HARRIS
RF COMMUNICATIONS

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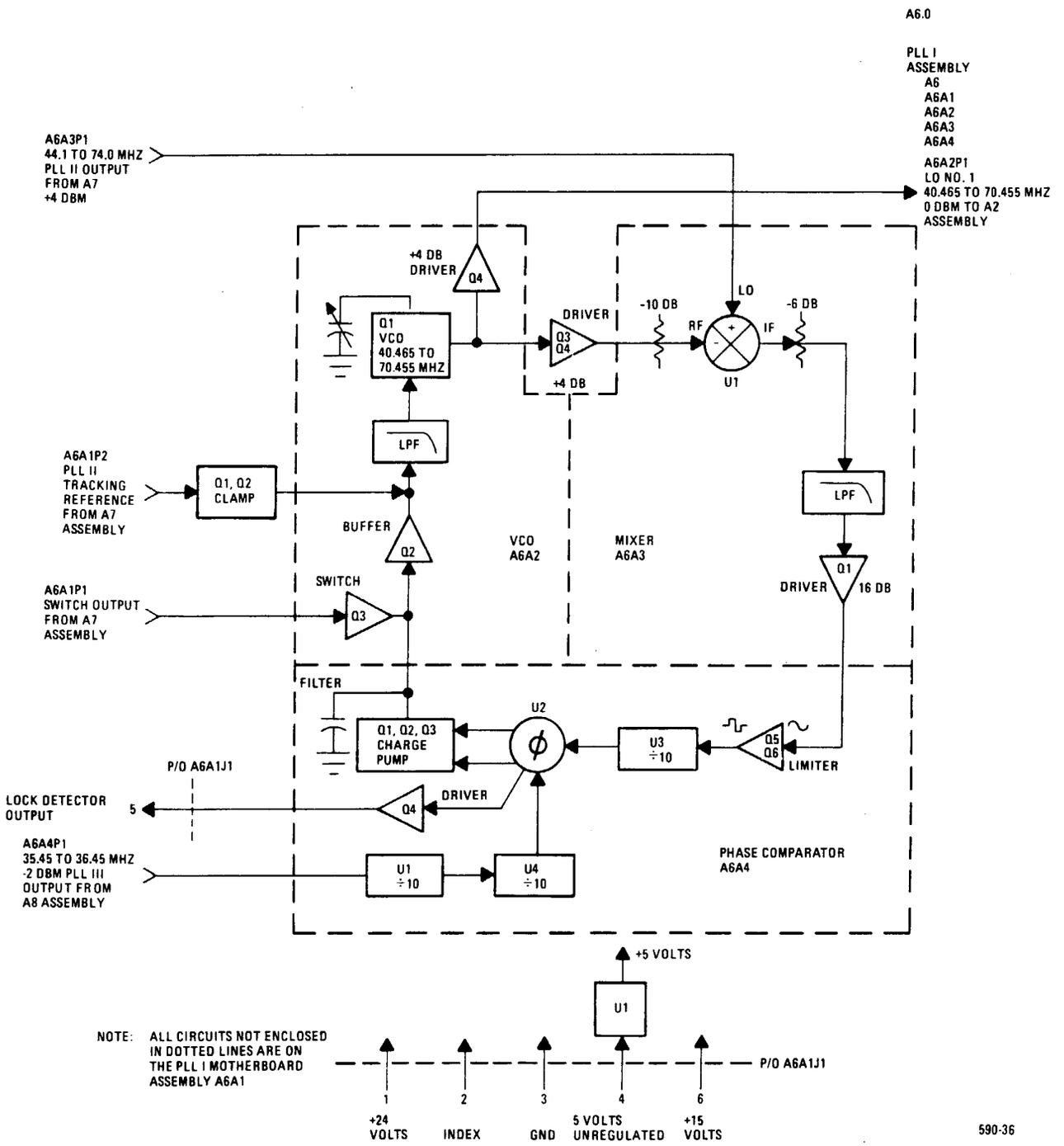

PLL I Assembly A6 Functional Block Diagram

1. GENERAL DESCRIPTION

PLL I Assembly A6 is a translation type phase lock loop which performs the following primary functions.

- Combination of the 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, and 10 MHz tuning increments information
- Frequency translation of these increments to the required Local Oscillator (LO) no. 1 range of 40.465 to 70.455 MHz

Coarse tuning increments (100 kHz, 1 MHz, and 10 MHz) arrive from the A7 assembly are combined with the fine tuning increments (1 Hz, 10 Hz, 100 Hz, 1 kHz, and 10 kHz) from the A8 assembly. Occurring simultaneously with this combination function is frequency translation to the Local Oscillator no. 1 range. This signal is then applied to First Converter Assembly A2, where it functions as the first local oscillator injection for A2 Mixer M1. This signal which is continuously variable in 1 Hz steps allows the RF-590 to tune from 10 kHz to 30 MHz, constantly maintaining a first intermediate frequency (IF) of 40.455 MHz (IF no. 1 = LO no. 1 - Radio tune frequency).

PLL I Assembly A6 consists of the following four separate subassemblies.

- Motherboard Assembly A6A1
- VCO Assembly A6A2
- Mixer Assembly A6A3
- Phase Comparator Assembly A6A4

The A6A2, A6A3, and A6A4 subassemblies are separate printed circuit boards which are mounted to the A6A1 motherboard. All three subassemblies are independently shielded from each other and other circuitry on the motherboard by separate shield cans which completely surround each subassembly.

Plug-in mating connectors connect each subassembly to the others. Signals which originate or terminate off the A6 assembly are connected via coax cables and connectors or through the one main plug-in type control connector, J1.

2. INTERFACE CONNECTIONS

Table 1 details the input/output connections and other relevant data for all signals which originate or terminate off the A6 assembly. (A6 subassembly interconnections are not shown.)

Table 1. PLL I Assembly A6 Interface Connections

Connector	Function	Characteristic
A6A1J1-1	+24 Volts	Approximately 20 mA
-2	Index	
-3	Ground	
-4	+5 Volts Unregulated	Approximately 200 mA
-5	Lock Detector Output	0 V = PLL locked, +5 V = PLL unlocked
-6	+15 Volts	Approximately 25 mA
A6A1P2	PLL II Tracking Reference	+3.5 to +19 Vdc
A6A2P1	LO no. 1	0 dBm, 40.465 to 70.455 MHz (PLL I Output)
A6A3P1	PLL II Output	+4 dBm, 44.1 to 74.0 MHz
A6A4P1	PLL III Output	-2 dBm, 35.45 to 36.45 MHz
A6A1P1	Switch	+4 V at tune frequency < 2 MHz 0 V at tune frequency $\geqslant 2$ MHz

3. A6 FREQUENCY GENERATION SCHEME

A PLL intermediate frequency (IF) signal in the range of 3.545 MHz to 3.645 MHz is produced at the output of mixer A6A3U1. This IF signal is a result of the subtractive mixing of the 44.1 to 74.0 MHz PLL II output with a VCO signal from VCO Assembly A6A2 in the range of 40.465 MHz to 70.455 MHz.

This IF signal is converted to TTL levels and divided down to a 354.5 kHz to 365.4 kHz range, and applied to one port of Phase Comparator A6A4U2. The second port of A6A4U2 is the reference signal, a variable 354.5 kHz to 365.4 kHz signal derived from PLL III Assembly A8. Any difference in frequency or phase between these two signals produces an error output from the phase comparator which forces the VCO to change its operating frequency. As the VCO frequency changes, the IF output at mixer A6A3U1 must also change. Eventually the IF derived signal will equal the reference frequency at the Phase Comparator inputs and the Phase Comparator will stop the VCO at the frequency which produced the correct IF.

Since the instantaneous frequencies of the PLL II output and the PLL III output represent the values of the 10 MHz, 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, 10 Hz, and 1 Hz receiver tuning positions respectively, the instantaneous frequency of the VCO will be a unique frequency representing all these values. The VCO output is applied to a mixer in the receivers front end at the A2 assembly and functions as that mixer's LO signal. A change in any of the 10 MHz to 1 Hz tuning positions will cause the LO to change to the frequency required to tune the receiver, producing a constant receiver first intermediate frequency of 40.455 MHz.

Given the receiver tune frequency $f_o = X_8\ X_7,\ X_6\ X_5\ X_4,\ X_3\ X_2\ X_1$ Hz where X_8 through X_1 represent the values of the 10 MHz through 1 Hz tuning positions, the A6 output frequency can be determined by the following formula:

$$FA6 = FA7 - \frac{1}{10} FA8, \text{ Hz}$$

where

$$FA7 = (441 + X_8\ X_7\ X_6)\ (100{,}000), \text{ Hz}$$
$$FA8 = [40{,}000{,}000 + 10\ (6000 - X_3\ X_2\ X_1)] - [10{,}000\ (361 + X_5\ X_4)], \text{ Hz}$$

Example: $f_o = 14{,}682{,}156$ Hz

$$FA7 = (441 + 146)\ (100{,}000) = 58{,}700{,}000 \text{ Hz}$$
$$FA8 = [40{,}000{,}000 + 10\ (6000 - 156)] - [10{,}000\ (361 + 82)] = 40{,}058{,}440 - 4{,}430{,}000 = 35{,}628{,}440 \text{ Hz}$$
$$FA6 = 58{,}700{,}000 - \frac{1}{10}\ (35{,}628{,}440) = 55{,}137{,}156 \text{ Hz}$$

Note that $FA6 - f_o = 40{,}455{,}000$ Hz. This relationship will be true for all receiver tune frequencies, since 40.455 MHz was chosen as the receiver's first IF.

