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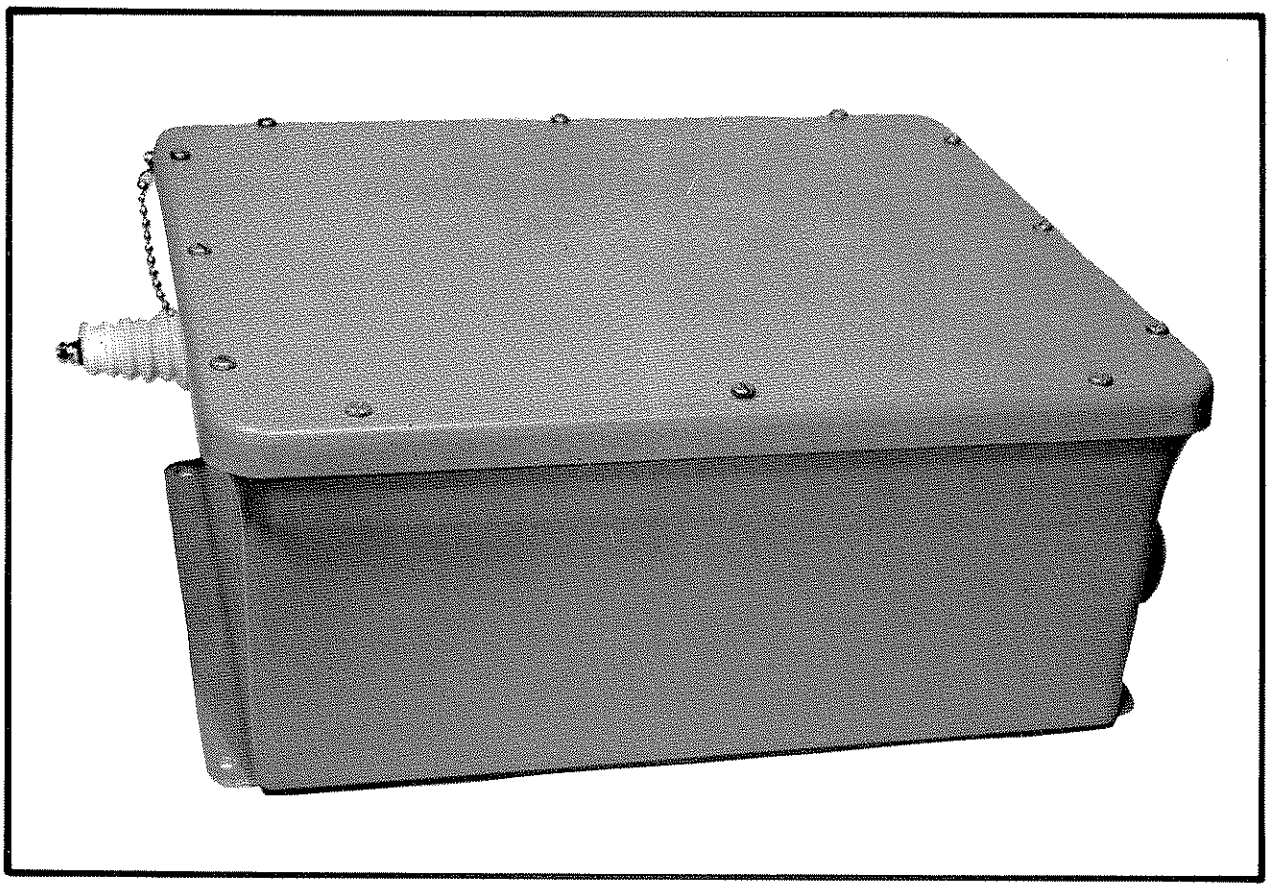

OPERATION AND MAINTENANCE MANUAL

GCU-910

ANTENNA COUPLER

1st EDITION, 1 SEPTEMBER, 1973
MANUAL PART NUMBER 5024-2001

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WARNING

WITH CERTAIN TYPES OF ANTENNAS, SEVERAL KILOVOLTS MAY BE PRESENT AT THE OUTPUT INSULATOR, E1, OF THE ANTENNA COUPLER WHEN TRANSMITTING. THE RADIO OPERATOR AND SERVICE TECHNICIAN SHOULD EXERCISE CAUTION NOT TO CONTACT E1 WHILE TRANSMITTING.

SECTION 1
GENERAL INFORMATION

1.1 SCOPE

This instruction manual contains information necessary to install, operate, maintain and repair the GCU-910 Remote Controlled Antenna Coupler and its associated Antenna Tuning Control Unit.

1.2 DESCRIPTION

1.2.1 GENERAL

The GCU-910 is a high quality remote controlled antenna coupler capable of matching a wide variety of antennas ranging from 9 foot whips to 150 foot long wires over a frequency range of 1.6 to 30 MHz. In addition, the coupler may be used as a "line flattener" to correct the V.S.W.R. of resonant antennas. The unit is designed for use with 100 watt 50 ohm transmitters and transceivers. The GCU-910 is designed to operate in conjunction with the Antenna Tuning Control Unit (5024-0423) and Remote Control cable (5024-9050) at separations of up to 250 feet. The coupler elements are adjusted by four motors which are controlled from the Antenna Tuning Control Unit. The Coupler contains a V.S.W.R. bridge which indicates forward and reflected power on the meter located on the Antenna Tuning Control Unit. The control unit is normally mounted on the front panel of the SUNAIR GSB-900 Synthesized SSB Transceiver but may be readily adapted for use with other 100 watt transmitters or transceivers. The coupler is mounted in a sturdy, fully gasketed fiberglass box designed for outside mounting near the antenna.

1.2.2 RF WATTMETER ASSY: Provides sensing of forward and reflected power. A null in reflected power indicates correct coupler tuning.

1.2.3 VARIABLE INDUCTOR ASSY: Consists of the variable roller inductor together with a mechanical actuator and microswitches to interrupt the motor and indicate the end limits. The inductor forms the series arm of the "PI" network in the coupler.

1.2.4 OUTPUT CAPACITOR ASSY: Consists of four banks of fixed capacitors, drive motor, and high voltage switch. This capacitor network forms the output branch of the "PI" network.

1.2.5 VARIABLE CAPACITOR ASSY: Consists of a multi-section variable capacitor together with mounting brackets. Operates in conjunction with fixed capacitors in the MOTOR/SWITCH Assy to form the input of the "PI" network.

1.2.6 MOTOR/SWITCH ASSY: Contains the fixed capacitors of the input branch of the "PI" network. Also contains the input switch and drive motor to select these capacitors plus the motor and mechanical and electrical limit mechanism to drive the variable capacitor.

1.2.7 RF ATTENUATOR ASSY: Consists of a 6 db resistive attenuator together with its IN/OUT relay. The attenuator is placed in the line between the input and "PI" coupler matching network to isolate the transceiver or transmitter from the widely-varying impedance of the coupler while it is being tuned.

1.2.8 CHASSIS ASSY: Provides a mounting platform for the various mechanical and electrical components.

1.3 SPECIFICATIONS

1.3.1 Operating Frequency Range: 1.6 to 30 MHz

1.3.2 RF Input power: Designed to operate with equipment supplying 100 watts P.E.P. and average.

1.3.3 Input impedance: Adjustable to 50 ohms, non reactive

1.3.4 Antenna matching capabilities:
9 foot whips
16 foot whips
24 foot whips
32 foot whips
50 foot to 150 foot long wire
Also suitable for use as a "line flattener"

1.3.5 ENVIRONMENTAL

1.3.5.1 Storage Temperature Range: −55 to +85°C

1.3.5.2 Operating Temperature Range: −30 to +65° C

1.3.5.3 Vibration: per MIL-STD-202D, method 201A

1.3.5.4 Shock: per MIL-STD-202D, method 213, test condition A

1.3.5.5 Humidity: per MIL-STD-202D, method 103B, test condition B

1.3.6 Enclosure: Fully gasketed fiberglass case. Designed for outdoor use.

1.3.7 Power Input: 28V, 1a max (during tune cycle only) supplied from GSB-900 transceiver via Antenna Tuning Control Unit and control cable.

1.3.8 Dimensions:
16.5H x 31.7W x 38D Centimeters
6-1/2H x 12-1/2W x 15D Inches

1.3.9 Weight:
16.5 lb,
7.5 kg

1.4 EQUIPMENT SUPPLIED

1.4.1 Remote Controlled Antenna Coupler, GCU-910

1.4.2 Ancillary Kit: consisting of
a) Connector, MS3106E-28-21S (mates with J2 on the Antenna Coupler)
b) Connector, MS3106E-28-21P (mates with ACCESSORY connector, 1A8J4 on GSB-900)
c) Sleeving, 3/16" Dia. Sunair #59245 (For cable fabrication)

1.5 EQUIPMENT REQUIRED - NOT SUPPLIED

1.5.1 Antenna Tuning Control Unit (SUNAIR part #5024-0423)

1.5.2 Cable, Remote Control (SUNAIR part # 5024-9050)—order by actual length desired. The system will operate with up to 250 feet of remote control cable.

1.5.3 Cable, coaxial, type RG58/U (SUNAIR # 58813): recommended where separation between transceiver and antenna coupler is less than 100 feet (specify length)

1.5.4 Cable, coaxial, type RG8/U (SUNAIR # 58864): recommended where separation between transceiver and antenna coupler will exceed 100 feet (specify length)

1.5.5 Connector, RF, PL-259 (SUNAIR #74219) mates with J1 on antenna coupler and antenna connector 1A8J1 on GSB-900 transceiver (two (2) required)

1.6 OPTIONAL EQUIPMENT - NOT SUPPLIED

		SUNAIR Part No.
1.6.1	Transceiver, GSB-900	5024-0010
1.6.2	Depot Spare Parts Kit for GCU-910	5024-9005
1.6.3	Doublet Antenna Kit	99624
1.6.4	75 Foot Long Wire Antenna Kit	99920
1.6.5	150 foot Long Wire Antenna Kit	99921
1.6.6	16 foot Mobile Fiberglass Whip Antenna (use with 1.6.7 or 1.6.8)	71295
1.6.7	Heavy Duty Strap-Type Bumper Mount (for 1.6.6)	71573
1.6.8	Heavy Duty 60° Ball Mount (for 1.6.6)	71574
1.6.9	35 foot Fiberglass Base Station Whip Antenna with Mount	71585

SECTION 2
INSTALLATION

2.1 UNPACKING AND INSPECTION

Unpack and inspect all parts and equipment as soon as received. Do not accept a shipment where there are visible signs of damage to the cartons until a complete inspection is made. If there is shortage or if any evidence of damage is noted, insist on a notation to that effect on the shipping papers before signing the receipt from the carrier.

If concealed damage is discovered after a shipment has been accepted, notify the carrier immediately in writing and await his inspection before making any disposition of the shipment. A full report of the damage should also be forwarded to Sunair. Include the following:

(a) Order number
(b) Model and serial number
(c) Name of transportation agency

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

2.2 RESHIPPING

The shipping carton for the GCU-910 has been carefully designed to protect the antenna coupler and its accessories during shipment. This carton and its associated packing materials should be retained in case it becomes necessary to reship the coupler. If the original shipping carton is not available, be sure to carefully pack each unit separately, using suitable cushioning material where necessary. Special attention should be given to providing enough packing material around controls, connectors, and other protrusions from the equipment. Rigid cardboard should be placed at the corners of the equipment to protect against denting. Be sure to mark the container "FRAGILE-ELECTRONIC EQUIPMENT".

IMPORTANT NOTE: RETURN OF SUBASSEMBLIES FOR REPAIR

When returning one or more subassemblies for repair, you must ship AIR PARCEL POST or AIR FREIGHT consigned to Sunair Electronics, 3101 S.W. 3rd Avenue, Fort Lauderdale, Florida, 33315 U.S.A., and plainly mark on all mailing documents:

"U.S. GOODS RETURNED FOR REPAIR.
VALUE FOR CUSTOMS – $100.00".

2.3 POWER REQUIREMENTS

All power necessary to operate the GCU-910 Antenna Coupler is supplied from the companion GSB-900 transceiver and Antenna Tuning Control Unit (5024-0423) via the Remote Control Cable (5024-9050). Consult section 2.6 for cable connections. If a transceiver or transmitter other than the GSB-900 is used, external power sources of +28 V.D.C. at 1 amp and +12 V.D.C. at 80 ma are required to power the Antenna Tuning Control Unit and GCU-910. As the +12 volts is only used to illuminate the meter on the Antenna Tuning Control, it can be derived from the +28V supply by using a 200 ohm, 5 watt wirewound dropping resistor.

2.4 INSTALLATION CONSIDERATIONS AND MOUNTING INFORMATION

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

IMPORTANT INSTRUCTIONS

2.4.1 GENERAL INSTALLATION PROCEDURES AND REQUIREMENTS

1. Carefully plan radio/coupler/antenna locations, observing the following requirements before starting installation.

2. Provide best possible RF ground for radio and coupler. Use flat copper strap 1" wide or #6 or larger wire and connect to ground terminal at rear of transceiver. Leads to ground system should be as short as possible.

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

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

5. If the radio is installed on a wood or fiberglass boat, approximately 10 to 12 square feet of metal surface area in contact with the water should be provided for use as an RF ground.

6. If operated on D.C. power, check for correct polarity before applying power.

7. The installation should be carefully planned beforehand in accordance with drawings on the following pages.

8. Linear amplifiers with low level modulation such as used in the GSB-900 will oscillate if the RF power output is radiated or conducted into the low level stages. Evidence of this situation is erratic or excessive power output. This is caused by too close proximity of the coupler output and antenna to the transmitter and/or inadequate RF grounds. Carefully following the above procedures will prevent this from occurring.

2.4.2 MOUNTING CONSIDERATIONS

See Figure 2.1 for coupler outline configuration.

2.4.2.1 Base Station Installation

A typical base installation consisting of a GSB-900 and GCU-910 is shown in Figure 2.2. Consult the GSB-900 operating manual for installation details. Refer to section 2.5 for recommendations for suitable antennas.

2.4.2.2 Vehicular Installation

Figure 2.3 shows a typical vehicular installation with a GSB-900 transceiver and shock mount assembly (Sunair Part # 5024-0025). See section 2.5 for specific antenna recommendations. In order to minimize R.F. pickup, it is important that the ground strap supplied with the shock mount be securely fastened between the ground post on the radio and the bottom of the right rear shock isolator. Consult the GSB-900 manual for further details.

2.4.2.3 Marine Installations

In marine installations, follow the same recommendations as outlined in paragraph 2.4.2.2 above. If the radio is installed in a wood or fiberglass boat, a ground plate of 12 square foot minimum area in contact with the water should be installed. A heavy ground lead such as 1 inch wide strap or braid should be connected between the ground post on the radio and the ground plate. The length of this ground lead should be held to an absolute minimum commensurate with a neat installation.

