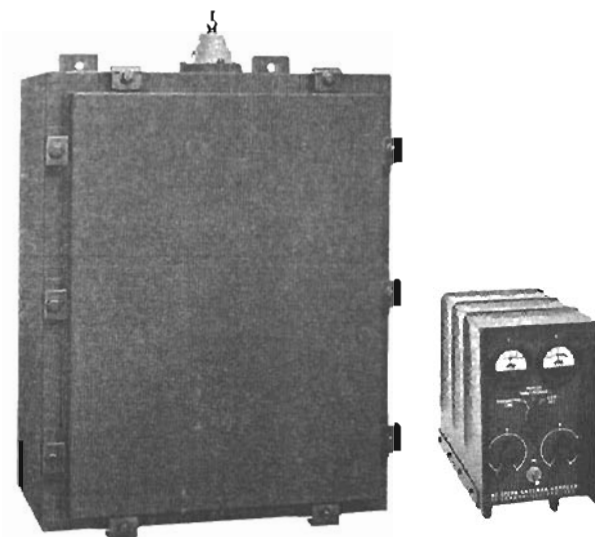


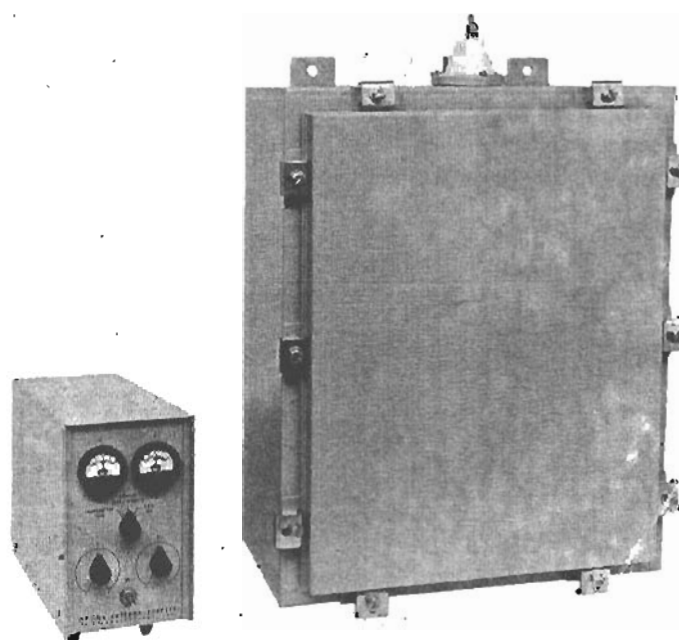


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RF-302RA

REMOTE CONTROLLED ANTENNA COUPLERS



RF-302R

HARRIS



RF COMMUNICATIONS

A DIVISION OF HARRIS-INTERTYPE CORPORATION

ADDENDUM

FOR INSTRUCTION MANUAL	ALL MANUALS	ADDENDUM NO.	L488	DATE	SEPT. 1985
APPLIES TO:		FOR:			
ALL MANUALS CONTAINING CMOS PROCEDURES		N/A			

Included in this manual is information that pertains to the protection of static sensitive CMOS devices. Please delete the existing information and replace it with the following:

To protect static sensitive devices from damage, the following suggested precautions should be followed:

- 1) Keep all static sensitive devices in their protective packaging until needed. This packaging is usually conductive and should provide adequate protection for the device. Storing or transporting static sensitive devices in conventional plastic containers could be destructive to the device.
- 2) Disengage power prior to insertion or extraction of sensitive devices. This also applies to PWBs containing sensitive devices.
- 3) Double check test equipment voltages and polarities prior to conducting any tests. Verify that no transients exist.
- 4) Use only soldering irons and tools that are properly grounded. Ungrounded soldering tips will destroy these devices. SOLDERING GUNS MUST NEVER BE USED.
- 5) Avoid contact with the leads of the device. The component should always be handled very carefully by the ends or the side opposite the leads.
- 6) Avoid contact between PWB circuits or component leads and synthetic clothing while handling static sensitive devices or assemblies containing them.

SHEET 1 OF 1

RF-P44B-C



HARRIS

HARRIS CORPORATION RF COMMUNICATIONS DIVISION ROCHESTER, NEW YORK U.S.A.

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NOTICE

This instruction manual covers the installation, operation, and maintenance of both the RF-302R and RF-302RA Antenna Couplers.

All references to RF-302R apply also to RF-302RA. Where applicable, such as in the Parts List, separate references to RF-302R and RF-302RA are used to identify non-identical items.



SECTION I

GENERAL INFORMATION

1.1 PURPOSE

This handbook contains the information necessary for installation, operation, and maintenance of Remote Controlled Antenna Coupler RF-302R. The RF-302R is designed to efficiently match the impedance of a 75 foot long-wire or a 15, 25, or 35 foot whip-type antenna to the 50 ohm transmission line output of a 150 watt HF transmitter over the frequency range of 2 to 26 MC. The RF-302R is a companion unit to the R. F. Communications (Model RF-301) SSB 100 watt Transceiver but can be used with any transceiver or transmitter with a maximum RF output of 150 watts.

1.2 PHYSICAL DESCRIPTION

The RF-302R consists of two equipments: a Coupler unit and a Control unit. The Coupler unit is housed in a ruggedized, waterproof metal case which mounts at the base of an antenna, up to 500 feet from the Control unit. Two input cables, not supplied, are connected to it; a coaxial cable (RF transmission line) from the transmitter, and a multiconductor (14 wires) control cable from the Control unit. The Coupler unit is 24-1/4 inches high, 16 inches wide, 9-1/4 inches deep, and weighs approximately 45 pounds.

The Control unit chassis forms a part of its case. A sturdy wrap-around cover slides over the top and is secured to the chassis to form a splashproof housing for the components. All controls, with the exception of the primary power selector switch and the fuses, are front panel mounted. Cable connections are to the rear. The Control unit is provided with small rubber feet which permit convenient operation from a desk or tabletop, or it may be installed with the RF-301 Transceiver in the RF-305 Shockmount. The Control unit is 9-1/4 inches high, 4-3/4 inches wide, 14-3/4 inches deep, and weighs approximately 9 pounds.

1.3 ELECTRICAL DESCRIPTION

The Coupler unit contains a motor-driven impedance matching network; a 100 watt, 50 ohm RF dummy load; and a discriminator assembly. The Control unit contains a power supply; the control circuits required to position the matching network in the Coupler unit; and meters for monitoring either the output from the Discriminator assembly or the position of the tuning elements in the matching network as selected by the front panel Mode Switch. While tuning the transmitter, a separate position of the Mode switch energizes a relay in the Coupler unit to switch the transmitter RF input to an RF dummy load. When the transmitter RF input is connected to the RF dummy load, lights in the front panel meters flash to alert the operator that the transmitter is not connected to the antenna.

The Coupler unit and Control unit require an operating voltage of 22-30 VDC. This may be supplied directly as primary voltage to the equipment, or the equipment may be operated from a 115 or 220 volt, 50-60 CPS source from which a power supply within the Control unit produces the required 22-30 VDC.

1.4 EQUIPMENT SUPPLIED

The following items constitute a complete Remote Controlled Antenna Coupler RF-302R. For R F Communications part numbers refer to the parts list in section V.

Coupler unit

Control unit

115 VAC Line Cord Assembly

*Primary Power Connector Kit

**Male Control Cable Connector Kit

**Female Control Cable Connector Kit

*Use for 220 VAC or 22-30 VDC power input.

**Connectors for cable between Control unit and Coupler unit.



Condensed Operating Procedure and Logging Chart

Instruction Manual

1.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED

Multiconductor Cable (14 wire)

Ground Strap

Coaxial Cable and RF Connectors

Antenna and lead-in

Transmitter or Transceiver

Miscellaneous installation hardware and components

*RF-302R/DSK Depot Spares Kit, RF Communications P/N 1001-0011.

1.6 DIFFERENCES IN PRODUCTION MODELS

Three separate production runs have been made on the RF-302R, and therefore there are some

slight differences in production models. The first production run included equipments with production serial numbers up to 162. The second production run included all equipments with serial numbers from 162 to 974. The third, all equipments with serial numbers 975 or greater. Production serial numbers are located on the Coupler unit chassis next to A2L3, and on the rear of the Control unit.

In the second production run, an improved discriminator assembly was used. The theory section of this manual contains a description of both models. In the third production run, an improved type of switch assembly was used for the Control unit A and B controls.

Electrically, the equipments from the three production runs are interchangeable, and any Coupler unit can be used with any Control Unit. However, the changes made require slight variations in mechanical replacement and alignment procedures. Where this occurs, replacement procedures cover parts replacement for equipments from the latest production run.

Section V lists repair parts for both models. When spare parts are ordered, however, parts supplied will be for the later production model, with instructions for installation on early production models.

*Depot Spares Kit is optional.



SECTION II

INSTALLATION

2.1 GENERAL

No special procedures are required to install the RF-302R. The equipment is fully adjusted and ready for use as shipped from the factory. However, one important factor should be considered; while the addition of an efficient antenna coupler such as the RF-302R is an improvement for any antenna system, it will not automatically solve all antenna system problems. Antenna sites should be selected with care, and good engineering practices observed for the installation. The following paragraphs will assist in ensuring that the RF-302R is properly installed.

2.2 UNPACKING AND INSPECTION

The RF-302R is shipped in two cartons. Carefully open both cartons and check the contents against the packing list. If no packing list is available, paragraph 1.4 contains a complete list of the equipment supplied. Carefully inspect both units for signs of damage. If any damage exists, save packing material to substantiate claim with transportation agency.

2.3 MOUNTING THE RF-302R COUPLER UNIT

The importance of mounting the Coupler unit close to the base of the antenna cannot be overstressed. The lead-in wire between the Coupler unit stand-off terminal and the antenna base acts as part of the antenna itself. It not only decreases efficiency, but also significantly impairs the range of operation of the Coupler unit. Therefore, the length of the lead-in should not exceed 1 foot. This dictates that the Coupler unit be mounted at the base of the antenna. Figure 2-1 illustrates the mounting dimensions. The Coupler unit may be mounted in any plane, but to facilitate maintenance, it should be mounted so that the cover is readily ac-

cessible. The Coupler unit can also be installed on tripod mounted antennas.

2.4 MOUNTING THE RF-302R CONTROL UNIT

The Control unit is equipped with rubber feet so that it may be set on any flat surface convenient to the transmitter operator. However, the distance between the Control unit and Coupler unit must not exceed 500 feet. When the RF-302R is used with the RF-301 Transceiver in mobile installations, the RF-301 and the RF-302R Control unit may be mounted together on the RF-305 Shock-mount.

2.5 POWER REQUIREMENTS

The RF-302R draws 20 watts maximum power and can operate from any one of three primary power sources: 220 VAC, 50-60 CPS; 115 VAC, 50-60 CPS; or 22-30 VDC. The primary power input is at the rear of the Control Unit (figure 2-2). When making the installation, select the primary power source to be used, and then position the switch on the rear of the Control unit so that the slot in the shaft is aligned with the correct voltage marking.

2.6 CONNECTIONS

The following paragraphs contain information on the cables required with the RF-302R. Since the distance between the transmitter and the Control unit, and the Coupler unit will vary with each installation, RF input and control cables are not supplied.

2.6.1 RF INPUT CABLE.

The RF cable between the transmitter and the Coupler unit connector J1 should be coaxial type RG-8A/U, RG-215/U, or a similar 50 ohm impedance type. A type "N" male connector (not supplied), to mate with the Coupler unit connector type UG-556B/U, will be

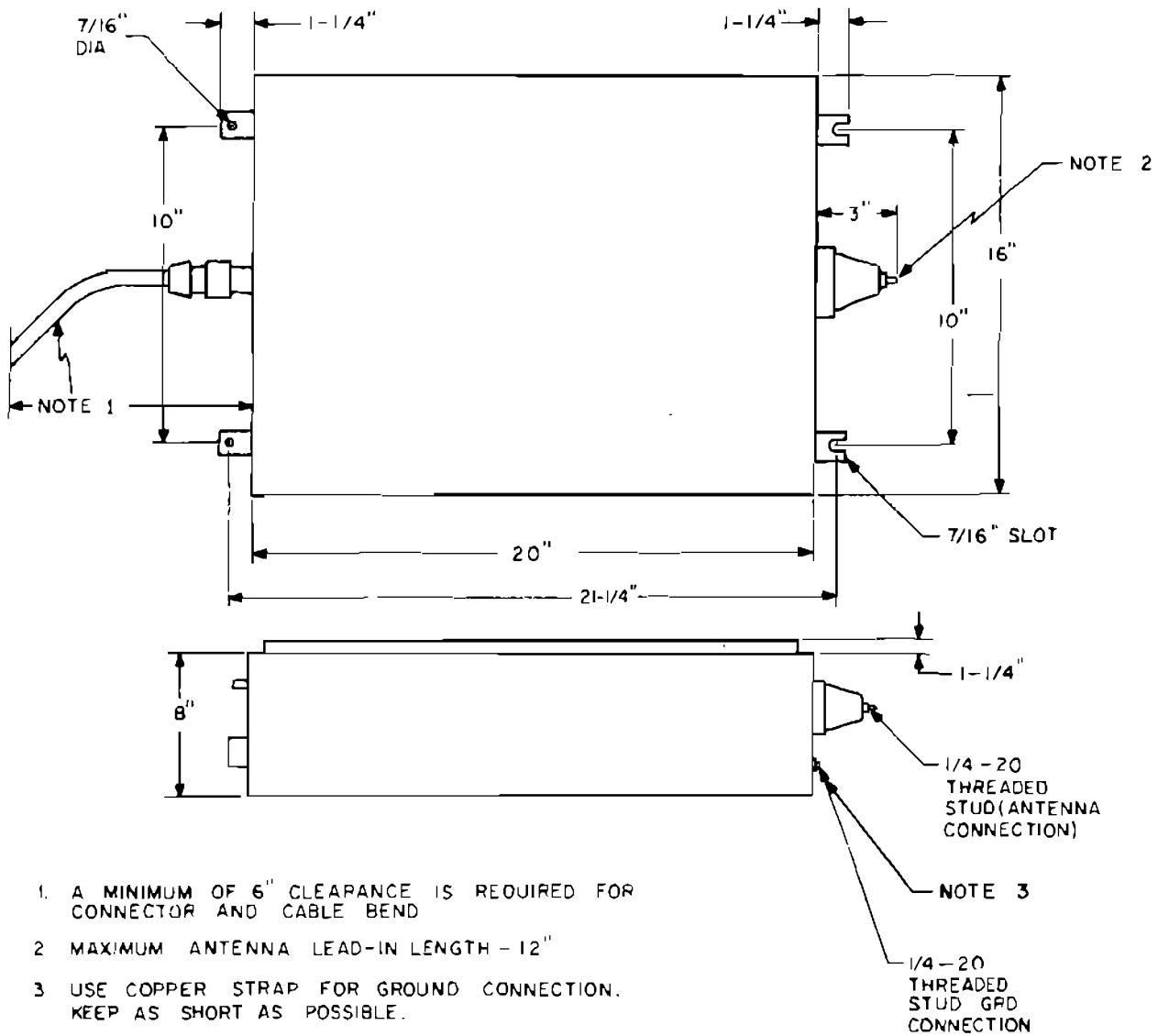


Figure 2.1 - Coupler Unit Mounting Dimensions

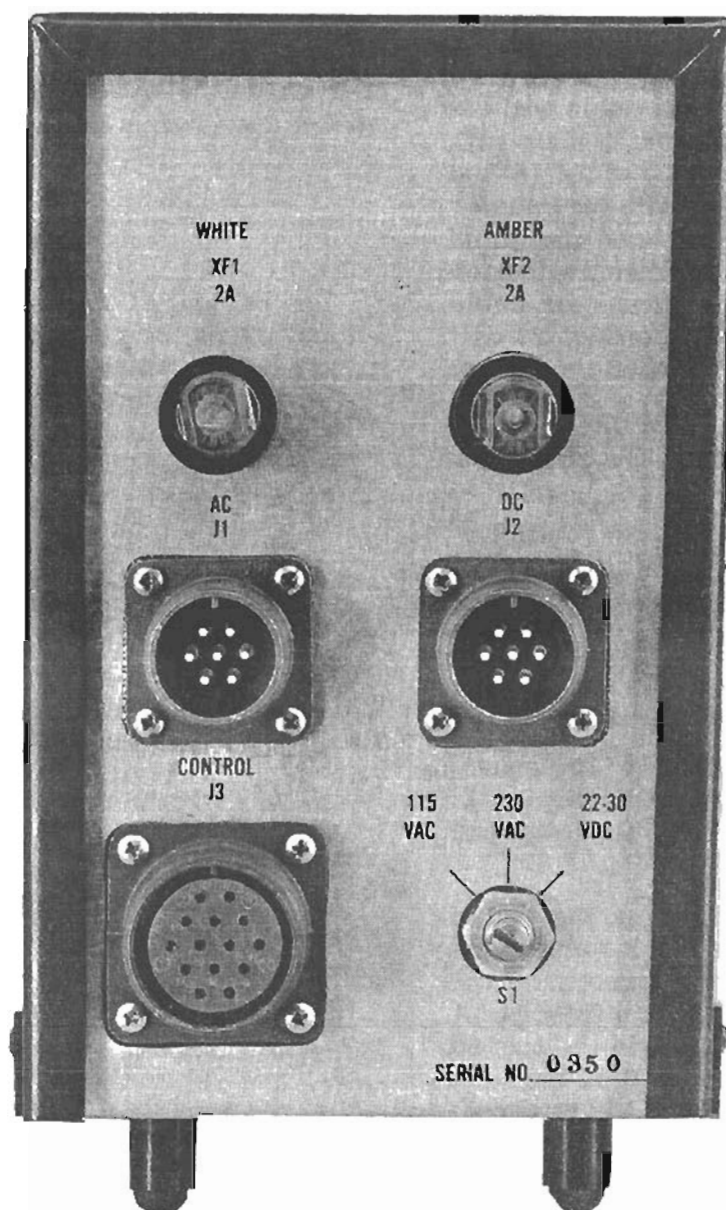


Figure 2.2 – Control Unit, Rear View



required for the Coupler end of the RF cable. For the transmitter end of the RF cable, a connector to mate with the transmitter RF output connector will be required. When the cable assembly is complete, tape the plug which connects to the Coupler unit connector with moisture proof conformal tape.

2.6.2 CONTROL CABLE.

Connectors for the control cable are supplied with the RF-302R. The control cable will use an MS3106A-20-27P connector to mate with the Control unit connector J3, and an MS3106 E-20-27S connector to mate with the Coupler unit connector J2. An MS3057-12B clamp and an AN3420-12A sleeve are furnished with each connector. A shielded multiconductor cable with a minimum of fourteen conductors will be required. Some recommended types are:

a. Type MSCA-14, 14 conductor Armored Cable, O. D. 0.718 maximum, Federal Stock No. GX6145-542-6892

b. Alpha Wire Corp, #1726, 15 conductor, #20 wire cable, nominal O. D. 0.410, Shielded with PVC jacket.

c. Alpha Wire Corp, #1255/15, 15 conductor, #20 wire cable, nominal O. D. 0.595, Shielded with a flexible rubber jacket.

d. Alpha Wire Corp, #1459/15, 15 conductor, #18 wire cable, nominal O. D. 0.640, Shielded with heavy duty flexible Neoprene jacket.