4. CIRCUIT DESCRIPTIONS

4.1 Mixer Assembly A6A3 Operation

A variable 44.1 to 74.0 MHz, +4 dBm signal containing 100 kHz, 1 MHz, and 10 MHz tuning information from PLL II Assembly A7 enters the A6A3 assembly at P1 and is applied to pin 8 of mixer U1. A VCO derived signal from the A6A2 assembly is fed through -10 dB attenuator network R1-R3 to pin 1 of the mixer. The resultant IF output is a signal in the range of 3.545 to 3.645 MHz at U1, pins 3 and 4.

This signal is attenuated by -6 dB network R4-R6 and then applied to a low pass filter network to remove all undersirable mixer products. Amplifier stage Q1 boosts this signal to approximately 300 mVrms for application to Phase Comparator Assembly A6A4.

4.2 Phase Detector Assembly A6A4 Operation

The IF signal from A6A3 assembly is converted to TTL levels by high gain limiter stage Q5 and Q6 and divided down to the 354.5 kHz to 364.5 kHz range by divide by 10 counter U3. This signal is then applied to the IF port of phase comparator U2.

The reference port of U2 is derived from the PLL III output, and is also in the 354.5 kHz to 364.5 kHz range after division by divide by 10 counters U1 and U4.

When these two signals are equal in frequency and phase, the phase comparator outputs at U2, pins 2 and 13, are at +5 Vdc. All transistors in charge pump network Q1, Q2, and Q3 are biased off. The voltage across C21 is constant, and this will bias transistor A6A2Q2 on the VCO assembly to produce a constant voltage drop across A6A2R9, at A6A2TP1. Consequently, the VCO on the A6A2 assembly is held at a constant frequency.

Assume that the A8 PLL III output increases in frequency due to decreasing the values of any of the 10 kHz through 1 Hz receiver tuning positions. Since the reference signal at the reference port of the Phase Comparator (pin 1) will suddenly be higher in frequency than the IF derived signal at the IF port, U1 produces an error command to lower the VCO frequency and thereby increase the IF feedback signal. This command is in the form of negative pulses at U2, pin 13. The pulse width of this signal is proportional to the difference in frequency and/or phase between the two Phase Comparator inputs. When these negative pulses occur, Q2 is forced on and a charge is drawn out of C21. This causes A6A2Q2 to conduct less, and the level of the VCO control voltage at A6A2TP1 will fall. As it decreases, the VCO frequency decreases, causing a corresponding increase in IF frequency at mixer A6A3U1's output. As the IF feedback signal at the Phase Comparator's input approaches the reference frequency, the output pulses at U2, pin 13, get narrower until they are essentially at a 5 Vdc level again. At this point, the two Phase Comparator inputs are equal in frequency, Q2 is turned off, and the voltage across C21 is constant (but at a new lower value). Consequently, the VCO control voltage is also constant, but at a new lower value, as is the VCO output frequency.

Note that the same sequence of events would have occurred if the A7 PLL II output frequency had decreased due to a decrease in the 10 MHz to 100 kHz receiver tuning positions.

Assume that the A7 PLL II output frequency increases due to increasing the 10 MHz to 100 kHz receiver tuning values. The instantaneous frequency at mixer A6A3U1's output will increase, causing a corresponding increase at the IF input port of the Phase Comparator. This signal will be greater in frequency than the reference signal and consequently U1 issues an error command to raise the VCO frequency in order to lower the mixer's output frequency. This time the negative pulses appear at pin 2 of the Phase Comparator. Q1 is forced on, and in so doing, turns Q3 on. Q3 begins pumping a charge into C21, raising its voltage. This turns A6A2Q1 on harder and a rising voltage occurs at A6A2TP1, the VCO control voltage. This voltage forces the VCO frequency to increase. Mixer A6A3U1's output (IF) frequency therefore decreases and continues to do so until the two signals at the Phase Comparator inputs are again equal. At that time, the output pulses at U2, pin 2, are essentially at 5 Vdc, Q1 and Q2 turn off, and the VCO control voltage stops at a new higher value (as does the VCO frequency).

Note that the same sequence of events would have occurred if the A8 PLL III output decreased in frequency due to increasing any of the values of the receiver's 10 kHz through 1 kHz tuning positions.

4.3 VCO/Loop Filter A6A2 Operation

A charge pump circuit on the A6A4 assembly converts the Phase Comparator's pulse outputs into an analog dc voltage and applies it to terminal E2 of VCO/Loop Filter Assembly A6A2. Q2 generates the actual VCO control voltage across R9 at TP1, and applies the signal through a low pass filter (LPF) network to the varactor diode string in the VCO. The LPF removes any noise transients on the VCO control voltage

line which could shift the VCO frequency. The VCO is a JFET Hartley Oscillator stage (Q1) whose frequency shifts as the varactor diodes capacitance changes in response to changes in VCO control voltage. A VCO control voltage range at TP1 of approximately 3.5 Vdc to 19.0 Vdc shifts the VCO frequency from 40.455 MHz to 70.455 MHz.

The VCO output is fed to two separate amplifier stages. The first, Q4, boosts the signal to 0 dBm and routes the signal through P1 to First Converter Assembly A2, where it functions as the first LO injection for mixer A2U1. The second stage is on the A6A1 motherboard and consists of transistors A6A1Q3 and A6A1Q4. This signal is simply referred to as the VCO output, and is boasted to approximately -6 dBm prior to application to mixer A6A3U1 on the mixer assembly; the VCO feedback loop is therefore completed.

4.3.1 Other VCO Control Circuits

There are two other circuits which can cause the VCO control voltage to change. They are the PLL II Tracking Reference/Clamp circuit (motherboard transistors A6A1Q1 and A6A1Q2) and the 2 MHz switch circuit (VCO/Loop Filter transistor A6A2Q3).

4.3.1.1 PLL II Tracking Reference/Clamp Circuit

The PLL II tracking reference/clamp circuit forces the PLL I VCO to track the PLL II VCO. In so doing, it shortens the receiver tuning time. It also prevents the PLL II VCO from running to the wrong side of the frequency conversion in the mixing process, which could cause failure or the loop to falsely lock up.

For example, assume that the PLL II output is at 74 MHz and the VCO output is at 70.455 MHz (the highest frequency it would normally operate at). The IF frequency produced at the A6A3U1 mixer output would then be (74 – 70.455) MHz = 3.545 MHz, which is in the normal PLL IF range.

Assume that the VCO exceeds its upper frequency bound, and is now at 77.545 MHz. The IF output at A6A3U1 would again be 3.545 MHz (77.545 MHz - 74 MHz = 3.545 MHz), and the Phase Comparator would lock, holding the VCO at the wrong frequency.

The potential problem is eliminated by forcing the A6A2 VCO to track the A7 PLL II VCO. The PLL II VCO does not have a mixer in its feedback path, and therefore does not have this problem. It does, however, contain a VCO circuit which is almost identical to the A6A2 VCO (with respect to control voltage levels and operational frequency). When the PLL I VCO control voltage changes from 3.5 to 19.0 Vdc, its frequency changes from 40.455 MHz to 70.455 MHz. When the PLL II VCO control voltage changes from 3.5 to 19.0 Vdc, its frequency changes from 44.1 to 74 MHz. Furthermore, whenever the PLL II control voltage and VCO frequency change, the PLL I control voltage and VCO frequency will always change by almost the same amount.

Knowing that the VCO control voltage levels of both VCOs should always be approximately the same, we could monitor both and know if the PLL I VCO frequency is incorrect, since if it is it would have a different control voltage level than the PLL II VCO.

The A6A1 Tracking Reference/Clamp circuit does this monitoring function, as well as forcing the PLL I VCO back to the correct control voltage range, if necessary. The PLL II tracking reference signal at A6A1P2 is the actual value of the instantaneous A7 control voltage and is applied to the input of the circuit. The clamp's output is PLL I VCO control voltage at the PLL I VCO input. So long as the two control voltages remain within approximately ±1.5 Vdc of each other (due to the diode drops of CR1, CR2, and Q1 or CR3, CR4, and Q2), Q1 and Q2 are nonconducting, and the PLL I control voltage is in an acceptable range of ±1.5 Vdc from the PLL II control voltage.

Assume that the PLL I control voltage took off, driving the VCO higher in frequency. As soon as the control voltage level exceeded the PLL II control voltage plus 1.5 Vdc, Q2 turns on, forcing the PLL I control voltage to stop. Simultaneously, the PLL I Phase Comparator would be reacting to this sudden increase in frequency and eventually would pull the control voltage back down to the correct level, at which time Q2 would turn off.

The Tracking Reference/Clamp circuit will act as a "quick reaction" method of holding the PLL I VCO to approximately the correct value until the Phase Comparator can react in the event of a VCO "run away" condition. (Note that Q1 would perform the controlling function if the PLL I control voltage dropped 1.5 Vdc below the PLL II control voltage.)

