MAINTENANCE MANUAL

COLLINS RADIO COMPANY • CEDAR RAPIDS, IOWA

AIRBORNE SSB
TRANSCEIVER
618T-( )

GUARANTEE

The equipment described herein is sold under the following guarantee:

Collins agrees to repair or replace, without charge, any equipment, parts, or accessories which are defective as to design, workmanship or material, and which are returned to Collins at its factory, transportation prepaid, provided

(a) Notice of the claimed defect is given Collins within one (1) year from date of delivery and goods are returned in accordance with Collins instructions.

(b) Equipment, accessories, tubes, and batteries not manufactured by Collins or from Collins designs are subject to only such adjustments as Collins may obtain from the supplier thereof.

(c) No equipment or accessory shall be deemed to be defective if, due to exposure or excessive moisture in the atmosphere or otherwise after delivery, it shall fail to operate in a normal or proper manner.

Collins further guarantees that any radio transmitter described herein will deliver full radio frequency power output at the antenna lead when connected to a suitable load, but such guarantee shall not be construed as a guarantee of any definite coverage or range of said apparatus.

The guarantee of these paragraphs is void if equipment is altered or repaired by others than Collins or its authorized service center.

No other warranties, expressed or implied, shall be applicable to any equipment sold hereunder, and the foregoing shall constitute the Buyer's sole right and remedy under the agreements in this paragraph contained. In no event shall Collins have any liability for consequential damages, or for loss, damage or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

HOW TO RETURN MATERIAL OR EQUIPMENT.

If, for any reason, you should wish to return material or equipment, whether under the guarantee or otherwise, you should notify us, giving full particulars including the details listed below, insofar as applicable. If the item is thought to be defective, such notice must give full information as to nature of defect and identification (including part number if possible) of part considered defective. (With respect to tubes we suggest that your adjustments can be speeded up if you give notice of defect directly to the tube manufacturer.) Upon receipt of such notice, Collins will promptly advise you respecting the return. Failure to secure our advice prior to the forwarding of the goods or failure to provide full particulars may cause unnecessary delay in the handling of your returned merchandise.

ADDRESS:

Collins Radio Company
Service Division
Cedar Rapids, Iowa

INFORMATION NEEDED:

(A) Type number, name and serial number of equipment
(B) Date of delivery of equipment
(C) Date placed in service
(D) Number of hours of service
(E) Nature of trouble
(F) Cause of trouble if known
(G) Part number (9 or 10 digit number) and name of part thought to be causing trouble
(H) Item or symbol number of same obtained from parts list or schematic
(I) Collins number (and name) of unit subassemblies involved in trouble
(J) Remarks

HOW TO ORDER REPLACEMENT PARTS.

When ordering replacement parts, you should direct your order as indicated below and furnish the following information insofar as applicable. To enable us to give you better replacement service, please be sure to give us complete information.

ADDRESS:

Collins Radio Company
Service Division
Cedar Rapids, Iowa

INFORMATION NEEDED:

(A) Quantity required
(B) Collins part number (9 or 10 digit number) and description
(C) Item or symbol number obtained from parts list or schematic
(D) Collins type number, name and serial number of principal equipment
(E) Unit subassembly number (where applicable)

MAINTENANCE MANUAL

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AIRBORNE SSB TRANSCEIVER

618T-( )

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MAINTENANCE MANUAL

RECORD OF REVISIONS

Airborne SSB Transceiver 618T-( )	LOCATION
ASSIGNED TO (JOB TITLE)	

REV. NO.	REVISION DATE	INSERTION DATE	BY	REV. NO.	REVISION DATE	INSERTION DATE	BY
1	Jan 15/62						

RETAIN THIS RECORD IN THE FRONT OF MANUAL OR CHAPTER.
ON RECEIPT OF REVISIONS, INSERT REVISED PAGES IN THE MANUAL, AND ENTER DATE INSERTED AND INITIALS.

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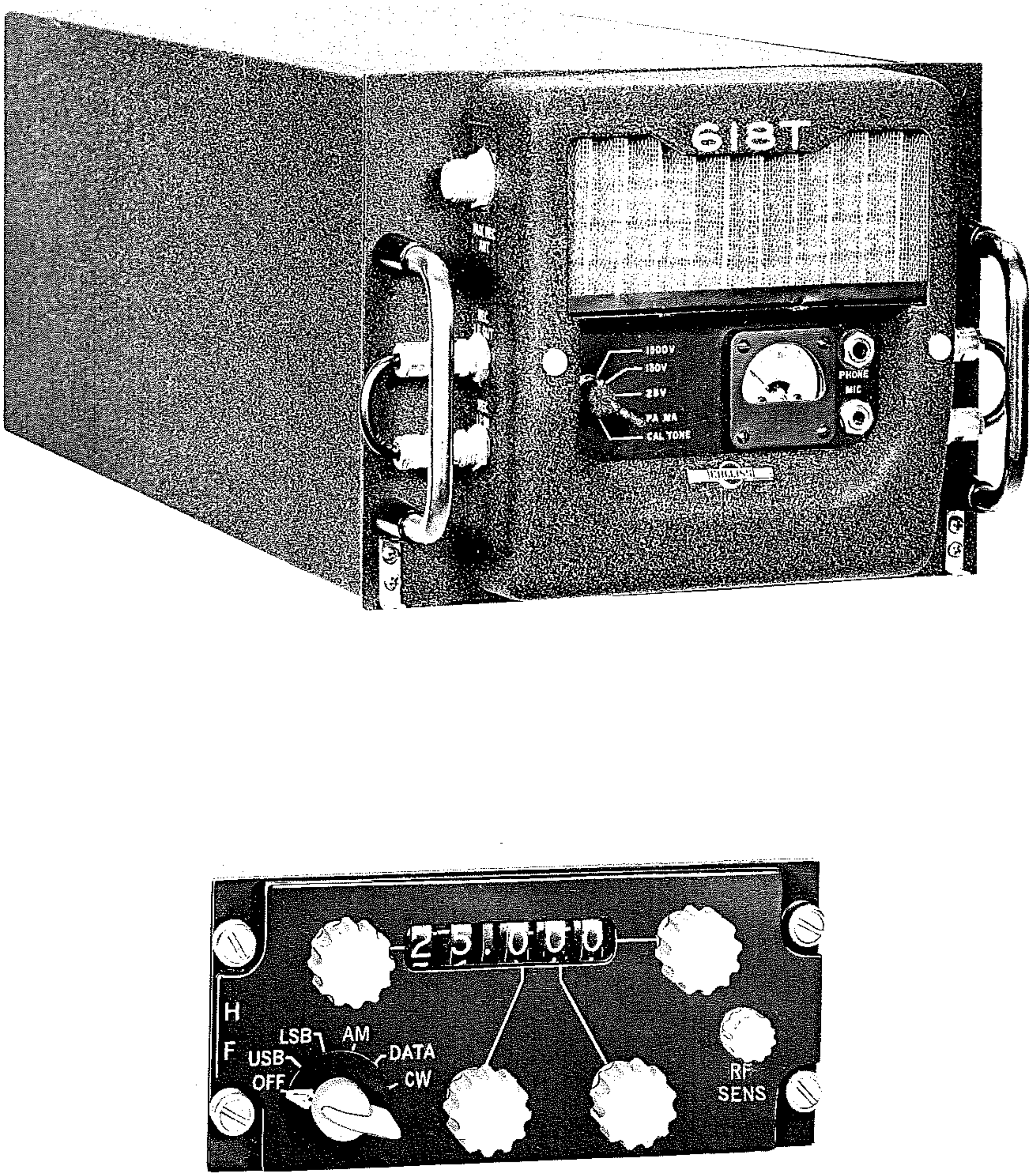


Airborne SSB Transceiver 618T-( ) and Control Unit 714E-3
Figure 1

AIRBORNE SSB TRANSCEIVER 618T-( ) - DESCRIPTION AND OPERATION

1. GENERAL.

This manual contains a description of Airborne SSB Transceiver 618T-( ), the principles of operation, and in-aircraft trouble shooting and maintenance procedures for the 618T-( ).

2. PURPOSE OF EQUIPMENT.

Airborne SSB Transceiver 618T-( ) is used for voice, CW, or data communications in the high-frequency band from 2 to 30 megacycles.

3. DESCRIPTION OF EQUIPMENT.

A. Physical.

Airborne SSB Transceiver 618T-( ) is shown in figure 1. The 618T-( ) weighs 50 pounds and is contained in a standard 1 ATR case which is 22-3/16 inches deep, 7-5/8 inches high, and 10-1/8 inches wide. A PHONE jack, MIC jack, meter, and meter selector switch are located on the front panel of the 618T-( ). Four meter selector switch positions are used to check supply voltages in the 618T-( ). A fifth position, CAL TONE, is used to compare the frequency of the 618T-( ) with WWV. A 400-cycle blower is also located on the front panel to provide forced-air cooling. Antenna connections are made at the front of the 618T-( ). All other connections are made at a 60-pin connector at the rear of the 618T-( ). A separate grounding pin is located beside the 60-pin connector.

The 618T-( ) is composed of 11 plug-in modules, including an interchangeable internal power supply (see paragraph 3.C., this section). Each module is equipped with plug-in connectors and locating pins. The locating pins prevent improper location of the module on the chassis, and align the connectors before engagement occurs to prevent damage to the connectors. There are no mechanical linkages (gear trains, etc.) between any of the 618T-( ) modules. The modular construction simplifies maintenance of the 618T-( ). Color-coded test points on the modules permit general trouble-shooting without removing mdoules from the chassis. Transistors are widely used in the 618T-( ) to increase reliability and reduce weight and power consumption.

The 618T-( ) is completely remote controlled from Control Unit 714E-( ), also shown in figure 1. Any one of 28,000 channels, spaced 1 kilocycle apart in the 2- to 30- megacycle range, can be directly selected at the control unit by rotating the four frequency selector of knobs until the operating frequency is displayed in the window on the front of the unit. The mode selector switch at the left front corner of the 714E-1/2 controls on-off, sideband selection, and AM operation. The 714E-3 (see figure 1) has two additional positions: DATA and CW. An r-f gain control, labeled RF SENS, is located on the right front of all three units.

Control Units 714E-1 and 714E-2 are similar, but not interchangeable. Either the 714E-1 or 714E-2 may be used in new installations by using the proper interwiring. The 714E-1 cannot be used in retrofit installations. The 714E-3 is used in installations which include data equipment or which are to be operated in the CW mode. Additional equipment needed to transmit data can be activated by placing the mode selector switch in the DATA position. When the switch is in the CW position, the upper sideband filter is switched into the circuit, and the CW keyline is connected to the 618T-( ) keyline.

B. Electrical.

The operating frequency of the 618T-( ) is crystal controlled and stabilized to within 1 part-per-million per month. The 618T-( ) is capable of 400 watts PEP output in sideband operation and 100 watts carrier output into a 52-ohm load in AM or CW operation.

The tuned circuits and output circuit of the 618T-( ) are automatically tuned by either an Autopositioner* or a servo motor. The receiver portion of the transceiver is muted during tuning. The tuning time, independent of an external antenna tuner, is 8 seconds maximum.

A complete discussion of the principles of operation of the 618T-( ) is given in paragraph 6.

C. Model Differences.

There are three models of the 618T-( ). The three models differ only in the type of high-voltage power supply used in each. The following paragraphs describe the three models.

(1) Airborne SSB Transceiver 618T-1.

The 618T-1 retrofits most 618S installations with no changes in aircraft wiring. Power Supply 516H-1 is mounted in the same shockmount which contained Power Supply 416W. The primary power source for the 618T-1 is 27.5 volts d-c.

(2) Airborne SSB Transceiver 618T-2.

The 618T-2 has a completely self-contained high-voltage power supply for use with a 115-volt, 400-cycle, 3-phase primary power source.

(3) Airborne SSB Transceiver 618T-3.

The 618T-3 has a completely self-contained high-voltage power supply for use with a 27.5-volt d-c primary power source. The 618T-3 may also be retrofitted into some 618S installations. Retrofit installation data is contained in the 618T Installation Manual, Collins part number 520-5970-006, chapter 23-10-0.

D. Equipment Supplied.

Table 1 lists all equipment supplied as part of the 618T-( ).

E. Equipment Required - Not Supplied.

Table 2 lists equipment required for new installations which is not furnished as part of the 618T-( ). Table 3 lists equipment required for retrofit installations.

F. Systems Designations.

Several of the many possible combinations of 618T-( ) transceivers and associated equipment have been designated High-Frequency Communications Systems. Table 4 describes each of these systems. Refer to 618T-( ) Installation Manual, Collins part number 520-5970-006, chapter 23-10-0, for installation and interconnection data for each of these systems.

*Registered in U. S. Patent Office.

TABLE 1. EQUIPMENT SUPPLIED

ITEM	TYPE	OVER-ALL DIMENSIONS (inches)			WEIGHT (lb)	COLLINS PART NUMBER
		H	W	D		
Airborne SSB Transceiver	618T-1	7-5/8	10-1/8	22-3/16	50	522-1230-00
or						
Airborne SSB Transceiver	618T-2	7-5/8	10-1/8	22-3/16	52	522-1501-00
or						
Airborne SSB Transceiver	618T-3	7-5/8	10-1/8	22-3/16	50	522-1660-00
Module pullers (2)	--	--	--	--		546-6463-002

TABLE 2. EQUIPMENT REQUIRED FOR NEW INSTALLATION - NOT SUPPLIED

ITEM	FUNCTION	COLLINS PART NUMBER
Control Unit 714E-1	Frequency and mode selection.	522-1261-00
or		
Control Unit 714E-2	Frequency and mode selection.	522-2213-00
or		
Control Unit 714E-3	Frequency and mode selection.	522-2457-00
Antenna Tuner 180L-( )	Match impedance of long wire antenna to 50-ohm output of 618T-( ).	622-1199-004 (180L-2) 522-0092-004 (180L-3)
Antenna Coupler 180R-6/7	Match impedance of long wire antenna to 50-ohm output of 618T-( ).	522-0998-004
Antenna Coupler Control 309A-2D	Required when 180R-6/7 is used.	522-2434-004
Antenna	Radiate in 2- to 30-mc band.	---
Microphone	Supply audio input.	---
Headphones	Monitor audio output.	---
Shockmount 390J-1	Mount 618T-( ).	522-1658-00

TABLE 3. EQUIPMENT REQUIRED FOR 618S-( ) RETROFIT INSTALLATION - NOT SUPPLIED

ITEM	FUNCTION	COLLINS PART NUMBER
Retrofit Adapter 49T-3	Retrofits 618T-3 to 618S-( ) installation.	522-1645-00
or		
Retrofit Adapter 49T-4	Retrofits 618T-1 to 618S-( ) installation.	522-1697-00
Power Supply 516H-1	Replaces Power Supply 416W-1 in 618T-1 retrofit installation.	522-1204-00
Control Unit 714E-2	Replaces Control Unit 614C-2 in retrofit installations.	522-2213-00

TABLE 4. DESCRIPTION OF HIGH-FREQUENCY COMMUNICATIONS SYSTEMS

DESIGNATION	COLLINS PART NUMBER	COMPONENTS
High-Frequency Communications System HF-101	522-2426-00	Airborne SSB Transceiver 618T-1 Retrofit Adapter, 49T-4 Control Unit 714E-2 Power Supply 516H-1
High-Frequency Communications System HF-102	522-2427-00	Airborne SSB Transceiver 618T-2 Control Unit 714E-2 Shockmount 390J-1
High-Frequency Communications System HF-103	522-2428-00	Airborne SSB Transceiver 618T-3 Control Unit 714E-2 Shockmount 390J-1
High-Frequency Communications System HF-104	522-2435-00	Airborne SSB Transceiver 618T-3 Retrofit Adapter 49T-3 Control Unit 714E-2

4. TECHNICAL DATA SUMMARY.

A. Specifications 618T-( ).

(1) General.

Ambient Temperature Range	-40 to +55 degrees C with 30 minutes operation at + 70 degrees C.
Ambient Humidity Range	Up to 95 percent relative humidity at 50 degrees C for 48 hours.
Altitude Range	Pressure equivalent of 40,000 feet with externally-supplied cooling air.
Power Requirements.	618T-1 with 516H-1: 27.5 volts d-c, approximately 900 watts. 115 volts, 400 cps, 1 phase, approximately 150 watts. 618T-2: 208 volts, 3-phase, 400 cps, approximately 700 watts. 27.5 volts d-c, approximately 100 watts. 618T-3: 27.5 volts d-c, approximately 950 watts. 115 volts, 400 cps, 1 phase, approximately 100 watts.
Frequency Range	2.000 to 29.999 megacycles.
Frequency Channels	28,000.
Frequency Stability	One part-per-million per month.
Time Required to Change. . . . . . Channels	8 seconds maximum independent of external antenna tuner.

(2) Transmit Characteristics.

R-F Power Output	SSB: 400 watts PEP ±1 db. AM: 100 watts carrier. CW: 100 watts, locked key.
R-F Output Impedance	52 ohms.

Audio Input Impedance	100 ohms unbalanced and 600 ohms balanced.
Audio Frequency Response	5 db peak-to-valley ratio from 300 to 3000 cps.
Distortion	SSB: Third order distortion products down at least 30 db.
	AM: Less than 15 percent at 80 percent modulation.

(3) Receive Characteristics.

Sensitivity	SSB: 1 microvolt for 10-db S+N/N ratio.
	AM: 3 microvolts modulated 30 percent 1000 cps for a 6-db S+N/N ratio.
Selectivity	SSB: 2.85 kc, 6 db down. 6.0 kc, 60 db down.
	AM: 5.5 kc, 6 db down. 14.0 kc, 60 db down.
AGC Characteristic	Maximum variation of audio output is 6 db for input signals from 10 to 100,000 microvolts. No overload below 1-volt signal output.
I-F and Image Rejection	80 db, minimum.
Audio Output Power	100 milliwatts into 300-ohm load.
Audio Distortion	Less than 10 percent.
Audio Frequency Response	5-db peak-to-valley ratio from 300 to 3000 cps.

B. Module Complement.

Table 5 lists the modules used in Airborne SSB Transceiver 618T-( ).

C. Transistor Complement.

Table 6 lists the transistors used in Airborne SSB Transceiver 618T-( ).

D. Vacuum-Tube Complement.

Table 7 lists the vacuum tubes used in Airborne SSB Transceiver 618T-( ).

E. Diode Complement.

Table 8 lists the diodes used in Airborne SSB Transceiver 618T-( ).

F. Relay Complement.

Table 9 lists the relays used in Airborne SSB Transceiver 618T-( ).

G. Motor Complement.

Table 10 lists the motors used in Airborne SSB Transceiver 618T-( ).

H. Crystal Complement.

Table 11 lists the crystal used in Airborne SSB Transceiver 618T-( ).

TABLE 5. 618T-( ) MODULE COMPLEMENT

MODULE	FUNCTION	COLLINS PART NUMBER
A1	Frequency Divider	546-2142-005
A2	Radio-Frequency Oscillator	544-9285-005
A3	I-F Translator	544-9286-00
A4	Kilocycle Frequency Stabilizer	528-0112-005
A5	Low Voltage Power Supply	544-9292-00
A6	Electronic Control Amplifier	544-9290-005
A7	Three-Phase High-Voltage Power Supply	544-9291-00
A8	27.5-Volt D-C High-Voltage Power Supply	545-4971-00
A9	AM/Audio Amplifier	546-6053-00
A10	Megacycle Frequency Stabilizer	544-9289-005
A11	Power Amplifier	544-9283-00
A12	R-F Translator	528-0113-00
A12A1	Autopositioner (Submodule)	546-6873-005
A12A2	Variable Frequency Oscillator (VFO) (Submodule)	522-1380-003 (70K-3) 522-2424-004 (70K-5)
A13	Single-Phase High-Voltage Power Supply	545-5858-00
	Chassis	544-9293-00

TABLE 6. 618T-( ) TRANSISTOR COMPLEMENT

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION	COLLINS PART NUMBER
A1	Frequency Divider	Q1	2N1285	Emitter Follower	352-0243-00
		Q2	2N1285	Locked Oscillator	352-0243-00
		Q3	2N1285	Emitter Follower	352-0243-00
		Q4	2N697	Locked Oscillator	352-0197-00
		Q5	2N1285	Pulse Inverter	352-0243-00
		Q6	2N697	Blocking Oscillator	352-0197-00
		Q7	2N1285	Isolation Amplifier	352-0243-00
		Q8	2N1285	Locked Oscillator	352-0243-00
		Q9	2N1285	Switch	352-0243-00
		Q10	2N491	Unijunction Divider	352-0116-00
		Q11	2N1285	Pulse Amplifier	352-0243-00
		Q12-Q13	2N404	1-Kc Keyer	352-0158-00
		Q14	2N1285	Keyed Oscillator	352-0243-00
A2	R-F Oscillator	Q1	2N1285	3-Mc Oscillator	352-0243-00
		Q2	2N1285	Buffer Amplifier	352-0243-00
		Q3	2N1285	Regenerative Mixer	352-0243-00
		Q4	2N1285	Frequency Multiplier	352-0243-00
		Q5, Q6 Q8	2N1285	Isolation Amplifiers	352-0243-00
		Q9	2N1285	Regenerative Mixer	352-0243-00
		Q10	2N1285	Frequency Multiplier	352-0243-00

TABLE 6. 618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION	COLLINS PART NUMBER
(A2)		Q11	2N1285	Isolation Amplifier	352-0243-00
		Q12	2N1184	Oven Amplifier	352-0164-00
		Q13	2N1184	Oven Driver	352-0164-00
		Q14, Q15	2N458	Oven Power Amplifiers	352-0151-00
A3	I-F Translator	Q1	2N78	ALC Amplifier	352-0032-00
		Q2-Q5	2N274	I-F Amplifiers	352-0096-00
		Q6	2N542	TGC-ADC Amplifier	352-0221-00
A4	Kilocycle-Frequency Stabilizer	Q1	2N1285	VFO Isolation Amplifier	352-0243-00
		Q2	2N1285	1st Mixer	352-0243-00
		Q3	2N1285	2nd Mixer	352-0243-00
		Q4	2N1285	Isolation Amplifier	352-0243-00
		Q5-Q8	2N1285	Signal I-F Amplifiers	352-0243-00
		Q9	2N332	10-Kc Keyer	352-0119-00
		Q10	2N1139	10-Kc Keyer	352-0230-00
		Q11	2N128	Keyed Oscillator	352-0269-00
		Q12	2N1285	Digit Oscillator	352-0243-00
		Q14	2N1285	Isolation Amplifier	352-0243-00
		Q15	2N1285	Reference Mixer	352-0243-00
		Q16-Q19	2N1285	Reference I-F Amplifiers	352-0243-00
A5	Low-Voltage Power Supply	Q1	2N674	Transient Blanker Switch	352-0168-00
		Q2	2N458	Transient Blanker Switch	352-0151-00

TABLE 6. 618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION	COLLINS PART NUMBER
(A5)		Q3	2N1131	Regulator Amplifier	352-0219-00
		Q4	2N332	Regulator Amplifier	352-0119-00
		Q5	2N550	Regulator Controller	352-0222-00
A6	Electronic Control Amplifier	Q1-Q4	2N651	Amplifiers	352-0194-00
		Q5	2N457	Driver	352-0134-00
		Q6-Q7	2N457	Push-Pull Output Amplifiers	352-0134-00
A8	27.5-Volt D-C High-Voltage Power Supply	Q1-Q2	2N158A	Saturable-Core Oscillators	352-0041-00
		Q3-Q6	2N1100	Push-Pull Switches	352-0121-00
A9	AM/Audio Amplifier	Q1-Q2	2N158	Audio Amplifiers	352-0055-00
		Q3-Q6	2N274	I-F Amplifiers	352-0096-00
		Q7	2N274	AGC Amplifier	352-0096-00
		Q8	2N651	Audio Amplifier	352-0194-00
		Q9	2N651	Selcal Audio Amplifier	352-0194-00
A10	Megacycle-Frequency Stabilizer	Q1	2N1285	Squaring Amplifier	352-0243-00
		Q2	2N697	Pulse Amplifier	352-0197-00
		Q3	2N697	Spectrum Generator	352-0197-00
		Q4-Q5	2N489	Automatic Level Detectors	352-0171-00
		A1Q1, A2Q1	2N1285	Limiting Amplifiers	352-0243-00
		A1Q2, A2Q2	2N697	Isolation Amplifiers	352-0197-00

TABLE 6. 618T-( ) TRANSISTOR COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	TRANSISTOR SYMBOL	TRANSISTOR TYPE	FUNCTION	COLLINS PART NUMBER
(A10)		A1Q3 A2Q3	2N697	Mixers	352-0197-00
		A1Q4 A2Q4	2N1285	1-Mc I-F Amplifiers	352-0243-00
A12A2	VFO Submodule	Q1	2N1196	Oscillator	352-0232-00
		Q2	2N1285	Amplifier	352-0243-00
		Q3	2N1285	Amplifier	352-0243-00
		Q4	2N384	Amplifier	352-0103-00
516H-1	External Power Supply	Q1-Q2	2N458	Saturable-Core Oscillators	352-0151-00
		Q3-Q8	2N1100	Push-Pull Switches	352-0121-00

TABLE 7. 618T-( ) VACUUM-TUBE COMPLEMENT

MODULE SYMBOL	LOCATION	TUBE SYMBOL	TUBE TYPE	FUNCTION	COLLINS PART NUMBER
A12	R-F Translator	V1	12AT7WA	Transmit L-F Mixer	255-0218-00
		V2	12AT7WA	Transmit 17.5-Mc Mixer	255-0218-00
		V3	12AT7WA	Transmit H-F Mixer	255-0218-00
		V4-V5	6DC6	R-F Amplifiers	255-0226-00
		V6-V7	6CL6	Drivers	255-0216-00
		V8	6AH6WA	Receive L-F Mixer	255-0344-00
		V9	6AH6WA	Receive 17.5-Mc Mixer	255-0344-00
		V10	6AH6WA	17.5-Mc Oscillator	255-0344-00
		V11	6AH6WA	H-F Oscillator	255-0344-00
		V12	12AT7WA	Receive H-F Mixer	255-0218-00
A11	Power Amplifier	V1-V2	RCA 7204	Power Amplifiers	256-0136-00

TABLE 8. 618T-( ) DIODE COMPLEMENT

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION	COLLINS PART NUMBER
A1	Frequency Divider	CR1	1N198	Blocking Oscillator Circuit (Protects Q6)	353-0160-00
		CR2	1N198	Switch Circuit	353-0160-00
		CR3, CR4	1N627	Unijunction Divider Circuit	353-2693-00
		CR5	1N627	Pulse Amplifier Circuit	353-2693-00
A2	R-F Oscillator	CR1, CR2	1N645	Limiters	353-2850-00
A3	I-F Translator	CR1	1N252	Diode Quad Balanced Modulator	353-2579-00
		CR3	HD2120	Protects Q2	353-2780-00
		CR4	HD2120	Protects Q3	353-2780-00
		CR5A/B	1N67	Product Detector	353-0127-00
		CR6	HD2160	Transmit-Receive Switch	353-2006-00
		CR7	HD2120	TGC Gate	353-2780-00
A4	Kilocycle-Frequency Stabilizer	CR1, CR11	1N926	Frequency Discriminator	353-2953-00
		CR3	1N629	Protects Q9	353-2584-00
		CR4, CR5	1N629	Protects Q10	353-2584-00
		CR6-CR8	1N2167A	VFO Bias (Referenced Breakdown)	353-2944-00
		CR9, CR10	1N926	Phase Discriminator	353-2953-00
		CR12	1N645	Digit Oscillator Circuit	353-2607-00
		CR13	1N270	Keyed Oscillator Circuit	353-2018-00
		CR14, CR15	1N457	Keyed Oscillator Circuit	353-0204-00
		CR16	1N198	Keyed Oscillator Circuit	353-0160-00
A5	Low-Voltage Power Supply	CR1	1N3018A	Transient Blanker Circuit (Breakdown)	353-1313-00

TABLE 8. 618T-( ) DIODE COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION	COLLINS PART NUMBER
(A5)		CR2	1N2621A	Regulator Circuit (Reference Breakdown)	353-2939-00
		CR3	1N1492	Half-Wave Rectifier	353-1661-00
A6	Electronic Control Amplifier	CR1, CR2	PS6315	Interstage Isolation (Breakdown)	353-2952-00
A7	Three-Phase High-Voltage Power Supply	CR1-CR36	1N1492	Full-Wave Rectifiers	353-1661-00
		CR37, CR38	1N1487	SSB TGC Rectifiers	353-1662-00
A8	27.5-Volt D-C High-Voltage Power Supply	CR1-CR5	1N1487	Oscillator Circuit	353-1662-00
		CR6-CR21	1N1492	Full-Wave Rectifiers	353-1661-00
		CR22, CR23	1N1487	SSB TGC Gates	353-1662-00
					353-5400-00
A9	AM/Audio Amplifier	CR1	1N645	SSB AGC Detector	353-2607-00
		CR2, CR3	HD2120	SSB AGC Detectors	353-2780-00
		CR4	HD2120	AM Audio Detector	353-2780-00
		CR5, CR6	HD2120	AM AGC Detectors	353-2760-00
		CR7	HD2120	SSB AGC Detector	353-2780-00
		CR8, CR9	1N645	CW Keying Circuit	353-2607-00
		CR12	1N645	CW Keying Circuit	353-2607-00
		CR14	HD2120	AGC Gate	353-2780-00
A10	Megacycle-Frequency Stabilizer	CR1-CR3	1N198	Spectrum Pulse Rectifiers	353-0160-00
		A1CR1 A2CR1	1N457	AM Detectors	353-0204-00
A11	Power Amplifier	CR1	1N1491	Half-Wave Bias Rectifier	353-1660-00
		CR2A/B	1N198	Phase Discriminator	353-2025-00
		CR3	1N198	ADC Rectifier	353-0160-00

TABLE 8. 618T-( ) DIODE COMPLEMENT

MODULE SYMBOL	LOCATION	DIODE SYMBOL	DIODE TYPE	FUNCTION	COLLINS PART NUMBER
(A11)		CR4	1N457	ADC Gate	353-0160-00
		CR5	1N3043B	Bias Stabilization (Breakdown)	353-3073-00
		CR6	1N3020B	TGC Reference Stabilization (Breakdown)	353-3050-00
		CR7, CR8	10M20-00Z2	400-Volt Screen Voltage Stabilization (Breakdown)	353-1145-00
A12	R-F Translator	CR1	1N645	Capacity Switch	353-2607-00
		CR5	1N645	Protects Relay K3	353-2607-00
		CR6	1N67A	AGC Rectifier	353-0147-00
A12A1	Autopositioner, Submodule	CR1, CR2	1N645	Protect Relays	353-2607-00
		CR3, CR4	1N457	Protect Relays	353-0204-00
	Chassis	CR1, CR2	1N39B	Sidetone Relay Rectifiers	353-2014-00
		CR3	1N645	Isolation Diode	353-2607-00
		CR4	1N647	400-Cycle Interlock Relay Rectifier	353-2596-00
		CR5	1N645	Protects Relay K8	353-2607-00
		CR6	1N457	Protects Relay K10	353-0204-00
A13	Single-Phase High-Voltage Power Supply	CR1-CR16	1N1492	Full-Wave Rectifiers	353-1661-00
		CR17, CR18	1N1487	SSB TGC Rectifiers	353-1662-00

TABLE 9. 618T-( ) RELAY COMPLEMENT

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION	COLLINS PART NUMBER
A3	I-F Translator	K1	2	T/R Relay	974-0655-00
		K2	2	Sideband Selector	974-0700-00

TABLE 9. 618T-( ) RELAY COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION	COLLINS PART NUMBER
(A3)		K3	2	AM/SB Relay	974-0655-00
		K4	2	AM/SB Relay	974-0655-00
		K5	2	By-Pass Relay	974-0655-00
A7	Three-Phase High-Voltage Power Supply	K1	4	Plate Contactor	972-1526-00
		K2	3	Step Start	972-1527-00
		K3	2	Overload	972-1515-00
A8	27.5-Volt D-C High-Voltage Power Supply	K1	2	H-V On-Off	972-1528-00
		K2	2	Overload	972-1515-00
A9	AM/Audio Amplifier	K1	2	CW Keying Relay	974-0720-00
		K2	2	CW T/R Delay Relay	408-1098-00
A11	Power Amplifier	K1	2	PA Band-Switch Interlock Relay	974-0559-00
		K2	1	Tune Power Relay	972-1465-00
A12	R-F Translator	K1	2	T/R Relay	974-0559-00
		K2	2	T/R Relay	974-0669-00
		K3	2	Band-Switch Motor Relay	974-0559-00
		K4	2	T/R Relay	974-0669-00
A12A1	Autopositioner Submodule	K1	2	1-Kc Motor Relay	974-0720-00
		K2	3	10-Kc Motor Relay	546-6857-003
A13	Single-Phase High-Voltage Power Supply Module	K1		H-V Delay	
		K2		Overload	
	Chassis (Relay Compartment)	K1	2	On-Off Relay	972-1544-00
		K2	4	Keying Relay	972-1335-00
		K3	4	Keying Relay	972-1335-00
		K4	4	Recycle Relay	972-1335-00

TABLE 9. 618T-( ) RELAY COMPLEMENT (Cont)

MODULE SYMBOL	LOCATION	RELAY SYMBOL	NUMBER OF TRANSFER SWITCHES	FUNCTION	COLLINS PART NUMBER
(A13)		K5	2	Antenna Transfer Relay	972-1531-00
		K6	2	Sidetone Relay	974-0464-00
		K7	1	Time Delay Relay	974-0711-00
		K8	2	18-Volt Delay Relay	402-0302-00
		K9	2	400-Cycle Interlock Relay	974-0712-00
		K10	2	Delay Interlock Relay	974-0587-00

TABLE 10. 618T-( ) MOTOR COMPLEMENT

MODULE	SYMBOL	FUNCTION	COLLINS PART NUMBER
Power Amplifier	B1	Band-Switch Motor	230-0303-00
	B2	Servo Tuning Motor	229-0222-00
R-F Translator	B1	Band-Switch Motor	230-0303-00
Autopositioner	B1	1-Kc Motor	230-0303-00
	B2	10-Kc and 100-Kc Motor	230-0303-00

TABLE 11. 618T-( ) CRYSTAL COMPLEMENT

MODULE	SYMBOL	FUNDAMENTAL FREQUENCY	COLLINS PART NUMBER
R-F Oscillator	Y1	3.000 mc	290-9977-00

5. SINGLE SIDEBAND THEORY.

The single sideband (SSB) method of communication provided by the 618T-( ) has proved to be a much more efficient and reliable means of voice communications than the amplitude modulation (AM) method.

SSB and AM signals can be compared by considering the frequency spectrums that make up each signal. Refer to figure 2. An AM signal is composed of three parts: an r-f carrier frequency, an upper sideband (the carrier frequency plus the audio spectrum), and a lower sideband (the carrier frequency minus the audio spectrum). See figure 2(B). These two sidebands are always generated in any modulation process. All of the audio information is contained in only one sideband. The other sideband merely duplicates this information and the carrier contains no information. If the duplicated sideband and carrier were completely eliminated and only the other sideband transmitted, the amount of information transmitted would be exactly the same as if all three parts were transmitted.

This is what is done in SSB transmission; a single sideband is transmitted. Because the carrier and one sideband are eliminated, the SSB signal requires only half the bandwidth required by an AM signal. Therefore, twice as many SSB signals as AM signals can be contained in the same spectrum space. Since the SSB signal consists of a single sideband, the other sideband and carrier must be eliminated in the SSB signal generation process. The SSB signal is generated in the 618T-( ) as follows.

The polarity of the amplified audio input is reversed at a 500-kc rate by a diode chopper. This chopper is called a balanced modulator. The magnitude of the output of the balanced modulator depends on the magnitude of the audio input. When there is no audio input, there will be no balanced modulator output.

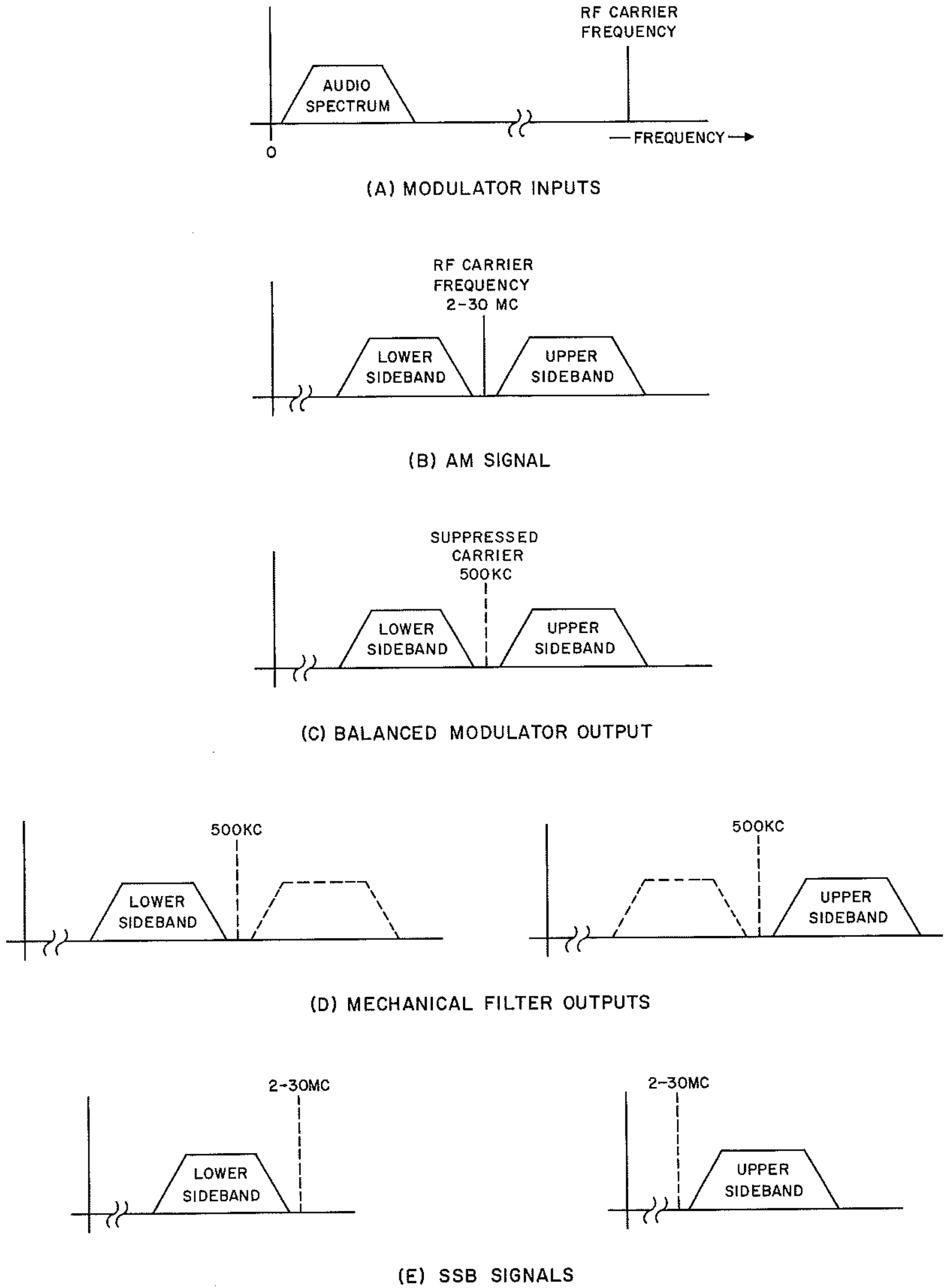
If the frequency spectrum of the balanced modulator output is analyzed, the upper and lower sidebands will be present, one on each side of 500 kc, just as in an AM modulator with a carrier frequency of 500 kc. Unlike the AM modulator output, however, the balanced modulator output contains a negligible 500-kc carrier frequency component. Thus, the carrier frequency has been balanced out, or suppressed, in the balanced modulator. See figure 2(C). The balanced modulator is described in more detail in paragraph 6.C.(1).

