



sunair electronics, inc.

SNR-601DAC

DIGITAL ANTENNA COUPLER

OPERATION AND MAINTENANCE MANUAL

P/N 8096200704

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SECTION I

GENERAL INFORMATION

1.1 SCOPE

This manual contains information necessary to install, operate, maintain and repair the 601DAC High Speed Digital Antenna Coupler.

1.2 DESCRIPTION

See Figure 1.1

1.2.1 GENERAL

The 601DAC is a high quality remotely controlled antenna coupler, capable of matching a wide variety of antennas over the frequency range of 2.0000 to 17.9999 MHz. The unit is designed for use with the SNR-601 system.

Operation of the 601DAC requires only the initiation of a "TUNE" command. When tuning has been completed (minimum VSWR of the antenna at the selected frequency), the green READY Lamp on the front panel indicates the transceiver is ready for use. The 601DAC continuously monitors the antenna VSWR when transmitting. If the antenna becomes detuned during operation (VSWR exceeds 2.0:1), the TUNE/FAULT Lamp will light on the front panel and the operator repeats the tune cycle.

1.2.2 ASSEMBLIES

1.2.2.1 Chassis Assembly 3A1

Provides the required mounting surfaces for the various electrical and mechanical components. The Motherboard 3A1A1 serves as the interconnect for all assemblies.

1.2.2.2 Computer Board 3A2

This assembly contains the microprocessor responsible for the operations and functions of the SNR-601DAC.

1.2.2.3 Comparator Board 3A3

This assembly contains the analog interface circuitry used to process the detector inputs to the microprocessor.

1.2.2.4 Detector/Pad Assembly 3A4

The Detector Assembly 3A4A1 contains the magnitude, phase and VSWR detectors. The Pad Assembly 3A4A2 plugs into the Detector Assembly and protects the transmitter from impedance variations during the tuning cycle.

1.2.2.5 RF Assembly 3A5

The two boards comprising the RF Assembly are the RF Input Board 3A5A1 and the RF Output Board 3A5A2. The boards contain all of the binary variable elements in the antenna matching network.

1.3 SPECIFICATIONS

1.3.1 GENERAL

FREQUENCY RANGE: 2.0000 to 17.9999 MHz

RF INPUT POWER: 100 Watts PEP

INPUT IMPEDANCE: 50 ohms, non-reactive

DUTY CYCLE: Continuous

TUNING TIME: Typically 2.5 seconds first tune, 1.0 seconds or less from memory

TUNE POWER REQUIRED: 25 Watts RF delivered

TUNE ACCURACY: 1.2:1 VSWR Typical

REMOTE CAPABILITY: Up to 250 ft. from transmitter

POWER INPUT: 27.5VDC + 10%-20%, 1 amp maximum

WEIGHT: 8.5 lbs (3.825 kgs)

SIZE: (INCHES) 8.85H x 8.80W x 13.00D
(CM) 22.48H x 22.35W x 33.02D

1.3.2 ENVIRONMENTAL

TEMPERATURE: Operating: -55°C to +70°C
(RTCA/DO-160A Category B)

HUMIDITY: +95% at +50°C (RTCA/DO-160A
Category A)

SHOCK: 6G in all planes, 15G crash safety

VIBRATION: 0.20" DA, 5 Hz to 14 Hz
0.02" DA, or 2G peak, 14 Hz to 44 Hz
3G peak, 44 Hz to 2 KHz
(RTCA/DO-160A Category J & Y)

ALTITUDE: 35,000 ft. (RTCA/DO-160A Category C)

1.4 EQUIPMENT SUPPLIED

High Speed Digital Antenna Coupler

CONNECTOR KIT

OPERATION AND MAINTENANCE MANUAL

SUNAIR PART NUMBER

8096200291

6035002099

8096200704

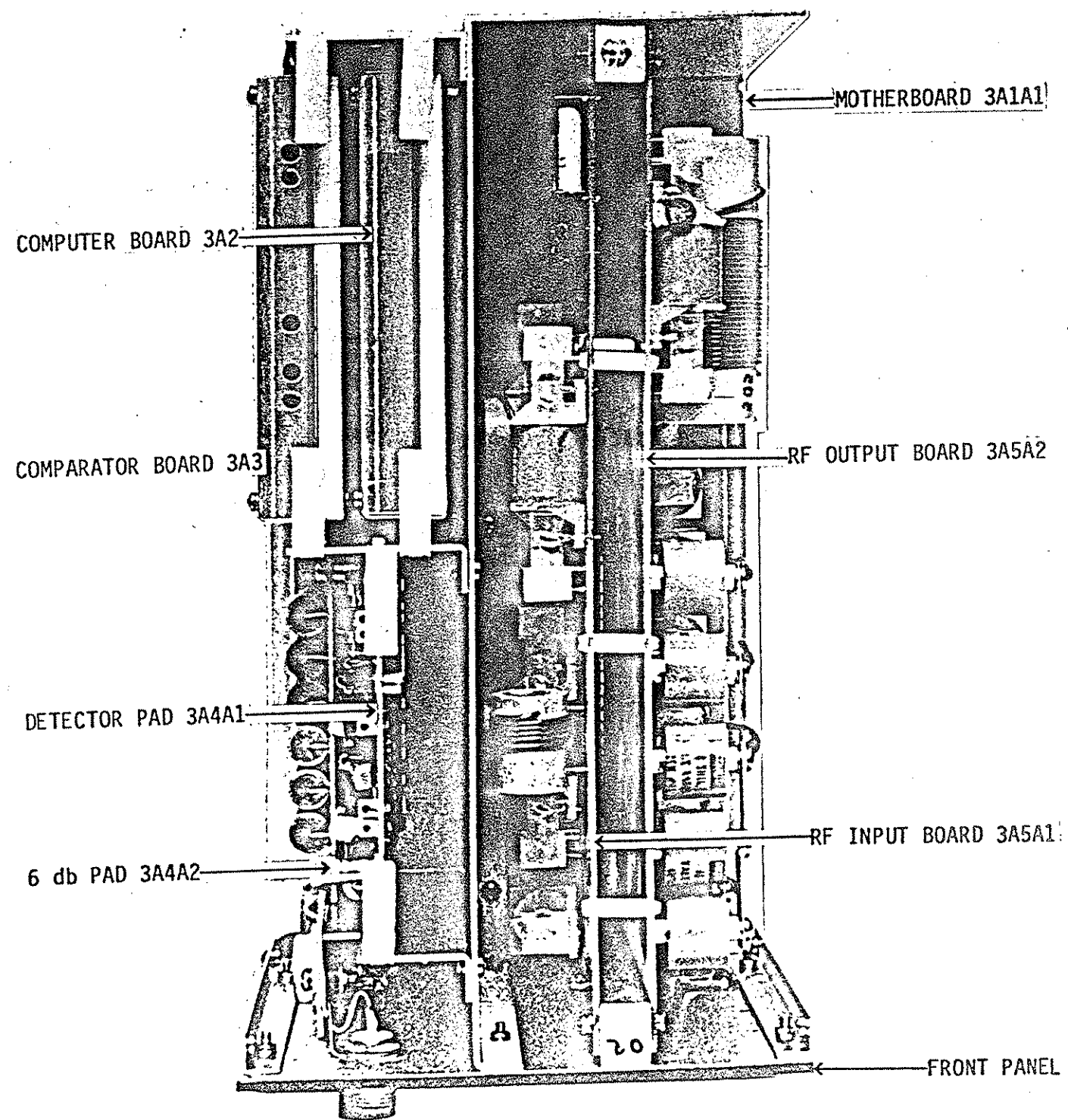


FIGURE 1.1 601DAC MAJOR ASSEMBLY LOCATIONS



CAUTION

TO INSURE THAT CABLE HAS NOT BEEN DAMAGED DURING SHIPMENT, ALL CABLE ASSEMBLIES MUST BE CHECKED FOR CONTINUITY OR SHORTS, FROM PIN TO PIN, BETWEEN CONNECTORS BEFORE INITIAL RADIO OR SYSTEM POWER UP.

WARNING

CONNECTORS INSTALLED BY THE CUSTOMER MUST BE WIRED IN ACCORDANCE WITH INSTALLATION INSTRUCTIONS PROVIDED IN THE OPERATION AND MAINTENANCE MANUAL. THE CABLE MUST BE CONTINUITY CHECKED AFTER INSTALLATION AND PRIOR TO RADIO OR SYSTEM POWER UP.

SECTION II

INSTALLATION

2.1 GENERAL

Section II contains all necessary instructions for the unpacking, inspection, and if necessary, reshipping of damaged equipment or parts. In addition, further information regarding location and mounting considerations, power requirements, antenna and ground system hook-ups and final checkouts after installation is also provided.

2.2 UNPACKING AND INSPECTION

As soon as you have received your unit(s), unpack and inspect all components and accessories. Check the packing list to be sure you have received all items ordered, and that all items necessary for operation have been ordered.

NOTE

Be sure to retain the carton and its associated packing materials should it be necessary to reship damaged equipment.

Do not accept a shipment when there are visible signs of damage to the cartons until a complete inspection is made. If there is a shortage of items or any evidence of damage, insist on a notation to that effect on the shipping papers before signing the receipt from the carrier. If concealed damage is discovered after the shipment has been accepted, notify the carrier immediately in writing and await his inspection before making any disposition of the shipment. A full report of the damage should also be forwarded to Sunair's Product Services Department. Include the following:

- a) order number
- b) model and serial number
- c) name of transportation agency

d) applicable dates.

When Sunair receives this information, arrangements will be made for repair or replacement.

2.3 RETURN OF EQUIPMENT TO FACTORY

The shipping container for the SNR-601DAC has been carefully designed to protect the equipment during shipment. The container and its associated packing materials should be used to reship the unit. When necessary to return equipment to Sunair for warranty or non-warranty repair, an authorization number is required. This number can be obtained from our Product Services Department, Telephone: 305-525-1505, TELEX: 51-4443, CABLE: SUNAIR, FAX: 305-765-1322.

If the original shipping carton is not available, be sure to carefully pack each unit separately, using suitable cushioning material where necessary. Very special attention should be given to providing enough packing material around connectors and other protrusions from the coupler. Rigid cardboard should be placed at the corners of the equipment to protect against denting.

When returning subassemblies or components for repair or replacement, be sure to pack each separately, using suitable cushioning material.

Shipment to be made prepaid consigned to:

SUNAIR ELECTRONICS, INC.
PRODUCT SERVICES DEPARTMENT
3101 SW Third Avenue
Fort Lauderdale, Florida 33315-3389
U.S.A.

Plainly mark with indelible ink all mailing documents as follows:

U.S. GOODS RETURNED FOR REPAIR

VALUE FOR CUSTOMS-\$100.00

Mark all sides of the package:

FRAGILE - ELECTRONIC EQUIPMENT

NOTE

Before shipping, carefully inspect the package to be sure it is marked properly and is securely wrapped.

2.4 POWER REQUIREMENTS

All power necessary to operate the SNR-601DAC Automatic Digital Coupler is supplied from the SNR-601 via the cable assembly.

CAUTION

During installation of the SNR-601DAC, insure that power is not applied to until completion of installation.

**2.5 INSTALLATION CONSIDERATIONS
AND MOUNTING INFORMATION**

The satisfactory operation of the equipment will depend upon the care and thoroughness taken during the installation.

IMPORTANT INSTRUCTIONS

**2.5.1 GENERAL INSTALLATION PROCEDURES
AND REQUIREMENTS**

1. Carefully plan radio /coupler/- antenna locations, observing the following requirements before starting installations.
2. Provide best possible RF ground for radio and coupler. Use flat copper strap-1" wide or #6 (or larger) wire and connect to ground terminals. Leads to ground system should be as short as possible.

3. Provide maximum separation between coupler output and the radio with its associated wiring. Coupler may be mounted up to 100 ft. from coupler control when RG-58 is used, and up to 250 ft. from coupler control when RG-8 is used.

4. Antenna lead from coupler to antenna must be insulated for at least 10 kv potential. The lead should not run parallel to metal objects that are bonded to the system ground. The coupler should be as close to the antenna as possible, and never more than 3 ft. away as this will decrease antenna efficiency.

5. If the coupler is installed on a wood or fiberglass boat, a 12 square foot minimum area of metal surface area in contact with the water should be provided for use as an RF ground.

6. If operating the coupler on external D.C. power, check for correct polarity before applying power.

7. Linear amplifiers with low level modulation may oscillate if the RF power output is radiated or conducted into the low level stages. Evidence of this situation is erratic or excessive power output. This is caused by too close proximity of the coupler output and antenna to the transmitter and/or inadequate RF grounds. Carefully following the above procedures will prevent this from occurring.

2.5.2 MOUNTING CONSIDERATIONS

See Figure 2.1.

2.6 ANTENNAS AND GROUND SYSTEMS

CAUTION

During installation of the SNR-601DAC, insure that power is not applied until completion of installation.

2.6.2 GENERAL

The SNR-601DAC can be used to match antennas ranging from 9 foot whips to 150 foot longwires. Although the coupler will match 9 foot whips down to 2.0 MHz, use of a 9 foot whip is not recommended for low frequency use due to poor radiation efficiency. The SNR-601DAC is placed close to the antenna and controlled from the companion SNR-601 Transceiver. As there are numerous types of antennas, a complete discussion is beyond the scope of this manual. Antennas requiring an antenna coupler for use in the 1.0 to 30 MHz spectrum generally fall into two categories:

- a) narrow band 50 ohm antennas
- b) random length non-resonant antennas.

Antennas falling into each of the above categories are discussed in this section. For specific recommendations, consult our Marketing and Product Services Departments.

Some general "DO's" and "DON'T's" of antenna installation are listed below:

- a) The antenna should be clear of all large objects such as trees and buildings.
- b) Although the coupler will match electrically short antennas (i.e. those under $1/8$ wavelength), such antennas are not efficient radiators. If the installation permits, antennas over $1/8$ wavelength long at the lowest operating frequency should be used. Antenna length generally limits system performance in vehicular applications at frequencies below 10 MHz as the size would be prohibitive.
- c) When using whip antennas, the ground system actually forms part of the radiating system. Where space permits (such as in a base station installation) a good ground plane or radial system should be installed at the base of the antenna.

NOTE

An inadequate ground system is most often responsible for disappointing performance when using a whip antenna.

2.6.2 NARROW BAND 50 OHM ANTENNAS

Typical of this type of antenna is the Inverted V. This type of antenna may be assembled from the Sunair Doublet Antenna Kit (p/n 0996240004). Its operation is efficient for only a narrow band of frequencies within approximately $2\frac{1}{2}\%$ of their center frequency. The antenna coupler is NOT generally required if the above frequency span is not exceeded. Separate antennas must be erected for each small band of frequencies to be used. The antenna exhibits somewhat directional characteristics. The direction of maximum radiation is perpendicular to the antenna wire. This antenna is particularly suitable for communication with nearby mobile stations (with vertical antennas) since a portion of the radiation is in a vertical direction.

2.6.3 RANDOM LENGTH NON-RESONANT ANTENNAS

Whips and longwires are popular non-resonant antennas. The whip antenna is often used in mobile, marine, portable or semi-portable installations because it is rugged and self supporting. The antenna impedance is strongly dependent on the operating frequency, and an antenna coupler therefore, must be used to match the antenna to the transceiver. Best radiation efficiency will be obtained if the antenna is at least $1/8$ wavelength long at the lowest operating frequency; however, this requirement does not result in a practical size antenna for low frequency operation. Thirty-two foot whip antennas offer a good compromise between practical height

and good electrical performance at low frequencies. The antenna coupler is designed to efficiently match whip antennas of 15 foot length or greater. An efficient match may also be obtained for a 9 foot whip above 4 MHz. The whip's performance is greatly influenced by its ground system. For temporary base station installations, a minimum of four six foot long ground rods should be driven into the ground symmetrically placed around the antenna base. The rods should be bonded together with a heavy strap and then connected to the antenna coupler ground by another short heavy strap. If the antenna is mounted on the roof of a building, where a short ground lead to coupler cannot be obtained, a minimum of four symmetrically placed ground radials should be installed at the base of the antenna, bonded together, and connected to the antenna coupler ground post. The radials should be made of number 12 gauge wire or larger and should be at least $\frac{1}{4}$ wave long at the lowest operating frequency. (Radial length in feet = $246/\text{frequency in MHz}$.) The whip's radiation pattern is omni-directional in the azimuthal plane.

The longwire antenna is a popular base station antenna where a wide range of operating frequencies are used. The antenna impedance varies greatly with frequency and therefore must be matched to the transmitter with the antenna coupler. The antenna coupler will efficiently match longwire antennas up to 150 foot in length. The radiation pattern of the longwire antenna is also a strong function of operating frequency. The two most popular longwire antennas, (75 and 150 foot available from Sunair) exhibit excellent low frequency radiation efficiency.

2.7 CHECKS AFTER INSTALLATION

CAUTION

Insure all equipment and antenna systems have been properly installed before applying power.

1. On the transceiver, select a frequency in the 2 to 3 MHz range, AM mode.
2. Upon initial power on, the FAULT lamp will come on. If it blinks, the frequency data in coupler memory has been lost or is unusable. If the FAULT lamp remains steady, the frequency data in memory from previous tuning cycles has been retained.
3. Depress the TUNE pushbutton. The FAULT lamp will extinguish.
4. After a short delay, the READY lamp will come on.
5. Select frequencies throughout the 2.0 to 30 MHz range. Depress the TUNE pushbutton and wait for the READY lamp to illuminate.

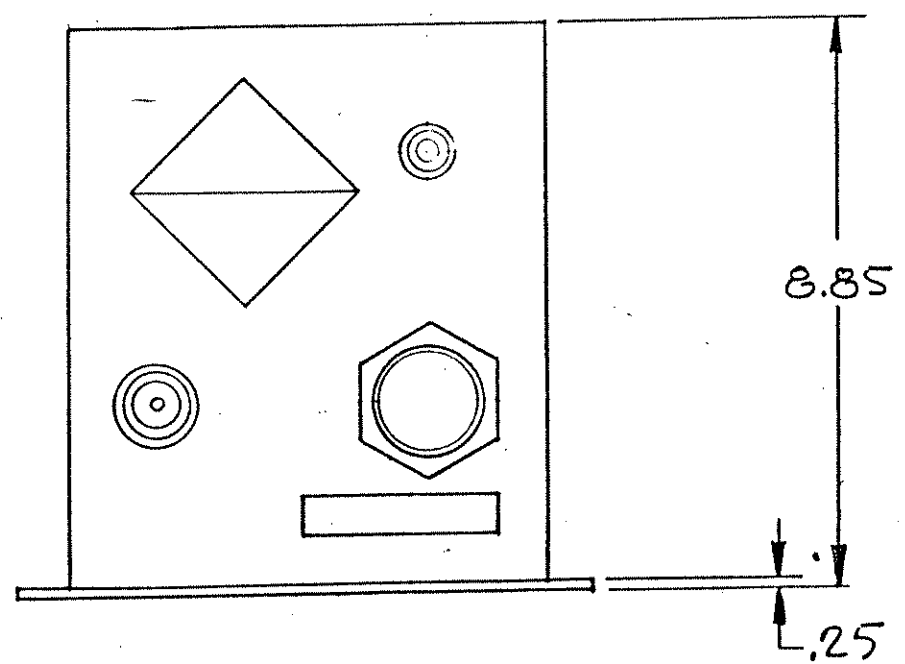
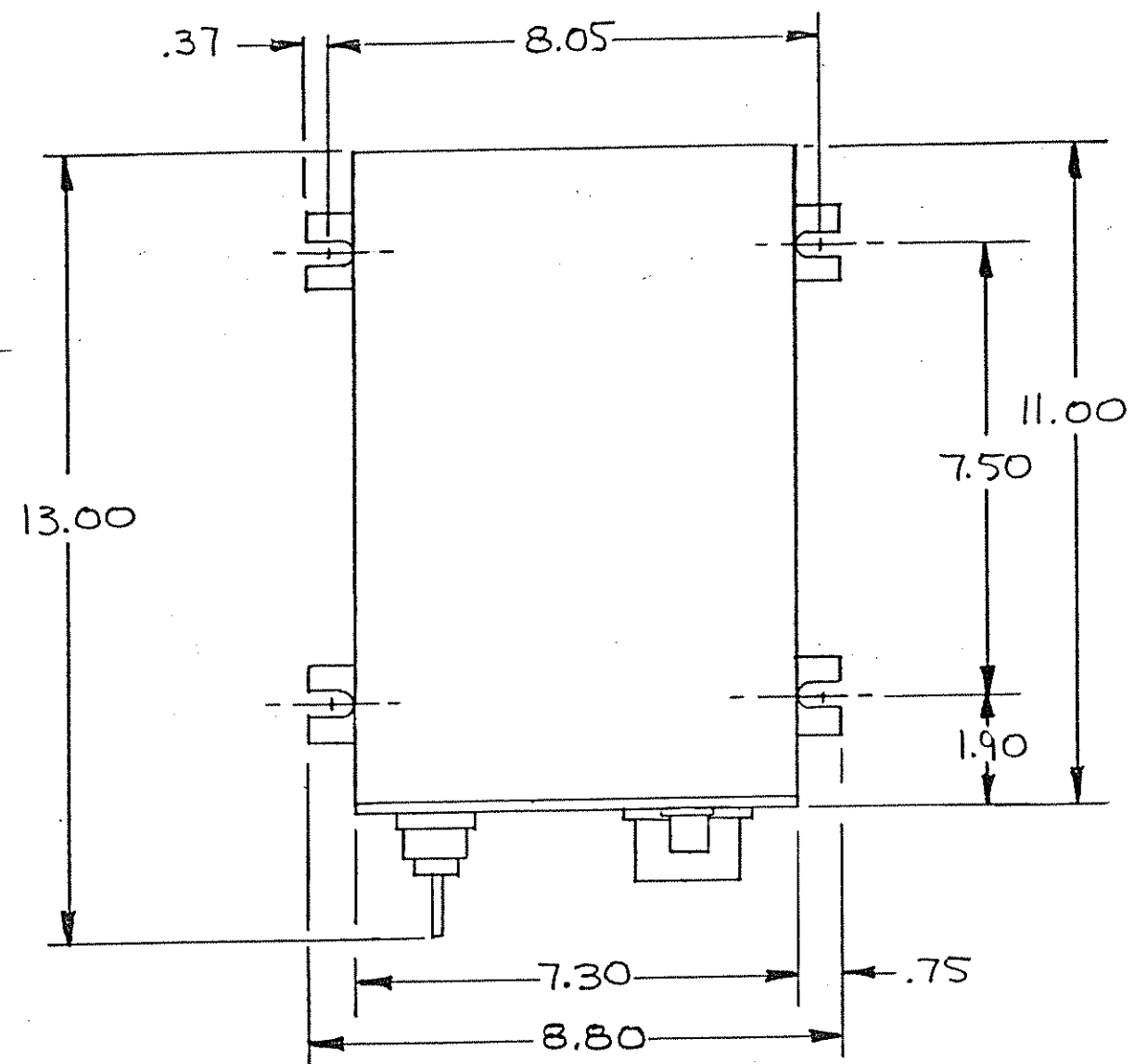


FIGURE 2.1 OUTLINE DIMENSIONS, SNR-601DAC



SECTION III

OPERATION

3.1 GENERAL

This section contains information concerning the proper operation of the SNR-601DAC High Speed Digital Antenna Coupler.

