TECHNICAL MANUAL
for

MULTI-MODE EXCITER

MODEL MMX(M)-3

THE TECHNICAL MATERIEL CORPORATION

MAMARONECK, N.Y. OTTAWA, ONTARIO

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THE TECHNICAL MATERIEL CORPORATION
COMMUNICATIONS ENGINEERS
700 FENIMORE ROAD MAMARONECK, N. Y.

Warranty

The Technical Materiel Corporation, hereinafter referred to as TMC, warrants the equipment (except electron tubes,* fuses, lamps, batteries and articles made of glass or other fragile or other expendable materials) purchased hereunder to be free from defect in materials and workmanship under normal use and service, when used for the purposes for which the same is designed, for a period of one year from the date of delivery F.O.B. factory. TMC further warrants that the equipment will perform in a manner equal to or better than published technical specifications as amended by any additions or corrections thereto accompanying the formal equipment offer.

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2. That the defect is not the result of damage incurred in shipment from or to the factory.
3. That the equipment has not been altered in any way either as to design or use whether by replacement parts not supplied or approved by TMC, or otherwise.
4. That any equipment or accessories furnished but not manufactured by TMC, or not of TMC design shall be subject only to such adjustments as TMC may obtain from the supplier thereof.

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Should it be necessary to return equipment or material for repair or replacement, whether within warranty or otherwise, a return authorization must be obtained from TMC prior to shipment. The request for return authorization should include the following information:

1. Model Number of Equipment.
2. Serial Number of Equipment.
3. TMC Part Number.
4. Nature of defect or cause of failure.
5. The contract or purchase order under which equipment was delivered.

PROCEDURE FOR ORDERING REPLACEMENT PARTS

When ordering replacement parts, the following information must be included in the order as applicable:

1. Quantity Required.
2. TMC Part Number.
3. Equipment in which used by TMC or Military Model Number.
4. Brief Description of the Item.
5. The *Crystal Frequency* if the order includes crystals.

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All correspondence pertaining to Warranty Claims, return, repair, or replacement and all material or equipment returned for repair or replacement, within Warranty or otherwise, should be addressed as follows:

THE TECHNICAL MATERIEL CORPORATION
Engineering Services Department
700 Fenimore Road
Mamaroneck, New York

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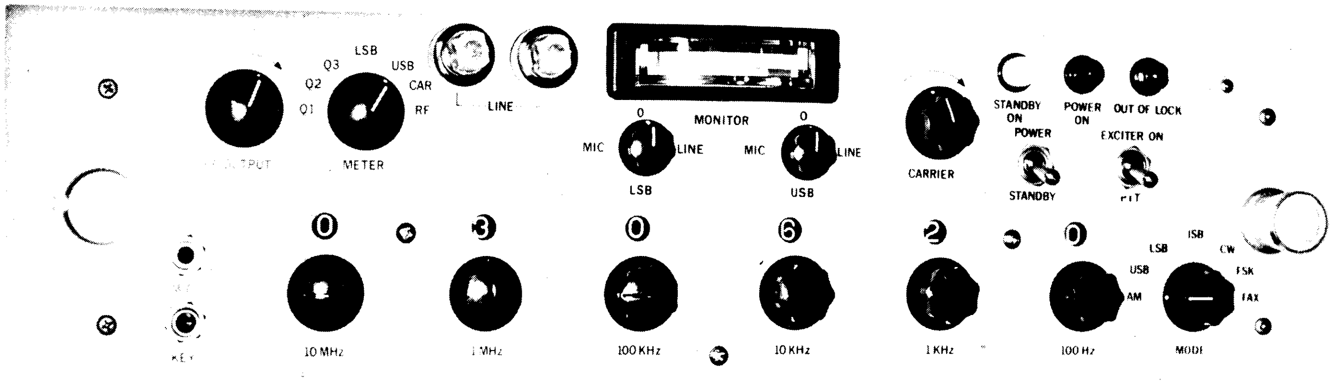

Figure 1-1. Multi-Mode Exciter MMX(M)-3

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SECTION 1

GENERAL INFORMATION

1-1. GENERAL.

This manual presents operating and maintenance instructions for Multi-Mode Exciter, Model MMX(M)-3, designed and manufactured by the Technical Materiel Corporation, Mamaroneck, New York. The manual includes a general description of the equipment, installation and operating procedures, principles of operation, maintenance data, a parts list, and the schematic diagrams.

1-2. PURPOSE AND USE.

Multi-Mode Exciter, Model MMX(M)-3 (figure 1-1), hereinafter referred to as the MMX(M)-3, or the Exciter, is a solid-state exciter used to control the r-f output frequency of a transmitter in a transmitting system. The MMX(M)-3 generates r-f output frequencies between 1.6 and 29.9999 mhz. Modulation capabilities are CW, AM, SSB (USB, LSB), ISB, FSK, and FAX. The bandwidth of the upper and lower sidebands is specified by the customer (refer to table 1-1). The carrier frequency is selectable in discrete 100-hz increments by means of six front-panel frequency selector switches. The Exciter also features built-in frequency stability of 1 part in 10^8/day, and provides a continuously adjustable 250 mw output in AM, SSB, AME, and optional ISB modes of operation. In addition, the Exciter provides an output of up to one watt for CW, FSK, and FAX operation.

1-3. GENERAL DESCRIPTION.

Front panel controls permit operator selection of the operating mode; AM, USB, LSB and (when provided) ISB, CW, FSK, or FAX. A variable CARRIER control on the front panel of the Exciter is used to establish the desired amount of carrier insertion. Additional front panel controls are provided to adjust the level of the USB or LSB mike/line input, the r-f output level, and for monitoring critical circuits. Two front panel jacks permit a -55 dbm low-impedance microphone and a dry-contact keyer to be coupled to the Exciter. A front panel multiammeter, used in conjunction with a METER select switch, enables the

TABLE 1-1. EXCITER SPECIFICATIONS

FREQUENCY RANGE	1.6 to 29.9999 mhz in 100-hz incremental steps.
FREQUENCY PRESENTATION	Direct reading, digital.
MODES OF OPERATION	CW, AM, SSB (including AME full carrier), FSK, FAX, and ISB (optional extra).
OUTPUT POWER	Continuously adjustable from 0 to 1 watt for CW, FAX, and FSK. Continuously adjustable from 0 to 250 mw PEP for SSB, ISB, AM, and AME.
OUTPUT IMPEDANCE	50 ohms nominal, unbalanced.
FREQUENCY STABILITY	1 part in 10^8 per day for ambient change of 15°C within the range of 0-50°C (using internal standard).
FREQUENCY CONTROL	All frequency determining elements referenced to a built-in 1-mhz source.
METERING	Built-in multimeter allows monitoring of critical circuits and r-f output.
TUNING	Digital frequency selection by front panel controls.
SIGNAL/DISTORTION RATIO	Distortion products are at least 40 db below either tone of a two-tone test at 250 mw PEP.
UNWANTED SIDEBAND REJECTION	A signal of 500 hz is at least 60 db down from PEP in the unwanted sideband.
SPURIOUS SIGNALS	Spurious signals greater than 120 hz removed from the carrier are at least 40 db below full PEP output.
HUM AND NOISE LEVEL	Noise level is at least 45 db down from either tone of a two-tone test.

TABLE 1-1. EXCITER SPECIFICATIONS (Continued)

CARRIER INSERTION	-55 db to full output, continuously variable.
AUDIO RESPONSE	1. Flat within ±1.5 db, 350-3500 hz, either upper or lower sideband. 2. A filter providing ±1.5 db, 250-3040 hz is available on special order. 3. A filter providing ±1.5 db, 250-6080 hz is available on special order.
HARMONIC SUPPRESSION	Secondary harmonics are attenuated 45 db below full PEP output, and all others at least 55 db below full PEP output, depending upon the linear amplifier utilized.
AUDIO INPUT LEVEL	For ISB, 2 independent 600-ohm channels balanced or unbalanced, -20 dbm to +5 dbm.
AUDIO CONTROL	Two front panel "fader" controls allow ease in selecting microphone or line input into either the upper or the lower sideband.
ALDC EXTERNAL..................	Will accept 0 to approximately -11 vdc from an associated linear amplifier to improve linearity, limit distortion, and deliver a relatively constant output level during high modulation peaks or load changes.
ENVIRONMENTAL CONDITIONS	Designed to operate in any ambient temperature between 0° and +50°C, and in value of humidity up to 95%.
CW KEYING INFORMATION	Key jack on front panel and connection on rear panel for up to 300 wpm dry contact carrier keying in CW mode.
<u>FSK CAPABILITY</u>	
KEYING INPUT	60 ma, 20 ma, 50 volt, 100 volt or CONT either positive or negative with respect to ground.

<u>FSK CAPABILITY</u> (Continued)	
KEYING SPEED	Up to 75 baud (higher keying speeds available).
SHIFT	±53 hz, ±106 hz, ±212 hz, or ±425 hz.
FASCIMILE INPUT	+1 to +10 volts will provide a linear frequency shift of 2 khz.
INSTALLATION DATA	Size: 5-1/4" (13.5 cm) M x 19" (48.25 cm) W x 18" (45.57 cm) D. Weight: Approximately 35 lbs (16 kg).
PRIMARY POWER	115/230 vac ±10% 50/60 hz, single-phase, 120 watts.
LOOSE ITEMS	Mating coaxial fittings (BNC) and instruction manual.
COMPONENTS AND CONSTRUCTION	All equipment manufactured in accordance with JAN/MIL specifications wherever practicable.
<u>OPTIONS/ACCESSORIES</u>	
1. Bandwidth Capability	6-khz bandpass filters may be substituted for 3 khz at additional cost.
2. Harmonic Suppression Filter	Available for added rejection.

operator to select and monitor one of seven circuits; Q1, Q2, Q3, LSB, USB, CARR, and RF. Selection of Exciter or press to talk (PTT) operation is accomplished by a front panel selector switch.

Standard BNC connectors are provided on the rear panel of the Exciter to interface the standard 1-mhz external input frequency, 1 mhz monitor, automatic load and drive control (ALDC) circuit, r-f output and r-f monitor with the external equipment. The remaining interface connections with the external equipment are made at three rear panel mounted terminal boards. These connections are detailed in Section 2, Installation.

1-4. PHYSICAL DESCRIPTION.

The MMX(M)-3 is designed for mounting in a standard 19-inch rack. The majority of the electronic components which constitute the Exciter are mounted on printed circuit boards which plug into chassis-mounted edge-board connectors, thereby facilitating maintenance, alignment, and troubleshooting procedures. The chassis is made of a rigid, light weight, sheet alloy.

1-5. TECHNICAL SPECIFICATIONS.

Table 1-1 presents a listing of the pertinent electrical and mechanical specifications of the Exciter.

SECTION 2

INSTALLATION

2-1. GENERAL.

The Exciter is calibrated and tested at the factory prior to shipment. When the Exciter is received at the operating site, inspect the packing case and contents for possible damage that might have occurred during transit. Unpack the equipment carefully, and inspect all packaging material for parts that have been shipped as loose items. With respect to damage to the equipment, for which the carrier is liable, The Technical Materiel Corporation will assist in describing methods of repair and furnishing of replacement parts.

2-2. LOOSE ITEMS.

In addition to the Exciter unit, loose items are supplied in the quantity detailed in table 2-1.

TABLE 2-1. LOOSE ITEMS

Item	Quantity
Power Cable, CA10658	1
Mating Connector, UG-88/2	6
Assembly, PCB Test Card A4533	1
Technical Manual	1

2-3. POWER REQUIREMENTS.

CAUTION

When ON/STANDBY switch (9, figure 3-1) is set to STANDBY and the line cord is connected to appropriate power source, the power supply is energized.

The Exciter is designed for 115/230 vac, 50/60 hz, single-phase power operation. Unless specifically ordered otherwise, the unit is shipped wired for 115 vac operation. For 230 vac operation, wiring changes must be made, as shown in the overall schematic diagram. For 230 vac operation, replace the line protective fuses with fuses that have half the 115 vac fuse rating.

2-4. MECHANICAL INSTALLATION.

The Exciter is equipped with a standard 19-inch wide front panel. To install the unit in an equipment rack, fasten the front panel to the rack with the screws and washers provided.

When the Exciter is equipped with a tilt-lock slide mechanism, installation is as follows: (See figure 2-1.)

a. Pull out center sections of tracks, located in equipment rack, until they lock in extended position.

b. Position slide mechanisms of unit in tracks, and ease unit into rack until release fingers engage holes in tracks.

c. Press release fingers and slide unit completely into rack. Secure front panel of unit to rack with screws and washers.

d. Make necessary electrical connections, as described in paragraph 2-5.

2-5. ELECTRICAL INSTALLATION.

All electrical connections between the Exciter and associated equipment are made at the rear of the unit. Figure 2-2 illustrates all rear panel connections, and table 2-2 lists the panel designation and function of each connection.

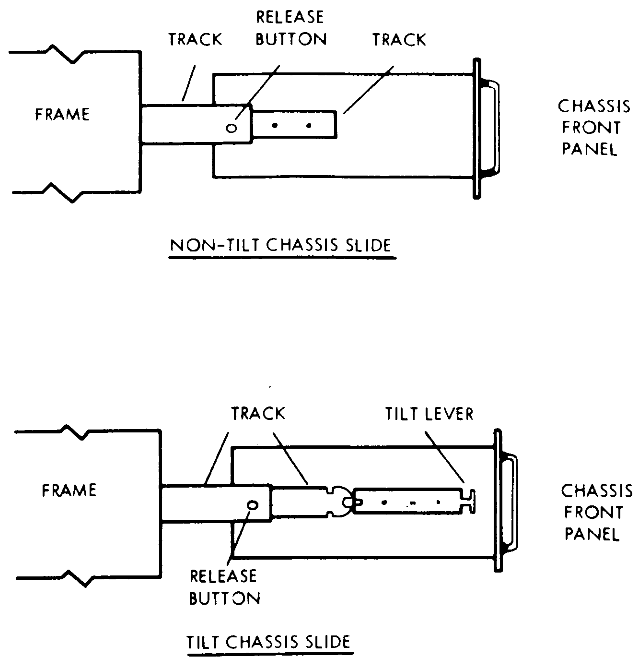

Figure 2-1. Tilt-Lock Slide Mechanism

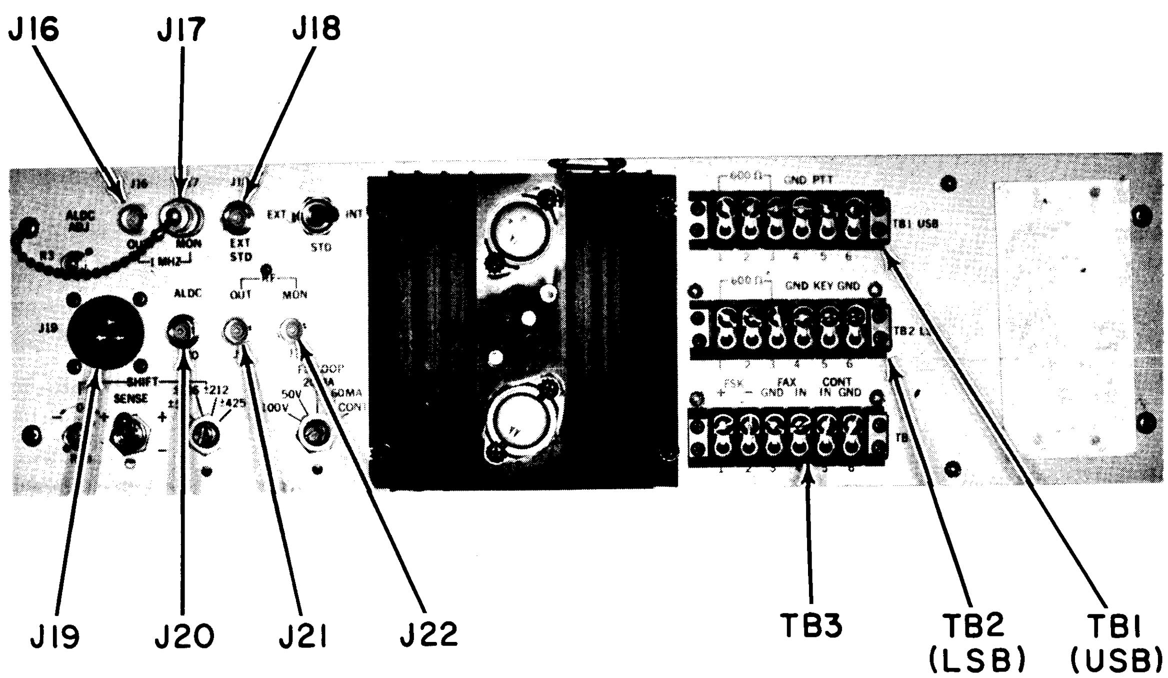

Figure 2-2. Rear Panel Connections

TABLE 2-2. REAR PANEL CONNECTIONS

Panel Designation	Function
J19 (power)	Power input for 115 vac or 230 vac line power.
J16 (1 MHz OUT)	1-mhz standard output jack.
J17 (1 MHZ MON)	1-mhz standard monitor jack.
J18 (EXT STD)	Input for external standard frequency.
J20 (ALDC)	Input from an associated linear amplifier to improve linearity, limit distortion, and deliver a relatively constant output level during high modulation peaks or load changes.
J21 (RF OUT)	R-f output jack.
J22 (RF MON)	R-f output monitor jack.
TB1 (USB)	
-1, -2, -3 (600 ohms)	USB 600-ohm balanced input
-4 (GRD)	Ground terminal
-5, -6	PTT relay contacts to external equipment
TB2 (LSB)	
-1, -2, -3 (600 ohms)	LSB 600-ohm balanced input
-4 (GRD)	Ground terminal
-5 (KEY)	Keyer input terminal for c-w keying
-6 (GRD)	Ground terminal for c-w keying
TB3	
-1, -2 (FSK)	FSK inputs for FSK transmission (TTY) battery loop
-3, -4	FAX input
-5, -6	Dry contact input for FSK mode of operation

2-6. INITIAL CHECKOUT PROCEDURE. (See figures 2-2 and 2-3.)

Although the Exciter has been aligned and thoroughly checked against the manufacturer's specifications prior to shimpment, it is necessary to ensure correct installation and proper Exciter operating conditions by performing the following checkout procedures. Refer to Section 3 for location and functions of all operating controls and indicators.

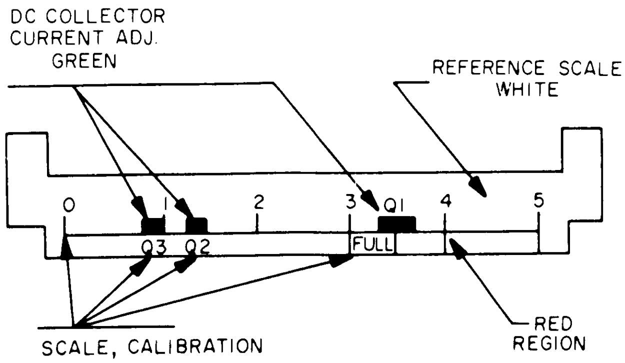

Figure 2-3. Front Panel Monitor Indicator

NOTE

Unless otherwise indicated, item numbers (numbers in parenthesis) and callouts refer to figure 3-1.

a. Set ON/STANDBY switch (9) to STANDBY.

b. Connect source of 115 vac line power to connector J19 (figure 2-2). STANDBY indicator (8) shall illuminate amber. Allow 15 minutes for warmup.

c. Position RF OUTPUT control (1) fully counterclockwise.

d. Using frequency selector switches (14), set output frequency to 29.9999 mhz.

e. Position CARRIER control (7) fully counterclockwise.

f. Set MODE switch (13) to ISB.

g. Set EXCITER switch (12) to ON.

h. Set LSB MIC/LINE control (4) and USB MIC/LINE control (6) to 0.

i. Set METER switch (2) to Q1.

j. Connect an audio generator Hewlett-Packard Model 200CD, or equivalent) to USB 600-ohm terminals (TB1) and LSB 600-ohm terminals (TB2), located on rear panel of Exciter. Set audio frequency for 1000 hz at a level of 70 mv RMS.

k. Set ON/STANDBY switch (9) to ON. STANDBY indicator (8) shall extinguish and POWER indicator (10) shall illuminate red.

l. Verify that MONITOR meter (5) is in the green region marked Q1. (See figure 2-3.)

m. Set METER switch (2) to Q2. MONITOR meter (5) shall indicate in the green region marked Q2. (See figure 2-3.)

n. Set METER switch (2) to Q3. MONITOR meter (5) shall indicate in the green region marked Q3. (See figure 2-3.)

o. Set METER switch (2) to RF. MONITOR meter (5) shall indicate zero.

p. Connect a 47-ohm 1/2-watt noninductive load resistor across RF OUT jack J21 on the rear panel. Connect a VTVM (Hewlett-Packard Model 410B, or equivalent) across the load resistor.

q. Adjust RF OUTPUT control (1) for a minimum indication of 3.5 volts on VTVM.

r. Set METER switch (2) to USB and adjust USB MIC/LINE control (6) for an indication of 2/5 full scale on MONITOR meter (5).

s. Set METER switch (2) to LSB and adjust LSB MIC/LINE control (4) for an indication of 2/5 full scale on MONITOR meter (5).

t. Set METER switch (2) to CAR. MONITOR meter (5) shall indicate zero.

u. Rotate CARRIER control (7) slowly clockwise. MONITOR meter (5) indication shall increase to FULL when CARRIER control (7) is fully clockwise.

v. Disconnect all test equipment and remove power from Exciter.

SECTION 3

OPERATOR'S SECTION

3-1. GENERAL.

The MMX(M)-3 provides rapid r-f frequency selection of AM, USB, LSB, or ISB intelligence in the 1.6 to 29.9999 mhz transmission range. Tuning over this frequency range is accomplished manually in incremental tuning steps of 100 hz using six front panel frequency-select switches. In addition, the Exciter contains provisions for operating in the CW, FSK, and FAX modes.

3-2. CONTROLS AND INDICATORS.

All operator controls and indicators are located on the front and rear panels of the Exciter. Figure 3-1 illustrates the front and rear panels, and table 3-1 presents a listing of the controls and indicators and explains the function of each.

3-3. OPERATING PROCEDURES.

Before initially placing the Exciter in operation, perform the initial checkout procedure outlined in Section 2, Installation. To place the Exciter in operation:

NOTE

Verify that ON/STANDBY switch (9, figure 3-1) is set to STANDBY.

a. Connect a source of 115 vac, single-phase power to connector J19 (figure 2-2). Observe that STANDBY indicator (8) illuminates amber.

b. Make the necessary interface connection on rear panel jack (figure 2-2).

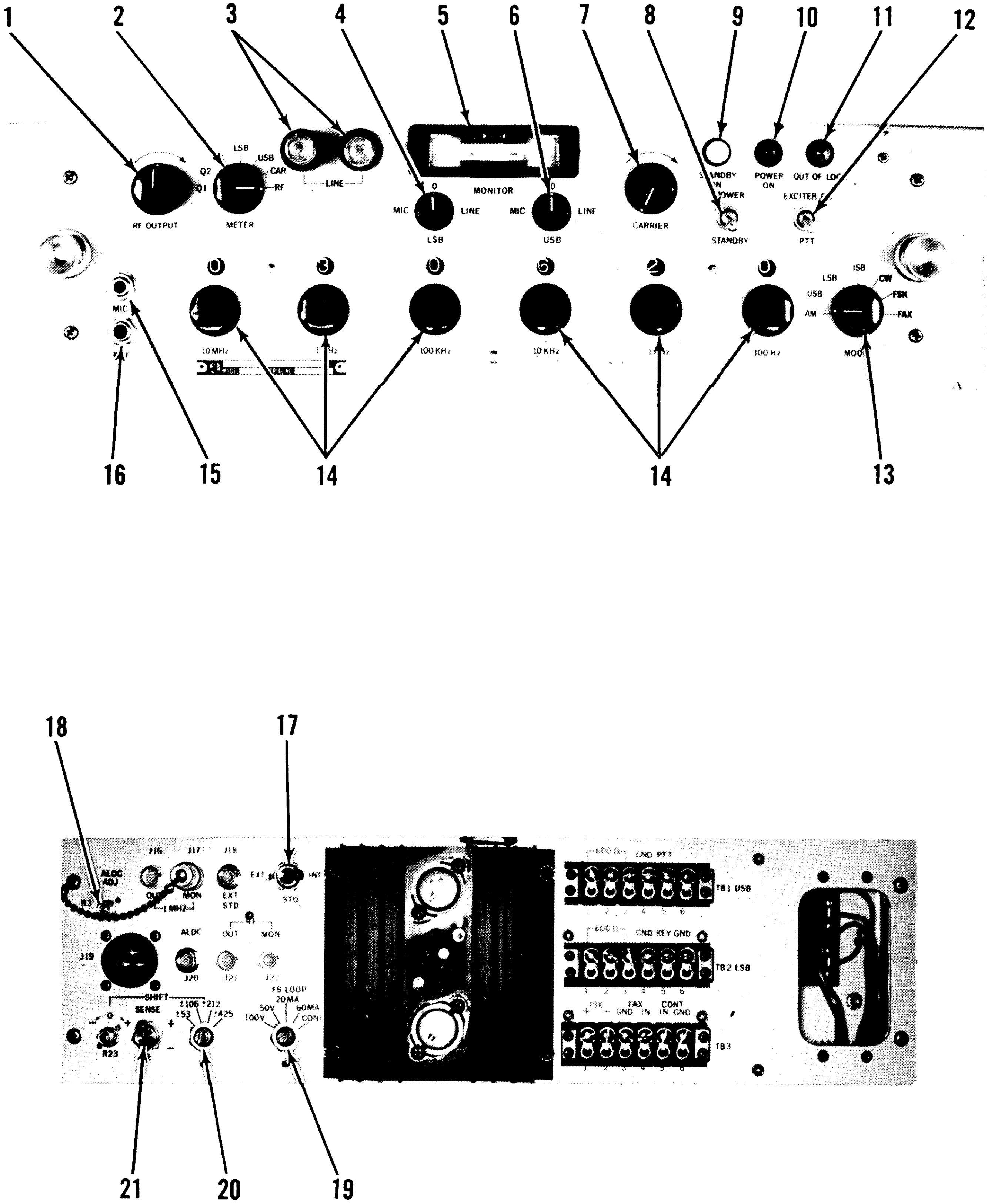

Figure 3-1. MMX(M)-3 Controls and Indicators

TABLE 3-1. CONTROLS AND INDICATORS

Item Number (figure 3-1)	Panel Designation	Function
1	RF OUTPUT control	Adjusts r-f output level.
2	METER switch (seven position)	Selects circuit in MMX(M)-3 to be monitored by MONITOR meter in the following modes:
	Q1	Displays r-f output transistor Q1 collector current (350 ma) on MONITOR meter.
	Q2	Displays r-f output transistor Q2 collector current (130 ma) on MONITOR meter.
	Q3	Displays r-f output transistor Q3 collector current (65 ma) on MONITOR meter.
	LSB	Displays LSB output level on MONITOR meter.
	USB	Displays USB output level on MONITOR meter.
	CAR	Displays carrier level on MONITOR meter.
	RF	Displays r-f output level on MONITOR meter.
3	LINE fuses (2)	One-ampere line voltage fuses.
4	LSB MIC/LINE control	Adjusts level of LSB input.
5	MONITOR meter	Monitors circuit function selected by METER switch.
6	USB MIC/LINE control	Adjusts level of USB input.
7	CARRIER control	Establishes the amount of carrier used.
8	STANDBY indicator	Lights amber when ON/STANDBY switch is set to STANDBY.

TABLE 3-1. CONTROLS AND INDICATORS (Continued)

Item Number (figure 3-1)	Panel Designation	Function
9	ON/STANDBY switch	In ON position, applies 12 and 24 vdc to modules and illuminates red POWER indicator. In STANDBY position, removes d-c voltages from modules and illuminates amber STAND-BY indicator.
10	POWER indicator	Lights red when ON/STANDBY switch is set to ON.
11	OUT OF LOCK indicator	Lights to indicate an out-of-lock condition.
12	EXCITER ON/PTT switch	Set to ON position for all operating modes using inputs other than MIC. Set to PTT position when using MIC input.
13	MODE switch (seven position)	Establishes one of seven operating modes, depending upon options supplied: AM, USB, LSB, ISB, CW, FSK, or FAX.
14	100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, and 10 MHz Frequency Select switches	Establishes desired operating frequency.
15	MIC jack	Accepts a 47,000-ohm impedance microphone input.
16	KEY jack	Accepts a dry contact keyer input used for CW mode of operation.

TABLE 3-1. CONTROLS AND INDICATORS (Continued)

Item Number (figure 3-1)	Panel Designation	Function
		NOTE The following controls are located on the rear panel.
17	STD switch	Used to select the internal 1-mhz oscillator frequency, or an external 1-mhz standard input frequency.
18	ALDC ADJ control	Adjusts sensitivity of ALDC circuitry.
19	FS LOOP input switch	Selects proper FSK loop input; 100V, 50V, 20MA, 60MA, or CONT.
20	SHIFT switch (four position)	Determines the "mark" and "space" frequency shift above or below the carrier frequency: ±53 Hz, ±106 Hz, ±212 Hz, or ±425 Hz.
21	SENSE switch	Establishes sense + (positive) or − (negative) in the FSK mode of operation.

NOTE

When operating the Exciter in the SSB and ISB, AM modes it is desirable to monitor the r-f output with a Spectrum Analyzer to establish the proper modulations with respect to the carrier. An RF MON jack J22 is provided on the rear panel for this purpose.

3-4. SINGLE SIDEBAND WITH ANY DEGREE OF CARRIER INSERTION (INCLUDING AME FULL CARRIER).

a. Set ON/STANDBY switch (9) to ON. The STANDBY indicator (8) will extinguish and the POWER indicator (10) will light.

b. Set EXCITER switch (12) to ON position when using the USB or LSB 600-ohm line (external signal source). Set EXCITER switch to PTT position when using MIC input (15).

c. Select desired sideband with MODE switch (13).

d. Set METER switch (2) at the desired sideband.

e. Adjust the MIC/LINE control of sideband used to appropriate level as indicated on MONITOR meter (5).

CAUTION

Do not enter red region. When MIC input is used, adjust level so as not to exceed red region with highest input from microphone.

f. Set METER switch (2) to CAR. Adjust CARRIER control (7) to the desired level as indicated on MONITOR meter (5).

g. Set METER switch (2) to RF. Adjust RF OUTPUT control (1) for desired level of r-f output as indicated on MONITOR meter (5).

NOTE

Turn RF OUTPUT control (1) fully counterclockwise before selecting different modes of operation.

3-5. INDEPENDENT SIDEBAND WITH ANY DEGREE OF CARRIER.

a. Set ON/STANDBY switch (9) to ON.

b. Set EXCITER switch (12) to ON position when using either the USB or LSB 600-ohm line (external signal source) inputs. Set EXCITER switch (12) to PTT position when using a MIC input (15).

c. Set USB MIC/LINE (6) and LSB MIC/LINE (4) controls to zero.

d. Select ISB position on MODE switch (13).

e. Set METER switch (2) to LSB. Adjust the LSB MIC/LINE control (4) for a MONITOR meter (5) indication of up to but not to exceed the red region.

f. Set METER switch (2) to USB. Adjust the USB MIC/LINE control (6) for a MONITOR meter (5) indication of up to but not to exceed the red region.

g. Set METER switch (2) to CAR. Adjust CARRIER control (7) to full, or the desired level, as indicated on MONITOR meter (5).

h. Set METER switch (2) to RF and adjust RF OUTPUT control (1) for the level of r-f output indicated on MONITOR meter (5).

3-6. CONVENTIONAL AM OPERATION.

a. Set ON/STANDBY switch (9) to ON.

b. Set EXCITER switch (12) to ON position when using either the USB or LSB 600-ohm line (external signal source) input. Set EXCITER switch (12) to PTT position when using MIC input (15).

c. Set MODE switch (13) to AM.

d. Connect a microphone to front panel MIC jack (15), if used.

e. Set METER switch (2) to the sideband being used.

f. Adjust the appropriate USB MIC/LINE or LSB MIC/LINE control to obtain an indication of not less than 2/5th full scale reading on the MONITOR meter (5).

g. Set METER switch (2) to RF. Adjust RF OUTPUT control (1) for desired level of r-f output as indicated on MONITOR meter (5).

3-7. FREQUENCY SHIFT TELEGRAPH OPERATION.

a. Set ON/STANDBY switch (9) to ON.

b. Set EXCITER switch (12) to ON.

c. Set MODE switch (13) to FSK.

d. Select appropriate FSK operation by setting FS LOOP (19) and SHIFT (20) switches.

e. Set SENSE switch (21) to desired sense (+) or (−).

f. Set METER switch (2) to RF. Adjust RF OUTPUT control (1) for desired MONITOR meter (5) reading.

3-8. FACSIMILE (FAX) OPERATION.

a. Set ON/STANDBY switch (9) to ON.

b. Set EXCITER switch (12) to ON.

c. Set MODE switch (13) to FAX.

d. Set METER switch (2) to RF. Adjust RF OUTPUT control (1) for desired MONITOR meter (5) reading.

3-9. CW TELEGRAPH OPERATION.

a. Set ON/STANDBY switch (9) to ON.

b. Set MODE switch (13) to CW.

c. Connect key to KEY input (16).

SECTION 4

PRINCIPLES OF OPERATION

4-1. GENERAL.

This section contains the principles of operation of the MMX(M)-3 Exciter which is presented in three parts. The first part is a block diagram description which groups the individual circuit boards and components into major functions. The second part provides a detailed block diagram description of the equipment to specify which assembly boards are responsible for generating each of the Exciter functions and defines the signal flow between board assemblies. The third part describes the operation of each functional group of circuits on the assembly boards to better understand circuit operation and to identify the associated circuit controls and adjustments for operation and maintenance.

4-2. BLOCK DIAGRAM DESCRIPTION. (See figure 4-1.)

The Exciter consists of three basic groups of circuits; input circuits, frequency generating circuits, and translation and output circuits. The input circuits receive the audio, FAX, FSK, and key signal inputs and a 1-mhz standard signal from the frequency generating circuits. The resultant output of the input circuits is a 3-mhz modulated signal developed by an internal voltage-controlled crystal oscillator (VXCO), with the modulation of the signal a function of the required frequency shift.

The frequency generating circuits receive a 1-mhz standard signal, either from an internal standard or an external standard, in addition to the signals from the front panel frequency select switches, and develop four resultant signals that are applied to the translation and output circuits. The 40-mhz signal is developed regardless of the setting of the front panel frequency select switches, and is applied to the translation and output circuits in all modes. The other two frequency signals are in the range of 10 to 11 and 104 to 132 mhz, and are a function of the setting of the front panel frequency select switches. The fourth signal is an out-of-lock signal in the event of an out-of-lock condition in any of the two (major or minor) synthesizers.

The translation and output circuits develop a 120-mhz frequency from the 40-mhz basic signal, mix the selected carrier frequency of the four least significant digits with the 3-mhz modulator frequencies, and mix the modulated sum frequency with the selected generator frequency representing the two most significant digits of the selected carrier frequency. When the upper frequency range (20-29.9999 mhz) is selected, a ground enable is applied to a filter in series with the r-f signal from the RF OUTPUT control. Therefore, the r-f signal is prefiltered prior to being applied to r-f output section.

4-3. DETAILED BLOCK DIAGRAM DESCRIPTION. (See figure 4-2.)

4-4. INPUT CIRCUITS.

4-5. The input circuits consist of sideband generator A11, carrier generator A10, and frequency shift generator A9. The sideband generator contains a microphone audio preamplifier and an audio impedance-matching transformer for translation of an external 600-ohm balanced or unbalanced audio line to a 500-ohm audio for application to the upper sideband (USB), lower sideband (LSB), and AM modulator circuits. Two balanced modulators produce the upper and/or lower sideband intelligence from the 250-khz signal subcarrier and the incoming USB and LSB audio signals; the 250-khz subcarrier is suppressed. The resulting USB and LSB signals are applied to frequency shift generator A9.

4-6. The carrier generator receives a 1-mhz standard input signal and divides this frequency by four to obtain a 250-khz basic subcarrier signal; this subcarrier is amplitude-modulated in AM mode of operation, is shifted in frequency by teletype mark and space modulation in FSK mode of operation, is applied to balanced modulators in the sideband generator to derive upper and lower single-sideband signals, and is applied to the frequency shift generator for CW mode of operation and for carrier reinsertion when desired. The 250-khz is also multiplied by 11 on the carrier generator board to produce the 2.75 mhz carrier which is applied to a mixer circuit on the frequency shift generator board. The 2.75-mhz carrier is combined with the modulated 250-khz signal to produce an AM, a single-sideband (SSB), or independent sideband (ISB) output with a 3-mhz center frequency.

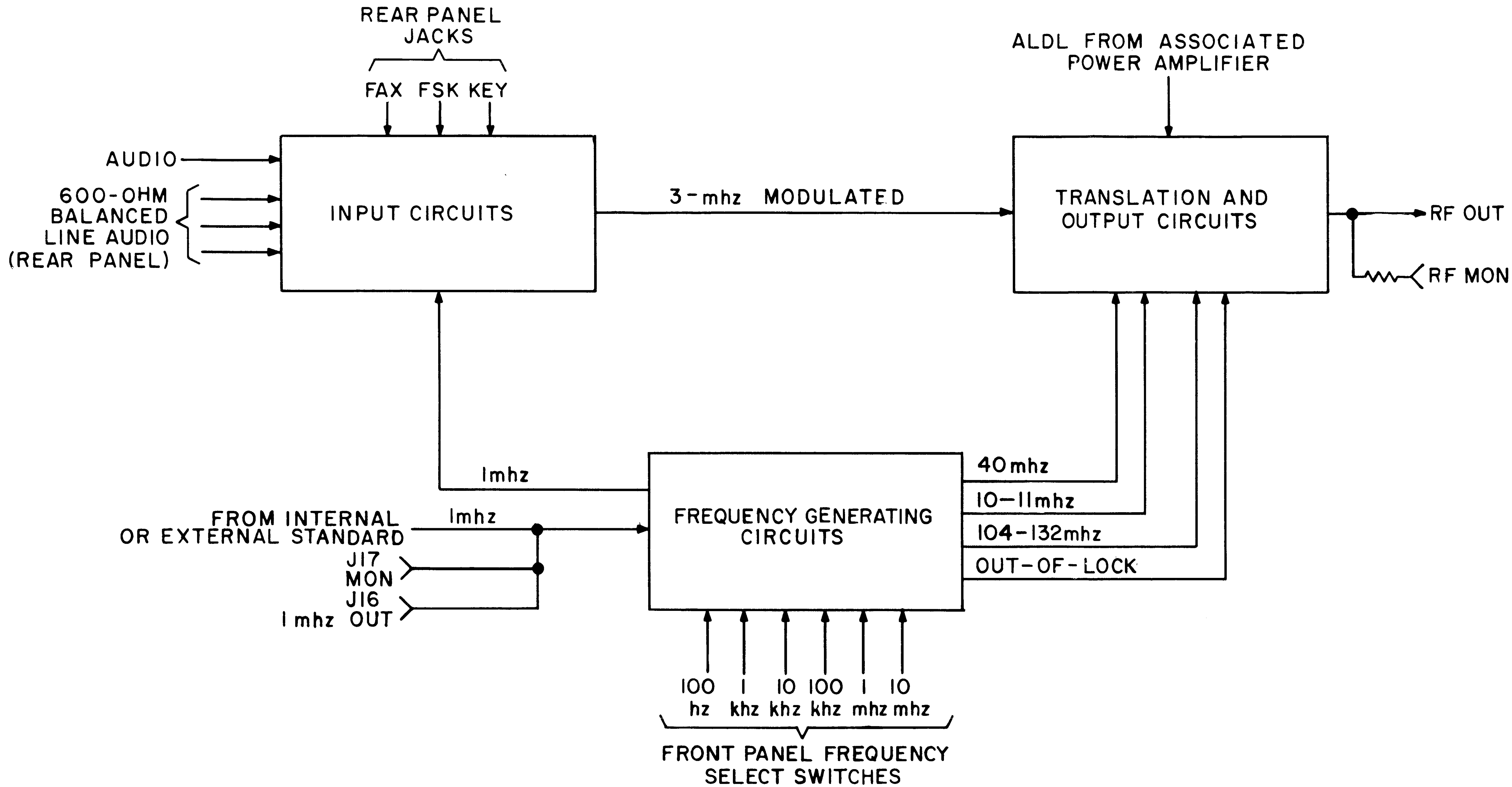

Figure 4-1. MMX(M)-3 Exciter, Block Diagram

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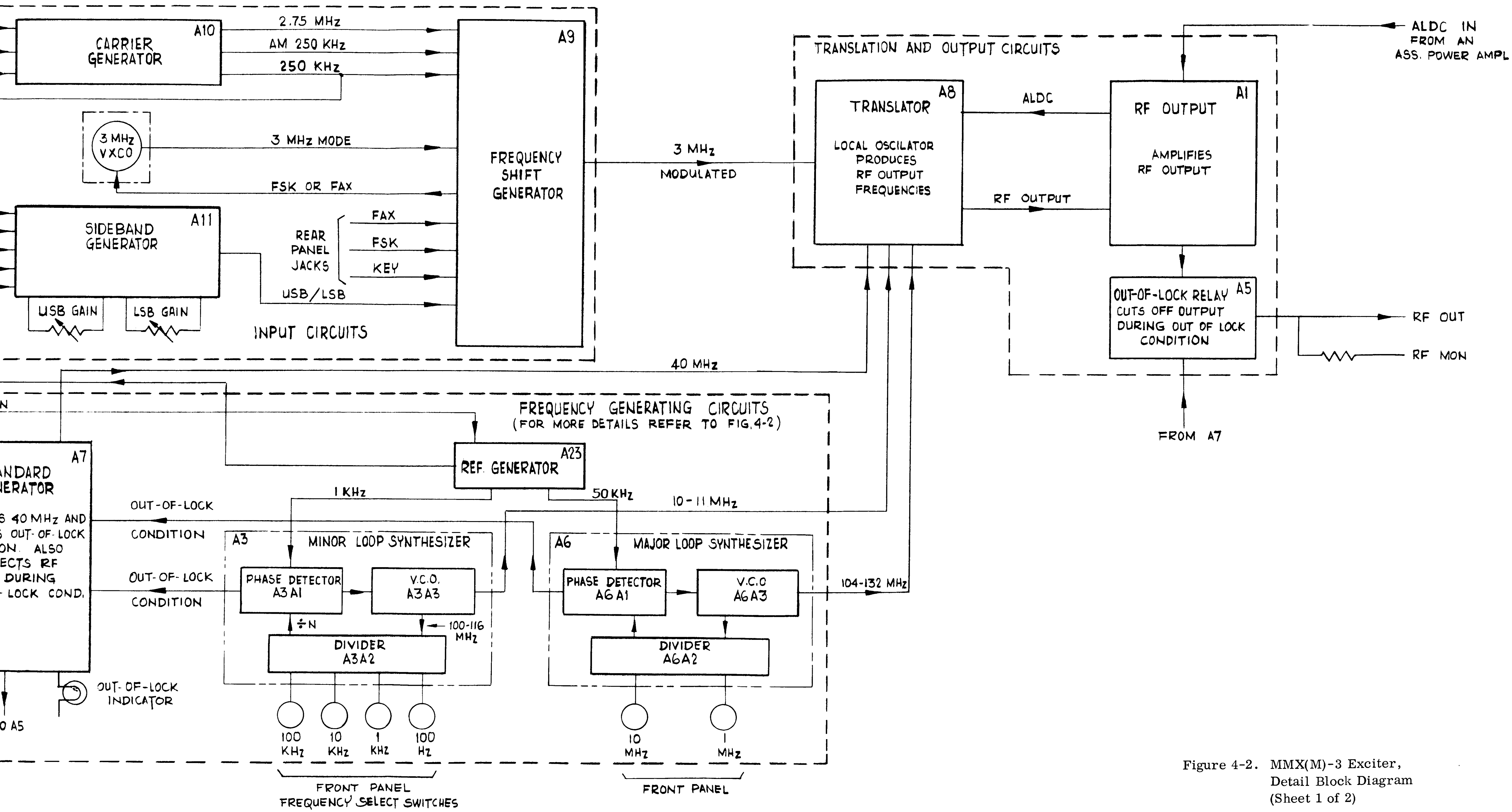
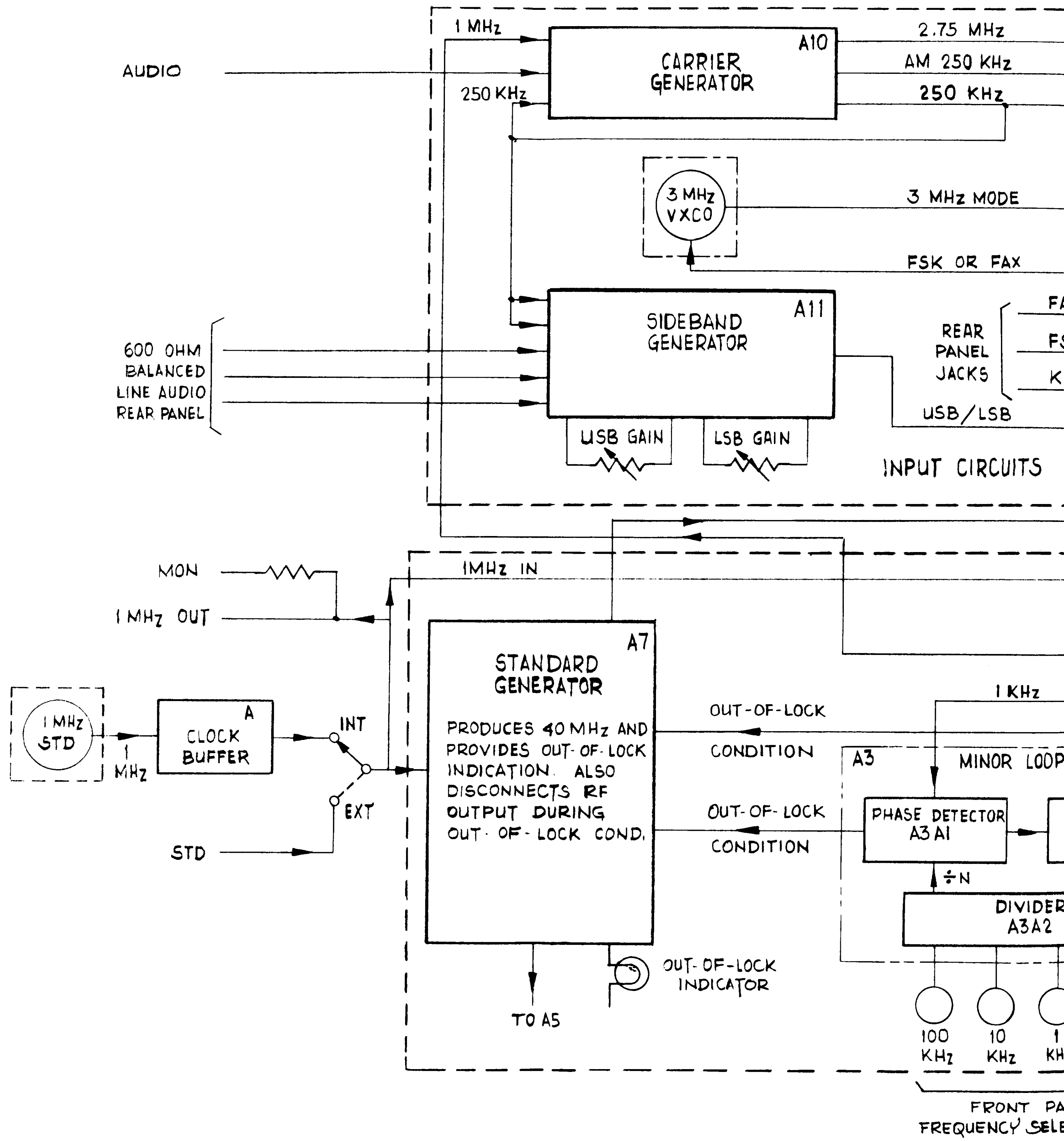