Slide the clamp and sleeve over the end of the cable, then solder the conductors to the cable pins. Install the second connector in the same manner, soldering the wire from pin A in the first connector to pin A in the second connector; the wire from pin B in the first to pin B in the second, etc. for all 14 wires. Ground all shields to the connector case. Moisture proof the cable by filling the rear of the connectors with silicone grease (DC-4 or equivalent) and wrap the assembled connection with moisture proof conformal tape. Install the assembled cable by attaching the connectors to the Coupler unit connector J2, and to the Control unit connector J3.

2.6.3 AC LINE CORD ASSEMBLY

The AC line cord assembly (supplied as a part of the RF-302R) is wired for 115 VAC

operation. Connect the MS type connector to the Control unit connector J1. A separate connector type MS3106A-16S-1S with an MS-3057-8B clamp and an AN-3420-6A sleeve are supplied for manufacture of a DC cable assembly to connect to J2, if required. See table 2-1 for DC cable connections. If 220 VAC operation is required, either disassemble the 115 VAC cable assembly, and resolder the connections according to table 2-1, or use the MS3106A-16S-1S connector and make the connections according to table 2-1.

Note

The DC and AC cable connections (to J1 and J2 on the rear of the Control unit) are mechanically interchangeable. However, different pin connections prevent the cables from being electrically interchangeable. The RF-302R will be inoperative if a wrong cable is used.

2.6.4 ANTENNA LEAD-IN

The antenna lead-in wire from the Coupler unit to the base of the antenna should not exceed one foot and should be made of AWG No. 10 or larger buss wire.

Note

The antenna lead-in will act as part of the antenna. For efficient operation, keep the antenna lead-in length as short as possible.

2.7 GROUNDING

A good ground should be used with the vertical antenna for efficient radiation. Grounds for long-wire antennas are not as critical, but are still necessary. Use copper strap, (preferred) or braided strap for all ground connections. Keep ground leads as short as possible. This is especially important with the Coupler unit. If the Coupler unit is located physically away from the ground plane, the ground lead acts as part of the antenna and the Coupler unit chassis may be at some high RF voltage above ground, and consequently dangerous.



In vehicular installations, connect the Coupler unit ground terminal to the metal body of the vehicle. The surface should be clean and free from paint at the point of connection.

In fixed station installations, one or two ground rods, of six to eight feet in length can be used, providing that the soil is conductive. A connection to a water pipe system at that point where the pipe comes out of the ground might also serve as a good ground. In dry

regions, a system of radials can be buried six to eight inches under the surface of the earth, extending away from the base of the antenna. These radials act as an artificial ground. The radials should be made of heavy gauge wire at least one quarter wave-length long at the lowest operating frequency. A minimum of 4 radials should be used for vertical antennas. For long wire antennas, one or two radials running under the antenna may be sufficient.

Table 2.1 - Power Cable Terminations

CONNECTOR PIN	FUNCTION		
	DC CABLE	220 VAC CABLE	115 VAC CABLE
A	N. C. (no connection)	N.C.	115 VAC
B	N. C.	220 VAC	N. C.
C	N. C.	AC common	AC common
D	Chassis ground	Chassis ground	Chassis ground
E	Plus 22-30 VDC input	N. C.	N. C.
F	DC (minus) Return	N. C.	N. C.
G	N. C.	N. C.	N. C.

SECTION III

OPERATION

3.1 GENERAL

No accessory equipment is needed to tune the RF-302R. The RF-302R may be tuned by one of two methods: Control A and Control B first may be set to the "home" position, and then adjusted for a "null" indication on the center reading meters (using COUPLER TUNE/OPERATE mode); or (if settings have been previously logged) Control A and Control B can be set for the approximate (logged) position (using A & B SET mode), and adjusted for a "null" indication on the center reading meters using COUPLER TUNE/OPERATE mode. For a better understanding of the functional operation of the RF-302R, refer to section IV.

CAUTION

It is generally good practice to tune the RF-302R with no more than 1/2 of the normal transmitter output (nominally 50 watts), since the Coupler unit does not present a proper load to the transmitter until it is correctly tuned. This precludes damage to the transmitter which could result from tuning at full power.

3.2 CONTROLS AND INDICATORS

Figure 3-1 illustrates the front panel of the Control unit, and table 3-1 lists and describes the functions of the various controls and indicators used by the operator.

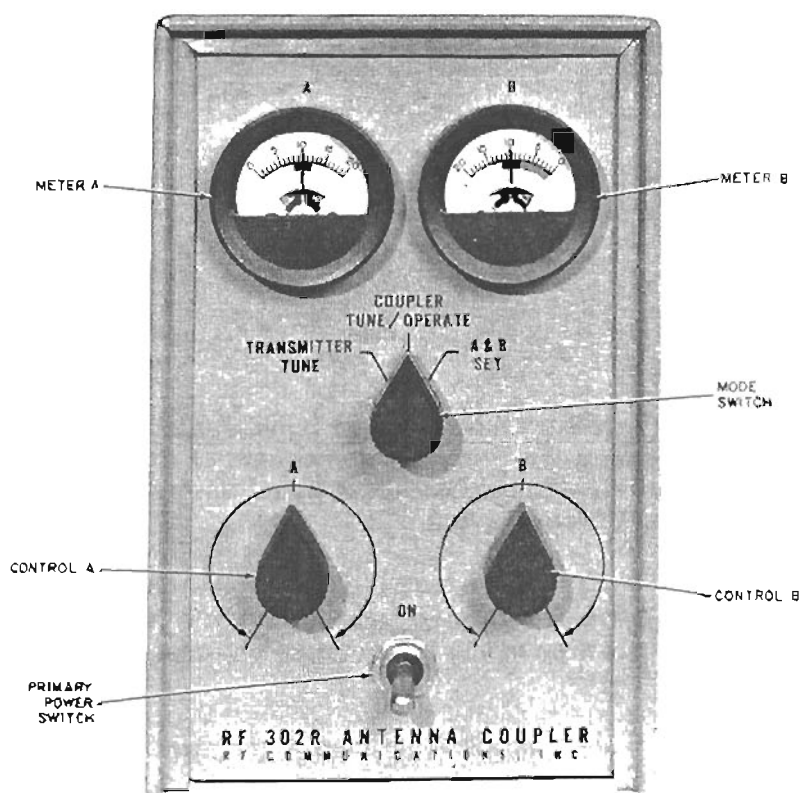


Figure 3.1 - Control Unit, Front Panel



Table 3.1 - Control Unit, Operating Controls and Indicators

CONTROL OR INDICATOR	FUNCTION								
Primary Power switch	Applies primary power to Control unit circuits when set at ON.								
Mode switch	Selects function of Coupler unit, and of metering circuits in Control unit. <table> <tr> <th><u>SWITCH POSITION</u></th><th><u>ACTION</u></th></tr> <tr> <td>TRANSMITTER TUNE</td><td>RF input to Coupler unit is connected to an internal 50 ohm dummy load for transmitter tuning. Meters A and B indicate center "Null". Meter dial lights flash as a reminder that transmitter is not connected to antenna.</td></tr> <tr> <td>COUPLER TUNE/OPERATE</td><td>RF input to Coupler unit is connected through matching network to antenna. Meters A and B monitor input to Coupler unit and indicate center "Null" when matching network is properly tuned.</td></tr> <tr> <td>A & B SET</td><td>RF input to Coupler unit is connected through matching network to antenna. Meters A and B indicate relative position of Coupler unit matching network elements.</td></tr> </table>	<u>SWITCH POSITION</u>	<u>ACTION</u>	TRANSMITTER TUNE	RF input to Coupler unit is connected to an internal 50 ohm dummy load for transmitter tuning. Meters A and B indicate center "Null". Meter dial lights flash as a reminder that transmitter is not connected to antenna.	COUPLER TUNE/OPERATE	RF input to Coupler unit is connected through matching network to antenna. Meters A and B monitor input to Coupler unit and indicate center "Null" when matching network is properly tuned.	A & B SET	RF input to Coupler unit is connected through matching network to antenna. Meters A and B indicate relative position of Coupler unit matching network elements.
<u>SWITCH POSITION</u>	<u>ACTION</u>								
TRANSMITTER TUNE	RF input to Coupler unit is connected to an internal 50 ohm dummy load for transmitter tuning. Meters A and B indicate center "Null". Meter dial lights flash as a reminder that transmitter is not connected to antenna.								
COUPLER TUNE/OPERATE	RF input to Coupler unit is connected through matching network to antenna. Meters A and B monitor input to Coupler unit and indicate center "Null" when matching network is properly tuned.								
A & B SET	RF input to Coupler unit is connected through matching network to antenna. Meters A and B indicate relative position of Coupler unit matching network elements.								
Meter A	Monitors Coupler unit input impedance (indicates "Null" when the resistive component of the impedance is 50 ohms) or relative position of shunt tuning elements as selected by Mode switch.								
Meter B	Monitors Coupler unit input impedance (indicates "Null" when RF voltage and current are in phase) or relative position of series tuning elements as selected by Mode switch.								
Control A	When rotated from center (off) position, Coupler unit circuits are energized to change shunt tuning elements in matching network. Speed of change is dependent upon the distance the control is rotated from center position. Direction of change is dependent upon direction of rotation of control from center.								

Table 3.1 – Control Unit, Operating Controls and Indicators (Cont)

CONTROL OR INDICATOR	FUNCTION
Control B	When rotated from center (off) position, Coupler unit circuits are energized to change series tuning elements in matching network. Speed of change is dependent upon the distance the control is rotated from center position. Direction of change is dependent upon direction of rotation of control from center.

Note

Switch A1S1, on the rear of the Control unit, is set for the proper primary power source at the time of installation. The operator will have no cause to change this switch position unless the primary power source is changed.

3.3 OPERATION WITHOUT PRELOGGED A & B SETTINGS

The following procedure is to be followed when tuning the Coupler unit to frequencies for which no previous Meter A & B settings have been logged for the type of antenna in use.

Note

The following procedures should be carefully performed, or a false tune may result.

CAUTION

When operating Control A and Control B, do not allow control to abruptly snap back to off position. Damage to switch may result.

3.3.1 Set Power Switch ON.

3.3.2 Set Mode switch at TRANSMITTER TUNE. Meter lamps should flash. (A 50-ohm load is now connected to the transmitter.)

3.3.3 Tune transmitter to the selected frequency, and set for a tune power output.

3.3.4 **IMPORTANT:** Unkey the transmitter.

3.3.5 The tuning procedure described in the following paragraphs is divided into three sequences:

- Preset
- Coarse Tuning
- Fine Tuning

3.3.6 PRESET

- Set Mode switch at A & B SET. Meter lamps should stop flashing and remain on.
- Rotate Control A counterclockwise and hold until Meter A indicates near zero (minimum at left).
- Rotate Control B clockwise and hold until Meter B indicates near zero (minimum at right).

Note

Control A and Control B may be operated simultaneously.

3.3.7 COARSE-TUNING

CAUTION

Before proceeding, first read and understand the following:



The Coupler is correctly tuned when both meters are reading center scale

Control A tunes Meter A, and Control B tunes Meter B.

During tuning, the direction to turn either control knob can be determined by the position of the respective meter. If the meter needle is to the left of center, the control knob should be rotated clockwise. If the needle is to the right of center, the control knob should be rotated counterclockwise.

The speed of tuning is determined by how far the control knob is rotated. The further it is rotated, the faster the tuning. This speed control is especially helpful near the end of the tuning cycle when sensitivity is usually quite high.

The Coupler will be coarse-tuned when Meter B, which at first has shown little or no movement, suddenly becomes sensitive to tuning and indicates to the right of center.

a. Set Mode switch at COUPLER TUNE/ OPERATE. Meters A and B should provide a center scale indication.

b. Key the transmitter in its tune position and observe the indication of Meters A and B. The deflection from the center position may be small because the antenna coupler is far from its proper tuning position.

c. Perform this step by one of two methods, depending on the selected operating frequency. Use method A if tuning above 3100 KC, method B if tuning below 3100 KC.

Method A. - Rotate Control B counterclockwise and hold until Meter B goes through a definite peak deflection to the right into the red area and begins to return toward the center null position. Proceed to paragraph 3.3.8.

NOTE

Most cases of inability to tune properly above 3100KC are due to releasing control B before Meter B reaches maximum deflection; control B must be held counterclockwise until Meter B goes through a peak deflection.

Method B. - Rotate control A clockwise and hold until Meter B indicates to the right in the

red area. Adjust for maximum deflection into red area, then proceed to paragraph 3.3.8.

3.3.8 FINE TUNING

CAUTION

When tuning Control A, Meter B normally will move off center. When this occurs, stop tuning Control A and recenter Meter B with Control B. Try to keep Meter B centered at all times. Alternately perform this until both meters are centered in the black area in the middle of the meter. Meter A should not be allowed to swing to the right during tuning. When it comes to center, next adjust Meter B toward center. The red area on Meter B is intended as an aid in tuning. It does not indicate an overload or other undesirable electrical condition.

a. First adjust Control B to center Meter B. Keeping Meter B centered with Control B, adjust Control A to center Meter A.

b. The coupler is now fine-tuned and ready for operation when both meters are centered.

3.3.9 Set transmitter for normal operation.

3.3.10 If this frequency will be used again in the future, set Mode switch at A & B SET and record meter positions on the logging chart. Reset Mode switch to TUNE/ OPERATE position.

3.4 OPERATION WITH PRELOGGED A & B SETTINGS

The following procedure is to be used when Meter A and B settings have been previously logged (table 5-1) for the frequency and type of antenna to be used, or if there is preset information in table 5-2 for the type of antenna being used.

3.4.1 Set Primary Power switch at ON. Meter lamps should light.

3.4.2 Set Mode switch at TRANSMITTER TUNE. Meter lamps should flash. (A 50-ohm load is now connected to the transmitter.)

3.4.3 Tune transmitter to the selected frequency and set for a tune power output.

3.4.4 Unkey Transmitter.

3.4.5 Set Mode switch at A & B SET. Meter lamps should stop flashing and remain on.

3.4.6 Observe Meter A indication. Rotate Control A in the direction required to provide a Meter A indication identical to the logged setting.

3.4.7 Observe Meter B indication. Rotate Control B in the direction required to pro-

vide a Meter B indication identical to the logged setting.

3.4.8 Set Mode switch at COUPLER TUNE/ OPERATE. Meters A and B should provide a center scale indication.

3.4.9 Key transmitter for a tune power output.

3.4.10 If both meters do not indicate at center, adjust Control B to center Meter B. Keeping Meter B centered with Control B, adjust Control A to center Meter A.

3.4.11 The coupler is tuned and ready for operation when both meters indicate at center.

3.4.12 Set transmitter for normal operation.

SECTION IV

PRINCIPLES OF OPERATION

4.1 GENERAL

Remote Controlled Antenna Coupler RF-302R consists of two units: a Coupler unit (A2) and a Control unit (A1). The Coupler unit contains the impedance matching network. The Control unit contains the metering and switching circuits required for the motor-driven tuning elements of the Coupler unit matching network. Normally the Coupler unit is mounted at the base of the antenna, while the Control unit is conveniently located near the transmitter. One multiconductor cable interconnects the two units. A separate RF transmission line from the transmitter is connected directly to the Coupler unit. Figure 4-1 illustrates the functional sections of the RF-302R.

4.2 RF SIGNAL PATH

During regular transmissions, the RF output from the transmitter is applied through discriminator assembly A2A1, and through the normally closed contacts of relay A2K1 to the matching network. The matching network provides an inductance-capacitance combination which transforms the impedance of the antenna to the 50 ohms resistive transmission line from the transmitter at the transmitting frequency. It consists of transformer A2T1, and four variable motor-driven elements: A2L1, A2L2, A2L3 and A2C1. Variable inductors A2L1 and A2L2 are positioned to provide enough reactance (shunt loading) to transform the antenna impedance to an inductive impedance that has a resistive component of 12.5 ohms. Capacitor A2C1 is then positioned to cancel this inductive reactance in the transmission line. Transformer A2T1 has a turns ratio of 2:1. Therefore, the input impedance of the RF-302R will be $50 + j0$ ohms. Variable inductor A2L3 extends the tuning range of A2C1.

When Mode switch A1S2 is set at TRANSMITTER TUNE, relay A2K1 is energized,

switching the transmitter RF input from the matching network to resistor A2R5, which serves as a 50 ohm 100 watt resistive dummy load for transmitter tuning. When relay A2K1 is energized, flasher A1K1 is also energized. A1K1 interrupts the voltage of Meter A and Meter B dial lights at a constant flashing rate to alert the operator that the transmitter is operating into the dummy load and not the antenna.

4.3 DISCRIMINATOR ASSEMBLY

The discriminator assembly used in equipments with serial numbers less than 162 was slightly different from the discriminator used in equipments with serial number 162 and over.

Both discriminator assemblies consist of two separate circuits; a phase discriminator, and a resistance discriminator (figure 5-4). The RF transmission line passes through the center of, and serves as the primary winding for toroid transformers A2A1T1 and A2A1T2.

4.3.1 PHASE DISCRIMINATOR (EQUIPMENTS WITH SN 162 OR GREATER)

The function of the phase discriminator is to produce a DC output which is 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. Center reading control unit meter A1M2 (Meter B) is connected to the DC output of the phase discriminator. When a reactive component is present, the resulting (positive or negative) DC voltage will cause a meter deflection from center scale which will be proportional to the magnitude of reactive deviation from 0 ohms.

