TECHNICAL MANUAL

Direct Support and General Support

Maintenance Manual

INTERROGATOR SET AN/TPX-46(V) 1, 2, 3, 4, and 6

ANTENNA-RADOME AS-2167/TPX-46(V) (NSN 5985-00-166-0223)

ANTENNA-RADOME AS-2740/TPX-46(V) (NSN 5985-00-166-0221)

CONTROL, ANTENNA C-8738/TPX-46(V) (NSN 5895-00-141-3606)

AND PEDESTAL, ANTENNA AB-1076/TPX-46(V) (NSN 5985-00-166-0222)

This copy is a reprint which includes current pages from Changes 1 through 8.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JANUARY 1973

WARNING

DANGEROUS VOLTAGE EXISTS IN THIS EQUIPMENT

DON'T TAKE CHANCES!

DANGEROUS VOLTAGES EXIST

IN POWER SUPPLY MODULE 1A2A5

15 VOLTS AC

CHANGE No. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON DC, *27 November 1981*

Direct Support and General Support Maintenance Manual
INTERROGATOR SET AN/TPX-46(V) 1, 2, 3, 4, and 6
ANTENNA-RADOME AS-2167/TPX-46(V) (NSN 5985-00-166-0223)
ANTENNA-RADOME AS-2740/TPX-46(V) (NSN 5985-00-166-0221)
CONTROL, ANTENNA C-8738/TPX-46(V) (NSN 5895-00-141-3606)
AND
PEDESTAL, ANTENNA AB-1076/TPX-46(V) (NSN 5985-00-166-0222)

TM 11-5895-34-5, 31 January 1973, is changed as follows:

1. Title of the manual is changed as shown above.
2. New or changed material is indicated by a vertical bar in the margin of the page.
3. Added or revised illustrations are indicated by a vertical bar in front of the figure caption.
4. Remove and insert pages as indicated below:

Remove	Insert
None	WARNING page A
3-5 and 3-6	3-5 and 3-6

5. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

Distribution:
To be distributed in accordance with Special List.

WARNING

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

Change No. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, *27 July 1981*

Direct Support and General Support Maintenance Manual
INTERROGATOR SET AN/TPX-46(V) 1,2,3,4, and 6
ANTENNA-RADOME AS-2167/TPX-46(V) (NSN 5985-00-166-0223)
ANTENNA-RADOME AS-2740/TPX-46(V) (NSN 5985-00-166-0221)
CONTROL, ANTENNA C-8738/TPX-46(V) (NSN 5985-00-141-3606)
AND
PEDESTAL, ANTENNA AB-1076/TPX-46(V) (NSN 5985-00-166-0222)

TM 11-5895-532-34-5, 31 January 1973, is changed as follows:

1. New or changed material is indicated by a vertical bar in the margin.
2. Remove and insert pages as indicated below:

Remove	*Insert*
FO-2	FO-2
FO-5(1)	FO-5(1)
FO-11(2)	FO-11(2)

3. File this change sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General United States Army
Chief of Staff

Official:

Robert M. Joyce
Brigadier, United States Army
The Adjutant General

Distribution:

Active Army:

COE (1)
TSG (1)
USAARENBD (2)
USAINSCOM (2)
TRADOC (2)
DARCOM (1)
TECOM (2)
ARRCOM (2)
OS Maj Comd (2)
USACC (2)
HISA (Ft. Monmouth) (15)
Armies (1)
CINCUSAREUR (3)
USAREUR (10)
7th USA (5)
COMUSKOREA (2)
USAFABD (2)
4th USA Msl Comd (2)
USAADS (100)
USAFACFS (5)
Ft. Gillem (5)
32d AD Comd (5)
Pirmasens Army Depot (10)
USASIGS (5)
Svc College (1)
WSMR (2)
Ft Carson (7)
USAERDAA (1)
USAERDAW (1)

Army Dep (1) except
SAAD (30)
TOAD (14)
ANAD (3)
SHAD (3)
NAAD (3)
SVAD (3)
USA Dep (1)
Sig Sec USA Dep (2)
Ft Richardson (CERCOM Ofc) (2)
USARAL (5)
Units org under fol TOE:
(1 copy each unit)
29-134
29-136
44-2
44-12
44-235
44-236
44-237
44-535
44-536
44-537
44-545
44-546
44-547
(2 copies each unit)
29-207
29-10

ARNG: None
USAR: None
For explanation of abbreviations used, see AR 310-50.

CHANGE No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *26 May, 1981*

Direct Support and General Support Maintenance Manual
INTERROGATOR SET AN/TPX-46(V) 1, 2, 3, 4, and 6
ANTENNA-RADOME AS-2167/TPX-46(V) (NSN 5985-00-166-0223)
ANTENNA-RADOME AS-2740/TPX-46(V) (NSN 5985-00-166-0221)
CONTROL, ANTENNA C-8738/TPX-46(V) (NSN 5985-00-141-3606)
AND
PEDESTAL, ANTENNA AB-1076/TPX-46(V) (NSN 5985-00-166-0222)

1. New or changed material is indicated by a vertical bar in the margin.
2. Remove and insert pages as indicated below:

Remove	*Insert*
4-5 through 4-12	4-5 through 4-10

3. File this change sheet in front of the manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

Distribution:
Active Army:

COE (1)
TSG (1)
USAARENBD (2)
USAINSCOM (2)
TRADOC (2)
DARCOM (1)
TECOM (2)
ARRCOM (2)
OS Maj Comd (2)
USACC (2)
HISA (Ft Monmouth) (21)
Armies (1)
CINCUSAREUR (3)
USAREUR (10)
7th USA (5)
COMUSKOREA (2)
USAFABD (2)
4th USA Msl Comd (2)
USAADS (100)
USAFACFS (5)
Ft Gillem (5)
32d AD Comd (5)
Pirmasens Army Depot (10)
USASIGS (5)
Svc Colleges (1)
WSMR (2)
Ft Carson (7)
USAERDAA (1)
USAERDAW (1)
USA Dep (1)
Army Dep (1) except
LBAD (3)
SAAD (30)
TOAD (14)
ANAD (3)
shad (3)
NAAD (3)
SVAD (3)
Sig Sec USA Dep (2)
Ft Richardson (CERCOM Ofc) (2)
USARAL (5)
Units org under fol TOE:
(1 copy each unit)
29-134
29136
44-2
44-12
44-235
44-236
44-237
44-535
44-536
44-537
44-545
44-546
44-547
(2 copies each unit)
29207
29610

ARNG: None
USAR: None
For explanation of abbreviations used, see AR 310-50.

TECHNICAL MANUAL
No. 11-5895-532-34-5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *31 January 1973*

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL
INTERROGATOR SET AN/TPX-46(V) 1, 2, 3, 4, and 6
ANTENNA-RADOME AS-2167/TPX-46(V) (NSN 5985-00-166-0223)
ANTENNA-RADOME AS-2740/TPX-46(V) (NSN 5985-00-166-0221)
CONTROL, ANTENNA C-8738/TPX-46(V) (NSN 5895-00-141-3606)
AND
PEDESTAL, ANTENNA AB-1076/TPX-46(V) (NSN 5985-00-166-0222)

			Paragraph	Page
CHAPTER	1.	INTRODUCTION		
Section	I.	General	1-1—1-5	1-1
	II.	Description and data	1-6	1-2
CHAPTER	2.	FUNCTIONAL DESCRIPTION		
Section	I.	Overall block diagram description	2-1—2-3	2-1
	II.	Antenna circuits functional block diagram description	2-4—2-6	2-2
	III.	Antenna positioning circuits overall functional description	2-7, 2-8	2-6
	IV.	Antenna positioning circuits (external mode-synchro radar antenna azimuth) functional block diagram description	2-9—2-14	2-7
	V.	Antenna positioning circuits (external mode resolver radar antenna azimuth) functional block diagram description)	2-15—2-18	2-10
	VI.	Antenna positioning circuits (internal mode) functional block diagram description	2-19—2-22	2-10
	VII.	Self-Test and monitoring circuits functional block diagram description	2-23—2-26	2-11
	VIII.	Power supply circuits functional block diagram description	2-27—2-30	2-13
	IX.	Power supply schematic diagram description	2-31—2-33	2-13
CHAPTER	3.	DIRECT SUPPORT MAINTENANCE INSTRUCTIONS		
Section	I.	Introduction	3-1—3-3	3-1
	II.	Antenna control assembly	3-4,3-5	3-1
	III.	Seven-foot antenna	3-6, 3-7	3-2
	IV.	Pedestal	3-8—3-13	3-2
	V.	Pedestal adapter assembly	3-14	3-9
	VI.	Fourteen-foot antenna	3-15	3-9
CHAPTER	4.	GENERAL SUPPORT MAINTEANCE INFORMATION		
Section	I.	Introduction	4-1—4-5	4-1
	II.	Tools and test equipment	4-6, 4-7	4-2
	III.	Equipment set-ups	4-8—4-15	4-2
	IV.	Antenna control assembly anent procedures	4-16—4-19	4-5
	V.	Functional test	4-20,4-21	4-10
	VI.	Test-bed set-up for 3° clockwise error	4-22	4-11
CHAPTER	5.	GENERAL SUPPORT MANANCE INSTRUCTIONS FOR ANTENNA CONTROL ASSEMBLY 1A2		
Section	I.	Introduction	5-1	5-1
	II.	Antenna control assembly chassis	5-2—5-6	5-1
	III.	Mode switching card 1A2A1	5-7—5-12	5-2
	IV.	Servo preamplifier card 1A2A2	5-13—5-19	5-4
	V.	T1i/self-test card 1A2A3	5-20—5-26	5-13
	VI.	Azimuth zero adjust module 1A2A4	5-27—5-30	5-19
	VII.	Power supply module A2A5	5-31—5-36	5-20—5-23
	VII.	Electronic control amplifier filter 1A2A6	5-37—5-40	5-24
	IX.	Electronic control amplifier 1A2A7	5-41, 5-42	5-24
CHAPTER	6.	GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR 7-FOOT ANTENNA 3A1, AND 14-FOOT ANTENNA, UNIT 4		
Section	I.	General	6-1—6-3	6-1
	II.	Troubleshooting and repair of 7-foot antenna 3A1 when using AN/TPM-25	6-4—6-6	6-1
	III.	Troubleshooting and re of 14-foot antenna, unit 4 when using AN/TPM-25A	6-7—6-9	6-5, 6-6
	IV.	Testing of 7-foot or 14-foot antenna when using AN/TPM-25A	6-10	6-6

*This manual supersedes TM 11-5895-532-34-5, 17 March 1972.

			Paragraph	Page
Section	V.	Troubleshooting and repair of 7-foot antenna 3A1 (using AN/UPM-98B (or C))	6-11—6-13	6-7—6-9
	VI.	Troubleshooting and repair of 14-foot antenna (using AN/UPM-98B (or C))	6-14—6-16	6-9—6-11
	VII.	Testing 7-foot or 14-foot antenna (using AN/UPM-98B (or C))	6-17	6-11
CHAPTER	7.	GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR PEDESTAL 3A2		
Section	I.	Introduction	7-1, 7-2	7-1
	II.	Overall pedestal maintenance	7-3, 7-4	7-1
	III.	Synchro subassembly A10 maintenance	7-5—7-10	7-8
	IV.	Motor-tachometer generator MG1 maintenance	7-11—7-14	7-12
	V.	Harmonic drive MP25 maintenance	7-15—7-18	7-12, 7-13
	VI.	Reed switch S1 maintenance	7-19—7-22	7-13
	VII.	Rotary coupler E1 maintenance (using AN/TPM-25A)	7-23—7-25	7-13, 7-14
	VIII.	Antenna pedestal, sealing against water entry	7-26—7-28	7-15
	IX.	Rotary coupler E1 maintenance when using AN/UPM-98B (or C))	7-29—7-31	7-16, 7-17
INDEX				Index-1

LIST OF ILLUSTRATIONS

Figure No.		Page
2-1	Seven-foot antenna configuration, block diagram	2-1
2-2	Seven-foot antenna, block diagram	2-3
2-3	Antenna pattern	2-4
2-4	Fourteen-foot antenna, block diagram	2-5
3-1	Pedestal test point and connector locations	3-6
3-2	Pedestal drive motor brushes and grease cartridge replacement	3-7
4-1	Pedestal assembly	4-4
5-1(1)	Servo preamplifier card 1A2A2, 60 Hz synchro azimuth data waveforms	5-7
5-1(2)	Servo preamplifier card 1A2A2, 60 Hz synchro azimuth data waveforms	5-8
5-2(1)	Servo preamplifier card 1A2A2, 400 Hz synchro azimuth data waveforms	5-9
5-2(2)	Servo preamplifier card 1A2A2, 400 Hz synchro azimuth data waveforms	5-10
5-3(1)	Servo preamplifier card 1A2A2, 4 kHz resolver azimuth data waveforms	5-11
5-3(2)	Servo preamplifier card 1A2A2, 4 kHz resolver azimuth data waveforms	5-12
5-4	T1i/Self-test card 1A2A3, 60 Hz synchro azimuth data waveforms	5-15
5-5	T1i/Self-test card 1A2A3, 400 Hz synchro azimuth data waveforms	5-16
5-6	T1i/Self-test card 1A2A3, 4 kHz resolver azimuth data waveforms	5-17
5-7	Typical printed circuit card	5-18
6-1	YSWR measurement test setup using AN/TPM-25A	6-3
6-2	VSWR measurement test setup using AN/UPM-98B (or C)	6-8
7-1(1)	General support pedestal troubleshooting flow	7-3
7-1(2)	General support pedestal troubleshooting flow	7-4
7-2	Pedestal subassembly removal and replacement	7-5
7-3	Diode bracket details	7-6
7-4	Motor and harmonic drive removal and replacement	7-7
7-5	Synchro subassembly A 10, assembly and disassembly	7-9
7-6	Synchro subassembly alignment	7-11
FO-1	Color code markings for MIL-STD resistors, inductors and capacitors	Fold-in
FO-2	Antenna positioning circuits, functional block diagram	Fold-in
FO-3	Power supply circuits, functional block diagram	Fold-in
FO-4	Test-bed setup, interconnection diagram using AN/TPM-25A	Fold-in
FO-5(1)	Antenna control assembly 1A2, schematic diagram	Fold-in
FO-5(2)	Antenna control assembly 1A2, schematic diagram	Fold-in
FO-6	Mode switching card, 1A2A1, schematic diagram	Fold-in
FO-7	Servo preamplifier card 1A2A2, schematic diagram	Fold-in
FO-8	T1i/self-test card 1A2A3, schematic diagram	Fold-in
FO-9	Power supply module 1A2A5, schematic diagram	Fold-in
FO-10	Electronic control amplifier filter 1A2A6, schematic diagram	Fold-in
FO-11(1)	Electronic control amplifier 1A2A7, schematic diagram	Fold-in
FO-11(2)	Electronic control amplifier 1A2A7, schematic diagram	Fold-in
FO-12	Seven-foot antenna 3A1 schematic diagram	Fold-in
FO-13	Pedestal 3A2, schematic diagram	Fold-in
FO-14	Fourteen-foot antenna, unit 4, schematic diagram	Fold-in
FO-15	Test-bed setup, interconnection diagram using AN/UPM-98B (or C)	Fold-in

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

This technical manual contains the functional description and maintenance for Antenna-Radome AS-2167/TPX-46(V) (7-foot antenna), Antenna-Radome AS-2740/TPX-46(V) (14-foot antenna), Control, Antenna C-8738/TPX-46(V) (antenna control assembly), and Pedestal, Antenna AB-1076/TPX-46(V) (pedestal). The antenna control assembly, 7-foot antenna, 14-foot antenna, and pedestal are functional components of Interrogator Set AN/TPX-46(V) (iff set); however, this manual treats these assemblies as an individual functional entity. References are made to the in set and its other component parts only where necessary to maintain continuity of the information presented. For additional information pertinent to these assemblies as operating parts of the iff set, refer to TM 11-5895-532-34-1 and TM 11-5895-532-12.

1-2. Forms and Records

a. Reports of Maintenance and Unsatisfactory Equipment. Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by TM 38-750.

b. Report of Packaging and Handling Deficiencies. Fill out and forward DD Form 6 (Packaging Improvement Report) as prescribed in AR 700-58/NAVSUPINST 4030.29/AFR 71-13/MCO P4030.29A, and DLAR 4145.8.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO P4610.19C and DLAR 4500.15.

1-3. Reporting of Errors

The reporting of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports should be submitted on DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703.

1-3.1. Reporting Equipment Improvement Recommendations (EIR)

EIR's will be prepared using Standard Form 368, Quality Deficiency Report. Instructions for preparing EIR's are provided in TM 38-750, The Army Maintenance Management System. EIR's should be mailed direct to Commander, US Army Communications and Electronics Materiel Readiness Command, ATTN: DRSEL-ME-MQ, Fort Monmouth, NJ 07703. A reply will be furnished direct to you.

1-4. Indexes of Publications

a. DA Pam 310-4. Refer to the latest issue of DA Pam 310-4 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

b. DA Pam 310-7. Refer to DA Pam 310-7 to determine whether there are modification work orders (MWO's) pertaining to the equipment.

1-5. General Information

a. Graphic Symbols. Graphic symbols used on illustrations in this manual are in accordance with those listed in MIL-STD-806C, Graphic Symbols for Logic Diagrams.

b. Reference Designations. The modules and assemblies constituting the antenna control assembly, 7-foot antenna, pedestal, and 14-foot antenna together with their assigned reference designations are listed below.

Reference designation	*Common name*
1A2 Antenna control assembly	
1A2A1	Mode switching card
1A2A2	Servo preamplifier card
1A2A3	T1i/self-test card
1A2A4	Azimuth zero adjust module
1A2A5	Power supply module
1A2A6	Electronic control amplifier filter
1A2A7	Electronic control amplifier
3A1	7-foot antenna
3A1DC1	Hybrid coupler
3A2	Pedestal
3A2A1	Antenna mast adapter
3A2A10	Synchro assembly
3A2E1	Rotary coupler
3A2MG1	Motor-tachometer generator
4	14-foot antenna
4DC1	Hybrid coupler

c. Panel Markings. Equipment panel markings re capitalized whenever they are mentioned in text and are blocked (enclosed within rectangular boxes) whenever they are shown in illustrations.

Section II. DESCRIPTION AND DATA

1-6. Purpose and Use

a. Antennas (7-foot and 14-foot). The purpose of both the 7-foot antenna and the 14-foot antenna is the radiation of iff challenge rf pulses and the receiving of iff reply rf pulses using a dual-channel sum-difference radiation and receiving pattern. The 14-foot antenna is used with those versions of the iff set where the iff antenna is mounted on the antenna of the associated radar. The 7-foot antenna is used with those versions of the iff set where the iff antenna is mounted on the pedestal.

b. Antenna Control Assembly. The antenna control assembly provides the drive power to the pedestal for the purpose of rotating the antenna. Rotation of the iff antenna is either synchronized with the antenna of the associated radar, using radar antenna azimuth data, or at one of 10 manually selected speeds; five clockwise speeds, five counter-clockwise speeds.

c. Pedestal. The pedestal provides the mount for the antenna and rotates the antenna in accordance with the drive signals from the antenna control assembly.

CHAPTER 2
FUNCTIONAL DESCRIPTION

Section I. OVERALL BLOCK DIAGRAM DESCRIPTION

2-1. GENERAL

This section contains overall functional block diagram descriptions of the two antenna configurations used with the iff set. Interrogator Sets AN/TPX-46(V)1, AN/TPX-46(V)2, and AN/TPX-46(V)4 use the 7-foot antenna configuration consisting of the 7-foot antenna, pedestal, and antenna control assembly. Interrogator Set AN/TPX-46(V) 8 uses the 14-foot antenna configuration, consisting of the 14-foot antenna mounted on the antenna of the associated radar.

2-2. Seven-Foot Antenna Configuration (fig. 2-1)

a. General. The 7-foot antenna configuration consisting of the 7-foot antenna mounted on the pedestal and driven by the antenna control assembly, contains three functional circuit groups: 7-foot antenna circuits, antenna positioning circuits, and power supply circuits.

b. Seven-Foot Antenna Circuits. The 7-foot antenna circuits contain two electrically separate channels, each with a different radiation pattern. When transmitting, sum and difference rf from the receiver-transmitter is radiated via the sum and difference channels of the 7-foot antenna circuits. When receiving, rf received via the sum and difference channels of the 7-foot antenna circuits is applied to the sum and difference channels of the receiver-transmitter. A more detailed description of the the 7-foot antenna circuits is given in Section II.

c. Antenna Positioning Circuits. The antenna positioning circuits, which provide drive signals that rotate the iff antenna, operate in either of two modes, external or internal. In the external mode, the antenna positioning circuits receive radar antenna azimuth data and a reference signal from the associated radar and synchronize the azimuth of the iff antenna to the azimuth of the radar antenna. In the internal mode, the

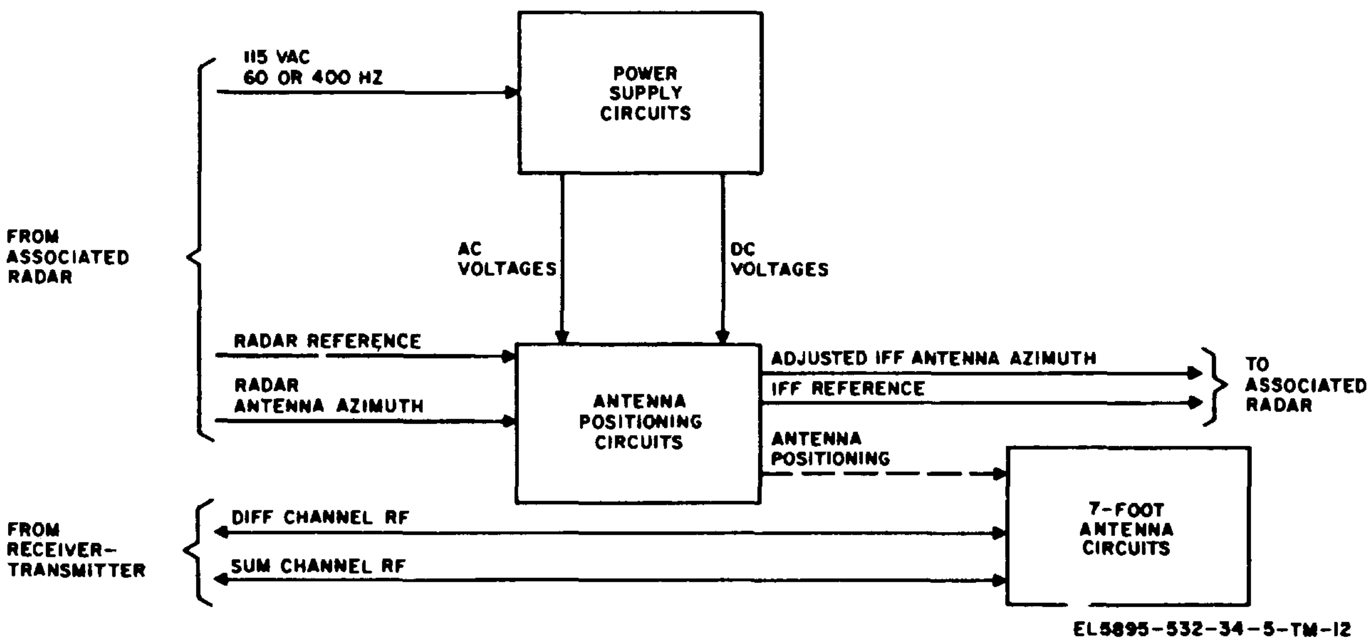


Figure 2-1. Seven-foot antenna configuration, block diagram.

antenna positioning circuits rotate the iff antenna at any of 10 manually-selected speeds and supply the corresponding iff antenna azimuth data and reference signals to the associated radar. A more detailed description of the antenna positioning circuits is given in Sections III through VII.

d. Power Supply Circuits. The power supply circuits receive 115 vac, 60 or 400 Hz, from the iff set and supply ac power and dc voltages to the antenna positioning circuits. A more detailed description of the power supply circuits is given in Section VIII.

2-3. Fourteen-Foot Antenna Configuration

This configuration contains the 14-foot antenna, which is mounted on the antenna of the associated radar. Therefore, the pedestal and control assembly are not required. The overall functional description for the 14-foot antenna is the same as the overall functional description for the 7-foot antenna given in paragraph 2-2*b*. A more detailed discussion of the 14-foot antenna circuits, which are the only functional circuits of this configuration, is given in section II.

Section II. ANTENNA CIRCUITS FUNCTIONAL BLOCKDIAGRAM DESCRIPTION

2-4. General

This section contains a functional block diagram description of the two configurations of antenna circuits used with the iff set. The antenna circuits used with Interrogator Sets AN/TPX-46 (V)1, AN/TPX-46(V)2, and AN/TPX-46(V)4 consist of a rotary coupler located in the pedestal, and a hybrid coupler and antenna arrays located in the 7-foot antenna. The antenna circuits used with Interrogator Set AN/TPX-46(V)3 consist of a hybrid coupler and antenna arrays located in the 14-foot antenna. Both antenna circuits have sum and difference channels for transmitting interrogations and receiving replies. During the transmission of an interrogation, the sum channel is used to transmit the rf challenge pulses and the difference channel is used to transmit the rf isls pulse. During the reception, both the sum and difference channels are used to receive rf replies from challenged transponders.

2-5. Seven-Foot Antenna Circuits
(fig. 2-2)

a. Rotary Joint. The rotary joint couples the sum and difference channel rf paths to the rotating antenna. Coupling is accomplished by means of coaxial choke joints which provide rf paths between the stationary and rotating portions of the coaxial transmission lines within the rotary joint. Physical contact between the stationary and rotating portions of the coaxial transmission lines is made by way of the inner conductor of the coaxial choke joints.

b. Hybrid Coupler. The hybrid coupler is a six-port stripline device used to route rf energy to and from the left and right halves of the sum-difference antenna and to the backfill dipoles. Transmitted sum channel rf enters the hybrid coupler at the SUM port and is sent to both halves of the sum-difference antenna in the same phase through ports FL (front left) and FR (front right). The rf power is split so that the two halves of the antenna receive equal amounts of rf power. Transmitted difference channel rf enters the hybrid coupler at the DIFF port and is also sent to both halves of the sum-difference antenna, but with a phase difference of 180 degrees between ports FL and FR; a small portion of the power is also fed to the two backfill dipoles through ports BL (back left) and BR (back right) in the same phase. When receiving, the signals from the left and right halves of the sum-difference antenna, entering at ports FL and FR, are combined in the same phase (added) for delivery to the rotary joint through the SUM port; the signals are combined 180 degrees out of phase (subtracted) for delivery to the rotary joint through the DIFF port.

c. Antenna. The antenna consists of a sum-difference antenna array, a reflector and choke assembly, and two backfill dipoles. The sum-difference antenna array, mounted in front of the reflector, is a vertically-polarized broad-side array of 10 full-wave printed circuit dipoles printed in two half-arrays (left-half and right-half) of five dipoles each. The left and right halves of the sum-difference antenna array are connected separately (fed) to obtain two different radiation patterns (fig. 2-3) a sum channel pattern when the two halves are fed in the same phase, and a difference channel pattern when the two halves are fed in opposite phases. The sum channel pattern is a single vertical fan-shaped beam centered on the antenna azimuth boresight, having an azimuth beamwidth of approximately 9° at the 3-dB points and an elevation beamwidth of approximately 50° at the 3-dB points. Azimuth side lobes are at least 22 dB below the main lobe. The difference channel pattern is a pair of vertical fan-shaped beams equally displaced from the antenna azimuth boresight with a null (at least 25 dB below the sum channel main lobe) along the antenna azimuth boresight. When a challenge is transmitted (challenge pulses in the sum channel pattern), aircraft transponders located along the antenna azimuth boresight receive the challenge pulses (sum channel rf) at much stronger level than the isls pulse (difference channel rf) and therefore respond by transmitting replies. Aircraft transponders that are located off the antenna azimuth boresight receive the isis pulse at a greater amplitude than the challenge pulses and therefore do not respond. In this way, the effective beamwidth of the antenna is reduced to about 5°. Aircraft transponders also are prevented from responding to the small side lobes and back lobes of the antenna pattern. In the region directly behind the antenna boresight, the sum-difference antenna array would produce sum and difference channel patterns that are of low power but of the same configuration as the patterns in front (the difference channel would have a null). To avoid the possibility of challenging aircraft transponders located in this region (180 degrees from the antenna azimuth boresight), the backfill dipoles are fed enough difference channel rf to fill the difference channel null, which would otherwise exist in the rear of the antenna. The two backfill dipoles are conventional half-wave dipoles fed in phase, mounted in a simple vertically-polarized broadside array behind the reflector.

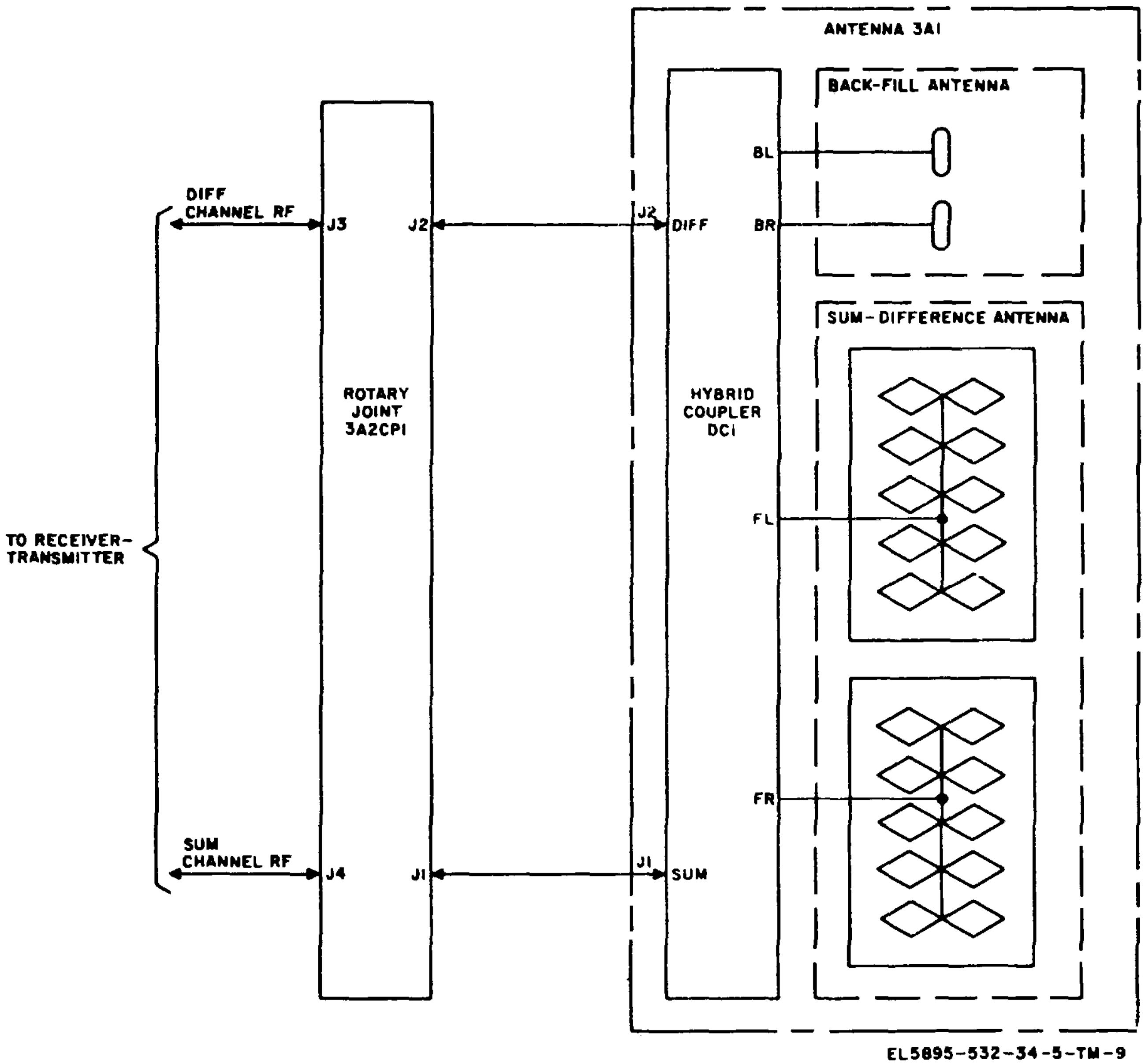
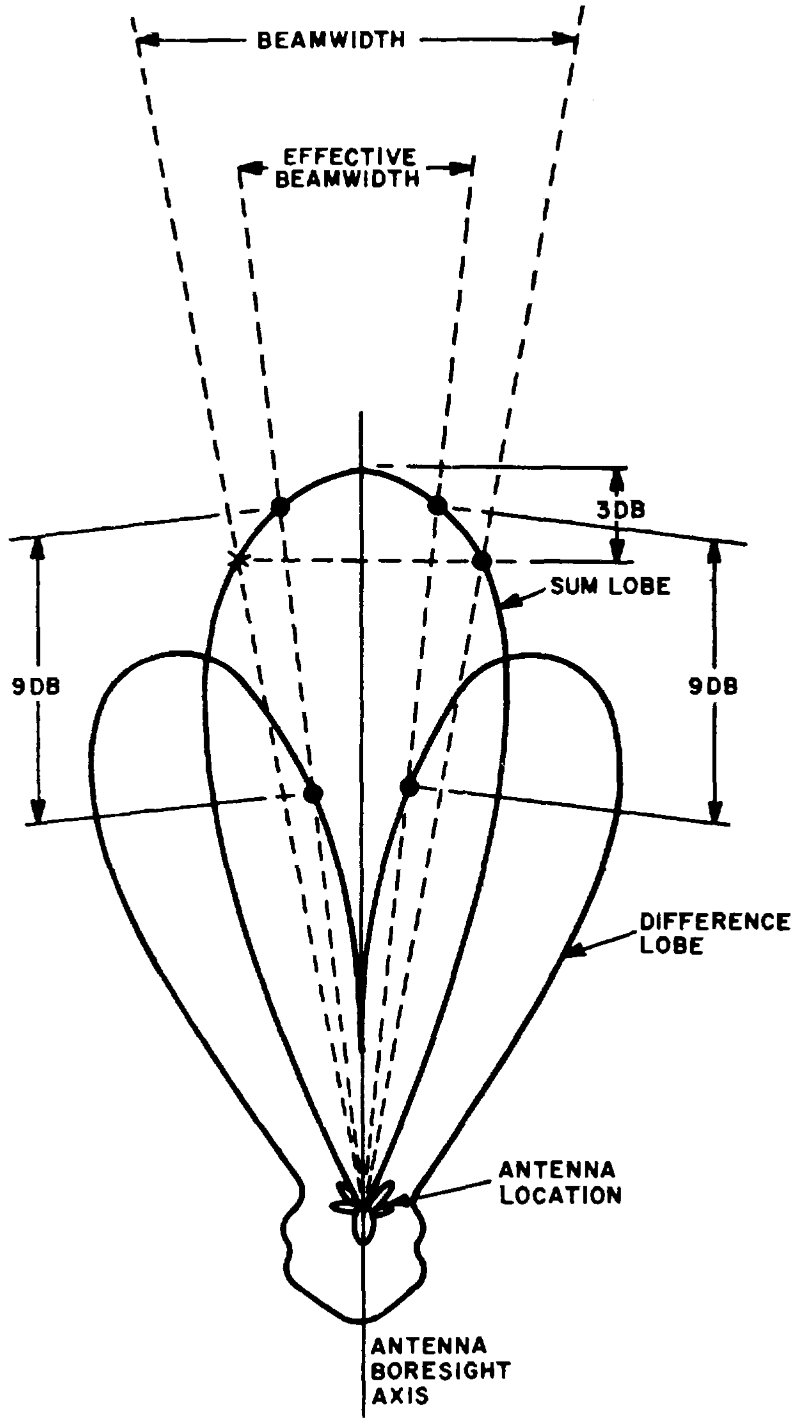


Figure 2-2. Seven-foot antenna, block diagram.



BEAMWIDTH DATA		
	7-FT ANTENNA	14-FT ANTENNA
BEAMWIDTH	9°	4-1/2°
EFFECTIVE BEAMWIDTH	4-1/2°	2-1/2°

EL5895-532-34-5-TM-17

Figure 2-3. Antenna pattern.

2-6. Fourteen-Foot Antenna Circuit
(fig. 2-4)

a. Hybrid Coupler. The hybrid coupler is a seven-port stripline deviced used to route rf energy to and from the four sections of the sum-difference antenna and to the backfill antenna. In order to obtain the desired radiation patterns more sum and difference channel rf power is applied to the sum-difference antenna via the main OUT ports (which feed the two inboard panels) than the CPL (coupled) ports (which feed the two outboard panels). A small percentage of the difference channel rf power is coupled to the backfill antenna via the SAMP 3 (sample) port. Transmitted sum channel rf entering at the SUM port is coupled in the same phase to four sections of the sum-difference antenna via the OUT and CPL ports. Transmitted difference channel rf entering at the DIFF port is sent to the left-half of the sum-difference antenna 180° out of phase with that sent to the right-half. When receiving, signals from both halves of the sum-difference antenna are combined in

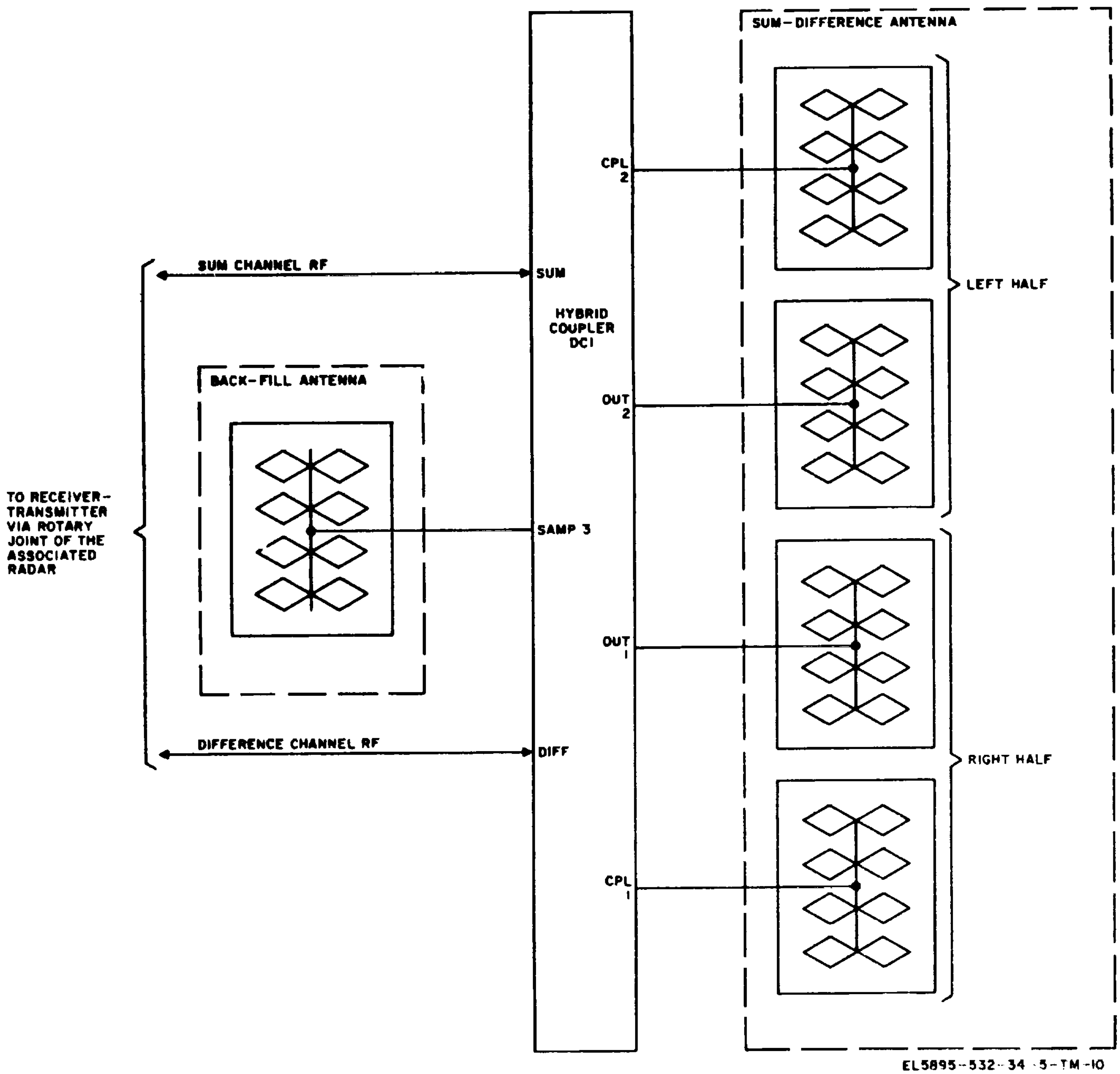


Figure 2-4. Fourteen-foot antenna, block diagram.

phase (added) for delivery to the rotary joint via the SUM port; and are combined out of phase (subtracted) for delivery to the rotary joint via the DIFF port.

b. Antenna. The 14-foot antenna is a longer version of the 7-foot antenna, utilizing similar electrical and mechanical design techniques. The increased length is obtained by using 16 dipoles in the sum-difference antenna instead of the 10 used in the 7-foot antenna. The sum-difference antenna consists of a vertically-polarized array of 16 fullwave printed circuit dipoles in two half-arrays (left-half and right-half). Each half-array contains two independently connected (fed) sections of four dipoles each. Each section of the left and right halves of the sum-difference antenna is fed separately to obtain two different radiation patterns similar to that of the 7-foot antenna (fig. 2-3). Single array of four printed circuit dipoles is used for backfill difference channel radiation instead of the two separate dipoles as used in the 7-foot antenna. The increased length of the 14-foot antenna results in increased gain and narrower beamwidth. The azimuth beamwidth at the 3-dB points is 4.5° compared to 9° for the 7-foot antenna. The effective beamwidth with isls operation also is reduced from 5 degrees to 2.5°

Section III. ANTENNA POSITIONING CIRCUITS OVERALL FUNCTIONAL DESCRIPTION

2-7. General

The antenna positioning circuits, which control the azimuth of the iff antenna, operate in either of two modes, external or internal, depending on the source of command signals. The circuits are normally operated in the external mode, with radar antenna azimuth data from the radar as the external command signal. In this mode, the antenna positioning circuits synchronize (slave) the iff antenna azimuth to the radar antenna azimuth, and because the radar indicator azimuth also is slaved to the radar antenna azimuth, the external mode results in a combined radar-iff display in which the radar video and iff display video are synchronized in azimuth. The internal mode is basically a radar-casualty mode in which an internal command signal is provided to rotate the iff antenna independently and continuously at any one of 10 manually-selected speeds in the range from 25-rpm counterclockwise (ccw) to 25-rpm clockwise (cw). This mode can provide an iff-only indicator display at the radar, if the radar is one which normally supplies radar antenna azimuth to the antenna positioning circuits as a synchro signal, and if the radar contains an indicator whose azimuth can be slaved to a synchro signal. While operating in the internal mode, the antenna positioning circuits supply such radars with a synchro signal representing iff antenna azimuth, and the iff-only indicator display is obtained by slaving the radar indicator azimuth to the iff antenna position synchro signal.

2-8. Modes of Operation

(fig. FO-2)

a. The complete antenna positioning circuits functional block diagram shows all signal paths, switching options, and adjustments, using logic symbols, block function symbols, and standard schematic symbols where necessary for clarity.

b. The antenna positioning circuits can be set up, during installation, to use any one of the following forms of radar antenna azimuth data in the external mode of operation:

Type of signal	*Speed*	*Reference voltage*
Synchro	1X	115 vac, 60 Hz
Synchro	1X	115 vac, 400 Hz
Resolver	1X	26 vac, 4 kHz

c. The installation setup of the antenna positioning circuits for the available radar antenna azimuth signal involves three procedures: the proper connection of P1 of the zero adjust module in the antenna control assembly, the proper connection of P1 in the pedestal, and the proper setting of the SYNCHRO REF and EXT REF FREQ selector switches on the chassis of the antenna control assembly.

(1) Azimuth zero adjust module 1A2A4 contains a synchro and a resolver for adjustment of radar azimuth signals. When synchro radar antenna azimuth is supplied, P1 of the zero adjust module 1A2A4 is connected to J2 in the antenna control assembly, connecting the synchro. When resolver radar antenna azimuth is supplied, P1 of the zero adjust module is connected to J1 in the antenna control assembly, connecting the resolver.

(2) The pedestal contains a synchro and a resolver for the detection of iff antenna position error. When synchro radar antenna azimuth is supplied by the associated radar, 3A2P1 is connected to 3A2J8, connecting the synchro. When resolver radar antenna azimuth is supplied by the associated radar, 3A2P1 is connected to 3A2J9, connecting the resolver.

(3) SYNCHRO REF switch 1A2S4 and EXT REF FREQ switch 1A2S5 are located on the chassis of the antenna control assembly. SYNCHRO REF switch 1A2S4 is effective only in the internal mode of operation. In this mode, synchro 3A2A10B1 in the pedestal generates iff antenna azimuth data which can be supplied to the associated radar. SYNCHRO REF switch 1A2S4 selects the source of the rotor voltage for synchro 3A2A10B1. When in the EXT position, the SYNCHRO REF switch selects the reference voltage from the associated radar. When in the INT position, the SYNCHRO REF switch selects the ac power voltage of the antenna control assembly. EXT REF FREQ switch 1A2S5 is set to the frequency of the radar reference voltage, 60 Hz, 400 Hz, or 4 kHz. Each position selects the proper phase and amplitude compensation for the corresponding radar reference voltage. d. The functioning of the antenna positioning circuits in the external mode (ANT SYNC switch 1A2S1 at EXT) is discussed in sections IV and V. Operation in the internal mode (1A2S1 at INT) is discussed in section VI. The antenna positioning self-test and monitoring circuits are discussed in section VII. The power supply circuits are discussed in section VIII.

Section IV. ANTENNA POSITIONING CIRCUITS (EXTERNAL MODE-SYNCHRO RADAR ANTENNA AZIMUTH) FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

2-9. General

The description of the antenna positioning circuits in the external mode of operation, using synchro radar antenna azimuth, is contained in this section. To enable the antenna positioning circuits to use synchro radar antenna azimuth, certain connections and switch settings must be made on the antenna control assembly and pedestal during installation. The significance of switch settings and connections is described in paragraph 2-8c. The external mode of operation is selected by placing ANT SYNC switch S1 on the front panel of the antenna control assembly to the EXT position.

2-10. Azimuth Zero Adjustment

(fig. FO-2)

The synchro radar antenna azimuth input consists of a three-wire synchro signal (S1, S2, S3) with its two-wire reference (rotor) voltage. The synchro signal designations S1, S2, and S3 correspond to the source connections at a 1X synchro control transmitter (CX) in the radar which rotates counterclockwise for increasing (clockwise) radar antenna azimuth. If instead, the CX rotates clockwise for increasing (clockwise) radar antenna azimuth, the connections to S1 and S3 must be transposed. The synchro signal is delivered through ANT SYNC switch 1A2S1, when an EXT, to J2 of the antenna control assembly. With P1 of zero adjust module 1A2A4 connected to J2, the radar antenna azimuth synchro signal is applied to the stator of control differential transmitter (CDX) 1A2A4B1. This CDX electrically adds its shaft angle to the radar antenna azimuth angle and delivers the result from its rotor as an adjusted radar antenna azimuth signal. The shaft of 1A2A4B1 is adjusted by means of the AZ ADJ shaft to correct for any angular difference between the iff antenna azimuth zero in the pedestal and the radar antenna azimuth zero at the radar. The adjusted radar antenna azimuth signal from 1A2A4B1 is routed through the ANT SYNC switch 1A2S1, when at EXT, to the pedestal.

2-11. Azimuth Error Detection

(fig. FO-2)

Within pedestal 3A2, control transformer (CT) A10B1 compares its shaft angle with the angle represented by the adjusted radar antenna azimuth signal at its stator. The ac rotor voltage of A10B1 is proportional to the difference and is called the iff azimuth error signal. This error signal has an amplitude of approximately 1.0 vac per degree of error (for small errors) and is either in phase or 180 degrees out of phase with the radar reference voltage, depending on the direction of error. The shaft of B1 in the pedestal is geared to rotate at 1:1 with the iff antenna. The iff azimuth error signal is sent to servo preamplifier card 1A2A2 and through the

ANT SYNC switch, when at EXT, to t1i/selftest card 1A2A3.

2-12. Azimuth Error Preamplification
(fig. FO-2)

a. The iff azimuth error signal is routed through summing resistor R24 on servo preamplifier card 1A2A2 where it is algebraically summed with the ac acceleration feedback voltage from summing resistor R21. The acceleration feedback voltage derived from the iff tachometer feedback voltage (para 2-14b) is applied to external mode damping potentiometer R1. The portion of the dc tachometer feedback provided by R1 is a dc velocity feedback voltage, which when differentiated by capacitor C1 and resistor R1 (bleeder R22 has too high a value to significantly affect the differentiation) and chopped by Q7/Q9 out of phase with the radar reference voltage, becomes an ac acceleration feedback voltage which subtracts from the iff azimuth error signal (discussed in para 2-14b). Phase splitter Q8, ac amplifiers Q5 and Q6, and demodulators Q1/Q2 and Q3/Q4 form a synchronous demodulator that produces a dc output whose magnitude is proportional to the iff azimuth error signal and whose polarity dictates whether the velocity of the drive motor should momentarily increase or decrease to correct for the error.

b. The third input to the servo preamplifier card is a phased radar reference voltage, which is used to switch chopper Q7/Q9 and demodulators Q1/Q2 and Q3/Q4 alternately on and off. The phase and amplitude of the radar reference voltage is adjusted on mode switching card 1A2A1 by means of an RC network. The phase shift is introduced in the reference voltage to compensate for the small but constant phase shift of the radar azimuth data produced by the imperfect transformer coupling through the azimuth zero adjust module and the CT in the pedestal. The amplitude of the radar reference voltage is adjusted to compensate for the lower amplitude of the 4-kHz reference, only 26 volts, as compared to 115 volts for the 60-Hz and 400-Hz radar reference voltages. The compensation for each reference frequency is selectable by EXT REF FREQ switch 1A2S5.

c. On servo preamplifier card 1A2A2, the ac iff azimuth error signal, with ac acceleration feedback from chopper Q7/Q9, is split in phase by phase splitter Q8 for delivery to ac amplifier Q6 with no phase reversal, and to ac amplifier Q5 with a 180° phase reversal. Both signals are then amplified and applied to demodulators Q1/ Q2 and Q3/Q4 1800 out of phase with each other. The demodulator stages are electronic switches which are alternately switched on and off by separate portions of the phased radar reference voltage supplied from two secondary windings of reference transformer 1A2T1. During the first half of each cycle of the phased radar reference voltage, demodulator Q1/Q2 is switched on and demodulator Q3/Q4 is switched off; during the second half of each cycle Q1/Q2 is switched off and Q3/Q4 is switched on. Resistor R5 is therefore connected to the output of ac amplifier Q5 during the first half of each reference voltage cycle and the output of ac amplifier Q6 during the second half of the cycle. Because the amplified error signal outputs of Q5 and Q6 are 180° out of phase with each other, and the demodulators are switched on during alternate half cycles of the phased radar reference voltage, the polarities of the error signal outputs switched to R5 by the demodulators always agree. The voltage delivered through resistor R5 to capacitor C4 is therefore a synchronous full-wave rectified error voltage whose magnitude is determined by the difference between iff antenna azimuth and radar antenna azimuth, and whose polarity depends on whether the iff antenna azimuth is greater or less than the radar antenna azimuth.

d. The resistor-capacitor network composed of R5, R13, R20, C4, and 1A2C1 is the servo lag network. The servo lag network shapes the frequency response curve of the overall error amplifier (servo amplifier) formed by the elements in the electronic path from the CT in the pedestal, to motor-tachometer 3A2MG1. The lag network shapes the frequency response curve to provide full servo amplifier gain at the low frequencies that correspond to actual antenna positioning requirements, but to provide a gain reduction with increasing frequency in regions where unstable performance or hunting would take place. For small low frequency error signals, where the error is constant or changing at a slow rate, the capacitive reactance of capacitors C4 and 1A2C1 is high. Therefore, the overall servo amplifier gain is determined by the divider network of R5, R13, R20, and the setting of the external loop gain adjustments on electronic control amplifier 1A2A7. For small higher frequency error signals, the impedance of the series parallel combination of R13, R20, and 1A2C1 starts to drop causing a reduction in the overall servo amplifier gain. The reduction in gain prevents the start of sustained oscillations in the servo loop. Diodes CR1 and CR2 produce this same gain reducing effect for large amplitude low-frequency error signals (greater than approximately 0.7-volt) from demodulators Q1/Q2 and Q3/Q4, and prevent errors from developing large charges on 1A2C1. At very high error signal frequencies, approaching the ripple frequency in the output from demodulators Q1/Q2 and Q3/Q4 (in 60 Hz operation), the reactance of C4 drops to a point where it starts to have an effect. At still higher frequencies C4 is effectively a short to ground and the gain of the servo amplifier drops to zero.

