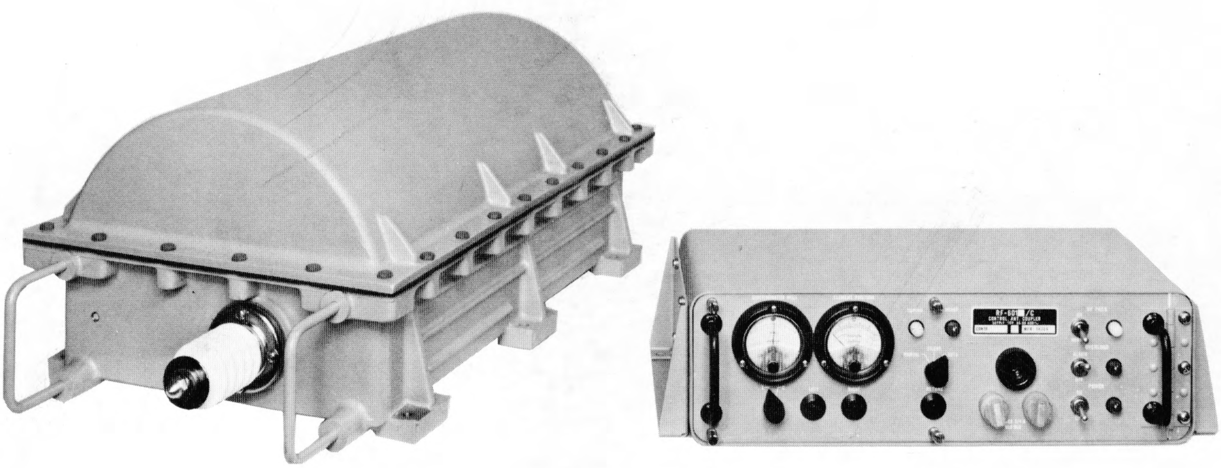
INSTRUCTION MANUAL 0902-0009E

Publication: July 1977

RF-601A

ANTENNA COUPLER GROUP



HARRIS

RF COMMUNICATIONS DIVISION

WARRANTY

R F Communications, Inc. warrants the equipment purchased hereunder to be free from defect in material and workmanship under normal use and service, when used for the purpose for which the same is designed, for a period of one year from the date of delivery, provided that notice of such defect is given to R F Communications within sixty (60) days after the discovery thereof and provided that inspection by R F Communications indicates the parts are defective to R F Communications' reasonable satisfaction. R F Communications' obligations under this warranty are limited to the repair or replacement of defective parts and the return of such repaired or replaced parts to the purchaser F.O.B. factory. At R F Communications' option, any defective part shall be returned to R F Communications' factory for inspection, properly packed and all expenses prepaid. No parts shall be returned unless the purchaser first obtains a return authorization number, which will be furnished on request. Electron tubes are warranted in accordance with the manufacturer's standard tube warranty policy, which will be furnished on request. Equipment furnished by R F Communications, but manufactured by another, bears only the warranty given by such other manufacturer, which will be furnished on request. No warranties other than those set forth in this section are given or are to be implied with respect to the equipment furnished hereunder and R F Communications shall in no event be liable for consequential damages, or for loss, damage, or expense directly or indirectly arising from the use of the products, or any inability to use them either separately or in combination with other equipment or materials, or from any other cause.

CORRESPONDENCE AND PARTS ORDERING

Whenever writing about this unit or ordering parts, always refer to the model and serial numbers and the approximate date of purchase. Special parts should be ordered by the R F part number and the schematic designation number. Standard parts can be obtained from your local parts distributor.

RETURN OF EQUIPMENT

No equipment or part thereof shall be returned to R F Communications unless the purchaser first obtains a return merchandise authorization number from R F Communications. This number is to be marked on the shipping container.

ACCESSORIES

From time to time, new accessories are added to our product line. Often, these are a result of particular customer needs. Our sales department will be happy to discuss your requirements and suggest possible solutions.

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RF-601A

ANTENNA COUPLER GROUP

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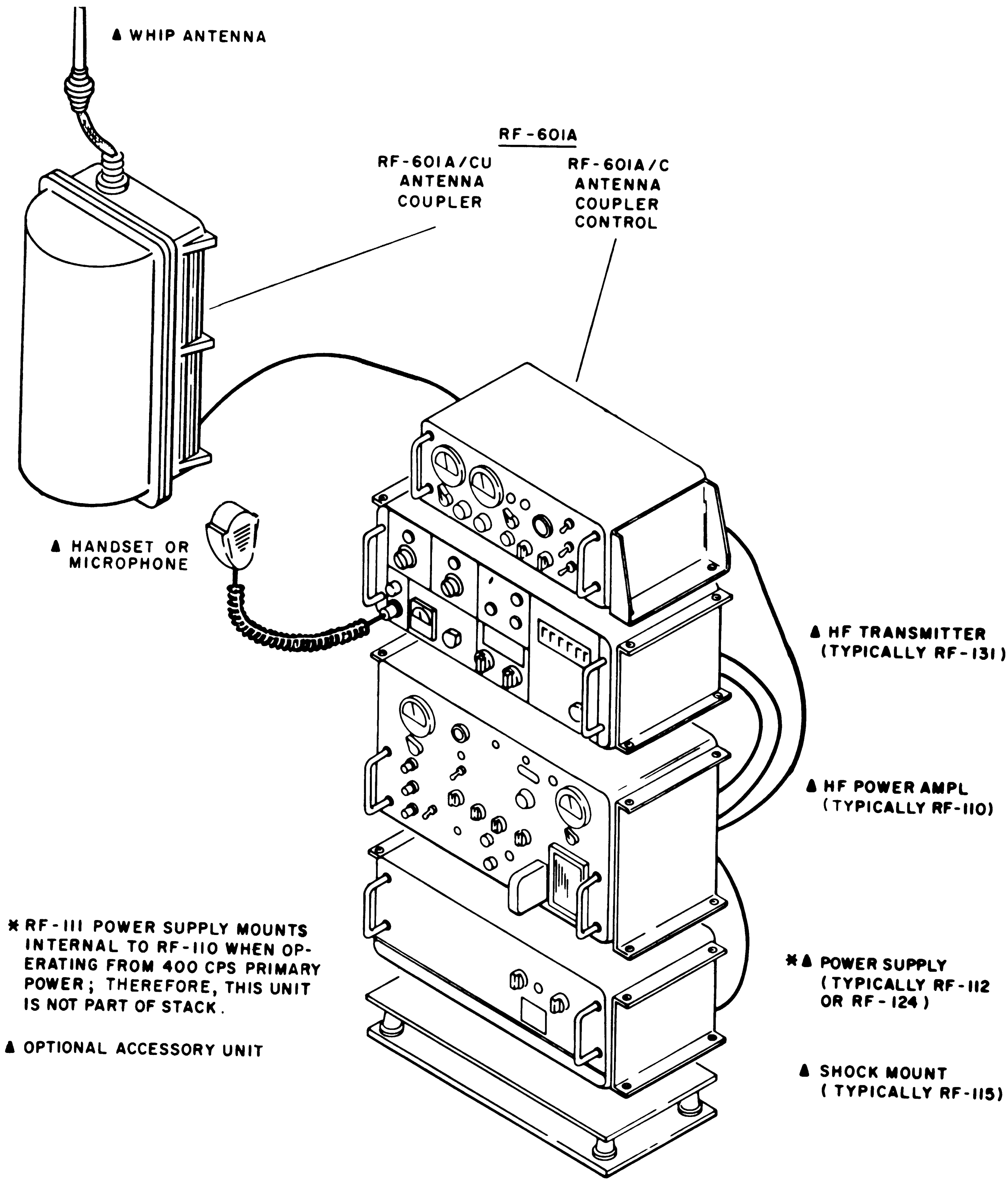


Figure 1.1. Typical Relationships of Units

SECTION 1
GENERAL INFORMATION

1.1 SCOPE.

This Technical Manual describes and contains the necessary information to install, operate, repair and maintain the RF-601A Antenna Coupler Group. Hereinafter, the RF-601A Antenna Coupler Group will be referred to as the RF-601A.

NOTE

> References in this manual are made with respect to a primary power source of 115 VAC. Some units are supplied with a 115/230 VAC primary power transformer part no. 0902-6135. See figure 5-18, 1 of 4, for 230 VAC strapping. When used with the RF-130 and AN/URT-23 transmitting systems, the RF-601A derives its power from the transmitter, which is normally 115 VAC regardless of primary power. The RF-601A should, therefore, be strapped for 115 VAC.

1.2 DESCRIPTION.

1.2.1 GENERAL.

The RF-601A (figure 1.1) is an automatic antenna tuning system intended primarily for surface ship and shore use with Radio Transmitting Sets RF-121, RF-130, RF-730, and RF-735. However, the equipment design includes provisions for manual and semi-automatic tuning, thus making the system readily adaptable for use with other radio transmitters with up to 1 KW power output. In addition, the manual tuning capability is useful when a failure occurs in the automatic tuning circuitry. Also, tuning can be accomplished without the use of RF power (silent tuning). This method is useful in installations where radio silence must be maintained except for brief transmission periods. The RF-601A consists of an antenna coupler (normally mounted at the base of the antenna) and an antenna coupler control unit (normally mounted with the associated radio transmitter).

1.2.2 RF-601A/CU ANTENNA COUPLER.

The function of the RF-601A/CU (figures 5.3 and 5.4) is to match the impedance of a 15, 25, 28, or 35 foot (4.57, 7.62, 8.53, or 10.67 m) whip antenna to a 50-ohm transmission line, at any frequency in the 2.0 to 30.0 MHz range. When operating in a compatible radio transmitting system, control signals from the associated antenna coupler control unit automatically tune the RF-601A/CU matching network in less than five seconds. During manual and silent operation, tuning is accomplished by the operator with the controls mounted on the antenna coupler control unit. A low power (not to exceed 200 watts) CW signal is required for tuning. Once tuned, the RF-601A/CU is capable of handling 1 KW of PEP and average power.

The RF-601A/CU is enclosed in an aluminum, air-tight, pressurized case that is approximately 29.5 inches long, 15 inches wide, and 10.5 inches high (75.5 x 38.5 x 27.0 cm). Access is gained to the chassis by removing the dome-shaped cover from the case. Fins on the bottom of the case carry heat from the unit. Six mounting feet enable the unit to be attached to the mast of a ship at the base of a whip antenna. The RF-601A/CU is pressurized to 6 PSIG (0.42 kg/cm^2) with dry nitrogen to aid internal heat transfer and prevent corona and arcing. All components of the RF-601A/CU are secured to a chassis which is mounted to the case so that an air duct exists between the chassis plate and the case. An internal fan circulates the nitrogen over and through the heat producing elements and then through the air duct. While passing through the air duct, the nitrogen loses its heat to the bottom of the case. This heat is then transferred to the ambient by convection through the fins on the case and by conduction through the mounting feet.

1.2.3 RF-601A/C ANTENNA COUPLER CONTROL.

The function of the RF-601A/C (figure 5.9) is to provide the power and control signals required to tune the RF-601A/CU. The control signals are either automatically produced by the RF-601A/C when a tune cycle is initiated, or manually produced with the front panel controls. All DC operating voltages are produced from a 115 volt, 48 to 63 or 350 to 450 Hz, single phase primary power source. Metering and protection circuits are provided to enable complete control of the RF-601A/CU from the remotely positioned RF-601A/C.

The circuits of the RF-601A/C are all mounted on a chassis and panel assembly housed in an aluminum case approximately 5 inches high, 19 inches wide, and 8.5 inches deep (12.7 x 48.3 x 21.6 cm). The chassis and panel assembly is attached to the case with a hinge, and secured by four front panel captive screws. Connections between chassis and connectors on the rear of the case are made through a flexible harness assembly and filter box.

1.3 REFERENCE DATA.

The following data are the electrical characteristics of the RF-601A.

a. Frequency range: 2.0 to 30.0 MHz.

b. RF signal capability: LSB, ISB, USB, CW, FSK and Compatible AM.

c. RF power capability: 1000 watts average and PEP.

d. Primary power requirements: 115 volts, 48 to 63 or 350 to 450 Hz, single phase. Units with 2A1T1 (part no. 0902-6235) may use a 230 VAC, 48 to 63 or 350 to 450 Hz, single phase primary power source.

e. VSWR: 1.5:1 maximum when tuned.

f. Antenna types: 15, 25, 28, or 35 foot whip (4.57, 7.62, 8.53, or 10.67 m); 35 foot (10.67 m) preferred.

g. Tuning time: Less than 5 seconds in automatic operation.

h. Modes of operation: Manual, Silent, Automatic.

i. Temperature limitations: -28 to +65 °C for RF-601A/CU; 0 to +50°C for RF-601A/C.

j. Power consumption: 80 watts maximum (continuous); 130 watts maximum (intermittent for less than 5 seconds).

k. Input impedance: 50 ohms unbalanced when tuned.

l. Transistor – Diode complement:

Diode	Qty
RF-601A/CU	
0902-1957	2 matched pairs*
1N3611	13
RF-601A/C	
1N277	37
1N753A	6
1N758A	2
1N3611	29
1N914	16
1N967B	2
TOTAL	111

*RF Communications part number for matched pairs of HP5082-2800 diodes. Eariler models used matched pairs of 1N914 or 1N4148.

Transistor	Qty
RF-601A/C	
2N2905	2
D19-0001-001	1*
2N297A	8
2N1132	4
2N1309	4
2N1613	31
2N2219	2
2N2102	2**
TOTAL	54

*RF Communications part number; G.E. type 2N2647. 347.
**Used in place of 2N1613 transistors supplied in the motor brake circuits of early units (2A1A3Q7, Q8, figure 5-18).

1.4 PREPARATION FOR RESHIPMENT.

Each item of the RF-601A is carefully packed to prevent damage during shipment. The units should be repacked carefully if the units are to be reshipped at a later date. If possible use the original shipping containers. Always de-pressurize the RF-601A/CU before repacking.

1.5 EQUIPMENT SIMILARITIES

The RF-601A is a commercial version of the military nomenclatured Antenna Coupler Group AN/URA-38A. The RF-601A/CU is equivalent to the CU-938A/URA-38 and the RF-601A/C is equivalent to the C-3698A/URA-38. The RF-601A is also similar to the earlier AN/URA-38 military version and is interchangeable with both the AN/URA-38 and AN/URA-38A.

1.6 ACCESSORIES

A complete line of Radio Transmitting Sets, Antennas, and Spare Part Kits are available for use with the RF-601A. Contact your RF Communications, Inc. Sales Representative.

Table 1.1. RF-601A Antenna Coupler Group Equipment Supplied

Qty Per Equip	Name	*Over-All Dimensions inches (Centimeters)			*Volume	*Weight
		Height	Width	Length	FT3 (m3)	Lbs (kgs)
1	RF-601A/CU Antenna Coupler	10.62 (27.0)	15.12 (38.4)	29.69 (75.4)	2.37 (0.067)	75.0 (34.1)
1	RF-601A/C Antenna Coupler Control	5.23 (13.3)	19.36 (49.2)	8.69 (22.1)	0.51 (0.014)	23.0 (10.4)
1	Interconnecting Cable W1					
1	Kit, Mating Connectors consisting of: one 10-109628-21P one 10-109628-21S one UG-982/U**					
2	Support Clamp, 10-36233-243					
1	Technical Manual, 0902-0009					

*Includes mounting materials.
**Later Units supplied with one UG-21D/U. Alternate is UG-982/U.

Table 1.2. RF-601A Antenna Coupler Group Typical Equipment And Cables Required But Not Supplied

Qty Per Equip	Name	Required Use	Electrical/ Equipment Characteristics
1	Antenna (15, 25, or 35 foot whip)	Reception and radiation of RF signals.	
1	Cable Set	Interconnection	Fabricate according to paragraph 2.5
1	Pressurization Kit*	To pressurize RF-601A/CU	Dry Nitrogen (15 PSIG max.)
1	Ground strap	Interconnection	
1	Electrical Dummy Load, Bird model 8894 or equivalent	Troubleshooting and maintenance procedures.	Frequency range: 2 to 30 MHz Input impedance: 50 ohms Power input: 0 to 1000 watts
1	Multimeter, Simpson model 260 or equivalent	Troubleshooting and maintenance procedures.	Voltage range: DC: 0 to 28 AC: 0 to 120 Accuracy: 5%
1	DC Differential Voltmeter, Fluke model 871A or equivalent	Troubleshooting and maintenance procedures.	Voltage range: 10MV to 10 volts
1	Wattmeter, Bird model 43 or equivalent	Troubleshooting and maintenance procedures.	Power range: 0 to 1KW Frequency range: 2 to 30 MHz
1	Set of Rack Mounting Brackets	Installation procedures.	Fabricate according to paragraph 2.4.3.
1	Set of Printed Circuit Board Extenders	Troubleshooting and maintenance procedures.	Fabricate according to paragraph 5.4.
1	Quick Release Plunger Adjustment Tool.	Maintenance procedures.	Fabricate according to paragraph 5.6.
1	Quick Release Plunger Adjustment Jig.	Maintenance procedures.	Fabricate according to figure 5.2.
1	Set of Torque wrenches, 0-100 in-lbs (0-11.525 kg-m)	Assembly procedures	
1	Standard Tool Set	Troubleshooting and maintenance procedures.	

*If pressurizing equipment is not available at operating site, RF Communications Dry Nitrogen Pressurization Kit (RF-628) is recommended. Also, the RF-636 Dry Air Pump is available as an accessory.

SECTION 2
INSTALLATION

2.1 UNPACKING AND HANDLING.

Special procedures need not be followed when unpacking the units of the RF-601A. Since the system is made up of accurately calibrated precision units, rough handling should be avoided. Caution should be taken when removing the units from the packing cartons to prevent damage to the controls, indicators, connectors, and valves.

2.2 POWER REQUIREMENTS.

The RF-601A is designed to operate from a nominal 48 to 63 or 350 to 450 Hz, 115 volt, single phase primary power source. When operating with the RF-121, RF-130, RF-730, or RF-735, the primary power is supplied through the normal equipment interconnections. When operating with radio transmitters other than those mentioned above, primary power must be patched into the cable which normally connects between the RF-110 HF Power Amplifier and the RF-601A/C, or applied directly to connector 2A2A1J1 on the RF-601A/C. Refer to figure 5.16 for a primary power distribution diagram of the RF-601A. Units with 2A1T1 (part number 0902-6135) may use a 230 VAC, 48 to 63 or 350 to 450 Hz, single phase primary power source.

NOTE

> References in this manual are made with respect to a primary power source of 115 VAC. Some units are supplied with a 115/230 VAC primary power transformer part number 0902-6135. See figure 5-18, 1 of 4, for 230 VAC strapping. When used with the RF-130 and AN/URT-23 transmitting systems, the RF-601A derives its power from the transmitter, which is normally 115 VAC regardless of primary power. The RF-601A should therefore, be strapped for 115 VAC.

2.3 SITE SELECTION.

In selecting a shipboard installation site, adequate consideration must be given to space requirements (figure 2.1). When the RF-601A/C is installed with the above mentioned transmitters, the space requirements for the system will satisfy the needs of the RF-601A/C. When the RF-601A/C is hard-mounted adjacent to the associated radio transmitter, space should be provided to allow the hinged front panel to be opened for servicing and for cable bends and cable removal at the rear of the unit. The antenna should be mounted as high above the ship's superstructure as possible. The RF-601A/CU must be mounted as close to the antenna base as possible to allow interconnection with a heavy copper conductor not to exceed 18 inches (45.7 cm); 12 inches (30.5 cm) or less is desired. Mount the RF-601A/CU in a vertical position with its antenna insulator upward. The interconnecting cable between the RF-601A/CU and RF-601A/C should not exceed 500 feet (152.4 m).

In selecting a shore installation site, similar considerations must be given to space requirements and cable lengths. The antenna should be mounted high enough to clear and surrounding hills, woods, or buildings. In addition, the antenna should be located as far as possible from any high power transmission lines, to prevent interference.

NOTE

> When the RF-601A Antenna Coupler is installed in a sea spray or water corrosion environment, apply Dow Corning DC-5 compound to the coupler insulator with a hot water and dry with a lintfree cloth before applying the DC-5. Apply a 1/8 inch thick coating of DC-5 over the insulator and ground connections.
>
> The coated insulators may leak RF current to ground when wetted by sea spray, squalls, or rainy weather, but the leakage will stop when the water path is broken. If the insulators are not coated, they will degrade slowly, from moist salt accumulation, to the point of arcing and/or shorting.

2.4 INSTALLATION REQUIREMENTS.

2.4.1 CONSIDERATIONS.

The following considerations should be made when determining the proper location of the RF-601A.

NOTE

> See figure 5-18 (1 of 4) for 2A1T1 (part no. 0902-6135) strapping requirements.

a. Best operating conditions.

b. Ease of maintenance, adjustment of equipment, and replacement and repair of defective parts or complete units.

c. Possibility of interaction between the units and other electronic equipment in the vicinity. Mount Coupler and antenna at least 40 feet away from other transmitting antennas.

d. Critical cable length requirements.

e. Availability of adequate ground.

2.4.2 RF-601A/CU ANTENNA COUPLER.

CAUTION

> Under certain conditions, the voltages on the RF-601A/CU antenna terminal may be as high as 15 KV. Extreme caution must be taken to isolate this "hot" terminal at least six inches

CAUTION (Cont)

from any nearby objects such as cables, guy wires, brackets or ground leads.

The exact method of mounting the RF-601A/CU depends on the type of installation. If possible, the RF-601A/CU should be mounted vertically (antenna insulator upward) to an aluminum base to provide maximum cooling efficiency. After determining the best location of the RF-601A/CU, proceed as follows:

a. Fabricate a mounting surface (aluminum alloy preferred) for the RF-601A/CU. (The exact size and shape of the surface will depend on the structure on which the RF-601A/CU is to be mounted.)

b. Set the mounting surface on a bench.

c. Place the RF-601A/CU on the selected mounting surface and mark off the mounting holes (eleven required, two for each of the six mounting feet, except the tapped hole used to connect ground strap in right front foot as viewed from antenna terminal).

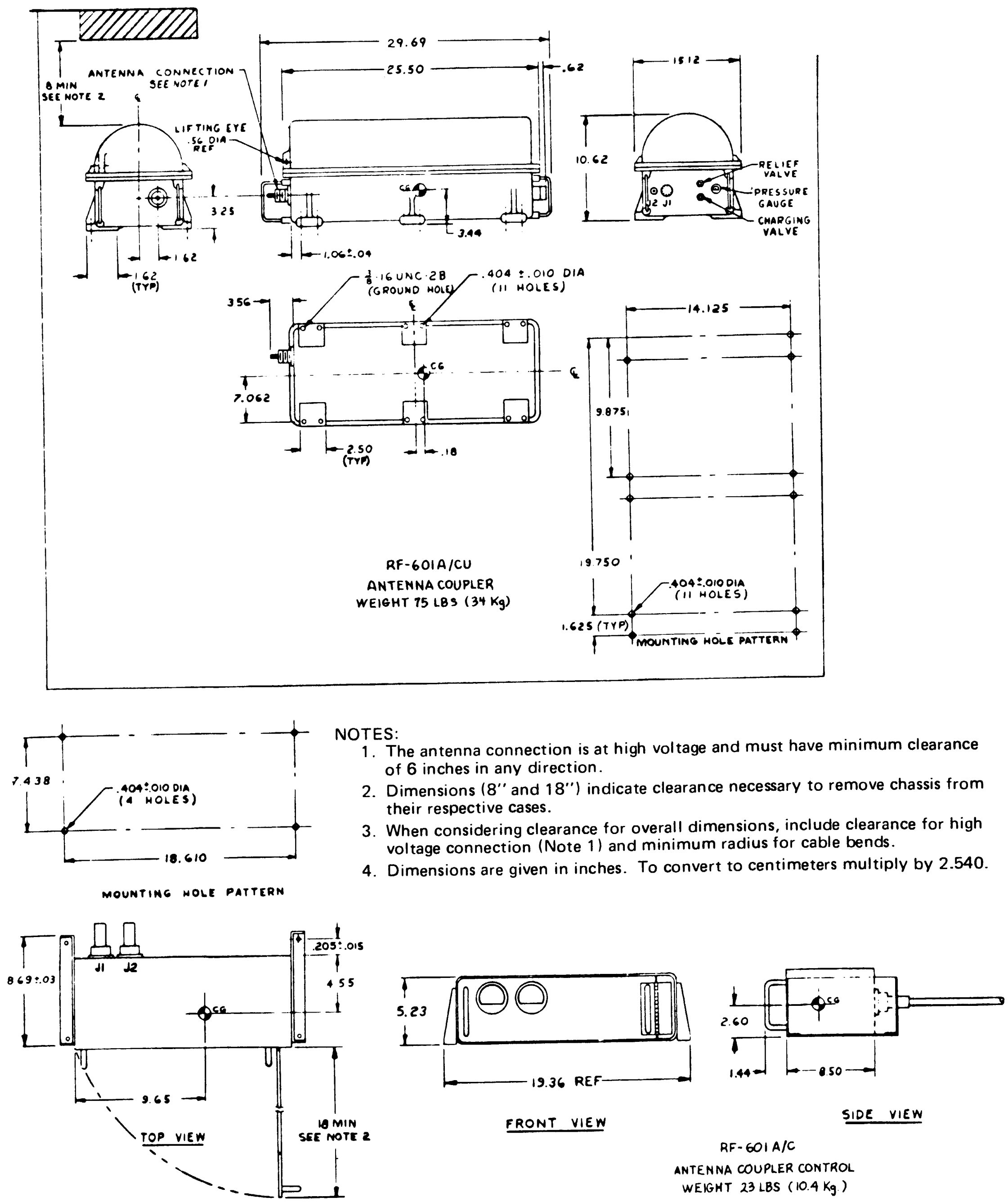


Figure 2-1. RF-601A Antenna Coupler Group Outline Drawing

d. Drill the eleven 0.404 inch (1.03 cm) diameter holes in the mounting surface.

e. Drill or prepare mounting surface as required and attach to supporting structure.

WARNING

To avoid injury to personnel and equipment, do not over-stress mounting bolts since shock may cause them to shear. Tighten 3/8-16 bolts to 20 ft-lb (2.77 kg-m) maximum.

f. Pressurize the RF-601A/CU using the procedure in paragraph 2.9.

g. Attach the RF-601A/CU to the mounting surface using eleven 3/8-16 bolts (furnished by the installing activity).

h. Refer to paragraph 2.6 for interconnection information.

2.4.3 RF-601A/C ANTENNA COUPLER CONTROL.

The RF-601A/C may be stack-mounted with suitable transmitters, mounted in a standard 19 inch electrical equipment cabinet, or hard-mounted adjacent to the associated transmitter. To install the RF-601A/C, proceed as follows:

a. To stack mount the RF-601A/C, refer to the Technical Manual for the RF-121 or RF-130.

b. To hard mount the RF-601A/C, procees as follows:

(1) Drill or prepare mounting surface as required.

(2) Place RF-601A/C on mounting surface.

(3) Mark off the mounting holes (the two 0.404 inch (1.03 cm) holes in each bracket).

(4) Drill the four marked-off holes.

(5) Attach the RF-601A/C to the mounting surface with four 3/8-16 bolts (furnished by the installing activity).

c. To rack mount the RF-601A/C in a 19 inch standard electrical equipment cabinet, proceed as follows:

(1) Fabricate the required rack mounting brackets using the information provided in figure 2.2.

(2) Remove the stack mounting brackets from the RF-601A/C and return them to stock.

(3) Attach the rack mounting brackets to the sides of the RF-601A/C using the hardware removed from the stack mounting brackets.

(4) Slide the RF-601A/C into the rack and attach using the required hardware (supplied by the installing activity).

d. Refer to paragraph 2.6 for interconnection information.

2.5 CABLE ASSEMBLIES

Variations among installations will determine the length of cables connected to the RF-601A. Since the RF-601A will often be operated with the RF-121 or RF-130, cable W1 which interconnects the RF-601A/C and the RF-110 HF Power Amplifier is supplied as a part of the RF-601A. The mating connectors required to fabricate the remaining two cables are also supplied. Tables 2.1 through 2.3 list connector terminations and cable type information.

CAUTION

All cables must be shielded to prevent RFI.

2.5.1 RF-601A CONTROL CABLE WATERPROOFING

The coupler end of the RF-601A control cable is to be waterproofed as follows:

a. Unplug cable connector that attaches to J1 on the RF-601A and disassemble connector as shown in figure 2.6.

b. Starting at point A on the cable, wrap plastic electrical tape along cable to point B (3-1/2 inches); then continue, without breaking the tape, to wrap a second layer back to point A and then a third layer back to point B.

c. Reassemble connector, sealing any holes or gaps with RTV type silicone rubber compound.

d. Plug connector to antenna coupler, jack J1.

e. After connectors have been plugged into jacks J1 and J2, wrap both connectors with several layers of plastic electrical tape, coming as close to the coupler case as possible.

2.5.2 INTERLOCK INFORMATION.

When operating the RF-601A with a transmitter other than the RF-121, RF-130, RF-730, or RF-735, an interlock network should be included between the keyer (handset, CW key, front panel switch, etc.) and the transmitter. This circuit enables the key interlock function to be used, preventing transmitter operation when an overload occurs, when the bypass relays have not had time to switch, or while coupler tuning elements are traveling to their "home" position at the start of a tune cycle. Figure 2.3 provides a suggested method for a keyline interlock circuit. Adapt and select components as necessary to fit the specific transmitter.

2.6 INTERCONNECTIONS.

Interconnect the RF-601A with the associated transmitter and antenna as shown in figure 2.4 and use copper ground straps to connect the equipment cases to the nearest ground plane.

CAUTION

Ensure good metal-to-metal bonding between units, and between the units and ground plane.

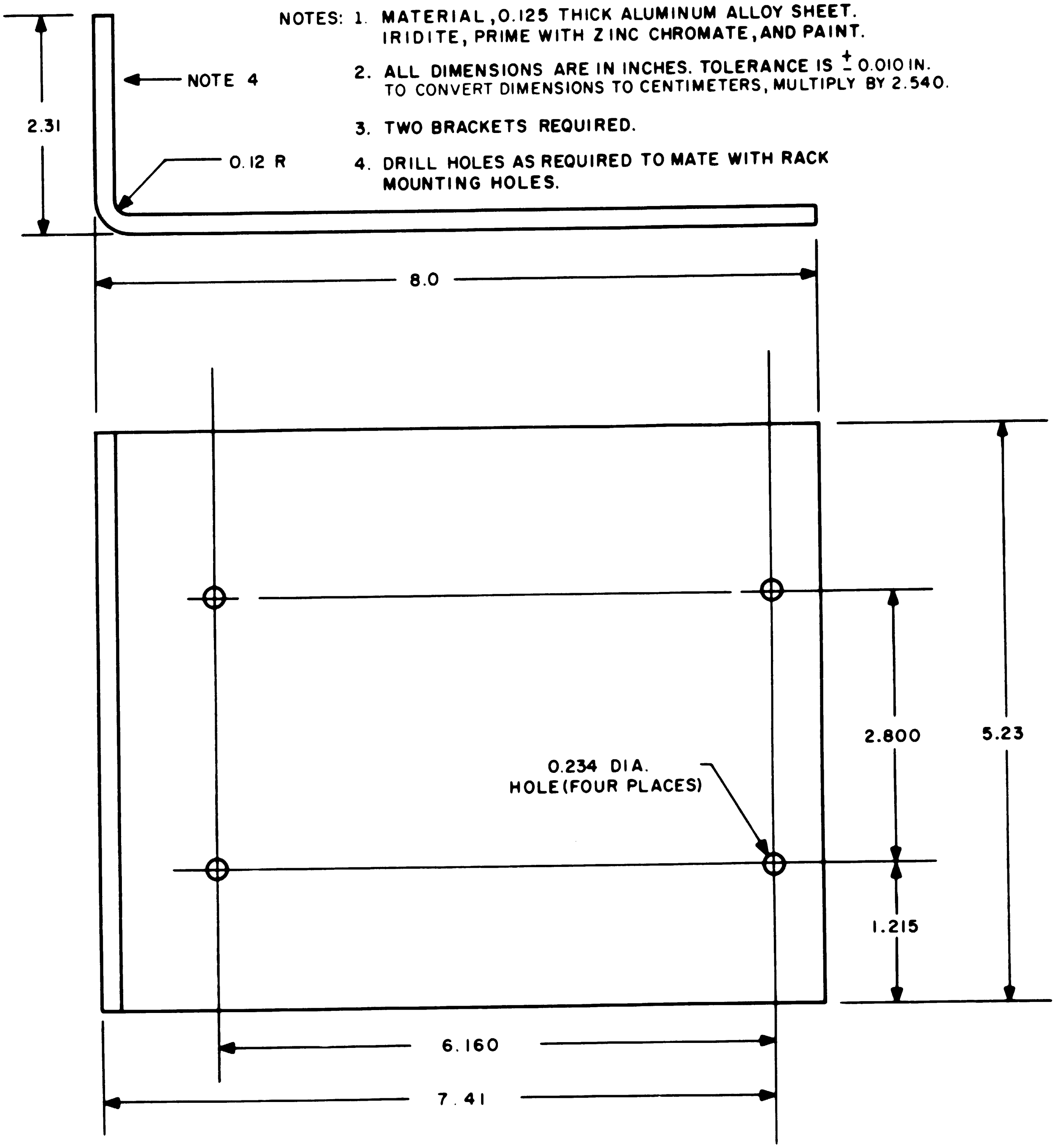


Figure 2.2. Rack Mounting Bracket, Fabrication Diagram

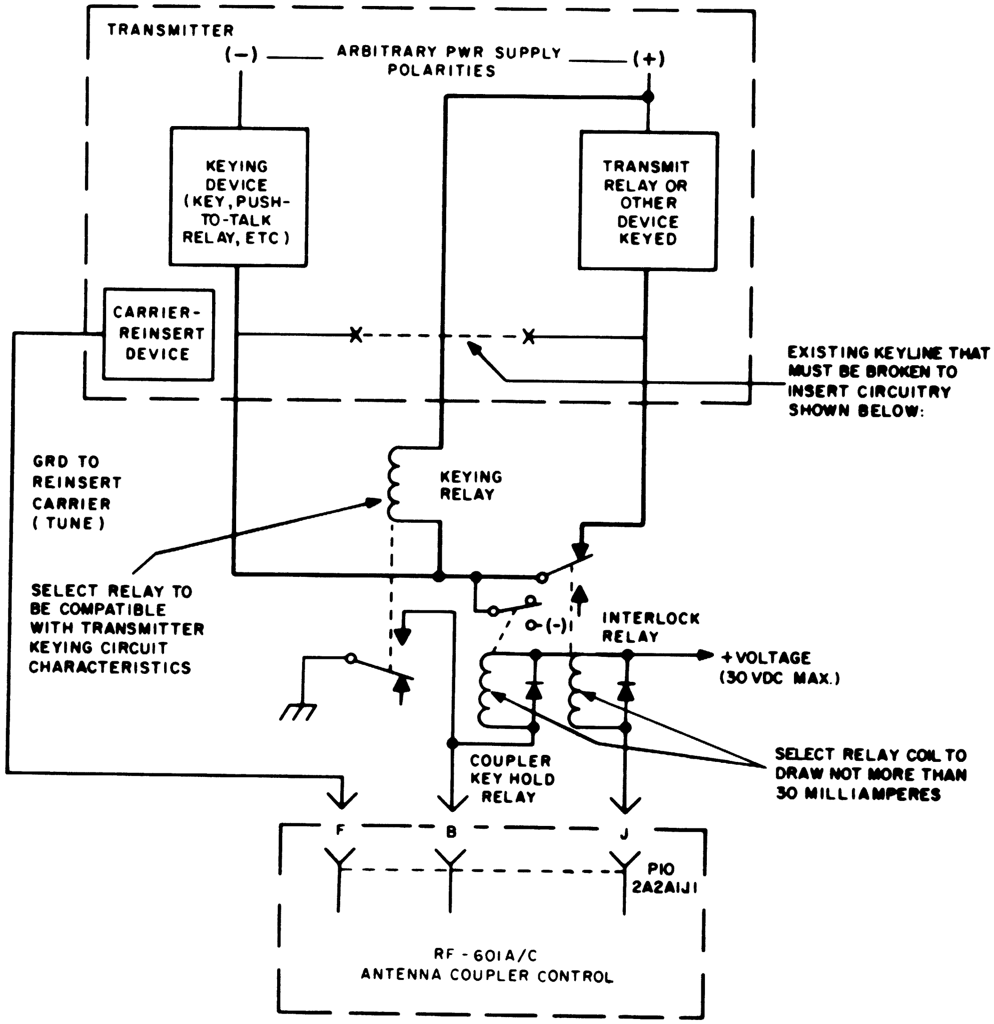


Figure 2.3. Interlock Information Diagram

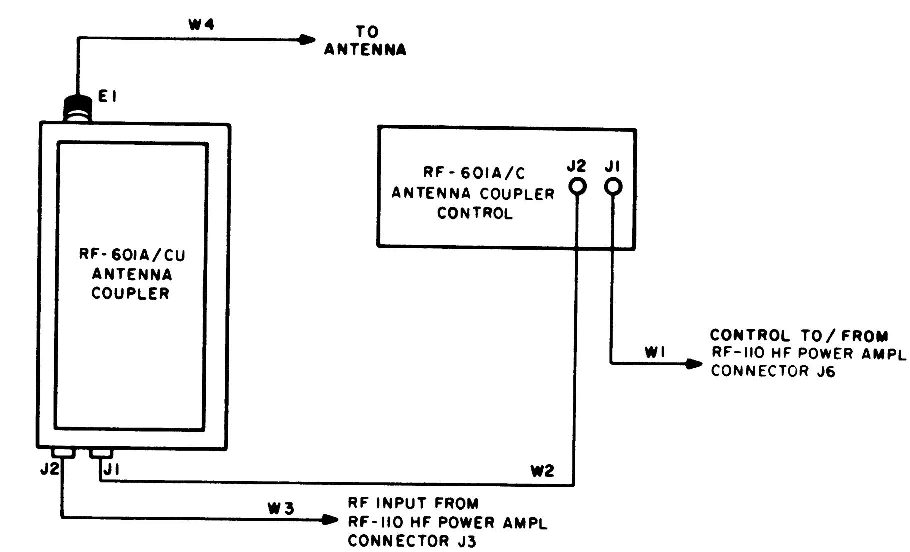


Figure 2.4. RF-601A Antenna Coupler Group, Interconnection Diagram

2.7 INSPECTION AND ADJUSTMENT

2.7.1 INSPECTION.

Carefully inspect the RF-601A for damage to indicators and switches and for loose hardware and knobs. Ensure that the RF-601A/CU has been pressurized (paragraph 2.9) by noting the indication on the pressure gauge. Loosen the four front panel screws on the RF-601A/C front panel, and open the hinged front panel. Check the connections on terminals 1, 2, and 3 of terminal board TB1. If 60 Hz primary power is being used, terminals 1 and 2 should be jumpered. If 400 Hz primary power is being used, terminals 2 and 3 should be jumpered. Close and secure RF-601A/C front panel. Check connectors for dirt, damage to pins, and broken insulators. Replace or repair as necessary.

2.7.2 ADJUSTMENT.

After installation and inspection, check the equipment by performing the operating procedures in Section 3. Should any adjustments be found necessary, refer to the applicable procedures in Section 5 of this manual. Before beginning the checkout procedures, ensure that all fuses are in place and of the correct value and that all cables are properly connected.

2.7.3 PERFORMANCE CHECKS.

To ensure correct installation, perform the procedures in Section 3 for all modes of operation prior to releasing the equipment to operating personnel. For all frequencies used, log the ELEMENT POSITION meter indications for both settings of the L-C switch in "Logged Element Position" table inside rear cover.

2.8 INTERFERENCE REDUCTION.

As a precaution against interference, ensure that all units are properly grounded. Operate only with the units bolted securely in their cases.

2.9 PRESSURIZATION.

NOTE

Should it become necessary to remove the RF-601A/CU cover, depress or remove the core in the charging valve 1A1MP4 (figure 5.3) to reduce internal pressure to zero. After cover is replaced, pressurize the unit as follows.

The RF-601A/CU must be pressurized with dry nitrogen (best coupler internal atmosphere) at the time of installation and thereafter as required to maintain 4 to 6 pounds/in^2 (0.28 to 0.42 kg/cm^2) as indicated on pressure gauge M1, figure 5.3. An RF-628 Dry Nitrogen Pressurization Kit is available as an optional accessory. For cases where dry nitrogen cannot be located or be obtained quickly, dry air may be used as a substitute (see paragraph 2.9.2). Paragraph 2.9.3 gives special emergency-type instructions for operating without any pressure in the Coupler or with pressure supplied directly from a manual (tire) pump.

2.9.1 PRESSURIZATION WITH NITROGEN.

a. Remove the valve cap from the RF-601A/CU charging valve (figure 5.3). Make sure that the valve core is screwed all the way into the charging valve and is tight.

b. Set the regulator on the dry nitrogen source at 15 pounds/in^2 (1.055 kg/cm^2) and attach the filling hose to the charging valve.

c. Open the nitrogen tank valve to flush the RF-601A/CU (through relief valve MP3) with nitrogen gas at 15 pounds/in^2 (1.055 kg/cm^2) gauge pressure indication.

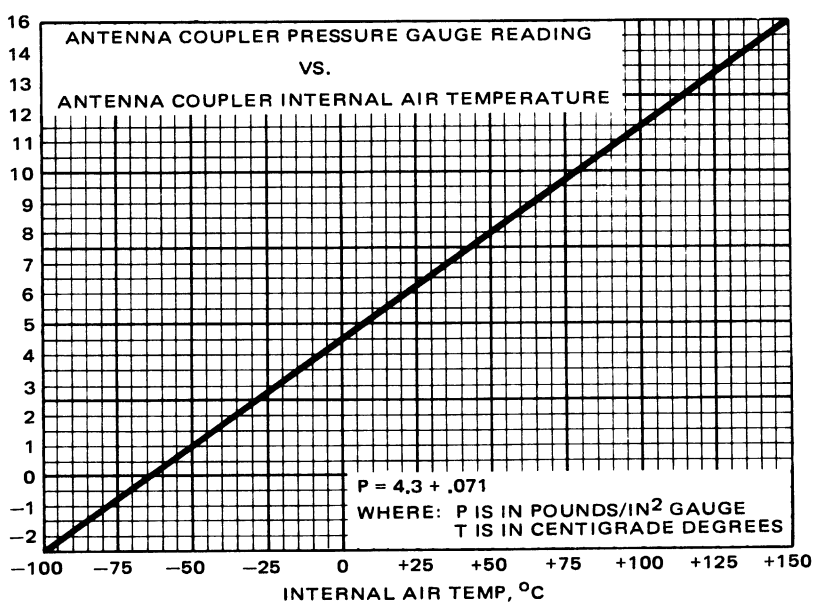


Figure 2.5. Coupler Charging Pressure Vs. Temperature.

d. After about 30 seconds, turn the nitrogen tank valve off, and disconnect the hose from the RF-601A/CU charging valve.

e. Using the valve cap, depress the valve core, and exhaust the RF-601A/CU to 6 pounds/in^2 (0.42 kg/cm^2) gauge pressure indication. Replace the valve cap. (It is assumed that the ambient temperature, the internal temperature of the RF-601A/CU, and the internal temperature of the nitrogen gas tank is approximately 25^{o}C. RF-601A/CU pressure gauge indicator will vary with temperature because of gas expansion/contraction. To find the correct gauge pressure at temperature other than 25^{o}C, refer to the chart on page 2-6 of the manual.)

2.9.2 PRESSURIZATION WITH DRY AIR PUMP RF-636.

An RF-636 Dry Air Pump is available as an optional accessory. The pressure vs. temperature chart, figure 2.5, and all pressure readings given in paragraph 2.9.1 apply to dry air as well as dry nitrogen. For units with serial numbers below 431, Relief Valve MP3 (figure 5.3) is a fixed pressure valve; with pressure set at 10 psig. Temporarily seal the valve with tape. Remove the core of the charging valve MP4 to relieve pressure. For units with serial numbers 431 or greater, Relief Valve MP3 is adjustable and may be set for the desired pressure by rotating the adjusting cap clockwise to increase, or counterclockwise to decrease, the pressure. Loosen the lock nut and turn the adjusting cap completely clockwise.

Attach the RF-636 Dry Air Pump to Charge Valve MP4 and pressurize the Coupler up to 15 psig. Remove the pump hose to relieve the pressure. Repeat two more times. Pressurize the Coupler a fourth time to 10 – 12 psig. Remove the tape from the pressure valve if it is the "fixed" type. The air pressure will reduce to 9 – 11 psig. If it is the adjustable type, slowly turn the adjustment cap counterclockwise until the pressure reduces to 10 psig ± 1 psig and secure with the locking nut.

Use the graph in figure 2.5 to determine the proper pressure for the case at its present ambient temperature, and bleed the Coupler to that pressure by depressing the valve core on the Charge Valve. (At 25^{o}C/77^{o}F, pressure should be 6 psig.) The Relief Valve set at 10 psig will prevent excessive pressure if Coupler temperature should become abnormal.

2.9.3 EMERGENCY PRESSURIZATION; EMERGENCY OPERATION.

Under emergency circumstances which require communications to be maintained, use of the RF-601A/CU may continue even though pressure is lost and no source of dry nitrogen or dry air is readily available. Such operations cannot be continued over any extended period (days) without harm to the equipment.

For temporary use to provide necessary communications, use a manual air pump (tire pump) to pressurize the RF-601A/CU to 6 pounds/in^2. (Do not pressurize over 6 pounds/in^2 and then exhaust the excess pressure as is done with dry nitrogen.) Operate the RF-601A/CU in a normal manner.

For emergency communications where there is no way of pressurizing the RF-601A/CU by any of the preceeding methods, leave the RF-601A/CU unpressurized and proceed to operate in an emergency configuration as given by paragraph 3.3 EMERGENCY OPERATION.

Table 2.1. Cable Types and Terminations

No.	From	Mating Connector	Cable Type	Mating Connector	To	Remarks
W1	RF-110 HF Power Amplifier J6	10-109620-27P	Multiconductor	10-109620-27S	RF-601A/C J1	Supplied as part of RF-601A. See table 2-2 for pin connections.
W2	RF-601A/C J2	10-109628-21P	Multiconductor MSCA-37 type (33 active)	10-109628-21S	RF-601A/CU J1	See table 2-3 for pin connections.
W3	Transmitter	---	RG-8/U Coax RG-219/U Coax (Alternate)	UG-21D/U UG-982/U	RF-601A/CU J2	RF input coaxial cable.
W4	RF-601A/CU E1	---	No. 6 stranded copper buss	---	Antenna termination	Maximum length 18 inches (45.7 cm), 12 inches (30.5 cm) prefeıred.

CAUTION

To minimize interference between cable wires, they must be free of crossovers and must maintain their same relative positions when fanned out and connected to the appropriate pins of mating connector.

Table 2.2. Cable W1 Pin Connections

Wire Size	From Connector Type	To Connector Type	Remarks
18	10-109620-27P	10-109620-27S	GROUND
▲	PIN A	PIN A	GROUND
	B	B	KEYLINE
	▲ C	▲ C	SPARE
	D	D	SPARE
	E	E	GROUND PULSE
	F	F	TUNE POWER
	G	G	SPARE
	H	H	SPARE
	I	I	SPARE
	J	J	KEY INTERLOCK
	K	K	SPARE
▼	▼ L	▼ L	115 VAC HOT
	M	M	115 VAC COMMON
18	PIN N	PIN N	SPARE

Table 2.3. Cable W2 Pin Connections

Wire Size	From Connector Type	To Connector Type	Remarks
	10-109628-21P	10-109628-21S	
18	PIN A	PIN A	Ø DISC OUTPUT
▲	▲ B	▲ B	Ø DISC REFERENCE
	C	C	SPARE
	D	D	R DISC OUTPUT
	E	E	R DISC REFERENCE
	F	F	GROUND
	G	G	L MOTOR ON
	H, J, K, U	H, J, K, U	C MOTOR, HOME (+), TUNE (–)
	L	L	FAR END STOP
	M	M	C POSITION
	N	N	C MOTOR ON
	P, R, S, c	P, R, S, c	C MOTOR, TUNE (+), HOME (–)
	T	T	RESET
	V, W	V, W	L MOTOR, HOME (+), TUNE (–)
	X	X	L MOTOR BRAKE
	Z	Z	L POSITION
	a, b	a, b	L MOTOR, TUNE (+), HOME (–)
	d	d	C MOTOR BRAKE
	e	e	+12.4 VDC
	f	f	OVERLOAD
	g	g	BYPASS
	h	h	+28 VDC
	j	j	ARC DETECTOR
	k	k	FAN (60 Hz)
	m	m	FAN (400 Hz)
	n	n	FAN COMMON
▼	▼ p	▼ p	SPARE
	r	r	SPARE
18	PIN s	PIN s	SPARE

2.10 NEAR FIELD ANTENNA INTERFERENCE.

Under certain conditions, nearby radiating transmitting antenna(s) may induce enough RF energy into the RF-601A to mistune the Coupler during tune-up or retune the Coupler after it is tuned and transmitting.

The Coupler must, therefore, be tuned when the interfering antenna(s) are not radiating. Also, to prevent retuning once the Coupler has been tuned, operate the Coupler Control Mode Selector switch to MANUAL. (Operate Mode Selector to AUTO position for automatic retuning if transmitting frequency is changed.)

Another means of preventing such retuning is to disable the surveillance by rewiring the Coupler Control as follows: Remove Surveillance Disable line (red-violet-white) from pin 3 of BYPASS switch and connect it (after splicing in length of No. 26 PVC or teflon-insulated wire) to pin J2, T of Logic Assembly A4 (Tune Sensitivity Drive output).

To allow switching of the Surveillance Disable line to either pin 3 of the BYPASS switch (Surveillance Enable) or to the Tune Sensitivity Drive output (Surveillance Disable), a SPDT switch may be used, and may be mounted on the Coupler Control's front panel or chassis.

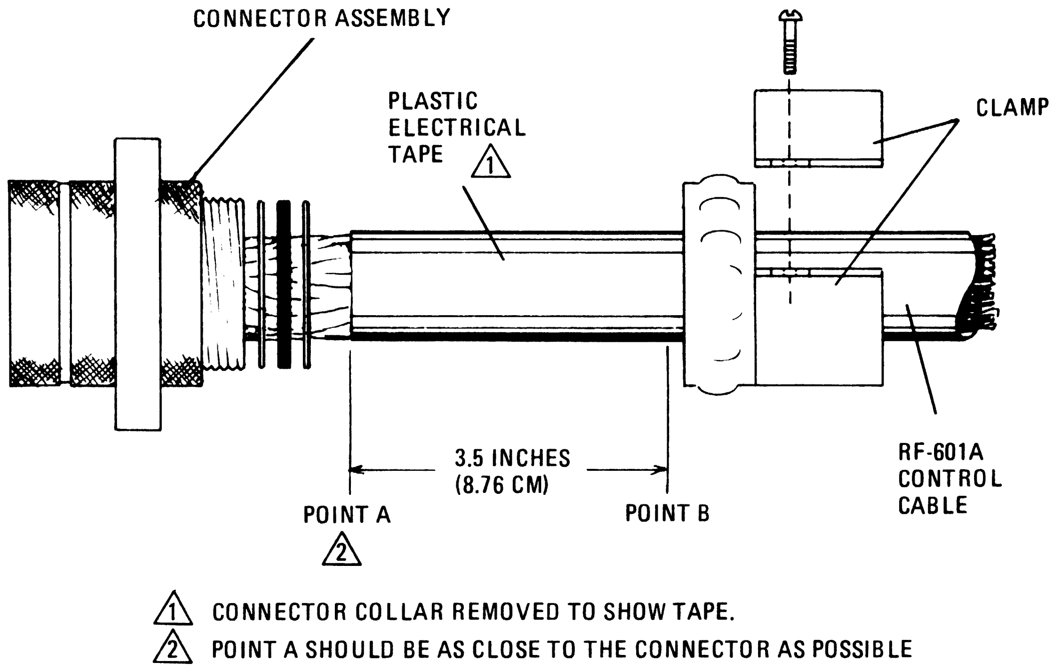


Figure 2.6. Control Cable Waterproofing Diagram.