2.5 ANTENNAS AND GROUND SYSTEMS

2.5.1 GENERAL

The GSB-900 is designed to operate into a 50 ohm resistive antenna system with a

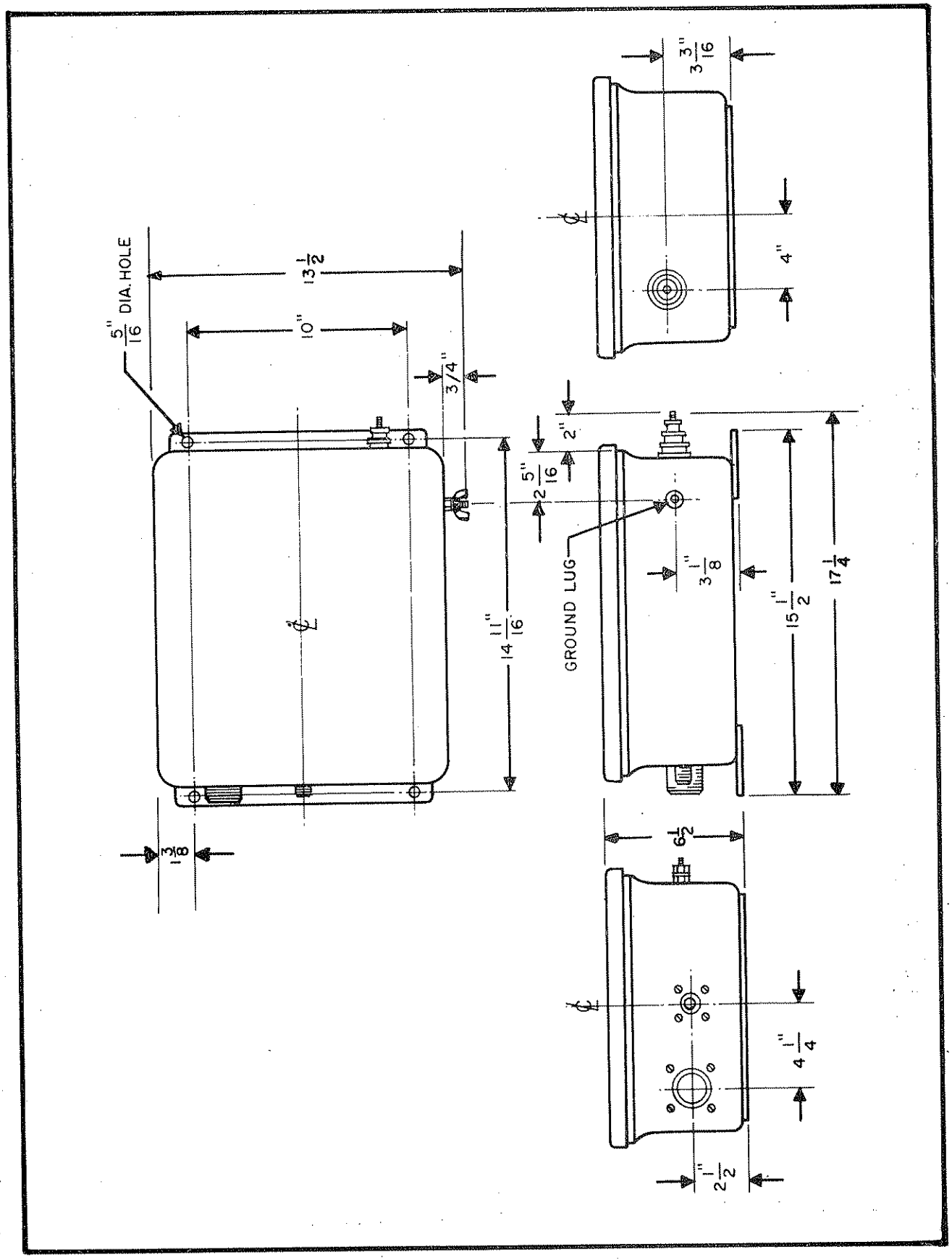


Figure 2.1, Antenna Coupler Outline Drawing

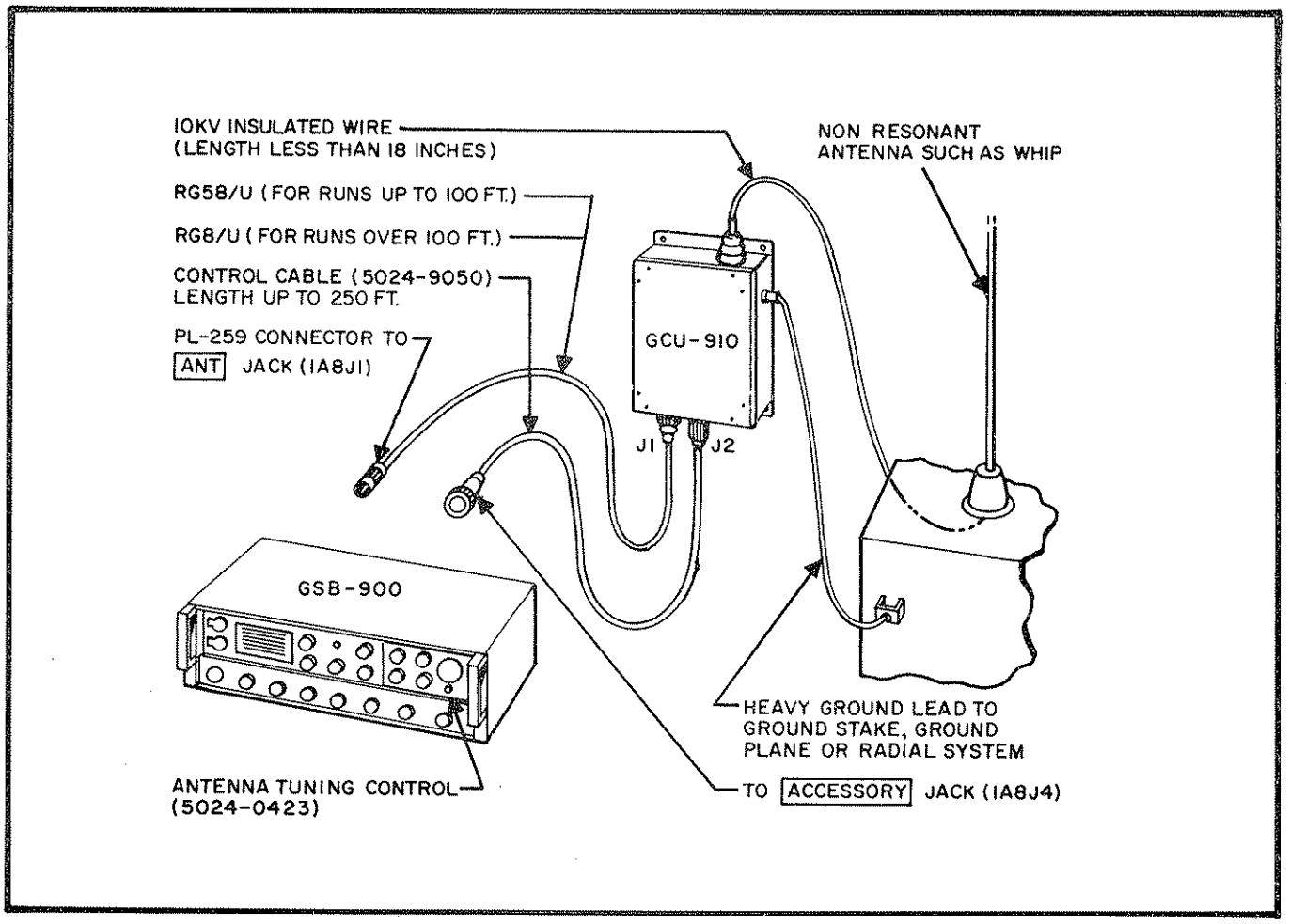


Figure 2.2 Typical Base Station Installation Using Non-Resonant Antennas

maximum voltage standing wave ratio (V.S.W.R.) of 2:1. When used with the GCU-910 Remote Controlled Antenna Coupler, the system will match antennas ranging from 9 foot whips to 150 foot long wires. Although the GCU-910 will match 9 foot whips down to 1.6 MHz, use of a 9 foot whip is not recommended due to poor radiation efficiency. The GCU-910 is unique in that it can be placed close to the antenna and controlled from the front panel of the GSB-900 Transceiver. This optimizes both operator convenience and electrical performance.

As there are numerous types of antennas, a complete discussion is beyond the scope of the manual. Antennas requiring an antenna coupler for use in the 1.6 to 30 MHz spectrum generally fall into two categories:

a) Narrow band 50 ohm antennas
b) Random length non resonant antennas

Several popular antennas falling into each of the above categories are discussed below. For specific recommendations, consult our experienced Field Service organization.

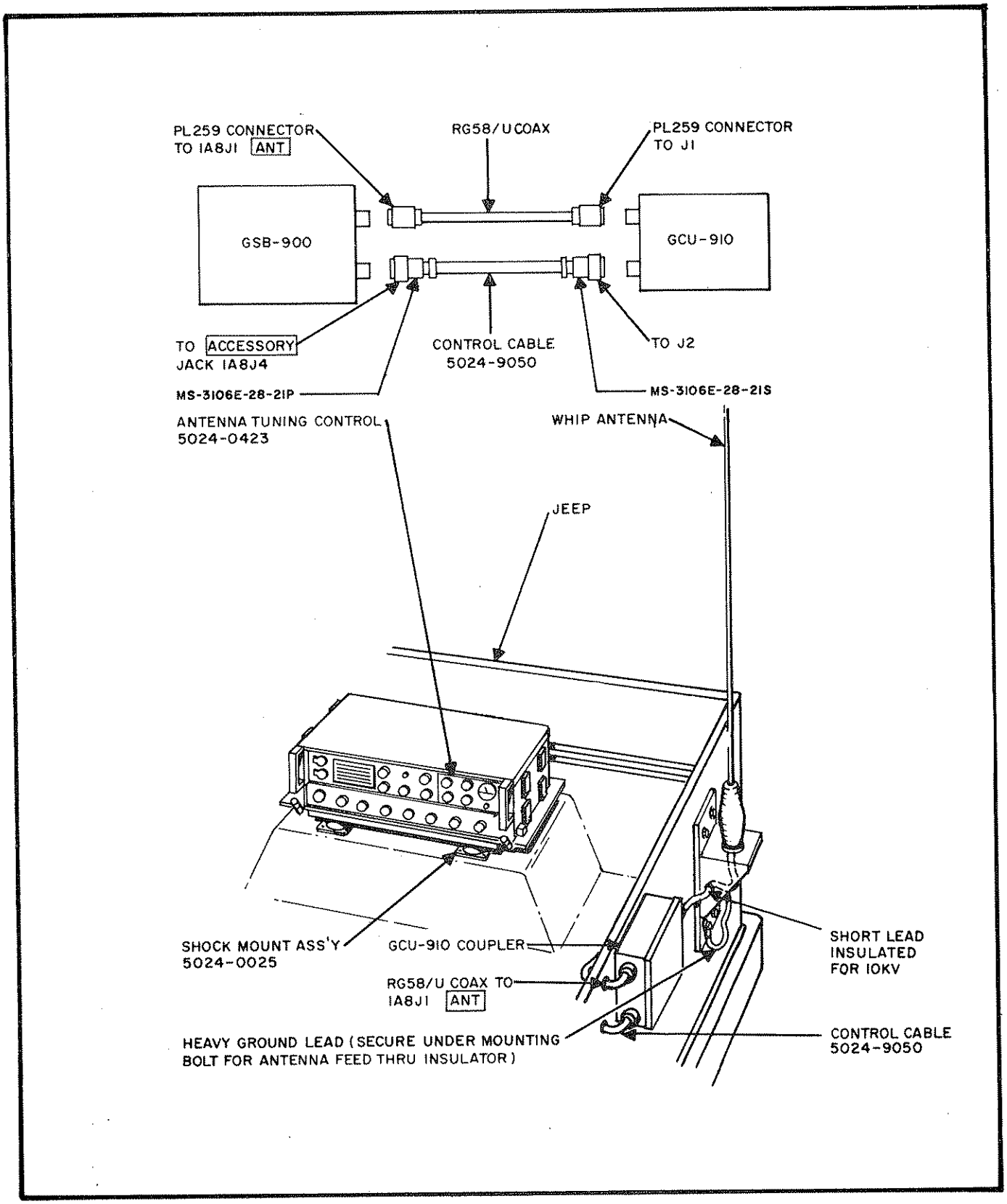


Figure 2.3 Typical Vehicular Installation

Some general "DO'S" and "DONT'S" of antenna installations are listed below:

1. Best performance will be obtained when the antenna is mounted as high as possible. The antenna should be clear of all large objects such as trees and buildings.

2. Although the GCU-910 coupler will match electrically short antennas (i.e. those under 1/8 wavelength), such antennas are not efficient radiators. If the installation permits, antennas over 1/8 wavelength long at the lowest operating frequency should be used. Antenna length generally limits system performance in vehicular applications at frequencies below 10 MHz as the size would be prohibitive.

3. When using whip antennas, the ground system actually forms part of the radiating system. Where space permits (such as in a base station installation) a good ground plane or radial system should be installed at the base of the antenna. (See Figure 2.4) AN INADEQUATE GROUND SYSTEM IS MOST OFTEN RESPONSIBLE FOR DISAPPOINTING PERFORMANCE WHEN USING A WHIP ANTENNA.

4. In vehicular installations and marine installations in a metal hull ship, 1 inch wide strap or braid should be connected between the antenna coupler ground and the frame of the vehicle. The length should be as short as possible. In an installation aboard a wood or fiberglass boat, a ground plate with at least 12 square feet in contact with the water should be attached to the hull and a short 1 inch wide strap should be connected between the coupler ground post and the plate.

2.5.2 RANDOM LENGTH NON RESONANT ANTENNAS

2.5.2.1 Whip Antenna

Whips and long wires are popular non resonant antennas. The whip antenna (illustrated in Figure 2.4) is often used in mobile, marine, portable or semi portable installations because it is rugged and self supporting. The antenna impedance changes with the operating frequency and therefore the GCU-910 antenna coupler must be used to match the antenna to the transceiver. Best radiation efficiency will be obtained if the antenna is at least 1/8 wavelength long at the lowest operating frequency; however, this requirement does not result in a practical size antenna for low frequency operation. Thirty-five foot whip antennas offer a good compromise between practical height and good electrical performance at low frequencies. The GCU-910 antenna coupler will match antennas as short as 9 feet, however the use of an antenna of this short length is not recommended due to the poor radiation efficiency particularly at frequencies below 10 MHz. The whip's performance is also greatly influenced by its ground system. For base station installations, a minimum of four six foot long ground rods should be driven into the ground symetrically placed around the antenna base. The rods should be bonded together with heavy strap and then connected to the antenna coupler ground by another short heavy strap. If the antenna is mounted on the roof of a building, where a short ground lead to the coupler cannot be obtained, a minimum of 4 symmetrically placed ground radials should be installed at the base of the antenna, bonded together, and connected to the antenna coupler ground post. The radials should be made of number 12 gauge wire or larger and should be at least 1/4 wave long at the lowest operating frequency. The whip's radiation pattern is omni-directional.