Figure 4-2. MMX(M)-3 Exciter, Detail Block Diagram (Sheet 1 of 2)



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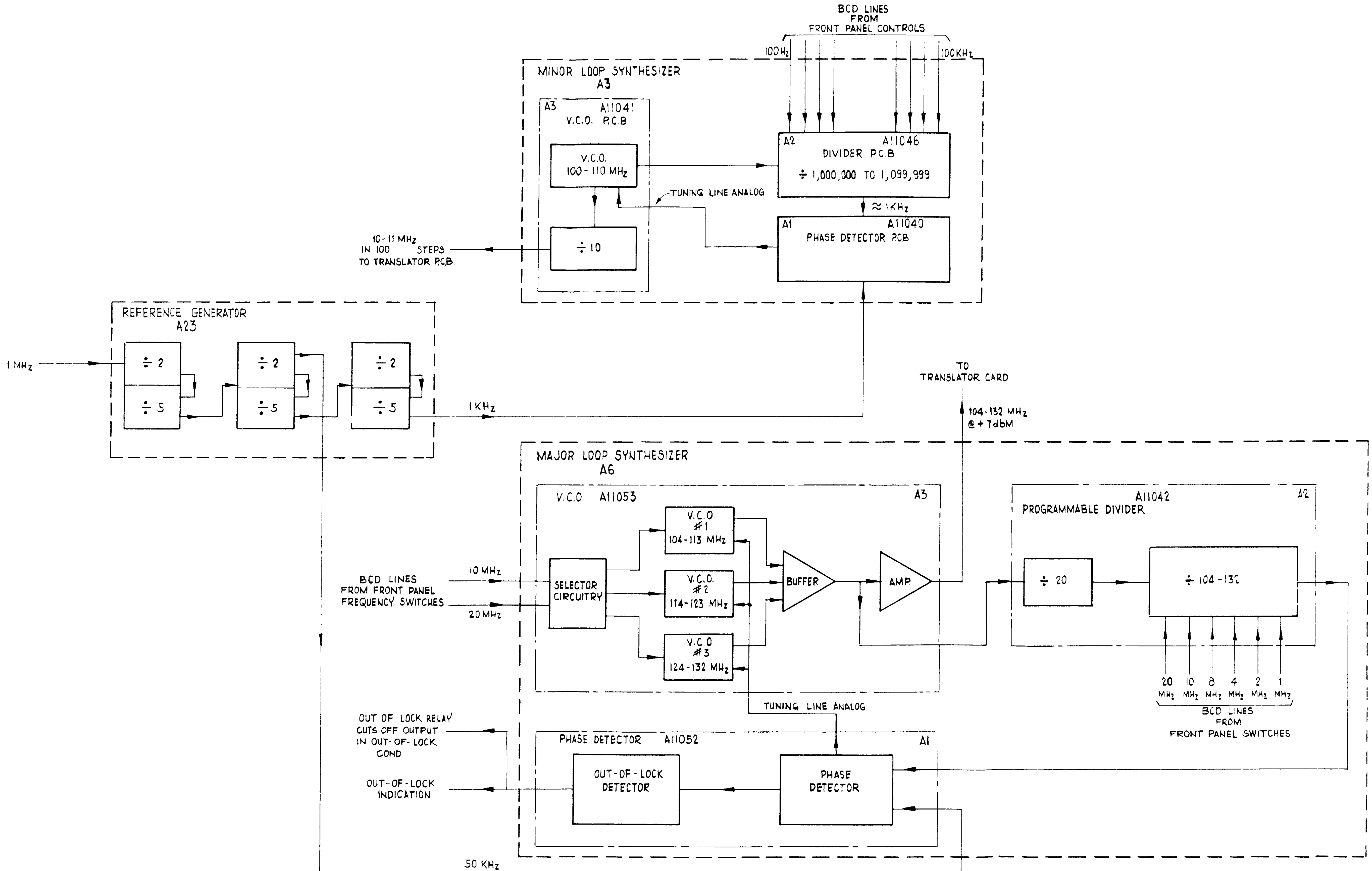

Figure 4-2. MMX(M)-3 Exciter, Detail Block Diagram (Sheet 2 of 2)

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4-7. The frequency shift generator board contains two sections; a frequency shift generator section and a converter section. The frequency shift generator section provides either frequency shift keyer (FSK) or facsimile (FAX) modes of operation. The FSK mode applies the 250-khz subcarrier to the keyer modulator which also receives an external teletype input via the rear panel FS LOOP switch. The 250-khz subcarrier is modulated by the teletype current producing a frequency shift above and below the 250-khz center frequency representing marks and spaces. This shift is rectified and translated to a d-c level which is then amplified and applied to the modulation input of the 3-mhz center frequency. The FAX mode connects an external FAX signal through a d-c regulator circuit which produces a variable d-c level at the input of the VXCO section, thereby producing the required frequency shift of the 3-mhz center frequency output signal. The converter section of the frequency shift generator board mixes the incoming 2.75-mhz carrier signal with the selected modulation signal (250 khz AM, USB, LSB, ISB, or CW) from the carrier and sideband generator boards. The modulated 3-mhz sum signal is amplified and applied as modulation to the translator board on the translation and output circuits.

4-8. FREQUENCY GENERATING CIRCUITS.

4-9. General.

4-10. The frequency generating circuits consist of four major assemblies; standard generator A7, reference generator A23, major loop synthesizer A6, and minor loop synthesizer A3. A standard frequency of 1 mhz, either from an external standard or from internal 1-mhz standard A21, is applied simultaneously to standard generator A7 and to reference generator A23. When internal standard A21 is used, its output is passed through clock buffer A4A1 which amplifies the signal before applying it to A7 and A23. The amplified 1-mhz signal is also made available at the rear panel jacks J16 (1 MHz OUT) and J17 (1 MHz MON).

4-11. Standard Generator A7.

4-12. Standard generator A7 consists of two subassemblies; A7A1 and A7A2. A7A1 is a 40-mhz generator which produces a 40-mhz signal from the 1-mhz standard frequency for translation purposes. The 1-mhz signal from the internal or external standard is amplified and applied across an 8-mhz series resonance circuit formed by an 8-mhz crystal. The 8-mhz frequency synthesized by the eighth harmonic in the 1-mhz standard frequency is collected in an 8-mhz collector tuned circuit. The 8-mhz signal is then multiplied by 5. The resultant 40-mhz signal is amplified and applied to translator board A8 in the translation and output circuits.

4-13. A7A2 is an out-of-lock detector circuit which continuously monitors the major and minor loop synthesizers. In the event of an out-of-lock condition in either one of the synthesizers, A7A2 develops an energizing current that cuts off the r-f output via out-of-lock relay board A5. Simultaneously, the front panel OUT OF LOCK indicator is lighted, alerting the operator to the occurrence of an out-of-lock condition.

4-14. Reference Generator A23.

4-15. Reference generator A23 receives the 1-mhz signal from the clock buffer A4A1 and divides the input signal to provide a stable 1-khz reference source for the minor loop synthesizer and to provide a stable 50-khz reference source for the major loop synthesizer. This is accomplished in three divide-by-10 counters. (See figure 4-2, sheet 2.) Each counter is divided into two parts; a divide-by-two stage and a divide-by-five stage. In the first counter, the output of first stage (divide-by-two) is applied to the input of divide-by-five stage. The resultant output (divide-by-10) is applied to the second counter. The output of the first stage of the second counter is the 50-khz reference frequency which is used in the major loop synthesizer. The 50-khz output is also applied to the second stage of the second counter. The output of the second stage, a stable 10-khz frequency, is further divided by 10 in the third counter. The output of the third counter, a stable 1-khz frequency, is used as a reference frequency in the minor loop synthesizer.

4-16. Minor Loop Synthesizer A3.

4-17. Minor loop synthesizer A3 contains three separate circuit boards; VCO (voltage controlled oscillator) A3A3, phase detector A3A1, and divider A3A2. The VCO tunes from 100 to 110 mhz depending on the d-c tuning line analog voltage from the phase detector. The 100 to 110 mhz output is divided by 10 to produce the 10-11 mhz output which is applied to to translator board A8 as a local oscillator signal. A portion of the 100-110 mhz is also applied to divider board A3A2.

4-18. A3A2 divides the 100-110 mhz input by a modulus ranging from 1,000,000 to 1,099,999. The modulus is selected by the BCD (binary coded decimal) lines from front panel selector switches 100 Hz through 100 KHz. The output of the divider is approximately 1 khz.

4-19. The phase detector compares the phase of the divider output with the 1-khz reference signal derived from the 1-mhz standard in reference generator A23. The resultant output of the phase detector is an analog voltage that is proportional to the phase difference between the two signals. This analog voltage tunes the VCO to a frequency such that the frequency divided by the modulus of the divider is 1 khz. Thus, the output frequency of the minor loop is the divider modulus times 100 hz.

4-20. Major Loop Synthesizer A6.

4-21. Major loop synthesizer A6 is functionally similar to the minor loop synthesizer, except that the VCO board contains three independent VCO's. Major loop synthesizer A6 contains three separate circuit boards; VCO A6A3, phase detector A6A1, and divider A6A2. VCO A6A3 contains three independent voltage controlled oscillators. One VCO is operative at a time as selected by the BCD voltage derived from front panel 1 MHz and 10 MHz frequency select switches. VCO selection is a function of the Exciter output frequency as follows:

Exciter Output Frequency (mhz)	VCO No.	VCO Frequency (mhz)
1-9	1	124-132
10-19	2	114-123
20-29	3	104-113

4-22. TRANSLATION AND OUTPUT CIRCUITS.

4-23. The translation and output circuits are divided into two parts; translator board A8 and an output section consisting of rf output board A1 and out-of-lock relay A5. Translator A8 produces an r-f output in the range of 1.600 to 29.9999 mhz. There are four inputs to the translator; 3 mhz modulated from frequency shift generator A9, 10-11 mhz in 100-hz steps from minor loop synthesizer A3, 40 mhz from standard generator A7, and 104-132 mhz in 1-mhz steps from major loop synthesizer A6. The 10-11 mhz input is mixed with the modulated 3-mhz input to develop 13.0000 to 13.9999 mhz. This frequency is then mixed with the 120 mhz derived from the 40-mhz input multiplied by a factor of three, producing a signal in the range of 133.0000-133.9999 mhz. The 104-132 mhz signal from the major loop synthesizer is then subtracted from 133.0000-133.9999 mhz, producing an output signal of 1.600-29.9999 mhz. This output signal is applied through the RF OUTPUT control and a pre-filtering network to rf amplifier A1.

4-24. The output section consists of rf amplifier A1 and out-of-lock relay A5. Rf amplifier A1 contains a three-stage amplifier which amplifies the output signal to the required level. A metering circuit monitors the collector currents of the three stages and monitors the r-f output level as selected by the front panel METER switch and displayed on the front panel MONITOR meter.

4-25. Out-of-lock relay A5 receives the out-of-lock signal from A7A2. In the event of an out-of-lock condition in either of the synthesizers, A7A2 develops an energizing current that activates the relay and cuts off the r-f output.

4-26. Rf output A1 can accept an ALDC (automatic level d-c voltage) from an associated power amplifier. The ALDC voltage is a function of r-f output strength, and allows control of the r-f output from an external linear power amplifier to improve linearity and limit distortion.

4-27. FUNCTIONAL ASSEMBLY CIRCUITS.

4-28. GENERAL.

The following paragraphs describe the operation of each functional group of circuits on the assembly boards. A block diagram of each assembly board is provided with each description, in addition to a reference to the applicable schematic diagram(s) in Section 7.

4-29. SIDEBAND GENERATOR A11. (See figures 4-3 and 7-33.)

4-30. Sideband generator A11 includes upper and lower sideband circuits which are similar in configuration and operation; the exception is the tuned frequency of the USB and LSB amplifier circuits. The sideband generator also contains a microphone audio preamplifier, and an audio impedance matching transformer for translation of externally applied 600-ohm USB/LSB line audio to a 500-ohm audio output. When a microphone input is used, the front panel EXCITER switch is set to the PTT (press-to-talk) position to furnish a PTT ground enable to the carrier generator via the mode switching network; in all other modes, the EXCITER switch is set to the ON position, which supplies a permanent ground to the same point, except in the case of CW. Microphone audio from 300 hz to 7.5 khz is applied to the sideband generator audio preamplifier circuit Q1 through Q5, and then to the mode switching network for redistribution to either or both, of the sideband generator modulator circuits. Similarly, 600-ohm line audio from 350 hz to 3.5 khz is translated to a 500-ohm line output and applied to the mode switching network. In the USB, LSB, and ISB modes, the audio is routed to the modulation input of the respective, or each, sideband generator; in the AM mode, the respective audio signal is applied to the AM amplifier in carrier generator A10. USB and LSB audio amplitude is controlled by a respective front panel MIC/LINE gain control.

4-31. The SSB modulation section of the sideband generator accepts both a 250 khz subcarrier input and the USB/LSB audio signal via the MODE switch. These two signals are applied to a balanced modulator to derive the upper and/or lower sideband intelligence; the 250 khz subcarrier is suppressed. The resulting USB and/or LSB signals are supplied to the mode switching network and are then routed to the converter section of frequency shift generator A9.

4-32. FREQUENCY SHIFT GENERATOR A9. (See figures 4-4 and 7-29.)

4-33. The frequency shift generator consists of two sections; the frequency shift generator section and the converter section. The frequency shift generator section operates in the FSK (frequency shift keyer) and FAX (facsimile) modes; it contains a 3 mhz amplifier, a keyer-modulator and d-c amplifier section, and the FAX circuit. FSK operation is controlled by the SHIFT and FS LOOP switches. The converter section operates in all other modes except FSK and FAX, and functions to produce an amplitude-modulated (AM) or single sideband (SSB) r-f carrier of 3 mhz for use in frequency translator A8.

4-34. Selecting the FSK mode applies the 250 khz subcarrier to the keyer modulator, which also receives an external teletype input via the FS LOOP switch. Therefore, the subcarrier is effectively modulated by a current input representing teletype marks and spaces; the FS LOOP switch network is set to the appropriate voltage rating and, when a dry-contact keyer is used, the switch is set to the CONT (contact) position. The keyer-modulator thus produces a shift in frequency above or below the 250-khz center frequency. This shift is rectified and translated to a d-c level, which is then amplified and applied to the 3-mhz variable crystal-controlled oscillator (VXCO) in the power supply assembly via the SHIFT switch network.

4-35. Selecting FSK or FAX operation supplies +12 vdc to both the frequency shift generator and to the VXCO in the power supply assembly. The VXCO will operate at the center frequency of 3 mhz. Upon application of the variable d-c level (E MOD) from the SHIFT switch, the frequency of the VXCO is shifted above and below center frequency, corresponding to respective marks and spaces, by an amount determined by SHIFT switch setting (±53, ±106, ±212, ±425). The frequency-shifted VXCO signal of 3 mhz is reapplied to the 3-mhz VXCO amplifier section of the frequency shift generator and then to the 3-mhz amplifier circuit of the converter section. Selecting FAX operation connects an externally applied FAX signal through a d-c regulator circuit. This produces a variable d-c level which is applied to the VXCO to produce the required frequency shift.

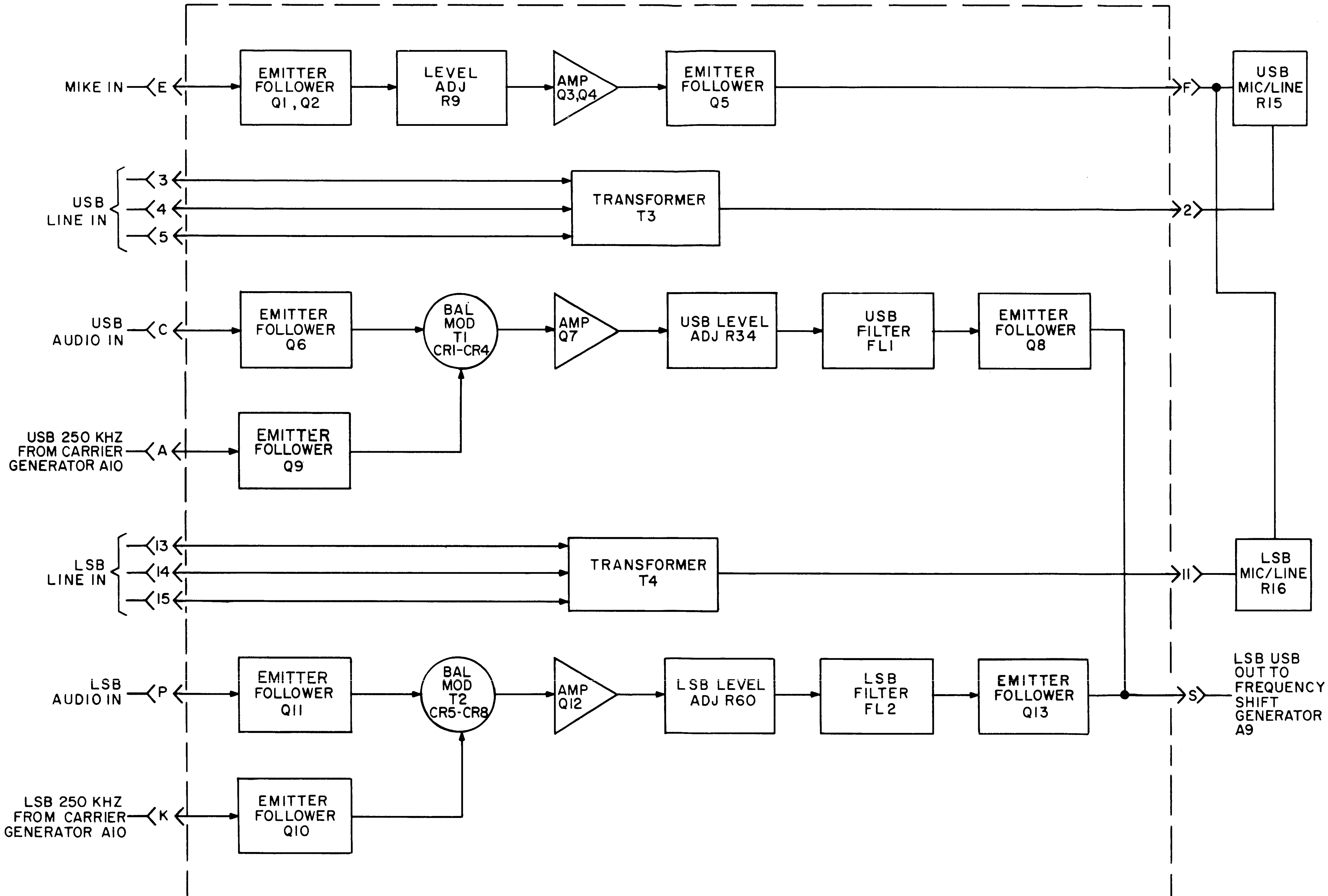

Figure 4-3. Sideband Generator A11, Block Diagram

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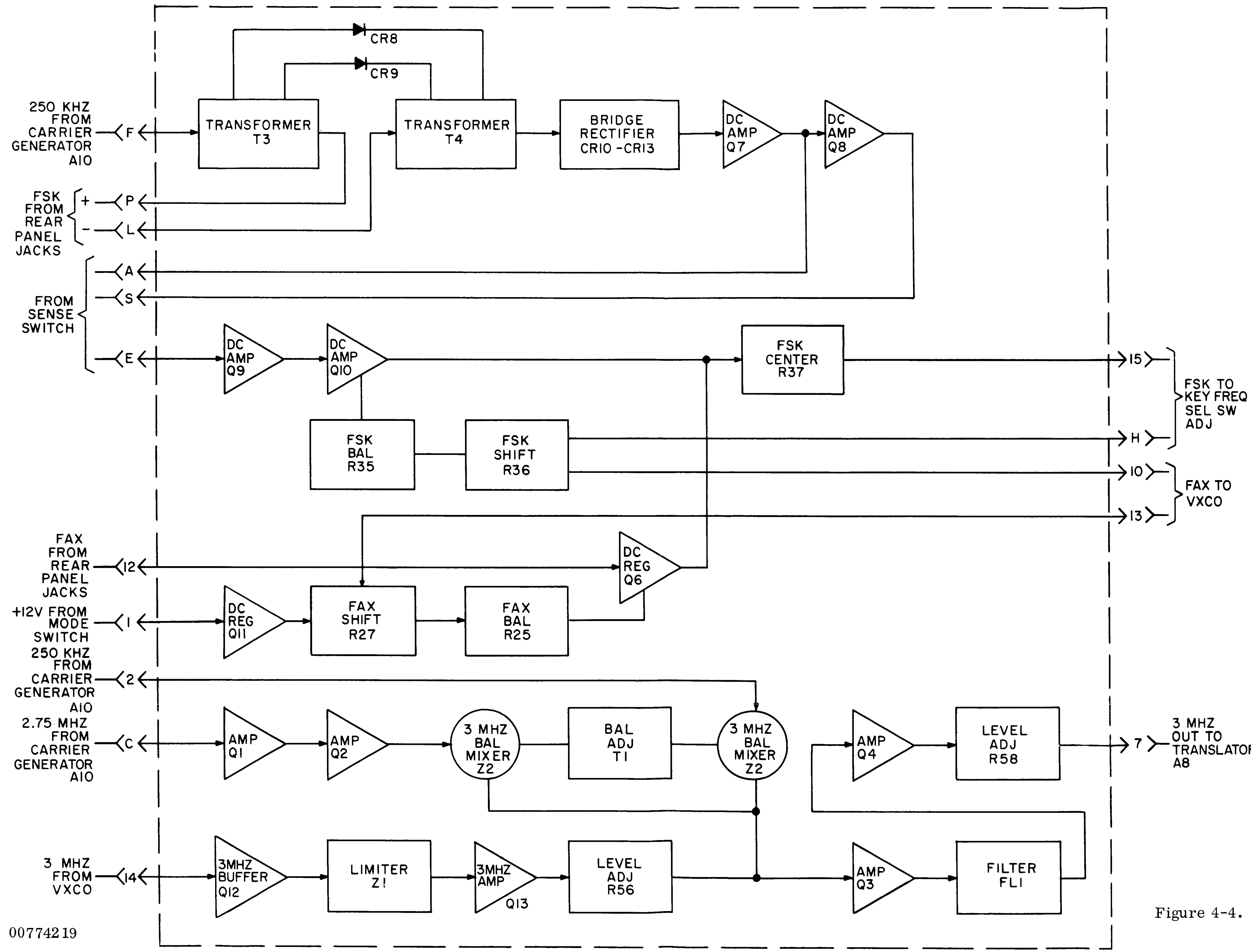

Figure 4-4. Frequency Shift Generator A9, Block Diagram

4-36. The converter section of the frequency shift generator accepts the 2.75-mhz carrier from carrier generator A10; the 250 kHz AM, USB, LSB, ISB, or CW input from the mode switching network; or the 3 mHz VXCO input from the 3 mhz VXCO amplifier in the frequency shift generator section.

4-37. In the AM mode, the 2.75 mhz carrier and the amplitude-modulated 250 khz signal are mixed in a balanced modulator to produce a sum amplitude-modulated carrier of 3 mHz, which is amplified and applied to translator A8. In the USB, LSB, and ISB modes, the input signals consist of the 2.75 mhz carrier and USB and/or LSB audio with, or without, the 250 khz signal, depending upon the amount of carrier suppression introduced by the CARRIER control network. This control permits continuously variable carrier reinsertion from zero (0) to full by attenuating the 250 khz input from the mode switching network. The attenuated 250 khz subcarrier from the CARRIER control is applied to the mode switching network, where it is reinserted with the USB and/or LSB audio as a pilot carrier prior to being sent to the converter section of the frequency shift generator. Therefore, the 250 khz USB, LSB, or ISB signal is mixed with the 2.75 mhz carrier to again produce a single sideband or independent sideband output with a 3 mhz center frequency.

4-38. In the CW mode, the 250 khz input is interrupted at the keyer rate and thus, results in a 3 mhz CW output. In the FSK and FAX modes, the 250 khz and 2.75 mhz inputs are not present; the only input is the 3 mhz VXCO signal from the frequency shift generator 3 mhz amplifier section, which is further amplified in the converter section and then applied to the translator A8. A keying relay is energized whenever the EXCITER switch is set to ON. As a result, when the CW mode is selected, the ground from the external key is coupled through the MODE switch and the normally-closed contacts of the relay to both the carrier generator and the translator, thereby initiating CW operation.

4-39. CARRIER GENERATOR A10. (See figures 4-5 and 7-31.)

4-40. Carrier generator A10 develops a basic subcarrier frequency of 250 khz, and a 2.75 mhz carrier frequency; it also contains a meter amplifier circuit for upper and lower sideband audio translation to an equivalent level for display on the MONITOR meter, when

USB or LSB audio is selected by the METER switch. In addition, an AM amplifier circuit provides an audio amplitude-modulated 250 khz output when the AM mode of operation is selected.

4-41. The carrier generator receives a 1-mhz standard frequency input which is supplied to both the 250 khz and 2.75 mhz frequency generation circuits. In the 250 khz channel, the 1 mhz input is divided by four to derive the basic 250 khz subcarrier frequency; a switched ground enable is applied from the mode switching network in the AM, USB, LSB, ISB, and FSK modes to enable a 250 khz subcarrier output signal; in the CW mode, the ground enable is interrupted at the key rate, thereby producing a 250 khz CW output. The 250 khz output is applied to the mode switching network for distribution to the various sections of the Exciter in accordance with the MODE switch setting, and to the CARRIER control network for reinsertion, when desired. In the FAX mode, the 250 khz channel is disabled.

4-42. The 2.75 mhz channel produces an r-f output by dividing the 1 mhz input by four and then multiplying the resultant by 11 to derive the 2.75 mhz translation frequency. Switched +12 vdc to this channel and to the AM amplifier section is controlled by the MODE switch and is present in the AM, USB, LSB, ISB, and CW positions. The 2.75 mhz output is supplied to the converter section of the frequency shift generator.

4-43. The AM amplifier section develops an amplitude-modulated 250 khz signal in the AM mode of operation, and consists of an audio amplifier and mixer circuit. In the AM mode, USB and/or LSB audio is routed to the audio amplifier stage and then to the mixer; the 250 khz subcarrier is applied directly to the mixer. The resultant amplitude-modulated 250 khz signal is then routed through the AM position of the MODE switch to the converter section of the frequency shift generator.

4-44. TRANSLATOR A8. (See figures 4-6 and 7-27.)

4-45. The translator contains a three stage 40 mhz tuned amplifier, an X3 multiplier which multiplies the 40 mHz to 120 mhz, a two stage 120 mhz amplifier, a 10 to 11 mhz input amplifier, a balanced mixer circuit which combines the modulated 3 mhz signal with the 10 to 10.9999 mhz least significant digits frequency, a two-stage 13 to 13.5 mhz tuned

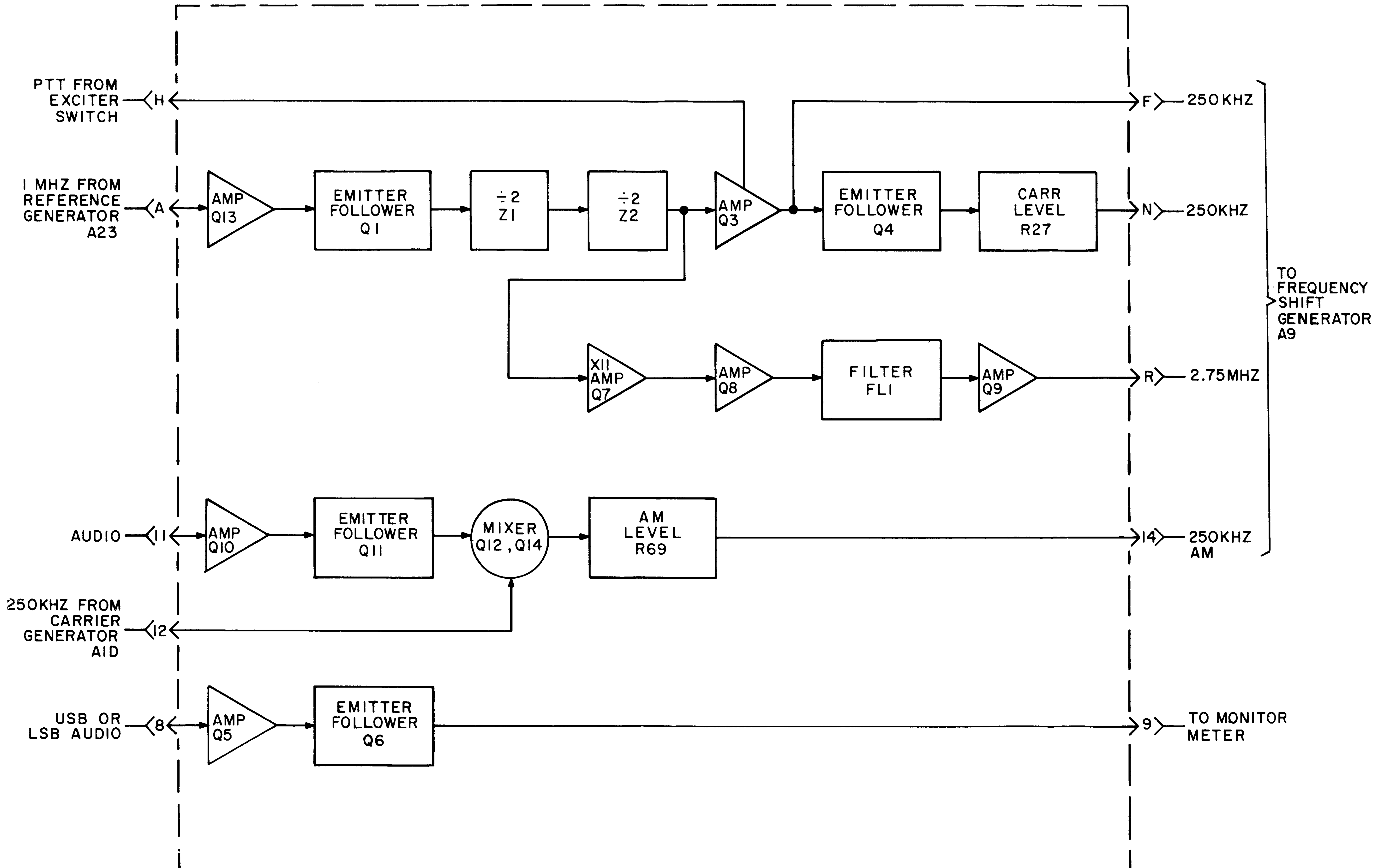

Figure 4-5. Carrier Generator A10, Block Diagram

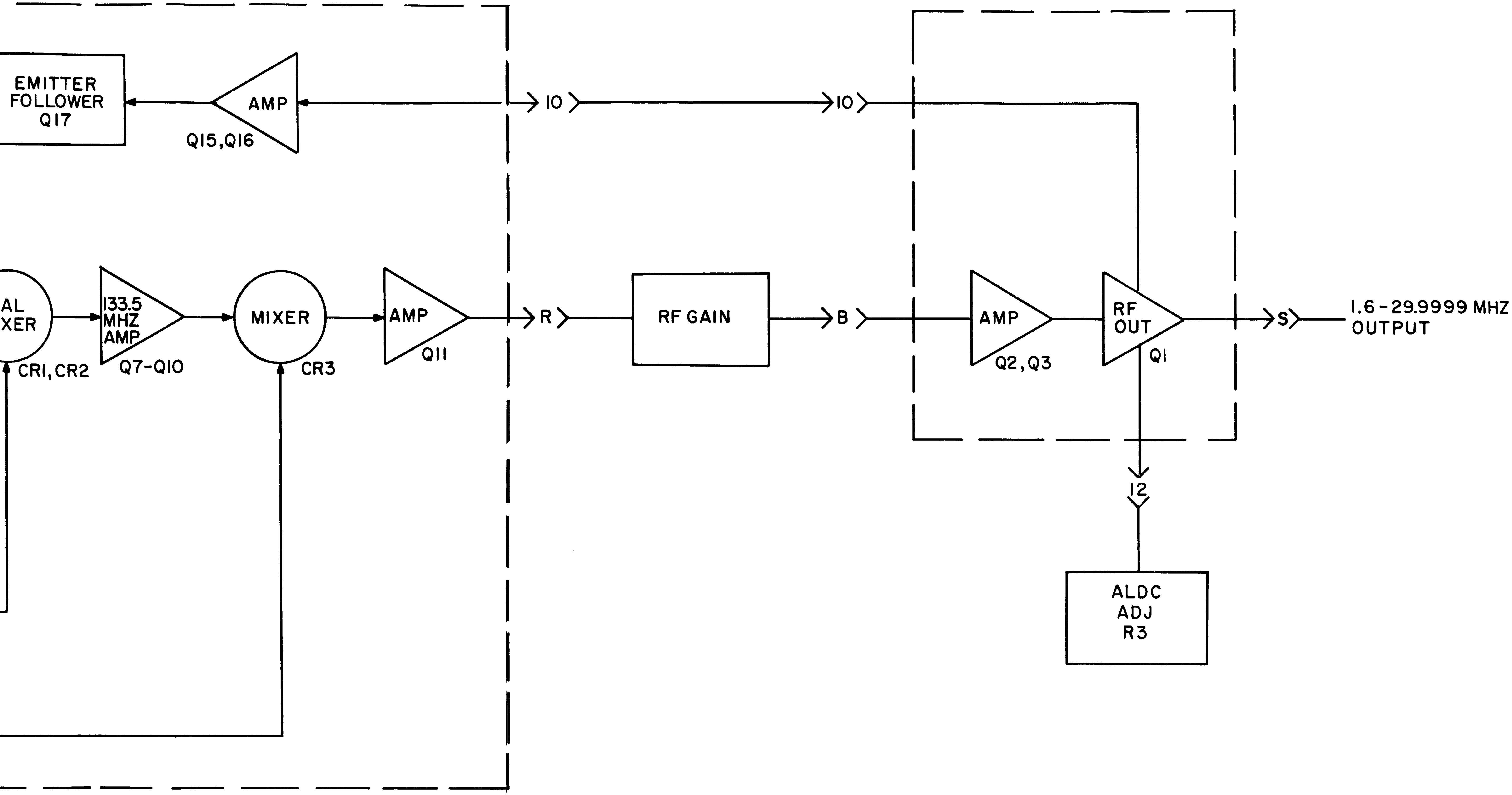

Figure 4-6. Translator A8 and RF Output A1, Block Diagram

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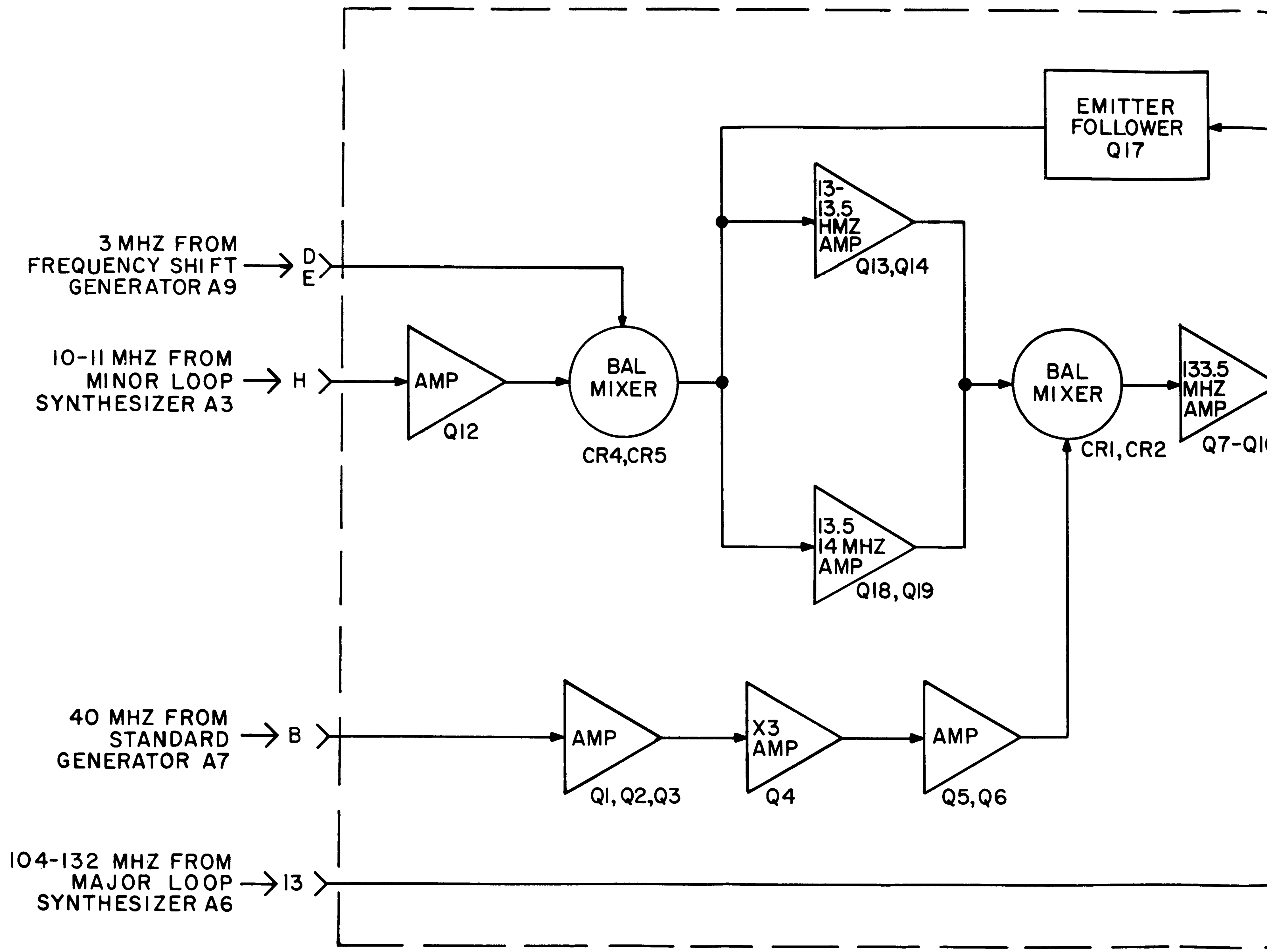

3 MHZ FROM
FREQUENCY SHIFT
GENERATOR A9
D
E
10-11 MHZ FROM
MINOR LOOP
SYNTHESIZER A3
H
40 MHZ FROM
STANDARD
GENERATOR A7
B
104-132 MHZ FROM
MAJOR LOOP
SYNTHESIZER A6
13
AMP
Q12
BAL
MIXER
CR4,CR5
13-
13.5
HMZ
AMP
Q13,Q14
13.5
14 MHZ
AMP
Q18, Q19
EMITTER
FOLLOWER
Q17
BAL
MIXER
CR1, CR2
133.5
MHZ
AMP
AMP
Q1, Q2,Q3
X3
AMP
Q4
AMP
Q5, Q6

amplifier and a two-stage 13.5 to 14 mhz amplifier, three-stage ALDC amplifier which produces a d-c level to control gain of the 13 to 13.5 mhz and 13.5 to 14 mhz amplifier, a sum mixer which mixes the 13 to 14 mhz signal with the 120 mhz frequency to produce a 133 to 134 mhz signal, a four stage 133.5 tuned amplifier, a difference mixer to mix the 133 to 134 mhz signal with the selected carrier frequency (104 to 132 mhz) to produce the final r-f carrier frequency (1.5 to 29.9999 mhz), and a single-stage r-f amplifier to match the r-f carrier to the output.

4-46. RF OUTPUT A1. (See figures 4-6 and 7-2.)

4-47. The rf output board contains three tuned r-f stages that provide a nominal 20 dB gain across the complete r-f frequency bandwidth (1.6 to 29.9999 mhz). A diode detector and associated filtering network provide an automatic level d-c voltage (ALDC) as a function of r-f output strength; this d-c level can be adjusted from 0 to -11 volts by the ALDC ADJ potentiometer on the rear panel of the Exciter. Additionally, an external minus ALDC level can be coupled to ALDC connector J20 on the rear panel to be summed with the internal ALDC level; this allows control of the r-f output from an external linear power amplifier to improve linearity and limit distortion. Each r-f stage has an individual BIAS ADJ potentiometer; these are set while monitoring the current flow through each stage to adjust each stage for optimum performance.

4-48. STANDARD GENERATOR A7. (See figures 4-7, 7-22, 7-23, and 7-25.)

4-49. Standard generator A7 is contained in the frequency generating circuits and consists of A7A1 and A7A2. The standard generator produces a 40-mhz frequency and provides an out-of-lock indication. Subassembly A7A1 receives the 1-mhz frequency input, either from an internal or external source, and amplifies the signal input in amplifiers Q1 and Q2. The amplified 1-mhz signal is then applied to an 8-mhz series resonant circuit Q3, Y1, with the 8-mhz output signal selected and applied to X5 multiplier Q4. The resultant 40-mhz output of Q4 is amplified by Q5 and Q6 and applied to translator board A8.

4-50. Subassembly A7A2 contains the circuitry and logic associated with the out-of-lock function. The major loop synthesizer and the minor loop synthesizer out-of-lock signals are applied to inverters. When the loop (either major or minor synthesizer) is locked, the low levels are inverted to high levels and applied to a NAND gate. With two high level inputs, the NAND gate output is at a low level. The low level signal inhibits drivers Q1 and Q2 and, as a result, maintains the front panel OUT OF LOCK indicator extinguished and does not apply a relay drive signal to out of lock relay A5.

4-51. If either one, or both, of the synthesizer loops becomes unlocked, a high level signal is applied to the associated inverter in A7A2. The high level is inverted to a low level and applied to the NAND gate. As a result of receiving one (or two) low input signal(s), the NAND gate output goes high. A high input to driver Q1 enables the driver and applies lamp drive to the front panel OUT OF LOCK indicator. Also, driver Q2 is enabled with the resultant relay drive output signal applied to out of lock relay A5, disconnecting the r-f output when an out of lock condition is sensed. Therefore, the r-f output is disconnected and the front panel OUT OF LOCK indicator lights to indicate the condition. The system returns to normal operation when the synthesizer(s) is again in a locked condition, extinguishes the front panel OUT OF LOCK indicator, and reconnects the r-f output.