The double-sideband, suppressed-carrier signal from the balanced modulator is fed to one of two mechanical filters. The bandwidth of each filter is approximately 3 kc, enough to pass the audio spectrum. One filter passes only the upper sideband, and the other passes only the lower sideband. Either filter may be selected by the mode selector switch on the remote control unit. The filter output is a single sideband. See figure 2(D). This 500-kc i-f sideband is heterodyned in several mixers to the selected operating frequency.

The SSB generator, then, is essentially a frequency translating device that translates an audio spectrum to an r-f spectrum which may be on either side of a missing r-f carrier frequency. See figure 2(E).

Because the SSB signal is a translated audio spectrum, it must be amplified linearly, just like an audio spectrum, in order to prevent excessive distortion. For this reason, Class C r-f amplifiers, like those used to amplify AM signals, cannot be used to amplify SSB signals.

To recover the audio information from the SSB signal at the receiver, the signal must be mixed with a carrier frequency which is generated at the receiver. The difference-frequency output of the mixer is the audio spectrum. In SSB receivers, the mixer that performs this demodulation is called a product detector. The product detector is described in more detail in paragraph 6.C.(2).



SSB and AM Signal Spectrums
Figure 2

6. OPERATION.

A. General.

The following paragraph contains a general explanation of Airborne SSB Transceiver 618T-( ). Detailed explanations of each module are contained in paragraphs C through P.

(1) Transmit Mode.

Refer to the upper part of figure 3. The audio output of the operator's microphone is fed through two audio amplifiers, A9Q1 and A9Q2. If the balanced audio input or CW tone input is used, an additional amplifier, A9Q8, is added. A sidetone output is provided from A9Q2 for monitoring the audio. The amplified audio is fed to a balanced modulator where it is combined with a 500-kc signal from the r-f oscillator. The balanced modulator output is the upper and lower sidebands, one on each side of 500 kc. The two sidebands are fed to A3Q1, the automatic load control (alc) amplifier. The gain of the alc amplifier is controlled by a feedback signal from the grid of the power amplifier. If the grid of the power amplifier is overdriven, the gain of the alc amplifier is reduced.

The two sidebands are further amplified by A3Q2, and fed through one of two mechanical filters, A3FL1 or A3FL2. The selection of the desired filter is controlled by the mode selector switch on Control Unit 714E-( ). One filter passes only the upper sideband, and the other passes only the lower sideband. When the transceiver is operated in the AM mode, the upper sideband is passed and a 500-kc carrier from the r-f oscillator is reinserted at the filter output.

The output of the mechanical filter is fed to 500-kc i-f amplifier A3Q4 through relay A3K5. The gain of A3Q4 is controlled by feedback signals from the plate of the power amplifier. If excessive plate current flows, the transmitter gain control (tgc) reduces the gain of A3Q4. If excessive r-f plate voltage swing occurs, the automatic drive control (adc) reduces the gain of A3Q4.

The 500-kc i-f output of A3Q4 is heterodyned by mixers A12V1, A12V2, and A12V3 to the selected operating frequency. The operating-frequency output of mixer A12V3 is fed through an r-f amplifier, A12V4 and A12V5, and then through a driver, A12V6 and A12V7. The driver output goes to the linear power amplifier, A11V1 and A11V2. The amplifier output network is automatically tuned by a servo loop and fed to a 52-ohm output.

(2) Receive Mode.

Refer to the lower part of figure 3. The antenna signal is coupled to an r-f amplifier, A12V4 and A12V5. The r-f output of the r-f amplifier is heterodyned by mixers A12V12, A12V9, and A12V8 to a 500-kc i-f. The 500-kc i-f output of mixer A12V8 is fed to both SSB and AM i-f amplifiers. The AM if amplifiers are operating in both the SSB and AM modes to provide a selcal (selective calling) output in either mode.

In the SSB mode, the output of the l-f mixer, A12V8, is fed to a 500-kc i-f amplifier, A3Q2, and then through one of two mechanical filters. Each filter has a bandwidth of 3 kc. One filter passes the upper sideband, and the other passes the lower sideband. The appropriate filter is selected at the mode selector switch on Control Unit 714E-( ). The filter output is amplified by i-f amplifiers A3Q3, A3Q4, and A3Q5. The output of A3Q5 is fed to a product detector which recovers the audio signal.

In the AM mode, the output of the l-f mixer, A12V8, is fed to a 500-kc i-f amplifier, A9Q3, and through a mechanical filter. This filter has a bandwidth of 6 kc in order to pass both sidebands. The filter output is amplified by i-f amplifiers A9Q4, A9Q5, and A9Q6. The output of A9Q6 is fed to an AM detector, which recovers the audio signal. Part of the output of i-f amplifier A9Q5 is amplified, detected, filtered, and fed to i-f amplifiers A9Q3 and A9Q4 for agc.

In either the SSB or AM mode, the detected audio is amplified by A9Q8, A9Q1, and A9Q2. Part of the output of audio amplifier A9Q2 is rectified and applied to r-f amplifier, A12V4 and A12V5, receive l-f mixer, A12V12, and SSB i-f amplifiers A3Q2 and A3Q3 for agc. the output of A9Q2 is fed to the operator's headphones.

B. Frequency Generation and Stabilization.

Airborne SSB Transceiver 618T-( ) transmits and receives on every 1-kc step from 2.000 to 29.999 mc. This provides 28,000 separate operating frequencies. The operating frequency is selected at Control Unit 714E-( ). The 100-kc, 10-kc and 1-kc frequency selector knobs on the control unit control the Autopositioner in the r-f translator module. The Autopositioner mechanically tunes a vfo (variable frequency oscillator) over the range from 3.500 to 2.501 mc in 1000 1-kc steps. The megacycle frequency selector knob on the control unit controls a motor in the r-f translator module. This motor switches tuning elements which tune an h-f oscillator to 28 frequencies, each 1 mc apart. The h-f oscillator, in conjunction with a 17.5-mc oscillator, provides 28 1-mc bands for each of the 1000 1-kc steps from the vfo. Thus, 28,000 steps are generated.

The extremely high stability of the 618T-( ) operating frequency is obtained by basing the frequency scheme of the entire transceiver on the frequency of a very stable crystal oscillator in the r-f oscillator module. To ensure that the frequency of this crystal oscillator is stable, the crystal is enclosed in a temperature-regulating oven that keeps the crystal temperature constant.

The injection frequency sources of the heterodyning mixers (h-f and 17.5-mc oscillators and vfo) are phase locked to the crystal-generated reference frequency by the action of circuits in the kilocycle and megacycle frequency stabilizer modules. The i-f injection frequency is also derived from the crystal oscillator. Therefore, the 618T-( ) operating frequency is as stable as the crystal oscillator, which is accurate to within one part-per-million per month.

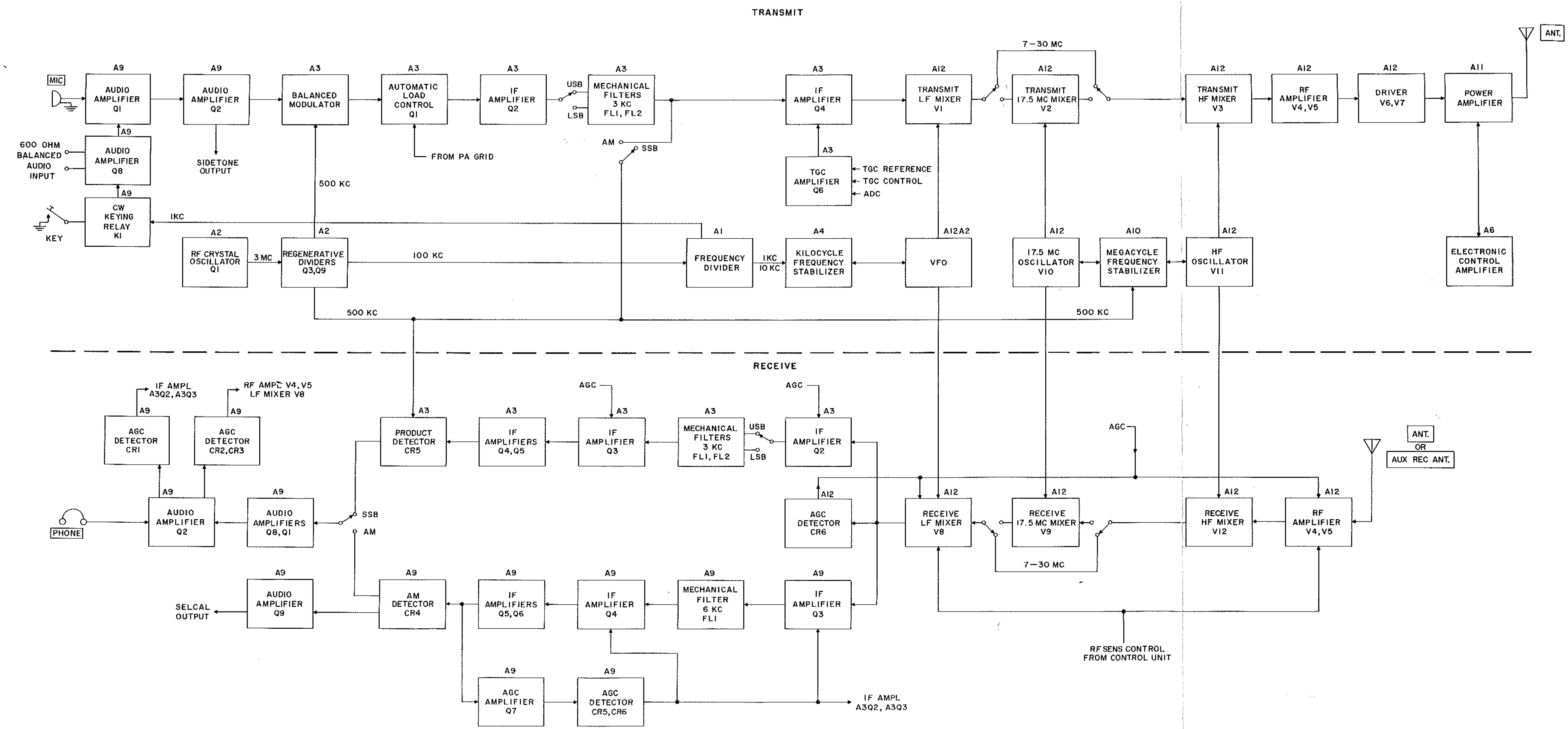
C. AM/Audio Amplifier Module, A9.

The AM/audio amplifier module (1) provides audio amplification in both the transmit and receive modes, (2) provides AM i-f amplification in the receive mode, (3) provides agc amplification and rectification, and (4) provides CW keying in the CW transmit mode. Figure 30 is a schematic diagram of the AM/audio amplifier module.

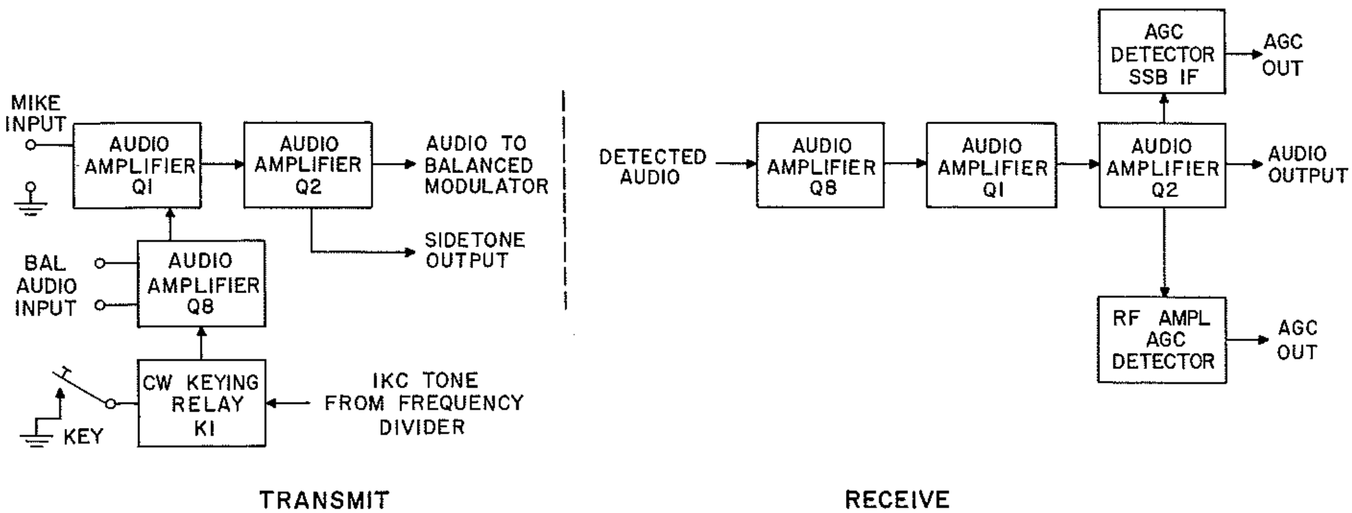
(1) Transmit Mode.

Refer to figure 4. The audio amplifier has three possible inputs: a 100-ohm unbalanced microphone input, a 600-ohm balanced audio input (for data), and a 1000-cycle tone input from the frequency divider module. This tone input is used during CW transmission and during the antenna tuner tuning cycle.

If an unbalanced microphone is used, the input signal is amplified by Q1 and Q2 before going to the balanced modulator in the i-f translator module. If the balanced input or



Airborne SSB Transceiver 618T-( ),
Block Diagram
Figure 3



Audio and CW Portion of AM/Audio Amplifier Module, Block Diagram
Figure 4

tone input is used, the input signal is amplified by Q8, Q1, and Q2 before going to the balanced modulator. A sidetone output is taken from Q2 for monitoring the audio input.

In the CW mode, the 1000-cycle tone is keyed into the upper sideband by relay K1. Relay K2 is a keyline relay that switches the 618T-( ) from receive to transmit when the CW key is depressed. Capacitors C47 and C49, placed across the coil of K2, hold the relay in the transmit position for 350 milliseconds after the key is released. This allows for spaces between words at normal CW keying speeds.

The 1000-cycle tone input is automatically fed into the audio input whenever the antenna tuner is tuning. Thus, the operator is signaled that the tuner is operating by the 1000-cycle tone at the audio output. Resistor R57 is selected at the factory for approximately 1-mv tune tone output during tuning. The tune tone level may be varied by changing the value of resistor R57.

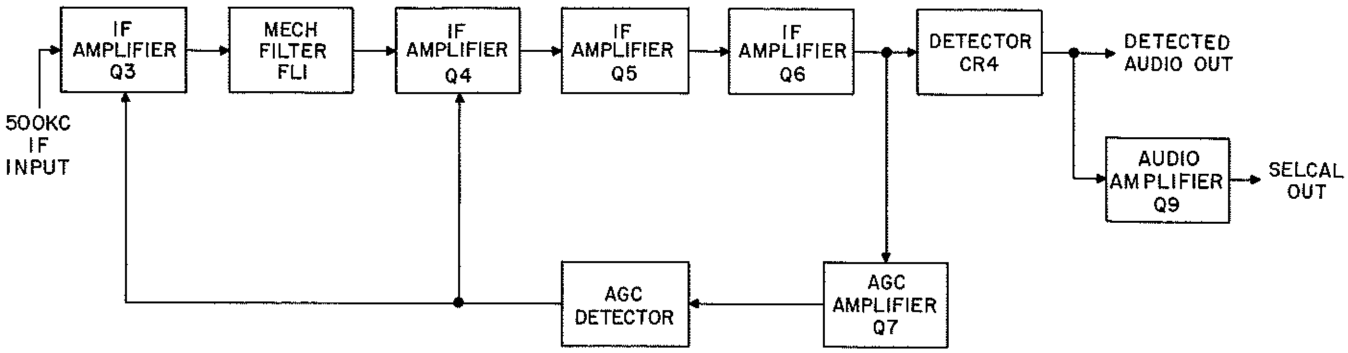
(2) Receive Mode.

The AM i-f amplifiers are operating whenever the 618T-( ) is in the receive mode to furnish a continuous selcal output.

Refer to figure 5. The 500-kc i-f input from the r-f translator module is fed to i-f amplifier Q3. The output of this amplifier is passed through a mechanical filter with a 6-kc bandwidth in order to pass both audio sidebands. The filter output is then amplified by i-f amplifiers Q4, Q5, and Q6. The output of Q6 is detected by CR4, filtered, and fed to the audio amplifier through AM/SB switching relay K3 in the i-f translator module. Part of the unswitched audio output from the AM detector is amplified by Q9 and fed to the selcal output at the rear connector.

Refer to figure 4. Three audio amplifiers, Q8, Q1, and Q2, are used in the receive mode. The audio inputs are from the AM detector in the AM mode, or from the product detector in the i-f translator module in the SSB mode.

Part of the 500-kc i-f output of Q6 goes to agc amplifier Q7. The amplifier output is rectified, filtered, and fed back to AM i-f amplifiers Q3 and Q4 for agc.



AM I-F Portion of AM/Audio Amplifier Module, Block Diagram
Figure 5

Part of the audio output of Q2 is rectified, filtered, and fed back to the r-f amplifiers, V4 and V5, and the receive 1-f mixer, V8, in the r-f translator module, for agc.

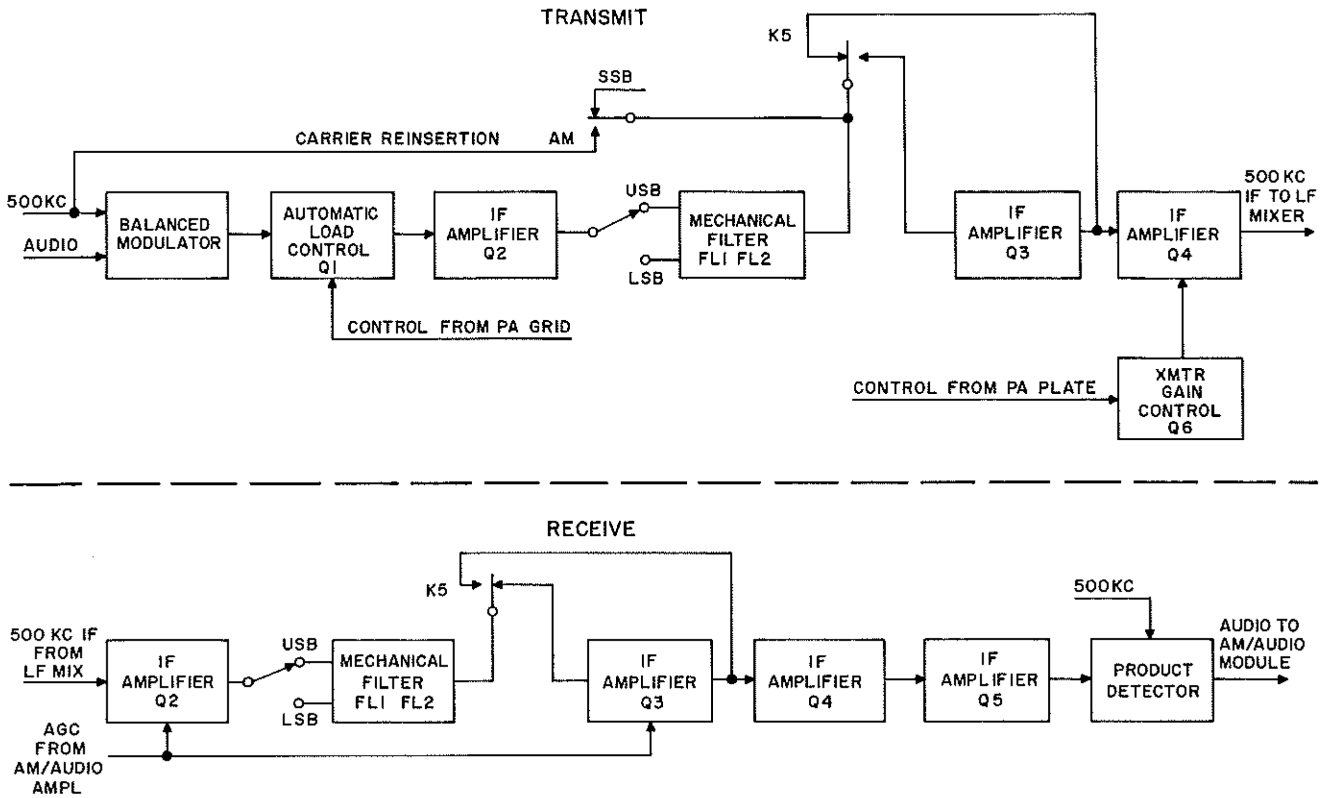
D. I-F Translator Module, A3.

The i-f translator module (1) generates a 500-kc SSB or AM signal in the transmit mode, and (2) contains SSB i-f amplifiers and product detector which are used in the receive mode. Figure 31 is a schematic diagram of the i-f translator module.

(1) Transmit Mode.

Refer to figure 6. The amplified audio from the AM/audio amplifier module is combined with a 500-kc signal from the r-f oscillator module in the balanced modulator, CR1. Refer to figure 7. The balanced modulator is essentially a diode chopper that reverses polarity of the audio input at a 500-kc rate. The 500-kc voltage switches the diodes on and off so that the audio input follows circuits as shown in figures 7(A) and 7(B) on successive half cycles. The 500-kc switching voltage is approximately 10 times larger than the audio, so that audio voltage peaks will not switch the diodes.

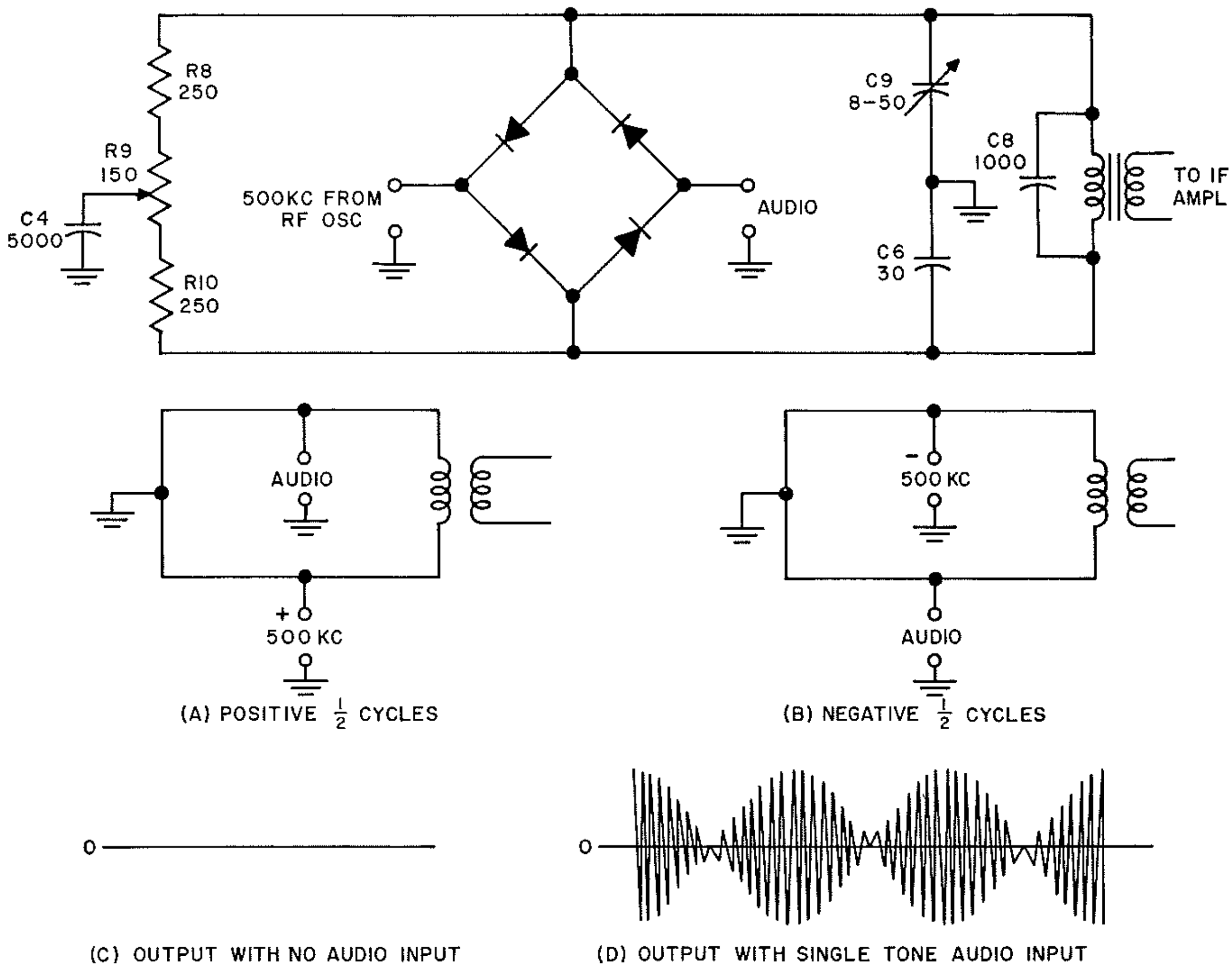
The switching action of the diodes causes equal 500-kc currents to flow in opposite directions through the primary of T1. The sum of the equal, opposite currents in the winding is zero. Therefore, the 500-kc carrier component has been balanced out of the modulator output. The diodes in the modulator circuit are matched so that the forward resistances of the diodes in the two on-biased conditions, 7(A) and 7(B), are equal. R9 and C9 are adjustable so that the currents can be balanced even more closely to ensure that the currents flowing through the diodes on successive half cycles will be equal. C6 and C9 overcome the effects of distributed capacitance in the modulator circuit. The balanced modulator output with a single-tone audio input is shown in figure 7(D).



I-F Translator Module, Block Diagram
Figure 6

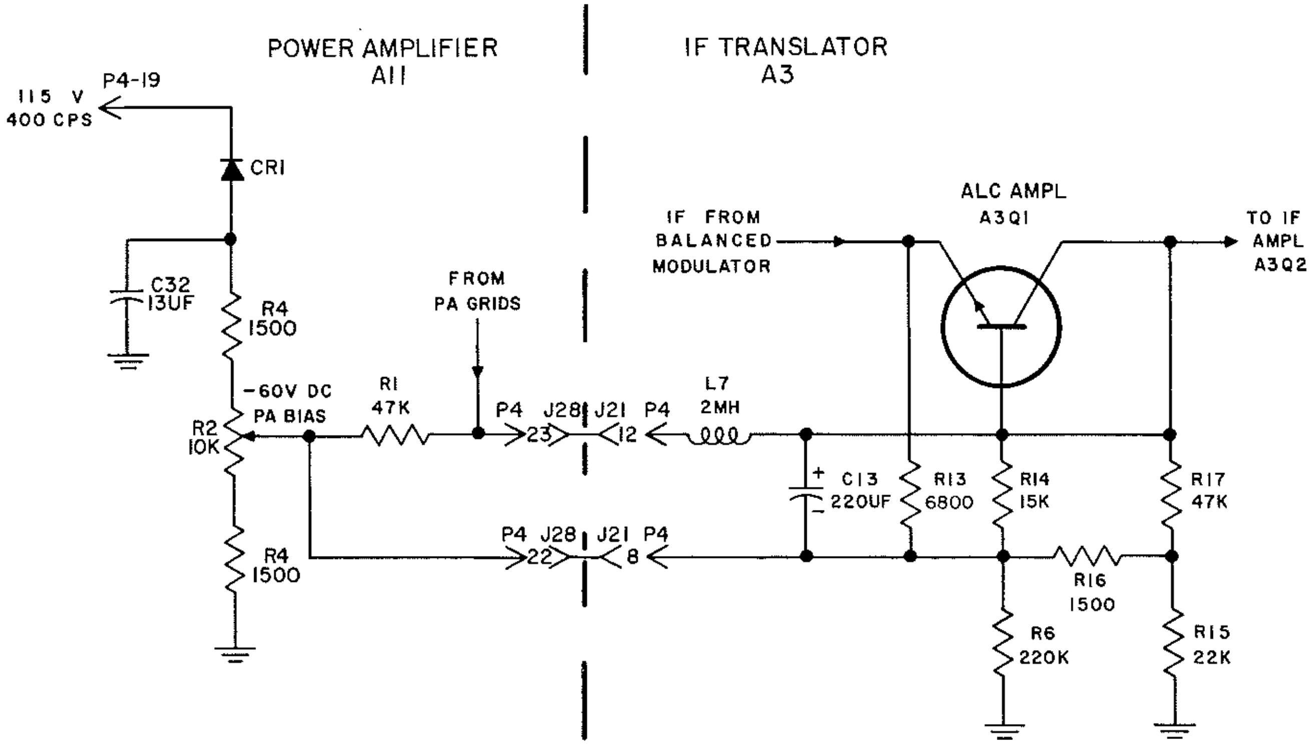
The balanced modulator output is fed through T1 to an automatic load control (alc) amplifier, Q1. Refer to figure 8. The alc amplifier is biased by voltages taken from the power amplifier bias supply in the power amplifier module. Resistor R1 in the power amplifier module is common to the grid circuit of the power amplifiers and the emitter-base circuit of the alc amplifier. When the grids of the power amplifier are overdriven, grid current will flow through R1. The voltage drop across R1 reduces the emitter current in the alc amplifier. This, in turn, decreases the amplifier gain and reduces the drive to the power amplifier. Thus, the power amplifier grid drive is kept at its maximum possible level without grid current flowing. Capacitor C13, across R1, provides fast attack-slow release action for the alc circuit.

The alc amplifier output is further amplified by i-f amplifier Q2 and fed to sideband relay K2. This relay, controlled by the mode selector switch at the control unit, switches the double sideband signal so that it passes either through the upper sideband (USB) filter, FL1, or the lower sideband (LSB) filter, FL2. When the mode selector switch is in the AM position, the USB filter is used and a 500-kc carrier frequency is reinserted at the filter output. The sideband signal then passes through contacts 8 and 3 of relay K5 and applied to the input of i-f amplifier Q4. Relay K5 is energized by the transmit-receive relay control and is energized in the transmit mode. The relay is used to bypass the sideband signal around i-f amplifier Q3 since the additional amplification provided by Q3 is not required in the transmit mode. I-f amplifier Q4 is the transmitter gain control (tgc) and automatic drive control (adc) stage.



Balanced Modulator, Simplified Schematic Diagram
Figure 7

Refer to figure 9. The gain of the tgc stage Q4, is controlled by the output of a d-c amplifier, Q6. Transistor Q6 has two inputs. One input is from the high-voltage power supply module. This negative voltage is proportional to the power amplifier plate current, which is drawn from the high-voltage power supply. The other input to Q6 comes from the power amplifier module and is proportional to the power amplifier r-f plate voltage swing. The level of this signal is adjusted so that a d-c voltage is present at the base of transistor Q6 only when the r-f plate voltage swing is excessive due to an open circuit at the output of the transmitter. If the power amplifier plate current tends to increase, or the r-f plate swing exceeds a preset value, the forward emitter-base voltage of tgc-adc amplifier Q6 is decreased causing the collector current to decrease. This collector current flows through resistors R27 and R28, which are common to the collector circuit of the tgc amplifier, Q6, and the emitter-base circuit of i-f amplifier Q4. When collector current decreases in Q6, the voltage across R22 and R28 decreases. This reduces the emitter current in Q4, and, thus, reduces its gain. This feedback action keeps the power amplifier plate current and r-f plate voltage swing from exceeding certain preset values.



ALC Circuit, Simplified Schematic Diagram
Figure 8

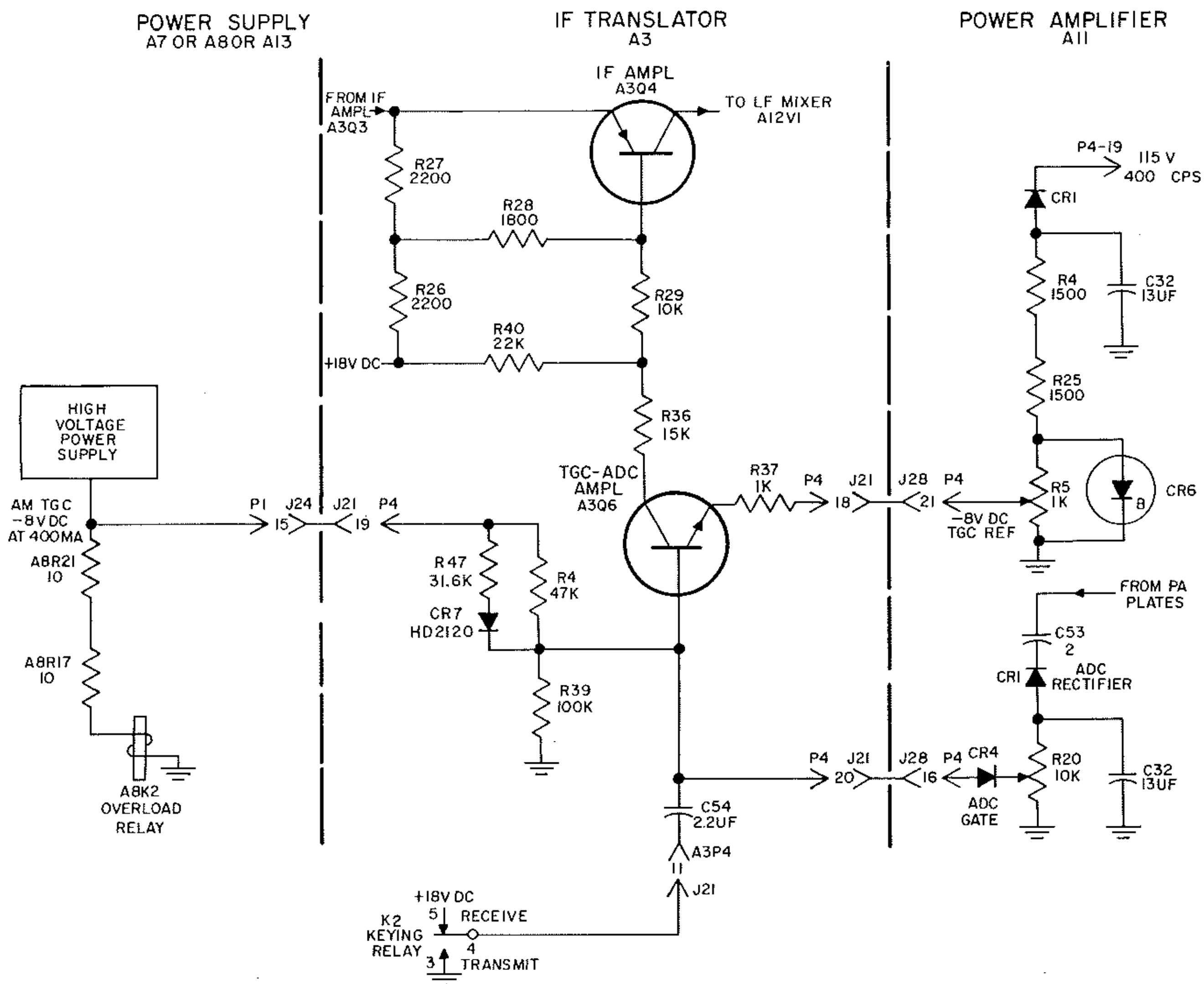
The tgc reference adjust, R5 in the power amplifier module, controls the transmitter power output. It is adjusted for approximately 100 watts into a 52-ohm load in the AM mode.

A protective circuit in the i-f translator module is used to prevent overdriving the transmitter before its gain control circuits are stabilized. An RC circuit, consisting of C54 and R39, gradually increases the transmitter gain from a low value to its normal value when the transmitter is keyed. Refer to figure 9. Capacitor C54, which is connected to the base of Q6, is charged through R39 to 18 volts when the 618T-( ) is in the receive mode. When the transmitter is keyed, C54 discharges through R39. This places a negative voltage on the base of Q6, cutting off the transistor at the instant the transmitter is keyed. As C54 discharges, the base of Q6 becomes less and less negative, until finally the input is forward biased and the amplifier is operating normally. The discharge time of the circuit is approximately 100 milliseconds.

(2) Receive Mode.

