

TECHNICAL MANUAL

**DIRECT SUPPORT, GENERAL SUPPORT
AND DEPOT MAINTENANCE MANUAL**

COUPLER, ANTENNA

CU-1658/A AND

CU-1669/GRC

HEADQUARTERS, DEPARTMENT OF THE ARMY

MARCH 1972

WARNING

DANGEROUS VOLTAGES are used in the operation of this equipment. DEATH ON CONTACT may result if safety precautions are not observed. Electrical potentials up to 400 volts dc exist in the receiver-transmitter to which the antenna coupler is connected when the radio set is energized. Do not make contact with exposed wires or connectors when the equipment is energized.

WARNING

Operator and maintenance personnel should be familiar with the requirements of TB SIG 291 before attempting installation or operation of the equipment covered in this manual. Failure to follow the requirements of TB SIG 291 could result in injury or DEATH.

WARNING

The metal case handle of the antenna coupler in the extended carry or pullout position is close to the output terminal. A short circuit is possible through the case whenever the antenna lead-in wire is connected to the output terminal and the handle is not in the down position.

High voltages and RF areas exist in the following locations:

Series Capacitor A9 and Shunt Capacitor A7

(right side of antenna coupler)

Series Varicoil A5 and Shunt Varicoil A6

(left rear corner of antenna coupler)

Capacitor Assembly A10

(top front of antenna coupler)

Loading-Phasing Discriminator A8\$

(bottom of antenna coupler)

CHANGE

No. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC 29 April 1983

DIRECT SUPPORT, GENERAL SUPPORT

AND DEPOT MAINTENANCE MANUAL

COUPLER ANTENNA CU-1658/A

(NSN 5985-00-999-5927)

AND

CU-1669/GRC (NSN 5985-00-939-7495)

TM 11-5985-326-35, 17 March 1972 is changed as follows:

1. Title of manual is changed as shown above.
2. New or changed material is indicated by a vertical bar in the margin of the page.
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1-1 through 1-5.....	1-1 through 1-5
2-1 through 2-23.....	2-1 through 2-26
3-3	3-3
3-4 through 3-28.....	3-4 through 3-28.3
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4-3 and 4-4	4-3 through 4-4.1
4-17 through 4-54.....	4-17 through 4-75
6-1 and 6-2 blank	6-1 and 6-2 blank
A-1 and A-2 blank.....	A-1/(A-2 blank)
None.....	Figure 6-2.1
None.....	Figure 6-4.1
	Figure 6-8(1)
	Figure 6-8(2)
None.....	Figure 6-8.1(1)
None.....	Figure 6-8.1(2)
None.....	Figure 6-8.1(3)
None.....	Figure 6-8.1(4)
Figure 6-9(1).....	Figure 6-9(1)
Figure 6-9(2).....	Figure 6-9(2)
Figure 6-10(1).....	Figure 6-10(1)
Figure 6-10(2).....	Figure 6-10(2)

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Distribution:

To be distributed in accordance with DA Form 12-36 Direct and General Support Maintenance requirements for CU-1658/A and CU- 1669/GRC.

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and Depot Maintenance Manual
COUPLER, ANTENNA
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WASHINGTON, DC, 17 March 1972

**DIRECT SUPPORT, GENERAL SUPPORT
AND DEPOT MAINTENANCE MANUAL**

COUPLER ANTENNA CU-1658/A

**(NSN 5985-00-999-5927
AND**

CU-1669/GRC (NSN 5985-00-939-7495

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, or DA Form 2028 (Recommended Changes to Publications and Blank Forms) direct to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, NJ 07703.

In either case, a reply will be furnished direct to you.

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Change 2 iii

CHAPTER 1

INTRODUCTION

1-1. Scope

a. This manual supplies information which will assist in the maintenance of Couplers, Antenna CU-1658/A and CU-1669/GRC. Failure to follow the procedures set forth in this manual may result in poor performance of the equipment. The manual applies to both models unless otherwise noted. The manual covers-

- (1) Functioning of the equipment (ch. 2).
- (2) Direct support maintenance (ch. 3).
- (3) General support and depot maintenance (ch. 4).
- (4) Depot overhaul standards (ch. 5).
- (5) Foldout illustrations (ch. 6).
- (6) References (app. A).

b. The complete technical manual includes TM 11-5985-326-20.

1-2. Consolidated Index of Army Publications and Blank Forms

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes or additional publications pertaining to the equipment.

1-3. Maintenance Forms, Records, and Reports

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System (TAMMS).

1-3.1. Reporting Equipment Improvement Recommendations (EIR)

If your antenna coupler needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: DRSEL-ME-MP, Fort Monmouth, NJ 07703. We will send you a reply.

1-4. Official Nomenclature and Common Names

Reference designation numbers have been assigned to each major component in the antenna coupler. *For example*, in Electronic Control Amplifier A3 parts are

prefixed by A3; that is, resistors in the A3 are designated A3R1, A3R2, A3R3.etc, and capacitors are designated A3C1, A3C2, A3C3.etc. The chart below lists the reference designation numbers and common names assigned to each major component. To make the manual easier to read, common names will be used throughout this manual.

<i>Official nomenclature</i>	<i>Common name</i>
Electrical Equipment Chassis A1.	Equipment chassis A1
Antenna Coupler Control A2.	Coupler control A2
Electronic Control Amplifier A3.	Control amplifier A3
Variable RF Stepping Coil A4.	Step coil A4
Variable RF Coil (Series Varicoil) A5.	Series varicoil A5
Variable RF Coil (Shunt Varicoil) A6.	Shunt varicoil A6
Variable RF Shunt Capacitor Assembly A7.	Shunt capacitor A7
Loading Phasing Discriminator A8.	Discriminator A8
Variable RF Series Capacitor Assembly A9.	Series capacitor A9
Capacitor Assembly A10	Capacitor assembly A10

1-5. Differences in Models

a. *External differences.* Refer to TM 11-5985-326-20.

b. *Internal differences.*

(1) Coupler, Antenna CU-1669/GRC has a transmit-receive relay and a receiver ground relay, Coupler, Antenna CU-1658/A has not (para 2-2c).

(2) There are two different models of coupler control A2. Part numbers 528-0465-000 (fig. 6-8) and 608-9500-002 (fig. 6-8.1) differ in fabrication techniques. Part number 608-9500-002 consists of four printed circuit board assemblies A2A1 through A2A4. Assemblies A2A1, A2A2, and A2A3 plug into interconnect board A2A4.

(3) There are two different models of control amplifier A3. Part number 775-4276-001 (fig. 6-3) uses electronic switching; part number 528-0467-000 (fig. 6-4) uses mechanical switching (para 2-11).

(4) There are two different models of step coil A4. Part numbers 528-0524-000 (fig. 4-1.1) and 777-3508-001 (fig. 4-1.2) differ in that part number

28-0524-000 has a different physical arrangement of switch sections and three protective diodes 4CR1, A4CR2, and A4CR3.

(5) There are two different models of shunt capacitor A7. Part numbers 528-0466-000 (fig.4-2.1) and 777-4500-001 (fig. 4-2.2) differ in the physical nature of the switches and part number 77-4500-001 does not need A7CR2.

c. *Equipment changes.* To find out what changes have been made-

d. *Wiring Changes.*

(1) Find out the module serial number. Serial numbers are stamped on each module.

(2) Refer to column (1) of the chart in d below. In column (1) find the module name.

(3) When the module name has been located in column (1), refer across the page to column (3). In column (3) find the serial number of the module.

(4) After the serial number has been found in column (3), refer back to column (2) for a description of changes to the module.

Module (1)	Change (2)	Effectivity (3)
Equipment Chassis A1	Wire from J6-4 to K2-1 was from J6-9 to K2-1. Added wire from J6-25 to J4-28. C1 thru C6 and C8 thru C16 changed from 1 µf to 1200 pf. C33 value changes from 0.68 to 6.8 µf. C7 value changed from 1 to 1200 pf. C17 thru C23 added. CR11 added between DS1-1 and DS2-1. Following connections added: J1-E to C7-1, J8-9 to C7-2, J6-26 to C19-2, J5-35 to C17-2, J1-Y to C18-1, C18-2 to ground, J1-Z to C20-1, J1-M to C17-1, J4-34 to C20-2, J1-c to C19-1, J1-T to C23-1, J1-F to C14-1, and J1-N to C21-1. Following wires deleted: J1-N to C10-1, DS1-1 to DS2-1, and E3 to C6-2. Wire from J6-8 to C21-2 was from J6-8 to C10-2. Wire from J8-25 to C23-2 was from J8-25 to C10-2. Wire from E2 to C11-2 was from E1 to C11-2. R1 from DS2-1 to E2 was from DS-1 to E2. CR10 from C21-2 to C23-2 added. CR3 from E21 (cathode) to E3 (anode) was from C1-2 to E3. CR12 added from J1-K to J1-a. Deleted wire from J1-a to C1-1. Wire from J4-48 to E21 was from J4-48 to C1-2. Wire from K3-L2 to J1-a was from K3-L2 to C8-1. R4 changed from 10K to 100K..... Added C7, C17, C18, and C19..... Added CR11 between DS1-1 and DS2-1. R1 from DS2-1 to E2 was from DSI-1 (DS2-1) to E2. Deleted wire from DSI-1 to DS2-1. Added C20, C21, C22 and C23. CR10 from C21-2 to C23-2 was from J1-N to J1-t. Wire from J8-25 to C23-2 was from J8-25 to C10-2. Wire from J1-T to C23-1 was from J1-T to C10-1. Added wires from J6-8 to C21-2 and J1-N to C21-1. Wire J1-Z to C20-1 was from J1-Z to C16-1. Wire from J4-34 to C20-2 was from J4-34 to C16-2. Wire from J1-M to C17-1 was from J1-M to C15-1. Wire from J5-35 to C17-2 was from J5-35 to C12-2. Wire from E2 to C11-2 was from E1 to C11-2. Deleted wire from E3 to C6-2. Added wire from J1-F to C14-1. Deleted K3 and associated wires: J5-23 to K3-5, J5-21 to K3-1, RF in to K3 Normally-closed contacts, RF out to center moving contact. Deleted C2 from normally-closed contacts to center moving contacts. Deleted CR1 from K3-1 to K3-5. C1-6 thru C8-16 changed from 1 µf to 1200 pf..... Added CR3 from C1-2 to C4-2 to C4-2 was from C1-2 to E2. Added CR12 from C4-2 to E22 (cathode). Wire from J4-48 to E22 was from J4-48 to C1-2. Wire from J6-24 to C1-2 was from J6-24 to C4-2. Added CR7 from E20 (anode) to C5-2 was from C3-2 to C5-2. Added CR12 from C4-2 to E22. Added CR13 from C6-2 to E1 (anode). Added CR14 from E21 (cathode) to E20 (anode). Wire from DS1-2 to E20 was from DS1-2 to C3-2. Wire from DS2-2 to E1 was from DS2-2 to C6-2. Wire from E21 to C3-2 was from C6-2 to E1. Deleted wire from J1-a to C-1. Added wire from A1J6-25 to A1C10-2 and from A1C10-1 to 2120 A1J1-U.	104, 111, 112, 115, 117, 123, 132, 137, 138, 319, 141, and up. 151 290 396 652 112 125 125 125, 132, 140, 151. 164, 166, 169, 181 thru 183, 186 thru 190, 193 thru 195, 197 thru 199, 201, 207, 208, 211, 213, 231, 233 thru 238, 241 thru 245, 247, 248 thru 251, 252.

d. Wiring Changes--Continued

Module (1)	Change (2)	Effectivity (3)
Coupler Control A2 (part number 528-0465-000) (MCN 180 through 671).	Added CR104 between R37 and R36. R36 from CR104 to C23 was from R37 to R39. R36 changed from 27K to 12K. Deleted R39 and replaced with wire from R36 to C23. Deleted R32 from CR44 to ground. Added R83 between CR44 and C23. C23 from R83 to ground was from R6 to ground. C23 changed from 56 μ f to 39 μ f. Added CR102 between C23 and R6. C29 from CR102 to ground was from Q11-e to ground. Changed R6 from 10K to 18K. RT3 added from R6 to ground.	181
	R14 changed form 120K to 150K, R75 changed from 39K to 47K.	275
	Added CR101 between K6-2 and K7-3.....	275
	Deleted CR92 from P1-26 to R4 and replaced with wire. R4 and R8 changed from 2700 to 1800 and 1000 to 680 ohms respectively.	
	Added CR103 between R14 to ground. Added R32 between CR85 and R14. R14 changed from 150K to 100K. Added C37 from R32 to ground. Added C38 from CR65 to ground.	400
	Changed R14 from 100K to 160K and R15 from 330K to 100K.	434
	Added CR107 between K21-8 to K6-6 and CR108 between K7-8 to K6-6. Deleted wire from K21-8 to ground. Added wire from K23-8 to ground. CR101 from K6-2 to K7-3 changed from IN977B to 1N645.	533, 561, 562, 565, 566, 567, 571, 573, 580, 586, 588, 590, 596, 599, 602, 604, 6-6, 618, 625, 627, 633.
	Deleted wire from P1-39 to K5-7	572
	Added CR107 between K21-8 to K6-6 and CR108 between K7-8 to K6-6. Deleted wire from K21-8 to ground. CR101 from K6-2 to K7-3 changed from IN977B to 1N645.	533, 561, 562, 565, 566, 567, 571, 573, 580, 586, 588, 590, 596, 599, 602, 604, 606, 618, 625, 627, 633, 673, 674, 679, 701, 703, 705, 707, 712, 715, 716, 717, 719, 721, 728, 729, 732, 733, 735, 742, 743, 746, 747, 752, 753, 754, 755, 758, 761, 764, 765, 766, 767, 773, 777, 779, 781, 783, 785, 795, 797, 799, 801, 803, 807, 809, 810, 811, 813, 814, 815, 820, 821, 822, 824, 829, 831, 832, 834, and up.
	Added CR109 between K12-8 and CR32. Added wire from K12-2 to K19-4 wire from K7-2 to K25-5 was from K7-2 to R78.	1168
Q1, Q2, Q4 and Q8 through Q17 changed from 3D1098 to CB1028. Added following capacitors: C33 from Q2-c to ground, C9 from Q4-c to ground, C1 from Q10-c to ground, C3 from Q11-c to ground, and C30 from Q17-c to ground. Changed following capacitors from 0.01 μ f to 0.02 μ f: C8, C6, C36, C29 and C38.	1567	
Added C40 between Q17-e and ground.....	760, 778, 818, 827, 855, 890, 907, 996, 1076, 1113, 1129, 1134, 1159, 1168, 1169, 1171, 1177, 1180, 1181, 1193, 1195, 1196, 1200, 1233, 1267, 1279, 1289, 1290, 1291, 1295, 1296, 1298, 1306 thru 1310, 1314, 1315, 1326, 1327, 1328, 1332, 1333, 1340, 1341, 1344, 1347, 1349, 1352, 1355, 1358, 1360, 1361, 1364, 1369, 1376, 1385, 1386, 1391, 1396, 1426, 1433, 1435, 1437, 1438, 1442, 1446, 1448, 1455, 1457, 1461, 1464, 1475, 1481, 1484, 1487, 1490, 1505, 1509, 1515, 1517, 1518, 1519, 1521, 1523, 1524, 1528 thru 1533, 1536 thru 1540, 1542, 1543, 1545, 1547 thru 1553, 1555, 1559, 1565, and up.	

d. Wiring Changes-Continued

Module (1)	Change (2)	Effectivity (3)
	Added C39 between CR38 to ground.....	2402, 2403, 2404, 2405, 2412, 2418, 2422, 2428, and up.
	Added R84 between R78 and P1-42. Added wire from K8-2 to P1-43.	2326 thru 2332, 2336, 2337, 2338, 2342, and up.
	Changed Q5 from 2N1481 to 2N697. Added CR101, CR105 and CR106. Changed R22 from 100 ohms to 680 ohms. Changed R21 from 180 ohms to 2700 ohms and R20 from 560 ohms to 1800 ohms.	MCN 672 and above.
Control Amplifier A2 (part number 528-0465-000) (MCN 3615 and above).	Added CR115 from K28-8 to K10-4 and P2-6. Connected K14-49100 to K1-4 and P1-44 to K6-5. R66 changed from 3900 to 8200 ohms. Added C42, C43, R85, and CR116 on base circuit of Q3. Changed R8 from 680 to 4700 ohms. Connected K4-2 to K17-3 and added CR118 from K17-3 to R16.	
	Added CR117, R86, and C44 between K10-5 and ground.	9450
	Removed C42, C43, R62, and R85. Added jumper from K14-6 and K14-4.	10600
Control Amplifier A2 (part number 608-9500-002).	No changes to date of this technical manual.	
Control Amplifier A3 (part number 528-0467-000).	R8 from K3-6 to ground was from K3-2 to ground. R11 from K3-7 to ground was from K3-3 to ground. Added wire from K3-8 to P1-28. Added wire from K3-3 to P1-29. Deleted wire from K3-4 to ground. Wire from K3-4 to K2-2 was from K3-8 to K2-2.	131
	CR19 was added from P1-27 to R52. R52 changed from 27K to 12K. C8 and C17 changed from 33 µf to 22 µf. CR20 added from P1-35 to Q1-b. CR21 added from P1-34 to Q7-b.	180
	Added wire from P1-25 to R62. Added R62 from P1-25 to CR19. Deleted wire from CR19 to P1-27.	181, 182, 184 thru 187, 189 thru 197, 199 thru 202, 205 thru 571.
	R11 changed from 75K to 51.1K.. R8 from K2-2 to K3-4 was from K3-6 to ground. Deleted wire from K3-4 to K2-2. Added wire from K3-6 to ground. Added wire from P1-26 to K3-7.	320
	Deleted circuit from P1-9 to P1-27 and P1-25 consisting of following: R52, C30, CR19, R62, CR12, RT7, C29, R51 and Q15. Added CR19 from P1-27 to P1-6. C29 from P1-35 to T1-6 was C23.	572
	Q13 and Q14 changed from 3D1098 to CB1028.....	783, 842, 891, 924, 975, 1055, 1071, 1095, 1111, 1136, 1139, 1142, 1145, 1149, 1150, 1153, 1154, 1158, 1165, 1170, 1171, 1173, 1174, 1177, 1180, 1202, 1219, 1242, 1521, 1526, 1527, 1530, 1531, 1535, and up.
	C5 and C12 changed from 0.28 µf to 0.27 µf. C13, C14, C21 and C22 changed from 4 µf to 4.7 µf.	1658, 1660, 1662 thru 1664, 1668, 1669, 1672 thru 1678, 1681, 1682, 1687, and up.
	Deleted L1 from P1-33 to P1-32. Deleted L6 from P1-30 to P1-31. Added R62 from P1-33 to P1-32. Added R63 from P1-30 to P1-31. C2 and C3 changed from 0.15 µf to 0.47 µf.	1992
Control Amplifier A3 (part number 775-4276-001).	C13, C14, C21, and C22 changed from 4.7 µf to 3.3 µf.....	2954
Series Varicoil A5 and Shunt Varicoil A6.	CR16 changed from type 1N3024B to type UZ715. R10 changed from 560 to 270 ohms. C8 changed from .1 µf to .47µf.	569
	Deleted S1B and following wires: P1-5 to S1B-9, P1-6 to SB-2, P1-13 to S1A-1, P1-16 to S1B-4, P1-18 to S1B-3, P1-25 to S1A-10, P1-10 to S1A-6, S1B-2 to S1B-10, and S1B-4 to S1B-8. Wafer switch not used.	835
Shunt capacitor A7 (part number 528-0466-000).	Added CR1 from E1 to E2 and CR2 from E4 to E3. Deleted wires from B1 (red) to P1-9, B1 (black) to P1-1, S2 (NO.) to P1-6, S2 (NC) to P1-7, E1 to P1-8 and S1 (NO) to S1 (NC). Added wires from E3 to P1-1, P1-9 to E2, and P1-7 to P1-8.	284
	Added S1B rear switch section.	A11
	Added wire identification as follows: TV3 (P1-25 to S1B(F)-4). TV3 (P1-3 to S1B(R)-9). TV8 was TV7. Reverse color coding of motor windings; black was red and red was black.	

d. *Wiring Changes-Continued*

Module (1)	Change (2)	Effectivity (3)
Shunt Capacitor A7 (part number 777-4500-001).	No changes to date of this technical manual. Added CR1 and S2 front from P1-9 to B1 winding. Added C2 from P1-1 to P1-9.	A11 1905 7791 through 7819, 7821 and above.
Discriminator A8	L3 from P3-6 to CR2 was from CR2 to ground. CR2 from CR3A to L3 was from CR3A to P3-1. Added wire from junction of CR2 and CR3A to R3. Added wire from CR1 to R1. Added wire from C2 to CR1. Reversed polarity of CR3A and CR3B. Wire from P3-4 to ground was from P3-4 to the junction of L1, L2, and C1. Added wire from L7 to T3. L1 changed from 0.33 to 1.5 μ h. L2 added from the junction of L1 and C1 to C2. Deleted wire from junction of L2 and C2 to junction of L1, R2, and CR1.	103 351 1961
Series Capacitor A9	CR3 added from S1A(F)-1 to S1A(R)-3. CR4 added to E3 to S1C(F)-5. Deleted wire from S1A (F)-1 to S1C (F)-4. Deleted wire from S1A(R)-4 to E2. Wire from P1-13 to E3 was from P1-13 to S1B(R)-4. Wire from P1-14 to S1C(F)-8 was from P1-14 to S1C(F)-3. Wire from S1A(R)-6 to E2 was from S1(R)-4 to E2. Added wire from P1-3 to S1A(R)-4.	115 150 966

Change 2 1-5

CHAPTER 2

FUNCTIONING OF EQUIPMENT

SECTION I. BLOCK DIAGRAM ANALYSIS

2-1. Overall Block Diagram
(fig 2-1)

a. A high frequency (hf) communication system consists of a receiver-transmitter, a radio set control, an antenna, and an antenna coupler (fig. 2-1). The system provides voice communications between aircraft and ground communication stations.

b. The receiver-transmitter can receive and transmit in the hf band (2.000 to 29.999 megahertz (MHz)). The receiver-transmitter also controls the antenna coupler tune cycle.

c. The radio set control furnishes frequency and mode information to the receiver-transmitter. This information is in the form of binary ground-or-open signals applied to the control wires of the radio set control.

d. The antenna coupler derives band information from the transmitted radio frequency (RF) signal. This band information is used to automatically tune the antenna coupler and match the antenna impedance with the receiver-transmitter impedance.

2-2. Functional Theory
(figs. 2-1 and 2-2)

a. The antenna coupler (fig. 2-2) automatically matches an antenna to a 50-ohm transmitter output impedance over the frequency range of 2.000 to 29.999 MHz. The tuning operation is a five-step sequence--

- (1) Home (para 2-3).
- (2) Rf On (para 2-4).
- (3) Tune A (para 2-20).
- (4) Tune B (para 2-24).
- (5) Operate and demand surveillance (para 2-

25).

NOTE

If tuning is not accomplished in the five steps listed above, the fault circuits disable the tuning circuits (para 2-26).

b. The tuning elements (fig. 2-2) include--

- (1) Step coil A4.
- (2) Series varicoil A6.
- (3) Shunt varicoil A6.
- (4) Series capacitor A9.
- (5) Shunt capacitor A7.

NOTE

The dc and servomotors position the tuning elements as commanded by the control circuits.

c. The tuning sequence is started by selecting a new frequency on the radio set control (fig. 2-1). At this time, the tuning elements move to their *home* positions (table 2-1) and remain there until the transmitter is keyed. In the CU-1669/GRC, transmit-receive relay A1K3 remains restored permitting reception with complete isolation from the coupler when the coupler is in the *home* position. In the operate position and keyed, receive ground relay A1K4 grounds the receiver input. Coupler, Antenna CU-1658/A has no provisions for signal reception.

d. Immediately after RF power is applied, discriminator A8 (fig. 2-2) samples the input to the I antenna coupler. It develops four dc voltages that are in proportion to the reactive component (phasing error), the 50-ohm impedance component (loading error), the forward power level, and the reflected power level. The phasing and loading error signals are dependent upon the frequency selected and are used to select, limit, and/or preposition the tuning elements. Forward and reflected power are used by the antenna coupler to determine the start and completion of the tuning sequence.

e. Immediately after the elements are properly positioned for the selected frequency, band relay A1K2 restores, removes the band information circuit, and connects the antenna circuit. Discriminator A8 now develops error signals in proportion to the reactive component of the antenna circuit. The control circuits continually decode the sensed error signals and all other external control inputs to initiate and govern the corrective action.

f. If the antenna appears capacitive, series varicoil A5 automatically runs to the position required for phasing. If series varicoil A5 runs to maximum before a phasing point is reached, step coil A4 adds inductance until the phasing error is within the range of series

varicoil A5. If both series varicoil A5 and step coil A4 reach maximum before phasing is accomplished, shunt capacitor A7 runs toward maximum until the resultant antenna impedance can be phased by series varicoil A5 and step coil A4. If, after phasing, the antenna resistance is equal to or greater than 50 ohms, shunt capacitor A7 runs toward maximum until the resistance is less than 50 ohms while series varicoil A5 maintains a phased antenna. Shunt varicoil A6 is then connected to the RF line and the antenna is phased and loaded until the voltage standing wave (vswr) is 1.3:1 or below.

g. If the antenna appears inductive, series capacitance is switched into the circuit until a capacitive reactance equal to or greater than 50 ohms is realized. If the capacitive reactance of the series capacitors is not great enough to make the antenna capacitive with an impedance equal to or greater than 50 ohms, the series capacitors are bypassed. At this point, shunt capacitor A7 runs toward maximum until discriminator A8 senses a capacitive load with an impedance equal to or greater than 50 ohms. Tuning now proceeds as previously explained for a capacitive antenna (*f* above). If the antenna coupler does not tune within 8 to 10 seconds, the fault circuits disable the tuning circuits which disable the coupler and both the OPR and TUNE indicators light.

h. The tuning operation of the antenna coupler is accomplished in eight sequential steps. These steps are shown in figure 6-2.1 and described in the following paragraphs. For the coupler to advance to the proper step, all steps must be performed in the order given.

(1) The selection of a new frequency on the radio set control begins the homing cycle. A momentary ground signal is received on DTIP (digital tune in progress). The home relays A2K22, A2K26, and A2K27 energize and cause the tuning elements to drive toward their home positions. Refer to table 2-1. After all tuning elements reach their home positions. A2K22, A2K23, A2K27 deenergize. The antenna coupler is then ready for tuning.

(2) The tuning cycle begins when the transmitter is keyed. Relays A2K7 and A2K8 energize and remain energized until the tuning cycle is completed, or a fault circuit energizes. Rf power is applied through the discriminator (fig. 6-2.1). From the rf power, phasing, loading, and forward and reflected power signals are developed. Reflected power is not used until the final phasing and loading corrections are made. The reflected power relays A2K24 and A2K25 deenergize and cause the forward power relays A2K2 and A2K3 to energize. At that time the tune light will turn on. Approximately 40 watts of forward power are

required to deenergize relays A2K24 and A2K25.

(3) The band information circuit determines in which band the transmitter is operating (e.g., 2 to 4, 4 to 8, 8 to 16, or 16 to 30 MHz). The band information is used to limit the travel of the tuning elements. Rf power is applied to the band information circuit through A1K2, for 1-1/2 seconds. Depending on which band is being used, this causes A3K1 and/or A3K2 to energize. Also, band information from A3K1 and A3K2 will ground and/or pretune some of the tuning elements, depending on which band is used. After 1-1/2 seconds, relay A2K17 energizes, and the band information sequence is completed. When A2K17 energizes, A1K2 deenergizes, causing rf power to be applied through the coupler to the antenna, and an inhibit ground signal is removed from the A2K18 and A2K19 circuits.

(4) Series capacitance is added when relay A2K17 is energized. If the transmitter is operating in the 2to 16-MHz bands, capacitance is limited to three steps. In the 16to 30-MHz bands, capacitance is limited to five steps. When operating in the 2to 16-MHz bands, shunt capacitance is added if the series capacitor reaches its maximum limit, and the antenna is not yet capacitive and greater than 50 ohms. The addition of capacitance is complete when the antenna is capacitive A2K16 (energizes) and greater than 50 ohms (A2K1 energizes). At that time, A2K4 energizes and, after a slight delay, A2K18 and A2K19 energize.

(5) The series varicoil is used to make the antenna resonant by adding inductance (phasing). The series varicoil is positioned so that it is limited to 1/2 of maximum inductance in the 16to 40-MHz bands. The varicoil drives until relay A2K16 deenergizes (antenna is not capacitive) or reaches its maximum inductance position. If the series varicoil reaches its maximum inductance position, the step coil and/or the shunt capacitor will be added into the circuit. Step coil inductance is added only when the transmitter is operating in the 2to 8-MHz bands. When operating in the 2to 4-MHz bands, there are no limits to the number of inductive steps. But in the 4to 8-MHz bands, inductance is limited to three steps. When the transmitter is operating in the 2to 8-MHz bands, shunt capacitance is added if the step coil reaches its limit before relay A2K16 is deenergized. In the 8to 30-MHz bands, shunt capacitance is added only if the series varicoil reaches its maximum limit. The phasing sequence is complete when relay A2K16 deenergizes (antenna is not capacitive).

(6) If the antenna load is greater than 50 ohms, shunt capacitance is added to lower the antenna

resistance. The series varicoil is retarded to maintain the antenna resonance. When the transmitter is operating in the 2 to 8-MHz bands, the step coil will be retarded to maintain resonance if the series varicoil reaches its maximum limit. But if the transmitter is in the 8 to 30-MHz bands, the series capacitor makes additional capacitive steps to maintain resonance if the series varicoil reaches its maximum limit. If antenna resistance is less than 50 ohms, relay A2K1 deenergizes and transistor A2Q11 conducts. Resonance must be maintained or A2Q11 will not conduct. When A2Q11 conducts, relays A2K15, A2K20, A2K21, and A3K5 energize.

(7) The shunt varicoil is now switched into the circuit and is used for final phasing. If necessary, the shunt capacitor works in conjunction with the shunt varicoil. The series varicoil makes the final loading adjustments. When the antenna vswr is less than 1.3:1 reflected power (approximately 2 watts), is no longer of sufficient amplitude to keep relays A2K24 and A2K25 deenergized. When A2K24 and A2K25 energize, final phasing and loading corrections are complete.

(8) When A2K24 and A2K25 energize, A2K2 and A2K3 deenergize. Then A2K7 and A2K8 will deenergize, which unkeys the transmitter. The tune light will go off and the green operate light will come on. The tuning cycle is now complete, and the sequence is in the operate and demand surveillance mode of operation.

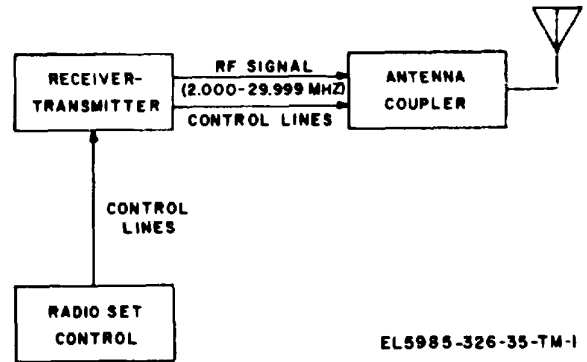


Figure 2-1. Basic Hf Communications Systems, Block Diagram

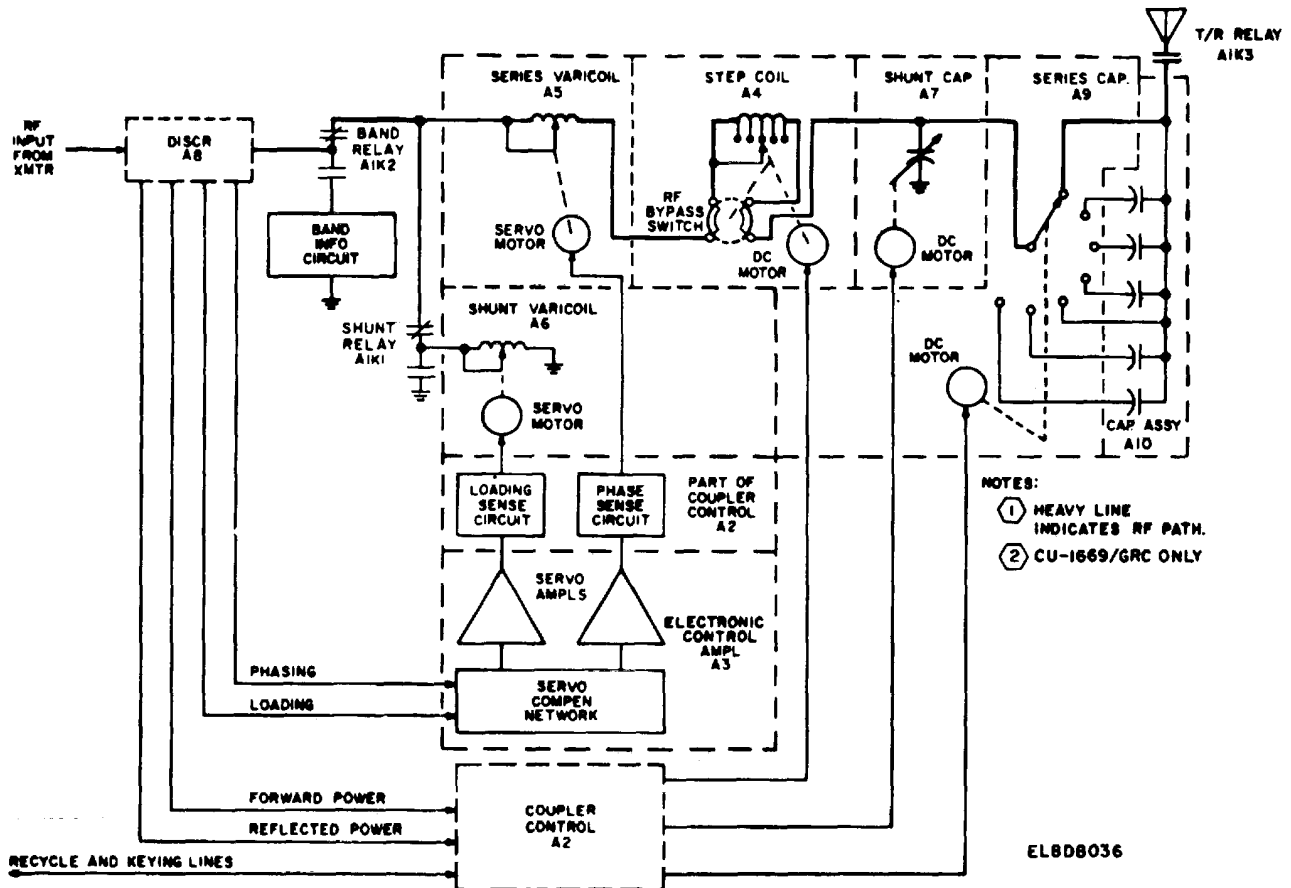


Figure 2-2. Antenna Coupler, Block Diagram.

Section II. CIRCUIT ANALYSIS

2-3. Homing Sequence
(fig. 2-3)

a. *Home* is the first position in the tuning cycle. All variable tuning elements move to the *home* position (table 2-1) when the tuning cycle is initiated. Selecting a frequency on the radio set control causes the receiver-transmitter to apply a momentary ground to the recycle line.

b. The ground on the recycle line appears on the cathode of A2Q13 (fig. 2-3). Silicon-controlled rectifier A2Q13 is enabled by +28 vdc (unfiltered) on the anode and gate and will conduct, operating A2K22 and A2K23. A holding ground is applied to the cathode of A2Q13 through A2K23-8 and -3, and enabling voltage is supplied to the gate until the variable elements are in the *home* position. When all elements are *home*, the enabling voltage is removed from the gate; and, as the anode voltage passes through zero reference level, A2Q13 will cut off, restoring A2K22 and A2K23. Gate enabling voltage is furnished to the gate of A2Q13 when step coil A4 and/or shunt capacitor A7 are not in the *home* position.

Table 2-1. Home Positions of Tuning Elements

Tuning elements	Home position
Step coil A4	Minimum inductance and bypassed.
Series varicoil A5.....	Minimum inductance.
Shunt varicoil A6.....	Maximum inductance and removed from the RF circuit.
Shunt capacitor A7	Minimum capacitance.
Series capacitor A9	Bypassed.

c. When step coil A4 is not *home*, A2K9 is operated by applying a ground to pin 5, through A2K23-8 and -3, A2P1-2, A4P1-23, A4S2(R)-5 and -6 (A4S1A(R)-14 and -13 in step coil A4), A4P1-22, A2P1-1 and A2CR18 to A2K9. Gate enabling voltage is developed across A2R53 and A2R51 when the circuit is completed by A2K22-4 and -7. When step coil A4 reaches *home*, switch A4S2-5 opens and the gate voltage is removed by restoring A2K9.

d. When shunt capacitor A7 is not *home*, A2K11 is operated by applying a ground to pin 5 through A2K23-8 and -3, A2P1-2, A7P1-5, A7S1 (R), A7P1-15, A2P1-14, and A2CR25. Gate voltage is developed across A2R53 when the circuit is completed by A2R23-4 and -7 and A2K11-7 and -4. When shunt capacitor A7 reaches *home*, gate voltage is removed by removing the ground and restoring A2K11.

e. If series capacitor A9 is not *home*, a ground is applied to A2K23-5 through A2K23-8 and -3, A2P1-2, A9P1-15, A9S1A(R)-3 and -6, A9CR1, until series capacitor A9 reaches *home*. The discharge of A2C24 through A2CR63 and A2R44 provides enabling gate voltage until A5 and A6 reach *home*.

f. The homing of shunt varicoil A6 is initiated when A2K22 is operated. This action completes a discharge circuit for A2C24 through A2R50, A2CR81, and normally-closed A3K5-8 and -2. The voltage developed by the discharge of A2C24 is applied as a homing error voltage to chopper A3Q10. The homing error voltage is chopped, amplified, and applied to the control windings of shunt varicoil drive motor A6B1. The 115 volts 400 Hz is supplied to the reference winding of A6B1 through normally closed A2K7-4 and -6 and A2K26-8 and -3. The phase relationship between the control winding voltage and the reference winding voltage determines the direction of rotation of A6B1. With a positive input to chopper A3Q10, shunt varicoil A6 will advance to the *home* position (maximum). When all elements are *home*, A2K23 will be restored, operating A1K1 and removing shunt varicoil A6 from the circuit until final tuning.

g. The *homing* of series varicoil A5 is initiated when A2K22 is operated. This action completes a discharge circuit for A2C24 through A2R74 and normally-closed A3K5-4 and -6. The voltage developed by the discharge of A2C24 is applied as a *homing* error voltage to chopper A3Q3. The *homing* error voltage is chopped, amplified, and applied to the control windings of series varicoil servomotor A5B1. The 115 volts 400 Hz is supplied to the reference winding of A6B 1 through normally-closed A2K7-4 and -6, A2K26-7 and -4, normally-closed A2K28-6 and -4, and A3K4-4 and -7. The phase relationship between the control winding voltage and the reference winding voltage determines the direction of rotation of A5B 1. With a positive input to chopper A3Q3, series varicoil A5 will move to the *home* position (minimum).

h. If step coil A4S2 rear (fig. 6-4.1) is not in the *home* position, the ground supplied by A2K23-8 and -3 through A2P1-2, A4P1-23, A4S2(R)-5 and -6, A4CR3, A4P1-22, and A2CR16 grounds the base bias circuit of A2Q6. When A2Q6 is disabled, A2K10 is restored, removing the short across step coil drive motor A4B1. A4B1 cannot run *home* until series varicoil A5 is in the *home* position. When series varicoil A5 reaches *home*, +28 volts dc is supplied to A4B1 through A5P1-16, A5SI-B(R)-4 and -3, A5P1-18, A2P2-25, normally -closed

A2K10-6 and -4, A2P2-6, A4P1-1, and S1(F). Ground is supplied to A4B1 through A5P1-6, A5S1B(F)-10 and -9, A5P1-5, A2P2-24, normally-closed A2K10-2 and -8, A2P2-19, A4P1-14, and S2(R). When step coil A4 reaches *home*, A4S2(R)-5 opens, and removes the ground from A2Q6 base bias circuit and A2P6 conducts, operating A2K10. A2K10-4 and -7 and A2K10-3 and -8 complete a short circuit across A4B1 providing dynamic braking.

i. If shunt capacitor A7 (fig. 2-5) is not in the *home* position, the ground supplied by A2K23-3 and -8 through A2P1-2, A7P1-5, A7S1, A7PI-15, and A2P1-14 grounds the base bias circuit of A2Q7. When A2Q7 is disabled, A2K12 is restored removing the short across shunt capacitor drive motor A7B1. The +28 volt dc *homing* voltage is supplied to A7B1 through A2K23-4 and -7, A2K11-7 and -4, normally-closed A2K12-6 and -4, A2P2-14, A7P1-9, and A7CRi. Ground is supplied to A7B1 through A2K11-8 and -3, A2P2-12, and A7PI-1. When shunt capacitor A7 reaches the *home* position, A7S1 opens, and removes the ground from A2Q7 base bias circuit. A2Q7 conducts operating A2K12. A2K12-7 and -4 complete a short circuit across A7B1 providing dynamic braking.

j. If series capacitor A9 (fig. 2-6) is not in the *home* position, a holding ground is supplied to A2K23-5 through A2K23-8 and -3, A2P1-2, A9P1-15, A9S1A(R)-3 and -6, A9CR1, A9P1-5, and A2P2-21. A2Q3 base bias circuit is grounded through A2K23-8 and -3, A2P1-2, A9P1-15, A9S1A(R)-3 and -6, A9CR2, and A2P1-26. When A2Q3 is disabled, A2K4 is restored, removing the short circuit across series capacitor drive motor A9B1. The +28 volts dc is supplied to A9B 1. The + 28 volts dc is supplied to A9B 1 through normally-closed A2K4-6 and -4, A2P2-3, and A9PI-1. Ground is supplied to A9B1 through normally-closed A2K4-2 and -8, A2P2-13, and A9PI-9. When series capacitor A9 reaches *home* position, A9S1A(R)-3 opens, and removes ground from A2K23 and from A2Q3 base bias circuit. A2Q3 conducts, operating A2K4. A2K4-8 and -3 and A2K4-7' and -4 complete a short circuit across A9B 1 providing dynamic braking.

k. When all tuning elements have been *homed*, the gate voltage for A2Q3 is removed, and relays A2K22 and A2K23 restore. The antenna coupler is now ready for the tuning operation.

2-4. RF On (fig. 2-2)

WARNING

Do not touch antenna or antenna feedline when radio is transmitting. Painful burns may result from high RF voltage.

a. The second step in the tuning sequence is RF on. Pressing the push-to-talk button on the microphone applies a momentary ground to the coupler control and transmitter key circuits which causes the power amplifier to supply rf to the coupler. Discriminator A8 uses forward and reflected power to initiate the tuning sequence. Forward power error voltages and key circuits are discussed in paragraphs 2-16 and 2-17.

b. RF power through band relay A1K2 (fig. 2-6. 1) from either the antenna system or frequency band information circuit (para2-5) develops discriminator error outputs. Error signals are fed to coupler control A2 for sequencing and to electronic control amplifier A3 for amplification by servoamplifiers (para 2-13).

c. Error signals to control amplifier A3 are received either from coupler control A2 (*homing* error volts) or from discriminator A8 (phasing and loading error volts). In control amplifier A3, the dc error signals are converted, amplified, and sent to the band sense circuits for band prepositioning of tuning elements, to sense circuits in coupler control A2, and to the series and shunt varicoils A5 and A6, respectively. The series A5 or shunt A6 varicoils add or reduce inductance only when reference voltage is applied to windings of A5B1 or A6B1. Reference winding voltage is applied to series varicoil motor A5B1 during *homing* and tuning operations; shunt varicoil motor A6B1 reference voltage is applied during *homing* and final tuning.

d. For efficient operation, the antenna must appear resistive and match the transmitter output impedance. This is accomplished in the antenna couplers by adding lumped inductance to cancel the capacitive component, or by adding lumped capacitance to cancel the inductive component.

2-5. Frequency Band Information Circuit (fig. 2-7)

a. The frequency band information circuit (fig. 2-7) consists of a parallel-tuned network that resonates at approximately 8.5 MHz and is used as a transmitter dummy load for a short time after RF power is applied. The dummy load displays a complex impedance above or below its resonant frequency. When the frequency of the receiver-transmitter is above or below 8.5 MHz, discriminator A8 uses the band information circuit to develop dc error voltages that are applied to the servo-amplifier and used to set the band sense circuits.

b. Discriminator A8 is referred to as the phasing discriminator, loading discriminator, forward power discriminator, or reflected power discriminator depending on the function of the module in the circuit being discussed.

c. The phasing discriminator senses capacitive or inductive conditions and produces polarized error voltages that activate control circuits to compensate for the capacitive or inductive component. The loading discriminator determines whether the load is more or less than 50 ohms. The outputs of the loading discriminator activate control circuits to correctly position the variable tuning elements for a 50-ohm load. The frequencies from 2 through 30 MHz are divided into four bands with the difference characteristics noted in the chart below:

<i>Band</i>	<i>Difference characteristics</i>
2-4 MHz...	Capacitive reactance greater than inductive reactance and less than 50 ohms.
4-8 MHz...	Capacitive reactance greater than inductive reactance and greater than 50 ohms.
<i>Band</i>	<i>Difference characteristics</i>

8-16 MHz... Inductive reactance greater than capacitive reactance and greater than 50 ohms.

16-30 MHz... Inductive reactance greater than capacitive reactance and less than 50 ohms.

**2-6. Discriminator A8 Functions
(fig. 4-1)**

The continual sampling of the RF signal input to the antenna coupler by discriminator A8 provides phasing, loading, forward power, and reflected power sensing information. Sensing information is derived by comparing transmission line voltage with transmission line current and producing proportional polarized dc error voltages. Phasing, loading, forward power, and reflected error output voltages control the shunt and bypass relays and the servomotors and dc motors for positioning tuning elements.

Change 2 2-6

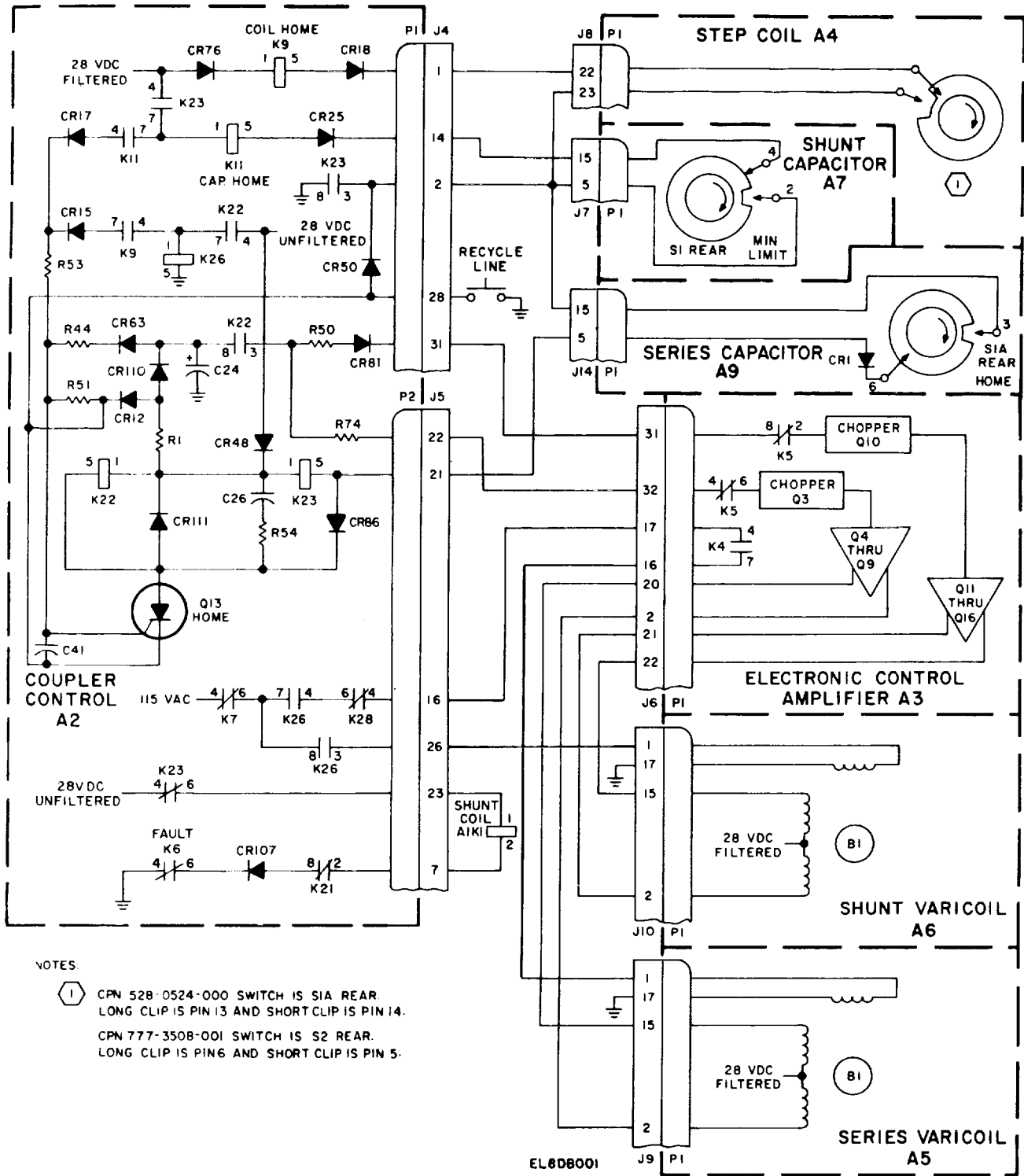


Figure 2-3. Horning Control Circuits, Simplified Schematic Diagram.

Change 2 2-7

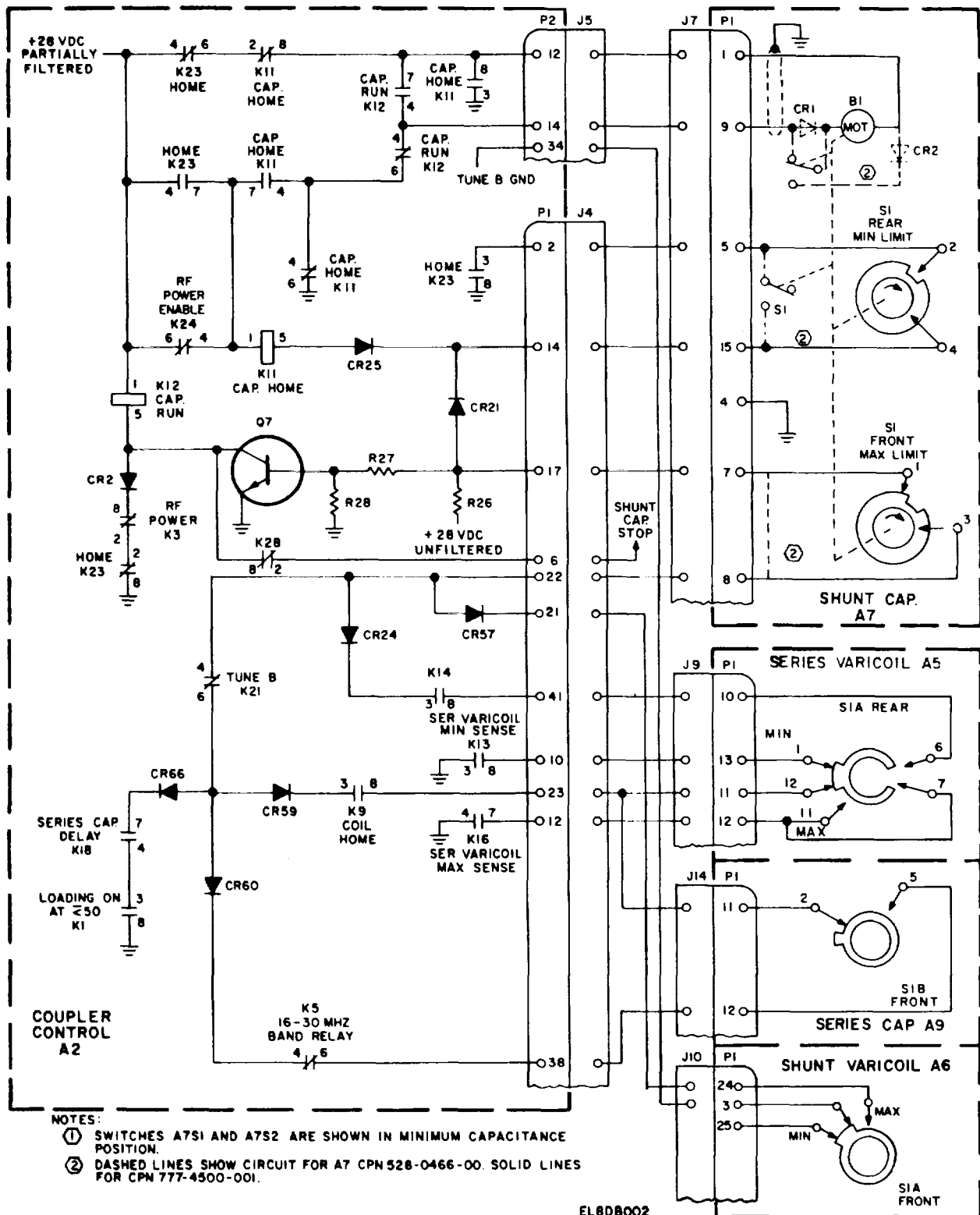
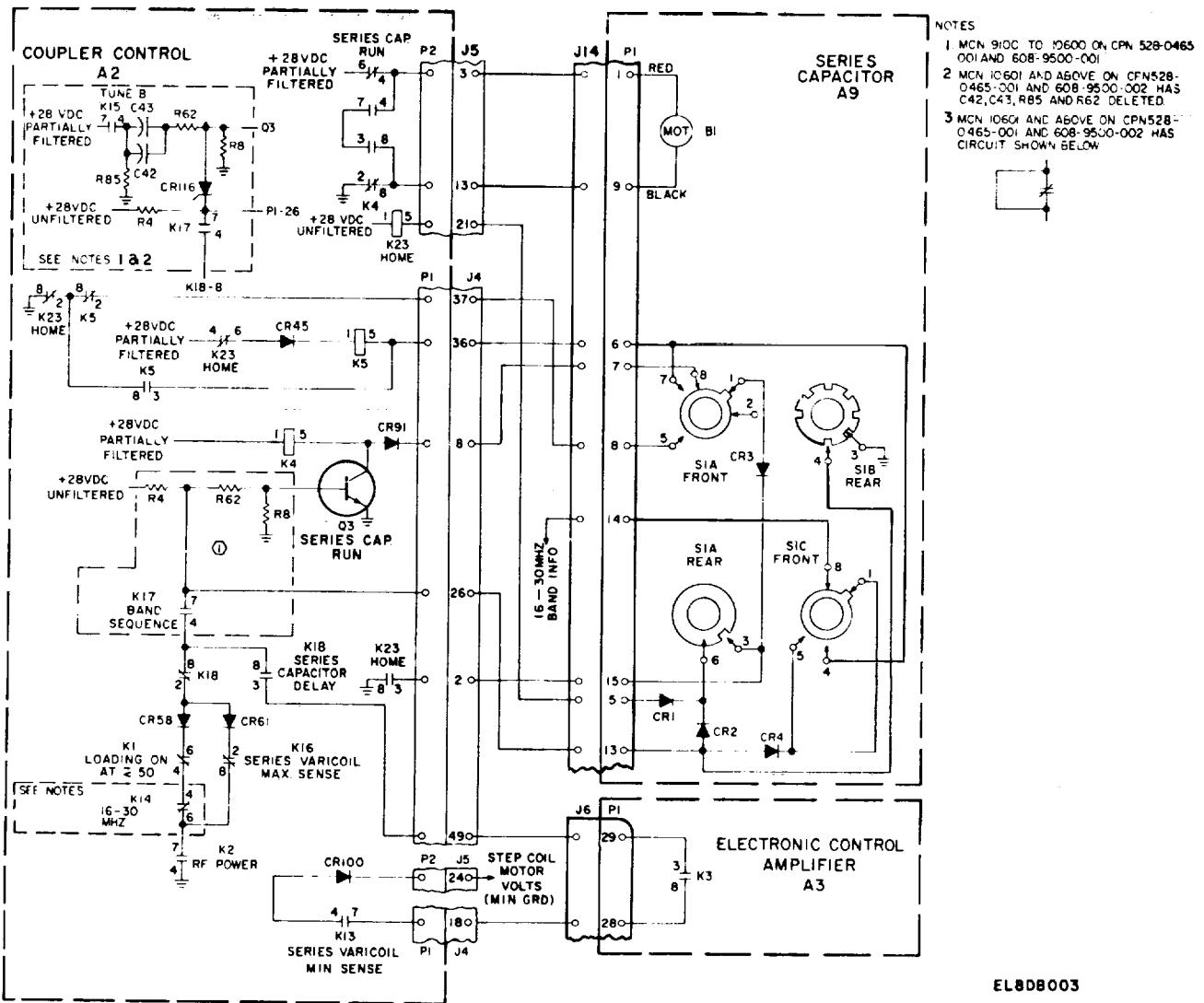


Figure 2-5. Shunt Capacitor A 7 Motor Circuit, Simplified Schematic Diagram.



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Figure 2-6. Series Capacitor A9 Motor Circuit, Simplified Schematic Diagram.

2-7. Discriminator A8 Phasing Theory (fig. 2-8)

a. The phasing function of discriminator A8 senses if the load (antenna circuit or band information circuit) is capacitive or inductive by comparing the transmission line voltage and current phase relationship and then developing dc error signals. When the antenna is resistive, the RF line voltage and RF line current are in phase and the error signal is zero. When the load is capacitive, the line current leads the line voltage and the error signal is negative. When the load is inductive, the line current lags the line voltage and the error signal is positive.

b. The phasing function is divided into two circuits: Circuit number 1 (B, C, E, and F), and circuit

number 2 (A, D, E, and F). A8R9 is factory adjusted to balance the impedance of the circuits. The RF line voltage e_L is sampled with no phase shift by voltage divider A8C12 and A8C13. The induced voltage in the secondary of transformer A8T3 is 90 degrees out of phase with current i_L . The vector addition of induced voltage e_2 and sampled voltage e_6 in circuit number 1 is resultant voltage e_4 . The vector addition of induced voltage e_2 and sampled voltage e_6 in circuit number 2 is resultant voltage e_4 . Phase voltages e_4 and e_5 are separately rectified by A8CR5 and A8CR6 and filtered by A8C15 and A8C16 with the resulting dc voltages being algebraically added (V_{ec} plus V_{ed}) for the error signal output.

c. When the antenna is resistive, line current i_L and line voltage e_L are in phase (A, fig. 2-8). The magnitude of the resultant voltage across circuit number 1 (e_4) is equal to the magnitude of the resultant voltage across number 2 (e_5), and no error voltage is developed.

d. When the antenna is capacitive, the vector addition of induced voltage e_3 and sampled voltage e_6 causes resultant voltage e_5 to increase in magnitude (B, fig. 2-8). The vector addition of induced voltage e_4 and sampled voltage e_4 causes resultant voltage e_4 to decrease in magnitude. The algebraic sum of resultant voltages e_4 and e_5 is a negative error signal output.

e. When the antenna is inductive, the vector addition of induced voltage e_2 and sampled voltage e_6 causes resultant voltage e_4 to decrease in magnitude (C, fig. 2-8). The vector addition of induced voltage e_3 and sampled voltage e_6 causes resultant voltage e_5 to increase in magnitude. The algebraic sum of resultant voltages e_4 and e_5 is a positive error signal.

f. Resultant voltage e_4 is rectified by diode A8CR6 and filtered by A8C16, A8L9, and A8C17. Resultant voltage e_5 is rectified by A8CR5 and filtered by A8C15, A8L8, and A8C14. The dc error signal output is proportional to the phase differences between the RF line voltage and the RF line current.

2-8. Discriminator A8, Loading Theory (fig. 2-9)

a. The loading function of discriminator A8 compares the magnitude of the RF current with the RF voltage. This comparison develops an error signal output that is proportional to the difference between the impedance of the RF circuit and 50 ohms. When the impedance of the RF circuit is 50 ohms, there is no error signal developed. When the RF circuit impedance is greater than 50 ohms, the error signal is negative. When the RF circuit impedance is less than 50 ohms, the error signal is positive.

b. Line current i_L induces voltage e_2 across transformer A9T2 secondary. When diode A8CR3A is forward biased, the current through resistor A8R4, diode A8CR3A, and the secondary of transformer A8T2 develops a voltage across A8RA(E_3) that is proportional to the line current.

c. Line voltage e_L is sampled by a voltage divider consisting of A8C4 and A8C5. When diode A8CR3B is reverse biased, the current through capacitor A8C7, resistor A8R5, inductor A8L6, and capacitor A8C4 develops a voltage E_4 across resistor R5. This voltage is proportional to the line voltage. Capacitor A8C4 is factory adjusted so that the voltage across A8R5 is equal to the voltage across A8R4 when the impedance of the RF circuit is 50 ohms.

Change 2 2-10

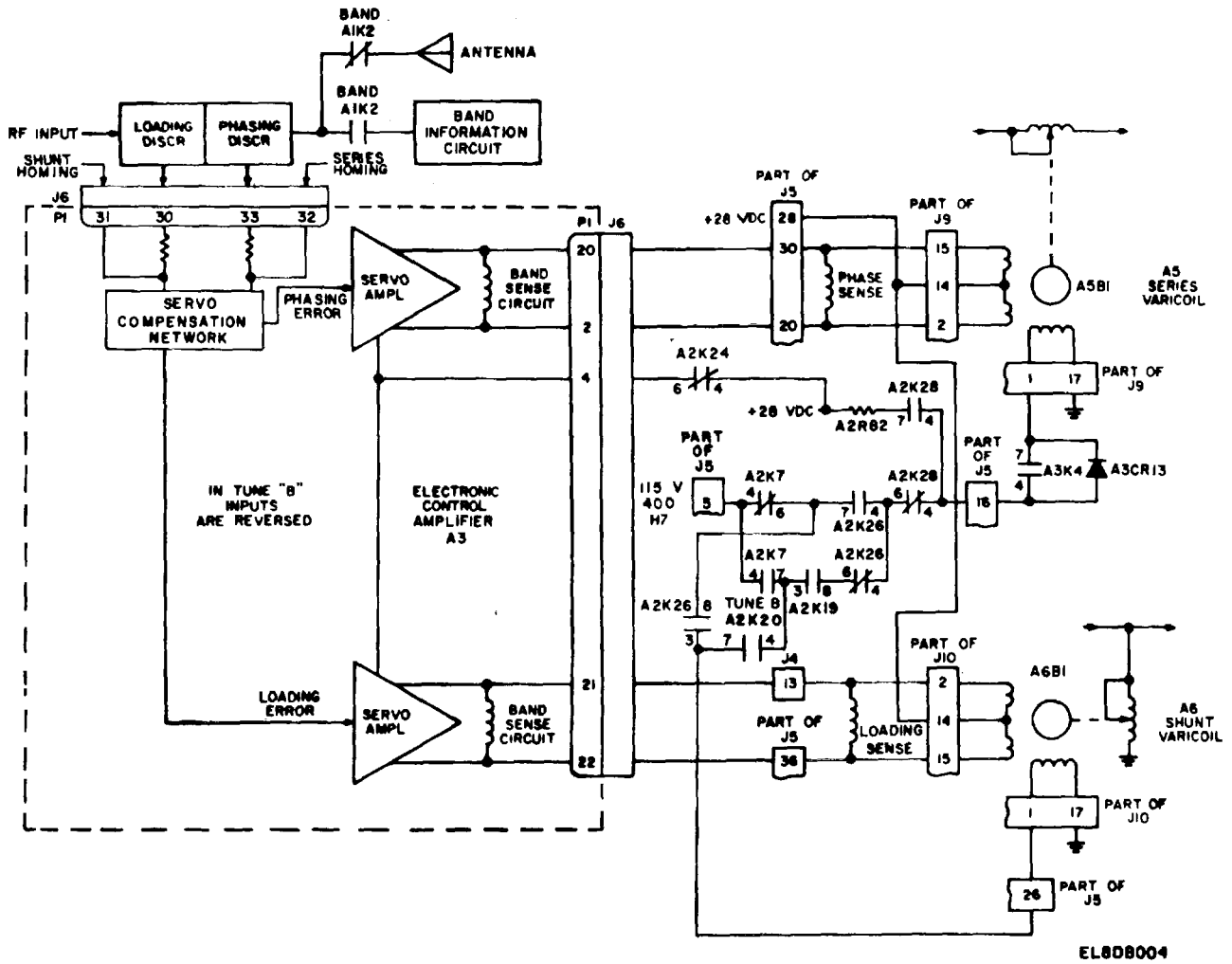


Figure 2-6.1. Sense Circuits and Varicoil Reference Voltage, Simplified Schematic Diagram.

Change2 2-11

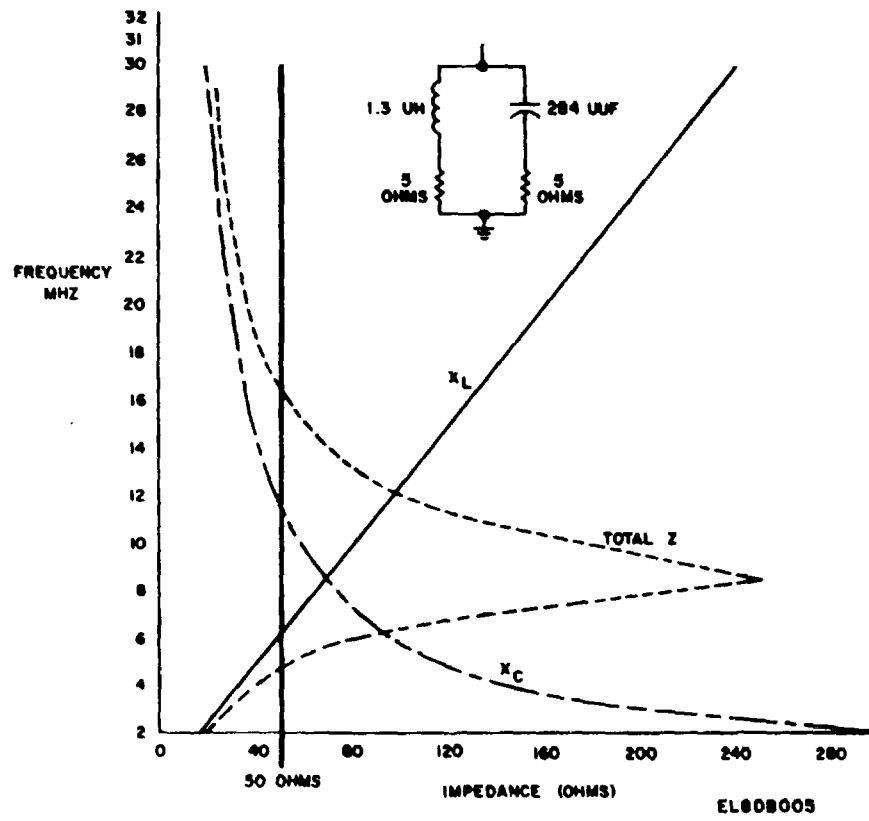


Figure 2-7. Frequency Band Information Circuit Diagram.

Change 2 2-12

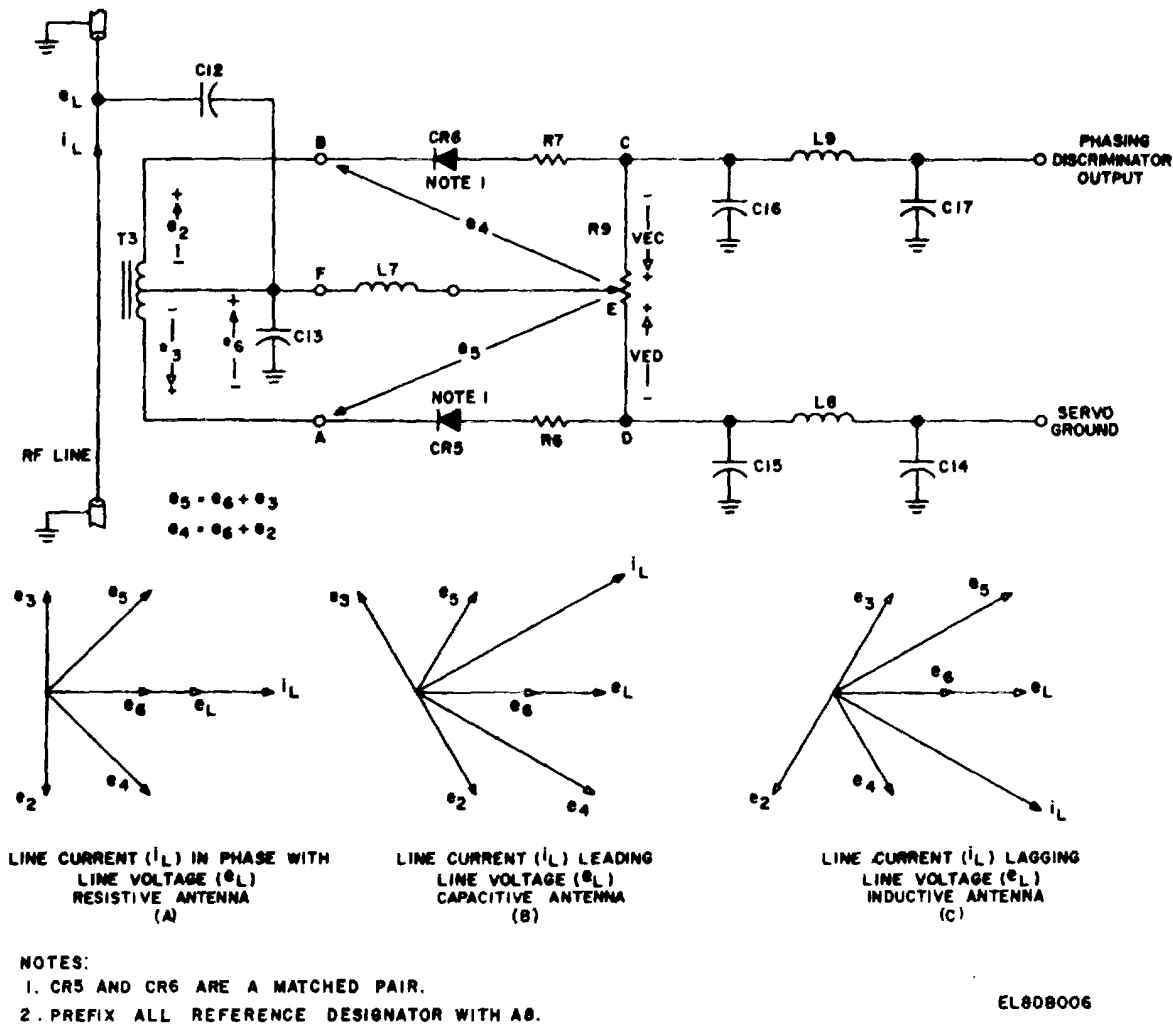


Figure 2-8. Discriminator A8, Phasing Operation, Simplified Schematic Diagram.

d. When the impedance of the RF circuit is greater than 50 ohms, the line current decreases and the line voltage tends to increase. The voltage induced in the secondary of transformer A8T2 is proportional to the line current. The voltage across resistor A8R4 decreases due to the decrease in A8T2 secondary voltage. The voltage across resistor A8R5 tends to increase since it is proportional to the line voltage. The voltage difference across resistors A8R4 and A8R5 is a negative error signal output.

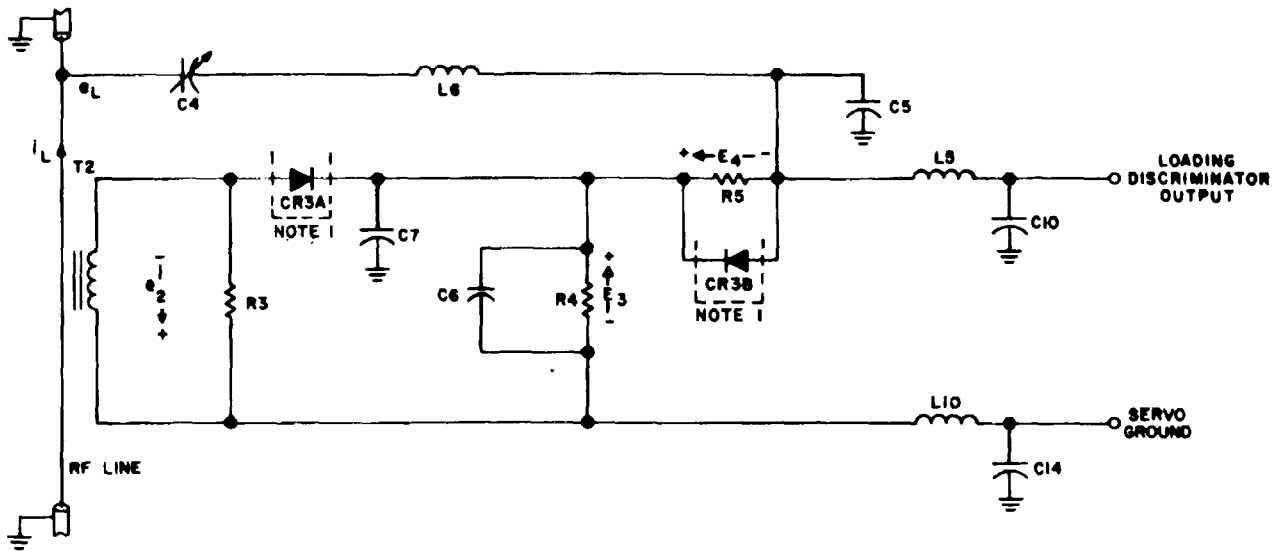
e. When the RF circuit impedance is less than 50 ohms, the line current increases and the line voltage tends to decrease. Since the voltage induced in the secondary of A8T2 is proportional to the line current, the voltage across A8R4 increases due to the increased voltage across A8T2 secondary. The voltage across resistor A8R5 tends to decrease since it is proportional to the line voltage. The voltage difference across resistors A8R4 and A8R5 is a positive error signal output.

2-9. Discriminator A8, Forward Power Theory (fig. 2-10)

a. The forward power function of discriminator A8 generates a dc error signal output proportional to the RF power traveling toward the antenna.

b. The secondary of transformer A8T2 is loaded with a low value of resistance (A8R3) and is connected to result in a secondary voltage (e_2) 180 degrees out of phase with the primary current.

c. The line voltage is sampled by the voltage divider consisting of A8C4 and A8C5 and appears at the junction of A8CR2 and A8L3. The sampled portion of the line voltage is 180 degrees out of phase with the secondary voltage across A8T2. On half the RF cycle, the induced voltage is greater in magnitude than the sampled voltage; therefore, diode A8CR2 is forward biased to produce a positive error signal output when forward power is present.



$E_4 + E_3 = 0 \text{ VDC}$	$E_4 + E_3 = \text{NEGATIVE VDC}$	$E_4 + E_3 = \text{POSITIVE VDC}$
$Z_{\text{ANTENNA}} = 50 \text{ OHMS}$ (A)	$Z_{\text{ANTENNA}} > 50 \text{ OHMS}$ (B)	$Z_{\text{ANTENNA}} < 50 \text{ OHMS}$ (C)

NOTES:

1. CR3A AND CR39 ARE A MATCHED PAIR, TYPE AD1259 PACKAGED AS A SINGLE COMPONENT,
2. PREFIX REFERENCE DESIGNATOR WITH AS.

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Figure 2-9. Discriminator A7, Loading Operation, Simplified Schematic Diagram.

2-10. Discriminator A8, Reflected Power Theory (fig. 2-11)

a. The reflected power function of discriminator A8 develops a dc error signal proportional to the deviation of the vswr from 1.0:1. The vswr deviates from 1.0:1 when the antenna impedance is not 50 ohms and resistive. Therefore, a reflected power error signal is developed when the antenna circuit is not resonant with a resistance of 50 ohms.

b. The secondary of transformer A8T1 is loaded with low value resistor A8R1 to result in secondary voltage e_2 in phase with line current i_L . The line voltage is sampled (with no phase shift) by voltage divider A8C1 and A8C2. A8C1 is factory adjusted to develop a sampled voltage, e_3 , equal to the induced voltage, e_2 , when the vswr is 1.0:1. With a vswr of 1.0:1, the cathode voltage of A8CR1 equals the anode voltage. This causes A8CR1 to be cut off and there is no error signal output.

c. When the antenna circuit is resonant with a

resistance of less than 50 ohms, the RF current increases and the RF voltage tends to decrease. Induced voltage e_2 is greater in magnitude than sampled voltage e_3 and A8CR1 is forward biased on the positive half-cycle. The conduction of A8CR1 develops a positive error output proportional to the reflected power.

d. When the antenna circuit is resonant with a resistance more than 50 ohms, the RF current decreases and the RF voltage tends to increase. Induced voltage e_2 is less than sampled voltage e_3 and A8CR1 is forward biased on the negative half-cycle. The conduction of A8CR1 develops a positive error output proportional to the reflected power.

e. When the antenna is reactive (nonresonant), the RF line voltage is out of phase with the RF line current. During a portion of each cycle, induced voltage e_2 , is more positive than sampled voltage e_3 , and diode A8CR1 is forward biased. The conduction of A8CR1 develops a positive error output proportional to the reflected power.

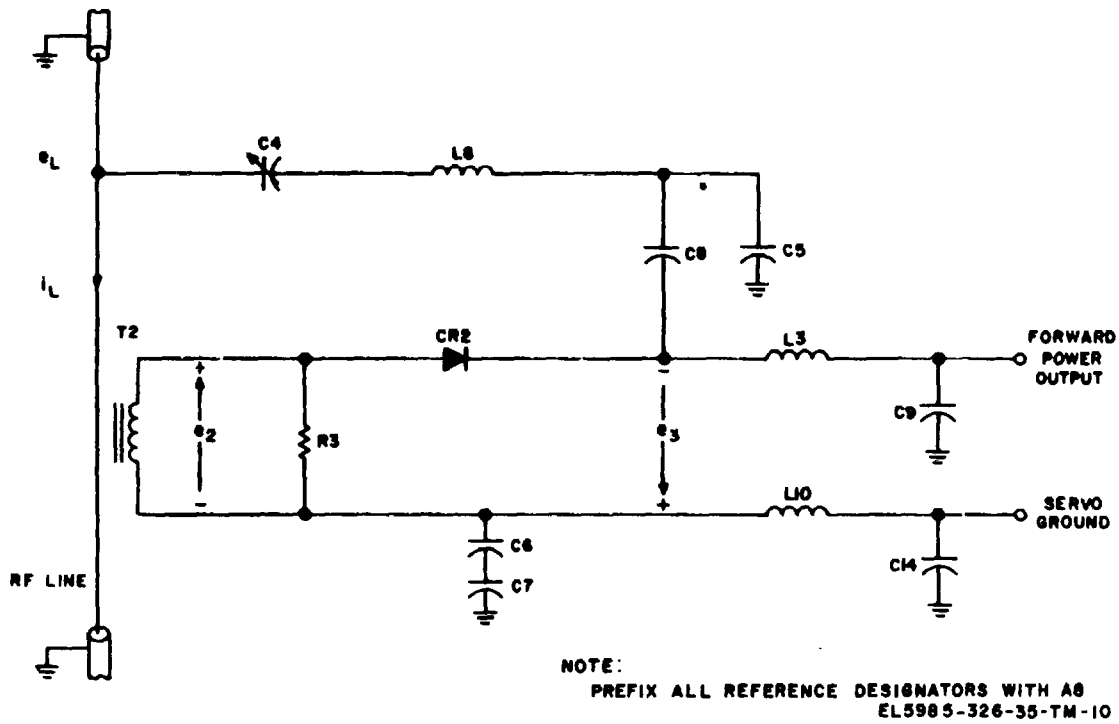


Figure 2-10. Discriminator A8, Forward Power Operation, Simplified Schematic Diagram.

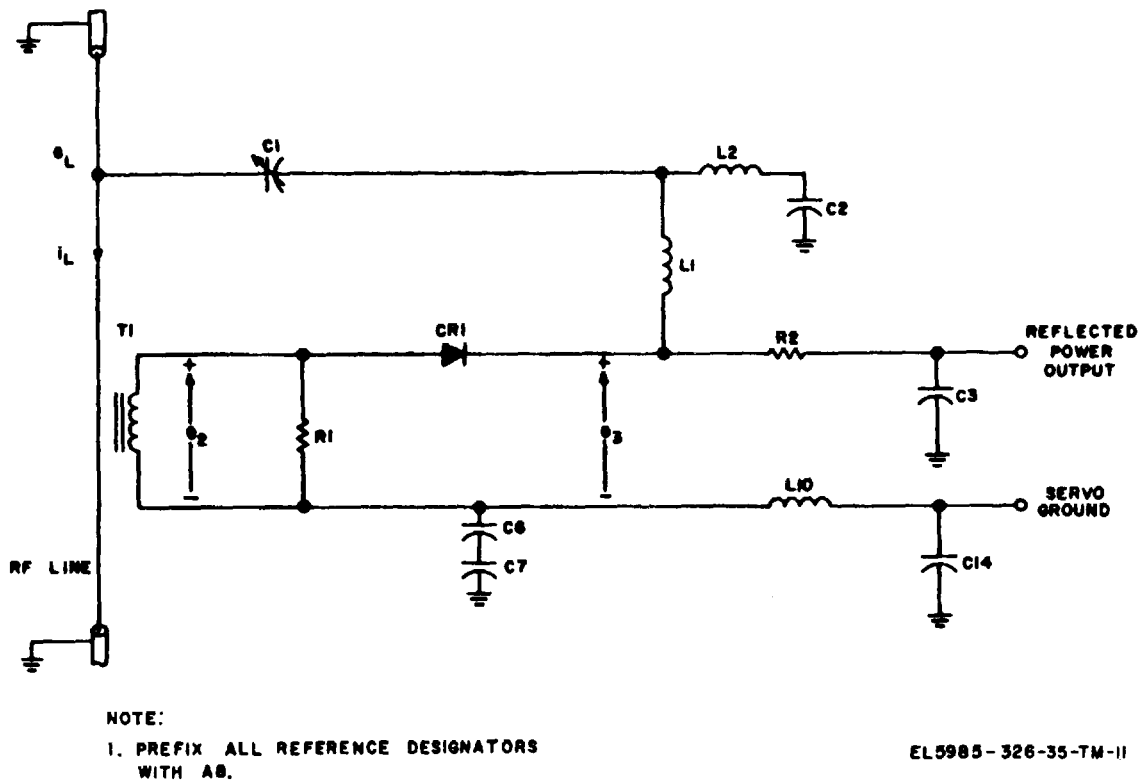


Figure 2-11. Discriminator A8, Reflected Power Operation, Simplified Schematic Diagram.

2-11. Control Amplifier A3 Functions

NOTE

Control amplifier A3 with Collins part No. 775-4276-001 (NSN 5821-00-0743984) (fig. 6-3) is discussed in paragraphs 2-11 through 2-14. Collins part No. 528-0467-000 (NSN 5821-00-911-1789) (fig. 6-4) operates in a similar manner.

Reflected power information sensed by discriminator A8 is sent to control amplifier A3 as phasing and loading dc error signals. The servocompensation network (para 2-12) receives the error signals and converts them to chopped 400-Hz square waves. These chopped square waves are amplified by the servoamplifiers (para 2-13). Servoamplifier outputs are furnished to band sense determining circuits (para 2-14) and to phasing and loading sense circuits (paras 2-18 and 2-19) located in coupler control A2. The servo outputs drive the series and shunt motors during homing or tuning when 115 volts ac has been applied to motor reference windings.

2-12. Control Amplifier A3 Servo Compensation (fig. 6-3)

The dc error voltages are furnished to their respective series or shunt compensation network channels during homing of the tuning elements or when the reflected power is above 1.3:1. Normally, the input to the series channel is phasing information, and the input to the shunt channel is loading information, but in final tuning (para 2-24) tune B relay A3K5 (fig. 6-3) operates, reversing the inputs. Prior to amplification, the dc error voltages are converted to synchronous ac voltages (chopped) proportional to the dc signal and with a phase relationship to the reference ac voltage of 0 or 180 degrees, depending upon the polarity of the dc error voltage. The input to the servoamplifiers (para 2-13) is held to 1 volt by A3CR17, A3CR18, A3CR20, and A3CR21 (fig. 6-3).

2-13. Servo Amplifiers (fig. 6-3)

a. The 400Hz chopped square waves are coupled to the first servoamplifier stages by capacitors A3C14 and A3C25. Transistors A3Q4 and A3Q5 and A3Q11 and A3Q12 are coupled by diodes A3CR19 and A3CR22. The bias supply is held constant by Zener diode A3CR16.

b. Multistage feedback compensation is provided by A3R48, A3C24, A3R37, A3C18, A3R38, A3R36, A3R35, and A3RT3 for the series servoamplifier and A3R69, A3C35, A3R58, A3C29, A3R59, A3R57, A3R56, and A3RT5 for the shunt servoamplifier. These networks

primarily determine the frequency response of the servoamplifiers.

c. Transistors A3Q4, A3Q5, A3Q11, and A3Q12 are connected in common emitter configurations. Transformers A3T3 and A3T4 provide impedance matching and coupling to the power output stages. Power output stages A3Q6 and A3Q8, A3Q7 and A3Q9, A3Q13 and A3Q15, A3Q14 and A3Q16 are connected in a Darlington configuration for high power gain.

d. During tune A (initial tuning) the chopped phasing error signal is amplified by the series channel and controls the series varicoil. At the end of tune A and the start of tune B (final tuning) relays A3K4 and A3K5 are energized and switch the phasing and loading errors to the opposite chopper. The phasing error signal then controls the shunt varicoil and the loading error signal controls the series varicoil.

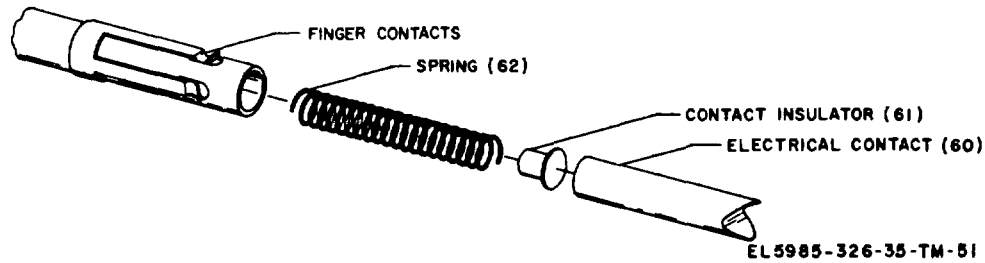
2-14. Band Information Sense Circuits (fig. 2-12)

a. Section of the 2 to 4-, 4 to 8-, 8 to 16-, or 16 to 30-MHz frequency band is initiated when band relay A1K2 (fig. 2-12) operates to allow the RF signal to be fed to the band information circuit. The final state of control amplified A3 band-switching relays after RF power is applied determines the initial position of the tuning elements in the antenna coupler.

b. Relay contacts A2K24-4 and -6 and A2K17 -2 and -8 (fig. 2-12) complete the circuit to operate band relay A1K2. The frequency band information circuit is switched into the RF line to replace the antenna circuit. The band information circuit presents the same load to the transmitter each time it is tuned to a given frequency. When RF power is supplied, normally operated RF power enable relay A2K24 restores and relay A2K17 remains restored for RF sampling of the band information circuit. When relay contacts A2K3-4 and -7 complete the gate circuit for A2Q2, and after capacitor A2C11 has charged to sufficient voltage to fire Zener diode A2CR88 (sufficient time to determine band information), A2K17 then operates, and band relay A1K2 restores, removing the band information circuit from the RF input signal. Relay terminals A3K1 -4 and A3K2-4 are grounded by the conduction of A2Q2. During the homing operation, the anode circuit of A2Q2 is opened by relay contacts A2K23-6 and -4.

c. The phasing error signal from discriminator A8 is amplified by the servoamplifier for series varicoil drive motor A5B1 and (after going through a phase shift) is applied to the gate circuit of A3Q1. The cathode of A3Q1 is grounded through A3CR2, A2CR99, and A2K17-2 and -8.

When the output of the servo-



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Figure 2-12. Band information sense circuit, simplified schematic diagram.

the servoamplifier is in phase with the unfiltered voltage on the anode, A2Q1 will conduct. Relay A3K1 is operated when A3Q1 conducts and completes the relay circuit. Relay A3K1 is maintained at ground by relay contacts A3K1-4 and -7.

d. The loading error signal output of discriminator A8 is amplified by the servoamplifier for shunt varicoil drive motor A6B1 and, after going through a phase shift circuit, is applied to the gate circuit of A3Q2. The cathode of A3Q2 is grounded through A3CR3, A2CR99, and A2K17-2 and -8. When the load error signal is in phase with the unfiltered voltages on the anode, A3Q2

conducts. Relay A3K2 is operated when A3Q2 conducts to complete the relay circuit. Relay A3K2-5 is maintained at ground by relay contacts A3K2-4 and -7. The disposition of relays A3K1 and A3K2 determines the band information for the tuning elements (table 2-2).

Change 2 2-17

Table 2-2. State of Relays

Frequency band (MHz)	State of relays	
	A3K1	A3K2
2 to 4.....	Operated	Operated
4 to 8.....	Operated	Restored
8 to 16.....	Restored	Restored
16 to 30.....	Restored	Operated

2-15. Coupler Control A2 functions

NOTE

Figures 6-5 through 6-8 are schematic diagrams of coupler control A2 (Part No. 528-0465-000). These diagrams reflect various circuit changes and are keyed to module serial numbers. All coupler control A2 modules operate in a similar manner. For this discussion, refer to figure 6-8.

The antenna coupler tune cycle begins when RF power is applied to discriminator A8 and ground is applied momentarily to the key circuits (para 2-17) in coupler control A2. The complete tuning operation is regulated by coupler control A2. Automatic sequencing is done by switching devices composed of silicon-controlled rectifiers, silicon transistor logic circuits, and hermetically sealed miniature relays. Prior to positioning of tuning elements, the following initial conditions exist in coupler control A2:

- a. The RF power relays are operated by forward power error signals, and RF power enable relays are restored. The TUNE indicator lamp is lit.
- b. The transmitter ground enables the key circuits keeping the transmitter keyed during antenna coupler tuning.
- c. Operated relay A2K7 allows external 115 volts ac to be applied to series varicoil A5 reference motor windings.
- d. Control amplifier A3 phasing and loading amplified error output signals are detected by sense circuits (paras 2-18 and 2-19) in coupler control A2.

2-16. RF Power Circuits (fig. 2-13)

a. Either forward power error signals derived from the RF input or reflected power error signals that occur when vswr of the antenna coupler is greater than 1:3: 1 will gate A2Q14. Conduction of A2Q14 grounds the gate circuit of A2Q16 power relays A2K2 and A2K3 and shunt capacitor motor A7B1 if A2K12 is restored. Conduction of A2Q16 ceases when the unfiltered anode voltage passes through zero reference.

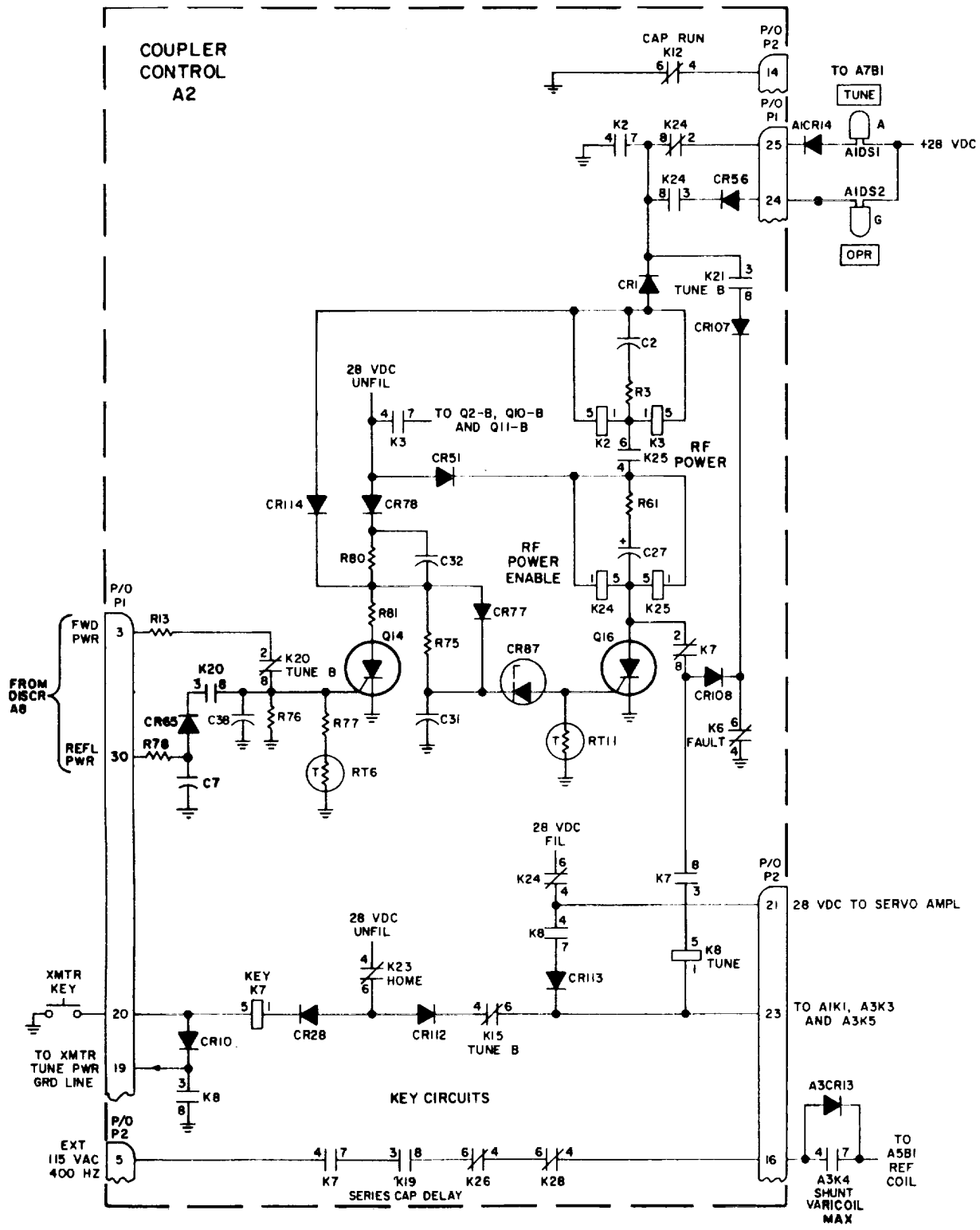
b. Normally operated relays A2K24 and A2K25 restore when A2Q16 stops conducting. Relay contacts A2K24-6 and -4 apply +28 volts dc to control amplifier A3 enabling the servoamplifiers; in addition, relay contacts A2K25-4 and -6 complete the +28-volt path for RF power relays A2K2 and A2K3.

c. Relay contacts A2K3-4 and -7 apply +28 volts to the gate circuit of A2Q2, A2Q10, and A2Q11 (part of logic circuits for sequencing the antenna coupler during tuning). Operated relay contacts A2K2-4 and -7 apply ground through relay contacts A2K24-8 and -2 and A1CR14. This action lights the TUNE indicator lamp. After the tuning elements are positioned by application of +28 volts dc through operated relay contacts A2K21-8 and -3 and A2K24-8 and -3 and A2CR56, I this voltage lights the OPR indicator lamp. Relay contacts A2K2-8 and -3 and A2K3-8 and -3 (fig. 6-8) regulate the frequency band information circuit and operation of the tuning drive motors.

d. Conduction of A2Q14 ceases when forward power or reflected power error signals are removed from the gate of A2Q14 and the anode voltage passes through the zero reference. With A2Q14 cut off, a triggering voltage breaks down Zener diode A2CR87 and is applied to gate A2Q16. Conduction of A2Q16 applies ground to the RF power enable relays A2K24 and A2K25. Relay contacts A2K24-6 and -4 remove +28 volts to the servoamplifiers, A2K25-6 and -4 remove + 28 volts from A2K2 and A2K3, and A2K24-8 and -3 apply ground to the OPR indicator lamp which lights when tuning is completed. Restored relays A2K2 and A2K3 remove power voltages for logic circuits that disable the dc motors in the tuning modules.

