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TECHNICAL MANUAL

FOR

ANTENNA COUPLER GROUP AN/SRA-34(V)

CHAPTER C
ANTENNA COUPLER
CU-1169/SRC-16

DEPARTMENT OF THE NAVY

NAVAL SHIP SYSTEMS COMMAND

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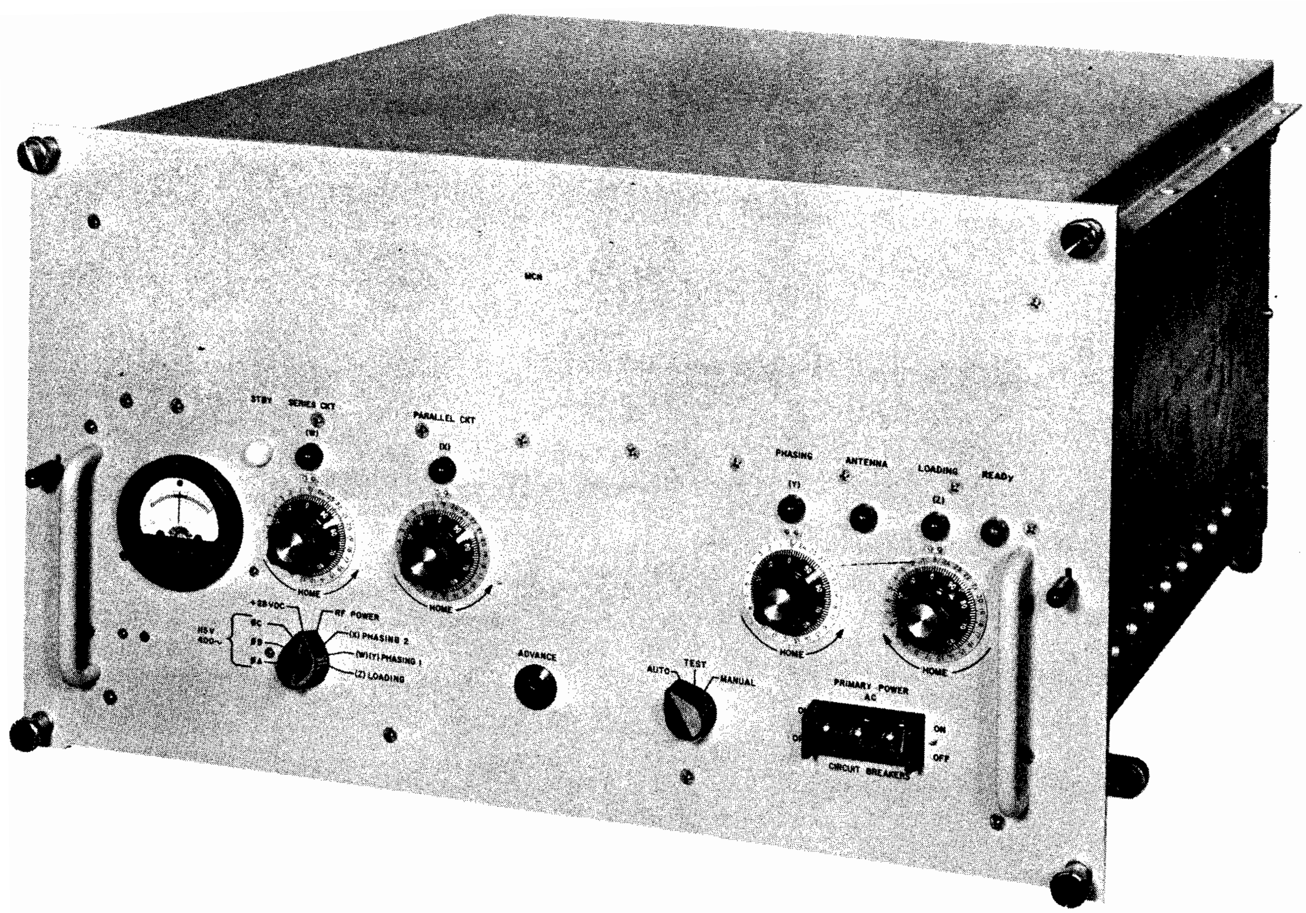

Figure 1-1. Antenna Coupler CU-1169/SRC-16

SECTION 1

GENERAL INFORMATION

1-1. SCOPE.

This chapter of the technical manual describes Antenna Coupler CU-1169/SRC-16. The chapter contains general information, operating instructions, troubleshooting procedures, and maintenance procedures. This chapter of the technical manual is in effect upon receipt. Extracts from this publication may be made to facilitate the preparation of other Department of Defense publications.

1-2. ASSOCIATED PUBLICATIONS.

The technical manual for Electronic Circuit Plug-in Unit Test Set AN/URM-158 contains the functional description and troubleshooting procedures for the following assemblies of the antenna coupler: power supply, electronic control amplifiers, antenna coupler servo control, and antenna coupler control. Reference is made to this manual at appropriate points throughout this chapter. The maintenance standards book for Antenna Coupler Group AN/SRA-34 includes the preventive maintenance procedures for Antenna Coupler CU-1169/SRC-16. Parts list information is included in chapter F of this technical manual.

1-3. GENERAL DESCRIPTION.

Antenna Coupler CU-1169/SRC-16 is shown in figure 1-1. The CU-1169/SRC-16 is an automatically tuned antenna multicoupler which provides sufficient frequency selectivity and isolation to permit up to eight receiver and/or transmitter combinations to operate simultaneously into a single 2- to 6-mc broadband antenna. Antenna Coupler CU-1169/SRC-16 operates over the frequency range of 2.000 mc to 5.999 mc and tunes automatically in response to control line information and rf energy supplied by associated equipment such as Radio Set AN/SRC-23(V). The CU-1169/SRC-16 tuning normally is completed within 30 seconds after initiation, although tuning time up to 1 minute, maximum, may sometimes be required.

1-4. REFERENCE DATA.

Frequency range .	2.000 mc to 6.000 mc.
Input impedance .	50 ohms nominal.
Antenna vswr (tuning range). .	4 to 1 (50 ohms) maximum.
Correct vswr (at power amplifier output)	1.33 to 1 (50 ohms) maximum.
Rf input power . .	6000 watts pep., 3000 watts average continuous, maximum. 100-watt average forward power required for automatic tuning and constant surveillance of antenna.
Efficiency	60 percent minimum.
Phase shift . . .	1 degree in 22 milliseconds, maximum.
Isolation, input to output	45 db minimum with channel frequencies separated 15 percent or more.
Isolation between inputs	50 db minimum with channel frequencies separated 15 percent or more.
Total distortion and noise. . . .	Not less than 120 db below the applied signal.
Control line inputs	Operate high power, reciever tune, and tune activate ground-on-line control signals are supplied by associated equipments.
Control line outputs	Tune complete, carrier insert, and alarm ground-on-line control signals are supplied by antenna coupler.
Primary input voltage	115 volts ±10 percent, 400 cps, 3-phase delta.
Primary input power	100 watts maximum.
Type of service . .	Continuous, unattended, remote.
Ambient temperature . .	0 to 50 °C (32 to 122 °F).
Ambient humidity	Up to 100-percent relative humidity.

Size	22-7/8 inches wide, 21-3/4 inches deep, 13-1/2 inches high.
Weight	140 pounds.
Mounting	Mounts in antenna coupler cabinet CY-4032/SRA-34(V).
Cooling.	Forced-air cooling is required and is supplied by a central blower in cabinet CY-4032/SRA-34(V).

1-5. PREPARATION FOR RESHIPMENT.

When the antenna coupler is prepared for shipment, it should be securely crated in a fabricated wooden case capable of withstanding the handling normally encountered in transit. Special packaging is not required except to protect the front panel controls and connectors protruding from the bottom of the unit. When technical manuals are shipped with the equipment, mark the packing case containing the manuals with the words TECHNICAL MANUALS INSIDE.

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SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

Antenna Coupler CU-1169/SRC-16 is packed in accordance with the best-known commercial practices. Normal care should be exercised in handling and unpacking the shipping container. After unpacking all units, perform the inspection checks of paragraph 2-4.

2-2. POWER REQUIREMENTS AND DISTRIBUTION.

Antenna Coupler CU-1169/SRC-16 requires a 115-volt, 400-cps, 3-phase delta-connected power source capable of delivering 100 watts. Provisions for adequate power are normally made by the installing activity. Power is supplied through Electrical Equipment Cabinet CY-4032/SRA-34(V) in which the antenna coupler is installed.

If primary power is disrupted for maintenance or other purposes, make certain that the phase sequence is restored as shown on the primary power distribution diagram in the installation section of chapter A. Proper phase sequence can be determined with a phase sequence indicator or by observing that the cabinet blowers are rotating in the direction indicated by the arrow on the blower case. If phase sequence is incorrect, reverse any two of the primary power leads entering the cabinet.

2-3. INSTALLATION REQUIREMENTS.

Make certain that the CU-1169/SRC-16 is secured in the cabinet slides and that it slides freely in both directions. Antenna Coupler CU-1169/SRC-16 should slide completely into the cabinet without the use of force. Forcing or slamming the couplers into the cabinet will damage the rf and control connectors. Examine the connectors at the bottom of the antenna coupler and on the cabinet shelves for deformation or misalignment.

a. INSTALLATION OF ANTENNA COUPLER CU-1169/SRC-16. - To install Antenna Coupler CU-1169/SRC-16 in Electrical Equipment Cabinet CY-4032/SRA-34(V), perform these steps in order. Mounting hardware is shown in figure 2-1.

(1) Extend cabinet slides until they lock in place.

(2) Place antenna coupler on cabinet slides, and engage two mitered retaining studs (B) on each side with grooves on antenna coupler sides (C).

(3) Push antenna coupler toward rear of cabinet (unit will move about 3 inches), and lock in place with two captive fasteners (D).

(4) Remove O-ring moisture seal washers from plastic envelope fastened to handle of coupler, and place these rings over rf connectors on bottom of unit so that they rest against the shoulders on these connectors.

(5) Release cabinet slide lock (A), and push antenna coupler firmly into the cabinet.

(6) Press in and turn clockwise four thumbscrews (see figure 3-1) to secure antenna coupler in place.

b. REMOVAL OF ANTENNA COUPLER CU-1169/SRC-16. - To remove Antenna Coupler CU-1169/SRC-16 from Electrical Equipment Cabinet CY-4032/SRA-34(V), perform these steps in order. Mounting hardware is shown in figure 2-1.

(1) Turn four thumbscrews counterclockwise (see figure 3-1) until thumbscrews are loose.

(2) Push up on two thumb-latch levers (see figure 3-1), and pull antenna coupler from cabinet as far as it will come.

CAUTION

If antenna coupler is to be operated in the extended position, be sure to connect the auxiliary blower and jumper cables according to the instructions in paragraph 5-2.

(3) Remove O-ring moisture seals from rf connectors, and place them aside until coupler is to be re-installed in cabinet.

(4) Turn two captive fasteners (D) counterclockwise as far as they will go.

(5) Pull antenna coupler about 4 inches further from cabinet, and lift coupler from cabinet slides.

2-4. INSPECTION.

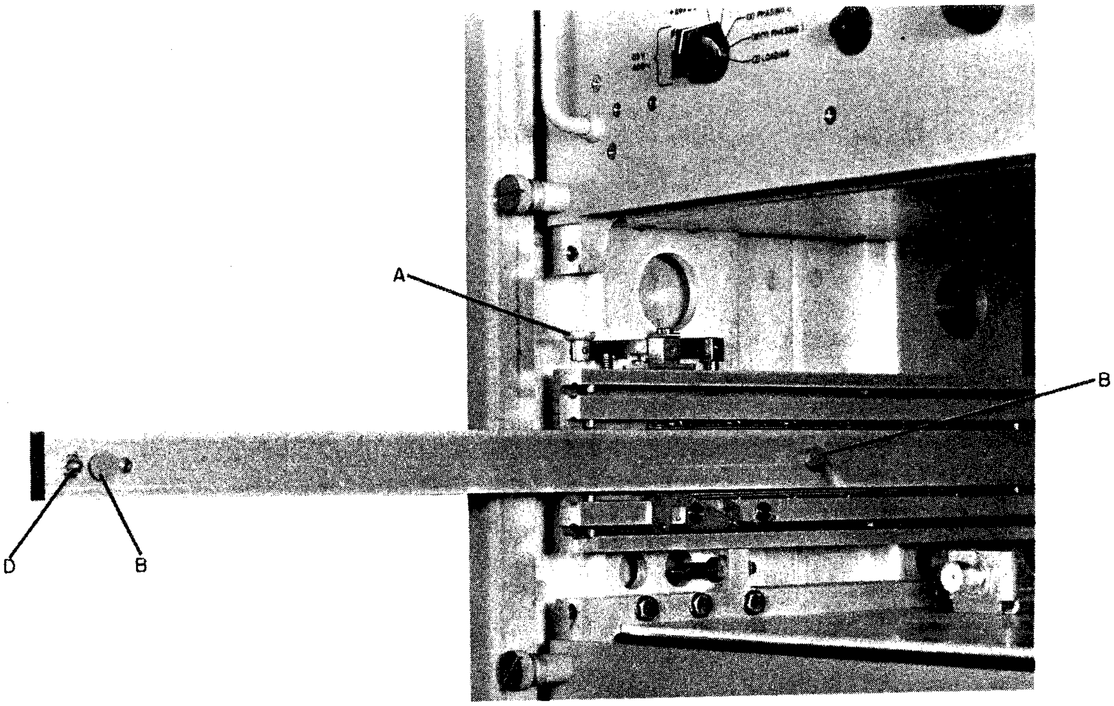
After the installing activity has completed installation of the equipment, perform the following mechanical checks.

a. Operate all front panel controls. Turn all tuning knobs through their full range of travel. Operation must be uniform and smooth.

b. Remove dust cover at top of unit. Check all subassemblies for secure mounting.

c. Check rf assemblies for secure mounting.

d. Inspect unit for obvious damage, particularly to the rf and control connectors at the bottom of the unit.



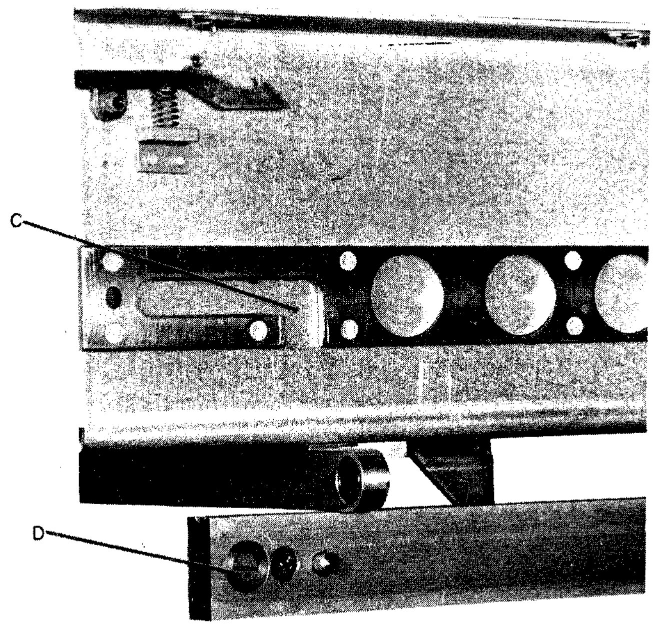


Figure 2-1. Antenna Coupler, Installation and Mounting Hardware

SECTION 3

OPERATION

3-1. FUNCTIONAL OPERATION.

Antenna Coupler CU-1169/SRC-16 operates automatically in response to control signals provided by associated equipment such as Radio Set AN/SRC-23(V). Front panel controls and indicators are provided for maintenance and emergency operation and for visual observation of correct operation.

Refer to the block diagram, figure 4-1. The antenna coupler is an rf tuning device composed of inductors and variable capacitors. When a radio channel is placed in operation, rf energy is supplied to the input of the antenna coupler. The phasing-loading discriminator and the phasing discriminator sense inaccuracies in the adjustment of the variable elements and, through a control circuit, cause servo motors to run. The servo motors are connected to the variable elements and drive them toward a point where the discriminators are able to sense no remaining tuning error.

The CU-1169/SRC-16 operates over the frequency range from 2.000 mc to 5.999 mc and has the capability of correctly tuning up to eight channels (each with its own antenna coupler), operating any combination of transmitters and receivers, into a common broadband antenna. The only restriction is that adjacent frequencies must be separated by at least 15 percent.

3-2. DESCRIPTION OF CONTROLS AND INDICATORS.

Table 3-1 lists the functions of antenna coupler controls and indicators. Refer to figure 3-1 for location of controls and indicators.

3-3. NORMAL OPERATING PROCEDURES.

Under normal circumstances, operation of Antenna Coupler CU-1169/SRC-16 is fully automatic and is controlled by control signals originating in the components of Radio Set AN/SRC-23(V). To energize the antenna couplers for operation, move the antenna coupler cabinet CIRCUIT BREAKER to the ON position. Move the POWER circuit breaker bar on each antenna coupler to the ON position. Check for approximately 115 volts on antenna coupler test meter when test selector switch is set to 115-volt, 400-cps ØA, ØB, and ØC. Check all three phases, and note that test meter indications are approximately equal for each phase. Finally, move the AUTO-TEST-MANUAL switch to the AUTO position. The equipment now is prepared for automatic operation. Cabinet doors may be closed, and no further attention is required. Make sure cabinet blowers are operating before closing cabinet doors and leaving the area.

TABLE 3-1. CONTROLS AND INDICATORS

CONTROL OR INDICATOR	FUNCTION
POWER ON circuit breakers	Protects 3-phase input power, and serves as off-on switch.
AUTO-TEST-MANUAL switch	
AUTO position	Enables antenna coupler to tune automatically in response to control information supplied by system.
TEST position	Used for maintenance only. Allows each tuning step to operate normally, but prevents the antenna coupler from advancing to the next tuning position until the ADVANCE pushbutton is operated.
MANUAL position	Prevents the antenna coupler from tuning automatically. Each tuning step must be performed manually, and indications must be derived from the test meter.

TABLE 3-1. (Continued)

CONTROL OR INDICATOR	FUNCTION
ADVANCE pushbutton	Advances antenna coupler tuning to the next step when the AUTO-TEST-MANUAL switch is in the TEST or MANUAL position and proper tuning sequence is followed.
Test selector switch	Selects the antenna coupler function to be monitored by test meter M1. Also causes the indicator light corresponding to the circuit being monitored to light with increased brilliance. Applies to the (X), (W), (Y), and (Z) positions only.
Test meter M1	Indicates voltage, rf power, or go-no-go status of the function selected by the test selector switch.
STBY indicator	Lights when antenna coupler is in the standby condition (ready for tuning).
SERIES CKT (W) tuning knob	For maintenance and emergency operation only. Knob is connected to variable capacitor C5 in series circuit.
SERIES CKT (W) indicator	Lights when series circuit is selected for tuning. Lights with increased brilliance when test selector is set to (W) (Y) PHASING 1 position.
PARALLEL CKT (X) tuning knob	For maintenance and emergency operation only. Knob is connected to variable capacitor C2 in parallel circuit.
PARALLEL CKT (X) indicator	Lights when parallel circuit is selected for tuning. Lights with increased brilliance when test selector is set to (X) PHASING 2 position.
PHASING (Y) tuning knob	For maintenance and emergency operation only. Knob is connected to variable capacitor C3 in phasing circuit.
PHASING (Y) indicator	Lights when phasing circuit is selected for tuning. Lights with increased brilliance when test selector is set to (W) (Y) PHASING 1 position.
LOADING (Z) tuning knob	For maintenance and emergency operation only. Knob is connected to variable capacitor C4 in loading circuit.
LOADING (Z) indicator	Lights when loading circuit is selected for tuning. Lights with increased brilliance when test selector is set to (Z) LOADING position.
ANTENNA indicator	Lights when loading and phasing circuits are tuning the broadband antenna.
READY indicator	Lights when the antenna coupler is completely tuned and ready for operation.

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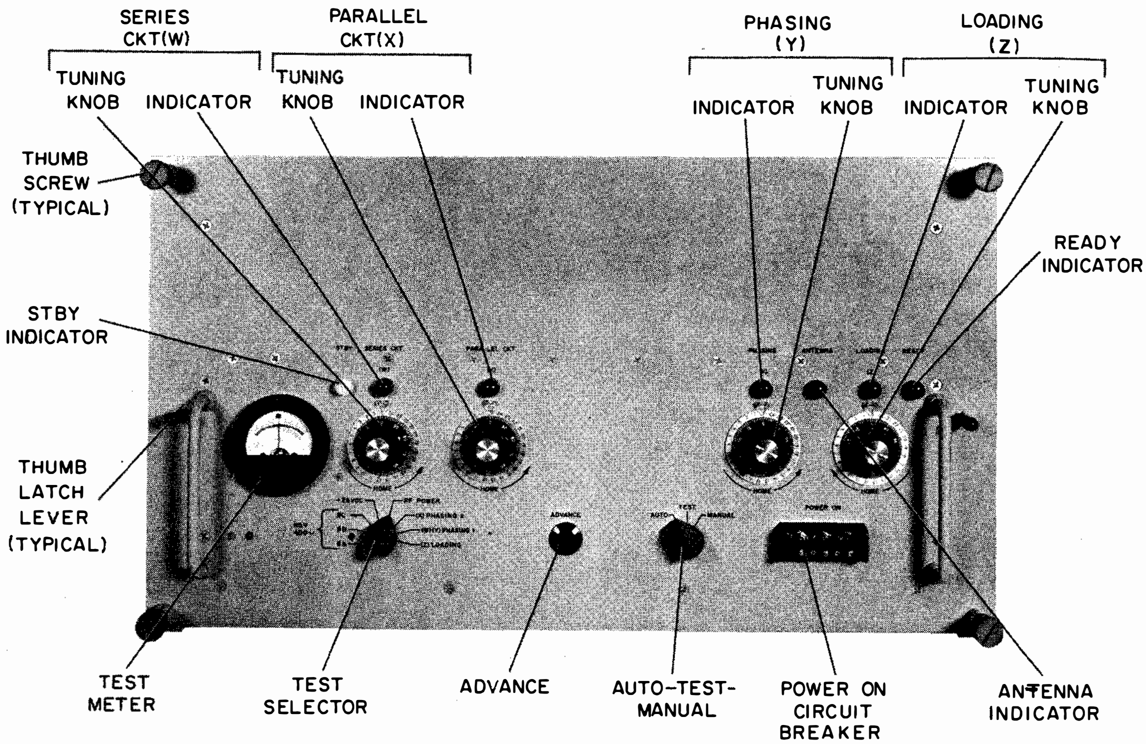

Figure 3-1. Antenna Coupler CU-1169/SRC-16,
Controls and Indicators

3-4. EMERGENCY OPERATING PROCEDURES.

a. AUTOMATIC TUNING FAILURE. - If any antenna coupler fails to tune automatically after the transmitter control TUNE - OPERATE pushbutton is pressed, perform the following steps:

(1) Move the antenna coupler AUTO-TEST-MANUAL switch to TEST and the test selector to (W) (Y) PHASING 1 (see figure 3-1). Press the ADVANCE pushbutton. If rf level is high enough, series circuit should tune, and test meter should indicate no error when tuning is completed. (Zero error is indicated when test meter pointer rests in the green area of the meter scale.)

CAUTION

Correct tuning points are indicated only when the test meter needle moves in the same direction the tuning knob is turned. Tuning on false tuning points will result in antenna coupler damage.

(2) Move the test selector to (X) PHASING 2, and press the ADVANCE pushbutton. The parallel circuit should tune, and the test meter should indicate no error when tuning is completed. (Zero tuning error is indicated when test meter pointer rests between 0 and -35 on meter scale.) If error is indicated, turn the PARALLEL CKT (X) tuning knob slightly to return the test meter pointer to within the proper limits. Be certain to tune on the correct tuning point. Refer to the caution following paragraph 3-4a(1).

(3) Move the test selector to (W) (Y) PHASING 1, and press the ADVANCE pushbutton. The phasing circuit should tune, and the test meter should indicate no error when tuning is completed. (Zero tuning error is indicated when test meter pointer rests in the green area of the meter scale.) Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4a(1).

(4) Press the ADVANCE pushbutton and, when tuning is completed, check both the (Z) LOADING and the (W) (Y) PHASING 1 test selector positions for tuning error. Correct manually if necessary. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4a(1).

(5) Press the ADVANCE pushbutton. If READY indicator is illuminated, antenna coupler is tuned and ready for operation.

If any of the preceding steps cannot be performed, follow the procedure of paragraph 3-4b below for manual tuning.

b. COMPLETE TUNING FAILURE. - In the event that an antenna coupler will not tune according to the above procedure, the following manual tuning steps can be performed. The antenna coupler must be supplied with primary power, and all control lines must be intact and delivering correct information.

(1) Move all four tuning knobs in the direction indicated by the HOME arrows on the antenna coupler front panel until the home stop is reached. Move the antenna coupler AUTO-TEST-MANUAL switch to MANUAL.

Note

If operating frequency is between 2.000 mc and 2.200 mc, turn the LOADING (Z) tuning knob to 12.00 before proceeding.

(2) Move test selector to (W) (Y) PHASING 1, and press the ADVANCE pushbutton. Turn the SERIES CKT (W) tuning knob away from home (clockwise) until the correct tuning point is found and the test meter needle is centered in the green area of test meter scale.

CAUTION

Correct tuning points are indicated only when the test meter needle moves in the same direction the tuning knob is turned. Tuning on false tuning points will result in antenna coupler damage.

(3) Move the test selector to (X) PHASING 2, and press the ADVANCE pushbutton. Turn the PARALLEL CKT (X) tuning knob away from home (clockwise) until the correct tuning point is found and the test meter needle rests between 0 and -35 on the meter scale. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4b(2).

(4) Move the test selector to (W) (Y) PHASING 1, and press the ADVANCE pushbutton. Turn the PHASING (Y) tuning knob away from home (clockwise) until the correct tuning point is found and the test meter needle is centered in the green scale area. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4b(2).

(5) Move the test selector to (Z) LOADING. Do not press the ADVANCE pushbutton. Turn the LOADING (Z) tuning knob away from home (counter-clockwise) until the correct tuning point is found and the test meter needle is centered in the green scale area. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4b(2).

(6) Move the test selector to (W) (Y) PHASING 1. Do not press the ADVANCE pushbutton. Turn the PHASING (Y) tuning knob in the opposite direction indicated by the test meter until the correct tuning point is found and the test meter needle is centered in the green scale area. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4b(2).

(7) Since the PHASING and LOADING controls interact, repeat paragraph 3-4b(4) and (5) a number of times until no error is indicated. With the test meter set to the correct position, always turn the tuning knobs opposite the direction indicated by the test meter to ensure tuning on the correct tuning point. (Refer to the caution, paragraph 3-4b(2).) If the antenna coupler is to be used with a receiver, omit paragraph 3-4b(8).