Refer to figure 6. The 500-kc i-f SSB signal from the r-f translator module is fed through i-f amplifier Q2 to the sideband mechanical filters. The filter that passes the sideband being received is switched into the circuit at the control unit. The filter output is further amplified by i-f amplifiers Q3, Q4, and Q5, since relay K5 is de-energized in receive mode, and then fed to the product detector.

The product detector is a diode mixer that mixes the 500-kc i-f sideband from Q5 with a 500-kc signal from the r-f oscillator module. The difference-frequency output of this



TGC and ADC Circuits, Simplified Schematic Diagram
Figure 9

mixer is the audio signal. A low-pass filter at the product detector output filters out the higher-order mixer products. The product detector output is fed through AM/SB switching relay K2 to the audio amplifier in the AM/audio amplifier module.

The gain of i-f amplifiers Q2 and Q3 is controlled by an agc voltage that is a combination of voltages from two sources. Part of this agc voltage comes from the i-f agc detector in the AM/audio amplifier module. The other part comes from the audio agc detector in the same module. Thus, the i-f amplifiers in the i-f translator module receive both i-f and audio agc from the AM/audio amplifier module.

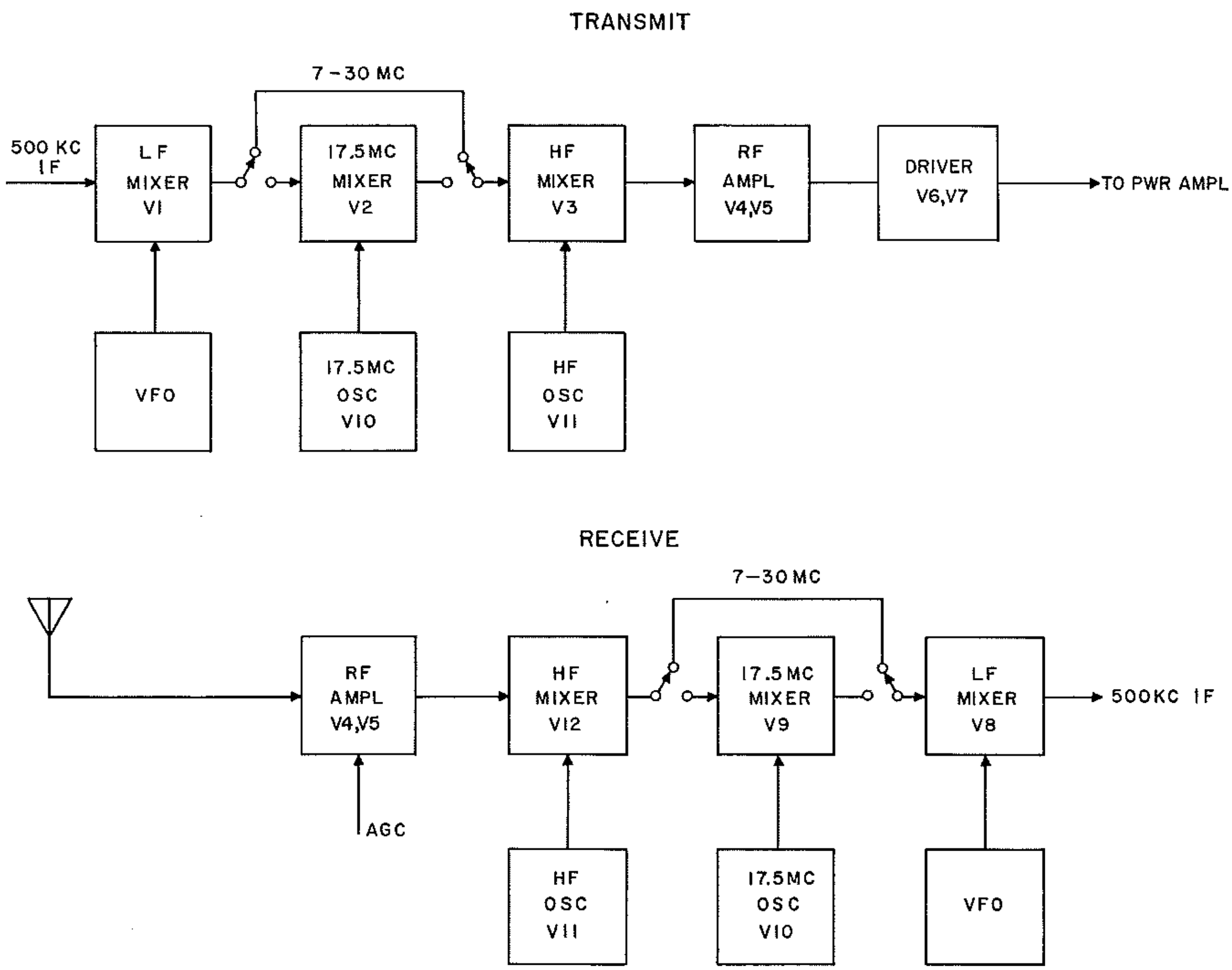
E. R-F Translator Module, A12.

The r-f translator module (1) translates the 500-kc i-f signal from the i-f translator module to the selected r-f operating frequency in the transmit mode, and (2) translates the r-f antenna signal to a 500-kc i-f signal in the receive mode. The Autopositioner and variable frequency oscillator (vfo) submodules are contained in this module. Figure 32 is a schematic diagram of the r-f translator module.

(1) Transmit Mode.

Refer to figure 10. The 500-kc i-f signal from the i-f translator module is combined with the vfo output in the transmit l-f mixer, V1. The vfo frequency varies from 3.500 to 2.501 mc in 1000 1-kc steps. Thus, the difference-frequency output of the l-f mixer varies from 2 to 3 mc in 1000 1-kc steps.

If the operating frequency is to be from 2.000 to 6.999 mc, the output of the l-f mixer is mixed with a 17.5-mc signal from the 17.5-mc oscillator, V10, in the transmit 17.5-mc mixer, V2. The 14.5- to 15.5-mc output of this mixer is then fed to the transmit h-f mixer, V3. If the operating frequency is to be from 7.000 to 29.999 mc, the output of the l-f mixer is fed directly to the h-f mixer.



R-F Translator Module, Block Diagram
Figure 10

The h-f mixer has 28 injection frequencies, spaced 1 mc apart. These 28 frequencies provide 28 bands for the 1000 steps from the vfo, making 28,000 channels available. The injection frequencies are generated by the h-f oscillator, V11. The h-f oscillator oscillates at only 16 fundamental frequencies, every 500 kc from 8.0 to 16.5 mc. To get the 28 frequencies, the oscillator output is tuned, in some cases, to twice the fundamental. The injection frequencies from the h-f oscillator for the 28 bands are tabulated in table 12.

The output of the h-f mixer is fed to the r-f amplifier, V4 and V5 connected in parallel, and then to the driver, V6 and V7 connected in parallel. The driver output is fed to the power amplifier module for amplification to the output power level.

The h-f oscillator, h-f mixer, r-f amplifier, and driver are tuned by the bandswitch motor, B1. This motor bandswitches tuning elements to 28 positions, one for each band. B1 is controlled by the megacycle selector knob at the control unit.

(2) Receive Mode.

The antenna signal is fed to the r-f amplifier, V4 and V5 connected in parallel. The amplifier output then goes through the receive h-f and l-f mixers, V12 and V8, and, if the received signal is from 2.000 to 6.999 mc, through 17.5-mc mixer V9. The tuned circuits of these receive mixers are the same circuits that tune the transmit mixers.

The r-f amplifier and l-f mixer receive agc voltage, which is derived from the rectified, filtered audio output. In addition to this audio agc, the amplifier and mixer are fed carrier agc, which is derived from the rectified, filtered r-f output of the l-f mixer. The 500-kc i-f signal output from the receive l-f mixer is fed to the i-f translator and AM/audio amplifier modules for both SSB and AM i-f amplification and detection.

The frequencies of the 17.5 and h-f oscillators are phase locked with the crystal-generated reference frequency from the r-f oscillator module by the action of circuits in the megacycle frequency stabilizer module. These oscillators are tuned by voltage-sensitive capacitors. Voltage-sensitive capacitors are semiconductor devices whose capacitance varies as the d-c voltage across them varies. A typical relationship between capacitance and d-c voltage is shown in figure 11. To obtain a linear relationship between capacitance and voltage, a d-c bias voltage is applied to the device and the voltage across it is varied by only a small amount.

(3) Autopositioner Submodule, A12A1.

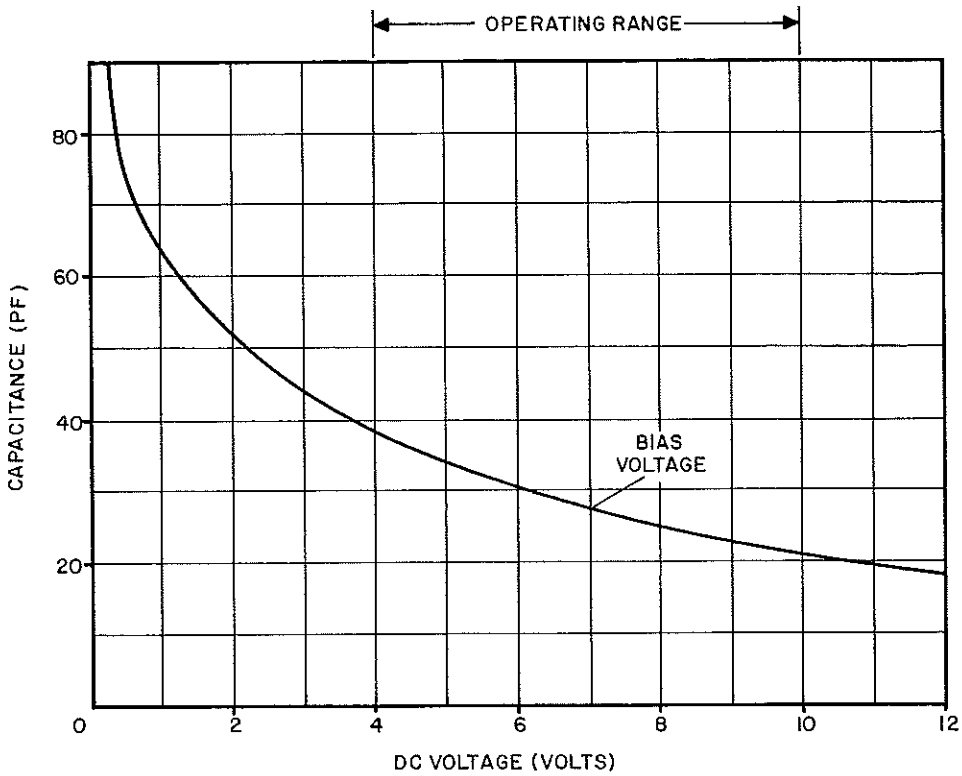
(a) General.

The Autopositioner is a motor-driven, electrically-controlled tuning mechanism. This mechanism automatically tunes the 618T-( ) to the frequency selected at the remote control unit. Thus, the 618T-( ) may be located, for example, in the radio compartment of the aircraft, and be completely controlled from a remote unit which is on or near the aircraft instrument panel.

TABLE 12. H-F OSCILLATOR FREQUENCY FOR EACH OPERATING FREQUENCY RANGE

OPERATING FREQUENCY (MC)	H-F OSCILLATOR FREQUENCY (MC)
2-3	12.5*
3-4	11.5*
4-5	10.5*
5-6	9.5*
6-7	8.5*
7-8	10.0
8-9	11.0
9-10	12.0
10-11	13.0
11-12	14.0
12-13	15.0
13-14	16.0
14-15	8.5**
15-16	9.0**
16-17	9.5**
17-18	10.0**
18-19	10.5**
19-20	11.0**
20-21	11.5**
21-22	12.0**
22-23	12.5**
23-24	13.0**
24-25	13.5**
25-26	14.0**
26-27	14.5**
27-28	15.0**
28-29	15.5**
29-30	16.0**

*These h-f oscillator frequencies are mixed with the 14.5- to 15.5-mc output from the 17.5-mc mixer.
**These h-f oscillator frequencies are doubled before injection into the h-f mixer.

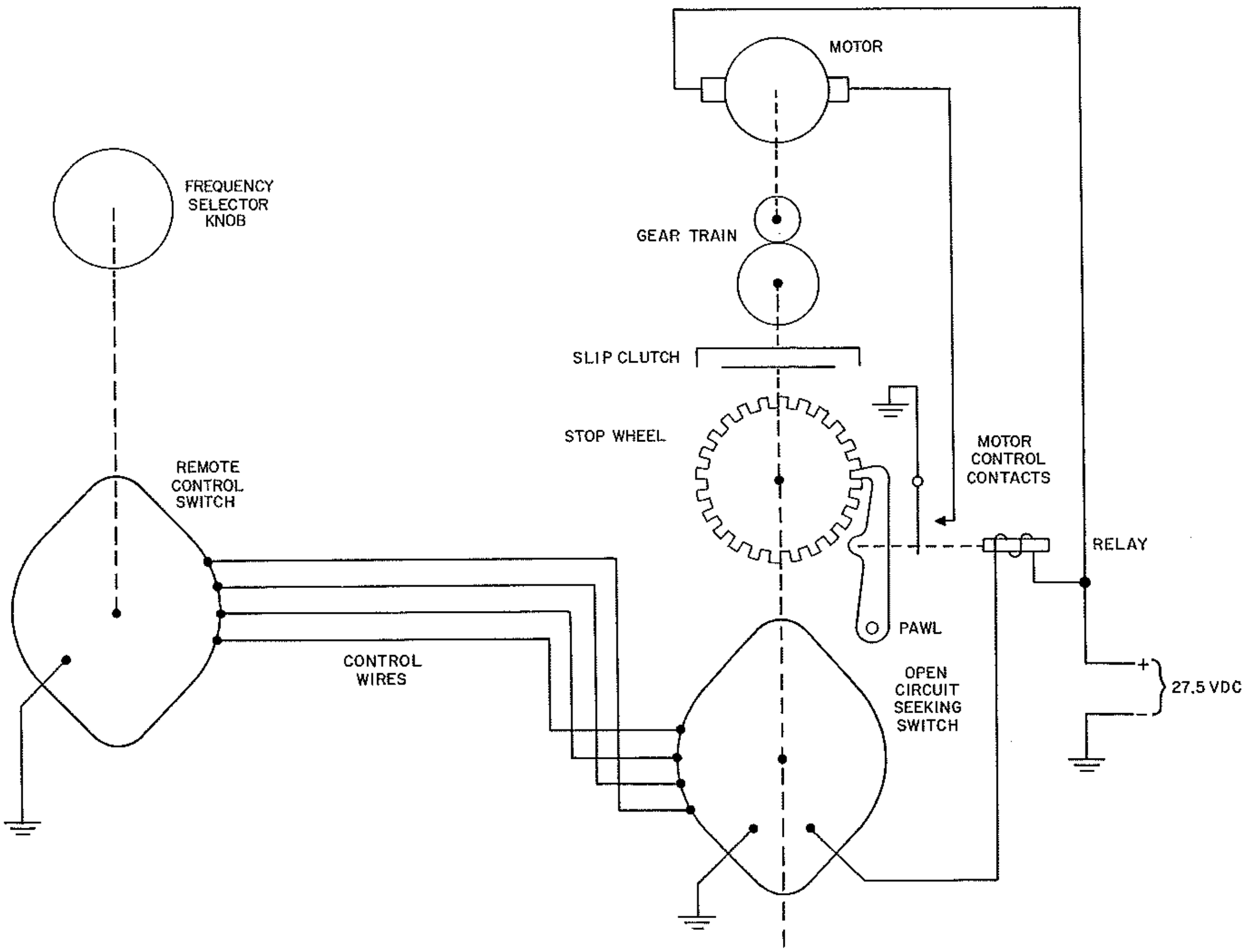


Voltage-Sensitive Capacitor, Typical Characteristics
Figure 11

The basic elements of the Autopositioner system are shown in figure 12. These elements are a motor and its gear reduction train, a slip clutch driving a rotary shaft, which is fastened to a notched stop wheel, a pawl which engages the notches in the stop wheel, and a relay which controls the pawl and operates a set of electrical contacts to start and stop the motor.

An electrical control system is part of each Autopositioner system. This control system consists of remotely-located control switches and electrically-similar seeking switches that are driven by the Autopositioner shaft. The control system is the open-circuit seeking type. Whenever the control switches and seeking switches are not set to the same electrical position, the Autopositioner is energized and drives its shaft (and the tuning elements to which the shaft is coupled) to the proper position to restore the symmetry of the control system.

A typical cycle of operation of the Autopositioner is as follows. The system is originally at rest with the control and seeking switches in corresponding positions (open circuit), relay in the de-energized position, pawl engaging a stop-wheel notch, and the motor not energized. When the operator changes the setting of the remote control frequency selector switch, the control system energizes the relay, lifting the pawl out of the stop-wheel notch and closing the motor control contacts. The motor starts, driving the Autopositioner shaft, the rotor of the seeking switches, and the tuning elements in tuned circuits. When the seeking switch reaches the point corresponding to the new position of the control switch, the relay circuit is opened and the pawl is dropped into a stop-wheel notch to stop shaft rotation. The motor



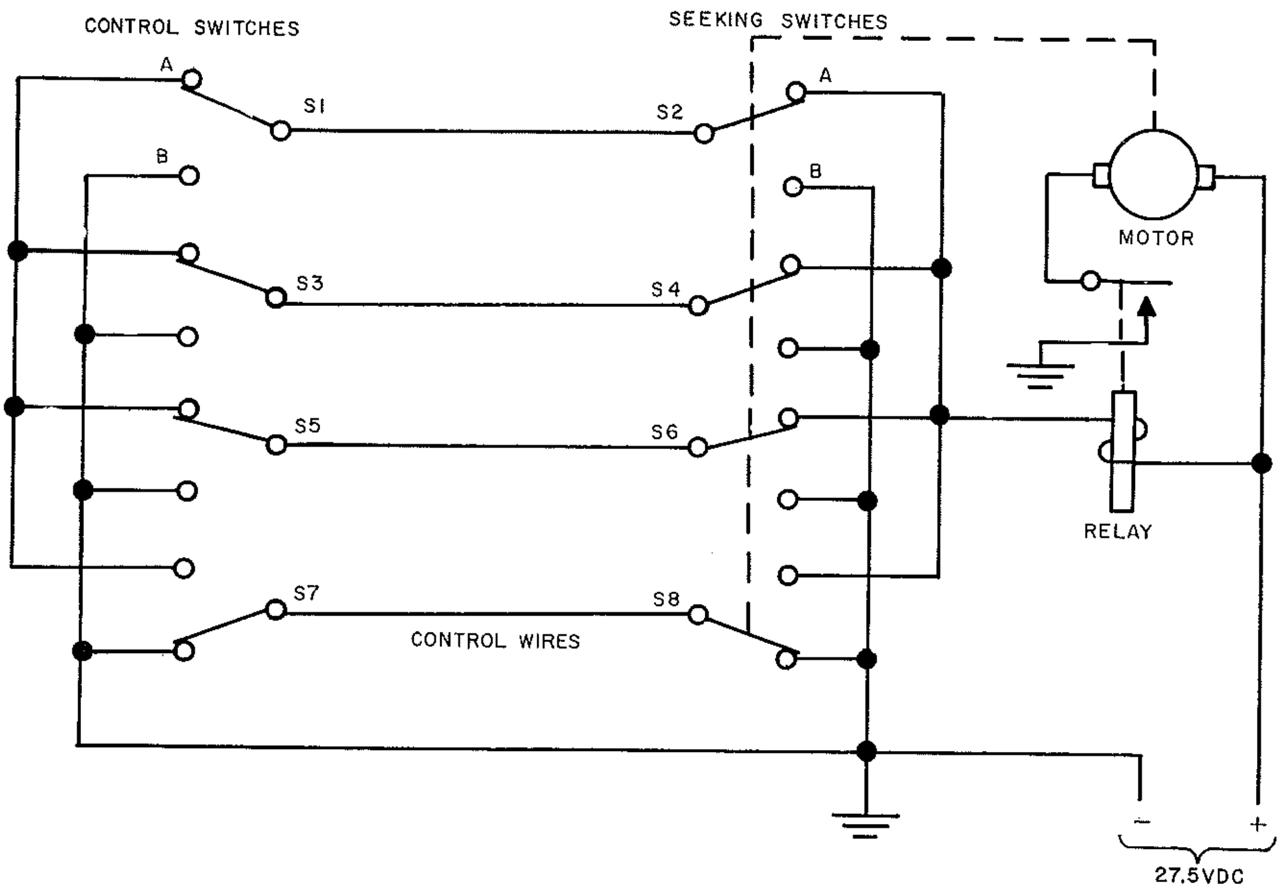
Autopositioner System, Basic Elements
Figure 12

control contacts open, and the motor coasts to a stop, dissipating kinetic energy in the slip clutch. The seeking switch of the control circuit is adjusted to open the relay circuit before the stop wheel reaches the point where the pawl engages the proper notch. The relay contacts controlling the motor are adjusted so that they do not open until the pawl drops into the notch.

(b) Autopositioner Control System.

A binary control system is used with the Autopositioner to provide a maximum number of tuning positions with a minimum number of control wires. This is done in the binary system by using the control wires in various combinations.

The binary system is like one composed of single-pole, double-throw switches as shown in figure 13. When the control and seeking switches are set symmetrically (S1 in the same position as S2, etc., as shown), there is no current path from the relay coil to ground, and the relay and motor are unenergized. If any of the control switches is set to a position opposite that of a corresponding seeking switch, a



Frequency Control System, Simplified Schematic Diagram
Figure 13

path to ground is closed, energizing the relay and motor. The motor turns the rotary seeking switches until they are again positioned in a symmetrical arrangement with the control switches. When this happens, the relay circuit opens and the motor stops.

The total number of combinations of switch positions in such a system is 2^n, where n is the number of control wires used. In the four-wire system shown, 2^4 or 16 different combinations exist. One combination, however, is not usable. If all the seeking switches in figure 13 are set to the B position, there can be no path from the relay coil to ground no matter how the control switches are set. Therefore, the maximum number of usable combinations in such a system is 2^n-1. The four-wire system shown can control 15 positions.

The control switches for the 618T-( ) Autopositioner system are contained in Control Unit 714E-( ). Figures 35, 36, and 37 are schematic diagrams of the three types of control units.

Early models of Control Units 714E-1 and 714E-2 contain r-f gain control circuits that differ from those in later models. The switching arrangement in both models, however, is the same.

(c) 618T-( ) Autopositioner.

The output shaft of the 618T-( ) Autopositioner is mechanically coupled to a variable inductor in the tuned circuit of the vfo. Ten turns of the output shaft tune the vfo through a 1-megacycle frequency range. Figure 34 is a schematic diagram of the 618T-( ) Autopositioner submodule.

There are three seeking switches in the 618T-( ) Autopositioner system: the 100-kc, 10-kc, and 1-kc seeking switches. For the selected vfo frequency to be set up, all three seeking switches must be satisfied. Since each of the three switches has 10 positions, there are 10^3 or 1000 possible switch combinations or shaft positions.

The 100-kc seeking switch is geared to the output shaft by an intermittent movement so that it is moved one position for each revolution (100 kc) of the output shaft. The 10-kc seeking switch and stop wheel are coupled directly to the output shaft. The stop wheel has 10 notches, making each notch position 10 kc apart in frequency. The 100-kc and 10-kc seeking switches are both driven by the same motor, B2.

The 1-kc seeking switch is driven by a separate motor, B1. This motor also drives a gear and cam arrangement that turns the output shaft to 10 intermediate positions between each notch on the stop wheel. Each of the 10 positions is a 1-kc step. These 10 positions, together with the 100 notch positions furnished by the 10 revolutions of stop wheel, give the required 1000 positions.

The Autopositioner mechanically tunes the vfo to within 2 kc of the selected operating frequency by the Autopositioner. The vfo is phase locked with the crystal-generated reference frequency from the r-f oscillator module by the action of circuits in the kilocycle frequency stabilizer module. Precision resistive dividers, which are ganged to the seeking switches in the Autopositioner submodule, furnish voltage information to the stabilizing circuits so that they will phase lock the vfo at the correct 1-kc frequency. As in the case of the 17.5 and h-f oscillators in the r-f translator module, the vfo is tuned by a voltage sensitive capacitor.

(4) Variable Frequency Oscillator Submodule, A12A2.

The frequency of the variable frequency oscillator (vfo) is controlled, through the Autopositioner, by the 100-, 10-, and 1-kc knobs on the control unit. It is tuned in 1000 1-kc steps from 3.500 to 2.501 mc. Figure 38 is a schematic diagram of the vfo submodule.

The oscillator in the vfo is a tuned-collector transistor oscillator, Q1. This oscillator is tuned by variable inductor L2, which is mechanically varied by the Autopositioner. It is phase locked by voltage-sensitive capacitor VC1. The d-c voltage that tunes VC1 is a combination of a mechanically-adjustable bias supply in the kilocycle frequency stabilizer module and a frequency- and phase-sensitive control voltages. These control voltages come from frequency and phase discriminators in the kilocycle stabilizer module. After the mechanical tuning is completed, the kilocycle stabilizer supplies a d-c control voltage from the frequency discriminator to bring the vfo frequency within the capture range of the phase discriminator. The phase discriminator then superimposes a strong d-c correction voltage to override the frequency discriminator and phase lock the vfo to the reference frequency from the r-f oscillator module. After the vfo is phase locked, the phase discriminator constantly changes the control voltage to VC1, if necessary, to keep the vfo frequency phase locked with the reference.

The vfo output goes through three amplifiers, Q2, Q3, and Q4, before it is coupled through transformer T2 to the l-f mixers in the r-f translator.

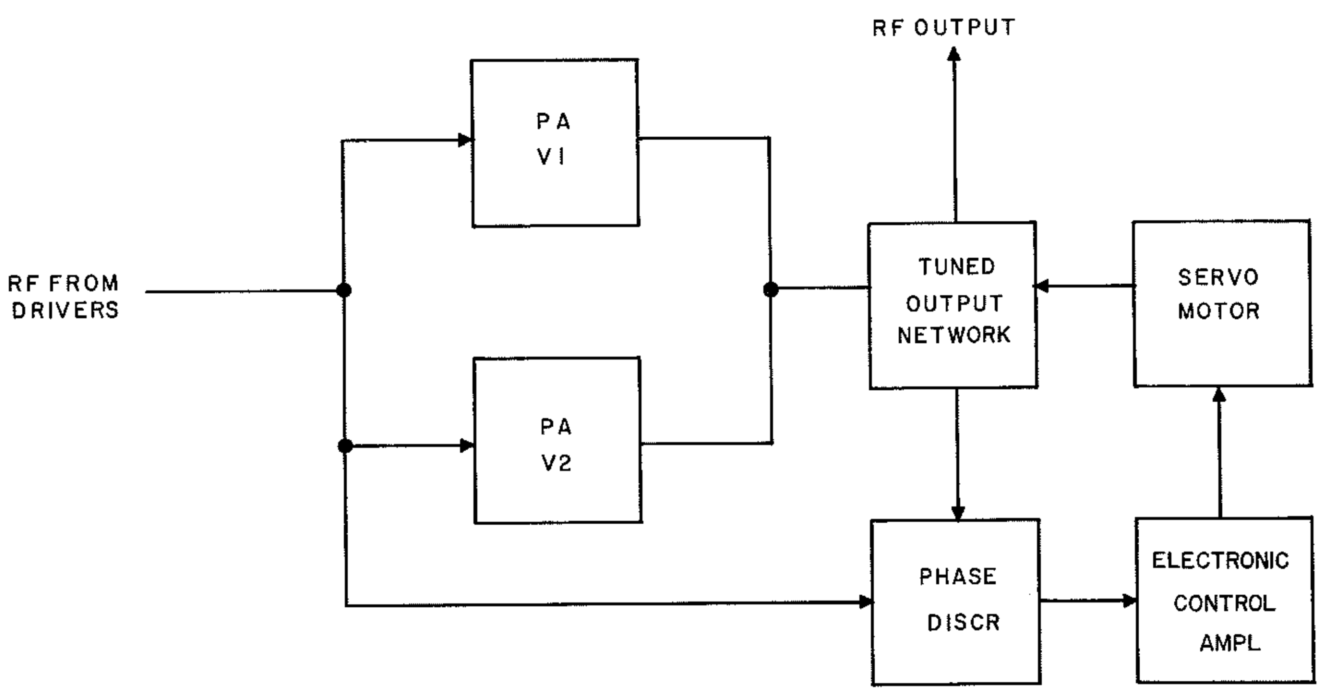
Figure 39 is a schematic diagram of vfo's used in early models of the 618T-( ). This model (70K-3) does not include the third amplifier, Q4. It also differs from the 70K-5 in the manner in which it receives tuning voltage from the kilocycle stabilizer module. Thus, the 70K-3 and 70K-5 are not electrically interchangeable, and each must be used with the proper kilocycle stabilizer module.

F. Power Amplifier and Electronic Control Amplifier Modules, A11 and A6.

The power amplifier module amplifies the 2- to 30-megacycle output of the r-f translator module to 400 watts PEP in the SSB mode or 100 watts carrier power in the AM or CW modes. Figure 40 is a schematic diagram of the power amplifier module.

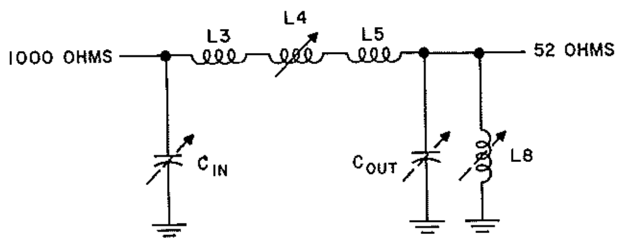
Refer to figure 14. The r-f signal from the r-f translator module is applied to the grids of the linear power amplifier, V1 and V2 connected in parallel. The power amplifier output network is a pi-section that steps up the 52-ohm antenna impedance to a 1000-ohm load for the power amplifier.

Refer to figure 15. The shunt capacitances and part of the series inductance of the output network is switched by motor B1 to 8 discrete steps, or bands. B1 is controlled by the megacycle frequency selector knob at the control unit. Part of the series inductance in the network is a variable inductor, L4, that is varied by a servo motor, B2. The servo motor is controlled by the output of a phase discriminator, which compares the phases of the input and output signals of the power amplifier. If these signals are not 180 degrees out of phase, the

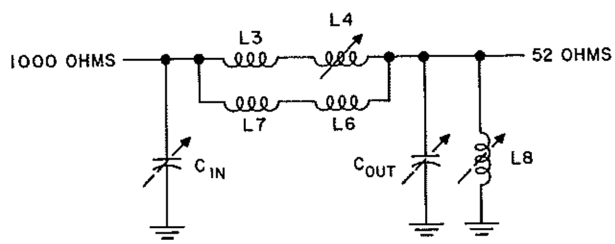


Power Amplifier Module, Block Diagram
Figure 14

phase discriminator produces a d-c output which is proportional in polarity and magnitude to the direction and magnitude of the phase error. This d-c error signal is changed to 400-cycle a-c by a mechanical chopper in the electronic control amplifier module, A6. Figure 41 is a schematic diagram of the electronic control amplifier module. The a-c error signal is amplified in the electronic control amplifier and applied to the servo motor. The motor drives the variable inductor, L4, which tunes the output circuit until the input and output signals are 180 degrees out of phase.



(A) BANDS 1 THROUGH 3.



(B) BANDS 4 THROUGH 8.

BAND	RANGE (MC)	FREQUENCY RATIO
1	2-3	1.5 : 1
2	3-4	1.3 : 1
3	4-6	1.3 : 1
4	6-8	1.5 : 1
5	8-11	1.4 : 1
6	11-16	1.5 : 1
7	16-22	1.4 : 1
8	22-30	1.4 : 1

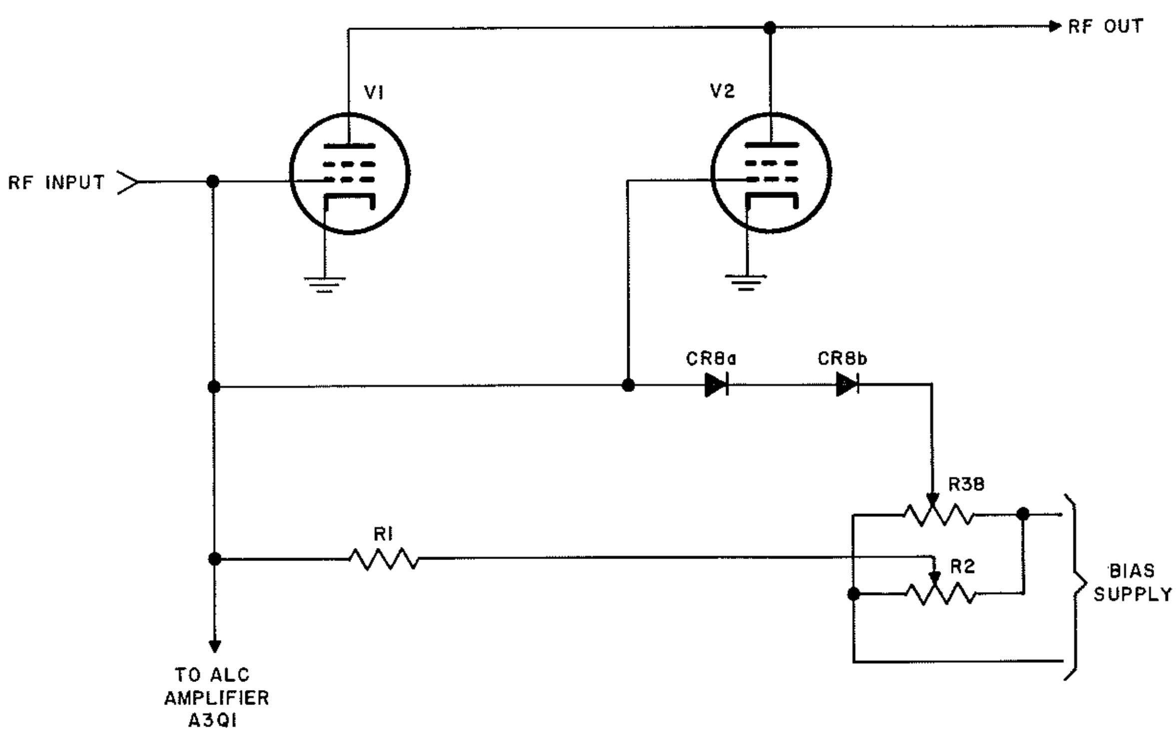
NOTE:
BROKEN ARROW INDICATES THAT VALUE IS VARRIED IN 8 STEPS.

Power Amplifier Output Network, Simplified Schematic Diagram
Figure 15

On some of the 8 bands, the variable inductor is combined in series with other inductors as shown in figure 15(A). On the other bands, L4 is in a series-parallel arrangement as shown in figure 15(B). In both circuits, the inductances are chosen so that the tuning range of the output circuit never exceeds 1.7 to 1 as the variable inductor is varied from one of its extremes to the other. All of the 8 bands have frequency ratios at their extremes that are less than 1.7 to 1. Band 1, for example, has a ratio of 3 mc to 2 mc, or 1.5 to 1. Therefore, it is in the 1.7 to 1 tuning range of the variable inductor. If the frequency ratio were allowed to reach 2 to 1, the phase discriminator would try to pick up the second harmonic of the fundamental input frequency, and the phase discriminator would not operate properly.

L8, shown in figures 15(A) and 15(B), is a compensating inductor that is tapped so that the parallel combination of L8 and C_{out} approaches resonance at the high end of the band being used. The high impedance of this parallel resonant circuit keeps the output impedance, and, therefore, the amplifier plate load, nearly constant over the entire tuning range of the band being used.

The 52-ohm output of the power amplifier module is coupled to an antenna tuner. A signal from the tuner during the tuning cycle energizes relay K2 and places a 22-ohm resistor in series with the power amplifier output during the tuning cycle. This reduces the power in the output circuit so that it will not be damaged when the antenna is being tuned. This resistor also provides isolation between the power amplifier and antenna tuner during the tuning cycle.



PEP Limiter, Simplified Schematic Diagram
Figure 16

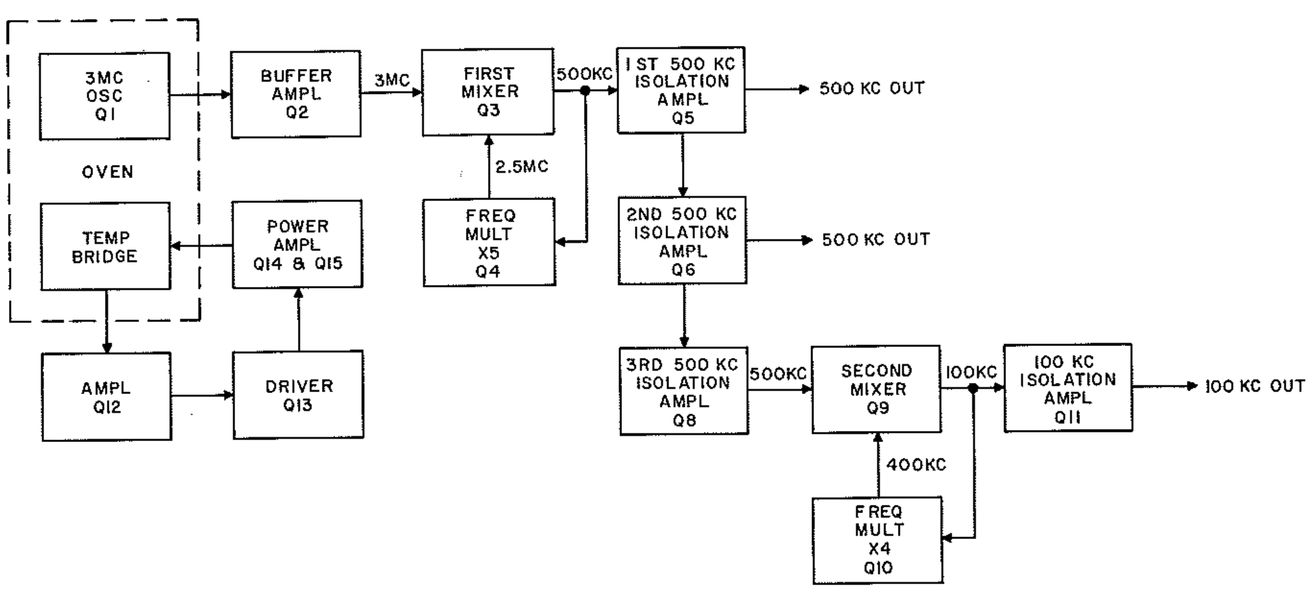
Figure 16 is a simplified schematic diagram of the PEP limiting circuit of the power amplifier. This circuit limits the peak envelope power applied to the antenna coupler to a safe level. Resistor R38 is adjusted so that a sufficiently large positive r-f voltage swing will cause diodes CR8a and CR8b to conduct. Current will flow through resistor R1, developing a voltage that is applied to the base of alc amplifier A3Q1 in the i-f translator module. This action limits the r-f driving voltage that is applied to power amplifier tubes V1 and V2 to a safe level.