2-17. Key Circuits (fig. 2-13)

After homing is completed, depressing the receiver transmitter key applies a momentary ground to operate key relay A2K7. In voice modes, keying is accomplished by depressing the push-to-talk switch of the microphone. The + 28 volts is applied through contacts of home relay A2K23-4 and -6, A2CR112, and tune B relay A2K15-4 and -6 to tune relay A2K8-1. Relay A2K8 operates when ground is received through contacts A2K7-8 and -3, A2CR108, and fault relay A2K6-6 and -4. A lockup circuit is provided for A2K7 through A2CR10 and relay contacts A2K8-8 and -3, and at the same time, a ground to the transmitter tune circuits keeps the transmitter keyed while the antenna coupler is tuning. The series varicoil motor begins to tune when 115 volts 400 Hz is applied through A2K7-4 and -7, A2K19-3 and -8, normally restored A2K26-6 and -4, normally restored A2K28-6 and -4 and A3K4-4 and -7 to the reference winding of A5B1.



NOTES:

1. PREFIX ALL REFERENCE DESIGNATORS WITH A2 UNLESS OTHERWISE INDICATED.
2. □ DENOTES EQUIPMENT MARKING.

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Figure 2-13. RF Power and Key Circuits, Simplified Schematic Diagram.

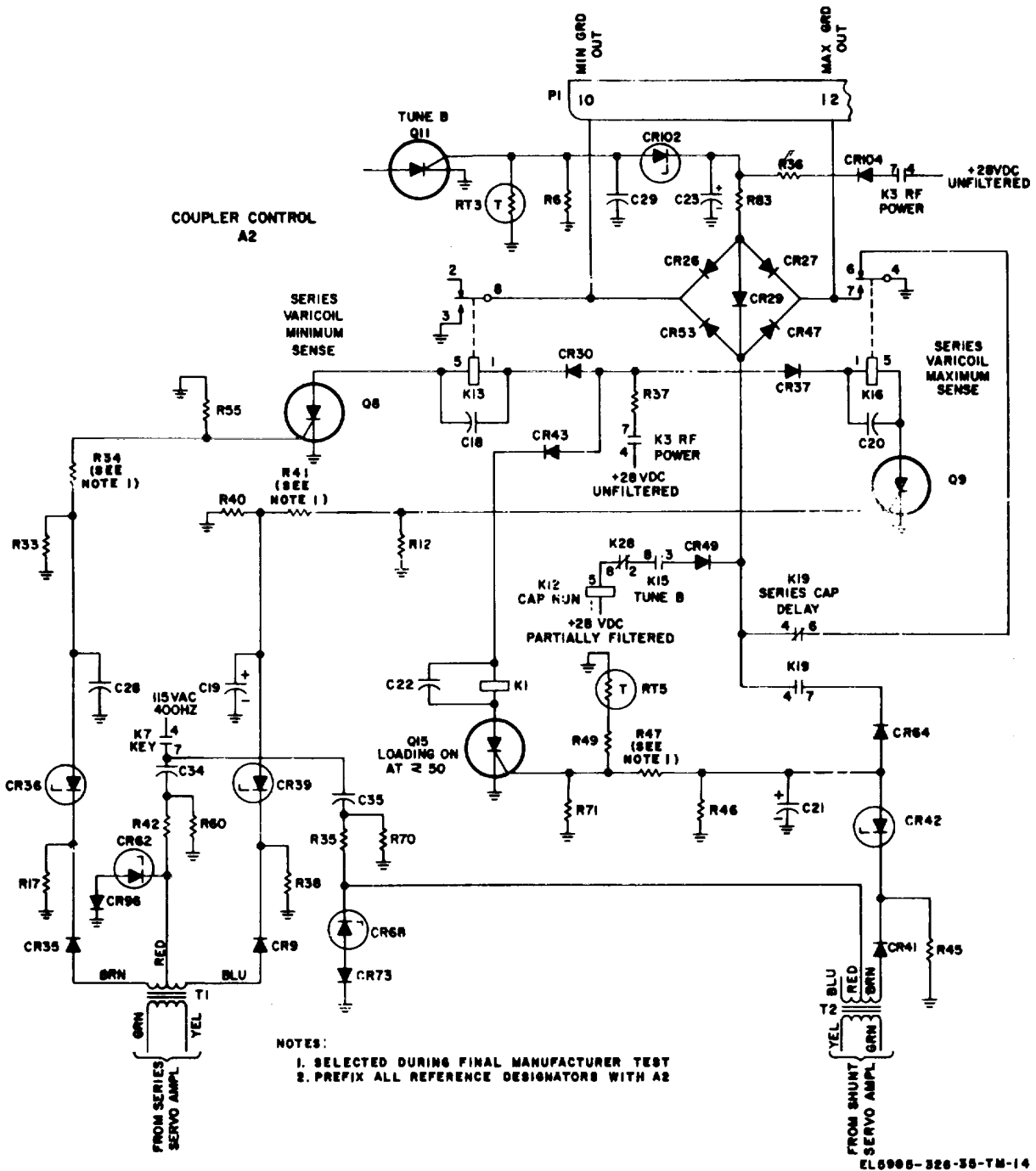


Figure 2-14. Phasing/loading Sense Circuits, Simplified Schematic Diagram.

2-18. Series Varicoil Phasing Sense Circuit (fig. 2-14)

a. The series varicoil phasing sense circuit compares the output of the series servoamplifier with a 400-Hz reference voltage to determine whether the antenna circuit is capacitive or inductive. If the antenna

circuit is capacitive, the series varicoil maximum sense circuit is activated, adding additional inductance. If the antenna circuit is inductive, the series varicoil minimum sense circuit is activated, reducing the amount of inductance as necessary for matching the antenna system. During the tuning operation, the series varicoil sense circuits, in conjunction with the

loading sense circuit, controls the positioning of the tuning elements.

b. The series servoamplifier output is applied to the primary of transformer A2T1. The secondary of transformer A2T1 is biased by a 90-degree phase-shifted, 400-Hz voltage. If the reactive component of the antenna circuit is inductive the 400-Hz biasing voltage is in phase with the induced voltage across the red and brown leads of the secondary.

The resultant voltage from the addition of the biasing and induced voltages breaks down Zener diode A2CR36 and activates A2Q8. Relay A2K13 is operated when A2Q8 conducts and completes the relay circuit. Operated relay A2K13 adds inductance by moving step coil A4 toward maximum.

c. If the reactive component of the antenna circuit is capacitive, the 400-Hz biasing voltage is in phase with the induced voltage across the red and blue leads of the secondary. The resultant voltage from the addition of the biasing and induced voltages breaks down Zener diode A2CR39 and activates A2Q9. When A2Q9 conducts, A2K16 operates.

2-19. Shunt Varicoil Loading Sense Circuit (fig. 2-14)

a. The shunt varicoil sense circuit (loading equal to or less than 50 ohms) compares the output of the shunt servoamplifier with a 90-degree, phaseshifted, 400-Hz reference voltage. This determines if the resistive component of the antenna system is above, equal to, or below 50 ohms. The sense circuit is activated when the antenna system is equal to or greater than 50 ohms.

b. The shunt servo output is fed to the primary of transformer A2T2 and the secondary is biased with a 90-degree, phase-shifted, 400-Hz reference voltage. When the biasing voltages are in phase, Zener diode A2CR42 conducts. Conducting of A2CR42 triggers A2Q15 completing the relay circuit, causing relay A2K1 to operate. If the resistive component of the antenna circuit is less than 50 ohms, the induced secondary voltage and the biasing voltage will be out of phase. The net effect is that the induced voltage is subtracted from the secondary bias and the resultant voltage is less than the breakdown voltage of A2CR42. As a result, A2Q15 is cut off when the unfiltered anode voltage passes through zero reference.

c. If the resistive component of the antenna circuit is greater than 50 ohms, the induced secondary voltage and the biasing voltage are in phase. The resultant voltage maintains the breakdown state of A2CR42 which activates; A2Q15. Relay A2K1 is operated if the resistive component of the antenna circuit is greater than 50 ohms and restored if the resistive component is

less than or equal to 50 ohms.

2-19.1. Coupler Control A2 (fig. 6-8.1)

Coupler control A2 (part no. 608-9500-002) performs the same functions as coupler control A2 (part no. 528-0465-000) as described in preceding paragraphs, beginning at 2-15. Coupler control A2 (part No. 608-9500-002) contains four printed circuit board assemblies, A2A1 through A2A4. A2A1, A2A2, and A2A3 plug into board A2A4 to form the coupler control assembly.

2-20. Tune A (Initial Tuning) (fig. 2-6)

a. *Antenna Circuit Made Capacitive and More Than 50 Ohms.*

(1) In the initial step of tuning in coupler control modules part no. 528-0465-000, MCN 101 to 9099 to 10601 and above, the antenna circuit is capacitive and equal to or greater than 50 ohms magnitude. The more than 50 ohms decision circuit is not enabled above 16 MHz in modules between MCN 9100 and 10600, but the antenna is still made capacitive. If the antenna circuit is inductive or less than 50 ohms, the antenna coupler adds series capacitance until the series capacitor reaches its maximum limit. If the antenna circuit is still no capacitive, the shunt capacitor adds capacitance until the antenna circuit is capacitive and, if required, greater than or equal to 50 ohms magnitude. A2K1 and A2K16 energize, causing A2K4 to energize, A2K4 in turn energizes A2K18 and A2K19, causing the antenna coupler to go to the next step in tuning. Coupler control module A2 part no. 608-9500-002 performs the same functions as part no. 528-0465-000, MCN 10601 and above.

(2) Series capacitance is added in steps to the RF circuit if the antenna circuit is inductive or less than 50 ohms. When the antenna circuit is inductive, the transistor A2Q3 base bias circuit is grounded through A2R62 (A2CR116 in A2 modules MCN 9100 and above), A2K17-7 and -4, A2K18-8 and -2, A2CR61, A2K16-2 and -8, and A2K2-7 and -4. When the antenna circuit is less than 50 ohms, the transistor A2Q3 base bias circuit is grounded through A2R62 (A2CR116 in A2 modules MCN 9100 and above), A2K17-7 and -4, A2K18-8 and -2, A2CR58, A2K1-6 and -4 and A2K2-7 and -4. In A2 modules MCN 9100 and above, from A2K6-4 the circuit is through A2K14-4, and -6, then A2K2-7, and -4. When transistor A2Q3 base bias circuit is grounded, relay A2K4 is restored, and series capacitor drive motor A9B1 is actuated. When A2K14 is energized by the 16-30 MHz band info signal the A2Q3 base circuit is not completed

and the 50-ohm decision is not made.

(3) Series capacitor drive motor A9B1 continues to operate until the antenna circuit becomes capacitive and equal to or greater than 50 ohms (or just capacitive with A2 modules MCN 9100 to 10600 in the 16to 30-MHz band) or until a predetermined electrical limit is reached. Relays A2K1 and A2K16 are energized when the antenna circuit becomes capacitive and equal to or greater than 50 ohms. Transistor A2Q3 conducts when relay contacts A2K1-4 and -6 and A2K16-2 and -8 open and remove the ground from the base of A2Q3. When transistor A2Q3 conducts, relay A2K4 is energized placing a short circuit across A9B1 providing dynamic braking.

(4) The electrical limit for series capacitor drive motor A9B1 is dependent upon the band of operation. If operating in the 2to 4-, 4to 8-, or 8to 16-MHz band, series capacitor A9 is limited to three steps of capacitance. Relay A2K4-5 is grounded through A2CR91, A9SIA(F)-8 and -5, A2K5-2 and -8, and A2K23-2 and -8. Relay A2K4 is operated after the third step of capacitance but before the fourth step of capacitance, when the rotor of switch A9-SIA(F) makes contact with terminal 5. If operating in the 16to 30-MHz band, series capacitor A9 is limited to five steps of capacitance. The 16to 30-MHz band information circuit grounds switch A9SIC(F)-8. Relay A2K5 is operated when the rotor of switch A9SIC(F) makes contact with terminal 4. Relay A2K5-5 is maintained at ground through A2K5-3 and -8 and A2K23 -2 and -8. When relay A2K5 is operated the ground line to switch A9S1A(F)-5 is opened, and A9SIA(F)-7 is grounded. Relay A2K4 is operated when the rotor of switch A9S1A(F) makes contact with terminal 7. A2K4-7 and -4 and A2K4-3 and -8 complete a short circuit across A9B1, providing dynamic braking.

(5) Shunt capacitance is added to the circuit if series capacitor A9 reaches the limit and if the antenna circuit is not capacitive (2to 16-MHz range). Transistor A2Q7 (fig. 2-5) base bias circuit is grounded through A7SI(F)-1 and -3, A2K21-4 and -6, A2CR60, A2K5-4 and -6, A9S1B(F)-5 and -2, A5SA®-12 and -1, and A2K13-8 and -3. When A2Q7 base bias circuit is grounded, relay A2K12 is restored and shunt capacitor drive motor A7B1 is energized. When the antenna circuit is capacitive, relay A2K13 is restored, removing the ground from the base of transistor A2Q7. When A2Q7 conducts, relay A2K12 is operated, completing a short circuit across A7B1 (fig. 2-6), providing dynamic braking.

b. Antenna Resonated With Resistance Less Than 50 Ohms.

(1) 2- to 4- or 4- to 8-MHz band. Discriminator

phasing error voltage drives series varicoil A5 from minimum toward maximum. If series varicoil A5 reaches maximum limit, step coil A4 inserts increments of inductance until the antenna becomes resonant. If the antenna is not resonated when step coil A4 reaches the maximum limit (2- to 4-MHz limit, all step of coil, or 4 to 8Mz limit, limited steps of coil), shunt capacitance is added. When step coil A4 inductance or shunt capacitance is added, the series varicoil A5 will run to maintain a phased antenna. Fault condition will occur after approximately 10 seconds if shunt capacitor A7 reaches its maximum limit.

(2) 8to 16or 16to 30-MHz band. In the 8to 16-MHz or 16to 30-MHz band, series varicoil A5 runs from minimum toward maximum. If series varicoil A5 reaches its maximum limit before the antenna is resonant, shunt capacitance is added. The antenna coupler will fault after a time delay of approximately 10 seconds if shunt capacitor A7 reaches maximum capacitance.

(3) *Resistance greater than 50 ohms after resonance.* If shunt capacitance is added during this loading operation, series varicoil A5 is decreased in inductance to maintain the antenna circuit at resonance. If series varicoil A5 reaches minimum inductance before resistance is decreased to 50 ohms the following occurs:

<i>Band</i>	<i>Circuit function</i>
2- to 8-MHz	Step coil A4 decreases inductance.
8- to 16-MHz	Series capacitance is added. Antenna coupler will fault if series or shunt capacitors reach maximum limits and resistance is not equal to or less than 50 ohms.

2-21. Operation in 2to 4or 4to 8-MHz Band

a. During the operation of the series capacitor drive motor (fig. 6-8) the gate current for A2Q10 is grounded through A2CR38, A2R48, and A2K4-2 and -8. In A2 modules part no. 528-0465-000, MCN 9100 and above and A2 modules part no. 608-9500-002, A2Q10 is grounded through A2CR38, A2R48, A2K4-8 and -2, and A2K17-8 and -3. After the series capacitor is positioned and relay A2K4 operated, there is a short time delay, then A2Q10 is activated. Relays A2K18 and A2K19 are operated when A2Q10 conducts. Relay A3K4 is operated when terminal 5 is grounded through switch A6SIA®-11 and -12. Series K varicoil drive motor A5B1 reference windings circuit is completed through A2K7-4 and -7, A2K19-3 and -8, A2K26-4 and -6, A2K28-4 and -6, and A3K4-4 and -7. The output of the servoamplifier for the series varicoil drive motor is applied to the control windings of series varicoil

drive motor A5B 1. Due to the phase relationship between the reference windings and the control windings, A5B1 advances the series varicoil A5 toward maximum inductance.

b. If the antenna circuit is not resonant when the series varicoil A5 reaches maximum inductance, incremental amounts of step coil A4 inductance are added. Shunt capacitance is added if step coil A4 reaches maximum limit. Diode A2CR115 prevents the shunt capacitor motor and the step coil motor from running simultaneously.

c. Step coil drive motor A4B1 operates when the base bias circuit of transistor A2Q6 is grounded through A2K16-4 and -7, A5S1A@-11 and -12, 2CR75, and A2R24 (fig. 2-4). Shunt capacitor drive motor A7B1 operates when the base bias circuit of transistor A2Q7 is grounded through A2K16-4 and -7, A5S1A@-11 and -12, A2K9-3 and -8, A2CR59, A2K21-6 and -4, and A2R27 (fig. 2-5). Shunt capacitor drive motor A7B1 continues to operate until the antenna circuit becomes inductive or maximum capacitance is reached. Step coil drive motor A4B1 continues to operate until the antenna circuit becomes inductive or a predetermined electrical number of steps is reached. The redetermined number of steps is dependent upon the frequency of operation. When operating the antenna coupler in the 2 to 4-MHz band, switch A4SI@-11A is grounded by A2K23-2 and -8 (fig. 2-4). When operating the antenna coupler in the 4 to 8-MHz band, switch A4SI@-8A is grounded by the band information circuit.

d. Shunt capacitor A7 operation begins when relay A2K9-5 (fig. 2-4) is operated by grounding through A2CR19, A2K2-8 and -3, A5S1A-(F)-8 and -9, and A4S1@-5A and when step coil A4 reaches the predetermined limit. If the antenna circuit is not resonant, the base bias circuit for A2Q7 (fig. 2-5) is grounded through A2K16-4 and -7, A5S1A@-11 and -12, A2K9 -3 and -8, A2CR59, A2K21-4 and -6, and A2R27. Shunt capacitor drive motor A7B1 operates when A2Q7 is cut off. A7B1 continues to operate until the antenna circuit is resonant (A2K16 restored) or it reaches maximum capacitance (A7S2 opened). The antenna coupler faults after approximately 10 seconds if shunt capacitor A7 reaches maximum capacitance and the vswr is more than 1.3: 1.

2-22. Operation in 8 to 16 or 16 to 30-MHz Bands

a. When the antenna coupler is operating in the 18 to 30-MHz band, step coil A4 inductance is not added. If series varicoil A5 reaches maximum inductance, relay A2K10 (fig. 2-4) is operated to brake step coil drive

motor A4B1 dynamically. Relay A2K10 operates when grounded by the band information circuit through A4S1@-5A and -10A, A5S1A(F)-8 and -9, A2K2-3 and -8, and A2CR20. Shunt capacitor A7 operates when the base bias circuit for transistor A2Q7 (fig. 2-5) is grounded through A2K16-4 and -7, A5S1A@-11 and -12, A2K9-3 and -8, A2CR59, and A2K21-4 and -6. Shunt capacitor A7 continues to operate until the antenna circuit is resonant (A2K16 restored) or until maximum capacitance is reached. The antenna coupler faults approximately 10 seconds after A7 reaches maximum capacitance.

b. To prevent self-resonance, series varicoil A5 is limited to approximately half its total inductance when operating within the 16 to 30-MHz band. Relay A2K14 is operated by the 16 to 30-MHz band information circuit (fig. 2-15). Relay A2K28-5 is operated when grounded through A2K16-4 and -7, A5S1A@-6 and -7, and A2K14-3 and -8. The 115-volt ac line to the reference windings of series varicoil drive motor A5B1 is opened by relay contacts A2K28-4 and -6. Motor A5B1 is braked dynamically when the +28-volt dc circuit is completed (through the reference windings) by relay contacts A2K28-4 and -7. Shunt capacitance is added if series varicoil A5 reaches the limit and the antenna circuit is not resonant. Shunt capacitor drive motor A7B1 operates when the base bias circuit of A2Q7 is grounded through A2K16-4 and -7, A5S1A@-6 and -7, A2K14-3 and -8, A2CR24, and A2R27. Shunt capacitor A7 continues to operate until the antenna circuit is resonant (A2K16 restored) or until maximum capacitance is obtained. The antenna coupler will fault in approximately 10 seconds after maximum capacitance is reached.

c. When the antenna circuit has been resonated, the ground (through A2CR64, A2K19-4 and -7, and the varicoil sense circuit (fig. 2-14) is removed from the gate of A2Q11 (fig. 2-16), and the loading circuits or the tune B circuits are actuated.

2-23. Loading if Resistance is Greater Than 50 Ohms

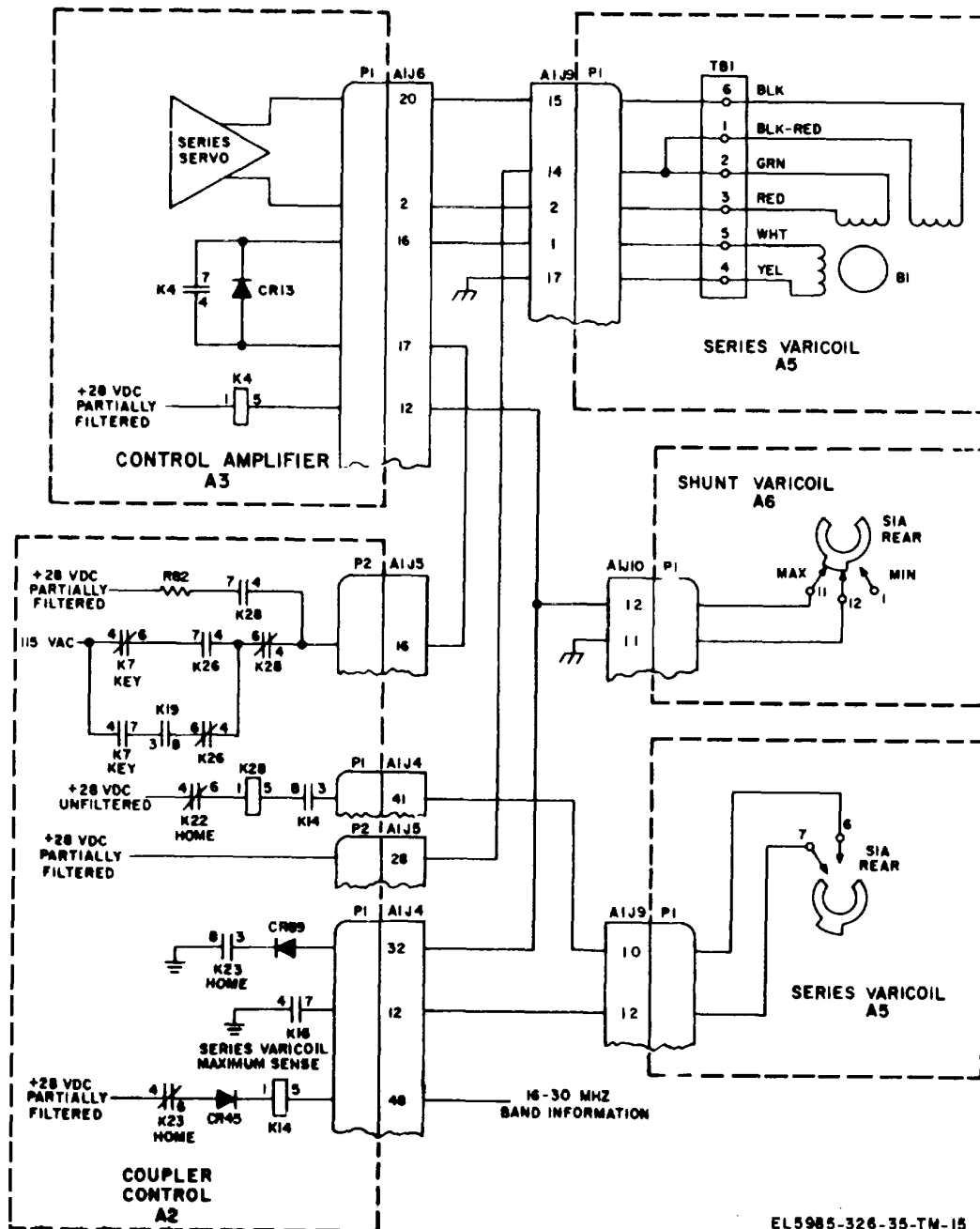
a. Shunt capacitance is added if the resistance of the antenna circuit is equal to or greater than 500 ohms after the circuit is resonant. Shunt capacitor drive motor A7B1 operates when the base bias circuit of transistor A2Q7 is grounded through A2K1-3 and -8, A2K18-4 and -7, A2CR66, A2K21-4 and -6, and A2R27 (fig. 2-5). Shunt capacitor A7 continues to operate until the antenna circuit is less than 50 ohms (A2K1 restored) or maximum capacitance is reached.

b. During this loading operation, series varicoil A5 inductance is decreased to maintain the antenna

circuit at resonance. Series capacitance is added if series varicoil A5 reaches minimum inductance before the resistance is decreased to less than 50 ohms (8 to 30-MHz band) (fig. 2-6). Series capacitor drive motor A9B 1 (fig. 2-6) operates when the base bias circuit of transistor A2Q3 is grounded through A2CR100. A2K13-4 and -7, A3K3-3 and -8, A2K18-3 and -8, A2-K17-4 and -7, and A2R62. Series capacitor A9 continues to operate until the antenna circuit is resonated or until the predetermined limit is reached.

c. The antenna coupler faults in approximately 10 seconds if series capacitor A9 reaches the limit or shunt capacitor A7 reaches maximum capacitance and the resistance is not 50 ohms or less.

d. When the resistance is less than 50 ohms, relay contacts A2K1-3 and -8 open to remove the ground from the gate circuit of A2Q11 (fig. 2-16). The antenna coupler circuits advance to the tune B mode of operation.



EL5985-326-35-TM-15

Figure 2-15. Series Varicoil A5 Motor Circuit, Simplified Schematic Diagram.

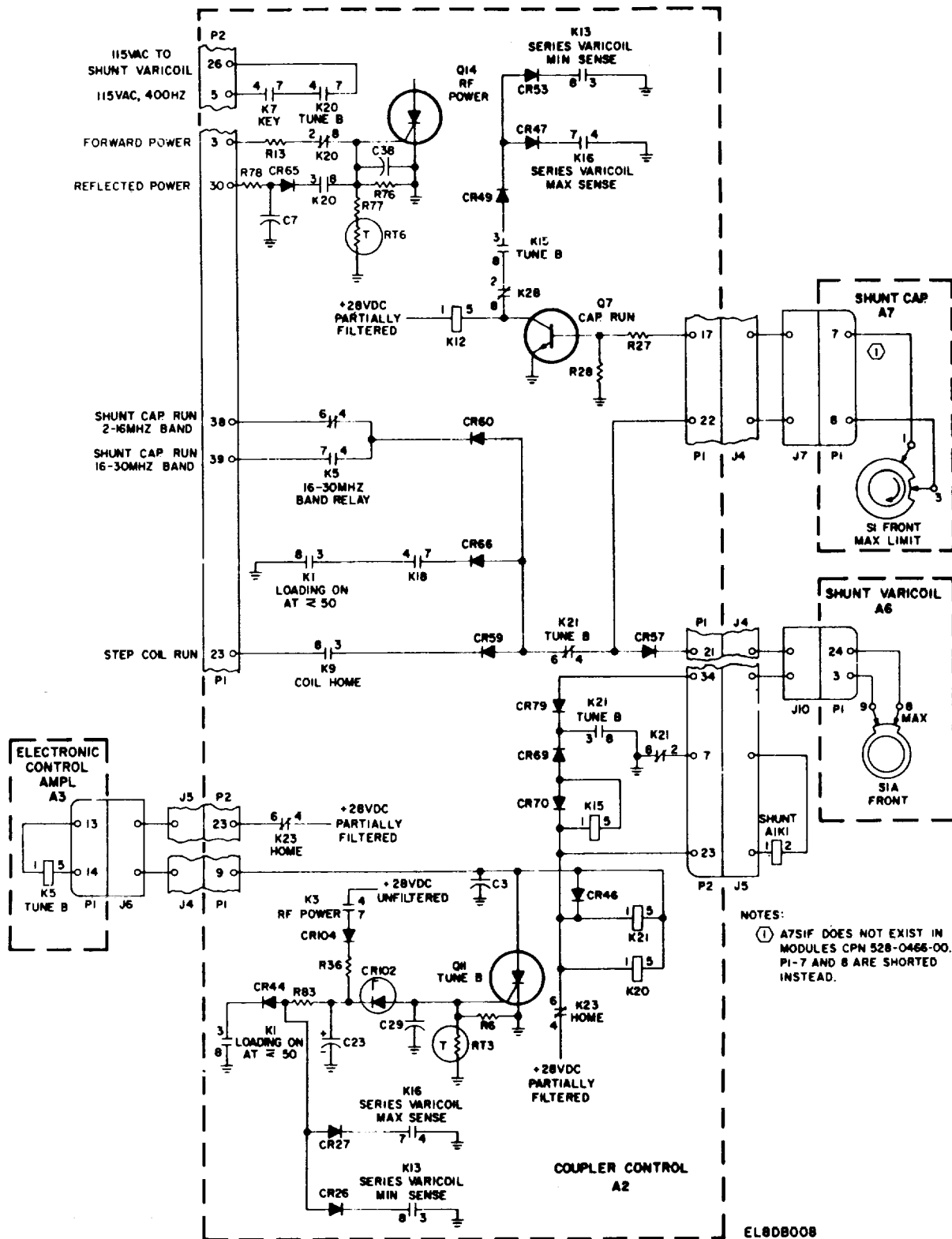


Figure 2-16. Tune B Circuit, Simplified Schematic Diagram.

2-24. Tune B (Final Tuning)
(fig. 2-16)

a. In tune B operation, shunt relay A1K1 restores

connecting shunt varicoil A6 into the antenna circuit; in addition, discriminator A8 phasing and loading error voltages are reversed to the ser-

voamplifiers. If shunt varicoil A6 reaches maximum, then shunt capacitance is added to the antenna circuit. The antenna coupler stays in this mode until the reflected power error voltage drops low enough to cut off A2Q14. This steps the antenna coupler to the operate and demand surveillance position (para 2-25).

b. When the antenna circuit is resonant with a resistance less than 50 ohms, relays A2K1, A2-K13, and A2K16 are restored. A2Q11 is activated when relay contacts A2K1-3 and -8, A2K13-3 and -8, and A2K16-4 and -7 and opened to remove the ground from the gate circuit. Relays A2K15, A2K20, A2K21, and A3K5 are operated when A2Q11 conducts. Relay A1K2 is restored when relay contacts A2K21-2 and -8 are opened to remove the ground from AIK1-2. When relay A1K1 is restored, shunt varicoil A6 is connected into the antenna circuit. The series and shunt varicoils are tuned to adjust for the phasing and loading impedance mismatch introduced by the inductance of shunt varicoil A6. When relay A3-K5 is operated, the loading error signal is applied to the servoamplifier for series varicoil drive motor A5B1, and the phasing error signal is applied to the servoamplifier for shunt varicoil drive motor A6B1. In A2 modules part no. 528-0465-000, MCN 9100 through 10600, when A2K17 is energized (during tune B), +28 V is applied through A2K15-4 and -7 to time delay circuit A2R85, A2C42, and A2C43. After a slight delay, to give the shunt varicoil time to start repositioning, A2Q3 conducts and energizes A2K4. With A2K4 energized, the series capacitor positions for proper loading. Module part no. 608-9500-002 tunes the same as part no. 528-0465-000, MCN 10601 and above.

c. The initial tuning control lines to the base of transistor A2Q7 are disconnected by relay contacts A2K21-4 and -6 (fig. 2-5). The operation of shunt capacitor A7 is controlled by series varicoil A5 sense circuit and shunt varicoil A6. Shunt capacitor drive motor A7B1 is braked dynamically by relay A2K12 when the antenna circuit is loading. Relay A2K12 is operated when grounded through A2K28-8 and -2, A2K15-8 and -3, A2CR49, A2CR47, and A2K16-7 and -4 (series varicoil A5 maximum sense circuit) or A2K28-8 and -2, A2K15-8 and -3, A2CR49, A2CR53, and A2K13-8 and -3 (series varicoil A5 minimum sense circuit). Shunt capacitance is added when shunt varicoil A6 reaches maximum inductance. Shunt capacitor drive motor A7B1 operates when the base bias circuit for transistor A2Q7 is grounded through A2R27, A2CR57, A6S1A(F)-8 and -9, A2CR79, and A2K21-3 and -8. Shunt capacitor A7

continues to operate until shunt varicoil A6 is moved from the maximum inductance position opening A6S1A(F)-8 and -9. In A2 modules MCN 672 and above, A2K21-3 is grounded through A2K21-8, A2CR107, and A2K6-6 and -4.

d. The forward power error signal circuit to the gate of A2Q14 is opened when relay contacts A2K20-8 and -2 are opened. The tuning of the antenna coupler is now controlled by the reflected power error signal. When the reflected power is decreased to a 1.3:1 vswr, the antenna coupler tuning is complete.

2-25. Operate and Demand Surveillance (fig. 2-13)

After tune B (para 2-24), the servosystem is turned off but the antenna coupler continues to monitor forward and reflected power. If the reflected power rises above a specific level, the demand surveillance system takes over. The demand surveillance system activates the antenna coupler tuning circuits causing retuning. The initial tuning of the coupler is from the home position. In the demand surveillance mode, the coupler is tuning with the elements starting from a position determined by the previously tuned antenna impedance. With the elements starting from a position other than the home position, the new antenna impedance may be outside the tuning limits of the coupler. For instance, the series and shunt capacitors do not reverse in the tuning mode. If in the demand surveillance mode the new impedance requires a reversal of either of these two elements, the coupler will not retune. A2Q14 is triggered causing A2Q16 to fire, thus restoring A2K24 and A2K25. This places the antenna coupler back into tune B (para 2-24) for retuning. If the transmitter is rechanneled, the antenna goes home.

2-26. Fault (fig. 6-8 or fig. 6-8.1)

If the antenna coupler does not tune in 8 to 10 seconds, the fault circuits disable the tuning circuits and both the OPR and TUNE indicators light. When power is applied, A2Q14 of power enable circuit turns on, causing A2Q16 to turn off and restoring A2K24 and A2K25. A2K25-4 and -6 apply 28 volts of unfiltered dc to A2C5 through CR85 and CR32, charging A2C5 to a level sufficient to turn on A2CR84 within 8 to 10 seconds and A2Q is gated on operating A2K6. A2K6-2 and -8 disable the key interlock circuits. A2K6-4 and -6 disable the key circuits. A2K6-4 and -7 light the OPR and TUNE indicators.

**CHAPTER 3
DIRECT SUPPORT MA'INTENANCE**

Section I. GENERAL

3-1. Scope

a. The maintenance allocation chart (MIAC) in TM 11-5985-326-20 authorizes the direct support repairman to-

- (1) Test the antenna coupler on a direct go/no-go basis.
- (2) Remove and replace defective modules.
- (3) Repair circuits which do not require disassembly of a module.

b. This chapter explains how to perform the maintenance listed in a above. The chapter covers-

- (1) Tools, test equipment, and materials required (para 3-2).
- (2) Troubleshooting procedures (sec. II).
- (3) Removal and replacement procedures (sec. III).
- (4) Testing procedures (sec. IV).

3-2. Tools, Test Equipment, and Materials Required

Item	Common name	Purpose	Applicable publication
Multimeter TS-352(*)/U	Multimeter	Measure voltage and resistance.	TM 11-6625-3-15
Test Set, Antenna Coupler AN/AIRM-109 consisting of:	Test set	Test antenna coupler	TM 11-6625-1636-15, TB 11-66125-1636-35/1.
Test Set, Antenna Coupler Control TS-2353/AIRM-109.	Control tester	Test coupler control A2.	
Test Set, Electronic Control Amplifier TS-2354/A RM-109. TS-2352/ARM-109.	Amplifier tester	Test control amplifier A3.	
Power Cable (FSN 761-4600-001).	W1	Connect ac power to test set.	
Cable CX-10735/U	W2	Used with control test set.	
Cable CX-10736/U	W3	Used with amplifier test set.	
Cable CG-3440	W4	Used with discriminator test set.	
Tool Kit, Electronic Equipment TK-105/G.	Toolkit	General use	SB 11-604
Radio Set AN/ARC-102	Receiver transmitter	Bench test	TM 11-5821-248-12
Electrical Dummy Load DA-487/U	Dummy load	Simulate antenna	TM 11-5985-327-15
Oscilloscope AN/USM-140(*)	Oscilloscope	Measure voltage	TM 11-6625-535-15, TM 11-6625-535-15-1.
Test Harness, Radio Set AN/URM-157.	Test harness	Bench test	TM 16'25-622-12, TM 11-6625-622-45.
Wattmeter AN/URM-120	Wattmeter	Measure RF power	TM 11-6625-446-15
Aluminum plate (FSN 9535-815-2213).	Aluminum plate	Test setup ground	None.

Section II. TROUBLESHOOTING

3-3. Troubleshooting Procedures

a. General. Troubleshooting must be systematic. If the proper sequence is followed, the trouble will be traced to a major component, then to a module, and finally to a defective part. The job of the direct support repairman is to trace the fault to a module.

(1) The first step is to trace fault to a major component (fig. 2-1). This is done at the using organization (TM 11-5985-326-20). *For example*, if the organizational repairman traces the fault to the antenna coupler, he will remove the antenna coupler from the aircraft and send it to the direct support level.

(2) The second step is to trace the fault to a module within the antenna coupler. This is done at the direct support level. When the direct support repairman traces the fault to a module, he will remove the module from the antenna coupler and send it to the general support or depot level.

NOTE

Direct support repair functions are limited only by the tools, test equipment, and replacement parts available, and the skill of the repairman.

(3) The last step is to trace the fault to a specific part. This is done at the general support and depot level.

b. Tracing Trouble to a Module. A group of tests are listed below. Use these tests to simplify work. The simple tests are used first. Those that follow are more complex. Follow the sequence given.

(1) *Visual inspection.* When fault is not apparent, make a visual inspection. If possible, find out how the equipment functioned at the time the trouble occurred. Check anything that has an abnormal color. Check input and output wires and cables.

(2) *Module substitution.* Coupler control A2, control amplifier A3, and discriminator A8 are plug-in modules. A quick way to trace fault to one of these modules is to substitute modules known to be operating correctly (para 3-5).

(3) *Continuity measurements.* These measurements will serve to pinpoint a fault in wiring. If module substitution does not correct a fault, make continuity measurements (para 3-6).

(4) *Voltage measurements.* Make voltage measurements at test points TPI through TP11 on control amplifier A3 (para 3-7). Normal voltage readings

at these test points mean that the module is operating correctly.

(5) *Coupler control A2 test.* This test uses a control tester. The tester uses lamps and voltage test points for a go/no-go test of the module (para 3-22).

(6) *Control amplifier A3 test.* This test uses an amplifier tester. The tester uses lamps and torque meter indications for a go/no-go test of the module (para 3-23).

(7) *Discriminator A8 test.* This test uses a discriminator tester. The tester simulates matched and unmatched loads. Error signals are shown on a meter on the front panel of the tester. Meter readings indicate whether or not the module is defective (para 3-24).

(8) *Operational test.* This test will reveal the efficiency of the tuning elements, the power output, and the condition of the fault circuit (para 3-25).

(9) *Troubleshooting chart.* The troubleshooting chart indicates the steps to follow after the above checks are completed. The chart gives a cause-and-effect procedure aimed at localizing trouble to one specific module (para 3-8).

(10) *Intermittent.* An antenna coupler is operating intermittently if from time to time it operates normally, but at other times it goes dead or develops some other type of trouble. Intermittent troubles include all types to which a coupler is subject, but they appear and disappear at random. Such troubles are hard to trace because they do not exist when the coupler is operating normally, and because the coupler may resume normal operation before the repairman can finish testing it. This type of trouble may be made to appear by tapping or jarring the antenna coupler. It is possible that some external connection may cause the trouble. Test wiring for loose connections and move wires and components with an insulated tool. This may show where a bad connection or faulty component is located.

34. General Precautions

Observe the following:

a. The metal case handle of the antenna coupler in the pullout position is close to the antenna coupler output terminal. A short circuit is possible through the case whenever the antenna leading wire is connected to the output terminal and the handle is not in the down position.

b. Be careful when the dust cover is removed; dangerous voltages are exposed. These points are not labeled.

c. Do not over-tightening screws when assembling mechanical couplings.

d. When changing a component that is held by screws, always replace the lockwashers.

e. Do not disturb any adjustment settings unless directed otherwise.

3-5. Module Substitution

a. This method of troubleshooting is effective when performed on equipment installed in an aircraft or as a test setup (para 3-25). Proceed as follows:

(1) Replace coupler control A2 (para 3-11), control amplifier A3 (para 3-12), and discriminator A8 (para 3-17) with modules known to be in good operating condition, one at a time.

(2) If the antenna coupler begins to operate normally, refer the last module removed to higher category of maintenance for repairs.

(3) Reinstall the other original modules in equipment chassis A1.

b. If an antenna coupler has more than one bad module at the same time, substituting modules one at a time will not locate the defective module. The original module may have been defective, but it was not evident because there is another defective module that is preventing normal operation. To correct this trouble-

(1) Remove coupler control A2, control amplifier A3, and discriminator A8 from equipment chassis A1.

(2) Install all good operating modules into equipment chassis A1.

(3) Reinstall the original modules, one at a time. When failure or change is noticed, refer the last

module installed to higher category of maintenance for repairs.

c. If none of the above procedures restores the antenna coupler to normal operation, further troubleshooting is necessary. If the antenna coupler is to be sent to a higher category of maintenance for repairs, reinstall all of the original modules in equipment chassis A1 even though one or more of the modules are suspected of being defective.

3-6. Continuity Measurements

a. *Test conditions.* Turn off all power to the antenna coupler. Disconnect external cables. Remove the dust cover (para 3-10a). Remove the modules as required for access to equipment chassis A1 jacks. Uncouple plugs and jacks as necessary. Use multimeter to make continuity measurements.

b. *Continuity measurements.* The wiring diagrams (figs. 6-9 and 6-10) show the function of interconnecting wires. Check wiring associated with the suspected function or module. Repair or replace defective wires or cables.

3-7. Voltage Measurements

Control amplifier A3 may be checked by measuring voltages at TP1 through TP11 (26, fig. 3-

1). Proceed as follows:

a. Remove the dust cover (para 3--10a).

b. Connect the test setup (para 3-23b).

c. Connect control amplifier A3 to the tester with cable W3.

d. Use oscilloscope to make the measurements listed in f or g below as applicable.

e. If the measurements are abnormal, refer the module to higher category of maintenance.

f. Control amplifier A3 (Part Number 528-0467-000) Voltage Measurements (fig. 6-4).

Test point	Test point color	Function	Normal indications
TP1	Brown	Input voltage to series varicoil A6 servoamplifier.	0.5 volt pulsating dc (during tuning)
TP2	Red	Input voltage to shunt varicoil A6 servoamplifier.	0.5 volt pulsating dc (during tuning)
TIP3	Orange	Series varicoil A5 homing voltage	1.5 volt dc (during homing)
TP4	Yellow	Shunt varieoil A6 homing voltage	1.5 volt de (during homing)
TP5	Green	Series varicoil As servoamplifier output.	28 volts dc (series varicoil A5 quiescent) 50 to 60 volts ac peak to peak (during operation).
TP6	Blue		
TIP7	Violet	Shunt varicoil A6 servoamplifier output.	28 volts dc (series varicoil AS quiescent) 50 59 60 volts ac peak to peak (during operation).
TP8	Gray		
TP9	White	4- to 8-MHz band information	0-1.,5 volt dc ,(when operating between 4 and 8 MHz).

Test point	Test point color	Function	Normal indications
TP10	Black	8-to 16-MHz band information.....	0-1.5 volt dc (when operating between 8 and 16 MHz).
TP11	Brown	16-to 30-MHz band information.....	0-1.5 volt dc (when operating between 16 and 30 MHz).

g. Control amplifier A3 (Part Number 775-4276-001) voltage measurements (fig. 6-3).

Test point	Test point color	Function	Normal indications
TP1	Brown	Input voltage to series varicoil A5 servoamplifier.	0.5 volt pulsating dc (during tuning)
TP2	Red	Input voltage to shunt varicoil A6 servoamplifier.	0.5 volt pulsating dc (during tuning)
TP3	Orange	Series varicoil A5 homing voltage	1.5 volt dc (during homing)
TP4	Yellow	Shunt varicoil A6 homing voltage	1.5 volt dc (during homing)
TP5	White	4-to 8-MHz band information	0-1.5 volts dc (when operating between 4 and 8 MHz).
TP6	Black	8- to 16-MHz band information	0-1.5 volt dc (when operating between 8 and 16 MHz).
TP7	Brown	16- to 30-MHz band information	0-1.5 volt dc (when operating between 16 and 30 MHz).
TP8	Blue	Series varicoil A5 servoamplifier output.	28 volts dc (series varicoil A5 quiescent) 50 to 60 volts ac peak to peak (during operation).
TP9	Green	Shunt varicoil A6 servoamplifier output.	28 volts dc (series varicoil A5 quiescent) 50 to 60 volts ac peak to peak (during operation).
TP10	Violet		

3-8. Troubleshooting Chart

a. General. The chart below lists symptoms which the repairman observes while making a few simple tests. The chart shows how to localize trouble to coupler control A2, discriminator A8, equipment chassis AI wiring, and relay A1K3 or AIK4. If trouble is traced to a module, refer the module to higher category of maintenance. If fault is traced to cabling or wiring, repair or replace the wiring. If trouble is pinpointed to a relay, replace the relay (para 3-20).

b. Troubleshooting Chart.

Item No.	Symptom	Probable trouble	Corrective action
1	Tuning elements not heard running to <i>home</i> when transmitter frequency changed.	a. Defective primary power path..... b. Defective recycle ground path	a. Measure continuity from A1J1-R to A2J5-29. Repair or replace defective wiring. b. Measure continuity from AIJ1-F to A2J4-28. Repair or replace defective wiring. Replace coupler control A2.
2	When KEY button depressed, TUNE indicator does not light.	c. Defective tuning elements	c. If tuning elements do not <i>home</i> , replace defective tuning element(s).
3	TUNE and OPR indicators light 8 to 10 seconds after transmitter frequency changed.	a. Low or no RF power	a. Measure continuity from A1J2 to A8P2. Repair or replace defective cabling. Replace discriminator A8.
4	CU-1669,GRC only. On MCN 651 and below, resistance between J103 and ground is not 10K ohms + 10%.	b. Defective key line	b. Measure continuity from A1J1-K to A2J4-20. Repair or replace defective wiring. Replace coupler control A2.
5	CU-1669/GRC only Resistance between AIJ2 and ANT terminal less than 1 megohm.	Key interlock 1 or 2 interrupted.	Measure continuity from AIJ1-K to A2J4-20. Repair or replace defective wiring. Measure continuity from A1J1-S to A2J4-7. Repair or replace defective wiring. Replace coupler control A2.
		Defective relay AIK34.....	Replace relay AIK4.
		Defective relay AIK3	Replace relay AIK3.

Section III. REMOVAL AND REPLACEMENT

WARNING

Dangerous voltages are in, on, and around the tuning elements. Avoid Contact. These voltages can cause injury or DEATH. Conform to safety requirements of TB SIG 291. Ensure that all power is disconnected.

3-9. General Parts Replacement Techniques

When removing or replacing a part-

- a. Note the old part position.
- b. Tag all leads.
- c. Install the new part in the same position the old part occupied.
- d. Use a pencil-type soldering iron for soldering jobs.
- e. On the new part, use the same length and dress of leads as used on the old part.

NOTE

Those index numbers that have a dash prefix are attaching parts that are listed but not shown in the field of the drawing.

3-10. Dust Cover (fig. 3-1)*a. Removal.*

- (1) Remove 14 screws.
- (2) Lift off the dust cover (15).

b. Replacement.

- (1) Position the dust cover (15) to equipment chassis A1 (43).
- (2) Secure the dust cover (15) with 17 screws.

3-11. Coupler Control A2 (fig. 3-1)*a. Removal*

- (1) Remove the dust cover (para 3-10a).
- (2) Loosen the four redheaded screws (part of 126, 27).
- (3) Pull out the module (27).

b. Replacement.

- (1) Plug the module (27) to the equipment chassis A1 (43).
- (2) Secure the module (27) in place by tightening the four redheaded screws (part of 26, 27).
- (3) Replace the dust cover (para 3-10b).

3-12. Control Amplifier A3 (fig. 3-1)*a. Removal*

- (1) Remove the dust cover (para 3-10a).
- (2) Loosen the four redheaded screws (part of 26).

- (3) Pull out the module (26).

b. Replacement.

- (1) Plug the module (26) to equipment chassis A1 (43).
- (2) Secure the module (26) in place by tightening the four redheaded screws.
- (3) Replace the dust cover (para 3-10b).

3-13. Step Coil A4 (Part Number 528-0524-000) (fig. 3-1)*a. Removal*

- (1) Remove the dust cover (para 3-10a).
- (2) Use a No. 4 Bristol wrench. Loosen two setscrews (-36) to remove the tuning capacitor tinned wire (35) from capacitor A7C1 (10, fig. 3-2). Lift the capacitor tinned wire (35) from capacitor A7C1.

(3) Detach the electrical strip (39, fig. 3-3) and attaching parts for the electrical contact (45, fig. 3-4) from the top plate (31, fig. 3-4 or 37, fig. 3-5A) of the series varicoil (30).

(4) Loosen the connector lock on connector A4PI (9A, fig. 3-3) by pushing the connector lock sideways with a screwdriver. Unplug connector A4P1 from connector A1J8 (84, fig. 3-5).

(5) Insert a long Phillips screwdriver through each of the four holes in the corners of the wraparound (6, fig. 3-3). Loosen the four captive screws (2, fig. 3-3) that hold step coil A4 (34, fig. 3-1) to equipment chassis A1 (43, fig. 3-1).

Carefully lift the step coil A4 (34) out of the equipment chassis A1.

*b. Replacement.***NOTE**

If shunt varicoil A6 (31, fig. 3-1) and/or series varicoil A5 (30, fig. 3-1) have been removed, do not replace step coil A4 until after shunt varicoil A6 and/or series varicoil A5 have been replaced.

(1) Position step coil A4 (34, fig. 3-1) to the equipment chassis A1. Plug connector A4PI (9A, fig. 3-3) into connector A1J8 (84, fig. 3-5). Slide the connector lock on A4P1 (9A, fig. 3-3) sideways. Check the locking action by trying to unplug A4P1.

(2) If shunt capacitor A7 (41, fig. 3-1) is mounted on equipment chassis A1 (43, fig. 3-1). secure the electrical strap (63, fig. 3-3) to capacitor A7C1 (10, fig. 3-2) with the capacitor tinned wire. Tighten the two setscrews (-36) to capacitor A7C1 (10, fig. 3-2) with a No. 4 Bristol wrench.

(3) Fasten step coil A4 (34, fig. 3-1) on top plate (31, fig. 3-4) of series varicoil A5 (30, fig. 3-1) with the electrical strip (39, fig. 3-3) and attaching parts for the electrical contact (45, fig. 3-4).

(4) Mount step coil A4 to equipment chassis Al by inserting a long Phillips screwdriver through the four holes in the corners of the wraparound (1A, and 6, fig. 3-3) Tighten the four captive screws.

(5) Replace the dust cover (para 3-10b).

3-13.1. Step Coil A4 (Part No. 777-3508-001 (fig. 3-3.1)

a. Removal.

(1) Remove the dust cover (para 3-10a).

(2) Remove lead (24) from capacitor assembly A7 (41, fig. 3-1) by removing screw (-3) and lock-washer.

(3) Remove bus wire from top of series varicoil A5 by removing screw and attaching hardware.

(4) Loosen retainer lock (17) by pushing it sideways with a screwdriver. Unplug connector (16) from equipment chassis Al.

(5) Loosen four captive screws (-6) in the corners of the step coil wraparound. Carefully lift the step coil from the equipment chassis Al.

b. Replacement.

NOTE

If shunt varicoil A6 (31, fig. 3-1) and/or series varicoil A5 (30, fig. 3-1) have been removed, do not replace step coil A4 until after shunt varicoil A6 and/or series varicoil A5 have been replaced.

(1) Position step coil A4 (34, fig. 3-1) in the equipment chassis, Al, and plug connector (16) into chassis. Slide connector lock sideways, and check locking action by attempting to unplug connector.

(2) If the shunt capacitor A7 is mounted on the chassis, secure lead (24) to capacitor wire terminal with screw (-3).

(3) Attach bus wire to the top of series varicoil A5 with attaching hardware.

(4) Tighten four captive screws (6) in corners of wraparound (5).

3-14. Series Varicoil A5 (fig. 3-1)

a. Removal

(1) Remove the dust cover (para 3-10a).

(2) Remove step coil A4 (para 3-13a or 3-13.1a).

(3) Use a No. 4 Bristol wrench. Loosen the setscrew in terminal connector (part of 69, fig. 3-4) that holds the wire to series varicoil A5 (30, fig. 3-1).

(4) Loosen four screws (75, fig. 3-4) that hold series varicoil A5 (30, fig. 3-1) to equipment chassis Al

(43, fig. 3-1). Lift series varicoil A5 from chassis Al.

(5) Loosen the connector lock on connector A5P1 (27, fig. 3-4) by pushing the connector lock sideways with a screwdriver. Unplug connector A5P1 from connector AlJ9 (82, fig. 3-5).

b. Replacement.

(1) Plug connector A5P1 (27, fig. 3-4) into connector AlJ9 (82, fig. 3-5). Slide the connector lock on A5P1 (27, fig. 3-4) sideways. Check the locking action by trying to unplug A5P1.

(2) Mount series varicoil A5 (30, fig. 3-1) to equipment chassis Al (43, fig. 3-1) by inserting coil end of series varicoil A5 (30, fig. 3-1) into terminal connector (part of 69, fig. 3-4). Tighten four screws (75, fig. 3-4).

(3) Fasten terminal connector (part of 69, fig. 3-4) from relay A1K1 on equipment chassis Al (43, fig. 3-1) to bottom of series varicoil A5 (30, fig. 3-1). Tighten the setscrew with the No. 4 Bristol wrench.

(4) Replace step coil A4 (para 3-13b 3-13.1b).

(5) Replace the dust cover (para 3-10b).

3-15. Shunt Varicoil A6 (fig. 3-1)

a. Removal.

(1) Remove the dust cover (para 3-10a).

(2) Remove step coil A4 (para 3-13a or 3-13.1a).

(3) Use a No. 4 Bristol wrench. Loosen the setscrew in the terminal connector (part of 69, fig. 3-4) that secures the wire to shunt varicoil A6 (31, fig. 3-1).

(4) Loosen the four screws (75, fig. 3-4) that secure shunt varicoil A6 (31, fig. 3-1) to equipment chassis Al (43, fig. 3-1). Lift shunt varicoil A6 from chassis Al.

(5) Loosen the connector lock on connector A6P1 (27, fig. 3-4) by pushing connector lock sideways with a screwdriver. Unplug connector A6P1 from connector A1J10 (145, fig. 3-4).

b. Replacement.

(1) Plug connector A6P1 (27, fig. 3-4) into connector A1J10 (145, fig. 3-5). Slide the connector lock on A6P1 (27, fig. 3-4) sideways., Check the locking action by trying to unplug A6P1.

(2) Mount shunt varicoil A6 (31, fig. 3-1) to equipment chassis Al (43, fig. 3-1) by inserting coil end of shunt varicoil A6 into terminal connector (part of 69, fig. 3-4). Tighten the four screws (75, fig. T 3-4).

(3) Fasten terminal connector (part of 69, fig. 3-4) from relay A1K1 (140, fig. 3-5) on equipment chassis A1(43, fig. 3-1), to bottom of shunt varicoil A6 (31, fig. 3-1). Tighten setscrew with a No. 41

Bristol wrench. Terminal connector must not touch the shield of the shunt varicoil.

(4) Replace step coil A4 (para 3-13b or -13.1b).

(5) Replace the dust cover (para 3-10b).

3-16. Shunt Capacitor A7 (fig. 3-1)

CAUTION

Do not disturb A7S1 and A7S2 switch settings. Switch settings are critical. Adjustment is authorized only at higher category of maintenance.

a. Removal

(1) Remove the dust cover (para 3-10a).

(2) Loosen the two setscrews (-36, fig. 3-1) and remove the tinned wire from capacitor A7-C1 (10, fig. 3-2 or 37, fig. 3-5.1).

(3) If step coil A4 (34, fig. 3-1) is mounted on equipment chassis AI (43, fig. 3-1), loosen two setscrews (-36, fig. 3-1) or two Phillips-head screws with a No. 4 Bristol wrench. Remove the electrical -strap (63, fig. 3-3 or 1A, figure 3-3.1).

(4) Loosen the connector lock on connector A7PI (54, fig. 3-2) by pushing the connector lock sideways with a screwdriver. Unplug connector A7P1 (54, fig. 3-2) from connector A1J7 (75, fig. 3-5).

(5) Insert a long Phillips screwdriver through holes in top of equipment chassis AI (43, fig. 3-1). Remove four screws (-42, fig. 3-1). Lift shunt capacitor A7 (41, fig. 3-1) and slide shunt capacitor A7 (41, fig. 3-1) out from bottom of equipment chassis AI (43, fig. 3-1).

b. Replacement.

(1) Slide shunt capacitor A7 (41, fig. 3-1) into position on equipment chassis AI (43, fig. 3-1). Secure shunt capacitor A7 (41, fig. 3-1) with four screws (-42, fig. 3-1). Use a long Phillips screwdriver.

CAUTION

Do not perform step (2) below unless step coil A4 (34, fig. 3-1) is already mounted on equipment chassis AI (43, fig. 3-1). Refer to paragraph 3-13b. or 3-13.1b).

(2) If step coil A4 (34, fig. 3-1) is mounted on equipment chassis AI (43, fig. 3-1), secure the electrical strap (63, fig. 3-3) to capacitor A7C1 (10, fig. 3-2) with capacitor tinned wire. Tighten two setscrews (-36, fig. 3-1) to capacitor A7C1 (10, fig. 3-2) with a No. 4 Bristol wrench.

(3) Plug connector A7PI (54, fig. 3-2) into connector AIJ7 (75, fig. 3-5). Slide the connector lock on A7P1 (54, fig. 3-2) sideways. Check the locking action by trying to unplug connector A7P 1.

(4) Replace the dust cover (para 3-10b).

3-17. Discriminator A8 (fig. 3-1)

a. Removal.

(1) Remove the dust cover (para 3-10a).

(2) Remove the four screws (-29) that secure module (28) to equipment chassis AI (43).

(3) Unplug the module (28) from equipment chassis AI (43).

b. Replacement.

(1) Plug the module (28) into equipment chassis AI (43).

(2) Secure the module (28) in place with four screws (-29).

(3) Replace the dust cover (para 3-10b).

3-18. Series Capacitor A9 (fig. 3-1)

a. Removal.

(1) Remove the dust cover (para 3-10a).

(2) Remove capacitor wire terminal (35) by loosening two setscrews (-36) and lifting wire terminal (35) from capacitor CI (10, fig. 3-2 or 37, fig. 3-5A).

(3) Remove screw (-35, fig. 3-5) and two screws (-48, fig. 3-5), four flat washers (-46, fig. 3-5), four lockwashers (-47, fig. 3-5) and four nuts (-45, fig. 3-5) securing insulator plate (43, fig. 3-5) to chassis.

(4) Do the procedures in paragraph 3-19 to remove capacitor assembly A10 from equipment chassis AI (43).

(5) Loosen connector lock by pushing it sideways with a screwdriver. Unplug connector P1 (43, fig. 3-6) from connector A1J4 (73, fig. 3-5).

(6) Remove four mounting screws (-40, fig. 3-1) with a long Phillips screwdriver inserted through holes in the top of chassis. Lift up rotary switch (39) and slide it out of the equipment chassis AI (43).

b. Replacement.

(1) Slide rotary switch (39) into the equipment chassis AI (43) and lower it into position. Secure rotary switch (39) with four screws (-40).

(2) Plug series capacitor connector P1 (43, fig. 3-6) into equipment chassis connector AIJ14 (73, fig. 3-5). Lock the connector by pushing the connector lock sideways with a screwdriver. Check locking action by attempting to unplug connector A9P1 (43, fig. 3-6).

(3) Secure insulator plate (43, fig. 3-5) to equipment chassis AI with two screws (-48, fig. 3-5), two flat washers (-46, fig. 3-5), two lock-washers (-47, fig. 3-5) and two nuts (-45, fig. 3-5).

(4) Secure insulator to top of equipment chassis

AI with screws.

(5) Secure capacitor wire terminal (35) to capacitor C1 (10, fig. 3-2) with two setscrews (-36).

(6) Replace the dust cover (para 3-10b).

3-19. Capacitor Assembly A10 (fig. 3-1)

a. Removal

(1) Remove dust cover (para 3-10a).

(2) Remove step coil A4 (para 3-13a or 3-13.1a).

(3) On the front panel of equipment chassis AI (43, fig. 3-1) remove the four screws (-22) and the two nonmetallic washers that hold washer (21, fig.3-1).

(4) On front panel, remove two flathead screws (-38) and two nonmetallic washers (-31, fig. 3-7), from ceramic posts (28 and 32, fig. 3-7). Remove capacitor assembly A10 (37, fig. 3-1) from front panel of equipment chassis AI (43).

b. Replacement.

(1) Mount capacitor assembly A10 (37) to equipment chassis AI (43) front panel with two flathead screws (-38) and two nonmetallic washers (-31, fig. 3-7). Apply small amount of Dow Silastic 140 (FSN 8040-962-0695) or equivalent to screw threads.

(2) Screw binding post (19, fig. 3-1) into terminal collect (18). Secure with setscrew (-20).

CAUTION

Bias wire from binding post (19) to relay A1K3 (30, fig. 3-5) must be within 1/8 inch from capacitor assembly A10 (CU-1669/GRC only).

(3) Mount washer (21, fig. 3-1) to equipment chassis AI front panel with the four screws (-22), two nonmetallic washers (-34, fig. 3-7) and insulator (23).

NOTE

Place the nonmetallic washers (34, fig. 3-7) between the two capacitor assembly ceramic posts (28 and 32, fig. 3-7) and equipment chassis AI front panel. Apply Dow Silastic 140 (FSN 8040-962-0695) or equivalent to screw threads.

(4) Refer to figure 3-7 in the following procedures. Secure terminal lug (35) (on wire from transmit-receive relay) to capacitor retainer (39) with screw (-38), nut (-36) and lockwasher (-37).

(5) Secure capacitor C35 (5) to capacitor retainer (39) with screw (-9), flat washer (-10A) and lockwasher (-11).

(6) Secure link number 2 (1A) to four capacitors C34, C33, C35, and C24 (3, 4, 5, 6) with four screws (-10), lockwashers (-11) and terminal lug (2) on capacitor C24 (6).

(7) Secure link number 1 (13) and terminal lug

(14) to capacitor C27 (15) with screw (-19) and lockwasher (-20).

(8) Remove capacitor C29 (23). Secure terminal lug (35) to capacitor retainer (39) with screw (-38), lockwasher (37), and nut (-36). Replace capacitor C29 (23).

(9) Secure terminal lug (24) to capacitor C29 (23) with screw (-25) and lockwasher (-27).

(10) Replace the dust cover (para 3-10b).

3-20. Equipment Chassis AI (fig. 3-5)

a. Disassembly.

(1) Remove the dust cover (para 3-10a).

(2) Remove coupler control A2 (para 3-1 la).

(3) Remove control amplifier A3 (para 3-12a).

(4) Remove step coil A4 (para 3-13a or 3-13.

1a).

(5) Remove series varicoil A5 (para 3-14a).

(6) Remove shunt varicoil A6 (para 3-15a).

(7) Remove shunt capacitor A7 (para 3-16a).

(8) Remove discriminator A8 (para 3-17a).

(9) Remove series capacitor A9 (para 3-18a).

(10) Remove capacitor assembly A10 (para 3-

19a).

(11) Remove 2 angle brackets (1B) from front of chassis by removing 4 each nuts (-2), lockwashers (-3), and screws (-4).

(12) Refer to figure 3-5. Unscrew indicator lenses (5 and 8) counterclockwise. Remove lamps A1DS1 and A1DS2 (6 and 9) from lampholders A1XDS1 and A1XDS2 (7 and 10).

(13) Unsolder and tag components and/or wires. Remove the lampholders from the front of the chassis. Remove the nuts, terminal lugs, non-metallic washers, and shoulder washers (all part of lampholders 7 and 10).

(14) Remove connector A1J2 (11) from chassis by removing the nut and lockwasher (both part of 11).

(15) Remove connector AIJ1 (12) by removing four screws (-13).

(16) CU-1669/GRC only. Remove connector A1J3 (14) by unsoldering the lead. Remove nut and lockwasher (both part of 14).

(17) CU-1669/GRC only. Remove relay A1-K3 (30) by removing the hex nut and lockwasher (both part of 30).

CAUTION

Remove the connector (part of 30) from relay A1K3 (30) before soldering. Heat of the soldering may break the glass envelope.

(18) Remove the handle (15) by holding two pins (-18) with nonmetallic pliers and removing two nuts (-16) and four washers (-17).

(19) CU-1669/GRC only. Remove receiver grounding relay A1-K4(25) from the chassis by removing two screws (-27), lockwashers (-28), and terminal lug (26).

(20) Remove capacitors A1C31 and A1C32 (33, 4) from the chassis as follows:

(a) Remove the screw (-35), flat washer -37), and two spring washers (-38) from the insulator plate (43) and screw (-36) from the top of the chassis.

(b) Remove the angle bracket and the insulator assembly (44 and 43 and attaching hardware) from chassis by removing two screws (-48) four flat washers (-46), and four lockwashers (-47) from the chassis.

(c) Position terminal lug (-41) to side and, while holding capacitor A1C31 (33), unscrew capacitor A1C32 (34) from stud (-42).

(d) Remove capacitor A1C31 (33) from stud -42) and terminal lug (-40).

(21) Remove chassis mounting plate (69) from the chassis by removing eight screws (-70).

(22) Remove connectors A1J4, A1J5 and A1J6 50, 54, 58) from chassis mounting plate (69) by removing two each nuts (-51, -55, and -59), spacers (-52, -56, and -60), and screws (-53, -57, and -61).

(23) Remove connector A1J9 (82) and A1J8 (84) by removing two each connector lock screws, nuts, flat washers and lockwashers (all part of sliding lock assembly 83 and 85).

(24) Remove connector A1J14 (73) and A1J7 (75) by removing two each connector lock screws, nuts, flat washers and lockwashers (all part of sliding lock assembly 74, 76).

(25) Remove of coil A1L1 (62) from chassis by removing screw (-63).

(26) Remove power transformer A1T1 (64) from chassis by removing four screws (-65) and four flat washers (-65A).

(27) If coil A1L2 (89) and band relay A1K2 (92) are mounted on a bracket, do the following before proceeding to step (28). Unsolder strap from connector A1J13 (102) and lead from top of relay. Remove four screws securing bracket to chassis. Pull bracket out of chassis.

(28) Remove coil A1L2 (89) from chassis by removing screw (-90).

(29) Remove band relay A1K2 (92) that connects to the series and shunt varicoils (30, 31, fig.3-1) by removing one 3/8 hex nut (part of 92); one 3/8 hex nut and flat washer if mounted on bracket.

(30) Remove discriminator power connector

A1J111 (97, fig. 3-5) by removing two nuts (-98) and screws (-99).

(31) Remove discriminator if input connector A1J12 (100) by removing nut (part of 100) and washer (-101).

(32) Remove discriminator of output connector A1J13 (102) by removing four screws (-103) and spring washers (-104).

(33) Remove filter mounting plate (134) from chassis by removing 11 screws (-135B). Remove parts (114 to 133) as necessary.

(34) Remove shunt varicoil connector A1J10 (145) by removing two connector locks, nuts, and lockwashers (all part of 146).

b. Reassembly.

(1) Mount connector A1J10 (145) to the chassis with the two sliding lock assemblies (146), nuts, and lockwashers (all part of 146).

(2) Mount parts (114 through 133) to the filter mounting plate (134) as necessary.

(3) Mount the plate (134) to the chassis with 11 screws (-135B).

(4) Mount connector A1J13 (102) to the chassis with four screws (-103) and lockwashers (-104).

(5) Mount connector A1J12 (100) with washer (-101) and nut (part of 100).

(6) Mount connector A1J11 (97) with two nuts (-98) and screws (-99).

NOTE

If band relay K2 (92) and coil L2 (89) are mounted to bracket, perform steps (7), (8), (9), and (10) and proceed to step (13). If band relay K2 (92) and coil L2 (89) are mounted directly to chassis, proceed with step (11).

(7) Mount band relay A1K2 (92) to bracket with a 3/8-inch hex nut and flat washer.

(8) Mount coil A1L2 (89) to bracket with screw (-90).

(9) Position bracket assembly in chassis and secure with four screws.

(10) Solder strap to connector A1J13 (102) and lead from relay A1K1 (140) to terminal on relay A1K2 (92).

(11) Mount band relay A1K2 (92) which connects to the if series and shunt coils (30, 31, fig. 3-1) with a 3/8-inch hex nut (part of 92).

(12) Mount coil A1L2 (89, fig. 3-5) to chassis with screw (-90).

(13) Mount connector A1J9 (82) and connector A1J8 (84) with the sliding lock assemblies (83 and 95), screws, flat washers, and lock-washers (all part of 83 and 85).

(14) Mount connector AIJ14 (73) and connector A1J7 (75) with sliding lock assemblies (74 and 76) screws, flat washers, and lockwashers and nuts (all part of 74 and 76).

(15) Mount connectors AIJ4 (50), A1J5 (54) and A1J6 (58) to the plate (69) with two each screws (-53, -57, and -61), spacers (-52, -56, and -60), and nuts (-51, -55, and -59).

(16) Mount chassis mounting plate (69) to the chassis with eight screws (70).

(17) Mount transformer A1T1 (64) to the chassis with four screws (-65).

(18) Mount coil A1L1 (62) to the chassis with screw (-63).

(19) Mount the ceramic post (-34A) to the chassis with washer (-39) and screw (-36).

(20) Mount the terminal lug (-40) and capacitor A1C31 (33) to the ceramic post (-34A) with the stud (-42).

(21) Mount capacitor A1C32 (34) and the terminal lug (-41) to capacitor A1C31 (33) with the stud (-42) and washer (-38).

(22) Mount the bracket (44) to the insulator plate (43) with two screws (-49), flat washers (-46), and lockwashers (-47).

(23) Mount the bracket-insulator plate assembly ((18) above) to the chassis with two screws (-48), flat washers (-46), and lockwashers (-47). Do not tighten the screws (-48).

(24) Mount the insulator plate (43) to capacitor A1C32 (34) with screw (-35), flat washer (-37), lockwasher (-38), and terminal lug (-41).

(25) CU-1669/GRC only. Mount relay A1K4 (25) to the chassis with two screws (-27), lockwashers (-28), flat washers and terminal lug (26).

(26) CU-1669/GRC only. Mount relay A1K3 (30) to the chassis with the lockwasher and hex nut. The hex nut and lockwasher are part of relay K3 (30).

CAUTION

Remove the connector (part of 30) from relay A1K3 before soldering. Heat of the soldering may break the glass envelope.

(27) Mount the handle (15) to the chassis with four plastic washers (-17), two pins (-18), and two nuts (-16). The plastic washers (-17) go between the handle (15) and the chassis, and between the two pins (-18) and the handle (15).

(28) CU-16691GRC only. Mount connector A1J3 (14) to the front panel of the chassis with lockwasher and nut (both part of 14).

(29) Mount connector A1J2 (12) to the chassis with four screws (-13).

(30) Mount connector A1J2 (11) with lockwasher and nut (both part of 11).

(31) Mount lampholders AXDS1 and AXDS2 (7 and 10) to the front of the chassis as follows:

NOTE

Parts not otherwise keyed in this step are part of lampholders (7 and 10).

(a) Assemble the shoulder washer to the lampholder.

(b) Insert the lampholder through its hole in the chassis.

(c) Assemble the nonmetallic washer, nut, terminal lug, lockwasher, and nut to the lampholder.

(32) Insert lamps A1DS1 and A1DS2 (6 and 9) into the lampholders (7 and 10) and secure with indicator lenses (5 and 8).

(33) Mount the two brackets (1B) to the chassis with the screws (-4), lockwashers (-3), and nuts (-2) four each.

(34) Replace capacitor assembly AIO (para 3-19b).

(35) Replace series capacitor A9 (para 3-18b).

(36) Replace discriminator A8 (para 3-17b).

(37) Replace shunt capacitor A7 (para 3-16b).

(38) Replace shunt varicoil A6 (para 3-15b).

(39) Replace series varicoil A5 (para 3-14b).

(40) Replace step coil A4 (para 3-13b or 3-13.1b).

(41) Replace control amplifier A3 (para 3-12b).

(42) Replace coupler control A2 (para 3-11b).

(43) Replace the dust cover (para 3-10b).

Legend for figure 3-1:

Note: Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

-1	Wire support	14	Adapter	24	Identification plate *	32	Clamp
2	Cable support	14A	Decal	24A	Plate	-33	Screw
-3	Screw (3)	15	Dust cover	-25	Screw	34	Step coil A4
4	Cable support	-16	Screw (17)	26	Control amplifier A3	35	Terminal
-5	Screw	116A	Plate	27	Coupler control A2	-36	Setscrew (2)
-6	Washer	17	Identification strip	28	Discriminator A8	37	Capacitor assembly A10
-7	Washer	17A	Insulator	-29	Screw (4)	-38	Screw (2)
8	Support plate	18	Terminal collet	30	Series varicoil A5	39	Series Capacitor A9
-9	Screw (2)	19	Binding post	31	Shunt varicoil A6	-40	Screw (4)
-10	Sleeve	-20	Setscrew	31A	Connector	41	Shunt capacitor A7
11	Support plate	21	Washer	31B	Shield	-42	Screw (4)
12	Nut (2)	-22	Screw (4)	-31C	Retainer	43	Equipment chassis AI
13	Cover and chain assy	23	Insulator				

Change 2 3-12

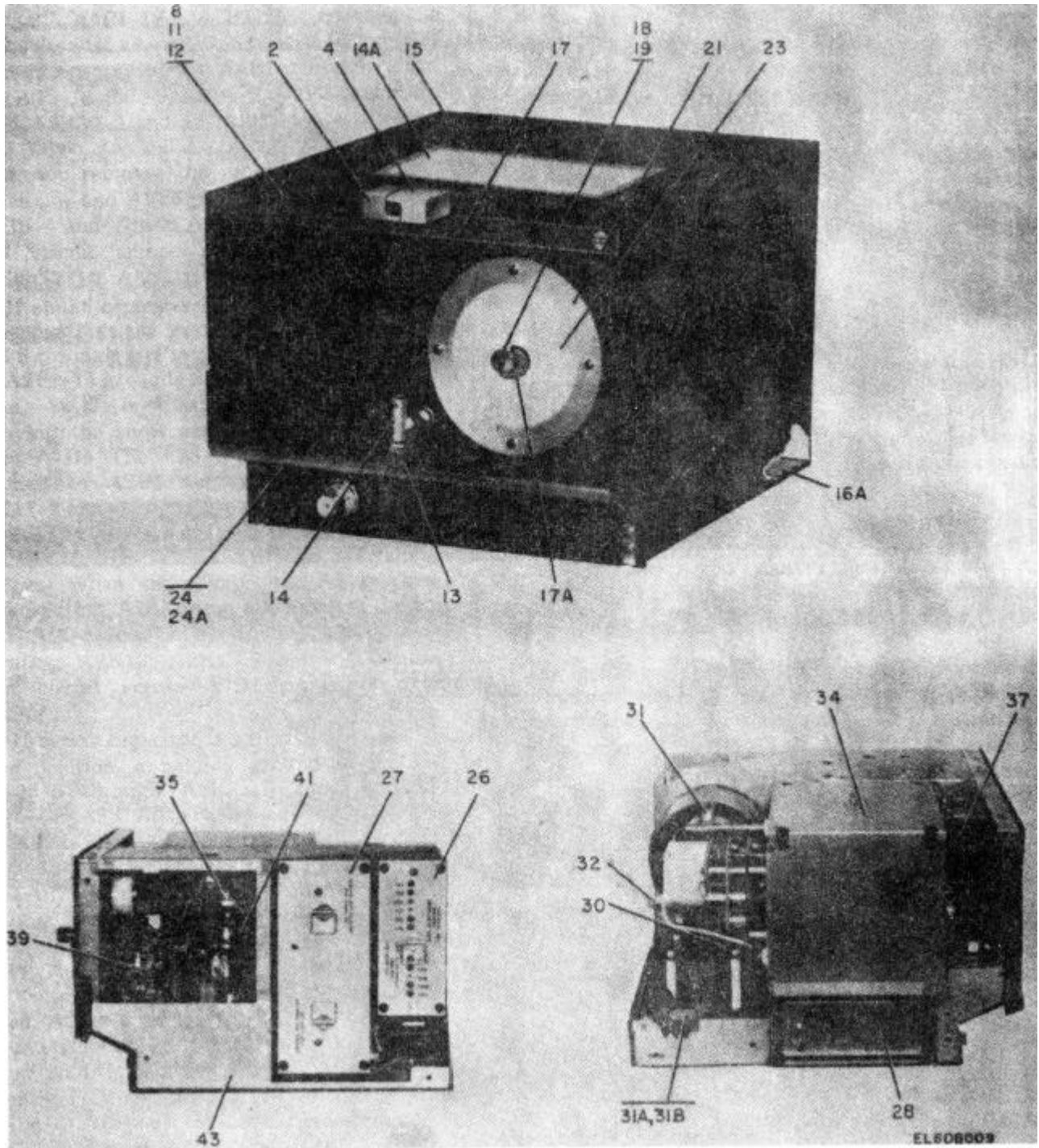


Figure 3-1. Couplers, antenna CU-1658/A and CU-1669/GRC, Parts Location.

Change 2 3-13

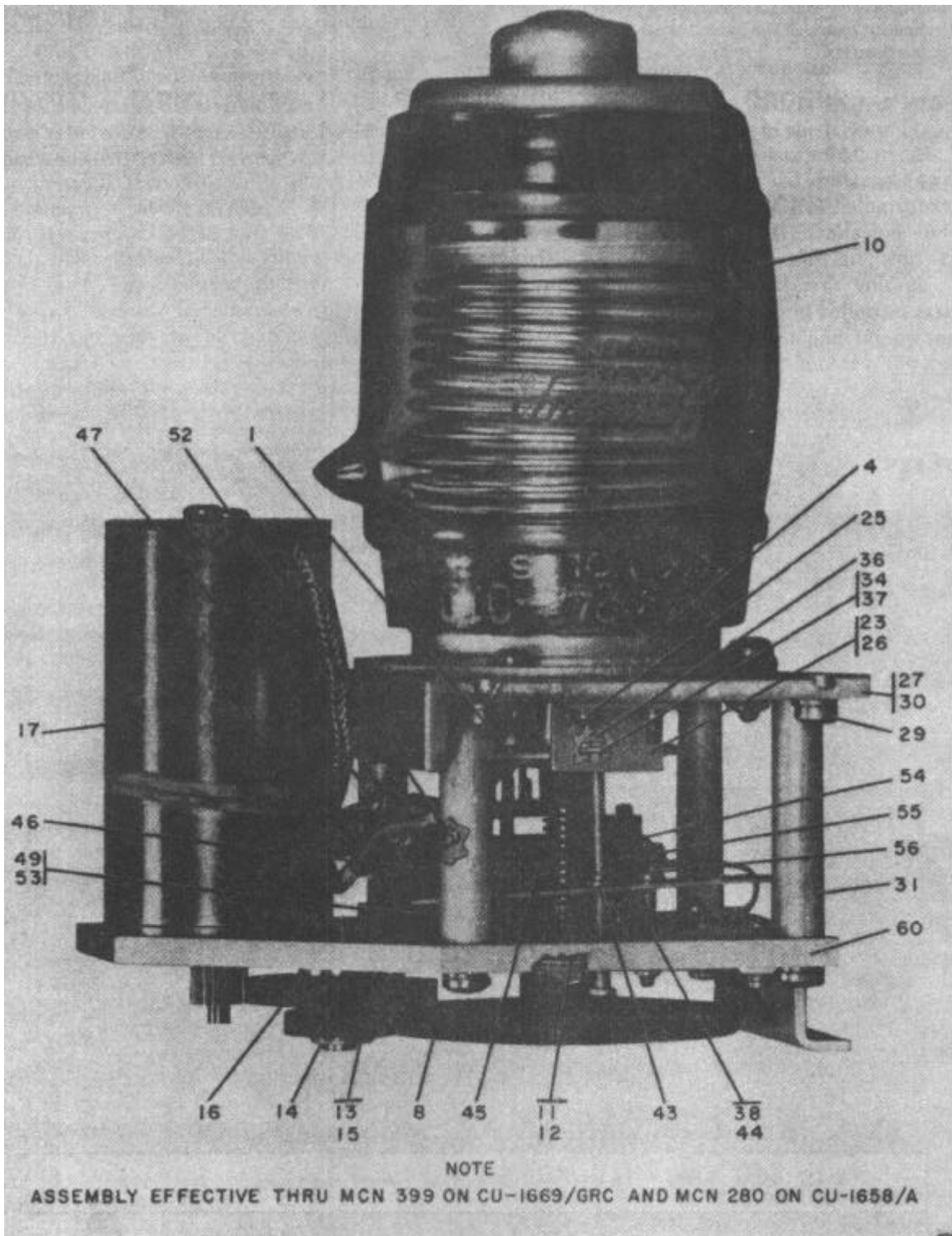


Figure 3-2(1). Shunt Capacitor A 7, (Part Number 528-0466-000), Parts Location (Part 1 of 2).

Change 2 3-14

Legend for figures 3-2(1) and 3-2(2):

Note: Those index numbers that have a dash prefix are attaching parts that are listed but no shown.

1	Flat washer	15	Cluster gear	-26J	Screw (2)	-42	Washer
1A	Capacitor retainer	16	Bearing	-26K	Screw	43	Nut
1B	Switch actuator adapter	17	Motor A7B1	27	Capacitor plate	44	Actuator
-2	Screw (3)	-18	Screw (2)	-28	Screw(4)	45	Nut
-3	Washer (3)	-19	Deleted	-28A	Lockwasher (4)	46	Switch A7S2
4	Spur gear	-20	Deleted	29	Nut (4)	47	Switch A7S1
-5	Nut (3)	21	Retaining washer	30	Plate	-48	Screw (4A)
-6	Lockwasher (3)	-22	Screws (4)	30A	Retaining plate	49	Bracket
-7	Screw (3)	23	Bracket	31	Shouldered post (4)	-50	Screw (2)
8	Spur gear No. 2	24	Screw (2)	-32	Screw (4)	-51	Washer (2)
-9	Roll pin	25	Nut 120)	-33	Sleeve spacer (4)	52	Nut (4)
10	Capacitor A7C1	26	Bracket	34	Washer	53	Bracket
10A	Diode A7CR1	26A	Adapater (2)	35	Screw	54	Connector A7P
10B	Diode A7CR2	26B	Switch A7S1	36	Nut	55	Sliding lock assy (2)
10C	Terminal t4)	26C	Switch A7S2	37	Washer	56	Bracket
-10	Screw (4)	-26D	Nut (4)	38	Actuator	-57	Screw(2)
11	Shim	-26E	Screw (4)	-39	Screw	-58	Terminal
12	Bearing	26F	Electrical switch bracket	40	Screw (4)	-59	Washer (2)
13	Cluster gear	-26G	Nut (2)				
14	Retaining ring	-26H	Washer				

Change 2 3-15

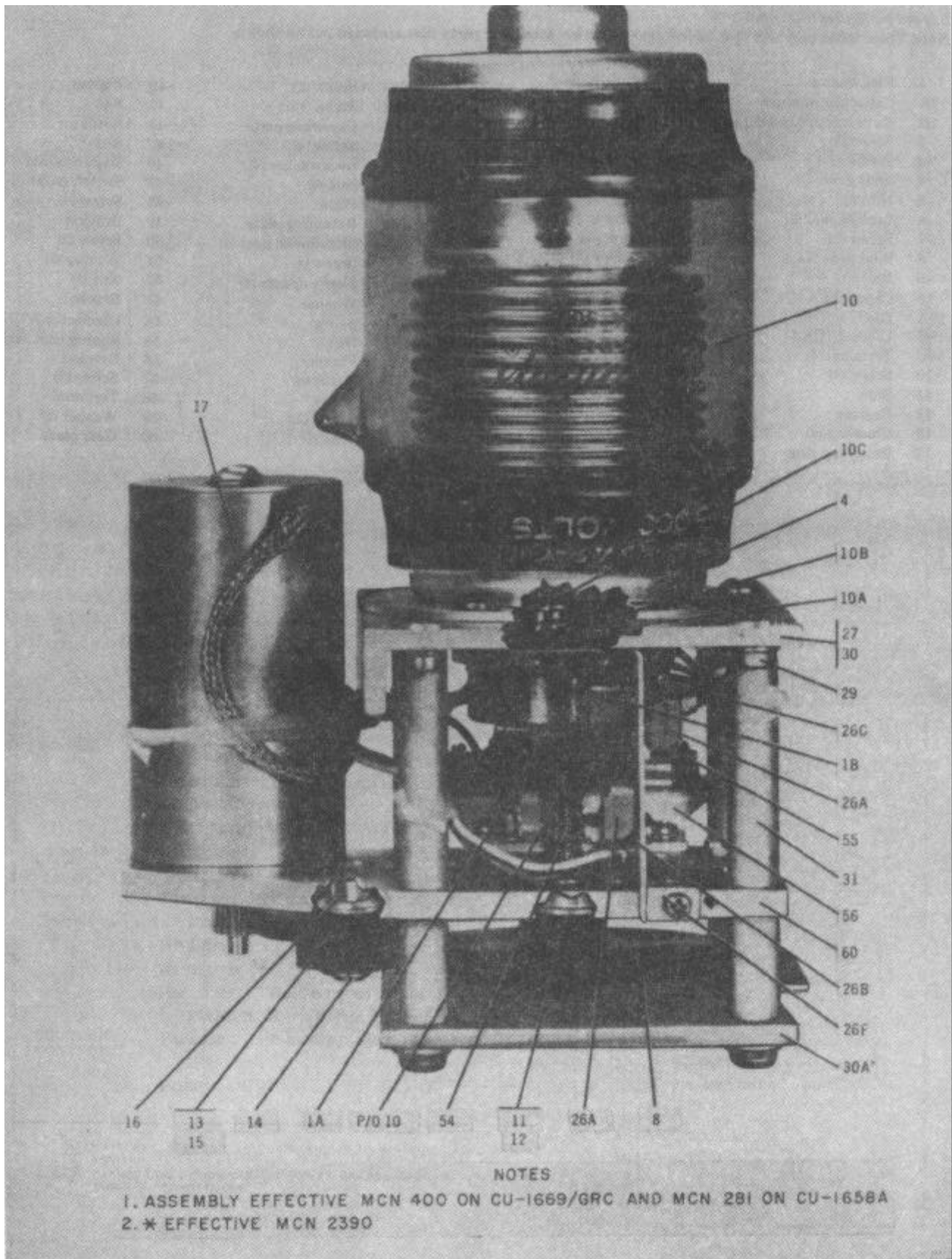


Figure 3-2(2). Shunt Capacitor A 7, (Part Number 528 0466-000), Parts Location (Part 2 of 2).

Legend for figure 3-2.1:

Note: Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

1A	Bracket	-12	Screw (2)	-26	Shim	-39	Lockwasher (3)
-2	Screw (2)	-13	Plastic washer (2)	-27	Retaining ring (2)	-40	Screw (3)
-3	Lockwasher (2)	14	Spur gear	28	Helical gear	40A	Shaft 4
4	Connector A7P1	-15	Flat washer	29	Shaft	-40B	Nut, gimbal
-5	Sliding lock assy (2)	-16	Shim	30	Sleeve bearing	-40C	Insert, thread screw
6	Bracket	18	Spur gear	31	Sleeve bearing	-40D	Insert, gimbel
-7	Screw (2)	-19	Pin	32	Plate	41	Terminal
-8	Lockwasher (2)	20	Worm shaft	-33	Screw (2)	-42	Screw 9
9	Gear	21	Ball bearing	-34	Lockwasher (2)	-43	Lockwasher
-10	Retaining ring	22	Ball bearing	35	Ball bearing	44	Gear housing
10A	Diode A7CR1	23	Motor A7B1	-36	Retaining ring	45	Self-locking nut (4)
10B	Capacitor A7C2	-24	Screw (2)	37	Capacitor A7C1	46	Eyelet
11	Switch A7S1	25	Shaft	-38	Nut (3)	47	Gear housing
11A	Switch A7S2						

Change 2 3-17

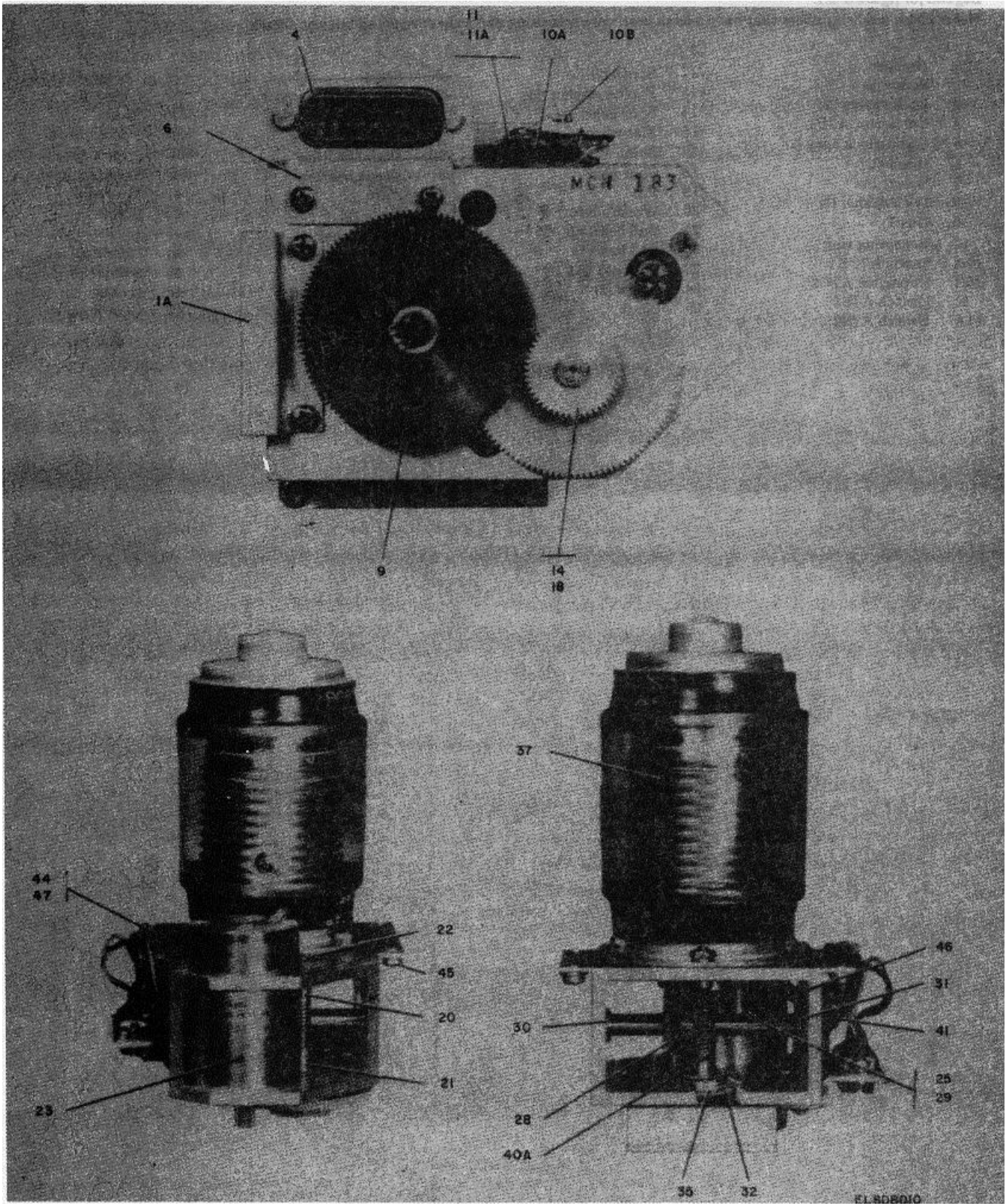


Figure 3-2.1. Shunt capacitor A7, (Part Number 777-4.500—001), Parts Location.

Legend for figure 3-3:

Note. Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

1	Wraparound	19	Bearing plate	39	Electrical strip	59	Front drum end
-2	Captive screw (4)	-20	Screw (2)	40	Actuator	-60	Screw (3)
-3	Screw (15)	-21	Terminal lug	-41	Screw (2)	61	Rotor coil drum
-4	Spring sleeve (4)	-22	Lockwasher	-42	Lockwasher (2)	-62	Deleted
5	Bushing (4)	-23	Retaining ring	43	Gear plate	63	Electrical strap
6	Wraparound	24	Plate	-44	Screw (3)	64	Actuator
7	Tuning drive assy	25	Switch spur gearshaft	45	Locating pin (3)	65	Screw (2)
-8	Screw (4)	-26	Ring	46	Pin (4)	-66	Lockwasher (2)
-9	Washer (4)	27	Gear	47	Shaft	67	Rear coil plate
9A	Connector A4P1	-28	Pin	48	Plate	-68	Screw (3)
9B	Shield	29	Shaft	49	Drum assy	-69	Locating pin (3)
9C	Retainer	30	Switch mounting base	-50	Shim washer	70	Coil plate
10	Switch cover	31	Gearbox mounting plate	-51	Shim washer	71	Jigging bar
-11	Screw (3)	-32	Flathead screw (2)	-52	Shim washer	72	Jigging bar
-12	Lockwasher (3)	33	Idler spur gear	-53	Alignment pointer	73	Jigging bar
13	Rubber grommet	-34	Retaining ring	54	Rear drum end	74	Coil A4L1
14	Rotary switch section A4S1B	35	Drum spur gear	-55	Screw (3)	75	Contact (2)
15	Rotary switch section A4S1A	-36	Retaining ring (2)	56	Drum drive	76	Contact (12)
-16	Short spacer (2)	37	Gear box mounting spacer	-57	Screw (4)	-77	Pin (28)
-17	Long spacer (2)	-38	Screw	-58	Lockwasher (4)	78	Coil
-18	Screw (2)						

Change 2 3-19

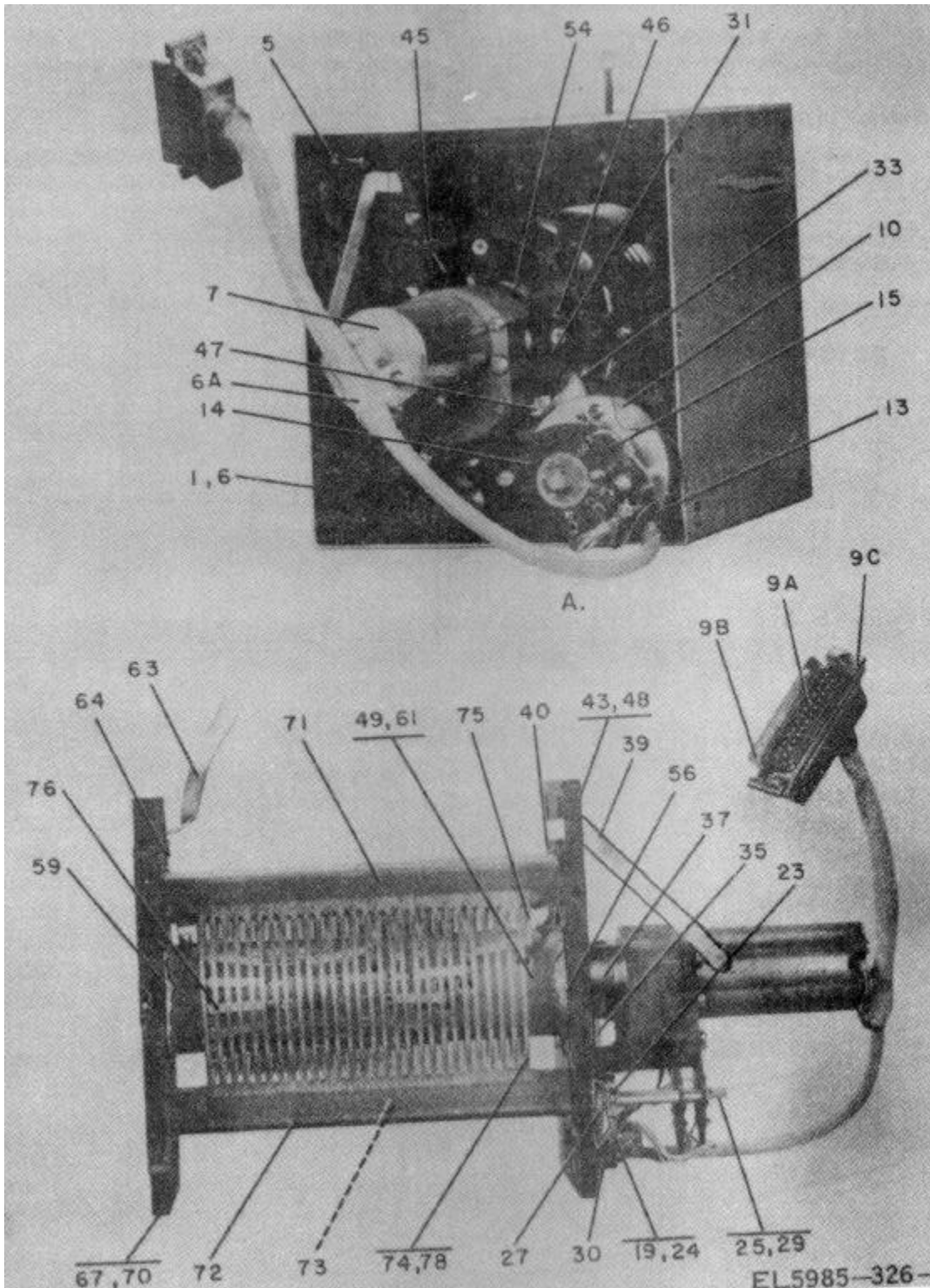


Figure 3-3. Step Coil A4, (Part Number 528-0324 -000), Parts Location.