4-52. REFERENCE GENERATOR A23. (See figures 4-8 and 7-39.)

4-53. Reference generator A23 provides a stable 1-khz reference source for the minor loop synthesizer, a stable 50-khz reference source for the major loop synthesizer, and also provides a 1-mhz signal to carrier generator A10. The reference generator input is the 1-mhz signal, either from an internal or external standard. The signal is amplified in drivers Q1 and Q2 and the resultant amplified 1-mhz output signal is applied to carrier generator A10 via a logic driver. The 1-mhz signal is also applied to a series counter network. Each counter network is a divide by 10 circuit. In turn, each divide by 10 circuit consists of a divide by two circuit followed by a divide by five circuit. In the first counter, the output of the first stage (divide by two) is applied to the input of the divide by five stage. The resultant output divide by 10 is applied to the second counter via a logic driver. The output of the first stage of the second counter is the 50-khz reference frequency which is applied to the m major loop synthesizer via a logic driver. The output is also applied to the second stage of the second counter. The output of the second stage, of the second counter. The output of the second stage, a stable frequency of 10-khz is further divided by 10 in the third counter.

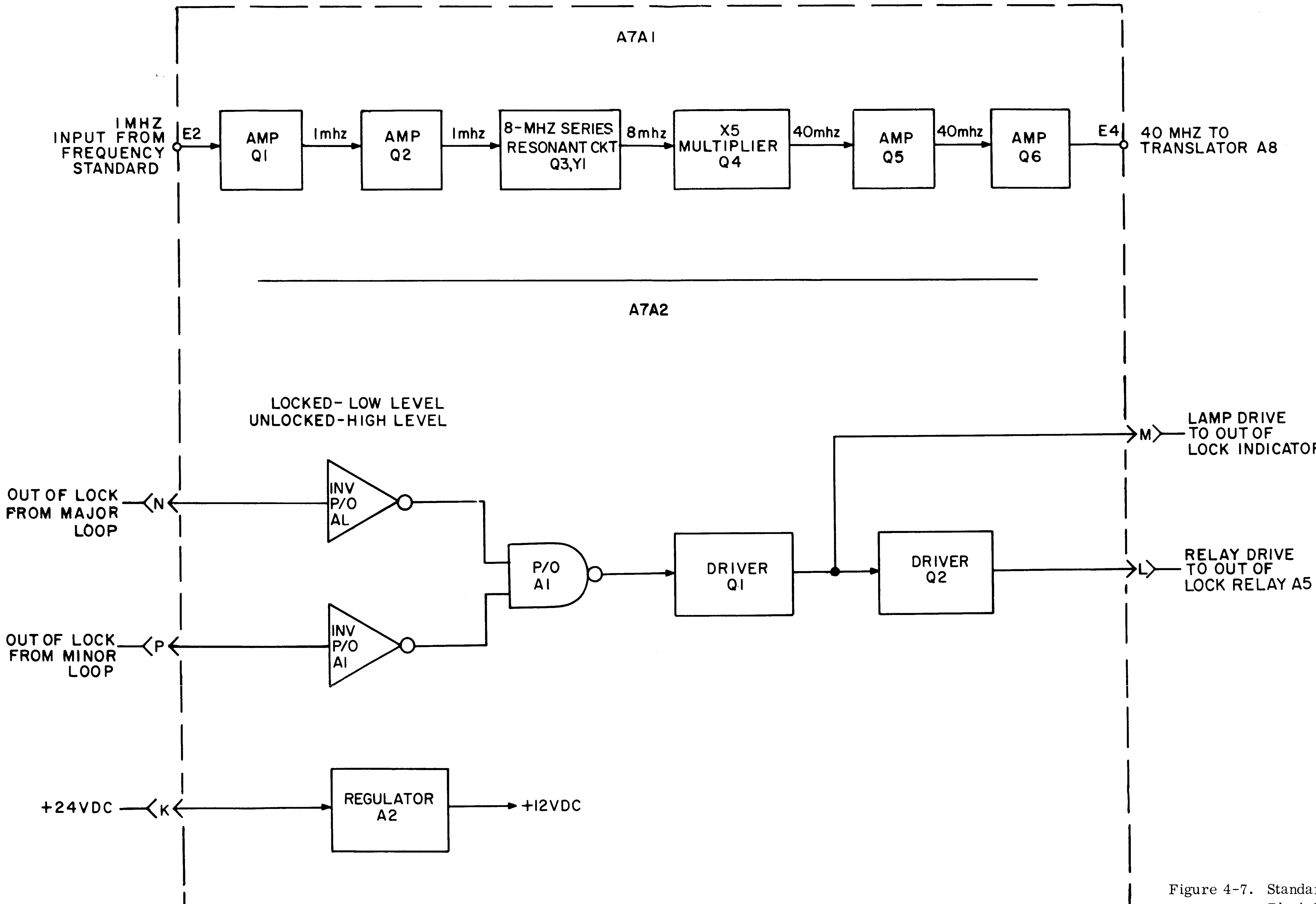


Figure 4-7. Standard Generator A7, Block Diagram

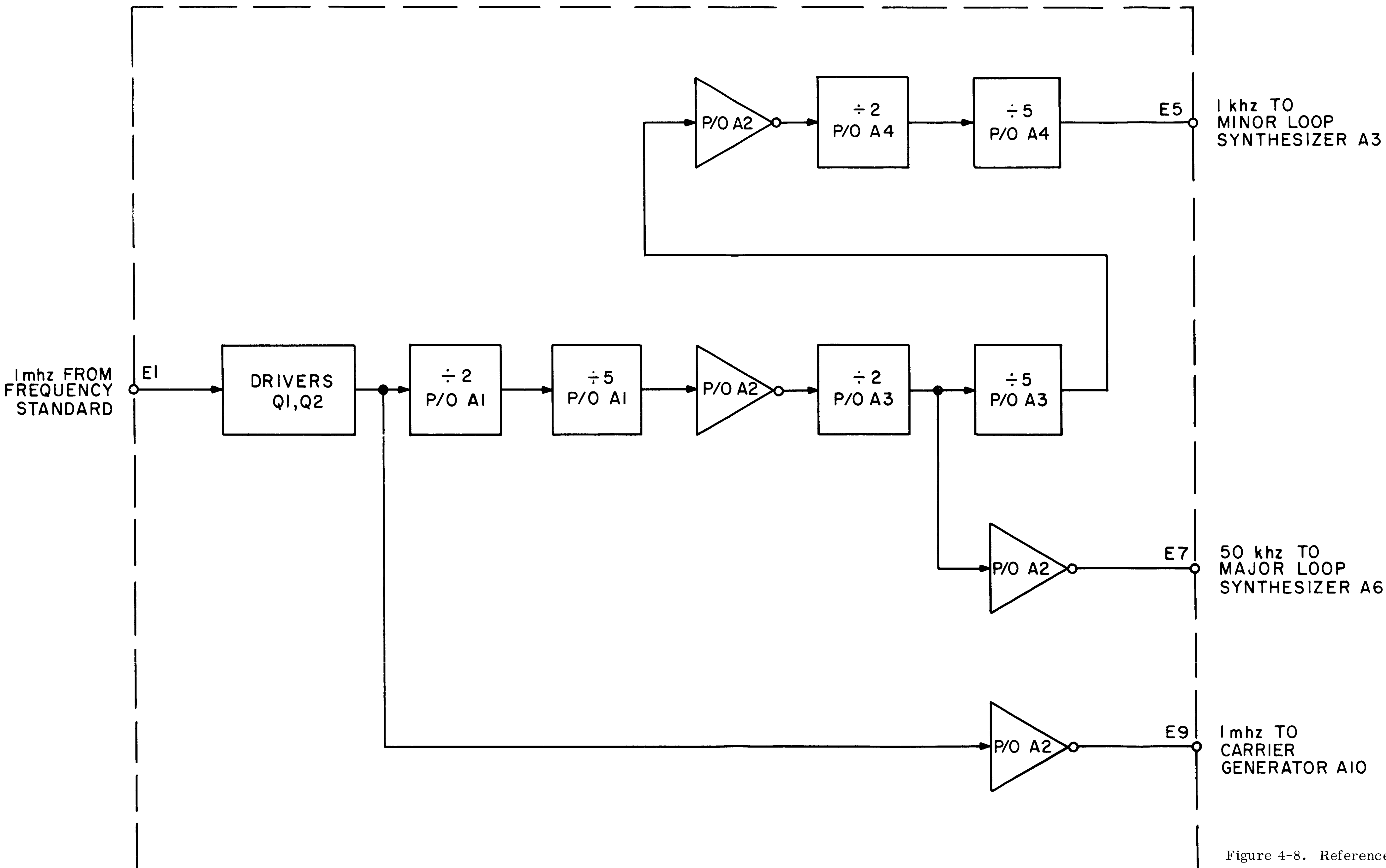


Figure 4-8. Reference Generator A23, Block Diagram

4-54. MINOR LOOP SYNTHESIZER A3. (See figure 7-4.)

4-55. General.

4-56. The minor loop synthesizer A3 consists of three circuit boards; phase detector A3A1, divider A3A2, and VCO A3A3. The VCO (voltage controlled oscillator) tunes from 100 to 110 mhz depending on the d-c voltage on the tuning line as derived from the phase detector. The 100 to 110 mhz output is divided by 10 to produce 10-11 mhz output which is applied to the translator board as a local oscillator signal. A portion of the 100-110 mhz is also applied to the divider board. The divider board divides the 100-110 mhz by a modulus ranging from 1,000,000 to 1,099,999 mhz. This modulus is selected by the binary coded decimal lines from the front panel frequency selector switches 100 hz through 100 khz. The output of the divider is approximately 1 khz. The phase detector compares the phase of the divider output and a very accurate 1-khz reference signal derived from the 1-mhz standard in reference generator A23. The output of the phase detector is an analog voltage proportional to the phase difference between the two signals. This analog voltage tunes the VCO to a frequency such that the frequency divided by the modulus of the divider is 1 khz. Thus, the output frequency of the minor loop is the divider modulus times 100 hz.

4-57. Phase Detector A3A1. (See figures 4-9 and 7-5.)

4-58. Phase detector A3A1 receives a 1-khz reference signal from reference generator A23, and a divide-by-N input at a frequency of 800 to 1200 hz from minor loop divider A3A2, and develops a tuning line analog output signal that is applied to VCO A3A3 to control the output frequency. The phase detector also develops a digital low level out of lock indication that is applied to the standard generator A7 when the minor loop synthesizer is in an unlocked condition.

4-59. The reference signal and the divide-by-N input are applied to quad 2-input positive NAND gates in A1. The resultant output of A1 is the reference signal that is applied to switch Q1 and the reference signal plus the divide-by-N signal that is applied to switch Q10. The basic phase detector circuit consists of Q1, Q2, Q3, Q5, Q6, Q7, Q8, and Q10, which compares the phase difference between the two input signals and develops an increasing analog d-c voltage output as the selected frequency is increased. Thus, the output of the phase detector is approximately 2 vdc at 0 khz and increases at the rate of 1 volt/ 100 khz increments. The increasing d-c voltage is obtained by charging capacitor C3 with the reference input signal, and then transferring the charge via FET Q7. In turn, FET Q7 is controlled by switch Q10, which, in turn, is switched on and off by the NANDed reference plus divide-by-N signal output of A1. Thus, as the front panel selector switches are set to an increasing selected operating frequency, the switching off of Q10 is performed at an increasing rate. Turning switch Q10 off at a greater rate permits capacitor C3 to charge to a greater voltage before FET Q7 is turned on and the charge is transferred. At the low frequency end (0 khz), switch Q10 is switched on at a rapid rate and the charge across capacitor C3 is transferred rapidly and not allowed to increase to its maximum. As a result, at 0 khz, the phase detector output is approximately 2 volts dc. As the front panel selector switches are set to a higher frequency setting, switch Q10 is held off for a longer period of time, and capacitor C3 is allowed to charge to a greater voltage value before FET Q7 is turned on and the charge is transferred. In this manner, the output voltage of the phase detector increases at a rate of 1 volt/each 100 khz increase in front panel selector switch setting.

4-60. The phase detector signal is also differentiated by capacitor C12 and resistor R28 and applied to operational amplifier A3. The resultant output of A3 is applied to monostable multivibrator A2 which develops a low level output when the system is out of lock.

4-61. The phase detector board contains two power supply regulator circuits that develop -10 volts and +5 volts for operation of its circuitry and logic elements.

4-62. Divider A3A2. (See figures 4-10 and 7-7.)

4-63. Minor loop divider board A3A2 receives binary code decimal information from the front panel 100 Hz switch S3, 1 KHz switch S4, 10 KHz switch S5, and 100 KHz switch S6A. Data bit 1 of the 1-2-4-8 bcd input is applied to the P0 input of 4-bit counters A3, A6, A9, and A13. Data bit 2 of the bcd input is inverted and applied to the P1 input of each 4-bit counter. Data bits 4 and 8 are inverted and applied to dual 4-bit multipliers A5, A7, A10, and A12. The resultant output of each multiplier is applied to the P2 and P3 inputs of the 4-bit counters.

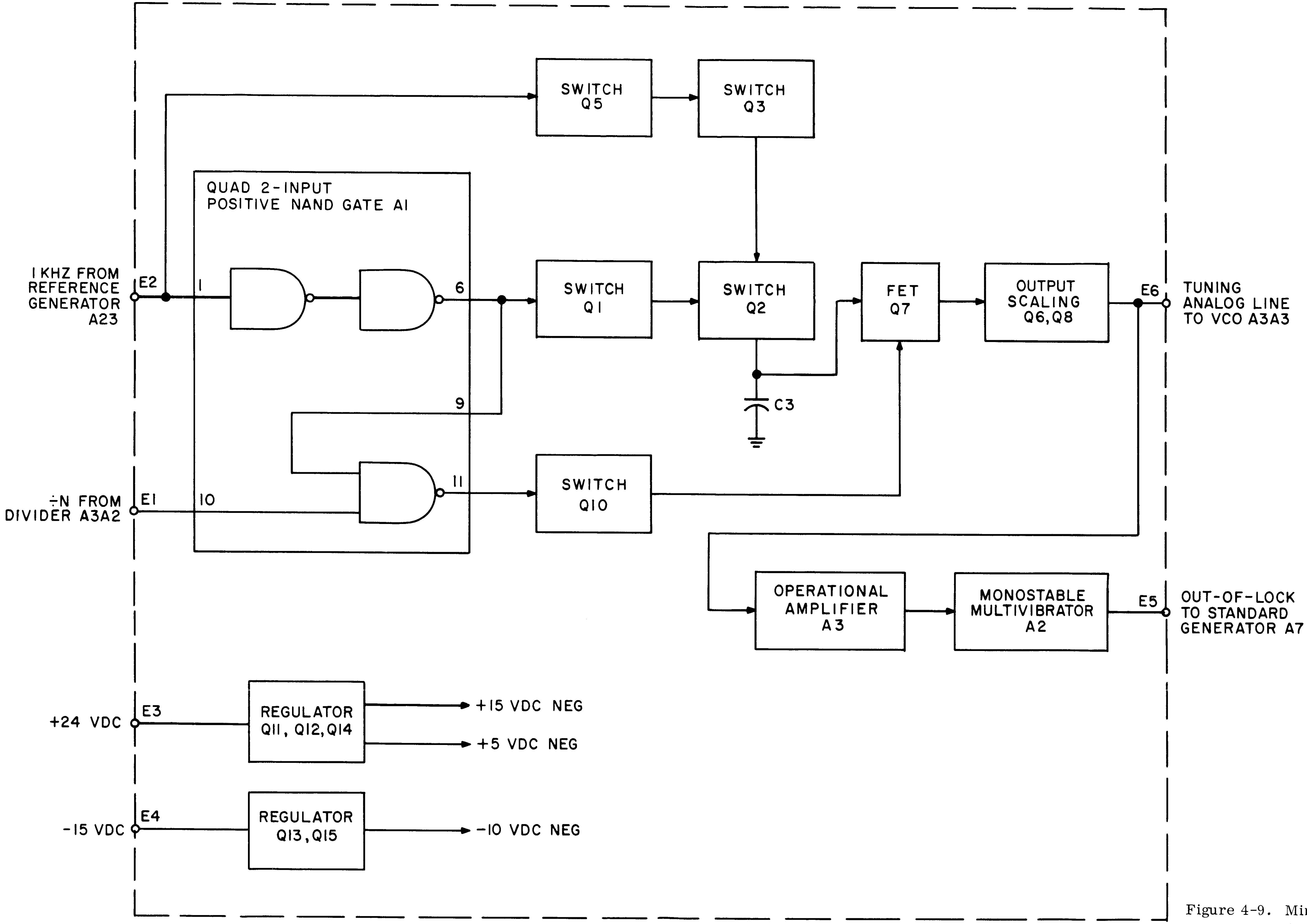


Figure 4-9. Minor Loop Phase Detector A3A1, Block Diagram

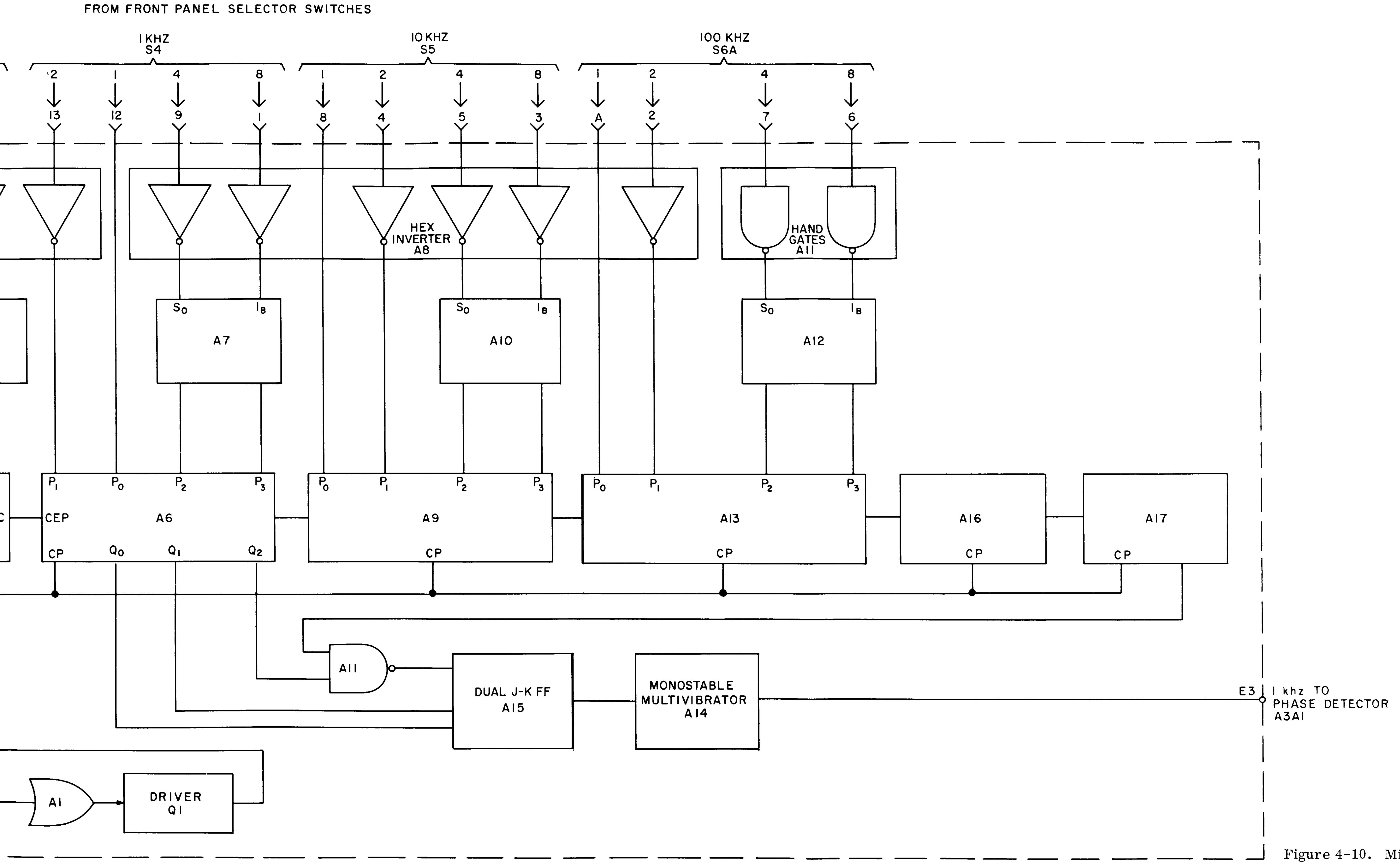
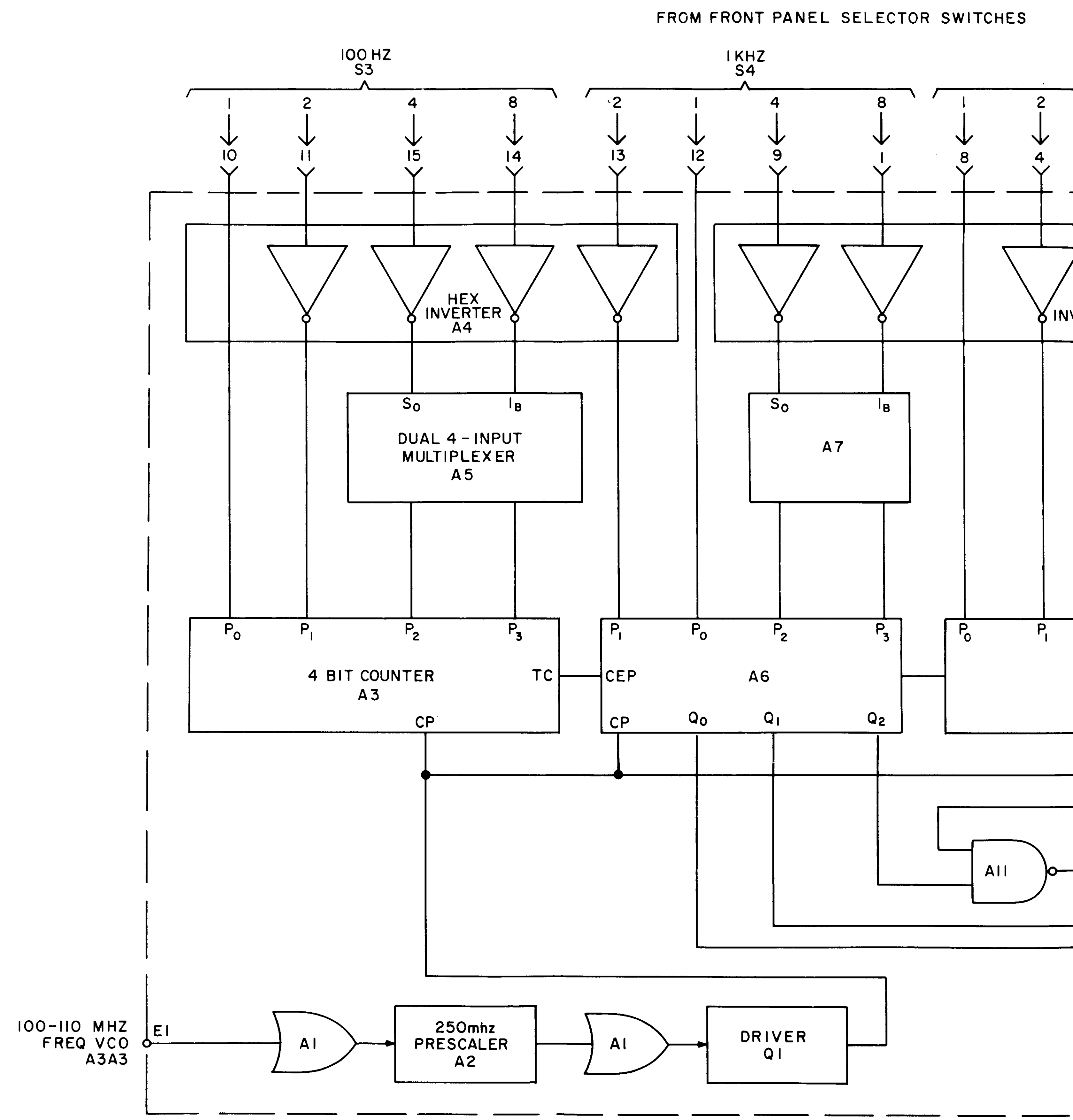


Figure 4-10. Minor Loop Divider A3A2, Block Diagram


FROM FRONT PANEL SELECTOR SWITCHES
100 HZ
S3
1KHZ
S4
HEX
INVERTER
A4
DUAL 4-INPUT
MULTIPLEXER
A5
A7
4 BIT COUNTER
A3
A6
TC
CEP
CP
A11
100-110 MHZ
FREQ VCO
A3A3
E1
A1
250mhz
PRESCALER
A2
DRIVER
Q1

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4-64. The divider board contains six 4-bit counters; A3, A6, A9, A13, A16, and A17. Applied to the clock (Cp) input of each counter is a 10-11 mhz signal derived from the VCO 100-110 mhz signal that is divided down in A2. The six 4-bit counters A3, A6, A9, A13, A16, and A17 perform divide-by-10 functions, with the resultant 1-khz output signal routed through flip-flop A15 and monostable multivibrator A14 to phase detector A3A1.

4-65. MINOR LOOP VCO A3A3. (See figures 4-11 and 7-9.)

4-66. Minor loop VCO A3A3 tunes from 100 to 110 mhz depending on the d-c voltage on the tuning line analog as derived from the phase detector. The 100 to 110 mhz output is divided by ten to produce 10-11 mhz output which is applied to the translator board as a local oscillator signal. A portion of the 100-110 mhz is also applied to the divider board.

4-67. MAJOR LOOP SYNTHESIZER A6. (See figures 7-13, 7-14, 7-16, and 7-18.)

4-68. The major loop synthesizer is functionally similar to the minor loop synthesizer, except for the input frequencies of 10 and 20 mhz from the front panel selector switches, and that the VCO board contains three independent VCO's. VCO selection is a function of the Exciter output frequency as detailed in paragraph 4-21. Also, refer to paragraph 4-54 for a description of the minor loop synthesizer A3 to understand the functioning of the major loop synthesizer.

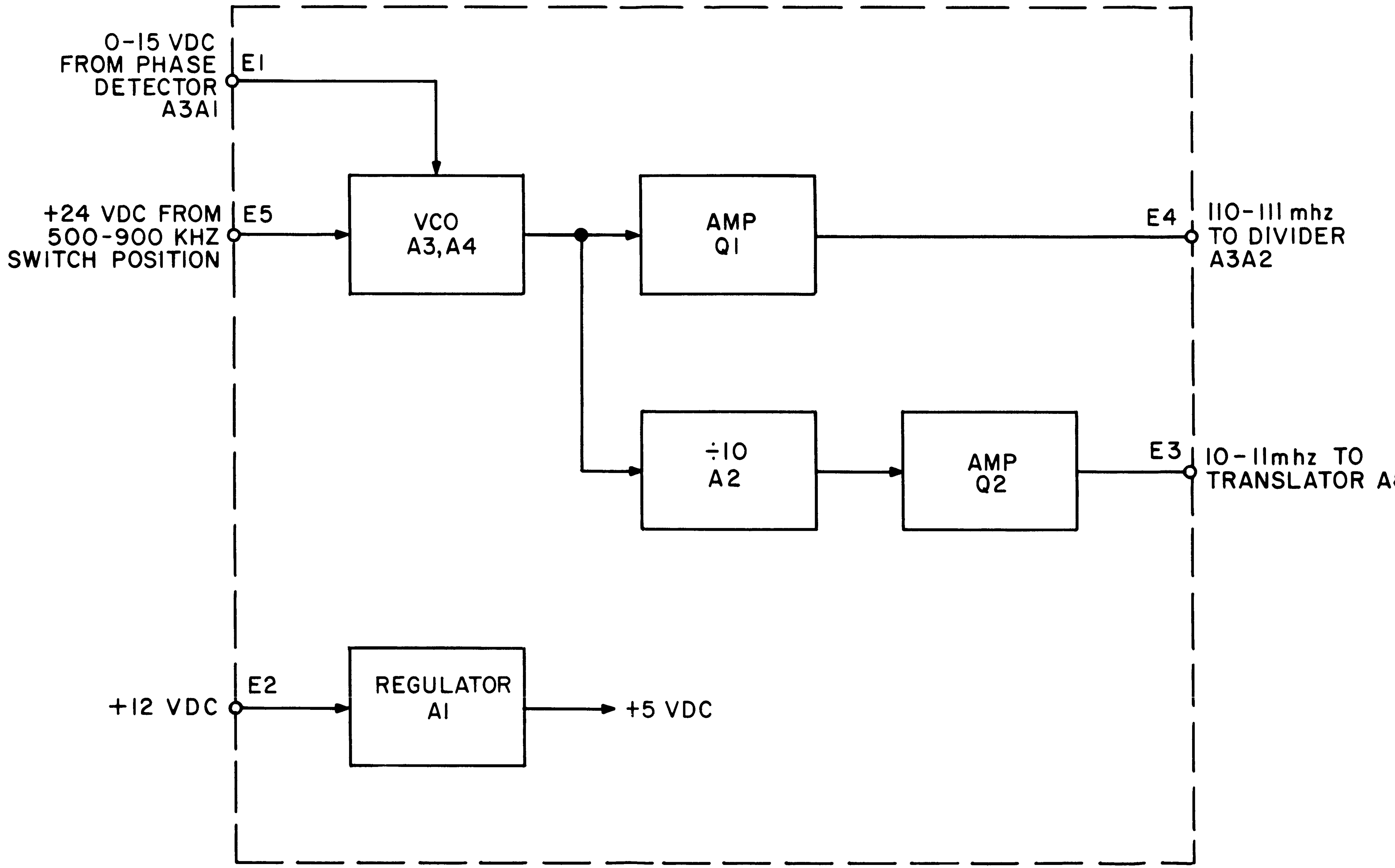

Figure 4-11. Minor Loop VCO A3A3, Block Diagram

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SECTION 5

MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

The following paragraphs describe procedures to inspect, check, and clean the components of the MMX(M)-3. In general, preventive maintenance provides a basis for recognizing future probable causes of equipment malfunction in the early stages of deterioration. Many such causes are apparent to the senses of sight, touch, and smell. Therefore, by adhering to a stringent program of preventive maintenance, involving periodic inspection and checks, the most probable causes of equipment malfunction can be avoided, thereby minimizing equipment downtime and the possibility of compromising important schedules. Refer to paragraph 5-10 for a listing of test equipment required for MMX(M)-3 maintenance.

5-2. INSPECTION AND TEST.

The following paragraphs describe equipment inspection and power supply checks to be performed on a weekly basis.

5-3. GENERAL INSPECTION.

A most important and least expensive tool in the preventive maintenance program is the sense of sight; a thorough visual inspection of an assembly or component for tell-tale signs of deterioration prior to failure can save hours of test and troubleshooting time after a complete breakdown. Table 5-1 presents a weekly inspection checklist for the MMX(M)-3.

5-4. POWER SUPPLY CHECKS.

Perform the power supply checks on a weekly basis as follows:

a. Using a VTVM, or equivalent, check d-c voltage across plus and minus output pins of -15 vdc power supply A19A2; voltage should be -15 vdc ± 1%.

b. Check voltage at pin M of A1J23; voltage should be +30 vdc ± 1%.

c. Check voltage at pin J of A1J23; voltage should be +5 vdc ± 1%.

TABLE 5-1. WEEKLY INSPECTION ROUTINE

Assembly or Subassembly	Check
Main Chassis Assembly	1. Check underside of chassis for dirt and dust.
	2. Check all inter-connector wiring for nicks, cracks, or fraying.
	3. Check all printed circuit boards for cracks; check components for looseness and evidence of deterioration from possible overheating.
	4. Check printed circuit board jacks for tightness against chassis.
	5. Check ground connections for security.
Front and Rear Panels	1. Check panel for general cleanliness.
	2. Check all control knobs for smooth action from limit-to-limit. Check all switches for positive action.
	3. Check MONITOR meter face for cracks, scratches, etc.
	4. Check indicator faces for cracks.
	5. Remove line fuses and check for proper 1-ampere or 0.5-ampere value and condition (0.5-ampere with 230 vac line).
	6. Check all input/output jacks for security against panel.

5-5. CLEANING INSTRUCTIONS.

In general, the MMX(M)-3 should be cleaned once a month, using a soft camel's hair brush, forced air pressure of not more than 20 psi and a suitable cleaning agent such as trichloroethylene or methylchloroform.

WARNING

When using toxic solvents, make certain that adequate ventilation is provided; prolonged or repeated breathing of the vapor shall be avoided. Avoid prolonged or repeated contact with skin. Flammable solvents shall not be used on energized equipment or near other equipment from which a spark may be received.

CAUTION

Trichloroethylene contains a paint removing solvent; avoid contact with painted surfaces.

Remove dirt or grease from wiring and chassis surfaces using cleaning solvent; dry with compressed air. Remove dust from printed circuit boards using a soft camel's hair brush. Blow out accumulated dust from inaccessible areas of chassis using forced air.

5-6. TROUBLESHOOTING.

5-7. The circuits of the MMX(M)-3 are contained on PC boards accessible from the top of the chassis. The card "A" numbers are the circuit reference designation prefix. Numbers prefixed with an "A" are the PC assembly part numbers by which they are identified and ordered. The "A" prefix number is silkscreened both on the card and on the chassis adjacent to the PC board receptacle. Some PC boards in the MMX(M)-3 are in other TMC equipment; although they are assigned different "A" designations (and in certain instances, "Z" designations), they have the same assembly number and are thus identical and interchangeable. These PC boards have similar keying at their plug ends and mating receptacles. The power supply assembly heat sink is mounted against the rear wall of the chassis; the smaller power supply boards are mounted forward of the heat sink and are removable.

5-8. In general, a malfunction of the MMX(M)-3 will usually manifest itself by lack of, or improper readings on the MONITOR meter, and can be quickly localized to a particular printed circuit board by the logical process of elimination. If a second MMX(M)-3 is obtainable, or a set of spare PC boards is available, troubleshooting can be facilitated by the board substitution method. In some instances, a particular board may require alignment or adjustment as outlined in paragraph 5-9. Table 5-2 presents a troubleshooting chart for the MMX(M)-3.

5-9. ALIGNMENT.

5-10. TEST EQUIPMENT REQUIRED. Table 5-3 presents a listing of the test equipment required for complete alignment of the Exciter.

5-11. CARRIER GENERATOR A10.

a. Adjust R27 fully counterclockwise, set ON/STANDBY switch to ON, and MODE switch to AM.

b. Connect oscilloscope and frequency counter to TP1. The signal should be 1 mhz, 10 volts P-P.

c. Connect oscilloscope and frequency counter to TP4. The signal should be 250 khz, approximately 1.4 volts P-P.

d. Connect oscilloscope and frequency counter to TP7. The signal should be 2.75 mhz. Adjust R47 for 70 millivolts.

5-12. SIDEBAND GENERATOR A11.

NOTE

Carrier generator card A10 must be checked and inserted before aligning sideband generator A11.

TABLE 5-2. TROUBLESHOOTING CHART

Step	Trouble	Probable Cause	Remedy
1	No r-f output at any selected frequency.	Check that POWER indicator is illuminated with ON/STANDBY switch set to ON.	If lamp is not illuminated, check power supply voltages as outlined in paragraph 5-4. If lamp is illuminated, proceed to step 2.
2		Check that STD switch is set to INT.	Set switch to INT. If switch is at INT, proceed to step 3.
3		Check for normal display on MONITOR with METER switch in Q1, Q2, and Q3 positions.	If all readings are normal, proceed to step 4. If any reading is abnormal, replace rf output board A1.
4		Check for 1-mhz output at 1 MHz MON jack on rear chassis.	If 1 mhz is present, proceed to step 5. If 1 mhz is not present, replace 1 mhz standard A21 and/or clock buffer A4A1.
5		Check for 40 mhz from standard generator A7.	If present, proceed to step 6. If not, replace A7.
6		Check for 50 and 1 khz outputs from reference generator A23.	If present, proceed to step 7. If not, replace A23.
7		Check for 3 mhz input to translator A8, pin D.	If not present, proceed to step 8. If present, proceed to step 9.
8		Check for 2.75 mhz, 250 khz, or 3 mhz input to frequency shift generator A9.	If not present, replace carrier generator A10. If present, replace frequency shift generator A9.

TABLE 5-2. TROUBLESHOOTING CHART (Continued)

Step	Trouble	Probable Cause	Remedy
9	No r-f output at any selected frequency. (continued)	Check for 10-11 mhz, 40 mhz, and 104 to 132 mhz input to translator A8.	If 10-11 mhz input is missing, check minor loop synthesizer A3. If 40 mhz is missing, check standard generator A10. If 104 to 132 mhz input is missing, check major loop synthesizer A6. If all inputs to translator A8 are present and still no output, replace A8.

TABLE 5-3. TEST EQUIPMENT REQUIRED

Equipment	Manufacturer*
Signal Generator	Hewlett-Packard Model 606B
Oscilloscope	Tektronix Model 541A
Spectrum Analyzer	Lavoie Laboratories, Inc., Model LA-40A
Audio Generator	Hewlett-Packard Model 200CD
VTVM	Ballantine Model 314
RF VTVM	Hewlett-Packard Model 411A
Frequency Counter	Hewlett-Packard Model 5244L
Attenuator	Telonic Model D-950
Millivolt Meter	Millivac Model MV-28B
VOM	Simpson 260

*or equivalent

a. Remove frequency shift card A9.

b. Connect audio generator with one side grounded to USB terminals on rear panel of the MMX(M)-3 unit. Adjust the audio generator for a 1-khz output at a level of 78 millivolts (-20 dbm).

c. Set MODE and METER switch as on front panel to USB.

d. Adjust USB MIC/LINE control for 2/5 of full scale reading on front panel METER. (Reading of 2.)

e. Connect VTVM to TP4. The level should be approximately 16 millivolts RMS (44 mv P-P).

f. Connect the oscilloscope and frequency counter to TP10 (output of the USB filter). The amplitude should be approximately 75 mv P-P at one single frequency of 251 khz.

g. Remove the audio generator from the USB terminals and connect the audio generator with one side grounded to the LSB terminals on the rear panel of the MMX(X)-3. Adjust the audio generator for a 1-khz output at a level of 78 millivolts (-20 dbm).

h. Set MODE and METER switches on front panel to LSB.

i. Set LSB MIC/LINE control for 2/5 of full scale reading on front panel METER. (Reading of 2.)

j. Connect VTVM to TP1. The level should be approximately 16 millivolts RMS (44 mv P-P).

k. Connect the oscilloscope and frequency counter to TP9 (output of the LSB filter). The amplitude should be approximately 75 mv P-P at one single frequency of 249 khz.

l. Connect audio generator to front panel MIC input. Adjust the audio generator to 1 khz, at 1 mv RMS. (Measure with a VTVM.)

m. Connect a short jumper across C49.

n. Connect the VTVM to TP3.

o. Adjust R9 for 40 mv RMS indication on VTVM.

5-13. FREQUENCY SHIFT GENERATOR A9.

NOTE

Do not attempt an alignment of the FSK and FAX adjustments without a one-hour warmup of the 3-mhz oven.

a. Plug A9 into its chassis slot with extender card. Set MODE switch to ISB. Adjust R58 fully counterclockwise. Turn CARRIER control on front panel fully clockwise and set ON/STANDBY switch to ON.

b. Connect oscilloscope and frequency counter to TP1. A 2.75 mhz signal at 70 millivolts P-P should be present.

c. Connect oscilloscope and frequency counter to TP2. A 250 khz signal at 70 millivolts P-P should be present.

d. Connect oscilloscope and frequency counter to TP5.

e. Set MODE switch to FSK.

f. On rear panel of MMX(M)-3, set R23 to mid range, SHIFT switch to ±425 cycles, and SENSE switch to + (up) position.

g. Adjust R56 for maximum signal.

h. Insert A9 into chassis slot without extender.

NOTE

Five adjustment holes are on top of card; these are 25 turn potentiometers and are, from front to rear, R35, R36, R37, R27, and R25.

i. Adjust R35 fully counterclockwise.

j. Adjust R37 for 3,000,000 cycles on the frequency counter.

k. Adjust R36 for 2,999,575 cycles on the frequency counter.

l. Set SENSE switch to – (down) and adjust R35 for 3,000,425 cycles.

m. Set SENSE switch to + (up), readjust R36 for 2,999,575 cycles. Set SENSE switch to – (down) and adjust R35 for 3,000,425 cycles. Repeat these steps until both frequencies are within 5 cycles of the required frequencies.

n. Set the rear panel SHIFT switch to ±212 cycles, and set the SENSE switch to +. The frequency counter should read 2,999,788 ± 15 cycles.

o. Set SENSE switch to –. The frequency counter should read 3,000,212 ± 15 cycles.

p. Set rear panel SHIFT switch to ±106 position, and SENSE switch to +. The frequency counter should read 2,999,894 ± 10 cycles.

q. Set SENSE switch to –. The frequency counter should read 3,000,106 ± 10 cycles.

r. Set rear panel SHIFT switch to ±53 position and set SENSE switch to +. The frequency counter should read 2,999,947 ± 5 cycles.

s. Set the SENSE switch to –. The frequency counter should read 3,000,047 ± 5 cycles.

t. Set MODE switch to FAX and adjust R25 fully clockwise.

u. Connect a variable d-c power supply to the FAX terminals on the rear panel.

v. Monitor the power supply output with a d-c meter and adjust the power supply output for +1 volt.

w. Adjust R27 for 2,999,600 ± 5 cycles.

x. Adjust the power supply output for +10 volts and adjust R25 for 3,000,400 ± 5 cycles.

y. Repeat the adjustments of R25 with +1.0 volt and R27 with +10 volts, until the specified frequencies can be obtained within five cycles.

z. Check the linearity of the FAX circuits by changing the input voltage from +1 to +10 volts. For each change of 1 volt, the frequency should change 89 ± 5 cycles. A typical measurement is shown below:

DC VOLTS	FREQUENCY (Cycles ±5)
1	2,999,600
2	2,999,689
3	2,999,778
4	2,999,867
5	2,999,956
6	3,000,045
7	3,000,134
8	3,000,223
9	3,000,312
10	3,000,400

SECTION 6

PARTS LIST

6-1. GENERAL.

6-2. This section contains the parts list for the MMX(M)-3. The parts list is presented in reference designation order of the assemblies comprising the unit, and follows the same order of arrangement of the schematic and component location diagrams in Section 7.