G. Radio Frequency Oscillator Module, A2.

The radio frequency oscillator module generates highly stable 500-kc and 100-kc outputs. The 500-kc output is used as an i-f frequency and as a reference frequency in the megacycle frequency stabilizer module. The 100-kc output is divided further in the frequency divider module and used as a reference frequency in the kilocycle frequency stabilizer module. Figure 42 is a schematic diagram of the r-f oscillator module.

Refer to figure 17. The oscillator in the r-f oscillator module is a 3-mc crystal oscillator, Q1. The 3-mc oscillator output goes through a buffer amplifier, Q2, to a regenerative frequency divider. This frequency divider consists of a mixer, Q3, and a multiplier, Q4. The mixer output is tuned to 500 kc. Part of the 500-kc mixer output is fed to the multiplier, whose output is tuned to 2.5 mc. This 2.5-mc multiplier output is mixed with the 3-mc oscillator output to give the 500-kc mixer output. Thermal noise is sufficient to initiate the mixing action.

The mixer output is amplified by Q5, Q6, and Q8. The 500 kc outputs of amplifiers Q5 and Q6 are fed to connectors P2A2 and P2A3 respectively. The output of Q8 is fed to another regenerative frequency divider. This frequency divider consists of a mixer, Q9, and a multiplier, Q10. The mixer output is tuned to 100 kc. Part of the 100-kc mixer output is fed to the multiplier, whose output is tuned to 400 kc. This 400-kc multiplier output is mixed with the 500-kc input to give the 100-kc mixer output. Thermal noise is sufficient to initiate the mixing action. The 100-kc mixer output is fed through isolation amplifier Q11 to connector P2A1.



R-F Oscillator Module, Block Diagram
Figure 17

The 3-mc crystal oscillator in this module is the basis of the entire 618T-( ) frequency scheme. Therefore, it is very important that the oscillator frequency be kept as constant as possible. To do this, the crystal is enclosed in a temperature-regulating oven which maintains the crystal temperature at 80 ±0.2 degrees C. The oven control circuit consists of a temperature-sensitive bridge and an audio amplifier composed of Q12 through Q15.

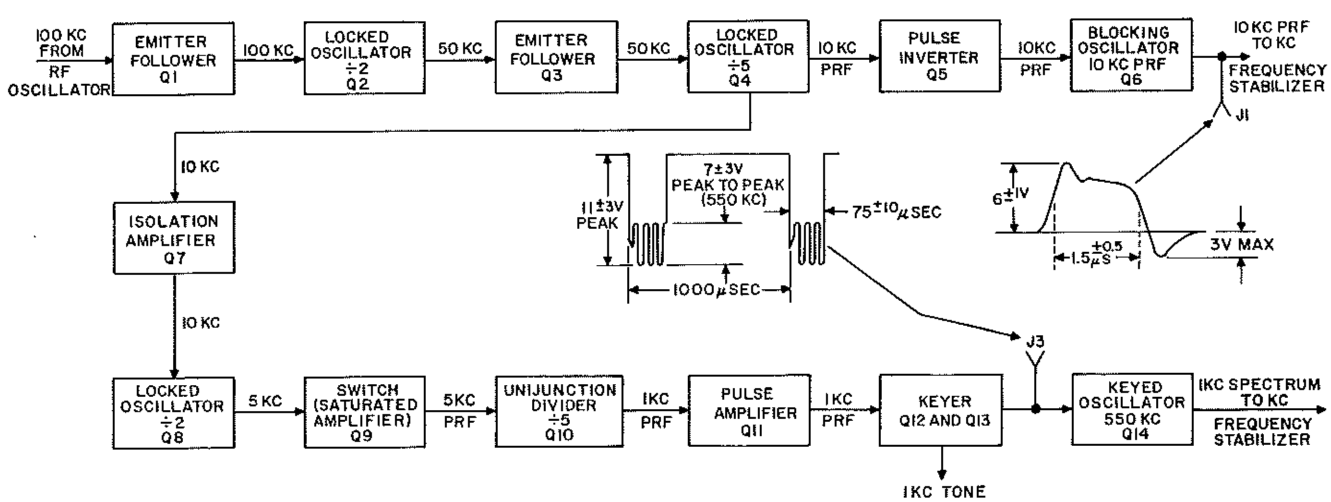
The bridge is composed of four resistance windings. The resistance values of two of the windings, made of a copper-nickel alloy, do not vary with temperature. These windings are on opposite legs of the bridge. The resistance values of the other two windings, which are made of pure copper, vary with temperature, the resistances being greater at a higher temperature. The resistances of the two temperature-variable windings are chosen so that when the temperature of the oven is at the preset value, the values of all four winding resistances are equal, and the bridge output is zero.

H. Frequency Divider Module, A1.

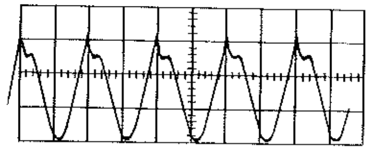
The frequency divider module transforms a 100-kc sine-wave input from the r-f oscillator module to a 10-kc pulse and a 1-kc spectrum which is centered at 550 kc. These outputs are used for frequency stabilization in the kilocycle stabilizer module. Figure 43 is a schematic diagram of the frequency divider module.

Refer to figures 18 and 19. The 100-kc input from the r-f oscillator module is fed through an emitter-follower amplifier, Q1, to a locked oscillator, Q2. This locked oscillator divides the 100-kc signal by two to produce a 50-kc output. The 50-kc output is fed through another emitter-follower amplifier, Q3, to another locked oscillator, Q4. This locked oscillator divides the 50 kc by five to produce a 10-kc output. The slightly distorted 10-kc signal is differentiated by C10 and R14 to produce a 10-kc pulse. This pulse is inverted by Q5 and used to trigger a blocking oscillator, Q6. The 10-kc pulse output of the blocking oscillator is coupled through transformer T1 to the connector plug.

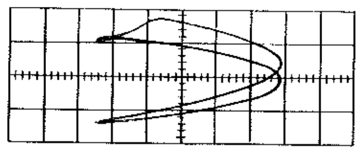
The 1-kc spectrum is produced as follows. Part of the 10-kc output of locked oscillator Q4 is fed through isolation amplifier Q7 to another locked oscillator, Q8. This locked oscillator divides the 10 kc by two to produce a 5-kc output. The 5-kc signal switches transistor Q9



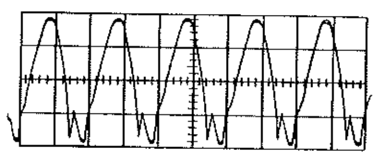
Frequency Divider Module, Block Diagram
Figure 18



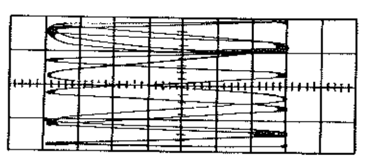
50-kc locked oscillator, TP1,
10 usec/cm,
1.5 volts peak to peak



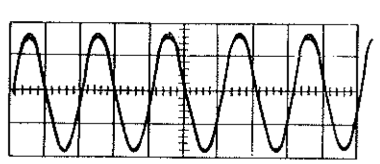
2-to-1 Lissajous figure, TP1



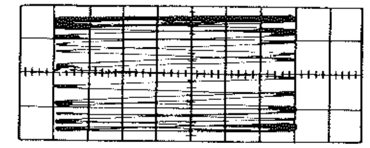
10-kc locked oscillator, TP2,
50 usec/cm,
2.3 volts peak to peak



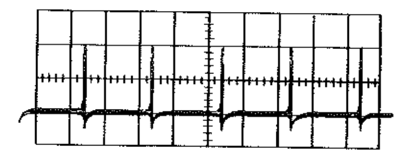
10-to-1 Lissajous figure, TP2



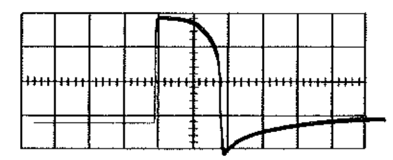
5-kc locked oscillator, TP3,
100 usec/cm,
4.5 volts peak to peak



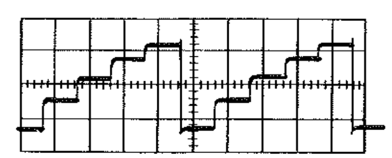
20-to-1 Lissajous figure, TP3



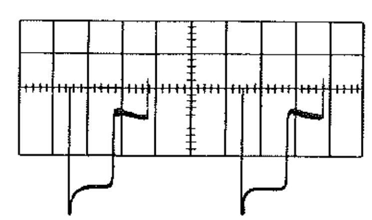
10-kc pulse output, J1,
50 usec/cm,
6 volts peak into
50-ohm load



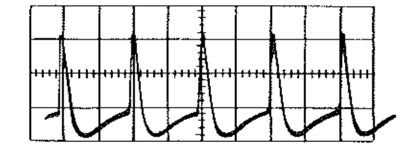
10-kc pulse output, J1,
1 usec/cm



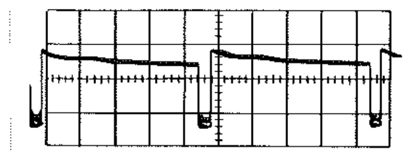
Unijunction divider, TP4,
200 usec/cm



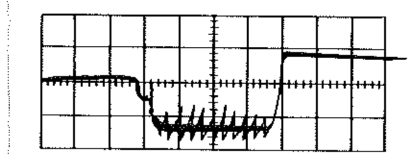
Unijunction divider, TP4,
5th step and firing point.
Firing point voltage
0.45 volt



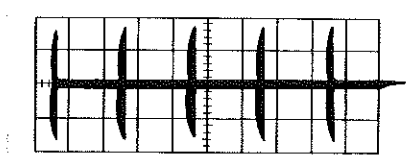
Cal tone output, TP6
(module extender)
500 usec/cm, 1.25
volts peak to peak
across 5.6K ohms.
(Remove AM/audio
amplifier module for
this check.)



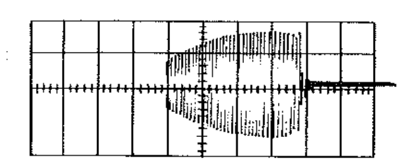
1-kc keyer, J3,
200 usec/cm,
-11 volts peak



1-kc keyer, J3,
expanded



1-kc spectrum, TP5,
500 usec/cm,
7 volts peak to peak



1-kc spectrum, TP5,
expanded

Frequency Divider Waveforms
Figure 19

to produce a positive square wave at the output of Q9. Refer to figure 43. When Q9 is switched on, C22, C45, and C23 are charged through R28. When Q9 is switched off, C22 and C45 discharge through diode CR3 and R27. The charge on C23 is trapped by diode CR4. Thus, each square wave pulse charges C23 to a higher voltage. The value of the C22-C45 parallel combination determines how much voltage is added to C23 during each cycle. C23 is connected to the input of unijunction transistor Q10.

A unijunction transistor is a single-junction semiconductor device whose input is shorted to ground when it exceeds a certain value. When the transistor input voltage across C23 becomes high enough, C23 is discharged through Q10, causing a positive pulse to appear at the output of Q10. The value of C45 is selected so that on every fifth cycle, the voltage across C23 is sufficient to cause Q10 to conduct. Therefore, the 5-kc square-wave input to Q10 produces a 1-kc pulse output. This 1-kc pulse is amplified by Q11 and used to trigger a monostable multivibrator composed of Q12 and Q13. The multivibrator output keys a keyed oscillator, Q14, on and off at a 1-kc rate. The free-running frequency of the keyed oscillator is 550 kc. Therefore, the output of Q14 is a 1-kc spectrum centered around 550 kc. A series tuned circuit, L8-C33, produces the spectrum pulse. The 10-kc pulse and 1-kc spectrum outputs of the frequency divider module are fed to the kilocycle frequency stabilizer module.

The spectrums used in the frequency stabilization circuits in the 618T-( ) are a series of descrete frequencies, or spectrum points, spaced at equal intervals over a frequency range. These spectrums are produced by creating pulses of a certain frequency. A pulse with a repetition rate of exactly 1 kc, for example, is composed of a series of sine waves of various frequencies. A 1-kc pulse contains many sine-wave frequencies, each spaced exactly 1 kc from the others, at 2 kc, 3 kc, 4 kc, etc. The amplitudes of these 1-kc spectrum points decrease as the frequencies get farther away from the fundamental 1 kc.

Each spectrum point frequency has precisely the same frequency stability and phase relations as the original, fundamental 1-kc frequency. Therefore, spectrum points may be used as injection frequencies or reference frequencies in frequency stabilization circuits if they are generated by pulses that are derived from the crystal oscillator in the r-f oscillator module.

It was mentioned earlier that the amplitude of the 1-kc spectrum point frequencies decreases as the frequencies get farther away from the fundamental 1 kc. In some instances, it is desirable to use spectrum points that are so far from the fundamental that their amplitude is too small to be useful. Suppose, for example, that the 1-kc spectrum points around 550 kc are needed. It is possible to increase the amplitude of the spectrum frequencies around 550 kc in the following manner.

The fundamental 1-kc pulse is used to synchronize a monostable multivibrator at 1 kc. The multivibrator output is a 1-kc rectangular pulse. This pulse keys a free-running oscillator on and off at a 1-kc rate. The keyed oscillator is tuned to the frequency about which the spectrum points are to be used; in this case, it is tuned to 550 kc.

It is not necessary, however, for the free-running frequency of the keyed oscillator to be exactly 550 kc in order for a spectrum point to be at 550 kc. The free-running oscillator frequency does not appear in the spectrum. It merely determines the frequency about which the amplitude of the spectrum frequencies will be greatest. In the example, if the keyed oscillator were tuned to 550.2 kc, and keyed by an exact 1-kc pulse, the spectrum output would be a series of frequencies, one at exactly 550 kc and others extending on each side of 550 kc at exact 1-kc intervals. The amplitudes of the spectrum points decrease as they get farther from 550 kc.

It is important to remember that each spectrum point frequency is as stable and exact as the original 1-kc keying frequency, and that the free-running frequency of the keyed oscillator only determines the frequency around which the amplitude of the spectrum points is greatest, so it does not have to be exact.

I. Kilocycle Frequency Stabilizer Module, A4.

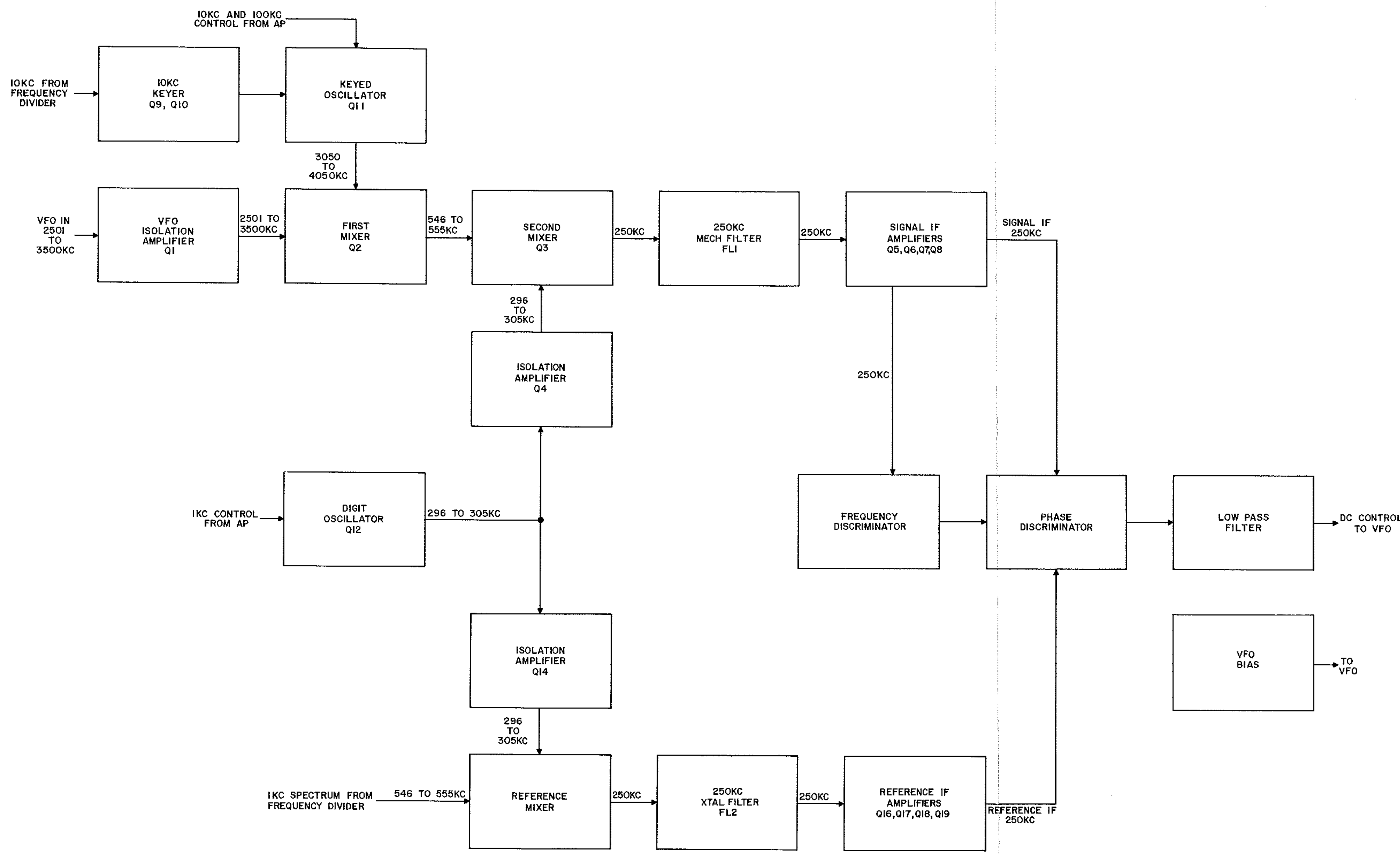
The kilocycle frequency stabilizer module stabilizes the frequency of the vfo submodule in the r-f translator module. Figure 44 is a schematic diagram of the kilocycle frequency stabilizer module.

Refer to figures 20 and 21. The vfo frequency is phase locked in 1-kc steps with the crystal-generated reference frequency from the r-f oscillator module by the action of the kilocycle stabilizer. A voltage-sensitive capacitor in the tuned circuit of the vfo tunes the vfo according to a d-c tuning voltage from the kilocycle stabilizer. The tuning voltage for this voltage-sensitive capacitor is a combination of an adjustable bias voltage from a bias supply in the kilocycle stabilizer module, and frequency- and phase-sensitive control voltages from frequency and phase discriminators in the module.

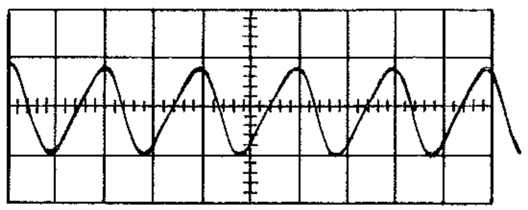
The inputs to the phase discriminator are two 250-kc signals. One is the vfo frequency that has been heterodyned to 250 kc. The other is the crystal r-f oscillator frequency that has been heterodyned to 250 kc. The phase discriminator output is a d-c error signal, proportional to the phase difference between the two 250-kc signals. This error signal "pulls" the vfo frequency, by tuning the voltage-sensitive capacitors in the vfo, until the two signals are phase locked. By phase locking the vfo to the r-f oscillator, the vfo frequency is as accurate as that of the r-f oscillator reference frequency.

The heterodyning of the vfo signal is as follows. The vfo output, which varies from 3500 to 2501 kc in 1000 1-kc steps, is amplified by Q1 and mixed in Q2 with a spectrum of frequencies, spaced 10 kc apart, which are centered 550 kc higher in frequency than the vfo. As the vfo is tuned from 3500 to 2501 kc, the center of the 10-kc spectrum moves from 4050 to 3050 kc. This 10-kc spectrum is derived from the 10-kc pulse from the frequency divider module. The 10-kc pulse synchronizes a monostable multivibrator, Q9 and Q10, which, in turn, keys a keyed oscillator, Q11, as to produce the spectrum. The free-running frequency of this keyed oscillator determines the frequency about which the 10-kc spectrum points are located, and is tuned to stay 550 kc higher than the vfo. The keyed oscillator is tuned by a d-c voltage applied to a voltage-sensitive capacitor, C52. The tuning voltage comes from a precision resistive divider located in the Autopositioner submodule.

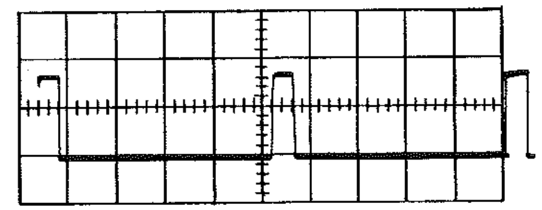
The output of mixer Q2 is the difference between the vfo frequency and the 10-kc spectrum frequencies. Therefore, the mixer output contains frequencies spaced 10 kc apart and centered around 550 kc. The exact frequencies present depend on the vfo frequency being fed into the mixer, Q2. This series of frequencies is fed into a second mixer, Q3, where it is mixed with a signal from a free-running digit oscillator, Q12. The digit oscillator output is a single frequency that is varied by the 1-kc frequency selector knob on the control unit. The digit oscillator is tuned by a voltage-sensitive capacitor, C66, to 10 1-kc frequencies from 296 to 305 kc. The tuning voltage for the digit oscillator is derived from another precision resistive divider in the Autopositioner submodule. The free-running digit oscillator frequency is such that when it is mixed in Q3 with the series of frequencies spaced 10 kc apart and centered around 550 kc, it will produce another series of frequencies spaced 10 kc apart, but centered around 250 kc. One of these frequencies will be 250 kc plus or minus the vfo frequency error and the digit oscillator frequency error. The output of mixer Q3 is passed through a mechanical filter, FL1, which has a bandwidth of 8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequencies are 10 kc away, and will not pass through the filter, whose bandwidth extends 4 kc on either side of 250 kc. The signal i-f frequency (250 kc plus or minus the vfo and digit oscillator errors) is then amplified by i-f amplifiers Q5 through Q8 and fed into the frequency discriminator.



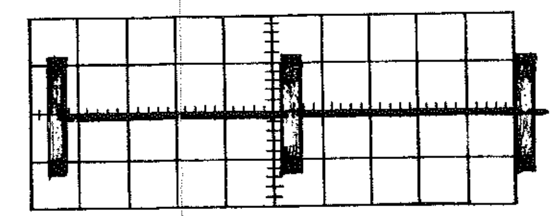
Kilocycle-Frequency Stabilizer Module,
Block Diagram
Figure 20



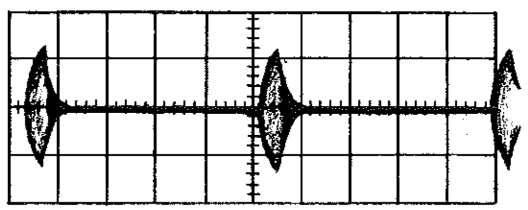
Vfo input, J1,
5 volts/cm, 2 usec/cm
(70K-5 vfo) 1 volt/cm,
2 usec/cm (70K-3 vfo)



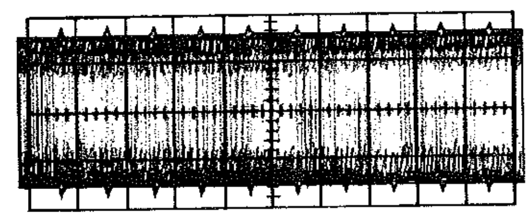
10-kc keyer output,
TP19,
5 volts/cm, 20 usec/cm



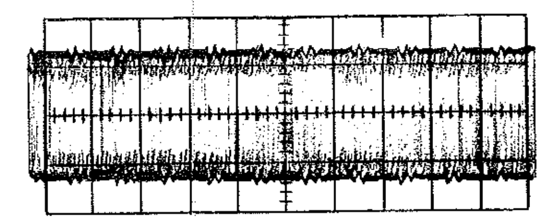
10-kc keyed oscillator
output, TP10,
2 volts/cm, 20 usec/cm



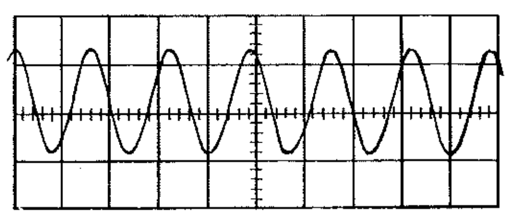
10-kc spectrum generator
output, TP8,
50 mv/cm, 20 usec/cm



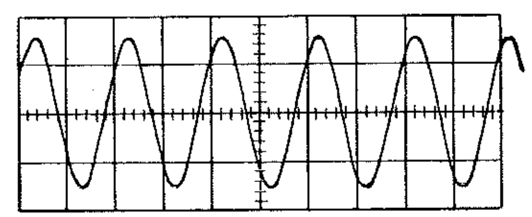
Vfo and 10-kc spectrum
input to first mixer TP1,
50 mv/cm, 100 usec/cm
(70K-5 vfo) 100 mv/cm,
100 usec/cm (70K-3 vfo)



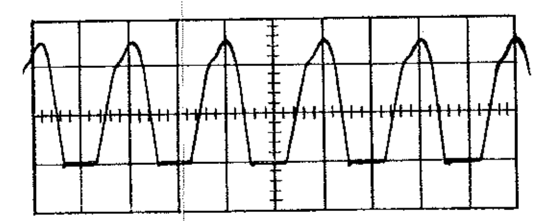
Digit oscillator and
10-kc spectrum input
to second mixer, TP2,
100 mv/cm, 100
usec/cm



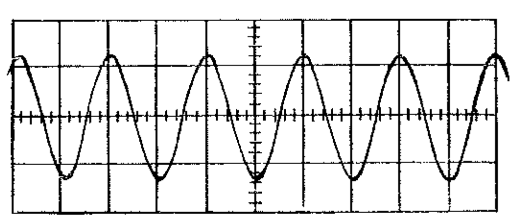
Digit oscillator isolation-
amplifier output, J5,
2 volts/cm, 2 usec/cm



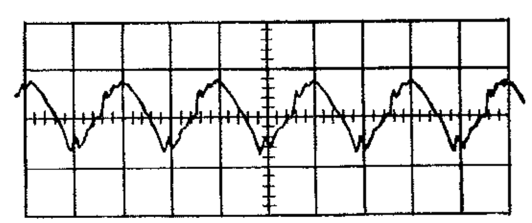
Mechanical filter
output-signal i-f input,
J7, 50 mv/cm, 2 usec/cm



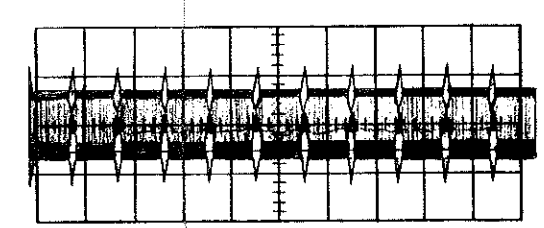
Signal i-f amplifier
interstage test point,
TP4,
1 volt/cm, 2 usec/cm



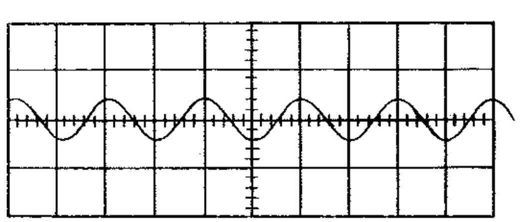
Signal i-f amplifier
output, TP5,
5 volts/cm, 2 usec/cm



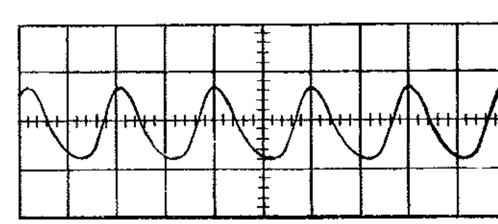
Signal i-f input to phase
discriminator, TP16,
5 volts/cm, 2 usec/cm



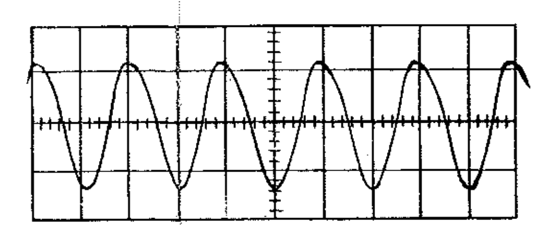
Digit oscillator and
1-kc spectrum input to
reference mixer, TP12,
100 mv/cm, 1 msec/cm



Crystal filter output-
reference i-f input, J8,
50 mv/cm, 2 usec/cm



Reference i-f amplifier
interstage test point,
TP14,
50 mv/cm 2 usec/cm



Reference i-f amplifier
output, TP15,
1 volt/cm, 2 usec/cm

Kilocycle-Frequency Stabilizer Waveforms
Figure 21

The frequency discriminator output is a d-c voltage that tunes the voltage-sensitive capacitor in the vfo tuned circuit. Therefore, the frequency discriminator output "pulls" the vfo signal closer to 250 kc and within the "capturing" range of the phase disriminator.

To provide a reference signal for the phase discriminator, the digit oscillator output is mixed in Q15 with a series of frequencies spaced 1 kc apart and centered at 550 kc. This 1-kc spectrum comes from the frequency divider module. When this 1-kc spectrum, centered around 550 kc, is mixed with the digit oscillator output, the mixer output is a series of frequencies spaced 1 kc apart, centered around 250 kc. One of these frequencies will be 250 kc plus or minus the digit oscillator error. The output of mixer Q15 is passed through a crystal filter, FL2, which has a bandwidth of 0.8 kc centered at 250 kc. The mixer output frequency near 250 kc is passed, but all the other frequencies are filtered out, for the nearest frequencies are 1 kc away, and will not pass through the filter, whose bandwidth extends 400 cycles on either side of 250 kc. The reference i-f frequency (250 kc plus or minus the digit oscillator error) is then amplified by i-f amplifiers Q16 through Q19, and fed into the phase discriminator.

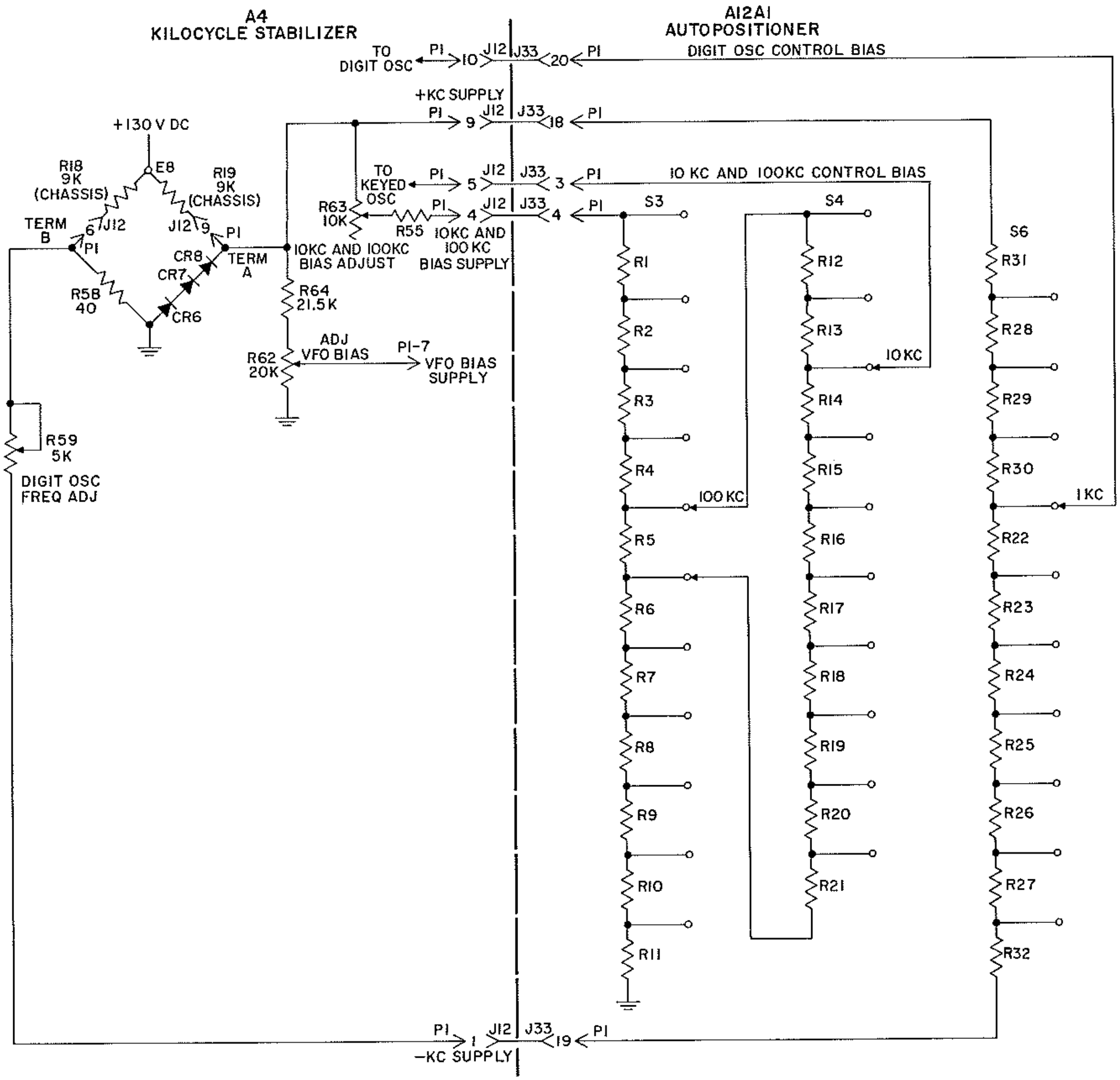
In order for the reference i-f to function properly, the digit oscillator must not vary more than ±200 cycles from its proper frequency. If the digit oscillator frequency exceeds these limits, the filter, FL2, will not pass the desired frequency to the reference i-f amplifiers. The error in the digit oscillator injection frequency is cancelled out in the phase discriminator because the oscillator output is mixed with both inputs to the discriminator. The phase discriminator control voltage overrides the frequency discriminator control voltage to phase lock the vfo frequency to the reference frequency, which is derived from the crystal r-f oscillator. Since all of the spectrum-point injection frequencies in the kilocycle stabilizer are derived from the crystal oscillator through the frequency divider module, they are all as stable as the crystal r-f oscillator itself. Therefore, the vfo is as stable as the r-f oscillator.

The vfo input from the vfo to the kilocycle stabilizer and the vfo d-c control voltage from the stabilizer to the vfo are both carried on the same line. The vfo r-f frequency is added to the d-c control voltage, so that there are both useful a-c and d-c components on the line. The two components are separated at the ends of the line. This method of carrying two separate information signals on the same line is called diplexing.

Because the frequency of the digit oscillator must be very accurate, the voltage that tunes the voltage-sensitive capacitor in the tuned circuit of the oscillator must be very exact. This tuning voltage (as well as the tuning voltages for the voltage-sensitive capacitors that tune the vfo and the keyed oscillator in the kilocycle stabilizer module) comes from a bridge circuit shown in figure 22. Part of the bridge is in the kilocycle stabilizer module, and part in the Autopositioner submodule.

The bridge circuit input is 130 volts d-c from the low-voltage power supply module. The bridge output is kept constant by the action of three series breakdown diodes, CR6, CR7, and CR8. The precision resistive divider in the Autopositioner that tunes the digit oscillator to its 10 steps is placed across the bridge output. The digit oscillator frequency may be adjusted by varying R59, which is in series with the resistive divider. The voltage that is tapped from the divider is fed to the voltage-sensitive capacitor in the digit oscillator tuned circuit.

The vfo bias voltage and tuning voltage for the keyed oscillator in the kilocycle stabilizer are taken from precision resistive dividers which are connected across the breakdown-diode leg of the bridge. Currents in both of these dividers may be varied to produce the correct tuning voltage for the voltage-sensitive capacitors. A 40-ohm resistor, R58, placed in the bridge circuit opposite the diodes, equals the resistance of the diodes in the breakdown condition. This balances out any transients that may occur on the 130-volt d-c supply line.



Voltage-Stabilizing Bridge Circuit, Simplified Schematic Diagram
Figure 22

J. Megacycle Frequency Stabilizer Module, A10.

The megacycle frequency stabilizer module stabilizes the frequency of the 17.5 mc and h-f oscillators in the r-f translator module. Figure 45 is a schematic diagram of the megacycle frequency stabilizer module.

Refer to figures 23 and 24. The tuning voltage for the voltage-sensitive capacitors in the tuned circuits of the stabilized oscillators in the r-f translator module comes from a diode detector in the megacycle stabilizer module. The signal into the detector is a combination of three 1-mc signals obtained by mixing the stabilized oscillator outputs with a 500-kc spectrum derived from a 500-kc output of the r-f oscillator module. The amplitude of the sum of these three 1-mc signals is proportional to the phase error of the oscillator. When the signal is detected, the magnitude of the detected, filtered output voltage will depend on the oscillator phase error. This detector output voltage is applied to the voltage-sensitive capacitors in the tuned circuits of the oscillators to "pull" the oscillator frequency until it is phase locked with the reference spectrum.