2-13. Azimuth Error Power Amplification
(fig. FO-2)

When ANT SYNC switch 1A2S1 is at EXT, the preamplified iff azimuth error from servo preamplifier card 1A2A2 is applied to electronic control amplifier 1A2A7. Within the electronic control amplifier, the preamplified iff azimuth error is adjusted in amplitude by GAIN A 60 HZ potentiometer R102 for 60-Hz power frequency operation or by GAIN G 400 HZ potentiometer R103 for 400-Hz power frequency operation and applied to a three-signal summing point at the input of the chopper-stabilized amplifier circuit. The 115 vac frequency is sensed by the 60-400 Hz switch circuit which automatically selects the proper gain, adjustment. The other two signals at the summing point are the internal mode rpm command from GAIN B potentiometer R104 and the internal mode tachometer feedback from GAIN H potentiometer R105, both of which are externally shorted to ground when the ANT SYNC switch is at EXT. In the chopper-stabilized dc amplifier circuit, the iff azimuth error is chopped to ac, amplified, and then synchronously demodulated to a push-pull dc output that controls the scr bridge triggering circuit. The scr bridge triggering circuit, in turn, controls the cw and ccw scr bridges. Both scr bridges received 115 vac 60-Hz or 400-Hz primary ac power, but neither bridge conducts until triggered by the triggering circuit. When the polarity of the preamplified iff azimuth error input to the electronic control amplifier is negative which calls for cw iff antenna rotation, the cw scr bridge is triggered. The bridge is triggered once during the positive excursion of the ac line voltage, and conducts until the polarity of the line voltage reverses again. This process is repeated for each cycle of the line voltage and results in a rectified output that causes antenna drive motor 3A2MG1 to rotate cw. The time during each cycle of the line voltage at which the scr bridge is triggered determines the scr conduction angle, and thereby determines the average current delivered on the motor drive lines to 3A2MG1. The motor drive current, in turn, determines the torque (and therefore the rpm) of 3A2MG1. A positive preamplified iff azimuth error input to the electronic control amplifier, which calls for ccw iff antenna rotation, causes the ccw scr bridge to be triggered, and results in ccw rotation of 3A2MG1. A sample of the motor drive current being supplied by the electronic control amplifier is obtained from current transformer T4, whose primary winding is in series with the common ac power input to the two scr bridges. The secondary voltages from T4 are applied to the current limiting circuit, which supplies a gain control voltage to the chopper-stabilized dc amplifier circuit. When the motor drive current exceeds a preset value established by the setting of CUR LIMIT adjust, R101, the effective gain of the chopper-stabilized dc amplifier circuit is reduced, resulting in reduced amplitude of the push-pull dc signal applied to the scr triggering circuit. This in turn, reduces the conduction angle of the scr bridge being triggered, thereby limiting the average motor drive current output.

2-14. Antenna Drive and Tachometer Feedback.
(fig. FO-2)

a. Antenna drive motor 3A2MG1 is a shunt-field dc motor with a permanent-magnet-field dc tachometer. The motor field is excited by the unfiltered dc output of a bridge rectifier located in the antenna pedestal. Its armature input is the motor drive supplied by electronic control amplifier 1A2A7. The motor rotates in response to the motor drive input at its armature, turning the iff antenna and the shaft of the CT in the pedestal in the proper direction and speed reducing the iff error signal from the rotor winding of the CT. The rotation becomes stabilized when the iff antenna is tracking the rotation of the radar antenna with just the small lag required to obtain an iff azimuth error large enough to rotate the iff antenna at the same rpm at which the radar antenna is rotating.

b. The permanent-magnet-field dc tachometer in 3A2MC-1 supplies a dc velocity feedback to servo preamplifier card 1A2A2 through the ANT SYNC switch, when at EXT. When the antenna drive motor is rotating at a constant speed, the velocity feedback is constant and has no effect on the operation of the servo loop.

When the servo loop is accelerating or decelerating in response to a large iff azimuth error, such as occurs at start-up or when the radar antenna speed is changed, the tachometer feedback changes with the changing drive motor rpm. On the servo preamplifier card, a portion of the change in tachometer feedback voltage from external mode damping potentiometer R1 is differentiated through capacitor C1 to produce a dc acceleration feedback voltage. The dc acceleration feedback voltage is chopped to ac by Q7/Q9 out of phase with the radar reference voltage and then is summed with the ac error voltage at the input to phase splitter Q8. The effect of the ac acceleration feedback is to oppose and reduce the error voltage so that the motor does not accelerate or decelerate too rapidly, thus minimizing the possibility of hunting.

Section V. ANTENNA POSITIONING CIRCUITS (EXTERNAL MODE-RESOLVER RADR ANTENNA AZIMUTH) FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

2-15. General

The description of the antenna positioning circuits in the external mode of operation, using resolver radar antenna azimuth, is contained in this section. To enable the antenna positioning circuits to use resolver radar antenna azimuth, certain connections and switch settings must be made on the antenna control assembly and pedestal during installation. The significance of switch settings and connections is described in paragraph 2-8*c*. The external mode of operation is selected by placing the ANT SYNC switch on the front panel of the antenna control assembly to the EXT position.

2-16. Azimuth Zero Adjustment

(fig. FO-2)

The resolver radar antenna azimuth input consists of a four-wire resolver signal (S1, S2, S3, S4) with its two-wire reference (rotor) voltage. The resolver signal designations S1, S2, S3, and S4 correspond to the source connections at the resolver CX in the radar which rotates ccw for increasing cw radar antenna azimuth. If instead, the CX actually rotates cw for increasing (cw) radar antenna azimuth, the S2 and S4 (sine) connections must be transposed. The resolver signal (S1, S2, S3, S4) is delivered directly to azimuth zero adjust module 1A2A4, where it is applied to the stator of CDXA10B2. The CDX electrically adds its shaft angle to the radar antenna azimuth and delivers the result from its rotor as an adjusted radar antenna azimuth signal. The shaft of B2 is adjusted by means of the AZ ADJ shaft to correct for any angular difference between the iff antenna azimuth zero in the pedestal 3A2 and the radar antenna azimuth zero at the radar. The adjusted radar antenna azimuth signal from B2 is sent to the pedestal 3A2.

2-17. Azimuth Error Detection

fig. FO-2)

Within the pedestal 3A2, CTA10B2 compares its shaft angle with the angle represented by the adjusted radar antenna azimuth signal at its stator. The ac rotor voltage of CTA10B2 is proportional to the difference angle and is called the iff azimuth error signal. The error signal is sent to the antenna control assembly 1A2 and applied to servo preamplifier card 1A2A2, and through the ANT SYNC switch, when at EXT, to t1i/ self-test card 1A2A3.

2-18. Azimuth Error Amplification and Antenna Drive

The remainder of the processing of the azimuth error signal is the same as described in paragraphs 2-12 through 2-14.

Section VI. ANTENNA POSITIONING CIRCUITS (INTERNAL MODE) FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

2-19. General

The description of the antenna positioning circuits in the internal mode of operation is contained in this section. The internal mode of operation is selected by placing the ANT SYNC switch on the front panel of the antenna control assembly to the INT position.

2-20. Motor Direction and Speed Selection
(fig. FO-2)

In the internal mode of operation, servo preamplifier card 1A2A2 is not used. ANT SYNC switch 1A2S1, when at INT, grounds the preamplified iff azimuth error signal from 1A2A2. A de internal mode rpm command signal, whose polarity indicates the desired direction and whose magnitude indicates the desired speed of rotation, is sent from INT ANT SYNC RPM switch 1A2S2 to electronic control amplifier 1A2A7.

2-21. Error Amplification and Tachometer Feedback
(fig. FO-2)

The dc internal mode rpm command is converted to a dc motor drive signal by electronic control amplifier 1A2A7, and the iff antenna begins to rotate. As the antenna speed increases, the internal mode tachometer feedback, which is summed with the rpm command signal in the electronic control amplifier, increases and subtracts from it. GAIN B potentiometer R104 and GAIN H potentiometer R105 in the electronic control amplifier are adjusted so that the speed of the antenna stabilizes at the selected rpm, thereby providing a means of calibrating the antenna speed.

2-22. Azimuth Data Generation
(fig. FO-2)

If the associated radar supplies a synchro radar antenna azimuth signal to the radar indicator and the antenna positioning circuits, the antenna positioning circuits are aligned to this signal in the external mode of operation. If a failure in the associated radar causes the loss of the radar antenna azimuth synchro signal, an iff-only display can be obtained by switching the antenna positioning circuits to the internal mode and supplying the adjusted iff antenna azimuth signal to the indicator of the associated radar. CX synchro 3A2A10B3 is electrically zeroed to CT synchro 3A2A10B1. Therefore, the output of 3A2A10B3 corresponds to the adjusted radar antenna azimuth in the external mode of operation. The output of 3A2A10B3 is applied to CDX B1 in zero adjust module 1A2A4, via ANT SYNC switch 1A2S1, when at INT, regardless of whether the zero adjust module is connected for synchro or resolver radar antenna azimuth data. The CDX electrically subtracts its shaft angle from the iff antenna azimuth signals from CX 3A2A1OBS. This is the same shaft angle added to the radar antenna azimuth to obtain the adjusted radar antenna azimuth. Therefore, the output of the CDX, which is called the adjusted iff antenna azimuth, is equivalent to the radar antenna azimuth synchro signal. Since the indicator of the associated radar has been aligned to the radar antenna azimuth synchro, an iff-only display can be obtained by substituting the equivalent adjusted iff antenna azimuth signal.

Section VII. SELF-TEST AND MONITORING CIRCUITS FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

2-23. General

This section contains a description of the circuits which are used for monitoring and aligning the antenna positioning circuits. The self-test circuits automatically monitor the overall operation of the antenna positioning circuits and light the ANT LAG FAULT indicator lamp if improper operation is detected. The metering circuits provide a manual means of monitoring the dc power supply voltages and the preamplified azimuth error signal within the antenna control assembly. The antenna zero pulse generator provides an indication on the ppi display for checking the alignment of the iff antenna with the antenna of the associated radar.

2-24. Self-Test Circuits
(fig. FO-2)

a. General. The performance of the antenna positioning circuits is monitored by the circuits on t1i/self-test card 1A2A3. In the external mode, these circuits receive the iff azimuth error signal and indicate a fault (ANT LAG) whenever the amplitude of the iff azimuth error signal exceeds a value corresponding to approximately ±2 degrees of error. In the internal mode, these circuits compare the iff tachometer feedback voltage with a reference voltage and indicate a fault (ANT LAG) whenever the comparison reveals an iff antenna rpm error greater than approximately ±20 percent.

b. External Mode Self-Test. As long as the iff antenna azimuth is equal to the radar antenna azimuth within approximately ± 2 °, the amplitude of the iff azimuth error voltage is too low at the output of emitter follower Q7 to activate Schmitt trigger Q8/Q9. The quiescent high output of the Schmitt trigger turns on relay driver Q6 and thereby energizes fault relay K1. With the fault relay energized (no fault), ANT LAG FAULT indicator lamp 1A2DS3 is off and the antenna lag fault enable output to the control system is a ground. When the iff antenna azimuth differs from the radar antenna azimuth by more than approximately ± 2 °' the amplitude of the iff azimuth error voltage at the output of emitter follower Q7 on the t1i/self-test card is high enough to activate Schmitt trigger Q8,Q9. The activated (low) output of the Schmitt trigger turns off relay driver Q6 and thereby deenergizes fault relay K1. With the fault relay deenergized (fault), ANT LAG FAULT indicator lamp 1A2DS3 is lighted, and an open antenna lag fault output is applied to the control box. The 400-Hz self-test threshold adjustment, R3, is connected in the circuit when operating in the external mode with 400-Hz radar antenna azimuth signals. This adjustment is necessary to compensate for the higher fault detection sensitivity at 400-Hz.

c. Internal Mode Self-Test. In the internal mode of operation, the internal mode tachometer feedback (self-test) is compared to a fixed positive or negative reference voltage, depending on whether cw or ccw rotation is selected at INT ANT SYNC RPM switch 1A2S2. The internal mode tachometer feedback (self-test) is derived by feeding the iff tachometer feedback through a series resistance on mode switching card 1A2A1. The value of the series resistance is selected by the INT ANT SYNC RPM switch so that the internal mode tachometer feedback (selftest) voltage will be equal to the self-test reference voltage when the iff antenna is rotating at the selected rpm. The internal node tachometer feedback (self-test) is compared to the self-test reference voltage by differential amplifier Q1/Q2/ Q3 on t1i/self-test card 1A2A3. If the rpm of the antenna is different than that selected at the INT ANT SYNC RPM switch, the internal mode tachometer feedback (self-test) will be different from the self-test reference voltage, causing the differential amplifier to be unbalanced. When the differential amplifier is unbalanced, the output voltage of one of its outputs will drop. This drop in voltage will be applied to the input of amplifier Q10, via CR4 or CR5 and emitter followers Q5 and Q4. If the rpm of the iff antenna is within approximately ± 20 percent of the selected rpm, the output of amplifier Q10 will be too low to activate Schmitt trigger Q8/Q9, via isolation diode CR7 and emitter follower Q7. The quiescent high output of the Schmitt trigger will turn on relay driver Q6, thereby energizing fault relay K1. With the fault relay energized (no fault), ANT LAG FAULT indicator lamp 1A2DS3 is off and the ant lag fault enable will be ground. If the rpm of the iff antenna differs from the selected rpm by more than approximately ± 20 percent, the differential amplifier will be further unbalanced resulting in a lower input to amplifier Q10. The lower voltage input to Q10 will cause its output to become high enough to activate the Schmitt trigger, via isolation diode CR7 and emitter follower Q7. When activated, the Schmitt trigger provides a low output, which turns off relay driver Q6, thereby de-energizing fault relay K1. With the fault relay de-energized (fault), ANT LAG FAULT indicator lamp 1A2DS3 is lighted and an open circuit antenna lag fault en-
able output is applied to the control box.

2-25. Metering Circuits

(fig. FO-2)

The metering circuits consist of PWR SUP TEST/NULL meter 1A2M1 and METER switch 1A2S3. In the +12V and -12V positions of 1A2S3, the +12 volt and -12 volt supplies are monitored for an output within tolerance. In the AZ COARSE and AZ FINE positions of 1A2S3, coarse and fine indications of the negative values of preamplified iff azimuth error voltage are indicated on meter 1A2M1. The null of the preamplified iff azimuth error voltage is used during installation to adjust the servo system of the antenna positioning circuits to the servo system of the associated radar.

2-26. Antenna Zero Pulse Generation

(fig. FO-2)

The antenna zero pulse is generated when magnetic reed switch 3A2S1 is actuated by a permanent magnet mounted on the azimuth ring of the antenna pedestal. During the installation, when the iff antenna is aligned with the radar antenna, the azimuth ring is adjusted so that the magnetic reed switch is actuated when the iff antenna passes through zero azimuth. Therefore, a low antenna zero pulse is sent to the synchronizer each time the iff antenna points to zero azimuth. The antenna zero pulse is used by the synchronizer to produce an indication on the ppi when the iff antenna passes through zero azimuth. This indication is selectable at the control box for the purpose of periodically checking the alignment of the iff antenna with the radar antenna.

Section VIII. POWER SUPPLY CIRCUITS FUNCTIONAL BLOCK DIAGRAM DESCRIPTION

2-27. General

The power supply circuits receive 115 volts ac, 60or 400-Hz, from the power distribution circuits of the iff set. The power supply circuits control the distribution of ac power and supply dc voltages to the antenna positioning circuits.

2-28. Ac Power Distribution

(fig. FO-3)

POWER circuit breaker 1A2CB1 controls the application of 115 volts ac to all the circuits within the antenna control assembly. With 1A2CB1 in the ON position, POWER indicator lamp DS1 will be lighted by 12.7 volts from transformer T1 in the power supply module 1A2A5. POWER EAC circuit breaker 1A2CB2, AZ DRIVE switch 3A2S2, and interlock circuit 1A2K1/K2 control the application of 115 volts ac to the scr bridge circuits of the electronic control amplifier. Without ac power to the scr bridge circuits, the electronic control amplifier cannot generate a motor drive to rotate the iff antenna. With the POWER EAC circuit breaker In the ON position, 115 volts ac is applied to the interlock circuit. If both POWER circuit breaker 1A2CB1 and AZ DRIVE switch 3A2S2 are in the ON position, the interlock circuit will apply 115 volts ac to the scr bridge circuits of the electronic control amplifier via electronic control amplifier filter 1A2A6. The 115 volts ac from the interlock circuit is also applied to transformer T2 where it is reduced to 12 volts ac to light POWER ECA indicator lamp DS2. AZ DRIVE switch S2 on the pedestal enables maintenance personnel to place the antenna in a safe condition for maintenance by disabling the antenna drive. With the AZ DRIVE switch in the OFF SAFE position, 115 volts ac will not be passed by the interlock circuit in the antenna control assembly. Without 115 volts ac applied to the scr bridge circuits of the electronic control amplifier 1A2A7, via electronic control amplifier filter 1A2A6, the antenna drive is disabled.

2-29. Dc Voltage Generation

(fig. FO-3)

The dc voltages required by the antenna positioning circuit are supplied by power supply 1A2A5. Transformer T1 in the power supply receives 115 volts ac from the POWER circuit breaker CB1. Two identical secondary outputs of T1 apply ac voltage to bridge rectifiers CR1 and CR2. The outputs of the bridge rectifiers are applied to identical current limiter and voltage regulator circuits. Current limiter and voltage regulator circuit Q1/Q2 supplies a regulated + 12 volts dc. Current limiter and voltage regulator Q3/Q4 supplies a regulated -12 volts dc. The output of bridge rectifier CR1 also is used as an unregulated 28-volt dc supply.

2-30. HAWK Radar Interlock Circuit

(fig. FO-3)

When operating with the HAWK radar, +28 volts dc is applied to AZ DRIVE switch 3A2S2 in the antenna pedestal. Depending on the position of the AZ DRIVE switch, switched +28 volts dc is or is not applied to the HAWK radar. The switched +28 volts dc is used by interlock circuits in the HAWK radar for the prevention of iff antenna rotation during maintenance. For a further description of the interlock circuits in the HAWK radar refer to the applicable HAWK radar technical manual.

Section IX. POWER SUPPLY SCHEMATIC DIAGRAM DESCRIPTION

2-31. General

(fig. FO-9)

The power supplies used to generate the + 12 and -12 vdc operate identically, therefore, only the +12 vdc supply is discussed. Full wave rectified and filtered de is voltage and current regulated.

2-32. Voltage Regulation

If the output voltage tends to increase, the voltage at the emitter of voltage regulator Q2 tends to increase. Since the base of Q2 is held at a constant voltage by zener diode VR1, the current through Q2 increases, thus increasing the voltage drop across Q1 and R1 and decreasing the voltage output at P1-7.

2-33. Current Regulation

If the output current increases, the voltage across current sensing resistor R1 increases, thus increasing the voltage at the emitter of Q1. Since the base of Q1 is held at a constant voltage by zener diode VR1, the current through Q1 decreases, thus decreasing the current output at P1-7. If the current continues to increase, the voltage across R1 increases until Q1 is cut-off.

CHAPTER 3
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. INTRODUCTION

3-1. General

a. This chapter contains direct support maintenance instructions for the antenna control assembly, 7-foot antenna, pedestal, 14-foot antenna, and the pedestal adapter assembly. Direct support maintenance for each assembly is covered as follows:

Antenna control assembly .... Section II
Seven-foot antenna .... Section III
Pedestal .... Section IV
Pedestal adapter assembly .... Section V
Fourteen-foot antenna .... Section VI

b. The antenna control assembly must be aligned when installed at a site. When a mobile site is moved from one location to another, no realignment of the antenna control assembly is required. Refer to TM 11-5895-532-12 for the antenna control assembly alignment procedure.

3-2. Tools Required

The tools required for direct support maintenance are listed below:

Tool nomenclature	*Manual*
Tool Kit, Electronic Equipment TK-100/G	SB 11-04
Tool Kit, Interrogator Set TK-228/TPX-46(V)	TM 11-5895-532-12

3-3. Test Equipment Required

The test equipment required for direct support maintenance is listed below:

Test equipment nomenclature	*Common name*	*Technical manual*
Multimeter TS-352B/U	Multimeter	TM 11-6625-366-15

3-3.1. Materials Required

The materials required for direct support maintenance are listed below:

Material nomenclature	*NSN*
Insulating varnish, electrical	5970-00-647-3676
Grease, Aircraft and Instrument (MIL-G-23827)	9150-00-985-7245

Section II. ANTENNA CONTROL ASSEMBLY

3-4. Removal of Antenna Control Assembly

NOTE

To maintain the code in the interrogator computer, the MODE 4 switch must be held in the guarded CODE HOLD position for at least 15 seconds prior to, and during, the time at which the POWER circuit breaker on the control box is placed in the OFF position.

a. Refer to above note if it is desired to maintain code in interrogator computer. Place POWER circuit breaker on control box in OFF position.

b. Loosen 10 captive screws on front panel of antenna control assembly.

c. Pull out antenna control assembly until outgoing slide locks are engaged.

CAUTION

To avoid damage to P5 and P4 during steps *d* and *e*, the spring-loaded cable return arm must be held in the extended position.

d. Disconnect P5 and P4 of the c-d group case from J3 and J4 of antenna control assembly.

e. Open cable clamp on left rear of antenna control assembly by turning fastening screw one-quarter turn counterclockwise. Remove cables and carefully place them inside the group case.

f While grasping chassis of antenna control assembly on sides about halfway back from front panel, depress outgoing slide locks on each of slide tracks and carefully pull antenna control assembly forward until it is free of slides of c-d group case.

3-5. Replacement of Antenna Control Assembly

a. While grasping chassis of replacement antenna control assembly, at its sides about one-half way back from front panel, align slides on the antenna control assembly with extended slides on c-d group case.

CAUTION

To prevent damage to P5 and P4 during steps d and e, the spring-loaded cable return arm must be held in the extended position.

b. Carefully slide antenna control assembly back onto slide of c-d group case until ingoing slide locks are engaged, then depress ingoing slide locks and push antenna control assembly further back until slide locks are engaged.

c. While antenna control assembly is locked in place, connect P5 and P4 of c-d group case to J3 and J4, respectively, of antenna control assembly.

d. Place cables inside cable clamp on rear left of antenna control assembly chassis, close clamp, and turn fastening screw one-quarter turn clockwise.

e. Depress ingoing slide locks and carefully slide antenna control assembly all the way into c-d group case.

f. Tighten 10, captive screws on front panel of antenna control assembly.

Section III. SEVEN-FOOT ANTENNA

3-6. Removal or :even-root Antenna

WARNING

To avoid serious injury due to accidental turn-on of the antenna drive during removal and replacement of antenna, disable the antenna drive by placing the AZ DRIVE switch on the pedestal to the SAFE OFF position.

a. Remove all power from the iff set.

b. If pedestal is mounted on Mast AB-621/G, follow procedures as described in TM 11-5895-532-12.

c. Remove all cables from antenna.

CAUTION

Support the antenna at each end when removing antenna from pedestal or hoist antenna using center lifting eye. Do not use the tilt adjusting strut as a handle.

d. Using the hex T-wrench, remove and retain six socket head capscrews and six washers which secure the antenna support base plate to the pedestal. Remove the antenna.

3-7. Replacement of Seven-Foot Antenna

CAUTION

Support the antenna at each end when positioning the antenna on the pedestal or hoist antenna into position using center lifting eye. Do not use the tilt adjusting strut as a handle.

a. Position the antenna on the pedestal so that the six mounting holes in the antenna support base plate align with the corresponding holes in the antenna mounting plate on the pedestal.

b. Secure the antenna to the pedestal using the six socket head capscrews and lockwashers removed in step 3-6*d.* Tighten the screws with the hex T-wrench.

c. Connect cables (removed in step 3-6*c*) to antenna.

d. If pedestal is mounted on Mast AB-621/G, follow procedures as described in TM 11-5895-532-12.

e. If pedestal is mounted on radar van or tripod, check the level of the radar van or tripod using the spirit levels on the pedestal (fig. 3-2). Refer to the associated radar technical manual for the detailed procedure.

Section IV. PEDESTAL

3-8. General

This section contains direct support removal and replacement, testing voltage and resistance charts, and scheduled maintenance for the pedestal.

3-9. Removal of Pedestal

WARNING

To avoid serious injury due to accidental turn-on of the antenna drive during removal and replacement of pedestal, disable the antenna drive by placing the AZ DRIVE switch on the pedestal to the SAFE OFF position.

a. Remove all power from the iff set.

b. If pedestal is mounted on Mast AB-621/G, follow removal and replacement procedures described in TM 11-5895-532-12. If pedestal is mounted on the tripod or on the radar van, follow the procedures in e through e below.

c. Remove all cables from antenna and pedestal.

CAUTION

Support the antenna at each end when removing antenna from pedestal or hoist antenna using center lifting eye. Do not use the tilt adjusting strut as a handle.

d. Using the hex T-wrench, remove and retain six socket head cap screws and six washers (fig. 3-1) which secure the antenna support base plate to the pedestal. Remove the antenna.

e. Remove and retain four 5/16-inch hex-head screws, four lock washers, eight flat washers, and four hex nuts which secure the pedestal to the mount on the tripod or on the radar van. Remove the pedestal.

3-10. Replacement of Pedestal

a. Place the pedestal upon the mount provided on the radar van or tripod. Align the mounting holes in the pedestal mounting flange with those in the mount.

b. Insert a 5/16-inch diameter hex-head screw equipped with a flat washer (removed in step 3-9*e*) through each of the four mounting holes in the pedestal and mount. Place a flat washer, lockwasher and hex nut on each screw, tighten securely.

CAUTION

Support the antenna at each end when positioning the antenna on the pedestal or hoist antenna into position using center lifting eye. Do not use the tilt adjusting strut as a handle.

c. Position the antenna on the pedestal so that the six mounting holes in the antenna support base plate align with the corresponding holes in the antenna mounting plate on the pedestal.

d. Secure the antenna to the pedestal using the six socket head cap screws and lockwashers removed in step 3-9d. Tighten the screws with the hex T-wrench.

e. Connect cables (removed in step 3--9c.) to antenna and pedestal.

f. If pedestal is mounted on Mast AB-621/G, follow procedures as described in TM 11-5895-532-12.

g. If pedestal is mounted on radar van or tripod, level the radar van or tripod using the spirit levels on the pedestal and referring to the associated radar technical manuals for detailed procedures.

3-11. Testing of Pedestal

WARNING

To avoid serious injury due to accidental turn-on of the antenna drive while testing the pedestal, disable the antenna drive by placing the AZ DRIVE switch on the pedestal to the SAFE OFF position.

a. If the pedestal is mounted on Mast AB621/G, lower mast as described in TM 11-5895532-15.

b. Rotate the antenna slowly by hand and insure that the antenna rotates smoothly.

c. Perform the voltage and resistance measurements in paragraph 3-12.

d. Set SYSTEM POWER circuit breaker 1A5CB1 to OFF and insure that the AZ DRIVE switch is set to SAFE OFF.

e. On the pedestal, disconnect 3A2P1 from 3A2J6.

WARNING

Exercise extreme caution when performing the following steps. Dangerous voltages are present at the pins on 3A2J6.

f. With the pedestal installed in an operating iff set, set the SYSTEM POWER circuit breaker 1A5CB1 to ON.

g. Using the miltimeter, measure the voltage between 3A2J6-H (black probe) and 3A2J6-A (red probe). The voltage should be +300 ± 60 vdc.

h. Set the AZ DRIVE switch to SAFE OFF and the POWER circuit breaker 1A2CB1 to OFF. Check for a voltage indication (on 10 vdc. scale of the multimeter) between pins D and E of cable CX-10773/V (2 ft.), while rotating the antenna slowly by hand.

3-12. Voltage and Resistance Charts for Pedestal (fig. 3-1)

WARNING

Dangerous voltages (120 volts ac) are present on the points at which the pedestal voltage measurements are made.

WARNING

To avoid serious injury due to accidental turn-on of the antenna drive while voltage measurements are being made, disable the antenna drive by placing the AZ DRIVE switch on the pedestal to the SAFE OFF position.

a. Voltage Measurements. All voltage measurements are made with the pedestal installed in an operating iff set. Voltage measurements for the points indicated in the voltage chart are to be taken with the multimeter. Unless indicated otherwise, the tolerance on all voltage measurements is ± 10 percent. To gain access to the test points on test-point block A11A1TB1 in the pedestal, remove the pedestal access plate, loosen the two warning plate retaining screws on the test-point warning plate, and remove the warning plate (fig. 3-1). Before taking the voltage measurements, set the controls of the iff set to the following positions:

Assembly	*Control*	*Position*
Pedestal	AZ DRIVE switch	SAFE OFF
Power control panel of c-d group case	SYSTEM POWER circuit breaker	ON
Control box	POWER circuit breaker	ON
Antenna control assembly	POWER circuit breaker	ON
Antenna control assembly	POWER ECA circuit breaker	OFF

Positive meter lead	*Negative meter lead*	*Meter ac volts range*	*Voltage*	*Notes*
A11A1E1	A11A1E2	1000	115	
A11A1E3	A11A1E4	100	0 to 90	1,2, and 3
A11A1E3	A11A1E5	100	0 to 90	1,2, and 3
A11A1E3	A11A1E4	100	0 to 26	1,3, and 4
A11A1E5	A11A1E6	100	0 to 26	1,3, and 4
A11A1E7	Chassis	100	0 to 66	1,2, and 5
A11A1E7	Chassis	100	0 to 26	1,4, and 5
A11A1E8	A11A1E9	100	0 to 90	5 and 6
A11A1E8	A11A1E10	100	0 to 90	5 and 6

Note

1. ANT SYNC switch 1A2S1 set to EXT.
2. Voltages applicable only when synchro radar antenna azimuth is supplied by associated radar, 3A2P1 connected to 3A2J8.
3. Voltage varies within indicated limits. Actual voltage is dependent on position of associated radar antenna.

Caution. The resolver 3A2B2 in the pedestal will be damaged if 3A2P1 is connected to RESOLVER connector 3A2J9 when synchro radar antenna azimuth data is supplied by the associated radar.

4. Voltage applicable only when resolver radar antenna azimuth is supplied by associated radar, 3A2P1 connected to 3A2J9.
5. Voltage varies within indicated limits, actual voltage depends on relative azimuth of iff antenna and associated radar antenna.
6. ANT SYNC switch 1A2S1 set to INT.

b. Resistance Measurements. Resistance measurements for the points indicated in the resistance chart are to be taken with the multimeter. The tolerance measurements is ± 20 percent.

WARNING

To avoid serious injury due to accidental turn-on of the antenna drive during the following procedure, place the AZ DRIVE switch on the pedestal in the SAFE OFF position. Before making resistance meas-urements, set the POWER switch on the control box to OFF, set the AZ DRIVE switch on the pedestal to SAFE OFF, disconnect the cable connections at 3A2J5 and 3A2J7, dis-connect cable CX-10773/V (2 ft) from 3A2J6, and disconnect A2P1 from A1J1. To gain ac-cess to the test points on test-point block A11A1TB1 in the pedestal, remove the pedes-tal access cover, loosen the two warning plate retaining screws on the test-point block, and remove the warning plate (fig. 3-1).

Positive meter lead	*Negative meter lead*	*Meter ohms range*	*Resistance in ohms*	*Reverse meter ohms range*	*Reverse resistance in ohms*	*Notes*
A11A1E1	A11A1E2	X1K	20K	X1K	20K	
A11A1E3	A11A1E4	X100	1600	X100	1600	1
A11A1E3	A11A1E5	X100	1600	X100	1600	1
A11A1E3	A11A1E4	X1	71	X1	71	2
A11A1E5	A11A1E6	X1	71	X1	71	2
A11A1E8	A11A1E9	X10	27	X10	270	

Positive meter lead	Negative meter lead	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms	Notes
A11A1E8	A11A1E10	X10	270	X10	270	
A11A1E7	J5-c	X10	750	X10	750	1
A11A1E7	J5-c	X1	207	X1	207	2
J5-e	J5-f	X1K	120K	X1K	120K	3
J5-N	J5-o	X1	195	X1	195	
A1J1-D	A1J1-E	X1	320	X1	320	
A1J1-K	A1J1-M	X1	0.5	X1	0.5	
A1J1-A	A1J1-H	X1	330	X1	330	
A2J1-A	A2P1-A	X1	0	X1	0	
A2J1-D	A2P1-D	X1	0	X1	0	
A2J1-E	A2P1-E	X1	0	X1	0	
A2J1-H	A2P1-H	X1	0	X1	0	
A2J1-K	A2P1-K	X1	0	X1	0	
A2J1-M	A2P1-M	X1	0	X1	0	

Notes:
1. 3A2P1 connected to 3A2J8.
2. 3A2P1 connected to 3A2J9.
3. Magnetic switch 3A2S1 deactivated.

3-13. Scheduled Maintenance on the Pedestal

a. General. Scheduled maintenance on the pedestal consists of simultaneous replacement of the drive motor brushes and the pedestal grease cartridge at regular intervals depending on the average speed of the iff antenna at the particular installation site. The interval at which this maintenance is performed versus average antenna rotation speed is as follows:

Antenna speed	*Maintenance interval (months)*
0-6 rpm	12
7-13 rpm	10
13-20 rpm	8
21-25 rpm	6

CAUTION

Check for water or moisture in filter assembly A4MP1 every 3 months (para 7-28v). Decrease inspection intervals as necessary.

NOTE

Remove old sealing compound from parts re-moved during servicing. Reseal with sealing compound when components are replaced and wipe off the excess with solvent.

CAUTION

The harmonic drive must be protected from contamination when replacing the grease cartridge. Remove the pedestal from the iff set and perform the work in a protected area. Take care to prevent dust or dirt from entering the harmonic drive. Removal of the pedestal is covered in chapter 5 of TM 11-5895-532-12.

b. Procedure. To replace the pedestal grease cartridge and the drive motor brushes, place the pedestal on its side on a workbench in a clean sheltered work area and proceed as follows (fig. 3-2):

(1) Remove eight socket-head cap screws and washers securing motor bracket and remove bracket.

(2) Disconnect A2P1 from A1 J1.

(3) Disconnect cable CX-10773/U (2 ft) between J6 and A2J1.

(4) Remove four socket-head cap screws, flat washers, and lockwashers securing motor-tachometer generator (motor) to pedestal and remove motor.

(5) Remove four screws and lockwashers securing the motor and cover. Use a strap wrench only to break the seal between the motor end cover and the brush assembly cover. Be careful not to damage the mating edge of the cover or the ability to seal against water entry will be affected.

(6) Remove three screws and lockwashers securing motor brush assembly cover. Slide motor brush assembly cover towards tachometer assembly to expose motor brushes. If necessary, use a strap wrench to break the cover seal. Do not attempt to pry loose.

WARNING

Compressed air shall not be used for cleaning purposes except where reduced to less than 29 pounds per square inch (psi) and then only with effective chip guarding and personnel protective equipment. Do not use compressed air to dry parts when TRICHLOROTRIFLUOROETHANE has been used. Compressed air is dangerous and can cause serious bodily harm if protective means or methods are not observed to prevent chip or particle (of whatever size) from being blown into the eyes or unbroken skin of the operator or other personnel.

(6.1). Prior to replacing motor brushes all dirt (carbon dust from brushes) and moisture must be removed from within the motor. Dirt may be blown out by using dry compressed air not exceeding 29 pounds per square inch. Higher pressure presents a safety hazard, could loosen the windings, and have a sand blast effect on the insulation. Hot air blowing can be used to force-dry the motor.

NOTE

Replace all four motor brushes. Use stock number NSN 5977-00-279-8451. Unit of issue is: each, I set of four brushes.

(7) To replace each of the four motor brushes, proceed as follows:

(a) Remove 6-32 screw and lockwasher securing brush lead lug and power lead to brush holder assembly Take care to prevent the screws or lockwashers from falling into the motor.

(b) Lift brush spring and remove brush from holder assembly.

(c) Install new brush into the holder assembly and reset the brush spring.

NOTE

Be sure that the motor brush is oriented so that the brush lead is closest to the mounting screw when installed in the brush holder assembly as shown in detail A, figure 3-2. To prevent premature brush hangup, arrange the lug to provide maximum brush lead slack before securing the lug under the mounting screw. Check that the brush spring is properly centered to ensure free movement into the guide slot as the brush wears.

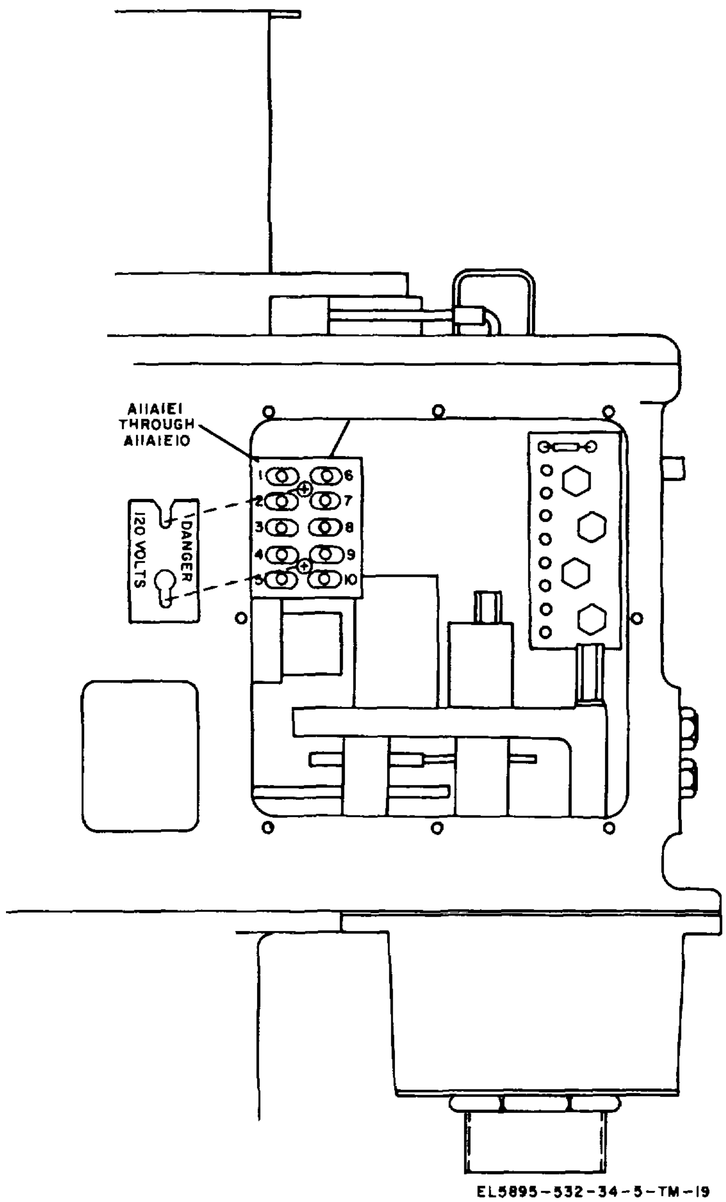


Figure 3-1. Pedestal Test Point and Connector Locations.

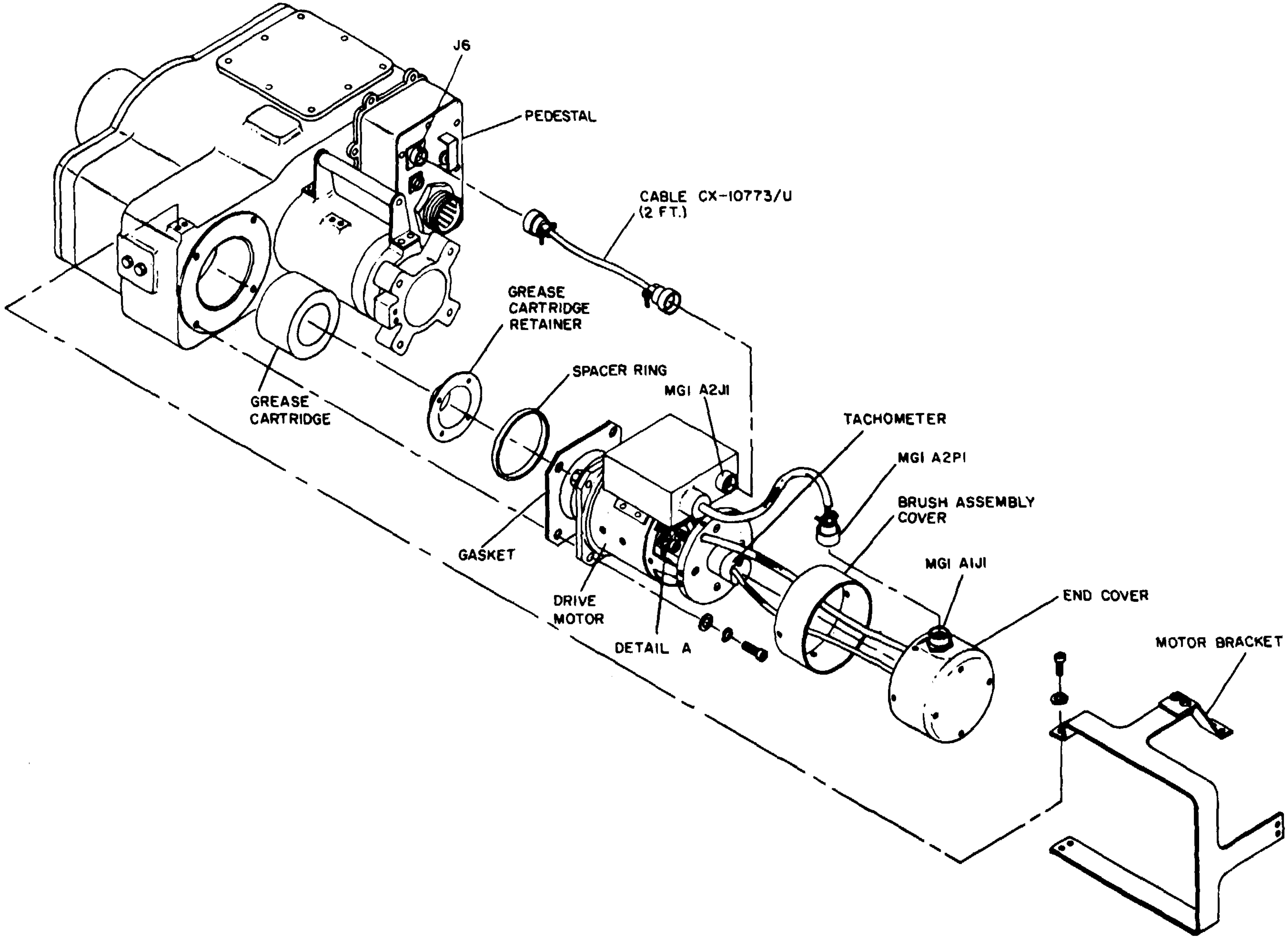
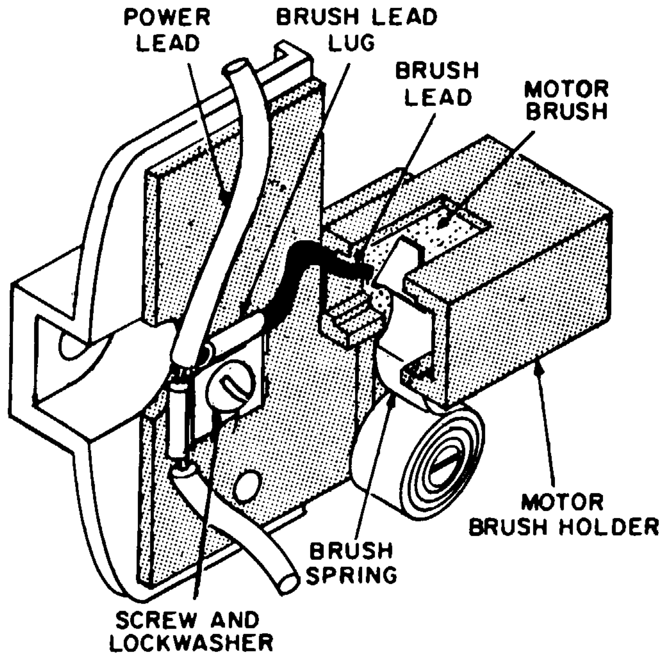


Figure 3-2 (1). Pedestal drive motor brushes and grease cartridge replacement.



DETAIL A. MOTOR BRUSH ASSEMBLY

NOTES

1. BE SURE THAT THE MOTOR BRUSH LEAD IS POSITIONED CLOSEST TO THE MOUNTING SCREW WHEN INSTALLED IN THE MOTOR BRUSH HOLDER.

2. TO PREVENT PREMATURE BRUSH HANG-UP, ARRANGE THE BRUSH LEAD LUG TO PROVIDE MAXIMUM BRUSH LEAD SLACK BEFORE SECURING THE LUG UNDER THE MOUNTING SCREW.

3. CHECK THE CENTERING OF THE BRUSH SPRING TO INSURE THAT IT WIL MOVE FREELY INTO THE BRUSH HOLDER GUIDE SLOT AS THE BRUSH WEARS.

4. CHECK THAT CORNERS AT END OF BRUSH SPRING HAVE BEEN DIAGONALLY CUT TO PREVENT SPRING HANG-UP .

EL5895-532-34-5-C3-TM-16(2)

Figure 3-2 (2). Pedestal drive motor brushes and grease cartridge replacement.

(d) Secure both brush lead lug and power lead lug with a 6-32 screw and lockwasher.

(8) After all brushes have been replaced, apply sealing compound around the motor housing edge that mates with the brush assembly cover. Slide the brush assembly cover over motor brush assembly and secure with three screws and lockwashers. Clean off excess sealant with solvent.

(9) Apply sealing compound around the mating edge of the motor end cover and install. Secure with four screws and lockwashers. Clean off excess sealant with solvent.

(10) Remove spacer ring.

(11) Remove grease cartridge retainer.

(12) Remove grease cartridge.

(13) Completely remove all grease from cartridge chamber using a clean lint-free cloth and methyl-ethyl ketone (per MIL-I-00261C) as a solvent.

(14) Using a hand-operated grease gun, add grease MIL-G-23827 to lubrication fitting at top of pedestal until new grease appears in grease cartridge chamber.

(15) Repeat step (13).

(16) Install new grease cartridge (NSN 5895-00-282-8389).

(17) Replace grease cartridge retainer.

(18) Replace spacer ring.

(19) Replace drive motor in pedestal and secure with four socket-head capscrews, lockwashers and sealant washers.

(20) Connect cable CX-10773/U (2 ft) between J6 and A2J1.

(21) Connect A2P1 to A1J1.

(22) Replace motor guard assembly and secure with six socket-head capscrews and lockwashers.

(23) Using a hand-operated grease gun, add 3.5 fluid ounces of grease MIL-G-23827 to pedestal via lubrication fitting.

Section V. PEDESTAL ADAPTER ASSEMBLY

3-14. Removal of Pedestal Adapter Assembly

Removal and replacement procedures for the pedestal adapter are described in TM 11-5895-532-12.

Section VI. FOURTEEN-FOOT ANTENNA

3-15. Removal and Replacement

Removal and replacement is the only direct support maintenance performed on the 14-foot antenna. Removal and replacement of the 14-foot antenna is covered in the associated radar technical manual.

CHAPTER 4
GENERAL SUPPORT MAINTENANCE INFORMATION

Section I INTRODUCTION

4-1. Purpose

The information contained in this chapter and chapters 5 through 8 of this manual is intended to aid the general support maintenance repairman in locating and correcting equipment trouble causing abnormal operation, and then in checking the serviceability of the repaired equipment. For information pertinent to localizing an iff set problem to an assembly of the iff set, refer to TM 11-5895-532-12 and TM 11-5895-532-34-1.

4-2. Locating an Antenna Control Assembly Problem

An antenna control assembly problem is sectionalized by substitution to the chassis, a module, or a printed wiring card at the organizational or direct support level. If a complete antenna control assembly has been returned, the antenna control assembly chassis must be suspected of being defective. Prior to performing any troubleshooting or repair, the suspect assembly must first be tested and adjusted, when applicable, to verify that the suspect assembly is defective. If the assembly is found to be operating properly, then it is returned to service. If the assembly is found to be defective, the applicable troubleshooting procedure must be performed. The assembly is then repaired and retested before it is returned to service.

4-3. Location a Pedestal Problem

When a pedestal Is suspected of being defective, the pedestal must first be tested to verify that a fault exists. If it is found to be operating properly, it is returned to service. If it is found to be defective, the pedestal is then repaired by general support, if possible. If the pedestal drive train gears are suspected of being defective, the pedestal must be sent to depot maintenance for repair.

4-4. Locating an Antenna Problem

When an antenna is suspected of being defective, the antenna must first be tested to verify that a fault exists. If it is found to be operating properly, it is returned to service. If it is found to be defective, the antenna troubleshooting procedure must be performed. The antenna is then repaired and retested before it is returned to service.