3.2 COUPLER CONTROLS/INDICATORS

The controls and indicators for the SNR-601DAC are located on the front panel of the SNR-601 Transceiver.

a) **PUSH TO TUNE:** Initiates a tune cycle.

b) **FAULT LAMP:** This lamp is illuminated when the transceiver is initially turned on, when returning to a previously tuned frequency, or when a tune cannot be properly achieved (approximately 10 seconds after tune was initiated).

c) **READY:** This lamp is illuminated when a tune is successfully achieved.

3.3 CHECK OUT PROCEDURES

See Checks After Installation Section 2.5.



SECTION IV

THEORY OF OPERATION

4.1 GENERAL

The SNR-601DAC is a fully automatic high speed digital antenna coupler designed for use with the Sunair SNR-601 Transceiver. The coupler is rated for 100 watts PEP and will tune various antenna systems. The SNR-601DAC tune cycle can be initiated either by depressing the PUSH TO TUNE button located on the front panel of the SNR-601, or automatically, upon the detection by the 601DAC electronics of a VSWR condition of 2:1 lasting for 100 ms to 200 ms or greater.

Automatic retuning of the 601DAC is limited to a single automatic tune cycle, preventing continuous automatic tune cycling when presented with a defective antenna. Depressing the PUSH TO TUNE button will reset the 601DAC and initiate a new tune cycle.

Upon initial application of power to the SNR-601 Transceiver, the FAULT lamp will illuminate and remain illuminated until a tune cycle has been initiated. (This tune cycle can be initiated either by depressing the PUSH TO TUNE button or automatically via VSWR detection. It should be noted here that detection of a VSWR 2.0:1 or greater can only be detected when the transmitter is keyed and a minimum of 25 watts of RF power is exciting the 601DAC detector circuits.) Upon completion of the tune cycle and a successful tune, the READY lamp illuminates. NOTE: With the exception of initial power application, illumination of the FAULT lamp indicates the coupler is prevented from automatic retuning, so the PUSH TO TUNE button must be used to initiate a tune.

After a change to a new (or different) frequency, the READY lamp will remain

illuminated. This is a false READY indication as the 601DAC, which generates the READY lamp signal, has no way of knowing the transmit/receive frequency was changed.

If the PUSH TO TUNE button is depressed following the change to a new frequency, the READY lamp will extinguish. If the PUSH TO TUNE button is not depressed following the operating frequency change, then one of the following events will occur:

- a. If in AM mode of operation, the 601DAC will detect a VSWR fault upon keying of the transmitter, and the coupler will enter a tune cycle.
- b. If in SSB mode of operation, the 601DAC will detect a VSWR fault and enter the tune mode at the beginning of the first voice transmission.
- c. In some case, the READY lamp will remain lit and the coupler will not go through a tune cycle. This may occur if the frequency change is small, or if the antenna impedance presented at the new frequency falls within the VSWR window, and no retune is required.

Completion of a successful tune is indicated by illumination of the READY lamp. The FAULT lamp also provides an indication that the coupler is not correctly tuned and a tune command must be initiated.

Memory is provided within the coupler for ten "last-tuned" channels. This memory

will be retained in the coupler for as long as the coupler is on. Whenever the FAULT Lamp is illuminated, the coupler is automatically placed into a "bypass" mode with RF input tied directly to the antenna terminal.

4.2 ANTENNA TUNING NETWORK

The antenna tuning network is basically an "L" low pass circuit with additional shunt output capacitance, where required, to transform the network into a "PI". An additional capacitor is provided at the output of the network to allow tuning of inductive antennas. A block diagram of the 601DAC is shown in Figure 4.1.

The input capacitor bank, located on the RF Input Board 3A5A1 (Figure 5.8) consists of C1 through C36, and provides binary stepped values from 0 to 10,276pf. The series inductor bank, located on the RF Input Board and RF Output Board 3A5A2 (Figure 5.9) and consisting of L1 through L10 provides binary stepped values from 0 to 21.25uh. The output capacitor bank, located on the RF Output Board consisting of C65 through C69 provides binary stepped values from 0 through 450 pf. The series phase correcting capacitor C70 located on the RF Output Board, provides 75 pf of series capacitance.

4.3 DETECTOR/PAD ASSEMBLY 3A4

Refer to Figure 5.7

4.3.1 GENERAL

The Detector/Pad Assembly contains the magnitude discriminator, the phase discriminator, the forward and reflected power detectors (Directional Wattmeter), the resistive pad network, the pad relay and the tune relay.

4.3.2 MAGNITUDE DISCRIMINATOR

The magnitude discriminator consists of T1 and its associated components. It provides a means of measuring the relative magnitude of the transformed antenna

impedance relative to 50 ohms. For a magnitude greater than 50 ohms, the magnitude discriminator produces an output (TP1) voltage less than the +5 VDC reference voltage (TP2). For a magnitude less than 50 ohms, an output greater than the +5 VDC reference is produced. A voltage sample is provided from the transmission line by L1, C2, C3, and is rectified by CR2 to give a DC voltage proportional to the RF voltage on the line. A voltage proportional to the current in the transmission line is generated by transformer T1 and is rectified by CR3. Capacitor C2 is adjusted so that the voltage sample is exactly equal to the current sample when the transmission line is terminated with 50 ohms resistance. The output of this discriminator is fed to differential amplifier U1B on the Comparator Board Assembly 3A3, Figure 5.6. Note that the output of the magnitude discriminator is floating and is referenced to +5 VDC, not ground. So all measurements of the magnitude discriminator must be referenced to +5 VDC (TP2).

4.3.3 PHASE DISCRIMINATOR

The phase discriminator consists of transformer T2 and its associated components. It provides a means of measuring the relative phase angle at the input to the tuning network by comparing the phase of the line voltage with that of the line current. The discriminator output is zero when the transmission line voltage and current samples are in phase (pure resistance terminating the transmission line). The voltage sample is derived by C13, R10, C7, which shifts it in phase by 90°. The current sample is generated by transformer T2 and is in phase with the line current. The voltage sample is fed to T2 center tap, and the resulting output is detected by CR4, CR5 to produce a DC voltage proportional to the phase difference between the voltage on the transmission line and the current in the line. R12 is the phase discriminator balance control and is adjusted so the phase output measured at TP3 is nulled (with respect to +5 VDC, TP2) when the

transmission line is terminated with a 50 ohm non-inductive load.

The sensing of the phase discriminator is established to provide a positive output for inductive loads (positive phase angle) and a negative output for capacitive loads (negative phase angle). The output of this discriminator is fed to differential amplifier U1A on the Comparator Board Assembly 3A3.

4.3.4 FORWARD AND REFLECTED POWER DETECTOR

The forward and reflected power detector consists of T3 and its associated components. The reflected power voltage sample obtained from C14, C15 is combined with the current sample obtained from T3, at CR6 to provide a DC voltage measured at TP4 which is proportional to reflected RF power on the transmission line. This detector compares both phase and magnitude of the voltage and current samples. Its output is always one polarity, i.e. positive with respect to ground, and is a minimum when the coupler network has tuned the antenna to provide a 50 ohm resistive load to the transmitter. C14 provides an adjustment to null the output when the transmission line is terminated with a 50 ohm, non-reactive load.

The forward power voltage sample from C19, C17 is combined with the current sample from T3 at CR7 to provide a DC voltage measured at TP5 which is proportional to forward power on the transmission line. It operates in much the same way as the reflected power detector, and its output is also positive with respect to ground, but maximum when the transmission line is terminated with a 50 ohm, non-reactive load.

This output is used for two functions: (1) to tell the microprocessor when RF energy is present, and (2) to provide a reference against which the reflected power is compared for the calculation of Voltage Standing Wave Ratio (VSWR). The VSWR is used as an indication of the

quality of the "tune" and is acceptable for values of 2:1 or better. If the VSWR exceeds 2:1, the FAULT Lamp will be illuminated, indicating that a tune command is required.

4.3.5 6 db ATTENUATOR PAD

The 6 db attenuator consists of R1 through R6 and relay K1 and associated circuitry. It is switched between the coupler tuning network and the transmitter whenever the VSWR is greater than 2:1, and the transmitter is keyed. The pad provides protection for the transmitter by limiting the impedance variations placed on the transmitter during the tuning cycle. When a satisfactory tune has been accomplished, the READY Lamp will come on and the pad is switched out of the circuit, allowing full transmit power to reach the antenna.

The Resistive Pad Subassembly 3A4A2, resistors R1 through R6, plugs into the Detector Board 3A4A1 to make up the Detector/Pad Assembly 3A4.

4.3.6 TUNE RELAY

The tune relay, K2, is energized by the microprocessor following receipt of a tune command from the transceiver. It grounds the transceiver keyline interlock line, putting the transceiver in transmit mode, disables the keyline, and supplies a +28 VDC signal to the transceiver. When the tune cycle has been terminated, the tune relay is de-energized allowing normal keyline operation.

4.4 COMPARATOR BOARD 3A3

Refer to Figure 5.6

4.4.1 GENERAL -

The Comparator Board 3A3 contains the analog interface circuitry used to process the detector outputs for use by the Computer Board 3A2. The Comparator Board consists of integrated circuits U1 through U4, Q1, Q2, and their associated circuitry.

4.4.2 PHASE DISCRIMINATOR INTERFACE

The phase discriminator interface consists of U1A, U2A, U2B, U4A and U4B. The phase discriminator output is compared with the +5 VDC reference voltage for magnitude and polarity in U1A. Potentiometer R6 determines the width of the output threshold "window". This window is adjusted to provide an output whenever the phase exceeds plus or minus 20 degrees. If the phase is positive and greater than 20 degrees, the discriminator output (3A4) is positive, U1A output is positive, U2A output is positive and U4A output is a low signal (ground), so a Low signal is sent to the Computer Board 3A2 on the >+20° line. Similarly if the phase is negative and less than 20 degrees, an output from U1A, U2B and U4B sends a Low signal to the Computer Board 3A2 on the <-20° line. Comparators U2A and U2B are used in conjunction with Schmitt triggers U4A and U4B to provide a toggle action to the phase commands, stabilizing the threshold limits. When the detected phase angle is within +/- 20° of 0°, both the >+20° and <-20° lines are High, indicating to the microprocessor that the phase angle is within an acceptable "window".

4.4.3 MAGNITUDE DISCRIMINATOR INTERFACE

The magnitude discriminator interface consists of U1B, U2C, U2D, U4C and U4D. The discriminator output is compared with the +5 VDC reference for magnitude and polarity, in U1B. Potentiometer R19 sets the width of the magnitude window relative to 50 ohms. The window is set to provide an output whenever the magnitude is greater than 60 ohms or less than 40 ohms. If the magnitude is greater than 60 ohms, the discriminator output is negative at the input of the Comparator Board 3A3 giving a Low on the >60 ohm line to the Computer Board 3A2. The unaffected comparator, U2C in this case, provides a Low output to U4C, which in turn supplies a High on the <40 ohm line. This way, only one output at a time may be Low, but both may be High, indicating

to the Computer Board that the magnitude is within an acceptable "window".

For magnitudes less than 40 ohms, operation is similar to that described above, supplying a Low from U4C to the <40 ohm line to the Computer Board 3A2.

4.4.4 "RF PRESENT" DETECTOR

Transistor Q2 acts as a switch to provide a Low to the Computer Board 3A2 whenever RF power is present at the coupler input. The transistor is turned on by a DC voltage from the forward RF power detector on the Detector/Pad Assembly 3A4. In order for the Computer Board to continue its tuning program, the RF line must be held Low.

4.4.5 VSWR COMPARATOR

Comparator U3A compares the relative magnitude of the forward and reflected power detectors to compute the VSWR. U4E will trigger when the computed VSWR exceeds 2:1. Potentiometer R43 sets the trigger level threshold of U4E. Diode CR7 provides a reference to keep the VSWR line High between transmit speech pauses, to keep the READY and FAULT Lamps from blinking. Diode CR8 isolates the base circuit of Q2 from the voltage supplied by CR7. Diode CR10 isolates the reflected power detector on the Detector/Pad Assembly 3A4 from voltages generated by U13A circuitry.

4.4.6 REFERENCE VOLTAGE SOURCES

Voltage regulators U5 and U6 provide +5 VDC and +10 VDC respectively for use by the operational amplifiers and voltage comparators. Since plus and minus sensing is required, U1 and U2 are "ground" referenced to +5 VDC (TP2).

Potentiometer R29 adjusts the output voltage of regulator U5 on pin 3 (TP2) to +5 VDC. Potentiometer R32 adjusts the output voltage of regulator U6, pin 3 to approximately 10 VDC (see section 5.3.3 and 5.3.7 for setting of the 10 VDC refer-

ence voltage). Zener diode CR9 drops the voltage to the regulators from the supplied +28 VDC, to minimize power dissipation in the regulators.

4.4.7 TUNE RELAY LATCH

A positive pulse from the transceiver turns Q1 on, pulling in the tune relay (3A4K2), and telling the Computer Board 3A2 to begin a tuning cycle. The microprocessor then sends a positive voltage back called TUNE LATCH to the base of Q1, keeping it on and the tune relay latched during the tune cycle. When the tune cycle is terminated, the voltage from the base is removed, Q1 no longer conducts, and the tune relay is de-energized.

4.5 COMPUTER BOARD 3A2

Refer to Figure 5.5

4.5.1 GENERAL

The microprocessor circuit on the Computer Board is the "brains" SNR-601DAC.

Here, all appropriate signals are monitored, decisions are made, and control commands are generated for controlling the capacitor and inductor steps. An algorithm, which determines the process by which the coupler elements are manipulated, to achieve the proper transformation of the antenna impedance to 50 ohms resistive, is resident in memory. Included in this section are the microprocessor U1, the address decoder U2 and U8, the address latch U3, the PROM U4, the RAM-I/O U5, the output ports U6, U7, element drivers U9, U10, U11, U12, and crystal oscillator circuit U13.

4.5.2 MICROPROCESSOR U1

The microprocessor U1 performs all of the required calculations from the information it receives from the discriminator and detectors, interrogates the program memory to determine the next logical step to take, and instructs the element drivers which elements to connect in the RF circuit. When an acceptable tune condi-

tion has been found, i.e. both phase and magnitude signals are in their respective "windows", U1 instructs the pad and tune relays to drop out, and illuminates the green READY Lamp on the Control Head SCU-55. U1 remains active at all times when power is applied and continuously monitors the VSWR. If following a good tune condition, the antenna load should change for any reason, U1 will initiate a retune cycle to correct the mismatch. If a load cannot be tuned or a coupler failure occurs, the FAULT Lamp will be illuminated. The coupler is also placed in a bypass mode (straight connection between the input and the antenna) whenever the FAULT Lamp is on. This prevents loss in the receive path, should a coupler fault occur. If the fault condition is only temporary, it may be cleared by depressing the TUNE Pushbutton on the Control Head. When power is initially applied, the FAULT Lamp is automatically illuminated, indicating that the status of the coupler to the selected frequency is unknown. A TUNE command to the coupler is required to clear the initial FAULT Lamp.

Crystal Oscillator U13 establishes the clock frequency for U1. Q1, R5, C50, R7 and R8 form a power-on reset network to assure correct initialization of U1 upon application of power.

4.5.3 ADDRESS DECODER U2

The address decoder consists of U2 and OR gates U8A and U8B. These circuits take address codes supplied by U1 on A8-A15 and uses them to enable the PROM U4, the RAM/I/O/Timer U5, and the output latches U6 and U7. U1 uses the address decoder circuit to enable the proper device when it needs to transfer information.

EXAMPLE: The software in U4 requires the VSWR status information to be sampled periodically. In order to do this U5 must be addressed. U1 places an address on A8-A15 which causes Y1 pin 14 of U2 to go Low. With Y1 Low, U1 issues a Low

read pulse on the RD line, which is connected to U5 pin 9. This Low enables the transfer of VSWR static information from the inputs of U5 to the DATA BUS. Once on the bus, U1 will proceed to process the information.

4.5.4 ADDRESS LATCH U3

The address latch U3, separates the address information from the data on bus lines AD0 through AD7 from microprocessor U1. U3 is employed to produce continuous address information to U4. Each time U1 produces address information to the inputs of U5 via DATA BUS, U1 also produces a positive going pulse called ALE (Address Latch Enable). The ALE pulse latches the address information on the DATA BUS inputs to U3 through to U3's outputs. The address information is then latched on the output lines (ADDRESS BUS) and sent to the PROM U4 to call up a specific memory location where the data requested by U1 is stored. This latching/information gathering sequence is repeated every time U1 needs to know the next step in the algorithm.

4.5.5 PROGRAMMABLE READ ONLY MEMORY (PROM) U4

The PROM U4, contains the data bits which make up the program algorithm used by the microprocessor U1 to adjust the network elements which tune the antenna. Address information from A8-A15 is sent to the PROM U4, when U1 requires information for the execution of the next algorithm instruction stored in U4. U4 responds by placing the instruction from its internal memory, onto the DATA BUS when U1 issues a brief Low going read pulse on the RD line pin 32. U1 collects the instruction from the DATA BUS, analyzes it, then acts on the directions provided.

4.5.6 INPUT PORTS

Integrated circuit U5 contains all the input ports to the microprocessor system. Through these ports, the microprocessor U1, can call up information, giving it

the status of the phase and magnitude discriminators, and the VSWR detector.

4.5.6.1 U5, Magnitude and Phase Inputs

There are six signals coming into integrated circuit U5: $>+20^\circ$, $<-20^\circ$, $>60\text{ ohm}$, $<40\text{ ohm}$, VSWR and TUNE Command. Signals $>+20^\circ$, $<-20^\circ$ are the magnitude discriminator interface outputs (refer to Sections 4.3.2 and 4.3.3). These four signals direct U1 through the tuning algorithm program stored in the PROM U4. A Truth Table for these signals follows.

The VSWR signal coming into U5 is a product of the VSWR Comparator (refer to Section 4.4.5) and is used by U1 to determine a tune ready condition (High on VSWR line), once the magnitude and phase discriminators fall in the window during a tune cycle. The VSWR is also sampled by U1 during transmissions. If the VSWR line into U5 goes Low for more than 100ms a retune is initiated by U1.

TUNE signal into U5 is sampled by U1 and when a High is detected on this line U1 initiates a tune cycle.

4.5.7 OUTPUT PORTS

The Output Ports U5, U6 and U7 are used in conjunction with element drivers U9, U10, U11, and U12, to energize the appropriate relays or lamps.

To understand how U1 performs an output operation, consider what is involved in turning on the READY Lamp. U1 issues an address on lines A8-A15, causing U2 output Y2 pin 13 to go Low. With Y2 Low, U1 issues a code onto the DATA BUS, placing a High on line AD4 pin 16. U1 also issues a short duration Low going write pulse on the WR line pin 31. OR gate U8A's Low inputs cause it to have a Low out on pin 3 to pin 11 of U6. The Low on U6 pin 11 clocks the information from the DATA BUS through U6 into Lamp/Relay Driver U2 illuminating the READY Lamp.

	U5 PIN 1 > 60 ohm	U5 PIN 39 < 40 ohm
*Illegal	0	0
> 60	0	1
< 40	1	0
In the window	1	1

*Note that a Low indication in both signals is not possible as the magnitude cannot be both greater than 60 ohms and less than 40 ohms simultaneously.

TABLE 4.1 MAGNITUDE DISCRIMINATOR TRUTH TABLE

	U5 PIN 38 > +20°	U5 PIN 37 < -20°
**Illegal	0	0
> +20°	0	1
< -20°	1	0
In the window	1	1

** Note that a Low indication in both signals is not possible as the phase cannot be both positive and negative simultaneously. A Low on any of these signals indicates the true state.

TABLE 4.2 PHASE DISCRIMINATOR TRUTH TABLE

4.5.8 TIMER

The timer resides within U5 and, in conjunction with U1, acts as a stop watch beginning at the initiation of the TUNE command. It is programmed to stop the microprocessor program and turn on the FAULT Lamp if a satisfactory tune is not accomplished within 7 seconds. The timer is reset whenever a new tune command is received. If a proper tune is achieved, the timer is disabled, and the READY Lamp is illuminated.

The timer is programmed at power up and receives its basic timing information from microprocessor U1. U1 continuously issues a signal called CLK OUT on pin 37, the timer in turn issues a brief Low going pulse on TIMER OUT pin 6 of U5, which clocks U1. As a tune cycle is initiated, U1 keeps sampling this line and uses it to stop the tune cycle if a satisfactory tune is not achieved within 7 seconds, then illuminates the FAULT Lamp. If a proper tune is achieved, U1 stops sampling the timer out signal, which is continuously issued by U5, and illuminates the READY Lamp.

4.5.9 RANDOM ACCESS MEMORY (RAM)

The RAM, also a part of U5, provides an area of temporary storage which U1 uses as a "scratch pad" when making its calculations. When the microprocessor needs to store information in RAM, U1 issues a code on lines A8-A15. This code makes output Y1 pin 14 of U2 go Low. While Y1 is Low, U1 will issue a Low on the IO/M line, the code it wants stored in RAM on the ADO-AD7 lines and a Low going write pulse on the WR line.