4.3.1.2 2 MHz Switch Circuit

At receiver tune frequencies less than approximately 2 MHz, the VCO control voltage required to drive the VCO is so low that the charge pump circuit on Phase Comparator Assembly A6A4 enters a nonlinear region of operation in an attempt to produce it. In order to correct this (at frequencies less than 2 MHz), the PLL Frequency Synthesizer A7U2 on the PLL II assembly outputs a 5 Vdc level to A6A1P1. This level occurs at A6A2E3 and turns Q3 on. Q3, which is connected across the control voltage input at Q2's base reduces the control voltage level by switching R7 into the circuit. The net result is that the charge pump on the A6A4 assembly must now force its output to increase the dc level at E2 in order to produce the proper VCO control voltage level at TP1. In so doing, the charge pump pulls itself out of its nonlinear region. At tune frequencies greater than 2 MHz, Q3 is off, and the charge pump functions normally. Note that this same scheme is used on the A7 assembly.

4.4 BITE Circuits

Lock detector A6A4Q4 on Phase Detector Assembly A6A4 monitors the status of the Phase Comparators outputs, A6A4U2 pins 2 and 13. If either output pulses low and remains low for a period exceeding the time constants of A6A4R10 and A6A4C4, A6A4Q4 turns on and outputs a 5 Vdc signal at (ultimately) connector A6A1J1, pin 5, Lock Detector Output. This immediately flags BITE monitoring circuits on Control Assembly A14 and a front panel fault light indicator will light.

5. MAINTENANCE

The following adjustments should not be made as part of a routine maintenance procedure but rather only when a failure indicates a definite need. All tests are performed with all connections in normal contact, unless otherwise specified.

5.1 VCO Tracking Adjustment

Perform the following procedures to adjust the VCO.

a. Connect equipment as shown in figure 1.

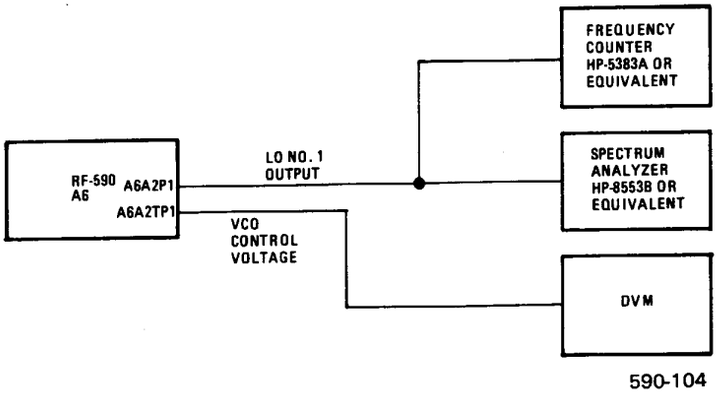

Figure 1. VCO Adjustment

b. Set the RF-590 to 29.900000 MHz. Note the VCO control voltage level at A6A2TP1 (should be approximately 16 - 19.0 Vdc).

c. Monitor the PLL II tracking reference from A7 to A6A1E2 with the DVM. The level should be the same as that noted in step b. If not, adjust PLL II Assembly A7C15 until the PLL II tracking reference is equal to the PLL I VCO control voltage at A6A2TP1.

d. Tune the radio to each of the frequencies listed in table 2. At each frequency, the PLL II tracking reference and the PLL I VCO control voltage should agree within ±.5 Vdc. The LO no. 1 output should be 0 dBm ±3 dB at the frequencies indicated.

e. Check that the switch input at A6A1E1 does change to approximately 4 ± .5 Vdc when the receiver is tuned below 2 MHz.

Table 2. VCO Frequency Range

Receiver Tune Frequency (MHz)	LO No. 1 Output Frequency (MHz)	Approximate PLL I VCO Control Voltage (Vdc)
29.900000	70.355000	17.75 ± 1.25
20.000000	60.455000	12.5 ± 1.0
10.000000	50.455000	7.5 ± 1.0
0.000000	40.455000	3.0 ± 1.0

f. Fully reconnect the A6 assembly to the RF-590 and initiate BITE self-test. The Receiver should not fail at any test concerning the A6 assembly. The test is now complete.

Tables 3 through 7 and figures 2 through 9 are the A6 assembly parts lists, component location drawings, and schematics.

Table 3. PLL I Assembly Maintenance Parts List (PL 10073-4100-01)

Ref. Desig.	Part Number	Description
	10073-7089	CABLE, COAX ASSY
A6	10073-4100-01	PLL1 ASSEMBLY
A6A1	10073-4110	PWB ASSY, PLL 1 MOTHER BD
A6A2	10073-4120-01	PWB ASSY, VCO
A6A3	10073-4130	PWB ASSY, MIXER
A6A4	10073-4160-01	PWB ASSY, PHASE DETECTOR

Table 4. PLL I Assembly A6A1 Maintenance Parts List (PL 10073-4110)

Ref. Desig.	Part Number	Description
	10073-4110	PWB, PLL 1 MOTHER BD
	J46-0003-001	HEADER, 1 PIN
	10073-7088	CABLE, COAX ASSY
	E70-0002-002	PAD MNT XSTR TO-5
C1	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
C4	M39014/02-1310	CAP .1UF 10% 100V CER-R
C5	C26-0025-100	CAP 10UF 20% 25V TANT
C6	M39014/02-1310	CAP .1UF 10% 100V CER-R
C7	M39014/01-1535	CAP .01UF 20% 100V CER
C8	M39014/01-1535	CAP .01UF 20% 100V CER
C9	M39014/01-1535	CAP .01UF 20% 100V CER
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C11	M39014/01-1535	CAP .01UF 20% 100V CER
C12	M39014/01-1535	CAP .01UF 20% 100V CER
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/01-1535	CAP .01UF 20% 100V CER
C15	CM04ED390J03	CAP 39PF 5% 500V MICA
C16	M39014/01-1535	CAP .01UF 20% 100V CER
C17	M39014/01-1535	CAP .01UF 20% 100V CER
C20	M39014/02-1310	CAP .1UF 10% 100V CER-R
C21	C26-0025-100	CAP 10UF 20% 25V TANT
C22	M39014/02-1310	CAP .1UF 10% 100V CER-R
C23	M39014/02-1310	CAP .1UF 10% 100V CER-R
C24	C26-0016-151	CAP 150UF 20% 16V TANT
C25	M39014/02-1310	CAP .1UF 10% 100V CER-R
C26	M39014/02-1310	CAP .1UF 10% 100V CER-R

Table 4. PLL I Assembly A6A1 Maintenance Parts List (PL 10073-4110) (Cont.)

Ref. Desig.	Part Number	Description
C27	C26-0035-100	CAP 10UF 20% 35V TANT
C28	10073-7035	CAP,FEED-THRU 100
C29	10073-7035	CAP,FEED-THRU 100
C30	10073-7035	CAP,FEED-THRU 100
C31	10073-7035	CAP,FEED-THRU 100
CR1	1N3064	DIODE 75mA 75V SW
CR2	1N3064	DIODE 75mA 75V SW
CR3	1N3064	DIODE 75mA 75V SW
CR4	1N3064	DIODE 75mA 75V SW
J1	J46-0032-006	HDR 6 PIN 0.100" SR
L1	L08-0001-001	CHOKE W B 50 MHZ
L2	L08-0001-001	CHOKE W B 50 MHZ
L3	MS14046-9	COIL 27UH 10% FXD RF
Q1	2N2222	XSTR SS/GP NPN TO-18
Q2	2N2907	XSTR SS/GP PNP TO-18
Q3	Q35-0003-000	XSTR U310 JFET HIGH GM
Q4	2N5109	XSTR RFPWR NPN TO-39
R1	R65-0003-473	RES 47K 5% 1/4W CAR FILM
R2	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R3	R65-0003-104	RES 100K 5% 1/4W CAR FILM
R4	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R5	R65-0003-221	RES 220 5% 1/4W CAR FILM
R6	R65-0003-221	RES 220 5% 1/4W CAR FILM
R7	R65-0003-101	RES 100 5% 1/4W CAR FILM
R8	R65-0003-101	RES 100 5% 1/4W CAR FILM
R9	R65-0003-151	RES 150 5% 1/4W CAR FILM
R10	R65-0003-470	RES 47 5% 1/4W CAR FILM
R11	R65-0003-242	RES 2.4K 5% 1/4W CAR FILM
R12	R65-0003-152	RES 1.5K 5% 1/4W CAR FILM
R13	R65-0003-101	RES 100 5% 1/4W CAR FILM
R14	R65-0003-121	RES 120 5% 1/4W CAR FILM
R15	R65-0003-100	RES 10 5% 1/4W CAR FILM
R16	R65-0003-471	RES 470 5% 1/4W CAR FILM
T1	10073-7014	TRANSFORMER, RF, FIXED
T2	10073-7014	TRANSFORMER, RF, FIXED
VR1	I11-0001-001	IC VR 7805 + 5V 1.5A 4%
VR2	1N4737	DIODE 7.5V 10% 1W ZENER