4-5. Troubleshooting Techniques

a. The troubleshooting charts contained in chapters 5 through 8 use printed wiring card test jacks, connector pins, and terminal standoffs to isolate a malfunction to a stage or a group of stages. In some instances it will be necessary to take measurements at intermediate test points such as the terminals of components. To do this it will be necessary to pierce the conformal coating with the test probe. The conformal coating must be restored after repair in accordance with the instructions provided in TM 11-5895-532 34-1.

b. When an abnormal indication is obtained at the output of a stage (after it has been determined that the input to the preceding stage is good) the troubleshooting charts assume that either that stage or a stage which provides an input to it is defective. This assumption may not always be valid, however, since a defective input circuit of a succeeding stage may load the output of a properly functioning circuit. To determine whether an abnormal indication of an active device is caused by the failure of that device or by the failure of a stage which receives its output, unsolder the output lead of the device from the printed wiring card land pattern and check the output again. If a normal indication is now obtained, the input circuit of a succeeding stage is defective. If the indication remains abnormal, the component being checked or a preceeding stage is defective. Conformal coating that is removed when unsoldering connections on printed wiring cards must be restored (refer to TM 11-5895-532-34-1).

Section II. TOOLS AND TEST EQUIPMENT

4-6. Tools Required

The tools required for general support maintenance are listed below:

Tool nomenclature	*Manual*
Heat Gun, Master Appliance Corporation HG-501	
Repair Kit, Printed Wiring Board MK-772/U	
Tool Kit, Electronic Equipment TK-100/G and TK-105G	SB 11-604

4-7. Test Equipment Required

The test equipment required for general support maintenance is listed below:

Test equipment nomenclature	*Common name*	*Technical manual*
Attenuator, fixed 10-dB CN-1024/U	10-dB attenuator	
Coaxial Tuner FXR S102N	Coaxial tuner	
Generator, Signal AN/URM-64	Rf signal generator	TM 11-6625-299-15
Indicator, Standing Wave Ratio IM-175/U	Swr indicator	TM 11-6625-545-15
Multimeter TS-352B/U	Multimeter	TM 11-6625-366-15
Oscilloscope AN/USM-281A	Oscilloscope	
Coaxial Slotted Line IM-92/U	Slotted line	TM 11-5109
Test Facilities	Test-bed	
System AN/TPM-41, consisting of:		
Alarm, Monitor BZ-162/TPX-46(V)	Monitor alarm	TM 11-5895-532-12
Coder-Decoder Group, OX-7(V) 1/TPX-46(V)	C-d group	TM 11-5895-532-12
Control, Interrogator Set C-7570/TPX-46(V)	Control box	TM 11-5895-532-12
Pedestal, Antenna AB-1076/TPX-46(V)	Pedestal	TM 11-5895-532-12
Receiver-Transmitter Group, OR-85/TPX-46(V)	R-t group	TM 11-5895-532-12
Test Facilities Set, AN/TPM-24(V) 2	Test facility set	TM 11-6625-2398-15-2
Test Set, Radar AN/UPM-98B (or C),or	Radar test set	TM 11-6625-403-15-1
Test Set, Radar AN/TPM-25A	Radar test set	TM 11-6625-2610-12
Voltmeter, Digital AN/GSM-64	Digital voltmeter	TM 11-6625-444-15

Section III. EQUIPMENT SET-UPS

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

4-8. General

This section contains the preliminary equipment set-ups for the antenna positioning circuits (para 4-9), the test-bed (para 4-13), and the oscilloscope (para 4-15).

4-9. Antenna Positioning Circuits Preliminary Set-Ups

The iff set antenna positioning circuits can operate with a test-bed input of either 60 Hz synchro azimuth data, 400 Hz synchro azimuth data, or 4 kHz resolver azimuth data. To set up the antenna positioning circuits to accept the desired input azimuth data, perform the procedure in paragraph 4-10, 4-11, or 4-12.

4-10. Antenna Positioning Circuits Set-Up for 60 Hz Synchro Azimuth Data

a. On GROUP CASE POWER subpanel of the interface adapter unit (IAU) set 60 Hz circuit breaker to OFF and 400 Hz circuit breaker to OFF.

b. Remove access cover from pedestal housing (fig. 4-1) by removing eight screws and washers.

c. On the pedestal, connect 3A2P1 to SYNCHRO connector 3A2J8. Place cap on RESOLVER connector 3A2J9. Replace access cover.

d. On the antenna control assembly, set SYNCHRO REF switch to EXT and EXT REF FREQ switch to 60 Hz.

e. On the antenna control assembly chassis, connect 1A2A4P1 to SYNC connector 1A2J2.

4-11. Antenna Positioning Circuits Set-Up for 400 Hz Synchro Azimuth Data

a. On GROUP CASE POWER subpanel of the interface adapter unit (IAU) set 60 Hz circuit breakers to OFF and 400 Hz circuit breaker to OFF.

b. Remove access cover from pedestal housing (fig. 4-1) by removing eight screws and washers.

c. On the pedestal, connect 3A2P1 to SYNCHRO connector 3A2J8. Place cap on RESOLVER connector 3A2J9. Replace access cover.

d. On the antenna control assembly, set SYNCHRO REF switch to EXT and EXT REF FREQ switch to 400 Hz.

e. On the antenna control assembly chassis, connect 1A2A4P1 to SYNC connector 1A2J2.

4-12. Antenna Positioning Circuits Set-Up for 4 kHz Resolver Azimuth Data

a. On GROUP CASE POWER subpanel of the interface adapter unit (IAU) set 60 Hz circuit breaker to OFF and 400 Hz circuit breaker to OFF.

b. Remove access cover from pedestal housing (fig. 4-1) by removing eight screws and washers.

c. On the pedestal, connect 3A2P1 to RESOLVER connector 3A2J9. Place cap on SYNCHRO connector 3A2J8. Replace access cover.

d. On the antenna control assembly, set EXT REF FREQ switch to 4 kHz.

e. On the antenna control assembly chassis, connect 1A2A4P1 to RSLVR connector 1A2J1.

4-13. Test-Bed Set-up

Prior to performing any general support testing or troubleshooting on an assembly, the test-bed must be set up to simulate on-site operating conditions. These conditions include supplying either 60 Hz synchro azimuth data, 400 Hz synchro azimuth data, or 4 kHz resolver azimuth data. Before setting up the test-bed, the antenna control assembly and the pedestal must be set-up (para 4-9) for desired azimuth data input. To set up the test-bed, perform the procedure in paragraph 4-14.

4-14. Procedure

a. Connect the test-bed in accordance with figure FO-4. Do not apply primary power to the test-bed until after all connections are made.

b. Set the controls on the interface adapter unit as follows:

Control	*Position* 60 Hz synchro azimuth data	400Hz synchro azimuth data	4kHz resolver azimuth data
GROUP CASE POWER subpanel:			
60 Hz circuit breaker	ON	ON	ON
400 Hz circuit breaker	ON	ON	ON
400 Hz circuit breaker	ON	ON	ON
GROUP CASE POWER SELECT	60Hz	400 Hz	60 Hz
POWER subpanel:			
60 Hz circuit breaker	ON	ON	ON
400 Hz circuit breaker	ON	ON	ON
FREQUENCY SELECT	60Hz	400 Hz	60 Hz
ANTENNA subpanel:			
RPM CONTROL	25 RPM	25 RPM	25 RPM
ANT ROTATION switch	STA	STA	STA
AZIMUTH DATA subpanel			

NOTE

The setting of FREQ SELECT switch must be the same as that of antenna control assembly EXT REF FREQ switch (para 4-10d, 4-11d, or 4-12d). FREQ SELECT 60 Hz 400 Hz 4000 Hz

CAUTION

To avoid damage to the resolver in the antenna control assembly or the pedestal, do not set the SYNC/RSLVR SEL switch to SYNC unless the antenna control assembly and the pedestal are set up for synchro azimuth data (para 4-10 or 4-11). SYNC/RSLVR SEL switch SYNC SYNC RSLVR

NOTE

Position of switches on ENABLES sub-panel is immaterial.

c. Set the controls on the iff set as follows:

Control	*Position*
C-d group case power control panel SYSTEM POWER circuit breaker	ON
Processor assembly POWER circuit breaker	OFF
Receiver-Transmitter POWER circuit breaker	OFF
Monitor alarm POWER circuit breaker	OFF
Control box POWER circuit breaker	ON

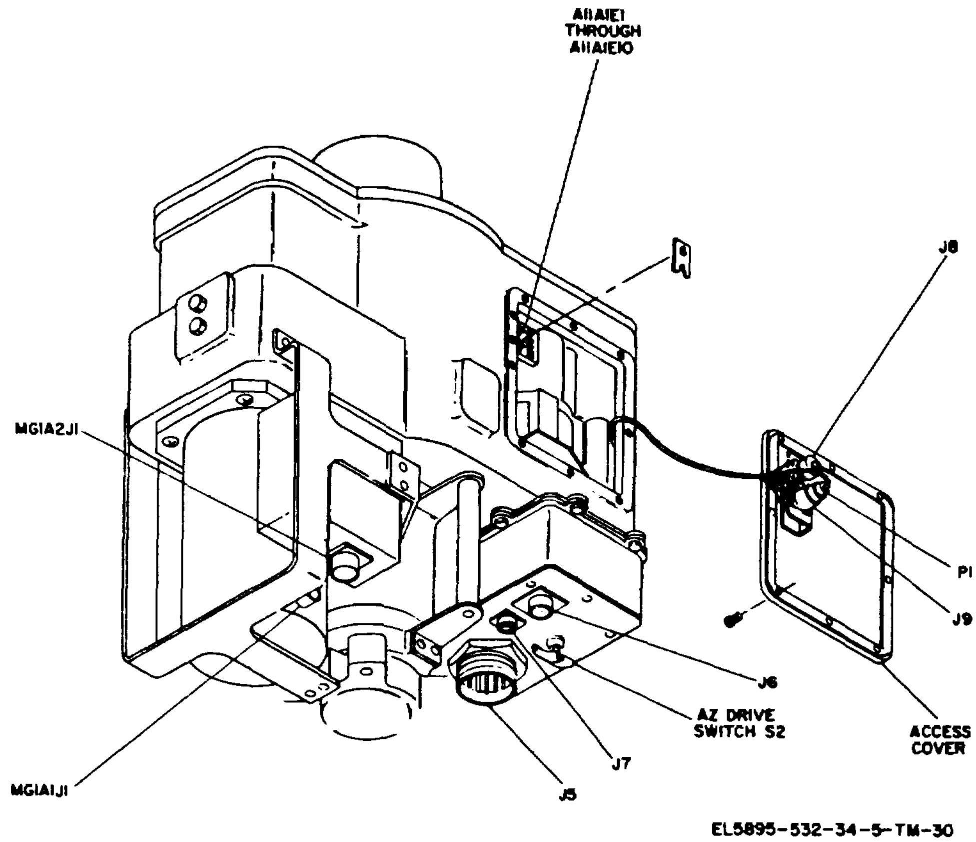


Figure 4-1. Pedestal assembly.

Control	*Position*
Antenna control assembly	
POWER circuit breaker	ON
POWER ECA circuit breaker	ON
SYNCHRO REF switch	EXT
Pedestal AZ DRIVE switch	ON

4-15. Oscilloscope Preliminary Set-up

a. On Mainframe OS-189A(P)/USM-281, set the controls as follows:

Controls	*Position*
POWER	Set POWER switch to its on (up) position to light POWER indicator lamp.
HORIZONTAL DISPLAY	INT
HORIZONTAL MAGNIFIER	X1
SCALE	Fully counterclockwise.
INTENSITY	As required for sharp and clear waveforms.
FOCUS	As required for sharp and clear waveforms.
HORIZONTAL POSITION	As required to center sweep trace.
HOIZONTAL EXT INPUT AC-DC	Immaterial.

b. On Dual Channel 50 MHz Vertical Amplifier PL-1186A/USM, set the controls as follows:

Controls	*Position*
DISPLAY	A
MAGNIFIER	X1
Channel A controls	
POLARITY	+UP
POSITION	As required to position zero vdc on centerline of oscilloscope scale.
VOLTS/DIV (outer)	In accordance with "VOLTS/ DIV" specified in waveform illustration and attenuation of probe. Use setting equal to 0.1 times the specified "VOLTS/DIV" and use a 10:1 probe.
VOLTS/DIV (inner)	CAL (fully clockwise)
AC-GND-DC	DC

Channel B control settings are immaterial

c. On Time Base and Delay Generator PL-1187A/USM, set the controls as follows:

Controls	*Position*
MAIN-MIXED-DELAYED (red)	MAIN

Controls	*Position*
TIMEIDIV (inner MAIN)	In accordance with "TIME/DIV" specified in waveform illustration.
TIME/DIV (outer DELAYED)	OFF
DIV DELAY	Immaterial
SWEEP MODE	NORMAL
MAIN VERNIER	CAL (fully clockwise)
DELAYED VERNIER	Immaterial
MAIN TRIGGER select	INT or LINE as specified in waveform illustration.
DELAYED TRIGGER select	Immaterial
MAIN TRIGGER SLOPE	+
DELAYED TRIGGER SLOPE	Immaterial
MAIN TRIGGER coupling	Immaterial
DELAYED TRIGGER coupling	Immaterial
MAIN TRIGGER LEVEL	As required for a synchronized sweep.
DELAYED TRIGGER LEVEL	Immaterial

SECTION IV. ANTENNA CONTROL ASSEMBLY ALIGNMENT PROCEDURES

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4

4-16. General

The antenna control assembly must be aligned for the type of azimuth data supplied by the test-bed. To align the antenna control assembly, perform the procedure in paragraph 4-17 (for 60 Hz synchro azimuth data), paragraph 4-18 (for 400 Hz synchro azimuth data) or paragraph 4-19 (for 4 kHz resolver azimuth data). Before performing the alignment, the antenna control assembly and pedestal must be set up for the desired input azimuth data (para 4-9) and the test-bed must be set up (para 4-13).

4-17. 60 Hz Synchro Asimuth Data Alignment Procedure

a. Set controls on interface adapter unit as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel	60 Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	60 Hz
SYNCJRSLVR SEL switch	SYNC
ANT ROTATION switch	CW
RPM CONTROL	0(maximum ccw)

b. On antenna control assembly, set METER switch to -12V.

c. Connect low lead of the digital voltmeter to chassis of antenna control assembly and high lead to 1A2A2J1-8.

d. Adjust -12V ADJ on power supply module 1A2A5 for a -12-volt indication on digital voltmeter. Limit -11.88 to -12.12 vdc.

e. Adjust TB1-R1 of meter board until POWER SUP TEST/NULL indicator indicates in center of green area.

f. Connect low lead of digital voltmeter to chassis of antenna control unit and high lead to 1A2A2J1-4.

g. Set METER switch on antenna control assembly to + 12V.

h. Adjust +12V ADJ on power supply module 1A2A5 for a +12-volt indication. Limit +11.88 to + 12.12 vdc.

i. Set METER switch on antenna control assembly to OUT.

j. On antenna control assembly, set ANT SYNC switch to EXT.

k. Set and hold to ON, the ROTATION ENABLE switch on interface adapter unit ANTENNA subpanel, for approximately 20 seconds. The inertial antenna load may rotate to the null point. Release the ROTATION ENABLE switch.

l. Set oscilloscope controls as follows:

Control	*Position*
DISPLAY	A
VOLTS/DIV chan A	0.1
INPUT chan A	AC
MAIN TIME/DIV	5 MSEC
MAIN-MIXED-DELAYED	MAIN
SWEEP MODE	NORM
MAIN trigger	INT
MAIN SLOPE	+

m. Connect channel A 10X oscilloscope probe to 1A2A2J1-5. Connect oscilloscope ground lead to antenna control assembly chassis.

n. On interface adapter unit ANTENNA sub-panel, manually adjust POSITION DEGREES FINE AZIMUTH dial until a minimum peak-to-peak voltage is observed on oscilloscope.

o. Adjust FINE AZIMUTH dial 2 degrees ccw from null position obtained in n above.

p. Connect channel A 10X oscilloscope probe to 1A2A2J1-2.

q. Error voltage observed on oscilloscope will resemble a full-wave rectified sinewave. Adjust phase potentiometer 1A2AlR1 for most symmetrical waveform.

r. Adjust demodulator balance potentiometers 1A2A2R3 and 1A2AR4 for most symmetrical waveform.

s. Adjust 60-Hz self-test threshold potentiometer 1A2A3R2 until FAULT ANT LAG indicator lamps on antenna control assembly and control box just light. If FAULT ANT LAG indicator lamps are already lighted, adjust 1A2A3R2 until indicators extinguish and then readjust until indicators just light.

t. Connect channel A 10X oscilloscope probe to 1A2A2J1-5.

CAUTION

Under no circumstances should the CUR LIMIT control be adjusted or serious damage may occur in the electronic control amplifier or the antenna drive motor. The CUR LIMIT alignment is performed at factory or depot only.

u. On electronic control amplifier 1A2A7, unlock GAIN A 60 HZ potentiometer and rotate fully ccw.

w. Rotate ext mode tach feedback adj potentiometer 1A2A2R1 about twenty turns cw.

w. Rotate chopper balance potentiometer 1A-2A2R2 about twenty turns ccw and then five turns cw.

x. On interface adapter unit ANTENNA sub-panel, set RPM CONTROL to 10.

NOTE

For at least 10 seconds before and during the performance of procedures y through ab, the ROTATION ENABLE switch must be held at ON

y. Set POWER ECA to ON; rotate GAIN A 60 Hz potentiometer cw until inertial antenna load rotates.

z. Rotate 1A2A2R1 cw or ccw until inertial antenna load rotates smoothly and there is a minimum amount of pulsing as observed on oscilloscope (1-to 1.5-volt amplitude desirable for 60 Hz).

aa. Repeat procedures y and z, until inertial antenna load rotates smoothly, FAULT ANT LAG indicator is extinguished, and minimum pulsing is observed on oscilloscope.

ab. Adjust 1A2A2R2 to further reduce pulsing observed on oscilloscope.

ac. On interface adapter unit ANTENNA sub-panel, set RPM CONTROL to 0 (maximum ccw) and hold ROTATION ENABLE switch to ON for approximately 20 seconds. The inertial antenna load shall stop rotating; release ROTATION ENABLE switch.

ad. Manually adjust FINE AZIMUTH dial until a minimum peak-to-peak voltage is observed on oscilloscope.

ae. Adjust FINE AZIMUTH dial 1.5 degrees cw from null position in ad above. aft Record peak-to-peak voltage observed on oscilloscope.

ag. Set RPM CONTROL to 10.

NOTE

For at least 10 seconds before and during the performance of procedure ah, the ROTATION ENABLE switch must be held at ON.

ah. Record peak-to-peak voltage observed on oscilloscope and set RPM CONTROL to 0.

ai. If peak-to-peak voltage recorded in ah exceeds voltage recorded in af above, repeat procedures u through ai.

aj. Lock GAIN A 60 HZ potentiometer on electronic control amplifier. On interface adapter unit ANTENNA subpanel, set RPM control to 0.

ak. On antenna control assembly, set ANT SYNC switch to INT and INT ANT SYNC RPM switch to 0.

CAUTION

To avoid damaging printed circuit card 1A2A3, the negative lead of the digital voltmeter must be isolated from ground when measuring the voltage between 1A2A3J1-6 and 1A2A3J1-4.

al. Connect digital voltmeter between 1A2A3J1-6 and 1A2A3J1-4.

am. Adjust differential amplifier balance potentiometer 1A2A3R1 for a minimum voltage indication (0.05 vdc maximum) on digital voltmeter.

an. On electronic control amplifier, unlock and rotate GAIN B and GAIN H potentiometers fully ccw.

ao. On antenna control assembly, set INT ANT SYNC RPM switch to CW 5.

NOTE

For at least 10 seconds before and during the performance of ap through as below, the RO-TATION ENABLE switch must be held at ON.

ap. Rotate GAIN H potentiometer one-quarter turn cw. The inertial antenna load should remain stationary.

aq. Rotate GAIN B potentiometer cw until inertial antenna load rotates continuously.

ar. Readjust GAIN H potentiometer until inertial antenna load rotates smoothly.

as. If FAULT ANT LAG indicator lamp is lighted, or flickering, readjust GAIN B and GAIN H potentiometers until inertial antenna load is rotating smoothly and FAULT ANT LAG indicator lamp remains extinguished.

at. On antenna control assembly, set INT ANT SYNC RPM switch to each position indicated below. On interface adapter unit ANTENNA subpanel, hold ROTATION ENABLE switch to ON. After waiting approximately 20 seconds, time inertial antenna load rotation for number of revolutions indicated. The time in each case shall be 60 ±12 seconds, if not, repeat *ak* through at above.

INT ANT SYNC RPM switch position	Number of revolutions
5 CW	5
10 CW	10
15 CW	15
20 CW	20
25 CW	25
5 CCW	5
10 CCW	10
15 CCW	15
20 CCW	20
25 CCW	25

au. Set INT ANT SYNC RPM switch to 0, then release ROTATION ENABLE switch.

CAUTION

Do not alter any control settings unless specifically instructed in testing or trouble-shooting procedures.

av. Disconnect digital voltmeter and oscilloscope.

4-18. 400 HZ Synchro Azimuth Data Alignment Procedure

a. Set controls on interface adapter unit as follows:

Control	*Position*
GROUP CASE POWER SELECT	400 Hz
FREQUENCY SELECT (on POWER subpanel)	400 Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	400 Hz
SYNC/RSLVR SEL switch	SYNC
ANT ROTATION switch	CW
RPM CONTROL	0 (maximum ccw)

b. On antenna control assembly, set METER switch to -12V.

c. Connect low lead of digital voltmeter to chassis of antenna control assembly and high lead to 1A2A2J1-8.

d. Adjust -12V ADJ on power supply module 1A2A5 for a -12-volt indication on digital voltmeter. Limit -11.88 to -12.12 vdc.

e. Adjust TB1-R1 of meter board until POWER SUP TEST/NULL indicator indicates in center of green area.

f. Connect low lead of digital voltmeter to chassis of antenna control unit and high lead to 1A2A2J1-4.

g. Set METER switch on antenna control assembly to +12V.

h. Adjust +12V ADJ on power supply module 1A2A5 for a +12-volt indication. Limit +11.88 to +12.12 vdc.

i. Set METER switch on antenna control assembly to OUT.

j. On antenna control assembly, set ANT SYNC switch to EXT.

k. Press and hold ROTATION ENABLE switch on interface adapter unit ANTENNA subpanel for approximately 20 seconds. The inertial antenna load may rotate to the null point. Release ROTATION ENABLE switch.

l. Set oscilloscope controls as follows:

Control	*Position*
DISPLAY	A
VOLTS/DIV chan A	0.1
INPUT chan A	AC
MAIN TIME/DIV	1 MSEC
MAIN-MIXED-DELAYED	MAIN
SWEEP MODE	NORM
MAIN trigger	INT
MAIN SLOPE	+

m. Connect channel A 10X oscilloscope probe to 1A2A2J1-5. Connect oscilloscope ground lead in antenna control assembly chassis.

n. On interface adapter unit ANTENNA sub-panel, manually adjust POSITION DEGREES FINE AZIMUTH dial until a minimum peak-to-peak voltage is observed on oscilloscope.

o. Adjust FINE AZIMUTH dial 2 degrees ccw from null position of n above.

p. Connect channel A 10X oscilloscope probe to 1A2A2J1-2.

q. Error voltage observed on oscilloscope will resemble a full-wave rectified sinewave. Adjust phase potentiometer 1A2A1R1, for most symmetrical waveform.

r. Adjust demodulator balance potentiometers 1A2A2R3 and 1A2A2R4 for most symmetrical waveform.

s. Connect channel A 10X oscilloscope probe to 1A2A2J1-5.

t. On interface adapter unit ANTENNA sub-panel, set ANT ROTATION switch to STA.

u. On antenna control assembly, set EXT REF FREQ to 60 Hz.

v. On interface adapter unit:

(1) AZIMUTH DATA subpanel, set FREQ SELECT to 60 HZ.

(2) POWER subpanel, set 400 HZ to OFF, FREQUENCY SELECT to 60 HZ, and 60 HZ to ON.

(3) GROUP CASE POWER subpanel, set 400 HZ to OFF, GROUP CASE POWER SELECT to 60 HZ, and 60 HZ to ON.

w. Set ANT ROTATION switch to CW.

x. Press and hold ROTATION ENABLE switch for approximately 20 seconds. The inertial antenna load shall rotate to the null position and stop.

y. Release ROTATION ENABLE switch.

z. Adjust FINE AZIMUTH dial 2 degrees ccw from null position obtained in x above.

aa. Adjust self-test threshold potentiometer 1A2A3R2 until FAULT ANT LAG indicator lamps on antenna control assembly and control box just light. If FAULT ANT LAG indicator lamps are already lighted, adjust 1A2A3R2 until indicators extinguish and then readjust until indicators just light.

ab. On interface adapter until ANTENNA subpanel, set ANT ROTATION switch to STA.

ac. On interface adapter unit, set controls as in a above.

ad. On antenna control assembly, set EXT REF FREQ to 400 Hz.

ae. On interface adapter unit, set ANT ROTATION switch to CW.

af. Press and hold ROTATION ENABLE switch for approximately 20 seconds. The inertial antenna load shall rotate to the null position and stop.

ag. Release ROTATION ENABLE switch.

ah. Adjust FINE AZIMUTH dial 2 degrees ccw from null position in af above.

ai. Adjust 400 Hz self-test threshold potentiometer 1A2A3R3 until FAULT ANT LAG indicator lamps on antenna control assembly and control box just light. If FAULT ANT LAG indicator lamps are already lighted, adjust 1A2A3R3 until indicators extinguish and then readjust until indicators just light. If FAULT ANT LAG indicator lamp can not be lighted, set FINE AZIMUTH dial to 3 degrees ccw and adjust 1A2A3R3 until FAULT ANT LAG lights, then set to 2.5 degrees and adjust 1A2A3R3, and finally to 2 degrees and adjust until FAULT ANT LAG lights.

CAUTION

Under no circumstances should the CUR LIMIT control be adjusted or serious damage may occur in the electronic control amplifier or the antenna drive motor. The CUR LIMIT alignment is performed at factory or depot only.

aj. On electronic control amplifier 1A2A7, unlock GAIN G 400 HZ potentiometer and rotate fully ccw.

ak. Rotate ext mode tach feedback adj potentiometer 1A2A2R1 about twenty turns cw.

al. Rotate chopper balance potentiometer 1A-2A2R2 about twenty turns ccw and then five turns cw.

am. On interface adapter unit ANTENNA subpanel, set RPM CONTROL to 10.

NOTE

For at least 10 seconds before and during the performance of procedures an through aq, the ROTATION ENABLE switch must be held at ON.

an. Rotate GAIN G 400 Hz potentiometer a half turn cw. Inertial antenna load rotates.

ao. Rotate 1A2A2R1 cw or ccw until inertial antenna load rotates smoothly and there is minimum amount of pulsing as observed on oscilloscope.

ap. Repeat an and ao above, until inertial antenna load rotates smoothly, FAULT ANT LAG indicator is extinguished and minimum pulsing is observed on oscilloscope.

aq. Adjust 1A2A2R2 to further reduce pulsing observed on oscilloscope.

ar. On interface adapter unit ANTENNA sub-panel, set RPM CONTROL to 0 (maximum ccw) and hold ROTATION ENABLE switch to ON for approximately 10 seconds. The inertial antenna load shall stop rotating. Release ROTATION ENABLE switch.

as. Manually adjust FINE AZIMUTH dial until a voltage null is observed on oscilloscope.

at. Adjust FINE AZIMUTH dial 1.5 degrees cw from null position.

au. Record peak-to-peak voltage observed on oscilloscope.

av. Set RPM CONTROL to 10.

NOTE

For at least 10 seconds before and during the performance of aw, the ROTATION ENABLE switch must be held at ON.

aw. Record peak-to-peak voltage observed on oscilloscope.

ax. If peak-to-peak voltage recorded in aw above, exceeds voltage recorded in au above, repeat procedures aj through ax.

ay. Lock GAIN G 400 HZ potentiometer on electronic control amplifier. Release ROTATION ENABLE switch on interface adapter unit, and set RPM control to 0.

az. On antenna control assembly, set ANT SYNC switch to INT and INT ANT SYNC RPM switch to 0.

CAUTION

To avoid damaging printed circuit card 1A2A3, the negative lead of the digital voltmeter must be isolated from ground when measuring the voltage between 1A2A3J1-6 and 1A2A3J1-4.

ba. Connect digital voltmeter between 1A2A3J1-6 and 1A2A3J1-4.

bb. Adjust differential amplifier balance potentiometer 1A2A3R1 for a minimum voltage indication (0.05 vdc maximum) on digital voltmeter.

bc. On electronic control amplifier, unlock and rotate GAIN B and GAIN H potentiometer fully ccw.

bd. On antenna control assembly, set INT ANT SYNC RPM switch to CW 5.

NOTE

For at least 10 seconds before and during per-formance of procedures bc through bh, the ROTATION ENABLE switch must be held at ON.

be. Rotate GAIN H potentiometer one-eighth turn cw. The inertial antenna load should remain stationary.

bf. Rotate GAIN B potentiometer cw until inertial antenna load rotates continuously.

bg. Readjust GAIN H potentiometer until inertial antenna load rotates smoothly.

bh. If FAULT ANT LAG indicator lamp is lighted, or flickering, readjust GAIN B and GAIN H potentiometers until inertial antenna load is rotating smoothly and FAULT ANT LAG indicator lamp remains extinguished.

bi. On interface adapter unit ANTENNA sub-panel, hold ROTATION ENABLE switch to ON. On antenna control assembly, set INT ANT SYNC RPM switch to each position indicated below. After waiting approximately 20 seconds, time inertial antenna load rotation for number of revolutions indicated. The time in each case shall be 60 +12 seconds, if not, repeat procedures *az* through *bi*.

INT ANT SYNC RPM switch position	*Number of revolutions*
5 CW	5
10 CW	10
15 CW	15
20 CW	20
25 CW	25
5 CCW	5
10 CCW	10
15 CCW	5
20 CCW	20
25 CCW	25

bj. Set INT ANT SYNC RPM switch to 0, then release ROTATION ENABLE switch.

CAUTION

Do not alter any control settings unless specifically instructed in testing or trouble-shooting procedures.

bk. Disconnect digital voltmeter and oscilloscope.

4-19. 4 kHz Resolver Azimuth Data Alignment Procedure

a. Set controls on interface adapter unit as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel)	60 Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	4000 Hz
SYNCIRSLVR SEL switch	RSLVR
ANT ROTATION switch	CW
RPM CONTROL	0 (maximum ccw

b. Set controls on antenna control assembly as follows:

Control	*Position*
INT ANT SYNC RPM	0
ANT SYNC	EXT
POWER	ON
EXT REF FREQ	4KHZ

c. Perform procedures in paragraph 4-17 except in subparagraph 1, set scope to 0.1 MSEC.

d. Perform procedures in paragraph 4-17*b* through 4-1 7*av*.

Section V. FUNCTIONAL TEST

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

4-20. General

Before performing the functional test procedure in paragraph 4-21, the antenna control assembly alignment procedure must be performed. The procedure in paragraph 4-21 can be used to test any of the following assemblies:

Reference designation	*Assembly*
1A2	Antenna control assembly
1A2A1	Mode switching card
1A2A2	Servo preamplifier card
1A2A3	T1i/self-test card
1A2A6	Electronic control amplifier filter
1A2A7	Electronic control amplifier
3A2	Pedestal (excluding rotary joint, synchro subassembly and reed switch).

4-21. Functional Test Procedure

a. Set the controls on the antenna control assembly as follows:

Control	*Position*
POWER circuit breaker	ON
POWER ECA circuit breaker	ON
ANT SYNC switch	INT

WARNING

To avoid injury from rotating inertial antenna load, stand clear of pedestal before performing the following procedures.

b. Set the INT ANT SYNC RPM switch on the antenna control assembly to each of the positions indicated below. Hold the ROTATION ENABLE switch on the interface adapter unit ANTENNA subpanel to ON. After waiting approximately 20 seconds, time the inertial antenna load for the number of revolutions indicated. The time in each case shall be 60 +12 seconds and; the ANT LAG LAMP on the antenna control assembly does not light after the 20-second stabilization period has elapsed.

INT ANT SYNC RPM switch position	*Number of revolutions*
5 CW	5
10 CW	10
15 CW	15
20 CW	20
25 CW	25
5 CCW	5
10 CCW	10
15 CCW	15
20 CCW	20
25 CCW	25

c. On the antenna control assembly, set the ANT SYNC switch to EXT.

d. On the interface adapter unit ANTENNA subpanel, set the RPM CONTROL to 5.

e. On the interface adapter unit ANTENNA subpanel, hold the ROTATION ENABLE switch to ON.

NOTE

For at least 10 seconds before and during the performance of procedures f through i, the ROTATON ENABLE switch must be held at ON.

f. Set the ANT ROTATION switch to CW. Within eight seconds the ANT LAG lamp will go out and remain out.

g. Set the ANT ROTATION switch to STA.

h. Set the ANT ROTATION switch to CCW: Within eight seconds the ANT LAG lamp will go out and remain out.

i. Set RPM CONTROL to the position indicated below and repeat procedures *e* through *h.* RPM

CONTROL setting
10
15
20
25

j. Release the ROTATION ENABLE switch.

k. Set the RPM CONTROL to 0 and the ANT ROTATION switch to CW.

l. Set the oscilloscope controls as follows:

Control	*Position*
DISPLAY	A
VOLTS/DIV chan A	05
INPUT chan A	AC
MAIN TIME/DIV	5 MSEC
MAIN-MIXED-DELAYED	MAIN
SWEEP MODE	NORM
MAIN trigger	INT
MAIN SLOPE	+

m. Connect channel A 10X oscilloscope probe to 1A2A2J1-5. Connect the oscilloscope ground lead to antenna control assembly chassis.

n. Press the ROTATION ENABLE switch on the interface adapter unit ANTENNA subpanel for approximately 20 seconds. The inertial antenna load shall rotate. Release the ROTATION ENABLE switch.

o. On the interface adapter unit ANTENNA subpanel, manually adjust POSITION DEGREES FINE AZIMUTH dial until a minimum peak-to-peak voltage is observed on the oscilloscope.

p. Adjust FINE AZIMUTH dial 1.5 degrees clockwise from null position of procedure o.

q. Record the maximum peak-to-peak voltage observed on oscilloscope.

r. Set the RPM CONTROL to 25.

s. Set the ANT ROTATION switch to CW.

t. While holding the ROTATION ENABLE switch to ON, observe the maximum peak-to-peak voltage on the oscilloscope. The voltage observed must be less than the voltage recorded in procedure q.

u. Set the ANT ROTATION switch to CCW.

v. While holding the ROTATION ENABLE switch to ON, observe the maximum peak-to-peak voltage on the oscilloscope. The voltage observed must be less than the voltage recorded in procedure q.

w. On the control box, set POWER circuit breaker to OFF.

Section VI. Test-BED SET-UP FOR 3° CLOCKWISE ERROR

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

4-22. Procedure

a. Perform equipment set-up outlined in section III.

b. On interface adapter unit ANTENNA sub-panel, set ANT ROTATION to CW and RPM CONTROL to 0.

c. Press ROTATION ENABLE switch for approximately 20 seconds. The inertial antenna load shall rotate. Release ROTATION ENABLE 5 switch.

d. Set oscilloscope controls as follows:

Control	*Position*
DISPLAY	A
VOLTS/DIV chan A	0.5
INPUT chan A	AC
MAIN TIME/DIV	5 MSEC
MAIN-MIXED-DELAYED	MAIN
SWEEP MODE	NORM
MAIN trigger	INT
MAIN SLOPE	+

e. Connect channel A 10X oscilloscope probe to 1A2A2J1-5. Connect oscilloscope ground lead to antenna control chassis.

f. On the interface adapter unit ANTENNA subpanel, manually adjust POSITION DEGREES FINE AZIMUTH dial until a minimum peak-to-peak voltage is observed on oscilloscope.

g. Adjust FINE AZIMUTH dial 30 counterclockwise from null position off above.

CHAPTER 5
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR ANTENNA CONTROL ASSEMBLY 1A2

Section I. INTRODUCTION

5-1. General

This chapter contains general support maintenance for each of the following assemblies:

Antenna control assembly chassis................Section II
Mode switching card 1A2A1 ....Section III
Servo preamplifier card 1A2A2 ....Section IV
T1li/self-test card 1A2A3 ....Section V
Azimuth zero adjust module 1A2A4..............Section VI
Power supply module 1A2A5........................Section VII
Electronic control amplifier filter 1A2A6........Section VIII
Electronic control amplifier 1A2A7 ....Section IX

Section II. ANTENNA CONTROL ASSEMBLY CHASSIS

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-2. General

This section contains general support troubleshooting, alignment, and testing of the antenna control assembly chassis. When an antenna control assembly is received by general support it can be assumed that direct support has isolated the fault to the antenna control assembly chassis. If the fault has not been isolated to the chassis, refer to the organizational and direct support troubleshooting procedures.

5-3. Antenna Control Assembly Chassis Troubleshooting Procedure

Antenna control assembly chassis troubleshooting (with all power off and card and modules disconnected), consists of point-to-point resistance measurements, resistance check of inductive components, and resistance check of meter board IA2TBI. To isolate a fault to a specific area and to perform point-to-point resistance measurements, refer to the antenna control assembly schematic diagram (fig. FO-5). For the resistance measurements on inductive components (transformers T1 and T2) refer to TM 11-5895-532-34-1. Typical multimeter resistance measurements on meter board TBI are as follows:

CAUTION

Prior to performing any measurements on meter board, disconnect lead to + terminal of POWER SUP TEST NULL meter by removing 5/16 inch nut cap and lockwasher, and check that METER switch is set to OUT.

Positive metered lead (red)	*Negative metered lead (black)*	*Meter Resistance ohms range*	*Reverse in ohms*	*Reverse meter ohms range*	*resistance in ohms*
TB1-1	TB1-3	RX10,000	12K	RX10,000	12K
TB1-2	TB1-3	RX10,000	132K	RX10,000	132K
TB1-4	TB1-5	RX100	180	RX10,000	1.7MEG
TB1-6	TB1-7	RX100	560	RX100	560
TB1-8	TB1-9	RX100	800	RX10,000	1 MEG
TB1-8	TB1-11	RX100	800	RX10,000	1 MEG

5-4. Antenna Control Assembly Chassis Alignment Procedure

The only adjustment contained on the antenna control assembly chassis is the meter adjust potentiometer on meter board TBI. To adjust the meter, install the antenna control assembly (with all cards and modules) in the test-bed, and perform the procedure in paragraph 5-5.

5-5. Meter Adjustment Procedure

a. Perform the test-bed set-up in paragraph 4-13.

b. Set MEIER switch on antenna control assembly to -12V position.

c. Connect low lead of digital voltmeter to chassis of antenna control assembly and high lead to A2J1-8.

d. Adjust -12V ADJ on power supply module for a -12 vdc indication on the digital voltmeter. Limit:-12.12 to -11.88 vdc.

e. Adjust TB1-R1 of meter board until the POWER SUP TEST/NULL meter indicates in the center of the green area.

5-6. Antenna Control Assembly Chassis Testing

a. Install the antenna control assembly (with all cards and modules) into the test-bed (para 3-5).

b. Connect antenna control assembly and pedestal for 60 Hz synchro azimuth data (para 4-9).

c. Perform the test-bed set-up (para 4-13) for 60 Hz synchro azimuth data.

d. Align the antenna control assembly (para 4-16) for 60 Hz synchro azimuth data.

e. Perform the functional test in paragraph 4-20.

Section III. MODE SWITCHING CARD 1A2A1

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for FO-4.

5-7. General

This section contains general support troubleshooting, alignment, and testing of mode switching card 1A2A1.

5-8. Mode Switching Card Troubleshooting Procedure

To perform troubleshooting on the mode switching card, refer to the schematic diagram (fig. FO-6) and check the resistance measurements listed in paragraph 5-11 and the voltage measurements in paragraph 5-12.

5-9. Mode Switching Card Alignment Procedure

The only adjustment contained on the mode switching card is the phase adjust potentiometer R1. This adjustment can only be made as part of the overall antenna control assembly alignment procedure. To perform this alignment, refer to paragraph 4-16.

5-10. Mode Switching Card Testing

a. Install the mode switching card into the test-bed.

b. Connect antenna control assembly and pedestal for 60 Hz synchro azimuth data (para 4-14).

c. Perform the test-bed set-up (para 4-13) for 60 Hz
synchro azimuth data.

d. Align the antenna control assembly for 60 Hz synchro azimuth data (para 4-17).

e. Perform the functional test in paragraph 4-20.

f. Align the antenna control assembly for 400 Hz synchro azimuth data (para 4-18).

g. Perform the functional test in paragraph 4-20.

h. Connect antenna control assembly and pedestal for 4 kHz resolver azimuth data (para 4-14).

i. Align the antenna control assembly for 4 kHz resolver azimuth data (para 4-19).

j. Perform the functional test in paragraph 4-20.

5-11. Resistance Measurements

Resistance measurements for mode switching card 1A2A1 are contained in the following chart. All measurements are made with the card or module removed from the antenna control assembly. All measurements should be made using Multimeter TS-352B/U. All resistance measurements should be within 20 percent of the indicated value.

Mode Switching Card 1A2A1-Resistance Measurements

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
P1-1	P1-2	X10K	20MEG*	X10K	20MEG*
P1-1	P1-5	X100	4750	X100	4750
P1-1	P1-12	X1K	52K	X1	52K

See footnotes at end of table.

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
P1-4	P1-2	X1K	38K*	X1K	38K*
P1-4	P1-15	1K	46K*	X1K	46K*
P1-15	P1-6	X100	14K	X100	14K
P1-15	P1-8	X100	18K	X100	18K
P1-15	P1-21	X100	2500	X100	2500
P1-15	P1-22	X100	6200	X100	6200
P1-15	P1-23	X100	10K	X100	10K
P1-17	P1-25	X100	7K	X100	7K
P1-19	P1-11	X10K	INF	K10K	INF
P1-19	P1-14	X10K	INF	X10K	INF
P1-19	P1-20	X100	24K**	X100	24K**
P1-19	P1-27	X100	7K	X100	7K
P1-24	P1-2	X10	2K	X10	2K
P1-24	P1-40	X10	470	X10	470
P1-29	P1-2	X10	980	X10	980
P1-30	P1-35	X100	3100	X100	3100
P1-31	P1-2	X10	2K	110	2K
P1-31	P1-35	X10	4704	X10	470
P1-32	P1-40	X100	3100	X100	3100
P1-33	P1-S	X10	980	X10	980
P1-34	P1-2	X10	470	X10	470
P1-35	P1-2	X10	2500	X10	2500
P1-36	P1-2	X10	470	X10	470
P1-38	P1-2	X10	1500	X10	1500
P1-39	P1-2	X10	1500	x10	1500
P1-40	P1-2	X10	2500	X10	2500
P1-41	P1-2	X1	0	X1	0

*Allow reading to stabilize.
**Reading may vary from 0 to 25K dependent on setting of 1A2A1R1.

5-12. Voltage Measurements

a. To perform voltage measurements on mode switching card 1A2A1, proceed as follows:

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Perform the test-bed set-up in paragraph 4-13.

(3) Set POWER ECA circuit breaker to ON, ANT SYNC switch to INT, and AZ DRIVE switch to ON.

b. All of the voltage measurements listed below are with respect to chassis ground. The notes are provided to describe the test conditions for each measurement. All measurements should be made using the digital voltmeter. Unless otherwise indicated, voltages should be within 20 percent of the indicated value.

Mode Switching Card 1A2A1-Voltage Measurements

Test point	*Voltage (vdc)*	*Notes*
P1-1	0	1
P1-1	-1.6	2
P1-1	-3.1	3
P1-1	-4.8	4
P1-1	-6.2	5
P1-1	-8.0	6
P1-1	1.5	7
P1-1	3.1	8
P1-1	4.8	9
P1-1	6.2	10
P1-1	8.0	11
P1-4	0	1,14,15
P1-4	1.6	2,14,15
P1-4	3.2	3,14,15
P1-4	4.8	4,14,15
P1-4	6.5	5,14,15
P1-4	8.2	6,14,15
P1-4	-1.6	7,14,15
P1-4	-3.2	8,14,15
P1-4	-4.8	9,14,15
P1-4	-6.5	10,14,15
P1-4	-8.2	11,14,15
P1-6	2.9	5, 14, 15
P1-6	-2.9	10,14,15
P1-8	2.9	6,14,16
P1-8	-2.9	11,14,16
P1-12	0	1
P1-12	-2.4	2
P1-12	-4.8	3
P1-12	-7.2	4
P1-12	-9.6	5
P1-12	-12.	6
P1-12	2.4	7
P1-12	4.8	8
P1-12	7.2	9

See footnotes at end of table.

Test point	*Voltage (vdc)*	*Notes*
P1-12	9.6	10
P1-12	12	11
P1-15	0	1, 15, 16
P1-15	10	2, 14, 15, 16
P1-15	21	3, 14, 15, 16
P1-15	32	4, 14, 15, 16
P1-15	42	5, 14, 15, 16
P1-15	54	6, 14, 15, 16
P1-15	-10	7, 14, 15, 16
P1-15	-21	8, 14, 15, 16
P1-15	-32	9, 14, 15, 16
P1-15	-43	10, 14, 15, 16
P1-15	-54	11, 14, 15, 16
P1-21	2.8	2, 14, 15, 16
P1-21	-2.8	7, 14, 15, 16
P1-22	2.9	3, 14, 15, 16
P1-22	-2.9	8, 14, 15, 16
P1-23	2.9	4, 14, 15, 16
P1-23	-2.9	9, 14, 15, 16
P1-24	9.6	10
P1-29	4.8	8
P1-30	-2.8	12
P1-31	-9.6	5
P1-32	2.75	13
P1-33	-4.8	3
P1-34	2.4	7
P1-35	-12	1
P1-36	-2.4	2
P1-38	-7.2	4
P1-39	7.2	9
P1-40	12	1

Notes

1. INT ANT SYNC RPM switch 1A2S2 set to 0.
2. INT ANT SYNC RPM switch 1A2S2 set to CW5.
3. INT ANT SYNC RPM switch 1A2S2 set to CW10.
4. NT ANT SYNC RPM switch 1A2S2 set to CW15.
5. INT ANT SYNC RPM switch 1A2S2 set to CW20.
6. INT ANT SYNC RPM switch 1A2S2 set to CW25.
7. INT ANT SYNC RPM switch 1A2S2 set to CCW5.
8. INT ANT SYNC RPM switch 1A2S2 set to CCW10.
9. IMNT ANT SYNC RPM switch 1A2S2 set to CCW15.
10. INT ANT SYNC RPM switch 1A2S2 set to CCW20.
11. TNT ANT SYNC RPM switch 1A2S2 set to CCW25.
12. For all CCW positions of TNT ANT SYNC RPM switch 1A2S2.
13. For all CW positions of TNT ANT SYNC RPM switch 1A2S2
14. Voltage tolerance is ±25 percent.
15. Hold ROTATION ENABLE switch on test facilities set to ON.
16. Wait approximately 20 seconds for voltage to stabilize.

Section IV. SERVO PREAMPLIFIER CARD 1A2A2

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-13. General

This section contains general support troubleshooting, alignment and testing of servo preamplifier card 1A2A2.

5-14. Servo Preamplifier Card Troubleshooting

a. General. The Servo preamplifier card troubleshooting can be performed using either 60 Hz or 400 Hz synchro azimuth data, or 4 kHz resolver azimuth data. The waveforms referenced in the troubleshooting chart are contained in figure 5-1 (for 60 Hz synchro azimuth data), figure 5-2 (for 400 Hz synchro azimuth data), and figure 5-3 (for 4 kHz resolver azimuth data).

b. Preparation for Troubleshooting.

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Connect antenna control assembly and pedestal for synchro or resolver azimuth data (para 4-9).

(3) Perform the test-bed set-up (para 4-13) for 60 Hz or 400 Hz synchro azimuth data or 4 kHz resolver azimuth data.

(4) Align the antenna control assembly (para 4-16).

(5) Set POWER ECA circuit breaker to OFF and ANT SYNC switch to EXT.

(6) Set-up test-bed for a 3° clockwise error (para 4-22).

c. Servo Preamplifier Card Troubleshooting Procedures.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	12AA2J1-1	Oscilloscope	Waveform A	If normal, proceed to step 2. If abnormal, check 1A2A2R1, 1A2A2R22 and 1A2A2C1.
2	1A2A2J1-5	Oscilloscope	Waveform D	If normal, proceed to step 3. If abnormal, check 1A2A2R24, 1A2A2VR1, 1A2A2VR2, 1A2A2Q7, 1A2A2Q9 and associated components.
3	1A2A2J1-7	Oscilloscope	Waveform F	If normal, proceed to step 4. If abnormal, check 1A2A2Q8 and associated components.
4	1A2A2J1-9	Oscilloscope	Waveform G	If normal, proceed to step 5. If abnormal, check 1A2A2Q6 and associated components.
5	1A2A2J1-3	Oscilloscope	Waveform C	If normal, proceed to step 6. If abnormal, check 1A2A2Q5 and associated components

Step	Test point	Test equipment	Normal indication	Corrective measures
6	1A2A2J1-2	Oscilloscope	Waveform B	If normal, proceed to step 7. If abnormal, check 1A2A2Q1 through 1A2A2Q4 and associated components.
7	1A2A2J1-10	Oscilloscope	Waveform H	If normal, proceed to step 8. If abnormal, check 1A2A2R5, 1A2A2R20,1A2A2R13,1A2A2C4,1A2A2CR1 and 1A2A2CR2.
8	1A2A2P1-1	Oscilloscope	Waveform J	If abnormal, check 1A2A2R6.

5-15. Servo Preamplifier Card Alignment Procedure

The adjustments contained on the servo preamplifier card are as follows:

External mode tach feedback adjust.............R1
Chopper balance..R2
Demodulator balance...................................R3 and R4

These adjustments can only be made as part of the overall antenna control assembly alignment procedure. To perform this alignment, refer to paragraph 4-16.

5-16. Servo Preamplifier Card Testing

a. Install the servo preamplifier card into the test-bed.

b. Connect antenna control assembly and pedestal for synchro azimuth data (para 4-9).

c. Perform the test-bed set-up for 60 Hz synchro azimuth data (para 4-13).

d. Align the antenna control assembly for 60 Hz synchro azimuth data (para 4-16).

e. Perform the functional test in paragraph 4-20.

f. Perform the test-bed set-up for 400 Hz synchro azimuth data (para 4-13).

g. Align the antenna control assembly for 400 Hz synchro azimuth data (para 4-16).

h. Perform the functional test in paragraph: 4-20.

i. Connect antenna control assembly and pedestal for 4 kHz resolver azimuth data (para 4-13).

j. Perform the test-bed set-up for 4 kHz resolver azimuth data (para 4-13).

k. Align the antenna control assembly for 4 kHz synchro azimuth data (para 4-16).

l. Perform the functional test in paragraph 4-20.