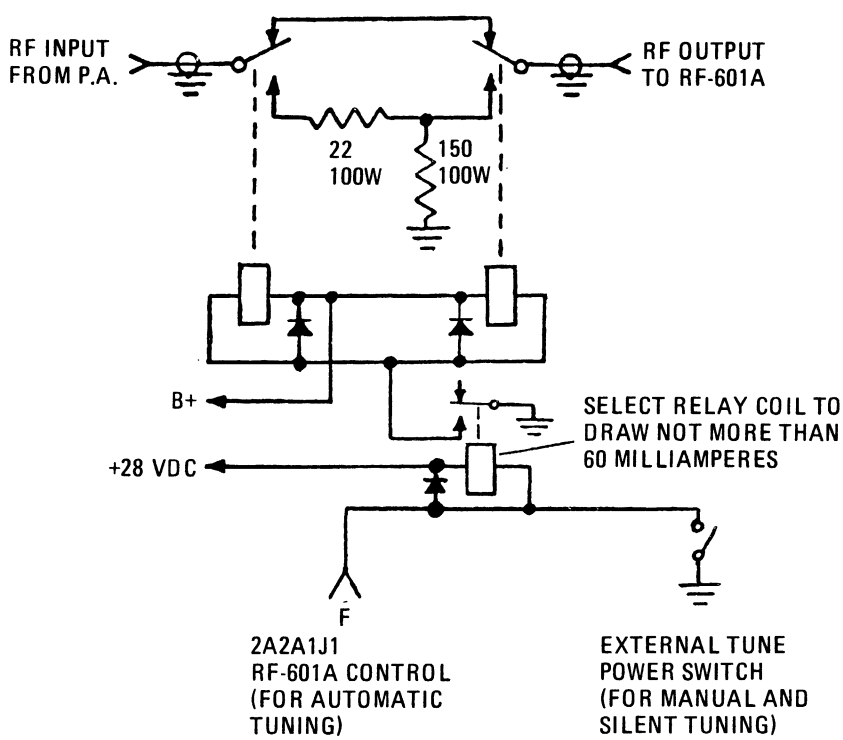


Figure 2.7. 3 dB Pad For Tune Power Interface with RF-601A Antenna Coupler

2.11 OPERATION WITH OTHER POWER AMPLIFIERS.

The RF-601A may be used with transmitters other than the RF-130, RF-121, RF-730, or RF-735. However, when the RF-601A is used with a power amplifier that cannot supply a suitable tune power signal over a wide range of impedance mismatches, a 3 dB pad (figure 2.7) will be used. This pad limits the VSWR to the power amplifier to approximately 3.5:1.

A tune power level of 200 – 400 watts, supplied at the input of the pad by the power amplifier, will provide adequate tune power to the RF-601A.

The pad will be inserted automatically when the coupler tuning elements are in the home position and the coupler is tuning. For pad insertion in the Manual and Silent tuning mode, an external Tune Power switch should be available.

2.12 INTERFACING CONSIDERATIONS

Interfacing an automatic antenna coupler with a power amplifier requires more than just connecting the control wires and a coaxial cable. Consideration must be given to the operation of the power amplifier (whether the power amplifier is manual or automatic) under conditions of load impedances other than 50 + j0 ohms.

The RF-601A has an input impedance, at 2 MHz in the "home" position (untuned), of about 0 – j300 ohms. This is assuming that the load placed on the power amplifier is about j180 ohms with 6 feet (1.8 meters) of RG-8 test cable, nearly a short circuit with 80 feet (24 meters), and approaching infinity with 160 feet (48 meters).

Power amplifiers use many methods of automatic level control to maintain a constant rf power level into 50 ohms resistive (ie, constant grid current, constant grid voltage, constant output forward power, constant output voltage, etc.). Since the RF-601A requires a constant rf tune power level of 50 – 200 watts forward power during its tuning sequence, the use of a forward power level control is ideal. Other (PA) level control schemes may cause the coupler to not initiate a tune cycle or cause high rf voltage or current levels, risking possible power amplifier or antenna coupler damage. Use of the 3 dB pad will overcome such effects.

SECTION 3
OPERATION

3.1 FUNCTIONAL OPERATION.

3.1.1 GENERAL.

Antenna Coupler Group RF-601A is an automatic antenna tuning system that is capable of matching the impedance of a 15, 25, 28 or 35 foot whip antenna to a 50-ohm transmission line at any frequency in the 2.0 to 30.0 MHz range. Once tuned, the RF-601A is capable of handling LSB, USB, ISB, FSK, CW, and Compatible AM transmissions at a nominal power rating of 1 KW average and PEP. The RF-601A is able to operate with a variety of radio transmitters since the equipment design includes provisions for automatic, manual, semi-automatic, and silent tuning.

The RF-601's two units contain an impedance transformation circuit which includes two servo driven tuning elements, a logic circuit, a metering and switching circuit, an overload protection circuit and a power supply. The operation of these circuits in each of the possible modes is explained in paragraphs 3.1.2.1 through 3.1.2.5.

3.1.2 OPERATION.

3.1.2.1 Automatic. During automatic operation (Mode Selector switch set at AUTO), the logic circuit produces signals to control and sequence the tuning of the RF-601A. When a home cycle is initiated, the logic circuit supplies a signal to position the motor-driven tuning elements at home (starting position). The home cycle is initiated each time primary power is applied, a frequency change of 1 kHz or more is made, by depressing the front panel RETUNE switch, or by excessive RF voltage on the transmission line. Once the tuning elements reach their home positions, the cycle halts until the operator momentarily keys the transmitter. The logic circuits then automatically hold the transmitter keyed, reduce the transmitter RF power output, and energize the servo loops for a tune cycle. During this cycle, the correction signals are produced to energize the servo motors for a direction of rotation which will move the tuning elements to the tuned position. The direction of rotation is reversed as required throughout the tuning cycle. Once the tuning cycle is completed, the transmitter key line is released and the READY indicator lamp lights to indicate that the RF-601A/CU is ready for full power operation. During full power operation, the servo loops fine tune the tuning elements to compensate for changes in antenna impedances.

3.1.2.2 Manual. During manual operation (Mode Selector switch set at MANUAL), the operator must manually position the tuning elements at home, reduce the transmitter RF power and key the transmitter. The tuning elements are then alternately positioned for a null indication on the DISCRIMINATOR NULL meter using the LEFT and RIGHT pushbuttons. The elements whose position is being changed is selected through the L-C switch. The READY indicator lamp and fine tuning circuits are inoperative during manual operation. (A separate circuit in the RF-601A/C enables slow speed operation of the RF-601A/CU tuning element motors in the MANUAL mode.)

3.1.2.3 Semi-automatic. During semi-automatic operation (Mode Selector switch set at AUTO), the operator must manually reduce RF power, depress the RETUNE pushbutton, and key the transmitter. The tuning elements then will be automatically tuned. The READY indicator lamp will light when tuning is completed. During full power operation, the servo loops will energize as required to fine-position the tuning elements to compensate for changes in antenna impedance. (An interlock network is required between the RF-601A and transmitter to operate semi-automatically as explained in paragraph 2.5.1.)

3.1.2.4 Silent. During silent operation (Mode Selector switch set at SILENT), the elements are positioned one at a time with the LEFT and RIGHT pushbuttons for a pre-recorded indication on the ELEMENT POSITION meter without using RF power. The element whose position is being moved is selected with the L-C switch. The READY indicator lamp is inoperative during silent operation. However, the servo loops are energized to fine-position the elements as required throughout the transmission to compensate for changes in antenna impedance.

3.1.2.5 Overload Protection. Circuits are provided to interlock the keyline of the transmitter if a pressure or temperature overload exists in the RF-601A/CU. The Overload alarm and OVERLOAD indicator lamp are energized any time an overload exists, providing visual and audible indication of the condition. In addition, a circuit is provided to initiate a retune cycle whenever a potentially damaging RF voltage occurs.

3.2 OPERATING PROCEDURES.

3.2.1 DESCRIPTION OF OPERATING CONTROLS AND INDICATORS.

All controls and indicators required for the operation of the RF-601A are located on the RF-601A/C front panel (figure 3.1). Table 3.1 lists each operating control and indicator and its function.

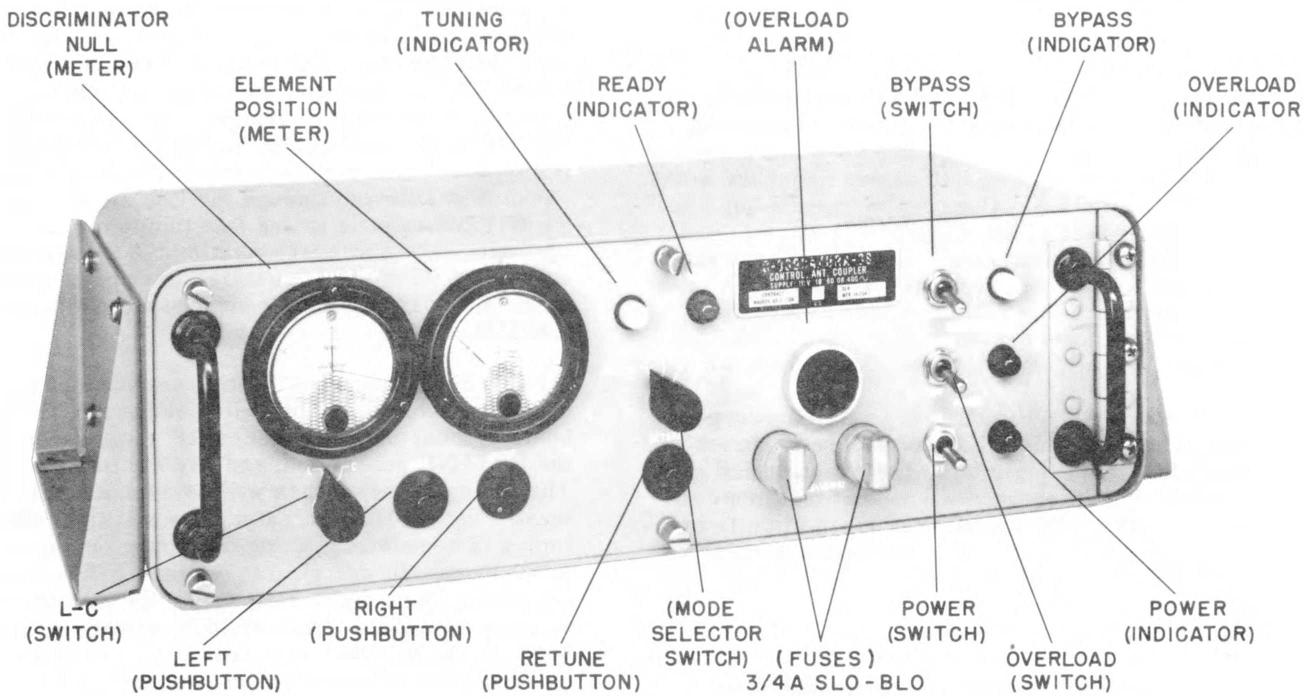


Figure 3.1. RF-601A/C Antenna Coupler Control, Operating Controls and Indicators

Table 3.1. RF-601A/C Antenna Coupler Control, Operating Controls and Indicators

Control/Indicator	Function
DISCRIMINATOR NULL meter	Provides an indication of degree (magnitude and polarity) of L or C element mistuning as selected by L-C switch during manual mode of operation.
ELEMENT POSITION meter	Provides an indication of L or C element positioning as selected by L-C switch.
L-C switch	Selects metering and switching required to tune L or C element during manual and silent modes of operation.
LEFT pushbutton	When depressed, tuning element selected by L-C switch is repositioned toward the home position.
RIGHT pushbutton	When depressed, tuning element selected by L-C switch is repositioned away from the home position, towards the far end stop.

Table 3.1. RF-601A/C Antenna Coupler Control, Operating Controls and Indicators (Cont)

Control/Indicator	Function
TUNING indicator lamp	Lights when either servo motor is energized.
READY indicator lamp	Lights when elements have completed tuning in automatic mode and RF-601A/CU is ready for full power operation.
Mode Selector switch	Selects RF-601A mode of operation: Switch Position — Equipment Response MANUAL — Permits manual tuning. SILENT — Permits coarse manual tuning without RF power. Fine tuning is automatic when keyed. AUTO — All tuning is automatic.
RETUNE pushbutton	When depressed with Mode Selector switch at AUTO or SILENT, a home cycle is initiated.
Overload alarm	Provides an audible indication when a pressure or temperature overload exists in the RF-601A/CU (OVERLOAD switch must be set at ALARM).
Fuses 3/4A SLO-BLO (with indicators)	Protect the RF-601A against overload; indicator glows when fuse is open.
BYPASS switch	When set at ON, the RF-601A/CU matching network is bypassed whenever transmitter is not keyed; allowing reception on a frequency different from that used for transmission. When set at NORMAL, RF-601A/CU matching network is in RF signal path during both receive and transmit operation.
BYPASS indicator lamp	Lights when RF-601A/CU matching network is bypassed.
OVERLOAD switch	When set at ALARM, audible overload alarm is connected to overload circuit.
OVERLOAD indicator lamp	Lights to provide visual indication when a pressure or temperature overload exists in RF-601A/CU.
POWER switch	Controls primary power application to RF-601A.
POWER indicator lamp	Lights when RF-601A is energized.

3.2.2 AUTOMATIC OPERATION

Automatic operation is normally possible only when operating with the RF-130, RF-730, or RF-735. To operate the RF-601A in an automatic mode of operation, proceed as follows:

a. Energize transmitter at desired operating frequency.

b. Set Mode Selector switch at AUTO.

c. Set POWER switch at ON, POWER indicator lamp should light. TUNING indicator lamp should light briefly, unless tuning elements are already at home.

d. When TUNING indicator lamp extinguishes, momentarily key transmitter. READY indicator lamp will light when RF-601A is ready for full power operation.

e. If reception is to be made on a frequency different from that of the transmission, set BYPASS switch at ON. Otherwise set BYPASS switch at NORMAL. (BYPASS indicator lamp will light when BYPASS switch is set at ON and transmitter is not keyed.)

f. Key transmission as required.

g. If a home cycle is initiated during operation (frequency change, depressing RETUNE pushbutton, or excessive RF voltage) the READY indicator lamp will extinguish and TUNING indicator lamp will momentarily light, indicating that the tuning elements are returning to home. When TUNING indicator lamp extinguishes, **repeat step d.**

h. If a pressure or temperature overload occurs during operation, the OVERLOAD indicator lamp will light, the audible Overload alarm will energize and the keyline will interlock. Operation will be inhibited until cause of overload condition is removed. If desired, the Overload Alarm can be de-energized by setting OVERLOAD switch at OFF. When overload condition is removed, depress RETUNE pushbutton and repeat step d.

Note

If silent operation is expected, perform steps a and d for each assigned operating channel. At each channel, set L-C switch at L and then C. Record ELEMENT POSITION meter indication for both positions of L-C switch at each operating channel in **"Logged Element Position" table inside rear cover.**

3.2.3 SEMI-AUTOMATIC OPERATION.

The RF-601A can be operated in a semi-automatic mode when the associated transmitter is not compatible. To operate in the semi-automatic mode, proceed as follows:

CAUTION

If the equipment is to be operated in this manner, some means must be provided to open the keyline to the transmitter when the RF-601A/C keyline interlock is grounded (paragraph 2.5.1).

a. This step must be performed the first time operation is accomplished on any one specific frequency. Thereafter, begin operation with step b.

(1) Ensure that transmitter is unkeyed.

(2) Decrease RF power output control on transmitter to zero, and connect a 50-ohm dummy load to transmitter output.

(3) Energize transmitter at desired frequency of operation.

(4) Key transmitter and increase power output to approximately 150 watts. Note and record amount of input drive, setting of power control, etc., required to obtain 150 watts at that operating frequency. Release key. Remove dummy load and reconnect RF cable.

b. Set transmitter for a 150 watt output at the desired operating frequency according to prerecorded information obtained in step a (4).

c. Set Mode Selector switch at AUTO.

d. Set POWER switch at ON. POWER and TUNING (unless elements are already at home) indicator lamps should light.

e. When TUNING indicator lamp extinguishes, key transmitter.

f. When READY indicator lamp lights increase transmitter RF power output to desired operate level.

g. Key transmission as required.

h. If reception is to be made on a frequency different from that of transmission, set BYPASS switch at ON. Otherwise set BYPASS switch at NORMAL. (BYPASS indicator lamp will light when BYPASS switch is set at ON and transmitter is not keyed.)

CAUTION

If it is desired to change frequencies, the following sequence must be observed to preclude damage to the equipment. Release transmitter key, depress RETUNE pushbutton, change frequency, adjust transmitter to previously recorded 150W setting for the new frequency, key transmitter, perform steps f and g above.

i. If a temperature or pressure overload occurs during operation, the OVERLOAD indicator lamp will light, the Overload alarm will energize, and the keyline will interlock. If this occurs, correct the cause of the condition before continuing operation.

j. If RETUNE pushbutton is depressed or a potentially dangerous RF voltage exists during operation, the READY indicator lamp will extinguish and the TUNING indicator lamp will momentarily light, indicating that the tuning elements are returning to home. When TUNING indicator lamp extinguishes, repeat steps b, and e through i.

3.2.4 MANUAL OPERATION.

If a failure occurs in the automatic tuning circuitry, or if the RF-601A is being used with a transmitter other than the RF-130, RF-730, or RF-735 (which does not permit automatic operation), the RF-601A can be manually tuned. The transmitter is adjusted for a low RF output (50 to 200 watts) and the elements are alternately selected by the L-C switch and positioned with the RIGHT and LEFT pushbutton until a center "null" indication is obtained on the DISCRIMINATOR NULL meter for each position of the L-C switch. Actually, since the antenna represents an unknown impedance, the exact setting for each element at any frequency can not be predicted and therefore must be discovered.

Also, tuning either element will result in a change in both discriminator error signals (as indicated by the DISCRIMINATOR NULL meter). To prevent repeatedly tuning through the proper tuning point for each element, the elements must be alternately positioned in a series of steps aimed at reducing the tuning error each time, rather than attempting to correctly position each element in a single step. The operator should tune up the equipment manually on several different operating frequencies at the first opportunity, in order to familiarize himself with the equipment response at different frequencies for each step of the procedure.

CAUTION

> It is possible, with certain frequencies and antenna impedances, to tune the RF-601A to a false null (the meter will provide null indications although the elements are incorrectly positioned for a proper tuned condition). This will not occur if all the steps in the procedure are carefully observed.
>
> If it is desired to use the bypass function when operating with a transmitter other than those known to be compatible, the interlock network described in paragraph 2.5.1 will have to be included. Otherwise the connection to terminal 3 of switch S4 must be broken to completely disable the bypass circuit.

a. When operating with a transmitter other than the RF-130, RF-730, or RF-735, set up the transmitter for a 150 watt output at the desired operating frequency by performing steps a and b of paragraph 3.2.3. When operating with the RF-130, RF-730, or RF-735, select frequency at the exciter (do not key transmitter).

b. Set Mode Selector switch at MANUAL.

c. Set POWER switch at ON. POWER indicator lamp will light.

Note

> If element positions have been logged for intended transmitting frequency, set L and C to logged positions, key transmitter, and proceed to step k.

d. Set L-C switch at C.

e. Depress LEFT pushbutton until TUNING indicator lamp extinguishes, to set C at home end stop.

f. Set L-C switch at L and repeat step e to set L at home end stop.

Note

> The flow chart shown in Table 3-3 may help in understanding the following steps.

g. Set L-C switch at C and note the DISCRIMINATOR NULL meter indication. If meter indication is to left of the center (NULL) position, proceed to step i If meter indication is at NULL or to right of NULL proceed to step h.

h. Set L-C switch at L and depress RIGHT pushbutton momentarily, then repeat step g.

i. Depress RIGHT pushbutton until DISCRIMINATOR NULL meter indicates NULL. (If no initial change can be noted in the DISCRIMINATOR NULL meter indication, momentarily unkey the transmitter, and use the pushbuttons to move the C element off the end stop 1 or 2 small divisions as indicated on the ELEMENT POSITION meter. Then key the transmitter and try again to adjust C for NULL.)

j. Set L-C switch at L and note the DISCRIMINATOR NULL meter indication. If meter indication is at NULL, proceed to step k. If meter indication is to left of NULL depress RIGHT pushbutton momentarily. If meter indication is to right of NULL, depress LEFT pushbutton until meter indicates NULL.

k. Set L-C switch at C and note the DISCRIMINATOR NULL meter indication. If meter indication is at NULL, proceed to step l. If meter indication is to left of NULL, depress RIGHT pushbutton. If meter indication is to right of NULL, depress LEFT pushbutton.

l. Set L-C switch at L and note the DISCRIMINATOR NULL meter indication. If meter indication is at NULL, tuning is complete. If meter indication is not at NULL, repeat steps j, k and l.

Note

> When tuning is complete, the DISCRIMINATOR NULL meter will read zero in both positions of the L-C switch. Depressing

the RIGHT pushbutton should make the meter read to the right and depressing the LEFT pushbutton should make the meter read to the left.

m. Unkey the transmitter.

n. Select desired mode of operation and proceed with normal full power transmissions.

o. Periodically during transmission, check discriminator null indications for both L and C, and fine tune as necessary.

p. If a temperature or pressure overload occurs during operation, the OVERLOAD indicator lamp will light, the Overload alarm will energize and the keyline will interlock. If this occurs, correct the condition before continuing operation.

3.2.5 SILENT OPERATION.

If the RF-601A is being operated under radio silence conditions, the tuning can be accomplished in the silent mode without the use of RF power by using meter settings previously obtained in paragraph 3.2.2 for each assigned operating channel. To operate the RF-601A in the silent mode, proceed as follows:

Note

The READY indicator lamp is inoperative during silent operation.

a. Turn transmitter primary power on.

b. Set Mode Selector switch at SILENT.

c. Set POWER at ON. POWER indicator lamp will light. TUNING indicator lamp will briefly light unless tuning elements are already at home.

d. Set L-C switch at L.

e. Depress LEFT and RIGHT pushbuttons as required to provide an indication on ELEMENT POSITION meter that is the same as the pre-recorded value for the frequency to be used.

f. Set L-C switch at C.

g. Repeat step e for the pre-recorded C element position.

h. Set transmitter to operating frequency for which the elements were tuned.

i. Key transmission as required. Fine tuning will be performed automatically.

j. If reception is to be made on a frequency different from that of transmission, set BYPASS switch at ON. Otherwise set BYPASS switch at NORMAL. (BYPASS indicator lamp will light when BYPASS switch is set at ON and transmitter is not keyed).

k. If a frequency change is made, the tuning elements will go to home. Tuning can then be performed using d through g above.

l. If a temperature or pressure overload occurs, the OVERLOAD indicator lamp will light, the Overload alarm will energize, and the keyline will interlock. Transmission will be inhibited until the condition causing the overload is corrected.

3.3 EMERGENCY OPERATION.

If a temperature or pressure overload occurs during automatic or silent operation, the logic circuits will interlock the keyline to prevent the transmitter from being keyed. If this occurs and it is necessary to maintain operation, proceed as follows:

a. Set OVERLOAD switch at OFF.

b. Loosen four screws on RF-601A/C front panel.

c. Swing hinged front panel open.

d. Set Key Interlock switch S10 at Disable.

e. Close front panel and secure with four front panel screws.

f. Continue operation with reduced power. (The equipment should not be operated in this condition any longer than absolutely necessary since its life will be greatly reduced.)

Note

The nature of the problem, emergency operating requirements and environmental conditions will have to dictate the amount of power reduction.

g. When cause of overload is repaired, set Key Interlock switch S10 at ON.

If a temperature or pressure overload occurs when operating in the manual mode, the transmitter interlock line is not interlocked unless the associated transmitter is the RF-121, RF-130, RF-730, or RF-735, or the interlock network (paragraph 2.5.1) is used. If the associated transmitter is one of those listed above or the interlock network is used, perform steps a through f of paragraph 3.3. Otherwise, set the OVERLOAD switch at OFF and continue operation at reduced power.

If the RF-601A will not automatically tune, set Mode Selector switch at MANUAL and attempt to tune using the procedures in paragraph 3.2.4. If the RF-601A still does not tune, try steps b through g of paragraph 3.2.5 to position the elements. If the elements still cannot be positioned, the equipment is inoperative at that frequency or the antenna cannot be tuned at the frequency due to a malfunction of the antenna.

3.4 OPERATOR'S MAINTENANCE.

3.4.1 OPERATING CHECKS.

When a system malfunction is encountered, the operator should perform the following checks to determine the cause of the trouble.

a. Check the two fuses; if either is open, the associated indicator lamp will light. Replace open fuses. If fuse opens again, refer problem to maintenance personnel.

b. Check all cables for breakage and connectors for proper connection and seating.

c. Check to see that the POWER indicator lamp is lighted. If operating with the RF-110 HF Power Amplifier, the RF-110 must be energized in order for primary power to be applied to the RF-601A.

d. Check to see that the Mode Selector switch is set for the desired mode of operation.

e. Check ELEMENT POSITION meter indication at both settings of the L-C switch. If indications are approximately 0, perform the operating procedures to retune. (Excessive RF voltage may have caused the elements to home.)

3.4.2 PREVENTIVE MAINTENANCE.

The preventive maintenance procedures that can be performed by the operator are listed in table 3.2.

3.4.3 EMERGENCY MAINTENANCE.

If the system malfunctions while a technician is not available, the operator should perform the following emergency procedures.

a. Try another mode of operation.

b. Perform steps a through e of paragraph 3.4.1.

c. Loosen front panel screws and open hinged front panel. Check that all printed circuit boards are properly seated in their associated connectors.

d. Check for a damaged antenna.

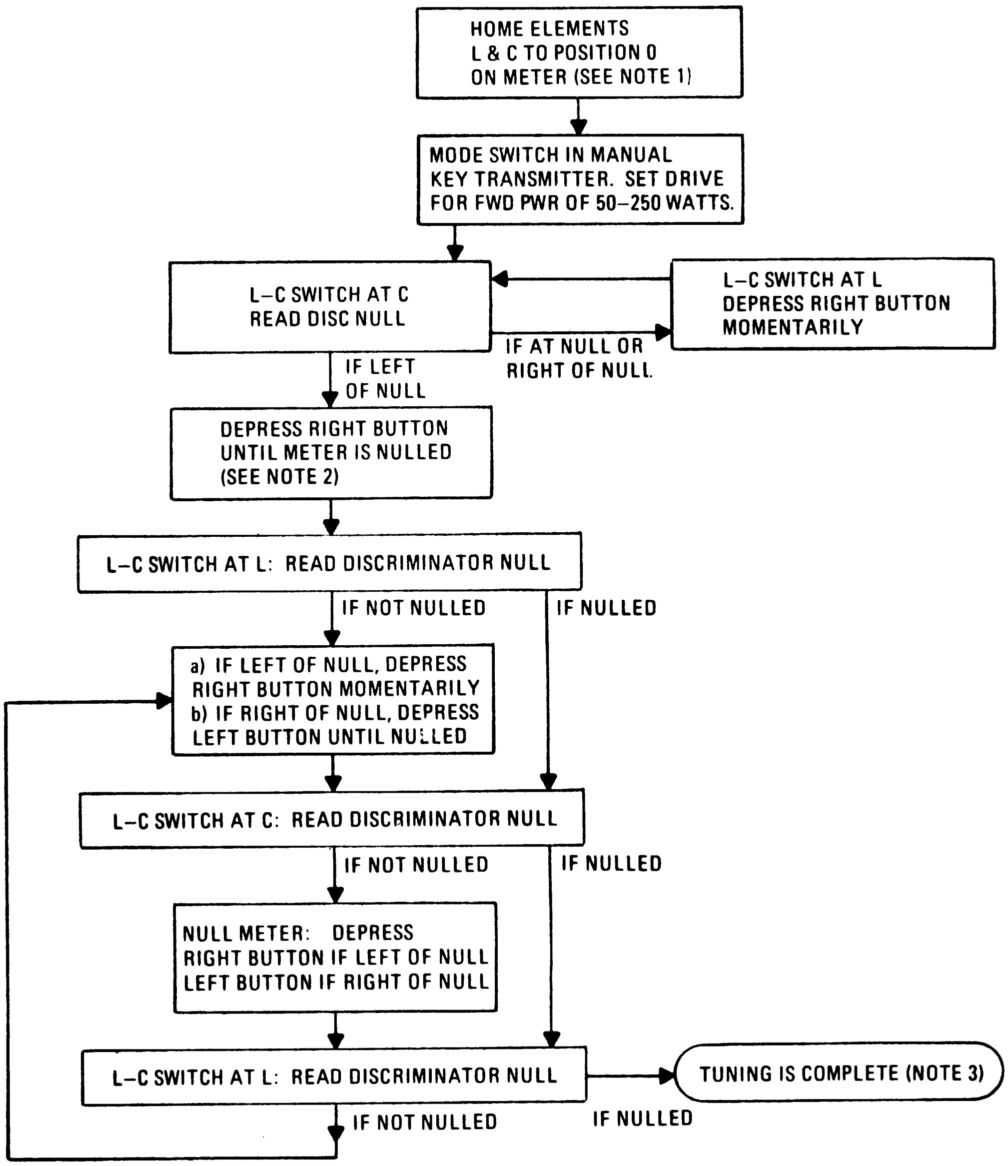
WARNING

LETHAL RF voltages are present at the antenna terminations during transmission.

Table 3.2. RF-601A Antenna Coupler Group
Preventive Maintenance Checks

Inspect For	Remedy
Low pressure in RF-601A/CU	Recharge RF-601A/CU using the procedures in paragraph 2.9.
Loose handles, mounting screws, and other hardware	Tighten loose hardware.
Cable assemblies, broken, frayed or damaged	Repair or replace.
Dust	Clean exterior with soft lint-free cloth. Clean interior with brush, cloth and compressed air.
Nicks, burrs, dents, scratches or rust	Smooth burrs with file, sandpaper corrosion, rust or scratches and refinish.

Table 3.3. Flow Chart for Manual Tuning



NOTES

1. THE TUNING ELEMENTS L AND C CAN BE HOMED BY ONE OF THE FOLLOWING:
   A. TURNING THE MODE SWITCH TO SILENT AND PRESSING THE RETUNE BUTTON, OR
   B. TURNING THE MODE SWITCH TO MANUAL AND PRESSING THE LEFT PUSHBUTTON UNTIL THE TUNING LAMP EXTINGUISHES FOR BOTH POSITIONS OF THE L–C SWITCH.
2. IF NO INITIAL MOVEMENT OF C CAN BE OBTAINED, UNKEY TRANSMITTER AND MOVE C OFF THE END STOP 1 OR 2 SMALL DIVISIONS ON THE ELEMENT POSITION METER. KEY TRANSMITTER AND CONTINUE TO NULL.
3. WHEN TUNING IS COMPLETE THE DISCRIMINATOR NULL METER WILL READ ZERO IN BOTH POSITIONS OF THE L–C SWITCH. PUSHING THE RIGHT BUTTON SHOULD MAKE THE METER READ TO THE RIGHT AND PUSHING THE LEFT BUTTON SHOULD MAKE THE METER READ TO THE LEFT.

SECTION 4
PRINCIPLES OF OPERATION

4.1 FUNCTIONAL DESCRIPTION.

4.1.1 GENERAL.

The RF-601A is an automatic antenna coupler group consisting of two units: the RF-601A/CU and the RF-601A/C. These units are for general purpose surface ship and shore use with radio transmitting sets such as the RF-121, RF-130, RF-730, and RF-735. However, the RF-601A may be manually tuned when operated with other transmitters. Additional provisions permit tuning without RF power. This is useful where radio silence must be maintained except during brief transmission periods. The RF-601A matches the impedance of a 15, 25, 28, or 35 foot whip antenna to a 50 ohm transmission line at any frequency in the 2.0 to 30.0 MHz range. The RF-601A will handle up to 1 KW of PEP or average power in an LSB, USB, ISB, CW, FSK, or Compatible AM mode. Figure 4.1 illustrates the relationship of the functional sections of the RF-601A.

When RF-601A is used with transmitters other than the RF-130, RF-121, or RF-735, refer to paragraphs 2.11 and 2.12 for interfacing information.

The RF input from the transmitter is applied through the phase (Ø) and resistance (R) discriminators to the matching network. The matching network consists of a transformer, a variable capacitor, and a variable inductor. The two variable tuning elements are motor driven to a tuned position in an automatic, manual, or silent mode of operation (paragraphs 4.1.2 through 4.1.4). When tuned, the matching network transforms the antenna impedance at the selected operating frequency to 50 ohms resistive. The discriminators sample line voltage and current to measure deviations in the resistive and reactive components of the line impedance from the desired 50 ohms resistive impedance. If a deviation exists, the appropriate discriminator produces an error with a polarity that is indicative of the direction of the deviation. The error signals are applied through a switching and metering network to the servo amplifiers (automatic operation) or to the DISCRIMINATOR NULL meter (manual operation) so that the impedance of the variable tuning elements in the matching network can be adjusted. (The discriminators do not produce an output while manually pretuning the elements in silent operation.)

The rotary solenoid permits the matching network to be bypassed during reception. Thus, reception can be made on a frequency different from that being used for transmission without a reduction in efficiency or the requirement of retuning. The rotary solenoid is energized by the coupler bypass circuit whenever the system is not keyed (provided the BYPASS switch is set at ON). When the system key is up, a time delay network in the coupler bypass circuit prevents the rotary solenoid from being energized until the RF has had time to completely decay. When the system is keyed (keyline grounded), the coupler bypass circuit is turned off, de-energizing the rotary solenoid. This connects the matching network back into the signal path. A time delay network is included in the keying logic to prevent the application of RF power to the matching network until the rotary solenoid has had time to de-energize.

4.1.2 AUTOMATIC TUNING CYCLE.

An automatic tuning cycle is initiated by one of the following: energizing the system, changing the transmitter operating frequency, depressing the RETUNE switch, or excessive RF voltage. In any case, a ground pulse is applied to the input of the home logic, producing a positive home signal to the servo amplifiers and key interlock logic. This positive level energizes the keyline interlock output to the transmitter, preventing the system from being keyed while the tuning elements are traveling to home. The positive home signal applied to the servo amplifiers turn on their respective home output stages, grounding the home output lines. The home lines are connected directly to the motor control circuits (paragraph 4.2.5). With the home input lines grounded, the two motor control circuits apply a ground to one side and 28 VDC to the other side of their respective servo motors with a polarity that drives the tuning elements to home. The grounds are also applied as L motor-on and C motor-on signals to both the brake logic and the motor-on logic. This produces a positive motor-on output signal from the motor-on logic which is applied to the home logic to lock that circuit on until the tuning elements reach home. The motor-on grounds energize the brake logic to release the motor brakes.

As each tuning element reaches home (maximum C, minimum L), its home end stop switch breaks the ground connection to its servo motor. Thus, the motor-on signal for that element is removed from the brake and motor-on logic circuits. The brake logic for the respective motor de-energizes, engaging the brake for that motor. Also, when the variable capacitor reaches home, its end stop switch supplies a forcing ground signal to the R discriminator (as described below). When the variable inductor reaches home, its end stop switch supplies a reset (ground) signal to the tune and ready light logic. This reset ground is applied through the tune logic to the transmitter as the tune power signal. The reset ground also sets the sensitivity of the servo amplifiers to maximum as required for low power (50 to 250 watt) tuning. The cycle halts at this point and remains in the conditions mentioned above until the system is keyed.

Momentarily keying the system releases the key interlock (after a slight time delay by the interlock logic), allowing the system to assume a keyed condition. Since the tune power signal is being applied to the transmitter, a low level (150 watt) output from the transmitter is applied to the RF-601A/CU. The Ø discriminator samples RF line voltage and current to produce a DC error signal proportional to the deviation of the line reactance from 0 ohms. The R discriminator samples RF line voltage and current to produce a DC error signal proportional to the deviation of the line resistance from 50 ohms. These error signals are applied through the metering and switching circuit to the servo amplifiers. The servo amplifiers will turn on, grounding the tune output lines to their respective motor control circuits. With the tune input lines grounded, the motor control circuits apply a ground to one side and 28 VDC to the other side of their respective servo motors with a polarity that drives the tuning elements towards a tune position. The grounds are also applied to the brake logic to release the motor brakes. As the tune point is approached, it is sometimes necessary for the elements to be "jockeyed" back and forth; the polarity of the discriminator outputs change as required to cause the motors to be driven in the right direction. For some antenna impedances at the lower part of the frequency range, the normal level of the error signals from the discriminators is not sufficient to turn on the servo amplifiers; therefore, a forcing ground is applied to unbalance the R discriminator, resulting in an error signal of sufficient level to the L servo amplifier. This forces the variable inductor to move in a tune direction. The forcing continues until the impedance changes sufficiently to produce an output from the Ø discriminator. At this time, the variable capacitor will move in a tune direction, opening its home end stop switch. This removes the forcing ground to the R discriminator, allowing normal tuning to take over.

The individual motor-on grounds applied to the brake logic are also applied to the motor-on logic while tuning, as during the home cycle. Therefore, the motor-on logic produces a positive motor-on output which is applied to the tune logic circuits. This positive level energizes the tune logic to lock in the tune power ground to the transmitter and tune sensitivity drive signal to the servo amplifiers, and produces a key hold signal to the keying logic. The key hold signal energizes the keying logic to lock in the system key. (The motor-on signal is also applied to the home logic, but an internal clamp prevents that circuit from being energized.) When the tuning elements reach their respective tune positions, the servo logic circuits change state to remove the key, motor-on, tune power, and tune sensitivity drive signals and engage the motor brakes. This removes all inhibits from the ready light logic. Therefore, the READY light is energized, indicating that the tune cycle has been completed. The automatic tuning cycle requires a maximum of 5 seconds to complete. When the system is keyed, full RF power (1 KW) is applied to the RF-601A/CU by the transmitter. As conditions change the antenna impedance, the discriminators produce error signals to fine-adjust the tuning elements. Therefore, a tuned condition is always maintained. While fine tuning, internal clamps in the logic circuits prevent motor-on signals from activating the home and tune logic circuits. If the RF voltage exceeds a safe limit, an arc will develop across the arc gap producing a ground pulse output to the home logic to interlock the transmitter keyline and initiate a tune cycle.

4.1.3 MANUAL TUNING CYCLE.

Manual tuning is accomplished by the operator with the RF-601A/C front panel controls. The transmitter power output must be reduced to between 50 and 250 watts, and the system must be keyed by the operator. During this mode of operation, the outputs from the discriminators are switched one at a time to the DISCRIMINATOR NULL meter, as determined by the setting of the L-C switch (which also selects the variable inductor (L) or the variable capacitor (C) for tuning). The selected tuning element is adjusted by depressing the LEFT or RIGHT pushbutton as required to provide a null indication on the DISCRIMINATOR NULL meter. The elements are alternately adjusted until a null indication is obtained on the DISCRIMINATOR NULL meter for both the L and the C settings of the L-C switch. To permit more efficient operator control of element positioning, the speed of the servo motors (which is very rapid during automatic operation) is reduced by changing the constant DC input of the servo motor to an electronically governed pulsed DC (paragraph 4.2.8). The servo amplifiers and most of the logic circuitry are disabled during manual operation. However, the key interlock circuit is maintained so that if an element is run up against its far end stop, or if an underpressure or overtemperature condition exists in the RF-601A/CU, RF power will be removed from the RF-601A/CU, precluding possible damage to the equipment.

4.1.4 SILENT TUNING CYCLE.

Initial silent tuning is accomplished without using RF power. Therefore, the discriminators, DISCRIMINATOR NULL meter, servo amplifiers, and logic circuits are not used at this time. Each tuning element is set to a pre-recorded indication on the ELEMENT POSITION meter using the LEFT and RIGHT pushbuttons. As with manual tuning, the DC input to the servo motors is pulsed to obtain a slow tuning speed. The elements are positioned one at a time as selected with the L-C switch. (The indications of the ELEMENT POSITION meter must have been recorded for each element at each assigned operating frequency during previous automatic or manual operation.) The ELEMENT POSITION meter indications are provided by potentiometers whose wipers are mechanically ganged to the individual tuning elements. As in manual operation, the key interlock circuit is maintained in case a tuning element is run up against its far end stop switch, or if an underpressure or overtemperature condition exists in the RF-601A/CU. When a full power transmission is keyed in the silent mode of operation, the servo amplifiers, motor control circuits, and brake logic are energized to enable the tuning elements to be automatically fine adjusted as required to maintain a tuned condition (during this fine adjustment, the DC to the servo motors is full voltage, not pulsed).

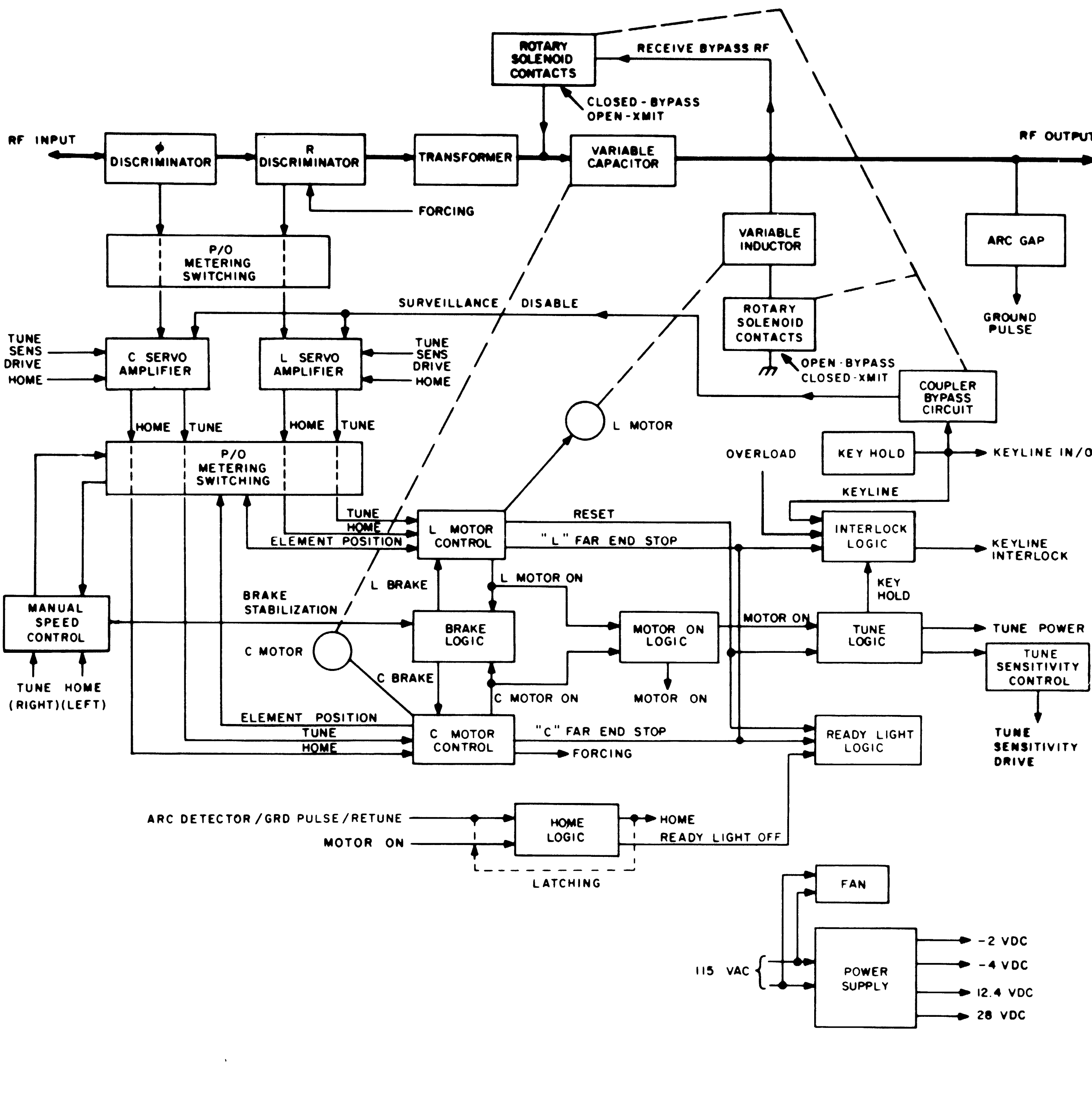


Figure 4.1. RF-601A Antenna Coupler Group Functional Block Diagram

4.1.5 POWER SUPPLY AND COOLING.

The power supply in the RF-601A/C is the source of all DC voltages required for operating the RF-601A. These voltages are produced from the 115 VAC, 48 to 63 or 350 to 450 Hz single phase primary power input. A single-input power transformer with two secondaries is used. One secondary output is half-wave rectified to provide -4 and -2 VDC, and the second is bridge rectified, to provide approximately 50 VDC unfiltered, and filtered +28 and +12.4 VDC. (The unfiltered DC is filtered in the Manual Speed Control assembly to provide +10 and +20 VDC operating voltages for that assembly). Primary power is also applied to the cooling fan in the RF-601A/CU to circulate the nitrogen atmosphere, when the internal temperature exceeds 80 degrees F.

The fan and the RF-601A/CU case form a heat exchanger to transfer internally generated heat to the ambient air.

4.2 DETAILED CIRCUIT DESCRIPTIONS.

4.2.1 MATCHING NETWORK.

The matching network (figure 4.2) consists of a transformer (T1), a variable inductor (L1), and a variable capacitor (C1). The function of these components is to transform the impedance of a system antenna to an impedance that is 50 ohms resistive.

Inductor L1 and capacitor C1 are motor driven to the exact value of capacitive and inductive reactance required for a tune condition (paragraph 4.2.5). Inductor L1 is adjusted to provide enough shunt loading reactance to transform the antenna impedance to an inductive impedance with an equivalent series resistive component of 22.2 ohms. Capacitor C1 is then adjusted to cancel the inductive reactance component of this impedance. Thus, the antenna impedance is transformed by capacitor C1 and inductor L1 to a purely resistive impedance of 22.2 ohms. Transformer T1 has a primary-to-secondary turns ratio of 3:2. Since impedance is transferred through a transformer proportionally to the square of the turns ratio, the input impedance of the RF-601A/CU (when tuned) is 50 ohms (9/4 x 22.2).

Rotary solenoid K1 is energized (paragraph 4.2.10) if a transmission is not being made, provided the bypass function is switched on. This opens the ground side of inductor L1 and shorts capacitor C1, thus bypassing the matching network. This allows reception on a frequency different from that of transmission. When the matching network is bypassed, resistor R1 allows a small DC current to flow through the rotary solenoid contacts to break down any surface resistance of the contacts.

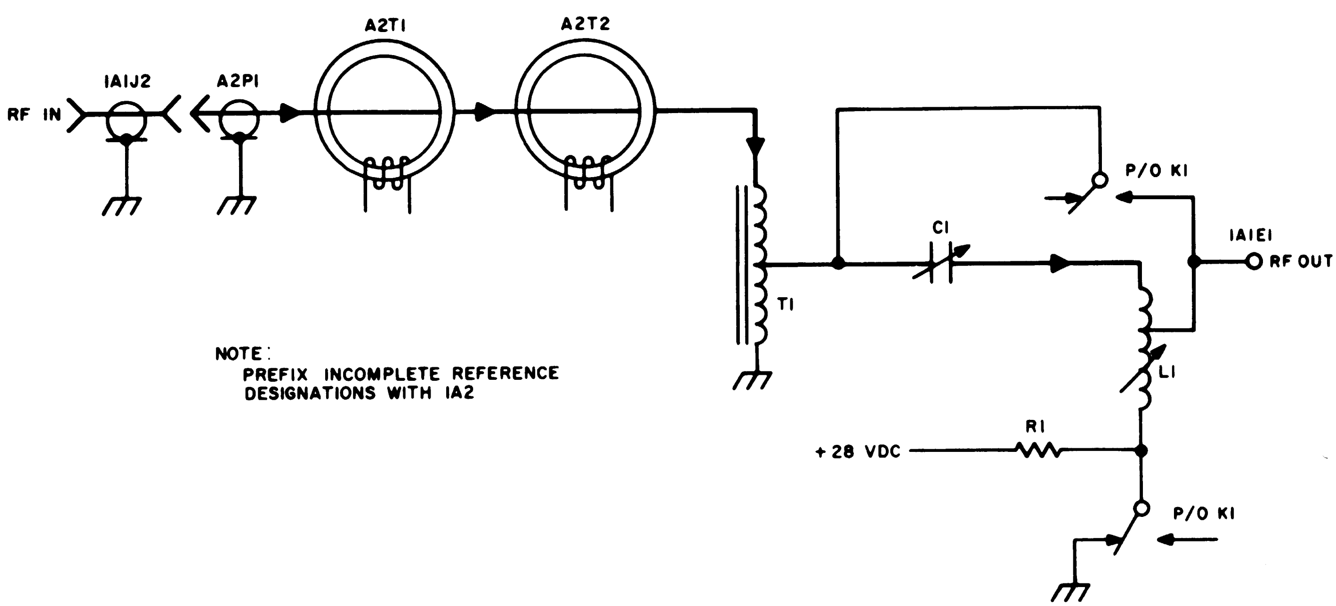


Figure 4.2. Matching Network, Simplified Schematic Diagram

4.2.2 Ø DISCRIMINATOR.

The function of the phase discriminator (figure 4.3) is to provide a DC output to C servo amplifier 2A1A1 indicative of the reactive component of the line impedance. This DC output will be zero when the reactive component is the desired 0 ohms, positive when the reactive component is capacitive, and negative when the reactive component is inductive.

The line current induces a voltage in transformer T1, half of this voltage across resistor R2 and half across resistor R1. Taking the junction of resistors R1 and R2 as a reference, the voltages across resistors R1 and R2 are in opposite phase, so that the voltage across resistor R2 is in phase with the line current and the voltage across resistor R1 is 180 degrees out of phase with the line current. (It is just as if the junction of resistors R1 and R2 were connected to a center-tap on the transformer.) Divider C1, R3, and R10 produces a reference voltage at the junction of resistors R1 and R2 90 degrees out of phase with the line voltage. The vector sum of the voltage drops across resistors R3, R10 and R1 is detected by diode CR1 and filtered by capacitor C2, producing a positive DC voltage across resistor R11. The vector sum of the voltages across resistors R3, R10 and R2 is detected by diode CR2 and filtered by capacitor C3, producing a negative DC voltage across resistor R12. The two DC voltages are summed through resistors R4, R5, and R6 and applied through pin A of connector 1A1J1 to one side of the differential amplifier input of C servo amplifier 2A1A1. If the reactive component of the line impedance is zero, then the line voltage and line current will be in phase. In this case, the voltages at the transformer terminals will be equal in amplitude, and thus the two DC voltages will also be equal (one positive, the other negative). Summing two equal and opposite DC voltages results in zero output, indicating that the variable capacitor is tuned. If the reactive component of the line impedance is other than zero, the line voltage and current will no longer be in phase and so the AC voltages (across resistors R3, R10 and R1 or R2) will no longer be equal. Therefore, the DC voltage outputs from diodes CR1 and CR2 must also be unequal, resulting in either a positive (for capacitive reactance) or a negative (for inductive reactance) error signal output to C servo amplifier 2A1A1 to correct the adjustment of the variable capacitor.

