARAD

* SELECTED - NEG T.C.

FIGURE 5-2

SCHEMATIC DIAGRAM
VFO 1 (A2)

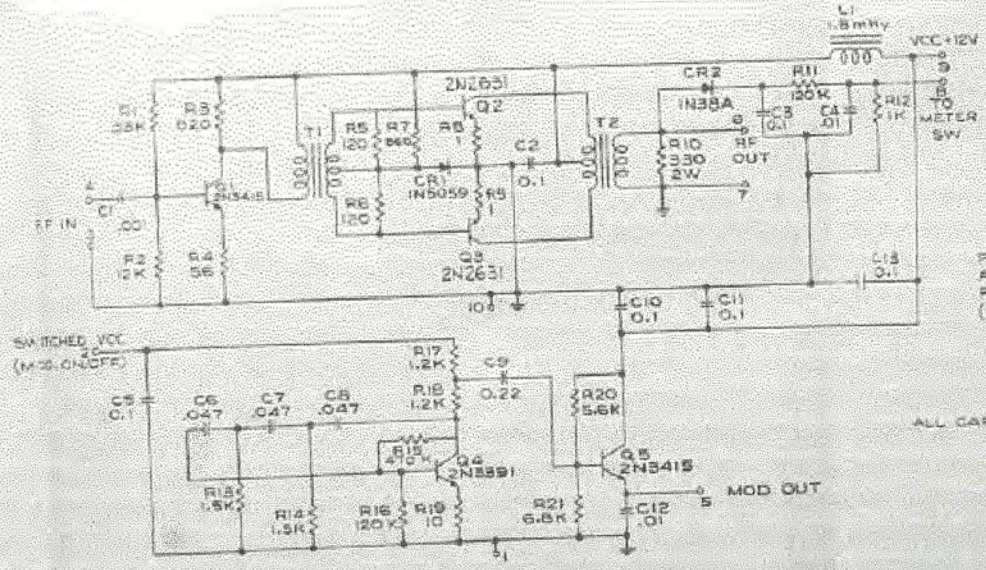
DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH "A5" (A5R1, A5Q2, ETC.)

* FRONT PANEL CONTROLS NOT PART OF SUBASSEMBLY

SCHEMATIC DIAGRAM IF AUDIO AMP (A5)



PARTIAL REFERENCE DESIGNATIONS ARE SHOWN; FOR COMPLETE DESIGNATION PREFIX WITH "A6". (I.E. A6R1, A6Q2, ETC.

ALL CAPS IN μF UNLESS NOTED

FIGURE 6-6

SCHEMATIC DIAGRAM
POWER AMP
(A-6)

DELTA ELECTRONICS, INC.
ALEXANDRIA, VIRGINIA