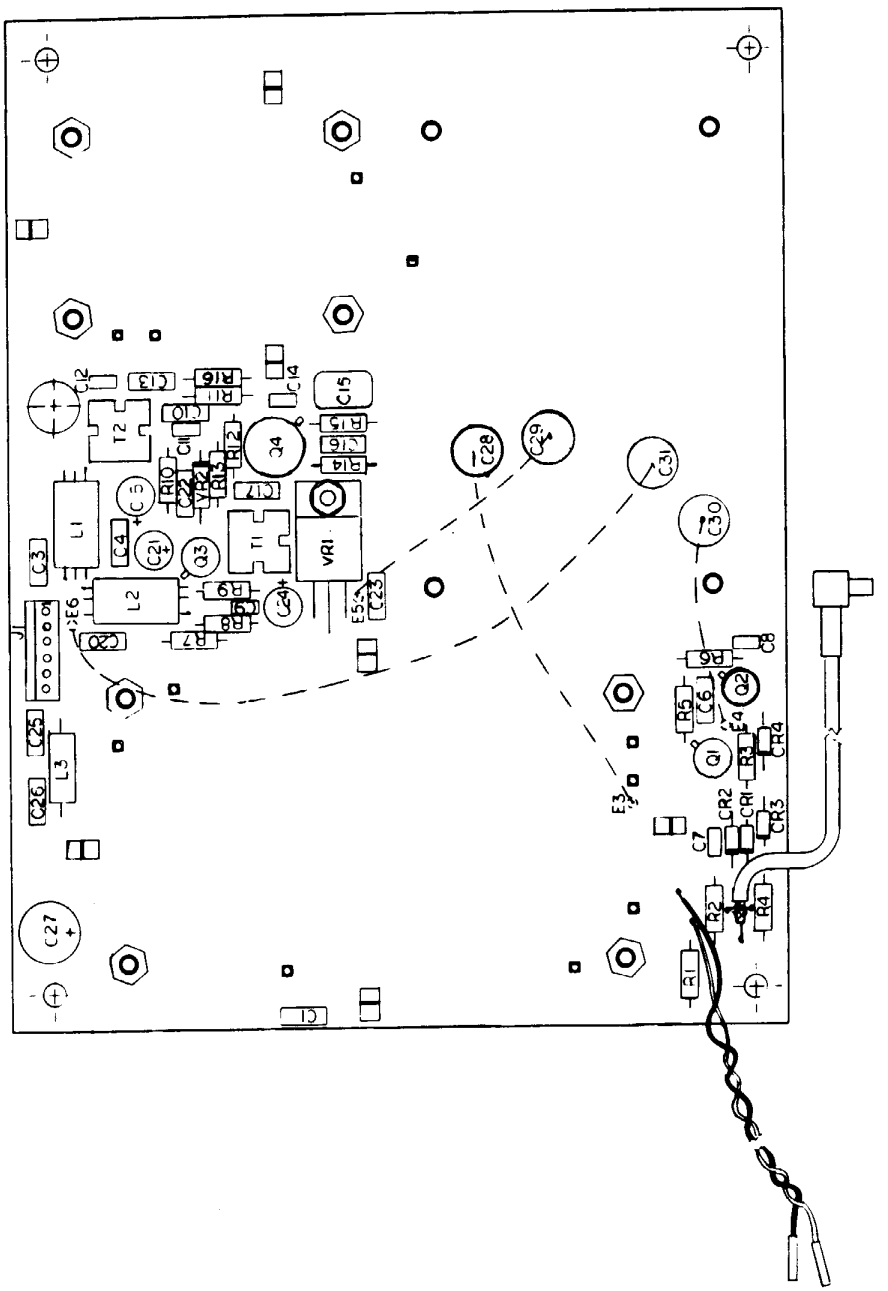

Figure 2. PLL I Assembly A6 and PLL I Motherboard Assembly A6A1
Component Location Diagram (PL 10073-4110, Rev. C)

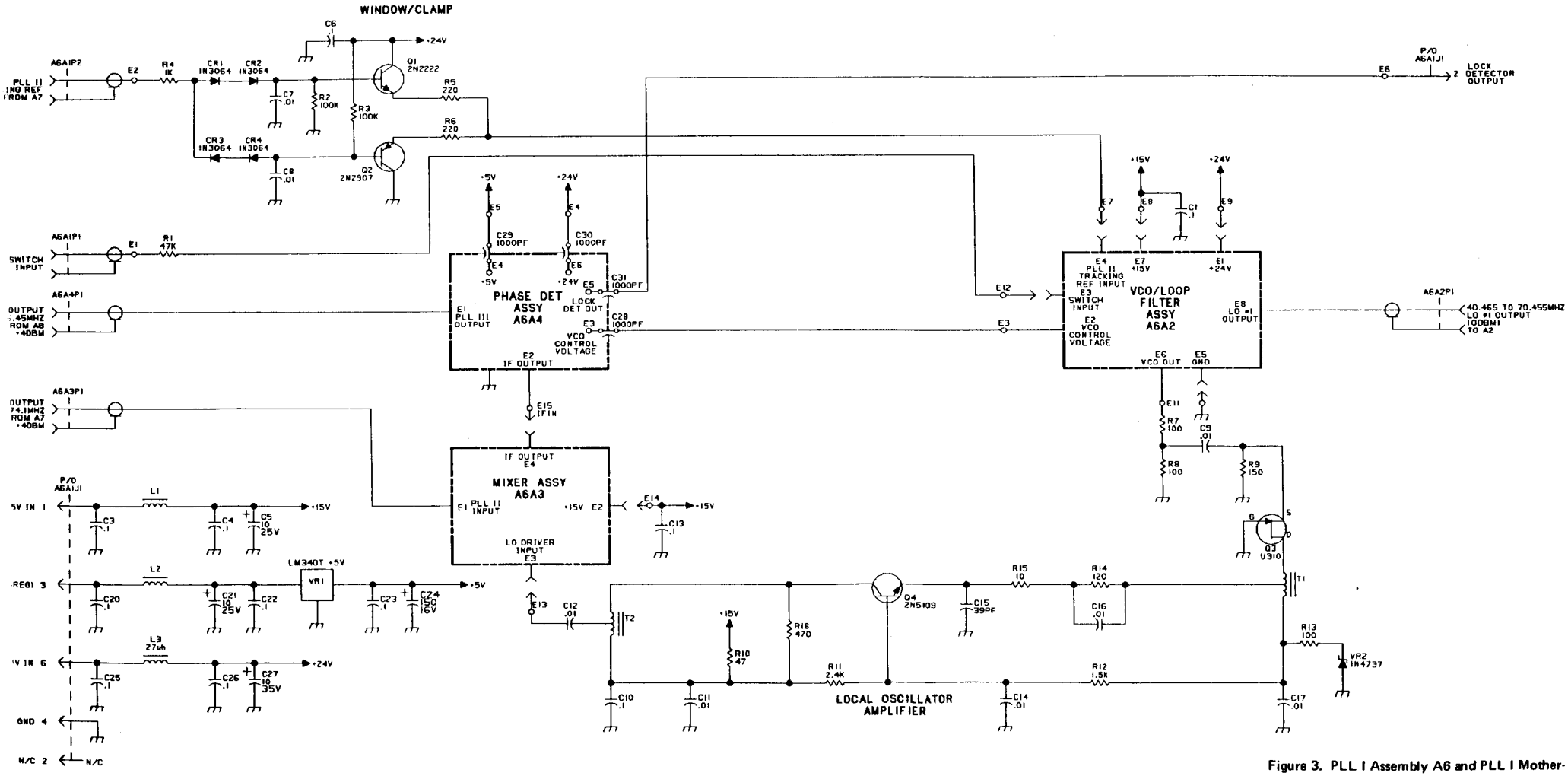

Figure 3. PLL I Assembly A6 and PLL I Mother-Board Assembly A6A1 Schematic Diagram (10073-4111, Rev. E)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.