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		RF OUTPUT A1			
C1	Capacitor, Fixed	CN114R82-5J	C20	Capacitor, Fixed, Mica	CM112F222G5S
C2	Capacitor, Fixed, Electrolytic	CE105-20-50	C21 thru C30	Not Used	
C3	Capacitor, Fixed, Ceramic	CC100-16	C31	Capacitor, Fixed, Electrolytic	CE105-50-15
C4	Same as C1		C32 thru C34	Same as C3	
C5 thru C17	Same as C3		C35	Capacitor, Fixed, Ceramic	CC100-29
C18	Capacitor, Fixed, Mica	CM111F621D5S	C36	Same as C3	
C19	Capacitor, Fixed, Electrolytic	CE105-50-50	C37	Same as C35	
			C38	Same as C3	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		RF OUTPUT A1 (Continued)			
C39	Capacitor, Fixed, Mica	CM112F112G5S	Q2	Transistor	2N3375
CR1	Semiconductor Device, Diode	1N4864	Q3	Transistor	2N3296
CR2	Semiconductor Device, Diode	1N100	R1	Resistor, Variable, Composition	RV124-1-103
CR3	Same as CR2		R2	Same as R1	
L1 thru L6	Coil, RF, Fixed	CL240-120	R3	Resistor, Fixed, Composition	RC20GF220J
L7	Coil, RF, Fixed	CL240-3R9	R4	Resistor, Variable, Composition	RV124-1-502
L8	Same as L1		R5	Resistor, Fixed, Composition	RC20GF562J
L9 thru L12	Not Used		R6	Resistor, Fixed, Composition	RC32GF332J
L13	Coil, RF, Fixed	CL275-121	R7	Resistor, Fixed, Composition	RC32GF102J
L14	Coil, RF, Fixed	CL240-120	R8	Same as R3	
L15 thru L22	Same as L13		R9	Resistor, Fixed, Composition	RC20GF102J
L23	Coil, RF, Fixed	CL275-2R2	R10	Not Used	
L24	Coil, RF, Fixed	CL240-5R6			
Q1	Transistor	2N5070			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		RF OUTPUT A1 (Continued)			
R11	Resistor, Fixed, Composition	RC20GF470J	R17	Same as R9	
R12	Same as R9		R18	Resistor, Fixed, Composition	RC20GF221J
R13	Resistor, Fixed, Composition	RC20GF100J	R19	Resistor, Fixed, Composition	RC20GF473J
R14	Resistor, Fixed, Composition	RC20GF101J	R20	Same as R14	
R15	Resistor, Fixed, Composition	RC20GF222J	R21	Resistor, Fixed, Composition	RC20GF433J
R16	Not Used		T1	Transformer, RF	TZ220
			T2	Transformer, RF	TZ219
		MINOR LOOP PHASE DETECTOR A3A1			
A1	Integrated Circuit	U6A900259X	C2	Same as C1	
A2	Integrated Circuit	U6A960159X	C3	Capacitor, Fixed, Ceramic	CC10026-19
A3	Integrated Circuit	U6A7710393	C4	Same as C1	
C1	Capacitor, Solid Tantalum	CE10014-4.7-35	C5	Capacitor, Fixed, Ceramic	CC10026-12

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MINOR LOOP PHASE DETECTOR A3A1 (Continued)					
C6	Capacitor, Fixed, Mica	CM111E221J5S	CR5	Semiconductor Device, Diode	1N5242
C7 and C8	Same as C1		CR6	Semiconductor Device, Diode	1N914B
C9	Capacitor, Electrolytic	CE10017-220-25-B	E1 thru E6	Terminal, Stud	TE127-2
C10 thru C12	Same as C1		Q1	Transistor	2N3904
			Q2	Transistor	2N1132A
C13	Capacitor, Electrolytic	CE10017-220-16-B	Q3	Transistor	2N2219A
C14	Same as C1		Q4	Not Used	
C15	Capacitor, Fixed, Ceramic	CC10026-3	Q5	Transistor	2N2222
			Q6	Transistor	2N3796
C16	Capacitor, Electrolytic	CE10017-220-35-B	Q7	Transistor	2N4222
			Q8	Same as Q5	
C17	Capacitor, Fixed, Ceramic	CC100-29	Q9	Not Used	
			Q10 and Q11	Same as Q5	
CR1	Semiconductor Device, Diode	1N5246			
			Q12	Same as Q3	
CR2	Semiconductor Device, Diode	1N5232	Q13	Transistor	2N2907
CR3	Semiconductor Device, Diode	1N5240	Q14	Same as Q3	
			R1	Resistor, Variable Composition	RV124-1-103
CR4	Same as CR2				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MINOR LOOP PHASE DETECTOR A3A1 (Continued)					
R2	Resistor, Fixed, Composition	RC32GF470J	R15	Same as R5	
			R16	Same as R3	
R3	Resistor, Fixed, Composition	RC07GF103J	R17	Resistor, Fixed, Composition	RC07GF271J
R4	Resistor, Fixed, Composition	RC07GF102J	R18	Same as R6	
			R19	Same as R1	
R5	Resistor, Fixed, Composition	RC07GF101J	R20	Resistor, Fixed, Composition	RC32GF680J
R6	Resistor, Fixed, Composition	RC07GF150J	R21	Resistor, Fixed, Composition	RC20GF681J
R7	Same as R4		R22	Resistor, Fixed, Composition	RC32GF271J
R8	Resistor, Fixed, Composition	RC07GF622J			
			R23	Resistor, Fixed, Composition	RC07GF471J
R9	Same as R4				
R10	Same as R5		R24	Resistor, Fixed, Composition	RC07GF221J
R11	Same as R3				
R12	Same as R4		R25	Same as R23	
R13	Resistor, Fixed, Composition	RC07GF183J	R26	Resistor, Fixed, Composition	RC07GF470J
R14	Not Used		R27	Same as R3	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

MINOR LOOP PHASE DETECTOR A3A1 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
R28	Resistor, Fixed, Composition	RC07GF472J	R32	Resistor, Fixed, Composition	RC07GF104J
R29	Resistor, Fixed, Composition	RC07GF331J	R33	Same as R31	
R30	Same as R28		R34	Resistor, Fixed, Composition	RC07GF392J
R31	Resistor, Fixed, Composition	RC07GF333J			

MINOR LOOP DIVIDER A3A2

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
A1	Integrated Circuit	U6B950259X	A9	Same as A3	
			A10	Same as A5	
A2	Integrated Circuit	U6B95H9059X	A11	Integrated Circuit	U6A900259X
A3	Integrated Circuit	U6B931059X	A12	Same as A5	
A4	Integrated Circuit	U6A901659X	A13	Same as A3	
			A14	Integrated Circuit	U6A960159X
A5	Integrated Circuit	U6B930959X			
			A15	Integrated Circuit	U6A900159X
A6	Same as A3				
A7	Same as A5		C1	Capacitor, Fixed, Ceramic	CC100-14
A8	Same as A4				

MINOR LOOP DIVIDER A3A2 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C2	Capacitor, Solid Tantalum	CE10014-4.7-10
C3	Same as C2	
C4	Capacitor, Fixed, Ceramic	CC100-7
E1 thru E3	Terminal, Stud	TE127-2
Q1	Transistor	2N5711

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R1	Transistor, Fixed, Composition	RC07GF271J
R2	Resistor, Fixed, Composition	RC07GF121J
R3 and R4	Same as R1	
R5 thru R9	Resistor, Fixed, Composition	RC07GF103J

MINOR LOOP VCO A3A3

REF. SYMBOL	DESCRIPTION	TMC PART NO.
A1	Integrated Circuit	UGH7806393
A2	Integrated Circuit	UGB95H9095X
A3	Integrated Circuit	UGB950359X
A4	Integrated Circuit	UGB950459X
C1	Capacitor, Fixed, Electrolytic	CE10014-4.7-35
C2	Capacitor, Fixed, Ceramic	CC100-29

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C3	Capacitor, Fixed, Electrolytic	CC100-42
C5	Capacitor, Fixed, Mica	CM111E150J1S
C6 and C7	Same as C2	
C8	Same as C5	
C9 thru C11	Same as C2	
C12	Same as C1	
C13 thru C15	Same as C2	

MINOR LOOP VCO A3A3 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C16 and C17	Same as C3	
C18	Capacitor, Fixed, Mica	CM111E201J1S
C19	Capacitor, Fixed, Mica	CM111E221J5S
C20	Capacitor, Fixed, Ceramic	CC10017-X5V-103M
C21	Same as C3	
CR1	Semiconductor Device, Diode	MV2104
CR2	Same as CR1	
L1	Coil, LF, Fixed	CL10065-1
L2	Same as L1	
L3	Coil, RF, Fixed	CL275-2R2
L4	Coil, RF, Fixed	CL275-121
L5	Coil, RF Fixed	CL275-R22
L6	Coil, RF, Fixed	CL275-120
Q1	Transistor	MPS918
Q2	Transistor	2143866
R1	Resistor, Fixed, Composition	RC07GF122J
R2	Resistor, Fixed, Composition	RC07GF102J
R3 and R4	Same as R1	
R5	Resistor, Fixed, Composition	RC07GF2R7J
R6 thru R9	Resistor, Fixed, Composition	RC07GF272J
R10 and R11	Same as R2	
R12	Resistor, Fixed, Composition	RC07GF221J
R13 thru R15	Same as R2	
R16	Same as R12	
R17	Resistor, Fixed, Composition	RC07GF331J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		MINOR LOOP VCO A3A3 (Continued)			
R18	Resistor, Variable, Composition	RV124-1-501	R20	Resistor, Fixed, Composition	RC07GF820J
R19	Same as R2		R21	Resistor, Fixed, Composition	RC07GF131J
		CLOCK BUFFER A4A1			
C1	Capacitor, Fixed, Electrolytic	CE105-220-35	R1	Resistor, Fixed, Composition	RC07GF102J
C2	Capacitor, Fixed, Ceramic	CC10026-10	R2	Resistor, Fixed, Composition	RC07GF470J
E1 thru E5	Terminal, Stud	TE127-2	R3	Resistor, Fixed, Composition	RC07GF471J
Q1	Transistor	2N2222	R4	Resistor, Fixed, Composition	RC07GF103J
		MAJOR LOOP PHASE DETECTOR A6A1			
A1	Integrated Circuit	U6A900259X	A3	Integrated Circuit	U6A7710393
A2	Integrated Circuit	U6A960159X	C1	Capacitor, Solid Tantalum	CE10014-4.7-35

REF. SYMBOL	DESCRIPTION	TMC PART NO.
MAJOR LOOP PHASE DETECTOR A6A1 (Continued)		
C2	Same as C1	
C3	Capacitor, Fixed, Ceramic	CC10026-10
C4	Same as C1	
C5	Capacitor, Fixed, Ceramic	CC10026-1
C6	Capacitor, Fixed, Mica	CM111E221J5S
C7 and C8	Same as C1	
C9	Capacitor, Electrolytic	CE10017-100-25-B
C10 and C11	Same as C1	
C12	Capacitor, Solid Tantalum	CE10014-1-35
C13	Capacitor, Electrolytic	CE10017-100-16-B
C14	Same as C1	
CR1	Semiconductor Device, Diode	1N5246
CR2	Semiconductor Device, Diode	1N5232
CR3	Semiconductor Device, Diode	1N5240
CR4	Same as CR2	
CR5	Semiconductor Device, Diode	1N5242
E1 thru E6	Terminal, Stud	TE127-2
Q1	Transistor	2N3904
Q2	Transistor	2N1132A
Q3	Transistor	2N2219A
Q4	Transistor	2N2907
Q5	Transistor	2N2222
Q6	Transistor	2N3796
Q7	Transistor	2N4222
Q8	Same as Q5	
Q9	Same as Q4	
Q10 and Q11	Same as Q5	
Q12	Same as Q3	
Q13	Same as Q4	
Q14	Same as Q3	
Q15	Same as Q2	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		MAJOR LOOP PHASE DETECTOR A6A1 (Continued)			
R1	Resistor, Variable, Composition	RV124-1-102	R14	Resistor, Fixed, Composition	RC07GF822J
R2	Resistor, Fixed, Composition	RC32GF470J	R15	Same as R5	
			R16	Same as R3	
R3	Resistor, Fixed, Composition	RC07GF103J	R17	Resistor, Fixed, Composition	RC07GF301J
R4	Resistor, Fixed, Composition	RC07GF102J	R18	Resistor, Fixed, Composition	RC07GF4R7J
R5	Resistor, Fixed, Composition	RC07GF101J	R19	Resistor, Variable, Composition	RV124-1-103
R6	Resistor, Fixed, Composition	RC07GF150J	R20	Resistor, Fixed, Composition	RC32GF680J
R7	Same as R4		R21	Resistor, Fixed, Composition	RC20GF681J
R8	Resistor, Fixed, Composition	RC07GF622J	R22	Resistor, Fixed, Composition	RC40GF271J
R9	Same as R4				
R10	Same as R5		R23	Resistor, Fixed, Composition	RC07GF471J
R11	Same as R3				
R12	Same as R4		R24	Resistor, Fixed, Composition	RC07GF221J
R13	Same as R3				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MAJOR LOOP PHASE DETECTOR A6A1 (Continued)					
R25	Same as R23		R29	Resistor, Fixed, Composition	RC07GF331J
R26	Resistor, Fixed, Composition	RC07GF100J	R30	Same as R28	
R27	Same as R3		R31	Resistor, Fixed, Composition	RC07GF303J
R28	Resistor, Fixed, Composition	RC07GF472J	R32	Resistor, Fixed, Composition	RC07GF104J
MAJOR LOOP DIVIDER A6A2					
A1	Integrated Circuit	U6B950259X	A8	Same as A4	
A2	Integrated Circuit	U6B95H9059X	A9	Same as A6	
A3	Integrated Circuit	U6B952859X	A10 and A11	Same as A5	
A4	Integrated Circuit	U6A901659X	A12	Same as A6	
A5	Integrated Circuit	SN7410N	A13 and A14	Same as A7	
A6	Integrated Circuit	U6A900259X	C1	Capacitor, Solid Tantalum	CE10014-4.7-10
A7	Integrated Circuit	U6B931059X	C2	Capacitor, Fixed, Ceramic	CC100-14

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
MAJOR LOOP DIVIDER A6A2 (Continued)					
C3	Same as C1		R6 and R7	Resistor, Fixed, Composition	RC07GF102J
C4 and C5	Capacitor, Fixed, Ceramic	CC100-29	R8	Resistor, Fixed, Composition	RC07GF101J
E1 thru E9	Terminal, Stud	TE127-2	R9	Resistor, Fixed, Composition	RC07GF221J
R1	Resistor, Fixed, Composition	RC07GF271J	R10	Resistor, Fixed, Composition	RC07GF331J
R2	Resistor, Fixed, Composition	RC07GF121J	R11	Resistor, Fixed, Composition	RC07GF222J
R3	Not Used				
R4 and R5	Resistor, Fixed, Composition	RC07GF122J			
MAJOR LOOP VCO A6A3					
A1	Integrated Circuit	UGH7806393	C1	Capacitor, Solid Tantalum	CE10014-4.7-35
A2	Integrated Circuit	UGB930159X	C2	Capacitor, Electrolytic	CE10017-220-6-B
A3	Integrated Circuit	UGB950359X	C3	Capacitor, Fixed, Ceramic	CC10026-10
A4	Integrated Circuit	UGB950459X			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		MAJOR LOOP VCO (Continued)			
C4	Capacitor, Fixed, Ceramic	CC100-29	R2 thru R4	Resistor, Fixed, Composition	RC07GF271J
C5	Capacitor, Fixed, Ceramic	CC100-14	R5 thru R7	Resistor, Fixed, Composition	RC07GF241J
C6	Capacitor, Fixed, Mica	CM112E102J1S	R8	Resistor, Fixed, Composition	RC07GF102J
C7	Same as C4				
CR1	Semiconductor Device, Diode	MV2104	R9 thru R14	Resistor, Fixed, Composition	RC07GF272J
CR2 and CR3	Semiconductor Device, Diode	MV2105	R15	Resistor, Fixed, Composition	RC07GF820J
L1	Coil, Rf, Fixed	CL275-102	R16	Resistor, Fixed, Composition	RC07GF131J
L2	Coil, Rf, Fixed	CL275-103	R17 thru	Resistor, Fixed, Composition	RC07GF122J
R1	Resistor, Fixed, Composition	RC07GF2R7J			
		MAJOR LOOP AMPLIFIER A6A4			
A1 and A2	Amplifier, Wideband	TMC P/N	E1 thru E5	Terminal, Stud	TE127-2

40 MHz REFERENCE GENERATOR A7A1

REF. SYMBOL		TMC PART NO.
C1	Capacitor, Fixed, Ceramic	CC10026-3
C2	Capacitor, Solid Tantalum	CE10014-4.7-35
C3	Capacitor, Fixed, Mica	CM111E220J1S
C4	Same as C2	
C5 and C6	Capacitor, Variable, Ceramic	CV112-11
C7	Capacitor, Fixed, Ceramic	CC100-29
C8 and C9	Same as C1	
C10	Same as C2	
C11	Capacitor, Fixed, Mica	CM111E820J1S
C12	Capacitor, Fixed, Mica	CM111E431J1S
C13	Same as C7	
C14 thru C16	Same as C1	
C17	Same as C2	
C18	Same as C1	
C19	Capacitor, Variable, Ceramic	CV112-6
C20	Capacitor, Fixed, Mica	CM111E431J1S
C21 thru C23	Same as C7	
C24	Same as C19	
C26	Same as C19	
L1 thru L3	Coil, Rf, Fixed	CL275-101
Q1 thru Q6	Transistor, Motorola	MPS918
R1	Resistor, Fixed, Composition	RC07GF103J
R2	Resistor, Fixed, Composition	RC07GF222J
R3	Resistor, Fixed, Composition	RC07GF102J
R4	Resistor, Fixed, Composition	RC07GF101J
R5	Same as R1	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
40 MHz REFERENCE GENERATOR A7A1 (Continued)					
R6	Same as R4		R13	Resistor, Fixed, Composition	RC07GF332J
R7	Resistor, Fixed, Composition	RC07GF474J	R14	Same as R3	
R8	Resistor, Fixed, Composition	RC07GF561J	R15 and R16	Same as R1	
R9	Same as R4		R17	Same as R3	
R10	Resistor, Fixed, Composition	RC07GF153J	R18	Resistor, Fixed, Composition	RC07GF472J
R11	Resistor, Fixed, Composition	RC07GF100J	T1	Transformer, Rf	TZ1005-1
R12	Resistor, Fixed, Composition	RC07GF391J	T2	Transformer, Rf	TZ1005-2
			T3	Transformer, Rf	TZ222
OUT-OF-LOCK DETECTOR A7A2					
A1	Integrated Circuit	UGH7812393	C2	Capacitor, Fixed, Ceramic	CC100-14
A2	Integrated Circuit	UGA900259X	C3	Capacitor, Fixed, Ceramic	CC10026-10
C1	Capacitor, Solid Tantalum	CE10014-4.7-35	C4	Capacitor, Fixed, Electrolytic	CE105-220-25

OUT-OF-LOCK DETECTOR A7A2 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
CR1	Semiconductor Device, Diode	1N914B
E1	Terminal, Stud	TE127-2
Q1 and Q2	Transistor	2N2219A
R1	Resistor, Fixed, Composition	RC07GF472J
R2	Resistor, Fixed, Composition	RC07GF102J
R3	Resistor, Fixed, Composition	RC07GF222J
R4	Resistor, Fixed, Composition	RC07GF100J

TRANSLATOR A8

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C1	Capacitor, Fixed, Ceramic	CC100-29
C2	Capacitor, Fixed, Mica	CM111C180J5S
C3	Same as C1	
C4	Capacitor, Fixed, Ceramic	CC100-28
C5 thru C7	Same as C1	
C8	Same as C4	
C9	Same as C2	
C10	Capacitor, Fixed, Mica	CM111C220J5S
C11 thru C13	Same as C1	
C14	Same as C2	
C15	Capacitor, Fixed, Ceramic	CC100-33
C16 thru C37	Not Used	
C38	Capacitor, Fixed, Ceramic	CC100-30
C39	Capacitor, Fixed, Mica	CM111E510G5S
C40 and C41	Not Used	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
TRANSLATOR A8 (Continued)					
C42	Capacitor, Variable, Ceramic	CV112-4	C60	Capacitor, Variable, Ceramic	CV112-2
C43	Capacitor, Fixed, Mica	CM111E470G5S	C61 and C62	Same as C38	
C44	Same as C38		C63	Same as C10	
C45	Same as C39		C64	Capacitor, Fixed, Mica	CM111E680F5S
C46	Same as C38		C65	Capacitor, Fixed, Mica	CM111E330G5S
C47	Same as C43		C66	Capacitor, Fixed, Ceramic	CC100-40
C48	Same as C42		C67	Same as C15	
C49	Same as C38		C68	Capacitor, Fixed, Ceramic	CC100-11
C50	Same as C1		C69	Same as C66	
C51	Same as C39		C70	Capacitor, Fixed, Mica	CM111F101G5S
C52	Same as C38		C71	Same as C4	
C53	Same as C43		C72	Capacitor, Fixed, Mica	CM111F511G5S
C54	Same as C42		C73	Same as C70	
C55 and C56	Same as C38				
C57	Same as C39				
C58	Same as C38				
C59	Capacitor, Fixed, Mica	CM111E750J5S			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

TRANSLATOR A8 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
C74	Capacitor, Fixed, Mica	CM111F561F5S
C75	Capacitor, Fixed, Mica	CM111F361G5S
C76	Same as C75	
C77	Same as C4	
C78 thru C80	Same as C1	
C81	Capacitor, Fixed, Mica	CM111F131G5S
C82	Same as C1	
C83	Capacitor, Fixed, Mica	CM111F391F5S
C84	Same as C66	
C85	Capacitor, Fixed, Mica	CM111F751G5S
C86	Same as C83	
C87	Capacitor, Fixed, Mica	CM111F111J5S
C88	Capacitor, Fixed, Mica	CM111C050D5S
C89	Same as C87	
C90 and C91	Same as C1	
C92 and C93	Same as C87	
C94	Same as C88	
C95 and C96	Same as C1	
C97 and C98	Same as C87	
C99	Same as C88	
C100	Same as C87	
C101 thru C106	Same as C1	
C107 and C108	Same as C87	
C109	Same as C88	
C110 thru C113	Same as C1	
C114	Same as C87	
C115 and C116	Same as C1	
C117	Same as C38	
C118	Capacitor, Fixed, Electrolytic	CE105-10-25
C119	Same as C38	

REF. SYMBOL	DESCRIPTION	TMC PART NO.
	TRANSLATOR A8 (Continued)	
CR1 thru CR5	Not Used	
CR6 and CR7	Semiconductor Device, Diode	1N914
CR8 thru CR10	Semiconductor Device, Diode	1N4864
L1 thru L3	Coil, Rf, Fixed	CL275-8R2
L4 thru L9	Not Used	
L10 thru L13	Coil, Rf,	CL275-1R0
L14	Coil, Rf, Fixed	CL412-23
L15	Coil, Rf, Fixed	CL275-220
L16	Same as L10	
L17	Coil, Rf, Fixed	CL275-0R39
L18	Same as L10	
L19	Coil, Rf, Fixed	CL275-0R82
L20 thru L22	Coil, Rf,	CL275-121
L23	Coil, Rf, Fixed	CL412-24
L24	Coil, Rf, Fixed	CL412-25
L25 and L26	Same as L20	
L27 and L28	Same as L1	
L29 and L30	Same as L15	
L31 thru L34	Same as L20	
Q1 thru Q3	Transistor	2N3646
Q4 thru Q6	Not Used	
Q7 thru Q11	Transistor	2N5179
Q12 thru Q19	Same as Q1	
R1	Resistor, Fixed, Composition	RC07GF470J
R2	Resistor, Fixed, Composition	RC07GF473J
R3	Resistor, Fixed, Composition	RC07GF104J

REF. SYMBOL	DESCRIPTION	TMC PART NO.
TRANSLATOR A8 (Continued)		
R4	Resistor, Fixed, Composition	RC07GF104J
R5	Resistor, Fixed, Composition	RC07GF101J
R6	Same as R1	
R7	Resistor, Fixed, Composition	RC07GF102J
R8	Same as R2	
R9	Same as R4	
R10	Same as R3	
R11	Same as R5	
R12	Same as R1	
R13	Same as R7	
R14	Same as R2	
R15	Same as R4	
R16	Same as R3	
R17	Same as R5	
R18	Same as R7	
R19 thru R36	Not Used	
R37	Resistor, Fixed, Composition	RC07GF822J
R38	Same as R7	
R39	Same as R5	
R40	Not Used	
R41	Resistor, Fixed, Composition	RC07GF390J
R42	Resistor, Fixed, Composition	RC07GF561J
R43	Same as R7	
R44	Resistor, Fixed, Composition	RC07GF151J
R45	Same as R1	
R46	Resistor, Fixed, Composition	RC07GF682J
R47	Resistor, Fixed, Composition	RC07GF331J
R48	Resistor, Fixed, Composition	RC07GF562J
R49	Same as R7	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

TRANSLATOR A8 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R50	Same as R44	
R51	Resistor, Variable, Composition	RV124-1-501
R52	Resistor, Fixed, Composition	RC07GF221J
R53	Resistor, Fixed, Composition	RC07GF472J
R54	Same as R7	
R55	Same as R44	
R56	Same as R41	
R57	Resistor, Fixed, Composition	RC07GF121J
R58	Same as R1	
R59	Same as R5	
R60	Resistor, Fixed, Composition	RC07GF332J
R61	Same as R37	
R62	Same as R44	
R63	Resistor, Fixed, Composition	RC07GF8R2J
R64 and R65	Same as R1	
R66	Same as R2	
R67	Same as R3	
R68	Same as R52	
R69	Same as R5	
R70	Not Used	
R71	Same as R51	
R72	Same as R57	
R73	Same as R52	
R74	Resistor, Fixed, Composition	RC07GF471J
R75	Same as R52	
R76	Resistor, Fixed, Composition	RC07GF223J
R77	Same as R7	
R78	Resistor, Fixed, Composition	RC07GF273J
R79	Resistor, Fixed, Composition	RC07GF220J

TRANSLATOR A8 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R80	Same as R3	
R81	Same as R1	
R82	Same as R7	
R83	Same as R74	
R84	Same as R76	
R85	Resistor, Fixed, Composition	RC07GF563J
R86	Resistor, Fixed, Composition	RC07GF103J
R87	Same as R2	
R88	Same as R1	
R89	Resistor, Fixed, Composition	RC07GF821J
R90	Resistor, Fixed, Composition	RC07GF683J
R91	Resistor, Fixed, Composition	RC07GF824J
R92	Resistor, Fixed, Composition	RC07GF334J
R93	Resistor, Fixed, Composition	RC07GF224J
I	Same as R74	
R95	Same as R86	
R96	Same as R53	
R97	Resistor, Variable, Composition	RV124-1-202
R98	Same as R76	
R99	Same as R3	
R100	Same as R79	
R101	Same as R78	
R102	Same as R7	
R103	Same as R1	
R104	Same as R74	
R105	Same as R76	
R106	Same as R85	
R107	Same as R86	
R108	Same as R2	
R109	Resistor, Variable Composition	RV124-1-101

REF. SYMBOL	DESCRIPTION	TMC PART NO.
	TRANSLATOR A8 (Continued)	
R110	Same as R89	
R111	Same as R90	
R112 and R113	Same as R1	
R114	Same as R57	
R115 thru R118	Not Used	
R119	Same as R52	
R120	Resistor, Fixed, Composition	RC07GF820J
T1 thru T3	Transformer, Rf, Adjustable	TT285-10
T4 thru T7	Not Used	
T8 thru T10	Transformer, Rf, Fixed	TZ215-1
T11	Transformer, Rf, Fixed	TZ220
T12	Transformer, Rf, Adjustable	TT285-4
T13	Transformer, Rf, Adjustable	TT285-2
T14	Transformer, Pulse	TF0228U13
T15 thru T23	Same as T13	
TP1 thru TP9	Terminal, Lug	TE0127-2
	FREQUENCY SHIFT GENERATOR A9	
C1	Capacitor, Fixed, Ceramic	CC100-28
C2 and C3	Capacitor, Fixed, Ceramic	CC100-41
C4	Same as C1	
C5	Same as C2	
C6	Capacitor, Fixed, Mica	CM111F361G5S
C7 thru C11	Same as C2	
C12	Same as C6	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
FREQUENCY SHIFT GENERATOR A9 (Continued)					
C13	Same as C2		CR3 thru CR7	Semiconductor Device, Diode	1N627
C14	Capacitor, Fixed, Ceramic	CC100-29	CR8 and CR9	Semiconductor Device, Diode	1N914
C15	Capacitor, Fixed, Mica	CM111F331G5S	CR10 thru CR13	Semiconductor Device, Diode	1N34A
C16 and C17	Same as C14		CR14	Semiconductor Device, Diode	1N754A
C18	Same as C1		FL1	Filter, BP	VX268
C19 thru C21	Same as C2		L1	Not Used	
C22	Capacitor, Fixed, Ceramic	CC100-40	L2	Coil, Rf, Fixed	CL275-102
C23 thru C26	Same as C2		L3	Coil, Rf, Fixed	CL275-221
C27	Capacitor, Fixed, Ceramic	CC100-33	L4 and L5	Coil, Rf, Fixed	CL275-101
C28 thru C30	Same as C22		Q1 thru Q4	Transistor	2N3646
C31	Same as C2		Q5	Transistor	2N696
C32	Same as C1		Q6 and Q7	Transistor	2N1711
C33	Same as C2		Q8 thru Q11	Same as Q5	
CR1 and CR2	Semiconductor Device, Diode	1N755A	Q12 and Q13	Same as Q1	

REF. SYMBOL	DESCRIPTION	TMC PART NO.
FREQUENCY SHIFT GENERATOR A9 (Continued)		
R1	Resistor, Fixed, Composition	RC07GF223J
R2	Resistor, Fixed, Composition	RC07GF333J
R3	Resistor, Fixed, Composition	RC07GF330J
R4	Resistor, Fixed, Composition	RC07GF561J
R5	Resistor, Fixed, Composition	RC07GF331J
R6 and R7	Not Used	
R8	Resistor, Fixed, Composition	RC07GF102J
R9 and R10	Not Used	
R11	Resistor, Fixed, Composition	RC07GF153J
R12	Resistor, Fixed, Composition	RC07GF182J
R13	Resistor, Fixed, Composition	RC07GF471J
R14	Resistor, Fixed, Composition	RC07GF101J
R15	Not Used	
R16	Resistor, Fixed, Composition	RC07GF152J
R17	Same as R11	
R18	Same as R1	
R19	Same as R13	
R20	Same as R14	
R21	Same as R8	
R22	Resistor, Fixed, Composition	RC07GF221J
R23	Resistor, Fixed, Composition	RC07GF104J
R24	Resistor, Fixed, Composition	RC07GF103J
R25	Resistor, Variable, WW-1W	RV119-3-102A

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
FREQUENCY SHIFT GENERATOR A9 (Continued)					
R26	Same as R24		R46	Same as R1	
R27	Resistor, Variable, WW-1W	RV119-3-103A	R47	Same as R24	
R28	Same as R24		R48	Resistor, Fixed, Composition	RC07GF472J
R29 thru R32	Resistor, Fixed, Composition	RC07GF473J	R49	Same as R8	
R33	Not Used		R50	Same as R1	
R34	Resistor, Fixed, Composition	RC07GF682J	R51	Same as R24	
R35	Same as R25		R52 and R53	Same as R1	
R36 and R37	Same as R27		R54	Same as R13	
R38	Same as R29		R55	Same as R48	
R39	Same as R5		R56	Resistor, Variable, Composition	RV124-1-253
R40	Same as R8		R57	Resistor, Fixed, Composition	RC07GF332J
R41 and R42	Resistor, Fixed, Composition	RC07GF222J	R58	Resistor, Variable, Composition	RV124-1-101
R43	Same as R8		R59	Not Used	
R44	Same as R16		R60	Same as R8	
R45	Same as R13		T1 and T2	Transformer, Rf, Adjustable	RTT285-16

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		FREQUENCY SHIFT GENERATOR A9 (Continued)			
TP3	Not Used		Z1	Frequency Divider	NW137
TP4 thru TP8	Same as TP1		Z2	Balanced Mixer	NW163
		CARRIER GENERATOR A10			
C1	Capacitor, Fixed, Ceramic	CC100-41	C17 and C18	Capacitor, Fixed, Electrolytic	CE105-10-25
C2	Capacitor, Fixed, Ceramic	CC100-28	C19 and C20	Capacitor, Fixed, Electrolytic	CE105-2-50
C3 and C4	Same as C1		C21	Same as C1	
C5	Capacitor, Fixed, Mica	CM112F392F5S	C22	Capacitor, Fixed, Mica	CM111F361F5S
C6 thru C8	Same as C2		C23 thru C26	Same as C1	
C9	Same as C5		C27	Capacitor, Fixed, Ceramic	CC100-29
C10 thru C12	Same as C2		C28	Same as C1	
C13	Capacitor, Fixed, Electrolytic	CE105-2-25	C29	Same as C22	
C14	Same as C1		C30	Same as C1	
C15 and C16	Same as C2		C31	Not Used	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
CARRIER GENERATOR A10 (Continued)					
C32 and C33	Capacitor, Fixed, Electrolytic	CE105-125-15	C52	Same as C1	
C34	Same as C1		C53 and C54	Same as C2	
C35 and C36	Same as C32		CR1	Semiconductor Device, Diode	1N746A
C37 and C38	Same as C2		CR2	Semiconductor Device, Diode	1N34A
C39	Same as C5		FL1	Filter, BP	VX267
C40 and C41	Same as C2		L1	Coil, Rf, Fixed	CL275-102
C42	Same as C27		L2	Coil, Rf, Fixed	CL275-221
C43	Same as C1		L3	Same as L1	
C44 and C45	Capacitor, Fixed, Ceramic	CC100-33	L4	Same as L2	
			L5	Same as L1	
C46 and C47	Capacitor, Fixed, Ceramic	CC100-40	Q1 thru Q14	Transistor	2N3646
C48 and C49	Same as C2		R1	Resistor, Fixed, Composition	RC07GF103J
C50	Capacitor, Fixed, Electrolytic	CE105-25-25	R2	Resistor, Fixed, Composition	RC07GF273J
C51	Capacitor, Fixed, Electrolytic	CE105-175-15	R3 and R4	Resistor, Fixed, Composition	RC07GF102J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
CARRIER GENERATOR A10 (Continued)					
R5	Resistor, Fixed, Composition	RC20GF181J	R20	Resistor, Variable, Composition	RV124-1-101
R6 and R7	Resistor, Fixed, Composition	RC07GF471J	R21	Same as R6	
			R22 and R23	Same as R3	
R8	Resistor, Fixed, Composition	RC07GF333J	R24	Same as R2	
			R25	Same as R1	
R9	Same as R1		R26	Same as R3	
R10	Same as R3		R27	Resistor, Variable, Composition	RV124-1-102
R11	Resistor, Fixed, Composition	RC07GF101J	R28	Resistor, Fixed, Composition	RC07GF223J
R12	Same as R3				
R13	Same as R11		R29	Resistor, Fixed, Composition	RC07GF682J
R14	Same as R8				
R15	Same as R1		R30	Resistor, Fixed, Composition	RC07GF332J
R16	Same as R3				
R17	Same as R11		R31	Same as R11	
R18	Same as R3		R32	Resistor, Fixed, Composition	RC07GF122J
R19	Resistor, Fixed, Composition	RC07GF152J			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.

CARRIER GENERATOR A10 (Continued)

REF. SYMBOL	DESCRIPTION	TMC PART NO.
R33	Resistor, Fixed, Composition	RC07GF472J
R34 and R35	Same as R1	
R36	Same as R11	
R37	Same as R3	
R38	Same as R8	
R39	Same as R33	
R40	Resistor, Fixed, Composition	RC07GF470J
R41	Same as R33	
R42	Same as R28	
R43	Same as R1	
R44 and R45	Same as R3	
R46	Same as R33	
R47	Resistor, Variable, Composition	RV124-1-502
R48	Same as R8	
R49	Same as R32	
R50	Same as R33	
R51	Resistor, Fixed, Composition	RC07GF331J
R52	Same as R3	
R53	Resistor, Fixed, Composition	RC07GF182J
R54	Same as R33	
R55	Same as R1	
R56	Same as R30	
R57	Same as R19	
R58	Same as R33	
R59	Resistor, Fixed, Composition	RC07GF390J
R60	Same as R33	
R61	Same as R40	
R62	Same as R30	
R63	Resistor, Fixed, Composition	RC07GF271J
R64	Resistor, Fixed, Composition	RC07GF102J
R65	Same as R3	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		CARRIER GENERATOR A10 (Continued)			
R66	Same as R1		T1	Transformer, Rf, Adjustable	TT285-12
R67	Same as R11				
R68	Resistor, Fixed, Composition	RC07GF123J	T2	Transformer, Rf, Adjustable	TT285-11
R69	Resistor, Variable, Composition	RV124-1-501	T3	Transformer, Rf, Adjustable	TT285-22
R70	Resistor, Fixed, Composition	RC07GF822J	T4	Transformer, Rf, Adjustable	TT285-23
R71	Same as R19		T5	Transformer, Rf, Adjustable	TT285-15
R72	Same as R3				
R73	Same as R51		T6	Transformer, Audio	TF420
R74	Same as R6				
R75	Same as R19		TP1 thru TP7	Terminal, Stud	TE0127-2
R76	Same as R30		Z1 and Z2	Frequency Divider	NW136
		SIDEBAND GENERATOR A11			
C1	Capacitor, Fixed, Ceramic	CC100-28	C3	Same as C1	
			C4	Capacitor, Fixed, Mica	CM111C220J5S
C2	Capacitor, Fixed, Electrolytic	CE105-75-15			

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
SIDEBAND GENERATOR A11 (Continued)					
C5 and C6	Capacitor, Fixed, Electrolytic	CE105-10-25	C35	Same as C1	
			C36	Same as C5	
C7	Capacitor, Fixed, Ceramic	CC100-41	C37	Same as C7	
			C38	Same as C1	
C8	Capacitor, Fixed, Electrolytic	CE105-2-50	C39	Same as C7	
			C40	Same as C21	
C9	Same as C5		C41 thru C48	Same as C1	
C10	Same as C7				
C11	Same as C8		C49	Capacitor, Fixed, Electrolytic	CE105-50-50
C12 thru C15	Same as C5		C50 and C51	Capacitor, Fixed, Mica	CM111F151F5S
C16	Same as C1				
C17	Same as C5		C52 and C53	Capacitor, Variable, Ceramic	CV112-5
C18	Same as C7				
C19	Same as C1		C54 and C55	Capacitor, Fixed, Ceramic	CC100-42
C20	Same as C7				
C21	Capacitor, Fixed, Mica	CM112F393F5S	CR1 thru CR8	Semiconductor Device, Diode	1N541
C22 thru C32	Same as C1		L1	Coil, Rf, Fixed	CL275-102
C33 and C34	Same as C5		L2	Coil, Rf, Fixed	CL275-221

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
		SIDEBAND GENERATOR A11 (Continued)			
L3 and L4	Coil, Rf, Fixed	CL275-332	R10	Resistor, Fixed, Composition	RC07GF223J
Q1 thru Q13	Transistor	2N3646	R11	Same as R3	
R1	Resistor, Fixed, Composition	RC07GF221J	R12	Resistor, Fixed, Composition	RC07GF152J
R2	Resistor, Fixed, Composition	RC07GF473J	R13	Resistor, Fixed, Composition	RC07GF101J
R3	Resistor, Fixed, Composition	RC07GF103J	R14	Resistor, Fixed, Composition	RC07GF471J
R4	Resistor, Fixed, Composition	RC07GF563J	R15	Same as R10	
			R16	Same as R3	
R5	Resistor, Fixed, Composition	RC07GF104J	R17	Same as R12	
			R18	Same as R13	
R6	Same as R4		R19	Same as R14	
R7	Resistor, Fixed, Composition	RC07GF474J	R20	Same as R2	
			R21	Resistor, Fixed, Composition	RC07GF153J
R8	Same as R3				
R9	Resistor, Variable, Composition	RV124-1-103	R22	Resistor, Fixed, Composition	RC07GF102J

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
SIDEBAND GENERATOR A11 (Continued)					
R23	Resistor, Fixed, Composition	RC07GF333J	R40	Same as R3	
			R41	Same as R22	
R24	Same as R21		R42	Same as R3	
R25 and R26	Same as R22		R43	Resistor, Fixed, Composition	RC07GF273J
R27	Same as R14		R44 and R45	Same as R22	
R28	Resistor, Variable, Composition	RV124-1-101	R46	Same as R43	
R29	Same as R14		R47	Same as R3	
R30	Same as R22		R48	Same as R22	
R31	Same as R23		R49	Same as R23	
R32	Same as R3		R50	Same as R21	
R33	Same as R22		R51 and R52	Same as R22	
R34	Same as R28		R53	Same as R14	
R35	Same as R14		R54	Same as R28	
R36	Same as R22		R55	Same as R14	
R37	Same as R14		R56	Same as R22	
R38	Same as R3		R57	Same as R23	
R39	Resistor, Fixed, Composition	RC07GF122J	R58	Same as R3	

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
SIDEBAND GENERATOR A11 (Continued)					
R59	Same as R22		R68 and R69	Same as R39	
R60	Same as R28		R70	Same as R22	
R61	Same as R14		R71 and R72	Same as R13	
R62	Same as R22		T1 and T2	Transformer, Rf, Adjustable	TT285-11
R63	Same as R39		T3 and T4	Transformer, Audio	TF359
R64	Same as R14		TP1 thru TP10	Terminal,	TE127-2
R65 and R66	Same as R3				
R67	Same as R22				
RF ADJUST A14					
C1	Capacitor, Fixed, Ceramic	CC100-28	L1 thru L3	Coil, Rf, Fixed	CL275-121
C2	Capacitor, Fixed, Ceramic	CC100-42	R1	Resistor, Fixed, WW	RR136
C3	Same as C1		R2 and R3	Resistor, Fixed, Composition	RC07GF122J
C4 thru C7	Same as C2		R4	Same as R1	
K1	Relay, Armature	RL156-1			

POWER SUPPLY A19A1

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
A1 and A2	Integrated Circuit	UGA7723393	R5	Resistor, Fixed, Composition	RC20GF911J
C1	Capacitor, Fixed, Mica	CM111E102J1S	R6 thru R8	Resistor, Fixed, Composition	RC32GF1R0J
C2	Capacitor, Fixed, Mica	CM111F511J3S	R9	Resistor, Fixed, Composition	RC07GF182J
CR1	Diode, Zener	1N5242	R11 thru R14	Same as R6	
R1	Resistor, Fixed, Composition	RC07GF751J	R15	Same as R9	
R2	Resistor, Variable, Composition	RV124-2-501	R16	Resistor, Variable, Composition	RV124-2-501
R3	Resistor, Fixed, Composition	RC07GF222J	R17	Resistor, Fixed, Composition	RC07GF682J
R4	Resistor, Fixed, Composition	RC07GF560J			

REFERENCE GENERATOR A23

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
A1	Integrated Circuit	U6A930559X	C1 and C2	Capacitor, Fixed, Ceramic	CC100-16
A2	Integrated Circuit	U6A901659X	C3 thru C6	Capacitor, Solid Tantalum	CE10014-4.7-10
A3 and A4	Same as A1				

REF. SYMBOL	DESCRIPTION	TMC PART NO.	REF. SYMBOL	DESCRIPTION	TMC PART NO.
REFERENCE GENERATOR A23 (Continued)					
C7 and C8	Capacitor, Electrolytic	CE10017-220-358	R2 and R3	Resistor, Fixed, Composition	RC07GF104J
E1 thru E10	Terminal, Stud	TE127-2	R4	Resistor, Fixed, Composition	RC07GF222J
Q1 and Q2	Transistor	MPS918	R5	Resistor, Fixed, Composition	RC07GF392J
R1	Resistor, Fixed, Composition	RC07GF472J			

SECTION 7

DIAGRAMS

7-1. GENERAL.

7-2. This section contains the schematic and component location diagrams of the MMX(M)-3. The overall wiring diagram of the unit is first presented, followed by the schematic, interconnection, and component location diagrams of the assemblies. The diagrams are arranged in reference designation order.