Change 2 3-20

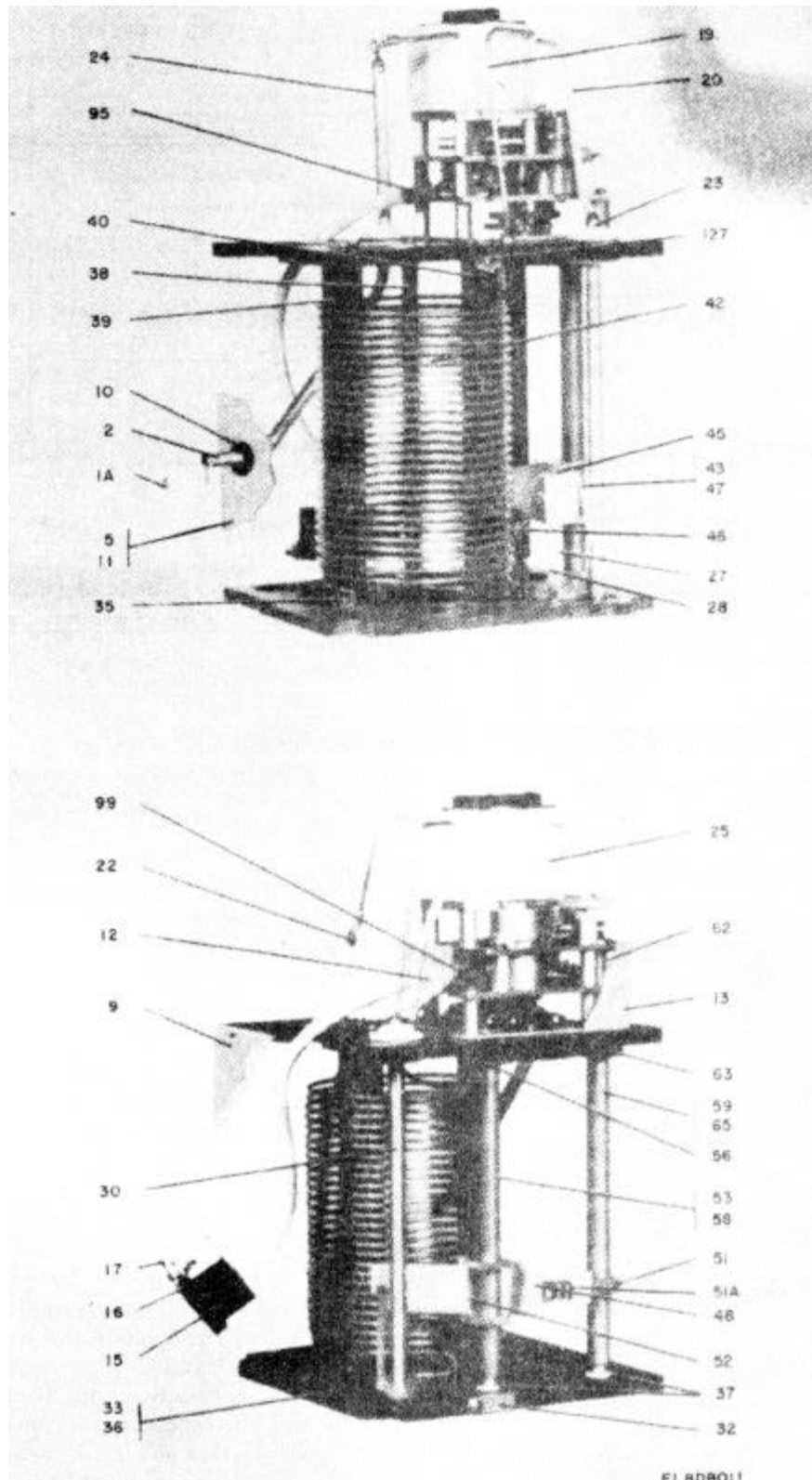


Figure 3-3.1(1). Step Coil A4, (Part Number 777-3508-001), Parts Location (Part 1 of 2)

Change 2 3-21

Legend for figures 3-3. 1(1) and 3-3.1(2):

Note: Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

1A	Lead, electrical	35	Pin (3)	66	Gearplace	96	Motor A4B1
2	Spacer	36	Plate	-67	Screw (3)	-97	Screw (2)
-3	Screw	37	Sleeve bearing	-68	Screw	-98	Lockwasher (2)
-4	Washer	38	Coil bar no. 1	-69	Spring washer	99	Terminal
5	Cover	39	Coil bar no. 2	70	Ball bearing	-100	Screw
-6	Screw (4)	40	Coil bar no. 3	71	Post(4)	-101	Lockwasher
-7	Sleeve(4)	-41	Screw (3)	-72	Screw (2)	102	Gear plate
-8	Screw (16)	42	RF coil	-73	Spring washer (2)	-103	Screw
9	Bushing (4)	43	Spring	-74	Stud (2)	-104	Spring washer
10	Insulator	-44	Retaining ring	75	Gearshaft	105	Ball bearing
11	Cover	45	Pin	76	Ball bearing	106	Ball bearing
12	Shield	46	Contact (2)	77	Ball bearing	107	Gearshaft
13	Shield	47	Spring	78	Diode A4CR2	108	Pin
-14	Screw (12)	48	Carriage	79	Diode A4CR3	109	Spur gear
15	Shield	-49	Grooved pin	80	SwitchA42	110	Shaft
16	Connector A4PI	-50	Retaining ring	-81	Screw(2)	111	Spurgear
17	Retainer	.51	Nut	-82	Plastic washer (2)	-112	Retaining ring
18	Lead, electrical	51A	Spring	83	Ball bearing	113	Star wheel
19	Lead, electrical	-51B	Retaining ring	84	Gear plate	-114	Retaining ring
20	Lead, electrical	-51C	Flat washer (2)	-85	Screw	115	Spline shaft
-21	Setscrew (4)	52	Channel, carriage	-86	Spring washer	116	Post (4)
22	Terminal	53	Leadscrew	87	Post (4)	-117	Screw (3)
23	Terminal (2)	-54	Retaining ring	-88	Screw (2)	-118	Screw
24	Lead, electrical	-55	Shim	-89	Spring washer (2)	119	Ball bearing
25	Switch A4S3	56	Spur gear	-90	Stud (2)	120	Ball bearing
-26	Screw (4)	-57	Pin	91	Diode A4CR1	121	Coil plate
27	Contact, electrical	58	Leadscrew, coil	92	Switch A4A1	122	Ball bearing
28	Contact, electrical	59	Leadscrew drive	-93	Screw(2)	123	Ball bearing
-29	Screw (4)	-60	Retaining ring (2)	-94	Plastic washer (2)	124	Washer
30	Contact	-61	Shim	95	Eyelet	125	Sleeve bearing
-31	Retaining ring	62	Spur gear	95A	Clamp	126	Terminal
32	Contact	63	Spur gear	-95B	Screw	127	Pin (3)
33	Plate	-64	Pin	-95C	Flat washer	128	Rear plate
-34	Screw (3)	65	Leadscrew, coil				

Change 2 3-22

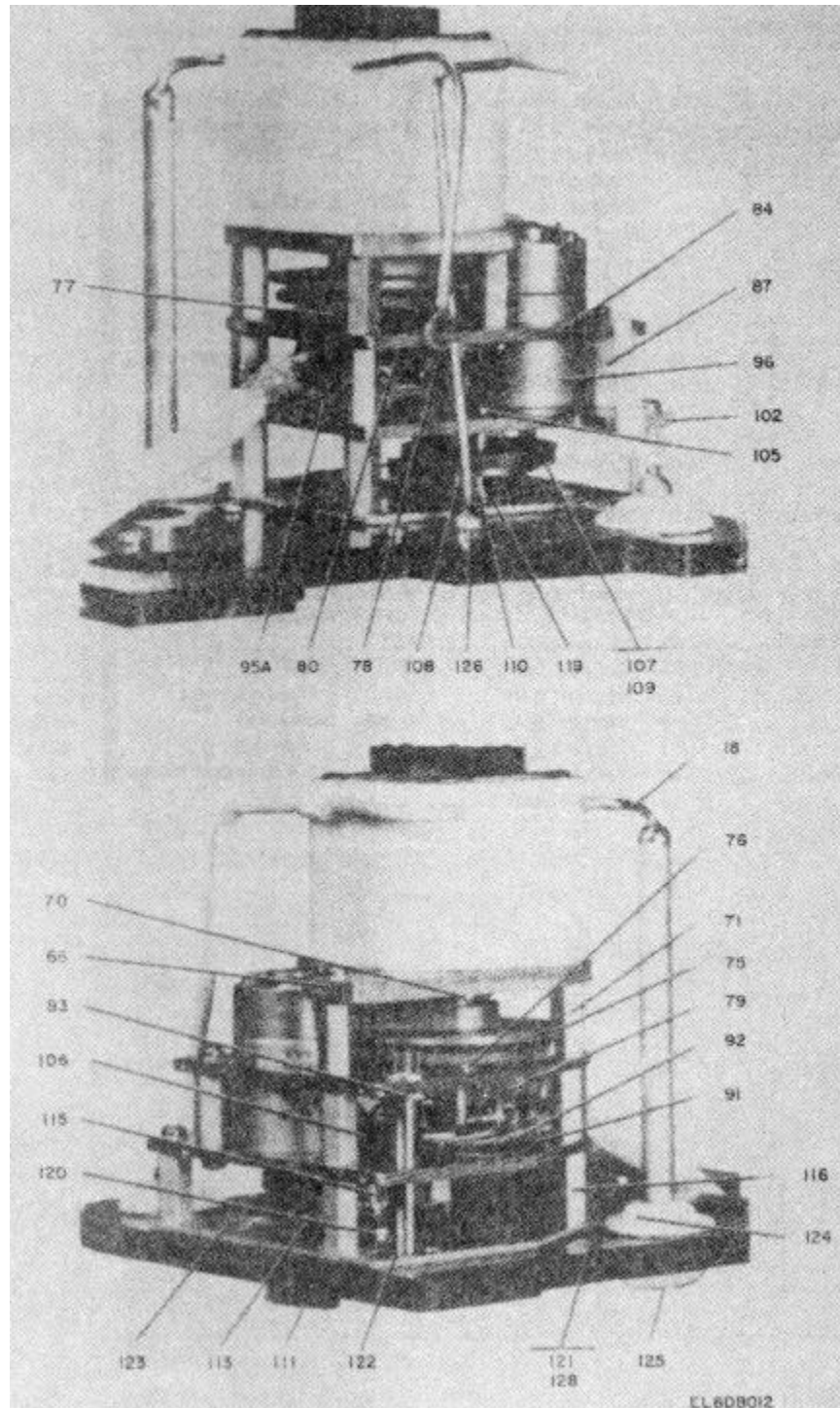


Figure 3-3.1(2). Step Coil A 4, (Part Number 777 3508 001), Parts Location (Part 2 of 2)

Change 2 3-23

Legend for figure 3-4:

Note. Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

1	Motor and gear assy	29	Bearing retainer	57	Electrical contact	66	No. 2 spur gear cluster
-2	Rim-clenching clamp (3)	-30	Screw (2)	-57A	Electrical bushing	-67	Retaining ring
-3	Screw (3)	31	Top plate	58	Drive shaft	-67A	Bearing
-4	Lockwasher (4)	-32	Retaining ring (4)	-58A	Machine screw	-67B	Gear cluster
5	Gear	33	Contact	58B	Electrical contact	68	Brazed gear shaft
-6	Pin	34	Contact	68C	Link	-68A	Ring
7	Motor A5B 1, A6B 1	-35	Rivet	58D	Electrical contact	69	Standoff terminal
8	Terminal bracket	-36	Rivet	58E	Pin	-70	Flathead screw
-9	Screw	-37	Washer (2)	59	Holder	71	Bearing retainer
-10	Terminal lug	38	Bearing	59A	Link	-72	Screw (2)
-11	Lockwasher	39	Plate	60	Electrical contact	-73	Lockwasher (2)
12	Terminal (6)	40	Top plate	-60A	Tubular rivet	74	Bearing
13	Bracket	-41	Screw (4)	-60B	Hex nut	75	Screw (4)
14	Cover	-42	Washer (4)	-60C	Flat washer	-76	Spring sleeve (4)
-15	Nut	-43	Retaining ring (4)	-60D	Machine screw	77	Pin retainer
-16	Pin	44	Electrical contact	-61	Deleted	-78	Screw (2)
-17	Rim-clenching clamp (2)	45	Electrical contact	61A	Plunger	-79	Lockwasher (2)
-18	Screw (2)	-46	Rivet (2)	-61B	Pin	80	Shouldered pin
-19	Lockwasher (2)	47	Plate	62	Helical spring	81	Rubber grommet
20	Bearing	48	Bearing	62A	Shaft	82	Bearing
21	Wafer switch A5S1B, A6S1B	49	Shield	62B	Insulator	82A	Disk
22	Wafer switch A5S1A, A6S1A	-50	Screw (4)	-62C	Pin	82B	Ring
-23	Sleeve spacer (2)	51	Support post	62D	Shaft	82C	Gasket
-24	Sleeve spacers	52	Support post	62E	Protective cover	82D	Post (2)
25	Screw (2)	53	Support post	-63	Screw (2)	-82E	Screw (2)
-26	Nonmetallic washer (4)	54	Support post	-64	Lockwasher 12)	-82F	Washer (2)
27	Connector A5P1, A6P1	-55	Flathead screw (4)	65	No. 4 spur gear cluster	83	Bottom plate
28	Retainer	56	Coil A5L1, A6L1				

Change 2 3-24

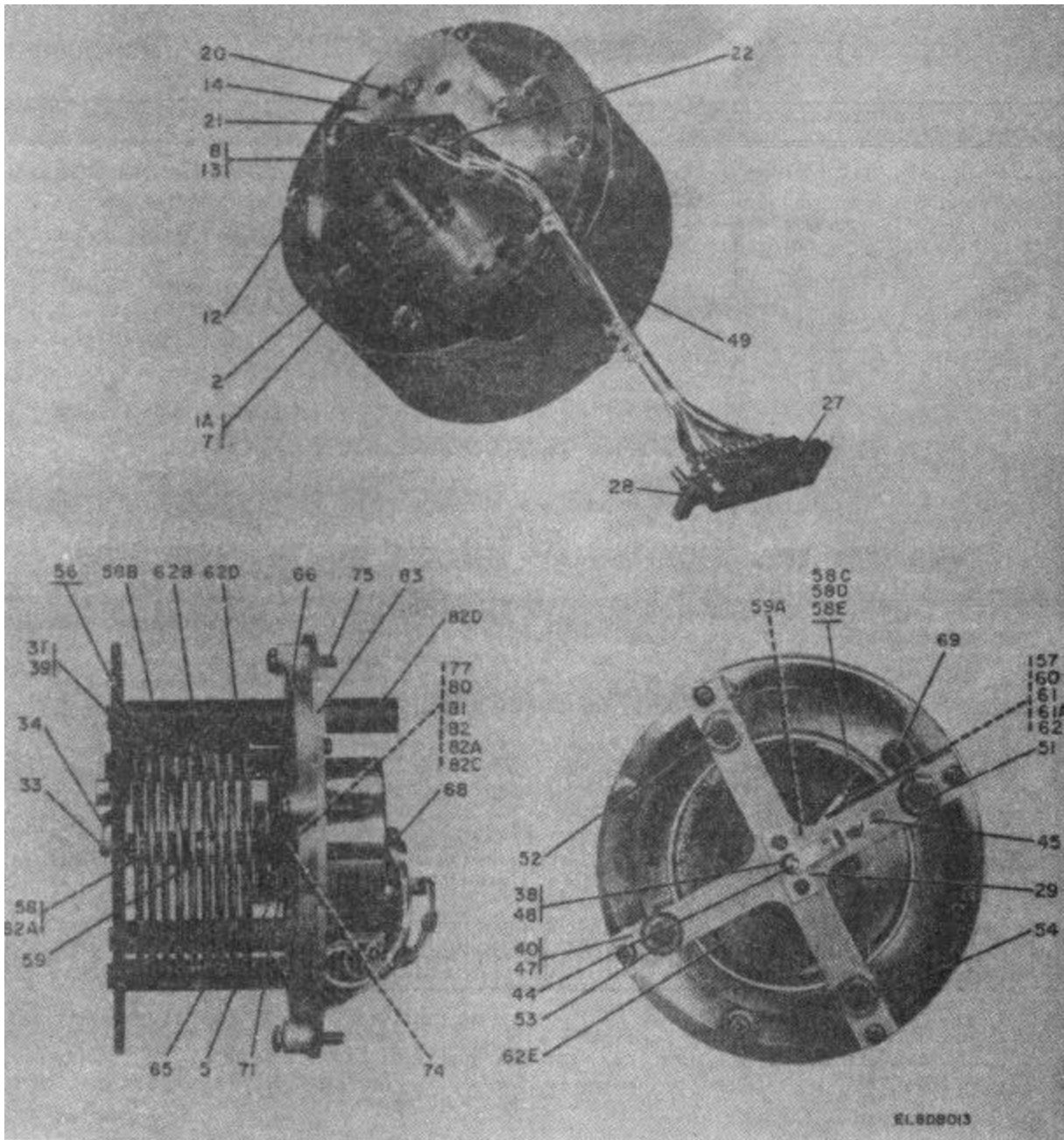


Figure 3-4. Series A5 and Shunt A6 Varicoils, Parts Location.

Change 2 3-25

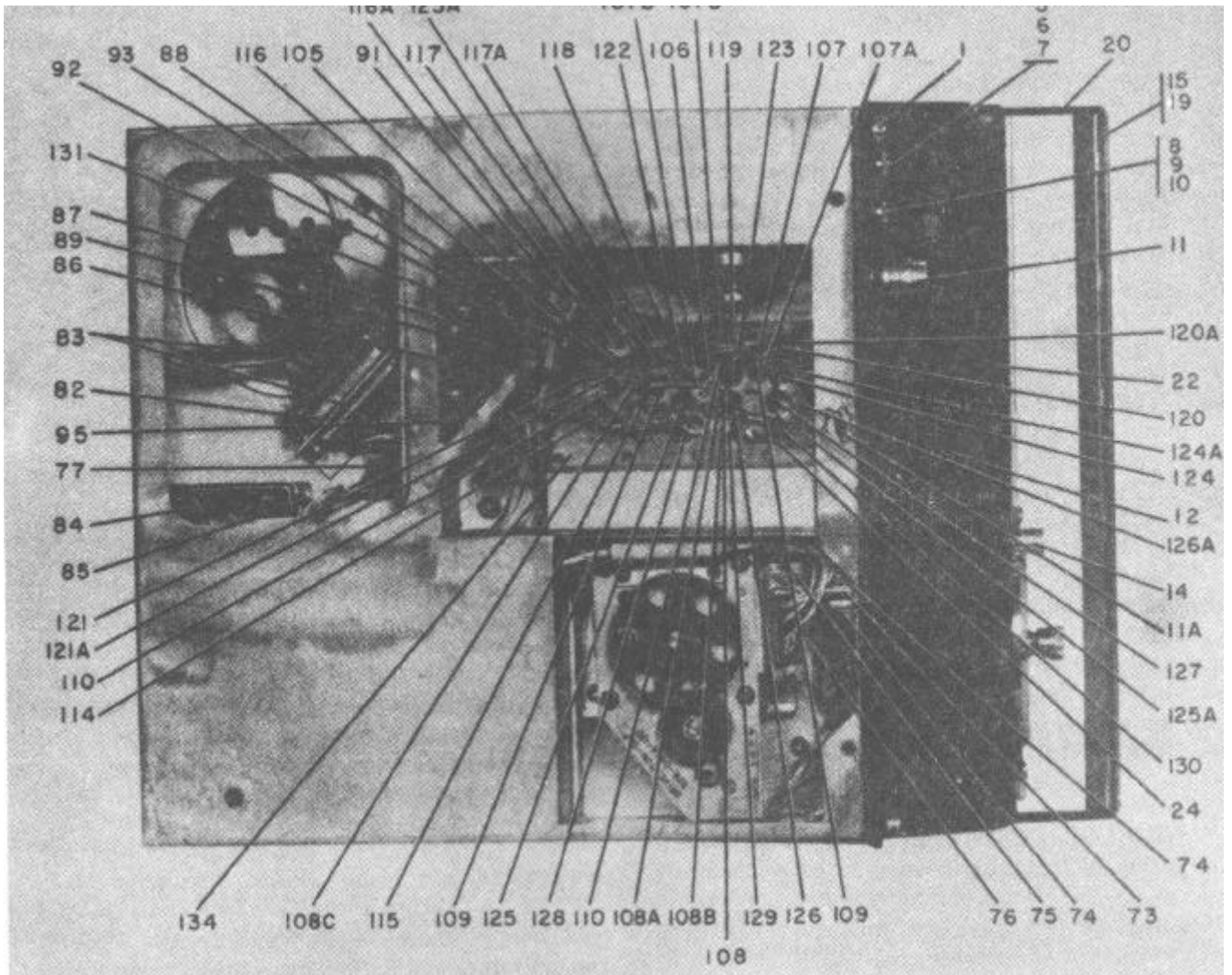


Figure 3-5(1). Equipment Chassis A1, Parts Location (Part 1 of 2).

Change 2 3-26

Legend for Figures 3-5(1) and 3-5(2):

Note. Those index numbers that have a dash prefix are attaching parts that are listed but not shown. Items preceded by # have different values and reference designations depending on MCN effectivity. Refer to para 1-5d.

1	Bracket (2)	-40	Terminal lug	84	ConnectorA1J8	#118	Capacitor AC3,A1C5
-2	Nut (4)	-41	Terminal lug (2)	85	Sliding lock assy	#119	Capacitor A1C4, A1C6
-3	Washer (4)	-41A	Spacer	86	Resistor A1R3	1120	Capacitor A1C5, A1C7
-4	Screw (4)	-42	Stud	87	Resistor A1R2	#120A	Capacitor A1C8
5	Indicator lens	-42A	Nut	88	Capacitor A1C30	#121	Capacitor A1C6
6	Lamp A1DSI	-43	Insulator plate	89	Coil A1L2	#121A	Capacitor A1C9
7	Lampholder A1XDS1	44	Bracket	-90	Screw	#122	Capacitor A1C8 A1C12
-7A	Washer	-45	Nut (4)	91	Diode A1CR2	#123	CapacitorA1C9, AC13
8	Indicator lens	-46	Washer (4)	92	Relay A1K2	#123A	Capacitor A1C11
9	Lamp A1DS2	-47	Washer (4)	93	Terminal(2)	#124	Capacitor A1C10, A1C14
10	Lampholder A1XDS2	-48	Screw (2)	-94	Screw (2)	#124A	Capacitor A1C15
-10A	Washer	-49	Screw (2)	-94A	Washer	#125	CapacitorA1C11,A1C16
11	Connector A1J2	50	Connector A1J4	95	Terminal	-125A	Capacitor A1C23
11A	Diode A1CR12	-51	Nut (2)	95	Terminal	#126	Capacitor A1C12, A1C17
12	Connector A1J1	-52	Spacer (2)	-96	Screw	126A	CapacitorA1C19
-13	Screw (4)	-53	Screw (2)	97	ConnectorA1J11	#127	Capacitor1A1C13A1C18
14	Connector A1J3	54	Connector A1J5	-98	Nut (2)	#128	Capacitor A1C14, A1C120
-14A	Nut	-55	Nut (2)	-98A	Ferrule (4)	#129	CapacitorA1C15,A1C21
15	Handle	-56	Spacker (2)	-99	Screw (2)	#130	Capacitor A1C16, A1C22
-16	Nut (2)	-57	Screw (2)	100	ConnectorA1J12	131	Post
-17	Washer (4)	58	Connector A1J6	-101	Washer	-132	Screw
-18	Pin (2)	-59	Nut (2)	102	ConnectorA1J13	-133	Lockwasher
19	Grip bar	-60	Spacer (2)	-103	Screw (4)	134	Plate
20	Strap	-61	Screw (2)	-104	Washer (4)	-135	Nut (16)
-21	Pin (2)	62	Coil A1L1	105	Diode A1CR3	-135A	Washer (16)
22	Front panel	-63	Screw	106	Diode A1CR4	-135B	Screw (11)
23	Resistor A1R4	64	Transformer A1T1-106A		Diode A1CR7	136	Resistor A1R1
24	Diode ACR10	-65	Screw (4)	107	Diode A1CR7	136A	DiodeA1CR11
25	RelayA1K4	-65A	Washer	107A	DiodeA1CR8	137	Terminal
26	Terminal lug	66	Post	107B	Diode A1CR12	-138	Screw
-27	Screw (2)	-67	Screw	107C	Diode A1CR13	-138A	Lockwasher
-28	Lockwasher (2)	-68	Washer	108	Diode A1CR4	139	Diode AA1CR1
28A	Diode A1CR9	69	Plate	108A	Resistor A1R5	140	Relay A1K1
28B	Grommet	-70	Screw (8)	108B	Capacitor A1C33	-140A	Electrical lead
29	Connector	71	Nut (6)	#108C	Capacitor A1C7, ALC10	-140B	Terminal
30	Relay A1K3	72	Plate	109	Terminal (4)	142	Terminal
-31	Setscrew (2)	73	Connector A1J14	110	Terminal (2)	-142	Nut
-32	Label	74	Sliding lock assy	-111	Nut	143	Washer
33	Capacitor A1C31	75	Connector A1J7	-112	Washer (4)	-144	Screw
34	Capacitor A1C32	76	Retainer	-113	Screw (5)	145	Connector A1J10
-34A	Ceramic post	77	Clamp	114	Filter A1FL1	146	Sliding lock assy
-35	Screw	78	Terminal	115	Filter A1FL2	146A	Clamp
-36	Screw	-79	Nut	#116	CapacitorA1C1	-146B	Nut
-37	Washer	-80	Washer	#116A	Capacitor A1C2	-146C	Washer
-38	Washer (2)	-81	Screw	#117	Capacitor A1C2, A1C3	-146D	Screw
-39	Washer (2)	82	Connector A1J9#117A		Capacitor A1C4	147	Chassis
-39A	Stud	83	Sliding lock assy				

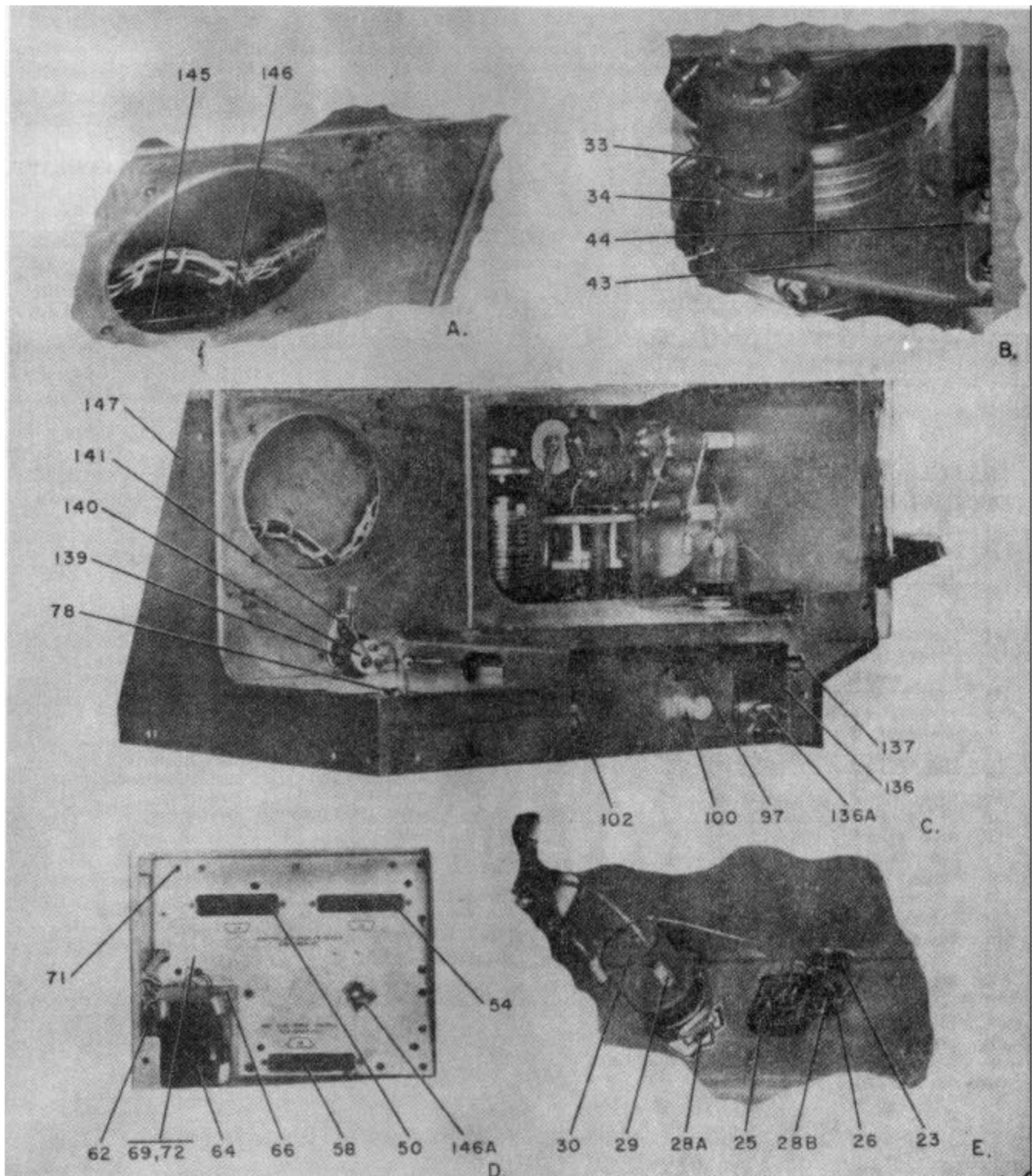


Figure 3-5(2). Equipment chassis A1, Parts Location (Part 2 of 2).

Change 2 3-28

Legend for figure 3-6:

Note. Those index numbers that have a dash prefix are attaching parts that are listed but not shown.

1	Resistor A9R1	12	Rotor	-21	Deleted	-35	Lockwasher (4)
2	Switch A9S2	13	Control cam	22	Motor A9B 1	-36	Flat washer (4)
-3	Nylon screw (4)	14	Geneva star wheel	-23	Screw (2)	-37	Nut (2)
4	Bearing	-14A	Screw (4)	24	Diode A9CR1	38	Plate
5	Post (4)	-14B	Washer (4)	25	Diode A9CR2	39	Terminal (3)
-6	Screw (4)	-14C	Washer (4)	26	Diode A9CR3	40	Terminal
6A	Protective cover	-15	Deleted	26A	Diode A9CR4	-41	Screw (3)
-6B	Nylon screw 3)	16	Shaft	27	Switch wafer A1S1C	-42	Washer
6C	Post (3)	17	Shaft	28	Switch wafer A9S1B	43	Connector A9P1
-6D	Screw (3)	-17A	Pin	29	Switch wafer A9S1A	44	Connector lock
-6E	Deleted	18	Geneva star wheel	-30	Ceramic spacer (4)	45	Gear plate
7	Gear shaft assembly	-18A	Screw (4)	-31	Ceramic spacer (2)	46	Post
8	Pin	-18B	Lockwasher (4)	-32	Screw (2)	47	Bearing
9	Rotor switch	-18C	Washer (4)	33	Switch mounting plate	-48	Nut (4)
-10	Screw (5)	19	Geneva gear	-34	Screw (4)	9	Plate
11	Contact	-20	Retaining ring				

Change 2 3-28.1

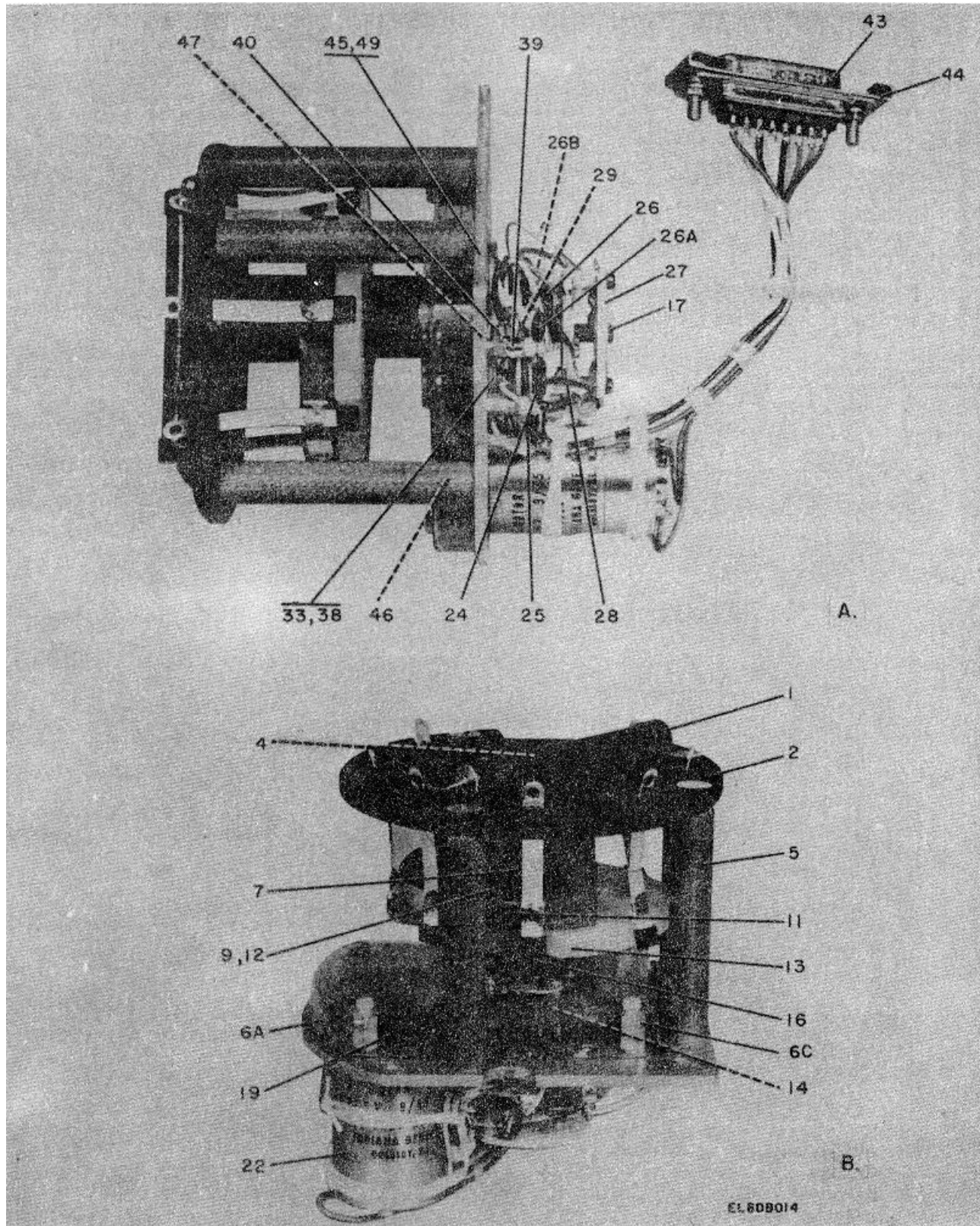


Figure 3-6. Series Capacitor A9, Parts Locations.

Change 2 3-28.2

Legend for figure 3-7:

Note. Those index numbers that have a dash prefix are attaching parts that are listed but not shown. Items preceded with # have different values depending on MCN effectivity. (Refer to para 1-5d).

- | | | | |
|------|--------------------|-----|------------------------|
| 1 | Link No. 2 | -20 | Lockwasher (6) |
| 2 | Terminal lug | -21 | Continuous stud (2) |
| 3 | Capacitor A10C34 | -22 | Screw (2) |
| 4 | Capacitor A10OC33 | #23 | Capacitor A10OC29 |
| 5 | Capacitor A10OC35 | 24 | Terminal lug |
| 6 | Capacitor A10OC24 | -25 | Screw |
| 7 | Ceramic post | -26 | Screw |
| -8 | Continuous stud | -27 | Lockwasher (2) |
| -9 | Screw (3) | -28 | Ceramic post |
| -10 | Screw (4) | -29 | Deleted |
| -10A | Washer (4) | -30 | Screw (2) |
| -11 | Lockwasher (8) | -31 | Nonmetallic Marker (21 |
| -12 | Nonmetallic washer | 32 | Ceramic post |
| 13 | Link No. 1 | -33 | Screw |
| 14 | Terminal | -34 | Nonmetallic washer (2) |
| 15 | Capacitor A10C27 | 35 | Terminal lug (2) |
| 16 | Capacitor A10OC28 | -36 | Nut (2) |
| 17 | Capacitor A10OC25 | -37 | Lockwasher (2) |
| 18 | Capacitor A10C26 | -38 | Screw (2) |
| -19 | Screw (2) | 39 | Capacitor retainer |

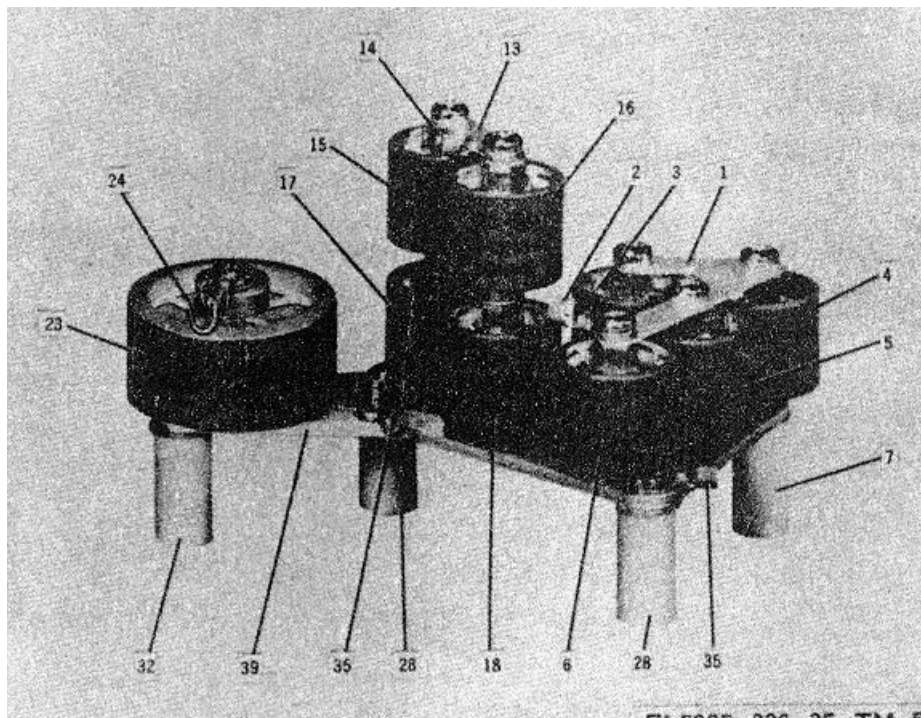


Figure 3-7. Capacitor Assembly A10, Parts Locations.

Change 2 3-28.3

Section IV. TESTING

3-21. General These tests are described in this section. Equipment To make sure that the antenna coupler is in good operating condition, certain tests must be made. passing these tests will operate satisfactorily.

Component	Common name	Purpose
Test Set, Antenna Coupler Control TS-2353/ARM-109. Cable CX-10735/U	Control tester	Test coupler control A2
Test Set, Electronic Control Amplifier TS-2354/ARM-109. Cable CX-107U6/U W3	W2 Amplifier tester	Test control amplifier A3
Test Set, Discriminator TS- 2352/ ARM-109. Cable CG-3440	Discriminator tester..... W4	Test discriminator A8

3-22. Coupler Control A2 Test CAUTION
(fig.3-8)

a. Test Equipment and Materials.

- (1) Control tester
- (2) Cable W2

b. Test Connections and Conditions.

- (1) Connect P1 of test set to a power source of 115 ± 1 volts at 400 ± 5 Hz.

Do not connect module to control tester at this time.

- (2) Set POWER switch to ON.
- (3) Set FUNCTION switch to position 17.

Press KEY pushbutton. Note that all lights are on. If all lights are not on, refer to TM 11-6625 1636-15 for corrective action. If all lights are on, proceed to c below.

c. Test Procedures.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Control tester: POWER: OFF FUNCTION: 17 SHUNT SERVO: MAX SERIES SERVO: MAX		a. Set FUNCTION switch to OFF.....a. None. b. Connect module to control tester.....b. None. Use cable W2 (fig.3-). c. Set POWER switch to ON.....c. ,None. Note. The KEY pushbutton must be pressed when the FUNCTION switch it in positions 8. 4.7. 8. and 12(even when just going past them) for the testing to work. d. Rotate FUNCTION switch to .....d LIGHTS P1 and LIGHTS P2 must light as shown in table 3-1. If lights do not light in Proper sequence, refer module to higher category of maintenance.	
2			Caution: DO NOT press KEY push-button when FUNCTION switch is at 17 and module is' connected to control tester. a. Connect multimeter test probe to.....a. None. P2-20 and common lead to P2-30. b. Rotate SERIES SERVO control.....b. Voltage varies from 0 to 21 ±2 volts ac. through entire range with..... FUNCTION switch set to positions 7 and 8. c. Set FUNCTION switch to 7.....c. Voltmeter mast indicate between10 and 1.3 volts c. Rotate SERJIES SERVO control until P1-12 green lamp threshold occurs. d. Set SERIES SERVO control to.....d None. full clockwise (cw) position. e. Reverse meter leads .....e. None.	

c. Test Procedures-Continued

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p><i>f</i> Set FUNCTION switch to 8</p> <p><i>g</i>. Rotate SERIES SERVO control counterclockwise (ccw) until P1-10 and P1-18 green lamp thresholds are reached. Return SERIES SERVO control to full cw position.</p> <p><i>h</i>. Connect multimeter to jacks P1-13 and P2-36</p> <p><i>i</i>. Rotate SHUNT SERVO control through entire range.</p> <p><i>j</i>. Rotate SHUNT SERVO control volts slowly until relay is heard chattering</p> <p><i>k</i>. Rotate SHUNT SERVO control to full cw position.</p> <p><i>l</i> Set FUNCTION switch to 12</p> <p><i>m</i>. Press KEY pushbutton. Hold P14-4 green lamp lights</p> <p><i>n</i>. Set POWER switch to OFF</p> <p><i>o</i>. Disconnect test setup</p>	<p><i>f</i> None.</p> <p><i>g</i>. Voltage is from 10 to 13. volts ac</p> <p><i>h</i>. None.</p> <p><i>i</i>. Voltage varies from 0 to 21 ±2 volts ac.</p> <p><i>j</i>. Voltage varies from 8 to 10 ac.</p> <p><i>k</i>. None.</p> <p><i>l</i>. None</p> <p><i>m</i>. Maximum allowable delay is 15 seconds.</p> <p><i>n</i>. None.</p> <p><i>o</i>. None.</p>

Table 3-1. Lighting Sequence

P1 LIGHTS	FUNCTION switch position											
	1	2	3	4	5	6	7	8	9	10	11	12
2			X									
4												X
6	X	X		X	X	X	X	X	X			X
9										X	X	
10								X				
11	X	X		X	X	X	X	X	X	X	X	X
12							X					
15	X	X		X	X	X	X	X	X	X	X	X
18								X				
19				X	X	X	X	X	X	X		
21						X	X	X				
22	X	X	X	X	X	X	X	X	X	X	X	X
24											X	
25					X	X	X	X	X	X		
31			X									
32			X									
33					X	X	X	X	X	X	X	X
34			X									
37				X	X	X	X	X	X	X	X	X
45					X	X	X	X	X	X	X	X
49										X		
50	X	X	X	X	X						X	

Table 3-1. Lighting Sequence- Continued

P1 LIGHTS	FUNCTION switch position											
	1	2	3	4	5	6	7	8	9	10	11	12
3	X	X	X	X			X	X	X	X	X	
7	X	X	X	X	X	X	X	X	X	X	X	
12	X	X	X	X	X	X	X	X	X	X	X	X
13	X	X	X	X		X	X	X	X	X	X	
14	X	X	X	X	X	X	X	X	X	X	X	X
16			X						X		X	
17			X		X	X	X	X	X	X	X	
19	X	X	X	X	X	X	X	X	X	X	X	X
21			X									
22			X									
23	X	X		X	X	X	X	X	X	X	X	X
25		X	X						X			
26			X					X				
27			X		X	X	X	X	X	X		
28	X	X	X	X	X	X	X	X	X	X	X	X
34										X	X	X
35										X	X	X

NOTES

- X indicates lighted lamps.
- All lamps are lighted when the FUNCTION switch is in position 17 and KEY button is pressed. (Module must not be connected to control tester.)
- KEY button must be pressed for correct indications when FUNCTION switch is in positions 3, 4, and 12.
- When FUNCTION switch is in positions 1 and 2, LAMPS P1-22 will not light in coupler control A2 modules above MCN 572 unless module has been modified to include wire from A2K5-7 to A2P1-39. Direct support personnel are not authorized to make this modification.
- When FUNCTION switch is in position 2 for module part number 628-0465-000, MCN 9100 and above, and part number 608-9500-002, green light P2-13 remains off.
- When FUNCTION selector is set to 1, P2-16 green lamp may glow dim.

3-23. Control Amplifier A3 Test (fig. 3-9)

a Test Equipment and Materials.

- Amplifier tester.
- Cable W3.

b. Test Connections and Conditions.

- Connect P1 of test set to a power source of 115 +1 volts at 400 ±5 Hz.

NOTE

Test will be invalid if primary power source is not within prescribed tolerances.

CAUTION

Do not connect module to tester at this time.

- Set POWER switch to ON.
- Set FUNCTION switch to OFF, and OFF-SELF TEST-ON switch to SELF TEST.
- After a 5-minute warm-up, see that all lamps are on and that the TORQUE METER indicates 0.40 +0.01 inch-ounce for part number 775-4276-001 or 0.40 ±0.05 for part number 528-0467-000.
- If indications are abnormal, refer to TM 11-6625-1636-15 for corrective action. If indications are normal, proceed to c below.

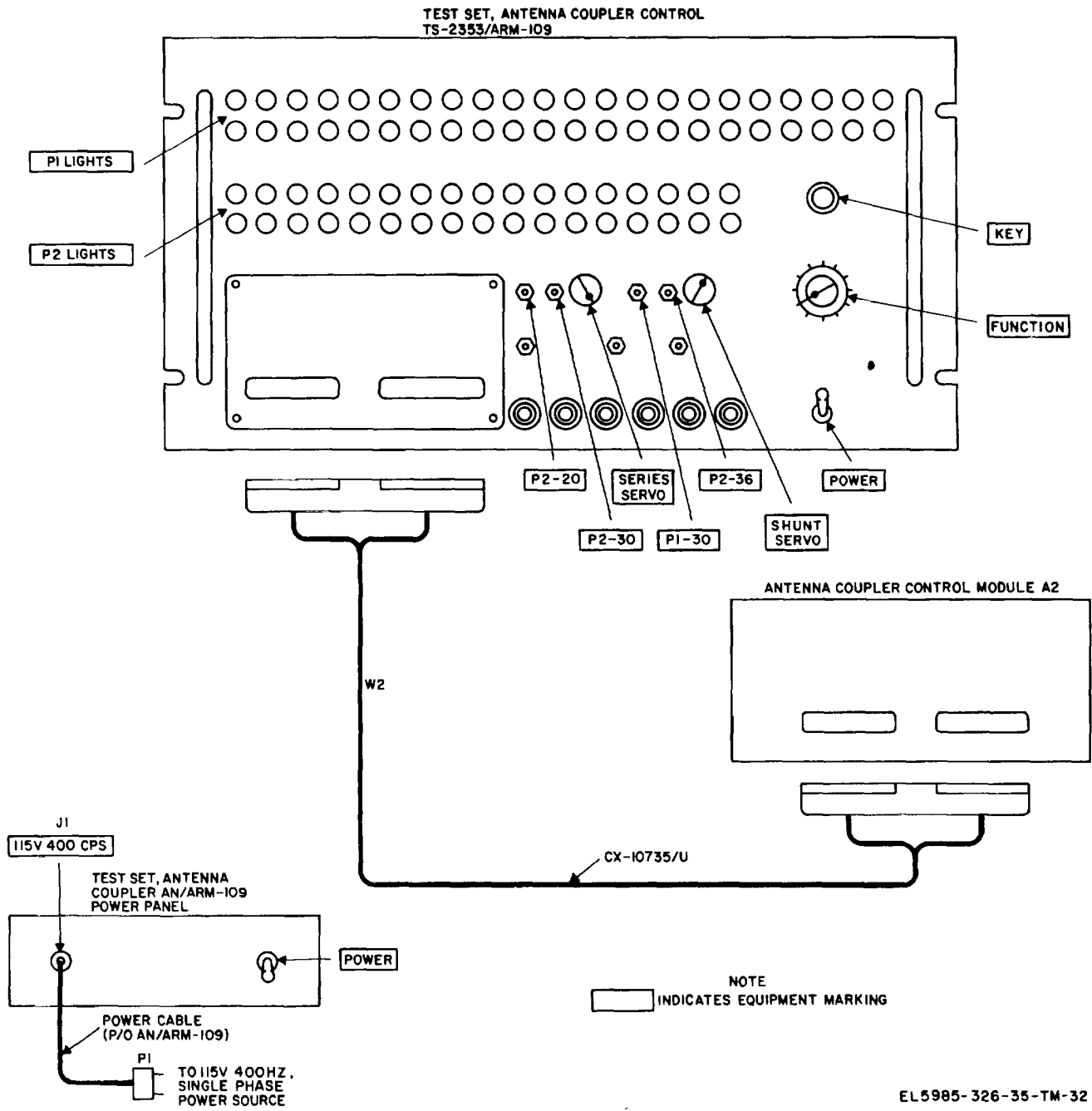


Figure 3-8. Coupler Control A2 Test Setup.

Change 2 3-32

c. Test Procedures

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	Amplifier tester: FUNCTION: OFF OFF-SELF TEST-ON: OFF VAR INPUT: 0	NA	a. Connect module to amplifier tester. Use cable W3 (fig. 3-9). b. Turn amplifier OFF-SELF TEST-ON switch to ON. c. Rotate amplifier tester FUNCTION switch to positions 1 through 10. At each positions (except 6), observe indicator lamps and TORQUE METER reading.	a. None. b. None. c. Lamps must light and TORQUE METER must indicate as shown in table 3-2-1 or table 3-2.1. If an abnormal symptom occurs, refer module to higher category of maintenance.

Table 3-2. TORQUE METER Indications for A3 Part Number 775-4276-001

FUNCTION switch position	Indicator lamps lighted	Normal TORQUE METER indications (in.-oz)
1	24	0.33 to 0.43
2	24	0.05 to 0.08
3	8	0.41 to 0.49
4	8	0.26 to 0.34
5	8 and 16	0 +0.03
6	Not used.	Not used.
7	24	0.59 to 0.67
8	24 and 27	0 +0.03
9	23 and 27	0.12 to 0.16
10	23	See note 2.

NOTES

- TORQUE METER indications apply only when the input power to test set is 115 ± 1 volt at 400 ± 5 Hz.
- In position 10, the VAR INPUT switch must be set to SAT. On control amplifier A3 MCNs above 1544, TORQUE METER must indicate 0 +0.30 (starting point) to not less than 0.62. On MCNs through 1543, TORQUE METER must indicate 0 +0.3 to not less than 0.50.

Table 3-2.1. TORQUE METER Indications for A3, Part Number 528-0467-000

FUNCTION switch position	Indicator lamps lighted	Normal TORQUE METER indications (in.-oz)
1	24	0.28 to 0.50
2	24 (Ignore lamp 27)	0.12 to 0.16
3	8 and 16	0.46 to 0.58
4	8 and 28	0.29 to 0.37
5	8 and 16	0 +0.03
6	Not used.	Not used.
7	24	0.48 to 0.62
8	24 and 27	0 +0.03
9	23 and 27	0.14 to 0.20
10	23	See note 2.
11	-	See note 2.

NOTES

- TORQUE METER indications apply only when the input power to test set is 115 ± 1 volt at 400 ± 5 Hz.
- In positions 10 and 11 the VAR INPUT switch must be set to SAT. TORQUE METER must indicate 0 +0.03 (starting point) to not less than 0.50.

3-24. Discriminator A8 Test

(fig. 3-10)

a. Test Equipment and Materials.

- (1) Discriminator tester.
- (2) Cable W4.
- (3) Radio Set AN/ARC-102.
- (4) Aluminum sheet.
- (5) Metal grounding straps.

b. Test Connections and Conditions.

(1) Secure the equipment to the aluminum sheet with metal grounding straps, Use two grounding straps for the receiver-transmitter (fig. 3-10).

NOTE

Use of wires or cables to connect the metal chassis of the test equipment does not insure good RF ground.

(2) Interconnect components of Radio Set AN/ARC-102 (TM 11-5821-248-12).

(3) Connect P1 of test set to a power source of 115 ±1 volts at 400 +5 Hz.

(4) Calibrate the discriminator tester (TB 11-6625-1636-35/1).

(5) Connect W4 from receiver-transmitter ANT terminal to J3 on discriminator tester.

(6) Start the receiver-transmitter (TM 11-5821-248-12). Set the transmitter frequency to 2.000 MHz.

(7) Set the test set POWER switch to ON.

(8) Set the discriminator tester CIRCUIT SELECTOR switch to INPUT POWER.

(9) Press microphone press-to-talk switch. Observe the discriminator tester METER. METER pointer must deflect. If the pointer does not deflect, refer to TM 11-6625-1636-15 for corrective action. If the pointer deflects, proceed to c below.

WARNING

Unkey transmitter before removing transmitter rf output cable from J3.

c. Test Procedures

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Radio Set Control Mode selector: AM Frequency: 2.000 MHz	NA	a Remove W4 from J3 and connect to RF INPUT J1. b. Plug module into discriminator tester. Turn test set POWER switch to ON. c. On discriminator tester, set CIRCUIT SELECTOR to PHASE. Change 2 3-32.2	a. None. b. None c. None.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
	<p><i>Discriminator tester:</i> CIRCUIT SELECTOR: INPUT POWER Test Set POWER: OFF</p>		<p><i>d.</i> On radio set control, set frequency to 29.909 MHz. Key transmitter. Observe discriminator METER indication.</p> <p><i>e.</i> Set frequency to 2 !MHz. Key transmitter. Read and record PHASE reading.</p> <p><i>f.</i> On discriminator tester, set CIRCUIT SELECTOR to 2 MC. Key transmitter. Read and record METER indication. Algebraically subtract this reading from reading in <i>e</i> above.</p> <p><i>g.</i> Set frequency to 8 MHz. Key transmitter. Read and record PHASE reading.</p> <p><i>h.</i> On discriminator tester, set CIRCUIT SELECTOR to 8 MC. Key from transmitter. Read and record METER indication. Algebraically subtract this reading from reading in step <i>g</i> above.</p> <p><i>i.</i> Set frequency to 14 MHz. Key transmitter. Read and record METER indication.</p> <p><i>j.</i> On discriminator tester, set CIRCUIT ,SELECTOR to 14 MC. Key transmitter. Read and record METER indication. Algebraically subtract this reading from reading in step <i>i</i> above.</p> <p><i>k.</i> Set frequency to 29.990 MHz. Key transmitter. Read and record METER indication.</p> <p><i>l.</i> On discriminator tester, set OTR-CUIT SELECTOR to 29.999 MC. Key transmitter. Read and record METER indication. Algebraically subtract this reading from reading in step <i>k</i> above.</p> <p><i>m.</i> On discriminator tester, set CIRCUIT SELECTOR to LOAD. Set transmitter frequency to 14.000 M-Hz. Key transmitter. Read and record METER indication.</p> <p><i>n.</i> On discriminator tester, set CIRCUIT SELECTOR to FWD POWER. Key transmitter. Observe METER indication.</p> <p><i>o.</i> On discriminator tester, set CIRCUIT SELECTOR to REFL POWER. Read and record meter indication.</p> <p><i>p.</i> On discriminator tester, set CIRCUIT SELECTOR to REFL SENS. Key transmitter. Read and record 'METER indication.</p>	<p><i>d.</i> METER must indicate 0 ± 2.0. If not, adjust AgR9 for zero indication.</p> <p><i>e.</i> None.</p> <p><i>f.</i> METER must indicate two METER units or more difference from PHASE reading in step <i>e</i> above. Example: Reading in <i>e.</i> +1.5 Reading In <i>f</i> -4.0 Difference - - -2.5 Since difference is more than 2 units, performance standard is met.</p> <p><i>g.</i> None.</p> <p><i>h.</i> METER must Indicate two METER units or more difference PHASE reading in step <i>g</i> above.</p> <p><i>i.</i> None.</p> <p><i>j.</i> METER must indicate two METER units or more difference from PHASE reading in step <i>i</i> above.</p> <p><i>k.</i> None.</p> <p><i>l.</i> METER must indicate two METER units or more difference from PHASE reading in step <i>k</i> above.</p> <p><i>m.</i> METER must indicate $0 * \pm .5$. If not, adjust AC for zero indication.</p> <p><i>n.</i> METER must indicate 4.5 ± 1.1.</p> <p><i>o.</i> METER must indicate +0.1 to +2L0. If not, adjust ASCI for zero indication.</p> <p><i>p.</i> None.</p>

c. Test Procedures

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
			<p>q. Algebraically subtract indication in step p above from indication in step o above.</p> <p>r. On discriminator tester, set CIRCUIT SELECTOR to LOAD SENSE. Key transmitter. Read and record METER indication.</p> <p>s. Algebraically subtract indication in step r above from indication in step m above.</p> <p>Repeat steps m through s and adjust the transmitter frequency to 2.0, 8.0, and 29.999 MHz respectively.</p> <p>u. Set the CIRCUIT SELECTOR to REFL POWER and the transmitter frequency to 29.999 MHz. Key the transmitter.</p>	<p>q. Difference between steps p and o above must be one or more METER units greater than above.</p> <p>r. None.</p> <p>s. Difference between steps m and r above must be three or more METER units greater than m above.</p> <p>Same as steps m through s.</p> <p>METER should indicate 0. If not, adjust A8C1 for zero METER indication.</p>

3-25. Operational Test

(fig.3-11)

a. *Test Equipment and Materials.*

- (1) Radio Set AN/ARC-102.
- (2) Test harness.
- (3) Wattmeter.
- (4) Aluminum sheet.
- (5) Grounding straps.
- (6) No. 12 bus wire (2).
- (7) Stopwatch.
- (8) Dummy load.

b. *Test Connections and Conditions.*

- (fig.3-11).
- (1) Locate equipment on aluminum sheet
 - (2) Set power switches on test harness and dummy load to OFF.

(3) Connect W1 from test harness connector 618T-2/3 to P40 on receiver-transmitter.

(4) Connect W7 from test harness NAT. CPLR connector to J 1 on antenna coupler.

(5) Connect RF cable assembly CG-409A/U from J4 on receiver-transmitter to J2 on antenna coupler.

(6) Connect No. 12 bus wire from E102 on antenna coupler to J 101 on wattmeter.

(7) Connect No. 12 bus wire from J102 on wattmeter to J 1 on dummy load.

(8) Connect W2 from test harness DC IN connector to 27.5-volt dc power source.

(9) Connect power cable from test harness AC IN connector to 115-volt 400-Hz power source.

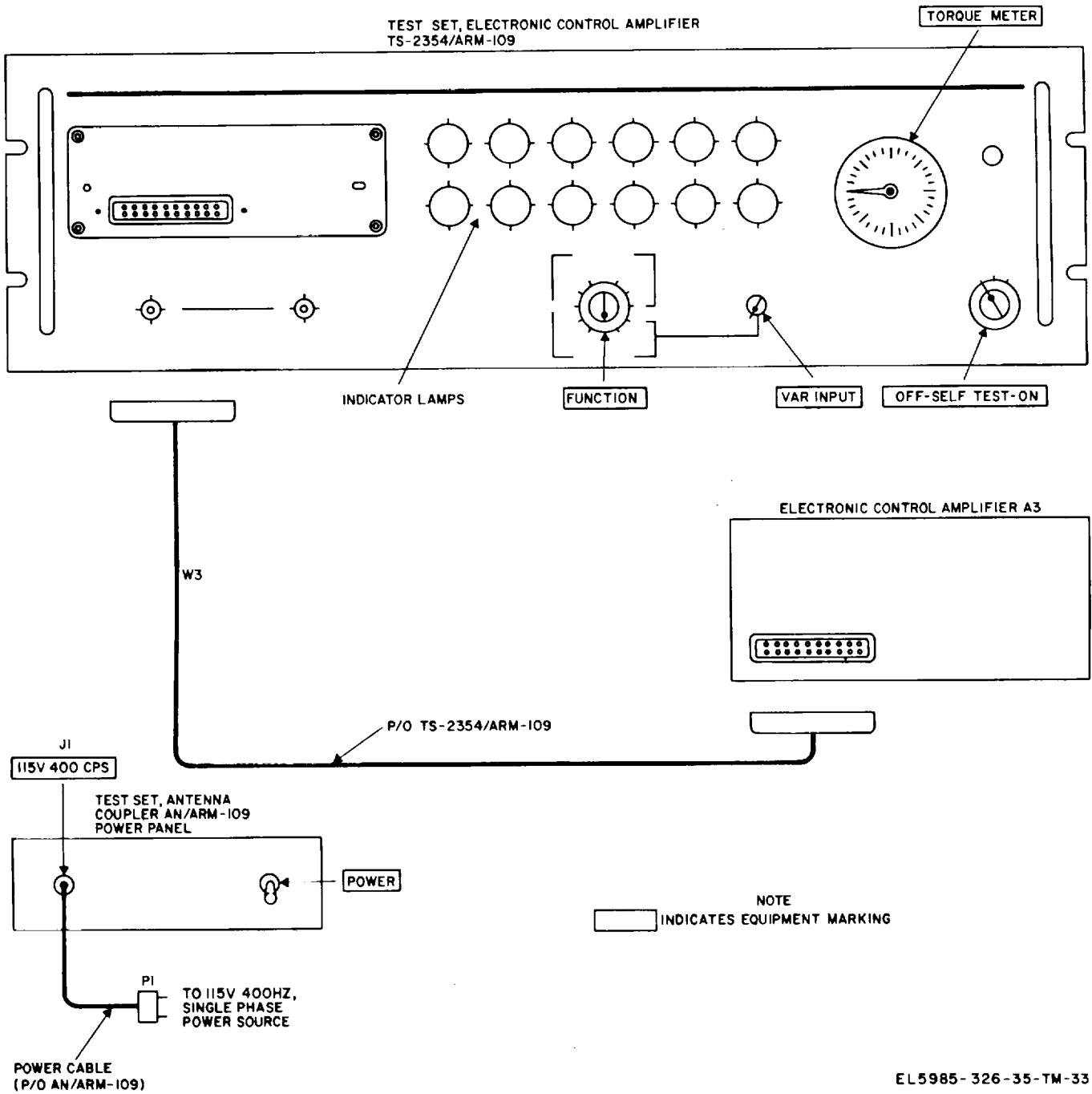
(10) Connect power cable from dummy load connector PI to 115-volt 400-Hz power source.

c. Test Procedures.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	<p><i>Test Harness:</i> AC ON-OFF: OFF DC POWER: OFF 618-2-OFF 618T-3: 618T-3 KEY INTLK-BY PASS-NOR- MAL: NORMAL Mode selector: OFF Frequency select- tor: 2.000 MHz</p>	NA	<p>Warning: Dangerous voltages exist at RF terminals. Be careful.</p> <p>a. Set test harness AC ON-OFF and DC POWER switches to ON.</p> <p>b. Set test harness mode selector switch to AM.</p> <p>c. Set test harness frequency selectors to each frequency listed below. Key transmitter for 1 minute at each frequency. Observe wattmeter reading at each frequency. 2.000 MHz .7560 3.300 MHz 8.500 MHz 14.000 MHz 19.200 MHz 24.200 MHz</p> <p>d Repeat step c above. Observe movement of series varicoil A5, shunt Varicoil A6, shunt capacitor A7, and series capacitor A9.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. Wattmeter must indicate following at each frequency: <i>Forward power:</i> more than 8 watts. <i>Reflected power:</i> less than 10 watts.</p> <p>d Tuning elements can be heard moving to home (table 2-1). Elements must <i>home</i> as follows:</p>

Change 2 3-34.1

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
				<p><i>Series varicoil A5:</i> Minimum inductance. Wiper at same end of coil as motor.</p> <p><i>Shuntvaricoil A6:</i> Maximum inductance. Wiper at coil end opposite motor.</p> <p><i>Shunt capacitor A7:</i> Minimum capacitance. Maximum airgap visible through glass above movable capacitor plate.</p> <p><i>Series capacitor A9:</i> When viewed from right side of coupler, has three visible contacts in front. Rotor contact should barely contact only right contact of three.</p>



EL 5985-326-35-TM-33

Figure 3-9. Control amplifier AS, test setup.

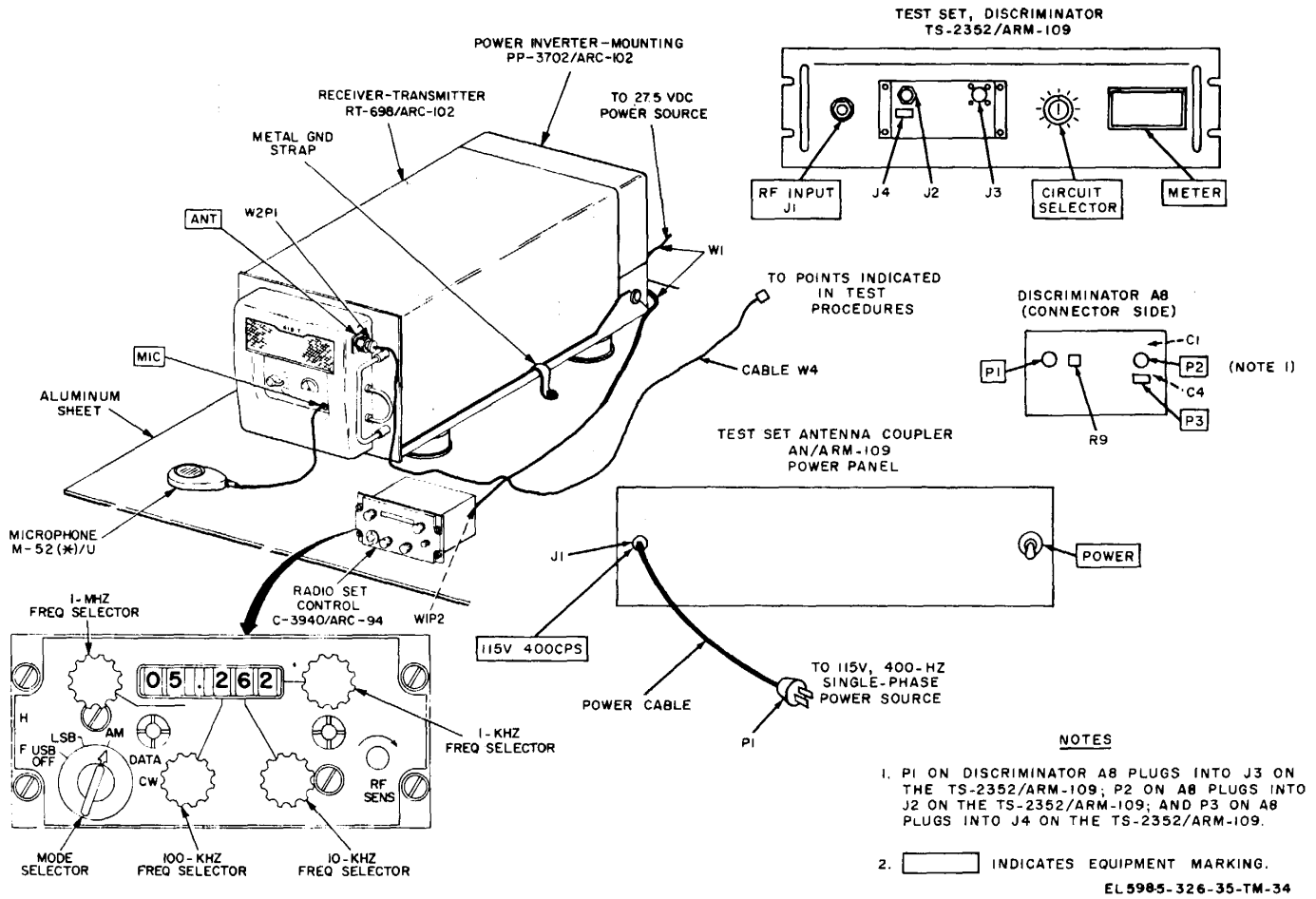


Figure 3-10. Discriminator A8, test setup.

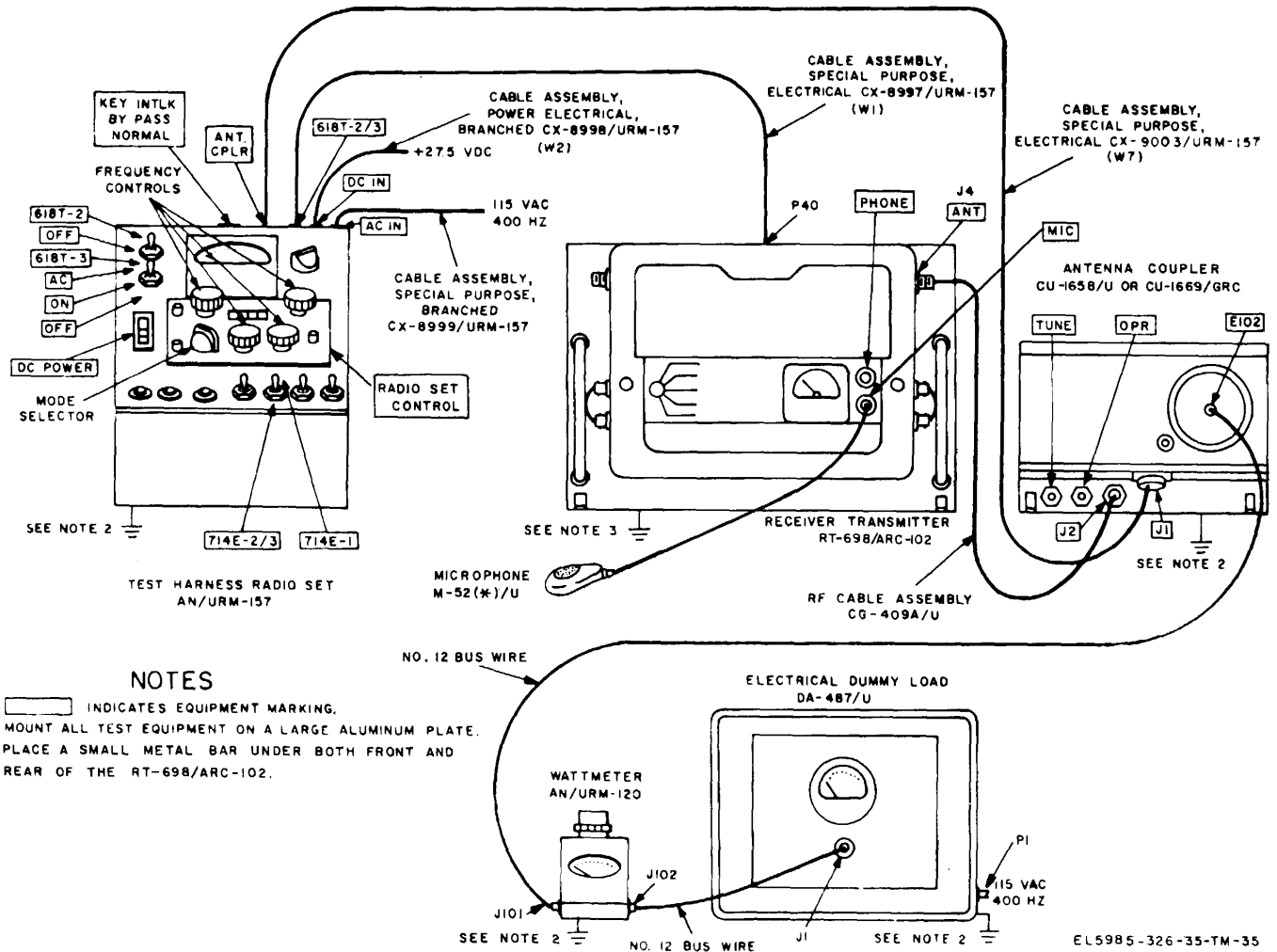


Figure 3-11. Operational test setup.

CHAPTER 4

GENERAL SUPPORT AND DEPOT MAINTENANCE

Section I. GENERAL

4-1. Scope

These procedures supplement direct support maintenance procedures (ch 3). The systematic troubleshooting procedure which begins at the organizational maintenance category, and supplemented by the direct support category, are carried to a higher category in this chapter.

4-2. Purpose

The information in this chapter will help to detect troubles, correct troubles, and check repaired equipment. Preventive maintenance is covered in TM-11-5985-326-20.

a. Detecting Trouble. The troubleshooting charts in section II are designed to locate trouble when modules are connected for bench servicing. Abnormal symptoms are given in the charts listed below.

- (1) Coupler control A2 troubleshooting chart (para 4-10).
- (2) Control amplifier A3 troubleshooting

chart (para 4-11).

(3) Discriminator A8 troubleshooting chart (para 4-12).

b. Correcting Trouble. The following data will help to correct trouble.

(1) Corrective measures in troubleshooting charts.

(2) Adjustment instructions in section III.

(3) Disassembly and reassembly instructions in section IV.

(4) Cleaning, inspection, and repair procedures in section V.

c. Checking Repaired Equipment. Testing procedures are contained in section VI.

4-3. Test Equipment Required

The test equipments required to troubleshoot the antenna coupler are the same as those listed in paragraph 3-2.

Section II. Troubleshooting

4-4. Troubleshooting Data

The following data should be used as required: *a.*

Block Diagrams (figs. 2-1 and 2-2). The block diagrams give a clear picture of equipment functions. By observing the symptoms and by reasoning the possible causes, it is often possible to trace a fault to one block.

b. Cabling Diagrams. The cabling diagrams (TM 11-598.5-326-20) show the external cables of the hf communications system. These diagrams can be used to check these cables.

c. Simplified Schematic Diagrams (figs.2-3 through 2-16). These diagrams are simple and easy to read. They can be found in chapter 2.

d. Parts Location Illustrations (figs.3-1 through 3-7, and 4-4 through 4-13). These figures can be used to locate parts mentioned in troubleshooting charts.

e. Resistor and Capacitor Color Code Diagrams (figs. 6-1 and 6-2). These figures will help to find the values of capacitors and resistors. Ratings and tolerances are also set forth in the figures.

f. Complete Schematic Diagrams (figs.4-1, 4- 2, and 6-3 through 6-8). These figures can be used to find faults in a specific module. See para- graph 1-5d for circuit changes.

g. Wiring Diagrams (figs.6-9 and 6-10).

These figures show the wiring in equipment chassis A1. The figures will help to trace trouble between modules.

h. Voltage Measurements. Paragraph 3-7 gives normal voltages at test points A3TP1 through A3TP11. This data is helpful in tracing troubles in control amplifier A3.

4-5. General Precautions

Observe the following precautions:

- n. Be careful when the dust cover is removed; dangerous voltages are exposed.
- b. Do not overtighten screws.
- c. Always replace lockwashers.
- d. Before a part is unsoldered, note and tag the leads.
- e. Do not damage other leads by pushing or pulling them.
- f. Do not use a large soldering iron.
- g. Do not allow solder to fall into the chassis.
- h. Make well soldered joints.
- i. Do not disturb adjustment settings.

4-6. Parts Substitution

- a. Do not substitute parts indiscriminately. Substitute only when trouble has been isolated to a specific stage.
- b. When an *open* capacitor is suspected, connect a good capacitor of equal value across the capacitor in question. Check the operation of the component.
- c. When all other possibilities of trouble are ruled out, substitute a good part for the one which is suspected of being defective.

4-7. Intermittents

- a. If the operation of a component is intermittently faulty, the trouble may be difficult to locate when the component is functioning normally. Such troubles can often be found by lightly tapping each part in the suspected stage or portion of the component with an insulated rod while watching test equipment indications. Lightly tap all of the parts including transistors and wiring. If the test equipment indications remain normal, repeat the tapping process at adjoining stages until the normal indications change.
- b. Intermittent operation can be caused by loose connections, broken wires, or parts with internal defects. Sometimes intermittent trouble can be located by observing erratic behavior of the antenna coupler indicator lights.

4-8. Transistor Troubleshooting

When troubleshooting, observing the following:

- a. When measuring voltages, use sleeving to insulate the test probe except for the extreme tip.
- b. Check the open circuit voltage across the ohmmeter test leads. Do not use the ohmmeter if the open circuit voltage exceeds 1.5 volt. Do not use the R X 1 scale when testing low power transistors.

c. Any change in the output circuit of one transistor amplifier stage can affect all preceding stages.

d. Common-emitter transistor amplifiers have a 180-degree phase shift between input and output voltages. However, there will be no phase shift if the base is shorted to the collector.

e. The dc base voltage should be slightly higher than the emitter voltage during normal operation of a common-emitter transistor amplifier. However, an open circuit between the base and the emitter will result in the emitter voltage approximating ground potential and a base voltage considerably greater than normal.

f. An unusually high dc collector voltage can be caused by -

- (1) An open emitter circuit.
- (2) An open collector circuit.
- (3) A short between base and emitter.
- (4) An open circuit between base and emitter.

g. An unusually low dc collector voltage indicates a short circuit across the output impedance or between -

- (1) Collector and ground.
- (2) Collector and emitter.
- (3) Collector and base.

h. When +28 volts dc is applied to the base of Q3, Q5, Q6, or Q7 in coupler control A2, the collector voltage should be nearly zero.

i. When checking the base-to-emitter resistance of NPN transistors, the ohmmeter ground must be connected to the emitter lead. The resistance indicated on the R X 1 scale should be greater than 10 ohms, but less than 50 ohms. However, when meter leads are reversed, the emitter-to-base resistance should be several thousand times greater.

j. When unsoldering transistor leads, use long-nosed pliers as a heat sink.

4-9. Isolating Trouble

a. The troubleshooting charts in this section list common malfunctions, their most likely causes, and the corrective action required. The charts do not list all malfunctions that may occur, however they may be used as an aid to diagnose symptoms not listed.

b. The troubleshooting charts supplement the tests given in chapter 3. For the purposes of the troubleshooting charts, it is assumed that all necessary signal inputs are applied to the circuit under test.

4-10. Coupler Control A2 Troubleshooting Chart

CAUTION

Read paragraph 4-18 before removing module components.

- a. *Test Equipment and Materials Required.* See paragraph 3-22a.
- b. *Test Connections and Conditions.* See paragraph 3-22b.
- c. *Procedure.*
(1) Rotate FUNCTION switch through all 12

positions.

- (2) Observe and record lighting sequence of LIGHTS P1 and LIGHTS P2 at each FUNCTION switch position. Refer to table 3-1 for proper lighting sequence.
- (3) When an abnormal sequence is observed, proceed to d below.

NOTE

Table 4-1 shows *normal* condition of relays in various FUNCTION switch positions.
d. *Troubleshooting Chart.*

Item No.	Symptom	Probable Cause	Checks and Corrective Action
1	<p>In FUNCTION position 1</p> <ul style="list-style-type: none"> a. P1-6 green indicator does not light. b. P1-45 green indicator lights c. P1-11 and P2-23 green indicators do not light. d. P1-2, ,P1-32, and P2-27 green indicators light. e. P1-15 green indicator does not light. P1-14 green indicator lights. f. P1-15 green Indicator does not light. P2-17 green indicator lights. n. P1-22 green indicator does not light. Note. Green and amber lights (PI-22) will not match in module above MCN 672 unless the module has been modified to include a wire K5-7 to P1-39. h. P1-22 green indicator does not light. P1-37 green indicator lights. i. P1-22 and P2-7 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light. j. P1-50 green indicator does not light. k. P2-3 green indicator does not light. l. P24 and P2-13 green indicators are brighter than the other lighted indicators. m. iP2-7 and P22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light. n. P2-12 green indicator does not light. o. P2-13 green indicator does not light. p. P2-13 and P2-3 green indicators are brighter than the other lighted indicators. 	<ul style="list-style-type: none"> a. K28 contacts damaged, Q7 not conducting and CR2 open or K3 contacts damaged. b. K3 operated. c. K23 contacts damaged or K23 operated. d. K23 contacts damaged or K23 operated. e. K6 operated or contacts damaged. f. K27 operated or contacts damaged. g. CR60 open. h. K5 restored, K5 contacts damaged, or CR60 open. i. K21 operated or contacts damaged. j. CR99 open, K17 operated, or K17 contacts damaged. k. 1(K4 contacts damaged. l. K4 restored. m. K21 operated, CR105 open, or K6 operated. n. K11 or K23 operated. n. K4 contacts damaged. p. K4 restored. 	<p>Throughout item 1, refer to simplified schematic diagram (fig.6-11). Repair or replace defective parts.</p>

d Troubleshooting Chart.--Continued

Item No.	Symptom	Probable Cause	Checks and Corrective Action
	<p><i>q.</i> P2-14 green indicator does not light.</p> <p><i>r.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>s.</i> P2-25 green indicator lights and P2-19 does not light.</p> <p><i>t.</i> P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>u.</i> P2-28 green indicator does not light.</p>	<p><i>q.</i> K12 contacts damaged or K12 restored.</p> <p><i>r.</i> K11 or K23 operated.</p> <p><i>s.</i> K10 restored or K10 contacts damaged.</p> <p><i>t.</i> K23 operated.</p> <p><i>u.</i> CR33 and CR34 both open.</p>	
2	<p>In FUNCTION position 2</p> <p><i>a.</i> P1-6 green indicator does not light.</p> <p><i>b.</i> P1-45 green indicator Lights.</p> <p><i>c.</i> P1-11 and P2-23 green indicators do not light.</p> <p><i>d.</i> P1-2, P1-32, P2-27 green indicators light.</p> <p><i>e.</i> P1-15 green indicator does not light. P1-4 green indicator does light.</p> <p><i>f.</i> P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p><i>g.</i> P1-22 green indicator does not light. Note. Green and amber lights (P1-22) will not match in modules above MCN 572 unless the module has been modified to include a wire from K5-7 to P1-39.</p> <p><i>h.</i> P1-22 green indicator does not light. P1-37 green indicator lights.</p> <p><i>i.</i> P1-22 and P2-7 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p><i>j.</i> P1-50 green indicator does not light.</p> <p><i>k.</i> P2-3 green indicator does not light.</p> <p><i>l.</i> P2-3 and P2-13 green indicators are very dim.</p> <p><i>m.</i> P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p><i>n.</i> P2-12 green indicator does not light.</p>	<p><i>a.</i> K28 contacts damaged, Q7 not conducting and CR2 open, or K3 contacts damaged.</p> <p><i>b.</i> K3 operated.</p> <p><i>c.</i> K23 contacts damaged or K23 operated.</p> <p><i>d.</i> K23 contacts damaged or K23 operated.</p> <p><i>e.</i> K6 operated or contacts damaged.</p> <p><i>f.</i> K27 operated or contacts damaged.</p> <p><i>g.</i> CR60 open.</p> <p><i>h.</i> K5 restored, K5 contacts damaged, or CR60 open.</p> <p><i>i.</i> 21 operated or contacts damaged.</p> <p><i>j.</i> CR99 open, K17 operated on contacts damaged.</p> <p><i>k.</i> K4 contacts damaged.</p> <p><i>l.</i> K4 operated.</p> <p><i>m.</i> K21 operated, CR105 open, or K6 operated.</p> <p><i>n.</i> K11 or K23 operated.</p>	<p>Note. When the voltage at TP5 on coupler control tester is less than 20 vdc, one diode may be open.</p> <p>Throughout item 2, refer to simplified schematic diagram (fig. 6-12). Repair or replace defective parts.</p>

d Troubleshooting Chart.--Continued

Item No.	Symptom	Probable Cause	Checks and Corrective Action
	<p style="text-align: center;">NOTE</p> <p>In module part number 528-0465-000, MCN 9100 and above, and part number 608-9500-002, green light P2-13 remains off. The * applies to module part number 528-0465-000, MCN 9100 and above, and part number 608-9500-002.</p> <p><i>o.</i> P2-13 green indicator does not light.</p> <p><i>p.</i> P2-13 and P2-3 green indicators are very dim.</p> <p><i>q.</i> P2-14 green indicator does not light</p> <p><i>r.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>s.</i> P2-19 green indicator does not light.</p>	<p><i>o.</i> K4 contacts damaged. *K17 energized</p> <p><i>p.</i> K4 operated. *17 energized.</p> <p><i>q.</i> K12 contacts damaged or K12 restored.</p> <p><i>r.</i> K11orK23operated.</p> <p><i>s.</i> K10 contacts damaged.</p>	

Change 2 4-4.1

Item No.	Symptom	Probable Cause	Checks and Corrective Action
3	<p><i>t.</i> P2-23 and P1-11 green indicators do not light. P1-2, P132, and P2-27 green indicators light.</p> <p><i>u.</i> P2-25 green indicator does not light.</p> <p><i>v.</i> P2-28 green indicator does not light.</p> <p>In FUNCTION position 3 with test set KEY button momentarily pressed:</p> <p><i>a.</i> P1-2, P1-32, P2-21, and P2-27 green indicators do not light. P1-6, P1-111, and P2-23 green indicators light.</p> <p><i>b.</i> P1-22 and P2-7 green indicators do not light.</p> <p><i>c.</i> P1-31 green indicator does not light,</p> <p><i>d.</i> P1-32 green indicator does not light. P1-2, P1-32, P2-21, and P2-27 green indicators do not light.</p> <p><i>e.</i> P1-34 green indicator does not light.</p> <p><i>f.</i> P1-50 green indicator does not light.</p> <p><i>g.</i> P2-3 green indicator does not light. P2-3 and P2-13 green indicators are brighter than other lighted indicators.</p> <p><i>h.</i> P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p><i>i.</i> P2-12 green indicator does not light.</p> <p><i>j.</i> P2-13 green indicator does not light.</p> <p><i>k.</i> P2-13 and P2-3 green indicators are brighter than other lighted indicators.</p> <p><i>l.</i> P2-14 green indicator does not light.</p> <p><i>m.</i> P2-16 green indicator does not light.</p> <p><i>n.</i> P2-16 and P2-26 green indicators do not light.</p> <p><i>o.</i> P2-17 green indicator does not light.</p> <p><i>p.</i> P2-19 green indicator does not light.</p> <p><i>q.</i> P2-21 green indicator does not light.</p> <p><i>r.</i> P2-,22 green indicator does not light.</p> <p><i>s.</i> P2-25 green indicator does not light.</p> <p><i>t.</i> P2-26 and P2-16 green indicators do not light.</p>	<p><i>t.</i> K23 operated.</p> <p><i>u.</i> K10 operated, contacts damaged, or CR16 open.</p> <p><i>v.</i> CR33 and CR34 both open.</p> <p><i>a.</i> K23 restored or K23 contacts damaged.</p> <p><i>b.</i> K21 operated, CR59 open, or K9 restored.</p> <p><i>c.</i> CR81 open, R50 open, K22 restored, or C24 defective.</p> <p><i>d.</i> CR89 open or K23 restored.</p> <p><i>e.</i> K9 restored or K9 contacts damaged.</p> <p><i>f.</i> CR99 open, K17 operated, or contacts damaged.</p> <p><i>g.</i> K4 contacts damaged or K4 restored.</p> <p><i>h.</i> K21 operated, CR105 open or K6 operated.</p> <p><i>i.</i> K11 restored or contacts damaged.</p> <p><i>j.</i> K4 contacts damaged.</p> <p><i>k.</i> K4 restored.</p> <p><i>l.</i> K11 restored.</p> <p><i>m.</i> K28 operated or contacts damaged.</p> <p><i>n.</i> K26 restored or contacts damaged, or K7 contacts damaged.</p> <p><i>o.</i> K27 restored or K27 contacts damaged.</p> <p><i>p.</i> 10 contacts damaged.</p> <p><i>q.</i> CR86 open, or K'23 operating circuit defective.</p> <p><i>r.</i> K22, R74, or C24 is open.</p> <p><i>s.</i> K10 operated, contacts damaged, or CR16 open.</p> <p><i>t.</i> K26 restored, or K26 contacts damaged.</p>	<p>Note. When the voltage at TPS on coupler control tester is less than 20 vdc, one diode may be open.</p> <p>Throughout item 3, refer to simplified schematic diagram (fig. 6-13). Repair or replace defective parts.</p>

Item No.	Symptom	Probable Cause	Checks and Corrective Action
4	<p><i>u.</i> P2 27, P1-2, P1-32, and P2-21 green indicators do not light. P1-6, P1-11, and P2-23 green indicators light.</p> <p><i>v.</i> P2-28 green indicator does not light</p> <p>In FUNCTION position 4 with test set KEY button momentarily pressed:</p> <p><i>a.</i> P1-6 green indicator does not light.</p> <p><i>b.</i> P1-45 green indicator lights</p> <p><i>c.</i> P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>d.</i> P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p><i>e.</i> P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p><i>f.</i> P1-19 green indicator does not light.</p> <p><i>g.</i> P1-22 green indicator does not light.</p> <p><i>h.</i> P1-22 and P2-7 green indicators do not light. P2-34 and p2-35 green indicators light.</p> <p><i>i.</i> P1-37 green indicator does not light.</p> <p><i>j.</i> P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>k.</i> P1-50 green indicator does not light.</p> <p><i>l.</i> P2-3 green indicator does not light.</p> <p><i>m.</i> P2-3 and P2-13 green indicators are brighter than the other lighted indicators.</p> <p><i>n.</i> P2-7 and P1-22 green indicators do not light. P1 - 25, P2-34, and P2-35 green indicators light.</p> <p><i>o.</i> P2-12 green indicator does not light.</p> <p><i>p.</i> P2-13 green indicator does not light.</p> <p><i>q.</i> P2-13 and P2-3 green indicators are brighter than other lighted indicators.</p> <p><i>r.</i> P2-14 green indicator does not light.</p> <p><i>s.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>t.</i> P2-25 green indicator lights, and P2-19 does not light.</p>	<p><i>u.</i> K23 contacts damaged or K23 restored.</p> <p><i>v.</i> CR33 and OR34 both open.</p> <p><i>a.</i> K28 contacts damaged, Q7 not conducting and OR2 open, or K3 contacts damaged.</p> <p><i>b.</i> K3 operated.</p> <p><i>c.</i> K23 contacts damaged or K23 operated.</p> <p><i>d.</i> K6 operated or contacts damaged.</p> <p><i>e.</i> K27 operated or contacts damaged.</p> <p><i>f.</i> CR6 open or K8 restored.</p> <p><i>g.</i> CR60 open.</p> <p><i>h.</i> K21 operated.</p> <p><i>i.</i> 1;5 operated or contacts damaged.</p> <p><i>j.</i> K23 operated or contacts damaged.</p> <p><i>k.</i> CR99 open, K17 operated, or contacts damaged.</p> <p><i>l.</i> Ti4 contacts damaged.</p> <p><i>m.</i> K4 restored.</p> <p><i>n.</i> K21 operated, CR105 open, or K6 operated.</p> <p><i>o.</i> K11 or 1K23 operated.</p> <p><i>p.</i> K14 contacts damaged.</p> <p><i>q.</i> 14 restored.</p> <p><i>r.</i> K12 contacts damaged or K12 restored.</p> <p><i>s.</i> K11 or K23 operated.</p> <p><i>t.</i> K10 restored or K10 contacts damaged.</p>	<p><i>Note.</i> When the voltage at TP5 on coupler control tester is lower than 20 vdc, one diode may be open.</p> <p>Throughout step 4, refer to simplified schematic (fig. 614). Replace or repair defective parts</p>

Item No.	Symptom	Probable Cause	Checks and Corrective Action
5	u. P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.	u. I2.3 operated.	<p>Note. When the voltage at TP5 on coupler control tester is less than 20 vdc, one diode may be open. Throughout item 5, refer to simplified schematic diagram (fig.6-15). Repair or replace defective parts.</p>
	v. P2-28 green indicator does not light	v. CR33 and CR34 open.	
	In FUNCTION position 5		
	a. P1-6 green indicator does not light.	a. K28 contacts damaged, Q7 not conducting and CR2 open, or K3 contacts damaged.	
	b. P1-45 green indicator lights	b. K3 operated.	
	c. P1-11 and P2-23 green indicators do not light.	c. K23 contacts damaged or K23 operated.	
	d. P1-2, P1-32, and P2-27 green indicators light.	d. K23 contacts damaged or K23 operated.	
	e. P1-15 green indicator does not light. P1-4 green indicator lights.	e. K6 operated or contacts damaged.	
	f. P1-15 green indicator does not light. P2-17 green indicator lights.	f. K27 operated or contacts damaged.	
	g. P1-19 green indicator does not light.	g. CR6 open or K8 restored.	
	h. P1-22 green indicator does not light.	h. CR60 open.	
	i. P1-22 and P2-7 green indicators do not light. P2-34 and P2-35 green indicators light.	i. K21 operated.	
	j. P1-25 green indicator does not light.	i. K2 restored or K2 contacts damaged.	
	k. P1-25 and P2-27 green indicators do not light. P1-24 green indicator lights.	k. K24 operated.	
	l. P1-33 green indicator does not light.	l. Q2 not conducting.	
	Note. When the FUNCTION switch is placed in position 5, a slight delay will occur before P1-33 will light.		
	m. P1-37 green indicator does not light.	m. K5 operated or contacts damaged.	
	n. P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.	n. K23 operated or contacts damaged.	
	o. P1-45 green indicator does not light.	o. K3 restored.	
	p. P1-50 green indicator does not light.	p. CR99 open, K17 operated, or contacts damaged.	
q. P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.	q. K21 operated, CR105 open, or K6 operated.		
r. P2-12 green indicator does not light.	r. K111 or K23 operated.		
s. P2-14 green indicator does not light.	s. K12 contacts damaged or K12 restored.		
t. P2-17 green indicator does not light.	t. K25 operated or contacts damaged.		
u. P2-25 green indicator lights and P2-19 does not light.	u. K10 restored or K10 contacts damaged.		