The following discussion describes the action which stabilizes the frequency of the 17.5-mc oscillator in the r-f translator module. It applies equally well, however, to any of the 16 frequencies from the h-f oscillator.

The three 1-mc signals into the detector are obtained as follows. One 1-mc signal is a frequency that is part of the 500-kc spectrum derived from the r-f oscillator. This spectrum consists of a series of frequencies spaced 500 kc apart in the range from 500 kc to approximately 25 mc. When this spectrum is mixed with the output of the 17.5-mc oscillator in mixer A2Q3, the mixer output will contain, in addition to the original spectrum, two frequencies that differ from 1 mc by the frequency difference of the oscillator from the exact 500-kc spectrum points. If, for example, the frequency of the 17.5-mc oscillator were 300 cycles from 17.5 mc, the mixer output would contain frequencies 300 cycles above and below 1 mc. These frequencies are obtained by the oscillator frequency mixing with spectrum points at 16.5 and 18.5 mc, 1 mc above and 1 mc below the oscillator frequency. When the frequency of the 17.5-mc oscillator is not phase locked with the spectrum point, the vector sum of these three 1-mc frequencies will be varying by the number of cycles per second by which the oscillator is displaced from the spectrum point, somewhat like an AM signal. Therefore, the output of the diode detector will be varying also, and the frequency of the 17.5-mc oscillator will vary because its frequency is controlled by the detector output. This control voltage will tune the oscillator until it is phase locked with the r-f oscillator spectrum frequency. When the oscillator is phase locked with the reference, the vector sum of the three 1-mc frequencies will be constant, and the constant detector output will keep the 17.5-mc oscillator phase locked with the reference.

Two unijunction transistors, Q4 and Q5, are placed across the outputs of the two detectors. If the detector output voltage exceeds a certain value, the unijunction transistor across the output conducts, shorting the output to zero volts. The voltage then begins to charge the capacitors, C13 and C14, connected to the base of the unijunction transistors, until it reaches the point where the oscillators lock. If the oscillators do not lock when the d-c control voltage reaches the locking point, the recycle stage operates again and the cycle is repeated until the oscillator locks. This sawtooth recycle voltage has a repetition rate of approximately 2 kc. The average locking time for the megacycle stabilizer is one-half second. Two recycle stages are provided so that each of the two oscillators being controlled may be locked on their assigned frequency independent of the other.

Transistors A1Q1, A2Q1, A1Q2, and A2Q2 are amplifiers that amplify the r-f inputs from the 17.5 mc and h-f oscillators before they go to the mixers, A1Q3 and A2Q3.

The 500-kc sine-wave input from the r-f oscillator is changed to the 500-kc spectrum as follows. The 500-kc input is fed to a squaring amplifier, Q1. The square-wave output of Q1 is differentiated by C7 and R5 to produce a 500-kc pulse. The pulse is amplified by Q2 and fed to Q3. A ringing circuit at the output of Q3, composed of L4 and its associated capacitance, rings the pulse output of Q3 at approximately 7 mc. Thus, the output of Q3 is a 500-kc spectrum extending from 500 kc to approximately 25 mc with its center at about 7 mc. This output is detected by CR1 and further differentiated by C9-L5 on C10-L6 to produce the spectrum pulse.

The r-f inputs and d-c control outputs in the megacycle stabilizer are diplexed, just as in the kilocycle stabilizer. The h-f oscillator r-f input and the d-c control voltage output for the 17.5-mc oscillator are on one line. The 17.5-mc oscillator r-f input and the d-c control voltage output for the h-f oscillator are on another line.

K. Low-Voltage Power Supply Module, A5.

The low-voltage power supply module (1) contains a transient blanker circuit that protects transistors in the 618T-( ) from transient line-voltage surges, (2) contains an 18-volt voltage regulator that provides stable transistor supply voltages, and (3) contains a rectifier-filter circuit that derives 130 volts d-c from a 115-volt, 400-cycle input. Figure 46 is a schematic diagram of the low voltage power supply module.

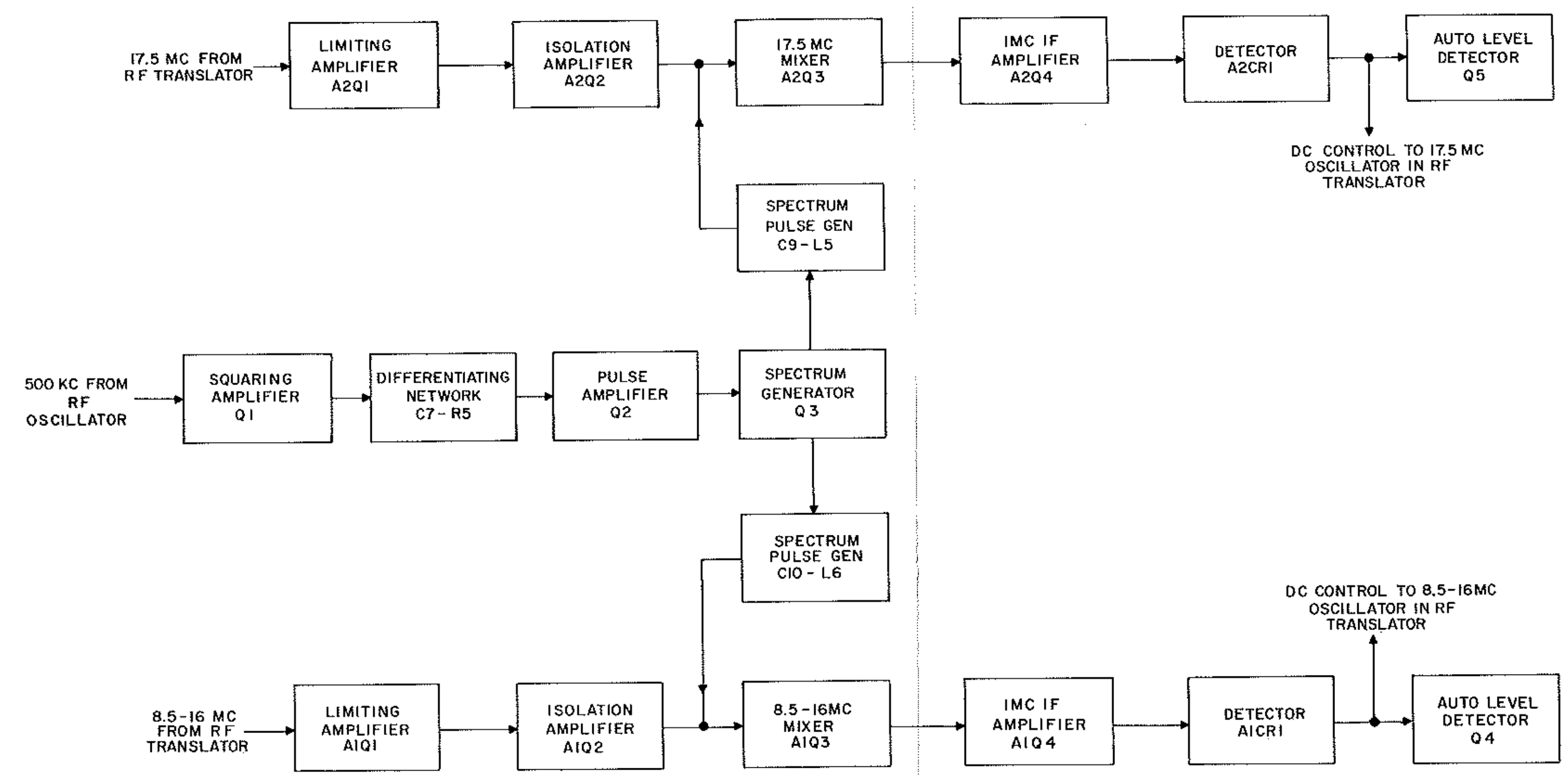
(1) Transient Blanker Circuit.

When large electric motors used in aircraft are switched off, the load on the aircraft main electrical power supply is changed, causing transient voltage peaks on the 27.5-volt d-c line to the 618T-( ). These voltage peaks reach approximately +80 volts, and return to normal line voltage in approximately 0.5 second. Since transistors used in the 618T-( ) will not stand such high voltages, a transient blanker circuit is used to protect the transistors. The blanker circuit drops the 27.5 volt d-c line voltage to approximately zero volt for the duration of the transient. The waveforms in figure 25 illustrate the action of the transient blanker circuit.

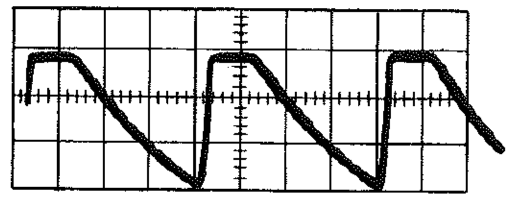
Refer to figure 26. The switching action of switching transistor Q2 is accomplished with a control transistor, Q1, a biasing control diode, CR1, and biasing resistors. R2 through R6 form a bias network which performs two functions. First, it allows Q2 to be biased to saturation when the line voltage is normal. This connects the output load to the 27.5 volt d-c line. Second, it provides a variable bias voltage at the tap of R5. This bias voltage controls the point at which the transient blanker circuit operates. The level at which the circuit operates is determined by the setting of potentiometer R5.

The operation of the transient blanker circuit is as follows. When the line voltage is less than +32 volts, bias current flows through the emitter-base junction of Q2 and through resistors R2 through R6. Q2 is saturated and places the collector at emitter potential, which is the 27.5-volt d-c line voltage. The bias voltage at the tap of R5 is too small to cause the breakdown diode, CR1, to conduct. Since CR1 does not conduct, Q1 is off-biased.

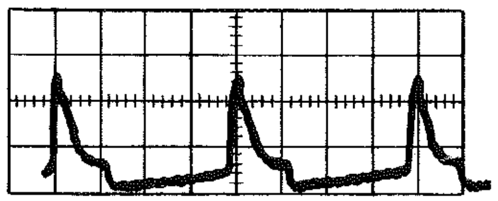
When a transient occurs on the 27.5-volt line, the emitter current in Q2 will increase. The voltage at the tap of R5 will increase proportionately. R5 is adjusted so that when the input (line) voltage reaches +32 volts d-c, the voltage at the tap on R5 will be sufficient to cause CR1 to break down and allow emitter current to flow in Q1. When this happens, Q1 will be biased to saturation. This will shunt the emitter-base circuit of Q2, removing the load from the 27.5-volt line. The blanking action will continue as long as the transient voltage is above +32 volts.



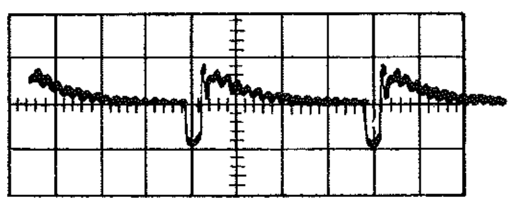
Megacycle-Frequency Stabilizer Module,
Block Diagram
Figure 23



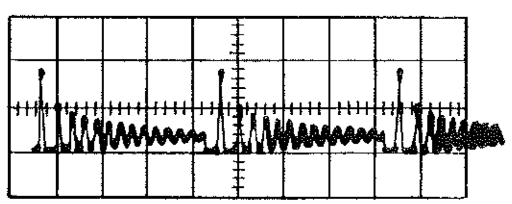
Squaring amplifier Q1 output, junction of R4 and C7, 0.5 usec/cm, 5.5 to 6.5 volts peak-to-peak a-c



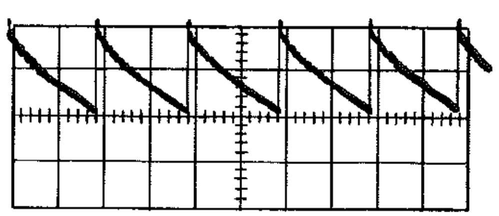
Pulse amplifier Q2 input, junction of C7 and R5, 0.5 usec/cm, 1 to 1.5 volts peak-to-peak a-c



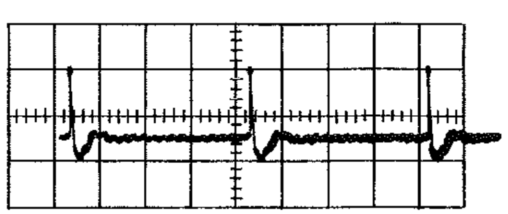
Spectrum generator Q3 input, junction of R6 and R7, 0.5 usec/cm, 7 to 10 volts peak-to-peak a-c



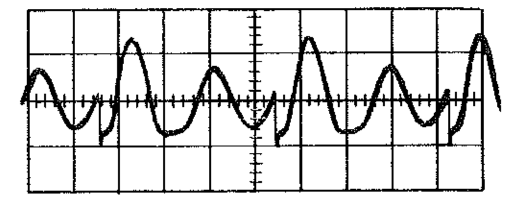
Spectrum generator Q3 output, junction of L4 and CR1, 0.5 usec/cm, 50 to 100 volts peak-to-peak a-c



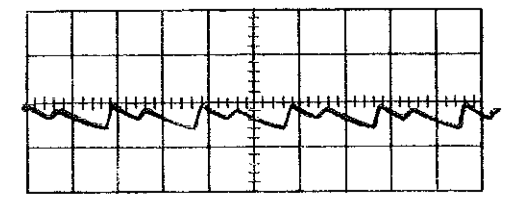
CR1-R8 output, 1 usec/cm, 60 to 90 volts peak to bottom of scale, 20 volts/cm d-c



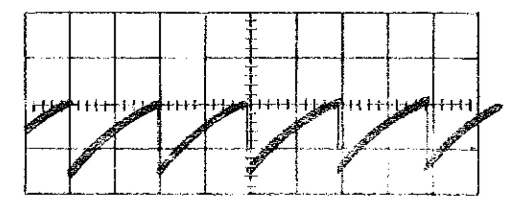
Spectrum pulse at junction of A1C5-A1R7 or A2C5-A2R7, no r-f input to megacycle-frequency stabilizer from tuner oscillators, 0.5 usec/cm, 0.8 to 1.2 volts peak to peak, 0.03 to 0.08 usec pulse width



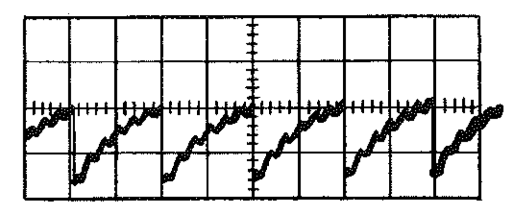
I-f amplifier input at junction of A1C7-A1L2 or A2C7-A2L2, 0.5 usec/cm 0.5 volt/cm a-c, no r-f input from tuner oscillators



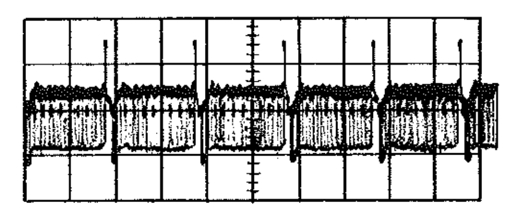
Detector output at junction of A1CR1-A1R11 or A2CR1- A2R11, 1 usec/cm, 5 volts/cm d-c referenced to bottom of scale, no r-f input from tuner oscillators



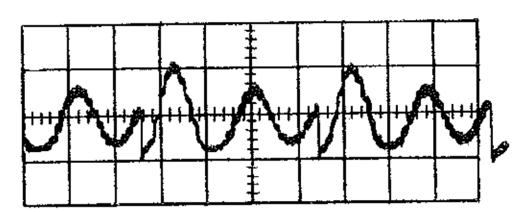
J1 or J3 recycle, 2 millisec/cm, 5 volts/cm d-c, 10 to 12 volts maximum, 0 to 4 volts minimum, 0.002 to 0.008 sec period



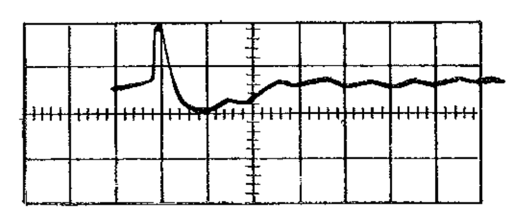
J1 with A2 on extender disconnected. J3 with A1 on extender disconnected. Recycle with tuner oscillator within 5 kc of desired frequency but with no d-c fed from megacycle-frequency stabilizer to oscillator



Input to A1Q3 or A2Q3, r-f input plus spectrum, junction of A1C5-A1R7 or A2C7-A2R5, 1 usec/cm, 0.5 volt/cm a-c, r-f -0.6 to 0.8 volt peak to peak, spectrum pulse -0.8 to 1.2 volts peak to center line of r-f



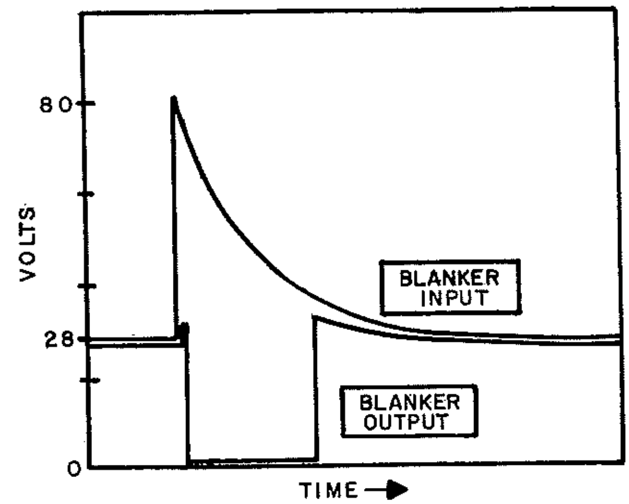
I-f amplifier input at junction of A1C7-A1L2 or A2C7-A2L2, 0.5 usec/cm, 0.5 volt/cm a-c, oscillators locked with 7 volts d-c from megacycle-frequency stabilizer



Spectrum pulse of picture at bottom of left-hand column expanded, 0.1 usec/cm 0.5 volt/cm a-c

Megacycle-Frequency Stabilizer Waveforms
Figure 24

When the transient voltage decreases to below +32 volts, CR1 will stop conducting and Q1 will be biased off. Q2 will no longer be shunted by Q1 and emitter current will flow again in Q2. Collector current flows through Q2 to the load, and normal operation is restored.

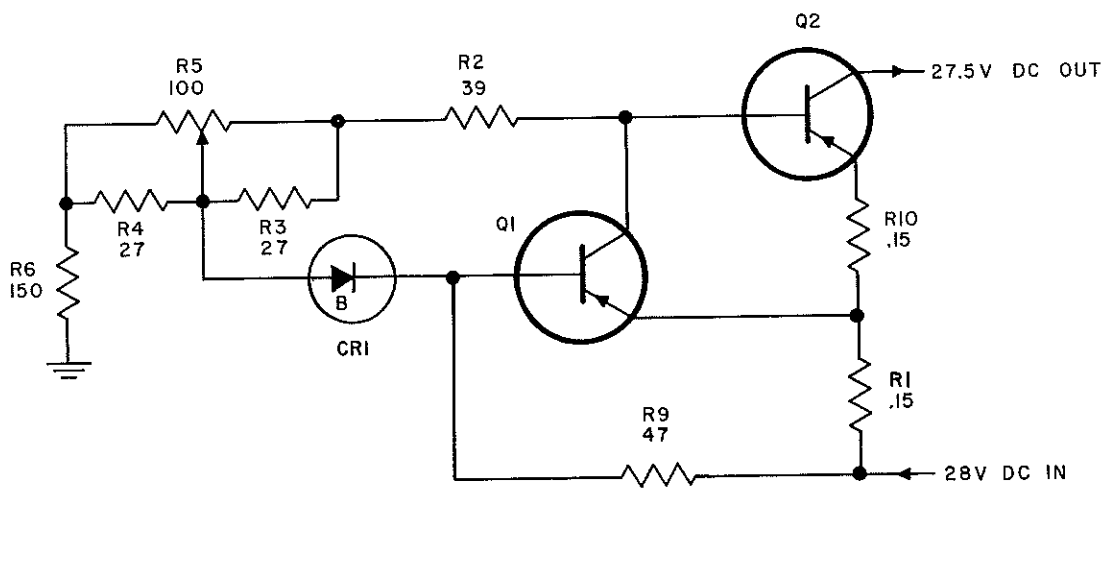


Transient Blanker Waveforms
Figure 25

(2) Voltage Regulator Circuit.

The 18-volt voltage regulator is composed of two cascaded amplifiers whose input is an error signal from the regulator output, and a control transistor whose voltage is very closely regulated by the amplifiers.

Refer to figure 46. The emitter voltage of Q4 is kept constant by a breakdown diode, CR2. The base voltage of Q4 is picked off a resistive divider in the output circuit, making it directly proportional to the output voltage. Thus, the emitter-base input of amplifier Q4 is proportional to the regulator output voltage. Amplifiers Q4 and Q3 amplify the output error signal. The output of Q3 controls the input of Q5, and, therefore, the emitter-collector voltage of Q5. R15 in the resistive divider is adjusted to give 18 volts d-c at the regulator output.



Transient Blanker Circuit, Schematic Diagram
Figure 26

If the regulator output is accidentally shorted, the regulator will be disabled, for the regulating action is controlled by the output voltage. In order to start the circuit after its output has been shorted, it is necessary to produce a positive voltage at the regulator output. This is done by interrupting the 25-volt input to the regulator, by switching the 618T-( ) off, then on again. When the input voltage is interrupted, C4, which has been charged to the input voltage, will discharge through R18. When the input voltage is reapplied, current will flow through the emitter-base junction of Q3, CR4, and R12 to charge C4. This transient current will cause collector current to flow in Q3 and through the emitter-base junction of Q5 and the resistive divider. The current through the resistive divider produces a positive voltage at the tap of R15 which starts the regulating action.

L. Power Supply 516H-1 and Single-Phase High-Voltage Power Supply Module, A13.

Power Supply 516H-1 is an external power supply that is used, in conjunction with a single-phase high-voltage power supply module, to provide operating voltages for Airborne SSB Transceiver 618T-1. The 516H-1 mounts directly in the shockmount tray used by Power Supply 416W, the power supply for the 618S, and is used primarily in 618S retrofit installations. Figure 47 is a schematic diagram of Power Supply 516H-1.

The 516H-1 is completely transistorized, and uses a saturable-core oscillator to convert 27.5 volts d-c to 1500-cycle a-c. The saturable-core oscillators, Q1 and Q2, used in the inverter circuit, are fast-acting switches whose switching action depends on the saturation of the core of transformer T1 in the oscillator circuit. When the oscillator is first energized, unbalance in the two halves of the oscillator circuit causes saturation current to flow in one transistor and the other transistor to be cut off. This current increases until the core of transformer T1 becomes saturated. When this occurs, voltage is no longer induced in the windings of T1 and the saturation current is cut off. When the magnetic field in the transformer windings starts to collapse, voltages are induced in the windings which cause the transistor that was previously cut off to be saturated, and vice versa. This action produces a square-wave output at the transformer output. This square wave switches transistors Q3 through Q8, in a push-pull power circuit, to provide a 400-volt, 1500-cycle square-wave output from the power supply. The output of Power Supply 516H-1 is fed to the single-phase high-voltage power supply module.

The single-phase high-voltage power supply module, which is contained in the 618T-1( ) case, steps up the 400-volt, 1500-cycle input to 1500 volts, and rectifies it to provide the 1500-volt d-c plate voltage for the power amplifier. Figure 48 is a schematic diagram of the single-phase high-voltage power supply module. This module also supplies tgc control voltage, vacuum-tube filament voltage, and a 260-volt d-c plate voltage for tubes in the r-f translator module. Early modules also provide 400-volts for power amplifier screen voltage. In later models of the 618T-( ), however, this screen voltage is derived from the 1500-volt plate voltage input to the power amplifier module. The single-phase high voltage power supply module also contains an overload relay which is automatically reset when the keyline ground is removed.

M. Three-Phase High-Voltage Power Supply Module, A7.

The three-phase high-voltage power supply module is a single unit that plugs into the 618T-2 chassis and derives its operating voltages from a 115-volt (line to neutral), 400-cycle, three-phase primary power source. This module is used only in Airborne SSB Transceiver 618T-2. Figure 49 is a schematic diagram of the three-phase high-voltage power supply module. The plate contactor relay, K1, is energized 30 seconds after the 618T-( ) is turned on at the control unit. This delay is accomplished by high-voltage time delay relay K7. See figure 49. Resistors R1, R2, and R3 are in series with the input transformer primary winding to limit the transient current which flows when relay K1 is energized. After the initial transient surge, step-start relay K2 is energized and the series resistors are shorted out of the circuit. The capacitors across the diodes in the rectifier circuit protect the diodes from transient supply voltage surges. The outputs of this module are the same as those of the single-phase high-voltage power supply module used in the 618T-1.

N. 27.5-Volt D-C High-Voltage Power Supply Module, A8.

The 27.5-volt d-c high-voltage power supply module is a single unit that plugs into the 618T-3 chassis and derives its operating voltages from a 27.5-volt d-c primary power source. This module is used only in Airborne SSB Transceiver 618T-3. Figure 50 is a schematic diagram of the 27.5-volt d-c high-voltage power supply module. The action of this module is the same as the action of Power Supply 516H-1 and the single-phase high-voltage power supply module combination. The outputs of this module are the same as those of the single-phase and three-phase high-voltage power supply modules used in the 618T-1 and 618T-2.

O. Chassis.

(1) General.

The 618T-( ) chassis contains all the wiring that interconnects the modules used in the 618T-( ). The chassis also contains a relay compartment, located under the front panel, that houses many of the control-circuit relays. Figure 51 is a wiring diagram of the 618T-( ) chassis.

(2) Power Distribution Circuits.

Figure 27 is a simplified schematic diagram of the power distribution circuits in the 618T-( ). These circuits are activated when the mode selector switch on the control unit is switched from OFF to any other position. A 400-cycle interlock relay in this circuit, K9, is connected so that the 618T-( ) operates only when there are both 115-volt, 400-cycle and 27.5-volt d-c inputs from the power supplies.

K8 in figure 27 is an 18-volt delay relay that removes transistor supply voltages from the kilocycle stabilizer module to make it inoperative during the tuning cycle. This action allows the vfo to be mechanically tuned by the Autopositioner to approximately the correct frequency before the phase-locking action of the stabilizer module is begun. Capacitors C13, C14, and C15, across the coil of K8, delay the energizing of K8 for approximately one-half second after the 130-volt voltage is applied in order to prevent the kilocycle stabilizer from phase locking the vfo with the incorrect spectrum point.

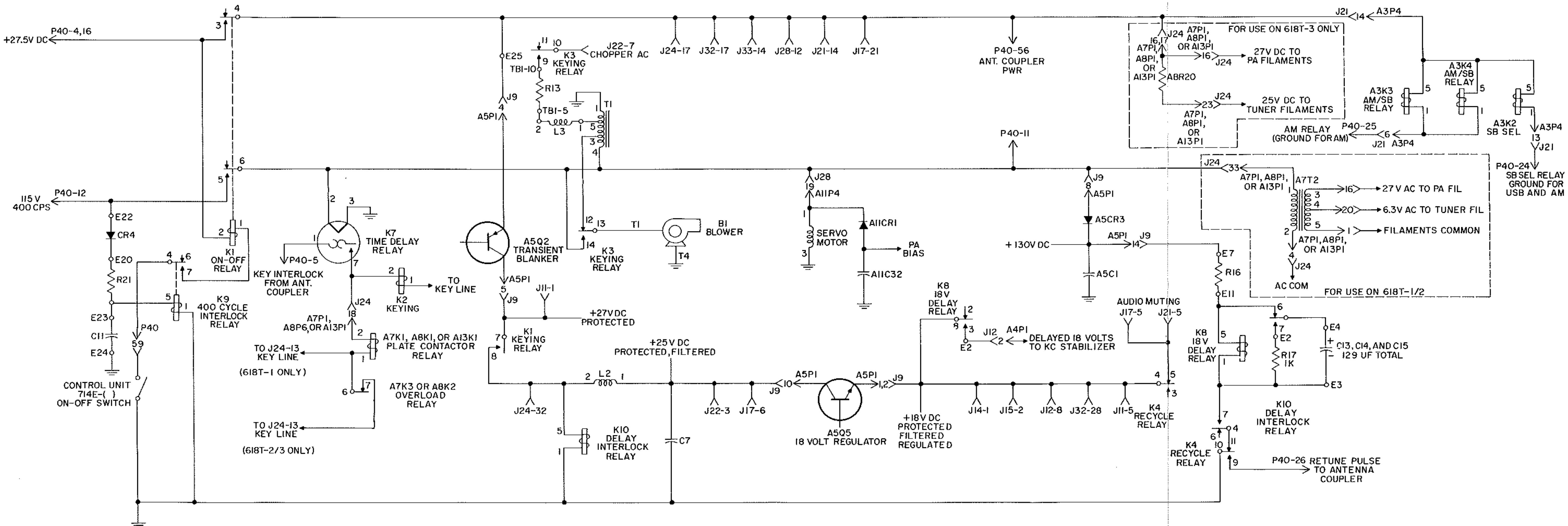
(3) Keying Circuits.

Figure 28 is a simplified schematic diagram of the keying circuits in the 618T-( ). These circuits are activated when the transmitter is keyed. The CW keying circuits are included in this diagram.

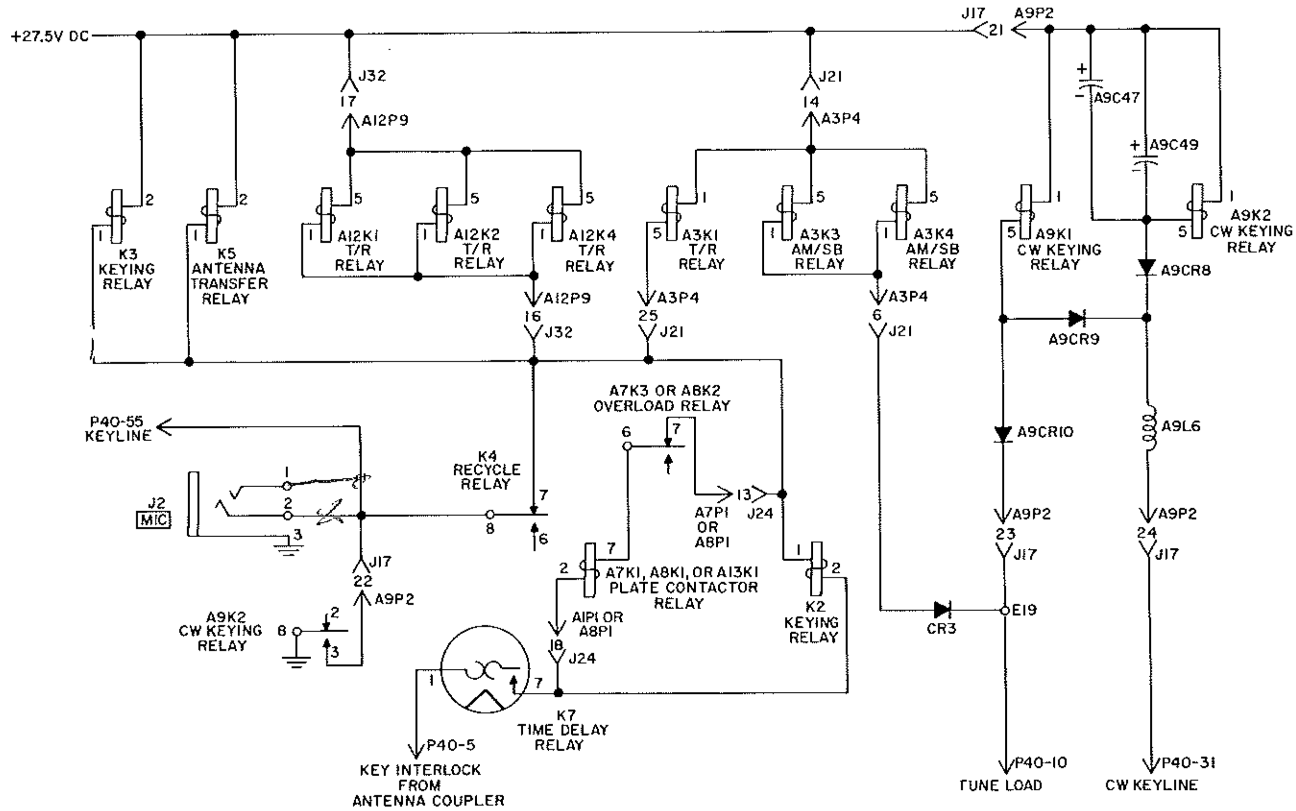
(4) Sidetone Circuits.

Figure 29 is a simplified schematic diagram of the sidetone circuits in the 618T-( ). The sidetone is taken from the last audio amplifier stage, A9Q2, to provide audio monitoring in the transmit mode. The audio signal from the audio amplifier is fed through a keying relay, K2, the sidetone level adjust network, and the sidetone relay, K6, to the audio output.

A combination of two voltages is necessary to energize the sidetone relay. One voltage is derived from the r-f output of the power amplifier. This r-f output is rectified by



Power Distribution Circuits,
Simplified Schematic Diagram
Figure 27

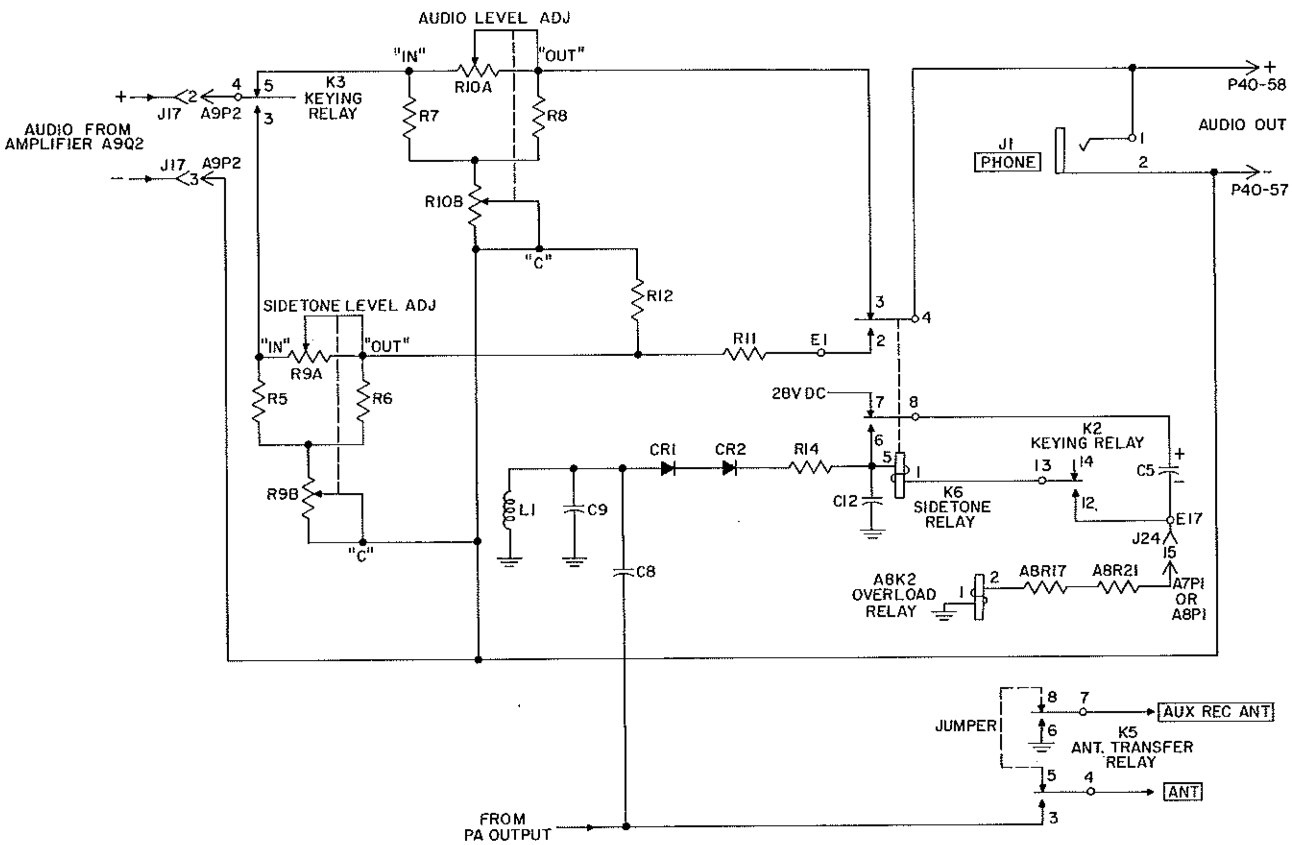


Keying Circuits, Simplified Schematic Diagram
Figure 28

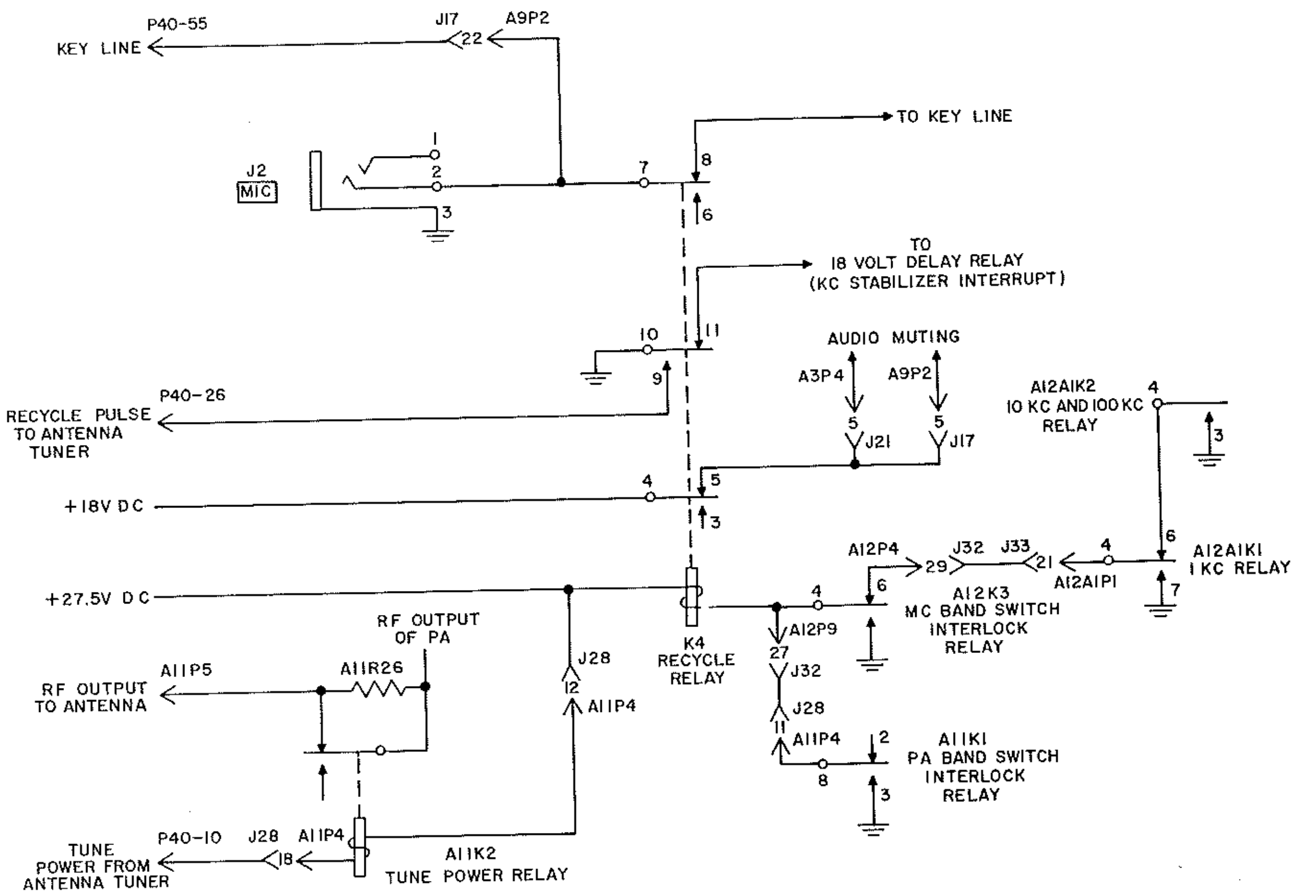
CR1 and CR2, filtered by C12, and applied to the sidetone relay coil. The second voltage, from the high-voltage power supply module, is proportional to the power amplifier plate current. This voltage is the same one that is used for tgc control in the i-f translator module. In order for the sidetone relay to be energized, both sufficient plate current and plate voltage swing must be present in the power amplifier. C5 is placed across the coil of the sidetone relay to keep the relay energized in the sideband transmit mode when the plate current varies with the applied audio signal.