The line current induces a voltage (in phase with the line current) in transformer A2A1T1,

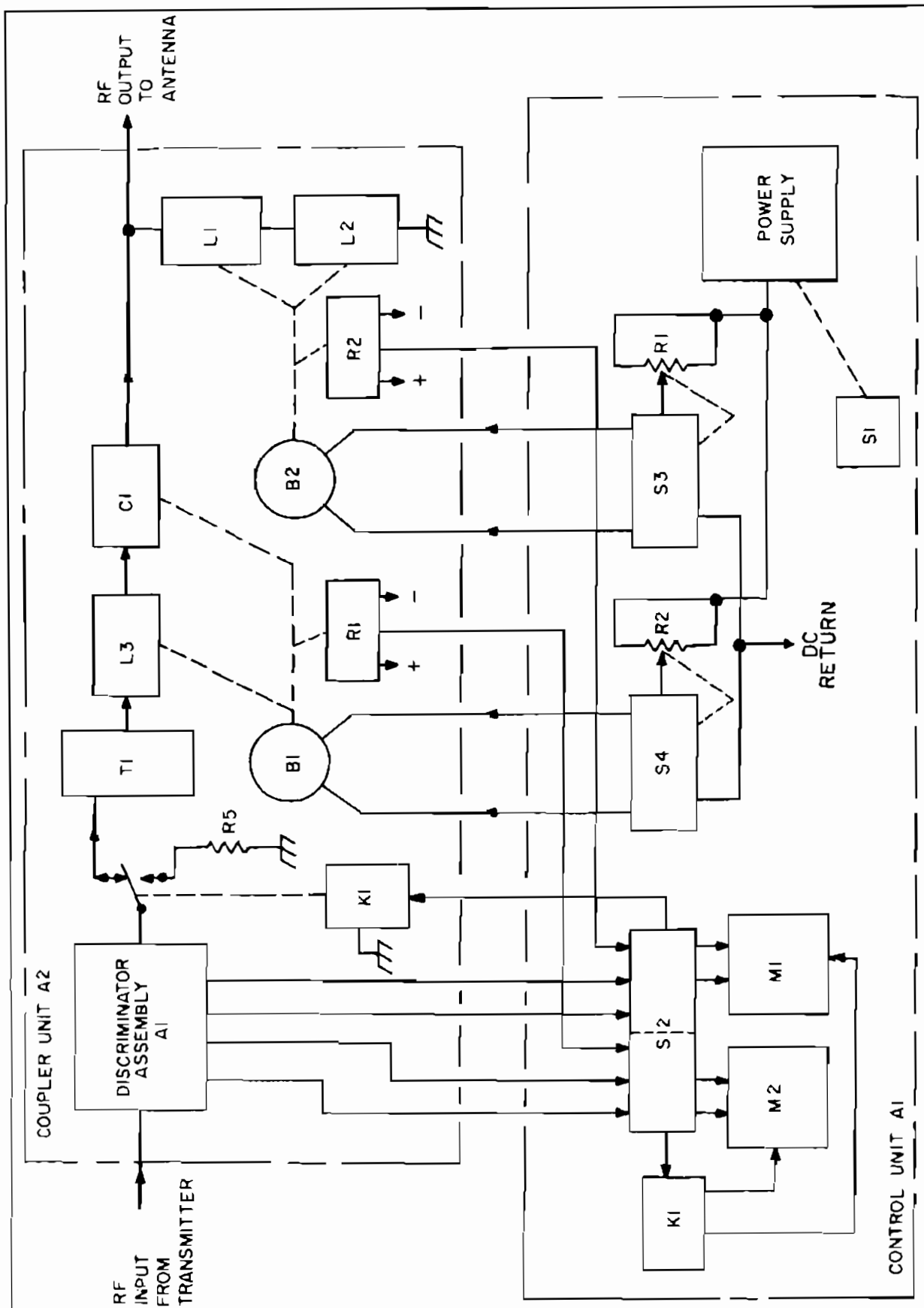


Figure 4.1 - Functional Block Diagram

which will appear across resistors A2A1R1 and A2A1R2. If the junction of the two resistors A2A1R1 and A2A1R2 is used as a reference point, the voltage across these resistors are in opposite phase, so that the voltage across resistor A2A1R2 is in phase with the line current and the voltage across resistor A2A1R1 is 180° out of phase with the line current. (It is just as if the junction of the resistors A2A1R1 and A2A1R2 were connected to a center-tap of the transformer.)

Divider A2A1C1-A2A1R3, A2A1R10 produces a reference voltage at the junction of resistors A2A1R1 and A2A1R2 90° out of phase with the line voltage. The vector sum of the voltage drops across resistors A2A1R3, A2A1R10 and A2A1R1 is detected by diode A2A1CR1, and filtered by capacitor A2A1C2, producing a positive DC voltage across resistor A2A1R11. The vector sum of the voltages across resistors A2A1R3, A2A1R10 and A2A1R2 is detected by diode A2A1CR2, and filtered by capacitor A2A1C3, producing a negative DC voltage across resistor A2A1R12. The two DC voltages (across A2A1R11 and A2A1R12) are summed through resistors A2A1R4, A2A1R5 and A2A1R6, and applied through the control cable and switch A1S2 (paragraph 4.5) to Meter A1M2 (Meter B). If the reactive component of the line impedance is zero, then the line voltage and the 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, and the other negative). Summing two equal and opposite DC voltages results in zero output, and center reading meter A1M2 will indicate a tuned condition. 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 A2A1R3, A2A1R10, and A2A1R1 or A2A1R2) will no longer be equal. Therefore, the DC voltage outputs from diodes A2A1CR1 and A2A1CR2 must also be unequal, resulting in either a positive (for capacitive reactance) or a negative (for inductive reactance) DC output to center reading meter A1M2.

The meter return lead from A1M2 is connected to ground at the discriminator. Capacitor A2A1C11 is an RF bypass. Potentiometer

A2A1R6 is factory adjusted to provide a zero DC output from the phase 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.

4.3.2 PHASE DISCRIMINATOR (EQUIPMENTS WITH SN LESS THAN 162)

Early production models of the discriminator assembly used the same type of phase discriminator circuit as described above, with the exception that the output circuit was slightly different. The two error signals, which are detected by A2A1CR1 and A2A1CR2 as explained above, are filtered by A2A1C2/A2A1C4/A2A1L1 and A2A1C3/A2A1C5/A2A1L2. When line impedance has no reactive component, the two dc voltages which will appear at TP2 and TP3 will be equal and opposite. Any reactive component will result in a difference between the two DC voltages which will result in a meter deflection. Diodes A2A1CR3 and A2A1CR4 determine the amount of load connected to the discriminator outputs according to the level of the error signals. With low level error signals, diodes A2A1CR3 and A2A1CR4 do not conduct, providing a high impedance load. Under normal conditions, the diodes conduct, connecting potentiometer A2A1R6 as the load. Potentiometer A2A1R6 is factory adjusted to balance the two DC output voltages when there is no reactive component in the line impedance. Resistors A2R8, A2R9 provide the proper load for the meter. Capacitors A2C6 and A2C7 are RF bypass.

4.3.3 RESISTANCE DISCRIMINATOR (EQUIPMENTS WITH SN 162 OR GREATER)

The function of the resistance discriminator is to produce a DC output which is indicative of the resistive component of the line impedance. This DC output will be zero when the resistive component is the desired 50 ohms, positive when the resistive component is less than 50 ohms, and negative when the resistive component is greater than 50 ohms. Center-reading control unit meter A1M1 (Meter A) is connected to the DC output of

the resistance discriminator. When the resistive component of the line impedance is other than 50 ohms, the resulting (positive or negative) DC voltage will cause a meter deflection from center scale which will be proportional to the magnitude of the deviation from 50 ohms.

Capacitor divider A2A1C6-A2A1C7 produces an output across capacitor A2A1C7 which is in phase with and proportional to the line voltage. This voltage is detected by diode A2A1CR5 and filtered by capacitor A2A1C8, producing a positive DC voltage which is developed across resistor A2A1R14. The line current induces a voltage in transformer A2A1T2 which is connected so that when the line impedance is 50 ohms resistive, the voltage across transformer A2A1T2 is 180° out of phase with and twice the amplitude of the voltage produced by divider A2A1C6-A2A1C7. The vector sum of the outputs from transformer A2A1T2 and divider A2A1C6-A2A1C7 is detected by diode A2A1CR6 and filtered by capacitor A2A1C9, producing a negative DC voltage across resistor A2A1R15. The two DC voltages (across resistors A2A1R14 and A2A1R15) are summed through resistors A2A1R16 and A2A1R17 and applied through the control cable and switch A1S2 to meter A1M1 (paragraph 4.5). If the resistive component of the line impedance is 50 ohms, then the two DC voltages will be equal in amplitude, and opposite (one positive and one negative). Summing two equal and opposite DC voltages results in zero output, and center reading meter A1M1 will indicate a tuned condition. If the resistive component of the line impedance is other than 50 ohms, the two DC voltages will no longer be equal, resulting in either a positive (for a line impedance greater than 50 ohms) or a negative (for a line impedance less than 50 ohms) DC output to center reading meter A1M1.

The meter return lead from A1M1 is connected to ground at the discriminator. Capacitor A2A1C10 is an RF bypass. Inductor A2A1L3 provides a DC return for detectors A2A1CR5 and A2A1CR6. Resistor A2A1R7 is the load resistor for transformer A2A1T2. At the high end of the operating frequency range, the leads of capacitor A2A1C7 produce a small amount of inductive reactance.

Therefore, inductor A2A1L1 is used to provide a corresponding amount of inductive reactance in series with capacitor A2A1C6 so that the output from divider A2A1C6-A2A1C7 will not be sensitive to frequency. Capacitor A2A1C6 is factory adjusted so that the voltage output from divider A2A1C6-A2A1C7 will be exactly half of that developed across transformer A2A1T2 when the line impedance is 50 ohms resistance.

4.3.4 FORCING.

At the low end of the operating frequency range, the variable capacitor tuning element at its home position appears as a high impedance load to the line (maximum capacitance position from which tuning is started). 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 source for each detector in each discriminator. Thus, both discriminators will produce a zero output (no meter deflection), falsely indicating that the tuning elements are properly adjusted. To prevent this condition, resistors A2A1R18 and A2A1R19 are connected in parallel with A2A1R14 to unbalance the R discriminator. Thus, a deflection from center will be noted on Meter A to provide the operator an indication that the elements are not tuned. Once the line impedance has been changed sufficiently to produce a proper output from the discriminators, or at frequencies where the condition described above does not occur, the unbalance caused by A2A1R18 and A2A1R19 is insignificant and does not degrade operation.

4.3.5 RESISTANCE DISCRIMINATOR (EQUIPMENTS WITH SN LESS THAN 162)

Early production models of the discriminator assembly used the same type of resistance

discriminator circuit as described above, with the exception that the output circuit was slightly different. The two DC voltages from A2A1CR5 and A2A1CR6 are filtered by A2A1C8/A2A1L4/A2A1C10 and A2A1C9/A2A1L5/A2A1C11 and appear as two voltages at A2A1TP4 and A2A1TP5. When line impedance is 50 ohms these two voltages are equal and opposite, and cancel. Any variation in line impedance will result in a difference between the two voltages which will result in a meter deflection.

Resistors A2R6 and A2R7 provide the proper load for the meter. Capacitors A2C8 and A2C9 are RF bypass.

4.4 CONTROL CIRCUITS

Two DC motors drive the variable elements in the Coupler unit matching network (figure 4-1). Motor A2B1 drives A2L3 and A2C1 and motor A2B2 drives A2L1 and A2L2. DC operating voltage for the drive motors is supplied by the Control unit power supply through switching circuits which permit the operator to select motor direction and speed. Since the two motor switching circuits are identical, only switching for motor A2B1 is discussed in detail below.

DC operating voltage for A2B1 is applied from the Control unit power supply through potentiometer A1R2, switch A1S4 and through switches A2S1 and A2S2. A1S4 determines the polarity of the voltage applied to A2B1. A1R2 is in series with the motor, reducing the voltage applied to the motor (and the motor speed). A1S4 and A1R2 are mechanically linked to front panel Control B. Spring tension maintains Control B in a center "off" position, which in turn maintains A1R2 wiper contact at mid-range, and A1S4 at off. When Control B is rotated in either direction, A1S4 is actuated, applying voltage to A2B1. As Control B is advanced from its center "off" position the wiper of A1R2 is advanced from

the mid-range point (maximum resistance), increasing the voltage applied to A2B1. Switches A2S1 and A2S2 are limit switches, actuated by A2B1 gear train assembly. When A2B1 approaches the high or low end of its range during tuning, one of the limit switches is actuated, switching A2R3 in series with A2B1. This reduces motor speed to prevent mechanical damage and limits current through A2B1 when stalled by the mechanical end stops.

4.5 METERING

The function of the two meters in the Control unit are determined by the position of the Mode switch (figure 5-3). When the Mode switch is set at TRANSMITTER TUNE or COUPLER TUNE/OPERATE, Meter A1M2 (Meter B) is connected to the output of the phase discriminator; and meter A1M1 (Meter A) is connected to the output of the resistance discriminator. When the Coupler unit is properly tuned, the outputs from the discriminators will provide a center scale "null" indication on Meters A and B (paragraph 4.3).

When the Mode switch is set at A & B SET, meter A1M2 is connected to a voltage divider network which contains potentiometer A2R1 (figure 4-2). The wiper of A2R1 is connected to the A2B1 gear train. Since the indication of A1M2 is dependent upon the position of the A2R1 wiper, A2L3/A2C1 can be rough-tuned if the indication for meter A1M2 has been previously logged at that frequency. In a similar manner, meter A1M1 is connected to a voltage divider network which contains potentiometer A2R2, the wiper of which is connected to the A2B2 gear train, providing a means of rough tuning A2L1/A2L2.

4.6 TROUBLESHOOTING

When troubleshooting, use a systematic approach which will quickly isolate the malfunction to a faulty circuit. Carefully check operating procedures to eliminate the possibility

of operator error, and read paragraphs 4.1 through 4.5 to develop an understanding of circuit functions. Do not attempt to adjust the discriminator assembly. If careful checks

have proven that the discriminator assembly is faulty, replace the complete assembly and ship the faulty unit back to the factory for repair.

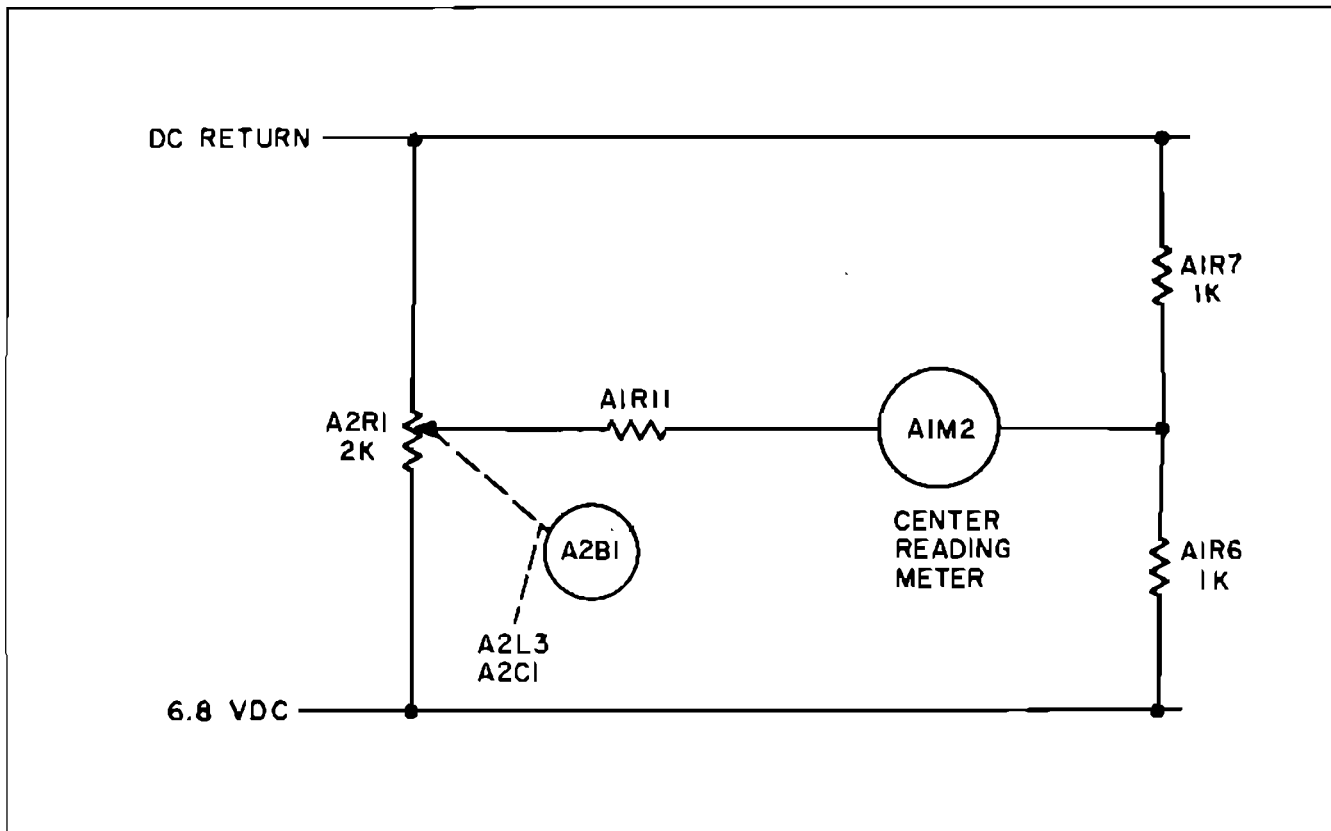


Figure 4.2 - Meter Network For Element Position Indication

SECTION V

MAINTENANCE

5.1 GENERAL

The RF-302R requires a minimum of maintenance. A semi-annual cleaning, lubrication, and tightening of seals is the only preventive maintenance required. Alignment and adjustment will be required only if the initial adjustments have been upset by troubleshooting or parts replacement.

WARNING

Lethal voltages are present within the Coupler unit during transmission. When the Control Unit is operated from an AC primary power source dangerous voltages are also present within the Control unit. When performing any maintenance on the equipment, ensure that both the primary power source and the transmitter are turned off and secured.

5.2 DIFFERENCES IN PRODUCTION MODELS

There are some slight mechanical differences between Antenna Coupler units with serial numbers below 162, and those with production serial numbers 162 and over. In addition, the A and B switch assemblies in Control units with serial numbers below 975, are different from the switch assemblies in Control units with serial numbers 975 and over. Operationally and electronically, the equipment are the same, and any RF-302R Antenna Coupler Control unit will work with any RF-302R Antenna Coupler. (Of course, A2R1 and A2R2 may have to be adjusted, to set Meter A and Meter B for zero $\pm$ 1, the first time any Coupler and Control unit are used with each other.) The differences between production runs mentioned above consists of changes in some mechanical parts and assemblies, with resulting differences in parts replacement and alignment

techniques. For the Coupler unit, figure 5-1, sheet 1 illustrates production models with a serial number less than 162, and figure 5-1 sheet 2 illustrates production models with a serial number of 162 or greater. For the Control unit, production models with serial number 975 or greater have an improved A and B control switch assembly (which is supplied as replacement parts for all Control units). Figure 5-2, sheet 1 illustrates units with serial numbers under 975, and figure 5-2, sheet 2 illustrates production units with serial numbers 975 or greater. Refer to parts replacement procedures in paragraph 5.4, and to the alignment procedures in paragraph 5.6 for any differences in maintenance techniques.