Also the RAM has the capacity to remember the last ten "tunes", so if a previous frequency is repeated, the tuning data already exists in memory, and is extracted first, rather than requiring a complete tuning cycle. Tunes obtained in this manner typically take less than 300 msec. When the "ten last tuned" memory is filled, the next new tune information

will be stored in the #1 memory location, all previous data will move up one memory location, and the data previously stored in memory location #10 will be dropped. Whenever a TUNE command is initiated from the Control Heads's TUNE Pushbutton, the ten last tuned channels are polled first, before the coupler begins a tuning cycle. If a retune is called for, i.e. a FAULT condition following a previous READY, the 10 channels are bypassed and the coupler is forced to retune.

4.6 CHASSIS ASSEMBLY 2A1

4.6.1 GENERAL

The Chassis Assembly contains the RF Assembly 3A5 and the Motherboard 3A1.

4.6.2 RF ASSEMBLY 3A5

4.6.2.1 General (Refer to Figures 5.8 and 5.9)

a) RF Input Board 3A5A1 (Figure 5.8)

The RF Input Board contains input capacitors C1-C36, L1-L6 and their respective switching relays.

b) RF Output Board 3A5A2 (Figure 5.9)

The RF Output Board contains inductor L7-L10 output capacitors C65, C66, C67, C68, C69 and C70 and their respective switching relays.

4.6.2.2 Theory of Operation

The two boards comprising the RF assembly contain all of the variable elements in the antenna matching network. The basic network is a low pass "L" with the capability of adding shunt output capacitance, transforming the network to a low pass "PI". In addition, a series capacitor is available at the output of the network to aid in tuning inductive antennas. Input capacitance is available in approximately 10 pf steps from 0 to 10276 pf (C1 through C36), selected in a binary progression, and is available in

.02 uh steps from 0 to 21.265 uh. The output capacitance, C65 through C69, is also a binary progression and furnishes values from 0 to 450 pf in 50 pf steps. The output series capacitor, C70, is selected whenever the initial load phase angle is positive.

The switching relays are high speed, where on or off transitions are made in approximately one millisecond. This allows the microprocessor to make decisions very rapidly, providing extremely fast tuning time, typically less than one second.

4.6.3 MOTHERBOARD 3A1

(Refer to Figure 5.4)

The Motherboard serves as an interconnection plane between the RF Assembly 3A5, the Computer Board 3A2, the Detector/Pad Assembly 3A4 and the coupler front panel. Transistor Q1 grounds the TUNING line during a coupler tune sequence.

U1 is the primary +5 VDC regulator supplying power to the Computer Board 3A2. It is mounted on the coupler sheet metal chassis for heat sinking, CR1 protects the coupler from high voltage transients.



8064000033A

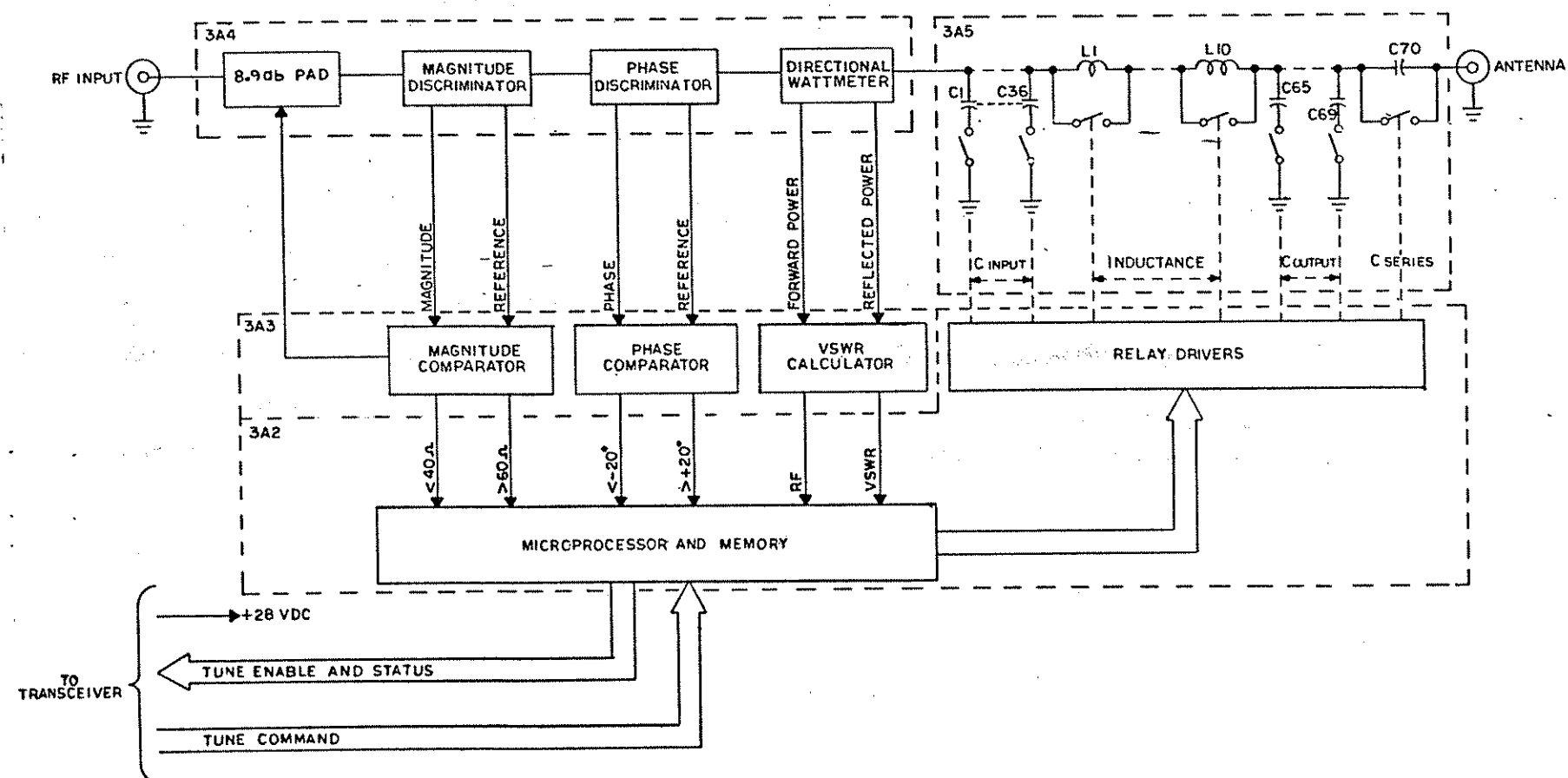


FIGURE 4.1

BLOCK DIAGRAM

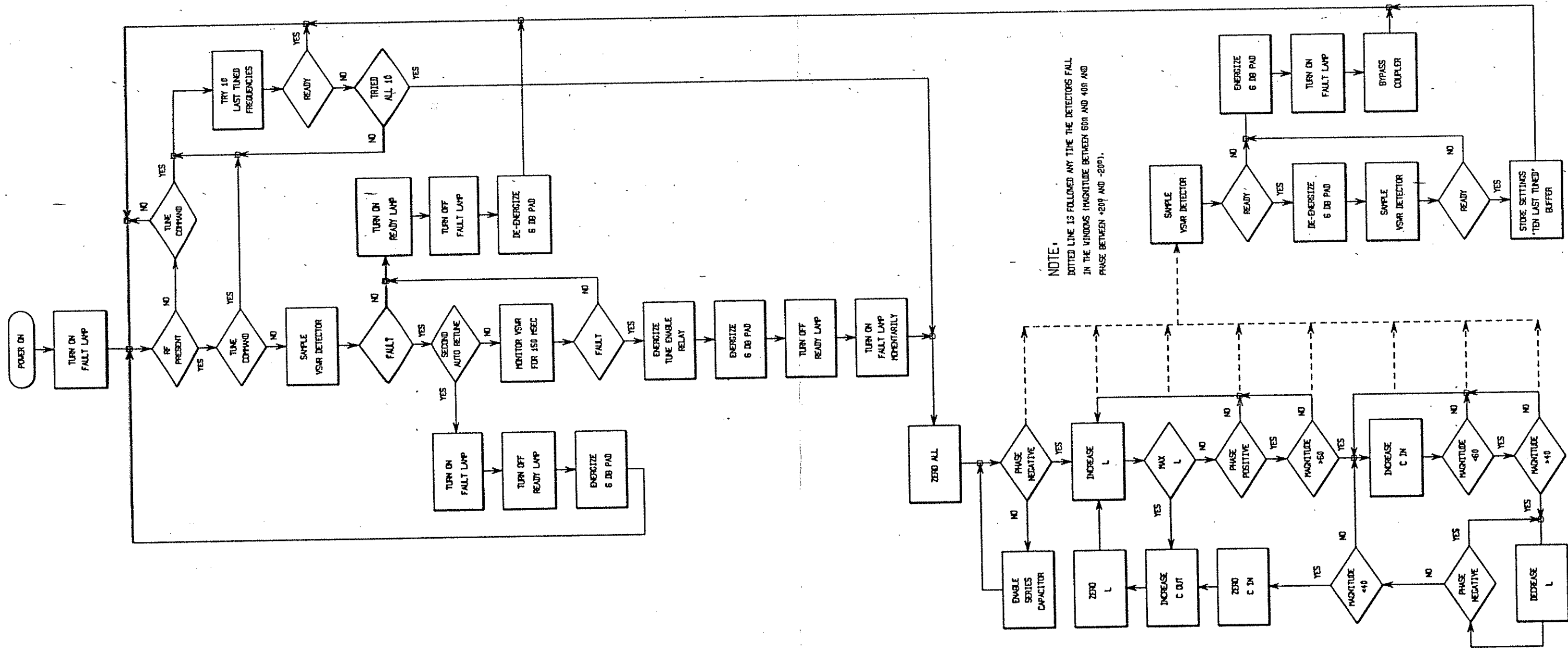


FIGURE 4.2 FLOW CHART
4-12

SECTION V

MAINTENANCE AND REPAIR

5.1 GENERAL

This section provides test procedures and evaluation of overall performance for the 601DAC High Speed Digital Antenna Coupler. A Fault Analysis Table is included to aid the repairman in isolating a fault to the defective module or subassembly.

5.2 PREVENTIVE MAINTENANCE

No preventive or periodic maintenance is required in the SNR-601DAC.

5.3 INSPECTION

If the 601DAC has the case removed for maintenance, a visual inspection should be performed and the resultant corrective action should be taken as follows:

1. Inspect chassis for loose or missing mounting hardware, deformation, damaged fasteners, or damaged connectors. Replace all damaged parts.
2. Inspect connectors for broken parts; check insulation for cracks; and check the pins for damage, misalignment, or bad plating. Carefully realign pins when possible, or, if connectors are otherwise severely damaged, replace connector. Check for loose, or poorly soldered connections to terminals of connectors. Tighten or solder as required.
3. Inspect wiring of chassis and sub-assemblies for any signs of physical damage or charring. Any damaged wires must be replaced.
4. Inspect for leaky, blistered, charred, or cracked capacitors, resistors, or diodes. Check for loose or corroded terminal connections. Obviously damaged components should be replaced.

5. Inspect for cold soldered or resin joints. Bad joints can be recognized by a dull, porous appearance. Resolder.

5.4 REPAIR OR REPLACEMENT

The repair or replacement of damaged and defective parts usually involves standard service techniques. Carefully examine the equipment to determine the correct technique required to effect the repair.

NOTE

The RF Output Board (3A5A2) standoff, the rear of the antenna coaxial connector (3A1J3) and the screw joining them together have been coated with RF Corona Dope. It is essential that the standoff, connector and screw be recoated with RF Corona Dope following servicing which requires the RF Output Board 3A5A2 to be removed or disconnected.

Several solder points, connections, screws and straps on both the top and bottom sides of the RF Output and RF Input Boards have been coated with RF Corona Dope. It is essential that these areas be recoated with RF Corona Dope following any service which disturbed the integrity of the coating.

5.4.1 GENERAL PRECAUTIONS

- a) Perform repairs and replace components with power disconnected from unit.
- b) Replace connectors, shielded conductors, and twisted pairs only with identical items.
- c) Reference to component side of a printed circuit board means the side on which the majority of components are located; solder or circuit side refers to the other side.
- d) When repairing circuits, carefully observe lead dress and component orientation. Keep leads as short as possible and observe correct repair techniques.
- e) Observe cable routing prior to disassembly, to enable the proper reinstallation of cabling during reassembly procedures.
- f) If component is defective beyond any reasonable doubt, remove and replace it according to the procedures given in paragraphs 5.5.2 through 5.5.4. If there is some doubt about the condition of a component, or if it is being removed for troubleshooting, remove it according to the procedures in paragraph 5.4.4.

5.4.2 CIRCUIT CARD ASSEMBLY, TWO-LEAD COMPONENT REMOVAL (Resistors, Capacitors, Diodes, etc.)

- a) Inspect solder side of component to determine if the leads were bent over prior to soldering. If they weren't, proceed with Step b. If they were, melt the solder and remove it with a desoldering tool, then straighten the leads and remove the component.
- b) Heat one lead from component side of board until solder flows and lift one lead from board; repeat for other lead and remove component (note orientation).

- c) Melt solder in each hole and using desoldering tool remove solder from each hole.
- d) Dress and form leads of replacement component; insert leads into correct holes.
- e) Solder in place and clip leads on solder side of boards.

5.4.3 CIRCUIT CARD ASSEMBLY, MULTI-LEAD COMPONENT REMOVAL (IC's etc.)

- a) Remove component by clipping each lead along both sides. Clip off leads as close to component as possible. Discard component.
- b) Heat hole from solder side and remove clipped lead from each hole.
- c) Melt solder in each hole and using a desoldering suction tool remove solder from each hole.
- d) Insert replacement component observing correct orientation.
- e) Solder component in place from solder side of board. Avoid solder runs. No solder is required on contacts where no track exists.

5.4.4 REMOVAL OF COMPONENTS OF DOUBTFUL CONDITION

- a) To remove components that are not heat-sensitive, melt the solder and remove it with a desoldering tool, then remove the component.
- b) To remove components that are heat-sensitive, such as diodes, transistors, and IC's, connect a heatsink to the lead between the solder joint, melt and remove the solder. Repeat for all leads of the component, then remove the component. Apply heat to the lead for the minimum amount of time necessary to remove the solder. When working with IC's, start at one corner, then go to the lead farthest

away, then back to where you started, etc... (Example: pins 1,8,14, 7,...) This is to keep heat buildup to a minimum. Remember that some solid state devices are extremely heat-sensitive, and even though maximum care is exercised during their removal, they may still be destroyed by the removal procedure.

- c) To install a heat-sensitive component, use a heatsink and the sequence outlined above to prevent heat from destroying the component.

5.5 PERFORMANCE TEST

The following tests will provide overall performance data on the 601DAC as well as aid in determining specific problems.

5.5.1 TEST EQUIPMENT

The following test equipment or equivalent is required to perform the test procedures outlined in this section:

1. SNR-601 Transceiver
2. 35 ft. antenna simulator Sunair p/n 8084001094
3. "THRULINE" wattmeter: Bird Model 43 with 100 watt 2-30 MHz element
4. VOM: Simpson 260
5. Digital Multimeter: H.P. Model 3476A
6. Oscilloscope: Tektronix 2445
7. Frequency Counter: Systron Donner Model 6242A
8. CARD Extender Sunair P/N 8064201594
9. Corona Dope Sunair P/N 1006040013.