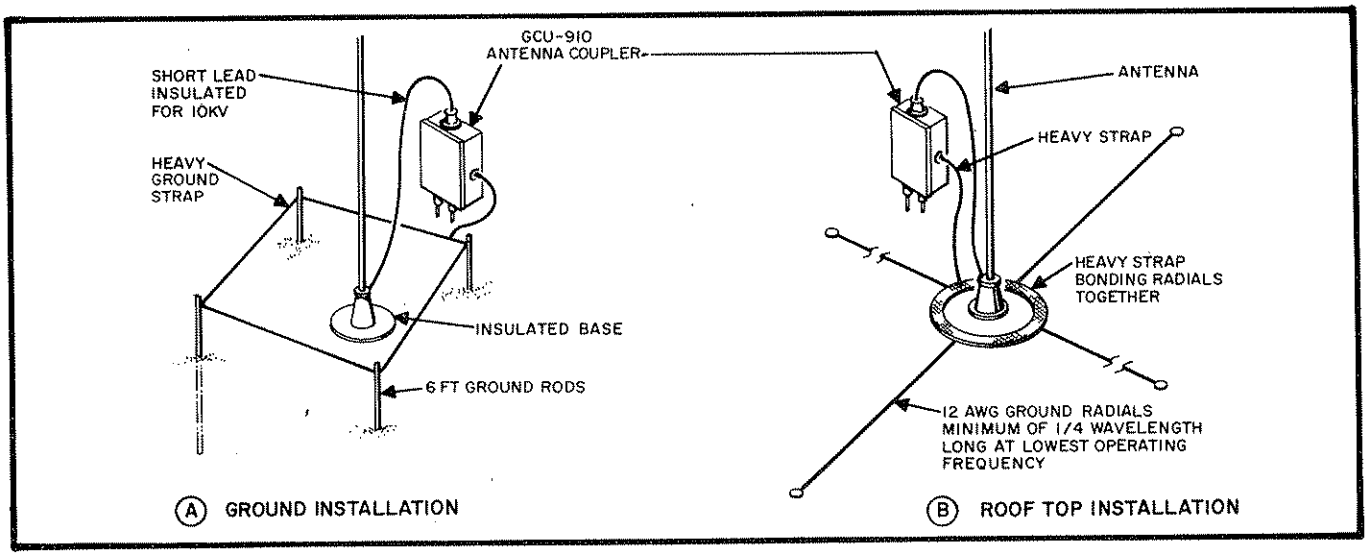


Figure 2.4 The Whip Antenna

2.5.2.2 Long Wire Antenna

The long wire antenna, illustrated in Figure 2.5, is a popular base station antenna where a wide range of operating frequencies are used. The antenna impedance varies greatly with frequency and therefore must be matched to the Transceiver with the GCU-910 antenna coupler. The GCU-910 antenna coupler will efficiently match long wire antennas up to 150 foot in length. The radiation pattern of the long wire antenna is also a strong function of operating frequency. The two most popular length long wire antennas, 75 and 150 foot (available from Sunair as part numbers 99920 and 99921 respectively) exhibit excellent low frequency radiation efficiency.

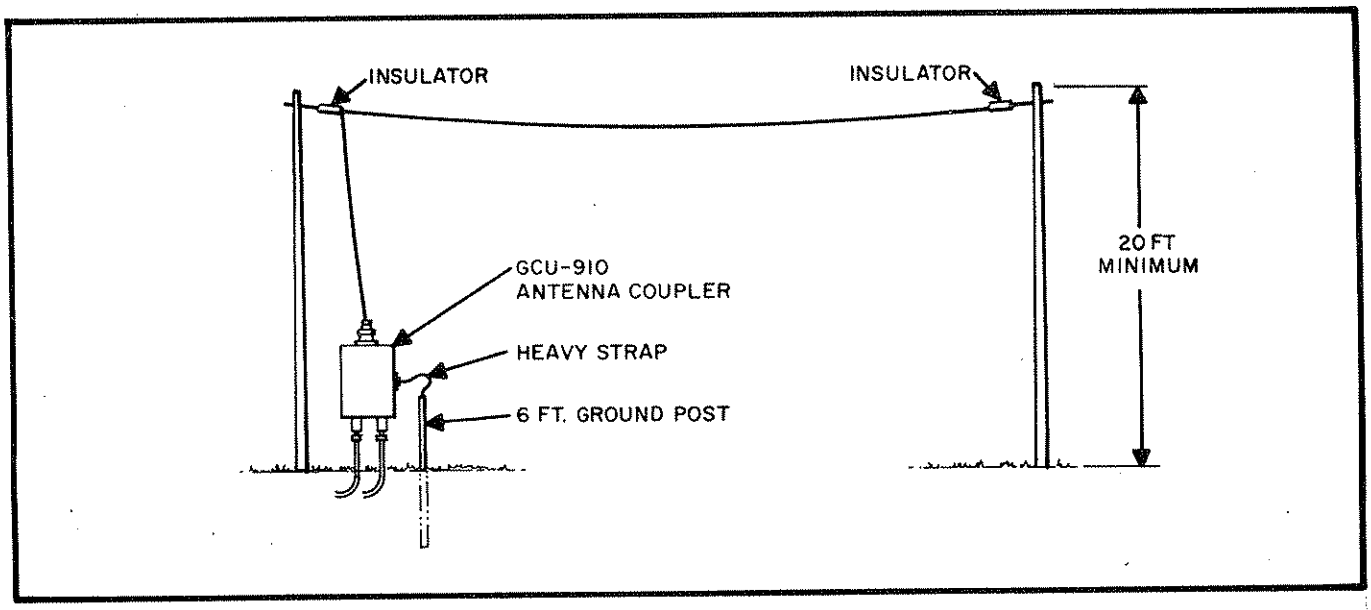


Figure 2.5 The Long Wire Antenna

2.6 INSTALLATION OF REMOTE CONTROL CABLE (5024-9050)

It is recommended that the remote control cable be procured from Sunair. However, if necessary the cable may be made from individual wires of #20 AWG with an overall braided shield and PVC jacket.

The remote control cable is shipped from the factory without connectors attached to facilitate the routing of this cable through walls, bulkheads, conduit, etc. After installing the cable, follow the procedure outlined below:

NOTE

The connector with the male pins (MS3106E-28-21P) should be wired at the transceiver end of the cable. The connector with female pins (MS3106E-28-21S) should be wired at the antenna coupler end of the cable. Refer to wire chart, Table 2.6.

1. Loosen both screws on one of the cable clamps.

2. Insert the rubber telescoping bushing (boot) through the rubber grommet on the inside of the cable clamp and push through until the lip on the boot bottoms on the rubber grommet. The boot should extend beyond the cable clamp.

3. Insert the remote control cable (5024-9050) into the open end of the boot and cable clamp and pull through until approximately 6 inches of cable extends from the inside of the cable clamp.

4. Carefully remove approximately 1-1/2 inches of the plastic outer jacket of the remote control cable using a knife or razor blade. Use care so as not to damage the shield or inner conductors.

5. Carefully unbraid the cable shield to within approximately 1/4 inch of the outer jacket. Carefully cut the unbraided shield wires at this point using a pair of small wire cutters.

6. Remove approximately 1 inch of insulation from the end of a 3 inch piece of #22 gauge hook-up wire. Wrap the wire around the outer shield of the cable just forward of the end of the outer jacket and solder the connection using a medium size soldering iron.

7. Note the mylar sleeve over the wire bundle. Carefully cut this sleeve, being careful not to nick the wires in the bundle, until the wire bundle is exposed back to the end of the shield.

8. Flare out the bundle of wires and separate the individual wires. Strip approximately 1/8 inch of insulation from each wire.

9. Cut a piece of insulated sleeving approximately 1/4 inch long (sleeving is supplied in the ancillary kit of the antenna coupler). Choose one of the wires and carefully tin it. Slip the sleeving over the wire, beyond the tinned area. Solder the wire to one of the cups of the connector. When the connection has cooled, force the insulated sleeving over the cup. Make a chart showing the wire color code and pin connection.

10. Proceed in a similar manner until all required wires are installed.

NOTE

Pin "h" of the connector should have a wire plus the #22 gauge wire from the shield, prepared in step 6 above, soldered to it.

WIRE #	GSB-900(male) CONNECTOR MS3106E(28-21P) PIN #	GCU-910(female) CONNECTOR MS3106E(28-21S) PIN #	FUNCTION
1	J	J	Coarse Input #1 Select
2	K	K	Coarse Input #2 Select
3	L	L	Coarse Input #3 Select
4	M	M	Coarse Input #4 Select
5	N	N	Coarse Input #5 Select
6	P	P	Coarse Input #6 Select
7	R	R	Coarse Input #7 Select
8	S	S	Coarse Output #1 Select
9	T	T	Coarse Output #2 Select
10	U	U	Coarse Output #3 Select
11	V	V	Coarse Output #4 Select
12	W	W	Coarse Output #5 Select
13	X	X	Coarse Output #6 Select
14	Z	Z	Variable Capacitor Clockwise
15	a	a	Variable Capacitor CCW
16	b	b	Variable Capacitor Limit
17	c	c	Variable Inductor CW
18	d	d	Variable Inductor CCW
19	e	e	Variable Inductor Limit
20	f	f	Forward Power
21	g	g	Reflected Power
22	h	h	Ground
NOTE: ALSO CONNECT CABLE SHIELD TO PIN h			
23	j	j	Coupler Tune
24	s	s	+28V DC
25	spare (no connection - tie off in cable)		
26	↓	↓	
27			
NOTE: UNUSED PINS ARE: A,B,C,D,E,F,G,H,k,m,n,p,r			

TABLE 2.6 WIRING CHART: REMOTE CONTROL CABLE (5024-9050)

11. When all connections are completed, screw the rear shell and cable clamp assembly on the connector and tighten. Push a small additional amount of cable into the connector to ensure some slack and then tighten the two screws on the cable clamp.

12. Follow an identical procedure to connect the other end of the cable.

NOTE

The cable should be wired pin-to-pin. That is, pin a of one connector should connect to pin a of the opposite connector, etc.

2.7 CHECKS AFTER INSTALLATION

When system installation is complete, perform the following checks:

1. Temporarily remove the top cover of the antenna coupler.

2. Connect a 50 ohm, 100W dummy load to the transceiver.

3. Place the MODE switch on the GSB-900 in the CPLR TUNE (coupler tune) position.

On the antenna tuning control unit, perform the following operations:

4. Place both the COARSE INPUT and OUTPUT switches in position "1". Refer to Section 4 for capacitance value selected with each switch position.

5. Rotate the FINE INPUT control to its maximum counterwise (CCW) position. Hold in this position until the LIMIT indicator over this control illuminates.

6. Rotate the TUNE control max. CCW and hold in this position until the LIMIT light over this control illuminates.

7. Sequence the COARSE INPUT switch through each of its 7 positions and observe that switch S1 in the GCU-910 Antenna Coupler advances one position clockwise (CW) each time the COARSE INPUT switch is increased one number. Visually check that the motor positions section S1A in the center of its contact. Refer to Section 5 for alignment procedure (if needed).

8. Sequence the COARSE INPUT switch CCW, one position at a time and again check (visually) for proper indexing of S1.

9. Repeat steps 7 and 8 for the COARSE OUTPUT switch. The COARSE OUTPUT switch should index S6 in the GCU-910 and only has 6 positions.

10. Rotate the FINE INPUT control CW to the first detent. In the GCU-910, check that the 4 section capacitor, C14, increases in capacity. Further rotation of the FINE INPUT switch CW should increase the speed of rotation of C14. The LIMIT indicator light over this control should illuminate when the capacitor has reached its maximum capacity position (plates fully meshed). If adjustment of the mechanical/electrical stops are needed, refer to section 5. Release the FINE INPUT control.

11. Rotate the FINE INPUT control CCW to the first detent. C14 should rotate towards minimum capacity. Further rotation of the FINE INPUT control CW should increase the speed of rotation of C14. When C14 has reached minimum capacity (plates fully unmeshed), the LIMIT light over this control should again illuminate. Release the FINE INPUT control.

12. Rotate the TUNE control CW to its first detent. The roller inductor, L3, in the Antenna Coupler should rotate CCW with the wheel contact moving toward the control cable end of the coupler. Further rotation of the TUNE control should increase the speed of rotation of L3. When the inductor has

reached maximum inductance, the LIMIT light over the TUNE control should illuminate. If adjustment of the electrical stops are required, refer to section 5. Release the TUNE control.

13. Rotate the TUNE control CCW to its first detent. The roller inductor, L3, in the Antenna Coupler should rotate CW towards minimum inductance. Further rotation of the TUNE control should increase the speed of rotation of L3. When the inductor has reached minimum inductance, the LIMIT light over the TUNE control should illuminate.

14. Place the MODE switch on the GSB-900 in the OFF position. Disconnect the 100W dummy load and reconnect the system for normal operation. Replace the cover on the Antenna Coupler.

15. Proceed to section 3 and follow the normal tune-up procedure to complete the system checks.

SECTION 3

OPERATING

3.1 GENERAL

This section includes information and instructions required for proper operation of the GSB-900 Transceiver with the GCU-910 Antenna Coupler.

3.2 GCU-910 ANTENNA COUPLER CONTROLS

(Contained on Coupler Control Panel 5024-0423 which mounts in the front panel of the GSB-900)

COARSE INPUT	Selects fixed input loading capacitors in Antenna Coupler: 7 position rotary switch. Position #1 selects lowest capacitor value. Capacitor values increase with clockwise rotation of switch. Used in conjunction with FINE INPUT switch.
COARSE OUTPUT	Selects fixed values of output loading capacitors in Antenna Coupler: 5 position rotary switch. Position #1 selects lowest capacitor value. Capacitor values increase with clockwise rotation.
FINE INPUT	Controls Fine Input (vernier) loading capacitor in Antenna Coupler. 4 position spring-loaded rotary switch with center-off position. Progressive rotation of switch in counterclockwise direction produces first slow, then rapid decrease in input loading capacitance. Progressive rotation of switch in clockwise direction produces first slow, then rapid increase in input loading capacitance. Switch operates in conjunction with END LIMIT indicator light located directly over control.
TUNE control	Operation similar to FINE INPUT switch above, except switch controls TUNE inductor in Antenna Coupler. Operates in conjunction with END LIMIT indicator light located directly over control.
PWR MONITOR Switch	Switches meter input when in TRANSMIT mode: FWD– indicates relative forward R.F. power on coax at input to Antenna Coupler. REFL–indicates relative reflected R.F. power on coax at input to Antenna Coupler. A null in this reading indicates that the antenna is correctly matched to the transceiver.
FINE INPUT END LIMIT indicator light	Located directly over FINE INPUT switch. Indicates that the Fine Input loading capacitor is at either end of its adjustment range
TUNE END LIMIT indicator light	Located directly over TUNE switch. Indicates that the TUNE inductor in the Antenna Coupler is at either end of its adjustment range
METER	a) RECEIVE Mode: indicates relative received signal strength in "S" units b) TRANSMIT mode: controlled by PWR MONITOR switch (see above)

NOTE

OPERATION OF THE FINE INPUT AND TUNE SWITCHES ARE AS FOLLOWS:

The switches are 4 position spring-loaded switches with a center-off position. The TUNE switch controls the TUNE INDUCTOR in the Antenna coupler. The FINE INPUT switch controls FINE INPUT (vernier) CAPACITOR in the Coupler. Rotation of these switches to their first counter-clockwise position causes a slow decrease in the respective element value. Further counter-clockwise rotation will produce a rapid decrease in the respective element value. Similarly, clockwise rotation will produce first a slow and then a rapid increase in the respective element value.

An END LIMIT indicating light is located above each control. If the lamp lights when the switch is activated, it signifies that the respective coupler element is at either end of its adjustment range. If this condition occurs, rotate the switch in the proper direction to make the lamp extinguish.