5.3 PREPARATION FOR MAINTENANCE

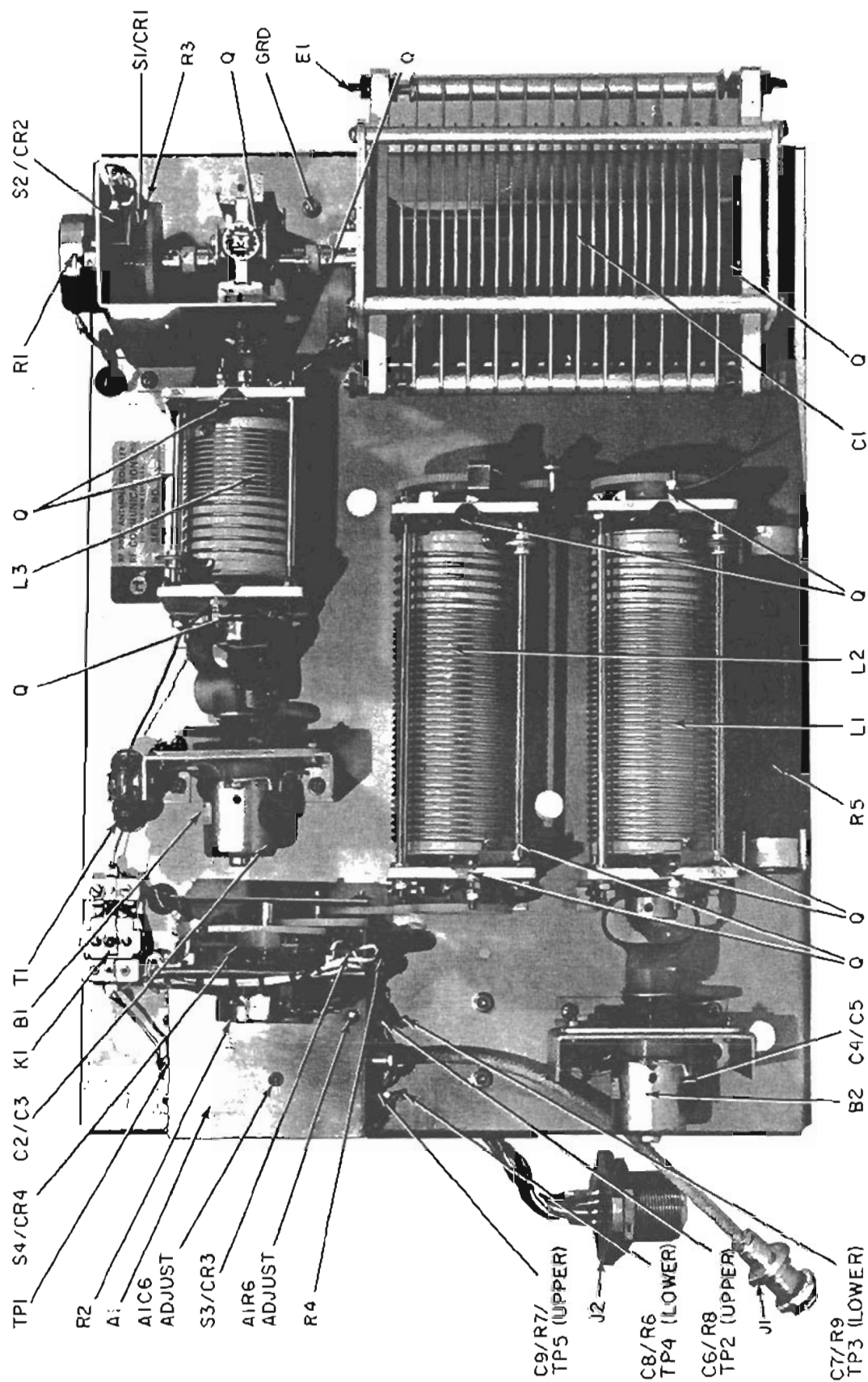
When a thorough cleaning and lubrication is planned for the RF-302R, considerable time may be saved if the procedures listed below are observed.

5.3.1 PARTS REPLACEMENT TECHNIQUES

Note

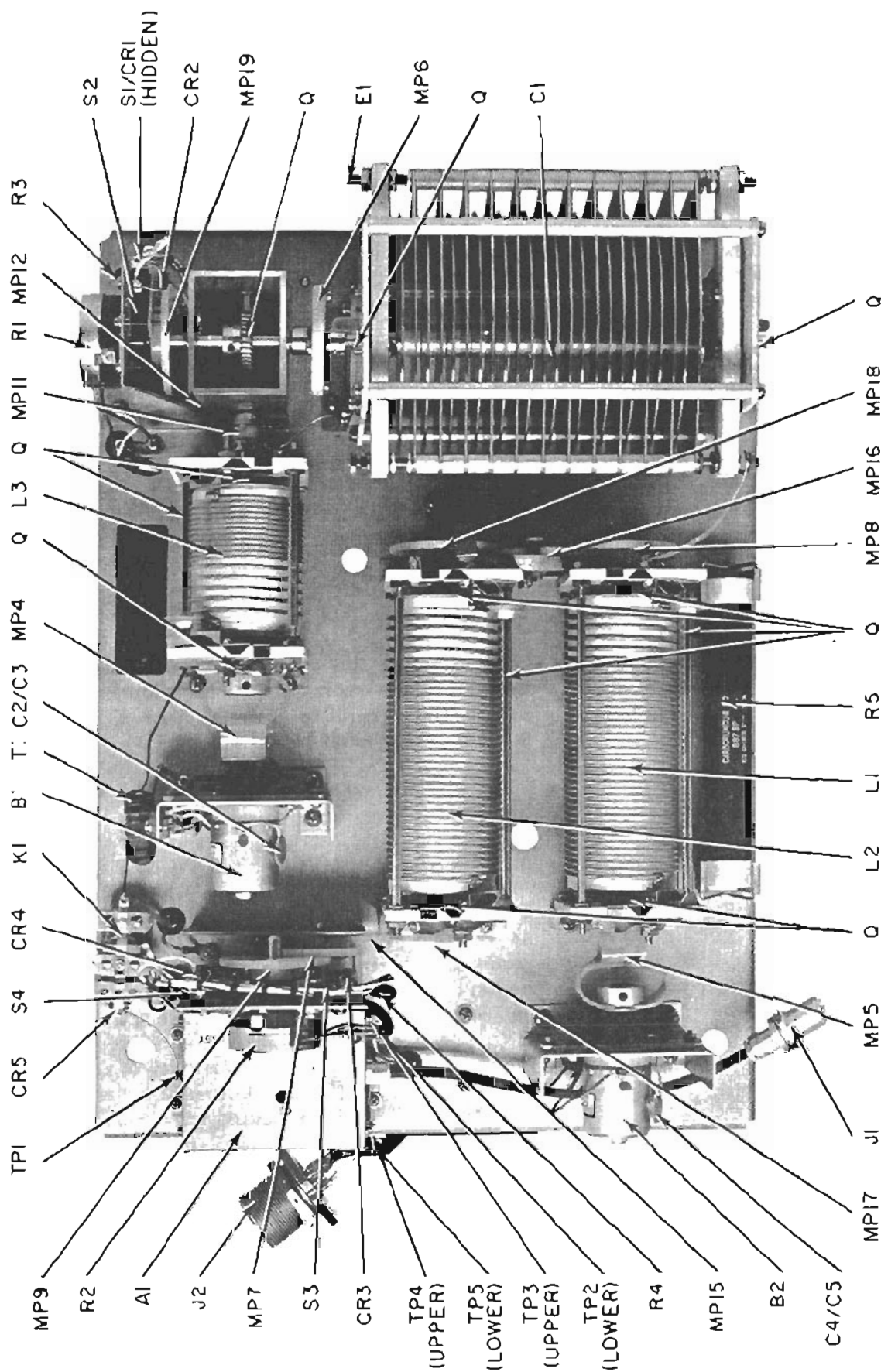
When replacing the Coupler unit cover on the case, torque the cover bolts to 30 in/lb.

The components and subassemblies of the Coupler unit and the Control unit are designed for easy removal and replacement without detailed techniques. However, because of mechanical linkages between assemblies which also have dependent electrical functions, alignment of components during and after parts replacement is important. Also, minor production variations in some provisioned spare parts require changes in parts replacement procedure. The procedures below and in the alignment section (paragraph 5.6) cover all parts replacement and alignment procedures when replacement or alignment may be required.



PREFIX REFERENCE DESIGNATION A2
COUPLER UNITS WITH SERIAL NO. LESS THAN 162

Figure 5.1 - Coupler Unit, Chassis Removed from Case (Sheet 1)



PREFIX REFERENCE DESIGNATION A2
 COUPLER UNITS WITH SERIAL NO. 162 OR GREATER.

Figure 5.1 - Coupler Unit, Chassis Removed from Case (Sheet 2)



When removing any mechanical part, carefully set aside the hardware in the order of removal, to avoid confusion during replacement. When replacing mechanical parts or assemblies, refer to the paragraph on cleaning and lubrication (paragraph 5.5) and accomplish the necessary lubrication during the installation.

When replacing electrical parts, make certain that circuit alignment has not been disturbed by minor differences in electrical characteristics between the original and the replacement part. This may be ascertained by rapidly checking the alignment using the procedure given as a guide.

When installing any components in the motor driven assemblies which were originally pinned, redrill the pin hole and use the next larger size roll pin. Under certain circumstances, such as replacing capacitor A2C1, a new hole may need to be drilled in a shaft. When drilling a new hole, use the coupling for a guide, and drill a pilot hole with a smaller drill, then drill both pieces with the proper drill for the roll pin. Carefully check for proper alignment and clearances before drilling and pinning.

CAUTION

To avoid damage to shafts and components provide support for shafts and couplings when drilling or removing and replacing pins.

5.3.2 REMOVAL OF COUPLER CHASSIS.

The Coupler unit chassis can be more easily serviced if it is removed from the case and placed on a bench. To do this, proceed as follows:

WARNING

Dangerous RF voltages are present within the Coupler unit when the transmitter is keyed. Always secure the transmitter against accidental keying before working on the Coupler unit.

- a. Turn off and secure the transmitter.

- b. Disconnect the RF input cable and the control cable.

- c. Remove the nut securing each connector to the Coupler unit and push the connector inside the case.

- d. Remove the antenna connection from the stud on capacitor A2C1, and carefully bend the copper strap close to the case.

- e. Remove the ground strap from the chassis and carefully bend the copper strap close to the case.

- f. Remove the six nuts (one from each corner and two in the center) which secure the chassis to the case and lift the chassis out.

5.3.3 REMOVAL OF CONTROL UNIT COVER.

The Control Unit cover can be removed as follows:

- a. Remove the four flat head machine screws from each side of the Control unit cover. (Be careful to save the formed plastic washer under each screw.)

- b. Lift the wrap-around cover up off the chassis.

5.3.4 FABRICATION OF TEST CABLE.

For bench testing and trouble-shooting, a short control cable for the RF-302R is convenient. Obtain an MS3106A-20-27P connector, and an MS-3106A-20-27S connector, and wire them pin to pin (pin A to pin A, pin B to pin B, etc.). For cable, use any short piece (approximately 2-5 foot long) of multi-conductor cable (14 conductors), or use 14 lengths of AWG #20 insulated wire.

5.3.5 TEST EQUIPMENT AND TOOLS REQUIRED.

The following test equipment and tools will be required:

Transmitter or Transceiver with at least 50 W output.

Multimeter, Simpson Model 269 or equivalent.

No. 1 Phillips screwdriver with 12" long shaft.

9/16 open end wrench.

5.4 PARTS REPLACEMENT

Note

When a component with a pinned coupling on its shaft is replaced, it is recommended that the coupling be repinned using the next larger size roll pin to assure proper pinning action.

5.4.1 REPLACEMENT OF LEVER SWITCHES A1S3 AND A1S4, ON EARLY PRODUCTION MODELS.

CAUTION

On all units with serial number 162 or greater, the new model switch was used. Replace all wiring on these units in the same order as removed.

An improved model is supplied as replacement for A1S3 or A1S4 (P/N 423-0009). The replacement part will be installed mechanically the same, but will require different wiring. To replace A1S3 or A1S4, proceed as follows:

a. Orient the replacement switch so that it is in the same position as when mounted, and viewed from the rear (that is, with the lever down and the bracket bending toward you). Count the contacts clockwise starting in the extreme counterclockwise position.

b. Using #20 buss wire insulated with plastic tubing, strap terminal 4 to terminal 5, terminal 3 to terminal 6, and terminal 1 to terminal 8.

c. Remove the wire from the old switch terminal 7 and solder to replacement switch terminal 2 (if in doubt, use the two schematics of figure 5-4 as a guide).

d. Remove the wire from the old switch terminal 2 and solder to replacement switch terminal 7.

e. Remove the wire from the old switch terminal 8 and solder to replacement switch terminal 4.

f. Remove the wire from the old switch terminal 5 and solder to replacement switch terminal 8.

g. Position and secure the replacement switch, using the original hardware.

h. Perform the control alignment for that control (paragraph 5.6.5 or 5.6.6).

5.4.2 TRANSMISSION ASSEMBLY REPLACEMENT (USE OF TRANSMISSION ASSEMBLY MODIFICATION KIT 423-0100)

A special modification kit has been prepared for the A2L3-A2C1 transmission assembly, for use when replacing parts in early production models (with production serial numbers below 162). This modification kit is to be used whenever any part of the transmission assembly, or potentiometer A2R1 requires replacement. All of the required parts for the modification are included in Transmission Assembly Modification Kit 423-0100. To make the modification, proceed as follows:

Note

On Coupler units with serial number 162 or greater, individual parts may be replaced, then the assembly aligned by using paragraph 5.6.3.2 as a guide.

a. Remove the chassis from the case (paragraph 5.3.2).

b. Check the extent of the damage to the motor-driven parts. Use an ohmmeter to check action of limit switches. (Do not be confused by the resistance of the diodes across the switches.)

Note

If limit switches and diodes are not damaged, the Millen drive assembly may be replaced without unsoldering the wires from these components.

c. Tag and disconnect the wires to potentiometer A2R1. Tag and disconnect the wires

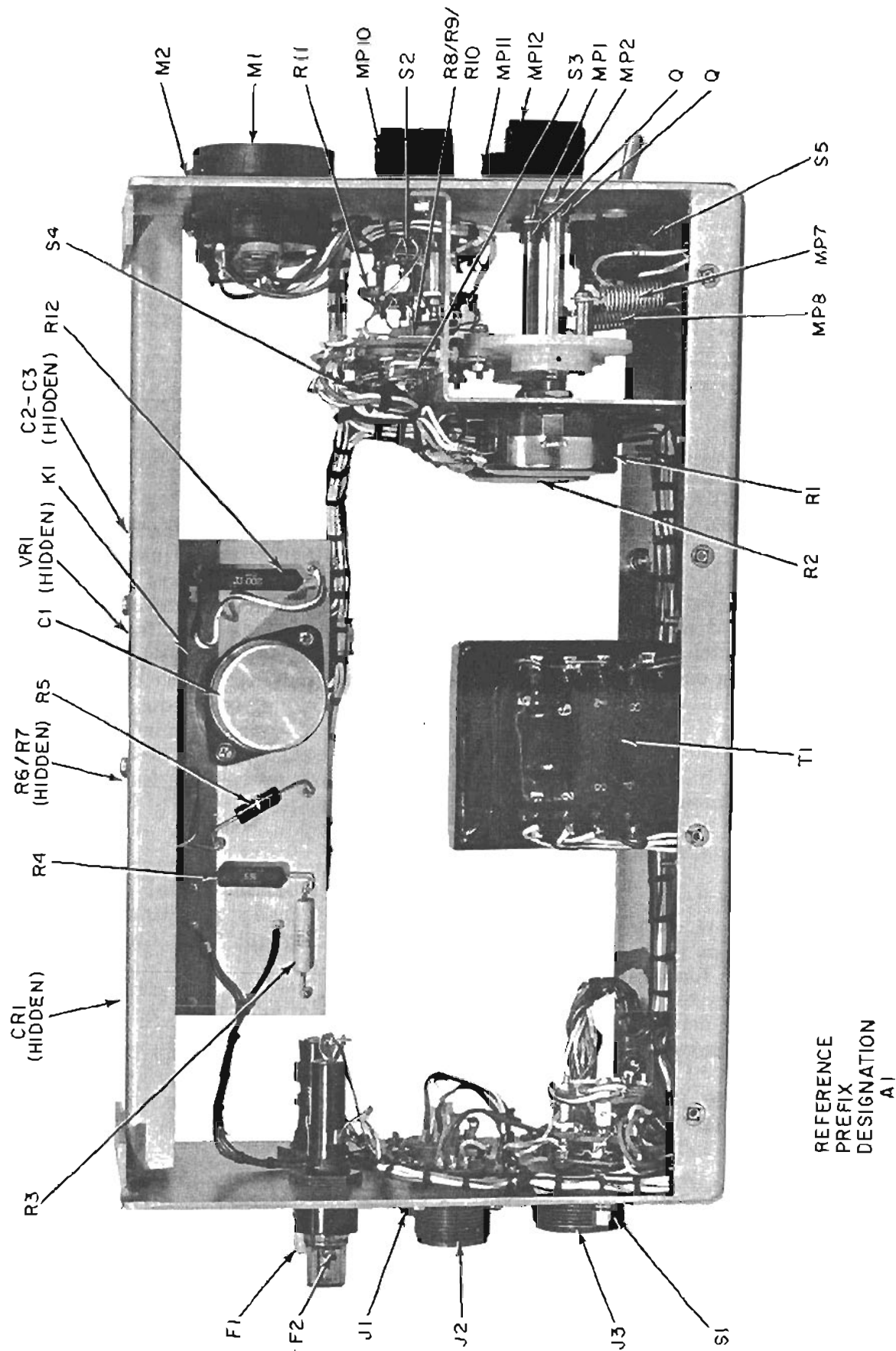


Figure 5-2 - Control Unit Chassis, Cover Removed (serial numbers under 975)