5-17. Waveforms

a. Waveforms for servo preamplifier card 1A-2A2 are contained in figures 5-1, 5-2, and 5-3. The waveforms in figure 5-1 can be observed when the test-bed is set-up to supply 60 Hz synchro azimuth data. The waveforms in figure 5-2 are for 400 Hz synchro azimuth data and the waveforms in figure 5-3 are for 4 kHz resolver azimuth data. To observe the waveforms, proceed as follows:

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Connect antenna control assembly and pedestal for synchro azimuth data (para 4-9).

(3) Perform the test-bed set-up (para 4-13) for either 60 Hz or 400 Hz, synchro azimuth data, or 4 kHz resolver azimuth data.

(4) Align the antenna control assembly (para 4-16).

(5) Set POWER ECA circuit breaker to OFF and ANT SYNC switch to EXT.

(6) Set-up test-bed for a 3° clockwise error (para 4-22).

b. The waveforms in figures 5-1, 5-2, and 5-3 were taken with dc coupling and the oscilloscope vertical positioning adjusted so that the center line on the oscilloscope represents zero vdc. Notes are provided to describe any unique test conditions. Refer to figure 5-7 for test point locations.

5-18. Resistance Measurements

Resistance measurements for servo preamplifier card 1A2A2 are contained in the following chart. All measurements are made with the card removed from the antenna control assembly. All measurements should be made using Multimeter TS-352B/U. All resistance measurements should be within 20 percent of the indicated value.

Servo Preamplifier Card 1A2A2-Resistance Measurements

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
J1-1	P1-38	X10,000	2.2 MEG	X10,000	2.2 MEG
J1-2	P138	X100	12K	X100	12K
J1-3	P1-38	X100	10K	X100	10K
J1-4	P1-38	X1000	20K*	X1K	40K
J1-5	P1-38	X10,000	42K	X10,000	46K
J1-6	P1-38	X10,000	220K*	X10,000	450K
J1-7	P1-38	X10,000	165K*	X10,000	700K
J1-8	P1-38	X10,000	170K*	X10,000	700K
J1-9	P1-38	X100	10K	X100	10K
J1-10	P1-38	X10	1500	X100	1500
P1-1	P1-38	X1K	52K	X1K	52K
P1-2	P1-38	X1K	52K	X1K	52K
P1-4	P1-38	X100	1500	X100	1500
P1-5	P1-38	X100	1500	X100	1500
P1-6	P1-38	X10	850	X10	850
P1-7	P1-38	X10	850	X10	850
P1-8	P1-38	X10,000	INF	X100	12R
P1-9	P1-38	X100	12K	X10,000	12K
P1-10	P1-38	X10,000	INF	X10,000	INF
P1-11	P1-38	X10,000	INF	X10,000	INF
P1-12	P1-38	X10,000	150K*	X10,000	600K*
P1-13	P1-.38	X10,000	150K*	X10,000	600K*
P1-24	P1-38	X10,000	70K	X10,000	70K
P1-25	P1-38	X10,000	70K	X10,000	70K
P1-26	P1-38	X10,000	200K*	X10,000	350K*
P1-27	P1-38	X10,000	200K*	X10,000	350K*
P1-28	P1-38	X10,000	1NF	X10,000	INF
P1-29	P1-38	X10,000	1NF	X10,000	INF
P1-30	P1-38	X100	1NF	X10,000	12.5K
P1-31	P1-38	X100	1NF	X10,000	12.5K
P1-32	P1-38	X10K	1NF	X10,000	INF
P1-33	P1-38	X10K	1NF	X10,000	INF
P1-34	P1-38	X10,000	1NF	X10,000	100K
P1-35	P1-38	X10,000	1NF	X10K	100K
P1-39	P1-38	X1	0	X1	0
P1-40	P1-38	X10,000	20K	X1K	20K
P1-41	P1-38	X10,000	20K	X1K	20K

*Allow reading stabilize.

5-19. Voltage Measurements

a. To perform voltage measurements on servo preamplifier card 1A2A2, proceed as follows.

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Connect antenna control assembly and pedestal for synchro azimuth data (para 4-9).

(3) Perform the test-bed set-up (para 4-13) for 60 Hz synchro azimuth data.

(4) Align the antenna control assembly for 60 Hz synchro azimuth data (para 4-16).

(5) Set ANT SYNC switch to EXT, and POWER ECA circuit breaker to ON.

b. All voltage measurements listed below are with respect to chassis ground. The notes are provided to describe the test conditions for each measurement. All measurements should be made using the digital voltmeter.

Servo Preamplifier Card 1A2A2-Voltage Measurements

Test Point	Voltage (vdc)	Notes
J1-4	12	1
J1-8	-12	1
P1-40	22	2,3
P1-40	-22	2,4

1. Voltage tolerance is ±20 percent.
2. Voltage tolerance is ±25 percent.
3. Antenna speed adjusted to 10 rpm clockwise.
4. Antenna speed adjusted to 10 rpm counterclockwise.

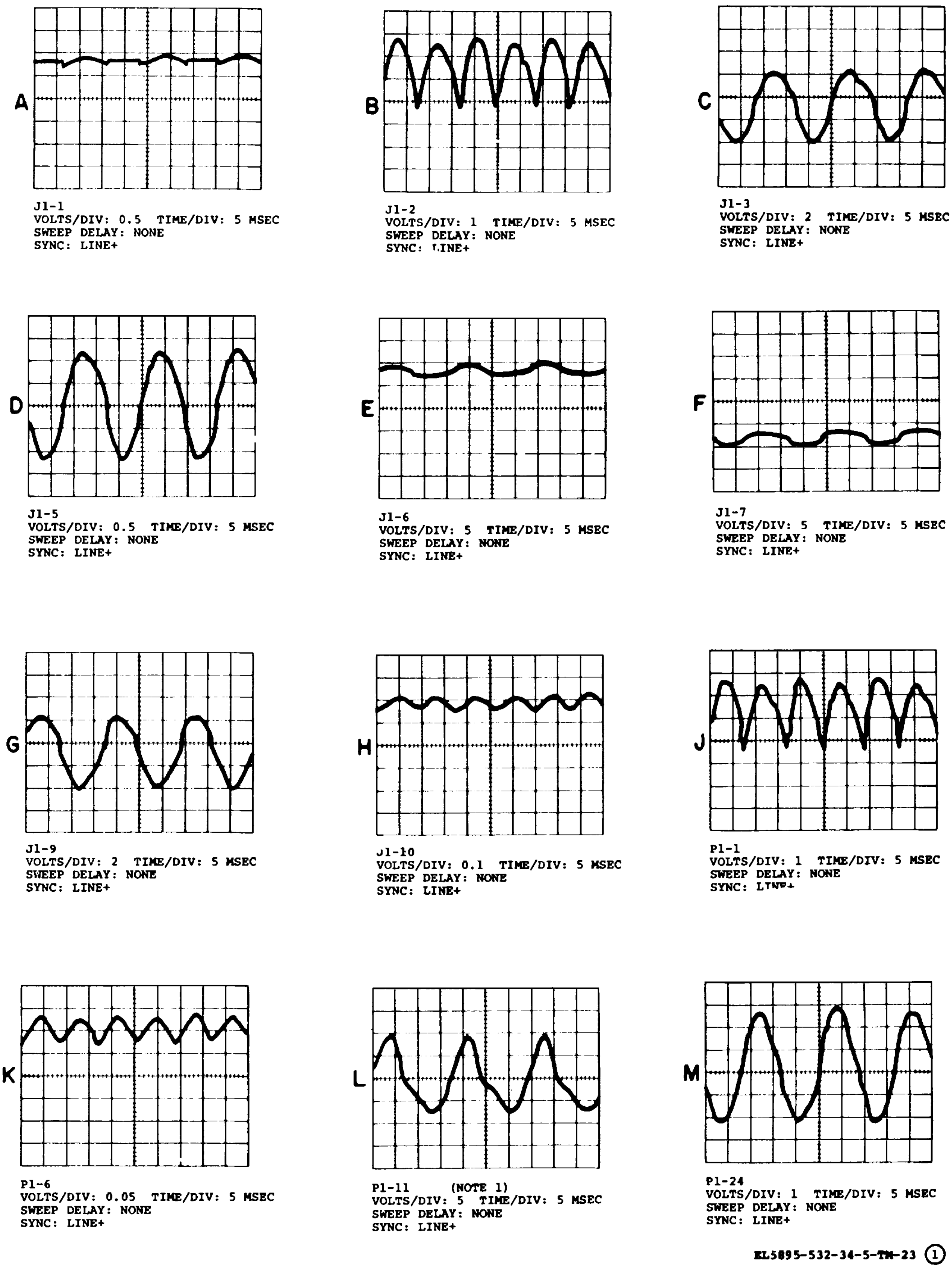
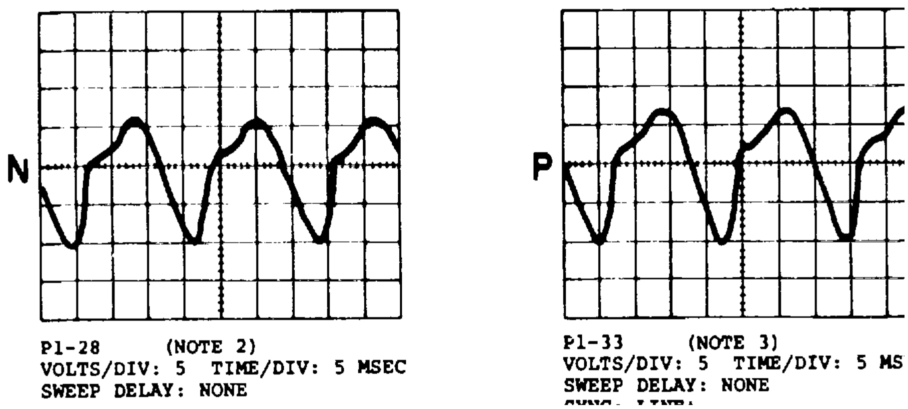


Figure 5-1(1). Servo preamplifier card 1A2A2, 60 Hz synchro azimuth data waveforms.



NOTES:

1. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-11, CHANNEL B PROBE CONNECTED TO P1-9, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
2. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-28, CHANNEL B PROBE CONNECTED TO P1-30, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, AND CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
3. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-33, CHANNEL B PROBE CONNECTED TO P1-35, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**

EL5895-532-34-5-TM-27 (2)

Figure 5-1(2). Servo preamplifier card 1A2A2, 60 Hz synchro azimuth data waveforms.

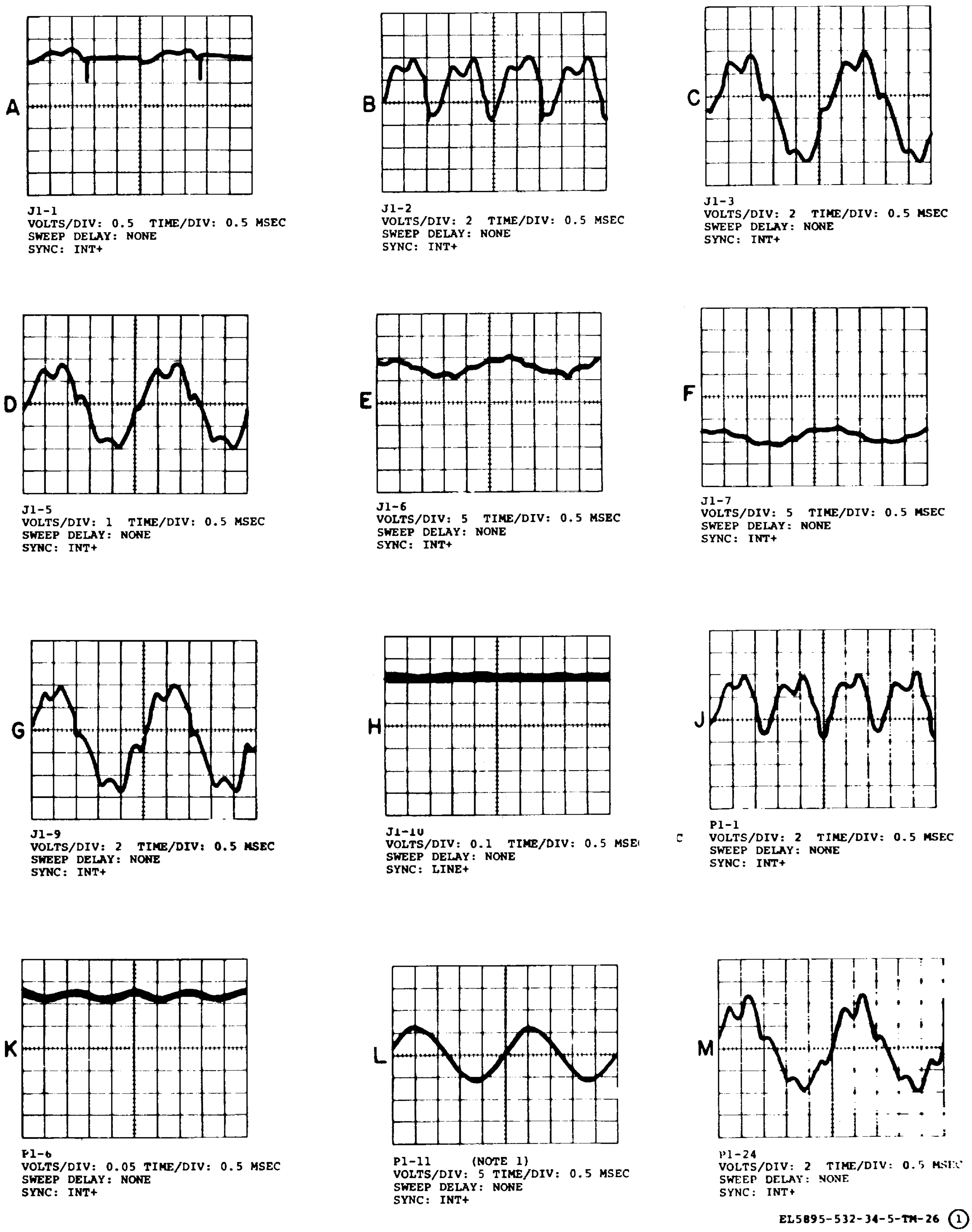
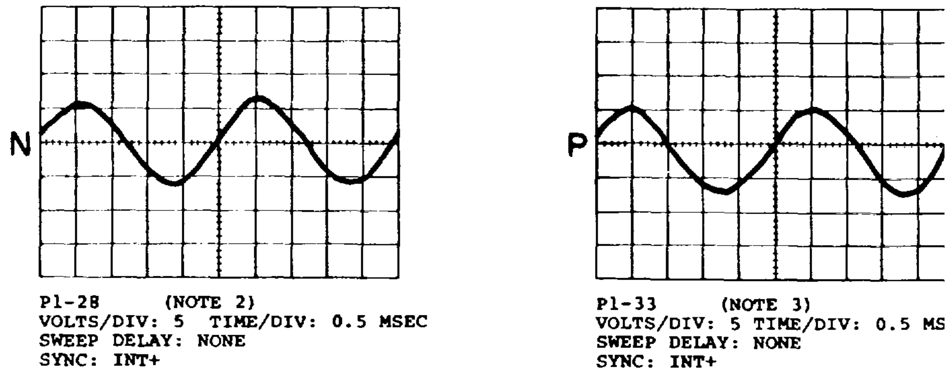


Figure 5-2(1). Servo preamplifier card 1A2A2, 400 Hz synchro azimuth data waveforms.



NOTES:

1. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-11, CHANNEL B PROBE CONNECTED TO P1-9, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
2. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-28, CHANNEL B PROBE CONNECTED TO P1-30, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, AND CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
3. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-33, CHANNEL B PROBE CONNECTED TO P1-35, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**

EL5895-532-34-5-TM-26 (2)

Figure 5-2(2). Servo preamplifier card 1A2A2, 60 Hz synchro azimuth data waveforms.

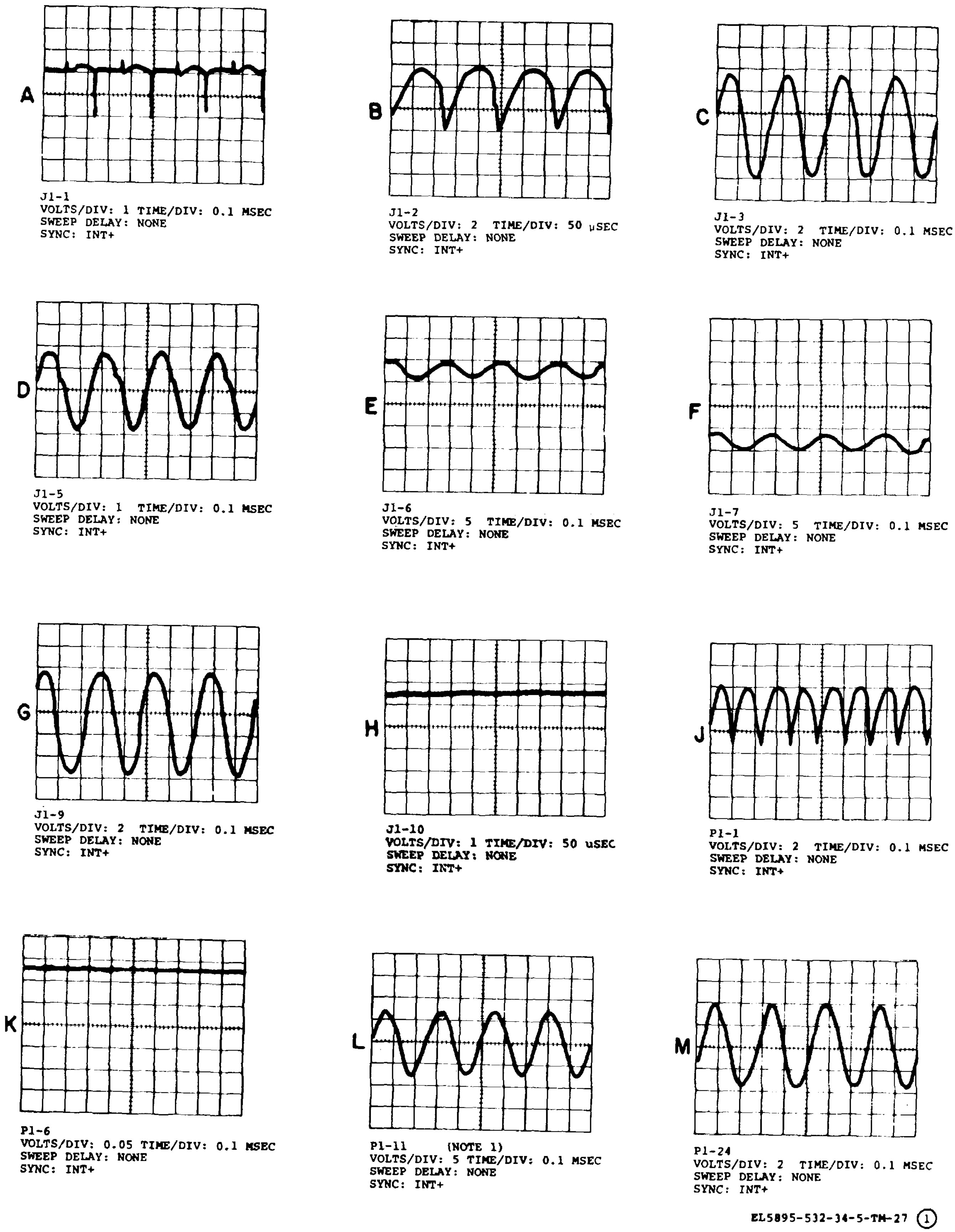
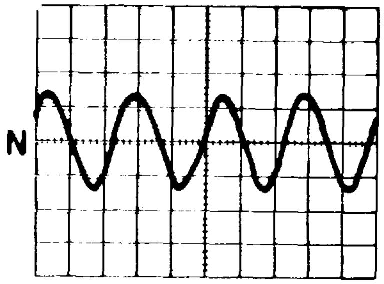
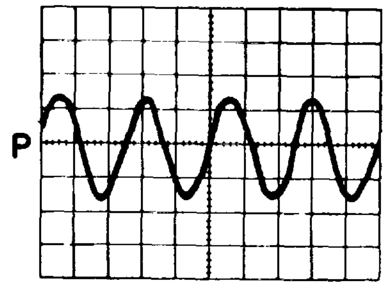


Figure 5-3(1). Servo preamplifier card 1A2A2, 4 Hz revolver azimuth data waveforms.





NOTES:

1. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-11, CHANNEL B PROBE CONNECTED TO P1-9, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
2. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-28, CHANNEL B PROBE CONNECTED TO P1-30, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, AND CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**
3. **WAVEFORM SHOWN IS WITH CHANNEL A PROBE CONNECTED TO P1-33, CHANNEL B PROBE CONNECTED TO P1-35, DISPLAY SELECTOR TO A+B, CHANNEL A POLARITY SWITCH TO +UP, CHANNEL B POLARITY SWITCH TO -UP, AND BOTH CHANNEL A AND CHANNEL B GAIN AT 5 VOLTS/DIV.**

EL5895-532-34-5-TM-27 (2)

Figure 5-3(2). Servo preamplifier card 1A2A2, 4 kHz resolver azimuth data waveforms.

Section V. TLI/SELF-TEST CARD 1A2A3

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-20. General

This section contains general support troubleshooting, alignment, and testing of t1i/self-test card 1A2A3.

5-21. T1i/Self-Test Card Troubleshooting

a. General. The t1i/self-test troubleshooting can be performed using either 60 Hz or 400 Hz synchro azimuth data or 4 kHz resolver azimuth data. The waveforms referenced in the troubleshooting chart are contained in figure 5-4 (for 60 Hz synchro azimuth data), figure 5-5 (for 400 Hz synchro azimuth data), and figure 5-6 (for 4 kHz resolver azimuth data).

b. Preparation for Troubleshooting.

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Connect antenna control assembly and pedestal for synchro or resolver azimuth data (para 4-9).

(3) Perform the test-bed set-up (para 4-13) for 60 Hz or 400 Hz synchro azimuth data, or 4 kHz resolver azimuth data.

(4) Align the antenna control assembly (para 4-16).

(5) Set POWER ECA circuit breaker to ON, ANT SYNC switch to EXT, and AZ DRIVE switch to ON.

(6) Set-up test-bed for a 3° clockwise error (para 4-22).

c. Tli/Self-Test Card 1A2A3 Troubleshooting Procedure.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	1A2A3J1-10	Oscilloscope	Waveform E	If normal, proceed to step 6. If abnormal, proceed to step 2.
2	1A2A3J1-5	Oscilloscope	Waveform A	If normal, proceed to step 3. If abnormal, check 1A2A3R26. If 1A2A3R3 (used in 400 Hz azimuth data only) is to be checked perform step 16.
3	1A2A3J1-9	Oscilloscope	Waveform D	If normal, proceed to step 4. If abnormal, check 1A2A3Q7 and components.
4	1A2A3J1-7	Oscilloscope	Waveform B	If normal proceed to step 5. If abnormal, check 1A2A3Q8, 1A2A3Q9, associated components.
5	1A2A3J1-8	Oscilloscope	Waveform C	If normal, check 1A2A3Q6 and associated components. If abnormal, check 1A2A3QS, 1A2A3Q9, and associated components.
6	1A2A3J1-10	Digital voltmeter	Voltage measurements in paragraph 5-26	If normal, check 1A2A3K1. If abnormal, proceed to step 7.
7	1A2A3J1-6	Digital voltmeter	Voltage measurements in paragraph 5-26	If normal, proceed to step 8. If abnormal, check 1A2A3Q1, 1A2A3Q2, 1A2A3Q3 and associated components.
8	1A2A3J1-4	Digital voltmeter	Voltage measurements in paragraph 5-26	If normal, proceed to step 9. abnormal, check 1A2A3Q1, 1A2A3Q2, 1A2A3Q3 and associated components.
9	1A2A3J1-3	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 10. If abnormal, check 1A2A3Q1, 1A2A3Q2, 1A2A3Q3 and associated components.
10	1A2A3J1-1	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 11. If abnormal, check 1A2A3Q4, 1A2A3Q5, and associated components.
11	1A2A3J1-2	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 12. If abnormal, check 1A2A3Q10 and associated components.
12	1A2A3J1-5	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 13. If abnormal, check 1A2A3CR7 and 1A2A3VR3.
13	1A2A3J1-9	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 14. If abnormal, check 1A2A3Q7 and associated components.
14	1A2A3J1-7	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, proceed to step 15. If abnormal, check 1A2A3Q8, 1A2A3Q9 and associated components.

Step	Test point	Test equipment	Normal indication	Corrective measures
15	1A2A3J1-8	Digital voltmeter	Voltage measurements in paragraph 5-26.	If normal, check 1A2A3Q6 and associated components. If abnormal, check 1A2A3Q8, 1A2A3Q9 and associated components

Note. L1i/self-test card must be removed from antenna control assembly prior to performing step 16

Step	Test point	Test equipment	Normal indication	Corrective measures
16	1A2A3J1-5 and 1A2A3P1-1	Multimeter	Varies between 20K ohms (1A2A3R3 maximum clockwise) and 0 ohms (1A2A3R3 maximum counterclockwise).	If abnormal, check 1A2A3R3.

5-22. Tli/Self-Test Card Alignment Procedure

a. General. The adjustments contained on the tli/self-test card are the differential amplifier balance R1, self-test threshold R2, and 400 Hz self-test threshold R3. The differential amplifier balance adjustment is contained in paragraph b. The self-test threshold and 400 Hz self-test threshold adjustments can only be made as part of the overall antenna control assembly adjustment procedure. To perform this alignment, refer to paragraph 4-16.

b Differential Amplifier Balance R1, Adjustment Procedure.

NOTE

Prior to performing this adjustment, the t1i/self-test card must be placed on an extender board and installed into the test-bed. Also, the test-bed set-up (para 4-13) must be performed.

(1) Set ANT SYNC switch on antenna control assembly to INT position.

(2) Set INT ANT SYNC RPM switch to 0.

CAUTION

To avoid damaging printed circuit card 1A2A3, the negative lead of the differential voltmeter must be isolated from ground when measuring the voltage between A3J1-6 and A3J1-4.

(3) Connect digital voltmeter between A3J1-6 and A3J1-4.

(4) Adjust potentiometer A3R1 to a minimum voltage (0.05-vdc maximum).

(5) Disconnect digital voltmeter.

5-23. Tli/Self-Test Card Testing

a. Install the t1i/self-test card into the test-bed.

b. connect the antenna control assembly and pedestal for 60 Hz synchro azimuth data (para 4-9).

c. Perform the test-bed set-up for 60 Hz synchro azimuth data (para 4-13).

d. Align the antenna control assembly for 60 Hz synchro azimuth data (para 4-16).

e. Perform the functional test in paragraph 4-20.

f. Perform the test-bed set-up for 400 Hz synchro azimuth data (para 4-13).

g. Align the antenna control assembly for 400 Hz synchro azimuth data (para 4-16).

h. Perform the functional test in paragraph 4-20.

i. Connect antenna control assembly and pedestal for 4 kHz resolver azimuth data (para 4-9).

j. Perform the test-bed setup for 4 kHz resolver azimuth data (para 4-13).

k. Align the antenna control assembly for 4 kHz resolver azimuth data (para 4-16).

l. Perform the functional test in paragraph 4-20.

5-24. Waveforms

a. Waveforms for t1i/self-test card 1A2A3 are contained in figures 5-4, 5-5, and 5-6. The waveforms in figure 5-4 can be observed when the test-bed is set-up to supply 60 Hz synchro azimuth data. The waveforms in figure 5-5 are for 400 Hz synchro azimuth data and the waveforms in figure 5-6 are for 4 kHz resolver azimuth data To observe the waveforms, proceed as follows:

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Connect antenna control assembly and pedestal for synchro or resolver azimuth data (para 4-9).

(3) Perform the test-bed set-up (para 4-13) for either 60 Hz or 400 Hz synchro azimuth data or 4 kHz resolver azimuth data.

(4) Align the antenna control assembly (para 4-16).

(5) Set ANT SYNC switch to EXT.

(6) Set-up test-bed for a 3° clockwise error (para 4-22).

b. The waveforms in figures 5-4, 5-5, and .5-6 were taken using dc coupling and the oscilloscope vertical positioning adjusted so that the center line on the oscilloscope represents zero vdc. Refer to figure 5-7 for test point locations.

5-25. Resistance Measurements

Resistance measurements for tl1/self-test card 1A-2A3 are contained in the following chart. All measurements are made with the card removed from the antenna control assembly. All measurements should be made using Multimeter TS-352 B/U. All resistance measurements should be within 20 percent of the indicated value.

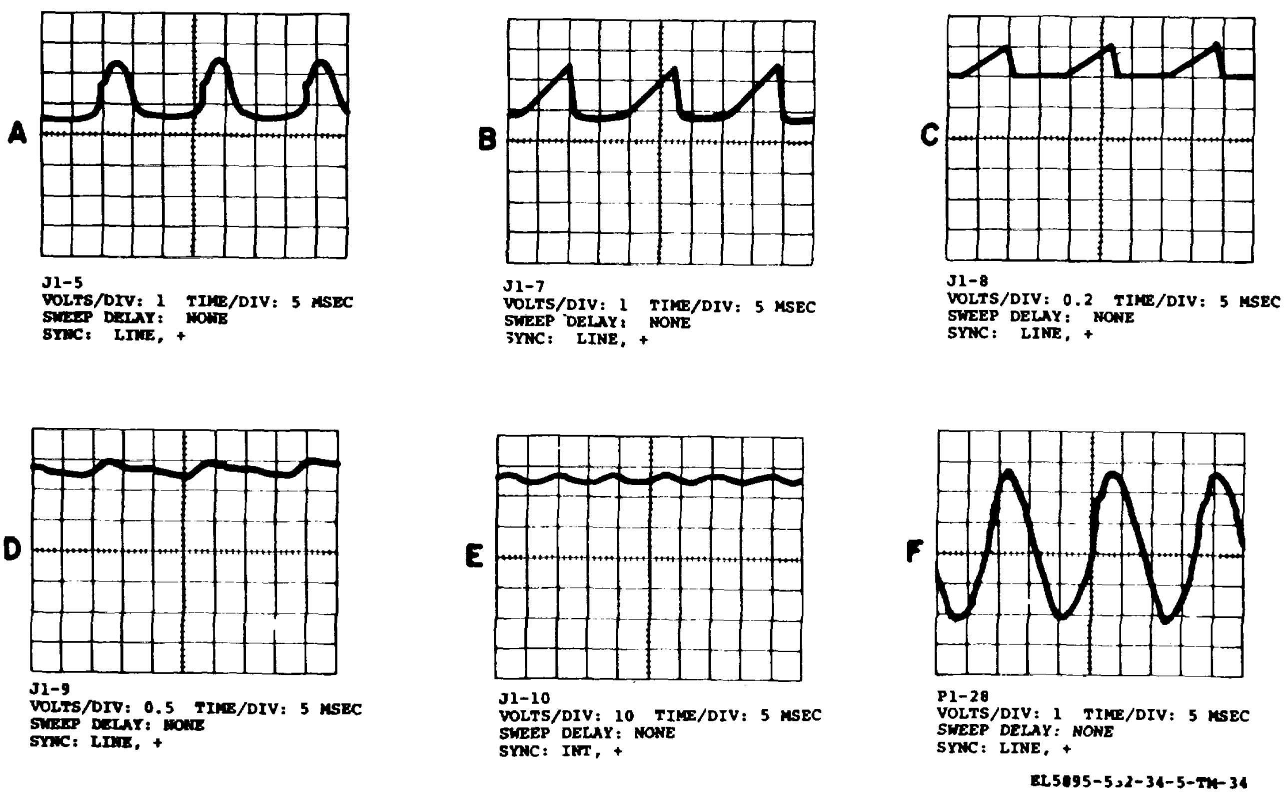


Figure 5-4. T1i/self-test card 1A2A3, 60 Hz synchro azimuth data waveforms.

Tli/Self-Test Card 1A2A3-Resistance Measurements

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
J1-1	P1-39	X100	2200	X100	2500
J1-2	P1-39	X10	1300	X10	1150
J1-3	P1-39	X100	5500	X10,000	30K
J1-4	P1-39	X100	4400	X100	1050
J1-5	P1-39	X100	4600	X100	1K
J1-6	P139	X100	4400	X100	1100
J1-7	P1-39	X100	3K	X100	1600
J1-9	P1-39	X100	1150	X100	3600
J1-10	P1-39	X100	3250	X100	INF
P1-1	P1-39	X1000	40K	X1000	50K
P1-2	P1-39	X10K	INF	X10K	INF
P1-3	P1-39	X1	0	X1	0

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
P1-4	P1-39	X1	0	X1	0
P1-5	P1-39	X1	0	X1	0
P1-6	P1-39	X10	360	X1000	4100
P1-7	P1-39	X10	420	X100	4100
P1-10	P1-39	X10K	INF	X10K	INF
P1-12	P1-39	X1	0	X1	0
P1-20	P1-39	x10	870	X10	900
P1-24	P1-39	X10	900	X10	900
P1-28	P1-39	100	13.5K	X100	19.5K
P1-38	P1-39	X1	0	X1	0
P1-40	P1-39	X10	230	X10	230
P1-41	P1-39	X10	230	X10	230

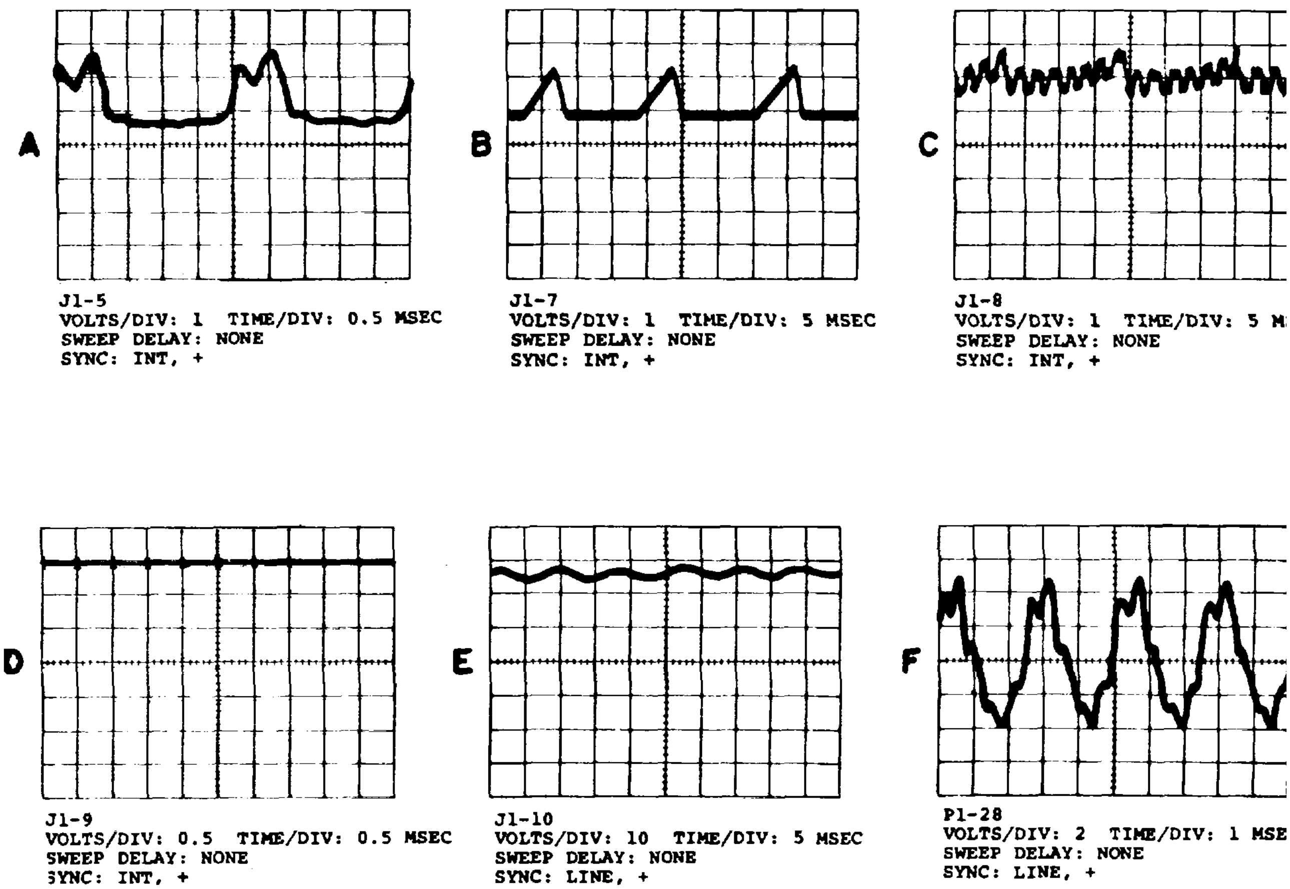


Figure 5-5. Tli/self-test card 1A2A3, 400 Hz synchro azimuth data waveforms

5-26. Voltage Measurements

a. To perform voltage measurements on t1i/ self-test card 1A2A3, proceed as follows:

(1) Place the card on an extender board and install in the antenna control assembly (part of the test-bed).

(2) Perform the test-bed set-up in paragraph 4-13 (AZIMUTH DATA control positions are immaterial, all voltage measurements are made in internal operation).

(3) Perform the differential amplifier balance 1A2A3R1 adjustment (para 5-22).

(4) Set ANT SYNC switch to INT, AZ DRIVE switch to ON, and POWER ECA circuit breaker to ON.

b. All voltage measurements listed below are with respect to chassis ground. All measurements should be made using the digital voltmeter.

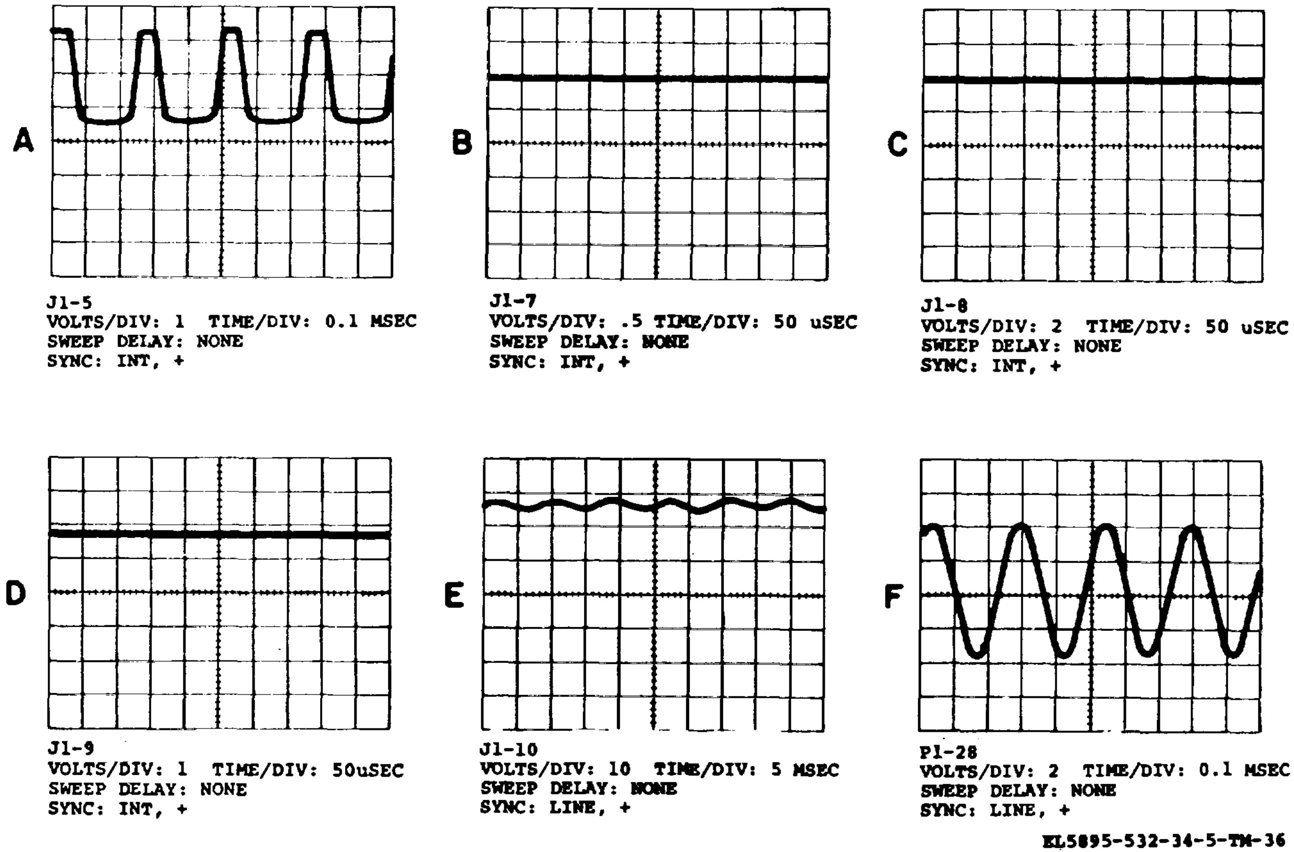


Figure 5-6. Tli/self-test card 1ASA3, 4 kHz resolver azimuth data waveforms.

Tli/Self-Test Card 1A2A3-Voltage Measurements

Test point	Switch Setting: ROTATION ENABLE	Switch Setting: INT ANT SYNC RPM	Voltage (Vdc)
J1-1	OFF	CW10	2.8
J1-1	OFF	CCW10	2.8
J1-1	ON	CW10	5.8
J1-1	ON	CCW10	5.8
J1-2	OFF	CW10	4.6
J1-2	OFF	CCW10	4.6
J1-10	OFF	CW10	27.0
J1-2	ON	CW10	.722
J1-2	ON	CCW10	.729
J1-3	OFF	CW10	4.0
J1-3	OFF	CCW10	4.0
J1-3	ON	CW10	7.1
J1-3	ON	CCW10	7.1
J1-4	OFF	CW10	3.6
J1-4	OFF	CCW10	11.9
J1-4	ON	CW10	6.1
J1-4	ON	CCW10	9.8
J1-5	OFF	CW10	4.0
J1-5	OFF	CCW10	4.0
J1-5	ON	CW10	0.0
J1-5	ON	CCW10	0.0
J1-6	OFF	CW10	12.0
J1-6	OFF	CCW10	3.5
J1-6	ON	CW10	9.9
J1-6	ON	CCW10	6.3
J1-7	OFF	CW10	1.0
J1-7	OFF	CCw10	1.0
J1-7	ON	CW10	8.7
J1-7	ON	CCW10	8.7
J1-8*	OFF	CW10	4.2
J1-8*	OFF	CCW10	4.2

Test point	Switch Setting: ROTATION ENABLE	Switch Setting: INT ANT SYNC RPM	Voltage (Vdc)
J1-8*	ON	CCW10	4.2
J1-8	ON	CCW10	4.2
J1-9	OFF	CW10	1.7
J1-9	OFF	CCW10	1.7
J1-9	OFF	CW10	0.004
J1-9	ON	CCW10	0.001
J1-10	OFF	CW10	27.0
J1-10	OFF	CCW10	27.0
J1-10	ON	CW10	1 max
J1-10	ON	CCW10	1 max
P1-2	OFF	CW10	2.1
P1-2	ON	CW10	0
P1-6-	-	12	
P1-8-	-	28	
P1-12	ON	CW10	12
P1-12	OFF	CW10	0
P1-20	-	CW10	2.75
P1-20	-	CCW10	-2.75
P1-24	ON	0	0
P1-24	ON	CW5	2.25
P1-24	ON	CW10	2.25
P1-24	ON	CW15	2.25
P1-24	ON	CW20	2.25
P1-24	ON	CW25	2.25
P1-24	ON	CCW5	-2.4
P1-24	ON	CCW10	-2.4
P1-24	ON	CCW15	-2.4
P1-24	ON	CCW20	-2.4
P1-24	ON	CCW25	-2.4

*Self-test threshold potentiometer 1A2A3R2 maximum clockwise

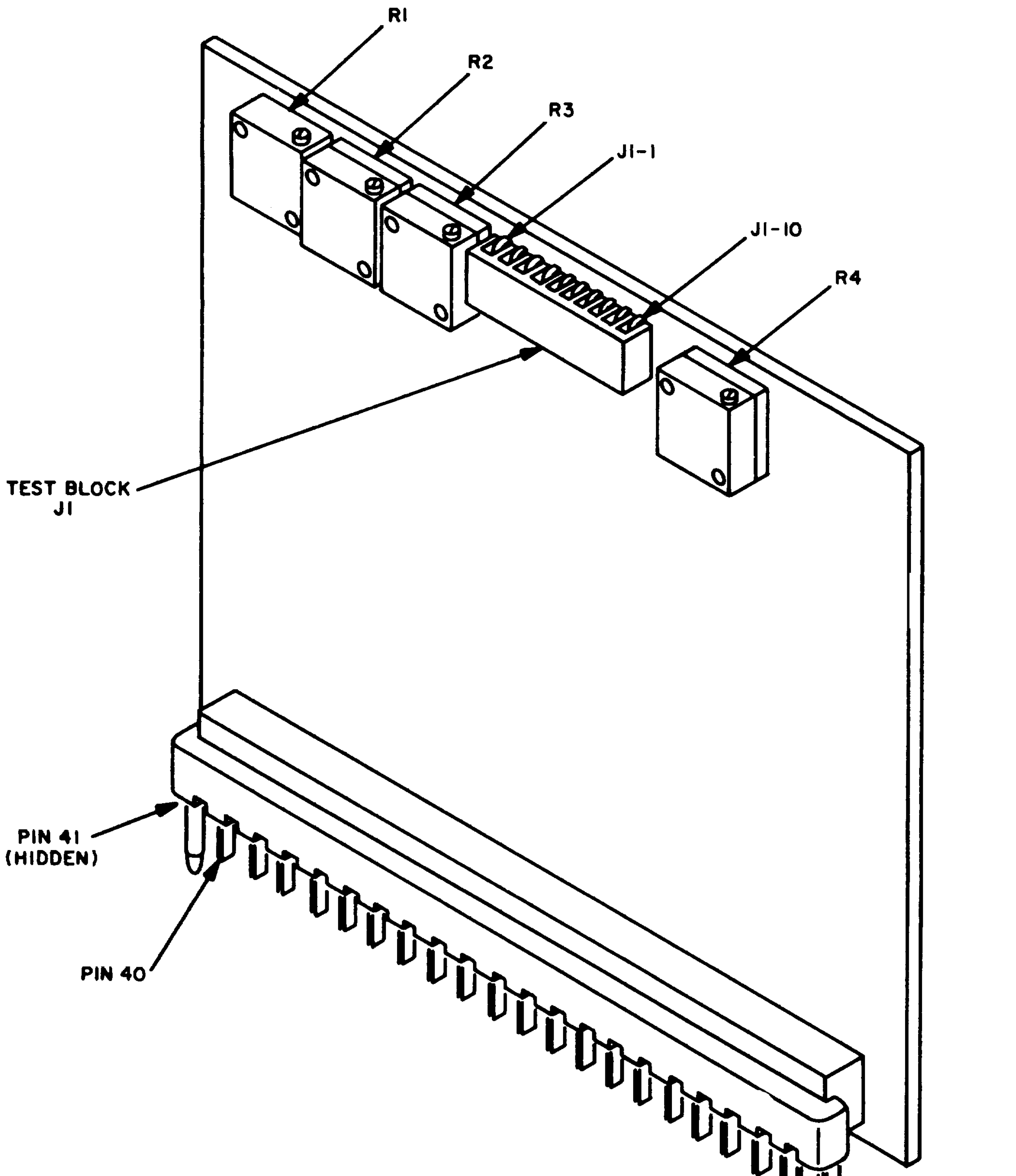


Figure 5-7. Typical printed circuit card.

Section VI. AXIMUTH ZERO ADJUST MODULE 1A2A4

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-27. General

This section contains general support testing and troubleshooting of azimuth zero adjust module 1A2A4. The AZ ADJ adjustment on the azimuth zero adjust module is only performed on-site by organizational or direct support maintenance personnel.

5-28. Azimuth Zero Adjust Module

Troubleshooting Procedure

a. Install the azimuth zero adjust module in a known good antenna control assembly (TM 11-5895-532-12).

b. Connect the antenna control assembly and pedestal for 60 Hz synchro azimuth data (para 4-9).

c. Perform the test-bed set-up (para 4-13) for 60 Hz synchro azimuth data.

d. Set the controls on the interface adapter unit as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel)	60 Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	60 Hz
SYNC/RSLVR switch	SYNC
ANT ROTATION switch	CW
RPM CONTROL	0 (max CCW)

e. Depress the ROTATION ENABLE switch on the interface adapter unit ANTENNA subpanel for approximately 20 seconds. The inertial antenna load shall rotate.

f. On antenna control assembly, open AZ ADJ access cover by loosening captive retaining screw. Loosen AZ ADJ LOCK.

NOTE

For at least 10 seconds prior to and during the performance of step g, the ROTATION ENABLE switch must be held at ON,

g. Rotate AZ ADJ in a clockwise direction (approximately 12 turns). The inertial antenna load will rotate one full revolution (360°). If the inertial antenna load fails to rotate one full revolution, check gears and wiring and replace synchro B1 if necessary.

h. On interface adapter unit, set GROUP CASE POWER SELECT to OFF.

i. Connect the antenna control assembly and pedestal for 4 kHz resolver azimuth data (para 4-9).

j. On the interface adapter unit, set the controls as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel)	60 Hz
FREQ SELECT (on AZIMUTH DATA SUBPANEL)	4000 Hz
SYNC/RSLVR switch	RSLVR
ANT ROTATION switch	CW
RPM CONTROL	(maxCCW)

k. Depress the ROTATION ENABLE switch for approximately 20 seconds. The inertial antenna load shall rotate.

NOTE

For at least 10 seconds prior to and during the performance of step 1, the ROTATION ENABLE switch must be held at ON.

I. Rotate AZ ADJ in a clockwise direction (approximately 12 turns). The inertial antenna load will rotate one full revolution (360°). If the inertial antenna load fails to rotate one full revolution, check gears and wiring and replace resolver B2 if necessary.

5-29. Azimuth Zero Adjust Module Testing

a. Install the azimuth zero adjust module in a known good antenna control assembly (FM 11-5895-532-12).

b. Connect the antenna control assembly and pedestal for 60 Hz synchro azimuth data (para 4-9).

c. Perform the test-bed set-up (para 4-13) for 60 Hz synchro azimuth data.

d. Set the controls on the interface adapter unit as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel)	60 Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	60 Hz
SYNC/RSLVR switch	SYNC
ANT ROTATION switch	CW
RPM CONTROL	(max CCW)

e. Depress the ROTATION ENABLE switch on the interface adapter unit ANTENNA subpanel for approximately 20 seconds. The inertial antenna load shall rotate.

f. On antenna control assembly, open AZ ADJ access cover by loosening captive retaining screw. Loosen AZ ADJ LOCK.