Item No.	Symptom	Probable Cause	Checks and Corrective Action
6	<p>v. P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light</p> <p>w. P2-27 and P1-25 green indicators do not light. P1-34 green indicator lights.</p> <p>x. P2-28 green indicator does not light</p> <p>In FUNCTION position 6</p> <p>a. P1-6 green indicator does not light.</p> <p>b. P1-6 and P2-14 green indicators do not light.</p> <p>c. P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p>d. P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p>e. P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p>f. P1-19 green indicator does not light.</p> <p>g. P1-21 and P1-22 green indicators do not light.</p> <p>h. P1-22 and P1-21 green indicators do not light.</p> <p>i. P1-25 green indicator does not light.</p> <p>j. P1-25 and P2-27 green indicators do not light. P1-24 green indicator lights.</p> <p>k. P1-33 green indicator does not light. Note. When the FUNCTION switch is In position 6, a slight delay will occur before P1-33 will light,</p> <p>l. P1-37 green indicator does not light.</p> <p>m. P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p>n. P1-45 green indicator lamp does not light.</p> <p>o. P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p>p. P2-12 green indicator does not light.</p> <p>q. P2-13 green indicator does not light.</p> <p>r. P2-13 and P2-3 green indicators are brighter than other lighted indicators.</p> <p>s. P2-14 green indicator does not light.</p>	<p>v. K23 operated.</p> <p>w. K24 operated.</p> <p>x. CR33 and CR34 open.</p> <p>a. K28 operated or contacts damaged. replace defective parts.</p> <p>b. Defective K12 operating circuit.</p> <p>c. K23 contacts damaged or K23 operated.</p> <p>d. K6 operated or contacts damaged.</p> <p>e. K27 operated or contacts damaged.</p> <p>f. CR6 open or K8 restored.</p> <p>g. CR57 open.</p> <p>h. CR57 open.</p> <p>i. K2 restored or K2 contacts damaged.</p> <p>j. K24 operated.</p> <p>k. Q2 not conducting.</p> <p>l. K5 operated or contacts damaged.</p> <p>m. K23 operated or contacts damaged.</p> <p>n. K3 restored.</p> <p>o. K21 operated, CR105 open, or K6 operated.</p> <p>p. K11 or K23 operated.</p> <p>q. K4 contacts damaged.</p> <p>r. K4 restored.</p> <p>s. K12 contacts damaged or K12 restored.</p>	<p>Note. When the voltage at TPI on, coupler control tester is less than 20 vdc one diode may be open. Throughout item 6, refer to simplified schematic (fig. 6-16). Repair or</p>

Item No.	Symptom	Probable Cause	Checks and Corrective Action
7	<p><i>t.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>u.</i> P2-17 green indicator does not light.</p> <p><i>v.</i> P2-25 green indicator lights and P2-19 does not light.</p> <p><i>w.</i> P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>x.</i> P2-27 and P1-25 green indicators do not light. P1-24 green indicator lights.</p> <p><i>y.</i> P2-28 green indicator does not light.</p> <p>In FUNCTION position 7</p> <p><i>a.</i> P1-6 green indicator does not light.</p> <p><i>b.</i> P1-6 and P2-14 green indicators do not light.</p> <p><i>c.</i> Voltage across test set jacks P2-20 and P2-30 does not measure 10 to 13 vac. Note. To obtain the above measurement, rotate tester SERIES SERVO control toward minimum until P1-12 green indicator flickers; record voltage; then return SERIES SERVO control to MAX (fully ccw).</p> <p><i>d.</i> P1-12 green indicator does not light.</p> <p><i>e.</i> P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p><i>f.</i> P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p><i>a.</i> P1-19 green indicator does not light.</p> <p><i>h.</i> P1-21 and P1-22 green indicators do not light.</p> <p><i>i.</i> P1-22 and P1-21 green indicators do not light.</p> <p><i>j.</i> P1-25 green indicator does not light.</p> <p><i>k.</i> P1-25 and P12-27 green indicators do not light. P1-24 green indicator lights.</p> <p><i>l.</i> P1-33 green indicator does not light. Note. When the FUNCTION switch is in position 7, a slight delay will occur before P1-33 will light.</p> <p><i>m.</i> P1-37 green indicator does not light.</p> <p><i>n.</i> P1-111, P1-6, and P2-2.3 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p>	<p><i>t.</i> K11 or K23 operated.</p> <p><i>u.</i> K125 operated or contacts damaged.</p> <p><i>v.</i> K10 restored or contacts damaged.</p> <p><i>w.</i> K23 operated.</p> <p><i>x.</i> K24 operated.</p> <p><i>y.</i> CR33 and CR34 open.</p> <p><i>a.</i> K28 operated or contacts damaged.</p> <p><i>b.</i> K12 operating circuit defective.</p> <p><i>c.</i> Series varicoil maximum sense circuit defective.</p> <p><i>d.</i> K16 restored.</p> <p><i>e.</i> K6 operated or contacts damaged.</p> <p><i>f.</i> K27 operated or contacts damaged.</p> <p><i>g.</i> CR6 open or K8 restored.</p> <p><i>h.</i> CR57 open.</p> <p><i>i.</i> CR57 open.</p> <p><i>j.</i> K2 restored or K2 contacts damaged.</p> <p><i>k.</i> K24 operated.</p> <p><i>l.</i> Q2 not conducting.</p> <p><i>m.</i> K5 operated or contacts damaged.</p> <p><i>n.</i> K23 operated or contacts damaged.</p>	<p>Note. When the voltage at TPS on coupler control tester is less than 20 vdc, one diode may be open. Throughout item 7, refer to simplified schematic (fig. 6-17). Repair or replace defective parts.</p>

Item No.	Symptom	Probable Cause	Checks and Corrective Action
	<p>o. P1-45 green indicator does not light.</p> <p>p. P2-3 green indicator does not light.</p> <p>q. P2-3 and P2-13 green indicators dim.</p> <p>r. P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p>s. P2-12 green indicator does not light.</p> <p>t. P2-13 green indicator does not light.</p> <p>u. P2-13 and P2-3 green indicators dim.</p> <p>v. P2-14 green indicator does not light.</p> <p>w. P2-17 green indicator does not light.</p> <p>x. P2-25 green indicator lights and P2-19 does not light.</p> <p>y. P2-23 and P1-11 green indicators do not light. P1J2, P1-32, and P2-27 green indicators light.</p> <p>z. P2-27 and P1-25 green indicators do not light. P1-24 green indicator lights.</p> <p>aa. P2-28 green indicator does not light</p>	<p>o. K3 restored.</p> <p>p. K4 contacts damaged.</p> <p>q. K4 remains operated.</p> <p>r. K21 operated, CR105 open, or K6 operated.</p> <p>s. K11 or K23 operated.</p> <p>t. K4 contacts damaged.</p> <p>u. K4 operated.</p> <p>v. K11 restored.</p> <p>w. K25 operated or contacts damaged.</p> <p>x. K10 restored or K10 contacts damaged.</p> <p>y. K23 operated.</p> <p>z. K24 operated.</p> <p>aa. CR'33 and CR34 open.</p>	
8	<p>In FUNCTION position 8</p> <p>a. P1-6 green indicator does not light.</p> <p>b. Voltage across test set jacks P2-20 and P2-30 does not measure 10 to 13 vac. Note. To obtain the above measurement, rotate tester SERIES SERVO control toward minimum until P1-10 and P1-18 green indicators flicker; record voltage; then return control to MAX (fully cw).</p> <p>c. P1-10 and P1-18 green indicators do not light.</p> <p>d. Voltage across test set jacks P1-13 and P2-36 does not measure 8.45 to 9.45 vac. Note. To obtain the above measurement, rotate tester SHUNT SERVO control toward minimum until relay K1 operates; record voltage; then return control to MAX (fully ew). (Listen for click of relay contacts.)</p> <p>e. P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p>f. P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p>g. P1-15 green indicator does not light. P2-17 green</p>	<p>a. K28 operated or contacts damaged.</p> <p>b. Defective series varicoil minimum sense circuit.</p> <p>c. K13 restored.</p> <p>d. K1 does not operate.</p> <p>e. K23 operated or contacts damaged.</p> <p>f. K6 operated or contacts damaged.</p> <p>g. K27 operated or contacts damaged.</p>	<p>Note. When the voltage at TP6 on coupler control tester is less than 20 vdc, one diode may be open. Throughout item 8, refer to simplified schematic (fig.6-18). Repair or replace defective parts.</p>

indicator lights.

Item No.	Symptom	Probable trouble	Corrective Action
	<p><i>h.</i> P1-18 green indicator does not light.</p> <p><i>i.</i> P1-18 and P1-10 green indicators do not light.</p> <p><i>j.</i> P1-19 green indicator does not light.</p> <p><i>k.</i> P1-21 and P1-22 green indicators do not light.</p> <p><i>l.</i> P1-22 and P1-21 green indicators do not light.</p> <p><i>m.</i> P1-25 green indicator does not light.</p> <p><i>n.</i> P1-25 and P2-27 green indicators do not light. P1-24 green indicator lights.</p> <p><i>o.</i> P1-33 green indicator does not light. <i>Note.</i> When the test set FUNCTION switch is in position 8, a slight delay will occur before P1-33 will light.</p> <p><i>p.</i> P1-37 green indicator does not light.</p> <p><i>q.</i> P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>r.</i> P1-45 green indicator does not light.</p> <p><i>s.</i> P2-3 green indicator does not light.</p> <p><i>t.</i> P2-3 and P2-13 green indicators are dim.</p> <p><i>u.</i> P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p><i>v.</i> P2-12 green indicator does not light.</p> <p><i>w.</i> P2-13 green indicator does not light.</p> <p><i>x.</i> P2-13 and P2-3 green indicators very dim.</p> <p><i>y.</i> P2-14 green indicator does not light</p> <p><i>z.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>aa.</i> P2-17 green indicator does not light.</p> <p><i>ab.</i> P2-25 green indicator lights and P2-19 does not light.</p> <p><i>ac.</i> P-23 and P1-11 green indicators do not light. P1-12, P1-32, and P2-27 green indicators light.</p> <p><i>ad.</i> P2-27 and P1-25 green indicators do not light. P1-2, green indicator lights.</p> <p><i>ae.</i> P2-28 green indicator does not light.</p>	<p><i>h.</i> CR100 open.</p> <p><i>i.</i> K13 restored.</p> <p><i>j.</i> CR6 open or K8 restored.</p> <p><i>k.</i> CR57 open.</p> <p><i>l.</i> CR57 open.</p> <p><i>m.</i> K2 restored or contacts damaged.</p> <p><i>n.</i> K24 operated.</p> <p><i>o.</i> Q2 not conducting.</p> <p><i>p.</i> K5 operated or contacts damaged</p> <p><i>q.</i> K23 operated or contacts damaged.</p> <p><i>r.</i> K3 restored.</p> <p><i>s.</i> K4 contacts damaged.</p> <p><i>t.</i> K4 operated.</p> <p><i>u.</i> K21 operated, CR105 open, or K6 operated.</p> <p><i>v.</i> K11 or K23 operated.</p> <p><i>w.</i> K4 contacts damaged.</p> <p><i>x.</i> K4 remains operated.</p> <p><i>y.</i> K12 contacts damaged or K12 restored.</p> <p><i>z.</i> K12 or K23 operated.</p> <p><i>a.</i> K25 operated or contacts damaged.</p> <p><i>ab.</i> K10 restored or contacts damaged.</p> <p><i>ac.</i> K23 operated.</p> <p><i>ad.</i> K24 operated.</p> <p><i>ae.</i> CR33 and CR34 open.</p>	<p><i>Note.</i> When the voltage at TP6 on coupler control tester is lower than 20 vdc, one diode may be open.</p>

Item No.	Symptom	Probable trouble	Corrective Action
9	<p>In FUNCTION position 9-----</p> <p>a. P1-6 green indicator does not light.</p> <p>b. P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p>c. P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p>d. P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p>e. P1-19 green indicator does not light.</p> <p>f. P1-22 green indicator does not light. P1-34 and P1-35 green indicators light.</p> <p>Note. When the FUNCTION switch is in position 9, a slight delay will occur before P1-22 will light.</p> <p>g. P1-25 green indicator does not light.</p> <p>h. P1-25 and P2-27 green indicators do not light. P1-24 green indicator lights.</p> <p>i. P1-33 green indicator does not light.</p> <p>Note. When the FUNCTION switch is in position 9, a slight delay will occur before P1-33 will light.</p> <p>j. P1-37 green indicator does not light.</p> <p>k. P1-1, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p>l. P1-45 green indicator does not light.</p> <p>m. P2-3 green indicator does not light.</p> <p>n. P2-3 and P2-13 green indicators are brighter than the other lighted indicators.</p> <p>o. P2-7 and P1-22 green indicators do not light. P1-25, P2-34, and P2-35 green indicators light.</p> <p>p. P2-12 green indicator does not light.</p> <p>q. P2-13 green indicator does not light.</p> <p>r. P2-13 and P2-3 green indicators - are brighter than the other lit indicators.</p> <p>s. P2-14 green indicator does not light.</p> <p>t. P2-12 and P2-14 green indicators do not light.</p> <p>u. P2-16 green indicator does not light.</p>	<p>a. K28 operated or contacts damaged. Repair or replace defective parts.</p> <p>b. K23 contacts damaged or K23 operated.</p> <p>c. K6 operated or contacts damaged.</p> <p>d. K27 operated or contacts damaged.</p> <p>e. CR6 open or K8 restored.</p> <p>f. K21 operated.</p> <p>g. K2 restored or contacts damaged.</p> <p>h. K24 operated.</p> <p>i. Q2 not conducting.</p> <p>j. K5 operated or contacts damaged.</p> <p>k. K23 operated or contacts damaged.</p> <p>l. K3 restored.</p> <p>m. K4 contacts damaged.</p> <p>n. K4 restored.</p> <p>o. K21 operated, CR105 open or K6 operated.</p> <p>p. K11 or K23 operated.</p> <p>q. K4 contacts damaged.</p> <p>r. K4 restored.</p> <p>s. K12 contacts damaged or restored.</p> <p>t. K11 or K23 operated.</p> <p>u. K26 operated or K19 restored.</p>	<p>Throughout item 9, refer to simplified schematic diagram (fig. 6-19).</p>

Item No.	Symptom	Probable trouble	Corrective Action
	<ul style="list-style-type: none"> v. P2-16 and P1-6 green indicators do not light. u. P2-17 green indicator does not light. x. P2-19 green indicator does not light. y. P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light. z. P2-25 green indicator does not light. aa. P2-27 and P1-25 green indicators do not light. P1-24 green indicator lights. ab. P2-28 green indicator does not light. 	<ul style="list-style-type: none"> v. K28 contacts damaged. u. K25 operated or contacts damaged. x. K10 contacts damaged. y. K23 operated. z. K10 operated, contacts damaged or CR16 open. aa. K24 operated. ab. CR33 and CR34 open. 	<p><i>Note.</i> When the voltage at TP5 on coupler control tester is less than 20 vdc, one diode may be open.</p>
10	<p>In FUNCTION position 10-----</p> <p><i>Note.</i> Normally, P2-7 green indicator goes off and P1-9 and P2-26 green indicators light after a slight delay.</p> <ul style="list-style-type: none"> a. P1-9, P2-26, 2-34, and P2-35 green indicators do not light. P2-7 green indicator lights. b. P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light. c. P1-15 green indicator does not light. P1-4 green indicator lights. d. P1-15 green indicator does not light. P2-17 green indicator lights. e. P1-19 green indicator does not light. f. P1-22 green indicator does not light. g. P1-25 green indicator does not light. h. P1-25 and P2-27 green indicators do not light. P1-24 green indicator lights. i. P1-33 green indicator does not light. <p><i>Note.</i> When the FUNCTION switch is in position 10, a slight delay will occur before P1-33 will light.</p> <ul style="list-style-type: none"> j. P1-37 green indicator does not light. k. P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light. l. P1-45 green indicator does not light. m. P1-49 green indicator does not light. n. P23 green indicator does not light. 	<ul style="list-style-type: none"> a. Q11, RT3, R6, C29, CR102, C23, or R36 defective. b. K23 contacts damaged or K23 operated. c. K6 operated or contacts damaged. d. K27 operated or contacts damaged. e. CR6 open or K8 restored. f. K14 restored. g. K2 restored or contacts damaged. h. K24 operated. i. Q2 not conducting. j. K5 operated or contacts damaged. k. K23 operated or contacts damaged. l. K3 restored. m. K18 operated or contacts damaged. n. K4 contacts damaged. 	<p>Throughout item 10, refer to simplified schematic diagram (fig. 6-13). Repair or replace defective parts.</p>

Item No.	Symptom	Probable trouble	Corrective Action
	<ul style="list-style-type: none"> o. P2-12 green indicator does not light. p. P2-13 green indicator does not light. q. P2-14 green indicator does not light. r. P2-17 green indicator does not light. s. P2-25 green indicator lights and P2-19 does not light. t. P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light. u. P2-26 green indicator does not light. v. P2-26 and P1-19 green indicators do not light. w. P2-27 and P1-25 green indicators do not light. P1-24 green indicator lights. x. P2-28 green indicator does not light. y. P2-34 and P2-35 green indicators do not light. P2-7 green indicator lights. z. P2-34 and P2-35 green indicators do not light. aa. P2-35 and P2-34 green indicators do not light. P2-7 green indicator lights. ab. P2-35 and P2-34 green indicators do not light. ac. P2-35 green indicator does not light. 	<ul style="list-style-type: none"> o. K11 or K23 operated. p. K4 contacts damaged. q. K12 operated or contacts frozen. r. K25 operated or contacts damaged. s. K10 restored or K10 contacts damaged. t. K23 operated. u. K20 restored. v. K7 restored. w. K24 operated. x. CR33 and CR34 open. y. K21 restored. z. CR79 open. aa. K21 restored or contacts damaged. ab. CR79 open. ac. CR93 open. 	<p><i>Note.</i> When the voltage at TPS on coupler control tester is lower than 20 vdc, one diode may be open.</p>
11	<p>In FUNCTION position 11-----</p> <ul style="list-style-type: none"> a. P1-9, P2-26. P2-34 and P2-35 green indicators do not light. P2-7 green indicator lights. b. P1-11 and P2-23 green indicators do not light. c. P1-15 green indicator does not light. P1-4 green indicator lights. d. P1-22 green indicator does not light. e. P1-24 green indicator does not light. <p><i>Note.</i> Normally, P2-17 goes off and P1-24 lights after a slight delay.</p> <ul style="list-style-type: none"> f. P1-33 green indicator does not light. <p><i>Note.</i> Normally, P1-33 lights after a slight delay.</p> <ul style="list-style-type: none"> g. P1-7 green indicator does not light. h. P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light. i. P2-3 green indicator does not light. 	<ul style="list-style-type: none"> a. Q11, RT3, R6, C29, CR102, C23, or RP36 defective. b. K23 contacts damaged or operated. c. K6G operated or contacts damaged. d. K14 restored. e. CR67 open, CR56 open, K21 or K24 restored. f. Q2 not conducting. g. K5 operated or contacts damaged. h. K23 operated or K23 contacts damaged. i. K4 contacts damaged. 	<p>Throughout item 11 refer to simplified schematic diagram (fig. 6-21). Repair or replace defective parts.</p>

Item No.	Symptom	Probable trouble	Corrective Action
	<p><i>j.</i> P2-3 and P2-13 green indicators brighter than the other lighted indicators.</p> <p><i>k.</i> P2-12 green indicator does not light.</p> <p><i>l.</i> P2-13 green indicator does not light.</p> <p><i>m.</i> P2-13 and P2-3 green indicators are brighter than the other lighted indicators.</p> <p><i>n.</i> P2-14 green indicator does not light.</p> <p><i>o.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>p.</i> P2-16 green indicator does not light.</p> <p><i>q.</i> P2-25 green indicator lights and P2-19 does not light.</p> <p><i>r.</i> P2-4-23 and P1-11 green indicators do not light. P1-2 P1-32,, and P2-27 green indicators light.</p> <p><i>s.</i> P2-28 green indicator does not light</p> <p><i>t.</i> P2-34 and P2-35 green indicators do not light. P2-7 green indicator lights.</p> <p><i>u.</i> P2-34 and P2-35 green indicators do not light.</p> <p><i>v.</i> P2-35 and P2-34 green indicators do not light. P2-7 green indicator lights.</p> <p><i>w.</i> P2-35 and P2-34 green indicator do not light.</p> <p><i>x.</i> P2-35 green indicator does not light.</p>	<p><i>j.</i> K4 restored.</p> <p><i>k.</i> K11 or K23 operated.</p> <p><i>l.</i> K4 contacts damaged.</p> <p><i>m.</i> K4 restored.</p> <p><i>n.</i> K12 contacts damaged or K12 restored.</p> <p><i>o.</i> K 11 or K23 operated.</p> <p><i>p.</i> K28 restored or R82 open.</p> <p><i>q.</i> K10 restored or contacts damaged.</p> <p><i>r.</i> K23 operated.</p> <p><i>s.</i> CR33 and CR34 open.</p> <p><i>t.</i> K21 restored.</p> <p><i>u.</i> CR79 open.</p> <p><i>v.</i> K21 restored or contacts damaged.</p> <p><i>w.</i> CR79 open.</p> <p><i>x.</i> CR93 open.</p>	<p>Note. When the voltage at TP5 on coupler control tester is less than 20 vdc, one diode may be open.</p>
12	<p>In FUNCTION position 12-----</p> <p><i>a.</i> P1-4 amber and green indicators are lighted.</p> <p><i>b.</i> P1-45 green indicator lights</p> <p><i>c.</i> P1-45 green indicator lights</p> <p><i>d.</i> P1-11 and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>e.</i> P1-15 green indicator does not light. P1-4 green indicator lights.</p> <p><i>f.</i> P1-15 green indicator does not light. P2-17 green indicator lights.</p> <p><i>g.</i> P1-24 green indicator does not light.</p> <p>Note. Normally, P2-17 goes off and P1-24 lights after a slight delay.</p> <p><i>h.</i> P1-33 green indicator does not light.</p> <p>Note. Normally, P1-33 green indicator lights after a slight delay.</p>	<p><i>a.</i> Defective fault circuit: K6, Q4, C6, R18, RT10, CR84, R15, C5, R14, CR103, R32, C37, or CR85 defective.</p> <p><i>b.</i> 1K28 contacts damaged, Q7 not conducting, CR2 open or K3 contacts damaged.</p> <p><i>c.</i> K3 operated.</p> <p><i>d.</i> K23 contacts damaged or K23 operated.</p> <p><i>e.</i> K6 operated or contacts damaged.</p> <p><i>f.</i> K27 operated or contacts damaged.</p> <p><i>g.</i> CR67 open, CR56 open, K21 restored, or K24 restored.</p> <p><i>h.</i> Q2 not conducting.</p>	<p>Throughout item 12, refer to simplified schematic diagram (fig 6-22). Repair or replace defective parts.</p>

Item No.	Symptom	Probable trouble	Corrective Action
	<p><i>i.</i> P1-37 green indicator does not light.</p> <p><i>j.</i> P1-11, P1-6, and P2-23 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>k.</i> P1-50 green indicator does not light.</p> <p><i>l.</i> P2-12 green indicator does not light.</p> <p><i>m.</i> P2-14 green indicator does not light.</p> <p><i>n.</i> P2-12 and P2-14 green indicators do not light.</p> <p><i>o.</i> P2-19 green indicator does not light.</p> <p><i>p.</i> P2-23 and P1-11 green indicators do not light. P1-2, P1-32, and P2-27 green indicators light.</p> <p><i>q.</i> P2-28 green indicator does not light.</p> <p><i>r.</i> P2-34 and P24 green indicators do not light. P2-7 green indicator lights.</p> <p><i>s.</i> P2-34 and P2-35 green indicators do not light.</p> <p><i>t.</i> P2-35 and P2-34 green indicators do not light. P2-7 green indicator lights.</p> <p><i>u.</i> P2-35 and P2-34 green indicators do not light.</p> <p><i>v.</i> P2-35 green indicator does not light.</p> <p><i>w.</i> When the test set KEY button is pressed, P1-4 green indicator does not light within 8 to 10 seconds.</p>	<p><i>i.</i> K5 operated or contacts damaged.</p> <p><i>j.</i> K23 operated or contacts damaged.</p> <p><i>k.</i> CR99 open, K17 operated or contacts damaged.</p> <p><i>l.</i> K11 or K23 operated.</p> <p><i>m.</i> K12 contacts damaged or K12 restored.</p> <p><i>n.</i> K11 or K23 operated.</p> <p><i>o.</i> K10 contacts damaged.</p> <p><i>p.</i> K23 operated.</p> <p><i>q.</i> CR33 and CR34 open.</p> <p><i>r.</i> K21 restored.</p> <p><i>s.</i> CR79 open.</p> <p><i>t.</i> K21 restored or damaged contacts.</p> <p><i>u.</i> CR79 open.</p> <p><i>v.</i> CR93 open.</p> <p><i>w.</i> Defective fault circuits: K6, Q4, C6, R18, RT10, CR84, R15, C5, R14, CR103, R32, C37, or CR85 defective.</p>	<p><i>Note.</i> When the voltage at TP5 on coupler control tester is less than 20 vdc, one diode may be open.</p>

Table 4-1. Relay Operations

TS 2353/ARM-109 FUNCTION SWITCH position	Relay																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
1				X	X				X		X													X	X			
2						X			X		X													X	X			
3				X	X				X		X													X	X			
3 (Key)				X					X		X											X	X	X	X	X	X	
4				X						X		X												X	X			
4 (Key)				X			X	X		X		X												X	X			
5	X	X	X	X			X	X		X		X																
6	X	X	X	X			X	X		X		X						X										
7 (Series svo pot. min)		X	X				X	X		X		X						X										
7 (Both svo pot. max)	X		X				X	X		X		X				X	X											
8 (Both svo pot. max)		X	X				X	X		X		X	X					X										
8 (Series svo pot. min)		X	X							X		X						X										
8 (Shunt svo pot. min)	X	X	X				X	X		X		X	X					X										
9	X	X	X	X			X	X			X							X	X	X								
10		X	X	X			X	X		X				X	X			X	X	X	X	X						X
11				X						X		X		X	X			X	X	X	X	X			X		X	X
12				X						X		X			X			X	X	X	X	X			X	X		
12 (Key)	X	X	X			X	X	X		X		X			X	X	X	X	X	X	X	X						
	*0	*0	*0			X 8 thru 10's	*0	*0							*0			X	X	X	X	X			*0	*0		

X-Relay operated. Blank indicates relay restored.

*Additional relay conditions for modules part number 528-0465-000 mcn 9100 and above part number 608-9500-002; X = energized; 0 = deenergized.

Change 2 4-17

4-11. Control Amplifier A3 Troubleshooting Chart

CAUTION

Read paragraph 4-19 or 4-20 as applicable before removing module parts.

- a. *Test Equipment and Material Required.* See paragraph 3-23a.
- b. *Test Connections and Conditions.* See paragraph 3-23b.
- c. *Procedure.*
 - (1) Rotate the FUNCTION switch through all

the positions. Position 6 is not used.

(2) Observe and record the lighting sequence of the tester lamps and TORQUE METER indication at each position.

(3) Refer to table 3-2 for normal indications. When an abnormal symptom is observed, proceed to *d* below.

NOTE

Table 4-2 shows TORQUE METER normal indications when amplifier tester input voltage and frequency varies from 115 volts, 400 Hz.

d. *Troubleshooting Chart (part number 775-4276-001).*

Item No.	Symptom	Probable trouble	Corrective Action
1	In FUNCTION position 1 .....	.....	Throughout item 1, refer to schematic diagram (fig. 6-3 or 6-4 as applicable).
	a. TORQUE METER does not indicate 0.33 to 0.43	a. Q4 through Q9 defective.....	a. Troubleshoot transistors (para 4-8).
	b. Green 24 lamp does not light. Green 8 lamp lights.	b. K1 operated	b. Replace K1.
	c. Green 24 lamp does not light. Green 23 lamp lights.	c. K2 operated	c. Replace K2.
2	d. No green lamps light.....	d. K1 and K2 operated	d. Replace K1 and K2.
	In FUNCTION position 2 .....	.....	Throughout item 2, refer to schematic diagram (fig. 6-4).
	a. TORQUE METER does not indicate 0.05 to 0.09.	a. Q4 through Q9 defective.....	a. Troubleshoot transistors (para 4-8).
	b. TORQUE METER indicates zero.	b. K5 restored	b. Replace K5.
3	c. Green 24 lamp does not light. Green 8 lamp lights.	c. K1 operated	c. Replace K1.
	d. Green 24 lamp does not light. Green 23 lamp lights.	d. K2 operated	d. Replace K2.
	e. No green lamps light.	e. K1 and K2 operated	e. Replace K1 and K2.
	In FUNCTION position 3 .....	.....	Throughout item 3, refer to diagram (fig. 6-4).
4	a. TORQUE METER does not indicate 0.41 to 0.49.	a. Q4 through Q9 defective	a. Troubleshoot transistors (para 4-8).
	b. TORQUE METER indicates zero.	b. K5 restored	b. Replace K5.
	c. Green lamp 8 does not light. Green 24 lamp lights.	c. (1) CR2 open.	c. (1) Replace CR2.
		(2) Q1 open.	(2) Replace Q2.
		(3) Defective Q1 gate circuit.	(3) Check T1, R1, R2, R3, C1, R4, C2, CR1, and RT1. Replace faulty component(s).
	(4) CR23 open.	(4) Replace CR23.	
	(5) CR7 open.	(5) Replace CR7.	
(6) K2 remains operated.	(6) Replace K2.		
(7) K1 coil open.	(7) Replace K1.		
d. Green 16 lamp does not light.	d. K2 restored.	d. Replace K2.	
In FUNCTION position 4 .....	.....	Throughout item 4, refer to schematic diagram (fig. 6-4).	
a. TORQUE METER does not indicate 0.26 to 0.34.	a. Q4 through Q9 defective	a. Troubleshoot transistors (para 4-8)	
	b. TORQUE METER indicates zero.	b. K5 restored	b. Replace K5.
	c. Green 8 lamp does not light. Green 24 lamp lights.	c. K1 restored	c. Replace K.1.
	d. Green lamp 28 does not light.	d. K3 restored	d. Replace K3.

d. Troubleshooting Chart (part number 775-4276-001)-Continued

Item No.	Symptom	Probable trouble	Corrective Action
5	<p>In FUNCTION position 5</p> <p>a. TORQUE METER does not indicate 0 + 0.03.</p> <p>b. Green 8 lamp does not light. Green 24 lamp lights.</p> <p>c. Green 16 amp does not light.</p> <p>NOTE FUNCTION position 6 is not used. Proceed to item 7.</p>	<p>a. Q4 through Q9.....</p> <p>b. Defective K1</p> <p>c. CR13 open.....</p>	<p>Throughout item 5, refer to schematic diagram (fig. 6-4).</p> <p>a. Troubleshoot transistors (para 4-8).</p> <p>b. Replace K1.</p> <p>c. Replace CR13.</p>
7	<p>In FUNCTION position 7</p> <p>a. TORQUE METER does not indicate 0.59 to 0.67.</p> <p>b. Green 24 lamp does not light. Green 23 lamp lights.</p>	<p>a. Q11 through Q16 defective</p> <p>b. (1) K2 operated. (2) Q2 anode to cathode shorted.</p>	<p>Throughout item 7, refer to schematic diagram (fig. 6-3).</p> <p>a. Troubleshoot transistors (para 4-8).</p> <p>b. (1) Replace K2. (2) Replace Q2.</p>
8	<p>In FUNCTION position 8</p> <p>a. TORQUE METER does not indicate 0 ± 0.03</p> <p>b. Green 24 lamp does not light. Green 23 lamp lights.</p> <p>c. Green 27 lamp does not light.</p>	<p>a. Q11 through Q16 defective.....</p> <p>b. (1) K2 operated. (2) Q2 anode to cathode shorted.</p> <p>c. CR10 open.....</p>	<p>Throughout item 8, refer to schematic diagram (fig. 6-4).</p> <p>a. Troubleshoot transistors (para 4-8).</p> <p>b. (1) Replace K2. (2) Replace Q2.</p> <p>c. Replace CR10.</p>
9	<p>In FUNCTION position 9</p> <p>a. TORQUE METER does not indicate 0.12 to 0.16.</p> <p>b. TORQUE METER indicates zero.</p> <p>c. Green 23 lamp does not light. Green 24 lamp lights.</p> <p>d. Green 23 lamp does not light. Green 8 lamp lights.</p> <p>e. Green 27 lamp is not matched with amber 27 lamp (both lamps not lighted).</p>	<p>a. Q11 through Q16 defective.....</p> <p>b. K5 remains in operated position.....</p> <p>c. (1) K2 coil open. (2) Q2 open. (3) Defective Q2 gate circuit.</p> <p>(4) CR8 open. (5) CR9 open.</p> <p>d. (1) Defective K1. (2) Q1 anode to cathode shorted.</p> <p>e. CR10 open</p>	<p>Throughout item 9, refer to schematic diagram (fig. 6-4).</p> <p>a. Troubleshoot transistors (para 4-8).</p> <p>b. Replace K5.</p> <p>c. (1) Replace K2. (2) Replace Q2. (3) Check T2, R8, R7, R6, C4, R5, C3, CR4, and RT2. Replace faulty component(s). (4) Replace CR8. (5) Replace CR9.</p> <p>d. (1) Replace K1. (2) Replace Q1.</p> <p>e. Replace CR10.</p>
10	<p>In FUNCTION position 10 with tester... VAR INPUT switch set to SAT:</p> <p>a. TORQUE METER indication is out of tolerance.</p> <p>NOTE On control amplifier A3 modules MCN 1 through 1543 inclusive, TORQUE METER should indicate to ± 0.3 (starting indication) to not less than 0.62.</p> <p>b. Green 23 lamp does not light.</p>	<p>a. Q4 through Q9 defective.....</p> <p>b. Defective K2</p>	<p>Throughout item 10, refer to schematic diagram (fig. 6-4).</p> <p>a. Troubleshoot transistors (para 4-8).</p> <p>b. Replace K2.</p>
11	<p>In FUNCTION position 11 with tester... VAR INPUT switch set to SAT:</p> <p>TORQUE METER indication is out of tolerance.</p> <p>NOTE On control amplifier A3 modules MCN 1 through 1543 inclusive, the TORQUE METER should indicate 0 ± 0.3 (starting indication) to not less than 0.55.</p>	<p>Q11 through Q16 defective.....</p>	<p>Throughout item 11, refer schematic diagram (fig. 6-4).</p> <p>Troubleshoot transistors (para 4-8).</p>

e. Troubleshooting Chart (Part number 528-0467-000).

Item No.	Symptom	Probable trouble	Corrective Action
1	In FUNCTION position 1 NOTE Disregard 27 lamp for this step. a. TORQUE METER does not indicate 0.28 to 0.50. b. Green 24 lamp does not light. Green lamp 8 lights. c. Green 24 lamp does not light. Green 23 lamp lights. d. No green lamps light.	..... a. Q1 through Q6 defective..... b. K4 operated c. K5 operated. d. K4 and K5 operated	Throughout item 1, refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8). b. Replace K4. c. Replace K5. d. Replace K4 and K5.
2	In FUNCTION position 2 NOTE Disregard lamp 27 for this step. a. TORQUE METER does not indicate 0.12 to 0.16. b. No TORQUE METER indication. c. Green 24 indicator not lighted. 8 green indicator lighted. d. Green 24 indicator not lighted, Green 23 indicator lighted. e. No green lamp lighted.	..... a. Q1 through Q6 defective b. K1 restored c. K4 operated or Q14 anode-to-cathode short d. K operated e. K4 and K5 operated	Throughout item 2 refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8). b. Replace K1. c. Replace K4 or replace Q14. d Replace K5. e. Replace K4 and K5.
3	In FUNCTION position 3 NOTE Disregard 27 lamp for this step. a. TORQUE METER does not indicate 0.46 to 0.58. b. No TORQUE METER indication. c. Green 8 lamp not lighted. Green 24 lamps lighted. d. Green 16 lamp not lighted.	..... a. Q1 through Q6 defective b. K1 restored c. K4 Restored K5 operated d. K2 restored	Throughout item 3, refer to schematic diagram (fig. 6-4). a Troubleshoot transistors (para 4-8). b. Replace K1. c. Replace K4. Replace K5. d. Replace K2.
4	In FUNCTION position 4 a. TORQUE METER does not indicate 0.29 to 0.37. b. No TORQUE METER indication. c. Green 8 lamp not lighted. Green 24 lamp lighted. d. Green 28 lamp not lighted.	..... a. Q1 through Q6 defective b. K1 restored c. K4 restored d. K3 restored	Throughout item 4 refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8). b. Replace K1. c. Replace K4. d. Replace K3.
5	In FUNCTION position 5 a. Green 8 lamp not lighted. Green 24 lamps lighted. b. Green 16 indicator not lighted.	..... a. K4 restored b. CR3 open	Throughout item 5, refer to schematic diagram (fig. 6-4). a. Replace K4. b. Replace CR3.
6	In FUNCTION position 7 a. TORQUE METER does not indicate 0.48 to 0.62 b. Green 24 indicator not lighted. Green 23 indicator lighted.	..... a. Q7 through Q12 defective..... b. K5 restored or Q13 anode-to-cathode short	Throughout item 7, refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8). b. Replace K5 or Q13.
7	In FUNCTION position 8 a. Green 27 indicator not lighted.	..... a. CR19 open	Throughout item 8, refer to schematic diagram (fig. 6-4). a. Replace CR19.
8	In FUNCTION position 9 a. TORQUE METER does not indicate 0.14 to 0.20. b. No TORQUE METER indication.	..... a. Q7 through Q12 defective b. K1 restored	Throughout item 8, refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8). b. Replace K1.

e. Troubleshooting Chart (Part number 528-0467-000).--Continued

Item No.	Symptom	Probable trouble	Corrective Action
9	c. Green 23 lamp not lighted. Green 24 indicator lighted. d. Green 23 lamp not lighted. Green 8 lamps lighted. e. Green 27 lamp does not light. In FUNCTION position 10 with VAR INPUT switch to SAT	c. K5 restored	c. Replace K5.
		d. K4 restored	d. Replace K4.
10		e. CR19 open	e. Replace CR19.
	a. TORQUE METER does not read 0 ± 0.03 (starting indication) To not less than 0.50. b. Green 23 lamp does not light. In FUNCTION position 11 with VAR INPUT switch to SAT.....	a. Q1 through Q6 defective	Throughout item 9 refer to schematic diagram (fig 6-4). a. Troubleshoot transistors (para 4-8).
		b. K5 restored.	b. Replace K5.
	a. TORQUE METER does not read 0 ± 0.03 (starting indication) to not less than 0.50.	a. Q7 through Q12 defective.....	Throughout item 10, refer to schematic diagram (fig. 6-4). a. Troubleshoot transistors (para 4-8)

Table 4-2. TORQUE METER Indications

Line voltage	Self-test	FUNCTION selector switch positions								Saturation 10 or 11
		1	2	3	4	5	7	8	9	
Line frequency = 390 Hz										
105	.29-.39	.26-.49	.10-.17	.35-.52	.26-.39	*	.34-.54	*	.12-.21	**NLT .39
110	.33-.43	.29-.51	.11-.18	.38-.55	.28-.40	*	.38-.58	*	.13-.22	**NLT .44
115	.37-.47	.31-.53	.12-.18	.41-.58	.30-.42	*	.42-.62	*	.13-.22	**NLT .48
120	.41-.51	.34-.56	.12-.19	.44-.61	.32-.44	*	.46-.67	*	.14-.23	**NLT .52
125	.45-.55	.36-.58	.13-.20	.47-.64	.34-.46	*	.51-.71	*	.14-.24	**NLT .56
Line frequency = 400 Hz										
105	.27-.37	.23-.46	.09-.16	.32-.49	.23-.36	*	.32-.52	*	.12-.20	**NLT .36
110	.31-.41	.26-.48	.10-.17	.35-.52	.25-.37	*	.36-.56	*	.13-.21	**NLT .41
115	.35-.45	.28-.50	.11-.17	.38-.55	.27-.39	*	.40-.60	*	.13-.21	**NLT .45
120	.39-.49	.31-.53	.11-.18	.41-.58	.29-.41	*	.44-.65	*	.14-.22	**NLT .49
125	.43-.53	.33-.55	.12-.19	.44-.61	.31-.43	*	.49-.69	*	.14-.22	**NLT .53
Line frequency = 410 Hz										
105	.25-.35	.20-.43	.08-.15	.29-.46	.20-.33	*	.30-.50	*	.11-.20	**NLT .33
110	.29-.39	.23-.45	.09-.16	.32-.49	.22-.34	*	.34-.54	*	.12-.21	**NLT .38
115	.33-.43	.25-.47	.10-.16	.35-.52	.24-.36	*	.38-.58	*	.12-.21	**NLT .42
120	.37-.47	.28-.50	.10-.17	.38-.55	.26-.38	*	.42-.63	*	.13-.22	**NLT .46
125	.41-.51	.30-.52	.11-.18	.41-.58	.28-.40	*	.47-.67	*	.13-.22	**NLT .50

*TORQUE METER cannot be read accurately between the line units. Positions 5 and 8 should read 0 ± 0.05 maximum without regard to input voltage and frequency.

**NLT indicates not less than.

4-12. Discriminator A8 Troubleshooting

CAUTION

Read paragraph 4-25 before removing module parts.

a. Test Equipment and Materials Required. See paragraph 3-24a.

b. Test Connections and Conditions. See paragraph 3-24b.

c. Procedure.

(1) Perform discriminator A8 test (para 3-24).

(2) When abnormal symptom is observed, proceed to d below. Enter *Symptom* column and locate description of abnormal condition. Then, refer to *Corrective action* column for isolation procedure. Refer to figure 4-1 for complete schematic.

d. Troubleshooting Chart.

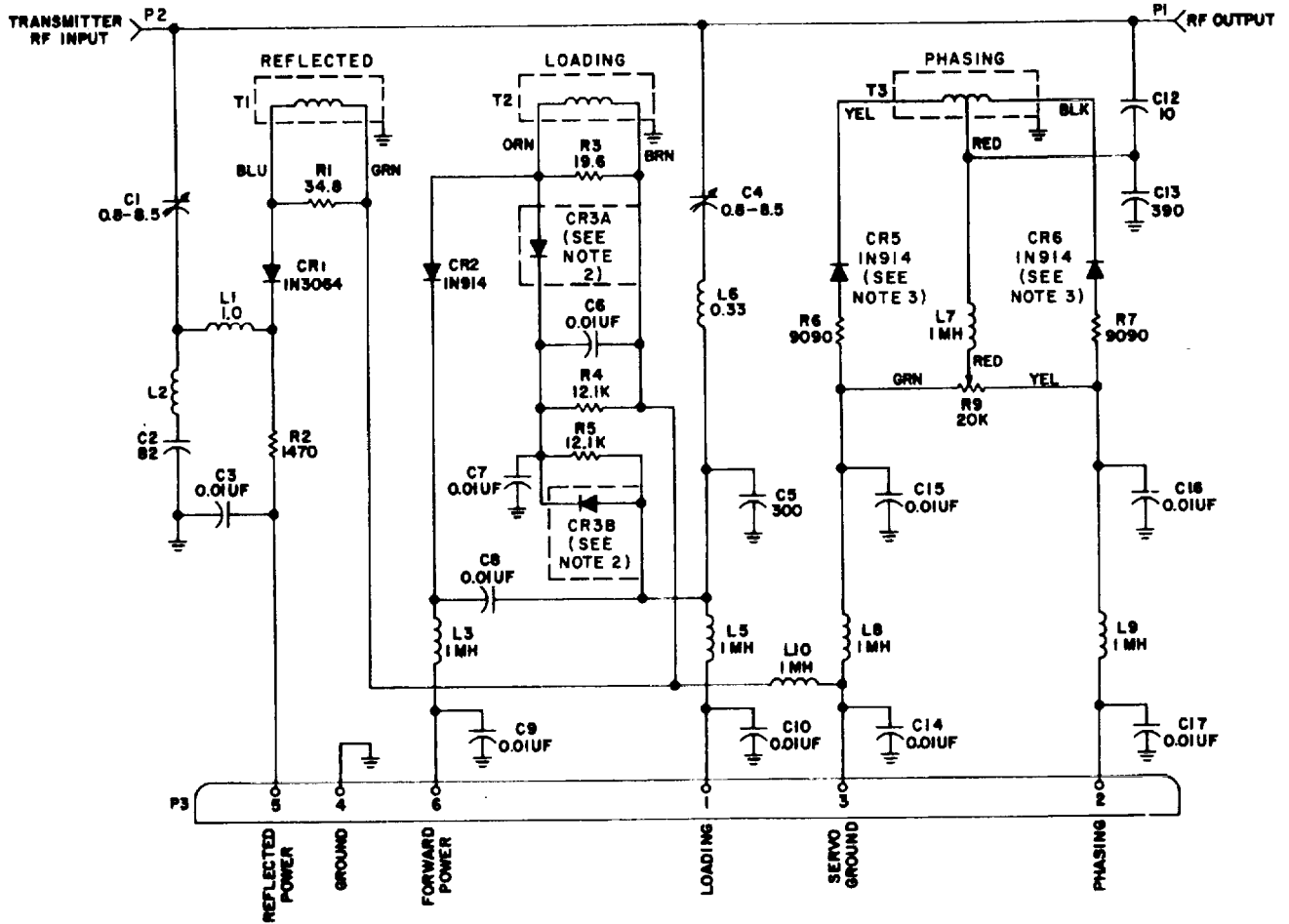
Item No.	Symptom	Probable trouble	Corrective Action
1	METER indication abnormal in- a. Step 1f, para 3-24 b. Step 1h, para 3-24 c. Step 1j, para 3-24 d. Step 1/para 3-24	a. Defective phasing circuits b. Same as a c. Same as a d. Same as a	a. Refer to fig. 2-8. Check components. Repair or replace defective component(s). b Same as a. c. Same as a. d. Same as a.
2	METER indication abnormal in step 1n, para 3-24.	Defective forward power circuits	Refer to fig. 2-10. Check components. Repair or replace defective component(s).
3	METER indication abnormal in step 1q, para 3-24.	Defective reflected power circuits	Refer to fig. 2-11. Check components. Repair or replace defective components.
4	METER indication abnormal in step is, para 3-24.	Defective loading circuits	Refer to fig. 2-9. Check components. Repair or replace defective components.

4-13. Tuning Elements Troubleshooting

- a. The tuning elements are-
- (1) Step coil A4 (fig. 2-4, 4-1.1 and 4-1.2).
 - (2) Series varicoil A5 (fig. 2-15 and 4-2).
 - (3) Shunt varicoil A6 (fig. 2-15 and 4-2).
 - (4) Shunt capacitor A7 (fig. 2-5, 4-2.1 and 4-2.2).
 - (5) Series capacitor A9 (fig. 2-6 and 4-2.3).

b. Troubleshooting procedures are limited when used with tuning elements due to their mechanical design. Normally, a visual inspection for mechanical damage or excessive wear will locate troubles. Clean, inspect, and repair as set froth in section V. Disassembly and reassembly instructions are given in section IV.

Change 2 4-22



NOTES:

1. UNLESS OTHERWISE INDICATED, ALL RESISTANCE VALUES ARE IN OHMS, ALL CAPACITANCE VALUES ARE IN PICOFARADS, AND ALL INDUCTANCE VALUES ARE IN MICRONHENRYS.
2. CR3A AND CR3B ARE A MATCHED PAIR, TYPE IN914 MATCHED BY PRODUCTION FOR CALIBRATION PURPOSES.
3. CR5 AND CR6 ARE A MATCHED PAIR, TYPE IN914 MATCHED BY PRODUCTION FOR CALIBRATION PURPOSES.

EL8DB015

Figure 4-1. Discriminator A8, Schematic Diagram.

Change 2 4-23

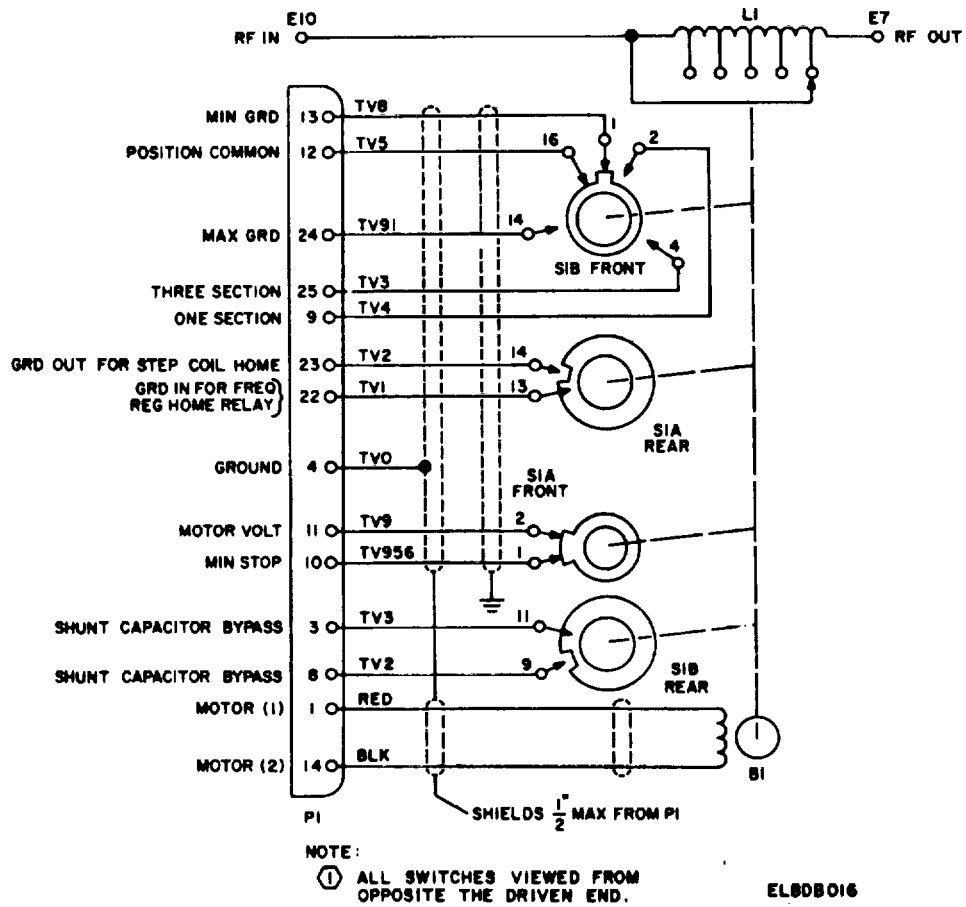


Figure 4-1.1. Step Coil A4, (Part Number 528-0524-000), Schematic Diagram.

Change 2 4-24

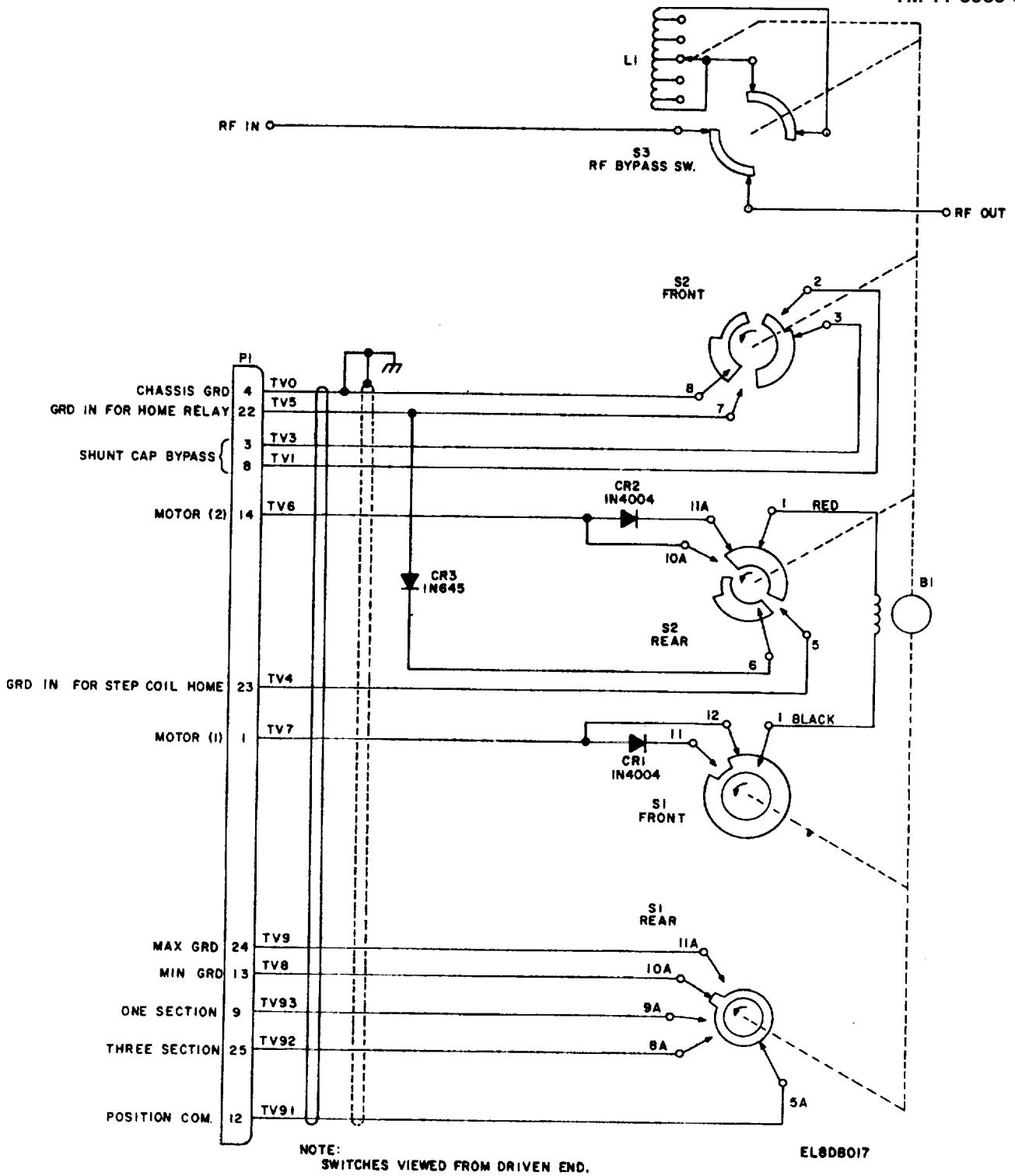
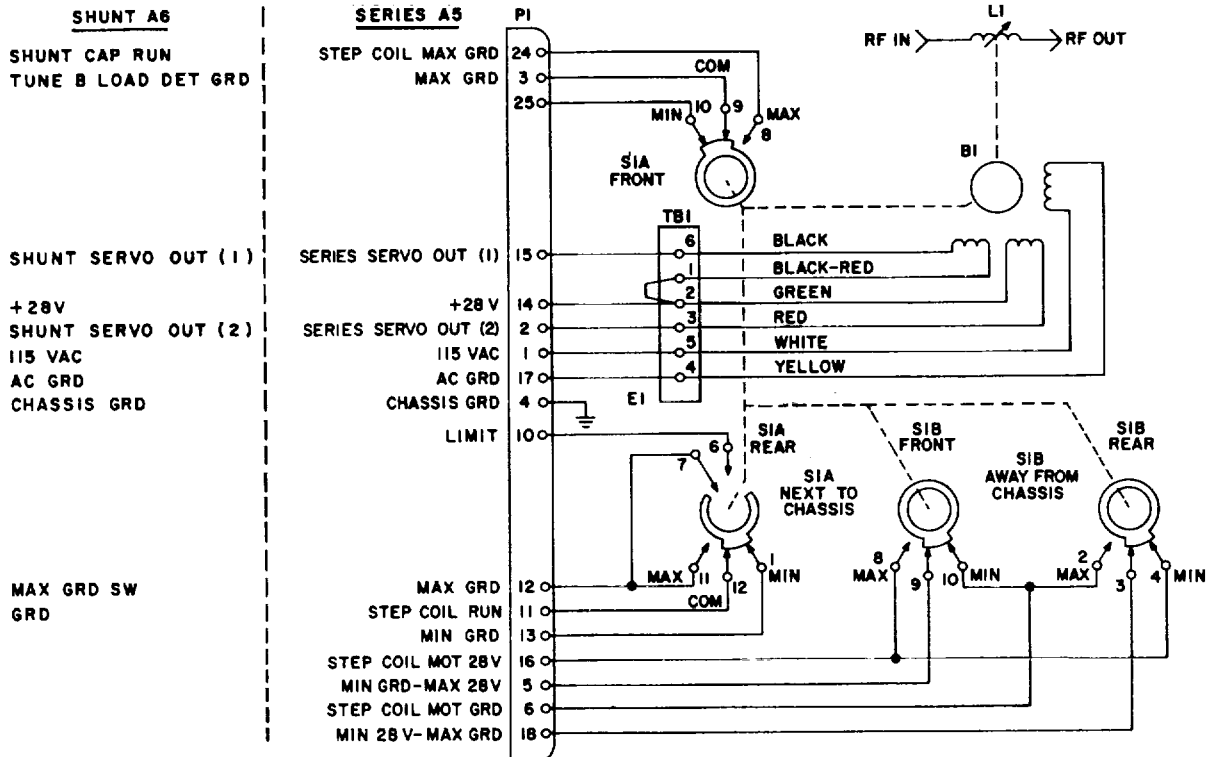


Figure 4-1.2. Step Coil A4, (Part Number 777-3508-001), Schematic Diagram.

Change 2 4-25



- NOTES:
1. ALL SWITCHES VIEWED FROM DRIVEN END.
 2. VARICOILS A5 AND A6 ARE BASICALLY THE SAME EXCEPT SWITCH SIB IS NOT IN A6.
 3. PREFIX REFERENCE DESIGNATORS WITH A5 FOR THE SERIES VARICOIL, AND WITH A6 FOR THE SHUNT VARICOIL.

EL5985-326-35-TM-17

Figure 4-2. Series A5 and Shunt A6 Varicoils, Schematic Diagram.

Section III. ADJUSTMENTS

4-14. Discriminator A8 Adjustments

To adjust discriminator A8, perform the test outlined in paragraph 3-24. During this test, the following are adjusted:

- a. Variable resistor A8R9.
- b. Variable capacitor A8C4.
- c. Variable capacitor A8C1.

4-15. Shunt Capacitor A7 Adjustments

- a. *Test Equipment and Materials Required* (fig. 4-3).
 - (1) Q- meter.
 - (2) Multimeter.
 - (3) 100-pf capacitor.

b. *Initial Steps.* Switches A7S1 and A7S2 should open when capacitor A7C1 is at 5 to 7 pf, and close at 490 to 510 pf. The Q-meter (TS-617B/U or equivalent) is used to measure these limits. The Q-meter range

must be extended. To extend the range of the Q-meter-

- (1) Measure exact capacity of 100-pf capacitor on Q-meter (TM 11-2635A).
- (2) Connect 100-pf capacitor in series with capacitor A7C1, then connect combination of two capacitors to Q-meter.
- (3) Compute Q-meter setting equivalent to 500 pf. Use following formula:

$$\frac{\text{Exact value 100-pf capacitor} \times 500 \text{ pf}}{\text{Exact value 100-pf capacitor} + 500 \text{ pf}} = \text{_____ pf} = \text{Q-meter setting}$$

- (4) Set Q-meter to value computed.
- (5) Proceed to *d* below.

d. *Adjustment Procedure.*

- (1) Connect 100-pf capacitor and capacitor A7C1 in parallel.
- (2) Connect parallel combination to Q-meter.
- (3) Set multimeter to measure continuity.
- (4) Connect multimeter between cathode of A7CR1 and cathode of A7CR2.

(5) Turn spur gear No. 2 (8, fig. 3-2) ccw until multimeter reads zero.

(6) Read Q-meter. Q-meter should indicate 490 to 510 pf. If not, adjust position of A7S2 on electrical switch bracket (26F, fig. 3-2) until Q-meter reads 500 pf.

(7) Disconnect multimeter from diodes.

(8) Connect multimeter between A7P1-15 (orange wire) and A7P1-5 (green wire).

(9) Turn spur gear No. 2 (8, fig. 3-2) cw until multimeter indicates open circuit.

(10) Read Q-meter. Q-meter should indicate 5 to 7 pf. If not, adjust position of A7S1 on electrical switch bracket (26F, fig. 3-2) until Q-meter reads 6 pf.

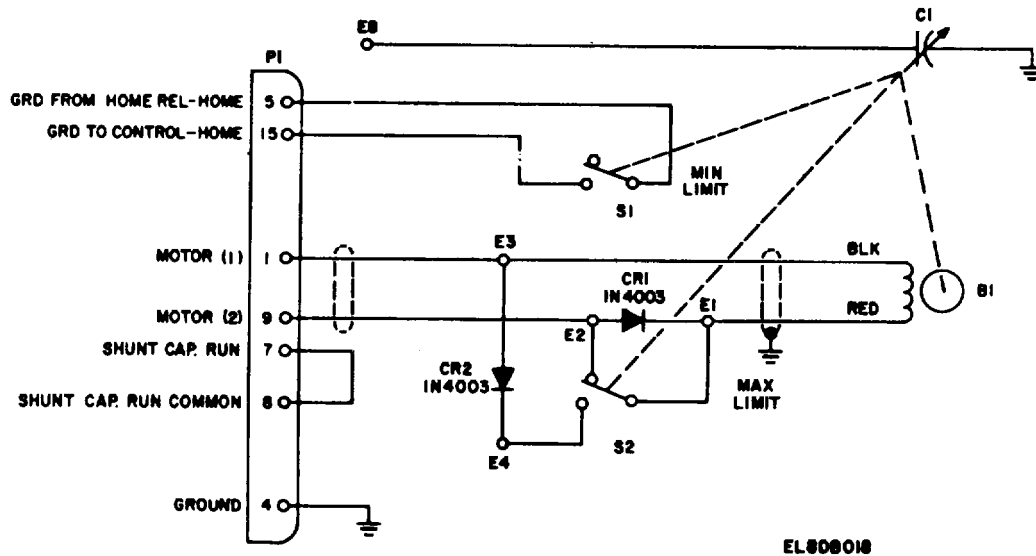


Figure 4-2.1. Shunt Capacitor A 7, (Part Number 528-0466-000), Schematic Diagram.

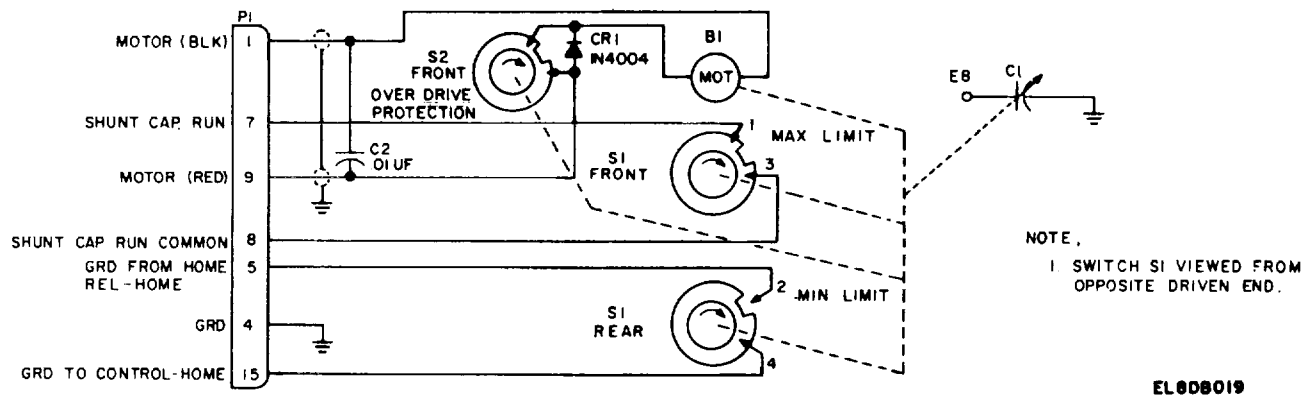
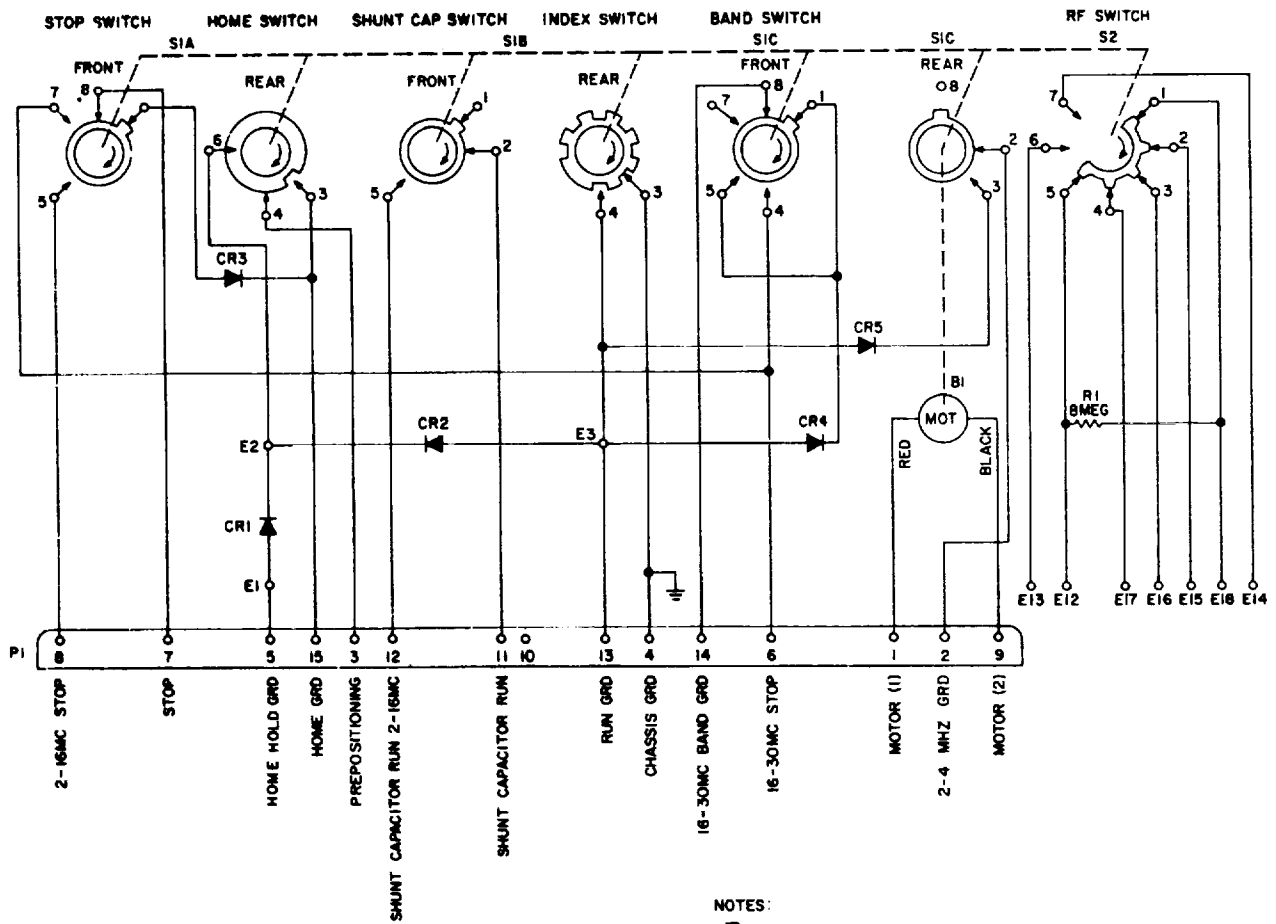


Figure 4-2.2. Shunt Capacitor A 7, (Part Number 777-4500-001), Schematic Diagram.

Change 2 4-27

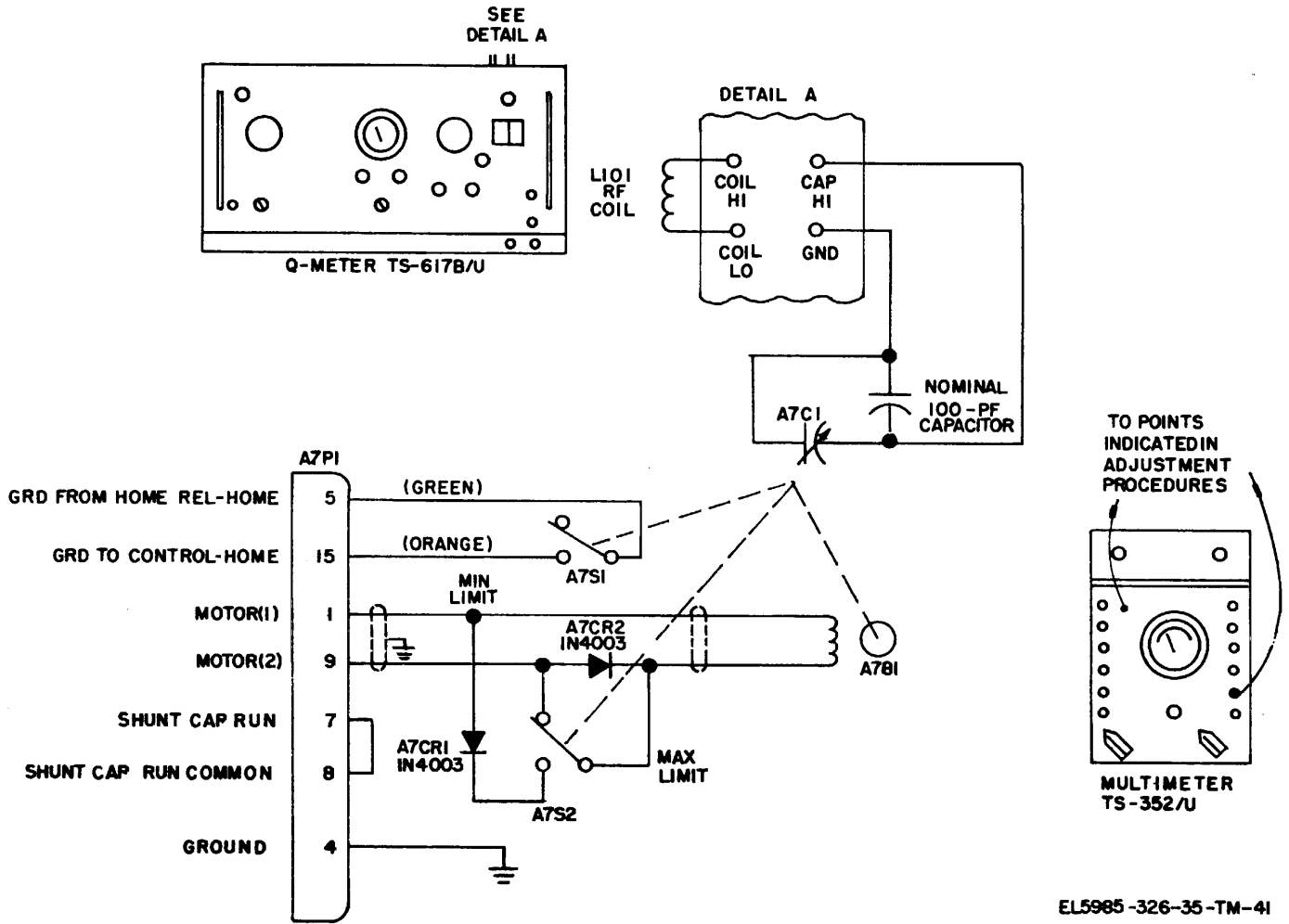


- NOTES:
 ① ALL SWITCHES VIEWED FROM OPPOSITE THE DRIVEN END.
 ② ALL DIODES ARE IN645.

EL00020

Figure 4-2.3. Series Capacitor A9, Schematic Diagram.

Change 2 4-28



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Figure 4-3. Shunt Capacitor A 7. Adjustment Setup.

Change 2 4-29

Section IV. DISASSEMBLY AND REASSEMBLY

4-16. General

This section explains how to disassemble and reassemble antenna coupler moduled. Disassemble modules only when repair is required. Do not disassemble a module as part of routine maintenance.

CAUTION

Disconnect all power before disassembly.

4-17. Lubricants and Sealants

Refer to paragraph 4-28 for a chart showing authorized lubricants, sealants, and cleaning materials. These materials, or their equivalents, will be used for cleaning, preserving, and lubrication purposes.

4-18. Coupler Control A2 (Part number 528-0465-000)

a. Disassembly.

(1) Remove coupler control A2 (para 3-11a).

(2) Refer to figure 4-4. Remove cover (1) from the chassis by removing two screws (-2).

(3) Remove four captive screws (89) by snapping out of their retainers. Remove the four retainers (90) by removing four screws (-91).

(4) Remove the front terminal board (92) from four posts (94) and long post (106) by removing four screws (-95), washer (-96), one screw (-95A) and one lockwasher (-96A). Refer to figure 4-5 for parts locations on the front terminal board.

(5) Remove rear terminal board (93) by removing four posts (94), screw (-95A) and lockwasher (-96A) from short post (105). Refer to figure 4-6 for parts locations on the rear terminal board (93).

NOTE

Four studs (-97) will each remain in one of the eight posts (94). Do not remove the remaining studs (-97) from the posts (94) unless necessary for replacement.

(6) Remove plastic insulator covering relay mounting hardware.

(7) Remove relays A2K1 through A2K28 (31 to 58) as necessary by removing two nuts (-51) and lockwashers (-60) for each relay.

(8) Remove connector A2P1 (98) from the chassis by removing two nuts (-91) and screws (-100).

(9) Remove connector A2P2 (101) from the chassis by removing two screws (-103, -103A) nuts (-102), and two lugs (-102A) (part of cable).

(10) Remove the capacitor holder (66) from

posts (67) by removing two screws (-69) and lockwashers (-70).

(11) Remove two posts (67) from the chassis by removing two screws (-68).

(12) Remove diodes A2CR33 and A2CR34 (79, 80) from the chassis by removing nut, lockwasher, flat washer, and mica washer from each diode. Remove diode from the chassis, and then remove the mica washer and the flat washer from each diode.

NOTE

All hardware listed in (12) above is usually supplied with a new diode.

(13) Remove 12 stud terminals E1 through E12 (85), as necessary by removing 11 screws (-87) and screw (-86). Stud terminal (85) has a terminal lug (87) and washer (-88) mounted underneath.

(14) Clean, inspect, and repair (sec. V).

b. Reassembly (Part Number 528-0465-000) (fig. 4-4).

(1) Mount 12 stud terminals E1 through E12 (85) with 12 screws (-86) or (-87) and lockwashers (-88A).

(2) Mount diodes A2CR33 and A2CR34 (79, 80) as follows:

(a) Place lug, mica washer, and flat washer on the studs of the diodes.

CAUTION

Insure that the Teflon insulator sleeve is in position on diode stud.

(b) Insert each diode through its respective hole in the chassis.

(c) Place another mica washer, flat washer, lockwasher, and nut on the stud and tighten nut.

NOTE

All hardware listed in step (2) usually is supplied when new diode (79 or 80) is purchased.

(3) Mount two posts (67) to the chassis with two screws (-68).

(4) Mount the capacitor holder (66) to the posts (67) with two screws (-69) and lockwashers (-70).

(5) Mount connector A2P1 (101) to the chassis with two screws (-193 and -103A), nuts (-102), and lugs (part of cable).

(6) Rewire as necessary.

CAUTION

Use a heat sink when soldering diodes.

(7) Mount connector A2P1 (98) to chassis with

two nuts (-99), screws (-100), two solder lugs and one lockwasher.

(8) Mount relay A2K1 through A2K28 (31 through 58) with two nuts (-59) and lockwashers (-60) each. Rewire as necessary.

(9) Dress wires to relays by taping wires from each individual relay together.

(10) Mount four posts (94) and terminal lug (part of cable) to chassis with four screws (-95) and lockwashers (-96).

NOTE

If the four studs (97) have been removed from posts (94), apply Glyptal (para 4-28) to one-half of the threads of each stud (-97). Screw the studs halfway into the four posts (94). Set the Glyptal by heating the post-stud assemblies (94, -97) with soldering iron.

CAUTION

Dress and route the cable wires so they are not pinched between the posts (94) and the front and rear terminal boards (92 and 93).

(11) Place plastic insulator over relay mounting hardware.

(12) Mount the rear terminal board (93) to the four posts (94) with four post-stud assemblies (see note in step (10)) and to short post (105) with screw (-95A) and lockwasher (-96A).

(13) Mount the front terminal board (92) to post-stud assemblies (step (10) and (12)) with four screws (-95) and lockwashers (-96), and to long post (106) with screw (-95A) and lockwasher (-96A).

(14) Mount the four retainers (90) with four screws (-91). Insert the four captive screws (89) into the holes in the chassis, and then snap them into the four retainers (90).

(15) Mount the cover (1A) to the chassis with two screws (-2).

(16) Replace coupler control A2 (para 3-11*b*).

4-18.1. Coupler Control A2 (Part Number 608-9500-002)

a. Disassembly.

(1) Remove coupler control A2 (para 3-11*a*).

(2) Refer to figure 4-6.1. Remove cover (2) from chassis by removing two screws (-3).

(3) Remove four captive screws (29) by snapping them out of their screw retainers (30). Remove four screw retainers (30) by removing four screws (-31).

(4) Remove circuit card assemblies A1, A2, and A3 (10, 11, 12) by lifting up on tabs and gently pulling from chassis.

(5) Remove bottom circuit card assembly A4

(15) by removing four nuts (-21) and four screws (-22) holding connectors (19, 20) in place, and by removing four nuts (-16), four flat washers (-17), and four screws (-18) holding card to chassis.

NOTE

Tag or otherwise identify wiring before unsoldering.

b. Reassembly (fig. 4-6.1).

(1) Mount bottom circuit card assembly A4 (15) to inside of chassis (34) with four screws (-18), four flat washers (-17), and four nuts (-16).

(2) Secure connectors (19, 20) to chassis (34) with four screws (-22) and four nuts (-21).

CAUTION

Insert circuit card assemblies A1, A2, and A3 into chassis carefully to avoid bending or breaking pins of pin fields or damaging circuit cards.

(3) Insert circuit card assemblies A1, A2, and A3 (10, 11, and 12) into card guides in chassis. Carefully mate connectors on each card with pin field on bottom circuit card assembly A4 (15).

(4) Mount four screw retainers (30) to chassis (34) using four screws (-31). Insert the four captive screws (29) into the holes in the chassis, and then snap them into the four retainers (30).

(5) Mount cover (2) over chassis (34) and secure using two screws (-3).

(6) Mount relays K1 through K28 (31 through 58) with two nuts (-59) and lockwashers (-60) for each relay. Rewire as necessary.

(7) Dress wires to relays by taping wires together from each individual relay.

(8) Mount four posts (94) and terminal lug (part of cable) to chassis with four screws (-95) and lockwashers (-96).

NOTE

If the four studs (-97) have been removed from posts (94), apply blue Glyptal (fig. 2-2) to one-half the threads of each stud (-97). Screw the studs halfway into four posts (94). Set the blue Glyptal by heating the post-stud assemblies (94, -97) with a soldering iron.

(9) Place plastic insulator over relay mounting hardware.

(10) Mount rear terminal board (93) to four posts (94) with four post-stud assemblies (see note in step 8) and to short post (105) with screw (-95A) and lockwasher (-96A).

CAUTION

Dress and route cable wires so they are not pinched between posts (94) and the terminal boards (92, 93).

(11) Mount front terminal board (92) to post-stud assemblies (steps (8) and (10)) with four screws (-95) and lockwashers (-96) and to long post (106 with screw (-95A1) and lockwasher (-96A).

(12) Mount four screw retainers (90) with four

screws (-91). Insert four captive screws (89) into holes in chassis, and snap into four screw retainers (90).

(13) Mount cover (1) to chassis with two screws (-2).

Legend for figure 4-4:

Note. Item prefixed with a dash are attaching parts that are listed but not shown. Items preceded by # have different values, depending on MCN effectivity. Refer to paragraph 1-5D for differences.

1	Cover	32	Relay A2K2	#77	Capacitor A2C34
-2	Screw (2)	33	Relay A2K3	#77A	Capacitor A2C35
-3	Screw (2)	34	Relay A2K4	78	Capacitor A2C15
-4	Rivet (4)	35	Relay A2K5	78A	Resistor A2R86
-5	Handle (2)	36	Relay A2K6	78B	Capacitor A2C44
6	Cover	37	Relay A2K7	78C	Diode A2CR117
#7	Diode A2CR62	38	Relay A2K8	78D	Diode A2CR115
7A	Diode A2CR112	39	Relay A2K9	79	Diode A2CR33
7B	Diode A2CR7	40	Relay A2K10	80	Diode A2CR34
7C	Diode A2CR58	41	Relay A2K11	81	Terminal
#8	Diode A2CR96	42	Relay A2K12	82	Terminal
#8A	Diode A2CR101	43	Relay A2K13	-83	Screw
#8B	Diode A2CR101	44	Relay A2K14	-84	Screw
8C	Diode A2CR113	45	Relay A2K28	85	Stud terminal (12)
9	Diode A2CR54	46	Relay A2K27	-86	Screw (12)
10	Diode A2CR4	47	Relay A2K26	-87	Terminal lug(3)
11	Diode A2CR8	48	Relay A2K25	-88	Washer
12	Diode A2CR11	49	Relay A2K24	89	Captive screw (4)
#12A	Diode A2CR105	50	Relay A2K23	90	Retainer (4)
#12B	Diode A2CR108	51	Relay A2K22	-91	Screw (4)
13	Diode A2CR74	52	Relay A2K21	92	Front terminal board
14	Diode A2CR97	53	Relay A2K20	93	Rear terminal board
15	Diode A2CR28	54	Relay A2K19	94	Post (8)
#15A	Diode A2CR106	55	Relay A2K18	-95	Screw(8)
16	Diode A2CR13	56	A2K17	-95A	Screw (2)
17	Diode A2CR14	57	Relay A2K16	-96	Washer(8)
18	Diode A2CR23	58	Relay A2K15	-96A	Washer (2)
19	Diode A2CR22	-59	Nut (56)	-97	Stud (4)
20	Resistor A2R82	-60	Lockwasher(56)	98	Connector A2P1
#21	Diode A2CR73	61	Diode A2CR31	-99	Nut (2)
21	Diode A2CR00	62	Diode A2CR32	-100	Screw (2)
#21A	Diode A2CR10, CR100	63	Capacitor A2C12	101	Connector A2P2
23	Diode A2CR51	64	Capacitor A2C13	-102	Nut (2)
24	Diode A2CR86	65	Capacitor A2C14	-103	Screw (2)
25	Diode A2CR418	66	Capacitor holder	104	Chassis
26	Diode A2CR46	67	Post (2)	105	Short post
#26A	Diode A2CR107	-68	Screw 12)	106	Long post
27	Diode A2CR55	-69	Screw (2)	107	Clip (2)
27A	Diode A2CR93	-70	Lockwasher (2)	-108	Rivet (4)
28	Diode A2CR49	71	Capacitor A2C17	-109	Washer (4)
29	Diode A2CR40	72	Capacitor A2C16	110	Pin (2)
30	Diode A2CR70	73	Capacitor A2C10	111	Nut (2)
30A	Diode A2CR61	74	Resistor A2R56	112	Chassis
30B	Diode A2CR66	75	Resistor A2R70		
31	Relay A2K1	76	Resistor A2R60		

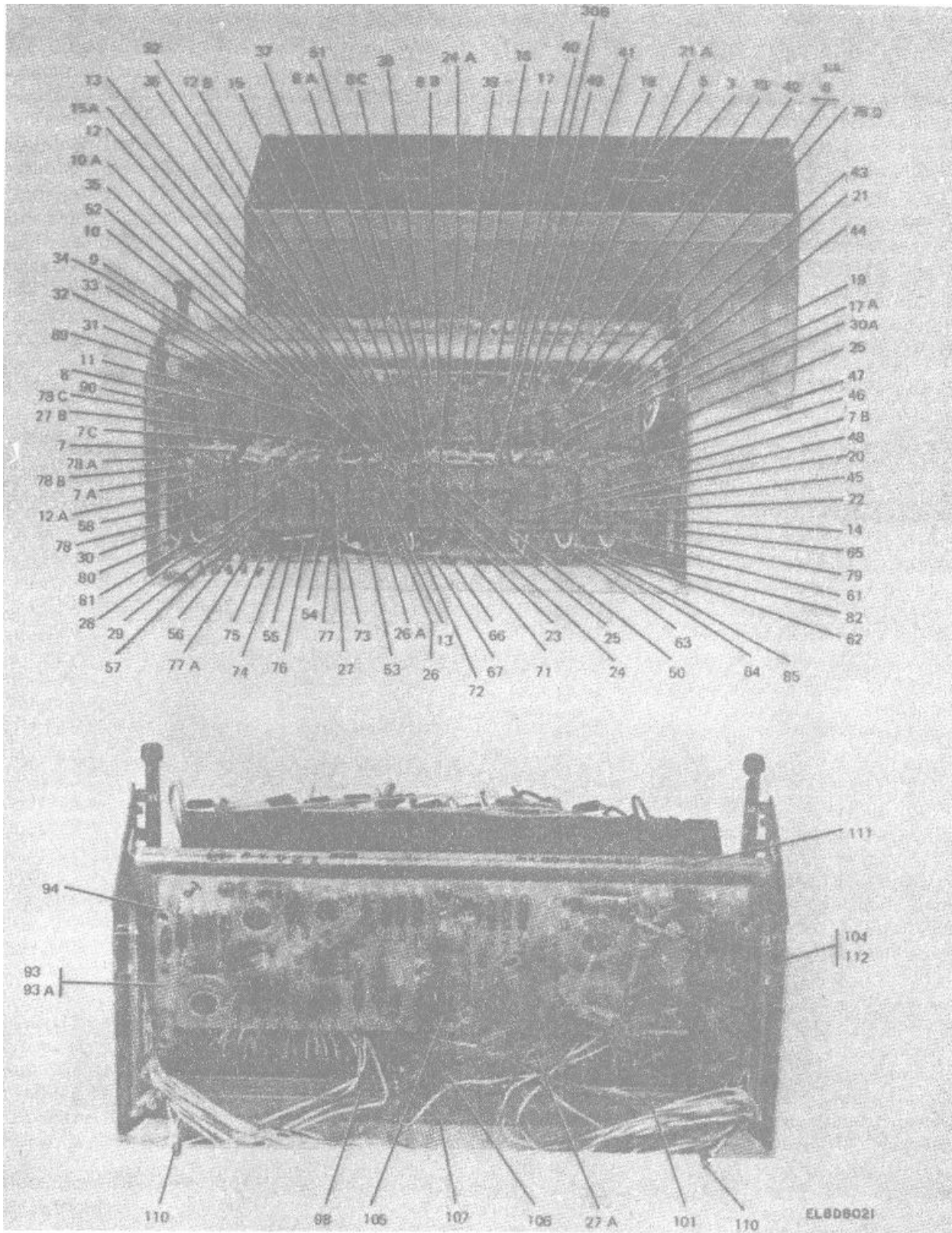
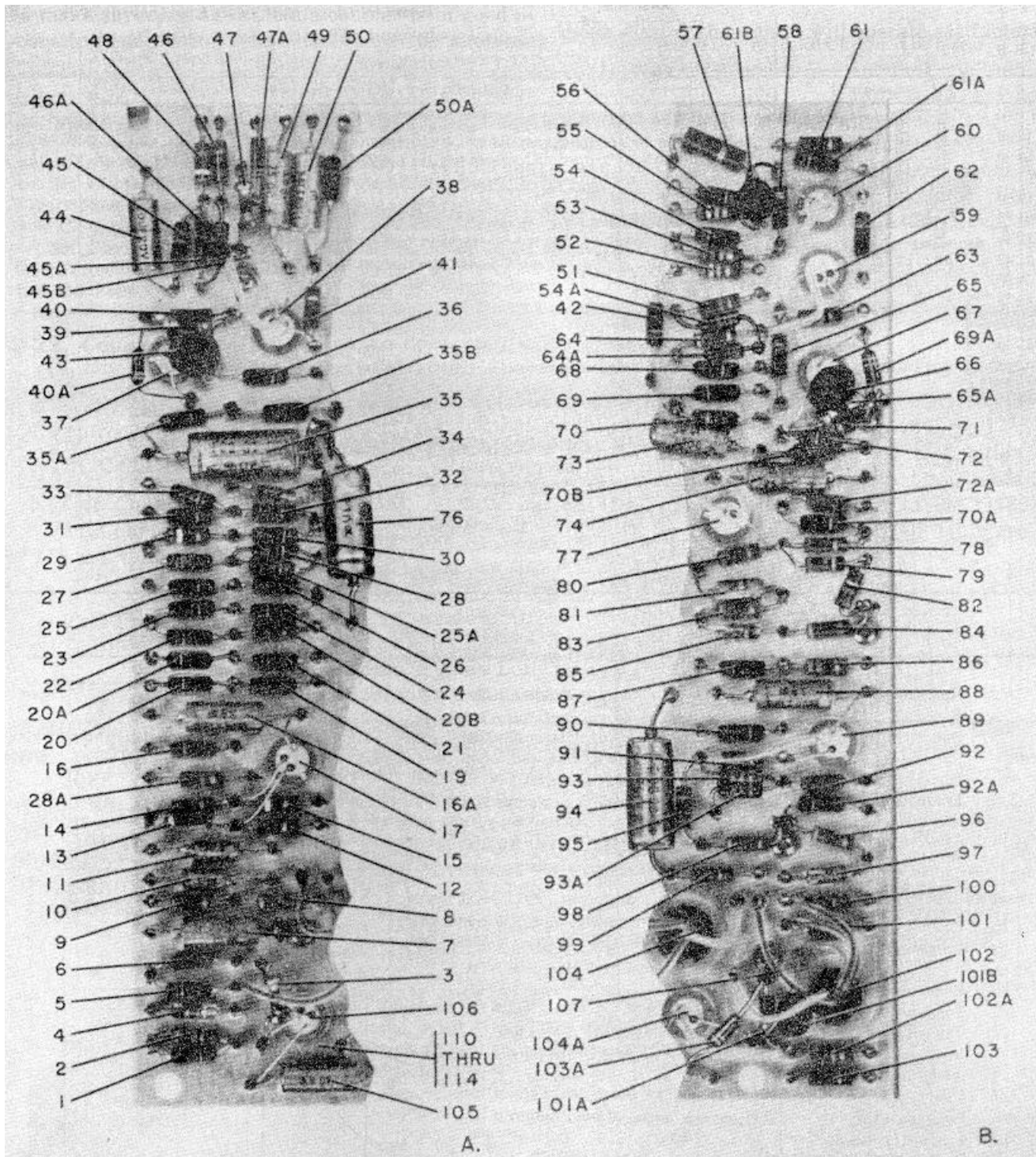


Figure 4-4. Coupler Control A2, Parts Location.

Legend for figure 4-5:

Note: Items prefixed with - are attaching parts and not shown. Items preceded by # have different values, depending on MCN effectivity. Refer to paragraph 1-5d for differences.

1	Terminal board P/O A2	#40A	Capacitor A2C1	#77	Transistor A2Q9
1A	Diode A2CR77	41	Resistor A2R81	#78	Transistor A2R12
#2	Resistor A2R75	42	Diode A2CR81	#79	Resistor A2R42
3	Resistor A2RT11	#43	Capacitor A2C36	#80	Resistor A2R41
4	Diode A2CR87	#44	Capacitor A2C7	#81	Capacitor A2C19
5	Diode A2CR41	45	Resistor A2R76	#82	Resistor A2RT4
#6	Diode A2CR42	#45A	Diode A2CR65	83	Resistor A2R40
7	Capacitor A2C31	#46	Resistor A2R78	84	Resistor A2R38
8	Resistor A2R46	#46A	Capacitor A2C3	#85	Diode A2CR39
9	Resistor A2R45	47	Resistor A2RT6	86	Resistor A2R37
#10	Capacitor A2C21	47A	Resistor A2R84	87	Diode A2R37
#11	Capacitor A2C28	48	Resistor A2R77	88	Capacitor A2C18
#12	Resistor A2R71	#49	Capacitor A2C26	#89	Transistor A2Q8
#13	Resistor A2RT5	50	Capacitor A2C32	90	Diode A2CR30
#14	Resistor A2R49	50A	Diode A2R109	91	Resistor A2R55
#15	Resistor A2R47	51	Resistor A2R44	#92	Resistor A2RT3
16	Diode A2CR64	52	Resistor A2R50	#92	Diode A2CR68
#16A	Capacitor A2C22	53	Resistor A2R53	#92A	Diode A2CR73
#17	Transistor A2Q15	54	Diode A2CR63	#93	Resistor A2R35
-18	Deleted	55	Resistor A2R74	#93A	Resistor A2R35
19	Diode A2CR44	56	Diode A2CR78	#94	Capacitor A2C4
#20	Resistor A2R32	57	Resistor A2R80	95	Resistor A2R34
#20A	Resistor A2R83	58	Resistor A2R51	96	Resistor A2R17
21	Diode A2CR43	#59	Transistor A2Q12	#97	Diode A2CR36
22	Diode A2CR29	#60	Transistor A2Q13	98	Resistor A2R33
23	Diode A2CR47	61	Resistor A2R54	#99	Resistor A2R69
24	Diode A2CR27	61A	Diode A2CR12	100	Diode A2CR35
25	Diode A2CR53	62	Diode A2CR45	101	Diode A2CR9
#25A	Diode A2CR104	63	Resistor A2R58	101A	Resistor A2R19
26	Diode A2CR26	64	Resistor A2R59	#101B	Capacitor A2C40
27	Diode A2CR71	65	Resistor A2R57	102	Transformer A2T1
#28	Resistor A2R36	#65A	Resistor A2RT3	103	Resistor A2R61
#28A	Resistor A2R36	#66	Capacitor A2C29	103A	Capacitor A2C30
#29	Resistor A2R66	#67	Transistor A2Q11	#103A	Capacitor A2C0
30	Diode A2CR83	68	Diode A2CR76	#104	Transformer A2T2
31	Diode A2CR50	69	Diode A2CR79	#104A	Transistor A2Q17
32	Resistor A2R16	#69A	Capacitor A2C3	#105	Capacitor A2C27
33	Diode A2CR89	70	Diode A2CR69	#106	Transistor A2Q16
34	Diode A2CR82	#70A	Diode A2CR96	107	Terminal (9)
35	Capacitor A2C25	#70B	Diode A2CR102	108	Nut (8)
35A	Diode A2CR98	#71	Resistor A2R6	-109	Washer (8)
35B	Diode A2CR99	#72	Resistor A2R39	109A	Screw (8)
36	Diode A2CR67	#72A	Diode A2CR93	110	Terminal board
#37	Transistor A2Q10	#73	Capacitor A2C23	#111	Holder(3)
#38	Transistor A2Q14	#74	Capacitor A2C20	112	Holder(10)
39	Resistor A2RT9	-75	Deleted	113	Terminal (153)
40	Resistor A2R31	76	Capacitor A2C24	114	Terminal board



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Figure 4-5. Coupler Control A2 Front Terminal Board, Parts Location.

Change 2 4-35

4-19. Control Amplifier A3 (Part No. 528-0467-000)

a. Disassembly.

(1) Remove control amplifier A3 (para 3-12a).

(2) Refer to figure 4-7. Remove the cover (1) by removing two screws (-2).

(3) Remove the four screws (7) on the terminal board (95) side of the chassis by snapping them out of their screw retainers (8).

(4) Remove at least one of the screw retainers (8) on the terminal board (95) side of the chassis by removing screw (-9).

(5) Remove terminal board (95) by removing four screws (-96).

(6) Remove relays A3K1 through A3K5 (18 through 22) from the relay bracket (79) by removing ten nuts (-23) and ten washers (-24).

(7) Remove the relay bracket (79) from the chassis by removing four screws (-80).

(8) Remove connector A3P1 (76) from the chassis by removing two screws (-78), two nuts (-77), and two terminal lugs (74).