(8) Press the ADVANCE pushbutton. The ANTENNA indicator should light. Repeat paragraphs 3-4b(4), (5), and (6) until no tuning error is indicated. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4b(2).

(9) Press the ADVANCE pushbutton. The READY indicator should light. The antenna coupler is tuned and ready for operation.

c. PRESET TUNING PROCEDURE. - To tune antenna couplers using logged preset tuning information, perform the following steps:

(1) Move the antenna coupler AUTO-TEST-MANUAL switch to MANUAL.

(2) Set SERIES CKT (W) tuning knob to a predetermined setting according to previously logged tuning information. See example, table 3-2. Place radio channel in OPR. Press antenna coupler ADVANCE pushbutton. If the antenna coupler is to be used with a transmitter, more accurate tuning may be desired. Move the test selector to (W) (Y) PHASING 1, and manually adjust the SERIES CKT (W) tuning knob until the test meter pointer rests in the green area of meter scale. Be certain to tune on the correct tuning point.

CAUTION

Correct tuning points are indicated only when the test meter needle moves in the same direction the tuning knob is turned. Tuning on false tuning points will result in antenna coupler damage.

(3) Set PARALLEL CKT (X) tuning knob to predetermined setting according to previously logged tuning information. Press the antenna coupler ADVANCE pushbutton. If the antenna coupler is to be used with a transmitter, more accurate tuning may be desired. Turn PHASING (Y) tuning knob in the HOME direction until limit is reached. Move test selector to (X) PHASING 2, and manually adjust PARALLEL CKT (X) tuning knob until test meter pointer rests between 0 and -35 on the meter scale. Be certain to tune on the correct tuning point. Refer to the caution, paragraph 3-4c(2).

(4) Set PHASING (Y) and LOADING (Z) tuning knobs to predetermined setting according to previously logged tuning information. Press antenna coupler

TABLE 3-2. ANTENNA COUPLER FREQUENCY LOGGING CHART, TYPICAL

Antenna coupler subassembly number ____________________

Antenna coupler unit number ____________________

Antenna coupler MCN number ____________________

FREQUENCY (mc)	SERIES CIRCUIT (W)	PARALLEL CIRCUIT (X)	PHASING (Y)	LOADING (Z)

NOTES:
1. Record frequency to nearest kilocycle when antenna coupler has been tuned with AUTO-TEST-MANUAL switch in MANUAL position. Take readings just after paragraph 3-4b(6).
2. PARALLEL CIRCUIT (X) tuning is critical. Record knob setting with care.
3. PHASING (Y) and LOADING (Z) knob readings will change with changing antenna conditions. Refer to paragraph 3-4c(5) and (6) above.

ADVANCE pushbutton twice. ANTENNA indicator should light. If the antenna coupler is to be used with a transmitter, more accurate tuning may be desired. Proceed to paragraph 3-4c(5). If antenna coupler is to be used with a receiver, proceed to paragraph 3-4c(8).

(5) Move test selector to (W)(Y) PHASING 1, and adjust PHASING (Y) tuning knob until test meter pointer rests in the green area of meter scale. Be certain to tune on correct tuning point. Refer to the caution, paragraph 3-4c(2).

(6) Move test selector to (Z) LOADING, and adjust LOADING (Z) tuning knob until test meter pointer rests in the green area of the meter scale. Be certain to tune on correct tuning point. Refer to the caution, paragraph 3-4c(2).

(7) Repeat paragraph 3-4c(5) and (6) until no improvement can be made.

(8) Press the antenna coupler ADVANCE pushbutton. READY indicator should light. The antenna coupler is now ready for use.

SECTION 4

TROUBLESHOOTING

4-1. LOGICAL TROUBLESHOOTING.

a. HISTORICAL DATA AVAILABILITY. - When adequate historical data is not available, troubleshooting procedures should be based on the six logical steps given in system description, section 4 of chapter A, Antenna Coupler Group AN/SRA-34(V).

4-2. OVERALL FUNCTIONAL DESCRIPTION.

The antenna coupler is an automatically tuned antenna multicoupler which provides frequency selectivity and isolation to permit up to eight receiver and/or transmitter combinations to operate simultaneously into a single 2- to 6-mc broadband antenna. Antenna Coupler CU-1169/SRC-16 operates over the frequency range of 2.000 mc to 5.999 mc (2- to 6-mc band) and tunes automatically in response to control line information and rf energy supplied by associated equipment. Refer to the block diagram, figure 4-1, the tuning sequence, figure 4-2, and the schematic diagram, figure 5-18, of the CU-1169/SRC-16.

The transmission line from the power amplifier of the associated transmitter equipment must be a 50-ohm coaxial cable. In order to ensure maximum forward power transfer from the power amplifiers to the antenna, this coaxial cable must be terminated in a load which is 50 ohms resistive. When the antenna-antenna coupler combination is tuned properly, transmission line current and voltage are in phase, and the load is said to be phased properly. When the antenna-antenna coupler combination appears to have an impedance of 50 ohms, it is said to be loaded properly. Loading and phasing of the antenna circuit are accomplished by capacitors C3 and C4 arranged in an L-network which derives its energy from fixed inductor L3. Inductor L3 is coupled loosely to the high-Q parallel resonant circuit made up of variable capacitor C2 and fixed inductor L2.

Variable capacitor C4 varies the impedance level presented to the transmission line, and variable capacitor C3 varies the reactance type (inductive, capacitive, or resistive) presented to the transmission line. These variable elements effectively tune out the reactance and adjust the impedance level of the antenna over a vswr range of 4:1 (50 ohms).

Also, in order to operate in the duplex mode (simultaneous transmit and receive) using a common antenna, the antenna coupler must provide isolation for any receiver tuned to a frequency separated by at least 15 percent from other transmit or receive frequencies. The antenna coupler accomplishes this isolation using a system of low-Q series and high-Q parallel resonant circuits delivering rf power to a lightly coupled transformer secondary which feeds rf power to the antenna.

Refer to the block diagram, figure 4-1. The antenna coupler tunes in three general steps as follows:

a. SERIES CIRCUIT. - The series circuit (C5-L5) tunes to resonance. During tuning, the circuit is loaded with a 50-ohm resistor. After tuning, a resistor is placed in parallel with the circuit to reduce circuit Q.

b. PARALLEL CIRCUIT. - The parallel circuit (C2-L2) tunes to resonance. During tuning, capacitor C3 is shorted so the C2-L2 combination does not react to reflected reactances coupled from the antenna circuit.

c. PHASING CIRCUIT. - Capacitors C3 and C4 load and phase the broadband antenna so that the transmission line from the power amplifier is terminated (effectively) in 50 ohms resistive.

Refer to the block diagram, figure 4-1. The rf transmission line is sampled by a loading-phasing discriminator which reacts to impedances other than 50 ohms resistive. The error signal produced by the phasing portion of this discriminator is a dc voltage. This dc error voltage is converted to a 400-cps square-wave voltage and amplified by a servo amplifier. The servo-amplifier output is used to drive servo motor B5 which adjusts a variable element in the series trap circuit. During this step of antenna coupler tuning, the series trap circuit is loaded with a 50-ohm resistor. Loading information is not needed.

The coupling between L1 and L2 is variable and is controlled by motor B1. Motor B1 runs on position information supplied by a control circuit. The position of the coupling link is determined by the frequency positioning of L1.

When the series circuit is tuned, relay K6 energizes and feeds the rf signal to the parallel circuit. A separate phasing discriminator is used to detect tuning errors, and discriminator output is amplified and used to drive servo motor B2 until capacitor C2 is tuned correctly. Variable capacitor C3 is shorted while the parallel circuit is tuning to prevent false tuning information from being reflected back from the antenna.

When the parallel circuit is tuned, phasing capacitor C3 is run by servo motor B3 until the antenna coupler is tuned into internal 50-ohm dummy load resistor R4. Phasing information is supplied by the phasing discriminator circuit of loading-phasing discriminator assembly A2.

When the phasing discriminator detects zero error, relay K4 energizes, and both phasing and loading capacitors C3 and C4 are run by servo motors B3 and B4 until the transmission line terminal impedance is 50-ohm resistive. When the antenna coupler is completely tuned, loading-phasing discriminator assembly A2 continues to sample the impedance and phase relationships on the transmission line. Any change in antenna characteristics will be reflected to these discriminators, and, if sufficient forward power is available, capacitors C3 and C4 will be driven to correct the tuning error. Thus, the antenna is kept under constant surveillance, and the addition of receivers or transmitters to the common antenna will not disrupt the transfer of forward power to the antenna.

The control of the various tuning steps of the antenna coupler is accomplished in antenna coupler control assembly A3. The coupler control assembly operates in response to control information supplied by associated equipments. See table 4-1.

4-3. OVERALL TEST DATA.

a. TEST DATA.

(1) REFERENCE ILLUSTRATIONS.

(a) Overall schematic diagram, figure 5-18.

(b) Block diagram, figure 4-1.

(c) Tuning sequence block diagram, figure 4-2.

(2) TEST EQUIPMENT REQUIRED.

(a) Multimeter AN/USM-116.

(b) Auxiliary blower and extender cable set (supplied with CY-4032/SRA-34(V).

(3) TROUBLE ISOLATION PROCEDURE. - The antenna coupler must be supplied with primary power, and all control lines must be intact and delivering correct information before this procedure can be run.

(a) Refer to paragraph 5-2, and install auxiliary blower and maintenance cable set.

(b) On local frequency control, set XMTR and RCVR FREQ SELECT-MC switches for a 6-mc transmitter and receiver frequency.

(c) Perform the trouble isolation procedures given in table 4-2.

4-4. LOADING-PHASING DISCRIMINATOR ASSEMBLY A2.

a. FUNCTIONAL DESCRIPTION. - Loading-phasing discriminator assembly A2 contains both a loading discriminator and a phasing discriminator. The loading discriminator measures the magnitude of the impedance at the input of the antenna coupler. If the impedance is not 50 ohms, a dc voltage will appear at the output of the discriminator. Impedances lower than 50 ohms develop a negative output voltage while impedances greater than 50 ohms develop a positive output voltage. The phasing discriminator measures the phase difference between the current and voltage on the transmission line. When the transmission line is inductive (voltage leading current), the phasing discriminator develops a positive output voltage. When the transmission line is capacitive (current leading voltage), the phasing discriminator develops a negative output voltage.

(1) LOADING DISCRIMINATOR. - The loading discriminator measures the magnitude of the transmission line voltage and current. When the ratio of voltage to current is 50 ohms, the circuit develops no output voltage. Transformer T1 is electrostatically shielded so that it is only magnetically coupled to the

TABLE 4-1. ANTENNA COUPLER CU-1169/SRC-16, CONTROL LINE FUNCTIONS

CONTROL LINE	COMMAND WHEN GROUNDED	COMMAND WHEN UNGROUNDED
Operate	Initiate tuning from home position	Home, standby.
Tune activate	Retune to a new frequency after a tuning cycle has been initiated.	Transmitter or receiver tuned.
Tune complete	Antenna coupler tuned.	Antenna coupler tuning.
Carrier insert	Key transmitter and power amplifier with carrier inserted.	Remove carrier.
High power	Desensitize servos for high-power operation after coupler is tuned.	Maintain high servo sensitivity for low-power operation after coupler is tuned.
Alarm	No alarm.	Alarm.
Thermal alarm override	Unsafe temperatures inside antenna coupler will not alarm system.	Unsafe temperatures will alarm system normally.
Receive tune	Antenna coupler to be used for receive. No power will be radiated on antenna during tuning.	Antenna coupler will be used for transmit. Final phasing and loading will be done on antenna.

TABLE 4-2. OVERALL TROUBLE ISOLATION PROCEDURE

STEP	TEST PROCEDURE	NORMAL INDICATION	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
1	Set POWER ON circuit breaker to ON.	Tuning elements (W), (X), (Y), and (Z) turn to home position, and STBY indicator is on.	Proceed to step 2.	If tuning elements fail to turn, check antenna coupler control assembly A3. If STANDBY indicator fails to light, check indicator and lamp and associated circuit.
2	Set AUTO-TEST-MANUAL switch to MANUAL. Press OPERATE-TUNE pushbutton on transmitter control. Press ADVANCE pushbutton.	SERIES CKT indicator is on bright when test selector switch is at (W) (Y) PHASING 1 and on dim in all other switch positions.	Proceed to step 3.	Check indicator lamp, antenna coupler control assembly A3, and associated circuit.
3	Press ADVANCE pushbutton.	PARALLEL CKT indicator is on bright when test selector switch is at (X) PHASING 2 and on dim in all other switch positions.	Proceed to step 4.	Same as step 2.
4	Set test selector switch to (W) (Y) PHASING 1, and press ADVANCE pushbutton.	PHASING indicator is on bright. LOADING indicator is on dim.	Proceed to step 5.	Same as step 2.
5	Set test selector switch to LOADING.	LOADING indicator is on bright. PHASING indicator is on dim.	Proceed to step 6.	Same as step 2.
6	Press ADVANCE pushbutton.	ANTENNA indicator is on bright.	Proceed to step 7.	Same as step 2.
7	Press ADVANCE pushbutton.	READY indicator is on bright.	Proceed to step 8.	Same as step 2.
8	Press ADVANCE pushbutton.	STBY indicator is on bright.	Proceed to step 9.	Same as step 2.
9	a. Set test selector switch to (W) (Y) PHASING 1, and press ADVANCE pushbutton.	More negative than -10 as measured on the front panel test meter.	Proceed to step 10.	Proceed to step 9b.
	b. Connect vtvm between test points J2 and J5 of loading-phasing discriminator A2. (Connect positive vtvm test probe to J2.)	Approximately 0.4 vdc.	Check circuit between A2 and test meter for defective wiring or components.	Check rf power cables for loose connections and loading-phasing discriminator assembly A2 for defective components.

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TABLE 4-2. (Continued)

STEP	TEST PROCEDURE	NORMAL INDICATION	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
10	a. Set AUTO-TEST-MANUAL switch to TEST.	Tuning element (W) turns cw and reduces discriminator voltage to the green area of meter scale.	Proceed to step 11.	If tuning element (W) turns but does not reduce discriminator voltage to green area of meter scale, check phase sensitive circuit, series tuning circuit, and antenna coupler control assembly A3. If tuning element (W) does not turn, proceed to step 10b.
	b. Connect vtvm to test points J1 and J2 of electronic control amplifier assembly A1.	Not less than 15 vac.	Check servo motor B5 and associated circuit.	Check coupler servo-control assembly A7, electronic control amplifier assembly A1, and associated chassis wiring.
11	Set AUTO-TEST-MANUAL switch to MANUAL and test selector switch to (X) PHASING 2. Press ADVANCE pushbutton.	Large positive discriminator voltage as measured on front panel test meter.	Proceed to step 12.	Check phasing discriminator assembly A5 and associated chassis wiring.
12	a. Set AUTO-TEST-MANUAL switch to TEST.	Tuning element (X) turns cw and reduces discriminator voltage to the green area of meter scale.	Proceed to step 13.	If tuning element (X) does not turn, proceed to step 12b. If tuning element (X) turns but does not reduce discriminator voltage to green area of meter scale, check phase sensitive circuit, parallel tuning circuit, and antenna coupler control assembly A3.
	b. Connect vtvm to test points J1 and J2 of electronic control amplifier assembly A1.	Not less than 15 vac.	Check servo motor B2 and associated circuit.	Check coupler servo-control assembly A7 and associated chassis wiring.
13	Set AUTO-TEST-MANUAL switch to MANUAL and test selector switch to (W) (Y) PHASING 1. Press ADVANCE pushbutton.	Large positive voltage as measured on front panel test meter.	Proceed to step 14.	Check loading-phasing discriminator assembly A2 and associated circuit.
14	a. Set AUTO-TEST-MANUAL switch to TEST. (Tuning element (Y) tunes into 50-ohm load.)	Tuning element (Y) turns to reduce discriminator voltage to the green area of meter scale.	Proceed to step 15.	If tuning element (Y) fails to turn, proceed to step 14b.

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TABLE 4-2. (Continued)

STEP	TEST PROCEDURE	NORMAL INDICATION	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
14 (Cont)	b. Connect vtvm to test jacks J1 and J2 to electronic control amplifier assembly A1.	Not less than 15 vac.	Check servo motor B3 and associated chassis wiring.	Check coupler servo-control assembly A7 and associated chassis wiring.
15	Set AUTO-TEST-MANUAL switch to MANUAL and test selector switch to (Z) LOADING. Press ADVANCE pushbutton.	Loading discriminator error voltage greater than +10 as measured on the front panel test meter.	Proceed to step 16.	Check loading-phasing discriminator assembly A2 (loading circuit) and associated chassis wiring.
16	a. Set AUTO-TEST-MANUAL switch to TEST.	Tuning elements (Y) and (Z) tune together to reduce discriminator error voltage to green area of meter scale.	Proceed to step 17.	If tuning element (Z) fails to turn, proceed to step 16b.
	b. Connect vtvm to test jacks J1 and J4 of loading-phasing discriminator assembly A2.	Approximately 0.5 vdc.	Proceed to step 16c.	Check loading-phasing discriminator assembly A2 (loading circuit) for defective components.
	c. Connect vtvm between test points J1 and J2 of electronic control amplifier A4. Measure servo excitation voltage.	Not less than 15 vac.	Check servo motor B4 and associated circuit.	Check coupler servo-control assembly A7, electronic control amplifier assembly A4, and associated chassis wiring.
17	Press ADVANCE pushbutton, (tuning elements (Y) and (Z) tune to antenna).	Discriminator voltage is within green area of meter scale. ANTENNA indicator is on.	Proceed to step 18.	Check loading circuit and antenna coupler control assembly A3.
18	Set test selector switch to (W) (Y) PHASING 1.	Discriminator voltage is within green area of meter scale.	Proceed to step 19.	Check phasing circuit and antenna coupler control assembly A3.
19	Press ADVANCE pushbutton.	READY indicator is on.	Proceed to step 20.	Check antenna coupler control assembly A3.
20	Press ADVANCE pushbutton.	All tuning elements return to HOME position. STANDBY indicator is on.	Proceed to step 21.	Check antenna coupler control assembly A3.
21	Press STANDBY pushbutton on transmitter control. Set AUTO-TEST-MANUAL (Cont)	All tuning elements turn and reduce discriminator voltage to green (Cont)	Proceed to step 22.	Check antenna coupler control assembly A3 and associated chassis wiring. If fault (Cont)

TABLE 4-2. (Continued)

STEP	TEST PROCEDURE	NORMAL INDICATION	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
21 (Cont)	(Cont) switch to AUTO, and press OPERATE TUNE pushbutton on transmitter control.	(Cont) area of test meter. READY indicator lights when antenna coupler has completed tuning.		(Cont) is not located, repeat steps 1 through 19.
22	Press OPERATE-TUNE pushbutton on transmitter control, and hold one of the tuning element knobs. Observe that antenna coupler faults and returns to standby.	Antenna coupler faults and returns to standby within 1 minute. STBY indicator lights.	Antenna coupler operating properly.	Check 1-minute delay circuit in antenna coupler control assembly A3.

transmission line. The voltage induced in transformer T1 will cause current to flow through potentiometer R9 and resistor R1. Resistor R1 swamps transformer T1 so that the current in phase with the voltage flowing through the parallel circuit is essentially independent of frequency. Diode CR2, capacitor C1, and resistor R2 form a rectifying and filtering network which produces a dc voltage from the rf voltage across resistor R9. Thus, there is produced across resistor R2 a voltage which is proportional to the current flow along the transmission line. Capacitors C5 and C6 form a voltage-dividing network which drops the rf voltage appearing on the transmission line. Inductor L4 compensates for voltage differences occurring with frequency changes. This rf voltage is rectified by diode CR3 and appears across resistor R3 as a dc voltage which is proportional to the amplitude of the voltage on the transmission line.

The dc voltage across resistor R3, resulting from the magnitude of the transmission line voltage, and the dc voltage across resistor R2, resulting from the magnitude of the transmission line current, oppose each other. During manufacture, a known voltage and current (with an impedance of 50 ohms) are introduced to the transmission line, and potentiometer R9 is adjusted for zero voltage at the discriminator output. Thereafter, if the transmission line current or voltage changes so that the impedance is not 50 ohms, a voltage proportional to the change will appear at the loading discriminator output.

(2) PHASING DISCRIMINATOR. - (Refer to figures 4-3 and 5-20.) The phasing discriminator produces a dc output the polarity of which is dependent on the reactance of the transmission line. In a transmission line which appears capacitive, current leads voltage. In a transmission line which appears inductive, current lags voltage. When the transmission line presents no reactance (resistance only), current and voltages are in phase. The phasing discriminator determines the direction and magnitude of any phase difference between transmission line current and voltage and converts such differences into dc voltages.

Transformer T2 is coupled magnetically and electrostatically to the center conductor of the transmission line. The voltages developed at points A and C are always 180 degrees out of phase with each other and are proportional to the transmission line current I_t. The voltage developed at point B is the result of stray capacity between the transformer secondary and primary and is in phase with and proportional to the transmission line voltage. Since the transformer is unloaded, the following phase relationships will exist whenever transmission line current and voltage are in phase: E_{cb} leads E_{bd} by 90 degrees; E_{ab} lags E_b by 90 degrees; and I_t, E_t, and E_{bd} are in phase. Refer to vector diagrams in figure 4-3.

When the phase relationships are as above, and the antenna coupler appears resistive to the transmission line, the dc current (rectified by CR5) through transformer half B-C, through CR5, R8, R7, L2, and back to point B is equal to the dc current (rectified by CR4) through transformer half A-B, through CR4, R5, R6, L2, and back to point B. The dc voltage developed across resistor pairs R5-R6 and R7-R8 is equal but of opposite polarity. Cancellation occurs, and discriminator output is zero. Potentiometer R8 adjusts for slight differences in diode balance. Inductors L5, L6, and L7 present a high impedance to any rf voltage on the dc discriminator output.

Assume that the transmission line appears capacitive and transmission line current leads the transmission line voltage. The voltages present in the phasing discriminator are shown in figure 4-3. Voltage E_{bd} is still in phase with transmission line voltage E_t, and voltage E_{cb} still leads transmission line current I_t by 90 degrees. The vector sums of voltages E_{ab}-E_{bd} and E_{cb}-E_{bd} still produce dc voltages E_{ad} and E_{cb}. However, the amplitudes are no longer equal, and the dc current through resistors R7-R8 is greater than the current through resistors R5-R6. Under these conditions, a negative dc voltage is developed across capacitor C11 and is taken as the discriminator output.

b. TEST DATA.

(1) REFERENCE ILLUSTRATIONS. - Simplified schematic diagram, figure 4-3, and schematic diagram, figure 5-18.

4-5. PHASING DISCRIMINATOR ASSEMBLY A5.

a. FUNCTIONAL DESCRIPTION. - The operation of phasing discriminator assembly A5 is similar to that described for the phasing portion of loading-phasing discriminator assembly A2. The resistors across which the output voltage is developed are of difference values.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-18.

4-6. ANTENNA COUPLER SERVO-CONTROL ASSEMBLY A7.

a. FUNCTIONAL DESCRIPTION. - The antenna coupler servo-control assembly operates on the dc error signals produced by the phasing and loading discriminators. The assembly produces a 400-cps square-wave output which is applied to the servo amplifier, adjusts the gain of the servo loop to compensate for changing error signal levels, and inserts the necessary lead or lag networks as required for stability or position accuracy. A more detailed description of antenna coupler servo-control assembly A7 is given in the technical manual for Electronic Circuit Plug-in Unit Test Set AN/URM-158.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-22.

(2) TROUBLESHOOTING. - Troubleshooting and adjustment procedures are given in the technical manufal for Electronic Circuit Plug-in Test Set AN/URM-158.

4-7. ELECTRONIC CONTROL AMPLIFIER ASSEMBLIES A1 AND A4.

a. FUNCTIONAL DESCRIPTION. - The dc error voltages originating from the discriminator assemblies is converted to a 400-cps square wave by the chopper in antenna coupler servo-control assembly A7. This 400-cps error signal is then applied to the electronic control amplifier assemblies which amplify the error signal to a level sufficient to drive the control windings of the tuning motors.

This 400-cps signal is either 90 degrees leading or 90 degrees lagging with respect to the chopper driver voltage supply, depending upon whether a negative or positive dc error signal is generated by the discriminator. The chopper ac supply is always 90 degrees out of phase with the 115-volt, 400-cps voltage applied to the reference windings of the tuning motors.

The ac output of the electronic control amplifier is in phase with the input and is, therefore, either +90 degrees or -90 degrees out of phase with the ac voltage applied to the tuning motor reference windings. The electronic control amplifier output is applied to the tuning motor control windings which are in quadrature with the reference windings. Thus, the tuning motor excitation voltage either leads or lags the reference voltage by 90 degrees, depending on the polarity of the dc error signal applied to the chopper by the discriminators. The lead or lag in phase angle determines the direction of rotation of the tuning motors, which, in turn, controls the direction in which the rf tuning elements are driven. A more complete description of electronic control amplifier assemblies A1 and A4 is given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-19.

(2) TROUBLESHOOTING. - Troubleshooting and adjustment procedures are given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

4-8. ANTENNA COUPLER CONTROL ASSEMBLY A3.

a. FUNCTIONAL DESCRIPTION. - The antenna coupler control assembly is a plug-in unit which performs the switching and control functions required by the antenna coupler. The assembly contains a small dc motor which drives a 7-section rotary switch, 25 relays, and 7 silicon controlled rectifiers (scr). Figure 5-21 is a schematic diagram of the unit, and figure 4-2 is a tuning sequence diagram which shows the general steps involved in antenna coupler tuning.

The antenna coupler is programmed in six steps; standby, series circuit tune, parallel circuit tune, phase (50-ohm load), phase load (antenna), and ready. The 12-position rotary switches driven by motor A3B1 stop at even-numbered positions of rotary switch section S7R (reference section). Each time motor A3B1 stops, a tuning function is performed and must be completed before the switch can advance.

Assume the antenna coupler control assembly is at some control position other than HOME. When the radio channel is placed in operation, a ground is placed on the tune-activate line. (Refer to figure 4-2.) This ground is generated in the receiver and transmitter when they are set to a new frequency or when they are cycled from STBY to OPR. A ground on the tune-activate line energizes relay A3K5 and causes motor A3B1 to return to standby (position 12).

The operate line is open circuited when the radio channel is placed in STBY. Note that relay A3K5 is maintained energized until motor A3B1 reaches the standby position.