NOTE

For at least 10 seconds prior to and during the performance of step g, the ROTATION ENABLE switch must be held at ON.

g. Rotate AZ ADJ in a clockwise direction (approximately 12 turns). The inertial antenna load will rotate one full revolution (360°).

h. On interface adapter unit, set GROUP CASE POWER SELECT to OFF.

i. Connect the antenna control assembly and pedestal for 4 kHz resolver azimuth data (para 4-9).

j. On the interface adapter unit, set the controls as follows:

Control	*Position*
GROUP CASE POWER SELECT	60 Hz
FREQUENCY SELECT (on POWER subpanel)	60Hz
FREQ SELECT (on AZIMUTH DATA subpanel)	4000 Hz
SYNC/RSLVR switch	RSLVR
ANT ROTATION switch	CW
RPM CONTROL	(maxCCW)

k. Depress the ROTATION ENABLE switch for approximately 20 seconds. The inertial antenna load shall rotate.

NOTE

For at least 10 seconds prior to and during the performance of step 1, the ROTATION ENABLE switch must be held at ON.

I. Rotate AZ ADJ in a clocking direction (approximately 12 turns). The inertial antenna load will rotate one full revolution (3600).

5-30. Resistance Measurements

Resistance measurements for antenna zero adjust module 1A2A4 are contained in the following chart. All measurements are made with the module removed from the antenna control assembly. All measurements should be made using Multimeter TS-352B/U. All resistance measurements should be within 20 percent of the indicated value.

Azimuth Zero Adjust Module 1A2A4-Resistance Measurements

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
P1-1	P1-2	X10	208	X10	208
P1-1	P1-3	X10	210	X10	210
P1-1	P1-5	X10,000	INF	X10,000	INF
P1-4	P1-5	X10	400	X10	400
P1-4	P1-6	X10	400	X10	400
P1-7	P1-11	X1	3.8	X1	3.8
P1-7	P1-12	X10,000	INF	X10,000	INF
P1-7	P1-13	X10,000	INF	X10,000	INF
P1-7	P1-14	X10,000	INF	X10,000	INF
P1-8	P1-12	X1	3.8	X1	3.8
P1-8	P1-13	X10,000	INF	X10,000	INF
P1-8	P1-14	X10,000	INF	X10,000	INF
P1-13	P1-14	X10,000	INF	X10,000	INF
P1-13	P1-15	X1	21	X1	21
P1-14	P1-16	X1	21	X1	21

Section VII. POWER SUPPLY MODULE 1A2A5

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-31. General

This section contains general support troubleshooting, adjustment, and testing of power supply module 1A2A5.

5-32. Power Supply Module Troubleshooting

a. Preparation for Troubleshooting.

(1) Connect the test-bed as shown in figure FO-4.

(2) On power supply module, remove 10 screws H21 (TM 11-5895-532-34P-5).

(3) Extend the module and install in the antenna control assembly using cable 2A2W1/2A2W2/2A2W3 (part of test-bed).

(4) On the interface adapter unit, set the controls as follows:

Controls	*Position*
GROUP CASE POWER subpanel:	
60 Hz circuit breaker	ON
400 Hz circuit breaker	OFF
GROUP CASE POWER SELECT	60Hz
POWER subpanel:	
60 Hz circuit breaker	ON
400 Hz circuit breaker	OFF
FREQUENCY SELECT	60Hz

(5) On the iff set, set the controls as follows:

Controls	*Position*
C-d group case power subpanel:	
SYSTEM POWER circuit break	ON
Control box:	
POWER circuit breaker	ON
Antenna control assembly:	
POWER circuit breaker	ON
POWER ECA circuit breaker	OFF

b. Power Supply module 1A2A5 Troubleshooting Procedure,

Step	[1] Test point	Test equipment	Normal indication	Corrective measures
1	POWER circuit breaker 1A2CB1 (Set to ON).	None	Remains at ON	If 1A2CB1 trips OFF, troubleshoot power supply module 1A2A5 using resistance measurements contained in paragraph 5-35.
2	1A2ASA1-E11	Digital voltmeter	+22 to +33 vdc	If normal, proceed to step 6. If abnormal, proceed to step 3.
3	1A2A5T1-1 and 1A2A5T1-2.	Multimeter	115 ±11.5 vac	If normal, proceed to step 4. If abnormal, check wiring between: 1A2A5P1-1 and 1A2A5T1-1, 1A2A5P1-3 and 1A2A5T1-2.
4	1A2A5T1-3 and 1A2A5T14.	Multimeter	35 ±5 vac	If normal, proceed to step 5. If abnormal, check 1A2A5T1.
5	CR1 (+)	Digital voltmeter	+33 ±5vdc	If normal, check 1A2A5L1. If abnormal, check 1A2A5CR1.
6	1A2A5A1-E11	Oscilloscope	Ripple voltage less than 5.0 volts peak: to-peak.	If normal, proceed to step 7. If abnormal, check 1A2A5C1 and 1A2A5L1.
7	1A2A5A1-E5	Digital voltmeter	0.0 vdc	If normal, proceed to step 8. If abnormal, check wiring between 1A2A5A1-5 and 1A2A5P1-10.
8	1A2A5A1-E7	Digital voltmeter	+12.0 ± 0.5 vdc	If normal, proceed to step 14. If abnormal, proceed to step 9.
9	1A2A5A1-E3	Digital voltmeter	Varies between +12 ±1.0 vdc (1A2A5A1R1 maximum clockwise) and +8 ±1.0 vdc (1A2A5A1R1 maximum counterclockwise).	If normal, proceed to step 12. If abnormal, set POWER circuit breaker 1A2CB1 to OFF, disconnect power supply module 1A2A5, and proceed to step 10.
10	1A2ASA1-E3 (red probe) and 1A2A5A1-E5 (black probe).	Multimeter	Varies between 330 ohms (1A2A5A1R1 maximum clockwise) and 220 ohms (1A2A5A1R1 maximum counterclockwise).	If normal, proceed to step 11. If abnormal, check 1A2A5A1R1 and 1A2A5A1R3.
11	1A2ASA1-E1 (red probe) and 1A2A5A1-E11 (black probe).	Multimeter	180 ohms	If normal, check 1A2A5A1C1 and 1A2A-5VR1. If abnormal, check 1A2A5R2.

Step	[1] Test point	Test equipment	Normal indication	Corrective measures
12	1A2A5A1-E9	Digital voltmeter	+11.5 ±2.0 vdc	If normal, proceed to step 13. If abnormal, check 1A2A5A1CR1, 1A2A5R3 and 1A2A5Q2.
13	1A2A5A1-E13	Digital voltmeter	+16.5 ±2.5 vdc	If normal, check 1A2A5R1. 1A2A5Q1, and 1A2A5A1R5. If abnormal, check 1A2A5A1VR1 and 1A2A5A1R5.
14	1A2A5A1-E7	Oscilloscope	Ripple voltage less than 0.4 volts peak to-peak.	If normal, proceed to step 15. If abnormal, check 1A2A5A1C1, 1A2A5A1C3, and 1A2A5A1C5.
15	1A2A5A1-E8	Digital voltmeter	0.0 vdc	If normal, proceed to step 16. If abnormal, check wiring between 1A2A5A1-8 and 1A2A5AP1-17.
16	1A2A5A1-E6	Digital voltmeter	-12.0 ±0.5 vdc	If normal, proceed to step 25. If abnormal, proceed to step 17.
17	1A2A5T1-5 and 1A2A5T1-7.	Multimeter	35 ±5 vac	If normal, proceed to step 18. If abnormal, check 1A2A5T1.
18	CR2 (+)	Digital voltmeter	+33 ±5 vdc	If normal, proceed to step 19. If abnormal, check 1A2A5CR2.
19	1A2A5A1-E12	Digital voltmeter	+22 to +33 vdc	If normal, proceed to step 20. If abnormal, check 1A2A5L1.
20	1A2A5A1-E4	Digital voltmeter	Varies between +12 ±1.0 vdc (1A2A5A1R2 maximum clockwise) and +8.0 ±1.0 vdc (1A2A5A1R2 maximum counterclockwise).	If normal, proceed, to step 23. If abnormal, set POWER circuit breaker 1A2CB1 to OFF, disconnect power supply module 1A2A5, and proceed to step 21.
21	1A2A5A1-E4 (red probe) and 1A2A5A1-E6 (black probe).	Multimeter	Varies between 330 ohms (1A2A5A1R2 maximum clockwise) and 220 ohms (1A2A5A1R2 maximum counterclockwise).	If normal, proceed to step 22. If abnormal, check 1A2A5A1R2 and 1A2A5A1R4.
22	1A2A5A1-E2 (red probe) and 5VR2. 1A2ASA1-E12 (black probe).	Multimeter	180 ohms	If normal, cheek 1A2A5A1C2 and 1A2A- If abnormal, check 1A2A5R5.
23	1A2A5A1-E10	Digital voltmeter	+11.5 ±2.0 vdc	If normal, proceed to step 24. If abnormal, check 1A2A5A1CR2, 1A2A6R6, and 1A2A5Q4.
24	1A2A5A1-E14	Digital voltmeter	+16.5 ±2.5 vdc	If abnormal, check 1A2A5R4, 1A2A5Q3, and 1A2A5A1R6. If abnormal, check 1A2A-5A1VR2, and 1A2A5A1R6.
25	1A2A5A1-E6	Oscilloscope	Ripple voltage less than 0.4 volts peak-to-peak.	If normal, proceed to step 27. If abnormal, proceed to step 26.
26	1A2A5A1-E12	Oscilloscope	Ripple voltage less than 5.0 volts peak-to-peak.	If normal, check 1A2A5A1C2, 1A2A6A1C4, and 1A2A5A1C6. If abnormal, check 1A2AC2 and 1A2A5L1.
27	1A2A5AT1-6 and 1A2A5T1-7.	Multimeter	12.7 ±1.3 vac	If normal, check wiring between 1A2A-5P1-12 and 1A2A5T1-6, 1A2A5P1-13 and 1A2A6T1-7. If abnormal, check 1A2A5T1.

[1] When using the digital voltmeter, connect the low lead to antenna control assembly; the high lead to the test point indicated.

5-33. Power Supply Module Adjustment Procedure

a. General. The only adjustments on the power supply module are for the +12 vdc and -12vdc outputs. To adjust these outputs, perform the procedure that follows.

b. Procedure.

(1) Perform the procedure (preparation for troubleshooting) in paragraph 5-32a.

(2) Connect low lead of the digital voltmeter to the chassis of antenna control assembly and high lead to 1A2A2J1-8.

(3) Adjust -12V ADJ on power supply module for a -12 volt indication on digital voltmeter. Limit -11.88 to -12.12 vdc.

(4) Connect low lead of digital voltmeter to chassis of antenna control assembly and high lead to 1A2A2J1-4.

(5) Adjust + 12V ADJ on power supply module for a +12 volt indication. Limit +11.88 to + 12.12 vdc.

5-34. Power Supply Module Testing

a. Perform the procedure (preparation for troubleshooting) in paragraph 5-32a.

b. Connect the low lead of the digital voltmeter to antenna control assembly chassis.

c. Connect the high lead of the digital voltmeter to the test point listed below and check that the correct indication is obtained.

Test point	*Voltage*
1A2A2J1-4	+12.0 ±0.5 vdc
1A2A2J1-8	-12.0 ±0.5 vdc
1A2A3P1-8	+22 to +33 vdc

d. Connect oscilloscope to the test point listed below and check the power supply ripple voltage.

Test point	*Ripple Voltage*
1A2A21J1-4	less than 0.4 volts peak-to-peak
1A2A2J1-8	less than 0.4 volts peak-to-peak
1A2A3P1-8	less than 5.0 volts peak-to-peak

e. Visually check that the POWER indicator lamp 1A2DS1 is on.

5-35. Resistance Measurements

a. Resistance measurements for power supply module 1A2A5 are contained in b below. All measurements are made with the module removed from the antenna control assembly, using Multimeter TS-352B/U. All measurements should be within 20 percent of indicated value.

NOTE

All odd numbered E point measurements were made with respect to 1A2ASE5; while even numbered E points measurements were made with respect to 1A2A5- E6.

b. Power Supply Module 1A2A5-Resistance Measurements

Positive meter lead (red)	Negative meter lead (black)	Meter ohms range	Resistance in ohms	Reverse meter ohms range	Reverse resistance in ohms
E3	E5	RX10	280	RX10	150
E4	E6	RX10	160*	RX10	280
E7	E5	RX100	2K	RX100	3800
ES	E6	RX100	2K	RX100	3800
E9	E5	RX100	6200	RX100	1400
E10	E6	RX100	6200	RX100	1400
E11	E5	RX10	330	RX10	480
E12	E6	RX10	330	RX10	480
E13	E5	RX100	1300	RX100	1300
E14	E6	RX100	1300	RX100	1300
CR1(+)	E5	RX100	500	RX100	500
CR2(+)	E6	RX100	500	RX100	500

*Dependent upon setting of 1A2A5R2.

5 36. Voltage Measurements

Normal power supply module voltages are those listed in the normal indication column of the troubleshooting chart (para 5-32b).

Section VIII. ELECTRONIC CONTROL AMPLIFIER FILTER 1A2A6

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-37. General

This section contains general support troubleshooting and testing of electronic control amplifier filter 1A2A6.

5-38. Electronic Control Amplifier Filter Troubleshooting

To perform troubleshooting on the electronic control amplifier filter, refer to the schematic diagram (fig. FO-10) and check the resistance measurements in paragraph 5-40.

5-39. Electronic Control Amplifier Filter Testing

a. General. Perform the resistance measurements in paragraph 5-40. If all measurements are normal, perform the procedure in b.

b. Procedure.

(1) Install the electronic control amplifier filter in the antenna control assembly (TM 11-5895-532-12).

(2) On the interface adapter unit, set the controls as follows:

Controls	*Position*
ANTENNA subpanel'	
ANT ROTATION switch	STA
GROUP CASE POWER subpanel:	
60 Hz circuit breaker	ON
400 Hz circuit breaker	OFF
GROUP CASE POWER SELECT	60 Hz
POWE'IR subpanel	
60 Hz circuit breaker	ON
400 Hz circuit breaker	OFF
FREQUENCY SELECT	60 Hz

(3) On the iff set, set the controls as follows:

Controls	*Position*
C-d group case power subpanel:	
SYSTEM POWER circuit breaker.................	ON
Control box:	
POWER circuit breaker................................	ON
Antenna control assembly:	
POWER circuit breaker................................	ON
POWER ECA circuit breaker........................	ON
INT ANT SYNC RPM switch.........................	CW25
ANT SYNC switch.......................................	
Pedestal	
Az DRIVE switch...	ON

(4) Depress the ROTATION ENABLE switch, on interface adapter unit ANTENNA subpanel, for approximately 20 seconds. The inertial antenna load shall rotate smoothly.

(5) Hold the ROTATION ENABLE switch to ON and time the inertial antenna load rotation for 25 revolutions. The time shall be 60 ± 12 seconds. Release the ROTATION ENABLE switch.

5-40. Resistance Measurements

Resistance measurements for electronic control amplifier filter 1A2A6 are contained in the following chart. All measurements are made with the card removed from the antenna control assembly. All measurements should be made using Multimeter TS-352B/U. All resistance measurements should be within 20 percent of the indicated value.

PositiveNegative meter lead (red)	Meter meter lead (black)	Resistance ohms range	Reverse in ohms	Reverse meter ohms range	resistance in ohms
J1-1	J2-1	RX1	0	RX1	0
J1-1	J2-3	RX10,000	INF	RX10,000	INF
J1-2	J2-2	RX1	0	RX1	0
J1-2	J2-3	RX10,000	INF	RX10,000	INF

Section IX. ELECTRONIC CONTROL AMPLIFIER 1A2A7

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for figure FO-4.

5-41. General

This section contains general support testing of electronic control amplifier 1A2A7. This assembly is not repairable at general support. If the assembly does not pass the test procedure in paragraph 5-42 it should be forwarded to the depot facility.

5-42. Electronic Control Amplifier Testing

a. Install the electronic control amplifier in the antenna control assembly (TM 11-5895-532-12).

b. Connect the pedestal and antenna control assembly for 60 Hz synchro azimuth data (para 4-10).

c. Set up the test-bed for 60 Hz synchro azimuth data (para 4-13).

d. Perform the alignment procedure to 60 Hz synchro azimuth data (para 4-17).

e. Perform the functional test in paragraph 4-20.

f. On the antenna control assembly, set EXT REF FREQ switch to 400 Hz.

g. Set up the test-bed for 400 Hz synchro azimuth data (para 4-13).

h. Perform the alignment procedure for 400 Hz synchro azimuth data (para 4-18).

i. Perform the functional test in paragraph 4-20.

CHAPTER 6
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR 7-FOOT ANTENNA 3A1, AND 14-FOOT ANTENNA, UNIT 4

Section I. GENERAL

6-1. General

This chapter contains general support maintenance instructions for the 7-foot and 14-foot antennas, including information relative to test equipment required, troubleshooting, repair, and testing. Refer to chapter 4 for general maintenance information.

6-2. Tools and Test Equipment

Tools and test equipment required for maintenance of the 7-foot and 14-foot antennas are listed below by common names. (Refer to para 4-6 and 4-7 for complete nomenclature of tools and test equipment.)

a. Radar test set.
b. Swr indicator.
c. Slotted line.
d. RF signal generator.
e. Test facilities set.
f. Multimeter.
g. Printed wiring repair kit.
h. Electronic equipment repair kit.

6-3. Reference Data

The data listed in the following chart is useful when troubleshooting the 7-foot or 14-foot antennas.

Reference	*Data*
Paragraph 2-5	7-foot antenna functional description.
Paragraph 2-6	14-foot antenna functional description.
Figure FO-12	7-foot antenna schematic diagram.
Figure FO-14	14-foot antenna schematic diagram.
TM 11-5895-532-34P-5	Parts location for 7-foot and 14-foot antennas.

Section II. TROUBLESHOOTING AND REPAIR OF 7-FOOT ANTENNA 3A1 WHEN USING AN/TPM-25A

NOTE

See section V when using AN/UPM-98B(or C).

6-4. Preparation for Troubleshooting and Repair of 7-Foot Antenna

Prepare the 7-foot antenna for troubleshooting as follows:

a. Loosen the 30 screws that hold the two halves of the radome together.

b. Disconnect WIPI and W2P1 from J1 and J2, respectively, and remove the rear half of the radome.

c. Set up the test equipment as shown in figure 6-1 with the output of the rf signal generator connected to LP IN of the radar test set.

NOTE

Reflections from large metal objects may have an effect on the vswr measurements. To obtain accurate measurements, the main-beam of the antenna must not be pointed at large metal objects within 20 feet of the antenna.

d. At the oscilloscope, set the controls as follows:

(1) Mainframe panel OS-189A(P)/USM-281 controls:

POWER	On
HORIZONTAL DISPLAY	INT
HORIZONTAL MAGNIFER	x1
SCALE	Fully counterclockwise.
FOCUS	As required for sharp and clear waveforms.
HORIZONTAL POSTION	As required to center sweep trace.
HORIZONTAL EXT INPUT	N/A

(2) Dual channel 50 MHz vertical amplifier panel PL-1186A/USM controls:

DISPLAY	ALT
MAGNIFIER	X
Channel A controls:	
POLARITY	+UP
POSITION	As required to position waveforms on CRT screen.
VOLTS/DIV (outer)	S
VOLTS/DIV (inner)	CAL (fully clockwise)
AC-GND-DC	DC
Channel B controls	Same settings as specified for channel A controls.

(3) Time base and delay generator panel PL-1187A/USM controls:

Sweep display switch (red knob)	DELAYED
MAIN TIME/DIV	IMSEC
DELAYED TIME/DIV	50
DELAY (DIV)	285
SWEEP MODE	NORM
MAIN VERNIER	CAL (fully clockwise)
DELAYED VERNIER	CAL (fully clockwise)
MAIN TRIGGER SOURCE	EXT
MAIN trigger source	AUTO
MAIN SLOPE	+
DELAYED SLOPE	N/A
MAIN trigger coupling switch	DC
DELAYED trigger coupling switch	N/A
MAIN TRIGGER LEVEL	As required for a synchronized sweep.
DELAYED TRIGGER LEVEL	N/A

e. At the rf signal generator, set controls as follows:

POWER	ON

SIGNAL FREQUENCY.......................... 1030
Sync Se .... CW
OUTPUT ATTENUATOR .... Fully CW

f. At the radar test set, set the measurement panel controls as follows:

FUNCTION SEL.................................... FREQ
DEMOD VID LEVEL.............................. Fully ccw
FREQ MEAS... 80
TRIG SEL INT/DCD/EXT .... INT
SIG GEN FUNCTION............................ SWP±MHz
POWER .... ON

g. Adjust the SIGNAL FREQUENCY control on the rf signal generator to position the peak of the pulse on A INPUT trace over the center frequency marker on the B INPUT trace. The rf signal generator is now set to 1030 MHz.

h. At the rf signal generator, set controls as follows:

PULSE WIDTH 10
PULSE RATE PPS................................ 100
Sync Sel .... RATE X10

i. At the slotted line, set the controls as follows:

Probe depth .... maximum
Drive knob .... midposition
Tuning knob .... midposition

j. At the SWR indicator, set controls as follows:

LINE... ON
METER SCALE.................................... NORMAL
RANGE 60
INPUT SELECTOR .... XTAL 200
VERNIER GAIN .... mid position

k. Transfer the rf signal generator output from LP IN of the radar test set to the slotted line adapter as shown in figure 6-1.

l. Terminate antenna connector W2P1 using electrical dummy load 2AT1 (50-ohm, 50-watt) from the test facility set.

m. Connect the slotted line to W1P1 of antenna and measure vswr as follows:

(1) On the swr indicator, set LINE switch to ON and adjust the tuning knob for maximum indication on the SWR indicator.

(2) Move the probe carriage along the length of the slotted line by sliding the carriage or by pushing in the drive knob and turning it. Set carriage to a position that gives a maximum reading on the SWR indicator (adjusting RANGE control as required).

NOTE

If the SWR indicator needle goes off scale, reduce the penetration of the probe depth into the slotted line or adjust the RANGE switch setting.

(3) Adjust the VERNIER GAIN controls on the SWR indicator to obtain a full-scale indication on the meter (1 on the Voltage Standing Wave Ratio scale).

(4) Move the carriage to obtain a minimum swr indicator meter deflection at this setting. This indication is the vswr.

(5) Deenergize power to equipment; disconnect all equipment.

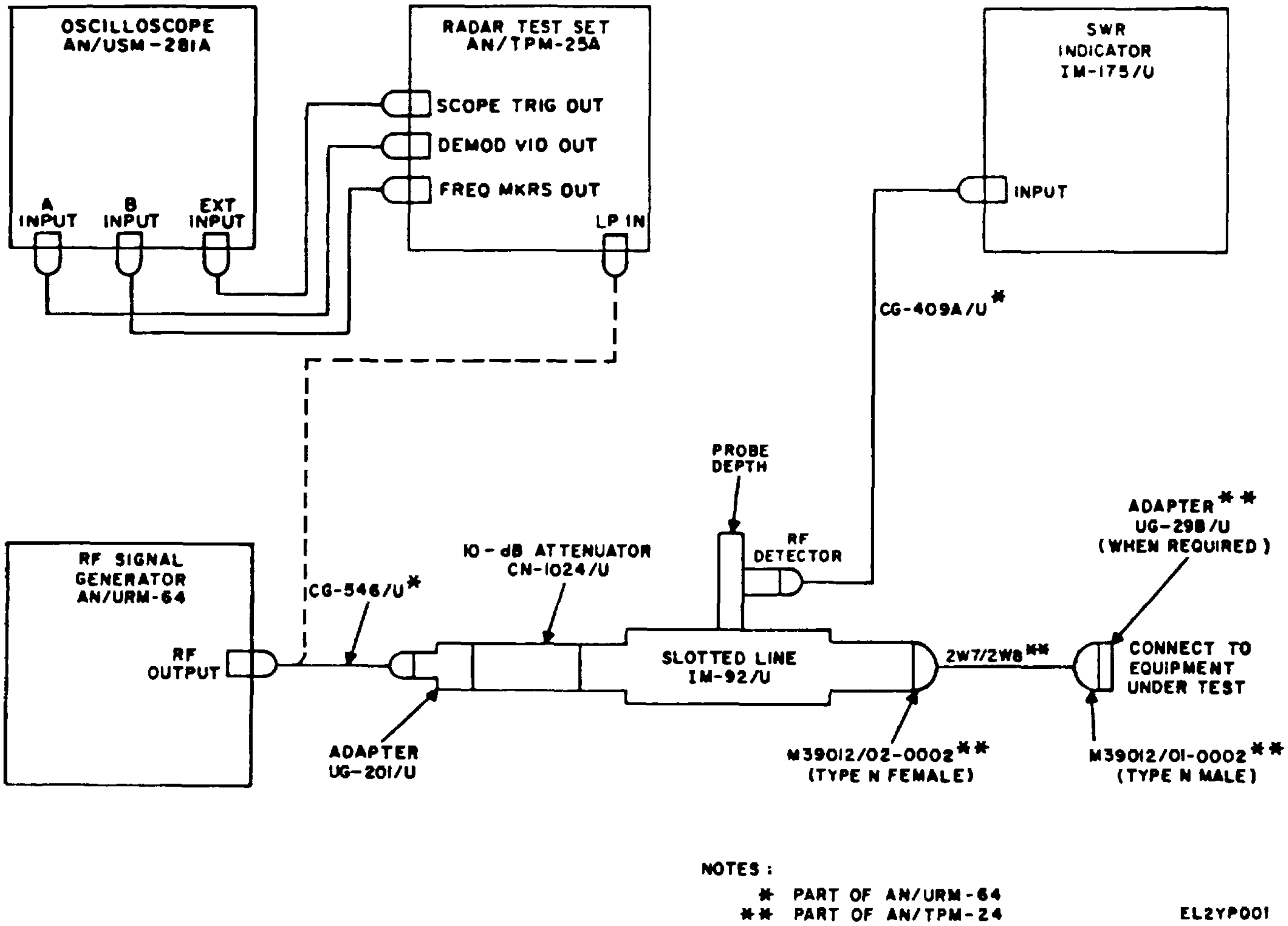


Figure 6-1.VSWR measurement test setup, using AN/TPM-25A.

6-5. Troubleshooting Procedure for 7-Foot Antenna

a. Troubleshoot the 7-foot antenna by performing the steps in the chart in b below. When required to change the frequency of the rf signal to 1090 MHz, use the setup procedure given in paragraph 6-4c through k, except for the following settings:

(1) In e, set SIGNAL FREQUENCY TO 1090 MHz.

(2) In g, adjust for lowest part of dip at the center frequency marker.

NOTE

When the procedure indicates that component replacement is necessary, refer to paragraph 6-6 for replacement procedures.

b. 7-Foot Antenna Troubleshooting Procedure.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	W1P1	SWR indicator.	1.6:1 max	If normal, adjust frequency of rf signal generator to 1090 ±1 MHz and proceed to step 2 If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
2	W1P1	SWR indicator.	1.6:1 max	If normal, transfer slotted line from W1P1 to W2P1, and termination from W2P1 to W1P1, and proceed to step 10. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
3	SUM input of DC1.	SWR indicator.	2.5:1 max	If normal, disconnect W1P2 from CP1, terminate W1P2, transfer slotted line

Step	Test point	Test equipment	Normal indication	Corrective measures
				from DC1 to W1P1, and proceed to step 4 If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
4	W1P1	SWR indicator.	1.2:1 max	If normal, disconnect W3P1 from DC1, terminate CP1, transfer slotted line from W1P1 to CP1, and proceed to step 6 If abnormal, replace W1.
5	W6P1	SWR indicator.	2:1 max	If normal, disconnect WSP1 from DC1, transfer slotted line from W6P1 to W5P1, and proceed to step 7. If abnormal, unsolder balun from antenna panel and proceed to step 8.
6	CP1	SWR indicator.	1.4 to 2.0:1.	If normal, replace W3. If abnormal replace CP1
7	WSP1	SWR indicator.	2:1 max	If normal, replace DC1. If abnormal, unsolder balun from antenna panel and proceed to step 9.
8	W6P1	SWR indicator.	2:1 max	If normal, replace right antenna panel. If abnormal, replace W6.
9	WSP1	SWR indicator.	2:1 max	If normal, replace left antenna panel. If abnormal, replace W5.
10	W2P1	SWR indicator.	1.6:1 max	If normal, adjust frequency of rf signal generator to 1030 ±1 MHz and proceed to step 14. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 11.
11	DIFF input of DC1.	SWR indicator.	2.5:1 max.	If normal, disconnect W2P2 from CP2, terminate W2P2, transfer slotted line from DC1 to W2P1 and proceed to step 12 If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
12	W2P1	SWR indicator.	1.2:1 max	If normal, disconnect W4P2 from DC1, terminate CP2, transfer slotted line
13	CP2	SWR indicator.	1.4 to 2.0:1	If normal, replace W4. If abnormal, replace CP2.
14	W2P2	SWR indicator.	1.6:1 max	If normal, 7-foot antenna is operating properly. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 11.

6-6. Repair of 7-Foot Antenna

Repair of the 7-foot antenna consists of replacement of parts found to be defective during troubleshooting. To replace defective parts of the 7-foot antenna, refer to the following list of replacement procedures.

a. Cable Assemblies. Replace defective cable assembly as follows:

(1) Loosen connectors at each end of cable to be replaced, open any cable ties securing cable, and remove cable.

(2) Install new cable, following the same run as that of the removed cable.

(3) Tighten any cable ties and tighten connectors on each end of the cable.

b. Coupler Adapter CP1 or CP2. Replace defective coupler adapter as follows:

(1) Disconnect cables from coupler adapter, remove mounting strap, and remove coupler adapter.

(2) Fill end of new coupler adapter (such as CP1) with silicone compound before pushing end cap on. The end cap is supplied with the coupler adapter.

(3) Connect cables to coupler adapter and secure in place with mounting strap.

c. Directional Coupler DC1. Replace defective directional coupler as follows:

(1) Disconnect cables from directional coupler.

(2) Remove the 4 screws and washers securing the coupler.

(3) Install the new coupler with the 4 screws and washers from the previous steps.

(4) Connect cables removed in step (1) above.

d. Antenna Panels. Replace defective antenna panels as follows:

(1) Loosen connector on end of balun assembly cable.

(2) Loosen 13 turnlock fasteners holding reflector to radome and remove 2 screws, holding reflector to balun assembly and remove reflector.

(3) Loosen 12 turnlock fasteners holding antenna panel to radome and remove antenna panel with balun assembly attached.

(4) Remove balun and cable assembly and install it on new antenna panel as described in steps e(2) through e(5).

(5) Install antenna panel on radome by tightening 12 turnlock fasteners.

(6) Install reflector on radome by tightening 13 turnlock fasteners and fasten the balun and cable assembly i to the reflector by installing 2 screws.

(7) Connect balun assembly cable connector to directional coupler.

e. Balun Assemblies. Replace defective balun assembly as follows:

(1) Remove antenna panel as described in steps d(l) through d(3).

(2) Unsolder link between balun assembly and antenna panel. Remove link by removing screw, lockwasher, washer, and spacer.

(3) Remove 2 screws, washers, and nuts holding balun assembly to antenna panel, and remove the balun assembly.

(4) Install new balun assembly on the antenna panel using the 2 screws, washers and nuts from the previous step.

(5) Fasten link in place with screw, lockwasher, washer, and spacer. Solder link to antenna panel.

(6) Replace antenna panel as described in steps d(5) through d(7).

Section III. TROUBLESHOOTING AND REPAIR OF 14-FOOT ANTENNA WHEN USING AN/TPM-25A

NOTE

See section VI when using AN/UPM-98B(or C).

6-7. Preparation for Troubleshooting of 14-Foot Antenna

Prepare the 14-foot antenna for troubleshooting, as follows:

a. Loosen the captive screw that holds the access door on the antenna closed. Open the access door, disconnect W1P1 and W2P1 from J1 and J2, respectively, and disconnect W9P2 from W10P1.

b. Loosen the 38 screws that hold the two halves of the radome together.

c. Remove the rear half of the radome.

d. Set up test equipment as shown in figure 6-1 with the output of rf signal generator connected to LP IN of the radar test set.

e. Perform the procedures in paragraph 6-4d through m.

NOTE

Reflections from large metal objects may have an effect on the vswr measurements. To obtain accurate measurements, the mainbeam of the antenna must not be pointed at large metal objects within 20 feet of the antenna

6-8. Troubleshooting Procedure for 14-Foot Antenna

a. Troubleshoot the 14-foot antenna by performing the steps in the chart, b below. When required to change the frequency of the rf signal generator to 1090 MHz, use the setup procedure given in paragraph 6-4c through l except for the following settings:

(1) In e, set SIGNAL FREQUENCY to 1090 MHz.

(2) In g, adjust for lowest part of dip at the center frequency marker.

b. 14-Foot Antenna Troubleshooting Procedure.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	W1P1	SWR indicator.	1.6:1 max	a. If normal, adjust frequency of rf signal generator to 1090 ±1 MHz and proceed to step 2. b. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
2	W1P1	SWR indicator.	1.6:1 max	a. If normal, transfer slotted line from W1P1 to W2P1, termination from W2PI to W1P1, and proceed to step 14. b. If abnormal, disconnect W3P2 from DCI, transfer slotted in from W1P1 to SUM input of DC1, and proceed to step 3.
3	SUM input of DC1.	SWR indicator.	2:1 max.	a. If normal, disconnect W1P2 from CP1, terminate W1P2, transfer slotted line from DC1 to W1P1, and proceed to step 4. b. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
4	W1P1	SWR indicator.	1.2:1 max	a. If normal, disconnect W3P1 from DC1, terminate CP1, transfer slotted line from W1P1 to CP1, and proceed to step 6. b. If abnormal, replace W1.
5	W6P1	SWR indicator.	2:1 max.	a. If normal, disconnect W5P1 from DC1, transfer slotted line from W6P1 to WSP1, and proceed to step 7. b. If abnormal, unsolder balun from antenna panel and proceed to step 12.
6	CP1	SWR indicator.	1.4 to 2.0:1	a. If normal, replace W3. b. If abnormal, replace CP1.
7	W5P1	SWR indicator.	2.1 max	a. If normal, disconnect W7P1 from DC1, transfer slotted line from W5P1 to W7P1 and proceed to step 8. b. If abnormal, unsolder balun from antenna panel and proceed to step 13.
8	W7P1	SWR indicator.	2:1 max	a. If normal, disconnect W8P1 from DC1, transfer slotted line from W7P1 to W8P1, and proceed to step 9. b. If abnormal, unsolder balun from antenna panel and proceed to step 10.
9	W8P1	SWR indicator.	2:1 max	a. If normal, replace DC1. b. If abnormal, unsolder balun from antenna panel and proceed to step 11.
10	W7P1	SWR indicator.	2:1 max	a. If normal, replace right inboard antenna panel. b. If abnormal, replace W7.
11	WSP1	SWR indicator.	2:1 max	a. If normal, replace right outboard antenna panel. b. If abnormal, replace left inboard antenna panel.
12	W6P1	SWR indicator.	2:1 max	a. If normal, replace left inboard antenna panel. b. If abnormal, replace W6.

Step	Test point	Test equipment	Normal indication	Corrective measures
13	W5P1	SWR indicator	2:1 max	a. If normal, replace left outboard antenna panel b. If abnormal, replace W5.
14	W2P1	SWR indicator.	1.6:1 max	a. If normal, adjust frequency of rf signal generator to 1030 ±MHz and proceed to step 18. b. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1 and proceed to step 15.
15	DIFF input DC1.	SWR indicator.	2:1 max	a. If normal, disconnect W2P2 from CP2, terminate W2P2, transfer slotted line from DC1 to W2P1 and proceed to step 16. b. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
16	W2P1	SWR indicator.	1.2:1 max	a. If normal, disconnect W4P2 from DC1, terminate CP2, transfer slotted line from W2P1 to CP2, and proceed to step 17. b. If abnormal, replace W2.
17	CP2	SWR indicator.	1.6:1 max	a. If normal, replace W4. b. If abnormal, replace CP2.
18	W2P2	SWR indicator.	1.6:1 max	a If normal, 7-foot antenna is good. b. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 15.

6-9. Repair of 14-Foot Antenna

Repair of the 14-foot antenna consists of replacement of parts found defective during troubleshooting. To replace defective parts of the 14-foot antenna, refer to the following list of replacement procedures.

a. Cable Assemblies. Replace defective cable assembly using the procedure in paragraph 6-13a.

b. Coupler Adapter CP1 or CP2. Replace defective coupler using the procedure in paragraph 6-6b, except replace W 1 on CP2 instead of using cap and silicone compound.

c. Directional Coupler DC1. Replace defective directional coupler as follows:

(1) Disconnect cables from directional coupler.

(2) Remove the 4 screws and washers securing the 4 mounting tabs of the directional coupler.

(3) Remove one mounting screw from middle of the directional coupler.

(4) Remove the defective coupler, and replace it with the new directional coupler using 4 screws and washers on the mounting tabs, and replace the screw in the middle of the coupler.

(5) Reconnect the cables removed in step (1), above.

d. Antenna Panels. Replace defective antenna panels as follows:

(1) Loosen connector on end of balun assembly cable.

(2) Loosen 16 turnlock fasteners holding reflector to radome, remove 2 screws holding balun assembly to the reflector and remove reflector.

(3) Loosen 16 turnlock fasteners holding antenna panel to radome and remove antenna panel with balun assembly attached.

(4) Remove balun assembly and install it on new antenna panel as described in e(2) through e(5).

(5) Install antenna panel to radome by tightening 16 turnlock fasteners.

(6) Install reflector to radome by tightening 16 turnlock fasteners and install 2 screws which fasten the balun assembly to the reflector.

(7) Connect balun assembly connector to directional coupler.

e. Balun Assemblies. Replace defective balun assembly as follows:

(1) Remove antenna panel as described in d(1) through d(3).

(2) Unsolder link between balun assembly and antenna panel. Remove link by removing screw, lock washer, and washer.

(3) Remove 2 screws, washers, and nuts holding balun assembly to the antenna panel and remove balun assembly.

(4) Install new balun assembly to antenna panel using 2 screws, washers, and nuts from above step.

(5) Fasten link in place with screw, lockwasher, and washer. Solder link to balun assembly.

(6) Replace antenna panel as described in d(5) through d(7).

Section IV. TESTING OF 7-FOOT OR 14-FOOT ANTENNA WHEN USING AN/TPM-25A

NOTE

See section VII when using AN/UPM-98B(or C).

6-10. Testing

The following test is used to determine whether the 7-foot antenna is defective and requires adjustment, or whether the antenna has been repaired satisfactorily.

a. Set up the equipment as described in paragraph 6-4c through k.

b. Terminate antenna connector W2P1 using electrical dummy load 2AT1 (50-ohms, 50-watt) from test facility set.

c. Connect slotted line to W1P1 of antenna and measure vswr using procedures in paragraph 6-4m (1), (2), and (3). The maximum allowable vswr is 1.6:1.

d. Transfer the slotted line from WIP1 to W2 P1 and the termination from W2P1 to W1P1 on the antenna.

e. Measure vswr using the procedures in paragraph 6-4m (1), (2), and (3). The maximum allowable vswr is 1.6:1.

f. Set up the equipment as described in paragraph 6-4c through j, except for the following two setting:

(1) In e, SIGNAL FREQUENCY to 1090 MHz.

(2) In g, adjust for lowest part of dip at the center frequency marker.

g. Measure the vswr using procedures in paragraph 6-4 (1), (2), and (3). The maximum allowable vswr is 1.6:1.

h. Transfer the slotted line from W2P1 to W1 P1 and the termination from W1P1 to W2P1 of the antenna.

i. Measure the vswr using procedures in paragraph 6-4 (1) through (4). The maximum allowable vswr is 1.6:1.

j. Deenergize power to equipment; disconnect all equipment.

Section V. TROUBLESHOOTING AND REPAIR OF 7-FOOT ANTENNA 3A1 (USING AN/UPM-98B (OR C))

6-11. Preparation for Troubleshooting and Repair of 7-Foot Antenna

To prepare the 7-foot antenna for troubleshooting, proceed as follows:

a. Loosen the 30 screws holding the two halves of the radome together.

b. Disconnect W1P1 and W2P1 from J1 and J2 respectively, and remove the rear half of the radome.

c. Set up the test equipment as shown in figure 6-2 with the output of the rf signal generator connected to the radar test set.

NOTE

Reflections from large metal objects may have an effect on the vswr measurements. To obtain accurate measurements, the mainbeam of the antenna must not be pointed at large metal objects within 20 feet of the antenna.

d. At the radar test set, set the controls as follows:

METER SELECT .... WM
WM SENS .... midposition
POWER.. ON
WAVEMETER FREQUENCY .1030 MHz

e. At the rf signal generator, set the controls as follows:

PULSE WIDTH 10
PULSE RATE......................... 100 PPS
Selector Switch .... Rate X 10
POWER................................. ON
SIGNAL FREQUENCY........... 1030 MHz, then increase or decrease until the lowest possible reading ("dip") is obtained on CAL-CONTROL, panel meter of radar test set.

f. At the SWR indicator, set the controls as follows:

LINE... ON
METER SCALE.................................... NORMAL
RANGE 60
INPUT SELECTOR .... XTAL 200 n
VERNIER GAIN .... midposition

g. At the slotted line, set the controls as follows:

Probe depth .... maximum
Drive knob .... midposition
Tuning knob .... midposition

h. Transfer the rf signal generator output from the radar test set to the slotted line as shown in figure 6-2.

i. Terminate antenna connector W2P1 using electrical dummy load 2AT1 (50-ohm, 50-watt) from the test facility set.

j. Connect the slotted line to W1P1 of antenna and measure vswr as follows:

(1) Adjust the tuning knob for maximum reading on the SWR indicator.

(2) Move the probe carriage along the length of the slotted line by sliding the carriage or by pushing in the drive knob and turning it. Set carriage to a position that gives a maximum reading on the SWR indicator (adjusting RANGE control as required).

NOTE

If the needle goes off scale, reduce the penetration of the tuneable probe into the slotted line or adjust the RANGE switch setting.

(3) Adjust the VERNIER GAIN controls on the SWR indicator to obtain a full scale reading on the meter (1 on the VSWR scale).

(4) Move the carriage to obtain a minimum meter deflection reading at this setting. The reading is the vswr.

6-12. Troubleshooting Procedure for 7-Foot Antenna

a. Troubleshoot the 7-foot antenna by performing the steps in the following chart. When required to change the frequency of the rf signal to 1090 MHz, use the setup procedure given in steps c through h of paragraph 6-11 except for the following settings:

(1) On the radar test set, set the WAVEMETER FREQUENCY control to 1090 MHz.

(2) On the rf signal generator, set the SIGNAL FREQUENCY control to 1090 MHz. When the procedure indicates that component replacement is necessary, refer to paragraph 6-13 for replacement procedures.

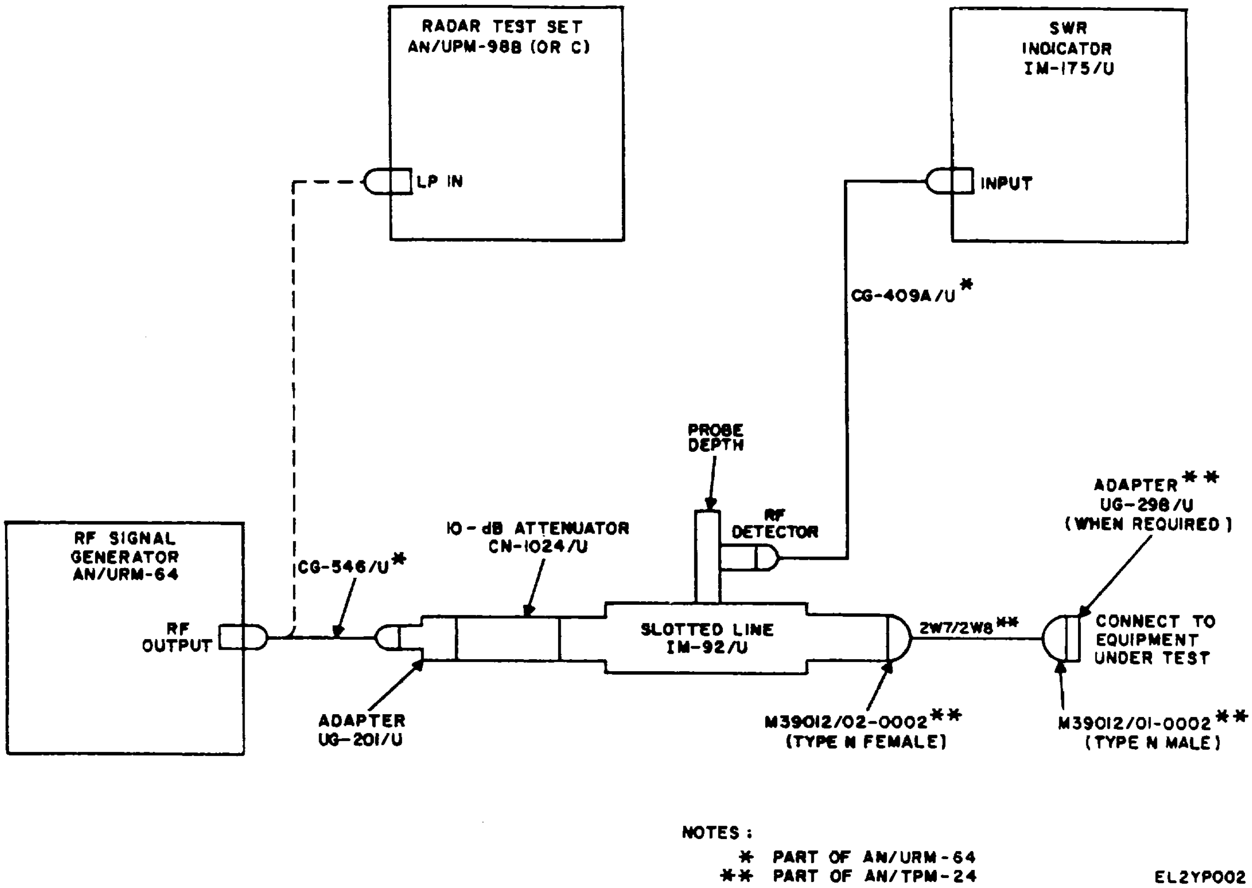


Figure 6-2. VSWR measurements test setup, using AN/UPM-98B (or C).

b. 7-Foot Antenna Troubleshooting Procedure.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	W1P1	SWR indicator	16.1 max	If normal, adjust frequency of rf signal generator to 1090 ±1MHz and proceed to step 2. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3
2	W1P1	SWR indicator	1.6.1 max	If normal, transfer slotted line from W1P1 to W2P1, and termination from W2P1 to W1P1, and proceed to step 10. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
3	SUM input of DC1.	SWR indictor	2.5:1 max.	If normal, disconnect W1P2 from CP1, terminate W1P2, transfer slotted line from DC1 to W1P1, and proceed to step 4. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
4	W1P1	SWR indicator	1.2:1 max	If normal, disconnect W3P1 from DC1, terminate CP1, transfer slotted line from W1P1 to CP1, and proceed to step 6. If abnormal, replace W1
5	W6P1	SWR indicator	2:1 max	If normal, disconnect W5P1 from DC1, transfer slotted line from W6P1 to W5P1, and proceed to step 7. If abnormal, unsolder balun from antenna panel and proceed to step 8.
6	CP1	SWR indicator	1.4 to 2.0:1	If normal, replace W3. If abnormal replace CP1.
7	W5P1	SWR indicator	2:1 max	If normal, replace DC1. If abnormal, unsolder balun from antenna panel and proceed to step 9.
8	W6P1	SWR indicator	2.1 max	If normal, replace right antenna panel. If abnormal, replace W6.
9	W5P1	SWR indicator	2:1 max	If normal, replace left antenna panel. If abnormal. replace W5.
10	W2P1	SWR indicator	1.6:1 max	If normal, adjust frequency of rf signal generator to 1030 ± 1 MHz and proceed to step 14. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 11.

Step	Test point	Test equipment	Normal indication	Corrective measures
11	DIFF input of DC1.	SWR indicator	2.5:1 max.	If normal, disconnect W2P2 from CP2, terminate W2P2, transfer slotted line from DC1 to W2P1 and proceed to step 12. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
12	W2P1	SWR indicator	1.2:1 max	If normal, disconnect W4P2 from DC1, terminate CP2, transfer slotted line from W2P1 to CP2, and proceed to step 13. If abnormal, replace W2.
13	CP2	SWR indicator	1.4 to 2.0:1	If normal, replace W4. If abnormal, replace CP2.
14	W2P2	SWR indicator	1.6:1 max	If normal, 7-foot antenna is operating properly. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 11.

6-13. Repair of 7-Foot Antenna

Repair of the 7-foot antenna consists of replacement of parts found to be defective during troubleshooting. To replace defective parts of the 7-foot antenna, refer to the following list of replacement procedures.

a. Cable Assemblies. Replace defective cable assembly as follows:

(1) Loosen connectors at each end of cable to be replaced, open any cable ties securing cable, and remove cable.

(2) Install new cable, following the same run as that of the removed cable.

(3) Tighten any cable ties and tighten connectors on each end of the cable.

b. Coupler Adapter CP1 or CP2. Replace defective coupler adapter as follows:

(1) Disconnect cables from coupler adapter, remove mounting strap, and remove coupler adapter.

(2) Fill end of new coupler adapter (such as CP1) with silicone compound before pushing end cap on. The end cap is supplied with the coupler adapter.

(3) Connect cables to coupler adapter and secure in place with mounting strap.

c. Directional Coupler DC1. Replace defective directional coupler as follows:

(1) Disconnect cables from directional coupler.

(2) Remove the 4 screws and washers securing the coupler.

(3) Install the new coupler with the 4 screws and washers from the previous steps.

(4) Connect cables removed in step (1) above.

d. Antenna Panels. Replace defective antenna panels as follows:

(1) Loosen connector on end of balun assembly cable.

(2) Loosen 13 turnlock fasteners holding reflector to radome and remove 2 screws, holding reflector to balun assembly and remove reflector.

(3) Loosen 12 turnlock fasteners holding antenna panel to radome and remove antenna panel with balun assembly attached.

(4) Remove balun and cable assembly and install it on new antenna panel as described in steps e(2) through e(5).

(5) Install antenna panel on radome by tightening 12 turnlock fasteners.

(6) Install reflector on radome by tightening 13 turnlock fasteners and fasten the balun and cable assembly to the reflector by installing 2 screws.

(7) Connect balun assembly cable connector to directional coupler.

e. Balun Assemblies. Replace defective balun assembly as follows:

(1) Remove antenna panel as described in steps d(1) through d(3).

(2) Unsolder link between balun assembly and antenna panel. Remove link by removing screw, lockwasher, washer, and spacer.

(3) Remove 2 screws, washers, and nuts holding balun assembly to antenna panel, and remove the balun assembly.

(4) Install new balun assembly on the antenna panel using the 2 screws, washers and nuts from the previous step.

(5) Fasten link in place with screw, lockwasher, washer, and spacer. Solder link to antenna panel.

(6) Replace antenna panel as described in steps d(5) through d(7).