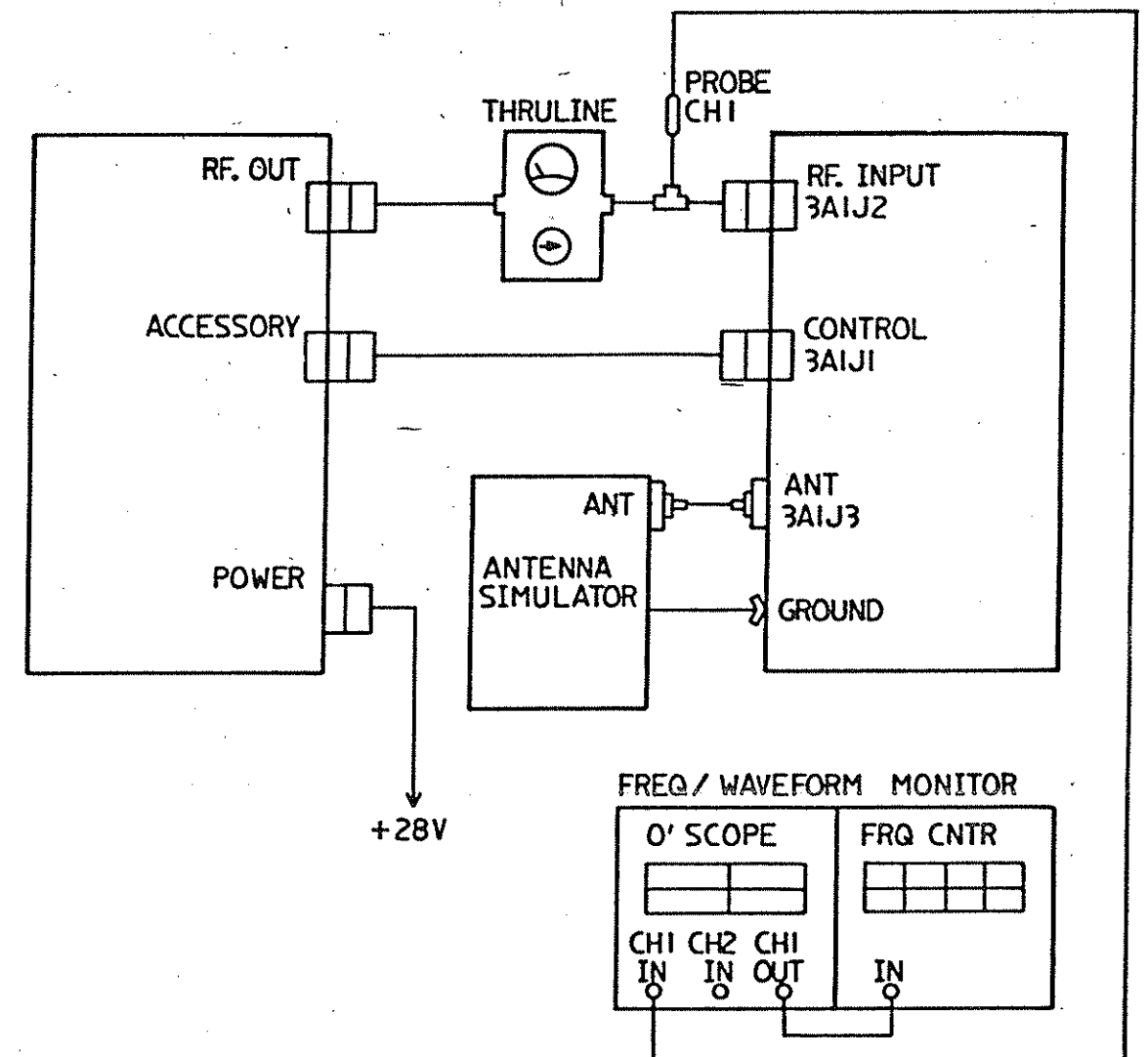


FIGURE 5.1 COUPLER TEST SETUP

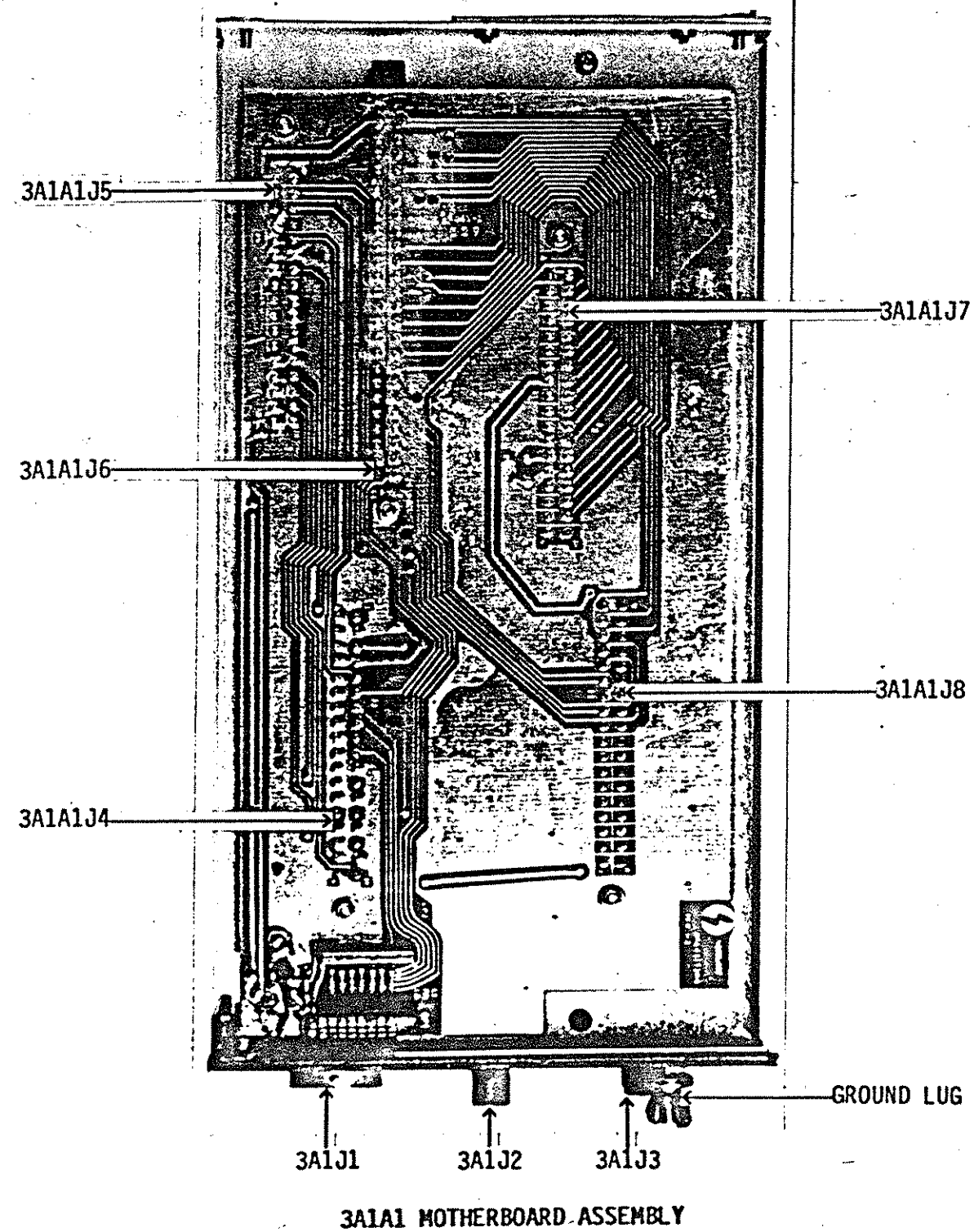
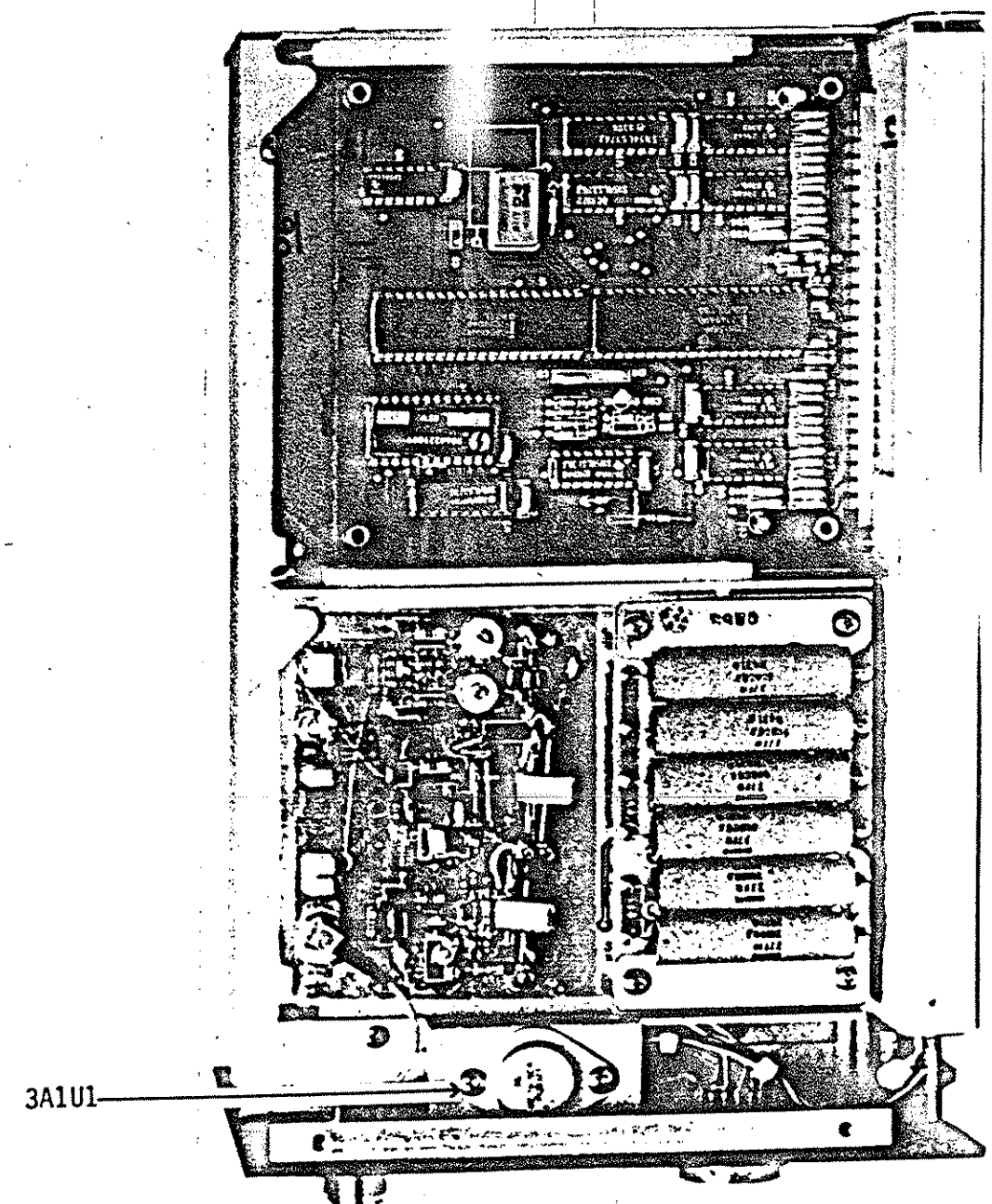
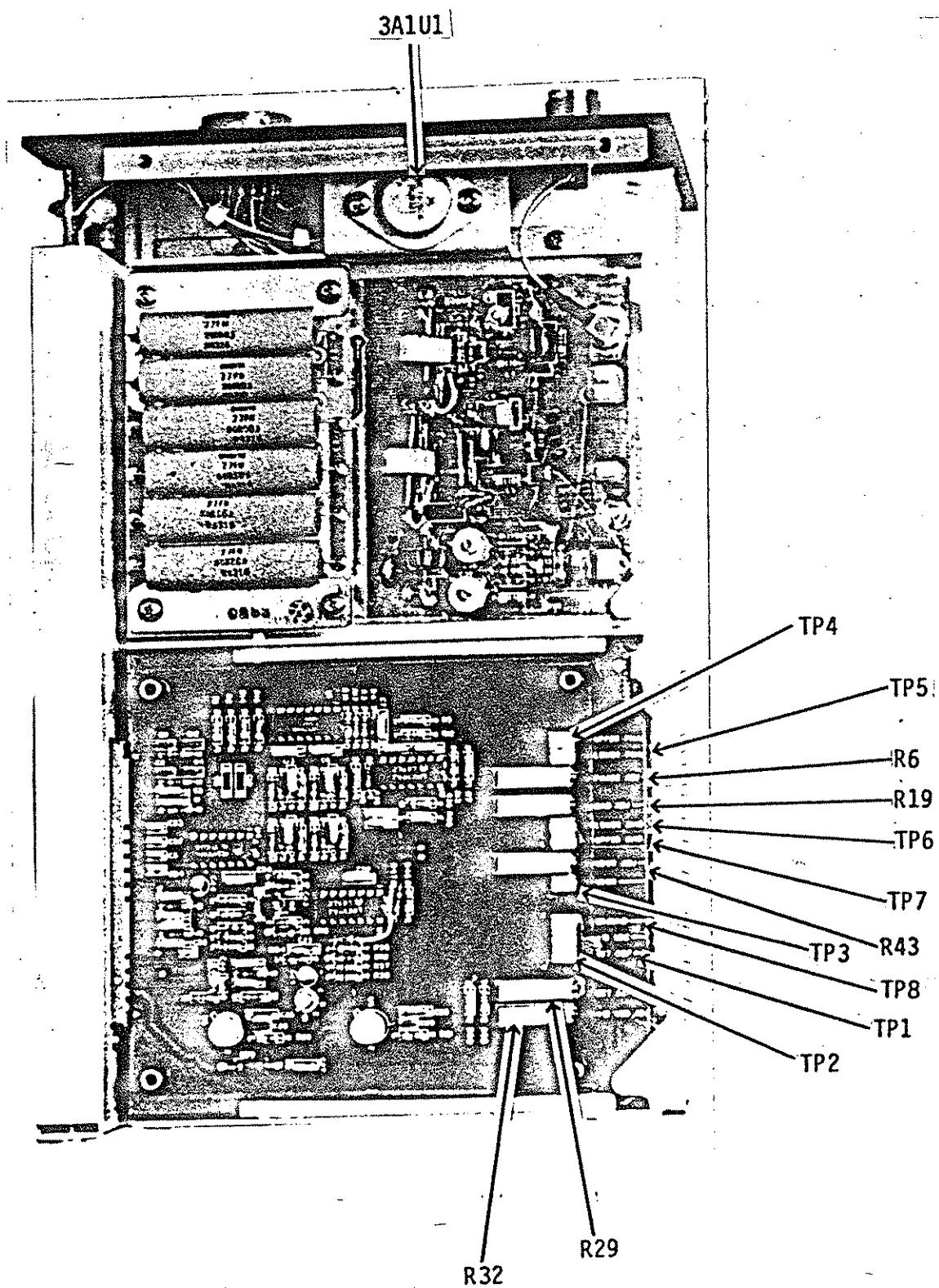


FIGURE 5.2 MAJOR ASSEMBLY AND COMPONENT LOCATIONS (Sheet 1 of 5)



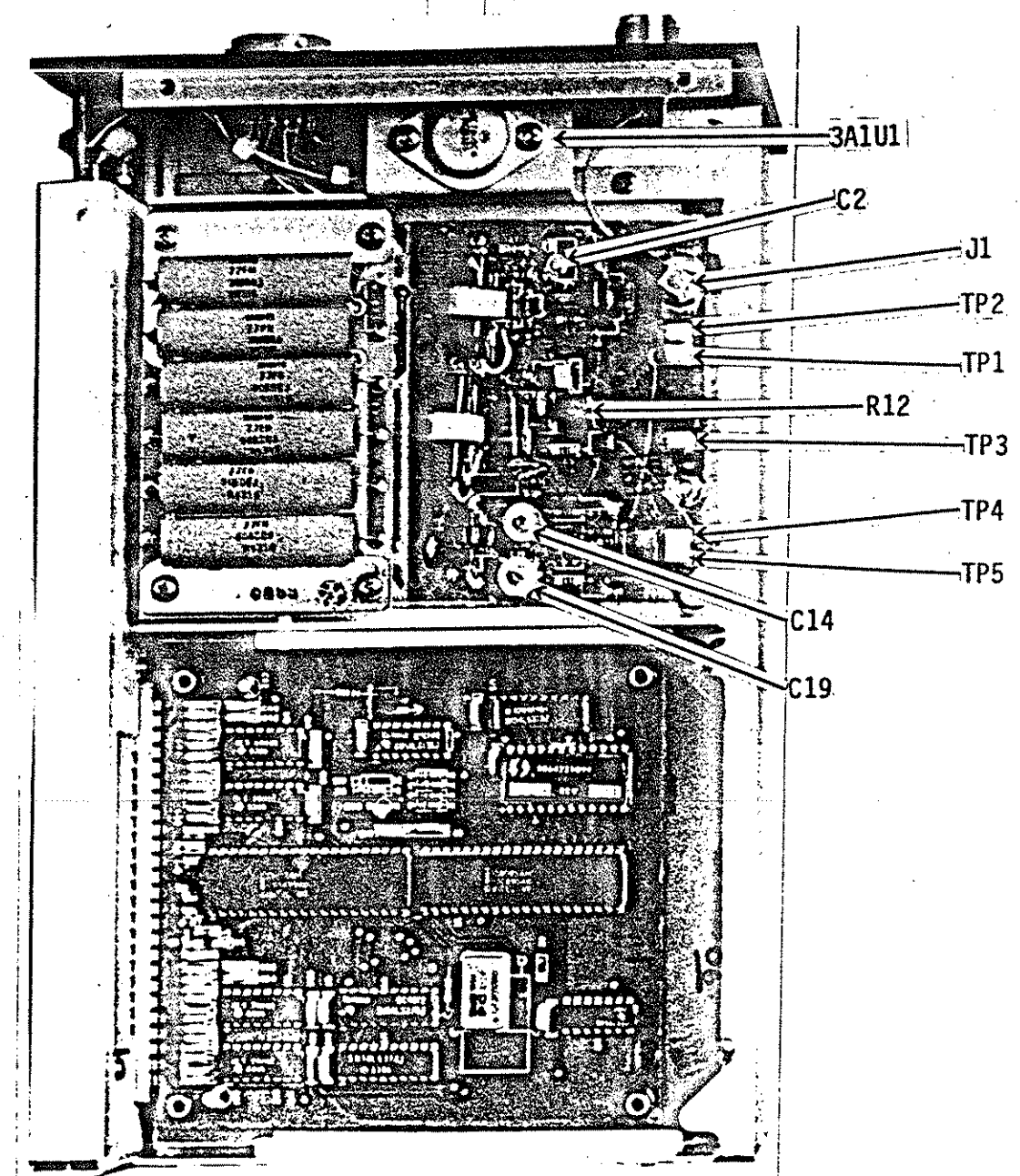
3A2 COMPUTER BOARD ASSEMBLY W/SHIELD AND 3A3 COMPARATOR BOARD REMOVED

FIGURE 5.2 MAJOR ASSEMBLY AND COMPONENT LOCATIONS (Sheet 2 of 5)



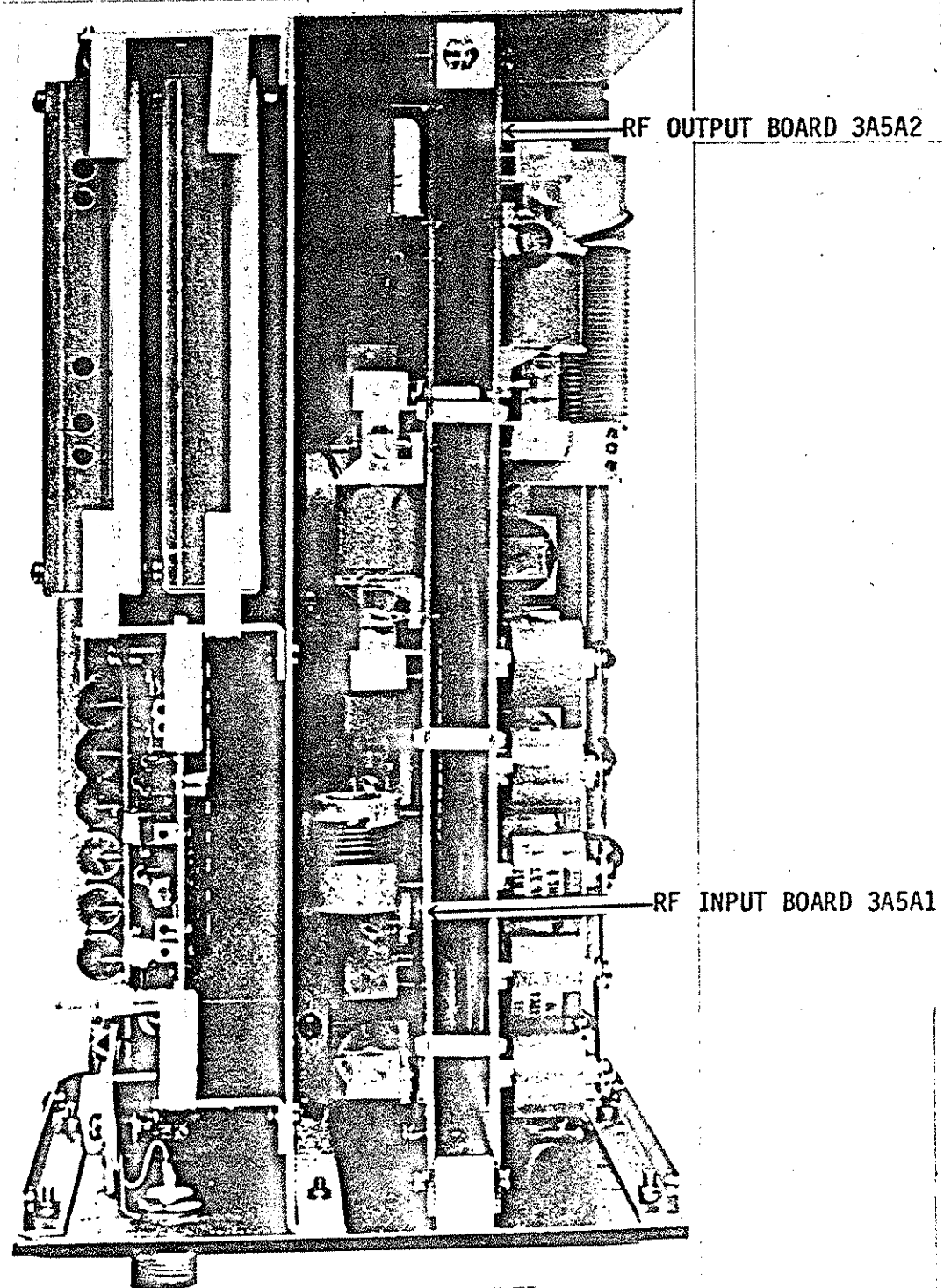
3A3 COMPARATOR BOARD ASSEMBLY W/SHIELD REMOVED

FIGURE 5.2 MAJOR ASSEMBLY AND COMPONENT LOCATIONS (Sheet 3 of 5)



3A4 DETECTOR/PAD ASSEMBLY

FIGURE 5.2 MAJOR ASSEMBLY AND COMPONENT LOCATIONS (Sheet 4 of 5)



3A5 RF ASSEMBLY

FIGURE 5.2 MAJOR ASSEMBLY AND COMPONENT LOCATIONS (Sheet 5 of 5)

TABLE 5.1 OPERATIONAL FAULT ANALYSIS

<u>SYMPTOM</u>	<u>POSSIBLE TROUBLE</u>	<u>CHECKS AND CORRECTIVE ACTION</u>
1. Coupler faults 7 seconds after TUNE Command.	a. No RF output from transceiver.	a. Defective transceiver. b. Defective Detector/Pad Assembly 3A4. Repair or replace.
2. Thruline Wattmeter reads normally in FWD position. No reading in REF position. Coupler faults 7 seconds after TUNE Command.	a. No RF to coupler. b. Coupler Detector Board 3A4, defective.	a. Check coax cable and connectors between transceiver and coupler. Meter in REF position should read greater than zero during TUNE, dipping to a low value when coupler TUNE is achieved. b. Repair or replace.
3. Thruline Wattmeter reads normally in both FWD and REF positions. Coupler faults 7 seconds after TUNE Command.	a. Computer Board 3A2 defective. b. Defective component on RF Assembly 3A5. c. Defective component on Comparator Board 3A3. d. Check antenna system.	a. Repair or replace Computer Board 3A2. b. Check components for damage and/or severe discoloration. Replace as required. c. Check components for damage. Repair as required. d. Repair or replace.
4. More than one coupler status light on.	a. +28VDC in transceiver is shut off. b. Defective Computer Board 3A2.	a. Check for +28VDC at RF Power Amplifier connector. Repair as necessary. b. Repair or replace Computer Board 3A2.
5. Coupler tunes normally, but faults when 100 watts is applied.	a. VSWR trip point set too low.	a. (1) Try to retune. (2) If tune is not satisfactory or fault condition is noted on more than just a few frequencies, check voltage on Comparator Board 3A3 TP3 to ground. Voltage should be 1.2VDC min. Reset by adjusting the VSWR control 3A3R43 to increase voltage reading to 1.2VDC or to a value approximately

(Table 5.1 Continued)

	b. Internal high voltage breakdown.	0.1 VDC higher than measured.
	c. Loose antenna or ground connection, or corrosion.	b. Observe coupler tune in darkened area and look for breakdown on RF Output Board 3A5A2. Repair or replace defective component.
	d. Defective internal ground connection.	c. Check antenna and ground connections for tightness and freedom from corrosion.
		d. (1) Check all Mother-board 3A1A1 and RF Assembly 3A5 ground screws for tightness. (2) Check Computer Board 3A2 and Comparator Board 3A3 connector contacts. Clean or replace.
6. FAULT light remains on, READY light blinks on and off.	a. TUNE Command is held high by transceiver.	a. Transceiver defective. Check manual for corrective action.
	b. TUNE Command line is held high by Comparator Board 3A3.	b. Check TUNE Command circuit on Comparator Board.
	c. Control cables shorted.	c. Repair or replace cables.

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2

NOTE: For this Test Procedure a Card Extender Sunair p/n 8064201594 and a 35Ft. Antenna Simulator Sunair p/n 8084001094 or equivalent is required. The Antenna Simulator may be constructed from the schematic diagram in Figure 5.3.

CIRCUIT UNDER TEST	INSTRUCTIONS	RESULT/ACTION
Preliminary Setup	<div>a. Test Equipment: Freq/Waveform Monitor, Figure 5.1.</div> <div>b. Remove dust cover from the coupler.</div> <div>c. Place Computer Board 3A2 on card extender.</div> <div>d. Connect 35FT. Antenna Simulator to couplers' antenna terminal, Figure 5.1.</div> <div>e. Transceiver: Power-up transceiver and place in AM Mode of operation.</div> <div>f. Refer to Figure 5.5.</div>	
1. 28V Supply	<div>a. Connect negative lead of DVM to Chassis and positive lead to Motherboard connector 3A1A1J6 pin B.</div>	<div>NORMAL: DVM indicates $28V \pm 4V$.</div> <div>ABNORMAL: Unplug the Computer and Comparator Boards. If DVM reads the specified voltage, check for shorts on the boards. If still reading the wrong voltage, check control cable. Check for shorts on the RF Assembly 3A5. Check 28V circuitry on Motherboard 3A1A1.</div>
2. 5V Supply	<div>a. Connect positive lead of DVM to Motherboard connector 3A1A1J5 pin K.</div>	<div>NORMAL: DVM indicates $5V \pm .5V$.</div> <div>ABNORMAL: Unplug Computer and Comparator Boards. If DVM reads the specified voltage, check the 5V regulator 3A1U1 mounted</div>

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2 (Continued)

on the Chassis Assembly 3A1,
repair or replace.

3. 1 MHz Clock	a. Remove RF Shield from board.	<u>NORMAL:</u> Frequency = 1MHz square wave, 4V p-p minimum. <u>ABNORMAL:</u> Replace U13.
4. TUNE Command Circuit	a. Connect scope probe to U5 pin 5. Momentarily depress TUNE button.	<u>NORMAL:</u> While TUNE button is depressed, line will go high (+5V). Coupler tunes. <u>ABNORMAL:</u> Check U5. Repair or replace.
5. FAULT Lamp Circuit	a. Connect scope probe to U6 pin 12. Turn transceiver power off. Wait approximately 4 seconds and turn power back on.	<u>NORMAL:</u> Scope will show a 3V level indication when transceiver is turned back on. For information on the function of the Output Ports, see paragraph 4.5.7. <u>ABNORMAL:</u> Check U6 and associated circuitry. Check FAULT Lamp. Check control cable between coupler and transceiver.
	b. Connect scope probe to U12 pin 11. Turn transceiver power off for approximately 4 seconds, then turn back on.	<u>NORMAL:</u> Scope will indicate a low voltage when the transceiver is turned back on. <u>ABNORMAL:</u> Check U12 and associated circuitry. Check FAULT Lamp. Check control cable between coupler and transceiver.
6. READY Lamp Circuit	a. Connect scope probe to U6 pin 9. Momentarily depress TUNE button.	<u>NORMAL:</u> Coupler will enter a tune cycle, scope will indicate a low and go high at the end of the tune cycle. For further information on the function of the Output Ports, see paragraph 4.5.7. <u>ABNORMAL:</u> Check U6 and associated circuitry. Check READY Lamp. Check control cable between coupler and transceiver.