3.3 OPERATING THE GCU-910 ANTENNA COUPLER WITH THE GSB-900 TRANSCEIVER (REF. FIGURE 3.1)

TO PLACE THE SYSTEM IN OPERATION, FOLLOW THE PROCEDURE OUTLINED BELOW:

1. Check to see that all antenna connections are secure.

2. Connect the GSB-900 Transceiver to its power source.

3. Place the COARSE INPUT and COARSE OUTPUT switches on the control unit (5024-0423) in their "1" positions.

NOTE

If a "standard" antenna is being used refer to page 3-5 or the Operating Instruction sheet of the GSB-900 for coarse switch positions.

4. Set the (6) FREQUENCY switches to the desired operating frequency.

5. Place the MODE switch in the CPLR TUNE (antenna coupler tune) position.

6. Place the METER switch on the control unit in the FWD (forward power) position. The meter should read approximately 0.25 relative power.

7. Place the METER switch in the REFL (reflected power) position. Turn the FINE INPUT switch on the control unit fully counterclockwise and hold the control in this position until the LIMIT lamp over this control lights.

8. Turn the TUNE switch fully counterclockwise and hold the control in this position until the LIMIT lamp over this control lights.

9. Rotate the TUNE switch fully clockwise and hold it in this position until a minimum meter reading or "null" in reflected power is obtained. Carefully rock this control back and forth until the best null can be obtained.

NOTE

The initial null obtained may not be too pronounced and may be rather broad. Use care in finding the best null before proceeding.

10. If the TUNE control reaches its clockwise end limit before a null occurs or if a pronounced null cannot be obtained, rotate the COARSE OUTPUT switch one position clockwise and repeat steps 8 and 9 above. Continue repeating these steps until a null can be obtained.

11. Rotate the FINE INPUT switch fully clockwise and hold in this position until a better null is obtained. Rock this control back and forth for the best null.

12. If minimum reflected power occurs with the FINE INPUT element at its counterclockwise end limit, rotate the COARSE OUTPUT switch one position clockwise and repeat

steps 7 through 11. Continue increasing the COARSE OUTPUT switch, one position at a time, repeating steps 7 through 11 until a null can be obtained with the FINE INPUT element away from this end limit.

13. If minimum reflected power occurs with the FINE INPUT element at its clockwise end limit, rotate the COARSE INPUT switch one position clockwise, return the FINE INPUT element to its counterclockwise end limit, and repeat step 11 above until a null in reflected power can be obtained.

14. Carefully adjust the TUNE and FINE INPUT controls, in sequence, until a complete null in reflected power is obtained. When adjustment is complete, the null should be such that the meter pointer does not move from the zero position by more than 1/2 pointer width.

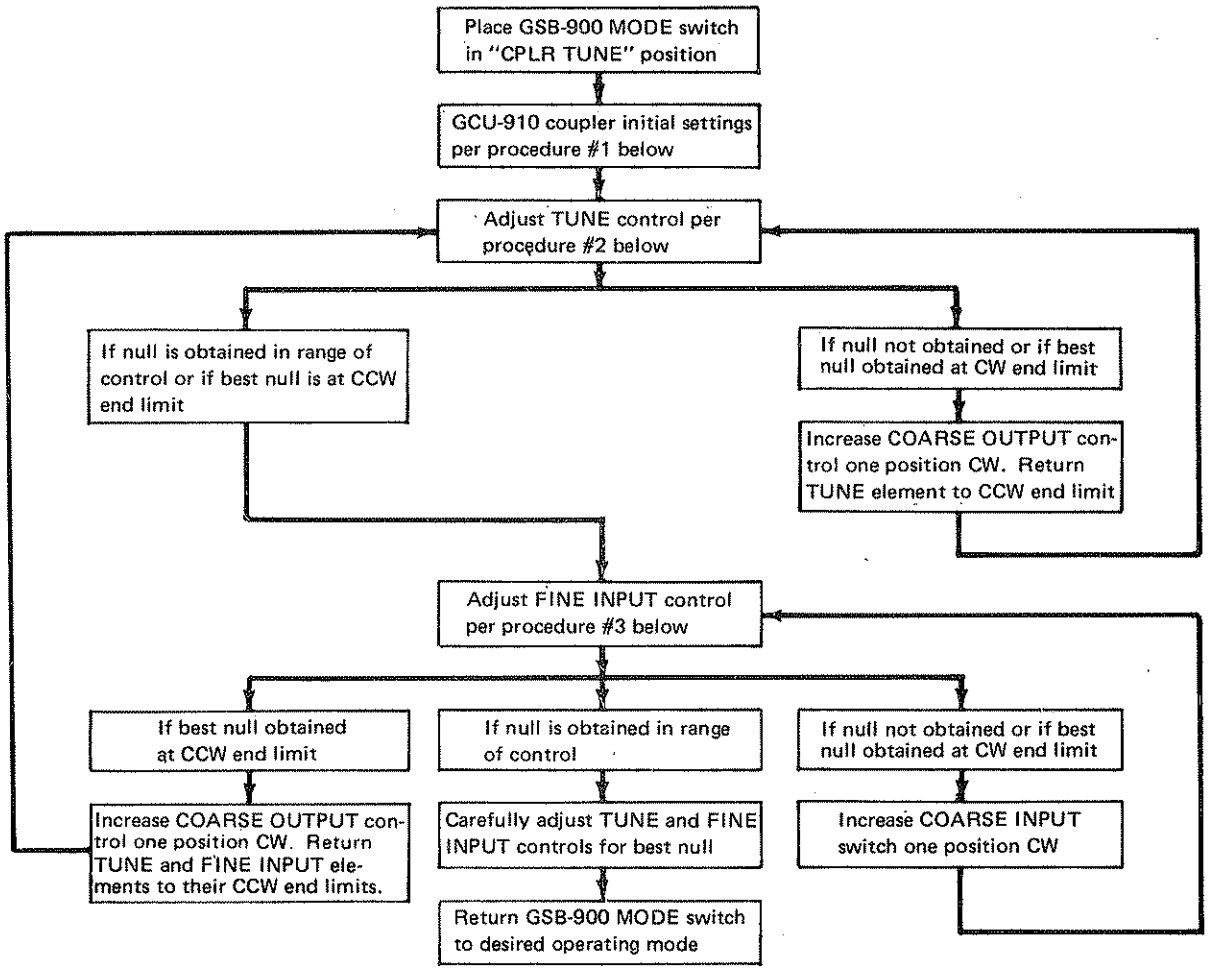
NOTE

With most antennas, additional complete nulls in reflected power can be obtained at higher numerical settings of the COARSE INPUT and COARSE OUTPUT controls. Although the antenna is properly "matched" to the transceiver with these settings, and the system may be operated in this manner, the antenna coupler is operating at reduced efficiency. For optimum system performance, the system should be operated with these controls at the lowest numerical settings that will produce a complete null in reflected power.

15. Refer to the operating procedure in the radio handbook for transceiver operating procedure.

CAUTION

Whenever the frequency is changed, the antenna coupler must be retuned. Failure to tune coupler will result in severely degraded communications and may cause the 28VDC "over current" protection in the GSB-900 to trigger upon keying the transmitter.



PROCEDURES:

1. INITIAL SETTINGS

   Place COARSE INPUT and COARSE OUTPUT switches in their "1" positions. Rotate TUNE control fully CCW and hold in this position until the END LIMIT lamp over the control lights. Rotate FINE INPUT control fully CCW and hold in this position until the END LIMIT lamp over the control lights. Place the METER switch in the "FWD" position and note that the meter indicates approximates .25 relative power. Place the METER switch in the REFL position.

2. TUNE CONTROL ADJUSTMENT

   Rotate the TUNE control fully CW and hold it in this position until a null is obtained. Carefully rock this control back and forth until the best null is obtained.

3. FINE INPUT CONTROL ADJUSTMENT

   Rotate the FINE INPUT control fully CW and hold it in this position until a null is obtained. Carefully rock this control back and forth until the best null is obtained.

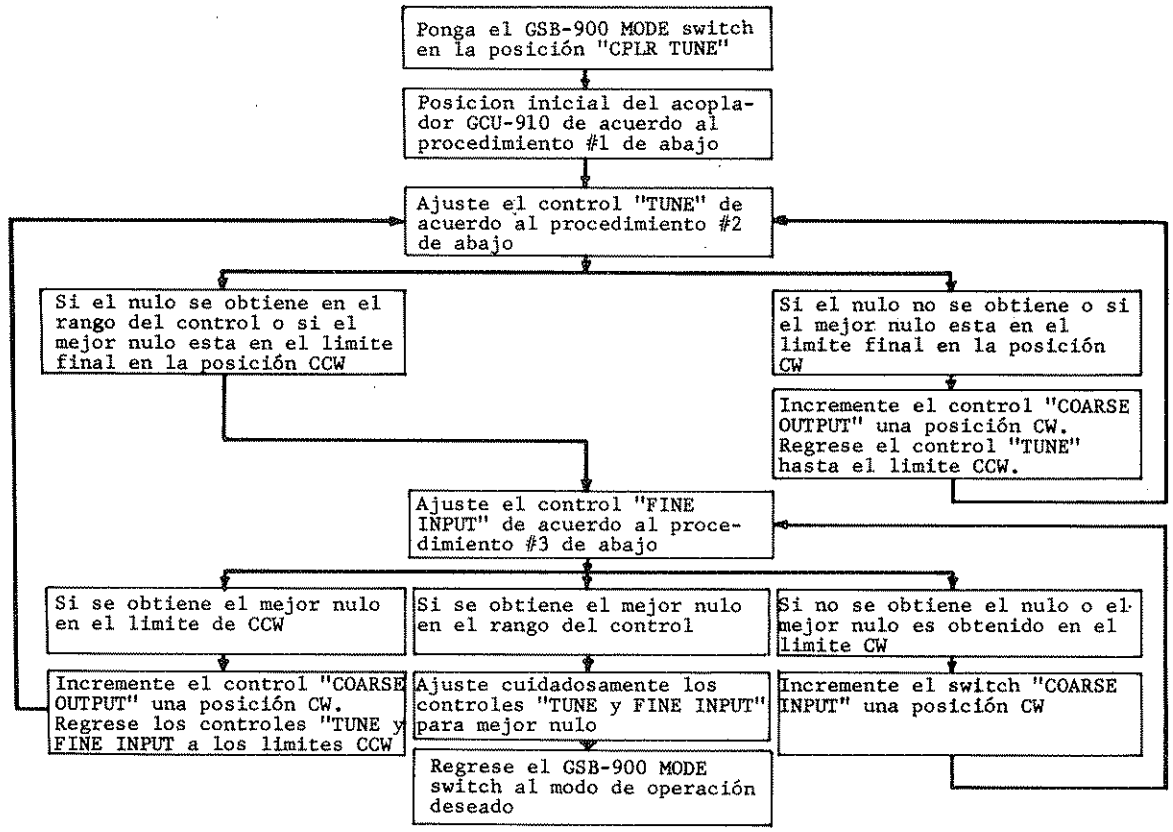
Figure 3.1 Antenna Coupler Tuning Procedure

GCU-910 ANTENNA COUPLER
COARSE TUNING DATA

FREQ MHz	2.7 METER VEHICULAR		4.9 METER VEHICULAR		7.3 METER MARINE WHIP		9.8 METER BASE-MARINE		23 METER LONG WIRE		46 METER LONG WIRE	
	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT
1.6	6	6	7	6	7	6	7	6	4	6	1	6
2.0	6	5	6	5	4	5	4	4	4	4	1	6
3.0	5	4	5	4	3	2	3	3	1	2	1	4
4.0	2	2	4	3	2	2	1	1	2	6	2	3
5.0	2	2	3	3	2	1	1	1	2	4	1	4
6.0	2	2	2	2	2	1	1	1	2	4	1	3
7.0	2	2	2	1	1	1	1	4	3	4	2	3
8.0	2	1	2	1	1	1	1	4	2	2	2	3
9.0	2	1	2	1	1	2	1	3	2	2	2	3
10.0	1	1	2	1	2	4	2	3	1	2	2	3
11.0	1	1	2	2	2	4	2	2	1	3	2	3
12.0	1	1	1	3	2	3	1	2	1	3	2	3
14.0	1	1	1	3	2	3	1	1	1	3	2	3
16.0	1	1	1	2	2	2	1	1	2	3	1	3
18.0	1	1	1	2	2	2	1	1	2	2	1	3
20.0	1	1	1	2	2	2	1	1	2	2	1	2
22.0	1	3	1	2	2	2	1	2	2	2	1	2
24.0	2	3	1	2	2	2	1	2	2	2	1	2
26.0	1	2	1	2	2	2	1	1	2	2	1	2
28.0	1	2	1	2	2	2	1	1	2	2	1	2
29.9	1	2	1	3	1	2	1	1	1	2	1	1

1. The readings given are for a typical installation. Actual coarse settings depend on antenna height and type of ground system. The above readings should, therefore, be used as a guide. Variations of one position either side of the nominal are common.
2. Best Antenna Coupler efficiency is always obtained with the COARSE switches at the lowest number which will permit a good impedance match.

TABLE 3.1



PROCEDIMIENTO:

1. POSICION INICIAL

   Ponga los switches COARSE INPUT y COARSE OUTPUT a su posición #1. Gire el control TUNE completamente CCW y mantenga esta posición hasta que la lampara END LIMIT se encienda. Gire el control FINE INPUT completamente CCW y mantenga en esta posición hasta que la lampara END LIMIT se encienda. Ponga el switch METER en la posición FWD y note que el METER indique aproximadamente .25 de la potencia relativa. Ponga el switch METER en la posición REFL.

2. AJUSTE DEL CONTROL TUNE

   Gire el control TUNE completamente CW y mantenga en esta posición hasta que se obtenga el nulo. Cuidadosamente gire el control en las dos direcciones (CCW y CW) hasta que obtenga el mejor nulo.

3. AJUSTE DEL CONTROL FINE INPUT

   Gire el control FINE INPUT completamente CW y mantenga en esta posición hasta que se obtenga el nulo. Cuidadosamente gire el control en las dos direcciones (CCW y CW) hasta que obtenga el mejor nulo.

Figura 3.1 Procedimiento para el Ajuste del Acoplador de Antenna

GCU-910 ANTENNA COUPLER
COARSE TUNING DATA

FREQ MHz	2.7 METER VEHICULAR		4.9 METER VEHICULAR		7.3 METER MARINE WHIP		9.8 METER BASE-MARINE		23 METER LONG WIRE		46 METER LONG WIRE	
	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT	COARSE INPUT	COARSE OUTPUT
1.6	6	6	7	6	7	6	7	6	4	6	1	6
2.0	6	5	6	5	4	5	4	4	4	4	1	6
3.0	5	4	5	4	3	2	3	3	1	2	1	4
4.0	2	2	4	3	2	2	1	1	2	6	2	3
5.0	2	2	3	3	2	1	1	1	2	4	1	4
6.0	2	2	2	2	2	1	1	1	2	4	1	3
7.0	2	2	2	1	1	1	1	4	3	4	2	3
8.0	2	1	2	1	1	1	1	4	2	2	2	3
9.0	2	1	2	1	1	2	1	3	2	2	2	3
10.0	1	1	2	1	2	4	2	3	1	2	2	3
11.0	1	1	2	2	2	4	2	2	1	3	2	3
12.0	1	1	1	3	2	3	1	2	1	3	2	3
14.0	1	1	1	3	2	3	1	1	1	3	2	3
16.0	1	1	1	2	2	2	1	1	2	3	1	3
18.0	1	1	1	2	2	2	1	1	2	2	1	3
20.0	1	1	1	2	2	2	1	1	2	2	1	2
22.0	1	3	1	2	2	2	1	2	2	2	1	2
24.0	2	3	1	2	2	2	1	2	2	2	1	2
26.0	1	2	1	2	2	2	1	1	2	2	1	2
28.0	1	2	1	2	2	2	1	1	2	2	1	2
29.9	1	2	1	3	1	2	1	1	1	2	1	1

1. The readings given are for a typical installation. Actual coarse settings depend on antenna height and type of ground system. The above readings should, therefore, be used as a guide. Variations of one position either side of the nominal are common.