Section VI. TROUBLESHOOTING AND REPAIR OF 14-FOOT ANTENNA, UNIT 4 (USING AN/UPM-98B (OR C))

6-14. Preparation for Troubleshooting of 14-Foot Antenna

To prepare the 14-foot antenna for troubleshooting, proceed as follows:

a. Loosen the captive screw which holds the access door on the antenna closed. Open the access door, disconnect W1P1 and W2P1 from J1 and J2, respectively, and disconnect W9P2 from W10P1.

b. Loosen the 38 screws holding the two halves of the radome together.

c. Remove the rear half of the radome.

d. Set up test equipment as shown in figure 6-2 with the output of rf signal generator connected to the radar test set.

e. Perform the procedures in steps d through j paragraph 6-11.

NOTE

Reflections from large metal objects may have an effect on the vswr measurements. To obtain accurate measurements, the main-beam of the antenna must not be pointed at large metal objects within 20 feet of the antenna.

6-15. Troubleshooting Procedure for 14-Foot Antenna

a. Troubleshoot the 14-foot antenna by performing the steps in the following chart. When required to change the frequency of the rf signal generator to 1090 MHz, use the setup procedure given in steps c through h of paragraph 6-11 except for the following settings:

(1) On the radar test set, set the WAVEMETER FREQUENCY control to 1090 MHz.

(2) On the rf signal generator, set the SIGNAL FREQUENCY control to 1090 MHz.

b. 14-Foot Antenna Troubleshooting Procedure.

Step	Test point	Test equipment	Normal indication	Corrective measures
1	W1P1	SWR indicator	1.6:1 max	a. If normal, adjust frequency of rf signal generator to 1090 ±1 MHz and proceed to step 2. b. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
2	W1P1	SWR indicator	1.6:1 max	a. If normal, transfer slotted line from W1P1 to W2P1, termination from W2P1 to W1P1, and proceed to step 14. b. If abnormal, disconnect W3P2 from DC1, transfer slotted line from W1P1 to SUM input of DC1, and proceed to step 3.
3	SUM input of DC1	SWR indicator	2:1max	a. If normal, disconnect W1P2 from CP1, terminate W1P2, transfer slotted line from DC1, to W1P1, and proceed to step 4. b. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
4	W1P1	SWR indicator	1.2:1 max	a. If normal, disconnect W3P1 from DC1, terminate CP1, transfer slotted line from W1P1 to CP1, and proceed to step 6. b. if abnormal, replace W1.
5	W6P1	SWR indicator	2:1max	a. If normal, disconnect W5P1 from DC1, transfer slotted line from W6P1 to W5P1, and proceed to step 7. b. if abnormal, unsolder balun from antenna panel and proceed to step 12.
6	CP1	SWR indicator	1.4 to 2.0:1	a. If normal, replace W3. b. If abnormal, replace CP1.
7	W5P1	SWR indicator	2:1 max	a. If normal, disconnect W7P1 from DC1, transfer slotted line from W5P1 to W7PI and proceed to step 8. b. If abnormal, unsolder balun from antenna panel and proceed to step 13.
8	W7P1	SWR indicator	2:1 max	a. If normal, disconnect W8P1 from DC1, transfer slotted line from W7P1 to W8P1, and proceed to step 9. b. If abnormal, unsolder balun from antenna panel and proceed to step 10.
9	W8P1	SWR indicator	2:1 max	a. If normal, replace DC1 b. If abnormal, unsolder balun from antenna panel and proceed to step 11.
10	W7P1	SWR indicator	2:1 max	a. If normal, replace right inboard antenna panel. b. If abnormal, replace W7.
11	W8P1	SWR indicator	2:1 max	a. if normal, replace right outboard antenna panel. b. if abnormal, replace W8.
12	W6P1	SWR indicator	2:1 max	a. If normal, replace left inboard antenna panel. b. If abnormal, replace W6.
13	W5P1	SWR indicator	2:1 max	a. if normal, replace left outboard antenna panel. b. If abnormal, replace W5.
14	W2P1	SWR indicator	1.6:1 max	a. If normal, adjust frequency of rf signal generator to 1030 ±1 MHz and proceed to step 18. b. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1 and proceed to step 15.
15	DIFF input DC1	SWR indicator	2:1 max	a. If normal, disconnect W2P2 from CP2, terminate W2P2, transfer slotted line from DC1 to W2P1 and proceed to step 16. b. If abnormal, disconnect W6P1 from DC1, transfer slotted line from DC1 to W6P1, and proceed to step 5.
16	W2P1	SWR indicator	1.2:1 max	a. If normal, disconnect W4P2 from DC1, terminate CP2, transfer slotted line from W2P1 to CP2, and proceed to step 17. b. If abnormal, replace W2.
17	CP2	SWR indicator	1.6:1 max	a. If normal, replace W4.

Step	Test point	Test equipment	Normal indication	Corrective measures
				b. If abnormal, replace CP2.
18	W2P2	SWR indicator	1.6:1 max	a. If normal, 7-foot antenna is good. b. If abnormal, disconnect W4P2 from DC1, transfer slotted line from W2P1 to DIFF input of DC1, and proceed to step 15.

6-16. Repair of 14-Foot Antenna

Repair of the 14-foot antenna consists of replacement of parts found defective during troubleshooting. To replace defective parts of the 14-foot antenna, refer to the following list of replacement procedures.

a. Cable Assemblies. Replace defective cable assembly I using the procedure in paragraph 6-13a.

b. Coupler Adapter CPJ or CP2. Replace defective coupler using the procedure in paragraph 6-13b, except replace W11 on CP2 instead of using cap and silicone compound.

c. Directional Coupler DC1. Replace defective directional coupler as follows:

(1) Disconnect cables from directional coupler.

(2) Remove the 4 screws and washers securing the 4 mounting tabs of the directional coupler.

(3) Remove one mounting screw from middle of the directional coupler.

(4) Remove the defective coupler, and replace it with the new directional coupler using 4 screws and washers on the mounting tabs, and replace the screw in the middle of the coupler.

(5) Reconnect the cables removed in step (1), above.

d. Antenna Panels. Replace defective antenna panels as follows:

(1) Loosen connector on end of balun assembly cable.

(2) Loosen 16 turnlock fasteners holding reflector to radome, remove 2 screws holding balun assembly to the reflector and remove reflector.

(3) Loosen 16 turnlock fasteners holding antenna panel to radome and remove antenna panel with balun assembly attached.

(4) Remove balun assembly and install it on new antenna panel as described in e(2) through e(5).

(5) Install antenna panel to radome by tightening 16 turnlock fasteners.

(6) Install reflector to radome by tightening 16 turnlock fasteners and install 2 screws which fasten the balun assembly to the reflector.

(7) Connect balun assembly connector to directional coupler.

e. Balun Assemblies. Replace defective balun assembly as follows:

(1) Remove antenna panel as described in d(1) through d(3).

(2) Unsolder link between balun assembly and antenna panel. Remove link by removing screw, lockwasher, and washer.

(3) Remove 2 screws, washers, and nuts holding balun assembly to the antenna panel and remove balun assembly.

(4) Install new balun assembly to antenna panel using 2 screws, washers, and nuts from above step.

(5) Fasten link in place with screw, lockwasher, and washer. Solder link to balun assembly.

(6) Replace antenna panel as described in d(5) through d(7).

Section VII. TESTING OF 7-FOOT OR 14-FOOT ANTENNA (USING AN/UPM-98B (OR C))

6-17. Testing

The following test is used to determine whether the 7-foot antenna is defective and requires adjustment, or whether the antenna has been repaired satisfactorily.

a. Setup the equipment as described in steps c through paragraph 6-11.

b. Terminate antenna connector J2 using electrical dummy load (50-ohm, 50-watt) from test facility set.

c. Connect slotted line to J1 of antenna and measure VSWR using procedures in steps j(1) through j(3) of paragraph 6-11. The maximum allowable vswr is 1.6:1.

d. Transfer the slotted line from J1 to J2 and the termination from J2 to J1 on the antenna.

e. Measure vswr using the procedures in steps j(1) through j(3) of paragraph 6-11. The maximum allowable vswr is 1.6:1.

f. Set up the equipment as described in steps c through h of paragraph 6-11, except for the following two settings:

(1) Set the WAVEMETER FREQUENCY control on the radar test set to 1090 MHz.

(2) Set the SIGNAL FREQUENCY control on the rf signal generator to 1090 MHz and retune the probe to 1090 MHz.

g. Measure the vswr using steps j(1) through j(3) in paragraph 6-11. The maximum allowable vswr is 1.6:1.

h. Transfer the slotted line from J2 to J1 and the termination from J1 to J2 of the antenna.

i. Measure vswr using procedures in steps j(1) through j(3) of paragraph 6-11. The maximum allowable vswr is 1.6:1.

CHAPTER 7
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR PEDESTAL 3A2

Section I. INTRODUCTION

7-1. General

This chapter contains general support maintenance instructions for pedestal 3A2 and its associated subassemblies. Separate sections are provided for overall pedestal maintenance and for maintenance of individual and major discrete pedestal components.

7-2. Maintenance Philosophy

Upon receipt of a suspected defective pedestal, overall pedestal maintenance (sec II) is performed. First testing is accomplished (par 7-3) to determine the operational condition of the pedestal. If the pedestal is found to be defective, troubleshooting (para 7-4) is performed and repair is effected. Subassemblies and major components found defective during troubleshooting are maintained in accordance with sections m through VII of this chapter, as applicable. Pedestal testing is again performed once troubleshooting and repair have been completed, to verify proper operation of the repaired pedestal.

NOTE

All reference designations used in this chapter are prefixed by 3A2.

Section II. OVERALL PEDESTAL MAINTENANCE

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for FO-4.

7-3. Pedestal Testing

a. Install the pedestal to be tested on the pedestal mount in the test bed in accordance with TM 11-6625-2398-15-2.

b. Install the inertial antenna load on the pedestal in accordance with TM 11-6625-2398-15-2. Do not connect any cables to the pedestal at this time.

c. Rotate the inertial antenna load by hand. The load shall rotate smoothly without binding.

d. Perform antenna positioning circuits set-up for 60 Hz synchro azimuth data in accordance with paragraph 4-10.

e. Perform test bed set-up for 60 Hz synchro azimuth data in accordance with paragraph 4-13.

f. Perform oscilloscope preliminary set-up in accordance with paragraph 4-15.

g. Perform 60 Hz synchro azimuth data alignment procedure in accordance with paragraph 4-17.

h. Perform functional test (para 4-20).

i. Perform antenna positioning circuits set-up for 4 kHz resolver azimuth data in accordance with paragraph 4-12.

j. Perform test bed set-up for 4 kHz resolver azimuth data in accordance with paragraph 4-13.

k. Perform 4 kHz resolver azimuth data alignment procedure in accordance with paragraph 4-19.

l. Perform functional test (para 4-20).

m. Test rotary coupler E1 in accordance with paragraph 7-25.

n. Disconnect all external cables from the pedestal.

o. Open pedestal access cover and connect P3 to SYNCHRO connector J8. Place dust cap on RESOLVER connector J9.

p. Connect jumper wires across the following pins of J5.

From	*To*
J5-G	J5-g
J5-K	J5-h
J5-H	J5-j

q. Connect a source of 115 vac, 60 Hz across pins J5-N and J5-0.

r. Set the controls on oscilloscope as follows:

Controls	*Position*
VOLTS/DIV chan A	2
DISPLAY	A
INPUT chan A	AC
MAIN-MTXED-DELAYED	MAIN
TIME/DIV-MAIN	5MS
SWEEP MODE	AUTO
MAIN TRIGGER	INT

s. Connect the oscilloscope 10X probe to pedestal connector J5-b. Connect the probe ground lead to J5-c.

t. Rotate the inertial antenna load by hand while observing the oscilloscope for a null. The oscilloscope shall display a sine wave that changes in amplitude as the inertial antenna load is rotated. As a null is approached, adjust the VOLTS/DIV control on the oscilloscope to maintain a convenient display. The voltage at the null point shall be less than 1v p-p.

u. Set multimeter to R x 1 scale.

v. Connect multimeter across pins A3E1 and A3E2 in pedestal.

w. Slowly rotate inertial antenna load by hand. As the magnet in the azimuth ring passes the reed switch, the multimeter shall momentarily indicate zero ohms.

7-4 Pedestal Troubleshooting Procedure

(fig. 7-1)

a. Perform antenna positioning circuits set-up for 60 Hz synchro azimuth data in accordance with paragraph 4-10.

b. Perform test bed set-up for 60 Hz synchro azimuth data in accordance with paragraph 4-13 with a known good pedestal installed in test bed.

c. Perform oscilloscope preliminary set-up in accordance with paragraph 4-15.

d. Perform 60 Hz synchro azimuth data alignment procedure in accordance with paragraph 4-17.

e. Set GROUP CASE POWER SELECT switch on interface adapter unit GROUP CASE POWER subpanel to OFF.

f. Remove known good pedestal from the pedestal mount and install suspected defective pedestal in its place. Do not connect any cables to the pedestal at this time.

g. Install the inertial antenna load on the pedestal in accordance with TM 11-6625-2398-15-2.

h. Inspect the pedestal to ensure that there are no obstructions to impede pedestal rotation. Remove any obstructions and tighten or replace any loose or missing hardware.

i. Rotate the inertial antenna load by hand. The load shall rotate smoothly without binding. If the load rotates freely, proceed to step j. If the load does not rotate freely, proceed to step r.

j. Remove access cover from pedestal housing (fig. 7-2) by removing eight screws and lockwashers.

k. On the pedestal, connect 3A2P1 to SYNCRO connector 3A2J8 (fig. 4-1). Place cap on RESOLVER connector 3A2J9. Replace access cover.

l. Interconnect the pedestal in the test bed in accordance with figure FO-4.

m. On the pedestal, set AZ DRIVE switch to ON.

n. On the interface adapter unit GROUP CASE POWER subpanel, set GROUP CASE POWER SELECT switch to 60 Hz.

WARNING

To avoid injury from rotating inertial antenna load, stand clear of pedestal while performing step o.

o. On the interface adapter unit hold ROTATION ENABLE switch to ON for approximately 30 seconds. After approximately ten seconds the inertial antenna load shall rotate smoothly in a counterclockwise direction at approximately 25 rpm. If the pedestal rotates in any fashion, proceed to step p. If the pedestal does not rotate, proceed to step aa.

p. On the interface adapter unit GROUP CASE POWER subpanel, set GROUP CASE POWER SELECT switch to OFF.

q. Disconnect cables from pedestal.

r. Remove access cover from pedestal and check forward resistance (1K ohms) and reverse resistance (infinite) of diodes CR1 through CR4 (fig. 7-3) and continuity of associated wiring. Also check for shorts between wiring and ground. Refer to TM 11-5895-532-35P-5 for location of diodes. If all resistances are normal, proceed to step s. If resistance indications are

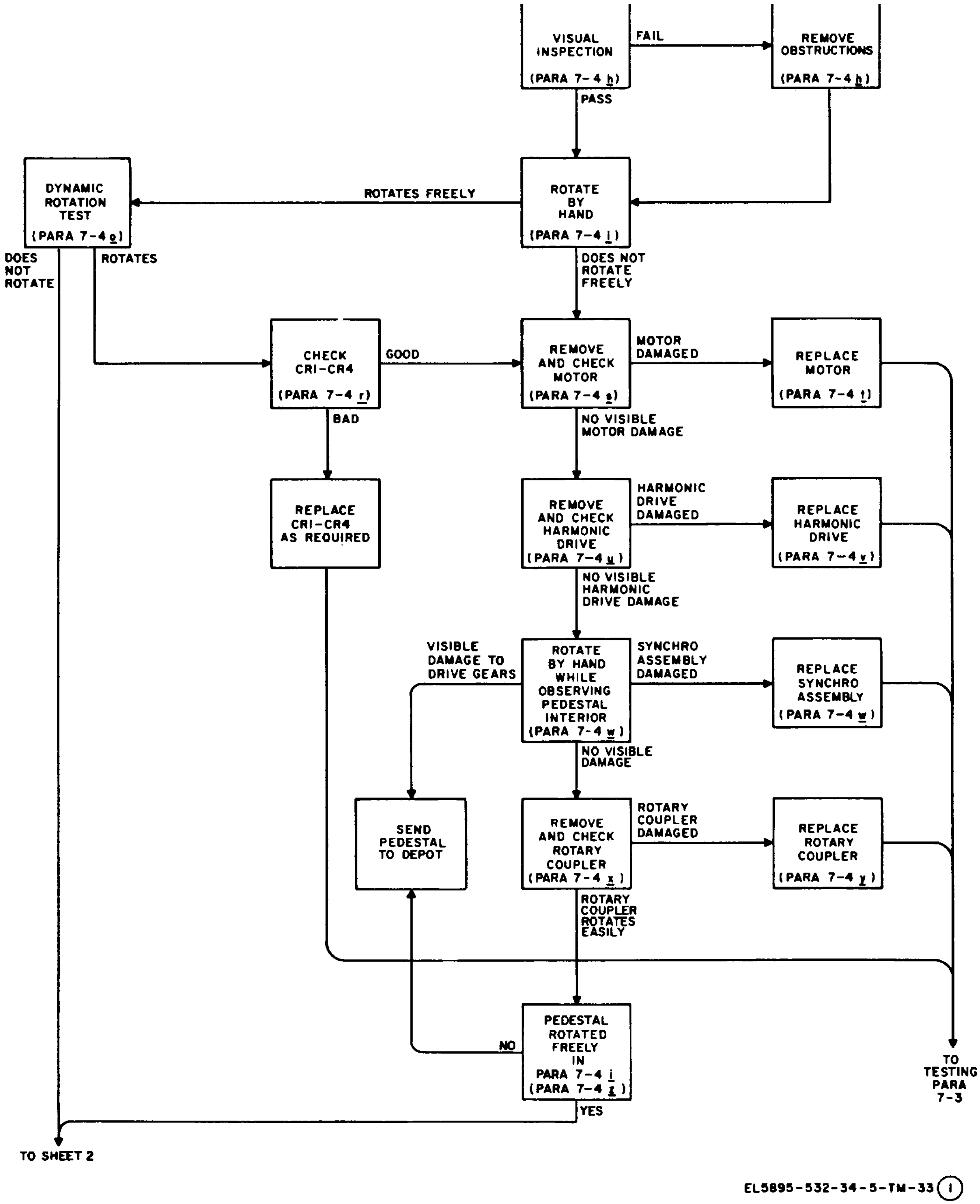


Figure 7-1 (1). General support pedestal troubleshooting flow.

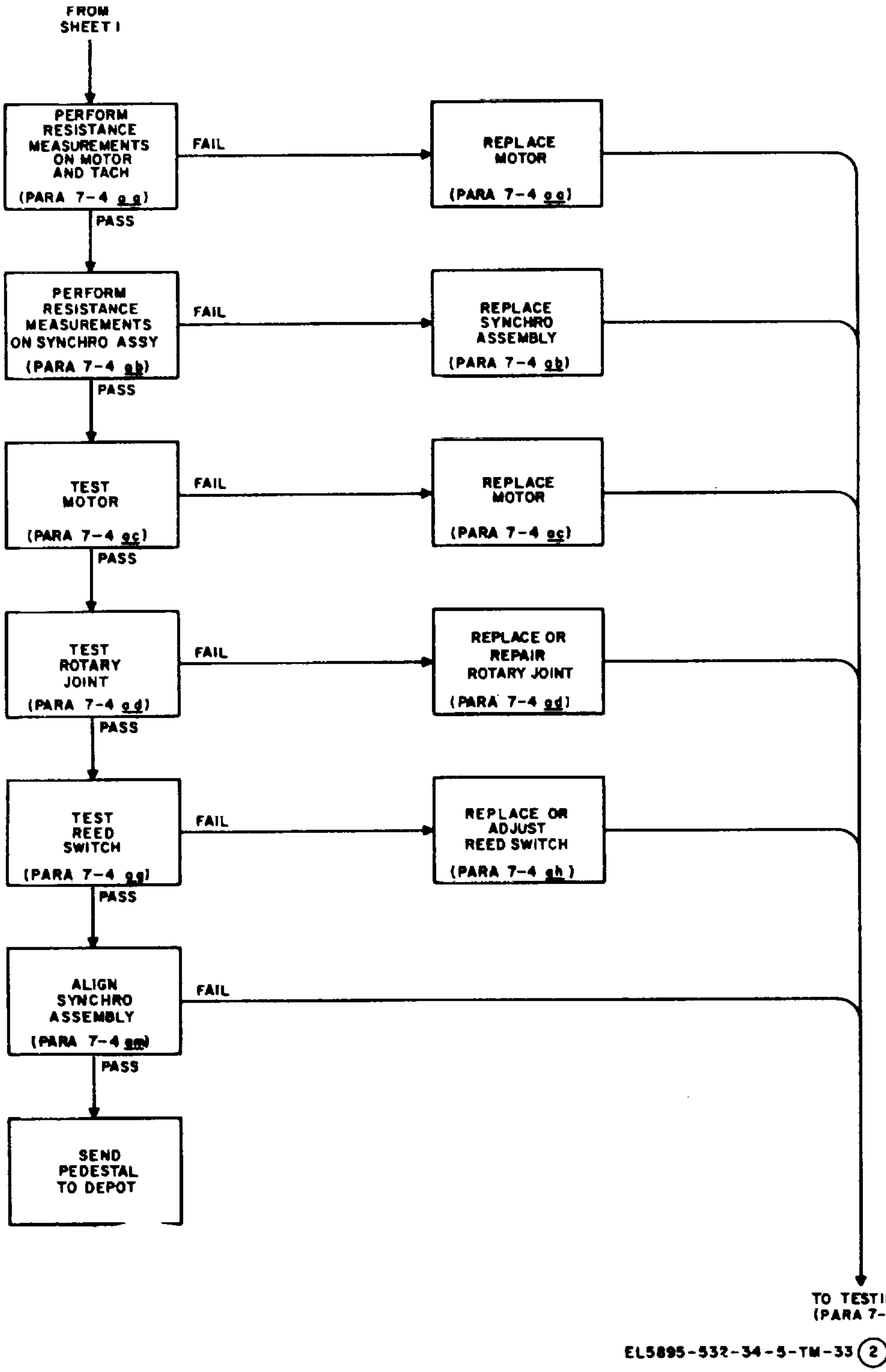


Figure 7-1 (2). General support pedestal troubleshooting flow.

not normal, replace diodes or repair pedestal wiring as required.

s. Remove motor from pedestal in accordance with paragraph 7-11.

t. Rotate shaft of motor by hand. If shaft does not rotate freely, replace motor. If shaft rotates freely, proceed to step u.

u. Perform steps b and c in harmonic drive removal procedure (para 7-15).

v. Refer to figure 7-4 and inspect circular

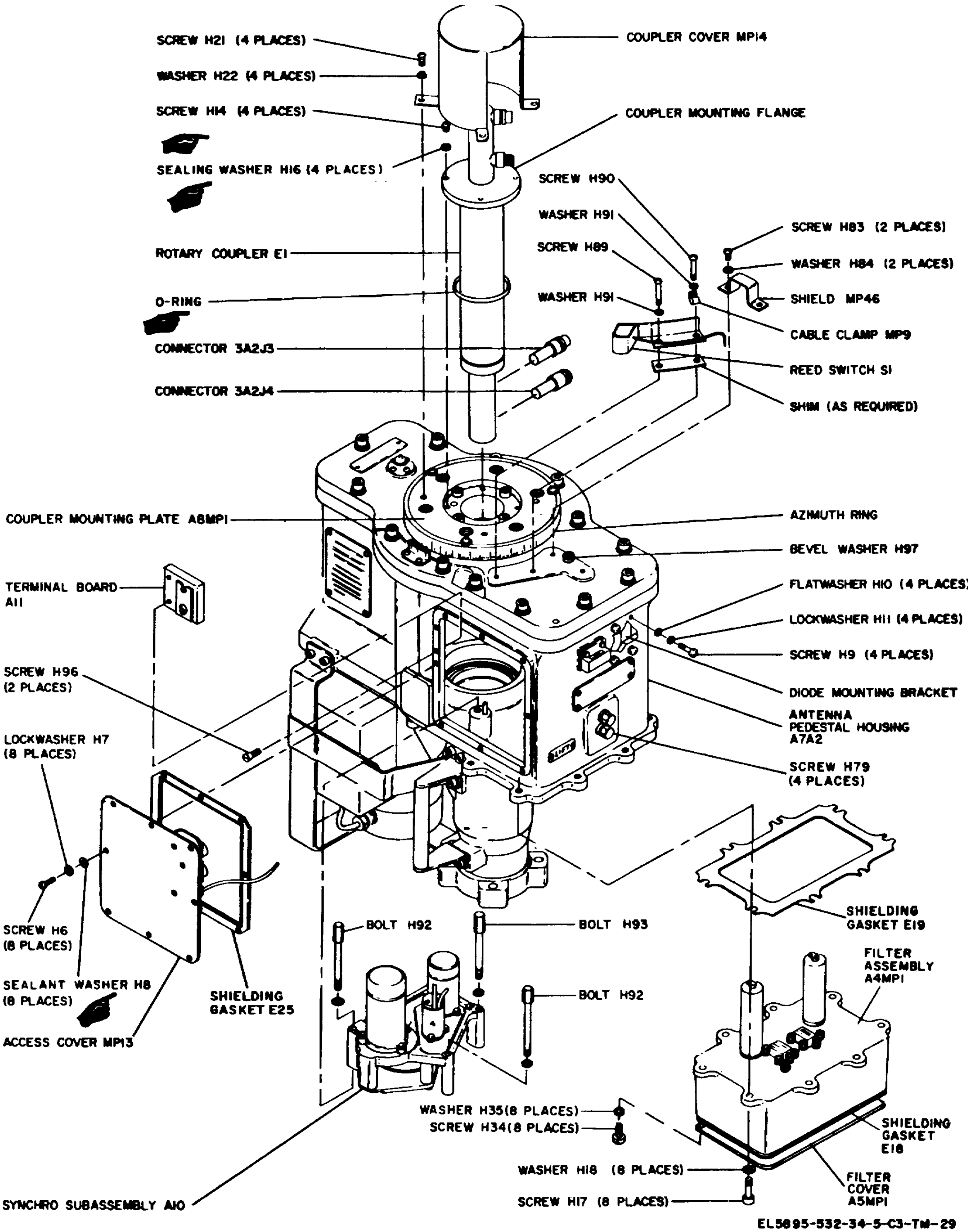


Figure 7-2. Pedestal subassembly, removal and replacement.

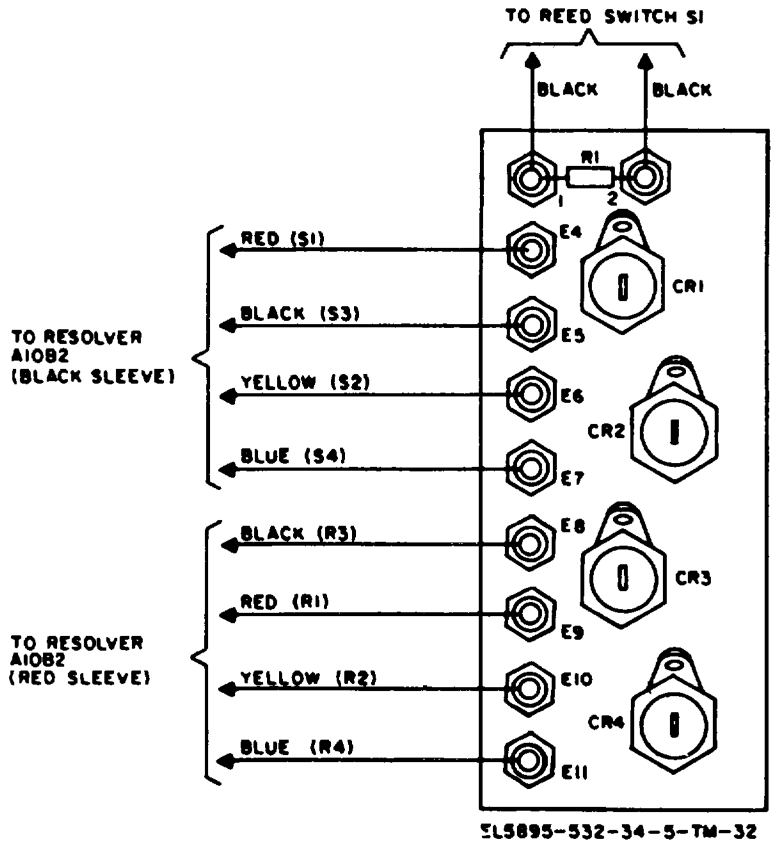


Figure 7-3. Diode bracket details.

spline and flexspline cup for damage or deformities. Inspect wave generator bearing for damaged or pitted ball bearings or races and chipped or broken ball bearing retainers. If any damage is apparent, replace entire harmonic drive. If no visible damage is present, proceed to step w.

w. Remove pedestal access cover. Rotate inertial antenna load while observing internal pedestal mechanical components. If any components on synchro subassembly A10 are visibly damaged, deformed, or binding, replace synchro subassembly. If any pedestal drive train components are damaged, reinstall all previously removed components and send pedestal to depot. If no damage is visible, proceed to step x.

x. Remove rotary coupler E1 in accordance with paragraph 7-23.

y. Rotate rotary coupler by hand. Coupler shall rotate easily with no binding. If coupler does not rotate easily, replace coupler. If coupler rotates easily, proceed to step z.

z. If pedestal did not rotate freely by hand in step i, install all components removed in the preceding steps and send pedestal to depot. If pedestal did rotate freely by hand in step i, proceed to step aa.

aa. Perform resistance measurements on motor MG1 and rfi filter MG1A2. Resistance measurements on motor should be made while shaft of motor is rotated slowly by hand. Also check for shorts between motor field and armature windings and between motor and tachometer windings and ground. If any resistance measurements are abnormal, replace motor.

ab. Perform resistance measurements on synchro subassembly A10 and associated pedestal wiring. Also check for shorts between rotor and stator windings of synchros B1 and B2 and resolver B3; check for shorts between synchro and resolver windings and ground. If any resistance measurements are abnormal, replace synchro assembly.

ac. Perform motor test procedure (para 7-13). If motor fails test, replace motor. If motor passes test, proceed to step ad.

ad. Test rotary coupler E1 in accordance with paragraph 7-25. If coupler fails test, replace coupler. If coupler passes test, proceed to step ae.

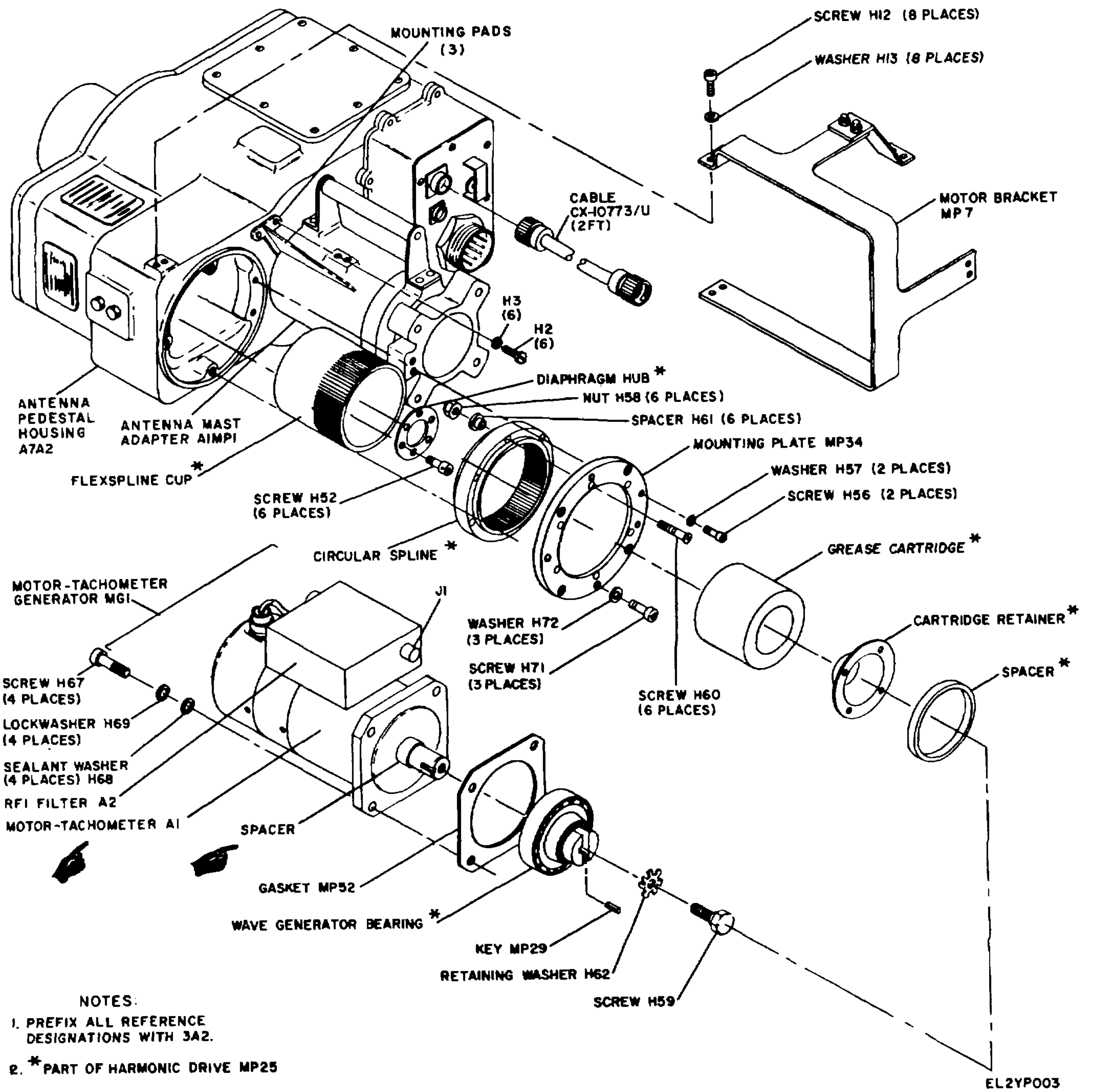


Figure 7-4. Motor and harmonic drive removal and replacement.

ae. Set multimeter to RX1 scale.

af. Connect multimeter across pins e and f of pedestal connector J5.

ag. Slowly rotate inertial antenna load by hand. As magnet in azimuth ring passes reed switch, multimeter shall indicate zero ohms. If meter deflects properly, proceed to step am. If meter does not deflect, proceed to step ah.

ah. Check reed switch height (para 7-20d). If height is correct, replace reed switch. If adjustment is necessary, proceed to step ai.

ai. Unfasten reed switch from pedestal by removing screws H89 and H90, washers H91, and cable clamp MP9. Retain any shims inserted under reed switch (fig. 7-2).

aj. Insert enough shims under reed switch to align marker on reed switch mounting bracket with top of azimuth ring (fig. 7-2).

ak. Fasten reed switch and cable clamp to pedestal housing with screws H89 and H90, and washers H91.

al. Perform steps af and ag.

am. Align synchro subassembly A10 in accordance with paragraph 7-9.

Section III. SYNCHRO SUBASSEMBLY A10 MAINTENANCE

NOTE

When using AN/UPM-98B (or C) substitute Figure FO-15 for FO-4.

7-5. Removal

(fig. 7-2)

a. Remove access cover from pedestal by removing eight screws, lockwashers and flatwashers.

b. Remove terminal block assembly All through pedestal access opening by removing two screws (fig. 7-2).

c. Remove eight screws, lockwashers and flatwashers securing filter assembly.

d. Lower filter assembly from pedestal housing. Do not disconnect any wires from the assembly.

e. Remove diode mounting bracket (fig. 7-4) by removing four screws, flatwashers, and lockwashers (H9, H10, and H11). Lift bracket through access opening in pedestal.

f. Unsolder and tag wires coming from resolver A10B2 connected to terminals E4 through E1 on diode mounting bracket (fig. 7-3).

g. Loosen two bolts H92 and one bolt H93 completely. Unseat synchro subassembly and lift out through access opening in pedestal.

h. Remove and tag wires in pedestal wiring harness from synchro control transformer A10B1 and synchro control transmitter A10B3.

7-6. Replacement

a. Align synchro subassembly in accordance with para- graph 7-9.

b. Connect wires from pedestal wiring harness to synchro control transformer A10B1 and synchro control transmitter A 10B3.

c. Install synchro subassembly in pedestal by aligning guide pins in pedestal with guide holes in synchro sub- assembly mounting feet. Install and tighten securely two bolts H92 and one bolt H93.

d. Install terminal block assembly A11 in pedestal housing with two screws (fig. 7-2).

e. Refer to figure 7-3 and solder wires from resolver A10B3 to terminals E4 through E11 on diode mounting bracket.

f. Install diode mounting bracket in pedestal with four screws, flatwashers, and lockwashers (fig. 7-2).

g. Install filter assembly in pedestal housing and secure with eight screws, lockwashers and flatwashers.

h. Install access cover on pedestal with eight screws, lockashers, and flatwashers.

7-7. Disassembly

(fig. 7-5)

NOTE

Disassemble synchro subassembly only to extent necessary to replace damaged component.

a. Remove synchro subassembly from pedestal in accordance with paragraph 7-5.

b. Loosen hub clamps A10MP2, A10MP3, and A10MP14.

c. Loosen three each servo clamps A10MP8, A10MP11, and A10MPI2.

d. Grasp spur gear A10MP7 in one hand and pull up- ward on the body of synchro control transmitter A10B3 with the other hand until the gear and synchro separate. Remove A10B3. Separate A10B1 and A10MP15, and A10B2 and A10MP6 in a similar manner.

e. Remove three screws A10A1H1 securing plate A10A1MP1 to synchro housing A10A1MP2.

f. Remove plate A10A1MP1 containing bearing A10MP13.

NOTE

Plate A10A1MP1 and synchro housing

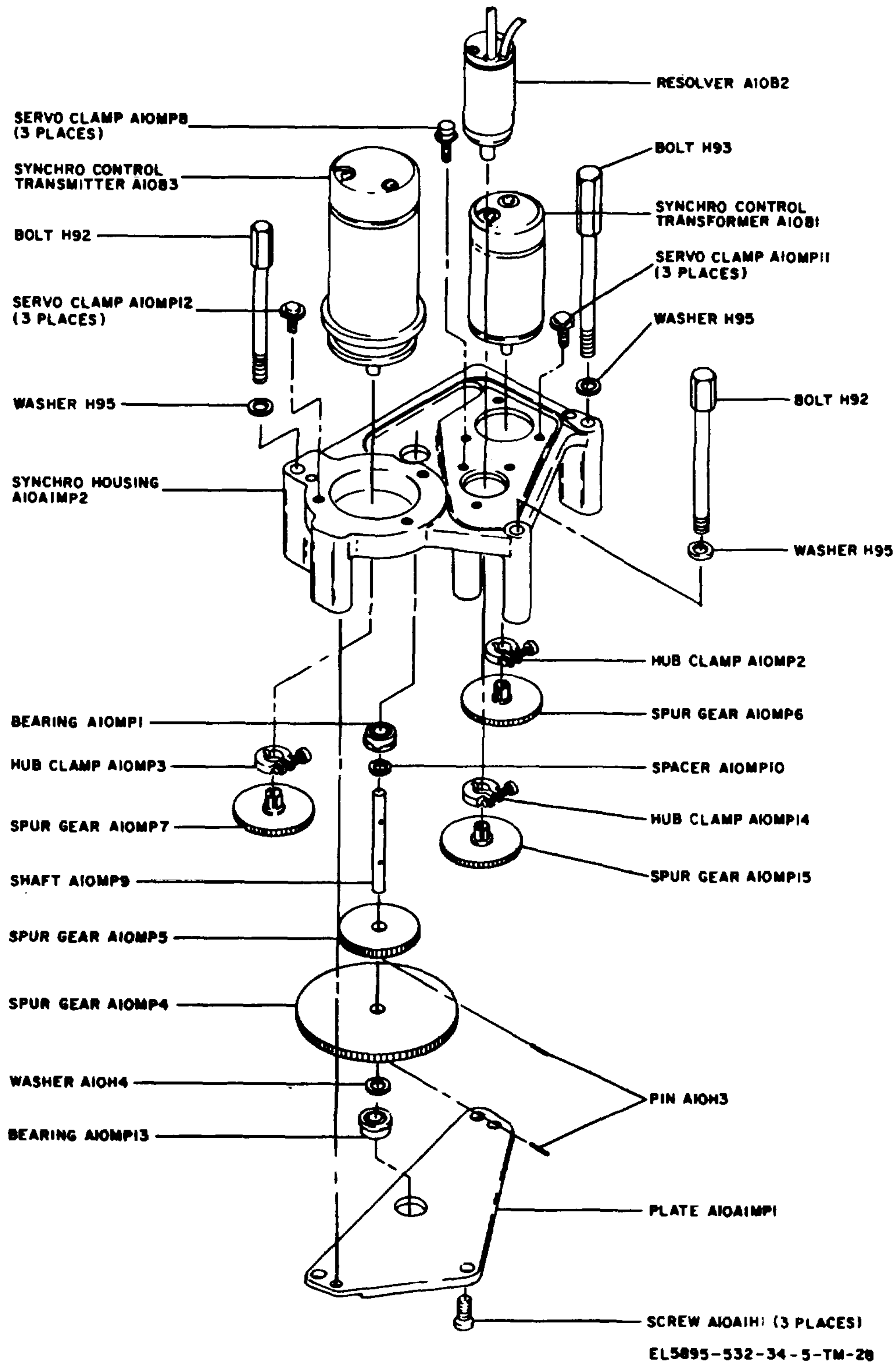


Figure 7-5. Synchro subassembly A10 assembly and disassembly.

A10A1MP2 are manufactured in matched sets and each bear the same serial number. Do not interchange these components with like components from other synchro subassemblies.

g. Remove bearing A10MP13 from plate A10-A1MP1.

h. Remove shaft A10M19 with attached spur gears A10MP4 and A10MP5 from synchro housing A10A1MP2.

i. Remove washer A10H4 and spacer A10MP10 from shaft A10MP9.

j. Remove pins A10H3 securing spur gears A10MP4 and A10MP5 to shaft A10MP9 with a drift. Discard pins.

k. Remove spur gears A10MP4 and A10MP5 from shaft A10MP9.

l. Remove bearing A10MP1 from synchro housing.

7-8. Assembly

(fig. 7-5)

a. Install spur gears A10MP4 and A10MP5 on shaft A10MP9. Align holes in gear hubs with holes in shaft.

b. Secure gears to shaft with new pins A10H3. Use a drift to install pins.

c. Install washer A10H4 and spacer A10MP10 on shaft A10MP9.

d. Install bearing A10MP1 in synchro housing A10A1MP2.

e. Install bearing A10MP13 in plate A10A1MP1.

f. Insert one end of shaft A10MP9 into bearing A10MP1.

g. Position bearing A10MP13 (attached to plate A10A1MPl) over free end of shaft A10MP9.

h. Secure plate A10A1MP1 to synchro housing with three screws A10A1H1.

i. Insert synchro control transmitter A10B3 into its mounting hole in synchro housing A10A1MP2. Secure A10B3 to housing by tightening three servo clamps A10MP12.

j. Insert resolver A10B2 into synchro housing and secure with three servo clamps A10MP8.

k. Insert synchro control transformer A10B1 into synchro housing and secure with three servo clamps A10MP11.

l. Install spur gear A10MP7 on shaft of A10B3. Align A10MP7 with spur gear A10MP5. Tighten setscrew on hub clamp A10MP3.

m. Install spur gear A10MP15 on shaft of A10B2. Align A10MP15 with spur gear A10MP5. Tighten setscrew on hub clamp A10MP14.

n. Install spur gear A10MP6 on shaft of A10- B1. Align A10MP6 with spur gear A10MP5. Tighten setscrew on hub clamp A10MP2.

o. Apply a thin film of MIL-G-23827 grease to teeth of gears A10MP4, A10MP5, A10MP6, A10MP7, and A10MP15.

7-9. Synchro Subassembly Alignment

a. Clamp spur gear A10MP4 to synchro housing A10A1MP2 with two "c" clamps and a wood or a metal block so that none of the gears in the synchro subassembly are free to rotate (A, fig. 7-6).

b. Set the controls on the oscilloscope as follows:

Control	*Position*
VOLTS/DIV chan A	5
VOLTS/DIV chan B	5
DISPLAY	A + B
POLARITY chan A	+ UP
POLARITY chan B	-UP
INPUT chan A	AC
INPUT chan B	AC
MAIN-MIXED-DELAYED	MAIN
TIME/DIV-MAIN	5MS
SWEEP MODE	AUTO
MAIN TRIGGER	INT

c. Interconnect synchro control transmitter A10B3 and synchro control transformer A10B1 in accordance with figure B, 7-6. Connect A10B3 reference inputs R1 and R2 to channel A and B oscilloscope inputs respectively. Use 10X probes. Do not connect ground leads on probes. Do not connect A10B1 reference leads at this time.

d. The oscilloscope shall display a sine wave. Set the MAIN SLOPE switch on the oscilloscope so that the positive-going portion of the wave- form appears to the left of the display.

e. Disconnect the oscilloscope from A10B3. Connect oscilloscope chan A and chan B to A10B1, R1 and R2 respectively.

f. Loosen the three servo clamps securing A10B3 to the synchro housing.

g. Rotate the body of A10B3 in a clockwise direction (as viewed from end with the electrical connections) until the oscilloscope displays a sine wave with the positive-going portion to the left of the display.

h. Rotate the body of A10B3 very slowly in a clockwise direction while observing the oscilloscope for a null. The amplitude of the waveform

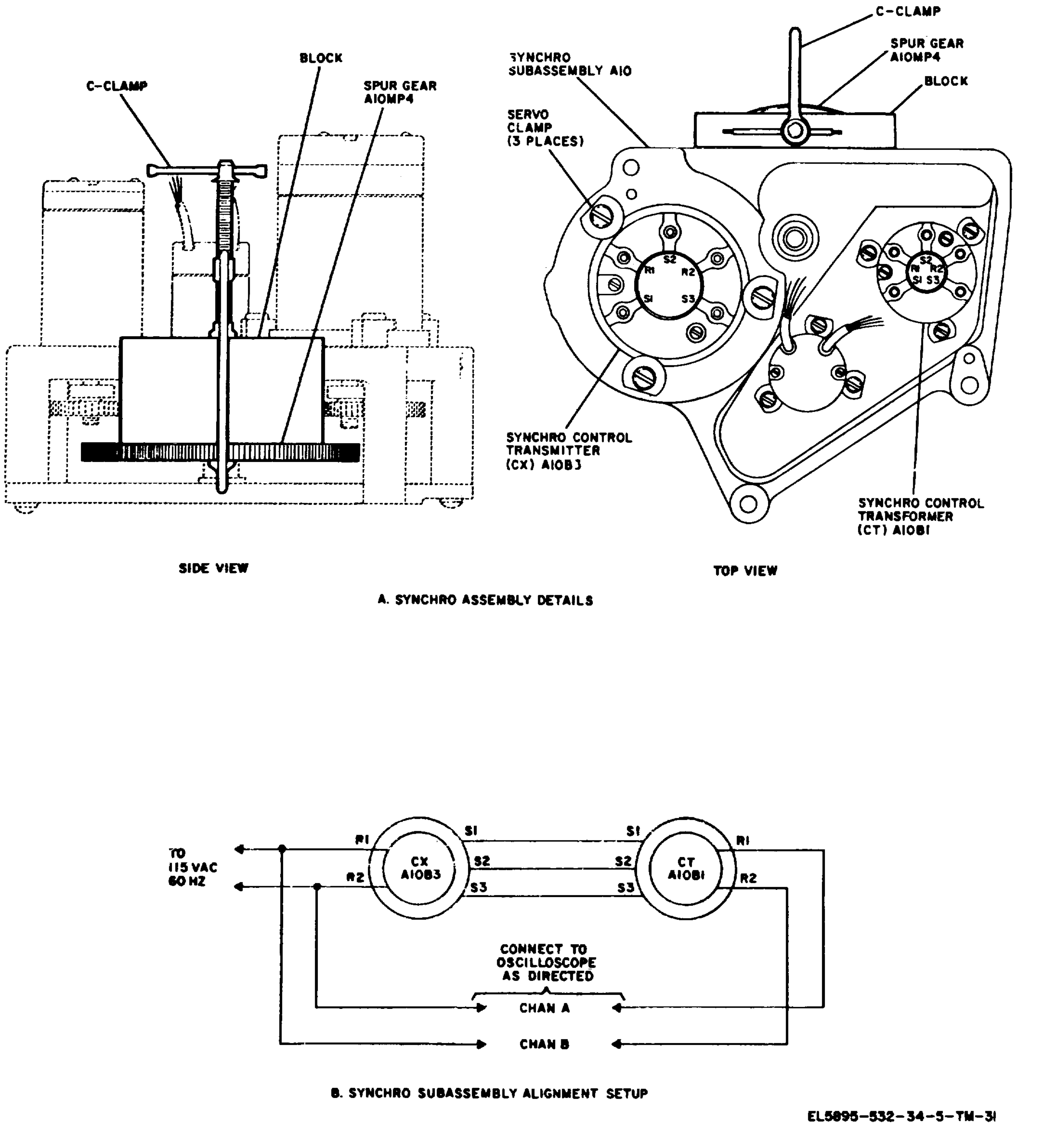


Figure 7-6. Synchro subassembly alignment.

shall decrease to a null and then increase. Adjust the chan A and chan B VOLTS/DIV controls on the oscilloscope as necessary to maintain display amplitude. When a null has been obtained tighten the three servo clamps securing A10B3.

i. Disconnect oscilloscope and remove synchro subassembly interconnections. Remove C- clamp from synchro subassembly.

7-10. Testing

The synchro subassembly is tested when installed and wired into the pedestal during pedestal testing (para 7-3).

Section IV. MOTOR-TACHOMETER GENERATOR MG1 MAINTENANCE

NOTE

When using AN/UPM-98B (or C) substitute figure FO-15 for FO-4.

7-11. Removal

(fig. 7-4)

a. Disconnect cable CX-10773/U (2 ft) from 3A2A2J1 and 3A2J6. Refer to TM 11-5895-532-12 for procedures.

b. Remove motor bracket from pedestal by removing
eight each screws H 12 and washers H 13.

c. Remove four screws H67, four lockwashers H69 and four flatwashers H68 securing motor MG1 to pedestal housing.

d. Lift motor away from housing and remove gasket MP52 from motor.

e. Remove screw H59 and retaining washer H62 from motor shaft.

f. Remove key MP29 and wave generator bearing from motor shaft.

7-12. Replacement

(fig. 7-4)

CAUTION

Before replacing MG1, refer to paragraph 7-28w. Apply instruction to MG1.

a. Place wave generator bearing over motor shaft. Align keyway in bearing with keyway in shaft.

b. Insert key MP29 into keyway so that top of key is flush with flat on wave generator bearing.

c. Place retaining washer H62 over wave generator bearing so that bent tab on washer rests in slot in bearing.

d. Insert screw H59 in motor shaft and tighten screw securely.

e. Bend up a tab on retaining washer H62 against a flat on screw H59 to prevent independent rotation of screw.

f. Place gasket MP52 over wave generator bearing and
insert motor into pedestal housing.