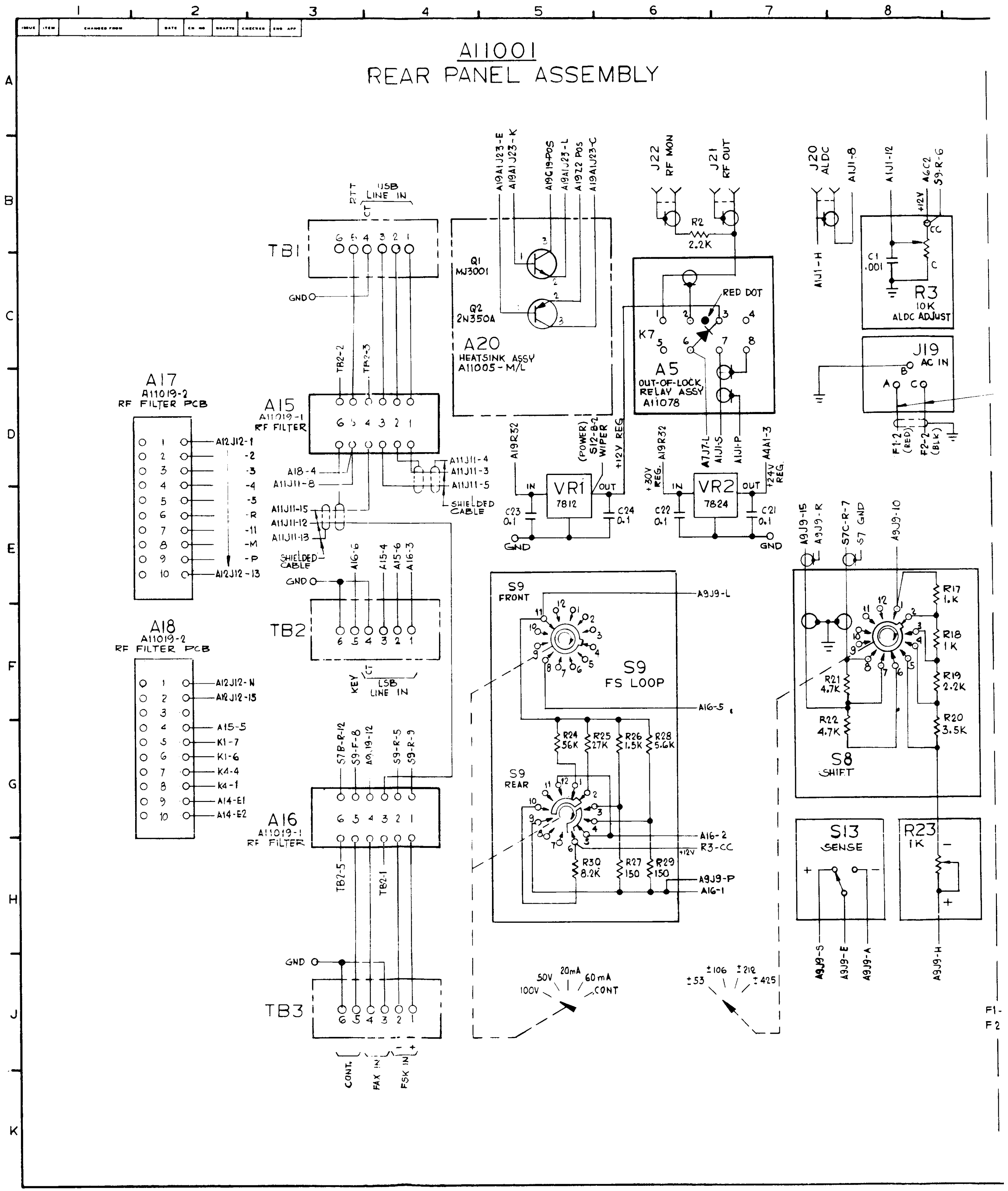

Figure 7-1. Multi-Mode Exciter MMX(M)-3, Overall Wiring Diagram (Sheet 1 of 3)

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SK10400-A

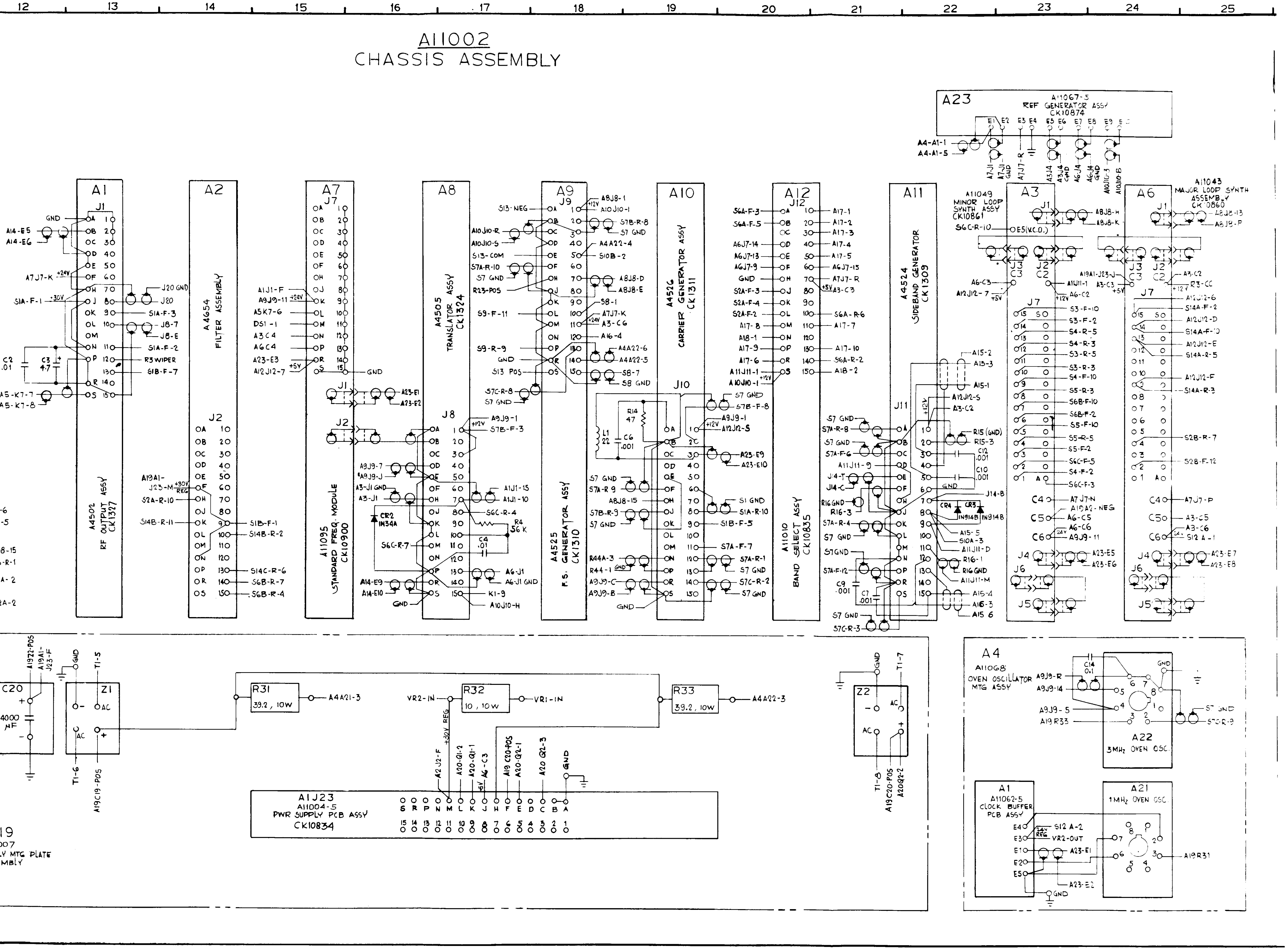
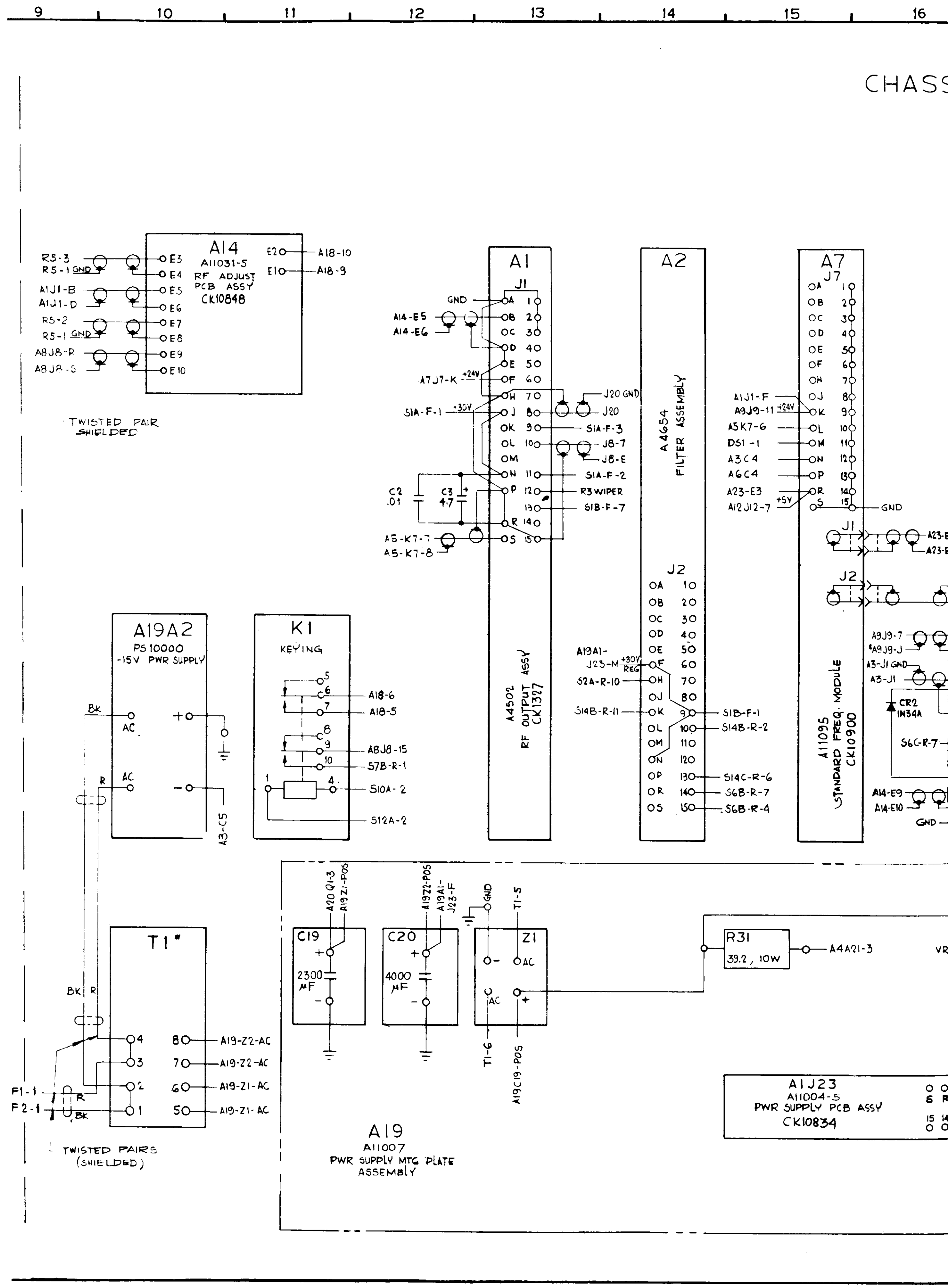


Figure 7-1. Multi-Mode Exciter MMX(M)-3, Overall Wiring Diagram (Sheet 2 of 3)



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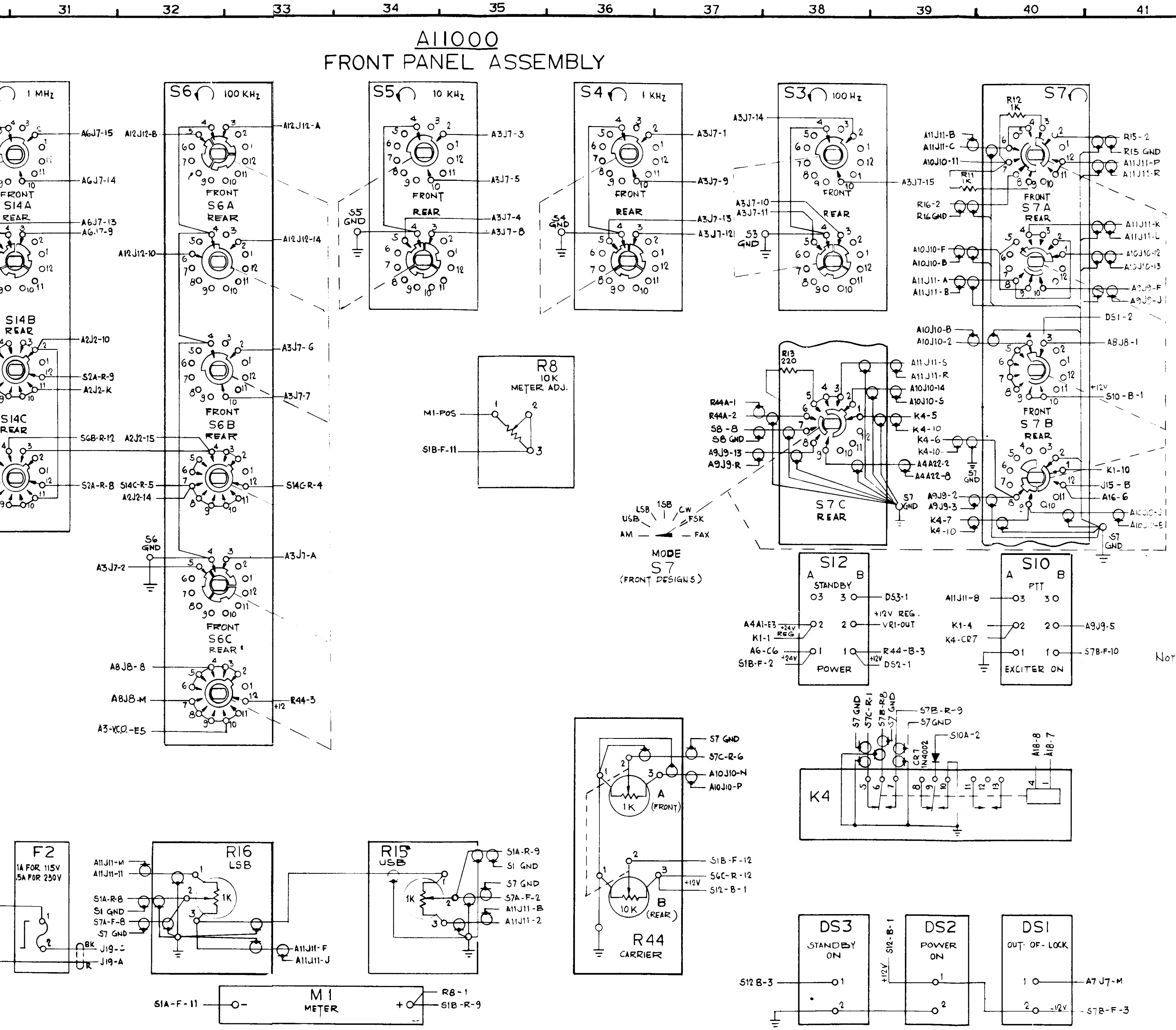
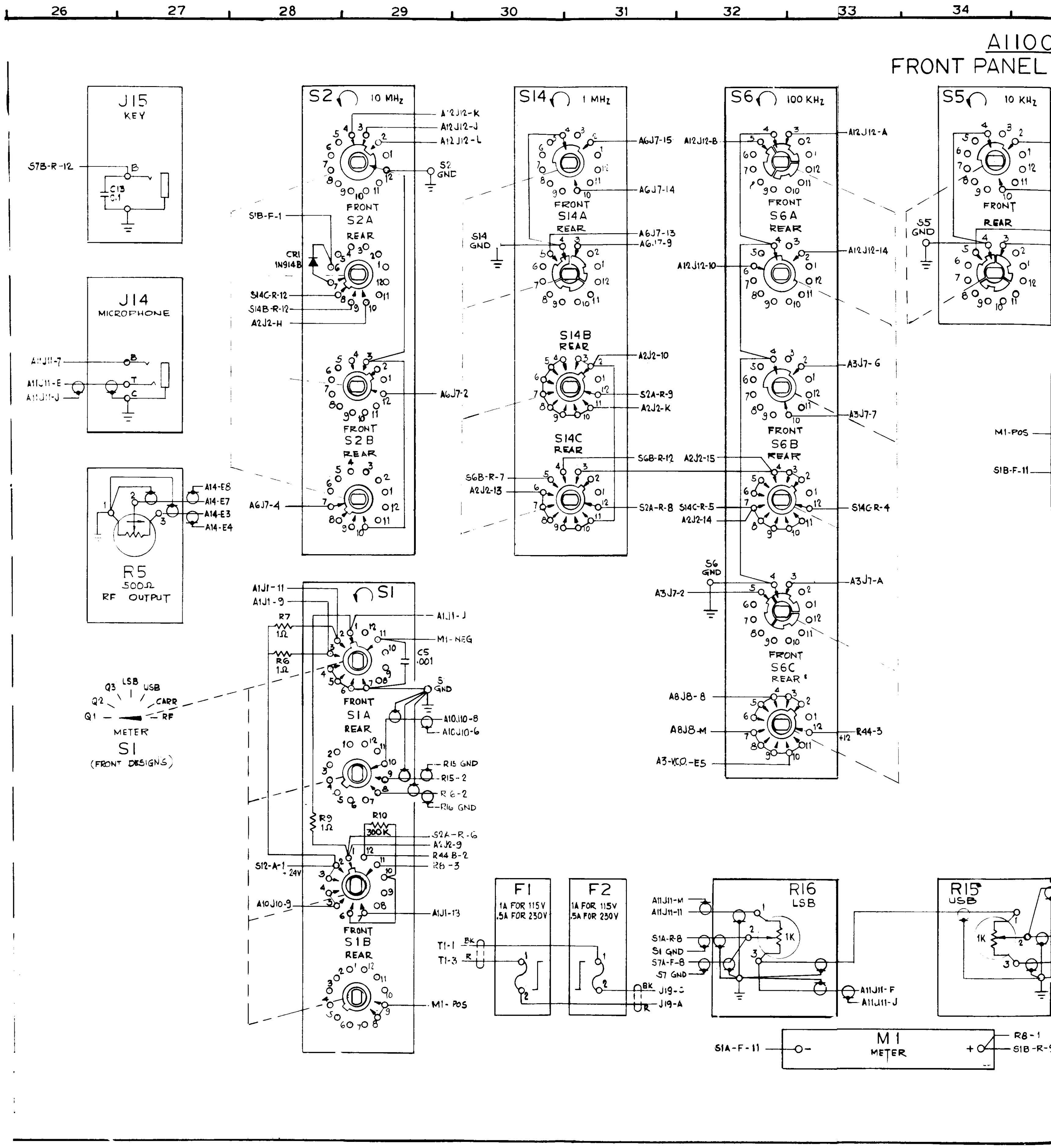


DESIGNATION	LOCATION	DESIGNATION	LOCATION
A1	B13	K1	F11
A2	B14	K4	[illegible]
A3	B23	M1	K33
A4 A1	J23	R3	C8
A4 A2	J24	R5	E27
A4 A2	H24	R8	D36
A5	D6	R15	H34
A6	B24	R16	H33
A7	B15	R23	G8
A8	B17	R44A	[illegible]
A9	B18	R44B	[illegible]
A10	B19	S1A (F & R)	G29
A11	B22	S1B (F & R)	J29
A12	B20	S2A (F & R)	B29
A14	B11	S2B (F & R)	D29
A15	D3	S3 (F & R)	A38
A16	G3	S4 (F & R)	A36
A17	D2	S5 (F & R)	A34
A18	F2	S6A (F & R)	[illegible]
A19 A1	J15	S6B (F & R)	[illegible]
A19 A2	F10	S6C (F & R)	[illegible]
A19 C19	H11	S7A (F & R)	B40
A19 C20	H12	S7B (F & R)	D40
A19 R31	H14	S7C (R)	E33
A19 R32	H17	S8	F8
A19 R33	H19	S9 (F)	F5
A19 Z1	H13	S9 (R)	G5
A19 Z2	H21	S10 (A & B)	F40
A20 Q1	C4	S12 (A & B)	F38
A20 Q2	C4	S13	G8
A23	B22	S14A (F & R)	B30
DS1	J40	S14B (R)	D30
DS2	J39	S14C (R)	E30
DS3	J38	T1	H10
F1	H30	TB1	C3
F2	H31	TB2	F3
J14	C27	TB3	J3
J15	A27	VR1	E5
J19	C8	VR2	E6
J20	B7		
J21	B7		
J22	B6		

NOTES:~

1. COMPONENTS [illegible] ARE VIEWED FROM THE REAR & [illegible] OF THE UNIT.
2. SWITCHES S2-S7 & S14 ARE [illegible] IN ZERO POSITION.
3. SWITCH DESIGNATION [illegible] MEANS: FRONT MTG PANEL; S6A S6B S6C; F-(FRONT); R-(REAR)

Figure 7-1. Multi-Mode Exciter MMX(M)-3, Overall Wiring Diagram (Sheet 3 of 3)



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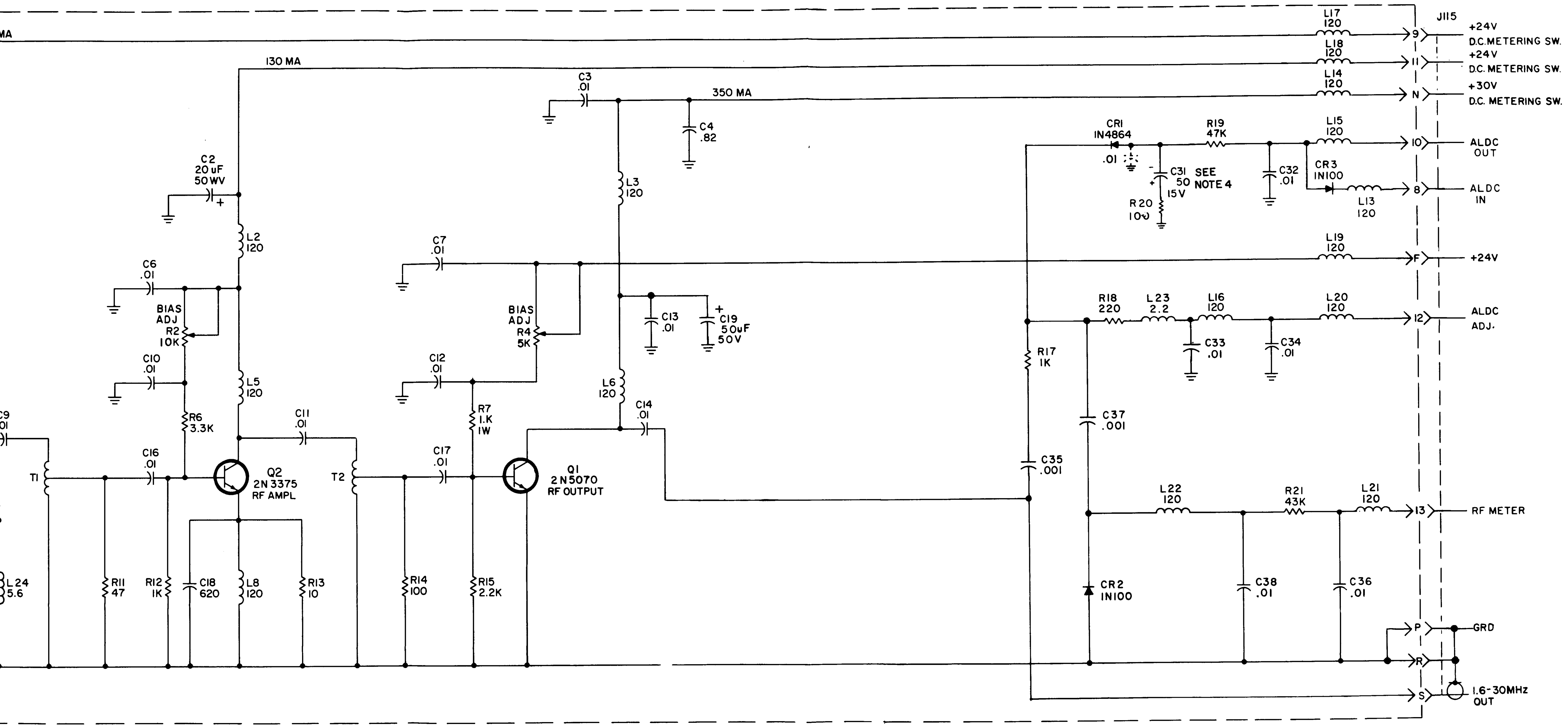

SYMBOL SERIES 1700	
LAST SYMBOL	MISSING SYMBOL
C39	C21 THRU C30
CR3	
L24	L9 THRU L12
Q3	
R21	R16, R10
T2	

E SPECIFIED
ALUES ARE IN OHMS, 1/2W.
CITANCE VALUES (.001) ARE IN MICROFARADS.
ER CAPACITANCE VALUES (47) ARE IN PICOFARADS.
ALUES ARE IN MICROHENRIES.
31 REPLACED BY .01 TO GND WHEN EXCITER IS USED

Figure 7-2. RF Output A1, Schematic Diagram

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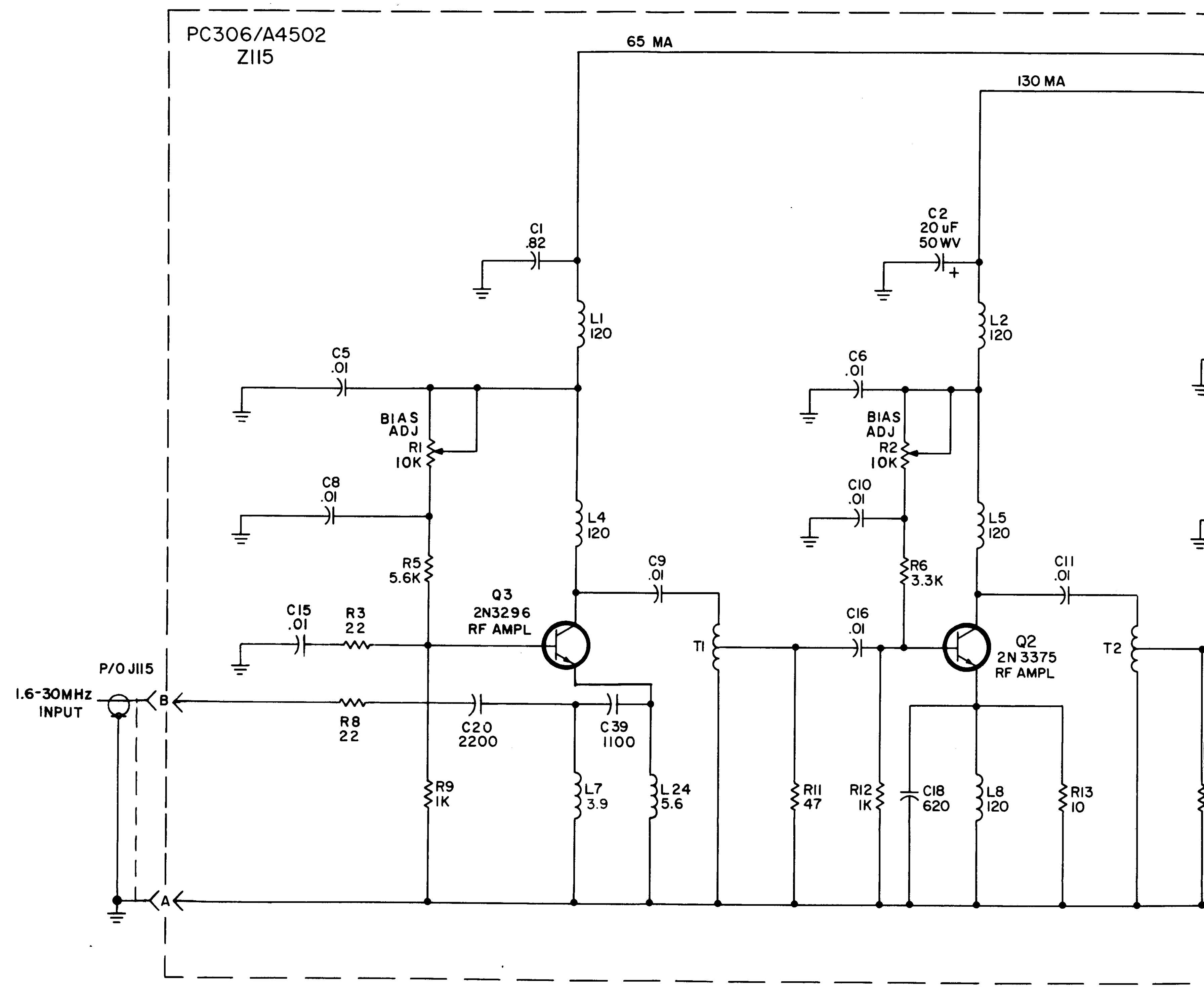

NOTES:
UNLESS OTHERWISE SPECIFIED
1- ALL RESISTANCE VALUES ARE IN OHMS, 1/2 W.
2- ALL DECIMAL CAPACITANCE VALUES (.001) ARE IN MICROFARADS.
ALL WHOLE NUMBER CAPACITANCE VALUES (47) ARE IN PICOFARADS.
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4- R20 DELETED & C31 REPLACED BY .01 TO GND WHEN EXCITER IS USED WITH HFLA-1K

SYMB
LAST SYMB
C39
CR3
L24
Q3
R21
T2

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CK1327-J

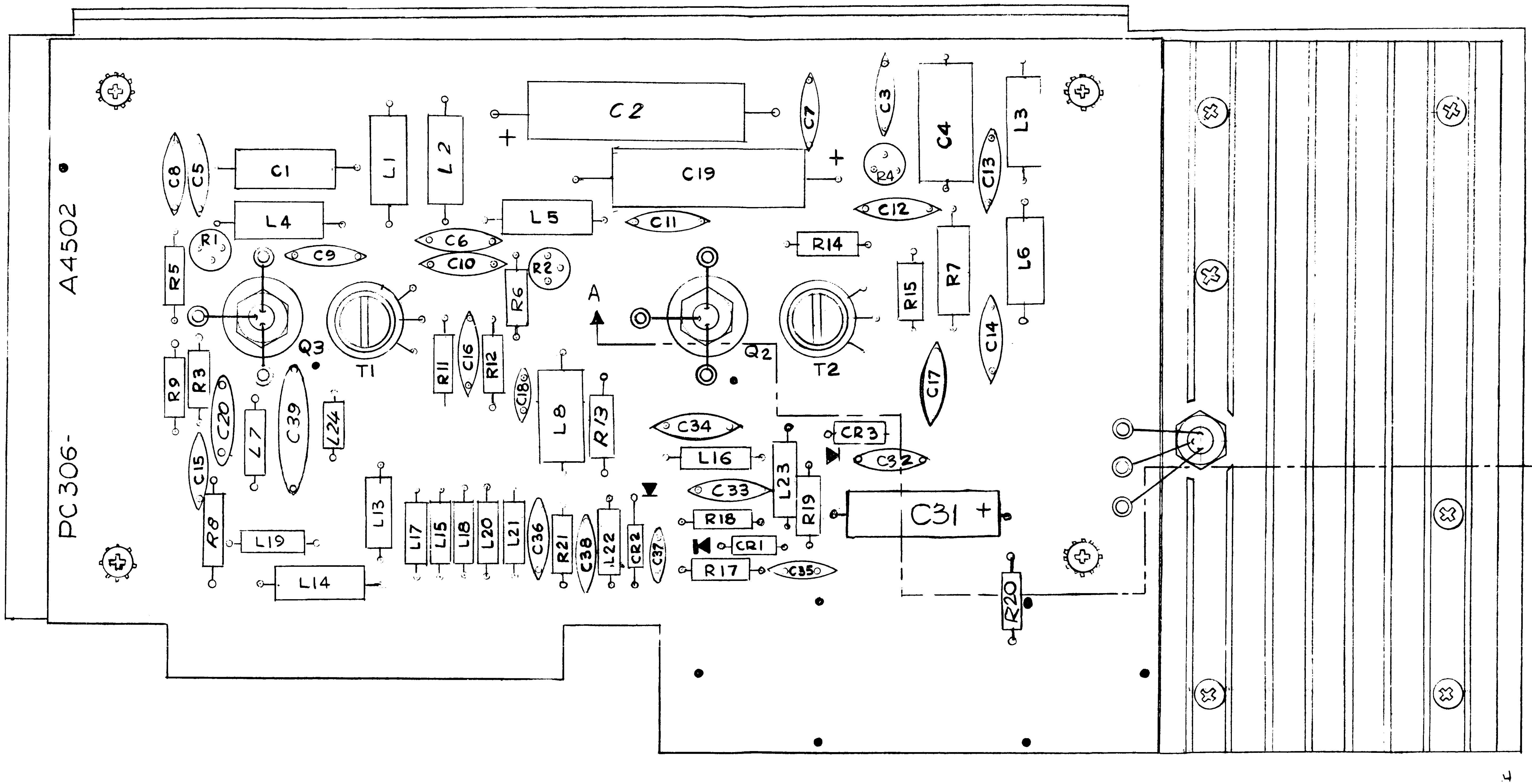

Figure 7-3. RF Output A1,
Component Location

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A4502-E

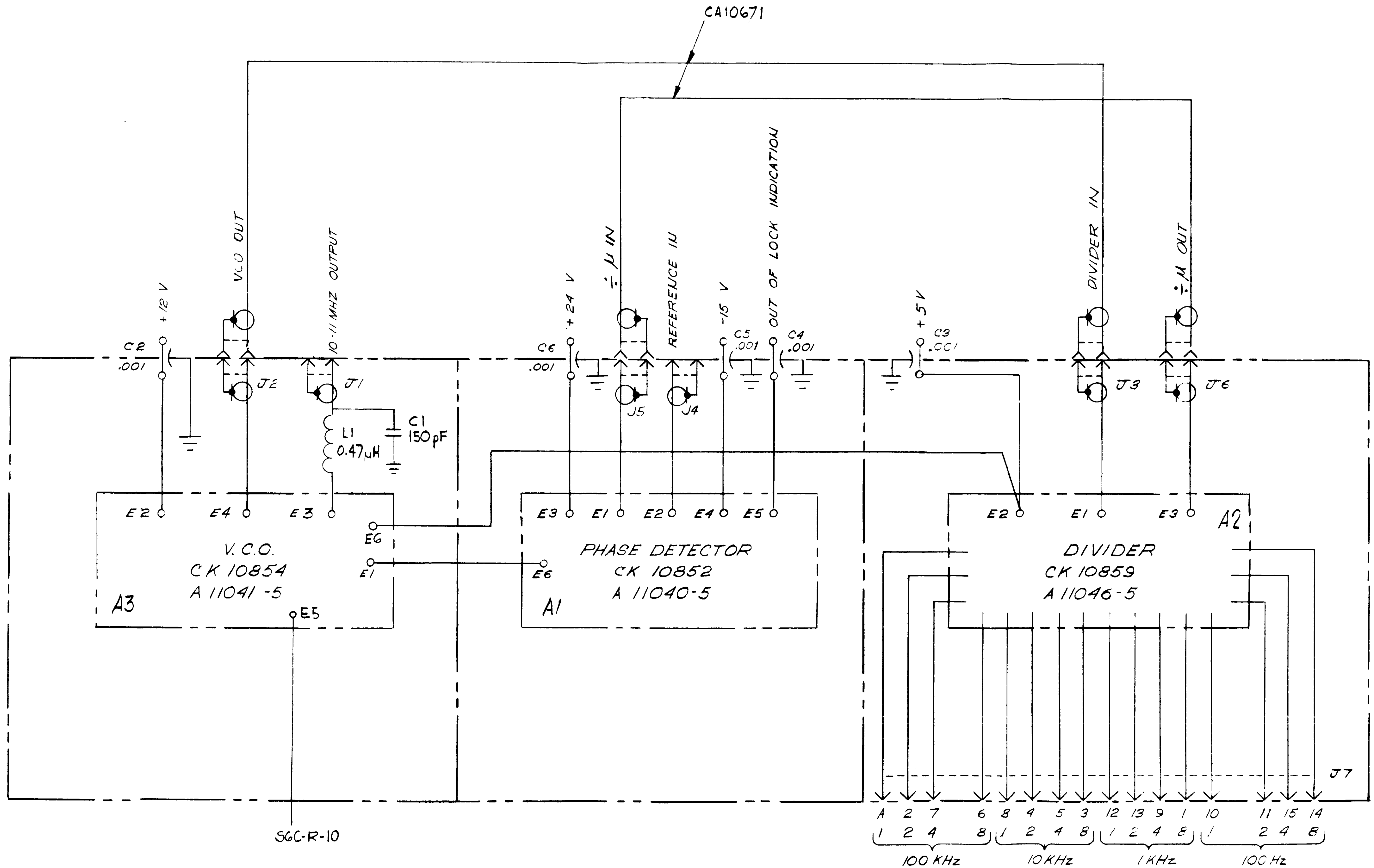

Figure 7-4. Minor Loop Synthesizer A3, Interconnection Diagram

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CK10861-B

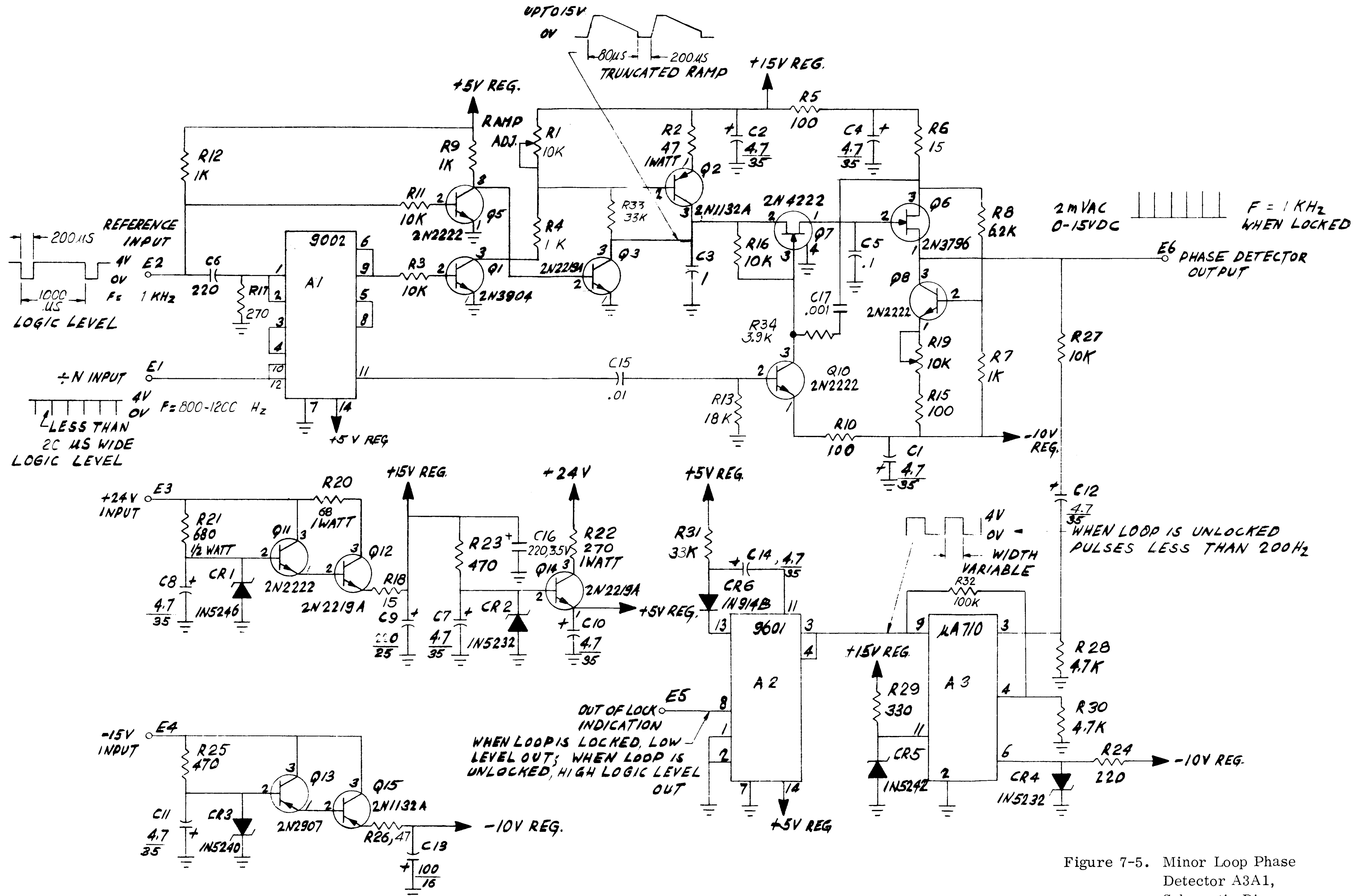

Figure 7-5. Minor Loop Phase Detector A3A1, Schematic Diagram

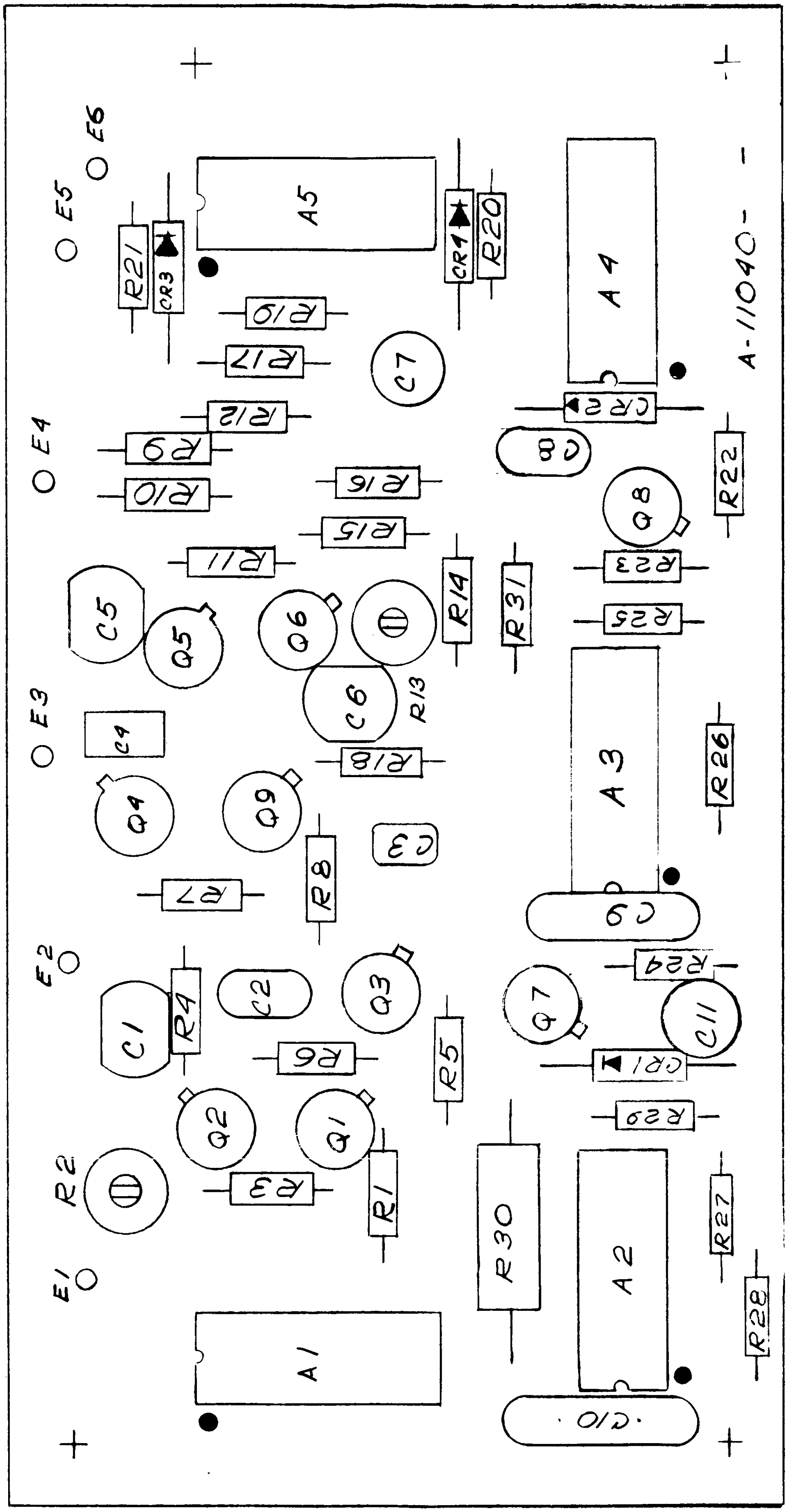

Figure 7-6. Minor Loop Phase Detector A3A1, Component Location

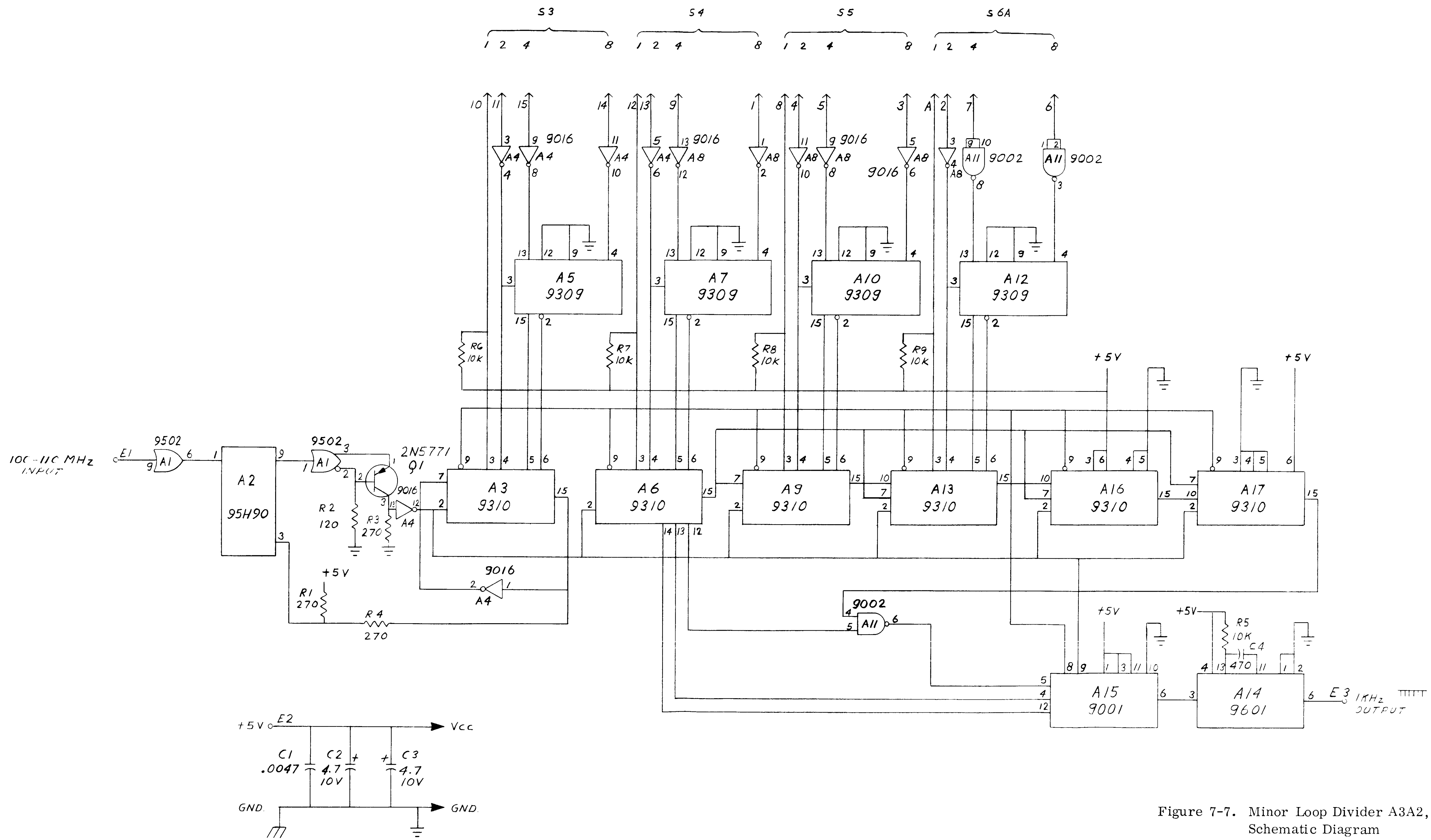

Figure 7-7. Minor Loop Divider A3A2, Schematic Diagram

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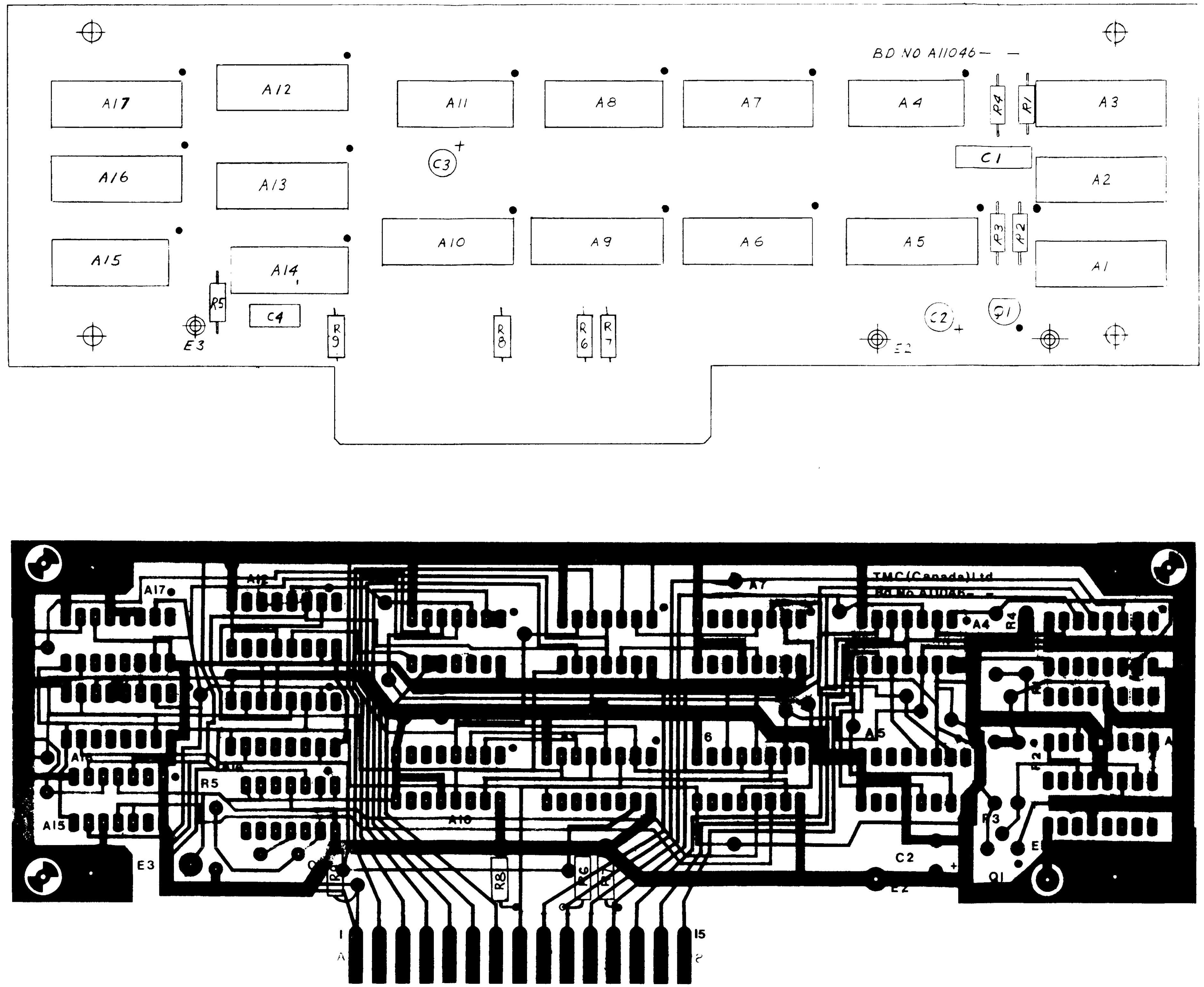