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2 (Continued)

	b. Connect scope probe to U12 pin 12.	<u>NORMAL:</u> Scope indicates a low
		<u>ABNORMAL:</u> Check related circuitry of U12. Check READY lamp Check control cable between coupler and transceiver.
7. Pad Relay	a. Connect scope probe to U6 pin 15. Momentarily depress the TUNE button	<u>NORMAL:</u> Scope indicates a High during the tune cycle, and a Low at the completion of the tune cycle.
		<u>ABNORMAL:</u> Check related circuitry. For further information on the function of the Output ports see paragraph 4.5.7.
	b. Connect scope probe to U12 pin 10. Momentarily depress the TUNE button	<u>NORMAL:</u> Scope indicates a Low during tuning, then it goes to approximately +28V at completion of tune cycle.
		<u>ABNORMAL:</u> Same as 7.a. above. Also check Detector/Pad Assembly 3A4. See Section 4.3.
8. RF Network Relay Drivers		
8a. C S 1 Circuit	a. Connect scope probe to U5 pin 23. Disconnect the 35FT. antenna simulator and short antenna terminal to ground terminal with a 3FT. clip lead. (WARNING: Short antenna terminal <u>ONLY</u> for testing of steps 8a.a. and b. NOT for any of the following like tests.) Set transceiver to AM Mode at 2.0000 MHz. Momentarily depress microphone key which will initiate a tune cycle.	<u>NORMAL:</u> Scope will indicate a 3V (200 msec minimum) change-of-state. NOTE: If the change-of-state was not observed during the tune cycle, then repeat the same procedure at a frequency 500 KHz higher. This procedure should be repeated several times to insure that the change-of-state is being observed.
		<u>ABNORMAL:</u> If after several cycles the scope does not indicate a change-of-state, check related circuitry. For further information on the function of the Output Ports, see paragraph 4.5.7.

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2 (Continued)

- b. Connect scope probe to U9 pin 14. Set transceiver to AM Mode at 2.0000 MHz. Depress microphone key.
- NORMAL: Scope indicates a 28V change-of-state. If the 28V change does not occur, then change the frequency by 500 KHz and repeat procedure in step 8a.a.
- ABNORMAL: Same as in 8a.a. above. Also check relay K33 on the RF Output Board 3A5A2.

NOTE: DISCONNECT CLIP LEAD SHORT CIRCUIT AND RECONNECT 35 FT. ANTENNA SIMULATOR.

8b. C Out 1
Circuit

- a. Connect scope probe to U5 pin 25. Set transceiver in AM Mode at 2.0000 MHz. Momentarily depress microphone key which will initiate a tune cycle.
- NORMAL: Scope will indicate a 3V (200 msec minimum) change-of-state was not observed during the tune cycle, then repeat the same procedure at a frequency 500 KHz higher. This procedure should be repeated several times to insure that the change-of-state is being observed.

ABNORMAL: If after several cycles the scope does not change, check related circuitry. For further information on the function of the Output Ports see paragraph 4.5.7. Also check relay K31 on the RF Output Board 3A5A2.

8c. C Out 2

- a. Connect scope probe to U5 pin 26. Proceed as in step 8b.a. above.
- NORMAL: Same as in step 8b.a. above.

ABNORMAL: Same as in step 8b.a. above.

- b. Connect scope probe to U9 pin 12. Proceed as in step 8b.b. above.
- NORMAL: Same as in step 8b.b.

ABNORMAL: Same as in step 8b.b. above. Also check relay K30 on the RF Output Board 3A5A2.

8d. C Out 3

- a. Connect scope probe to U5 pin 27. Proceed as in step 8b.a. above.
- NORMAL: Same as in step 8b.a.

ABNORMAL: Same as in step 8b.a.

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2 (Continued)

b. Connect scope probe to U9 pin 11. Proceed as in step 8b.b. above.

NORMAL: Same as in step 8b.b.

ABNORMAL: Same as in step 8b.b. Also check relay K29 on the RF Output Board 3A5A2.

NOTE: For the remainder of these checks, only the component and pin numbers along with the relay number will be listed. Follow the established test procedures which have been outlined above in steps 8b through 8d.

8e. C IN 1	a. U5 pin 29 b. U9 pin 10	Relay K19 on RF Input Board 3A5A1.
8f. C IN 2	a. U5 pin 30 b. U10 pin 16	Relay K18 on RF Input Board 3A5A1.
8g. C IN 3	a. U5 pin 31 b. U10 pin 15	Relay K17 on RF Input Board 3A5A1.
8h. C IN 4	a. U5 pin 32 b. U10 pin 14	Relay K16 on RF Input Board 3A5A1.
8i. C IN 5	a. U5 pin 33 b. U10 pin 13	Relay K15 and K14 on RF Input Board 3A5A1.
8j. C IN 6	a. U5 pin 34 b. U10 pin 12	Relay K13 and K12 on RF Input Board 3A5A1.
8k. C IN 7	a. U5 pin 35 b. U10 pin 11	Relay K10 and K11 on RF Input Board 3A5A1.
8l. C IN 8	a. U5 pin 36 b. U10 pin 10	Relay K7, K8 and K9 on the RF Input Board 3A5A1.
8m. C IN 9	a. U6 pin 2 b. U11 pin 16	Relay K4, K5 and K6 on the RF Input Board 3A5A1.
8n. C IN 10	a. U6 pin 5 b. U11 pin 15	Relay K1, K2 and K3 on the RF Input Board 3A5A1.
8o. L1	a. U7 pin 5 b. U11 pin 13	Relay K25 on RF Input Board 3A5A1.
8p. L2	a. U7 pin 6 b. U11 pin 12	Relay K24 on RF Input Board 3A5A1.
8q. L3	a. U7 pin 9 b. U11 pin 11	Relay K23 on RF Input Board 3A5A1.
8r. L4	a. U7 pin 12 b. U11 pin 10	Relay K22 on RF Input Board 3A5A1.

TABLE 5.2 FAULT ANALYSIS AND TROUBLESHOOTING, COMPUTER BOARD 3A2 (Continued)

8s. L5	a. U7 pin 15 b. U12 pin 16	Relay K21 on the RF Input Board 3A5A1.
8t. L6	a. U7 pin 16 b. U12 pin 15	Relay K20 on the RF Input Board 3A5A1.
8u. L7	a. U7 pin 19 b. U12 pin 14	Relay K28 on the RF Output Board 3A5A2.
8v. L8	a. U6 pin 16 b. U12 pin 13	Relay K27 on the RF Output Board 3A5A2.
8w. L9	a. U6 pin 19 b. U11 pin 14	Relay K26 on the RF Output Board 3A5A2.
8x. L10	a. U7 pin 2 b. U9 pin 15	Relay K23 on the RF Output Board 3A5A2.

TABLE 5.3 FAULT ANALYSIS AND TROUBLESHOOTING, COMPARATOR BOARD 3A3

NOTE: For this Test Procedure a Card Extender Sunair p/n 8064201594 and a 35FT. Antenna Simulator Sunair p/n 8084001094 or equivalent is required. The Antenna Simulator may be constructed from the schematic diagram in Figure 5.3.

CIRCUIT UNDER TEST	INSTRUCTIONS	RESULT/ACTION
Preliminary Setup	<div>a. Test Equipment: Freq/Waveform Monitor, Figure 5.1.</div> <div>b. Remove dust cover from the coupler.</div> <div>c. Place Comparator Board 3A3 on card extender, and remove RF shield.</div> <div>d. Connect 35FT. Antenna Simulator to couplers' antenna terminal, Figure 5.1.</div> <div>e. Transceiver: Power-up transceiver and place in AM Mode of operation.</div> <div>f. Refer to Figure 5.6.</div>	
1. TUNE Command Circuit	<div>a. Connect scope probe to CR2 anode. Depress TUNE button</div> <div>b. Connect scope probe to Q1 base. Depress TUNE button</div>	<div><u>NORMAL</u>: Scope indicates a momentary +0VDC to +12VDC low to high change. Coupler tunes.</div> <div><u>ABNORMAL</u>: Check Motherboard 3A1A1. Check control cable between transceiver and coupler. Check transceiver for proper inputs to the coupler.</div> <div><u>NORMAL</u>: Scope indicates a +1V level at Q1 base. This level remains until coupler has tuned, then indicates 0V.</div> <div><u>ABNORMAL</u>: Check Q1 and associated circuitry.</div>

TABLE 5.3 FAULT ANALYSIS AND TROUBLESHOOTING, COMPARATOR BOARD 3A3 (Continued)

	c. Connect scope probe to Q1 collector. Depress TUNE button.	<p><u>NORMAL</u>: Scope indicates a voltage level of +1V at Q1 collector while tuning. Level should remain low until coupler has completed the tune cycle. Scope indicates a +24V level.</p> <p><u>ABNORMAL</u>: Repair or replace Q1 or associated circuitry. Check Motherboard 3A1A1. Check Tune Relay on Detector Board Assembly 3A4. Refer to Section 4.3.</p>
2. +10VDC Regulator	a. Connect DVM negative lead to ground (chassis) and connect positive lead to TP1.	<p><u>NORMAL</u>: DVM indicates a reading of approximately 10V \pm .5V.</p> <p><u>ABNORMAL</u>: If voltage is off by more than .5V check U6 circuitry for defective component.</p>
3. Detector 5V Reference Level	a. Connect DVM negative lead to ground (chassis) and connect positive lead to TP2; Detector Reference test point.	<p><u>NORMAL</u>: DVM indicates a reading of 5V \pm 0.01V.</p> <p><u>ABNORMAL</u>: Adjust R29 for proper reading. If proper voltage cannot be obtained, check voltage at CR9 cathode. Cathode reading should be approximately 28V. Anode readings should be approximately 16V. If these are correct, replace U5.</p>
4. Phase and Magnitude Comparators	<p>a. Connect scope probe to U1A pin 12. Change frequency of transceiver and momentarily depress microphone key. Coupler tunes.</p> <p>b. Connect scope probe to U1B pin 10. Change frequency of transceiver and momentarily depress microphone key. Coupler tunes.</p>	<p><u>NORMAL</u>: Scope indicates a 2V p-p varying voltage (3 to 5 V). This continues until the tune cycle is complete.</p> <p><u>ABNORMAL</u>: Check circuitry related to U1A and check Detector/Pad Assembly 3A4. Refer to Section 4.3.</p> <p><u>NORMAL</u>: Same as 4a. above.</p> <p><u>ABNORMAL</u>: Same as 4a. above.</p>

TABLE 5.3 FAULT ANALYSIS AND TROUBLESHOOTING, COMPARATOR BOARD 3A3 (Continued)

		Detector/Pad Assembly 3A4. See Section 4.3.
6. RF Detector (Forward Power Det) Sampling Circuitry	a. Connect scope probe to TP3. Change frequency of transceiver. Momentarily depress microphone key.	<u>NORMAL</u> : Scope indicates varying voltage until end of tune cycle. Then it reads approximately 1.2V. <u>ABNORMAL</u> : Check U3A and associated circuitry. Check Detector/Pad Assembly 3A4. See Section 4.3.
7. $\overline{\text{RF}}$	a. Connect scope probe to collector of Q2. Momentarily depress TUNE button.	<u>NORMAL</u> : The scope indicates a low during the tune cycle. At the end of the cycle the scope indicates a high. <u>ABNORMAL</u> : Check Q2 and associated circuitry. Check Forward Power Detector on Detector/Pad Assembly 3A4. See Section 4.3.

TABLE 5.4

ALIGNMENT PROCEDURE

IF UPON COMPLETION OF THE FAULT ANALYSIS TABLES 5.1, 5.2 AND 5.3, THE ACU-150D IS STILL NOT OPERATING PROPERLY, THEN ACCOMPLISH THE FOLLOWING ALIGNMENT PROCEDURE.

NOTE: All of the following measurements and adjustments are accomplished on the Comparator Board 3A3.

1. Turn on the transceiver. (Necessary to supply power to the coupler.)
2. Connect negative lead of DVM to ground, TP8. Set meter scale to read +50 VDC.
3. Measure voltage on TP1 (U6 pin 3). Adjust R32 until voltage is +10VDC.
4. Set meter scale to read +5VDC. Measure voltage on TP2 (U5 pin 3). Adjust R29 until voltage is +5VDC.
5. Measure voltage on TP3 (U3A pin 4). Adjust R43 until voltage is +1.2 VDC.
6. Connect negative lead of DVM to TP7 (U2D pin 11) and connect positive lead to TP6 (U2C pin 8). Set meter scale to read +1 VDC. Adjust R19 until a reading of +200 mv \pm 10 mv is obtained.
7. Connect negative lead of DVM to TP2 (DET REF). Measure voltages on TP6 (U2C pin 8) and TP7 (U2D pin 11). Adjust R32 until TP6 reads +100 mv \pm 5 mv and TP7 read +100 mv \pm 5 mv.
8. Connect negative lead of DVM to TP5 (U2B pin 7) and positive lead to TP4 (U2A pin 4). Adjust R6 until a reading of +120 mv \pm 6 mv is obtained.
9. Repeat steps 7 and 8 as required to obtain correct reading.

FIGURE 5.3 35 FT. ANTENNA SIMULATOR

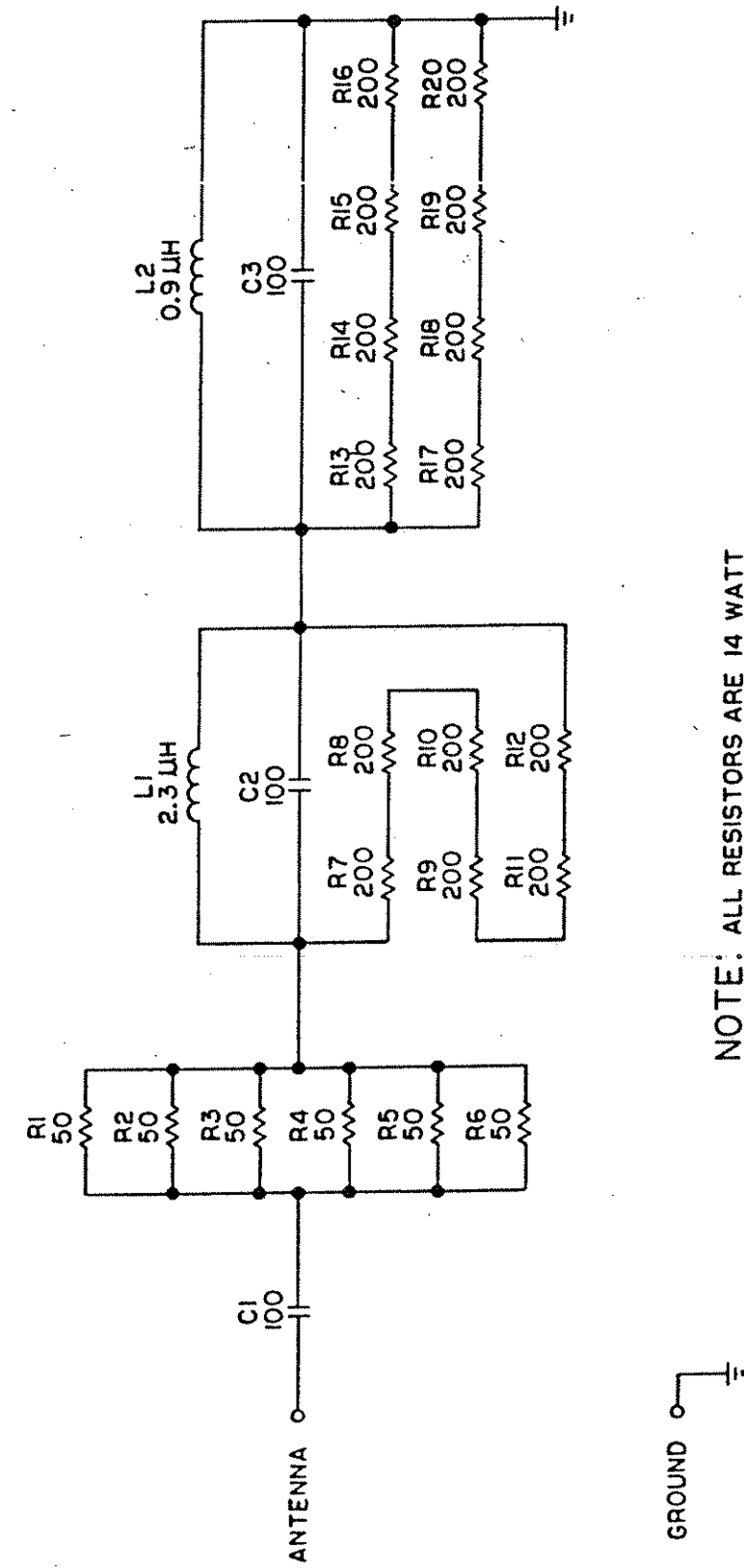


TABLE 5.5 TABLE OF ASSEMBLIES

DESIGNATOR		DESCRIPTION	SUNAIR PART NUMBER
ASSEMBLY	SUBASSEMBLY		
3A1		Chassis Assembly	8096210092
	3A1A1	Motherboard Assembly	8064215099
3A2		Computer Board Assembly	8064220092
3A3		Comparator Board Assembly	8064230098
3A4		RF Detector Assembly	8064260094
	3A4A1	Detector/Pad Assembly	8056160094
	3A4A2	Pad Assembly	8056161091
3A5		RF Assembly	8064203091
	3A5A1	RF Input Board Assembly	8064240093
	3A5A2	RF Output Board Assembly	8064250099

CHASSIS ASSY 3A1

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	CHASSIS ASSY 3A1	
3A1A1	PC Assy, Mother	8064215099
3A1J1	Connector, Power, 26 Pin Round	0754480003
3A1J2	Connector, RF, UHF	0753300001
3A1J3	Connector, RF, HN UG-496/U	0753040000
C2	Cap. 0.1 μ f, 100V, Z5U	0244080003
C3	Cap. 1 μ f, 35V, T368	0283630001
C4	Cap. 1 μ f, 35V, T368	0283630001
U1	IC. Linear, Vol. Reg. MC7805CK	0447190008
	<u>MISCELLANEOUS</u>	
	Bracket, Card Guide	8064207100
	Bracket, Card Guide/Heatsink	8064207207
	Card, Guide, Plastic	1005870039
	Chassis	8064211000
	Connector, RF, Subminiature	0753700000
	Nut, Wing No. 10-32	0519320000
	Shield, Center	8064207002
	Socket, Transistor TO-3	0841550000

8064215099A PC ASSY, MOTHER 3A1A1

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PC ASSY, MOTHER 3A1A1	8064215099
3A1A1J4	Connector, PC, 18 Pin Female	0753610001
3A1A1J5	Connector, PC, 18 Pin Female	0753610001
3A1A1J6	Connector, PC, 25 Pin DBL Root	1005820015
3A1A1J7	Connector, PC, 18 Pin Female	0753610001
3A1A1J8	Connector, PC, 18 Pin Female	0753610001
C1	Cap. 0.01 μ f, 25V, X55	0281620008
C5	Cap. 15 μ f, 50V, 1960	0274000008
CP1	Capacitor, NTWK, 10 Pin, .1 μ f	1006580018
CP2	Capacitor, NTWK, 10 Pin, .1 μ f	1006580018
CR1	Diode, Transzorb 1N5646A	1006680021
L1	Inductor, Molded, 6.8 μ h 245ma	0664180001
L2	Inductor, Molded, 6.8 μ h 245ma	0664180001
L3	Inductor, Molded, 6.8 μ h 245ma	0664180001
L4	Inductor, Molded, 6.8 μ h 245ma	0664180001
L5	Inductor, Molded, 6.8 μ h 245ma	0664180001
L6	Inductor, Molded, 6.8 μ h 245ma	0664180001
L7	Inductor, Molded, 6.8 μ h 245ma	0664180001
L8	Inductor, Molded, 6.8 μ h 1080ma	0652200001
Q1	Transistor, NPN, SI. 2N4124	0448010003
R1	Resistor, 47K, 10%, 1/4W	0171060008
R2	Resistor, 4.7K, 5%, 1/4W	0170770001

FINAL ASSY

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	FINAL ASSY	
3A1	Chassis Assy	8064210097
3A2	PC Assy, Computer	8064220092
3A3	PC Assy, Comparator	8064230098
3A4	PC Assy, RF Detector, Airborne	8064260094
3A5	RF Assembly	8064203091

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PC ASSY, COMPARATOR 3A3	8064230098A
C1	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C2	Cap. 0.01μf, 50V, X7R, 20%	0281730008
C3	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C4	Cap. 0.01μf, 50V, X7R, 20%	0281730008
C6	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C7	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C8	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C9	Cap. 0.1μf, 50V, X7R, 20%	0281730008
C11	Cap. 0.01μf, 50V, X7R, 20%	0281730008
C12	Cap. 0.01μf, 50V, X7R, 20%	0281610002
C13	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C14	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C15	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C16	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C17	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C18	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C19	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C20	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C21	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C22	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C23	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C24	Cap. 6.8μf, 20V, T368	0296780006
C25	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C26	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C27	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C28	Cap. 0.01μf, 50V, X7R, 20%	0281730008
C29	Cap. 0.01μf, 50V, X7R, 20%	0281730008
C30	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C31	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C32	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C33	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C34	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C35	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C36	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C37	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C38	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C39	Cap. 0.1μf, 50V, X7R, 20%	0281610002
C40	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C41	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C42	Cap. 0.47μf, 50V, X5V, 20%	0283370009
C43	Cap. 0.001μf, 100V, X7R, 20%	0281630003
C44	Cap. 1μf, 50V, 1980	0280910002
CR1	Diode, Rectifier 1N4004	0405180004
CR2	Diode, Rectifier 1N4004	0405180004
CR3	Diode, Rectifier 1N4004	0405180004
CR4	Diode, Rectifier 1N4004	0405180004
CR5	Diode, Rectifier 1N4004	0405180004
CR6	Diode, Rectifier 1N4004	0405180004
CR7	Diode, Rectifier 1N4004	0405180004
CR8	Diode, Signal, Germ. 1N542E	0405610009
CR9	Diode, Zener 1N5349A	0405380003
CR10	Diode, Signal, Germ. 1N542E	0405610009
CR11	Diode, Signal, Germ. 1N542E	0405610009
L1	Inductor, Molded, 22μh, 10%	0664060005
L2	Inductor, Molded, 22μh, 10%	0664060005
L3	Inductor, Molded, 22μh, 10%	0664060005
L4	Inductor, Molded, 22μh, 10%	0664060005
L5	Inductor, Molded, 22μh, 10%	0664060005
L6	Inductor, Molded, 22μh, 10%	0664060005
Q1	Transistor, NPN, SI, 2N2222A	0448580004
Q2	Transistor, NPN, SI, 2N4124	0448010003
R1	Resistor, 6.8K, 5%, 1W	0174810008
R2	Resistor, 6.8K, 5%, 1W	0174810008
R3	Resistor, 100, 5%, 1W	0171180003
R4	Resistor, 2.2K, 5%, 1W	0178070009
R5	Resistor, 10K, 1%, 1/8W	1003050026
R6	Pot. 5K, 10%, 1W, 15 Turns	0338490086
R7	Resistor, 10K, 1%, 1/8W	1003050026