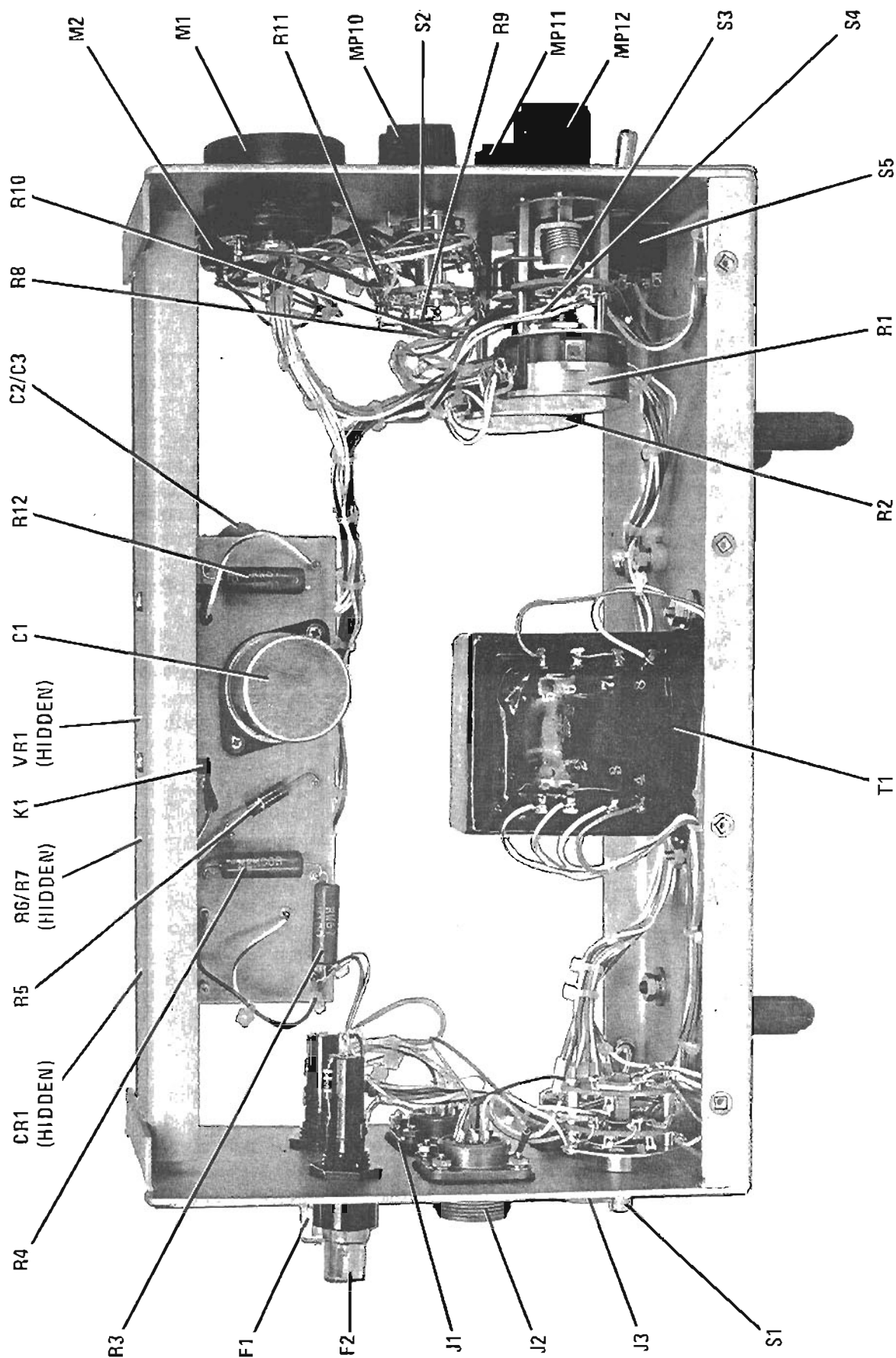


Figure 5.2 – Control Unit Chassis, Cover Removed
(serial number 975 and over)



to any damaged switch on the old Millen drive assembly.

d. Remove the hardware securing the limit switches to the Millen drive assembly.

e. Drive out the roll pin securing the coupling between the Millen drive assembly and A2C1 at the A2C1 end.

f. Unbolt the Millen drive assembly and remove it from the chassis. The coupling between the assembly shaft and A2L3 will come apart at the insert. Save the insert.

g. Set the new transmission assembly in position on the chassis but do not bolt down.

h. Secure the limit switches to the new transmission assembly, using the original hardware. Use figure 5.3 as a guide.

i. Solder the wires to potentiometer A2R1 and to any limit switches which have been replaced.

j. Connect the Coupler unit chassis to the Control unit using the test cable fabricated according to the instructions of paragraph 5.3.3.

k. Set the Control unit Primary Power switch at ON, and Mode switch at A & B SET.

l. Rotate the transmission assembly shaft by hand until the spacer on the cam is in position to actuate limit switch A2S2 and Control unit Meter B indicates close to 0.

CAUTION

Do not let spacer slip behind limit switch actuating lever.

m. Rotate A2L3 until the coil roller is at the end stop next to the motor drive assembly.

CAUTION

When aligning shafts for couplings, align to within 1/32 in. When mating coupling halves between the transmission assembly and A2L3, allow

1/32 in. end play in coupling to prevent insert from binding.

n. Carefully align the transmission assembly shafts with the shaft of A2C1 and A2L3 and secure the transmission assembly to the chassis. It may be necessary to loosen and realign A2C1 and/or A2L3 to obtain the proper alignment. Rotate the transmission assembly shaft if necessary to align the coupling with A2L3, and put in the coupling insert before tightening down the transmission assembly.

o. Rotate coil A2L3 until it is one turn from the end stop nearest the motor.

p. Loosen limit switch A2S2, and adjust the switch until the switch actuates with the coil at this (one turn from the end stop) position. Carefully adjust switch so that as the coil is rotated the last turn to the end stop, the switch lever is depressed further, to ensure that the switch will be actuated throughout that last turn of the coil. Carefully tighten the switch in this position, then rotate coil to end stop.

q. Loosen A2R1 pot locator bracket and rotate the potentiometer housing until Meter B on the Control unit indicates 0. Tighten the pot locator bracket.

r. Use Control unit Control B to rotate A2L3 until it is one turn from the end stop nearest the transmission assembly.

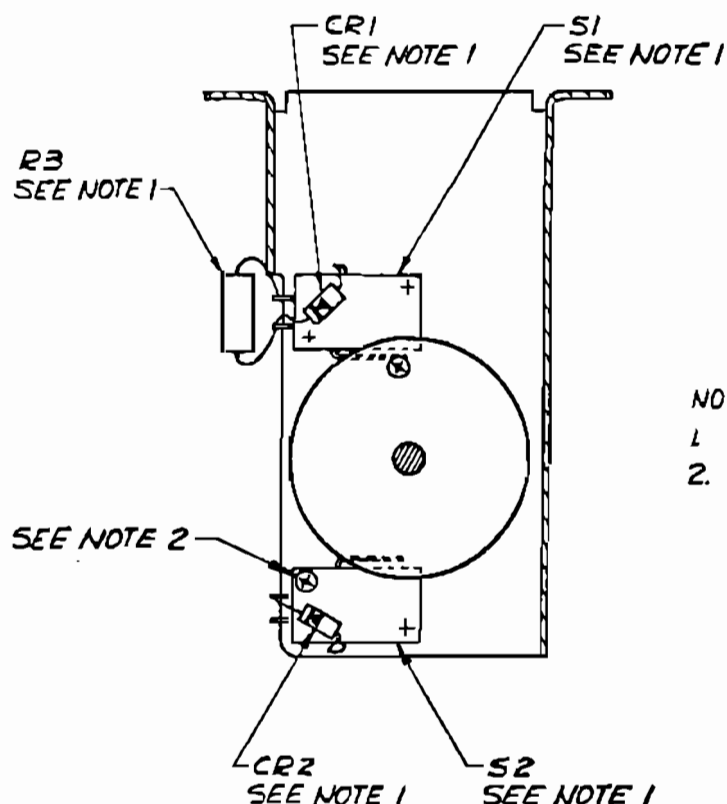
s. Loosen limit switch A2S1, and adjust the switch so that it is actuated at this one turn position, and remains actuated throughout the last turn of the coil as in step p. Carefully tighten the switch in this position.

t. Set coil A2L3 at the end stop nearest the transmission assembly.

u. Rotate A2C1 rotor until the leaves are fully unmeshed, and there is approximately the same distance between stator and rotor on each side.

v. Pin the coupling between the transmission assembly and A2C1.

w. Use Control B on the Control unit to traverse A2L3 roller from one end of the coil to the other, and check that the limit



NOTES:

- 1 OBTAINED FROM ORIGINAL ASSY
- 2 USE HARDWARE OBTAINED FROM PREVIOUS ASSY

Figure 5.3 - Transmission Assembly Switch Location

switches actuate to reduce motor speed when the coil roller is one turn + 120° - 60° from the end stop. Readjust the limit switches if necessary.

5.4.3 REPLACEMENT OF ZENER DIODE A1VR1

Slight differences in electrical characteristics between zener diodes may require that Meter A or Meter B be readjusted for zero indication when the zener is replaced. To re-zero the meters, use Control A to set Meter A and Control B to set Meter B for their minimum indication (with Mode Selector switch in the A&B SET position). Then open the Coupler unit case, and adjust each potentiometer (A2R1 and A2R2) in turn, for a zero indication or minimum, whichever is greater, on its respective meter. After the two meters are adjusted for zero, use Control A and Control B to check the meters for maximum indication (20 ± 2).

Note

On a few early production models,

a resistor was added to bring meter maximum indication within tolerance. If meter maximum indications are out of tolerance after replacing zener, find and remove the resistor across R6 and R7 in the control unit.

5.4.4 METER A OR METER B REPLACEMENT

When Meter A or Meter B is replaced, adjust the new replacement meter for zero after installation, by removing the cover to the coupler and adjusting the potentiometer (A2R1 for A1M2 Control and Meter B, A2R2 for A1M1 Control and Meter A).

Note

If the meter indication is $\pm 1/2$ division of the old meter indication, re-alignment will not be necessary.

5.4.5 REPLACEMENT OF POTENTIOMETERS A1R1, A1R2, A2R1 AND A2R2.

When the potentiometer shaft and associated parts are not damaged, potentiometers A2R1

and A2R2 can be easily replaced by removing the shaft. To remove the shaft, insert a screwdriver blade in the slot between the shaft and the potentiometer housing and twist, to snap the shaft out of the slot.

CAUTION

During assembly, shaft can easily be inserted into potentiometer 180 degrees from proper position. To correct, use screwdriver to remove shaft rotate shaft or pot 180 degrees and re-assemble by pushing shaft into pot until it snaps in place.

Potentiometers A1R1 and A1R2 in the Control unit must be replaced with their attached roller cam and shaft as an assembly however, since the roller cam is carefully oriented to the center position on the pot, and once the cam is pinned at the factory the cam (and shaft) are no longer interchangeable with other potentiometer cams.

5.4.6 DISCRIMINATOR REPLACEMENT

Note

Under normal conditions, it is very unlikely that a discriminator failure will occur. Exhaust all other possibilities for equipment malfunction before replacing the discriminator.

For equipment with serial numbers 162 or greater, there are no special instructions for replacement of the discriminator. For equipments with serial numbers less than 162, replace the discriminator as follows:

a. Remove the Coupler chassis from its case (paragraph 5.3.2).

b. Use Figure 5.1 sheet one and Figure 5.4 sheet one for reference and part location, and remove and discard A2C6, A2C7, A2C8, and A2C9. Also remove and discard A2R6, A2R7, A2R8 and A2R9.

c. Remove and tag the wires to the old discriminator.

d. Remove the screws securing the assembly to the chassis.

e. Mount the replacement discriminator on the chassis.

f. Resolder the wires to the test points on the discriminator, soldering the wire removed from TP2 to TP3, the wire removed from TP3 to TP2, the wire removed from TP4 to TP5 and the wire removed from TP5 to TP4. Resolder the wire removed from TP1 to TP1.

Note

The wires will still go to the same mechanical configuration, but the numbering of the test points on the chassis for the new discriminator are different than the old. To double check, use an ohmmeter to check as follows:

A2J2-	I	to	A2A1TP-	2
"	H	"	"	3
"	F	"	"	4
"	G	"	"	5

g. Remove the cover from the control unit (paragraph 5.3.3).

h. Use figure 5.2 and figure 5.4, sheet one, for reference and part location, remove and discard A1R8 and A1R9, replacing each with a 10 ohm 1/2 W, 10% composition resistor (Federal Stock Number RC20GF100K).

i. Carefully check equipment performance before returning to normal operation.

j. Mark up equipment schematics to indicate changes made.

5.4.7 REPLACEMENT OF COMPONENTS IN MOTOR DRIVEN NETWORKS

Since the replacement of components in the motor driven tuning networks is closely related to alignment, parts replacement for A2L3, A2C1, the transmission assembly, or the A2L1-A2L2 assembly is covered in the alignment procedures for that part.



5.4.8 SWITCH ASSEMBLY REPLACEMENT-LATE MODEL CONTROL A OR CONTROL B.

In production models with serial numbers 975 and over, a different type of control mechanism was used for Control A and Control B (figure 5-2A). The functional operation of the switch was not changed, and electrically all control units are interchangeable. However, the mechanical difference between the different types of switches require a different replacement procedure from that called out in paragraphs 5.4.1 for the switches and 5.4.5 for the potentiometers. Each switch assembly (A1S3 or A1S4) and its associated potentiometer (A1R1 or A1R2) is now replaced as a complete unit. Paragraph 5.4.8.1 covers installation of new switch assembly in models with serial numbers 975 and over. Paragraph 5.4.8.2 covers installation of new switch assembly in equipments with serial numbers 974 and under.

5.4.8.1 EQUIPMENTS WITH SERIAL NUMBERS 975 OR OVER.

- a. Remove the control unit cover according to paragraph 5.3.3.
- b. Tag and unsolder the four wires connected to the switch, and the three wires connected to the potentiometer of the assembly to be replaced.
- c. Remove the front panel control knob on the assembly to be replaced.
- d. Remove the jam nut and washers from the control shaft. The old assembly may now be removed from inside the chassis.
- e. Insert the replacement assembly into the hole in the front panel and orient so that tab on front plate of assembly fits into hole in rear of front panel.
- f. Secure assembly by installing first the flat washer, then the lockwasher and finally the jam nut. Be sure jam nut is securely tightened.

g. Check that the two outside terminals of the potentiometer on the replacement switch assembly are connected by a short length of insulated buss wire.

h. Reconnect and solder the wires removed in step b. (the sketch following paragraph 5.4.8.2 will assist in rewiring the switch.)

i. Check the installation by performing the electrical test called out in paragraph 5.6.4. then replace cover.

5.4.8.2 EQUIPMENTS WITH SERIAL NUMBERS 974 AND UNDER.

On these units, the new replacement assembly replaces both switch and potentiometer.

- a. Remove the control unit cover according to paragraph 5.3.3.
- b. Remove control knob on switch assembly to be replaced.
- c. Disconnect switch cam spring from bottom of chassis.
- d. Remove front panel control shaft bushing and associated hardware (save hardware for installing new assembly).
- e. Firmly grasp shaft and plastic cam and pull towards front panel. Control shaft, cam and spring will snap from potentiometer shaft. Cam and shaft may then be removed from the rear.
- f. Remove jam nut securing potentiometer to mounting bracket, and remove potentiometer. (Save the hardware removed from the potentiometer. Push potentiometer to one side, leads will be unsoldered later.)
- g. Install flat washer (removed in step f) on end of new replacement assembly shaft.
- h. Orient replacement assembly with tabs on potentiometer on top, and insert in bracket

in position previously occupied by potentiometer. Install flat washer, lock washer and jam nut on assembly shaft in that order, and tighten with fingers (Jam nut will be properly tightened after proper shaft alignment.)

i. Using hardware removed from bushing in step d, slide jam nut, lockwasher and flat washer on extension shaft (supplied with replacement assembly) in that order.

j. Slide extension shaft from the rear, through hole for control shaft in front panel. Slide front panel bushing (removed in step d) over exposed end of extension shaft, and secure to front panel, using hardware previously slipped over extension shaft. Hardware should be flat washer next to rear of front panel, followed by lock washer, and jam nut, in that order. Tighten only hand tight.

k. Align extension shaft with shaft of replacement assembly. Insert replacement assembly shaft into bushing on end of extension shaft and secure by tightening two allen set screws.

Note

While tightening assembly jam nut, hold assembly so that index tab on assembly front plate is in line with hole in mounting bracket.

l. Check alignment of switch assembly and extension shaft through bracket and front panel holes, then tighten jam nuts on assembly and front panel bushing.

m. Unsolder wires from old potentiometer (removed in step f) and resolder then in the same order removed to the potentiometer on the replacement assembly. Check to ensure that the two outside terminals of the potentiometer are connected by a short length of insulated buss wire.

n. Unsolder wires from old switch and resolder to the switch on the replacement assembly according to the diagram and table below.

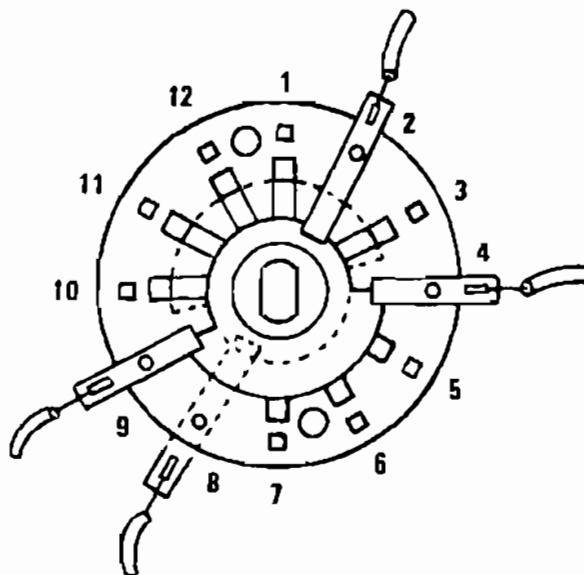
Note

Old switch assembly may be removed or left in as desired.

o. Perform the electrical test called out in paragraph 5.6.4 to check performance, then replace cover.

SWITCH TERMINATIONS

PIN	WIRE COLOR	
	CONTROL A (Switch 1A1S3)	CONTROL B (Switch 1A1S4)
2	Purple	Purple
4	Red	Orange
8	White/Black	White/Red
9	White/Red	White/Orange



Switch Viewed From Front Panel Side

5.5 CLEANING AND LUBRICATION

Note

When replacing Coupler Unit Cover, torque cover bolts to 30 in/lb.

Periodically, depending on the amount of usage and the operating conditions, the RF-302R should be cleaned and lubricated. It is recommended that this be done approximately

every six months. When cleaning, care should be taken not to disturb the mechanical relationship of the components in the separate gear trains and the switch linkage. Use a soft brush and a lint free cloth to remove accumulated dirt and dust. Pay particular attention to the Coupler unit variable coils, the variable capacitor, and gear trains. While cleaning the unit, inspect for signs of excessive wear or damage. Tighten any loose hardware. The shaft bearings on the end of the variable capacitor should be lubricated with a drop of SAE 20 weight Pennsylvania motor oil. The roller shafts on the three coils should be lightly greased with DC-33 Silicone grease manufactured by Dow Corning Corp., Midland, Michigan. The worm gear on the C1 transmission assembly should be lubricated with DC-33 after assembly has been cleaned of old grease. Finally, all potentiometer bearings and their shaft bearings, both in the Coupler unit and in the Control unit and the A and B Control springs at the point where they attach to the stand-off on the roller cams, should be lubricated with one drop of the SAE 20 Pennsylvania motor oil used above. Lubrication points are indicated on figures 5-1 and 5-2 by the letter "Q".

Note

The nylon gears in the Coupler unit gear trains and the motors do not require lubrication.

5.6 ALIGNMENT PROCEDURE

5.6.1 GENERAL

The Coupler unit was carefully aligned at the factory. Parts were securely fastened in place with quality locking devices. Couplings and gears were pinned to shafts to prevent maladjustment. Therefore, there is little likelihood that the alignment would be disturbed. The normal maintenance check would be to tighten all hardware at the time of cleaning and lubrication and then perform the electrical check described in paragraph 5.6.4.

If this check indicates an alignment problem, or if replacement of a component in the Coupler unit creates a requirement for re-alignment of a particular section, then the following factory alignment procedures

will provide a guide, illustrating the important factors to be considered.