NOTE

Refer to paragraph 2-8o for sealing procedures.

g. Position motor on pedestal housing so that holes in motor flange align with notes in housing.

h. Secure motor to housing with four each screws H67, lockwasher H69, and sealant washer H68.

i. Attach motor bracket to pedestal with eight each screws H12 and washers H13.

j. Connect cable CX-10773/U (2 ft) between 3A2A2J1 and 3A2J6. Refer to TM 11-5895-532-12 for procedures.

7-13. Testing of Motor

NOTE

Testing of motor is accomplished with motor removed from suspected defective pedestal. If motor is mounted in pedestal, perform motor removal procedure in accordance with paragraph 7-11 before performing this procedure.

a. Connect motor to pedestal by connecting cable CX-10773/U (2 ft) between pedestal connector J6 and motor connector A2J1.

b. Perform antenna positioning circuits for 60 Hz synchro azimuth data in accordance with paragraph 4-10.

c. Perform test bed set-up for 60 Hz synchro azimuth data in accordance with paragraph 4-13.

d. Perform oscilloscope preliminary set-up in accordance with paragraph 4-15.

e. Perform 60 Hz synchro azimuth data alignment procedure (para 4-17) steps a through j only.

f. Depress ROTATION ENABLE switch on the inter- face adapter unit ANTENNA subpanel for approximately 20 seconds. The motor shall rotate without excessive noise or apparent binding.

7-14. Troubleshooting of Motor

Troubleshooting of motor is performed during the pedestal troubleshooting procedure and consists of resistance and operational checks.

NOTE

If antenna drive motor is replaced, perform the Antenna Control Assembly alignment procedures in TM 11-5895-532-12, paragraph 2-5.

Section V. HARMONIC DRIVE MP25 MAINTENCE

7-15. Removal

(fig. 7-4)

a. Remove motor in accordance with paragraph 7-11.

b. Remove spacer, cartridge retainer, and grease cartridge from pedestal interior.

c. Remove mounting plate MP34 and circular spline from pedestal housing by removing three each screws H71, and washers H72, and two each screws H56 and washers H57.

d. Detach mounting plate MP34 from circular spline by removing six each screws H60, spacers H61 and self-locking nuts H58.

NOTE

Refer to depot maintenance for removal of six socket-head screws (H52), the diaphragm hub, and the flexspline cup.

7-16. Replacement

(fig. 7-4)

a. Attach mounting plate MP34 to the circular spline with six each screws H60, spacers H61 and self-locking nuts H58.

NOTE

The circular spline is stamped with the letter "B" on face. This face should bear against mounting plate MP34 when the spline is assembled to mounting plate MP34.

b. Attach assembled spline and mounting plate to pedestal housing with three each screws H71 and washers H72, and two each screws H56 and washers H57.

c. Insert grease cartridge, cartridge retainer, and spacer into pedestal.

d. Replace motor in accordance with paragraph 7-12.

CAUTION

Pedestal must be lubricated (TM 11-5895-532-12) whenever harmonic drive is replaced.

7-17. Testing

The harmonic drive is tested as an integral part of the pedestal during pedestal testing (para 7-3).

7-18. Troubleshooting

Troubleshooting of the harmonic drive is performed during pedestal troubleshooting (para 7-4) and consists entirely of a visual inspection.

Section VI. REED SWITCH S1 MAINTENANCE

7-19. Removal

(fig. 7-2)

a. Remove pedestal access cover MP3 by removing eight retaining screws H6, lockwashers H7, and flat- washers H8.

b. Remove diode mounting bracket by removing four screws, flatwashers and lockwashers. Lift bracket through access opening in pedestal.

c. Unsolder black wires coming from reed switch attached to terminals 1 and 2 on diode mounting bracket (fig. 7-3).

d. Remove shield MP46 by removing two screws H83 and two washers H84.

e. Unfasten reed switch S1 from pedestal by removing Screws H89 and H90, washers H91, and cable clamp MP9. Save any shims inserted under reed switch.

f. Loosen bevel washer H97 and remove reed switch wires.

7-20. Replacement

(fig. 7-2)

a. Route reed switch wires through bevel washer H97 and cable clamp MP9.

b. Insert shims used with original reed switch under reed switch bracket.

c. Fasten reed switch and cable clamp to pedestal housing with screws H89 and H90, and washers H91.

d. When reed switch mounting screws are fully tightened, marker on reed switch mounting bracket should be even with the top of the azimuth ring. Remove or add shims, as required, to achieve proper alignment.

e. Solder wires from reed switch to terminals 1 and 2 on diode bracket (fig. 7-3).

f. Attach diode mounting bracket to pedestal with four screws H9, lockwashers H11, and flatwashers H10.

g. Tighten bevel washer H97.

h. Attach shield MP46 to pedestal with two screws H83 and two washers 184.

i. Install access cover on pedestal with eight screws H6, lockwashers H7, and flatwashers H8.

7-21. Testing

Reed switch testing is performed as an integral part of pedestal testing (para 7-3).

7-22. Troubleshooting

Reed switch troubleshooting is accomplished during pedestal troubleshooting (para 7-4).

Section VII. ROTARY COUPLER E1 MAINTENANCE (USING AN/UPM-25A)

NOTE

See section IX when using AN/UPM-98B (or C).

7-23. Removal

(fig. 7-2)

a. Remove coupler cover MP14 by removing four screws H21 and four washers H22.

b. Remove connector 3A2J3 from coupler.

c. Remove connector 3A2J4 from coupler.

d. Place location marks on the coupler mounting flange and coupler mounting plate (A8MP1). The marks should be made so that the coupler may have the same orientation when replaced,

e. Remove coupler from pedestal by removing four each screws H14, lockwashers H15, and flatwashers H16. Grasp top of coupler and lift gently upward to separate coupler from pedestal.

7-24. Replacement

(fig. 7-2)

CAUTION

Before replacing E1, refer to para 7-28 w. Apply instructions to E1.

NOTE

Before replacement, examine the bottom of the rotary coupler and the inside of the antenna pedestal housing into which it fits. The bottom of the rotary coupler contains two holes which mate with two studs in the

antenna pedestal housing. During replacement the studs and mating holes are hidden from view. Proper assembly of these two items can only be made by feeling the studs into the mating holes.

a. Insert coupler gently into pedestal and align marks (7-23d, above), so that the coupler mounting flange will be placed in the exact position it was removed from. Do not fasten screws.

CAUTION

If the studs in the antenna pedestal housing are not properly seated into the base of the rotary coupler, the base will be scored and the coupler bearing will be damaged.

b. Align the studs with the mating holes by applying hand pressure on the top of the rotary coupler while slowly rotating the lower portion of the coupler back and forth. The studs are engaged when the holes in the rotary coupler are felt to drop over them.

c. Secure coupler to mounting plate A8MP1 with four each screws H14, lockwashers H15, and flatwashers H16 as follows:

(1) Set screws, lockwashers and flatwashers in place and finger tighten.

(2) Tighten each screw a small amount in turn so as to apply an even pressure around the flange while tightening. This will ensure proper seating of the "O" ring and prevent water leak- age.

(3) Check that each of the 4 screws are fully tightened.

CAUTION

Do not fingerprint internal teflon insulation in coupler when performing steps d and e. Fingerprints may cause internal rf shorts in coupler.

d. Attach connector 3A2J3 to coupler.

e. Attach connector 3A2J4 to coupler.

f. Place coupler cover MP14 over coupler and align mounting holes in cover with holes in coupler mounting plate A8MP1.

g. Attach cover to plate with four screws H21 and four washers H22.

7-25. Testing

NOTE

The rotary coupler may be tested when installed or removed from the pedestal. If a coupler is to be tested when it is removed from the pedestal, connectors 3A2J1 and 3A2J2 must be installed on the coupler.

a. Connect test setup in accordance with figure 6-1 with the output of rf signal generator connected to LP IN of radar test set.

b. At the oscilloscope, set the controls as outlined in paragraph 6-4d.

c. At the radar test set, set the controls as follows:

MEASUREMENT panel:

FUNCTION SEL.................................. FREQ
DEMOD VID LEVEL............................ Fully ccw
FREQ MEAS....................................... 80
TRIG SEL INT/DCD/EXT .... INT
SIG GEN FUNCTION.......................... SWP ± 5 MHz
POWER .... ON

d. At the signal generator, set controls as follows:

POWER .... ON
SIGNAL FREQUENCY......................... 1030
Sync Sel .... CW
OUTPUT ATTENUATOR .... Fully cw

e. Adjust SIGNAL FREQUENCY control on the rf signal generator to position the peak of the pulse on A INPUT trace over the center frequency marker on B INPUT trace. The rf signal generator out- put is now set to 1030 MHz.

f. At the rf signal generator, set the controls as Follows:

PULSE WIDTH u s............................... 10
PULSE RATE PPS............................... 100
Sync Sel .... Rate x 10

g. At the SWT indicator, set the controls as follows:

LINE.. ON
METER SCALE................................... NORMAL
RANGE 60
INPUT SELECTOR .... XTAL 200 n
VERNIER GAIN .... Midposition

h. At the slotted line, set the controls as follows:

Probe depth .... Maximum
Drive knob .... Midposition
Tuning knob .... Midposition

i. Transfer the rf signal generator output from LP IN of the radar set to the slotted line as shown in figure 6-1.

j. Terminate pedestal connector 3A2J1 using UG-29B/U adapter and electrical dummy load 2AT1 from test facilities set.

k. Connect slotted line to 3A2J4 and measure the vswr as follows:

(1) Move carriage along the length of slotted line by sliding carriage or by pushing in drive knob and turning it. Set carriage to position that gives maximum indication on SWR indicator (adjusting RANGE SWR indicator switch as required).

NOTE

If the SWR indicator needle goes off- scale, reduce the penetration of the probe depth into the slotted line or ad- just the RANGE switch setting.

(2) Adjust the VERNIER GAIN controls on the SWR indicator to obtain a full-scale indication on the meter (1 on the Voltage Standing Wave Ratio scale).

(3) Move the carriage to obtain a minimum SWT indicator deflection at this setting. The vswr indicator should be 1.15:1 maximum.

l. Rotate rotary coupler and check vswr as described in k above every successive

m. Set rf signal generator for 1090 mHz utilizing procedure described in a through f above except in (e), set signal generator for 1090 mHz and adjust for lowest part of dip at center frequency marker.

n. Repeat vswr measurements at every successive as described in k and l above.

o. Transfer slotted line from 3A2J4 to 3A2J3, Terminate 3A2J2 with electrical dummy load 2AT1 from test facilities set and repeat k through n above. The vswr should be 1.15:1 maximum for all readings.

p. Deenergize power to equipment; disconnect all equipment.

Section VIII. ANTENNA PEDESTAL SEALING AGAINST WATER ENTRY

7-26. General

The antenna pedestal is susceptible to water leak during rain conditions. Collection of water inside the antenna pedestal causes formation of rust and corrosion on the metal parts. Sufficient water buildup will cause electrical short circuits of the electronic components and cable connectors. The sealing procedures described below utilize sealing compound applied at critical junctions and on screw threads. For additional sealing protection, special sealant washers are used to replace the eight flatwashers H8 on access cover MP13 and four flatwashers H68 on motor-tachometer generator MG1.

7-27. Personnel, Tools, and Materials Required

a. Personnel. Two technicians are required to handle the antenna pedestal.

b. Tools and Materials. Following are tools and materials required to perform the water-sealing procedure on the antenna pedestal. National stock numbers (NSN) are given for new or non-standard items.

Item	(NSN)
Allen wrench 9/16-in.	5120-00-984-0247
Allen wrenches 5/32-in., 5/16-in., 1/4-in.	(Part of tool kit)
Screwdriver	
Wirebrush	
Sealant washer 3/16-in. (8 required)	5330-00-9154783
Sealant washer 5/16-in. (4 required)	5330-00-811-1100
Sealing compound	8030-00-599-7753
Solvent (denatured alcohol)	6505-00-2056513
Grease, MIL-G-23827	
Lint-free cleaning cloth	
Waterproof tape (approximately 2-in wide)	
Insulating varnish, electrical	5970-00-647-3676

7-28. Sealing Procedures

(fig. 7-2 and 7-4)

NOTE

Carefully inspect the interior of the antenna pedestal for presence of water when components are removed. Extract water by tilting, draining, sponging, and wiping the interior dry before resealing.

a. Remove motor bracket MP7 (fig. 7-4) by removing eight each screws H12 and washers H13.

b. Remove the filter box from motor-tachometer generator MG1 by disconnecting the connector from A1J1 and removing the four slotted screws on the mounting bracket.

NOTE

Removal of motor-tachometer generator MG1 may require combined forcible pulling and rocking to release the wave generator bearing from the remaining harmonic drive components.

c. Remove motor-tachometer generator MG1 from the antenna pedestal housing by removing four each screws H67, lockwashers H69, and sealant washers H68.Set the motor-tachometer generator aside.

d. Remove mounting plate MP34 from the antenna pedestal housing by removing three each large screws H71, washers H72, and two each small screws H60 located along the inner edge of the mounting plate.

NOTE

Mounting plate MP34 may be more easily removed by partly inserting two of the motor-tachometer generator screws H67 into two diagonally opposite holes on the mounting plate, and pulling it off.

e. Examine the circular spline (fig. 7-4) for rust or corrosive residue. Remove foreign matter using a wire brush. Apply a light coat of grease (MIL-G-23827) to the inner surface of the circular spline.

NOTE

Use a clean cloth to wipe off grease or foreign residue from all surfaces to be coated with sealing compound. Components previously treated with sealing compound that are removed for servicing should be retreated with sealing compound and installed in accordance with the procedures described below.

f. Clean and apply a thick layer of sealing com- pound around the lip of the antenna pedestal housing and around the edge of plate MP34.

g. Replace mounting plate MP34 (reverse the procedure in d, above). Apply a small quantity of sealing compound to the screw threads before installing the five screws. Remove excess sealing compound with solvent.

h. Turn the antenna pedestal upside-down to rest on coupling cover MP14. Care should be taken to prevent tipping.

CAUTION

Be careful not to damage the rotary joint rf connectors when handling antenna mast adapter A1MP1.

i. Disengage antenna mast adapter A1MP1 (fig. 7-4) from antenna pedestal housing A7A2, by removing six each screws H2 and washers H3 from the three mounting pads.

j. Clean and apply a thick layer of sealing compound around the flange of the antenna mast adapter and where it will make contact with the antenna pedestal housing.

k. Replace antenna mast adapter A1MP1 (reverse procedure in i, above). Center the rotary joint connector jacks before tightening the six screws. Remove excess sealing compound with solvent.

/. Lay the pedestal on its side. Remove the grease cartridge by pulling out the spacer and cartridge retainer.

m. Clean, repack with grease (MIL-M-23827), and replace the grease cartridge. Replace the cartridge retainer and spacer.

n. Replace motor-tachometer generator MG1 (reverse the procedure in c, above). Carefully fit the wave generator bearing into position and with a rocking motion, force into place. Align gasket MP52 for proper fit.

o. Apply a small quantity of sealing compound to the screw threads and on both sides of the washers before in- stalling. Remove excess compound with solvent.

p. Replace the filter box on the motor-tachometer generator (reverse the procedure in b, above).

q. Replace motor bracket MP7 (reverse procedure in a, above).

r. Remove access cover MP13 (fig. 7-2) from the antenna pedestal housing by removing eight each screws H6, lockwashers H7, and washers H8.

s. Remove the three countersunk screws clustered on access cover MP13. Apply a small quantity of sealing compound to the underside of screw heads and reinstall on the access cover. Remove excess sealing compound with solvent.

t. Replace access cover MP13 by carefully aligning shielding gasket E25 (fig. 7-2) under the access cover Apply a small quantity of sealing compound to each or eight screws H6 and on both sides of sealant washers 118, and install (reverse the procedure in r, above). Remove excess sealing compound with solvent.

u. If four mounting screws H79 (fig. 7-2) or other special hardware are on the antenna pedestal, remove them, apply sealing compound and reinstall. If the antenna does not include the mounting screws or other hardware, use a strip of waterproof tape to temporarily seal the mounting screw holes.

v. Inspect for water in filter assembly A4MP1 (fig. 7-2). Remove filter cover A5MP1 by removing eight each screws H34 and washers H35. Remove all traces of water that may be present.

w. Dry the inside of the filter assembly and inspect for damage that may require additional repairs. If no damage is evident, remove corrosion residue from the interior compartment and spray all components inside the compartment with insulating varnish. Allow to dry before replacing the cover.

x. Replace the filter cover by carefully aligning shielding gasket E18 under the cover and installing the eight screws and washers.

Section IX. ROTARY COUPLER E1 MAINTENANCE WHEN USING AN/UPM-98 (OR C)

7-29. Removal

(fig. 7-2)

a. Remove coupler cover MP14 by removing four screws H21 and four washers H22.

b. Remove connector 3A2J3 from coupler.

c. Remove connector 3A2J4 from coupler.

d. Place location marks on the coupler mounting flange and coupler mounting plate (A8MP1). The marks should be made so that the coupler may have the same orientation when replaced.

e. Remove coupler from pedestal by removing four each screws H14, lockwashers H15, and flatwashers H1116. Grasp top of coupler and lift gently upward to separate coupler from pedestal.

7-30. Replacement

(fig. 7-2)

CAUTION

Before replacing E1, refer to para 7-28w. Apply instructions to G1.

NOTE

Before replacement, examine the bottom of the rotary coupler and the inside of the antenna pedestal housing into which it fits. The bottom of the rotary coupler contains two holes which mate with two studs in the antenna pedestal housing. During replacement the studs and mating holes are hidden from view. Proper assembly of these two items can only be made by feeling the studs into the mating holes.

a. Insert coupler gently into pedestal and align marks (7-29d, above), so that the coupler mounting flange will be placed in the exact position it was removed from. Do not fasten screws.

CAUTION

If the studs in the antenna pedestal housing are not properly seated into the base of the rotary coupler, the base will be scored and the coupler bearing will be damaged.

b. Align the studs with the mating holes by applying hand pressure on the top of the rotary coupler while slowly rotating the lower portion of the coupler back and forth. The studs are engaged when the holes in the rotary coupler are felt to drop over them.

c. Secure coupler to mounting plate A8MP1 with four each screws H14, lockwashers H15, and flatwashers H16 as follows:

(1) Set screws, lockwashers and flatwashers in place and finger tighten.

(2) Tighten each screw a small amount in turn so as to apply an even pressure around the flange while tightening. This will ensure proper seating of the "O" ring and prevent water leakage.

(3) Check that each of the 4 screws are fully tightened.

CAUTION

Do not fingerprint internal teflon insulation in coupler when performing steps d and e. Fingerprints may cause internal rf shorts in coupler.

d. Attach connector 3A2J3 to coupler.

e. Attach connector 3A2J4 to coupler.

f. Place coupler cover MP14 over coupler and align mounting holes in cover with holes in coupler mounting plate A8MP1.

g. Attach cover to plate with four screws H21 and four washers H22.

7-31. Testing

NOTE

The rotary coupler may be tested when installed or removed from the pedestal. If a coupler is to be tested when it is removed from the pedestal, connectors 3A2J1 and 3A2J2 must be installed on the coupler.

a. Connect test setup in accordance with figure 6-2 with the output of rf signal generator connected to radar test set.

b. At the radar test set, set the controls as follows:

METER SELECT .... WM
WM SENS .... midposition
POWER .... ON
WAVEMETER FREQUENCY. 1030 MHz

c. At the rf signal generator, set the controls as follows:

PULSE WIDTH 10
PULSE RATE......................... 100PPS
Selector Switch .... Rate x 10
POWER .... ON
SIGNAL FREQUENCY........... 1030 MHz, then increase or decrease until lowest possible reading ("dip") is obtained on CAL-CONTROL panel meter of radar test set.

d. At the SWR indicator, set the controls as follows:

LINE... ON
METER SCALE.................................... NORMAL
RANGE.. 60
INPUT SELECTOR.............................. XTAL 200 Ω
VERNIER GAIN .... midposition

e. At the slotted line, set the controls as follows:

Probe depth .... maximum
Drive knob .... midposition
Tuning knob .... midposition

f. Transfer the rf signal generator output from the radar set to the slotted line as shown in figure 6-2.

g. Terminate pedestal connector 3A2J1 using UG-29B/U adapter and electrical dummy load 2AT1 from test facilities set.

h. Connect slotted line to 3A2J4 and measure vswr as follows:

(1) Move probe carriage along length of slotted line by sliding carriage or by pushing in drive knob and turning it. Set carriage to position that gives maximum reading on SWR indicator, adjusting RANGE control as required.

NOTE

If the needle goes off-scale, reduce the penetration of the tuneable probe into the slotted line or adjust the RANGE switch setting.

(2) Adjust the VERNIER GAIN controls on the SWR indicator to obtain a full scale reading on the meter
(1 on the vswr scale).

(3) Move the carriage to obtain a minimum reading at this setting. The vswr reading should be 1.15:1 maximum.

i. Rotate rotary coupler and check vswr as described in step h every 90°.

j. Set rf signal generator for 1090 MHz utilizing procedure described in steps a through c.

k. Repeat vswr measurements at every 90°as described in steps h and i.

l. Transfer slotted line from 3A2J4 to 3A2J3 terminate 3A2J2 with electrical dummy load 2AT1 from test facilities set and repeat steps h through k. The vswr should read 1.15:1 maximum for all readings.

INDEX

	Paragraph	Page
AC power distribution	2-28	2-13
Adjustments (See specific item)		
Alignment (See specific item)		
Antenna, fourteen foot:		
Circuits	2-6	2-5
Direct support maintenance	3-15	3-8
Functional block diagram description	2-6	2-5
General support maintenance instructions	6-1	6-1
Hybrid Coupler	2-6a	2-5
Locating a problem	4-4	4-1
Overall block diagram description	2-3	2-2
Purpose and use	1-6a	1-2
Removal and replacement	3-15	3-8
Repair	6-9	6-6
Testing	6-10	6-7
Troubleshooting	6-7	6-5
Antenna, seven-foot:		
Circuits	2-2b	2-1
Direct support maintenance	3-6	3-2
Functional block diagram description	2-5	2-2
General support maintenance instructions	6-1	6-1
Hybrid coupler	2-5b	2-2
Locating a problem	4-4	4-1
Overall block diagram description	2-2	2-1
Positioning	2-2c	2-1
Purpose and use	1-6a	1-2
Removal	3-6	3-2
Repair	6-6	6-4
Replacement	3-7	7-2
Rotary joint	2-5a	2-2
Testing	6-10	6-7
Troubleshooting	6-4	6-1
Antenna control assembly:		
Alignment procedure	4-16	4-5
Locating a problem	4-2	4-1
Purpose and use	1-6b	1-2
Removal	3-4	3-1
Replacement	3-5	3-1
Antenna control assembly chassis:		
Alignment procedure	5-4	5-1
General	5-2	5-1
Meter adjustment procedure	5-5	5-1
Testing	5-6	5-2
Troubleshooting procedure	5-3	5-1
Antenna drive and tachometer feedback (External mode-synchro radar antenna azimuth)	2-14	2-9
Antenna positioning circuits:		
External mode-resolver radar antenna azimuth	2-15	2-10
External mode-synchro radar antenna azimuth	2-9	2-7
Internal mode	2-19	2-10
Modes of operation	2-8	2-6
Overall functional description	2-7	2-6
Preliminary setup	4-9	4-2
Antenna zero pulse generation	2-26	2-12
Assembly procedures (see specific items)		
Azimuth data generation (interval mode)	2-22	2-11

	Paragraph	Page
Azimuth error amplification and antenna drive (External mode-resolver radar antenna azimuth)	2-18	2-10
Azimuth error detection (External mode-synchro radar antenna azimuth	2-11	2-7
External mode-resolver radar antenna azimuth	2-17	2-10
Azimuth error power amplification (External mode-synchro radar antenna azimuth)	2-13	2-9
Azimuth error preamplification (External mode-synchro radar antenna azimuth)	2-12	2-8
Azimuth zero adjust module 1A2A4:		
General	5-27	5-19
Resistance measurements	5-30	5-20
Testing	5-29	5-19
Troubleshooting procedure	2-28	5-19
Azimuth zero adjustment:		
(External mode-synchro radar antenna azimuth)	2-10	2-7
(External mode-resolver radar antenna azimuth)	2-16	2-10
Block diagram descriptions:		
Antenna circuits	2-4	2-2
Antenna positioning circuits (External mode-resolver radar antenna azimuth)	2-15	2-10
Antenna positioning circuits (External mode-synchro radar antenna azimuth)	2-9	2-7
Antenna positioning circuits (internal mode)	2-19	2-10
Antenna positioning circuits, overall	2-7	2-6
Metering circuits	2-25	2-12
Overall	2-1	2-1
Power supply circuits	2-27	2-13
Self-test and monitoring circuits	2-23	2-11
Current regulation	2-33	2-14
DC voltage generation	2-29	2-13
Direct support maintenance instructions	3-1	3-1
Disassembly procedures (See specific Items).		
Electronic control amplifier 1A2A7:		
General	5-41	5-24
Testing	5-42	5-24
Electronic control amplifier filter 1A2A6:		
General	5-37	5-24
Resistance measurements	5-40	5-24
Testing	5-39	5-24
Troubleshooting	5-38	5-24
Equipment setups	4-8	4-2
Errors, Reporting of	1-3	1-1
Error amplification and tachometer feedback (internal mode)	2-21	2-11
Functional description	2-1	2-1
Functional test	4-20	4-10
General information	1-5	1-1
General support:		
Antenna control assembly chassis 1A2	5-2	5-1
Azimuth zero adjust module 1A2A4	5-27	5-19
Electronic control amplifier 1A2A7	5-41	5-24
Electronic control amplifier filter 1A2A6	5-37	5-24
General	5-1	5-1
Locating an antenna control assembly problem	4-2	4-1
Locating an antenna problem	4-4	4-1
Locating a pedestal problem	4-3	4-1
Maintenance Information	4-1	4-1
Mode switching card 1A2A1	5-7	5-2
Power supply module 1A2A5	5-31	5-20
Servo preamplifier card 1A2A2	5-13	5-4
Test equipment required	4-7	4-2
Tli self-test card 1A2A3	5-20	5-13
Tools required	4-6	4-2
Troubleshooting procedure	4-5	4-1
Graphic Symbols	1-5a	1-1
Handling, report of deficiencies in	1-2b	1-1

	Paragraph	Page
Harmonic drive:		
Removal	7-15	7-12
Replacement	7-16	7-13
Testing	7-17	7-13
Troubleshooting	7-18	7-13
HAWK radar interlock circuits	2-30	2-13
Hybrid coupler of:		
Fourteen-foot antenna	2-6a	2-5
Seven-foot antenna	2-5b	2-2
Logic symbols	1-5a	1-1
Maintenance forms and records	1-2	1-1
Maintenance, reports of	1-2a	1-1
Meter adjustment procedure	5-5	5-1
Metering circuits	2-25	2-12
Mode switching card 1A2A1:		
Alignment procedure	5-9	5-2
General	5-7	5-2
Resistance measurements	5-11	5-2
Testing	5-10	5-2
Troubleshooting procedure	5-8	5-2
Voltage measurements	5-12	5-3
Modes of operation	2-8	2-6
Motor direction and speed selection (internal mode)	2-20	2-11
Motor-tachometer generator:		
Removal	7-11	7-12
Replacement	7-12	7-12
Testing	7-13	7-12
Troubleshooting	7-14	7-12
Oscilloscope preliminary setup	4-15	4-4
Packaging, report of deficiencies in	1-2b	1-1
Panel markings	1-5c	1-1
Pedestal:		
Direct support	3-9	3-2
General	3-8	3-2
General support maintenance, general	7-1	7-1
General support maintenance, harmonic drive MP25	7-15	7-12
General support maintenance, motor-tachometer generator MG1	7-11	7-12
General support maintenance, reed switch S1	7-19	7-13
General support maintenance, rotary coupler E1	7-23	7-14
General support maintenance, synchro subassembly A10	7-5	7-8
Locating a problem	4-3	4-1
Purpose and use	1-6c	1-2
Removal	3-9	3-2
Replacement	3-10	3-3
Resistance charts	3-12b	3-4
Scheduled maintenance	3-13	3-5
Testing, direct support	3-11	3-3
Testing, general support	7-3	7-1
Troubleshooting	7-4	7-2
Voltage charts	3-12a	3-4
Pedestal adapter assembly:		
Removal	3-14	3-8
Replacement	3-15	3-8
Power supply module 1A2A5:		
Adjustment procedure	5-33	5-23
General	5-31	5-20
Resistance measurements	5-35	5-23
Testing	5-34	5-23
Troubleshooting procedure	5-32	5-20
Voltage measurements	5-36	5-23
Power supply schematic diagram description	2-31	2-13
Publications, index of	1-4	1-1

	Paragraph	Page
Purpose and use	1-6	1-2
Read switch:		
Removal	7-19	7-13
Replacement	7-20	7-13
Testing	7-21	7-14
Troubleshooting	7-22	7-14
Reference designations	1-5b	1-1
Resistance measurements (See specific item).		
Rotary joint	2-5a	2-2
Rotary coupler:		
Removal	7-23	7-14
Replacement	7-24	7-14
Testing	7-25	7-14
Scope	1-1	1-1
Self-test circuits	2-24	2-11
Servo preamplifier card 1A2A2:		
Alignment procedure	5-15	5-5
General	5-13	5-4
Resistance measurements	5-18	5-5
Testing	5-16	5-5
Troubleshooting	5-14	5-4
Voltage measurements	5-19	5-4
Waveforms	5-17	5-5
Synchro subassembly:		
Alignment	7-9	7-10
Assembly	7-8	7-10
Disassembly	7-7	7-8
Removal	7-5	7-8
Replacement	7-6	7-8
Testing	7-10	7-11
Test bed setup	4-13	4-3
Test equipment required:		
(Direct support)	3-3	3-1
(General support)	4-1	4-1
Testing (See specific item).		
Three degree clockwise error, test bed setup for	4-22	4-11
Tli/self-test card 1A2A3:		
Alignment procedure	5-22	5-14
General	5-20	5-13
Resistance measurements	5-25	5-15
Testing	5-23	5-14
Troubleshooting	5-21	5-13
Voltage measurements	5-26	5-16
Waveforms	5-24	5-14
Tools required:		
(Direct support)	3-2	3-1
(General support)	4-6	4-2
Troubleshooting (See specific items).		
Voltage measurements (See specific items).		
Voltage regulation	2-32	2-14
Waveforms:		
Servo-preamplifier card 1A2A2	5-17	5-5
Tli/self-test card 1A2A3	5-24	5-14

By Order of the Secretary of the Army:

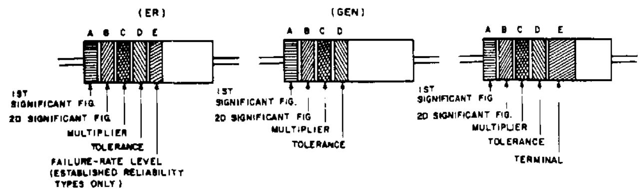
CREIGHTON W. ABRAMS
General, United States Army
Chief of Staff

Official:
VERNE L. BOWERS
Major General, United States Army
The Adjutant General

Distribution:
Active Army:
CNGB (1)
Dir of Trans (1)
COE (1)
TSG (1)
ACSC-E (2)
USAMB (10)
USAARENBD (2)
USASA (2)
USACDC (2)
USACDCCEA (1)
USACDCCEA Ft Huachuca (1)
CONARC (2)
AMC (1)
MICOM (5)
TECOM (2)
MUCOM (2)
ARADCOM (5)
ARADCOM Rgn (2)
ECOM (2)
OS Maj Comd (2)
USACDCEC (10)
USASTRATCOM (2)
USAESC (60)
Armies (1)
CINCUSAREUR (3)
USAREUR (10)
7th USA (5)
COMUSKOREA (2)
USAFABD (2)
USARADBD (2)
USASCS (10)
USASESS (5)
Svc Colleges (1)
Fort Huachuca (5)
WSMR (2)
Fort Carson (7)
USAERDAA (2)
USAERDAW (2)
USACRREL(2)
Army Dep (1) except
LBAD (7)
SAAD (30)
TOAD (14)
LEAD (7)
ATAD (10)
NAAD (3)
SVAD (3)
USA Dep (1)
Sig Sec USA Dep (5)
Sig Dep (5)
Sig FLDMS (1)
Ft Richardson (ECOM Ofc) (2)
1st Cav Div (2)
USAADS (10)
USAADCENFB (10)
USAFACFS (5)
USARAL (3)
CINCAL (5)
CINCPAC (3)
USARPAC (3)
ADA Regt (2)
32d AD Comd (5)
4th USA Msl Comd (2)
Pirmasen Army Dep (10)
Units org under fol TOE:
(1 copy each)
11-158
29-134
29-136
44-2
44-12
44-102
44-112
44-235
44-236
44-237
44-255
44-256
44-257
44-535
44-436
44-537
44-545
44-546
44-547

NG: None.
USAR: None.
For explanation of abbreviations used, see AR 310-50.

*U.S. GOVERNMENT PRINTING OFFICE: 1944 - 342-421/80981



COLOR CODE MARKING FOR COMPOSITION TYPE RESISTORS.

COLOR-CODE MARKING FOR FILM-TYPE RESISTORS.

TABLE 1
COLOR CODE FOR COMPOSITION TYPE AND FILM TYPE RESISTORS.

BAND A		BAND B		BAND C		BAND D		BAND E		
COLOR	FIRST SIGNIFICANT FIGURE	COLOR	SECOND SIGNIFICANT FIGURE	COLOR	MULTIPLIER	COLOR	RESISTANCE TOLERANCE (PERCENT)	COLOR	FAILURE RATE LEVEL	TERM.
BLACK	0	BLACK	0	BLACK	1			BROWN	M=1.0	
BROWN	1	BROWN	1	BROWN	10			RED	P=0.1	
RED	2	RED	2	RED	100			ORANGE	R=0.01	
ORANGE	3	ORANGE	3	ORANGE	1,000			YELLOW	S=0.001	
YELLOW	4	YELLOW	4	YELLOW	10,000	SILVER	±10 (COMP. TYPE ONLY)	WHITE	......	SOLDERABLE
GREEN	5	GREEN	5	GREEN	100,000	GOLD	±5			
BLUE	6	BLUE	6	BLUE	1,000,000	RED	±2 (NOT APPLICABLE TO ESTABLISHED RELIABILITY).			
PURPLE (VIOLET)	7	PURPLE (VIOLET)	7							
GRAY	8	GRAY	8	SILVER	0.01					
WHITE	9	WHITE	9	GOLD	0.1					

BAND A — THE FIRST SIGNIFICANT FIGURE OF THE RESISTANCE VALUE (BANDS A THRU D SHALL BE OF EQUAL WIDTH)

BAND B — THE SECOND SIGNIFICANT FIGURE OF THE RESISTANCE VALUE

BAND C — THE MULTIPLIER (THE MULTIPLIER IS THE FACTOR BY WHICH THE TWO SIGNIFICANT FIGURES ARE MULTIPLIED TO YIELD THE NOMINAL RESISTANCE VALUE)

BAND D — THE RESISTANCE TOLERANCE.

BAND E — WHEN USED ON COMPOSITION RESISTORS, BAND E INDICATES ESTABLISHED RELIABILITY FAILURE-RATE LEVEL (PERCENT FAILURE PER 1,000 HOURS) ON FILM RESISTORS, THIS BAND SHALL BE APPROXIMATELY 1-1/2 TIMES THE WIDTH OF OTHER BANDS, AND INDICATES TYPE OF TERMINAL.

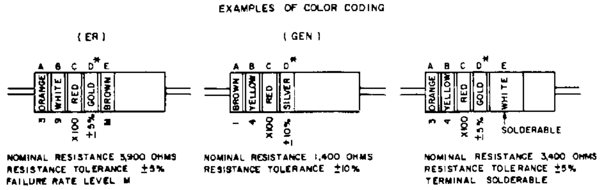
RESISTANCES IDENTIFIED BY NUMBERS AND LETTERS
(THESE ARE NOT COLOR CODED)

SOME RESISTORS ARE IDENTIFIED BY THREE OR FOUR DIGIT ALPHA NUMERIC DESIGNATORS. THE LETTER R IS USED IN PLACE OF A DECIMAL POINT WHEN FRACTIONAL VALUES OF AN OHM ARE EXPRESSED. FOR EXAMPLE:

2R7 = 2.7 OHMS   10R0 = 10.0 OHMS

FOR WIRE-WOUND-TYPE RESISTORS COLOR CODING IS NOT USED, IDENTIFICATION MARKING IS SPECIFIED IN EACH OF THE APPLICABLE SPECIFICATIONS.

EXAMPLES OF COLOR CODING



NOMINAL RESISTANCE 3,900 OHMS
RESISTANCE TOLERANCE ±5%
FAILURE RATE LEVEL M

NOMINAL RESISTANCE 1,400 OHMS
RESISTANCE TOLERANCE ±10%

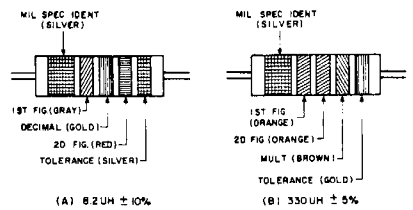
NOMINAL RESISTANCE 3,400 OHMS
RESISTANCE TOLERANCE ±5%
TERMINAL SOLDERABLE

COMPOSITION-TYPE RESISTORS

FILM-TYPE RESISTORS

* IF BAND D IS OMITTED, THE RESISTOR TOLERANCE IS ±20% AND THE RESISTOR IS NOT MIL-STD.

A. COLOR CODE MARKING FOR MILITARY STANDARD RESISTORS.



COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES. AT A, AN EXAMPLE OF OF THE CODING FOR AN 8.2UH CHOKE IS GIVEN AT B, THE COLOR BANDS FOR A 330 UH INDUCTOR ARE ILLUSTRATED

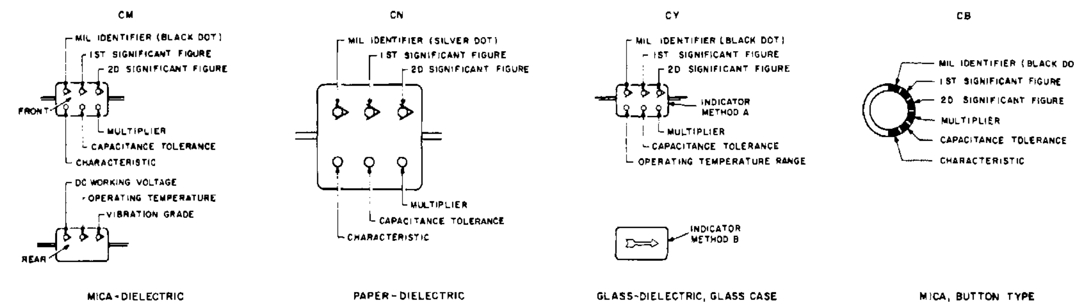
TABLE 2
COLOR CODING FOR TUBULAR ENCAPSULATED R F CHOKES.

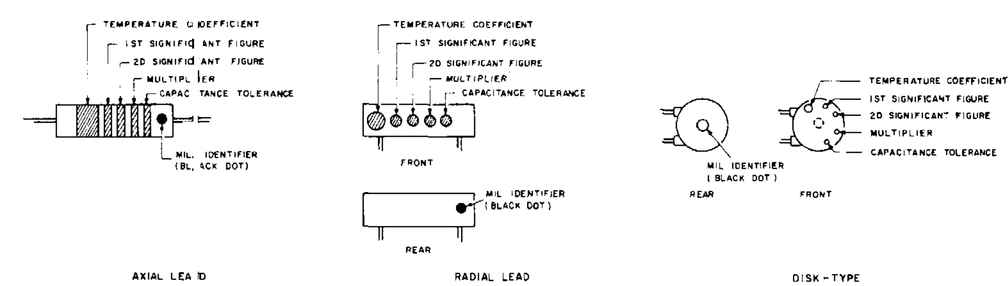
COLOR	SIGNIFICANT FIGURE	MULTIPLIER	INDUCTANCE TOLERANCE (PERCENT)
BLACK	0	1	
BROWN	1	10	1
RED	2	100	2
ORANGE	3	1,000	3
YELLOW	4		
GREEN	5		
BLUE	6		
VIOLET	7		
GRAY	8		
WHITE	9		
NONE			20
SILVER			10
GOLD	DECIMAL POINT		5

MULTIPLIER IS THE FACTOR BY WHICH THE TWO COLOR FIGURES ARE MULTIPLIED TO OBTAIN THE INDUCTANCE VALUE OF THE CHOKE COIL.

B. COLOR CODE MARKING FOR MILITARY STANDARD INDUCTORS.

CAPACITORS, FIXED, VARIOUS-DIELECTRICS, STYLES CM, CN, CY, AND CB.





C. COLOR CODE MARKING FOR MILITARY STANDARD CAPACITORS

TABLE 3 — FOR USE WITH STYLES CM, CN, CY AND CB.

COLOR	MIL ID	1ST SIG FIG.	2D SIG FIG	MULTIPLIER[1]	CAPACITANCE TOLERANCE				CHARACTERISTIC[2]			DC WORKING VOLTAGE	OPERATING TEMP RANGE	VIBRATION GRADE
					CM	CN	CY	CB	CM	CN	CB	CM	CY, CM	CM
BLACK	CM, CY CB	0	0	1			±20%	±20%		A			−55° TO +70°C	10-55HZ
BROWN		1	1	10					B	E	B			
RED		2	2	100	±2%		±2%	±2%	C				−55° TO +85°C	
ORANGE		3	3	1,000		±30%			D		D	300		
YELLOW		4	4	10,000					E				−55° TO +125°C	10-2,000Hz
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%						

TABLE 4 — TEMPERATURE COMPENSATING, STYLE CC.

COLOR	TEMPERATURE COEFFICIENT[4]	1ST SIG FIG.	2D SIG FIG.	MULTIPLIER[1]	CAPACITANCE TOLERANCE		MIL ID
					CAPACITANCES OVER 10 UUF	CAPACITANCES 10 UUF OR LESS	
BLACK	0	0	0	1		±2.0 UUF	CC
BROWN	−30	1	1	10	±1%		
RED	−80	2	2	100	±2%	±0.25 UUF	
ORANGE	−150	3	3	1,000			
YELLOW	−220	4	4				
GREEN	−330	5	5		±5%	±0.5 UUF	
BLUE	−470	6	6				
PURPLE (VIOLET)	−750	7	7				
GREY		8	8	0.01			
WHITE		9	9	0.1	±10%		
GOLD	+100					±1.0 UUF	
SILVER							

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-20D, MIL-C-11272B, AND MIL-C-10950C RESPECTIVELY.

3. LETTERS INDICATE THE TEMPERATURE RANGE AND VOLTAGE-TEMPERATURE LIMITS DESIGNATED IN MIL-C-11015D.

4. TEMPERATURE COEFFICIENT IN PARTS PER MILLION PER DEGREE CENTIGRADE.

ESC-FM 1794-71

Figure FO-1. Color code markings for MIL-STD resistors, inductors and capacitors.

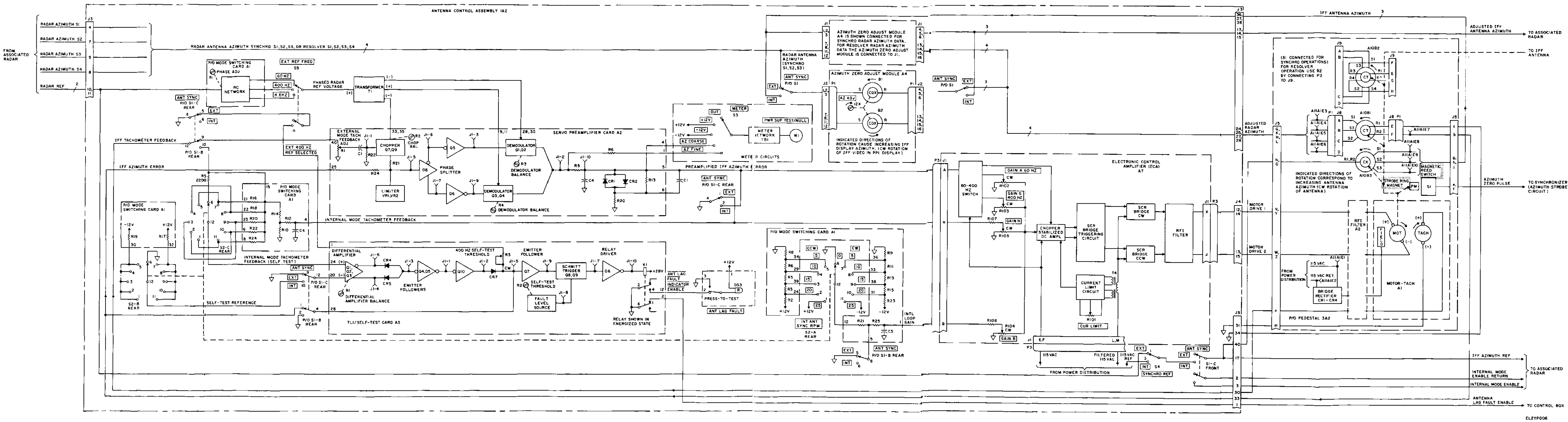


Figure FO-2. Antenna positioning circuits, functional block diagram.

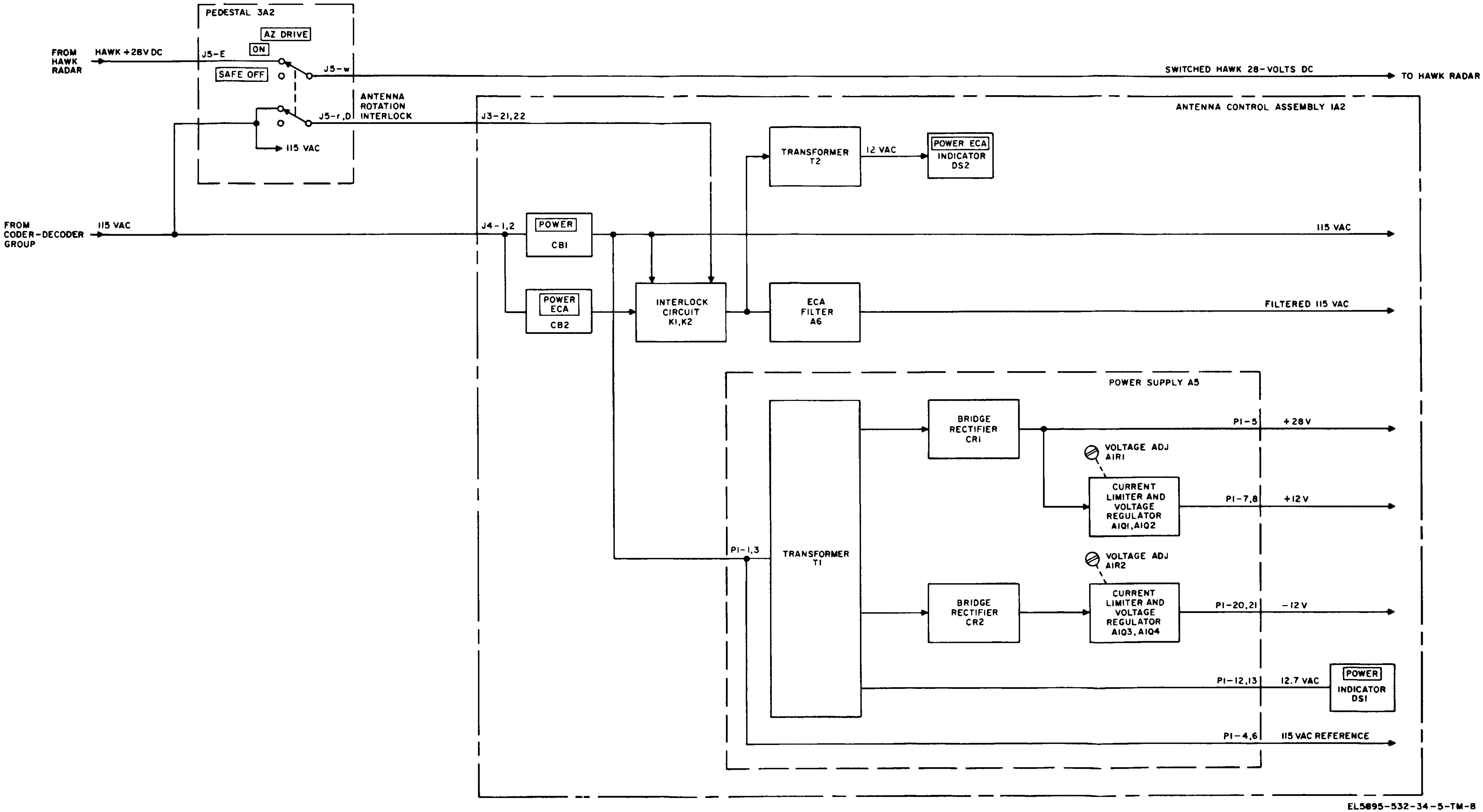


Figure FO-3. Power supply circuits, functional block diagram.

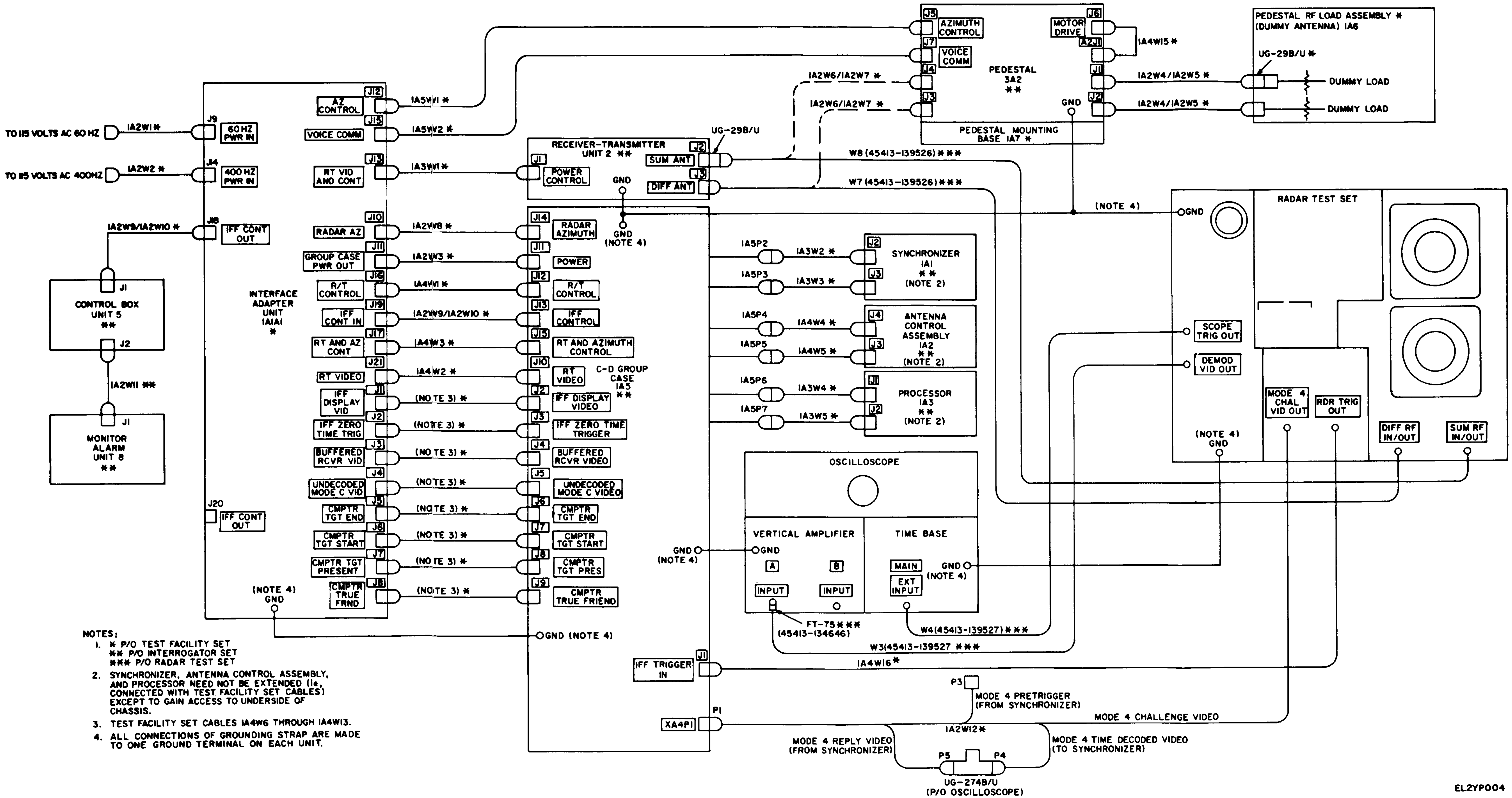


Figure FO-4. Test-bed setup, interconnection diagram using AN/TPM-25A.