Figure 7-8. Minor Loop Divider A3A2, Component Location

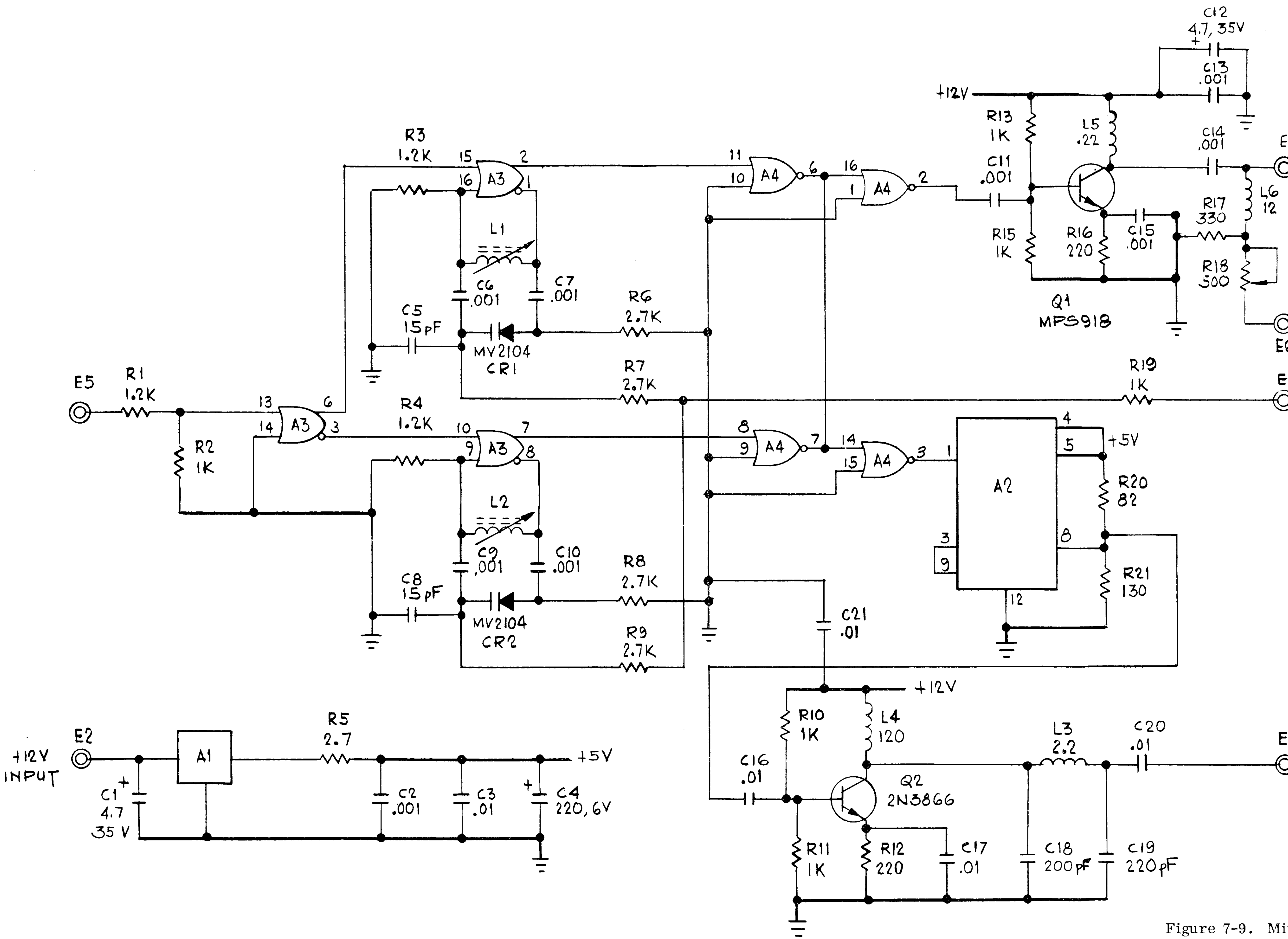

Figure 7-9. Minor Loop VCO A3A3, Schematic Diagram

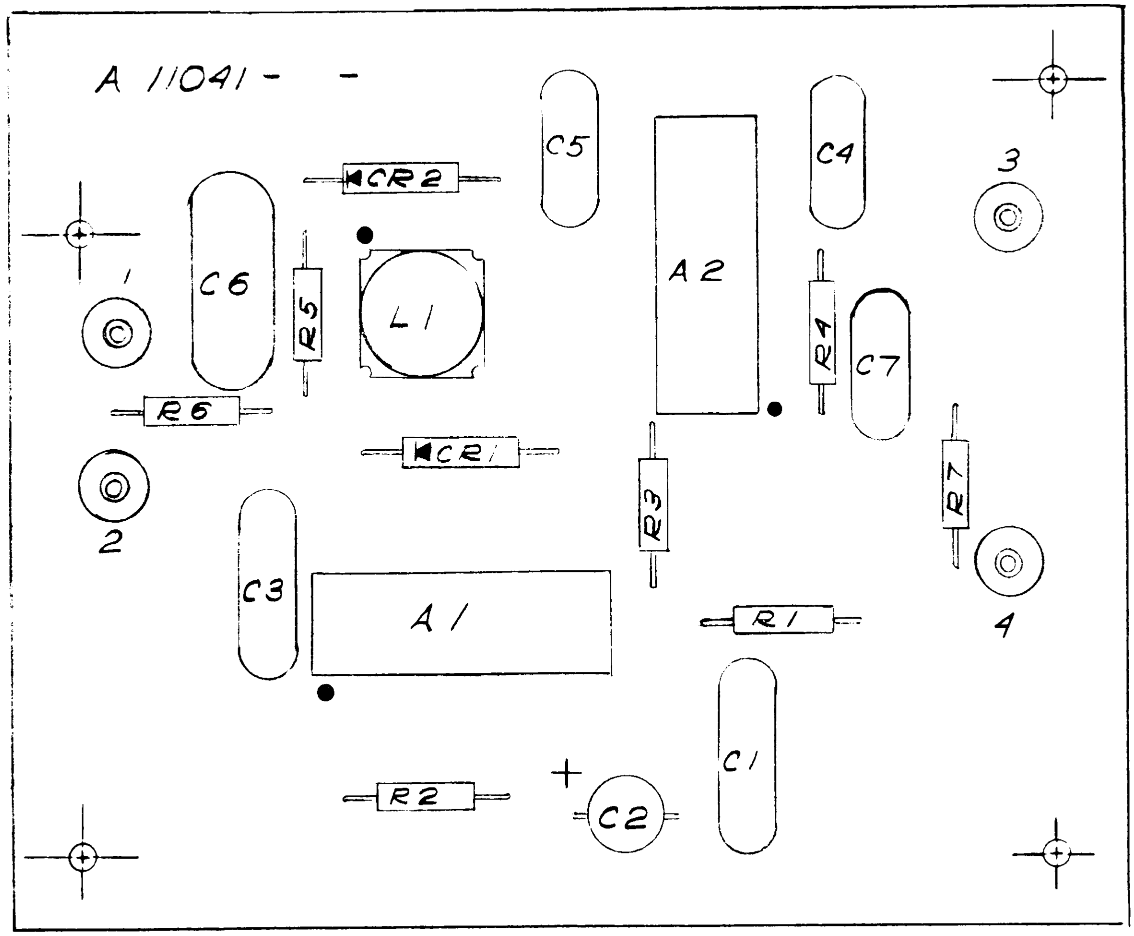

Figure 7-10. Minor Loop VCO A3A3, Component Location

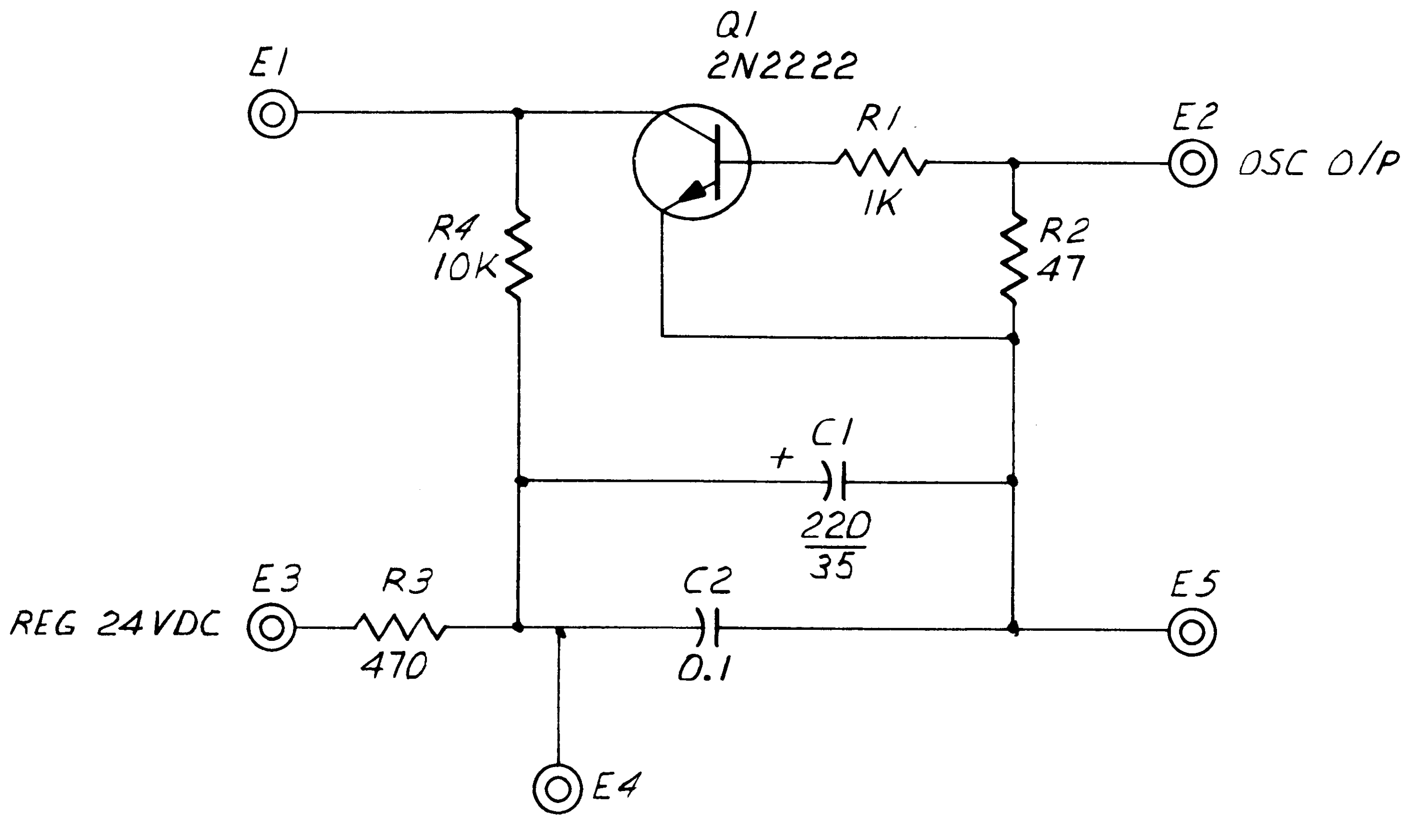

Figure 7-11. Clock Buffer A4A1, Schematic Diagram

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CK10873-A

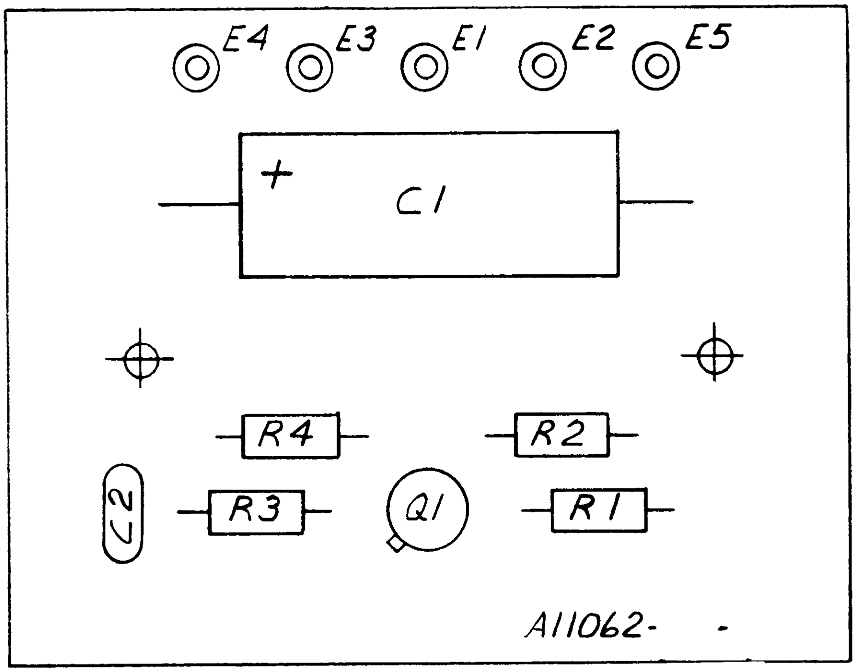


Figure 7-12. Clock Buffer A4A1, Component Location

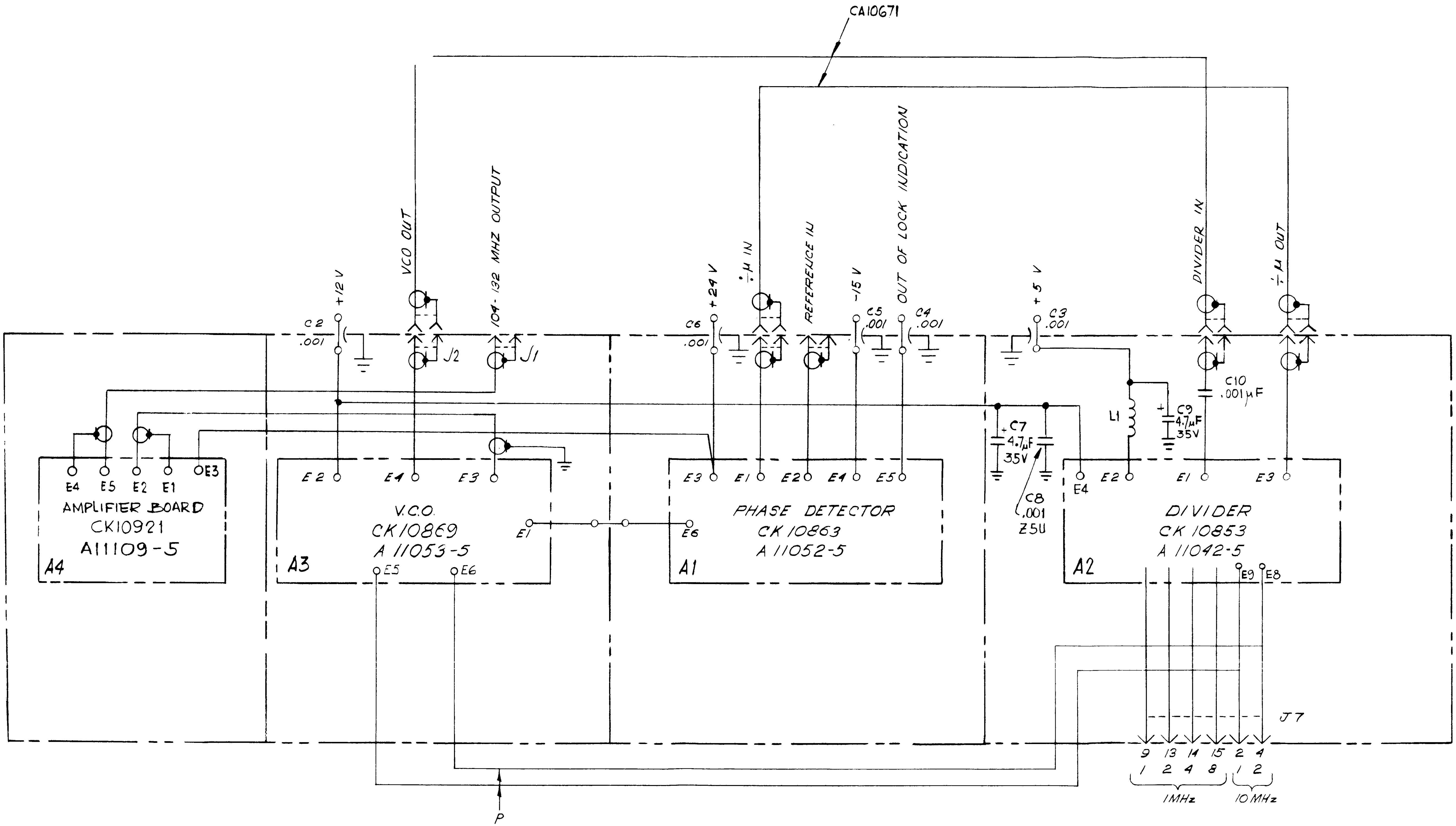


Figure 7-13. Major Loop Synthesizer A6, Interconnection Diagram

007742119
CK10860-B

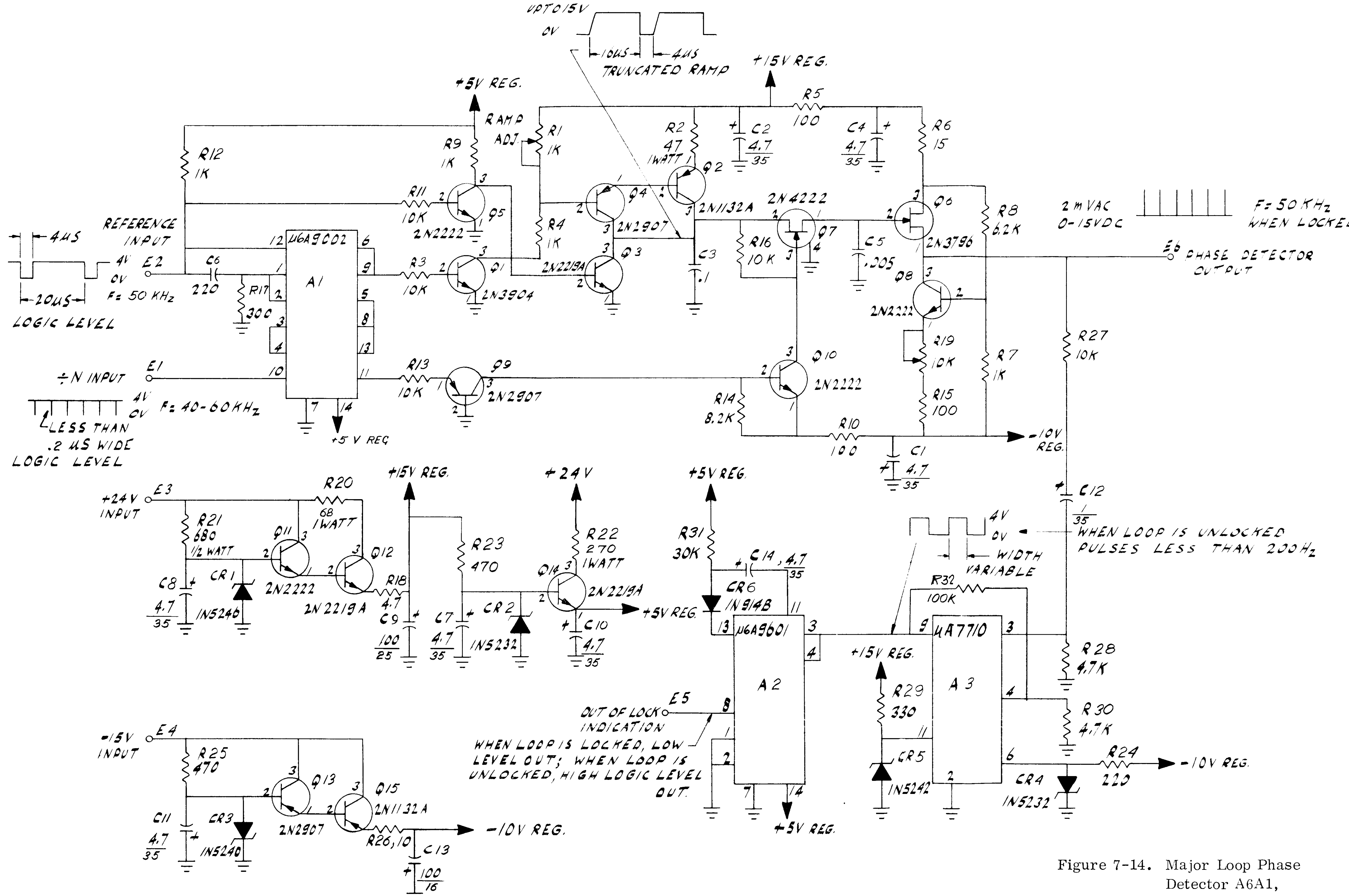


Figure 7-14. Major Loop Phase Detector A6A1, Schematic Diagram

007742119
CK10863-Ø

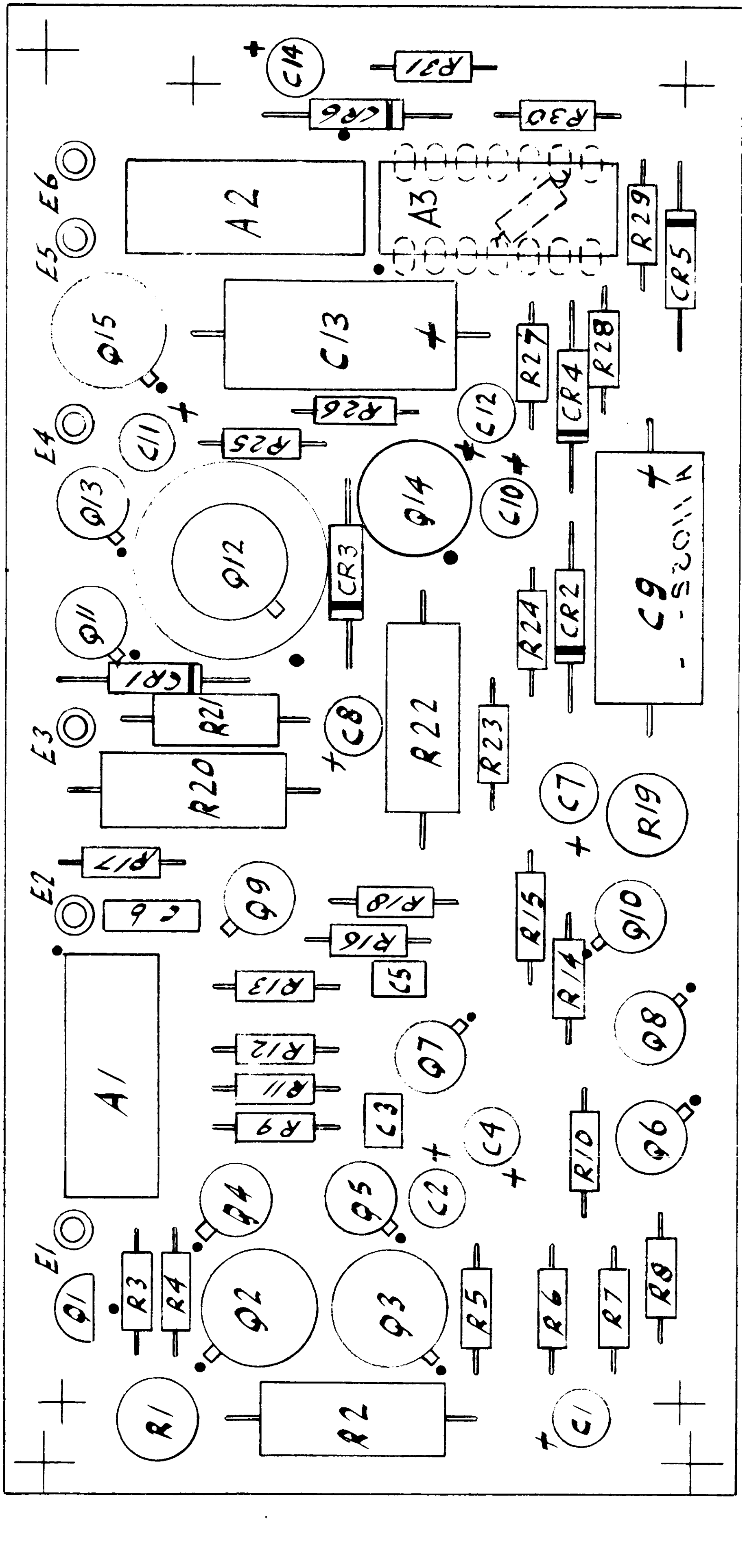


Figure 7-15. Major Loop Phase Detector A6A1, Component Location

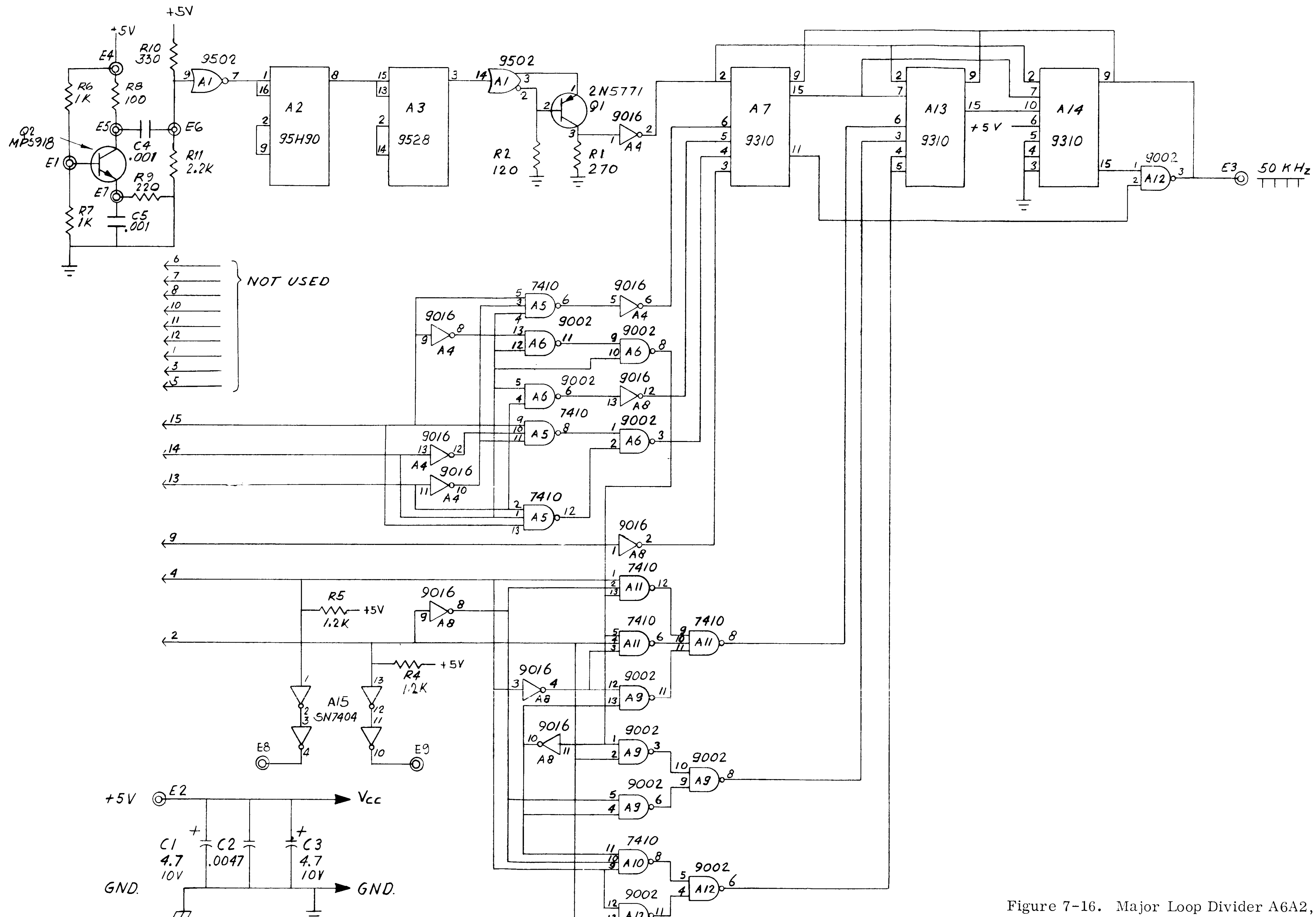
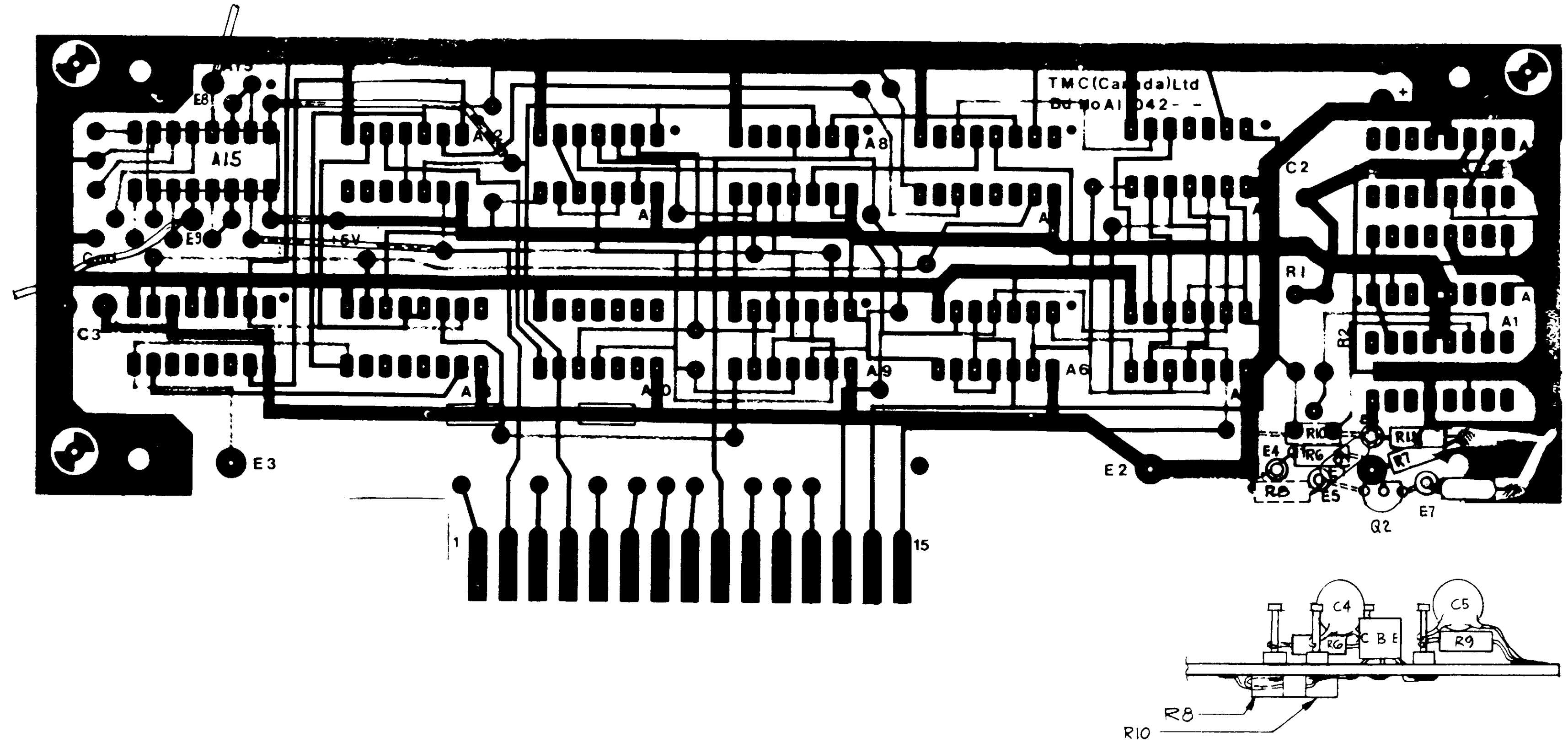