5.6.2 COIL ASSEMBLY A2L1-A2L2 ALIGNMENT

Note

For all equipments, any time that A2L1 or A2L2 coil assembly becomes damaged, the complete A2L1-A2L2 assembly must be replaced.

a. Remove the three mounting screws from coil pot drive bracket and tilt the assembly to disengage the gears from the A2L1-A2L2 assembly gears.

b. Lift the roller of A2L1 and move to end of coil closest to A2C1. Place roller on last turn. Do the same with A2L2. This end of assembly is denoted as the home position of Control A.

c. Manually rotate coils so that coil roller A2L1 hits the end stop and rests there. Check the position of the coil A2L2 roller. If the A2L2 roller is within .09 inches of the end stop, proceed to step f. If not, proceed to step d.

d. Loosen and disengage idler gear at end of coil next to A2C1. Rotate A2L2 until its roller rests against the stop.

e. Re-engage idler gear, being careful to mesh gears properly while maintaining minimum backlash. Be certain that there is no binding caused by the idler gear.

f. Loosen the mounting nut for potentiometer A2R2 and adjust the position of A2R2 for proper mesh of the gear affixed to its shaft and the adjoining nylon gear. Tighten the nut moderately.

g. Manually run the potentiometer drive gears until the spacer in the gear affixed to the potentiometer shaft is positioned opposite the plunger of A2S3.

h. Install the potentiometer drive assembly so that its drive gear meshes properly with the coil gear, maintaining minimum backlash. Install and tighten the three screws and associated hardware removed in step a.

i. With the Mode switch on the Control

unit in the A & B SET position, rotate the body of pot A2R2 either CW or CCW until Meter A on the Control unit front panel reads zero or minimum, whichever is greater. Be careful not to upset the position of the gears, disturbing their mesh. Securely tighten A2R2 mounting nut.

j. Check coil drive coupling to ascertain that the screw in the coil end plate does not hit the coil drive coupling. Also, check that copper strap on end of coil does not interfere with coupling rotation.

k. Turn Control A on Control unit front panel in a CW direction until the coil roller moves one turn away from the home end stop.

l. Adjust lever switch A2S3 so that the switch is activated at the one turn point when the coil roller is moving towards the home position. Make certain that the spacer would continue to depress the switch actuator as the coil rotates towards home, ensuring that the switch will always activate. Tighten down A2S3. Be careful not to allow the spacer to fall behind the actuator where it will jam.

m. Run coils until coil rollers are one turn from the end opposite the home end of the coils. Adjust the position of switch A2S4 in a manner similar to step l except the switch shall further depress as the coil roller approaches end stop away from home end. Tighten down A2S4.

n. Check action of switch at both ends to ensure that they activate when the coil roller is one turn (+120° -60°) from their respective ends and remain activated during that last turn. Readjust switches if necessary.

5.6.3 A2L3-A2C1 ASSEMBLY ALIGNMENT

Note

For all equipments with serial numbers 162 or over, and for equipments with serial numbers under 162 which have had transmission assembly modification kit 423-0100 installed, use the alignment procedure detailed in paragraph 5.6.3.2. For all equipments with serial numbers under 162 which have not had the transmission assembly modification kit installed, use the procedure in paragraph 5.6.3.1 below.

5.6.3.1 Equipments With Serial Numbers Under 162

a. Position A2L3 assembly approximately parallel to the edge of the chassis and tighten it down.

b. Move drive motor assembly so that its output shaft is axially aligned with the A2L3 drive shaft (1/32 inch).

c. Make certain that the screw on the coil end behind the coil drive coupling (motor end) does not interfere with the coupling.

d. Make certain that the strap on the motor end of the coil does not interfere with the coupling.

e. Loosen the set screws on the Rembrandt coupling between the gear and potentiometer A2R1. Also, loosen those on coupling between Millen gear drive and A2C1.

f. Move the Millen drive horizontally and vertically until its input shaft is axially aligned with the output shaft of A2L3 ($\pm 1/32$ inch).

g. With the Millen drive still aligned per step f, check for squareness with the chassis. Place gear drive for proper coupling mesh into A2L3 and tighten down drive.

h. Place A2L3 roller at end of coil nearest motor. Manually rotate coil until the roller rests against the end stop. This is the home reference point for Control B.

i. Loosen A2R1 and position so that its shaft is axially aligned with the Millen drive shafts ($\pm 1/32$ inch). Tighten down moderately.

j. Turn Control B on the Control unit front panel CCW, and run A2L3 until it is one turn from the home end.

k. Manually turn A2R1 shaft until the spacer in its gear is halfway up the trip lever of A2S2.

l. Tighten the set screws on the Rembrandt coupling between the pot and Millen gear drive.

m. Adjust A2S2 so that it activates at the point where the coil is one turn from the home end, using a procedure similar to that in step 1 of paragraph 5.6.2. Tighten down A2S2.

n. Run coil back home and turn the body of Potentiometer A2R1 CW or CCW until Meter B on the Control unit reads zero or minimum, whichever is greater. Tighten A2R1 securely, making certain that its alignment has not been disturbed, and that the settings for the limit switches had not been upset.

o. Rotating Control B on the Control unit front panel CCW, run the motor until A2L3 is one turn from the end opposite the home end.

p. Adjust lever switch A2S1 until it just activates at this point using a manner similar to step 1 of paragraph 5.6.2. Tighten down A2S1.

q. Run A2L3 to end stop at end opposite home end.

r. Adjust position of A2C1 horizontally and vertically so that its shaft is axially aligned with Millen gear drive shafts. Tighten down A2C1.

Note

If alignment cannot be made within $\pm 1/64$ inch, move Millen drive until it can and then allow the resulting axial misalignment to A2L3. If Millen drive has been moved, then repeat steps i, j, m, o, and p being careful not to rotate A2R1.

s. Rotate A2C1 rotor so that rotor plates are completely unmeshed with stator plates, and the distance between the rotor plates and stator plates is the same on each side of the capacitor.

t. Tighten down the coupling between the capacitor and Millen gear drive.

u. Run "B" assembly end to end to check for operation of switches in a manner similar to step n of paragraph 5.6.2.

v. Pin all couplings and remove all set-screws.

5.6.3.2 Equipments with Serial Numbers 162 Or Over.

(Use the following procedure for all models that have Transmission Assembly Modification Kit 423-0100 installed, or which have a serial number 162 or greater.)

a. Position the transmission assembly approximately parallel to the edges of the chassis (as shown in figure 5-1, sheet 2) but do not secure it to the chassis.

b. Secure the limit switches to the transmission assembly, using the original hardware. Use figure 5-3 as a guide.

c. If wires were disconnected in the transmission assembly switches and potentiometer, during repair, resolder all connections.

d. Connect the Coupler Unit chassis to the Control unit, using the test cable fabricated according to the instructions of paragraph 5.3.4.

e. Set the Control unit Primary Power switch at ON, and Mode switch at A & B SET.

f. Carefully rotate coil A2L3 assembly by hand until the coil roller is one turn from the end stop nearest motor A2B1 (the "home" position).

g. Rotate the transmission assembly gear train by hand until the spacer on the cam is in position to actuate switch A2S2.

Note

If potentiometer will not permit gear train to be rotated to the proper point, potentiometer has been inserted 180° from proper position. Use a small screwdriver to pry potentiometer from its shaft, rotate potentiometer shaft 180° , and reinstall by pressing potentiometer back on shaft.



h. Set the A2L3, motor drive, and A2C1 assemblies in position on the chassis and align shafts.

CAUTION

When aligning shafts for couplings, align to within 1/32 inch. When mating coupling halves between the transmission assembly and A2L3, allow 1/32 inch end play in coupling to prevent insert from binding.

i. Carefully align the transmission assembly shafts with the shaft of A2L3 and A2C1, and secure all three assemblies to the chassis, inserting the coupling insert in the coupling between A2L3 and the transmission assembly during the process. If necessary, rotate transmission assembly shaft to align coupling insert.

j. Align the motor drive assembly with the A2L3 coil shaft. Secure the motor drive assembly to the chassis and tighten the coupling.

k. Repeat steps p through w of paragraph 5.4.2.

5.6.4 ELECTRICAL OPERATION CHECK

The electrical operation check will be the same for all models of the RF-302R.

a. Using Control A on Control unit front panel, check to make certain that Meter A goes to zero ± 1 division when Control A is rotated CCW and the A2L1-A2L2 assembly goes to the home position. (Mode switch on Control unit should still be at A & B SET.) Meter A should read approximately 20 when the assembly is at end opposite home.

b. Make certain that when coil assembly is one turn (+120°, -60°) from either end, the motor slows down and that coil assembly slowly runs into the end stop.

c. Using Control B on the Control unit front panel, check to make certain that Meter B goes to 0 ± 1 division when Control B is rotated CW and the A2L3 coil assembly runs in the home direction. Meter B should read approximately 20 when the coil is at end opposite home.

d. Make certain that the motor slows down when the coil is one turn (+120°, -60°) from either end and that the coil assembly slowly runs into the end stop.

e. Set Mode switch at TRANSMITTER TUNE. Note that relay armature is down and check resistance of RF input connector with an ohm meter. Resistance should be approximately 50 ohms to ground. Meters A and B should both read 10 (center scale).

f. Set Mode switch at COUPLER-TUNE/operate. Note that resistance between RF input and ground should read approximately zero ohms. (Relay armature should be up). Meters A and B should both read 10.

g. Set Mode switch at A & B SET. Note that resistance between RF input and ground is still approximately zero and that the relay's armature is still up.

h. Check all hardware affecting alignment for tightness.

i. Alignment and DC tests are now completed.

5.6.5 CONTROL A ALIGNMENT

(Equipment with serial numbers less than 975)

a. Check position of A1R1 for proper meshing of slot in plastic cam with nylon idler in switch A1S3 assembly. Note also that shaft from A1R1 to knob on front panel should be capable of being parallel to the sides of the chassis by moving shaft bearing at knob end. Move potentiometer A1R1 to accomplish this as necessary.

b. Move Control A shaft bearing on front panel until the shaft is parallel with respect to the sides of the case. Check for alignment by rotating knob 90° in each direction and then releasing knob. Knob must return to center position by itself. When knob turns freely tighten down bearing nut on back of front panel securely and tighten potentiometer A1R1 locking nut securely.

c. Check freedom of action again to assure that alignment did not move during tightening.

5.6.6 CONTROL B ALIGNMENT

(Equipment with serial numbers less than 975)

Check alignment of Control B, potentiometer



A1R2, and switch A1A4 using steps a through c of paragraph 5.6.5.

5.6.7 DISCRIMINATOR ALIGNMENT.

CAUTION

The discriminator used in this Coupler unit is a passive device. There are no components which would normally deviate with age, causing misadjustment. Therefore, before deciding that the discriminator is in need of adjustment, be absolutely certain that no other part of the Coupler unit is causing the discriminator to produce error signals. Remember that the discriminator is the main element in accomplishment of proper tuning and that, therefore, any adjustment may critically affect tuning (and equipment performance). For these reasons it is strongly advised that when equipment malfunction has been directly traced to the discriminator, the discriminator be replaced as a unit (paragraph 5.4.6), and the faulty discriminator returned to the factory for repair and alignment. The following procedure is provided for field use where return of damaged units to the factory is not possible. It will not duplicate factory alignment, which uses sophisticated test equipment and procedures not adaptable to field alignment.

a. Connect an in-line watt meter in the transmission line between the transmitter and the RF-302R Antenna Coupler unit.

b. Set up and key transmitter on 7.0 MHz at 100-150 watts (150 preferred), and fine tune RF-302R for 0 watts reflected power is indicated on the wattmeter.

c. Unkey the transmitter and disconnect the control cable between the RF-302R Coupler unit and Control unit.

d. Connect a differential voltmeter between discriminator test points TP2(-) and TP3(+), for adjustment of Phasing discriminator.

e. Key the transmitter, and adjust R6 on the discriminator for zero volts, on the differential voltmeter.

f. Unkey transmitter.

g. Connect the differential voltmeter, between discriminator test points (TP5(+)) and TP4(-), for adjustment of R discriminator.

h. Key the transmitter and adjust C6 on the discriminator for -70 millivolts, as indicated on the differential voltmeter.

i. Unkey the transmitter and disconnect the test equipment, reconnecting RF-302R control cable and transmission line.

Note

Step b. calls for tuning coupler to 7.0 MHz. However, if discriminator is far out of adjustment, the Coupler may not adjust. Then switch to "transmitter tune". The 50 ohm load will assist in getting discriminator adjustment close enough for general operating purposes. The above steps may then be performed.



ANTENNA TYPE _____

FREQ(MC)	A	B

FREQ(MC)	A	B

ANTENNA TYPE _____

FREQ(MC)	A	B

FREQ(MC)	A	B

Table 5.1 – Logging Chart

ANTENNA TYPE _____

FREQ(MC)	A	B

FREQ(MC)	A	B

ANTENNA TYPE _____

FREQ(MC)	A	B

FREQ(MC)	A	B

Table 5.1 (Cont)



Freq.	35 Ft. Whip		25 Ft. Whip		15 Ft. Whip	
	A	B	A	B	A	B
2.0MC	12.0	12.0	14.7	16.0	18.5	16.0
3.0	6.5	10.7	8.0	14.7	10.2	16.5
4.0	3.2	9.5	5.0	13.0	6.5	16.0
5.0	2.0	10.0	3.5	13.5	5.0	16.5
6.0	1.0	9.5	2.0	12.0	3.8	15.5
7.0	1.5	11.0	1.5	12.0	2.8	15.0
8.0	2.0	12.7	1.0	12.2	2.0	15.5
9.0	2.0	14.0	1.0	13.0	1.8	16.0
10.0	2.0	15.0	1.5	14.0	1.5	15.5
11.0	2.0	16.0	1.7	15.0	1.0	15.0
12.0	1.5	16.2	1.5	15.5	1.0	15.0
13.0	1.5	16.7	1.5	16.0	1.0	15.2
14.0	1.2	17.0	1.2	16.5	1.0	15.5
15.0	1.0	17.5	1.2	17.0	1.0	16.0
16.0	1.0	17.5	1.2	17.2	1.0	16.2
17.0	1.0	17.5	1.0	17.7	1.0	16.7
18.0	1.0	17.5	1.0	18.0	1.0	17.0
19.0	1.0	17.0	1.0	18.0	1.0	17.5
20.0	1.0	17.0	1.0	18.2	1.0	17.5
21.0	1.0	17.2	1.0	18.5	1.0	18.0
22.0	1.0	17.7	1.0	18.7	1.0	18.2
23.0	1.0	18.0	1.0	18.7	1.0	18.3
24.0	1.0	18.2	1.0	18.7	1.0	18.7
25.0	1.0	18.7	1.0	18.5	1.0	18.7
26.0	1.0	19.0	1.0	18.2	1.0	19.0

Table 5.2 – Approximate A & B Settings For Whip Antennas

PARTS LIST

The table below lists repair parts covering both the RF-302R and the RF-302RA. In cases where the manufacturer feels that components used in later production runs are a refine-

ment of components used in earlier production runs, the improved part is supplied, with any necessary instructions for replacement on early production models.

DESIG	DESCRIPTION	RF P/N
A1	Control Unit	423-0001 (RF-302R)
A1	Control Unit	423-1001 (RF-302RA)
A2	Coupler Unit	423-0002 (RF-302R)
A2	Coupler Unit	423-1002 (RF-302RA)
	115 VAC Line Cord	423-0050
	Primary Power Connector Kit	423-0053
	Male Control Cable Connector Kit	423-0056
	Female Control Cable Connector Kit	423-0057
	Logging Chart	423-0054
	Instruction Manual	PM-0335
A1C1	Capacitor Fixed Electrolytic, 500 UF 50 VDCW	C23-0001-001
A1C2, C3	Capacitor, Fixed Ceramic, .01 UF, 600V	C11-0001-021
A1CR1	Rectifier, 1Ø, Full Wave	D22-5003-003
A1F1, F2	Fuse, 2A, 3AG, 250V	F02A250V2A
A1J1, J2	Connector, Chassis Mount, 7 pin	MS3102A16S-1P
A1J3	Connector, Chassis Mount, 14 pin	MS3102A20-27S
A1K1	Flasher, Lamp	K90-0001-000
A1M1	Meter A	423-0046
A1M2	Meter B	423-0047
† A1MP1	Bearing, Panel	423-0065
† A1MP2	Bearing, Panel	423-0065
A1MP3, MP4	Mtg Foot, Rear	423-0044 (RF-302R)
A1MP5, MP6	Mtg Foot, Front	423-0043 (RF-302R)
A1MP3 to A1MP6	Mtg Feet, Front and Rear	423-1043 (RF-302RA)
† A1MP7	Spring	Z20-0001-402