The error signal described above is applied to one side of a differential amplifier in C servo amplifier 2A1A1. The other side of the differential amplifier input is connected to ground through resistor R13. Resistor R13 is used instead of a short circuit to ground so that both sides of the differential amplifier will have the same impedance. This resistor is located in the discriminator assembly rather than the C servo amplifier assembly so that both sides of the differential amplifier will have the same length of lead, and therefore, the same amount of stray hum or noise pickup. Since a differential amplifier responds only to *differences* in signal level between its two inputs, hum or noise signals present equally at both inputs will not be amplified. Capacitors C4 and C11 are RF bypasses. Potentiometer R6 is adjusted to provide a zero DC output from the Ø discriminator when the line voltage and current are in phase (zero reactive component in the line impedance), thus compensating for any unbalance in the discriminator caused by component tolerances.

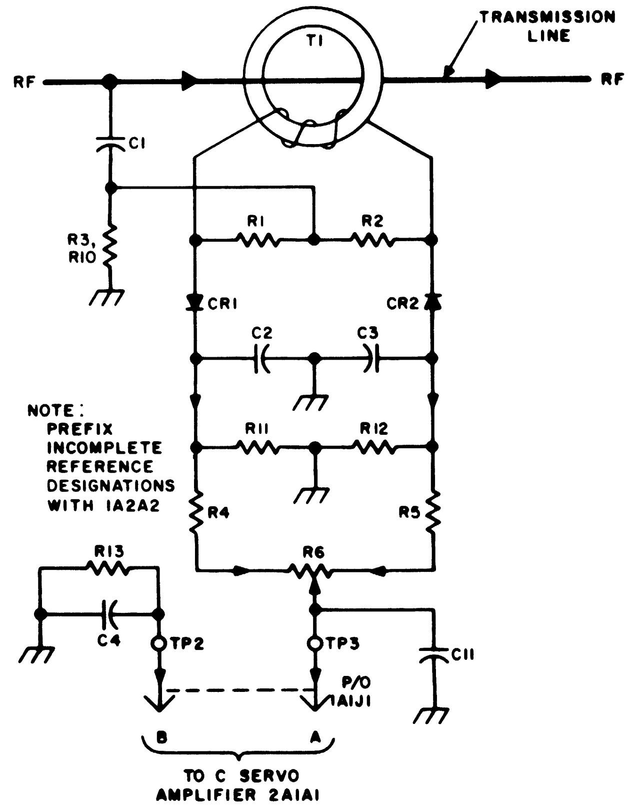


Figure 4.3. Ø Discriminator, Simplified Schematic Diagram

4.2.3 R DISCRIMINATOR.

The function of the R discriminator (figure 4.4) is to provide a DC output to L servo amplifier 2A1A2 indicative of the resistive component of the line impedance. This DC output will be zero when the resistive component is the desired 50 ohms, negative when the resistive component is less than 50 ohms, and positive when the resistive component is greater than 50 ohms.

Capacitive divider C6-C7 produces an output across capacitor C7 which is in phase with and proportional to the line voltage. This voltage is detected by diode CR5 and filtered by capacitor C8, producing a positive DC voltage which is developed across resistor R14. The line current induces a voltage in transformer T2 which is connected so that when the line impedance is 50 ohms resistive, the voltage across transformer T2 is 180 degrees out of phase with and twice the amplitude of the voltage produced by divider C6-C7. The vector sum of the outputs from transformer T2 and divider C6-C7 is detected by diode CR6 and filtered by capacitor C9, producing a negative DC voltage across resistor R15. The two DC voltages are summed through resistors R16 and R17 and applied through pin D of connector 1A1J1 to one side of the differential amplifier input to L servo amplifier 2A1A2. If the resistive component of the line impedance is 50 ohms, the sum of the two DC voltages will be zero, indicating that the variable inductor is correctly tuned. If the resistive component is other than 50 ohms, the voltage induced in transformer T2 will no longer be exactly twice the voltage developed by divider C6-C7. Thus the voltages developed across resistors R14 and R15 will no longer be equal and opposite, and their sum at the junction of resistors R16 and R17 can no longer be zero. The resulting error signal (positive for a line impedance greater than 50 ohms, negative below 50 ohms) is applied to L servo amplifier 2A1A2 to correct the adjustment of the variable inductor.

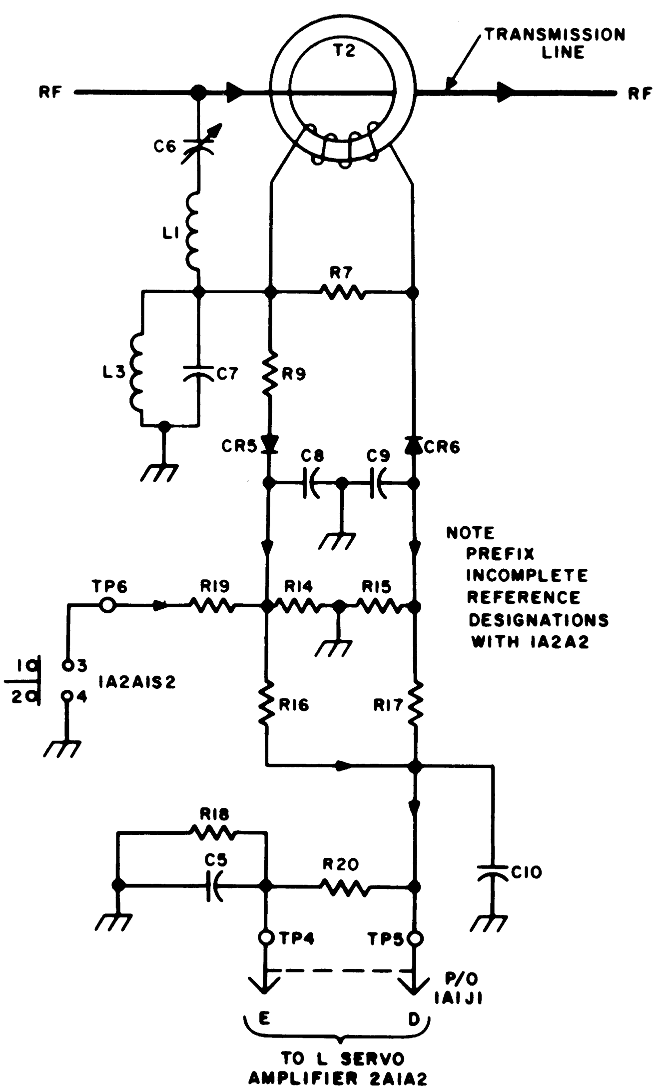


Figure 4.4. R Discriminator, Simplified Schematic Diagram

Resistor R20 sets the sensitivity of the R discriminator. Resistor R18 and capacitors C5 and C10 have the same functions as the corresponding parts in the Ø discriminator. Inductor L3 provides a DC return for detectors CR5 and CR6. Resistor R7 is the load resistor for transformer T2. Resistor R9 provides detector CR5 with the same source impedance that resistor R7 provides to detector CR6, thus maintaining balance. At the high end of the operating frequency range, the leads of capacitor C7 produce a small amount of inductive reactance. Therefore, inductor L1 is used to provide a corresponding amount of inductive reactance in series with capacitor C6 so that the output from divider C6-C7 will be frequency insensitive. Capacitor C6 is adjusted so that the voltage output from divider C6-C7 will be exactly half of that developed across transformer T2 when the line impedance is 50 ohms resistive.

At the low end of the operating frequency range, the variable capacitor in the home position (the maximum capacitance position from which tuning is started) appears as a high impedance load to the line. This condition produces a high RF line voltage and low RF line current. Therefore, essentially no voltage is induced in the toroidal transformer of either discriminator. The voltage divider in each discriminator then becomes the only source for both detectors in each discriminator. Thus, both discriminators will produce zero output, falsely indicating that the tuning elements are properly adjusted. To prevent this condition, the variable capacitor's home end stop switch is used to connect resistor R19 in parallel with R14 in the R discriminator. This unbalances the R discriminator, producing an error signal which forces the variable inductor to be adjusted. This forcing is continued until the line impedance changes sufficiently to provide an output from the Ø discriminator. At this time, the variable capacitor will begin to tune, opening the home end stop switch to remove unbalancing resistor R19 from the R discriminator. Normal tuning then continues to adjust both tuning elements to a correct position.

4.2.4 SERVO AMPLIFIER.

The servo amplifier (figure 4.5) consists of a differential amplifier (Q3, Q5), a cross-coupled amplifier (Q4, Q6), four drivers (Q1, Q2, Q7, Q8) and two capacitor discharge transistors (Q9, Q10). The function of these circuits is to provide either a home or a tune output to the respective motor control circuit during automatic or silent operation. The servo amplifiers are not used during manual operation and are used only for fine adjustments during silent operation.

The DC output from the discriminator is applied through switch 2A1S1 (paragraphs 4.2.6 through 4.2.7) to the base of transistor Q5. The other input to the differential amplifier, the base of transistor Q3, is tied to ground through a resistor in the discriminator. The emitters of transistors Q3 and Q5 are returned to -4 VDC. Therefore, both transistors are conducting all the time. The polarity of the discriminator output determines which of the two tran-

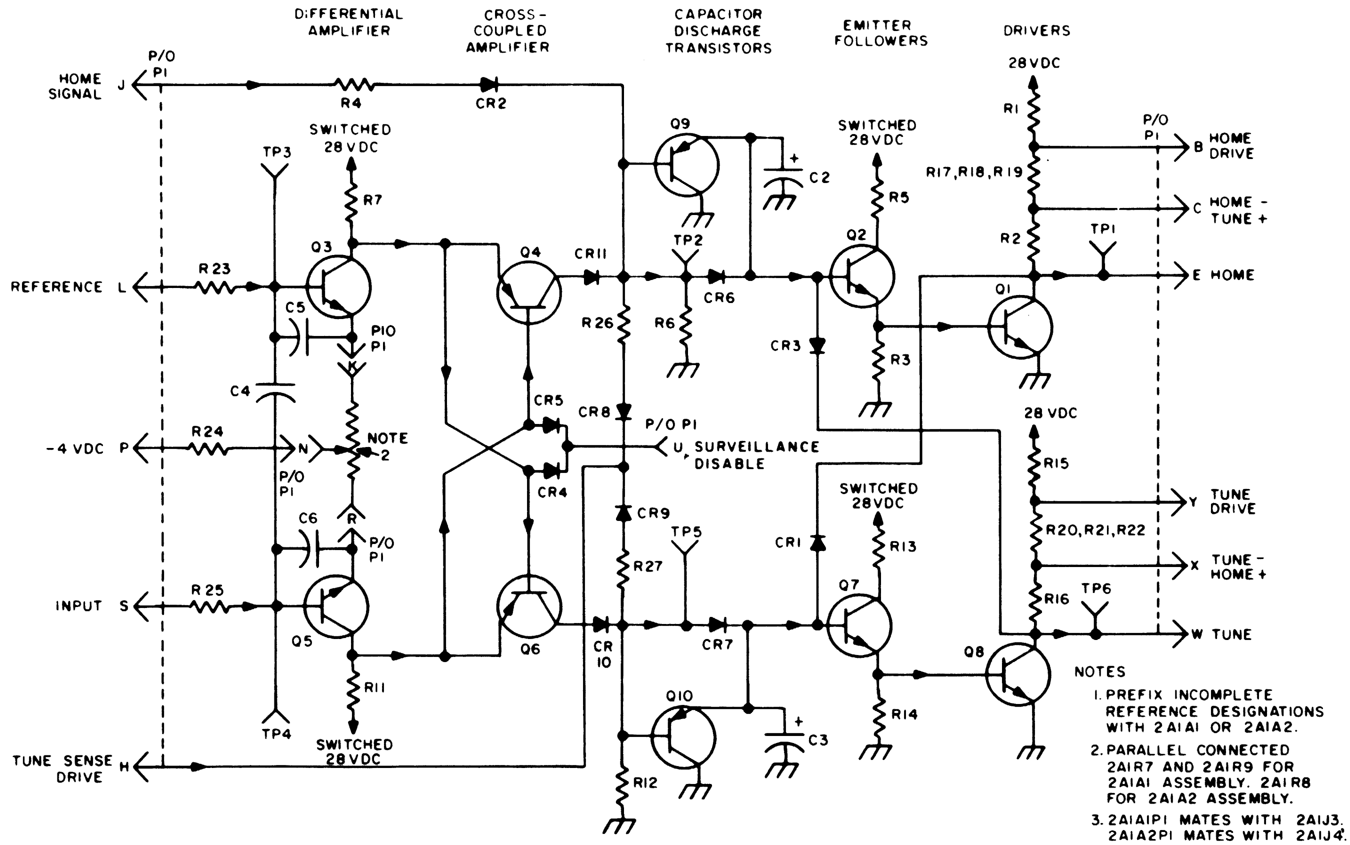


Figure 4.5. Servo Amplifier, Simplified Schematic Diagram

sistors in the differential amplifier will conduct the most, and therefore, which side of the cross-coupled amplifier will turn on.

Assume that the polarity of the discriminator output is negative. This condition turns on transistor Q3 harder than transistor Q5. Therefore, transistor Q6 in the cross-coupled amplifier becomes forward biased and transistor Q4 becomes reversed biased. The output from transistor Q6 turns on transistor Q7 which turns on transistor Q8. Transistor Q8 will conduct into saturation, grounding the tune line input to the motor control circuit, and grounding the base of Q2 through CR3, to ensure that Q1 does not turn on and ground the home line input to the motor control. Similarly, if the assumed polarity of the discriminator output had been positive, transistors Q5, Q4, Q2 and Q1 would have energized and applied a ground to the home input line to the motor control circuit, while preventing a ground on the tune input by grounding the base of Q7 through CR1.

Capacitors C2 and C3 serve as audio bypasses for cross-coupled amplifiers Q4 and Q6, respectively. They prevent the servo motors from trying to follow voice modulation. Transistors Q9 and Q10 rapidly discharge the capacitors when the discriminator error signals drop to zero at the tune point; otherwise, the charge stored in the capacitors would cause the motors to run past the tune point. So long as the output from the cross-coupled amplifier is positive, the diode (CR6 or CR7) is forward biased, keeping the transistors cut off. When the cross-coupled amplifier output drops to zero, resistor R12 or R6 pulls the base towards ground, turning the transistor on, and thus, quickly discharging the capacitor.

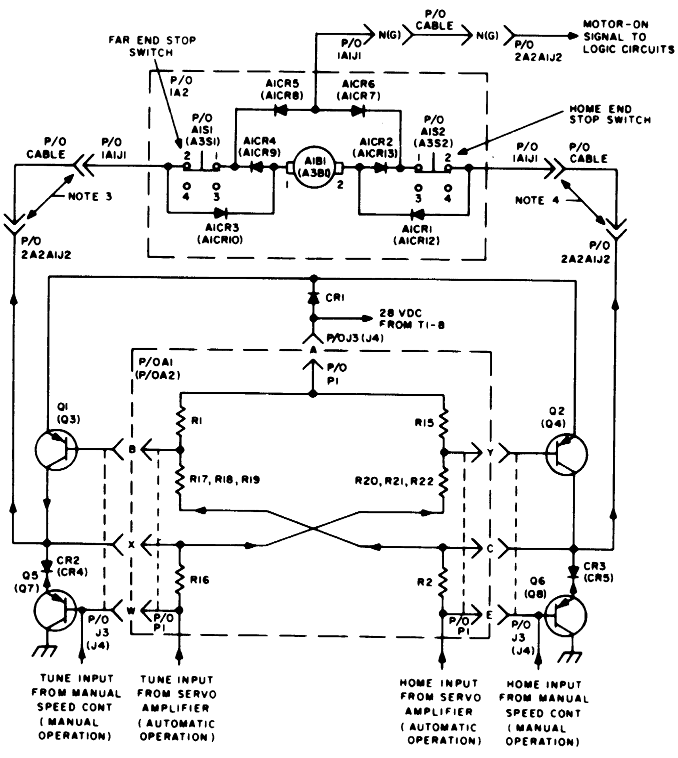
Potentiometer 2A1R7 or 2A1R8 is used to balance the differential amplifier. Resistor 2A1R9 provides the C servo amplifier with increased sensitivity. Capacitors C4, C5, and C6 are RF bypasses. During low power tuning, resistors R12 and R6 are the loads for the cross-coupled amplifier. When fine tuning at high power, the tune logic (paragraph 4.2.9.5) grounds the cathodes of diodes CR9 and CR8 thus connecting resistor R27 in parallel with R12 and R26 in parallel with R6. This reduces the sensitivity of the servo amplifier during high power operation when the discriminator produces larger output levels.

When the system is in a receive condition, induced signals in the antenna from other nearby transmitters could create discriminator error signals and cause the system to false tune. To prevent this, a "surveillance disable" ground signal is applied from the bypass circuit (paragraph 4.2.10) through diodes CR5 and CR4, to the bases of Q4 and Q6 respectively, to disable the cross coupled amplifier, when no system (transmitted) RF signal is present.

At the onset of an automatic tuning cycle, the home logic circuit provides a positive voltage through resistor R4 and diode CR2 to the base of transistor Q2 (paragraph 4.2.9.2.). This turns transistors Q2 and Q1 on to produce a home ground output to the motor control circuits. Thus, the servo motors are energized to send the tuning elements to home (a predetermined starting position for starting the tune cycle). Blocking diode CR11 prevents the home signal input from being grounded through Q4. Diode CR10 preserves the symmetry of the cross coupled amplifier outputs.

4.2.5 MOTOR CONTROL CIRCUIT.

Each motor control circuit (figure 4.6) consists of four drivers, a servo motor, two end stop switches, and various diode gates. With the exception of reference designations and connections, two identical motor control circuits are used: one in the L servo loop and one in the C servo loop. The circuit components are located partly in the RF-601A/C and partly in the RF-601A/CU. Intercircuit and interunit connection details are explained in paragraphs 4.2.6 and 4.2.7. The function of these circuits is to turn on the servo motors with the correct polarity to run them in the desired direction. Two speed operation for the servo motors is provided by using full voltage DC for high speed automatic operation, and by feedback controlled pulsing of the DC supplied to the servos during manual operation (paragraph 4.2.8). Reference designations used in the following discussion are for the C motor control circuit.



NOTES:
1 PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 2A1.
2. REFERENCE DESIGNATIONS IN PARENTHESES ARE FOR L-MOTOR CONTROL; OTHERS ARE FOR C-MOTOR CONTROL.
3. PINS H,J,K,U FOR C-MOTOR CONTROL; V, W FOR L-MOTOR CONTROL
4. PINS P,R,S,c FOR C-MOTOR CONTROL, a,b FOR L-MOTOR CONTROL

Figure 4.6. Motor Control, Simplified Schematic Diagram

If we wish to energize the C servo motor for a tune direction of rotation, transistor 2A1A1Q8 is turned on, applying ground to the base of transistor Q5. This ground turns transistor Q5 on, resulting in the application of ground to terminal 1 of C servo motor 1A2A1B1. This ground is also applied through diode 1A2A1CR5 to energize the brake logic (paragraph 4.2.9.4) to release the motor brake. Turning transistor Q5 on also grounds the bottom of voltage divider A1R15-R20-R21-R22, causing transistor 2A1Q2 to conduct. Therefore, 28 VDC is applied through transistor Q2 and diode 1A2A1CR1 to terminal 2 of C servo motor 1A2A1B1. This establishes current flow through the servo motor in the correct polarity for a tune direction of rotation.

If the home direction of rotation is needed, the C servo amplifier output grounds the base of transistor Q6. Therefore, ground is applied to terminal 2 of C servo motor 1A2A1B1 and through diode 1A2A1CR6 to the brake logic. Transistor Q1 is energized by voltage divider A1R1-R17-R18-R19 to apply 28 VDC to terminal 1 of C servo motor 1A2A1B1. This produces current flow through the servo motor with the correct polarity for a home direction of rotation.

Home end stop switch 1A2A1S2 (1A2A3S2 for the L servo motor) and far end stop switch 1A2A1S1 (1A2A3S1 for the L servo motor) serve as limit switches to stop the motors and protect the tuning elements from being driven too far. They also provide signals to the logic circuits indicating that the home or far end positions have been reached. For example, initiating a tuning cycle causes the servo motors to drive the tuning elements to their home positions (maximum capacitance and minimum inductance). When the elements reach home, the normally closed contacts of end stop switches 1A2A1S2 and 1A2A3S2 open, de-energizing the servo motors. The normally open contacts of these end stop switches now close, applying the reset signal (ground) to the tune and ready light logic (paragraphs 4.2.9.5 and 4.2.9.7) and the forcing signal (ground) to the R discriminator (paragraph 4.2.3). On the other hand, if a tuning element is driven up against its far end stop (end opposite home), it opens the normally closed contacts of its far end stop switch (1A2A1S1 or 1A2A3S1), de-energizing the motor. In addition, the normally open contacts of the switch close, applying the far end stop signal (ground) to the interlock and ready light logic (paragraphs 4.2.9.6 and 4.2.9.7) to remove RF power and extinguish the READY light. (RF power is removed because reaching a far end stop is an abnormal condition occurring only with a disconnected or damaged antenna or the coupler's inability to tune properly.)

4.2.6 C SERVO LOOP SWITCHING AND METERING.

4.2.6.1 General. The C servo loop switching and metering circuitry (figure 4.7) provides switching and metering to allow variable capacitor 1A2C1 to be adjusted automatically or manually according to the mode of operation.

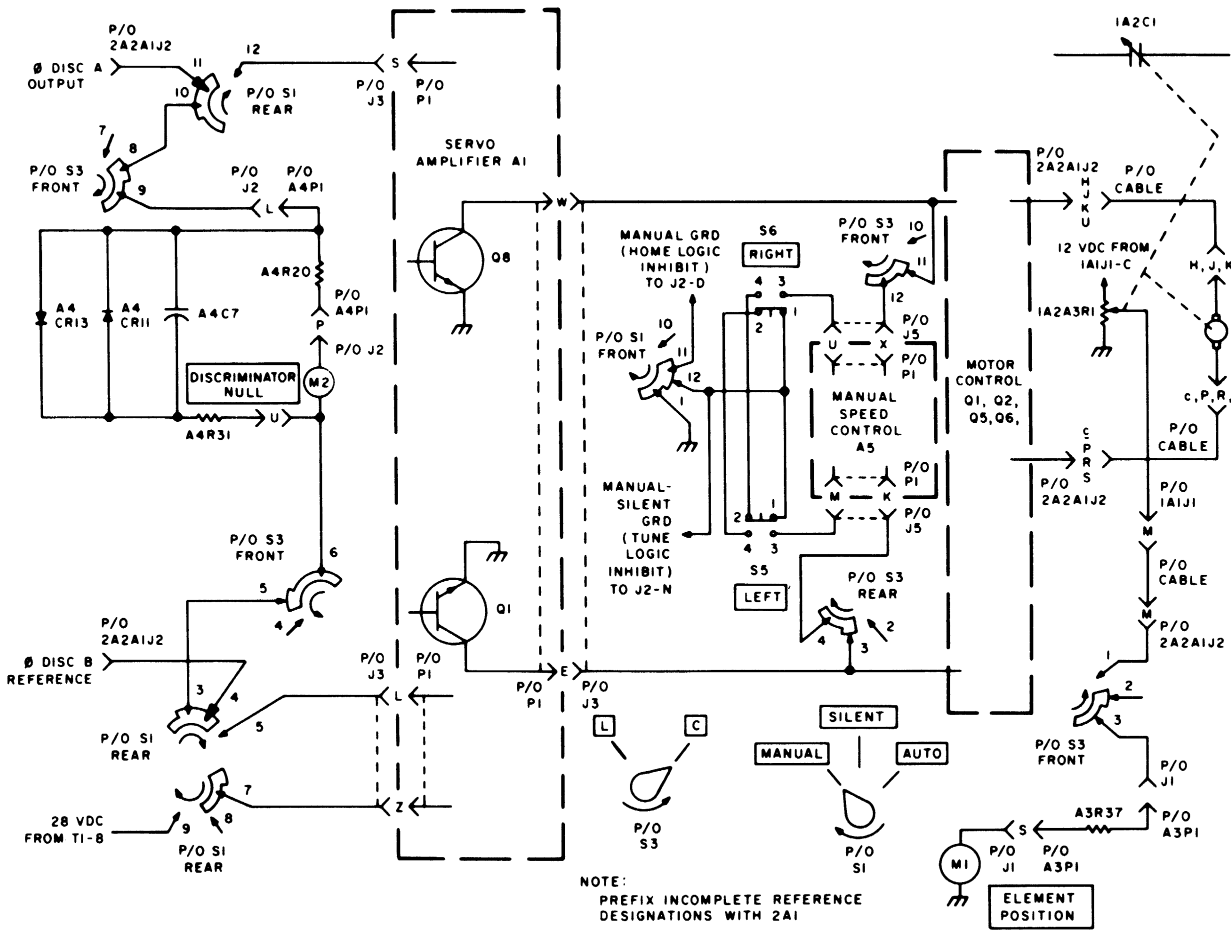


Figure 4.7. C Servo Loop, Simplified Switching and Metering Diagram

4.2.6.2 Automatic Operation. During automatic operation, Mode Selector switch S1 provides all the necessary switching. (The tuning cycle is completely automatic.) The input from the Ø discriminator is applied through pin A of connector 2A2A1J2, contacts 11 and 12 of S1-rear, and pin S of connector J3 to servo amplifier A1. The Ø discriminator reference is applied through pin B of connector 2A2A1J2, contacts 4 and 5 of S1-front, and pin L of connector J3. When a discriminator error signal is present, the polarity of the signal at pin S, with reference to the signal at pin L, will cause the servo amplifier to apply turn on signals of the proper polarity to the motor control transistors as explained in paragraph 4.2.4. (During this mode of operation, RIGHT and LEFT pushbuttons (S6 and S5) are disabled by breaking the ground path through contacts 1 and 12 of S1-front. This avoids the possibility that accidentally depressing one of the pushbuttons while the set was automatically tuning or tuned could interfere with the automatic tuning process.)

4.2.6.3 Silent Operation. Silent operation allows variable capacitor 1A2C1 to be pre-positioned without the use of RF power. This is accomplished by using the LEFT and RIGHT pushbuttons to position the capacitor to a pre-recorded setting, as indicated on ELEMENT POSITION meter M1. The ELEMENT POSITION meter is connected through the L-C switch (which selects the element to be monitored and adjusted) to potentiometer 1A2A1R1 on the gear drive assembly for variable capacitor 1A2C1 in the RF-601A/CU. The wiper of the potentiometer is mechanically connected to the gear drive assembly and therefore provides a DC potential to the meter which will be representative of the position of the tuned element. Indications of the ELEMENT POSITION meter are recorded each time a new operating frequency is used. Thereafter, variable capacitor 1A2C1 can be adjusted without RF power to the proper setting for any previously used operating frequency by setting the L-C switch at C and depressing the LEFT and RIGHT pushbuttons alternately as required until the ELEMENT POSITION meter indicates the position recorded. (The manner in which the servos are energized by the LEFT and RIGHT pushbuttons is described in paragraph 4.2.8 for the Manual Speed Control Circuit.)

4.2.6.4 Manual Operation. Manual operation allows variable capacitor 1A2C1 to be adjusted if a failure occurs in the logic or servo amplifier circuits, or when the RF-601A is being used with a transmitter other than the RF-121, RF-130, RF-730, or RF-735.

When the Mode Selector switch is set at MANUAL and the L-C switch is set at C, the Ø discriminator output is connected through contacts 11 and 10 of S1-rear, contacts 8 and 9 of S3-front, pin L of connectors J2 and A4P1, resistor A4R20, and pin P of connectors A4P1 and J2 to one side of DISCRIMINATOR NULL meter M2. The Ø discriminator reference lead is connected through contacts 4 and 3 of S1-front, and contacts 5 and 6 of S3-front to the other side of DISCRIMINATOR NULL meter M2. When the transmitter is keyed, DISCRIMINATOR NULL meter M2 provides a relative indication of the polarity and magnitude of the discriminator error signal. Using this indication as a guide, the servo motor can be energized using the pushbuttons (as explained for manual operation in paragraph 4.2.8) to position capacitor 1A2C1 to obtain a null indication on DISCRIMINATOR NULL meter M2. The magnitude of the error signal applied to DISCRIMINATOR NULL meter M2 is limited by diodes A4CR13 and A4CR11 to prevent damage to the meter. Capacitor A4C7 is an RF bypass. During automatic and silent operation, 28 VDC for energizing servo amplifier A1 is applied through contacts 9 and 7 of S1-front and pin Z of connectors J3 and A1P1. During manual operation, the servo amplifier is not used, and thus, the 28 VDC is not supplied.

4.2.7 L SERVO LOOP SWITCHING AND METERING.

The L servo loop switching and metering circuitry (figure 4.8) provides switching and metering to allow variable inductor 1A2L1 to be adjusted automatically or manually according to the mode of operation. These circuits are identical to those used in the C servo loop, with the exception of switch contacts and connector pins.

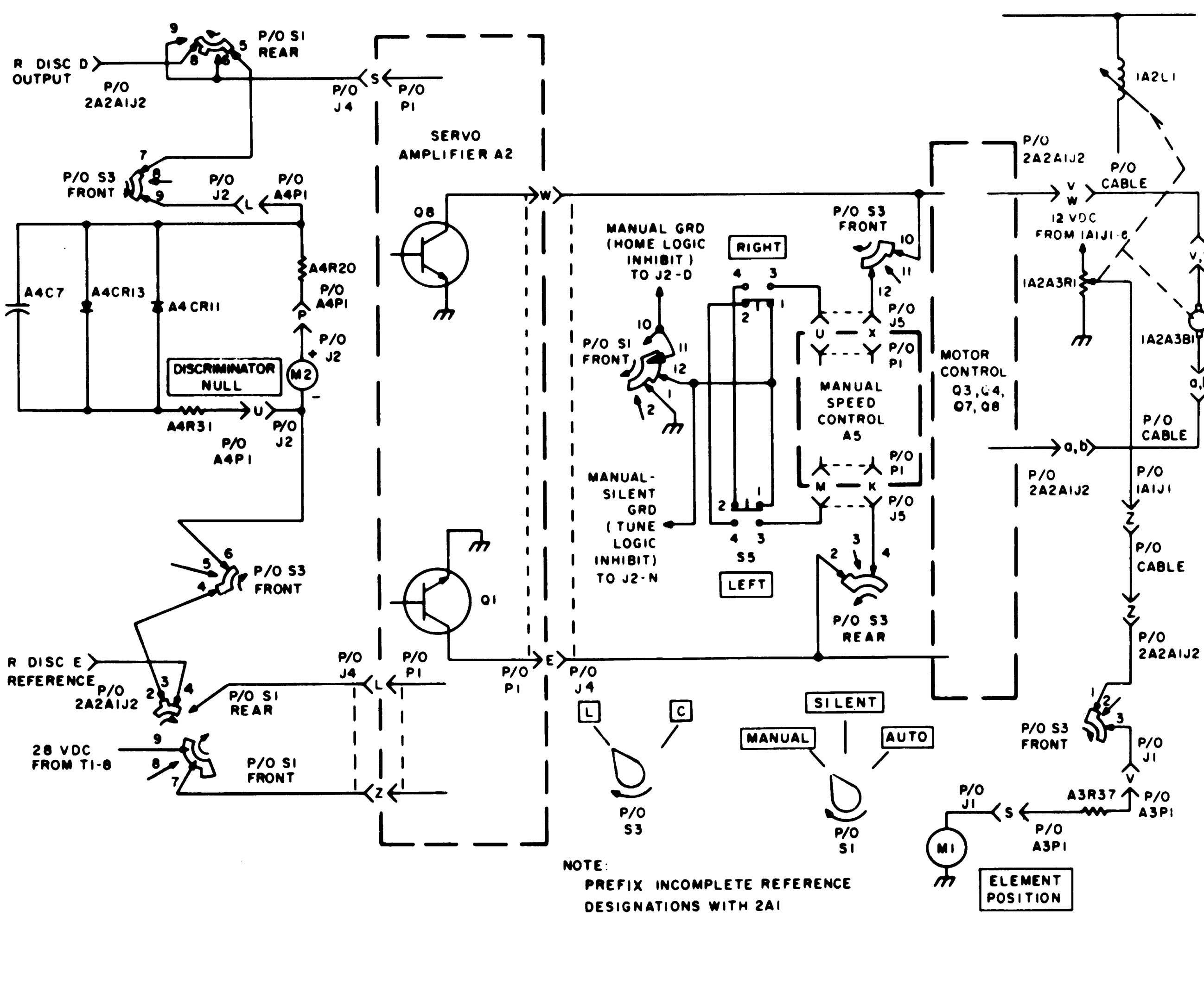


Figure 4.8. L Servo Loop, Simplified Switching and Metering Diagram

4.2.8 MANUAL SPEED CONTROL

4.2.8.1 General. The function of the Manual Speed Control Circuit is to reduce the speed of the servos (which is very rapid during automatic tuning) to permit easier operator control of element positioning in manual and silent modes of operation. As explained in the description of the motor control circuit above (paragraph 4.2.5), servo operation and direction of rotation is controlled by the selective application of grounds to the appropriate motor drive transistors. In manual or silent modes of operation, these grounds are applied (from the RIGHT or LEFT pushbutton switches on the front panel) through the Manual Speed Control Circuit, to the servo selected by the L-C switch. To reduce servo speed without seriously affecting motor torque, the servo supply voltage is turned on and off at a rapid rate by the Manual Speed Control Circuit, which interrupts, or "pulses" the ground applied to the motor drive transistors. Tuning time (which is a function of motor speed) is maintained constant under the different torque requirements for the elements over the tuning range by using the back EMF (generated by the servo motors coasting between pulses) to control pulse width. Amplifiers Q5, Q6, Q8-Q11 of the Manual Speed Control Assembly operate from the standard 28 VDC output of the power supply. However, to provide constant reference voltages for critical circuits, unfiltered DC from the output of the bridge rectifier in the power supply is applied to series connected zener diodes VR1 and VR2 within the Manual Speed Control Assembly, resulting in regulated DC voltages of +10 and +20 VDC. The Manual Speed Control Circuit (figure 4.9) consists of an oscillator, a pulse generator, separate amplifier and switching stages for the two directions of motor rotation, and a speed sensing circuit.

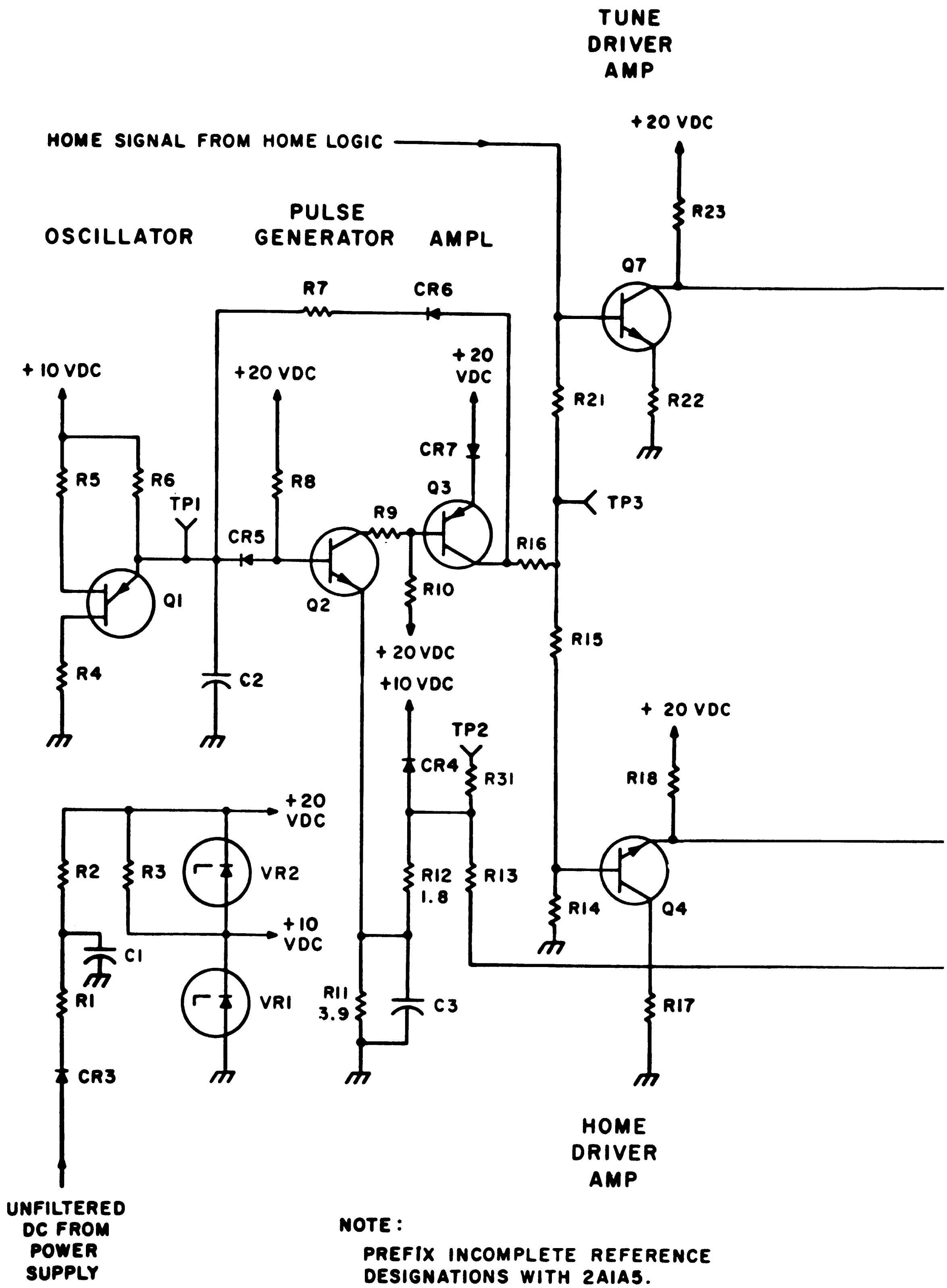
4.2.8.2 Pulse Generator Circuit Description. The oscillator consists of unijunction transistor Q1, which operates as a relaxation oscillator to provide a sawtooth wave, with repetition rate controlled by R6 and C2. The sawtooth wave is generated as C2 is slowly charged until Q1 becomes forward biased to conduct rapidly and discharge C2, providing a sawtooth wave signal to the cathode of diode CR5. Pulse Generator Q2 is normally biased to conduct by the 20 VDC applied to the base through R8. However, when C2 is discharged through Q1, a point will be reached where the voltage at the junction of CR5 cathode and C2 is lower than the voltage at CR5 anode (and Q2 base). Diode CR5 will conduct, grounding the base of Q2 through Q1, until the next cycle of the oscillator charges C2 sufficiently to back bias CR5. The resulting output from Q2 will be a series of pulses at the repetition rate of the oscillator, with pulse width controlled by the voltage divider network consisting of CR4, R12 and R11, and the input from comparator Q11 through R13 to the junction of CR4 and R12, as explained later.

Since the base of Q3 is connected to the collector of Q2, Amplifier Q3 will be on when Q2 is on, and off when Q2 is off. To prevent the sawtooth wave of the oscillator from being distorted by the different charging rates for C2 which will occur when CR5 is conducting and not conducting, diode CR6 is connected from the collector of Q3 to the junction of C2 and CR5. (When CR5 is conducting, the 20 VDC through R8 will charge C2. When CR5 is not conducting, the 20 VDC through CR7, Q3, CR6, and R7 will charge C2, thereby keeping the unijunction frequency constant for various pulse widths.)

The positive pulses on the collector of Q3 are applied to the base of Tune Driver Amplifier Q7 and Home Driver Amplifier Q4, causing Q7 and Q4 to conduct for the duration of each pulse. Tune Switch Q8 and Home Switch Q5 are normally forward biased to saturation by the 20 VDC applied to the base of each. However, when Driver Amplifiers Q7 and Q4 conduct, the bases of the switches are grounded through the driver amplifiers and the switches are turned off. This means that Tune Switch Q8 and Home Switch Q5 will be turned *on* to provide a ground path through the switch emitter and collector, only when pulse generator Q2 is turned *off* between pulses. This changes the constant ground applied to the emitter from the pushbuttons to an electrically governed pulsed ground, which is applied to the motor drive transistors as explained below.

4.2.8.3 Switching Circuit Description. When Mode Selector switch 2A1S1 is set at MANUAL or SILENT positions, a ground path is completed through contacts 12 and 1 on 2A1S1-front to the number 1 contacts on LEFT pushbutton 2A1S5 and RIGHT pushbutton 2A1S6, so that pushbuttons may be used for element positioning. Since the functional operation of each switch and associated circuits is the same, only the action of depressing the RIGHT pushbutton to cause the desired element in the RF-601A/CU to be positioned in the Tune direction will be covered. For positioning the elements in a Home direction, substitute LEFT pushbutton switch for RIGHT pushbutton switch, and Home transistor stages for Tune transistor stages.

Depressing RIGHT pushbutton 2A1S6 (figure 4.7) connects the ground applied to contact 1 from Mode Selector switch 2A1S1-front through normally closed contacts 1 and 2 of LEFT pushbuttons 2A1S5, normally open contacts 3 and 4 of RIGHT pushbutton 2A1S6 to Manual Speed Control Assembly 2A1A5 through 2A1J5-U. Within the Manual Speed Control Assembly (figure 4.7), the ground is applied to the Tune Switch, the Home Speed Sense Gate and the brake stabilizing circuits. Paragraph 4.2.8.5 explains the function of the brake stabilizing circuit. The ground applied through CR8 to the junction of R19 and CR10 turns off Home Speed Sense Gate Q6 during Tune operations. The ground applied through CR19 to Tune switch Q8 emitter will be applied through Q8 to the junction of diodes CR20 and CR23 each time Q8 is turned on from the pulse generator as explained above, resulting in a series of (ground potential) pulses at this point. The pulses are applied through CR20, and connection 2A1J5-X (figure 4.7) to wiper contact 12 of 2A1S3 front (L-C switch).



NOTE:

PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 2A1A5.

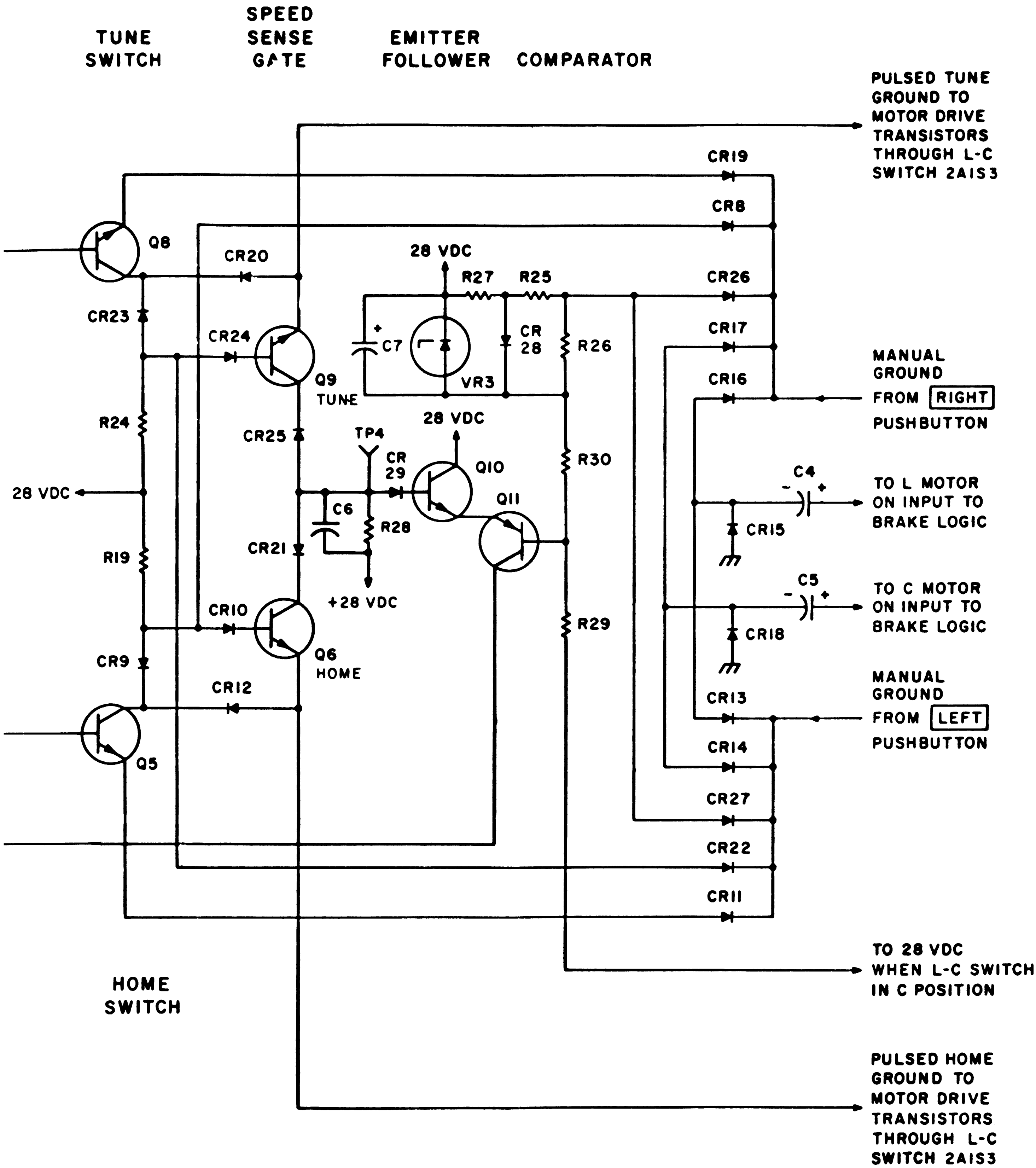


Figure 4.9. Manual Speed Control, Simplified Schematic Diagram

When L-C switch 2A1S3 is set at C (to position variable capacitor 1A2C1 in the RF-601A/CU) the pulses are applied through 2A1S3-front contacts 12 and 11 to the base of Motor Drive Transistor 2A1Q5. Each pulse will therefore energize the C servo in a Tune direction, as explained in paragraph 4.2.5. If a problem occurs which energizes the home logic (paragraph 4.2.9.2), the positive "home signal" applied to the servo amplifiers is also applied through connector 2A1J5-J to the base of Tune Driver Amplifier Q7 in the Manual Speed Control Assembly, to lock Q7 on (and Tune switch Q8 off) and thereby prevent the manual "tune" command from the RIGHT pushbutton from interfering with the home signal from the servo amplifier. (This also applies during silent modes of operation, when the elements are reset to home by the home logic.)

4.2.8.4 Speed Sensing Circuit Description. The speed sensing circuit has two functions. First, it compensates for variations in motor speed caused by differences in torque over the tuning range, and second it provides the L servo with a faster motor speed, to compensate for the greater number of revolutions required to cover the tuning range. Both functions are accomplished by varying the positive voltage applied to the emitter of pulse generator Q2, to vary pulse width (and thereby control the speed of the servo motors). Although the supply voltage to the servos is pulsed during pushbutton operation (by interrupting the ground return) the brakes are energized for the length of the operate command to the servo (time the pushbutton is depressed) since the motor brakes are not capable of following the pulsed voltage. This means the servos will coast between pulses. Assume that the RIGHT pushbutton has been depressed to apply ground pulses to the base of Motor Drive Transistor 2A1Q5 (paragraph 4.2.8.3). Between pulses, the 28 VDC applied through the divider network in C Servo Amplifier Assembly 2A1A1 will return the base of 2A1Q5 to approximately 28 VDC, and de-energize the servo. This voltage will also be applied from the base of 2A1Q5, back through contacts 12 and 11 of 2A1S3-front, (figure 4.7) and connection 2A1J5-X to the emitter of Tune Speed Sense Gate Q9 (figure 4.9). However, the servo, coasting between pulses will act as a generator to generate a voltage (back EMF) which will have the same polarity as the voltage applied during pulses. This voltage (which will of course vary with speed), will be applied back from the servo (and through connection 2A1J3-X for Motor Drive Transistor 2A1Q5) to the voltage divider network in the Servo Amplifier, where it will oppose part of the 28 VDC applied to the base of Motor Drive Transistor 2A1Q5 (through the line from the Manual Speed Control Assembly) at the emitter of Tune Speed Sense Gate Q9.

While Q8 is conducting, the pulses through CR20 which turn on the servo are also applied through CR23 to the junction of R24 and CR24 to turn off Q9 and prevent the 28 VDC through the emitter and collector of Q9 from affecting the pulses applied to the line to the motor drive transistor. Between pulses, Q9 will conduct, with the rate of conduction controlled by the base-emitter voltage, which will be the constant 28 VDC applied through R24 and CR24 to the base, and the positive voltage applied back from the base of the motor drive transistor to the emitter. When servo speed increases, the back EMF will oppose more of the positive DC present at the emitter, and Q9 will conduct more. This will effectively lower the voltage on the line to the base of Emitter Follower Q10 (through CR29), causing Q10 to conduct less, and causing the emitters of Q10 and Comparator Q11 to go less positive. Capacitor C6 in the base circuit of Q10 converts the pulsed DC to an average DC.

The collector of Q11 is tied to the voltage divider network consisting of R11, R12, and R13, at the emitter of Pulse Generator Q2. This means that variations in Comparator Q11 collector voltage will control Pulse Generator Q2 base-emitter voltage, and hence Q2 on-off time (pulse width). Normally, the base of Q11 is maintained at almost the potential of the emitter, by the 28 VDC applied through R27 and CR28. When a ground is applied through one of the pushbuttons, the ground for motor on pulses is also applied through diodes CR26 *or* CR27 to the junction of R25 and R26 to reduce the voltage applied to the base of Q11 through R27, CR28 and R30. When the L-C switch 2A1S3 is set at L and either LEFT or RIGHT pushbutton is depressed, the positive voltage through 6 volt zener diode VR3 will control the base of Q11, and Q11 will conduct heavily. However, when L-C switch 2A1S3 is set at C and either pushbutton is depressed, the positive voltage applied from the 28 VDC through 2A1S3-rear contacts 10 and 9 and resistor R29 in parallel with R30, CR28 and R27, will control the base of Q11, and the more positive voltage will result in a lower rate of conduction for Q11. The three different base reference voltages for Q11 will result in three different voltage levels applied from the collector to the voltage divider network at Q2 emitter and will result in three different levels of operation for Q2. Q2 "off" pulses (which become motor drive pulses at Q8 as explained in paragraph 4.2.8.2) will be relatively narrow when no pushbutton ground is present, medium for L servo operation, and relatively wide for C servo operation. C7 across VR3 imparts a time delay to the turn on of Q11. This allows the operator to move the tuning elements in small increments (necessary when near a tuned condition) lessening the tendency to overshoot. For either L or C servo operation, the variations in back EMF from the servo will vary Q11 emitter voltages (as explained above) which will generate corresponding variations in the voltage applied at the emitter of Q2, varying pulse width to control servo on time.

The functions of Home Driver Amplifier Q4, Home Switch Q5 and Home Speed Sense Gate Q6 are the same as their counterparts in the Tune circuit, and speed is controlled in the same manner. Although the application of a tune signal to the C servo was only covered, the selection of tune or home signals to either the L or C servo are a function of the contacts of the L-C switch 2A1S3, and the LEFT and RIGHT pushbuttons 2A1S5 and 2A1S6, and servo operation and speed control are the same.