Figure 7-16. Major Loop Divider A6A2, Schematic Diagram

007742119
CK10853-Ø



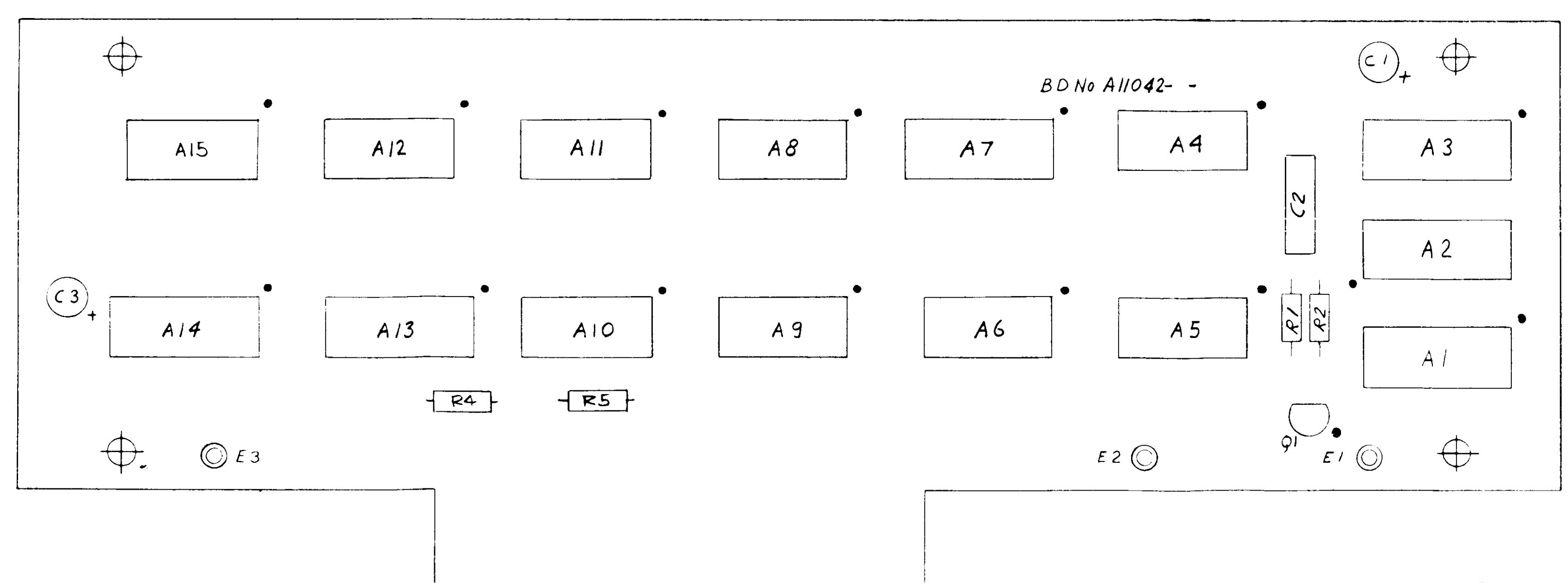


Figure 7-17. Major Loop Divider A6A2, Component Location

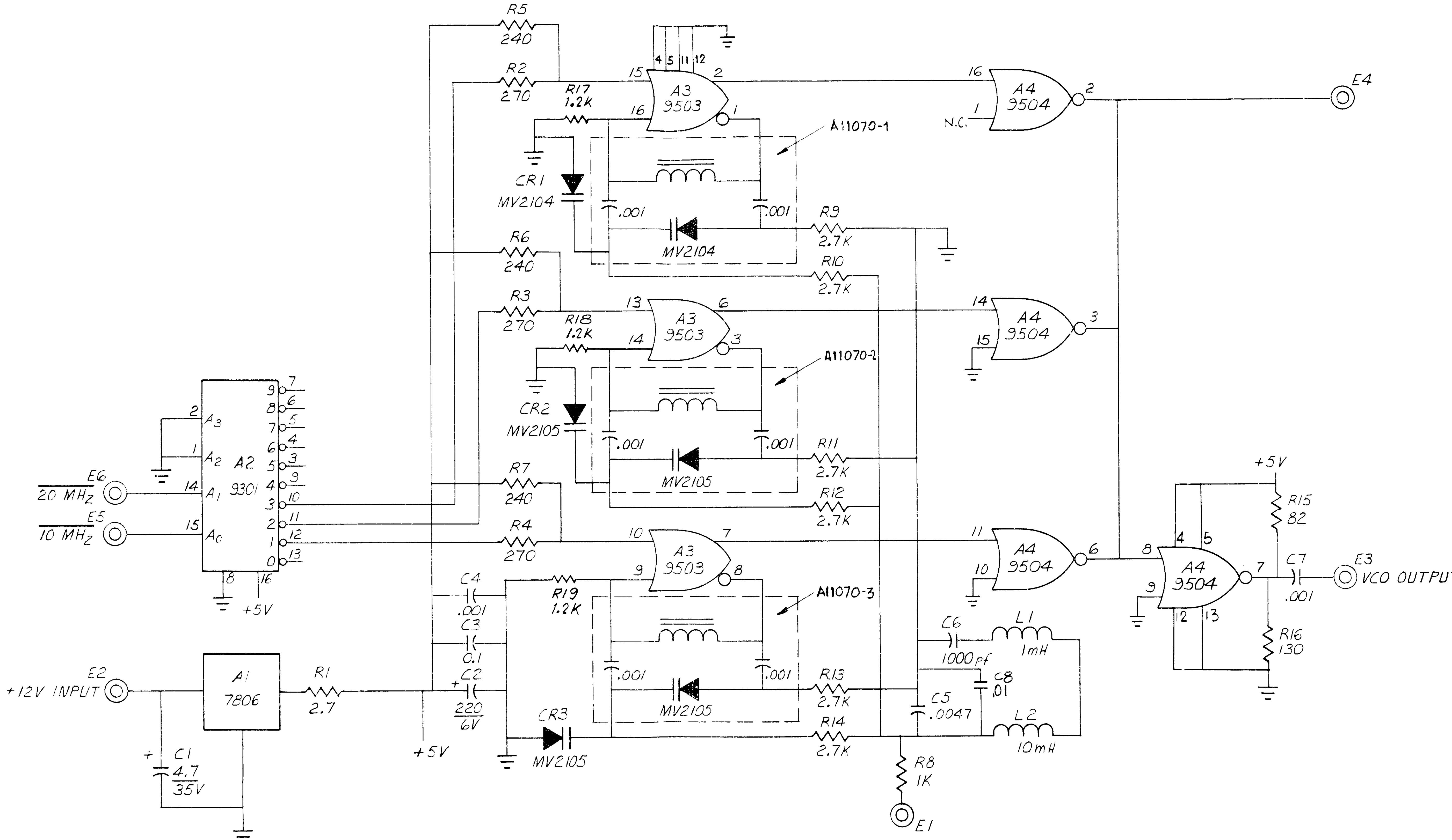


Figure 7-18. Major Loop VCO A6A3, Schematic Diagram

007742119
CK10869-Ø

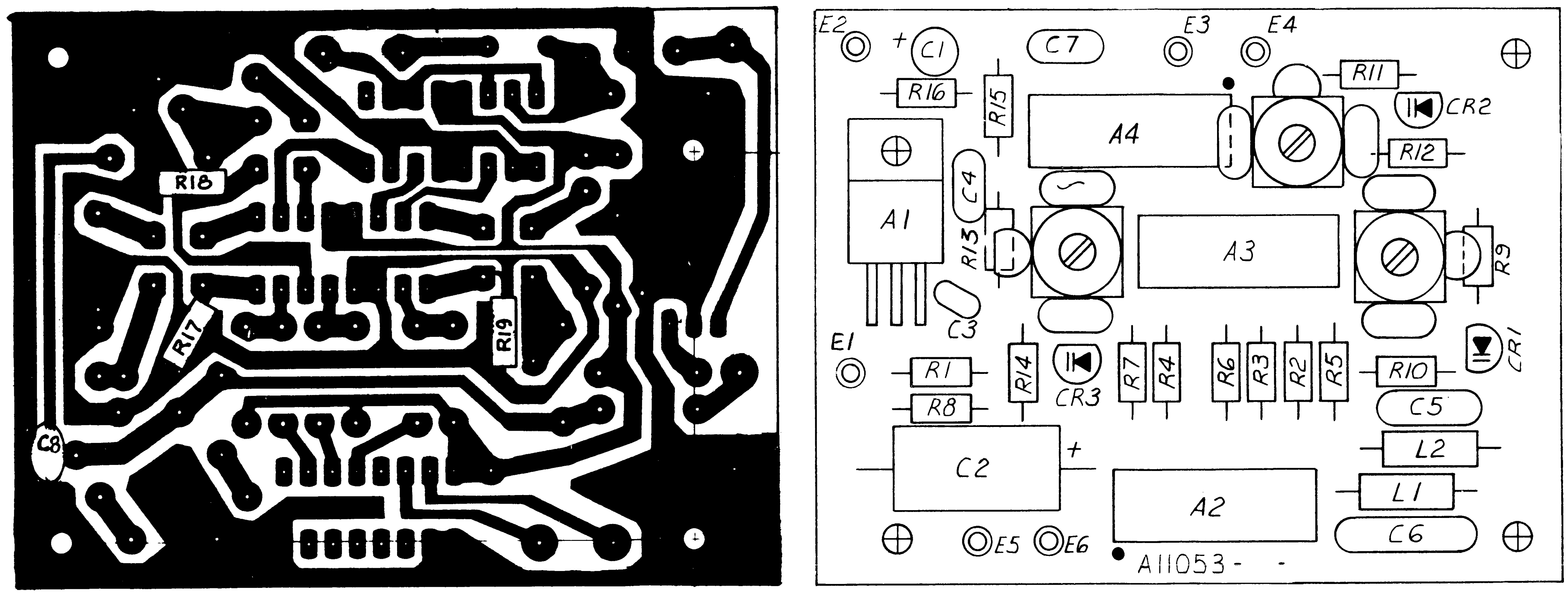


Figure 7-19. Major Loop VCO A6A3, Component Location

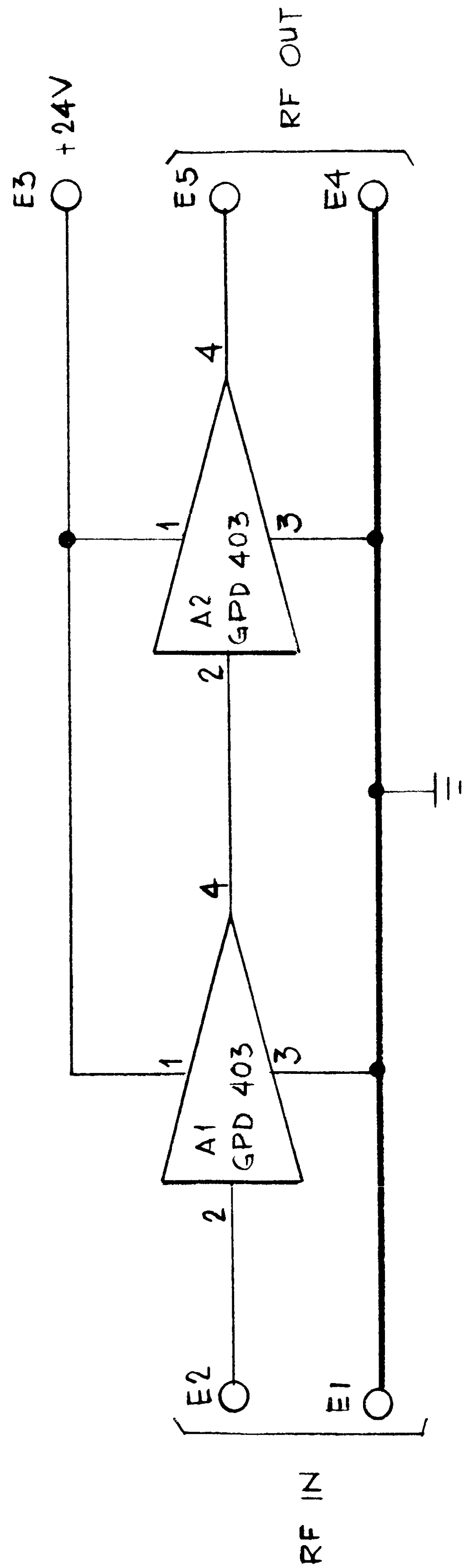


Figure 7-20. Major Loop Amplifier A6A4, Schematic Diagram

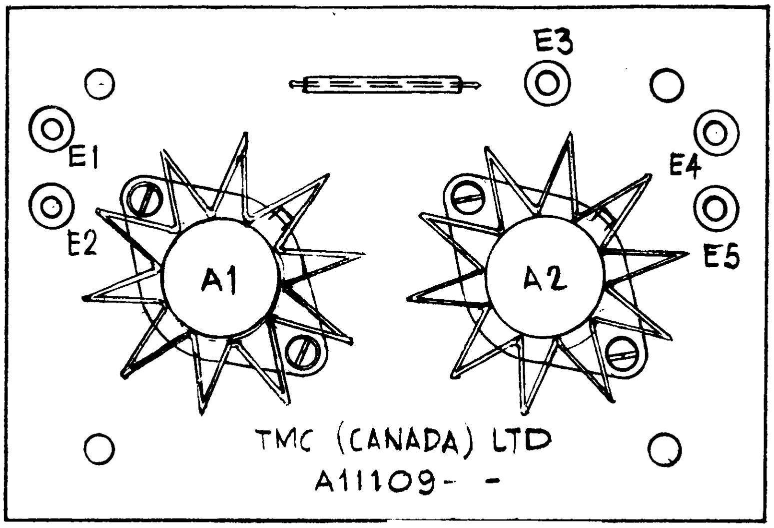


Figure 7-21. Major Loop Amplifier A6A4, Component Location

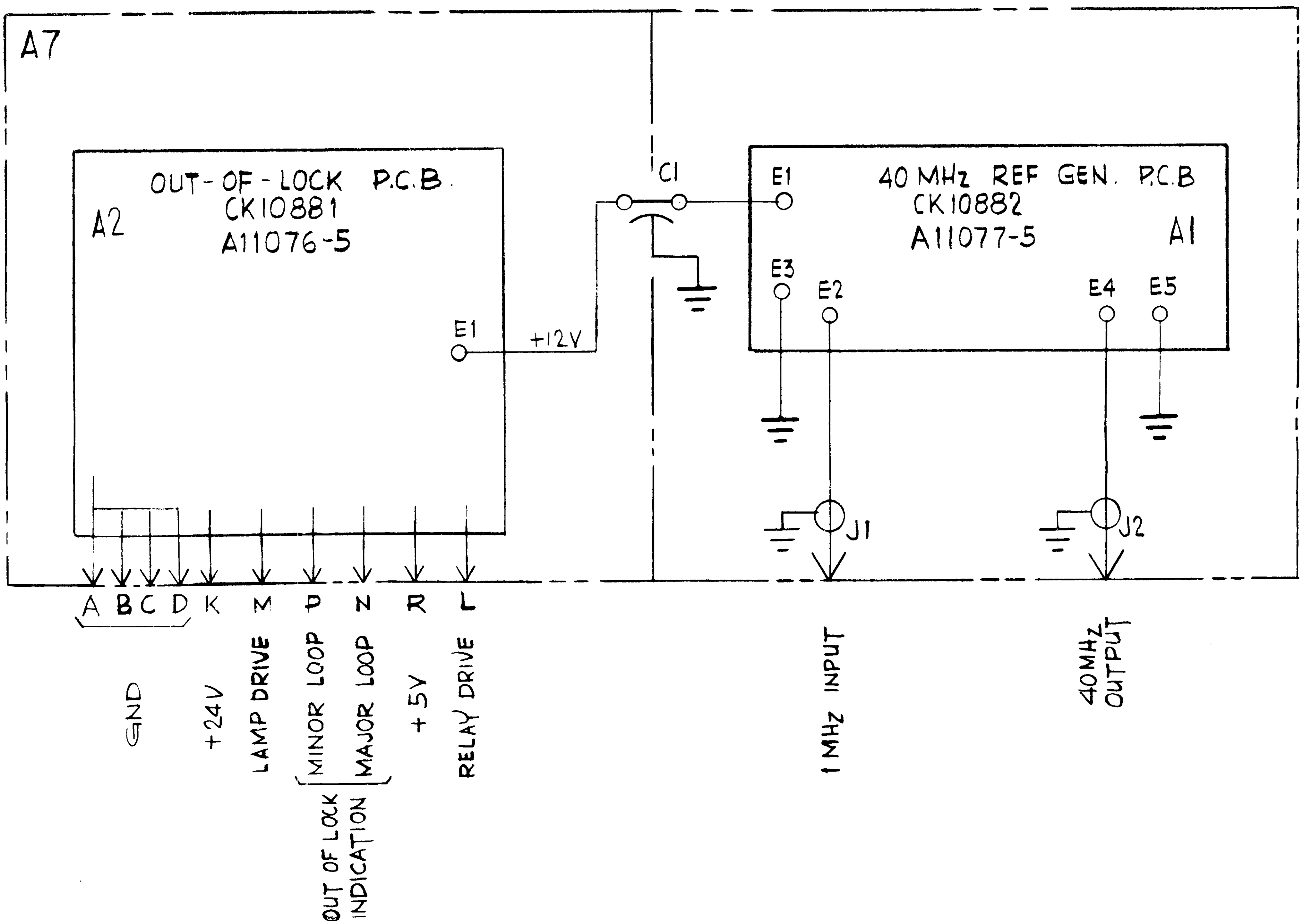


Figure 7-22. Standard Frequency Generator A7, Interconnection Diagram

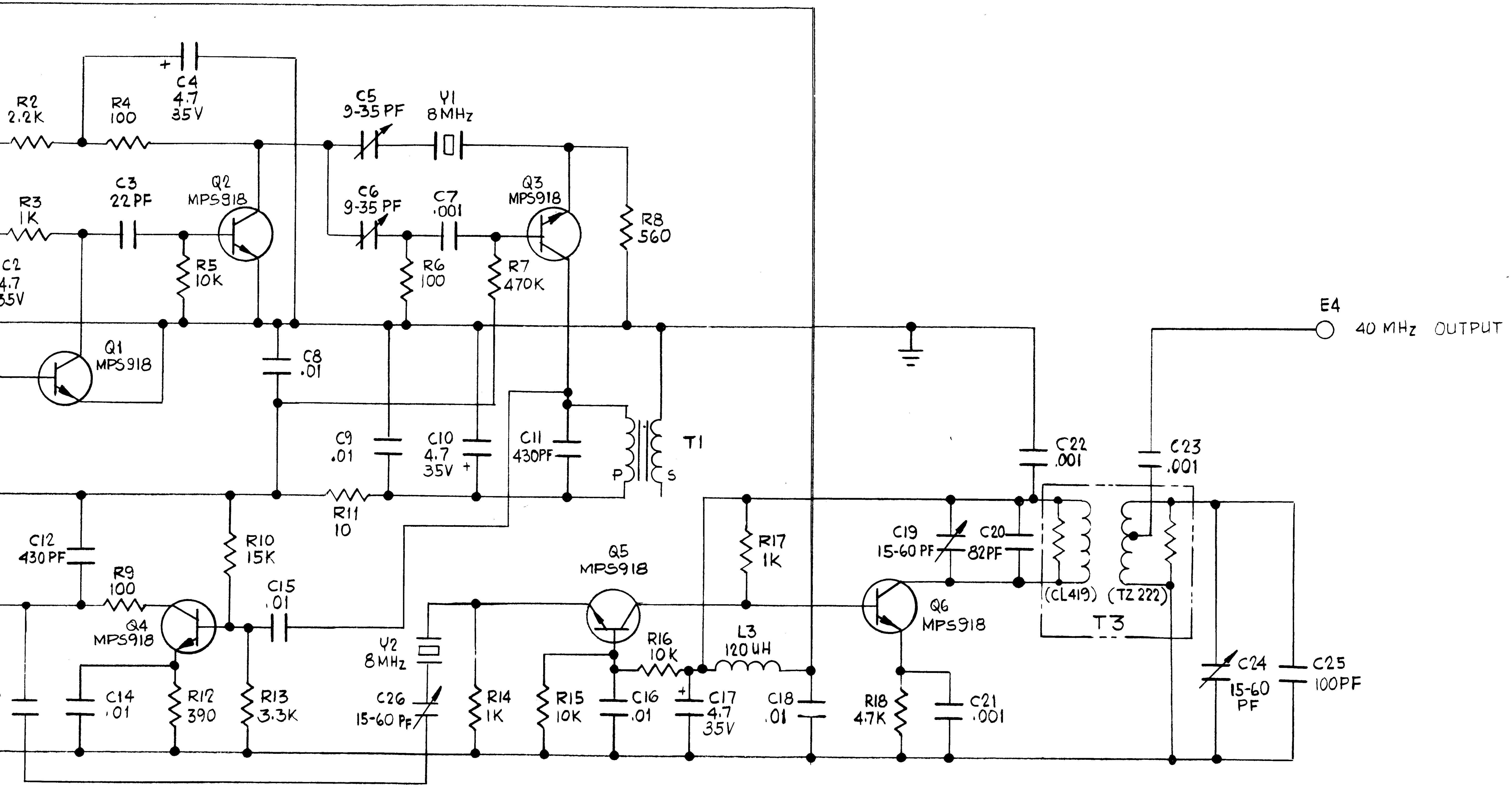
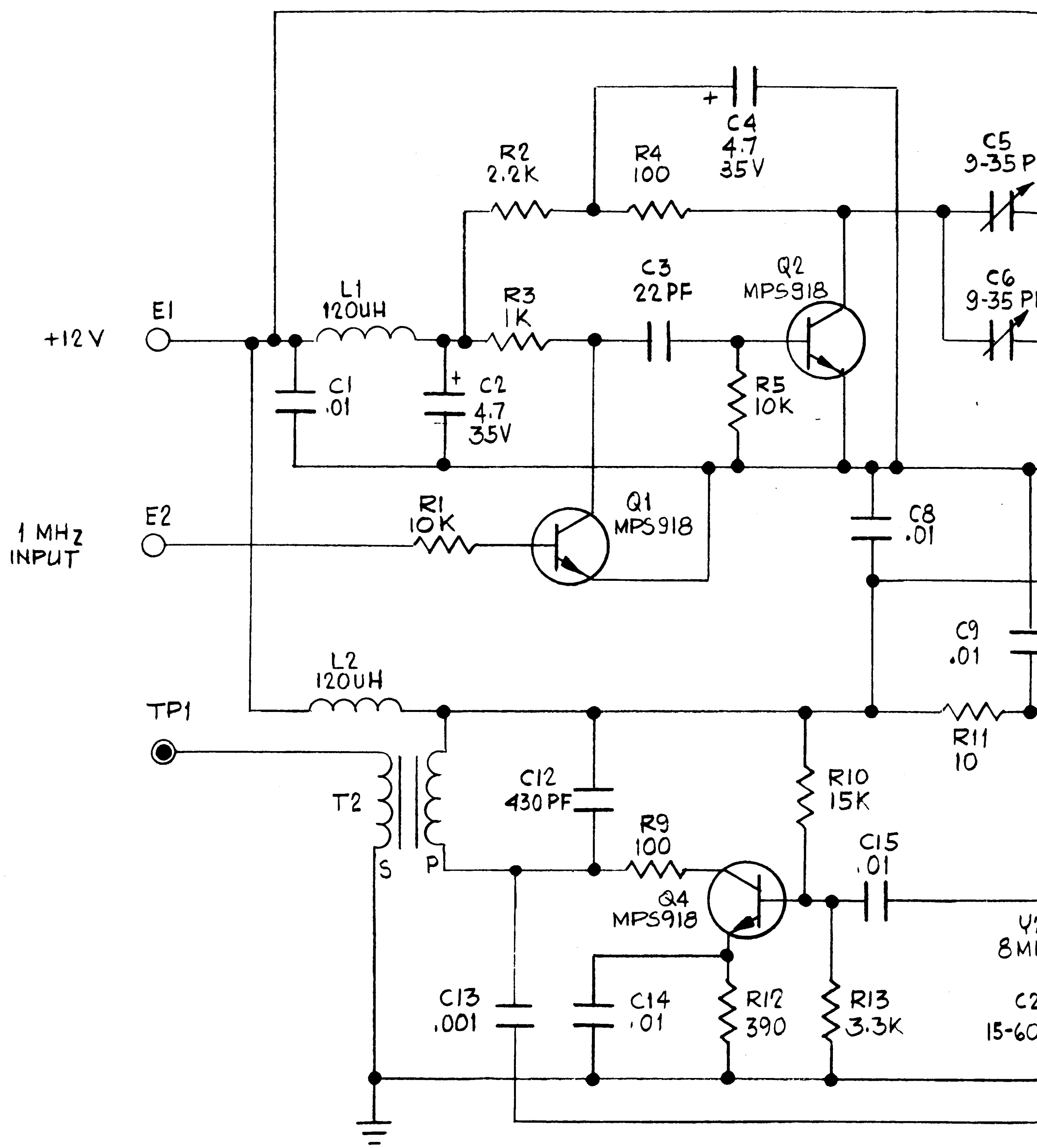


Figure 7-23. 40 MHz Reference Generator A7A1, Schematic Diagram

007742119
CK10882-A



007742119
CK10882-A

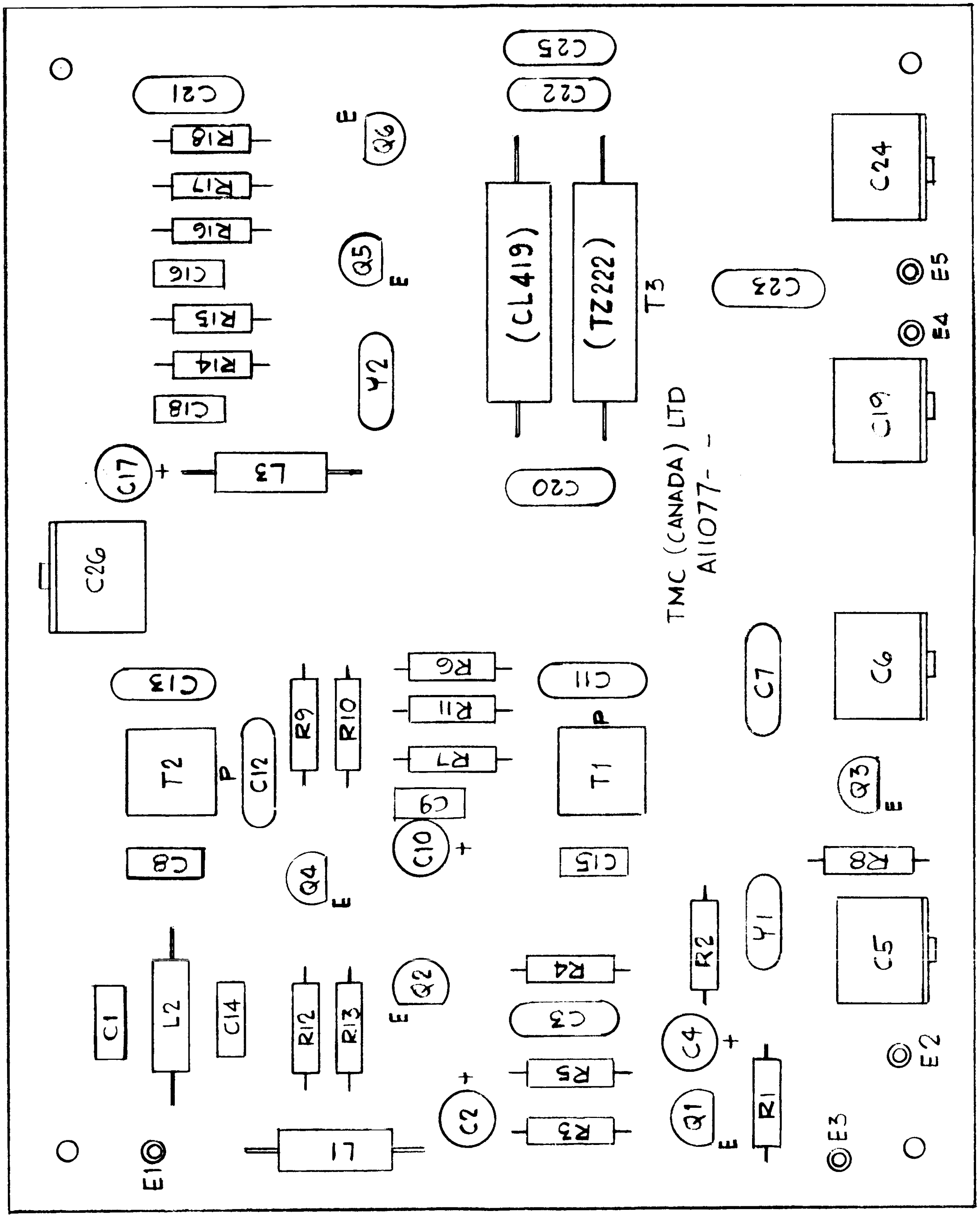


Figure 7-24. 40 MHz Reference Generator A7A1, Component Location

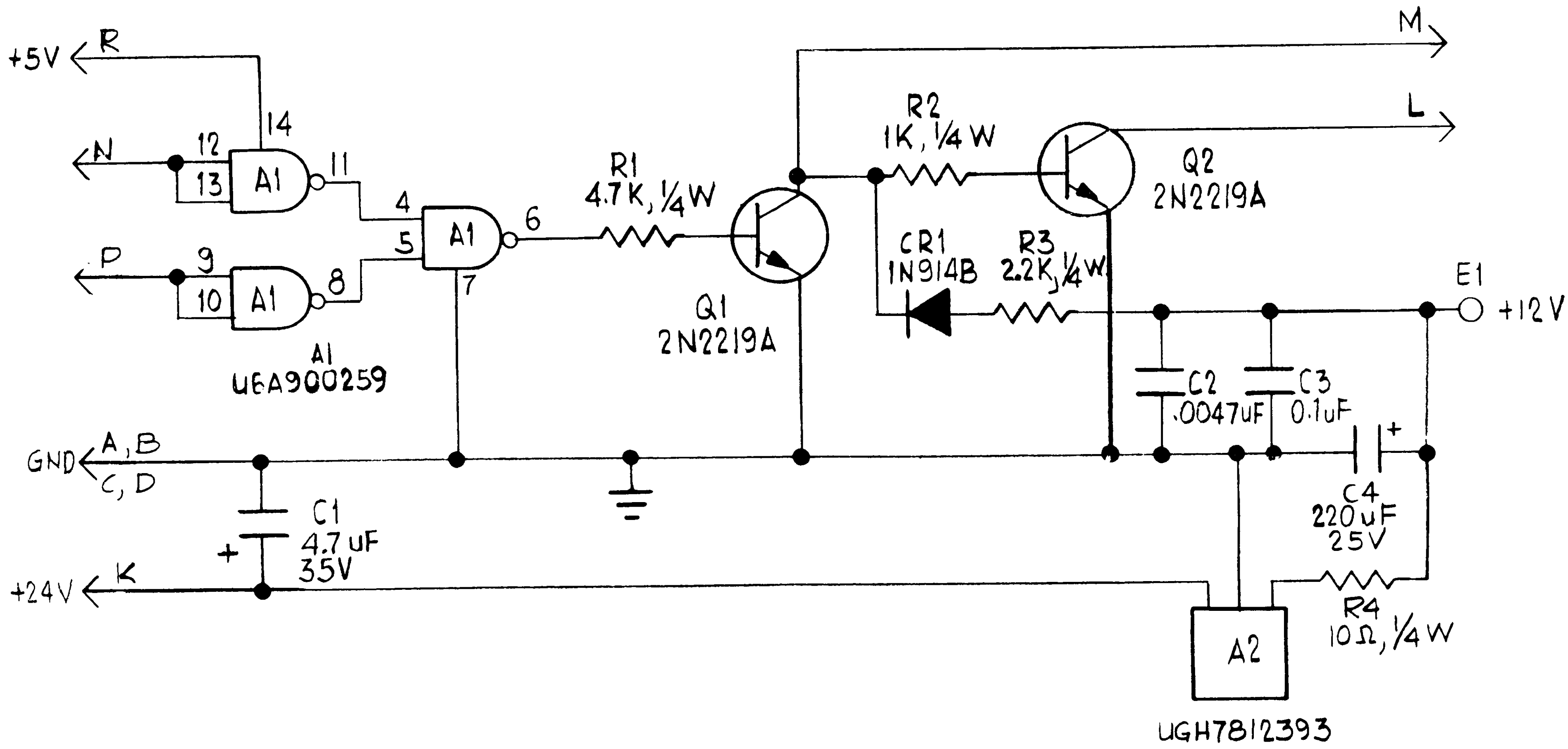


Figure 7-25. Out-Of-Lock Detector A7A2, Schematic Diagram

007742119
CK10881-A

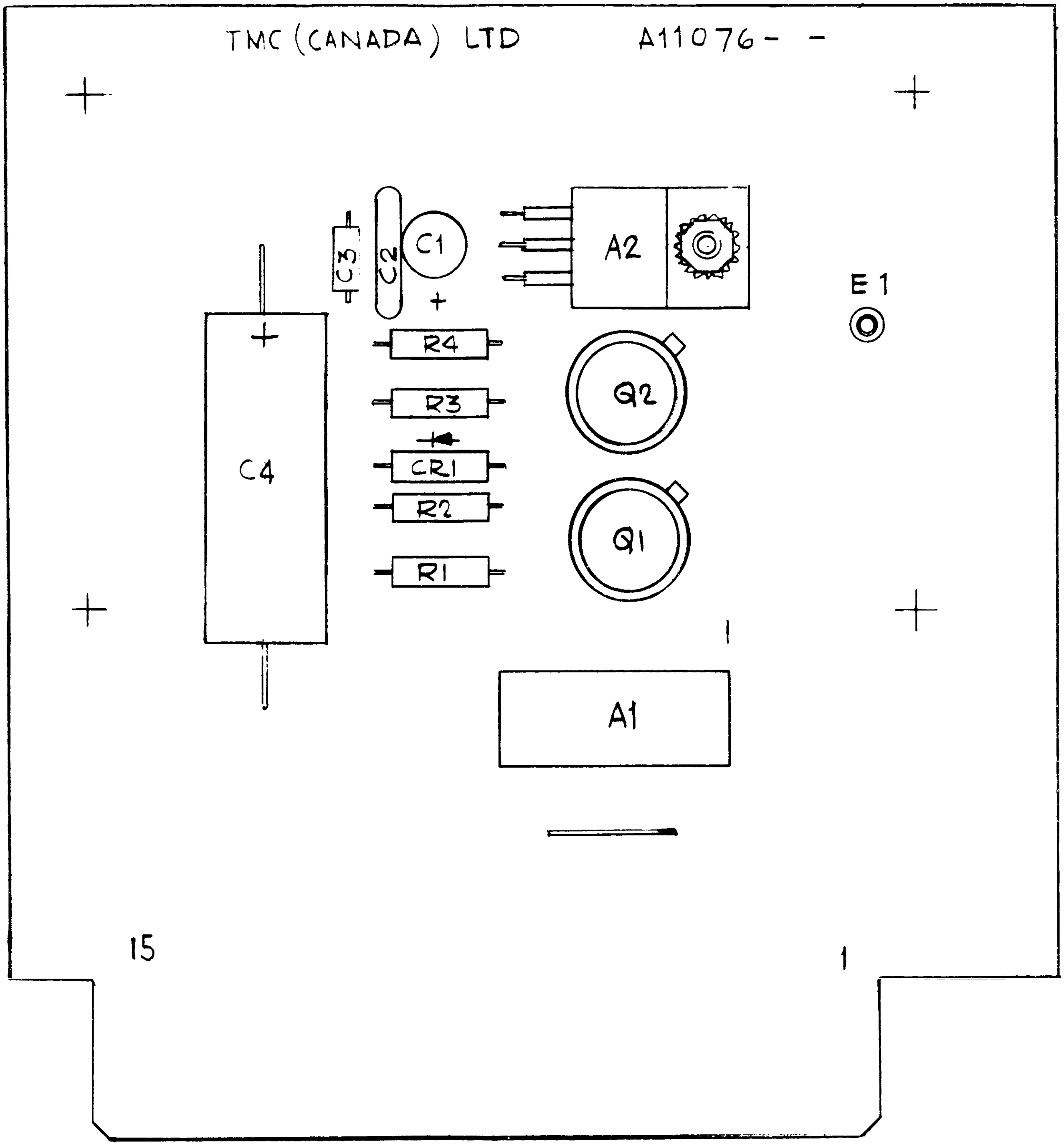


Figure 7-26. Out-Of-Lock Detector A7A2, Component Location

LAST SYMBOLS	MISSING SYMBOLS
C119	C40, C41
CR10	
L34	
Q19	
R120	R70
T23	
TP9	

NOTES:
UNLESS OTHERWISE SPECIFIED

1- ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
2- ALL DECIMAL CAPACITANCE VALUES (.001) ARE IN MICROFARADS. ALL WHOLE NUMBER CAPACITANCE VALUES (47) ARE IN PICOFARADS.
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4- ALL TRANSISTORS (EXCEPT THOSE INDICATED) ARE "2N3646".
*5- CR1 & CR2, CR4 & CR5 ARE "HP8403'S", MATCHED PAIRS.

NOTES: (CONT.)

6- COMPONENTS CONTAINED IN OUTLINE MARKED —·—·— ARE MOUNTED ON SEPARATE PC BOARD (REF. PC377/A4600)

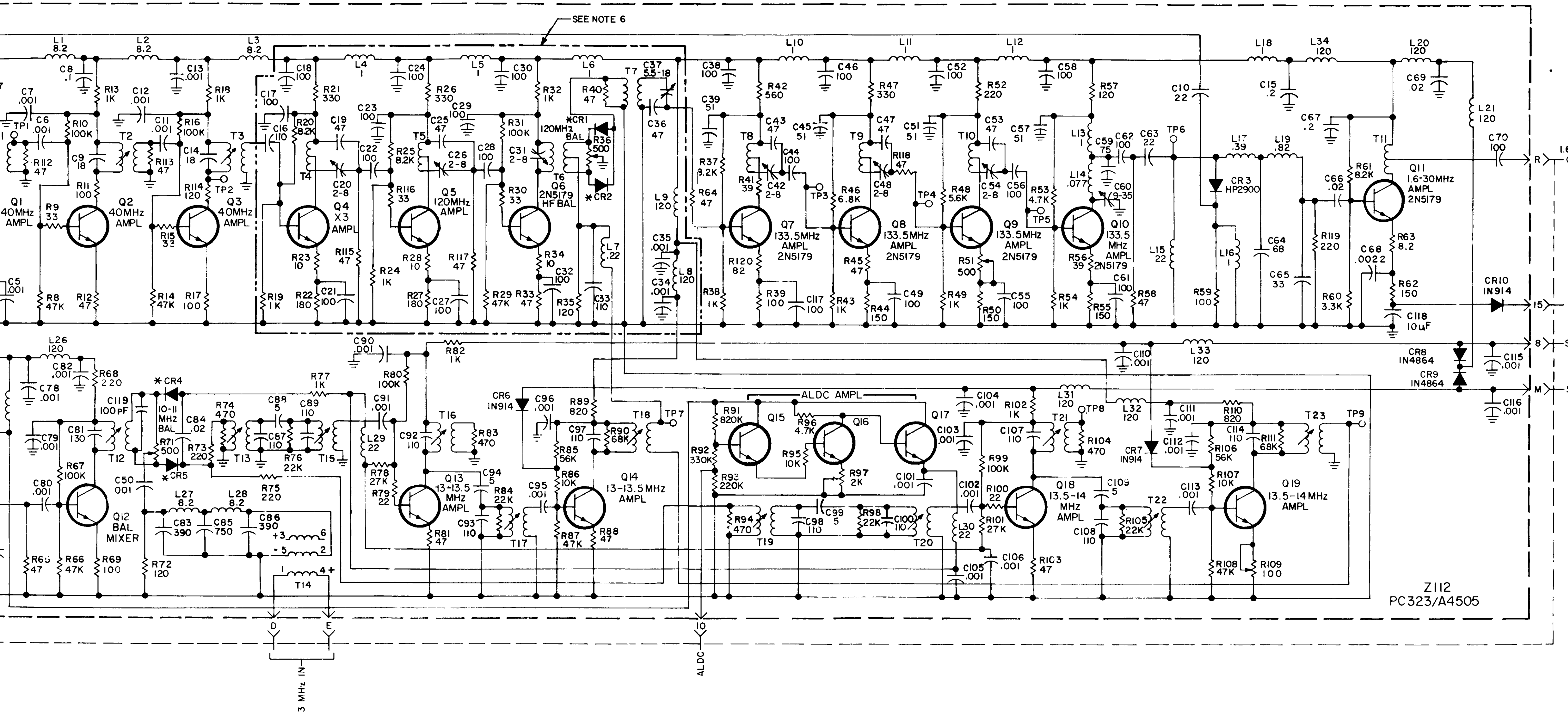


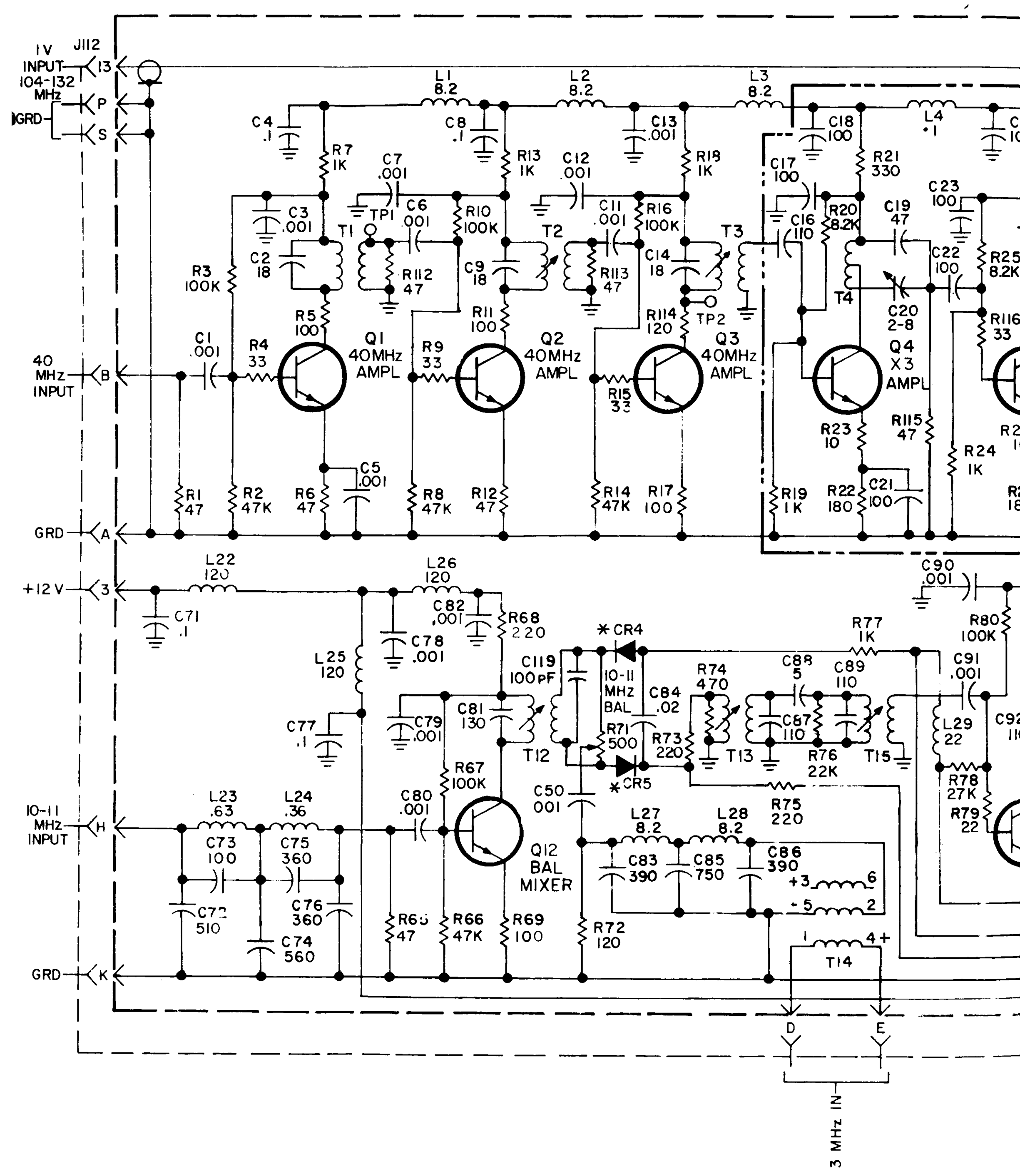
Figure 7-27. Translator A8, Schematic Diagram

007742119
CK1324-I

LAST SYMBOLS	MISSING SYMBOLS
C119	C40, C41
CR10	
L34	
Q19	
R120	R70
T23	
TP9	

NOTES:
UNLESS OTHERWISE SPE

1-ALL RESISTANCE VALUES
2-ALL DECIMAL CAPACITAN
ALL WHOLE NUMBER CAP
3-ALL INDUCTANCE VALUE
4-ALL TRANSISTORS (EXC
*5-CR1 & CR2, CR4 & CR5



007742119
CK1324-I

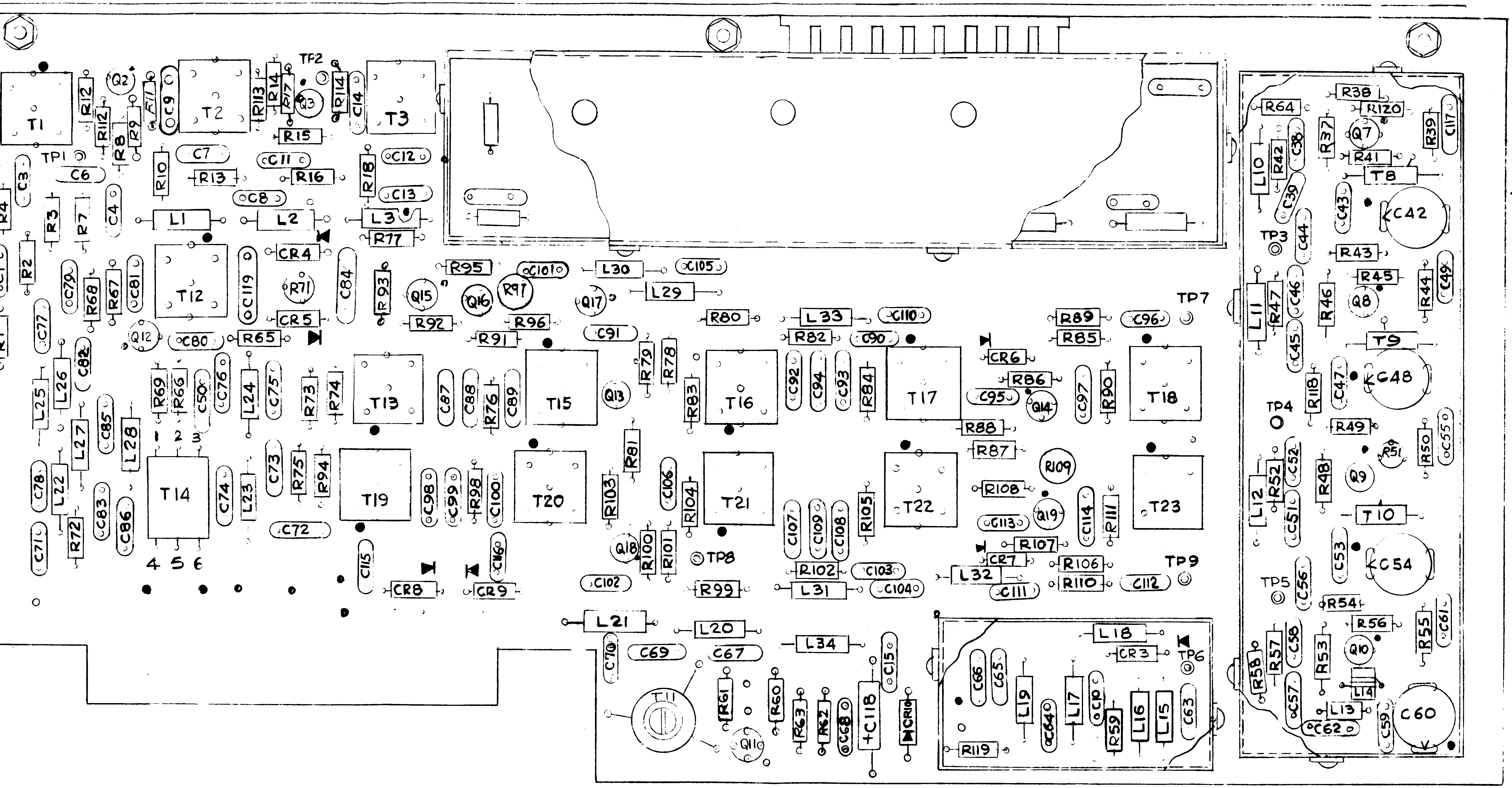
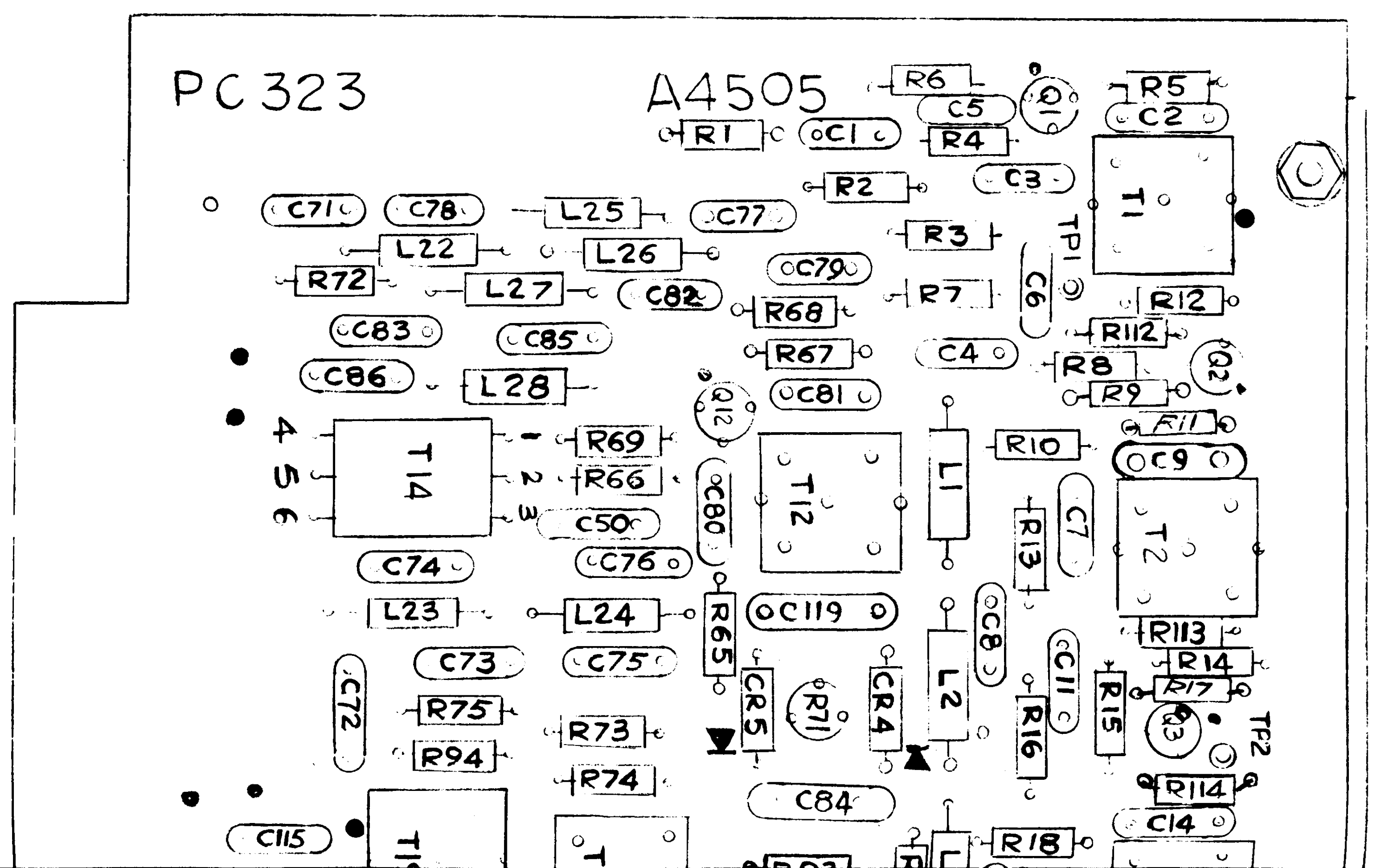
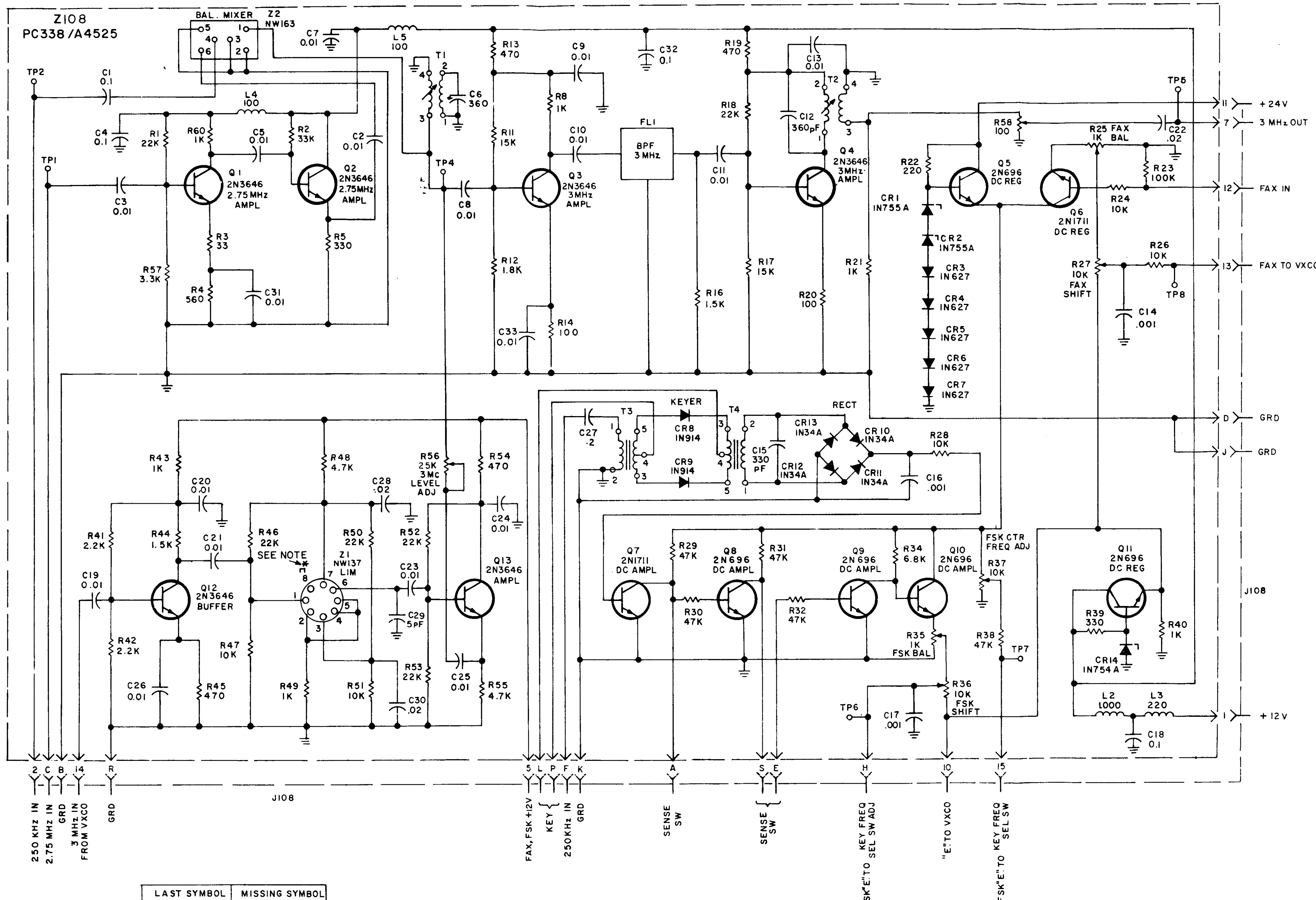


Figure 7-28. Translator A8, Component Location

007742119
A4505-D



007742119
A4505-D



LAST SYMBOL	MISSING SYMBOL
C33	L1
CR14	R6,7,9,10,15,33,59
FL1	
L5	
Q13	
R60	
T4	
TP8	TP3
Z2	

UNLESS OTHERWISE SPECIED

1-ALL RESISTANCE VALUES ARE IN OHMS, 1/4 W.
2-ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3-ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
*"⊓" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK.