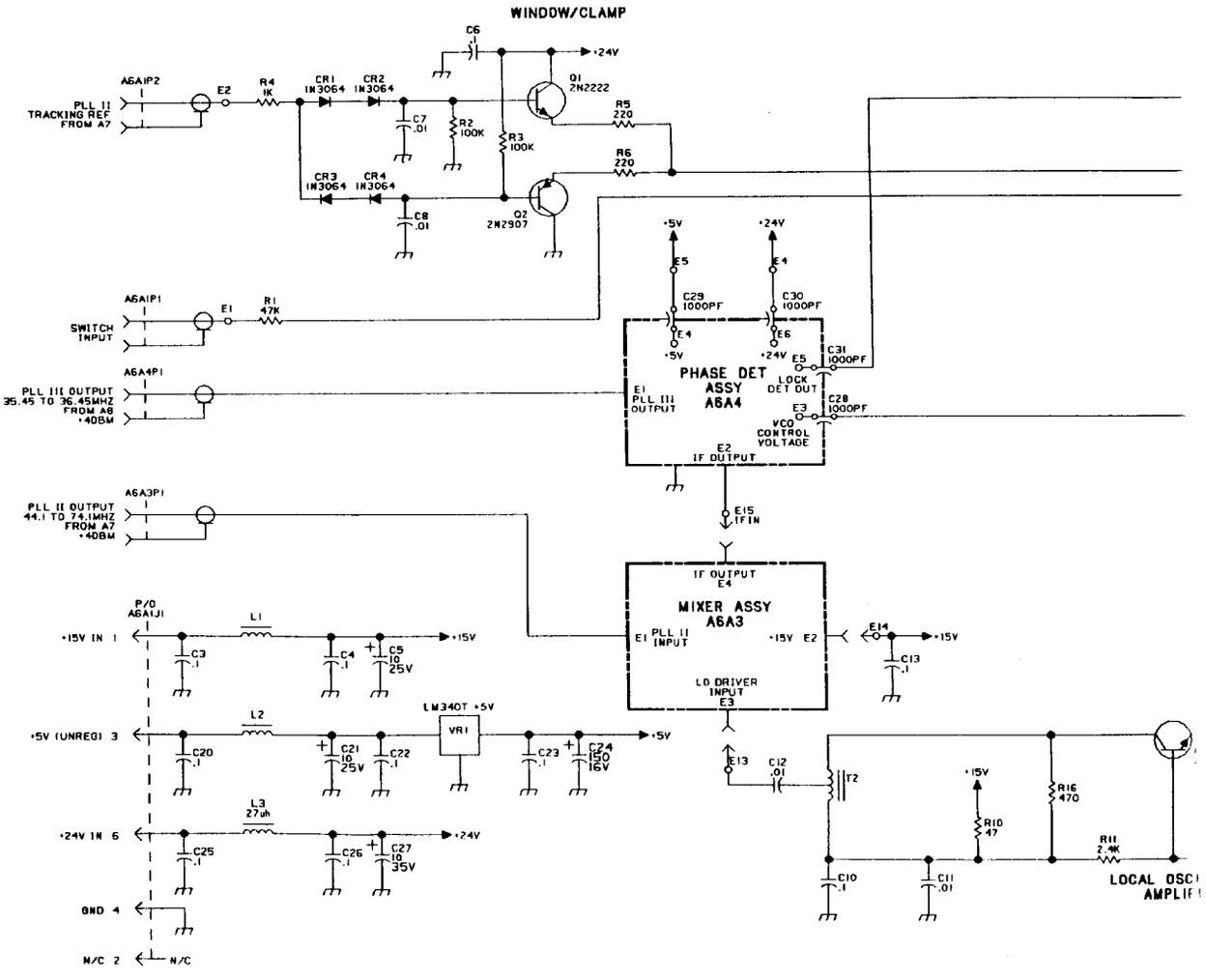

Table 5. VCO Board A6A2 Parts List (PL 10073-4120-01)

Ref. Desig.	Part Number	Description
	10073-4120-01	PWB, VCO
	10073-7089	CABLE, COAX ASSY
C1	C26-0025-100	CAP 10UF 20% 25V TANT
C2	M39014/02-1310	CAP .1UF 10% 100V CER-R
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
C4	M39014/02-1310	CAP .1UF 10% 100V CER-R
C5	C26-0025-100	CAP 10UF 20% 25V TANT
C6	CK05BX102M	CAP 1000PF 20% 200V CER
C7	C26-0025-339	CAP 3.3UF 20% 25V TANT
C8	CK05BX103M	CAP .01UF 20% 100V CER
C9	C66-0050-102	CAP 1000PF 5% 50V FILM
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C11	M39014/02-1310	CAP .1UF 10% 100V CER-R
C12	C26-0035-100	CAP 10UF 20% 35V TANT
C13	CK05BX102M	CAP 1000PF 20% 200V CER
C14	C26-0035-229	CAP 2.2UF 20% 35V TANT
C15	C-2496	CAP 470PF 2% 500V MICA
C16	C-2495	CAP 430PF 2% 500V MICA
C17	C-2501	CAP 680PF 2% 300V MICA
C18	C66-0050-152	CAP 1500PF 5% 50V FILM
C19	C66-0050-122	CAP 1200PF 5% 50V FILM
C20	C66-0050-182	CAP 1800PF 5% 50V FILM
C21	C66-0050-122	CAP 1200PF 5% 50V FILM
C22	C66-0050-102	CAP 1000PF 5% 50V FILM
C23	C-2501	CAP 680PF 2% 300V MICA
C24	C-2503	CAP 820PF 2% 300V MICA
C25	C66-0050-102	CAP 1000PF 5% 50V FILM
C26	CK05BX103M	CAP .01UF 20% 100V CER
C27	CK05BX103M	CAP .01UF 20% 100V CER
C28	M39014/02-1310	CAP .1UF 10% 100V CER-R
C29	CK05BX102M	CAP 1000PF 20% 200V CER
CR1	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR2	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR3	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR4	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR5	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR6	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR7	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR8	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR9	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR10	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR11	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR12	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR13	D25-0002-001	VARACTOR 26.0 - 32.0pF
CR14	D25-0002-001	VARACTOR 26.0 - 32.0pF

Table 5. VCO Board A6A2 Parts List (PL 10073-4120-01) (Cont.)

Ref. Desig.	Part Number	Description
CR15	1N6263	DIODE .40W 60V HOT CARR
E1	J42-0008-001	CONTACT, SOCKET
E2	J42-0008-001	CONTACT, SOCKET
E3	J42-0008-001	CONTACT, SOCKET
E4	J42-0008-001	CONTACT, SOCKET
E5	J42-0008-001	CONTACT, SOCKET
E6	J42-0008-001	CONTACT, SOCKET
E7	J42-0008-001	CONTACT, SOCKET
E8	E36-0026-001	TERM TUR BRS .178L
E9	E36-0026-001	TERM TUR BRS .178L
E10	E36-0026-001	TERM TUR BRS .178L
E11	E36-0026-001	TERM TUR BRS .178L
JMP1	MP-1142	CIRCUIT JUMPER
L1	MS75084-11	COIL 8.2UH 10% FXD RF
L2	10073-7042	INDUCTOR, 2.4MH
L3	10073-7042	INDUCTOR, 2.4MH
L4	10073-7042	INDUCTOR, 2.4MH
Q1	Q35-0003-000	XSTR U310 JFET HIGH GM
Q2	2N5088	XSTR SS/GP
Q3	2N2222	XSTR SS/GP NPN TO-18
Q4	Q35-0003-000	XSTR U310 JFET HIGH GM
R1	R65-0003-101	RES 100 5% 1/4W CAR FILM
R2	R65-0003-470	RES 47 5% 1/4W CAR FILM
R3	R65-0003-513	RES 51K 5% 1/4W CAR FILM
R4	R65-0003-103	RES 10K 5% 1/4W CAR FILM
R5	R65-0003-101	RES 100 5% 1/4W CAR FILM
R6	R65-0003-224	RES 220K 5% 1/4W CAR FILM
R7	R65-0003-683	RES 68K 5% 1/4W CAR FILM
R8	R65-0003-223	RES 22K 5% 1/4W CAR FILM
R9	R65-0003-202	RES 2.0K 5% 1/4W CAR FILM
R10	RN55D4641F	RES,4640 1% 1/8W MET FLM
R11	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R12	RN55D4750F	RES,475.0 1% 1/8W MET FLM
R13	R65-0003-270	RES 27 5% 1/4W CAR FILM
R14	R65-0003-151	RES 150 5% 1/4W CAR FILM
R15	R65-0003-101	RES 100 5% 1/4W CAR FILM
T1	10073-7002	TRANSFORMER, RF, FIXED
T2	10073-7014	TRANSFORMER, RF, FIXED
TP1	J-0071	TP PWB BRN TOP ACCS .080"
VR1	I12-0006-012	IC VR 78L12A + 12V .10A 4%