4.2.8.5 Brake Stabilizing Circuit Description. When either (C or L) servo is turned on, the brake logic receives a constant ground signal from the motor circuits in the RF-601A/CU which causes the brake logic to energize the brake for the on servo. During silent or manual modes, when pushbutton operation causes the motor on signal to be pulsed, the resulting pulsed input to the brake logic would cause the brake to chatter. This is prevented by the filtering action of C4 for the L servo or C5 for the C servo, on Manual Speed Control Assembly A5. When the RIGHT pushbutton is depressed to energize the servo as explained above (paragraph 4.2.8.3) the ground applied from the pushbutton through connection 2A1J5-U and CR19 to turn on the servo is also applied from 2A1J5-U through diodes CR17 to C5 for the C servo brake logic, and CR16 to C4 for the L servo brake logic. During the periods when the C servo is pulsed on, as explained above, capacitor C5 is discharged through 2A1J5-W to the "C motor on" input to the brake logic at 2A1J1-R. Between motor on pulses, the discharged capacitor C5 will delay the return of the "C Motor on" line potential to sufficient positive voltage to de-energize the brake logic (and the servo brake). When the LEFT pushbutton is depressed, a ground is applied to C5 through CR14 and to C4 through CR13. (Capacitor C4 functions in a similar manner to prevent the L servo brake from de-energizing between pulses.

4.2.9 LOGIC CIRCUITS.

4.2.9.1 General. The logic circuits provide the necessary control signals in the proper sequence to automatically position the tuning elements for any selected operating channel. These circuits are basically all located in the RF-601A/C with the exception of the end stop switches which are located in the RF-601A/CU. The RF-601A protection circuits are also included in the logic to interrupt the tuning cycle and/or inhibit operation if a malfunction or overload develops. Figure 4.10 illustrates, and paragraphs 4.2.9.2 through 4.2.9.7 explain the sequencing of the automatic tuning cycle.

1. Tuning cycle is initiated by:	a. Setting POWER switch at ON. b. Disturbing the setting of the Exciter frequency controls. c. Depressing the RETUNE pushbutton. d. An arc caused by excessive RF line voltage.
2. Home logic activates, energizing:	a. Servo motors (toward home). b. Keyline interlock.
3. When tuning elements reach home:	a. Servo motors are de-energized. b. Reset signal is generated. c. Keyline remains interlocked.
4. Reset signal generated above energizes:	a. Tune power signal to transmitter. b. Tune sensitivity drive signal to servo amplifiers.
5. Cycle halts at this point until transmitter is keyed.	
6. Keying transmitter causes release of keyline interlock, allowing transmitter to supply RF to the RF-601A.	
7. RF through discriminators results in discriminator error signal outputs which energize servo amplifiers, motor control circuits, and servo motors.	
8. Energizing servo motor(s) produces a motor-on signal(s).	
9. Motor-on signal(s)	a. Locks system in keyed condition. b. Locks on tune sensitivity drive signal to servo amplifiers. c. Locks on tune power signal to transmitter.
10. When tuning elements have reached a tune position:	a. Servo motors de-energize. b. System key is released. c. Tune sensitivity drive signal is removed from servo amplifiers. d. Tune power signal is removed from transmitter. e. READY light is energized.
11. System is tuned and ready for full power operation. Fine tuning will be accomplished as required during the transmission.	

Figure 4.10. RF-601A Antenna Coupler Group, Automatic Tuning Sequence Diagram

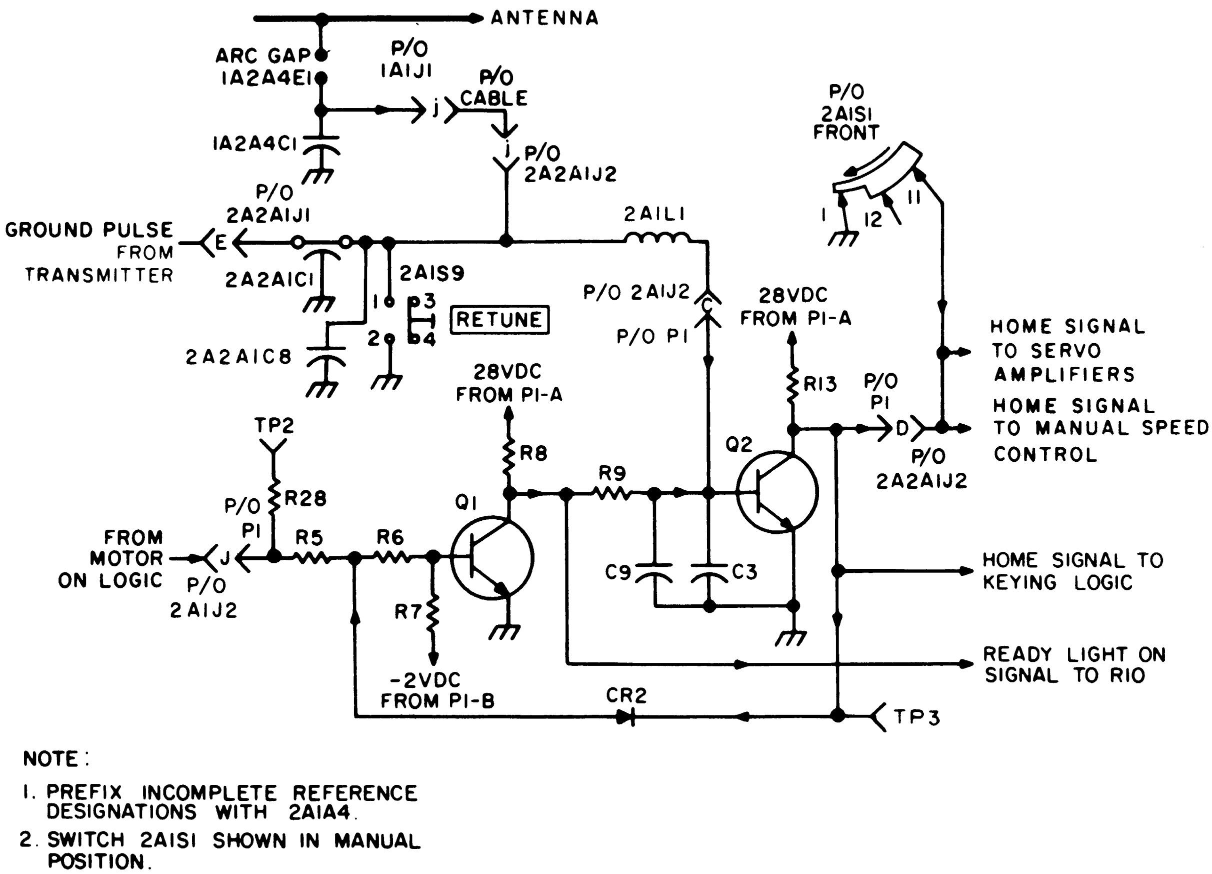


Figure 4.11. Home Logic, Simplified Schematic Diagram

4.2.9.2 Home Logic. The home logic (figure 4.11) consists of two inverters (Q1 and Q2) and a clamp (CR2) which function as a flip-flop. This circuit is used only during the automatic or silent modes of operation. When a home cycle is initiated, this circuit produces the necessary output to drive the tuning elements home (that is to the predetermined starting position). A home cycle is initiated by turning the primary power on, changing the Exciter operating frequency, or depressing the RETUNE switch, or by a ground from the arc gap, all as described below.

Applying primary power results in the base of transistor Q2 momentarily being pulled to ground by capacitor C3. When the Exciter operating frequency is changed, a ground pulse is applied through pin E of connector 2A2A1J1, feedthru capacitor 2A2A1C1, RF suppression filter 2A2A1C8 and 2A1L1, and pin C of connectors 2A1J2 and P1 to the base of transistor Q2. Depressing the RETUNE switch, or a ground from the arc gap, also produce a momentary ground pulse at the base of transistor Q2. Therefore, in each of the four conditions, the base of transistor Q2 is (momentarily) grounded, forcing transistor Q2 off, if it was on. When transistor Q2 is off, the positive level at its collector (the "home signal") is applied to the servo amplifiers to energize the servo motors to drive the tuning elements home (paragraph 4.2.4). In addition, the home signal is applied to the interlock logic to prevent the system from being keyed during the home cycle (paragraph 4.2.9.6), and to the Manual Speed Control assembly to lock the tune switching circuit off thereby preventing a manual tune command from interfering with the Home logic, possible in silent operation (paragraph 4.2.8.3).

When the motors energize, the motor-on logic is turned on (paragraph 4.2.9.3), applying a positive level through pin J of connectors 2A1J2 and P1 and resistors R5 and R6 to the base of transistor Q1. This turns on transistor Q1, grounding the base of transistor Q2. Therefore, transistor Q2 and the ready light logic (paragraph 4.2.9.7) are clamped at ground until the tuning elements reach home. At this time, the servo motors de-energize (by tripping their home end stop switches), removing the positive motor-on signal from base of transistor Q1. This turns transistor Q1 off, turning transistor Q2 on through resistors R8 and R9. When transistor Q2 turns on, the base of transistor Q1 is clamped to ground through the small collector-to-emitter resistance of transistor Q2 and diode CR2. This prevents motor-on-signals generated during the tuning and operating cycles from re-energizing the home logic. The positive level at the collector of transistor Q1 is now applied as the "ready light on signal" to the ready light logic (paragraph 4.2.9.7). During manual operation, the output from the home logic is inhibited by the ground applied through contacts 1 and 11 of switch 2A1S1-front. Capacitor C9 is an RF bypass.

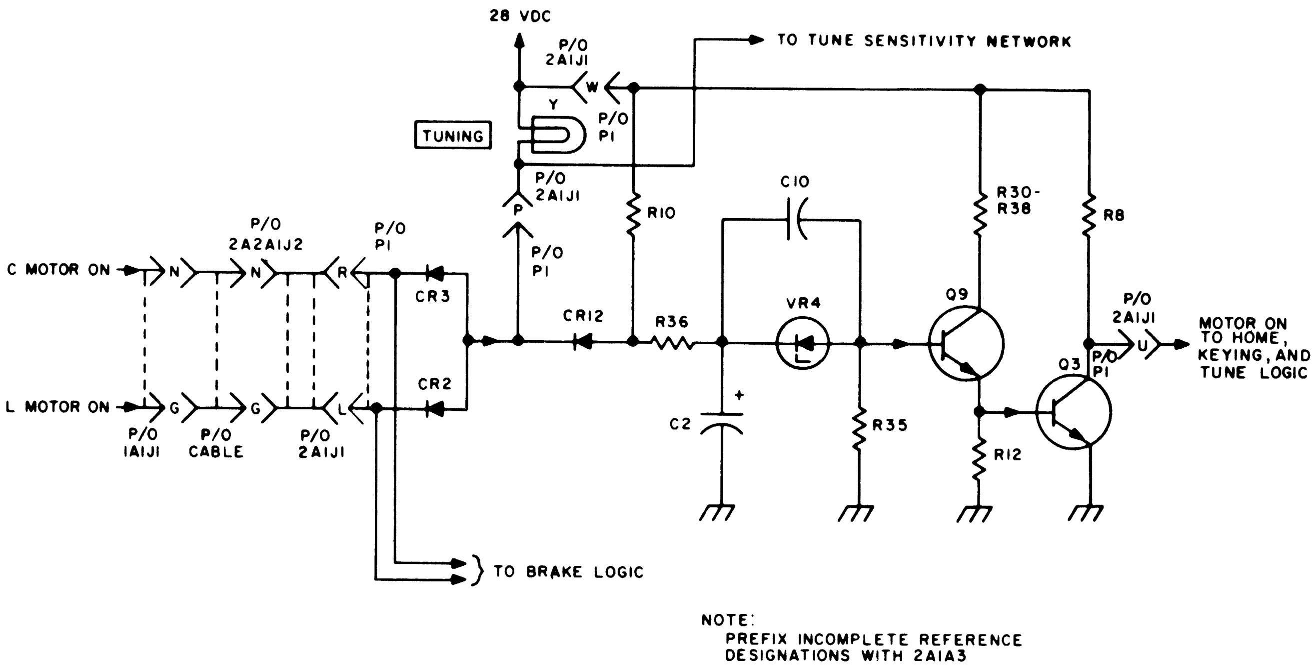


Figure 4.12. Motor-On Logic, Simplified Schematic Diagram

4.2.9.3 Motor-on Logic. The motor-on logic (figure 4.12) consists of a driver (Q9), and inverter (Q3), and various gates. The function of this circuit is to generate a positive level for application to the keying logic (paragraph 4.2.9.6), tune logic (paragraph 4.2.9.5), and home logic (paragraph 4.2.9.2) whenever either or both of the servo motors have an energizing voltage applied. This circuit is used only during automatic and silent operation.

When the servo motors are not energized, Zener diode VR4 conducts through resistors R35, R36, and R10. This forward biases transistor Q9, turning on transistor Q3. The collector of transistor Q3 will effectively go to ground, removing the positive level from the keying, tune,and home logic circuits. The two inputs to the motor-on logic are also the inputs to the brake logic; they come from the motor control circuits in the form of a ground whenever a servo motor is energized (paragraph 4.2.5). This ground is applied through diode CR3 and/or diode CR2 and diode CR12 to the junction of resistors R36 and R10. This turns Zener diode VR4 and transistors Q9 and Q3 off, allowing the voltage at the collector of transistor Q3 to go positive. This positive level is then applied as the "motor-on signal" to the home, keying, and tune logic circuits. Zener diode VR4 is included to ensure proper cut-off of transistor Q9, since the L-and C-motor-on grounds do not actually go all the way to ground, but remain 3 to 4 volts positive because of the diode junction drops in the motor control circuits. Since this is less than the 6.2 volt drop of VR4, the Zener diode will not conduct, forcing transistor Q9 off. Capacitor C2 and resistor R10 delay the turn-on of transistor Q9 for a short time when the motors de-energize, thus preventing the motor-on signal from de-energizing when the motors repeatedly reverse direction of rotation while approaching the tune point. This assures that the home logic and tune logic circuits do not become locked off prematurely, before the actual tune point is reached (paragraphs 4.2.9.2 and 4.2.9.5). Resistor R35 provides a discharge path for capacitor C2. Capacitor C10 is an RF bypass.

The L- and C-motor-on grounds are applied to the brake logic at the same time that they are applied to transistor Q9 to release the motor brakes (paragraph 4.2.9.4). When the motors are energized, the ground(s) used to turn off transistor Q9 are also applied through pin P of connectors P1 and 2A1J1 to TUNING indicator 2A1DS3, energizing it to provide an indication that the tuning cycle is in process, and to the tune sensitivity network (paragraph 4.3.9.4).

4.2.9.4 Brake Logic. The brake logic (figure 4.13) consists of two identical circuits; one for controlling the brake on servo motor 1A2A1B1, and one for controlling the brake on servo motor 1A2A3B1. In each case, the circuit consists of two inverters (Q2 and Q7) or (Q6 and Q8).

Each of the motors has a mechanical brake which releases so long as current is driven through the brake winding. The reference designations used in the discussion are for the L brake logic circuit. When L servo motor 1A2A3B1 is not energized, the L-motor-on signal is absent, thus Zener diode VR5 conducts, turning on transistor Q2. Transistor Q2 conducts into saturation, effectively causing the collector to go to ground. This ground turns off transistor Q7, preventing conduction through the motor brake winding. Therefore, a brake is engaged. When the energizing potential is applied to the motor, a motor-on ground is applied to Zener diode VR5 at the same time that it is applied to the motor-on logic (paragraph 4.2.9.3). This ground turns off Zener diode VR5 and in turn transistor Q2, allowing its collector to go positive and forward bias transistor Q7. Therefore, transistor Q7 is turned on and conducts through the motor brake winding. This current flow through the brake winding disengages the motor brake, permitting the L servo motor to rotate the variable coil tuning element. Zener diode VR5 assures that transistor Q2 is turned off by the motor-on ground signal, which is slightly above ground (as in the motor-on logic). Resistor R9 and capacitor C9 form a transient suppressor circuit to prevent the high voltage transients, produced by halting the current flow through the brake windings, from damaging transistor Q7. During manual pushbutton operation, capacitor C5 on the manual speed control assembly prevents the motor-on input from turning off VR5 between pulses, and causing brake "chatter" (paragraph 4.2.8.5).

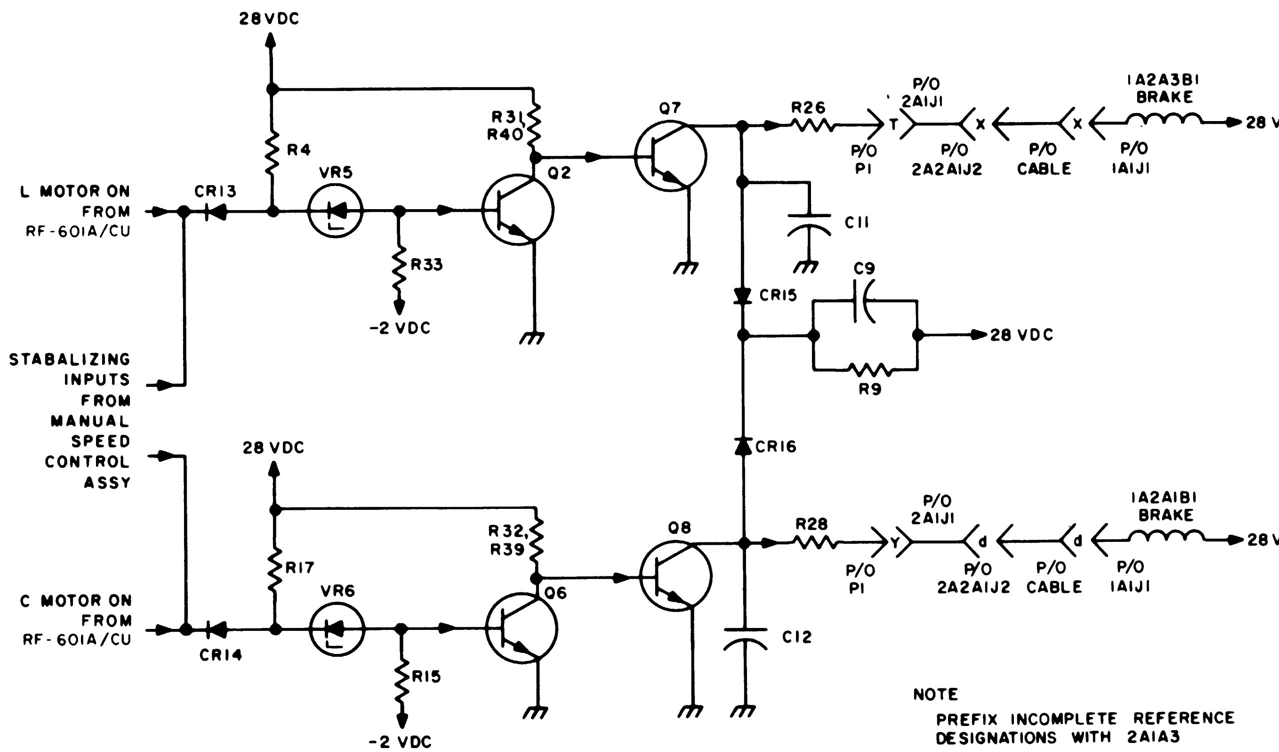


Figure 4.13. Brake Logic, Simplified Schematic Diagram

4.2.9.5 Tune Logic. The tune logic (figure 4.14) consists of two inverters (A4Q4 and A4Q5) and various other associated components. The function of this circuit is to provide (1) a "tune power signal" for application to the transmitter to reduce the RF power level to 150 watts while tuning, and (2) a positive "tune sensitivity drive signal" to increase the sensitivity of the servo amplifiers during the tuning cycle (paragraph 4.2.4). This circuit is used only during automatic operation.

When the variable inductor tuning element reaches the home position, the normally open contacts of end stop switch 1A2A3S2 close. This applies ground through pin T of connector 2A2A1J2 to pin F of connector 2A2A1J1 from which it is connected to the transmitter so that when the system is keyed, the RF power level will be limited to 150 watts for tuning. In addition, this "reset ground" is applied through pin K of connectors 2A1J2 and P1 to the ready light logic (paragraph 4.2.9.7). Also, the ground is applied through diode A4CR10 to the base circuit of transistor A4Q5. Transistor A4Q5 normally conducts, grounding the tune sensitivity drive input to the servo amplifiers by grounding the cathode of A6CR3. The ground applied to the base circuit turns off A4Q5, removing the ground from the cathode of A6CR3, applying a positive tune sensitivity drive input to the servo amplifiers to increase their sensitivity (paragraph 4.2.4).

Since the tune power signal is applied to the transmitter when the variable coil tuning element reaches home, momentarily keying the system results in a reduced RF power level being applied to the RF-601A/CU. Application of the RF power causes the discriminators to produce error signals and activate the servo loops causing C and/or L servo(s) to turn on. The ground applied from the (C or L) motor-on line to the input of the motor-on logic and to the TUNING indicator (paragraph 4.2.9.3) energizes the motor-on logic resulting in a positive motor-on signal being applied to the tune logic, and a ground "tuning-signal" being applied to the tune sensitivity network. The positive motor-on signal is applied through pin J of connectors 2A1J2 and A4P1 and isolation resistor A4R19 to the keying logic circuit as the "key hold signal" to lock the system in a keyed condition during the tuning cycle. In addition, the positive motor-on signal is applied to voltage divider A4R22-R21, forward biasing transistor A4Q4, causing its collector to go to ground and lock inverter A4Q5 off. The tune power ground and positive tune sensitivity drive signals are thus maintained until the tuning cycle is complete.

At the completion of the tuning cycle, the servo loops de-energize, turning off transistor A4Q4, and turning on transistor A4Q5. Therefore, the tune sensitivity drive signal goes to ground and the tune power signal goes positive. The conduction of transistor Q5 also grounds the base circuit of transistor Q4 through clamping diode CR9, preventing transistor Q4 from turning on. Therefore, when the system is keyed for full power operation, motor-on signals produced by the fine tuning process will not activate the tune or keying logic circuits. During manual and silent operation, the tune and keying logic are inhibited by the ground applied through contacts 1 and 12 of switch 2A1S1-front.

The tune sensitivity network is normally inactive, and the tune sensitivity drive signal is controlled through A4Q5 as explained above. At some frequencies, however, the proper tuning point requires a very exact setting of the L and C elements to eliminate discriminator error signals large enough to actuate the servos while the positive tune sensitivity drive signal is applied to the servos. At these frequencies, the slight overshoot of the servo motor(s) caused by the delay between application of the brake and motor stop, will cause the motors to hunt back and forth, or "chatter" as the rapidly reversing error signals cause the motors to repeatedly overshoot in first one direction then the other. This results in a rapid series of motor-on signals, which are applied as a pulsed ground "tuning signal" through 2A1J1-P (from the C and/or L motor-on lines) to the junction of A6C3 and A6C1 in the tune sensitivity network. The pulses are applied through A6C3 to a voltage doubler consisting of A6CR1-CR2, developing a negative voltage at the anode of A6VR1. When this negative voltage exceeds the turn-on voltage of 6.2 volt Zener A6VR1, A6VR1 will suddenly conduct, grounding the tune sensitivity drive signal from A4Q5. When this happens, the servo amplifiers will be returned to their normal sensitivity. At normal sensitivity, the small discriminator error signals caused by motor overshoot will not turn on the servos and the tune logic will then return to its normal state, with A4Q5 conducting and grounding the tune-sensitivity drive input to the servos. When the servo motors "chatter" stops, the ground pulses will be removed from the tune sensitivity network. The negative charge on A6C4 will be dissipated through bleeder resistor A6R1 and A6VR1 will turn off, returning the tune sensitivity network to its normally inactive state.

4.2.9.6 Keying Logic. The keying logic (figure 4.15) consists of a DC amplifier (2A1A3Q4), two inverters (2A1A3Q5 and 2A1Q4Q3), the RF-601A/CU pressure and temperature overload circuitry, and various other gates and parts. The functions of this circuit are (1) to interlock the keyline to prevent keying during the home cycle, (2) to hold the system keyed during the tuning cycle, and (3) to interlock the transmitter key circuits to prevent the system from being keyed if there is a temperature or pressure overload or if one of the tuning elements is run against its far end stop. The keying portion of the circuit is used only during automatic operation. However, the interlock portion of the circuit is used in all modes of operation.

While the tuning elements are being driven home during a home cycle, the home logic (paragraph 4.2.9.2) applies a positive level through diode gate CR5 to voltage divider R17-R18. This forward biases transistor Q3, causing the collector to go to ground. The ground is applied through pin F of connectors P1 and 2A1J2, feedthru capacitor 2A2A1C5, pin J of connector 2A2A1J1, and the interconnecting cabling to the transmitter. Within a compatible transmitter, this ground inhibits the keying circuit to prevent the transmitter from applying an RF output to the RF-601A/CU. At the completion of the home cycle, and if a ground does not exist on the keyline, transistor Q3 is held on by the 28 VDC applied to base voltage divider R17-R18 through resistor R15 and diodes CR6 and CR7.

When the tuning cycle is initiated by momentarily keying the system, the motor-on and tune logic circuits (paragraphs 4.2.9.3 and 4.2.9.5) provide a positive key hold signal through pin J of connectors 2A1J1 and P1 to voltage divider 2A1A3R20-R21. This positive level turns on transistor 2A1A3Q4, which in turn biases transistor 2A1A3Q5 on, causing its collector to go to ground. This ground is applied through pin K of connectors 2A1A3P1 and 2A1J1, feedthru capacitor 2A2A1C2, pin B of connector 2A2A1J1 and the interconnecting cabling to the transmitter. Transistor 2A1A3Q5 also grounds resistor R15, removing forward bias on transistor Q3 to release the keyline interlock and permit RF power to be generated by the transmitter. The tune logic maintains a low power RF output from the transmitter until the tuning cycle

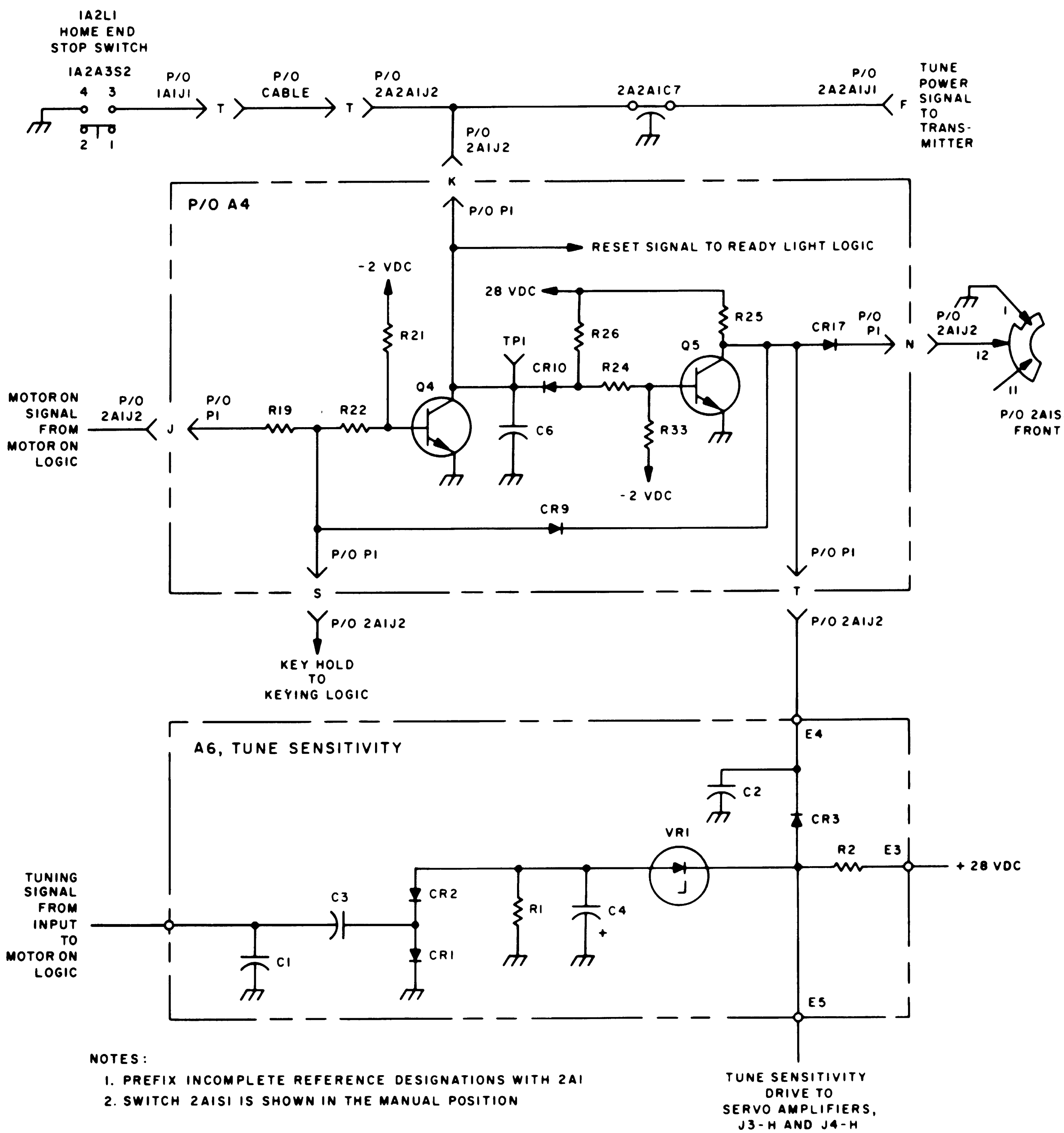


Figure 4.14. Tune Logic, Simplified Schematic Diagram

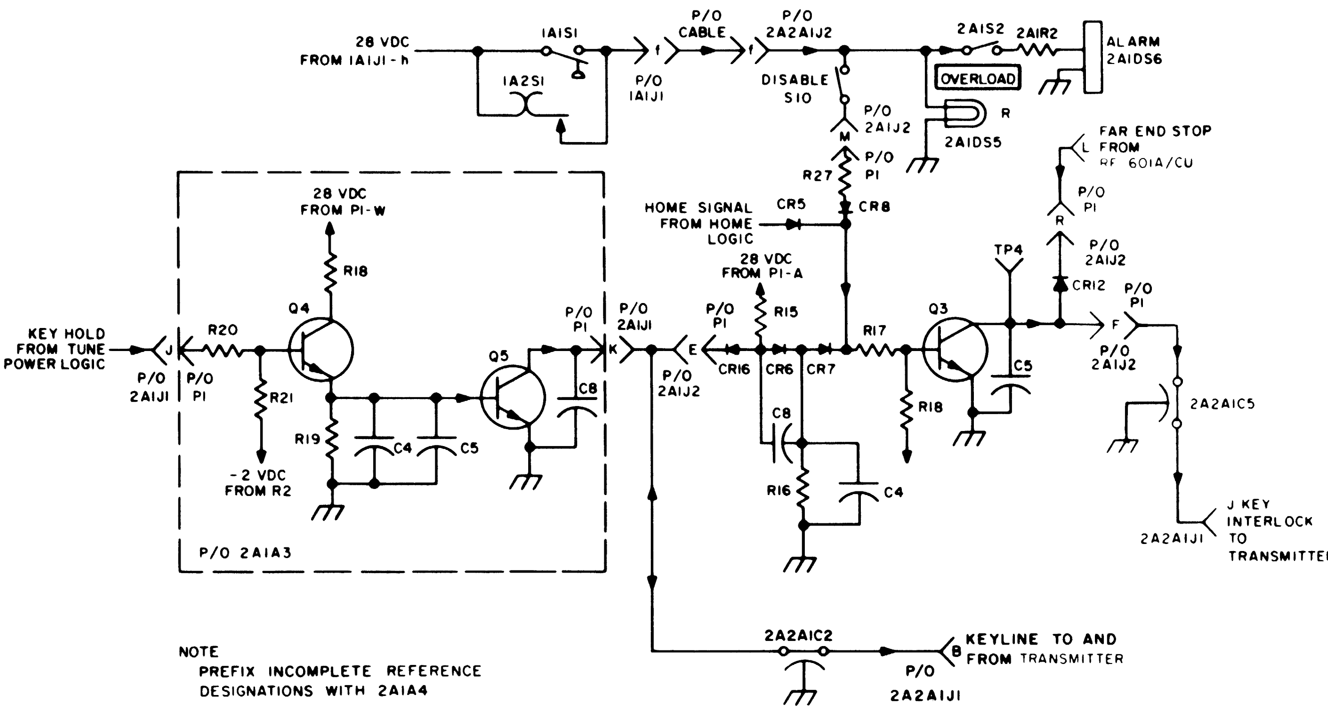


Figure 4.15. Keying Logic, Simplified Schematic Diagram

has been completed. At the completion of the tuning cycle, the key hold signal goes away, releasing the ground on the system keyline and re-applying the ground to the keyline interlock line. The RF-601A is now ready for full power operation.

Each time the system is keyed, capacitor C4 delays the release of the key interlock ground (and therefore the application of RF power) for a period of time sufficient to allow the rotary solenoid in the bypass circuit (paragraph 4.2.10) to de-energize. The duration of this delay is determined by the discharge of capacitor C4 through resistors R16 and R17. Capacitors C5, C8, 2A1A3C4, and 2A1A3C8 assures that transistor 2A1A3Q5 will have adequate base drive to remain fully saturated even when supplying the peak currents required on the keyline.

If the temperature within the RF-601A/CU becomes excessive or the pressure decreases below about 2 PSIG, switch 1A2S1 or 1A1S1 will close and apply 28 VDC through pin f of connector 1A1J1, the interconnecting cabling, and pin f of connector 2A2A1J2, to Disable switch 2A1S10, OVERLOAD indicator 2A1DS5 and through OVERLOAD switch 2A1S2 and resistor 2A1R2 to alarm 2A1DS6 which provide visual and audible indications that an overload exists. When Disable switch 2A1S10 is set at its normally closed position, the 28 VDC will be applied through the switch, Pin M of connectors 2A1J2 and P1, resistor R27, and diode CR8 to the base circuit of inverter Q3. This grounds the key interlock, removing RF power until the overload condition is removed, or until 2A1S10 is set at off, to open the line and permit emergency operation (see paragraph 3.3 for emergency operations procedure).

4.2.9.7 Ready Light Logic. The ready light logic (figure 4.16) consists of driver Q6, and various diode gate and switching circuits. The function of these circuits is to light READY indicator 2A1DS4 when the tuning cycle has been completed. These circuits are operational only in the automatic mode.

During the home portion of the tuning cycle, the base of transistor Q6 is held at ground through transistor Q1 in the home logic. At the completion of the home cycle, this line goes positive. However, the reset line holds the base of transistor Q6 at ground throughout the tuning cycle; initially through the end stop switch when the variable inductor is at home, and then through inverter Q4 in the tune logic (paragraph 4.2.9.5). These grounds inhibit the positive output from the home logic from turning on driver Q6. At the completion of the tuning cycle the inhibits are removed, allowing the positive output from the home logic to be developed across voltage divider R11-R12. This forward biases driver Q6, allowing READY indicator lamp 2A1DS4 to ground through transistor Q6.

If one of the elements traverses to the far end stop (end opposite home position), a ground is applied through end stop switch 1A2A1S1 or 1A2A3S1, pin L of connector 1A1J1, the interconnecting cable, pin L of connector 2A2A1J2, pin R of connectors 2A1J2 and P1, and diode CR3 to the base of driver Q6. This prevents the READY light from lighting, indicating that a malfunction has occurred, and inhibits future transmissions.

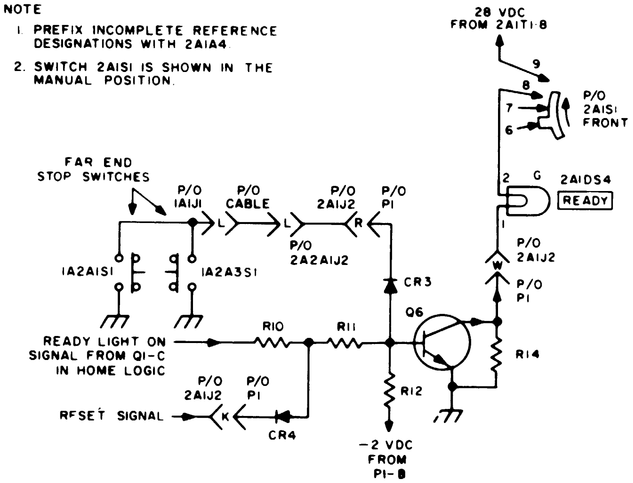


Figure 4.16. Ready Light Logic, Simplified Schematic Diagram

4.2.10 COUPLER BYPASS CIRCUIT.

The coupler bypass circuit (figure 4.17) consists of a single switching circuit (2A1A3Q1). The function of this circuit is to energize rotary solenoid 1A2K1 when reception is being made on a frequency different from that being used for transmission and to provide an output, slaved to the keyline, which will disable the servos (automatic and silent tuning) to prevent accidental false tuning during reception. (A strong signal from a nearby transmitter on a different operating frequency could induce voltages in the RF-601A/CU antenna tuning network, strong enough to generate discriminator error signals which would activate the servo networks).

When the system is receiving (not keyed), Zener diode 2A1A3VR3 conducts, turning on transistor 2A1A3Q1, and grounding its collector. The ground is applied through pin E of 2A1A3P1 and 2A1J1 to the BYPASS switch, and through pins U of 2A1J3 (for C Servo Amplifier Assembly A1) and 2A1J4 (for L Servo Amplifier Assembly A2). On each servo amplifier assembly, the ground is applied through diodes CR4 and CR5 to the bases of Q6 and Q4 respectively, in the cross-coupled amplifier, disabling the cross-coupled amplifier, and thereby preventing any discriminator error signals from activating the servos.

If BYPASS switch 2A1S4 is set at ON, the ground applied to the switch from Q3 is applied through switch 2A1S4, pin g of connector 2A2A1J2, the interconnecting cable, and pin g of connector 1A1J1 to one side of rotary solenoid 1A2K1. Since the other side of its coil is at 28 VDC, the rotary solenoid energizes and shunts the RF line from the input of the RF-601A/CU around the tuning elements (paragraph 4.2.1). In addition, the ground through the BYPASS switch is applied to BYPASS indicator 2A1DS1, causing it to light and provide visual indication that the RF-601A is in a receiving condition, with its antenna tuning elements switched out of the antenna circuit.

When the system is keyed for transmitting, ground is applied through pin K of connectors 2A1J1 and 2A1A3P1 to the cathode of diode 2A1A3CR4, dropping the voltage applied to Zener diode 2A1A3VR3 below its threshold. Transistor 2A1A3Q1 then turns off, removing the ground disable from the servo amplifier assemblies, and de-energizing the rotary solenoid. A time constant circuit is used in the keying logic (paragraph 4.2.9.6) to maintain the key interlock activated when the system key is released, thus delaying application of RF to the transmission line until the rotary solenoid has had time to de-energize. The time constant of resistor 2A1A3R3 and capacitor 2A1A3C7 prevents the rotary solenoid from energizing until the RF has had time to completely decay.

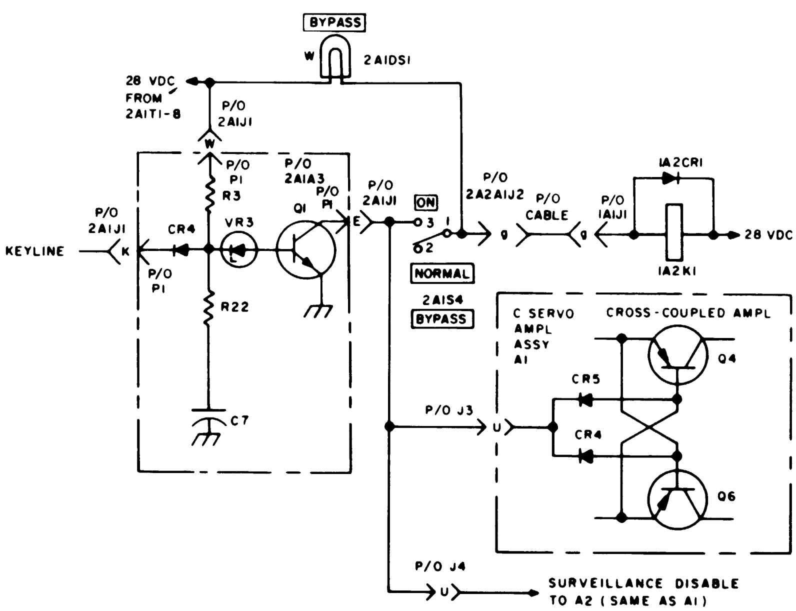


Figure 4.17. Coupler Bypass Circuit, Simplified Schematic Diagram

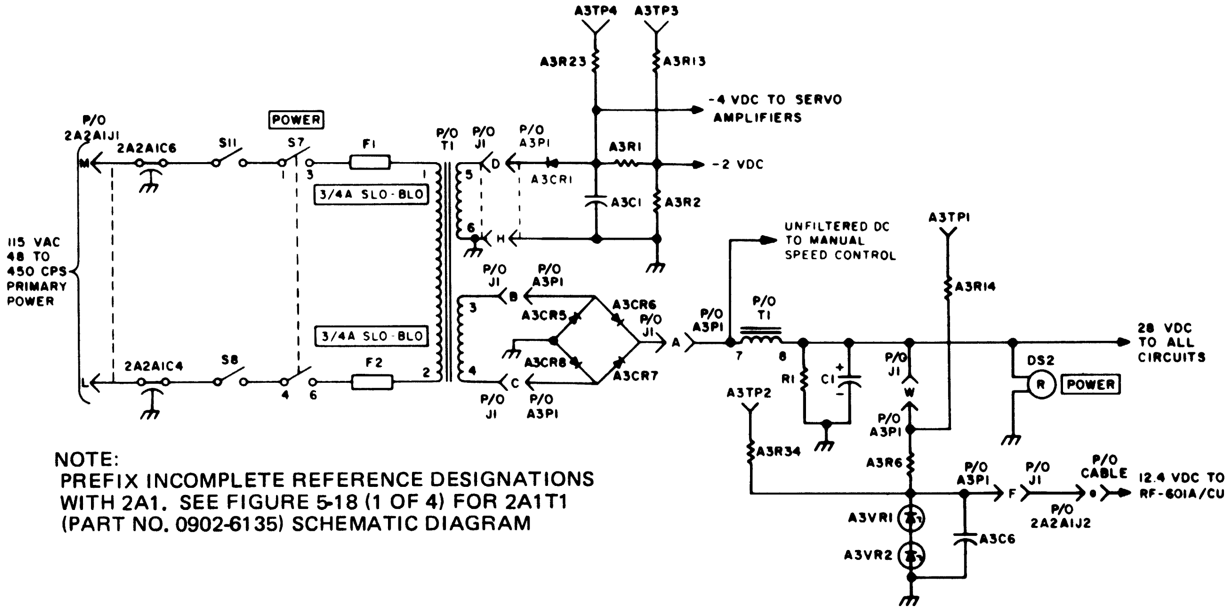


Figure 4.18. Power Supply, Simplified Schematic Diagram

4.2.11 POWER SUPPLY.

The power supply (figure 4.18) consists of a transformer (T1), rectifiers (A3CR1 and A3CR5 through A3CR8), and various other components. This circuit produces all DC operating voltages required by the RF-601A.

The 115 VAC, 48 to 63 or 350 to 450 Hz, single phase primary power is applied through pins M and L of connector 2A2A1J1, feedthru capacitors 2A2A1C6 and 2A2A1C4, interlock switches S11 and S8, POWER switch S7, and fuses F1 and F2 to the primary of transformer T1. Interlock switches S11 and S8 interrupt the primary power when the RF-601A/C chassis is extended from its case. Transformer T1 secondary 3-4 steps down the 115 VAC and applies the resulting voltage through pins B and C of connectors J1 and A3P1 to full-wave bridge rectifier A3CR5 through A3CR8. The DC output from the bridge rectifier is applied through pin A of A3P1 and J1 to the inductor portion of T1 (terminals 7-8) and through pin B of connectors J5 and A5P1 to Zener diodes A5VR1 and A5VR2 to provide zenered 10 and 20 VDC on the Manual Speed Control Assembly. The bridge rectifier output is filtered by the inductor portion of T1 and capacitor C1 to provide 28 VDC operating voltage for the servo motors, transistor circuits, relays, and indicator lamps. POWER indicator DS2 lights when the power supply has energized. The filtered 28 VDC also supplies the 12.4 VDC regulator which consists of Zener diodes A3VR1 and A3VR2 and resistor A3R6. The 12.4 VDC is applied to the position potentiometers in the RF-601A/CU to enable the position of the tuning elements to be accurately determined with the ELEMENT POSITION meter.

The 115 VAC primary power is also stepped down by transformer T1 secondary 5-6 and applied through pin D of connectors J1 and A3P1 to half-wave rectifier A3CR1. The output from this rectifier is filtered by capacitor A3C1 to provide -4 VDC to the servo amplifiers (paragraph 4.2.4). The -4 VDC is also divided to -2 VDC by resistors A3R1 and A3R2. This voltage is used in the transistor stages in the logic circuits as a base return to ensure reliable cutoff.

Units with 2A1T1 (part no. 0902-6135) may be strapped to use a 230 VAC, 48 to 63 or 350 to 450 Hz single phase primary power source.

4.2.12 HEAT EXCHANGER.

The fan used in the heat exchanger (figure 4.19) can be operated from a 48 to 63 or 350 to 450 Hz, 115 volt, single phase primary power source. The

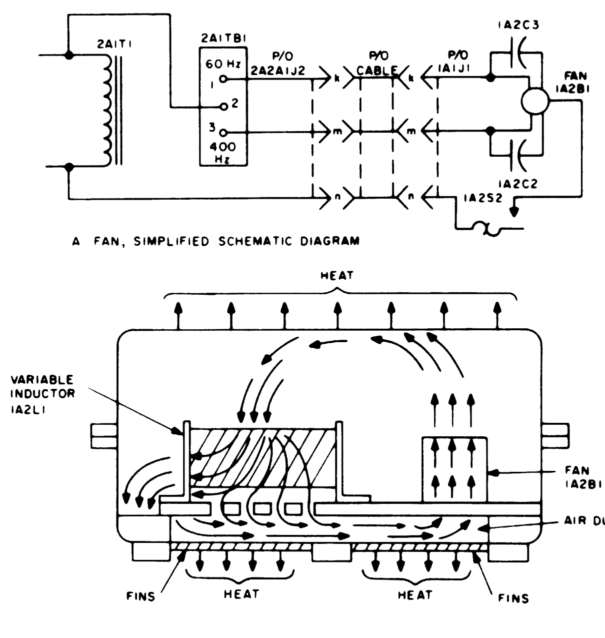


Figure 4.19. Heat Exchanger

power applied to the primary of transformer 2A1T1 is applied to either the 60 Hz or 400 Hz input of fan 1A2B1 by connecting terminal 2 of terminal board 2A1TB1 to either terminal 1 or terminal 3 at the time of installation according to the frequency of the primary power source. The common (AC return) line for the fan is connected through contacts on thermal switch 1A2S2, which close to permit fan operation when cooling is required.

The fan and case form a heat exchanger which is used to dissipate the heat produced by inductor 1A2L1 (heat producing element). The fan circulates the nitrogen atmosphere over and through the inductor, and then through the air duct between the bottom of the case and the chassis. The heat is transferred to the nitrogen as it passes over the inductor, and then from the nitrogen to the case as it passes through the air duct. The heat is transferred from the case to the outside air and mounting structures by a combination of conduction, convection, and radiation.

4.3 SYSTEM TROUBLESHOOTING.

Table 4.1 is not intended to be a complete troubleshooting chart. Instead, it provides a listing of symptoms and probable faults most likely to be encountered when troubleshooting the equipment. This quick reference information may isolate a problem area without the requirement of a detailed analysis.

Table 4-1. Troubleshooting

Symptom	Probable Fault
RF power is removed as soon as TUNE KEY is released during automatic operation.	1. Defective motor-on logic. 2. Defective tune logic. 3. Defective keying logic.
System can not be energized.	1. RF-110 HF Power Amplifier POWER is not set at ON. 2. Open interlock switch 2A1S8 or 2A1S11. 3. Open fuse 2A1F1 or 2A1F2.
A tune condition can not be achieved (VSWR less than 1.5:1)	1. Defective or unbalanced servo amplifier. 2. Defective forcing. 3. Defective or mistuned discriminator assembly. 4. No tune sensitivity drive. 5. Adequate tune power not maintained throughout time cycle.
Erratic logic signals during silent or automatic operation.	Defective -2 VDC power supply.
Can not tune at low frequencies (2 to 6 MHz).	Defective forcing.
Tuning elements can not be repositioned.	Defective brake logic.
Fuse 2A1F1 or 2A1F2 opens.	1. Shorted power transistor (2A1Q1 through 2A1Q8). 2. Defective home logic. 3. Defective 28 VDC supply.
No RF power applied during automatic operation.	1. Defective home logic. 2. Defective keying logic.
Elements do not go to home when frequency is changed.	1. No ground pulse from transmitter. 2. Defective home logic.
After homing, TUNING lamp does not come on when system is keyed.	1. Inadequate RF power for tuning. 2. Faulty or mistuned discriminator(s). 3. Faulty or misbalanced servo amplifiers. 4. Faulty motor drive transistors.
System does not lock in the system key to maintain RF signal for tuning; however will tune if system is held keyed manually.	1. Faulty brake logic or brakes. 2. Motor drive system jammed.
Ready light does not come on at completion of tuning.	1. Tuning element run up against far end stop switch.

SECTION 5
MAINTENANCE

5.1 MAINTENANCE DATA.

Other maintenance aids in this manual are as follows; Fig. 1.1, Relationship of Units, Reference data, Para. 1.3, Fig 2.1, Outline Drawing, Fig 2.3, Interlocks, Fig. 2.4, Interconnections, Pressurization, Para 2.9, Table 2.1, Cables, Table 2.2 and 2.3, Cable pin connections.

Figure 3.1, Controls and Indicators, Table 3.1, Control Descriptions and Normal Meter/Indicator Readings for Operation and Test. Operating Procedures, Operator Maintenance, para. 3.4, Table 3.2, Preventive Maintenance Checks, Table 3.3, Flow Chart for Manual Tuning.

Circuit Description and Theory, Section 4, Fig. 4.1, Overall Functional Block Diagram, Simplified circuit Diagrams, Fig. 4.10, Automatic Tuning Sequence, Table 4.1, Troubleshooting Chart, and Parts List and Servicing Block Diagrams at the end of Section 5.

5.2 TUNING AND ADJUSTMENT.

WARNING

The RF-601A/CU is extremely hazardous when operated with cover removed or chassis removed from the case. The following precautions should always be taken.

a. Never touch the unit before checking that the transmitter is unkeyed.

b. Never let bystanders approach within arms length of the unit while it is being operated.

c. Never leave the unit unattended while the transmitter is keyed.

d. Always clear the area within arms length of the unit before keying the transmitter.

e. Before attempting to remove the unit from its mounting, disconnect the interconnecting cables. ALWAYS REMOVE THE RF INPUT CABLE *BEFORE* DISCONNECTING THE ANTENNA CABLE.

5.2.1 DISCRIMINATOR ADJUSTMENT.

5.2.1.1 General. The discriminator adjustment procedures are critical. Maladjustment could damage the equipment, depending on the degree of mismatch between the transmitter and the antenna. Therefore, the procedures should be followed only when the assembly has been repaired or if specific reference has been made to these procedures from Section 4 of this manual. Furthermore, adjustment should only be attempted after conclusive tests have indicated that the discriminator requires adjustment.

5.2.1.2 Test Equipment and Special Tools. The following test equipment and special tools are required to adjust the discriminator assembly.

a. Fiber Screwdriver adjustment Tool.

b. Test Cables (paragraph 5.5).

c. Electrical Dummy Load, Bird Model 8894.

d. DC Differential Voltmeter, Fluke Model 871A.