When motor A3B1 is in the standby position, tuning servo motors B2, B3, B4, and B5 are operated by homing relays A3K1, A3K2, A3K3, and A3K4 until they reach the HOME position, and operate limit switches S7, S9, S11, and S12. While the tuning motors are homing, relay A3K5 remains energized. Relay A3K5 will also be energized if alarm relay A3K10 becomes deenergized. Relay A3K10 can deenergize because of loss of primary power, loss of +28 volts dc from the antenna coupler power supply, more than 1-minute

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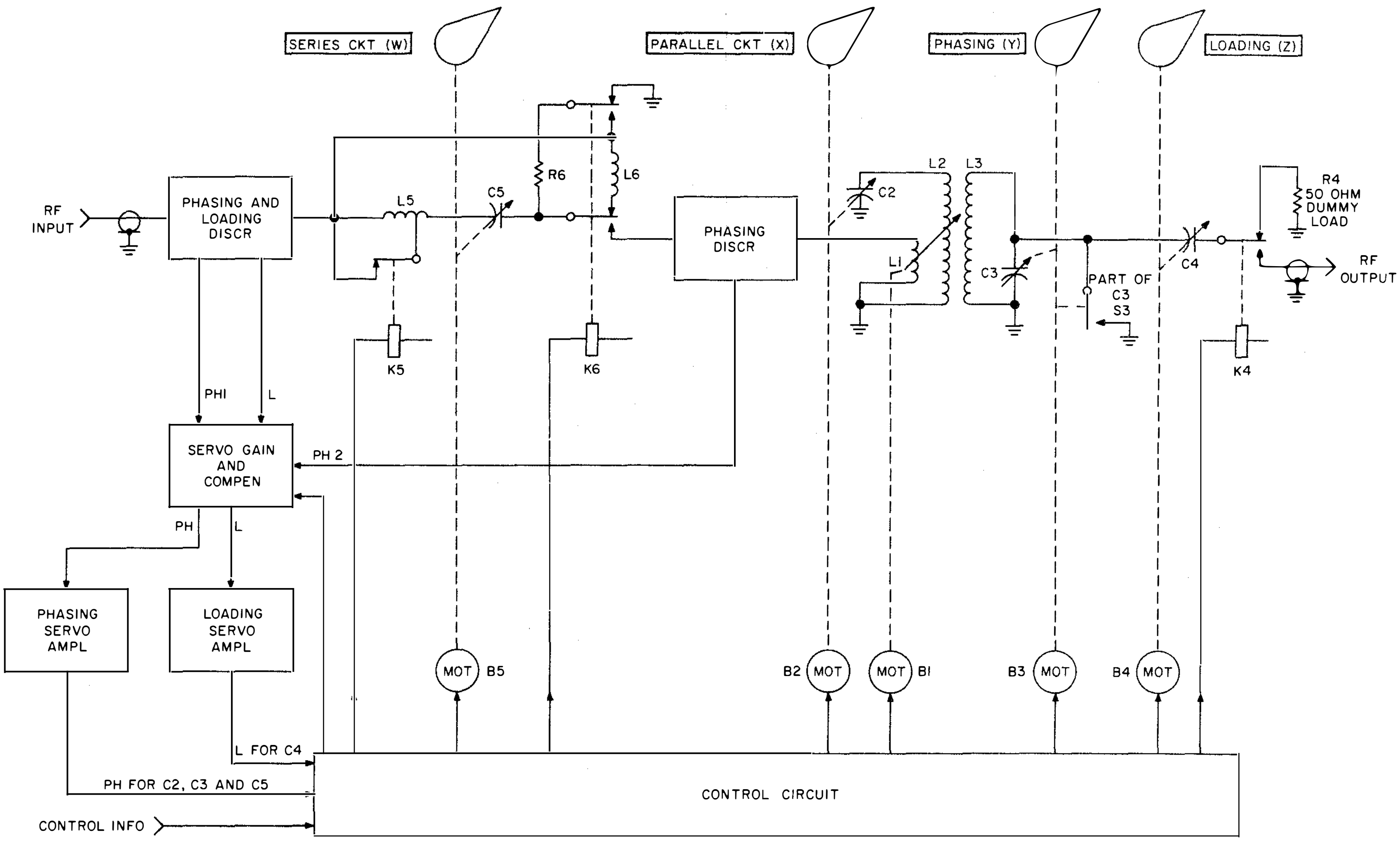

TUNE-UP SEQUENCE

1 DE-ENERGIZE K4, K5, K6
2 HOME RF ELEMENTS: C4 TO MIN C, C2, C3, C5 TO MAX C, C3 CLOSES S3.
3 PHASE C5 (PH I), POSITION LI FOR OPTIMUM COUPLING, CLOSE K5 ABOVE 4MC.
4 ENERGIZE K6.
5 PHASE C2 (PH 2)
6 OPEN S3 (AS C3 RUNS FROM MAX).
7 PHASE C3 (PH I) INTO 50 OHM LOAD. (LOAD C4 INTO 50 OHM LOAD FOR RECEIVE ONLY)
8 ENERGIZE K4. OMIT STEP 9 FOR RECEIVE ONLY.
9 PHASE C3 (PH I) AND LOAD C4 INTO SHIPS ANTENNA FOR TRANSMIT.
10 READY – TRANSMIT OR RECEIVE.

Figure 4-1. Antenna Coupler CU-1169/SRC-16, Block Diagram

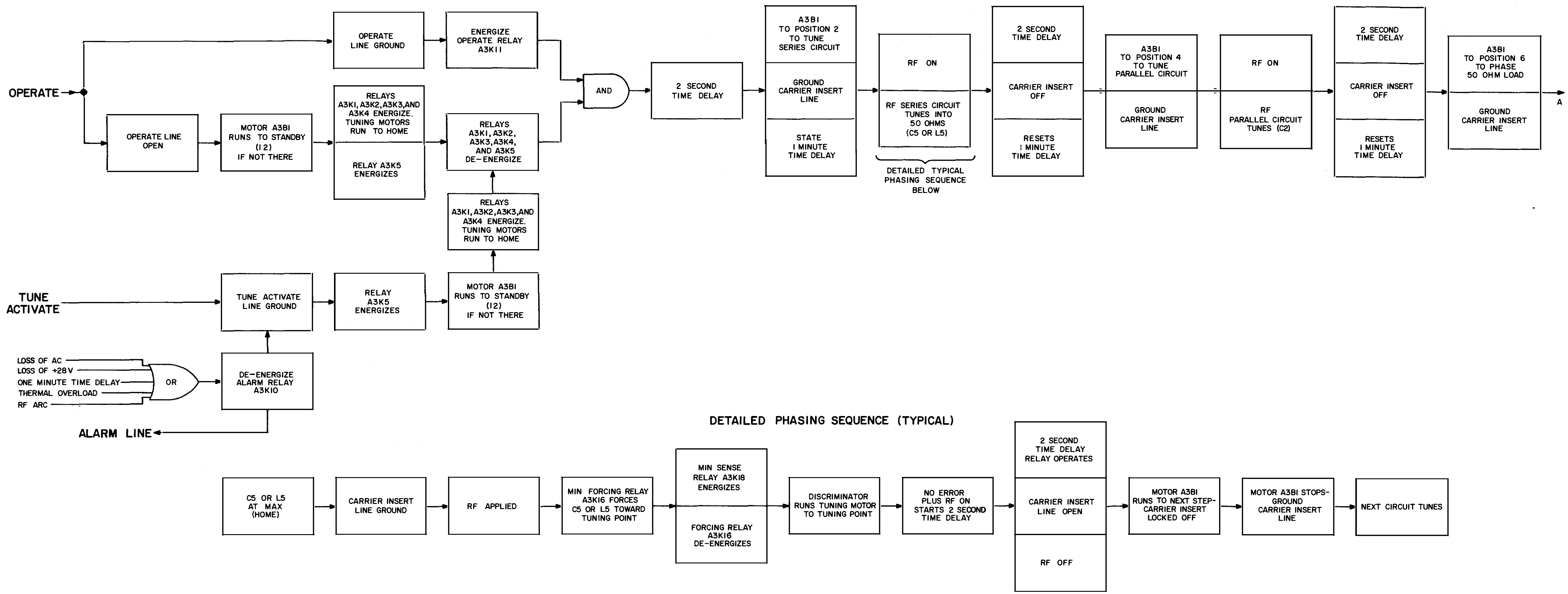

Figure 4-2. Antenna Coupler CU-1169/SRC-16, Tuning Sequence, Block Diagram (Sheet 1 of 2)

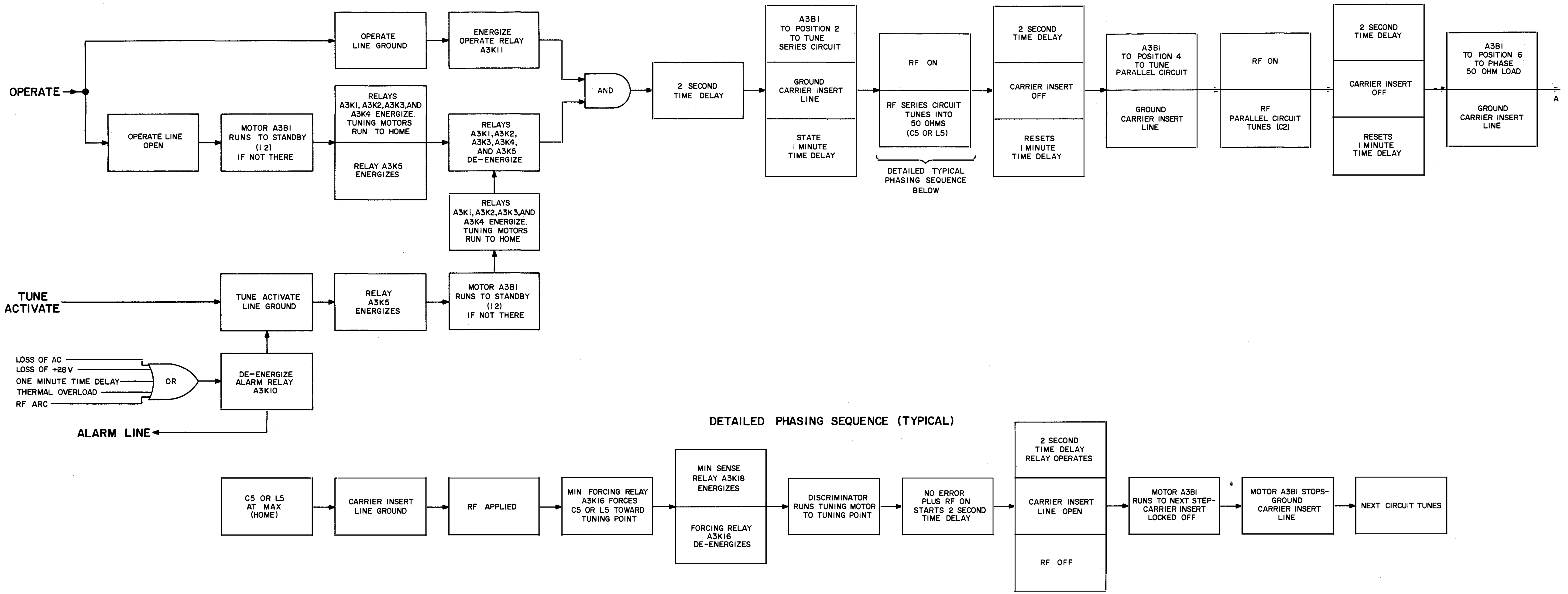

Figure 4-2. Antenna Coupler CU-1169/SRC-16, Tuning Sequence, Block Diagram (Sheet 1 of 2)

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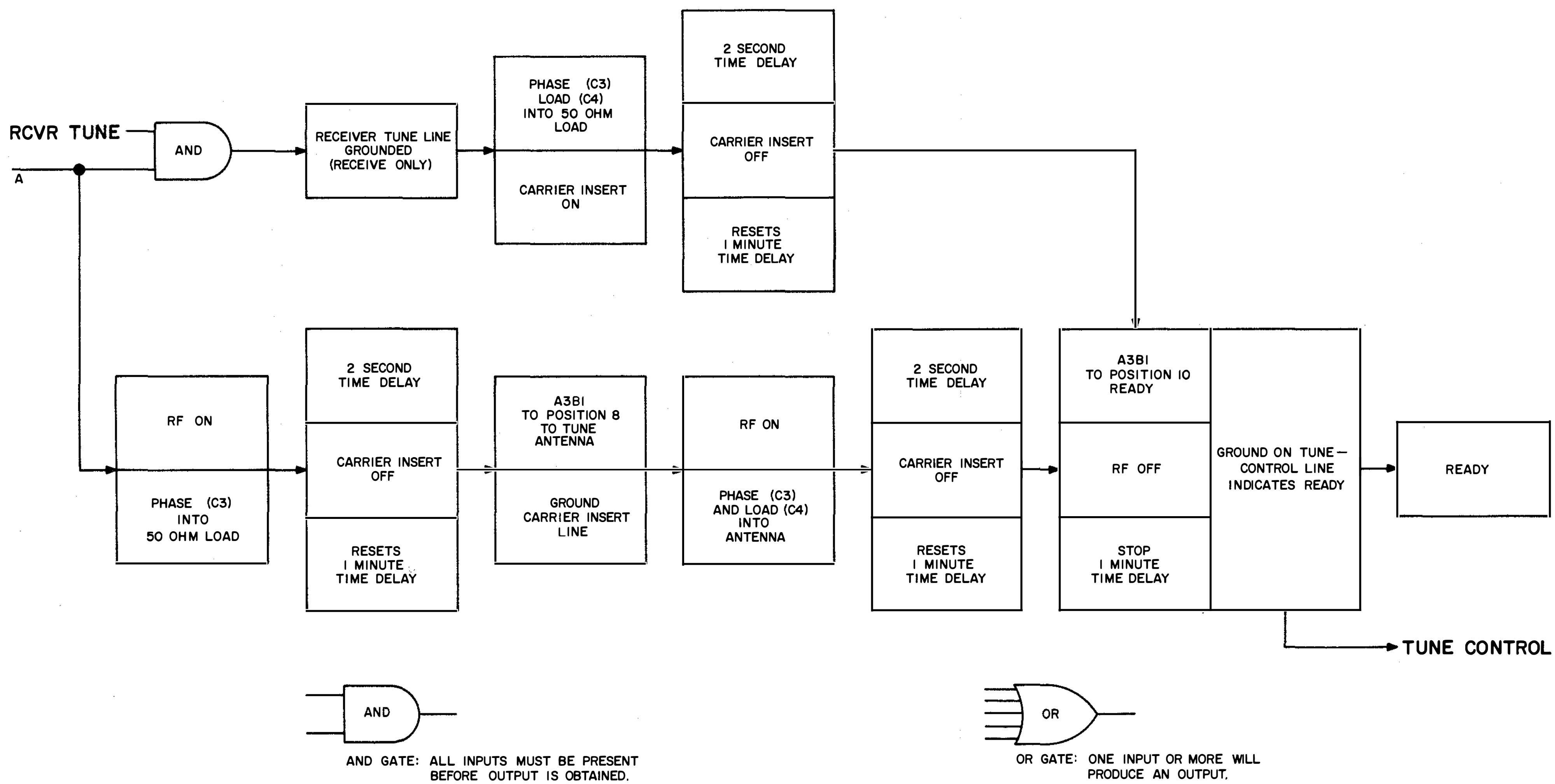

Figure 4-2. Antenna Coupler CU-1169/SRC-16, Tuning Sequence, Block Diagram (Sheet 2 of 2)

elapsed time required to tune any rf circuit, high internal temperatures, or an rf arc.

When all tuning motors are homed, relay A3K5 deenergizes, and the antenna coupler control is ready to receive an operate command from the system.

With relay A3K5 deenergized, one of the conditions for advancement of motor A3B1 is fulfilled. When a ground is placed on the operate line (radio channel placed in OPR), operate relay A3K11 is energized, and the other condition for motor advancement is met. The 2-second time delay relay (A3K8) will be energized. (Refer to detailed phasing sequence at bottom of figure 4-2.)

The carrier insert line is grounded through switch A3S5R, and rf power will be delivered to the antenna coupler by the associated equipments. The 1-minute delay is started. (An alarm will occur if each tuning step is not completed in 1 minute.) If the forward power sensor detects sufficient tune power (100 watts forward), maximum forcing relay A3K17 will be energized. Contacts on relays A3K16 and A3K17 apply 36 volts dc and ground to the control winding of servo motor B5 through contacts on servo-motor selector switch sections A3S3F and A3S4F.

Servo-motor B5 runs on minimum forcing information until phasing discriminator information energizes minimum sense relay A3K18 through the phase sensitive circuit. When the minimum sense relay energizes, minimum forcing is dropped out, and servo motor B5 runs on discriminator error to the tuning point.

When phasing discriminator error information drops to zero, and if sufficient forward tune power is still present, the 2-second time delay is restarted. After 2 seconds have elapsed, the carrier insert line is ungrounded, and the rf input is removed from the coupler. The 1-minute time delay is reset, and motor A3B1 moves to position 4.

The carrier insert line is again grounded, rf power is received, and the paralleled circuit tunes until no tuning error is detected. The carrier insert line is ungrounded, the 2-second time delay is started, the 1-minute time delay is reset, and motor A3B1 moves to position 6.

The carrier insert line is again grounded, and phasing capacitor C3 is operated by servo motor B3 until no error is detected with the phasing capacitor phased into the internal 50-ohm load.

If the antenna coupler is to be used with a receiver, a ground will be placed on the receiver tune line. Switch motor A3B1 will not advance, but loading capacitor C4 will be run by servo motor B4 until no error is detected. In this tuning step, servo motors B3 and B4 run together because the loading and phasing capacitors cause interaction and detune each other. When both C3 and C4 are tuned so that no error is detected, the carrier insert line is ungrounded, the 2-second time delay is started, and the 1-minute time delay is reset.

With the receiver tune line grounded, switch motor A3B1 runs through position 8 and stops at 10. At position 10, the carrier insert line is ungrounded, the 1-minute time delay is stopped, and a ground is placed on the tune complete line to indicate that the antenna coupler is tuned and ready for use. Antenna relay K4 is energized, and the broadband antenna replaces the internal 50-ohm load.

If the receiver tune line is ungrounded, the antenna coupler will be used with a transmitter, and phasing and loading capacitors C3 and C4 are tuned differently. In switch motor position 6, servo motor B3 runs capacitor C3 to phase the antenna coupler into the internal 50-ohm load. When the antenna coupler is to be used with a transmitter, switch motor A3B1 is run to position 8. In position 8, antenna relay K4 is energized, and the broadband antenna replaces the internal 50-ohm resistor. Loading and phasing are repeated, and servo motors B3 and B4 run capacitors C3 and C4 until no error is detected. When the tuning point is reached, the carrier insert line is ungrounded, the 2-second time delay is started, and the 1-minute time delay is reset. Switch motor A3B1 advances to position 10 (ready), the 1-minute time delay is stopped, and a ground is placed on the tune complete line. A ground on the tune complete line indicates that the antenna coupler is tuned and ready for use. A more detailed description of antenna coupler control assembly A3 is given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-21.

(2) TROUBLESHOOTING. - Troubleshooting and adjustment procedures are given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

4-9. PHASE SENSITIVE CIRCUIT.

a. FUNCTIONAL DESCRIPTION. - (Refer to figure 4-4.) Antenna Coupler CU-1169/SRC-16 uses a phase sensitive circuit which determines the sense of the phasing error signal amplified by the phasing servo amplifier. The phase sensitive circuit provides signals which operate minimum and maximum phase sense relays K18 and K19.

Phasing discriminator error voltage is applied to the center tap of Scott-T transformer T1. Discriminator error voltage is a 400-cps square wave which may be either in phase with, or 180 degrees out of phase with the 18-volt secondary voltage of transformer T1. The phase of the signal is determined by whether the discriminator error is positive or negative.

Depending on its polarity, the discriminator error voltage may either add to, or subtract from the secondary voltage of transformer T1. Assume a polarity such that the voltage at the cathode of diode CR12 is greater than the 18-volt secondary voltage and the voltage at the cathode of diode CR13 is less than the 18-volt secondary voltage. Diode CR12 and capacitor C9 rectify and filter the square-wave voltage and apply it to zener diode CR14. Because the sum of discriminator error voltage and secondary voltage are sufficient to cause zener diode CR14 to conduct, a positive voltage is developed across resistor R1. The error voltage rectified and filtered by diode CR13 and capacitor C10 is not sufficient to cause zener diode CR15 to

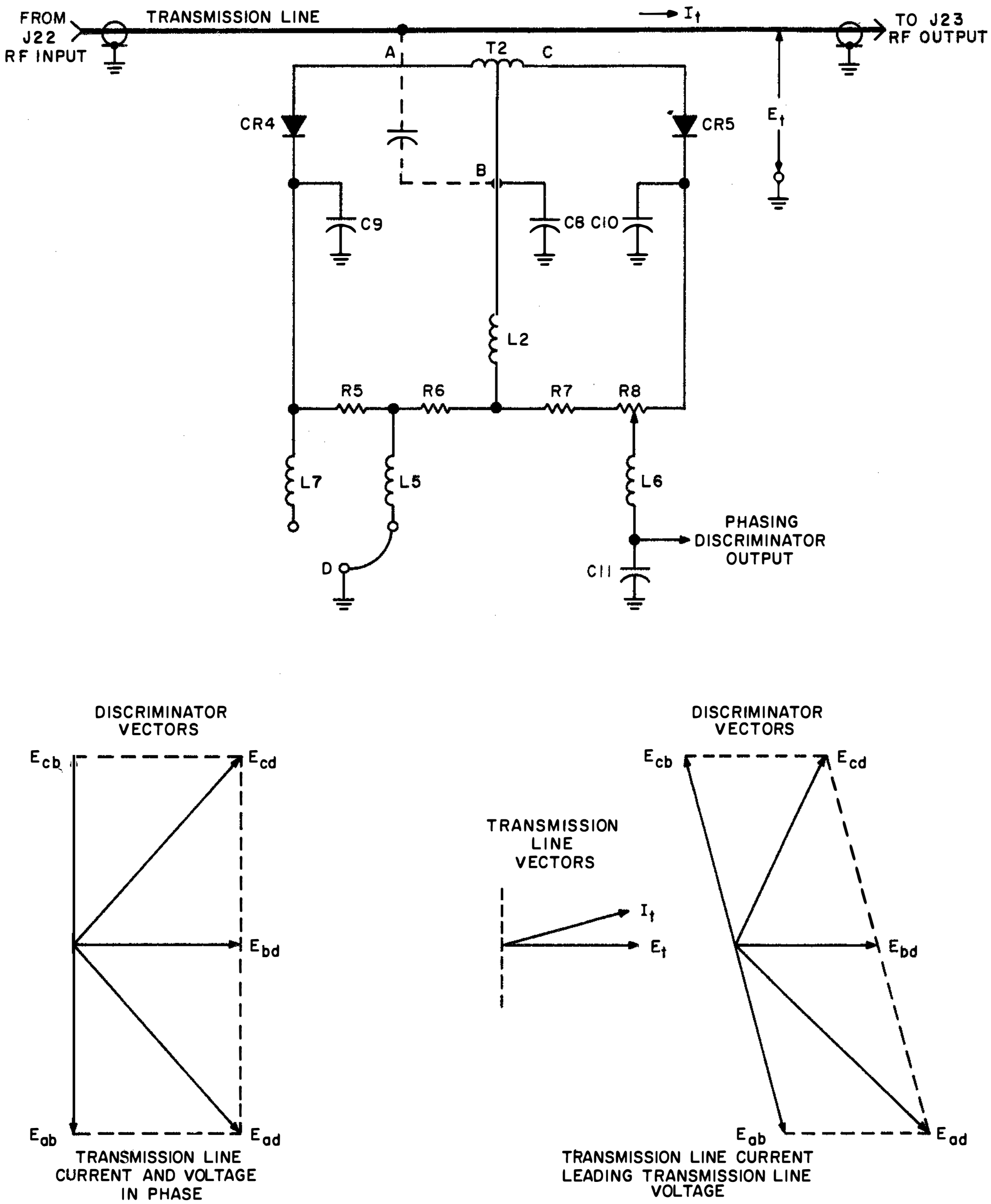

Figure 4-3. Phasing Discriminator, Simplified Schematic Diagram

conduct, and the voltage developed across resistor R2 is essentially zero.

Relay K3 switches gain resistors R15, R19, R16, and R20 as required to establish proper signal level for the gates of scr Q5 and Q6. Thus the phase sensitive circuit generates a dc voltage on one of its two outputs depending on the polarity of the phasing discriminator error. The dc voltage is applied to one of two scr circuits in the antenna coupler control assembly to operate minimum phase sense or maximum phase sense relays K18 or K19.

b. TEST DATA.

(1) REFERENCE ILLUSTRATIONS. - Schematic diagram, figure 5-18 and simplified schematic diagram, figure 4-4.

(2) SPECIAL PROCEDURES. - No special procedures or test equipment are required, other than an AN/USM-116 Multimeter, to troubleshoot the phase sensitive circuit.

4-10. RF TUNING CIRCUITS.

a. FUNCTIONAL DESCRIPTION. - The antenna coupler contains five tuning elements which are used to correct for varying antenna impedances. These circuits are a series resonant trap circuit, a parallel resonant circuit, a variable coupling device, a shunt capacitor for phasing the antenna, and a series capacitor for loading the antenna.

(1) SERIES CIRCUIT. - The series circuit is made up of inductor L5 and variable capacitor C5 which operate in parallel with 50-ohm resistor R6. During tuning operation, the series circuit is loaded with resistor R6, and variable capacitor C5 is operated by servo motor B5 until resonance is indicated by the phasing discriminator in assembly A2. Inductor L6 provides a dc path to ground during tuning (a requirement of some power amplifiers).

Magnetic brake MP5 brakes the shaft of variable capacitor C5 when tuning is completed to prevent accidental movement of the capacitor. Limit switch S6 operates at the minimum capacity position of capacitor C5, and limit switch S7 operates at the maximum capacity position. These switches provide information for the antenna coupler control assembly and enable it to cause servo motor B5 to run in the opposite direction.

(2) VARIABLE COUPLING LINK L1. - Inductors L1 and L2 are fixed inductors with variable coupling between them. The coupling between L1 and L2 is a function of frequency and is determined by the position of variable capacitor C5. Rotary switches S14 and S16 are driven by motor B5. These sending switches operate to provide a ground to the contacts of seeking switch S15. Switch S15 is connected to the shaft of variable link L1 and its driving motor B1. Motor B1 runs until a position is found where the rotor of seeking switch S15 does not contact a grounded pin and then stops at that position.

(3) PARALLEL CIRCUIT. - Fixed inductor L2 and variable capacitor C2 make up a parallel resonant circuit. This circuit is tuned to resonance by servo motor B2 which drives variable capacitor C2. Servo motor B2 operates on error information derived from phasing discriminator assembly A5. During tuning, capacitor C3 is short-circuited so that false tuning points will not be reflected to inductor L2 from inductor L3. Switches S8 and S9 are minimum and maximum capacitance limit switches. Magnetic brake MP2 prevents accidental movement of C2 after tuning is completed.