2. Best Antenna Coupler efficiency is always obtained with the COARSE switches at the lowest number which will permit a good impedance match.

TABLE 3.1

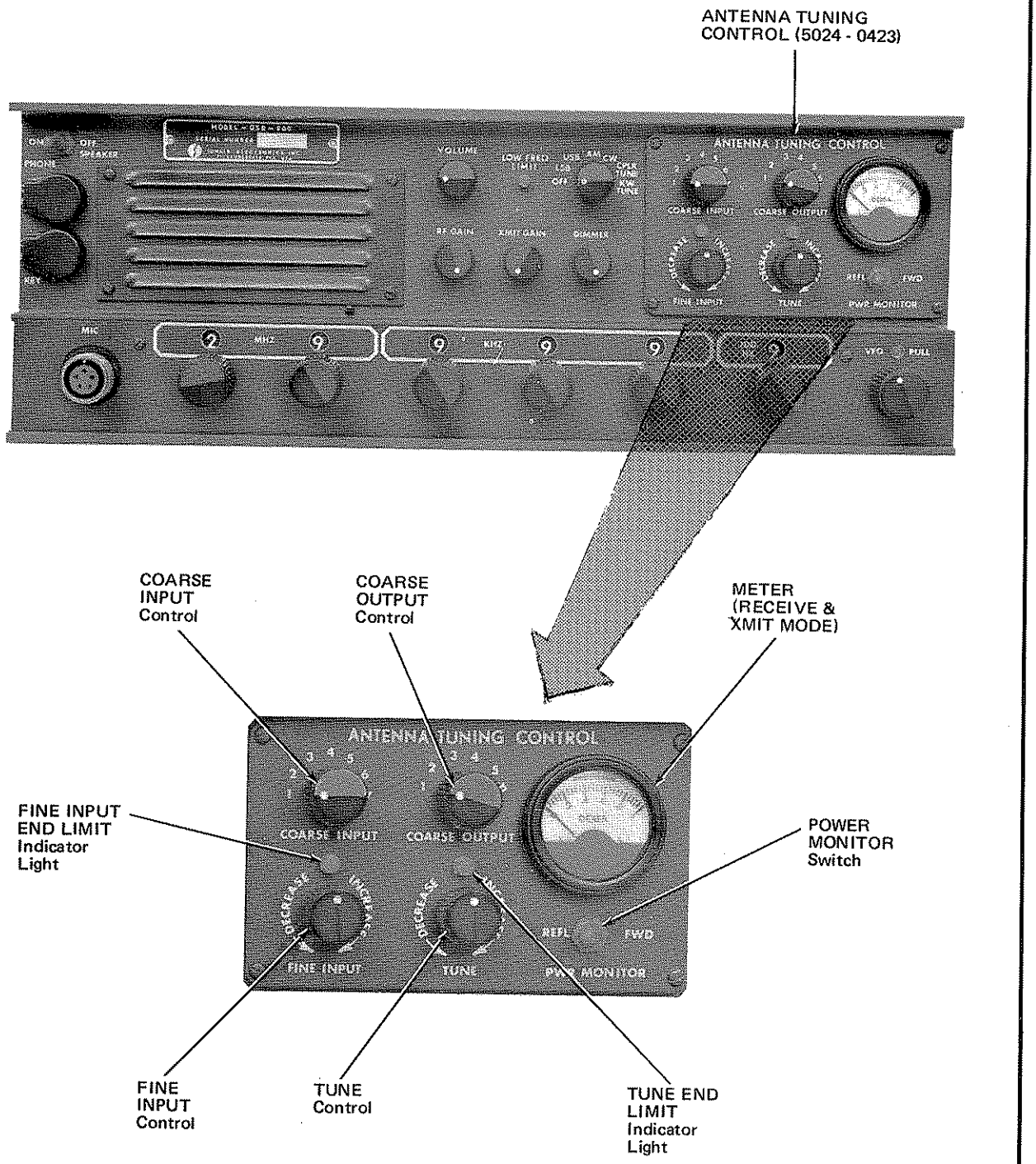


Figure 3.2 Antenna Tuning Control

SECTION 4

THEORY OF OPERATION

4.1 ANTENNA TUNING NETWORK

4.1.1 GENERAL

The antenna tuning network consists of a conventional "PI" network enabling the matching of antennas with a wide range of impedances to the required 50 ohms. The tuning network consists of three elements, (1) input shunt capacitance (2) series inductance, (3) output shunt capacitance. A simplified schematic of the GCU-910 is shown in Figure 4.1 below.

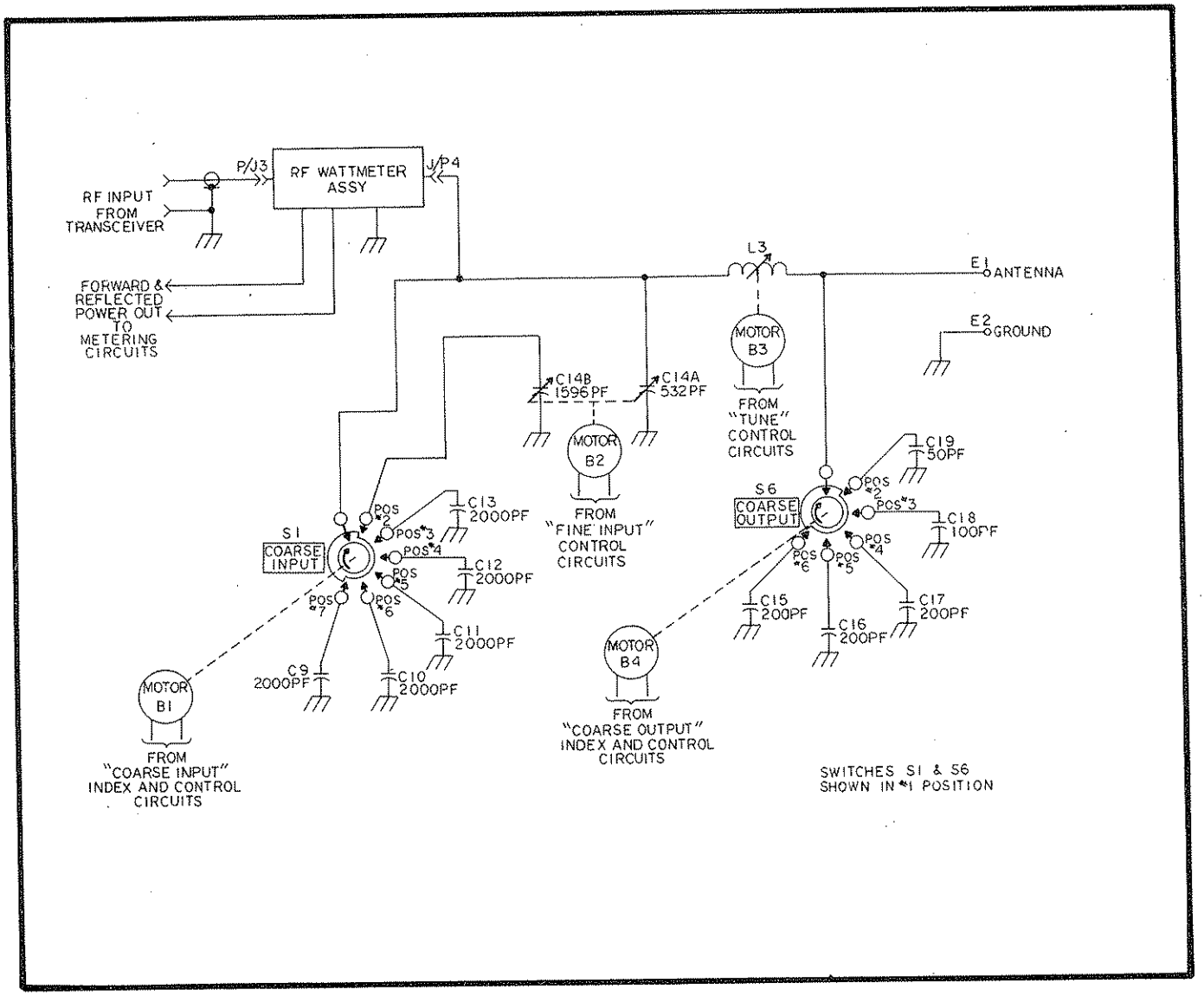


Figure 4.1 Simplified Schematic: RF Circuitry

4.1.2 INPUT SHUNT CAPACITANCE

The input shunt branch of the "PI" network consists of a 4 section air variable capacitor, C14, plus various fixed mica capacitors. C14A (one section of the variable capacitor C14) is always connected on the input line. With the COARSE INPUT switch on the Antenna Tuning Control (5024-0423) in position #1, no additional capacity is selected and only C14A (532 pf) is connected. Rotating the the COARSE INPUT switch clockwise, progressively switches more fixed and variable capacity into the circuit. Table 4.2 below gives capacitance vs switch position.

4.1.3 SERIES INDUCTANCE

The variable roller inductor, L3, forms the series branch of the "PI" network. The inductance range of this inductor is nominally 0.1 to 18 microhenry. The high unloaded Q of this inductor (typically 200) and large power handling capacity contribute to the high efficiency of the antenna coupler. It is controlled by the TUNE control switch.

4.1.4 OUTPUT SHUNT CAPACITANCE

The output shunt branch of the "PI" network consists of 5 banks of high voltage capacitors selected by switch S6. With the COARSE OUTPUT switch in position 1, no capacitance is switched into the circuit. The antenna tuning network then consists of an "L" section with the switch in position 1. At higher numerical settings of the COARSE OUTPUT switch, progressively higher values of capacity are selected in accordance with table 4.3.

4.2 CIRCUIT EFFICIENCY

The efficiency, (the ratio of power output to power input), of the antenna coupler is strongly dependent on the reactive circulating current through the series inductor, L3, and on the quality factor (Q) of this element. The circulating current, in turn, is dependent on the value of output capacity in the circuit. The output capacity, in a "PI" network, transforms the impedance of the antenna into the range of the antenna coupler. A "PI" network may therefore be considered to be an "L" network preceded by an impedance transforming capacitor. In the GCU-910, therefore, as with all wide range antenna couplers, a good impedance match may always be obtained at high output capacitor settings. However it is important that the operator follow the recommended tuning procedure and search for an impedance match at the lowest possible setting of output capacity, (lowest number position of COURSE OUTPUT switch), in order to transfer maximum power to the antenna.

COARSE INPUT SWITCH POSITION	FIXED CAPACITANCE (pf)	MAXIMUM VARIABLE CAPACITANCE (pf)	MAXIMUM TOTAL CAPACITANCE (pf)
1	0	532	532
2	0	2128	2128
3	2000	2128	4128
4	4000	2128	6128
5	6000	2128	8128
6	8000	2128	10,128
7	10,000	2128	12,128

TABLE 4.2 MAXIMUM INPUT CAPACITY vs. COARSE INPUT SWITCH POSITION

COARSE OUTPUT SWITCH POSITION	OUTPUT CAPACITANCE (pf)
1	0
2	50
3	150
4	350
5	550
6	750

TABLE 4.3 OUTPUT CAPACITANCE vs. COARSE OUTPUT SWITCH POSITION

CAUTION

With certain types of antennas, several kilovolts may be present at the output insulator, E1, of the antenna coupler when transmitting. The radio operator and service technician should exercise caution not to contact E1 while transmitting.

4.3 RF WATTMETER ASSEMBLY

The RF wattmeter assembly measures the forward and reflected power at the input to the antenna coupler. A null in reflected power indicates that the input impedance of the antenna coupler is 50 ohms resistive. The circuit consists of a toroidal transformer (T1) which monitors the current flowing in the coaxial transmission line and produces a voltage proportional to, and in phase with this current. Also in the circuit are two capacitive voltage dividers C2, C4 and C3, C5 which produce a voltage proportional to, and in phase with the voltage on the transmission line. Diodes CR3 and CR4 rectify the reflected and forward power, respectively, into an analog D.C. voltage which is indicated on the meter in the Antenna Tuning Control (5024-0423). L1, C6 and L2, C7 are RF filter networks which filter rf energy from the output lines.

Operation of the reflected power monitor is as follows: If the transmission line "looks" like 50 ohms resistive at the sampling point, the voltage produced at the secondary of T1 and the voltage produced at the junction of C2 and C4 will be 180° out of phase. Furthermore, the value of C2 is adjusted so that the voltage at the junction of C2 and C4 is exactly equal to the portion of the secondary voltage of T1 developed across R7. These two voltages will therefore cancel and there will be no rectified D.C. voltage on the output line. If the transmission line is reactive or if the impedance is not 50 ohms, an RF voltage will appear at the input to detector diode CR3 and a rectified D.C. voltage will appear on the output line.

Operation of the forward power monitor is essentially identical to that of the reflected power monitor except that the voltage developed across R8 is in phase with the voltage appearing at the junction of C3 and C5. The resultant voltage is rectified by CR4 and a D.C. voltage therefore appears on the output line.

4.4 CONTROL CIRCUITS, FIGURES 5.2, 5.3

4.4.1 TUNE/OPERATE CIRCUITRY

When the MODE switch on the GSB-900 front panel is placed in the CPLR TUNE (coupler tune) position, relays K1 and K2 in the antenna coupler are energized. Relay K1 switches the 6 db high power attenuator (pad) in series with the input line to isolate the varying impedance of the antenna coupler from the power amplifier in the GSB-900. Relay K2 enables the four motor control circuits and also increases the sensitivity of the reflected power monitor circuit. When the MODE switch is not in the CPLR TUNE position, relays K1 and K2 are deenergized and the motor control circuits are disabled to prevent inadvertent changing of the antenna coupler settings by the radio operator while in an operating mode.

4.4.2 COARSE INPUT CONTROL CIRCUITRY

The coarse input switch, S1, is positioned by motor B1 through the "open seeking"

contacts of S1B. In the following discussion, assume that the MODE switch on the GSB-900 is in the CPLR TUNE position: Relay K2 is energized and one side of K3 is therefore grounded. Assume that switch position #2 on the COARSE INPUT switch of the Antenna Tuning Control has been selected. +28 volts will appear on pin K of J2 in the GCU-910 coupler and therefore on S1B terminal 2. The +28V will appear on the wiper (terminal 8) of S1B. Relay K3 will be energized and motor B1 will rotate switch S1. When the switch reaches position 2, the open-seeking contact will be broken, K3 will deenergize and stop the motor. When K3 is deenergized, the motor winding is also shorted by K3 applying dynamic braking to quickly stop the motor.