5.2.1.3 Test Setup. Connect the equipment as follows:

a. Perform steps a through d of paragraph 5.3.2.1.1 to remove cover from case.

b. Unsolder lead between discriminator assembly terminal TP1 and toroid transformer T1.

c. Set POWER switch at ON and Mode Selector switch at MANUAL.

d. With the L-C switch set at C, depress RIGHT pushbutton momentarily to ensure that the variable capacitor is not at home end stop.

e. Set Power switch at OFF and disconnect control cable from RF-601A/CU connector 1A1J1.

f. Solder center conductor of discriminator test cable (paragraph 5.5.4) to TP1 on discriminator assembly. Solder test cable shield to nearest ground point. Connect other end of cable to the dummy load.

g. Connect RF output cable fabricated in paragraph 5.5.3 between transmitter and connector 1A1J2 on RF-601A/CU.

h. Connect differential voltmeter between discriminator terminals TP5 (+) and TP4 (–) and set for 100 MV full scale range.

5.2.1.4 Control Settings. Energize the transmitter in an AM mode of operation at a frequency of 21 MHz. Ensure that control cable between RF-601A/C and RF-601A/CU is disconnected.

5.2.1.5 Instructions. To adjust the discriminator assembly, proceed as follows:

a. Key and adjust transmitter for a 150 watt output.

CAUTION

Use insulated adjustment tool (5.2.1.2a) to make required adjustments.

b. Adjust discriminator assembly capacitor C6 for a zero ± 2 MV indication on the differential voltmeter.

c. Unkey transmitter.

d. Disconnect the differential voltmeter from TP5 and TP4 and connect to TP3 (+) and TP2 (−).

e. Set transmitter for a frequency output of 30 MHz.

f. Key and adjust transmitter for a 150 watt output.

g. Adjust discriminator assembly potentiometer R6 for a −100 MV ± 5% indication on the differential voltmeter.

h. Unkey transmitter.

i. Disconnect all test equipment from RF-601A/CU.

j. Unsolder test cable.

k. Resolder lead between transformer T1 and discriminator assembly TP1.

l. If further maintenance is to be accomplished proceed as required; if not, proceed to paragraph 5.3.2.1.2 and replace RF-601A/CU cover.

5.2.1A ALTERNATE DISCRIMINATOR ADJUSTMENT.

The following alternate procedure allows emergency field adjustment without a differential voltmeter.

5.2.1A.1 Test Equipment and Special Tools. The following test equipment and special tools are required to adjust the discriminator assembly with the alternate procedure.

a. Fiber Screwdriver Adjustment Tool.

b. Test Cables (paragraph 5.5).

c. Electrical Dummy Load, Bird Model 8894 or equivalent.

5.2.1A.2 Test Setup. Connect the equipment as follows:

a. Perform steps a through d of paragraph 5.3.2.1.1 to remove cover from case.

b. Unsolder the lead between the Discriminator assembly 1A2A1 terminal TP1 and the toroid transformer 1A2T1.

c. Interconnect the RF-601A/CU and the RF-601A/C using the cables fabricated in paragraphs 5.5.1 and 5.5.2.

d. Apply power to the associated transmitter and set RF-601A/C POWER switch to ON.

e. Set Mode selector switch to MANUAL and the L−C switch to C.

f. Depress the RIGHT pushbutton to ensure that the variable capacitor is not at the home end stop.

g. Set POWER switch to OFF.

h. Using the discriminator test cable (fabricated per paragraph 5.5.4), solder the short center conductor lead to 1A2A2TP1 and the braid to the nearest ground point. Connect the other end of the cable to the 50 ohm dummy load.

i. Connect the RF output cable (fabricated per paragraph 5.5.3) between the transmitter and connector 1A1J2 on the RF-601A/CU.

5.2.1A.3 Control Settings. Energize the transmitter in the AM mode of operation for 21.00 MHz. Set the Mode selector switch on the RF-601A/C to MANUAL.

5.2.1A.4 Instructions. To adjust the discriminator assembly, proceed as follows:

a. Check and adjust the DISCRIMINATOR NULL meter pointer for a center line zero.

b. Key the transmitter and adjust the level for a nominal 150 watts output (level not critical).

c. With the L−C switch set at L, adjust Discriminator assembly capacitor 1A2A2(C6) so that the meter pointer swings both sides of the center zero. This verifies operation of both diodes. Make final setting at the center line zero.

d. Unkey the transmitter and set the transmitter frequency to 29.99 MHz.

e. Key the transmitter and adjust for a nominal 150 watts output.

f. With the L−C switch set at C, adjust Discriminator assembly potentiometer 1A2A2(R6) so that the meter pointer swings both sides of the letter "N" in NULL on the face of the meter. The left edge of the "N" represents the negative 100 millivolt offset required. Make the final setting at the left edge of the "N" as in figure 5.1A.

g. Repeat step c at 21.00 MHz.

h. Repeat step f at 29.99 MHz.

i. Unkey transmitter. Unsolder the test cable from the Discriminator and resolder the lead from TP1 and the toroid transformer terminal 1A2T1.

j. If further maintenance is to be accomplished proceed as required; if not, proceed to paragraph 5.3.2.1.2 and replace RF-601A/CU cover.

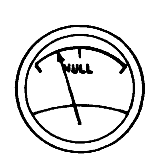


Figure 5.1A. Null Offset Indication

5.2.2 SERVO AMPLIFIERS ADJUSTMENT.

5.2.2.1 General. The servo amplifiers should be adjusted whenever one of the assemblies has been repaired or if reference has been made to these procedures from Section 4.

5.2.2.2 Test Equipment. The following test equipment is required to perform the servo amplifier adjustment:

a. Variable DC Power Supply.

b. Multimeter, Simpson Model 260 (two required).

5.2.2.3 Special Fixture. Fabricate a test fixture as shown in figure 5.1.

5.2.2.4 Control Settings. Set the Mode Selector switch at AUTO prior to starting the procedures.

5.2.2.5 Test Setup: Connect the equipment as follows:

a. Loosen RF-601A/C front panel captive screws and swing chassis out from case.

b. Disconnect control cable from RF-601A/C connector 2A2A1J2.

c. Defeat interlock switches on rear of chassis by pulling switch plungers straight out.

d. Connect the four leads on the test fixture as indicated in figure 5.1.

e. Adjust potentiometer 2A1R7 for servo amplifier 2A1A1 or potentiometer 2A1R8 for servo amplifier 2A1A2. Set the potentiometer to approximately mid range.

f. Connect one multimeter between TP6 and ground, and the other between TP1 and ground. Set both multimeters to measure 30 VDC maximum.

5.2.2.6 Instructions. To adjust either servo amplifier, proceed as follows:

a. Set RF-601A/C POWER switch at ON.

b. Turn on variable DC power supply and adjust for minimum DC output.

WARNING

115 VAC is present on exposed terminals of 2A2A1C4 and 2A2A1C6.

c. Simulate a keyed condition by grounding 2A2A1C2 inside the RF-601A/C case of the chassis. Both multimeters should indicate approximately 30 VDC.

d. Slowly increase output of variable DC power supply while observing indications of multimeters. A point will be reached where indication of one multimeter will drop toward zero.

e. Note voltage (or position of the voltage control) of variable DC power supply which results in +12 VDC indication on multimeter which changed indication in step d.

f. Reset variable DC power supply to zero, and change the position of test fixture switch.

g. Repeat steps d and e while observing other multimeter.

h. Adjust potentiometer (2A1R7 or 2A1R8) and repeat steps d through g until same DC voltage from variable DC power supply results in +12 VDC indication on one of the multimeters for each position of test fixture switch.

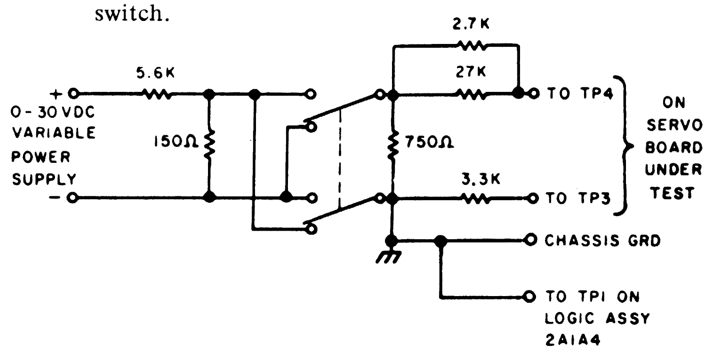


Figure 5.1. Servo Amplifier Test Fixture

i. Remove jumper from 2A2A1C2.

j. Disconnect all test equipment.

k. If further maintenance is to be performed, proceed as required; if not, proceed to step l.

l. Swing RF-601A/C chassis into case and secure with front panel captive screws.

m. Reconnect control cable to RF-601A/C connector 2A2A1J2.

5.2.3 PROTECTOR ASSEMBLY 1A2A4 GAP ADJUSTMENT.

5.2.3.1 General. The arc-gap of the Protector Assembly should be adjusted so that the voltage required to make it arc is higher than that encountered during normal operation but lower than the voltage capability of the various high voltage components of the coupler.

The voltage required to arc across the arc-gap will vary with the air pressure. That is, the arc-gap will arc over at a lower voltage with no pressurization than that when the coupler is pressurized with dry nitrogen.

The following procedure is preferred, however if the proper test equipment is not available, use the alternate procedures in paragraph 5.2.4.

5.2.3.2 Test Equipment. The following test equipment, or equivalent, is required to perform the arc-gap, gap adjustment.

a. Dummy load – 15 foot antenna or 75 to 100 pf, 20 KV capacitor.

b. High voltage voltmeter – ITT Jennings model J-1003 or J-1005. MFR: ITT Jennings 970 McLaughlin Avenue, San Jose, California 95108 Code 73905

5.2.3.3. Instructions. To adjust the Arc Protector, proceed as follows:

a. Remove the antenna coupler cover. (See paragraph 5.3.2.1.1). Connect the above test equipment to the antenna insulator of the antenna coupler.

b. Tune the coupler system in the automatic mode at 2 to 2.5 MHz. Slowly increase the rf input power until the arc-gap arcs or until 11 to 13 kv peak is reached on the antenna terminal as read on the voltmeter. Carefully watch the coupler rf components for arcing. Be prepared to quickly turn off the rf power input in case of an arc.

c. If necessary, as determined above, reset the arc-gap to arc over between 11 and 13 kilovolts peak. Make sure no other components arc first (check above alignment procedures). Upon arcing, the coupler should automatically rechannel itself.

d. Check the flipper mechanism per paragraph 5.3.2.10.2 h, i and j before installing cover.

e. Replace the cover and pressurize the coupler to 6 pounds/cm^2 (0.42 kg/cm^2) gage pressure (see paragraph 2.9). With this increased pressure the coupler will arc around 16 to 18 kv peak.

5.2.4 PROTECTOR ASSEMBLY 1A2A4 GAP ADJUSTMENT (ALTERNATE).

This alternate procedure may be used if the proper test equipment is not available. It allows for an approximate arc-gap voltage arc-over setting and assures that it will arc over before any other components. To adjust, proceed as follows:

a. Remove the antenna coupler cover. (See paragraph 5.3.2.1.1). Observe the same safety precautions as in 5.2.3 above.

b. Set the arc-gap to .140 inches $\pm$ .020 inches.

c. Connect the antenna insulator to a high impedance load such as a 15 or 35 ft whip dummy antenna or a 75 to 150 pf, 20 kv capacitor.

WARNING

Be extremely cautious when operating the coupler system. Lethal voltages will be present when the system is connected to the transmitter and keyed.

d. Tune the coupler system in the automatic mode at 2 to 2.5 MHz. Slowly increase the rf input power until the arc-gap arcs or until 1 KW rf input is reached. If a 35 ft. whip with adequate radials, and a well grounded coupler is used, the arc-gap should arc over with an rf input level of about 800–1000 watts at 2.0 MHz. If a 15 ft whip is used the rf input level to cause an arc will be much less than 1000 watts at 2.0 MHz (500 to 700 watts). A 75 pf capacitor with a high Q should cause an arc around 300 to 500 watts. Carefully watch the coupler rf components for arcing. Be prepared to quickly turn off the rf power input in case of an arc.

e. Only if necessary, as determined above, reset the arc-gap to arc over. Make sure no other components arc first. Upon arcing across the arc-gap the coupler should automatically rechannel itself.

f. Check the flipper mechanism per paragraph 5.3.2.10.2 h, i and j before installing the cover.

g. Replace the cover and pressurize the coupler. (See paragraph 2.9). With increased pressure the coupler arc-gap will arc over at a higher power level. At 6 pounds/in^2 gauge at 25° C the power level will be about twice that obtained with the cover removed.

5.3 REPAIR.

5.3.1 RF-601A/C ANTENNA COUPLER CONTROL.

5.3.1.1 General. The method of removal and replacement of parts in the RF-601A/C is obvious. However, the information provided in paragraph 5.3.1.2 should be followed when replacing parts on the printed circuit board assemblies.

5.3.1.2 General PCB Parts Replacement Techniques. When repairing printed circuit boards, the procedures below should be carefully followed to avoid damage.

a. Use a pencil-type soldering iron with 25 watt maximum capacity. Use an isolating transformer with an ac-operated iron. Do not use a soldering gun; damaging voltages can be induced into the components.

b. When soldering transistors or diodes, solder quickly; where wiring permits, use a heat sink (such as long nose pliers) between the soldered joint and the part being replaced.

c. Excessive heat can separate the copper strip from the board. Cement such strips in place with a quick drying acetate base cement having good electrical insulating properties.

d. Use high quality rosin core solder when repairing printed circuit boards. NEVER USE PASTE FLUX. After soldering, clean off any excessive flux and coat the repair area with a high quality electrical varnish or lacquer.

e. Repair a break in the copper of a printed circuit board by soldering a buss wire across the break.

f. When removing parts from a printed circuit board, apply heat sparingly to the lead of the part to be replaced. Remove part from the printed circuit board as the iron heats the lead. Use an awl to carefully clean the inside of the holes left by the old part.

g. When the part is replaced, tin the leads on the new part. Bend the clean tinned leads on the new part and carefully insert them through the holes in the printed circuit board. Bend the leads close to the foil and cut so that approximately one-sixteenth of an inch of lead length is left. Hold part against the board and quickly solder the leads.

5.3.2 RF-601A/CU ANTENNA COUPLER.

Removal and Replacement of many of the parts in the RF-601A/CU require procedures which are not obvious. Paragraphs 5.3.2.3 through 5.3.2.10 provide all the necessary information for replacement of those parts. All screws removed during the repair procedures must be torqued when replaced. Table 5.1 provides a listing of the torque required for different types of screws used in the RF-601A/CU. When repairing the discriminator assembly, the general information paragraph 5.3.1.2 should be followed. The procedures in paragraph 5.3.2.3 through 5.3.2.10 assume that the cover has been removed from the case as described in paragraph 5.3.2.1.1 below.

5.3.2.1 Cover.

5.3.2.1.1 Removal.

CAUTION

Extreme care should be exercised to prevent the sealing flanges on the case or cover from being nicked, scratched or marked in any way. This type of damage prevents the unit from being properly sealed. Therefore, always protect the flanges from damage while the equipment is being serviced.

a. Depressurize RF-601A/CU by depressing plunger in charging valve.

b. Remove 28 screws around case. Remove cover and gasket.

c. Connect RF-601A/C to the RF-601A/CU using the test cable fabricated in paragraph 5.5.1. Connect primary power to RF-601A/C connector 2A2A1J1.

d. Cover exposed flanges on case with cloth or pressure sensitive tape.

Note

Save all hardware removed while performing the disassembly procedures. Reassembly procedures require the use of this hardware. Note the order in which hardware is removed. Flat washers are always placed next to plastic with lockwashers between the flat washers and nut or screw head.

Table 5.1. Torque Requirements For Screws

Screw Size	Torque Required in-lbs (kg-m)
4-40	6 (.07) ±5%
6-32	10 (.12) ±5%
8-32	21 (.24) ±5%
10-32	33 (.38) ±5%
3/8-16	240 (2.77) ±5%

5.3.2.1.2 Replacement.

a. Clean protective coating from flange of case.

b. Position gasket and cover on case. (If gasket is damaged or shows signs of deterioration, replace with new gasket obtained from stores.

c. Fasten cover screws with a torque of 70-in-lbs (0.81 kg-m). (Use original hardware which has been specially treated to prevent corrosion.)

d. Refer to paragraph 2.9 for procedures for pressurizing the case.

CAUTION

If chassis connectors have been loosened (to remove chassis from case) connector jam nuts must be properly tightened to prevent gas leaks after pressurization.

5.3.2.2 Removal of Chassis from Case. For most parts replacement procedures, mounting hardware and adjustments will be more accessible if the RF-601A/CU chassis is removed from the case. To remove the chassis, proceed as follows:

Note

Observe order in which hardware is removed for assistance when reassembling.

a. Remove cover and gasket from case according to paragraph 5.3.2.1.1.

CAUTION

If coupler unit uses plastic antenna insulator, use two wrenches on antenna terminal stud nuts to prevent stud from turning and damaging seal.

b. Remove wire from the stud on inside end of antenna terminal.

c. Unsolder and tape the two leads to pressure switch 1A1S1.

d. Remove screw securing cable clamp to chassis, on multiconductor cable to connector 1A1J1.

e. Remove cable connector 1A2A2P1 from 1A1J2.

f. Remove jam nut from connector 1A1J1 and carefully push connector inside case. (The connector should not be pushed through until chassis is slid away from connector slightly to provide clearance.)

g. Carefully lift chassis out from case and place it on a convenient working surface.

WARNING

Be extremely cautious when operating the RF-601A/CU removed from the case. Lethal RF voltages will be present when system is keyed and connected to a transmitter.

h. Connect RF-601A/C to RF-601A/CU using test cable fabricated in paragraph 5.5.1. Connect primary power to RF-601A/C. (If normal primary power cable connection is not available, fabricate a cable according to paragraph 5.5.2.)

CAUTION

If RF-601A/CU is to have RF applied, an antenna load or dummy load will be required. When tuning into a 50 ohm dummy load, the frequency of operation must be above 7 MHz.

i. Put all loose hardware inside case and store empty case and cover where flanges will not be damaged.

5.3.2.3 Element Position Potentiometer Replacement. The following procedure details the steps necessary to replace element position potentiometer R1 on either capacitor gear drive assembly 1A2A1 or inductor gear drive assembly 1A2A3.

a. Remove chassis from case and connect to bench test cables as explained in paragraph 5.3.2.2.

b. Set Mode Selector switch at AUTO, then POWER switch at ON.

c. Allow elements time to home, then set POWER switch at OFF.

Note

If replacing inductor gear drive assembly potentiometer 1A2A3R1, remove the machine screws securing the blower and move blower to one side to provide access to motor mounting bracket.

d. Tag and unsolder wires connected to each terminal of potentiometer (figure 5.4).

Note

Before proceeding, note orientation of bracket, potentiometer indexing tab, and potentiometer to prevent installation with potentiometer housing rotated 180 degrees from original position. The potentiometer shaft is slotted. It is not necessary to remove pin from end stop switch lever arm.

e. Remove and set aside the two screws (and spacers) securing potentiometer mounting bracket. Pull bracket straight away from gear drive housing to disengage potentiometer shaft.

f. Remove potentiometer from bracket.

CAUTION

Damage to gear drive assembly will result if potentiometer shaft is incorrectly oriented.

g. Mount and secure new (replacement) potentiometer on bracket. Check that indexing tab is in correct hole in bracket.

h. Rotate potentiometer shaft to its maximum position as viewed from shaft end; fully counterclockwise for potentiometer on inductor gear drive assembly, or fully clockwise for potentiometer on capacitor gear drive assembly.

i. Position potentiometer mounting bracket on gear drive housing, rotating potentiometer shaft slightly as necessary to align slot in shaft with pin in end stop switch lever arm.

j. Secure potentiometer mounting bracket with screws and spacers removed in step e.

k. Resolder wires removed in step d.

l. Loosen the four machine screws securing servo motor mounting bracket.

m. Slide servo motor back from its normal position to disengage gears.

n. Rotate gear drive assembly by hand from one end of its range to the other to ensure smooth operation.

o. Reposition servo motor so that gears mesh properly, and secure by tightening the four screws in the servo motor mounting bracket.

Note

If replacing 1A2A3R1, reposition blower assembly and secure with original hardware.

p. If no further maintenance is required, replace chassis in case by performing steps in paragraph 5.3.2.2 in reverse order.

q. Replace cover on case by performing paragraph 5.3.2.1.2.

Note

Inform operating personnel that accuracy of ELEMENT POSITION meter indications for element with new element position potentiometer must be checked.

5.3.2.4 Servo Motor Replacement. To replace the servo motor on either of the gear drive assemblies, proceed as follows:

Note

> The replacement procedure can be more easily accomplished if the chassis is removed from the case (paragraph 5.3.2.2).

a. If L servo motor is to be replaced, remove and set aside the four machine screws securing blower motor to chassis. This allows access to unsolder servo motor leads. (Blower motor leads need not be unsoldered.)

b. Tag and unsolder servo motor leads (figure 5.4).

c. If removing the capacitor gear drive assembly servo motor, remove and set aside servo motor lead clamp.

d. Loosen the four screws securing the servo motor mounting bracket.

e. Slide servo motor back out of gear drive assembly.

f. Slide new (replacement) servo motor into gear drive assembly, and position so that motor leads are on top and gears are properly meshed. Secure by tightening the four screws in the servo motor mounting bracket.

g. Solder servo motor leads to terminals, using tags on defective motor as a guide.

h. If blower motor was moved, reposition and secure using four machine screws removed in step a. (If capacitor gear drive assembly servo motor was replaced, reinstall motor lead clamp.)

i. If no further servicing is required, replace chassis in case by reversing procedure of paragraph 5.3.2.2.

j. Replace cover on case by performing paragraph 5.3.2.1.2.

5.3.2.5 Capacitor Gear Drive Assembly Replacement. The following procedure details the steps necessary to replace capacitor gear drive assembly 1A2A1. When required to drill holes for pinning parts in new components, use a 0.063 drill. Replace damaged pins with spring pin number MS171436. Refer to figures 5.4 and 5.6 for locations of parts while performing the procedure.

a. Remove chassis from case and connect to bench test cables according to paragraph 5.3.2.2.

b. Set Mode Selector switch at AUTO and POWER switch at ON.

c. Allow elements time to home, then set POWER switch at OFF.

Note

> If mechanical damage prevents the elements from homing, manually set elements to home during reassembly.
>
> If components are not damaged, leads to end stop switches, servo motor and element position potentiometer need not be unsoldered.

d. Remove and set aside four machine screws securing servo motor mounting bracket. Slide motor back until clear of gear drive assembly.

CAUTION

> Fiber washers under diode board mounting screws provide clearance for terminations on rear of board - be sure to save them. Leave servo motor lead clamp on motor lead.

e. Remove and set aside the two machine screws and fiber washers securing diode board to capacitor gear drive assembly.

f. Loosen the two machine screws which secure coupling to primary shaft of gear drive assembly. Rotate shaft slightly to make coupling screws accessible if necessary.

g. Remove and set aside two machine screws and spacers securing element position potentiometer bracket, and disengage bracket from gear drive assembly. (The end of the potentiometer shaft is slotted, so the pin need not be removed from the hub of the end stop switch lever.

h. Remove and set aside the two screws securing each end stop switch, and gently push switches clear.

i. Remove and set aside three machine screws securing gear drive assembly to chassis.

j. Slide gear drive assembly back to disengage coupling and remove from chassis.

k. Set new (replacement) gear drive assembly in position on chassis and secure with the three screws removed in step i.

l. Install the two end stop switches on the new gear drive assembly. Do not tighten the mounting screws.

m. Position quick release plunger adjustment jig (figure 5.2) in front of one of the switches over switch actuator button.

n. Rotate primary gear drive shaft until end stop switch lever rests against jig. Hold lever, jig, and end stop switch so that jig aligns face of end stop switch parallel with face of end stop switch lever. Tighten the two screws which secure end stop switch to gear drive housing.

o. Repeat steps m and n for other end stop switch.

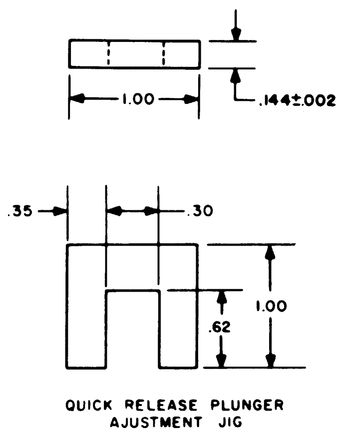


Figure 5.2. Quick Release Plunger Adjustment Jig

p. Rotate primary shaft on capacitor gear drive assembly until end stop switch lever is actuating home end stop switch S2 (figure 5.6).

q. Rotate lead screw on capacitor counterclockwise until lead screw begins to disengage and lead screw housing becomes loose. (On some capacitors, the housing is screwed on and, therefore, won't become loose. On these, turn lead screw CCW until it stops.)

r. Rotate lead screw clockwise until housing just seats firmly, then turn an additional quarter turn. (On capacitors with screw-on housing, just turn lead screw one-quarter turn.)

s. Rotate both gear drive assembly primary shaft and capacitor lead screw a small amount to align flats on shaft with set screws on coupling. (If necessary, loosen clamps on capacitor mounting flanges, and rotate body of capacitor slightly to align coupling set screws. Then retighten clamps to secure capacitor.)

t. Apply loctite (MIL-S-22743B, grade E) to each coupling set screw and tighten.

u. Secure diode board to capacitor gear drive assembly with the two screws removed in step e. (Be sure and reinstall fiber washers between board and gear drive assembly for each screw, and the servo motor lead clamp.)

v. Rotate Element position potentiometer shaft maximum clockwise. Then rotate shaft slightly counterclockwise until slot in shaft is aligned with pin in end stop switch lever hub. (The capacitor is still set at the home end stop.)

w. Slide Element position potentiometer into position, with shaft engaged in hub of end stop switch lever, and secure with the original hardware (screws and spacers).

x. Slide servo motor into gear drive assembly, with motor slightly back from normal position so that gears are not meshed. Position and secure motor mounting bracket with original hardware to secure motor.

y. Set RF-601A/C Mode Selector switch at MANUAL, and POWER switch at ON.

Note

In the following steps, the servo motor will not drive assembly since gears are not meshed. Energizing the servo motor from pushbuttons and rotating gear drive by hand will safely check out end stop switches.

z. Carefully note position of capacitor lead screw. This is the home end stop position.

aa. Rotate the capacitor lead screw (and primary shaft of the gear drive assembly) clockwise until end stop switch lever is clear of home end stop switch. Then rotate capacitor lead screw counterclockwise, while depressing the RF-601A/C LEFT pushbutton and note the point at which the quick release plunger on the end stop switch lever actuates the home end stop switch to de-activate the servo motor.

Note

Use a small screwdriver modified according to paragraph 5.6 for adjusting quick release plungers.

ab. Rotate the capacitor lead screw clockwise until the slotted end of the quick release plunger is exposed. Loosen the lock nut on the plunger and adjust the plunger, repeating step aa and adjusting the plunger until the motor is de-activated by the end stop switch when the capacitor lead screw is rotated counterclockwise to the home position. Then tighten the lock nut to lock the quick release plunger in position.

ac. Rotate the capacitor lead screw 23–23¼ turns clockwise from the home position to the far end stop position. Carefully note the exact far end stop position for the capacitor lead screw, then using the procedure followed in steps aa and ab above, depress the RF-601A/C RIGHT pushbutton to activate the motor, and adjust the quick release plunger so that the far end stop switch de-activates the motor when the capacitor lead screw is rotated clockwise to the far end stop position.

ad. Loosen the screws in the motor mounting bracket. Slide the Servo motor forward to engage the gears and retighten the screws in the motor mounting bracket.

ae. Using the RF-601A/C LEFT and RIGHT pushbuttons, carefully nudge the capacitor through its full tuning range, while observing the action of the end stop switches, and the element position potentiometer.

Note

Inform operating personnel that all logged ELEMENT POSITION meter indicates for the C position of the L-C switch must be re-checked, for accuracy with new gear drive.

af. If no further maintenance is necessary, reinstall chassis in case by reversing the procedure in paragraph 5.3.2.2.

ag. Reinstall cover on case by performing paragraph 5.3.2.1.2.

5.3.2.6 Variable Capacitor Replacement. To replace the variable capacitor, proceed as follows:

a. Remove chassis from case and connect to bench test cables according to paragraph 5.3.2.2.

b. Set Mode Selector switch at AUTO, and POWER switch at ON. (Servo should automatically position capacitor at home end stop.) Then set POWER switch at OFF.

c. Loosen machine screws in servo motor bracket and slide motor back slightly to disengage gears.

d. Loosen two set screws in coupling between capacitor lead screw and gear drive assembly shaft. If necessary, rotate coupling slightly by hand to expose screws in coupling.

e. Remove and set aside two mounting bolts supporting each (front and rear) metal mounting flange.

f. Loosen clamping screws on both rear and front mounting flanges.

g. Remove and set aside machine screw securing while lead from side of inductor to rear capacitor mounting flange.

h. Remove rear mounting flange.

i. Slide capacitor back away from gear drive assembly to disengage coupling, and remove capacitor with coupling attached from front bracket.

j. Remove coupling from damaged capacitor lead screw. Temporarily install coupling to replacement capacitor.

k. Turn lead screw on replacement capacitor counterclockwise until lead screw begins to disengage and lead screw housing becomes loose. (On some capacitors, the housing is screwed on and, therefore, won't become loose. On these, turn lead screw CCW until it stops).

l. Turn lead screw clockwise until housing just seats frimly, then turn an additional one-quarter turn. (On capacitors with screw-on housing, just turn lead screw one-quarter turn.)

m. Hold replacement capacitor so that nipple on glass envelope is down, and slide lead screw end through from mounting flange and into position on chassis. Turn the housing so the lubrication hole is up. (On capacitors with screw-on housing, there is no nipple. Just rotate capacitor until lubrication hole is up.)

n. Ensure that coupling is properly engaged with gear drive assembly shaft, and capacitor is in proper position for mounting. If necessary, loosen coupling on capacitor lead screw, and rotate so that coupling set screws on gear drive assembly shaft end align with flats on shaft.

o. When proper position for coupling has been determined, tighten set screws on flat of capacitor shaft.

p. Carefully reinsert capacitor through front mounting flange, engage coupling with gear drive assembly shaft. (Glass nipple on capacitor envelope should be on bottom towards chassis.)

q. Slide rear mounting flange on rear of capacitor.

r. Secure front and rear mounting flanges to supports using original hardware.

s. Ensure that coupling is properly aligned and oriented, and tighten clamping screws on both rear and front mounting flanges.

t. Reconnect white lead from inductor to rear mounting flange, using original hardware.

u. Carefully check to ensure that coupling set screws are aligned with the flats on the gear drive assembly shaft. Apply loctite, (MIL-S-22473B, Grade E) to each coupling set screw and tighten securely.

v. Slide servo motor forward to engage gears, and tighten screws in motor mounting bracket.

w. Set Mode Selector switch at MANUAL, and POWER switch at ON.

x. Use RIGHT and LEFT pushbuttons to carefully nudge capacitor through its complete tuning range several times to check tuning action. If necessary, refer to paragraph 5.3.2.7 and adjust end stop switches.

y. If no further servicing is to be accomplished, return chassis, to case by reversing the procedure called out in paragraph 5.3.2.2, and reinstall cover by performing paragraph 5.3.2.1.2.

5.3.2.7 End Stop Switch Replacement. To replace an end stop switch on either gear drive assembly, proceed as follows:

a. Remove chassis from case and connect to bench test cables as explained in paragraph 5.3.2.2.

b. Set Mode Selector switch at MANUAL and POWER switch at ON. Use RIGHT or LEFT pushbuttons to position assembly with damaged end stop switch at mid range. Then set POWER switch at OFF.

Note

If end stop switch is on inductor gear drive assembly, it may be convenient to remove the four screws securing the blower, and slide the blower to one side for easier access to the assembly. (Blower leads need not be unsoldered.)

c. Remove and set aside the two machine screws and spacers securing element position potentiometer bracket. Carefully disengage potentiometer shaft and swing potentiometer to one side.

d. Tag and unsolder leads to damaged end stop switch.

e. Remove two machine screws, and remove damaged end stop switch. Position new (replacement) end stop switch on gear drive assembly and insert but do not tighten the two machine screws.

Table 5-2. Position of Contact Arm of Variable Inductor Rotor After Being Stopped Dynamically

Condition	Turns From Coil End
Home position	0.25 turns (90° from coil home end)
Tripper arm actuating range	10.0 – 14.0 turns
Far end stop position	37.25 turns (315° from coil tune end)

f. Solder leads to new end stop switch.

g. Loosen four machine screws securing servo motor drive bracket, and slide servo motor back to disengage gears.

h. Position quick release plunger adjustment jig (figure 5.2) in front of replaced end stop switch over the switch actuator button.

i. Rotate primary shaft until end stop switch lever is against the jig. Hold lever, jig, and end stop switch so that jig aligns face of end stop parallel with face of lever. Tighten screws securing end stop switch.

j. Remove jig.

k. Rotate gear drive assembly shafts to set end stop switch lever against home end stop switch (figure 5.6 for capacitor gear drive assembly, figure 5.7 for inductor gear drive assembly).

l. Ensure tuning element is at home according to table 5.2 for variable inductor, or steps k and l of paragraph 5.3.2.6 for variable capacitor.

m. Carefully rotate element position potentiometer shaft maximum *counterclockwise* for inductor gear drive assembly, or maximum *clockwise* for capacitor gear drive assembly. Then back potentiometer shaft away from maximum position slightly to align with pin in hub of end stop switch lever. Position element position potentiometer bracket on gear drive assembly with the potentiometer shaft properly engaged, and secure with the original two machine screws and spacers.

n. Rotate gear drive assembly primary shaft by hand to check setting of quick release plunger on replaced end stop switch. Paragraph 5.3.2.6 steps k and l describe the capacitor home position. The capacitor far end stop position is 23 to 23¼ from the home position. Table 5.2 lists end stop positions for the inductor. Adjust end stop positions slightly if necessary.

o. Loosen machine screws on servo motor mounting bracket, and properly position servo motor so that gears are meshed. Tighten machine screws to secure servo motor and mounting brackets.

Note

If blower was moved, reposition and secure with original hardware.

p. Using RIGHT and LEFT pushbuttons, carefully "nudge" servo motor a few turns at a time over complete tuning range to recheck proper operation of end stop switches and element position potentiometer.

Note

Under full speed, element may overshoot end stop settings made without applying power to servo. Check end stops with servo motor driving element.

q. If no further servicing is to be done, replace chassis in case by reversing the procedure of paragraph 5.3.2.2.

r. Replace cover on case by performing paragraph 5.3.2.1.2.

5.3.2.8 Tripper Spring Replacement. To replace the tripper spring on the inductor gear drive assembly, proceed as follows (refer to figure 5.7 for parts identification):

a. Remove chassis from case and connect to bench test cables as explained in paragraph 5.3.2.2.

b. Remove and set aside the "O" ring retaining damaged tripper spring to tripper arm on shorting contact shaft.

c. Remove split ring from pin on flipper arm. Shove pin back out of flipper arm until it hits gear drive housing and spring will drop out (flipper arm must be in the maximum counter clockwise position).

d. Move the tripper arm back and forth by hand without the spring installed. It should be free from stop to stop. (If a gram gauge is available, the pressure to move the stop back and forth should not exceed 40 grams.)

e. Position new spring between holes in flipper arm and secure by sliding pin all the way through flipper arm. Reinstall split ring on pin.

f. Secure opposite end of spring to tripper arm on shorting contact shaft, using the "O" ring removed in step c.

Note

Shorting contacts should touch turns of inductor when the tripper arm on the shorting contact shaft is held 1/16 inch (0.159 cm) from its maximum upward position.

g. Check operation of tripper arm and shorting contact shaft by hand. Tripper arm should snap from one position to the other, and the shorting contact shaft should snap shorting contacts against or away from the coils of the inductor.

h. Correctly position flipper arm, down when inductor is at home, with shorting contacts against coil, or up when inductor rotor is at far end, with shorting contacts away from coil.

i. Set Mode Selector switch at MANUAL and POWER switch at ON.

j. Use RIGHT and LEFT pushbuttons to actuate servo motor and check tripper action.

k. If no further maintenance is to be performed, return chassis to case by reversing the procedure of paragraph 5.3.2.2.

l. Replace cover on case by performing paragraph 5.3.2.1.2.

5.3.2.9 Inductor "Paddleboard" Assembly Repair. Variable inductor 1A2L1, along with its associated gear drive assembly, servo motor, end stop switches and element positioning potentiometer are all mounted on a separate metal plate (paddleboard) attached to the inductor assembly or the gear drive, the paddle board may be removed from the main chassis.

5.3.2.9.1 Removal. To remove the paddle board assembly proceed as follows (refer to figure 5.4, 5.7 and 5.8 for component identification):

a. Remove the chassis from the case according to paragraph 5.3.2.2. (Do not attach bench test cable to chassis.)

b. Remove and set aside the screw and washer securing the ground strap to the chassis (figure 5.8).

c. Remove and set aside the two machine screws securing thermal switch S2 to inductor end bracket. Pull switch from bracket and swing clear.

d. Remove and set aside the two machine screws securing thermal switch S1 to the front inductor end bracket. Remove the machine screw securing resistor R1 to the contact on the end bracket, and pull switch and resistor clear.

e. Remove machine screws securing blower and slide blower to one side.

Note

If components are not damaged, leads will not have to be unsoldered from end stop switches, element position potentiometer or servo motor.

f. Remove two screws securing element position potentiometer to gear drive assembly. Disengage potentiometer shaft from hub of end stop switch lever (the shaft is slotted, so it will not be necessary to remove pin from end stop switch lever), and swing potentiometer clear of gear drive assembly.

g. Remove two machine screws securing each end stop switch and push switches clear of gear drive assembly.

h. Remove two screws securing connector strip to gear drive assembly.

i. Loosen four screws in motor mounting bracket and slide motor clear of gear train assembly.

j. Remove screw securing white lead from capacitor bracket to inductor support.

k. Remove screw securing white lead from arc gap protector to inductor support.

l. Remove and set aside three screws securing gear drive assembly to chassis (gear drive will still be secured to paddleboard by two hidden screws).

m. Remove and set aside the eight screws securing the inductor to the chassis (inductor will still be secured to paddleboard by hidden screws).

n. Slide inductor assembly away from rotary solenoid to clear contacts, and lift paddleboard from chassis.

5.3.2.9.2 Replacement. To replace the paddleboard assembly proceed as follows:

a. Set the paddleboard assembly in position on the main chassis and secure with original hardware (three machine screws in gear drive assembly, eight in inductor assembly).

Note

For steps b and c, use one brass machine screw, two flat washers and a lockwasher to attach each lead. Place flat washers next to plastic.

b. Secure white lead from arc gap protector to inductor support.

c. Secure white lead from capacitor bracket to inductor support.

d. Reinstall connector strip to side of gear drive assembly with original hardware.

e. Reinstall thermal switch S1 and resistor R1 to inductor end bracket next to gear drive assembly, using original hardware.

f. Reinstall thermal switch S2 in opposite inductor end bracket.

g. Slide servo motor into gear drive assembly, with motor slightly back from normal position so that gears are not meshed.

h. Secure inductor ground strap to chassis with original hardware.

i. Set each end stop switch in position and install (but do not tighten) original hardware.

j. Position quick release plunger adjustment jig (figure 5.2) in front of home end stop switch, and over the switch actuator button.

k. Rotate primary shaft of gear drive assembly until end stop lever is against jig. (Make sure inductor rotor does not turn.) Hold lever, jig, and end stop switch so that jig aligns face of end stop switch parallel with face of lever. Tighten screws securing end stop switch.

l. Remove jig.

m. Rotate gear drive shaft until quick release plunger is actuating home end stop switch.

n. Orient coupling so that inductor rotor is at home position according to table 5.2, and coupling set screws are over flats on gear drive assembly primary shaft. Apply a small amount of grade E Loctite per MIL-S-22473B to set screws, and tighten.

o. Check that inductor is at home position when end stop switch actuates. Rotate the primary shaft of the gear drive assembly up to the end stop position until the switch actuates several times to be sure.

p. Use adjustment tool (paragraph 5.6) and readjust quick release plunger if necessary.

CAUTION

When traversing inductor rotor from one end to other of inductor coil, ensure that tripper arm lever is in proper position for tripping according to the direction of travel, to prevent damage to gear drive assembly.

q. Rotate gear drive shaft to position end stop switch lever at far end stop switch.

r. Repeat steps j through l to secure far end stop switch parallel to end stop switch lever.

s. Rotate primary shaft of gear drive assembly to position inductor rotor at far end stop position according to table 5.2, and check that end stop switch is actuated at this point. Repeat several times to be sure. Use adjustment tool and readjust quick release plunger if necessary.

t. Reset inductor rotor to home end stop position according to table 5.2.

u. Rotate element position potentiometer shaft maximum counterclockwise. Then rotate shaft clockwise slightly until the slotted shaft will engage the pin in the end of the end stop switch lever hub. Engage shaft and secure potentiometer and mounting bracket with original machine screws and spacers.

v. Loosen servo motor mounting bracket, and slide motor forward to mesh gears. Secure motor by tightening screws in motor mounting bracket.

w. Connect RF-601A/C to the RF-601A/CU using the test cable fabricated in paragraph 5.5.1. Connect primary power to RF-601A/C connector 2A2A1J1.

x. Set Mode Selector switch at MANUAL, and POWER switch at ON.

y. Use LEFT and RIGHT pushbuttons to carefully nudge inductor through complete tuning range and check proper end stop switch and tripper arm function.

CAUTION

Under full speed, the servo motor may cause the rotor to overshoot end stop positions slightly. Ensure that quick release plungers actuate end stop switches at end stop positions with servos approaching end stop at full speed.

z. As a final step, use pushbuttons to traverse the rotor from one end of inductor to other at full speed to check end stop switch positioning.

aa. Reposition the blower and secure with original hardware.

ab. In no further servicing is to be accomplished, return chassis to case by reversing the procedure called out in paragraph 5.3.2.2 and reinstall cover by performing paragraph 5.3.2.1.2.

Note

Inform operating personnel that all logged ELEMENT POSITION meter indications for the L position of the L-C switch must be re-checked for accuracy.

5.3.2.10 Variable Inductor Assembly Repair. To repair or replace the variable inductor, inductor rotor, or inductor gear drive assembly, first remove the paddleboard assembly, then refer to the proper paragraph below for further instructions.

5.3.2.10.1 Rotor Replacement.

a. Make sure motor has returned to home position (rotor assembly is positioned close to mechanical end stop (end stop furthest from motor – see figure 5.9A).

b. See figures 5.8, 5.9, 5.9A, and 5.9B. Note that only one arm of rotor assembly contains electrical contacts. Using a pencil, mark the position of these contacts on the inductor coil. Also, mark the contact arms position on the flat of inductor drive shaft. These reference marks assure proper rotor assembly orientation at reassembly.

c. See figure 5.9A. Turn paddleboard assembly over and remove the two lower end bracket screws from paddleboard and inductor end bracket.

d. Remove brass hex nut, lockwasher, flat washer, Phillips head screw, white lead and remaining flat washer from mechanical end stop inductor support (end of mechanical end stop nearest inductor coil).

e. Remove brass hex nut, lockwasher, flat washer and Phillips head screw and secures mechanical end stop to inductor support (this screw also secures inductor support to inductor end bracket). Note that screw that retains white wire is smaller in diameter.

f. Remove brass cap head hex nut, lockwasher, flat washer, Phillips-head screw, and flat washer that holds remaining top inductor support to inductor end bracket.

g. Remove the two remaining brass hex nuts, lockwashers, and Phillips-head screws and separate inductor supports from inductor end bracket.

h. Remove and save spring and flat washers from end of inductor shaft.

i. Loosen set screws that secure coupling to gear drive assembly 1A2A3 primary shaft (see figure 5.7). This will allow inductor shaft to be turned freely by hand.

j. Slowly rotate inductor shaft until rotor assembly is free of inductor coil. Discard defective rotor assembly.

k. Examine replacement rotor assembly and figure 5.9B. Note that it is constructed of two pieces of material bolted together to form a triangular shape with three arms. Each arm touches the inductor coil. One arm contains the metal contact, the other two are guide slots. The guide slot in one arm is in one piece of material only and the other is formed by the two pieces bolted together.

l. Align replacement rotor assembly with inductor shaft such that its contact arm is in line with the previously marked inductor shaft flat, step b.

m. Slide rotor assembly onto inductor shaft. Face assembly such that guide slots will follow pitch of coil (when rotor assembly is engaged with coil in subsequent step t). Also, make sure that threaded ends of two screws holding metal contact arm to rotor assembly are facing towards the home end of the inductor assembly (threaded end of two other rotor screws will face far end stop end of inductor assembly).

n. Adjust rotor assembly backlash as follows:

(1) Loosen, do not remove, backlash adjustment screws (see figure 5.9B).

(2) Move plastic front piece of back piece towards or away from inductor shaft to obtain 0.100 to 0.150 inch total rotational travel of the metal contact on the inductor coil turns (from one extreme to the other – see figure 5.9B).

Note

Make sure backlash is as specified after backlash screws is retightened.

(3) Tighten backlash adjustment screws.

o. Reinstall spring and flat washer on inductor shaft.

p. Holding rotor bar grounding contact aside, alaign inductor end bracket with inductor supports and paddleboard plate.

q. Place two brass Phillips-head screws through lower inductor end bracket holes and lower inductor supports. Plate a flat washer, lockwasher and hex nuts onto screws and tighten finger-tight (flat washer is next to plastic).

r. Place flat washer onto brass Phillips-head screw, then push screw through upper left-hand inductor end bracket hole (as viewed from end of bracket) and inductor support. Install flat washer, lock washer, and cap head hex nut in place. Tighten cap head hex nut finger tight.

s. Start rotor assembly onto inductor coil. The plastic arm with guide slot made of one piece (figure 5.9B) should be guided on first, followed by the guide slot made of two pieces, then the metal contact arm. Rotate rotor assembly until contacts align with previously marked spot on the inductor coil, step b.

t. Align mechanical end stop with upper right hand inductor support and inductor end bracket holes. Place a brass Phillips-head screw through inductor end bracket, inductor support and mechanical end stop. Secure with flat washer, lock washer and hex nut.

u. Assemble white lead to smaller diameter brass Phillips-head screw. Assemble flat washer on screw and place assembly through upper right hand inductor support and mechanical end stop. Secure with flat washer, lock-washer and hex nut.

v. Tighten slotted head setscrews that secure coupling to inductor drive shaft.

w. Tighten all inductor end brackets – inductor support hex nuts.

x. Turn paddleboard assembly over and replace two lower end bracket screws in paddleboard and inductor end bracket.

y. Reassemble paddleboard assembly on chassis as described in paragraph 5.3.2.9.2.

5.3.2.10.2 Inductor Assembly Replacement. To replace inductor on paddleboard assembly, proceed as follows:

a. Loosen the two set screws on the rotor shaft couplings. (Also from shorting shaft coupling, if its a one piece type.)

b. Turn paddleboard over and remove six screws securing inductor. Gently remove defective part from paddleboard by sliding backwards to disengage two couplings.

c. Remove the coil portion of the coupling from the shorting contact shaft and remove it from the defective inductor. (Drive out pin if coupling is one piece.) Slide it onto the shorting contact shaft of the new (replacement) inductor. Do not tighten the set screws yet.

d. Drive pin from rotor shaft coupling and remove coupling from defective inductor.

e. Discard defective inductor assembly.

f. Carefully adjust rotor on replacement inductor to home position (table 5.2). Inductor home end is opposite from coupling.

g. Slide coupling on to rotor shaft. Orient so that set screws in end of coupling to mate with gear drive will be up for easy access later. Provide mechanical support for shaft to prevent damage to bearings and drill and pin coupling to shaft using an 0.063 drill and a new MS171436 pin if old pin was damaged.

h. Set inductor or paddleboard assembly. Engage couplings and secure inductor to paddleboard with original hardware removed in step b. Adjust shorting contact coupling for .020 to .030 play or gap between plastic center piece and metal portion of coupling. Apply Grade E Loctite to set screws and tighten set screws securely to flats on the shaft. (If coupling is one piece type, disregard the preceding gap adjustment procedure).

i. Observe the gear drive assembly (figure 5.7). Note the small block mounted on the contact shorting shaft called out as the tripper arm, to which the spring from the flipper arm attaches. Insert a one-sixteenth inch (0.159 cm) shim between the tripper arm and the upper stop for the tripper arm and hold tripper arm against shim so that tripper arm is held away from the upper stop by the thickness of the shim. Position each shorting contact on the inductor assembly so that they are just touching the turns of the inductor. With tripper arm and shorting contacts in these positions, tighten the shorting contact screws. Remove the shim and check that shorting contacts are held against the turns of the inductor under tension when the flipper arm is in the down position. (Spring has forced tripper arm up.) The tripper arm should not touch the upper stop. Manually move the tripper arm to observe whether the shorting arms contact the coil simultaneously. If they do not, loosen the contact fingers and repeat the above adjustment. Push the Flipper Assembly to open the shorting arms. Measure the distance between the bottom of the V-groove and the coil. The distance should be five-eights to seven-eights of an inch (1.59 cm to 2.32 cm). If not, note the point on the Tripper arm that is stopped by the Tripper Pin. File a notch in the Tripper Arm to allow for further travel of the Tripper Arm. Should it be necessary to remove the Tripper Arm to facilitate filing, remove the O-ring from the Tripper Arm pin and remove the Tripper Spring. Remove the C-ring from the end of Tripper Arm shaft. Loosen the Gear Drive from the Paddle board, turn it outward and remove the Tripper Arm Assembly. File a one-sixteenth inch (0.159 cm) deep square cut in the Tripper Arm on the bottom where it hits the stop pin on the casting. Reassemble the mechanism and check again for the five-eights to seven-eights inch (1.59 cm to 2.32 cm) gap between the shorting arms and coil. If the gap is satisfactory, tighten all screws. Make sure at least one set screw of the coupling is on a flat of the Tripper Arm shaft. Use Grade D or E loctite for the set screws. Recheck the contact fingers for contact pressure when the Tripper Arm is up. If the shorting shaft coupling is of the one piece type drill and pin the coupling to the inductor shorting contact shaft using a 0.063 drill and a new MS171435 pin if the old pin was damaged. Remove the set screws used to temporarily secure the coupling to the inductor shorting contact shaft during the pinning operation. Apply Loctite (MIL-S-22473B, grade E) to the remaining inductor shorting contact shaft coupling set screws. Do not tighten the primary shaft coupling set screws yet. Make sure the Flipper Assembly is in the right position before turning the coupler on. The shorting fingers should be closed when the coil rotor is at its "home" position. (Home is at the coil end opposite the gear drive and couplings).

j. If flipper arm spring was removed or must be replaced refer to paragraph 5.3.2.8. If the spring need not be replaced, check the flipper assembly for proper operation per paragraph 5.3.2.8 b, d, f, g and h.

k. Remount the paddle board on the chassis according to paragraph 5.3.2.9.2.