(4) PHASING CIRCUIT. - A low value of fixed air coupling is provided between fixed inductor L2 of the parallel circuit and fixed inductor L3 of the phasing circuit. When the parallel circuit is tuned to resonance, rf energy is coupled to inductor L3 by transformer action. Variable capacitor C3 is tuned with information derived from the phasing discriminator in assembly A2. Magnetic brake MP3 prevents accidental movement of capacitor C3 after tuning is completed. Limit switches S10 and S11 are minimum and maximum capacitance limit switches.

During one stage of tuning (phase 50 ohms), 50-ohm dummy load resistor, R4, is placed across output of the antenna coupler instead of the antenna, allowing varible capacitor C3 to tune to the approximate point required by the broad-band antenna.

(5) LOADING CIRCUIT. - Variable capacitor C4 is tuned by the loading discriminator in assembly A2. It is tuned until the rf amplifier is terminated in 50 ohms. During the final stage of tuning, capacitors C4 and C3 operate together because a change in the setting of one will require an adjustment in the setting of the other. Magnetic brake MP4 prevents accidental movement of capacitor C3 after tuning is completed. Limit switches S12 and S13 are minimum and maximum capacitance limit switches.

During operation after tuning is initially completed, the loading and phasing discriminators maintain constant surveillance on transmission line conditions. Any time during operation that forward power is 100 watts or greater, loading and phasing capacitors C3 and C4 will retune to compensate for antenna disturbances which affect the impedance of the system.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-18.

(2) ADJUSTMENT PROCEDURES. - Adjustment procedures for the magnetic brakes, capacitor lead screws, link motor switches, and limit switches are given in paragraph 5-2.

4-11. ARC PROTECTION CIRCUIT.

a. FUNCTIONAL DESCRIPTION. - (Refer to figure 4-5.) The antenna coupler contains an arc protection circuit which will alarm associated equipments if an rf arc develops within the antenna coupler. Spark gaps E1, E2, and E3 are placed at arc-susceptible locations in the rf circuit of the coupler. The arc path to ground is from the rf line, through the spark gap, through capacitor C23 or C20, to ground. If an arc occurs, a low impedance path to ground is also provided for the ground return of arc alarm relay K2. When relay K2 is energized, holding contacts 8 and 3 maintain a direct dc ground through thermal switch S17. When contacts 2 and 8 on relay K2 open, the dc ground for relay A3K10 is lost, relay K10 deenergizes, a ground

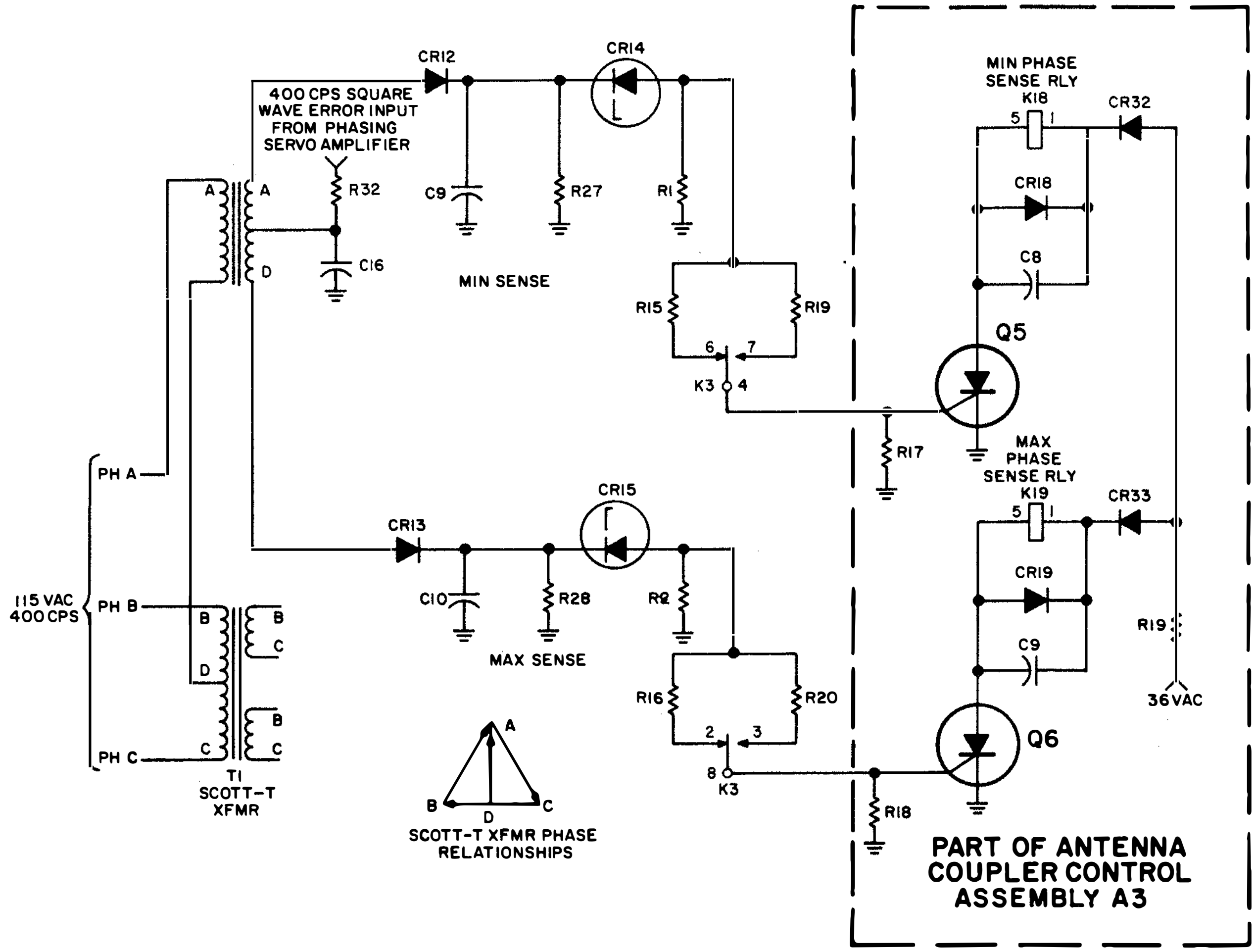

Figure 4-4. Phase Sensitive Circuit, Simplified Schematic Diagram

is removed from the coupler alarm line, and the loss of this ground signals the system that trouble exists in the antenna coupler. Rf power is removed, and the radio channel remains in an alarm state until the antenna coupler is reset.

Other unsafe conditions within the antenna coupler can cuase the alarm relay to deenergize. If 1-minute time delay relay A3K9 energizes (signifying that a tuning step has taken longer than 1 minute), or if thermal switch S17 operates (signifying that excess temperatures exist within the antenna coupler), alarm relay A3K10 will deenergize and alarm the system.

In addition to providing a system alarm, an rf arc in the antenna coupler will cause the SERIES CKT (W) indicator to be lit along with the STBY indicator. Contacts 4 and 7 on arc alarm relay K2 supply +28 volts to the SERIES CKT (W) indicator whenever arc alarm relay K2 is energzied. No other condition except an arc alarm will cause these two indicators to be lit at the same time. The arc alarm relay can be deenergized by momentarily removing the power to the antenna coupler.

b. TEST DATA.

(1) REFERENCE ILLUSTRATIONS. - Schematic diagram, figure 5-18, and simplified schematic diagram, figure 4-5.

(2) ADJUSTMENT PROCEDURES. - Adjustment procedures are given in paragraph 5-3b.

(3) TROUBLE ISOLATION PROCEDURES.

(a) Refer to paragraph 5-2, and install auxiliary blower and maintenance cable set.

(b) Remove series-parallel circuit assembly from antenna coupler chassis. The front panel of the antenna coupler must be removed to permit removal of the series-parallel circuit assembly.

(c) Remove dust cover from series-parallel circuit assembly, and replace series-parallel circuit assembly in antenna coupler chassis. Front panel does not have to be replaced.

(d) Connect all rf and control cables, including front panel connector P17.

(e) Set POWER ON circuit breaker to on position (up), and perform the troubleshooting procedure given in table 4-3.

TABLE 4-3. ARC-PROTECTION CIRCUIT TROUBLESHOOTING PROCEDURE

STEP	PROCEDURE	NORMAL INDICATION	IF INDICATION IS NORMAL	IF INDICATION IS ABNORMAL
1	a. Short spark gap E1 in series-parallel circuit assembly with blade of screwdriver.	STBY and SERIES CKT indicators light. All tuning elements return to HOME position.	Proceed to step 2.	Proceed to step b.
	b. Short spark gap E2 in phasing-loading circuit assembly with blade of screwdriver.	STBY and SERIES CKT indicators light. All tuning elements return to HOME position.	Check components C23, C24, L12, and associated chassis wiring.	Check STBY and/or SERIES CKT indicators lamps T1, K2, and associated chassis wiring.
2	Set POWER ON circuit breakers to off position then back to on position. (Deenergizes arc alarm relay K2.) Short spark gap E2 in phasing-loading circuit assembly with blade of screwdriver.	STBY and SERIES CKT indicators light. All tuning elements return to HOME position.	Proceed to step 3.	Check components L3, L11, C20, C21, and associated chassis wiring.
3	Set POWER ON circuit breaker to off position then back to on position. Short spark gap E3 in phasing-loading circuit assembly with blade of screwdriver.	STBY and SERIES CKT indicators light. All tuning elements return to HOME position.	Arc protection circuit is operating properly. Reassemble antenna coupler in accordance with the procedures given in paragraphs 5-4g and 5-4h.	Check L4 and associated chassis wiring.

4-12. POWER SUPPLY ASSEMBLY A6.

a. FUNCTIONAL DESCRIPTION. - Power supply assembly A6 is a conventional full-wave, 3-phase, transformer-operated power supply using silicon diode rectifiers. The power supply input is 115 volts, 3 phase, 400 cps, delivered at pins 1, 2, and 3 of P1. Positive 28-volt dc output is taken at P1-5 with the ground return at P1-8.

The output of the supply is filtered by R1 and C1 in parallel. Test point J1 is located on the assembly to allow monitoring the power supply output voltage without removing the assembly dust cover.

A more detailed description of power supply assembly A6 is given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-18.

(2) ADJUSTMENT PROCEDURES. - Troubleshooting and adjustment procedures are given in the technical manual for Electronic Circuit Plug-in Test Set AN/URM-158.

4-13. RF INTERFERENCE FILTER ASSEMBLY A8.

a. FUNCTIONAL DESCRIPTION. - The antenna coupler is provided with an rf interference filter assembly to filter all power and control lines entering the equipment. The unit is mounted on the bottom of the antenna coupler. Each filter is a pi-section LC filter which attenuates any rf energy which may be picked up from stray fields within the antenna coupler case. Diodes are placed in some control lines to prevent false control information from being supplied to the external system by the antenna coupler.

b. TEST DATA.

(1) REFERENCE ILLUSTRATION. - Schematic diagram, figure 5-18.

(2) ADJUSTMENT PROCEDURES. - No special adjustment procedures or test equipment (other than an AN/USM-116 Multimeter) are required to troubleshoot the rf interference filter.

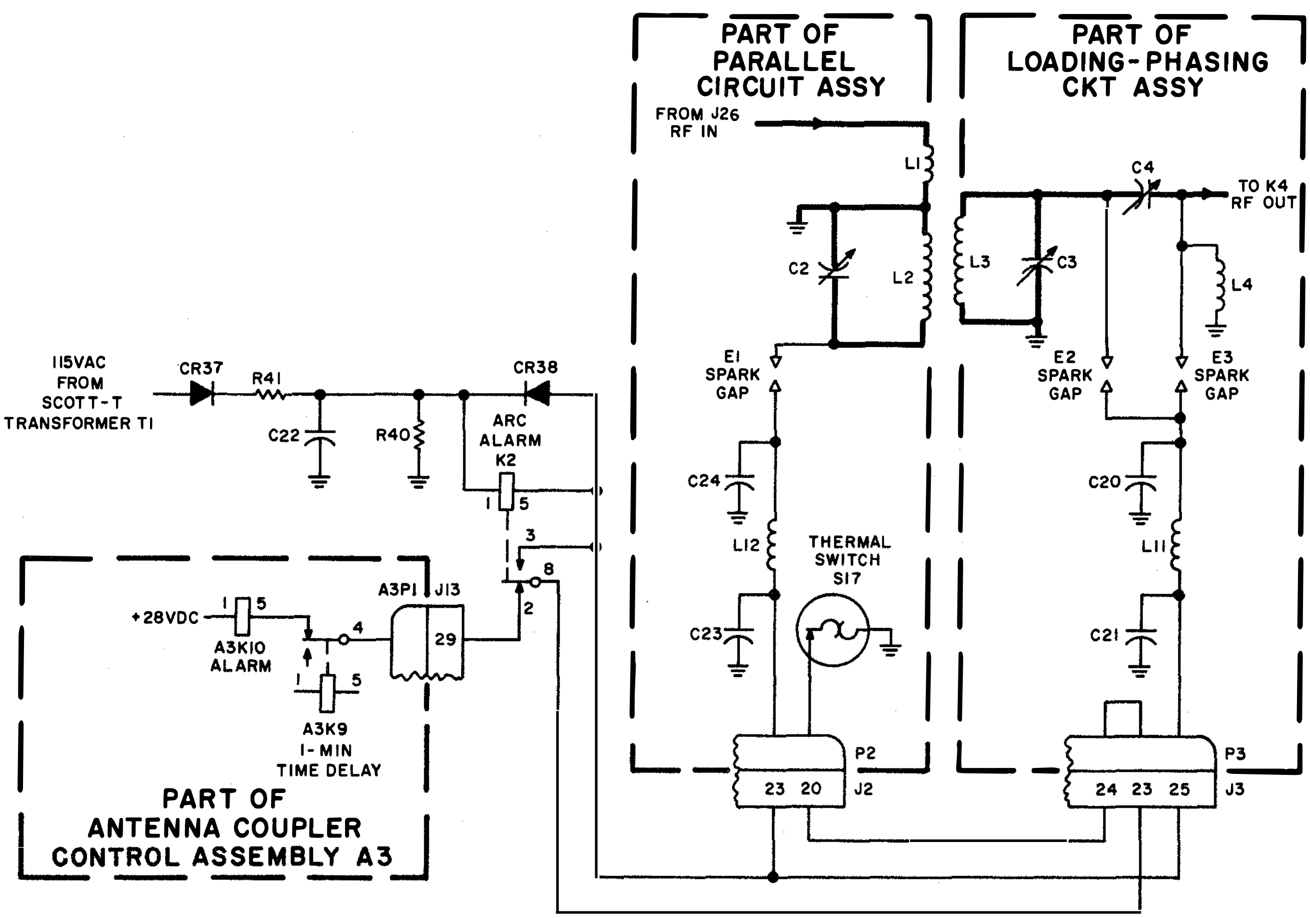

Figure 4-5. Arc Protection Circuit, Simplified Schematic Diagram

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SECTION 5

MAINTENANCE

5-1. PREVENTIVE MAINTENANCE.

Preventive maintenance schedules and procedures for the antenna coupler are described in the maintenance standards book for associated equipments.

5-2. AUXILIARY BLOWER AND EXTENDER CABLE SET.

Some troubleshooting and repair of the antenna coupler must be accomplished with the antenna coupler extended on the cabinet slides and with primary and rf power applied. To prevent serious damage to the antenna coupler under these conditions, auxiliary cooling must be used. An auxiliary blower and extender cable set are provided in the CY-4032/SRA-34(V) and should be used.

a. AUXILIARY BLOWER. - To install the auxiliary blower and air plenum, perform the following steps:

(1) Extend the antenna coupler on the cabinet slides.

(2) Install auxiliary air plenum by hooking top clips to antenna coupler case before hooking bottom clips. Press plenum in and down to fasten bottom clips.

(3) Install auxiliary blower by hooking top clips to air plenum before hooking bottom clips. Press blower in and down to fasten bottom clips. Figure 5-1 shows the auxiliary blower and air plenum properly installed.

(4) Insert blower pendant cable into the auxiliary blower power jack on CY-4032/SRA-34(V).

b. EXTENDER CABLE SET. - To install the extender cables, perform the following steps:

(1) Ensure that auxiliary blower is properly installed and running and that POWER ON circuit breaker on antenna coupler is in the off position.

(2) Install two rf cables between the two jacks on the cabinet shelf and the two plugs on the antenna coupler.

(3) Attach connector retainers at all four rf connections.

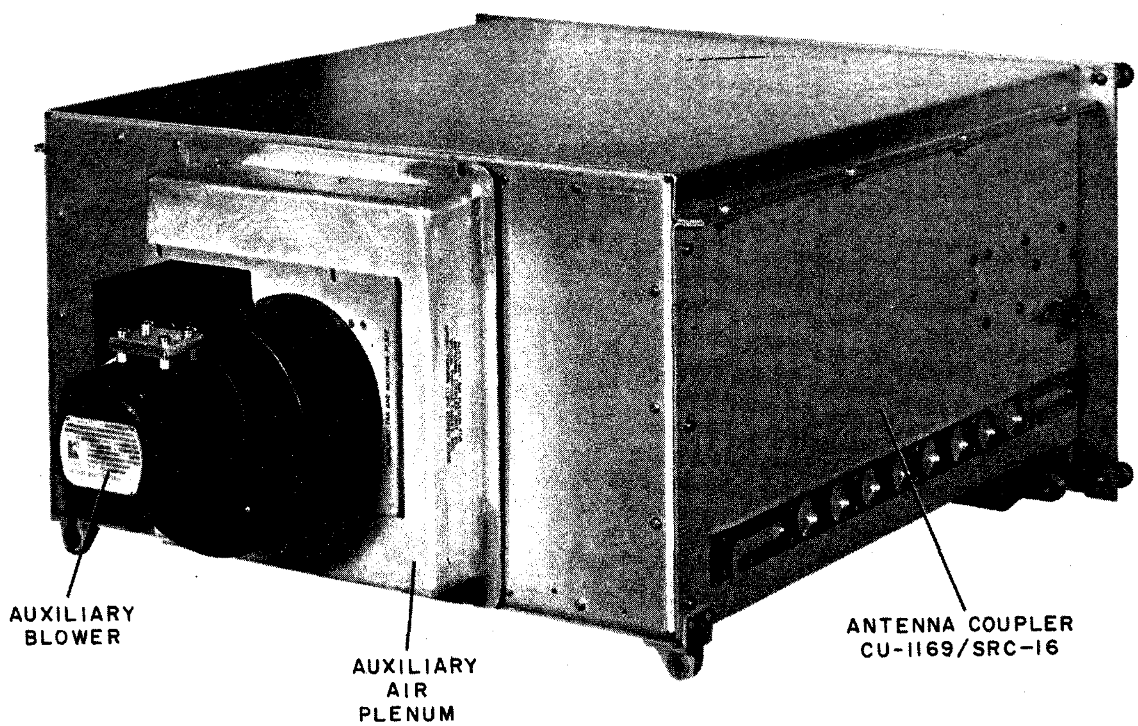

Figure 5-1. Antenna Coupler CU-1169/SRC-16, Auxiliary Air Plenum and Blower Installed

CAUTION

Connectors are spring loaded. Good electrical contact cannot be made unless connector retainers are installed properly. Equipment damage will result if rf power is applied while connectors are unfastened or improperly mated.

(4) Install control lines cable. The control lines cable does not require a connector retainer at the antenna coupler end. It will snap firmly into place when properly installed.

(5) Restore power to the antenna coupler, and perform necessary troubleshooting or maintenance.

5-3. ALIGNMENT AND ADJUSTMENT.

The following alignment and adjustment procedures shall be performed when necessary to ensure optimum performance of the equipment.

a. MAGNETIC BRAKES. - Adjust the spacing to 0.015 inch between the tap lock on magnetic brakes MP2, MP3, MP4, and MP5 and the associated gear.

b. SPARK GAPS.

(1) CAPACITOR C2. - Adjust spark gap E1 to 0.230 inch on capacitor C2.

(2) CAPACITOR C3. - Adjust spark gap E2 to 0.150 inch on capacitor C3.

(3) CAPACITOR C4. - Adjust spark gap E3 to 0.040 inch on capacitor C4.

c. LEAD SCREWS.

(1) CAPACITOR C5. - Adjust capacitor C5 lead screw so that maximum capacity is obtained when the capacitor knob shaft is 1/4 ±1/16 turn from the mechanical end stop.

(2) CAPACITOR C2. - Adjust capacitor C2 lead screw so that maximum capacity is obtained when the capacitor knob shaft is 3/4 ±1/16 turn from the mechanical end stop.

(3) CAPACITOR C3. - Adjust capacitor C3 lead screw so that maximum capacity is obtained when the capacitor knob shaft is 3/4 ±1/16 turn from the mechanical end stop.

(4) CAPACITOR C4. - Adjust capacitor C4 lead screw so that maximum capacity is obtained when the capacitor knob shaft is at the mechanical end stop (±1/16 turn).

d. LINK MOTOR SWITCHES.

(1) SWITCH C15. - Adjust wafer switch S15 so that when the leading edge of the stator slot has just passed tab 14, link inductor L1 will induce maximum energy to link inductor L2 (maximum coupling). Any further movement of wafer switch S15 toward tab 15 will result in reducing the amount of energy induced from link inductor L1 to link inductor L2.

(2) SWITCHES S14 AND S16. - Adjust wafer switches S14 and S16 so that when capacitor C5 is at the maximum capacity end stop, the wafer switch stator tabs are centered on tab 23.

e. LIMIT SWITCH ADJUSTMENTS.

Note

The microswitches must be adjusted while the assembly is resting in the normally operated position.

(1) MICROSWITCH S6. - Adjust microswitch S6 to actuate when capacitor C5 knob shaft is 1/2 ±1/8 turn from and advancing toward the minimum capacity mechanical end stop.

(2) MICROSWITCH S7. - Adjust microswitch S7 to actuate when capacitor C5 knob shaft is 1/2 ±1/8 turn from and advancing toward the maximum capacity mechanical end stop.

(3) MICROSWITCH S8. - Adjust microswitch S8 to actuate when capacitor C2 knob shaft is 3/8 ±3/16 turn from and advancing toward the minimum capacity mechanical end stop.

(4) MICROSWITCH S9. - Adjust microswitch S9 to actuate when capacitor C2 knob shaft is 3/8 ±3/16 turn from and advancing toward the maximum capacity mechanical end stop.

(5) MICROSWITCH S10. - Adjust microswitch S10 to actuate when capacitor C3 knob shaft is 3/8 ±1/16 turn from and advancing toward the minimum capacity mechanical end stop.

(6) MICROSWITCH S11. - Adjust microswitch S11 to actuate when capacitor C3 knob shaft is 3/8 ±1/16 turn from and advancing toward the maximum capacity mechanical end stop.

(7) MICROSWITCH S12. - Adjust microswitch S12 to actuate when capacitor C4 knob shaft is 3 +1/16 -0 turns from and advancing toward the minimum capacity mechanical end stop.

(8) MICROSWITCH S13. - Adjust microswitch S13 to actuate when capacitor C4 knob shaft is 8 +0 or -1/2 turns from the minimum capacity mechanical end stop and advancing toward the maximum capacity mechanical end stop.

5-4. REPAIR.

a. REMOVAL OF UNIT DUST COVER. - Loosen nine quarter-turn fasteners to remove the unit top dust cover. Both a Phillips and a flatblade screwdriver are required.

b. REMOVAL OF SUBASSEMBLIES. - To remove plug-in subassemblies, remove four captive screws at subassembly corners, and lift from chassis. The phasing discriminator subassembly cannot be removed until pendant and coaxial cables are disconnected. The rf interference filter subassembly (bottom of unit) is shielded and cannot be removed until the shield is removed. Remove four 8-32 screws at shield corners, and remove shield. Remove pendant cable clamp. Loosen six recessed 8-32 captive screws, and remove subassembly from chassis.

c. REMOVAL OF SUBASSEMBLY DUST COVERS. - All subassembly dust covers, except those on the rf interference filter and coupler servo-control subassemblies, are retained by two 6-32 screws in the subassembly top. The rf interference filter and coupler servo-control subassembly dust covers are removed by removing four 4-40 screws on each side.

d. REMOVAL OF FRONT PANEL. - To remove the front panel, perform the following steps in order.

(1) Remove the two black plastic knobs on thumb latch levers.

(2) Remove nineteen 10-32 flathead screws securing front panel to equipment.

(3) Front panel is connected to equipment by a pendant cable attached to P17. Unscrew two captive screws holding connector, and remove front panel. Do not lose four nylon couplings which will fall free when front panel is removed.

e. REMOVAL OF MODULE CHASSIS ASSEMBLY. - To remove the module chassis assembly, perform the following steps in order:

(1) Remove front panel according to instructions in paragraph 5-4d(1) through (3).

(2) Remove all subassemblies on module chassis assembly.

(3) Remove captive screws securing P2 to J2 and P3 to J3. Remove connectors.

(4) Remove seven 6-32 screws at inside bottom of module chassis. Remove two 2-56 elastic stop nuts holding J1. Pull J1 loose.

(5) Remove four 4-40 screws holding P21. Work connector loose.

(6) Remove two 8-32 screws holding module chassis at right side of antenna coupler.

(7) Remove nine 8-32 screws holding module chassis at left side of antenna coupler. Lift module chassis assembly straight up and out of equipment.

f. REMOVAL OF RF CIRCUIT ASSEMBLIES.

(1) Remove front panel and module chassis assembly according to the instructions in paragraphs 5-4d(1) through (3) and 5-4e(1) through (7).

(2) Remove four 4-40 screws securing P27. Perform this step only if the phasing-loading circuit assembly is to be removed.

(3) Remove five flathead 10-24 screws holding rf circuit assembly tie bar to bottom front of rf circuit assemblies.

(4) Remove five 10-24 screws which secure tie bar to chassis spine rod. Remove tie bar.

(5) Remove five 12-24 screws which secure spine bar to chassis bottom. Remove spine bar.

(6) Remove ten 6-32 screws from rear panel of antenna coupler chassis. Each rf circuit assembly is secured with 10 screws. Remove either set, or both, depending on which rf circuit assembly is to be removed.

(7) If the series-parallel circuit assembly is to be removed, lift up and forward, and remove. If the phasing-loading circuit assembly is to be removed, carefully work coaxial connector P27 (bottom of chassis) free, lift assembly up and forward, and remove.

g. REPLACEMENT OF FRONT PANEL. - Replacement of the front panel is essentially the reverse of removal. Be careful when replacing the four nylon couplings on tuning element drive shafts. These couplings are more easily replaced if they are pushed on the coupling halves attached to the front panel rather than on the coupling halves attached to the rf circuit assemblies. S t tuning knobs to zero. Refer to paragraph 5-4i(1) through (5).

h. REPLACEMENT OF RF CIRCUIT ASSEMBLIES. - Replacement of rf circuit assemblies is essentially the reverse of removal. Be careful when replacing the nylon couplings on tuning element drive shafts. These couplings are more easily replaced if they are pushed on the coupling halves attached to the rf circuit assemblies rather than on the coupling halves attached to the front panel. Set tuning knobs to zero. Refer to paragraph 5-4i(1) through (5).

i. TUNING KNOB ZERO ADJUSTMENT. - Each time the front panel of the antenna coupler is replaced, set the front panel tuning knobs to 0.