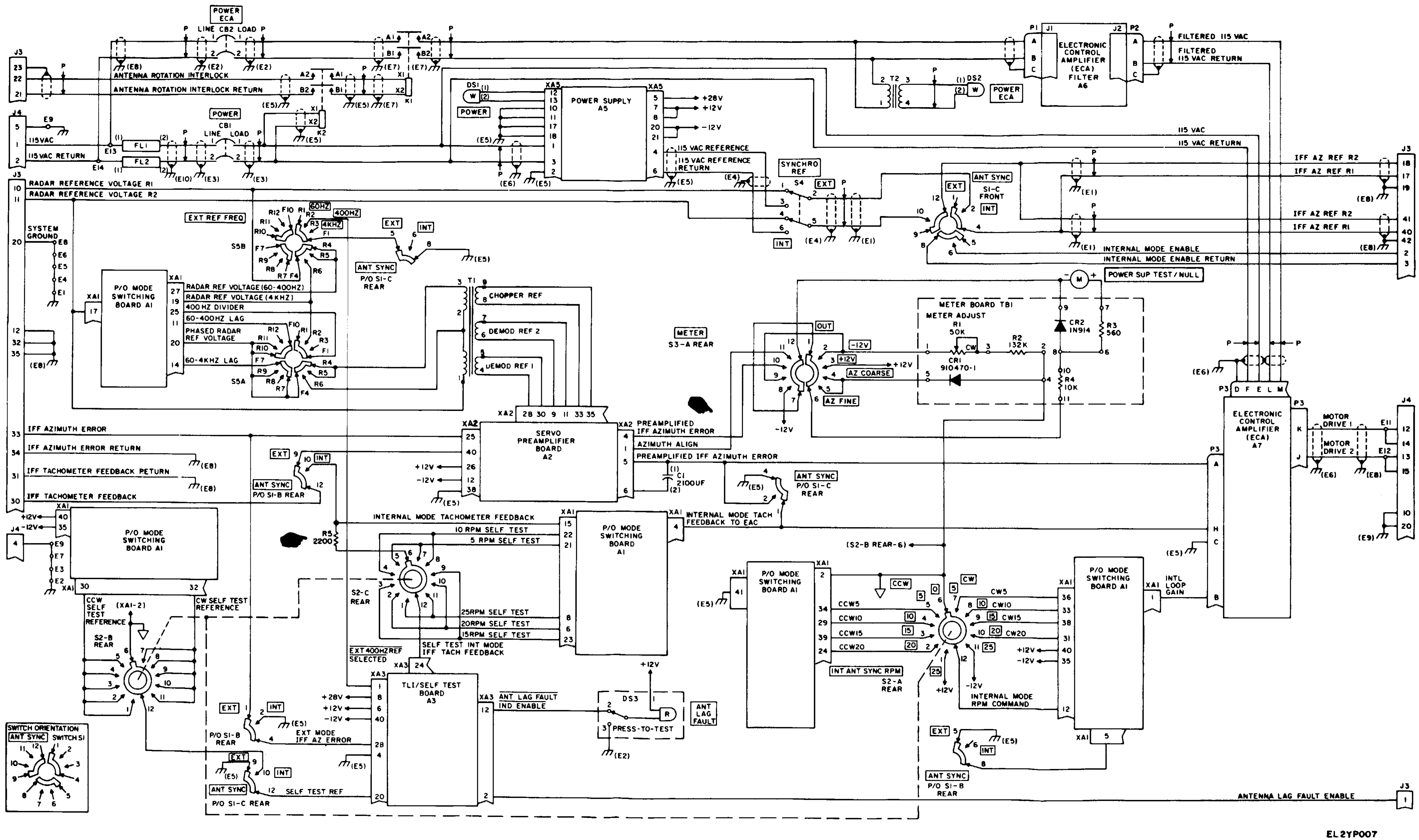


Figure FO-5(1). Antenna control assembly 1A2, schematic diagram.

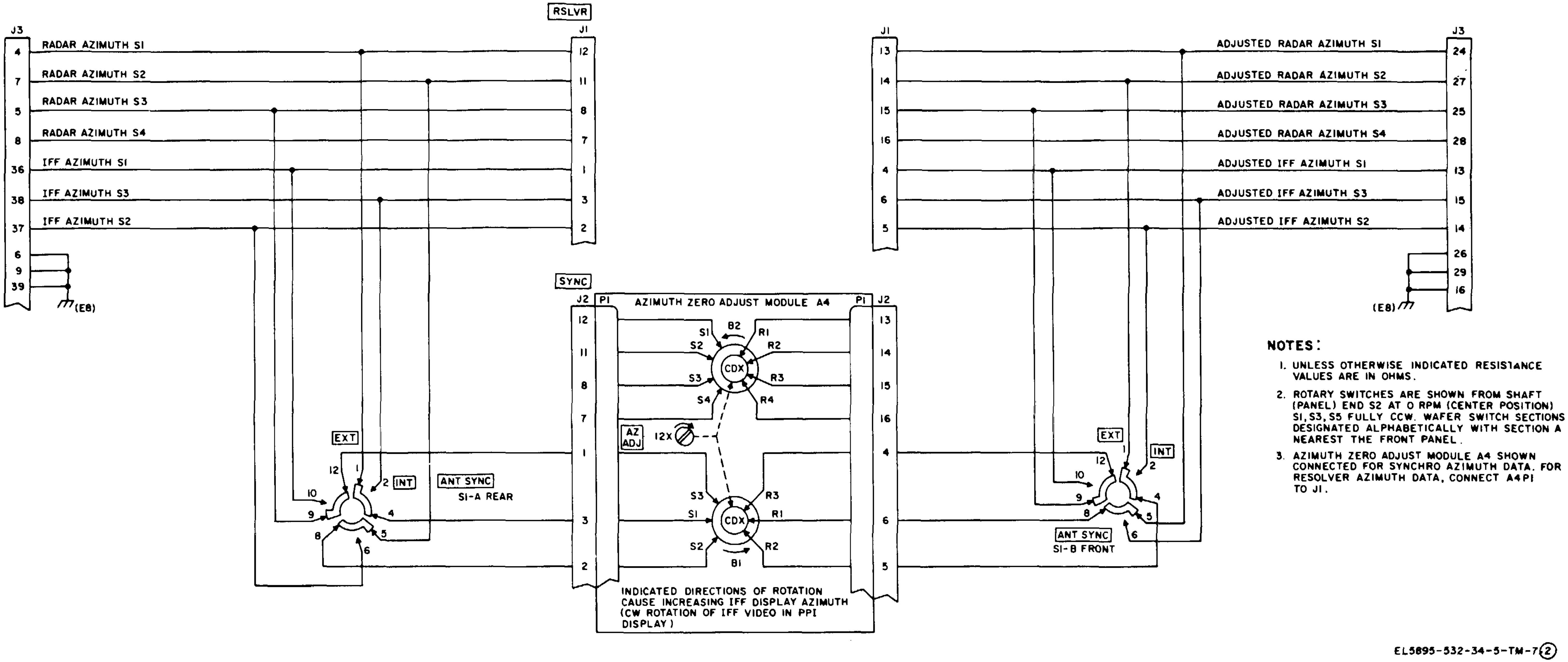


Figure FO-5(2). Antenna control assembly 1A2, schematic diagram.

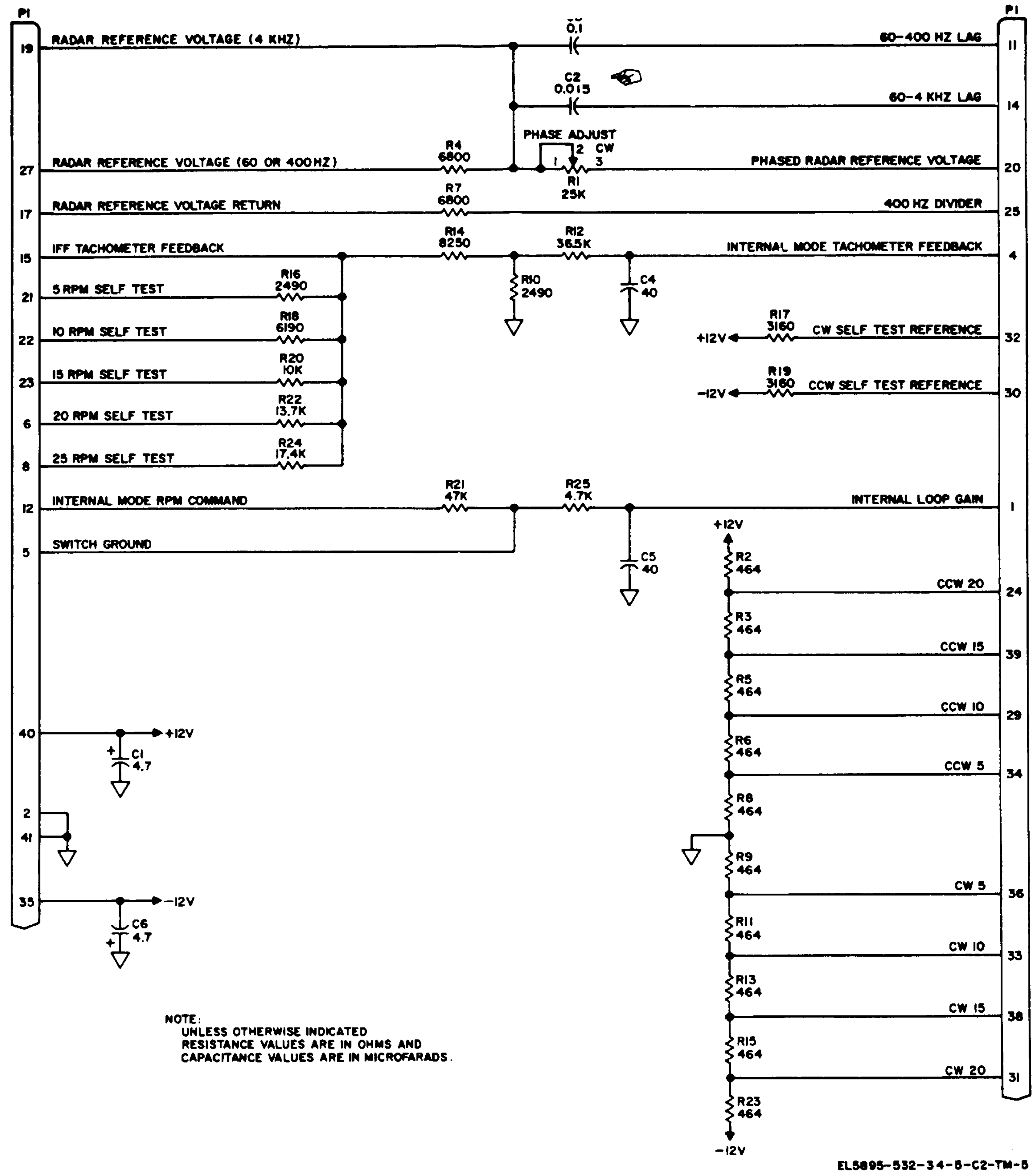


Figure FO-6. Mode switching card 1A2A1, schematic diagram.

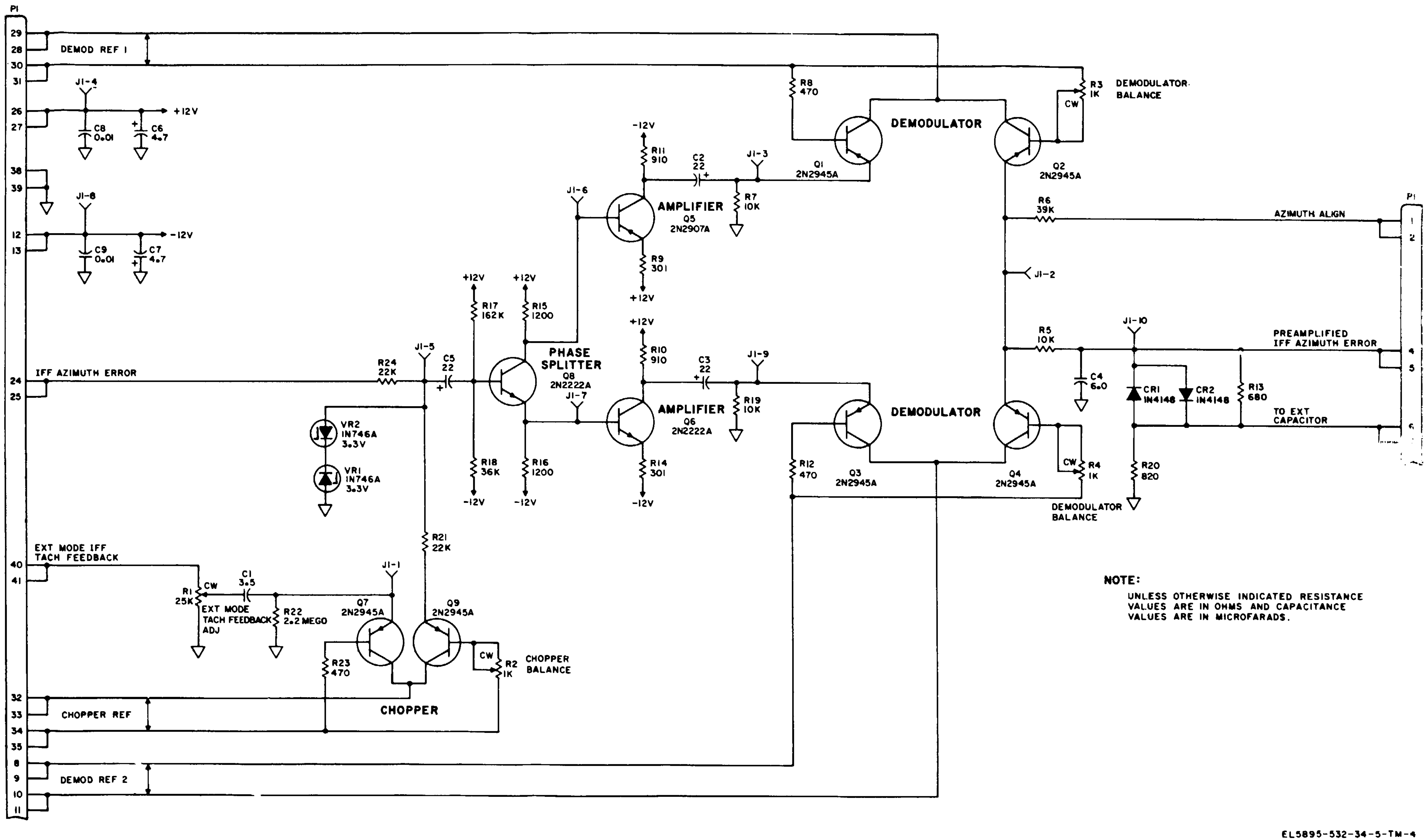


Figure FO-7. Servo preamplifier card 1A2A2, schematic diagram.

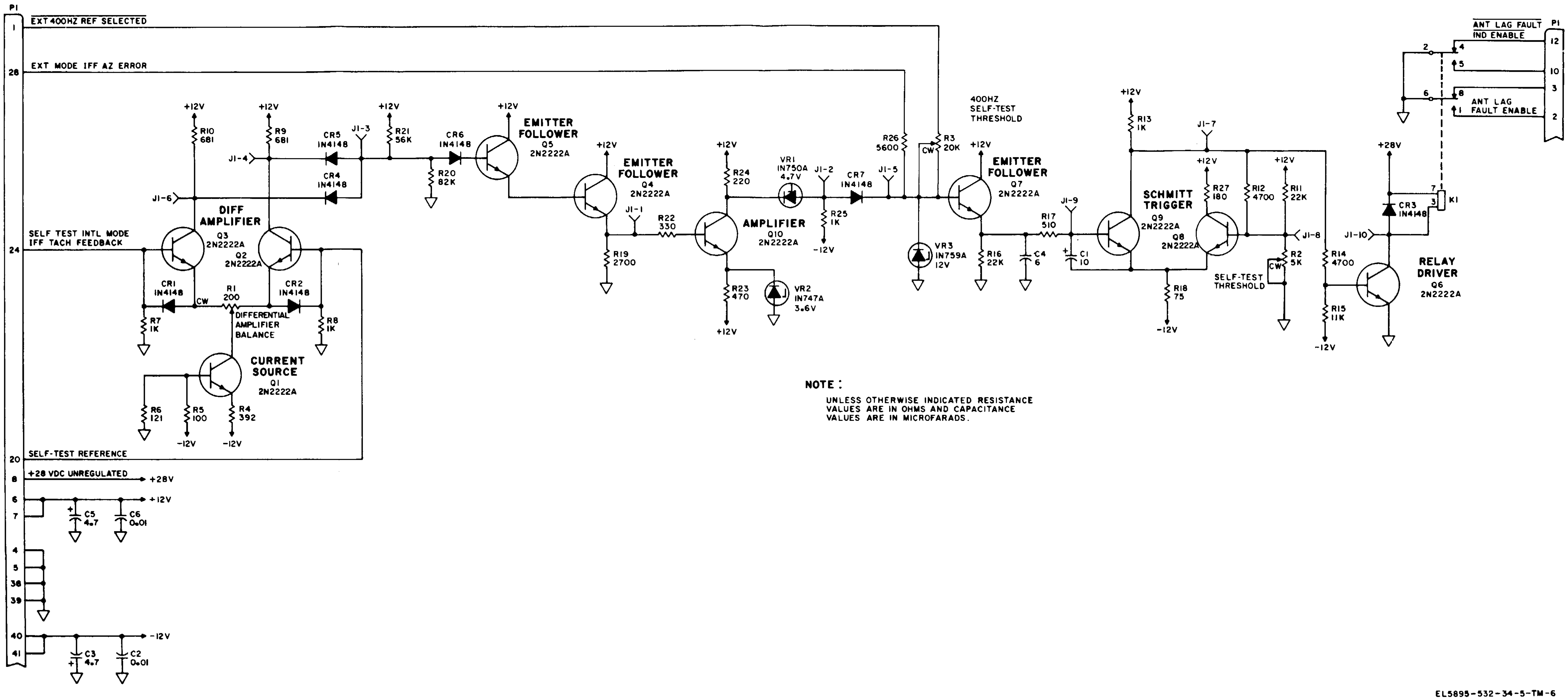
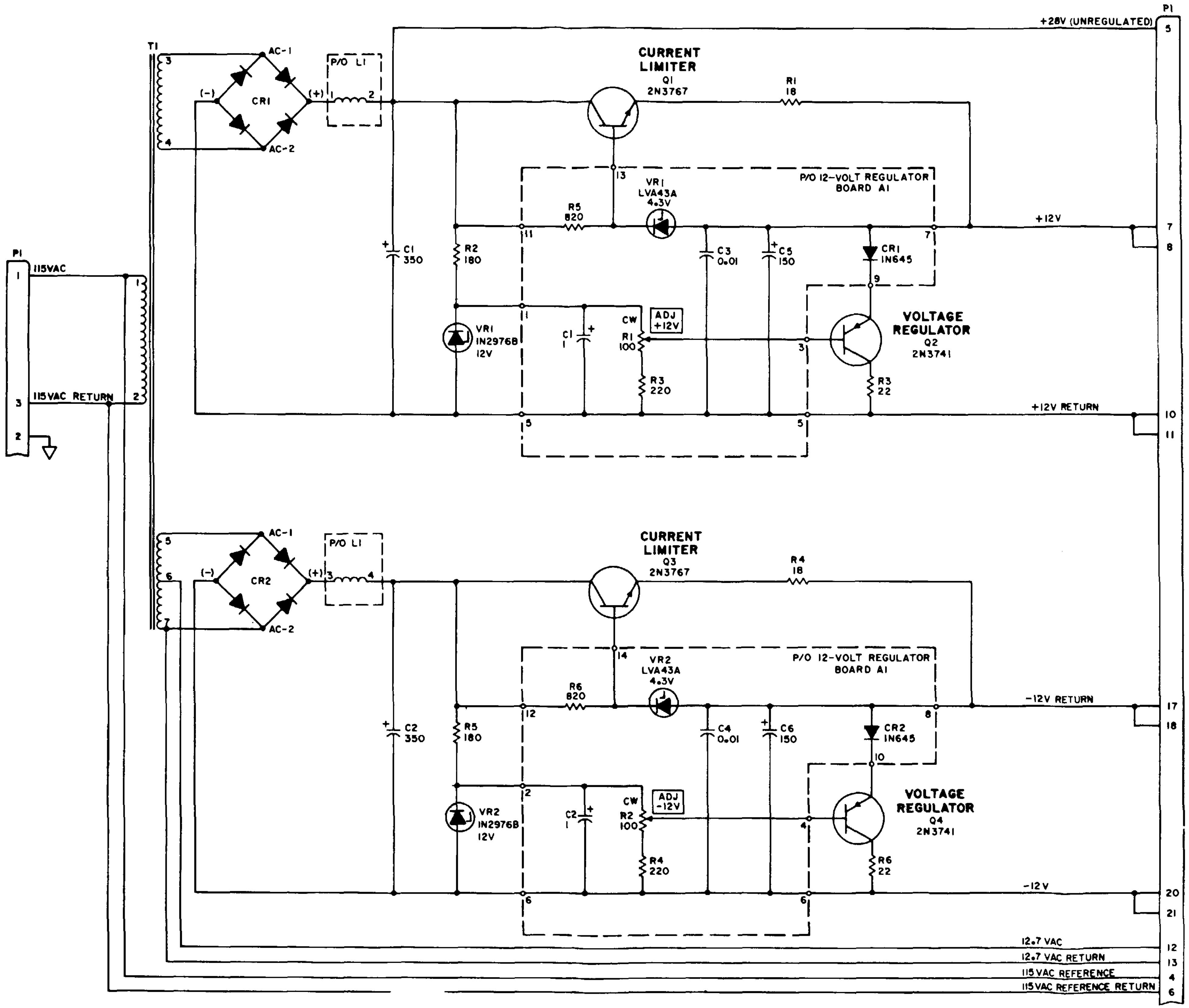


Figure FO-8. Tli/Self-test card 1A2A3, schematic diagram.

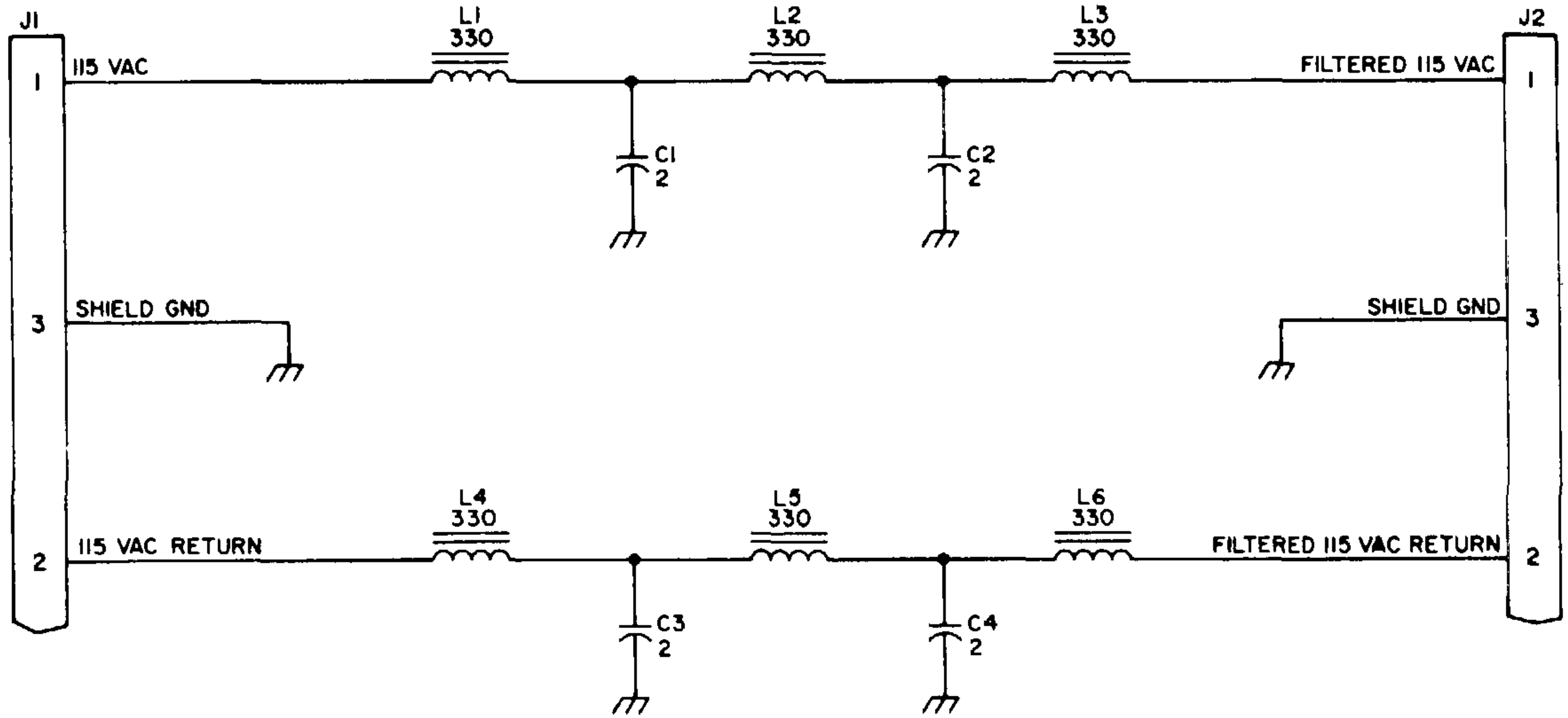


NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCE VALUES ARE IN OHMS AND CAPACITANCE VALUES ARE IN MICROFARADS.
2. PREFIX REF DESIG OF BOARD-MOUNTED COMPONENTS WITH BOARD REF DESIG A1, POWER SUPPLY MODULE REF DESIG A5, AND ACU ASSEMBLY DESIG 1A2. FULL REF DESIG OF BOARD MOUNTED VR2 IS 1A2A5A1VR2.
3. PREFIX REF DESIG OF NON-BOARD-MOUNTED COMPONENTS WITH POWER SUPPLY MODULE REF DESIG A5 AND ACU ASSEMBLY REF DESIG 1A2. FULL REF DESIG OF T1 IS 1A2A5T1.

EL5895-532-34-5-TM-3

Figure FO-9. Power supply module 1A2A5, schematic diagram.



NOTE:

UNLESS OTHERWISE INDICATED CAPACITANCE VALUES ARE IN MICROFARADS AND INDUCTANCE VALUES ARE IN MICROHENRYS.

EL5895-532-34-5-TM-2

Figure FO-10. Electronic control amplifier filter 1A2A6, schematic diagram.

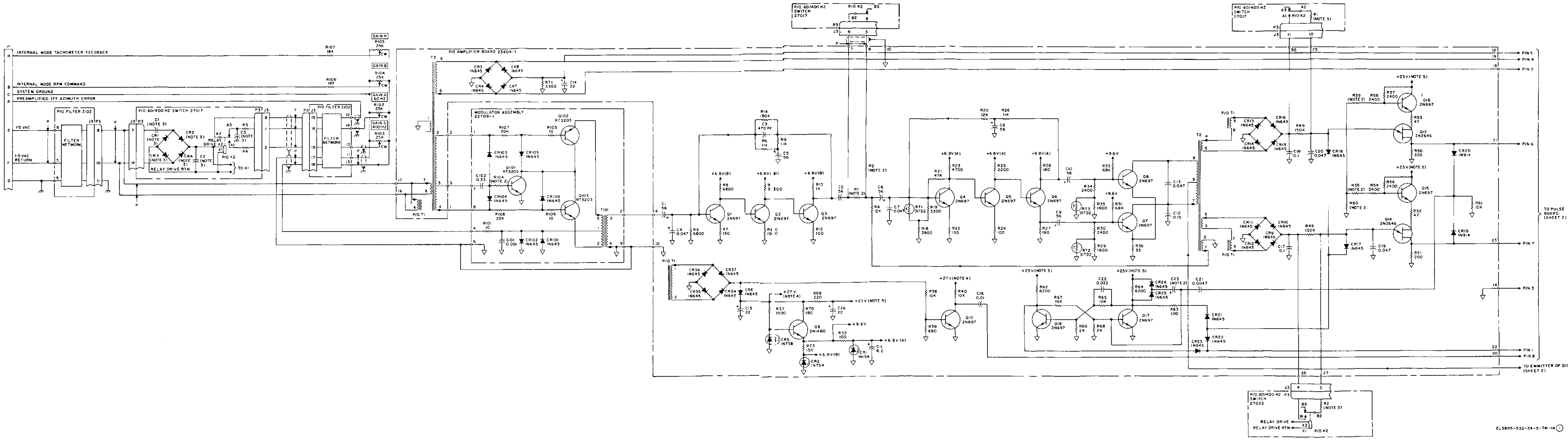


Figure FO-11(1). Electronic control amplifier 1A2A7, schematic diagram.

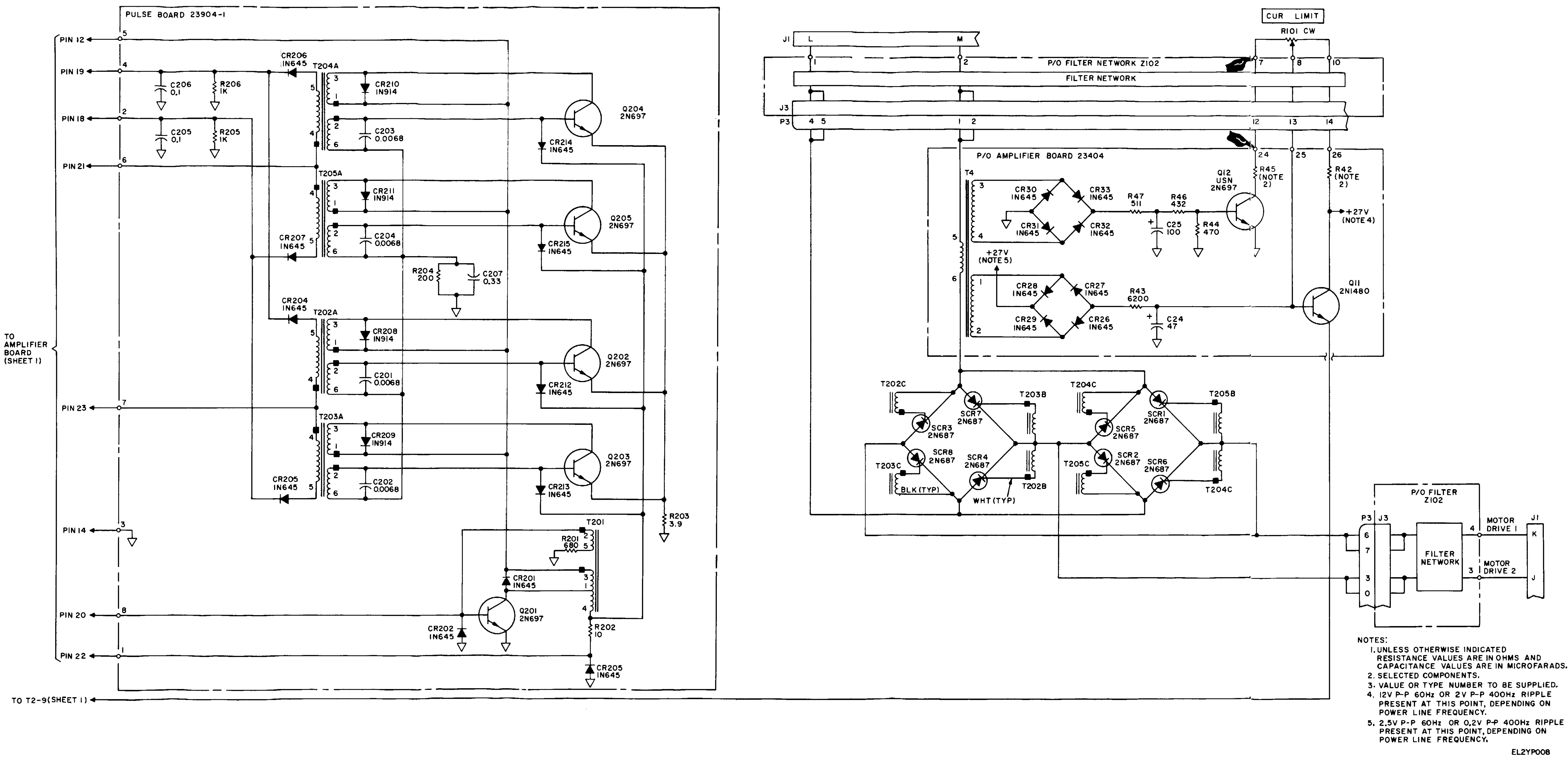


Figure FO-11(2). Electronic control amplifier 1A2A7, schematic diagram.

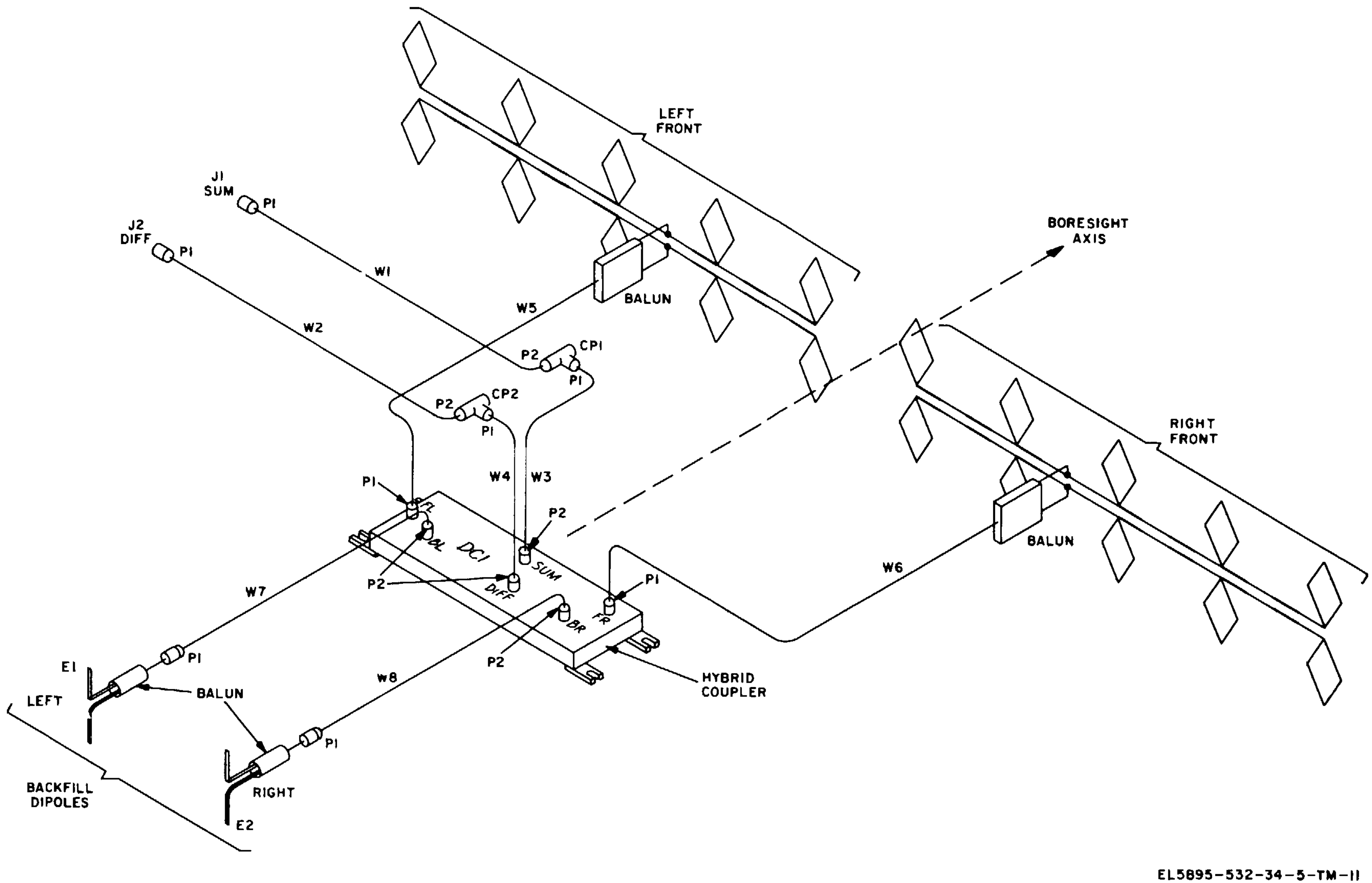
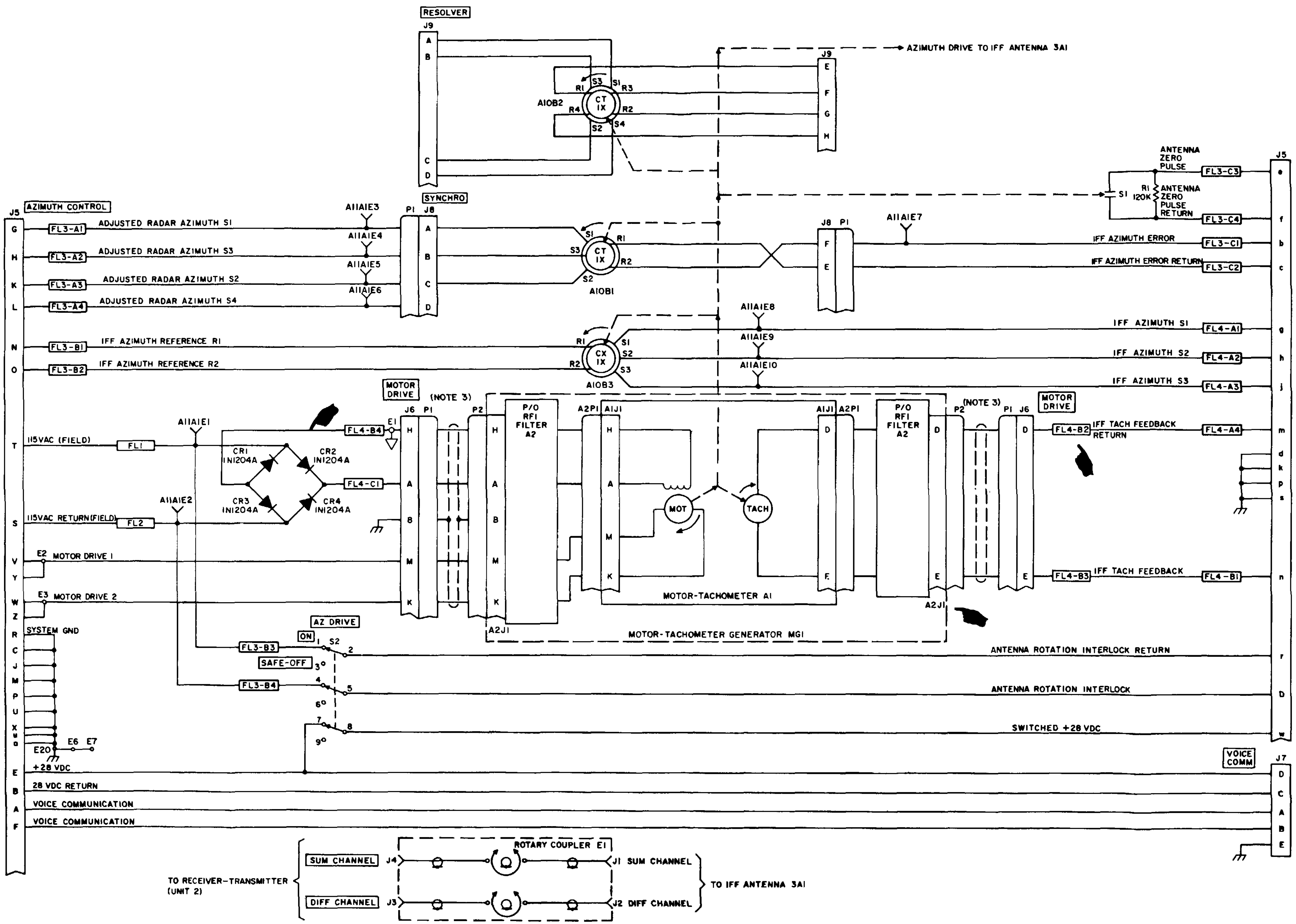


Figure FO-12. Seven-foot antenna 3A1, schematic diagram.



NOTES:

1. UNLESS OTHERWISE INDICATED RESISTANCE VALUES ARE IN OHMS.
2. WHEN RESOLVER B2 IS USED IN LIEU OF SYNCHRO B1, DISCONNECT P3 FROM J8 AND CONNECT P3 TO J9.
3. CABLE CX-10773/U (2 FT.) SHOWN FOR REFERENCE ONLY, NOT PART OF PEDESTAL.
4. DIODES CR1 THRU CR4; PREFERRED TYPE 1N1204A. USE TYPE 1N1126A UNTIL SUPPLY IS EXHAUSTED.

EL5895-532-34-5-C3-TM-1

Figure FO-13. Pedestal 3A2, schematic diagram.

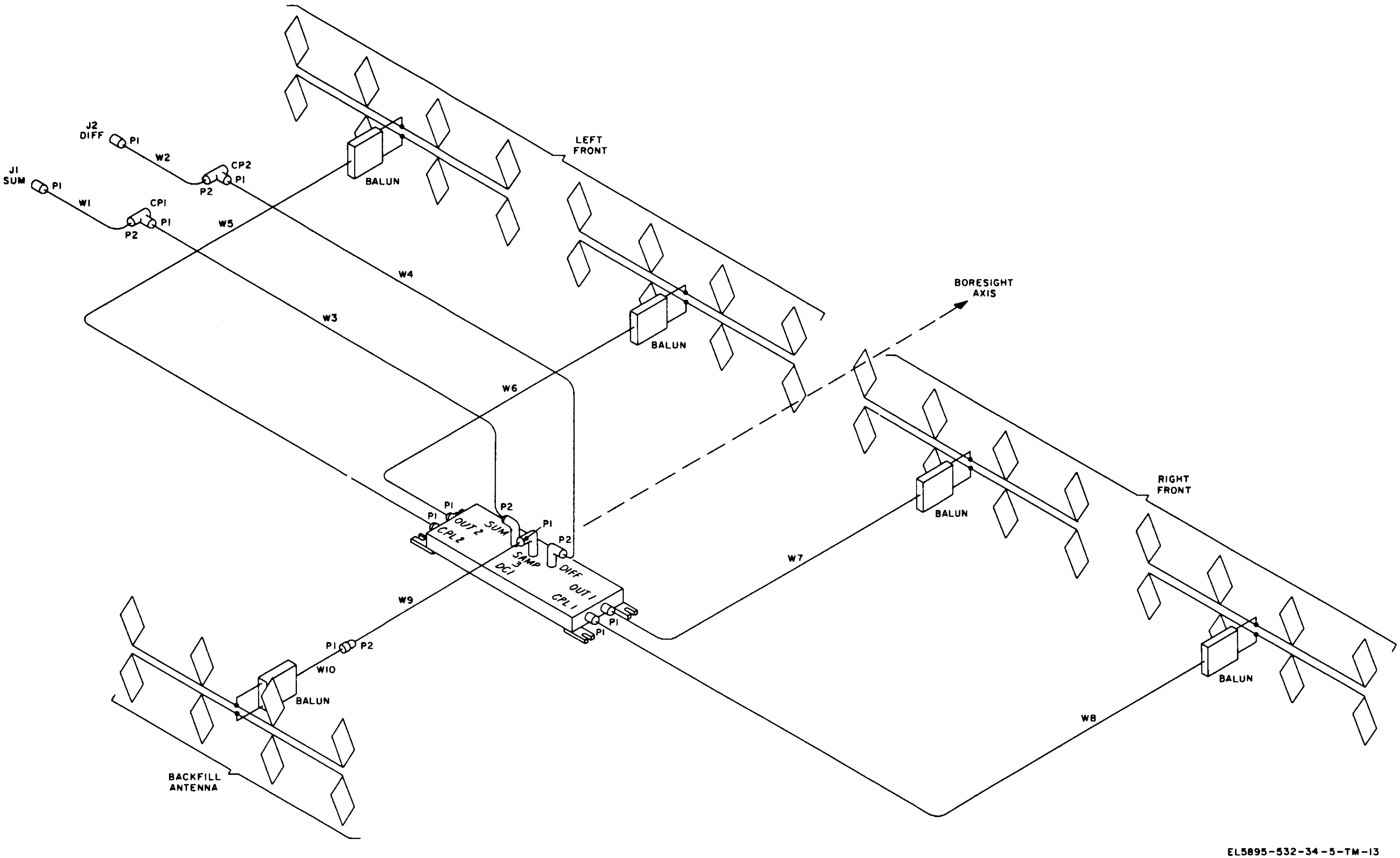


Figure FO-14. Fourteen-foot antenna, unit 4, schematic diagram.

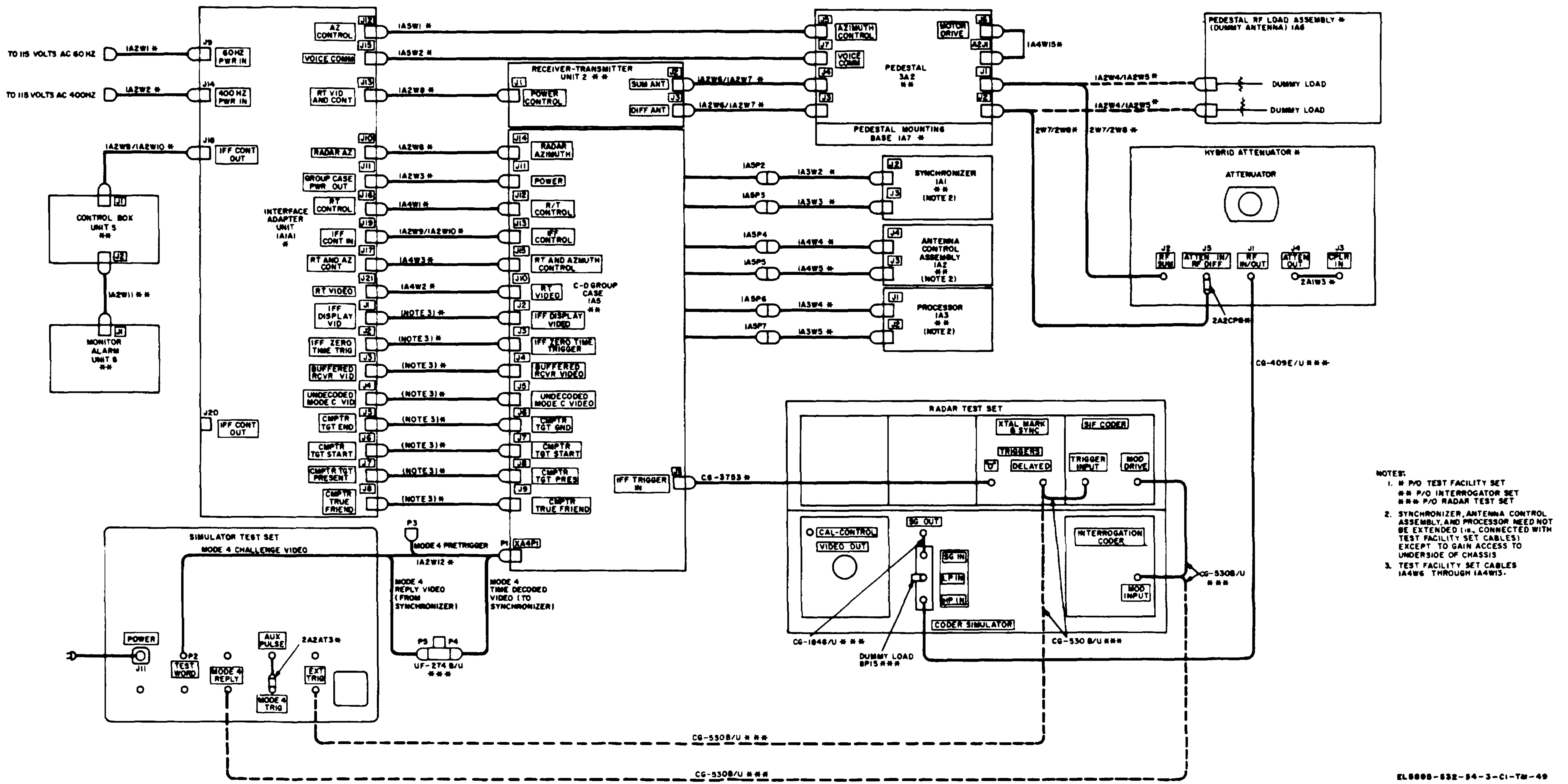
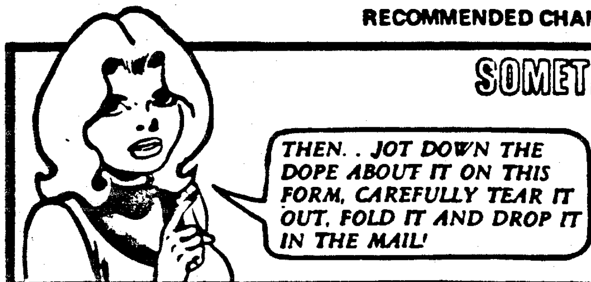


Figure FO-15. Test-bed setup, interconnection diagram, using AN/UPM-98B (or C).

TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS



SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO	TABLE NO.	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE:

DA FORM 1 JUL 79 2028-2 PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

PIN: 014687-000