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
R8	Resistor, 4.7K, 5%, 1W	0170770001
R9	Resistor, 100K, 10%, 1W	0170390004
R10	Resistor, 4.7K, 5%, 1W	0170770001
R11	Resistor, 100K, 10%, 1W	0170390004
R12	Resistor, 22M, 10%, 1W	0180950002
R13	Resistor, 22M, 10%, 1W	0180950002
R14	Resistor, 6.8K, 5%, 1W	0174810008
R15	Resistor, 6.8K, 5%, 1W	0174810008
R16	Resistor, 100, 5%, 1W	0171180003
R17	Resistor, 2.2K, 5%, 1W	0178070009
R18	Resistor, 10K, 1%, 1/8W	1003050026
R19	Pot. 5K, 10%, 1W, 15 Turns	0338490086
R20	Resistor, 10K, 1%, 1/8W	1003050026
R21	Resistor, 4.7K, 5%, 1W	0170770001
R22	Resistor, 100K, 10%, 1W	0170390004
R23	Resistor, 4.7K, 5%, 1W	0170770001
R24	Resistor, 100K, 10%, 1W	0170390004
R25	Resistor, 22M, 10%, 1W	0180950002
R26	Resistor, 22M, 10%, 1W	0180950002
R28	Resistor, 330, 5%, 1W	0170910008
R29	Pot. 500, 10%, 1W, 15 Turns	0338490078
R30	Resistor, 560, 5%, 1W	0183200004
R31	Resistor, 270, 10%, 1W	0178450006
R32	Pot. 500, 10%, 1W, 15 Turns	0338490078
R33	Resistor, 1.5K, 10%, 1W	0172470005
R34	Resistor, 6.8K, 5%, 1W	0174810008
R35	Resistor, 4.7K, 5%, 1W	0170770001
R36	Resistor, 10, 5%, 1W	0177160004
R37	Resistor, 1K, 10%, 1W	0171560001
R38	Resistor, 1K, 10%, 1W	0171560001
R39	Resistor, 15K, 10%, 1W	0172350000
R40	Resistor, 15K, 10%, 1W	0172350000
R41	Resistor, 150K, 10%, 1W	0176750002
R42	Resistor, 22K, 5%, 1W	0172230004
R43	Pot. 100K, 10%, 1W, 15 Turns	0338450051
R44	Resistor, 15K, 10%, 1W	0172350000
R45	Resistor, 15K, 10%, 1W	0172350000
R46	Resistor, 2.2M, 10%, 1W	0176870008
R47	Resistor, 4.7K, 5%, 1W	0170770001
TP1	Test Point, White	0753640007
TP2	Test Point, White	0753640007
TP3	Test Point, White	0753640007
TP4	Test Point, White	0753640007
TP5	Test Point, White	0753640007
TP6	Test Point, White	0753640007
TP7	Test Point, White	0753640007
TP8	Test Point, White	0753640007
U1	IC. Linear UA747ADMQB	1006430024
U2	IC. Linear LM239AJ	1006430032
U3	IC. Linear LM239AJ	1006430032
U4	IC. Digital MC145848AL	1006440003
U5	IC. Linear LM117	1006440011
U6	IC. Linear LM117	1006440011
	MISCELLANEOUS	
	Card Ejectors	1003320015
	Mounting Pad, Transistor	0502710004
	Shield, Front, Computer	8064220408
	Shield, Rear	8064220505

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PC ASSY, COMPUTER 3A2	8064220092B
C3	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C4	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C5	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C6	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C7	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C8	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C9	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C10	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C11	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C12	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C13	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C14	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C15	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C16	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C17	Cap. 0.001µf, 100V, X7R, 20%	0281630003
C18	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C19	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C20	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C21	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C22	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C23	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C24	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C25	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C26	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C27	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C28	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C29	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C30	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C31	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C32	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C33	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C34	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C35	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C36	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C37	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C38	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C39	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C40	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C41	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C42	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C43	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C44	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C45	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C46	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C47	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C48	Cap. 0.1µf, 50V, X7R, 20%	0281610002
C49	Cap. 0.1µf, 50V, X7R, 20%	0281610002

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C50	Cap. 1µf, 50V, 1980	0280910002
C51	Cap. 1µf, 50V, 1980	0280910002
C52	Cap. 1µf, 50V, 1980	0280910002
C53	Cap. 0.1µf, 50V, X7R, 20%	0281610002
L1	Inductor, Molded, 22µh, 10%	0664060005
Q1	Transistor, P-CH, FET 2N5461	0446160008
R1	Resistor, 10K, 10%, 1/4W	0170410005
R2	Resistor, 10K, 10%, 1/4W	0170410005
R3	Resistor, 10K, 10%, 1/4W	0170410005
R4	Resistor, 10K, 10%, 1/4W	0170410005
R5	Resistor, 220K, 10%, 1/4W	0177780002
R6	Resistor, 470, 5%, 1/4W	0184110009
R7	Resistor, 100K, 10%, 1/4W	0170390004
R8	Resistor, 39K, 10%, 1/4W	0177800003
U1	IC. Digital ID8085AH	1006410007
U2	IC. Digital SN54LS138J	1006410015
U3	IC. Digital SN54LS373J	1006410023
U4	EPROM	8064221099
U5	IC. Digital ID8155H	1006420002
U6	IC. Digital SN54LS374J	1006420011
U7	IC. Digital SN54LS374J	1006420011
U8	IC. Digital SN54LS32J	1006420029
U9	IC. Linear ULS2004R	1006420037
U10	IC. Linear ULS2004R	1006420037
U11	IC. Linear ULS2004R	1006420037
U12	IC. Linear ULS2004R	1006420037
U13	Crystal, Oscillator, 1.00 Mhz	1006670025
MISCELLANEOUS		
	Card Ejectors	1003320015
	Shield, Front, Computer	8064220408
	Shield, Rear	8064220505
	Socket, IC. 24 Pin	1006240021

8056160094E PC ASSY, DETECTOR/PAD 3A4A1

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
3A4A2	PC ASSY, DETECTOR/PAD	8056160094
C2	PC Assy, Pad	8056161091
C3	Cap. 5-20pf, 100V, Ceramic	0282930001
C4	Cap. 390pf, 500V, DM15, 5%	0286000008
C5	Cap. .01uf, 50V, X7R, 20%	0281730008
C6	Cap. .01uf, 50V, X7R, 20%	0281730008
C7	Cap. .01uf, 50V, X7R, 20%	0281730008
C8	Cap. .01uf, 50V, X7R, 20%	0281610002
C9	Cap. .47uf, 50V, X7R, 20%	0281610002
C10	Cap. .01uf, 50V, X7R, 20%	0283377771
C11	Cap. .01uf, 50V, X7R, 20%	0281730008
C12	Cap. .01uf, 50V, X7R, 20%	0281730008
C13	Cap. 12pf, 500V, DM15	0281730008
C14	Cap. 2-8pf, 350V, NPO	1005320039
C15	Cap. 91pf, 500V, DM15, 5%	0268220000
C16	Cap. .01uf, 50V, X7R, 20%	0298740001
C17	Cap. 91pf, 500V, DM15, 5%	0281730008
C18	Cap. .01uf, 50V, X7R, 20%	0298740001
C19	Cap. 2-8pf, 350V, NPO	0281730008
C20	Cap. 33pf, 500V, DM15, 2%	0268220000
CR1	Diode, Rectifier 1N4004	0281020001
CR2	Diode, Signal, Germ. 1N542E	0405180004
CR3	Diode, Signal, Germ. 1N542E	0405610009
CR4	Diode, Signal, Germ. 1N542E	0405610009
CR5	Diode, Signal, Germ. 1N542E	0405610009
CR6	Diode, Signal, Germ. 1N542E	0405610009
CR7	Diode, Signal, Germ. 1N542E	0405610009
CR8	Diode, Rectifier 1N4004	0405610009
J1	Connector, RF, Snap-On	0405180004
K1	Relay, 4PDT, 24V, PC MT 7.5A	1000170012
K2	Relay, 4PDT, 24V, PC MT 7.5A	0661600009
L1	Inductor, Molded, 0.47uh, 5%	0661600009
L2	Inductor, Molded, 100Qh, 10%	0649410009
L3	Inductor, Molded, 100Qh, 10%	0664940005
L4	Inductor, Molded, 100Qh, 10%	0664940005
L5	Inductor, Molded, 100Qh, 10%	0664940005
L6	Inductor, Molded, 100Qh, 10%	0664940005
L7	Inductor, Molded, 100Qh, 10%	0664940005
L8	Inductor, Molded, 100Qh, 10%	0664940005
L9	Inductor, 0.15uh	8056162097
R7	Resistor, 12K, 10%, 1W	0183180003
R8	Resistor, 18, 5%, 1W	0184730007
R9	Resistor, 12K, 10%, 1W	0183180003
R10	Resistor, 100, 10%, 1W	0165540001
R11	Resistor, 56, 10%, 1W	0168890003
R12	Pot. 10K, 5%, 0.6W, 15 Turns	0344410005
R13	Resistor, 33, 10%, 1W	0182530001
R14	Resistor, 33, 10%, 1W	0182530001
R15	Resistor, 220, 10%, 1W	0171320000
R16	Resistor, 220, 10%, 1W	0171320000
T1	Transformer, Ampl. Detector	6035040802
T2	Transformer, Phase Detector	6035040900
T3	Transformer, Current	8080003602
TP1	Test Point, White	0753640007
TP2	Test Point, White	0753640007
TP3	Test Point, White	0753640007
TP4	Test Point, White	0753640007
TP5	Test Point, White	0753640007
MISCELLANEOUS		
	Socket, Pin	1005990034
	Socket, Relay, 4PDT Contacts	0754700003
	Spring, Relay, Hold-Down	0881930008

8056161091A PC ASSY, PAD 3A4A2

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PC ASSY, PAD 3A4A2	8056161091
R1	Resistor, 50, 5%, 14W	0191160008
R2	Resistor, 50, 5%, 14W	0191160008
R3	Resistor, 50, 5%, 14W	0191160008
R4	Resistor, 50, 5%, 14W	0191160008
R5	Resistor, 200, 5%, 14W	0197410006
R6	Resistor, 200, 5%, 14W	0197410006

8064260094A PC ASSY, RF DETECTOR, AIRBORNE 3A4

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
3A4A1	PC ASSY, RF DETECTOR, AIRBORNE	8064260094
	PC ASSY, Detector/Pad	8056160094
	Card Ejectors	1003320015

8064240093A PC ASSY, RF INPUT 3A5A1

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
	PC ASSY, RF INPUT 3A5A1	8064240093
C1	Cap. 910pf, 500V, DM19, 5%	0297570005
C2	Cap. 910pf, 500V, DM19, 5%	0297570005
C3	Cap. 820pf, 500V, DM19, 2%	0281280002
C4	Cap. 820pf, 500V, DM19, 2%	0281280002
C5	Cap. 820pf, 500V, DM19, 2%	0281280002
C6	Cap. 820pf, 500V, DM19, 2%	0281280002
C7	Cap. 430pf, 500V, DM19, 5%	0254900003
C8	Cap. 430pf, 500V, DM19, 5%	0254900003
C9	Cap. 430pf, 500V, DM19, 5%	0254900003
C10	Cap. 430pf, 500V, DM19, 5%	0254900003
C11	Cap. 430pf, 500V, DM19, 5%	0254900003
C12	Cap. 390pf, 500V, DM19, 2%	0282640002
C13	Cap. 220pf, 500V, DM15, 2%	0281420009
C14	Cap. 220pf, 500V, DM15, 2%	0281420009
C15	Cap. 220pf, 500V, DM15, 2%	0281420009
C16	Cap. 220pf, 500V, DM15, 2%	0281420009
C17	Cap. 200pf, 500V, DM15, 5%	0258040009
C18	Cap. 200pf, 500V, DM15, 5%	0258040009
C19	Cap. 160pf, 500V, DM15, 2%	0281340005
C20	Cap. 160pf, 500V, DM15, 2%	0281340005
C21	Cap. 160pf, 500V, DM15, 2%	0281340005
C22	Cap. 160pf, 500V, DM15, 2%	0281340005
C23	Cap. 91pf, 500V, DM15, 5%	0298740001
C24	Cap. 91pf, 500V, DM15, 5%	0298740001
C25	Cap. 91pf, 500V, DM15, 5%	0298740001
C26	Cap. 75pf, 500V, DM15, 2%	0281110000
C27	Cap. 47pf, 500V, DM15, 2%	0282420002
C28	Cap. 47pf, 500V, DM15, 2%	0282420002
C29	Cap. 47pf, 500V, DM15, 2%	0282420002
C30	Cap. 47pf, 500V, DM15, 2%	0282420002
C31	Cap. 47pf, 500V, DM15, 2%	0282420002
C32	Cap. 47pf, 500V, DM15, 2%	0282420002
C33	Cap. 47pf, 500V, DM15, 2%	0282420002
C34	Cap. 12pf, 500V, DM15	1005320039
C35	Cap. 15pf, 500V, DM15	1005320021
C36	Cap. 12pf, 500V, DM15	1005320039
C41	Cap. 0.01μf, 100V, Z5V	0273210009
C42	Cap. 0.01μf, 100V, Z5V	0273210009
C43	Cap. 0.01μf, 100V, Z5V	0273210009
C44	Cap. 0.01μf, 100V, Z5V	0273210009
C45	Cap. 0.01μf, 100V, Z5V	0273210009
C46	Cap. 0.01μf, 100V, Z5V	0273210009
C47	Cap. 0.01μf, 100V, Z5V	0273210009
C48	Cap. 0.01μf, 100V, Z5V	0273210009
C49	Cap. 0.01μf, 100V, Z5V	0273210009
C50	Cap. 0.01μf, 100V, Z5V	0273210009
C51	Cap. 0.01μf, 100V, Z5V	0273210009

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
C52	Cap. 0.01μf, 100V, Z5V	0273210009
C53	Cap. 0.01μf, 100V, Z5V	0273210009
C54	Cap. 0.01μf, 100V, Z5V	0273210009
C55	Cap. 0.01μf, 100V, Z5V	0273210009
C56	Cap. 0.01μf, 100V, Z5V	0273210009
K1	Relay, Reed, 24V, 2 Form A	1005900027
K2	Relay, Reed, 24V, 2 Form A	1005900027
K3	Relay, Reed, 24V, 2 Form A	1005900027
K4	Relay, Reed, 24V, 2 Form A	1005900027
K5	Relay, Reed, 24V, 2 Form A	1005900027
K6	Relay, Reed, 24V, 2 Form A	1005900027
K7	Relay, Reed, 24V, 2 Form A	1005900027
K8	Relay, Reed, 24V, 2 Form A	1005900027
K9	Relay, Reed, 24V, 2 Form A	1005900027
K10	Relay, Reed, 24V, 2 Form A	1005900027
K11	Relay, Reed, 24V, 2 Form A	1005900027
K12	Relay, Reed, 24V, 2 Form A	1005900027
K13	Relay, Reed, 24V, 2 Form A	1005900027
K14	Relay, Reed, 24V, 2 Form A	1005900027
K15	Relay, Reed, 24V, 2 Form A	1005900027
K16	Relay, Reed, 24V, 2 Form A	1005900027
K17	Relay, Reed, 24V, 1 Form A	1005910006
K18	Relay, Reed, 24V, 1 Form A	1005910006
K19	Relay, Reed, 24V, 1 Form A	1005910006
K20	Relay, Reed, HV, 24V, 1 Form A	1005920001
K21	Relay, Reed, HV, 24V, 1 Form A	1005920001
K22	Relay, Reed, HV, 24V, 1 Form A	1005920001
K23	Relay, Reed, HV, 24V, 1 Form A	1005920001
K24	Relay, Reed, HV, 24V, 1 Form A	1005920001
K25	Relay, Reed, HV, 24V, 1 Form A	1005920001
L1	Inductor, 0.04μh	8064240506
L2	Inductor, 0.08μh	8064240603
L3	Inductor, 0.20μh	8064240701
L4	Inductor, 0.375μh	8064240808
L5	Inductor, 0.70μh	8064240905
L6	Inductor, 1.35μh	8064241006

8064203091A RF ASSEMBLY 3A5

REF SYMBOL	DESCRIPTION	SUNAIR PART NO.
3A5A1	RF ASSEMBLY 3A5	8064203091
3A5A2	PC Assy, RF Input	8064240093
	PC Assy, RF Output	8064250099
	MISCELLANEOUS	
	Bracket, PC Board	8064203201
	Spacer, Insulator, Snap-In	1006300023