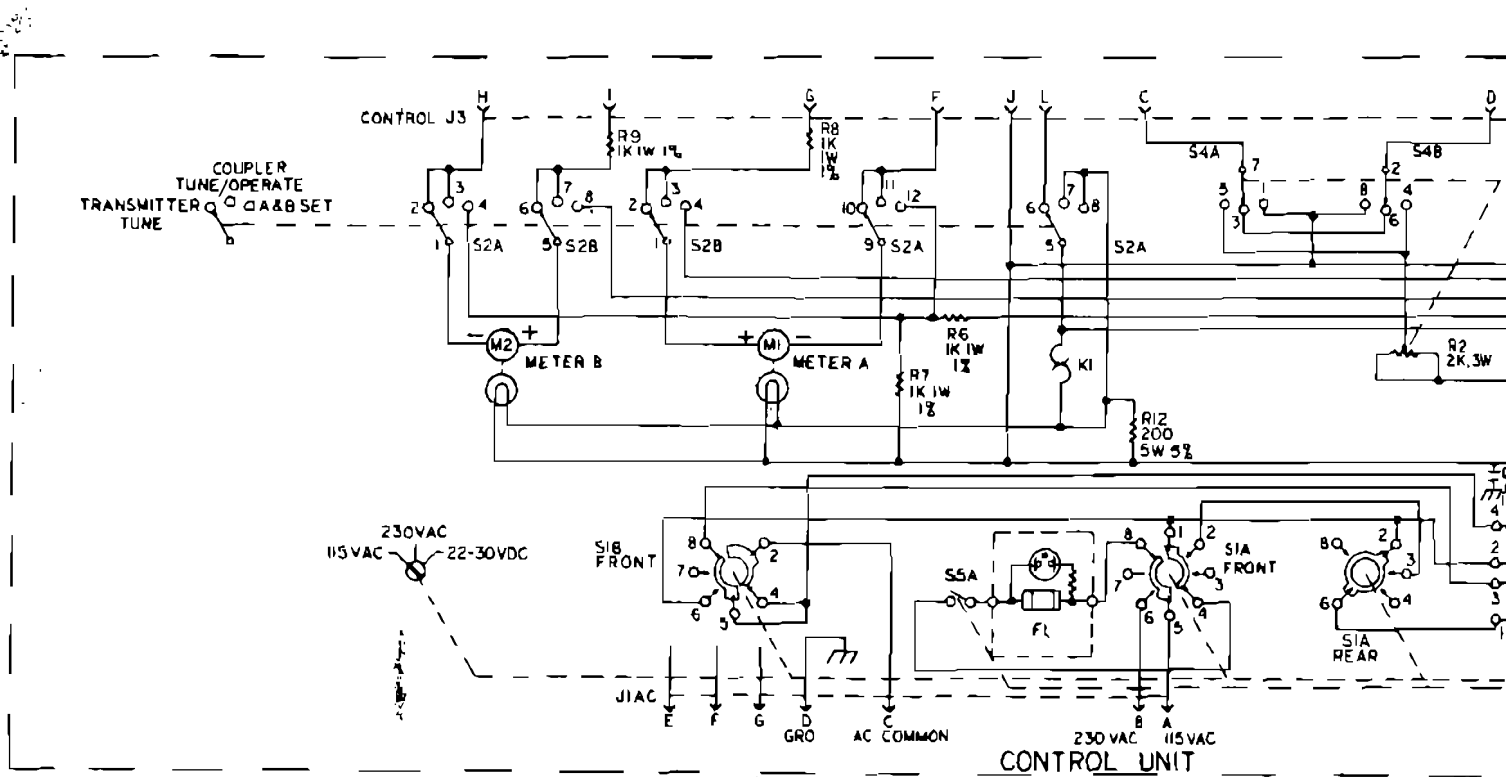
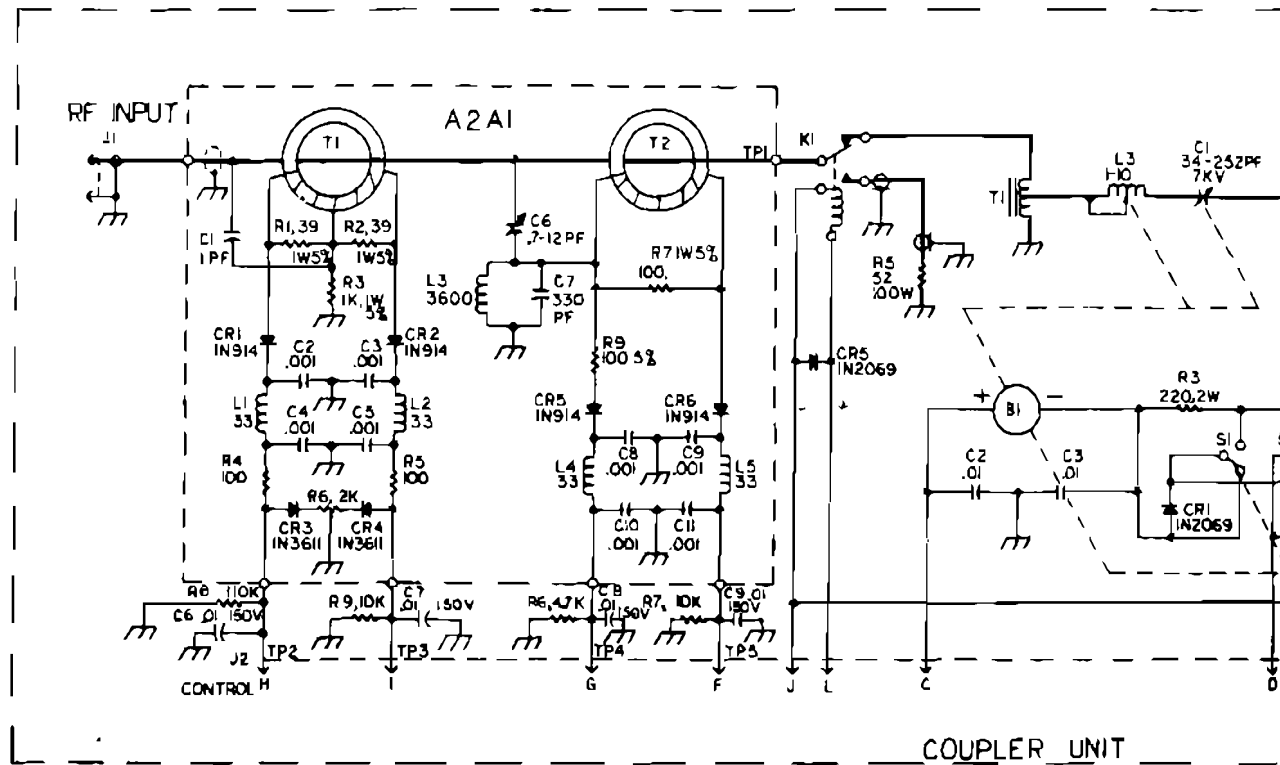
DESIG	DESCRIPTION	RF P/N
† A1MP8	Spring	Z20-0001-402
A1MP9	Cover, Cont Unit	423-0042 (RF-302R)
A1MP9	Cover, Cont Unit	423-1042 (RF-302RA)
A1MP10 to A1MP12	Knob	MS91528-1K2B
A1MP13 to A1MP16	Bumper, Rubber	Z17-0002-000
A1MP17	Washer, Rolled, Nylon	H44-0001-000 RF-302R only)
† A1R1	Resistor Assembly	423-0001-60
† A1R2	Resistor Assembly	423-0001-60
A1R3	Resistor, Fixed Wirewound, 10ohm, 5%, 5W	RW67V100
A1R4	Resistor, Fixed Wirewound, 300 ohm, 5%, 5W	RW67V301
A1R5	Resistor, Fixed Composition, 1Kohm, 10%, 1W	RC32GF102K
A1R6	Resistor, Fixed Composition, 1Kohm, 1%, 1W	R16-0001-193
A1R7	Resistor, Fixed Composition, 1Kohm, 1%, 1W	R16-0001-193
*A1R8	Resistor, Fixed Composition, 10 ohm, 10%, 1/2W	RC20GF100K
*A1R9	Resistor, Fixed Composition, 10 ohm, 10%, 1/2W	RC20GF100K
A1R10	Resistor, Fixed Composition, 30.1K ohm, 1%, 1W	R16-0001-345
A1R11	Resistor, Fixed Composition, 15K ohm, 1%, 1W	R16-0001-316
A1R12	Resistor, Fixed Wirewound, 200 ohm, 5%, 5W	RW67V201

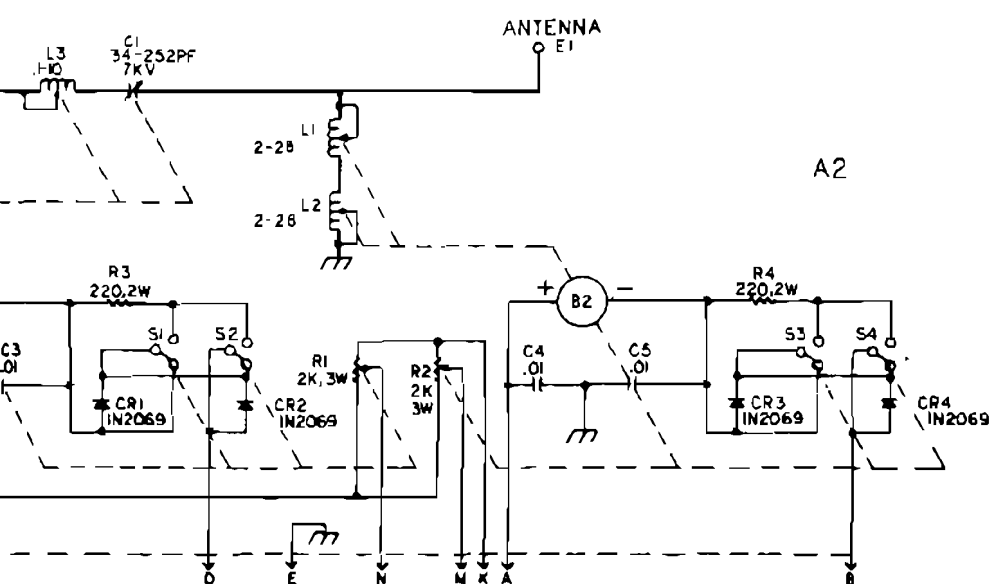
*A1R8 & A1R9 are 1K ohm, 1% 1W, P/N R16-0001-193 in production models with serial numbers less 162.

† Order replacement switch assembly part number 423-0140

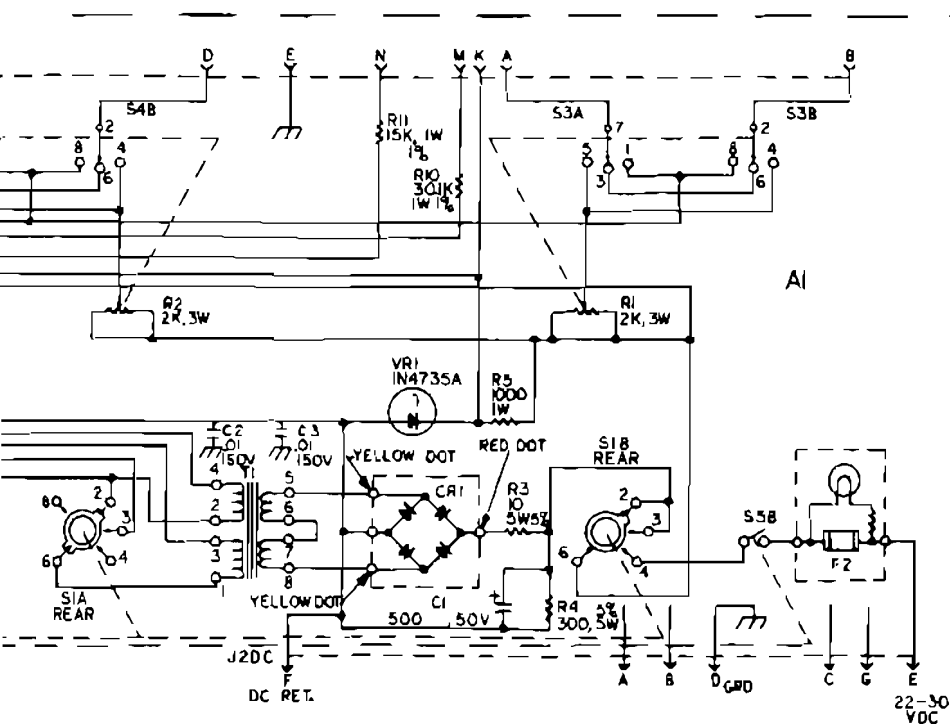
DESIG	DESCRIPTION	RF P/N
A1S1	Switch, Power, Rotary	423-0045
A1S2	Switch, Rotary	423-0005
A1S3	Switch, Modified Rotary, Lever Action, DPDT	423-0009
A1S4	Switch, Modified Rotary, Lever Action, DPDT	423-0009
A1S5	Switch, Toggle	MS25100-23
A1T1	Transformer, Step-Down	423-0038
A1VR1	Voltage Regulator, Zener	1N4736A
A1XF1	Fuseholder, Indicating	J50-0002-001
A1XF2	Fuseholder, Indicating	J50-0003-001
A2B1	Motor, Low Speed, 24 VDC	B11-0003-000
A2B2	Motor, Low Speed, 24 VDC	B11-0003-000
A2C1	Capacitor, Variable	423-0058
A2C2	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
A2C3	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
A2C4	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
A2C5	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
**A2C6	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
**A2C7	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
**A2C8	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
**A2C9	Capacitor, Fixed Ceramic, .01UF, 600V	C11-0001-021
A2CR1	Diode	1N2069
A2CR2	Diode	1N2069
A2CR3	Diode	1N2069
A2CR4	Diode	1N2069
A2CR5	Diode	1N2069
A2J1	Connector, Coaxial	UG-556 B/U
A2J2	Connector, Chassis Mount, 14 pin	J10-0002-000
A2K1	Relay, SPDT, DC	K30-0005-003
A2L1-L2	Inductor, Coil Assembly	423-0301

DESIG	DESCRIPTION	RF P/N
A2L3	Inductor, Variable Rotary, 10 UH	423-0002-180
A2MP1	Rod, Threaded	423-0049
A2MP2	Insulator Bowl	E11-0001-000
A2MP3	Insulator Gasket	423-0015
A2MP4	Coupling	423-0016
A2MP5	Coupling	423-0016
A2MP6	Coupling, Cap. Dr.	423-0086
A2MP7	Gear, Comb Nylon	Z07-0001-001
A2MP8	Gear, Comb Nylon	423-0026
A2MP9	Gear, Comb Nylon	423-0021
A2MP10	Washer, Insulating	E12-0001-009
A2MP11	Coupling	423-0067
A2MP12	Transmission Assembly	423-0100
A2MP13	Case Assembly	423-0013
A2MP14	Ground Termination	423-0086
A2MP15	Gear, Comb Nylon	Z07-0001-001
A2MP16	Gear, Comb Nylon	Z07-0001-001
A2MP17	Gear, Comb Nylon	423-0026
A2MP18	Gear, Comb Nylon	423-0026
A2MP19	Gear, Comb Nylon	423-0021
A2R1	Resistor, Control B	R21-0001-000
A2R2	Resistor, Control A	423-0010
A2R3	Resistor, Fixed Composition, 220 ohm, 10%, 2W	RC42GF221K
A2R4	Resistor, Fixed Composition, 220 ohm, 10%, 2W	RC42GF221K
A2R5	Resistor, Fixed Composition, 52 ohm, 10%, 100W	R90-0001-000
**A2R6	Resistor, Fixed Composition, 4.7K ohm, 10%, 1/2W	RC20GF472K
**A2R7	Resistor, Fixed Composition, 10K ohm, 10%, 1/2W	RC20GF103K
**A2R8	Resistor, Fixed Composition, 10K ohm, 10%, 1/2W	RC20GF103K
**A2R9	Resistor, Fixed Composition, 10K ohm, 10%, 1/2W	RC20GF103K
A2S1	Switch, Sensitive, SPDT	423-0083
A2S2	Switch, Sensitive, SPDT	423-0083
A2S3	Switch, Sensitive, SPDT	423-0083
A2S4	Switch, Sensitive, SPDT	423-0083
A2T1	Transformer, RF	423-0048
A2A1	Discriminator Assembly	423-0064



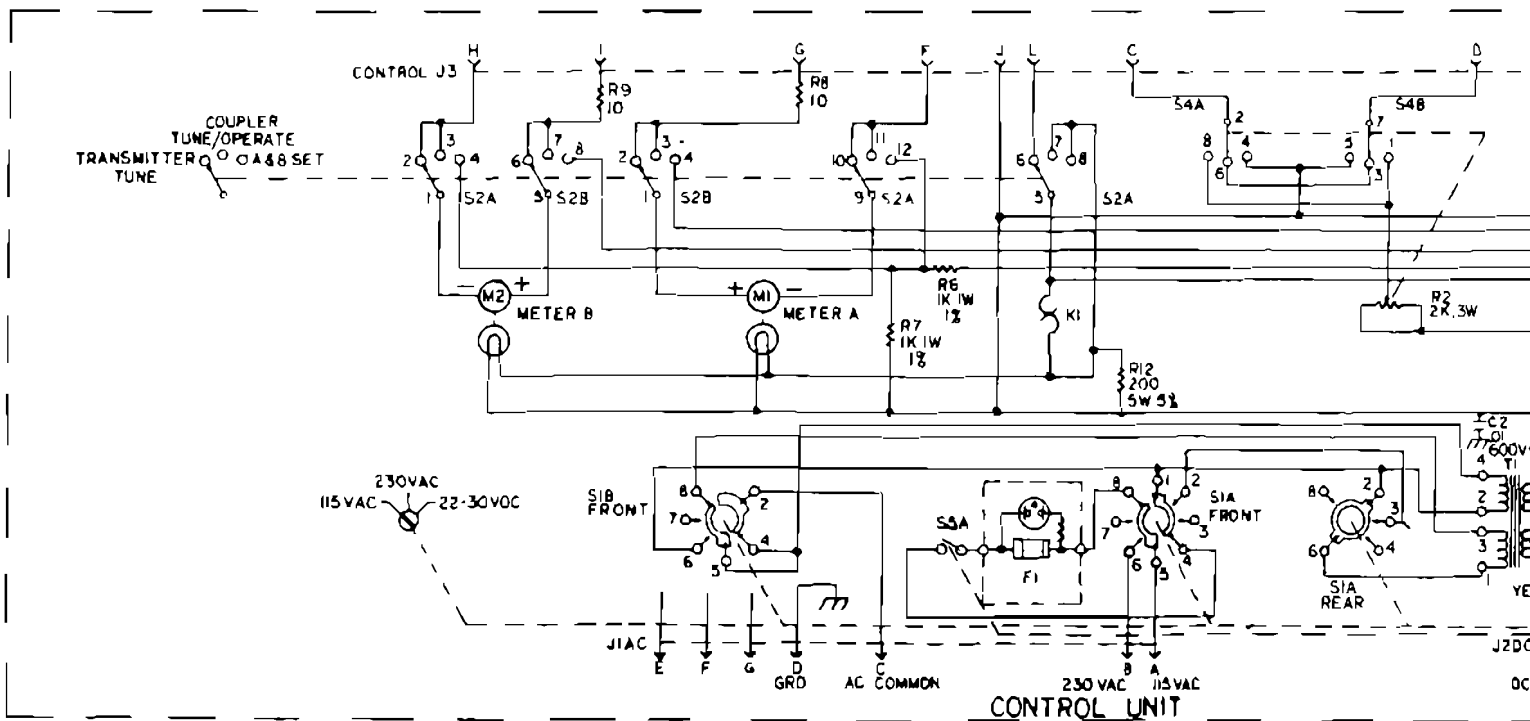
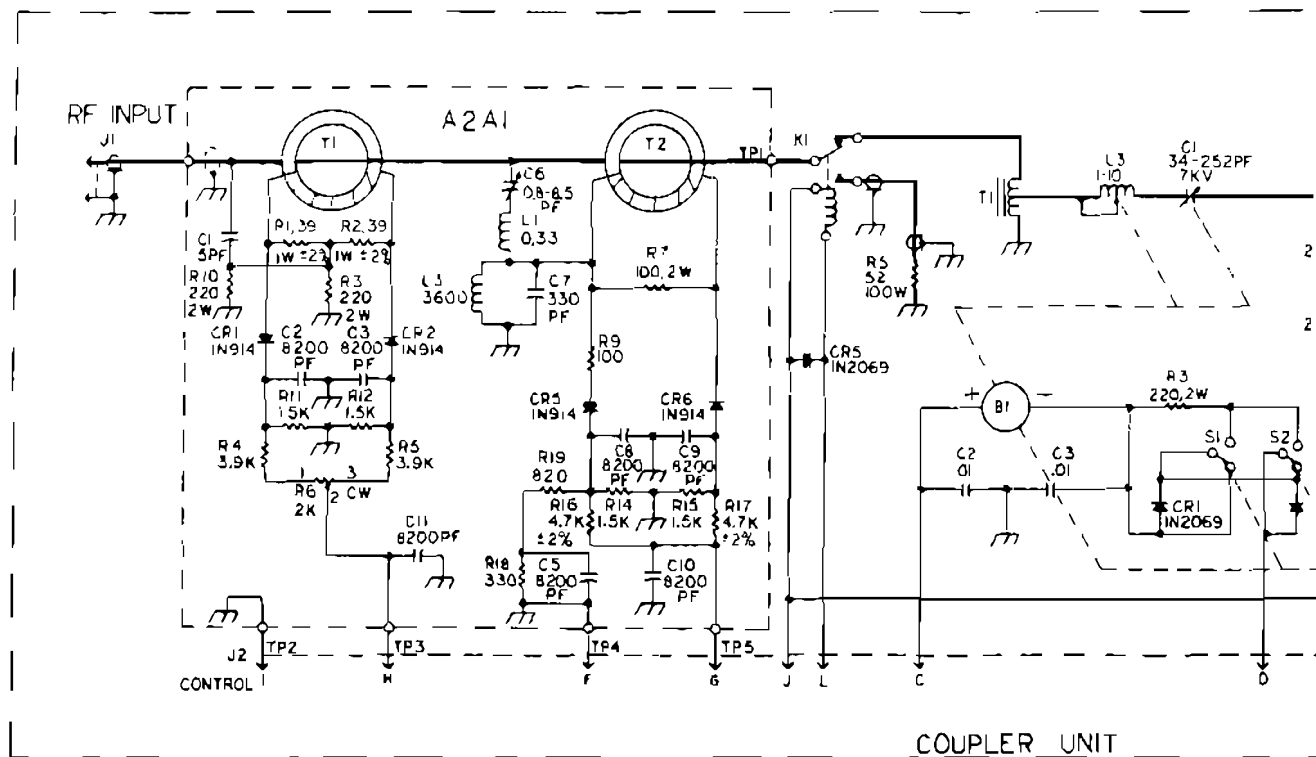