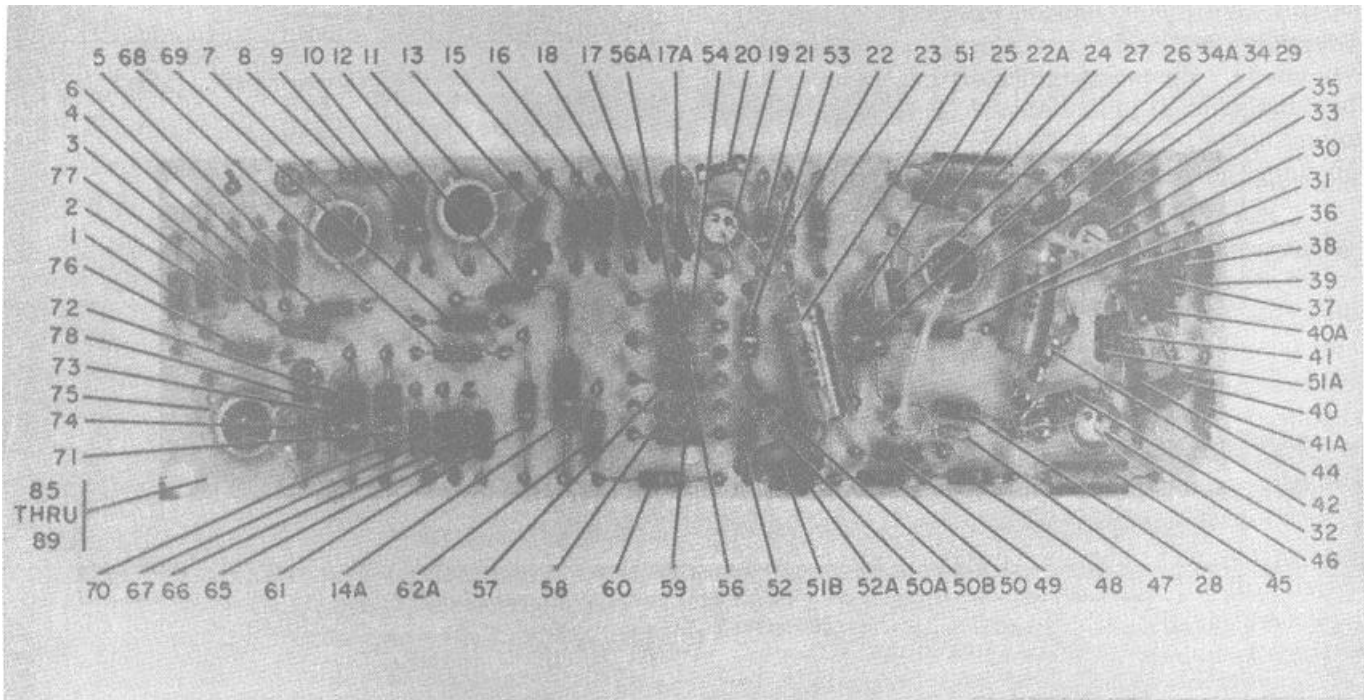
(9) Remove chopper A3G1 (26) by removing four screws (-28), four nuts (-27), and the ground lug (75).

(10) Remove the transistor holders (79, fig. 4-8) from the terminal board (95, fig. 4-7) as necessary by removing screws and nylon washers (supplied with 79, fig. 4-8).

Legend for figure 4-6:

Note: Items preceded with a dash are attaching parts that are listed but not shown. Items preceded with # have different values depending on MCN effectivity. Refer to paragraph 1-5d for differences.

1	Diode A2CR75	#31	Capacitor A2C11	56	Diode A2CR6
2	Diode A2CR59	32	Resistor A2R11	56A	Diode A2CR10
3	Diode A2CR60	#33	Transistor A2Q2	57	Diode A2CR5
4	Diode A2CR25	34	Resistor A2R48	58	Resistor A2R13
5	Diode A2CR19	#34A	Capacitor A2C39	59	Resistor A2R7
6	Diode A2CR20	35	Diode A2CR38	#60	Resistor A2R10
7	Transistor A2Q6	36	Resistor A2R30	#61	Resistor A2R21
8	Resistor A2R25	37	Diode A2CR94	61A	Capacitor A2C43
9	Resistor A2R24	38	Diode A2CR61	62	Deleted
10	Resistor A2R65	39	Diode A2CR58	62A	Diode A2CR90
#11	Transistor A2Q5	#40	Capacitor A2C8	-63	Deleted
12	Diode A2CR72	#40A	Capacitor A2C33	-64	Deleted
#13	Resistor A2R22	41	Diode A2CR88	65	Diode A2CR17
13A	Resistor A2R85	41A	Resistor A2R1	66	Diode A2CR15
14	Capacitor A2C42	42	Resistor A2RT7	67	Diode A2CR18
#14A	Resistor A2R20	43	Deleted	68	Diode A2CR24
#15	Diode A2CR7	#44	Resistor A2R2	69	Diode A2CR57
16	Diode A2CR56	#45	Capacitor A2C2	70	Diode A2CR16
#17	Capacitor A2C6	#46	Transistor A2Q1	71	Resistor A2R23
#17A	Capacitor A2C9	46A	Diode A2CR118	72	Resistor A2R26
18	Diode A2CR2	47	Resistor A2RT1	73	Resistor A2R27
#19	Transistor A2Q4	48	Resistor A2R3	74	Resistor A2R28
20	Resistor A2RT10	49	Diode A2CR91	75	Transistor A2Q7
21	Resistor A2R18	50	Diode A2CR1	76	Diode A2CR66
22	Diode A2CR84	#50A	Diode A2CR103	77	Diode A2CR21
#22A	Resistor A2R69	#50B	Resistor A2R15	78	Terminal (8)
23	Resistor A2R63	#51	Capacitor A2C5	-79	Nut (81)
#24	Resistor A2R15	#51A	Resistor A2R83	-80	Washer (8)
#24	Capacitor A2C4	#51B	Capacitor A2C37	85	Terminal Board
#25	Resistor A2R4	#52	Resistor A2R32	86	Holder (3)
26	Resistor A2R62	#52A	Diode A2CR85	87	Holder (4)
#27	Diode A2CR92	#53	Resistor A2R14	88	Terminal (105)
#28	Resistor A2R8	54	Diode A2CR3	89	Terminal board
29	Transistor A2Q3	-55	Deleted		
30	Diode A2CR95				



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Figure 4-6. Coupler Control A2, Rear Terminal Board, Parts Location.

(11) Remove transformers A3T3 (67, fig. 4-7) and A3T4 (63) by pushing them out of their holders. Press the holders (68 and 64) from holes in the chassis.

(12) Clean, inspect, and repair (sec. V).

b. Reassembly.

(1) Mount chopper A3G1 (26, fig. 4-7) with four screws (-28) and nuts (-27). Mount terminal lug (-74) under nut (-27) that is farthest from the corner of the chassis.

(2) Mount the relay bracket (79) to the chassis with four screws (-80).

(3) Mount relays A3K1 through A3K5 (18 through 22) to the relay bracket (79) with ten washers (-24) and ten nuts (-23).

(4) Insert the holders (64, 68) into the chassis, and insert transformers A3T3 and A3T4 (67, 63) into the holders.

(5) Mount the twelve transistor holders (79,

fig. 4-8) to the terminal board (95, fig. 4-7) with twelve screws and nylon shoulder washers (supplied with 79, fig. 4-8). Apply Glyptal (para 4-28) to screws.

(6) Place two terminal lugs (-74) under nuts (-77). Mount connector A3P1 (76, fig. 4-7) to the chassis with two screws (-78) and nuts (-77).

(7) Mount the terminal board (95) to the chassis with four screws (-96).

(8) Mount the four screw retainers (8) to the chassis with four screws (-9). Apply Glyptal (para 4-28) to screws.

(9) Place four screws (7) through the holes in the chassis, and snap into the screw retainers (8).

(10) Replace the cover (1) and secure with the two screws (-2).

(11) Replace control amplifier A3 (para 3-12b).

Legend for figure 4-6.1:

Note: Item prefixed with a dash is listed but not shown.

-1	Antenna coupler control A2	-22	Screw (4)
2	Cover	23	Capacitor A2C17
-3	Screw (2)	24	Capacitor A2C16
-4	Bumper (2)	25	Terminal, stud (2)
-5	Bumper	26	Terminal, stud
6	Clip, handle (2)	-27	Screw (3)
-7	Contact, rivet (4)	-28	Lockwasher (3)
8	Cover, handle (2)	29	Screw (4)
9	Cover	30	Retainer (4)
10	Tune sequence circuit card assembly A2A1	-31	Screw (4)
11	Tune sequence circuit card assembly A2A2	32	Plate, card guide - 2
12	Tune sequence circuit card assembly A2A3	-33	Screw (4)
13	Plate, card guide - no. 1	34	Chassis
-14	Screw (4)	35	Pin
15	Tune sequence circuit card assembly A2A4	36	Clip (12)
-16	Nut (4)	-37	Rivet (14)
-17	Flat washer (4)	38	Clip, spring tension (2)
-18	Screw (4)	-39	Rivet (6)
19	Connector A2P1	40	Nut (2)
20	Connector A2P2	41	Chassis
-21	Nut (4)		

Change 2 4-38

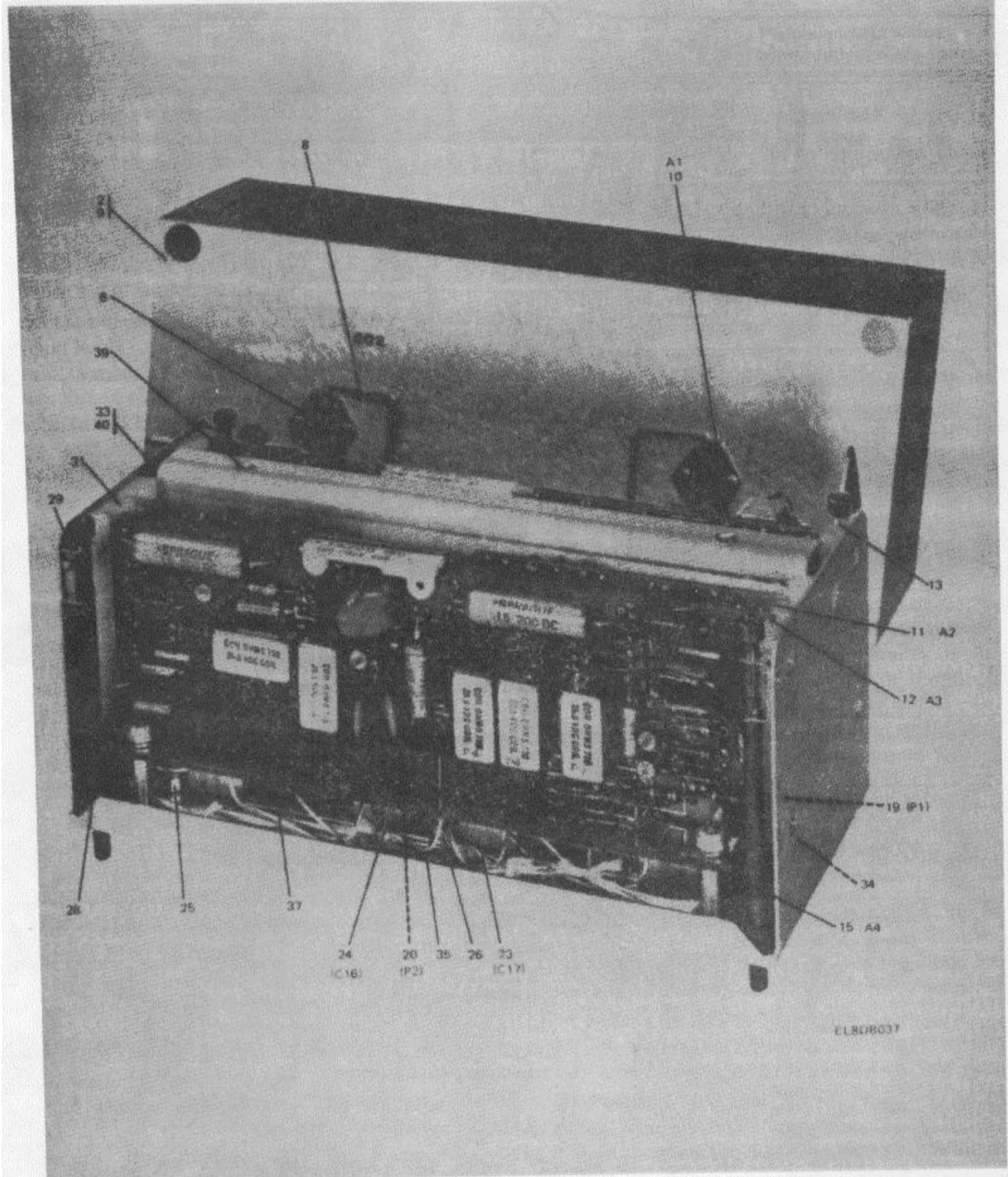


Figure 4-6.1. Coupler Control A2 (Part Number 608-9500-002), Parts Location.

Change 2 4-39

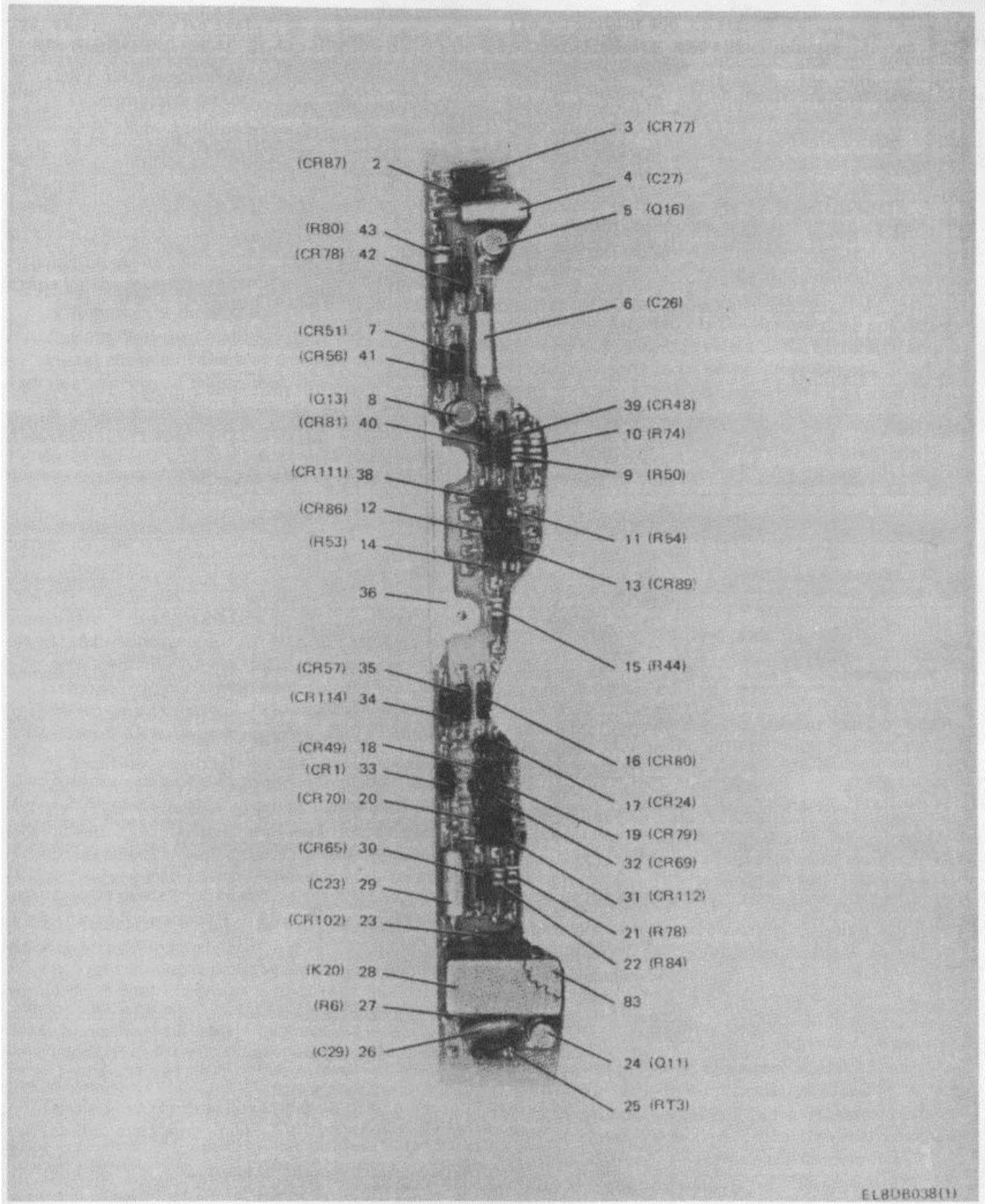


Figure 4-6.2(1). Tune Sequence Circuit Card Assembly A2A1, Parts Location (Part 1 of 2).

Legend for figures 4-6.2(1) and 4-6.2(2):

Note: Item prefixed with a dash is listed but not shown.

-1	Tune sequence circuit card assembly A2A1	30	Diode A2A1CR65	59	Diode A2A1CR93
2	Diode A2A1CR87	31	Diode A2A1CR112	60	Diode A2A1CR67
3	Diode A2A1CR77	32	Diode A2A1CR69	61	Resistor A2A1R13
4	Capacitor A2A1C27	33	Diode A2A1CR1	62	Diode A2A1CR46
5	Transistor A2A1Q16	34	Diode A2A1CR114	63	Capacitor A2A1C3
6	Capacitor A2A1C26	35	Diode A2A1CR57	64	Capacitor A2A1C7
7	Diode A2A1CR51	36	Handle	65	Relay A2A1K27
8	Transistor A2A1Q13	-37	Pin	66	DiodeA2A1CR52
9	Resistor A2AIR50	38	DiodeA2A1CR111	67	DiodeA2A1CR7
10	Resistor A2A1R74	39	Diode A2A1CR48	68	Resistor A2A1R82
11	Resistor A2A1R54	40	Diode A2A1CR81	69	Resistor A2A1R51
12	Diode A2A1CR86	41	Diode A2A1CR56	70	Capacitor A2A1C41
13	Diode A2A1CR89	42	Diode A2A1CR78	71	Diode A2A1CR63
14	Resistor A2A1R53	43	Resistor A2A1R80	72	Relay A2A1K23
15	Resistor A2A1R44	44	Resistor A2A1R61	73	Relay A2A1K22
16	Diode A2A1CR80	45	Resistor A2A1R75	74	Relay A2A1K24
17	Diode A2A1CR24	46	Capacitor A2A1C32	75	Relay A2A1K25
18	Diode A2A1CR49	47	Capacitor A2A1C31	76	Thermistor A2A1RT6
19	Diode A2A1CR79	48	Capacitor A2A1C38	77	Transistor A2A1Q14
20	Diode A2A1CR70	49	Resistor A2A1R1	78	Capacitor A2A1C24
21	Resistor A2A1R78	50	Diode A2A1CR110	79	Resistor A2A1R76
22	Resistor A2A1R84	51	Diode A2A1CR12	80	Resistor A2A1R77
23	Diode A2A1CR102	52	Diode A2ACR50	81	Resistor A2A1R81
24	Transistor A2A1Q11	53	Relay A2A1K14	82	Thermistor A2A1RT11
25	Thermistor A2A1RT3	54	Diode A2A1CR97	83	Insulator (11)
26	Capacitor A2A1C29	55	Relay A2A1K28	84	Contact (29)
27	Resistor A2A1R6	56	Relay A2A1K26	85	Contact (30)
28	Relay A2A1K20	57	Relay A2A1K15	86	Housing connector
25	Capacitor A2A1C23	58	Relay A2A1K21	87	Board

Change 2 4-41

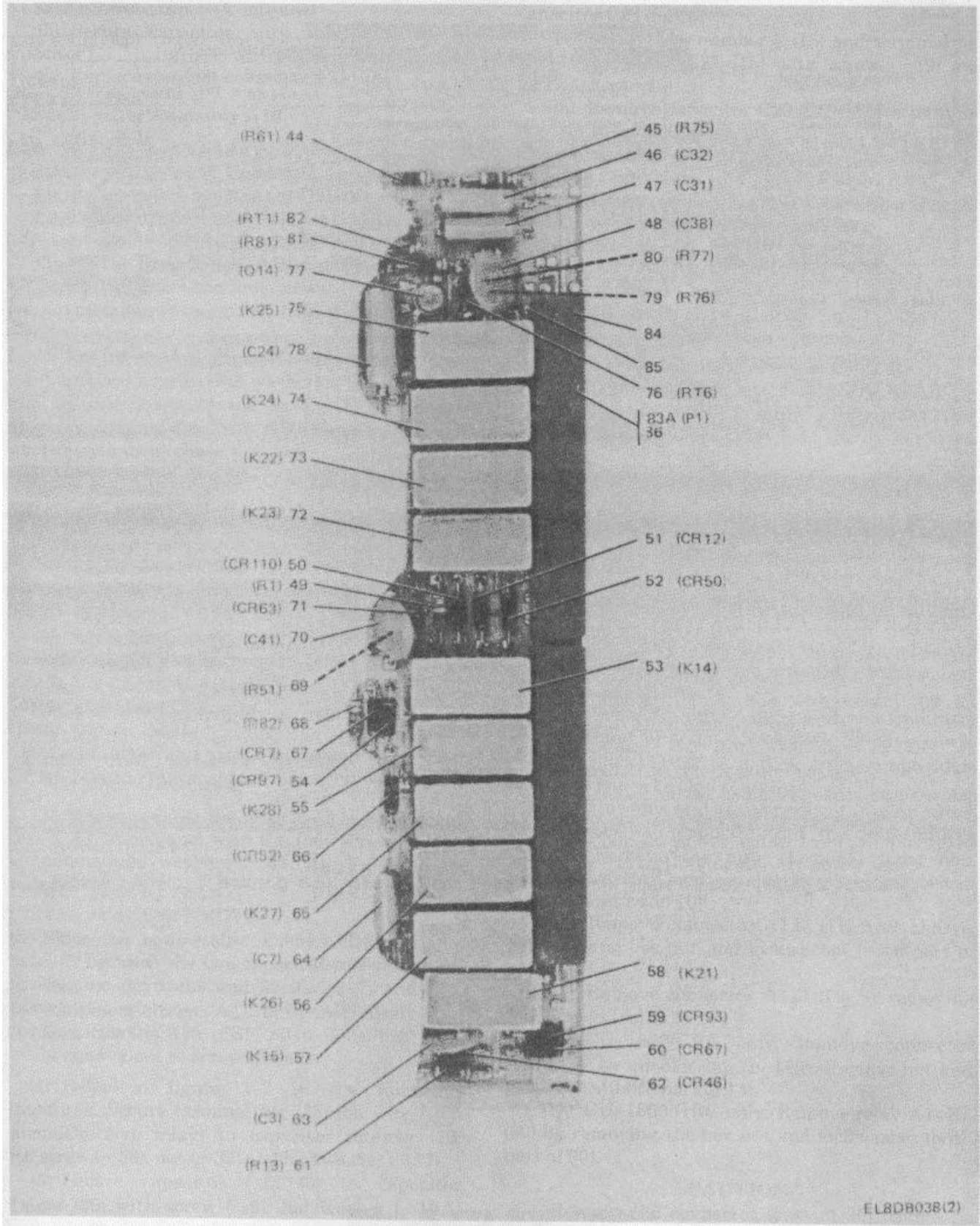


Figure 4-6.2(2). Tune Sequence Circuit Card Assembly A2A1, Parts Location (Part 2 of 2)

Legend for figure 4-6.3:

Note: Item prefixed with a dash is listed but not shown.

-1	Tune sequence circuit card assembly A2A2	32	Capacitor A2A2C9	63	Diode A2A2CR45
2	Diode A2A2CR22	33	Resistor A2A2R32	64	Diode A1A2CR90
3	Diode A2A2CR115	34	Resistor A2A2R15	65	Diode A2A2CR95
4	Relay A2A2K12	35	Diode A2A2CR103	66	Diode A2A2CR94
5	Diode A2A2CR31	36	Capacitor A2A2C33	67	Diode A2A2CR3
6	Diode A2A2CR32	37	Diode A2A2CR85	68	Relay A2A2K8
7	Diode A2A2CR21	38	Transistor A2A2Q2	69	Relay A2A2K7
8	Resistor A2A2R28	39	Capacitor A2A2C8	70	Diode A2A2CR105
9	Resistor A2A2R23	40	Thermistor A2A2RT7	71	Diode A2A2CR108
10	Transistor A2A2Q7	41	Resistor A2A2R11	72	Diode A2A2CR101
11	Capacitor A2A2C44	42	Capacitor A2A2C11	73	Diode A2A2CR113
12	Diode A2A2CR16	43	Handle	74	Transistor A2A2Q4
13	Diode A2A2CR75	-44	Pin	75	Relay A2A2K6
14	Diode A2A2CR15	45	Resistor A2A2R86	76	Diode A2A2CR11
15	Diode A2A2CR59	46	Resistor A2A2R26	77	Capacitor A2A2C5
16	Resistor A2A2R10	47	Resistor A2A2R27	78	Relay A2A2K5
17	Resistor A2A2R7	48	Capacitor A2A2C13	79	Diode A2A2CR8
18	Diode A2A2CR88	49	Capacitor A2A2C13	80	Diode A2A2CR76
19	Resistor A2A2R30	50	Diode A2A2CR109	81	Relay A2A2K9
20	Diode A2A2CR5	51	Relay A2A2K11	82	Relay A2A2K10
21	Resistor A2A2R63	52	Diode A2A2CR17	83	Resistor A2A2R69
22	Resistor A2A2R14	53	Diode A2A2CR23	84	Resistor A2A2R25
23	Capacitor A2A2C37	54	Transistor A2A2Q6	85	Resistor A2A2R65
24	Capacitor A2A2C6	55	Diode A2A2CR20	86	Resistor A2A2R24
26	Diode A2A2CR107	56	Diode A2A2CR117	87	Capacitor A2A2C4
26	Diode A2A2CR10	57	Diode A2A2CR14	88	Diode A2A2CR25
27	Thermistor A2A2RT10	58	Diode A2A2CR19	89	Contact (29)
28	Diode A2A2CR74	59	Diode A2A2CR18	90	Contact (30)
29	Diode A2A2CR28	60	Diode A2A3CR13	91	Housing, connector
30	Resistor A2A2R18	61	Diode A2A2CR60	92	Insulator (8)
31	Diode A2A2CR84	62	Diode A2A2CR106	93	Board

Change 2 4-43

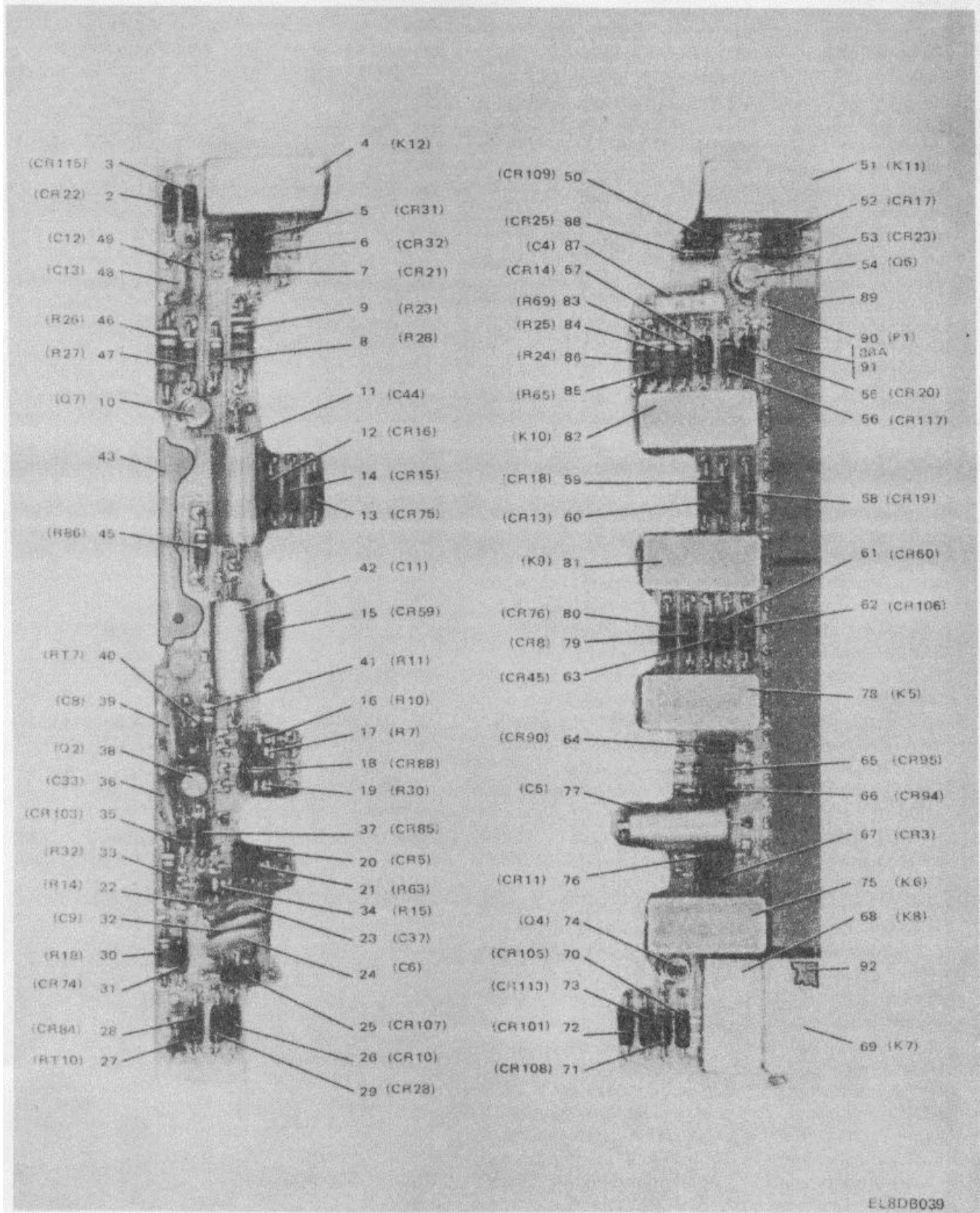


Figure 4-6.3. Tune Sequence Circuit Card Assembly A2A2, Parts Location.

Legend for figure 4-6.4:

Note: Item prefixed with a dash is listed but not shown.

-1	Tune sequence circuit card assembly A2A3	50	Diode A2A3CR71	98	Transformer A2A3T2
2	Resistor A2A3R60	51	Resistor A2A3R66	99	Resistor A2A3R45
3	Diode A2A3CR9	52	Resistor A2A3R16	100	Diode A2A3CR41
4	Transformer A2A3T1	53	Resistor A2A3R48	101	Diode A2A3CR104
5	Diode A2A3CR62	54	Handle	102	Relay A2A3K1
6	Diode A2A3CR26	-55	Pin	103	Resistor A2A3R36
7	Diode A2A3CRS3	56	Diode A2A3CR29	104	Resistor A2A3R37
8	Diode A2A3CR47	57	Diode A2A3CR27	105	Relay A2A3K19
9	Diode A2A3CR30	58	Capacitor A2A3C34	106	Diode A2A3CR55
10	Diode A2A3CR37	59	Diode A2A3CR100	107	Resistor A2A3R31
11	Diode A2A3CR98	60	Diode A2A3CR96	108	A2A3CR40
12	Diode A2A3CR118	61	Resistor A2A3R42	109	Diode A2A3CR99
13	Capacitor A2A3C39	62	Diode A2A3CR39	110	Relay A2A3K17
14	Thermistor A2A3RT9	63	Capacitor A2A3C19	111	Relay A2A3K16
15	Diode A2A3CR82	64	Resistor A2A3R40	112	Capacitor A2A3C20
16	Transistor A2A3Q10	65	Resistor A2A3R17	113	Capacitor A2A3C28
17	Diode A2A3CR38	66	Diode A2A3CR36	114	Relay A2A3K13
18	Diode A2A3CR8 3	67	Diode A2A3CR35	115	Capacitor A2A3C18
19	Capacitor A2A3C21	68	Resistor A2A3R12	116	Transistor A2A3Q8
20	Capacitor A2A3C22	69	Resistor A2A3R33	117	Transistor A2A3Q9
21	Thermistor A2A3RT5	-70	Resistor Kit (Nonprocurable)	-118	Resistor Kit (Nonprocurable)
22	Resistor A2A3R49	71	Resistor A2A3R34	119	Resistor A2A3R41
23	Resistor A2A3R71	72	Resistor A2A3R34	120	Resistor A2A3R41
24	Resistor A2A3R46	73	Resistor A2A3R34	121	Resistor AA3R41
25	Diode A2A3CR73	74	Resistor A2A3R34	122	Resistor A2A3R41
26	Diode A2A3CR68	75	Resistor A2A3R34	123	Resistor A2A3R41
27	Resistor A2A3R35	76	Resistor A2A3R34	124	Resistor A2A3R41
28	Capacitor A2A3C35	77	Resistor A2A3R34	125	Resistor A2A3R41
29	Resistor A2A3R70	78	Resistor A2A3R34	126	Resistor A2A3R41
-30	Resistor Kit (Nonprocurable)	79	Resistor A2A3R34	127	Resistor A2A3R41
31	Resistor A2A3R47	80	Resistor A2A3R34	128	Resistor A2A3R41
32	Resistor A2A3R47	81	Resistor A2A3R34	129	Resistor A2A3R41
33	Resistor A2A3R47	82	Resistor A2A3R34	130	Resistor A2A3R41
34	Resistor A2A3R47	83	Resistor A2A3R34	131	Resistor A2A3R41
35	Resistor A2A3R47	84	Resistor A2A3R34	132	Resistor A2A3R41
36	Resistor A2A3R47	85	Resistor A2A3R34	133	Resistor A2A3R41
37	Resistor A2A3R47	86	Resistor A2A3R41	134	Resistor A2A3R41
38	Resistor A2A3R47	87	Resistor A2A3R34	135	Resistor A2A3R41
39	Resistor A2A3R47	88	Resistor A2A3R34	136	Resistor A2A3R41
40	Resistor A2A3R47	89	Resistor A2A3R55	137	Resistor A2A3R38
41	Resistor A2A3R47	90	Capacitor A2A3C25	138	Contact (6)
42	Resistor A2A3R47	91	Capacitor A2A3C36	139	Contact (21)
43	Resistor A2A3R47	92	Capacitor A2A3C1	140	Contact (22)
44	Resistor A2A3R47	93	Resistor A2A3R83	141	Housing, connector
45	Resistor A2A3R47	94	Diode A2A3CR44	142	Clip (2)
46	Resistor A2A3R47	95	Diode A2A3CR43	-143	Rivet (2)
47	Resistor A2A3R47	96	Diode A2A3CR64	144	Insulator (5)
48	Resistor A2A3R47	97	Diode A2A3CR42	145	Board
49	Transistor A2A3Q15				

Change 2 4-45

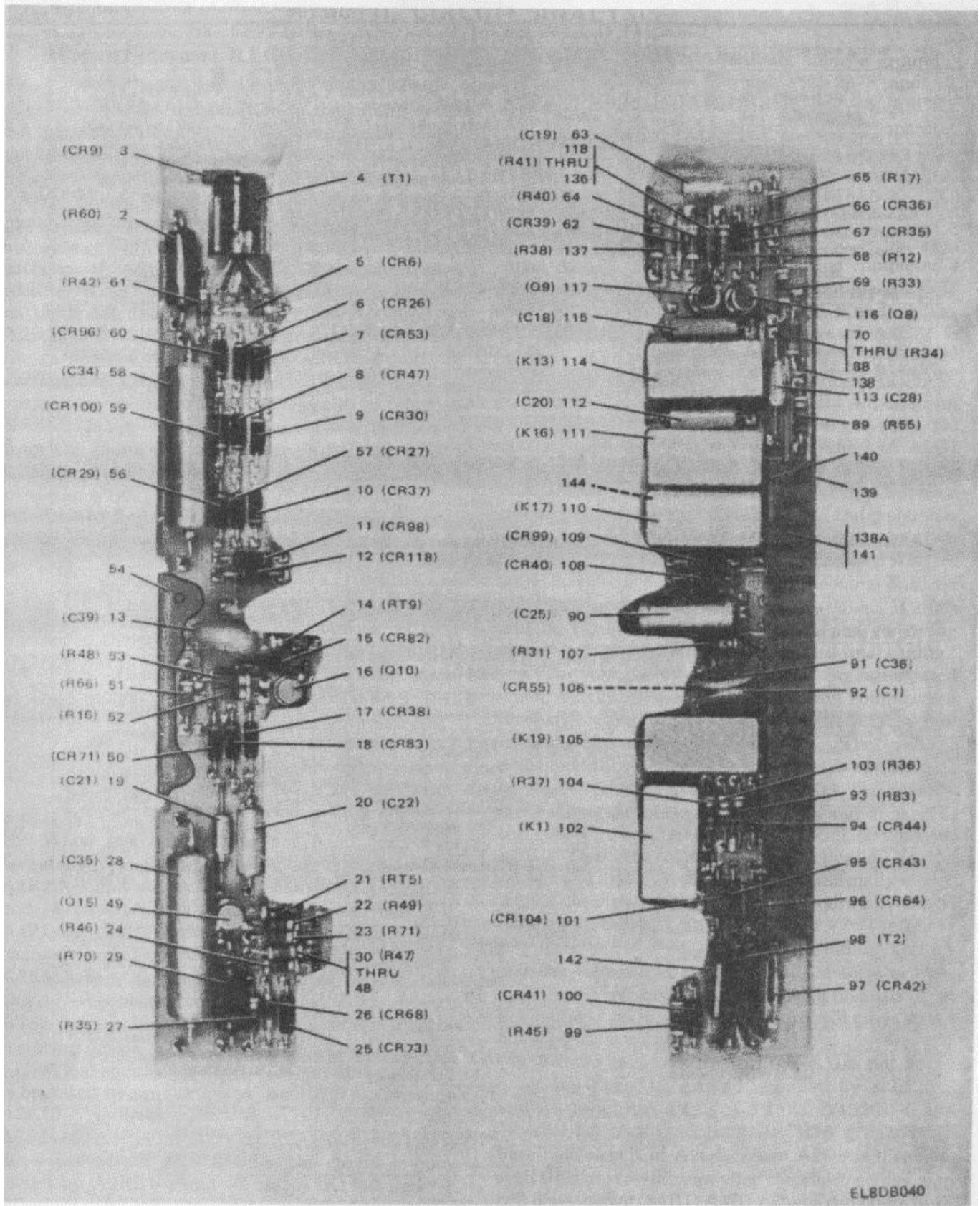


Figure 4-6.4. Tune Sequence Circuit Card Assembly A2A3, Parts Location.

Legend for figure 4-6.5:

Note: Item prefixed with a dash is listed but not shown.

-1	Tune sequence circuit card assembly A2A4-13	(Not used)	-24	(Not used)	
2	Diode A2A4CR61	14	Diode A2A4CR33	-25	(Not used)
3	Diode A2A4CR58	15	Capacitor A2A4C14	26	Relay A2A4K3
4	Resistor A2A4R3	16	Capacitor A2A4C15	27	Capacitor A2A4C2
5	Diode A2A4CR2	17	Diode A2A4CR34	28	Relay A2A4K18
6	Diode A2A4CR6	18	Diode A2A4CR91	29	Diode A2ACR66
7	Relay A2A4K2	19	Resistor A2A4R8	30	Blade, Index (3)
-8	(Not used)	20	Diode A2A4CR116	31	Spacer (4)
9	Capacitor A2A4C10	21	Diode A2A4CR54	32	Contact (173)
10	Diode A2A4CR4	22	Resistor A2A4R56	33	Insulator (4)
11	Transistor A2A4Q3	23	Relay A2A4K4	34	Board
12	Resistor A2A4R4				

Change 2 4-47

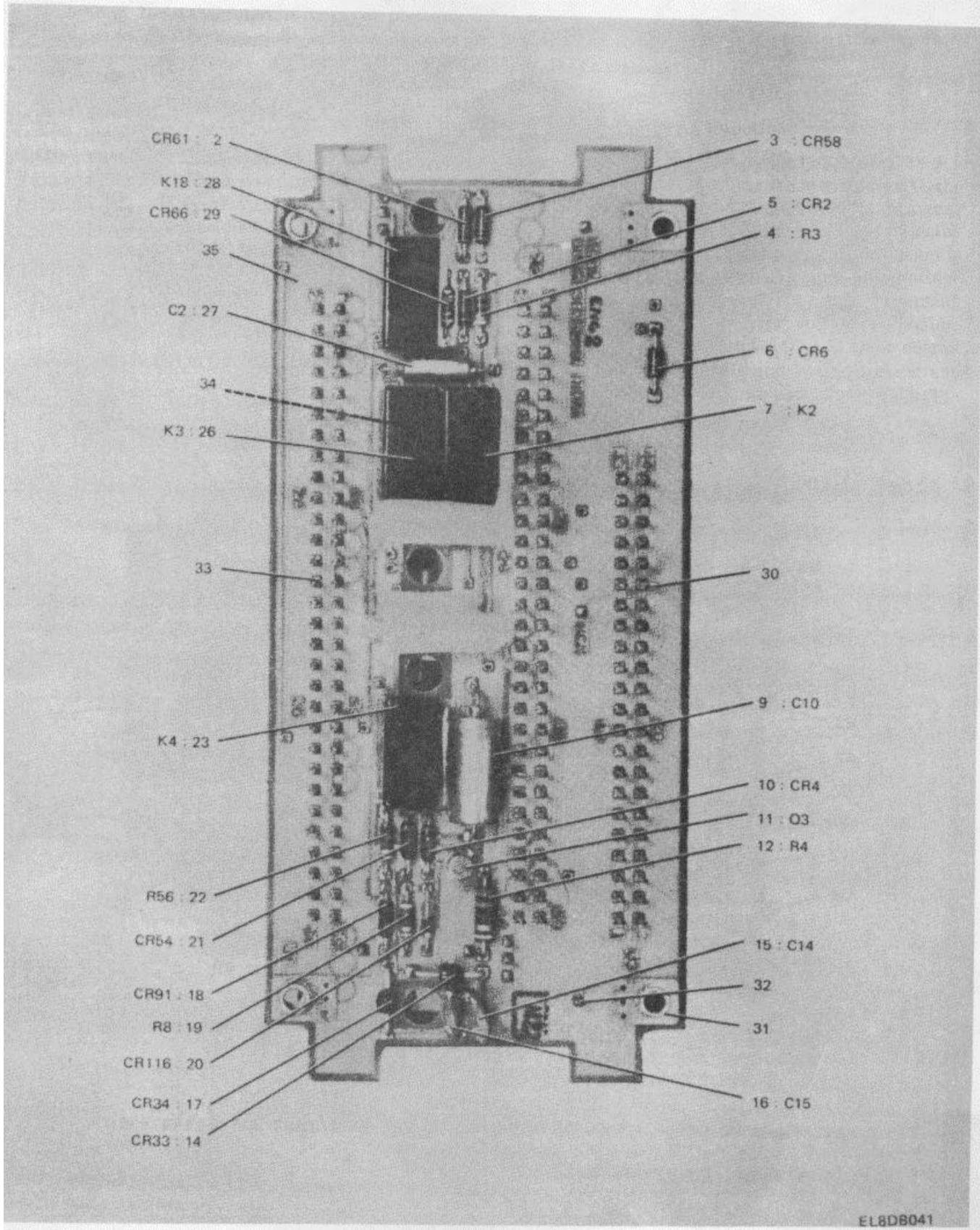


Figure 4-6.5. Tune Sequence Circuit Card Assembly A2A4, Parts Location.

4-20. Control Amplifier A3 (Part No. 775-4276-001)*a. Disassembly.*

(1) Remove control amplifier A3 (para 3-12a).

(2) Refer to figure 4-9. Remove the cover (1) by removing two screws (-2).

(3) Remove four screws (7) on the terminal board side of the chassis by snapping them out of their screw retainers (8).

(4) Remove at least one of the screw retainers (8) on the terminal board side of the chassis by removing screw (-9).

(5) Remove control terminal board A2TB1 (104, fig. 4-10) by removing four screws (-11).

(6) Remove relays A3K1 through A3K5 (56 through 60) from the chassis by removing 10 nuts (-61) and 10 screws (-62).

(7) Remove connector A3P1 (13) from the chassis by removing two screws (-16), two nuts (-14), and lug (15).

(8) Remove four transistors (28, 29, 30, and 31) by removing 8 nuts (-33), washers (-34), insulators (-35), screws (-37), 16 spacers (-36), and 4 lugs (32).

(9) Remove transistor holders (41, fig. 4-10) from terminal board A2TB1 (1)4, fig. 4-10) as necessary by removing screws and nylon washers (supplied with 41, fig. 4-10).

(10) Refer to figure 4-9 and remove transformers A3T1 (46) and, A3T2 (45).

(11) Refer to figure 4-10 and remove transformers A3T3 (89) and A3T4 (83).

b. Reassembly.

(1) Refer to figure 4-9. Mount transformers A3T1 (46) and A3T2 (45) to the chassis using Silastic 140 (para 4-28).

(2) Mount transformers A3T3 and A3T4 (89 and 83, fig. 4-10) to the chassis using Silastic 140 (para 4-28).

(3) Mount the transistor holders (41, fig. 4-10) to terminal board A3TB1 (104, fig. 4-10) with screws and washers (supplied with 41, fig. 4-10). Liquid-stake screws.

(4) Mount the four transistors (28, 29, 30, and 31, fig. 4-9) with 8 nuts (-33), washers (-34), insulators (-35), screws (-37), 16 spacers (-36), and 4 lugs (32).

(5) Mount connector A3P1 (13) to the chassis with two screws (-16), nuts (-14), and lug (15).

(6) Mount relays A3K1 through A3K5 (56 through 60) to the chassis with ten nuts (-61) and screws (-62).

(7) Mount terminal board (104, fig. 4-10) with four screws (-11, fig. 4-9).

(8) Mount screw retainer (8, fig. 4-9) on the terminal board side of the chassis with screw (-9, fig. 4-9).

(9) Mount four screws (7) on the terminal board side of the chassis by inserting into the screw retainers (8).

(10) Mount the cover (1) with two screws (-2).

(11) Replace control amplifier A3 (para 3-12b).

Change 2 4-49

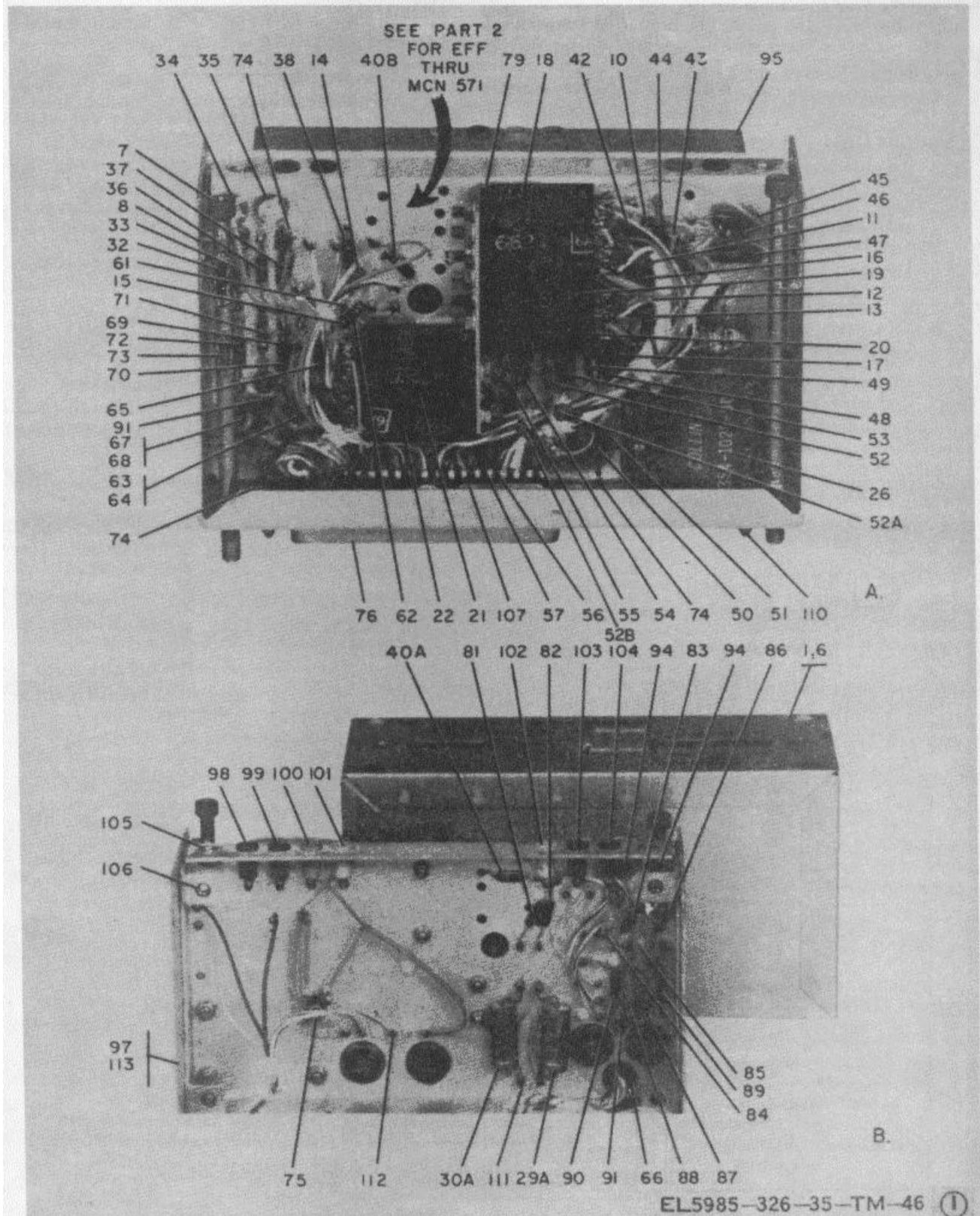


Figure 4-7(1). Control Amplifier A3 (Part Number 528-0467-000), Parts Location (Part 1 of 2).

Legend for figures 4-7(1) and 4-7(2):

Note: Items prefixed with a dash are attaching parts that are listed but not shown. items preceded by # have different values depending on MCN effectivity. Refer to paragraph 1-5d for differences.

1	Cover	#39	Resistor A3R52	76	Connector A3P1
-2	Screw (2)	#40	Diode A3CR12	-77	Nut (2)
-3	Retainer, handle	#40A	Diode A3CR19	-78	Screw (2)
-4	Rivet (2)	#40B	Diode A3CR19	79	Relay bracket
-5	Handle	#41	Resistor A3R51	-80	Screw (4)
6	Cover	42	Resistor A3R3	-80A	Stud (4)
7	Screw (4)	43	Capacitor A3C4	81	Diode A3CR15
8	Screw retainer (4)	44	Resistor A3R7	82	Diode A3CR16
-9	Screw (4)	45	Resistor A3R6	83	Diode A3CR9
10	Diode A3CR1	46	Resistor A3R5	84	Resistor A3RT6
11	Diode A3CR2	47	Resistor A3R10	85	Resistor A3RT5
12	Diode A3CR3	48	Resistor A3R2	86	Diode A3CR8
13	Diode A3CR4	#49	Capacitor A3C3	87	Capacitor A3C25
#14	DiodeA3CR17	#50	Coil A3L6	88	Capacitor A3C26
#15	Diode A3CR18	#51	Holder	89	Resistor A3R58
16	Resistor A3R8	52	Capacitor A3C1	90	Resistor A3R60
#17	Resistor A3R11	#52A	Resistor A3R63	91	Terminal (5)
18	Relay A3K1	#52B	Resistor A3R62	-92	Nut (5)
19	Relay A3K2	53	Resistor A3R4	-93	Washer (5)
20	Relay A3K3	54	Resistor A3R1	-93A	Screw (5)
21	Relay A3K4	#55	Capacitor A3C2	94	Holder (2)
22	Relay A3K5	#56	Coil A3L1	95	Terminal board
-23	Nut (10)	#57	Holder	-96	Screw (4)
-24	Washer (10)	#58	Transistor A3Q15	97	Chassis
-25	Deleted	#58A	Holder	98	Jack A3TP1
26	Chopper A3G1	#59	Resistor A3RT7	99	Jack A3TP2
27	Nut (4)	#60	Capacitor A3C29	100	Jack A3TP3
-28	Screw (4)	61	Diode A3CR10	101	Jack A3TP4
#29	Capacitor A3C27	62	Diode A3CR11	102	Jack A3TP9
#29A	Capacitor A3C27	#63	Transformer A3T4=	103	Jack A3TP10
#30	Capacitor A3C28	#64	Holder	104	Jack A3TP11
#30A	Capacitor A3C28	65	Resistor A3R61	105	Nut (2)
31	Capacitor A3C30	66	Grommet	106	Nut (4)
32	Resistor A3R53	#67	Transformer A3T3	107	Clip (2)
#33	Capacitor A3C23	#68	Holder	-108	Washer (4)
#33	Capacitor A3C29	69	Diode A3CR13	-109	Rivet (4)
#34	Transistor A3P13	70	Diode A3CR14	110	Locating pin (2)
#35	Transistor A3Q14	71	Resistor A3R56	111	Terminal (39)
36	Resistor A3R54	72	Resistor A3R57	112	Terminal (27)
37	Capacitor A3C24	73	Resistor A3R55	113	Chassis
37A	Resistor A3R62	74	Terminal lug (4)		
38	Resistor A3R59	75	Terminal ground lug (2)		

Change 2 4-51

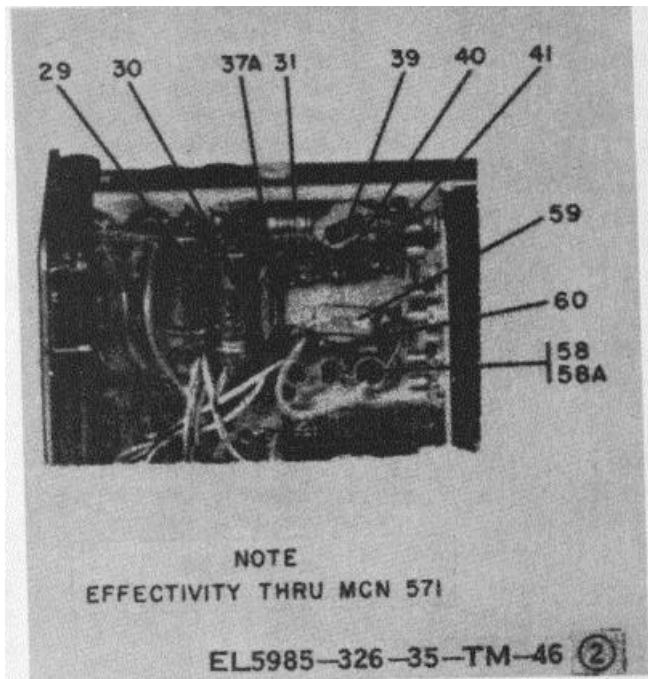


Figure 4-7(2). Control Amplifier A3 (Part Number 528-0467-000), Parts Location (Part 2 of 2).

14-21. Step Coil A4 (Part Number 528-0524-000)

a. *Disassembly* (fig. 3-3).

(1) Remove step coil A4 (para 3-13a).

(2) Remove the tuning drive assembly (7) by removing four screws (-8) and washers (-9). Pull the tuning drive assembly (7) away from the gear box mounting plate (31). Do not disassemble tuning drive assembly; return to manufacturer for repair and alignment.

(3) Remove the gear box mounting plate (31)

by removing three flathead screws (-32). Gently work the gear box mounting plate (31) off three locating pins.

(4) Remove the switch cover (10) from the bearing plate (19) by removing three screws (11) and lockwashers (-12).

(5) Remove rotary switch sections A4S1B and A4S1A (14, 15) by removing two screws (-18), short spacers (-16), and long spacers (-17). Record the switch wiring arrangement; then unsolder the wires.

NOTE

If replacement of the rotary switches is not necessary, loosen two screws (-18), but do not remove screws (-18), rotary switch sections A4S1B and A4S1A (14 and 15), or spacers (-16 and -17).

(6) Mark the position and remove the bearing plate (19) from the switch mounting base (30) by removing two screws (-20), terminal lug (-21), and lockwasher (-22). Gently work the bearing plate and the switch mounting base off of the two locating pins.

(7) Remove the switch spur gearshaft (25) from the bearing plate by removing the retaining ring (-23).

(8) Remove the idler spur gear (33) from post by removing retaining ring (-34).

(9) Remove the drum spur gear (35) from the drum drive (56) by removing two retaining rings (-36).

(10) Loosen the gearbox mounting spacer (37) by removing screw (-38). Gently work the gearbox mounting spacer (37) off of the locating pins.

(11) Place step coil A4 on its side and carefully remove the drum assembly (49).

Legend for figure 4-8:

Note: Items prefixed with a dash are attaching parts that are listed but not shown. Items preceded by # have different values depending on MCN effectivity. Refer to paragraph 1-5d for differences.

#1	Capacitor A3C21	29	Resistor A3R15	59	Diode A3CR6
#2	Capacitor A3C14	30	Transistor A3Q3	60	Transformer A3T2
3	Resistor A3R25	31	Resistor A3R20	61	Transformer A3T1
#4	Resistor A3R26	32	Transistor A3Q4	62	Resistor A3R47
5	Capacitor A3C11	33	Resistor A3R29	63	Resistor A3R34
6	Capacitor A3C10	34	Resistor A3R30	64	Transistor A3Q7
#6A	Capacitor A3C23	35	Transistor A3Q5	65	Transistor A3Q8
7	Resistor A3R12	36	Transistor A3Q6	66	Resistor A3R38
8	Resistor A3R17	37	Resistor A3R23	67	Resistor A3R31
#9	Capacitor A3C6	38	Resistor A3RT1	68	Resistor A3RT4
#9A	Diode A3CR20	39	Resistor A3R24	#69	Capacitor A3C12
10	Capacitor A3C7	#40	Resistor A3R27	70	Resistor A3R33
11	Resistor A3R16	41	Resistor A3R22	#71	Capacitor A3C17
12	Capacitor A3C9	42	Resistor A3R19	72	Resistor A3R21
13	Capacitor A3C18	#43	Capacitor A3C13	73	Diode A3CR7
14	Resistor A3R36	44	Capacitor A3C22	#74	Capacitor A3C8
15	Capacitor A3C16	45	Resistor A3R39	75	Resistor A3R13
#15A	Diode A3CR1	46	Resistor A3R41	#76	Capacitor A3C5
#16	Capacitor A3C 15	#47	Resistor A3R46	77	Resistor A3RT3
17	Resistor A3R37	48	Resistor A3R43	78	Resistor A3R50
18	Resistor A3R32	49	Resistor A3RT2	79	Transistor holder (12)
19	Capacitor A3C19	50	Resistor A3R42	-79A	Washer (12)
20	Capacitor A320	51	Transistor A3Q11	80	Terminal board
#21	Resistor A3R45	52	Transistor A3Q12	81	Terminal (74)
22	Resistor A3R44	53	Resistor A3R49	82	Terminal (29)
23	Resistor A3R18	54	Transistor A3Q10	83	Jack A3TP5
24	Transistor A3Q2	55	Resistor A3R48	84	Jack A3TP6
25	Transistor A3Q1	56	Resistor A3R40	85	Jack A3TP7
26	Resistor A3R14	57	Transistor A3Q9	86	Jack A3TP8
27	Resistor A3R28	58	Resistor A3R35	87	Terminal board
28	Diode A3CR5				

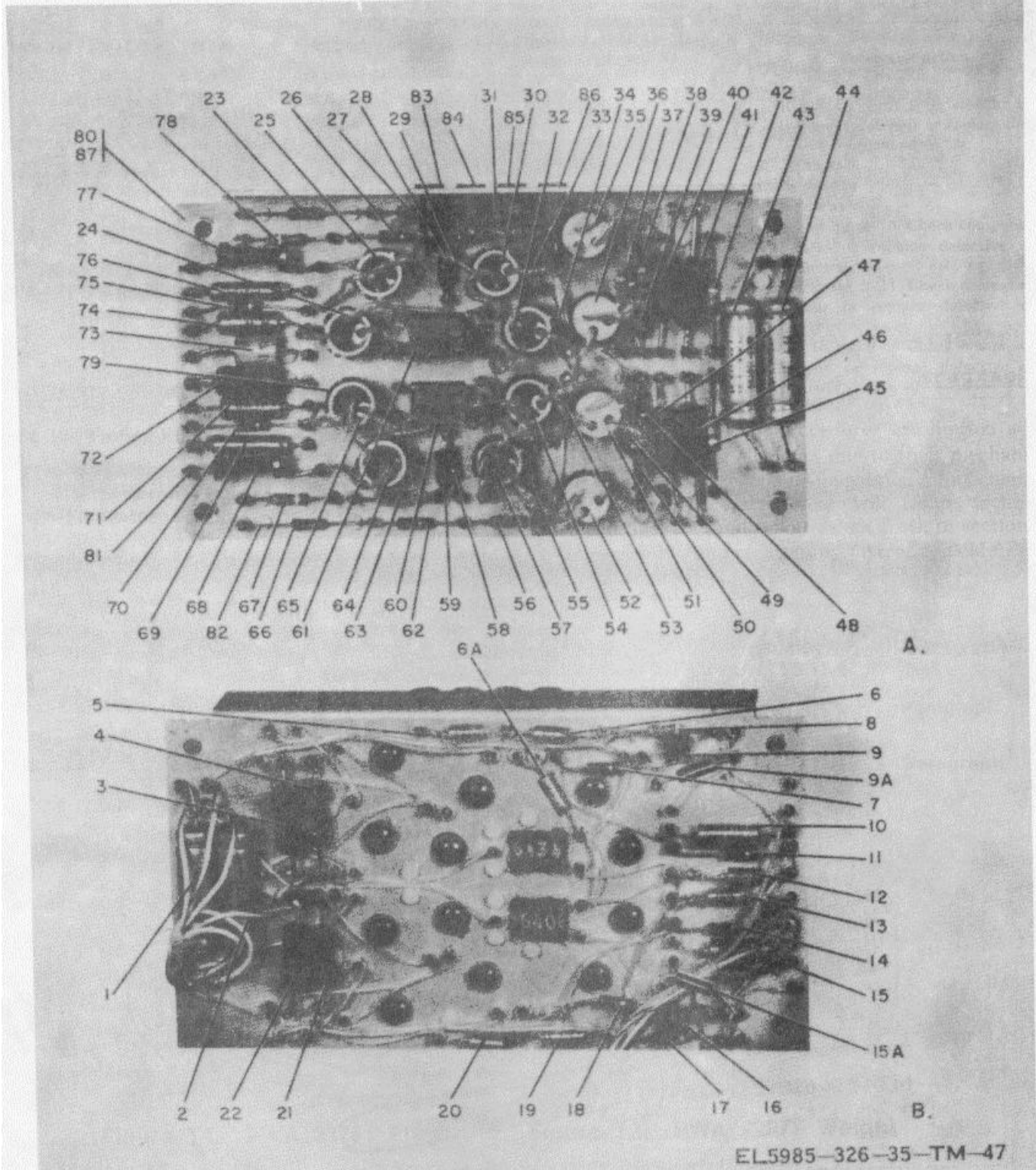


Figure 4-8. Control Amplifier A3 (Part Number 528-0467-000) Terminal Board, Parts Location

Change 2 4-54

(12) Place masking tape over rear and front drum ends (54 and 59) of the drum assembly so shim washers (-50, -51, and -52) do not fall off. This step will facilitate reassembly.

(13) Remove rear drum end (54 and attached parts) from rotor coil drum (61, part of 49) by removing three screws (-55).

(14) Remove drum drive (56) from rear drum end (54) by removing four screws (-57) and lockwashers (-58).

(15) Remove the front drum end (59) from the rotor coil drum (61, part of 49) by removing three screws (-60).

(16) Remove the actuator (64) from the rear coil plate (67) by removing two screws (-65) and lockwashers (-66).

(17) Remove the wraparound (1A) from the rear coil plate (67) and from gear plate (43) by removing 15 screws (-3).

(18) Remove four captive screws (2) from the wraparound by pressing them out of the spring sleeves (-4).

(19) Remove the actuator (40) from the gear plate by removing two screws (-41) and lockwashers (-42).

CAUTION

Jigging bars (71, 72, and 73) should be laced together at the ends before removing.

(20) Loosen the rear coil plate (67) from the jigging bars (71, 72, and 73) by removing three screws (-68). Remove by gently working the rear coil plate (67) off three locating pins (-69).

(21) Loosen the gear plate (43) from the jigging bars (71, 72, and 73) by removing three screws (-44). Remove by gently working the gear plate (43) off three locating pins (45).

(22) Remove the contacts (76) as necessary by heating with a soldering iron and pulling the contacts toward the center axis of coil A4L1 (74).

(23) Clean, inspect, and repair (sec. V).

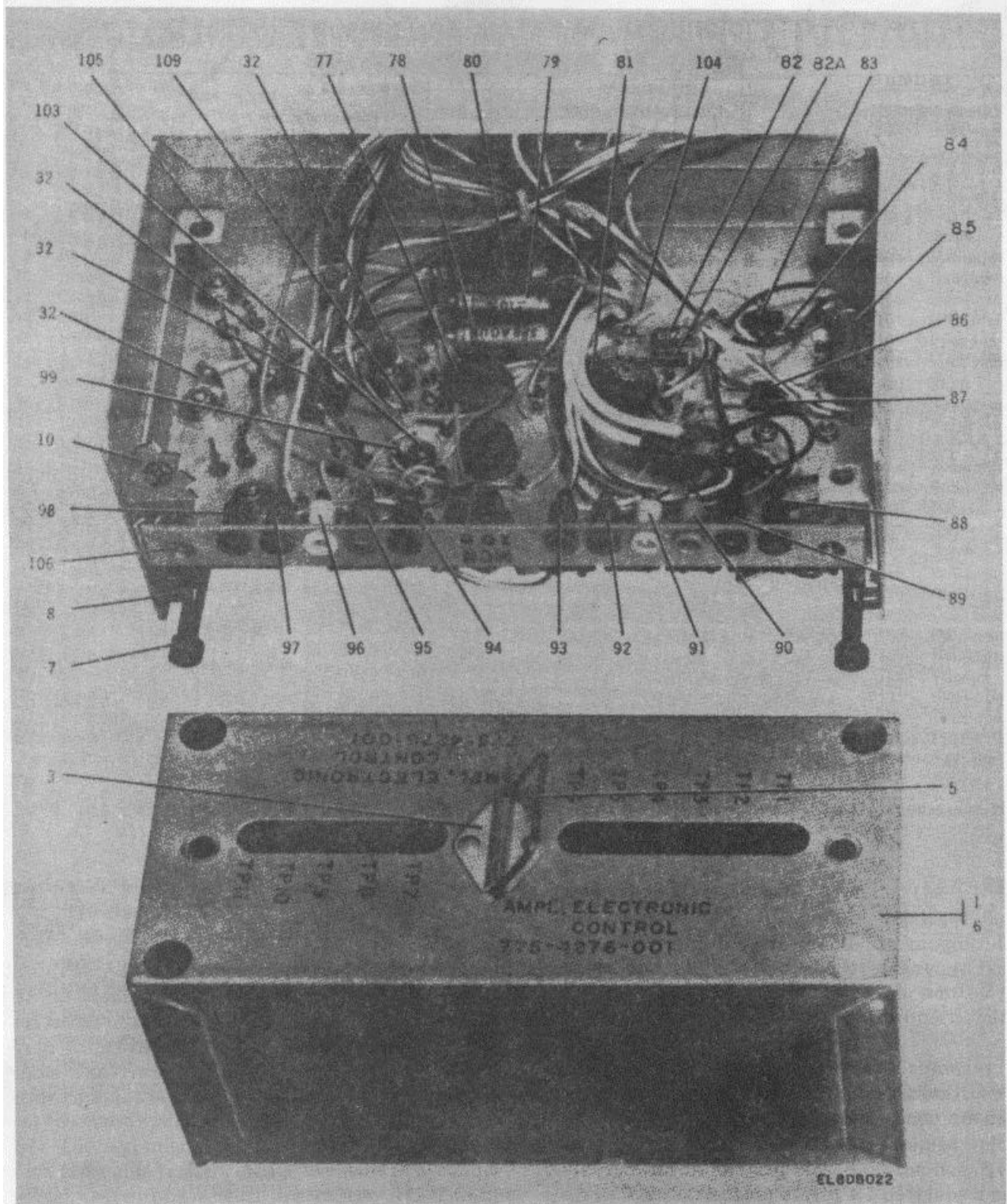


Figure 4-9(1). Control Amplifier A3 (Part Number 775-4276-001), Parts Location (Part 1 of 2).

Change 2 4-56

Legend for figures 4-9(1) and 4-9(2):

Note: Items preceded with - are attaching parts and not shown.

1	Cover	39	Resistor A3R6	76	Resistor A3R27
-2	Screw (2)	40	Resistor A3R8	77	Capacitor A3C4
3	Retainer, handle	41	Resistor, thrm A3RT4	78	Capacitor A3C33
-4	Rivet (2)	42	Resistor A3R67	79	Capacitor A3C22
5	Handle, bail	43	Resistor, thrm A3RT6	80	Resistor A3R46
6	Cover	44	Resistor A3R68	81	Capacitor A3C1
7	Screw (4)	45	Transformer A3T2	82	Capacitor A3C9
8	Screw retainer (4)	46	Transformer A3T1	82A	Resistor A3R70
-9	Screw (4)	47	Resistor A3R2	83	Resistor A3R13
10	Electronic components assy	48	Resistor A3R12	84	Resistor A3R12
-11	Screw (4)	49	Resistor A3R3	85	Capacitor A3C5
-12	Wiring harness	50	Resistor A3R1	86	Resistor A3R19
13	Connector A3PI	51	Semicond device A3CR11	87	Semicond device A3CR10
-14	Nut (2)	52	Semicond device A3CR12	88	Jack, brn A3TP1
-15	Lug	53	Semicond device A3CR13	89	Jack, red A3TP2
-16	Screw (2)	54	Semicond device A3CR14	90	Jack, orn A3TP3
17	Amplifier, electronic control	55	Terminal	91	Jack, yel A3TP4
18	Semicond device A3CR8	56	Relay A3K1	92	Jack, grn A3TP5
19	Semicond device A3CR7	57	Relay A3K2	93	Jack, blu A3TP6
20	Resistor A3R21	58	Relay A3K3	94	Jack, vio A3TP7
21	Semicond device A3CR9	59	Relay A3K4	95	Jack gy A3TP8
22	Semicond device A3CR23	60	Relay A3K5	96	Jack, wht A3TP9
23	Resistor A3R9	-61	Nut (10)	97	Jack, blk A3TP10
24	Resistor A3R47	62	Washers (10)	98	Jack, brn A3TP11
25	Capacitor A3C23	63	Semicond device A3CR5	99	Terminal
26	Capacitor A3C34	64	Semicond device A3CR6	-100	Nut
27	Resistor A3R7	65	Resistor A3R20	-101	Washer
28	Transistor A3Q9	66	Capacitor A3C11	-102	Screw
29	Transistor A3Q8	67	Resistor A3R15	103	Terminal (15)
30	Transistor A3Q16	68	Resistor A3R18	104	Eyelet
31	Transistor A3Q15	69	Resistor A3R17	105	Nut (4)
32	Terminal (4)	70	Resistor A3R16	106	Nut (2)
-33	Nut (8)	71	Capacitor A3C6	107	Clip (2)
-34	Washer (8)	72	Capacitor A3C10	-108	Rivet (4)
-35	Insulator (8)	73	Resistor A3R11	109	Terminal (47)
-35A	Semicond device (2)	74	Resistor A3R14	110	Pin, locating (2)
-36	Spacer (16)	75	Capacitor A3C8	111	Chassis, electrical equip
-37	Screw (8)				
38	Resistor A3R5				

Change 2 4-57

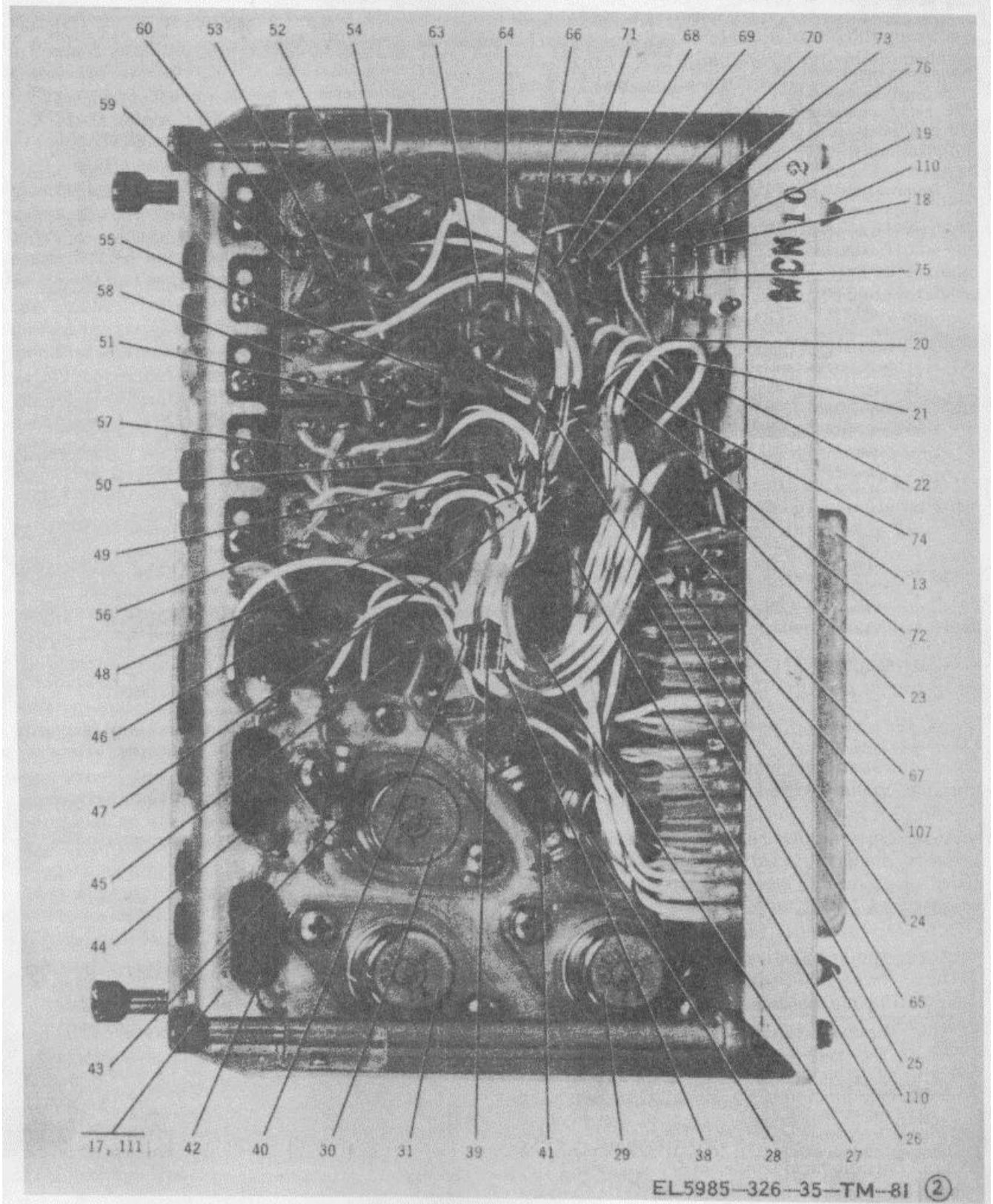


Figure 4-9(2). Control Amplifier A3 (Part Number 775-4276-001), Parts Location (Part 2 of 2).

Change 2 4-58

b. Reassembly (fig. 3-3).

(1) Mount contacts (76) to coil A4L1 (74) by assembling two pins (-77) to contact (76). Assemble contact and pins to holes in coil A4L1 (74). Secure by soldering.

CAUTION

If the jiggling bars (71, 72, and 73) were replaced, Dow Silastic 140, or equivalent (para 4-28), must be inserted between the coil windings and the slots in the jiggling bars.

(2) Seat the rear coil plate (67) to jiggling bar locating pins (-69), and secure with three screws (-68). Apply Glyptal (para 4-28) to screw threads.

(3) Mount the actuator switch number 2 (40) to the gear plate (43) with two screws (41) and lockwashers (-42). Apply Glyptal (para 4-28) to screw threads. Remove lacing from the jiggling bars (71, 72, 73).

(4) Seat the gear plate to jiggling bar locating pins (45) and secure with three screws (-44).

(5) Mount four captive screws (-2) to the wraparound (1A) by pressing them into their spring sleeves (-4).

(6) Slide coil A4L1 (74 and attached parts) into the wraparound (1A) so that the large notch in one side of the wraparound (1A) is nearest the two threaded mounting holes for the actuator (64) on the rear coil plate (67).

(7) Mount the wraparound (1A) to the rear coil plate (67) and the gear plate (43) with 15 screws (-3). Apply Glyptal (para 4-28) to screw threads.

(8) Mount the actuator switch number 1 (64) to the rear coil plate (67) with two screws (-65) and lockwashers (-66).

(9) Mount the front drum end (59) to rotor coil drum (61) with three screws (-60).

(10) Mount drum drive (56) to rear drum end (54) with four screws (-57) and lockwashers (-58).

Legend for figure 4-10.

Note: Items preceded by # have different values depending on MCN effectivity. Refer to paragraph 1-5d for differences.

1 Component assy	36 Capacitor A3C32	71 Resistor A3R30
#2 Resistor A3R10	37 Transistor A3Q14	72 Semicond device A3CR18
3 Resistor A3R32	38 Resistor A3R58	73 Semicond device A3Q4
4 Resistor A3R31	39 Resistor A3R22	74 Holder (8)
5 Capacitor A3C2	40 Transistor A3Q13	75 Capacitor A3C15
6 Semicond device A3Q5	41 Transistor holder (4)	76 Resistor A3R29
#7 Semicond device A3CR16	42 Insulator (4)	77 Capacitor A3C17
8 Resistor A3R34	43 Capacitor A3C12	78 Resistor, thrm A3RT3
9 Capacitor A3C3	44 Resistor A3R59	79 Capacitor A3C13
10 Capacitor A3C19	45 Resistor A3R23	80 Capacitor A3C29
11 Semicond device A3Q1	46 Semicond device A3CR15	81 Capacitor A3C35
12 Resistor A3R36	47 Resistor A3R57	82 Resistor A3R62
13 Resistor, thrm A3RT1	48 Resistor A3R39	83 Transformer A3T4
14 Resistor A3R38	49 Resistor A3R60	84 Capacitor A3C20
15 Semicond device A3CR2	50 Resistor A3R24	85 Resistor A3R41
16 Semicond device A3CR3	51 Capacitor A3C30	86 Capacitor A3C24
17 Transistor A3Q6	52 Resistor A3R25	87 Capacitor A3C18
18 Resistor, thrm A3RT2	53 Resistor A3R26	88 Semicond device A3CR4
19 Capacitor A3C21	54 Resistor A3R55	89 Transformer A3T3
20 Semicond device A3Q2	55 Transistor A3Q3	90 Semicond device A3CRI
21 Resistor A3R37	56 Resistor A3R52	91 Semicond device A3CR22
22 Transistor A3Q7	57 Resistor A3R53	92 Semicond device A3CR19
23 Resistor A3R48	58 Transistor A3Q10	93 Capacitor A3C7
24 Resistor A3R40	59 Resistor, thrm A3RT5	94 Resistor A3R35
25 Resistor A3R45	60 Semicond device A3Q12	95 Resistor A3R33
26 Resistor A3R43	61 Capacitor A3C28	96 Capacitor A3C16
27 Resistor A3R42	62 Resistor A3R50	97 Semicond device A3CR17
28 Resistor A3R44	63 Capacitor A3C26	98 Resistor A3R56
29 Capacitor A3C31	64 Semicond device A3Q11	99 Semicond device A3CR20
30 Resistor A3R65	65 Semicond device A3CR21	100 Capacitor A3C27
31 Resistor A3R63	66 Resistor A3R51	101 Resistor A3R54
32 Resistor A3R64	67 Resistor A3R49	102 Terminal (15)
33 Resistor A3R66	68 Capacitor A3C25	103 Terminal (101)
34 Resistor A3R61	69 Resistor A3R28	104 Terminal board A3TB1
35 Resistor A3R69	70 Capacitor A3C14	

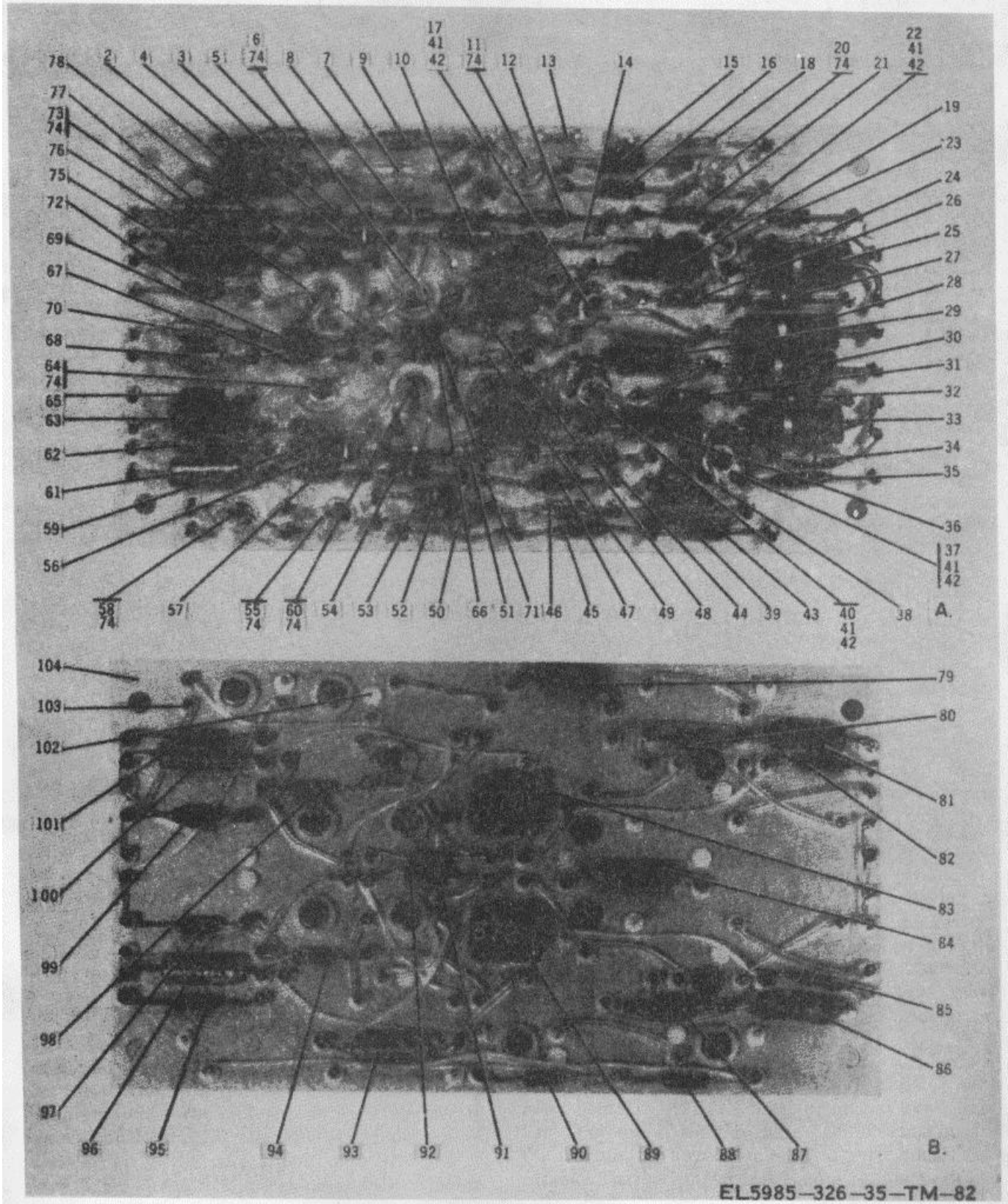


Figure 4-10. Control Amplified A3, Electronic Components Assembly, Parts Location.

Change 2 4-60

(11) Mount rear drum end assembly (54 and attached parts) to rotor coil drum (61) with three screws (-55).

(12) If masking tape was placed over the ends of the drum assembly (49) during disassembly, remove the tape from the front drum end (59).

NOTE

Use Tester, Spring Re-Silancy 0-100 grams (NSN 6635-00-545-8500). Check tension on contacts of rotor coil drum. It should take 20 ± 5 grams pressure to push the contacts off their stops with the force at right angle to the axis of the rotor coil drum. Decrease contact tension by pressing contacts beyond their point of elasticity. Increase tension by inserting a small screwdriver between the contacts and the drum proper (part of 61) and turning slightly.

(13) Carefully place the drum assembly through hole in the gear plate (43) and into the small hole in rear coil plate (67). Observe whether contacts of rotor coil drum (61) can be centered on contacts (76) of coil A4L1 (74). If not, adjust by varying the number of shim washers (-50, -51, and -52) on the front drum end (59).

(14) Remove the masking tape from rear drum end (54).

(15) Temporarily seat the gearbox mounting spacer (37) to the locating pins on the gear plate (43) and check the end play of the drum assembly (49). End play of the drum assembly (49) should be 0.008 ± 0.005 inch. Adjust by varying the number of shim washers (-50, -51, and -52) on the rear drum end (54).

(16) Recheck steps (14) and (15). Mount the gearbox mounting spacer (37) to the rear coil plate (67) with screw (-38).

(17) Mount the drum spur gear (35) to the drum drive (56) with two retaining rings (-36).

(18) Mount the idler spur gear (33) to the post with retaining ring (-34).

(19) Mount the gearbox mounting plate (31) to the rear coil plate (67) with three flathead screws (-32). Apply Glyptal (para 4-28) to screw threads.

(20) Mount the switch spur gearshaft (25) to the bearing plate (19) with retaining ring (-23).

(21) Press the switch mounting base (30) on the two locating pins.

(22) Seat the bearing plate (19) to the switch mounting base (30) and mount with two screws (-20), terminal lug (-21), and lockwasher (-22).

(23) Position switch sections A4S1B, A4S1A (14 and 15) to switch spur gear shaft (25) so that the following conditions exist:

(a) Small dimples adjacent to the switch rotor shaft holes (part of 14 and 15) are on the same flat

of the switch shaft (part of 25).

(b) Rotor switch section A4S1A (15) is nearest rear coil plate (67).

(c) Contacts on both rotor switch sections A4S1B, A4S1A (14 and 15) are pointing away from the rear coil plate (67) and are nearest to the top edge of the wraparound (1A).

(24) Mount rotary switch sections A4S1B, A4S1A (14 and 15) to the rear coil plate (67) with hardware in the following order: two long spacers (-17), rotary switch section A4S1A (15), two short spacers (-16), rotary switch section A4S1B (14), and two screws (-18). Rewire as necessary.

(25) Manually turn drum spur gear (35) until the alignment pointer (-53) on the rear drum end (54) is in line with the red mark on the gearbox mounting spacer (37).

(26) Unmesh the drum spur gear (35) with the idler spur gear (33) by moving the drum spur gear (35) away. Then, turn switch shaft (part of 27) until rotor contacts of A4S1A and A4S1B (part of 14 and 15) are centered (first contact to the right of X) on A4S1A-1 and A4S1B-1.

NOTE

The hole in the rear coil plate (67) is large enough so unmeshing of gears (33 and 35) can be accomplished. These gears are held in mesh by the tuning drive assembly (7).

(27) When the alignments in steps (25) and (26) are both obtained, remesh the drum spur gear (35) with the idler spur gear (33).

(28) Turn the small screw adjustment that is adjacent to the control motor of the tuning drive assembly (7) so the slot is tangential to the control motor cover.

NOTE

The spline gear on the tuning drive assembly (7) should now be locked. Check by attempting to turn it manually.

(29) Position the spline gear on the tuning drive shaft (part of 7) to the drum drive (56). Rotate the tuning drive assembly +1/9 turn to align it to the holes in the gearbox mounting plate (31). Then mount the tuning drive assembly (7) to gearbox mounting plate (31) with four screws (-8) and washers (-9).

CAUTION

Do not loosen setscrew more than 1/8 turn. Point of setscrew must remain engaged in the V-groove of wormshaft.

(30) Loosen setscrew just enough to unlock

wormshaft on the tuning drive assembly (7) with a No. 4 Bristol wrench.

(31) Turn the wormshaft with a screwdriver until the alignment (-53) pointer is in line with the red mark as in step (25) above and rotor contacts A4S1A and A4S1B are centered on A4S1A-1 and A4S1B1 as in step (26) above. Retighten setscrew on the tuning drive assembly.

(32) Mount the switch cover (10) to the bearing plate (19) with three screws (-11) and lockwashers (-12). Assure that the rubber grommet (13) around the switch wires engages the slot of the switch cover.

(33) Replace the step coil A4 (para 3-13b).

4-21.1. Step Coil A4 (Part number 777-3508-001)

a. Disassembly (fig. 3-3.1).

(1) Remove step coil A4 (para 3-13a).

(2) Remove lead (24) from insulator (10).

(3) Remove cover (5) by removing 16 screws (-8).

(4) Remove spacer (2) or insulator (10) and place if necessary for repair.

(5) On older units, remove shields (12, 13) by removing 12 screws (-14).

(6) Rotate gear (109) far enough to clear setscrews (-21) under contacts on switch (25).

(7) Loosen four setscrews (-21) and remove leads (18, 19, 20).

(8) Remove switch (25) by removing four screws (-26).

(9) Remove plate (66) by removing three screws (-67), one screw (-68), and lockwasher (-69).

(10) Remove bearing (70).

(11) Remove gearshaft (75).

(12) Remove bearings (76, 77).

(13) Remove four posts (71).

(14) Remove plate (84) by removing one screw (-85) and spring washer (-86).

(15) Remove bearing (83) from plate (84).

(16) Remove four posts (87).

(17) Remove plate (102) by removing four posts (87), cable clamp (96A), screw (-95B), flat washer (-95C), screw (-103), spring washer (-104), and retaining ring (-60).

(18) Remove gear assembly (107).

(19) Remove gear (111) by removing retaining ring (-112).

(20) Remove star wheel (113) and gear shaft (115).

(21) Remove plate secured to coil mounting plate (121) by removing three flathead Phillips screws, three screws (-117), and one screw (-118) securing posts (116).

(22) Remove three screws (-34), and four screws (-29) securing electrical contacts (27, 28) to

remove mounting plate (33).

(23) Remove lead screws (58, 65) and carriage contact assembly (48) by removing retaining rings (-54, -60).

b. Reassembly (fig. 3-3.1).

NOTE

If coil bars (38, 39, 40) were replaced, Dow Silastic 140 must be inserted between coil windings and slots in coil bars.

(1) Seat coil plate (121) to coil bars (38, 39, 40) and secure with three screws (-117).

(2) Replace lead screws (58, 65) in coil plate (121) and secure with retaining rings (-54, -60).

(3) Replace carriage contact assembly (48) by rotating lead screws counterclockwise. Check coil contact to ensure that it makes contact the full length of the coil. Set coil contact (46) on the fifth full turn of the coil. Ensure that carriage contact assembly does not bind on lead screws. Pressure between electrical contact (46) and coil (42) should be 90 to 120 grams (3.174 to 4.232 oz). Pressure between electrical contact (47) and electrical rod (30) should be 90 to 120 grams (3.174 to 4.232 oz). If pressure is not within tolerance, rotate contact assembly (43-47) away from coil and electrical contact rod.

(4) Insert leadscrews (58, 65) into bearings (37). Seat coil plate (33) to coil bars (38, 39, 40) and secure with three screws (-34).

(5) Secure electrical contact (28) to coil plate (33) with two screws (-29). Solder end of rf coil to electrical contact (28).

(6) Secure plate to coil mounting plate (121) using three flathead Phillips screws.

(7) Replace bearings (119, 120) on plate secured to coil mounting plate (121).

(8) Replace star wheel (113) on shaft (115) and secure with retaining ring (-114).

(9) Place star wheel (113) and splined end of shaft (115) into bearing (120).

(10) Replace gear (111) on shaft (115) and secure with retaining ring (-112)

(11) Secure four posts (116) to plate with three screws (-117) and one screw (-118).

(12) Replace gear assembly (107) into bearing (119). Pinion on gear (107) must be clear of star wheel.

(13) Replace bearing (105, 106) into plate (102).

(14) Replace plate (102) and secure with two posts (87), screw (-103), and washer (-104).

(15) Replace two posts (87).

(16) Replace retaining ring (-60) on leadscrew drive (59).

(17) Secure cable clamp (95A) to plate (102)

with screw (-95B) and flat washer (-95C). (18) Replace bearing (83) on leadscrew drive (59).

(19) Replace plate (84) and secure with two posts (71), two screws (-85), and lockwashers (-86).

(20) Replace bearings (76, 77) in plate (84).

(21) Replace gear assembly (75). Rotate gear assembly (75) until the rotor of switch (92) is in contact 10A (violet wire).

(22) Replace bearing (70) in plate (66).

(23) Replace plate (66) and secure with three screws (-67), one screw (-68), and lockwasher (-69).

(24) Replace switch (25) and secure with four screws (-26). Switch (25) must be in the bypass position. Rotate gear assembly (107) counter clockwise (as viewed from the switch end of module). Switch (25) must operate 90 degrees as the coil contact is advanced from the fifth full turn to the sixth full turn, and return when the coil contact moves from the sixth to the fifth turn. Switch (25) must not move when the coil contact is in any position other than 5 and 6. If switch (25) does not operate properly, remove switch (25). Disengage gear assembly (75) and rotate it one gear tooth clockwise (as viewed from the switch end of module). Replace gear assembly (75). Replace switch (25) and check for proper operation. If switch (25) does not operate properly, repeat alignment procedure.

(25) Replace leads (18, 19, 20) and tighten setscrews (-21).

(26) On older units, replace shields (12, 13) and secure with 12 screws (-14).

(27) Replace clip (32) on front mounting plate (33).

(28) Replace cover (7) and secure with 15 screws (-8).

(29) Align lead (24) with insulator (10).

(30) Replace spacer (2), if necessary.

(31) Secure electrical lead (1) to spacer (2) with screws (-3) and washer (-4).

4-22. Series Varicoil A5

a. *Disassembly* (fig. 3-4).

(1) Remove the series varicoil A5 (para 3-14a).

(2) Refer to figure 3-4). Remove the top plate (31) from the four support posts (51 through 54) by prying gently with a knife blade under the four retaining rings (-32) and working off the support posts (51 through 54). Then, lift the top plate (31) off the support posts (51 through 54).

(3) Remove the bearing retainer (29) from the top plate (31) by removing two screws (-30). Remove bearing (38) from the top plate (31).

(4) Turn the drive shaft (58) counterclockwise to its stop. Disengage and remove electrical contact (60), contact insulator (62B), and helical spring (62) from

the drive shaft.

(5) Remove A5L1 coil assembly (51 through 54, and 56) from the bottom plate (83) by removing four flathead screws (-55).

(6) Remove standoff terminal (69) from the bottom plate by removing flathead screw (-70).

(7) Remove the motor and gear assembly (1A) from the bottom plate (83) by removing three screws (-3), lockwashers (-4), and rim clenching clamps (-2). Remove terminal bracket (8) and terminal lug (-10) by removing screw (-9) and lockwasher (-11).

(8) Remove the gear (5) from the motor pinion (part of 7) by driving out the pin (-6) with a punch of less than 1/32-inch diameter.

(9) Loosen the protective cover (62E) from the bottom plate (23) by removing two screws (-63) and lockwashers (-64).

(10) Loosen the drive shaft (58) by removing special screw (-58A) with the drive shaft wrench.

NOTE

Figure 4-11 shows how the drive shaft wrench must be fabricated.

(11) Remove drive shaft (58), protective cover (62E), and number 4 spur gear cluster (65).

(12) Remove number 2 spur gear cluster (66) from bottom plate post (part of 83) by removing retaining ring (-67).

(13) Remove bearing retainer (71) from bottom plate (83) by removing two screws (-72). Remove bearing (74).

(14) On older units, remove pin (-16) from nut (-15) by driving out with punch of less than 1/32-inch diameter.

(15) On older units, hold brazed gear shaft (68) by gear, and remove nut (-15). Remove brazed gear shaft (68) from bottom plate (83). Remove bearing (20) from cover (14).

(16) On older units, remove cover (14) from bottom plate (83) by removing two screws (-18), lockwashers (-19), and rim clenching clamps (-17).

(17) Remove wafer switches A5S1A and A5SB (22, 21) by removing two screws (-25), sleeve spacers (-23) and nonmetallic washers (-26).

(18) Remove terminal bracket (8) by removing screw (-9), terminal lug (-10), and lockwashers (-11).

(19) Remove six terminals (12) from bracket (13) by pressing.

(20) If required, remove the pin retainer (77) from the bottom plate (83) by removing two screws (-78) and two lockwashers (-79). Remove the shouldered pin (80) and the rubber grommet (81).

(21) Remove four screws (75) from the bottom plate (83) by pressing them out of their four spring sleeves (-76).

(22) Clean, inspect, and repair (sec. V).

b. *Reassembly* (fig. 3-4).