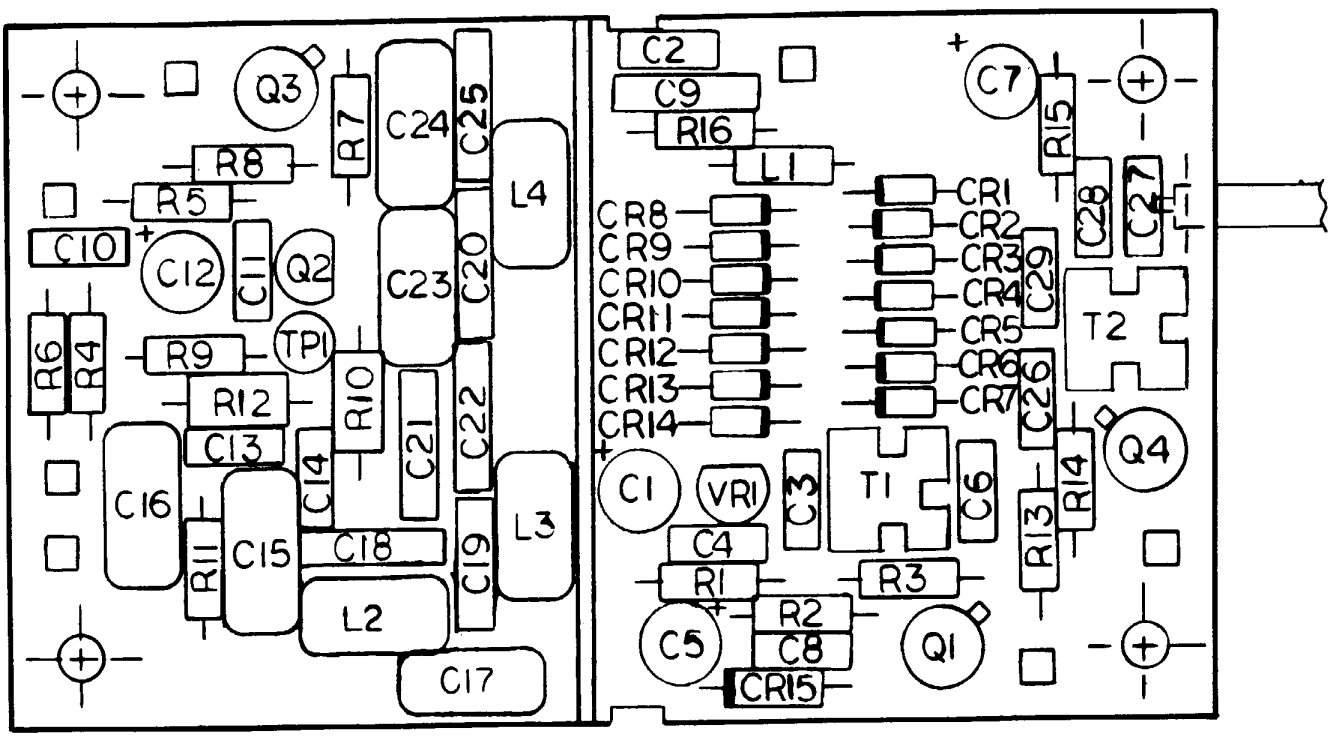

Figure 4. VCO Board A6A2 Component Location Diagram (10073-4120-01, Rev. G)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/4W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. CR1-CR14 ARE KV3901.
5. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
6. ON 10073-4120-02 ASSY'S : R12 = RN55D8250F, C14 = CK06BX474M
7. L5 MAY BE REQUIRED ON SOME ASSY'S TO OBTAIN THE DESIRED CONTROL VOLTAGE RANGE AND TRACKING.

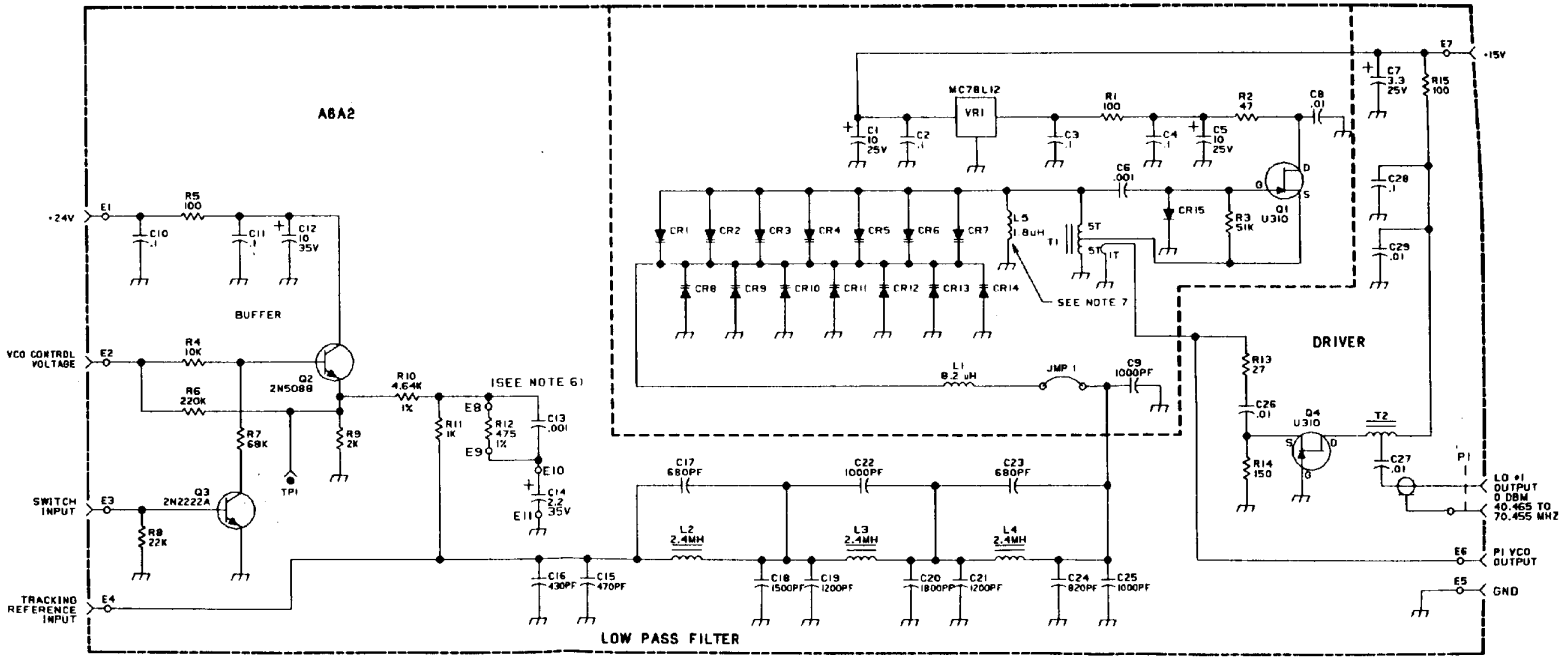

Figure 5. VCO Board A6A2 Schematic Diagram (10073-4121, Rev. H)

Table 6. Mixer Board A6A3 Maintenance Parts List (PL 10073-4130)

Ref. Desig.	Part Number	Description
	10073-4130	PWB, MIXER
	10073-7087	CABLE, COAX ASSY
	E70-0002-005	PAD MNT XSTR TO-18
C1	CM04FD151J03	CAP 150PF 5% 500V MICA
C2	CM04FD151J03	CAP 150PF 5% 500V MICA
C3	CM04ED330J03	CAP 33PF 5% 500V MICA
C4	CM04FC271J03	CAP 270PF 5% 300V MICA
C5	CM04FC301J03	CAP 300PF 5% 300V MICA
C6	CM04FD151J03	CAP 150PF 5% 500V MICA
C7	CM04FC271J03	CAP 270PF 5% 300V MICA
C8	CM04FC271J03	CAP 270PF 5% 300V MICA
C9	CM04FD121J03	CAP 120PF 5% 500V MICA
C10	CM04FD111J03	CAP 110PF 5% 500V MICA
C11	CM04FD121J03	CAP 120PF 5% 500V MICA
C12	M39014/02-1310	CAP .1UF 10% 100V CER-R
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/02-1310	CAP .1UF 10% 100V CER-R
C15	M39014/02-1310	CAP .1UF 10% 100V CER-R
L1	MS18130-9	COIL 1.2UH 10% FXD RF
L2	MS18130-9	COIL 1.2UH 10% FXD RF
L3	MS18130-8	COIL 1.0UH 10% FXD RF
L4	MS75085-7	COIL 100UH 10% FXD RF
Q1	2N2369	XSTR SS/RF NPN
R1	R65-0002-101	RES 100 5% 1/8W CAR FILM
R2	R65-0002-750	RES 75 5% 1/8W CAR FILM
R3	R65-0002-101	RES 100 5% 1/8W CAR FILM
R4	R65-0002-151	RES 150 5% 1/8W CAR FILM
R5	R65-0002-390	RES 39 5% 1/8W CAR FILM
R6	R65-0002-151	RES 150 5% 1/8W CAR FILM
R7	R65-0002-560	RES 56 5% 1/8W CAR FILM
R8	R65-0002-103	RES 10K 5% 1/8W CAR FILM
R9	R65-0002-201	RES 200 5% 1/8W CAR FILM
R10	R65-0002-472	RES 4.7K 5% 1/8W CAR FILM
R11	R65-0002-100	RES 10 5% 1/8W CAR FILM
R12	R65-0002-471	RES 470 5% 1/8W CAR FILM
U1	I51-0003-003	MIXER DB 50mW 500MHZ