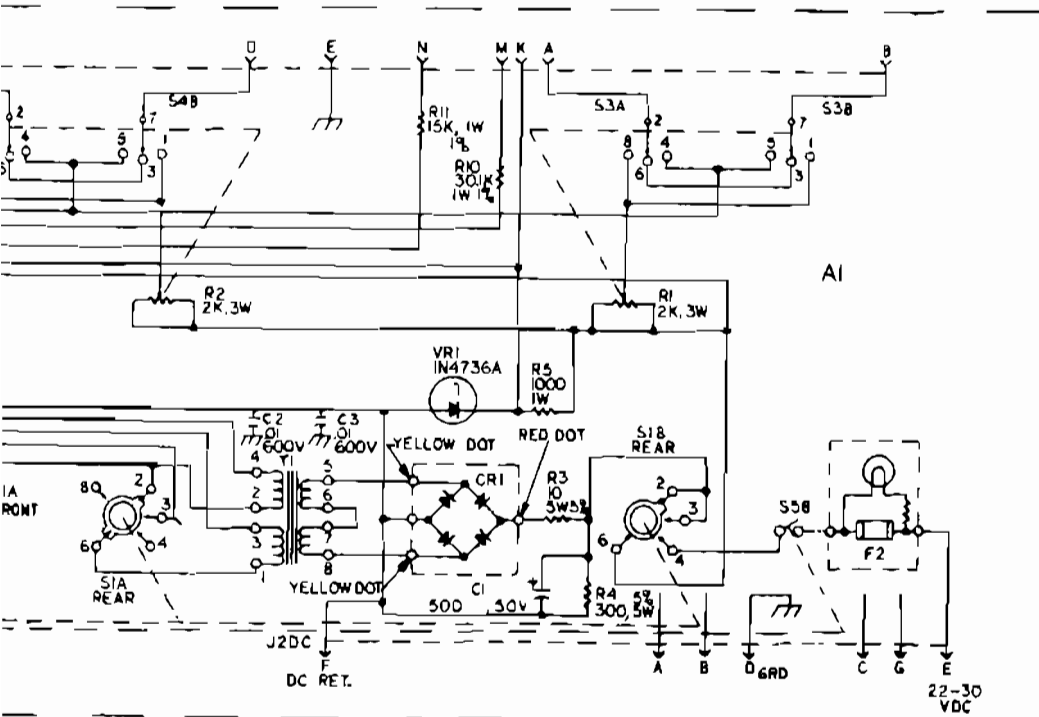
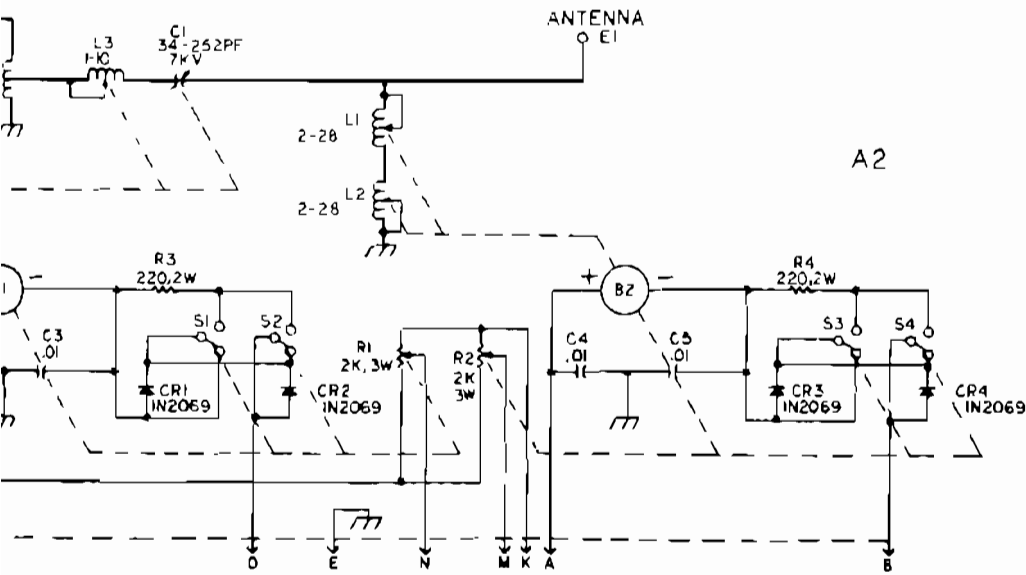
UNIT



- NOTES:
1. ALL RESISTOR IN OHMS, $\frac{1}{2}$ WATT 10% UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS IN UF UNLESS OTHERWISE NOTED.
 3. ALL INDUCTORS IN MH UNLESS OTHERWISE NOTED.

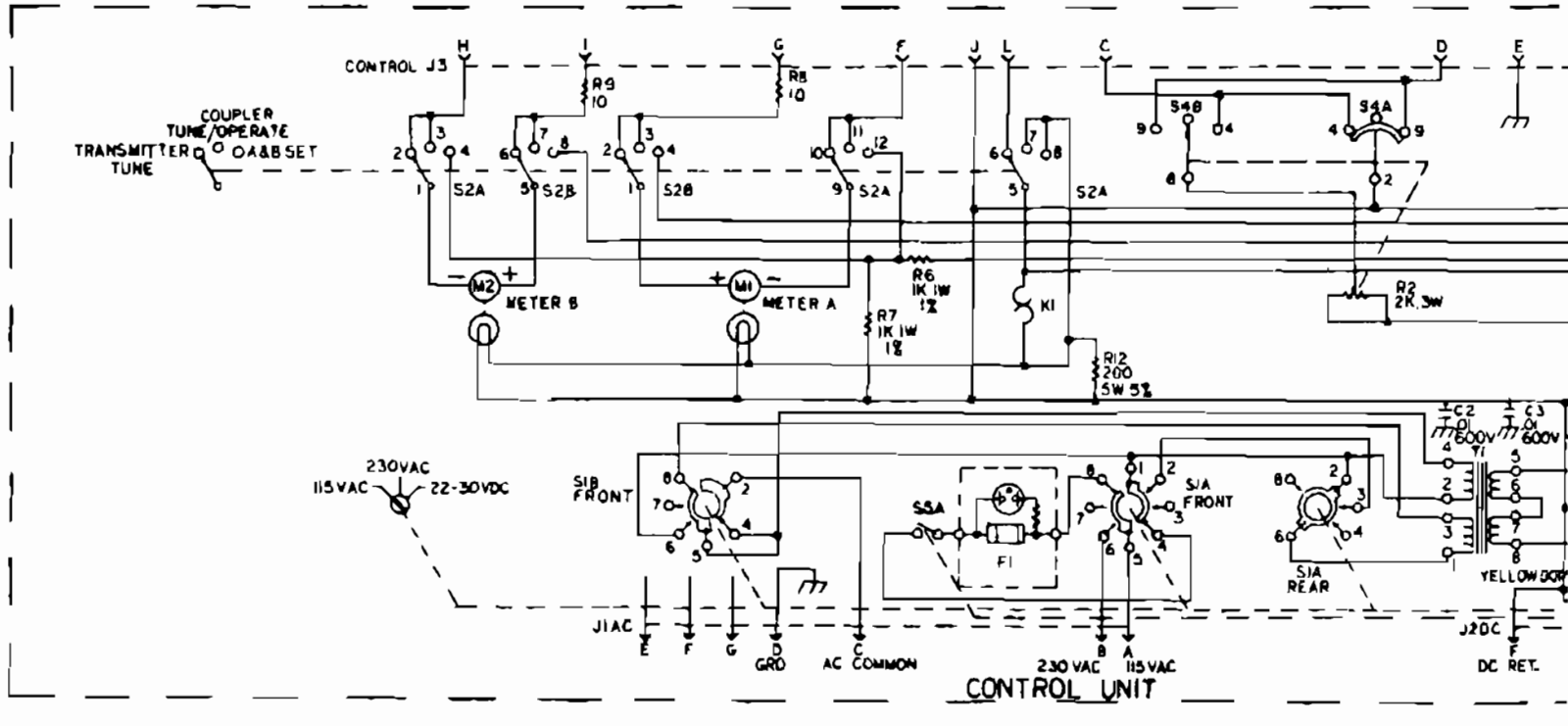
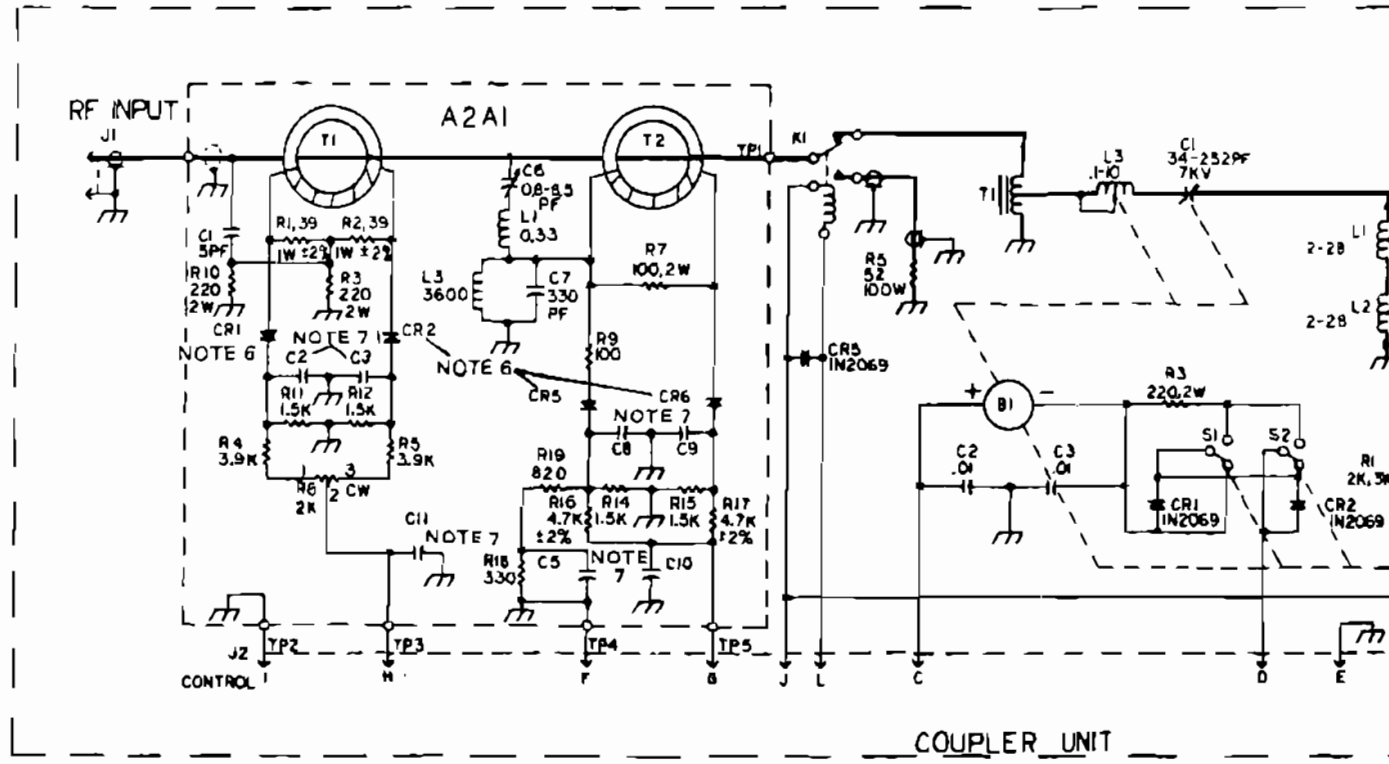
Figure 5.4 - Remote Controlled Antenna Coupler RF-302R,
Schematic Diagram (Sheet 1, Coupler
units with SN less than 162).

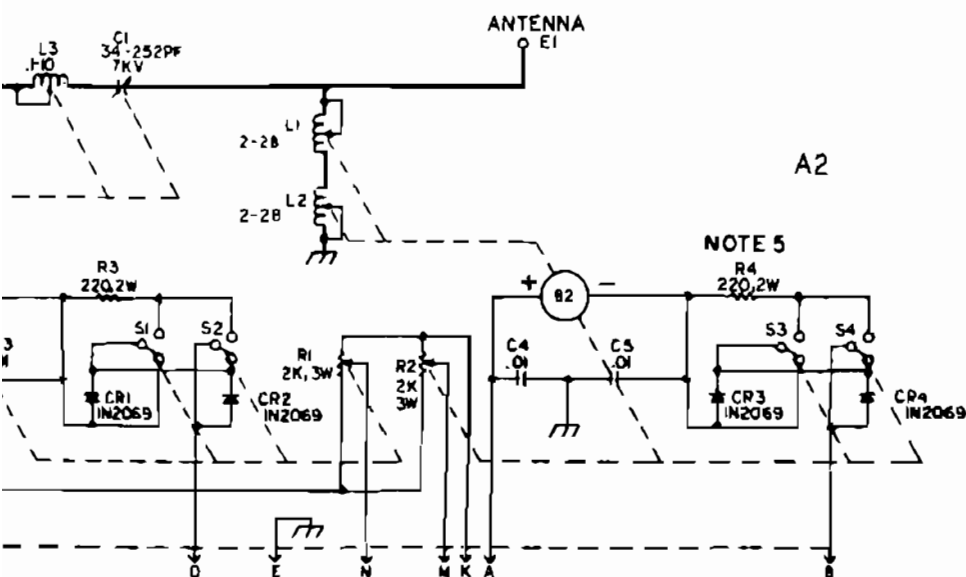




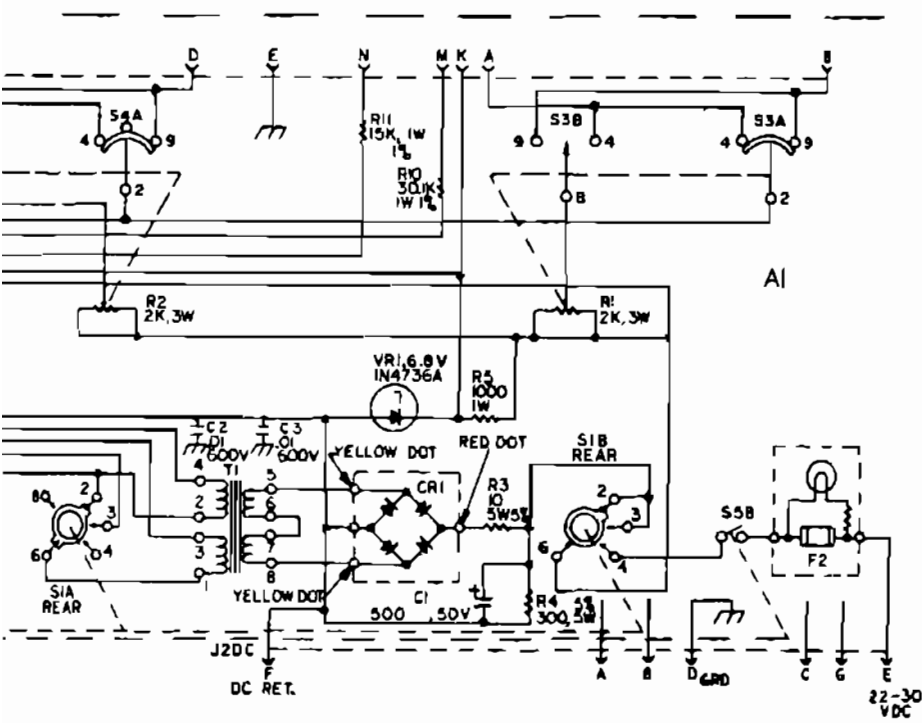
- NOTES:
1. ALL RESISTOR IN OHMS, $\frac{1}{2}$ WATT 10% UNLESS OTHERWISE NOTED.
 2. ALL CAPACITORS IN UF UNLESS OTHERWISE NOTED.
 3. ALL INDUCTORS IN UH UNLESS OTHERWISE NOTED.

Figure 5.4. Remote Controlled Antenna Coupler RF-302R, Schematic Diagram (Sheet 2, Coupler units with SN162 to 974).





UNIT



NOTES:

1. ALL RESISTORS IN OHMS, 1/2 WATT 10%, UNLESS OTHERWISE NOTED.
2. ALL CAPACITORS IN UF, UNLESS OTHERWISE NOTED.
3. ALL INDUCTORS IN UH, UNLESS OTHERWISE NOTED.
4. SWITCHES A1S3 AND A1S4 IN CONTROL UNIT NUMBERED CW AS VIEWED FROM KNOB END STARTING AT 1 O'CLOCK POSITION.
5. RESISTOR A2R4 IN COUPLER UNIT IS 150 OHMS IN EQUIPMENTS WITH SERIAL NUMBER 1115 OR GREATER.
6. A2A1CR1, A2A1CR2 AND A2A1CR5, A2A1CR6 (P/N 0902-1957) ARE MATCHED PAIRS.
7. COUPLER UNIT CAPACITORS A2A1C2, C3, C5, C8, C9, C10, AND C11 ARE EITHER ALL 10,000 pF OR ALL 8,200 pF.

Figure 5.4. Remote Controlled Antenna Coupler RF-302R, Schematic Diagram (Sheet 3, Coupler units with SN975 or Greater).

R F COMMUNICATIONS

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