(1) Assemble the shouldered pin (80) to the rubber grommet (81) and place this assembly (80, 81) into the bottom plate (83). Apply lubricant DC-4 MIL-I-8660, or equivalent (para 4-28) liberally to counterbored hole in the bottom plate (83) before assembling. Connect four screws (75) to the bottom plate by pressing them in the four spring sleeves (-76).

(2) On older units, mount the pin retainer (77) to the bottom plate (83) with two screws (-78) and lockwashers (-79).

(3) Assemble brazed gear shaft (68) to the bottom plate. Turn the gear (part of 68) clockwise to its stop where the gear engages shouldered pin (80). Maintain this gear position and turn over the bottom plate.

(4) Place wafer switches A5S1A (22) and A5S1B (21) on shaft (part of 68) so that the following conditions exist:

(a) Contacts (A5S1A-8, -9, and -10) A5S1B-8, -9, and -10) are nearest the center of the bottom plate and are facing away from the bottom plate.

(b) The small dimples adjacent to the shaft holes of both switch rotors (part of 22 and 21) are on the flat of the switch shaft (part of 68) that faces toward the center of the bottom plate.

(5) With the switch shaft (part of 68) positioned as in step (3) above and wafer switches (22, and 21) positioned as in step (4) above, mount the wafer switch to the bottom plate (83) with the following hardware: two screws (-25), wafer switch A5S1B (21), two long sleeve spacers (-24), two nonmetallic washers (-26), wafer switch A5S1A (22), two nonmetallic washers (-26), two short sleeve spacers (-23), and the bottom plate.

(6) Check switch action by manually turning brazed gear (part of 68) from stop to stop.

(a) At the clockwise stop (viewed from brazed gear shaft (68) side of bottom plate), wafer rotor (part of 21) should be connecting A5S1B-9 (gray wire) with A5S1B-10 (sleeved bus), and the wafer rotor (part of 22) should be connecting A5S1A-9 (white-red wire) with A5S1A-10 (violet wire).

(b) At the counterclockwise stop (viewed from brazed gear shaft (68) side of bottom plate), wafer rotor (part of 21) should be connecting A5S1B-9 (gray wire) with A5S1B-8 (sleeved bus), and the wafer rotor (part of 22) should be connecting A5S1A-9 (white-red wire) with A5S1A-8 (white-blue wire).

(c) If necessary, loosen screws (-25), reposition switch wafers (21, 22) slightly, and retighten screw (-25).

CAUTION

Switch wafers must not bind when rotated.

(7) Place the bearing (74) into the bottom plate. Mount the bearing retainer (71) to the bottom plate with two screws (-72) and lockwashers (-73).

(8) Mount number 2 spur gear cluster (66) to the bottom plate post and secure with the retaining ring (-67).

(9) Mount the standoff terminal (69) to the bottom plate with flathead screw (-70).

(10) Place coil A5L1 extended wire (part of 56) into the standoff terminal and mount coil A5L1 assembly (51 through 54, 56) to the bottom plate with four flathead screws (-55). Solder coil A5L1 extended wire (part of 56) to the standoff terminal.

(11) Turn the gear (part of 68) to its clockwise stop. Slide the protective cover (62E) on the drive shaft (58) and assemble number 4 spur gear cluster (65) to the drive shaft (58). Now position the drive shaft (58) to its bearing (74), and mesh number 4 spur gear cluster with number 2 spur gear cluster (66) so that the contact holder (part of 58) points directly at the standoff terminal (69). Finally, secure the drive shaft (58) to the bottom plate (83) with special screw (-58A) using drive shaft wrench (fig. 4-11).

CAUTION

Relationship of gear (part of 68), contact holder (part of 58), and standoff terminal (69) stated in step (11) above is essential to proper functioning of the equipment. Recheck wafer rotor positioning explained in step (6)(a) above, and readjust as necessary.

(12) Mount gear (5) to motor A5B1 (7) with pin (-6).

NOTE

If gear (5) has been replaced, drill 0.0315inch hole (-0.0005 to +0.0010) through both gear (5) and motor pinion (part of 7) 0.125 inch from motor housing (part of 7).

(13) Mount the motor and gear assembly (1A) to the bottom plate (83) with three rim-clinching clamps (2), screws (-3), and lockwashers (-4). Insure a proper mesh of the gear (5) with number 4 spur gear cluster (65).

(14) Mount the protective cover (62E) to the bottom plate (83) with two screws (-63) and lockwashers (-64).

(15) Mount the terminal bracket (8) to the bottom plate (83) with screw (-9), terminal lug (-10), and lockwasher (-11).

(16) Rewire as necessary.

(17) Place the bearing (82) in the cover (14). Mount the cover to the bottom plate (83) with two rim-clenching clamps (-17), screws (-18), and lockwashers (-19).

(18) Run nut (-15) onto the switch shaft (part of 68) until there is 0.003- to 0.006-inch end play of the switch shaft (part of 68). Drill a 0.0310-to 0.0325-inch hole through both the nut (-15) and the flats of the switch shaft (part of 68) and secure with pin (-16).

(19) Place the bearing (38) to the top plate and secure with the bearing retained (29) and two screws (-30).

(20) Manually turn the drive shaft (58) to the counterclockwise stop. Assemble the helical spring (62), contact insulator (62B), and electrical contact (60) to contact holder (part of 58) (fig. 4-12) and reengage contact (60) to top turn of coil A5L1 (56).

(21) Rotate drive shaft (58) to clockwise stop. Use Tester, Spring Resiliency 0-100 grams (NSN 6635-00-545-8500). By stretching or compressing the spring (62), adjust for contact pressure of 22 ± 2 grams pressure on rf coil (56).

(22) Adjust the finger contacts (fig. 4-12) for 6 ± 2 grams pressure on the electrical contact (60).

(23) Mount the top plate (31) to the support posts (51 through 54) with four retaining rings (-32).

NOTE

Apply a small amount of Dow Silastic 140, or equivalent (para 4-28) to the hole in each support post (51 through 54).

(24) Replace series varicoil A5 (para 3-14b).

4-23. Shunt Varicoil A6

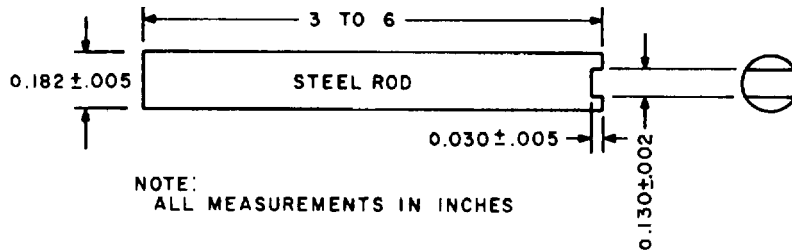
a. Disassembly.

(1) Refer to figure 3-4. Remove shunt varicoil A6 (para 3-15a).

(2) Remove top plate (40) from support posts (51 through 54) by prying gently with a knife blade under the four retaining rings (-43) and working them off the posts (51 through 54). Then remove four screws (-41) and washers (-42). Lift the top plate from the support posts.

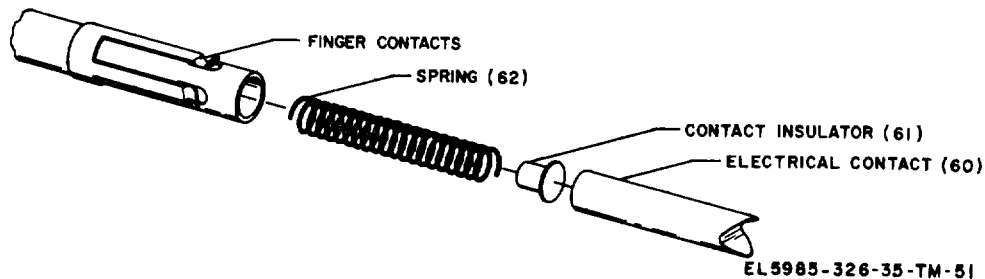
(3) Remove bearing retainer (29) from the top plate (40) by removing two screws (-30). Remove the bearing (48) from the top plate (40).

(4) Remove the shield (49) from the bottom plate (83) by removing four screws (-50).



EL5985-326-35-TM-50

Figure 4-11. RF Coil Drive Shaft Wrench, Fabrication Diagram..



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Figure 4-12. Varicoil Wiper Assembly.

(5) If necessary to replace electrical contacts (44 and 45), carefully drill out two rivets (-46) from the top plate.

(6) Remaining disassembly procedures of shunt varicoil A6 are identical to that of series varicoil A5. Refer to paragraph 4-22a (4) above, and continue as directed.

b. Reassembly.

(1) Perform paragraph 4-22b (1) to (18) above, then proceed to (2) below.

(2) Mount the shield (49) to the bottom plate (83) with four screws (-50).

(3) Mount the top plate (40) to the support posts (51 through 54) with four retaining rings (-43). One arm of the top plate has a slot in the bottom. This arm must be mounted to the post nearest the end of the coil.

NOTE

Apply a small amount of Dow Silastic 140 or equivalent (para 4-28) to the hole in each support post.

(4) Mount the top plate (40) to the shield (49) with four screws (-41) and washers (-42).

(5) Place bearing (48) to the top plate (40) and secure with bearing retainer (29) and two screws (-30).

(6) Turn the drive shaft (57) to its counterclockwise stop. Assemble the helical spring (62), contact insulator (62B), and electrical contact (60) to the contact holder (part of 57), and reengage the electrical contact (60) to the top turn of coil A6L1 (56).

(7) Rotate the drive shaft (57) to clockwise stop. Use Tester, Spring Re-Silancy 0-100 grams (NSN 6635-00-545-8500). By stretching or compressing the helical spring (62), adjust for contact pressure of 22 ± 2 grams pressure on RF coil A6L1 (56).

(8) Replace the shunt varicoil A6 (para 3-15b).

14-24. Shunt Capacitor A7 (Part number 528-0466-00)

a. Disassembly.

(1) Remove shunt capacitor A7 (para 3-16a).

(2) Refer to figure 3-2. Remove lead screw (part of 10) and spur gear number 2 (8) from capacitor A7C1 (10) as follows:

(a) Turn spur gear number 2 (8) counterclockwise until the lead screw (part of 10) disengages.

(b) Carefully pull the lead screws (part of 10) from the bearing (12).

(c) Remove the shim (11) which may remain on the bearing or on the lead screws (part of 10).

(3) Remove spur gear number 2 (8) (part of 10) from the lead screw (part of 10) by removing the roll pin (-9).

(4) Remove the spur gear number 2 and cluster gear (13) from the gear plate (60) by removing the retaining ring (14).

(5) Remove motor A7B1 (17) from the gear plate (60) by removing two screws (-18).

(6) Remove the gear plate from the four shoulder posts (31) by removing four screws (-32) and sleeve spacers (-33), and electrical switch. Remove electric switch bracket (26F) by removing screw (26K) and lockwasher (26H).

(7) Remove the bracket (56) and terminal (-58) from the gear plate (60) by removing two screws (-57) and two washers (-59).

(8) Remove connector A7P1 (54) from sliding lock assembly (55) by removing two nuts, two lockwashers, four flat washers, (all part of 54), and sliding lock assembly (55, set of two).

(9) Remove the electric switch bracket (26F) from the capacitor plate (27) by removing two screws (-26J) and nuts (-26G).

(10) Remove the adapter (26A) and switch A7S1 (26B) from the electric switch bracket by removing two screws (-26E) and nuts (-26D).

CAUTION

Proper readjustment of A7S1 and A7S2 switch actuators requires use of Q-Meter TS-617B/U or equivalent (para 4-15). Do not disassemble either A7S2 actuator assembly (26B and attached parts) or A7S1 actuator assembly (26C and attached parts) unless Q-Meter TS-617B/U or equivalent is available (para 4-15).

(11) Remove the adapter (26A) and switch A7S2 (26C) from the electric switch bracket (26F) by removing two screws (-26E) and nuts (-26D).

(12) Remove the capacitor retainer (1B) and the switch actuator adapter (1C) from capacitor A7C1 (10) by removing four screws (-32) and the sleeve spacers (-33).

(13) Remove capacitor A7C1 (10) from the capacitor plate (27) by removing three screws (-7) lockwashers (-6), and nuts (-5).

(14) Remove the four shoulder posts (31) from the capacitor plate by removing four screws (-28), and lockwashers (-28A).

(15) Clean, inspect, and repair (sec. V).

b. Reassembly.

(1) Connect the four shoulder posts (31) to the capacitor plate (27) with four screws (-28) and lockwashers (-28A).

(2) Mount capacitor A7C1 (10) to the capacitor plate (77) with three screws (-7), lockwashers (-6), and nuts (-5).

(3) Connect the capacitor retainer (1B) and the switch actuator adapter (1C) to capacitor A7C1 (10) with four screws (-32) and sleeve spacers (-33).

(4) Connect the adapter (26A) and the switch (26C) to the electrical switch bracket (26F) with two screws (-26E) and nuts (-26D).

(5) Connect the switch (26B) and adapter (26A) to the electrical switch bracket (26F) with two screws (-26E) and nuts (-26D).

(6) Connect the electrical switch bracket (26F) to the capacitor plate (27) with two screws (-26J) and nuts (-26G).

(7) Connect connector A7P1 (54) to the bracket (56) with two nuts, two lockwashers, four flat washers (all part of 54), and sliding lock assembly (55, set of two).

(8) Connect bracket (56) and terminal (-58) to the gear plate (60) with two screws (-57) and washers (-59).

(9) Connect the gear plate (60) to four shoulder posts (31) with four screws (-32) and sleeve spacers (-33) and to the electrical switch bracket (26F) with a screw (-26K) and washer (-26H).

(10) Mount motor A7B1 (17) to the gear plate (60) with two screws (-18).

(11) Dress the tie wires from connector A7P1 (54) to motor A7B1 (17) and to switches A7S1 and A7S2 (26B, 26C). Also tie the wires to shoulder post (31).

(12) Mount the cluster gear (13) to the gear plate and mesh with the motor shaft (part of 17). Secure with the retaining ring (14).

(13) If necessary, replace spur gear number 2 (8) on the capacitor lead screw (part of 10) as follows:

(a) Secure the hub of spur gear number 2(8) to a V-block.

(b) Insert the lead screw (part of 10) through the hub until it is flush ± 0.01 inch to the outer gear flange surface (part of 8). Secure in position.

(c) Measure and center-punch the hub (part of 8) 0.125 \pm 0.005 inch from outer flange of the hub. Drill a 0.061 to 0.065-inch hole through the spur gear hub number 2 (8) and lead screw (part of 10).

CAUTION

Do not reuse a roll pin (-9); a used pin may have lost its tension and may roll out.

(d) Pin spur gear number 2 (8) to lead screw (part of 10) with a roll pin (-9).

(14) Assemble the shim (11) to the lead screw gear assembly (8, part of 10). Lubricate the lead screw (part of 10) with MIL-G-3278 lubricant or equivalent (para 4-28). Lubricate gear assembly (8) with a 25:1 mixture, by weight, of MIL-VV-D-001078 oil and MIL-M-7866A (ASG) (para 4-27) respectively. This mixture must be vigorously agitated before applying to insure suspension of MIL-M-7866A (ASG) in the oil MIL-VV-D-

001078 (para 4-28).

(15) Insert the lead screw gear assembly (8, part of 10) through the capacitor plate (60) and carefully turn into capacitor retainer (1B), switch actuator adapter (1C) until gear teeth of spur gear number 2(8) mesh with teeth of cluster gear (13).

(16) Using mixture described in (14) above, relubricate by operating the unit as mounted to minimum capacity; lubricate the shaft -rear of the bearing. Operate the capacitor from maximum capacity to minimum capacity and return several times to insure uniform distribution of the lubricant on all shaft and bearing surfaces. Wipe off excess oil from around bearings.

(17) On assemblies MCN 2390 and above, connect retaining plate (30A) to bottom of tuning drive assembly and secure with four screws (-32) and spacers (-33).

(18) Refer to paragraph 4-15 for proper adjustment of shunt capacitor A7.

4-24.1. Shunt Capacitor A7 (Part Number 777-4500-001)

a. Disassembly.

(1) Remove shunt capacitor A7 (para 3-16.1.).

(2) Refer to figure 3-2.1. Remove cable bracket (1A) by removing two screws (-2) and washers (-3).

(3) Remove gear (9) by removing retaining ring (-10).

(4) Remove switches (11) and (11A) by removing two screws (-12) and fiber washers (-13).

(5) Remove gearshaft assembly (25) by removing two retaining rings (-27).

(6) Remove capacitor (37) by removing three screws (-40), nuts (-38), washers (-39), and retaining ring (-36).

(7) Remove gear assembly (14) by removing retaining ring (-17).

(8) Remove motor (23) by removing two screws (-24).

b. Reassembly.

(1) Replace motor (23) and secure with two screws (-24).

(2) Replace bearings (21, 22).

(3) Replace washer (21) on worm shaft (20).

(4) Replace capacitor (37) and secure with three screws (-40); nuts (38), washers (-39), and retaining ring (-36).

(5) Replace gear assembly (14) and secure with retaining ring (-17).

(6) Replace bearing (31).

(7) Replace gearshaft (25) and secure with retaining ring (-27).

(8) Replace bearing (30) and secure with retaining ring (-27).

(9) Replace switches (11) and (11A), and secure with screws (-12) and washers (-13).

(10) Replace gear (9) and secure with retaining ring (-10).

(11) Replace cable bracket (1A) and secure with two screws (-2) and washers (-3).

(12) Refer to paragraph 4-24a(14), (15), and (16) for lubricating instructions.

4-25. Discriminator A8

a. Disassembly.

(1) Remove discriminator A8 (para 3-17a).

(2) Refer to figure 4-13. Remove the housing (1A) by removing seven screws (-2 and -2A) and lockwashers (-3).

(3) Remove the connector bracket (4 or 5B) by removing two screws (-5) and two nuts.

(4) Remove connector A8P3(6) from the connector bracket by removing two screws (-8) and nuts (-7).

(5) Remove the terminal board assembly (9) by removing three screws (-12) and spacing sleeves (-10) from the RF shields (81 and 86) and one screw (-13), and spacing sleeve (-11) from the transformer (63). Tag and unsolder wires as necessary to remove board.

(6) Remove resistor A8R9 (15) from the terminal board (9, 50, and 56) by removing nut (-16), flat washer (-18), and screw (-19) or two screws and bracket.

(7) Unsolder the parts (20 to 49) from the terminal board (50) as necessary for test and replacement.

(8) Remove the Teflon feedthrough terminals (51) and Teflon stud terminals (52) as necessary by pulling the terminal pin away from the Teflon base. Then, push the terminal out of terminal board (50 and 56).

(9) Remove the resistor holder (67) from the RF shields (81 and 86) by removing two screws (-68).

(10) Remove resistors A8R1 (66) and A8R3 (65) from the resistor holder.

(11) Remove connector receptacle A8P2 (73) from RF shield number 1 (81) by removing two screws (-74) and flatwashers (-75A).

(12) Remove connector receptacle A8P1 (76) from RF shield number 2 (86) by removing two screws (-77) and flat washers (-78A).

(13) Remove capacitor A8C4 (59) from the capacitor mounting plate (79) by removing nut and lockwasher (both part of 59) and terminal lug (60).

(14) Remove capacitor A8C1 (61) from the capacitor mounting plate by removing nut and lockwasher (both part of 61) and terminal lug (62).

(15) Remove the capacitor mounting plate (79) from RF shield number 1 (81) by removing two screws (-80).

(16) Remove the transformer (63) from the RF shields (81 and 86) by removing four screws and lockwashers (part of 63) nearest ends of transformer (63). Then, remove two nuts (-64) and the RF shields from the transformer (63). Do not disassemble the transformer (63). Temporarily replace four screws and lockwashers (part of 63) removed from the ends of the transformer (63).

(17) Clean, inspect, and repair (sec. V).

b. Reassembly.

(1) Remove four screws and lockwashers from the ends of the transformer (63), and position the RF shields (81 and 86) to the transformer (63).

(2) Mount the transformer (63) to the RF shields (81, 86) with two nuts (-64). Replace four screws and lockwashers (part of 63) to the transformer. Tighten nuts (-64); apply EC-847 (para 4-15) to the exposed threads of the transformer and to junction of nuts (-64) and RF shields.

NOTE

Observe relative positioning of the RF shields and the transformer as shown in figure 4-14.

(3) Mount capacitor mounting plate (79) to RF shield number 1 (81) with two screws (-80).

(4) Mount capacitor A8C1 (61) to the capacitor mounting plate with the terminal lug (62) and lockwasher and nut (both part of 61).

(5) Mount capacitor A8C4 (59) to the capacitor mounting plate with the terminal lug (60) and nut and lockwasher (both part of 59).

(6) Mount connector receptacle A8P1 (76) to RF shield number 2 (86) with two screws (-77) and lockwashers (-78) and flat washers (-78A). Do not fully tighten screws (-77) at this time.

(7) Mount connector receptacle A8P2 (73) to RF shield number 1 (81) with two screws (-74) lockwashers (-75) and flat washers (75A). Do not fully tighten screws (-74) at this time.

(8) Place resistors A8R1 (66) and A8R3 (65) into clips (69) of the resistor holder (67).

(9) Mount the resistor holder of the rf shields with two screws (-68).

(10) Install the new Teflon feedthrough and stud terminals (51 and 53) to the terminal board (56) as necessary by inserting the terminal through the terminal board. Then flare Teflon base by pressing the terminal pin into the Teflon base.

NOTE

Long-nose pliers with serrated jaws can be used for flaring the Teflon stud Terminals (53). The same long-nose pliers can

be used for flaring Teflon feed-through terminals (51) if a 0.060 in 0.0010-inch hole is drilled near the top of one of the plier jaws. Use the modified long-nose pliers as follows:

(a) Insert a Teflon feedthrough terminal (51) into terminal board (56).

(b) Position the plier jaw with the hole to the feedthrough terminal on same side that the feedthrough terminal was inserted into the terminal board.

(c) Flare the feedthrough terminal (51) by pressing the terminal pin into the Teflon base. The hole in the long-nose pliers allows one plier jaw to rest on the Teflon base, and the plier jaw without the hole can press the terminal pin into the Teflon base of the terminal.

(11) Rewire the terminal board (50 with terminals, 56 without terminals, or 9 with all components soldered in place) as necessary. Also, rewire resistors, A8R1 (66) and A8R3 (65) in the resistor holder (67) as necessary.

(12) Mount resistor A8R9 (15) to the terminal board (50) with screw (-19), flat washer (-18), and nut (-16).

(13) Mount the terminal board assembly (9) to the RF shields (81 and 86) with three screws (-12) and spacing sleeves (-10). Mount terminal board assembly (9) to the transformer (63) with screw (-13), spacing sleeve (-14), and spacing sleeve (-11).

(14) Mount connector A8P3 (6) to the connector bracket (4) with two screws (-8) and nuts (-7).

(15) Mount the connector bracket (4) to RF shield number 1 (81) with two screws (5). Do not fully tighten the screws (-5) at this time.

(16) Mount housing (1A) to fully assembled discriminator A8 with seven screws (-2, -2A) and lockwashers (-3).

(17) Refer to figure 4-14. Position connectors A8P1 (76) and A8P2 (73) as shown, and then fully tighten the mounting screws (-77 and -74). Position connector A8P3 (6) as shown, and then tighten the

connector bracket mounting screws (-5).

(18) Replace discriminator A8 (para 3-17b).

4-26. Series Capacitor A9

a. Disassembly.

(1) Remove series capacitor A9 (para 3-18a).

(2) Refer to figure 3-6. Remove switch A9S2 (2) by removing the four nylon screws (-3) from the four posts (5). Carefully lift off switch A9S2 (2).

(3) Remove the four posts (5) from the gear plate (45) by removing four screws (-5).

(4) Loosen protective cover (6A) by removing screws (-6B).

(5) Remove gear shaft assembly (7) protective cover (6A) and shaft (17) from gear plate (45).

(6) Separate control cam (13) and rotor switch (9) by removing five screws (-10).

(7) Remove the Geneva star wheel (14) from the gear shaft assembly (7) by removing four screws (-14A), four washers (-14B), and four washers (-14C). Remove the Geneva star wheel (14), protective cover (6A, and control cam (13).

(8) Remove the shaft (17) from the gear shaft assembly (7) by driving out pin (-17A) with a 0.060/0.065-inch (1/16-inch nominal) punch.

(9) Remove the rotor switch (9) from the gear shaft assembly (7) by removing pin (-8).

(10) Remove motor A9B1 (22) from the gear plate (45) by removing two screws (-23).

(11) Remove switch wafers A9S1A (29, nearest gear plate 45), A9S1B (28), and A9S1C (27, farthest from gear plate 45) from switch mounting plate (33) by removing two screws (-32), four ceramic spacers (-30), and two spacers -31).

(12) Remove switch mounting plate (33) from gear plate (45) by removing four screws (-34), four lockwashers (-35), and four flat washers (-36).

(13) Remove connector lock (44) from connector A9P1 (43) by removing two screws, two lockwashers, and two nuts (all part of 44).

(14) Clean, inspect, and repair (sec. V).

Legend for figure 4-13.

Note: Items preceded with - are attaching parts and not shown. Items preceded by I have different values depending on MCN effectivity. Refer to paragraph 1-5d for differences.

- | | | |
|------------------------|------------------------------------|-----------------------------|
| 1 Housing | 31 Coil 8L5 | 61 Capacitor A8C1 |
| -2 Screw (7) | 32 Diode a8CR2 | 62 Terminal lug |
| -3 Lockwasher (7) | 33 Capacitor A8C5 | 63 Transformer |
| 3A Handle | 34 Coil 8L6 | -64 Nut (2) |
| 3B Clip | 35 Capacitor A8C8 | 65 Resistor A8R3 |
| 4 Connector bracket | 36 Resistor A8R5 | 66 Resistor A8R1tt |
| -5 Screw (2) | 37 Diodes A8CR3A & B | 67 Resistor holder |
| 6 Connector A8P3 | 38 Capacitor A8C7 | -68 Screw (2) |
| -7 Nut(2) | 39 Resistor A8R4 | 69 Clip (2) |
| -8 Screw (2) | 40 Capacitor A8C6 | -70 Rivet (2) |
| 9 Terminal board assy | 41 Coil 8L10 | 71 Nut |
| -10 Spacing sleeve (3) | 42 Capacitor A8C2 | 72 Holder |
| -11 Spacing sleeve | 43 Capacitor A8C3 | 73 Connector A8P2 |
| -12 Screw (3) | 44 Resistor A8R2 | -74 Screw (2) |
| -13 Screw (4) | #45 Coil A8L1 | -75 Lockwasher (2) |
| -14 Spacing sleeves | #45A Coil A8L2 | -76A Washer (2) |
| 15 Resistor A8R9 | 46 Coil 8L7 | 76 Connector A8P 1 |
| -16 Nut | 47 Diode A8CR1 | -77 Screw (2) |
| -17 Lockwasher | 48 Diode A8CR5 | -78 Lockwasher (2) |
| -18 Flat washer | 49 Diode A8CR6 | -78A Washer (2) |
| -19 Screw | 50 Terminal board | 79 Capacitor mounting plate |
| 20 Coil A8L8 | 51 Teflon feedthrough terminal (6) | 80 Screw (2) |
| 21 Capacitor A8C14 | 52 Terminal (5) | 81 RF shield No. 1 |
| 22 Resistor A8R6 | 53 Teflon stud terminal (17) | 82 Terminal |
| 23 Capacitor A8C15 | 54 Terminal (2) | 83 Nut 2) |
| 24 Resistor A8R7 | 55 Terminal | 84 Nut 4) |
| 25 Coil 8L9 | 56 Terminal board | 85 RF shield No. 3 |
| 26 Capacitor A8C16 | 57 Capacitor A8C13 | 86 RF shield No. 2 |
| 27 Capacitor A8C17 | 58 Capacitor A8C12 | 87 Terminal (2) |
| 28 Capacitor A8C9 | 59 Capacitor A8C4 | 88 Nut 2) |
| 29 Capacitor A8C10 | 60 Terminal lug | 89 Shield |
| 30 Coil 8L3 | | |

Change 2 4-70

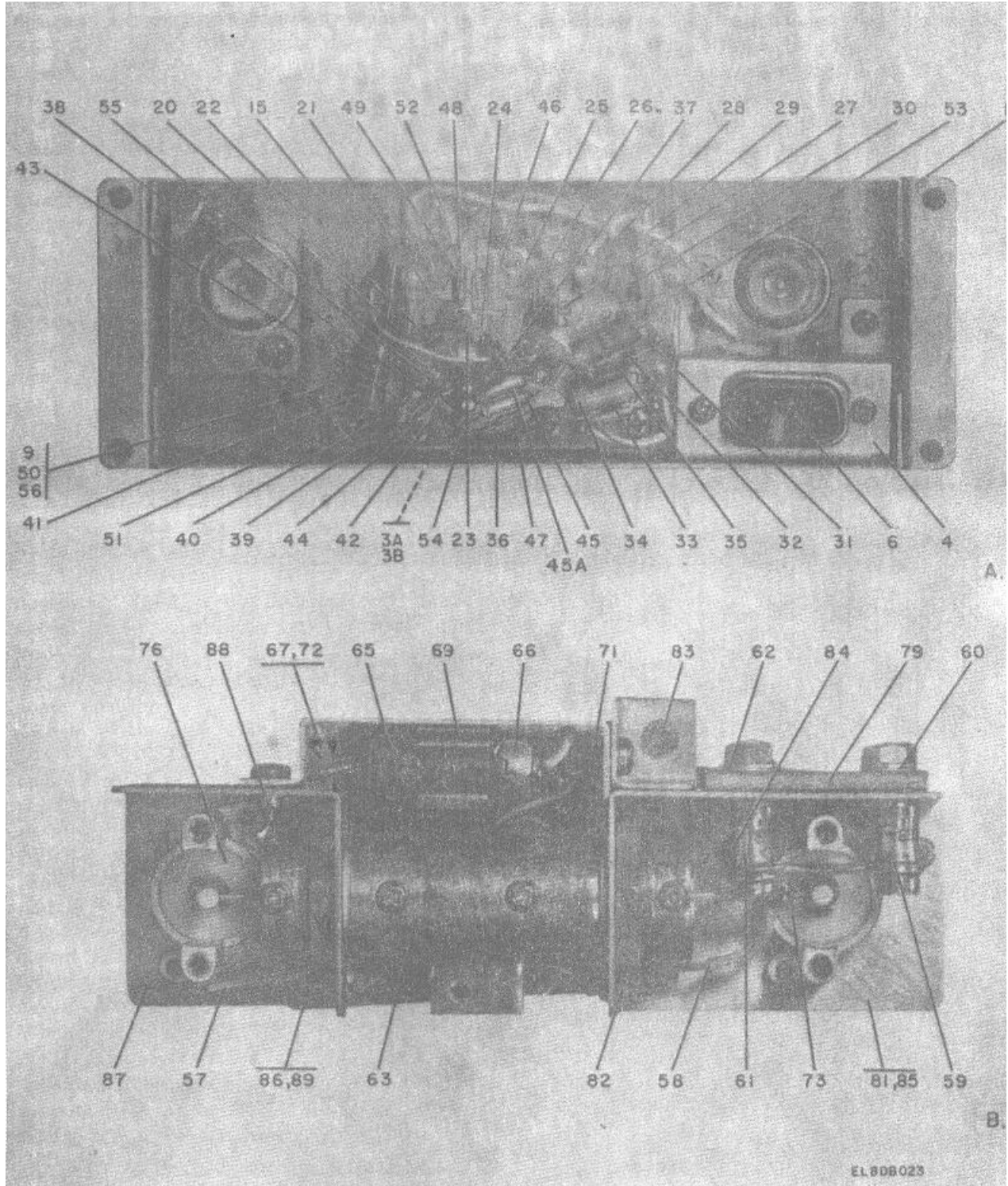


Figure 4-13. Discriminator A8, Parts Location.

Change 2 4-71

b. Reassembly.

(1) Position the gear plate (45) bottom side up, with curved side to left. Position the switch mounting plate (33) so that the two nuts (-37) are touching the gear plate and are on the upper left to lower right diagonal of the gear plate. When positioned as above, mount the switch mounting plate to the gear plate with four screws (-34, lockwashers (-35), and flat washers (-36). Turn the switch mounting plate as far clockwise as possible before tightening screws (-34).

(2) Assemble wafer switches A9S1C, A9S1B,

and A9S1C (27, 28, and 29) to the switch mounting plate as follows:

(a) Attach the two screws (-32) to wafer A9S1C (27) so red dot on A9S1C (27) is on side opposite screwheads.

(b) Attach the two ceramic spacers (-30) to the screws (-32).

(c) Position A9S1B (28) so the red dot is directly under the red dot on A9S1C (27).

(d) Attach two more ceramic spacers (-30) to the screws (-32).

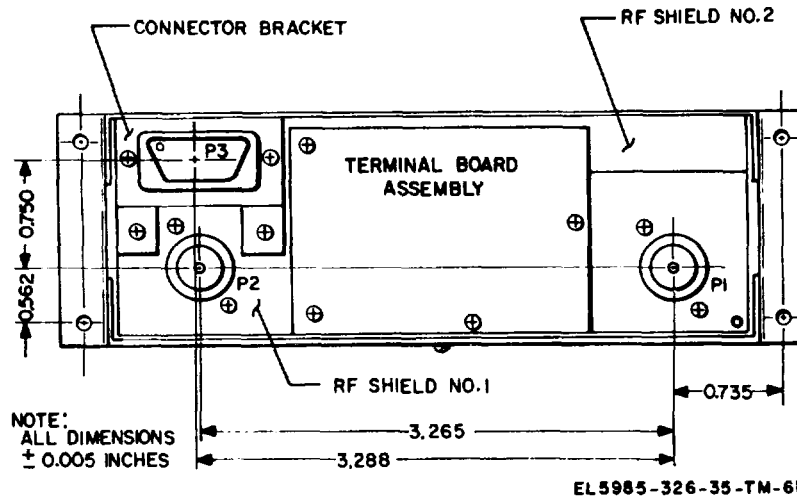


Figure 4-14. Discriminator A8, Connector Positioning Diagram.

(e) Position A9S1A (29) so the red dot is directly under the red dots on A9S1B and A9S1C (28, 27).

(f) Attach two ceramic spacers (-31) to screws (-32).

CAUTION

The red dots on the wafer switches must be on the side opposite the screwheads (part of -32).

(g) Mount the wafer switch assembly (parts assembled in step (2) above) to the switch mounting plate so the red dots on the switch wafers (27, 28, and 29) are nearest the lower right corner of the gear plate. Apply Glyptal (para 4-28) to threads of screws (-32) before mounting.

(3) Mount motor A9B1 (22) to the gear plate with two screws (-23).

(4) Mesh the spur gear cluster (19) with motor pinion (part of 23) and place on the gear plate (45). Secure with retaining ring (-20).

(5) Replace rotor switch (9) on gear shaft assembly (7), and secure with pin (-8).

NOTE

If the rotor switch (9) or the gear shaft assembly (7) is replaced, a 0.156 in .001-inch-diameter hole 1 inch deep must be drilled to accommodate pin (-8). A pilot hole is provided in the flat side of rotor switch (9) to facilitate drilling the hole for pin (-8). The flat side of rotor switch (9) must be parallel with the flat side of shaft (17). Rotor switch (9) must be located 0.547 inch from contact assembly A9S2 (2).

(6) Replace shaft (17) on gear shaft assembly (7), and secure with pin (-17A).

NOTE

If shaft (17) on gear shaft assembly (7) is replaced, a 0.062 + 0.003-inch-diameter - 0.000

hole must be drilled through shaft (17) and gear shaft assembly (7). A pilot hole is provided in shaft (17) to facilitate drilling the 0.062-inch hole. The flat side

of shaft (17) must be parallel with the flat side of rotor switch (9).

(7) Position control cam (13) and protective cover (6A) on gear shaft assembly (7).

(8) Replace Geneva star wheel (14) on gear shaft assembly (7), and secure with four washers (-14C), four lockwashers (-14B), and four screws (-14A).

(9) Secure control cam (13) to rotor switch (9) with five screws (-10).

(10) Position rotors on wafers A9S1C, A9S1B, and A9S1A (27, 28, 29) so the notch in the switch shaft holes are all directly under each other. Insert gear shaft assembly (7) through gear plate (45) and wafers (27, 28, 29) so the flat circumference on rotor switch (9) is toward same side of gear plate (45) as notches on wafers (27, 28, 29).

(11) Mount four posts (5) to gear plate (45), and secure with four screws (-6).

(12) Secure protective cover (6A) to gear plate (45) with three screws (-6B).

(13) Carefully position contact assembly A9S2 (2) over four posts (5). Guide contacts on contact assembly A9S2 (2) so they all engage gear shaft assembly (7).

CAUTION

Do not force, or contacts (part of 2) will be bent by gear shaft assembly (7).

Secure contact assembly (2) to four posts (5) with four screws (-3). Contact pressure must be 20 grams minimum when the contact is resting against the rotor.

(14) Mount connector lock (44) to connector A9P1 (43) with two screws, two lockwashers and two nuts (all part of 44).

(15) Replace series capacitor A9 (para 3-18b).

4-27. Capacitor Assembly A10

a. *Disassembly.*

(1) Remove capacitor assembly A10 (para 3-19a).

(2) Refer to figure 3-7. Remove screw (-25) and lockwasher (-27) securing terminal lug (24) to capacitor A10C29 (23).

(3) Remove capacitor A10C29 (23), screw (-26), and lockwasher (-27) from capacitor retainer (39).

(4) Remove two nuts (-36), lockwashers (-37) and screws (-38) securing two terminal lugs (35) to capacitor retainer (39).

(5) Remove link number 2 (1A) from four capacitors A10C34, A10C33, A10OC35 and A10C24 3, 4, 5, 6) by removing four screws (-10), lockwashers (-11), and terminal lug (2) on capacitor A10C24 (6).

(6) Remove capacitor A10OC35 (5) from capacitor retainer (39) by loosening from screw (-9), flat

washer (-10A) and lockwasher (11).

(7) Remove screw (-19) and lockwasher (-20), securing terminal lug (14) to link number 1 (13). Remove capacitor assembly from chassis.

(8) Remove two capacitors A10C34 and A10C24 (3, 6) from capacitor retainer (39) by removing two screws (-9), flat washers (-10A) and lockwashers (-11).

(9) Remove capacitor A10C33 (4) from capacitor retainer (39) by removing ceramic post (7), nonmetallic washer (-12), flat washer (-10), and lockwasher (-11). If necessary, remove continuous stud (-8) from ceramic post(7).

(10) Remove link number 1 (13) from capacitors A10C27 and A10C28 (15, 16) by removing remaining screw (-19) and lockwasher (-20).

(11) Remove capacitors A10C27 and A10C28 (15, 16) from capacitors A10C25 and A10C26 (17, 18) by turning them counterclockwise. Remove two lockwashers (-20) and link number 1 (13) on top of capacitors A10C25 and A10C26. Remove continuous studs (21) from capacitors A10C25 and A10C26 (17, 18).

(12) Remove capacitors A10C25 and A10C26 (17, 18) from capacitor retainer (39) by removing two screws (-22) and lockwashers (-20).

(13) Clean, inspect, and repair (sec V).

b. *Reassembly.*

(1) Mount ceramic post (32) to capacitor retainer (39) with flathead screw (-33) and nonmetallic washer (-34). Liquid-stake screw threads.

(2) Mount two ceramic posts (28) to capacitor retainer (39) with two screws (-30), and nonmetallic washers (-31).

(3) Mount capacitor A10C29 (23) to capacitor retainer (39) with screw (-26) and lockwasher (-27).

(4) Mount capacitors A10C25 and A10C26 (17, 18) to capacitor retainer (39) with two screws (-22) and lockwashers (-20).

(5) Mount capacitors A10C27 and A10C28 (15, 16) to capacitors A10C25 and A10C26 (17, 18) with two continuous studs (21), a link number 1 (13), and two lockwashers (-20).

(6) Mount a link number 1 (13) to capacitors A10C27 and A10OC28 (15, 16) with two screws (-19), lockwashers (-20), and a terminal lug (14). Position terminal lug (14) as shown in figure 3-7.

(7) Mount capacitor A10C33 (4) to capacitor retainer (39) with continuous stud (-8), lockwasher (-11), nonmetallic washer (-12), and ceramic post (7).

(8) Mount three capacitors A10C34, A10C35, and A10C24 (3, 5, 6) to capacitor retainer (39) with three screws (-9), lockwashers (-11), and flat washers (-10).

(9) Mount link number 2 (1A) to four capacitors A10C34, A10C33, A10C35 and A10C24 (3, 4, 5, 6) with four screws (110) and lock washers (-11) and a

terminal lug (2) on capacitor A10C24 (6) only. Position terminal lug (2) as shown in figure 3-7.

(10) Replace capacitor assembly A10 (para 3-19b).

Section V. CLEANING, INSPECTION, AND REPAIR

WARNING

Adequate ventilation should be provided while using TRICHLOROTRIFLUOROETHANE. Prolonged breathing of vapor should be avoided. The solvent should not be used near heat or open flame; the products of decomposition are toxic and irritating. Since TRICHLOROTRIFLUOROETHANE dissolves natural oils, prolonged contact with skin should

be avoided. When necessary, use gloves* which the solvent cannot penetrate. If the solvent is taken internally, consult a physician immediately.

4-28. General

This section explains how to clean, inspect, and repair disassembled components of the antenna coupler. The chart below lists the authorized lubricants and sealants.

FSN or MIL Spec	Manufacturers designation	Manufacturer	Where used
MIL-6-7118	AEROSHELL7A	Shell Oil Co	Step coil tuning drive
M1L-I-8660	DC-4	Dow Corning	Series and shunt varicoils, shouldered pin and rubber grommet assembly.
MIL-G-3278	Beacon 325	Esso Standard Oil Co.	Shunt capacitor lead screw.
5970-503-4608	Glyptal AV-903	General Electric	On all hardware where no other locking means is provided (lockwasher, etc).
P-D-680, Type II 7930-395-9542	Solvent .....	.....	General cleaning.
	EC-847	Minnesota Mining and Mfg. Co	Discriminator transformer mounting nuts, locking device. nuts, locking device.
MIL-4003 8040-3090-7959 (qt-for GS and depot). 8040-336-1872 (pt-for DS). 8040-957-0538 (qt-for GS and depot). 8040-962-0695 (pt-for DS).	Silastic 140	Dow Corning	Step coil jiggling bars and thread screws on all RF subassemblies.
MIL-L-6085A	Univis P-38	Esso Standard Oil Co.	All ball bearings
MIL-VV-D-001078	#200 Oil	Dow Corning	Shunt capacitor gear assy.
MIL-M-7866A (ASG)	Molykote Type Z	Dow Corning	Shunt capacitor gear assy.
MIL-L-7870	NA	NA	Bare steel surfaces.

4-29. Ball Bearings (Nonsealed)

a. Cleaning.

- (1) Wash the bearing in solvent.
- (2) Remove the bearing from the solvent.

Direct an air jet at the side of the bearing opposite from the holder until dry. Do not permit airflow to spin the bearing.

(3) Demagnetize the bearing by passing it through throat of a demagnetizer; once in a forward direction, then in reverse. While doing so, rotate the bearings one or two revolutions.

(4) Repeat (1) and (2) above using a fresh clean solvent.

b. Inspection.

(1) Inspect for pitted, scarred, or scuffed loadbearing surfaces.

(2) Check for burns, corrosion, or discoloration.

(3) Check for rust.

c. Repair. If defective, replace bearing.

4-29.1. Ball Bearings (Sealed)

a. Cleaning. Wiping with a clean, dry, lintless cloth is the only cleaning normally required for shielded ball bearings.

NOTE

Shielded ball bearings are lubricated by the manufacturer for lifetime operation and require no additional lubrication.. However, if the bearings are cleaned in a spray cleaning machine or in an ultrasonic cleaner for purposes of

inspection, relubrication is necessary. With a number 27 needle, apply MIL-L-6085 oil to bearings until all bearing surfaces are coated with a light film of oil. Carefully work oil into bearing and blow off excess oil. Protect bearings from dust and moisture.

b. Inspection

(1) Inspect for blue or purple discoloration (from overheating) of any part of bearing.

(2) Inspect for tarnished outer surfaces (indicated by a light discoloration of highly finished surfaces).

(3) Inspect for rust.

(4) Inspect for pitted, scarred, or scuffed surfaces.

(5) Inspect for undersized outside diameter.

c. Repair. If defective, replace bearing.

4-29.2. Bronze Bearings (Porous)

a. Cleaning. Wiping with a clean, dry, lintless cloth is the only cleaning recommended for porous bronze bearings. Porous bronze bearings are lubricated by the manufacturer for lifetime operation and require no additional lubrication. Wipe dust from items that contain porous bronze bearings with a clean, dry, lintless cloth. Protect bearings from dust and moisture. Porous bronze bearings that are removed must be replaced with new bearings.

b. Inspection. Inspect all bearings for pitted, scarred, or scuffed load-bearing surfaces. Check for burns, corrosion, and any other abnormal conditions occurring on load-bearing surfaces.

c. Repair. If defective, replace bearing.

4-30. Cables

a. Cleaning.

(1) Wipe dirt from the surface with a solvent-moistened lintless cloth.

(2) Dry with a clean lintless cloth.

(3) Wipe lug terminations with solvent-moistened lintless cloth. Dry with a clean lintless cloth.

b. Inspection.

(1) Inspect for loose connectors.

(2) Check for broken or bent pins.

(3) Check insulation.

c. Repair. In multiconductor cables, the most common trouble is broken conductors. To make repairs-

(1) Disassemble the connector. Remove the broken end from the terminal while heating with a soldering iron.

(2) Replace the connector. If the remaining wire is too short to reach the terminal, splice and solder an extension. Slip the tubing over the wire before the splice is made. After splicing and soldering, slide the tubing over the joint.

(3) Solder the other end of the extension to a proper terminal. If necessary, clean out excess solder from the terminal by heating with a soldering iron. Shake out the old solder while it is still hot. All conductors should be inspected, if one is broken, others may be broken, or be near the breaking point. If the others are badly worn, replace the entire cable.

4-31. Castings

a. Cleaning.

(1) Remove grease with rags.

(2) Blow dust from surfaces, holes, and recesses with an air jet.

CAUTION

Castings that contain shielded ball bearings or porous bronze bearings should not be immersed in solvent or otherwise chemically cleaned. This removes the factory lubricant. Refer to paragraphs 4-29.1 and 4-29.2 for proper cleaning procedures.

(3) Immerse the casting in solvent and scrub until clean. Work over the surfaces and into holes and recesses with a nonmetallic brush.

(4) Raise the casting from the solvent and permit the solvent to drain off. Use an air jet to blow out the solvent.

(5) When dry, touchup any minor damage to finish. Extensive damage may require a complete refinishing.

b. Inspection. Inspect for cracks, breaks, and marred or damaged machined surfaces. Determine whether the finish requires any touchup repairs.

c. Repair. If unrepairable, replace the casting. Touch up finish as required.

4-32. Wired Chassis

a. Cleaning.

CAUTION

Avoid air blasting the small coils, leads, and other delicate parts. Use caution in use of brushes on delicate parts. When necessary to disturb the dress of wiring and cables, the dressing should be noted, and cables and wires restored to these positions and dress after cleaning is completed.

(1) Remove dirt from surfaces, including parts and wiring, using soft-bristled brushes and an air jet.

- (2) Clean jacks (para 4-37).
- (3) Clean sockets (para 4-43).
- (4) Clean connectors (para 4-33).
- (5) Clean switches (para 4-41, 4-42).
- (6) Clean insulators (para 4-36).
- (7) Complete the cleaning by wiping down the surfaces with a solvent-moistened lintless cloth.
- (8) Dry and polish using a clean lintless cloth.

b. Inspection.

(1) Inspect the seating of the pluck-out items.

(2) Inspect the wires for cuts, breaks, frays, kinks, and strains.

(3) Inspect the resistors, bushings, and insulators for cracks, chipping, blistering, discoloration, and moisture.

(4) Inspect the terminals for corrosion, dirt, and loose contacts.

c. Repair.

(1) Tighten the switches, terminal blocks, and interiors not readily accessible.

(2) Tighten the mountings and connectors for transformers, coils, etc.

4-33. Connectors

a. Cleaning.

(1) Wipe dirt from the bodies, shells, and cable clamps using a solvent-moistened, lintless cloth. Wipe dry with a clean lintless cloth.

(2) Remove dirt from the inserts using a small soft-bristled brush and an air jet.

CAUTION

Do not allow the solvent to run into the sleeves or conduits covering the wires or cables which are connected to the contact terminals of the inserts.

(3) Wash any dirt or lubricant from the inserts, insulation, and contacts, using the solvent applied sparingly with a small camel's-hair brush.

(4) Dry the insert with an air jet.

b. Inspection.

(1) Inspect the connector bodies for broken parts, deformed shells, or clamps.

(2) Inspect for broken or cracked insulation and for contacts that are broken, deformed, or out of alignment.

(3) Check for corroded or damaged plating on the contacts and for loose, poorly-soldered, broken, or corroded terminal connections.

c. Repair. It is not economical to repair connectors. Replace as required.

4-34. Covers and Shields

Clean, inspect and repair all unfinished, finished, and partly finished sheet metal covers, such as dust covers, inspection covers, chassis covers, and housings, according to applicable steps of procedures used for cleaning, inspecting, and repairing castings. Refer to paragraph 4-31.

4-35. Gears

a. Cleaning.

(1) Clean the metal gears as set forth in paragraph 4-38.

(2) Clean composition or plasticized gears and nylon friction clutches as described in (3) and (4) below.

CAUTION

Solvent should not be used to clean nylon gears because swelling results. Clean nylon gears with washing bath of 2 ounces of detergent powder to 1 gallon of water and suitable brushes. Epoxy gears will become soft if excessive amounts of solvent are used.

(3) Remove dirt using a soft-bristled brush and an air jet.

(4) Wipe off dirt with a solvent-moistened lintless cloth.

(5) Dry with a clean lintless cloth.

b. Inspection.

- (1) Inspect for broken, chipped, or badly worn teeth.
- (2) Inspect the gear bodies for cracks and deformations.
- (3) Inspect surfaces for corrosion and other abnormal conditions.

c. Repair. Replace tears if found defective.

4-36. Insulators

a. Cleaning.

(1) Wipe with clean, lintless cloth lightly moistened with solvent.

(2) Wipe dry and polish using dry lintless cloth.

b. Inspection. Inspect ceramic, Mycalex, or plastic insulators for evidence of damage such as broken or chipped edges, burned areas, or presence of foreign material.

c. Repair. It is uneconomical to repair insulators, replace as necessary.

4-37. Jacks

a. Cleaning.

(1) Remove dust from the exteriors with a camel's-hair brush and an air jet.

(2) Blow dust from the interior of female contact with an air jet.

b. Inspection. Inspect for corrosion, rust, loose or broken parts, cracked insulation, bad contacts, and other irregularities.

c. Repair. If uneconomical to repair, replace with new jack.

4-38. Machined Metal Parts

a. Cleaning. Detached shafts, keys, pins, collars, worms, springs, and similar machined parts should be cleaned in a cleaning machine, otherwise, proceed as follows:

- (1) Remove surface grease with rags.
- (2) Immerse in solvent and scrub until clean.

CAUTION

To avoid corrosion, do not touch parts with hands after parts have been cleaned.

(3) Dry in dust free area. Radiant heat in ventilated inclosure is recommended.

(4) When dry, immediately apply light coat of MIL-L-7870 lubricating oil or equivalent (para 4-28) to bare steel surfaces.

b. Inspection.

(1) Check for physical damage to surfaces, corners, and edges.

(2) Inspect machined surfaces, holes, bores, counterbores, slots, grooves, shoulders, flanges, teeth, tapped holes, and threaded members for roughness of surface or corrosion.

(3) Inspect plated areas for damage requiring replating or refinishing beyond touchup repair.

c. Repair. Machined metal parts are uneconomical to repair. Replace as necessary.

4-39. Mechanical Metal Parts

a. Cleaning. Mechanical metal parts include ventilating grills, mounting plates, mounting clamps and brackets, nuts, bolts, screws, washers, handles, fasteners, and hardware. Clean in cleaning machine, or as set forth in paragraph 4-31.

b. Inspection. Inspect for physical damage or deformation. Check for corrosion and damage which would require replating or refinishing beyond practical touchup.

c. Repair. It is uneconomical to repair mechanical metal parts. Replace as necessary.

4-40. Molded Plastic Parts

Plastic parts include insulating members, terminal boards, mounting blocks, etc. Proceed as follows:

a. Cleaning.

(1) Use an air jet to blow dirt from surfaces, holes, and crevices.

(2) Wipe clean with a solvent-moistened lintless cloth.

(3) Dry and polish with a clean lintless cloth.

b. Inspection. Inspect for signs of corrosion, crackled, or charred insulation, and missing or loose mounting hardware.

c. Repair. It is uneconomical to repair molded plastic parts. Replace as necessary.

4-41. Switches, Concentric RF

a. Cleaning.

(1) Remove dust with an air jet. Gently turn the switch rotor while applying air.

(2) Wash the contacts with solvent lightly applied with a small brush.

(3) Dry with an air jet; take care that the solvent is not blown into the switch bearings.

b. Inspection.

(1) Examine for bent, weak, broken, or deformed contacts.

(2) Check for corrosion and damage to contact plating.

(3) Check to see that movable contacts rotate freely.

(4) Inspect for cracked or broken contact insulation.

(5) Inspect components mounted on the switch for physical damage.

c. *Repair.* Defective switches must be replaced, not repaired.

4-42. Switches, Phenolic Wafer

a. *Cleaning.*

(1) Remove dust with an air jet. Turn the switch rotor back and forth several times while blowing.

(2) Wash the contacts and insulation with solvent lightly applied with small brush.

(3) Dry with an air jet.

b. *Inspection.* Same as paragraph 4-41b.

c. *Repair.* Defective switches must be replaced, not repaired.

4-43. Bakelite 'Sockets

a. *Cleaning.*

CAUTION

Do not use metal tools to remove dirt from the contacts.

(1) Remove resin from the silver-plated contacts. Use a hardwood stick dressed to a wedge point.

(2) Wash contacts with solvent lightly applied with small soft-bristled brush.

(3) Use a solvent-moistened lintless cloth to remove dirt.

(4) Dry with an air jet.

b. *Inspection.*

(1) Inspect for loose, broken, or missing socket mounting rings. Check for cracked, broken, or charred insulation.

(2) Inspect for broken, corroded, or deformed contacts, and loose, poorly soldered, broken, or corroded connections.

c. *Repair.* It is uneconomical to repair the sockets. Replace when defective.

Section VI. TESTING

4-44. General

a. This section contains tests for use by general support organizations. These tests prescribe standards that repaired antenna couplers must meet before being returned to the using organization. A summary of performance standards is given in paragraph 4-56.

b. Comply with the instructions preceding the body of each test chart. Perform each test in sequence. *Do not vary the sequence.* For each step, perform all the actions required in the *Control settings* column; then

perform each specific test procedure, and verify it against its performance standard. Figure 4-15 is a nomograph used in one of the tests; its use is explained in the test procedure.

4-45. Test Equipment and Materials Required

Test equipment and materials required to perform the tests are listed below. Common names will be used when referring to test equipment and materials.

a. *Test Equipment.*

Nomenclature	Common name	Federal stock No.	Technical manual
Radio Set AN/ARC-102 including: Receiver-transmitter RT-698/ARC-102. Power Inverter-Mounting PP-3702/ARC-102.	Radio set ----- Receiver-transmitter ----- Power inverter-mounting -----	----- 5821-050-8255 5821-050-8169	11-5821-248-12
Microphone M-52(*)----- Electrical Dummy Load DA487/U.	Microphone ----- Dummy load -----	----- -----	11-5985-327-15
Multimeter TS-352(*)/U ----- Test Harness, Radio Set AN/URM-157.	Multimeter ----- Test harness -----	6625-24'2-5023 6625-7664685	11-6625-36645 11-6625-622-12
Wattmeter AN, /URM-120----- Stopwatch -----	Wattmeter ----- Stopwatch -----	6625-813-8430	11-6625-446-15

b. *Materials.*

Nomenclature	Common name	Federal stock No.	Technical manual
Aluminum plate	Aluminum plate -----	9535-815-2213	
Grounding straps (2) (1" x 6").	Grounding straps		
Capacitor, ceramic, nonpolarized, 3,000 μmf, 5,000 wvdc.	Capacitor		
No. 12 bus wire (2) -----	No. 12 bus wire		

4-46. Test Facilities

A 27.5-volt dc power source is required for the test harness and radio set. In addition, the test harness needs a 115-volt ac, 400-Hz, three-phase power source. The dummy load needs a 115-volt ac, 400-Hz single-phase power source. All equipment should be mounted on an unpainted aluminum sheet to provide a good RF ground. Secure each unit to the aluminum sheet with metal ground straps; use two ground straps for the receiver-transmitter.

NOTE

Use of wires or cables to connect the chassis of the units does not insure a good RF ground.

4-47. Modification Work Orders

The tests assume that all MWO's have been performed. See DA Pam 310-7 for a list of current MWO's.

4-48. Preliminary Steps

WARNING

Dangerous voltages exist at the RF terminals. Be careful.

- a. Remove the dust cover (para 3-10a).
- b. Set the equipment on the aluminum sheet. Place small metal bars under the front and rear ends of the receiver-transmitter.
- c. Interconnect the radio set (TAI 11-5821-248-12).
- d. On the test harness, set the AC ON-OFF switch to OFF.
- e. On the test harness, set the DC Power switch to OFF.
- f. Connect W1 from the test harness 618T-2/3 jack to the receiver-transmitter connector P40.

g. Connect W7 from the test harness ANT. CPLR connector to J1 on the antenna coupler.

h. Connect RF cable assembly CG-409A/U from J4 (ANT) jack on the receiver-transmitter to J2 on the antenna coupler.

i. Connect W2 from the test harness DC IN jack to +27.5-volt dc power.

j. Connect the ac power cable from the test harness AC IN jack to 115-volt ac, 400-Hz, three-phase power.

k. Proceed to paragraph 449 for initial settings.

4-49. Initial Settings

Set test harness controls as follows:

- a. 618T-2/OFF/618T-3 switch to 618T-3.
- b. 714E-1/714E-2/3 switch to 714E-2/3.
- c. KEY INTLK BYPASS-NORMAL switch to NORMAL.
- d. Mode selector to OFF.

4-50. Starting Procedure

Set test harness controls as follows:

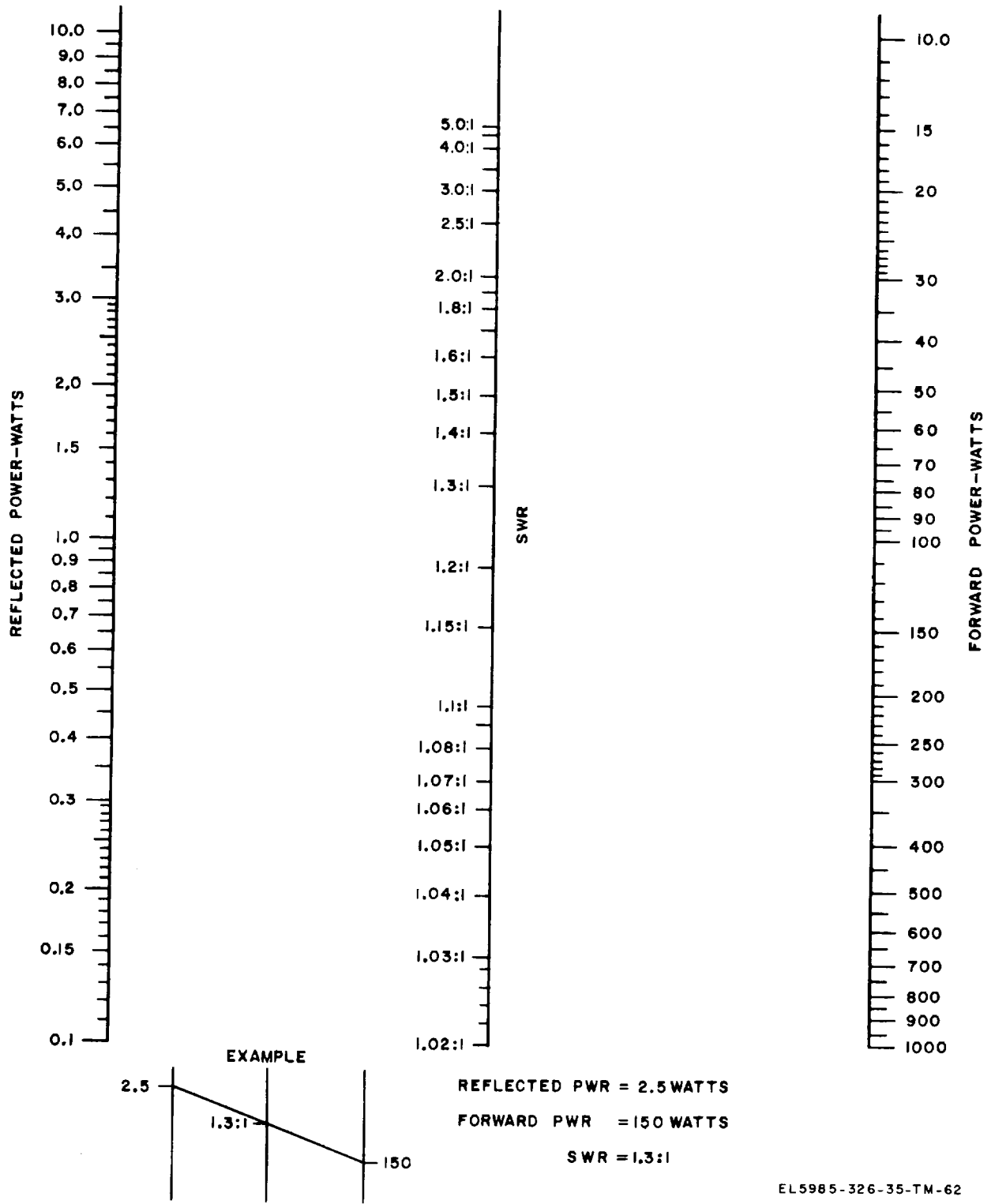
- a. AC ON-OFF switch to ON.
- b. DC POWER switch to ON.
- c. Mode selector to AM.

CAUTION

Check receiver-transmitter blower. If blower is not running, immediately set test harness mode selector to OFF. Do not conduct test if blower does not run.

4-51. Physical Tests and Inspection

- a. *Test Equipment and Materials.* None.
- b. *Test Connections and Conditions.* Remove dust cover (para 3-10a).



EL 5985-326-35-TM-62

Figure 4-15. VSWR nomograph.

c. *Procedures.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	N/A	N/A	a. Inspect mechanical assemblies for loose or missing screws, nuts, or bolts. b. Inspect modules for loose and damaged parts. c. Inspect front panel and dust cover for damage and condition of finish and panel lettering.	a. Screws, nuts, and bolts in place and tightly secured. b. No loose or damaged parts. c. No damage. External painted surfaces do not show bare metal. Bottom of dust cover and front panel do not show paint or applied finish. Panel lettering is legible.
2	N/A	N/A	Move each varicoil wiper one or more turns. Caution: Do not remove wiper from coil turn on which it is riding or run wiper off end of coil. If either event occurs, wiper must be resynchronized with varicoil limit switches, using overhaul procedures.	Varicoil wipers move freely.

4-52. Home, Receiver Ground Relay, and T/R Relay Tests

- a. *Test Equipment and Materials*
- (1) *Radio set.*
 - (2) *Harness.*
 - (3) *Multimeter.*
 - (4) *Aluminum plate.*
 - (5) *Ground straps.*

b. *Test Connections and Conditions.*

- (1) Perform preliminary steps (para 4-48).
- (2) Connect test setup (fig. 4-16).
- (3) Make initial settings (para 4-49).
- (4) Start equipment (para 4-50).
- (5) Warm up for 1 minute.

NOTE

Step 1 is home test; step 2 is receiver ground relay test, and step 3 is T/R relay test. Steps 2 and 3 are not applicable to CU-1658/A.

c. *Procedures.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1			a. Set test harness frequency controls to various frequencies. Observe tuning elements. b. Check antenna coupler TUNE and OPR lights. c. Set test harness mode selector to OFF.	a. Tuning elements home as Follows: Shunt varicoil A6: maximum inductance (wiper at coil end opposite motor). Series varicoil A5: minimum inductance (wiper at same end of coil as motor). Shunt capacitor A7: minimum capacitance (maximum air gap visible through glass above movable capacitor plate). Series capacitor A9: series switch, when viewed from right side of antenna coupler, has three visible contacts in front. Rotor contact must be in contact with right contact of switch only. b. TUNE and OPR lights off. c. None.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
2		CU-1669/ GRC only	<ul style="list-style-type: none"> a. Set test harness AC ON-OFF switch to OFF. b. Set test harness DC POWER switch to OFF. c. Remove cables from CU-1669/GRC antenna coupler. d. On antenna coupler, connect multimeter between J103 and chassis ground. Read multimeter. e. On antenna coupler, apply + 28 volts dc to J1-W (high side) and J1-X. Read multimeter. f. On antenna coupler, reconnect W7 to J1. 	<ul style="list-style-type: none"> a. None. b. None. c. None. d. On MCN 651 and below, multimeter must indicate 10K ohms ± 10%. e. Multimeter must indicate less than 1 ohm. f. None.
3		CU-1669/	<ul style="list-style-type: none"> a. On antenna coupler, connect multimeter between J2 and E102. Measure resistance. b. Set test harness KEY INTLK BYPASS-NORMAL switch to BYPASS. c. Press microphone push-to-talk switch. Read multimeter. d. Release microphone push-to-talk switch. e. Change multimeter lead from J2 to J103. f. Set test harness KEY INTLK BYPASS-NORMAL switch to NORMAL. Read multimeter. g. Set test harness KEY INTLK BYPASS-NORMAL switch to BYPASS. h. Press microphone push-to-talk switch. Read multimeter. i. Release microphone push-to-talk switch. j. Set test harness KEY INTLK BYPASS-NORMAL switch to NORMAL. Reconnect cables to antenna coupler. 	<ul style="list-style-type: none"> a. Multimeter must indicate more than 1 megohm. b. None. c. Multimeter must indicate less than 1 ohm. d. None. e. None. f. Multimeter must indicate less than 1 ohm. g. None. h. Multimeter must indicate more than 1 megohm. i. None. j. None.

4-53. Fault Circuit Test
(fig. 4-17)

a. *Test Equipment and Materials.*

- (1) Radio set.
- (2) Test harness.
- (3) Wattmeter.
- (4) Stopwatch.
- (5) Aluminum plate.
- (6) Ground straps (2).
- (7) No. 12 bus wire

b. *Test Connections and Conditions*

- (1) Perform preliminary steps (para 4-48).

(2) Connect No. 12 bus wire from the receiver-transmitter ANT jack to J101 on the wattmeter (fig 4-17).

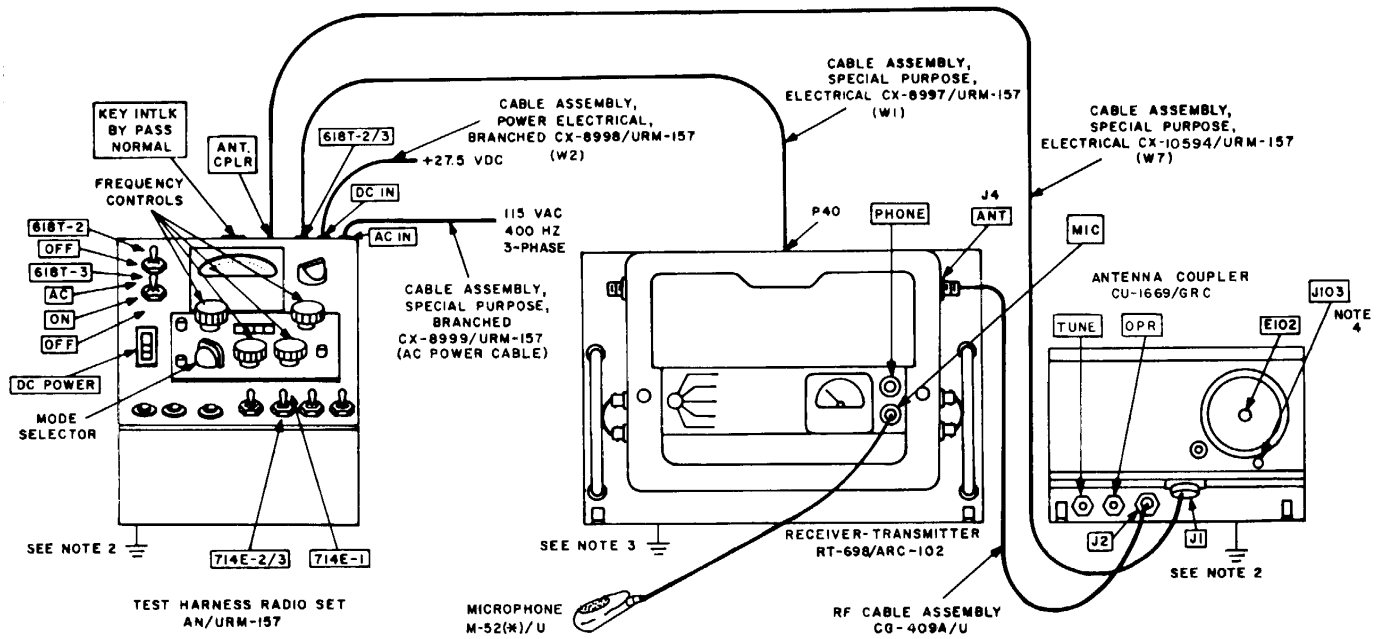
(3) Connect No. 12 bus wire from J102 on the wattmeter to J2 on the antenna coupler.

(4) Connect one end of No. 12 bus wire to E102 on the antenna coupler. Curve the other end of the bus wire and place the free end under the antenna coupler. Let the weight of the antenna coupler hold the bus wire to the aluminum plate (fig. 4-17).

(5) Make the initial settings (para 4-49).

(6) Start the equipment (para 4-50).

(7) Warm up for 1 minute.



NOTES

1. INDICATES EQUIPMENT MARKING.
2. MOUNT ALL TEST EQUIPMENT ON A LARGE ALUMINUM PLATE.
3. PLACE A SMALL METAL BAR UNDER BOTH FRONT AND REAR OF THE RT-698/ARC-102.
4. FOR CU-1669/GRC TEST HOOKUP ONLY.

EL5985-326-35-TM-56

Figure 4-16. Home test setup, receiver ground relay test, and T/R relay test.

Change 1 4-62

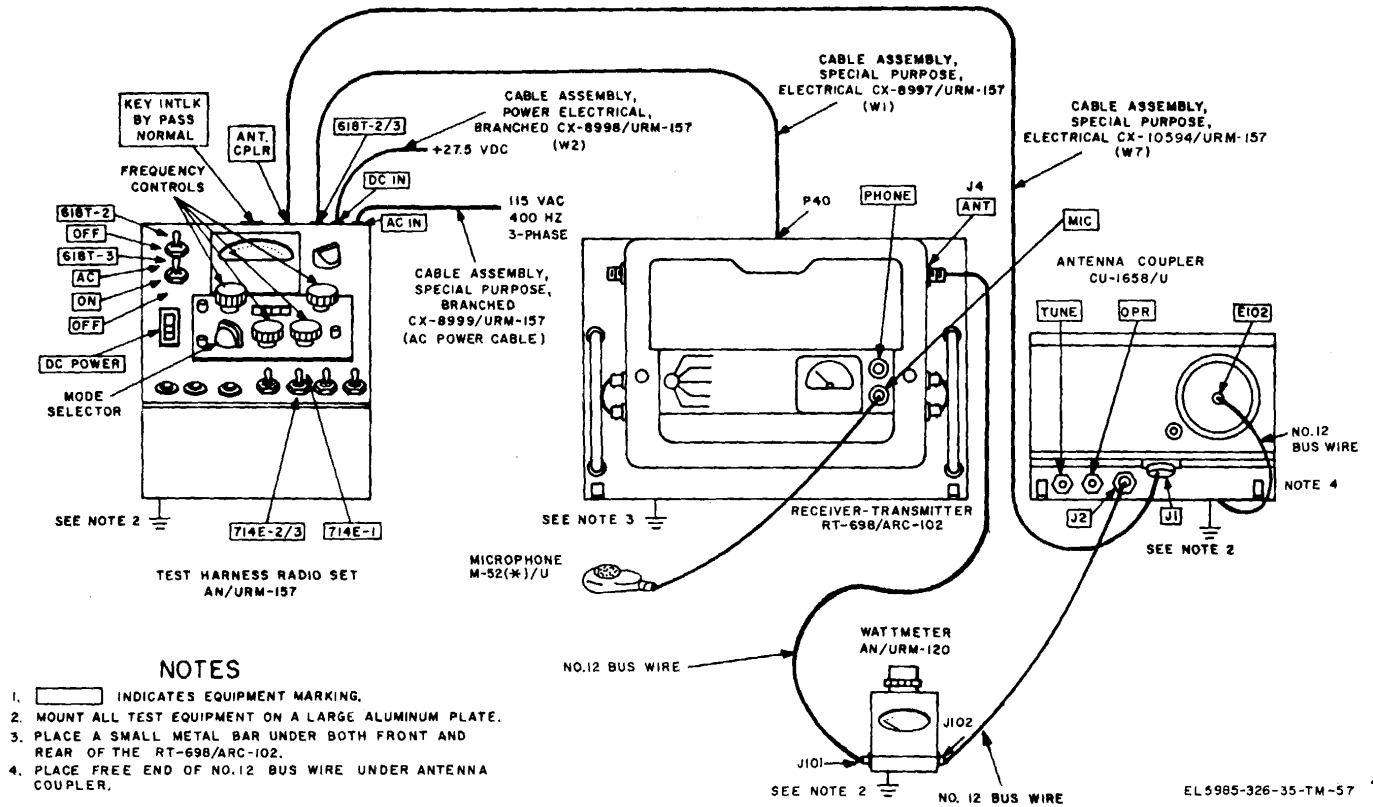


Figure 4-17. Fault circuit test setup.

Change 1 4-63

c. Procedure.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	<p><i>Test Harness:</i> Mode selector: OFF</p> <p><i>Wattmeter:</i> Directional coupler: Arrow towards antenna coupler. Range: 500 watts.</p>	N/A	<p>a. Record settings of test harness frequency controls.</p> <p>b. Set test harness mode selector to AM, and frequency controls to 29.999 MHz.</p> <p>c. Press and release microphone push-to-talk switch. Use stopwatch to measure time when TUNE light comes on until OPR light comes on. Read wattmeter.</p> <p>d. Reset test harness frequency controls to frequency recorded in a above. Observe TUNE and OPR lights.</p> <p>e. Set test harness mode selector to OFF.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. While TUNE light is on, wattmeter must indicate 70 watts or more. OPR light must come on within 12 seconds. TUNE and OPR lights must stay on. Wattmeter must then indicate zero.</p> <p>d. TUNE and OPR lights must go off.</p> <p>e. None.</p>

4-54. Demand 'Surveillance and Vswr Tests
(fig. 4-18).

a. *Test Equipment and Materials.*

- (1) Radio set.
- (2) Test harness.
- (3) Wattmeter.
- (4) Dummy load.
- (5) Capacitor, ceramic, 3,000 μμf, 5,000 wvdc, unpolarized.
- (6) Aluminum plate.
- (7) Ground straps (2).

b. test Connections and Conditions

- (1) Perform preliminary steps (para 4-48).
- (2) Connect the No. 12 bus wire in series with the capacitor from E102 on the antenna coupler to J1 on the dummy load (fig. 4-18).

(3) On the dummy load, set the ON-OFF power switch to OFF.

(4) Connect the dummy load connector P1 to 115-volt ac, 400-Hz, single-phase power.

(5) make the initial settings (para 4-49).

(6) Start equipment (para 4-50).

(7) On dummy load, set ON-OFF power switch to ON. Check that dummy load power-on light is lit and blower is running.

CAUTION

If the blower is not running, immediately set the ON-OFF power switch to OFF. Do not conduct the test if the blower is nor running.

(9) Warm up for 1 minute.

NOTE

Step 1 below is the demand surveillance test; step 2 is the vswr test.

c. *Procedures.*

NOTE

Be sure coupler-detector CU-753/URM-120 is in the wattmeter.

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	<p><i>Test Harness:</i> Mode selector: AM</p> <p><i>Wattmeter:</i> Directional coupler: Arrow towards an-</p>	N/A	<p>a. Momentarily press microphone push-to-talk switch.</p> <p>b. Set test harness mode selector to OFF.</p> <p>c. Remove capacitor from E102 -----</p> <p>d. Remove capacitor from No. 12 bus wire.</p>	<p>a. None.</p> <p>b. None.</p> <p>c. None.</p> <p>d. None.</p>

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
2	tenna coupler.E102. Range: 500 500 watts.		<p>e. Reconnect No. 12 bus wire to</p> <p>f. Set test harness mode selector to AM. Warmup for 1 minute.</p> <p>g. Press microphone push-to-talk switch. Observe TUNE and OPR lights.</p> <p>h. Read wattmeter-----</p> <p>i. On wattmeter, turn directional coupler so arrow points toward receiver-transmitter.</p> <p>j. On wattmeter, set range to 50 watts.</p> <p>k. Read wattmeter-----</p> <p>l. Release microphone push-to-talk switch.</p>	<p>e. None.</p> <p>f. None.</p> <p>g. TUNE light must come on during tuning; then, TUNE light must go off, and OPR light must come on.</p> <p>h. Wattmeter must indicate more than 70 watts.</p> <p>i. None.</p> <p>j. None.</p> <p>k. Wattmeter must indicate less than 6 watts.</p> <p>l. None.</p>
			<p>a. On wattmeter, turn directional coupler so arrow points toward antenna coupler. Set wattmeter range to 500 watts.</p> <p>b. Press microphone push-to-talk switch. Read and record wattmeter indication.</p> <p>c. On wattmeter, turn directional coupler so arrow points toward receiver-transmitter. Set wattmeter range to 50 watts.</p> <p>d. Press microphone push-to-talk switch. Read and record wattmeter indication.</p> <p>e. Release microphone push-to-talk switch. On wattmeter, turn directional coupler so arrow is toward antenna coupler. Set wattmeter range to 500 watts.</p> <p>f. Repeat a through d for frequency settings of 2.999, 3.999, 7.999, 14.999, 22.999, and 29.999 MHz. Read and record wattmeter indication at each setting.</p> <p>g. Use indications in b, d, and f to determine vswr for each frequency checked. For each frequency, lay straight-edge on figure 4-15 as shown in example. Read vswr off centerline.</p>	<p>a. None.</p> <p>b. Wattmeter must not indicate more than 200 watts.</p> <p>c. None.</p> <p>d. Wattmeter must not indicate more than 3.7 percent of reading in b above.</p> <p>e. None.</p> <p>f. Same as b and d.</p> <p>g. Vswr must be less than 1.5 to 1.</p>

4-55. Tuning Time and Voice Emission Test

(fig. 4-19)

a. Test Equipment and Materials

- (1) Radio Set.
- (2) Test harness.
- (3) Dummy load.
- (4) Aluminum plate.
- (5) Ground straps (2)
- (6) Stopwatch.

b. Test Connections and Conditions.

- (1) Perform the preliminary steps (para 4-48).
- (2) On the dummy load, set the power ON-OFF switch to OFF.
- (3) Connect the dummy load connector P1 to 115-volt ac, 400-Hz, single-phase power (fig. 4-19).
- (4) Make the initial settings (para 4-49).

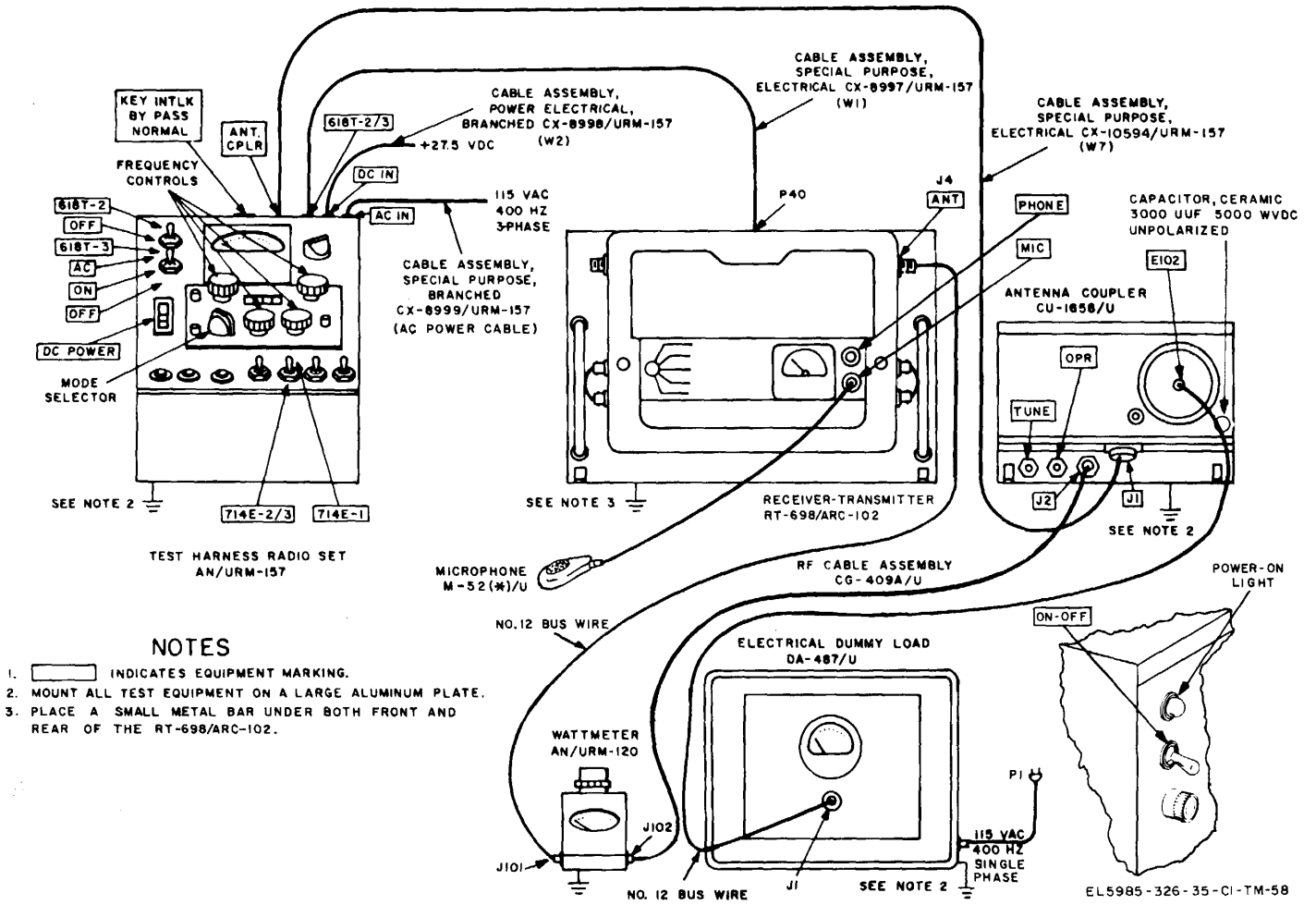


Figure 4-18. Demand surveillance and vswr test setup.

Change 1 4-66

- (5) Start equipment (para 4-50).
- (6) On the dummy load, set the ON-OFF power switch to ON. Check that the dummy load power-on light is lit and that the blower is running.

the dummy load power ON-OFF switch to OFF.

- (7) Warm up for 1 minute.

CAUTION

Do not proceed if the dummy load blower is not running. Immediately set

NOTE

Step 1 below is the tuning time test; step 2 is the voice emission test.

c. *Procedures.*

Step No.	Control settings		Test procedure	Performance standard
	Test equipment	Equipment under test		
1	Test Harness: Mode selector: AM Frequency controls: 2.000 MHz	N/A	<ul style="list-style-type: none"> a. Press microphone push-to-talk switch. Measure time when TUNE light comes on until TUNE light goes off, and OPR light comes on. b. Release push-to-talk switch c. Set test harness frequency controls to 2.999 MHz. d. Repeat a and b e. Repeat a and b for frequency settings of: 3.999, 7.999, 14.999, 22.999, and 29.999 MHz. 	<ul style="list-style-type: none"> a. Time interval must not be more than 5 seconds. b. None. c. None. d. Same as a. e. Same as a.
2			<ul style="list-style-type: none"> a. Press microphone push-to-talk switch. b. Speak loudly into microphone. Observe tuning coils, and TUNE light. c. Release push-to-talk switch. Set test harness mode selector to OFF. 	<ul style="list-style-type: none"> a. None. b. There must be no corona or arcing on coils. TUNE light must stay off. c. None.

4-56. Summary of Test Data

<i>Test</i>	<i>Performance standard</i>
1. Physical tests and inspection (para 4-51). <ul style="list-style-type: none"> a. Damaged or missing parts b. Finish c. Varicoil wipers 	<ul style="list-style-type: none"> a. No parts damaged or missing. b. Finish good. c. Move freely.
2. Home (step 1, para 4-52). <ul style="list-style-type: none"> a. Position of moving elements _ b. TUNE and OPR lights 	<ul style="list-style-type: none"> a. All elements at home. b. Off when at home.
3. Receiver ground relay (step 2, para 4-52). <ul style="list-style-type: none"> a. Resistance J103 to ground b. Resistance J1-W to J1-X 	<ul style="list-style-type: none"> a. 10, 000 ohms f'10 percent. b. 1 ohm max.
4. T/R relay (step 3, para 4-52). <ul style="list-style-type: none"> a. Resistance J2 to E102 b. Resistance J2 to J103 	<ul style="list-style-type: none"> a. More than 1 megohm. b. Less than 1 ohm.
5. Fault circuit (para 4-53). <ul style="list-style-type: none"> a. TUNE and OPR lights b. Wattmeter 	<ul style="list-style-type: none"> a. Lights perform as indicated. b. Wattmeter indicates zero.
6. Demand surveillance (step 1, para 4-54). <ul style="list-style-type: none"> a. TUNE and OPR lights b. Forward power c. Reflected power 	<ul style="list-style-type: none"> a. Lights perform as indicated. b. 70 watts min. c. 6 watts max.
7. Voltage standing-wave ratio (step 2, para 4-54). <ul style="list-style-type: none"> a. Forward power b. Reflected power c. Vswr 	<ul style="list-style-type: none"> a. 200 watts max. b. 1.7 percent of forward power max. c. 1.5 : 1 max.

8. Tuning time (step 1, para 4-55).
 - a. TUNE and OPR lights
 - b. Tuning time
 9. Voice emission (step 2, para 4-55).
 - a. Varicoils
 - b. TUNE light
- a. Lights perform as indicated.
 - b. 5 seconds max.
- a. No corona or arcing.
 - b. Stays off, no flicker.

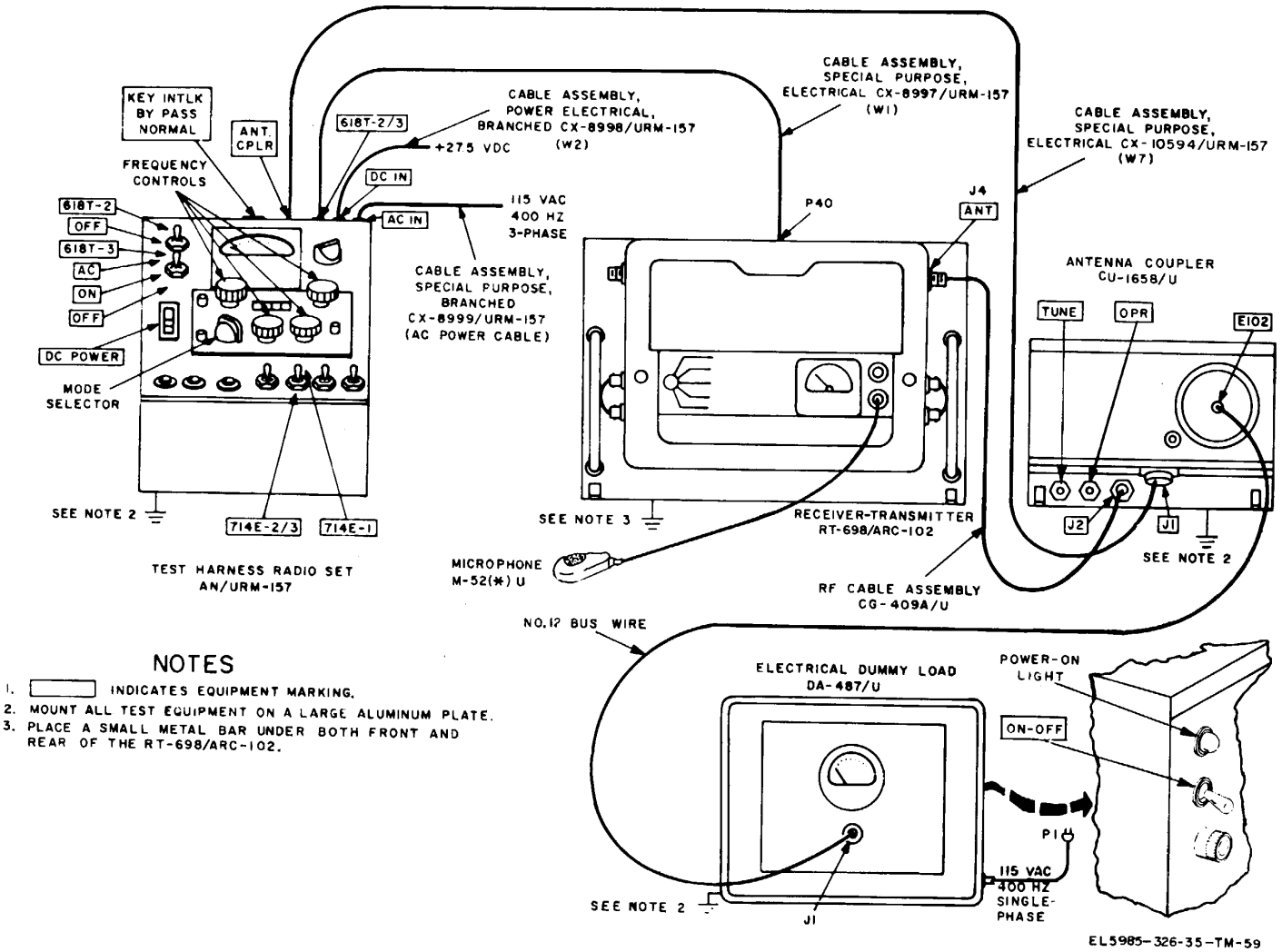


Figure 4-19. Tuning time and voice emission test.

CHAPTER 5

DEPOT OVERHAUL STANDARDS

5-1. Applicability

a. The tests listed in this chapter are designed to measure antenna coupler performance. Equipment that is returned to stock must pass these tests.

b. Applicable procedures of depots performing these tests and the standards given in TB SIG 355-1, TR SIG 355-2, and TB SIG 355-3 form a part of the test requirements.

5-2. Test Procedures

The equipment required for depot overhaul standards are the same as shown in paragraphs 4-44 and 4-45. The tests for depot overhaul standards are the same as those in chapter 4. Perform the tests in sequence. Results must meet the performance standards shown in each test.

CHAPTER 6

FINAL (FOLD-OUT ILLUSTRATIONS)

6-1. General

This chapter contains all fold-out illustrations referenced in the manual. A list of these illustrations is given below.

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6-1	Color code marking for MIL-STD resistors.
6-2	Color code marking for MIL-STD capacitors.
6-2.1	Antenna coupler, operational sequence.
6-3	Control amplifier A3, part number 775-4276-001, schematic diagram.
6-4	Control amplifier A3, part number 528-0467-000, schematic diagram.
6-4.1	Step coil A4 motor circuit, simplified schematic diagram.
6-5	Coupler control A2 (MCN 101 through 179), schematic diagram.
6-6	Coupler control A2 (MCN 180 through 671), schematic diagram.
6-7	Coupler control A2 (MCN 672 through 3614), schematic diagram.
6-8	Coupler control A2 (MCN 3615), schematic diagram.
6-8.1(1)	Coupler control A2 (part number 608-9500-002), schematic diagram (part 1 of 4).
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6-8.1(3)	Coupler control A2 (part number 608-9500-002), schematic diagram (part 3 of 4).
6-8.1(4)	Coupler control A2 (part number 608-9500-002), schematic diagram (part 4 of 4).
6-9(1)	Antenna coupler CU-1658/A equipment chassis A1, wiring diagram (part 1 of 2).
6-9(2)	Antenna coupler CU-1658/U equipment chassis A1, wiring diagram (part 2 of 2).
6-10(1)	Antenna coupler CU-1669/GRC equipment chassis A1, wiring diagram (part 1 of 2).
6-10(2)	Antenna coupler CU-1669/GRC equipment chassis A1, wiring diagram (part 2 of 2).
6-11	Coupler control A2, using Test Set TS-2353/ARM-109 in position 1., simplified schematic diagram (reference only).
612	Coupler control A2, using Test Set TS-2353/ARM-109 in position 2, simplified schematic diagram (reference only).
6-13	Coupler control A2, using Test Set TS-2353/ARM-109 in position 3, simplified schematic diagram (reference only).
6-14	Coupler control A2, using Test Set TS-2353/ARM-109 in position 4, simplified schematic diagram (reference only).
6-15	Coupler control A2, using Test Set TS-2353/ARM-109 in position 5, simplified schematic diagram (reference only).
6-16	Coupler control A2, using Test Set TS-2353/ARM-109 in position 6, simplified schematic diagram (reference only).
6-17	Coupler control A2, using Test Set TS-2353/ARM-109 in position 7, simplified schematic diagram (reference only).
6-18	Coupler control A2, using Test Set TS-2353/ARM-109 in position 8, simplified schematic diagram (reference only).
6-19	Coupler control A2, using Test Set TS-2353/ARM-109 in position 9, simplified schematic diagram (reference only).
6-20	Coupler control A2, using Test Set TS-2353/ARM-109 in position 10, simplified schematic diagram (reference only).
6-21	Coupler control A2, using Test Set TS-2353/ARM-109 in position 11, simplified schematic diagram (reference only).
6-22	Coupler control A2, using Test Set TS-2353/ARM-109 in position 12, simplified schematic diagram (reference only).

APPENDIX A

REFERENCES

The following publications contain information applicable to the operation and maintenance of Couplers, Antenna CU-1658/A and CU-1669/GRC:

DA Pam 310-4	Index of Technical Manuals, Technical Bulletins, Supply Manuals (Types 7, 8, and 9), Supply Bulletins, and Lubrication Orders.
DA Pam 310-7	U. S. Army Equipment Index of Modification Work Orders.
SB 11-604	Replacement of Tool Kits, Radar and Radio Repairman TK-87/U and TK-88/U with Tool Kits, Electronic Equipment TK-105/G and TK- 100/G.
TB SIG 291	Safety Measures To Be Observed When Installing and Using Whip Antennas, Field Type Masts, Towers, Antennas and Metal Poles That Are Used with Communications, Radar and Direction Finding Equipment.
TB 11-6625-1636-35/1	Calibration Procedure for Antenna Coupler Test Set AN/ARM-109.
TM 11-5821-248-12	Organizational Maintenance Manual: Radio Set AN/ARC-102.
TM 11-5985-326-20	Organizational Maintenance Manual: Coupler, Antenna CU-1658/A and CU-1669/GRC.
TM 11-5985-327-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Electrical Dummy Load DA-487/U.
TM 11-6625-366-15	Organizational, DS, GS, and Depot Maintenance Manual: Multimeter TS-352B/U.
TM 11-6625-446-15	Operator, Organizational, Field and Depot Maintenance Manual: Wattmeter AN/URM-120.
TM 11-6625-535-15	Operator, Organizational, DS, GS and Depot Maintenance Manual: Oscilloscope AN/US, M-140A.
TM 11-6625-535-15-1	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Oscilloscope AN/USM-140B, A, N/USM-140C, AN/USM-141A, and AN/USM-141B.
TM 11-6625-622-12	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Test Harness, Radio Set AN/URM-157.
TM 11-6625-622-45	GS and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Test Harness, Radio Set AN/URM-157.
TM 11-6625-1636-15	Organizational, DS, GS, and Depot Maintenance Manual: Test Set, Antenna Coupler AN/ARM-109.
TM 38-750	The Army Maintenance Management Systems (TAMMS).