(1) Turn the rf tuning element knob in the HOME direction as far as it will go.

(2) Loosen two Bristol setscrews in black plastic knob. Remove the knob.

(3) Turn the outer dial to 0.

(4) Replace knob so that inner dial reads 0. Do not move outer dial or tuning element shaft. When replacing knob, be careful not to damage nylon gear. Leave approximately 1/4-inch of end play.

(5) Tighten two Bristol setscrews, and check that at the extreme HOME position both dials read 0 and are aligned.

j. PRINTED CIRCUIT BOARD REPAIR. - Parts mounted on the printed circuit boards are bonded to the board to protect them from damage from humidity and moisture. This bonding, or postcoating, also serves to protect the parts against excessive vibration in service. If the repair process requires that a part be removed from the board and replaced with another part, the following procedure should be followed. The bonding agent to be used in recoating the boards is a postcoating material, Dennis 1169 (federal stock number 5970-738-5960). This material consists of two parts, Dennis 1169A and 1169B, which must be mixed.

(1) Inspect the board for evidence of burns, scorches, or heat damage; corroded metal parts or terminals; or delamination of the base laminate. If any of these defects are evident, replace the entire board rather than attempt repair. If the board appears repairable, proceed as follows:

(2) Remove the designated part from the printed board by destroying the protective postcoating with a hot soldering iron, then unsolder the part, and lift it off the board with a pair of long-nosed pliers.

CAUTION

Do not use soldering irons rated above 100 watts on boards bearing transistors, Cerafil capacitors, or other heat sensitive components. Exercise care when removing components from printed circuit boards so that the circuitry is not damaged.

(3) If necessary, remove the excess solder from the joint with a soldering iron.

(4) Insert the new wire or component lead in the correct tubelet, and clinch the wire over the tubelet.

(5) Apply solder to the joint using any rosin flux core solder conforming to QQ-S-571 type AR or 63/37 (tin-lead) solid wire solder and rosin flux. Do not use a solder that has a core of hydrazine, acid, or other unapproved flux. Do not keep the iron on the joint longer than necessary to complete the solder flow throughout the joint.

(6) Inspect the solder joint to be sure the solder completely covers metal surfaces, component leads, tubelets, eyelets, or terminals and that there is a smooth continuous fillet of solder between tubelet flares and the circuitry. Note also that there are no cold or fractured solder joints, and no excess solder globules, peaks, strings, or bridges between adjacent parts or circuits.

(7) Clean the joint to remove the flux, using a medium-bristled brush and a small amount of organic solvent, such as trichloroethylene, toluol, or proprietary solvents such as Freon TMC. Remove as much of the melted plastic flux from the soldered area as possible. Remove excess solvent and dissolved flux with absorbent material.

Note

Use solvent sparingly since the postcoating will also be dissolved. Apply a small amount to the area of the solder joint only.

(8) Combine one part each of Dennis 1169A and 1169B liquid. Mix liquids thoroughly by stirring with stainless steel spatula in a stainless steel, wax-free paper, or polyethylene container.

(9) Apply the Dennis 1169 mixture to the newly soldered joint (or joints), covering all areas where the original coating was damaged and any new components which were added. Use a soft-bristled brush to apply the Dennis 1169.

(10) Allow the newly coated boards to dry to a tack-free condition (approximately 2 hours) before reassembling the module. The final cure will take approximately 7 days at room temperature or 1 hour at +60 °C (140 °F). However, the equipment may be operated during the curing period.

5-5. ILLUSTRATIONS.

Refer to figures 5-2 through 5-17 for location and identification of test points and detail parts on Antenna Couplers CU-1169/SRC-16. Refer to figures 5-18 through 5-22 for schematics.

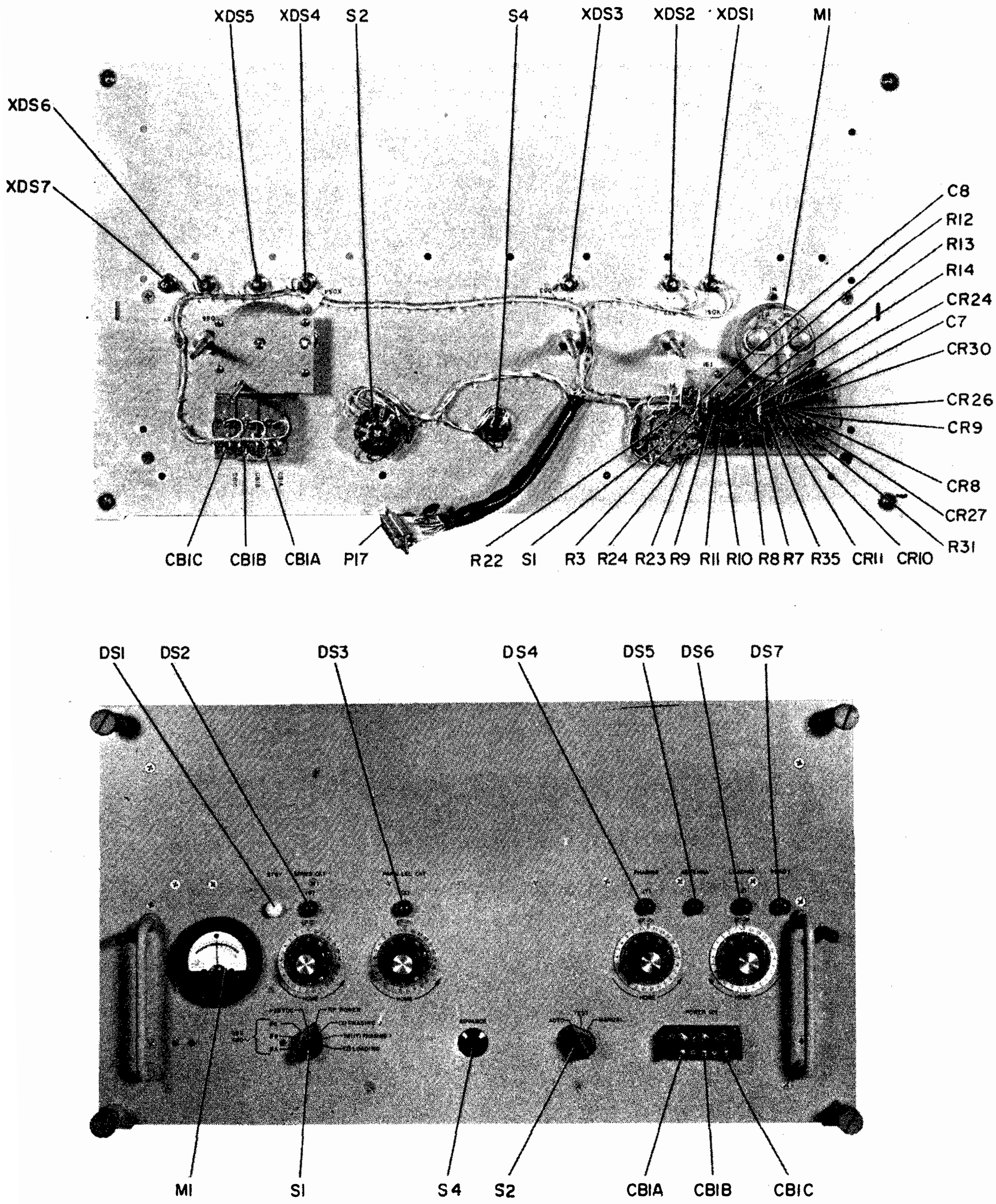

Figure 5-2. Antenna Coupler CU-1169/SRC-16, Front Panel, Parts Location

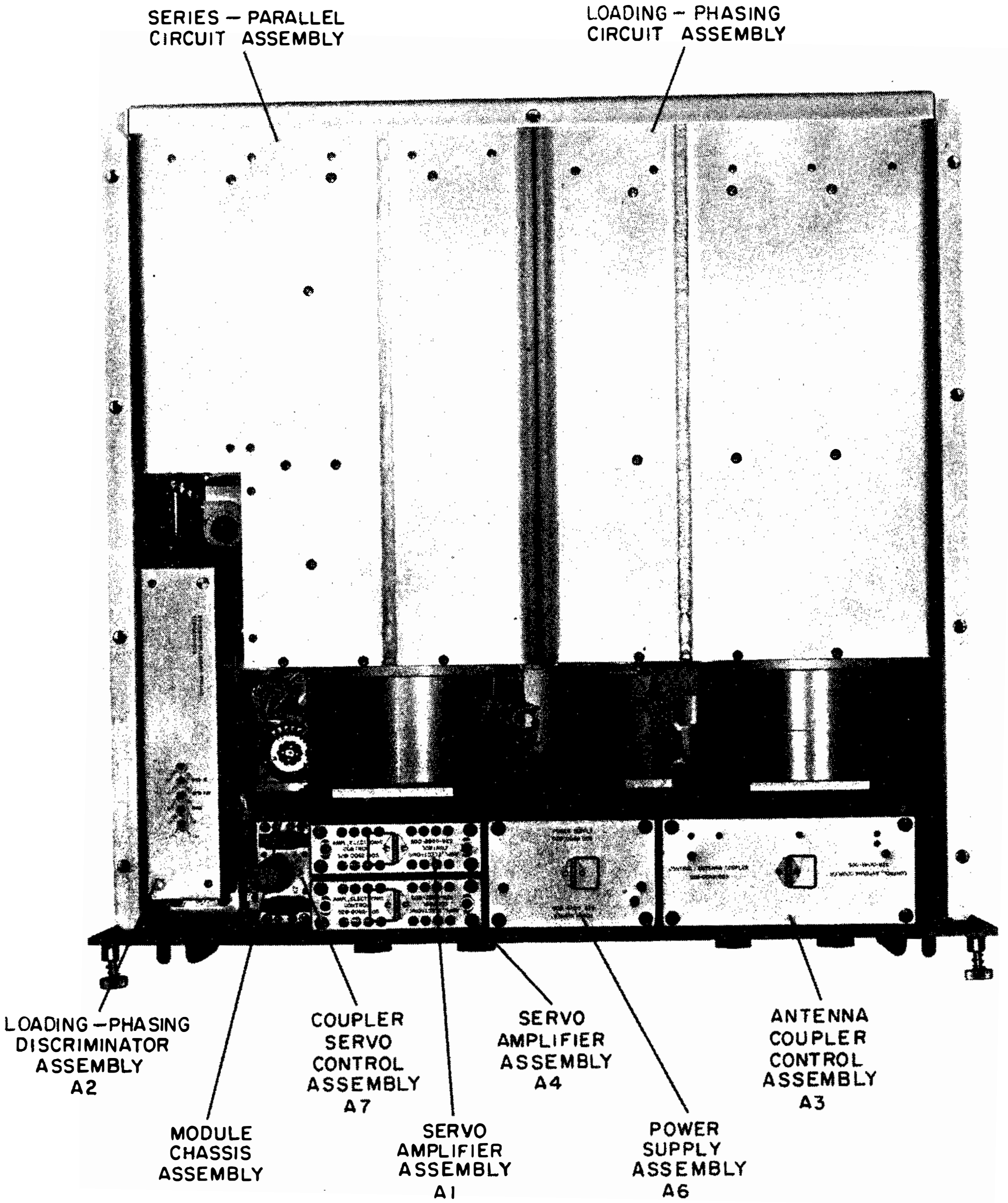

Figure 5-3. Antenna Coupler CU-1169/SRC-16, Top View, Dust Cover Removed, Parts Location

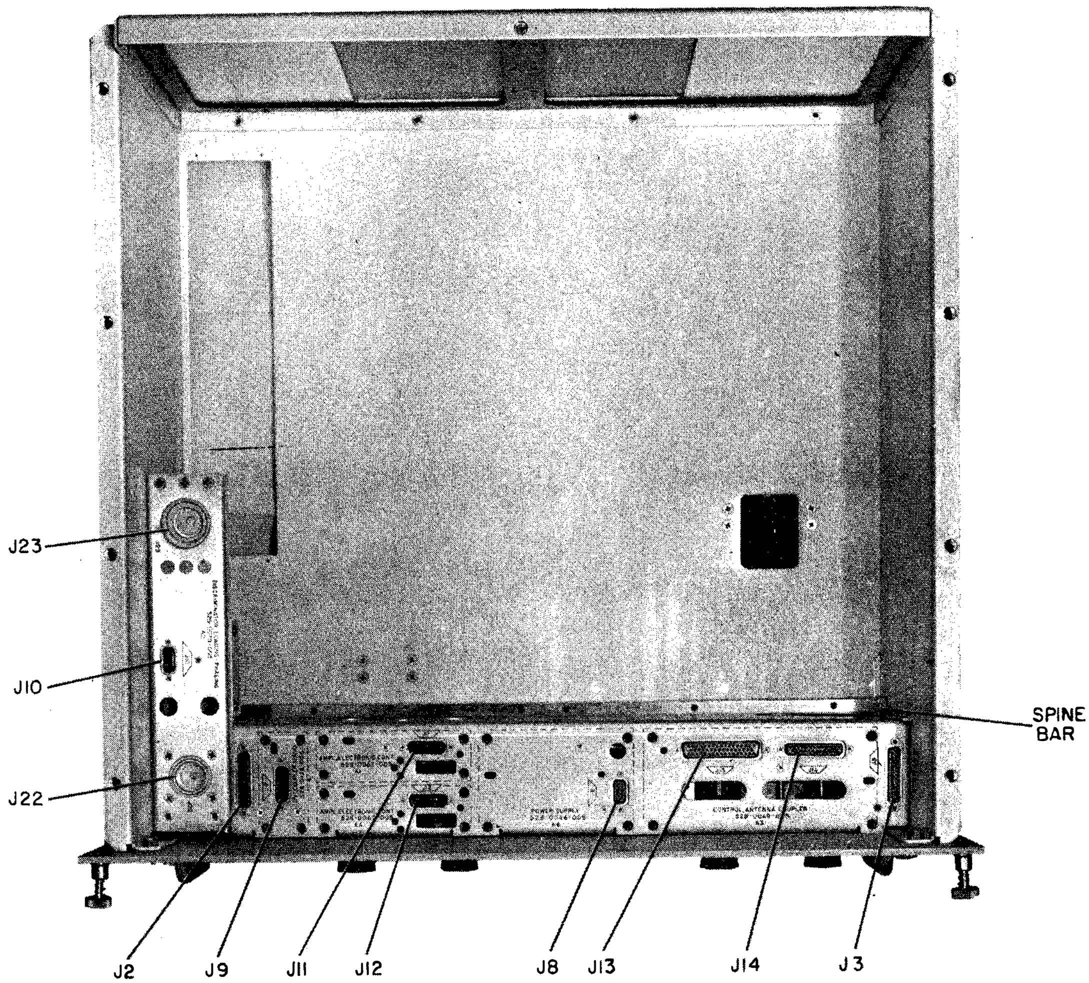

Figure 5-4. Antenna Coupler CU-1169/SRC-16, Top View, Assemblies Removed, Parts Location

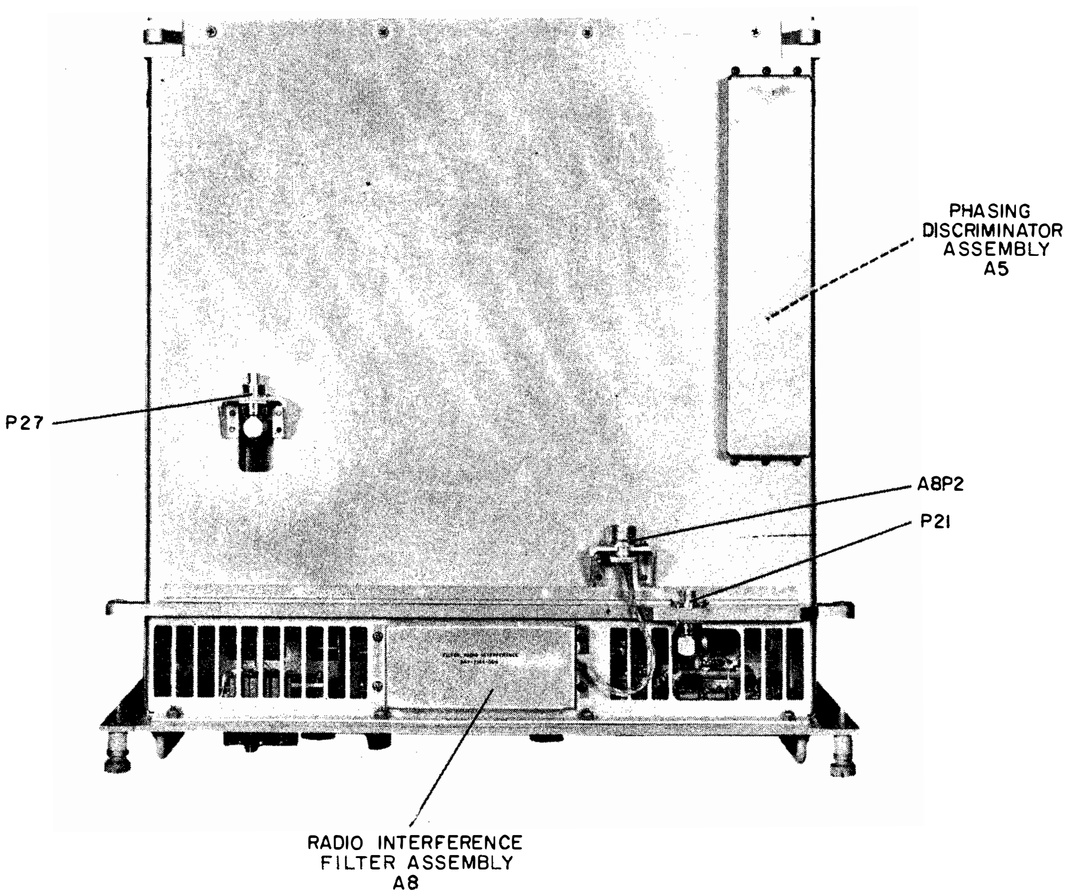

Figure 5-5. Antenna Coupler CU-1169/SRC-16, Bottom View, Parts Location

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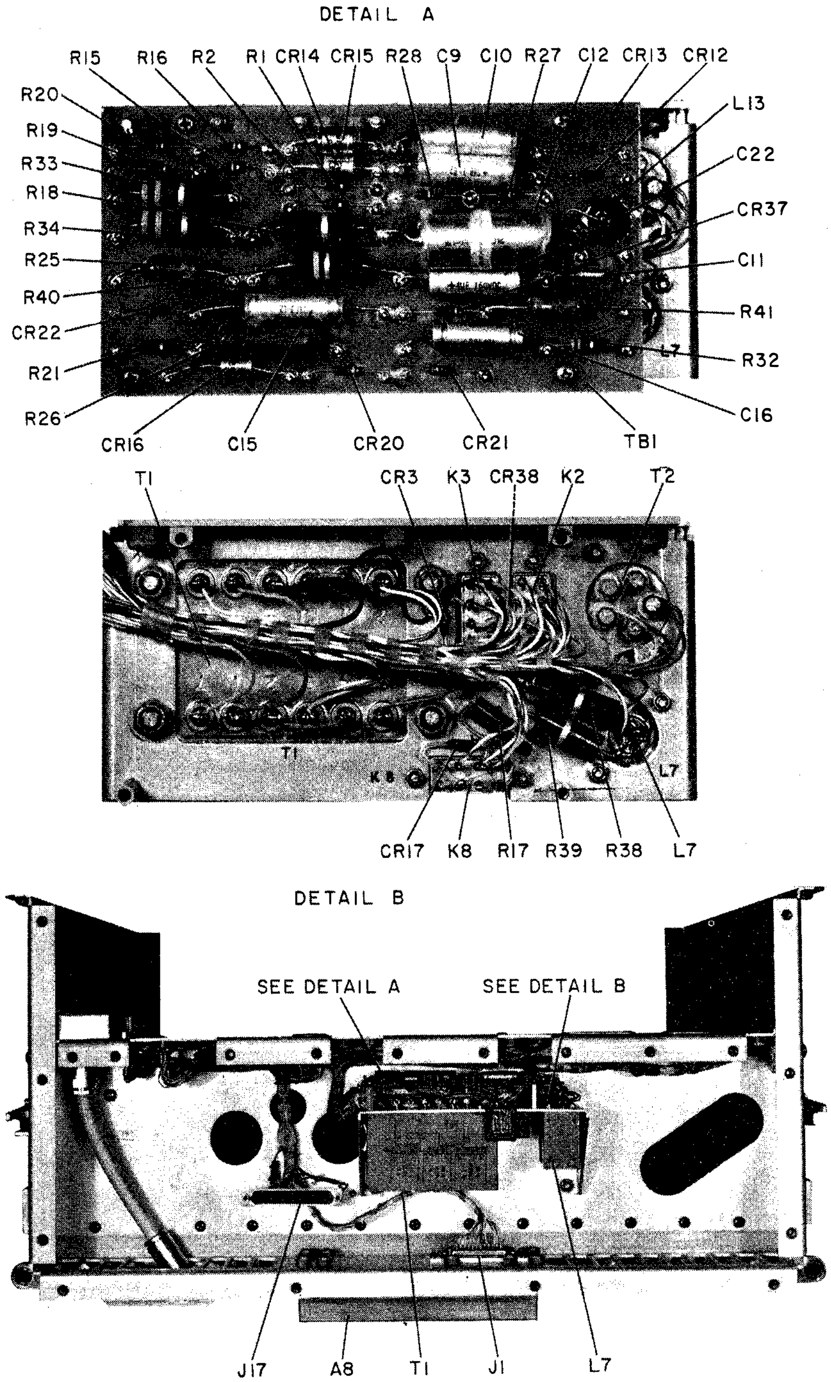

Figure 5-6. Antenna Coupler CU-1169/SRC-16,
Front Panel Removed, Parts Location

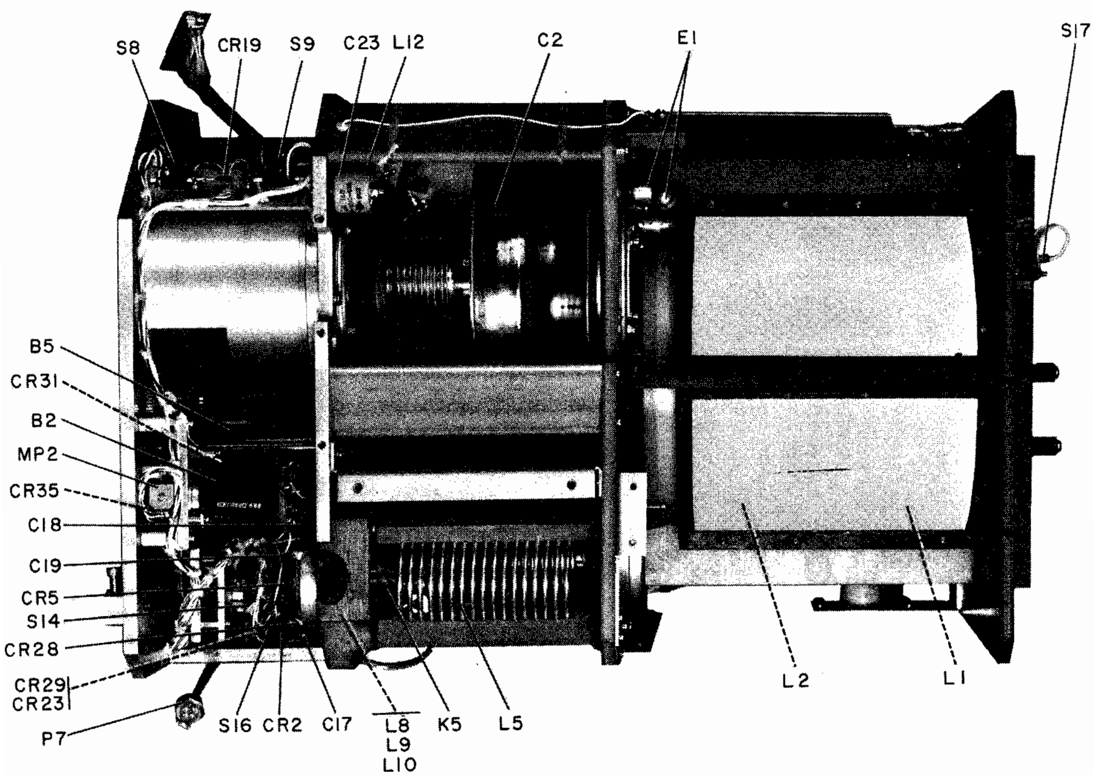

Figure 5-7. Series-Parallel Circuit Assembly, Right Side, Parts Location

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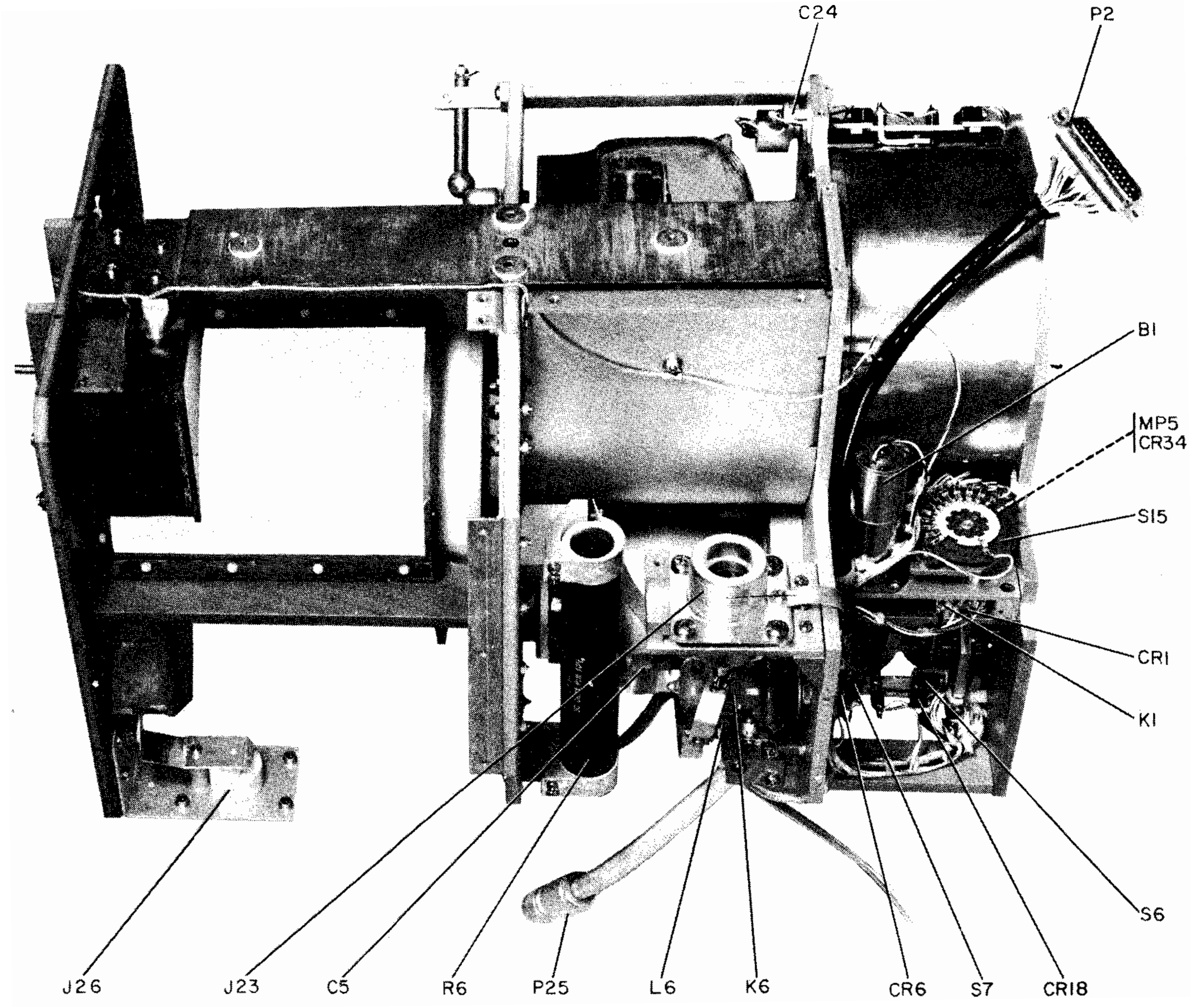