4.4.3 COARSE OUTPUT CONTROL CIRCUITRY

Operation of this circuit is identical to the coarse input circuitry described in 4.4.2 above except that relay K4 is operated by the open-seeking contacts of switch S6B and motor B4 is energized.

4.4.4 FINE INPUT CONTROL CIRCUITRY

Assume that the variable capacitor is at neither its clockwise or counterclockwise limit. Microswitches S2 and S3 in the GCU-910 will therefore both be in their normally-open state as indicated on the schematic (i.e. diodes CR7 and CR8 will be shorted). Assume also that the GSB-900 MODE switch has been placed in the CPLR TUNE position, resulting in the energizing of K2. Rotation of the FINE INPUT switch, 1A2S3 in the Antenna Tuning Control one position clockwise will result in voltage being applied to motor B2 through the dropping resistor R1 and switch contacts 1 and 3 of the FINE INPUT switch. Also, ground will be applied to the other side of the motor through FINE INPUT switch contacts 7 and 9 and microswitches S2 and S3 in the GCU-910. This will result in slow rotation of C14 towards maximum capacity. Rotation of the FINE INPUT switch to its second clockwise position shorts R1 and therefore applies full +28V to motor B2 resulting in rapid rotation of C14 towards maximum capacity. When C14 reaches its clockwise end limit (at maximum capacity), microswitch S3 opens, diode CR8 is reverse biased, removing voltage from the motor, and the FINE INPUT end limit light on the Antenna Tuning Control, DS1, is powered through the normally-open contacts on S3 and R11 in the GCU-910.

Operation with the FINE INPUT switch rotated counterclockwise is identical to the above except one side of the motor is grounded through contacts 1 and 12 of 1A2S3 and voltage is applied to the other side of the motor through contacts 7 and 6 (in the slow speed position) and contacts 7 and 5 (in the rapid position). At the counterclockwise end limit of C14 (minimum capacity), microswitch S2 opens, reverse biasing CR7 and therefore removing voltage from the motor. The FINE INPUT end limit light is powered through the normally-open contacts of S2 and dropping resistor R11 in the Antenna Coupler.

4.4.5 TUNE CONTROL CIRCUITRY

Operation of the TUNE control circuitry is identical to that of the FINE input control circuitry described in 4.4.4 above except that motor B3, microswitches S4 and S5, diodes CR9 and CR10 and resistor R12 in the antenna coupler and 1A2S4, R3, R4 and DS2 in the Antenna Tuning Control determine operation of inductor L3 in the antenna coupler.

SECTION 5

MAINTENANCE AND REPAIR

5.1 PERIODIC MAINTENANCE

In order to assure continued trouble-free operation from the GCU-910 Antenna Coupler, the following periodic maintenance should be performed every 12 months (every 6 months if operated in a salty atmosphere as in marine applications).

1. Remove the cover from the GCU-910.

2. Inspect the rubber cover gasket for signs of deterioration and possible water leaks. Carefully clean the gasket using a solvent such as Trichloroethane.

3. Check all hardware and retorque if necessary.

4. Apply a small amount of molybdenum grease such as "MOLYKOTE"* type G to the roller bar and end bearings of roller inductor, L3. Rotate L3 through its adjustment range several times to evenly distribute the grease.

CAUTION

Molybdenum grease is a special electrically conducting lubricant. The use of regular petroleum-based grease will cause erratic operation and will void the equipment warranty.

5. Carefully check the antenna coupler for the presence of foreign matter and corrosion and thoroughly clean.

6. After the solvent (applied in step 2. above) has thoroughly dried, coat the rubber cover gasket with silicone grease. Remount the cover on the coupler taking care to apply even torque to all the screws.

5.2 TROUBLESHOOTING AND REPAIR

5.2.1 REQUIRED TEST EQUIPMENT

1. "THRULINE" wattmeter: Bird model 43 with 100 watt 2-30 MHz element

2. V.O.M., 20,000 ohms/volt: Simpson model 260 or equivalent

NOTE

The use of an electronic voltmeter such as a V.T.V.M. is not recommended in this application due to the possibility of R.F. pickup influencing the meter readings.

3. Dummy Load, 50 ohm, 80W: Bird model 81B or equivalent

4. Adapter: S0-239 to BNC

5. Adapter: type N to BNC (3 required)

6. Coax cable: 5 foot (approximately) RG-58/U coax terminated at both ends in male BNC connectors (2 required)

7. Adapter, tee, BNC, double female

*MOLYKOTE is the trademark of the Dow-Corning Corp.

5.2.2 TESTS

The following tests are to check for correct operation and to isolate faults to the component level

STEP No.	TEST	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK
1	Coarse Input Switching	Connect dummy load to ANTENNA jack 1A8A1 on GSB-900 using coax cable. Place MODE switch on GSB-900 in CPLR TUNE. Sequence COARSE INPUT switch through each of its 7 positions in clockwise direction. Repeat in counterclockwise direction	a) Correct indexing of switch in each position (refer to schematic) b) Proper mechanical centering on switch contacts.	a) If indexing fails to occur in one or more switch positions, check: 1) Antenna Tuning Control (5024-0423) for broken wire (+28 volts should appear on "COARSE INPUT #1" line with COARSE INPUT switch in position #1, etc). 2) GSB-900 Harness for broken wire 3) Remote Control Cable (5024-9050) for broken wire. 4) GCU-910 for broken wire. b) If indexing fails to occur in all 7 positions, check tune/operate relays K1 and K2 in the GCU-910, and associated system wiring. c) If the switch is not centered on its contact when the motor comes to rest (usually problem would be present in all switch positions), refer to section 5.3.1 and align switch.
2	Coarse Output Switching	Connect dummy load as in step 1. MODE switch in CPLR TUNE position. Sequence COARSE OUTPUT switch through all 6 positions in both clockwise and counterclockwise directions	a) Correct indexing of switch S6 in GCU-910 (refer to schematic). b) Proper mechanical centering of S6 in each position.	a) If indexing fails to occur in one or more switch positions, check: 1) Antenna Tuning Control for broken wire (+28V should appear on "COARSE OUTPUT #1" line with COARSE OUTPUT switch in position #1, etc. 2) GSB-900 harness for broken wire. 3) Remote Control Cable for broken wire. 4) GCU-910 for broken wire. b) If indexing fails to occur in all 6 positions, check tune/operate relays K1 & K2 and associated wiring. c) If switch is not centered on contact when motor comes to rest, refer to section 5.3.2 and align switch (usually this problem would be present in each position).

STEP No.	TEST	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK
3a	FINE INPUT Circuitry	Setup same as in steps 1 and 2 above. Rotate FINE INPUT switch clockwise (CW) to its first detent. If END LIMIT indicator lamp is illuminated, first rotate switch counterclockwise to move capacitor C14 off its end limit to mid capacity.	Slow rotation of C14 towards maximum capacity	a) B2, S2, S3, K2 and associated system wiring b) 1A2S3 and R1 in the Antenna Tuning Control
3b	FINE INPUT Circuitry (cont'd)	Same as 3a above. Rotate switch to 2nd CW detent (i.e. fully CW)	Rapid rotation of C14 towards maximum capacity Illumination of END LIMIT indicator (located over FINE INPUT switch) when C14 is within 10 degrees of maximum inductance	a) If motor stops but indicator does not illuminate, check: 1) DS1 in Antenna Tuning control-replace if burned out. 2) VBL CAP Limit wiring in GSB-900, Remote Control cable and GCU-910 3) Microswitch S3 in GCU-910 b) If limit circuitry operates properly but C14 is positioned greater than 10° from maximum capacity, refer to section 5.3.3 and align cam.
3c	FINE INPUT Circuitry (cont'd)	Setup same as in step 3a. Rotate FINE INPUT switch counterclockwise (CCW) to its first detent.	Slow rotation of C14 towards minimum capacity.	1A2S3 and R2 in Antenna Tuning Control and associated wiring.
3d	FINE INPUT Circuitry (cont'd)	Leave setup the same as in step 3a. Rotate switch to second CCW detent.	Rapid rotation of C14 towards minimum capacity. When C14 is within 15 degrees of minimum capacity, END LIMIT indicator located over FINE INPUT switch should illuminate.	a) If motor stops but indicator does not illuminate, check microswitch S2 in the GCU-910 and associated wiring. b) If limit circuitry operates properly, but capacitor is positioned greater than 15° from minimum capacity, refer to section 5.3.3 and align cam.

STEP No.	TEST	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK
4a	TUNE Circuitry	Setup same as in steps 1 and 2. Rotate TUNE switch to its first CW detent. (If END LIMIT indicator is illuminated, first rotate switch fully CCW until L3 rotates approximately 10 turns off its end limit.)	Slow rotation of L3 towards maximum inductance.	a) B3, S4, S5, K2 and associated system wiring. b) 1A2S4 and R3 in Antenna Tuning Control.
4b	TUNE Circuitry (cont'd)	Leave setup as in 4a above. Rotate TUNE switch to its 2nd CW detent (i.e. fully CW).	Rapid rotation of L3 towards maximum inductance. Illumination of END LIMIT indicator over TUNE switch when L3 is within 1/4 turn of maximum inductance.	a) If motor stops but indicator doesn't illuminate, check: 1) DS2 in Antenna Tuning Control, replace if burned out. 2) VBL IND LIMIT wiring in GSB-900, Remote Control Cable, and GCU-910 3) Microswitch S5 in GCU-910 b) If limit circuitry operates properly, but inductor is positioned greater than 1/4 turn from maximum inductance, or roller wheel hits end of coil termination refer to section 5.3.4 and align stop mechanism.
4c	TUNE Circuitry (cont'd)	Setup same as in step 4a. Rotate TUNE switch to its first CCW detent.	Slow rotation of L3 towards minimum inductance.	1A2S4 and R4 in Antenna Tuning Control and associated wiring.
4d	TUNE Circuitry (cont'd)	Setup same as in step 4a. Rotate TUNE switch to its 2nd CCW detent (i.e. fully CCW).	Rapid rotation of L3 towards minimum inductance. Illumination of END LIMIT light over TUNE switch when L3 is within 1/4 turn of minimum inductance.	a) If motor stops, but END LIMIT indicator doesn't illuminate, check microswitch S4 in GCU-910 and associated wiring. b) If limit circuitry operates properly, but inductor is positioned greater than 1/4 turn from minimum inductance, or roller wheel hits end of coil termination refer to section 5.3.4 and align stop mechanism.

STEP No.	TEST	PROCEDURE	REQUIRED PERFORMANCE	IF FAULTY, CHECK
5a	RF Wattmeter Assy	Place GSB-900 MODE switch in OFF position and disconnect GSB-900 from power line. Disconnect dummy load from GSB-900 (added in step 1) and connect the coax cable between the GSB-900 and GCU-910. Disconnect the BNC connector, P4 in the GCU-910 RF wattmeter assy and connect the dummy load to J4 on the RF wattmeter using coax cable. Connect the GSB-900 to the power line and set GSB-900 FREQUENCY to 1.6 MHz. Set MODE switch in CPLR TUNE position.	1. Meter on Antenna Tuning Control reads approximately 0.25 relative power with METER switch in the FWD position. 2. Meter also reads less than 0.05 relative power with switch in REFL position.	a) Defective component in RF Wattmeter-check and replace. If component is replaced, refer to section 5.2.8 and align assembly. b) Broken wire in GCU-910, Remote Control cable or GSB-900 c) Defective meter or switch 1A2S5 in Antenna Tuning Control. d) RF Wattmeter out of alignment. Proceed to section 5.3.6.
5b	RF Wattmeter (cont'd)	Same as 5a above but set FREQUENCY to 9.9 MHz	Same as 5a above.	Same as 5a above
5c	RF Wattmeter (cont'd)	Same as 5a above but set FREQUENCY to 29.9 MHz	Same as 5a above	Same as 5a above
5d	RF Wattmeter (cont'd)	Remove power from GSB-900. Disconnect dummy load from J4 and reconnect P4 to J4.		
6	Complete Check	Perform checks of Section 3.3.		

5.3 ALIGNMENT PROCEDURES

5.3.1 COARSE INPUT SWITCH (S1) INDEXING

a) Terminate the GSB-900 with the dummy load, using coax cable.

b) Place the GSB-900 MODE switch in CPLR TUNE.

c) Sequence the COARSE INPUT switch through each of its positions and note the direction of indexing error.

d) Remove power from the GSB-900 by placing the MODE switch at off and disconnecting the radio from the power line.

e) Loosen the two nuts (marked "A" in figure 5.1) securing switch S1 to the L-shaped mounting bracket and rotate the front and rear sections of this switch in opposite directions to properly correct the indexing error.

f) Secure the nuts loosened in step e).

g) Repeat steps b) through f) until proper indexing is obtained.

NOTE

A small difference in indexing between clockwise and counterclockwise rotation of switch S1 may be noted. This is due to the inertia in the motor and switch assembly. The above alignment adjustments should be set for the best compromise between CW and CCW rotation.

5.3.2 COARSE OUTPUT SWITCH (S6) INDEXING

a) Follow steps a) and b) in paragraph 5.3.1 above.

b) Sequence the COARSE OUTPUT switch through each of its positions, both in a clockwise and counterclockwise direction and carefully note the direction of indexing error. Remove power from the GSB-900.

NOTE

It is normal for small differences in indexing between CW and CCW rotation of S6 to exist due to motor and switch inertia. The proper indexing adjustment is with equiangular error between CW and CCW rotation.

c) Loosen the two screws (marked "B" in figure 5.1) securing the front (phenolic) switch section S6B to the L-shaped motor mounting bracket and carefully rotate S6B in the proper direction to correct the alignment error. Tighten the screws.

d) Reconnect power to the GSB-900 and repeat steps a) through c) until proper indexing is obtained.