5.3.2.10.3 Inductor Gear Drive Replacement. To replace the inductor gear drive assembly, proceed as follows:

a. Remove the paddleboard assembly according to paragraph 5.3.2.9.1.

b. Loosen the set screws in the two couplings, on the end which engages gear drive assembly shafts.

c. Turn paddleboard over and remove the two screws securing the gear drive assembly to the paddleboard. Disengage couplings and remove defective gear drive assembly from the paddleboard.

d. Set replacement gear drive assembly in position on the paddleboard. Engage, but do not tighten the two couplings and secure the gear drive to the paddleboard with the two machine screws removed in step c.

e. Tighten the set screws in the shorting contact shaft coupling. Apply a small amount of Loctite (MIL-S-22473B, grade E) to each coupling set screw.

f. Remove motor mounting bracket from defective gear drive assembly and install on new gear drive assembly.

g. Perform step i of paragraph 5.3.2.10.2 to check, and if necessary adjust, the shorting contacts.

h. Remount the paddleboard on the chassis according to paragraph 5.3.2.9.2

5.4 PRINTED CIRCUIT BOARD EXTENDER FABRICATION.

To enable testing and troubleshooting the RF-601A/C printed circuit boards, extenders will have to be fabricated. Five extenders are required; one for each printed circuit board. Each of the five extender boards will require a connector equivalent to the mating chassis connector for the printed circuit board as listed in table 6-2. For each extender, obtain one Vero Electronics Inc. plug-in board, part number 292 (five required), and two small right angle brackets (ten required). The right angle brackets should be made from 1/32 inch (0.08 cm) thick aluminum, 1/4 inch (0.635 cm) wide and 1/2 inch (1.27 cm) long on each side. Assemble each extender as follows:

a. Drill two angle brackets as required and attach connector to copper side of board.

b. Wire each extender connector pin to contact strips such that pin A of extender connector will connect with pin A of corresponding chassis connector, pin B to B, etc.

c. Each of the five printed circuit board extenders must be keyed by cutting a slot 0.08 to 0.1 inch (0.203 to 0.254 cm) wide by 0.5 inch (1.27 cm) deep to remove one of the contacts on the board. Refer to the printed circuit board layouts (figures 5-10 through 5-13) for location of the slot on each board.

5.5 TEST CABLE FABRICATION.

To permit complete bench testing of the RF-601A/CU in proximity to the RF-601A/C, the following test cables will be required.

5.5.1 CONTROL CABLE.

A multiconductor test cable must be fabricated to permit bench testing of the RF-601A/C with the RF-601A/CU. Use a convenient length of MSCA-37 cable and wire connections as outlined in table 2.3.

5.5.2 PRIMARY POWER CABLE.

If it is not convenient to bench test the RF-601A with the RF-601A/C receiving primary power from its regular source, a primary power cable will be required. Use a convenient length of 3 conductor cable (with three AWG No. 18 conductors). Connect an AC plug to one end which mates with bench 115 VAC power receptacles, and install a connector type 10-109620-27S to mate with connector 2A2A1J1 on the rear of the RF-601A/C. Connect wires as follows:

a. Pin A, ground.

b. Pin L, 115 VAC hot.

c. Pin M, 115 VAC common.

Note

If power and control are still to be supplied from transmitting system, use 7-conductor cable and refer to table 2.1 for connections for other signal functions.

5.5.3 TRANSMISSION CABLE.

If RF power is to be applied to the RF-601A/CU, a coaxial RF transmission cable will be required. Use a convenient length of 50 ohm coaxial cable (such as RG-8/U). Install a coaxial connector to mate with the transmitter RF output connector on one end, and a UG-21D/U connector, to mate with connector 1A1J2 on RF-601A/CU.

CAUTION

If RF is to be applied to the RF-601A/CU, a 1 KW RF load must be connected to RF-601A/CU antenna connection E1.

5.5.4 DISCRIMINATOR TEST CABLE.

A test cable must be fabricated to perform the discriminator adjustment procedure. This cable should be a three foot length of RG-58/U with a UG-536/U connector on one end. Strip the other end back *no further than one inch.* Separate conductor and shield. Strip insulation from center conductor, and tin both center conductor and shield.

5.6 QUICK RELEASE PLUNGER ADJUSTMENT TOOL FABRICATION.

The quick release plungers in the end stop switch lever arm can be adjusted with a pair of brass jaw pliers. However, a slight modification to a small screwdriver will provide a tool which may be more convenient to use. Select a small screwdriver with a blade tip approximately 0.150 inch (0.381 cm) wide by 0.040 inch (0.1 cm) thick. In the center of the tip, cut a small notch, 0.060 inch (0.152 cm) wide and 0.075 inch (0.19 cm) deep.

5.7 RF-601A/CU LUBRICATION AND INSPECTION.

At least once a year the RF-601A/CU should be inspected and lubricated. Remove RF-601A/CU from mounting and connect to RF-601A/C using test cable fabricated in paragraph 5.5.1. Depressurize case and remove top cover. Check exposed electrical connections for indications of arcing. Check ball gap for excessive damage due to arcing. Check that rotary solenoid K1 bypass arm rotates freely. Check gear drive assemblies for signs of excessive wear.

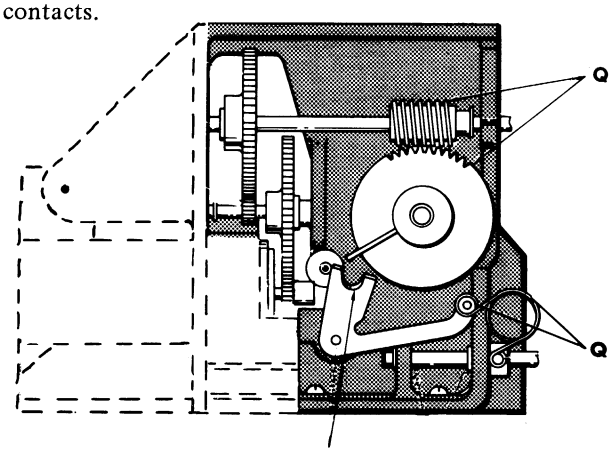
Recommended lubricants are given in the following chart:

LUBRICANT	MANUFACTURER
Anderol 788 Grease	Tenneco Chemicals Inc. Nuodex Division, P.O. Box 2, Piscataway New Jersey 08554 MFR code 99559
Anderol L4555 Oil	Same as above
Aero Lubriplate	Fiske Bros. Refining Co. Newark, New Jersey 07105 MFR code 73219
Bendix No. 10 oil	Bendix Navigation and Control Division, Teterboro, New Jersey 07608 MFR code 19315

Krylon No. 1329	Borden, Inc. Chemical Division Krylon Department, Norristown, Pennsylvania 19404 MFR code 87187
Dow Corning Molykote Z	Dow Corning Corporation Midland, Michigan 48641 MFR code 71984
Dow Corning DC-33 or DC-44	Same as above

5.7.1 LUBRICATION OF INDUCTOR ASSEMBLY 1A2L1.

Spray inductor turns of variable inductor with silicone spray (Krylon no. 1329 or equivalent) or use a small swab to apply a light coating of Dow Corning DC-33 to each inductor turn. Using a small swab to reach between the turns of the inductor, apply lubricant (Dow Corning Molykote Z if existing lubricant is black, or Dow Corning DC-33 if existing lubricant is clear) to the metal contacts at the hub of the rotor, and on the four sides of the square center shaft of the rotor. Apply a small amount of the same lubricant to each end of the rotor shaft at the ground contacts.



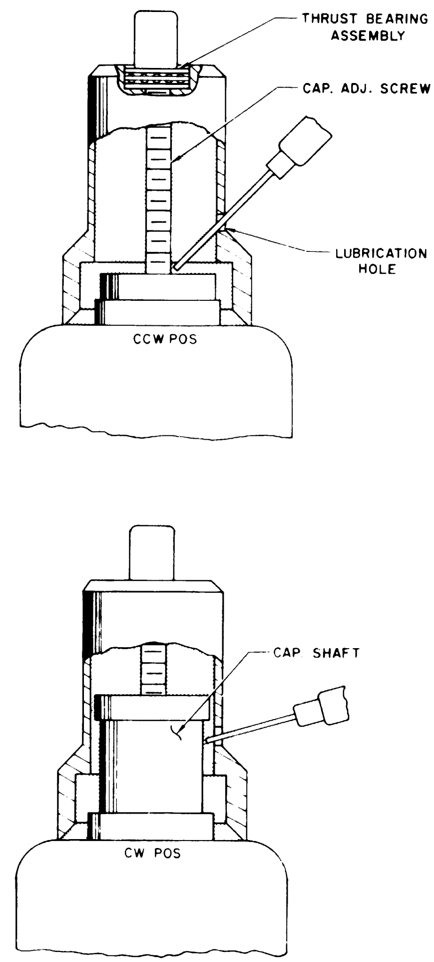
Gear Drive Assembly Lubrication Points

5.7.2 LUBRICATION OF GEAR DRIVE ASSEMBLIES 1A2A1 AND 1A2A3.

Apply lubricant (Dow Corning Molykote Z if existing lubricant is black, or Dow Corning DC-33 if existing lubricant is clear) to all areas marked with the letter Q in the above illustration, on both gear drive assemblies. No lubricant need be applied to oilite bushings or nylon gears.

5.7.3 LUBRICATION OF CAPACITOR 1A2C1.

Using the manual positioning pushbuttons on the RF-601A/CU control rotate the 1A2C1 adjustment screw to its maximum counter-clockwise position. Refer to the following illustration. Insert nozzle of lubricator through 3/16 inch (0.48 cm) lubrication hole in side of capacitor lead screw housing and apply a small amount of Anderol 788 grease (preferred) or Aero Lubriplate grease to the capacitor adjustment screw. Rotate 1A2C1 drive mechansim to rotate capacitor adjustment screw to maximum clockwise position. Insert nozzle of lubricator through hole in side of adjustment screw housing, and apply a small amount of Anderol L4555 oil (preferred) or Bendix No. 10 oil to the capacitor shaft.



Lubrication of Vacuum Capacitor

5.7.4 FINAL CHECKING AND ASSEMBLY.

Energize RF-601A/C and use RIGHT and LEFT pushbuttons and L-C switch to alternately traverse inductor and capacitor through their tuning ranges to spread lubricants and to check tuning.

Carefully remove any dust or dirt from the inside of the RF-601A/CU case. Wipe case and cover flanges and replace gasket and cover. Use a torque wrench to tighten cover mounting bolts to 70 in-lb (0.81 kg-m). Pressurize the case as outlined in paragraph 2.9.

5.8 TRANSISTOR VOLTAGE MEASUREMENTS.

Table 5-3 provides a listing of transistor DC voltage measurements. All readings were taken with a 20,000 ohms/volt meter and should be within ±20% of the indicated values, unless otherwise specified. Set POWER switch at ON and Mode Selector at AUTO.

Note

The voltage of the +28V supply varies considerably, from about +31 volts under quiescent condition to about +16 volts when the motors are running. Bear in mind that any voltage depending on the +28V supply for B+ will vary similarly with the motors stopped or running.

In the cross coupled amplifier stage of the two servo amplifier assemblies (2A1A1 and 2A1A2), the absolute value of the voltages may vary several volts depending on the amplitude of the discriminator error signal and the extent to which the motors load down the +28V supply. More important than the exact voltages themselves are the *differences* in polarity of base-to-emitter voltage between opposite sides of the amplifier; that is, which is being turned on and which is held cut off. The voltages in the chart were measured in a unit with about 300 MV error signals simulated from the discriminator, using the test fixture shown in figure 5.1. In addition, servo amplifier voltages were measured with the keyline grounded, A4TP1 grounded, and control cable removed from RF-601A/C connector 2A1A1J2. Voltages at A3Q5 and A4Q3 collectors depend on associated transmitter. Values shown in chart assume that the RF-601A is connected to the RF-110 HF Power Amplifier.

Table 5.3. Transistor DC Voltage Measurements

TRANSISTOR	CONDITION		DC VOLTAGE TO GROUND		
			B	E	C
Differential Amplifier (A1 or A2) Q3-Q5	No Input	Q3	0	- 0.60	22.8
		Q5	0	- 0.60	22.8
	Tune Input	Q3	0	- 0.65	14.7
		Q5	- 0.37	- 0.77	15.3
	Home Input	Q3	0	- 0.38	14.7
		Q5	0.32	- 0.27	14.1
Cross-Coupled Amplifier (A1 or A2) Q4-Q6	No Input	Q4	22.8	22.8	0
		Q6	22.8	22.8	0
	Tune Input	Q4	15.3	14.7	0
		Q6	14.7	15.3	2.5
	Home Input	Q4	14.1	14.7	2.5
		Q6	14.7	14.1	0
Capacitor Discharge Transistors (A1 or A2) Q9, Q10	No Input	Q9	0	0	0
		Q10	0	0	0
	Tune Input	Q9	0	0	0
		Q10	2.3	1.53	0
	Home Input	Q9	2.25	1.5	0
		Q10	0	0	0

Table 5.3. Transistor DC Voltage Measurements (Cont)

TRANSISTOR	CONDITION		DC VOLTAGE TO GROUND		
			B	E	C
Emitter Followers (A1 or A2) Q2, Q7	No Input	Q2 Q7	0 0	0 0	31.0 31.0
	Tune Input	Q2 Q7	0 1.54	0 0.81	30.0 0.95
	Home Input	Q2 Q7	1.51 0	0.78 0	0.92 30.0
Drivers (A1 or A2) Q1, Q8	No Input	Q1 Q8	0 0	0 0	31.0 31.0
	Tune Input	Q1 Q8	0 0.81	0 0	28.0 0.014
	Home Input	Q1 Q8	0.78 0	0 0	0.014 28.0
A3Q1	Bypass ON, Key up Bypass ON, Key Down		0.9 0	0 0	0.25 31.0
A3Q2	L Motor Off L Motor Running		0.7 - 2.0	0 0	0.21 0.8
A3Q3	Motor(s) Stopped Motor(s) Running, Initial Tune Motor(s) Running After Initial Tune or to Home		0.75 0 0	0 0 0	0.2 18.0 14.0
A3Q4	Motor(s) Stopped Motor(s) Running, Initial Tune Motor(s) Running After Initial Tune or to Home		- 0.9 1.6 - 0.4	0 0.9 - 0.04	31.0 1.1 28.0
A3Q5	System Unkeyed with PA in OPERATE System unkeyed with PA in STANDBY System Keyed by RF-601A & Tuning System Keyed External to RF-601A		0 0 0.9 0	0 0 0 0	38.2 28.0 0.05 0
A3Q6	C Motor Off C Motor Running		0.7 - 2.0	0 0	0.21 0.8
A3Q7	L Motor Running L Motor Off		0.8 0.2	0 0	1.2 31.0
A3Q8	C Motor Running C Motor Off		0.8 0.2	0 0	1.2 31.0
A3Q9	Motors Stopped Motor(s) Running		1.3 0	0.7 0	0.8 28.0

Table 5.3. Transistor DC Voltage Measurements (Cont)

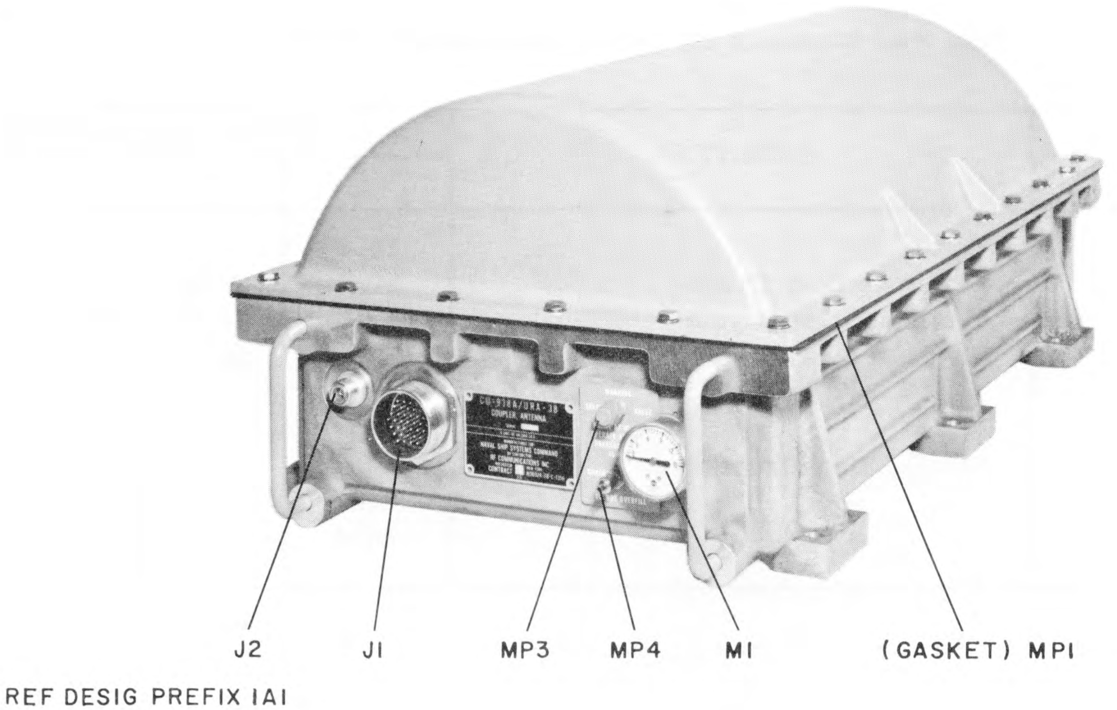
TRANSISTOR	CONDITION		DC VOLTAGE TO GROUND		
			B	E	C
A4Q1	Retune (Element(s) Running Home) Otherwise		0.7 0 to - 1.2	0 0	0.1 7.1 to 12.0
A4Q2	Retune (Element(s) Running Home) Otherwise		0.1 0.7	0 0	12.0 0.1
A4Q3	System keyed, Either Tuning or Tuned System Unkeyed and/or Homing		- 0.7 0.7	0 0	35.0 0.1
A4Q4	Inductor at Home Tuning (Initial Tune) Otherwise		- 0.8 0.7 - 0.14 to - 0.9	0 0 0	0 0.1 44.0
A4Q5	Elements at Home or Tuning (Initial Tune) Otherwise		- 0.1 0.7	0 0	26.0 to 30.0 0.1
A4Q6	Tuned, With or Without RF Otherwise		0.8 - 0.6 to + 0.05	0 0	0.3 24.0 to 29.0
Motor Drive Transistors Function switch MANUAL Coupler cable disconnected at J2	No motor drive command:	Q1, Q2, Q3, Q4 Q5, Q6, Q7, Q8	31.0 31.0	31.0 30.0	31.0 0
	Press RIGHT button (Tune Direction)	(C) (L) Q1 or Q3 (Home +) Q2 or Q4 (Tune +) Q5 or Q7 (Tune -) Q6 or Q8 (Home -)	 30.0 29.0 5.7 29.3	 29.3 29.3 5.8 28.0	 6.5 29.3 0 0
	Press LEFT button (Home Direction)	(C) (L) Q1 or Q3 (Home +) Q2 or Q4 (Tune +) Q5 or Q7 (Tune -) Q6 or Q8 (Home -)	 29.0 30.0 29.3 5.7	 29.3 29.3 29.0 5.8	 29.3 6.5 0 0

Table 5.3. Transistor DC Voltage Measurements (Cont)

TRANSISTOR	CONDITION	DC VOLTAGE TO GROUND		
		B	E	C
A5Q1	Any	.07 (B1)	5.5	10.0 (B2)
A5Q2	L Motor Running Minimum Duty Cycle Maximum Duty Cycle	1.12 0.95 1.30	3.8 2.5 7.6	12.0 9.1 20.9
A5Q3	L Motor Running Minimum Duty Cycle Maximum Duty Cycle	20.8 20.5 22.3	21.2 21.2 22.1	15.2 18.5 2.18
A5Q4	Run L - Left PB Run L - Right PB Minimum Duty Cycle Maximum Duty Cycle	0.87 0.87 1.05 0.17	0.35 0.35 0.43 0.07	0.88 6.5 2.42 19.4
A5Q5	Run L - Left PB Run L - Right PB Minimum Duty Cycle Maximum Duty Cycle	0.88 6.5 2.42 19.4	0.33 6.0 2.0 19.7	18.9 28.4 30.5 30.5
A5Q6	Run L - Right PB Run L - Left PB Minimum Duty Cycle Maximum Duty Cycle	20.4 18.9 30.2 30.2	28.9 18.5 31.0 31.0	24.2 24.2 30.2 30.2
A5Q7	Run L - Right PB Run L - Left PB Minimum Duty Cycle Maximum Duty Cycle	0.87 0.87 1.07 0.17	0.35 0.35 0.44 0.07	0.88 6.3 2.37 19.5
A5Q8	Run L - Right PB Run L - Left PB Minimum Duty Cycle Maximum Duty Cycle	0.88 6.3 2.37 19.5	0.34 6.5 2.07 19.5	20.7 28.7 31.2 31.2
A5Q9	Run L - Right PB Run L - Left PB Minimum Duty Cycle Maximum Duty Cycle	18.5 20.0 30.2 30.2	18.6 28.5 31.0 31.0	24.2 24.2 30.2 30.3
A5Q10	Run L Minimum Duty Cycle Maximum Duty Cycle	23.0 30.5 30.5	23.0 30.8 30.8	29.1 30.8 30.8

Table 5.3. Transistor DC Voltage Measurements (Cont)

TRANSISTOR	CONDITION	DC VOLTAGE TO GROUND		
		B	E	C
A5Q11	Run L	23.0	23.0	7.8
	Minimum Duty Cycle	30.8	30.8	2.17
	Maximum Duty Cycle	30.8	30.8	12.0
	Run C, home direction	25.2 to 25.5	25.6 to 25.9	4.3 to 5.5
	Run C, tune direction	24.5 to 25.0	24.9 to 25.4	6.2 to 9.5



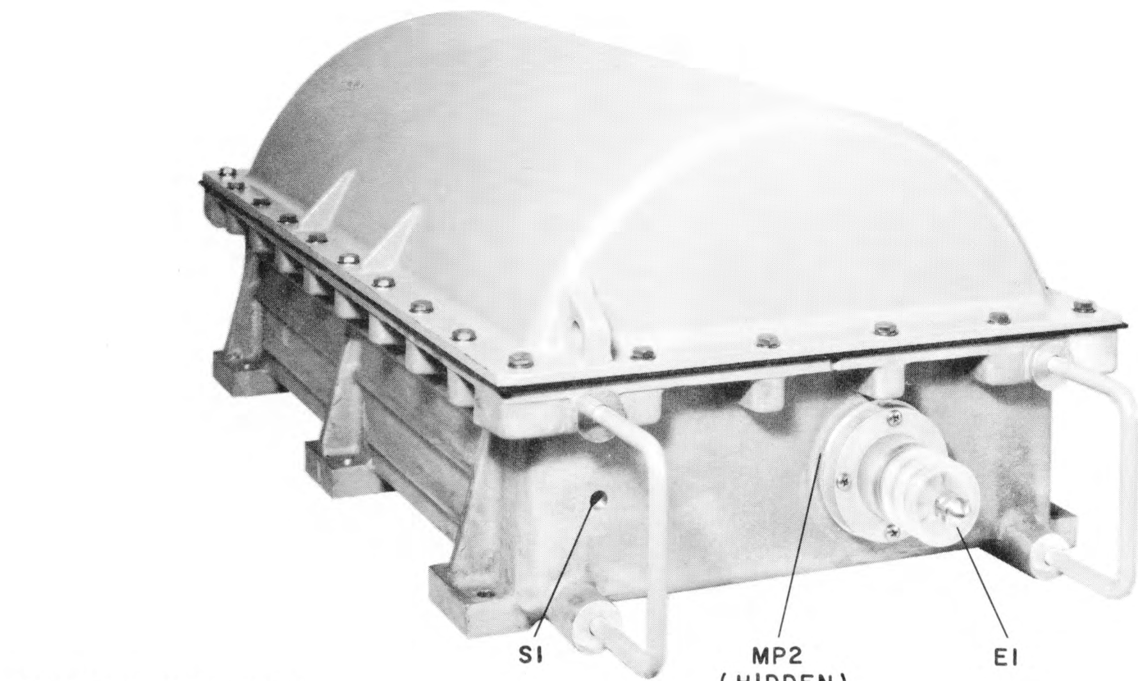


Figure 5.3. RF-601A/CU Antenna Coupler Case, Component Locations

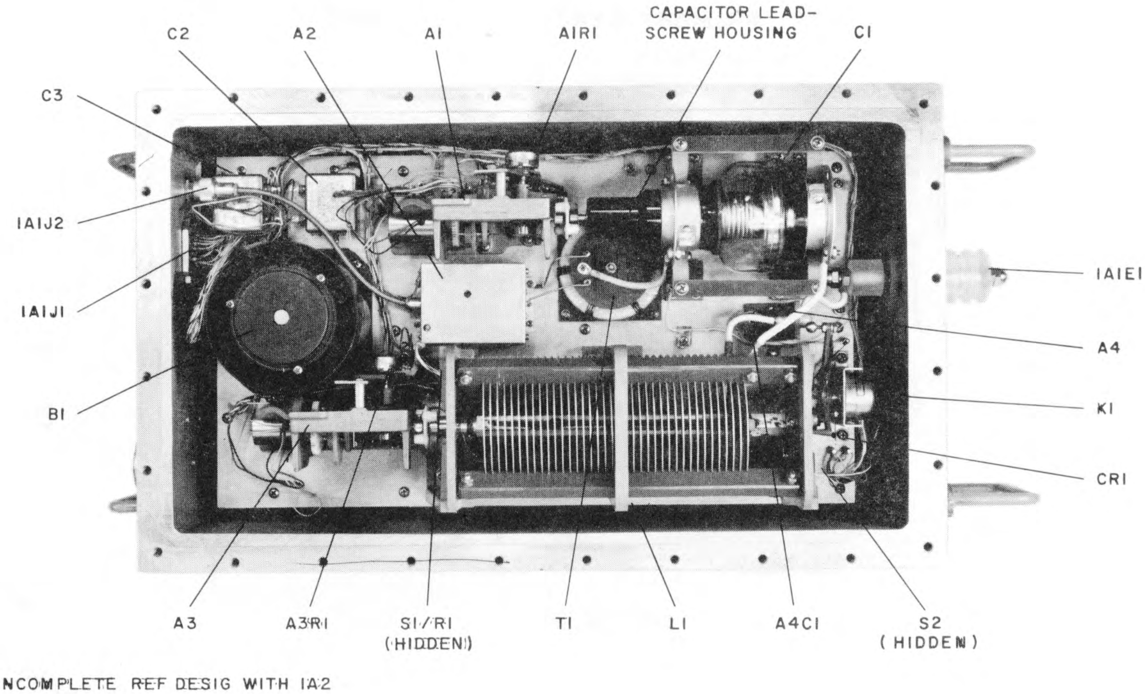


Figure 5.4. RF-601A/CU Antenna Coupler Chassis, Component Locations

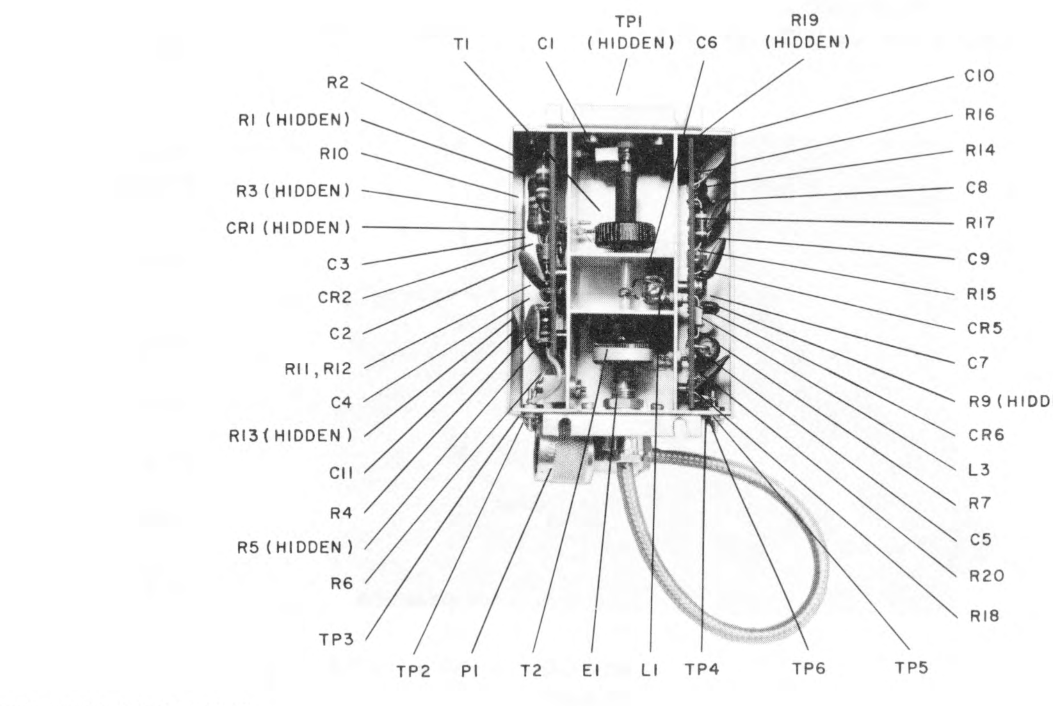
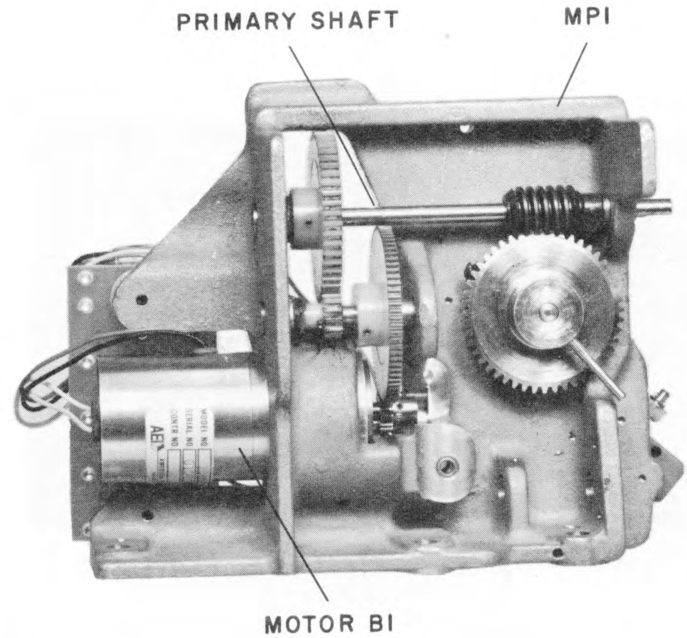
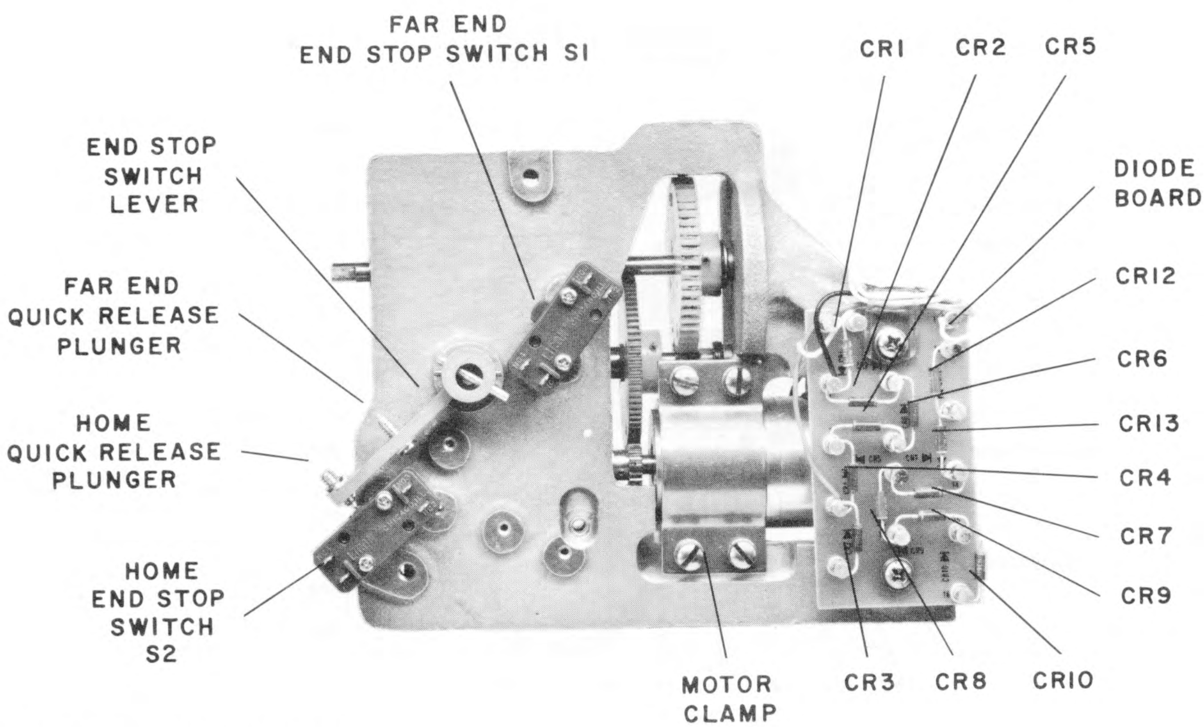


Figure 5.5. Discriminator Assembly 1A2A2, Component and Test Point Locations

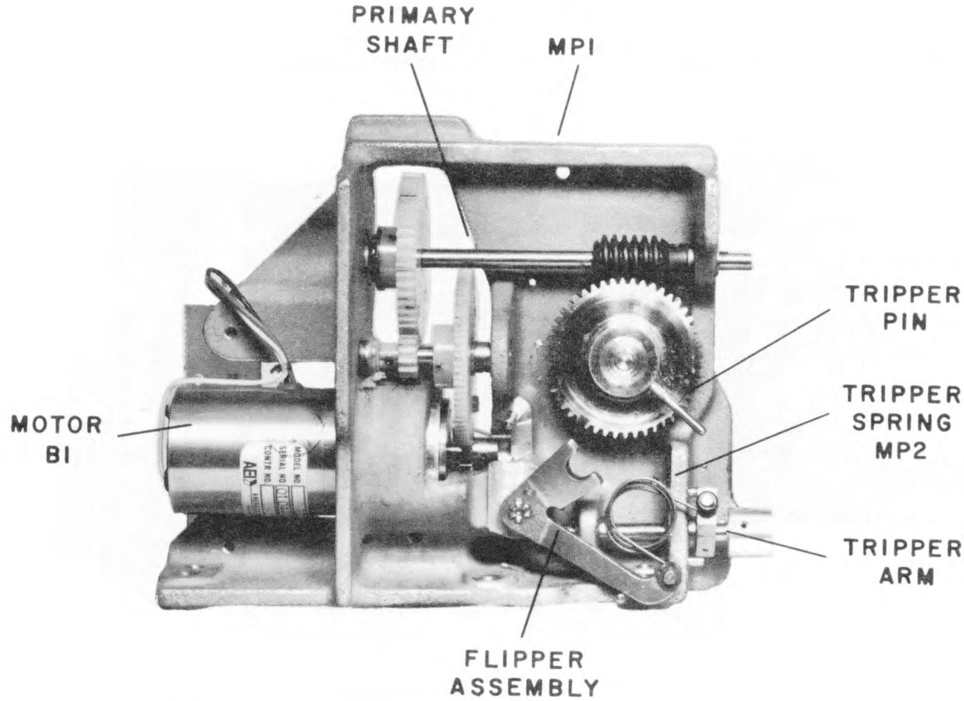


REF DESIG PREFIX IA2AI

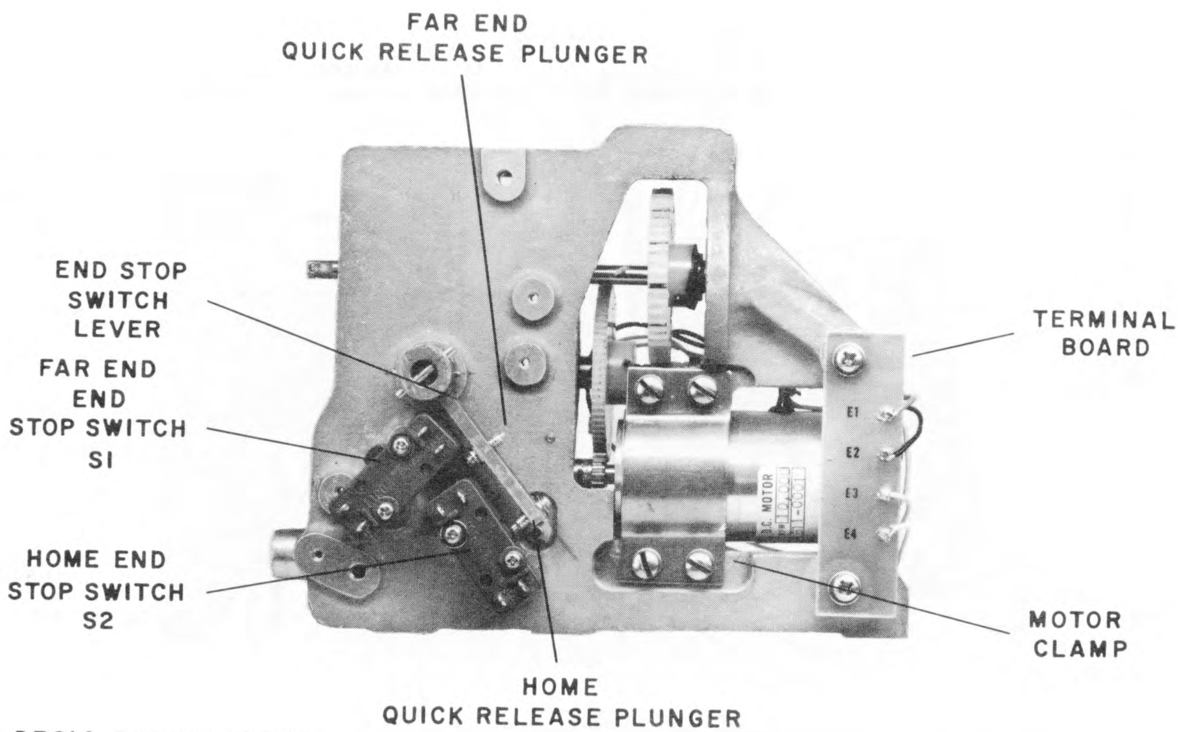


REF DESIG PREFIX IA2AI

Figure 5.6. Gear Drive Assembly 1A2A1, Component Locations



REF DESIG PREFIX IA2A3



REF DESIG PREFIX IA2A3

Figure 5.7. Gear Drive Assembly 1A2A3, Component Locations

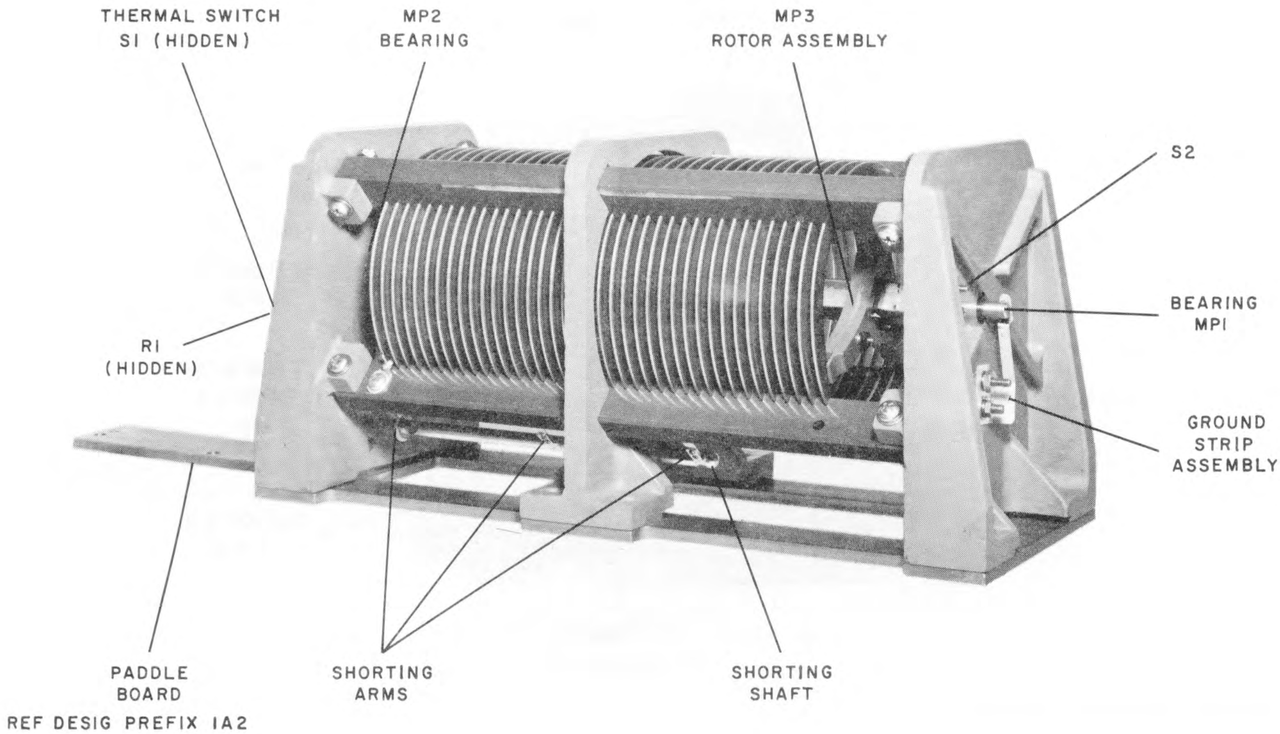


Figure 5.8. Inductor Assembly 1A2L1, Component Locations

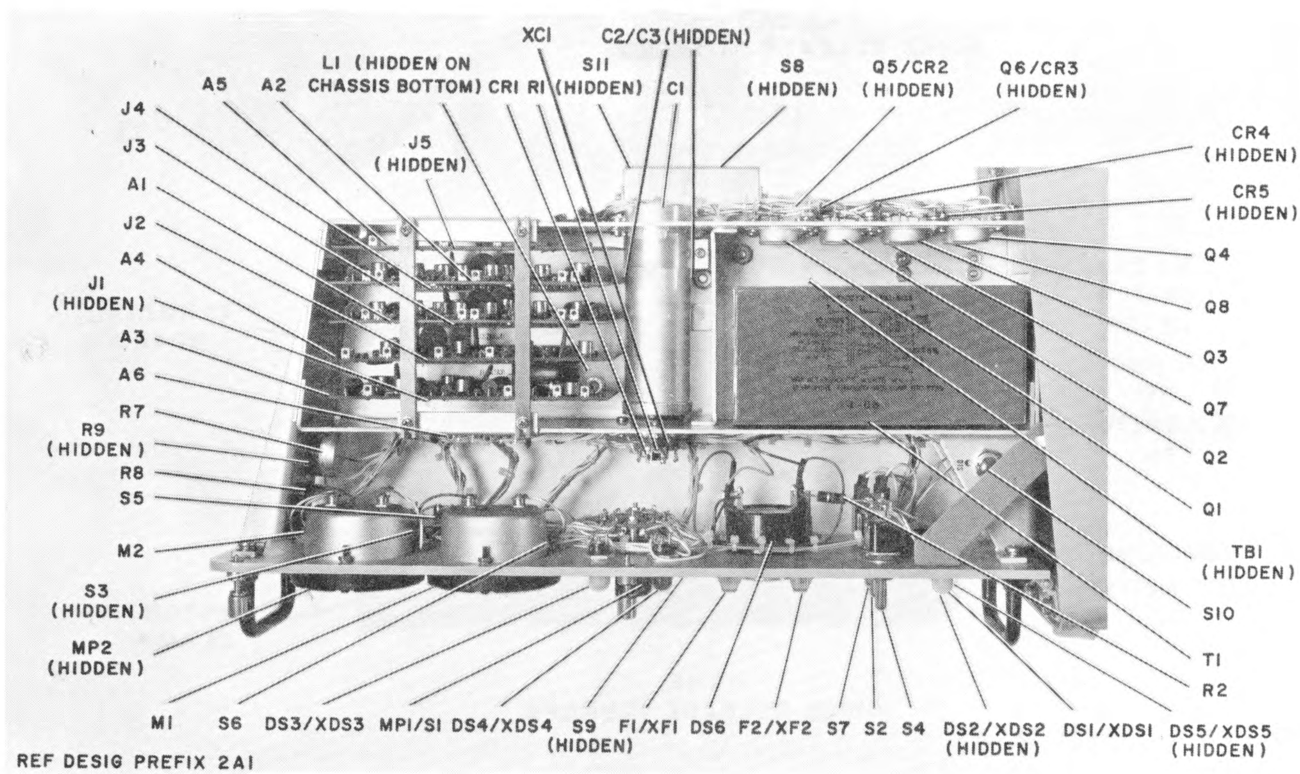


Figure 5.9. RF-601A/C Antenna Coupler Control Chassis Panel Assembly, Component Locations

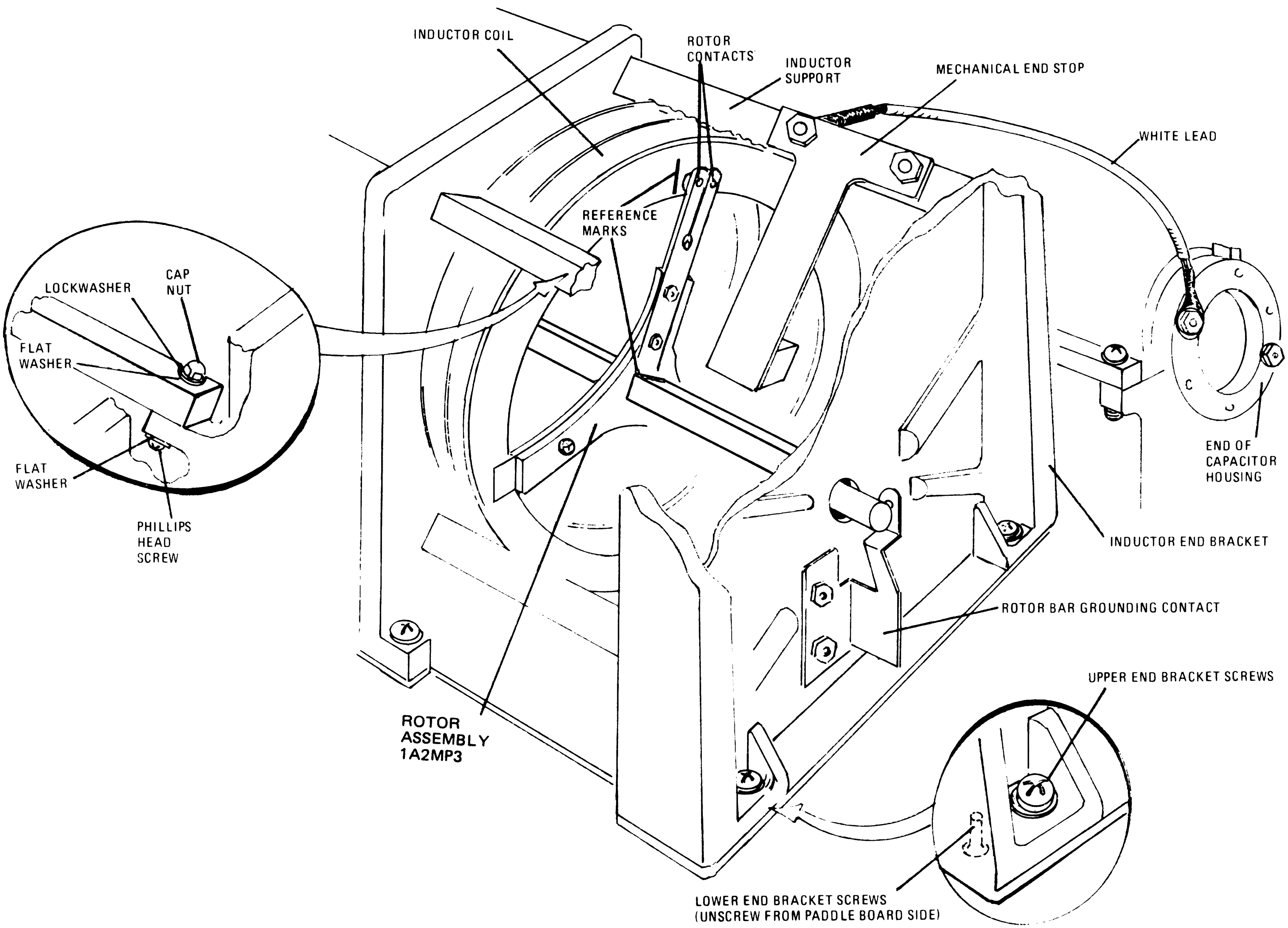


Figure 5-9A. Inductor Assembly 1A2L1 Detail View

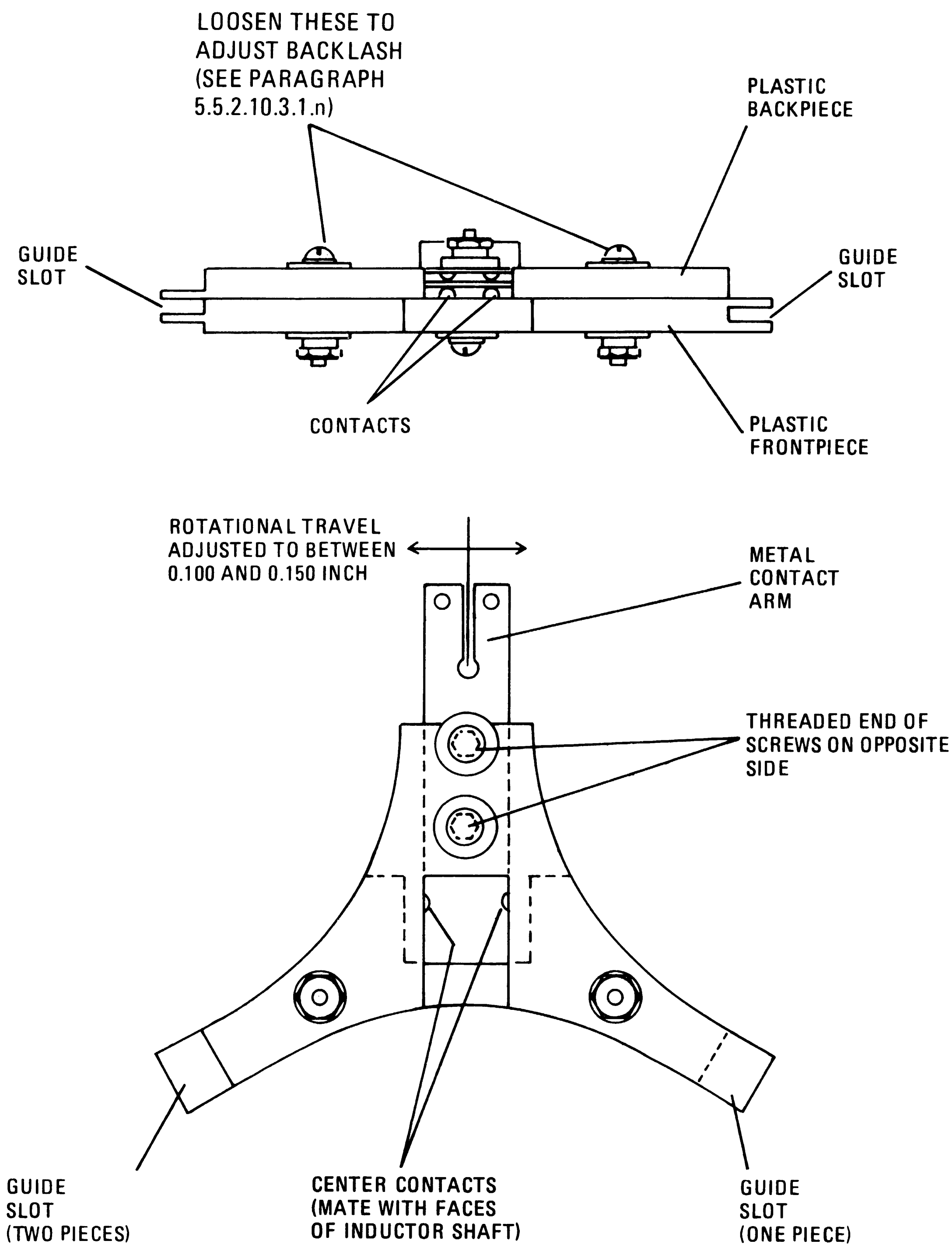
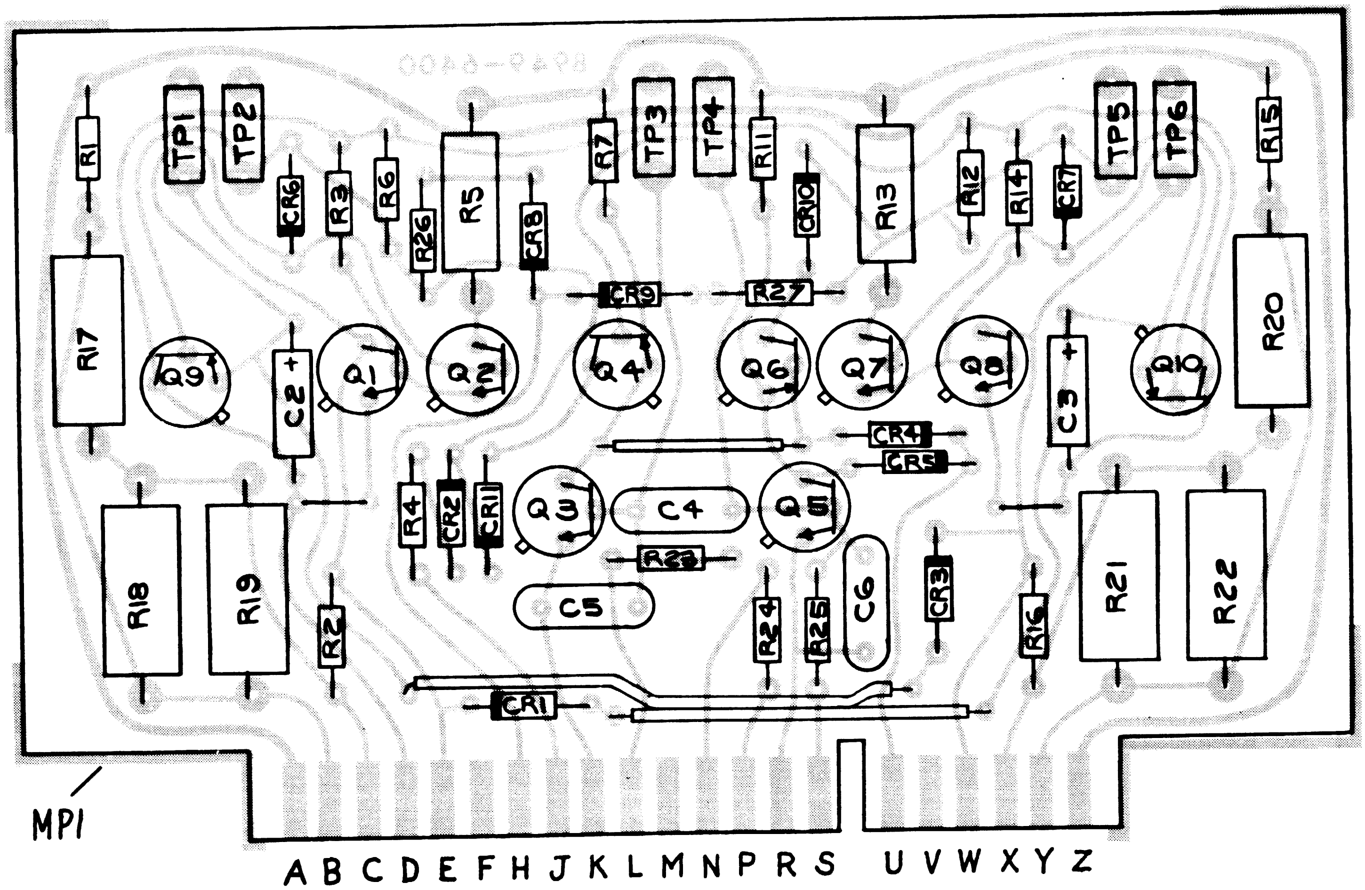