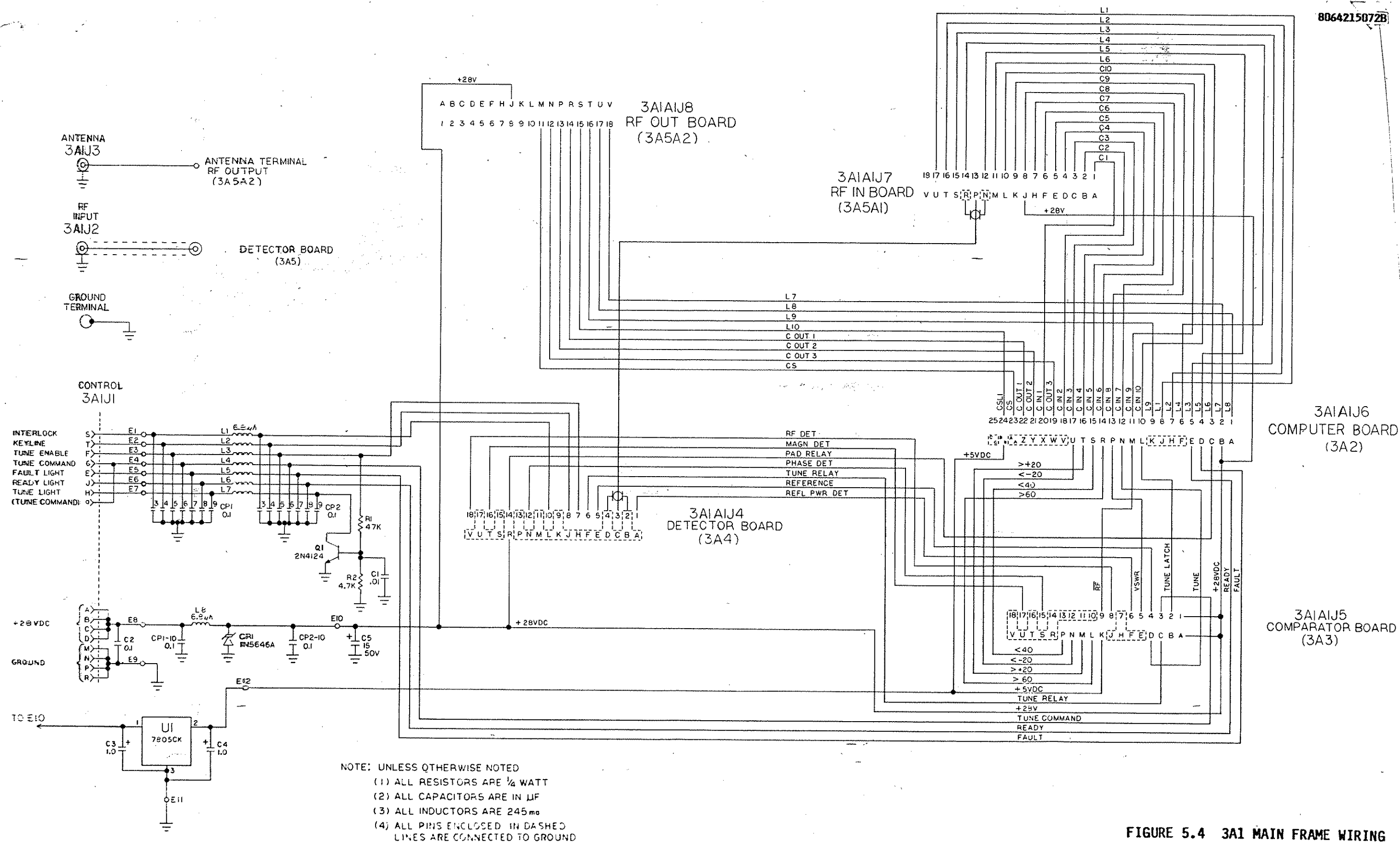
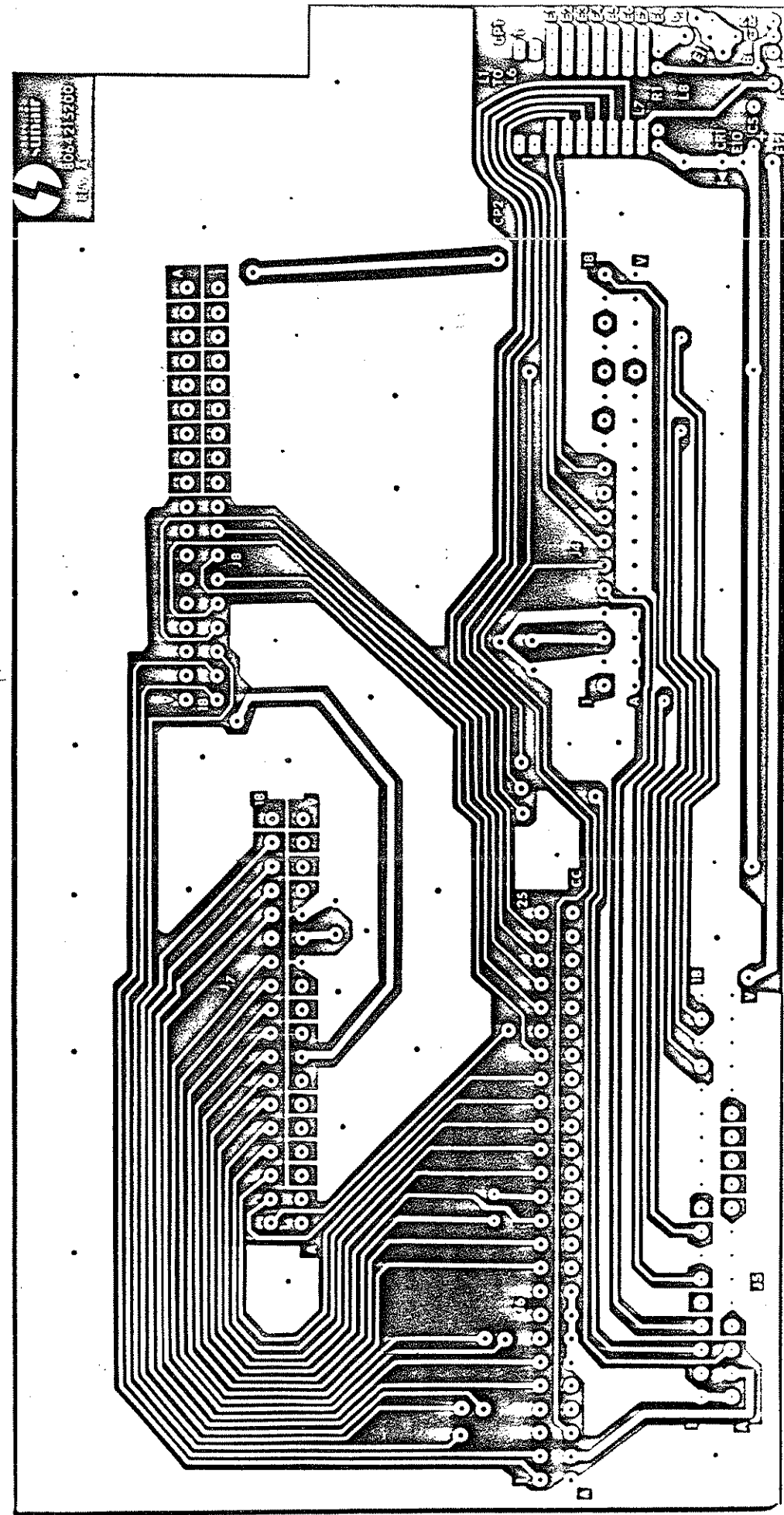
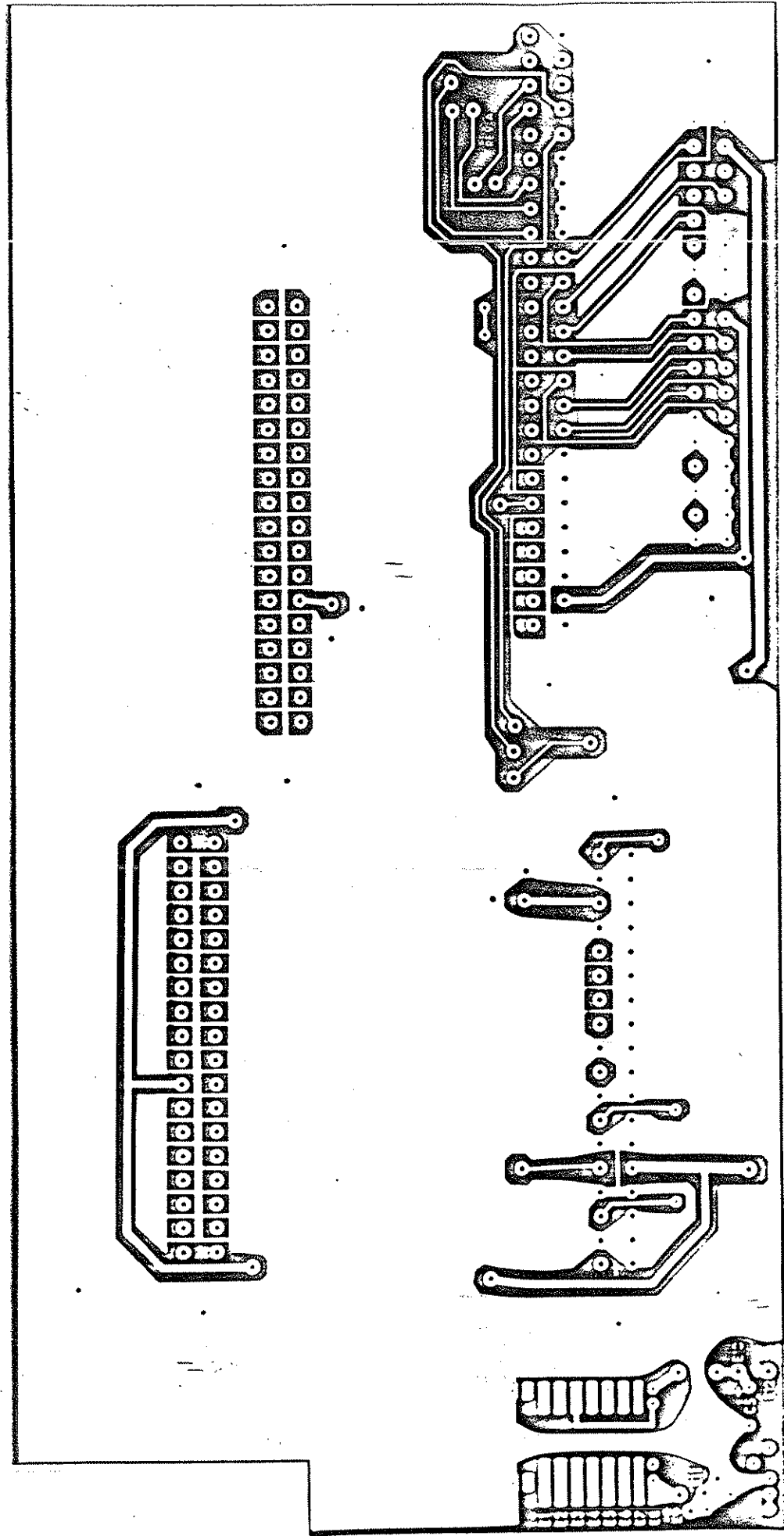


FIGURE 5.4 3A1 MAIN FRAME WIRING



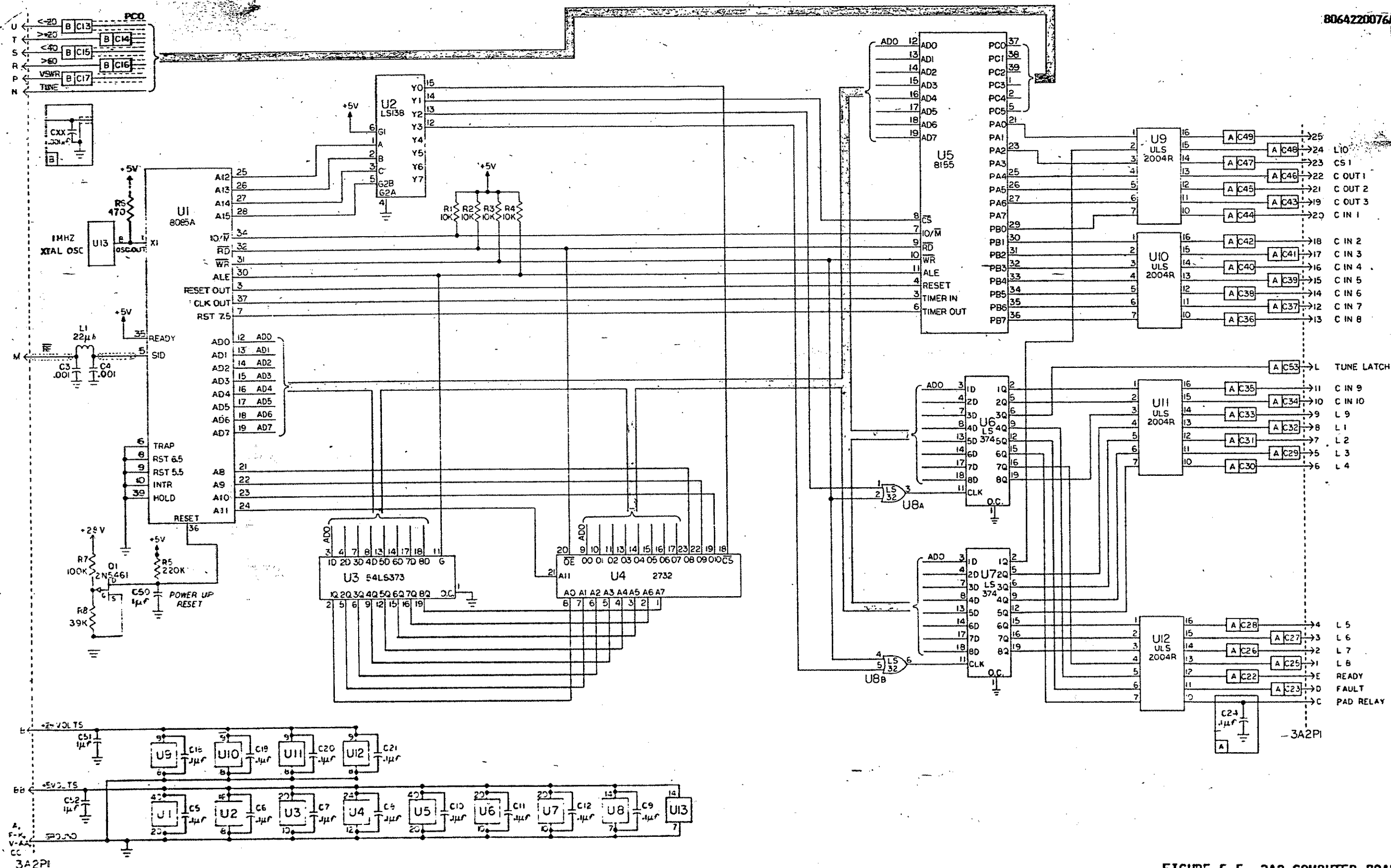
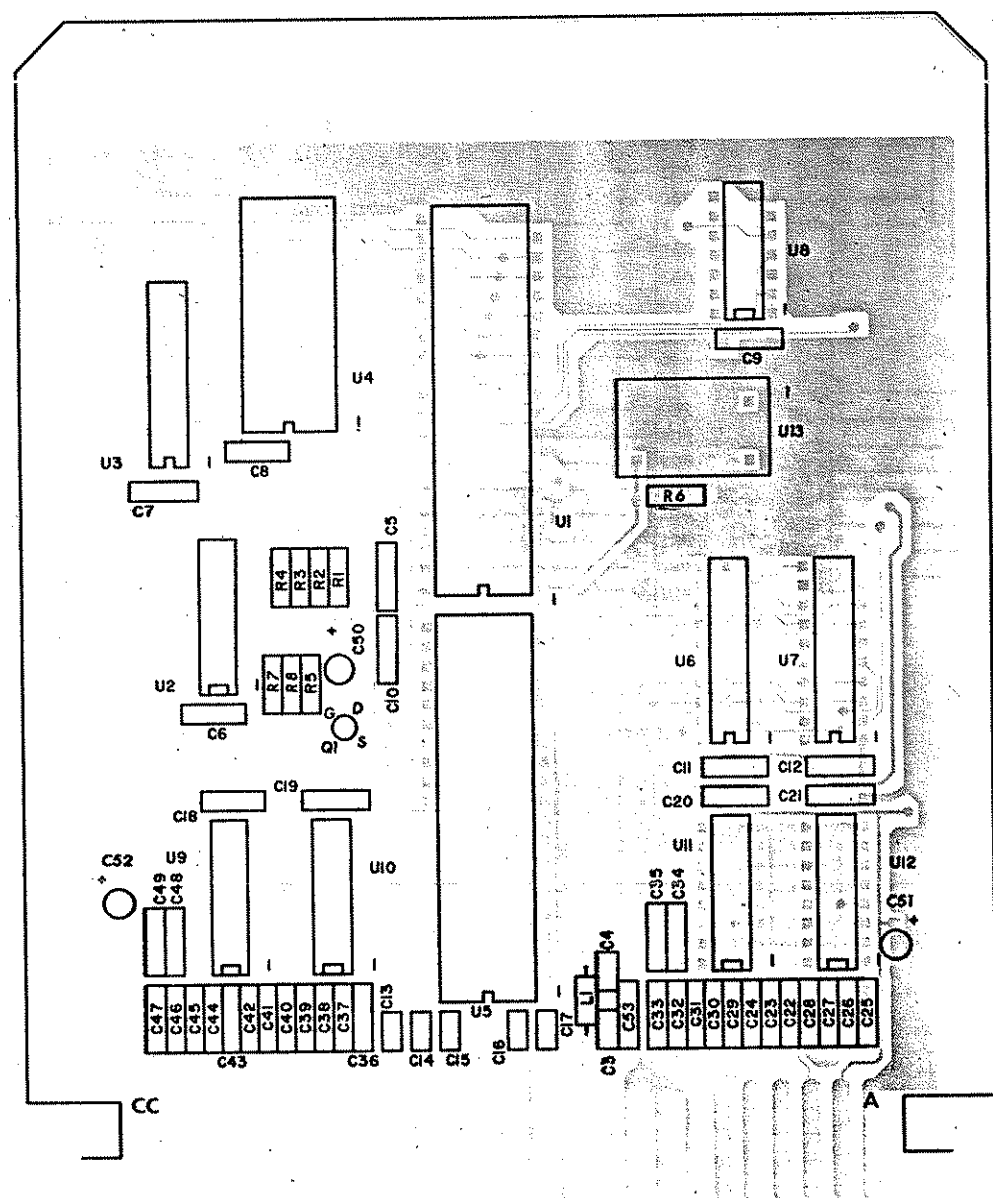
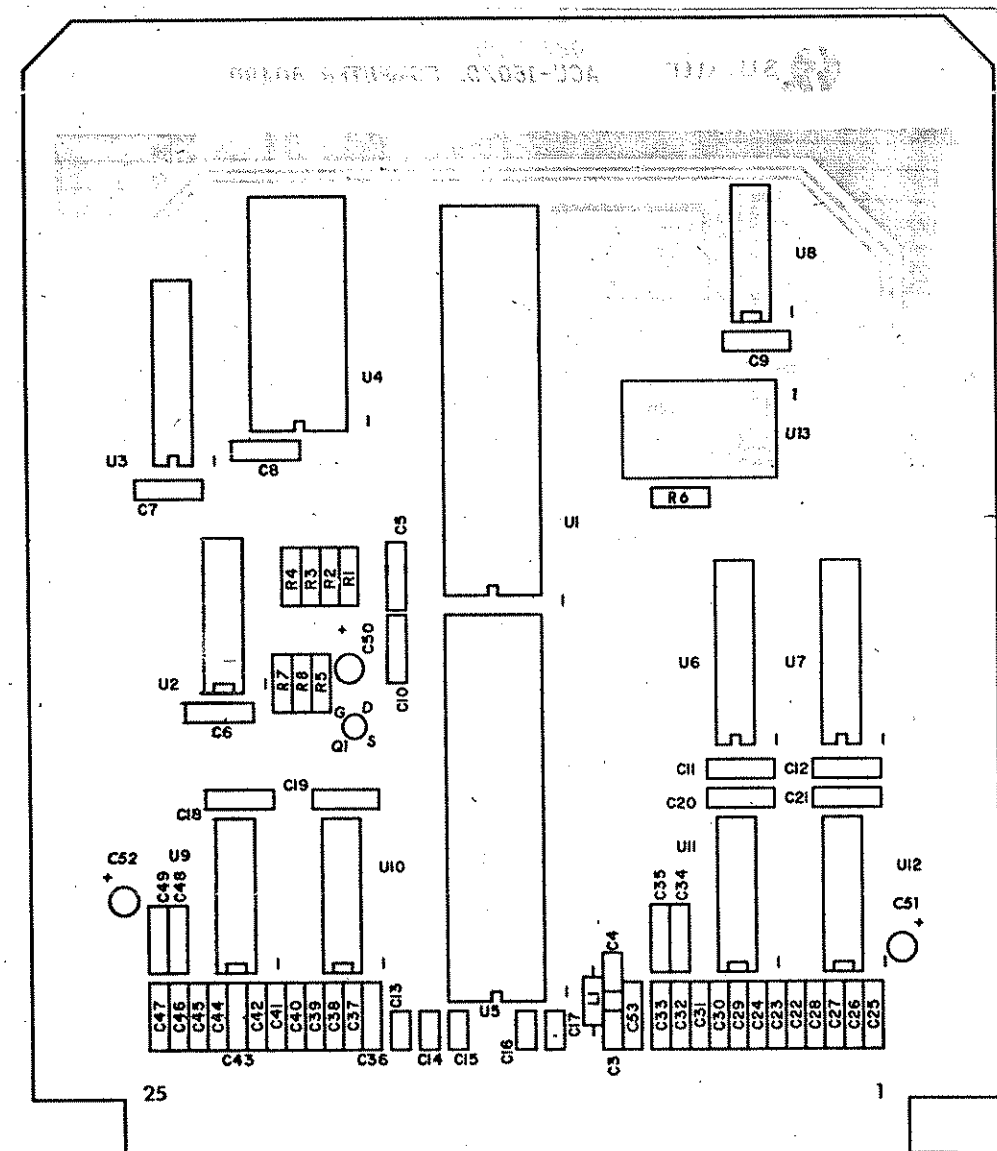