5.3.3 FINE INPUT CAPACITOR END LIMITS

a) Follow steps a) and b) in paragraph 5.3.1 above.

b) Rotate the FINE INPUT switch alternately fully clockwise and full counterclockwise and carefully note the positions where the capacitor, C14, in the GCU-910 comes to rest. If:

1) the capacitor comes to rest greater than 10 degrees from either maximum or minimum capacity,
OR
2) the capacitor hits its mechanical stop at either the maximum or minimum capacity end,

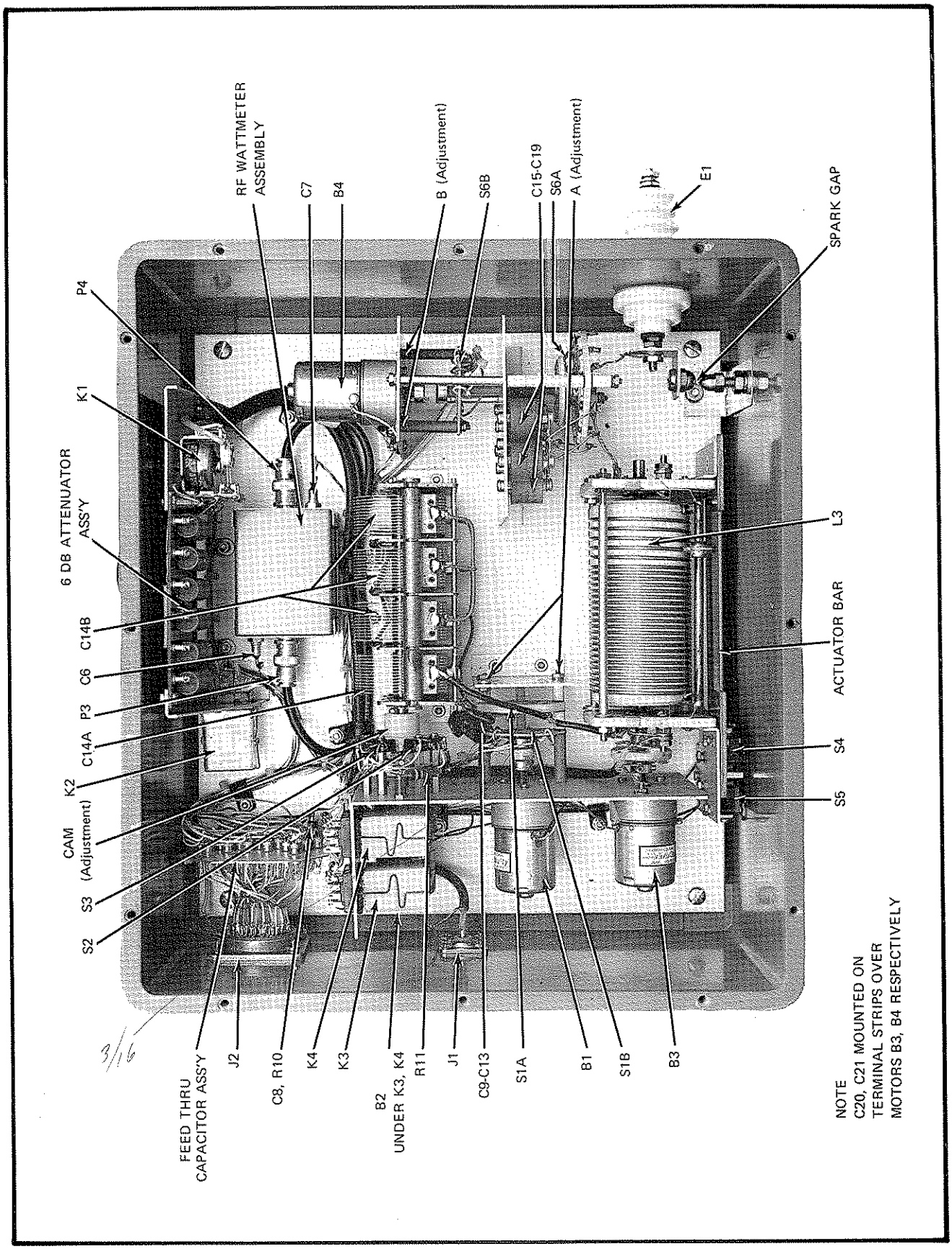


Figure 5.1 Parts and Alignment Points Location

Proceed to step c). If neither condition is present, alignment is not required.

c) Loosen the set screw securing the plastic cam to the shaft of the tuning capacitor.

d) Loosen the set screw securing the coupling between the capacitor and motor shafts, at the capacitor end of the coupling.

e) Manually rotate the tuning capacitor so that it is approximately 15 degrees from maximum capacity. (Plates meshed)

f) Holding the tuning capacitor in this position, rotate the plastic cam until S3, (left microswitch viewing the coupler from the connector end) just releases. Temporarily tighten the set screw securing the cam to the capacitor shaft. Do not tighten motor coupling set screw at this time.

g) Manually rotate the tuning capacitor towards minimum capacity. (Plates not meshed) Check that S2, (right hand microswitch viewed from the connector end of the coupler) releases when the capacitor is approximately 15 degrees from minimum capacity. If necessary, readjust the plastic cam so that the points at which the two microswitches release are at equiangular spacing from maximum and minimum capacity.

h) Carefully tighten the set screws on the motor coupling and cam.

5.3.4 TUNE INDUCTOR END LIMITS

a) Place the MODE switch on the GSB-900 in the OFF position and disconnect the GSB-900 from the power line.

b) Loosen the mounting screws of microswitches S4 and S5 (located on the side of the front mounting bracket of the roller inductor.

c) Move both microswitches in the proper direction to correct the end limit alignment. S4 is actuated at minimum inductance (roller at antenna hi-voltage insulator end of coil). Retorque all screws.

NOTE

When the alignment is complete, there should be less than 1/32 inch free play between the actuator arm and the microswitch actuators. This may be checked by manually pushing the actuator arm back forth and measuring with a rule.

d) If correct alignment still cannot be obtained, a worn actuator arm should be suspected and it should be replaced.

5.3.5 SPARK GAP

The spark gap on the output of the antenna coupler should be set at a nominal spacing of 0.25 inches. If the chassis has been removed from the case, this setting should be rechecked. The setting may be adjusted by loosening the nut under the wing nut on the ground post, E2, and turning the threaded rod until the proper spacing is obtained. Retorque the nut and recheck the spacing.

5.3.6 RF WATTMETER ALIGNMENT

RF Wattmeter alignment is normally necessary only if a component has been replaced in the RF Wattmeter assembly. Proceed as follows:

a) Connect the ANTENNA jack 1A8J1 on the GSB-900 to the GCU-910;

b) Make sure that the GSB-900 is disconnected from the power line.

c) In the GCU-910, disconnect BNC connector P4 from the R.F. Wattmeter assembly. Connect a coaxial cable between J4 on the RF wattmeter and the dummy load.

d) Press in on the sides of the cover of the RF Wattmeter assembly and remove the cover.

e) Reconnect power to the GSB-900 and place the MODE switch in the AM position. Set the XMIT GAIN control fully counterclockwise.

f) Depress the push-to-talk (PTT) button on the microphone.

g) Set the METER switch on the Antenna Tuning Control to REFL (reflected power). Adjust trimmer capacitor C2 (the trimmer nearest the connector end of the GCU-910) for minimum meter reading. Release the PTT button.

h) Place the MODE switch at OFF and disconnect power from the GSB-900.

i) Disconnect the coaxial connector, P3, from J3 on the wattmeter assembly. Disconnect the dummy load from J4 and connect it to J3 on the wattmeter assembly. Connect a double female BNC connector to P3 and connect it to J4 on the RF Wattmeter assembly using a short piece of coaxial cable terminated in BNC connectors.

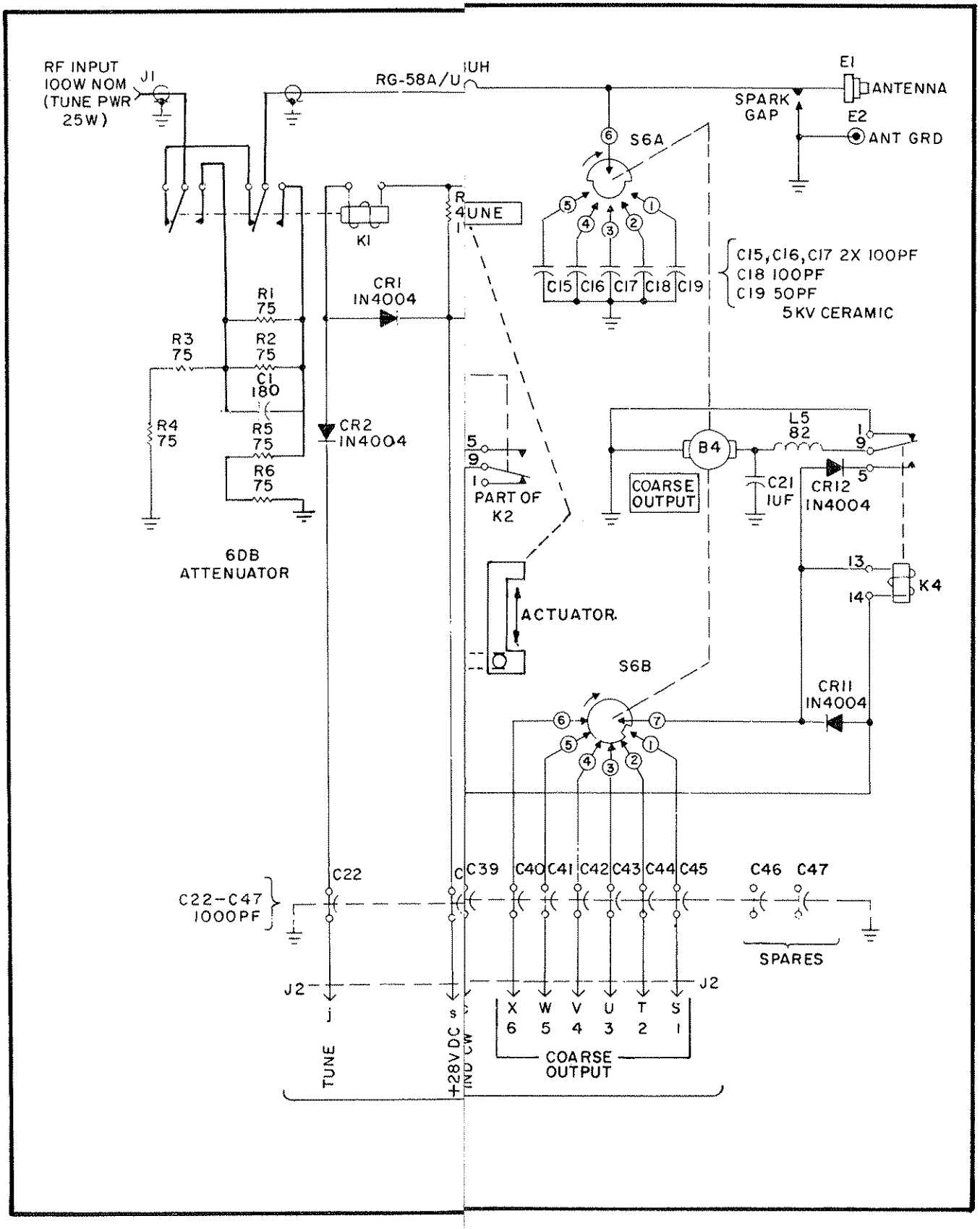
j) Reconnect the GSB-900 to the power line, and place the MODE switch in the AM position.

k) Place the METER switch on the Antenna Tuning Control in the FWD (forward power) position.

l) Depress the PTT button on the microphone. Adjust trimmer capacitor C3 in the wattmeter assy (the capacitor furthest from the connector end of the coupler) for minimum meter reading.

m) Place the GSB-900 MODE switch at OFF and disconnect the GSB-900 from the power line. Disconnect the dummy load. Reconnect P3 to J3 and P4 to J4 on the RF Wattmeter assembly.

n) Replace the cover on the RF Wattmeter assembly, making sure the cover snaps in place.



gure 5.2 Schematic: GCU-910 Antenna Coupler

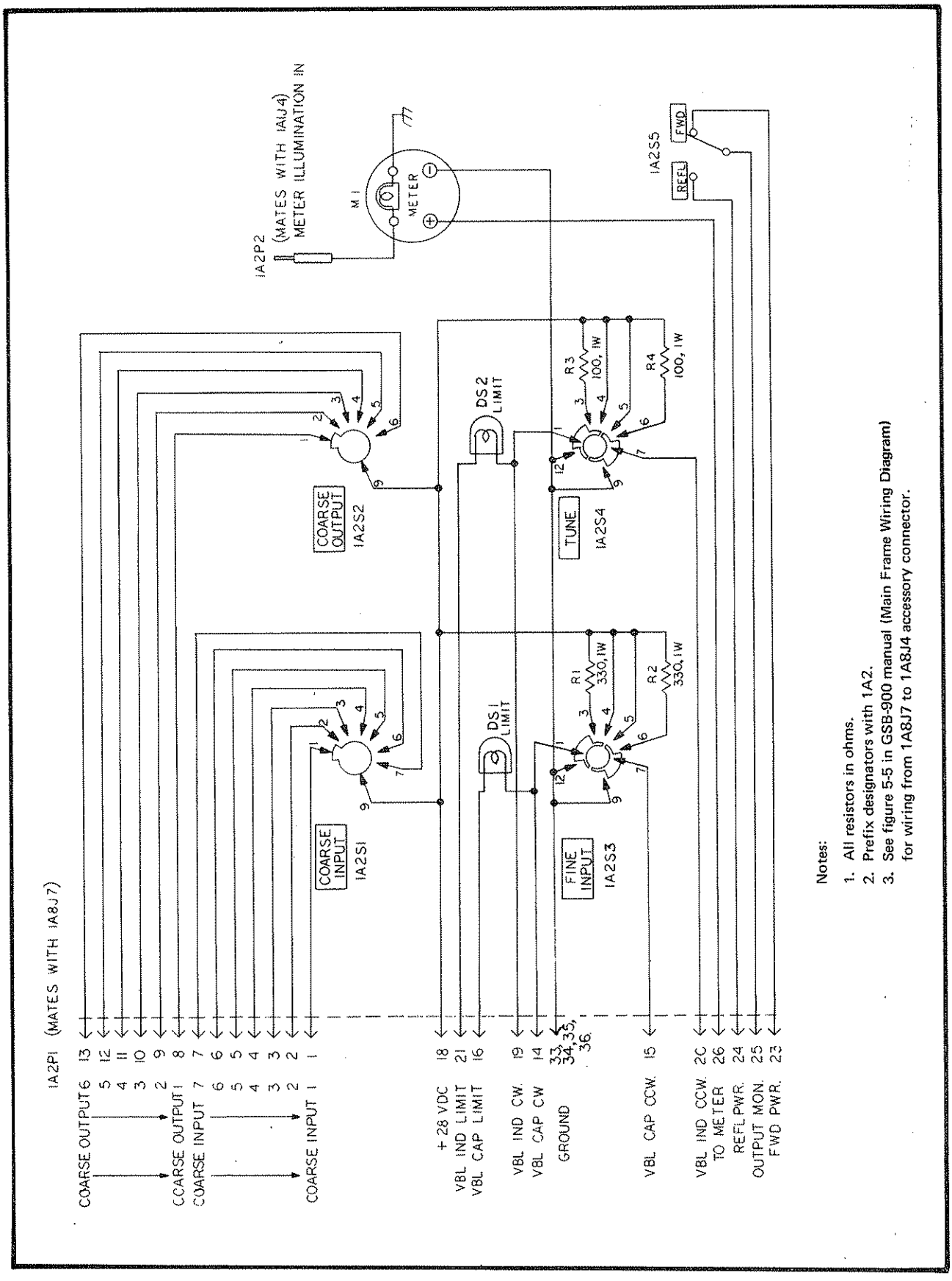


Figure 5.3 Schematic: Antenna Tuning Control Unit

SECTION 6
APPENDIX

6.1 PARTS LIST

CIRCUIT DESIGNATOR	DESCRIPTION	SUNAIR PART NUMBER
	RF Wattmeter Assembly	5024-2020
–	Enclosure with cover	5024-2023
–	Terminal Strip	85907
C2	Capacitor, var, cerm, 2-8PF	26822
C3	Capacitor, var, cerm, 2-8PF	26822
C4	Capacitor, mica, 220PF, 5%	28325
C5	Capacitor, mica, 220PF, 5%	28325
C6	Capacitor, feedthru, 1000PF, 20%	27644
C7	Capacitor, feedthru, 1000PF, 20%	27644
CR3	Diode, silicon, 1N3064	40526
CR4	Diode, silicon, 1N3064	40526
J3	Connector, RF, BNC	74374
J4	Connector, RF, BNC	74374
L1	Inductor, 2 MH, 99MA	65359
L2	Inductor, 2 MH, 99MA	65359
R7	Resistor, carb, 56 ohm, 5%, 1W	19720
R8	Resistor, carb, 56 ohm, 5%, 1W	19720
T1	Transformer, current	5024-2027
	Motor/Switch Assembly	5024-2030
–	Motor Mounting Bracket	5024-2013
–	Switch Support Bracket	5024-2014
B1	Motor, 24 V.D.C.	5024-2041
B2	Motor, 24 V.D.C.	5024-2042
B3	Motor, 24 V.D.C.	5024-2043
C9 thru C13	Capacitor, mica, 2000 pf, 2%	28141
C20	Capacitor, mylar, 1.0 uf, 100V	27230
CR5 thru CR8	Diode, silicon, 1N4004	40518
CR11, CR12	Diode, silicon, 1N4004	40518
K3	Relay, 4PDT	66688
K4	Relay, 4PDT	66688
L4	Inductor, 82 uH	64654
L5	Inductor, 82 uH	64654
R11	Resistor, carb, 220 ohm, 10%, 1W	19719
S1A	Switch section, 1 pole, 6 pos, progressive short	5024-2025
S1B	Switch section, 1 pole, 12 pos, open seeking	5024-2024