(5) Recycle Circuits.

Figure 30 is a simplified schematic diagram of the recycle circuits in the 618T-( ). These circuits are activated when any of the frequency selector knobs on the control unit are turned. When the knobs are turned, the recycle relay is energized. This relay remains energized as long as any of the tuning motors in the 618T-( ) are operating. The recycle relay (1) disconnects transistor supply voltage to the audio amplifier to mute the audio during the tuning cycle, (2) provides a ground to activate the antenna tuner, (3) interrupts the operation of the kilocycle stabilizer during the tuning cycle, and (4) disconnects the keying so that the transmitter cannot be keyed during the tuning cycle.



Sidetone Circuits, Simplified Schematic Diagram
Figure 29



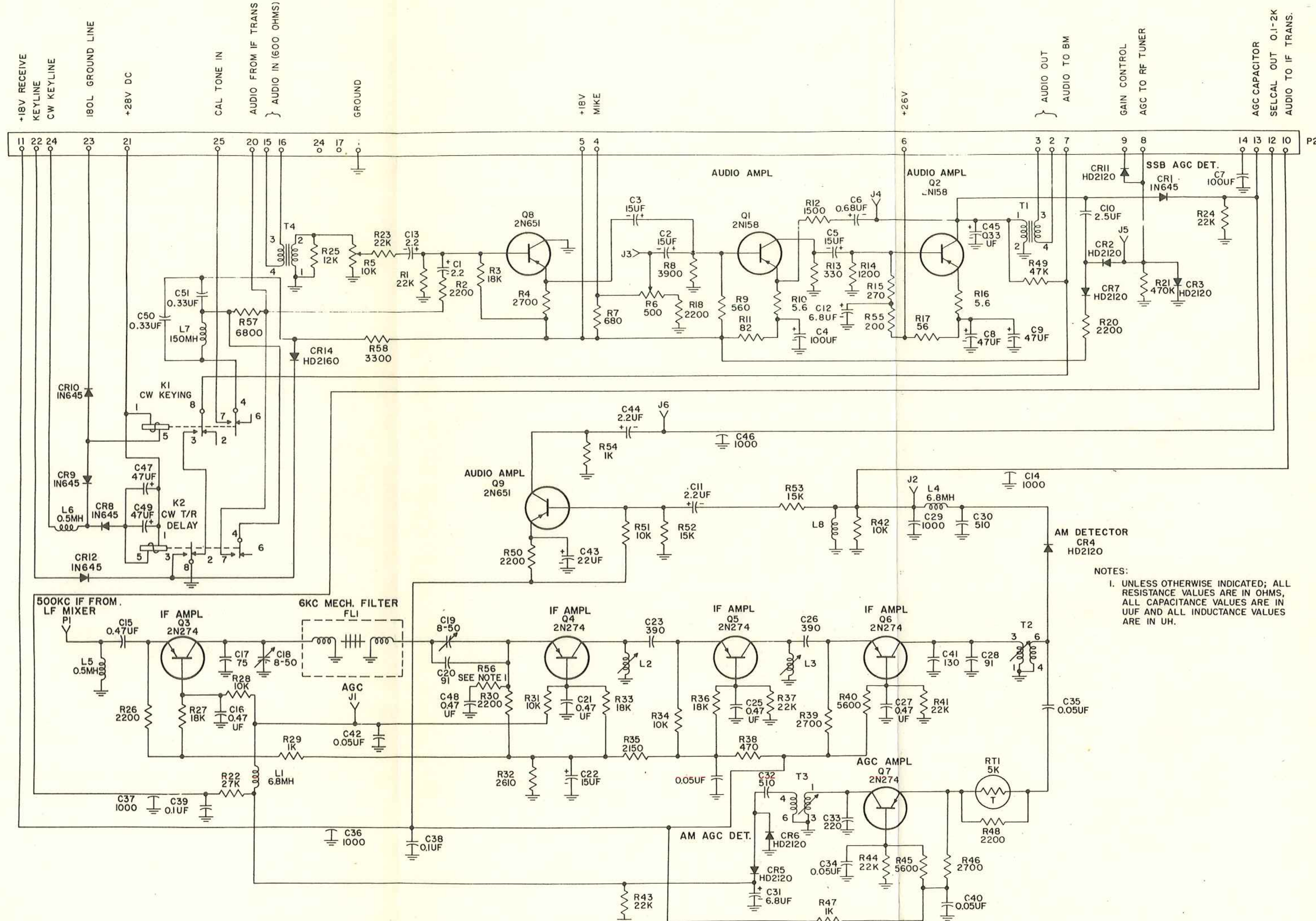
Recycle Circuits, Simplified Schematic Diagram
Figure 30

REVISION REFERENCE

The following descriptions identify the changes to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
CR1 (1N645) was CR1 (HD2120)	To increase reliability.	MCN 1729
Changed T1 symbol	Was air-core symbol.	All models
C31 (6.8 uf) was C31 (15 uf)	To increase reliability.	All models
C39 (0.1 uf) was C39 (0.1-50)	To increase reliability.	All models
Added L8	To change CW wave shape.	MCN 1729
C13 (2.2) was C12 (2.2)	To change CW wave shape.	MCN 1729
Added C51 (0.33 uf)	To change CW wave shape.	MCN 1729
C50 (0.33 uf) was C50 (0.18 uf)	To change CW wave shape.	MCN 1729
Circuitry from L7 to K1-4 was to P2-25	To change CW wave shape.	MCN 1729
Circuitry from P2-20 to C51 was to K1-6	To change CW wave shape.	MCN 1729
Circuitry from R2 to P2-20 was to K1-4	To change CW wave shape.	MCN 1729
Added circuitry from C51 to K2-7	To change CW wave shape.	MCN 1729
Added R58 (3300)	To adjust tune tone level.	MCN 2088
Added CR14 (HD2160)	To adjust tune tone level.	MCN 2088
Added R57 (6800)	To adjust tune tone level.	MCN 2088
Added CR12 (1N645)	To adjust tune tone level.	MCN 2088
Circuitry from K2-4 to R57 was to ground	To adjust tune tone level.	MCN 2088
Circuitry from K1-3 to R57 was to K2-6	To adjust tune tone level.	MCN 2088
Circuitry from K2-7 to R57 was to C51	To adjust tune tone level.	MCN 2088
Added circuitry from C51 to C58	To adjust tune tone level.	MCN 2088

AM/Audio Amplifier Module, Schematic Diagram
(Sheet 1 of 2)
Figure 31



AM/Audio Amplifier Module, Schematic Diagram (Sheet 2 of 2)
Figure 31

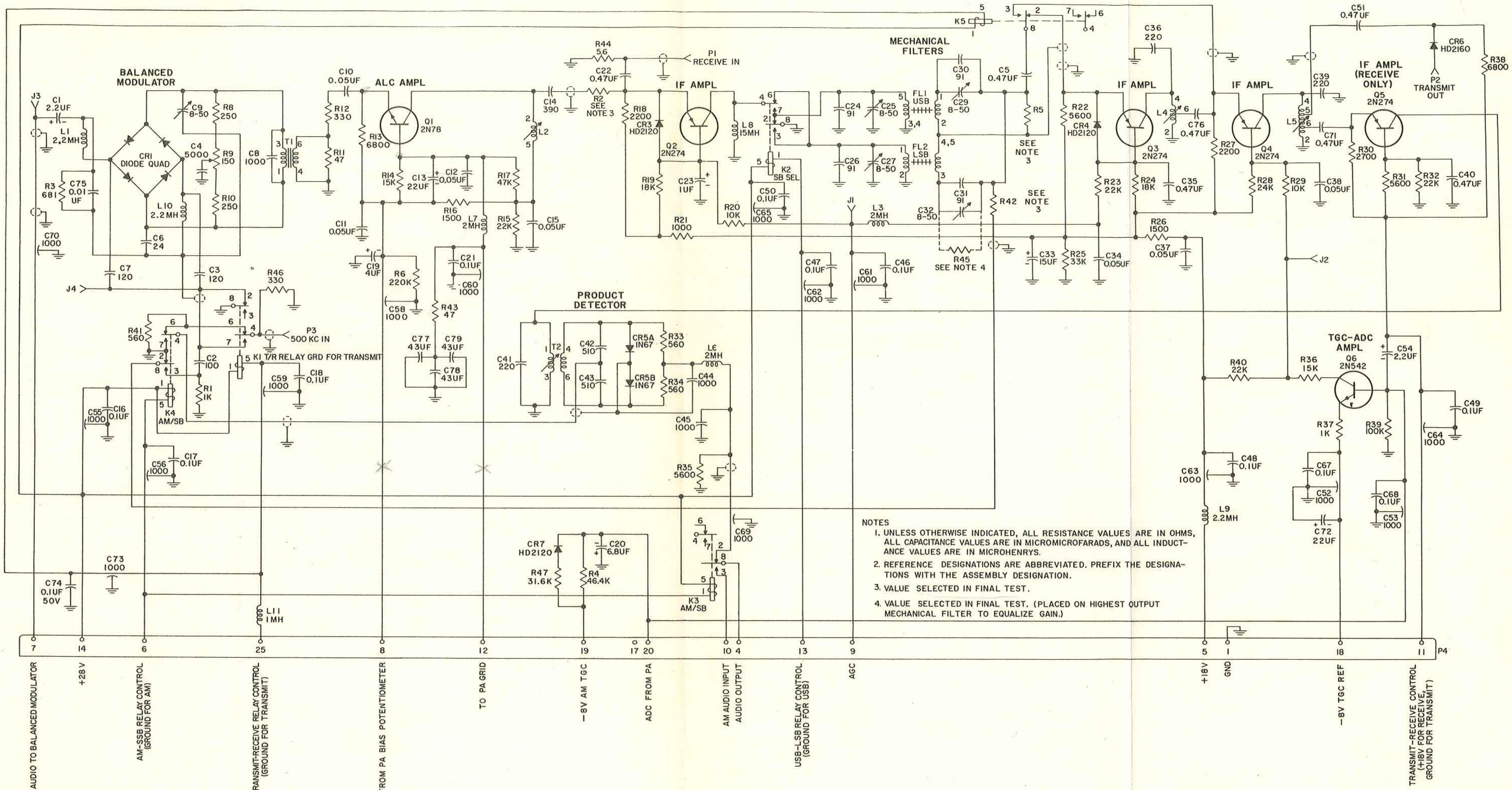
REVISION REFERENCE

The following descriptions identify the changes to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
Reversed contacts 1 and 5 of K4	To correct problems that occurred under environmental conditions.	MCN 1561
Added L11 (1 mh)	Same as above.	MCN 1561
Changed connections of C44	Same as above.	MCN 1561
Added CR7 (HD2120)	Same as above.	MCN 1561
Added R47 (31.6K)	Same as above.	MCN 1561
Deleted circuitry from K3-6 to P4-17	Same as above.	MCN 1561
Deleted circuitry from C20 to K3-4	Same as above.	MCN 1561
Changed connection of C10	Same as above.	MCN 1561
R12 (330) was R12 (18K)	To correct improper CW keying wave shape due to alc overshoot.	MCN 1751
R13 (6800) was R13 (2200)	Same as above.	MCN 1751
C13 (22 uf) was C13 (220 uf)	Same as above.	MCN 1751
Added R43 (47)	Same as above.	MCN 1751
Added C77 (43 uf), C78 (43 uf), and C79 (43 uf)	Same as above.	MCN 1751
C23 (1 uf) was C23 (0.47 uf)	To correct problems that occurred under environmental conditions.	MCN 1561
C63 (1000) was C63 (100)	Same as above.	MCN 1561
Changed connection of R42	Same as above.	MCN 1561
Changed connection of L1	To correct problems that occurred under environmental conditions.	MCN 1561
L1 (2.2 mh) was L1 (2 mh)	Same as above.	MCN 1561
R3 (681) was R3 (560 .5%)	Same as above.	MCN 1561
Changed connection of C4	Same as above.	MCN 1561
Added C75 (0.01 uf)	Same as above.	MCN 1561
C6 (24) was C6 (39)	Same as above.	MCN 1561
Changed connection of C9	Same as above.	MCN 1561
Added L10 (2.2 mh)	Same as above.	MCN 1561
Changed connection of J4	Same as above.	MCN 1561
Changed connection of C7	Same as above.	MCN 1561
C7 (120) was C7 (220)	Same as above.	MCN 1561
R8 (250) was R8 (220)	Same as above.	MCN 1561
R10 (250) was R10 (220)	Same as above.	MCN 1561
Changed connection of C8	Same as above.	MCN 1561

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
C8 (1000) was C8 (220)	Same as above.	MCN 1561
Changed connection of C3	Same as above.	MCN 1561
C3 (120) was C3 (1000)	Same as above.	MCN 1561
Changed contact numbers of K1	Same as above.	MCN 1561
R1 (1K) was R1 (47)	Same as above.	MCN 1561
Changed connection of R5	To correct problems that occurred under environmental conditions.	MCN 1561
Deleted C28	Same as above.	MCN 1561
Added K5	Same as above.	MCN 1561
R22 (5600) was R22 (10K)	Same as above.	MCN 1561
R23 (22K) was R23 (47K)	Same as above.	MCN 1561
Changed connection of L4	Same as above.	MCN 1561
Changed connection of C36	Same as above.	MCN 1561
C36 (220) was C36 (470)	Same as above.	MCN 1561
Added C76 (0.47 uf)	Same as above.	MCN 1561
R36 (15K) was R36 (8200)	Same as above.	MCN 1561
C54 (2.2 uf) was C54 (1.5 uf)	Same as above.	MCN 1561
R37 (1K) was R37 (2200)	Same as above.	MCN 1561
Added C72 (22 uf)	Same as above.	MCN 1561
Added C73 (1000)	Same as above.	MCN 1561
Added C74 (0.1 uf, 50 v)	Same as above.	MCN 1561

I-F Translator Module, Schematic Diagram
(Sheet 1 of 2)
Figure 32



NOTES

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION.
3. VALUE SELECTED IN FINAL TEST.
4. VALUE SELECTED IN FINAL TEST. (PLACED ON HIGHEST OUTPUT MECHANICAL FILTER TO EQUALIZE GAIN.)

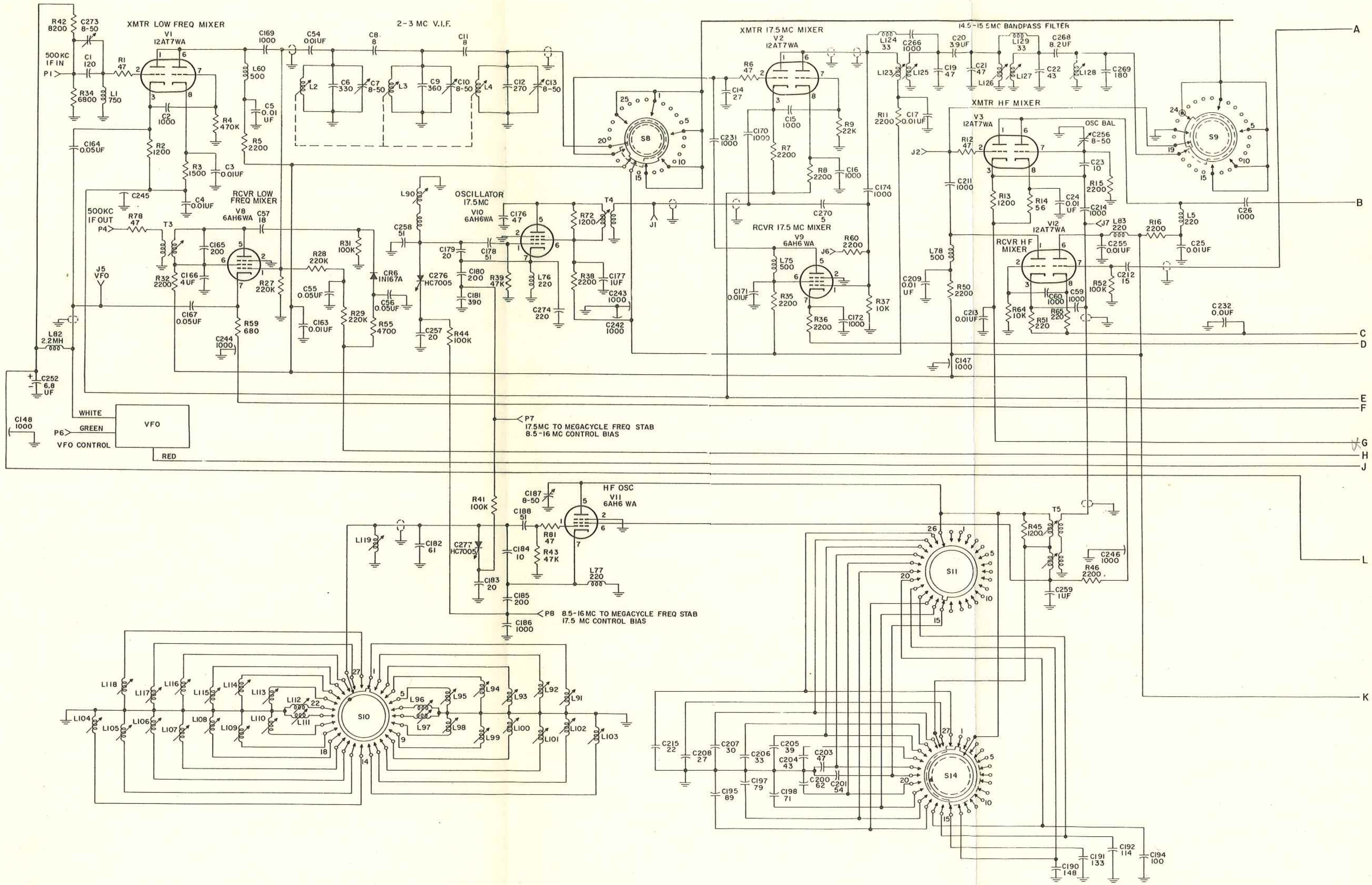
I-F Translator Module, Schematic Diagram
(Sheet 2 of 2)
Figure 32

REVISION REFERENCE

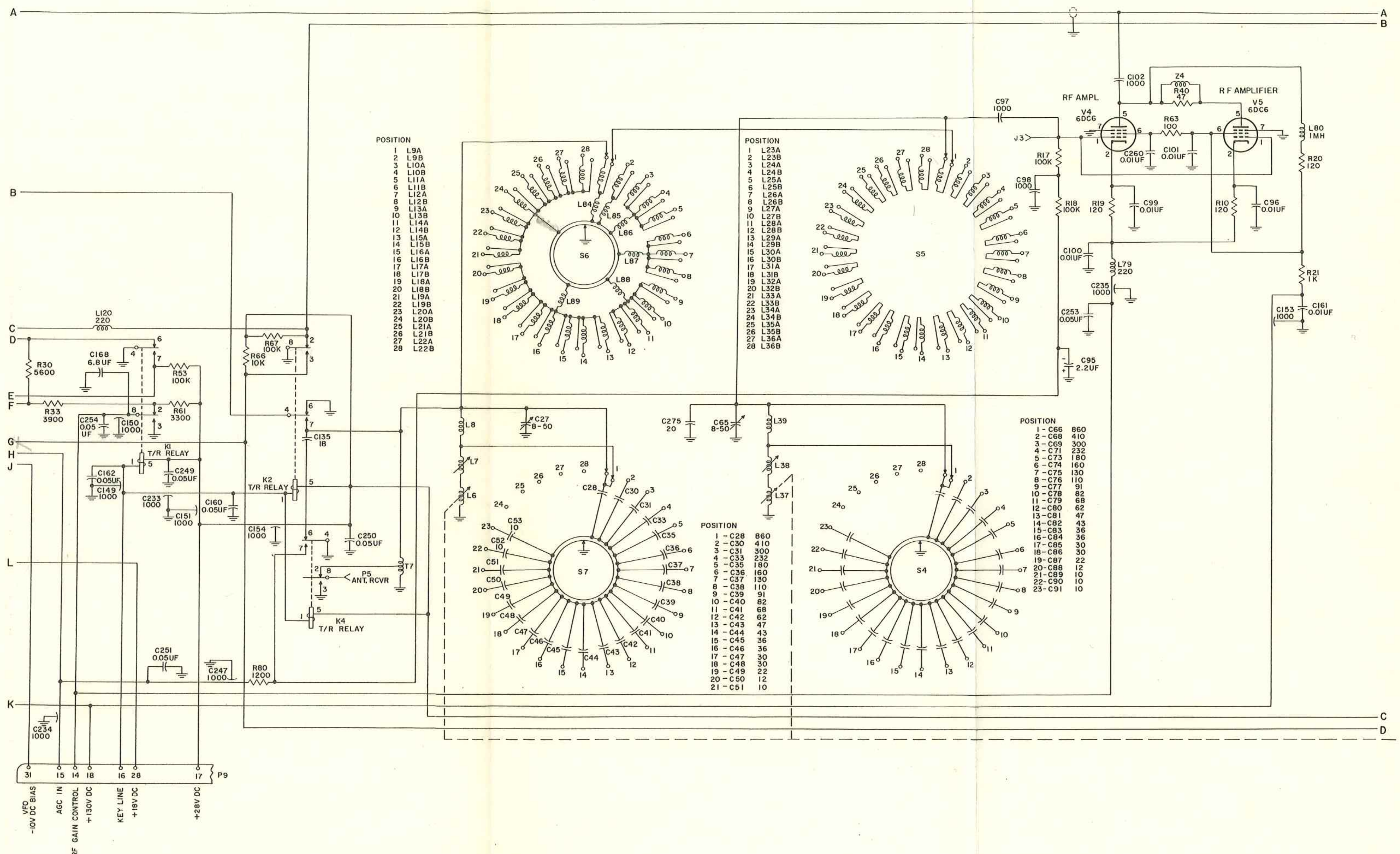
The following descriptions identify the change to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
Added R86 (400)	To improve performance	MCN 375
Added R87 (630)	Same as above.	MCN 375
Changed connection of L121	Same as above.	MCN 375
R66 (10K) was R66 (200)	Same as above.	MCN 375
C135 (18) was C135 (24)	Same as above.	MCN 375
R15 (2200) was C15 (2200)	To correct drafting error.	All models
C277 (HC7005) was VC2 (HC7005)	Change of nomenclature.	All models
C276 (HC7005) was VC2 (HC7005)	Change of nomenclature.	All models
R27 (220K) was R27 (470K)	To improve performance.	MCN 375
Deleted circuitry from T5 to R46	Same as above.	MCN 375
L82 (2.2 mh) was L82 (2 mh)	Same as above.	MCN 375
C8 and C11 (8) were C8 and C11 (10)	Same as above.	MCN 375

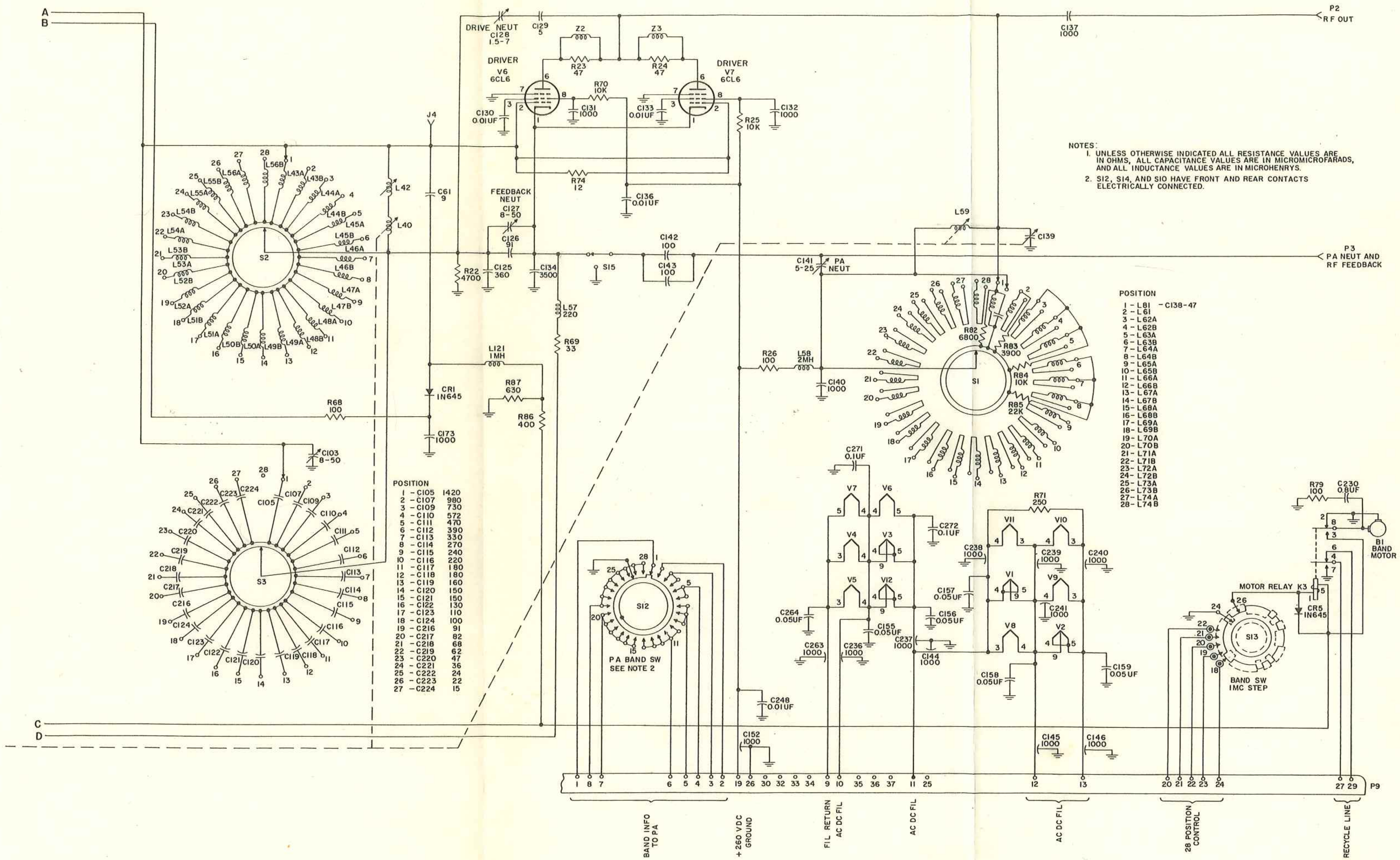
R-F Translator Module, Schematic Diagram
(Sheet 1 of 4)
Figure 33



R-F Translator Module, Schematic Diagram (Sheet 2 of 4)
Figure 33



R-F Translator Module, Schematic
Diagram (Sheet 3 of 4)
Figure 33



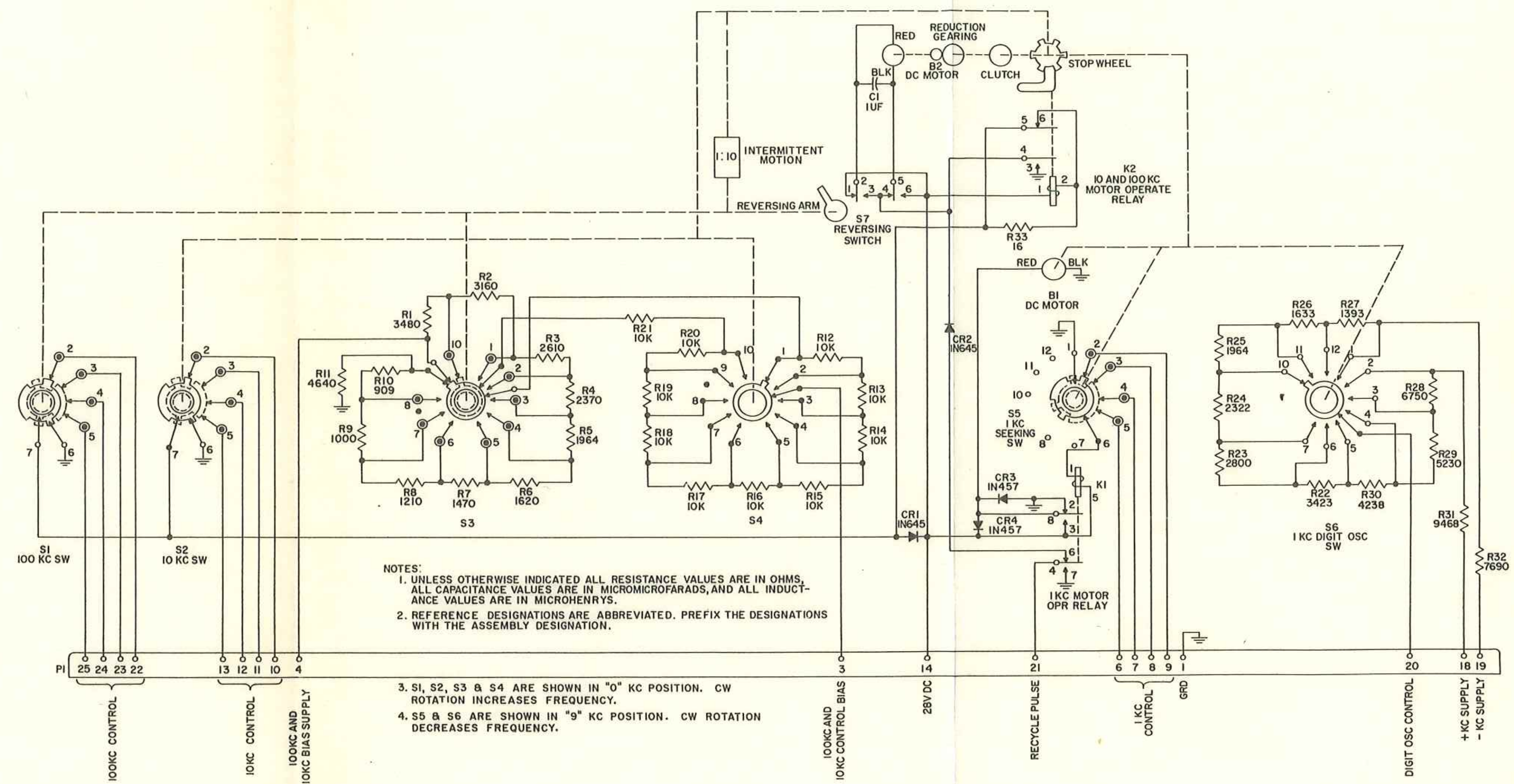
R-F Translator Module, Schematic Diagram (Sheet 4 of 4)
Figure 33

REVISION REFERENCE

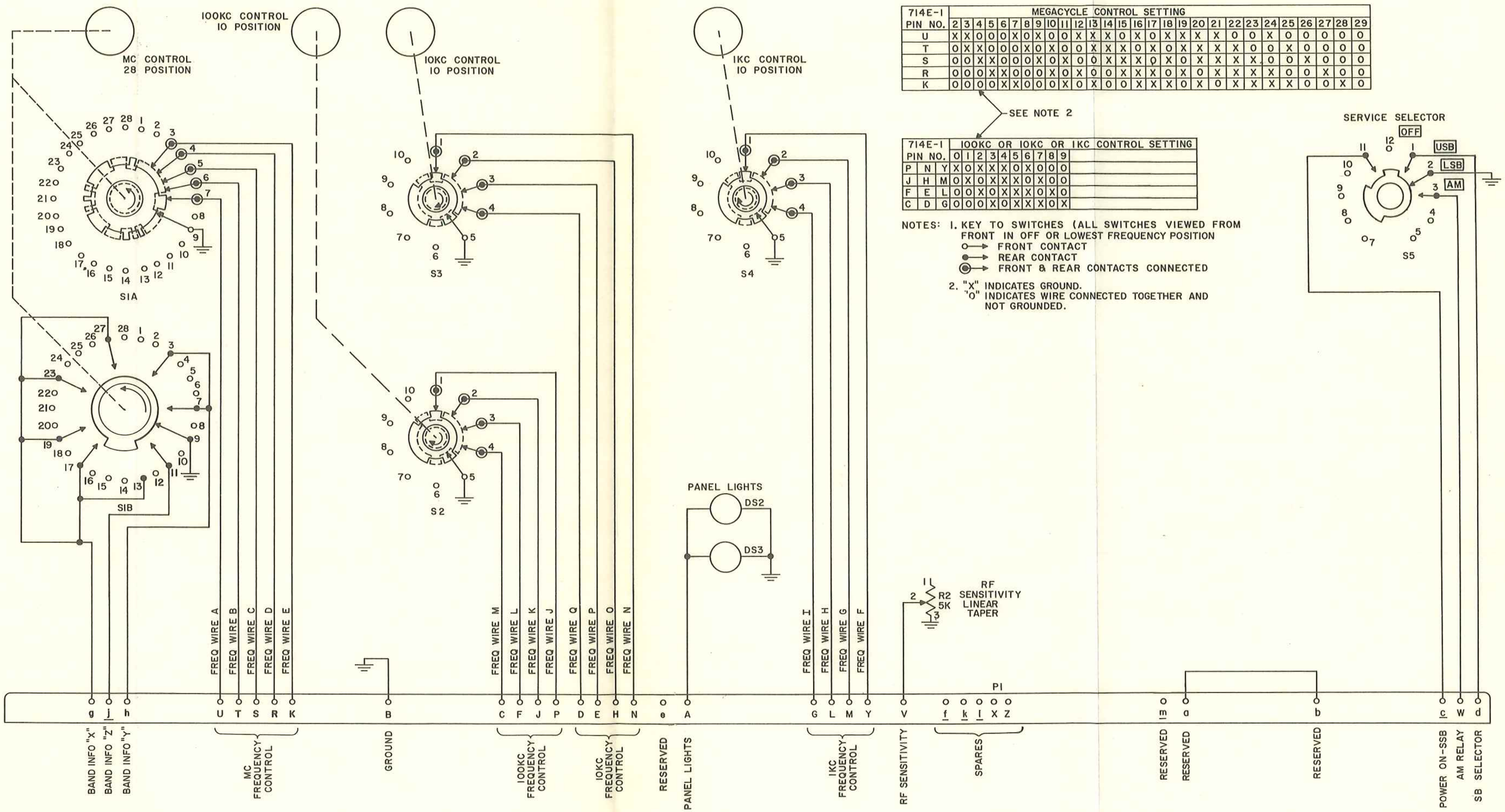
The following description identifies the change to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
Added CR3 and CR4	To protect relay.	101

Autopositioner Submodule, Schematic Diagram
(Sheet 1 of 2)
Figure 34



Autopositioner Submodule, Schematic Diagram
(Sheet 2 of 2)
Figure 34



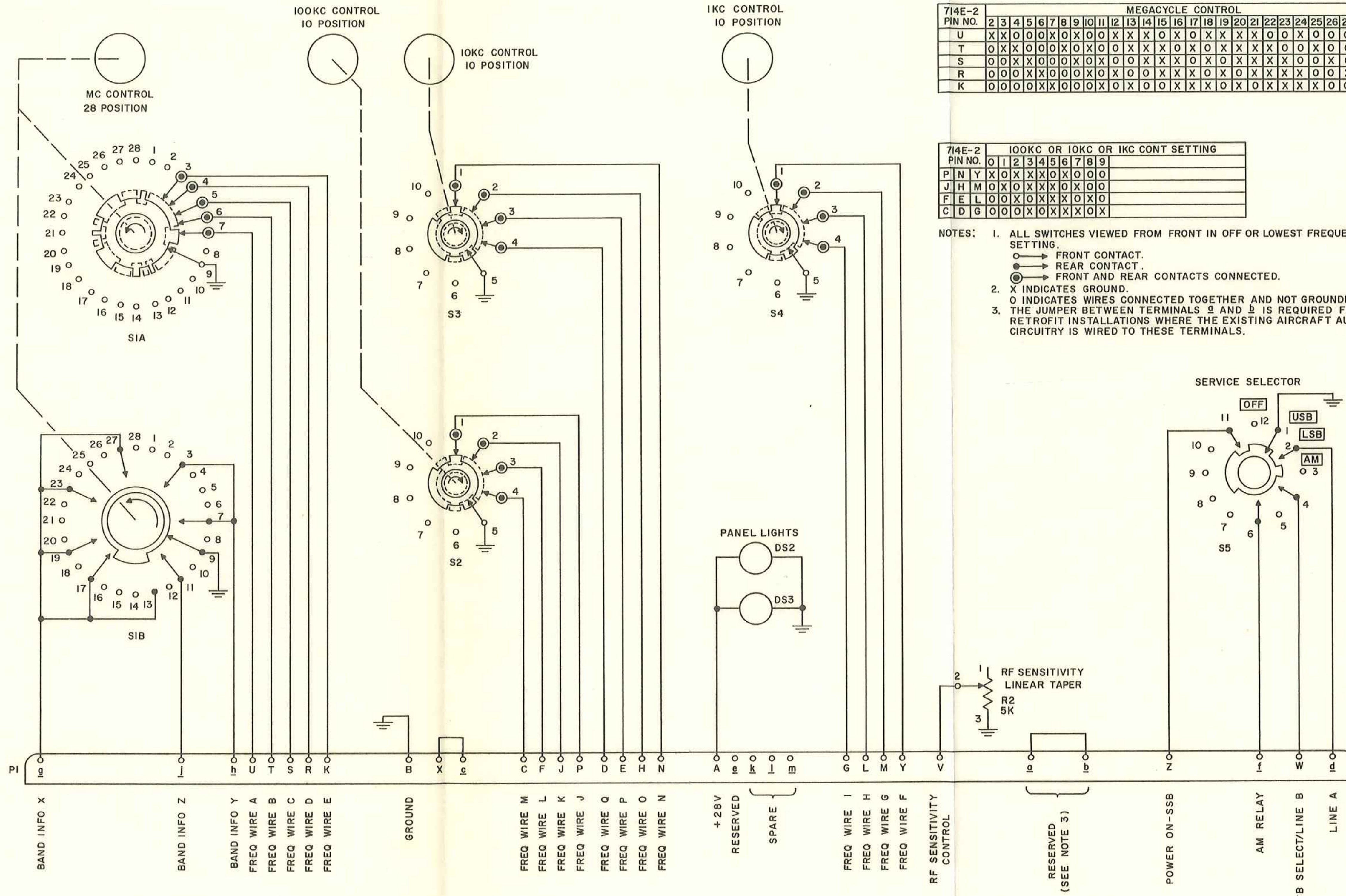
714E-1	MEGACYCLE CONTROL SETTING																										
PIN NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
U	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
T	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
S	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
R	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
K	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

SEE NOTE 2

714E-1			100KC OR 10KC OR 1KC CONTROL SETTING									
PIN NO.			0	1	2	3	4	5	6	7	8	9
P	N	Y	X	O	X	X	X	O	X	O	O	O
J	H	M	O	X	O	X	X	X	O	X	O	O
F	E	L	O	O	X	O	X	X	X	O	X	O
C	D	G	O	O	O	X	O	X	X	X	O	X

NOTES:
1. KEY TO SWITCHES (ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY POSITION
   - o→ FRONT CONTACT
   - •→ REAR CONTACT
   - ◉→ FRONT & REAR CONTACTS CONNECTED
2. "X" INDICATES GROUND.
   "O" INDICATES WIRE CONNECTED TOGETHER AND NOT GROUNDED.