Figure 5-9B. Rotor Assembly 1A2MP3 Detail View

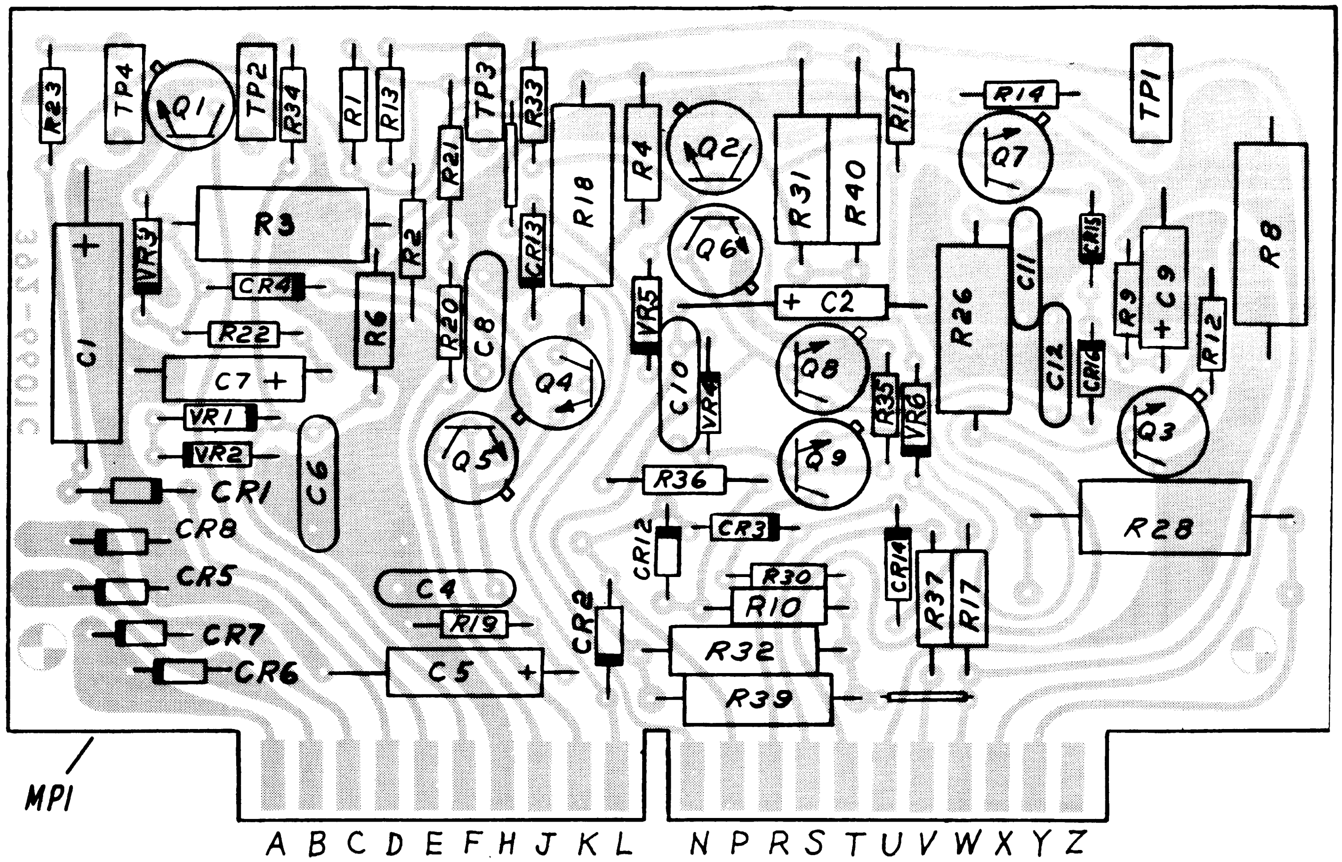


REF DESIG PREFIX
2A1A1 or 2A1A2

PIN CALLOUTS

A - +28 VDC
B - Home Output
C - Home Output
D - Chassis Ground
E - Home Output
F - (Not used)
H - Tune Sensitivity In
J - Home Signal From Logic
K - To Balance Pot
L - Discriminator Ref
M - (Not used)
N - To Balance Pot
P - -4 VDC
R - To Balance Pot
S - Discriminator Input
T - (T is keyway)
U - Surveillance Disable
V - (Not used)
W - Tune Output
X - Tune Output
Y - Tune Output
Z - Switched 28 VDC In

Figure 5.10. Printed Circuit Boards 2A1A1 and 2A1A2, Component and Test Point Locations

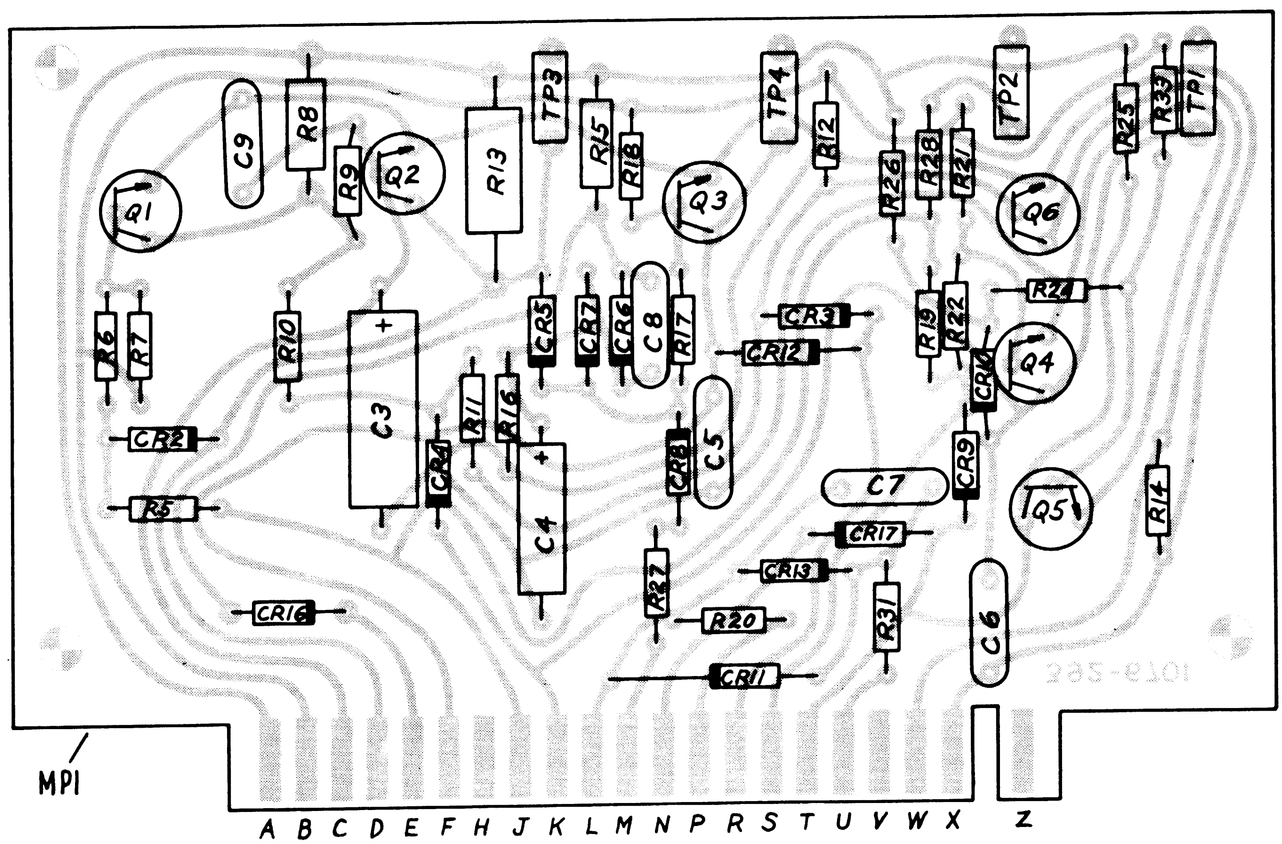


REF DESIG PREFIX
2A1A3

PIN CALLOUTS

A - 28 VDC		N - 4 VDC Out	
B - 28 VAC		P - To Tune Lamp	
C - 28 VAC		R - C Motor On	
D - 4 VAC		S - Element Pos. Meter	
E - Bypass		T - L Motor Brake	
F - 12.4 VDC		U - Motor On	
H - Chassis GRD		V - Element Pos. Pot.	
J - Key Hold		W - 28 VDC	
K - Keyline		X - -2 VDC Out	
L - L Motor On		Y - C Motor Brake	
M - (M is Keyway)		Z - (not used)	

Figure 5.11. Printed Circuit Board 2A1A3, Component and Test Point Locations



REF DESIG PREFIX
2A1A4

PIN CALLOUTS

A - 28 VDC
B - -2 VDC
C - GRD Pulse In
D - Home Signal Out
E - Keyline In
F - Key Interlock Out
H - (not used)
J - Motor On
K - Reset In
L - Discriminator Home
M - Overload In
N - Manual - Silent GRD
P - +Null Meter
R - Far End Stop In
S - Key Hold Out
T - Tune Sensitivity Drive
U - -Null Meter
V - (not used)
W - Ready Lamp Out
X - Chassis GRD
Y - (Y is Keyway)
Z - (not used)

Figure 5.12. Printed Circuit Board 2A1A4, Component and Test Point Locations

REF DESIG PREFIX
2A1A5

PIN CALLOUTS

A – (not used
B – Unfiltered DC Input
C – Chassis Ground
D – (not used)
E – (E is Keyway)
F – (not used)
H – (not used)
J – Home Signal Input
K – Home Motor On
L – (not used)
M – Home Manual Ground Input
N – (not used)
P – (not used)
R – (not used)
S – (not used)
T – (not used
U – Tune Manual Ground Input
V – L Motor On
W – C Motor On
X – Tune Motor On
Y – Switched 28 VDC
Z – 28 VDC

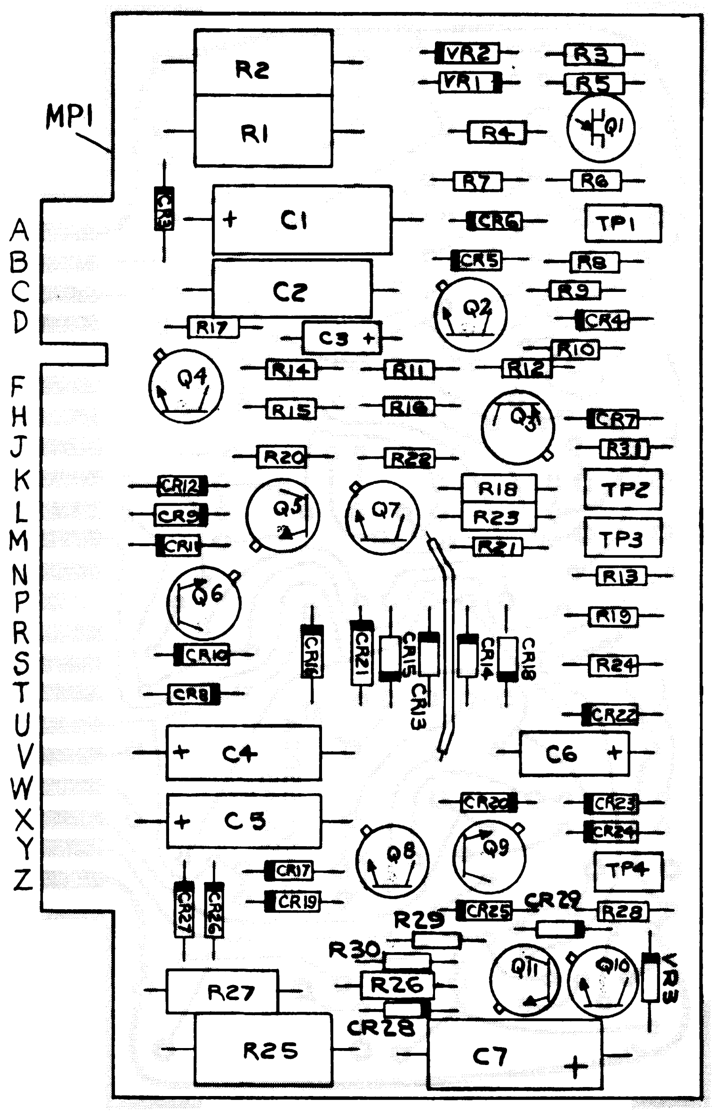


Figure 5.13. Printed Circuit Board 2A1A5, Component and Test Point Locations

TERMINAL CALLOUTS

E1 – Ground
E2 – Tuning Signal
E3 – +28 VDC
E4 – Tune-Sensitivity-Drive Input
E5 – Tune-Sensitivity-Drive Output

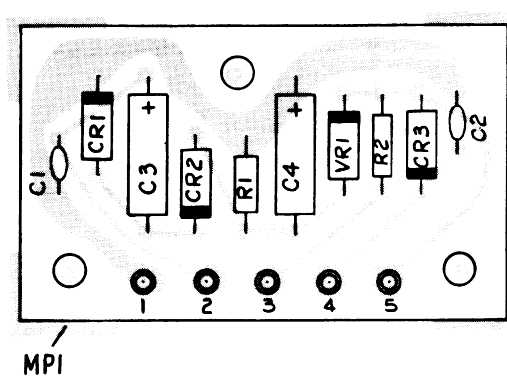


Figure 5.14. Printed Circuit Board 2A1A6, Component Locations

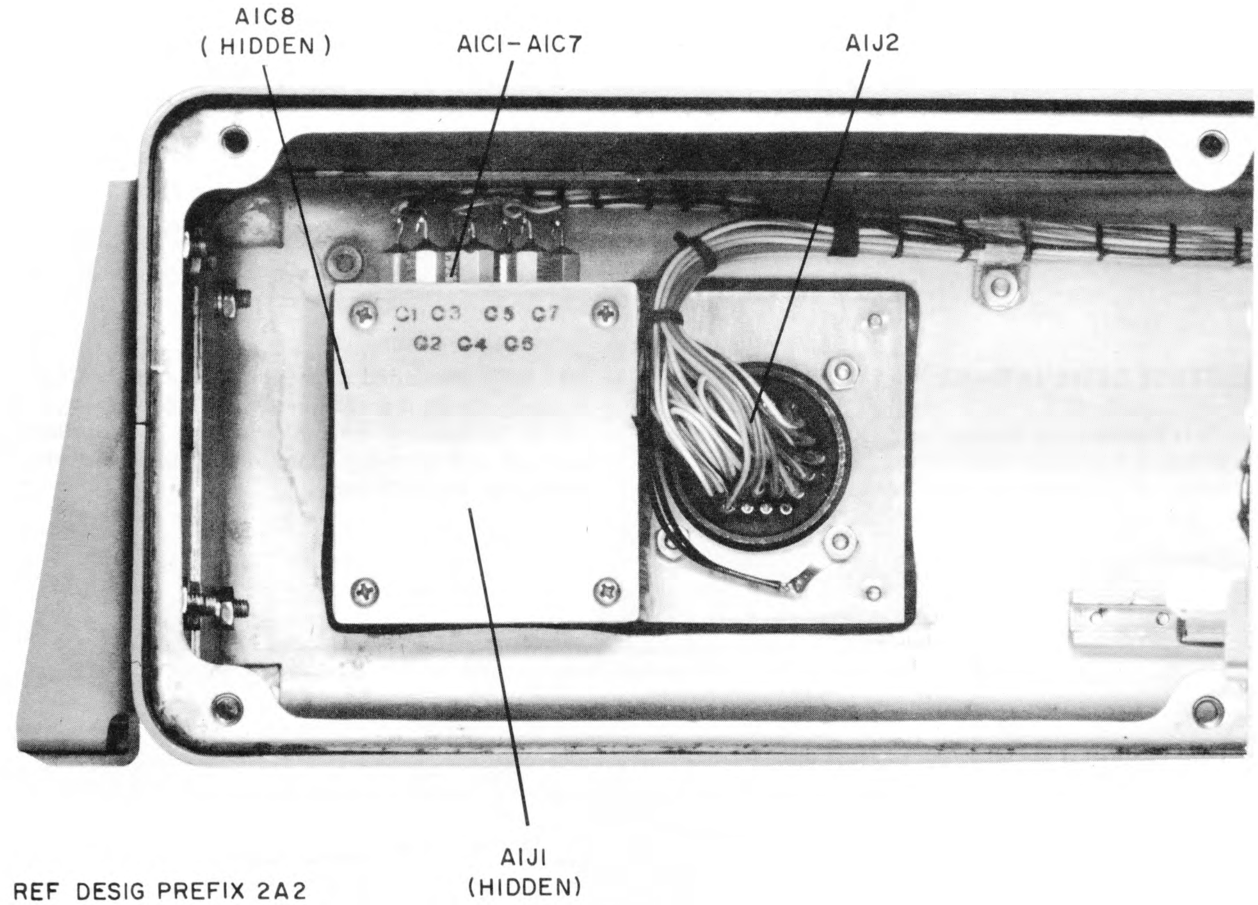


Figure 5.15. RF-601A/C Antenna Coupler Control Case, Component Locations

NOTE: SEE FIGURE 5-18 (1 OF 4) FOR 230 VAC STRAPPING OF 2A1T1 (PART NO. 0902-6135)

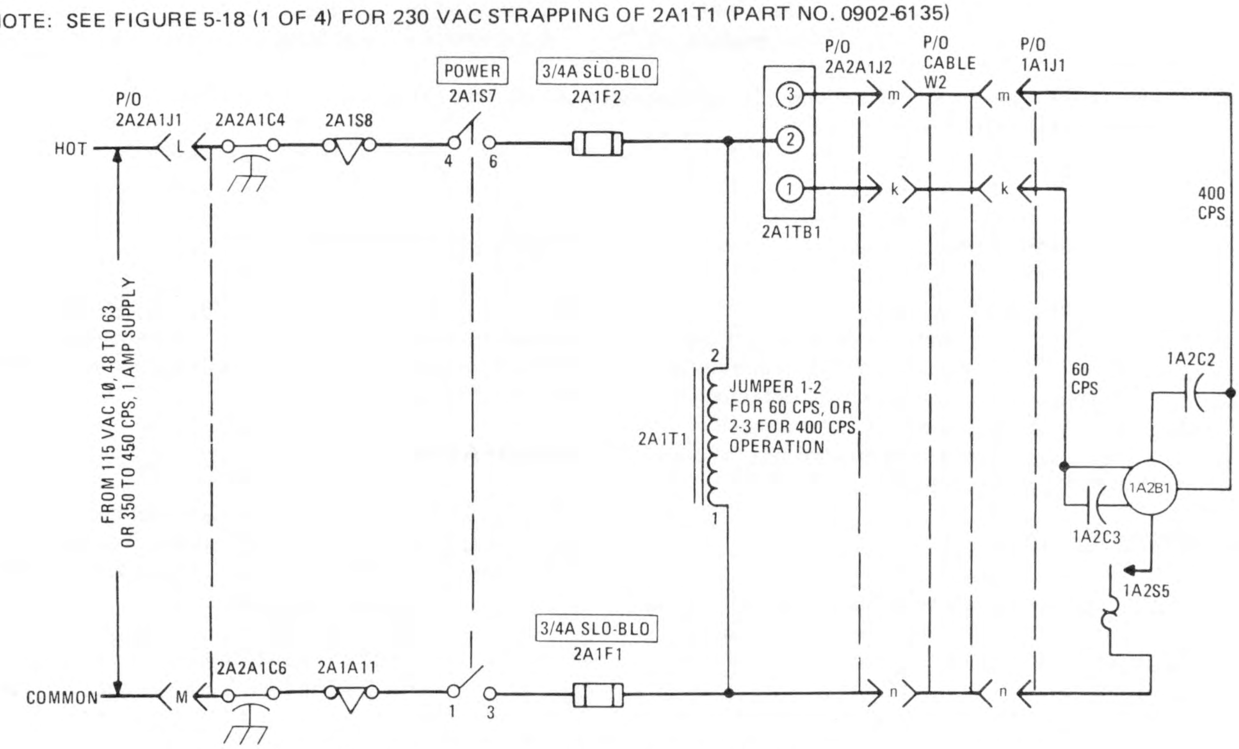


Figure 5.16. Primary Power Distribution Diagram

PARTS LIST

REFERENCE DESIGNATIONS.

The unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies, and parts. This method has been expanded as much as necessary to adequately cover the various degrees of subdivision of the equipment. Examples of this unit numbering method and typical expansions of the same are illustrated by the following:

Example 1: 1 R 1

Unit No. — Class of Item — Item No. within class

Read as: First (1) resistor (R) of first unit (1).

Example 2: 2 A1 R1

Unit No. — Subassembly designation — Class and No. of item

Read as: First (1) resistor (R) of first (1) subassembly (A) of second (2) unit.

Example 3: 2 A1 A2 R1

Unit No. — Subassembly designation — Subassembly designation — Class and No. of item

Read as: First (1) resistor (R) of second (2) subassembly (A) of first (1) subassembly (A) of second (2) unit.

REFERENCE DESIGNATION PREFIX.

Partial reference designations are used on the equipment and illustrations. The partial reference designations consist of the class letter(s) and the identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on illustrations following the notation "REF DESIG PREFIX".

UNIT IDENTIFICATION.

Each RF-601A includes two units. Unit 1 is the RF-601A/CU Antenna Coupler; Unit 2 is the RF-601A/C Antenna Coupler Control.

PARTS LIST SEQUENCE.

The sequence of the parts list follows the numerical and alphabetic order of the units and their assemblies and parts. Unit 1 items are listed in the front of the parts list, followed by Unit 2 items.

MANUFACTURER CODE.

Most of the listed parts are standard military parts, listed by their MIL part number. Non-standard items have the RF Communications manufacturer code, MFR 14304.

Harris Corporation
RF Communications Division
1680 University Avenue
Rochester, New York 14610

PARTS LIST

Ref Desig	Name and Description	Fig.
1	RF-601A/CU ANTENNA COUPLER – MFR 14304, PN 0902-1000	5-3
1A1	CASE ASSEMBLY – MFR 14304, PN NONE	5-3
1A1E1	TERMINAL, ANTENNA – MFR 14304, PN 8949-2103 (See Note 1)	5-3
1A1J1	CONNECTOR, RECEPTACLE, ELECTRICAL – MFR 14304, PN J10-0006-000	5-3
1A1J2	CONNECTOR, RECEPTACLE, ELECTRICAL – MIL TYPE UG-30D/U	5-3
1A1M1	GAUGE, PRESSURE – MFR 14304, PN 0902-1954	5-3
1A1MP1	GASKET – MFR 14304, PN 0902-1005	5-3
1A1MP2	O-RING – MIL TYPE MS9021-030 (See Note 2)	5-3
1A1MP3	VALVE, RELIEF – MFR 14304, PN Z40-0004-005	5-3
1A1MP4	VALVE, CHARGING – MFR 14304, PN Z40-0002-000	5-3
1A1S1	SWITCH, PRESSURE – MFR 14304, PN S75-0001-002	5-3
1A2	CHASSIS ASSEMBLY – MFR 14304, PN NONE	5-4
1A2B1	FAN, DUAL FREQUENCY – 115 VOLTS, 60 OR 400 HZ, MFR 14304, PN 392-1404	5-4
1A2C1	CAPACITOR, VARIABLE, VACUUM – 10-500 PF, MFR 14304, PN C95-0001-000	5-4
1A2C2	CAPACITOR, FIXED, PAPER – 3UF, 400 WVDC, MFR 14304, PN C70-0001-001	5-4
1A2C3	SAME AS 1A2C2	
1A2C4	CAPACITOR, FIXED, DISC – .01 UF, MIL TYPE CK63AW103M	5-4
1A2CR1	DIODE – MIL TYPE 1N3611	5-4
1A2K1	RELAY, ROTARY SOLENOID – MFR-14304, PN B11-0005-001	5-4
1A2L1	VARIABLE COIL ASSEMBLY – MFR 14304, PN 0902-1900-2	5-4
1A2L2	CHOKE, RF – 5600 UH, MIL TYPE MS90541-05	
1A2MP1	BEARING, BALL – MFR 14304, PN Z05-0010-001	5-8
1A2MP2	SAME AS 1A2MP1	5-8
1A2MP3	ROTOR ASSEMBLY – MFR 14304, PN 0902-1935	5-8
1A2R1	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF103K	5-4/ 5-8

Ref Desig	Name and Description	Fig.
1A2S1	SWITCH, THERMAL – MFR 14304, PN S70-0001-000	5-4/ 5-8
1A2S2	SWITCH, THERMAL – MFR 14304, PN S70-0005-001	5-4/ 5-8
1A2T1	TRANSFORMER, TOROID – MFR 14304, PN 392-1320	5-4
1A2A1	CAPACITOR DRIVE ASSEMBLY – MFR 14304, PN 0902-2300	5-4/ 5-6
1A2A1B1	MOTOR & PINION ASS'Y MFR 14304, PN 6049-4652	5-6
1A2A1CR1 THROUGH 1A2A1CR10	SAME AS 1A2CR1	5-6
1A2A1CR11	NOT USED	
1A2A1CR12	SAME AS 1A2CR1	5-6
1A2A1CR13	SAME AS 1A2CR1	5-6
1A2A1MP1	GEAR DRIVE – MFR 14304, PN 0902-4654	5-6
1A2A1R1	RESISTOR, VARIABLE – MFR 14304, PN 392-1607	5-4
1A2A1S1	SWITCH, LIMIT – MIL TYPE MS25343-1	5-6
1A2A1S2	SAME AS 1A2A1S1	5-6
1A2A2	DISCRIMINATOR ASSEMBLY – MFR 14304, PN 0902-1500	5-4/ 5-5
1A2A2C1	CAPACITOR, FIXED, GLASS – MIL TYPE CY13C5R1C	5-5
1A2A2C2	CAPACITOR, FIXED, CERAMIC – MIL TYPE CK62AW822M	5-5
1A2A2C3 THROUGH 1A2A2C5	SAME AS 1A2A2C2	5-5
1A2A2C6	CAPACITOR, VARIABLE, GLASS – MIL TYPE PC41J8R5	5-5
1A2A2C7	CAPACITOR, FIXED, MICA – MIL TYPE CM05D331J03	5-5
1A2A2C8 THROUGH 1A2A2C11	SAME AS 1A2A2C2	5-5
1A2A2CR1 } 1A2A2CR2 }	DIODE MATCHED PAIR 0902-1957	5-5 5-5
1A2A2CR3	NOT USED	
1A2A2CR4 } 1A2A2CR5 }	DIODE MATCHED PAIR 0902-1957	5-5

NOTES

1. ON COUPLERS WITH SN531 AND HIGHER, A CERAMIC ANTENNA TERMINAL, P/N 0902-2103 , IS USED. REPLACE ANTENNA TERMINAL ON COUPLERS WITH SN530 OR LOWER, WITH EITHER PART NUMBER.
2. USE O-RING MS9021-030 WITH ANTENNA TERMINAL 8949-2103; USE GASKET 0902-1963 WITH ANTENNA TERMINAL 0902-2103.

Ref Desig	Name and Description	Fig.
1A2A2CR6	SAME AS 1A2A2CR1	5-5
1A2A2E1	TERMINATION, COAXIAL – MIL TYPE MX-1530A/U	5-5
1A2A2L1	COIL, FIXED RF – MIL TYPE LT4K029	5-5
1A2A2L2	NOT USED	
1A2A2L3	COIL, FIXED RF – MFR 14304, PN L10-0002-054	5-5
1A2A2P1	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE UG-536B/U	5-5
1A2A2R1	RESISTOR, FIXED, FILM – MIL TYPE RL32S390G	5-5
1A2A2R2	SAME AS 1A2A2R1	5-5
1A2A2R3	RESISTOR, FIXED, FILM – MIL TYPE RL42S221J	5-5
1A2A2R4	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF392K	5-5
1A2A2R4	SAME AS 1A2A2R4	5-5
1A2A2R6	RESISTOR, VARIABLE – MIL TYPE RT11C2P202	5-5
1A2A2R7	RESISTOR, FIXED, FILM – MIL TYPE RL42S101J	5-5
1A2A2R8	NOT USED	
1A2A2R9*	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF101J	5-5
1A2A2R10	SAME AS 1A2A2R3	5-5
1A2A2R11	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF152K	5-5
1A2A2R12	SAME AS 1A2A2R11	5-5
1A2A2R13	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF332K	5-5
1A2A2R14	SAME AS 1A2A2R11	5-5
1A2A2R15	SAME AS 1A2A2R11	5-5
1A2A2R16	RESISTOR, FIXED, FILM – MIL TYPE RL20S472G	5-5
1A2A2R17	SAME AS 1A2A2R16	5-5
1A2A2R18	SAME AS 1A2A2R13	5-5
1A2A2R19**	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF821K	5-5
1A2A2R20	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF123K	5-5
1A2A2T1	TRANSFORMER, TOROID – MFR 14304, PN T10-0002-000	5-5
1A2A2T2	TRANSFORMER, TOROID – MFR 14304, PN T10-0001-000	5-5
1A2A3	COIL DRIVE ASSEMBLY – MFR 14304, PN 0902-1600	5-4/ 5-7
1A2A3B1	SAME AS 1A2A1B1	5-7
1A2A3MP1	GEAR DRIVE – MFR 14304, PN 0902-4655	5-7
1A2A3MP2	SPRING, TRIPPER – MFR 14304, PN 6049-4656	5-7
1A2A3R1	SAME AS 1A2A1R1	5-4
1A2A3S1	SAME AS 1A2A1S1	5-7
1A2A3S2	SAME AS 1A2A1S1	5-7

*LATER UNITS USE PART NO. RC20GF820J

**LATER UNITS USE PART NO. RC20GF122K

Ref Desig	Name and Description	Fig.
1A2A4	PROTECTOR ASSEMBLY – MFR 14304, PN 0902-2200	5-4
1A2A4C1	SAME AS 1A2A2C2	5-4
2	RF-601A/C ANTENNA COUPLER CONTROL – MFR 14304, PN 0902-6000	5-9
2A1	CHASSIS - PANEL ASSEMBLY– MFR 14304, PN 0902-6100	5-9
2A1C1	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CE51C222G	5-9
2A1C2, 2A1C3	CAPACITOR, FIXED MFR 14304, P/N C22-0001-007	5-9
2A1C4	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BE107K	5-9
2A1CR1 THROUGH 2A1CR5	SAME AS 1A2CR1	5-9
2A1DS1 THROUGH 2A1DS5	LAMP, INCANDESCENT – MIL TYPE MS25237-327	5-9
2A1DS6	ALARM, SONALERT – 6-28 VDC, 3-14 MA, SOUND 68-80 DB, 2.5 KHZ, MFR 14304, PN U40-0001-000	5-9
2A1F1, 2A1F2	FUSE, CARTRIDGE – MIL TYPE F02B250V0.75AS	5-9
2A1J1 THROUGH 2A1J5	CONNECTOR, RECEPTACLE, ELECTRICAL – MIL TYPE M21097/6-47	5-9
2A1L1	CHOKE, RF – MIL TYPE MS16221-15	5-9
2A1M1	METER, PANEL – MFR 14304, PN 392-6106	5-9
2A1M2	METER, PANEL – MFR 14304, PN 392-6107	5-9
2A1MP1	KNOB – MIL TYPE MS91528-1K2B	5-9
2A1MP2	SAME AS 2A1MP1	5-9
2A1Q1	TRANSISTOR – MIL TYPE 2N297A	5-9
2A1Q2 THROUGH 2A1Q8	SAME AS 2A1Q1	5-9
2A1R1	SAME AS 1A2R1	5-9
2A1R2	RESISTOR, FIXED COMPOSITION – MIL TYPE RC32GF102K	5-9
2A1R3 THROUGH 2A1R6	NOT USED	
2A1R7	RESISTOR, VARIABLE – MIL TYPE RV4LAYSA501A	5-9
2A1R8	SAME AS 2A1R7	5-9
2A1R9	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF121K	5-9
2A1S1	SWITCH, ROTARY – MFR 14304, PN 392-6117	5-9
2A1S2	SWITCH, TOGGLE – MIL TYPE MS35058-22	5-9

PARTS LIST (Cont'd)

Ref Desig	Name and Description	Fig.
2A1S3	SWITCH, ROTARY – MFR 14304, PN 8949-6118	5-9
2A1S4	SAME AS 2A1S2	5-9
2A1S5	SWITCH, PUSH – MIL TYPE MS25089-3C	5-9
2A1S6	SAME AS 2A1S5	5-9
2A1S7	SWITCH, TOGGLE – MIL TYPE MS35059-22	5-9
2A1S8	SWITCH, INTERLOCK – MIL TYPE MS16106-4	5-9
2A1S9	SWITCH, PUSH – MIL TYPE MS25089-1C	5-9
2A1S10	SAME AS 2A1S2	5-9
2A1S11	SAME AS 2A1S8	5-9
2A1T1*	TRANSFORMER, POWER – MFR 14304, PN 392-6135	5-9
2A1TB1	TERMINAL BLOCK – MIL TYPE 37TB3	5-9
2A1XC1	SOCKET, OCTAL – MIL TYPE TS101P01	5-9
2A1XDS1	LAMPHOLDER – MIL TYPE LH73LC12WT	5-9
2A1XDS2	LAMPHOLDER – MIL TYPE LH73LC12RT	5-9
2A1XDS3	LAMPHOLDER – MIL TYPE LH73LC12YT	5-9
2A1XDS4	LAMPHOLDER – MIL TYPE LH73LC12GT	5-9
2A1XDS5	SAME AS 2A1XDS2	5-9
2A1XF1	FUSEHOLDER – MIL TYPE FHL17G	5-9
2A1XF2	SAME AS 2A1XF1	5-9
2A1A1	SERVO AMPLIFIER PC BOARD ASSEMBLY – MFR 14304, PN 8949-6400	5-10
2A1A1C1	NOT USED	
2A1A1C2	CAPACITOR, FIXED ELECTROLYTIC – MIL TYPE CS13BB685K	
2A1A1C3	SAME AS 2A1A1C2	
2A1A1C4 THROUGH 2A1A1C6	SAME AS 1A2A2C2	
2A1A1CR1	DIODE – MIL TYPE 1N277	
2A1A1CR2 THROUGH 2A1A1CR5	SAME AS 2A1A1CR1	
2A1A1CR6	SAME AS 1A2CR1	
2A1A1CR7	SAME AS 1A2CR1	
2A1A1CR8 THROUGH 2A1A1CR11	SAME AS 2A1A1CR1	
2A1A1MP1	SERVO AMPLIFIER PC BOARD – MFR 14304, PN 8949-6401	
2A1A1Q1	TRANSISTOR – MIL TYPE 2N1613	
2A1A1Q2	SAME AS 2A1A1Q1	
2A1A1Q3	SAME AS 2A1A1Q1	
2A1A1Q4	TRANSISTOR – MIL TYPE 2N1132	
2A1A1Q5	SAME AS 2A1A1Q1	
2A1A1Q6	SAME AS 2A1A1Q4	5-10
2A1A1Q7	SAME AS 2A1A1Q1	5-10
2A1A1Q8	SAME AS 2A1A1Q1	
2A1A1Q9	TRANSISTOR – MIL TYPE 2N1309	
2A1A1Q10	SAME AS 2A1A1Q9	
2A1A1R1	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF330K	
2A1A1R2	SAME AS 2A1A1R1	
2A1A1R3	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF332K	
2A1A1R4	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF392K	
2A1A1R5	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC32GF182K	
2A1A1R6	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF682K	
2A1A1R7	SAME AS 2A1A1R6	
2A1A1R8 THROUGH 2A1A1R10	NOT USED	
2A1A1R11	SAME AS 2A1A1R6	
2A1A1R12	SAME AS 2A1A1R6	
2A1A1R13	SAME AS 2A1A1R5	
2A1A1R14	SAME AS 2A1A1R3	
2A1A1R15	SAME AS 2A1A1R1	
2A1A1R16	SAME AS 2A1A1R1	
2A1A1R17	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF561K	
2A1A1R18 THROUGH 2A1A1R22	SAME AS 2A1A1R17	
2A1A1R23	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF471K	
2A1A1R24	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF182K	
2A1A1R25	SAME AS 2A1A1R23	
2A1A1R26	SAME AS 2A1A1R24	
2A1A1R27	SAME AS 2A1A1R24	
2A1A1TP1	JACK, TEST – MFR 14304, PN J60-0001-008	
2A1A1TP2	JACK, TEST – MFR 14304, PN J60-0001-002	
2A1A1TP3	JACK, TEST – MFR 14304, PN J60-0001-006	
2A1A1TP4	JACK, TEST – MFR 14304, PN J60-0001-007	
2A1A1TP5	JACK, TEST – MFR 14304, PN J60-0001-004	
2A1A1TP6	JACK, TEST – MFR 14304, PN J60-0001-010	
2A1A2	SAME AS 2A1A1	5-10
2A1A3	POWER SUPPLY PC BOARD ASSEMBLY – MFR 14304, PN 0902-6600	5-11

*2A1T1, PART NO. 0902-6135, MAY BE USED TO ALLOW 115 VAC or 230 VAC PRIMARY POWER OPERATION.

PARTS LIST (Cont'd)

Ref Desig	Name and Description	Fig.
2A1A3C1	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BB337K	5-11
2A1A3C2	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BC396K	
2A1A3C3	NOT USED	
2A1A3C4	SAME AS 1A2A2C2	
2A1A3C5	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BE106M	
2A1A3C6	SAME AS 1A2A2C2	
2A1A3C7	SAME AS 2A1A3C2	
2A1A3C8	SAME AS 1A2A2C2	
2A1A3C9	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BF685K	
2A1A3C10 THROUGH 2A1A3C12	SAME AS 1A2A2C2	
2A1A3CR1 THROUGH 2A1A3CR3	SAME AS 1A2CR1	
2A1A3CR4	SAME AS 2A1A1CR1	
2A1A3CR5 THROUGH 2A1A3CR8	SAME AS 1A2CR1	
2A1A3CR9 THROUGH 2A1A3CR11	NOT USED	
2A1A3CR12	SAME AS 1A2CR1	
2A1A3CR13	SAME AS 2A1A1CR1	
2A1A3CR14	SAME AS 2A1A1CR1	
2A1A3CR15	SAME AS 1A2CR1	
2A1A3CR16	SAME AS 1A2CR1	
2A1A3MP1	PC BOARD – MFR 14304, PN 392-6601	
2A1A3Q1	TRANSISTOR – MIL TYPE 2N2219	
2A1A3Q2 THROUGH 2A1A3Q4	SAME AS 2A1A1Q1	
2A1A3Q5	SAME AS 2A1A3Q1	
2A1A3Q6	SAME AS 2A1A1Q1	
2A1A3Q7, 2A1A3Q8	TRANSISTOR – MIL TYPE 2N2102	
2A1A3Q9	SAME AS 2A1A1Q1	
2A1A3R1	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF391K	
2A1A3R2	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF821K	
2A1A3R3	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF102K	
2A1A3R4	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF222K	
2A1A3R5	NOT USED	
2A1A3R6	SAME AS 1A2A2R11	5-11
2A1A3R7	NOT USED	

Ref Desig	Name and Description	Fig.
2A1A3R8	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF821K	5-11
2A1A3R9	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF103K	
2A1A3R10	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF223K	
2A1A3R11	NOT USED	
2A1A3R12	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF472K	
2A1A3R13	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF102K	
2A1A3R14	SAME AS 2A1A1R6	
2A1A3R15	SAME AS 2A1A1R3	
2A1A3R16	NOT USED	
2A1A3R17	SAME AS 2A1A3R4	
2A1A3R18	SAME AS 2A1A3R8	
2A1A3R19	SAME AS 2A1A1R3	
2A1A3R20	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF222K	
2A1A3R21	SAME AS 2A1A3R12	
2A1A3R22	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF470K	
2A1A3R23	SAME AS 2A1A3R13	
2A1A3R24	NOT USED	
2A1A3R25	NOT USED	
2A1A3R26	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF150K	
2A1A3R27	NOT USED	
2A1A3R28	SAME AS 2A1A3R26	
2A1A3R29	NOT USED	
2A1A3R30	SAME AS 2A1A1R6	
2A1A3R31	SAME AS 2A1A1R5	
2A1A3R32	SAME AS 2A1A1R5	
2A1A3R33	SAME AS 2A1A1R3	
2A1A3R34	SAME AS 2A1A3R13	
2A1A3R35	SAME AS 2A1A3R12	
2A1A3R36	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF100K	
2A1A3R37	RESISTOR, FIXED, FILM – MIL TYPE RL20S242G	
2A1A3R38	NOT USED	
2A1A3R39	SAME AS 2A1A1R5	
2A1A3R40	SAME AS 2A1A1R5	
2A1A3TP1 THROUGH 2A1A3TP4	SAME AS 2A1A1TP1 THROUGH 2A1A1TP4	
2A1A3VR1	DIODE – MIL TYPE 1N753A	
2A1A3VR2 THROUGH 2A1A3VR4	SAME AS 2A1A3VR1	
2A1A3VR5	DIODE – MIL TYPE 1N965B	
2A1A3VR6	SAME AS 2A1A3VR5	5-11

PARTS LIST (Cont'd)

Ref Desig	Name and Description	Fig.
2A1A4	LOGIC PC BOARD ASSEMBLY – MFR 14304, PN 392-6700	5-12
2A1A4C1	NOT USED	
2A1A4C2	NOT USED	
2A1A4C3	SAME AS 2A1A3C2	
2A1A4C4	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BE106K	
2A1A4C5 THROUGH 2A1A4C9	SAME AS 1A2A2C2	
2A1A4CR1	NOT USED	
2A1A4CR2 THROUGH 2A1A4CR13	SAME AS 2A1A1CR1	
2A1A4CR14	NOT USED	
2A1A4CR15	NOT USED	
2A1A4CR16	SAME AS 1A2CR1	
2A1A4CR17	SAME AS 2A1A1CR1	
2A1A4MP1	PC BOARD – MFR 14304, PN 392-6701	
2A1A4Q1 THROUGH 2A1A4Q6	SAME AS 2A1A1Q1	
2A1A4R1 THROUGH 2A1A4R4	NOT USED	
2A1A4R5	SAME AS 2A1A1R3	
2A1A4R6	SAME AS 2A1A1R3	
2A1A4R7	SAME AS 2A1A3R12	
2A1A4R8	SAME AS 2A1A3R4	
2A1A4R9	SAME AS 2A1A3R9	
2A1A4R10	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF122K	
2A1A4R11	SAME AS 2A1A3R13	
2A1A4R12	SAME AS 2A1A3R12	
2A1A4R13	SAME AS 2A1A1R5	
2A1A4R14	SAME AS 2A1A1R4	
2A1A4R15	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF272K	
2A1A4R16	SAME AS 2A1A3R9	
2A1A4R17	SAME AS 2A1A1R3	
2A1A4R18	SAME AS 2A1A3R12	
2A1A4R19	SAME AS 2A1A3R13	
2A1A4R20	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF101K	
2A1A4R21	SAME AS 2A1A3R12	
2A1A4R22	SAME AS 2A1A1R24	
2A1A4R23	NOT USED	
2A1A4R24	SAME AS 2A1A3R13	
2A1A4R25	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF153K	
2A1A4R26	SAME AS 2A1A1R6	
2A1A4R27	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF152K	
2A1A4R28	SAME AS 2A1A1R6	5-12
2A1A4R29	NOT USED	
2A1A4R30	NOT USED	

Ref Desig	Name and Description	Fig.
2A1A4R31	SAME AS 2A1A1R24	5-12
2A1A4R32	NOT USED	
2A1A4R33	SAME AS 2A1A3R12	
2A1A4TP1 THROUGH 2A1A4TP4	SAME AS 2A1A1TP1 THROUGH 2A1A1TP4	5-12
2A1A5	MANUAL SPEED CONTROL PC BOARD ASSEMBLY MFR 14304, PN 8949-6500	5-9/ 5-13
2A1A5C1	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BF476K	5-13
2A1A5C2	CAPACITOR, FIXED, PAPER MIL TYPE CH08A1NC104K	5-13
2A1A5C3	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BC475K	5-13
2A1A5C4	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BF156K	5-13
2A1A5C5	SAME AS 2A1A5C4	5-13
2A1A5C6	CAPACITOR, FIXED, ELECTROLYTIC – MIL TYPE CS13BF565K	5-13
2A1A5C7	SAME AS 2A1A3C1	5-13
2A1A5CR1	NOT USED	
2A1A5CR2	NOT USED	
2A1A5CR3	SAME AS 1A2CR1	5-13
2A1A5CR4 THROUGH 2A1A5CR10	DIODE – MIL TYPE 1N914	5-13
2A1A5CR11 THROUGH 2A1A5CR20	SAME AS 1A2CR1	5-13
2A1A5CR21 THROUGH 2A1A5CR29	SAME AS 2A1A5CR4	5-13
2A1A5MP1	PC BOARD – MFR 14304, PN 8949-6501	5-13
2A1A5Q1	TRANSISTOR – MFR 14304, PN D19-0001-001	5-13
2A1A5Q2	SAME AS 2A1A1Q1	5-13
2A1A5Q3	TRANSISTOR – MIL TYPE 2N2905	5-13
2A1A5Q4 THROUGH 2A1A5Q10	SAME AS 2A1A1Q1	5-13
2A1A5Q11	SAME AS 2A1A5Q3	5-13
2A1A5R1	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF151J	5-13
2A1A5R2	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF121J	5-13
2A1A5R3	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF562J	5-13
2A1A5R4	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF470J	5-13
2A1A5R5	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF471J	5-13
2A1A4R6	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF273J	5-13
2A1A5R7	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF105J	5-13

PARTS LIST (Cont'd)

Ref Desig	Name and Description	Fig.
2A1A5R8	SAME AS 2A1A5R7	5-13
2A1A5R9	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF153J	5-13
2A1A5R10	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF822J	5-13
2A1A5R11	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF332J	5-13
2A1A5R12	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF222J	5-13
2A1A5R13	SAME AS 2A1A5R3	5-13
2A1A5R14	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF392J	5-13
2A1A5R15	SAME AS 2A1A5R11	5-13
2A1A5R16	SAME AS 2A1A5R11	5-13
2A1A5R17	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF390J	5-13
2A1A5R18	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF182J	5-13
2A1A5R19	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF103J	5-13
2A1A5R20	SAME AS 2A1A5R14	5-13
2A1A5R21	SAME AS 2A1A5R11	5-13
2A1A5R22	SAME AS 2A1A5R17	5-13
2A1A5R23	SAME AS 2A1A5R18	5-13
2A1A5R24	SAME AS 2A1A5R19	5-13
2A1A5R25	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC42GF681J	5-13
2A1A5R26	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC20GF272J	5-13
2A1A5R27	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC32GF391J	5-13
2A1A5R28	SAME AS 2A1A5R19	5-13
2A1A5R29	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF102J	5-13
2A1A5R30	SAME AS 2A1A5R5	5-13
2A1A5R31	SAME AS 2A1A5R12	5-13
2A1A5TP1	JACK, TEST – MFR 14304, PN J60-0001-008	5-13
2A1A5TP2	JACK, TEST – MFR 14304, PN J60-0001-002	5-13
2A1A5TP3	JACK, TEST – MFR 14304, PN J60-0001-006	5-13
2A1A5TP4	SAME AS 2A1A1TP1	
2A1A5VR1	DIODE – MIL TYPE 1N758A	5-13
2A1A5VR2	SAME AS 2A1A5VR1	5-13
2A1A5VR3	SAME AS 2A1A3VR1	5-13

Ref Desig	Name and Description	Fig.
2A1A6	TUNE – SENSITIVITY CONTROL – MFR 14304, PN 8949-6800	5-9/ 5-14
2A1A6C1	CAPACITOR, FIXED, CERAMIC – MIL TYPE CK60AW102M	5-14
2A1A6C2	SAME AS 2A1A6C1	5-14
2A1A6C3	SAME AS 2A1A3C9	5-14
2A1A6C4	SAME AS 2A1A3C9	5-14
2A1A6CR1	DIODE – MIL TYPE 1N914	5-14
2A1A6CR2	SAME AS 2A1A6CR1	5-14
2A1A6CR3	SAME AS 2A1A1CR1	5-14
2A1A6R1	SAME AS 2A1A3R12	5-14
2A1A6R2	RESISTOR, FIXED, COMPOSITION – MIL TYPE RC07GF104K	5-14
2A1A6VR1	SAME AS 2A1A3VR1	5-14
2A2	CASE ASSEMBLY – MFR 14304, PN 392-6200	5-15
2A2A1	FILTER BOX ASSEMBLY – MFR 14304, PN 392-6300	5-15
2A2A1C1	CAPACITOR, FIXED, CERAMIC – MIL TYPE CK70AW152M	5-15
2A1A1C2	SAME AS 2A2A1C1	5-15
2A2A1C3	NOT USED	
2A2A1C4 THROUGH 2A2A1C7	SAME AS 2A2A1C1	5-15
2A1A1C8	CAPACITOR, FIXED, PAPER .1 UF, 200 WVDC, PORM 20 PCT, MFR 14304, PN C70-0002-051	5-15
2A2A1J1	CONNECTOR RECEPTACLE, ELECTRICAL – MIL TYPE MS3102R20-27P	5-15
2A2A1J2	CONNECTOR, RECEPTACLE, ELECTRICAL – MIL TYPE MS3102R28-21S	5-15
	<u>ANCILLARY ITEMS</u>	
P1	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE 10-109628-21S	
P2	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE 10-109628-21P	
P3	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE UG-982/U OR UG21D/U	
W1	CABLE ASSEMBLY – MFR 14304, PN 399-0028	
W1P1	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE 10-109620-27P	
W1P2	CONNECTOR, PLUG, ELECTRICAL – MIL TYPE 10-109620-27S	

NOTES

1. PREFIX PARTIAL REFERENCE DESIGNATIONS WITH 1A2 PLUG SUB-ASSEMBLY NUMBER, IF ANY
2. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTANCE VALUES ARE IN OHMS; K INDICATES THOUSANDS OF OHMS.
   B. ALL RESISTORS ARE 1/2W, ± 5%.
   C. ALL DIODES ARE 1N3611
   D. ALL CAPACITANCE VALUES ARE IN PICOFARADS
   E. ALL INDUCTANCE VALUES ARE IN MICROHENRIES
3. A2CR1, A2CR2 AND A2CR5, A2CR6 ARE MATCHED PAIRS, PN 0902-1957.
4. 1A2C4 AND 1A2L2 ADDED ON SN446 AND HIGHER.
5. REPLACED WITH 82 OHM RESISTOR ON LATER UNITS.
6. REPLACED WITH 1.2K RESISTOR ON LATER UNITS.