CIRCUIT DESIGNATOR	DESCRIPTION	SUNAIR PART NUMBER
	Motor/Switch Assembly—Con't.	
S2	Switch, micro, SPDT, 5A, 250V, with roller	34556
S3	Switch, micro, SPDT, 5A, 250V, with roller	34556
XK3	Socket, relay	76700
XK4	Socket, relay	76700
—	Spring, retaining, relay	87826
—	Coupling, nylon, 1/4 in. to 1/4 in.	34577 (see note 1)
—	Coupling, nylon, 3/16 in. to 3/16 in.	34544 (see note 1)
—	Coupling, ceramic, 1/4 in. to 1/4 in.	52653
—	Adapter, reducing, 1/4 in. to 3/16 in.	52654
—	Shaft, fiberglass	33353-3
	RF Attenuator Assembly	5024-2035
—	Terminal Board	5024-2033
—	Bracket, mounting	5024-2031
—	Spring, retaining, relay	87826
—	Standoff, insulated, 4-40	50639
C1	Capacitor, mica, 180 PF	29410
CR1, 2	Diode, silicon, 1N4004	40518
K1	Relay, RF, 5A, DPDT, 12V coil	66731
K2	Relay, 4PDT, 12V coil	66664
R1 thru R6	Resistor, non inductive, 75 ohm, 14W	19130
R9	Resistor, carb, 1.8K, 10%, 1/4W	17819
R13	Resistor, carb, 470 ohm, 10%, 1W	16528
R14	Resistor, carb, 560 ohms, 10%, 1/4W	18320
XK2	Socket, relay	76700
	Feedthru Capacitor Assembly	5024-2040
—	Bracket, mounting	5024-2034
C22 thru C47	Capacitor, feedthru, 1000 pf	25866
C8	Capacitor, tant, 6.8 uF, 15V	29678
R10	Resistor, carb, 5.1K, 5%, 1/2 W	18370
	Capacitor, Variable, Assembly	5024-2044
—	Bracket, mounting	5024-2016
C14	Capacitor, variable, air, 4 section, 532 pf/section	5024-2039
—	Gear blank, modified (cam)	5024-2029

Note 1. The coupling between the motor shaft and switch shaft in the GCU-910 actually consists of a 3/16 in. to 1/4 in. coupling which is made by combining part numbers 34577 and 34544. If replacement is necessary, both parts must be ordered.

SUNAIR ELECTRONICS INC

ENGINEERING CHANGE NOTICE

NUMBER 5024-245

DATE 10-16-74

TITLE

Motor/Switch Assy. B/M 5024-2030
Output Capacitor Assy. B/M 5024-2045

MODEL: GCU-910

DWG/NEW REV.: See title

ORIGINATOR Jacks

DATE 10-8-74

ASSEMBLIES AFFECTED
5024-2030
5024-2045

S/N When 34636

EFFECTIVE availab

DATE EFFECTIVE

DESCRIPTION OF CHANGE

1. On B/M 5024-2030, page 2 of 4
   a. Add "effectivity: when 34636 is available"
   b. Delete item 3, 34577, Coupling, Nylon, 1/4-1/4
   c. Delete item 4, 34544, Coupling, Nylon, 3/16-3/16
   d. Add item 3, 34636, Qty. 2, Fat 3, Top 12, Coupling, Flexible, 3/16-1/4
   e. Add item 4, 50216-2, Qty.8,Fat12, Top12, Set Screw,Bristol,4-40,1/81g
   f. Add note to item 5, 52653:"When stock is depleted, use 34636."
   g. Add note to item 6, 52654,"When stock of 52653 is depleted, Delete thi

2. On B/M 5024-2045, page 1 of 3
   a. Add "effectivity: When 34636 is available"
   b. Delete item 13, 34577, Coupling, Nylon, 1/4-1/4
   c. Delete item 14, 34544, Coupling, Nylon, 3/16-3/16
   d. Add item 13, 34636, Qty. 1, Top 12, Coupling, Flexible, 3/16-1/4
   e. Add item 14, 50216-2, Qty.4, Top 12, Set screw, Bristol, 4-40, 1/81g.

REASON FOR CHANGE: To improve Coupling reliability, and reduce cost.

PURCHASING Purchase P/N34636. Do not purchase 52653 for future.

PRODUCTION Use P/N 34636, when available, on all couplings except motor to inductor: Continue to use P/N 52653 until stock is depleted, then use P/N 34636.

PARTS DISPOSITION	USE AS IS	REWORK	SCRAP	NOTED ABOVE	N A
PARTS - RAW MATERIALS				X	
ROCESS MBLIES	X				
PLETED MBLIES	X				
ED UCTS	X				

DOCUMENTATION AFFECTED BY THIS CHANGE ACTION
Check in "A" column denotes revision has been completed.
Check in "B" column denotes follow-up action is required.

DESCRIPTION	A	B	RESPONSIBILITY
ENG. DRAWING			
BILL OF MATERIAL	X	X	EK
KIT LIST	X	X	EK
INSTRUCTION MANUAL			
SERVICE BULLETIN			
PARTS BOOK			
OPERATIONS SHEET		X	CH
PRODUCTION SAMPLE		X	CH
BUY CARD		X	GK
PRODUCTION CONTROL			

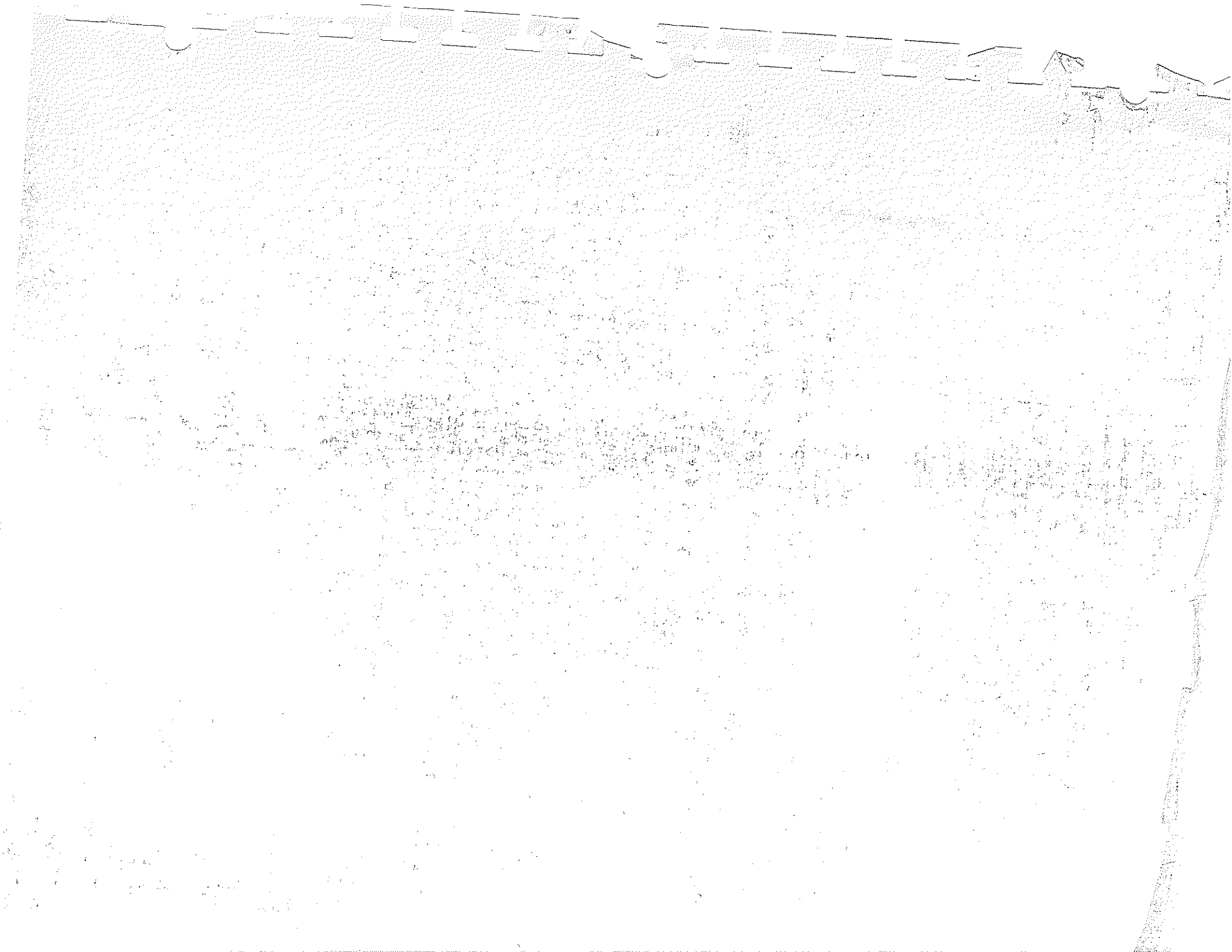
APPROVALS

REVIEWER [signature] 12/3/74 DAT

PROJ. ENG. [signature] 12/3/74 DAT

CHIEF ENG. [signature] 12/3/74 DAT

GEN. MGR. [signature] DAT



CIRCUIT DESIGNATOR	DESCRIPTION	SUNAIR PART NUMBER
	CABLE,INTERCONNECTING,CONTROL	
P2(Coupler End)	Connector,37 pin, MS3106E(28-21S)	74764
P4(Radio End)	Connector,37 pin, MS3106E(28-21P)	75469
	Cable, 27 cond. Shielded & Jacketed	5024-9050
	Tubing, PVC, 3/16 ID	59245

6.2 DEPOT SPARE PARTS KIT (PART NUMBER 5024-9005)

CIRCUIT DESIGNATOR	QTY	DESCRIPTION	SUNAIR PART NUMBER
B3	2	Motor, 24 V.D.C., inductor drive	5024-2043
B2	2	Motor, 24 V.D.C., Var. cap. drive	5024-2042
B1, B4	3	Motor, 24 V.D.C. in/out cap. dr.	5024-2041
S1A	2	Switch section	5024-2025
S1B, S6B	2	Switch section	5024-2024
S6A	1	Switch section	5024-2026
S4, S5	4	Switch, micro	34616
S2, S3	4	Switch, micro	34556
K1	2	Relay, R.F.	66731
K2	2	Relay, 4PDT	66664
K3, K4	4	Relay, 4PDT	66688
L3	2	Inductor, var, 18 uH	5024-2046
C14	3	Capacitor, var., air, 4 X 532 pf	5024-2039
CR1, CR2, CR5 thru CR12	8	Diode, silicon, 1N4004	40518
R1 thru R6	4	Resistor, non inductive, 75 ohm, 14W	19130
C22 thru C47	5	Capacitor, feedthru, 1000 pf	25866
1A2S1 (on 5024-0423 assy)	2	Switch, coarse input	5024-0427
1A2S2 (5024-0423 assy)	2	Switch, coarse output	5024-0428
1A2S3,S4 (5024-0423 assy)	3	Switch, fine input and tune	5024-0426
1A2DS1,DS2(5024-0423 assy)	4	Indicator, end limit	84087
1A2M1 (5024-0423 assy)	2	Meter	5024-0422
— — — —	5	Bulb, type 330 (for 1A2M1)	87852
1A2S5 (5024-0423 assy)	3	Switch, toggle, fwd/refl power	33461
1A2R1,R2 (5024-0423 assy)	5	Resistor, carb, 330 ohm, 1W	16530
1A2R3,R4 (5024-0423 assy)	5	Resistor, carb, 100 ohm, 1W	16554
— — — —	2	Marine Sealant (3 oz. tube)	86511
— — — —	1	Lubricant, MOLYKOTE type G (3 oz.)	84095

CIRCUIT DESIGNATOR	DESCRIPTION	SUNAIR PART NUMBER
	Output Capacitor Assembly	5024-2045
–	Bracket, motor mounting	5024-2015
–	Capacitor/switch support bracket	5024-2017
B4	Motor, gear, 24 V.D.C.	5024-2041
S6A	Switch section, 1 pole, 5 pos., progressive shorting	5024-2026
S6B	Switch section, 1 pole, 12 pos., open seeking	5024-2024
C15 thru C18	Capacitor, 100 pf, 5%, 5K.V.	29044
C19	Capacitor, 50 pf, 5%, 7.5 K.V.	29020
C21	Capacitor, mylar, 1 uF, 100V	27230
–	Shaft, fiberglass	33253-2
–	Coupling, nylon, 1/4 in. to 1/4 in.	34577 (see note 1)
–	Coupling, nylon, 3/16 in. to 3/16 in.	24544 (see note 1)
–	Rod, threaded, 5-40 by 4 5/8 in. long	50833
	Variable Inductor Assembly	5024-2050
L3	Inductor, variable roller, 18 uH	5024-2046
S4, S5	Switch, micro	34616
CR9, CR10	Diode, silicon, 1N4004	40518
–	Arm, actuator	5024-2036
–	Bracket, support, actuator	5024-2038
R12	Resistor, carb, 220 ohm, 10%, 1W	19719
	Chassis and Main Frame	
J2	Connector, 37 pin, MS3102C(28-21P)	74752
P3, P4	Connector, RF, BNC, UG88/U	74403
–	Enclosure, fiberglass, machined	5024-2022
J1	Connector, RF, UHF	74192
E1	Insulator, feedthru (antenna connector)	5024-2019
E2	Bracket, spark gap	5024-2018
	Nut, wing	50773
	ANTENNA TUNING CONTROL ASSY	
	(Mounted in GSB-900 Panel)	5024-0423
DS1	Lamp Assembly, Amber, 14V	84087
DS2	Lamp Assembly, Amber, 14V	84087
M1	Meter, Illuminated, 1ma	5024-0422
P1	Connector, 36 pin	75407
P2	Phone, Tip plug, Red	75368
S1	Switch, Rotary, Coarse Input	5024-0427
S2	Switch, Rotary, Coarse Output	5024-0428
S3	Switch, Rotary, Fine Input	5024-0426
S4	Switch, Rotary, Tune	5024-0426
S5	Switch, Toggle	33461
	Knob, w/dot	34606
R1,R2	Resistor 220 ohm 1W	19719
R3,R4	Resistor 75 ohm 3W	16944