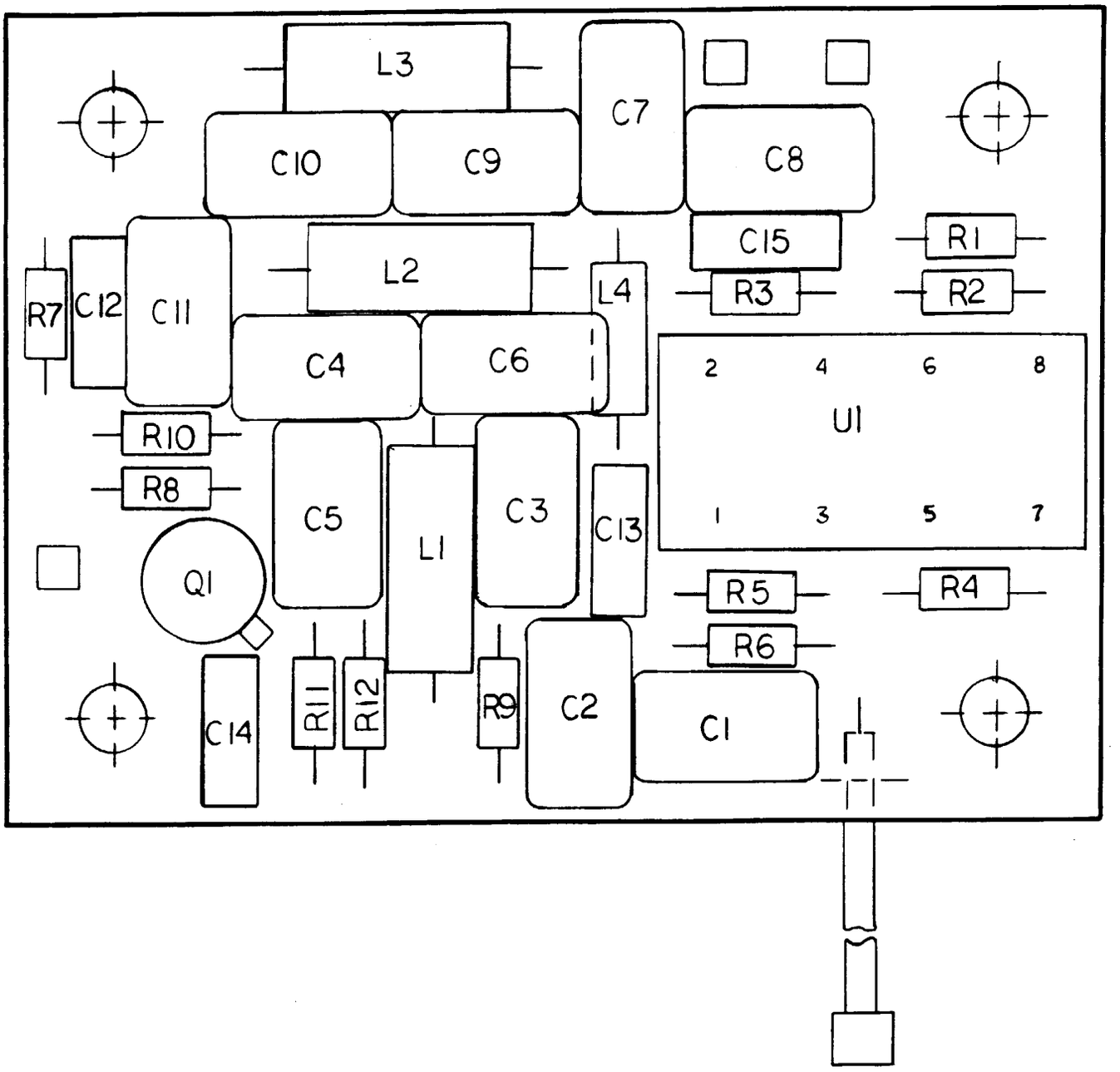

Figure 6. Mixer Board A6A3 Component Location Diagram (10073-4130, Rev. B)

Table 7. Phase Detector Board Maintenance Parts List (PL 10073-4160)

Ref. Desig.	Part Number	Description
	10073-4160-01	PWB, PHASE DETECTOR
	E70-0002-002	PAD MNT XSTR TO-5
C1	CM04ED330J03	CAP 33PF 5% 500V MICA
C2	CM04ED270J03	CAP 27PF 5% 500V MICA
C3	M39014/02-1310	CAP .1UF 10% 100V CER-R
C4	C26-0035-109	CAP 1.0UF 20% 35V TANT
C5	M39014/02-1310	CAP .1UF 10% 100V CER-R
C6	M39014/02-1310	CAP .1UF 10% 100V CER-R
C7	M39014/02-1310	CAP .1UF 10% 100V CER-R
C8	M39014/01-1535	CAP .01UF 20% 100V CER
C9	M39014/02-1310	CAP .1UF 10% 100V CER-R
C10	M39014/02-1310	CAP .1UF 10% 100V CER-R
C11	M39014/02-1310	CAP .1UF 10% 100V CER-R
C12	M39014/02-1310	CAP .1UF 10% 100V CER-R
C13	M39014/02-1310	CAP .1UF 10% 100V CER-R
C14	M39014/02-1310	CAP .1UF 10% 100V CER-R
C15	C25-0003-411	CAP 150UF 10% 15V TANT
C16	C26-0025-100	CAP 10UF 20% 25V TANT
C17	C26-0035-100	CAP 10UF 20% 35V TANT
C18	M39014/02-1310	CAP .1UF 10% 100V CER-R
C19	C26-0035-220	CAP 22UF 20% 35V TANT
C20	M39014/02-1310	CAP .1UF 10% 100V CER-R
C21	C26-0035-229	CAP 2.2UF 20% 35V TANT
C22	CM04ED200J03	CAP 20 PF 5% 500 V MICA
CR1	1N3064	DIODE 75mA 75V SW
CR2	1N3064	DIODE 75mA 75V SW
CR3	1N3064	DIODE 75mA 75V SW
CR4	1N3064	DIODE 75mA 75V SW
L1	L08-0001-001	CHOKE W B 50 MHZ
L2	MS75084-14	COIL 15.0UH 10% FXD RF
Q1	2N3866	XSTR SS/RF NPN TO-39
Q2	2N3866	XSTR SS/RF NPN TO-39
Q3	2N5160	XSTR RFPWR PNP
Q4	2N2907	XSTR SS/GP PNP TO-18
Q5	Q-0153	XSTR SS/RF PNP
Q6	2N2369	XSTR SS/RF NPN
R1	R65-0003-680	RES 68 5% 1/4W CAR FILM
R2	RN55D4990F	RES,499.0 1% 1/8W MET FLM
R3	RN55D2002F	RES,20.0K 1% 1/8W MET FLM
R4	RN55D4990F	RES,499.0 1% 1/8W MET FLM
R5	R65-0002-332	RES 3.3K 5% 1/8W CAR FILM
R6	RN55D1821F	RES,1820 1% 1/8W MET FLM

Table 7. Phase Detector Board Maintenance Parts List (PL 10073-4160-01) (Cont.)

Ref. Desig.	Part Number	Description
R7	R65-0002-332	RES 3.3K 5% 1/8W CAR FILM
R8	RN55D4990F	RES,499.0 1% 1/8W MET FLM
R9	R65-0002-221	RES 220 5% 1/8W CAR FILM
R10	R65-0003-472	RES 4.7K 5% 1/4W CAR FILM
R11	R65-0002-472	RES 4.7K 5% 1/8W CAR FILM
R12	R65-0002-472	RES 4.7K 5% 1/8W CAR FILM
R13	R65-0002-472	RES 4.7K 5% 1/8W CAR FILM
R14	R65-0002-391	RES 390 5% 1/8W CAR FILM
R15	R65-0003-241	RES 240 5% 1/4W CAR FILM
R16	R65-0003-472	RES 4.7K 5% 1/4W CAR FILM
R17	R65-0003-332	RES 3.3K 5% 1/4W CAR FILM
R18	R65-0002-270	RES 27 5% 1/8W CAR FILM
R19	R65-0003-331	RES 330 5% 1/4W CAR FILM
R20	R65-0003-562	RES 5.6K 5% 1/4W CAR FILM
R21	R65-0003-102	RES 1.0K 5% 1/4W CAR FILM
R22	R65-0002-101	RES 100 5% 1/8W CAR FILM
R23	RN55D4990F	RES,499.0 1% 1/8W MET FLM
U1	I65-0004-001	IC 12013 PLASTIC ECL
U2	IC-0430	IC MC4044 CERAMIC CMOS
U3	I05-0000-090	IC 74LS90 PLASTIC TTL
U4	I05-0000-090	IC 74LS90 PLASTIC TTL