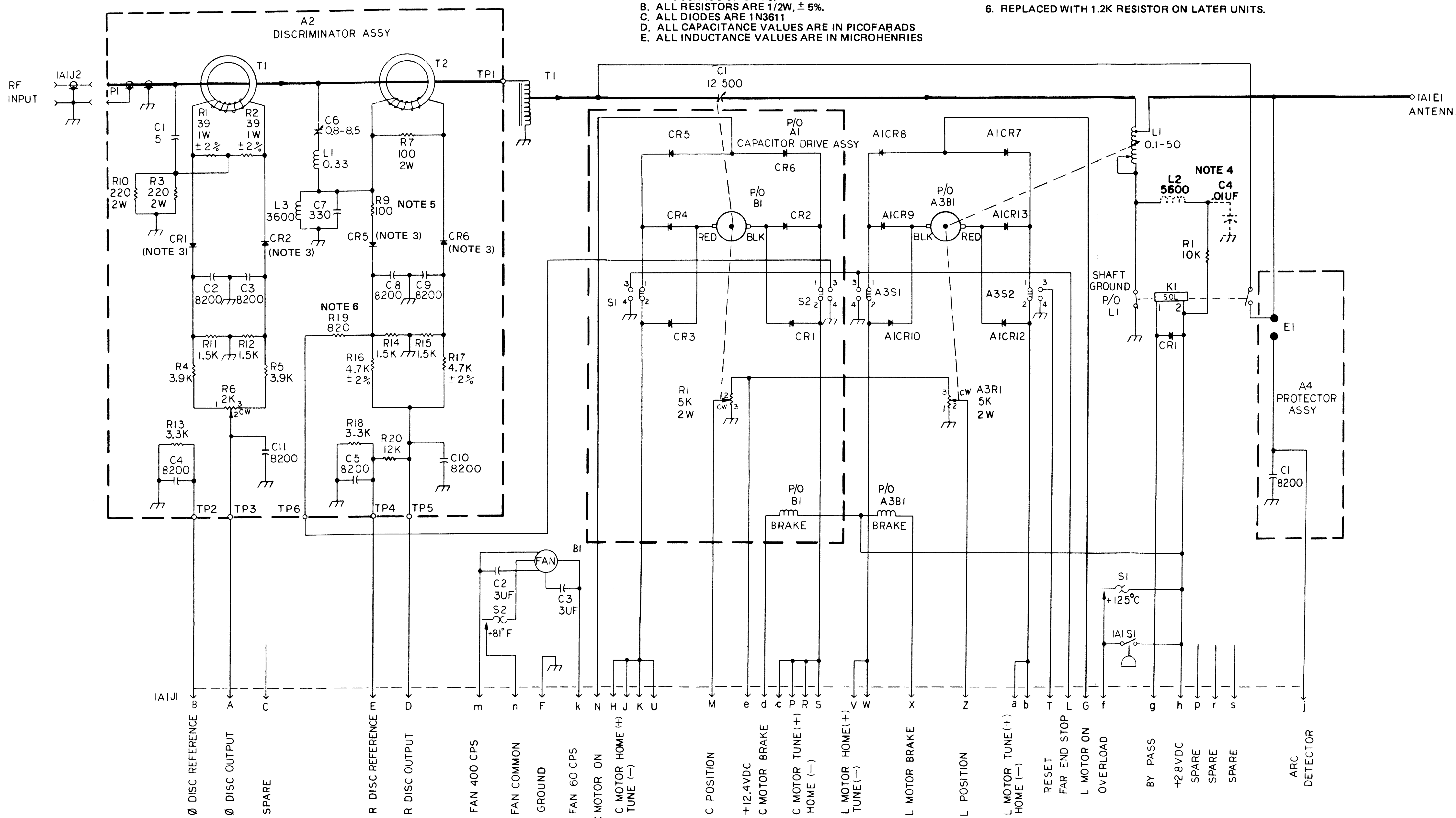
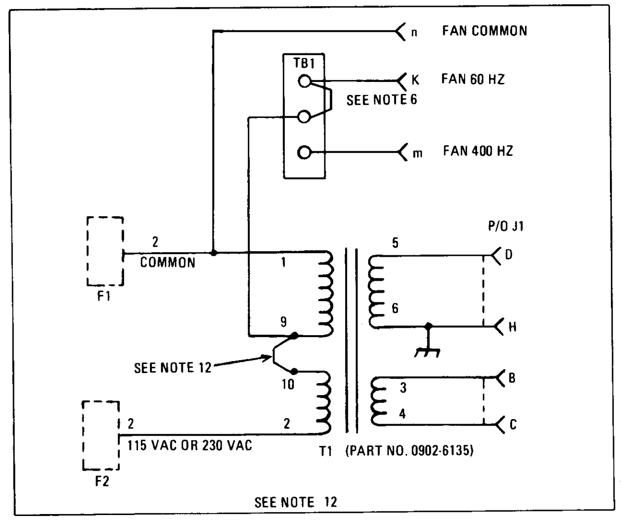


Figure 5.17. RF-601A/CU Schematic

NOTES

1. PREFIX INCOMPLETE REFERENCE DESIGNATIONS WITH 2A1
2. UNLESS OTHERWISE SPECIFIED:
   A. ALL RESISTORS ARE 1/4 WATT, ± 10% TOLERANCE
   B. ALL RESISTANCE VALUES ARE IN OHMS. K INDICATES THOUSANDS OF OHMS
   C. ALL DIODES ARE 1N277
   D. ALL TRANSISTORS ARE 2N1613
   E. ALL CAPACITANCE VALUE ARE IN PICOFARADS
3. THE LETTERS CW PLACED ADJACENT TO TERMINAL 3 OF A POTENTIOMETER INDICATES THE DIRECTION OF CLOCKWISE ROTATION WHEN VIEWED FROM THE SHAFT END. TERMINALS ARE NUMBERED IN A CCW ↶ DIRECTION AS VIEWED FROM THE KNOB ON ACTUATOR END OF CONTROL
4. ▭ INDICATES EQUIPMENT OPERATION MARKINGS (FRONT PANEL CONTROL)
5. WAFER SWITCHES S1 AND S3 ARE SHOWN IN THE EXTREME CCW POSITION AS VIEWED FROM THE KNOB END OF THE SWITCH (Sheets 3 AND 4)
6. AS SUPPLIED, TERMINALS 1 AND 2 OF TB1 ARE JUMPERED FOR OPERATION WITH 60 CPS PRIMARY POWER. IF 400 CPS PRIMARY POWER IS TO BE USED REMOVE JUMPER FROM TERMINALS 1 AND 2 AND CONNECT TERMINALS 2 AND 3
7. EARLY MODULES USED 2N1613. REPLACE WITH 2N2102
8. C2, C3 USED ON S/N 261 AND OVER, EXCEPT 271, 272, 273, 293 AND 295 (Sheet 2)
9. A5R11 AND A5R12 ARE SELECTED IN FACTORY TEST. TYPICALLY, R11 IS 3.3K AND R12 IS 2.2K (Sheet 4)
10. R9 WAS CHANGED FROM 4.7K TO 10K ON S/N 431 AND OVER (Sheet 2)
11. C4 USED ON S/N 431 AND OVER (Sheet 2)
12. FOR UNITS WITH T1 PART NO. 0902-6135 ONLY:
    A. FOR 115 VAC OPERATION STRAP T1-1 TO T1-10 AND STRAP T1-2 TO T1-9.
    B. FOR 230 VAC OPERATION STRAP T1-9 TO T1-10.

    REFERENCES IN THIS MANUAL ARE MADE WITH RESPECT TO A PRIMARY POWER SOURCE OF 115 VAC. SOME UNITS ARE SUPPLIED WITH A 115/230 VAC PRIMARY POWER TRANSFORMER (PART NO. 0902-6135). WHEN USED WITH THE RF-130 AND AN/URT-23 TRANSMITTING SYSTEMS, THE RF-601A DERIVES ITS POWER FROM THE TRANSMITTER, WHICH IS NORMALLY 115 VAC REGARDLESS OF PRIMARY POWER. THE RF-601A SHOULD, THEREFORE, BE STRAPPED FOR 115 VAC.



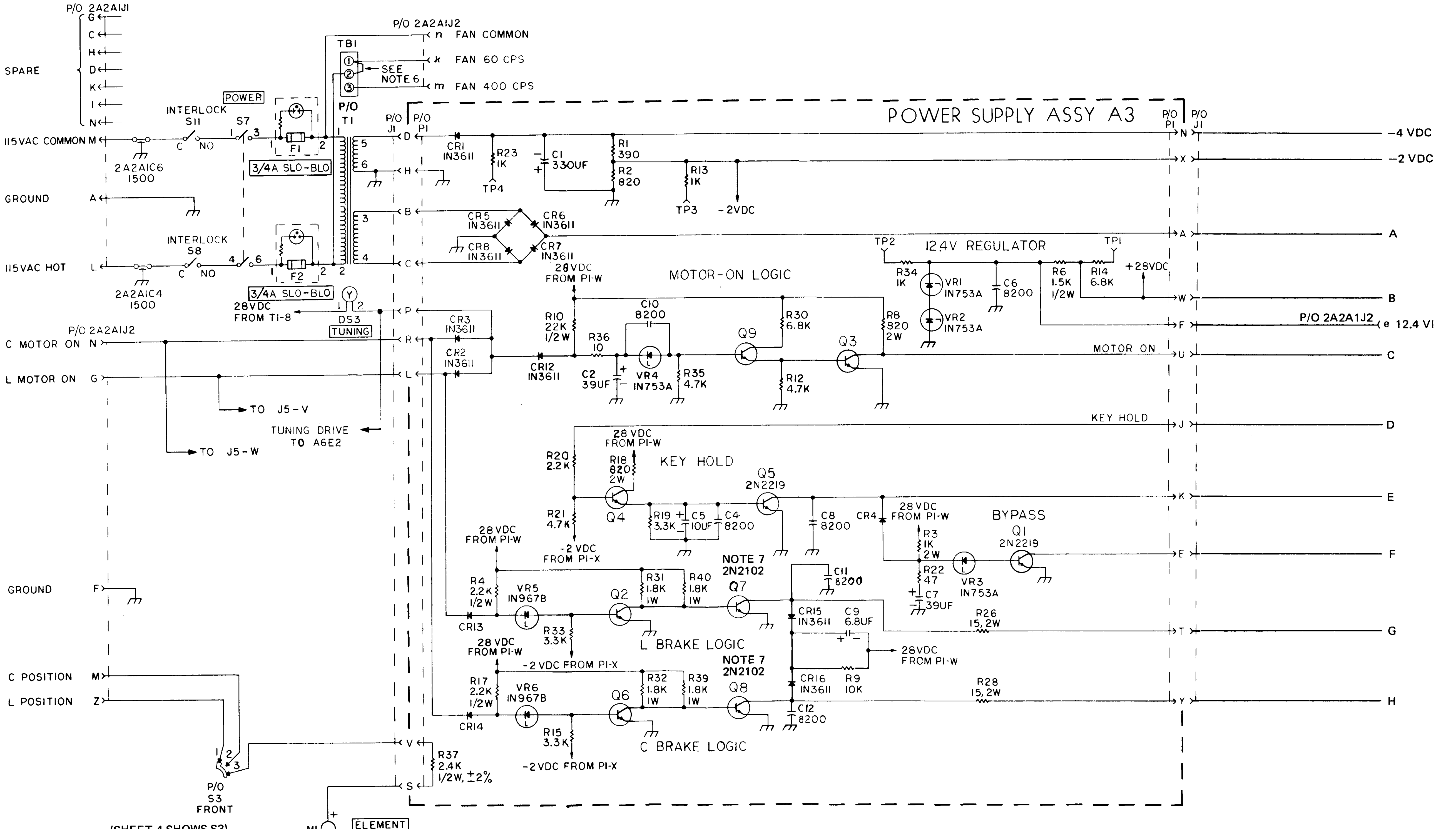


Figure 5.18. RF-601A/C Schematic (Sheet 1 of 4)

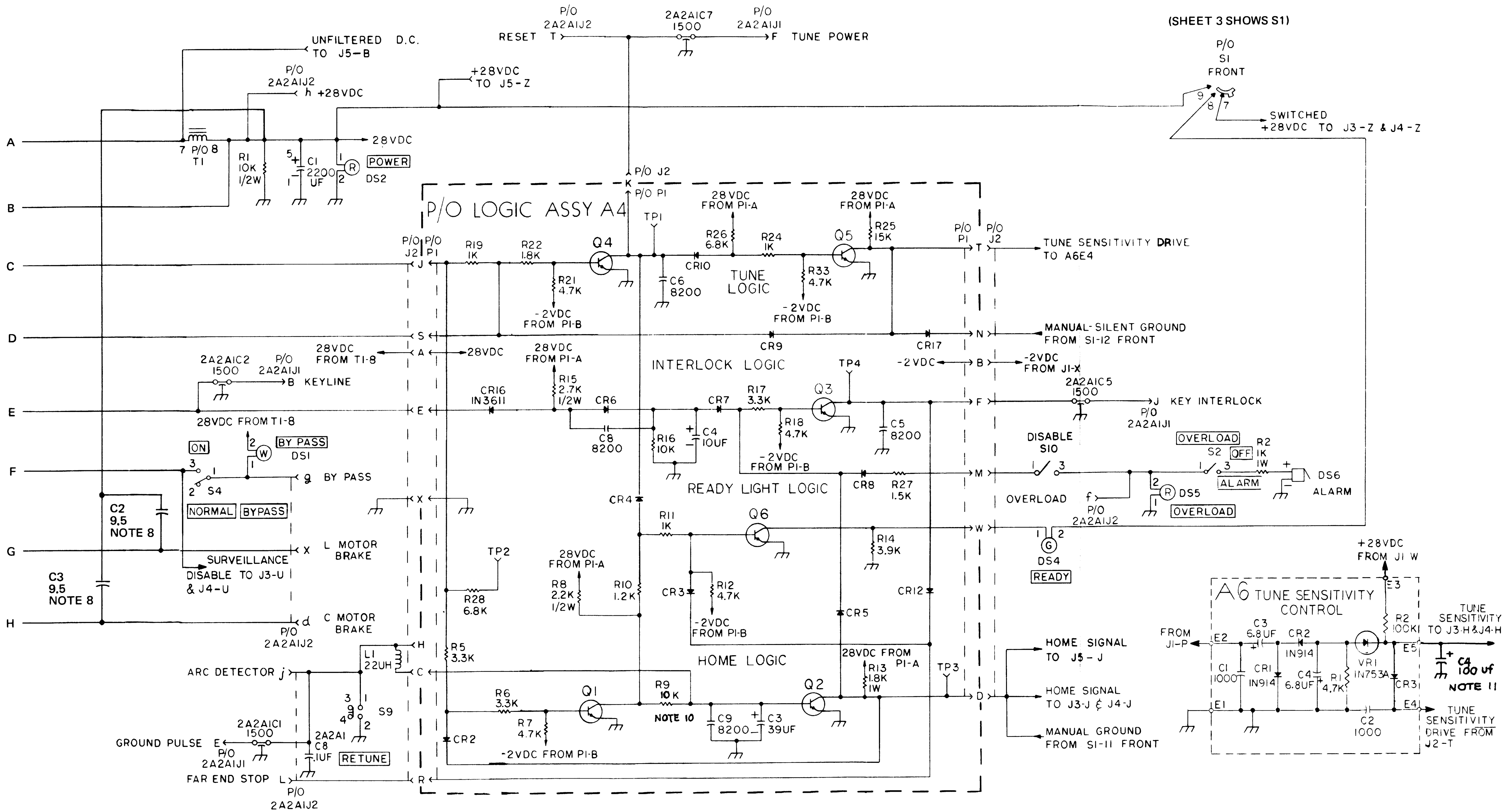


Figure 5.18. RF-601A/C Schematic

(Sheet 2 of 4)

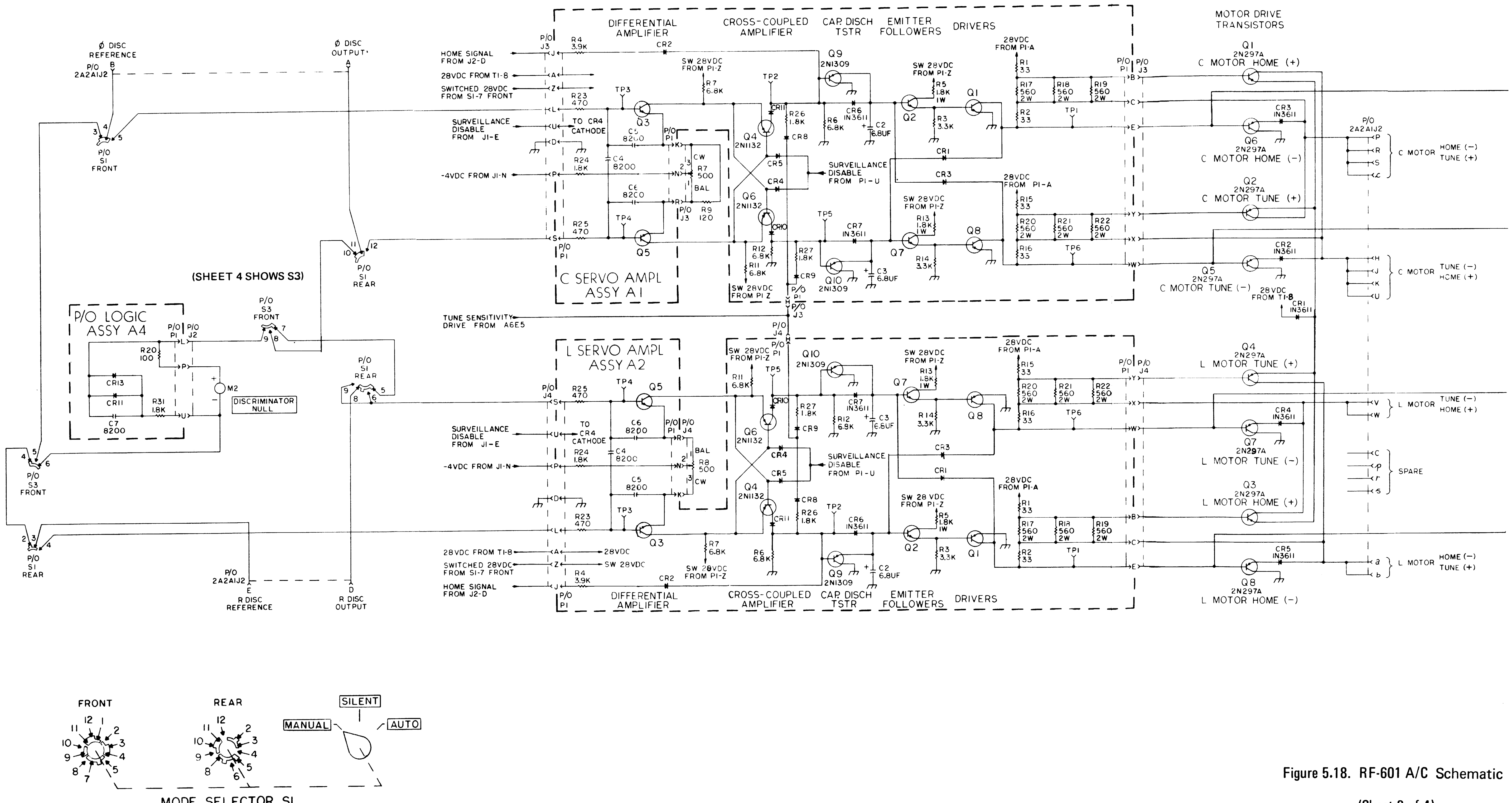


Figure 5.18. RF-601 A/C Schematic

(Sheet 3 of 4)

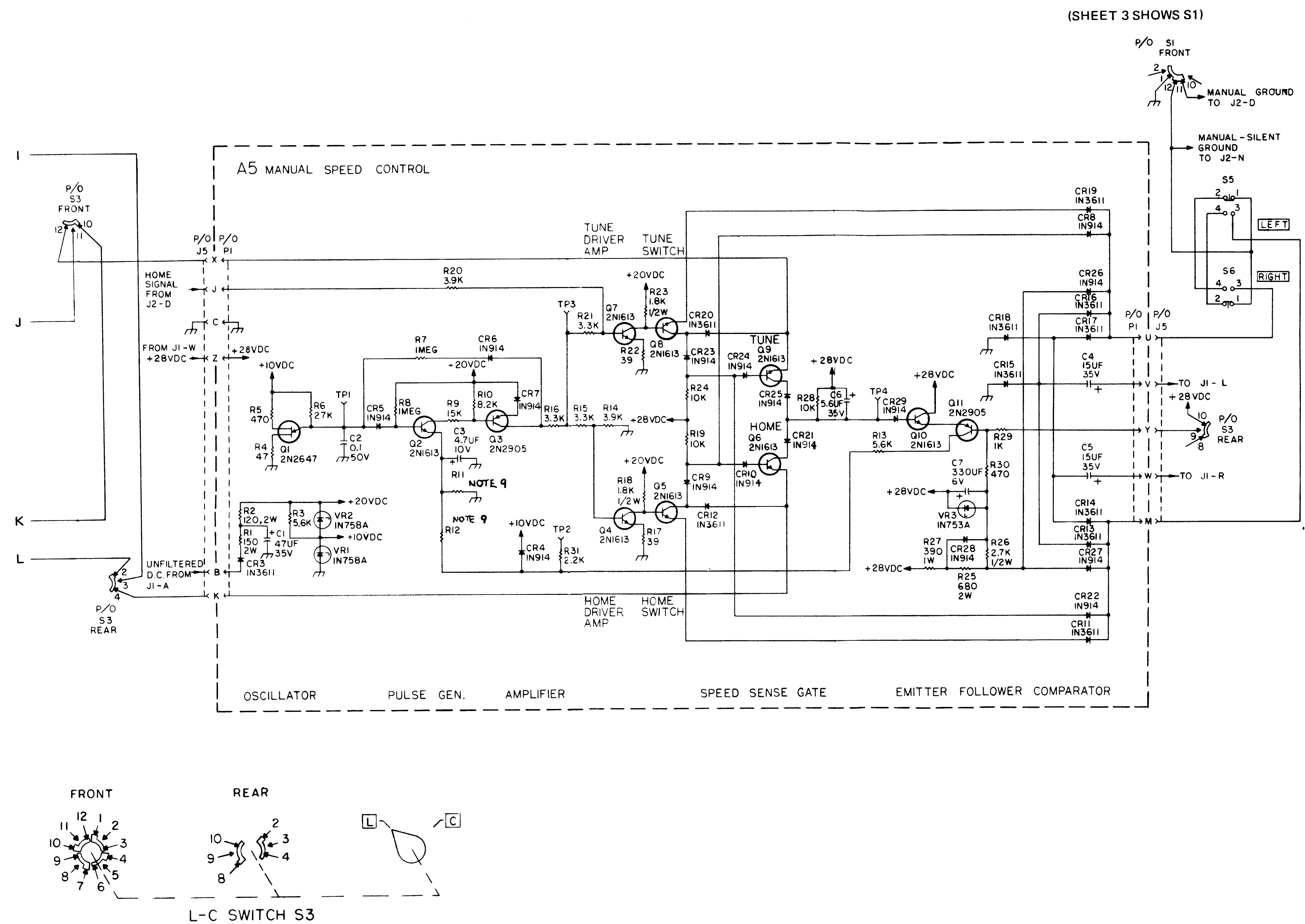


Figure 5.18. RF-601A/C Schematic

(Sheet of 4 of 4)

NOTES

1. LETTERS OUTSIDE TRANSISTOR AND DIODE BLOCKS INDICATE ELEMENT.
2. HEAVY LINES INDICATE MAIN SIGNAL PATHS.
3. LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
4. ALL MEASUREMENTS TAKEN WITH A SIMPSON 260 MULTIMETER AND SHOULD BE WITHIN 20% OF THE INDICATED VALUE, UNLESS OTHERWISE SPECIFIED.
5. ALL MEASUREMENTS MADE WITH SWITCH 2A1S1 SET AT AUTO.

TEST POINT INFORMATION

TEST POINT	CONDITION	DC VOLTAGE
5 (A4TP2)	MOTORS STOPPED MOTOR(S) RUNNING, INITIAL TUNE MOTOR(S) RUNNING HOME OR FINE TUNING	+0.2V +18V +14V
6 (A4TP3)	RETUNE (ELEMENTS RUNNING HOME) OTHERWISE	+14V +0.1V
7 (A4TP1)	INDUCTOR AT HOME TUNING (INITIAL TUNE) OTHERWISE	0V +0.1V +4.0 to +6.2V
8 (A4TP4)	SYSTEM KEYED SYSTEM UNKEYED	+35.0V +0.1V
9	MOTORS STOPPED MOTOR(S) RUNNING, INITIAL TUNE MOTOR(S) RUNNING HOME OR FINE TUNING	+0.2V +18V +14V
10	ELEMENTS AT HOME OR TUNING (INITIAL TUNE) OTHERWISE	+28V +0.1V
11 (A3TP4)		-2.3V
12 (A3TP2)		+12.4V
13 (A3TP1)		+28.0V
14 (A3TP3)		-5.0V
15	L MOTOR ON L MOTOR OFF	+1.2V +31.0V
16	C MOTOR ON C MOTOR OFF	+1.2V +31.0V

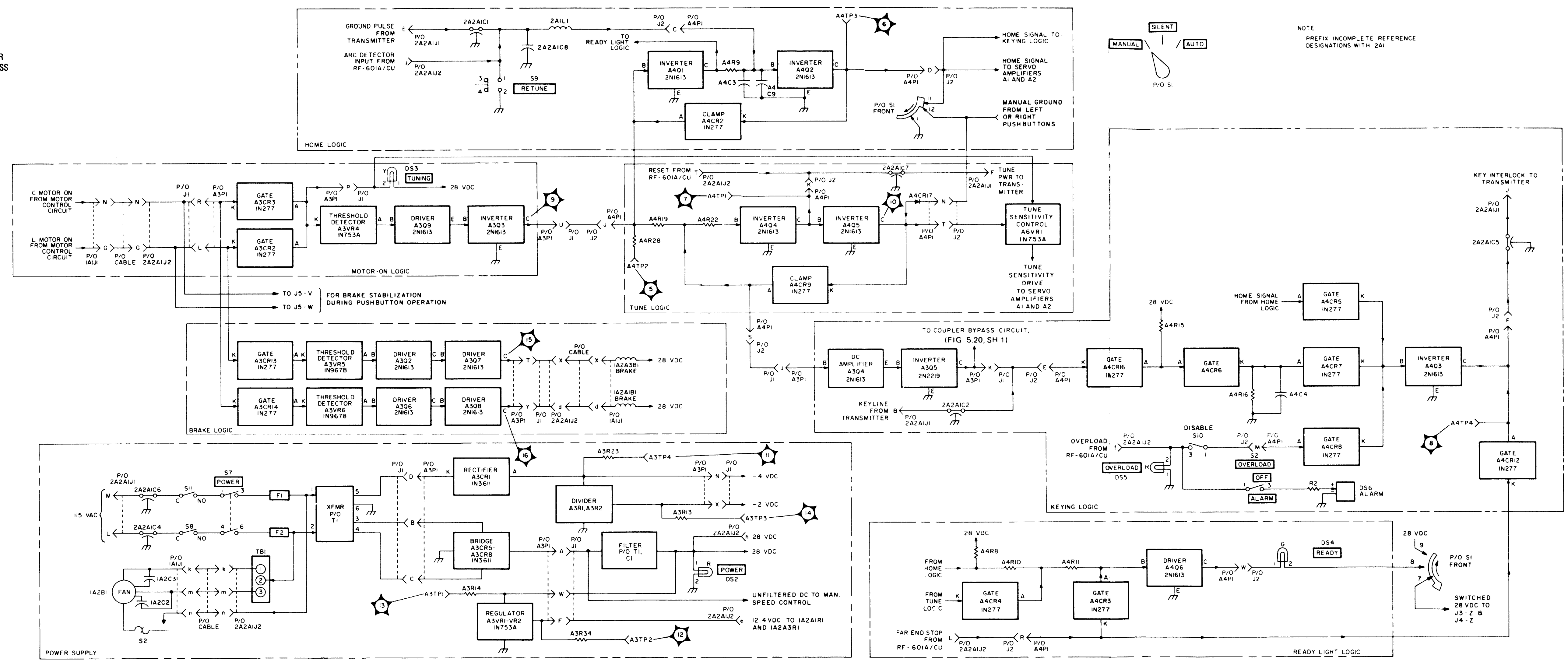


Figure 5.19. RF-601A Antenna Coupler Group, Logic and Power Supply Servicing Block Diagram

NOTES

1. LETTERS OUTSIDE TRANSISTOR AND DIODE BLOCKS INDICATE ELEMENT.
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3. LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
4. ALL MEASUREMENTS TAKEN WITH A SIMPSON 260 MULTIMETER AND SHOULD BE WITHIN 20% OF THE INDICATED VALUE, UNLESS OTHERWISE SPECIFIED.
5. ALL MEASUREMENTS MADE WITH SWITCH 2A1S1 SET AT AUTO.

TEST POINT INFORMATION

TEST POINT	CONDITION	DC VOLTAGE
1 (A2TP4)	"HOME" SIGNAL FROM DISCRIMINATOR	+.1 to +.5V
	"TUNE" SIGNAL FROM DISCRIMINATOR	−.1 to −.6V
	NORMAL (NO RF, OR COUPLER TUNED)	0V
2 (A2TP3)		0V
3 (A2TP6)	NO INPUT	+31.0V
	"TUNE" INPUT	0.014V
	"HOME" INPUT	28.0V
4 (A2TP1)	NO INPUT	+31.0V
	"TUNE" INPUT	28.0V
	"HOME" INPUT	0.014V
A (A2TP5)	TUNING	+2.3V
	OTHERWISE	0V
B (A2TP2)	HOMING	+2.25V
	OTHERWISE	0V

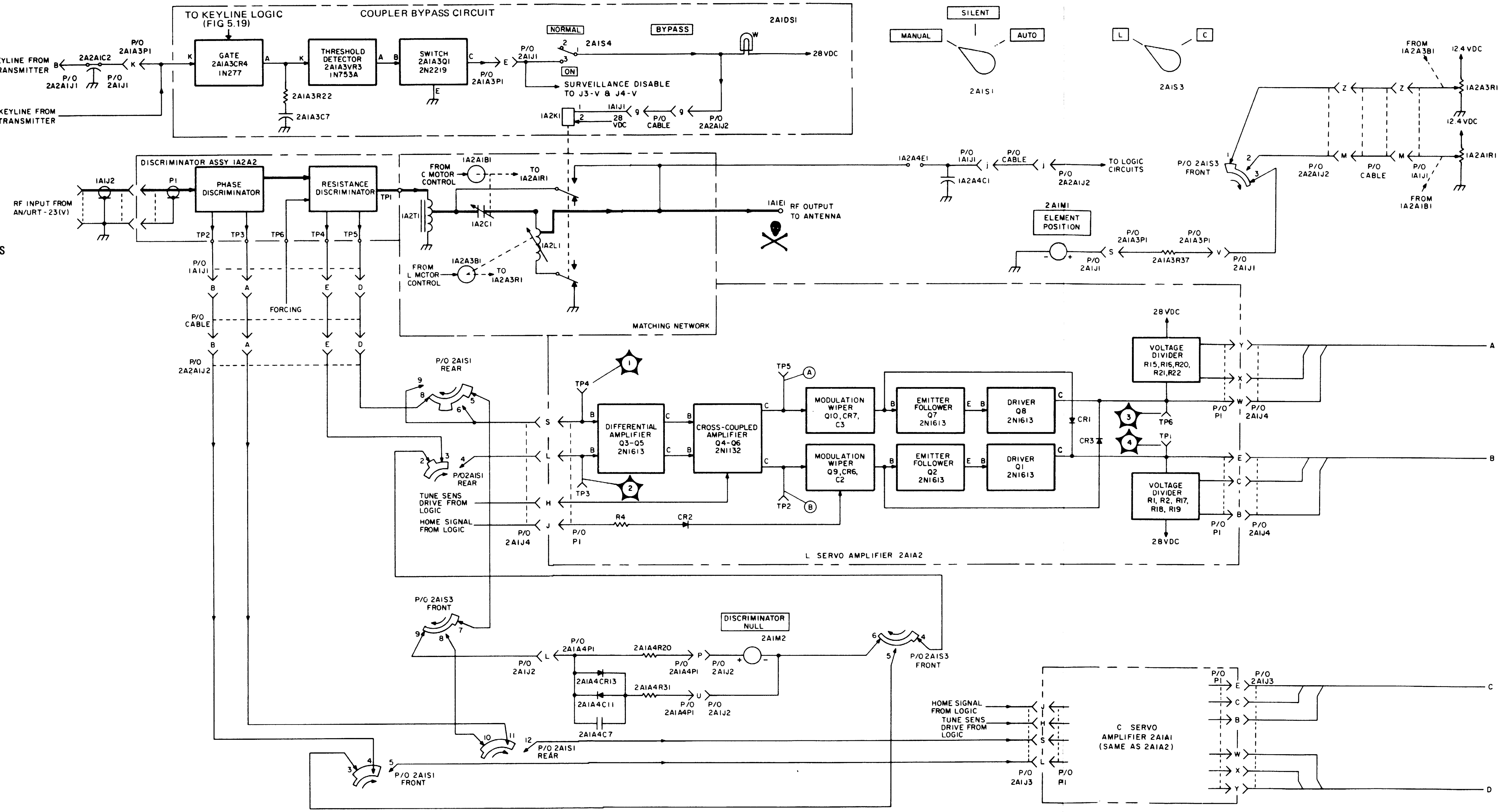


Figure 5.20. RF-601A Antenna Coupler Group, Servo Loops and Matching Network, Servicing Block Diagram (Sheet 1 of 2)

NOTES

1. LETTERS OUTSIDE TRANSISTOR AND DIODE BLOCKS INDICATE ELEMENT.
2. HEAVY LINES INDICATE MAIN SIGNAL PATHS.
3. LIGHT LINES INDICATE AUXILIARY OR SECONDARY SIGNAL PATHS.
4. ALL MEASUREMENTS TAKEN WITH A SIMPSON 260 MULTIMETER AND SHOULD BE WITHIN 20% OF THE INDICATED VALUE, UNLESS OTHERWISE SPECIFIED.
5. ALL MEASUREMENTS MADE WITH SWITCH 2A1S1 SET AT AUTO.

TEST POINT INFORMATION

TEST POINT	CONDITION	DC VOLTAGE
17 (A5TP1)		+5.4V
18 (A5TP2)	SERVOS DE-ENERGIZED	+2.27V
	L-SERVO ENERGIZED WITH PUSHBUTTONS	+4.5V
	LEFT PB DEPRESSED WITH ELEMENTS AT HOME	+11.8V
19 (A5TP3)	SERVOS DE-ENERGIZED	+6.3V
	L-SERVO ENERGIZED WITH PUSHBUTTONS	+5.8V
	LEFT PB DEPRESSED WITH ELEMENTS AT HOME.	+1.17V
20 (A5TP4)	SERVOS DE-ENERGIZED	+30.8V
	L-SERVO ENERGIZED WITH PUSHBUTTONS	+24.7V
	C-SERVO ENERGIZED WITH RIGHT PUSH-BUTTON, NEAR FAR END STOP	+25.8V
	SERVOS ENERGIZED AFTER RETUNE PUSHBUTTON DEPRESSED IN SILENT MODE	+0.73V

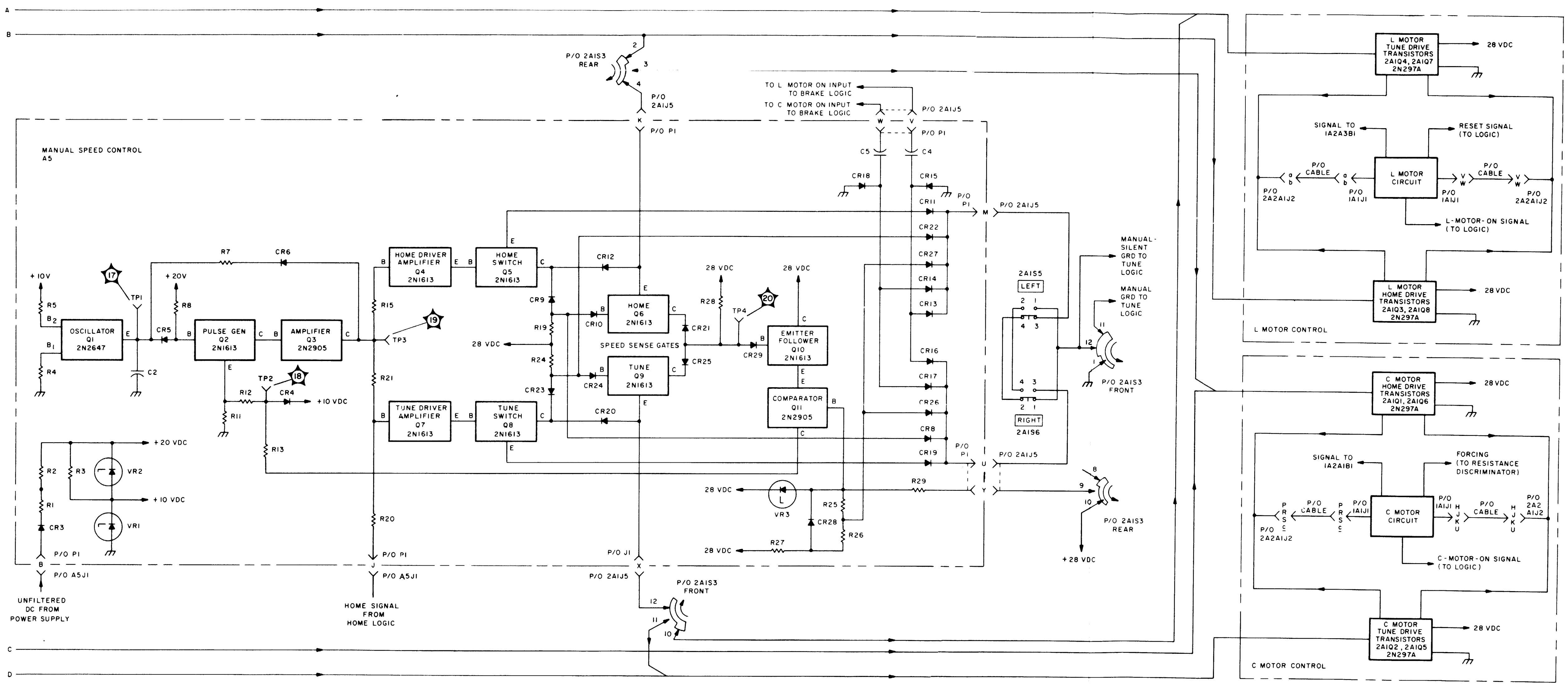


Figure 5.20. RF-601A Antenna Coupler Group, Servo Loops and Matching Network, Servicing Block Diagram (Sheet 2 of 2)

SECTION 6

RF-625 AND RF-625A WIRE ADAPTERS (Optional)

6.1 GENERAL DESCRIPTION

The RF-625 and RF-625A Long Wire Adapters are units which enable the AN/URA-38( ), RF-601( ), and RF-610 1 KW whip antenna couplers to match the impedance of doublet and dipole antennas, and long-wire antennas of 75 feet (22.73 meters) or longer (see figure 6-1). They are also convenient to use as test equipment to allow the antenna coupler to be operated into a 50 ohm dummy load for bench testing. The RF-625 consists of a drip-proof box which contains a 150 pF vacuum capacitor. The RF-625A consists of a drip-proof box which contains a 100 pF capacitor assembly. The capacitor (or capacitor assembly - RF-625A) is inserted in series with the antenna lead-in to change the antenna impedance to one which can be matched with the antenna coupler.

6.2 MOUNTING (See figure 6-2)

The RF-625 and RF-625A are mounted with their flange under the two cover bolts (supplied), just to the left of the coupler antenna insulator. Remove the existing cover bolts (at the locations shown - Note 1 of figure 6-2) and replace them with the two bolts supplied. The flange is bent at slightly less than a 90 degree angle to provide spring action for holding the rubber bumpers against the coupler cage when the bolts are tightened.

6.3 CONNECTION (See figure 6-2)

High voltage wire PN 0908-0015 is provided to connect the right side insulator of the RF-625 or RF-625A to the normal antenna lead insulator of the coupler. Connect the antenna lead-in wire to the front insulator. One leg of the antenna coupler is tapped to accept a bolt for making ground connections to the coupler. For doublet antennas or other devices with coaxial cables, the coax braid may be connected to the ground screw on the front of the RF-625 or RF-625A, providing a strap (one-inch or wider plated copper) is connected from the RF-625 or RF-625A ground screw to the tapped leg of the coupler. For bench testing, it is strongly recommended that a large sheet pf aluminum be placed on the bench with the coupler and dummy load resting on it.

6.4 REPLACEMENT PARTS

Parts may be ordered by the RF-625 or RF-625A model number, serial number and a description of the required part.

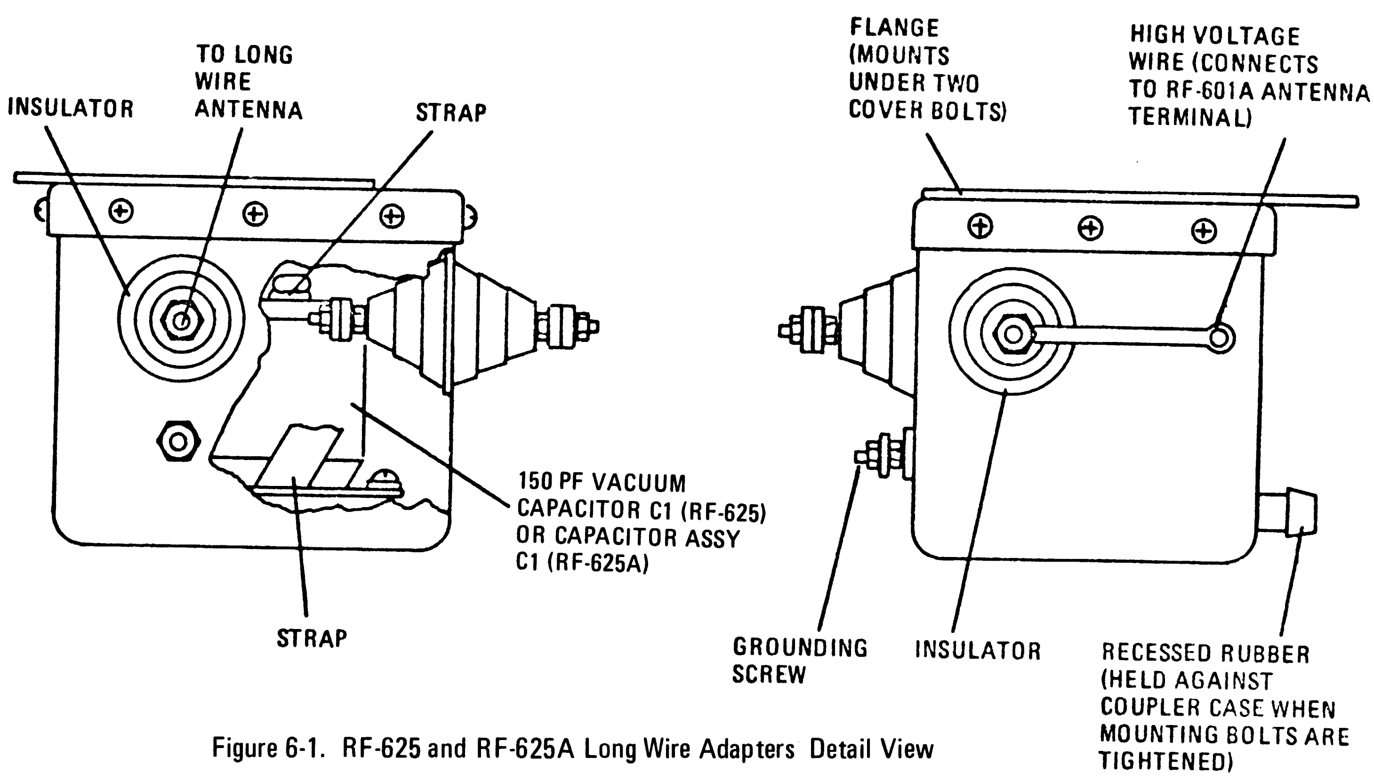
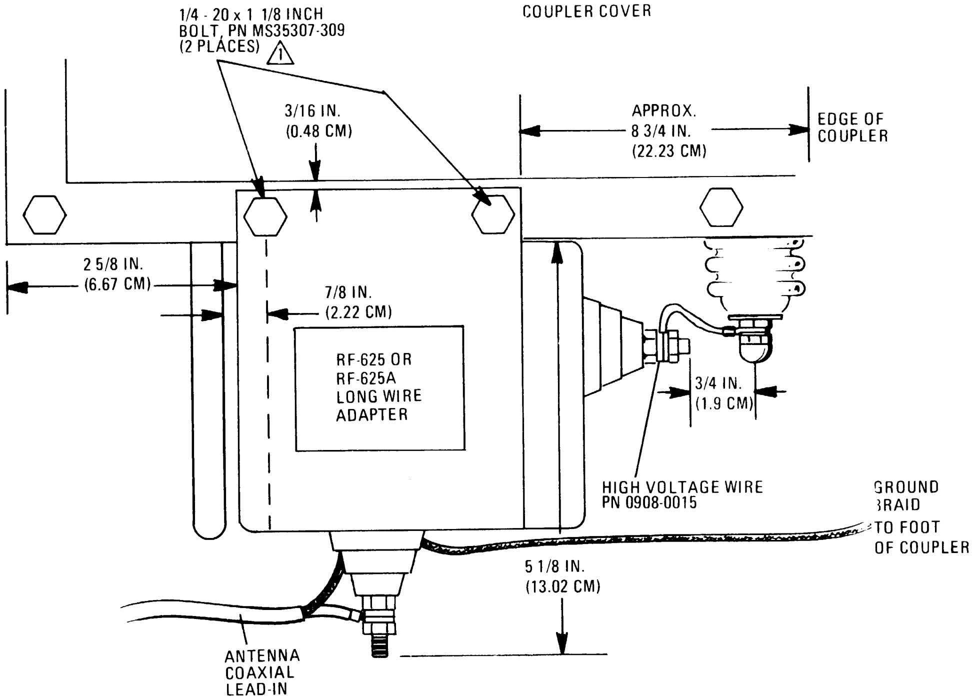
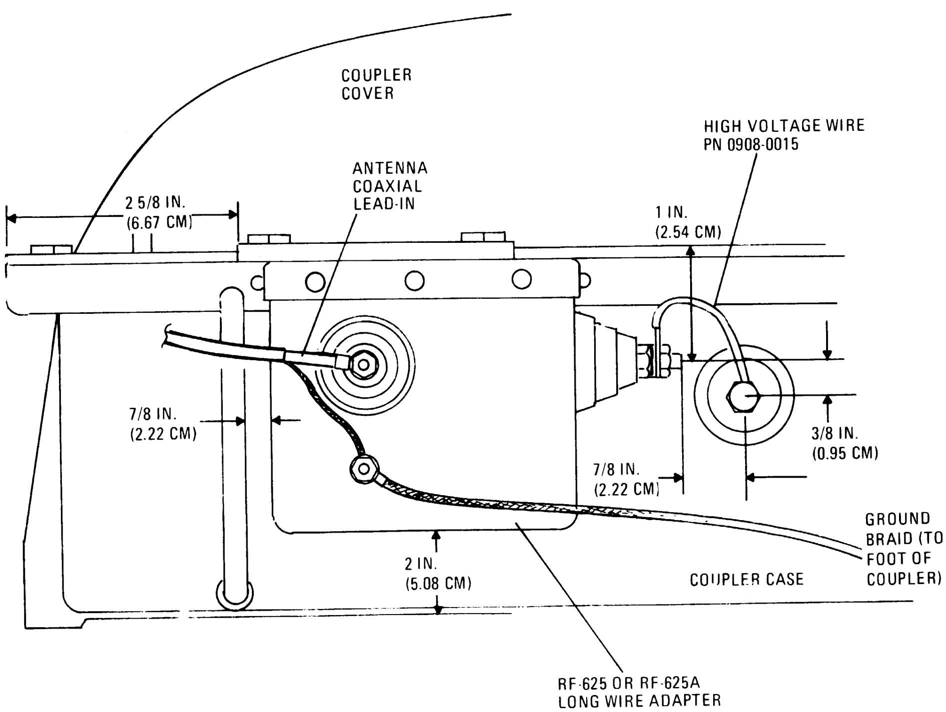


Figure 6-1. RF-625 and RF-625A Long Wire Adapters Detail View



TOP VIEW



END VIEW

1 REMOVE BOLTS SUPPLIED WITH COUPLER AT THIS LOCATION (SAVE WASHERS) AND REPLACE WITH THOSE SPECIFIED.

2 ALL DIMENSIONS GIVEN ARE ± 1/16 INCH. (0.159 CM).

Figure 6-2. RF-625 and RF-625A Long Wire Adapters Dimensional Views