FIGURE 5.5 3A2 COMPUTER BOARD



COMPONENT SIDE



CIRCUIT SIDE

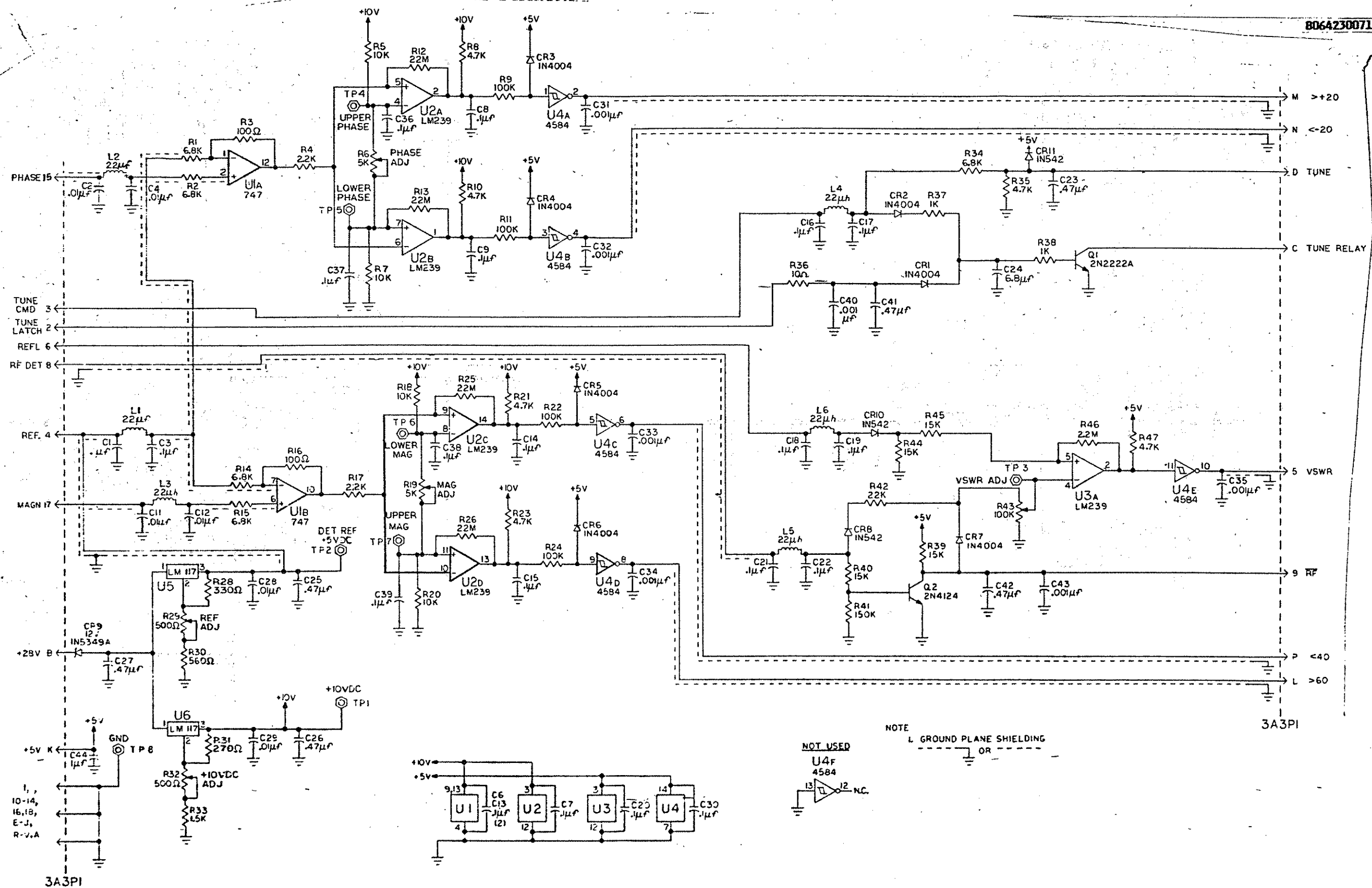
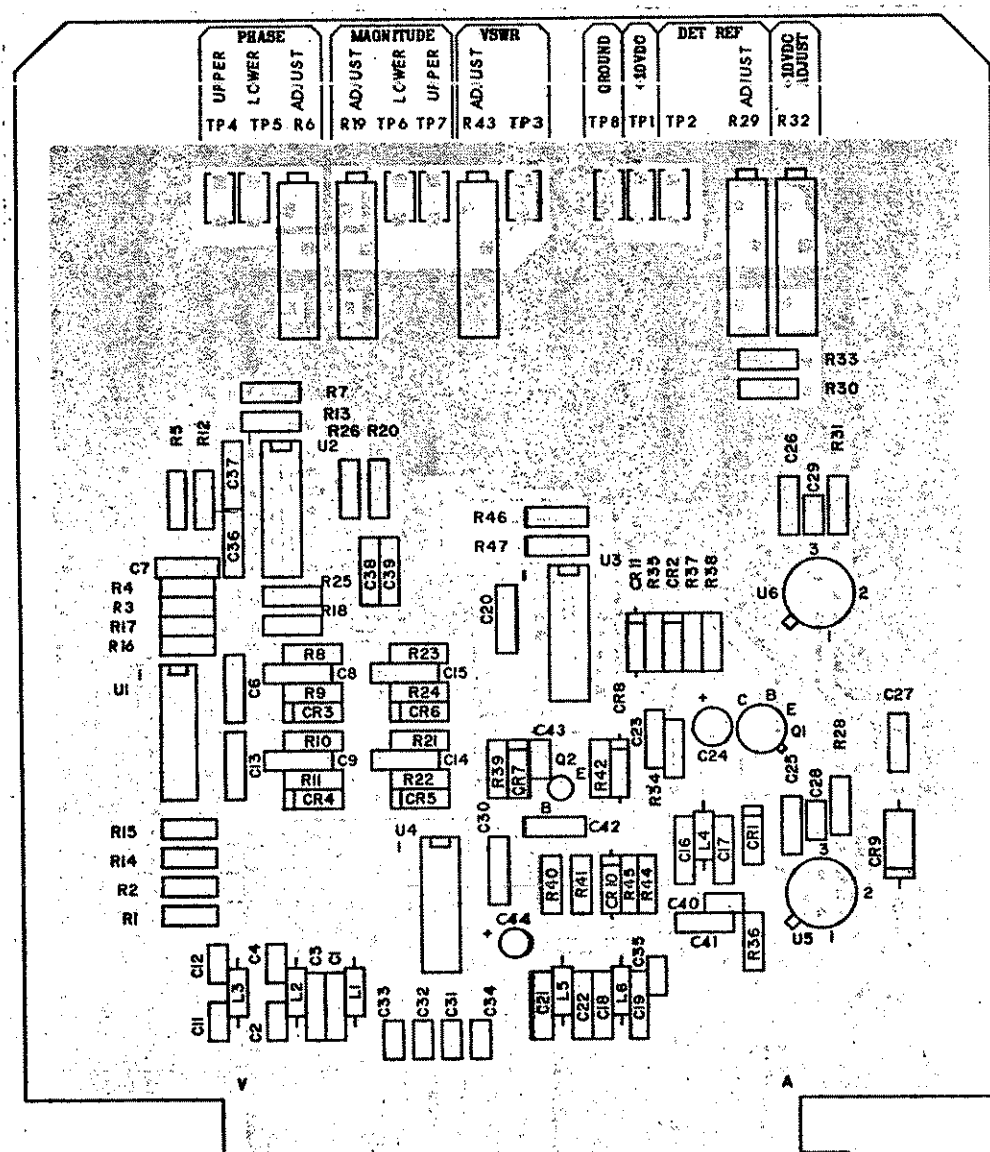
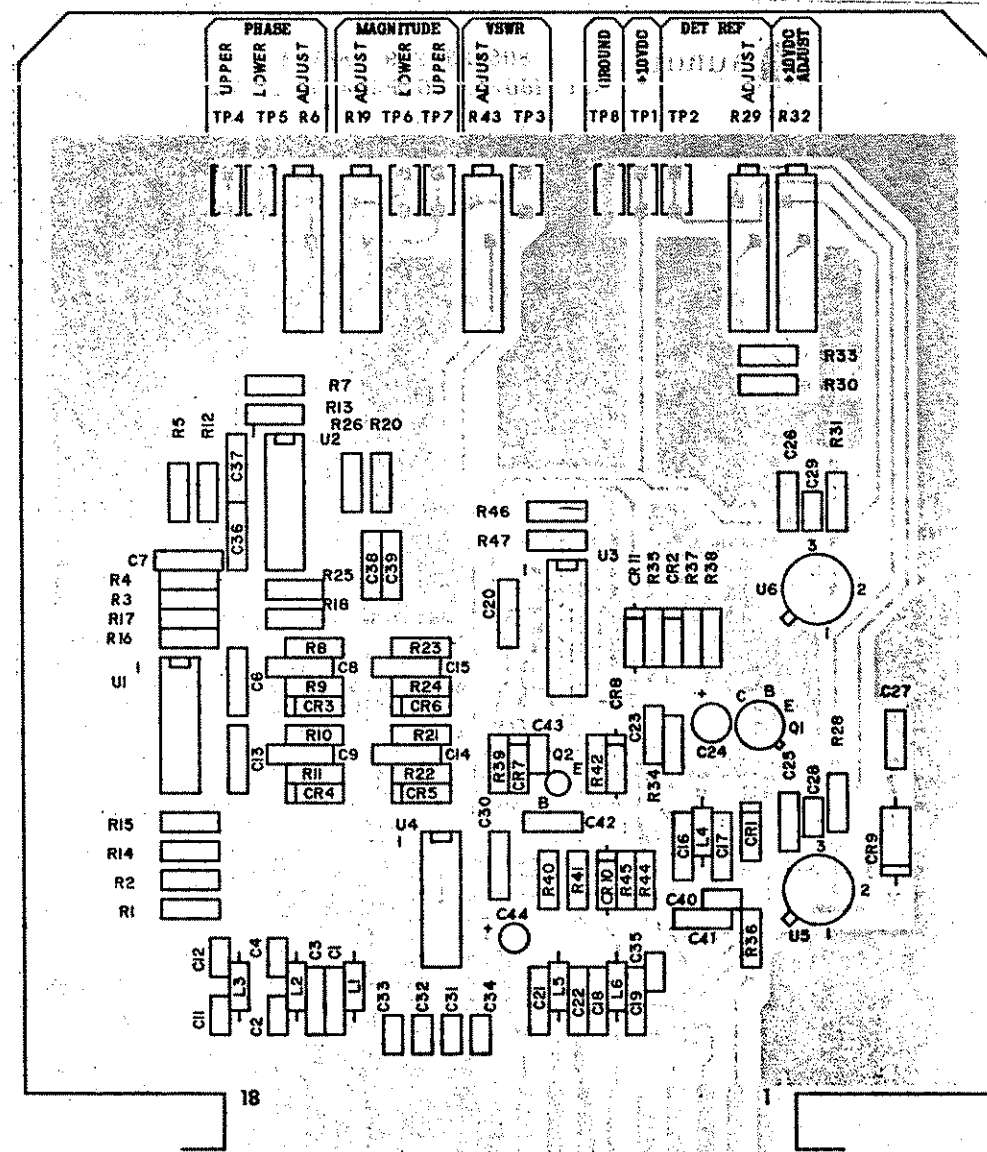


FIGURE 5.6 3A3 COMPARATOR BOARD



COMPONENT SIDE



CIRCUIT SIDE

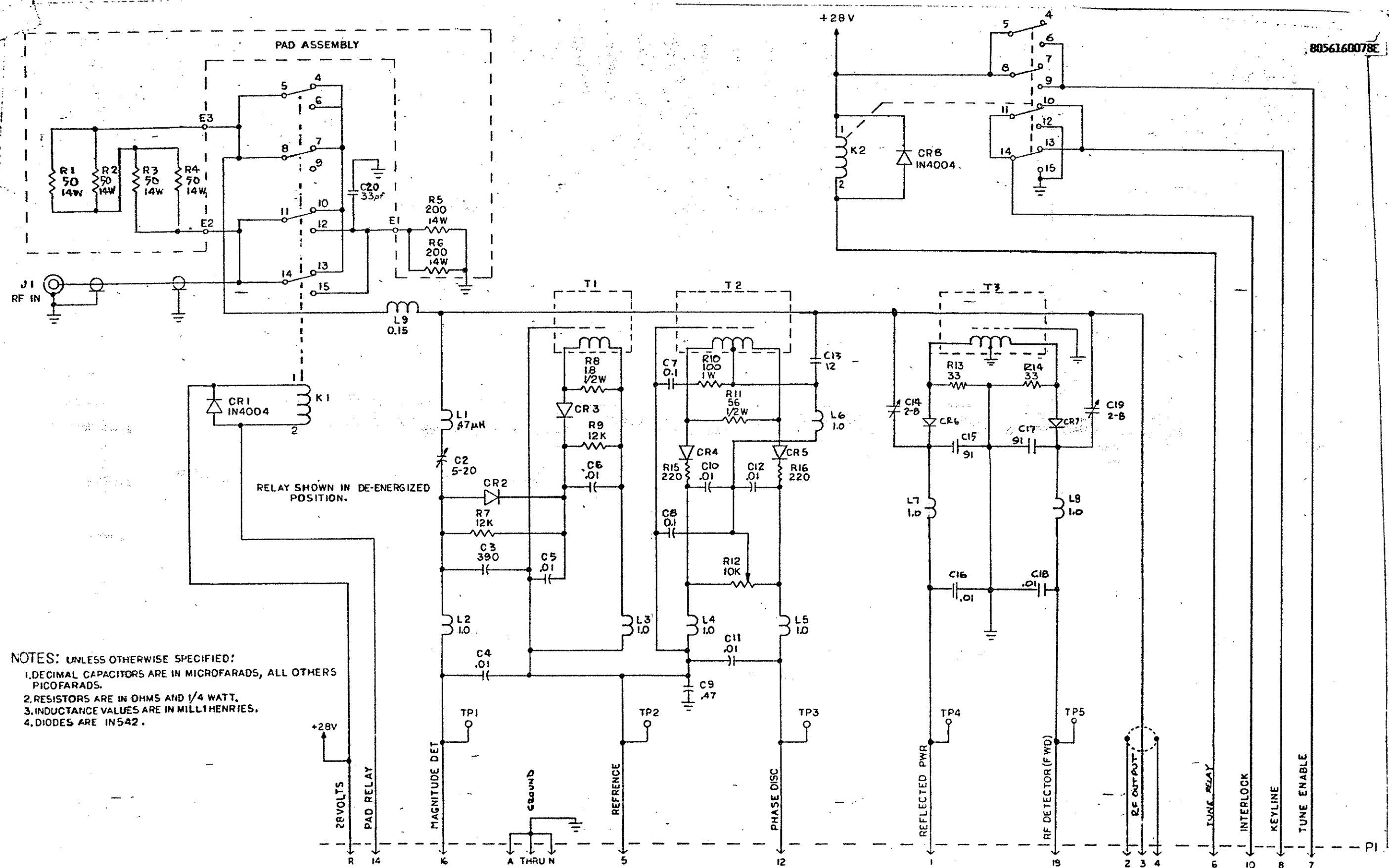
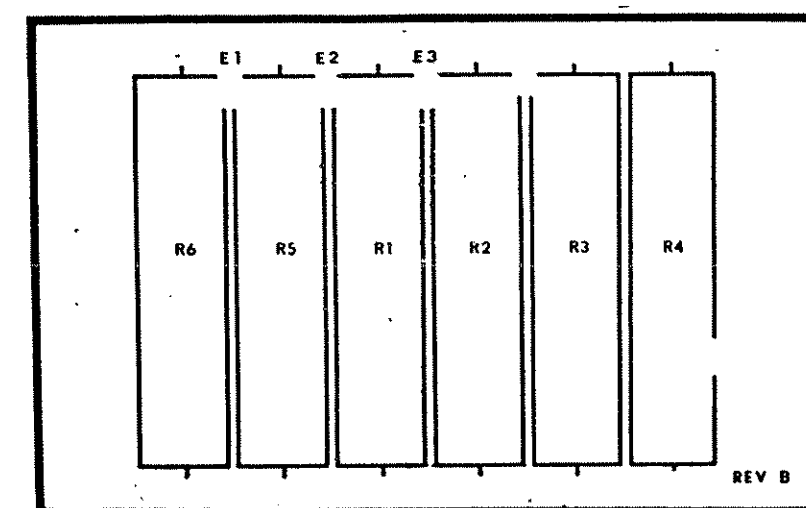
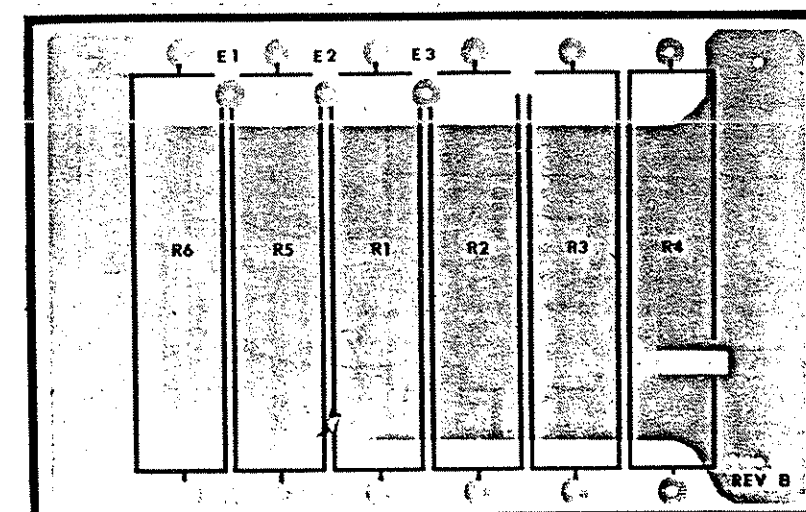
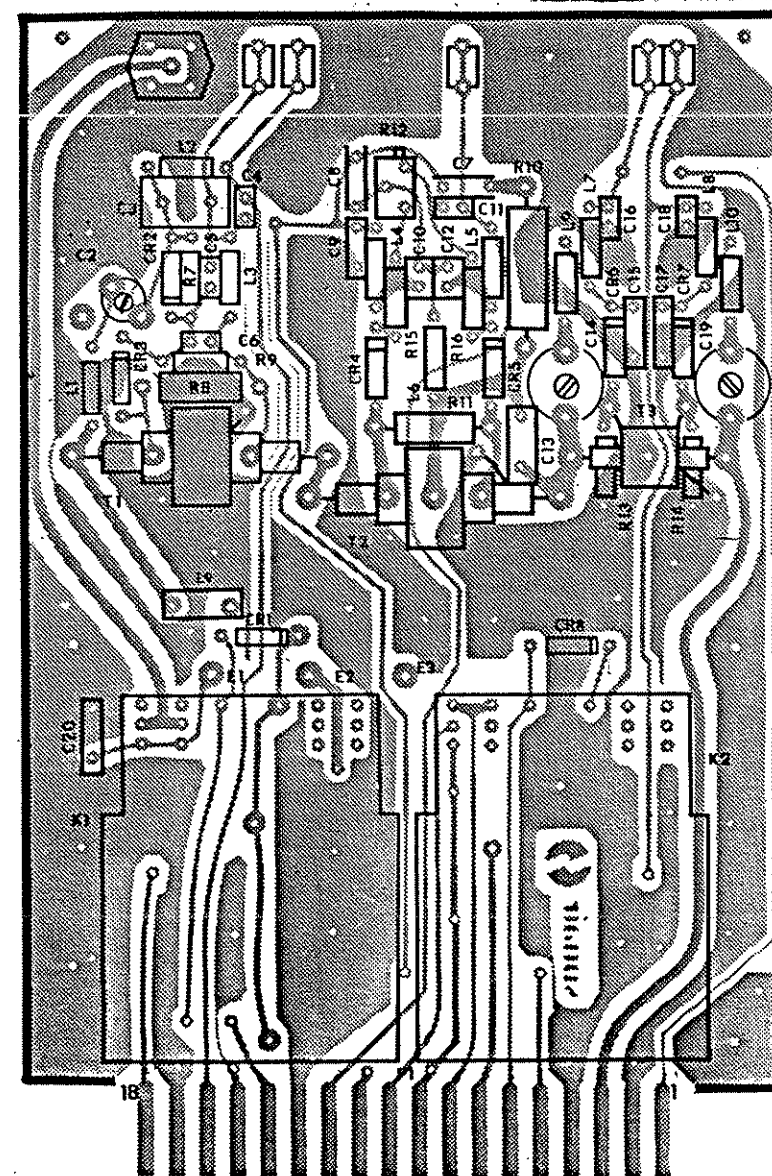
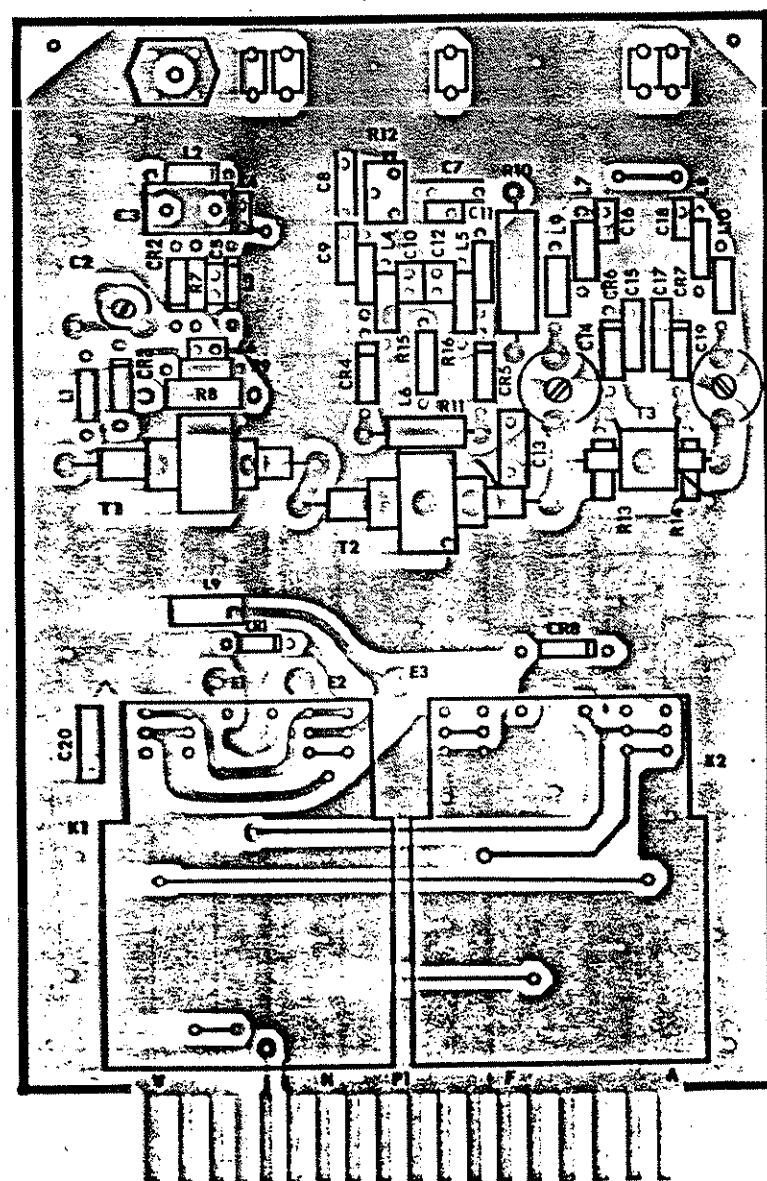
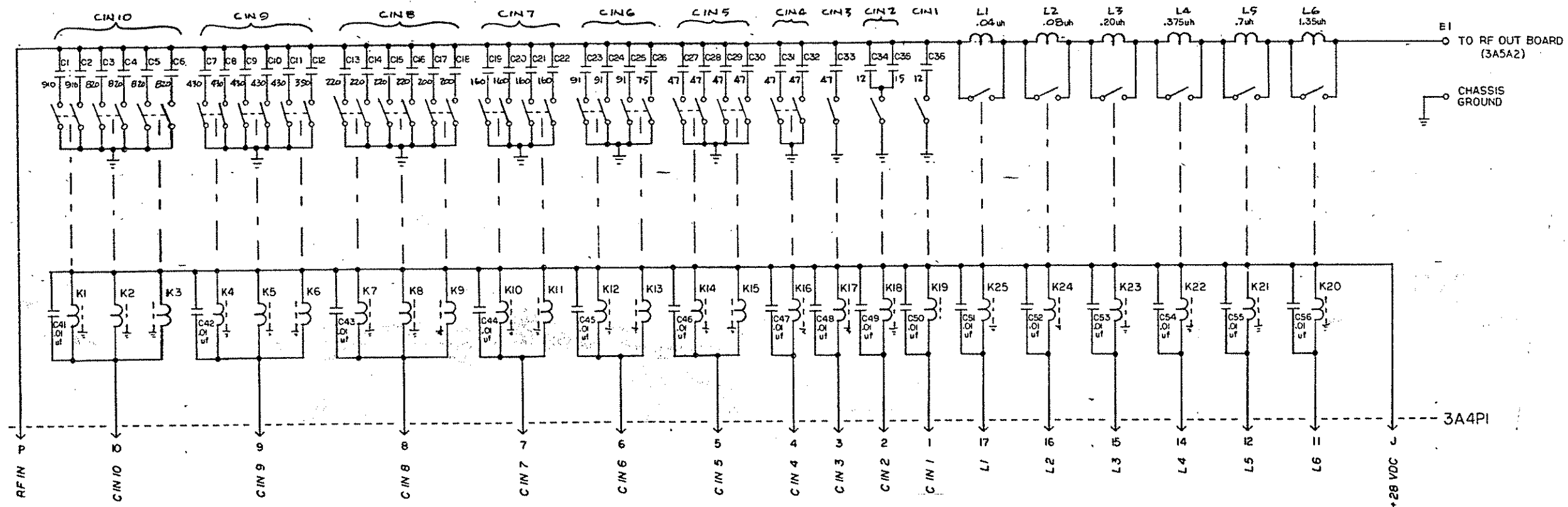


FIGURE 5.7 3A4 RF DETECTOR/PAD ASSEMBLY





NOTE: UNLESS OTHERWISE SPECIFIED
(1) ALL CAPACITORS ARE IN PF

FIGURE 5.8 3A5A1 RF INPUT BOARD