Figure 5-8. Series-Parallel Circuit Assembly, Parts Location

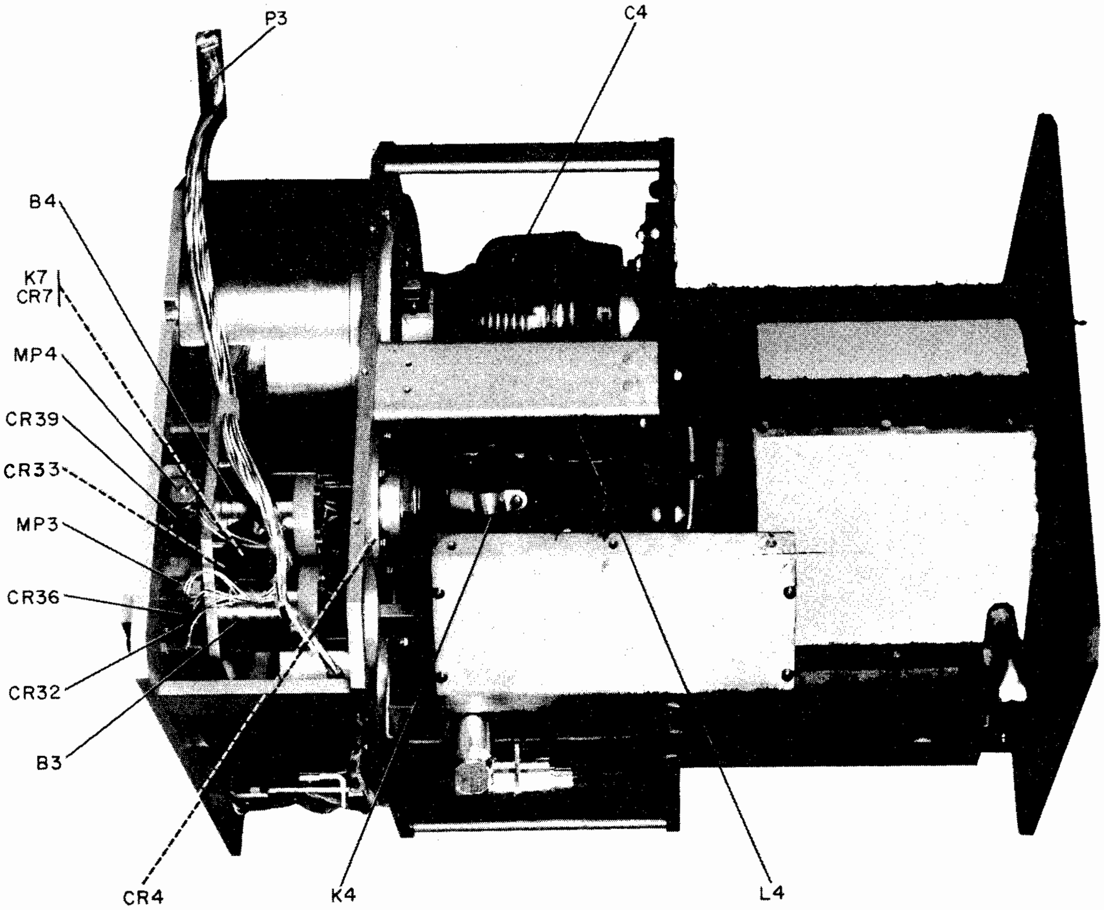

Figure 5-9. Loading-Phasing Circuit Assembly, Right Side, Parts Location

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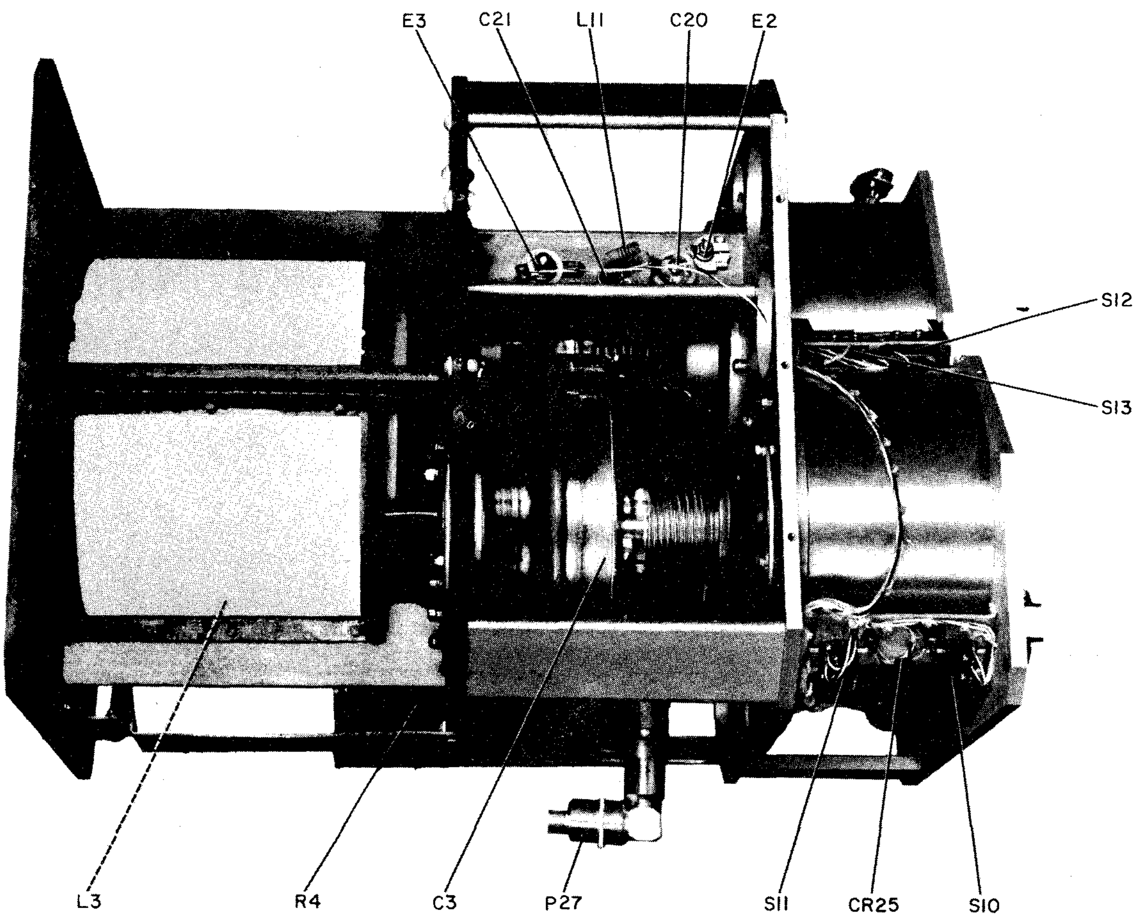

Figure 5-10. Loading-Phasing Circuit Assembly, Left Side, Parts Location

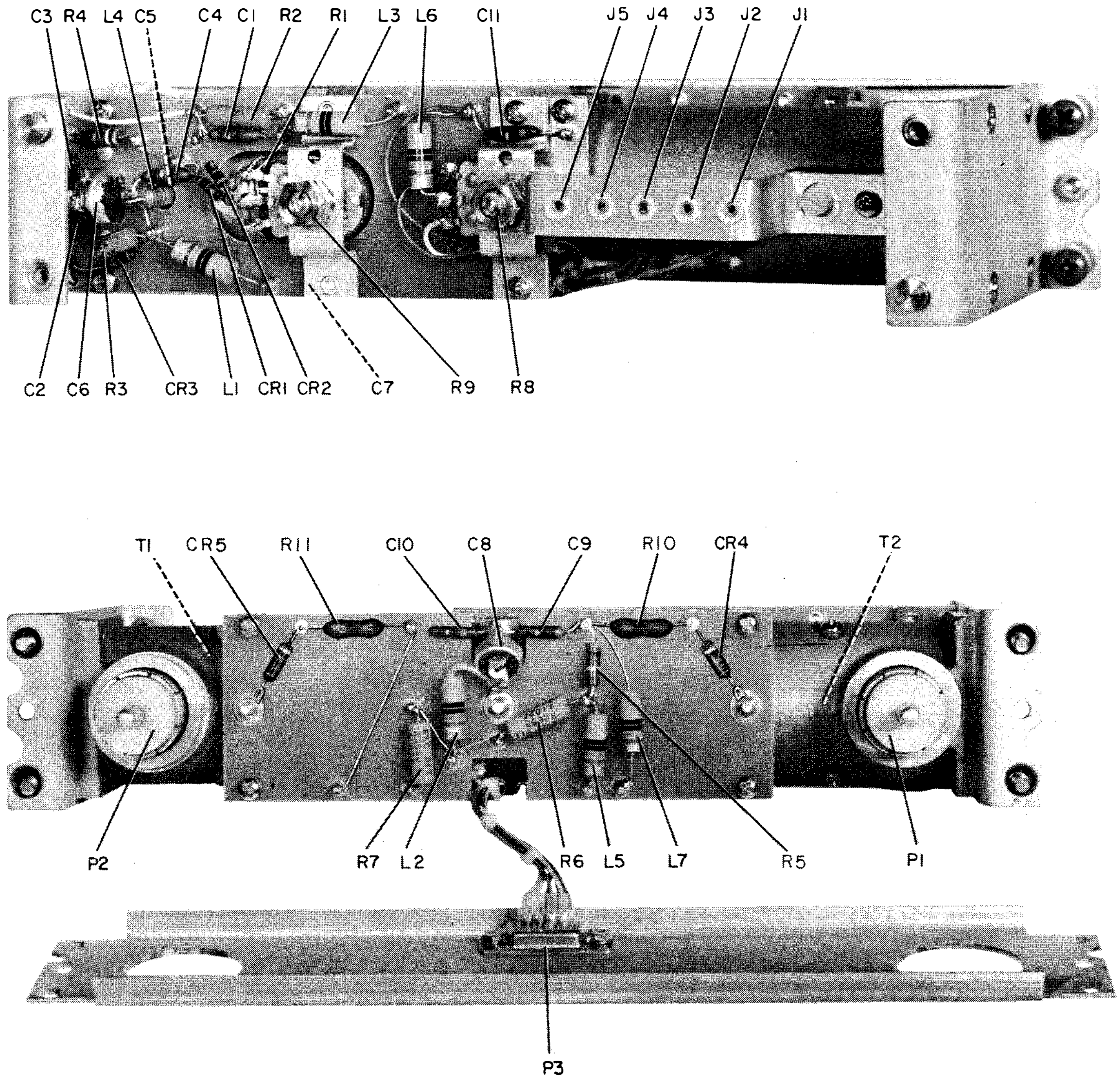

Figure 5-11. Loading-Phasing Discriminator Assembly A2, Parts Location

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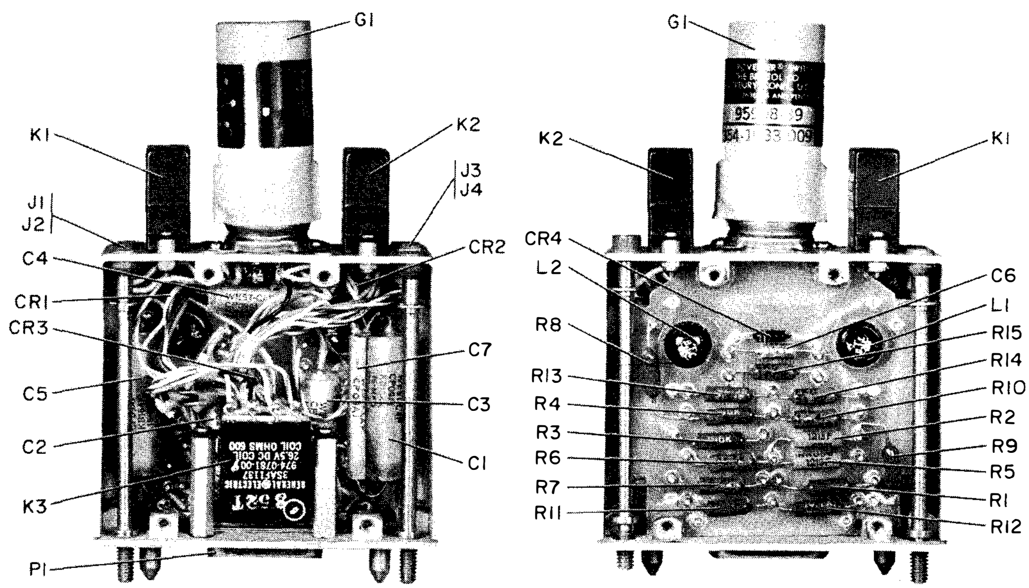


Figure 5-12. Antenna Coupler Servo-Control Assembly A7, Parts Location

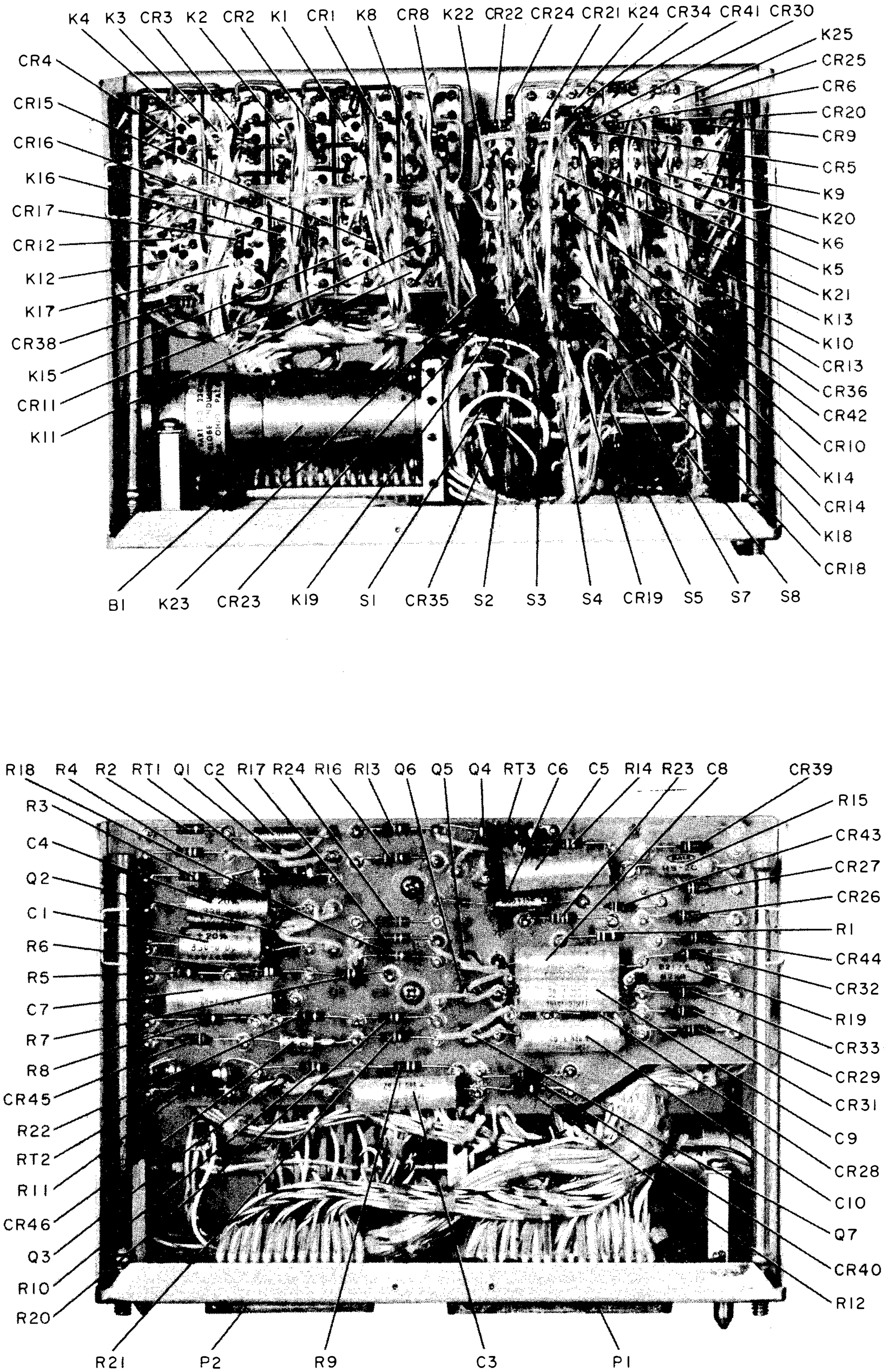


Figure 5-13. Antenna Coupler Control Assembly A3, Parts Location

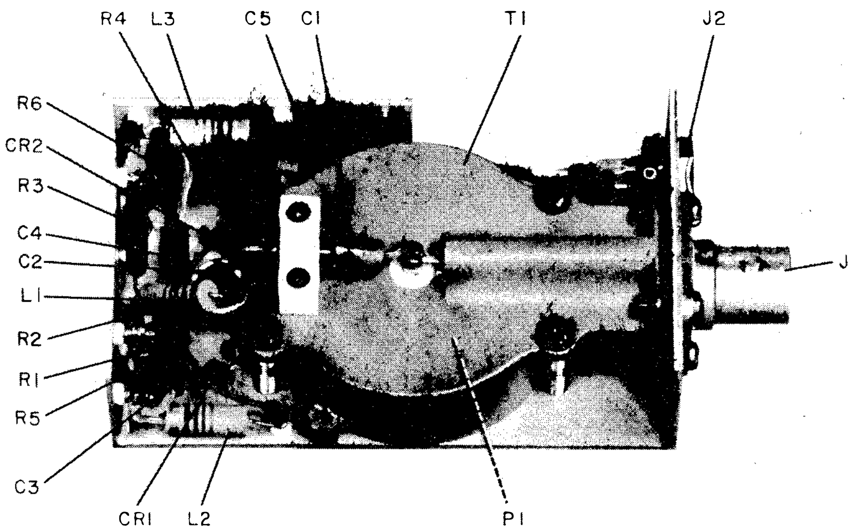
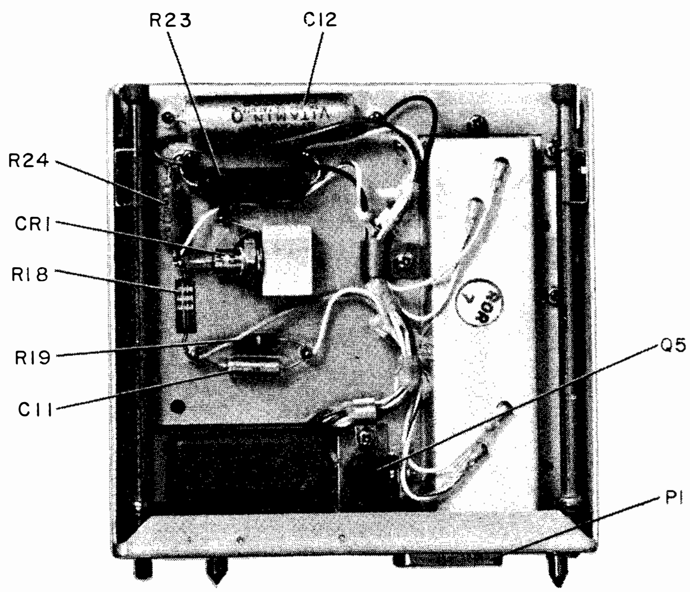


Figure 5-14. Phasing Discriminator Assembly A5, Parts Location



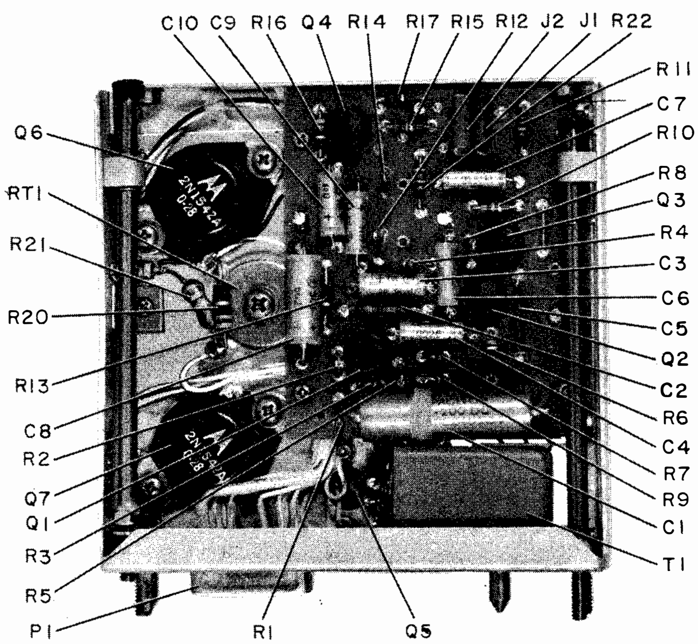


Figure 5-15. Electronic Control Amplifier Assembly A1 and A4, Parts Location

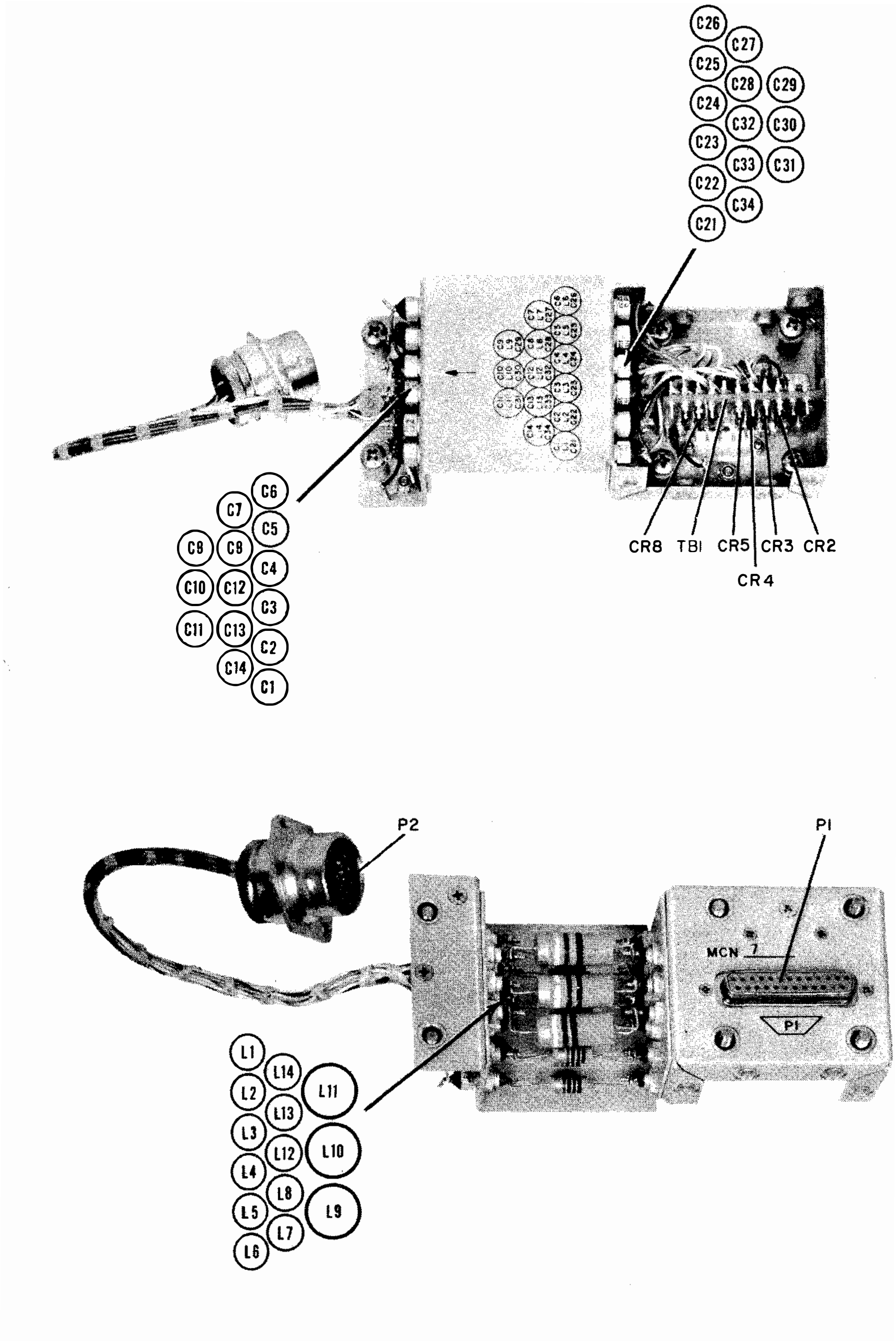


Figure 5-16.. Radio Frequency Interference Filter Assembly A8, Parts Location

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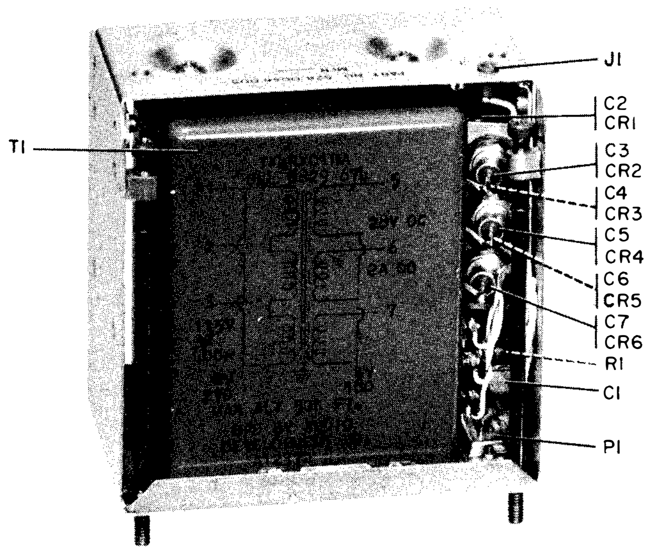