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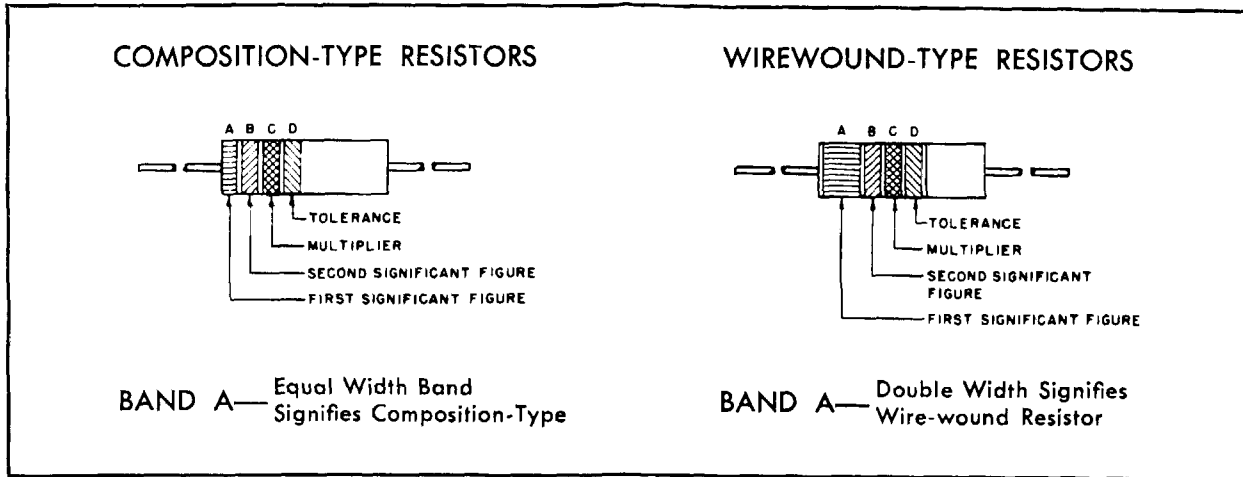
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COE (1)	SAAD (30)
TSG (1)	TOAD (14)
CofSptS (1)	LEAD (7)
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USAMB (10)	SVAD (5)
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WRAMC (1)	11-225
USACDCEC (10)	11-226
Instl (2) except	111-227
Ft Gordon (10)	11-500(AA-AC)
Ft Huachuca (10)	29-134
WSMR (3)	29-136

NG: None
 USAR: None

For explanation of abbreviations used, see AR 310-50.

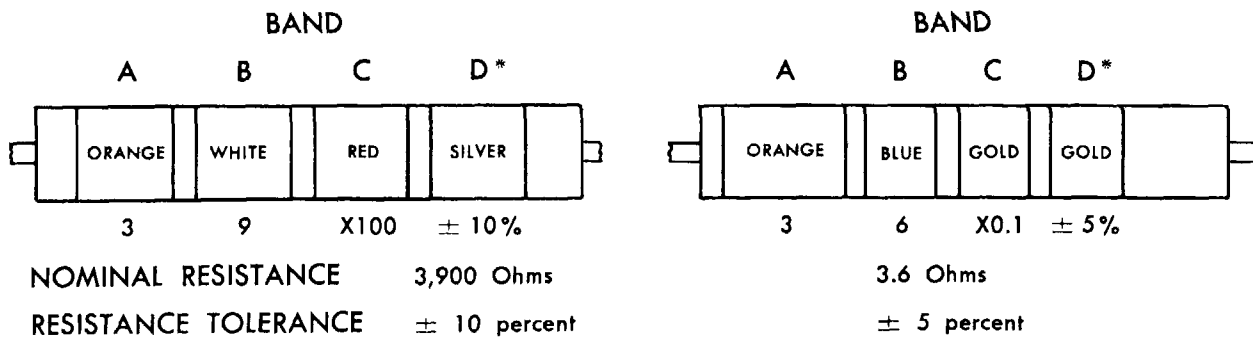
COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS



COLOR CODE TABLE

BAND A		BAND B		BAND C		BAND D*	
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)
BLACK	0	BLACK	0	BLACK	1		
BROWN	1	BROWN	1	BROWN	10		
RED	2	RED	2	RED	100		
ORANGE	3	ORANGE	3	ORANGE	1,000		
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	± 10
GREEN	5	GREEN	5	GREEN	100,000	GOLD	± 5
BLUE	6	BLUE	6	BLUE	1,000,000		
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7				
GRAY	8	GRAY	8	SILVER	0.01		
WHITE	9	WHITE	9	GOLD	0.1		

EXAMPLES OF COLOR CODING



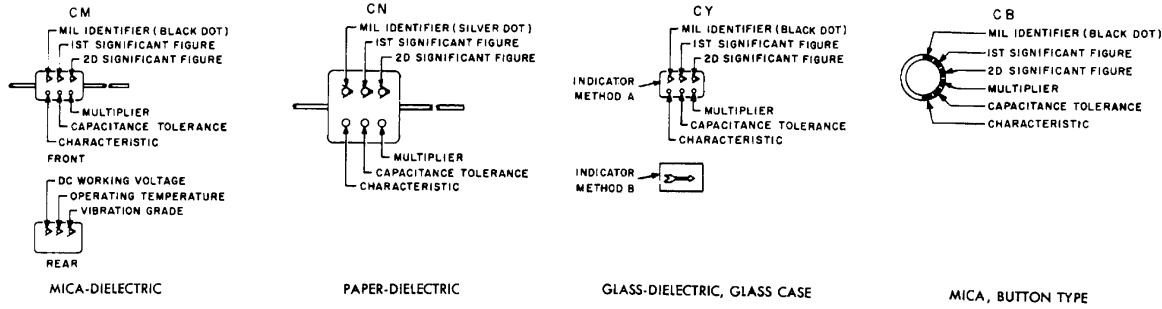
*If Band D is omitted, the resistor tolerance is ± 20%, and the resistor is not Mil-Std.

STD-R2

Figure 6-1. Color code marking for MIL-STD resistors

COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

GROUP I Capacitors, Fixed, Various-Dielectrics, Styles CM, CN, CY, and CB



COLOR CODE TABLES

TABLE I - For use with Group I, Styles CM, CN, CY and CB

COLOR	MIL ID	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE				CHARACTERISTIC ²			DC WORKING VOLTAGE	OPERATING TEMP. RANGE	VIBRATION GRADE	
					CM	CN	CY	CB	CM	CN	CB	CM	CM	CM	
BLACK	CM, CY, CB	0	0	1			± 20%	± 20%	A				-55° to +70°C	10-55 cps	
BROWN		1	1	10					B	E		B			
RED		2	2	100	± 2%		± 2%	± 2%	C		C		-55° to +85°C		
ORANGE		3	3	1,000		± 30%					D	D	300		
YELLOW		4	4	10,000							E			-55° to +125°C	10-2,000 cps
GREEN		5	5		± 5%						F		500		
BLUE		6	6											-55° to +150°C	
PURPLE (VIOLET)		7	7												
GREY		8	8												
WHITE		9	9												
GOLD				0.1			± 5%	± 5%							
SILVER	CN				± 10%	± 10%	± 10%	± 10%							

GROUP II Capacitors, Fixed Ceramic-Dielectric (General Purpose) Style CK

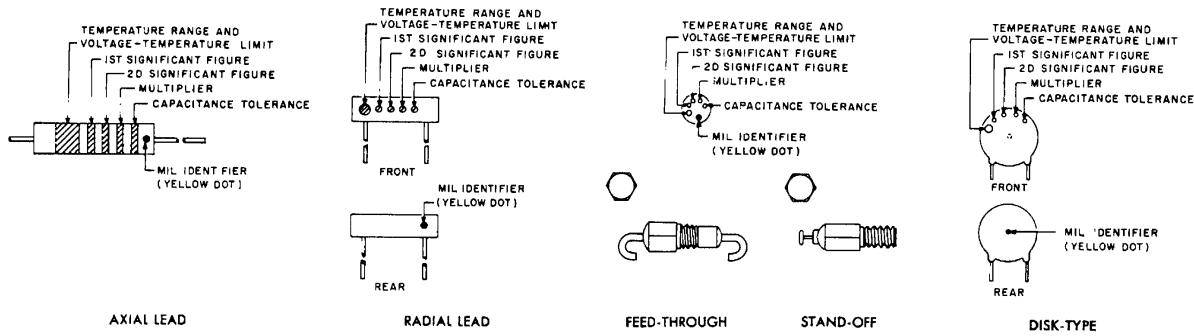


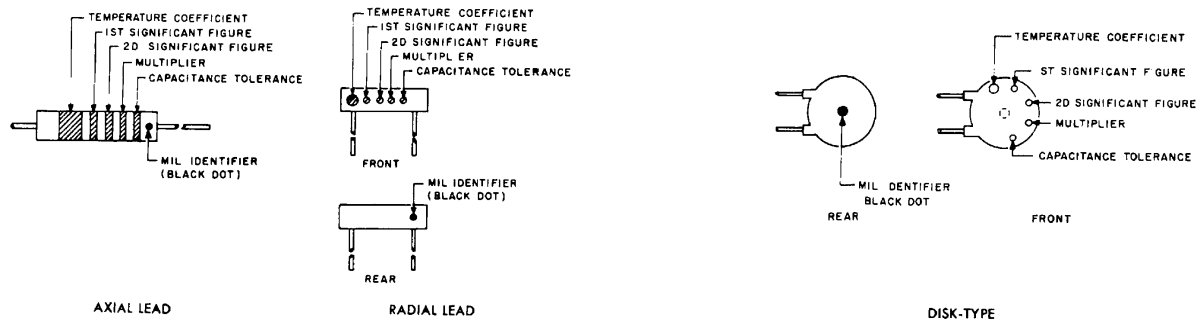
TABLE II - For use with Group II, General Purpose, Style CK

COLOR	TEMP. RANGE AND VOLTAGE - TEMP. LIMITS ³	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE	MIL ID
BLACK		0	0	1	± 20%	
BROWN	AW	1	1	10	± 10%	
RED	AX	2	2	100		
ORANGE	BX	3	3	1,000		
YELLOW	AV	4	4	10,000		CK
GREEN	CZ	5	5			
BLUE	BY	6	6			
PURPLE (VIOLET)		7	7			
GREY		8	8			
WHITE		9	9			
GOLD						
SILVER						

TABLE III - For use with Group III, Temperature Compensating, Style CC

COLOR	TEMPERATURE COEFFICIENT ⁴	1st SIG FIG	2nd SIG FIG	MULTIPLIER ¹	CAPACITANCE TOLERANCE		MIL ID
					Capacitances over 10uuf	Capacitances 10uuf or less	
BLACK	0	0	0	1		± 2.0uuf	CC
BROWN	30	1	1	10	± 1%		
RED	80	2	2	100	± 2%	± 0.25uuf	
ORANGE	150	3	3	1,000			
YELLOW	220	4	4				
GREEN	330	5	5		± 5%	± 0.5uuf	
BLUE	470	6	6				
PURPLE (VIOLET)	750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	± 10%		
GOLD	± 100					± 1.0uuf	
SILVER							

GROUP III Capacitors, Fixed, Ceramic-Dielectric (Temperature Compensating) Style CC



1. The multiplier is the number by which the two significant (SIG) figures are multiplied to obtain the capacitance in uuf.
2. Letters indicate the Characteristics designated in applicable specifications: MIL-C-5, MIL-C-91, MIL-C-11272 and MIL-C-10950 respectively.
3. Letters indicate the temperature range and voltage-temperature limits designated in MIL-C-11015.
4. Temperature coefficient in parts per million per degree celsius.

Figure 6-2. Color code marking for MIL-STD capacitors.

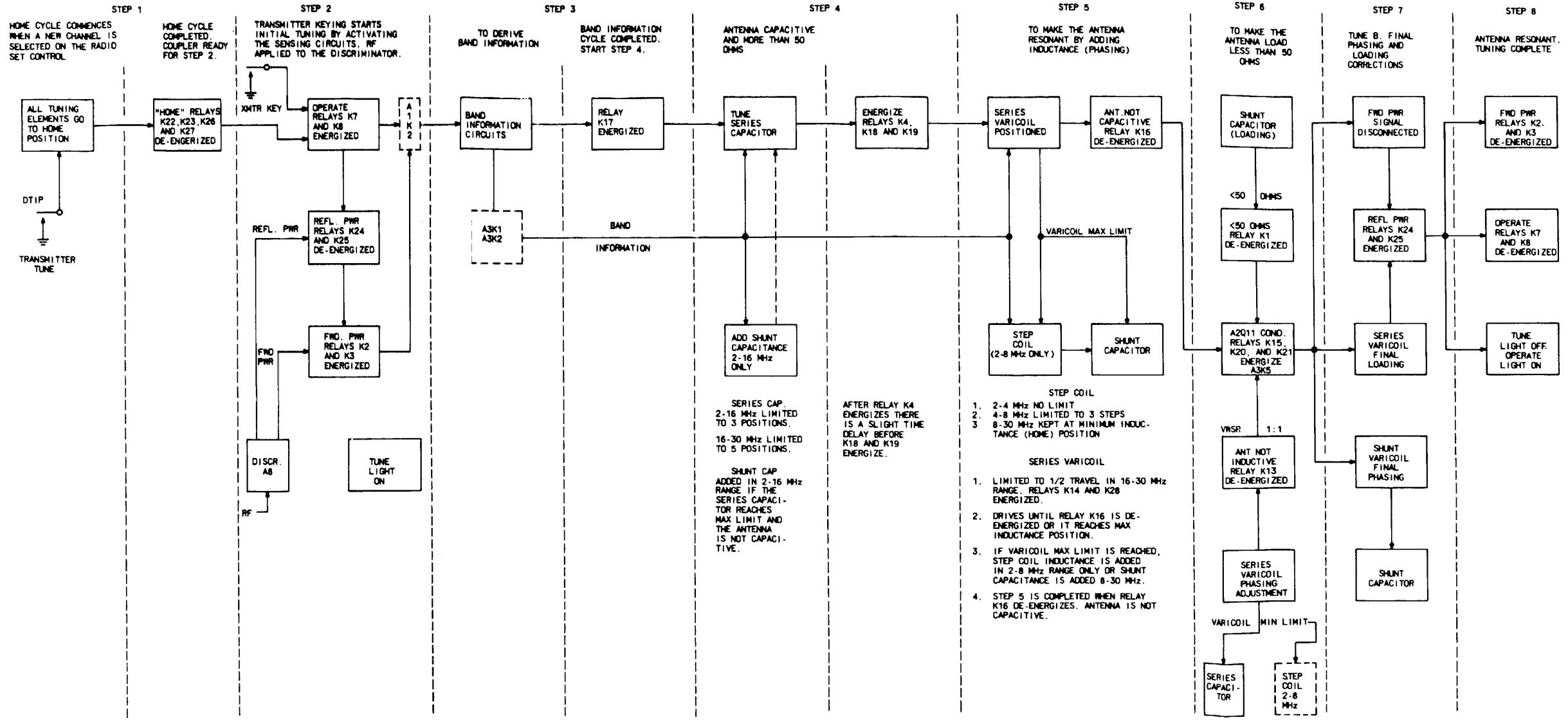
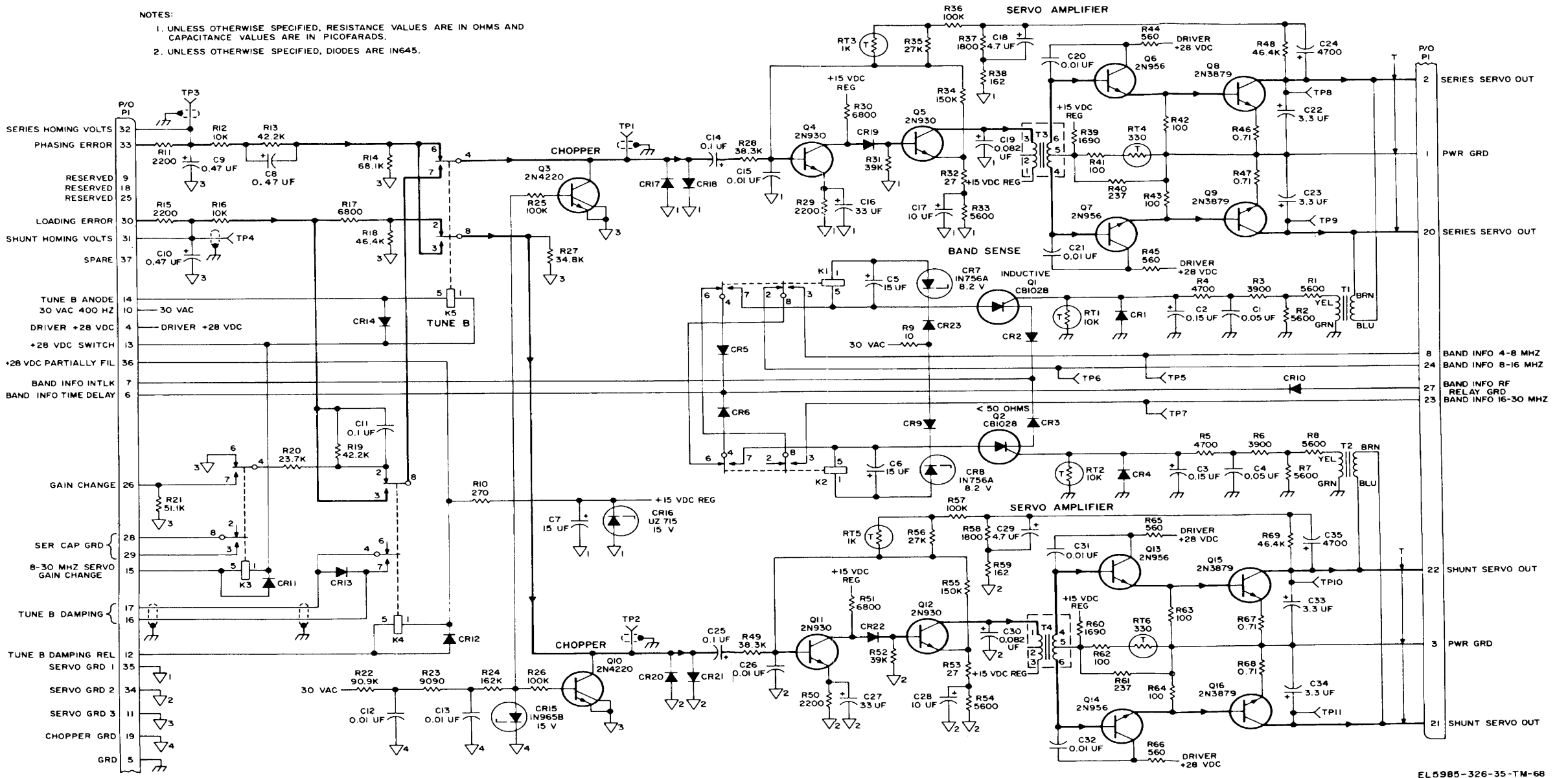


Figure 6-2.1. Antenna Coupler, Operational Sequence

Change 2 FO 6-2.1



EL 5985-326-35-TM-68

Figure 6-3. Control amplifier A3, part No. 775-4276-001, schematic diagram.

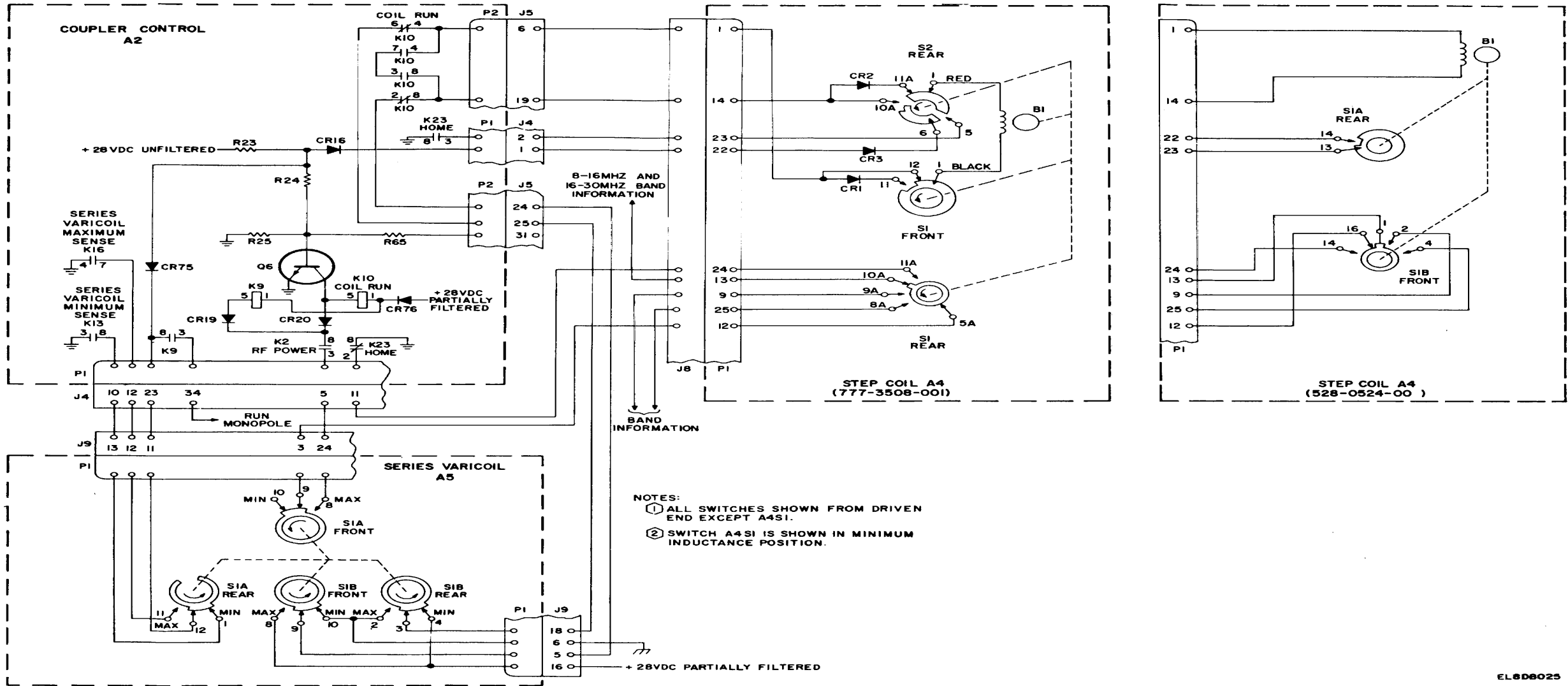


Figure 6-4.1. Step Coil A4 Motor Circuit , Simplified Schematic Diagram.

Change 2 FO 6-4.1

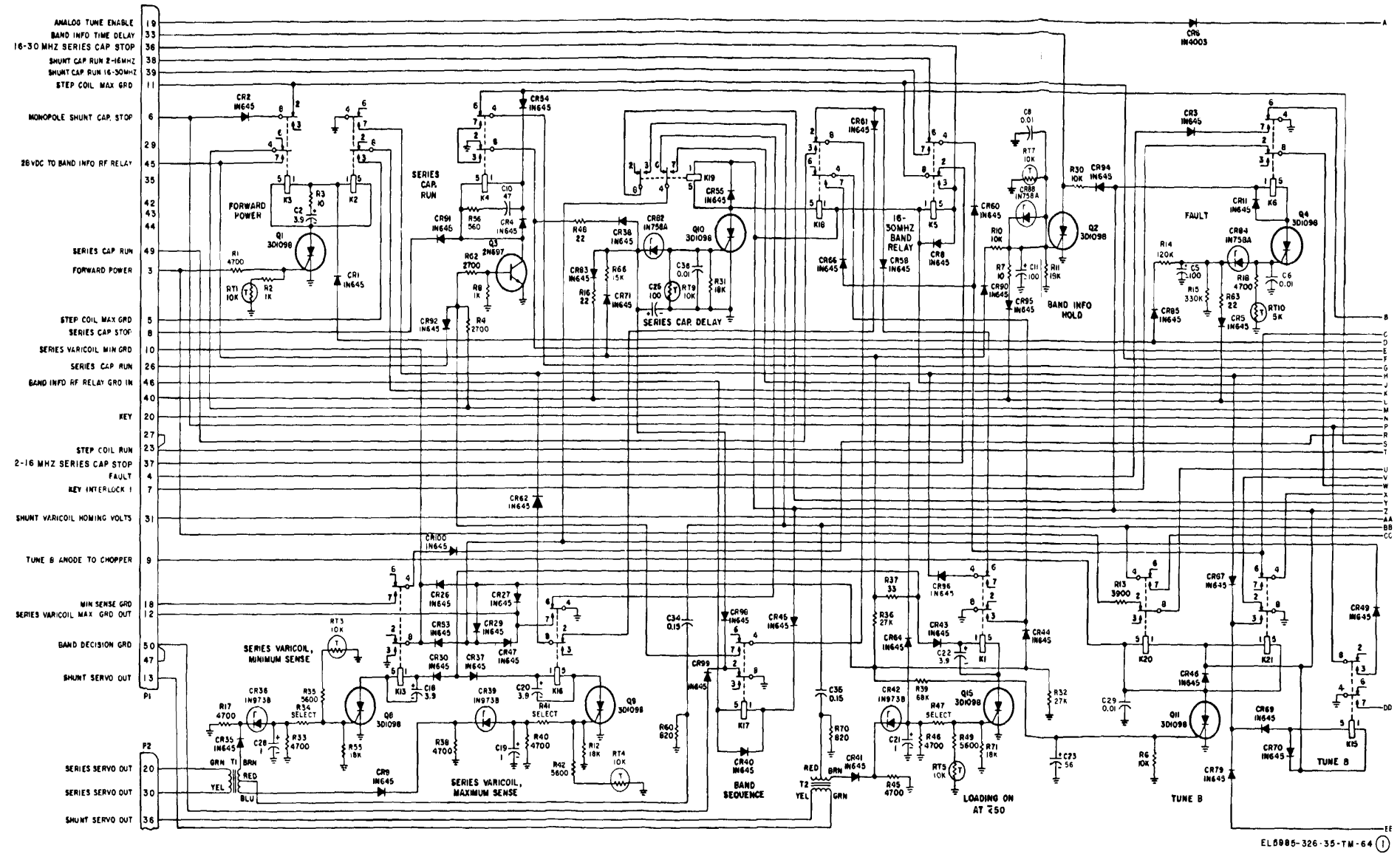
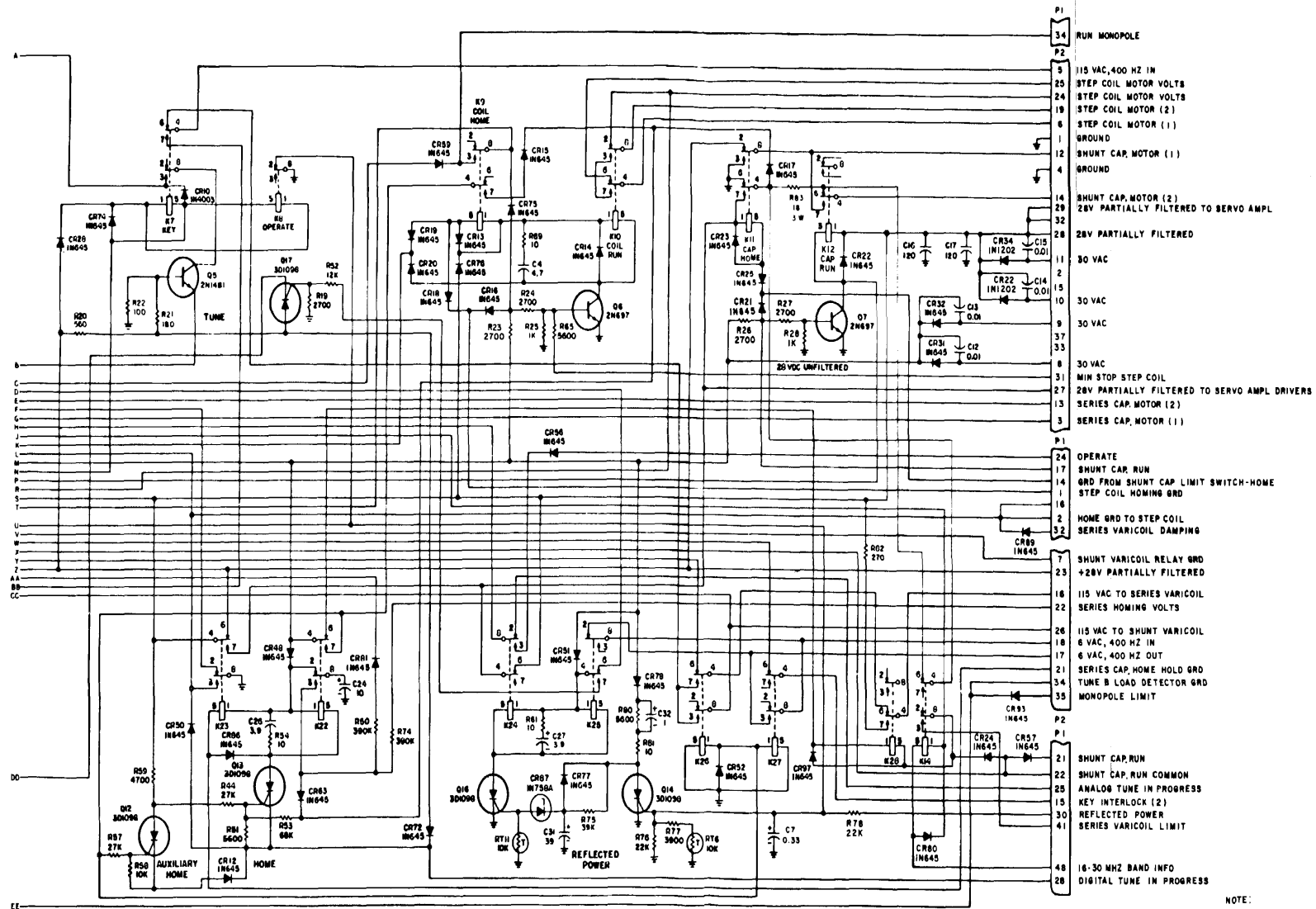


Figure 6-5(1). Coupler control A2 (MCN 101 through 179), schematic diagram (Part 1 of 2)



NOTE:
 UNLESS OTHERWISE INDICATED,
 ALL RESISTANCE VALUES ARE IN OHMS
 ALL CAPACITANCE VALUES ARE IN MICROFARADS
 EL 5985-326-35-TM-64 (2)

Figure 6-5(2). Coupler control A2 (MCN 101 through 179), schematic diagram (part 2 of 2).

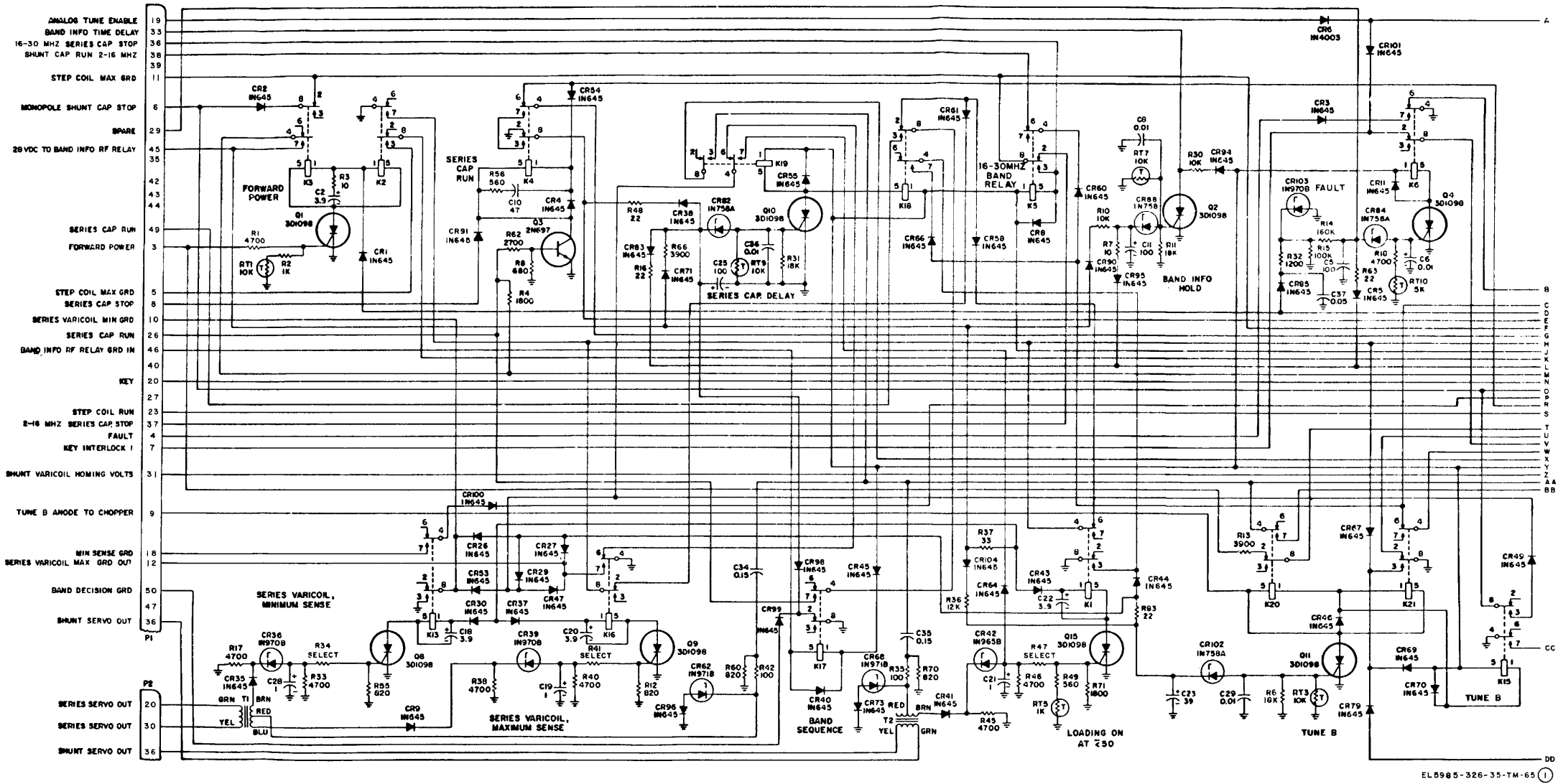


Figure 6-6(1). Coupler control A2 (MCN 180 through 671), schematic diagram (part 1 of 2).

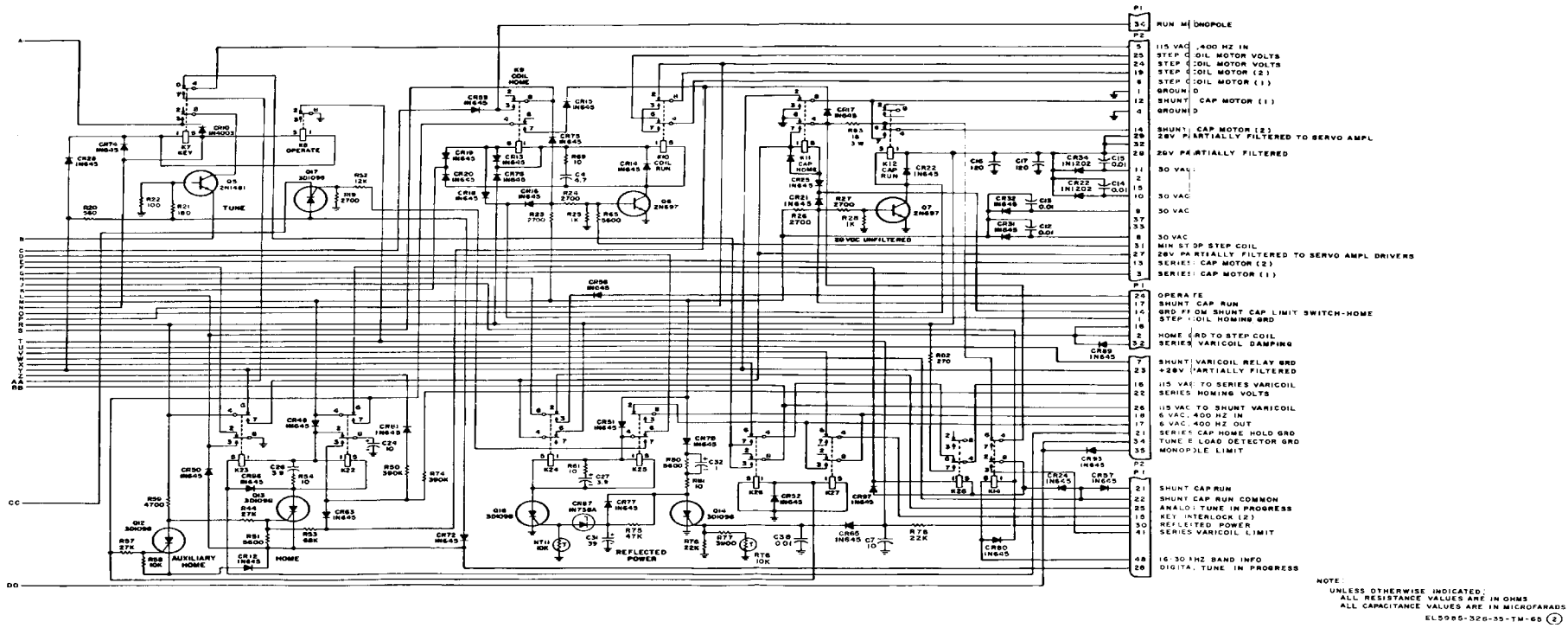


Figure 6-6(2). Coupler control A2 (MCN 180 through 671), schematic diagram (part 2 of 2).

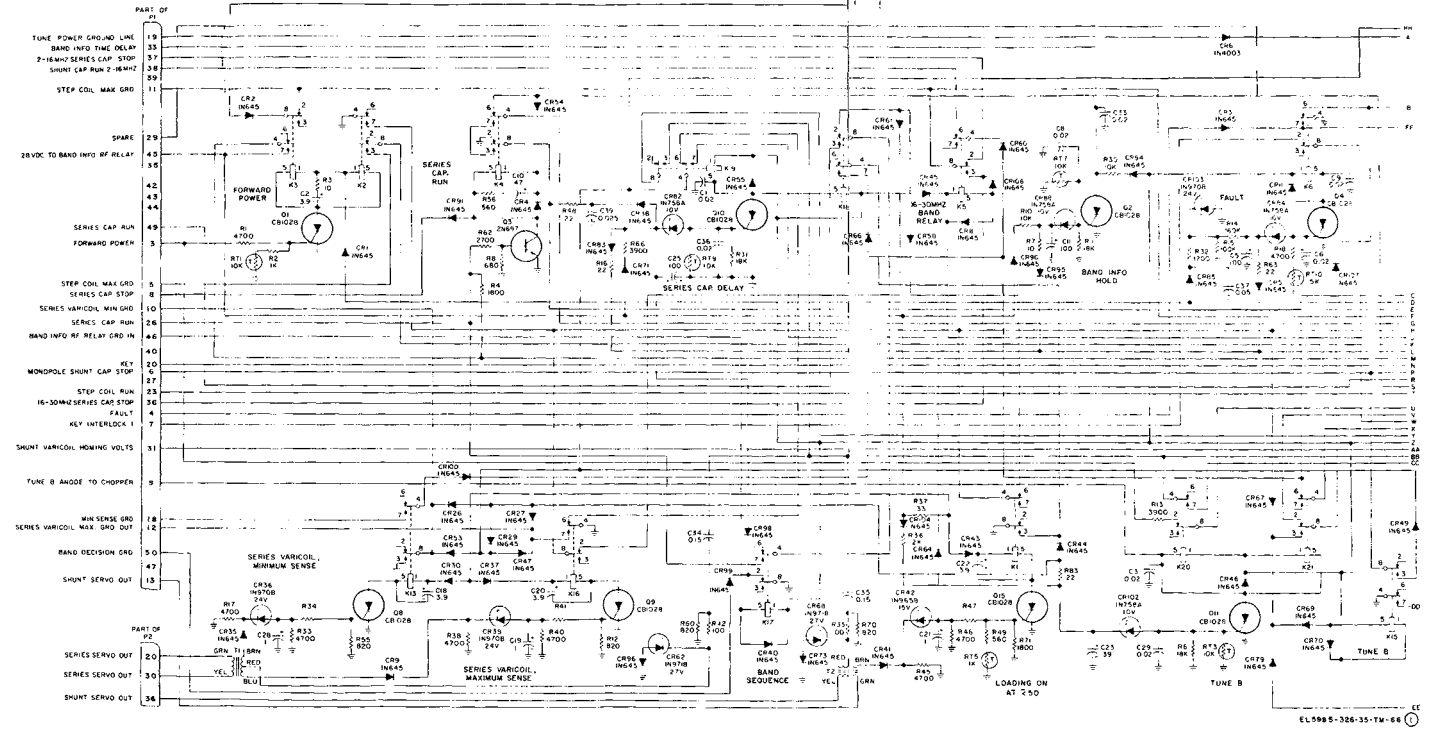


Figure 6-7(1). Coupler control A2 (MCN 672-3614), schematic diagram (part 1 of 2).

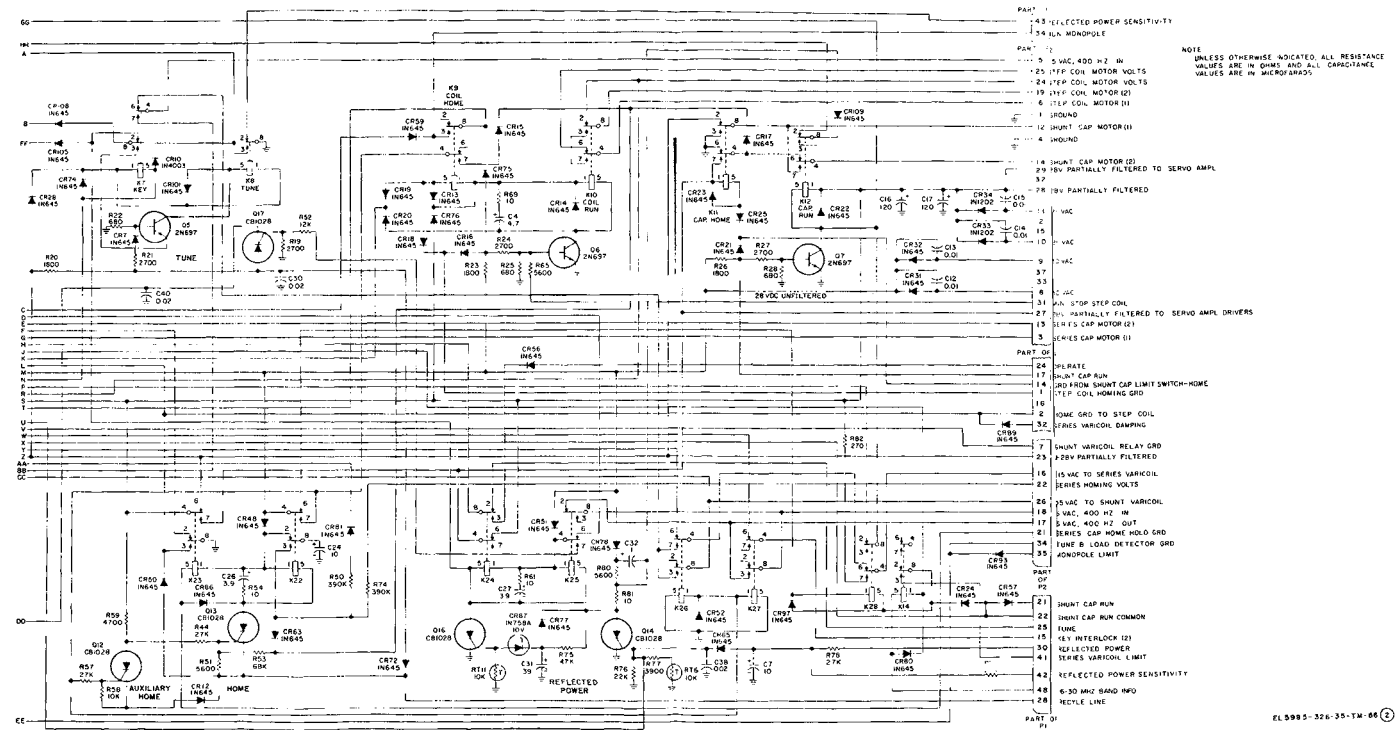
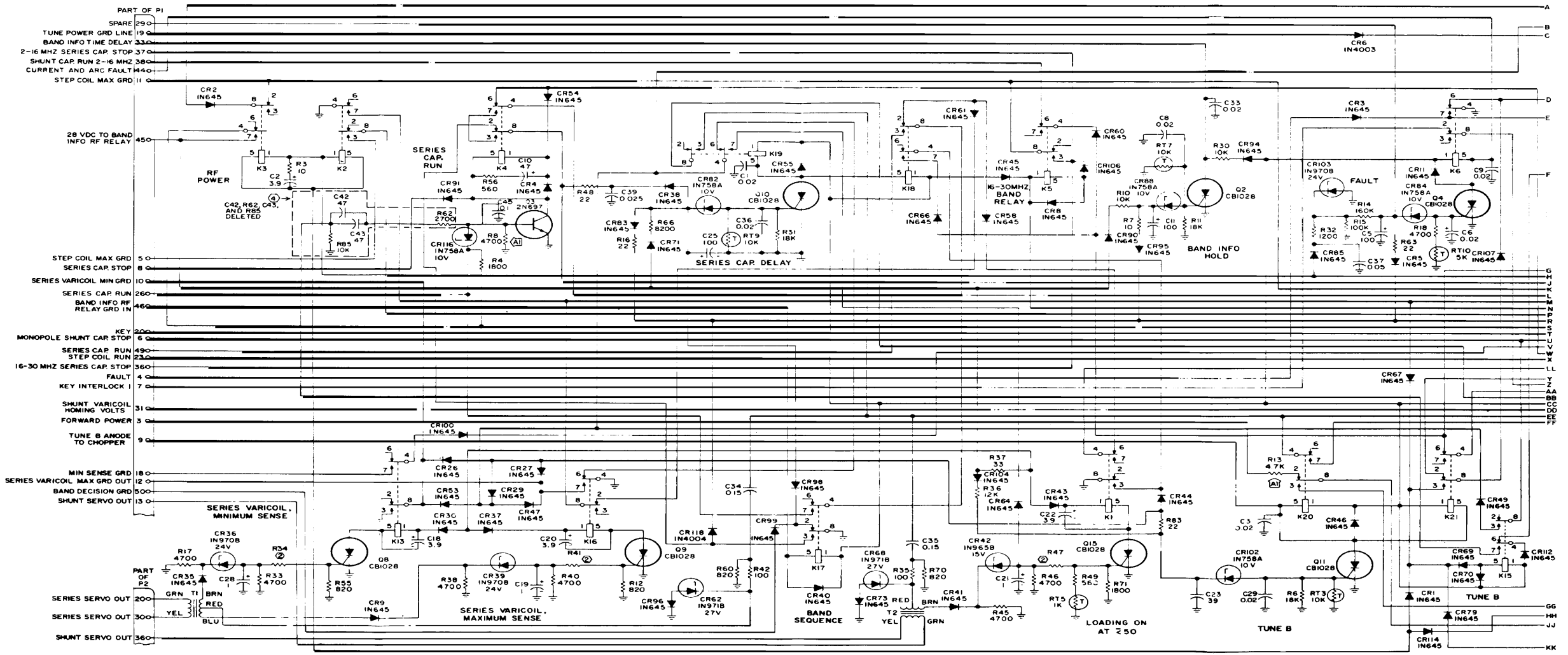


Figure 6-7(2). Coupler control A2 (MCN 672 through 3614), schematic diagram (part 2 of 2).



EL8DB026

Figure 6-8(1). Coupler Control A2(MCN 3615), schematic Diagram (part 1 of 2).

Change 2 FO 6-8(1)

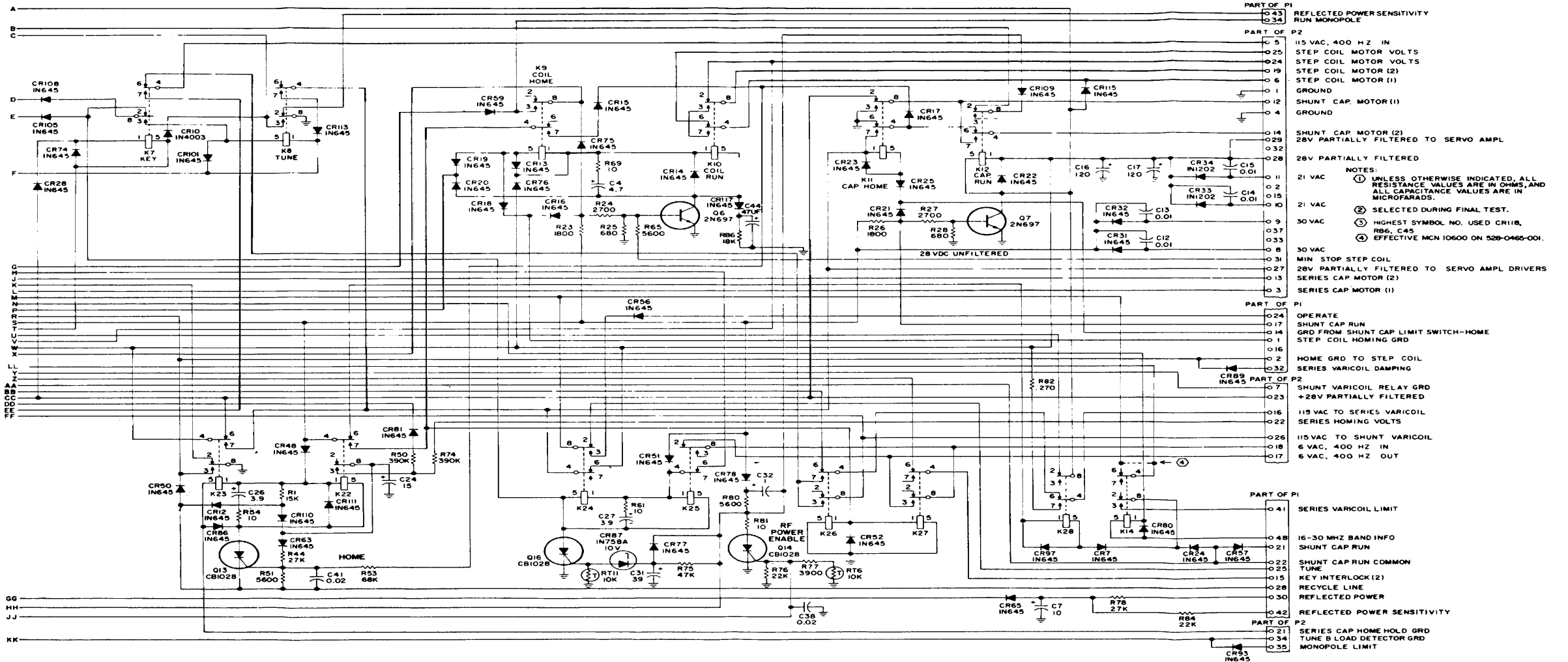


Figure 6-8(2). Coupler Control A2(MCN 3615) Schematic diagram (part 2 of 2)

Change 2 FO 6-8 (2)

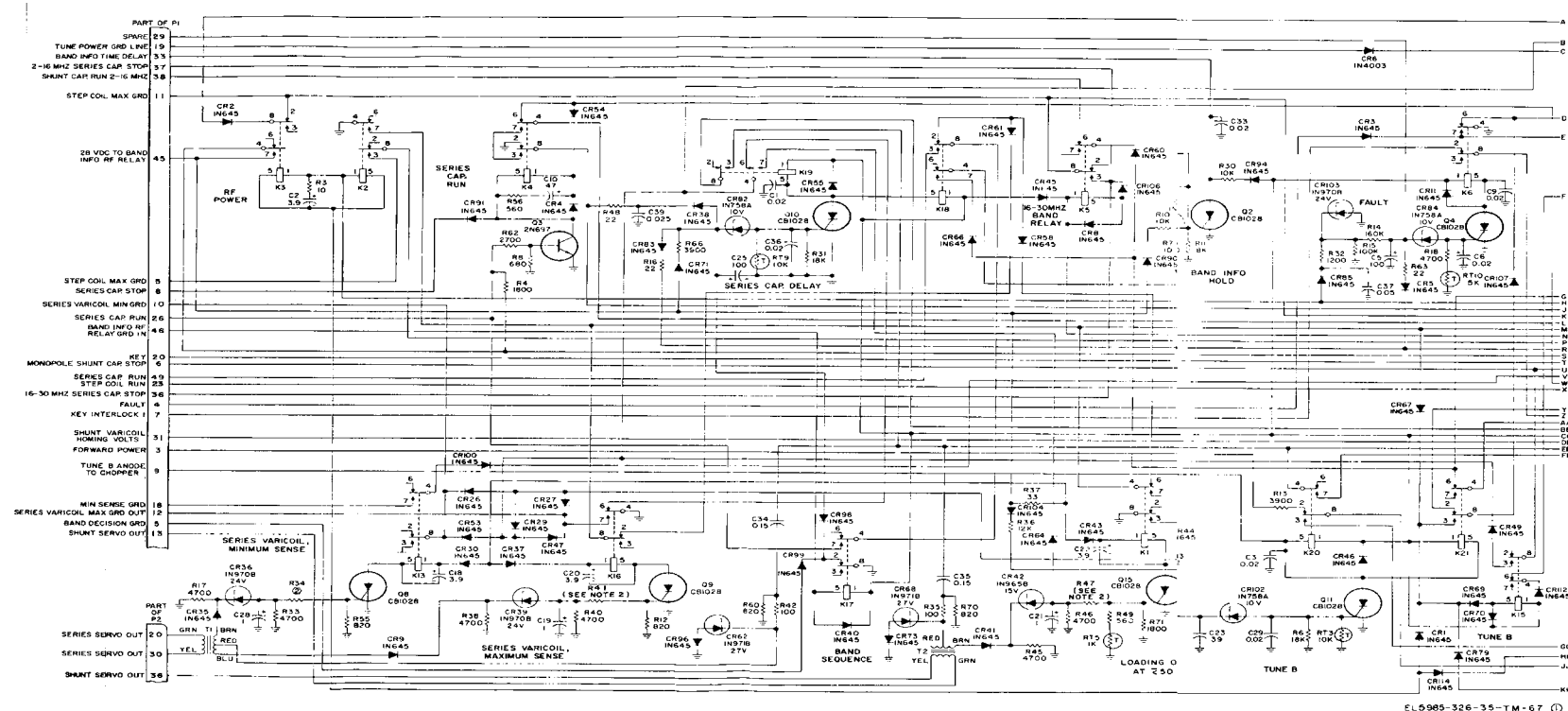


Figure 6-8(1). Coupler control A2 (MCN 3615), schematic diagram (part 1 of 2).

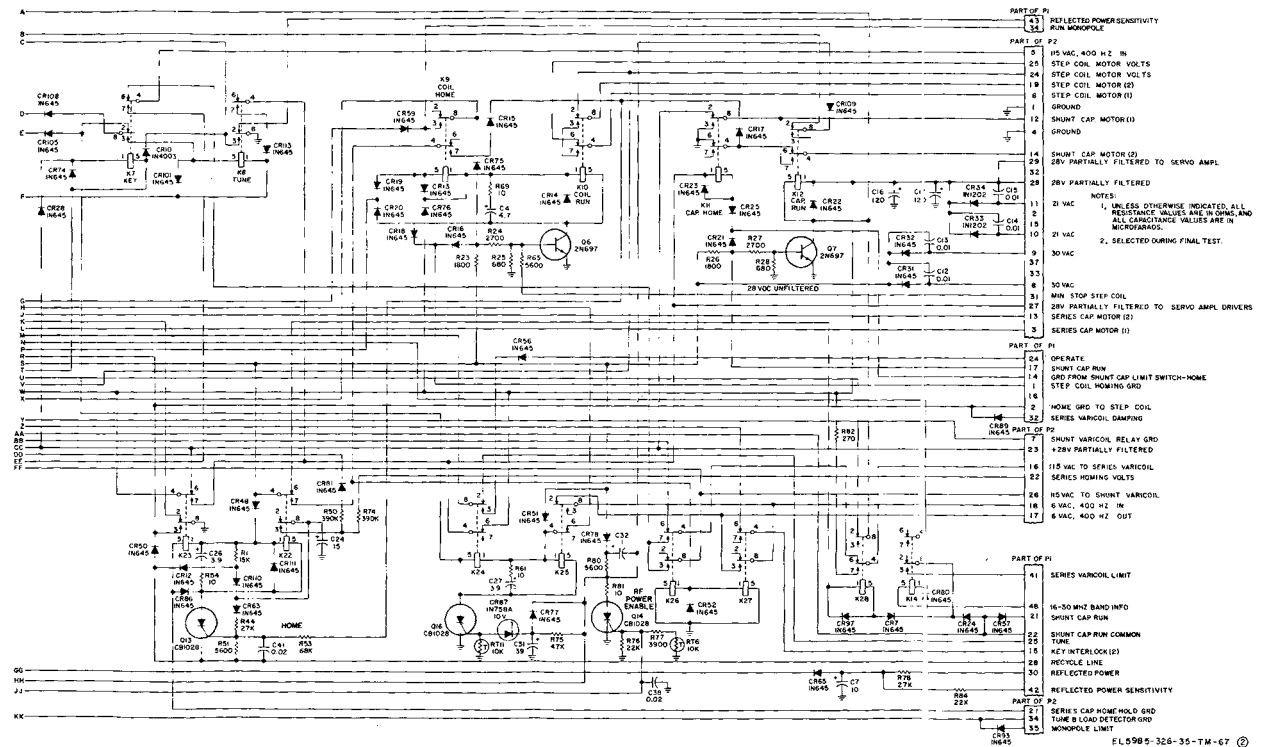
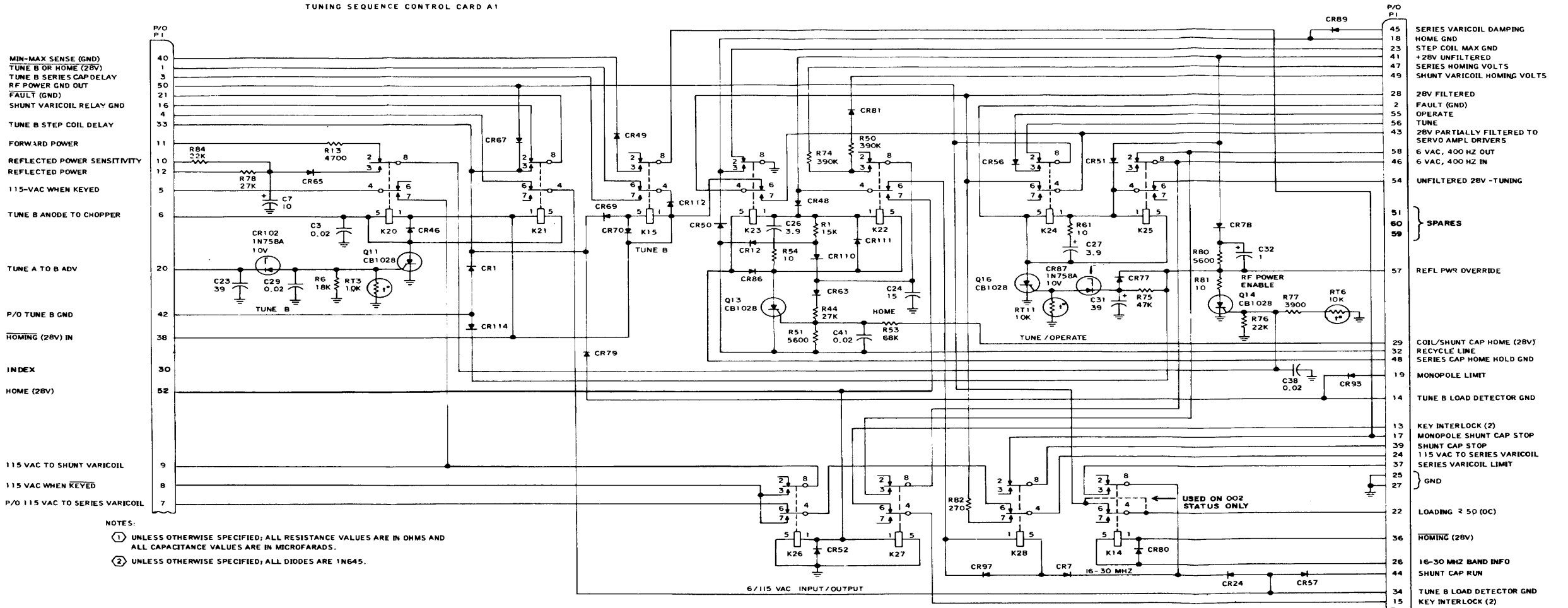


Figure 6-8(2). Coupler control A2 (MCN 3615), schematic diagram (part 2 of 2).

TUNING SEQUENCE CONTROL CARD A1



NOTES:
 ① UNLESS OTHERWISE SPECIFIED; ALL RESISTANCE VALUES ARE IN OHMS AND ALL CAPACITANCE VALUES ARE IN MICROFARADS.
 ② UNLESS OTHERWISE SPECIFIED; ALL DIODES ARE 1N645.

Figure 6-8.1(1). Coupler Control A2(Part Number 608-9500-002), Schematic Diagram (Part 1 of 4).

Change 2 FO 6-8.1 (1)

EL6DB028

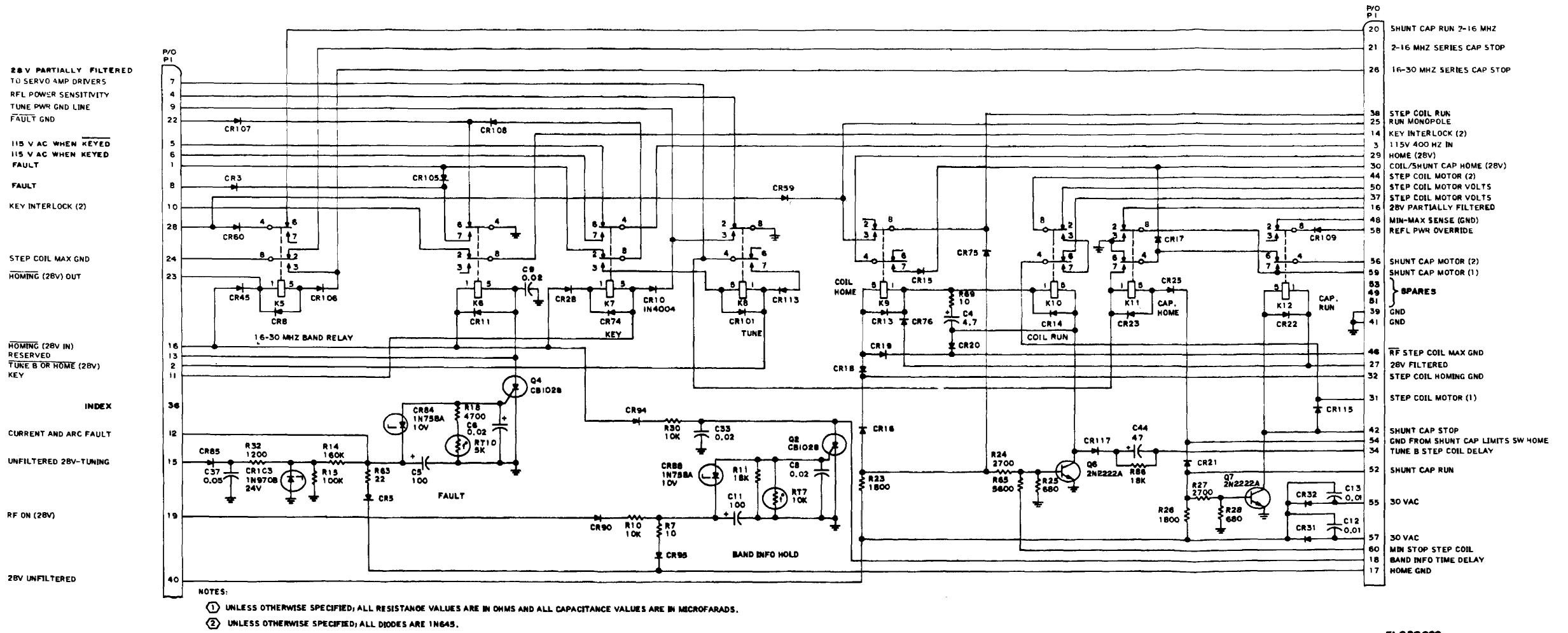


Figure 6-8.1(2). Coupler Control A2(Part Number 608-9500-002), Schematic Diagram (Part 2 of 4).

Change 2 FO 6-8.1 (2)

EL 8 DB 029

TUNING SEQUENCE CONTROL CARD A3

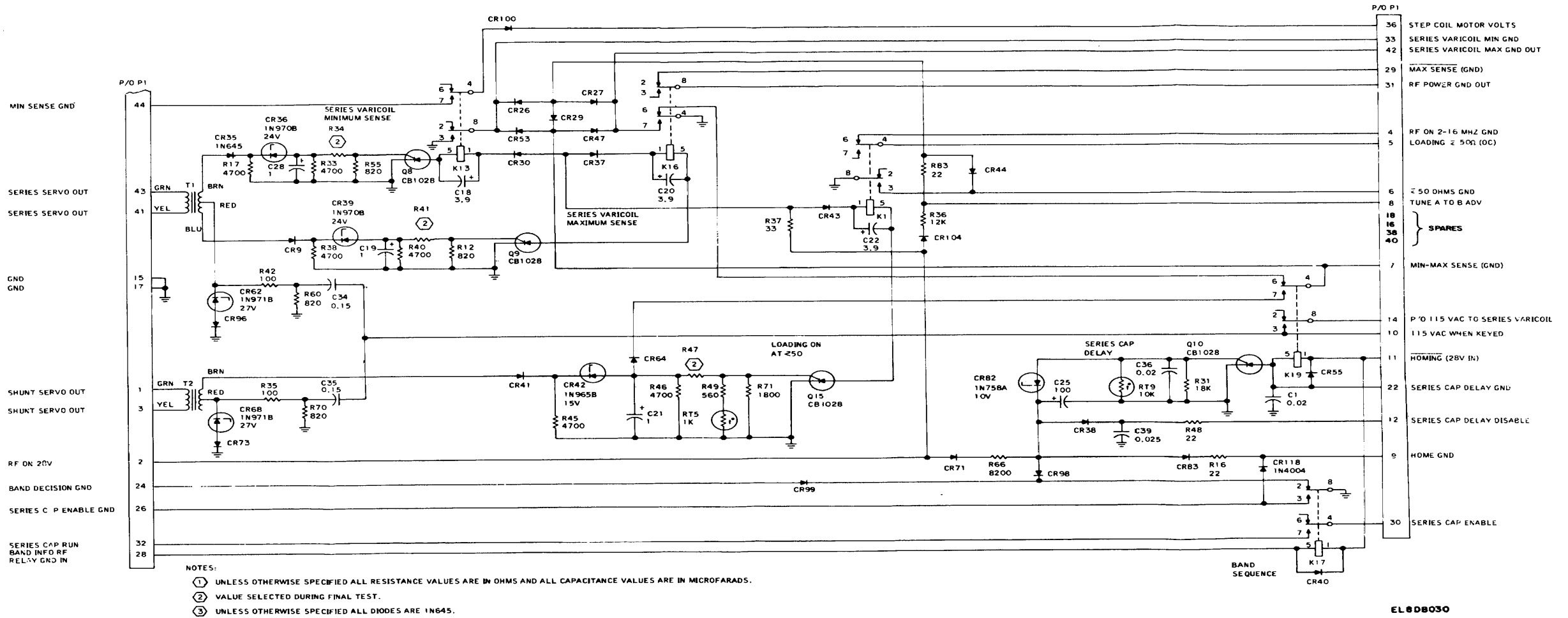


Figure 6-8.1(3). Coupler Control A2(Part Number 608-9500-002) Schematic Diagram (Part 3 of 4).

Change 2 FO 6-8.1 (2)

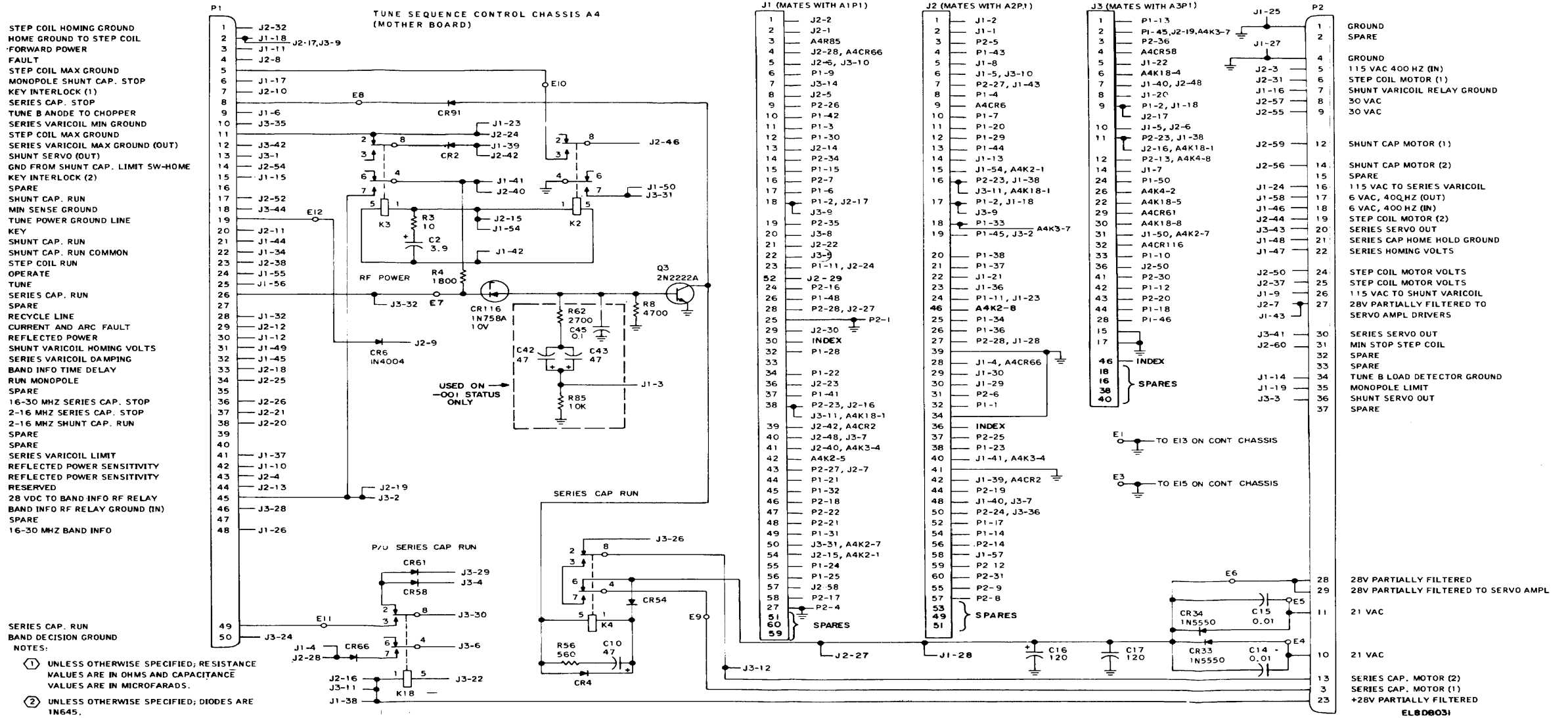


Figure 6-8.1(4). Coupler Control A2(Part Number 608-9500-002), Schematic Diagram (Part 4 of 4)

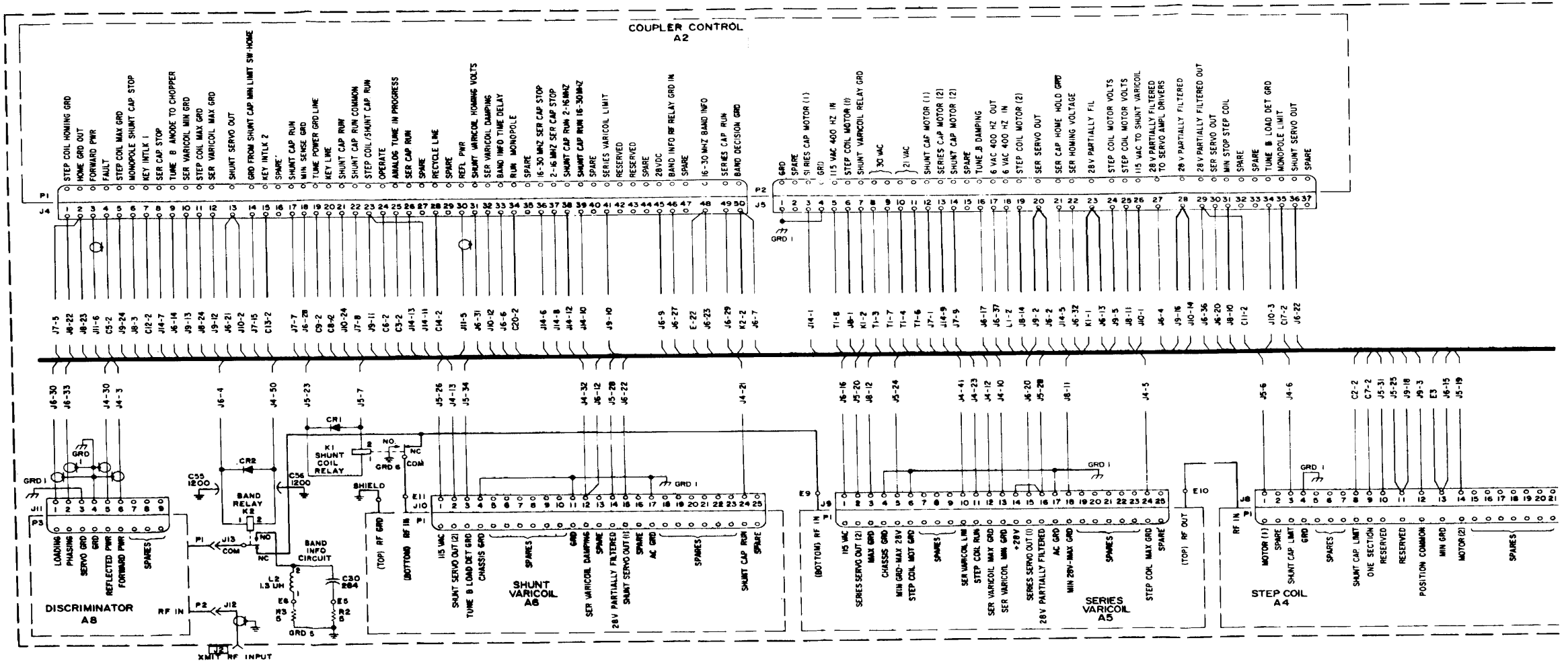


Figure 6-9(1). Antenna Coupler CU-1658/A Equipment Chassis A1, Wiring Diagram (Part 1 of 2).

Change 2 FO 6-9 (1)

EL8DB032

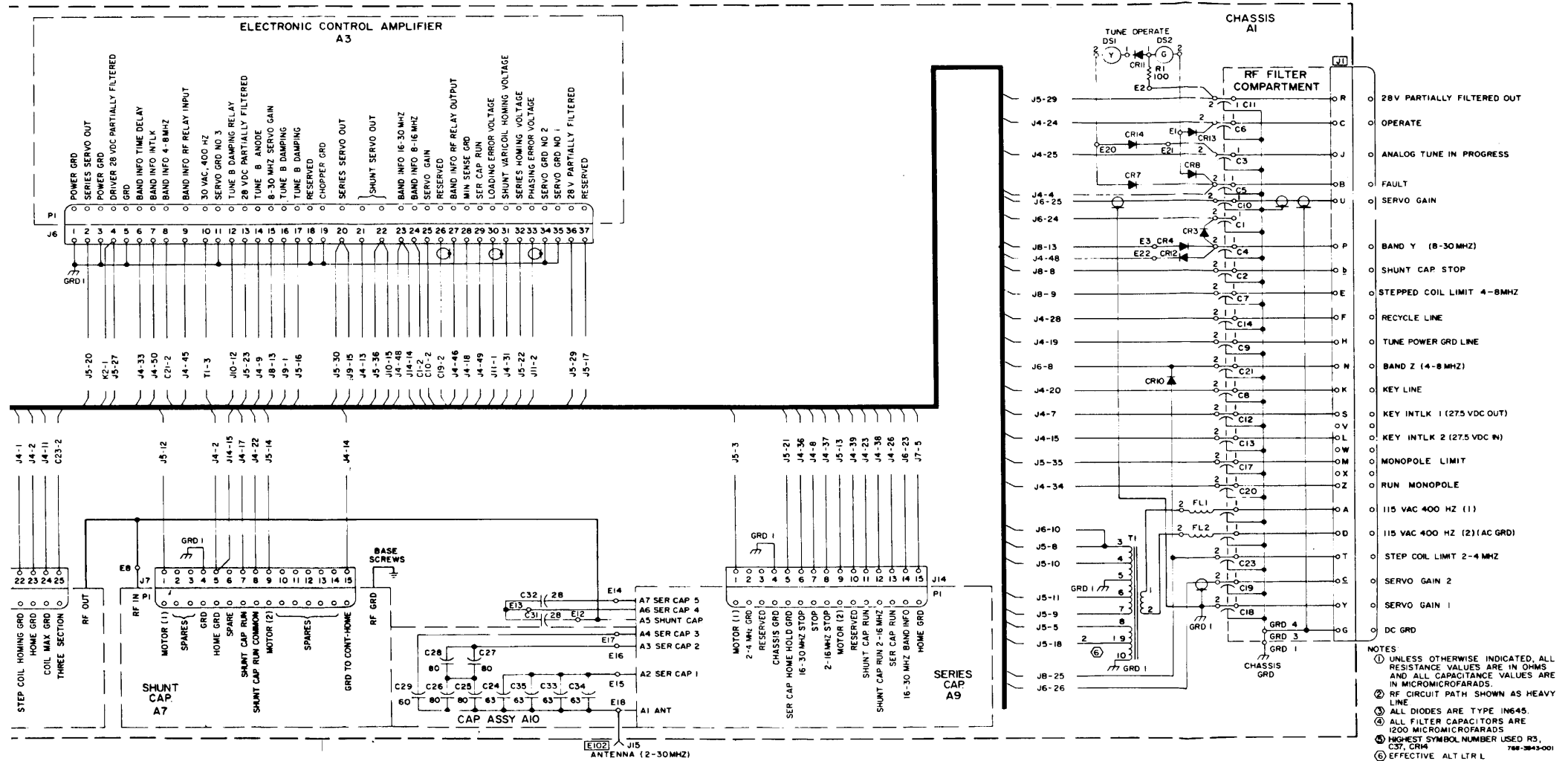


Figure 6-9(2). Antenna Coupler CU-1658/A Equipment Chassis AI, Wiring Diagram (Part2 of 2)

Change 2 FO 6-9 (2)

EL00B033

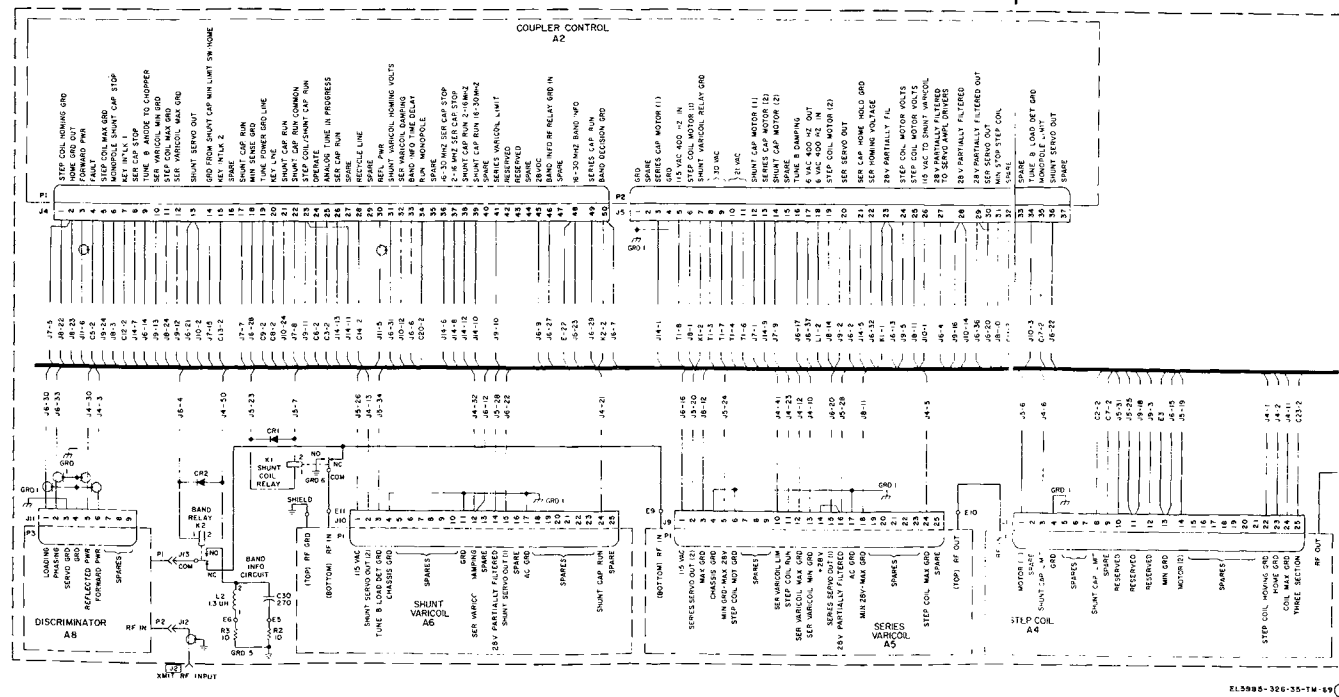


Figure 6-9(1). Antenna Coupler CU-1658/A equipment chassis A-1, wiring diagram (part 1 of 2)

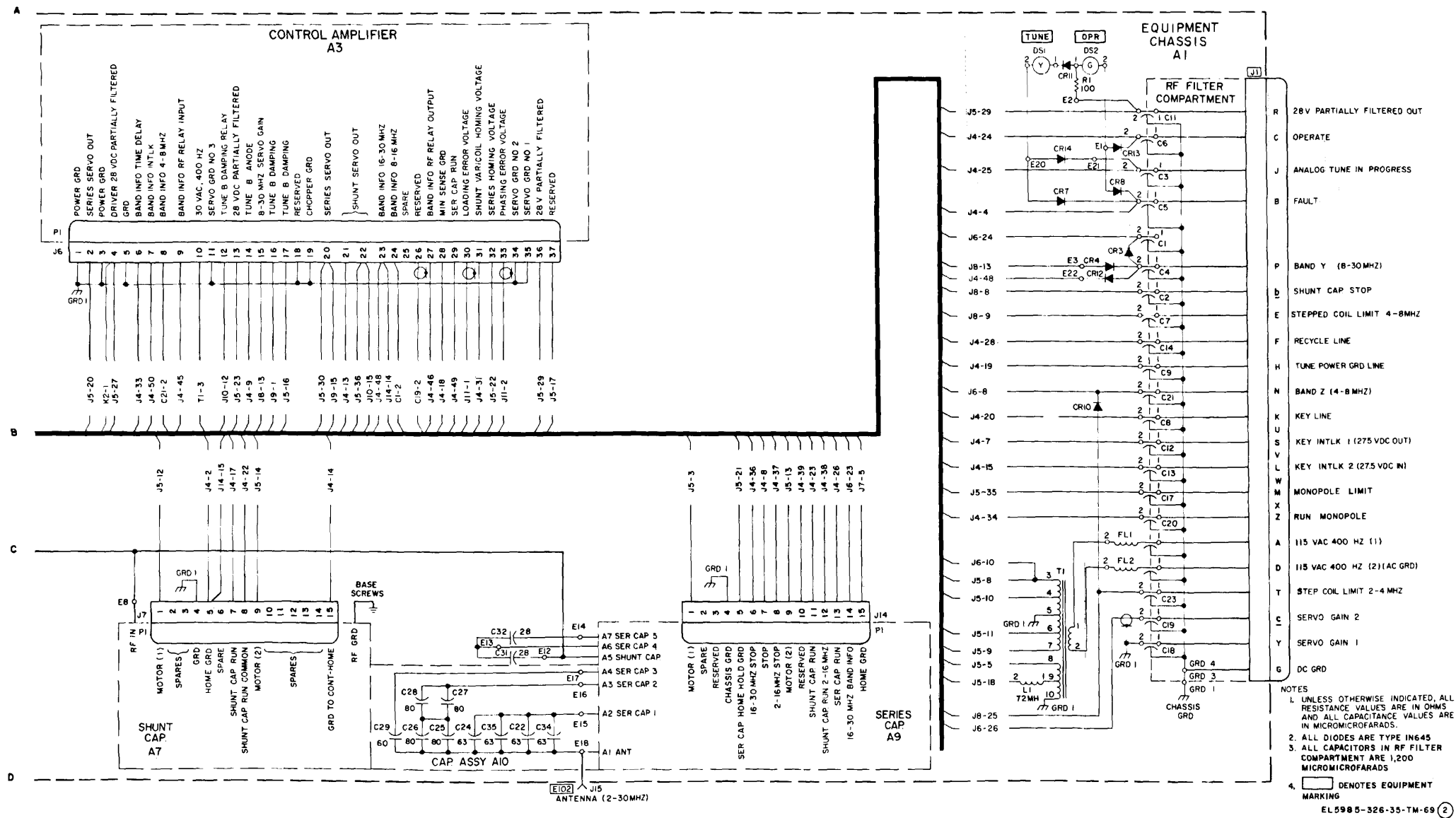


Figure 6-9(2). Antenna Coupler CU-1658/A equipment chassis A1, wiring diagram (part 2 of 2).

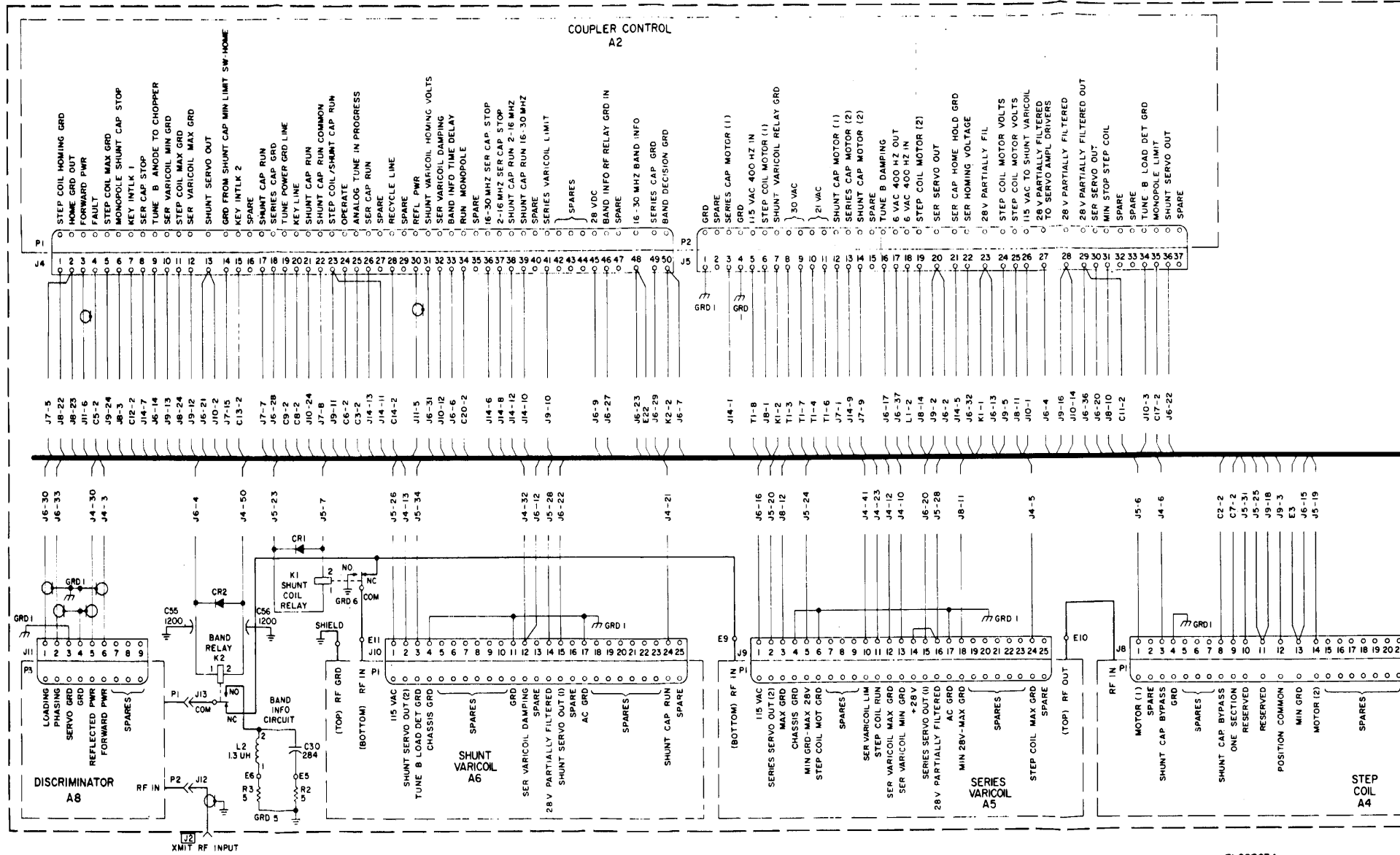


Figure 6-10(1). Antenna Coupler CU-1669/GRC Equipment Chassis AI, Wiring Diagram (Part I of 2).

Change2 FO 6-10 (1)

EL808034

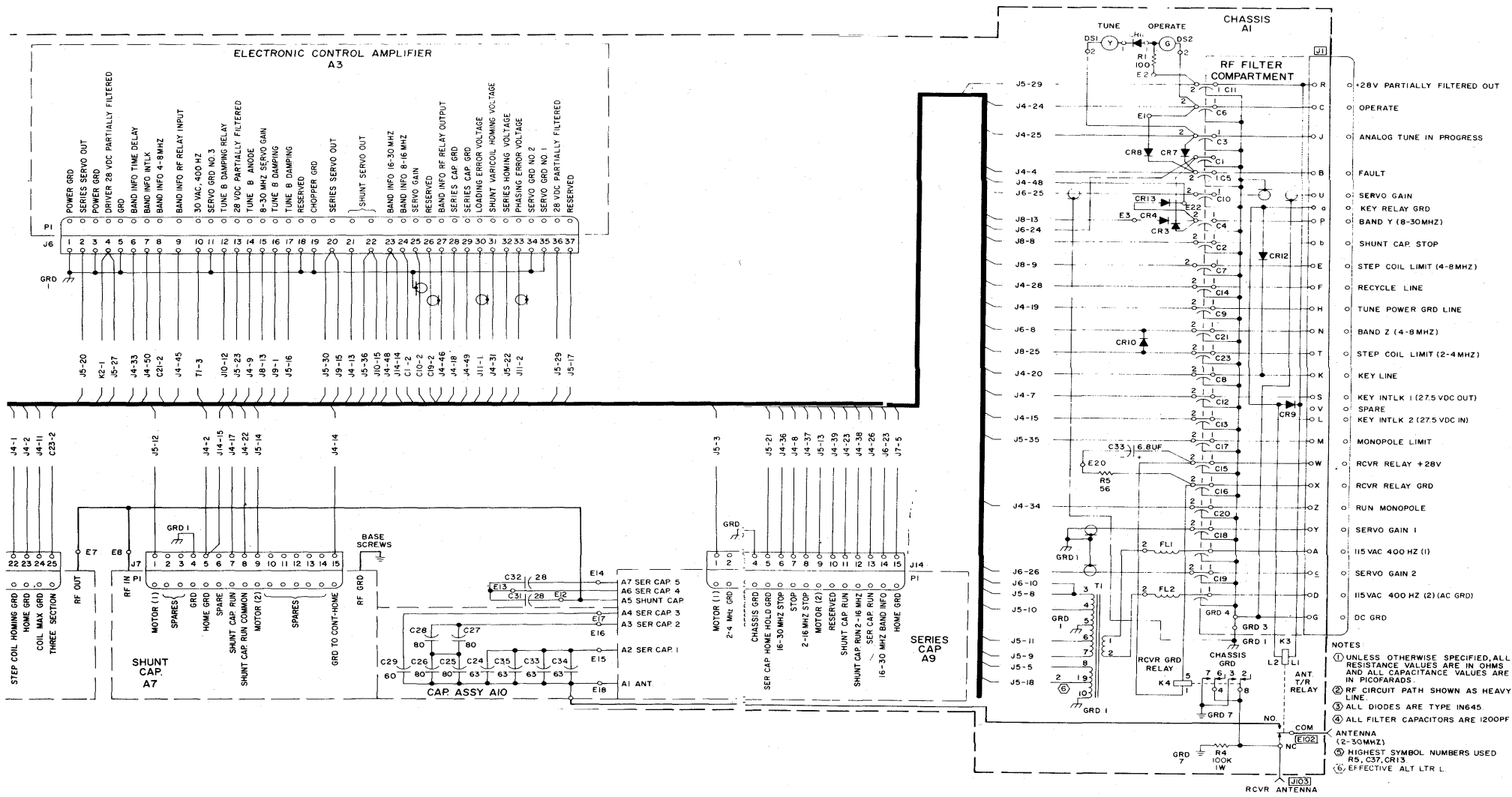


Figure 6-10(2). Antenna Coupler CU-1669/GRC Equipment Chassis A1, Wiring Diagram (Part2 of2).