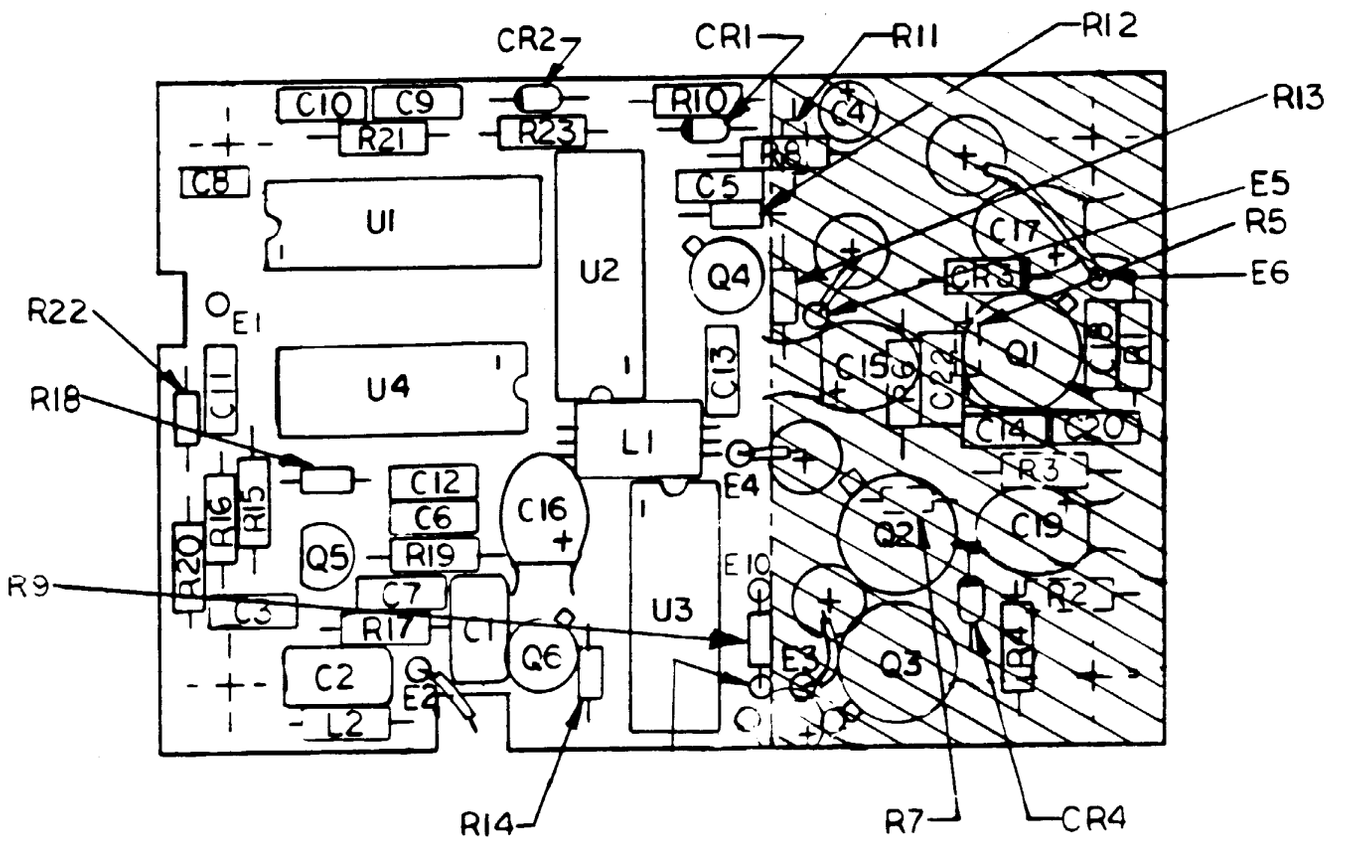

Figure 8. Phase Detector Board A6A4 Component Location Diagram (10073-4160-01, Rev. G)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/8W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
5. ALL INDUCTOR VALUES ARE IN MICROHENRIES.

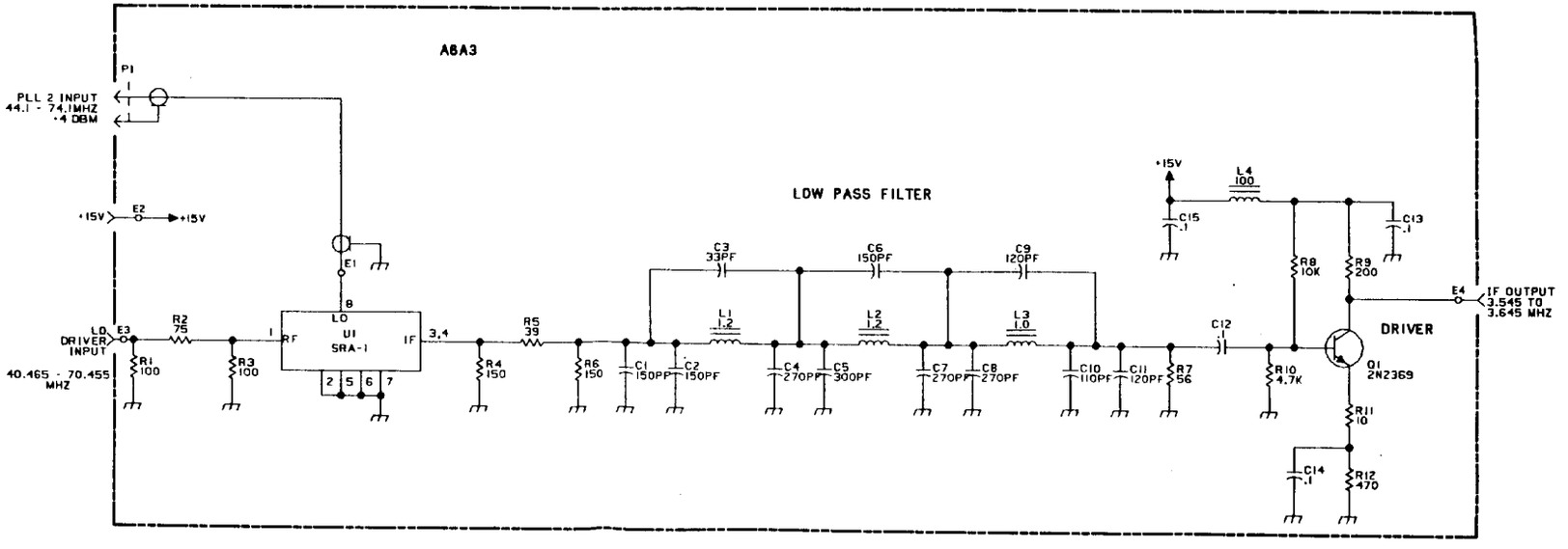

Figure 7. Mixer Board A6A3 Schematic Diagram (10073-4131, Rev. C)

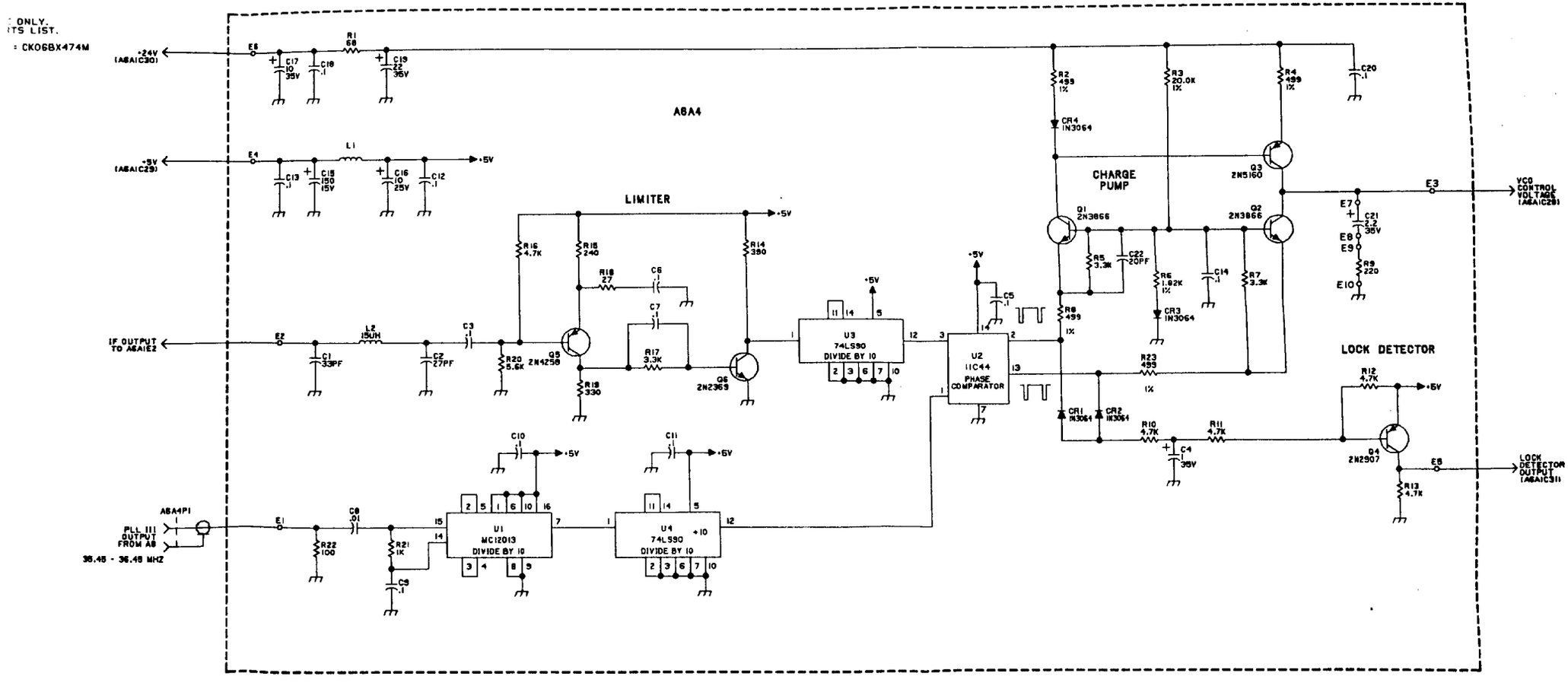

Figure 9. Phase Detector Board A6A4 Schematic Diagram (10073-4161, Rev. E)

NOTE: UNLESS OTHERWISE SPECIFIED:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR A COMPLETE DESIGNATION, PREFIX WITH UNIT NO. AND/OR ASSEMBLY NO. DESIGNATION.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/8W, ±5%.
3. ALL CAPACITOR VALUES ARE IN MICROFARADS.
4. VENDOR PART NO. CALLOUTS ARE FOR REFERENCE ONLY. COMPONENTS ARE SUPPLIED PER PART NO. IN PARTS LIST.
5. ON 10073-4160-02 ASSY'S : R9 = R65-0002-511: C21 = CK06BX474M