Figure 5-17. Power Supply Assembly A6, Parts Location

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PARTS LOCATION INDEX

Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc
A1	18A	A6CR1	29A	A8CR8	29F	CB1	51D	DS3	51B	L11	82A	R27	39D
A1P1	14B	A6CR2	29A	A8L1	25F			DS4	57A	L12	72E	R28	39E
		A6CR3	31A	A8L2	26F	CR1	68C	DS5	57C	L13	4C	R29	17C
A2	6A	A6CR4	31A	A8L3	26F	CR2	64D	DS6	57B			R30	22C
A2P1	2A	A6CR5	32A	A8L4	27F	CR3	41F	DS7	51G	M1	55G	R31	55G
A2P2	6A	A6CR6	32A	A8L5	27F	CR4	84C					R32	37C
A2P3	2B	A6R1	33B	A8L6	28F	CR5	60D	E1	72D	MP2	68E	R33	37B
		A6P1	26B	A8L7	29F	CR6	66B	E2	79A	MP3	76E	R34	16C
A3	13H	A6T1	28A	A8L8	29F	CR7	81F	E3	80A	MP4	78D	R35	53F
A3P1	1G			A8L9	30F	CR8	55F			MP5	61E	R38	13F
A3P2	14G	A7	12A	A8L10	30F	CR9	55F	J1	25E			R39	14F
		A7P1	7B	A8L11	31F	CR10	52F	J2	59G	P2	59G	R40	40F
A4	23A	A8	34F	A8L12	32F	CR11	56C	J3	73G	P3	73G	R41	38F
A4P1	19B	A8C1	25G	A8L13	32F	CR12	38D	J8	26B	P7	70E		
		A8C2	26G	A8L14	33F	CR13	38E	J9	8C	P17	45A	S1A-F	53G
A5	70A	A8C3	27G	A8P1	25E	CR14	40D	J10	2C	P21	1A	S1A-R	53D
A5C1	69A	A8C4	27G	A8P2	25G	CR15	40E	J11	14C	P25	67A	S1B-F	56G
A5C2	69A	A8C5	28G			CR16	40C	J12	19C	P27	85A	S1B-R	57F
A5C3	68B	A8C6	28G	B1	69C	CR17	41C	J13	1F			S1C-F	55A
A5C4	70B	A8C7	29G	B2	67F	CR18	60D	J14	14F	R1	40D	S1C-R	53A
A5C5	70D	A8C8	30G	B3	75E	CR19	68D	J17	44A	R2	40E		
A5CR1	68A	A8C9	30G	B4	79D	CR20	41G	J22	2A	R3	50A	S2A-F	47C
A5CR2	70A	A8C10	31G	B5	62F	CR21	42G	J23	6A	R4	85B	S2A-R	47B
A5J1	68A	A8C11	31G			CR22	39B	J26	71A	R6	65A	S2B-F	47F
A5J2	70D	A8C12	32G	C2	72B	CR23	63B			R7	54F	S2B-R	47D
A5L1	70B	A8C13	33G	C3	74A	CR24	52F	K1	68C	R8	53F		
A5L2	70C	A8C14	33G	C4	80A	CR25	77D	K2	42F	R9	55G	S3	76A
A5L3	71C	A8C21	25F	C5	62A	CR26	54B	K3	41F	R10	53G	S4	48E
A5P1	71A	A8C22	26F	C7	55F	CR27	55B	K4	84B	R11	54F	S6	61D
A5R1	69B	A8C23	27F	C8	54G	CR28	59F	K5	60D	R12	53E	S7	61E
A5R2	70B	A8C24	27F	C9	38D	CR29	63C	K6	66B	R13	54E	S8	67D
A5R3	70C	A8C25	28F	C10	38E	CR30	54F	K7	81F	R14	53F	S9	67E
A5R4	71C	A8C26	28F	C11	4C	CR31	67F	K8	40C	R15	40C	S10	75C
A5R5	68B	A8C27	29F	C12	22G	CR32	79E			R16	40D	S11	75D
A5R6	71B	A8C28	30F	C15	39C	CR33	75F	L1	72A	R17	41B	S12	79C
A5T1	70A	A8C29	30F	C16	37D	CR34	60F	L2	72A	R18	22F	S13	79C
		A8C30	31F	C17	59E	CR35	68F	L3	73A	R19	40D	S14	65B
A6	31A	A8C31	31F	C18	61B	CR36	76E	L4	83A	R20	41E	S15	67C
A6C1	33A	A8C32	32F	C19	61C	CR37	38F	L5	60A	R21	40B	S16-F	65F
A6C2	29B	A8C33	33F	C20	82B	CR38	42G	L6	64A	R22	51A	S16-R	64F
A6C3	30A	A8C34	33F	C21	83B	CR39	78E	L7	14F	R23	56A	S17	71F
A6C4	31B	A8CR2	26F	C22	39F			L8	59D	R24	55B		
A6C5	31A	A8CR3	26F	C23	72F	DS1	51F	L9	60B	R25	38B	T1	37D
A6C6	33B	A8CR4	27F	C24	72E	DS2	50B	L10	60C	R26	39B	T2	23G
A6C7	33A	A8CR5	27F										

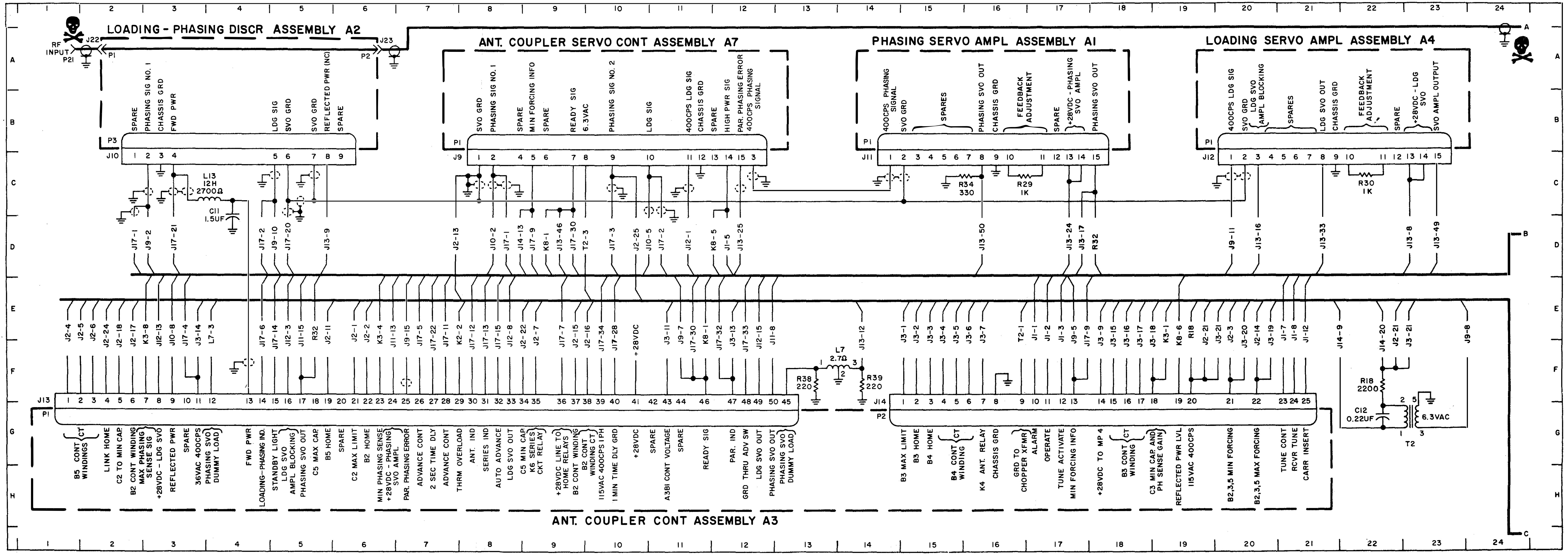


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 1 of 4)

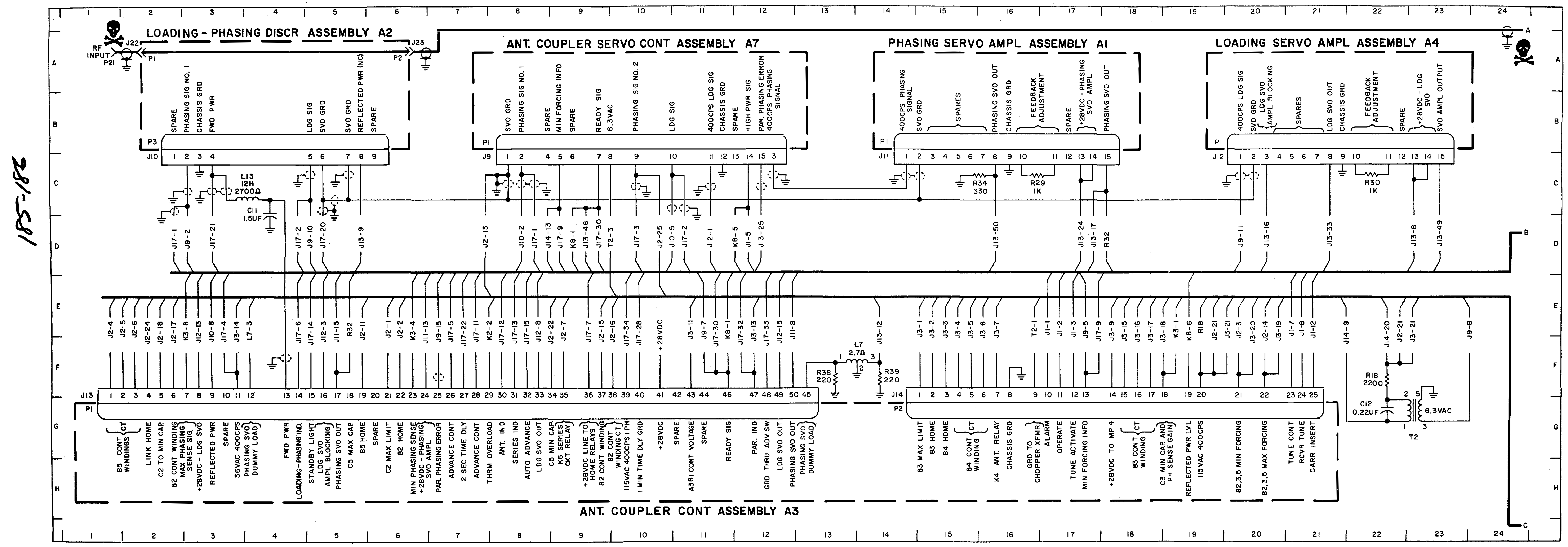


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 1 of 4)

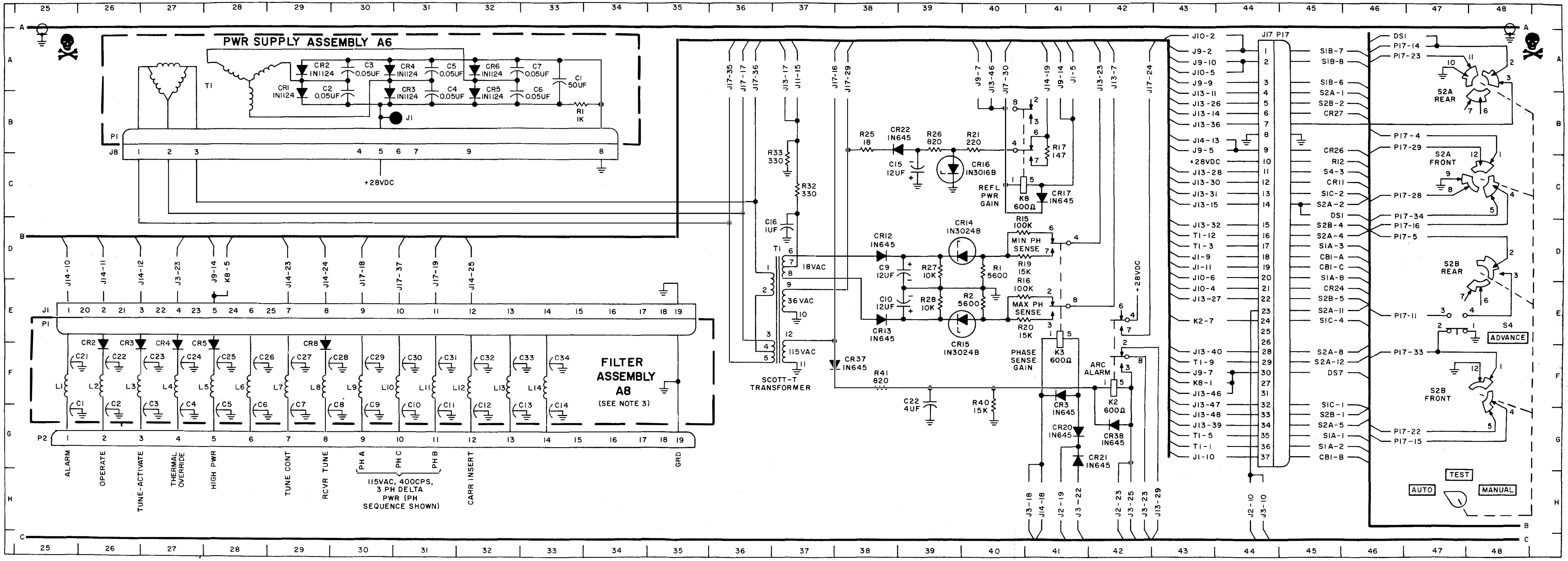


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 2 of 4)

189-190

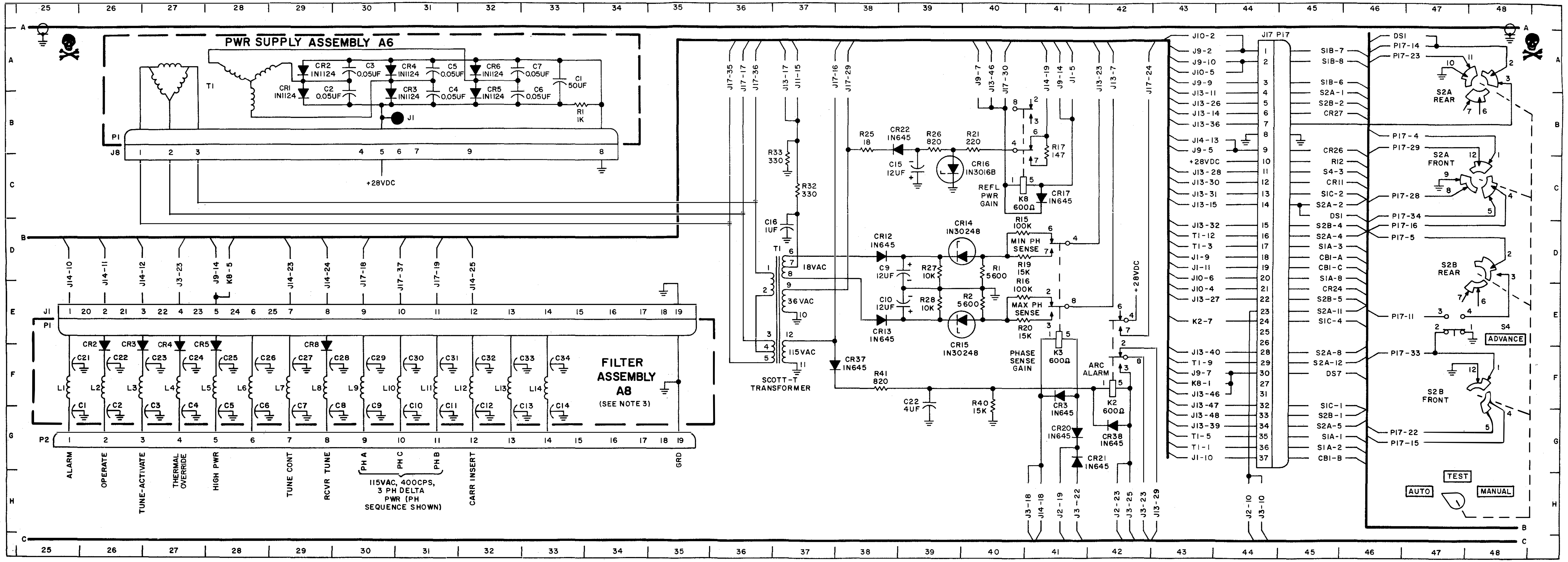


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 2 of 4)

191-192

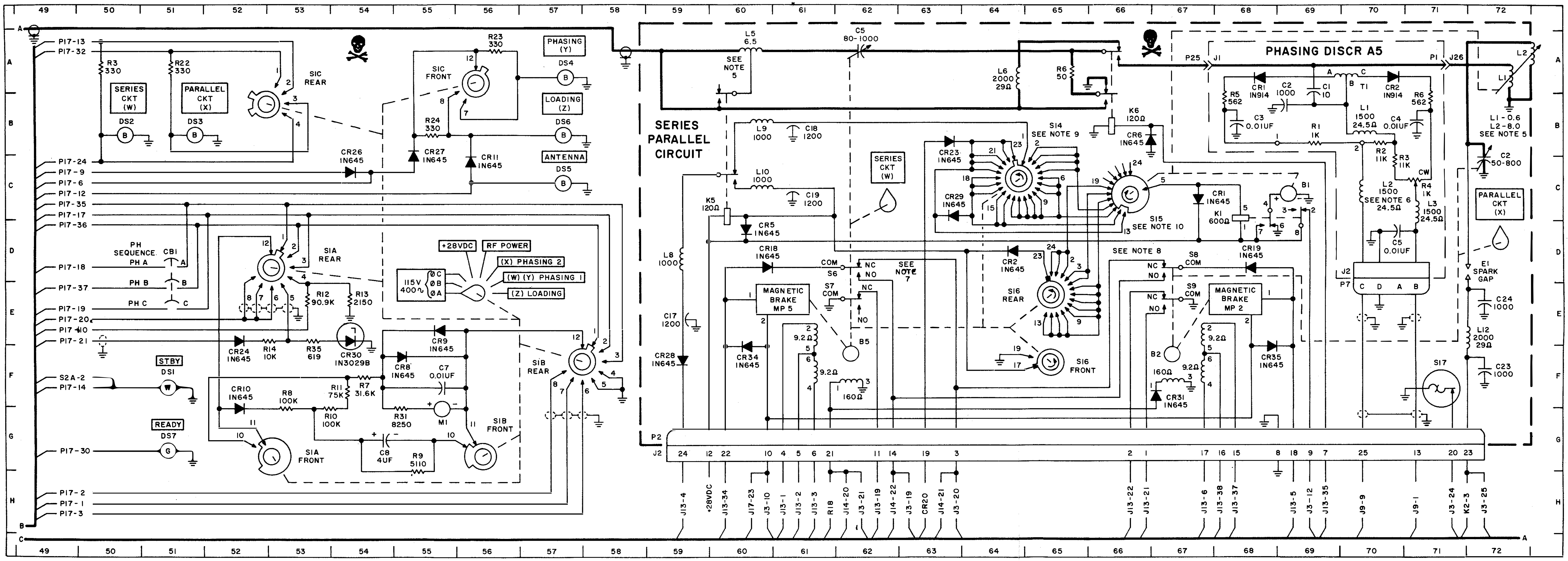


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 3 of 4)

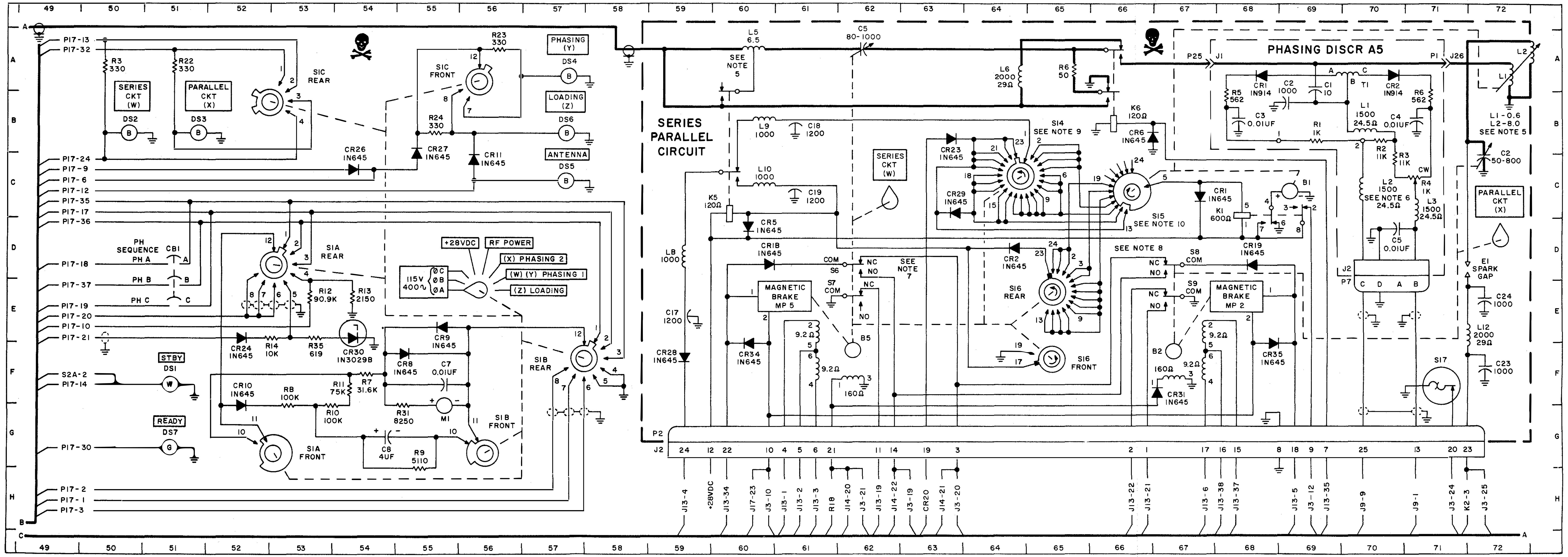
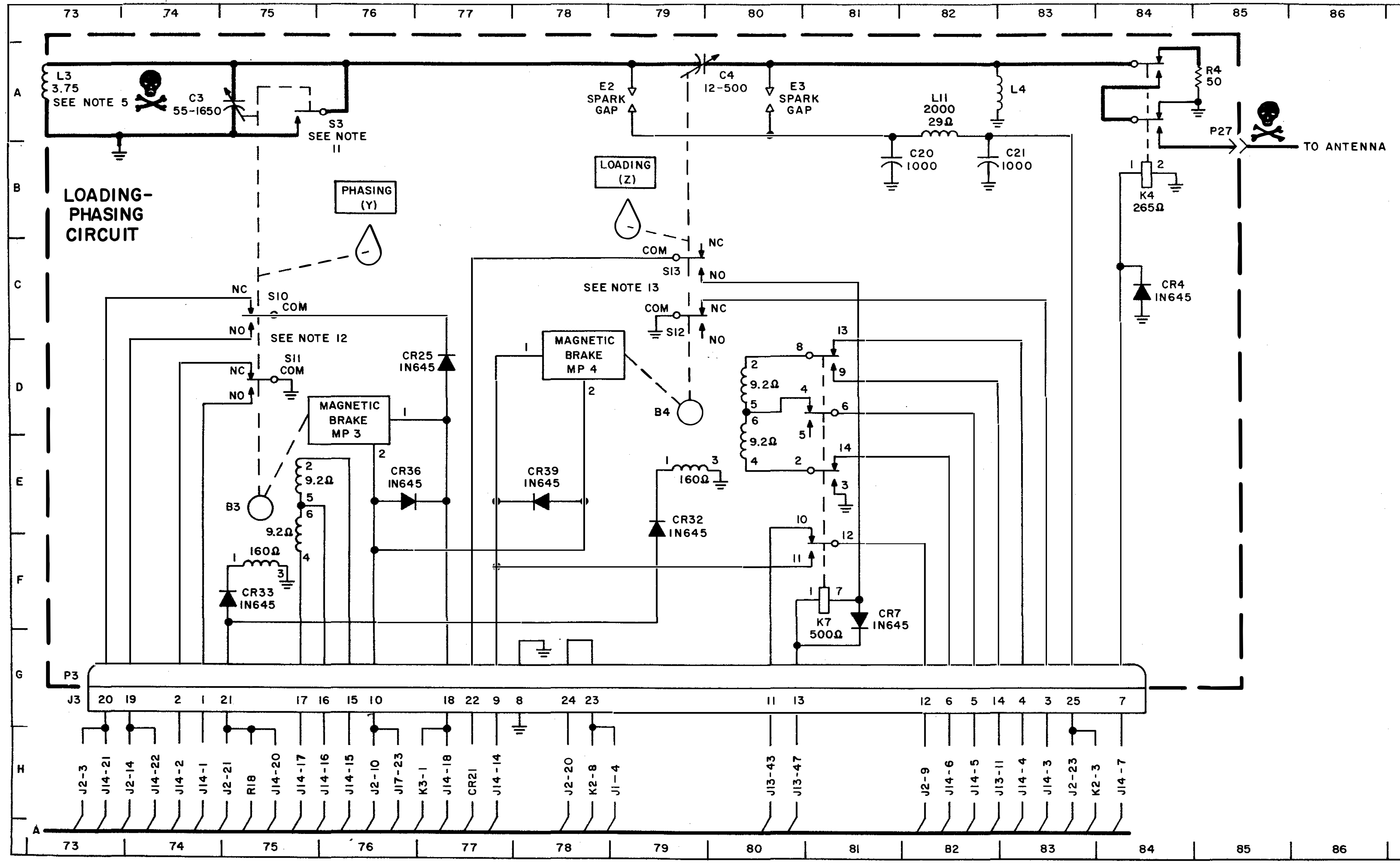


Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 3 of 4)