Control Unit 714E-1, Schematic Diagram
Figure 35



714E-2 PIN NO.	MEGACYCLE CONTROL																										
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
U	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
T	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
S	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
R	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
K	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

714E-2 PIN NO.			100KC OR 10KC OR 1KC CONT SETTING									
			0	1	2	3	4	5	6	7	8	9
P	N	Y	X	O	X	X	X	O	X	O	O	O
J	H	M	O	X	O	X	X	X	O	X	O	O
F	E	L	O	O	X	O	X	X	X	O	X	O
C	D	G	O	O	O	X	O	X	X	X	O	X

NOTES:
1. ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY SETTING.
   ○——▶ FRONT CONTACT.
   ●——▶ REAR CONTACT.
   ◉——▶ FRONT AND REAR CONTACTS CONNECTED.
2. X INDICATES GROUND.
   O INDICATES WIRES CONNECTED TOGETHER AND NOT GROUNDED.
3. THE JUMPER BETWEEN TERMINALS a AND b IS REQUIRED FOR RETROFIT INSTALLATIONS WHERE THE EXISTING AIRCRAFT AUDIO CIRCUITRY IS WIRED TO THESE TERMINALS.

Control Unit 714E-2, Schematic Diagram
Figure 36

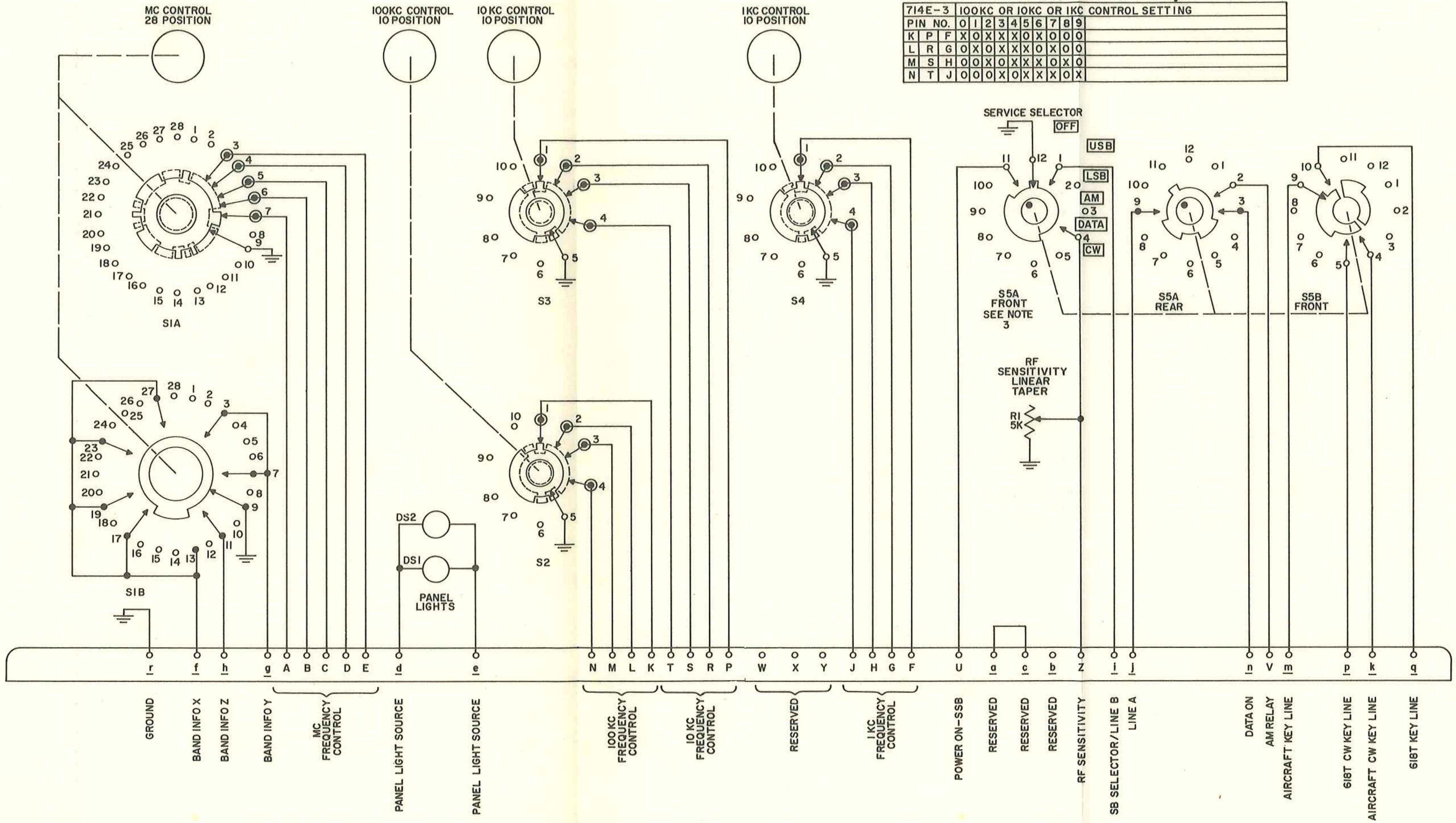
NOTES:

1. KEY TO SWITCHES, (ALL SWITCHES VIEWED FROM FRONT IN OFF OR LOWEST FREQUENCY SETTING.)
   - o→ INDICATES FRONT CONTACT.
   - •→ INDICATES REAR CONTACT.
   - ◉→ INDICATES FRONT AND REAR CONTACTS CONNECTED.
2. "X" INDICATES GROUND.
   "O" INDICATES WIRES CONNECTED TOGETHER AND NOT GROUNDED.
3. FRONT AND REAR ROTORS ON THE "A" WAFER OF S5 ARE ELECTRICALLY CONNECTED BY A SOLDERED TAB.

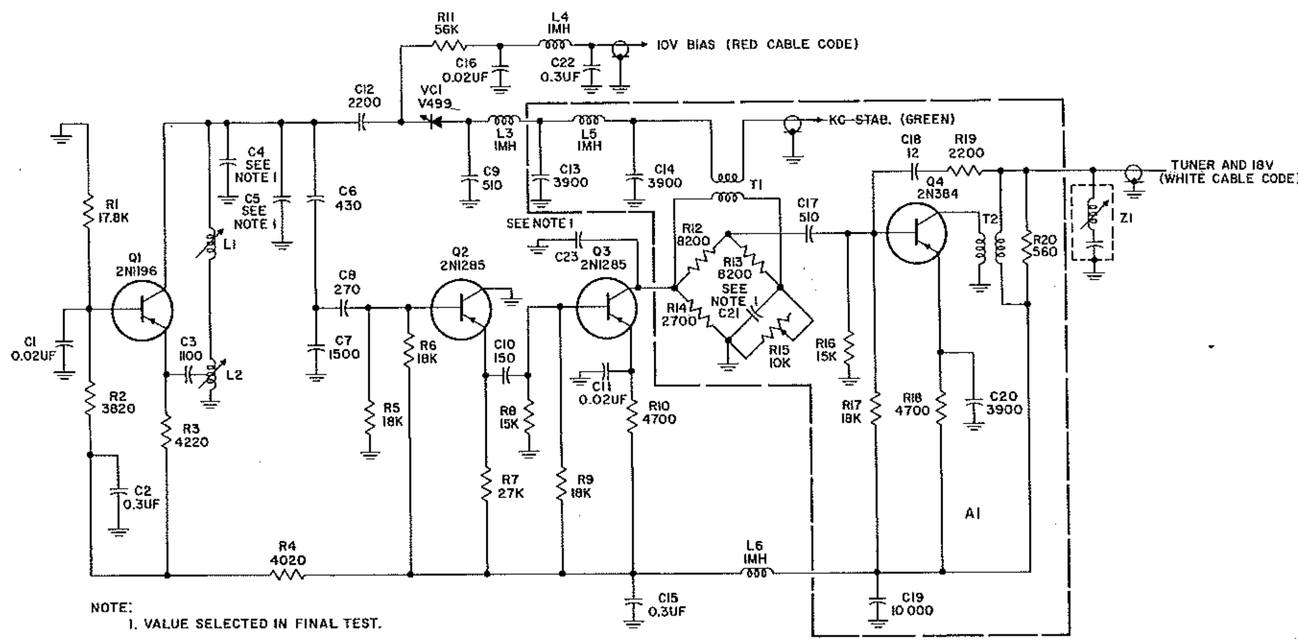
714E-3	MEGACYCLE CONTROL SETTING																										
PIN NO.	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
A	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O	O
B	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O	O
C	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O	O
D	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O	O
E	O	O	O	O	X	X	O	O	O	X	O	X	O	O	X	X	X	O	X	O	X	X	X	X	O	O	X	O

SEE NOTE 2

714E-3			IOOKC OR IOKC OR IKC CONTROL SETTING									
PIN NO.			0	1	2	3	4	5	6	7	8	9
K	P	F	X	O	X	X	X	O	X	O	O	O
L	R	G	O	X	O	X	X	X	O	X	O	O
M	S	H	O	O	X	O	X	X	X	O	X	O
N	T	J	O	O	O	X	O	X	X	X	O	X



Control Unit 714E-3, Schematic Diagram
Figure 37

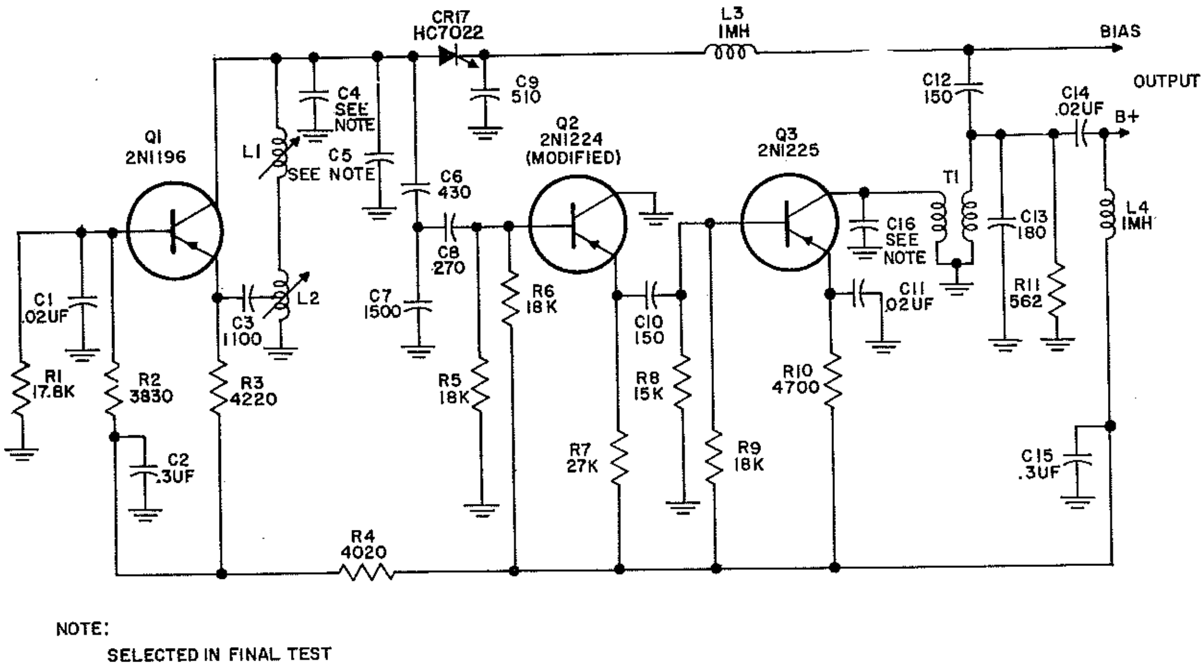


REVISION REFERENCE

The following description identifies the change to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
VC1 (V499) was VC1 (HC7041)	To increase reliability.	Unknown

VFO Submodule, 70K-5, Schematic Diagram
Figure 38



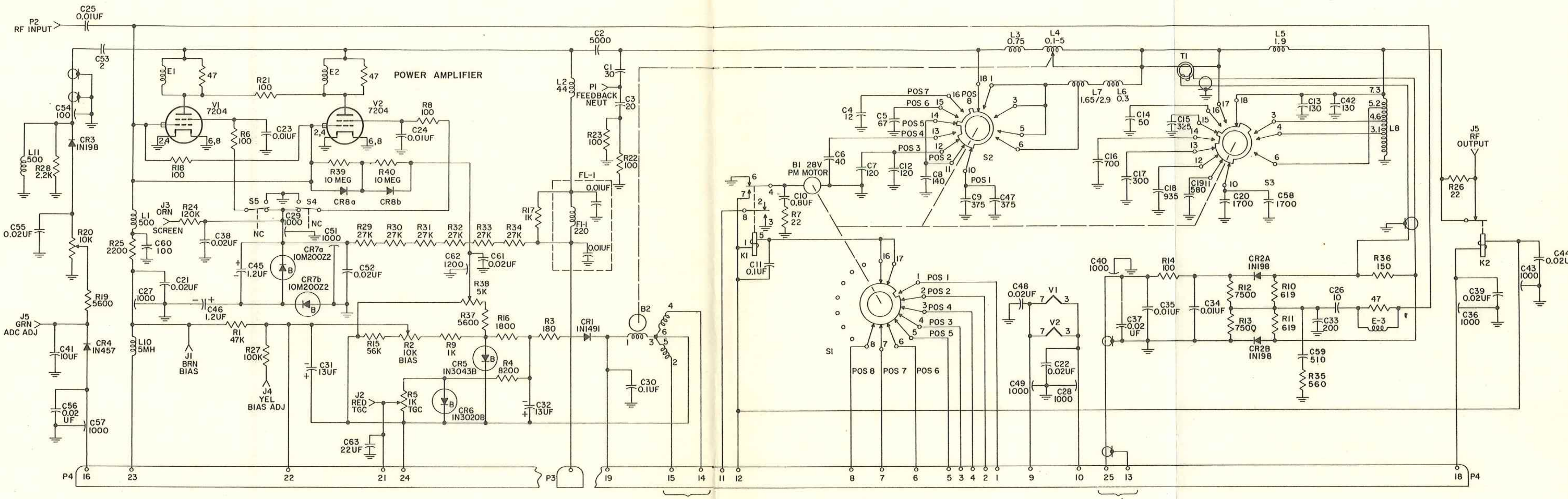
VFO Submodule 70K-3, Schematic Diagram
Figure 39

REVISION REFERENCE

The following descriptions identify the change to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
Added R39 (10M)	To add PEP limiter.	2003
Added R40 (10M)	To add PEP limiter.	2003
Added CR8a (FD1000)	To add PEP limiter.	2003
Added CR86 (FD1000)	To add PEP limiter.	2003
Added C62 to GND (1200 UF)	To add PEP limiter.	2003
Added C61 to GND (.02 UF)	To add PEP limiter.	2003
Added R38 (5K) 1 w	To add PEP limiter.	2003
Added R37 (5.6K) 1 w	To add PEP limiter.	2003
R16 (1800) was (4700)	To add PEP limiter.	2003
Deleted GND at cathode of CR6	To add PEP limiter.	2003
At P4-11: Recycle line was key line	To add PEP limiter.	2003

Power Amplifier Module, Schematic Diagram
(Sheet 1 of 2)
Figure 40



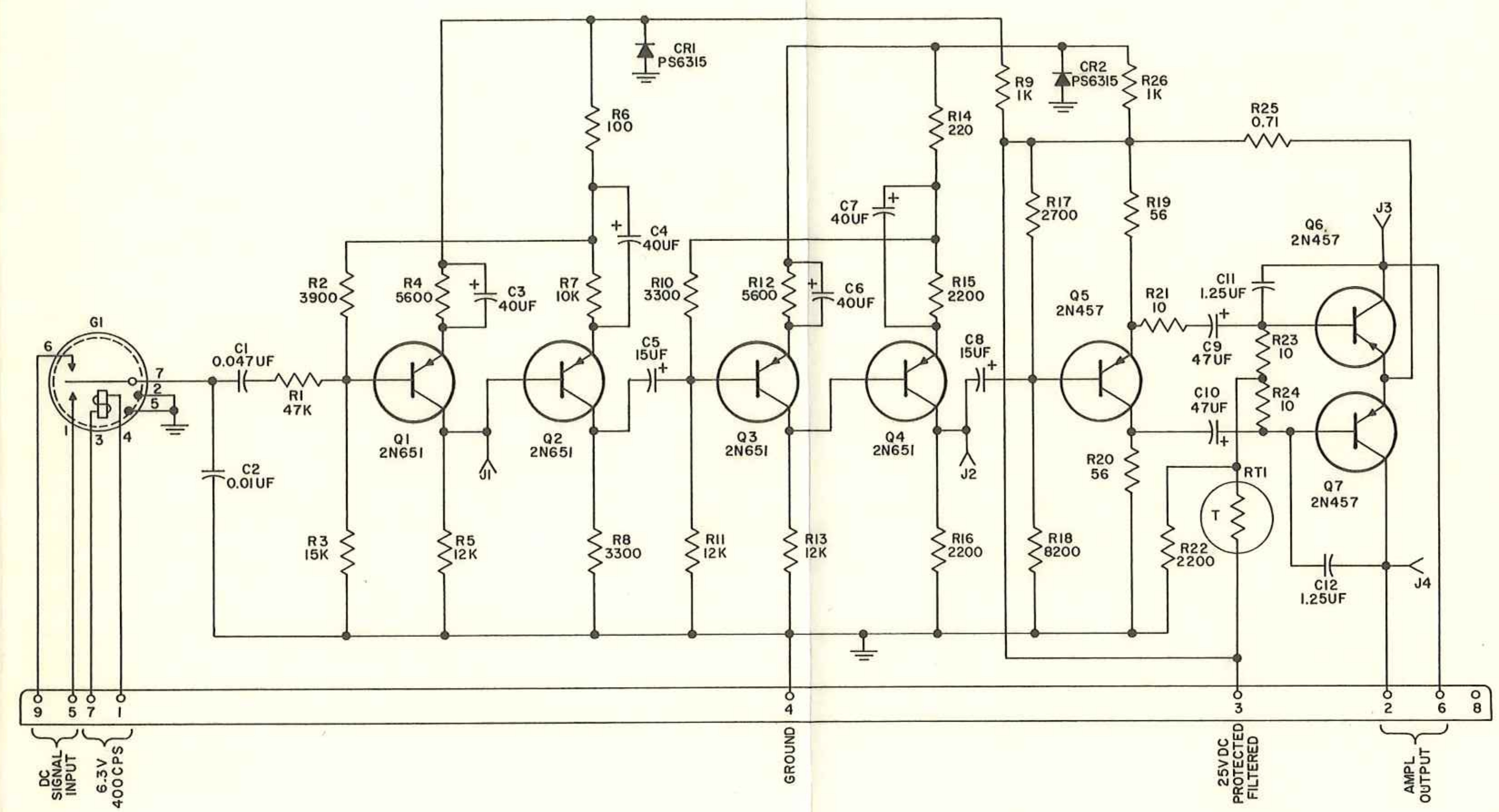
NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION.

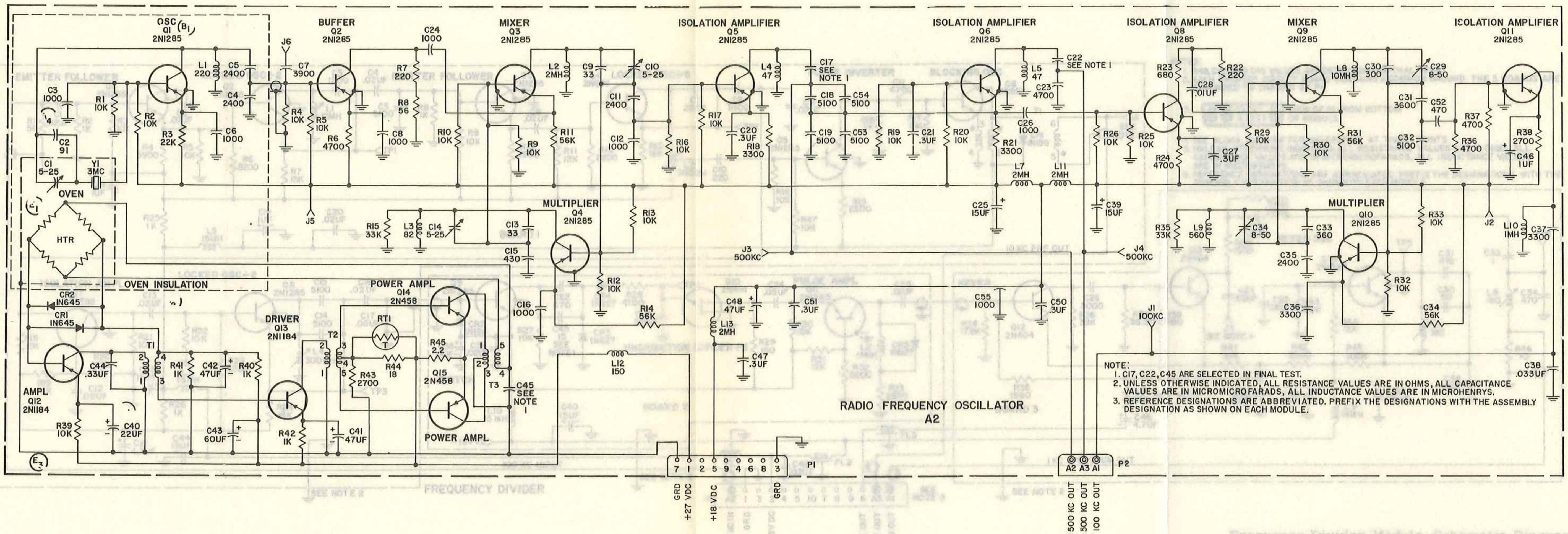
BAND COVERAGE

POS.	
1	2MC-3MC
2	3MC-4MC
4	6MC-8MC
3	4MC-6MC
5	8MC-11MC
6	11MC-16MC
7	16MC-22MC
8	22MC-30MC

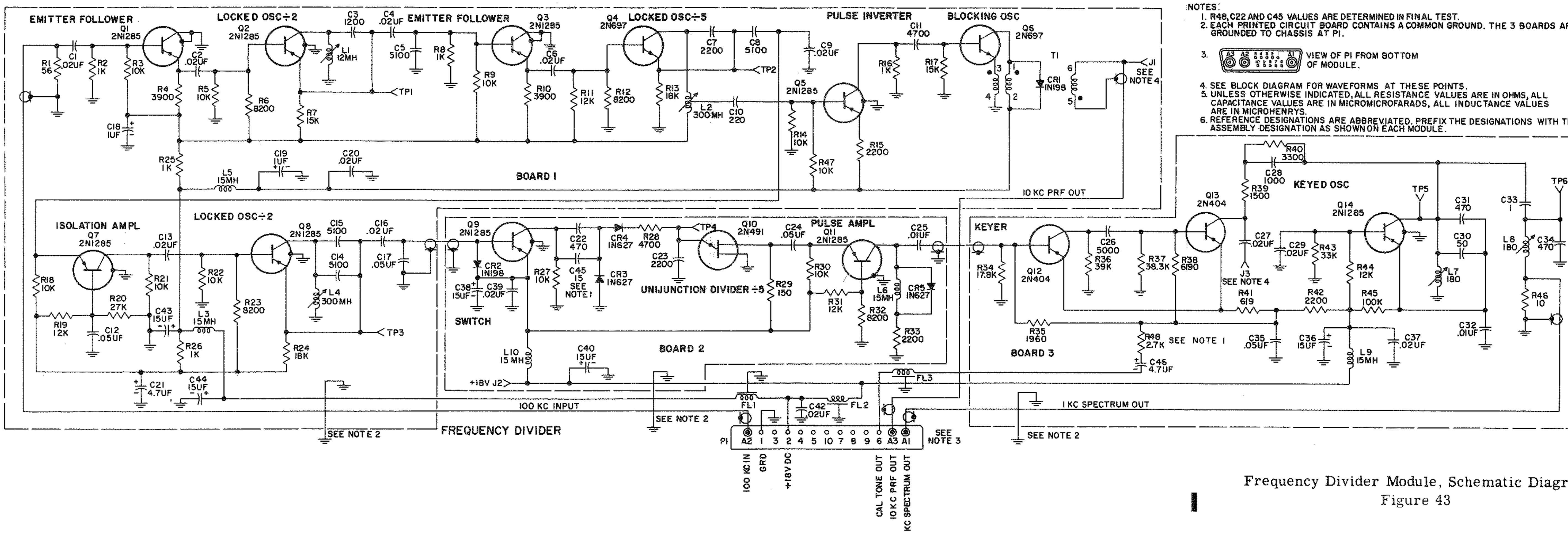
Power Amplifier Module, Schematic Diagram
(Sheet 2 of 2)
Figure 40



Electronic Control Amplifier Module,
Schematic Diagram
Figure 41



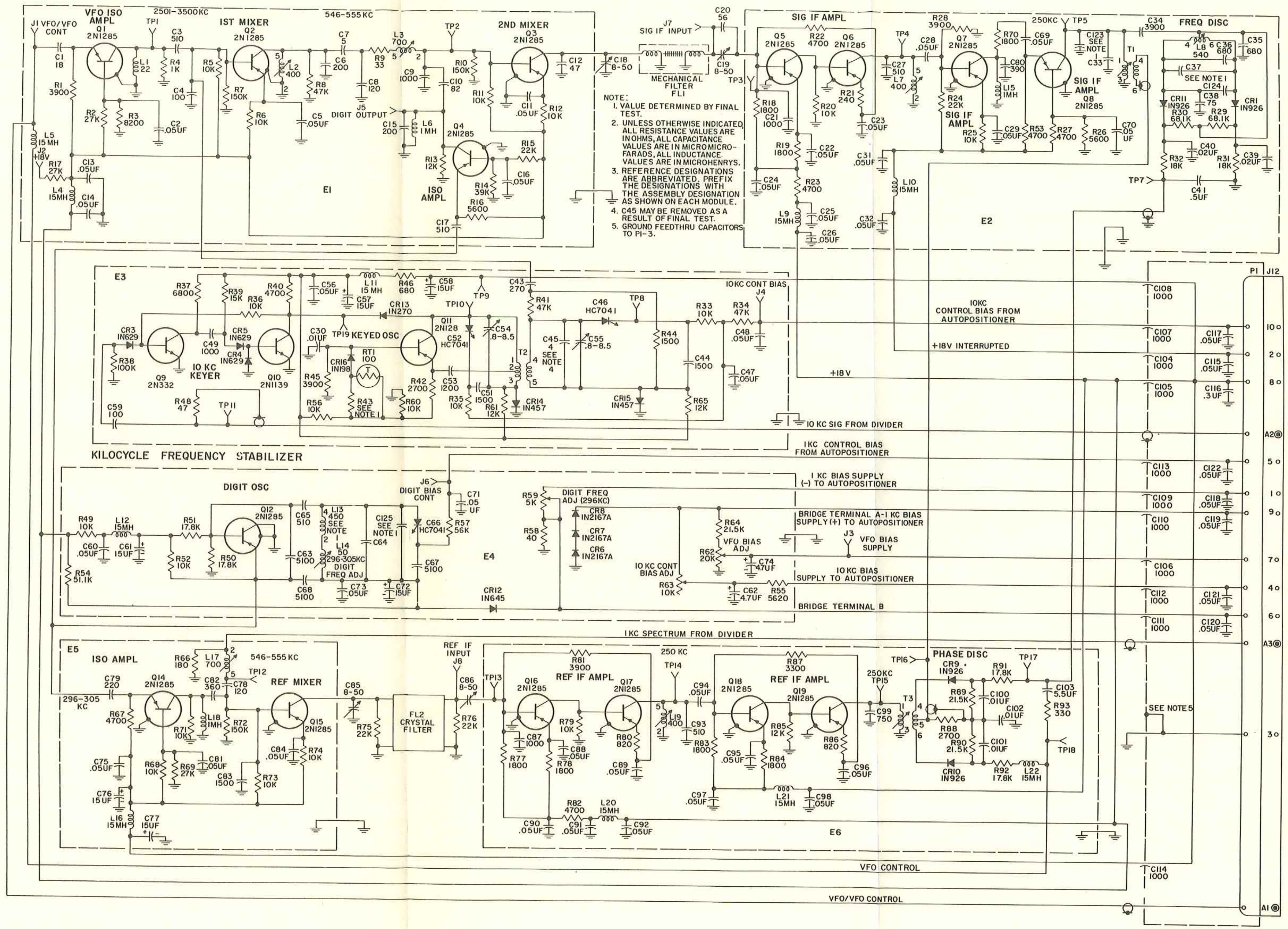
R-F Oscillator Module, Schematic Diagram
Figure 42



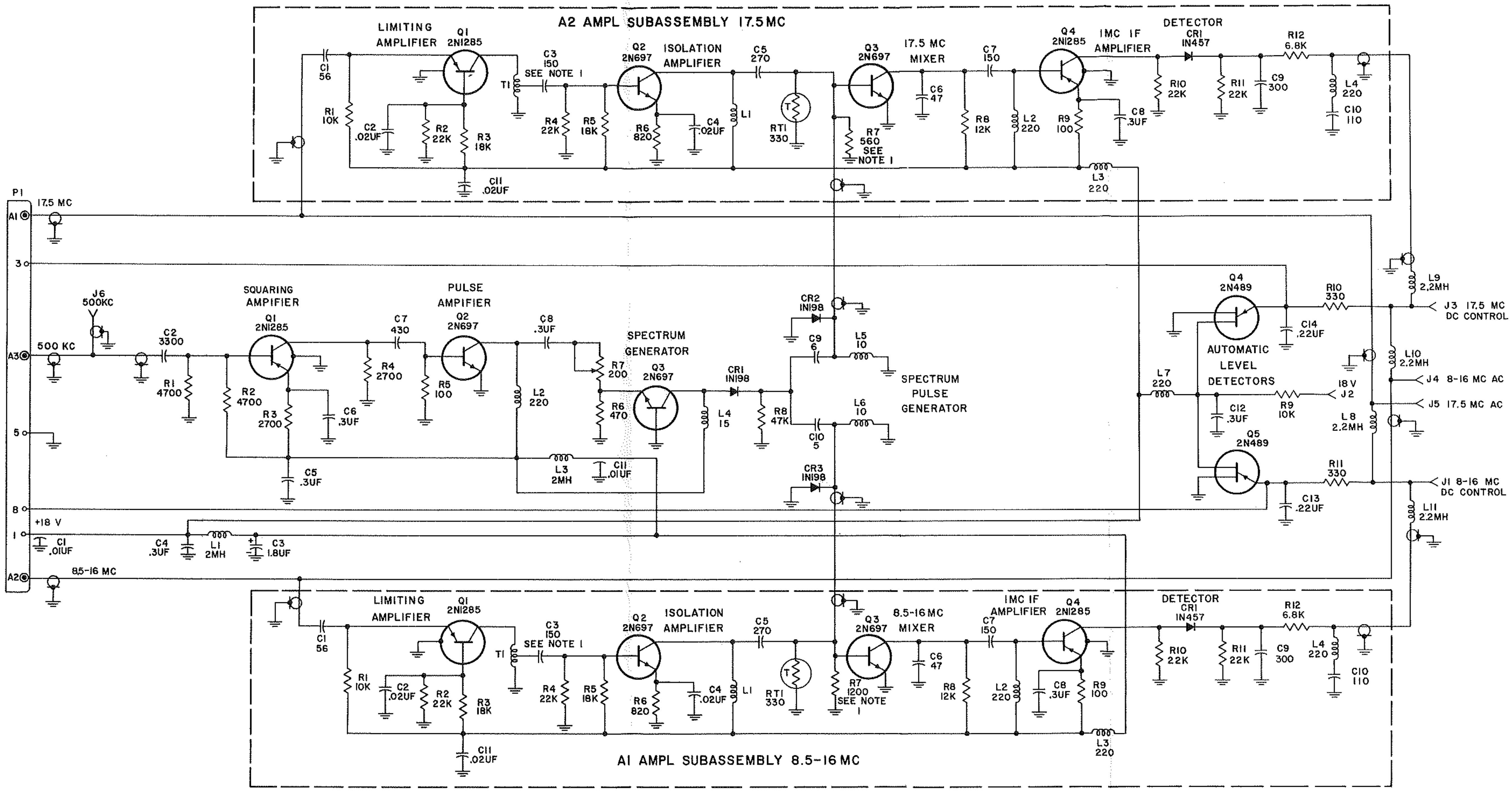
NOTES:

1. R48, C22 AND C45 VALUES ARE DETERMINED IN FINAL TEST.
2. EACH PRINTED CIRCUIT BOARD CONTAINS A COMMON GROUND. THE 3 BOARDS ARE GROUNDED TO CHASSIS AT P1.
3. VIEW OF P1 FROM BOTTOM OF MODULE.
4. SEE BLOCK DIAGRAM FOR WAVEFORMS AT THESE POINTS.
5. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
6. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION AS SHOWN ON EACH MODULE.