Figure 7-29. Frequency Shift Generator A9, Schematic Diagram

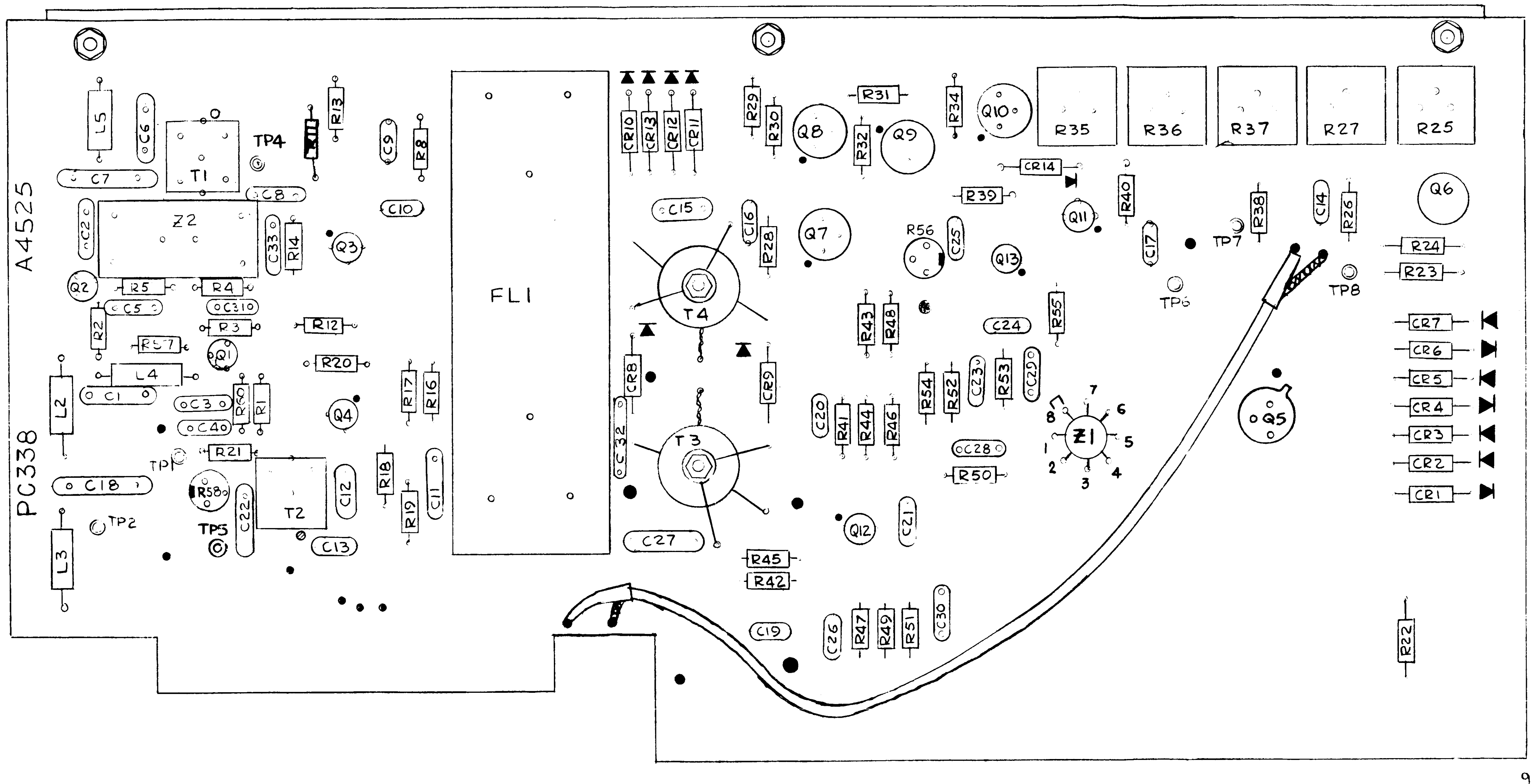
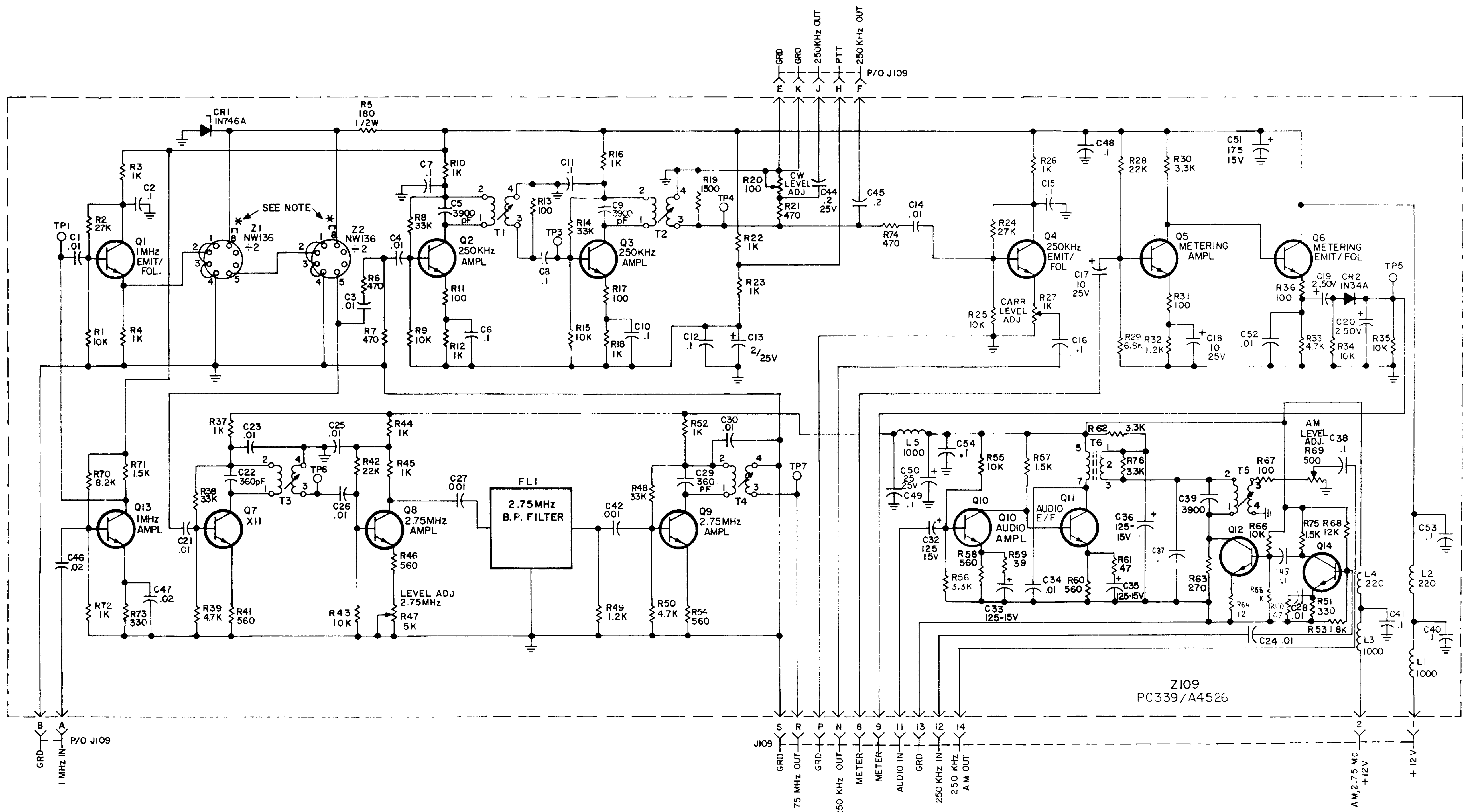


Figure 7-30. Frequency Shift Generator A9, Component Location



LAST SYMBOLS	MISSING SYMBOLS
C54	C31
CR2	
FL1	
L5	
Q14	
R76	
T6	TP2
TP7	
Z2	

NOTES - UNLESS OTHERWISE SPECIFIED

1-ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
2-ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3-ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4-ALL TRANSISTORS ARE TYPE 2N3646.

* "⊓" SYMBOL DENOTES FLAT SIGNIFYING PIN 8 ON NETWORK.

Figure 7-31. Carrier Generator A10, Schematic Diagram

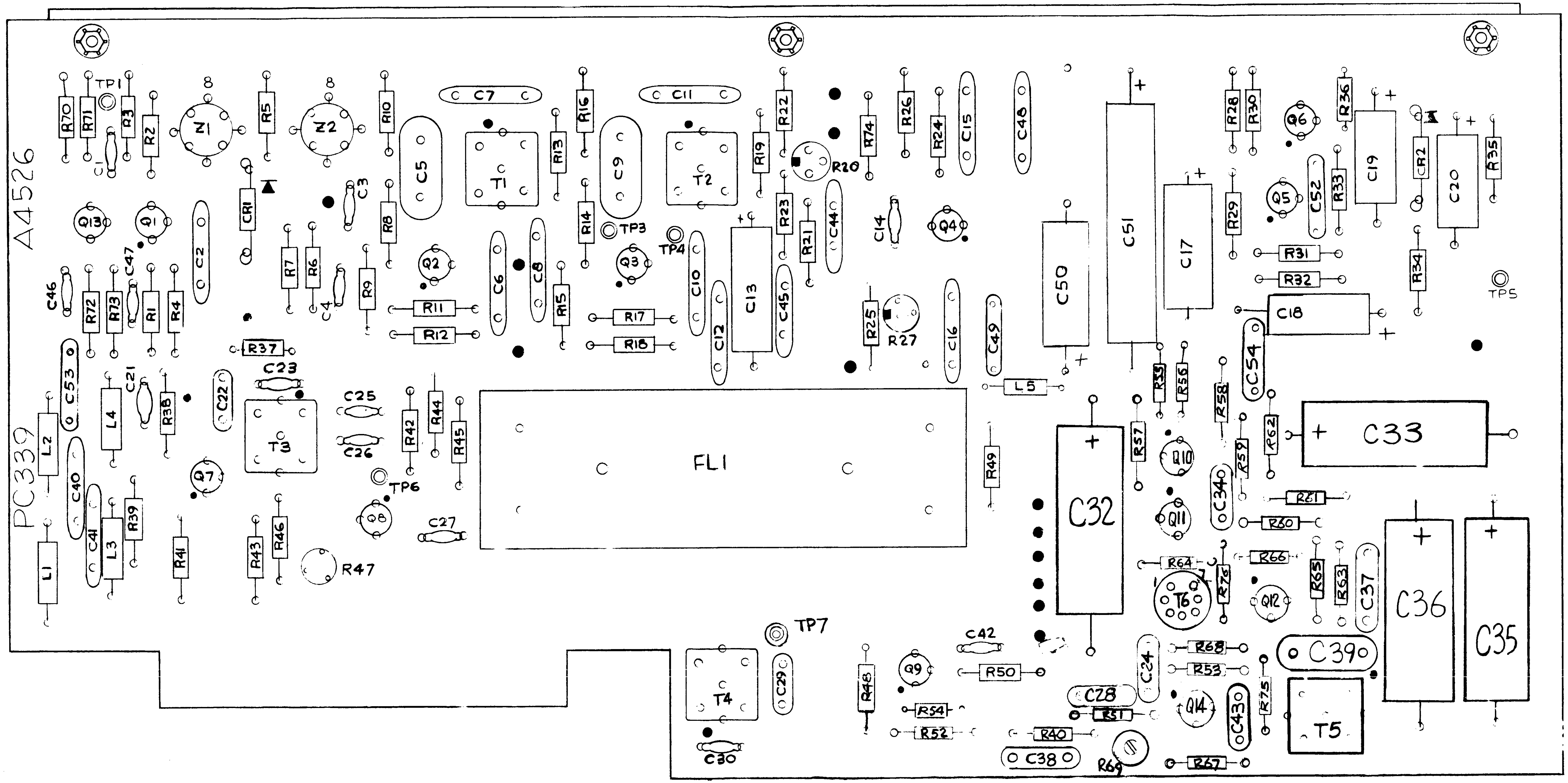
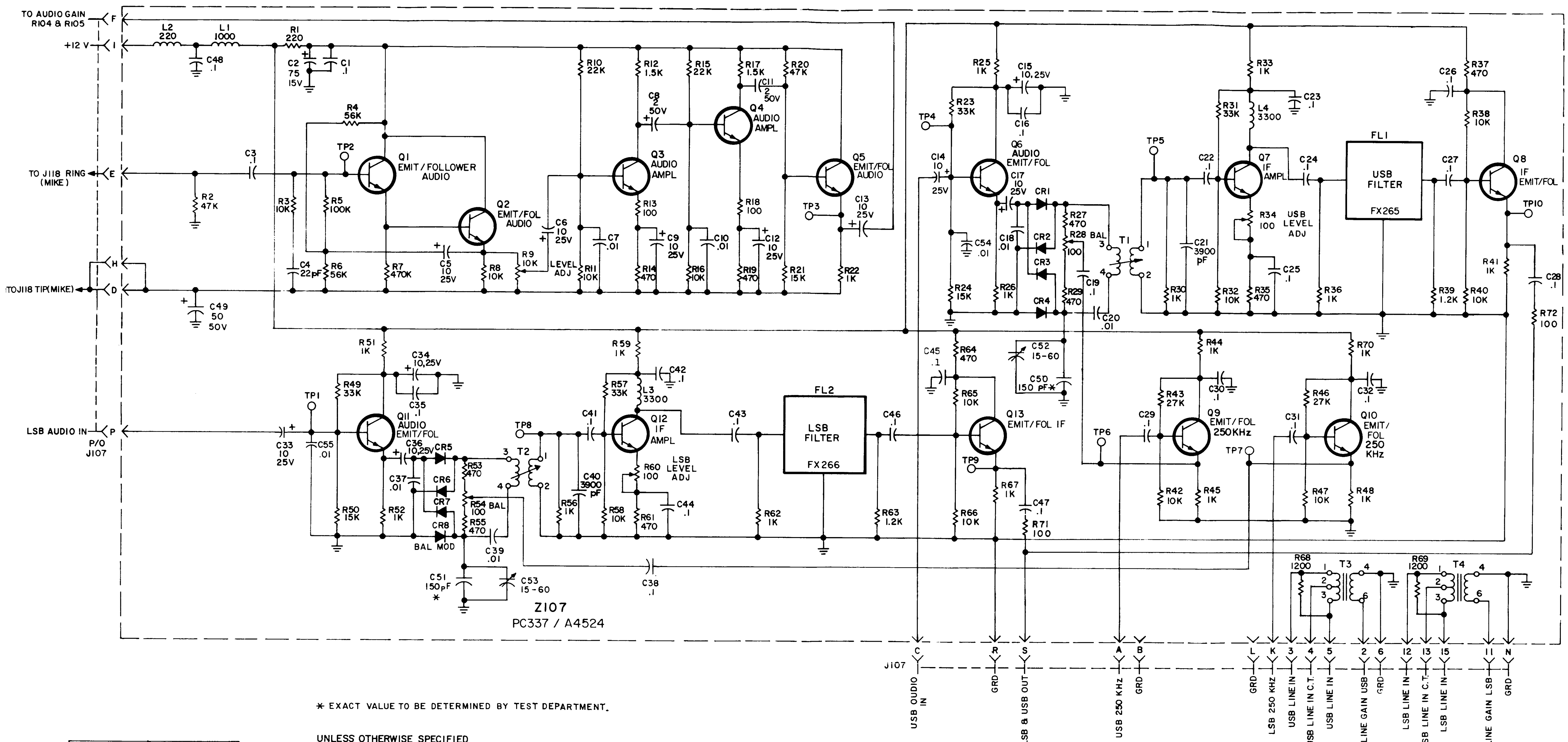


Figure 7-32. Carrier Generator A10, Component Location

007742119
A4526-C



* EXACT VALUE TO BE DETERMINED BY TEST DEPARTMENT.

UNLESS OTHERWISE SPECIFIED

1- ALL RESISTANCE VALUES ARE IN OHMS, 1/4 WATT.
2- ALL CAPACITANCE VALUES ARE IN MICROFARADS.
3- ALL INDUCTANCE VALUES ARE IN MICROHENRIES.
4- ALL TRANSISTORS ARE 2N3646.
5- ALL DIODES ARE IN541.

LAST SYMBOLS	MISSING SYMBOLS
C55	
CR8	
FL2	
L4	
Q13	
R72	
T4	
TP10	

Figure 7-33. Sideband Generator A11, Schematic Diagram

007742119
CK1309-G

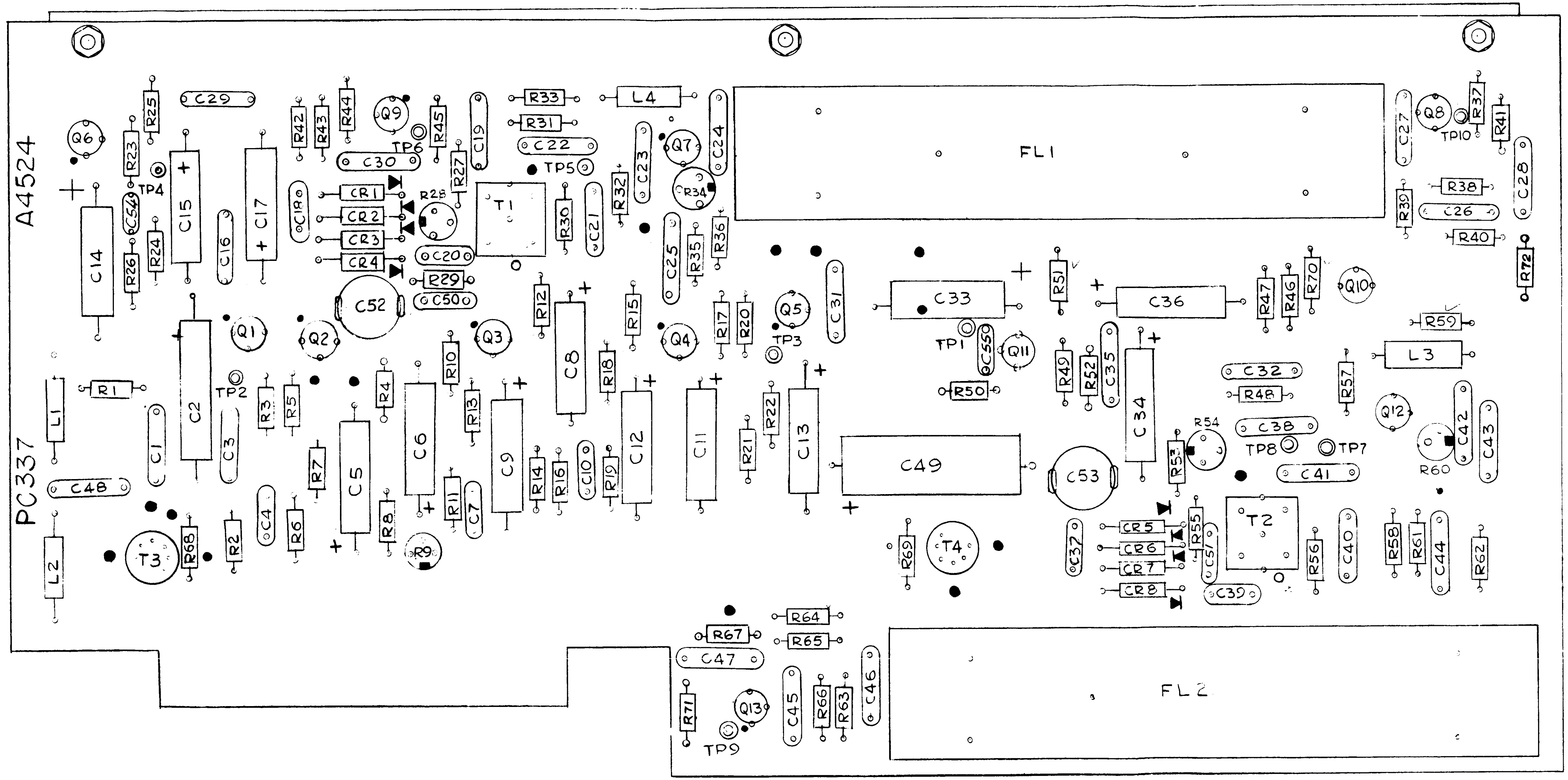
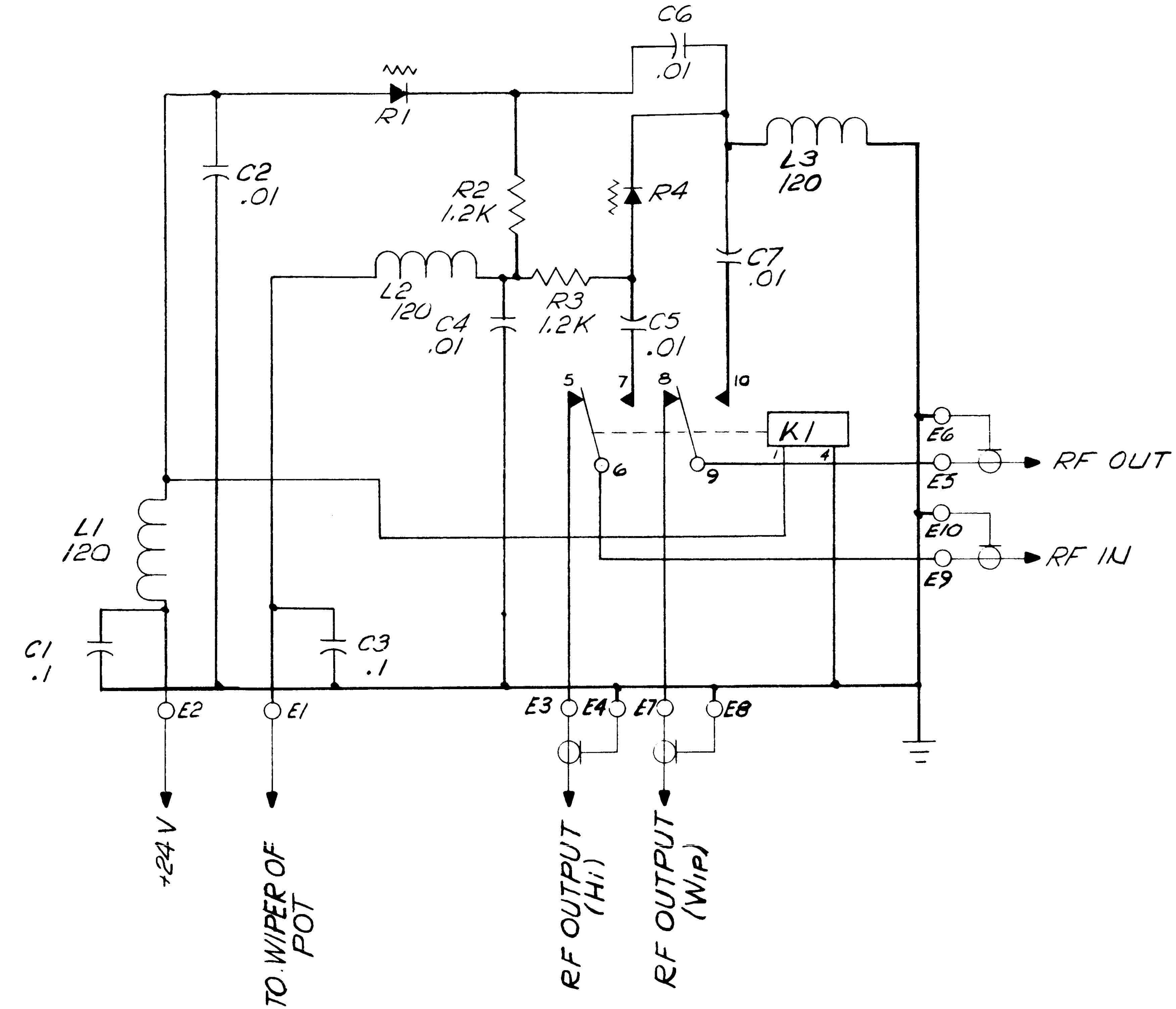


Figure 7-34. Sideband Generator A11, Component Location

007742119
A4524-D



RESISTANCE IN OHMS
RESISTORS ARE 1/4 W

INDUCTANCE IN MICROHENRIES

CAPACITANCE IN MICROFARADS

Figure 7-35. RF Adjust A14, Schematic Diagram

007742119
CK10848-Ø

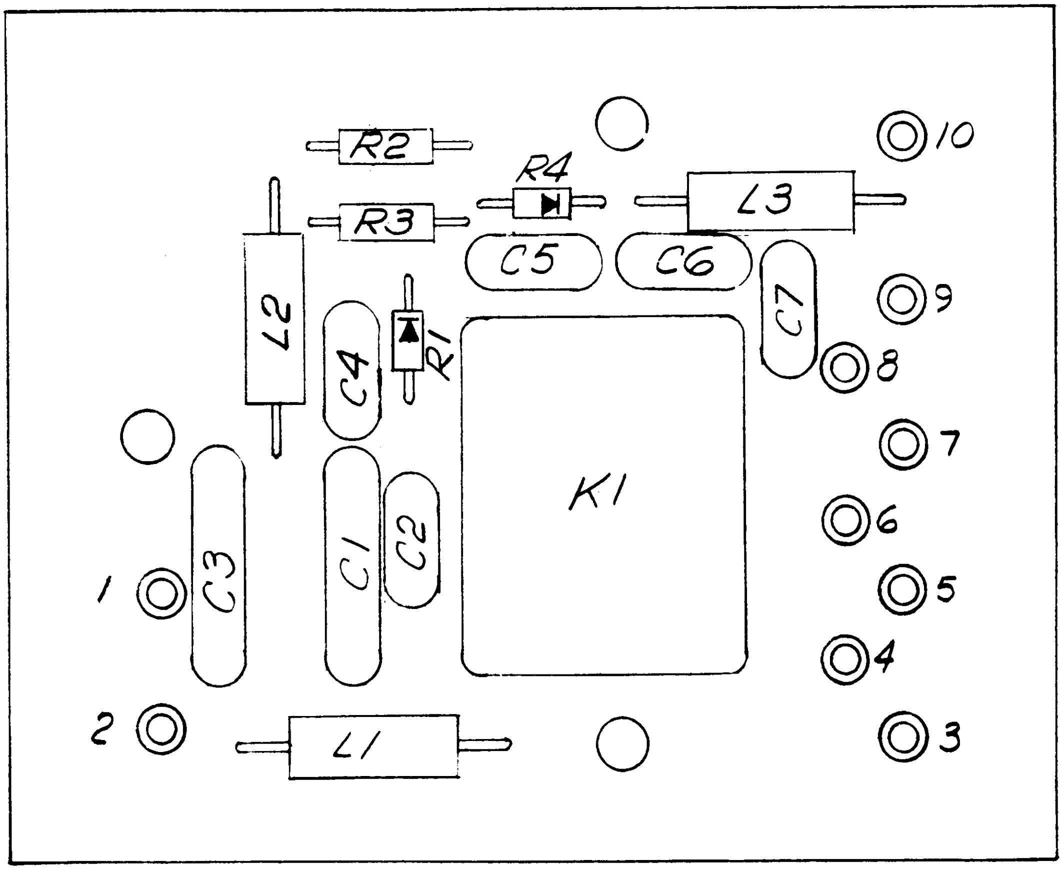


Figure 7-36. RF Adjust A14, Component Location

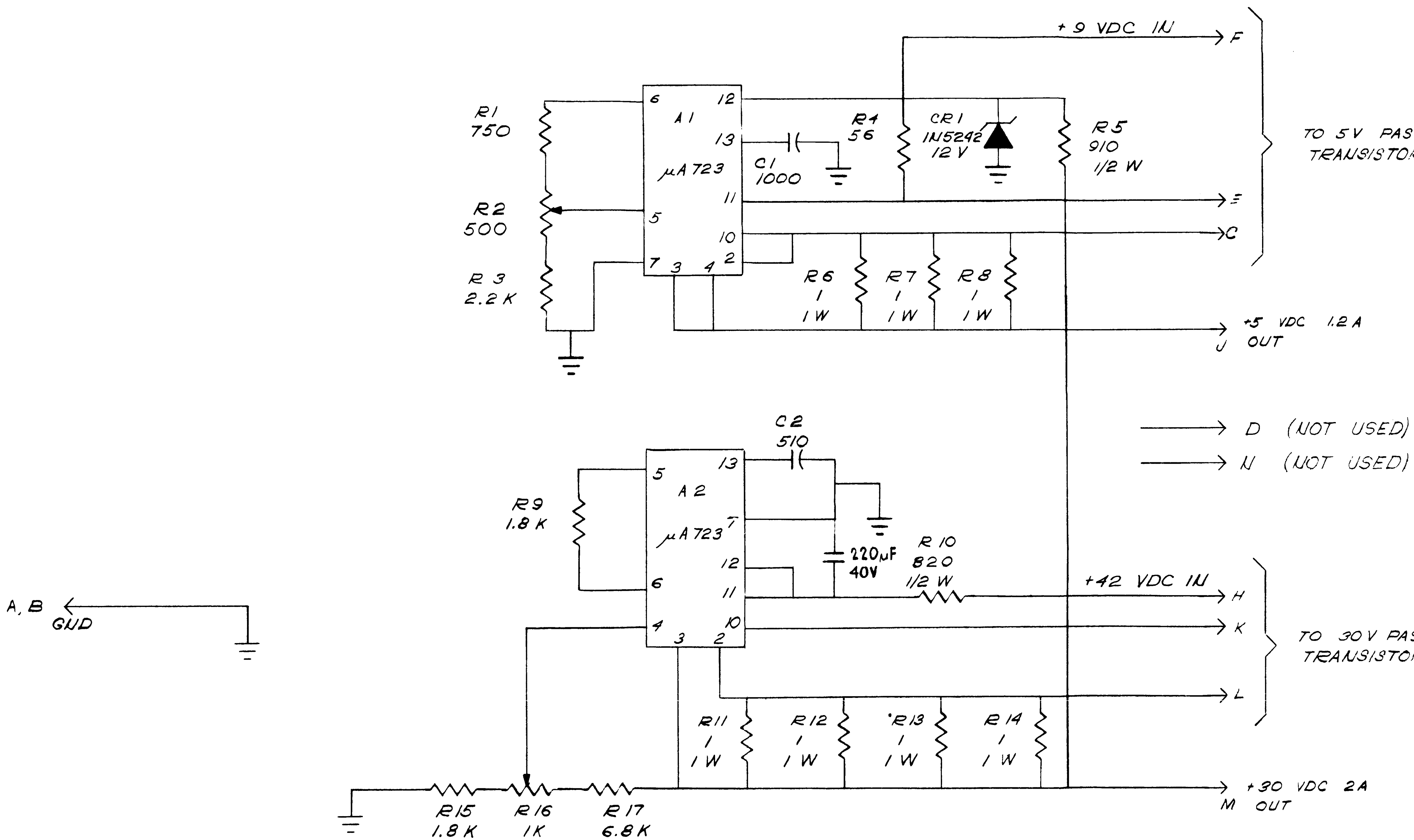


Figure 7-37. Power Supply A19A1, Schematic Diagram

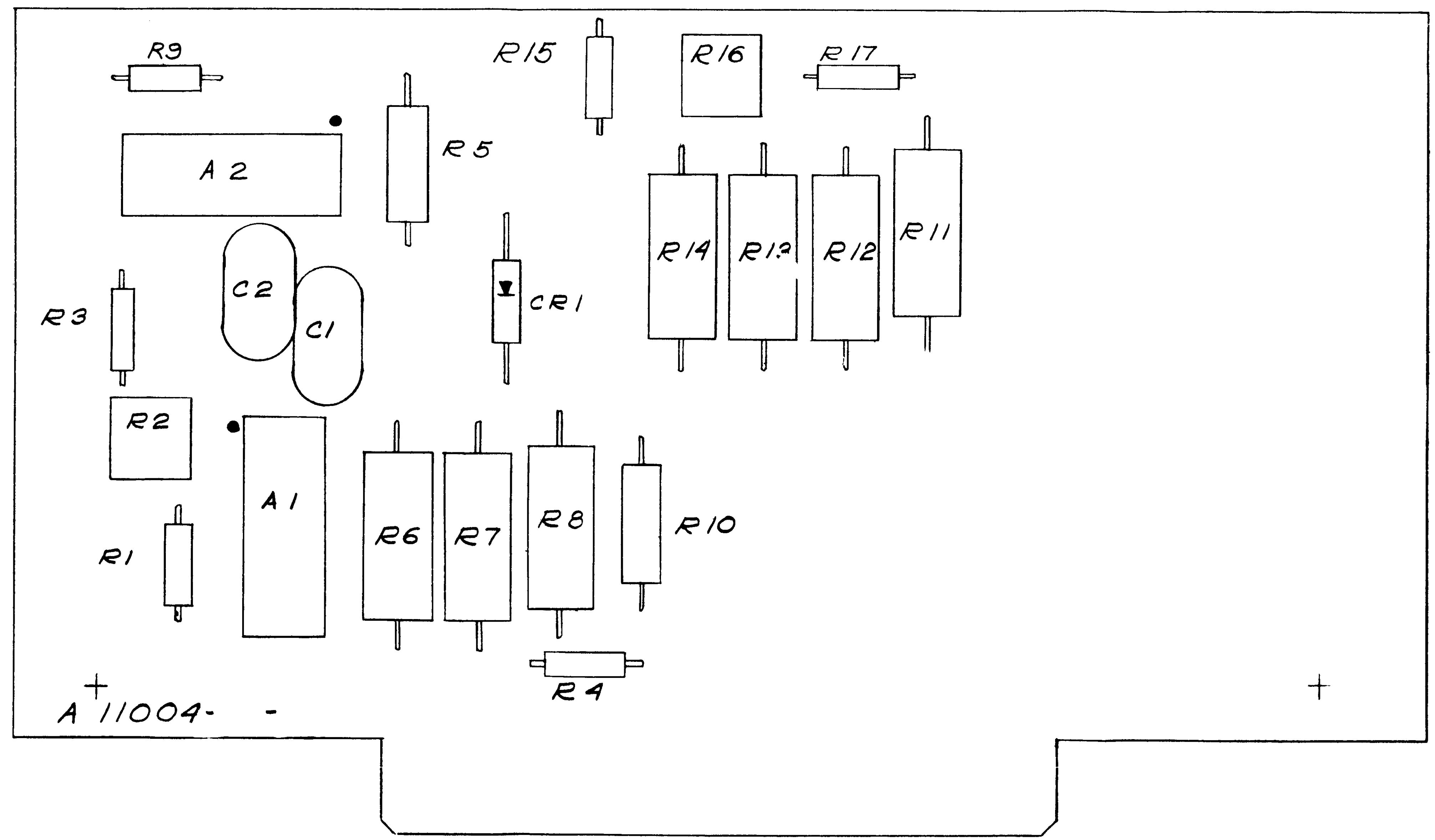


Figure 7-38. Power Supply A19A1, Component Location

007742119
A11004-5-B

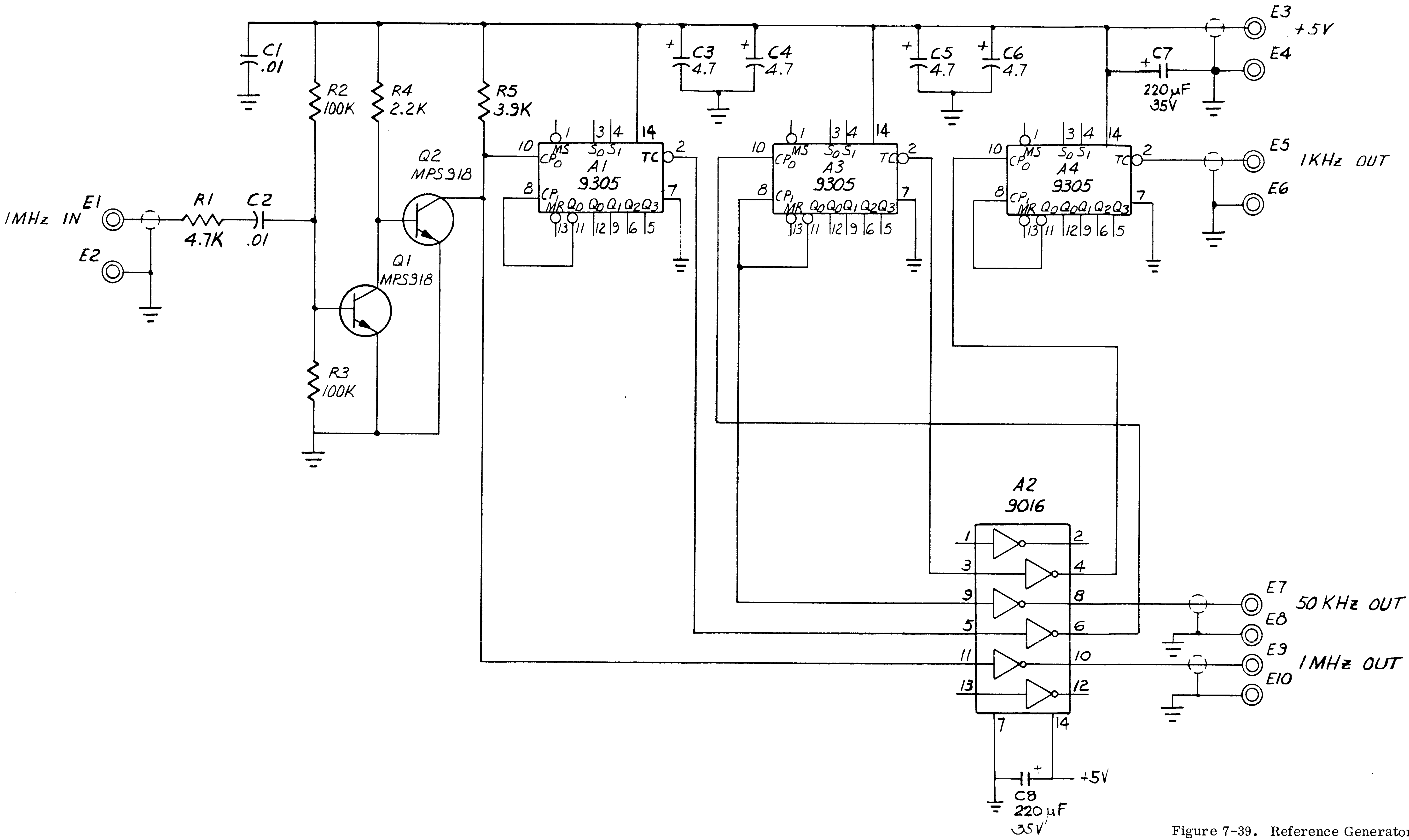


Figure 7-39. Reference Generator A23, Schematic Diagram

007742119
A11067-5-Ø

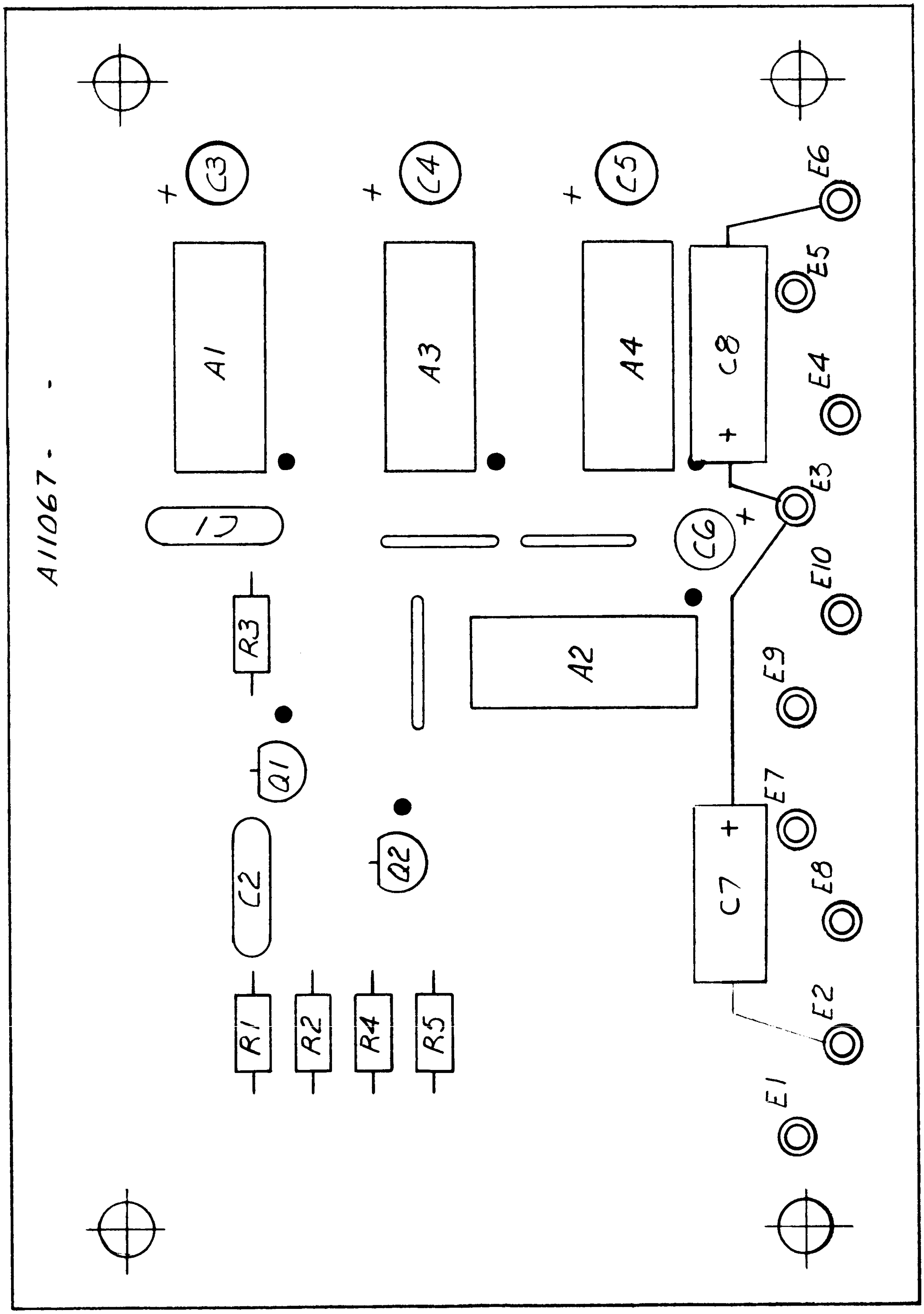


Figure 7-40. Reference Generator A23, Component Location