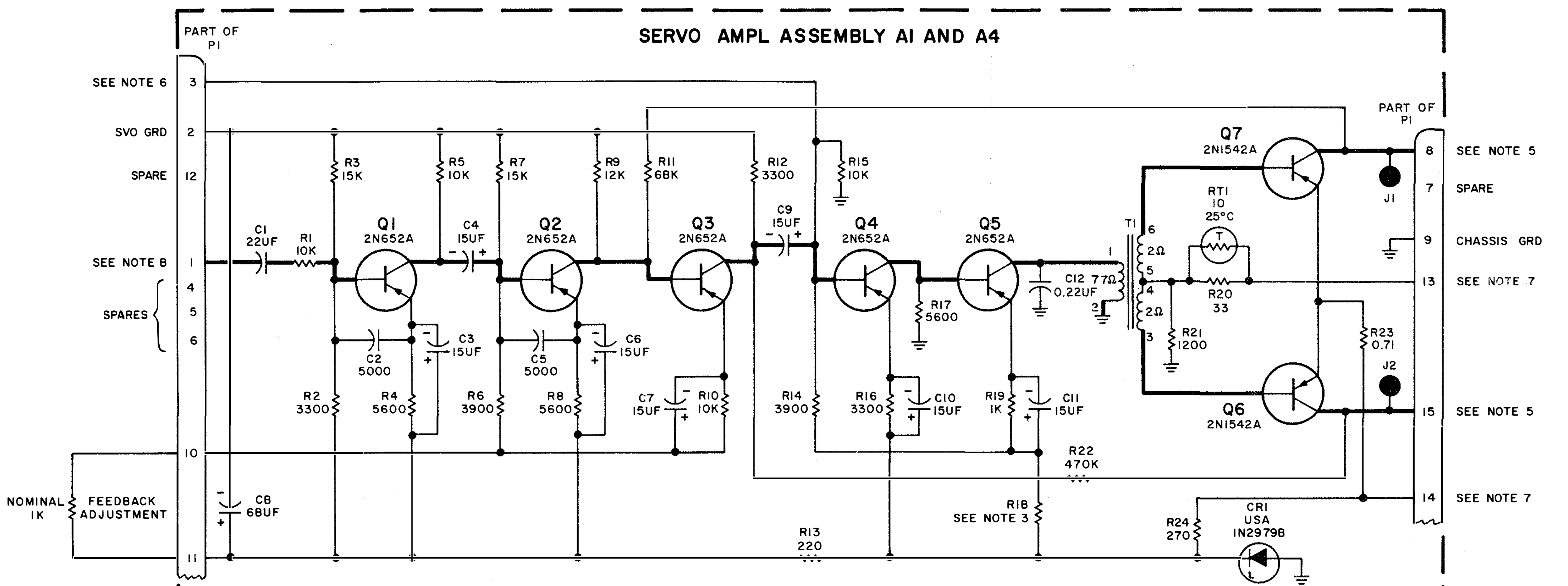
195-196



NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX DESIGNATIONS WITHIN ASSEMBLIES WITH ASSEMBLY DESIGNATION.
3. L9, L10, AND L11 ARE 450 MICROHENRYS, 1.2 OHM. L1 THRU L8, AND L12 THRU L14 ARE 1000 MICROHENRYS, 16.7 OHMS. C1 THRU C34 ARE 1200 MICROHENRYS. CR2, 3, 5, AND 8 ARE IN645.
4. ALL SWITCHES VIEWED FROM THE KNOB OR DRIVEN END.
5. TYPICAL VALUES SHOWN. ACTUAL VALUES DETERMINED IN PRODUCTION.
6. L2 MAY BE CONNECTED TO POINT 1 OR 2 AS CIRCUIT BALANCE REQUIRES.
7. S6 OPERATES AT MINIMUM CAPACITY (C5). S7 OPERATES AT MAXIMUM CAPACITY (C5).
8. S8 OPERATES AT MINIMUM CAPACITY (C2). S9 OPERATES AT MAXIMUM CAPACITY (C2).
9. S14 SHOWN AT 2MC OR HOME POSITION, AND C5 AT MAXIMUM CAPACITY.
10. S15 SHOWN AT 2MC OR HOME POSITION, AND MAXIMUM COUPLING OF L1, L2, AND L3.
11. S3 CLOSES AT MAXIMUM CAPACITY (C3).
12. S10 OPERATES AT MINIMUM CAPACITY (C3). S11 OPERATES AT MAXIMUM CAPACITY (C3)
13. S12 OPERATES AT MINIMUM CAPACITY (C4).
14. NON STANDARD SYMBOL: Ω DESIGNATES DC RESISTANCE IN OHMS.
15. UNLESS OTHERWISE INDICATED, DC RESISTANCES OF RF COILS ARE LESS THAN 1 OHM.
16. THE LETTER (CW) PLACED ADJACENT TO THE APPROPRIATE TERMINAL OF A POTENTIOMETER INDICATES THE DIRECTION OF ROTATION WHEN VIEWED FROM THE SHAFT END.
17. ☠ SIGNIFIES DANGEROUSLY HIGH VOLTAGES EXIST. KEEP CLEAR! USE EXTREME CARE WHEN MEASURING.

Figure 5-18. Antenna Coupler CU-1169/SRC-16, Schematic Diagram (Sheet 4 of 4)



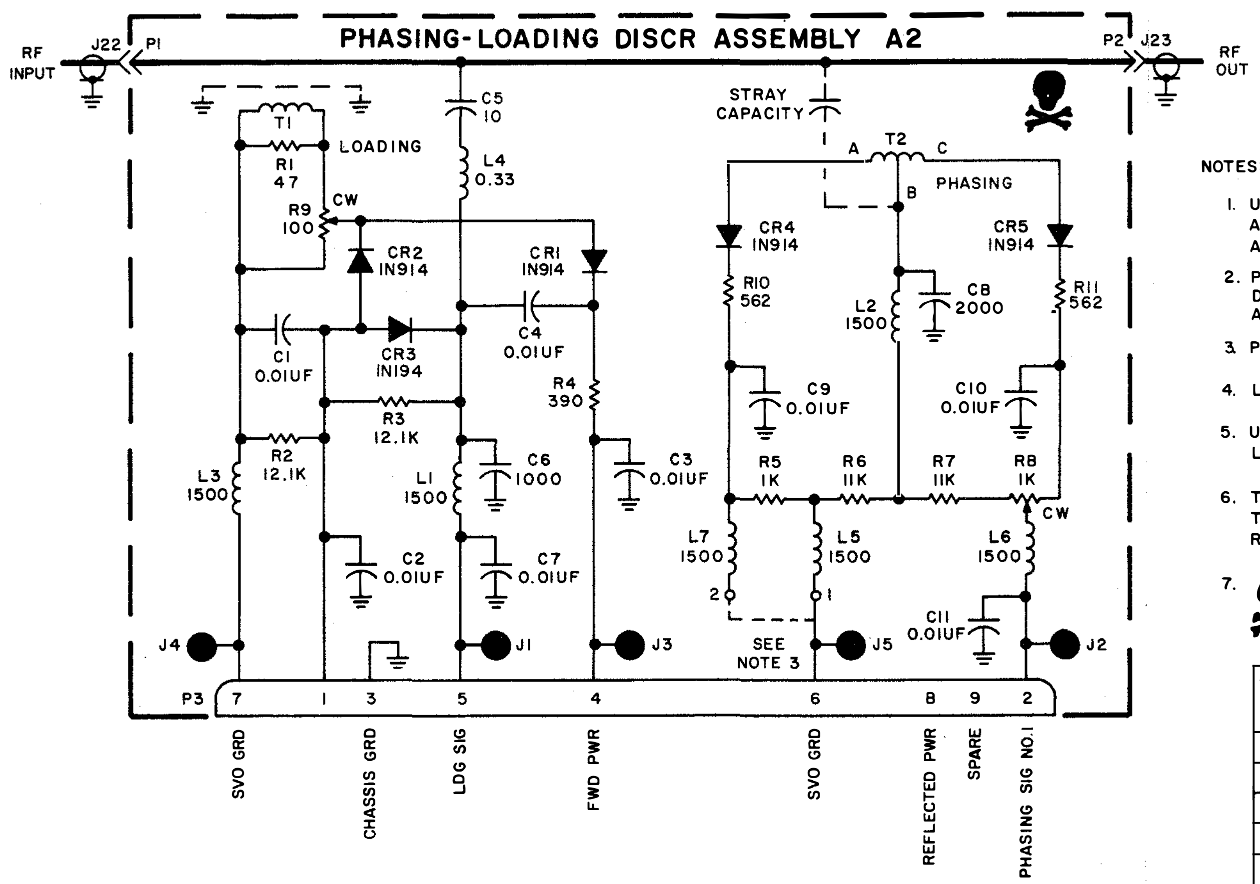
HIGHEST REFERENCE DESIGNATION	
R24	CR1
Q6	RT1
C12	J2
T1	P1
REFERENCE DESIGNATIONS NOT USED	

NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN PICOFARADS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
3. R18 TO BE SELECTED IN PRODUCTION.
4. PHASING ERROR INPUT TO SUBASSEMBLY A1. LOADING ERROR INPUT TO SUBASSEMBLY A4.
5. PHASING SERVO OUT FROM SUBASSEMBLY A1. LOADING SERVO OUT FROM SUBASSEMBLY A4.
6. LOADING SERVO AMPLIFIER BLOCKING INPUT TO SUBASSEMBLY A4 ONLY.
7. +28VDC - PHASING SERVO AMPLIFIER TO SUBASSEMBLY A1. +28VDC - LOADING SERVO TO SUBASSEMBLY A4.
8. 400CPS PHASING TO SUBASSEMBLY A1. 400CPS LOADING SIGNAL TO SUBASSEMBLY A4.
9. NON STANDARD SYMBOL: Ω DESIGNATES DC RESISTANCE IN OHMS.

Figure 5-19. Electronic Control Amplifier Assembly A1 and A4, Schematic Diagram

199-200



NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION, PREFIX WITH UNIT NUMBER AND/OR ASSEMBLY DESIGNATION.
3. P3-6 IS CONNECTED TO POINT 1 OR 2 AS CIRCUIT BALANCE REQUIRES.
4. L1, L2, L3, L5, L6, AND L7 DC RESISTANCE VALUES ARE 24.5 OHMS.
5. UNLESS OTHERWISE INDICATED, DC RESISTANCES OF RF COILS ARE LESS THAN 1 OHM.
6. THE LETTER (CW) PLACED ADJACENT TO THE APPROPRIATE TERMINAL OF A POTENTIOMETER INDICATES THE DIRECTION OF ROTATION WHEN VIEWED FROM THE SHAFT END.
7. ☠ SIGNIFIES DANGEROUSLY HIGH VOLTAGES EXIST. KEEP CLEAR! USE EXTREME CARE WHEN MEASURING.

HIGHEST REFERENCE DESIGNATION	
R11	C11
L7	CR5
T2	J5
P3	
REFERENCE DESIGNATIONS NOT USED	

Figure 5-20. Loading-Phasing Discriminator Assembly A2, Schematic Diagram

201-202

PART LOCATION INDEX

Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc	Ref Desig	Loc
B1	15C	CR12	18D	CR36	26G	K13	19F	R1	20C	RT1	27E
		CR13	19F	CR37		K14	19H	R2	29E	RT2	32B
C1	28G	CR14	18H	CR38	19C	K15	20C	R3	27E	RT3	32C
C2	28E	CR15	20C	CR39	18F	K16	20F	R4	29E		
C3	28D	CR16	20F	CR40	29D	K17	24C	R5	29F	S1F	1A
C4	28G	CR17	23C	CR41	28B	K18	24E	R6	28F	S1R	5A
C5	18F	CR18	24E	CR42	18G	K19	24H	R7	28F	S2F	1C
C6	28A	CR19	24H	CR43	29A	K20	27B	R8	29G	S2R	5C
C7	32H	CR20	26B	CR44	20C	K21	27D	R9	32A	S3F	1D
C8	23E	CR21	26D	CR45	33G	K22	27F	R10	32B	S3R	5E
C9	23G	CR22	26F	CR46	32G	K23	27G	R11	32B	S4F	1F
C10	26B	CR23	26G			K24	27B	R12	28D	S4R	5F
		CR24	28B	K1	6G	K25	27D	R13	32C	S5F	1G
CR1	6G	CR25		K2	10G			R14	32D	S5R	4G
CR2	9G	CR26	12D	K3	10C	P1	36A	R15	18E	S6F	
CR3	11G	CR27	12D	K4	10G	P2	42B	R16	33C	S6R	
CR4	12G	CR28	11G	K5	14B			R17	32E	S7F	7A
CR5	14B	CR29	11H	K6	14D	Q1	28E	R18	32F	S7R	9A
CR6	14D	CR30	14B	K7		Q2	29H	R19	22G	S8F	6C
CR7		CR31	26A	K8	14G	Q3	31A	R20	31H	S8R	9C
CR8	14G	CR32	23E	K9	15B	Q4	31C	R21	31G		
CR9	16B	CR33	23G	K10	15D	Q5	31D	R22	32H		
CR10	16D	CR34	28B	K11	15G	Q6	31E	R23	32A		
CR11	16G	CR35	2G	K12	19C	Q7	31G	R24	29G		

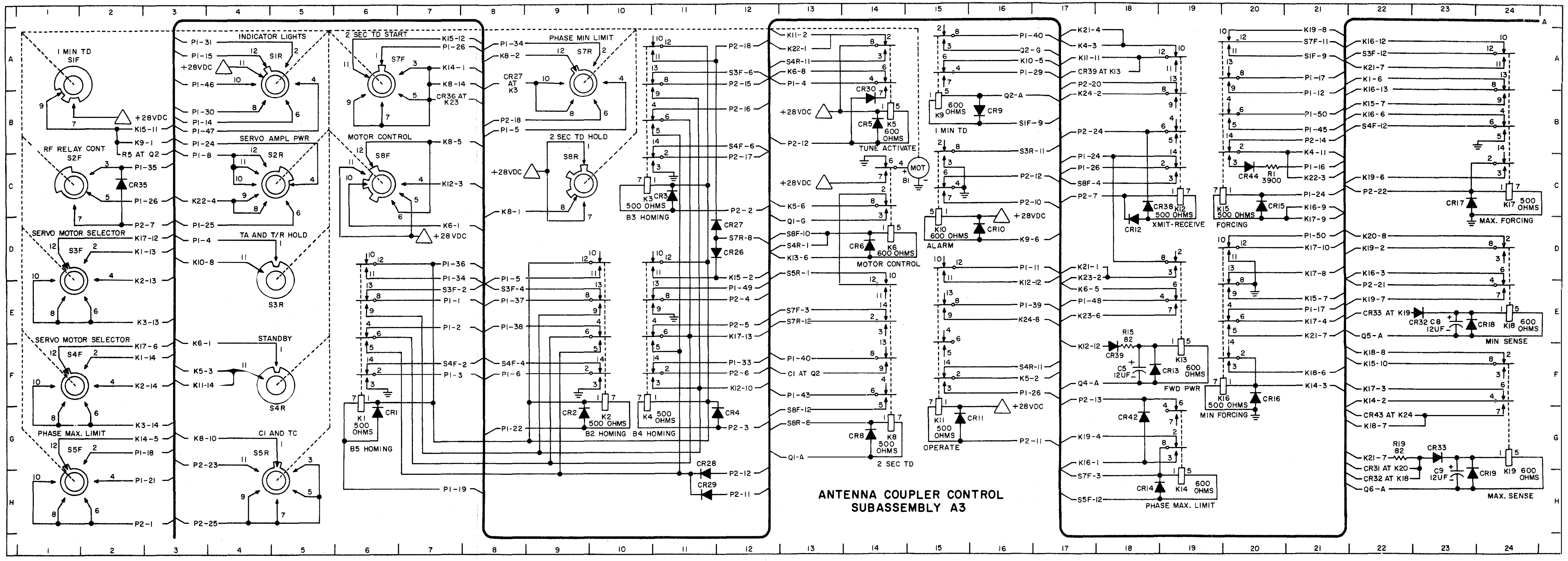


Figure 5-21. Antenna Coupler Control Assembly A3, Schematic Diagram (Sheet 1 of 2)

203-204

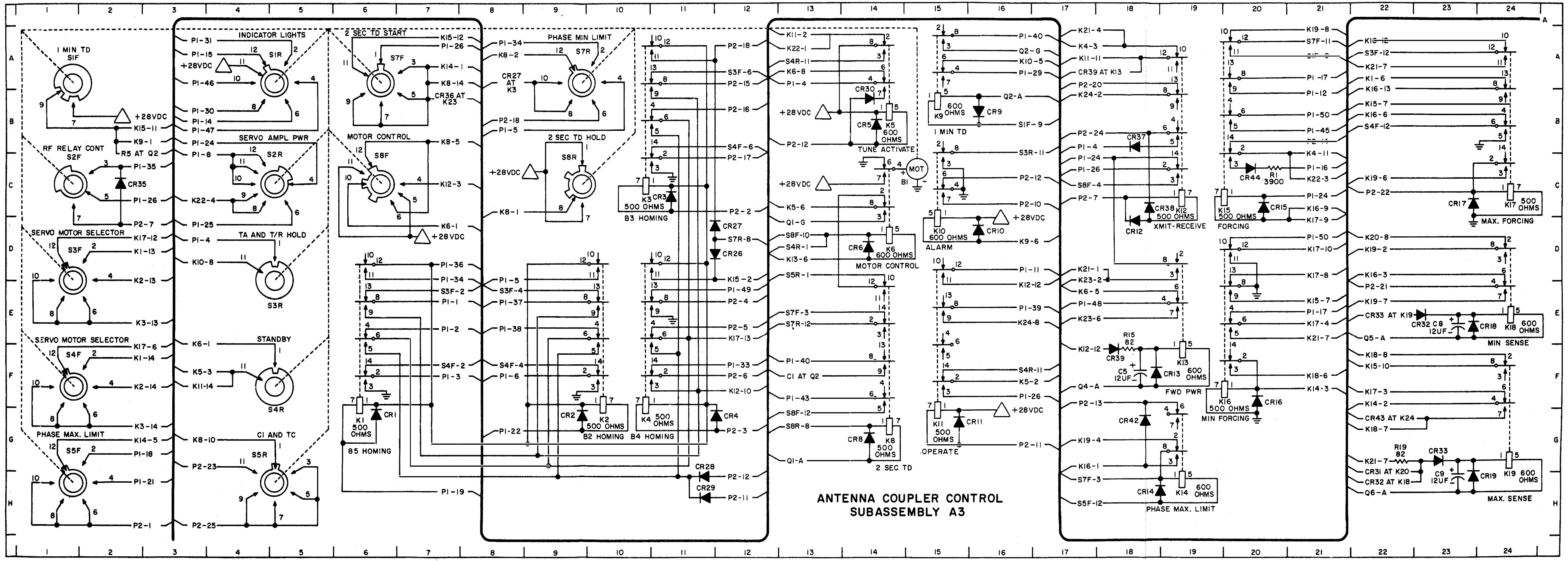


Figure 5-21. Antenna Coupler Control Assembly A3, Schematic Diagram (Sheet 1 of 2)

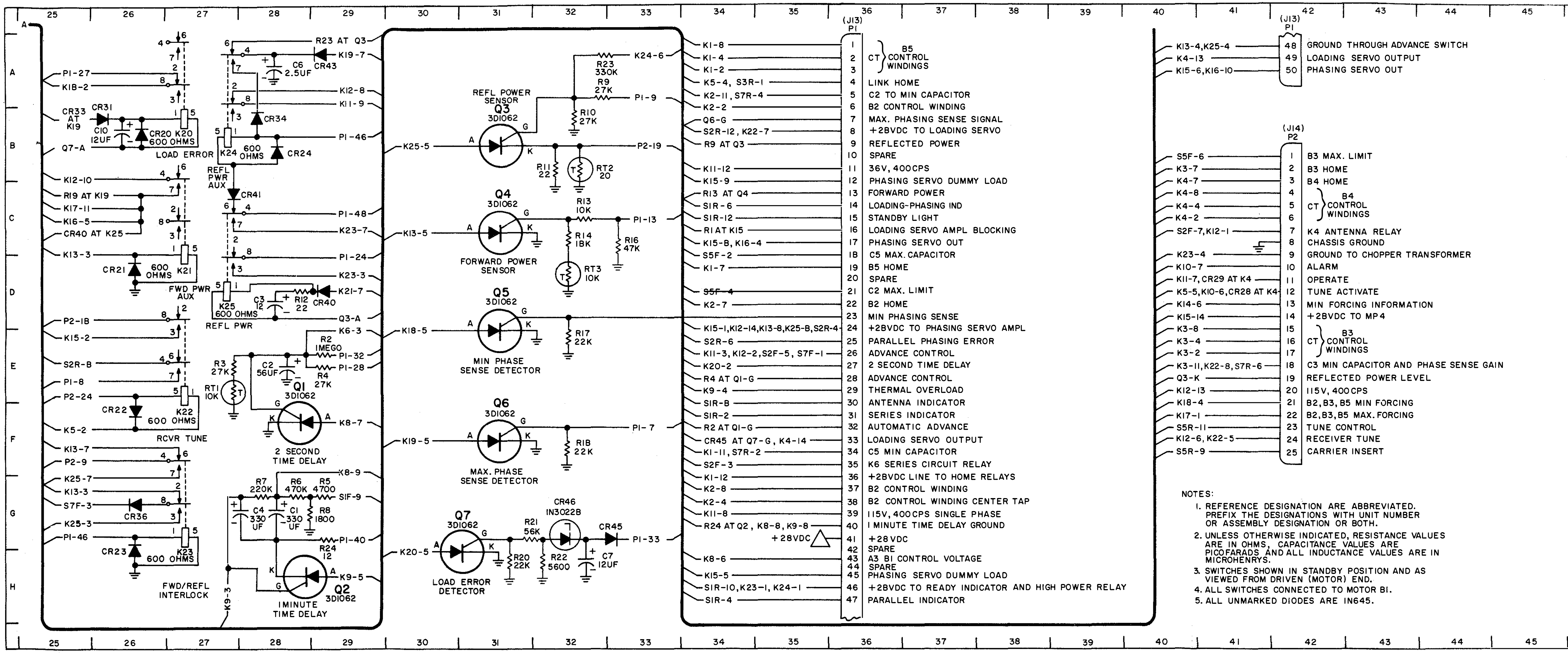
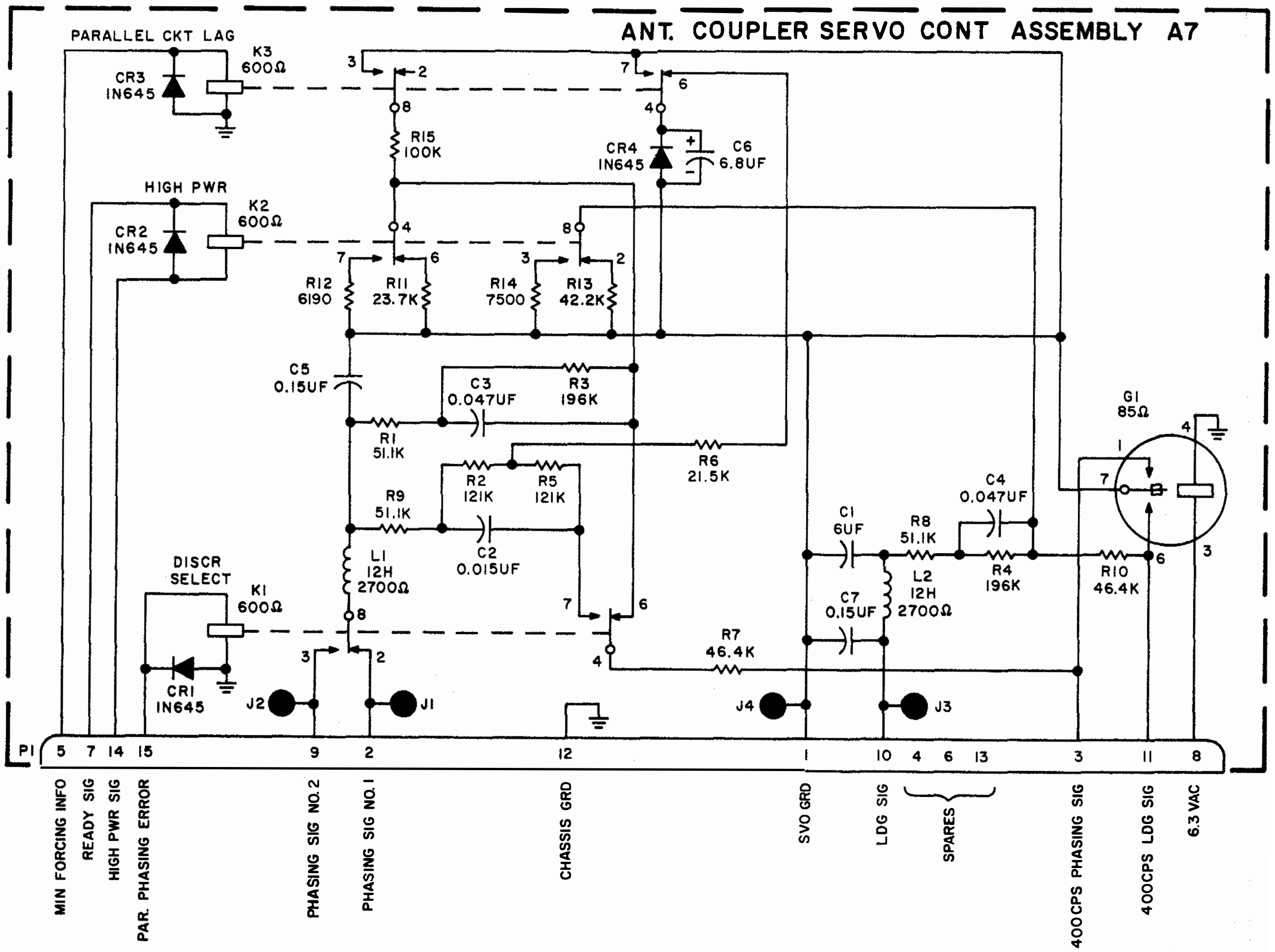


Figure 5-21. Antenna Coupler Control Assembly A3, Schematic Diagram (Sheet 2 of 2)

207-208



NOTES:

1. UNLESS OTHERWISE INDICATED; ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICROHENRYS.
2. REFERENCE DESIGNATIONS ARE ABBREVIATED. PREFIX DESIGNATIONS WITHIN ASSEMBLIES WITH ASSEMBLY DESIGNATION.
3. NON STANDARD SYMBOL : Ω DESIGNATES DC RESISTANCE IN OHMS.

HIGHEST REFERENCE DESIGNATION	
C7	K3
CR4	L2
G1	P1
J4	R15
REFERENCE DESIGNATIONS NOT USED	

Figure 5-22. Antenna Coupler Servo-Control Assembly A7, Schematic Diagram