Change 2 FO 6-10 (2)

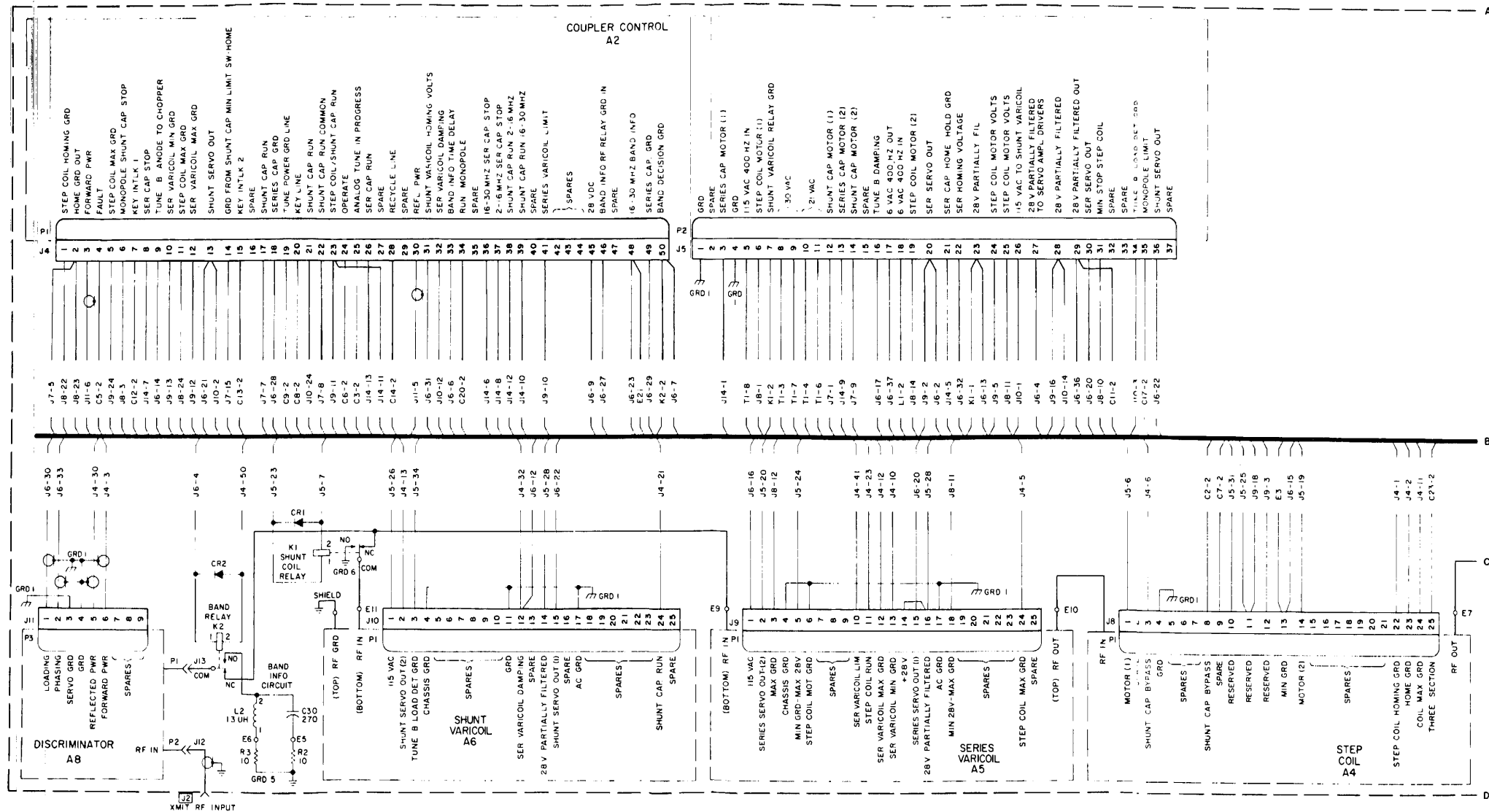


Figure 6-10(1). Antenna Coupler CU-1669/GRC equipment chassis A1, Wiring diagram (part 1 of 2)

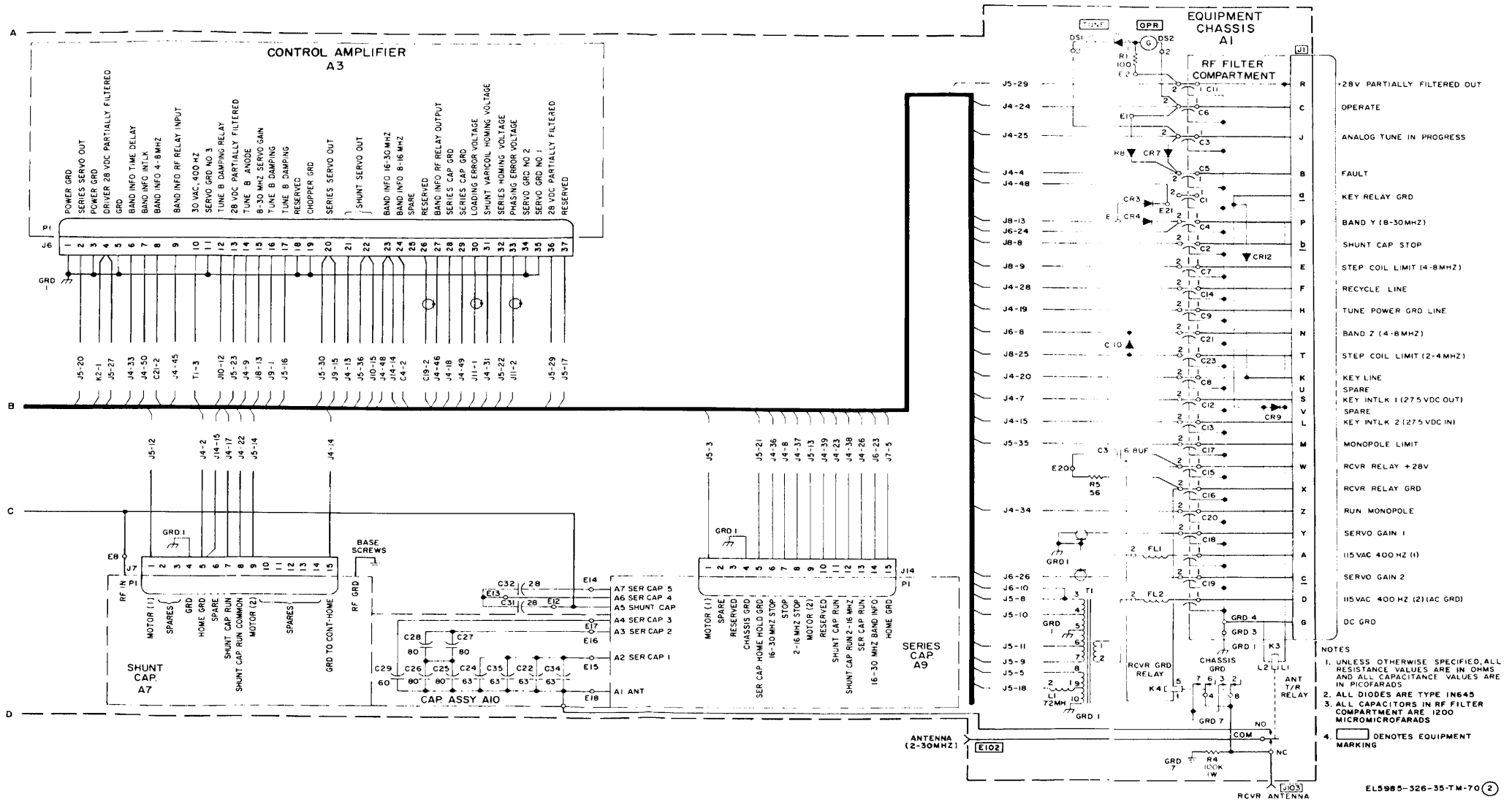


Figure 6-10(2). Antenna coupler CU-1669/GRC equipment chassis A1, wiring diagram (part 2 of 2).

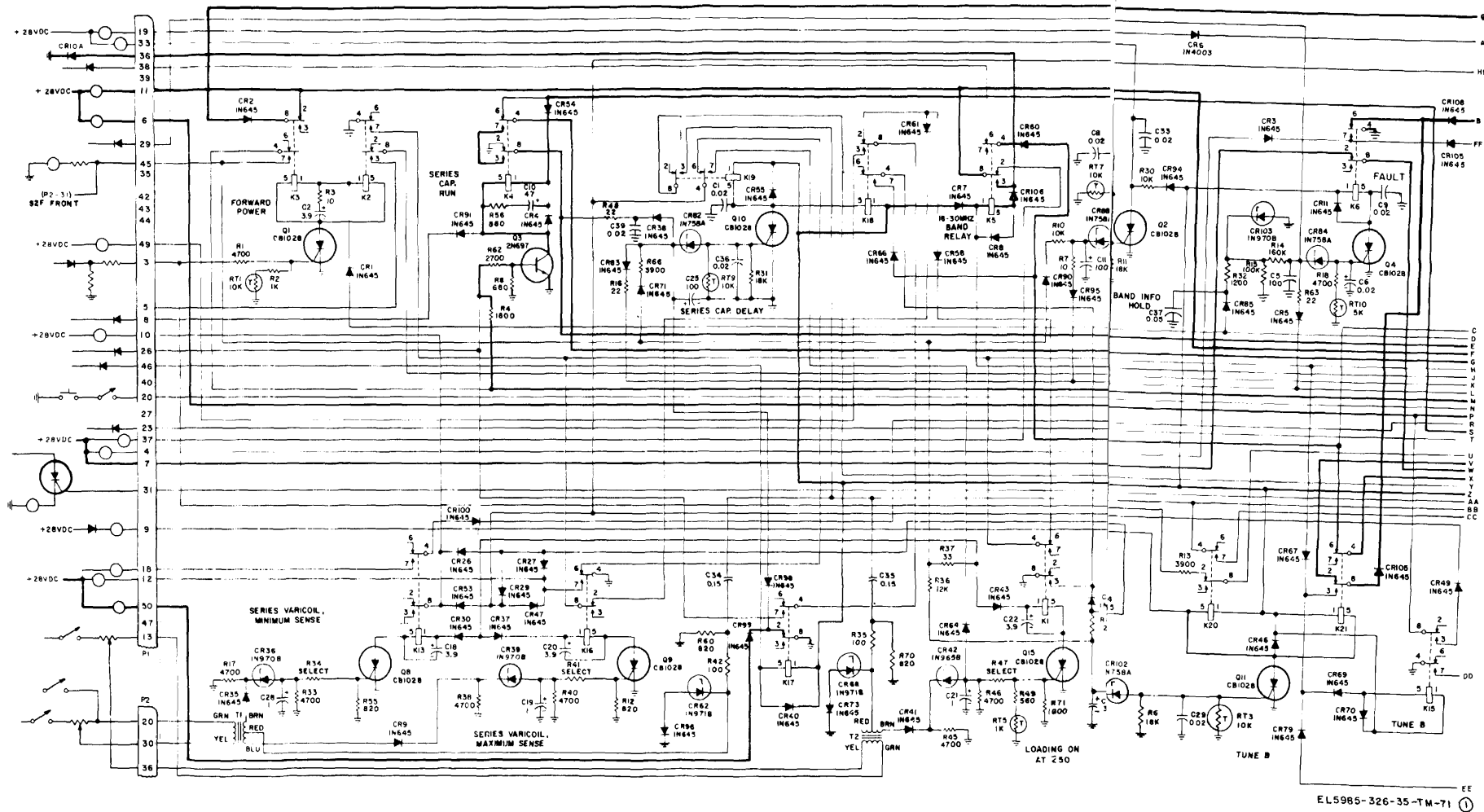


Figure 6-11(1). Coupler control A2, using Test Set TS-2353/
ARM-109 in position 1, simplified schematic diagram (reference only)
(part 1 of 2).

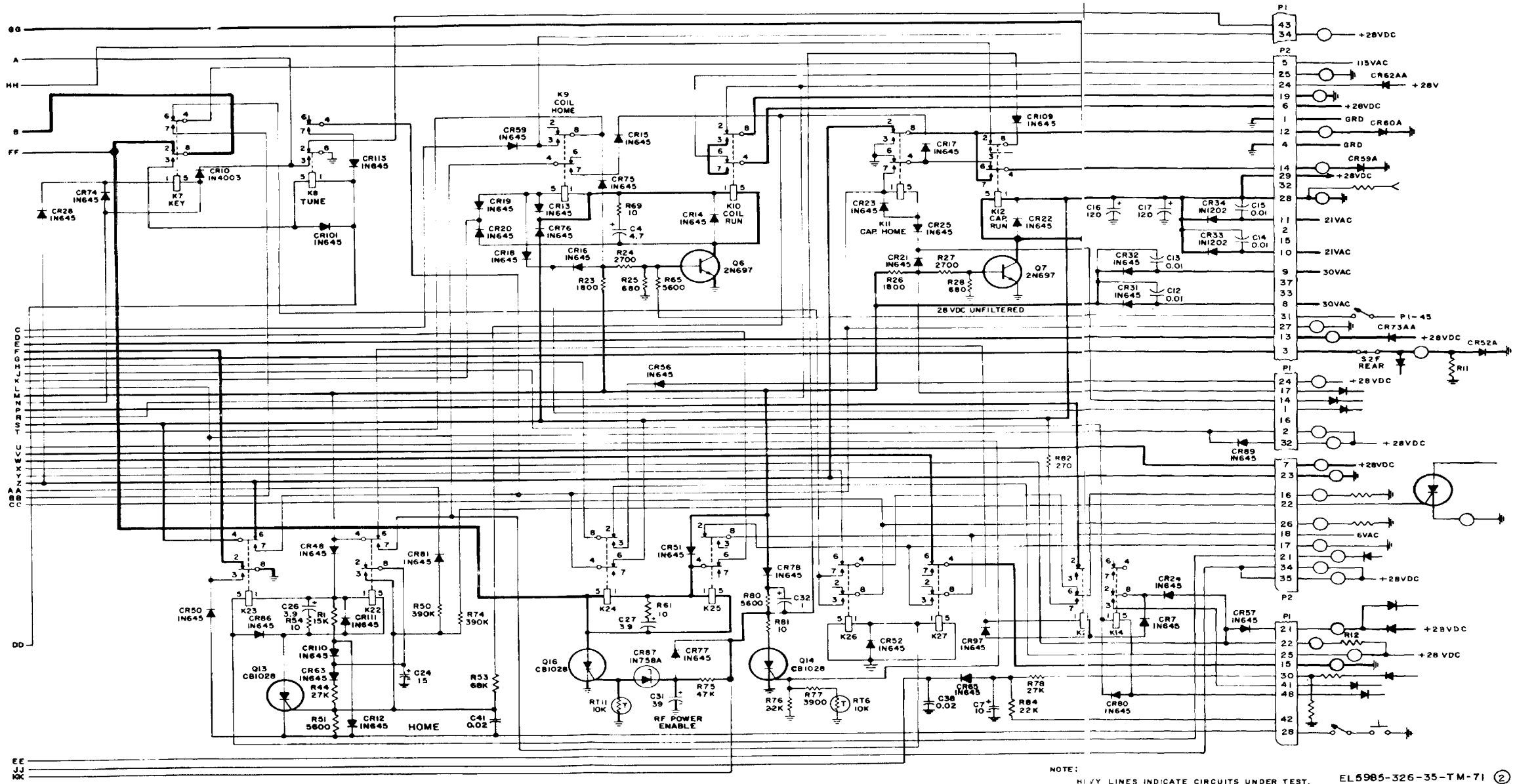


Figure 6-11(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 1, simplified schematic diagram (reference only) (part 2 of 2).

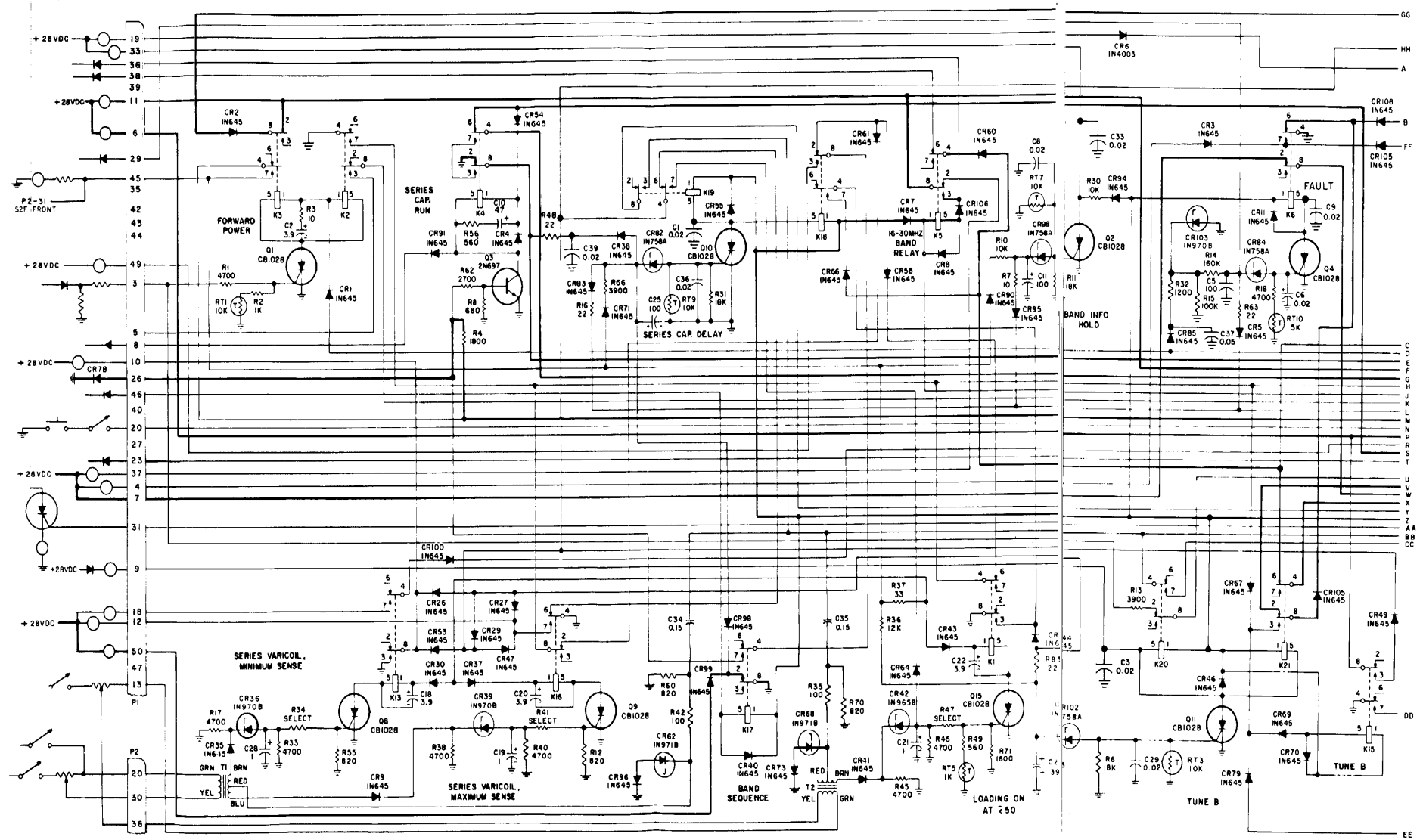
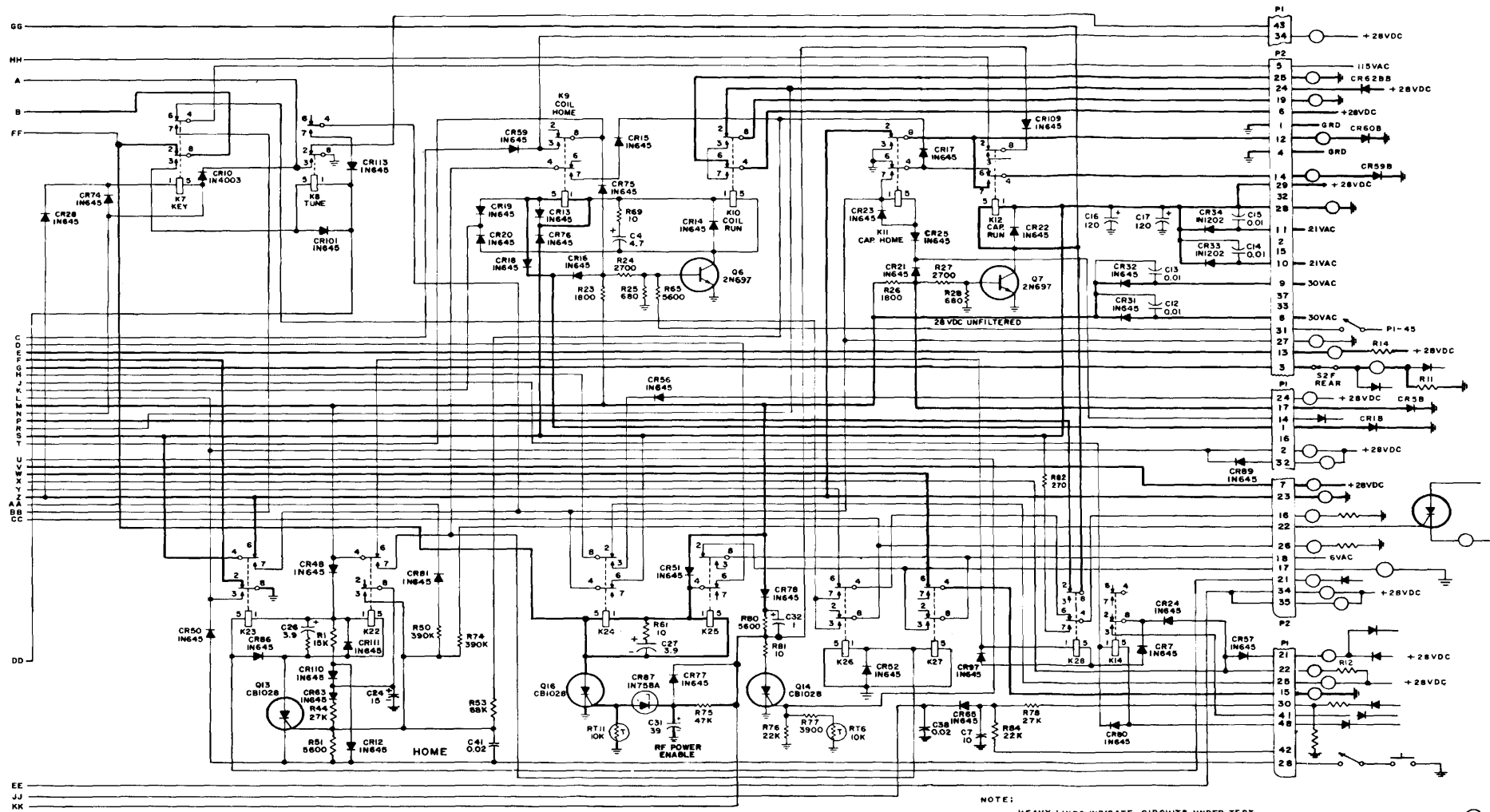


Figure 6-12(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 2, simplified schematic diagram (reference only) (part 1 of 2).



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Figure 6-12(2). Coupler control A2, using Test Set TS-2352/ARM-109 in position 2, simplified schematic diagram (reference only) (part 2 of 2).

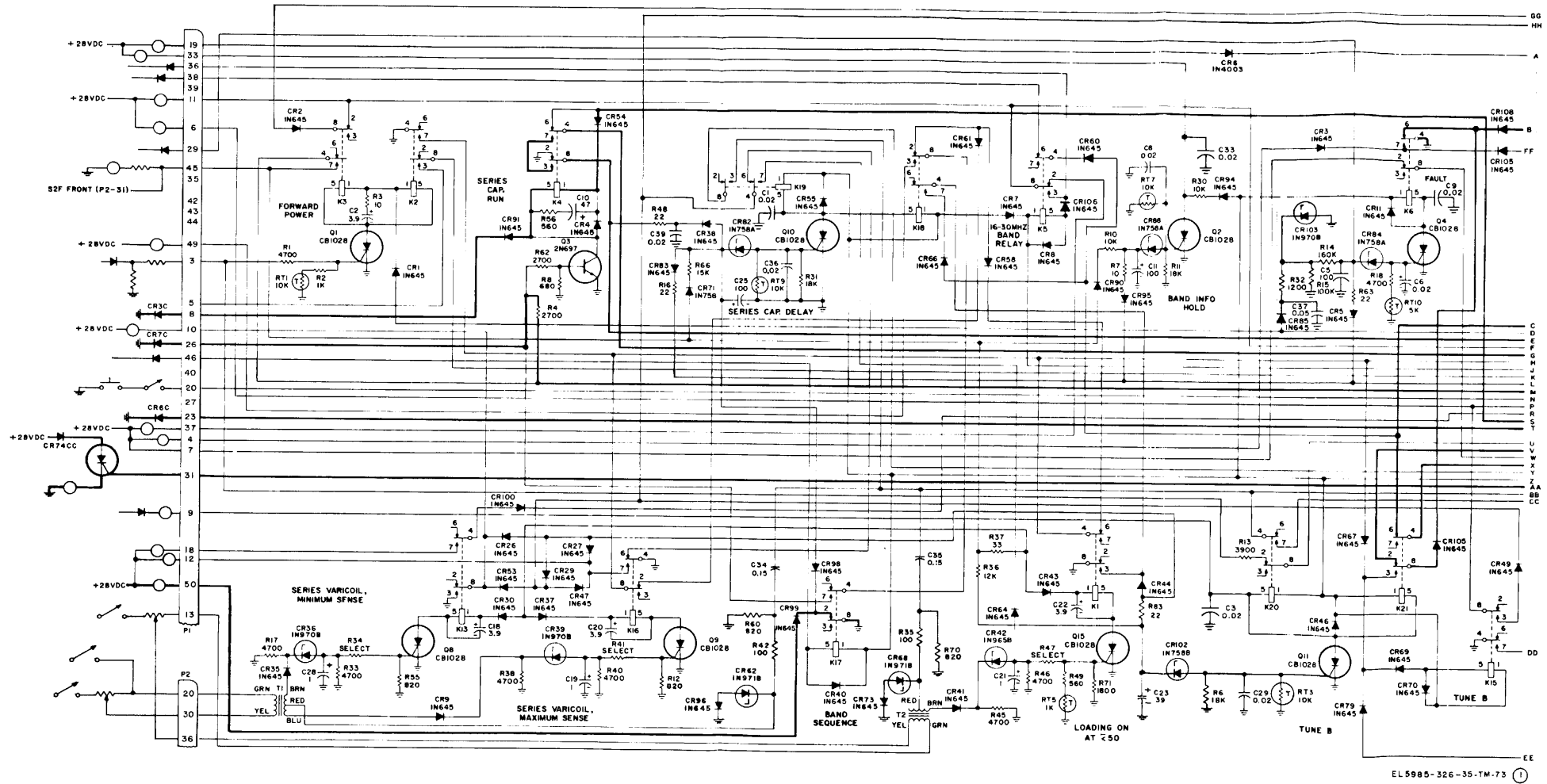


Figure 6-13(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 3, simplified schematic diagram (reference only) (part 1 of 2).

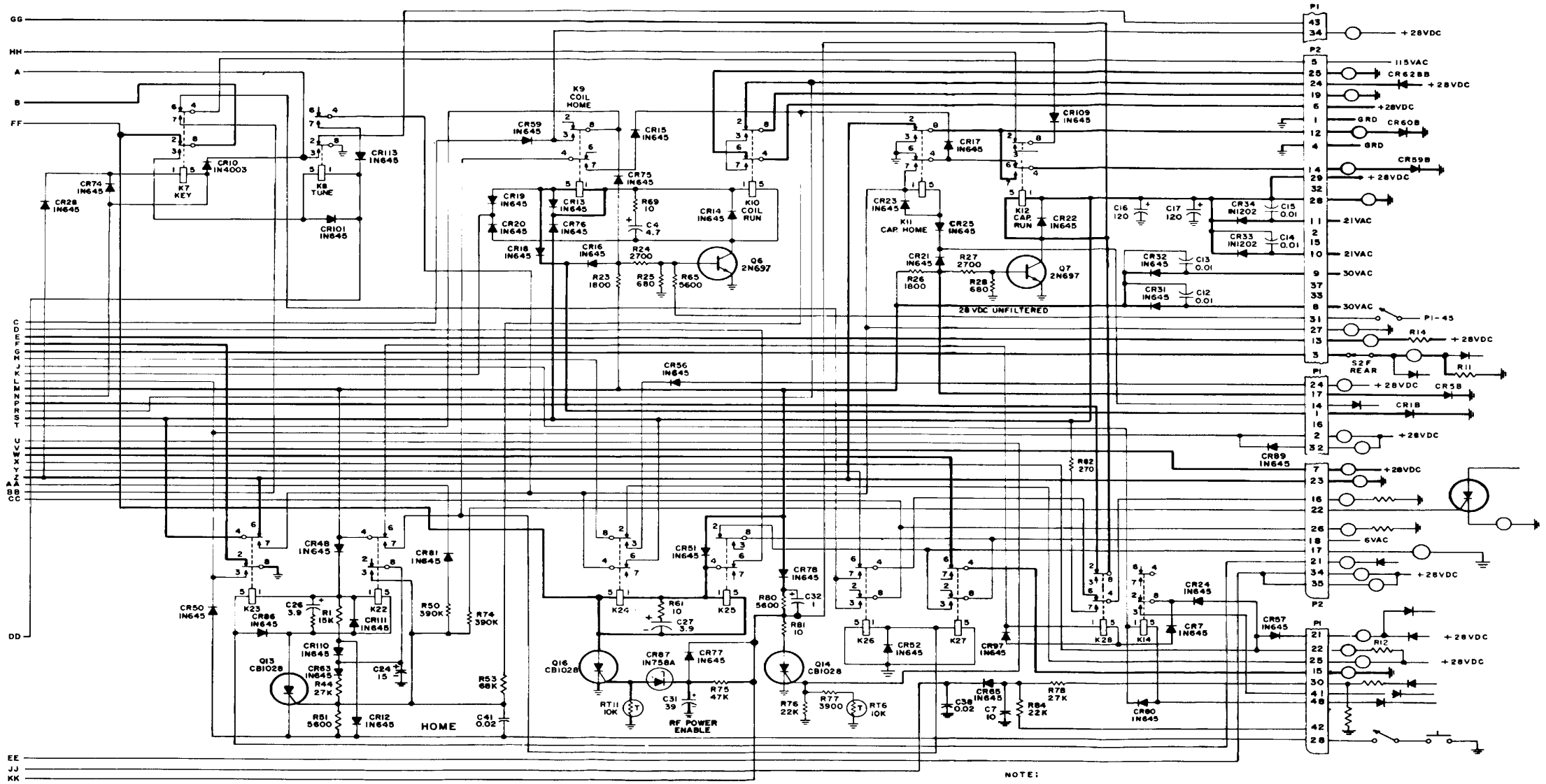


Figure 6-13(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 3, simplified schematic diagram (reference only) (part 2 of 2).

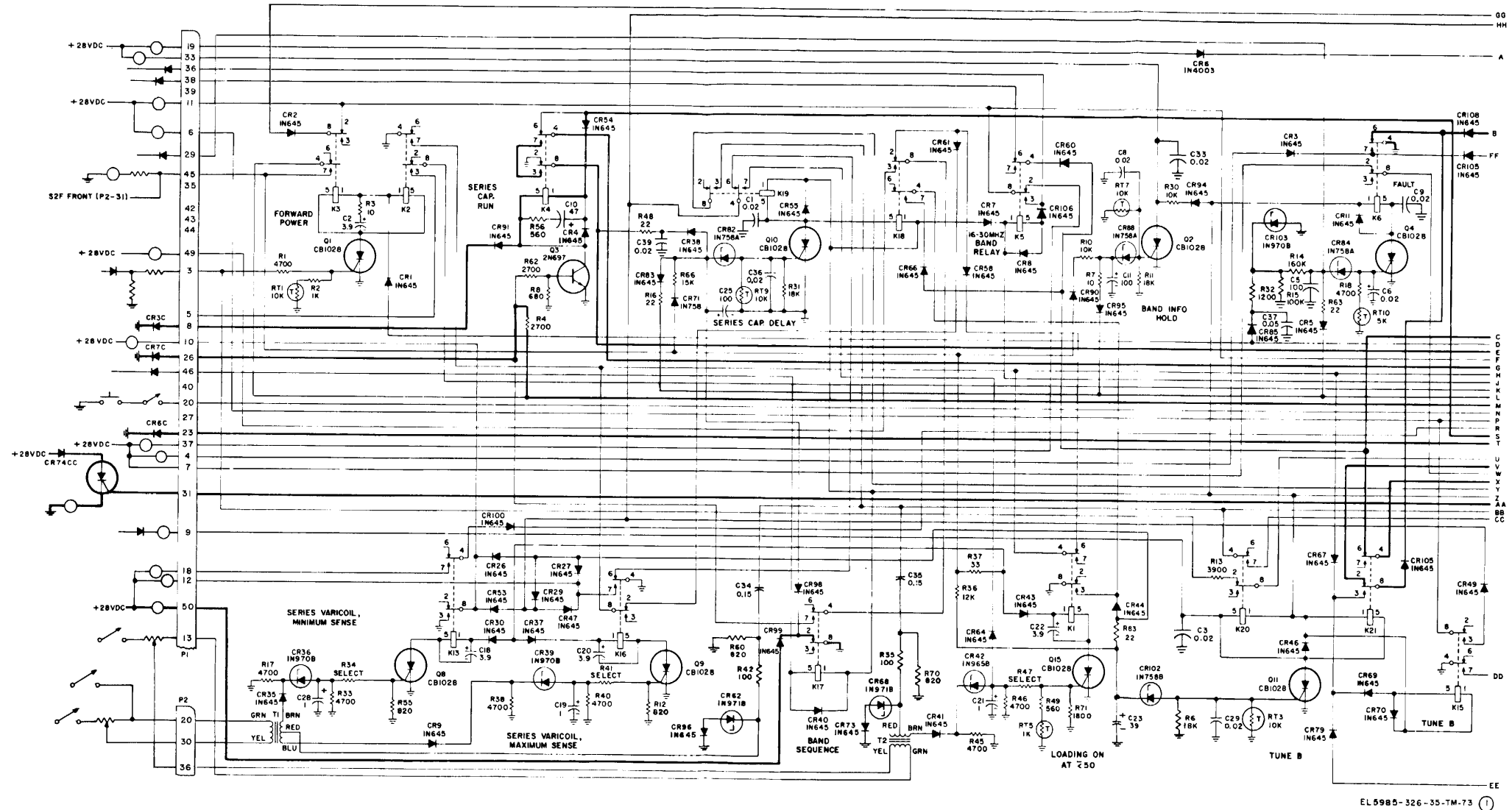


Figure 6-14(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 4, simplified schematic diagram (reference only) (part 1 of 2).

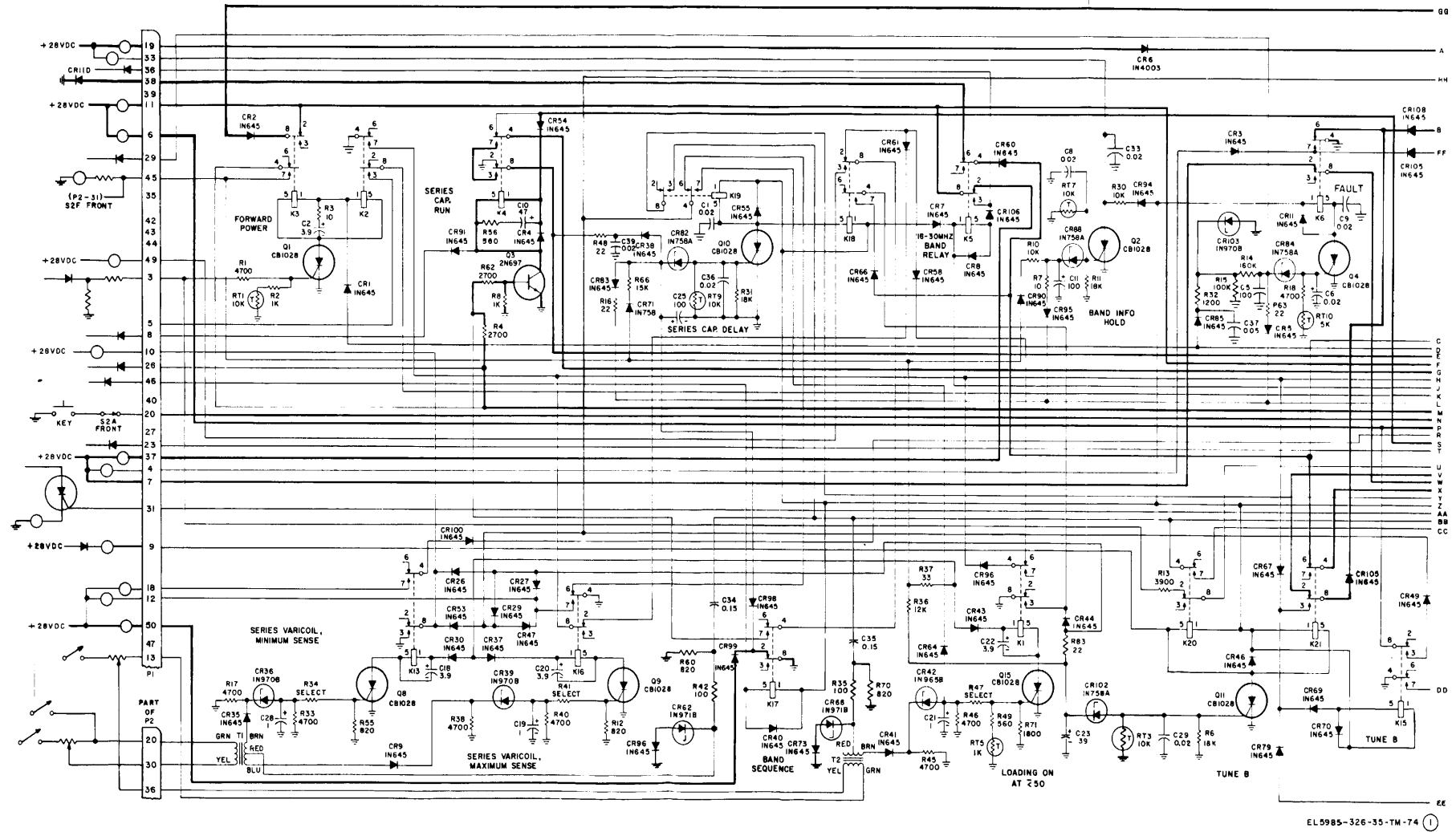


Figure 6-14(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 4, simplified schematic diagram (reference only) (part 2 of 2).

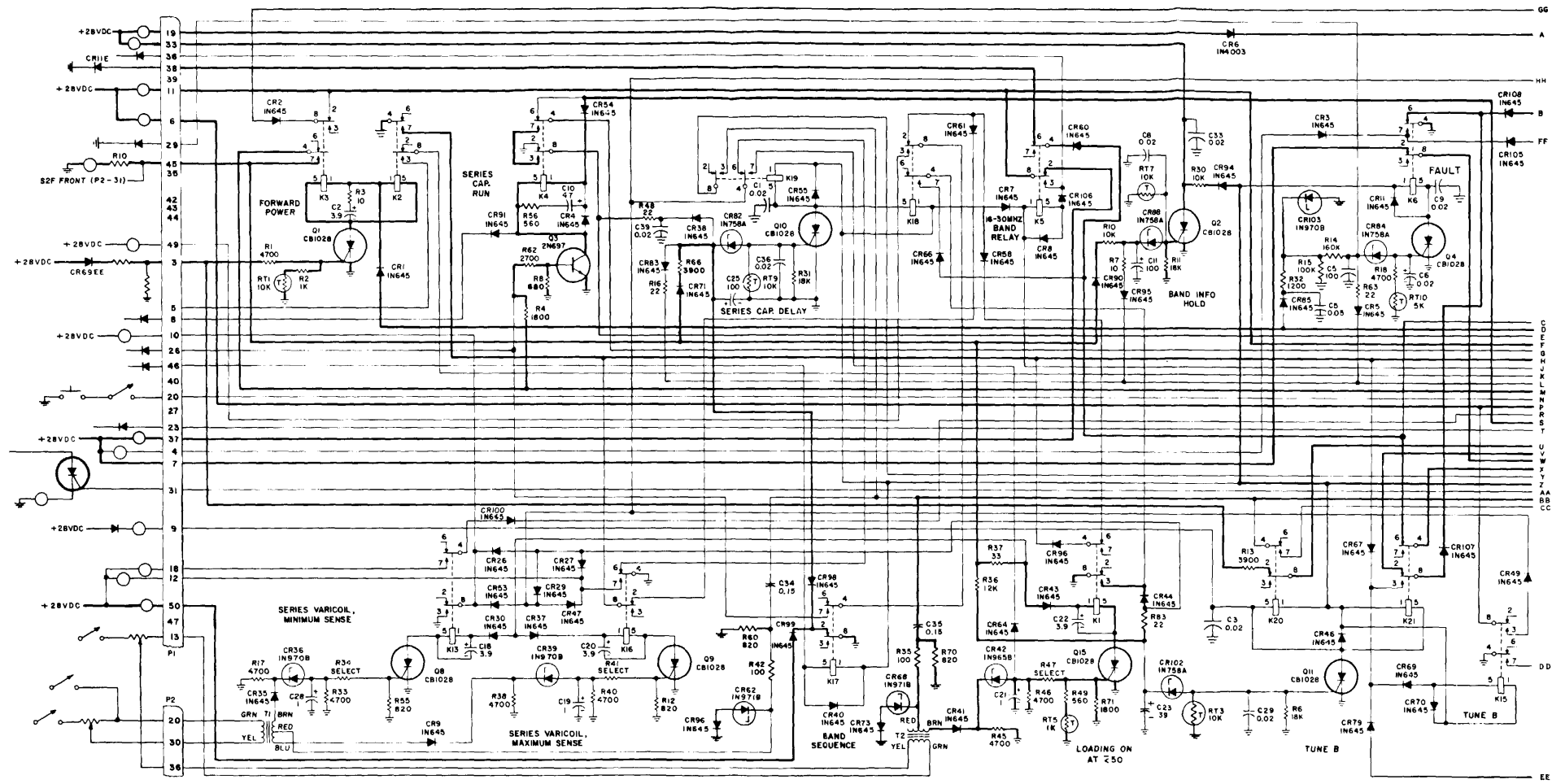


Figure 6-15(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 54, simplified schematic diagram (reference only) (part 1 of 2).

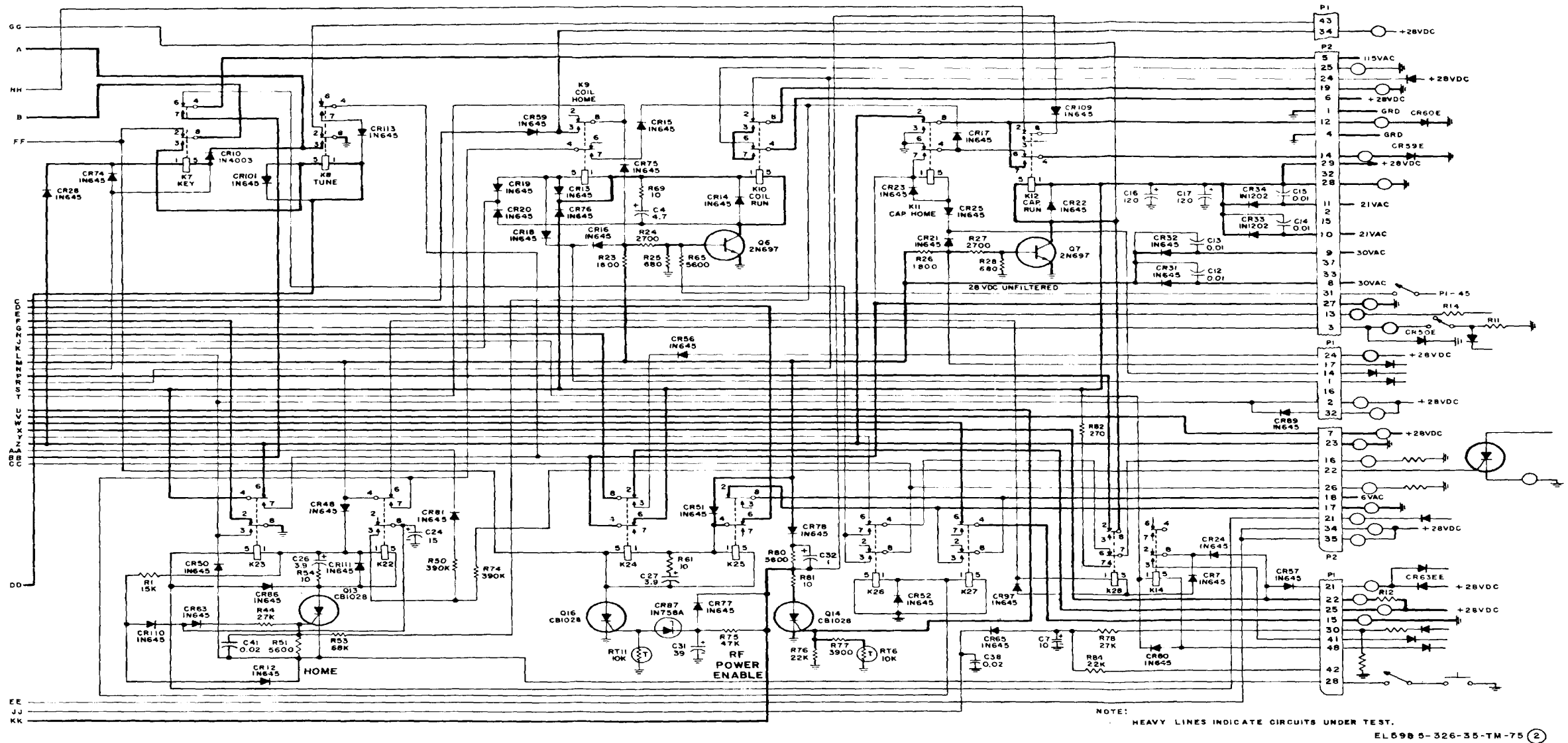
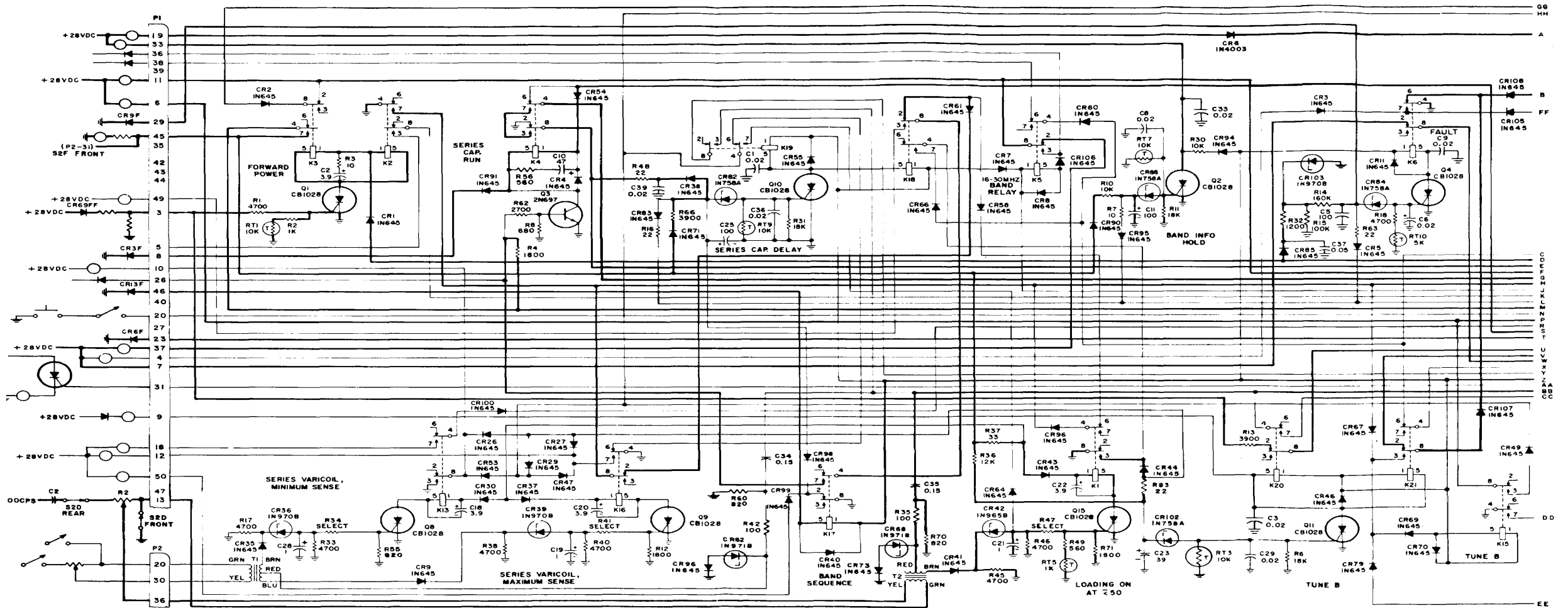


Figure 6-15(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 5, simplified schematic diagram (reference only) part 2 of 2).



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Figure 6-16(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 6, simplified schematic diagram (reference only) (part 1 of 2).

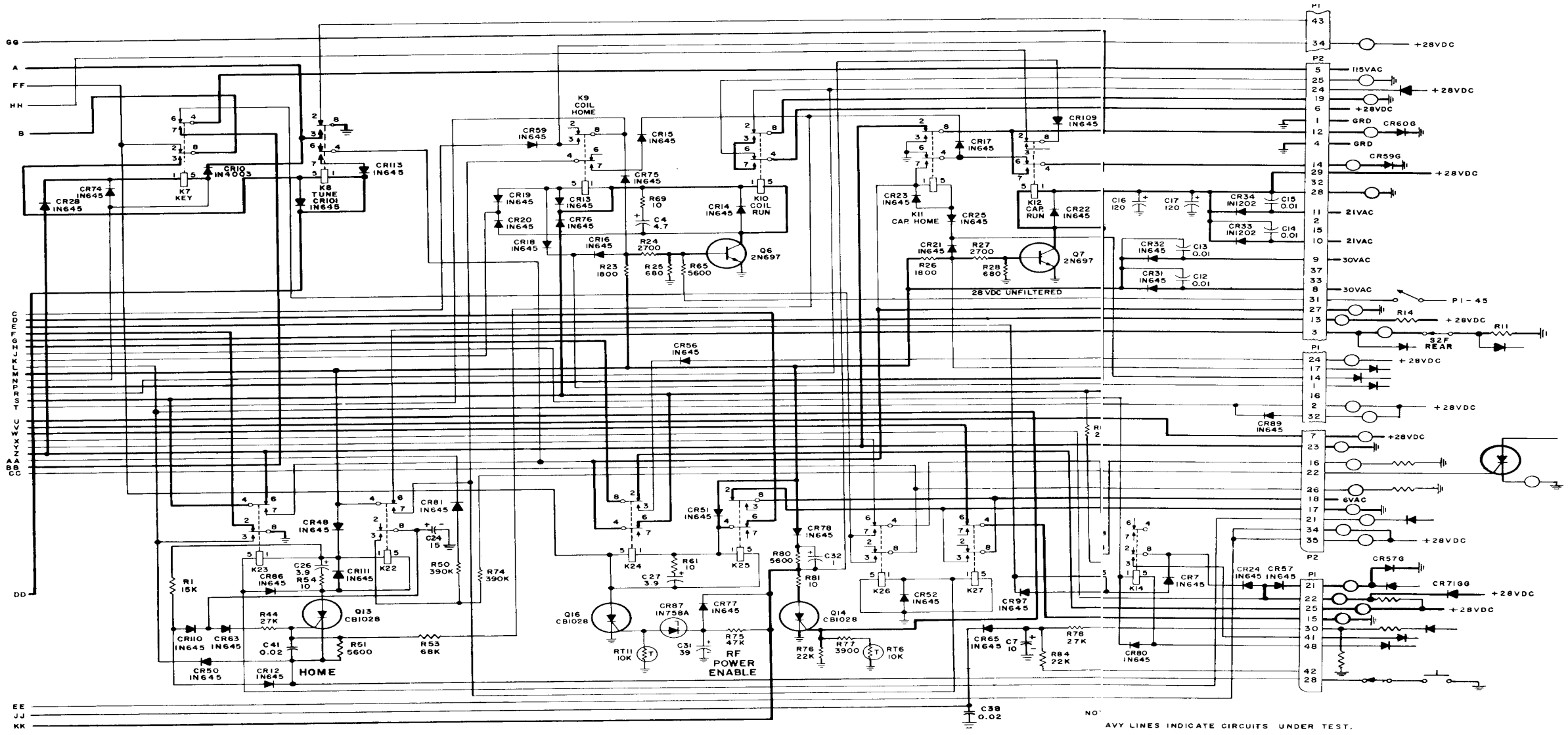


Figure 6-16(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 6, simplified schematic diagram (reference only) part 2 of 2).

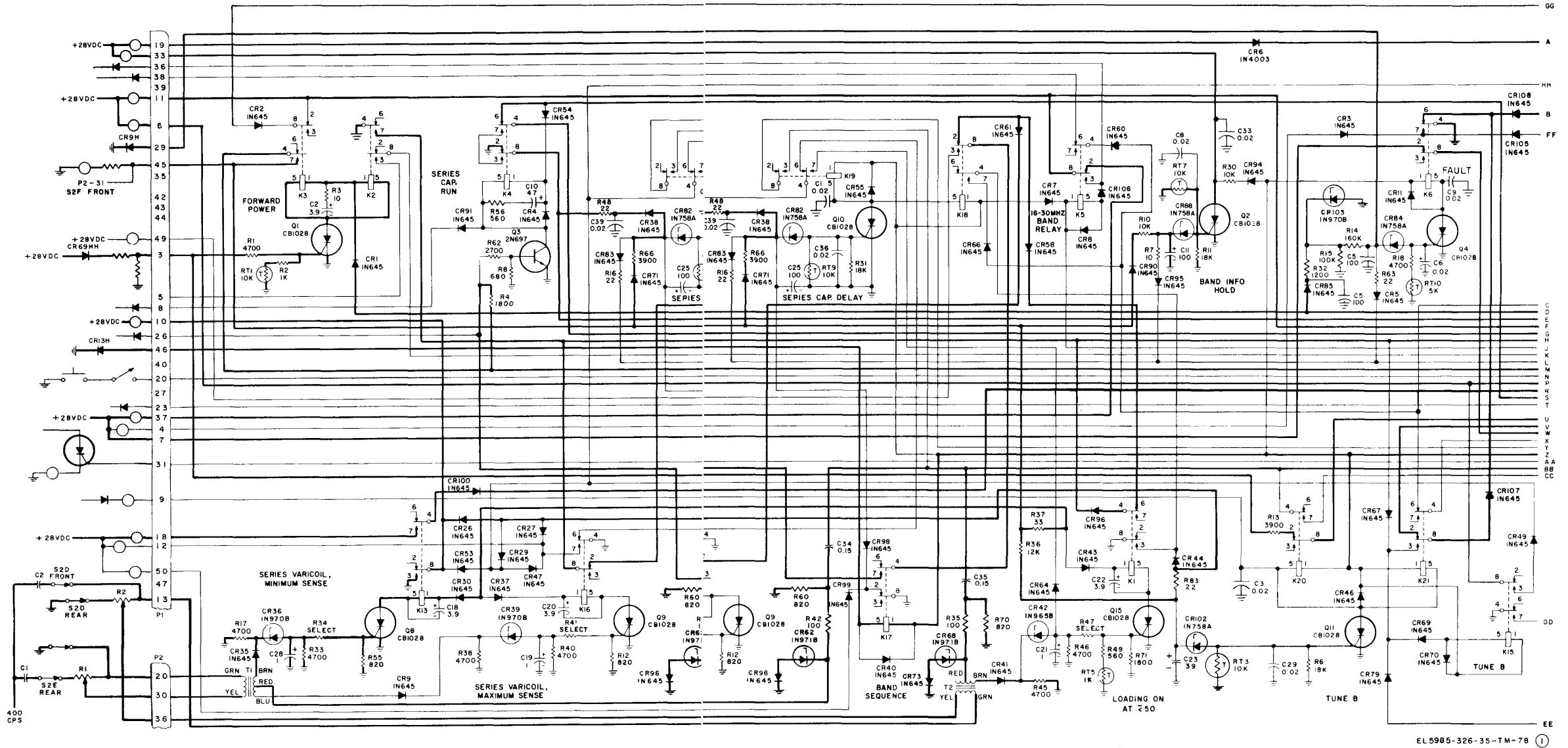


Figure 6-17(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 7, simplified schematic diagram (reference only) (part 1 of 2)

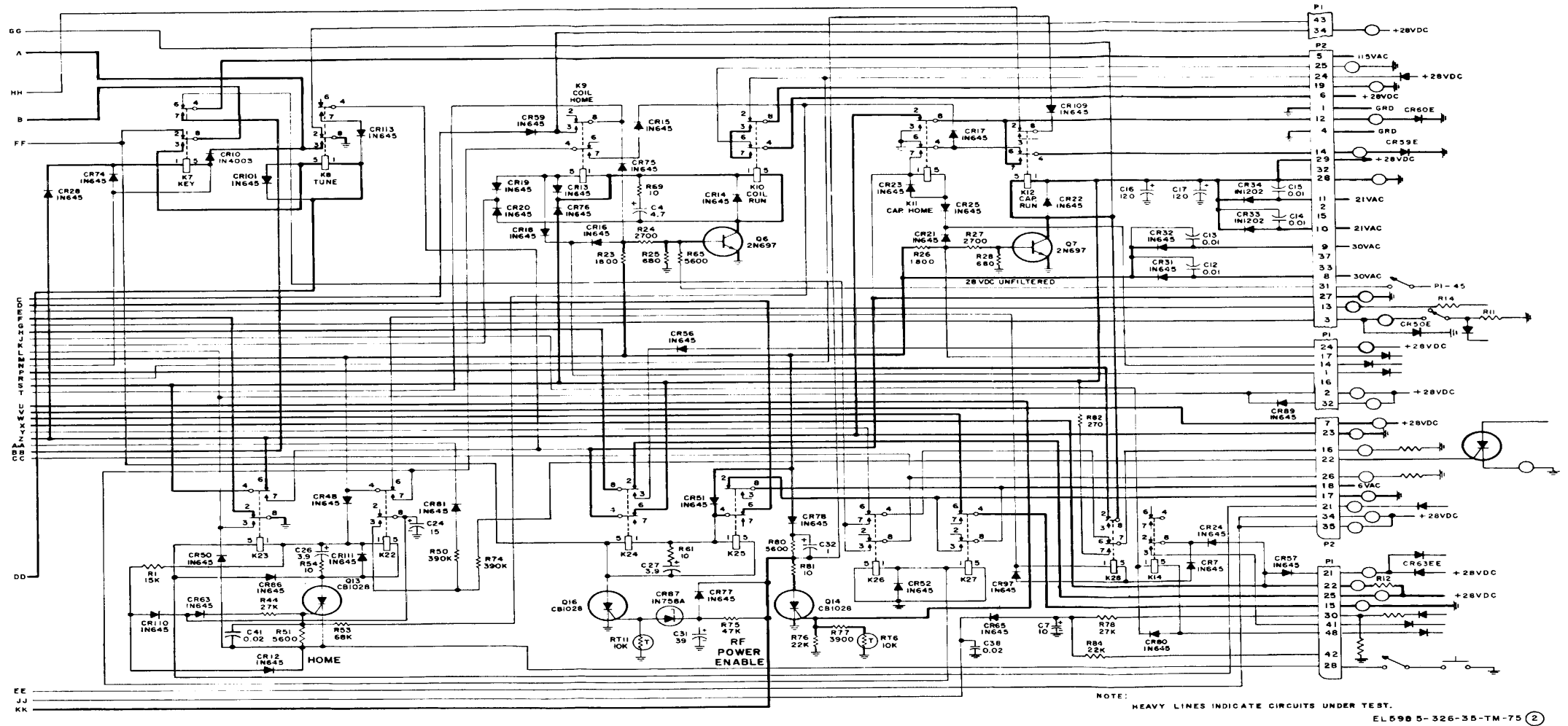
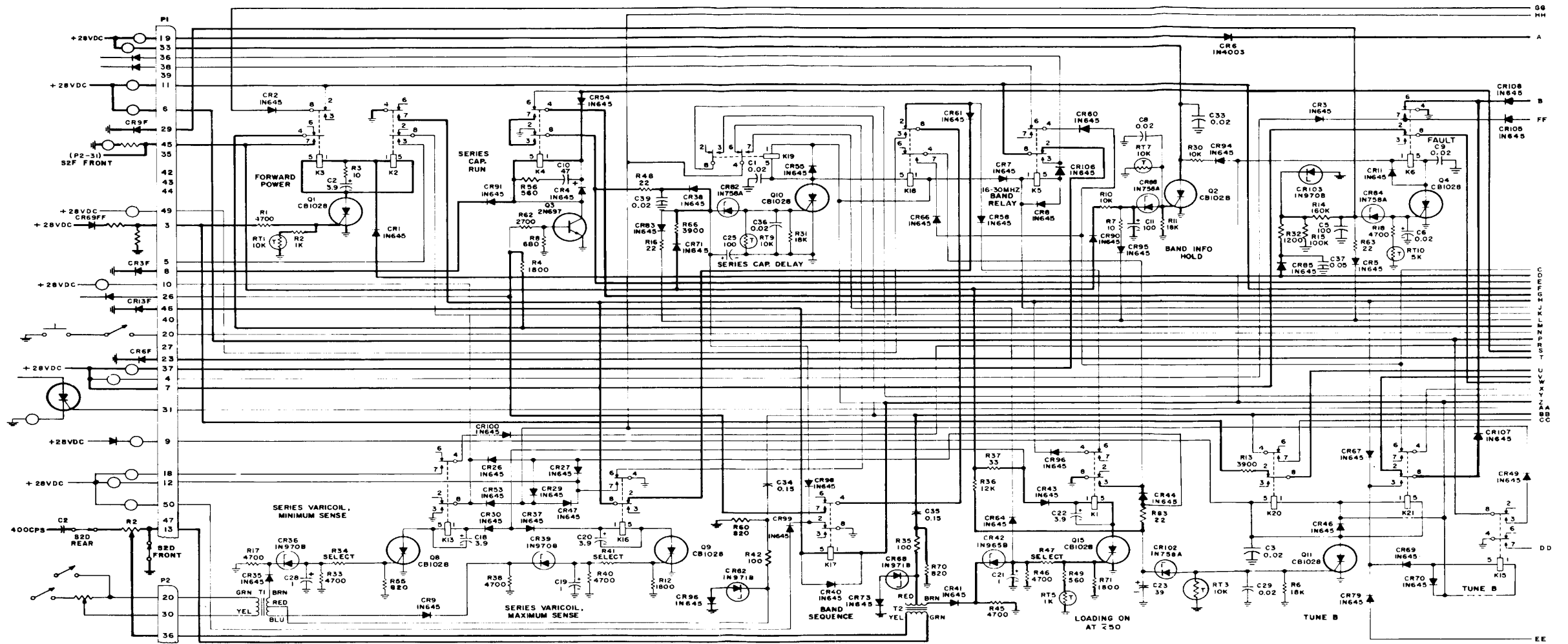


Figure 6-17(2). Coupler control A2, using test Set TS-2353/ARM-109 in position 7, simplified schematic diagram (reference only) (part 2 of 2)



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Figure 6-18(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 8, simplified schematic diagram (reference only) (part 1 of 2).

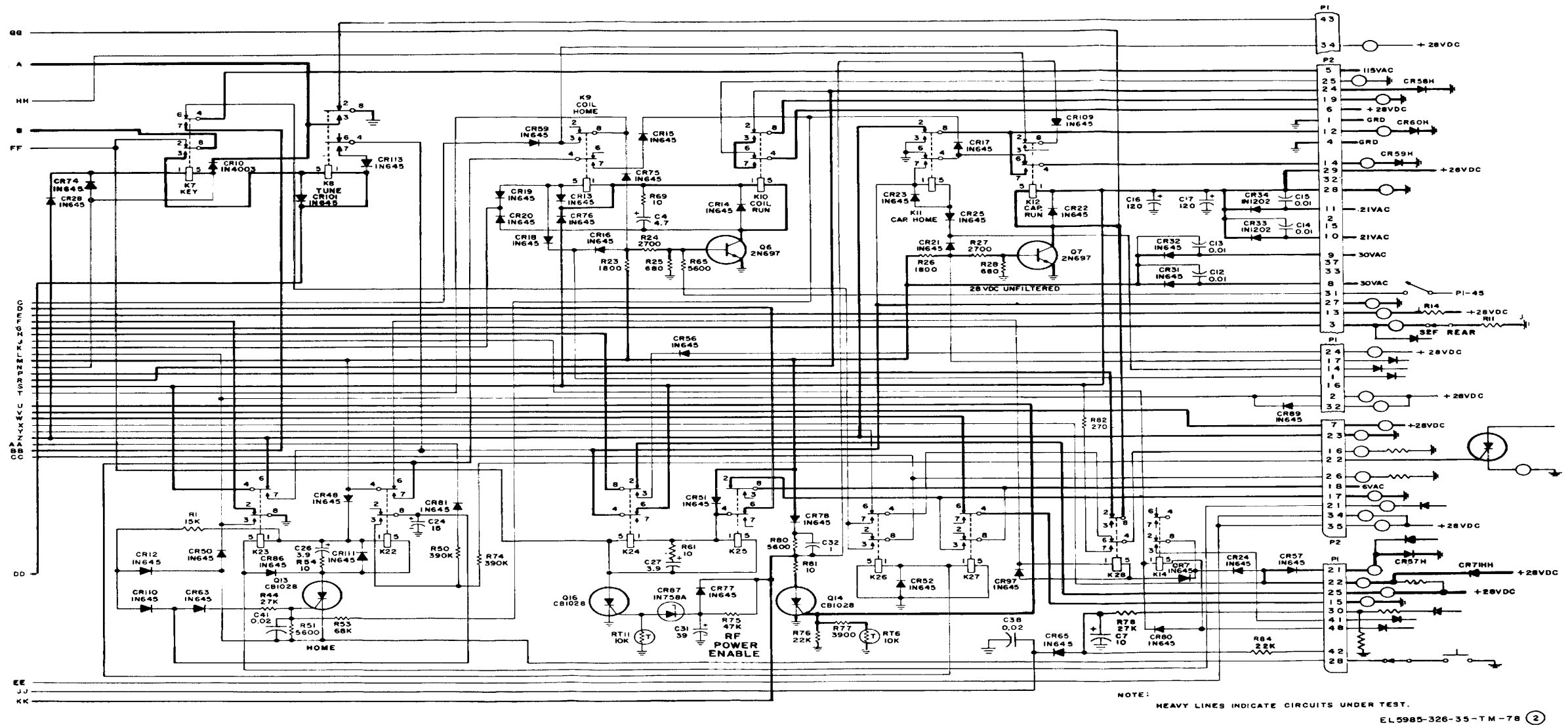
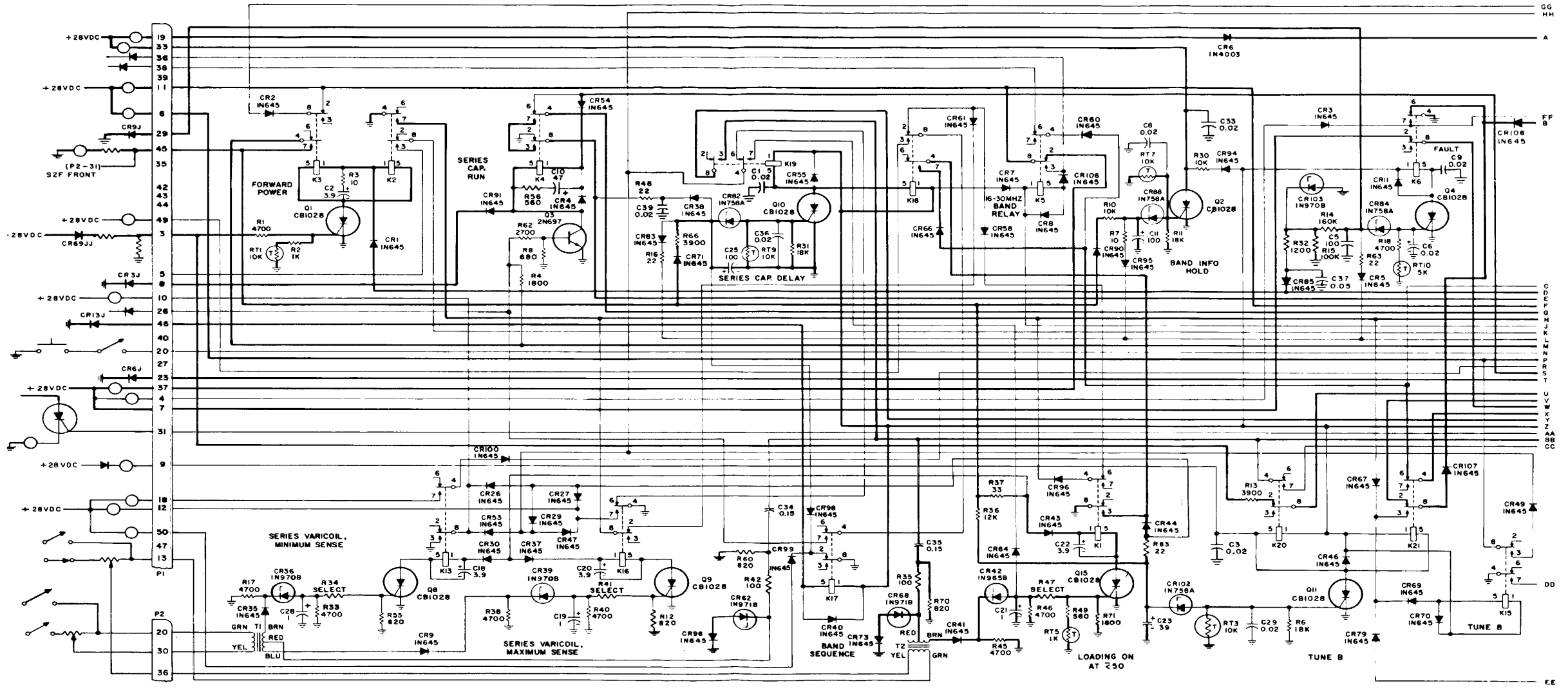


Figure 6-18(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 8, simplified schematic diagram (reference only) (part 2 of 2).



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Figure 6-19(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 9, simplified schematic diagram (reference only) (part 1 of 2).

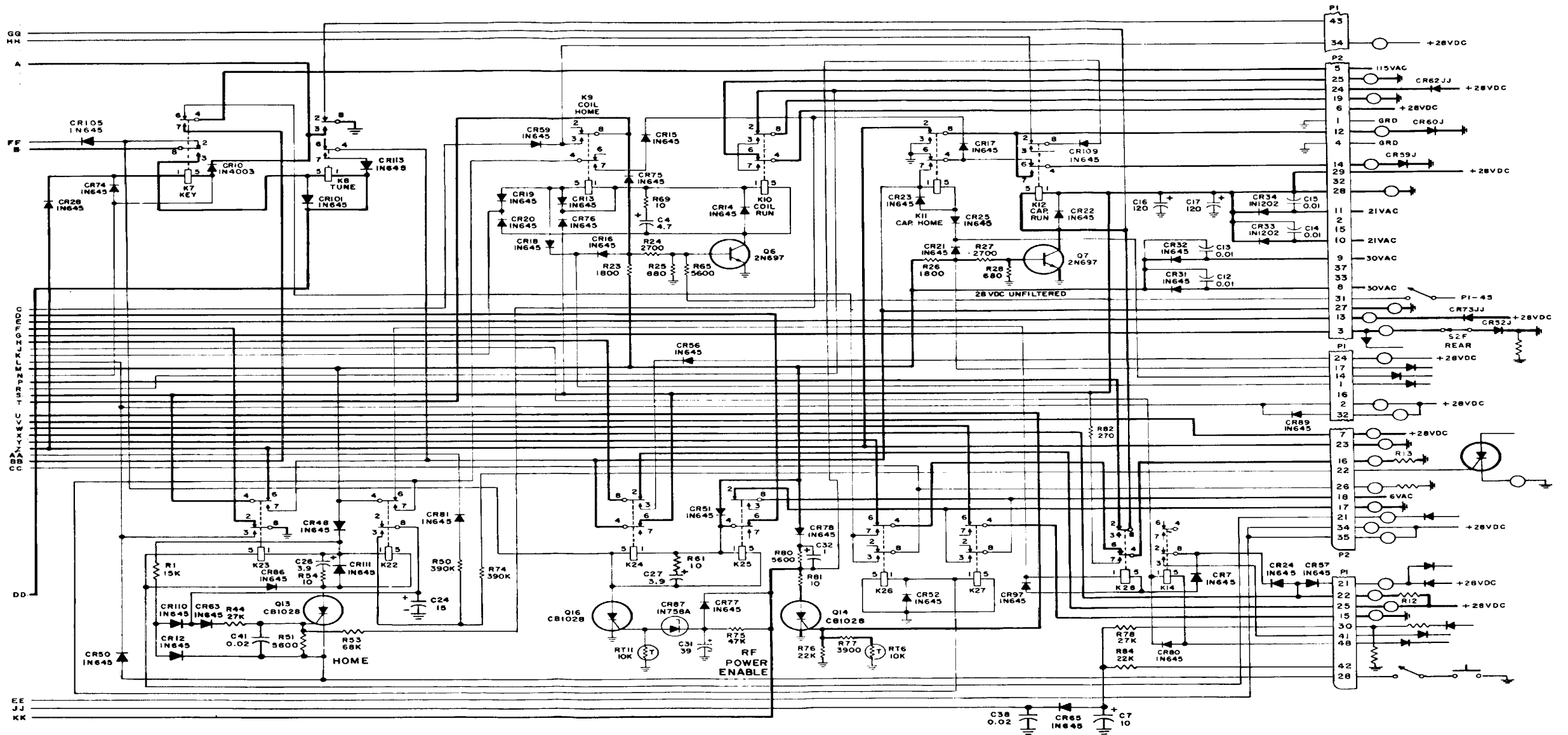


Figure 6-19(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 9, simplified schematic diagram (reference only) (part 2 of 2).

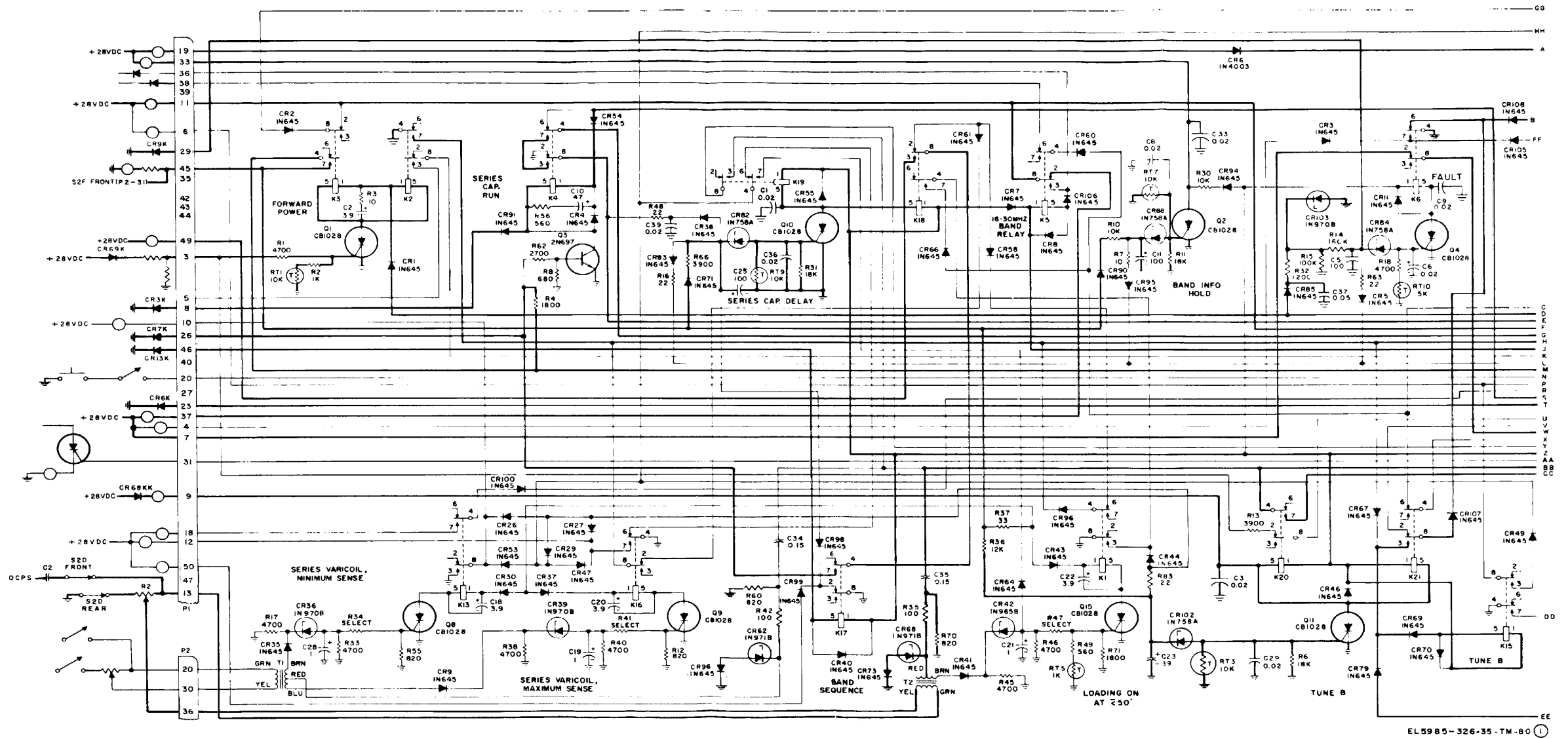


Figure 6-20(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 10, simplified schematic diagram (reference only) (part 1 of 2).

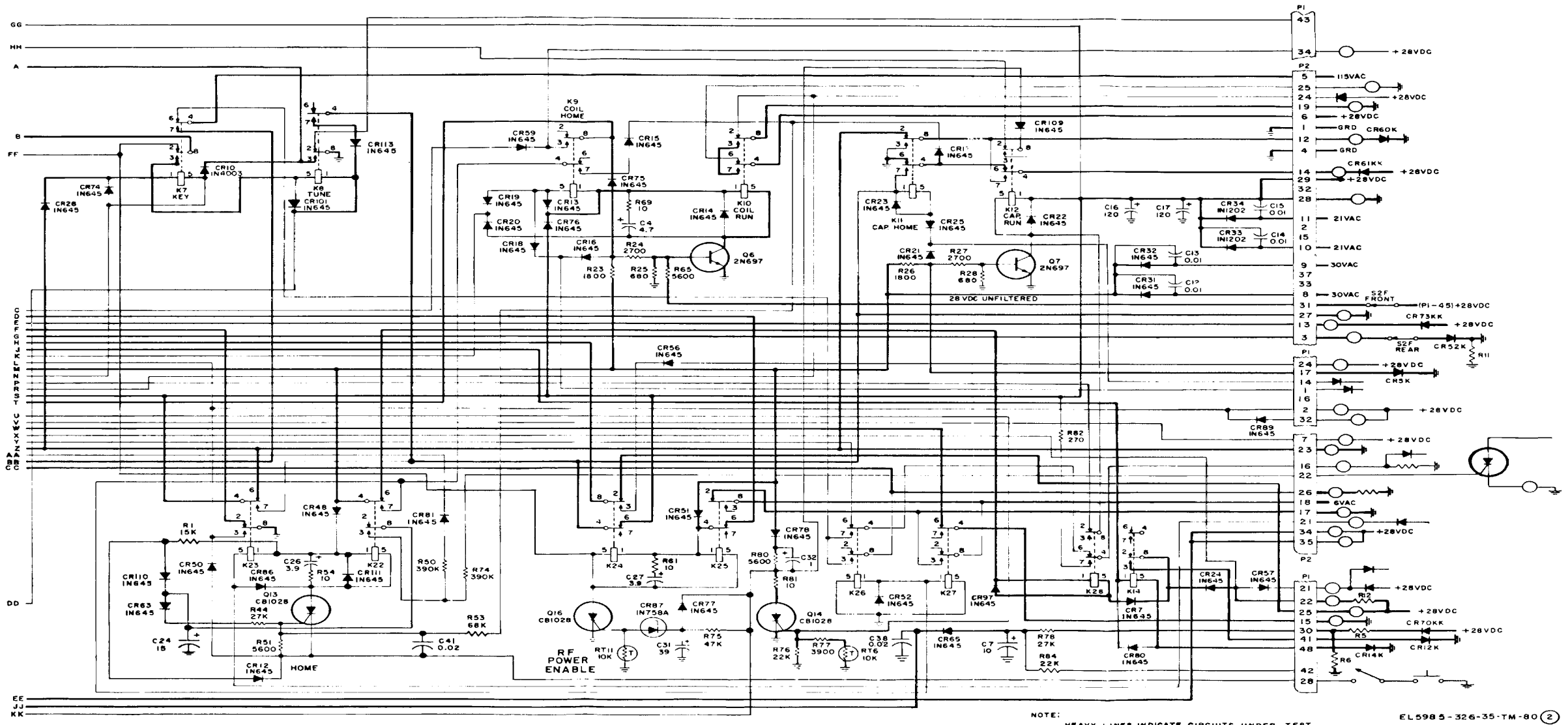


Figure 6-20(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 10, simplified schematic diagram (reference only) (part 2 of 2).

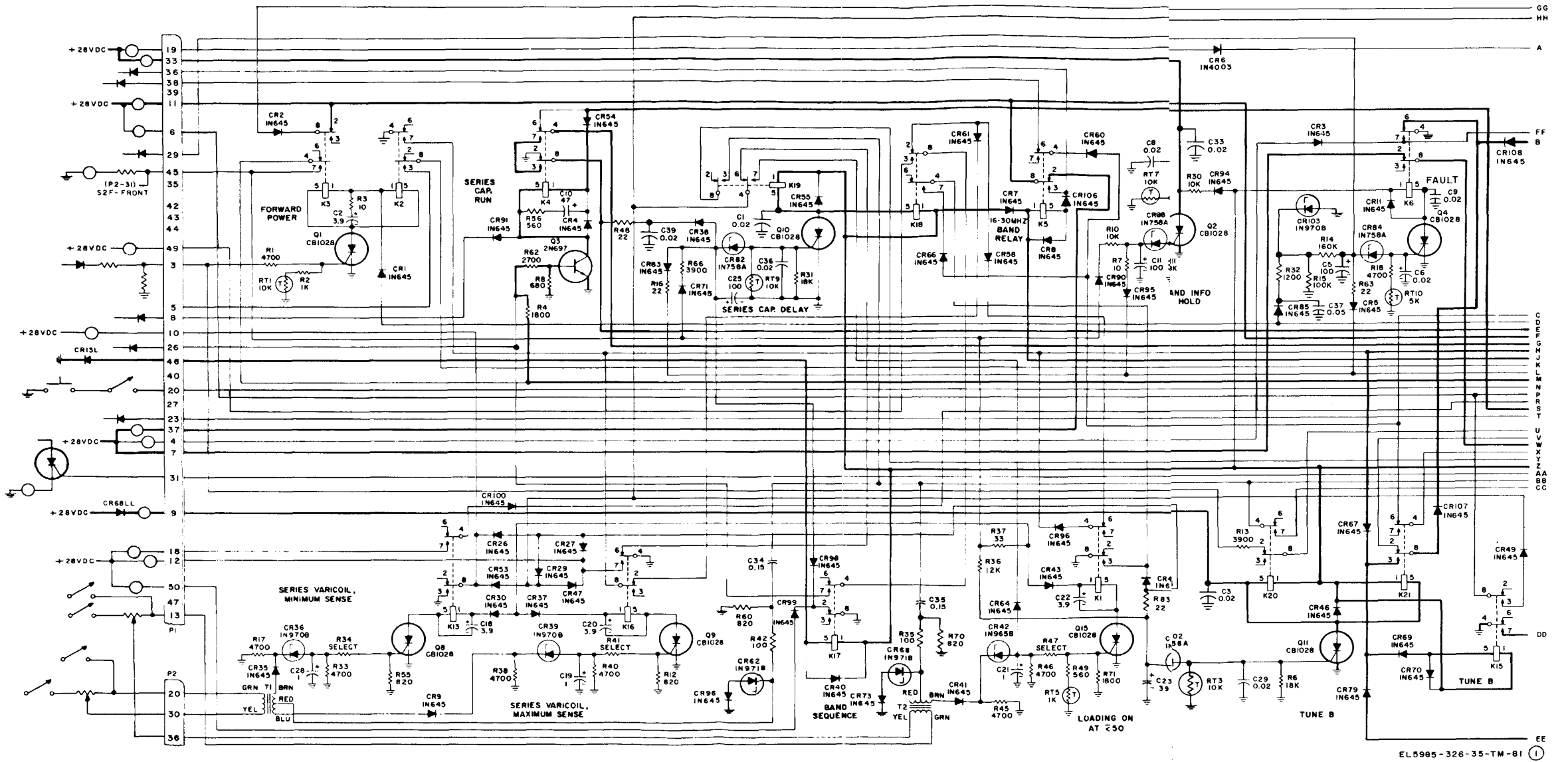


Figure 6-21(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 11, simplified schematic diagram (reference only) (part 1 of 2).

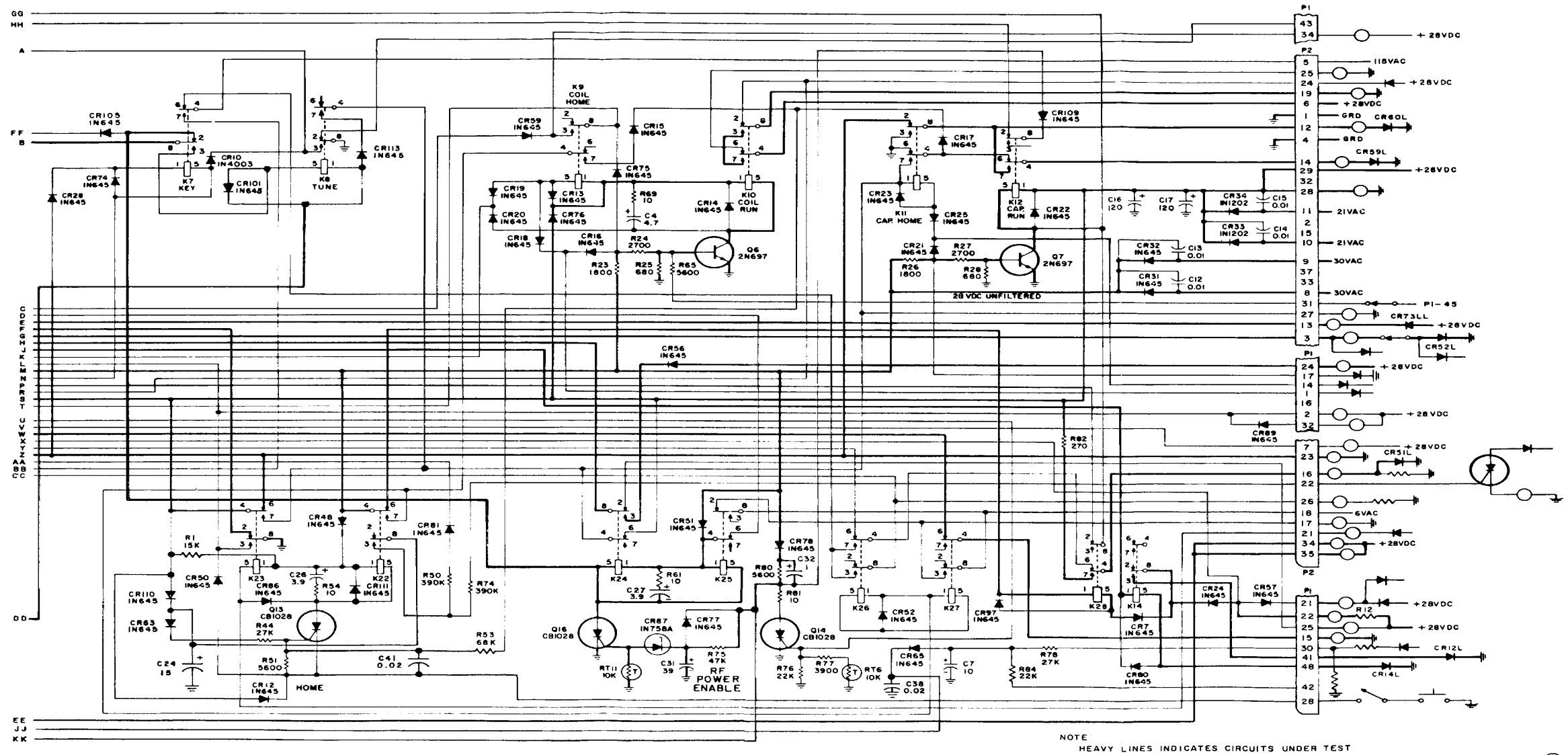


Figure 6-21(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 11, simplified schematic diagram (reference only) (part 2 of 2).

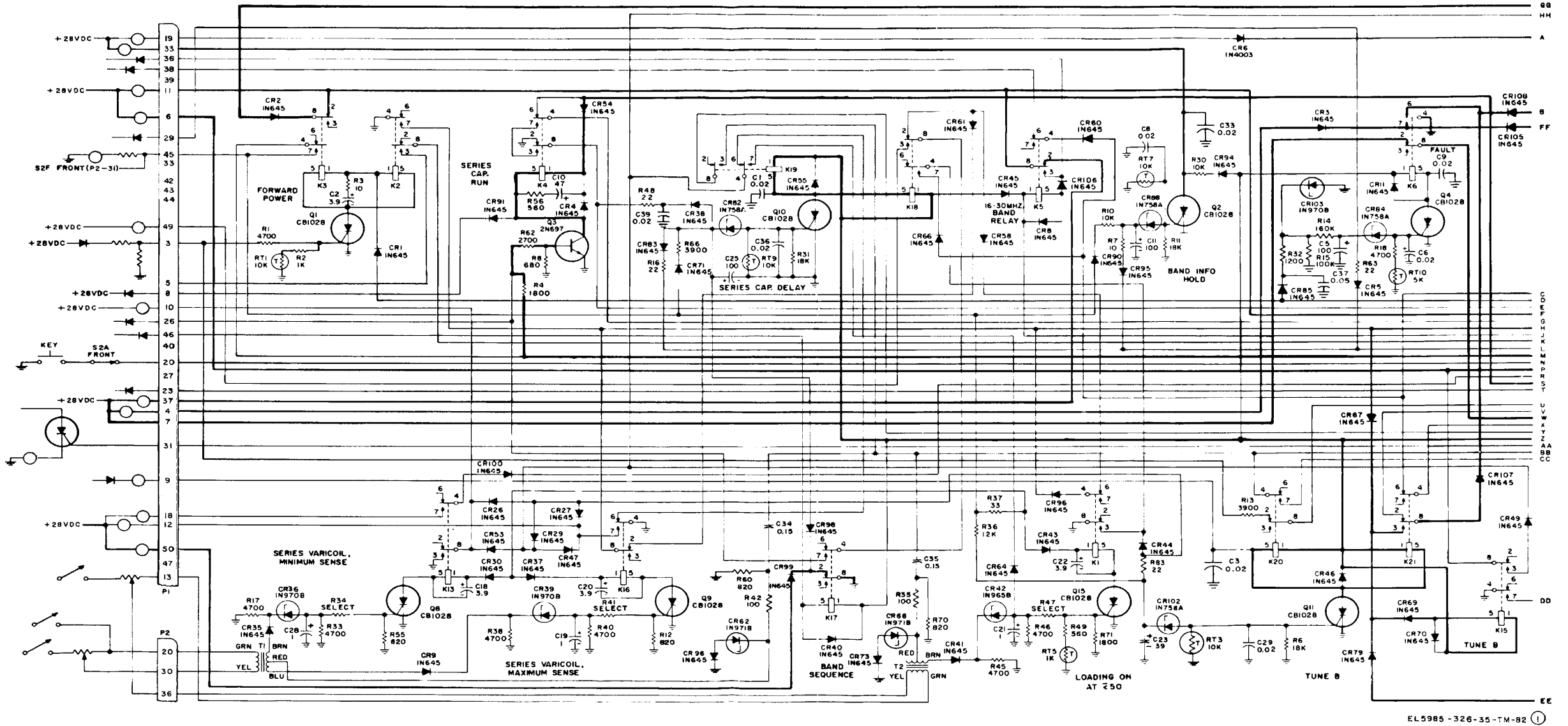
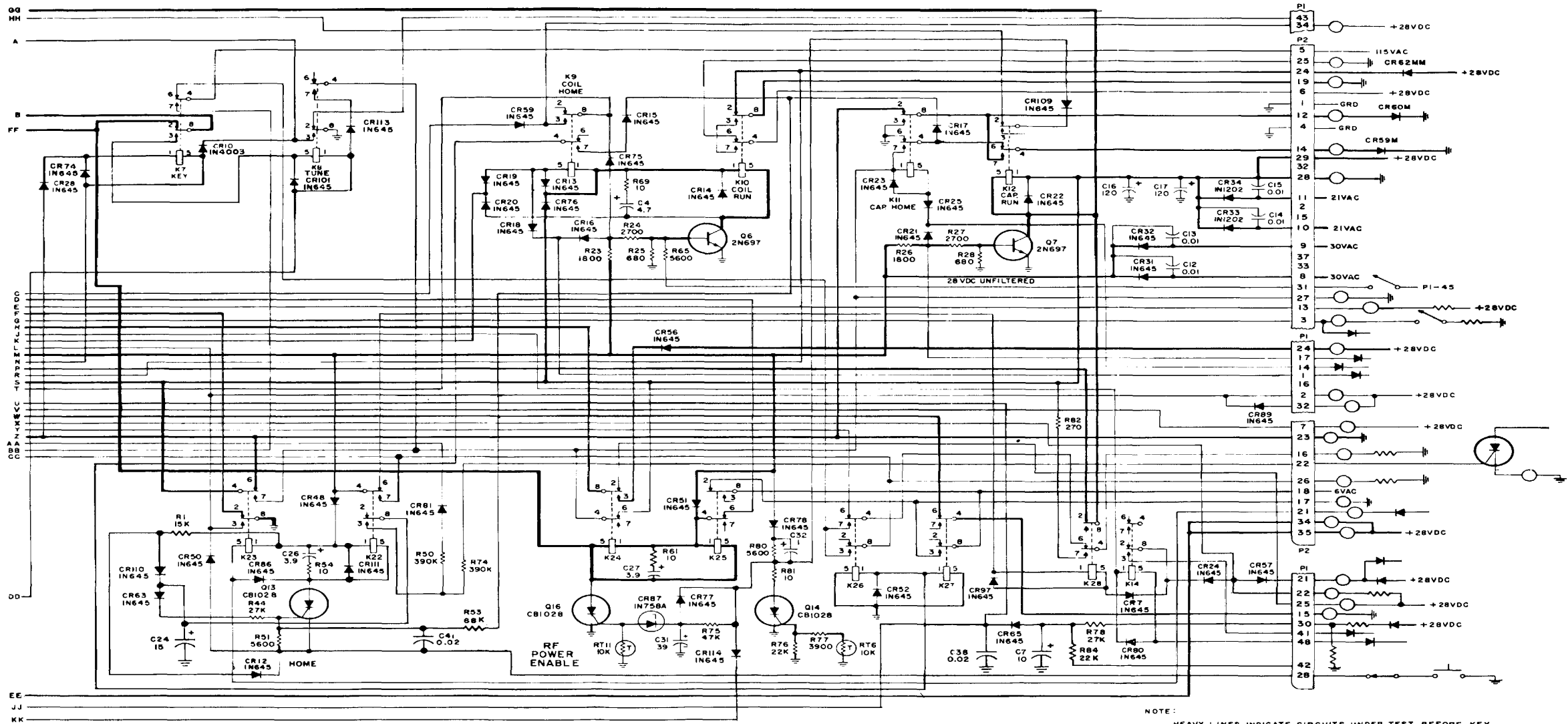


Figure 6-22(1). Coupler control A2, using Test Set TS-2353/ARM-109 in position 12, simplified schematic diagram (reference only) (part 1 of 2).



NOTE:
HEAVY LINES INDICATE CIRCUITS UNDER TEST BEFORE KEY.

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Figure 6-22(2). Coupler control A2, using Test Set TS-2353/ARM-109 in position 12, simplified schematic diagram (reference only) (part 2 of 2).

APPENDIX A

REFERENCES

The following publications contain information applicable to the operation and maintenance of couplers, Antenna CU-1658/A and CU-1669/GRC:

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
SB 11-604	Replacement of Tool Kits, Radar and Radio Repairman TK-87/U and TK-88/U with Tool Kits, Electronic Equipment TK-105/G and TK- 100/G.
TB SIG 291	Safety Measures To Be Observed When Installing and Using Whip Antennas, Field Type Masts, Towers, Antennas and Metal Poles That Are Used With Communications, Radar and Direction Finding Equipment.
TB 11-6625-1636-35/1	Calibration Procedure for Antenna Coupler Test Set AN/ARM-109 (NSN 6625-00-691-6594).
TM 11-5821-248-12	Organizational Maintenance Manual: Radio Set AN/ARC-102 (NSN 5821-00-050-8255).
TM 11-5985-326-20	Organizational Maintenance Manual: Coupler, Antenna CU-1658/A and CU-1669/GRC.
TM 11-5985-327-15	Operator, Organizational, DS, GS, and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Electrical Dummy Load DA-487/U.
TM 11-6625-366-15	Organizational, Direct Support, General Support, and Depot Maintenance Manual: Multimeter TS-352B/U (NSN 6625-00-553-0142).
TM 11-6625-446-15	Operator, Organizational, Field and Depot Maintenance Manual: Wattmeter AN/URM-120 (NSN 6625-00-813-8430).
TM 11-6625-535-15	Operator, Organizational, DS, GS and Depot Maintenance Manual: Oscilloscope AN/USM-140A.
TM 11-6625-535-15-1	Operator, Organizational, DS, GS, and Depot Maintenance Manual: Oscilloscope AN/USM-140B, AN/USM-140C, AN/USM-141A, and AN/USM-141B.
TM 11-6625-622-12	Organizational Maintenance Manual Including Repair Parts and Special Tool Lists: Test Harness, Radio Set AN/URM-157 (NSN 6625-00-766-4685) and AN/URM-157A (6625-00-236-1557).
TM 11-6625-622-45	GS and Depot Maintenance Manual Including Repair Parts and Special Tool Lists: Test Harness, Radio Set AN/URM-157.
TM 11-6625-1636-15	Organizational, DS, GS, and Depot Maintenance Manual: Test Set, Antenna Coupler AN/ARM-109.
TM 38-750	The Army Maintenance Management System (TAMMS).

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