Frequency Divider Module, Schematic Diagram
Figure 43



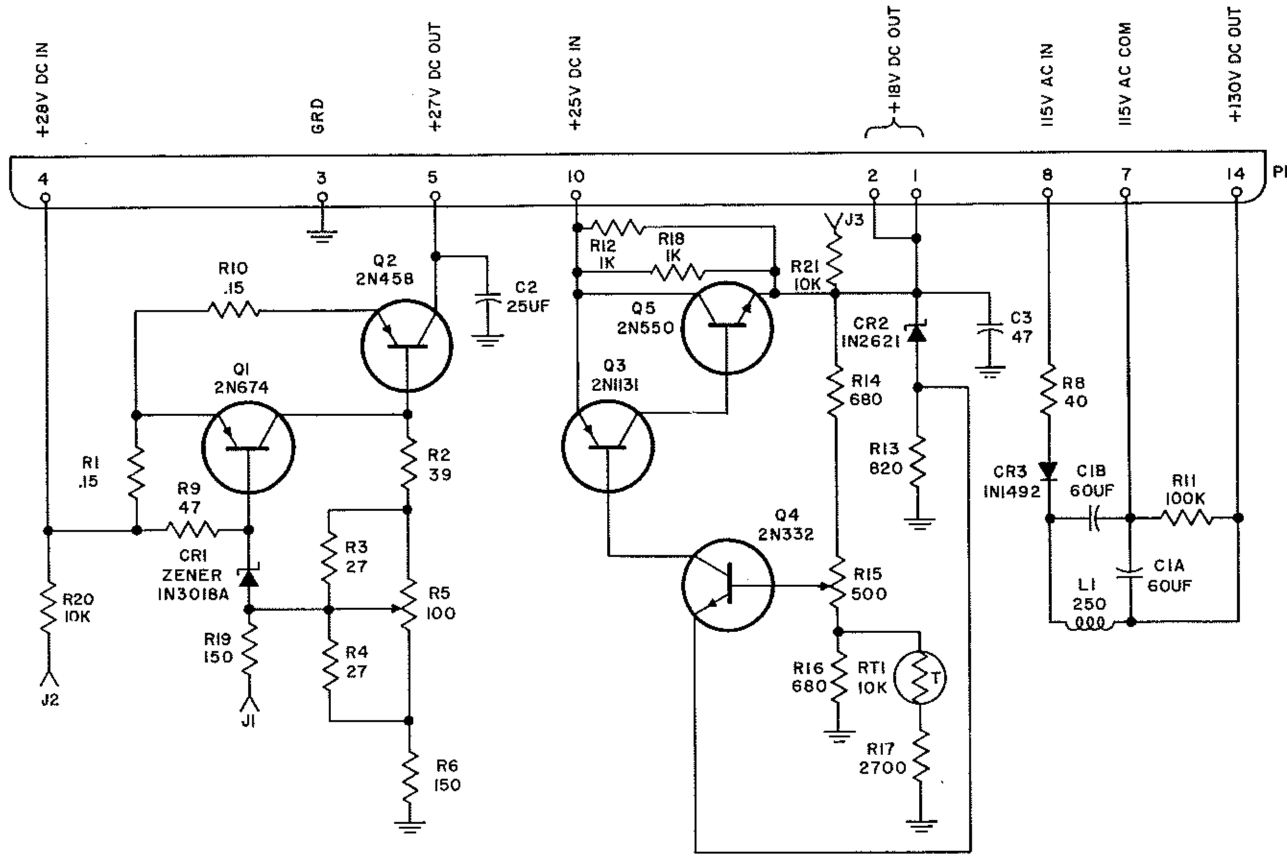
Kilocycle-Frequency Stabilizer Module, Schematic Diagram
Figure 44



NOTES:

1. NOMINAL VALUE SELECTED DURING TEST.
2. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN MICROMICROFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
3. PREFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX THE DESIGNATIONS WITH THE ASSEMBLY DESIGNATION AS SHOWN ON EACH MODULE.
4. EARLIER SERIAL NUMBERED MODULES USE 2N1224 TRANSISTORS IN PLACE OF 2N1285

Megacycle-Frequency Stabilizer Module,
Schematic Diagram
Figure 45

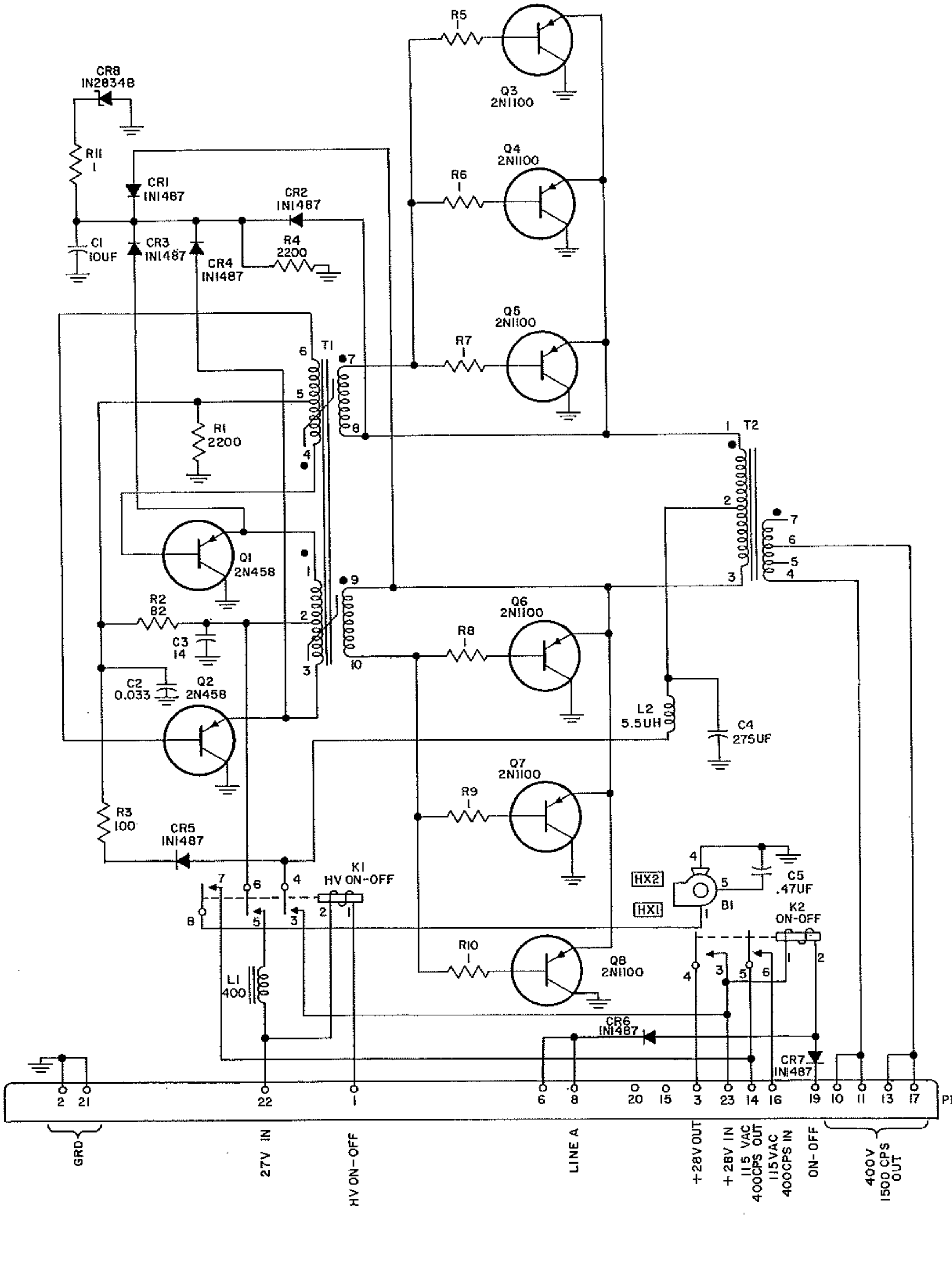


REVISION REFERENCE

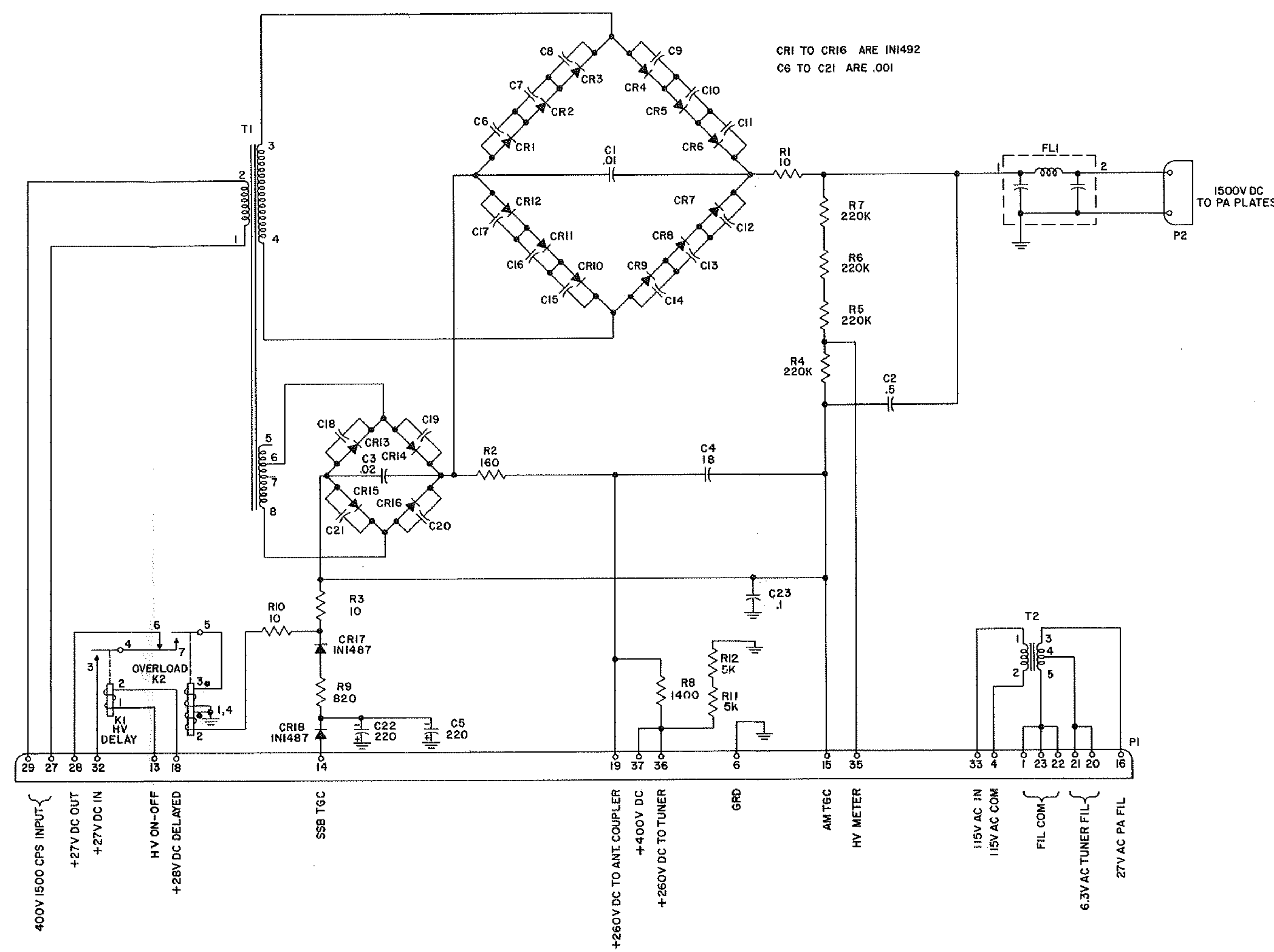
The following descriptions identify the changes to this schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
Deleted R18 (33K)	To increase reliability.	MCN 1649
Deleted CR4 (1N645)	Same as above.	MCN 1649
Deleted R12 (47K)	Same as above.	MCN 1649
Deleted C4 (4.7 uf)	Same as above.	MCN 1649
Added R12 (1K) and R18 (1K)	Same as above.	MCN 1649
R19 (150) was R15 (150)	Same as above.	MCN 1649
CR1 (1N3018A) was CR1 (SV808)	Same as above.	Unknown

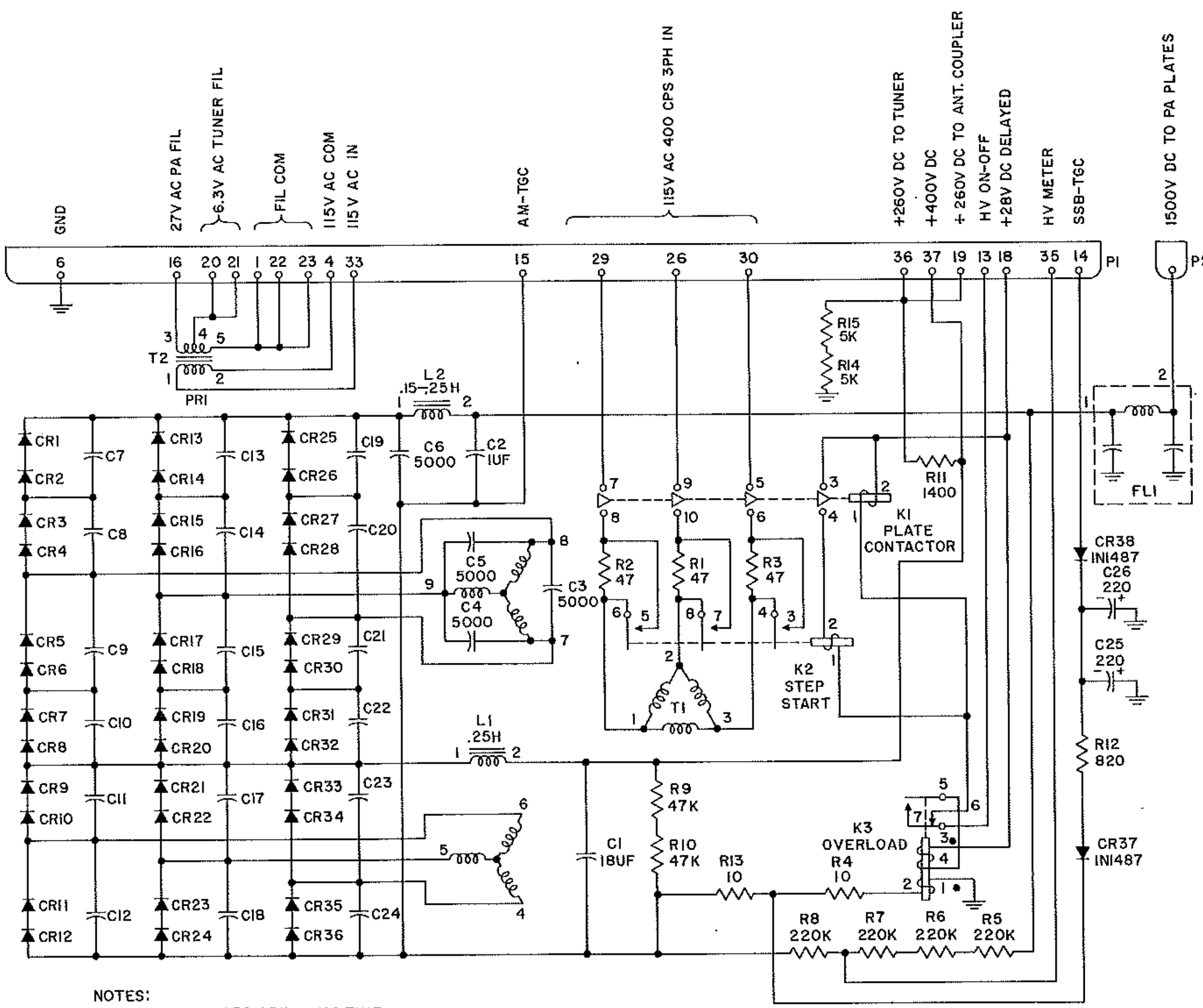
Low-Voltage Power Supply Module, Schematic Diagram
Figure 46



Power Supply 516H-1, Schematic Diagram
Figure 47

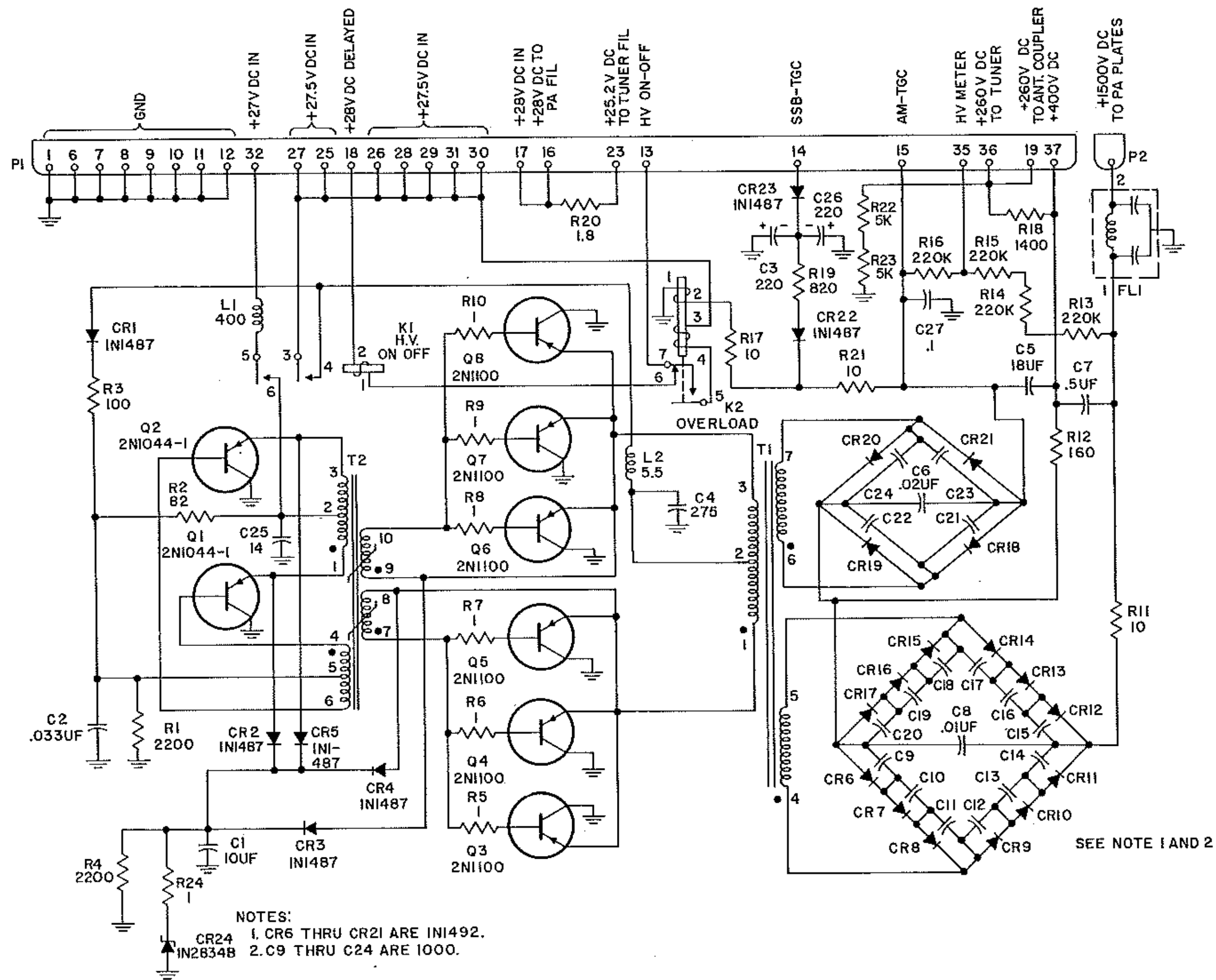


Single-Phase High-Voltage Power Supply
Module, Schematic Diagram
Figure 48



NOTES:
1. CR1 THRU CR36 ARE 1N1492 TYPE.
2. C7 THRU C24 ARE 1000 UUF.

Three-Phase High-Voltage Power Supply Module, Schematic Diagram
Figure 49



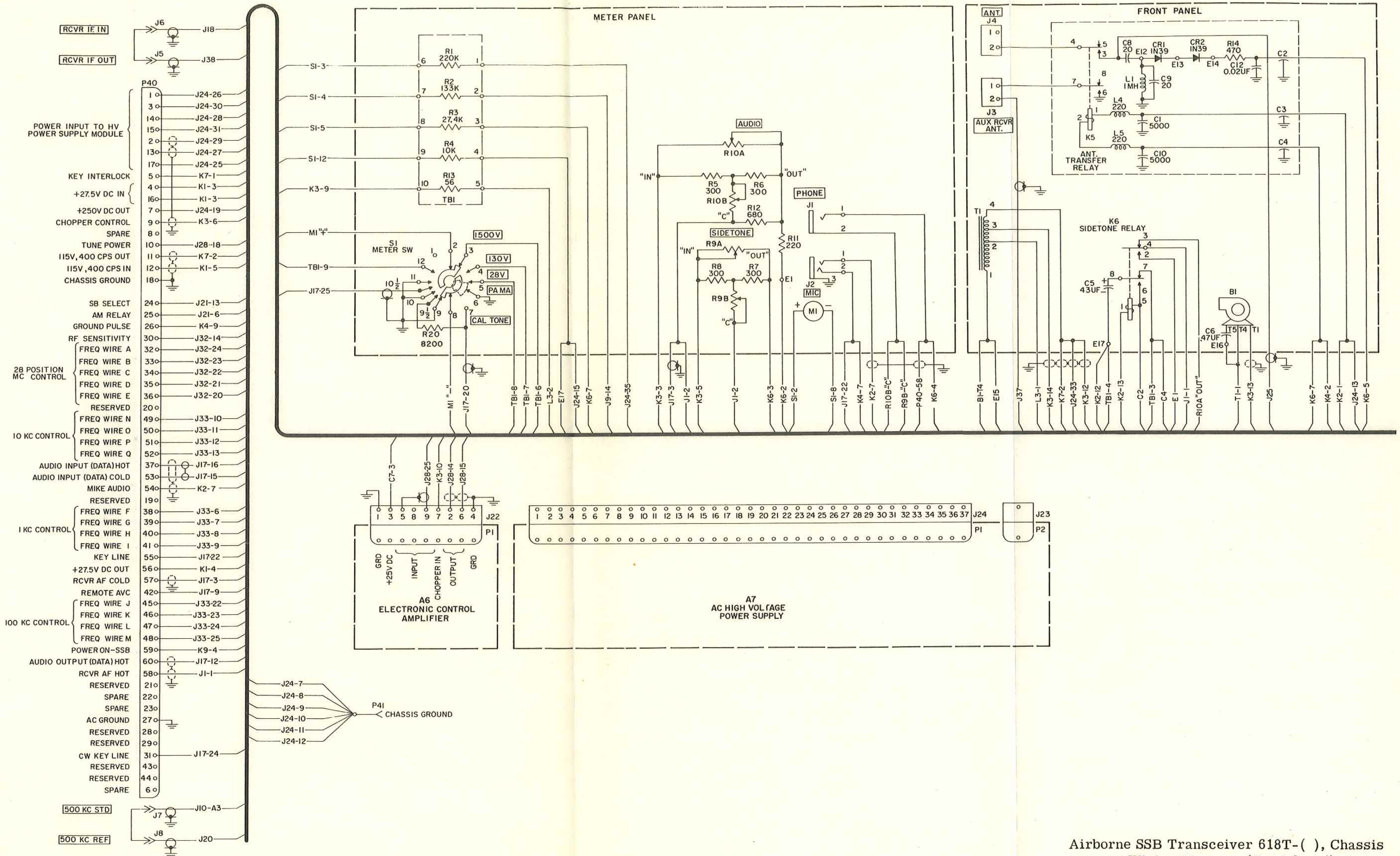
27.5-Volt D-C High-Voltage Power Supply Module, Schematic Diagram
Figure 50

REVISION REFERENCE

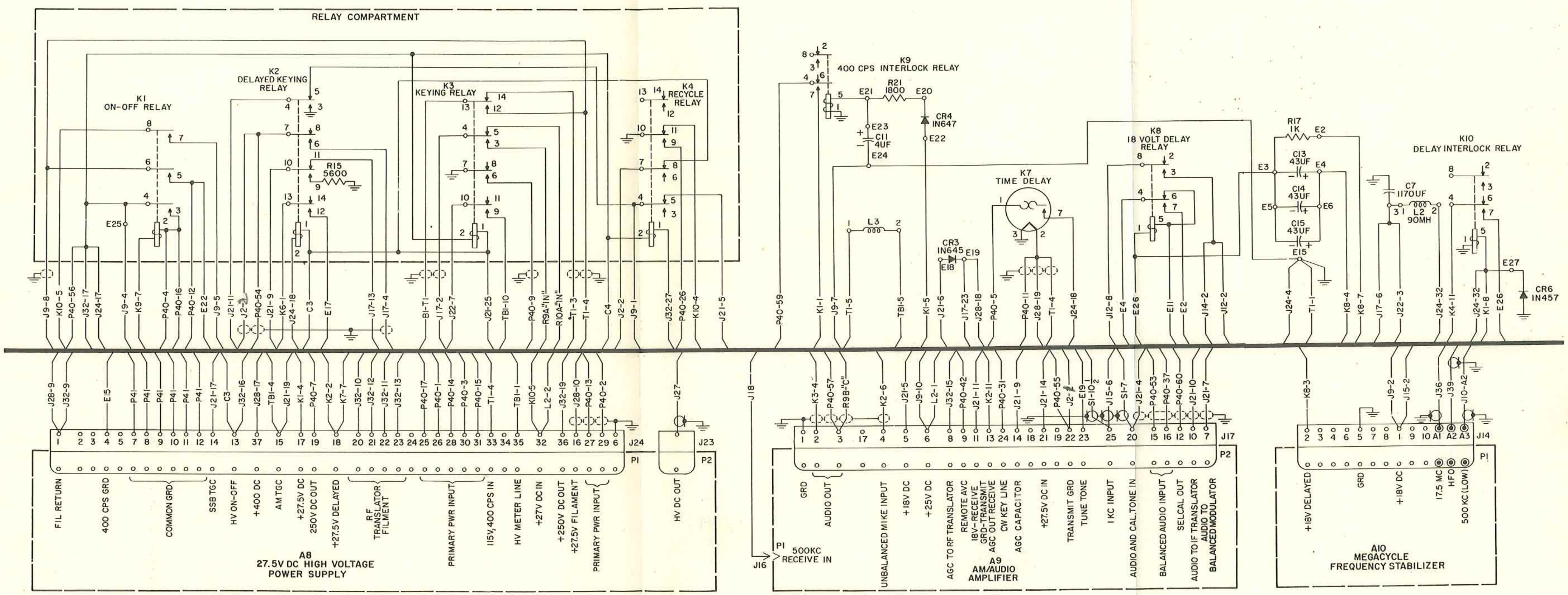
The following descriptions identify the changes to the schematic diagram.

DESCRIPTION OF REVISION	REASON FOR REVISION	MCN EFFECTIVITY
RCVR IF. IN was REC IF IN	Changed silk screening.	All models
RCVR IF. OUT was REC IF OUT	Changed silk screening.	All models
Changed P40-45 through P40-48 to 100 KC CONTROL was 1 KC CONTROL	To correct drafting error.	All models
R20 (8200) was R20 (1K)	To change level of CAL TONE.	1750
AUDIO and SIDETONE silk screening interchanged	To correct drafting error.	All models
AUX RCVR ANT. was AUX ANT. REC	Changed silk screening.	All models
Removed jumper between contacts 1 and 8 of K5	To improve performance.	1502
Changed connection of wire from contact 5 of K4 to contact 4 of K4	To improve performance.	1502
Changed 1KC OUT in frequency divider to CAL TONE OUT	To clarify labeling.	All models
Added shield on wire between J21-18 and J28-21.	To improve performance.	1830
Added and changed CR5 and CR6	To protect relays.	1501

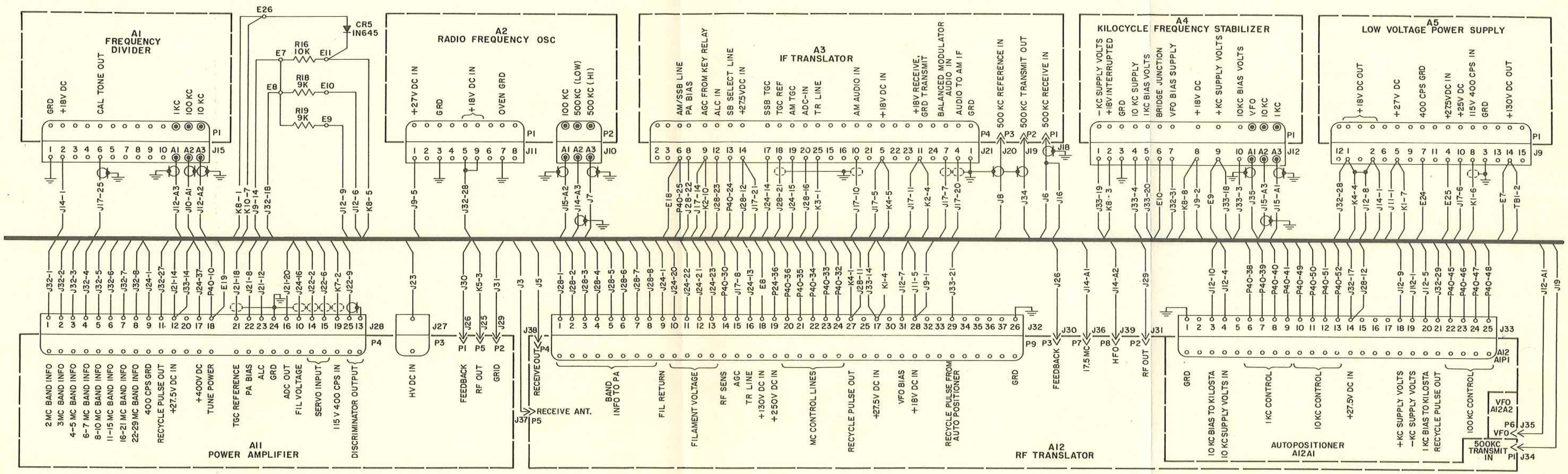
Airborne SSB Transceiver 618T-( ), Chassis
Wiring Diagram (Sheet 1 of 4)
Figure 51



Airborne SSB Transceiver 618T-( ), Chassis Wiring Diagram (Sheet 2 of 4)
Figure 51



Airborne SSB Transceiver 618T-( ), Chassis Wiring Diagram (Sheet 3 of 4)
Figure 51



Airborne SSB Transceiver 618T-( ), Chassis Wiring Diagram (Sheet 4 of 4)
Figure 51

AIRBORNE SSB TRANSCEIVER 618T-( ) - TROUBLE SHOOTING

1. GENERAL.

The following procedures are to be used by line maintenance personnel to locate system difficulty while the unit is installed in the aircraft. The complete 618T-( ) installation includes Airborne SSB Transceiver 618T-( ), its shockmount, control unit, antennas, antenna tuner, power supplies, and interconnecting cables. Trouble-shooting procedures should be such that the difficulty is isolated to one of these components. Once the defective component is identified, replace it with one known to be in good operating condition.

2. PROCEDURES.

A. Shockmount Check.

(1) Visually check the shockmount in a normal, loaded position. Check for noticeable saggng in any of the resilient mounts.

(2) Depress one end of the shockmount from a normal, loaded position until the resilient mounts are at a bottom position. The resilient mounts should permit a minimum travel of one-sixteenth inch. Check the other end of the shockmount in the same manner.

(3) Lift up one end of the shockmount until the resilient mounts are at an upward position. The resilient mounts should permit a minimum travel of one-sixteenth inch. Check the other end of the shockmount in the same manner.

(4) If the shockmount fails these tests, replace it with one known to be in good condition.

B. Interconnecting Wiring.

The 618T-( ) Installation Manual, Collins part number 520-5970-00, chapter 23-10-0, contains diagrams of the installations possible with the 618T-( ) and its associated equipment. Make interconnecting wiring tests with reference to the installation diagram applicable to the specific installation.

C. System Trouble Shooting.

Perform the tests described in the testing section of this manual.

AIRBORNE SSB TRANSCEIVER 618T-( ) - SERVICING

1. GENERAL.

Airborne SSB Transceiver 618T-( ) requires no servicing, other than periodic tests, to establish that it is operating properly. Testing procedures are given in the testing section of this manual.

AIRBORNE SSB TRANSCEIVER 618T-( ) - REMOVAL/INSTALLATION

1. GENERAL.

This section describes procedures to be used in removing and reinstalling Airborne SSB Transceiver 618T-( ) and its associated equipment.

2. REMOVAL OF AIRBORNE SSB TRANSCEIVER 618T-( ).

A. Disconnect the cables from the front of the 618T-( ). Identify and tag the disconnected cables.

B. Loosen and disengage the hold-down clamps on the shockmount.

C. Carefully disengage the rear connector from the shockmount plug by pulling the two handles on the front of the 618T-( ).

3. INSTALLATION OF AIRBORNE SSB TRANSCEIVER 618T-( ).

A. Place the 618T-( ) on the shockmount, and push toward the rear. Make sure that the plug on the 618T-( ) is properly inserted in the shockmount receptacle.

B. Engage and tighten the hold-down clamps on the shockmount.

C. Safety wire the shockmount clamps.

4. REMOVAL OF SHOCKMOUNT.

A. Disconnect the ground straps.

B. Remove the sixteen no. 10-32 screws, lock washers, and nuts that fasten the shockmount to the radio shelf.

C. Remove the electrical connector from the rear of the shockmount.

5. INSTALLATION OF SHOCKMOUNT.

A. Reconnect the electrical connector to the rear of the shockmount.

B. Fasten the shockmount to the radio shelf with sixteen no. 10-32 screws, lock washers, and nuts.

C. Connect the ground straps under each shockmount foot. Make sure that a good ground contact is made.

6. ANTENNA AND CONTROL UNIT.

Instructions for removing and reinstalling the antenna and control unit will vary according to the types of units used. Outline and mounting dimensions for the control unit and antennas are furnished in the Installation Manual, Collins part number 520-5970-00, chapter 23-10-0.

If an auxiliary antenna is connected to the AUX. REC. ANT. jack on the front of the radio, the jumper connecting the auxiliary antenna with the main antenna should be removed. This jumper is located in the relay compartment under the front panel. Refer to the chassis wiring diagram, figure 49, for the location of this jumper.

AIRBORNE SSB TRANSCEIVER 618T-( ) - ADJUSTMENT/TEST

1. GENERAL.

This section describes adjustments and tests which may be made on Airborne SSB Transceiver 618T-( ) while the equipment is installed in the aircraft.

2. ADJUSTMENTS.

No adjustments should be attempted while the unit is installed in the aircraft. Adjustments which may be made when the equipment has been removed from the aircraft are described in the 618T-( ) Overhaul Manual, Collins part number 520-5970-003.

3. TESTS.

A. Test Equipment Required.

No special test equipment is required to perform tests on the 618T-( ) while it is installed in the aircraft.

B. Test Procedure.

(1) Set the mode selector switch on Control Unit 714E-( ) to AM. Allow 5 minutes for the 618T-( ) to warm up. Check to make sure that the rear connector plug, antennas, and antenna tuner are connected to the 618T-( ).

(2) Tune the 618T-( ) to several WWV frequencies. These frequencies are:

2.500 mc	15.000 mc
5.000 mc	20.000 mc
10.000 mc	25.000 mc

Perform an approximate frequency check on the 618T-( ) by listening to WWV with the mode selector switch in the USB, LSB, and AM positions during an announcement interval. The voice quality should be good in all three modes.

(3) Set the meter selector switch on the front panel to 130 V. The meter should indicate in the red area.

(4) Set the meter selector switch to 28 V. The meter should indicate in the red area.

(5) Tune the 618T-( ) to a frequency on which the transmitter may be keyed.

(6) Set the meter selector switch to 1500 V. When the transmitter is not keyed, the meter indication should be zero. Key the transmitter. The meter should indicate in the red area.

(7) Set the meter selector switch to PA MA. When the transmitter is not keyed, the meter indication should be zero. Disconnect the coax jumper from the 500 KC STD. jack on the right front panel of the 618T-( ). Key the transmitter. The meter should indicate approximately 300 ma. Unkey and replace the coax jumper. Again key the transmitter. The meter should indicate in the red area. Speak into the microphone. The meter indication should not vary.

(8) Set the mode selector switch on the control unit to LSB. When the front panel switch is set to PA MA and transmitter is not keyed, the meter indication should be approximately 260 ma. Key the transmitter. Speak into the microphone. The meter indication should follow the applied audio. The meter indication on audio peaks should be approximately 300 ma. Check that sidetone is present.

(9) Set the mode selector switch on the control unit to USB. Repeat the procedure given in step (8).

If the above tests indicate that the 618T-( ) is not operating properly, do not attempt to make repairs while the equipment is in the aircraft. Remove the 618T-( ) from its shockmount and refer to the 618T-( ) Overhaul Manual, Collins part number 520-5970-003, Chapter 23-10-0, for more detailed testing and trouble-shooting procedures.

AIRBORNE SSB TRANSCEIVER 618T-( ) - INSPECTION CHECK

1. GENERAL.

This section describes inspections and checks to be performed upon the 618T-( ) and its associated equipment while it is installed in the aircraft.

2. PROCEDURE.

A. Check the shockmount in a normal loaded position. Check for noticeable sagging in any of the resilient mounts.

B. Check the equipment for damage to the finish.

C. Check all cabling to the equipment for signs of wear, broken wires, or bad connections. Check that all cable connectors are secure. Check that all ground straps are secure.

D. Check that the equipment is securely fastened to the shockmount and that the tightening nuts on the shockmount are safety wired.

E. Check the blower air filter. The filter may be removed by removing the two Dzus fasteners holding the front panel cover to the chassis. Pull the filter straight up to remove it from its holder. If the filter needs cleaning, refer to Overhaul Manual, Collins part number 520-5970-003, Chapter 23-10-0.

AIRBORNE SSB TRANSCEIVER 618T-( ) - CLEANING/PAINTING

1. GENERAL.

No cleaning or painting is required or recommended while the equipment is installed in the aircraft. Approved cleaning and painting procedures should be performed when the equipment is removed from the aircraft as described in the 618T-( ) Overhaul Manual, Collins part number 520-5970-003, Chapter 23-10-0.

AIRBORNE SSB TRANSCEIVER 618T-( ) - APPROVED REPAIRS

1. GENERAL.

Do not attempt repairs which require the removal of the dust cover of the 618T-( ) while the equipment is installed in the aircraft. Complete overhaul instructions are furnished in the 618T-( ) Overhaul Manual, Collins part number 520-5970-003, chapter 23-10-0.

WARNING: ANY ATTEMPTED REPAIRS OF THE 618T-( ) WITHOUT THE REQUIRED TEST FACILITIES SPECIFIED IN THE OVERHAUL MANUAL MAY RESULT IN MIS-ALIGNMENT OF THE EQUIPMENT, AND CAUSE LOSS OF ACCURACY AND REDUCED RELIABILITY.